

Description

1/8 - 25HP

V1000 NEMA 4X Drive

V1000-4X



The V1000-4X is a version of the standard V1000 in an integral enclosure that meets NEMA type 4X/12 indoor use requirements, UL type 4X/12 standards, and the IP66 rating of IEC 529. This enclosure provides the protection required in tough washdown or dust-tight environments, common in Food and Beverage Processing, Packaging, Metal Machining, Woodworking, Pumping, Refrigeration, and Printing. The enclosure is coated to protect against the harmful effects of sanitizing chemicals commonly used in food industries.

Performance Features

- Ratings:
 - 1/8 to 3 HP at 200-240 VAC 1-Phase
 - 1/8 to 25 HP (ND) at 200-240 VAC 3-Phase
 - 1/2 to 25 HP (ND) at 380-480 VAC 3-Phase
- Overload Capacity:
 - 150% for 60 sec. (Heavy Duty)
 - 120% for 60 sec. (Normal Duty)
- Control Methods: V/f Control, Open Loop Current Vector Control, PM Open Loop Current Vector Control, Simple closed loop speed control
- DC injection braking, ramp to stop
- Electronic reversing
- Adjustable accel/decel: 0.01 to 6000 seconds
- Controlled speed range:
 - 40:1⁽¹⁾ 100:1⁽²⁾
- Speed Regulation:
 - ± 0.5 to 1% with slip compensation⁽¹⁾
 - ± 0.2%⁽²⁾
- Displacement power factor: 0.98
- Output frequency: 0 to 400 Hz
- Frequency resolution:
 - 0.01 Hz with digital reference
 - 0.06 / 60 Hz with analog reference
- Frequency accuracy:
 - 0.01% with digital command
 - 0.5% with analog command
- Volts / hertz ratio: infinitely adjustable pattern
- DC Injection braking: adjustable amplitude, duration, current limited
- Torque boost: full range, auto
- Power loss ride-thru: 0.5 sec.
- Speed search
- Auto restart
- 3 Critical frequency rejection settings
- Slip Compensation
- Energy Savings Function
- Enhanced PID with loss of feedback function

Design Features

- Dual microprocessor logic
- Digital keypad operator, 5 digits
- LED status display, door-mount
- Remote Mount Keypad Capability
- RJ-45 Style Digital Operator Connector
- 7 multifunction digital inputs
- 3 multifunction digital outputs
- Hardwire baseblock (EN954-1 Cat. 3)
- Programmable form C output contact for customer use: 1A at 250 VAC or 30 VDC
- 24 VDC control logic compatible with sourcing or sinking outputs (PNP or NPN)
- Carrier frequency: 15 kHz max; swing PWM
- 16 multi-speed settings plus jog speed
- 2 Remote speed references:
 - 0-10 VDC (20 kohms) or isolated 4-20 mA (250 ohms)
- Signal follower: bias and gain
- 2 programmable open collector outputs
- Analog monitor output:
 - 0-10 VDC proportional to output frequency or output current
- Approximately 400 parameters
- Digital pulse train input (33 kHz max.)
- Cooling fan controlled by drive run/stop
- RS-422/485 Modbus 115 kbps
- UL recognized electronic overload
- MTBF: 28 years
- Built-in Dynamic Braking Transistor
- NEMA 4X/IP66 enclosure
- Application presets
- Maintenance monitors

⁽¹⁾ V/f Mode

⁽²⁾ Open Loop Current Vector Mode

Protective Features

- Current limit, stall prevention during accel, decel, and run
- Motor and drive overload
- Over voltage prevention function
- Instantaneous over current
- Short circuit
- Under voltage
- Heatsink overheat
- Ground fault protection
- Over/under torque
- Short circuit withstand rating: 30K RMS

Service Conditions

- Ambient service temperature:
 - 10° to 40°C (+14° to 104°F) NEMA 1
 - 10° to 50°C (+14° to 122°F) Open Chassis
- Ambient storage temperature:
 - 20° to 60°C (-4° to 140°F)
- Humidity: to 95% non-condensing
- Altitude: to 3300 ft; higher by derating
- Service factor: 1.0
- Input voltage: -15% to +10%
 - 200 to 240 VAC, 380 to 480 VAC
- Input frequency: +/-5%; 50/60 Hz
- Input phase sequence insensitive

Options

- 120VAC Interface
- Profibus-DP, DeviceNet Communications
- Modbus TCP/IP, EtherNet/IP Communications
- DriveWizard™ Plus
- Y-Stick Copy Unit
- Reactors, 3% and 5%
- Dynamic Braking Resistor (external)
- Multi-lingual, full text remote LCD with copy
- EMC filter Type C1

Standards

- UL 508C (Power Conversion)
- CSA 22.2 No. 14-95 (Industrial Control Equipment)
- UL, cUL listed; CE marked
- RoHS compliant
- EN 50178 (LVD)
- EN 50081-2, EN 50082-2 (EMC)
- EN 954-1, Category 3 Safety Standard
- EN 61800-3
- IEC 529, 146
- FCC CFR 47 Part 15 Subpart B (w/ External Filter)
- TUV
- NEMA type 4X/12
- IP66 rating of IEC60529

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Rated Input Voltage	Drive Model Number CIMR-VU	Normal Duty ⁽¹⁾		Heavy Duty ⁽¹⁾	
		Rated Output Current (Amps)	Nominal HP ⁽²⁾	Rated Output Current (Amps)	Nominal HP ⁽²⁾
200-240V 1-Phase	BA0001GAA	1.2	1/8 & 1/4	0.8	1/8
	BA0002GAA	1.9	1/4	1.6	1/4
	BA0003GAA	3.3	1/2 & 3/4	3.0	1/2
	BA0006GAA	6.0	1	5.0	3/4 & 1
	BA0010GAA	9.6	2 & 3	8.0	2
	BA0012GAA	12.0	3	11.0	3
200-240V 3-Phase	2A0001GAA	1.2	1/8 & 1/4	0.8	1/8
	2A0002GAA	1.9	1/4	1.6	1/4
	2A0004GAA	3.5	1/2 & 3/4	3.0	1/2
	2A0006GAA	6.0	1	5.0	3/4 & 1
	2A0010GAA	9.6	2 & 3	8.0	2
	2A0012GAA	12.0	3	11.0	3
	2A0020GAA	19.6	5	17.5	5
	2A0030GAA	30.0	7.5 & 10	25.0	7.5
	2A0040GAA	40.0	10	33.0	10
	2A0056GAA	56.0	20	47.0	15
	2A0069GAA	69.0	25	60.0	20
380-480V 3-Phase	4A0001GAA	1.2	1/2	1.2	1/2
	4A0002GAA	2.1	3/4 & 1	1.8	3/4
	4A0004GAA	4.1	2	3.4	1 & 2
	4A0005GAA	5.4	3	4.8	3
	4A0007GAA	6.9	4	5.5	3
	4A0009GAA	8.8	5	7.2	4
	4A0011GAA	11.1	7.5	9.2	5
	4A0018GAA	17.5	10	14.8	7.5 & 10
	4A0023GAA	24.0	15	18.0	10
	4A0031GAA	31.0	20	24.0	15
	4A0038GAA	38.0	25	31.0	20

