



# AC Variable Speed Drives For HVAC Applications



The drive for **perfection**

# The IMO Jaguar VXH range can make a significant reduction in global energy usage

Up to 50% of energy consumption in schools, hospitals, shopping centres, hotels and office buildings is related to air conditioning. The IMO Jaguar VXH series is a dedicated inverter for HVAC applications that offers functions and features designed to create the optimal environment for the people using the building whilst keeping the energy consumption in AHUs, water pumps, compressors, condensers, and others to a minimum.

Equally at home as part of a BMS system or as a standalone solution the IMO Jaguar VXH range has been designed specifically for energy saving and can significantly help to reduce our Global Carbon Footprint.

## Wide range from 0.75kW to 710kW

All drives up to 90kW have integral EMC filter and DCR as standard and are available as IP21 or IP55, thus offering a wide range of installation options.

Inverter capacity	EMC Filter	DC reactor	Protective structure
0.75kW to 90kW	Built-in	Built-in	IP21/IP55
110kW to 710kW	Built-in	External	IP00

## Optimised control with energy saving

- Linearization function
- Temperature based control and pressure based control
- Energy saving functions including wet-bulb temperature estimation control
- Automatic energy saving operation

## Slim body

The slim body design and uniform frame size of the IP21 and IP55 variants enables installation in compact spaces?

## Specific HVAC functions

- 4 built in PID controllers
- Pick-up rotating motor function
- Torque vector control
- Programmable Logic Controller
- Password function
- Cumulative kWh data logger
- Fire mode (forced operation)
- Real time clock / Timer functions
- Filter clogging prevention function
- User friendly, informative keypad
- Broken belt detection

## Peace of mind

The IMO Jaguar VXH range has a 10 year design life, backed by our unique 5 Year Warranty.



# Optimum Control for HVAC Applications

## **Air Handling Unit (AHU) Supply fan / Return fan**

The speed of supply and return fans can be adjusted to optimise performance according to pressure, discharge temperatures, room temperature, or other environmental conditions.

The highest level of energy efficiency can be achieved by controlling the air flow based on the carbon dioxide level in the room.

## **Chilled water pump**

The chilled water pump circulates the chilled water generated by the freezing machine to the air conditioner and fan coil. The pump speed is adjusted to optimum performance according to the header pressure.

In addition, the pump pressure can be controlled to the correct value by correlating the flow rate signal with the target pressure using the linearization function.

## **Cooling water pump**

The cooling water pump circulates the cooling water to the cooling tower in order to cool the heat generated by the freezing machine. The pump speed is adjusted to attain its optimum performance, according to the temperature and flow rate of the cooling water.

In addition, the inverter can control the cooling pump so that the difference of cooling water temperature between the inlet and outlet is always constant. (Temperature difference constant control).

## **Cooling tower fan**

The cooling tower fan is used to cool the cooling water by emitting it into the air. The fan speed is optimised according to the cooling water temperature at the outlet.

To further improve energy efficiency, the inverter estimates the wet-bulb temperature automatically to control the fan so that the temperature of cooling water (wet bulb) is interlocked to the air temperature. (Wet-bulb temperature estimation control).

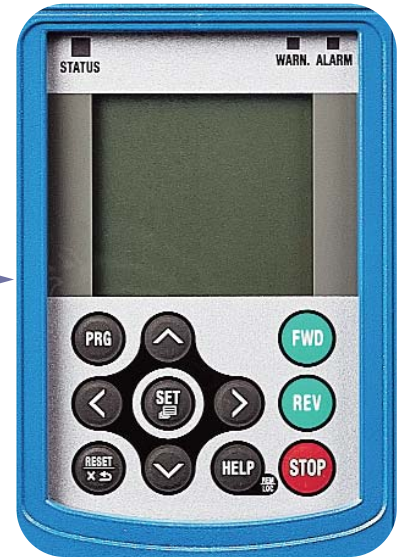


# User friendly, easy to see keypad

The following values can be shown on the enlarged LCD display

- |                          |                   |                       |
|--------------------------|-------------------|-----------------------|
| 1. Present value (PV)    | 5. Output current | 9. Power consumption  |
| 2. Set value (SV)        | 6. Output voltage | 10. Cumulative energy |
| 3. Manipulate value (MV) | 7. Torque         |                       |
| 4. Frequency             | 8. Rotation speed |                       |

