ENVIRONMENTALLY FRIENDLY MOTOR DRIVES
MATRIX CONVERTER
Varispeed AC

200V CLASS 5.5kW to 45kW
400V CLASS 5.5kW to 75kW

Certified for ISO9001 and ISO14001

JQA-0422 JQA-EM0498

Blue Sky & Green Technology

The storm has finally cleared, revealing a rainbow stretched across the sky.
The Varispeed AC Matrix converter pushes back the clouds to lead a new age of technology.
The Varispeed AC incorporates innovative technology as the world's first matrix converter to directly convert input AC voltage to output AC voltage. The Varispeed AC not only improves energy efficiency, but also overcomes many problems typically associated with conventional general-purpose inverters.

(Pending)

World's First

Matrix Innovation

Improved Energy Efficiency with
*Direct Conversion from **AC** to **AC***

World's First

Varispeed AC Advantages

1 Environmentally Friendly	No harmonics.	P.5
2 Energy Saving	High efficiency with a simple design.	P.6
	Power regeneration for even greater energy efficiency.	P.6
3 Compact	Construct your system even in limited space.	P.7
4 Powerful	Operate continuously at low speeds.	P.7
5 User Friendly	Easy to use.	P.8
	Easy to maintain.	P.8

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Applications

Main Applications

Ventilation Fans and Water-Supply Pumps

Variable speed applications in hospitals, schools, office buildings, and so on with strict requirements for harmonics distortion.

Cranes, Elevators, and Escalators

Lift applications with heavy repetitive loads and regenerative power.

Centrifuges

Applications requiring regenerative power for long periods to decelerate high inertia loads to stop.

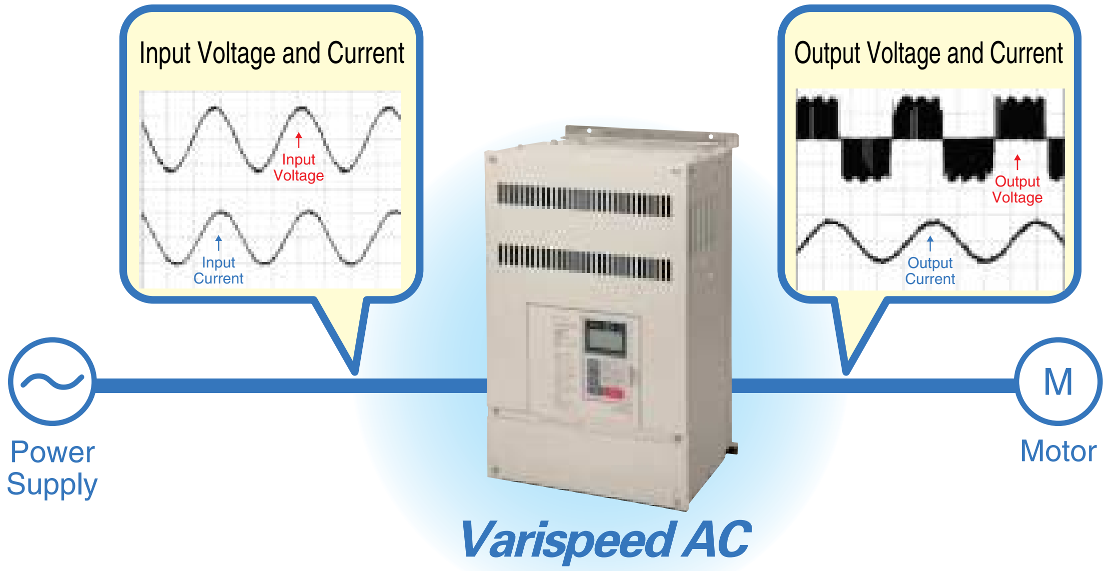
Note: Matrix Innovation and the Matrix Innovation logo are trademarks of Yaskawa Electric Corporation.

1 Environmentally Friendly

World's First

No harmonics with innovative technology.

Without peripheral devices, the input current waveform becomes sinusoidal, similar to that of a commercial power supply, so the harmonic pollution of the power supply is minimized for the protection of surrounding machinery. The available power system capacity can be increased, and the regulations on harmonics easily met.



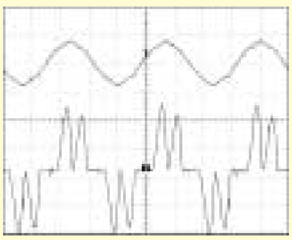
Input Waveform Comparison with Conventional General-Purpose Inverter

Conventional General-Purpose Inverter
(Diode Rectified-PWM Inverter)

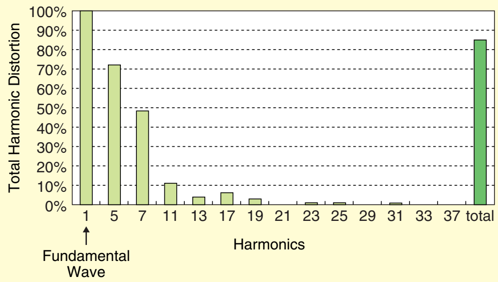
■ Input Waveform

Input Voltage

Input Current



■ Spectrum



Total Harmonic Distortion (Current) = Approx. 85%*

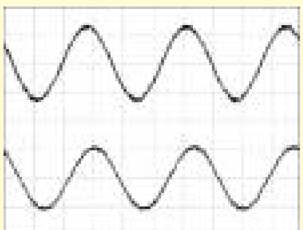
*:Without reactor, rated load.

Varispeed AC

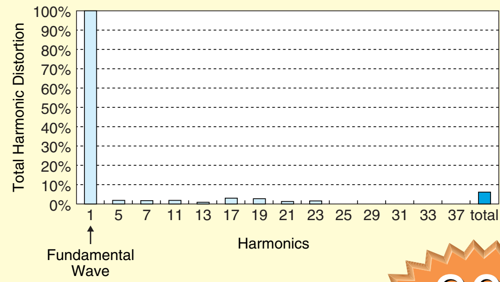
■ Input Waveform

Input Voltage

Input Current



■ Spectrum



Total Harmonic Distortion (Current) = Approx. 7%

90% less distortion

Test Conditions: One transformer, rated load, input voltage distortion is 1% or less.

Advantages

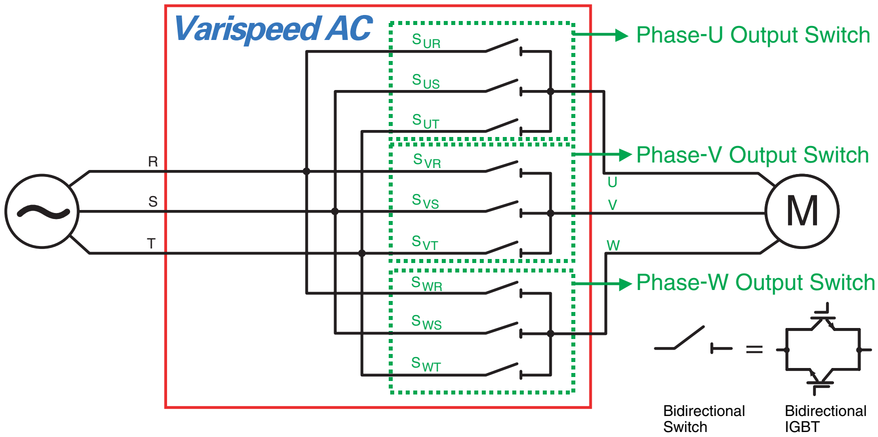
2 Energy Saving

Matrix Converter Technology

World's First

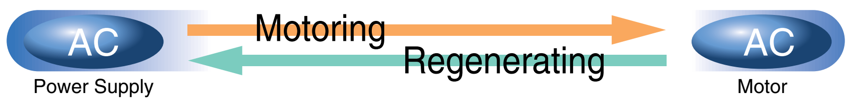
High efficiency with a simple design using an innovative technology.

The Varispeed AC controls 9 bi-directional switches with Yaskawa's own sine-wave PWM control. It directly converts the 3-phase AC power to the AC power required for precise control of the voltage and frequency output to the motor. Differing from general-purpose inverters, the Varispeed AC has no sine-wave converter to prevent harmonics and no DC link circuit with diodes and electrolytic capacitors. As a result, the design has been greatly simplified.



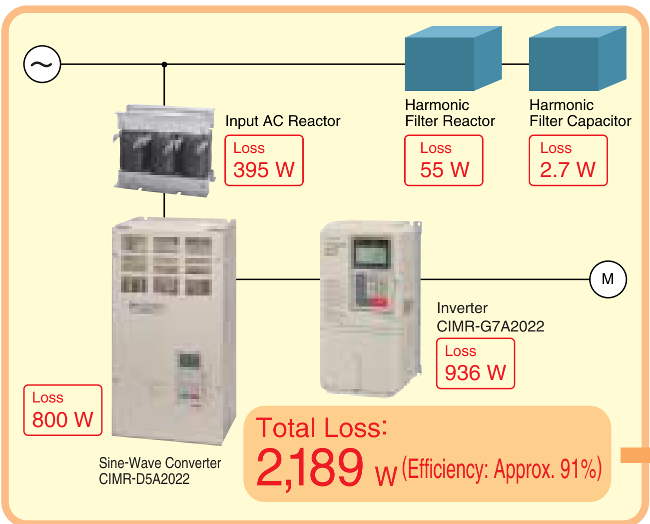
Power regeneration for even greater energy efficiency.

The Varispeed AC returns the motor's regenerative energy to the power supply without having to connect any special device. Energy is used with extreme efficiency.

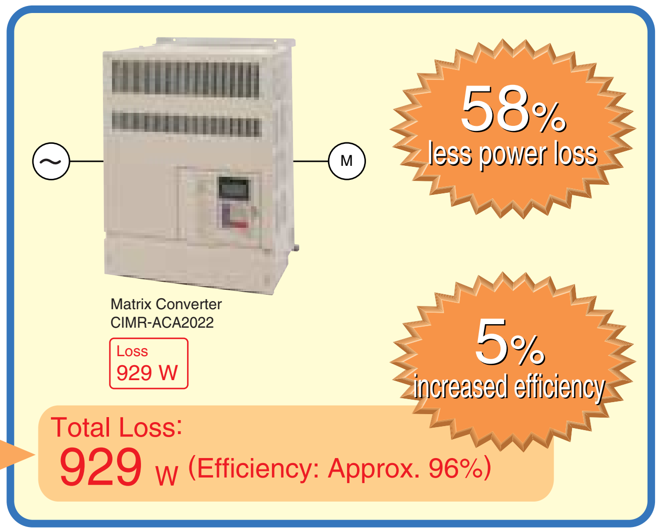


Power Loss Comparison with Conventional Methods (200 V Class, 22 kW at Rated Load)

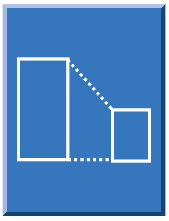
Sine-Wave Converter + Conventional General-Purpose Inverter



Varispeed AC (Matrix Converter Technology)



3 Compact

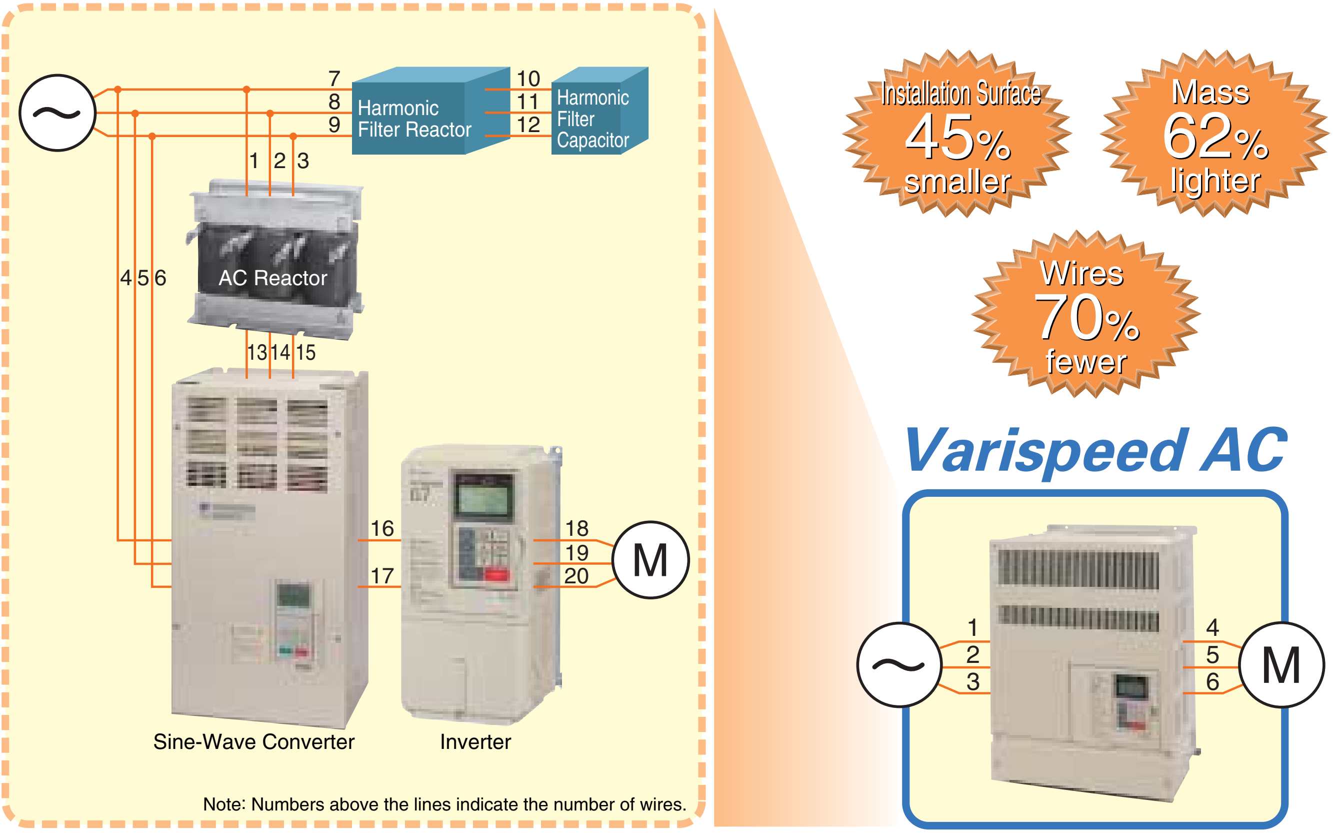


Construct your system in limited space.

No peripheral devices such as sine-wave converters, devices to prevent harmonics, or braking units are needed. As a result, installation space can be saved with the Varispeed AC. This also eliminates the wiring for those unnecessary devices simplifying the enclosure design, installation, and maintenance.

Installation Space, Mass, and Wiring Comparison (200 V Class, 22 kW)

Sine-Wave Converter + Conventional General-Purpose Inverter



Total Installation Surface	: 0.364 m^2
Total Mass	: 118.2 kg
Total Number of Wires	: 20

Installation Surface	: 0.201 m^2
Mass	: 45 kg
Number of Wires	: 6

4 Powerful

Operate continuously at low speeds.

Even during low-speed operation, all IGBTs in the main circuit turn off and on for switching according to the frequency of the AC power supply. Switching is divided evenly among the IGBTs for a uniform heat load. As a result, the Varispeed AC does not need any extra capacity for low-speed operation.

