

YASKAWA AC Drive-V1000

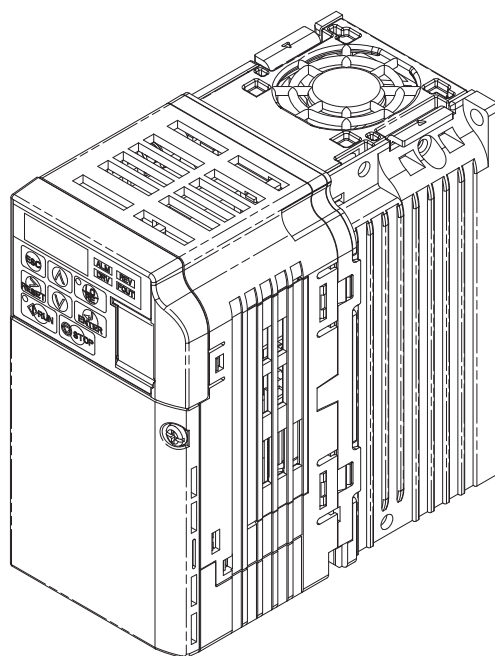
Compact Vector Control Drive

Technical Manual

Type: CIMR-VU

Models: 200 V Class, Three-Phase Input: 0.1 to 18.5 kW
200 V Class, Single-Phase Input: 0.1 to 3.7 kW
400 V Class, Three-Phase Input: 0.2 to 18.5 kW

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



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1.2 Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

- Inspect the drive for damage.
- If the drive appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the nameplate.
- If you have received the wrong model or the drive does not function properly, contact your supplier.

◆ Nameplate

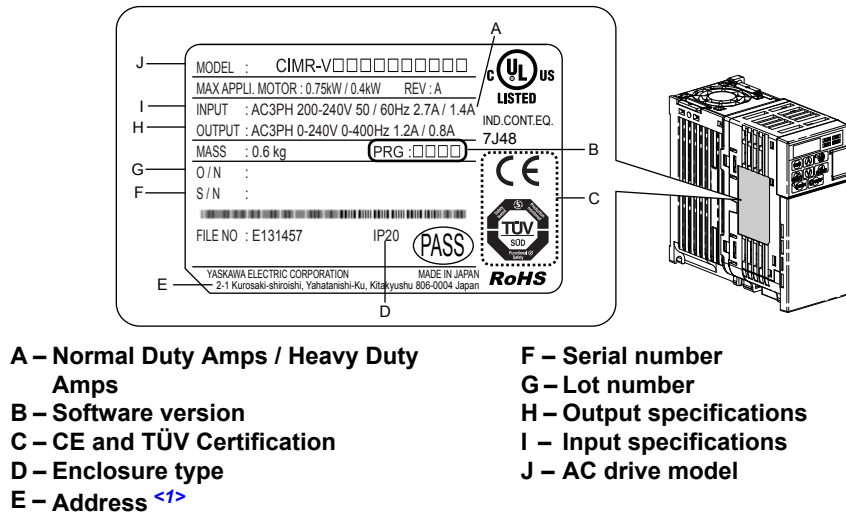
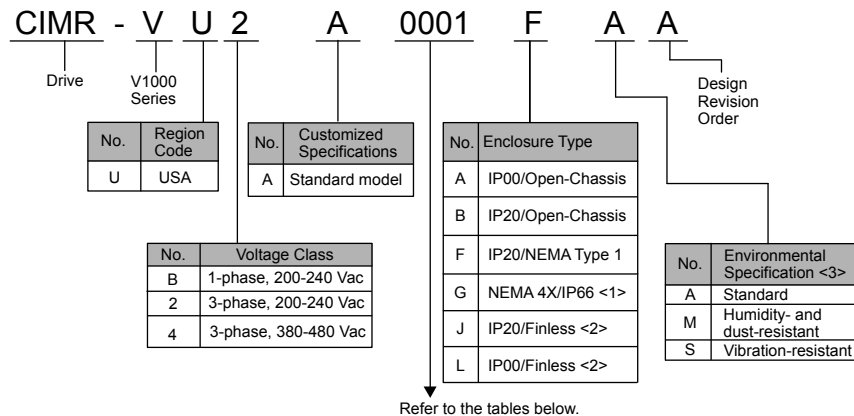


Figure 1.1 Nameplate Information Example

<1> The address of the head office of Yaskawa Electric Corporation (responsible for product liability) is shown on the nameplate.



