



Automation for a Changing World

# Delta Field Oriented Control Drive C2000 Series



[www.delta.com.tw/ia](http://www.delta.com.tw/ia)

 **DELTA**  
Smarter. Greener. Together.



## Leading the Future of Drive Technology

Delta Electronics, a leading brand in drive technology, has officially launched its most cost-effective classical field oriented control AC motor drive: The VFD-C2000 series. This series offers four competitive values: high efficiency, high performance, low cost of maintenance and long product life, to customers to enhance their competitive advantage while spending less.

## Standard Models (IP20/NEMA1)

Power range: 230V 0.75~90kW, 460V 0.75~355kW

230V (kW)	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45
230V (HP)	1	2	3	5	7.5	10	15	20	25	30	40	50	60
Frame Size	A				B			C			D		
460V (kW)	0.75	1.5	2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30	37
460V (HP)	1	2	3	5	5	7.5	10	15	20	25	30	40	50
Frame Size	A						B			C			

### High-performance Variable-frequency Technology

1. High bandwidth control
2. Speed/torque/position control mode
3. Dual rating design (Normal duty/heavy duty)
4. 4-quadrant torque control and limit
5. A drive for induction motors and synchronous motors

### Environmental Adaptability

1. 50°C operating temperature
2. Built-in DC reactor
3. Coated circuit boards
4. Built-in EMI filter
5. Global safety standards (CE/UL/cUL)

\*Note: Please refer to the Product Specification

- **Field oriented control with built-in PLC function**
- **Wide variety of applications**
- **Modular design for easy maintenance and many extensions**
- **Built-in MODBUS communication**
- **Long-life design and self diagnosis**
- **Enhanced protections and adaptation to ambient conditions**
- **Complies with global safety standards, including CE, UL and cUL**
- **Wide range of models to meet requirements**
- **High-speed communication interface**  
(optional cards for PROFIBUS-DP, DeviceNet, MODBUS TCP and EtherNet/IP)
- **Fully CANopen master and slave functions prepared, only option converter card CMC-COP01 needed.**

1. Built-in safe stop function
2. Built-in PLC function
3. Built-in brake unit
4. Supports various network protocols
5. Synchronous point-to-point control

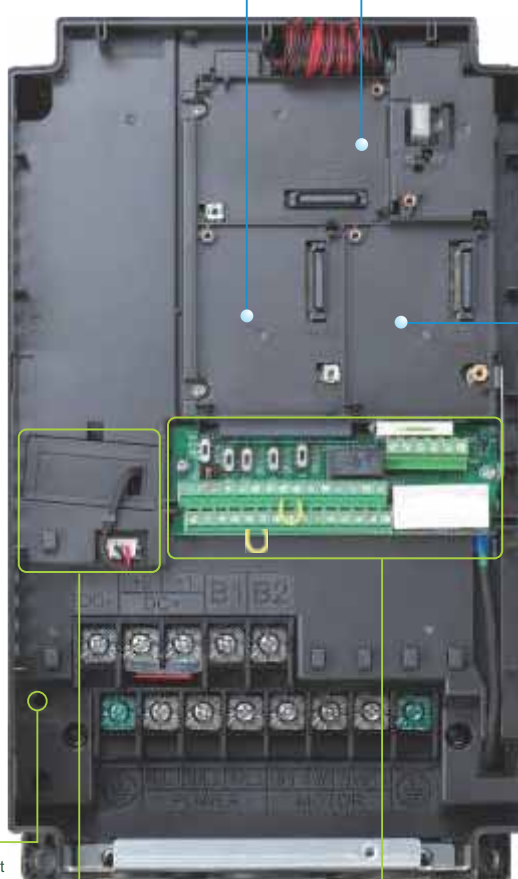
1. Hot plug LCD keypad
2. I/O extension cards
3. Various PG (encoder) feedback cards
4. Network cards for fieldbus modules
5. Removable fan



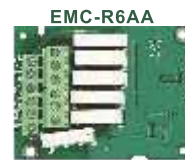
# Modular Design

- Various accessories options, such as I/O extension cards, encoder feedback cards, communication cards, hot plug LCD keypad, removable terminals and removable fan.

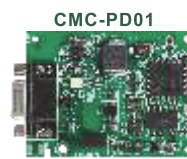
## ► PG (Encoder) cards



## ► I/O cards



## ► Communication cards



## ■ Removable fan

To ensure personal safety, do not begin wiring before the indicator light is off.

## ■ Power indicator

To prevent personal injury, please do not perform wiring before power indicator is off.

\*NOTE: "►" are optional accessories.

## ■ Removable terminals

Convenient wiring and safety equipment.

## Analog I/O switch



## Termination resistor



## Dual RJ45 communication ports





- The modular design fulfills the needs of system applications and equipment maintenance.



## Excellent Environment Adaptability

- Built-in DC choke\*
- Built-in EMI filter
- Enhanced coating on the control board's PCB to ensure reliability of VFD in an adverse environment.
- Flange mounting: designed to completely separate the heat dissipating system and other electronic components. Its installation can disperse heat out of the VFD. Cooling fan method can blow cold air into aluminum heat sink. Both heat dissipating methods are efficient, choose the one that fits the working environment for the best heat dissipation results.

\*Note: Please refer to the Product Specification



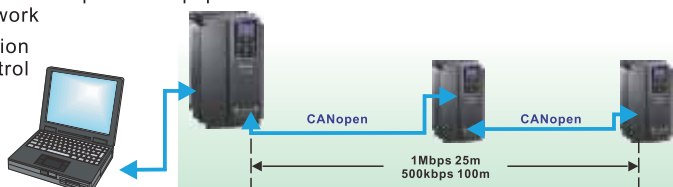
# High-speed Network Building

- Provides optional MODBUS RTU and various fieldbus cards for flexible communication applications
- Advanced network functions
- Built-in MODBUS communication interface
- **CANopen (DS402)**



Ability to control up to 8 Slave drives via the CANopen Master function

- Supports all Delta industrial automation products (all EDS files of Delta industrial automation products are built-in)
- I/O data layout of each piece of equipment on the CANopen Network
- Planning function for motion control
- WPL Soft



- TAP-CN03 distribution box for long distances



- RJ45 cable



Delta DeviceNet Builder software is specially designed for DeviceNet communication. With this software, it is easy to plan DeviceNet equipment and remote I/O via parameters to build a standard DeviceNet monitoring structure.

- Supports all Delta industrial automation products (all EDS files of Delta industrial automation products are built-in)
- I/O data layout of each piece of equipment in the DeviceNet network
- DeviceNet layout software



## MODBUS TCP

Delta's communication integrator software not only provides graphic module setting and human interface design but also supports settings and online monitoring for all Ethernet products

- Delta software for Ethernet/MODBUS TCP products
- Graphic module setting and human interface design
- Auto search function
- Setting interface for virtual COM port



# Convenient Operation Platform for Drive System Management

- Provides a complete operation platform for users' easy control and monitoring via PC, including parameters save/setting, real-time wave monitor, quick setup, for multiple languages and with multi-language operation systems.



### Start-up display

Displays horsepower, rated voltage and current of present model



### Parameter management

Provides parameter setting/save/copy/comparison for convenient parameter management.

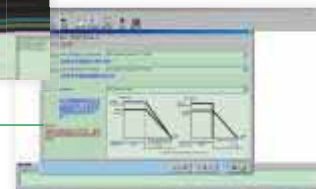


### Trend records

Monitors operation curve of the drive by communication and displays I/O terminal status. Useful for tasks such as "trial run monitoring".

### Quick setup

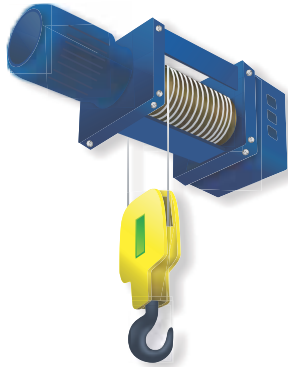
Guides the user step-by-step through the drive settings according to quick setup wizard.



\*NOTE: please download the software above at Delta website

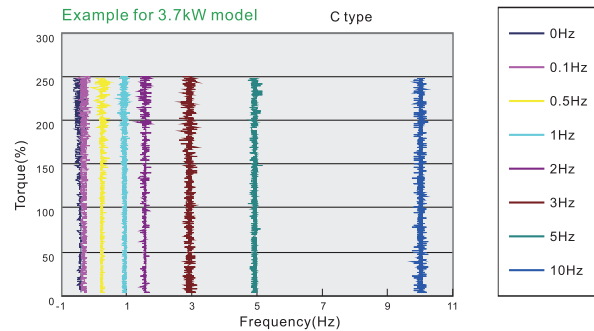
## Enhanced Motor Efficiency in General Applications

Improved sensorless vector control (SVC) response and torque control in, for example, crane applications.



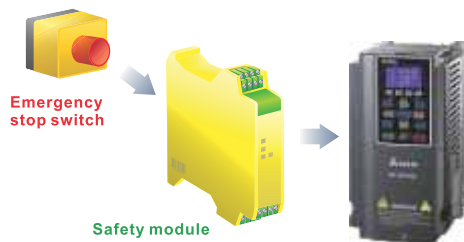
## High-performance Field Oriented Control

In FOC+PG mode, C2000 is capable of creating a start-up torque up to 200% at extremely low speed to result in a much more stable speed control.



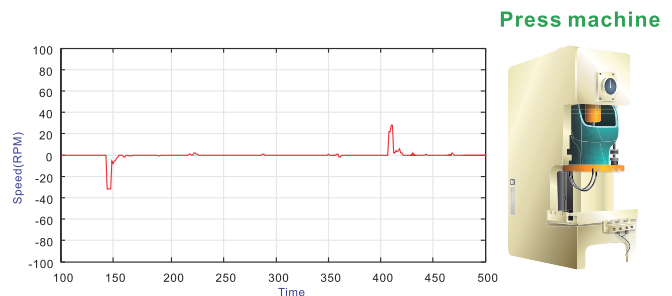
## Safe Stop Function

VFD-C2000 series is built according to category safe stop standard: EN954-1, EN60204-1 and IEC6158 to prevent personal injury at accidental start-up.



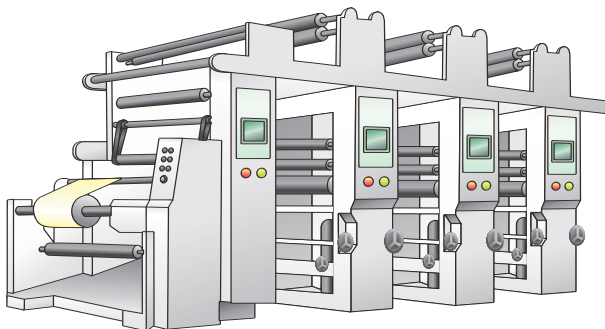
## Improved Load Impact

When load changes, VFD-C2000 will provide a best torque response by FOC to minimize the vibration of load impact.



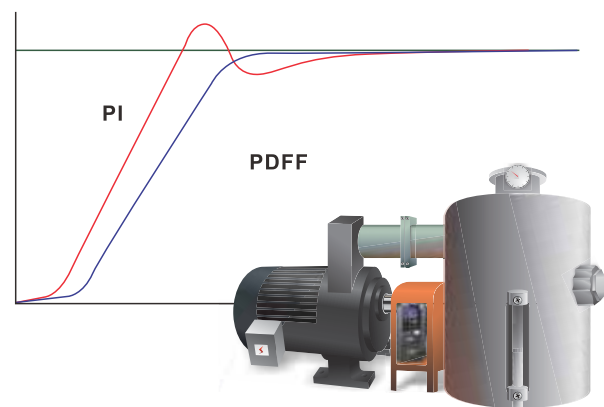
## High-performance Field Oriented Control

A best choice for precise position and speed control, such as for controlling printing machines.



## Advance PID Technology

Apart from traditional PI control, VFD-C2000 also provides PDFF control in speed regulation to eliminate overshoot and increase response time.







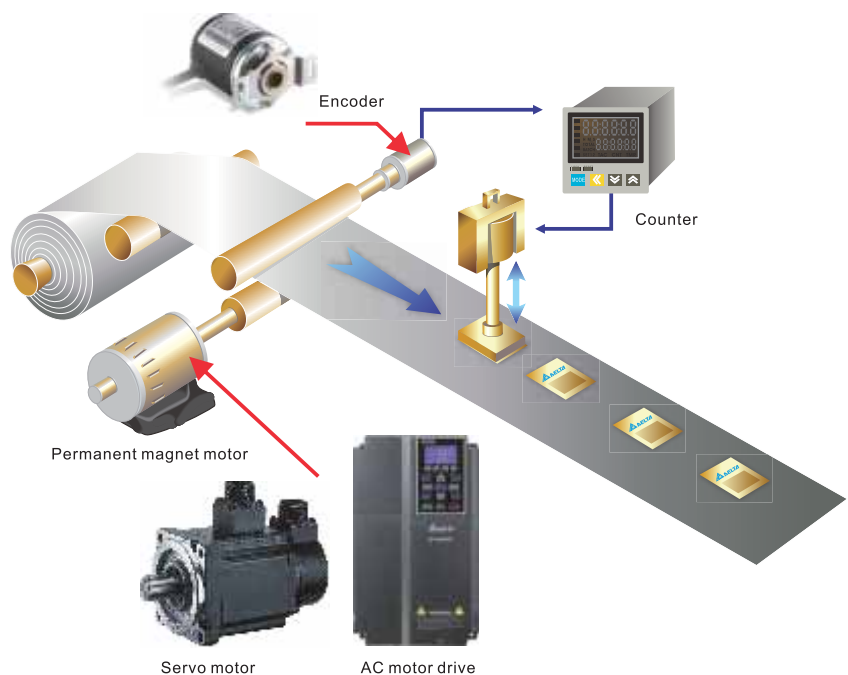
## Intelligent Programmable Logic Controller

In network systems, distributed control and independent operation can easily be achieved with the built-in Delta PLC.




## A Drive for Permanent Magnet (PM) Motors


VFD-C2000 is a dual mode drive for induction motors and permanent magnet motors. The dynamic response of a PM motor provides precise control of position, speed and torque.