Capable of 100% torque in continuous operation at zero speed*, and 150% torque for one minute at zero speed*.

*: In flux vector control.

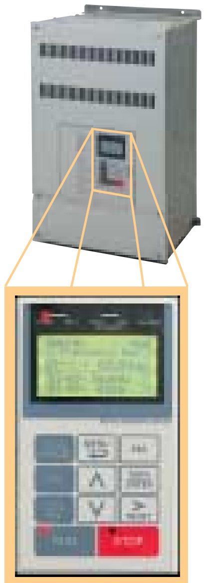
Advantages

5 User Friendly

Easy to use.

Easily set parameters with the user-friendly digital operator.

- 5-digit LCD makes it easy to confirm information.
- Quick Mode to operate the Varispeed AC with the minimum parameter settings.
- Verify Mode to check parameters that have been changed from the factory settings.
- Copy function for easy uploading/downloading of parameters. Set parameters for several matrix converters all at once.
- Extension cable (optional) for remote operation.



Easy to inspect and maintain.

Structure is easy to maintain.
Enhanced monitoring functions are easy to use.

- DriveWizard*, an Inverter support tool, lets you manage parameters on your PC. Manage parameters for each Varispeed AC with a single program, reducing the time required for adjustment and maintenance. ✻:Under development.
- Various monitoring functions such as output power, watt-hour, I/O terminal status, fault history, accumulated operation hours, and cooling-fan operation hours.
- Removable terminals are used for the control circuit so that the Varispeed AC unit can be easily replaced without removing the wiring.
- Long-life cooling fan with ON/OFF control boosts system reliability.
- No electrolytic capacitors are required, which would otherwise limit the

Model Designation

CIMR − AC A 4 011

Varispeed AC (MxC)

No.	Specifications
A	Standard model

No.	Voltage Class
2	AC Input, 3-phase, 200 V
4	AC Input, 3-phase, 400 V

No.	Max. Applicable Motor Output
5P5	5.5 kW
011	11 kW
022	22 kW
045	45 kW*
075	75 kW*

"P" indicates the decimal point.
✻:Under development.

Example Nameplate

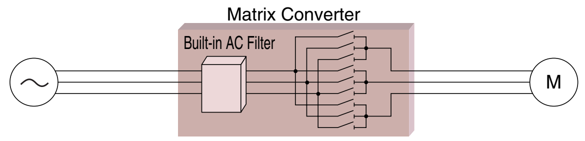
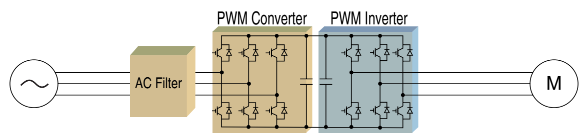
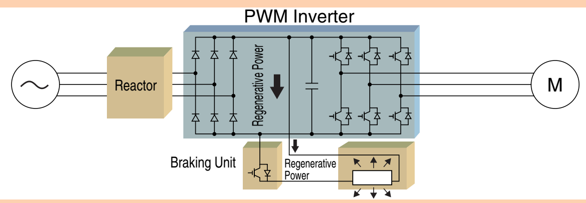
Model → MODEL :CIMR-ACA4011 SPEC:40110A ← Specifications
Input Specifications → INPUT :AC3PH 380-480V 50/60Hz 26A
Output Specifications → OUTPUT :AC3PH 0-460V 0-120Hz 27A 19kVA
Lot Number → O/N : MASS : 30kg ← Mass
Serial Number → S/N : PRG : 1030 ← Software Version
YASKAWA ELECTRIC CORPORATION MADE IN JAPAN

4 011 0 A

No.	Revision History
A to Z	Revision (A to Z)

No.	Protective Structure
0	Open chassis (IEC IP00)
1	Enclosed wall-mounted [IEC IP20, NEMA1(Type1)]

Comparison with Conventional Inverters (Example : Use in Cranes)

Configuration of Power-Conversion System			No Harmonics	Energy Efficiency	Power Regeneration	Low-Speed Continuous Operation	Size
Varispeed AC		18 Switches (9 bidirectional switches)	Best	Best	Best	Best	Best
Sine-Wave Converter + Conventional General-Purpose Inverter		12 Switches	Best	Excellent	Best	Good (Derating required)	Fair
Conventional General-Purpose Inverter		6 Diodes 6 Switches	Good (Reactor required)	Excellent	Not Applicable	Good (Derating required)	Fair

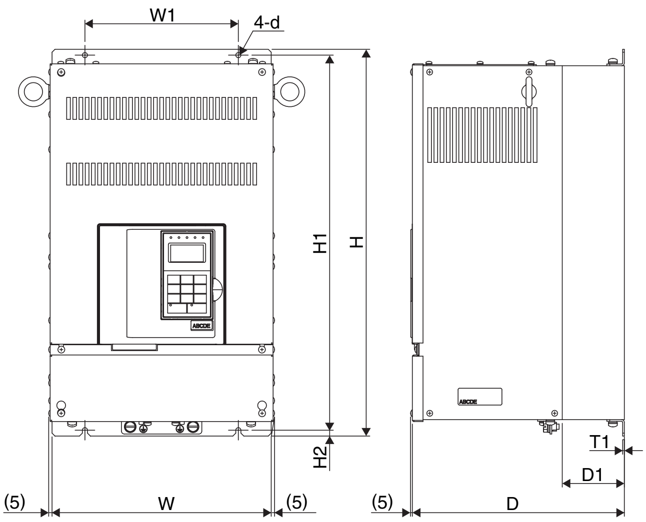
Specifications

Voltage Class		200 V				400 V				
Model Number CIMR-ACA		25P5	2011	2022	2045*1	45P5	4011	4022	4045*1	4075*1
Max. Applicable Motor Output*2 kW		5.5	11	22	45	5.5	11	22	45	75
Rated Input Current*3 A		26	47	91	–	14	26	49	–	–
Output Characteristics	Rated Output Capacity kVA	9	17	33	–	10	19	36	–	–
	Rated Output Current*4 A	27	49	96	–	15	27	52	–	–
	Max. Output Voltage	95 % of input voltage								
	Max. Output Frequency	Frequencies supported up to 120 Hz using parameter setting								
Power Supply Characteristics	Rated Voltage and Frequency	3-phase, 200/208/220 V, 50/60 Hz				3-phase, 380/400/415/440/460/480 V, 50/60 Hz				
	Allowable Voltage Fluctuation	+10% to −15%								
	Allowable Frequency Fluctuation	±3% (Frequency fluctuation rate: 1 Hz/100 ms or less)								
	Allowable Power Voltage Imbalance between Phases	Within 2%								
	Input Power Factor	0.95 or more (When the rated load is applied.)								
Control Characteristics	Control Method	Sine-wave PWM [Flux vector control, open-loop vector control, V/f control (switched by parameter setting)]								
	Torque Characteristics	150% / 0 Hz (Flux vector control)*5								
	Speed Control Range	1 : 1000 (Flux vector control)*5								
	Speed Control Accuracy*6	±0.2% (Open-loop vector control : 25℃ ±10℃)*5, ± 0.05% (Flux vector control : 25℃ ±10℃)*5								
	Speed Control Response	30 Hz (Flux vector control)*5								
	Torque Limits	Provided for vector control only (4 quadrant steps can be changed by parameter settings.)								
	Torque Accuracy	±10% (Flux vector control : 25℃ ±10℃ with a vector motor, carrier frequency of 4 kHz)*5								
	Frequency Control Range	0.01 Hz to 120 Hz								
	Frequency Accuracy (Temperature Characteristics)	Digital reference : ± 0.01% (−10℃ to +40℃), Analog reference : ±0.1% (25℃ ±10℃)								
	Frequency Setting Resolution	Digital reference : 0.01 Hz, Analog reference : 0.03 Hz / 60 Hz (11bit with no sign)								
	Output Frequency Resolution	0.001 Hz								
	Overload Capacity*7	150% of rated output current per minute (for carrier frequency of 4 kHz)								
	Accel/Decel Time	0.00 to 6000.0 s (4 selectable combinations of independent acceleration and deceleration settings)								
	Braking Torque	Same overload capacity for motoring and regeneration								
	Main Control Functions	Momentary power loss restart, Speed search, Overtorque detection, Torque limit, 17-speed control (maximum), Accel/decel time change, S-curve accel/decel, 3-wire sequence, Autotuning (rotational or stationary), Dwell function, Cooling fan ON/OFF control, Slip compensation, Torque compensation, Jump frequency, Frequency upper/lower limit settings, DC injection braking at start/stop, PID control (with sleep function), MEMOBUS communication (RS-485/422, max.19.2 kbps), Fault restart, Droop control, Parameter copy, Torque control, Speed/torque control switching, etc.								
Protective Functions	Regenerative Function	Provided								
	Motor Protection	Protection by electronic thermal overload relay.								
	Instantaneous Overcurrent	Stops at approx. 200% of rated output current.								
	Fuse Blown Protection	Stops for fuse blown.								
	Overload Protection	150% of rated output current per minute (for carrier frequency of 4 kHz)								
	Overvoltage Protection	Stops when input power supply voltage is greater than 250 VAC.				Stops when input power supply voltage is greater than 550 VAC.				
	Undervoltage Protection	Stops when input power supply voltage is less than 150 VAC.				Stops when input power supply voltage is less than 300 VAC.				
	Momentary Power Loss	Stops for 2 ms or more. By parameter setting, operation can be continued if power is restored within 2 s.*8								
	Cooling Fin Overheating	Protection by thermistor.								
	Stall Prevention	Stall prevention during acceleration, deceleration, or running.								
	Grounding Protection*9	Protection by electronic circuits. (Overcurrent level)								
	Charge Indicator	Lit when the main circuit DC voltage is approx. 50 V or more.								
Environment	Ambient Operating Temperature	−10℃ to +40℃ (Enclosed wall-mounted type), −10℃ to +45℃ (Open chassis type)								
	Ambient Operating Humidity	95% max. (with no condensation)								
	Storage Temperature	−20℃ to +60℃ (short-term temperature during transportation)								
	Application Site	Indoor (no corrosive gas, dust, etc.)								
	Altitude	1000 m max.								
	Vibration	10 to 20 Hz : 9.8 m/s², 20 to 55 Hz : 5.9 m/s²								
Protective Structure		Open chassis type (IP00) and enclosed wall-mounted type (NEMA1)								

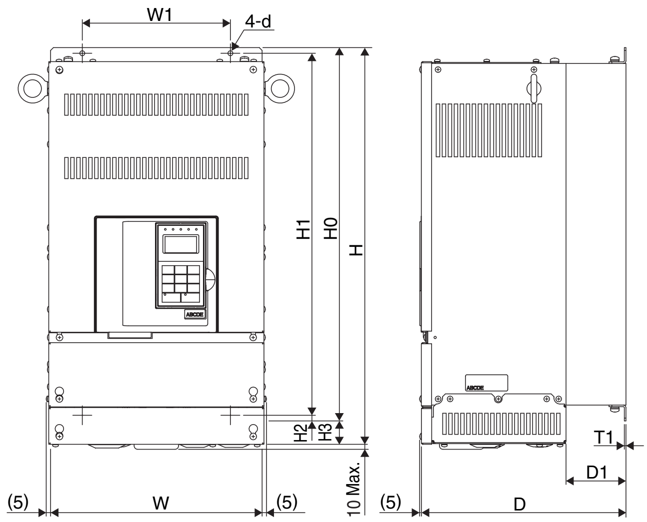
*1 : Under development.
*2 : The maximum applicable motor output is given for a standard 4-pole Yaskawa motor. When selecting the actual motor and MxC, be sure that the MxC's rated current is applicable for the motor's rated current.
*3 : The rated current will vary in accordance with the values of the voltage or impedance of the power supply (including the power transformer, the input reactor, and wires).
*4 : Required to reduce the rated output current in accordance with the values of the carrier frequencies or control mode.
*5 : Rotational autotuning must be performed to ensure obtaining the specifications given for open-loop or flux vector control.
*6 : The speed control accuracy depends on the installation conditions and type of motor used. Contact your Yaskawa representative for details.
*7 : Applications with repetitive loads may require derating (reducing carrier frequency and current, which involves increasing the frame size of the MxC). Contact your Yaskawa representative for details.
*8 : If the CIMR-ACA25P5, 2011, 2022, 45P5, or 4011 needs two seconds or more for the momentary power loss ridethru time, a back-up capacitor unit for momentary power loss is necessary. If L2-01 (Momentary Power Loss Detection Selection) is enabled, the MxC will stop 2 ms after the momentary power loss occurs. Contact your Yaskawa representative for details about use in applications, such as trolley cranes, with a tendency to have momentary power losses or open phases.
*9 : The ground fault here is one which occurs in the motor wiring while the motor is running. A ground fault may not be detected in the following cases.
· A ground fault with low resistance which occurs in motor cables or terminals. · A ground fault occurs when the power is turned on.

Dimensions

Open Chassis (IEC IP00)



Enclosed Wall-Mounted (NEMA1 IP20)



Units : mm

Open Chassis (IEC IP00)

Voltage Class	Max. Applicable Motor Output kW	Dimensions in mm									Approx. Mass kg	Heat Generation W			Cooling Method
		W	H	D	W1	H1	H2	D1	T1	d		External	Internal	Total Heat Generation	
200 V (3-phase)	5.5	300	530	290	210	514	8	85	2.3	M6	28	160	143	303	Fan
	11	300	530	290	210	514	8	85	2.3	M6	30	326	200	526	
	22	360	560	300	260	545	7.5	130	2.3	M6	45	615	314	929	
	45*	–	–	–	–	–	–	–	–	–	–	–	–	–	
400 V (3-phase)	5.5	300	530	290	210	514	8	85	2.3	M6	29	160	138	298	
	11	300	530	290	210	514	8	85	2.3	M6	30	303	185	488	
	22	360	560	300	260	545	7.5	130	2.3	M6	45	665	310	975	
	45*	–	–	–	–	–	–	–	–	–	–	–	–	–	
	75*	–	–	–	–	–	–	–	–	–	–	–	–	–	

✻ : Under development.

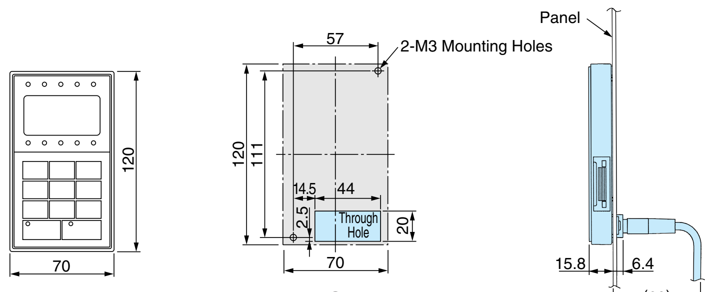
Enclosed Wall-mounted (NEMA1 IP20)

Voltage Class	Max. Applicable Motor Output kW	Dimensions in mm											Approx. Mass kg	Heat Generation W			Cooling Method
		W	H	D	W1	H0	H1	H2	H3	D1	T1	d		External	Internal	Total Heat Generation	
200 V (3-phase)	5.5	300	565	290	210	530	514	8	35	85	2.3	M6	30	160	143	303	Fan
	11	300	565	290	210	530	514	8	35	85	2.3	M6	32	326	200	526	
	22	360	725	300	260	560	545	7.5	165	130	2.3	M6	48	615	314	929	
	45*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
400 V (3-phase)	5.5	300	565	290	210	530	514	8	35	85	2.3	M6	31	160	138	298	
	11	300	565	290	210	530	514	8	35	85	2.3	M6	32	303	185	488	
	22	360	725	300	260	560	545	7.5	165	130	2.3	M6	48	665	310	975	
	45*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
	75*	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

✻ : Under development.

