Safety precautions

⚠ Caution

- Please read the instruction manual carefully in advance and use the product correctly.
- This inverter is not designed or manufactured for use in equipment or systems that could endanger human life.
- Do not use this inverter for special applications such as passenger vehicles, medical equipment, aerospace equipment, nuclear control equipment, submarine relay equipment, or systems.
- This inverter is manufactured under strict quality control, However, safety devices must also be installed to prevent serious accidents in case it is applied to important equipment that could endanger human life or that is expected to cause significant losses or damages, if the inverter fails.
- When using the VF100 for loads other than three-phase AC motors, please consult with our company.
- This inverter requires electrical work to be installed. Electrical work must be performed by a qualified professional.

[Manufacturing and Sales]

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IKE076A-A25-12 PAZ

Our Heart and Technology for the Future

VF100

TOYO INTELLIGENT INVERTER

TOYO INTELLIGENT INVERTER VF100 2.2kW~7.5kW

Industrial System & Electrical Equipment

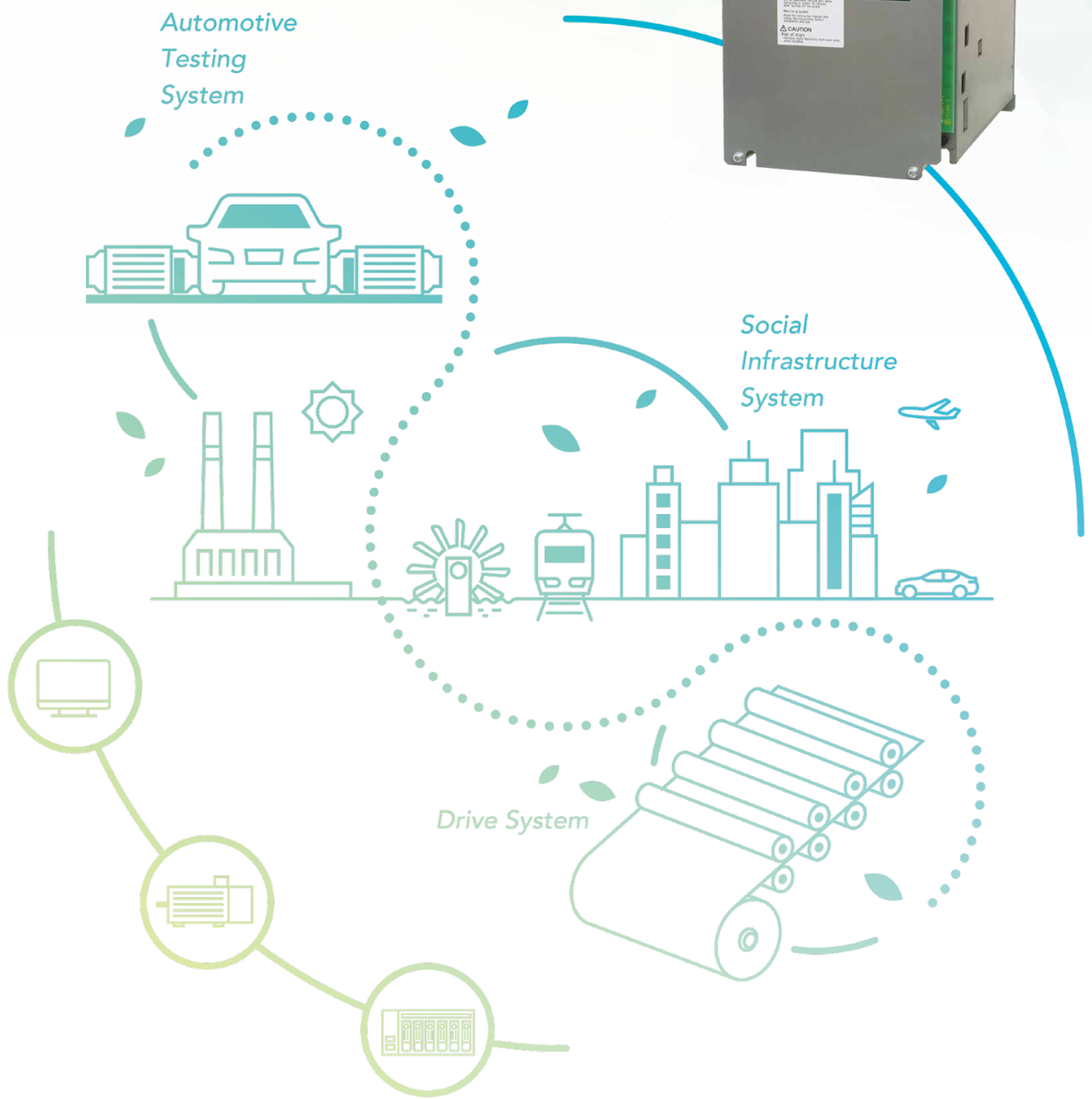
To realize an environmentally friendly society,
we deliver technology and excitement to our customers
& users by high-precision, high-response,
and high-efficiency power electronics.