# Environment for Operation, Storage and Transportation

DO NOT expose the AC motor drive to bad environments, such as dust, direct sunlight, corrosive/ inflammable gasses, humidity, liquid or vibrations. The salt in the air must be less than 0.01mg/cm <sup>2</sup> every year.		
Installation location	IEC60364-1/IEC60664-1 Pollution degree 2, Indoor use only	
Surrounding Temperature	Storage/ Transportation	-25°C ~ +70°C
	No condensation, no frost	
Rated Humidity	Operation	Max. 90%
	Storage/ Transportation	Max. 95%
	No condensation, no frost	
Air Pressure	Operation/ Storage	86 to 106 kPa
	Transportation	70 to 106 kPa
Pollution Level	IEC60721-3-3	
	Operation	Class 3C2 : Class 3S2
	Storage	Class 2C2 : Class 2S2
	Transportation	Class 1C2 : Class 1S2
	No condensation, no frost	
Altitude	Operation	If AC motor drive is installed at altitude 0~1000m, follow normal operation restriction. If it is install at altitude 1000~3000m, decrease 2% of rated current or lower 0.5°C of temperature for every 100m increase in altitude. Maximum altitude for Corner Grounded is 2000m.
Package Drop	Storage/ Transportation	ISTA procedure 1A(according to weight) IEC60068-2-31
Vibration	1.0mm, peak to peak value range from 2Hz to 13.2 Hz; 0.7G~1.0G range from 13.2Hz to 55Hz; 1.0G range from 55Hz to 512 Hz. Comply with IEC 60068-2-6	
Impact	IEC/EN 60068-2-27	
Operation Position	Max. allowed offset angle ± 10° (under normal installation position)	

# Specification for Operation Temperature and Protection Level

Model	Frame	Top Cover	Conduit Box	Protection Level	Operation Temperature
VFDxxxCxxA VFDxxxCxxS	Frame A~C 230V: 0.75~22kW 460V: 0.75~30kW	Remove top cover	Standard conduit plate	IP20/UL Open Type	-10°C ~50°C
		Standard with top cover		IP20/UL Type1/NEMA1	-10°C ~40°C
	Frame D~H 230V: >22kW 460V: >30kW	N/A	No conduit box	IP00 IP20/UL Open Type	-10°C ~50°C
					
VFDxxxCxxE VFDxxxCxxU	Frame A~C 460V: 0.75~30kW	Remove top cover	Standard conduit plate	IP20/UL Open Type	-10°C ~50°C
		Standard with top cover		IP20/UL Type1/NEMA1	-10°C ~40°C
	Frame D~H 230V: >22kW 460V: >30kW	N/A	Standard conduit box	IP20/UL Type1/NEMA1	-10°C ~40°C

# Specifications

230V			Frame Size		A				B			C			D		E			F	
			Model VFD-__ C__		007	015	022	037	055	075	110	150	185	220	300	370	450	550	750	900	
			Applicable Motor Output (kW)		0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	
Output Rating	NORMAL DUTY	HEAVY DUTY	Rated Output Capacity (kVA)		1.9	2.8	4.0	6.4	9.6	12	19	25	28	34	45	55	68	81	96	131	
			Rated Output Current (A)		4.8	7.1	10	16	24	31	47	62	71	86	114	139	171	204	242	329	
			Carrier Frequency (kHz)		2~6kHz (2kHz)																
			Rated Output Capacity (kVA)		2.0	3.2	4.4	6.8	10	13	20	26	30	36	48	58	72	86	102	138	
			Rated Output Current (A)		5	8	11	17	25	33	49	65	75	90	120	146	180	215	255	346	
			Carrier Frequency (kHz)		2~15kHz (8kHz)						2~10kHz (6kHz)					2~9kHz (4kHz)					
Input Rating			Input Current (A) Heavy Duty		6.1	11	15	18.5	26	34	50	68	78	95	118	136	162	196	233	315	
			Input Current (A) Normal Duty		6.4	12	16	20	28	36	52	72	83	99	124	143	171	206	245	331	
			Rated Voltage/Frequency		3-phase AC 200V~240V (-15%~+10%), 50/60Hz																
			Operating Voltage Range		170~265Vac																
			Frequency Tolerance		47~63Hz																
Drive Weight			2.6± 0.3Kg				5.4± 1Kg			9.8± 1.5Kg			38.5± 1.5Kg		64.8± 1.5Kg			86.5± 1.5Kg			
Cooling Method			Natural cooling	Fan cooling																	
Braking Chopper			Frame A to C (built-in); Frame D and above (optional)																		
DC Choke			Frame A to C (optional); Frame D and above (built-in)																		
EMI Filter			Frame A to C (optional); Frame D and above (optional)																		
EMC-COP01			VFDXXC23A (optional); VFDXXXC23E (built-in)																		

460V		Frame Size	A						B			C			
Model VFD-__C__			007	015	022	037	040	055	075	110	150	185	220	300	
Applicable Motor Output (kW)			0.75	1.5	2.2	3.7	4.0	5.5	7.5	11	15	18.5	22	30	
Output Rating	NORMAL DUTY	HEAVY DUTY	Rated Output Capacity (kVA)	2.3	3.0	4.5	6.5	7.6	9.6	14	18	24	29	34	45
		Rated Output Current (A)	2.9	3.8	5.7	8.1	9.5	11	17	23	30	36	43	57	
		Carrier Frequency (kHz)	2~6kHz (2kHz)												
		Rated Output Capacity (kVA)	2.4	3.2	4.8	7.2	8.4	10	14	19	25	30	36	48	
		Rated Output Current (A)	3.0	4.0	6.0	9.0	10.5	12	18	24	32	38	45	60	
		Carrier Frequency (kHz)	2~15kHz (8kHz)									2~10kHz (6kHz)			
		Input Rating	Input Current (A) Heavy Duty		4.1	5.6	8.3	13	14.5	16	19	25	33	38	45
Input Current (A) Normal Duty			4.3	5.9	8.7	14	15.5	17	20	26	35	40	47	63	
Rated Voltage/Frequency			3-phase AC 380V~480V ( -15%~+10%), 50/60Hz												
Operating Voltage Range			323~528Vac												
Frequency Tolerance			47~63Hz												
Drive Weight			2.6± 0.3Kg						5.4± 1Kg			9.8± 1.5Kg			
Cooling Method			Natural cooling		Fan cooling										
Braking Chopper			Frame A to C (built-in); Frame D and above (optional)												
DC Choke			Frame A to C (optional); Frame D and above (built-in)												
EMI Filter			VFDXXXC43A Frame A to C (No EMI Filter) VFDXXXC43E (Built-in); VFDXXXC43A/43E Frame D and above (optional)												
EMC-COP01			VFDXXC43A (optional); VFDXXXC43E (built-in)												

## NOTES:

- The carrier frequency is default. Increasing the carrier frequency requires a reduction in current.
- The motor drive should operate in derating current when its control method is set to TQC+PG, PM, FOC Sensorless or TQC Sensorless mode.
- The application of the load characteristics is the impact load. The motor drive requires big one grade.
- For FRAME A, B and C, Model VFDXXC43A is under IP20/NEMA1/UL TYPE1 protection level.
- For FRAME D and above, if the last character of the model is A then it is under IP20 protection level but the wiring terminal is under IP00 protection level; if the last character of the model is E, it is under IP20/NEMA1/UL TYPE1 protection level.



460V

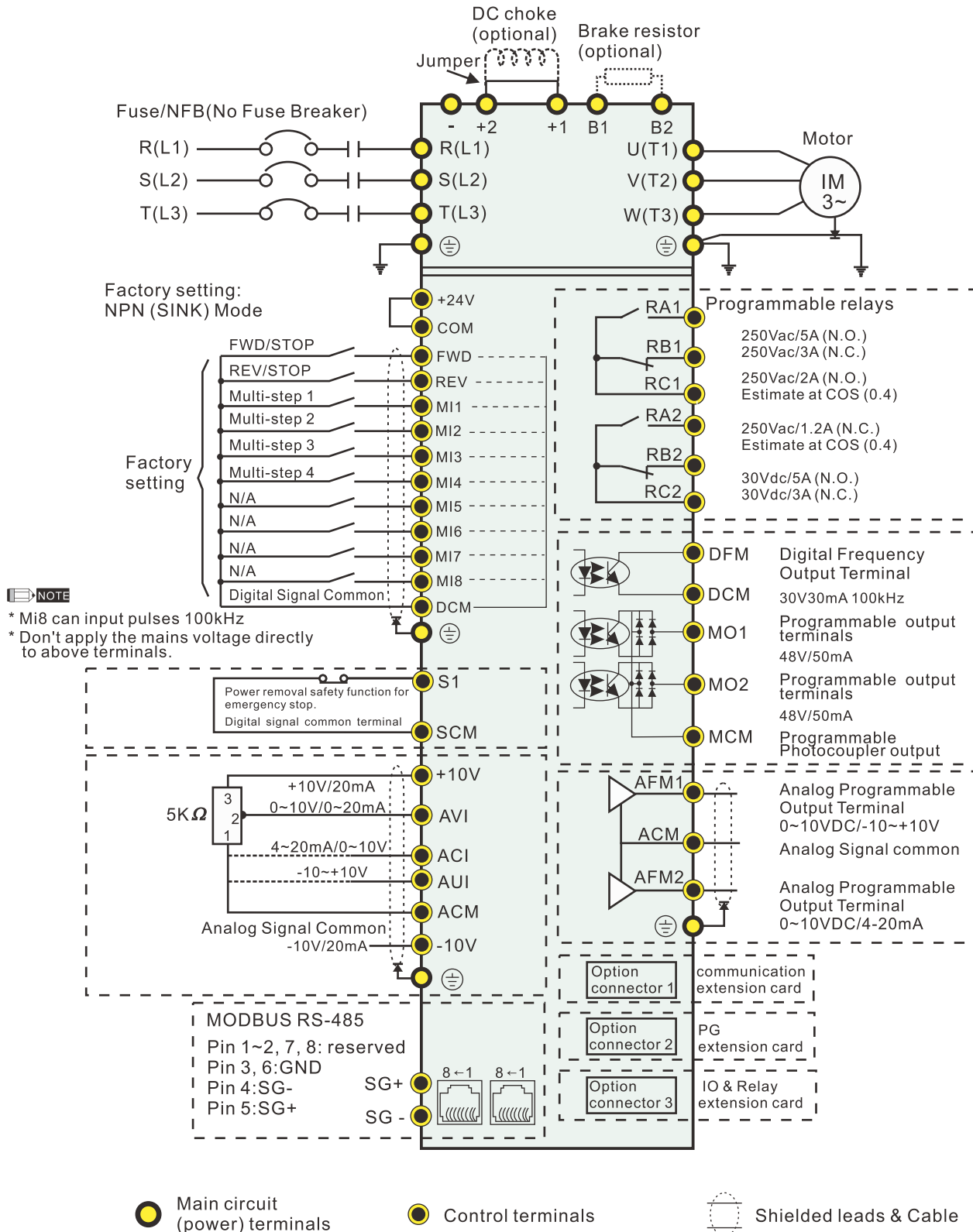
460V		Frame Size		D				E		F		G		H			
		Model VFD-__C__		370	450	550	750	900	1100	1320	1600	1850	2200	2800	3150	3550	
		Applicable Motor Output (kW)		37	45	55	75	90	110	132	160	185	220	280	315	355	
Output Rating	HEAVY DUTY      NORMAL DUTY	Rated Output Capacity (kVA)		55	69	84	114	136	167	197	235	280	348	417	466	517	
		Rated Output Current (A)		69	86	105	143	171	209	247	295	352	437	523	585	649	
		Carrier Frequency (kHz)		2~6kHz (2kHz)													
		Rated Output Capacity (kVA)		58	73	88	120	143	175	207	247	295	367	438	491	544	
		Rated Output Current (A)		73	91	110	150	180	220	260	310	370	460	550	616	683	
		Carrier Frequency (kHz)		2~10kHz (6kHz)					2~9kHz (4kHz)								
Input Rating		Input Current (A) Heavy Duty		70	96	108	149	159	197	228	285	361	380	469	527	594	
		Input Current (A) Normal Duty		74	101	114	157	167	207	240	300	380	400	494	555	625	
		Rated Voltage/Frequency		3-phase AC 380V~480V ( -15%~+10%), 50/60Hz													
		Operating Voltage Range		323~528Vac													
		Frequency Tolerance		47~63Hz													
Drive Weight		38.5± 1.5Kg					64.8±1.5Kg		86.5±1.5Kg		134±4Kg		228				
Cooling Method		Fan cooling															
Braking Chopper		Frame A to C (built-in); Frame D and above (optional)															
DC Choke		Frame A to C (optional); Frame D and above (built-in)															
EMI Filter		VFDXXXC43A Frame A to C (No EMI Filter) VFDXXXC43E (Built-in); VFDXXXC43A/43E Frame D and above (optional)															
EMC-COP01		VFDXXC43A (optional); VFDXXXC43E (built-in)															

## General Specifications

Control Characteristics	Control Method	Pulse Width Modulated (PWM)
	Control Mode	1: V/F, 2: SVC, 3: VF+PG, 4: FOC+PG, 5: TQC+PG, 6: PM+PG, 7: FOC sensorless, 8: TQC sensorless, 9: PM sensorless
	Starting Torque	Reach up to 150% or above at 0.5Hz. Under FOC+PG mode, starting torque can reach 150% at 0Hz.
	V/f Curve	4-point adjustable V/f curve and square curve
	Speed Response Ability	5Hz (vector control can reach up to 40Hz)
	Torque Limit	Max. 200% torque current
	Torque Accuracy	±5%
	Max. Output Frequency (Hz)	Normal duty: 0.00~600.00Hz; Heavy duty: 0.00 ~ 300.00 Hz
	Frequency Output Accuracy	Digital command: ±0.01%, -10°C ~ +40°C, Analog command: ±0.1%, 25±10°C
	Output Frequency Resolution	Digital command: 0.01Hz, Analog command: 0.03 X max. output frequency/60 Hz (±11 bit)
	Overload Tolerance	Normal duty: rated output current is 120% for 60seconds Heavy duty: rated output current is 150% for 60seconds
	Frequency Setting Signal	+10V~-10, 0~+10V, 4~20mA, 0~20mA, Pulse input
Protection Characteristics	Accel./decel. Time	0.00~600.00/0.0~6000.0 Seconds
	Main Control Function	Torque control, Droop control, Speed/torque control switching, Feed forward control, Zero-servo control, Momentary power loss ride thru, Speed search, Over-torque detection, Torque limit, 17-step speed (max), Accel/decel time switch, S-curve accel/decel, 3-wire sequence, Auto-Tuning (rotational, stationary), Dwell, Cooling fan on/off switch, Slip compensation, Torque compensation, JOG frequency, Frequency upper/lower limit settings, DC injection braking at start/stop, High slip braking, PID control (with sleep function), Energy saving control, MODBUS communication (RS-485 RJ45, max. 115.2 kbps), Fault restart, Parameter copy
	Fan Control	230V model: VFD150C23A(include) and series above: PMW control; VFD150C23A and series below: on/off switch control 460V model: VFD150C43A(include) and series above: PMW control; VFD150C43A and series below: on/off switch control
	Motor Protection	Electronic thermal relay protection
	Over-current Protection	Over-current protection for 240% rated current current clamp 『Normal duty: around 170~175%』; 『Heavy duty: around 180~185%』
	Over-voltage Protection	230: drive will stop when DC-BUS voltage exceeds 410V 460: drive will stop when DC-BUS voltage exceeds 820V
	Over-temperature Protection	Built-in temperature sensor
Protection Characteristics	Stall Prevention	Stall prevention during acceleration, deceleration and running independently.
	Restart after Instantaneous Power Failure	Parameter setting up to 20 seconds
	Grounding Leakage Current Protection	Leakage current is higher than 50% of rated current of the AC motor drive

