YASKAWA

SUPER ENERGY SAVING MEDIUM VOLTAGE INVERTER
FSDrive-MV1S

3 kV 200 to 3000 kVA
6 kV 400 to 6000 kVA

Reduces CO_2 Emissions and Puts the Brakes on Global Warming!

New Functions

Easy Maintenance

Standard Specifications

Certified for ISO9001 and ISO14001

JQA-0422 JQA-EM0498

Muffles High-Frequency Noise and Harmonics, and Achieves Eco-Friendly Super Energy Savings.

In 1996, Yaskawa introduced Japan's first commercially produced PWM (pulse-width modulation), medium-voltage inverters with multi-outputs connected in series. Building on this pioneering technique, Yaskawa has made even further improvements. The FSDrive-MV1S inverter is the result of Yaskawa's search for an inverter that is both easy to use and offers improved operability and monitoring. By using the FSDrive-MV1S with either general purpose machines or those powered by wind or water, you can dramatically reduce CO_2 emissions to help stop global warming while still maintaining a comfortable environment and optimum operating conditions in industrial fields.

New Functions

The latest technology brings even more stable operation

New functions, such as high-level control, excessive deceleration prevention to avoid overvoltage during deceleration, speed search at momentary power loss, overload operation for quick acceleration in cement mixer drives and similar equipment, V/f control for multiple motor operation and more, make the FSDrive-MV1S even easier to use.

Easy Maintenance

Easy to manage power cell structure, and improved monitoring for reduced down time

Each individual power cell can be removed for maintenance, and the enhanced trace function also simplifies maintenance and monitoring.

Standard Specifications

PWM control with multi-output connected in a series for optimum operation conditions and global conservation

The standard specifications include input waveforms without harmonics, sinusoidal wave voltage, low torque ripple that is good for loads, and high-efficiency operations for greater reliability.

Applications

Wind/Water Force Machines		
Blowers	● Dust blowers ● Boilers IDF	● Incinerators ● Other types of blowers
Pumps	● Descaling pumps ● Roll cooling water pumps ● Sewage pumps	● Schafer pumps ● Rainwater pumps ● Drain pumps

General Industrial Machines (Constant Torque)
Extruders
Mixers
Kilns
Banbury mixers
Power supply facilities

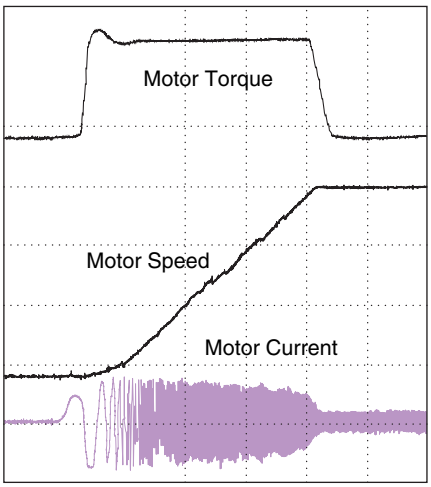
The Latest Technology Brings Even More Stable Operation.

High-level Control

Full-scale flux vector control improves starting torque characteristics and responsiveness to fluctuations in the load, without using a speed detector. Attain stable operation even when there are load fluctuations.

Medium-voltage Three-phase Induction Motor

● Starting Characteristics

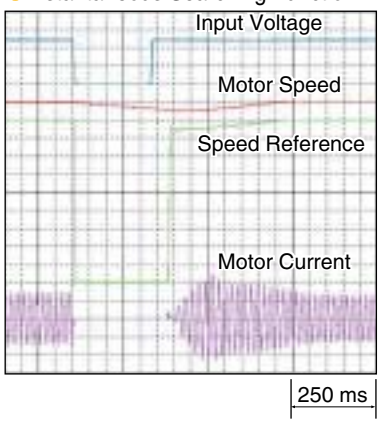


Controlled and Secure Operation at Momentary Power Loss

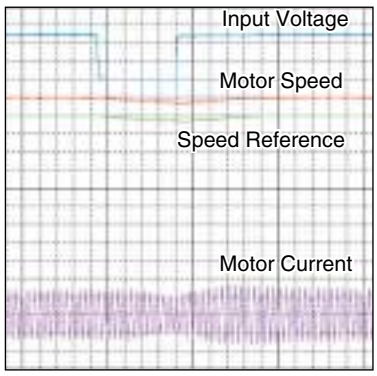
The inverter continues to operate during a momentary power loss of several cycles*1. The inverter re-accelerates to the reference speed almost at the same time as the power is restored to ensure that the drive starts smoothly.

*1 : Holding time depends on the load forms or operation status.

● Instantaneous Searching Function



● KEB Function*2

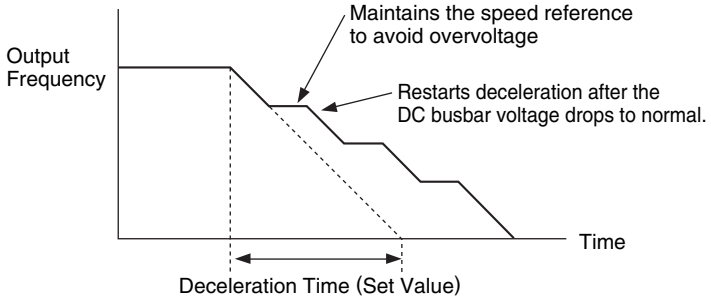


*2 : KEB (Kinetic Energy Back-up) Function: Function to continue operation without base-blocking during momentary power loss.

Stable Deceleration Operation

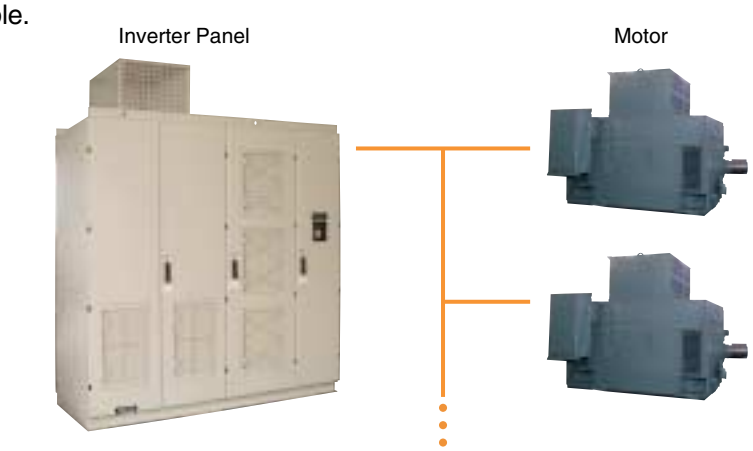
A function to prevent excessive deceleration has been added to avoid overvoltage during deceleration.
When the DC busbar voltage in the cell rises during deceleration in the set time, the inverter stops deceleration. This prevents DC busbar overvoltage from occurring, and enables continuous operation.

● Function to Prevent Excessive Deceleration



Operation Using Multiple Motors

Parallel operation of mutiple motors with one inverter is possible and the scale reduction of the drive equipment is possible.



Note : In multiple motor operation models, each motor requires a protective device.

Enerhy saving Control

High efficiency drive is realized by minimizing the motor current to the required output torque. In this way,outstanding energy saving effect is shown in the drive of fans and pumps to machines for general use.

FSDrive-MV1S Easy Maintenance

Easy to manage power cell structure, and improved monitoring for reduced down time.

Individual Cell Maintenance (140 A or Less)

Each individual cell can be removed for replacement or maintenance. This structure shortens replacement time and simplifies maintenance.