\*User defined process value display options



**Multi-language function: 19 languages + user customized language**

# Real time clock (RTC) is provided as standard

Alarm function:

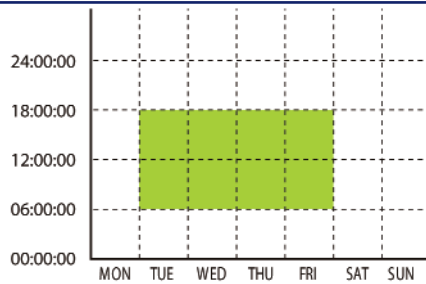
- Alarm information with date and time
- Previous 10 alarms are stored and displayed with date and time

Timer function:

- Ability to set up to four timers per week
- Ability to set up to 20 holidays per year
- Daylight saving feature

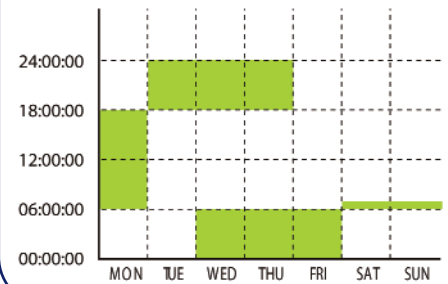
**Example:**

When operation is performed to the same schedule throughout a week



**Example:**

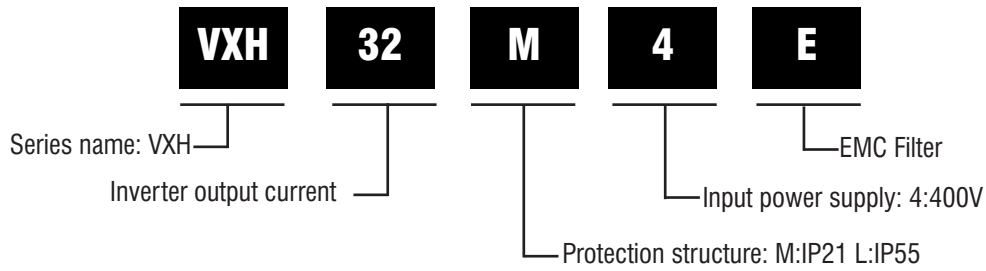
The operational schedule can be set using four independent timers when operation requirement varies depending on the day of the week.



**Unit conversion function between PV and SV values**

- Unit conversion allows you to easily set data

Function	Units			
Unit conversion	No conversion	%	RPM	l/min
	m³/h	C	mbar	bar
	kPa	mWG	mmHg	kW
	in-wg	psi	F	ppm
	PSI			

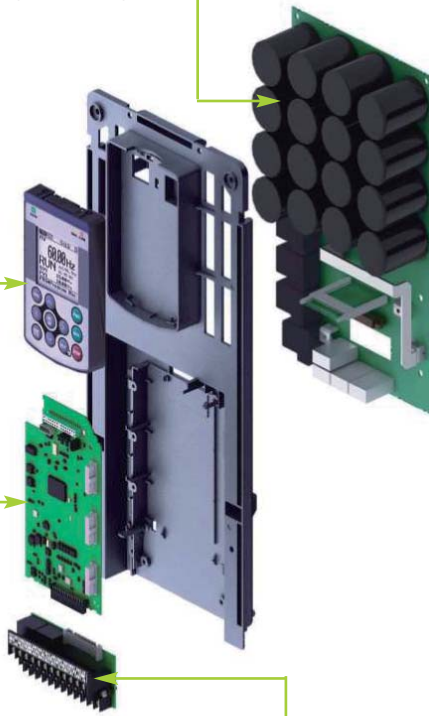


### 1. User-friendly, easy to see dedicated keypad

Multi-language supported, HELP function featured, unit setting with SV and PV values, data copy (three kinds), detachable and can be attached on the panel (using an optional cable)

### 4. Capacitor board

Outputs the life prediction signal determining capacitor level drop and cumulative running hours. This allows the user to determine replacement period.



### 2. Control board

USB port equipped.  
Max. three types of built-in optional boards can be mounted at the same time.  
Optional battery connection for RTC.  
Various communications option functions.