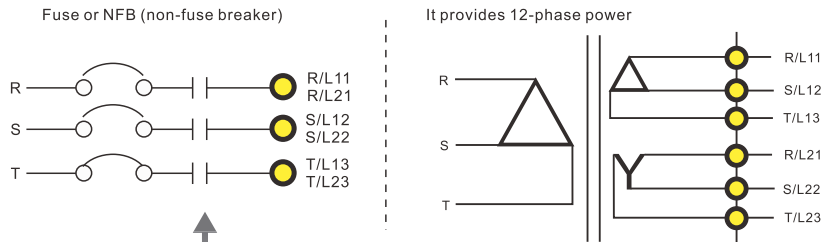
# Wiring

## Frame A~C Offers 3-phase power supply

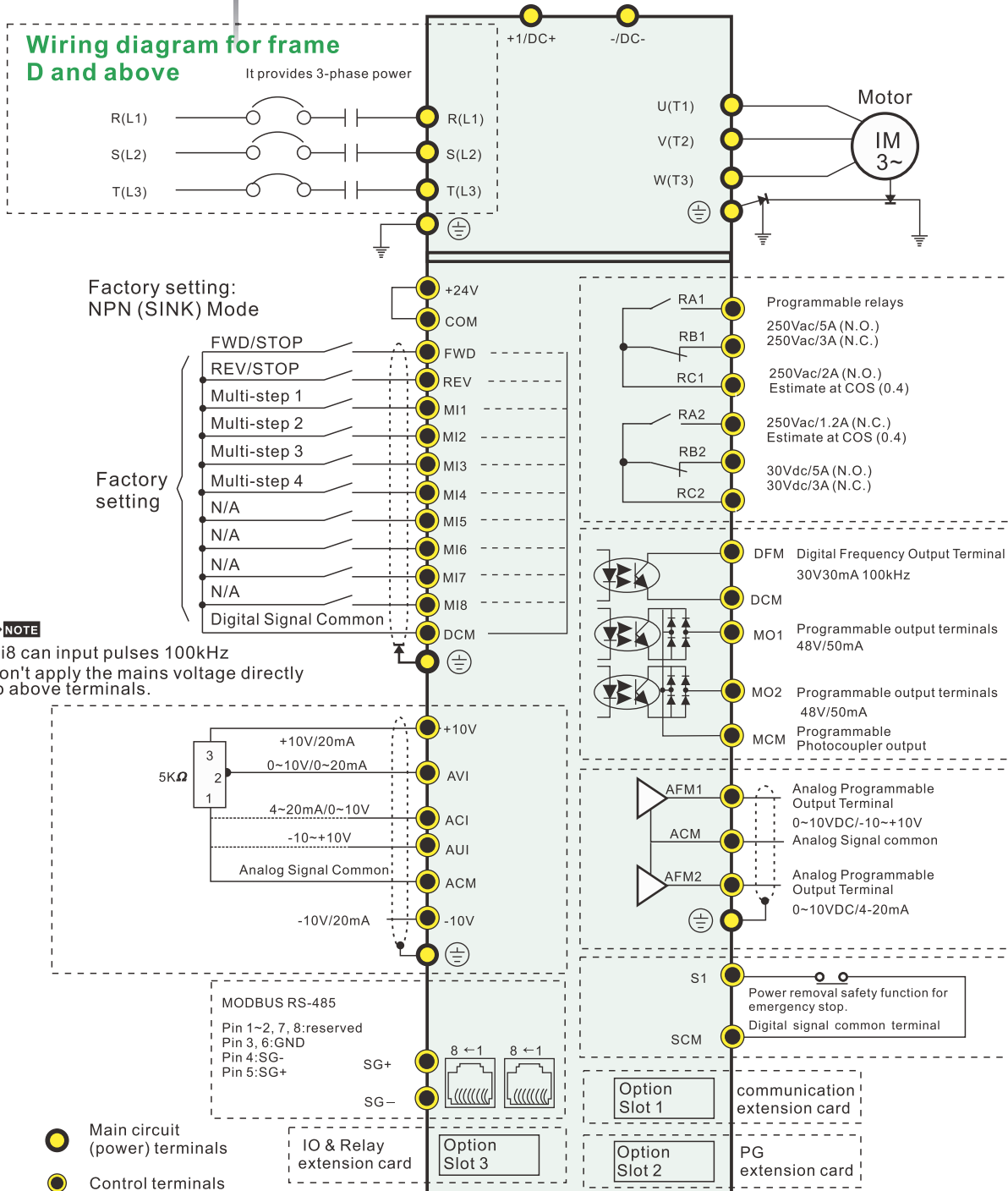


NOTE: It is recommended NOT to connect any phase advance capacitor or automatic power factor regulator (APFR) directly to the motor drive. If it is necessary to connect any of them, please make sure a reactor is installed between the motor drive and phase advance capacitor/APFR.

## Input power terminals for frame G and H Provides 3-phase power



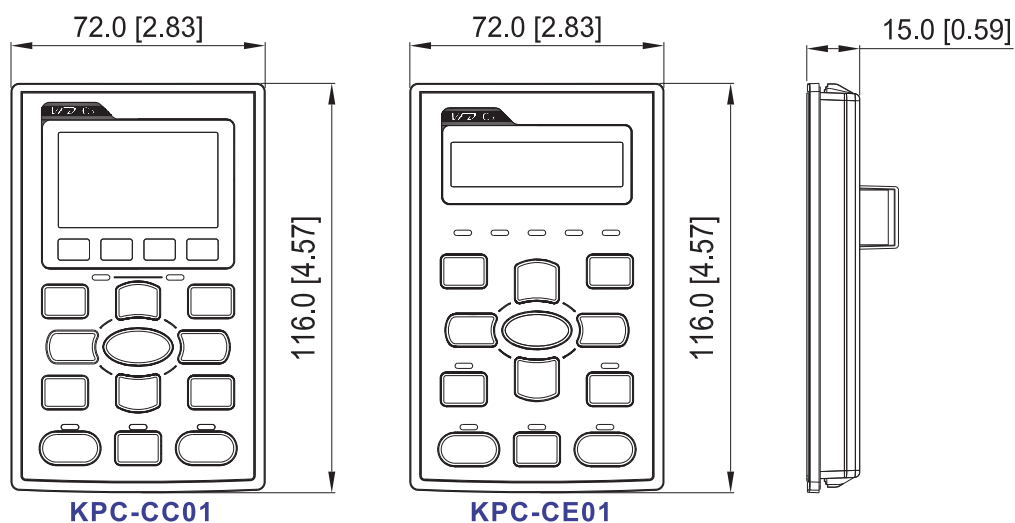
## Wiring diagram for frame D and above



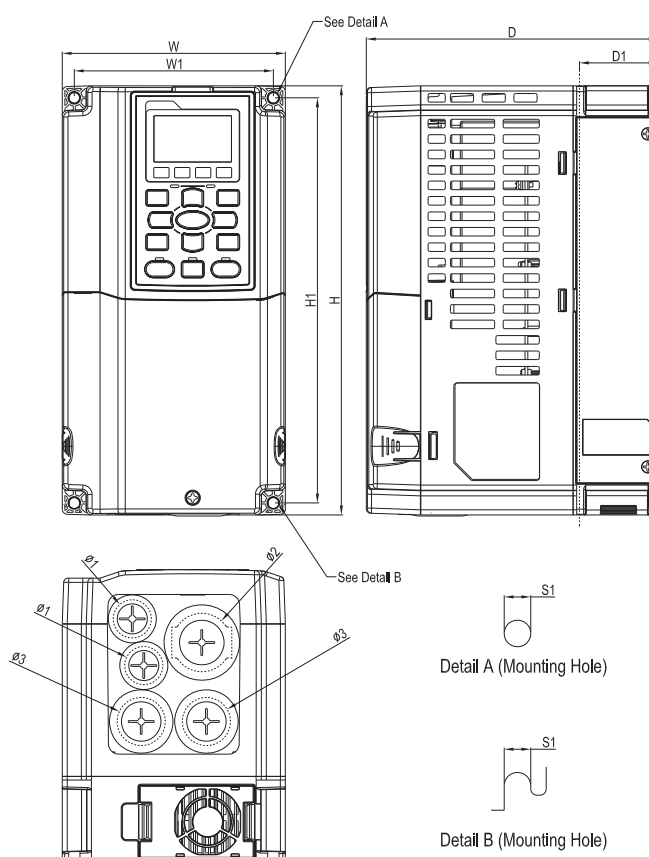


# Dimensions

## Digital Keypad



## Frame A



### MODEL

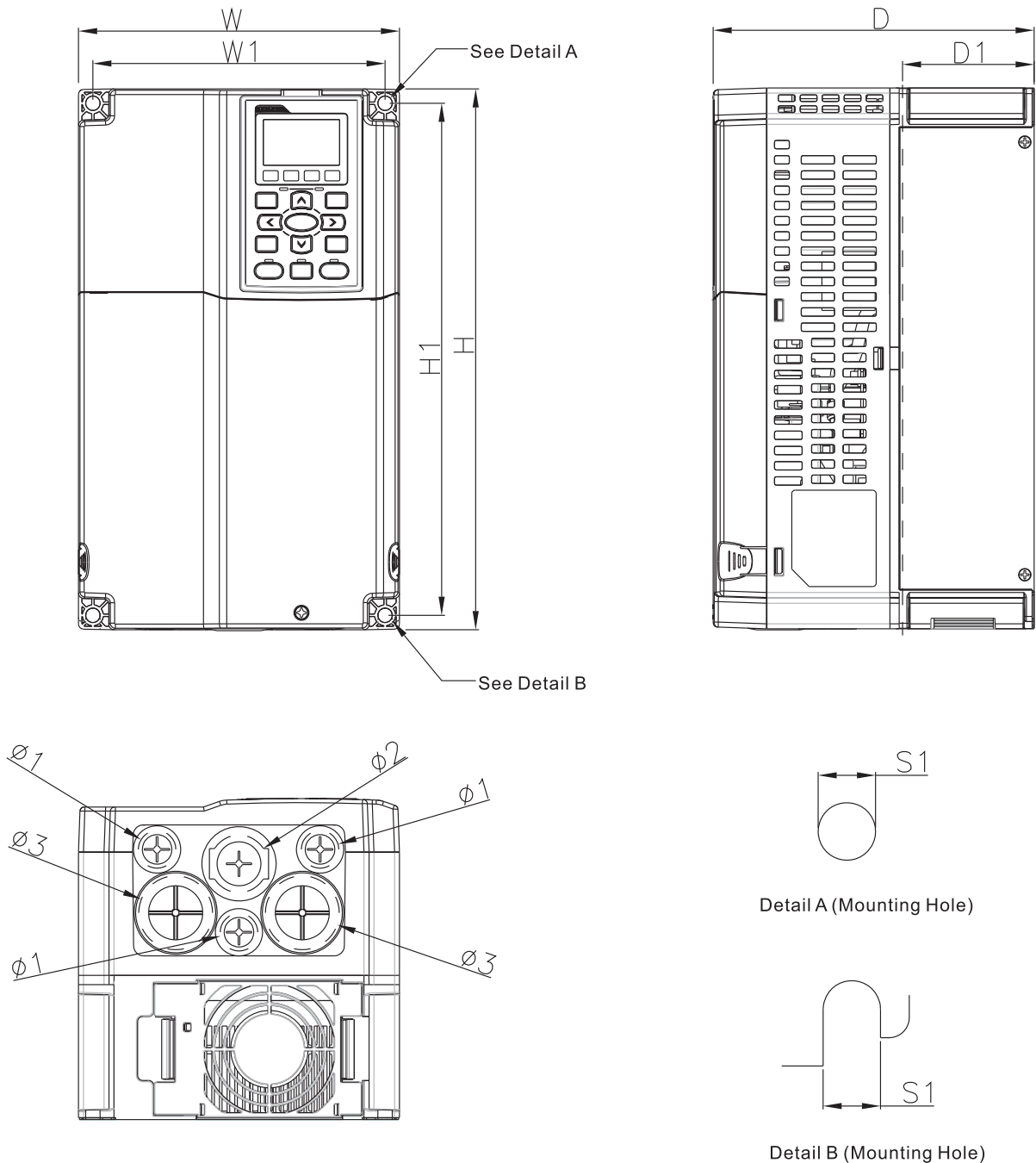
VFD007C23A  
VFD007C43A/43E  
VFD015C23A  
VFD015C43A/43E  
VFD022C23A  
VFD022C43A/43E  
VFD037C23A  
VFD037C43A/43E  
VFD040C43A/43E  
VFD055C43A/43E

Unit : mm[inch]

Frame		W	H	D	W1	H1	D1*	Ø	Ø1	Ø2	Ø3
A1	mm	130.0	250.0	170.0	116.0	236.0	45.8	6.2	22.2	34.0	28.0
	inch	5.12	9.84	6.69	4.57	9.29	1.80	0.24	0.87	1.34	1.10