Digital Operator

LCD Monitor
Model : JVOP-160
(Attached as Standard)



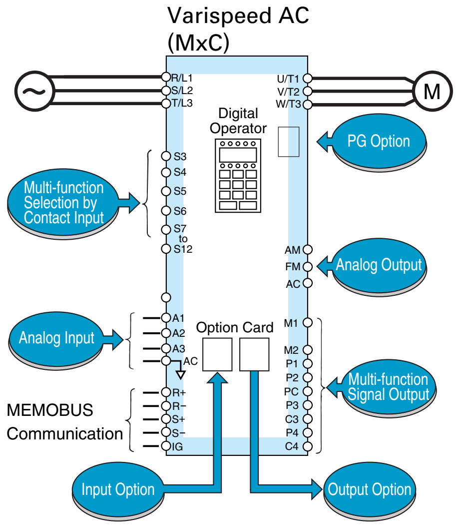
Panel Cutout

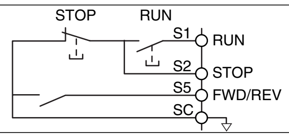
Units : mm

Software Functions

The Varispeed AC matrix converter (MxC*) incorporates a variety of application features. Select special functions from a multitude of possibilities to perfectly match your machine requirements.

*: In this brochure, the Varispeed AC matrix converter is hereinafter referred to as the MxC.



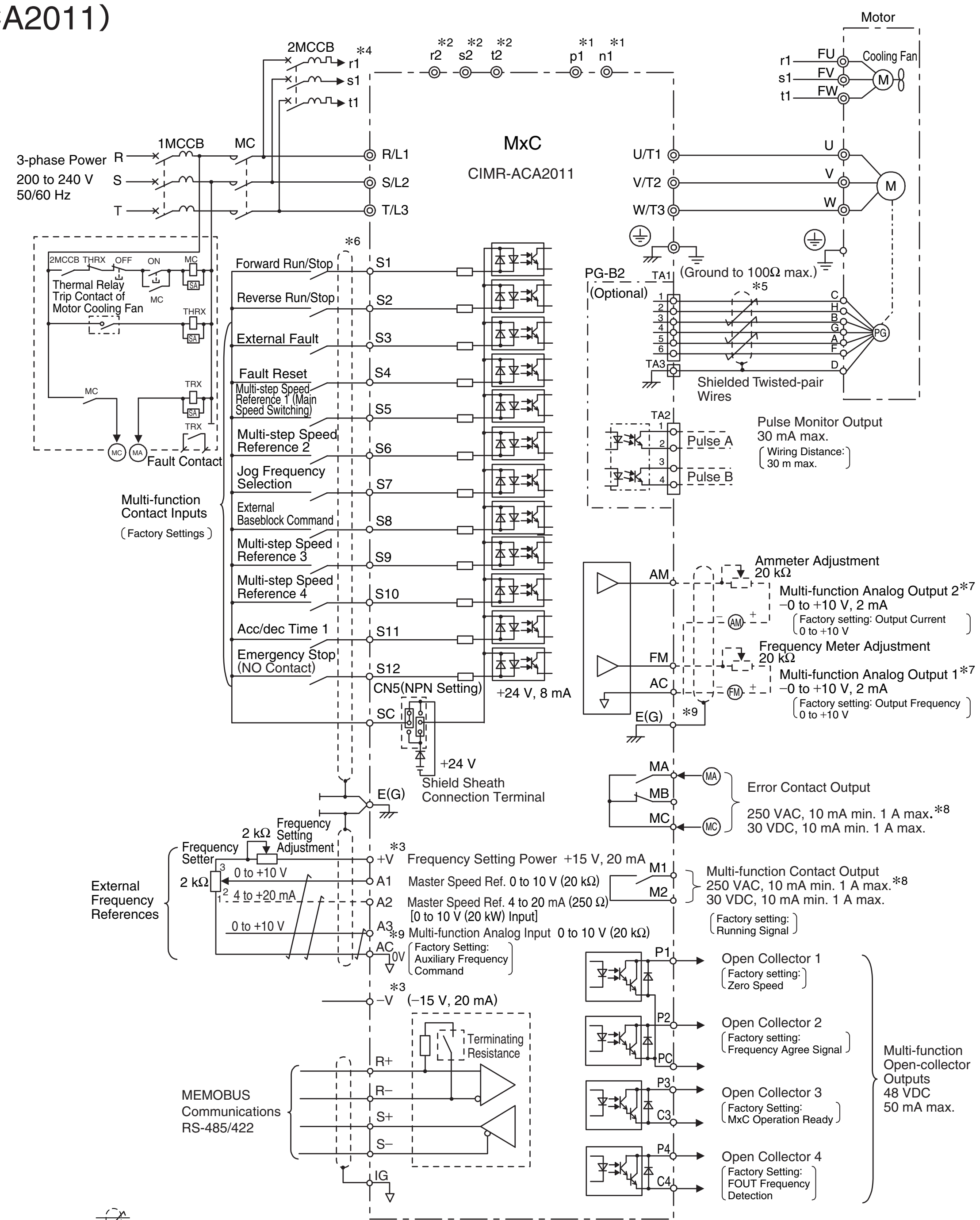
Function		Target Market	Application	Description of Function
Multi-Function Selection	PID Control	Pumps, air conditioning, etc.	Automatic process control	Processes PID operations in the MxC and uses the results as frequency references. Controls pressure and air/water quantities.
	Speed Search Operation	Inertia load drives such as blowers, etc.	Starting a free running motor	Starts the MxC 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	Blowers, pumps, etc. which have wind-mill effects	Starting a 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 restarted by the MxC.
	Commercial Power Source/MxC Switchover Operation	Blowers, pumps, mixers, etc.	Automatic switching between commercial power source and MxC	Switching of commercial power source to MxC or vice versa is enabled without stopping the motor.
	Multi-step Speed Operation	Transporting equipment	Scheduling operations under fixed speeds	Multi-step operation (up to 17-step) can be programmed by setting the contact combinations, and the connection with the PLC is simplified. When combined with limit switches, can also allow simple positioning.
	Accel/Decel Time Changeover Operation	Automatic control panels, transporting equipment, etc.	Accel/decel time changeover with an external signal	The accel/decel times are switched by an external contact signal. Necessary for smooth acceleration or deceleration at high speeds.
	MxC Overheat Prediction	Air conditioners, etc.	Preventive maintenance	When the ambient temperature of the MxC rises to within 10℃ of the maximum allowable temperature, a warning is given. (Thermoswitch is required as an option.)
	3-wire Sequence	General	Simple configuration of control circuit	Operation can be accomplished using a spring-loaded push-button switch. 
	Operating Site Selection	General	Easy operation	Operation and settings (digital operator/external instruction, signal input/option) can be selected while the MxC is online.
	Frequency Hold Operation	General	Easy operation	Temporarily holds frequencies during acceleration or deceleration.
	UP/DOWN Command	General	Easy operation	Sets speed by ON/OFF from a distance.
	Fault Trip Retry Operation	Air conditioners, etc.	Improvement of operation reliability	When the MxC trips, it begins to coast, is immediately diagnosed by the computer, resets automatically, and returns to the original operation speed. Up to 10 retries can be selected.
	Torque Limit (Drooping characteristics)	Pumps and blowers	· Protection of machine · Improvement of continuous operation reliability · Torque limit	The output frequency can be automatically reduced to the balancing point of the load in accordance with the overload as soon as the motor torque reaches a preset level. Needed to prevent overload tripping in applications such as pumps or blowers.

Function		Target Market	Application	Description of Function
Multi-Function Selection (Cont'd)	Torque Control*	Cranes	Torque booster (Twin drives)	Adjusts motor torque externally. Appropriate for controlling the result of torque booster.
	Droop Control*	Separately-driven conveyors and transporting equipment	Dividing loads	Arbitrarily sets motor speed regulation. High insulation characteristics share multi-motor loads.
	Upper/Lower Frequency Limit Operation	Pumps and blowers	Motor speed limit	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)	General	Preventing mechanical vibration in the equipment	The motor can simply pass through the preset speed, but continuous running cannot be done at this speed. This function is used to avoid mechanical resonance points.
	Carrier Frequency Setting*	General	Reducing noise	The carrier frequency can be set to reduce acoustic noise from the motor and machine system. Use to set the carrier frequency to 4 kHz, 8 kHz, or 12 kHz for flux vector control.
	Automatic Continuous Operation when the Speed Reference is Lost	Air conditioners	Improvement of continuous operation reliability	When the frequency reference signal is lost, operation is automatically continued at the pre-programmed speed. (If the host computer fails.) This function is important for air conditioning systems in intelligent buildings.
Multi-Function Signal Output	Load Speed Display	General	Monitor function enhancement	Can indicate motor speed (min^{-1}), machine speed under load (min^{-1}), line speed (m/min), etc.
	Run Signal	General	Zero-speed interlock, etc.	" Closed " during operation. " Open " while coasting to a stop. Can be used as an interlock contact point during a stop.
	Zero-speed Signal	General	Zero-speed interlock	" Closed " when output frequency is under min. frequency.
	Frequency (Speed) Agreed Signal	General	Reference speed reach interlock	" Closed " when inverter output frequency reaches the set value. Can be used as an interlock for lathes, etc.
	Overtorque Signal	Blowers	· Protection of machine · Improvement of continuous operation reliability	" Closed " when overtorque setting operation is completed. Can be used as a torque limiter.
	Low Voltage Signal	General	Assortment of fault signals	" Closed " only when tripped by low voltage. Can be used as a countermeasure power loss detection relay.
	Free Unintentional Speed Agreement Signal	General	Reference speed agreed interlock	" Closed " when the speed agrees at the arbitrary frequency reference.
	Output Frequency Detection 1	General	Gear change interlock, etc.	" Closed " at or over the arbitrary output frequency.
	Output Frequency Detection 2	General	Gear change interlock, etc.	" Closed " at or below the arbitrary output frequency.
	Base Block Signal	General	Operation interlock, etc.	Always " closed " when the MxC output is OFF.
	Frequency Reference Sudden Change Detection	General	Improvement of continuous operation reliability	" Closed " when the frequency reference suddenly drops to 10% or less of the set value. Can be used to detect an error in the host controller.
Analog Input	Multi-function Analog Input Signal	General	Easy operation	Functions as a supplementary frequency reference. Also used for fine control of frequency reference, output voltage adjustment, external control of accel/decel time, and fine adjustment of overtorque detection level.
Analog Output	Multi-function Analog Output Signal	General	Monitor function enhancement	Use two of the following devices: a frequency meter, ammeter, voltmeter wattmeter, or U1 monitor.
Input Option	Analog Input (Optional)	General	Easy operation	Enables external operation with high resolution instructions (AI-14U, AI-14B). Also enables normal and reverse operation using positive or negative voltage signals (AI-14B).
	Digital Input (Optional)	General	Easy operation	Enables operation with 8-bit or 16-bit digital signals. Easily connects to NC or PC (DI-08, DI-16H2).
Output Option	Analog Output (Optional)	General	Monitor function enhancement	Monitors output frequency, output current, and I/O voltage (AO-08, AO-12).
	Digital Output (Optional)	General	Monitor function enhancement	Indicates errors through discrete output (DO-08).
PG Option	PG Speed Control (Optional)	General	Enhancement of speed control	Installing PG control card (PG-B2 and PG-X2) considerably enhances speed control accuracy.

* : Applicable for flux vector control.

Connection Diagram and Terminal Functions

Example of 200 V 11 kW (CIMR-ACA2011)



Notes :1 indicates shielded wire and indicates twisted-pair shielded wire.
2 Terminal symbols: ◎ shows main circuit; ○ shows control circuit.

*1: Connect to the momentary power loss ridethru unit. Do not connect power lines to these terminals.
*2: Normally not used. Do not connect power lines to these terminals.
*3: The output current capacity of the +V terminal is 20 mA. Do not create a short between the +V, −V, and AC control-circuit terminals. This may cause the MxC to malfunction.
*4: The wiring for a motor with a cooling fan is not required for self-cooling motors.
*5: PG circuit wiring (i.e., wiring to the PG-B2 Card) is not required for control without a PG.
*6: Sequence input signals S1 to S12 are labeled for sequence connections (0 V common and Sinking Mode) for no-voltage contacts or NPN transistors. These are the factory settings. For PNP transistor sequence connections (+24 V common and Sourcing Mode) or to provide a 24 V external power supply, refer to the Instruction Manual.
*7: The multi-function analog output is a dedicated meter output for an analog frequency meter, ammeter, voltmeter, wattmeter, etc. Do not use this output for feedback control or for any other control purpose.
*8: The minimum load of a multi-function contact output and an error contact output is 10 mA. Use a multifunction open-collector output for a load less than 10 mA.
*9: Do not ground the AC terminal of the control circuit and do not connect it to the grounding terminal on the MxC enclosure. This may cause the MxC to malfunction.

Control Circuit and Communication Circuit Terminal Arrangement

E(G)	FM	AC	AM	P1	P2	PC	SC
SC	A1	A2	A3	+V	AC	−V	
S1	S2	S3	S4	S5	S6	S7	S8

	P3	C3	P4	C4
	R+	R−	S+	S−
S9	S10	S11	S12	IG

MA	MB	MC	
M1		M2	E(G)

Terminal Functions

Main Circuit

Voltage Class	200 V				400 V				
Model CIMR-ACA ☐	25P5	2011	2022	2045*1	45P5	4011	4022	4045*1	4075*1
Max Applicable Motor Output kW	5.5	11	22	45	5.5	11	22	45	75
R/L1 S/L2 T/L3	Main circuit power inputs			–	Main circuit power inputs			–	–
U/T1 V/T2 W/T3	MxC outputs			–	MxC outputs			–	–
p1*2 n1*2	For connection to back-up capacitor unit for momentary power loss (optional)			–	For connection to Back-up capacitor unit for momentary power loss (optional)			–	–
r2*2 s2*2 t2*2	Usually, not used.			–	Usually, not used.			–	–
⏚	Ground (100 Ω or less)			–	Ground (10 Ω or less)			–	–

*1 : Under development. *2 : Do not connect power lines to these terminals.