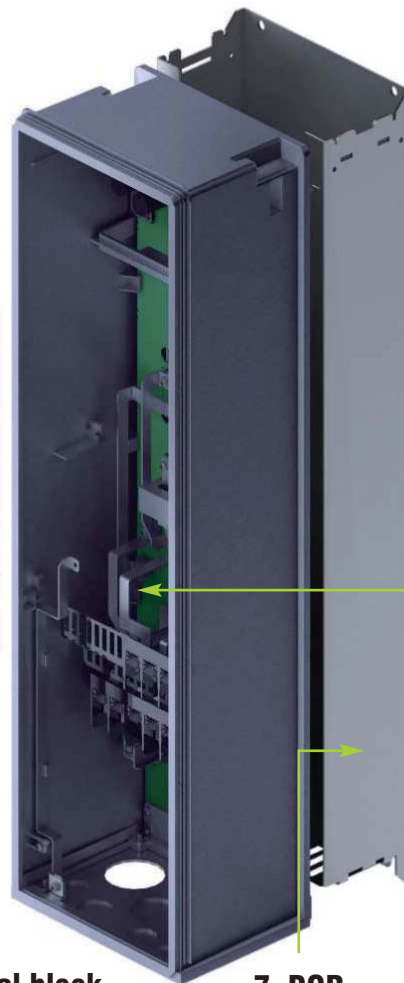
### 3. Control terminal block

A detachable control terminal block is used. This allows the control PCB to be replaced easily without disconnecting cables.



### 5. Cooling fan

Easy replacement just by simply removing and attaching the part. Life expectancy can be increased by controlling ON and OFF.



### 6. EMC filter

Effectively reduces noise. Integral to units of all capacities. Conforming to IEC61800-3.

### 7. DCR

Effectively reduces harmonic noise. Conforming to IEC/EN61000-3-2 and IEC/EN61000-3-12. Provided as standard (models up to 90kW), and can be attached externally as an option (to models from 110kW to 710kW).

### 8. Environmental immunity

3C2, IEC60721-3-3 supported

### 9. Others

Support/analysis software by loader, RTC backup by battery (option)

Standard equipment	Optional Equipment	
BACnet MS/TP	LonWorks	DeviceNet
Modbus RTU	Ethernet	CANopen
Metasys N2	Profibus	CC-Link

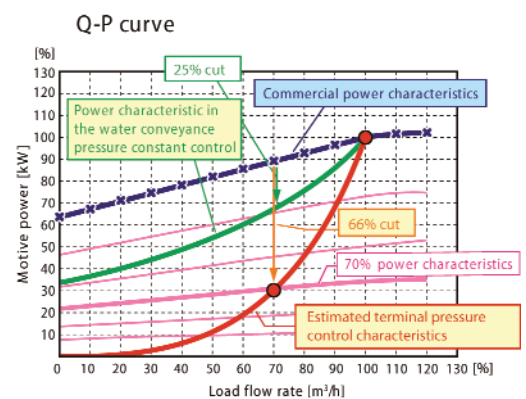
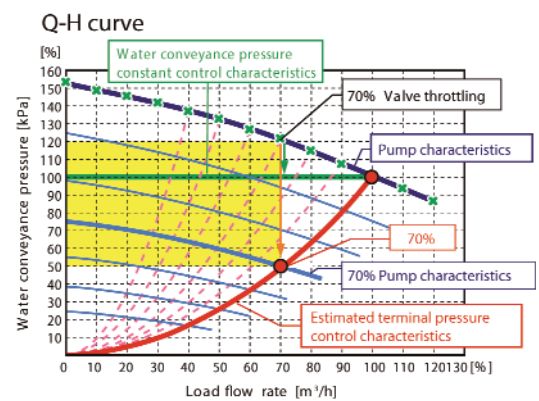
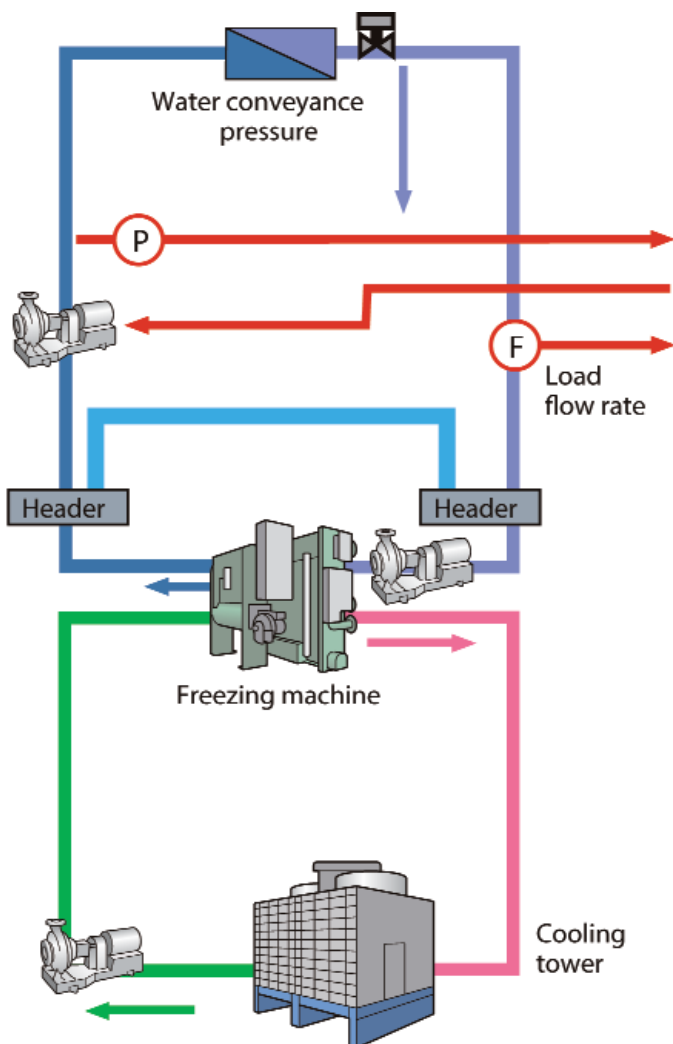
# Specific HVAC Functions

