TOSHIBA
Leading Innovation

Variable Speed Drive
TOSVERT VF-MB1

Variable Speed Drive
Single phase-240V: 0.2kW to 2.2kW
Three phase-500V: 0.4kW to 15kW
Shape Your Industry

- Fit your application by 3 advanced features.
- The VF-MB1 can drive elevator, lifting, conveyor, food & beverage processing, material handling, machine tool and various applications.

**SLIM SHAPE BODY**
- Side-by-side installation
- Flat Mounting Installation

**ADVANCED MOTOR DRIVE**
- Sensor-less Permanent Magnetic motor, SPM/IPM, and Induction Motor drive capability
- Toshiba unique magnetic pole position detection

**FLEXIBLE OPERATION**
- Simple Panel
  - "Turn and Push" setting dial
  - RUN and STOP keys
- Communication
  - *Built-in*
    - RS485 and CANopen®
  - *Add-on option*
    - EtherNet/IP™, Modbus® TCP, PROFIBUS® DP, DeviceNet™, EtherCAT® (coming soon)
- Dual rating
  - Two types of rating can drive variable torque and constant torque applications with minimal drive size.

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EC directive (CE marking), UL, CSA
SLIM SHAPE BODY
The slim design VF-MB1 fit to limited space and it can minimize the total machine spaces.

Side-by-side installation
The VF-MB1 has been minimized width size in comparison with conventional model. In addition, side-by-side installation can save space in control cabinet (*1).

Slim design
For 240V-0.2kW to 0.75kW and 500V-0.4kW to 1.5kW models are fitted to 45mm slim design. And also, 240V-1.5kW to 2.2kW and 500V-2.2kW to 4.0kW models can be fitted to 60mm.

Flat Mounting installation
The VF-MB1 can be mounted by Flat Mounting and front block can be attached 90 degree by using additional mount bracket (*2). The space can be minimized with various installation (*1).

FLEXIBLE OPERATION
Flexible interface and improvement of a network communication can easily modify to arrange the wide range of application.

Simple panel
Setting dial, 4 keys, and 4 small LEDs with Green 7 segments LEDs can be easy to set parameters and operations.

Communication
Built-in (RJ45)
- RS485 (Modbus® RTU) Baud rate 38.4 kbps max.
- CANopen®: Baud rate 1.0Mbps max.
Optional (Add-on option)
- EtherNet/IP™-Modbus® TCP
- PROFINET® DP
- DeviceNet™
- EtherCAT® (Coming soon)
- CANopen®: Baud rate 1.0Mbps max.

Dual rating (CT/VT)
The VF-MB1 can be used for the constant torque and variable torque applications by dual rating operation. (5.5kW or larger type)
For example, if variable torque application (fan and pump) require 15kW drives, it can be operated by 11kW rated of VF-MB1.

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

Variable torque application
The torque value of variable torque application such as Fan, Pump and HVAC require low torque until starts to operating speed. (Compressor is excluded)

Example: VFMB1-4110PL
11kW rated drive can be used for 15kW motor

*1: Current reduction is required if VF-MB1 is installed into less ventilation spaces such as narrow space and side-by-side installation.
*2: The model whose front block is attached 90 degree is modified with additional mount bracket in factory.
Please request 90 degree type with order, if it is required.
ADVANCED MOTOR DRIVE

Induction motor and Permanent Magnetic (PM) motor drive

The VF-MB1 controls not only 3-phase induction motors (Standard, High efficiency motor) but also Interior Permanent Magnetic Motor (IPM) and Surface Permanent Magnetic Motor (SPM) for high efficiency, high torque, energy saving, downsizing and lightening.

PM drive technology

Power-ON sensor less initial magnetic pole detection
- Initial magnetic pole position can be detected quickly without magnetic pole sensor.
- It can minimize motor space, wiring and suitable with system requirements.
  (If the auto-tuning performed with motor rated parameter settings, high torque control operation can be achieved.) (*1)

Hit and stop function (Torque limit function)
Extra limit switch can be eliminated for conveyor, machine tool or other mechanical application by using Hit and stop function with torque limit function which can be adjusted torque value of motor torque, and motor rotation can be stopped by torque detection.