D1\* : Flange mounting

Frame B



**MODEL**  
VFD055C23A  
VFD075C23A  
VFD075C43A/43E  
VFD110C23A  
VFD110C43A/43E  
VFD150C43A/43E

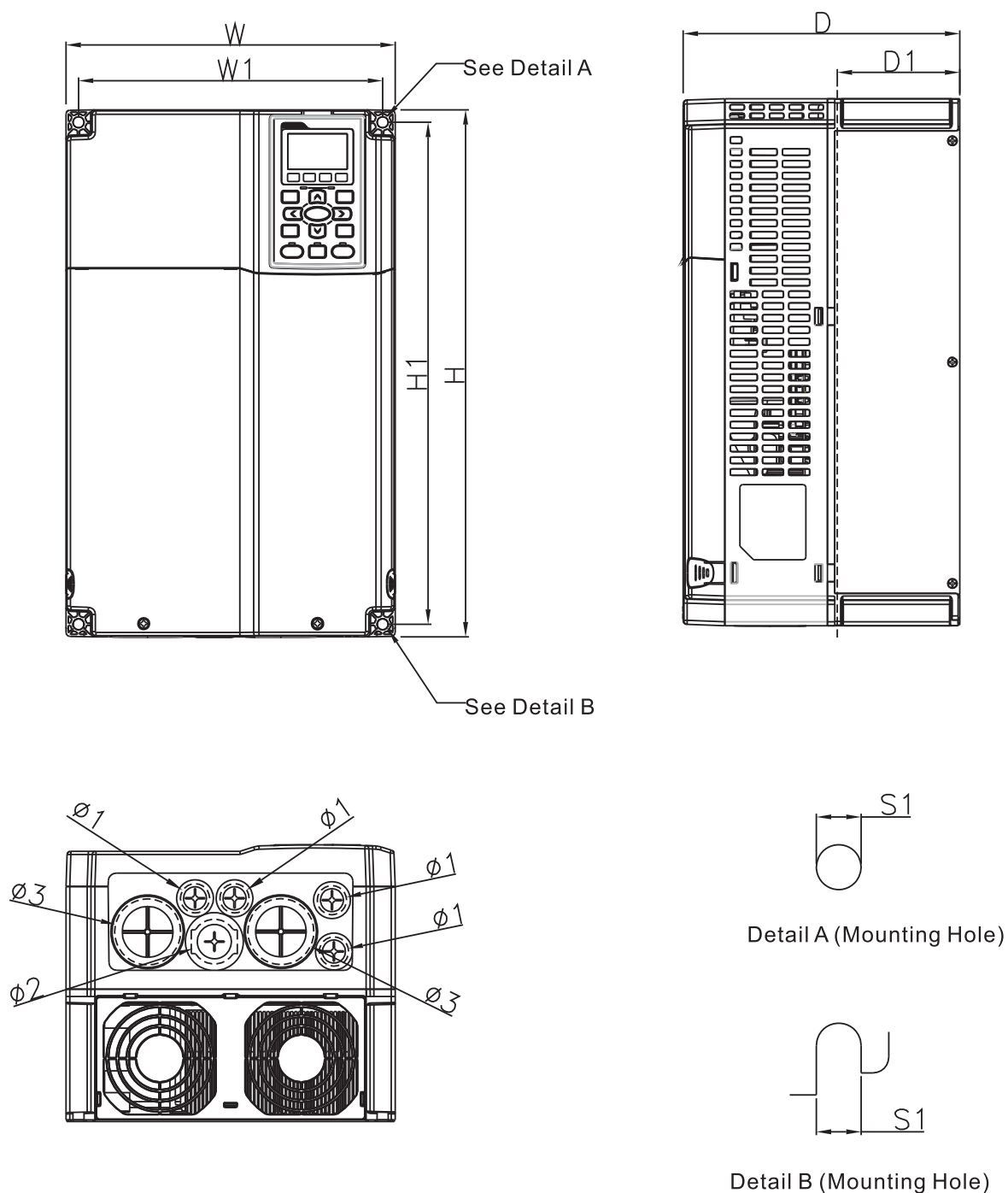
Unit : mm[inch]

Frame		W	H	D	W1	H1	D1*	S1	Ø1	Ø2	Ø3
B1	mm	190.0	320.0	190.0	173.0	303.0	77.9	8.5	22.2	34.0	28.0
	inch	7.48	12.60	7.48	6.81	11.93	3.07	0.33	0.87	1.34	1.10

D1\* : Flange mounting

# Dimensions

## Frame C



### MODEL

VFD150C23A  
VFD185C23A  
VFD185C43A/43E  
VFD220C23A  
VFD220C43A/43E  
VFD300C43A/43E

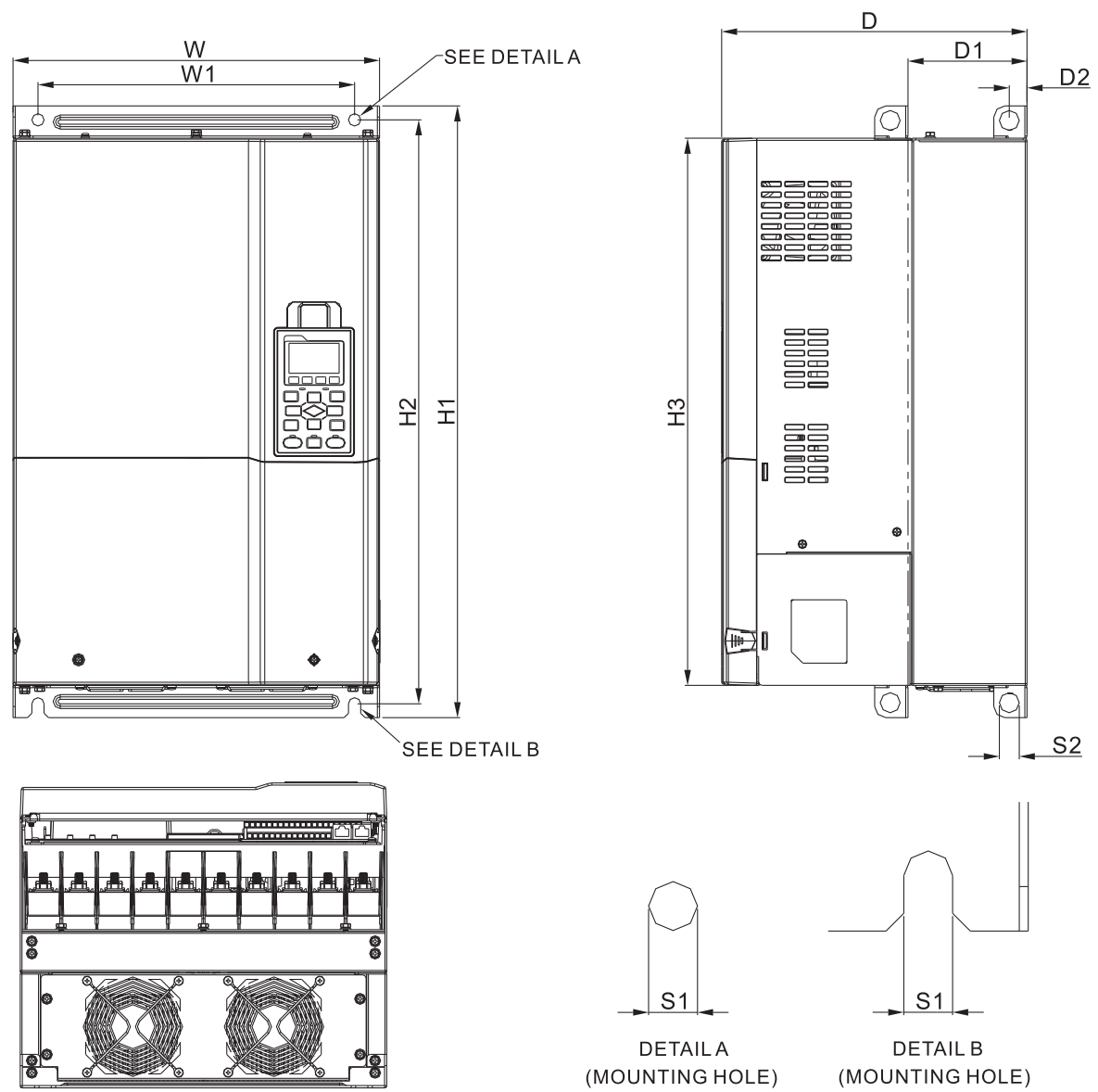
Unit : mm[inch]

Frame		W	H	D	W1	H1	D1*	S1	$\phi 1$	$\phi 2$	$\phi 3$
C1	mm	250.0	400.0	210.0	231.0	381.0	92.9	8.5	22.2	34.0	50.0
	inch	9.84	15.75	8.27	9.09	15.00	3.66	0.33	0.87	1.34	1.97

D1\* : Flange mounting



Frame D



MODEL

FRAME\_D1  
VFD300C23A  
VFD370C23A  
VFD370C43A  
VFD450C43A  
VFD550C43A  
VFD750C43A

FRAME\_D0-1  
VFD370C43S  
VFD450C43S

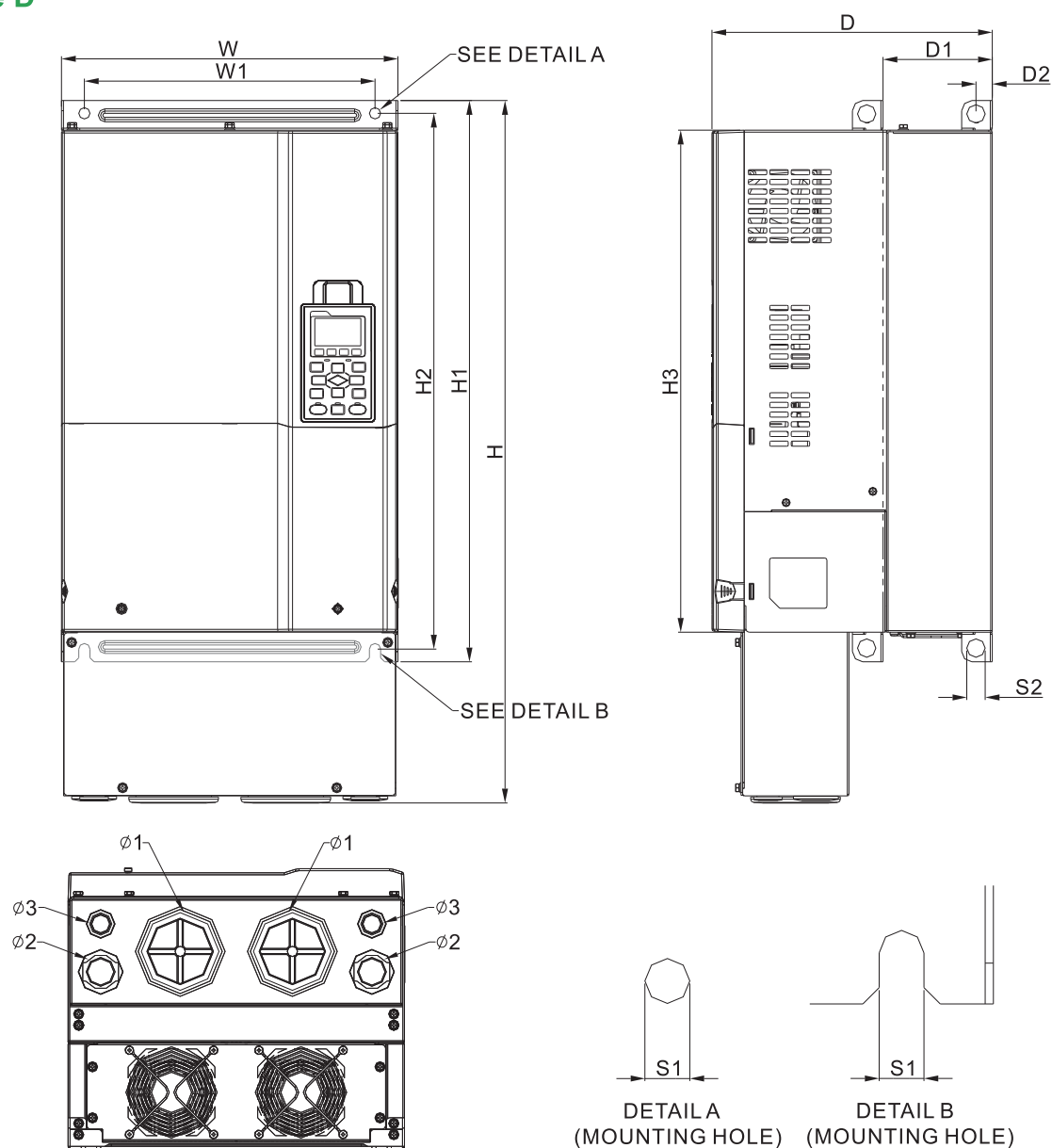
Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	Ø1	Ø2	Ø3
D1	mm	330.0	-	275.0	285.0	550.0	525.0	492.0	107.2	16.0	11.0	18.0	-	-	-
	inch	12.99	-	10.83	11.22	21.65	20.67	19.37	4.22	0.63	0.43	0.71	-	-	-
Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2			
D0-1	mm	280.0	-	255.0	235.0	500.0	475.0	442.0	94.2	16.0	11.0	18.0			
	inch	11.02	-	10.04	9.25	19.69	18.70	17.40	3.71	0.63	0.43	0.71			

