IMO JAGUAR CUB·CM

SINGLE PHASE MICRO-VERTER 0.2 - 2.2KW

5 Year Guarantee

Index

Caution

⚠ This publication is only to be used as a guide. Please seek the full instruction manual before installation. If in doubt please call IMO on 020 8452 6444 or visit our website on www.imopc.com

(Please refer to inside back cover for further details)

5 Year Guarantee

Great performance in a compact package.
IMO Jaguar low-noise inverters:
Specifications for the new generation.

Environment-friendly features

- Utilizes a low-noise control power supply system which minimizes noise interference on peripheral devices such as sensors.

- Minimal motor noise driving whether high carrier frequency (lower-noise) or low carrier frequency is selected.

- Equipped with terminals for connecting DC REACTOR for harmonics suppression.

PID control function: for fans and pumps

- Complete with a PID control function which can optimise the flow rate of fans and pumps.

Compact

- Only 80mm wide and 120mm high (up to 0.75kW): can be installed easily in panels.

- Mountable on 35mm IEC compliance rails using the optional rail mounting base (up to 0.75kW).
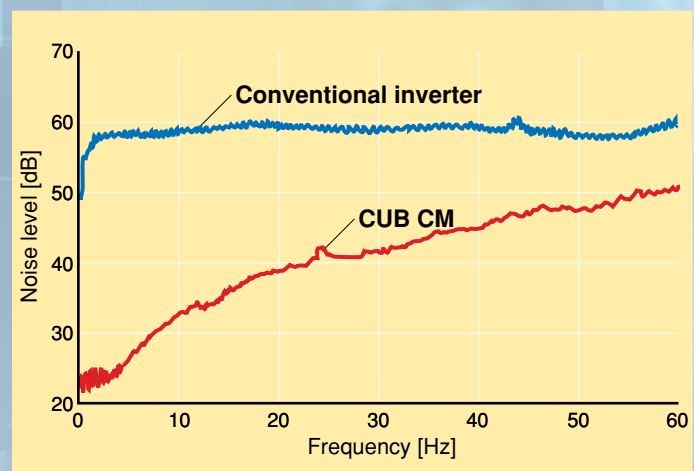
Conformity to Low Voltage Directive
The Jaguar CUB CM Series conforms to the Low Voltage Directive with EN50178.
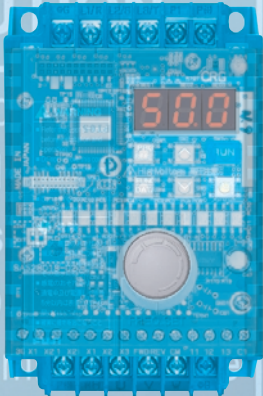
Conformity to EMC Directive
- Emission requirement
  EMC filters in compliance with EN61800-3 are provided for all models as an optional extra
- Immunity requirement
  The Jaguar CUB CM Series inverters meet EN61800-3 as standard.

Easy operation and simple, wiring

- Equipped with a large potentiometer (on the front of the inverter) which sets output frequency.

- Control through various input signals: from 0 to 10V DC, from 0 to 5V DC, and from 4 to 20 mA.

- Separated main circuit input terminals and output terminals, arranged at the top and the bottom of the inverter for confusion-free connections.

- Easy to wire control inputs/outputs.
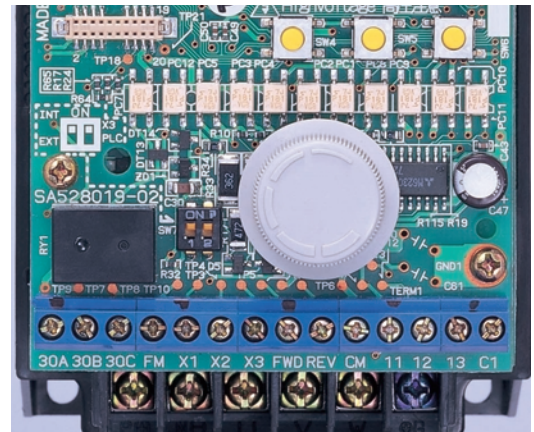
Serial communication (RS485)

- Serial data communication conforming to RS485 through the optional personal computer interface card.

Other useful features

- Compliant with major world safety standards: UL, cUL, TÜV, EN (CE marking) standards.

- Equipped with inrush current control circuit in order to protect magnetic contactor.

- Records accumulated operation time.

- Cooling fan stop operation to increase fan life, reduce its air noise and save energy.

Controlling fans and pumps using variable speed to save energy

The PID* control function lets the inverter optimally control air conditioning systems and various types of fans The CUBCM can also accurately control pump speeds.

*Proportional, Integral, Derivative
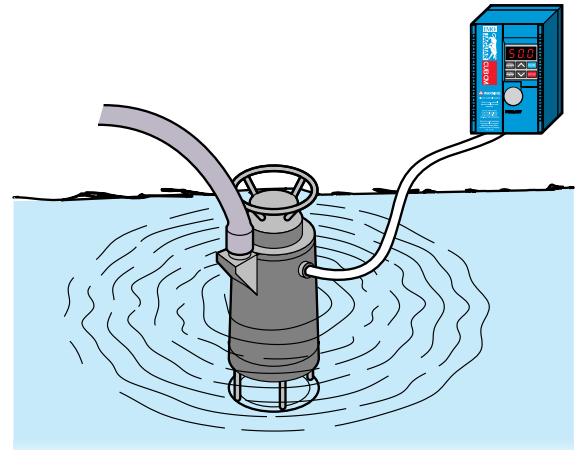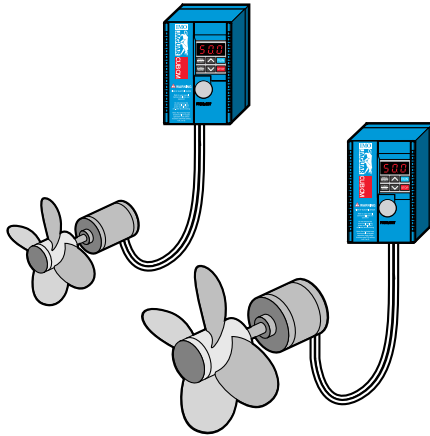
Conveyors

Adjusting the conveyor speed according to cycle time.
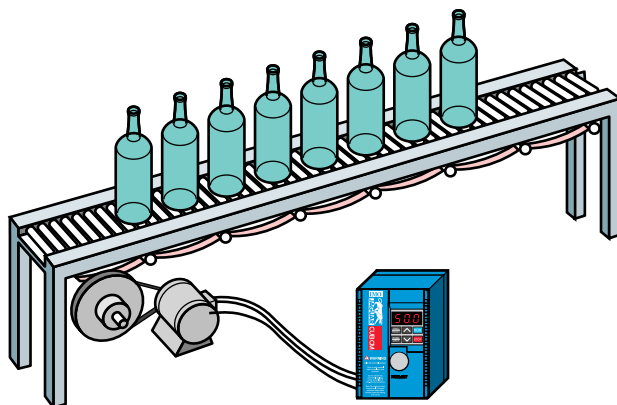
Mixers

Variable speed control of agitators and separators.
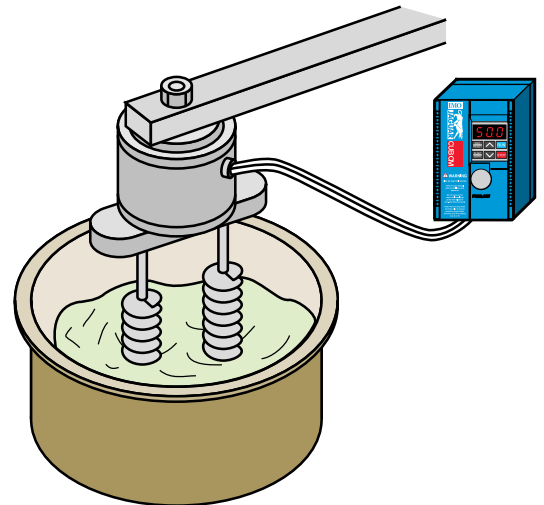
Other applications
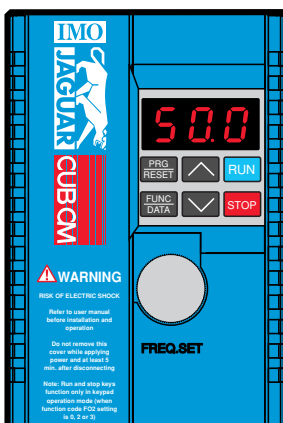
- Machine tool coolant pumps
- Screw feeders
- Industrial washing machines
- Palletisers
- Jaccuzzis
- Labelling machines
- Filling machines
- Spindle drives