Servo lock function
The VF-MB1 and PM motor combined, servo lock function can be used for automated system. It can control easily for stop and go applications by smooth speed reduction control for shock-less mechanical braking.

Sensor less step-out detection
The VF-MB1 will keep detecting the pole position during PM motor is rotating. This function can prevent the step-out even if motor has impact and variable load torque.

Constant and Variable torque control
The VF-MB1 can drive PM motor with not only variable torque but also constant torque which is required large torque when motor start to rotate.

*1: There is a possibility that some PM motors can NOT be driven by the VF-MB1 even if the motor parameters are set by auto-tuning function.

FLEXIBLE TERMINALS

Control terminal layout

Logic outputs:
- (1 open collector, 1NO relay, 1NO/NC relay)
- Pulse train output ("OUT" terminal, 2kpps max.)
- Analog outputs: ("FM" terminal, Motor, 0-10V, 0-20mA)
- Analog inputs: (3 analog input terminals, 0-10V, +/-10V, 0-20mA)

Combination I/O

Multiple input terminal functions can be assigned with single input terminal, also output terminal can be assigned by "AND" and "OR" logics. This variety of functions allow for flexible system design.

Covered input terminals
Easy connection of front side input terminals with safety quick open cover.

Removable output terminal block
Easy install and maintenance by quick detachable output terminal block (up to 4.0kW)
FUNCTIONALITY

Internal software

PID Control
Temperature, Pressure, Flow and Motion control can be controlled with minimal over or less drive by using feedback analog signals from a sensor, detector and process control.

Torque limit function
Output frequency can be decreased or increased according to the loading condition when the motor torque reaches the limit level such as paper and film rolling machine.

Light-load high-speed operation
The light-load high-speed operation is used to improve the operating efficiency of the machine by increasing the rotational speed of the motor when it is operated under light load. This function is useful for constant-torque load applications which repeatedly drive light and heavy loads, such as lifts and transfer equipment.

Braking function
Lifts, crane and similar equipment require the smooth operation for braking and release timing with motor torque. The motor can produce enough torque before the brake is released by this function.

Droop control
When single load is operated by multiple drives and motors, each drive and motor are necessary to control same value of load to prevent overload. This function can share the single loads to multiple drives.

Other functions

V/F 5 points setting
Forced re-speed control
Bumpless operation
Tracing functions
Integrating wattmeter
Traverse
Logic sequence function

PROGRAMMING

The VF-MB1 can be programmed by using computer based software “Logic sequence setting tool” and “PCM001Z”. Setup time and adjustment time for installation saving and appropriate setting for any conditions are achieved.

Sequence programming software
(Logic sequence setting tool)

The VF-MB1 has logic sequence function and once VF-MB1 is connected with computer, it can be programmed by “Logic sequence setting tool”. “Logic sequence setting tool” can monitor the online input / output signals and monitoring status.

Communication software
(PCM001Z)

The PCM001Z communication software allows you to edit, monitor and trace parameter data on a computer, also operating condition can be analyzed by monitoring function. Inverter can be managed by easy data settings.

EASY for ADVANCED CONTROL

Simple setup by Easy key

For quick setting, pressing the EASY key on the panel allows you to operate the inverter by eight basic parameters. When setting each of the functions, press the EASY key to move to the standard mode by one-touch operation. In this mode, you can access all parameters. The maximum of 32 target parameters are displayed and assigned to suit with your specific setup requirements. You can also use the EASY key as a local/remote key to switch between panel and remote operation, and as a shortcut key to directly access any specific setup or display screen.

Setting dial “turn-and-push”

The large setting dial at the center of the front panel allows you to set the parameters easily. Just turn the setting dial until you get the right parameter and push the setting dial to select. You can also use the setting dial to set the reference frequency.
SAFETY

Safety function
The VF-MB1 supports the Safe Torque Off (STO) function according to the following standards.
- EN/IEC 61508
- EN954-1
- ISO 13849-1
The STO function can be set by using parameter settings. When STO input is open, drive stops and start is prohibited until STO input is reconnected.

ENVIRONMENT

EMC noise filter inside
Built-in noise filters are ideal for sites such as commercial facilities and offices where attention must be paid to peripheral devices. Compared to filter not integrated models, space and wiring can be saved by incorporating filter in the panel. The VF-MB1 complies with the European EMC Directive.

