

Adjustable Frequency Drives

Contents

<i>Description</i>	<i>Page</i>
NFX9000 Drives	40-2
MVX9000 Drives	
Open Drives	40-8
Enclosed Drives	40-16
SLX9000 Drives	
Open Drives	40-27
Enclosed Drives	40-37
SVX9000 Drives	
Product Family Overview	40-49
Open Drives	40-51
Enclosed Drives	40-85
VFD Pump Panels	40-112
SPX9000 Drives	40-132
HVX9000 Drives	
Open Drives	40-167
IntelliPass/IntelliDisconnect Drives	40-195
CFX9000 Drives	40-210
CPX9000 Drives	40-240
LCX9000 Liquid Cooled Drives	40-262
SPA9000/SPI9000/SPN9000 Common DC Bus Drive Products	40-280



Contents

Description	Page
NFX9000 Drives	
Product Description	40-2
Features and Benefits	40-2
Technical Data and Specifications	40-3
Wiring Diagrams	40-4
Dimensions	40-6
Catalog Number Selection	40-7
Product Selection	40-7



Model NFX9000

Product Description

Cutler-Hammer® NFX9000 adjustable frequency AC Drives from Eaton's electrical business are designed to provide adjustable speed control of three-phase motors. These micro-processor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The NFX9000 volts-per-hertz product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the NFX9000 make it ideal for hassle free installation where size is a primary concern.

Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 2 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1/2 hp size range.

The standard drive includes a digital display, operating and programming keys on the keypad.

The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. The drives feature RS-485 serial communications.

Features and Benefits

Table 40-1. Features and Benefits

Feature	Customer Benefit
V/Hz Control.	Provides 150% starting torque and advanced low speed control.
Clearly laid out and easy to understand keypad with 4-character LED display, 4 status indicating LEDs, speed potentiometer, and 5 function keys.	Most informative operator's interface in this class of VFD, provided as standard. All parameters, diagnostic information and metering values are displayed with a bright 4-character LED display.
1 analog input 4 programmable, intelligent digital inputs 1 programmable relay	Provide enhanced application flexibility.
Serial communication port (RS-485).	Direct connection to serial communications networks.
Single-phase or three-phase input capability on 115/240V AC rated units.	Operate three-phase motor with single-phase supply.

Technical Data and Specifications

Output Ratings

- Horsepower;
 - 90V – 132V, 1/4 – 1/2 hp
 - 200 – 240V, 1/2 – 2 hp
- Frequency Range: 0.1 – 400 Hz
- Overload Rating: 150% for 60 seconds
- Frequency Resolution:
 - Digital: 0.1 Hz
- Frequency Accuracy
 - Digital: $\pm 0.01\%$ of max. frequency
 - Analog: $\pm 0.2\%$ of max. frequency
- Undervoltage Carryover Limit: 0.3 to 25 seconds

Motor Performance

- Motor Control: V/Hz
- Constant Torque: Standard
- Speed Regulation: 0.5% of base speed

Input Power

- Voltage at 50/60 Hz ± 3 Hz
 - 100V – 120V, -10% +10% / 1-phase
 - 200V – 240V, -10% +5% / 1-phase
 - 200V – 240V, -10% +5% / 3-phase
- Displacement Power Factor: Better than 0.95
- Efficiency: Typically greater than 95%

Design Type

- Microprocessor: 32-Bit
- Converter Type: Diode
- Inverter Type: Insulated Gate Bipolar Transistor
- Waveform: PWM Volts/Hertz

Environment

- Operating Temperature:
 - -10°C to +40°C
- Humidity: 20 to 90% non-condensing
- Maximum Elevation: 1000 meters (3300 ft.)

Codes and Standards

- NEMA, IEEE, NEC: Design Standards
- UL Listed
- cUL Listed
- CE Marked

Enclosure

- Standard: Protected Chassis (IP20)

Protective Features

- Ground Fault: Standard
- Overload Protection: Standard
- Overcurrent: Standard
- Overvoltage: Standard
- Undervoltage: Standard
- Overtemperature: Standard
- Overload Limit: Standard

Set Up Adjustments, Performance Features, Operator Control and External Interface

Keypad

- Alphanumeric Display: Standard, 1 x 4 character
- Digital Indications: RUN/STOP and FORWARD/REVERSE
- Diagnostics: Last 3 trips with cause
- LED Status Indicators: 4 (RUN/STOP and FORWARD/REVERSE)
- Operator Functions: RUN/STOP, Speed control (digital or potentiometer), RESET, MODE Keys and ENTER.