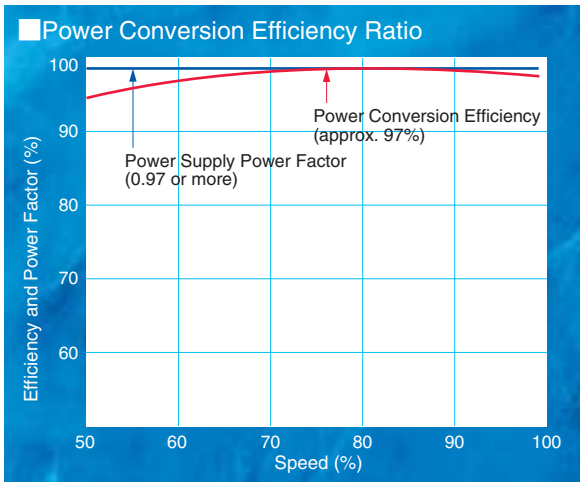
Easy Monitoring of Operation Status

The enhanced trace function and LAN compatibility enable you to easily monitor the operation status for protective maintenance and quick intervention.

The PWM Control with Multi-output Connected in a Series Helps Protect Nature, Power, and the Machine.

The Most Efficient Use of Energy

Since this Inverter is a direct medium-voltage inverter that does not need an output transformer, it can maintain a power conversion efficiency of approx. 97% so as not to waste energy.
Power supply factor is always kept at approx. 0.97.
Since the power factor does not change even if the operation speed changes, no power factor improvement capacitor is needed.



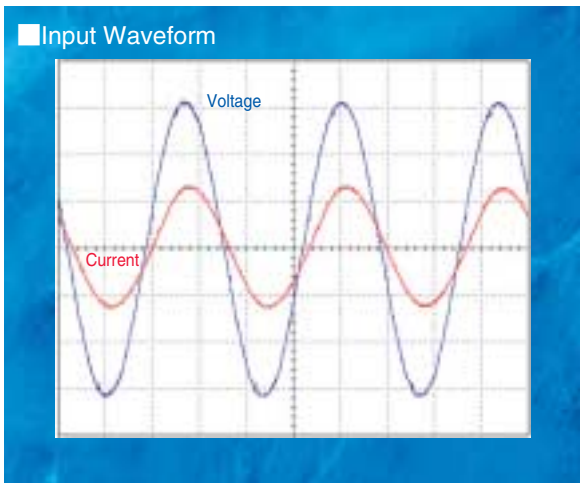
Perfect Harmonics Measure

The input waveform is sinusoidal wave and rarely contains harmonics.
Therefore, the inverter single-unit has cleared the harmonics control guideline specified by the Ministry of Economy, Trade and Industry (former ministry of International Trade and Industry) so that any harmonics filter or active filter is not needed.

Guideline of the Ministry of Economy, Trade and Industry, and measured value of harmonics in input current of FSDrive-MV1S (In case of 3.3 kV, 630 kW, 60 Hz, all-load contract demand 630 kW)

	5th	7th	11th	13th	17th	19th	23rd	25th	29th	31st
Guideline	4.00	2.80	1.80	1.50	1.10	1.00	0.87	0.80	0.80	0.80
FSDrive-MV1S Measured Value	1.07	0.53	0.90	0.49	0.78	0.76	0.06	0.26	0.11	0.07

(Unit : %)

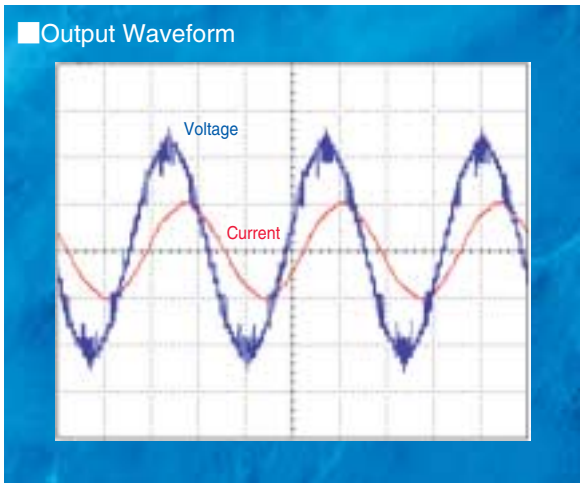


Easy Application to Existing Motors

By employing the multiple PWM control, sinusoidal wave voltage is output to the Inverter without a filter. Therefore; the following features have been achieved:

- Free from oscillation surge voltage affecting the motor
- Low torque ripple good for loads
- Noise as low as commercial power supply operation

The existing motors or wiring cables can be used without being modified.



3-kV class Components

Transformer Section

- Power supply lead-in terminal, output terminal section, and input multi- phase transformer stored.
- Air-cooled, dry-type transformer* employed.

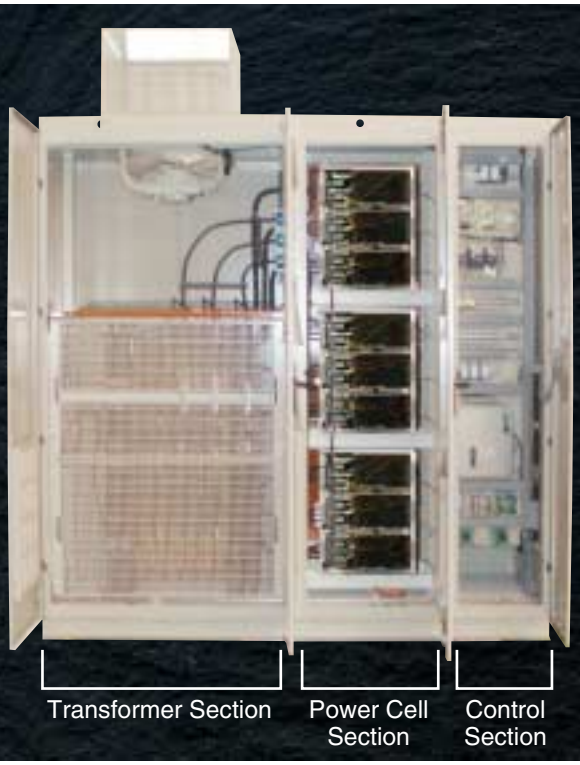
Power Cell Section

- 3 cells connected in series per Inverter output phase.
- Output phase star-connected to output 3 kV class directly.
- Each individual cell can be removed for maintenance.

Control Section

- Control board for multiple PWM control stored.
- Communication with power cells using noise resistant optical communications.

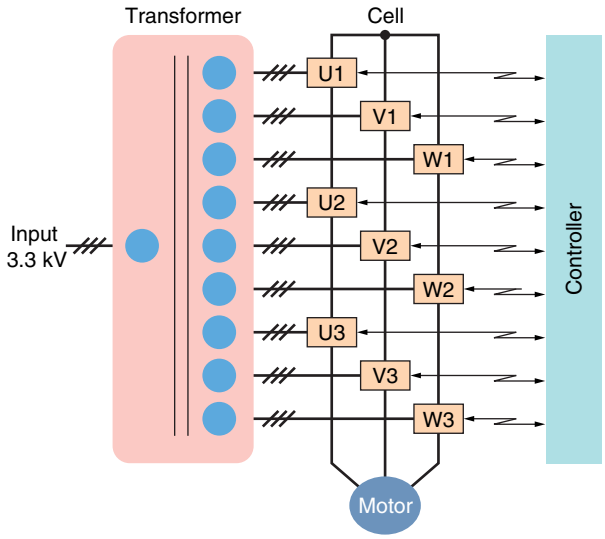
* : Transformer in-rush current flows when the input power supply is turned ON.



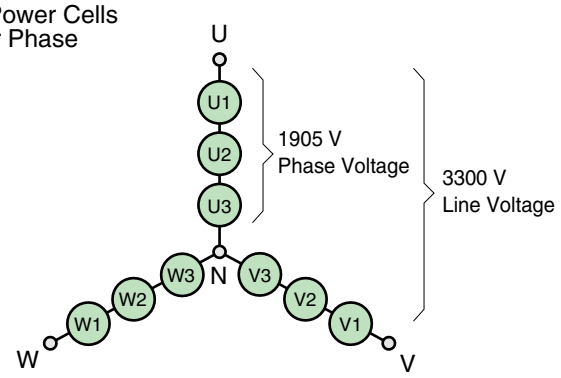
Circuit Configuration

The FSDrive-MV1S employs PWM control with multi-output connected in a series which connects 3 power cells per phase (single-phase inverter).