(1) Normal Duty overload current rating is 120% of rated output current for 60 seconds; Heavy Duty overload current rating is 150% of rated output current for 60 seconds

(2) Horsepower rating is based on standard NEMA B 4-pole motor design and NEC table 430.150 Full-Load Current, Three-Phase Alternating Current Motors

Dimensions and Data

Rated Input Voltage	Drive Model Number CIMR-VU	Normal Duty		Heavy Duty		Physical Dimensions (in.)			Mounting Dimensions (in.)		Weight (lbs.) ⁽¹⁾
		Rated Output Current (Amps)	Nominal HP	Rated Output Current (Amps)	Nominal HP	H	W	D	H1	W1	
200-240V 1-Phase	BA0001GAA	1.2	1/8 & 1/4	0.8	1/8	8.74	6.38	7.28	8.27	5.32	10.4
	BA0002GAA	1.9	1/4	1.6	1/4	8.74	6.38	7.28	8.27	5.32	10.4
	BA0003GAA	3.3	1/2 & 3/4	3.0	1/2	8.74	6.38	7.28	8.27	5.32	10.8
	BA0006GAA	6.0	1	5.0	3/4 & 1	10.04	7.36	9.25	9.49	6.22	17.2
	BA0010GAA	9.6	2 & 3	8.0	2	10.04	7.36	9.25	9.49	6.22	17.2
	BA0012GAA	12.0	3	11.0	3	10.04	7.36	9.25	9.49	6.22	18.1
200-240V 3-Phase	2A0001GAA	1.2	1/8 & 1/4	0.8	1/8	8.74	6.38	7.28	8.27	5.32	10.4
	2A0002GAA	1.9	1/4	1.6	1/4	8.74	6.38	7.28	8.27	5.32	10.4
	2A0004GAA	3.5	1/2 & 3/4	3.0	1/2	8.74	6.38	7.28	8.27	5.32	10.6
	2A0006GAA	6.0	1	5.0	3/4 & 1	8.74	6.38	7.28	8.27	5.32	10.6
	2A0010GAA	9.6	2 & 3	8.0	2	10.04	7.36	9.25	9.49	6.22	17.0
	2A0012GAA	12.0	3	11.0	3	10.04	7.36	9.25	9.49	6.22	17.0
	2A0020GAA	19.6	5	17.5	5	10.04	7.36	9.25	9.49	6.22	17.9
	2A0030GAA	30.0	7.5 & 10	25.0	7.5	16.54	11.42	12.01	15.75	10.43	48.1
	2A0040GAA	40.0	10	33.0	10	16.54	11.42	12.01	15.75	10.43	48.1
	2A0056GAA	56.0	20	47.0	15	16.54	11.42	12.01	15.75	10.43	51.2
380-480V 3-Phase	4A0001GAA	1.2	1/2	1.2	1/2	8.74	6.38	7.28	8.27	5.32	11.1
	4A0002GAA	2.1	3/4 & 1	1.8	3/4	8.74	6.38	7.28	8.27	5.32	11.1
	4A0004GAA	4.1	2	3.4	1 & 2	8.74	6.38	7.28	8.27	5.32	11.3
	4A0005GAA	5.4	3	4.8	3	10.04	7.36	9.25	9.49	6.22	17.0
	4A0007GAA	6.9	4	5.5	3	10.04	7.36	9.25	9.49	6.22	17.5
	4A0009GAA	8.8	5	7.2	4	10.04	7.36	9.25	9.49	6.22	17.5
	4A0011GAA	11.1	7.5	9.2	5	10.04	7.36	9.25	9.49	6.22	17.9
	4A0018GAA	17.5	10	14.8	7.5 & 10	16.54	11.42	12.01	15.75	10.43	47.9
	4A0023GAA	24.0	15	18.0	10	16.54	11.42	12.01	15.75	10.43	48.1
	4A0031GAA	31.0	20	24.0	15	16.54	11.42	12.01	15.75	10.43	50.5
4A0038GAA	38.0	25	31.0	20	16.54	11.42	12.01	15.75	10.43	51.2	