D1\* : Flange mounting

# Dimensions

## Frame D



### MODEL

#### FRAME\_D2

VFD300C23E  
VFD370C23E  
VFD370C43E  
VFD450C43E  
VFD550C43E  
VFD750C43E

#### FRAME\_D0-2

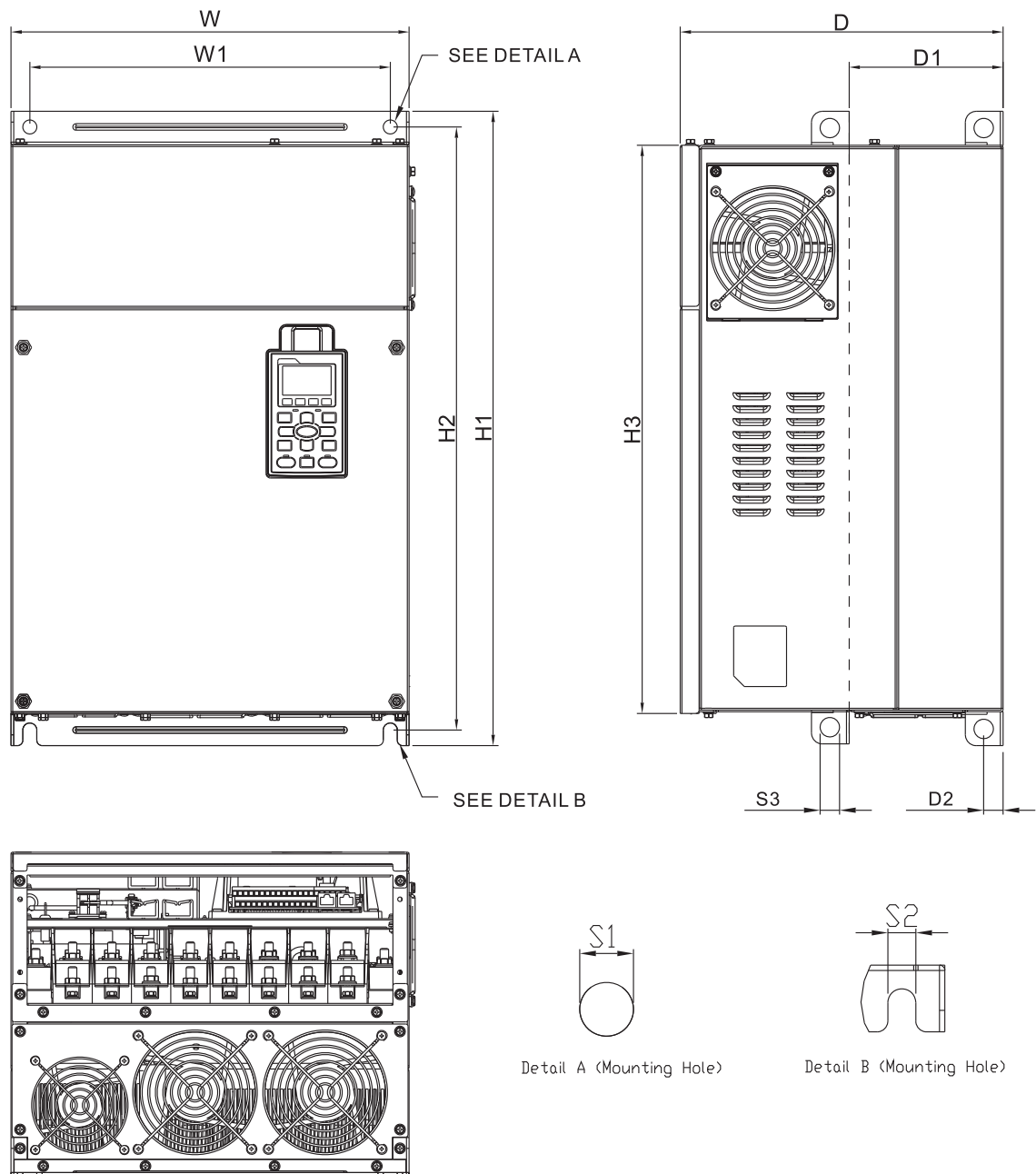
VFD370C43U  
VFD450C43U

Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	$\phi 1$	$\phi 2$	$\phi 3$
D2	mm	330.0	688.3	275.0	285.0	550.0	525.0	492.0	107.2	16.0	11.0	18.0	76.2	34.0	22.0
	inch	12.99	27.10	10.83	11.22	21.65	20.67	19.37	4.22	0.63	0.43	0.71	3.00	1.34	0.87
Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	$\phi 1$	$\phi 2$	$\phi 3$
D0-2	mm	280.0	614.4	255.0	235.0	500.0	475.0	442.0	94.2	16.0	11.0	18.0	62.7	34.0	22.0
	inch	11.02	24.19	10.04	9.25	19.69	18.70	17.40	3.71	0.63	0.43	0.71	2.47	1.34	0.87

D1\* : Flange mounting

Frame E



**MODEL**  
**FRAME\_E1**  
VFD450C23A  
VFD550C23A  
VFD750C23A  
VFD900C43A  
VFD1100C43A

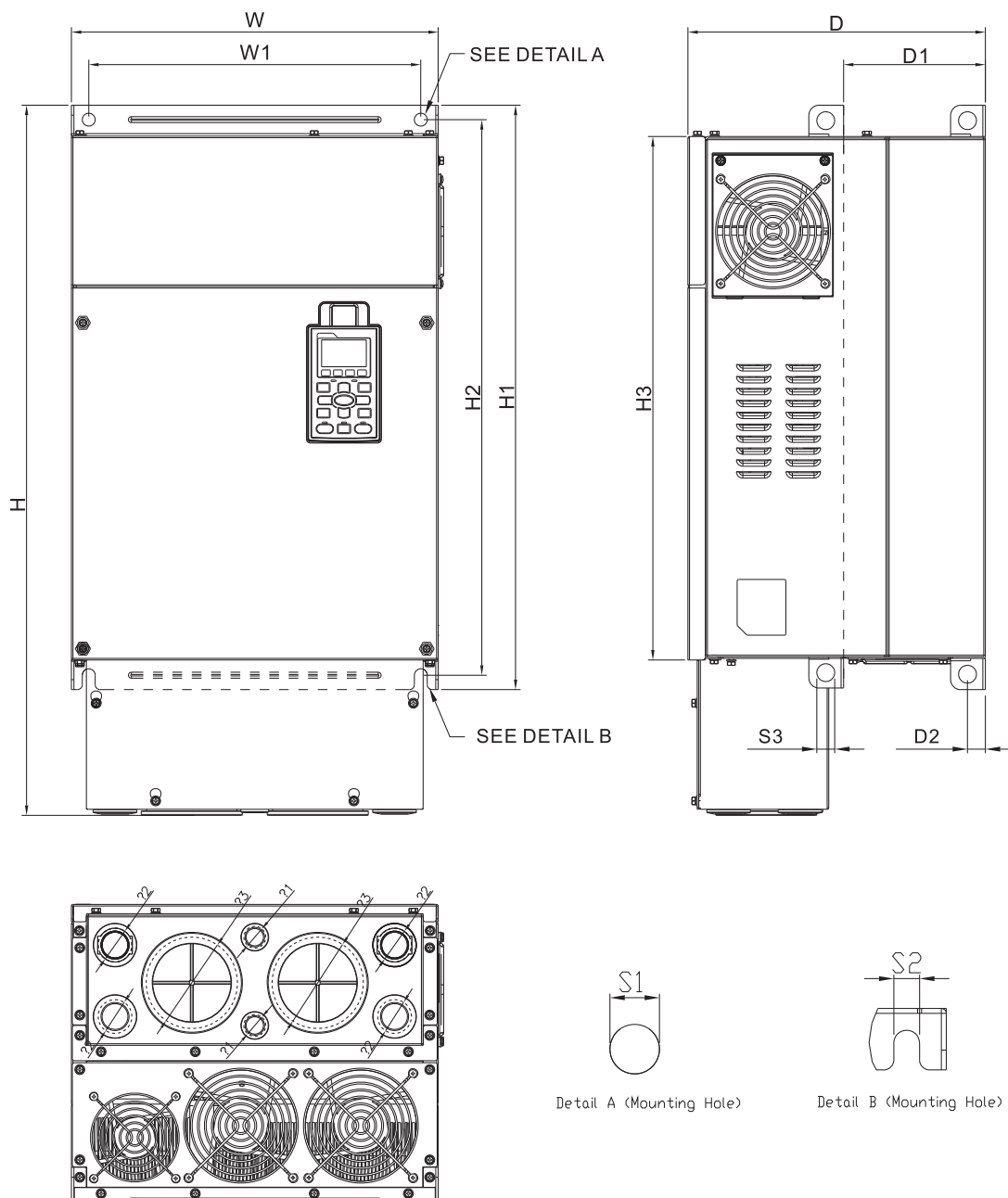
Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3	Ø1	Ø2	Ø3
E1	mm	370.0	-	300.0	335.0	589	560.0	528.0	143.0	18.0	13.0	13.0	18.0	-	-	-
	inch	14.57	-	11.81	13.19	23.19	22.05	20.80	5.63	0.71	0.51	0.51	0.71	-	-	-

D1\* : Flange mounting

# Dimensions

## Frame E



Detail A (Mounting Hole)

Detail B (Mounting Hole)

### MODEL

#### FRAME\_E2

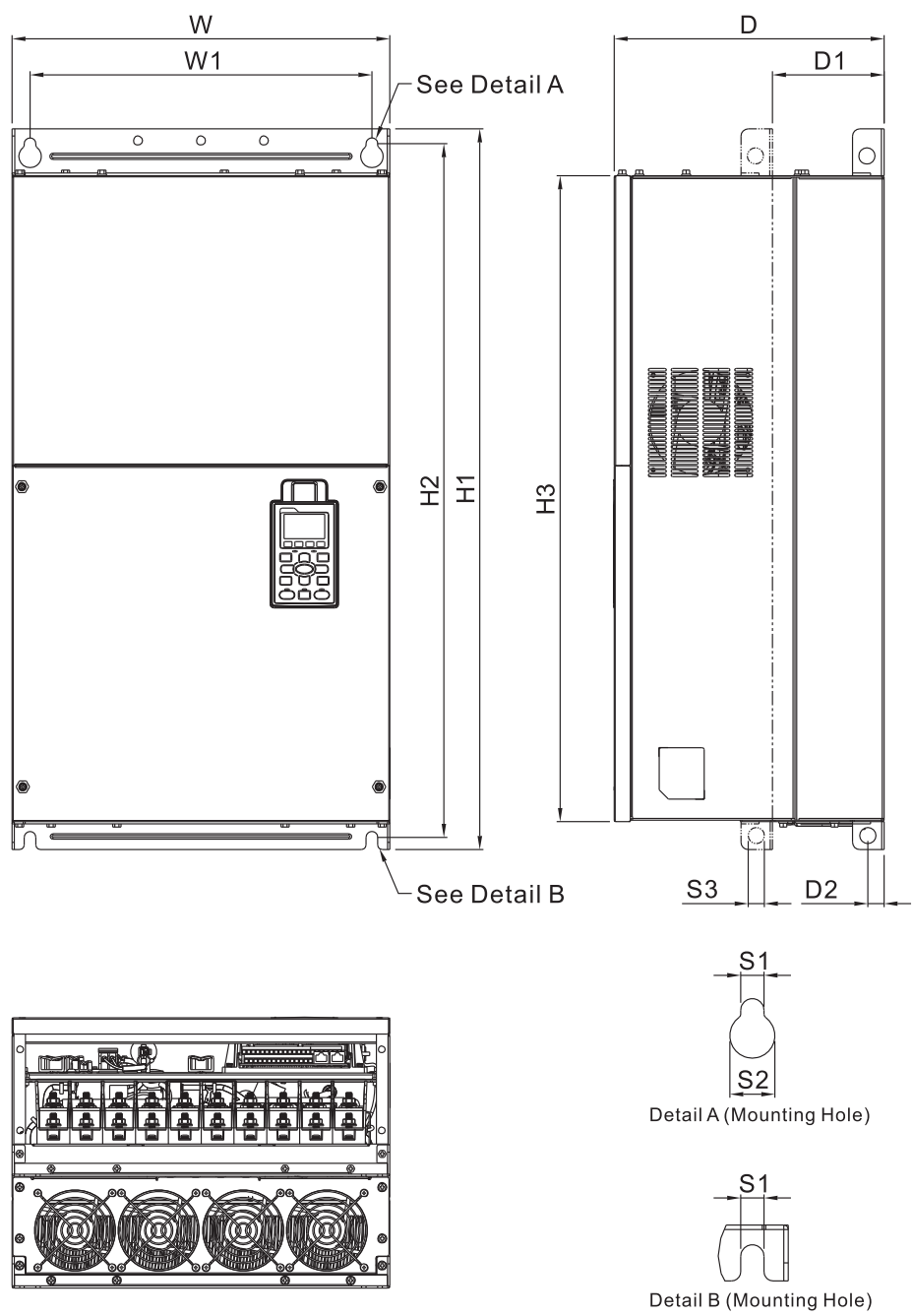
VFD450C23E  
VFD550C23E  
VFD750C23E  
VFD900C43E  
VFD1100C43E

Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3	Ø1	Ø2	Ø3
E2	mm	370.0	715.8	300.0	335.0	589	560.0	528.0	143.0	18.0	13.0	13.0	18.0	22.0	34.0	92.0
	inch	14.57	28.18	11.81	13.19	23.19	22.05	20.80	5.63	0.71	0.51	0.51	0.71	0.87	1.34	3.62

D1\* : Flange mounting

**Frame F**



**MODEL**

**FRAME\_F1**  
VFD900C23A  
VFD1320C23A  
VFD1600C23A

Unit : mm[inch]

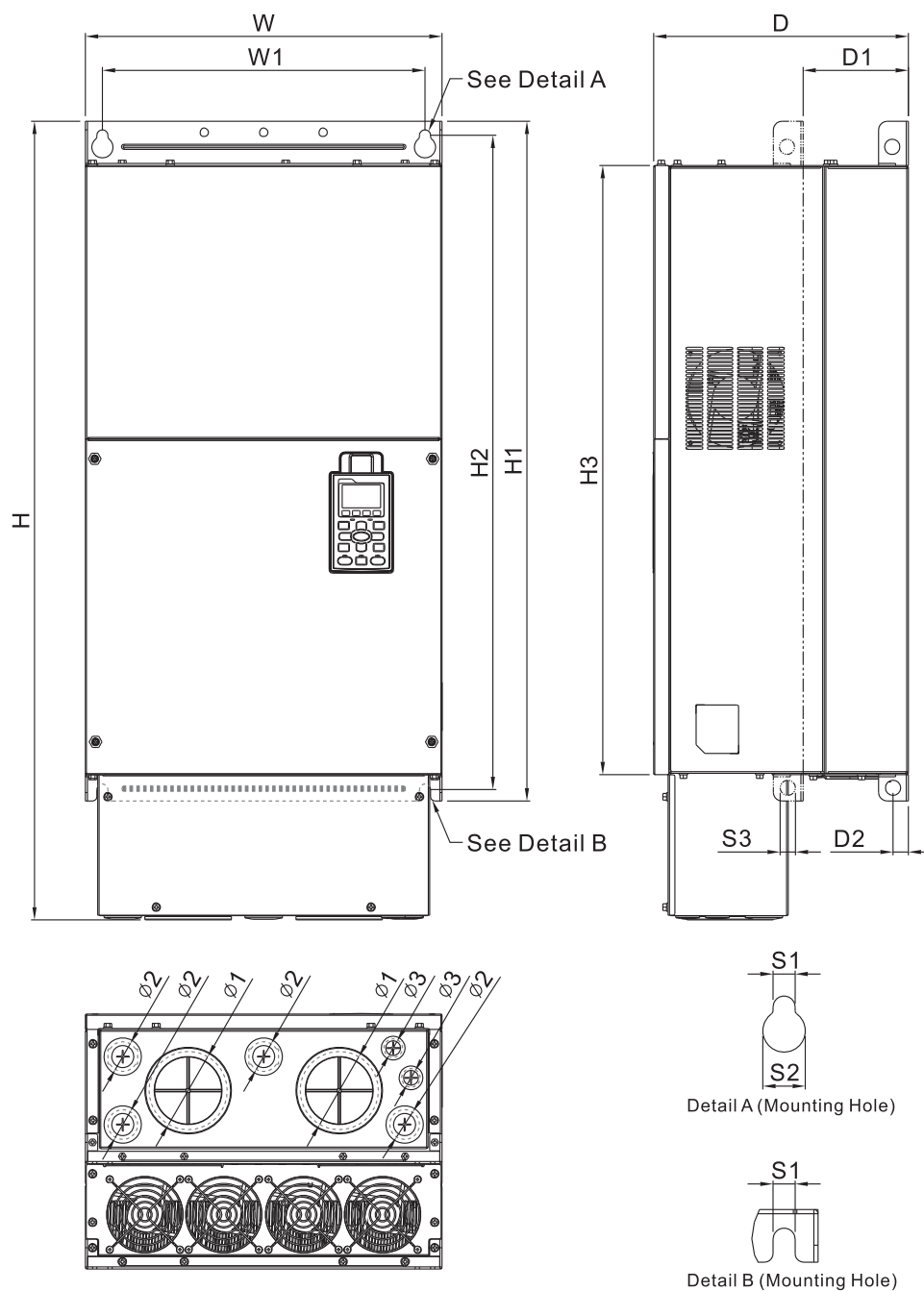
Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3	Ø1	Ø2	Ø3
F1	mm	420.0	-	300.0	380.0	800.0	770.0	717.0	124.0	18.0	13.0	25.0	18.0	92.0	35.0	22.0
	inch	16.54	-	11.81	14.96	31.50	30.32	28.23	4.88	0.71	0.51	0.98	0.71	3.62	1.38	0.87