Control Circuit (200/400 V Class)

Type	No.	Signal Name	Function	Signal Level
Sequence Input Signals	S1	Forward Run/Stop Command	Forward run when ON; stopped when OFF.	24 VDC, 8 mA Photocoupler isolation
	S2	Reverse Run/Stop Command	Reverse run when ON; stopped when OFF.	
	S3	Multi-function input 1	Factory setting: External fault when ON.	
	S4	Multi-function input 2	Factory setting: Fault reset when ON.	
	S5	Multi-function input 3	Factory setting: Multi-speed reference 1 effective when ON.	
	S6	Multi-function input 4	Factory setting: Multi-speed reference 2 effective when ON.	
	S7	Multi-function input 5	Factory setting: Jog frequency selected when ON.	
	S8	Multi-function input 6	Factory setting: External baseblock when ON.	
	S9	Multi-function input 7	Factory setting: Multi-speed reference 3 effective when ON.	
	S10	Multi-function input 8	Factory setting: Multi-speed reference 4 effective when ON.	
	S11	Multi-function input 9	Factory setting: Acceleration/deceleration time 1 selected when ON.	
	S12	Multi-function input 10	Factory setting: Emergency stop (NO contact) when ON.	
	SC	Sequence input common	–	
Analog Input Signals	+V	+15 V power output	+15 V power supply for analog references	+15 V (Max. current: 20 mA)
	–V	–15 V power output	–15 V power supply for analog references	–15 V (Max. current: 20 mA)
	A1	Master speed frequency reference	–10 to +10 V/–100 to +100% 0 to +10 V/100%	–10 to +10 V, 0 to +10 V (Input impedance: 20 kΩ)
	A2	Multi-function analog input	4 to 20 mA/100%, –10 to +10 V/–100 to +100%, 0 to +10 V/100% Factory setting: Added to terminal A1 (H3–09 = 0)	4 to 20 mA (Input impedance: 250 Ω)
	A3	Multi-function analog input	4 to 20 mA/100%, –10 to +10 V/–100 to +100%, 0 to +10 V/100% Factory setting: Analog speed 2 (H3–05 = 2)	4 to 20 mA (Input impedance: 250 Ω)
	AC	Analog reference common	0 V	–
	E(G)	Shield sheath, optional ground line connection point	–	–
Open Collector Outputs	P1	Multi-function PHC output 1	Factory setting: Zero-speed Zero-speed level (b2-01) or below when ON.	50 mA max. at +48 VDC
	P2	Multi-function PHC output 2	Factory setting: Frequency agreement detection Frequency within 2 Hz of set frequency when ON.	
	PC	Photocoupler output common for P1 and P2	–	
	P3 C3	Multi-function PHC output 3	Factory setting: Ready for operation when ON.	
	P4 C4	Multi-function PHC output 4	Factory setting: FOUT frequency detected when ON.	
Relay Outputs	MA	Fault output signal (NO contact)	Fault when closed across MA and MC	Dry contacts Contact capacity: 10 mA min. 1 A max. at 250 VAC 10 mA min. 1 A max. at 30 VDC Minimum permissible load: 5 VDC, 10 mA
	MB	Fault output signal (NC contact)	Fault when open across MB and MC	
	MC	Relay contact output common	–	
	M1 M2	Multi-function contact output (NO contact)	Factory setting: Operating Operating when ON across M1 and M2.	
Analog Monitor Outputs	FM	Multi-function analog monitor 1	Factory setting: Output frequency, 0 to +10 V/100% frequency	0 to +10 VDC ±5% 2 mA max.
	AM	Multi-function analog monitor 2	Factory setting: Current monitor, 5 V/MxC's rated current	
	AC	Analog common	–	

Communication Circuit Terminal (200/400 V Class)

Type	No.	Signal Name	Function	Signal Level
RS-485/422	R+ R–	MEMOBUS communications input	For 2-wire RS-485, short R+ and S+ as well as R– and S–.	Differential input, photocoupler isolation
	S+ S–	MEMOBUS communications output		Differential output, photocoupler isolation
	IG	Communications shield sheath	–	–

Fault Detection

When the MxC detects a fault, a fault contact output is triggered and the operator screen will display the appropriate fault code. The MxC output is shut off, which causes the motor to coast to a stop. The user may select how the MxC should stop the motor for some faults, and the MxC will obey the specified stop method when those faults occur.
If a fault occurs, refer to the Instruction Manual (Manual No. TOEP C710636 00) to identify and correct the problem that caused the fault. Use one of the following methods to reset the fault before restarting the MxC:

- Set a multi-function digital input (H1-01 to H1-10) to 14 (Fault Reset) and turn on the fault reset signal.
- Press the > RESET key on the digital operator.
- Cycle power to the MxC (i.e., turn the main circuit power supply off and back on again).
  A fault may occur if there is a short between the +V, –V, and AC terminals. Be sure the terminals have been wired properly.

Fault		Display	Meaning
Overcurrent	(OC)	OC Overcurrent	The MxC output current exceeded the overcurrent detection level. (200% of rated current)
Ground Fault*	(GF)	GF Ground Fault	The ground fault current at the MxC output exceeded approximately 50% of the MxC rated output current.
Power Supply Undervoltage	(AUV)	AUV Power UV	The power supplied to the MxC is below the minimum amount set to L2-21. 200 V class: Approx. 150 VAC 400 V class: Approx. 300 VAC
Control Circuit Overvoltage	(OV)	OV PS Overvolt	The control circuit voltage exceeded the overvoltage detection level. 200 V class: Approx. 410 V 400 V class: Approx. 870 V
Power Supply Overvoltage	(AOV)	AOV Power OV	The power-supply voltage exceeded the overvoltage detection level. 200 V class: Approx. 250 VAC 400 V class: Approx. 550 VAC
Control Circuit Undervoltage	(UV1)	UV1 Undervoltage	The control circuit DC voltage is below the Undervoltage Detection Level (L2-05). 200 V class: Approx. 190 V 400 V class: Approx. 380 V
Control Power Fault	(UV2)	UV2 CTL PS Undervolt	Not enough voltage is being produced by the power supply.
Power Supply Frequency Fault	(FDV)	FDV Freq DEV	The fluctuation in the power frequency exceeded the allowable amount.
Power Phase Rotation Variation	(SRC)	SRC Power Phase Err	After control power supply is on, the direction of the phase rotation changes.
Output Open-phase	(LF)	LF Output Pha Loss	An open phase occurred at the MxC output. This fault is detected when L8-07 is set to “ Enabled ”.
Cooling Fin Overheating	(OH,OH1)	OH, OH1 Heatsnk Overtemp	The temperature of the MxC’s cooling fins exceeded the setting in L8-02, 100˚C, or the overheating protection level.
Motor Overheating Alarm	(OH3)	OH3 Motor Overheat 1	The motor temperature exceeds the alarm detection level when L1-01 is set to 0, 1, or 2.
Motor Overheating Fault	(OH4)	OH4 Motor Overheat 2	The motor temperature exceeds the operation detection level.
Resistor Overheat	(SOH)	SOH Dischrg Res. Flt	The temperature of the resistor exceeded tolerance.
Internal Resistance Overheat	(DOH)	DOH Dumping OH	The temperature of the built-in resistor exceeded the set value.
Motor Overload	(OL1)	OL1 Motor Overloaded	The motor overload protection function has operated based on the internal electronic thermal value.
MxC Overload	(OL2)	OL2 MxC Overloaded	The MxC overload protection function has operated based on the internal electronic thermal value.
Overtorque Detected 1	(OL3)	OL3 Overtorque Det 1	The current is greater than the setting in L6-02 for longer than the setting in L6-03.
Overtorque Detected 2	(OL4)	OL4 Overtorque Det 2	The current is greater than the setting in L6-05 for longer than the setting in L6-06.
Undertorque Detected 1	(UL3)	UL3 Undertorq Det 1	The current is less than the setting in L6-02 for longer than the setting in L6-03.
Undertorque Detected 2	(UL4)	UL4 Undertorq Det 2	The current is less than the setting in L6-05 for longer than the setting in L6-06.
Overspeed	(OS)	OS Overspeed Det	The speed is greater than the setting in F1-08 for longer than the setting in F1-09.
PG Disconnection Detected	(PGO)	PGO PG Open	No PG pulse was input when the MxC was outputting a frequency.
Excessive Speed Deviation	(DEV)	DEV Speed Deviation	The speed deviation is greater than been greater than the setting in F1-10 for longer than the setting in F1-11.
Control Fault	(CF)	CF Ctl Fault	The torque limit is continuously reached for three seconds or longer during a decelerate to stop with open-loop vector control.

Fault	Display	Meaning
PID Feedback Reference Lost (FBL)	FBL Feedback Loss	A PID feedback reference loss was detected (b5-12 = 2) and the PID feedback input was less than b5-13 (PID feedback loss detection level) for longer than the time set in b5-14 (PID feedback loss detection time).
External Fault Input from Communications Option Card (EF0)	EF0 Opt External Flt	An " external fault " was input from a communications option card.
External Fault (Input Terminal S3) (EF3)	EF3 Ext Fault S3	An " external fault " was input from a multi-function input terminal.
External Fault (Input Terminal S4) (EF4)	EF4 Ext Fault S4	
External Fault (Input Terminal S5) (EF5)	EF5 Ext Fault S5	
External Fault (Input Terminal S6) (EF6)	EF6 Ext Fault S6	
External Fault (Input Terminal S7) (EF7)	EF7 Ext Fault S7	
External Fault (Input Terminal S8) (EF8)	EF8 Ext Fault S8	
External Fault (Input Terminal S9) (EF9)	EF9 Ext Fault S9	
External Fault (Input Terminal S10) (EF10)	EF10 Ext Fault S10	
External Fault (Input Terminal S11) (EF11)	EF11 Ext Fault S11	
External Fault (Input Terminal S12) (EF12)	EF12 Ext Fault S12	
Zero-servo Fault (SVE)	SVE Zero Servo Fault	The rotation position moved during zero-servo operation.
Digital Operator Connection Fault (OPR)	OPR Oper Disconnect	The connection to the digital operator was broken during running for a Run command from the digital operator.
MEMOBUS Communications Error (CE)	CE Memobus Com Err	A normal reception was not possible for 2 seconds or longer after control data was received once.
Option Communications Error (BUS)	BUS Option Com Err	A communications error was detected during a Run command or while setting a frequency reference from a communications option card.
Digital Operator Communications Error 1 (CPF00)	CPF00 COM-ERR(OP&INV)	Communications with the digital operator were not established within 5 seconds after the power was turned on.
CPU External RAM Fault (CPF00)		A fault has occured in the external RAM of the CPU.
Digital Operator Communications Error 2 (CPF01)	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)	CPF03 EEPROM Error	The control circuit is damaged.
CPU Internal A/D Converter Error (CPF04)	CPF04 Internal A/D Err	
CPU External A/D Converter Error (CPF05)	CPF05 External A/D Err	
Option Card Connection Error (CPF06)	CPF06 Option error	The option card is not connected properly.
ASIC Internal RAM Fault (CPF07)	CPF07 RAM-Err	The control circuit is damaged.
Watchdog Timer Fault (CPF08)	CPF08 WAT-Err	
CPU-ASIC Mutual Diagnosis Fault (CPF09)	CPF09 CPU-Err	
ASIC Version Fault (CPF10)	CPF10 ASIC-Err	
Communications Option Card A/D Converter Error (CPF20)	CPF20 Option A/D error	Communications option card fault.
Communications Option Card Self Diagnostic Error (CPF21)	CPF21 Option CPU down	
Communications Option Card Model Code Error (CPF22)	CPF22 Option Type Err	
Communications Option Card DPRAM Error (CPF23)	CPF23 Option DPRAM Err	

＊: The ground fault here is one which occurs in the motor wiring while the motor is running. A ground fault may not be detected in the following cases.
· A ground fault with low resistance which occurs in motor cables or terminals.
· A ground fault occurs when the power is turned on.

Alarm Detection

Alarms are detected as a type of MxC protection function that do not operate the fault contact output. The system will automatically return to its original status once the cause of the alarm has been removed.
The digital operator display flashes and the alarm is output from the multi-function outputs.

Alarm		Display	Meaning
Forward/Reverse Run Commands Input Together	EF (Flashing)	EF External Fault	Both the Forward and Reverse Run Commands have been on for more than 0.5 s.
Control Circuit Undervoltage	UV (Flashing)	UV PS Undervolt	The following conditions occurred when there was no run signal. · The control circuit voltage was below the undervoltage detection level setting (L2-05). · The control power supply voltage was below the CUV level.
Power Supply Undervoltage	AUV (Flashing)	AUV Power UV	The power supply is below the undervoltage detection level (L2-21). 200 V class: Approx. 150 VAC 400 V class: Approx. 300 VAC
Power Supply Frequency Fault	FDV (Flashing)	FDV Freq DEV	The fluctuation in the power frequency exceeded the allowable amount.
Power Supply Undervoltage	FDV (Flashing)	FDV Freq DEV	The power supply is below the undervoltage detection level (L2-21). 200 V class: Approx. 150 VAC 400 V class: Approx. 300 VAC
Power Phase Rotation Variation	SRC (Flashing)	SRC Power Phase Err	After control power supply is on, the direction of the phase rotation changes.
Control Circuit Overvoltage	OV (Flashing)	OV PS Overvolt	The control circuit voltage exceeded the overvoltage detection level. 200 V class: Approx. 410 V 400 V class: Approx. 870 V
Cooling Fin Overheating	OH (Flashing)	OH Heatsink Overtemp	The temperature of the MxC's cooling fins exceeded the setting in L8-02.
MxC Overheating Pre-alarm	OH2 (Flashing)	OH2 Over Heat 2	An OH2 alarm signal (MxC overheating alarm signal) was input from a multi-function input terminal (S3 to S12).
Motor Overheating	OH3 (Flashing)	OH3 Motor Overheat 1	The MxC continues or stops the operation according to the setting of L1-03.
Internal Resistance Overheat	DOH (Flashing)	DOH Dumping OH	The temperature of the built-in resistor exceeded the set value.
Overtorque 1	OL3 (Flashing)	OL3 Overtorque Det 1	The current is greater than the setting in L6-02 for longer than the setting in L6-03.
Overtorque 2	OL4 (Flashing)	OL4 Overtorque Det 2	The current is greater than the setting in L6-05 for longer than the setting in L6-06.
Undertorque 1	UL3 (Flashing)	UL3 Undertorq Det 1	The current is less than the setting in L6-02 for longer than the setting in L6-03.
Undertorque 2	UL4 (Flashing)	UL4 Undertorq Det 2	The current is less than the setting in L6-05 for longer than the setting in L6-06.
Overspeed	OS (Flashing)	OS Overspeed Det	The speed is greater than the setting in F1-08 for longer than the setting in F1-09.
The PG is Disconnected	PGO (Flashing)	PGO PG Open	The MxC is outputting a frequency, but no PG pulse is being input.
Excessive Speed Deviation	DEV (Flashing)	DEV Speed Deviation	The speed deviation is greater than the setting in F1-10 for longer than the setting in F1-11.
External Fault Detected for Communications Card	EF0 (Flashing)	EF0 Opt External Flt	Continuing operation was specified for EF0 (F6-03=3) and an external fault was input from the option card.
External Fault (Input Terminal S3)	EF3 (Flashing)	EF3 Ext Fault S3	An external fault was input from a multi-function input terminal.
External Fault (Input Terminal S4)	EF4 (Flashing)	EF4 Ext Fault S4	
External Fault (Input Terminal S5)	EF5 (Flashing)	EF5 Ext Fault S5	
External Fault (Input Terminal S6)	EF6 (Flashing)	EF6 Ext Fault S6	
External Fault (Input Terminal S7)	EF7 (Flashing)	EF7 Ext Fault S7	
External Fault (Input Terminal S8)	EF8 (Flashing)	EF8 Ext Fault S8	
External Fault (Input Terminal S9)	EF9 (Flashing)	EF9 Ext Fault S9	
External Fault (Input Terminal S10)	EF10 (Flashing)	EF10 Ext Fault S10	
External Fault (Input Terminal S11)	EF11 (Flashing)	EF11 Ext Fault S11	
External Fault (Input Terminal S12)	EF12 (Flashing)	EF12 Ext Fault S12	

Alarm	Display	Meaning
PID Feedback Reference Lost FBL (Flashing)	FBL Feedback Loss	A PID feedback reference loss was detected (b5-12=2) and the PID feedback input was less than b5-13 (PID feedback loss detection level) for longer than the time set in b5-14 (PID feedback loss detection time).
MEMOBUS Communications Error CE (Flashing)	CE MEMOBUS Com Err	Normal reception was not possible for 2 s or longer after received control data.
Option Card Communications Error BUS (Flashing)	BUS Option Com Err	A communications error occurred in a mode where the Run Command or a frequency reference is set from an communications option card.
Communications on Standby CALL (Flashing)	CALL Com Call	Control data was not normally received when power was turned on.