I/O Terminal Block

- Analog Inputs:
 - 1 Input: 0 – 10V DC, 4 – 20 mA
 - Potentiometer: 1K ohm to 2K ohm
 - Analog Voltage: Nominal 10V DC (10K ohm input impedance)
 - Analog Current: Nominal 4 – 20 mA (250 ohm)
- Digital Inputs: 4 Programmable Inputs
- Digital Outputs: 1 Form A Relay contact

Programmable Parameters

- Out of the Box: Factory settings loaded for quick start-up.
- Accel. and Decel.: 2 separately adjustable Linear or S Curve times: 0.1 – 600 seconds
- DC Injection Braking
- External Fault: Terminal input
- Jog: Terminal input
- Fault Reset: STOP/RESET or terminal input
- I/O: NO/NC Selectable
- Jump Frequencies: 3 (with adjustable width)
- Parameter Security: Programmable software lock
- Preset Speeds: 2 preset speeds
- Reversing: Keypad or terminal
- Speed Setting: Keypad, terminal or pot
- RUN/STOP Control: Keypad or terminal
- Stop Modes: Decel, coast or DC injection

Reliability

- Pretested Components: Standard
- Surface Mount Technology: Standard (PCBs)
- Computerized Testing: Standard
- Final Test with Full Load: Standard
- Eaton's Cutler-Hammer Engineering Systems and Service: National network of AF drive specialists

Table 40-2. Watts Loss

Horsepower	Catalog Number	Volts	Watts Loss
			9 kHz
1/4 1/2	NFXF25A0-1 NFXF50A0-1	115V AC	20W 20W
1/4 1/2 1 2	NFXF25A0-2 NFXF50A0-2 NFX001A0-2 NFX002A0-2	230V AC	20W 20W 38W 75W

Wiring Diagrams

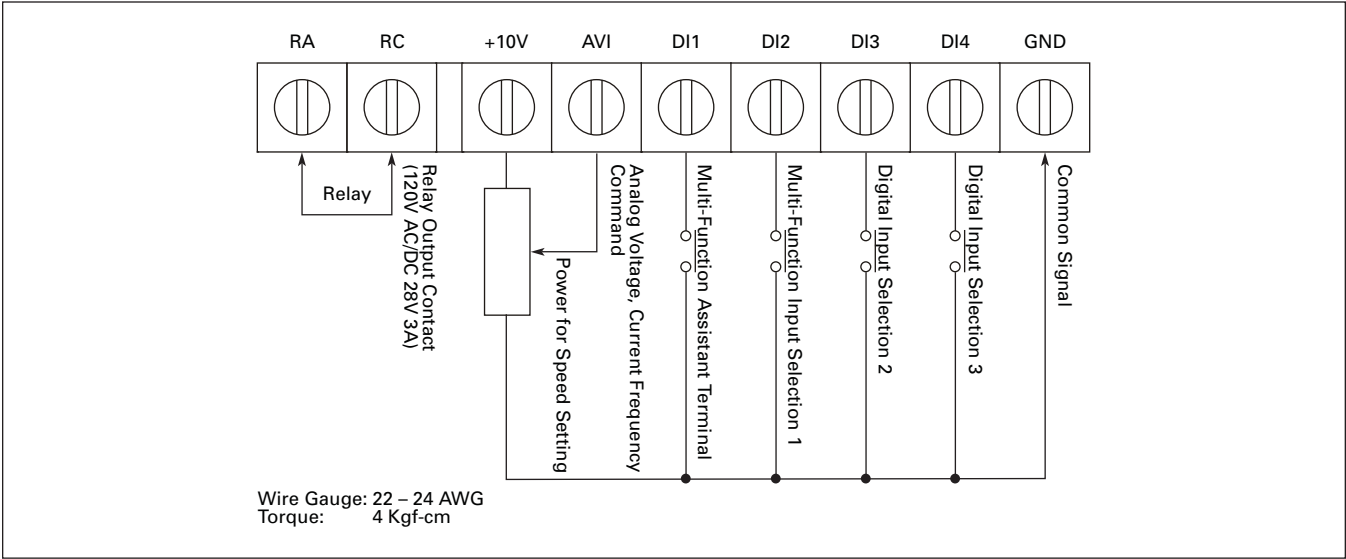


Figure 40-1. Control Terminal Wiring (Factory Settings)