D1\* : Flange mounting



# Dimensions

## Frame F



### MODEL

#### FRAME\_F2

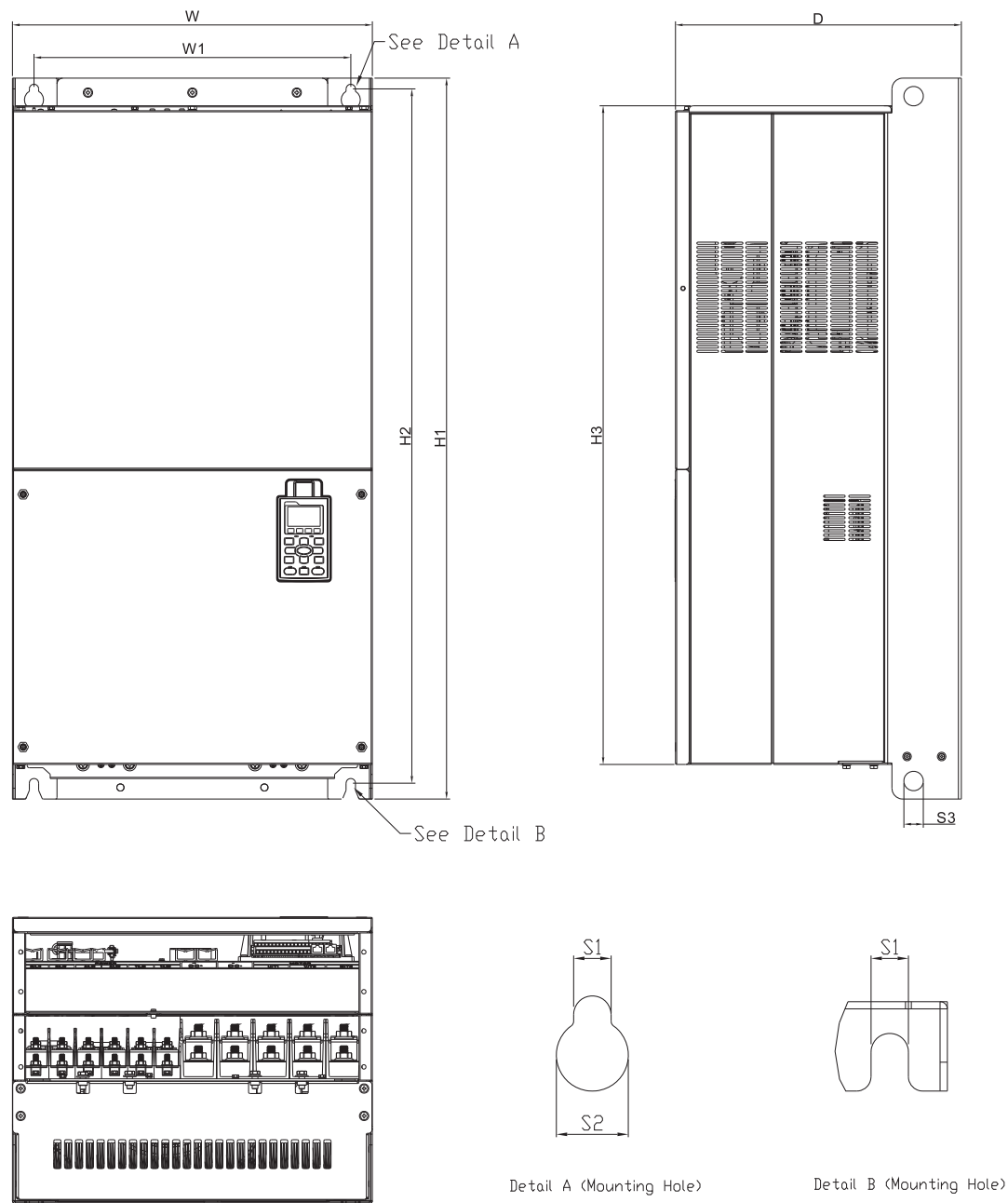
VFD900C23E  
VFD1320C43E  
VFD1600C43E

Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	D1*	D2	S1	S2	S3	Ø1	Ø2	Ø3
F2	mm	420.0	940.0	300.0	380.0	800.0	770.0	717.0	124.0	18.0	13.0	25.0	18.0	92.0	35.0	22.0
	inch	16.54	37.00	11.81	14.96	31.50	30.32	28.23	4.88	0.71	0.51	0.98	0.71	3.62	1.38	0.87

D1\* : Flange mounting

**Frame G**



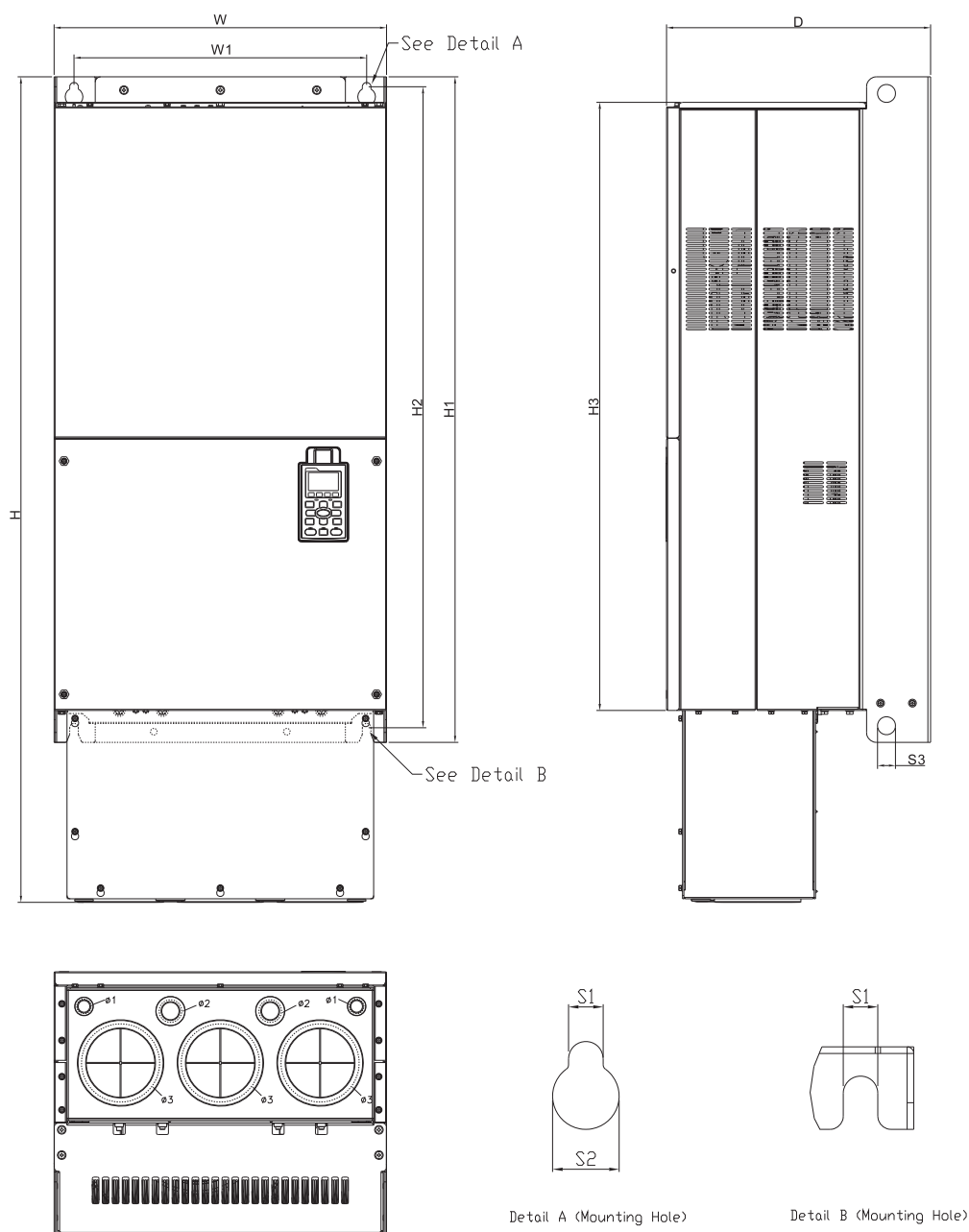
**MODEL**  
**FRAME\_G1**  
VFD1850C43A  
VFD2200C43A

Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	S1	S2	S3	Ø1	Ø2	Ø3
G1	mm	500.0	-	397.0	440.0	1000.0	963.0	913.6	13.0	26.5	27.0	-	-	-
	inch	19.69	-	15.63	217.32	39.37	37.91	35.97	0.51	1.04	1.06	-	-	-

# Dimensions

## Frame G

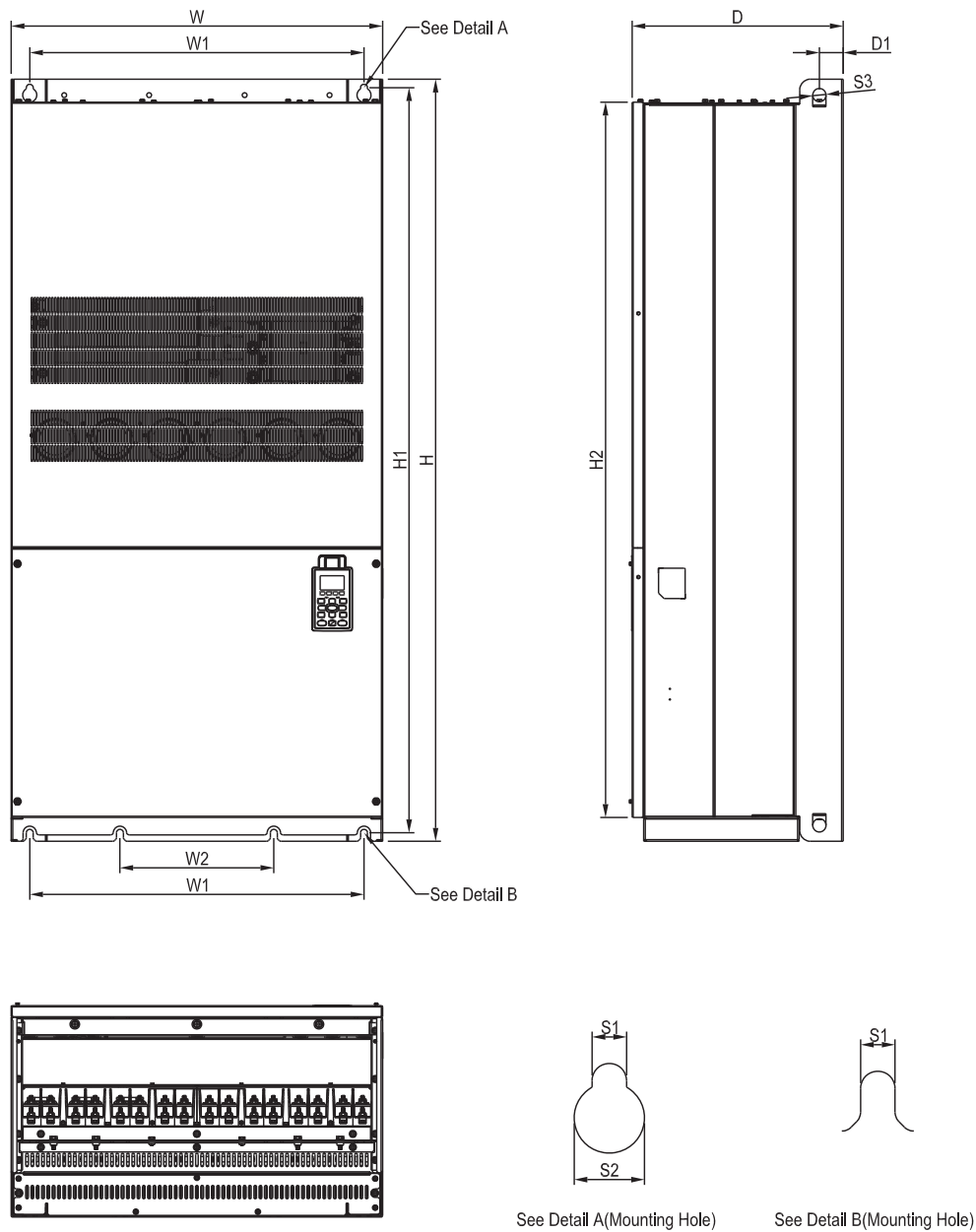


**MODEL**  
**FRAME\_G2**  
 VFD1850C43E  
 VFD2200C43E

Unit : mm[inch]

Frame		W	H	D	W1	H1	H2	H3	S1	S2	S3	Ø1	Ø2	Ø3
G2	mm	500.0	1240.2	397.0	440.0	1000.0	963.0	913.6	13.0	26.5	27.0	22.0	34.0	117.5
	inch	19.69	48.83	15.63	217.32	39.37	37.91	35.97	0.51	1.04	1.06	0.87	1.34	4.63