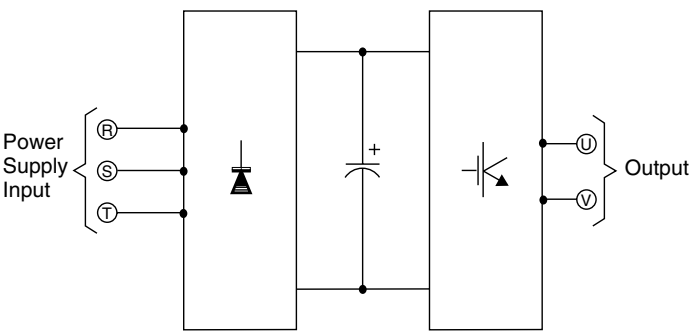
Example of 3 kV



3 Power Cells per Phase



Configuration of One Power Cell



6-kV class Components

Transformer Section

- Power supply lead-in terminal, output terminal section, and input multi- phase transformer stored.
- Air-cooled, dry-type transformer* employed.

Power Cell Section

- 6 cells connected in series per Inverter output phase.
- Output phase star-connected to output 3 kV class directly.
- Each individual cell can be removed for maintenance.

Control Section

- Control board for multiple PWM control stored.
- Communication with power cells using noise resistant optical communications.

* : Transformer in-rush current flows when the input power supply is turned ON.

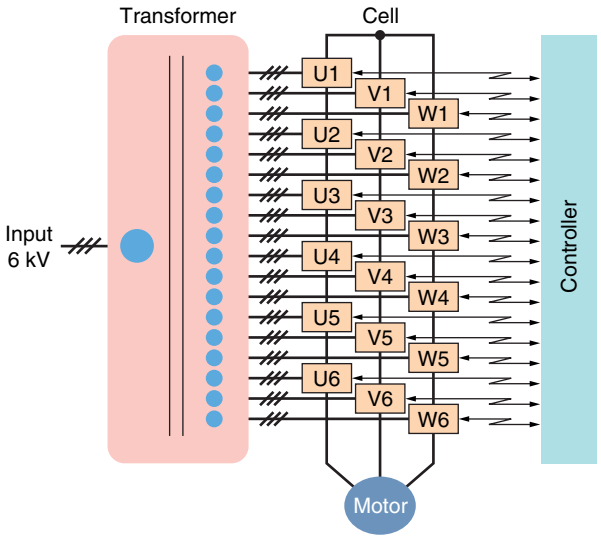
Upper part : Control Section
Lower part : Transformer Section

Power Cell Section

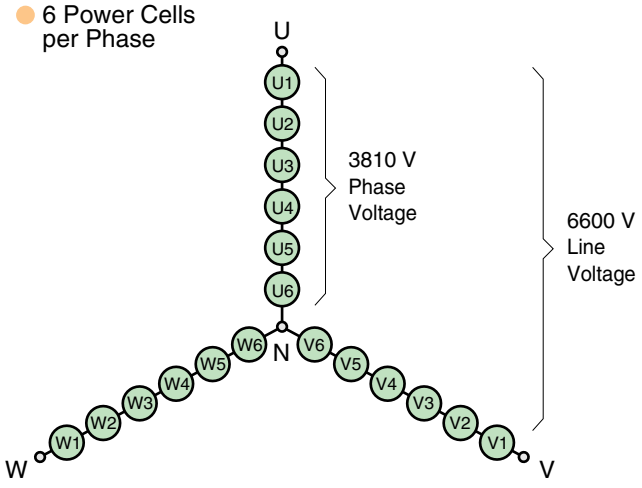
Circuit Configuration

The FSDrive-MV1S employs PWM control with multi-output connected in a series which connects 6 power cells per phase (single-phase inverter).

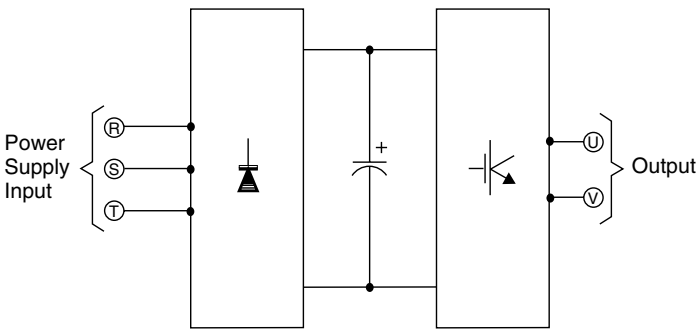
Example of 6 kV



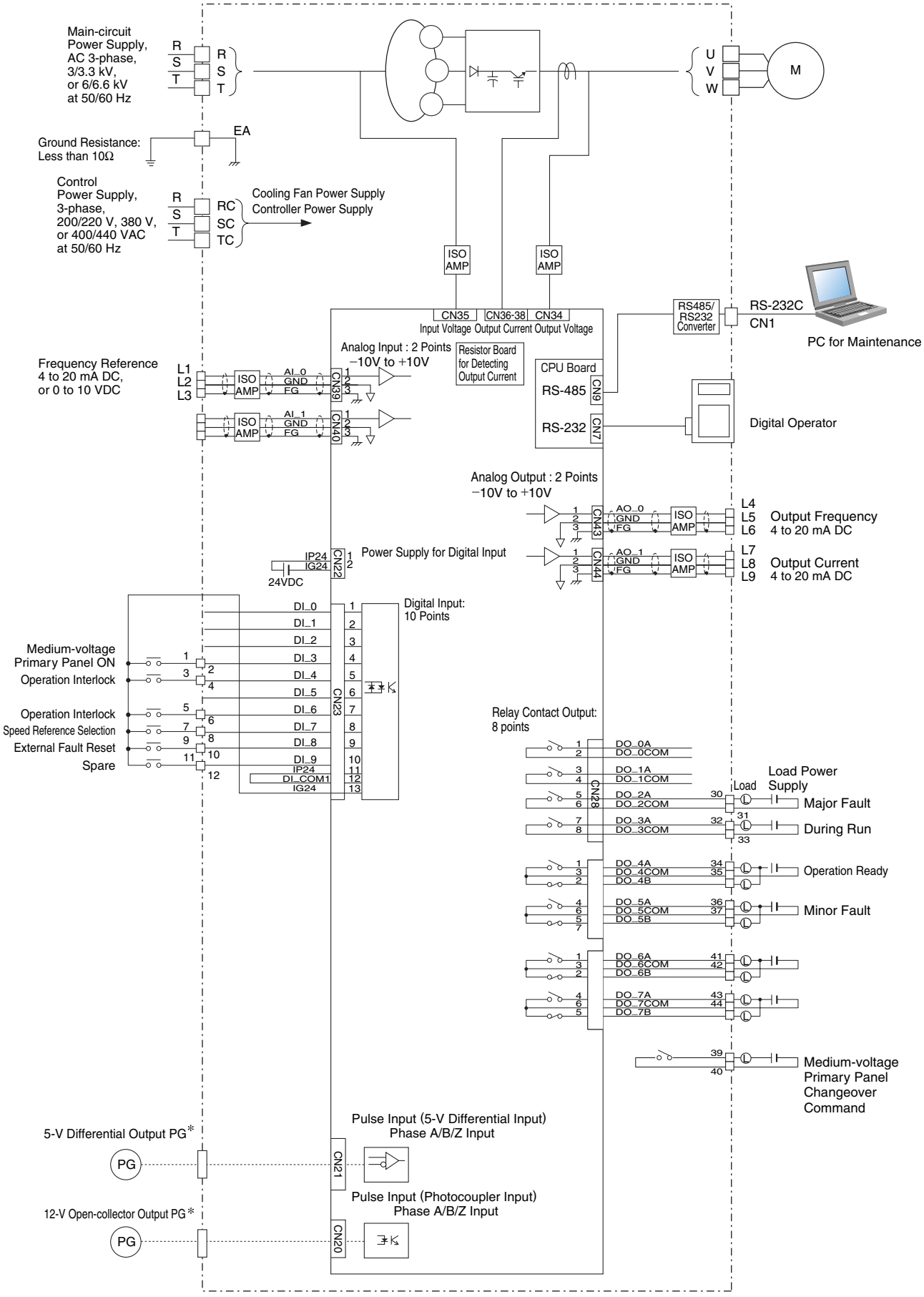
6 Power Cells per Phase



Configuration of One Power Cell



Connections



*: Either one can be selected.