- Potato sorters
- Boiler temperature control
- Automatic shutter doors
- Wood turning lathes
- Tread mills
- Labelling machines
- Vibrators
- Classifiers
- Knitting machines

STANDARD SPECIFICATIONS

Single-phase 200V series

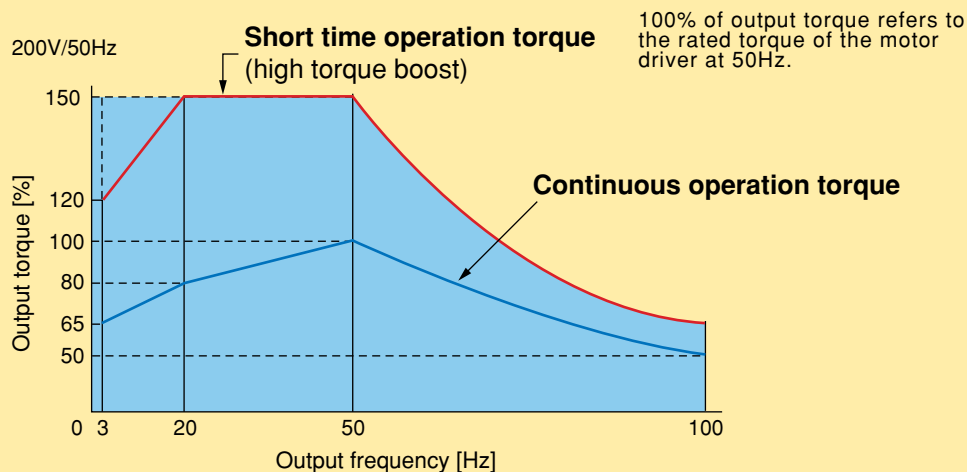| Type	Jaguar CUB CM		–	0.2	0.4	0.75	1.5	2.2
Nominal applied motor		kW	–	0.2	0.4	0.75	1.5	2.2
Output ratings	Rated capacity *1)	kVA		0.53	0.95	1.5	2.6	3.8
	Rated voltage *2)	V	3-phase, 200V/50Hz; 200, 220, 230V/60Hz					
	Rated current *3)	A	–	1.4	2.5	4.0	7.0	10.0
	Overload capability		150% or rated current for 1 minute					
	Output frequency	Hz	0.1 – 120					
Input ratings	Phases, Voltage, Frequency		l-phase, 200 to 240V, 50/60Hz					
	Voltage/frequency variations		• Voltage: +10 to -10% • Frequency: +5 to -5%					
	Momentary voltage dip capability		When the input voltage is 165V or more, the inverter can be operated continuously When the input voltage drops below 165V from rated voltage, the inverter can be operated for 15ms (less than 85% load of nominal applied motors)					
	Rated current *4) (with DCR)		–	2.0	3.5	6.5	11.8	17.7
	(without DCR)		–	3.9	6.4	11.4	19.8	28.5
	Required power supply capacity *5)	kVA	–	0.4	0.7	1.3	2.4	3.6
Braking	Torque (standard) *6)		150%		100%		50%	30%
	DC injection braking		• Starting frequency: 3.0Hz (Fixed) • Braking time: 0.0 to 30.0s • Braking level: 0 to 100% of rated current					
Enclosure (IEC 60529)			IP 20					
Cooling method			Natural cooling				Fan cooling	
Standards			• UL/cUL, Low Voltage Directive, EMC Directive • IEC 61800-2 (Rating, specifications for low voltage adjustable frequency a.c. power drive systems) • IEC 61800-3 (EMC product standard including specific test methods)					
Mass		kg	–	0.6	0.7	0.9	1.6	2.2

*1) Inverter output capacity (kVA) at 220V.   *2) Output voltage is proportional to the power supply voltage and cannot exceed the power supply voltage.   *3) Current derating may be required in case of low impedance loads such as high frequency motor.   *4) This value is calculated using IMO calculation method. (Refer to Technical Information).   *5) When a power-factor correcting DC REACTOR is used.   *6) With a nominal applied motor, this value is average torque when the motor decelerates and stops from 60Hz. (It may change according to motor loss).

Torque characteristics

Item		Explanation
Output frequency	**Setting** — **Maximum frequency**	50 to 120Hz (in 1Hz steps)
	Base frequency	50 to 120Hz (in 1Hz steps)
	Starting frequency	1 to 6Hz (in 1Hz steps)
	Carrier frequency	0.75 to 15kHz
	Accuracy (Stability)	• Analog setting : ±1.0% of maximum frequency (at 25 ±10°C) • Digital setting : ±0.01% of maximum frequency (at -10 to +50°C)
	Setting resolution	• Analog setting : 1/256 of maximum frequency ex.) 0.25Hz at 60Hz, 0.5Hz at 120Hz • Digital setting : 0.01Hz at maximum frequency of up to 99.9Hz (1Hz at maximum frequency of 100Hz and above)
Control	**Control method**	• Sinusoidal PWM control
	Voltage/freq. (V/f) characteristic	Maximum output voltage proportional to line input voltage (without AVR control)
	Torque boost	Manual: Code selection (0 to 31), including the save energy pattern for variable torque load
	Starting torque	150% (at 6Hz) (Torque boost code (F09) is 20 and above.)
	Operation method	• KEYPAD operation : RUN key, FWD key • Digital input signal operation : FWD or REV command • LINK operation : RS485 (Option)
	Frequency setting	• KEYPAD operation : ∧ or ∨ key • Built-in potentiometer: Potentiometer is standard equipment • Analog input: 0 to +10VDC (0 to +5VDC) v to 20mADC • Multistep frequency: 4 different frequencies can be selected by terminal (SS1) and (SS2). • LINK operation: RS485 (Option)
	Running status signal	Relay output: Alarm output for any fault. (1SPDT) Analog output: Output frequency, output current, PID feedback value, DC link circuit voltage
	Acceleration time	0.0 to 60s (0.0 = 0.01s)
	Deceleration time	0.1 to 60s
	Frequency limiter	High and low limiter can be preset.
	Bias frequency	Bias frequency can be preset (-120 to 120Hz)
	Gain for frequency setting	100% (For 0 to +10VDC) or 200% (For 0 to +5VDC)
	Jump frequency control	Jump frequency (3 points) and its common jump hysteresis width (0 to 30Hz0 can be preset
	Auto-restart after momentary power failure	Automatic restart is available after a momentary power failure (retry method)

	PID control	This function can control flow rate pressure, etc. (with an analog feedback signal.)
		• Reference signal (F01): • KEYPAD operation (∧ or ∨ key)
		  • Voltage input (Terminal 12)
		  • Current input (Terminal C1)
		  • Analog input (Built-in Potentiometer)
		• Feedback signal (H21) • Terminal 12 (0 to +10V DC or 1 to 5V DC)
		  • Terminal C1 (4 to 20mA DC)

Indication	**Operation mode (running or stopping)**	• Output frequency, output current, PID reference value, PID feedback value • Setting frequency
	Program mode	Function code, data code
	Trip mode	Displays trip fault code as follows • OC1 (Overcurrent during acceleration) • OC2 (Overcurrent during deceleration) • OC3 (Overcurrent running at constant speed) • OU1 (Overvoltage during acceleration) • OU2 (Overvoltage during deceleration) • OU3 (Overcurrent running at constant speed) • LU (Low voltage) • OH1 (Overheating at heatsink) • OH2 (External thermal relay tripped) • OL (Motor overload) • OLU (Inverter unit overload) • Er1 (Memory error) • Er3 (CPU error) • Er8 (RS485 error)
	Operation and Trip mode	Trip history (passed/4 times
	Charge lamp (Red)	When the DC link circuit voltage is higher than 50V,. the charge lamp is ON
Protection	**Overload**	Protects the inverter by electronic thermal overload relay and detection of inverter temperature
	Overvoltage detection	Detects DC link circuit voltage (400V), and stops the inverter
	Undervoltage	Detects DC link circuit undervoltage (200V) and stops the inverter
	Overheating	Protects the inverter by detection of inverter temperature
	Short-circuit	Short-circuit protection for inverter output circuit
	Ground fault	Ground fault protection for inverter output circuit (detection at starting)
	Motor overload (running or stopping)	• Protects the motor after the inverter trips • Electronic thermal overload relay can be selected for standard motor or IMO inverter motor
	Stall prevention	• Controls the output frequency to prevent OC (overcurrent) trip when the output current exceeds the limit value during acceleration • Lowers the output frequency to hold almost constant torque when the output current exceeds the limit value during operation at constant speed • Controls the output frequency to prevent OU (overvoltage) trip when the DC link circuit voltage exceeds the limit value during deceleration
	Auto reset	When the inverter is tripped, it resets automatically and restart. 5-times auto reset can be selected
Condition (Installation and operation)	**Installation location**	Free from a dusty location, corrosive gases, oil mist and direct sunlight. Indoor use only
	Altitude	1000m or less. (Applicable to 3000m with power derating: -10%/1000m)
	Ambient temperature	-10° to +50°C
	Ambient humidity	5 to 95% RH (non-condensing)
	Vibration	3mm at 2 to 9Hz, 1m/s² at 9 to 200Hz
Storage conditions		• Temperature: -25° to +65°C • Humidity: 5 to 95% RH