<1> Refer to manual TOBPC71060635 for more information on these models.

<2> Refer to manual TOBPC71060621 for more information on these models.

<3> Drives with these specifications do not guarantee complete protection for the specified environmental condition.

■ Single-Phase 200 V Class

Model	Normal Duty		Heavy Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
BA0001	0.2	1.2	0.1	0.8
BA0002	0.4	1.9	0.2	1.6
BA0003	0.75	3.3	0.4	3.0
BA0006	1.1	6.0	0.75	5.0
BA0010	2.2	9.6	1.5	8.0
BA0012	3.0	12.0	2.2	11.0

1.2 Model Number and Nameplate Check

Model	Normal Duty		Heavy Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
BA0018 <1>	—	—	3.7	17.5

<1> Available with Heavy Duty rating only.

■ Three-Phase 200 V Class

Model	Normal Duty		Heavy Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
2A0001	0.2	1.2	0.1	0.8
2A0002	0.4	1.9	0.2	1.6
2A0004	0.75	3.5	0.4	3.0
2A0006	1.1	6.0	0.75	5.0
2A0010	2.2	9.6	1.5	8.0
2A0012	3.0	12.0	2.2	11.0
2A0020	5.5	19.6	3.7	17.5
2A0030	7.5	30.0	5.5	25.0
2A0040	11	40.0	7.5	33.0
2A0056	15	56.0	11	47.0
2A0069	18.5	69.0	15	60.0

■ Three-Phase 400 V Class

Model	Normal Duty		Heavy Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
4A0001	0.4	1.2	0.2	1.2
4A0002	0.75	2.1	0.4	1.8
4A0004	1.5	4.1	0.75	3.4
4A0005	2.2	5.4	1.5	4.8
4A0007	3.0	6.9	2.2	5.5
4A0009	3.7	8.8	3.0	7.2
4A0011	5.5	11.1	3.7	9.2
4A0018	7.5	17.5	5.5	14.8
4A0023	11	23.0	7.5	18.0
4A0031	15	31.0	11	24.0
4A0038	18.5	38.0	15	31.0

Note: Refer to [Component Names on page 28](#) for differences regarding enclosure protection types and component descriptions.

1.3 Drive Models and Enclosure Types

The following table describes drive enclosures and models.

Table 1.1 Drive Models and Enclosure Types

Voltage Class	Enclosure Type		
	IP20/Open-Chassis Drive Model	IP00/Open-Chassis Drive Model	IP20/NEMA Type 1 Drive Model
Single-Phase 200 V Class	BA0001B	–	BA0001F
	BA0002B	–	BA0002F
	BA0003B	–	BA0003F
	BA0006B	–	BA0006F
	BA0010B	–	BA0010F
	BA0012B	–	BA0012F
	BA0018B	–	BA0018F
Three-Phase 200 V Class	2A0001B	–	2A0001F
	2A0002B	–	2A0002F
	2A0004B	–	2A0004F
	2A0006B	–	2A0006F
	2A0010B	–	2A0010F
	2A0012B	–	2A0012F
	2A0020B	–	2A0020F
	–	2A0030A	2A0030F
	–	2A0040A	2A0040F
	–	2A0056A	2A0056F
	–	2A0069A	2A0069F
Three-Phase 400 V Class	4A0001B	–	4A0001F
	4A0002B	–	4A0002F
	4A0004B	–	4A0004F
	4A0005B	–	4A0005F
	4A0007B	–	4A0007F
	4A0009B	–	4A0009F
	4A0011B	–	4A0011F
	–	4A0018A	4A0018F
	–	4A0023A	4A0023F
	–	4A0031A	4A0031F
	–	4A0038A	4A0038F

Two types of enclosures are offered for V1000 drives.