Frame H



MODEL  
FRAME\_H1  
VFD2800C43A  
VFD3150C43A  
VFD3550C43A

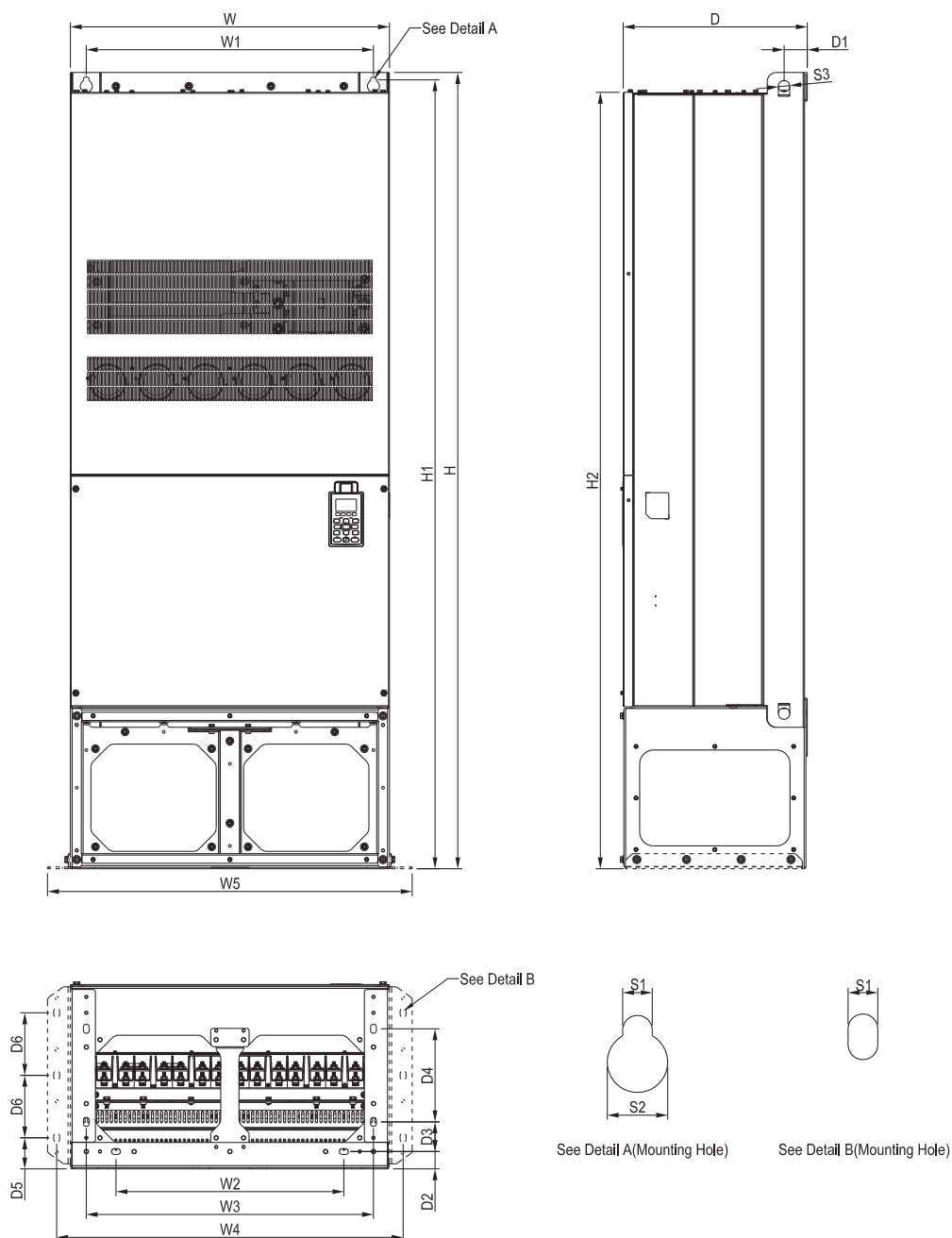
Unit : mm[inch]

Frame		W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H1	mm	700.0	-	398.0	-	630.0	290.0	-	-	-	-	1435.0	1403.0	-
	inch	27.56	-	15.67	-	24.80	11.42	-	-	-	-	56.50	55.24	-

Frame		H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Ø1	Ø2	Ø3
H1	mm	1346.6	45.0	-	-	-	-	-	13.0	26.5	25.0	-	-	-
	inch	53.02	1.77	-	-	-	-	-	0.51	1.04	0.98	-	-	-

# Dimensions

## Frame H



**MODEL**  
**FRAME\_H2**  
 VFD2800C43E-1  
 VFD3150C43E-1  
 VFD3550C43E-1

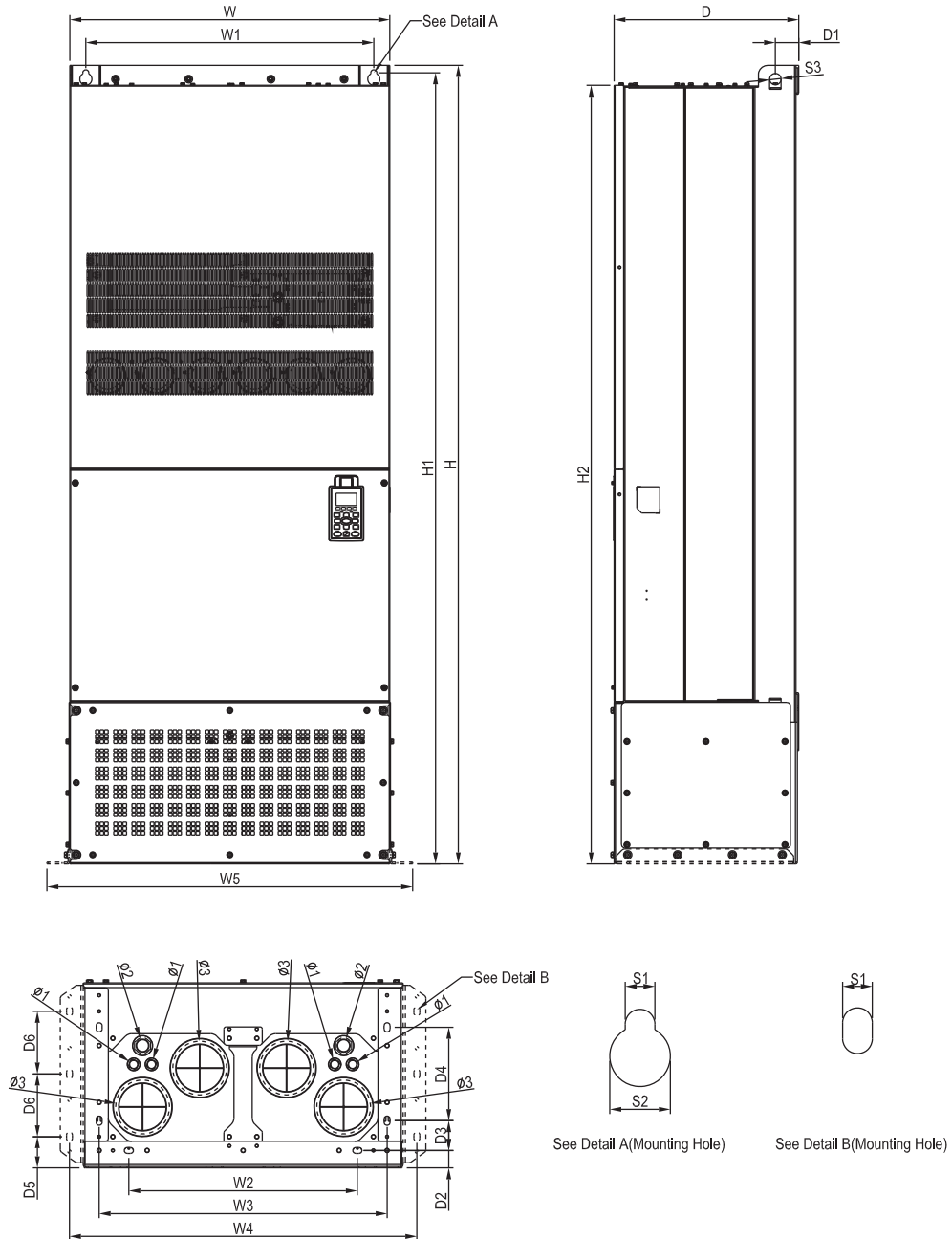
Unit : mm[inch]

Frame		W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H2	mm	700.0	1745.0	404.0	800.0	-	-	500.0	630.0	760.0	1729.0	-	-	1701.6
	inch	27.56	68.70	15.91	31.50	-	-	19.69	24.80	29.92	68.07	-	-	66.99

Frame		H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Ø1	Ø2	Ø3
H2	mm	1346.6	51.0	38.0	65.0	204.0	68.0	137.0	13.0	26.5	25.0	-	-	-
	inch	53.02	2.01	1.50	2.56	8.03	2.68	5.39	0.51	1.04	0.98	-	-	-



## Frame H



**MODEL**  
**FRAME\_H3**  
VFD2800C43E  
VFD3150C43E  
VFD3550C43E


Unit : mm[inch]

Frame		W	H	D	W1	W2	W3	W4	W5	W6	H1	H2	H3	H4
H3	mm	700.0	1745.0	404.0	800.0	-	-	500.0	630.0	760.0	1729.0	-	-	1701.6
	inch	27.56	68.70	15.91	31.50	-	-	19.69	24.80	29.92	68.07	-	-	66.99


Frame	H5	D1	D2	D3	D4	D5	D6	S1	S2	S3	Ø1	Ø2	Ø3	
H3	mm	1346.6	51.0	38.0	65.0	204.0	68.0	137.0	13.0	26.5	25.0	22.0	34.0	117.5
	inch	53.02	2.01	1.50	2.56	8.03	2.68	5.39	0.51	1.04	0.98	0.87	1.34	4.63

# Option Cards


## EMC-PG01L

 Set by Pr.10-00~10-02	Terminals		Descriptions
	PG1	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
		DCM	Common for power and signal
		A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal (Line Driver) It can be 1-phase or 2-phase input; Max. input frequency: 300kP/sec
	PG2	A2, /A2, B2, /B2	Pulse input signal (Line Driver or Open Collector) Open collector input: +5V/+12V (Note1) It can be 1-phase or 2-phase input; Max. input frequency: 300kP/sec.
	PG OUT	AO, /AO, BO, /BO, ZO, /ZO, SG	PG card output signals. It has division frequency function: 1~255 times Max. output voltage for Line driver: 5Vdc Max. output current: 50mA; Max. output frequency: 300kP/sec SG: The GND of PG card is the same as the host controller or PLC, so a common output signal is attained.

## EMC-PG01O


 Set by Pr.10-00~10-02	Terminals		Descriptions
	PG1	VP	Output voltage for power: +5V/+12V±5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
		DCM	Common for power and signal
		A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal (Line Driver or Open Collector) Open collector input: +5V/+12V (Note1) It can be 1-phase or 2-phase input; Max. input frequency: 300kP/sec
	PG2	A2, /A2, B2, /B2	Pulse input signal (Line Driver or Open Collector) Open collector input: +5V/+12V (Note1) It can be 1-phase or 2-phase input; Max. input frequency: 300kP/sec.
	PG OUT	V+, /V+	Needs external power source for PG OUT circuit. Input voltage of power: +12V ~ +24V
		V-	Negative power supply input
		A/O, B/O, Z/O	PG card output signals. It has division frequency function: 1~255 times Add a pull-up resistor to the open collector output signals to avoid signal interferences. [Three pull-up resistors are included in the package (1.8kΩ/1W)] Max. Output current: 20mA; Max output frequency: 300KP/Sec

## EMC-PG01R

 Set by Pr.10-00~10-02	Terminals		Descriptions
	PG1	R1- R2	Resolver output power 7Vrms, 10kHz
		S1, S2, S3, S4,	Resolver input signal 3.5±0.175Vrms, 10kHz
	PG2	A2, /A2, B2, /B2	Pulse input signal (Line Driver or Open Collector) Open collector input: +5V/+12V (Note1) It can be 1-phase or 2-phase input; Max. input frequency: 300kP/sec.
	PG OUT	AO, /AO, BO, /BO, ZO, /ZO, SG	PG card output signals. It has division frequency function: 1~255 times Max. output voltage for Line driver: 5Vdc Max. output current: 50mA Max. output frequency: 300kP/sec SG: The GND of PG card is the same as the host controller or PLC, so a common output signal is attained.

## EMC-PG01U

■ FJMP1  : Standard UVW Output Encoder;  : Delta Encoder

 Set by Pr.10-00~10-02	Terminals		Descriptions
	PG1	VP	Output voltage for power: +5V/+12V5% (use FSW3 to switch +5V/+12V) Max. output current: 200mA
		DCM	Common for power and signal
		A1, /A1, B1, /B1, Z1, /Z1	Encoder input signal (Line Driver) 1-phase or 2-phase input. Max. input frequency: 300kP/sec
		U1, /U1, V1, /V1, W1, /W1	Encoder input signal
	PG2	A2, /A2 B2, /B2	Pulse Input signal Open collector input: +5V/+12V (Note1) 1-phase or 2-phase input; Max. input frequency: 300kP/sec.
	PG OUT	AO, /AO, BO, /BO, ZO, /ZO, SG	PG card output signals. Division frequency function: 1~255 times Max. output voltage for Line driver: 5Vdc Max. output current: 50mA Max. output frequency: 300kP/sec SG: The GND of PG card is the same as the host controller or PLC, so a common output signal is attained.

Note 1: For the Open Collector, set input voltage to 5~15mA and install a pull-up resistor

【5V】 Recommended pull-up resistor: 100~220Ω · 1/2W and above

【12V】 Recommended pull-up resistor: 510~1.35kΩ · 1/2W and above

【24V】 Recommended pull-up resistor: 1.8k~3.3kΩ · 1/2W and above


## Screw Specifications for Option Card Terminals

EMC-D42A / EMC-D611A EMC-BPS01	Wire gauge	24~12AWG ( 0.205~3.31mm <sup>2</sup> )
	Torque	4Kg-cm [3.47lb-in]
EMC-R6AA	Wire gauge	24~16AWG ( 0.205~1.31mm <sup>2</sup> )
	Torque	6Kg-cm [5.21lb-in]
EMC-PG01L / EMC-PG01O EMC-PG01R / EMC-PG01U	Wire gauge	30~16AWG ( 0.0509~1.31mm <sup>2</sup> )
	Torque	2Kg-cm [1.74lb-in]




# Option Cards


## EMC-D42A

 <p>I/O Extension Card</p>	Terminals	Descriptions
	COM	Common for multi-function input terminals Select SINK (NPN) /SOURCE (PNP) in J1 jumper / external power supply
	MI10~ MI13	Refer to parameters 02-26~02-29 to program the multi-function inputs MI10~MI13. Internal power is applied from terminal E24: +24Vdc $\pm$ 5% 200mA, 5W External power +24Vdc: max. voltage 30Vdc, min. voltage 19Vdc, 30W ON: the activation current is 6.5mA; OFF: leakage current tolerance is 10iA
	MO10~MO11	Multi-function output terminals (photocoupler) Duty-cycle: 50%; Max. output frequency: 100Hz Max. current: 50mA; Max. voltage: 48Vdc
	MXM	Common for multi-function output terminals MO10, MO11(photocoupler) Max 48Vdc 50mA


## EMC-D611A

 <p>I/O Extension Card</p>	Terminals	Descriptions
	AC	AC power common for multi-function input terminal (Neutral)
	MI10~ MI15	Refer to Pr. 02.26~ Pr. 02.31 for multi-function input selection Input voltage: 100~130VAC; Input frequency: 57~63Hz Input impedance: 27Kohm Terminal response time: ON: 10ms; OFF: 20ms

## EMC-R6AA

 <p>Relay Extension Card</p>	Terminals	Descriptions
	RA10~RA15 RC10~RC15	Refer to Pr. 02.36~ Pr. 02.41 for multi-function input selection Resistive load: 5A(N.O.)/250VAC 5A(N.O.)/30Vdc Inductive load (COS 0.4) 2.0A(N.O.)/250VAC 2.0A(N.O.)/30Vdc It is used to output each monitor signal, such as for drive in operation, frequency attained or overload indication.