Terminal functions

	Symbol	Terminal name	Function	Remarks	Func. code
Main circuit	L1/L, L2/N	Power input	Connect 1-phase 200V power supply		
	U, V, W	Inverter output	Connect 3-phase induction motor		
	P1, P(+)	For DC REACTOR	Connect the DC REACTOR (option) for power-factor correction or harmonic current reduction		
	⏚ G	Earth	Terminal for inverter chassis		
Analog input	13	Potentiometer	+10VDC power supply for setting potentiometer (POT: 1 to 5kΩ)	Allowable maximum output currrent: 10mA	
	12	Voltage input	0 to +10VDC/0to 100% (0 to +VDC/0 to 100%)	• Input impedance: 22kΩ • Allowable maximum input voltage: 50mA • If input voltage is 10 to 15VDC, then the inverter clamps it at 10VDC	F01
		(PID control)	Used for PID control reference signal or feedback signal		F01, H21
	C1	Current input	4 to 20mA DC/0 to 100%	• Input impedance: 250Ω • Allowable maximum input current: 30mA DC • If input voltage is 20 to 30mA DC, then the inverter clamps it at 20mA DC	F01
		(PID control)	Used for PID control feedback signal or reference signal		F01, H21
	11	Common	Common for analog signals	Same potential as CM – 0V	
Digital input	FWD	Forward operation command	FWD – ON .... The motor runs in the forward direction FWD – OFF ...... The motor decelerates and stops	When FWD and REV are simultaneously ON, the motor decelerates and stops	F02
	REV	Reverse operation command	REV – ON .... The motor runs in the reverse direction REV – OFF ...... The motor decelerates and stops	When FWD and REV are simultaneously ON, the motor decelerates and stops	
	X1 X2 X3	Digital input 1 Digital input 2 Digital input 3	These terminals can be preset as follows	• Sink type terminal specifications • ON state maximum input voltage: 2V (maximum source current: 6mA) • OFF state maximum terminal voltage: 24 to 27V (allowable maximum leakage current: 0.5mA)	E01 to E03
	(SS1) (SS2)	Multistep freq. select	(SS1): 0, 1 different frequencies can be selectable (SS1, SS2): 0 to 3 different frequencies can be selectable	0 frequency (All (SS1) and (SS2) signals are OFF) is set by "F01"	C05 to C07
	(BX)	Coast-to-stop command	(BX) – ON ...... Motor will coast-to-stop (No alarm signal will be output)	• The motor restarts from 0Hz by turning off BX with the operation command (FWD or REV) ON • Assigned to terminal X2 at factory setting	
	(RST)	Alarm reset	(RST) – ON ...... Faults are reset (This signal should be held for more than 0.1s)	• During normal operating, this signal is ignored • Assigned to terminal X3 at factory setting	
	(THR)	Trip command (External fault)	(THR) – OFF ...... "0H2 trip" occur and motor will coast-to-stop	This alarm signal is held internally	
	(WE-KP)	Write enable for KEYPAD	(WE-KP) – ON ...... The data will be changed by KEYPAD panel		F00
	(Hz/PID)	PID control cancel	(Hz/PID) – ON ...... The PID control is cancelled and KEYPAD panel frequency setting (⌃ or ⌄) is effective		H20 to H25
	(LE)	Link enable (RS485: Option)	(LE) – ON ...... The link operation is effective	For switch link operation to communication	
	P24/CM	P24: DC voltage supply	DC voltage supply (+24V, max 100mA)	DIPSW select: SW7	
	11	CM: common	Common for digital signal	Same potential as 11	
Analog output	FM	Analog monitor	• Output voltage (0 to 10VDC) is proportional to selected function's value as follows · Output frequency (0 to max. frequency) · Output current (0 to 200%) · PID feedback value (0 to 100%) · DC link circuit voltage	Allowable maximum output currrent: 2mA	F30, F31
	11	(Common)	• Bias value can be preset		
Relay output	30A, 30B 30C	Alarm relay output	Outputs a contract signal when protective function is activated Changeable exciting mode active or non-exciting mode active by function No. F36	Contact rating: • 250V AC, 0.3A, cos ø=0.3 • 48VDC, 0.5A, non-inductive Applicable maximum voltage for CE marking (Low Voltage Directive) Applicable maximum voltage for UL/cUL	F36

Terminal arrangement

● Main circuit terminals

Input   1-phase

⏚G	L1/L		L2/N	P1	P(+)
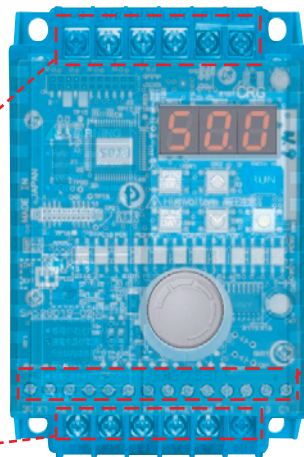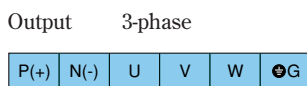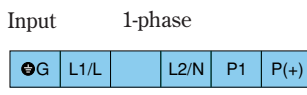
● Control circuit terminals

30A	30B	30C	FM	X1	X2	X3	FWD	REV	P24/CM	11	12	13	C1

Output   3-phase

P(+)	N(-)	U	V	W	⏚G

Keypad panel operation

The following diagram is for reference only. **For detailed wiring diagrams, refer to the relevant instruction manual.**

Power supply

1-phase 200 to 240V
50/60Hz

FILTER

*MCCB
or
ELCB

L1/L
L2/N
G

U
V
W
G

*Motor
M

P1
P(+)
P(+)
N(-)

P1
(*1) P(+)

When DC
REACTOR is used
E

13
12
11
C1
FWD
REV
X1
X2
X3
P24/CM
FM

30A
30B
30C
30

Alarm relay output

*: Option

Warning – Inverter must be earthed.
Input wiring must be protected against short/earth faults.
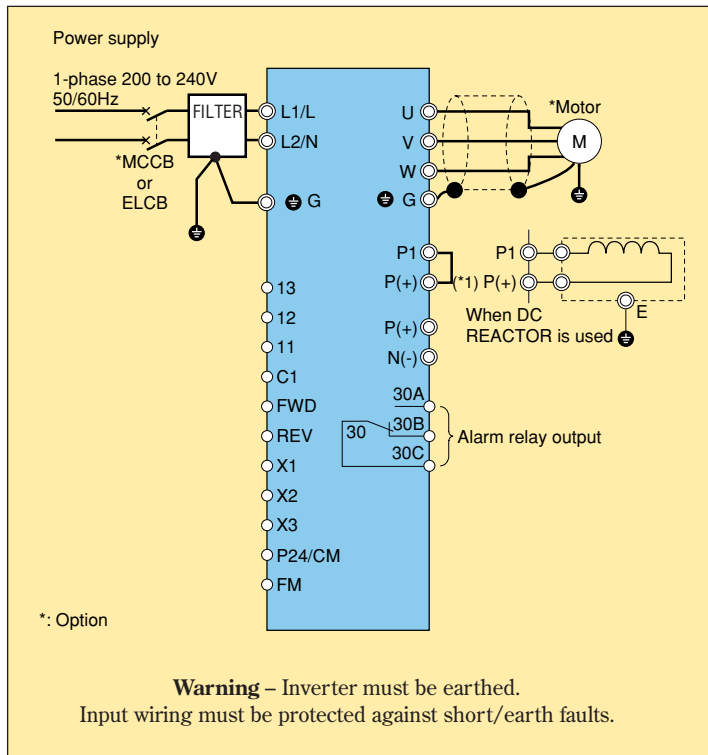
Connect the inverter to the power supply and the motor. Then, turn on the power to enable variable-speed operation.