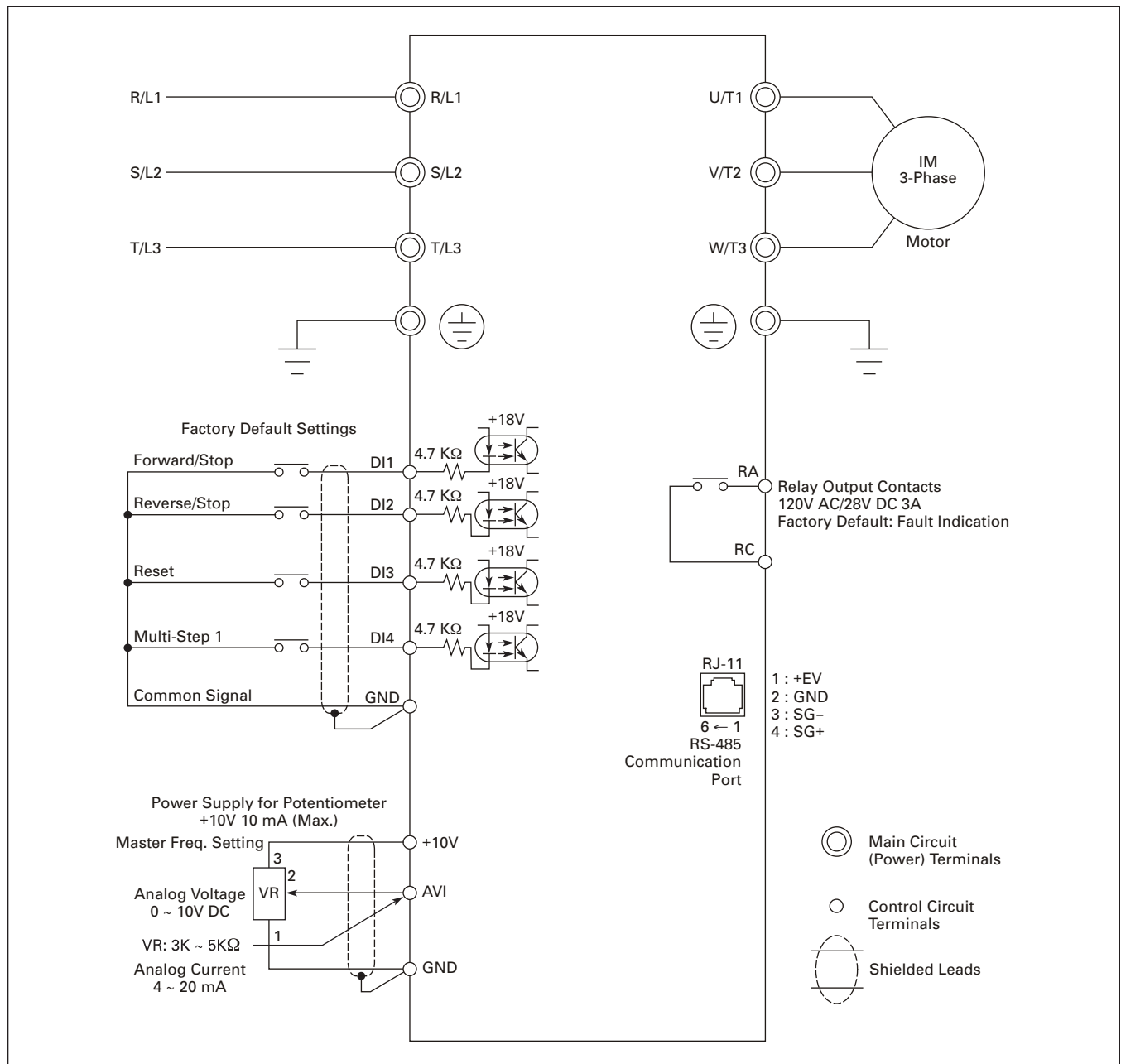


Figure 40-2. Basic Wiring Diagram

Note: Do not plug a modem or telephone line to the RS-485 communication port, permanent damage may result. Terminals 1 and 2 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

- Use power terminals R/L1 and S/L2 for single-phase connection to models: NFXF25A0-1, NFXF50A0-1, NFXF25A0-2, NFXF50A0-2 or NFX001A0-2.
- Use power terminals R/L1, S/L2 and T/L3 for three-phase connection to models: NFXF25A0-2, NFXF50A0-2, NFX001A0-2 or NFX002A0-2.
- Single-phase power must not be used for model NFX002A0-2.