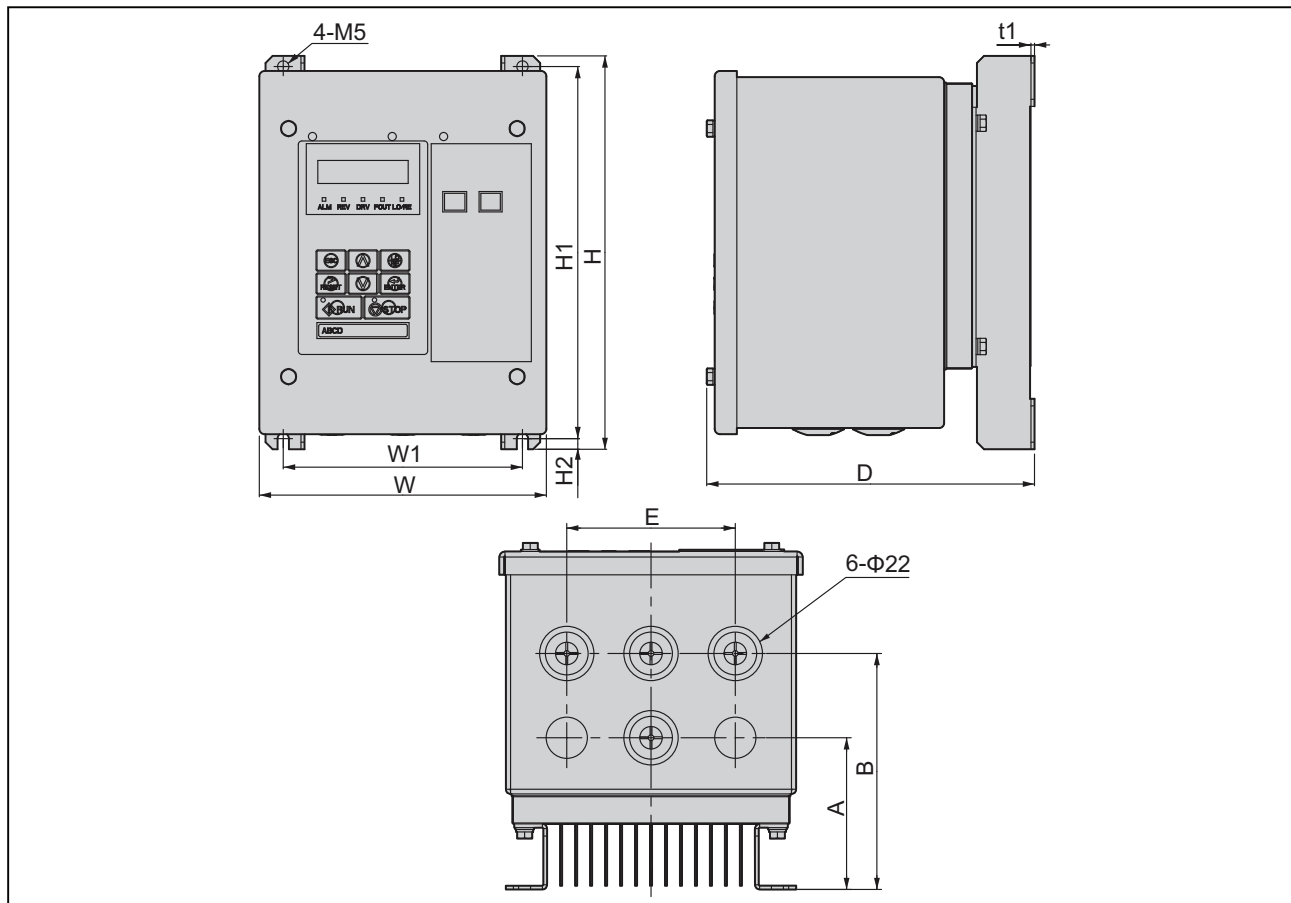
(1) This data represents the drive weight only, not shipping weight

Dimension Drawing

DD.V1000-4X.01

NEMA 4X/IP66

V1000-4X



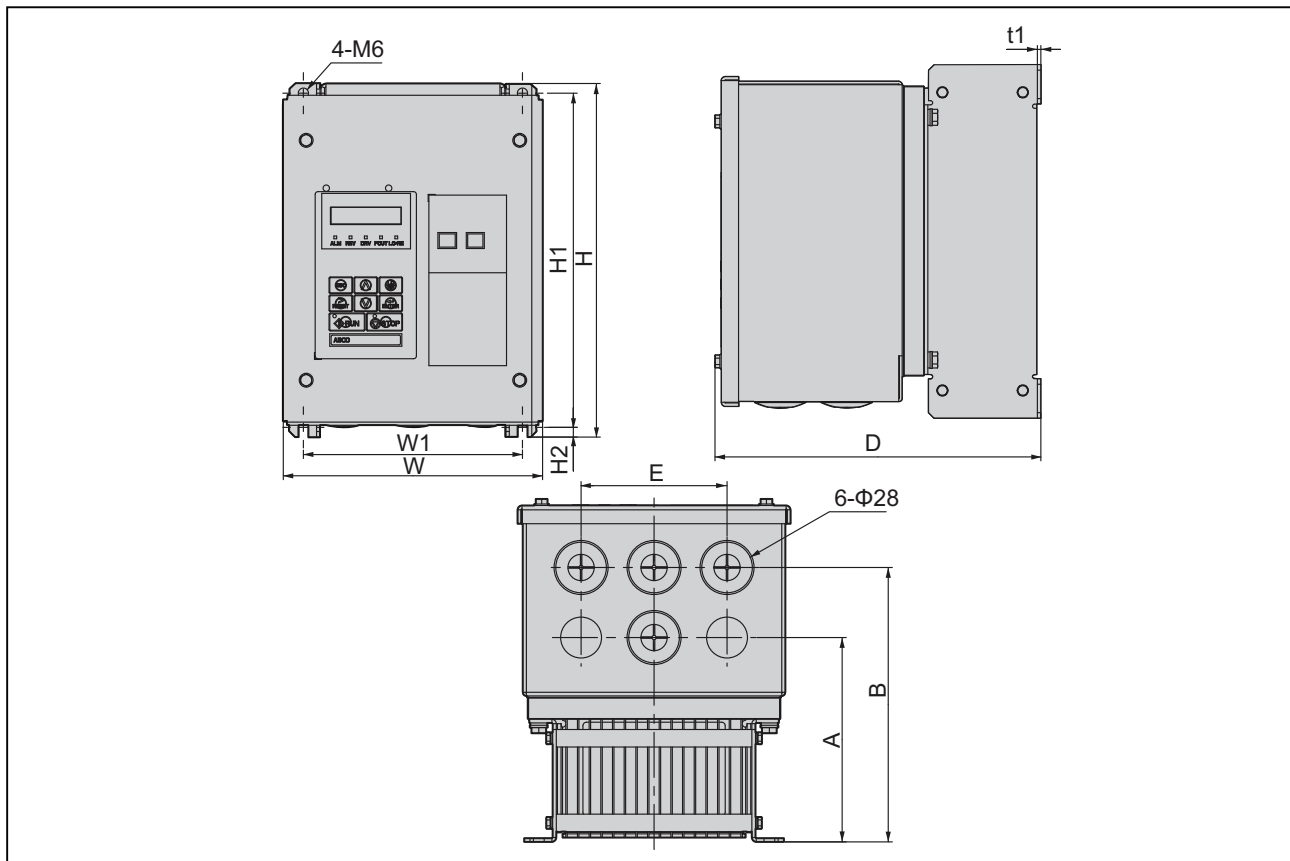
Voltage Class	Drive Model CIMR-V□	Dimensions mm (in)										Weight kg (lb.)	
		W	H	D	W1	H1	H2	t1	A	B	E		
Single-Phase 200 V Class	BA0001G												4.7 (10.36)
	BA0002G												4.7 (10.36)
	BA0003G												4.9 (10.80)
Three-Phase 200 V Class	2A0001G												4.7 (10.36)
	2A0002G	162	222	185	135	210	6	2	81	126	90		4.7 (10.36)
	2A0004G	(6.38)	(8.74)	(7.28)	(5.32)	(8.27)	(0.24)	(0.08)	(3.19)	(4.96)	(3.54)		4.8 (10.58)
	2A0006G												4.8 (10.58)
Three-Phase 400 V Class	4A0001G												5.0 (11.02)
	4A0002G												5.0 (11.02)
	4A0004G												5.1 (11.24)