Terminal Functions

Main Circuit (For all models)

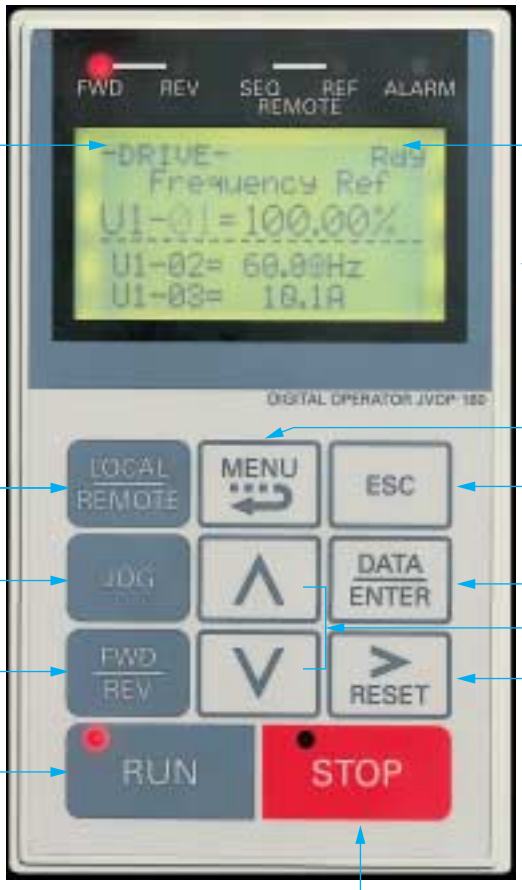
Terminal No.	Application
R	Main-circuit input power supply
S	3/3.3 kV or 6/6.6 kV 50/60 Hz
T	
U	Main-circuit output power supply
V	
W	
EA	Ground resistance: Less than 10Ω
RC	Control power supply
SC	200/220 V, 380 V, 400/440 V 50/60 Hz
TC	

Control Circuit (For all models)

Type	Terminal No.	Signal Name	Function	Signal Level
Input Signal	L1	Frequency reference	4 to 20 mA 0 to 10 VDC	Input impedance:10MΩ Input impedance:1MΩ
	L2			
	L3			
Output Signal	L4	Output frequency	4 to 20 mA	Load resistance : 500Ω or less
	L5			
	L6			
	L7	Output current	4 to 20 mA	Load resistance : 500Ω or less
	L8			
	L9			
Input Signal	1	Medium-voltage primary panel ON	“Closed” at medium-voltage primary panel ON	100/110 VAC circuit
	2			
	3	Operation interlock	ON when operation interlock is enabled.	100/110 VAC circuit
	4			
	5	Operation interlock (Optional)	ON when operation interlocks is enabled.	100/110 VAC circuit
	6			
	7	Speed reference selection (Optional)	ON when speed is specified. OFF with external input command.	100/110 VAC circuit
	8			
	9	External fault reset (Optional)	ON when external fault is reset	100/110 VAC circuit
	10			
	11	Spare	—	100/110 VAC circuit
	12			
Output Signal	30	Inverter major fault	“Closed” at major fault.	Dry-contact Contact capacity: 250 VAC, 1 A
	31			
	32	During run	“Closed” during run.	Dry-contact Contact capacity: 250 VAC, 1 A
	33			
	34	Operation ready	“Closed” at operation ready.	Dry-contact Contact capacity: 250 VAC, 1 A
	35			
	36	Inverter minor fault	“Closed” at minor fault.	Dry-contact Contact capacity: 250 VAC, 1 A
	37			
	39	Medium-voltage primary panel changeover command	Host power-control panel open when contact is “closed”.	Dry-contact Contact capacity: 250 VAC, 1 A
	40			
	41	Spare	—	—
	42			
	43	Spare	—	—
	44			

Digital Operator

Digital Operator Functions



Rotating Direction Display

FWD : LED lights at forward run.
REV : LED lights at reverse run.

Remote Mode

Lights when selecting input mode from the control circuit terminal.
SEQ : LED lights when selecting run command from control circuit terminal.
REF : LED lights when selecting frequency reference from control circuit terminals A1, A2, and A3.

Alarm Display

Mode Display

DRIVE : LED lights at Drive Mode.

QUICK : LED lights at Quick Programming Mode.

ADV : LED lights at Advanced Programming Mode.

A. TUNE : LED lights at Autotuning Mode.

Rdy Display

Can operate when a run command is input.

Operation Mode Selection Key

The operation mode is alternated with REMOTE (control circuit terminal) and LOCAL (digital operator) (When run command and frequency reference are set at control circuit terminal.)

Data Display

Displays data for monitoring, parameters, and set values.
(1 line×13 characters and 3 lines×16 characters)

Menu Key

Changes the display of operation and programming mode.

Escape Key

Returns to the status entered before [DATA/ENTER] key was pressed.

Run Command Keys

Run command keys for use by digital operator. Enabled only in the drive mode.

JOG : Jog run is enabled while depressing this key.
FWD/REV : Selects forward or reverse run. Forward and reverse run is alternated.
RUN* : Red LED lights by depressing RUN.
STOP* : Red LED lights by depressing STOP.

DATA/ENTER Key

Selects mode, group, function or parameter name. Displays each parameter set value while displaying a parameter name. By pressing this key again, the set value is written in.

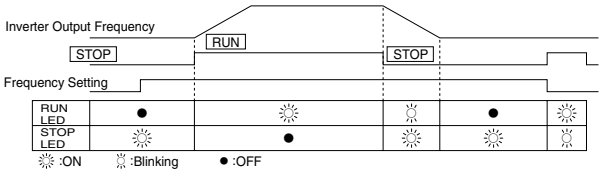
∧ : Increment Key
∨ : Decrement Key

Selects mode, group, function, parameter name or set value.

Shift/Reset Key

Selects a digit of a set value to be changed. The selected digit blinks.
(Resets operation at faults.)

*: RUN or STOP LED turns ON , OFF, or blinks in accordance with each operation.