Toyo Denki Seizo contributes to customers & users all over the world through;
- General industrial machines & equipment
- Testing machines for automobile development
- Social & industrial infrastructure equipment that is essential to people's daily lives.

We provide products like energy-saving motors, inverters and FA controllers,
and integrate advanced systems with them and networks.

We are also committed to manufacturing that contributes to an environmentally friendly society.

TOYO INTELLIGENT INVERTER
VF100

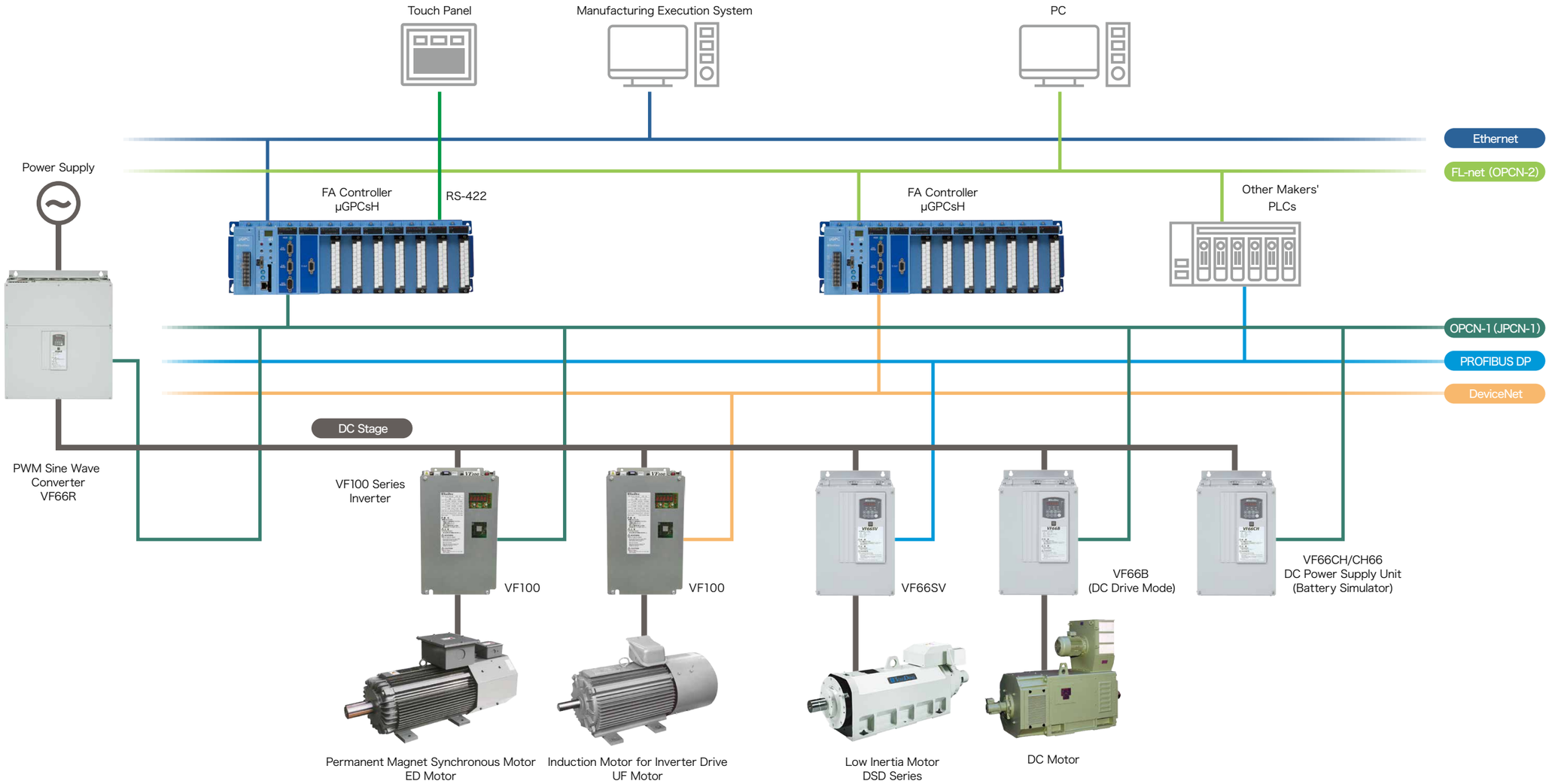


INDEX

TNS — Toyo Network System —

TNS builds flexible and optimal network systems for each layer.