## Linearization function

This function estimates the target pressure using the flow rate, which allows the estimated terminal pressure to be controlled.

For an air-conditioning heat source system, the quantity of the cooling or heating water required fluctuates due to outside temperature or day/night requirements. Therefore, maintaining a constant water pressure may lead to unnecessarily high pressures on terminals at a low operating state and wasted energy at the pump.

By controlling the pump, using a correlation of required pressure and the estimated terminal pressure, using the detected load flow rate through the PID controller, it is possible to reduce the wasted pump power to achieve a greater energy-saving effect.

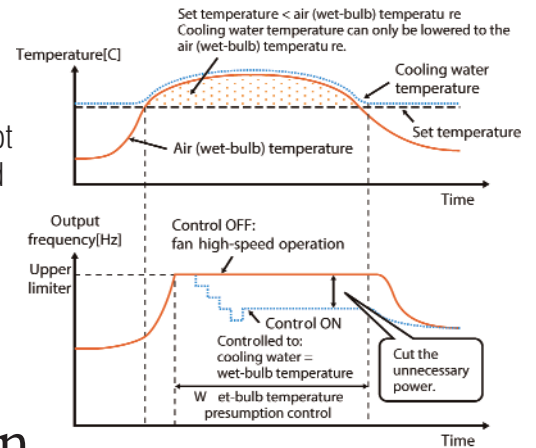


# Wet-bulb temperature estimation control

This function is used for controlling cooling tower and fans.

The wet-bulb temperature could be higher than the set temperature if the external air temperature is too high. In this case the water temperature would not be able to reach the set temperature so the fan keeps rotating at high speed and fails to deliver energy savings.

Jaguar-VXH automatically estimates the wet-bulb temperature and controls the fan so that the cooling water is interlocked with the air temperature so as not to use unnecessary energy.



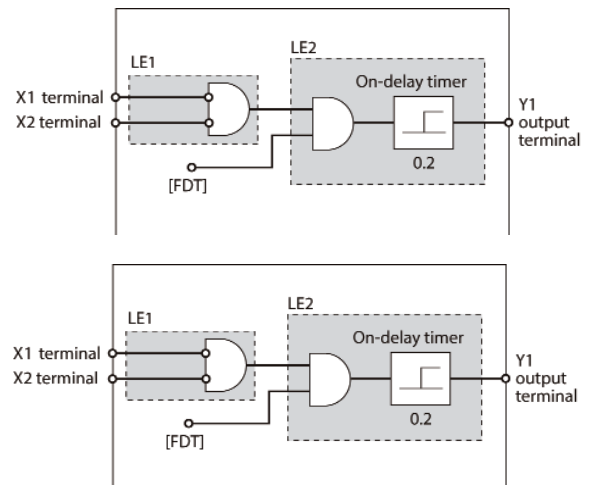
# Filter clogging prevention function

This function detects clogging of the fan filter by monitoring output current and pressure sensor value.