## EMC-BPS01

 <p>External Power Supply Card</p>	Terminals	Descriptions
	24V GND	Input power: 24V $\pm$ 5% Maximum input current:0.5A Note: (1) Do not connect the control terminal +24V (Digital control signal common: SOURCE) directly to the EMC-BPS01 input terminal 24V. (2) Do not connect control terminal GND directly to the EMC-BPS01 input terminal GND.

## CMC-MOD01



### Features

- MDI/MDI-X auto-detect
- Virtual serial port.
- Supports MODBUS TCP protocol
- AC motor drive keypad/Ethernet configuration
- E-mail alarm
- Baud rate: 10/100Mbps auto-detect

### Network Interface

Interface	RJ-45 with Auto MDI/MDIX	Transmission speed	10/100 Mbps Auto-Detect
Number of ports	1 Port	Network protocol	ICMP, IP, TCP, UDP, DHCP, SMTP, MODBUS OVER TCP/IP, Delta Configuration
Transmission method	IEEE 802.3, IEEE 802.3u		
Transmission cable	Category 5e shielding 100M		

## CMC-EIP01



### Features

- MDI/MDI-X auto-detect
- Supports MODBUS TCP and Ethernet/IP protocol
- Baud rate: 10/100Mbps auto-detect
- AC motor drive keypad/Ethernet configuration
- Virtual serial port

### Network Interface

Interface	RJ-45 with Auto MDI/MDIX
Number of ports	1 Port
Transmission method	IEEE 802.3, IEEE 802.3u
Transmission cable	Category 5e shielding 100M

Transmission speed	10/100 Mbps Auto-Detect
Network protocol	ICMP, IP, TCP, UDP, DHCP, SMTP, MODBUS OVER TCP/IP, Delta Configuration

## CMC-PD01



### Features

- Supports PZD control data exchange.
- Supports PKW polling AC motor drive parameters.
- Supports user diagnosis function.
- Auto-detects baud rates; supports Max. 12Mbps.

### PROFIBUS DP Connector

Interface	DB9 connector
Transmission method	High-speed RS-485
Transmission cable	Shielded twisted pair cable
Electrical isolation	500VDC

### Communication

Message type	Cyclic data exchange
Module name	CMC-PD01
GSD document	DELA08DB.GSD
Company ID	08DB (HEX)
Serial transmission speed supported (auto-detection)	9.6kbps; 19.2kbps; 93.75kbps; 187.5kbps; 125kbps; 250kbps; 500kbps; 1.5Mbps; 3Mbps; 6Mbps; 12Mbps (bits per second)

## CMC-DN01



### Features

- Based on the high-speed communication interface of Delta HSSP protocol, able to conduct immediate control of AC motor drive.
- Supports Group 2 only connection and polling I/O data exchange.
- For I/O mapping, supports Max. 32 words of input and 32 words of output.
- Supports EDS file configuration in DeviceNet configuration software.
- Supports all baud rates on DeviceNet bus: 125kbps, 250kbps, 500kbps and extendable serial transmission speed mode.
- Node address and serial transmission speed can be set up on AC motor drive.
- Power supplied from AC motor drive.

### DeviceNet Connector

Interface	5-PIN open removable connector. Of 5.08mm PIN interval
Transmission method	CAN
Transmission cable	Shielded twisted pair cable (with 2 power cables)
Transmission speed	125kbps, 250kbps, 500kbps and extendable serial transmission speed mode
Network protocol	DeviceNet protocol

### AC Motor Drive Connection Port

Interface	50 PIN communication terminal
Transmission method	SPI communication
Terminal function	1. Communicating with AC motor drive 2. Transmitting power supply from AC motor drive
Communication protocol	Delta HSSP protocol



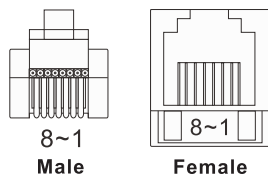
# Option Cards

## EMC-COP01

Built-in EMC-COP01 card are available for VFDXXXC23E and VFDXXXC43E.



### RJ-45 Pin definition



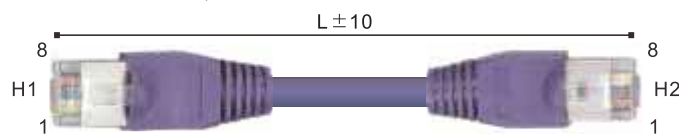
Pin	Pin name	Definition
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	Ground/0V/V-
6	CAN_GND	Ground/0V/V-

### Specification

Interface	RJ-45
Number of ports	1 Port
Transmission method	CAN
Transmission cable	CAN standard cable
Transmission speed	1M 500k 250k 125k 100k 50k
Communication protocol	CANopen

## CANopen Communication Cable

Model: TAP-CB03, TAP-CB04



Title	Part No.	L	
		mm	inch
1	TAP-CB03	500 ± 10	19 ± 0.4
2	TAP-CB04	1000 ± 10	39 ± 0.4

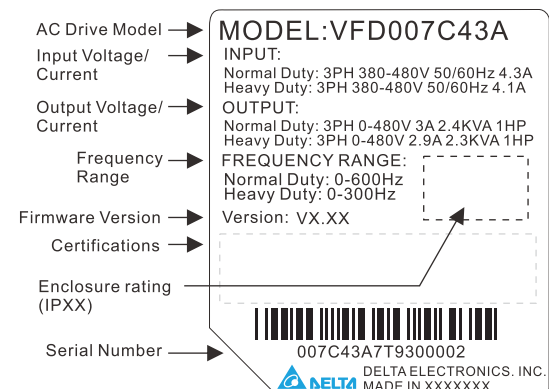
## Digital Keypad Accessories: RJ45 Extension Leads and CMC-EIP01 Cables

Applicable Models : CBC-K3FT 、CBC-K5FT 、CBC-K7FT 、CBC-K10F 、CBC-K16FT

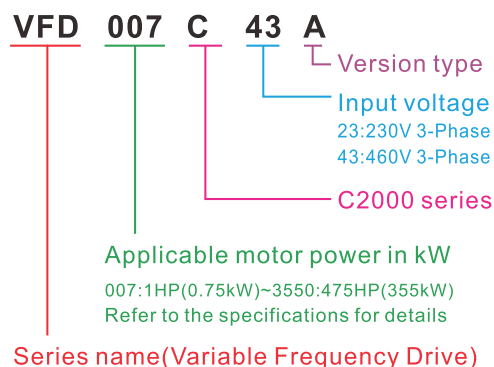
Title	Part No.	Explanation
1	CBC-K3FT	RJ45 extension lead, 3 feet (approximately 0.9m)
2	CBC-K5FT	RJ45 extension lead, 5 feet (approximately 1.5m)
3	CBC-K7FT	RJ45 extension lead, 7 feet (approximately 2.1m)
4	CBC-K10FT	RJ45 extension lead, 10 feet (approximately 3m)
5	CBC-K16FT	RJ45 extension lead, 16 feet (approximately 4.9m)

# Ordering information

## Nameplate



## Model name



## Ordering information

<b>Frame A</b> 	<b>230V :</b> ND : 0.75~3.7kW HD : 0.4~2.2kW  <b>460V :</b> ND : 0.75~5.5kW HD : 0.4~4.0kW	VFD007C23A VFD037C23A VFD007C43A/E VFD015C43A/E VFD037C43A/E VFD040C43A/E VFD055C43A/E  VFD015C23A/E VFD022C23A/E VFD022C43A/E
<b>Frame B</b> 	<b>230V :</b> ND : 5.5~11kW HD : 3.7~7.5kW  <b>460V :</b> ND : 7.5~15 kW HD : 5.5~11kW	VFD055C23A VFD075C23A VFD110C23A/E VFD075C43A/E VFD110C43A/E VFD150C43A/E
<b>Frame C</b> 	<b>230V :</b> ND : 15~22 kW HD : 11~18.5 kW  <b>460V :</b> ND : 18.5~30 kW HD : 15~22 kW	VFD150C23A VFD185C23A VFD220C23A VFD185C43A/E VFD220C43A/E VFD300C43A/E
<b>Frame D</b> 	<b>230V :</b> ND : 30~37 kW HD : 20~30 kW  <b>460V :</b> ND : 37~75 kW HD : 30~45 kW	VFD300C23A VFD370C23A VFD370C43A VFD450C43A VFD550C43A VFD750C43A VFD370C43S VFD450C43S  VFD300C23E VFD370C23E VFD370C43E VFD450C43E VFD550C43E VFD750C43E VFD370C43U VFD450C43U
<b>Frame E</b> 	<b>230V :</b> ND : 45~75 kW HD : 37~55 kW  <b>460V :</b> ND : 90~110 kW HD : 55~90 kW	VFD450C23A/E VFD550C23A/E VFD900C43A/E VFD1100C43A/E VFD750C23A/E
<b>Frame F</b> 	<b>230V :</b> ND : 90 kW HD : 75kW  <b>460V :</b> ND : 132~160 kW HD : 110~132 kW	VFD900C23A/E VFD1320C43A/E VFD1600C43A/E
<b>Frame G</b> 	<b>460V :</b> ND : 185~220 kW HD : 160~185 kW	VFD1850C43A/E VFD2200C43A/E
<b>Frame H</b> 	<b>460V :</b> ND : 280~355 kW HD : 220~315 kW	VFD2800C43A/E VFD3150C43A/E VFD3550C43A/E



NOTE: Model VFD007C43E~VFD300C43E will be available for ordering soon.



## Attention

### Standard Motors

**Used with 400V Standard Motors**  
It is recommended to add an AC output reactor when using with a 400V standard motor to prevent damage to motor insulation.

#### Torque Characteristics and Temperature Rise

When a standard motor is drive controlled, the motor temperature will be higher than with DOL operation.  
Please reduce the motor output torque when operating at low speeds to compensate for less cooling efficiency.  
For continuous constant torque at low speeds, external forced motor cooling is recommended.

#### Vibration

When the motor drives the machine, resonances may occur, including machine resonances.  
Abnormal vibration may occur when operating a 2-pole motor at 60Hz or higher.

#### Noise

When a standard motor is drive controlled, the motor noise will be higher than with DOL operation.  
To lower the noise, please increase the carrier frequency of the drive. The motor fan can be very noisy when the motor speed exceeds 60Hz.

### Special Motors

#### High-speed Motor

To ensure safety, please try the frequency setting with another motor before operating the high-speed motor at 120Hz or higher.

#### Explosion-proof Motor

Please use a motor and drive that comply with explosion-proof requirements.

#### Submersible Motor & Pump

The rated current is higher than that of a standard motor.  
Please check before operation and select the capacity of the AC motor drive carefully.  
The motor temperature characteristics differ from a standard motor, please set the motor thermal time constant to a lower value.

#### Brake Motor

When the motor is equipped with a mechanical brake, the brake should be powered by the mains supply.  
Damage may occur when the brake is powered by the drive output. Please DO NOT drive the motor with the brake engaged.

#### Gear Motor

In gearboxes or reduction gears, lubrication may be reduced if the motor is continuously operated at low speeds.  
Please DO NOT operate in this way.

#### Synchronous Motor

These motors need suitable software for control. Please contact Delta for more information.

#### Single-phase Motor

Single-phase motors are not suitable for being operated by an AC Motor Drive. Please use a 3-phase motor instead when necessary.

### Environmental Conditions

#### Installation Position

1. The drive is suitable for installation in a place with ambient temperature from -10 to 50°C.
2. The surface temperature of the drive and brake resistor will rise under specific operation conditions. Therefore, please install the drive on materials that are noncombustible.
3. Ensure that the installation site complies with the ambient conditions as stated in the manual.

### Wiring

#### Limit of Wiring Distance

For the remote operation, please use twist-shielding cable and the distance between the drive and control box should be less than 20m.

#### Maximum Motor Cable Length

Motor cables that are too long may cause overheating of the drive or current peaks due to stray capacitance.  
Please ensure that the motor cable is less than 30m.  
If the cable length can't be reduced, please lower the carrier frequency or use an AC reactor.

#### Choose the Right Cable

Please refer to current value to choose the right cable section with enough capacity or use recommended cables.

#### Grounding

Please ground the drive completely by using the grounding terminal.

### How to Choose the Drive Capacity

#### Standard Motor

Please select the drive according to applicable motor rated current listed in the drive specification.

Please select the next higher power AC drive in case higher starting torque or quick acceleration/deceleration is needed.

#### Special Motor

Please select the drive according to: Rated current of the drive > rated current of the motor

### Transportation and Storage

Please transport and store the drive in a place that meets environment specifications.

### Peripheral Equipment

#### Molded-Case Circuit Breakers (MCCB)

Please install the recommended MCCB or ELCB in the main circuit of the drive and make sure that the capacity of the breaker is equal to or lower than the recommended one.

#### Add a Magnetic Contactor(MC) in the Output Circuit

When a MC is installed in the output circuit of the drive to switch the motor to commercial power or other purposes, please make sure that the drive and motor are completely stopped and remove the surge absorbers from the MC before switching it.

#### Add a Magnetic Contactor (MC) in the Input Circuit

Please only switch the MC ONCE per hour or it may damage the drive. Please use RUN/STOP signal to switch many times during motor operation.

#### Motor Protection

The thermal protection function of the drive can be used to protect the motor by setting the operation level and motor type (standard motor or variable motor).  
When using a high-speed motor or a water-cooled motor the thermal time constant should be set to a lower value.

When using a longer cable to connect the motor thermal relay to a motor, high-frequency currents may enter via the stray capacitance.  
It may result in malfunctioning of the relay as the real current is lower than the setting of thermal relay. Under this condition, please lower the carrier frequency or add an AC reactor to solve this.

#### DO NOT Use Capacitors to Improve the Power Factor

Use a DC reactor to improve the power factor of the drive. Please DO NOT install power factor correction capacitors on the main circuit of the drive to prevent motor faults due to over current.

#### Do NOT Use Surge Absorber

Please DO NOT install surge absorbers on the output circuit of the drive.

#### Lower the Noise

To ensure compliance with EMC regulations, usually a filter and shielded wiring is used to lower the noise.

#### Method Used to Reduce the Surge Current

Surge currents may occur in the phase-lead capacitor of the power system, causing an overvoltage when the drive is stopped or at low loads.

It is recommended to add a DC reactor to the drive.

[illegible]



Smarter. Greener. Together.

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