TNS supports many kinds of open networks, like Ethernet, Profibus DP, DeviceNet, etc. and maximizes its capabilities through combinations of products tailored to various network layers.

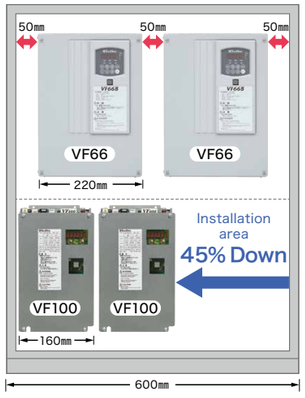


1

Features and functions

For downsizing design of equipment and cubicle panel

By structural design based on the premise of being installed inside a cubicle panel and eliminating the need for cooling space on the left and right sides of the VF100 series inverter, we have reduced the installation space by more than 40% compared to our conventional products (VF66 series)(2.2kW and 3.7kW models have been reduced by more than 20%). In addition, we offer two ratings (ND: Standard Load, LD: Light Load) specifications are available, allowing users to select an inverter tailored to specific applications.



Reduced maintenance costs

By adopting long-life components and parts, the expected service life has been extended compared to our previous product (VF66 series).
As a result, the maintenance cycle can also be extended and maintenance costs can be reduced.
Specified at an ambient temperature of 40°C, load factor (ND specification) 100%/ (LD specification) 80%, and 24 hours of operation per day.
Additionally, the cooling fan is unitized for easy replacement.

Cooling fan: 10 years　Main circuit capacitor: 10 years

Enhanced environmental resistance

SGMCC (highly corrosion-resistant plated steel sheet) is used for the sheet metal of the inverter main body, which offers superior corrosion resistance.

Equipped with five modes to support a wide range of applications

The VF100 inverter, which incorporates our motor drive technology, can drive induction motors and permanent magnet synchronous motors (hereinafter called "ED motor"), making it suitable for a wide range of applications.

Control mode	Induction motor			ED motor	
	V/f control	Speed sensor less vector control	Vector control with speed sensor	Position and speed sensor less vector control	Vector control with position and speed sensor
Starting torque(*1)	—	200%	200%	150%	200%
Speed control range	—	1 : 150	1 : 1000	1 : 100	1 : 1000

* 1 : The above applies when using our company's dedicated motor.

Application examples

Control method	Application	Application example
V/f control	Suitable for applications requiring variable speed control of general-purpose induction motors.	Fans, pumps, compressors, conveyors, mixers, etc.
Sensor less vector control	Suitable for applications requiring high torque or speed control with higher accuracy than V/f control.	Extruders for rubber, resin, etc., paper machine line control, printing machines, etc. (Not suitable for some applications involving long periods of low-speed operation or regenerative operation at low speeds.)
Sensor-based vector control	Suitable for applications requiring high torque and high-precision speed control.	Film, metal winding machines, printing machines, cranes, etc.

Auto-tuning as a standard

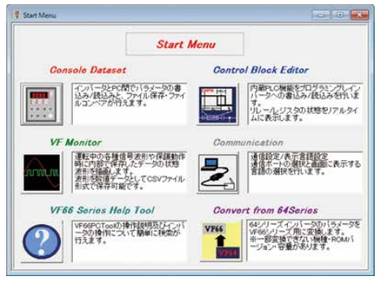
The inverter measures parameters such as motor resistance and inductance and automatically sets the parameters inside using the automatic tuning function.
Each control mode, V/f control, induction motor vector control, and ED motor vector control enable optimal operation.

Can be switched between two control modes or motors

Up to two control methods and motor types can be set. By setting the control method and motor parameters in advance, you can switch between two modes (control method or motor) simply by inputting an external signal to the inverter. However, when switching between two motors, it is necessary to switch the wiring to the motor using a contactor or similar device.