- IP20/Open-Chassis and IP00/Open-Chassis models are often placed inside a large enclosure panel where the front of the drive is covered to prevent someone from accidentally touching charged components.
- IP20/NEMA Type 1 models mount to an indoor wall and not inside a large enclosure panel.

A.4 Drive Specifications

- Note:**
1. Perform rotational Auto-Tuning to obtain OLV performance specifications.
 2. For optimum performance life of the drive, install the drive in an environment that meets the environmental conditions.

Item		Specification
Control Characteristics	Control Method	The following control methods are available: Open Loop Vector Control (current vector), V/f Control, and PM Open Loop Vector (for use with SPM and IPM)
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy	Digital input: within $\pm 0.01\%$ of the max output frequency (-10 to +50 °C) Analog input: within $\pm 0.5\%$ of the max output frequency (25 °C ± 10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/1000 of maximum output frequency
	Output Frequency Calculation Resolution	$1/2^{20}$ x Maximum output frequency (E1-04)
	Frequency Setting Signal	Main frequency reference: 0 to +10 Vdc (20 k Ω), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference: Pulse Train Input (max 32 kHz)
	Starting Torque	200%/0.5 Hz (OLV Control, HD rating, IM of 3.7 kW or smaller), 50%/6 Hz (OLV/PM Control)
	Speed Control Range	1:100 (OLV Control), 1:40 (V/f Control), 1:10 (OLV/PM Control)
	Speed Control Accuracy	$\pm 0.2\%$ in Open Loop Vector Control $\triangleleft/\triangleright$
	Speed Response	5 Hz (25 °C ± 10 °C) in Open Loop Vector Control (excludes temperature fluctuation when performing Rotational Auto-Tuning)
	Torque Limit	Open Loop Vector Control only. Adjustable in 4 quadrants.
	Accel/Decel Time	0.00 to 6000.0 s (allows four separate settings for accel and decel)
	Braking Torque	Instantaneous Average Decel Torque $\triangleleft/\triangleright$: 0.1/0.2 kW: over 150%, 0.4/0.75 kW: over 100%, 1.5 kW: over 50%, 2.2 kW and above: over 20% Continuous Regen Torque: 20%, 125% with a Braking Resistor Unit $\triangleleft/\triangleright$: (10% ED) 10 s with an internal braking transistor.
	V/f Characteristics	Preset V/f patterns and user-set program available.
Control Characteristics	Functions	Momentary Power Loss Ride-Thru Speed Search Over/Undertorque Detection Torque Limit, Multi-Step Speed (17 steps max) Accel/Decel Time Switch S-Curve Accel/Decel, 2-Wire/3-Wire Sequence Rotational Auto-Tuning Stationary Auto-Tuning of Line-to-Line Resistance Dwell Cooling Fan ON/OFF Slip Compensation Torque Compensation Jump Frequencies (reference dead band) Frequency Reference Upper/Lower Limit DC Injection Braking (start and stop), High Slip Braking PID Control (with Sleep Function) Energy Saving MEMOBUS/Modbus (RS-485/RS-422 Max 115.2 kbps) Fault Reset Parameter Copy DriveWorksEZ Fault Restart Removable Terminals with Parameter Backup Function