Operation Errors

An operation error will occur if there is an invalid setting or a contradiction between two parameter settings. The MxC cannot be started until the parameters have been correctly set (the alarm output and fault contact outputs will not operate either).

Error	Display	Meaning
Incorrect MxC Capacity Setting OPE01	OPE01 kVA Selection	The MxC capacity setting doesn't match the MxC being used. Contact your Yaskawa representative.
Parameter Setting Range Error OPE02	OPE02 Limit	The parameter setting is outside of the valid setting range.
Multi-Function Input Selection Error OPE03	OPE03 Terminal	Multi-Function Input Selection Error
Option Card Selection Error OPE05	OPE05 Sequence Select	The option card was selected as the frequency reference source by setting b1-01 to 3, but an option card isn't connected (C option).
Control Method Selection Error OPE06	OPE06 PG Opt Missing	Flux Vector Control was selected by setting A1-02 to 3, but a PG Speed Control Card isn't connected.
Multi-Function Analog Input Selection Error OPE07	OPE07 Analog Selection	The same setting is selected for the analog input selection and the PID function selection.
Parameter Selection Error OPE08	OPE08 Ctrl Func Error	A setting has been made that is not required in the current control method.
PID Control Selection Error OPE09	OPE09 PID Select Error	PID Control Selection Error
V/f Data Setting Error OPE10	OPE10 V/f Ptrn Setting	Parameters E1-04, E1-06, E1-07, and E1-09 do not satisfy the following conditions: · E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN) · E3-02 (FMAX) ≥ E3-04 (FA) > E3-05 (FB) ≥ E3-07 (FMIN)
Default Error OPE20	OPE20 Factory Setting Err	The defaults were not set replacing the control card.
EEPROM Write Error ERR	ERR EEPROM R/W Err	A verification error occurred when writing EEPROM.

Option Cards

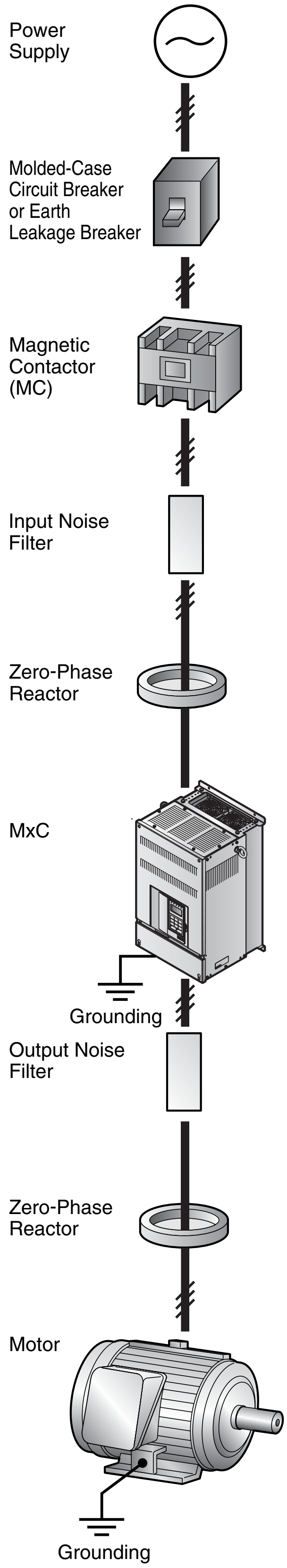
Type		Name	Code Number	Function	Document Number
Built-in (connect to connector)	Speed (Frequency) Reference Option Cards	Analog Reference Card AI-14U	73600-C001X	Enables high-precision, high-resolution setting of analog speed references. · Input signal level : 0 to +10 VDC (20 kΩ), 1 channel 4 to 20 mA DC (250 Ω), 1 channel · Input resolution : 14-bit (1/16384)	TOE-C736-30.13
		Analog Reference Card AI-14B	73600-C002X	Enables high-precision, high-resolution setting of analog speed references. · Input signal level : 0 to +10 VDC (20 kΩ) 4 to 20 mA (500 Ω), 3 channels · Input resolution : 13-bit + sign (1/8192)	TOBP C730600 15
		Digital Reference Card DI-08	73600-C003X	Enables 8-bit digital setting of speed references. · Input signal : 8-bit binary 2-digit BCD + sign signal + set signal · Input voltage : +24 V (isolated) · Input current : 8 mA	TOE-C736-30.15
		Digital Reference Card DI-16H2	73600-C016X	Enables 16-bit digital setting of speed references. · Input signal : 16-bit binary 4-digit BCD + sign signal + set signal · Input voltage : +24 V (isolated) · Input current : 8 mA With 16-bit/12-bit switch.	TOE-C736-40.7
	Monitoring Option Cards	Analog Monitor Card AO-08	73600-D001X	Converts analog signals to monitor the MxC's output status (output frequency, output current, etc.) to absolute values and outputs them. · Output resolution : 8-bit (1/256) · Output voltage : 0 to +10 V (not insulated) · Output channels : 2 channels	TOE-C736-30.21
		Analog Monitor Card AO-12	73600-D002X	Output analog signals to monitor the MxC's output status (output frequency, output current, etc.). · Output resolution : 11 bits (1/2048) + sign · Output voltage : –10 to +10 V (not insulated) · Output channels : 2 channels	TOE-C736-30.22
		Digital Output Card DO-08	73600-D004X	Outputs isolated digital signals to monitor the MxC's operating status (alarm signals, zero-speed detection, etc.) Output form: Photocoupler outputs, 6 channels (48 V, 50 mA max.) Relay contact outputs, 2 channels (250 VAC: 1 A max., 30 VDC: 1 A max.)	TOE-C736-30.24
		2C-Relay Output Card DO-02C	73600-D007X	Provides two multi-function outputs (DPDT relay contacts) in addition to those provided by the MxC.	TOE-C736-40.8
	PG Speed Control Cards*1	PG-B2	73600-A013X	· Used for Flux Vector Control. · A-, B-phase input (complimentary input) · Maximum input frequency: 32767 Hz · Pulse monitor output: Open-collector (PG power supply output: +12 V, 200 mA max.)	TOBP C730600 09
		PG-X2	73600-A015X	· A-, B-, Z-phase pulse (differential pulse) input · Maximum input frequency: 300 kHz · Input: Conforms to RS-422 · Pulse monitor output: RS-422 (PG power supply output: + 5 V or +12 V, 200 mA max.)	TOBP C730600 10
	Communications Option Cards	MECHATROLINK Interface Card SI-T	*2	Used to communicate with the MxC from a host controller using MECHATROLINK to start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	–
		DeviceNet Interface Card SI-N1	*2	Used to communicate with the MxC from a host controller using DeviceNet to start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	–
		CC-Link Interface Card SI-C	73600-C032X	Used to communicate with the MxC from a host controller using CC-Link to start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	TOBZ-C736-70.6
		Profibus-DP Interface Card SI-P1	*2	Used to communicate with the MxC from a host controller using Profibus-DP to start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	–
		LONWORKS Interface Card SI-J	*2	Used to communicate with the MxC from a host controller using LONWORKS to control HVAC, start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	–
		CANopen Interface Card SI-S1	*2	Used to communicate with the MxC from a host controller using CANopen to start/stop MxC operation, read/set parameters, and read/set monitor parameters (output frequencies, output currents, etc.).	–

*1 : PG speed control card is required for PG control.
*2 : Under development.

Notes : DeviceNet is a registered trademark of the Open DeviceNet Vendor Association(ODVA).
LONWORKS is a registered trademark of Echelon Corp.

Peripheral Devices

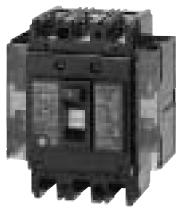
Purpose	Name	Model (Code)	Descriptions	Ref.Page
Protects the MxC wiring	MCCB or Earth Leakage Breaker *	NF□	Always connect a breaker to the power supply line to protect the MxC wiring.	P22
Prevents burning of the MxC	Magnetic Contactor	SC series	Install to prevent the MxC from burning out when faults occur at the input terminal side of the MxC. Always attach a surge absorber to the coil.	P22
Contains switching surge	Surge Suppressor	DCR2-□	Absorbs surge from the magnetic contactor and control relays. Connect surge suppressors to all magnetic contactors and relays near the MxC.	P22
Isolates I/O signals	Isolator	DGP□	Isolates the I/O signals of the MxC and is enabled against inductive noise.	P28
Reduces the effects of radio and control device noise	Input Noise Filter	LNFD-□ FN-□	Reduces noise coming into the MxC from the power supply line and noise flowing from the MxC into the power supply line. Connect as close to the MxC as possible.	P23
	Finemet Zero-Phase Reactor to Reduce Radio Noise	F6045GB (FIL001098) F11080GB (FIL001097)	Reduces noise coming into the MxC from the power supply line and noise flowing from the MxC into the power supply line. Insert as close to the MxC as possible. Can be used on both the input and output sides.	P26
	Output Noise Filter	LF-□	Reduces noise generated by the MxC. Connect as close to the MxC as possible.	P25
Operates the MxC externally	VS Operator (Small Plastic Operator)	JVOP-95·□ (73041-0905X-□)	Allows frequency reference settings and ON/OFF operation control to be performed by analog references from a remote location (50 m max). Frequency counter specifications: 60/120 Hz, 90/180Hz	–
	VS Operator (Standard Steel-Plate Operator)	JVOP-96·□ (73041-0906X-□)	Allows frequency reference settings and ON/OFF operation control to be performed by analog references from a remote location (50 m max) Frequency counter specifications: 75 Hz, 150 Hz, 220 Hz	–
	Digital Operator Extension Cable	1 m cable: (WV001) 3 m cable: (WV003)	Extension cable to use a digital operator remotely. Cable length: 1 m or 3 m	P26
Controls the MxC system	VS System Module	JGSM-□	A system controller that can be matched to the automatic control system to produce an optimum system configuration. Document No. : TSE-C730-30	–
Saves the momentary power loss compensation time of the MxC	Back-up Capacitor Unit for Momentary Power Loss	P00□0 (73600-P00□0)	Safety measure taken to protect against momentary power loss of the control power supply. Document No. : TOE-C736-50.6	P28
Sets/monitors frequencies sand voltages externally	Frequency Meter	DCF-6A	Devices to set or monitor frequencies externally.	P27
	Frequency Setting Potentiometer	RV30YN20S 2kΩ (RH000739)		
	Frequency Setting Knob	CM-3S		
	Output Voltmeter	SCF-12NH	Devices to measure the output voltage externally.	P27
Corrects frequency reference input, frequency meter, ammeter scales	Potentiometer for Frequency Reference	2 kΩ (ETX003270) 20 kΩ (ETX003120)	Connected to the control circuit terminals to input a frequency reference.	P27
	Frequency Meter Adjusting Potentiometer	RV30YN20S 20 kΩ (RH000850)	Calibrates the scale of frequency meters and ammeters.	P27



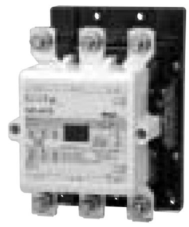
＊: Use an earth leakage breaker which has harmonics protection and a minimum current of 30 mA per MxC. Otherwise, the harmonic leakage current may cause a malfunction. If a malfunction occurs in an earth leakage breaker without harmonic protection, lower the carrier frequency of the MxC, replace the earth leakage breaker with one that has harmonic protection, or raise the current of the earth leakage breaker to 200 mA or more per MxC.
(Example) Mitsubishi Electric Corporation NV series (those produced after 1988)
Fuji Electric FA Components & Systems Co., Ltd. EG, SG series (those produced after 1984)

Molded-Case Circuit Breaker (MCCB) and Magnetic Contactor (MC)

Be sure to connect MCCBs between power supply and MxC input terminals R/L1, S/L2, T/L3. Recommended MCCBs are listed as follows. Connect MC if required.



Molded-Case Circuit Breaker (MCCB)
[Mitsubishi Electric Corporation]



Power Supply Magnetic Contactor (MC)
[Fuji Electric FA Components & Systems Co., Ltd]

200 V Class

Motor Capacity kW	MxC Model CIMR-AC ☐	Molded-Case Circuit Breaker Model	Molded-Case Circuit Breaker Rated Current (A)	Magnetic Contactor Model	Magnetic Contactor Rated Current (A)
5.5	25P5	NF50	40	SC-N2	35
11	2011	NF100	75	SC-N4	80
22	2022	NF225	150	SC-N6	125
45	2045*	NF400	250	SC-N10	220

* : Under development.

400 V Class

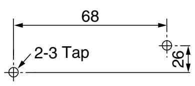
Motor Capacity kW	MxC Model CIMR-AC ☐	Molded-Case Circuit Breaker Model	Molded-Case Circuit Breaker Rated Current (A)	Magnetic Contactor Model	Magnetic Contactor Rated Current (A)
5.5	45P5	NF30	20	SC-N1	25
11	4011	NF50	40	SC-N2S	48
22	4022	NF100	75	SC-N4	80
45	4045*	NF225	150	SC-N6	110
75	4075*	NF225	225	SC-N8	180

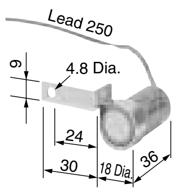
* : Under development.

Surge Suppressor (NIPPON CHEMI-CON CORPORATION)

Install surge suppressors for coils in electromagnetic contactors, control relays, electromagnetic valves, and electromagnetic brakes used as the MxC peripheral units.

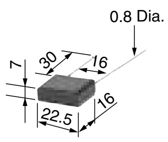
Details of Mounting Hole Dimensions





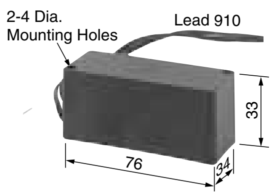
Mass : 22 g

Type: DCR2-50A22E



Mass : 5 g

Type: DCR2-10A25C



Mass : 150 g

Type: RFN3AL504KD

Units : mm

<table>
<tr><th colspan="3">Surge Suppressor / Peripheral Units</th><th>Model</th><th>Specifications</th><th>Code No.</th></tr>
<tr><td rowspan="2">200 V to 230 V</td><td colspan="2">Large-Size Magnetic Contactors</td><td>DCR2-50A22E</td><td>220 VAC, 0.5μF+200Ω</td><td>C002417</td></tr>
<tr><td>Control Relay</td><td>MY2*1, MY3*1
MM2*1, MM4*1
HH22*2, HH23*2</td><td>DCR2-10A25C</td><td>250 VAC, 0.1μF+100Ω</td><td>C002482</td></tr>
<tr><td colspan="3">380 V to 460 V</td><td>RFN3AL504KD</td><td>1000 VDC, 0.5μF+220Ω</td><td>C002630</td></tr>
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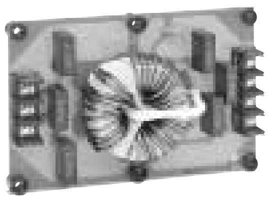
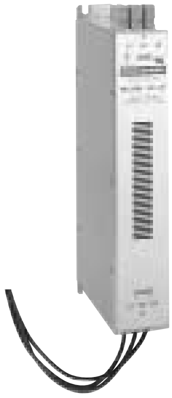
*1 : Manufactured by Omron Corporation.
*2 : Manufactured by Fuji Electric FA Components & Systems Co., Ltd.