Design and adjustment tools support your work

Using the VF66 PC Tool (shared with the VF66 series), you can just connect the inverter to a PC with a dedicated cable to provide powerful support from inverter installation adjustments to maintenance.

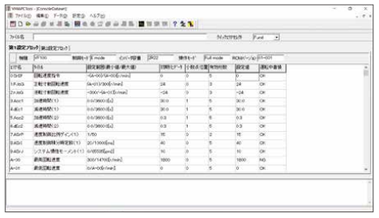


VF66 PC Tool Menu Screen

- Console data set function
- Monitor function
- Control block editor function (Built-in PLC programming tool)
- Help function
- Communication mode setting and language selection function (VF66 PC Tool is optional)

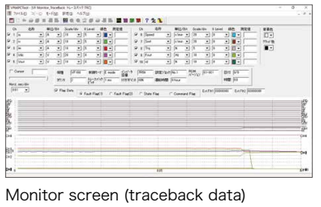
Console data set function

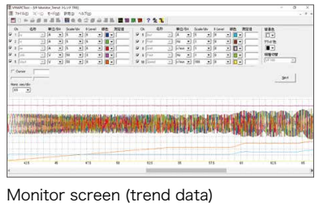
The console data set function allows you to read out the inverter setting data into a PC. The read-out setting data can be copied to the inverter from which it was read out or to another inverter. In addition, the setting data can be recorded and stored on a PC for each model, making maintenance easy.

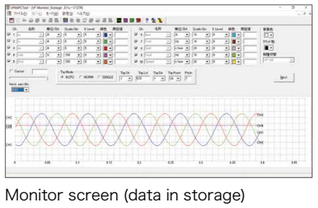

Console Dataset Screen

Monitor function

VF100 has a traceback function that reads out information such as operating status, voltage, and current stored during protective operation and displays it on a PC. It also has a trend and storage function that displays logic information such as operating commands and data such as output voltage and current in real time.


Monitor screen (traceback data)


Monitor screen (trend data)


Monitor screen (data in storage)

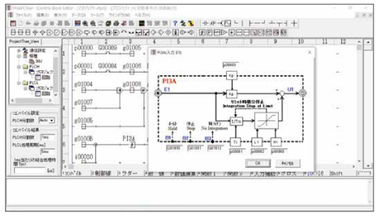
Customization functions tailored to your system

The VF100's built-in PLC (Programmable Logic Controller) function allows you to customize the inverter's motor control and sequence functions to provide an inverter that is optimized for your system. (VF66 PC Tool is required to use the built-in PLC function.)

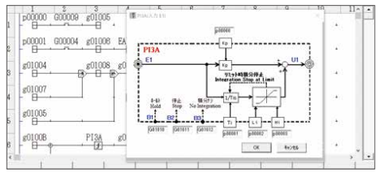
*The built-in PLC function allows users to program control blocks and sequence functions related to motor control and incorporate them into the inverter, enabling optimal control for various applications.

Control block Editor (built-in PLC programming tool)

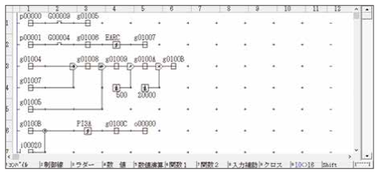
To apply the built-in PLC function, program it using the control block editor in VF66 PC Tool and embed it in the inverter. Programming can be easily performed by arranging, editing, and connecting on a PC screen, just like a general-purpose PLC.



Control block and sequence function programming screen



Control block setting screen



Built-in PLC function circuit editing screen

Energy-saving effects when using ED motors

The use of high-efficiency ED motors enables energy savings, and the longer the usage time and the larger the capacity, the greater the reduction in running costs and greenhouse gas emissions.
The reduction in running costs and greenhouse gas emissions can be calculated using the following formula. Please contact us for information on the losses of our motors and inverters.

Running cost reduction effect (*1)

Electricity rate [yen/kWh] × ($P_{loss2} - P_{loss1}$) [kW] × Operating hours [h] × Operating days [days]

Greenhouse gas reduction effect (*2)

Emission factor [t-CO_2/kWh] × ($P_{loss2} - P_{loss1}$) [kW] × Operating hours [h] × Operating days [days]

Total losses of motors and inverters in use [kW] : $P_{loss1} = P_{M\_loss1} + P_{INV\_loss1}$
Losses in the motor you are using [kW] : P_{M_loss1}
Losses in the inverter you are using [kW] : P_{INV_loss1}

Total losses of our motors and inverters [kW] : $P_{loss2} = P_{M\_loss2} + P_{INV\_loss2}$
Losses in our motors [kW] : P_{M_loss2}
Losses in our inverters [kW] : P_{INV_loss2}

* 1: Basic charges and fuel adjustment charges are not included in the running cost reduction effect.
* 2: Use one of the following for emission factors.
  - In case of receiving the electricity from an electric power company: Emission factors for each electric power company.
  - In case of receiving the electricity from a source other than an electric power company: Appropriate factors based on actual measurements, etc.
  - Other than the above (when calculation is not possible, etc.): Factors published by the government or official agency/organization.