V1000-4X

Dimension Drawing

DD.V1000-4X.02

NEMA 4X/IP66



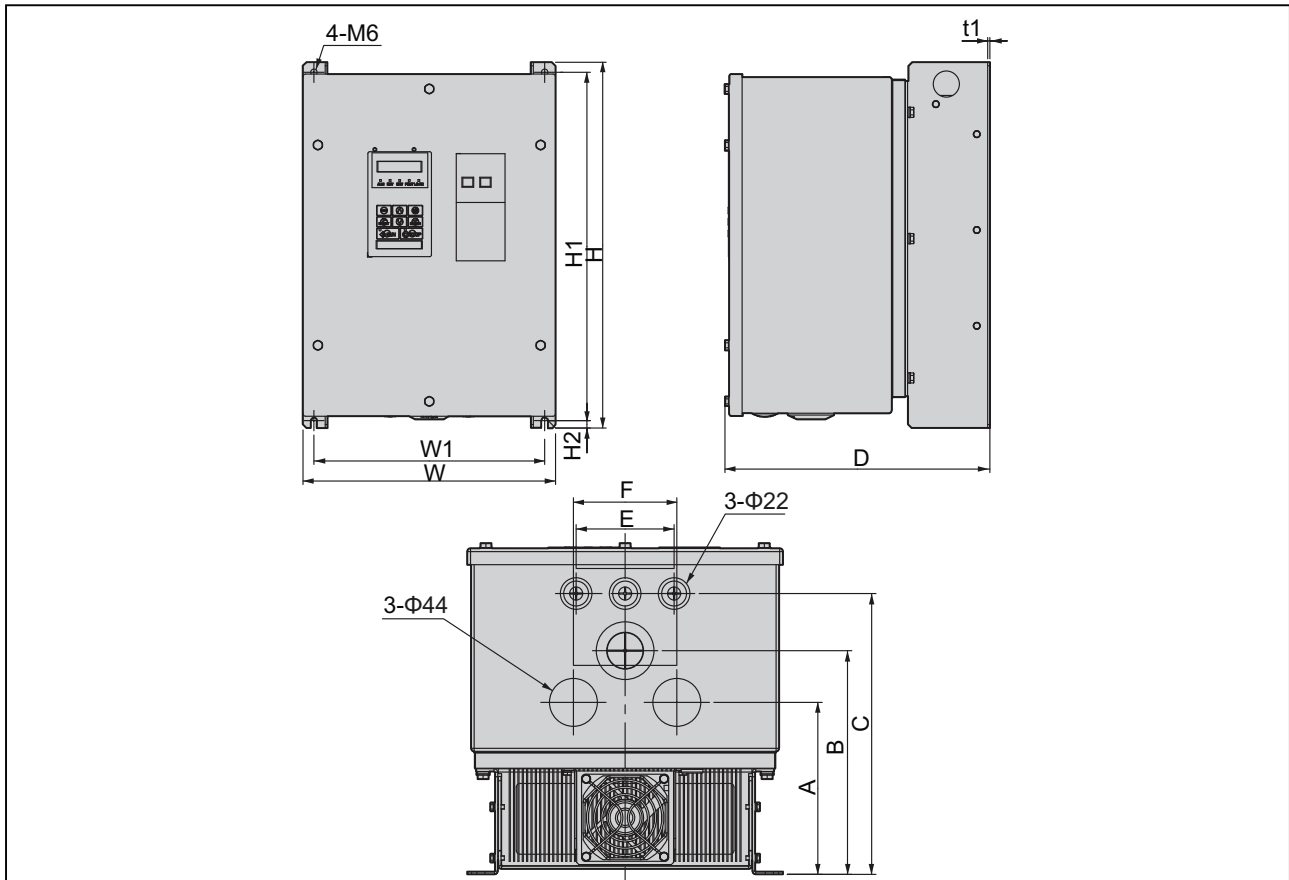
Voltage Class	Drive Model CIMR-V□	Dimensions mm (in)										Weight kg (lb.)	
		W	H	D	W1	H1	H2	t1	A	B	E		
Single-Phase 200 V Class	BA0006G												7.8 (17.2)
	BA0010G												7.8 (17.2)
	BA0012G												8.2 (18.08)
Three-Phase 200 V Class	2A0010G												7.7 (16.98)
	2A0012G	187	255	235	158	241	7	2.5	140	188	100		7.7 (16.98)
	2A0020G	(7.36)	(10.04)	(9.25)	(6.22)	(9.49)	(0.28)	(0.10)	(5.51)	(7.40)	(3.94)		8.1 (17.86)
Three-Phase 400 V Class	4A0005G												7.7 (16.98)
	4A0007G												7.9 (17.42)
	4A0009G												7.9 (17.42)
	4A0011G												8.1 (17.86)