Dimensions

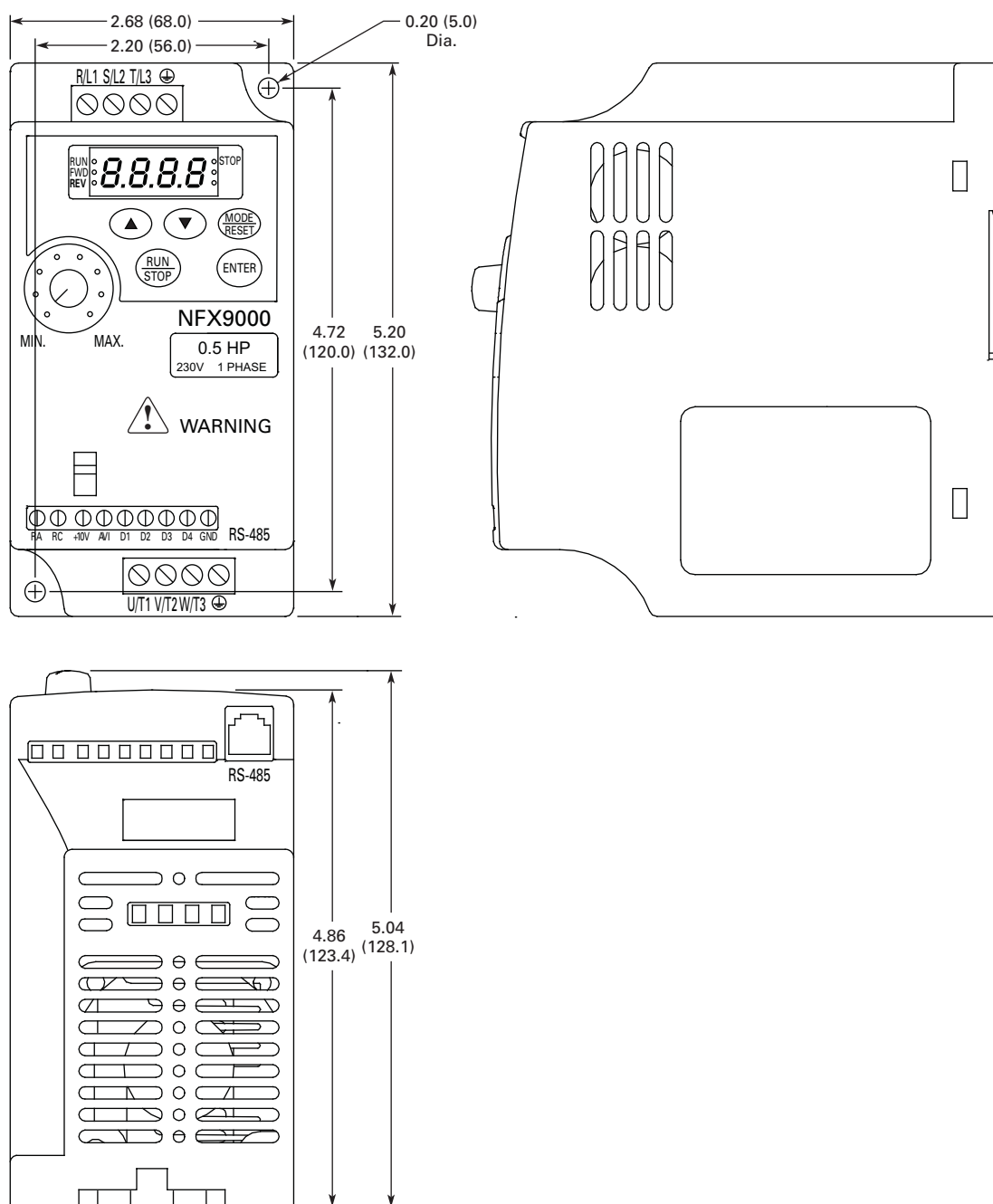
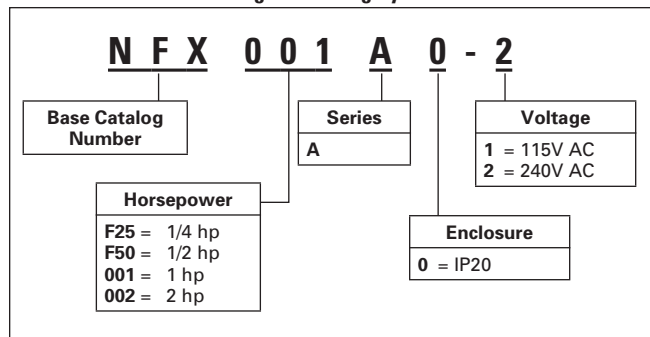