2

Models list

200V class

Inverter model			2R22	3R72	5R52	7R52
Applicable motor capacity [kW]		ND	2.2	3.7	5.5	7.5
		LD	3.7	5.5	7.5	11
Rated output current [A]		ND	10.0	17.0	24.0	32.5
		LD	17.0	24.0	32.5	46.0
Maximum output voltage [V]			200 to 220V (depends on input voltage)			
Rated input AC voltage/frequency			Three-phase, 200 to 220 V ±10%, 50/60 Hz ±5%			
Input power factor			Delay approx. 0.7 (approx. 0.9 when connected to DCL)			
Input capacity [kVA]	Without DCL	ND	4.5	7.4	11.0	14.5
		LD	7.4	11.0	14.5	21.3
	With DCL	ND	3.3	5.2	8.2	10.4
		LD	5.2	8.2	10.4	15.0
Rated input current [A]	Without DCL	ND	12.9	21.1	31.8	41.8
	With DCL	ND	9.3	15.0	23.5	29.9
		LD	15.0	23.5	29.9	43.3
DCL (*1)		ND	DCL3R722	DCL3R722	DCL7R522	DCL7R522
		LD	DCL3R722	DCL7R522	DCL7R522	DCL1122
Cooling method			Forced air cooling			
Weight [kg]			9.0	9.0	9.0	9.0

400V class

Inverter model			2R24	3R74	5R54	7R54
Applicable motor capacity [kW]		ND	2.2	3.7	5.5	7.5
		LD	3.7	5.5	7.5	11
Rated output current [A]		ND	5.5	9.2	13.0	17.0
		LD	9.2	13.0	17.0	24.0
Maximum output voltage [V]			380 to 460V (depends on input voltage)			
Rated input AC voltage/frequency			Three-phase, 380 to 460 V ±10%, 50/60 Hz ±5%			
Input power factor			Delay approx. 0.7 (approx. 0.9 when connected to DCL)			
Input capacity [kVA]	Without DCL	ND	4.0	7.5	10.9	15.0
		LD	7.5	10.9	15.0	21.3
	With DCL	ND	2.8	5.3	7.8	10.8
		LD	5.3	7.8	10.8	15.7
Rated input current [A]	Without DCL	ND	5.7	10.9	15.7	21.7
	With DCL	ND	4.1	7.6	11.2	15.5
		LD	7.6	11.2	15.5	22.7
DCL (*1)		ND	DCL3R744	DCL3R744	DCL7R544	DCL7R544
		LD	DCL3R744	DCL7R544	DCL7R544	DCL1544
Cooling method			Forced air cooling			
Weight [kg]			9.0	9.0	9.0	9.0

* 1: DCL is optional. However, it is required when used with LD specifications.