Dimension Drawing

DD.V1000-4X.03

NEMA 4X/IP66

V1000-4X



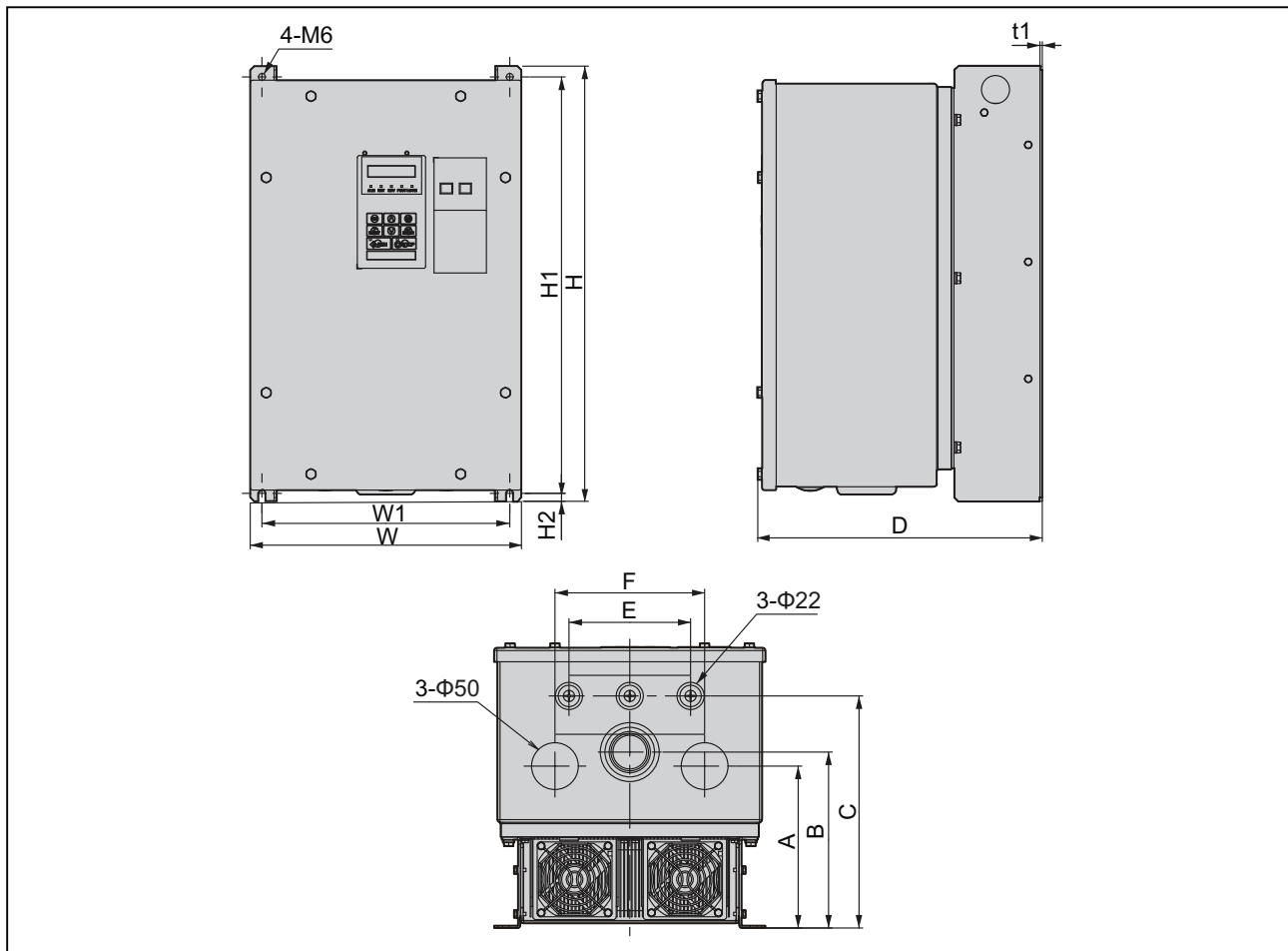
Voltage Class	Drive Model CIMR-V□	Dimensions mm (in)											Weight kg (lb.)		
		W	H	D	W1	H1	H2	t1	A	B	C	E		F	
Three-Phase 200 V Class	2A0030G														21.8 (48.06)
	2A0040G														21.8 (48.06)
	2A0056G														23.2 (51.15)
Three-Phase 400 V Class	4A0018G	290 (11.42)	420 (16.54)	305 (12.01)	265 (10.43)	400 (15.75)	8.5 (0.33)	2.5 (0.10)	158 (6.22)	205.5 (8.09)	258 (10.16)	90 (3.54)	95 (3.74)	21.7 (47.84)	
	4A0023G													21.8 (48.06)	
	4A0031G													22.9 (50.49)	
	4A0038G													23.2 (51.15)	

V1000-4X

Dimension Drawing

DD.V1000-4X.04

NEMA 4X/IP66



Voltage Class	Drive Model CIMR-V□	Dimensions mm (in)											Weight kg (lb.)	
		W	H	D	W1	H1	H2	t1	A	B	C	E		F
Three-Phase 200 V Class	2A0069G	290 (11.42)	465 (18.31)	305 (12.01)	265 (10.43)	445 (17.52)	8.5 (0.33)	2.5 (0.10)	173 (6.81)	188 (7.40)	248 (9.76)	130 (5.12)	160 (6.30)	27.7 (61.07)

Operator, LCD Digital Remote, NEMA Type 1. This option allows the drive to be programmed before installation from a remote location, and provides a 16-character, 5-line alpha-numeric LCD. This option requires Remote Operator Cable (UWR0051 or UWR0052), sold separately.

Note: This option requires the V1000 drive to contain 1012 software or later; please consult your Yaskawa representative to ensure proper operation.

Model No. JVOP-180

Operator Cable, Remote. These cables are used to connect the Remote LCD Digital Operator (JVOP-180). They are available in one (1) or three (3) meter lengths.

Model No. UWR0051 (1 meter)

Model No. UWR0052 (3 meter)

Operator Kits, NEMA Type 3R/4X. This option is used to extend an LCD Digital Remote Operator to the wall of a separately priced, oversized UL Type 3R, 4, 4X, or 12 enclosure (IPX6 environment). Price includes a faceplate bezel with digital operator brackets and membrane to cover the operator cutout in the enclosure door, a 3-foot cable, a 10-foot cable, and a 1:1 template for cutting the necessary cutouts in the enclosure. Keypad can be removed after kit installation. Designed for use with the LCD Operator JVOP-180 sold separately. Connects to RJ45 port and mounts to enclosure wall.

Model No. UUX000526 (Blank Membrane)

Model No. UUX000527 (Yaskawa Logo Membrane)

DriveWizard Plus Software. This optional software package allows upload and download of parameters via PC for data storage and for programming multiple drives. The software also includes graphing and monitoring tools. It is a Windows-based program designed to make startup, commissioning, and troubleshooting of the J1000 as simple as possible. Refer to our website at www.yaskawa.com to download the software, and for more information, including minimum system requirements and cable information to interface a PC to V1000 or J1000 drives.

No Model No.

PC Interface Cable. This 6-foot cable interconnects the drive keypad port to the 9-pin communication port on a PC. This cable is used in conjunction with DriveWizard Plus software.

Model No. UWR00468-2

USB Copy Unit (Y-Stick). This option allows the drive to connect to the USB port on a PC. It can read, copy and verify drive parameter settings from one drive to another like drive. The unit plugs into the RJ-45 port on the front of the digital operator. Refer to our website at www.yaskawa.com to download the software.

Model No. JVOP-181

CopyUnitManager Software for USB Copy Unit (Y-Stick). This option allows the user to transfer and save parameter files from the Copy Unit (JVOP-181), sold separately, to a PC and vice versa. Refer to our website at www.yaskawa.com to download the software.

No Model No.