Notes:

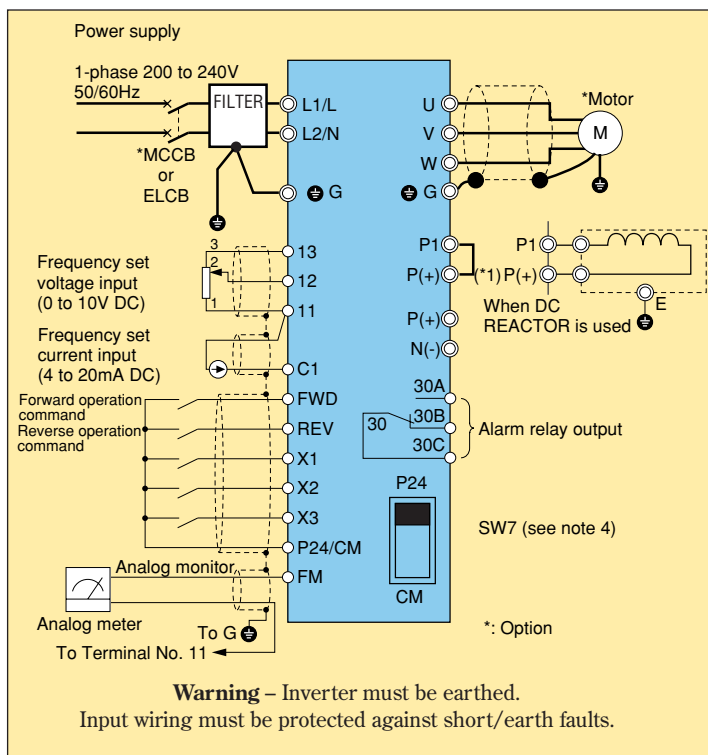1) To operate the inverter using the factory-settings, proceed as follows:
   (1) Start/stop........................Press `RUN` or `STOP` key on the keypad panel. (*2)
   (2) Setting frequency...........Use the frequency setting potentiometer (VR) on the keypad panel.
2) To enable $\wedge$ and $\vee$ keys for frequency setting, select function code F01 and change the data from 4 to 0. Change of the data code disables the VR (frequency setting potentiometer).
3) Keep the control circuit wires at least 100 mm away from the main circuit wires and put them in separate ducts to prevent high frequency coupling and resultant malfunctions. Where control wiring crosses the main wiring, ensure that they cross each other at right angles.
4) For the wiring of the control circuit, use shielded or twisted pairs with the shortest possible length. (When using shielded wires, connect one end of the shields to the inverter ground terminal and leave the other end free.)
5) If there is a magnetic contactor or a solenoid close to the inverter, mount a surge absorber to the coil in a parallel connection. Keep the wiring length to a minimum.

*1 When connecting the optional DC reactor, remove the jumper wire from between P1 and P(+).
*2 Drive will run in forward direction as set in factory.

External operation

The following diagram is for reference only. **For detailed wiring diagrams, refer to the relevant instruction manual.**

Power supply

1-phase 200 to 240V
50/60Hz

FILTER

*MCCB
or
ELCB

L1/L
L2/N
G

U
V
W
G

*Motor
M

P1
P(+)
P(+)
N(-)

P1
(*1) P(+)

When DC
REACTOR is used
E

Frequency set
voltage input
(0 to 10V DC)

3
2
1

13
12
11

Frequency set
current input
(4 to 20mA DC)

C1

Forward operation
command
Reverse operation
command

FWD
REV
X1
X2
X3
P24/CM

30A
30B
30C
30

Alarm relay output

P24

SW7 (see note 4)

CM

Analog monitor
FM

Analog meter
To G
To Terminal No. 11

*: Option

Warning – Inverter must be earthed.
Input wiring must be protected against short/earth faults.

Notes:

1) This wiring diagram shows the connection for stopping the inverter or setting frequency through external signals. When "1" is set at F01, you can set a frequency by using input signal from 0 to 10V DC. When "2" is set at F01, you can set a frequency by using an input signal between 4 and 20mA. In this case, set "1" at F02.
2) If there is a magnetic contactor or a solenoid close to the inverter, mount a surge killer to the coil in a parallel connection. Keep the wiring length to a minimum.
3) To wire the control circuit, use shielded or twisted wires. When using shielded wires, connect the shields to ⏚G.
4) Control logic is selectable as sink/source by position of switch SW7 on pcb ie. SW7 = UP, inputs are referenced to onboard power supply P24 (24 VDC). SW7 = DOWN, inputs require external power supply and are referenced to zero volts at inverter CM terminal.

*1 When connecting the optional DC reactor, remove the jumper wire from between P1 and P(+).

Keypad panel

Digital monitor

In Operation mode: Displays output frequency,*[1] or output current.
In Stop mode: Displays the set frequency. *[2]
In Program mode: Displays function codes and data codes.
In Trip mode: Displays code indicating the cause of the trip.

Program/Reset key

Switches between operation mode and program mode.
When tripped: Releases the trip-stop state and changes to operation mode after the cause of trip has been removed.

Function/Data key

In Operation mode: Switches the display between output frequency and output current.
In Stop mode: Switches the display between set frequency and set current.
In Program mode: Sets data for function codes.
Some function code data can be changed during operation.

Up/Down keys

In Operation mode: Increases or decreases frequency (motor speed).

In Program mode: Increases or decreases function code number and data set value.

Run key

Starts the inverter output.
In Stop mode:
Inactive when the function code F02 is set to 1 (external operation).

Stop key

Stops the inverter output.
In Operation mode: Invalid when the function code F02 is set to 1 (external operation).

Frequency setting potentiometer

Increases or decreases the frequency.
Active only when the function code F02 is set to 04 (inverter on-board pot).

*1 When PID control operation (H20:1 or 2) is selected, the monitor displays the PID feedback value instead of the output frequency.
*2 When PID control operation (H20:1 or 2) is selected, the monitor displays the PID reference value instead of the set frequency.

Keypad panel operation method

1. Turn on the power supply. The monitor shows data as illustrated above.

When you press the RUN key, the inverter gradually increases the frequency until 60Hz is reached to rotate the motor clockwise according to the factory-settings. To stop the motor, press the STOP key.

To increase or decrease the operation frequency, adjust the frequency setting pot. For wiring connections, refer to the basic wiring diagram on page 8.

2. Selecting function codes and changing data codes

To select the function code and change the data code, proceed as follows:
● Press the PRG RESET key to select the program mode.
● Pressing the FUNC DATA key alternates the displayed data between the function code and its data.
● With data displayed, press the ∧ ∨ key to change the data code.
● Press the FUNC DATA key to update the data for the selected function code.
* In step 2, if the ∧ ∨ key is pressed when the function code is displayed, only the function code changes sequentially (see below).
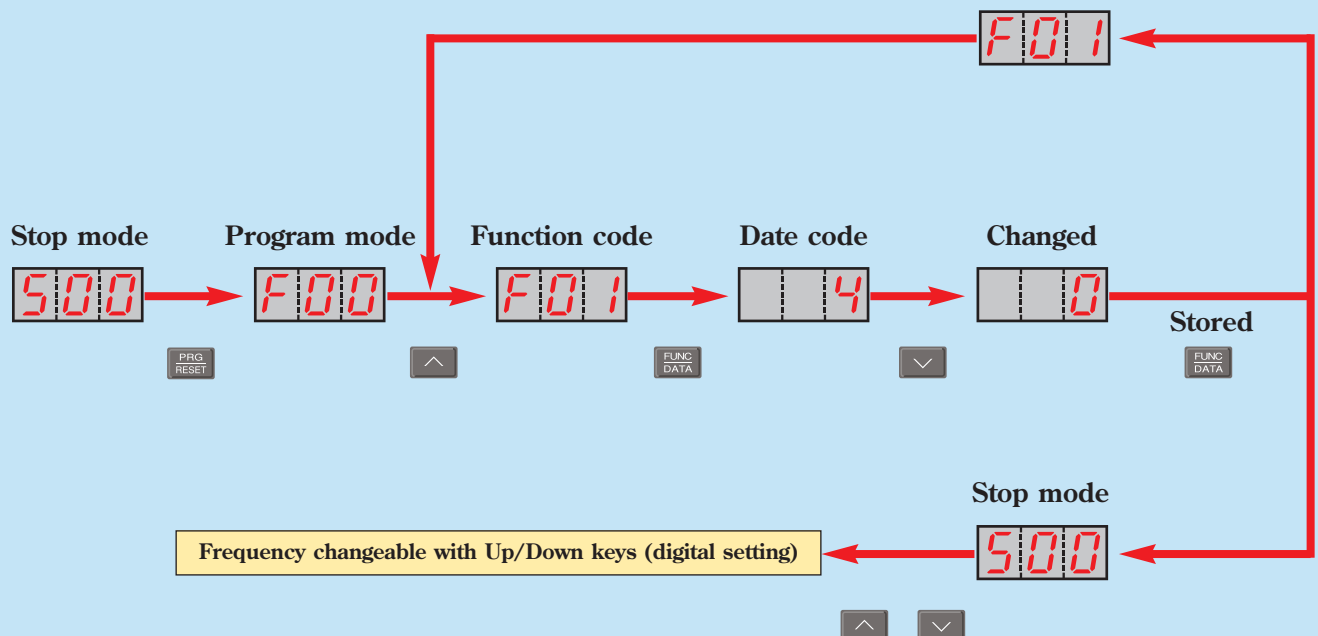(F00 → F01 → F02 → F03 ....)