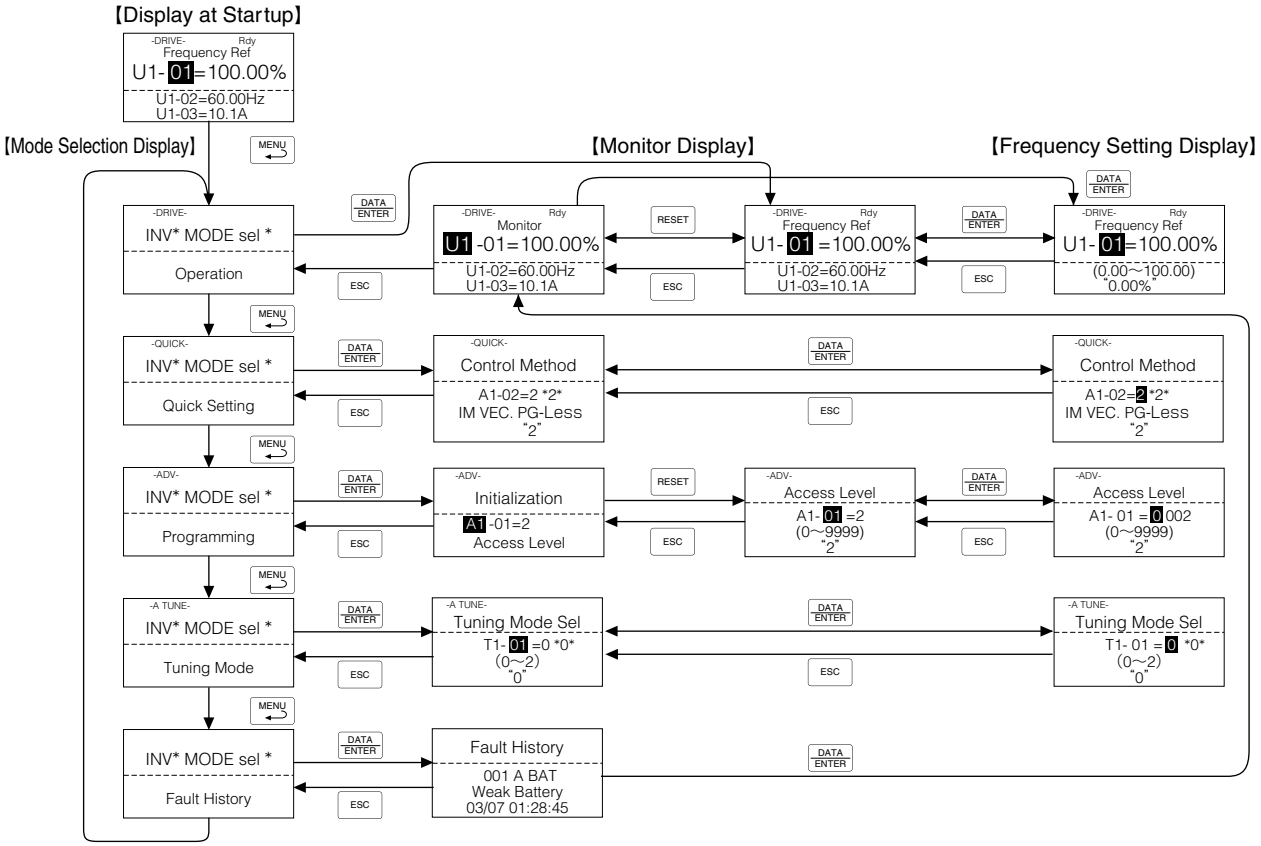
Easy Operation with Digital Operator

Description	Key Operation	Operator Display
①Power ON ・Displays frequency reference value.		-DRIVE- Rdy Frequency Ref U1-01 = 0.00% U1-02= 0.00Hz U1-03= 0.0A
②Operation Condition Setting ・Select LOCAL mode.	LOCAL REMOTE	REMOTE(SEQ.REF)LED ON (d1-01=0.00 %) REMOTE(SEQ.REF)LED OFF FWD LED ON
③Frequency Setting ・Change reference value.	DATA ENTER	-DRIVE- Rdy Frequency Ref U1-01=000.00% (0.00←→100.00) 0.00%
	RESET ∨ ∧	-DRIVE- Rdy Frequency Ref U1-01=025.00% (0.00←→100.00) 0.00%
・Write-in set value.	DATA ENTER	-DRIVE- Rdy Enter Accepted
(cont'd)		-DRIVE- Rdy Frequency Ref U1-01=025.00% (0.00←→100.00) 0.00%

Description	Key Operation	Operator Display
・Select output frequency monitor display.	ESC	-DRIVE- Rdy Frequency Ref U1-01 = 25.00% U1-02= 0.00Hz U1-03= 0.0A
	∧	-DRIVE- Rdy Output Freq U1-02 = 0.00Hz U1-03= 0.0A U1-04= 2
④Forward Run ・Forward Run(15Hz)	RUN	-DRIVE- Rdy Output Freq U1-02 =15.00Hz U1-03= 1.5A U1-04= 2 RUN LED ON
⑤Reverse Run ・Switch to reverse run.	FWD REV	-DRIVE- Rdy Output Freq U1-02 =15.00Hz U1-03= 1.1A U1-04= 2 REV LED ON
⑥Stop ・Decelerates to a stop.	STOP	-DRIVE- Rdy Output Freq U1-02 = 0.00Hz U1-03= 0.0A U1-04= 2 STOP LED ON (RUN LED blinks during deceleration.)

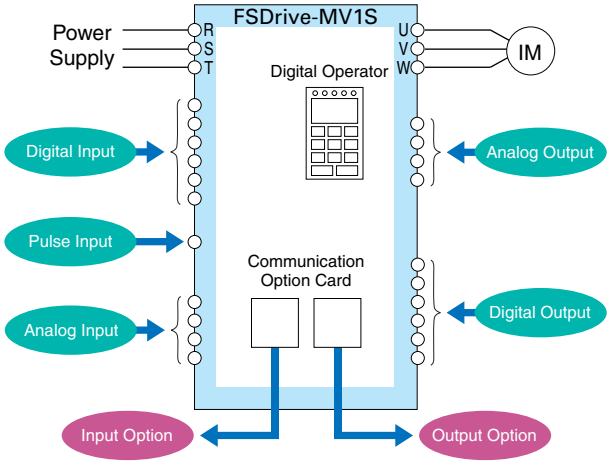
Note: ■ expresses blinking of numbers.

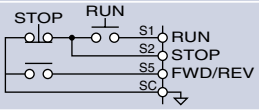
Monitor Display Procedure



Software Functions

The FSDrive-MV1S flexible inverter incorporates a variety of application features. Select special functions from a multitude of possibilities to perfectly match your machine requirements.



Function	Application	Description of Function
Energy Saving Control	Most efficient automatic operation	Supplies voltage to motor to always be most effective according to load and rotating speed.
Speed Search Operation	Starting the free running motor	Starts the inverter at the specified frequency, automatically detects the synchronization point, and performs at the operation frequency. No speed detector is required.
DC Injection Braking at Start	Starting the free running motor	When the direction of the free running motor is not fixed, the speed search operation function is difficult to use. The motor can be automatically stopped by DC injection braking, and be restarted by the inverter.
Commercial Power Source/Inverter Switchover Operation	Automatic switching between commercial power source and inverter	Switching of commercial power source to inverter or vice versa is done without stopping the motor.
Multi-step Speed Operation	Schedule operation under fixed speed and positioning	Multi-step operation (up to 8-step) can be set by setting the contact combinations.
Accel/Decel Time Changeover Operation	The accel/decel time changeover with an external signal	The accel/decel times are switched by an external contact signal.
3-wire Sequence	Simple configuration of control circuit	Operation can be accomplished using a spring-loaded push-button switch. 
Operating Site Selection	Easy operation	Operation and settings can be selected while the inverter is online. (digital operator/external instruction, signal input/output)
Frequency Hold Operation	Easy operation	Temporarily holds frequencies during acceleration or deceleration.
UP/DOWN Command	Easy operation	Sets speed by ON/OFF from a distance.
Torque Limit	Protection of machine, improvement of operation reliability, torque limit	The inverter can be switched to coasting or motor speed reducing mode as soon as it reaches a certain preset torque level. For pump or blower, the operation frequency can be automatically reduced to the load balancing point, according to the overload condition, and prevent overload tripping.
Upper/Lower Frequency Limit Operation	Motor speed limit	The upper and lower limits of the motor speed, reference signal bias and gain can be set independently without peripheral operation units.
Prohibit Setting of Specific Frequency (Frequency Jump Control)	Prevent mechanical vibration in the equipment	The motor simply passes through the preset speed, but continuous running cannot be done at this speed. This function is used to avoid the mechanical resonance point of the equipment.
Run Signal	Zero-speed interlock	"Closed" during operation. "Open" during coasting to a stop. Can be used as interlock contact point during stop.
Zero-speed Signal	Zero-speed interlock	"Closed" when output frequency is under min. frequency.
Frequency (Speed) Agreed Signal	Reference speed reach interlock	The contact closes when inverter output frequency reaches the set value. Can be used as an interlock for lathes, etc.
Overtorque Signal	Protection of machine, improvement of operation reliability	"Closed" when overtorque setting operation is accomplished.
Low Voltage Signal	System protection for undervoltage	"Closed" only when tripped by low voltage. Can be used as a countermeasure power loss detection relay.
Free Unintentional Speed Agreement Signal	Reference speed agreed interlock	"Closed" when the speed agrees at arbitrary frequency reference.
Output Frequency Detection 1	Gear change interlock, etc.	"Closed" at or over an arbitrary output frequency.
Output Frequency Detection 2	Gear change interlock, etc.	"Closed" at or below the arbitrary output frequency.
Base Block Signal	Operation interlock, etc.	Always "closed" when the inverter output is OFF.
Frequency Reference Sudden Change Detection	Improvement of operation reliability	"Closed" when the frequency reference suddenly drops to 10 % or below of the set value. Can be used to detect an error in the host controller.
Multi-function Analog Input Signal	Easy operation	Functions as supplementary frequency reference. Also used for fine control of input reference, output voltage adjustment, external control of accel/decel time, and fine adjustment of overtorque detection level.
Multi-function Analog Output Signal	Monitor function enhancement	Use two of the following devices: a frequency meter, ammeter, voltmeter, wattmeter, or U1 monitor.
V/f control (for multiple motor operation)	Multiple motor control	Simultaneous parallel operation of multiple motors is possible. Single or multiple motor control is selected with the user parameter.
Excessive deceleration prevention	Improvement of operation reliability	When the DC busbar voltage in the cell rises during deceleration, the inverter stops deceleration and maintains the speed. (Disable/enable selection by parameter.)