3

Common specifications

Rated input AC voltage/frequency	200V class	Three-phase, 200 to 220 V ±10%, 50/60 Hz ±5%				
	400V class	Three-phase, 380 to 460 V ±10%, 50/60 Hz ±5%				
Overload current rating		ND mode: 150% (60 seconds), 200% (3 seconds) LD mode: 110% (60 seconds)				
Control specifications	Control method		Induction motor			ED motor	
		V/f control	Speed sensorless vector control	Vector control with speed sensor	Position and speed sensorless vector control (*)	Vector control with position and speed sensor
	Output frequency range	0.1 to 400.0Hz				
	Starting torque (cold temperature, when using our motors)	—	200%	200%	150%	200%
	Speed control range (When using our motors)	—	1 : 150	1 : 1000	1 : 100	1 : 1000
	Torque limit	Power/regeneration range: 0 to 150%	Forward power/ forward regeneration/ reverse power / reverse regeneration Range: 0 to 200% each			
	Torque control	Not available	Available			
	PWM carrier frequency ND	1 to 6kHz				
	PWM carrier frequency LD	1 to 3kHz			—	
	Acceleration and deceleration time	0.1 to 3600.0 seconds (0.1-second increments)				
	Other driving functions	Inching, S-curve acceleration/deceleration, speed/frequency jump, drooping control, regenerative stall prevention, instantaneous power failure restart, DC brake, rotation direction switch, auto tuning, protection retry, cooling fan “ON”/“OFF” function , cumulative operating time timer. V/f control only: Torque boost, stabilizer, V/f characteristics (V/f constant, square reduction, step)Induction motor vector control only: Initial excitation				
Input signal	Analog input	・Number of inputs: Standard 1 channel, optional maximum 2 channels, but standard 1 channel and optional 1 channel are 4 to 20 mA current input possible ・0 to +10 V (unipolar) voltage input, 0 to ±10 V (bipolar) voltage input, 4 to 20 mA current input				
	Digital input (optional)	ProfiBus、OPCN-1、RS-485 (Modbus RTU)				
	Rotational speed /Frequency command	・0 to +10V (single polarity) voltage input or ±10V (maximum rotation speed/10V, maximum frequency/10V) ・4 to 20mA (maximum rotation speed/20mA, maximum frequency/20mA) ・±20000 digits when using communication options (maximum rotation speed/20000 digits, maximum frequency/20000 digits)				
	Torque command	0 to ±10V (bipolar) voltage input (150%/–10V)±10000 digits (150%/7500 digits) when using communication options				
	Terminal block input	Switchable between sink mode and source mode				
	Fixed function terminal	1 Contact: Forward rotation command				
	Functional terminal	・Number of inputs: Standard 5 points, optional 6 points ・Input items: Preset frequency command/rotational speed (7 points), acceleration/deceleration time selection (4 types), acceleration/deceleration operation by contact, rotational speed/frequency hold, S-curve acceleration/deceleration prohibition, maximum rotational speed/ maximum frequency reduction, drooping control inoperative, torque control selection, reverse operation command, DC brake command, initial excitation command, external fault signal (4 contacts), traceback external trigger, second setting block selection, emergency stop (B contact), frequency command/rotational speed terminal block,, initial excitation command, external fault signal (4 contacts), traceback external trigger, second setting block selection, emergency stop (B contact), frequency command/rotation speed terminal selection, reverse operation command, forward jog command, reverse jog command, emergency stop (A contact), protection reset				

Output signal	Output for rotation speed /frequency meter	PWM pulses at 6 times the rotation speed/output frequency Analog meter can be connected. However, simultaneous use with standard analog monitor output is not available.
	Analog monitor output	・Output number: Standard 1ch, optional 2ch, but optional 1ch is capable of 4 to 20mA current output. ・0 to ±10V (bipolar) voltage output, 4 to 20mA current output. ・Output items: Output voltage, output current, output torque, rotation speed/ output frequency, rotation speed command/frequency comm and, built-in PLC output, etc.
	Functional terminal	・Number of outputs: Standard 2 points, optional 2 points Open collector output ・Output items: Rotational speed/frequency detection (2 points), setting reached, torque detection (2 points with polarity and absolute value), power failure, overload protection pre-alarm, retry in progress, reverse in progress, protection operation code, in operation, timer remaining time 1 elapsed, timer remaining time 2 elapsed, second setting block selection in progress
Built-in PLC function	Program capacity	16 kB, approx. 1024 steps However, a PC tool (VF66 PC Tool) is required to edit the built-in PLC functions.
	Sequence	・Input: Standard 5 points, optional 6 points, communication input from upper CPU (optional) ・Output: Open collector (standard 2 points, optional 2 points), contact output (1a, 1c), communication output to upper CPU (optional) ・Internal relay types: Input relay, output relay, on-timer relay, off-timer relay, etc. ・Commands: A contact, B contact, C contact ・Functions: Polarity reversal, addition, subtraction, multiplication, division, remainder, etc. (approximately 30 types)
	Function (control block)	Approximately 15 types, including PI amplifiers and speed control
Monitor display items		Output frequency, rotation speed, frequency/rotation speed command, output current, output torque, DC voltage, input/output terminal check, protection history, etc.
Protective function		Overcurrent, DC overvoltage, undervoltage, overspeed/over frequency, over torque, unit overheating, motor overheating, charging resistor overheating, overload, IGBT protection operation, memory abnormality, current sensor abnormality, start-up congestion, communication timeout error, speed control error, etc.
Personal computer tool		Console Dataset (parameter settings), Control Block Editor (built-in PLC editing), VF Monitor (operation and protection monitoring)
Environmental conditions		Operating temperature: -10 to 50℃ Humidity: 20 to 90% RH (no freezing or condensation) Altitude: 1000 m or less storage Temperature: -20 to 70℃ Atmosphere: No corrosive gases, metal powders, oils, halogens, or DOP (phthalate ester) plasticizers Vibration: 5.9 m/s² (0.6 G or less, 10 to 55 Hz), compliant with JIS C60068-2-6 Environment meeting the overvoltage category III and pollution degree 2 or less specified in IEC 60664-1
Protective structure		IP00 (JIS C 0920): Open structure that does not specifically consider protection for the human body, protection against the intrusion of solid objects, or protection against water intrusion.