120 VAC Interface. This option mounts directly to the control terminal block on the drive and allows the use of 120 VAC control logic circuits to produce multi-function control input signals for the drive.

Model No. DI-100

DriveWorksEZ (DWEZ) Standard and Pro. A software system that provides the means to create custom drive functionality in the V1000 using function block programming to distribute control away from a PLC. Must attend one of the two classes below to obtain software CD.

DriveWorksEZ (DWEZ) Standard Certification. A 3-day V1000 Application Programming training class (TRM010-V1000) must be attended to become certified. Provides 20 connections and 119 basic functions.

Model No. CD.DWEZ.02

DriveWorksEZ (DWEZ) Pro Certification. A 2-day DWEZ-specific training class (TRM020-DriveWorksEZ) must be attended to become certified. This class is intended for those well-versed in V1000 programming. DWEZ Pro provides increased functionality, with 50 connections and 225 function blocks compared to the Standard version.

Model No. CD.DWEZ.03

To enroll in class, call Technical Training Services at 847-887-7228.



Options

V1000-4X Drive

DeviceNet™ With ADR. This option complies with all pertinent aspects of the ODVA (Open DeviceNet Vendor Association) specification and AC drive profile. All parameters, diagnostics and operational commands are accessible via DeviceNet. Automatic Device Replacement (ADR) is supported in this DeviceNet option, including the functions of Auto Baud Rate sensing and Faulted Node Recovery (using Group 4 messaging). Each DeviceNet network supports up to 63 drives. Controllers are available from many PLC and/or PC suppliers. The board mounts integrally in the drive and provides a DeviceNet standard open tap connector. The option is configured using parameters within the drive, which allows for easy configuration eliminating the use of hardware switches. Status LEDs are viewable through the front cover and a monitor has been added to allow for improved diagnostics.

Note: This option requires the V1000 drive to contain 1012 software or later; please consult your Yaskawa representative to ensure proper operation.

Model No. SI-N3/V

EtherNet/IP. This option complies with the EtherNet/IP protocol specification, and allows for communication over 10/100 Mbps Ethernet networks. This option has the ability to configure the IP Address from a user specified IP address, from a DHCP host, or from a BootP host. The IP address can be set from the drive keypad or from the network. All parameters, diagnostics and operational commands are accessible via EtherNet/IP. The web interface allows management of diagnostic information through a standard web browser. The embedded web pages include the main page, drive status page, network monitor page, and documentation page.

Note: This option requires the V1000 drive to contain 1012 software or later; please consult your Yaskawa representative to ensure proper operation.

Model No. SI-EN3/V

Profibus DP. This option complies with the Profibus DP protocol specification. All parameters, diagnostics and operational commands are accessible via Profibus. The option board provides a 9-pin (F) type D-Sub connector for easily connecting to a standard Profibus style, shielded twisted-pair cable. Each Profibus network supports up to 99 drives. This option supports all of the Profibus data rates from 9.6 Kbps to 12 Mbps. Up to 32 bytes of input data and 32 bytes of output data are provided per message transaction. Sync and Freeze modes are supported for groups. Profibus DP-V1 support (cyclic and acyclic data exchange). Configurable PPO read and write parameters. The option is configured using parameters within the drive, which allows for easy configuration eliminating the use of hardware switches. Status LEDs are viewable through the front cover, and a monitor has been added to allow for improved diagnostics. Option is backwards compatible with the previous generation option cards.

Note: This option requires the V1000 drive to contain 1010 software or later; please consult your Yaskawa representative to ensure proper operation.

Model No. SI-P3/V

Modbus TCP/IP. This option complies with the Modbus TCP/IP protocol specification. This allows for Modbus communication over 10/100 Mbps Ethernet networks. This option has the ability to configure the IP Address from a user-specified IP address, from a DHCP host, or from a BootP host. All parameters, diagnostics and operational commands are accessible via Modbus TCP/IP. This option supports up to 10 simultaneous PLC/PC connections.

Note: This option requires the V1000 drive to contain 1015 software or later; please consult your Yaskawa representative to ensure proper operation.

Mounts at option connector CN5.

Model No. SI-EM3/V

Technical Training

In today's world of global competition, it is impossible for a company to survive without "state-of-the-art" technically trained associates and customers. Yaskawa America, Inc. Technical Training Service's mission is to provide inverter drives training classes to our customers that are "right on target" with knowledge they need to perform their jobs.

Yaskawa America, Inc. has three training facilities in the United States. The primary training facility is in Yaskawa America, Inc.'s North American Headquarters in Waukegan, Illinois (45 miles north of Chicago, 50 miles south of Milwaukee). This facility has four training rooms: two lecture halls and two training labs. Two additional facilities are located in Cypress, California, and Plain City, Ohio.

Besides the possibility of attending training classes in Waukegan, Yaskawa America, Inc. can also bring training to the customer. On-site classes are available in two varieties. The first is to duplicate the official training classes at the customer's location. Full functioning demo units, data projector, computer and documentation can be shipped to recreate the official class on-site. The second variety is road show training. Road show training is a one-day training class that is specifically tailored to the students' needs and questions. Only basic demos are used and the topics covered in class are generated by the students in attendance.

The Yaskawa Virtual Training Room is another training option. All you need is an Internet connection and a telephone. This is a live, interactive training class, which gives you the ability to talk to the instructor as well as other students. The Internet connection allows us to show slides and demonstrate software packages. The telephone is for the audio portion of the training class. Web classes can be found on the Yaskawa formal training schedule and can also be done on-demand, per the time and preference of the customer.

Finally, the eLearning Module (eLM™) is a complement to our adjustable frequency drive training seminars. They are modular in nature, pinpoint specific topics, can be completed on or offline, and each one only takes about 30 minutes to complete.

The eLM is a perfect fit for an experienced engineer who needs to understand a specific topic. The eLM does not allow for some typical training practices such as hands-on exercises or student discussions. Students with limited prior experience, and who require a broader and long-term understanding of our products, are advised to take a traditional factory training class.

This list contains available classes at Yaskawa for the J1000 and V1000. If your training need cannot be met by the current training class schedule, please send an email to the Yaskawa Training Coordinator.

Product	eLearning Modules	Factory Classes	List
J1000	eLM.J1000.01	Not Available	N/A
V1000 V1000-4X	eLM.V1000.01	V1000 Installation and Startup Class Number: TRM015-V1000	\$460
		V1000 Application Programming Class Number: TRM010-V1000	\$690

To enroll, contact Technical Training Services.