Protective Functions

If a fault occurs, the type of fault is displayed on the digital operator, and details are stored in the internal memory.

Drive Faults

Fault	Display*		Meaning
Main Circuit Overvoltage	IOV	Over Voltage	The voltage of the power supply for the main circuit exceeded 120% of the rated voltage.
Main Circuit Undervoltage	IUV	Under Voltage	The voltage of the power supply for the main circuit dropped to 55 % of the rated voltage or less.
Control Power Fault	CUV	CTL PS Under Volt	The voltage of the control power dropped.
Inverter Overcurrent	IOC	Over Current	The current from the inverter exceeded the overcurrent detection level (approx. 132 % of the rated current).
Output Overvoltage	OOV	Output Ov Fault	The output voltage exceeded the voltage set in L9-06 for the time set in L9-07.
Motor Overload	OL1	Motor Overloaded	The motor overload protection function has operated based on the internal electronic thermal value.
Inverter Overload	OL2	INV Overloaded	The inverter overload protection function has operated based on the detected current.
Overtorque 1	OL3	Overtorque Det 1	There has been a current greater than the setting in L6-02 for longer than the time set in L6-03.
Overtorque 2	OL4	Overtorque Det 2	There has been a current greater than the setting in L6-05 for longer than the time set in L6-06.
Undertorque 1	UL3	Undertorque Det 1	There has been a current less than the setting in L6-02 for longer than the time set in L6-03.
Undertorque 2	UL4	Undertorque Det 2	There has been a current less than the setting in L6-05 for longer than the time set in L6-06.
PG Disconnected	PGO	PG Open	PG pulses were not input when the inverter was outputting a frequency.
Excessive Speed Deviation	DEV	Speed Deviation	The speed deviation has been greater than the setting in H7-10 for longer than the time set in H7-11.
Overspeed	OS	Overspeed Det	The speed has been higher than the setting in H7-08 for longer than the time set in H7-09.
Output Ground Fault	OGF	Ground Fault	・The ground fault current at the inverter output exceeded approx. 25% of the rated output current. ・The total value of the output voltage for three phases exceeded the value set in L9-21 for the time set in L9-22.
Output Open-phase	LF	Output Pha Loss	An open-phase occurred at the inverter output.(Detected when L8-07 is set to Enabled.)
Control Fault	CF	Out of Control	The torque limit was reached continuously for 3 seconds or longer during a deceleration stop at open-loop vector control.
Digital Operator Disconnected	OPR	Opr Disconnect	The connection to the digital operator was broken during operation for a run command from the digital operator.
Digital Operator Communications Error 1	CPF00	COM-ERR (OP&INV)	Communications with the digital operator were not established within 1 second after the power was turned on.
Digital Operator Communications Error 2	CPF01	COM-ERR (OP&INV)	After communications were established, there was a communications error with the digital operator for more than 2 seconds.
EEPROM Error	CPF03	EEPROM Error	The inverter control circuit was damaged.
A/D Converter Error	CPF05	External A/D Err	
Hardware Fault	HDE	HARD Fault	
Modulator Watchdog Timeout Fault	DTM	MB Watchdog Flt	
CPU Fault	CER	CTL CPU Fault	
Analog Power Supply Fault	CTF	Analog Pwr Fault	The power-supply voltage (±15V) of the analog detection circuit was lowered.
Lowered Battery Voltage	BAT	Battery Lowered	The battery voltage (3V) was lowered.
External Fault (Input Terminals S3 to S16)	EF3 to EF16	Ext Fault (S3 to S16)	An " external fault " was input from a multi-function input terminal.

Cell Faults

Fault	Display*		Meaning
Cell Overheated	TMP	xx:Over Temp	The cell temperature was greater than 90℃.
CCB Control Power Fault	UVB	xx:PWR FLT	The voltage of the cell's control power supply dropped.
Communications Error (Link Error)	LIN	xx:LINK FLT	A cell communications error (link error) occurred.
Burnout of Power Fuse	FUB	xx:FUB FLT	The input fuse of the battery cell burned out.
Cell Fault	CFA		One of the following faults occurred in the cell.
		xx:OVR VOLT	・DC busbar overvoltage: The voltage of the power supply of the cell's main circuit increased to a value greater than the allowable voltage.
		xx:UDR VOLT	・DC busbar undervoltage: The voltage of the power supply of the cell's main circuit dropped to a value less than the allowable voltage.
		xx:CAP FLT	・DC capacitor overvoltage: The capacitor voltage of the cell's main circuit increased to a value greater than the allowable voltage.
		xx:COM FLT	・Communications error (parity check error): A cell communications error (parity check error) occurred.
		xx:Q1～4 FLT	・IGBT Q1 to Q4 fault: Short circuit between the emitter and the collector of IGBT Q1 to Q4.

*:×× represents the cell number.

Specifications

Standard Specifications

3kV Class	Model: CIMR-MV1S□A□□□		**132**	**200**	**315**	**450**	**630**	**900**	**13C**	**15C**	**18C**	**25C**
	Nominal Capacity	kVA	200	285	400	570	800	1150	1500	1900	2300	3000
	Maximum Applicable Motor Capacity*1	kW	132	200	315	450	630	900	1250	1500	1800	2500
	Output Rating: Rated Output Current	A	35	50	70	100	140	200	260	330	400	520
	Output Rating: Rated Output Voltage		3-phase, 3 /3.3 kV (sinusoidal wave)									
	Main-circuit Power Supply		3-phase, 3 / 3.3 kV±10%, 50 / 60 Hz±5%									
6kV Class	Model: CIMR-MV1S□C□□□		**250**	**400**	**630**	**900**	**13C**	**18C**	**25C**	**30C**	**36C**	**43C**	**50C**
	Nominal Capacity	kVA	400	570	800	1150	1600	2300	3000	3800	4600	5300	6000
	Maximum Applicable Motor Capacity*1	kW	250	400	630	900	1250	1800	2500	3000	3600	4300	5000
	Output Rating: Rated Output Current	A	35	50	70	100	140	200	260	330	400	460	520
	Output Rating: Rated Output Voltage		3-phase, 6 / 6.6 kV(sinusoidal wave)									
	Main-circuit Power Supply		3-phase, 6 / 6.6 kV±10%, 50 / 60 Hz±5%									