Input Noise Filter

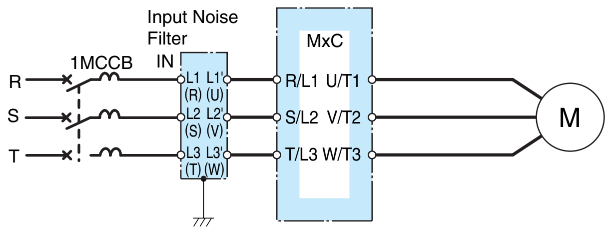


Manufactured
by YASKAWA



Manufactured by
Schaffner Electronik AG

Example of Noise Filter Connection



Notes : 1 Symbols in parentheses are for YASKAWA noise filters.
2 Be sure to connect input noise filter on MxC input side (R/L1, S/L2, T/L3).

200 V Class

MxC Model CIMR-ACA□	Max. Applicable Motor Output kW	Yaskawa Noise Filter without Case				Yaskawa Noise Filter with Case				Noise Filter by Schaffner Electronik AG			
		Model	Code No.	Qty.	Rated Current A	Model	Code No.	Qty.	Rated Current A	Model	Code No.	Qty.	Rated Current A
25P5	5.5	LNFD-2203 DY	72600-D2203 DY	2	40	LNFD-2203 HY	72600-D2203 HY	2	40	FN258L-42-07	FIL001065	1	42
2011	11	LNFD-2303 DY	72600-D2303 DY	3	90	LNFD-2303 HY	72600-D2303 HY	3	90	FN258L-75-34	FIL001067	1	75
2022	22	LNFD-2303 DY	72600-D2303 DY	4	120	LNFD-2303 HY	72600-D2303 HY	4	120	FN258L-130-35	FIL001069	1	130
2045*	45	–	–	–	–	–	–	–	–	FN359P-250-99	FIL001071	1	250

* : Under development.

400 V Class

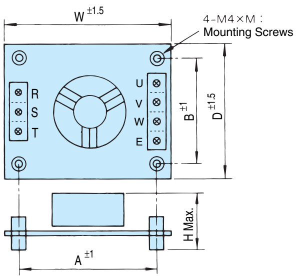
MxC Model CIMR-ACA□	Max. Applicable Motor Output kW	Noise Filter without Case				Noise Filter with Case				Noise Filter by Schaffner Electronik AG			
		Model	Code No.	Qty.	Rated Current A	Model	Code No.	Qty.	Rated Current A	Model	Code No.	Qty.	Rated Current A
45P5	5.5	LNFD-4203 DY	72600-D4203 DY	1	20	LNFD-4203 HY	72600-D4203 HY	1	20	–	–	–	–
4011	11	LNFD-4203 DY	72600-D4203 DY	2	40	LNFD-4203 HY	72600-D4203 HY	2	40	FN258L-42-07	FIL001065	1	42
4022	22	LNFD-4303 DY	72600-D4303 DY	3	90	LNFD-4303 HY	72600-D4303 HY	3	90	FN258L-75-34	FIL001067	1	75
4045*	45	LNFD-4303 DY	72600-D4303 DY	4	120	LNFD-4303 HY	72600-D4303 HY	4	120	FN258L-130-35	FIL001069	1	130
4075*	75	–	–	–	–	–	–	–	–	FN359P-250-99	FIL001071	1	250

* : Under development.

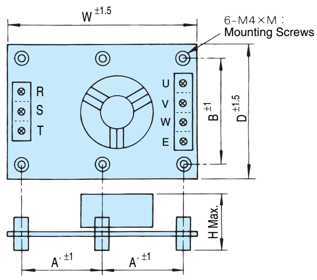
Input Noise Filter (Cont'd)

● Dimensions

Without Case

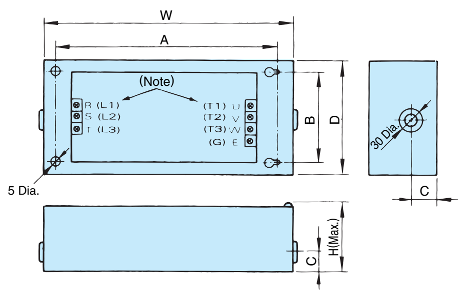


Drawing 1



Drawing 2

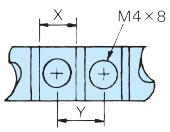
With Case



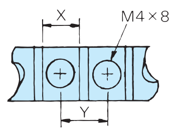
Note: The drawing shows when using a noise filter for 3-phase power supply.

Units : mm

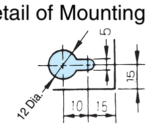
Detail of Terminal Station



Detail of Terminal Station



Detail of Mounting Hole

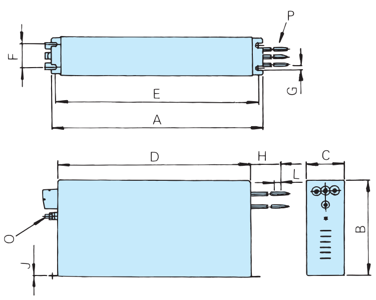


Mounting Screw : 4-M4×10

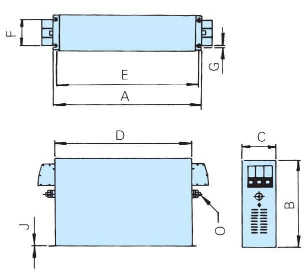
Model LNFD-□	Code No. 72600-	DWG	Noise Filter W	D	H	A(A')	B	M	Terminal X	Y	Mass kg
2203DY	D2203DY	1	170	90	70	158	78	20	9	11	0.4
2303DY	D2303DY	2	170	110	70	(79)	98	20	10	13	0.5
4203DY	D4203DY	2	200	145	100	(94)	133	30	9	11	0.5
4303DY	D4303DY	2	200	145	100	(94)	133	30	10	13	0.6

Model LNFD-□	Code No. 72600-	Noise Filter W	D	H	A	B	C	Terminal X	Y	Mass kg
2203HY	D2203HY	240	125	100	210	95	33	9	11	1.5
2303HY	D2303HY	240	125	100	210	95	33	10	13	1.6
4203HY	D4203HY	270	155	125	240	125	43	9	11	2.2
4303HY	D4303HY	270	155	125	240	125	43	10	13	2.2

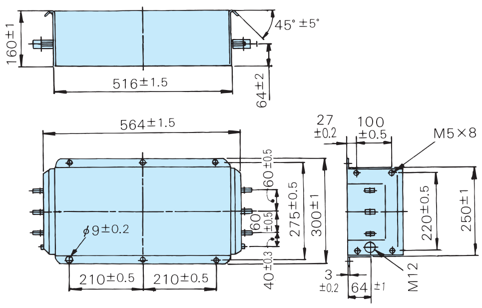
Manufactured by Schaffner Electronik AG



Drawing 1



Drawing 2

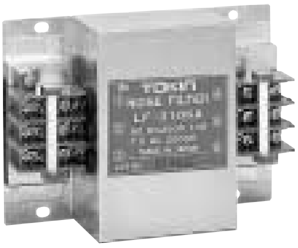


Drawing 3

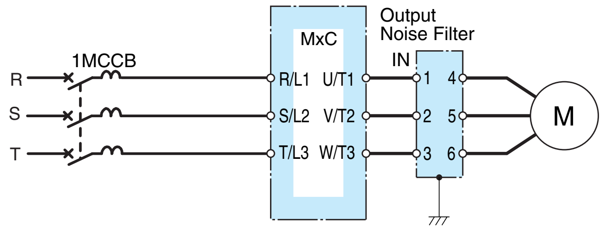
Units : mm

Model	DWG	A	B	C	D	E	F	G	H	J	L	O	P	Mass kg
FN258L-42-07	1	329	185±1	70	300	314	45	6.5	500	1.5	12	M6	AWG8	2.8
FN258L-75-34	2	329	220	80	300	314	55	6.5	–	1.5	–	M6	–	4.0
FN258L-130-35	2	439±1.5	240	110±0.8	400±1.2	414	80	6.5	–	3	–	M10	–	7.5
FN359P-250-99	3	See dimensions in the drawing.												16

Output Noise Filter (Tohoku Metal Industries Co., Ltd.)



Example of Noise Filter Connection



200 V Class

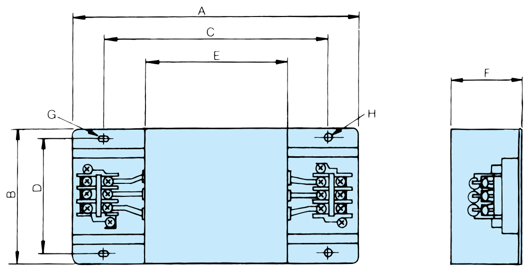
MxC Model CIMR-ACA□	Max. Applicable Motor Output kW	Output Noise Filter Model	Code No.	Qty.*1	Rated Current A
25P5	5.5	LF-350 KA	FIL000070	1	50
2011	11	LF-350 KA	FIL000070	2	100
2022	22	LF-350 KA*2	FIL000070	3	150
		LF-3110 KB*2	FIL000076	1	110
2045*3	45	LF-3110 KB	FIL000076	2	220

400 V Class

MxC Model CIMR-ACA□	Max. Applicable Motor Output kW	Output Noise Filter Model	Code No.	Qty.*1	Rated Current A
45P5	5.5	LF-320 KB	FIL000072	1	20
4011	11	LF-335 KB	FIL000073	1	35
4022	22	LF-375 KB	FIL000075	1	75
4045*3	45	LF-3110 KB	FIL000076	1	110
4075*3	75	LF-3110 KB	FIL000076	2	220

*1 : When two filters or more are required, connect them in parallel.
*2 : Use one of noise filters for the CIMR-ACA2022 model.
*3 : Under development.

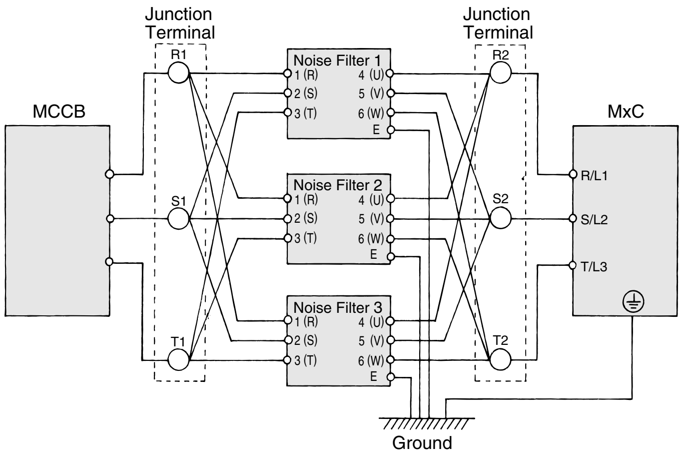
Dimensions



Units : mm

Model	Terminal Plate	A	B	C	D	E	F	G	H	Mass kg
LF-350 KA	TE-K22 M6	260	180	180	160	120	65	7×4.5 Dia.	4.5 Dia.	2.0
LF-320 KB	TE-K5.5 M4	140	100	100	90	70	45	7×4.5 Dia.	4.5 Dia.	0.6
LF-335 KB	TE-K5.5 M4	140	100	100	90	70	45	7×4.5 Dia.	4.5 Dia.	0.8
LF-375 KB	TE-K22 M6	540	320	480	300	340	240	9×6.5 Dia.	6.5 Dia.	12.0
LF-3110 KB	TE-K60 M8	540	340	480	300	340	240	9×6.5 Dia.	6.5 Dia.	19.5

Input/Output Noise Filter Parallel Installation Example (If connecting three input noise filters in parallel)



· When connecting noise filters in parallel, install junction terminals to equalize ground return.
· Ground wires for noise filter and MxC should be thick and as short as possible.

Peripheral Devices

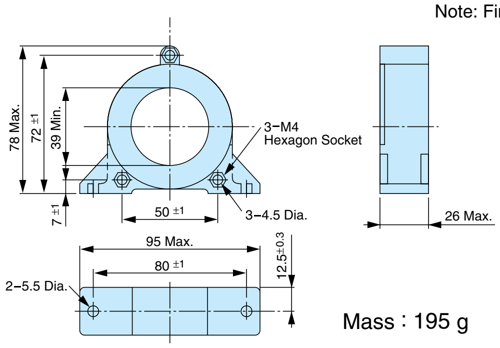
Zero-Phase Reactor

Finemet Zero-Phase Reactor to Reduce Radio Noise (Hitachi Metals, Ltd.)

Units : mm

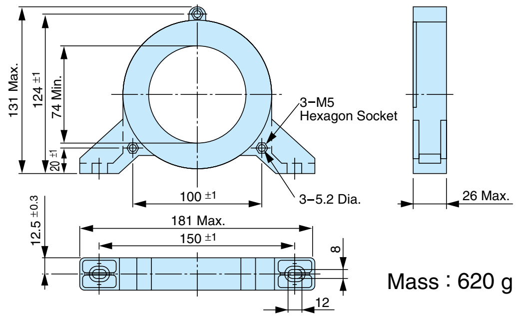
Note: Finemet is a registered trademark of Hitachi Metals, Ltd.

Can be used both for input and output sides of the MxC and is effective for noise reduction.



Mass : 195 g

Model: F6045GB



Mass : 620 g

Model: F11080GB

200 V Class

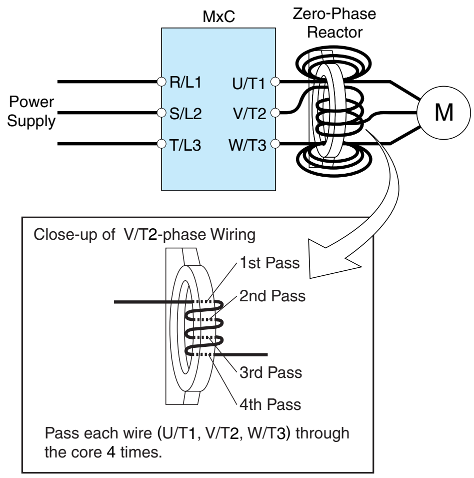
MxC			Finemet Zero-Phase Reactor			
MxC Model CIMR-ACA□	Recommended Wire Size mm² Input Side	Recommended Wire Size mm² Output Side	Model	Code No.	Qty.	Recommended Wiring Method*2
25P5	8	8	F11080GB	FIL001097	1	4 passes through core (Diagram A)
2011	22	22	F6045GB	FIL001098	4	4 series (Diagram B)
2022	50	50	F11080GB	FIL001097		
2045*1	50×2P	50×2P				

400 V Class

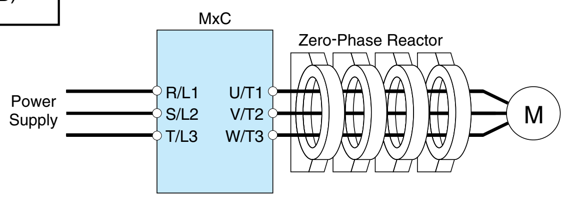
MxC			Finemet Zero-Phase Reactor			
MxC Model CIMR-ACA□	Recommended Wire Size mm² Input Side	Recommended Wire Size mm² Output Side	Model	Code No.	Qty.	Recommended Wiring Method*2
45P5	5.5	5.5	F6045GB	FIL001098	1	4 passes through core (Diagram A)
4011	8	8	F11080GB	FIL001097		
4022	22	22	F6045GB	FIL001098	4	4 series (Diagram B)
4045*1	50	50	F11080GB	FIL001097		
4075*1	100	100				

*1 : Under development.
*2 : Determined by wire size.