Phone: 1-800-Yaskawa (1-800-927-5292) and (then dial 2 for "Drives" and 4 for "Training")

Fax: 847-785-2724

E-mail: training@yaskawa.com

Check out the latest class schedule and cut sheets at www.yaskawa.com

Terms and Conditions

YASKAWA AMERICA, INC. ("YAI"), DRIVES & MOTION DIVISION - TERMS AND CONDITIONS OF SALE

1. GENERAL:

(a) All sales of products or services by Yaskawa America, Inc., Drives & Motion Division (hereinafter "D&M"), is governed exclusively by these Terms and Conditions of Sale ("Terms"), which supersede all inconsistent or additional terms on Buyer's purchase order or any other document. These Terms constitute the final, complete and exclusive agreement between the parties as to the subject matter hereof. These Terms may be amended only in writing signed by an authorized representative of D&M.

(b) Orders must be submitted in the form of a written purchase order or letter from Buyer, setting forth all information necessary for D&M to fill the Order, if accepted. All proposals, quotations or similar communications from D&M are considered invitations to submit an Order. A binding sales contract will result only when D&M accepts Buyer's Order, at D&M's office in Waukegan, Illinois or such other place as designated by D&M.

2. PRICES:

(a) D&M's quoted prices are firm for thirty (30) days from the date of D&M's written proposal. Thereafter, the applicable prices are those in effect at the time Buyer's Order is placed with D&M. D&M will notify Buyer of any price changes for incorporation into a revised Order prior to acceptance by D&M. Pricing based on volume discounts is subject to adjustment by D&M if actual shipping volumes do not meet minimum volume requirements of agreement. Clerical errors in any element of a proposal, purchase order, invoice or contract are subject to correction by D&M.

3. TERMS OF PAYMENT:

(a) All payments are due within thirty (30) days from date of D&M's invoice. Payment shall be made at the agreed time, to the place specified, and in the currency indicated on D&M's invoice. D&M reserves the right to require payment in advance, or satisfactory security, for any shipment or sale. D&M reserves the right to seek any other remedy available at law or equity and Buyer shall be liable for all expenses, including attorneys' fees, relating to the collection of past due amounts. Buyer's default constitutes a waiver of Buyer's right to demand D&M's performance under the contract.

(b) When an amount becomes past due according to its payment terms, Buyer shall pay interest on the balance due, at the greater of 1.50% per month (18% per annum) or the maximum permitted by law, until paid in full.

(c) If delivery and/or payment in installments is accepted by D&M, Buyer's failure to pay any installment when due shall give D&M the right to suspend work or delivery until such payment is made. In the event that any such default by Buyer continues for more than fifteen (15) days, D&M may then cancel the contract by written notice to Buyer.

(d) All duties, tariffs, fees, costs and other charges connected with shipment, insurance, exportation and importation of the products are the responsibility of Buyer, and, if paid by D&M, such expenses may be recovered by D&M from Buyer, and Buyer shall indemnify D&M against claims for the same. Buyer is responsible for all taxes applicable or related to this transaction, including all sales, use and excise taxes.

4. SECURITY INTEREST:

To secure any indebtedness due and owing from Buyer from time to time, Buyer hereby grants to D&M, and D&M hereby reserves, a continuing purchase money security interest in all Yaskawa-brand and other products heretofore or hereafter sold and delivered to Buyer by D&M, and all related parts, components and accessories therefor, and all proceeds arising from the sale or other disposition of the foregoing, including, but not limited to, cash, accounts, contract rights, accounts receivable, instruments and chattel paper.

Buyer shall at no time grant any security interest that conflicts with that granted to D&M herein. Buyer shall cooperate with D&M, and hereby appoints D&M as its attorney-in-fact, to execute and file, on Buyer's behalf, any documents necessary to evidence and perfect D&M's security interest. D&M reserves all rights and remedies available to it under the Uniform Commercial Code and other applicable law in the event of Buyer's default.

5. SHIPMENT, FORCE MAJEURE, AND ERROR:

(a) Shipment/delivery dates are approximations only. D&M shall not be liable to pay any penalty or damages, including consequential damages, for any delay in shipment.

(b) All shipments are F.O.B. D&M's (or its suppliers') manufacturing plant or warehouse. D&M will, at Buyer's expense, arrange for the transportation of the products from the manufacturing plant or warehouse designated by D&M. All products shall be packaged for domestic shipment in accordance with D&M's standard specifications. If special packaging is required, it must be clearly requested on Buyer's Order. The price for any special packaging shall be billed to Buyer. Buyer is responsible to timely procure all necessary export and import licenses and all permits required for the consummation of the transaction and to obtain insurance coverage on all shipments of products supplied by D&M. Risk of loss and/or damage to the products shall pass to Buyer upon delivery thereof to Buyer or its representative, or to a carrier for shipment to Buyer or its designated customer, as the case may be, at the FOB point.

(c) D&M shall not be liable for any damages, including consequential damages, caused by delays or non-performance resulting from or related to force majeure or other causes beyond D&M's reasonable control, including, but not limited to, war, blockade, civil disturbances, strikes and lockouts, labor shortages, fire and other casualties, acts of nature, accidents and governmental acts (including regulations concerning export and import licensing and currency exchange). In case of non-delivery, D&M's obligation shall be limited to the refund of any advance payment received from Buyer.

(d) All claims for loss of or damage to products, whether concealed or obvious, must be made, in writing, to the carrier and to D&M by Buyer as soon as possible after receipt of shipment, and in no case beyond 30 days of shipment, or such claims shall be deemed waived. D&M will render reasonable assistance in providing information necessary for Buyer to process such damage claims with the carrier or any insurance company.

(e) Buyer agrees to accept delivery within fifteen (15) days following the anticipated date of delivery. If Buyer refuses to take delivery within the fifteen (15) day period, D&M reserves the right to charge Buyer for storage charges plus interest.

6. RETURNS/CANCELLATION CHARGES:

Buyer shall not return products to D&M without the written consent of, and upon terms agreed to, by D&M. If Buyer refuses to accept delivery, or improperly revokes acceptance of product, Buyer shall be responsible for D&M's cancellation charges and expenses. Before any returns, a Return Merchandise Authorization ("R.M.A.") number must be obtained from D&M. Products returned without an R.M.A. number clearly marked on the outside of the shipping carton will be refused. Except for approved warranty returns, D&M will only accept for return and credit new, unused, undamaged, current stock items, in the original packaging. Buyer shall be responsible for all freight charges, import/export charges, duties, tariffs, taxes, insurance and risk of loss/damage regarding return shipment to D&M.