When clogging is detected, the fan is rotated in reverse to eject dust before continuing its normal operation. An alarm output signals maintenance is required.

# Programmable logic control

The customized logic interface enables the user to apply logic and arithmetic functions to the digital and analogue input and output signals, allowing simple relay sequences to be built to process the signals.



# 4 PID controllers

The inverter is equipped with 4 PID controllers as standard. One PID module is used to control the output frequency of the inverter, the other three can be used to control external devices. To utilize all of four PIDs the optional card (OPC-G1-A10) is required.

# Fire mode (forced operation)

In this mode the inverter will continue operating the fan or pump for as long as possible in case of an emergency. All of the inverter protection functions are ignored and operation continues until failure.

# Password

Passwords can be set to restrict unauthorised users and protect against improper use. Entering the incorrect password repeatedly will lock the drive for security.

# Pick-up operation function

The pick-up function enables the inverter to match the output frequency to a rotating motor regardless of the direction of rotation, and pick up the motion smoothly. This function is particularly useful when switching the motor directly from mains operation to inverter operation.

# Standard Specifications

Item		Specification													
Model	VXH#**-4E	2A5	4A1	5A5	9	13A5	18A5	24A5	32	39	45	60	75	91	112
Applicable standard motor (rated output) [kW] <sup>*1</sup>		0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Output ratings	Rated capacity [kVA] <sup>*2</sup>	1.9	3.1	4.1	6.8	10	14	18	24	29	34	45	57	69	85
	Voltage [V] <sup>*3</sup>	3-phase, 380 to 480V (with AVR function)													
	Rated current [A]	2.5	4.1	5.5	9.0	13.5	18.5	24.5	32	39	45	60	75	91	112
	Overload current rating	110%-1min (Overload tolerated interval: compliant with IEC 61800-2)													
	Rated frequency [Hz]	50, 60Hz													
Input Power Supply	Main power supply (No. of phase, voltage, frequency)	3-phase, 380 to 480V, 50/60Hz													
	Control power supply auxiliary-input (No. of phase, voltage, frequency)	Single phase, 380 to 480V, 50/60Hz													
	Voltage, frequency variations	Voltage: +10 to -15% (Unbalance rate between phases is with 2%) <sup>*4</sup> Frequency: +5 to -5%													
	Rated input current [A]	1.6	3.0	4.3	7.4	10.3	13.9	20.7	27.9	34.5	41.1	55.7	69.4	83.1	102
	Required power supply capacity [kVA]	1.2	2.1	3.0	5.2	7.2	9.7	15	20	24	29	39	49	58	71
Braking	Braking torque [%] <sup>*5</sup>	20										10 to 15			
	DC braking	Braking starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 60%													
EMC Filter	Built-in [Compliant with EMC standard (IEC/EN61800-3:2004)]														
DC reactor (DCR)	Built-in (IEC/EN61000-3-2, IEC/EN61000-3-12)														
Compliant with Electrical Safety Standards	UL508C, C22.2 No.14, IEC/EN61800-5-1:2007														
"#" Enclosure (IEC/EN60529)	IP21/IP55														
Cooling method	Natural cooling						Fan cooling								
Weight/ Mass	IP21/IP55	10	10	10	10	10	10	18	18	18	18	23	23	TBD	TBD