* : In the case of ED motor position/speed sensor less vector control, sufficient torque may not be obtained during regeneration.

4

Function upgrade option (shared with VF66 series)

	Name	Model	Application	Remarks
Function upgrade option	External console	SET66EX-Z	Parameter settings and recording options	
	Extension cable	CBL64- □	Connect the inverter main body and external console, three lengths: 1 m, 3 m, and 5 m	
	Console mounting bracket	–	Fittings used to attach SET66EX-Z to control panel doors	
	PC tool connection cable	USBIF66	USB cable to connect to a computer	
	Insulated input/output option	IO66-Z	Analog isolated input/output 2ch/2ch Multifunction input/output 6ch/2ch PG (complementary input) circuit	Replace with PG66-Z printed circuit board and install (*2)
	Resolver Input options	RESO66-Z	Position and speed detection options (resolver (*1))	1 Select a model and mount it on print boards such as VFC66-Z and PG66-Z
	Line driver input method PG option	PLIN66-Z	Position and speed detection options (line driver)	
	Temperature detection option for motors with built-in PT100ohm	TVPT66-Z	Motor temperature detection option	1 Select a model and install it on the PG66-Z print board
	Temperature detection option for motors with built-in thermistors	TVTH66-Z	Motor temperature detection option	
Network (*3)	OPCN-1 (JPCN-1)	OPCN66-Z	OPCN-1 compliant class Compliant with TYPE-S521	Select one type, replace the printed circuit board PG66-Z, and install (*2)
	RS422/485、RS232C、Modbus RTU	ASYC66-Z	Step-synchronous serial communication function	
	PROFIBUS	PBUS66-Z	PROFIBUS communication	

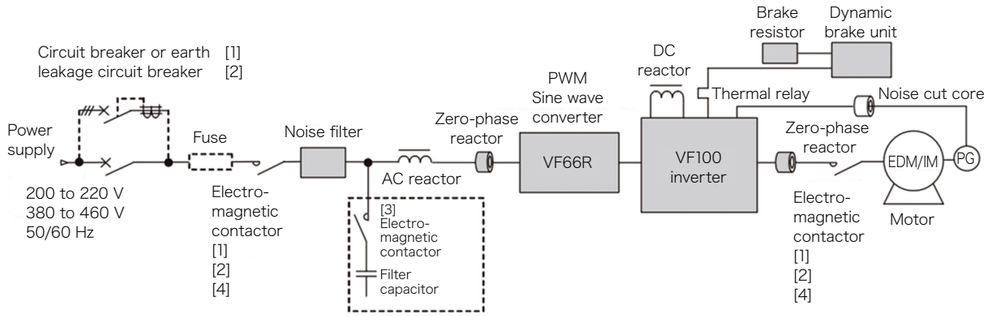
* 1: Compatible with resolvers used in our company's dedicated motors.
* 2: PG66-Z printed circuit board is installed as standard, so please remove PG66-Z before installation.
* 3: Please contact our company for information on compatibility with CC-Link, Device-Net, and Ether net IP.

Optional input/output

Type	Multifunctional input	Multifunctional output	Analog input	Analog output	PG input
IO66-Z	6	2	2	2	1
OPCN66-Z	6	2	1	1	1
ASYC66-Z	6	2	1	1	1
PBUS66-Z	6	–	1	1	1

5

Peripheral options



	Name	Application	Remarks
Peripheral devices (*)	DC reactor (DCL)	Apply when improving input power factor.	
	AC reactor (ACL)	Apply when improving input power factor and suppressing distorted waveforms.	For input side connection
	Noise filter	Apply when reducing electromagnetic noise emitted from inverters.	For input side connection
	PWM sine wave converter	Apply when significant improvement in power regeneration braking, power supply harmonics, and power factor is required. When using a PWM sine wave converter, it is necessary to install an AC reactor for the converter. Various capacities are available, so please contact us for details.	Applicable to inverter input side
	Dynamic brake unit /brake resistor /thermal relay	Use when motor braking force is required. When using, combine with a dynamic brake unit, brake resistor, and thermal relay. (Units rated at 7.5 kW or less have a dynamic braking function built into the inverter unit.)	