Connection Diagram A : Example of Wiring on the Output Side

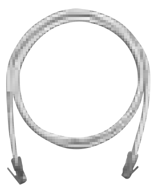


Connection Diagram B : Example of Wiring on the Output Side



Put all wires (U/T1, V/T2, W/T3) through 4 cores in series without winding.

Digital Operator Extension Cable

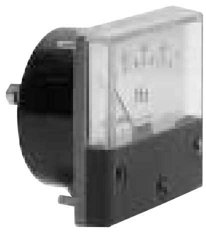


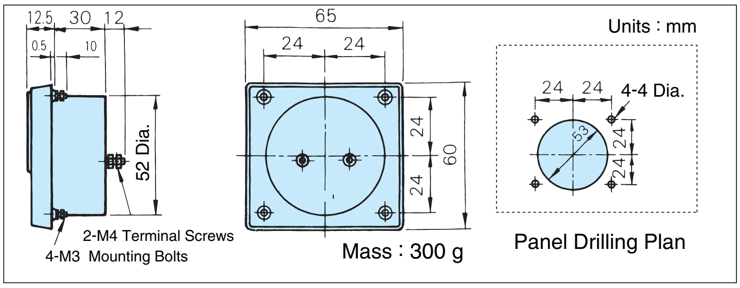
Length	Code No.
1 m	WV001
3 m	WV003

PC Communications Support Tool Cable

Specification	Code No.
IBM-Compatible Computer (DOS/V) (DSUB9P) Cable Length : 3 m	WV103

Frequency Meter/Ammeter 1 mA Full-Scale [Model : DCF-6A*, 3 V]



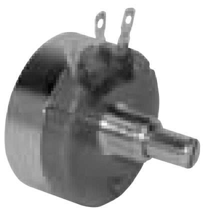


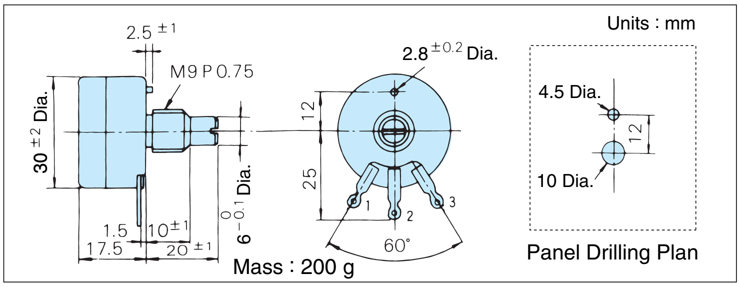
*: DCF-6A is 3 V, 1 mA, 3 kΩ. For MxC multi-function analog monitor output, set frequency meter adjusting potentiometer (20 kΩ) or parameter H4-02, -05 (analog monitor output gain) within the range of 0 to 3 V (initial setting is 0 to 10 V).

Note : For scale of ammeter, contact your YASKAWA representative.

Frequency Setting Potentiometer [Model : RV30YN20S, 2kΩ (Code No. RH 000739)]

Frequency Meter Adjusting Potentiometer [Model : RV30YN20S, 20 kΩ (Code No. RH 000850)]

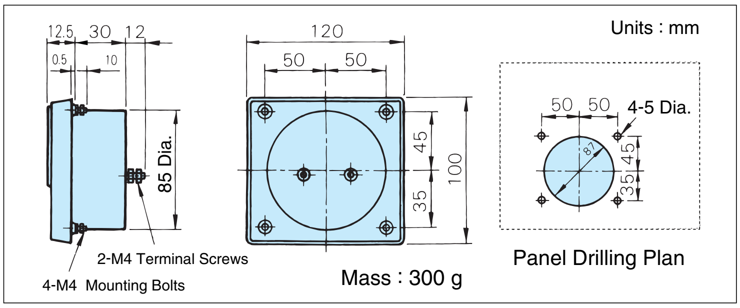




Output Voltmeter Rectification Type Class 2.5 [Model : SCF-12NH]

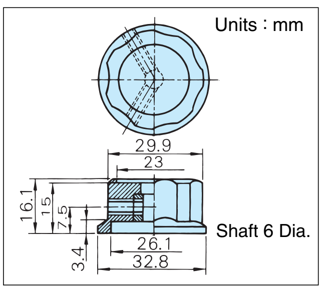
200 V Class : 300 V Full-scale [Output Voltmeter : Code No. VM000481]

400 V Class : 600 V Full-scale [Output Voltmeter : Code No. VM000502
Transformer for Instrument : Code No. PT000084]



Frequency Setting Knob

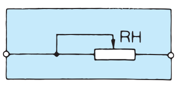
[Model : CM-3S]



Potentiometer

- 2 kΩ for frequency reference control (Code No. EXT003270)
- 20 kΩ for scale adjusting (Code No. EXT003120)

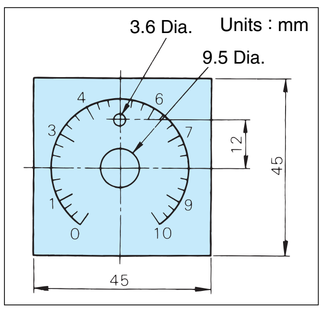
Mass : 20 g



Note : Attach to MxC terminal.

Scale Plate

(Code No. NPJT41561-1)



Isolator (Insulation Type DC Transmission Converter)

Performance

(1) Allowance: ±0.25 % of output span (Ambient temp.: 23℃)

(2) Temperature Influence: With ±0.25 % of output span (The value at ±10℃ of ambient temp.)

(3) Aux. Power Supply Influence: With ±0.1 % of output span (The value at ±10 % of aux. power supply)

(4) Load Resistance Influence: With ±0.05 % of output span (In the range of load resistance)

(5) Output Ripple: With 0.5 % peak to peak of output span

(6) Response Time: 0.5 s or less (Time to settle to ±1 % of final steady value)

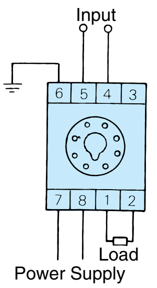
(7) Withstand Voltage: 2000 VAC for one min. (between each terminal of input, output, power supply, and enclosure)

(8) Insulation Resistance: 20 MΩ and above (by 500 VDC megger) (between each terminal of input, output, power supply, and enclosure)

Product Line

Model	Input Signal	Output Signal	Power Supply	Code No.
DGP2-4-4	0 to 10 V	0 to 10 V	100 VAC	CON 000019.25
DGP2-4-8	0 to 10 V	4 to 20 mA	100 VAC	CON 000019.26
DGP2-8-4	4 to 20 mA	0 to 10 V	100 VAC	CON 000019.35
DGP2-3-4	0 to 5 V	0 to 10 V	100 VAC	CON 000019.15
DGP3-4-4	0 to 10 V	0 to 10 V	200 VAC	CON 000020.25
DGP3-4-8	0 to 10 V	4 to 20 mA	200 VAC	CON 000020.26
DGP3-8-4	4 to 20 mA	0 to 10 V	200 VAC	CON 000020.35
DGP3-3-4	0 to 5 V	0 to 10 V	200 VAC	CON 000020.15

● Wiring Connections



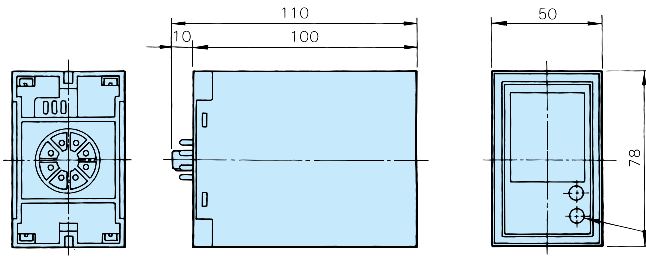
Terminal	Description
1	Output +
2	Output –
3	–
4	Input +
5	Input –
6	Ground
7	Power
8	Supply

● Cable Length

- 4 to 20 mA : Within 100 m
- 0 to 10 V : Within 50 m

● Dimensions Units : mm

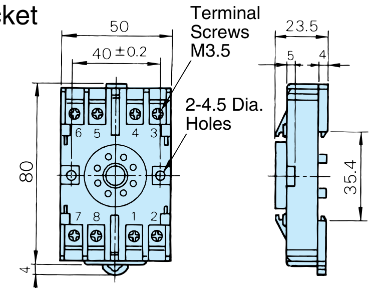
Isolator



*:Potentiometer's adjuster position varies according to the model.

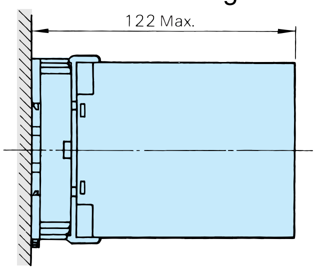
Approx. Mass : 350 g

Socket



Approx. Mass : 60 g

View of Socket Mounting

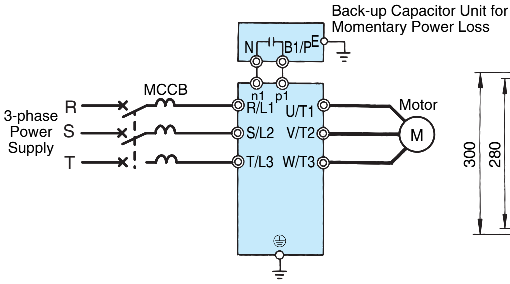


● Back-up Capacitor Unit for Momentary Power Loss

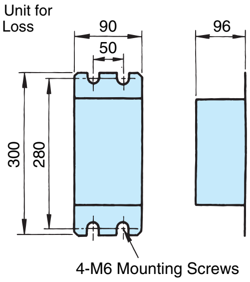
Use this unit to extend the MxC's power loss ride-thru ability to 2 seconds.*
200 V Class [P0010] (Code No.: 73600-P0010)
400 V Class [P0020] (Code No.: 73600-P0020)

Mass : 2 kg

● Connection with MxC



● Dimensions Units : mm



*: If this unit is not used, the MxC can ride thru a power loss for 0.5 to 2 seconds, depending on the MxC's capacity and operating conditions.

Varispeed AC Application Precautions

Selection

■Reduction Ratio of Carrier Frequency, Control Method, and Rated Current

The following table shows the reduction ratio of the carrier frequency, control methods, and rated current.
Model : CIMR-ACA25P5, 2011, 2022, 45P5, and 4011

Carrier Frequency	Control Method	Continuous Rating	60-second Rating
4 kHz	V/f Open-Loop Vector Flux Vector	100 %	150 %
8 kHz	Flux Vector	90 %	135 %
12 kHz	Flux Vector	80 %	120 %

Model : CIMR-ACA4022

Carrier Frequency	Control Method	Continuous Rating	60-second Rating
4 kHz	V/f Open-Loop Vector Flux Vector	100 %	150 %
8 kHz	Flux Vector	80 %	120 %
12 kHz	Flux Vector	60 %	90 %

Note: 100% means the rated current value.

■Required Time to be Ready

The MxC needs one second more than general-purpose inverters to prepare for operation. Be careful of this delay if using an external reference input.

Model	Required Time to be Ready after Power is Turned on
Varispeed AC (MxC)	Approx. 1.5 seconds*
Varispeed G7/F7	Approx. 0.5 seconds*

*: This time is required if no optional device is used with the MxC. If an optional communications device is used, the time required for the MxC to be ready for operation will vary in accordance with the startup time of the optional communications card.

■Number of Motors

An MxC is capable of operating only one motor. Do not use a single MxC to operate several motors.

■Improving the Power Factor

No AC reactor or DC reactor is required to improve the power factor.

■Selection of Power Capacity

Use a power supply that is greater than the rated input capacity (kVA) of the MxC. If the power is lower than the rated capacity of the MxC, the device will be unable to run the application properly and a fault will occur.
The input capacity of the MxC, S_{CONV} (kVA), can be calculated by the following formula.

$S_{CONV} = \sqrt{3} \times I_{in} \times V_{in} \div 1000$

(I_{in} : MxC Rated input current [A], V_{in} : Applicable power line-to-line voltage [V])

■Connection to Power Supply

The total impedance of the power supply and wiring for the rated current of the MxC is %Z = 10 % or more. If the impedance of the power supply is too large, then power voltage distortion may occur. If the wiring is too long, be sure that proper preventative measures such as thick cables or series wiring have been taken to lower the impedance of the wiring.

■Installing a Noise Filter

When a noise filter is attached on the MxC power supply side, use a noise filter such as the finemet zero-phase reactor.

■When the Power Supply is a Generator

- Select a generator capacity approx. twice as large as the MxC input power supply capacity. For further information, contact your Yaskawa representative.
- Set deceleration time or load so that the regenerative power from the motor will be 10% or less of the generator capacity.

■When a Phase Advance Capacitor or Thyristor Controller is Provided for the Power Supply

No phase advance capacitor is needed for the MxC. Installing one on the MxC will result in reduction of power factor.
For the phase advance capacitor that has already been installed on the same power supply system as the MxC, attach a series reactor to prevent oscillation with the MxC.
Contact your Yaskawa representative if any device generating voltage surge or voltage distortion, such as a DC motor drive thyristor controller or magnetic agitator, is installed on the same power supply system.

■Prevention against EMC (Radio Noise) or Harmonic Leakage Current

Preventive actions against EMC (radio noise) or harmonic leakage current are necessary for the MxC as well as for general inverter drives.
If a device that will be affected by noise is near the MxC, use the finemet zero-phase reactor as a noise filter.
If a leakage relay or an earth leakage breaker is attached to the MxC power-supply end, use relays or breakers that are protected against harmonic leakage currents.

■Guideline for Harmonics Reduction

Guidelines for harmonics are available for users who receive 6.6 kV or more from the power supply system. In addition, note that harmonics are not completely eliminated.

■Influence by Power Supply Distortion

When the power supply voltage is distorted, or when several devices are connected in parallel to the same power supply, the harmonics increase, since the harmonics of the power supply system enter the MxC.

■Applications with Repetitive Loads

Applications with repetitive loads (cranes, elevators, etc.) may require derating (reducing carrier frequency and current, which involves changing accel/decel timing or increasing the frame size of the MxC). Contact your Yaskawa representative for details.