The keypad panel modes are classified in the following 5 modes:

Mode / Monitor, keys		Program mode (operation stopped)	Program mode (during operation)	Stop mode	Operation mode	Trip mode
Monitor	`0.0.0`	Displays the function code or data code. (Solid)	Displays the function code or data code. (Solid)	Displays the set frequency, output current, or PID command value. (Flashing)	Displays the output frequency, output current, or PID feedback value. (Solid)	Displays the trip content or alarm history. (Solid)
Keys	PRG RESET	Switches to stop mode.	Switches to operation mode.	Switches to program mode while stopped.	Switches to program mode during operation.	Releases the trip and switches to stop mode.
	FUNC DATA	Changes the display between function code and data code, stores data code, and updates then function code.		Switches the digital display.		Invalid
	∧ ∨	Selects the function code, increases/ decreases the data code number.	Selects the function code, increases/ decreases the data code number.	Increases/decreases the frequency to be set.		Displays the alarm history.
	RUN	Invalid	Invalid	Switches to operation mode.	Invalid	Invalid
	STOP	Invalid	Switches to program mode.	Invalid	Switches to program mode.	Invalid .

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*Procedure for selecting function codes and data codes

(Ex. Changing data code from `4` to `0` by selecting function mode `F01`)

To select other function codes, press the Up/Down keys, the same way.

Stop mode	Program mode	Function code	Date code	Changed
`5.0.0`	`F00`	`F01`	`4`	`0`
PRG RESET	∧	FUNC DATA	∨	FUNC DATA

Stored

Stop mode

`5.0.0`

Frequency changeable with Up/Down keys (digital setting)

∧ ∨

FUNCTION SETTINGS

The functions in the white boxes can be set while the inverter is running. Other functions must be set while the inverter is stopped.

Fundamental Functions

	Function		Setting range	Unit	Min. unit	Factory setting
	Code	Name				
Basic Functions	F00	Data protection	0: Data change enable 1: Data protection	–	–	0
	F01	Frequency command 1	0: KEYPAD operation (∧ or ∨ key) 1: Voltage input (terminals 12 and V2) (0 to +10VDC, 0 to +5VDC) 2: Current input (terminal C1) (4 to 20mA DC) 3: Voltage and current input (terminals 12 and C1) 4: Analogue input (Internal Potentiometer)	–	–	4
	F02	Operation method	0: KEYPAD operation (RUN or STOP key) 1: FWD or REV command signal operation 2: KEYPAD operation (FWD) 3: KEYPAD operation (REV)	–	–	2
	F03	Maximum frequency	50 to 120Hz	1Hz	1	50
	F04	Base frequency 1	25 to 120Hz	1Hz	1	50
	F05	Rated voltage	0 (Free), (Fixed)	–	–	0
	F06	Maximum voltage	0 (Free), (Fixed)	–	–	0
	F07	Acceleration time	0.0 (0.01s), 0.1 to 60.0s	s	0.1	6.0
	F08	Deceleration time	0.01 to 60.0s	s	0.1	6.0
	F09	Torque boost	0,1: for variable torque load 2 to 31: for constant torque load	–	1	13
	F10	Electronic thermal overload relay (Select)	0: Inactive 1: Active (for 4-pole standard motor) 2: Active (for 4-pole inverter motor)	–	–	1
	F11	(Level)	Approx. 20 to 135% of rated current	A	0.01	*1
	F12	(Thermal time constant)	0.5 to 10.0 min	min.	0.1	5.0
	F14	Restart mode after momentary power failure	0: Inactive (Trip and alarm when power failure occurs) 1: Inactive (Trip and alarm when power recovers) 2: Active (Momentarily stops and restarts at output frequency from before power failure) 3: Active (Momentarily stops and restarts at starting frequency)	–	–	0
	F15	Frequency limit limiter (High)	0 to 120Hz	Hz	1	70
	F16	(Low)		Hz	1	0
	F17	Gain (for frequency setting signal)	0: For 0 to +10VDC 1: For 0 to +5VDC	–	–	0
	F18	Bias frequency	-120 to 120Hz	Hz	1	0
	F20	DC brake (Starting freq.)	3Hz (Fixed)	Hz	–	3.0
	F21	(Braking level)	0 to 100%	%	1	50
	F22	(Braking time)	0.0 (DC brake inactive). 01. to 30.0s	s	0.1	0.0
	F23	Starting Frequency (Freq.)	1 to 6Hz	Hz	1	1
	F24	(Holding time)	0.0 (Fixed)	–	–	0.0
	F25	Stop frequency	1 to 6Hz	Hz	1	1
	F26	Motor sound (Carrier freq.)	0 (0.75kHz), 1 to 15kHz	kHz	1	15
	F27	(Sound tone)	0: level 0 1: level 1 2: level 2 3: level 3	–	–	0
	F30	FMA (Voltage adjust)	0 to 200%	%	1	100
	F31	(Function)	0: Output frequency 1: Output current 2: PID feedback value 3: DC link circuit voltage	–	–	0
	F36	30RY operation mode	0: The relay (30) excites on trip mode 1: The relay (30) excites on normal mode	–	–	0

*Typical value of IMO standard 4-pole motor

The functions in the white boxes can be set while the inverter is running. Other functions must be set while the inverter is stopped.

Extension terminal functions

Function			Setting range	Unit	Min. unit	Factory setting
	Code	Name				
X1-X3 Terminal	E01	X1 terminal function	Selects from the following items	–	–	0
	E02	X2 terminal function		–	–	2
	E03	X3 terminal function		–	–	3
			0: Multistep frequency select 1 (SS1) 1: Multistep frequency select 2 (SS2) 2: Coast-to-stop command (BX) 3: Alarm reset (RST) 4: Trip command (external fault) (THR) 5: Write enable for KEYPAD (WE-KP) 6: PID control cancel (Hz/PID) 7: Link enable (RS485: option) (LE)			

Control functions of frequency

Function			Setting range	Unit	Min. unit	Factory setting
	Code	Name				
Jump Hz Control	C01	Jump frequency (Jump freq. 1)	0 to 120Hz	Hz	1	0
	C02	(Jump freq. 2)		Hz	1	0
	C03	(Jump freq. 3)		Hz	1	0
	C04	(Hysteresis)	0 to 30Hz	Hz	1	3
Multi-Hz Control	C05	Multistep frequency setting (Freq. 1)	0.0 to 120Hz	Hz	0.1	0.0
	C06	(Freq. 2)		Hz	0.1	0.0
	C07	(Freq. 3)		Hz	0.1	0.0

Motor parameters

Function			Setting range	Unit	Min. unit	Factory setting
	Code	Name				
Motor	P00	Motor characteristic	0 to 10	–	–	0