Figure 40-3. 1/4 to 2 hp Drive Approximate Dimensions in Inches (mm)

Catalog Number Selection

Table 40-3. NFX9000 Catalog Numbering System



Product Selection

Table 40-4. NFX9000 Basic Controller IP20

Description		Input Ampere Single-/ Three-Phase Rating	Continuous Output Amp Rating	Catalog Number	Price U.S. \$
hp ^①	Volts ^②				
1/4 1/2	90 – 130	6.0/— 9.0/—	1.6 2.5	NFXF25A0-1 NFXF50A0-1	
1/4 1/2 1 2	200 – 240	4.9/— 6.5/— 9.7/— —/9.0	1.6 2.5 4.2 7	NFXF25A0-2 NFXF50A0-2 NFX001A0-2 NFX002A0-2	

- ① Horsepower ratings are based on the use of a 240V or 480V NEMA B, 4- or 6-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the NFX9000 rated continuous output current.
- ② For 208V, 380V or 415V applications, select the unit such that the motor current is less than or equal to the NFX9000 rated continuous output current.

Contents

Description	Page
MVX9000 Open Drives	
Product Description	40-8
Features and Benefits	40-8
Technical Data and Specifications	40-9
Wiring Diagrams	40-10
Dimensions	40-12
Catalog Number Selection	40-15
Product Selection	40-15
Options	40-15

Product Description

Cutler-Hammer® MVX9000 sensorless vector adjustable frequency AC Drives from Eaton's electrical business are designed to provide adjustable speed control of three-phase motors. These microprocessor-based, sensorless vector drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The MVX9000 sensorless vector product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the MVX9000 make it ideal for hassle free installation where size is a primary concern.

Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 10 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/2 to 7-1/2 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1 hp size range.

The standard drive includes a digital display, operating and programming keys on a removable keypad.

The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. Other features provided as standard include built-in DC braking, RS-485 serial communications and PID control.

Features and Benefits

Table 40-5. Features and Benefits

Feature	Customer Benefit
Sensorless Vector Control with auto tuning.	Provides 200% starting torque and advanced low speed torque control.
Clearly laid out and easy to understand keypad with 4-character LED display, 7 status indicating LEDs, speed potentiometer, and 6 function keys.	Most informative operator's interface in this class of VFD, provided as standard. All parameters, diagnostic information and metering values are displayed with a bright 4-character LED display.
2 analog inputs 6 programmable, intelligent digital inputs 1 programmable digital output 1 programmable relay	Provide enhanced application flexibility.
PID control of a process variable such as pressure, flow, temperature, liquid level, etc.	Eliminates requirement for separate setpoint controller.
Built-in dynamic braking chopper.	Superior deceleration performance.
Serial communication port (RS-485).	Direct connection to serial communications networks.
Single-phase or three-phase input capability on 240V AC rated units, 3 hp and below.	Operate three-phase motor with single-phase supply.



Model MVX9000

Technical Data and Specifications

Output Ratings

- Horsepower:
 - 90 – 132V, 1/4 – 1 hp
 - 200 – 240V, 1/2 – 7-1/2 hp
 - 380 – 480V, 1 – 10 hp
 - 425 – 660V, 1 – 10 hp
- Frequency Range: 0.1 – 400 Hz
- Overload Rating: 150% for 60 seconds
- Frequency Resolution:
 - Digital: 0.1 Hz
 - Analog: Max. (Set Frequency/1000) Hz
- Frequency Accuracy
 - Digital: $\pm 0.01\%$ of max. frequency
 - Analog: $\pm 0.2\%$ of max. frequency
- Undervoltage Carryover Limit: 0.3 to 25 seconds

Motor Performance

- Motor Control: Sensorless Vector
- Constant and Variable Torque: Standard
- Speed Regulation: 0.5% of base speed