■Initial Torque

The startup and acceleration characteristics of the motor are restricted by the overload current ratings of the MxC that is driving the motor. The torque characteristics are generally less than those required when starting with a normal commercial power supply. If a large initial torque is required, increase the frame size of the MxC or increase the capacity of both the motor and the MxC.

■Emergency Stop

Although the MxC's protective functions will stop operation when a fault occurs, the motor will not stop immediately. Always provide mechanical stop and protection mechanisms on equipment requiring an emergency stop.

■Options

Terminals r2, s2, t2, p1, n1 are only for connecting options specifically provided by Yaskawa. Never connect any other devices to these terminals.

Installation

■Installation in Enclosures

Either install the MxC in a clean location not subject to oil mist, air-bourne matter, dust, or other contaminants, or install the MxC within completely enclosed panels. Provide cooling measures and sufficient panel space so that the temperature surrounding the MxC does not go beyond the allowable range. Do not install the MxC on wood or other combustible materials.

■Installation Direction

Mount the MxC vertically on a wall or on a horizontal surface.

Settings

■Upper Limits

The Digital Operator can be used to set high-speed operation up to a maximum of 120 Hz (depending on the carrier frequency). Incorrect settings can be dangerous. Use the maximum frequency setting functions to set upper limits. The maximum output frequency is factory-set to 60 Hz.

■DC Injection Braking

The motor can overheat if the DC injection braking voltage or braking time is set to a large value.

■Acceleration/Deceleration Times

The motor's acceleration and deceleration times are determined by the torque generated by the motor, the load torque, and the load's inertial moment ($GD^2/4$). If stall prevention functions are activated during acceleration or deceleration, increase the acceleration or deceleration time. The stall prevention functions will increase the acceleration or deceleration time by the amount of time the stall prevention function is active.
To reduce the acceleration or deceleration times, increase the capacity of the motor and MxC.

Handling

■Wiring Check

Internal damage will occur if the power supply voltage is applied to output terminal U/T1, V/T2, or W/T3 or to optional connection terminal r2, s2, t2, p1, and n1. Check the wiring for any mistakes before supplying power. Be sure to check all wiring and sequences carefully.

■Magnetic Contactor Installation

Do not start and stop operation frequently with a magnetic contactor installed on the power supply line. Doing so can cause the MxC to malfunction. Do not turn the MxC on and off with a magnetic contactor more than once every 30 minutes.

■Maintenance and Inspections

After turn off the main circuit power supply, always confirm that the CHARGE indicator is not lit before performing maintenance or inspection. The voltage remaining in the capacitor may cause electric shock.

Using the MxC for an Existing Yaskawa Standard Motor

When a standard motor is operated with the MxC, power loss is slightly higher than when operated with a commercial power supply. Observe the following precautions when using the MxC for an existing standard motor.

■Low Speed Ranges

Cooling effects diminish in the low-speed range, resulting in increased motor temperature. Therefore, the motor torque should be reduced in the low-speed range whenever using a motor not made by Yaskawa. If 100% torque is required continuously at low speed, consider using a special MxC or vector motor.

■Installation Withstand Voltage

If the input voltage is high (440 V or higher) or the wiring distance is long, the motor insulation voltage must be considered. Contact your Yaskawa representative for details.

■High-speed Operation

When using the motor at a high speed (60 Hz or more), problems may arise in dynamic balance and bearing durability. Contact your Yaskawa representative for details.

■Torque Characteristics

The motor may require more acceleration torque when the motor is operated with the MxC than when operated with a commercial power supply. Check the load torque characteristics of the machine to be used with the motor to set a proper V/f pattern.

■Resonance with the Natural Frequency of the Mechanical System

Take special care when a machine that has been operated at a constant speed is to be operated in variable speed mode. If resonance occurs, install vibration-proof rubber on the motor base or use the frequency jump function to skip any resonating frequency.

■Imbalanced Rotor

Take special care when the motor is operated at higher speeds (60 Hz or more).

■Noise

Noise varies with the carrier frequency. At high carrier frequencies, the noise is almost the same as when the motor is operated with a commercial power supply. Motor noise, however, increases when the motor is operated at a speed higher than the rated speed (60 Hz).

Using the MxC for Motors other than Yaskawa Standard Motors

The MxC can drive three-phase induction motors with two, four, or six poles. The MxC cannot run PM motors, motors for machine tools, or multi-pole motors with eight poles or more.
If using the MxC with a motor not made by Yaskawa, contact your Yaskawa representative.

Power Transmission Mechanism (Speed Reducers, Belts, and Chains)

If an oil-lubricated gearbox or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range. The power transmission mechanism will make noise and suffer problems with service life and durability if the motor is operated at a speed higher than 60 Hz.

Applicable Motors

Recommended Casting Motors

Torque Characteristics	Speed Control Range	Speed Control Accuracy	Control Method	PG
Constant Torque 3.7 kW max.	1 : 10	±0.2	Vector	Not provided.
Variable Torque 5.5 kW min.	With conditions.			

Output kW \ Speed min⁻¹	1750 (4 poles)	
Voltage	200 V Class	
Installation	Foot-mounted	Flanged
0.4		
0.75		
1.5	□FEQ-X	☆FELQ-5X
2.2		
3.7		
5.5	□FEF-X	☆FELF-5X
7.5		
11		○FELF-5
15		
18.5		
22	○FEF	
30		☆FELF-5
37		
45		
55		
75 or more	Contact your Yaskawa representative.	

Inverter Motors

Constant Torque 1 : 10

Torque Characteristics	Continuous Speed Control Range	Speed Control Accuracy	Control Method: Vector	Control Method: V/f	PG
Constant Torque	1 : 10	±0.2	○		Not provided.
		2% to 3%		○	

Output kW \ Speed min⁻¹	1750 (4 poles) 200 V Class	1750 (4 poles) 400 V Class	1450 (4 poles) 200 V Class	1450 (4 poles) 400 V Class	1150 (6 poles) 200 V Class	1150 (6 poles) 400 V Class
0.4	□					
0.75	FEQ-X					
1.5	☆					
2.2	FELQ -5X					
3.7						
5.5						
7.5			☆FEK-I (Foot-mounted) ☆FELK-5I (Flanged)			
11	□					
15	FEK-I					
18.5	☆					
22	FELK -5I					
30						
37						
45			☆FEK-IK	☆FELK-5IK		
55	☆FEK-IK ☆FELK-5IK			☆FCK-IK		
75 or more						

Constant Torque 1 : 20

Torque Characteristics	Continuous Speed Control Range	Speed Control Accuracy	Control Method	PG
Constant Torque	1 : 20	±0.2	Vector	Not provided.

Output kW \ Speed min⁻¹	1750 (4 poles) 200 V Class	1750 (4 poles) 400 V Class	1450 (4 poles) 200 V Class	1450 (4 poles) 400 V Class	1150 (6 poles) 200 V Class	1150 (6 poles) 400 V Class
0.4						
0.75						
1.5						
2.2						
3.7						
5.5	□					
7.5	FEK-I			☆FEK-I (Foot-mounted) ☆FELK-5I (Flanged)		
11	☆					
15	FELK -5I					
18.5						
22						
30						
37						
45			☆FEK-IK	☆FELK-5IK		
55	☆FEK-IK ☆FELK-5IK			☆FCK-IK		
75 or more						

Notes: 1 A circle, a square, or a star beside the model number will indicate the availability of the product.
○: Available for immediate delivery.
□: In stock.
☆: Available by custom order.

2 In the model number labeled □□□-IK, "K" indicates that the motor has a motor fan for forced cooling.

3 The following modifications are available upon request.
①Enclosure
- Outdoor use(–O)
- Corrosion resistant class 2(–C2)
- Outdoor use, corrosion resistant class 2(–C2O)

Motor with PG cannot be used outdoors.
②Thermostat

4 The manufacturers and their motors are:
Nidec Power Motor Corporation: Frame No. F-225 or smaller
Yaskawa TECO Motor Engineering Co. : Frame No.F-250 or larger

Inverter Motors

Constant Torque 1 : 100

Torque Characteristics	Continuous Speed Control Range	Speed Control Accuracy	Control Method	PG
Constant Torque	1 : 100	±0.2	Vector	Not provided.

Output kW \ Speed min⁻¹	1750 (4 poles) 200 V Class	1750 (4 poles) 400 V Class	1450 (4 poles) 200 V Class	1450 (4 poles) 400 V Class	1150 (6 poles) 200 V Class	1150 (6 poles) 400 V Class
0.4	□ FEK-I ☆ FELK-5I	☆FEK-I (Foot-mounted) ☆FELK-5I (Flanged)				
0.75						
1.5						
2.2						
3.7						
5.5						
7.5						
11						
15						
18.5	☆FEK-IK ☆FELK-5IK (With Motor Fan for Forced Cooling)					
22						
30						
37						
45						
55			☆FCK-IK			
75 or more						

Constant Torque 1 : 1000

Torque Characteristics	Continuous Speed Control Range	Speed Control Accuracy	Control Method	PG
Constant Torque	1 : 1000	±0.02	Vector	Provided.

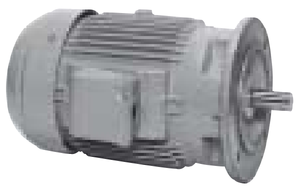
Output kW \ Speed min⁻¹	1750 (4 poles) 200 V Class	1750 (4 poles) 400 V Class	1450 (4 poles) 200 V Class	1450 (4 poles) 400 V Class	1150 (6 poles) 200 V Class	1150 (6 poles) 400 V Class
0.4	☆EEK-IM ☆EELK-5IM (Totally enclosed and fan-cooled.)					
0.75						
1.5	☆FEK-IKM (Foot-mounted) ☆FELK-5IKM (Flanged) (With Motor Fan for Forced Cooling)					
2.2						
3.7						
5.5						
7.5						
11						
15						
18.5						
22						
30						
37						
45						
55			☆FCK-IKM			
75 or more						

Standard Motors (Variable Torque)

Torque Characteristics	Continuous Speed Control Range	Speed Control Accuracy	Control Method: Vector	Control Method: V/f	PG
Variable Torque	1 : 20	±0.2	○		Not Provided.
		2% to 3%		○	

Output kW \ Speed min⁻¹	1750 (4 poles) 200 V Class	1750 (4 poles) 400 V Class	1450 (4 poles) 200 V Class	1450 (4 poles) 400 V Class	1150 (6 poles) 200 V Class	1150 (6 poles) 400 V Class
0.4	○ FEQ ○ FELQ-5	○ FEQ ☆ FELQ-5	☆ FEQ ☆ FELQ-5	☆ FEQ ☆ FELQ-5	○ FEQ ○ FELQ-5	☆ FEQ ☆ FELQ-5
0.75						
1.5						
2.2						
3.7						
5.5	○ FEF ○ FELF-5	☆ FEF ☆ FELF-5	☆ FEF ☆ FELF-5	☆ FEF ☆ FELF-5	○FEF ○FELF-5	☆ FEF ☆ FELF-5
7.5					○ FEF ☆ FELF-5	
11						
15						
18.5						
22	○ FEF ○ FELF-5					
30						
37						
45						
55			Contact your Yaskawa representative.			
75 or more						

Foot-mounted



Flanged

With Motor Fan for Forced Cooling (Foot-mounted)

Applicable Motors

Varispeed AC (MxC) Specification Form

1. Company Name ______________________ Name of Facility
   (Phone No.) TEL ______________________ (Name of Application) ______________

2. Type of Load Machine
   ☐ Fan ☐ Pump ☐ Lift ☐ Centrifuge ☐ Other ______________

3. Load Machine Characteristics
   ☐ Variable torque ☐ Constant torque ☐ Constant output ☐ Other ______________
   $J(GD^2/4)$ ______________ kg・m^2

4. Power Supply Specifications
   Power Supply Capacity ________ kVA Main Circuit Voltage ________ V ________ Hz
   Frequency Fluctuation ________ % Momentary Power Loss ________ Second(s)

5. Motor Specifications
   Model No. ______________________ Manufacturer ______________
   Output ____________ kW Voltage ____________ V Current ____________ A
   Frequency ____________ Hz Number of poles ____________ P Speed ____________ min^{-1}
   PG ☐ Provided ☐ Not Provided PG Specifications ______________

6. Control Specifications
   ☐ Flux Vector Control ☐ Open-Loop Vector Control ☐ V/f Control
   Speed Control Range ________ min^{-1} to ________ min^{-1} or ________ Hz to ________ Hz
   Acceleration/Deceleration Time Acceleration ____________ Second(s)
   Deceleration ____________ Second(s)
   Speed Setting
   ☐ Manual Speed Adjusting Operation
   ☐ Multi-Step Speed Signal Changeover Operation
   ☐ Process Signal 4 to 20 mA Operation ☐ Other ______________
   Overload Capacity ____________ % ____________ Second(s)

7. Ambient Conditions
   Indoors Ambient temperature ________ ˚C to ________ ˚C Humidity ________ % or less
   Air-conditioning facility ☐ Provided ☐ Not provided

8. Remarks
   ____
   ____
   ____

Service Network

Region	Service Area	Service Location	Service Agency	Telephone/Fax
North America	U.S.A	Chicago(HQ) Los Angeles New Jersey Boston San Francisco, Ohio North Carolina	① YASKAWA ELECTRIC AMERICA INC.	Headquarters ☎ +1-847-887-7303 FAX +1-847-887-7070
	Mexico	Mexico City	② PILLAR MEXICANA. S.A. DE C.V.	☎ +52-5593-28-69 FAX +52-5651-55-73
South America	South America	Sao Paulo	③ YASKAWA ELÉCTRICO DO BRASIL COMÉRCIO LTD.A.	☎ +55-11-5071-2552 FAX +55-11-5581-8795
	Colombia	Santafe De Bogota	④ VARIADORES LTD. A.	☎ +57-91-635-7460 FAX +57-91-611-3872
Europe	All of Europe and South Africa	Frankfurt	⑤ YASKAWA Electric EUROPE GmbH	☎ +49-6196-569-300 FAX +49-6196-569-398
			⑥ YASKAWA Engineering EUROPE GmbH	☎ +49-6196-569-520 FAX +49-6196-888-598
Asia	South Korea	Seoul	⑦ YASKAWA ELECTRIC KOREA Co.	☎ +82-2-784-7844 FAX +82-2-784-8495
			⑧ YASKAWA ENGINEERING KOREA Co.	☎ +82-2-3775-0337 FAX +82-2-3775-0338
			⑨ Rockwell Samsung Automation Co.,Ltd.	☎ +82-331-200-2981 FAX +82-331-200-2970
	China	Beijing, Guangzhou, Shanghai	⑩ YASKAWA ELECTRIC (SHANGHAI) Co., Ltd.	☎ +86-21-5385-2200 FAX +86-21-5385-3299
			⑪ Shanghai Yaskawa-Tongji M&E Co.,Ltd.	☎ +86-21-6553-6060 FAX +86-21-5588-1190
	Taiwan	Taipei	⑫ YASKAWA ELECTRIC TAIWAN Co.	☎ +886-2-2502-5003 FAX +886-2-2505-1280
	Singapore	Singapore	⑬ YASKAWA ELECTRIC (SINGAPORE) Pte. Ltd.	☎ +65-6282-3003 FAX +65-6289-3003
			⑭ YASKAWA ENGINEERING ASIA-PACIFIC Pte. Ltd.	☎ +65-6282-1601 FAX +65-6282-3668
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