Long lifetime
10 years of operation design
The main-circuit capacitor, cooling fan and control board capacitors are designed for 10 years lifetime design.
- Conditions -
  - Ambient temperature: 40 °C
  - Output current: 80% of the rated current
  - Running time: 24 hours/365 days
  - The designed lifetime is calculated value.
  - It is not guaranteed time.
Monitor informs when to replace major parts
The VF-MB1 tells you when to replace major parts and keeps track of the cumulative operation time. Since the VF-MB1 can generate warning, you can prevent a problem before it occurs.

Eco design
The VF-MB1 complies with the European RoHS Directive.

OPTIONAL DEVICES

LCD Extension Panel Option (coming soon)
This panel is an 23-character x 8-line display, and can be used for simple setup and monitoring by selection of parameters using the jog dial. The display language can be switched between English and Japanese.

LED Extension Panel Option (RKP002Z)
This RKP002Z is using 20 mm LEDs, the largest in its class in the market, to ensure outstanding visibility. It has also been designed to be fitted into panels for use as an extension panel or display.
(Note: Parameter copy function is available with RKP002Z-2 or later LED panels.)

LED Extension Panel Option (RKP007Z)
Compact extension panel RKP007Z also available parameter read and writing.

USB communications conversion unit (USB001Z)
This USB001Z converts USB port signal to the VF-MB1 built-in (RJ45) port for data communication. By using serial data communication, all parameters and monitoring data can be accessed for commissioning and maintenance.

Add-on communication option
Add-on option lineups EtherNet/IP™ – Modbus® TCP, PROFIBUS® DP DeviceNet™, EtherCAT® and CANopen® (Insulated). The VF-MB1 can be connected to the common industrial networks.

Touch Panel (TR PMIU)
3.5” and 5.7” touch panel can be connected with the VF-MB1 by using RS485 (Modbus® RTU) communication. All commands, monitoring and parameter setting is preprogrammed in touch panel programming software. System operation can be achieved simply and quickly.

Intelligent I/O (TR SPUX)
Advanced sequence programming for system control can be structured. Various analog and digital I/Os are arranged for wide range applications.
Specifications

### 1-phase 240V

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>200V to 240V</td>
</tr>
<tr>
<td>Applicable motor capacity</td>
<td>0.2, 0.4, 0.75, 1.5, 2.2 kW</td>
</tr>
</tbody>
</table>

Table: Applicable motor (kW)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Input voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>200V</td>
<td>3-phase 200V</td>
</tr>
<tr>
<td>230V</td>
<td>3-phase 230V</td>
</tr>
<tr>
<td>240V</td>
<td>3-phase 240V</td>
</tr>
</tbody>
</table>

Table: Output voltage (V) Note 1)

<table>
<thead>
<tr>
<th>Rated power</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 kW</td>
<td>110</td>
</tr>
<tr>
<td>0.4 kW</td>
<td>110</td>
</tr>
<tr>
<td>0.75 kW</td>
<td>110</td>
</tr>
<tr>
<td>1.5 kW</td>
<td>110</td>
</tr>
<tr>
<td>2.2 kW</td>
<td>110</td>
</tr>
</tbody>
</table>

Table: Built-in filter

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFMB1</td>
<td>EMC filter</td>
</tr>
</tbody>
</table>

Table: Color

<table>
<thead>
<tr>
<th>RAL7016</th>
</tr>
</thead>
</table>

Table: Cooling method

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced air-cooled</td>
<td></td>
</tr>
</tbody>
</table>

Table: Special specification code

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADD</td>
<td>Additional function I</td>
</tr>
<tr>
<td>C00</td>
<td>Special function II</td>
</tr>
</tbody>
</table>

### 3-phase 500V

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>380V to 500V</td>
</tr>
<tr>
<td>Applicable motor capacity</td>
<td>0.4, 0.75, 1.5, 2.2, 4.0, 5.5, 7.5, 11, 15 kW</td>
</tr>
</tbody>
</table>

Table: Applicable motor (kW)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Input voltage</th>
</tr>
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<tbody>
<tr>
<td>380V</td>
<td>3-phase 380V</td>
</tr>
<tr>
<td>500V</td>
<td>3-phase 500V</td>
</tr>
</tbody>
</table>