High performance functions

Function			Setting range	Unit	Min. unit	Factory setting
	Code	Name				
High Performance Functions	H01	Operation time	Display the inverter accumulated operation time	100hr	1	0
	H02	Trip history	Display trip history (last four trips)	–	–	–
	H03	Data initialising (Data reset)	0: Manual set values 1: Return to factory set values	–	–	0
	H04	Auto-reset (Times)	0: Inactive 1: Active (5 attempts)	–	1	0
	H06	Fan stop operation	0: Inactive 1: Active (Fan stops at low temperature mode (up to 1.5kW)	–	1	0
PID Control	H20	PID control (Mode select)	0: Inactive 1: Active (PID output: Normal operation mode) 2: Active (PID output: Inverse operation mode)	–	–	0
	H21	(Feedback signal)	0: Terminal 12 (0 to 10V) 1: Terminal C1 (4 to 20mA) 2: Terminal 12 (1 to 5V)	–	–	1
	H22	(P-gain)	0.01 to 10.0	p.u.	0.01	0.01
	H23	(I-gain)	0.0: Inactive 0.1 to 999s	s	0.1	0.0
	H24	(D-gain)	0.0: Inactive 0.01 to 10.0s	s	0.1	0.0
	H25	(Feedback filter)	0.0 to 60.0s	s	0.01	0.5

PROTECTIVE FUNCTIONS

Function	Description		Digital monitor	Operation
Overcurrent protection	• The inverter stops when a short circuit or an overcurrent due to an overload occurs on inverter output side • The inverter stops when a ground fault on the output side is detected at startup	During acceleration	OC1	• Inverter output stops • The motor coasts to a stop • An alarm signal (1SPDT) is output • The alarm remains until RESET command is issued[1]
		During deceleration	OC2	
		While running at constant speed	OC3	
Undervoltage protection	• When the DC link circuit voltage drops below the undervoltage level, the inverter stops		LU	• Inverter output stops • An alarm signal is output at power recovery[2] • The alarm remains until RESET command is issued[1],[2]
Overvoltage protection	• When the DC link circuit voltage reaches the overvoltage level, the inverter stops	During acceleration	OU1	• Inverter output stops • The motor coasts to a stop • An alarm signal (1SPDT) is output • An alarm remains until RESET command is issued[1],[2]
		During acceleration	OU2	
		While running at constant speed	OU3	
Heat sink over-heating protection	• When an abnormal temperature rise is detected in the heat sink, the inverter stops		OH1	
Electronic thermal overload relay	• The inverter stops when internal electronic thermal overload detects an overload in: • the motor (4-pole standard or 4-pole forced air cooled inverter motor) • the inverter power module		OL OLU	
External alarm input	• The inverter stops on receiving external alarm signal		OH2	
Memory error	• The inverter stops in the event of a memory error		Er1	
CPU error	• The inverter stops in the event of a CPU error		Er3	
RS485 communication error	• The inverter stops in the event of a RS485 communication error		Er8	

NOTES:

*1 If the inverter output is held off while an internal alarm signal is being output, the alarm signal cannot be retained.

*2 No alarm signal is output when automatic restart function has been selected.

Notes:

1) To issue RESET command, press the [PRG/RESET] key on the keypad panel or connect terminals RST and P24 to clear the trip condition after removing the cause of trip

2) Fault history data is stored for the past four trips. Select H02 and press ⌄ key to review the data.

Fig. 1

CUB CM20
CUB CM40
CUB CM75
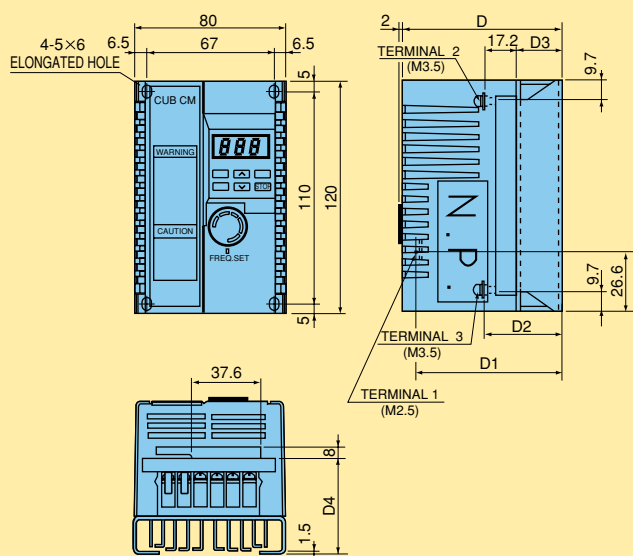
Type	Rated current (A)	External dimensions (mm)				
		D	D₁	D₂	D₃	D₄
CUB CM20	1.4	85	73.5	32.2	15	48.2
CUB CM40	2.5	115	103.5	42.2	25	58.2
CUB CM75	4.0	140	128.5	67.2	50	83.2

RS Option dimension chart

Inverter + option	External dimensions (mm)
	D
CUB CM20 + CUB CM COMMS A	95
CUB CM40 + CUB CM COMMS A	125
CUB CM75 + CUB CM COMMS A	150
CUB CM150 + CUB CM COMMS B	159
CUB CM220 + CUB CM COMMS C	147

Fig. 2

CUB CM150

Mounting hole positions

Fig. 3

CUB CM220

Mounting hole positions

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OPTIONS
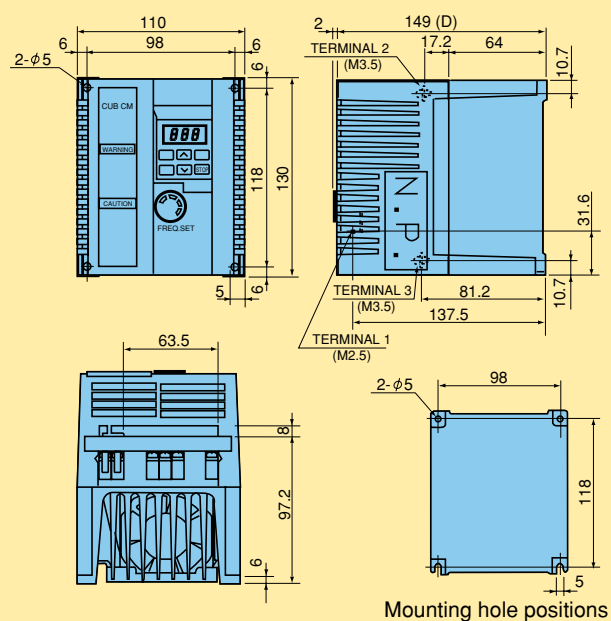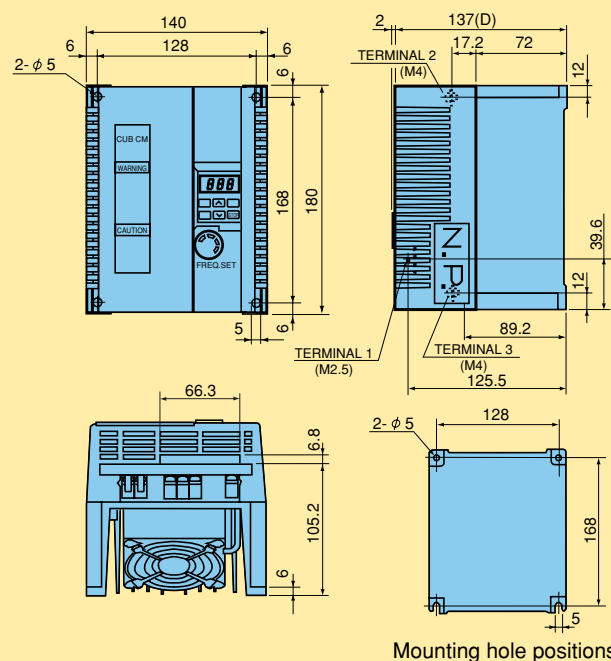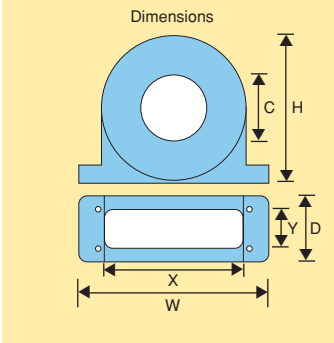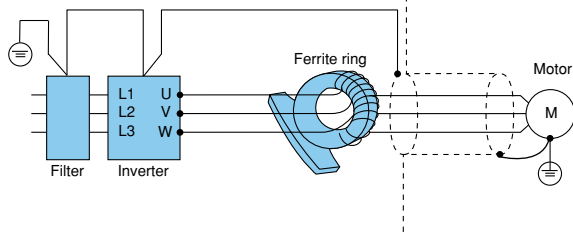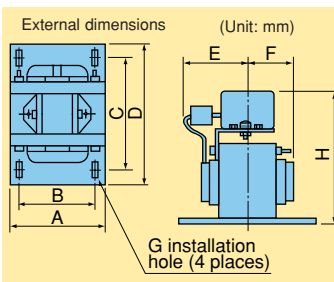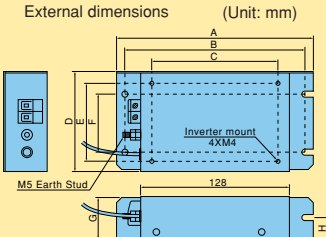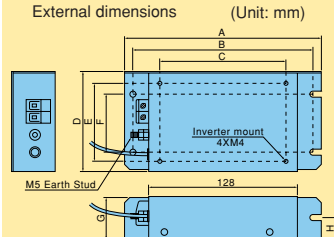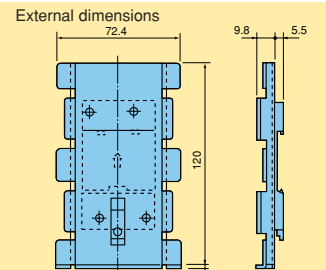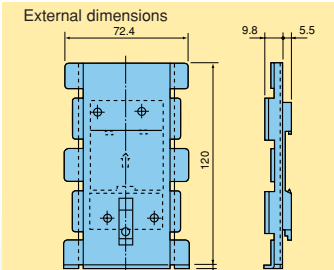
Reactor, Filter and Other Accessories