* Please contact us for information on selecting and installing peripheral equipment.

[1]: Refer to the VF100 inverter instruction manual for information on selecting circuit breakers for wiring, input-side and output-side electromagnetic contactors, and wiring sizes.

[2]: Use an earth leakage circuit breaker applicable to the inverter unit.

[3]: Filter capacitors and electromagnetic contactors are required when using a PWM sine wave converter (VF66R). The electromagnetic contactor should be used to turn ON during PWM sine wave converter operation and OFF during shutdown.

[4]: Input-side and output-side electromagnetic contactors should be used according to application requirements. ED motors generate voltage even when the inverter is stopped because they have built-in permanent magnets. When using the constant output (power constant) range or when the motor is driven by other power sources, use an electromagnetic contactor on the output side too for safety. In this case, set the electromagnetic contactor on the output side to operate with the operating contact (52MA) in the inverter unit.

6

Compliance with guidelines for higher harmonic suppression measures

This product is subject to the “Guidelines for Higher Harmonic Suppression Measures for Consumers Receiving High Voltage or Extra High Voltage” (hereinafter referred to as “Guidelines”)as a higher harmonic-generating device [1]. If harmonic suppression is required based on the “Guidelines,” please implement appropriate harmonic suppression measures.

The circuit classification, type, and conversion factor of this product are as shown in the table below. Please use this information when determining compliance with the “Guidelines.”

Circuit classification	Circuit type		Conversion factor KI
3	Three-phase bridge (capacitor smoothing)	6 Pulse converter without reactor	K31=3.4
		6 Pulse converter with reactor (AC side)	K32=1.8
		6 Pulse converter with reactor (DC side)	K33=1.8
		6 Pulse converter with reactor (AC/DC side)	K34=1.4

[1]: Machines and devices equipped with inverters are not subject to this requirement if the input current per phase is 20A or less.

7

Product warranty

1) Free warranty period

The free warranty period is “one year from the date of delivery”, or “18 months from the date of shipment from our factory or storage warehouse”, whichever comes first. If repairs, overhauls, or other maintenance are performed by our company or a company designated by our company after the free warranty period has expired, the warranty shall cover only the repaired or replaced parts for one year after inspection or acceptance.

2) Scope of warranty

(1) Fault Diagnosis

Initial diagnosis of faults shall, in principle, be carried out by customers. However, upon requests from customers, our company or our service network may perform these tasks on behalf. Please note that if the cause of the fault is not attributable to our company, the fee shall be charged on customers.

(2) Fault Repair

Repairs, replacement of defective products, and on-site service calls in response to a fault will be provided free of charge. However, the following cases shall be subject to a fee:

① Cases caused by improper handling, conditions, environment, or usage methods by customers or users.

② Cases caused by design content or other factors related to customers or users.

③ Cases caused by defects in programs made by customers or users.

④ When the cause of the malfunction is due to reasons other than the delivered product.

⑤ When the malfunction is caused by modifications made to our products without our approval.

⑥ When the malfunction is caused by repairs or modifications performed by parties other than our company or our designated companies.

⑦ When the malfunction is caused by force majeure such as natural disasters, fires, or other disasters.

⑧ When the malfunction is caused by reasons beyond our company's control.

⑨ When the free warranty period has expired.

3) Disclaimer

Regardless of whether it is within or outside the free warranty period, we shall not be liable for any damages caused by reasons grounds not attributable to our control, opportunity loss at customers and users due to malfunction of our products, lost profits, secondary damages, accident compensation, or property damage to products other than our products caused by the failure of our products.

4) Repair period after production discontinuation

We will repair discontinued products for a period of seven years after production discontinuation. However, please note that electronic components have a short life cycle and may become difficult to procure or produce. Therefore, repairs may not be possible even within the repair period.

5) Delivery conditions

For standard products without orders for commissioning or on-site adjustment, delivery shall be made upon delivery to the nominated places by customers, and commissioning and adjustment work at the site shall be outside the scope of our responsibilities.