Item		Specification													
Model	VXH#**-4E	150	176	210	253	304	377	415	520	585	650	740	960	1170	1370
Applicable standard motor (rated output) [kW] <sup>*1</sup>		75	90	110	132	160	200	220	280	315	355	400	500	630	710
Output ratings	Rated capacity [kVA] <sup>*2</sup>	114	134	160	192	231	287	316	396	445	495	563	731	891	1044
	Voltage [V] <sup>*3</sup>	3-phase, 380 to 480V (with AVR function)													
	Rated current [A]	150	176	210	253	304	377	415	520	585	650	740	960	1170	1370
	Overload current rating	110%-1min (Overload tolerated interval: compliant with IEC 61800-2)													
	Rated frequency [Hz]	50 60Hz													
Input Power Supply	Main power supply (No. of phase, voltage, frequency)	3-phase, 380 to 480V, 50/60Hz													
	Control power supply auxiliary-input (No. of phase, voltage, frequency)	Single phase, 380 to 480V, 50/60Hz													
	Voltage, frequency variations	Voltage: +10 to -15% (Unbalance rate between phases is with 2%) <sup>*4</sup> Frequency: +5 to -5%													
	Rated input current [A]	136	162	201	238	286	357	390	500	559	628	705	881	1115	1256
	Required power supply capacity [kVA]	95	113	140	165	199	248	271	347	388	436	489	611	773	871
Braking	Braking torque [%] <sup>*5</sup>	10 to 15													
	DC braking	Braking starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 60%													
EMC Filter	Built-in [Compliant with EMC standard (IEC/EN61800-3:2004)]														
DC reactor (DCR)	Built-in						Standard accessory (IEC/EN61000-3-2, IEC/EN61000-3-12)								
Compliant with Electrical Safety Standards	UL508C, C22.2 No.14, IEC/EN61800-5-1:2007														
"#" Enclosure (IEC/EN60529)	IP21/IP55						IP00								
Cooling method	Fan cooling														
Weight/ Mass	IP21/IP55	TDB	TDB												
	IP00			62	64	94	98	129	140	245	245	245	330	530	530

\*1) Applicable standard motors are the case for IMO 4-pole standard motors

\*2) The rated capacity indicates the case of 440V ratings

\*3) Output voltage cannot exceed the power supply voltage

\*4) Interphase voltage unbalance ration [%] = (max. voltage [V] - min. voltage [V])/3 phase average voltage [V]x67 (see IEC61800-3). When unbalance ratio is between 2 - 3% please use optional AC reactor (ACR).

\*5) Average braking torque obtained by use of a motor. 9Varies with the efficiency of the motor)

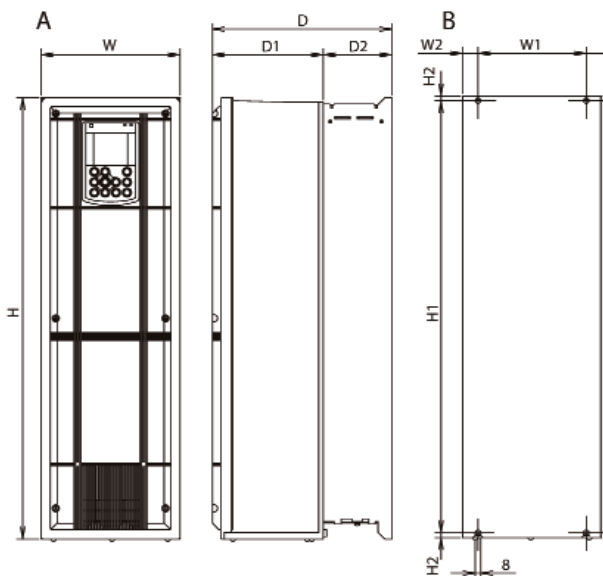


# Outline drawing

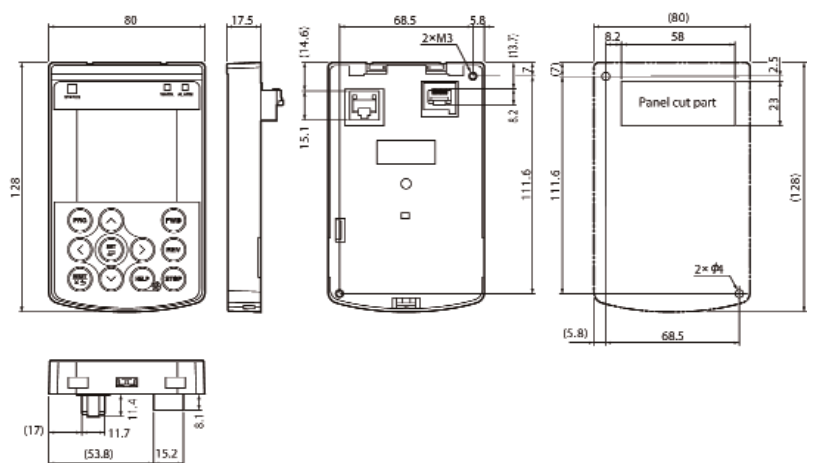
Power supply voltage	Applicable standard motor (kW)	Inverter model	Outside dimensions (mm)					Mounting dimensions (mm)														
			Drawing	W	H	D	D1	D2	Drawing	W1	W2	H1	H2									
3-phase 400V	0.75	VXH2A5#-4E	A	150	465	262	162	100	B	115	17.5	451	7									
	1.5	VXH4A1#-4E																				
	2.2	VXH5A5#-4E																				
	3.7	VXH9#-4E																				
	5.5	VXH13A5#-4E																				
	7.5	VXH18A5#-4E																				
	11	VXH24A5#-4E																				
	15	VXH32#-4E																				
	18.5	VXH39#-4E																				
	22	VXH45#-4E																				
	30	VXH60#-4E																				
	37	VXH75#-4E																				
	45	VXH91#-4E																				
	55	VXH112#-4E																				
	75	VXH150#-4E																				
	90	VXH176#-4E																				
	110	VXH210S-4E	B	530	740	315	135	180	430	50	710	15.5										
	132	VXH253S-4E																				
	160	VXH304S-4E																				
	200	VXH377S-4E																				
	220	VXH415S-4E																				
	280	VXH520S-4E																				
	315	VXH585S-4E																				
	355	VXH650S-4E																				
	400	VXH740S-4E																				
	500	VXH960S-4E																				
	630	VXH1170S-4E																				
	710	VXH1370S-4E																				