Table: Output voltage (V) Note 3)

<table>
<thead>
<tr>
<th>Rated power</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4 kW</td>
<td>380</td>
</tr>
<tr>
<td>0.75 kW</td>
<td>380</td>
</tr>
<tr>
<td>1.5 kW</td>
<td>380</td>
</tr>
<tr>
<td>2.2 kW</td>
<td>380</td>
</tr>
<tr>
<td>4.0 kW</td>
<td>500</td>
</tr>
<tr>
<td>5.5 kW</td>
<td>500</td>
</tr>
<tr>
<td>7.5 kW</td>
<td>500</td>
</tr>
<tr>
<td>11 kW</td>
<td>500</td>
</tr>
<tr>
<td>15 kW</td>
<td>500</td>
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Table: Built-in filter

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<td>Forced air-cooled</td>
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### Standard specifications

#### Power

- Voltage range: 200V to 240V
- Applicable motor capacity: 0.2, 0.4, 0.75, 1.5, 2.2 kW

#### Cooling method

- Built-in filter: EMC filter
- Color: RAL7016

### Common specification

#### General Type

- Type: TOSVERT VFAB series
- Input (AC) voltage: 200V to 240V
- Applicable motor capacity: 0.2, 0.4, 0.75, 1.5, 2.2 kW
- Number of power phases: 1-phase: 1-phase, 3-phase: 3-phase

### Operation panel

- Operation panel: Provided
- Special specification code: ADD, C00

### Additional function I

- None: No filter inside
- Additional function: High-attenuation EMC filter

### Additional function II

- None: Special product
- Additional special function: Y: Special specifications

### Explanation of the type-form

The type-form is composed of the model name (TOSVERT VFAB), the input voltage range (200V to 240V), the applicable motor capacity (0.2, 0.4, 0.75, 1.5, 2.2 kW), the number of power phases (1-phase: 1-phase, 3-phase: 3-phase), the additional function (None: No filter inside), and the special specification code (ADD: Additional function I, C00: Additional function II).
### Standard connection diagram

**SINK (Negative)**  
(common CC)

**SOURCE (Positive)**  
(common PS4)

*OFF*: Less than DC12V  
*ON*: DC17V or more

-.lib/VS1 to sink side or source side.
- The T3A terminal is not provided for multi-phase models.
- *1*: Only one terminal is used as input terminal.
- *2*: When using the OUT, output terminal is wired to logic mode, output the NO and NC terminal. When using the NO terminal, output the NO and NC terminal.
- *3*: The TO terminal is used as logic input terminal. Setting the parameter F.1.9 = 0, the terminal is used as the default logic input terminal.
- *4*: When the NO terminal is used as logic input terminal, set the parameter F.1.9 = 0.
- *5*: To supply control power from an external power supply for backing up the control power supplies. Set the parameter F.2.4 = 0 for this setting.
- *6*: When STO terminal is used as compliance with safety standards, refer to instruction manual.

### Power circuit terminal functions

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<thead>
<tr>
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<tr>
<td>R/L1,S/L2,T/L3</td>
<td>500V class: Three-phase 380 to 500V-50/60Hz</td>
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<tr>
<td>U/T1,N/T2,W/H1</td>
<td>300V class: Three-phase 380 to 500V-50/60Hz</td>
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<td>+SU</td>
<td>Control power 24Vdc-5mA or less.</td>
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<tr>
<td>R</td>
<td>500V class: Three-phase 380 to 500V-50/60Hz</td>
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<td>RC</td>
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<td>S1</td>
<td>24Vdc-5mA or less.</td>
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<td>500V class: Three-phase 380 to 500V-50/60Hz</td>
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<td>CC</td>
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### Standard connection diagram

**SINK (Negative)**  
(common CC)

**SOURCE (Positive)**  
(common PS4)

-.lib/VS1 to sink side or source side.
- The T3A terminal is not provided for multi-phase models.
- *1*: Only one terminal is used as input terminal.
- *2*: When using the OUT, output terminal is wired to logic mode, output the NO and NC terminal. When using the NO terminal, output the NO and NC terminal.
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<td>S1</td>
<td>24Vdc-5mA or less.</td>
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**Peripheral devices**