A.4 Drive Specifications

Item		Specification
Protection Functions	Motor Protection	Motor overheat protection via output current sensor
	Overcurrent Protection	Drives stops when output exceeds 200% of the rated current (Heavy Duty)
	Overload Protection	A stop command will be entered after operating at 150% for 60 s (Heavy Duty) <4>
	Overvoltage Specification	200 V Class: Stops when DC bus voltage exceeds approx. 410 V 400 V Class: Stops when DC bus voltage exceeds approx. 820 V
	Low Voltage Protection	Drive stops when DC bus voltage falls below the levels indicated: <5> 190 V (3-phase 200 V), 160 V (single-phase 200 V), 380 V (3-phase 400 V), 350 V (3-phase 380 V)
	Momentary Power Loss Ride-Thru	3 selections available: Ride-Thru disabled (stops after 15 ms), time base of 0.5 s, and continue running as long as the drive control board is powered up. <6>
	Heatsink Overheat Protection	Protected by thermistor
	Braking Resistor Overheat Protection	Overheat input signal for braking resistor (Optional ERF-type, 3% ED)
	Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run. Separate settings for each type of stall prevention determine the current level at which stall prevention is triggered.
	Cooling Fan Failure Protection	Circuit protection ("fan-lock" sensor)
	Ground Fault Protection	Electronic circuit protection <7>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V
Environment	Storage/Installation Area	Indoors
	Ambient Temperature	IP20/NEMA Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F) IP20/IP00 Open-Chassis enclosure: -10 °C to +50 °C (14 °F to 122 °F) Finless Type: IP20/IP00 enclosure: -10 °C to +50 °C (14 °F to 122 °F) NEMA Type 4X/IP66 enclosure: -10 °C to +40 °C (14 °F to 104 °F)
	Humidity	95% RH or less with no condensation
	Storage Temperature	-20 to +60 °C (-4 to +140 °F) allowed for short-term transport of the product
	Altitude	Up to 1000 meters without derating; up to 3000 meters with output current and voltage derating. Refer to Altitude Derating on page 352 for details.
	Shock, Impact	10 to 20 Hz: 9.8 m/s ² 20 to 55 Hz: 5.9 m/s ²
	Surrounding Area	Install the drive in an area free from: - oil mist and dust - metal shavings, oil, water or other foreign materials - radioactive materials - combustible materials - harmful gases and liquids - excessive vibration - chlorides - direct sunlight
	Orientation	Install the drive vertically to maintain maximum cooling effects
Standards		- UL508C - EN 61800-3:2004/A1:2012, IEC/EN 61800-5-1 - ISO/EN 13849-1 Cat.3 PLd, IEC/EN 61508 SIL2 Time from input open to drive output stop is less than 1 ms.
Protective Enclosure		IP20/Open-Chassis or IP00/Open-Chassis <8> IP20/NEMA Type 1 <9>
Cooling Method		BA0001 to BA0006: self-cooled BA0010 to BA0018: cooling fan 2A0001 to 2A0004: self-cooled 2A0006 to 2A0069: cooling fan 4A0001 to 4A0004: self-cooled 4A0005 to 4A0038: cooling fan

<1> Speed control accuracy varies somewhat according to the type of motor and drive settings.

<2> Instantaneous average deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from the rated motor speed down to zero in the shortest time.

<3> Ensure that Stall Prevention Selection during Deceleration is disabled (L3-04 = 0) or set to 3 when using a braking resistor or the Braking Resistor Unit. The default setting for the stall prevention function will interfere with the braking transistor.

<4> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.

- <5> Parameter settings allow up to 150 V.
- <6> A Momentary Power Loss Ride-Thru Unit is required for 200/400 V class drives 7.5 kW and less if the application needs to continue running during a momentary power loss up to 2 seconds.
- <7> Ground protection cannot be provided under the following circumstances when a ground fault is likely in the motor windings during run: Low ground resistance for the motor cable and terminal block; low ground resistance for the motor cable and terminal block; or the drive is powered up from a ground short.
- <8> The following models have an IP20/Open-Chassis enclosure as standard. Customers may convert these models to IP20/NEMA Type 1 enclosures using the IP20/NEMA Type 1 Kit Option:
 2A0030 to 2A0069
 4A0018 to 4A0038
- <9> The following models have an IP20/NEMA Type 1 enclosure as standard. For an IP20/Open-Chassis or IP00/Open-Chassis design, remove the top and bottom covers:
 BA0001 to BA0018
 2A0001 to 2A0020
 4A0001 to 4A0011

Note: Time from input open to drive output stop is less than 1 ms.