# (Protective structure) : M: IP21, L: IP55  
 S (Protective structure) : IP00

## Body



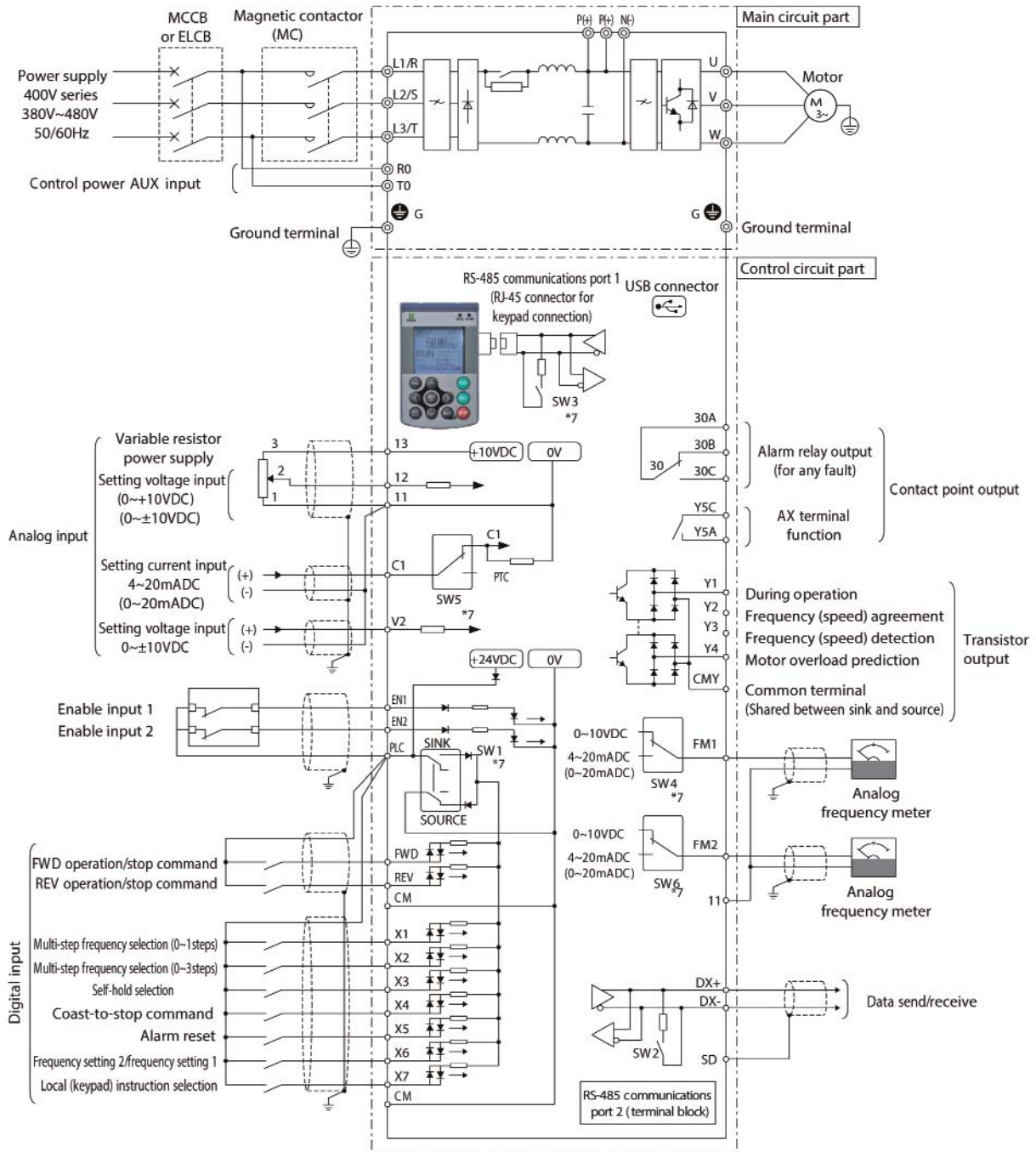
## Keypad



# Outline drawing

Basic configuration diagram

(Factory shipped condition: with SOURCE mode input and enable input function)



# Options

Description	Part Number
Relay output interface card	OPC-G1-RY
Relay output interface card	OPC-G1-RY2
Analogue input interface card	OPC-G1-AIO
Analogue current output interface card	OPC-G1-AO
CC-Link communications card	OPC-G1-CCL
DeviceNet communications card	OPC-G1-DEV
PROFIBUS DP communications card	OPC-G1-PDP
CANopen communications card	OPC-G1-COP
LonWorks communications card	OPC-G1-LNW (Coming soon)
Ethernet communications card	OPC-G1-ETH
PT100 temperature sensor input card	OPC-G1-PT (Coming soon)
Battery	OPK-BP

## The Jaguar Range



From our market leading CUB, VXR, VXG, VXH and VXA range of drives with varying functionality and power, IMO has the right frequency inverter to meet the needs of your application, whatever it might be. From a simple small pump or fan through to the most complex large scale hoists, you can be assured that IMO has the drive and the knowledge to meet your application needs.

The IMO CUB features a full range of functions, a compact body, simple operation, wide model variations and global compatibility. It will meet the needs of higher performance machines and equipment such as conveyors, fans, pumps, centrifugal separators and food processing machines, as well as the needs of system integration, energy saving, labour saving and total cost reduction.