- Power supply
- Molded-case circuit breaker MCCB
- Magnetic contactor MC
- Input AC reactor (AC)
- High-attenuation radio noise reduction filter (1)
- EMC noise reduction filter (Compliant with European standards)
- Zero-phase reactor core-type radio noise reduction filter (2)
- Motor-end surge voltage suppression filter (for 500V modules only)

**Wiring devices**

<table>
<thead>
<tr>
<th>Voltage class</th>
<th>Applicable input (V)</th>
<th>Inverter type</th>
<th>Input current (A)</th>
<th>Moulded-case circuit breaker MCCB</th>
<th>Earth leakage circuit breaker (ELCB) Note3</th>
<th>Magnetic contactor (MC)</th>
<th>Wire size (mm²)</th>
<th>Main-circuit (using 10AWG)</th>
<th>Breaking resistor (using 10AWG)</th>
<th>Grounding cable (using 10AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-phase 240V</td>
<td></td>
<td></td>
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<td>2.2</td>
<td>UWM10-1002R</td>
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<td>1.5</td>
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<td></td>
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<td>7.5</td>
<td>UWM10-2007R</td>
<td>7.5</td>
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<td>15</td>
<td>UWM10-4015R</td>
<td>15</td>
<td>28.0</td>
<td>40</td>
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<td>20</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
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<tr>
<td>3-phase 240V</td>
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<td>2.2</td>
<td>UWM10-1002R</td>
<td>2.2</td>
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**Options**

**Table of add-on communication options**

- CANopen terminal option CAN003Z
- CANopen daisy chain option CAN001Z
- DeviceNet communication option DEV003Z
- PROFIBUS-DP communication option PDP003Z
- Ethernet/IP communication option IP003Z
- USB communication conversion unit USB001Z
- LED extension panel RP8002Z

**USB communication conversion unit**

- Type: USB001Z
  - Inverter unit connection cable Type: CAB0001 (1m)
  - CAB0001 (2m)
  - CAB0001 (5m)
  - USB cable (A Type connection) Use a commercially available USB cable. (Compliant with USB1.1/2.0)
For inverter users

1. When studying how to use our inverters

Notes

- Do not install in any location of high temperature, high humidity, moisture condensation, or corrosive gas (gas that corrode metal or solvents that adversely affect plastic).
- 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.
- Do not connect input power to the output (motor side) terminals (U/T1, V/T2, W/T3).
- When the inverter is connected to another power distribution system, the inverters and motors must be connected to ground securely. In case of grounding for the inverter, make sure that the installation is in an inflammable object, this can result in fire.

2. Selecting the Capacity (model) of the Inverter

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<th>Conditions</th>
<th>Torque Boost</th>
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3. When installing, wiring and operating the inverter

Installation and wiring

- To prevent current leakage, it is recommended to take the following measures.

Power factor improvement capacitors

- Do not install a power factor improvement capacitor on the output side of the inverter. Installing a power factor improvement capacitor may be quite different from the inverter's data sheet.

Install a magnetic contactor (MC) [secondary side]

- When the inverter is connected to another power distribution system, the inverters and motors must be connected to ground securely. In case of grounding for the inverter, make sure that the installation is in an inflammable object, this can result in fire.

Pole-changing motor

- If 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.

Single-phase motor

- All models, noise can be greatly reduced as they have a built-in EMC noise reduction filter on their input side.

4. When changing the motor speed

Application to special motors

Gear motor

- All models, noise can be greatly reduced as they have a built-in EMC noise reduction filter on their input side.
To users of our inverters:  Our inverters are designed to control the speeds of three-phase induction motors for general industry.

⚠️ Precautions

- Read the instruction manual before installing or operating the inverter unit and store it in a safe place for reference.
- When using our inverters for equipment such as nuclear power control, aviation and space flight control, traffic, and safety, and there is a risk that any failure or malfunction of the inverter could directly endanger human life or cause injury, please contact our headquarter as below. Special precautions must be taken and such applications must be studied carefully.
- When using our inverters for critical equipment, even though the inverters are manufactured under strict quality control always fit your equipment with safety devices to prevent serious accident or loss should the inverter fail (such as issuing an inverter failure signal).
- Do not use our inverters 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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