7. DRAWINGS/MEASUREMENTS:

All ratings, drawings, tables, graphs and the like submitted by D&M or set forth in written materials or on the company's website are approximations only. Weights, measurements, capacities and all other particulars of products or services offered by D&M are approximations only. D&M is not responsible for such approximations, including, in particular, based on data supplied by Buyer.

8. LIMITED WARRANTY:

(a) At the time of shipment, new and unused product sold by D&M shall be free from defects in materials and workmanship. D&M warrants that for a period of one (1) year from the date the product is first used by Buyer, or 18 months from the date of shipment, whichever occurs first, if any product or part is found by D&M to be defective, D&M will, at its sole discretion and as Buyer's exclusive remedy, either repair, replace or return the purchase price paid to D&M; provided that the subject product is used under normal conditions for which it was designed and installed, operated and maintained in accordance with D&M's instructions and in accordance with generally accepted industrial practices. Products repaired or replaced during the warranty period shall be covered by the foregoing warranty for the remainder of the original warranty period or ninety (90) days from date of the repair or shipment of the replacement, whichever is longer. D&M warrants, for a period of ninety (90) days, that services shall be performed in a workmanlike manner. Buyer's sole remedy for a breach of this service warranty is limited to further service or a refund or credit of amounts paid by Buyer, at Seller's option.

(b) D&M's warranty obligation shall be conditioned upon receipt by D&M of written notice of any alleged defects within sixty (60) days after discovery. D&M will not be responsible for unauthorized repairs to any products, even if defective. D&M shall not be responsible for any products which have been altered, abused, misused, or improperly installed or repaired, or for any loss, damage, defect, claim or non-performance resulting from or attributable to Buyer's specifications. D&M does not guarantee production rates or the quality of goods made using D&M's products or services, nor shall any longer warranty periods apply, except as agreed in writing signed by an authorized D&M representative.

(c) Where Buyer orders non-stock products or parts manufactured by a third-party, D&M will, to the extent permitted, pass through to Buyer any warranty of the manufacturer. As to such items, Buyer's sole remedy for breach of warranty shall be the remedy offered by and available from the manufacturer, if any.

(d) **D&M'S WARRANTY HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES OF D&M AND ANY PARENT OR AFFILIATED COMPANIES OF D&M. D&M DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE OR USE.**

(e) **UNDER NO CIRCUMSTANCES SHALL D&M, OR ANY PARENT OR AFFILIATED COMPANY OF D&M, BE LIABLE TO BUYER OR ANY ENTITY FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER ARISING FROM BREACH OF CONTRACT, TORT, NEGLIGENCE, MISREPRESENTATION, STRICT LIABILITY OR OTHERWISE, INCLUDING FOR LOST PROFITS, IMPAIRMENT OF GOODS, WORK STOPPAGE OR OTHERWISE, IN ANY WAY ARISING OUT OF OR RELATED TO PRODUCTS OR SERVICES SUPPLIED BY D&M OR ANY TRANSACTION TO WHICH THESE STANDARD TERMS APPLY. THE MAXIMUM LIABILITY OF D&M, INCLUDING, BUT NOT LIMITED TO, WITH RESPECT TO THE DESIGN, MANUFACTURE, SALE, DELIVERY, RESALE, INSPECTION, ASSEMBLY, INSTALLATION, TESTING, REPAIR, REPLACEMENT, MAINTENANCE OR USE OF ANY PRODUCT OR THE PERFORMANCE OF ANY SERVICE, SHALL NOT EXCEED THE PURCHASE PRICE PAID TO D&M.**

9. INFRINGEMENT:

The liability of D&M, any parent or affiliated company for patent infringement is limited to D&M's defense of proceeding brought against Buyer based on a claim that products, when employed in the manner intended by D&M, constitutes an infringement of any U.S. patent. If Buyer's use of the products in the manner intended by D&M is finally enjoined in such action, D&M shall, at its option, procure for Buyer the right to continue using the products, replace the same with non-infringing products, modify the products so that they become non-infringing equivalent products, or refund the purchase price (less allowance for use, damage or obsolescence). D&M makes no warranty against patent infringement resulting from portions of the products made to Buyer's specifications or the use of products in combination with any other goods or in the practice of any process, and if a claim is brought against D&M or any parent or affiliate of D&M, Buyer shall defend, indemnify and hold D&M (and its parent/affiliates) harmless from and against any and all claims, losses or damages arising therefrom.

10. GOVERNING LAW, FORUM AND JURY WAIVER:

These Terms and the relationship of the parties are governed by the internal laws of the State of Illinois, U.S.A., without regard to its choice of law rules. For all claims or disputes arising out of or relating to the sale of products or services by D&M and/or the relationship of the parties, Buyer shall file any and all lawsuits or claims exclusively in the state or federal courts located in Cook County, Illinois. Buyer hereby submits to the personal jurisdiction of said courts and waives any claim of improper or inconvenient venue. To the fullest extent permitted by law, Buyer hereby agrees to waive the right to trial by jury for all claims or disputes arising out of or relating to the sale of products or services by D&M and/or the relationship of Buyer and D&M. The parties agree that U.N. Convention of Contracts for the International Sale of Goods shall not apply to their relationship or the sale of products by D&M.

11. EXPORT CONTROL:

Buyer acknowledges that the products and related software and technology may be subject to export controls of the U.S. Government, including the Export Administration Regulations of the U.S. Department of Commerce. Buyer shall comply with all applicable laws, regulations, treaties and agreements regarding the use, import, export or re-export of the products and shall be solely responsible for obtaining all required licenses or approvals. The products are not intended for use in any nuclear, chemical or weapons production or environmental damage or for export, re-export, or distribution to any restricted or embargoed country or to a person or entity whose privilege to participate in exports has been denied or restricted by the U.S. Government. Buyer shall indemnify, hold harmless and defend D&M, its parent and affiliated companies from any violation of this section by Buyer or its employees, consultants, agents and customers.

12. MISCELLANEOUS:

(a) Failure on the part of D&M to enforce any of its rights derived from these Terms shall never be construed as a waiver of any of D&M's rights.

(b) The invalidity of one or more of the clauses herein shall not affect the validity of the other clauses, which for this purpose are considered severable.

(c) Any use by Buyer of any YAI trademark must be approved by YAI in writing.

(d) Buyer may not delegate its performance or assign its rights under these Terms except upon the express written consent of D&M. In any case, these Terms shall be binding upon the successors and legal representatives of Buyer.