With an extended range of functions, the IMO VXR features connectivity, compact body, wide model variations and global compatibility. The VXR with Dynamic Torque Vector Control sets new standards for vector controlled drives. It will meet the needs of high performance machines and equipment such as pumps, fans, conveyors, material handling machines, packaging, special machines and textile machines.

The Building Services specific VXH drive has been designed with energy saving in mind. It is equally at home as part of a BMS system with its many inputs and outputs, or as a stand-alone solution with its 4 PID controllers, PLC and real time clock functions.

The VXA or AQUA drive has been designed to suit the demands of the water industry, including application specific functions cascading pump control, anti jam and dry pump detection.

The high performance VXG, multi function inverter boasts state-of-the-art technology, with control performance that has evolved to a new dimension. Control methods now include: PG Vector control, sensorless vector control, dynamic torque vector control and V/F Control. It meets the needs of the most demanding drives applications such as hoisting, packaging, material handling, wood, textile and process machinery.

Providing the highest performance levels in the industry and redefining the common sense of general purpose inverters, the IMO Jaguar range is ready to answer your needs.



## IMO Worldwide Offices

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### IMO Automazione

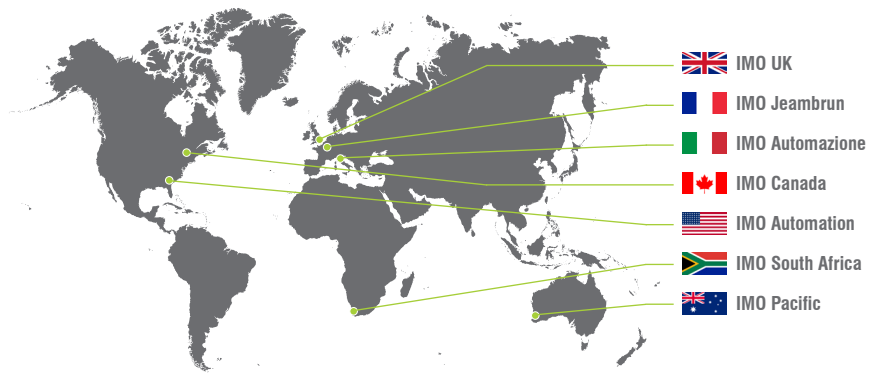
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