Input Power

- Voltage at 50/60 Hz ± 3 Hz
 - 100V – 120V, -10% +10% / 1-phase
 - 200V – 240V, -10% +5% / 1-phase
 - 200V – 240V, -10% +5% / 3-phase
 - 380V – 480V, -10% +10% / 3-phase
 - 500V – 600V, -15% +10% / 3-phase
- Displacement Power Factor: Better than 0.95
- Efficiency: Typically greater than 95%

Design Type

- Microprocessor: 32-Bit
- Converter Type: Diode
- Inverter Type: Insulated Gate Bipolar Transistor
- Waveform: Sensorless Vector

Environment

- Operating Temperature:
 - -10°C to +50°C
 - -10°C to +40°C (above 7-1/2 hp)
- Humidity: 20 to 90% non-condensing
- Maximum Elevation: 1000 meters (3300 ft.)

Codes and Standards

- NEMA, IEEE, NEC: Design Standards
- UL Listed
- cUL Listed
- CE Marked (Requires EMI filter)

Enclosure

- Standard: Protected Chassis (IP20)

Protective Features

- Ground Fault: Standard
- Overload Protection: Standard
- Overcurrent: Standard
- Overvoltage: Standard
- Undervoltage: Standard
- Overtemperature: Standard
- Overload Limit: Standard

Set Up Adjustments, Performance Features, Operator Control and External Interface

Keypad

- Alphanumeric Display: Standard, 1 x 4 character
- Digital Indications: Frequency (Hz), Motor Current (amps), User-Defined RUN/STOP, FORWARD/REVERSE and Parameters
- Diagnostics: Last 3 trips with cause
- LED Status Indicators: 8 (RUN/STOP, FORWARD/REVERSE, Hz, Amps, User Defined, and Input Speed)
- Operator Functions: START/STOP, Speed control (digital or potentiometer), RESET, SETUP Keys and ENTER.

I/O Terminal Block

- Analog Inputs:
 - 2 Inputs: 0 – 10V DC, 4 – 20 mA
 - Potentiometer: 1K ohm to 2K ohm
 - Analog Voltage: Nominal 10V DC (10K ohm input impedance)
 - Analog Current: Nominal 4 – 20 mA (250 ohm)
- Digital Inputs: 6 Programmable Inputs
- Digital Outputs: 1 Programmable Open collector and 1 Form C Relay contact

Analog Monitor Output:

- Analog meter – frequency or output current
- Dynamic Brake Chopper

Programmable Parameters

- Out of the Box: Factory settings loaded for quick start-up.
- Accel. and Decel.: 2 separately adjustable Linear or S Curve times: 0.1 – 3000 seconds
- Auto Restart: Overcurrent, overvoltage and undervoltage with 4 selectable retry restart modes
- DC Injection Braking
- External Fault: Terminal input
- Jog: Terminal input
- Fault Reset: STOP/RESET or terminal input
- I/O: NO/NC Selectable
- Jump Frequencies: 3 (with adjustable width)
- Parameter Security: Programmable software lock
- Preset Speeds: 7 preset speeds
- PID Controller: PID process control
- Reversing: Keypad or terminal
- Speed Setting: Keypad, terminal or pot
- START/STOP Control: Keypad or terminal
- Stop Modes: Decel, coast or DC injection

Reliability

- Pretested Components: Standard
- Surface Mount Technology: Standard (PCBs)
- Computerized Testing: Standard
- Final Test with Full Load: Standard
- Eaton's Cutler-Hammer Engineering Systems and Service: National network of AF drive specialists

Table 40-6. Heat Loss Data

Model	Watts Lost at 9 kHz	Model	Watts Lost at 9 kHz	Watts Lost at 6 kHz
MVXF25A0-1 (1-phase)	20	MVX001A0-4	38	—
MVXF50A0-1 (1-phase)	20	MVX002A0-4	75	—
MVX001A0-1 (1-phase)	38	MVX003A0-4	110	—
MVXF50A0-2 (1-phase)	20	MVX005A0-4	185	—
MVXF50A0-2 (3-phase)	20	MVX007A0-4	275	—
MVX001A0-2 (1-phase)	38	MVX010A0-4	375	—
MVX001A0-2 (3-phase)	38	MVX001A0-5	—	30
MVX002A0-2 (1-phase)	75	MVX002A0-5	—	58
MVX002A0-2 (3-phase)	75	MVX003A0-5	—	83
MVX003A0-2 (1-phase)	110	MVX005A0-5	—	132
MVX003A0-2 (3-phase)	110	MVX007A0-5	—	191
MVX005A0-2	185	MVX010A0-5	—	211
MVX007A0-2	275	—	—	—