Name	Function	Mounting position
Surge arrester (Contact IMO)	Suppresses induced transient surges from power source, thus protecting all equipment connected to the power supply.	
Ferrite ring for reducing radio noise (OC1-OC5)	Reduces radio frequency noise. If the wiring between motor and inverter is shorter than 20m, use the ferrite ring in the power supply side. If longer than 20m, use it in the output side, if required.	
RFI Filter (RFI☐☐CM)	This is a special filter which complies with the European EMC (Emission) Directive. This filter should be used with a screened motor cable. *Note: Other prerequisites must be fulfiled to ensure compliance with EMC Directives. Refer to IMO for details.*	
Optional Sin O/P filter (Contact IMO)	Connected to the output circuit of inverters under low-noise operation with carrier frequency from 8 to 15kHz, (6kHz higher for 30kW or larger inverters), this filter has the following functions: 1. Suppresses fluctuation of motor terminal voltage. Protects the motor insulation from being damaged by PWM voltage overshoot. (400V series) 2. Suppresses leakage current from output side wiring. Reduces leakage current caused when several motors are operated in parallel or connected with long wiring. *Total wiring length should be less than 400m. 3. Suppresses radial noise or inductive coupling from output side wiring. Effective noise suppression device for long wiring applications such as plant. *Note: When connecting this filter, set the carrier frequency F26 at 8kHz or more.*	
DC Reactor (DCR) (VXMLC) (optional for smaller power ratings)	(Use the DCR to normalise the power supply in the following cases.] 1. The power transformer capacity is 500kVA or over and exceeds the inverter rated capacity by 10 times. 2. The inverter and a thyristor converter are connected with the same transformer. * Check if the thyristor converter uses a commutation reactor. If not, AC reactor must be connected to the power supply side. 3. Overvoltage trip occurs due to open/close of the phase-advancing capacitor for the power supply lines. 4. The voltage unbalance exceeds 2%. $$\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage [V] - Min. Voltage [V]}}{\text{Three-phase average voltage [V]}} \times 67 \ (\%)$$ (For improving input power-factor, reducing harmonics) • Used to reduce input harmonic current (correcting power-factor) • For the resultant effects, contact IMO.	
AC Reactor (ACR) (LO☐☐☐-3)	Optional. May be fitted to compensate for long motor cables, or shock loads	
Frequency meter (X72M10V)	Analog frequency meter 72mm square, 0-10VDC, M/C, 1000Ω/V	
Frequency setting device (JAGPOT1K)	Frequency setting potentiometer (mounted externally)	
Rail mounting base (MAC9)	Use to mount the inverter on IEC compliance 35mm rail (up to 0.75kW).	

* Screened motor cable not shown for simplicity

Name (type)	Dimensions
Ferrite ring	Dimensions **Optional ferrite ring wiring position for further HF noise reduction (if required)**

DC REACTOR (Typical)*

External dimensions (Unit: mm)

G installation hole (4 places)

Applicable inverter	Reactor	Dimensions								Terminal	Mass
Single-phase 200V series	Type	A	B	C	D	E	F	G	H	hole dia.	(kg)
CUB CM20	CMLC20	66	56	72	90	60	35	5.2x8	94	M4	1.0
CUB CM40	CMLC40	66	56	72	90	65	40	5.2x8	94	M4	1.4
CUB CM75	CMLC75	66	56	72	90	65	45	5.2x8	94	M4	1.6
CUB CM150	CMLC150	86	71	80	100	60	40	6x9	110	M4	1.8
CUB CM220	CMLC220	86	71	80	100	70	50	6x9	110	M4	2.6

EMC filter

External dimensions (Unit: mm)

Inverter mount 4XM4

M5 Earth Stud

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Inverter Type	Filter Required	Rated Current (A)	Dimensions (mm)							
			A	B	C	D	E	F	G	H
CUB CM20	RFI20CM	4	180	155.5	110	86	67	60	38	19
CUB CM40, CM75	RFI75CM	12								
CUB CM150	RFI150CM	20	190	165	118	117	98	89	46	23
CUB CM220	RFI220CM	29	240	216	168	148	128	118	46	23

Rail mounting base

External dimensions

(Unit: mm)

*Maybe subject to change, please consult IMO if required

Name (type)	Description
Personal computer interface card	RS485 communication is optional on the CUB CM. An optional card must be mounted on this control board. Three types of option card: OPC-C11S-RSA, OPC-C11S-RSB, and OPC-C11S-RSC, are available depending on the applicable inverter. The following operations are possible from personal computers, PLCs and similar host controllers through RS485 communication. • Frequency setting, forward rotation, backward rotation, stop, free-run, alarm cancel, and other running operations • Monitoring output frequency, output amperage, operating conditions, alarm content, etc. • Setting function codes Up to 31 inverters can be connected to one line and controlled by one host controller. Easy host controller program development for transmission frames fixed at 16 bytes of character data. Refer to the dimensions in RS Option dimension chart on page 16.

Serial transmission protocol

Items	Specifications
Physical level	EIA RS-485 standard (Two-phase)
No. of linked inverters	1 host, 31 inverters (station addresses: 1 to 31)
Transmission rate	19200, 9600, 4800, 2400, 1200 BPS
Synchronisation	Start-stop system
Transmission system	Half duplex
Transmission protocol	Polling/selecting, broadcast
Character set	ASCII 7 bit
Character length	8 bit, 7 bit selection possible
Electrical separation	Maximum 500m
Stop bit length	1 bit, 2 bit selection possible
Frame length	Standard frame: 16 byte fixed; compressed frame: 8 or 12 byte
Parity	None, even, odd selection possible
Error check system	Checksum, parity, framing error

Wiring equipment

Power supply voltage	Nominal applied motor (kW)	Inverter type	MCCB or ELCB Rated current (A)		Magnetic contactor (MC)			Recommended wire size (mm²)				
					Input circuit		Output circuit	Input circuit (R, S, T)		Output circuit (U, V, W)	DCR circuit (P1,P(+))	Control wiring
			With DCR	Without reactor	With DCR	Without reactor		With DCR	Without reactor			
Single phase 200V	0.2	CUB CM20	6	6	K212A				1.5	1.5	1.5	0.75
	0.4	CUB CM40		10								
	0.75	CUB CM75	10	16	K216A			1.5	2.5	2.5	2.5	
	1.5	CUB CM150	16	20					2.5			
	2.2	CUB CM220	20	32	K230A			2.5	2.5	2.5	2.5	

Notes:
For molded-case circuit breakers (MCCB) and earth leakage circuit breakers (ELCB), the required frame type and series depend on the facility transformer capacity and other factors. When selecting such breakers, refer to the relevant technical data.
Also select the rated sensitive current of ELCB utilizing the technical data.
The recommended wire sizes are based on the condition that the temperature inside the panel does not exceed 50°C.
The above wires are 600V IV insulated and the wires in ( ) are 600V cross-linked polyethylene.
The power source impedance obtained without the reactor is equivalent to 0.1% when converted into inverter capacity. The current imbalance caused by voltage imbalance is assumed to be 10%.
If ambient temperature or power voltage differs from the above table, requirements will differ.