Inverter Efficiency / Power Factor		Efficiency : Approx. 97%, Power Factor: 0.97 or more
Over Load Tolerance		110% / 60seconds, 120% / 15seconds
Cooling Method		Forced air-cooling by fan (with failure detection)
Control Power Supply		Controller : 3-phase, 200/220, 380, 400/440 V±10%, 50/60 Hz ±5%, 3kVA or more*2
Control Specifications	Control Method	Open-loop vector control, flux vector control, V/f control (for multiple motor operation)
	Main Circuit	Voltage type PWM control with multi-output connected in a series
	Frequency Control Range	0.01 to 120 Hz
	Frequency Control Accuracy	±0.5%
	Analog Input Resolution	0.03 Hz
	Accel/Decel Time	0.1 to 6000 s
	Main Control Functions	Restart after momentary power loss*3, torque limit, acceleration stall prevention, catching the coast, Excessive deceleration prevention, operation prohibition at specified speeds, S-curve accel/decel, multi-step speed operation, KEB function, Energy saving control etc.
Protective Functions		Overcurrent, overvoltage, undervoltage, output ground fault, output open-phase, cooling-fan error, overload, motor overheat, etc.
Communication (optional)		Applicable to various types such as Modbus, CP-215, and CP-218 (Ethernet)
Maintainability	Digital Operator	Status display, fault display, run command, parameter setting, parameter reference
	Display Tools on PC	Trend display, data analysis tool
	Main Circuit	Module configuration
Input Transformer		Class H dry type, N/+5%/+10% tap, secondary multi-phase winding
No. of I/O Terminals		Digital input: 10 points: digital output: 8 points: analog input: 2 points : analog output : 2 points
Temperature Protection		Power cells: protected by thermistor for temperature, transformer : protected by thermostat

Notes:1 This inverter does not have any regenerative braking function.
2 Please inquire of YASKAWA next items
- 11000V input and output voltage for power circuit
- 4160V input and output voltage for power circuit
- Life extension of the panel cooling fan
- Application to non-standard environmental conditions

*1 : The figures shown for maximum applicable motor output were obtained by using Yaskawa's standard four-pole motors.
*2 : The required control power supply capacity will vary, depending on the inverter capacity.
*3 : When the restart function for the momentary power loss is used, an uninterruptive power supply unit for the control power supply is needed optionally.

Environmental Conditions

Conditions		Specifications
Applicable Standards		JIS, JEC, JEM
Environment	Atmosphere	General environmental conditions (free from dust and corrosive gases)
	Ambient Temperature	−5 to +40℃
	Relative Humidity	45 to 85%RH (no condensing)
	Storage Temperature	0 to +50℃
	Amplitude	1000 m or less
Cabinet Specifications	Form	Made of enclosed steel sheets, vertically-standalone type, protective front panal type
	Painting	5Y7/1 semi-gloss both for inner and outer faces
Enclosure		IP40 (dustproof type)

Communication Option Cards

Card Name	Code No.	Function
CP-215 communications I/F card 215IF	JEBC-61603 7910161-6030X-S010Y	Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CP-215 communications with the host controller. Used as real-time network at high speeds with N/N as control method for media access. Cyclic and message communications with a shared memory are available.
CP-218 communications I/F card 218IF	JEBC-61604 7910161-6040X-S010Y	Used for running or stopping the inverter, setting or referencing parameters, and monitoring output frequency, output current, or similar items through CP-218 communications with the host controller. Used as Ethernet with MEMOBUS, MELSEC, or no protocol.

Dimensions Units:mm

Fig.1

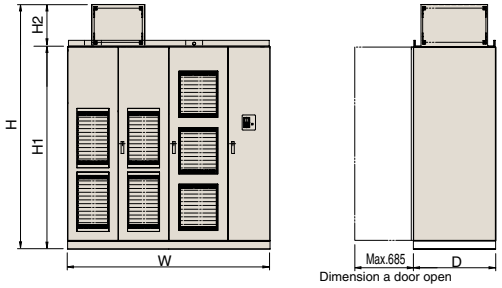


Fig.2

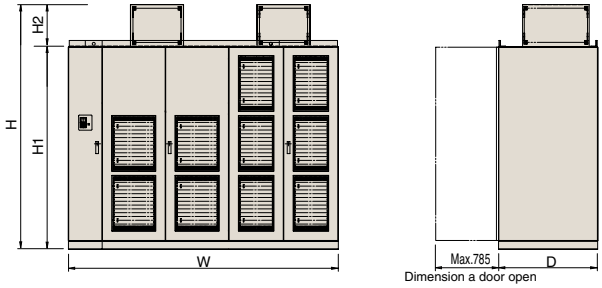


Fig.3

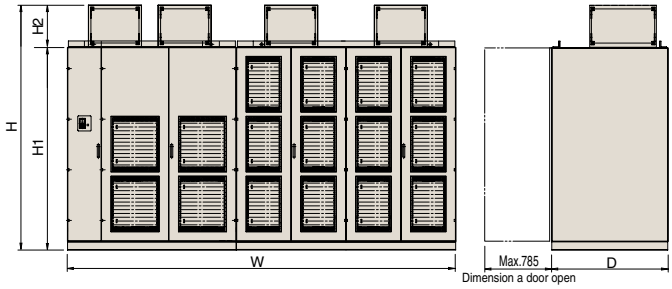


Fig.4

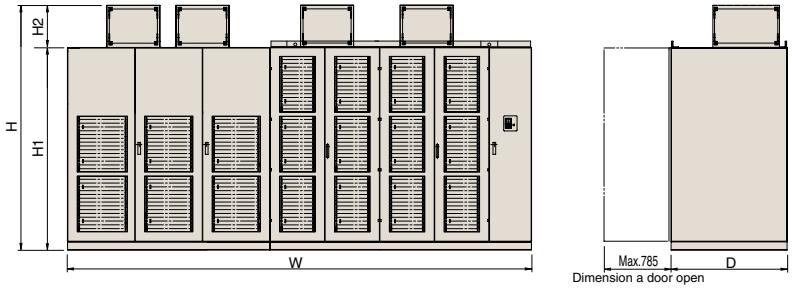
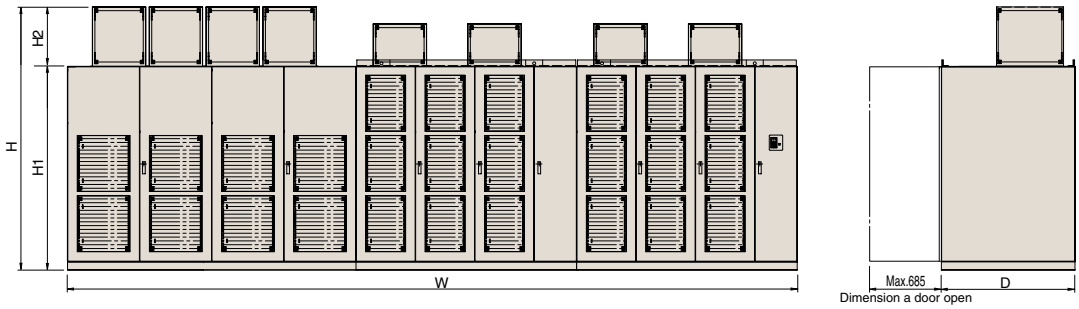


Fig.5



	Model CIMR-MV1S□□□	Figure	Dimensions mm W	H	H1	H2	D	Approx. Mass*2 kg
3kV Class	132	Fig.1	2300	2900	2400	500	1000	2000
	200							2200
	315		2400					2500
	450							2800
	630							3500
	900	Fig.2	3200				1200	4400
	13C							4900
	15C		3600*1				1400	5300
	18C							6400
	25C	Fig.4	5600*1					9500
6kV Class	250	Fig.2	3400	2900	2400	500	1000	2900
	400							3200
	630						1200	3700
	900							4500
	13C							5300
	18C	Fig.3	4600*1				1400	7000
	25C	Fig.4	5500*1					8700
	30C		6500*1				1600	9400
	36C							12000
	43C	Fig.5	8000*1					13600
	50C			3150		750		16000

*1 : Block construction.
*2 : A value for the approx. mass shows the maximum value.

Model Numbers

C I M R - M V 1 S □ □ □ □ □

Inverter

FSDrive-MV1S

Input Voltage, Frequency

A : 3300 V at 60 Hz
B : 3000 V at 50 Hz
C : 6600 V at 60 Hz
D : 6000 V at 50 Hz
E : 3300 V at 50 Hz
F : 6600 V at 50 Hz

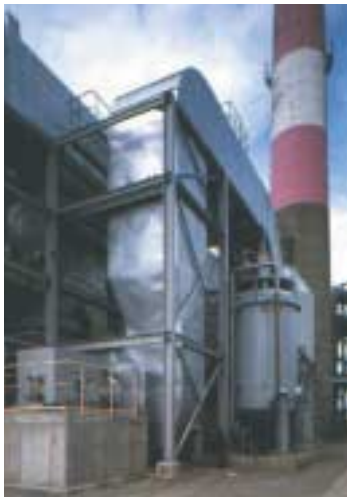
Output Voltage Class

A : 3 kV class
C : 6 kV class

Maximum Applicable Motor Capacity

132 : 132 kW
200 : 200 kW
250 : 250 kW
315 : 315 kW
400 : 400 kW
450 : 450 kW
570 : 570 kW
630 : 630 kW
900 : 900 kW
13C : 1250 kW
15C : 1500 kW
18C : 1800 kW
25C : 2500 kW
30C : 3000 kW
36C : 3600 kW
43C : 4300 kW
50C : 5000 kW

Energy-saving Power Calculation for Fan/Blower

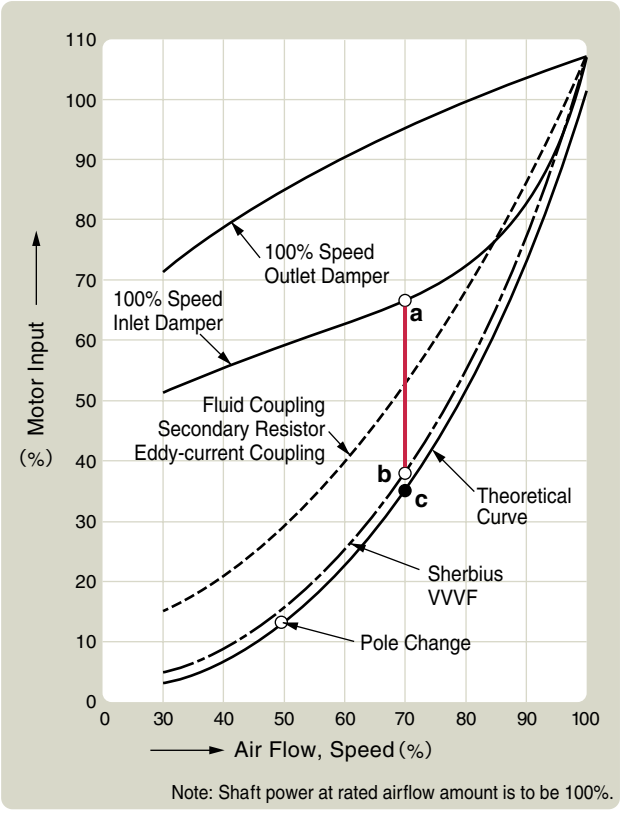


The most significant point of the energy-saving operation for fans or blowers is application of speed control by using inverters.
Compared to the airflow control by using dampers, the inverter drives can save a great deal of power.

Conditions

(1) Applicable motors: 3300 V, 500 kW, 6P.
(with 95% motor efficiency)
(2) 70% airflow operation.
(with 90% motor efficiency at 100% airflow)

◆Consumed power of blower motor



Note: Shaft power at rated airflow amount is to be 100%.

1

Power at inlet damper control

$$500 \times 0.9 \times 0.68^{*} \times \frac{1}{0.95\ \text{Motor efficiency}} \fallingdotseq 322\text{kW} \cdots\cdots ①$$

＊Point “a” in the characteristics curve

2

Power at inverter energy-saving control

◆Motor output (point c)

$$500 \times 0.9 \times (0.7)^{3} = 154.3\text{kW}$$

◆Motor input power

$$154.3 \times \frac{1}{0.95\ \text{Motor efficiency}} = 162.4\text{kW}$$

◆Inverter input power (point b)

$$162.4 \times \frac{1}{0.97\ \text{Inverter efficiency}} \fallingdotseq 167\text{kW} \cdots\cdots ②$$

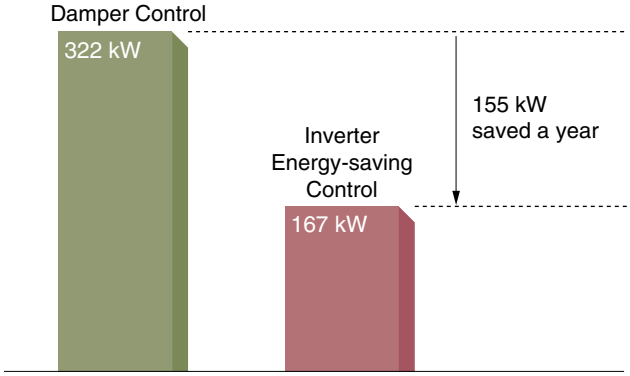
3

Power saved

◆Annual power saving by employing inverters

①−②
(322−167) kW×6000h=930,000kWh

Assume that the annual operating time is 6,000 hours
(Equivalent to 8.2 months when operating continuously for 24 hours)



Examination of capacity 1

Selection of optimum capacity for blower motors (for actual loads)

The applicable inverter capacity is determined as follows when the available commercial power supply operation method is changed into the speed control method.

(Example) Motor rating: 500 kW, 4P, 3 kV at 50 Hz

Assuming that:

・Motor rated current value : 120 A

・Maximum value of actual operation load current : 95 A

For the applicable inverter capacity, rated output current 100A (nominal capacity 600 kVA) should be selected. (100 A ＞ 95 A)

Examination of capacity 2

Inverter application for extruder motors

(Example) Motor rating: 400 kW, 6P, 3.3 kV at 60 Hz

Assuming that:

・Motor rated current value: 88 A

・Required overload capacity: 120% for 60 seconds

The applicable inverter capacity will be as shown below considering the allowance of 10%;

88 A × 1.3 = 115 A

Therefore, rated current 140 A (nominal capacity 800 kVA) should be selected.(140 A > 115 A)

Examination of capacity 3

Inverter application for cement kiln motors

(Example) Motor rating: 500 kW, 6P, 6.6 kV at 60 Hz

Assuming that:

・Motor rated current value: 53 A

・Required overload capacity: 250% for 60 seconds

The applicable inverter capacity will be as shown below considering the allowance of 10%;

53 A × 2.6 = 138 A

Therefore, rated current 140 A (nominal capacity 1600 kVA) should be selected.

(140 A > 138 A)

Fill out the following form for estimation.

1	Name of facility or application	
2	Name of load machine	☐Pump ☐Fan ☐Blower ☐Compressor ☐Extruder ☐Others
3	Load machine characteristics	☐Variable torque ☐Proportional torque ☐Constant torque ☐Constant output J(GD²／4) kg・m²
4	Operation conditions	Motor current A Operation time Annual hours
5	Motor model to be driven	☐Squirrel-cage induction motor ☐Wound-rotor type motor ☐Existing ☐New
6	Motor specifications	Output kW Voltage V Frequency Hz Number of poles p Speed min⁻¹ Rated current A Efficiency % Power factor
7	Speed control range	Minimum min⁻¹ to Maximum min⁻¹ or Minimum Hz to Maximum Hz
8	Speed setting procedure	☐Process signal 4 to 20 mA operation ☐Manual rotating speed adjusting operation ☐UP/DOWN signal adjusting operation ☐Multi-step speed signal changeover operation
9	Pattern operation(with/without)	☐Acceleration time Second(s)／ min⁻¹ ☐Deceleration time Second(s)／ min⁻¹
10	Overload capacity	%／ Second(s)
11	Commercial power supply by-pass operation circuit	☐Not needed ☐Needed〈Inverter _ commercial power supply operation ☐Automatic changing method ☐Manual changing method〉
12	Power supply specifications	Power supply shortcircuit capacity MVA Main circuit voltage V Hz Control circuit voltage200/220V, 50/60Hz, 3-phase 3-step method 400/440V
13	Ambient conditions	Indoors ☐Ambient temperature to ℃ ☐Humidity % or less ☐Air-conditioning facility (Provided/Not provided)

FSDrive-MV1S

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