IMO Jaguar Drives 5 Year Warranty

IMO JAGUAR drives are covered by a unique 5 year warranty against failure arising as a result of inferior material or workmanship.

In the event of a unit failing within 5 years despatch from IMO, we will repair or replace the drive free of charge.

Whenever possible, in the interest of providing the fastest service to our customers, we will replace the failed drive with a new or service exchange unit at IMO's discretion. This may not be possible, however, if the failed unit is in poor condition owing to abuse or neglect. In such circumstances, the customer may elect to have the unit repaired within the warranty if viable, but physical refurbishment will be chargeable.

IMO will, upon request, provide a service exchange unit in advance of receipt of the failed unit if an order number is provided along with details of the failed unit. Replacements will be dispatched at IMO's cost and credit will be issued upon receipt of the failed unit in good physical condition. Full credit will not be given if in IMO's judgment the unit has been physically or electrically abused. A no-fault-found charge will be levied upon units returned and found not to be faulty.

The terms of warranty do not provide for on-site service although a service engineer will be provided upon receipt of an order. IMO may elect to waive any charge should the findings on site indicate that any problem found lies within the scope of the warranty.

IMO Precision Controls Limited
Technical Helpline
Tel 00 44 (0) 20 8452 6444
8am to 6pm UK time Monday to Friday
Full product technical manuals available on our website: www.imopc.com

IMO Precision Controls Limited
is a registered ISO 9002 company.

Safety Precautions

Safety at Work
It is the responsibility of the owner, installer and user to ensure that the installation of the equipment and the way in which it is operated and maintained complies with the requirements of the Health & Safety at Work Act in the United Kingdom and other applicable legislation, regulations and codes of practice in the UK or elsewhere.
Only qualified personnel should install this equipment, after first reading and understanding the information in this publication. The installation instructions should be adhered to. Any question or doubt should be referred to IMO Precision Controls Ltd.

Operational Safety
Users and operators of the equipment must take all necessary precautions to prevent damage to equipment and especially to prevent the risk of injury to personnel working on or near the motor and the driven equipment.
The stop and start inputs should not be relied upon alone to ensure the safety of personnel. If a safety hazard could arise from the expected starting of the motor, an interlock mechanism should be provided to prevent the motor from running except when it is safe for it to do so.

Documentation
Every effort has been made by IMO Precision Controls Ltd to ensure that this document accurately and completely represents the Jaguar CUB CM range of inverters at the time of going to press. Information with respect to installation is necessarily generalised, and the supplier accepts no liability for contingencies over which he has no control in respect of the selection, installation and/or operation of equipment.

In line with IMO's policy of continuous improvement, the contents of this document are subject to change without prior notice.

CAUTION

Applicable to standard motors

Driving a 230V, 3 phase standard motor
When driving a 230V standard motor with an inverter, damage may occur in the insulation of the motor. Use the output circuit filter (OFL) if necessary after confirmation with the motor manufacturer.

Torque characteristics and temperature rise
When the inverter is used to operate a standard motor, the temperature rises a little higher than during operation by a commercial power supply. The cooling effect decreases in the low-speed range, reducing the allowable output torque. (If a constant torque is required in the low-speed range, use an inverter motor or a motor fitted with a separately excited fan.)

Vibration
Use of an inverter does not increase vibration of a standard motor, but when the motor is mounted to a machine, resonance may be caused by the natural frequencies including the natural frequency of the machine system.
• IMO recommend that you use rubber coupling or anti-vibration rubber, where possible[1].
• We also recommend that you use the inverter skip frequency control function to avoid resonance point in the motor operation.
Note that operation of a 2-pole motor at 60Hz or over may cause abnormal vibration.

Audible noise
When an inverter drives a standard motor, the motor noise level increases compared with driven by a commercial power supply. To reduce noise, set the inverter carrier frequency at a high level[1]. High-speed operation at 60Hz or over can result in more noise.

Installation location
Use the inverter in an ambient temperature range between -10 to 50˚C.
• When driving an inverter of 22kW or smaller at a place in a temperature of 40˚C or over, remove the ventilation covers. Install an inverter on non-flammable material. The inverter and braking resistor surfaces become hot under certain operating conditions.

Applicable to special motors

Explosion-proof motors
When driving an explosion-proof motor with an inverter, use a combination of a motor and an inverter that has been approved in advance. Such approved products are available in our special product series. Contact IMO for details.

Submersible motors and pumps
These motors have a larger rated current than standard motors. Select the inverter capacity so that these motors can run within the inverter rated current. These motors differ from standard motors in thermal characteristics. Set a small value according to the thermal time constant of motor for setting electronic thermal relay function.

Brake motors
For motors with parallel-connection brakes, obtain the brake power from the primary circuit (commercial power supply). If you connect the brake power to the inverter power output circuit by mistake, problems may occur. Do not use inverters for driving motors equipped with series-connection brakes.

Geared motors
When the power transmission mechanism uses an oil-lubricated gearbox or speed changer/reducer, continuous motor operation at low speed may cause poor lubrication.

Synchronous motors
It is necessary to use software suitable for the motor type. Contact IMO for details.

Single-phase motors
Single-phase motors are not suitable for inverter-driven variable speed operation. Use three-phase motors.
• Even if a single-phase power supply is available, use a three-phase motor, because the inverter provides three-phase output.

Combination with peripheral device

Installing MCCBs
Install an Auto Breaker (MCCB) or earth-leakage circuit breaker in the primary circuit of the inverter to protect cables[2].

Magnetic contactor in the motor circuit
If a magnetic contactor is mounted in the motor circuit for switching to the commercial power supply or for any other purposes, ensure that the inverter and the motor are stopped before you turn on or off the contactor.

Magnetic contactor in the primary circuit
Do not open or close the magnetic contactor in the primary circuit more than six times an hour. If frequent starts or stops are required during motor operation, send FWD or REV signals to the control terminal.

Protecting the motor
When you drive a motor with an inverter, the motor can be protected with an electronic thermal relay function of the inverter. In addition to the operation level, set the motor type (standard motor, inverter motor). For high-speed motors or water-cooled motors, set a small value as the thermal time constant and protect the motor in combination with the "cooling system OFF" signal. When driving several motors with an inverter, connect a thermal relay to each motor and turn on the inverter's electronic thermal relay function. If you connect the motor thermal relay to the motor with a long cable, high-frequency current may flow into the wiring floating capacity. This may cause the relay to trip at a current lower than the set value for the thermal relay. If this happens, lower the carrier frequency or use the output circuit filter (OFL) or output choke.

Power-factor correcting capacitor
Do not mount the power-factor correcting capacitor in the inverter primary circuit. (Use the DC reactor to improve the inverter power factor.) Do not use the power-factor correcting capacitor in the inverter secondary circuit. Overcurrent trip will occur, disabling motor operation.

Reducing electronic noise (EMI)
Use of filter and shielded wires are typical measures against noise that meets EMC Directives. For details, refer to the operation procedure manual.

Measures against surge current
If OU trip occurs while the inverter is stopped or operated under a light load, it is assumed that the surge current is generated by open/close of the phase-advancing capacitor in the power system.
• Connect a DC reactor to the inverter.

Megger test
When checking insulation resistance of the inverter, use a 500V megger and follow the instructions described in the instruction manual.

Wiring

Control circuit wiring length
When conducting a remote control, limit the wiring length between the inverter and operator box to 20m or less and use twisted shielded cable.

Wiring length between inverter and motor
If long wiring is used between the inverter and the motor, the inverter will overheat or trip because of overcurrent (under the influence of high-frequency current flowing into the cable capacitance) in the wires connected to the phases. Ensure that the wiring is shorter than 50m. If this length must be exceeded, lower the carrier frequency or mount an output circuit filter (OFL).

Wiring size
Select a cable with a sufficient capacity by referring to the current value or recommended wire size given in the regulations.

Earthing
Securely ground the inverter using the earth terminal.

Inverter Capacity

Driving standard motor
Select an inverter from the capacity range of nominal applied motors shown in the inverter standard specifications table. When large starting torque is required or acceleration or deceleration is required in a short time, select an inverter with a capacity one class greater than the standard.

Driving special motor
Select an inverter that meets the following condition:
Inverter rated current > Motor rated current.

Transportation, storage

When transporting or storing inverters, select the procedures and places that meet the environmental conditions given in the inverter specifications. Ensure that the above environmental conditions are met also when transporting an inverter mounted to a machine.

[1] Caution – this may cause EMC problems – check with IMO first.
[2] Can cause nuisance tripping.

If in doubt contact IMO.