Open Drives

Table 40-7. All Braking Resistors & Braking Units Used in AC Drives

Applicable Motor		Braking Resistor Kit P/N	Qty of Resistors in Kit & Wiring	Total Resistance and Wattage applied to MVX	Full Load Torque (kgf-m) of System	Braking Torque @ 10%ED with Kit
hp	kW					
115V Series						
1/4	.20	K13-000034-0821	1	80W 200Ω	.108	220%
1/2	.37	K13-000034-0821	1	80W 200Ω	.216	220%
1	.75	K13-000034-0821	1	80W 200Ω	.427	125%
230V Series						
1/2	.37	K13-000034-0821	1	80W 200Ω	.216	220%
1	.75	K13-000034-0821	1	80W 200Ω	.427	125%
2	1.5	K13-000034-0824	1	300W 70Ω	.849	125%
3	2.2	K13-000034-0824	1	300W 70Ω	1.262	125%
5	3.7	K13-000034-0825	1	400W 40Ω	2.080	125%
7-1/2	5.5	K13-000034-0826	2 in Parallel	500W 30Ω	3.111	125%
480V Series						
1	.75	K13-000034-0841	1	80W 750Ω	.427	125%
2	1.5	K13-000034-0843	1	300W 250Ω	.849	125%
3	2.2	K13-000034-0843	1	300W 250Ω	1.262	125%
5	3.7	K13-000034-0844	1	400W 150Ω	2.080	125%
7-1/2	5.5	K13-000034-0845	2 in Parallel	500W 100Ω	3.111	125%
10	7.5	K13-000034-0846	3 in Parallel	1000W 75Ω	4.148	125%
575V Series						
1	.75	K13-000034-0851	1	300W 400Ω	.427	125%
2	1.5	K13-000034-0851	1	300W 400Ω	.849	125%
3	2.2	K13-000034-0852	—	600W 200Ω	1.262	125%
5	3.7	K13-000034-0852	—	600W 200Ω	2.080	125%
7-1/2	5.5	K13-000034-0852	—	600W 200Ω	3.111	125%
10	7.5	K13-000034-0853	—	2000W 100Ω	4.148	125%

Wiring Diagrams

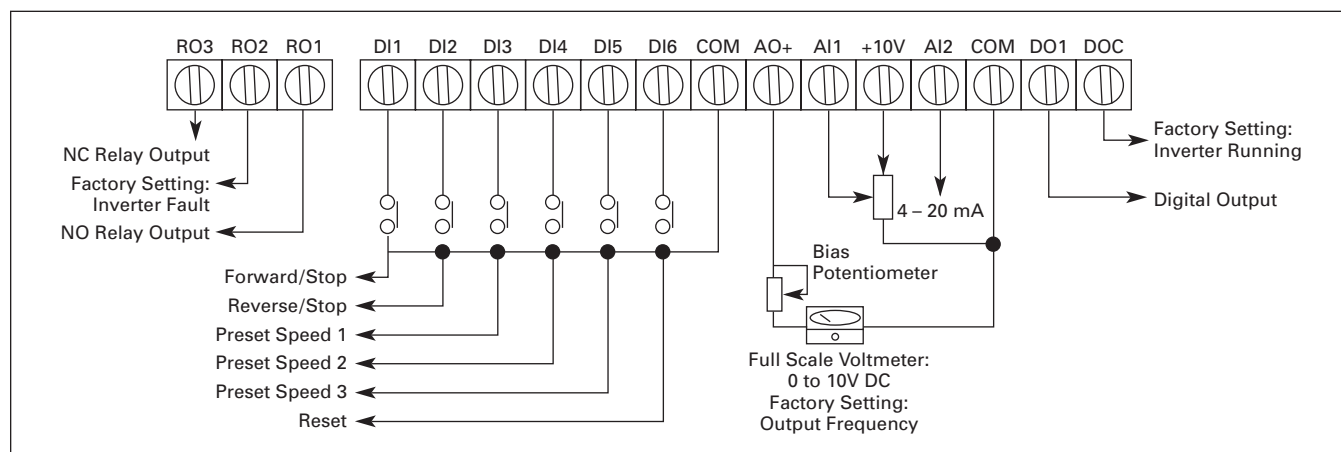
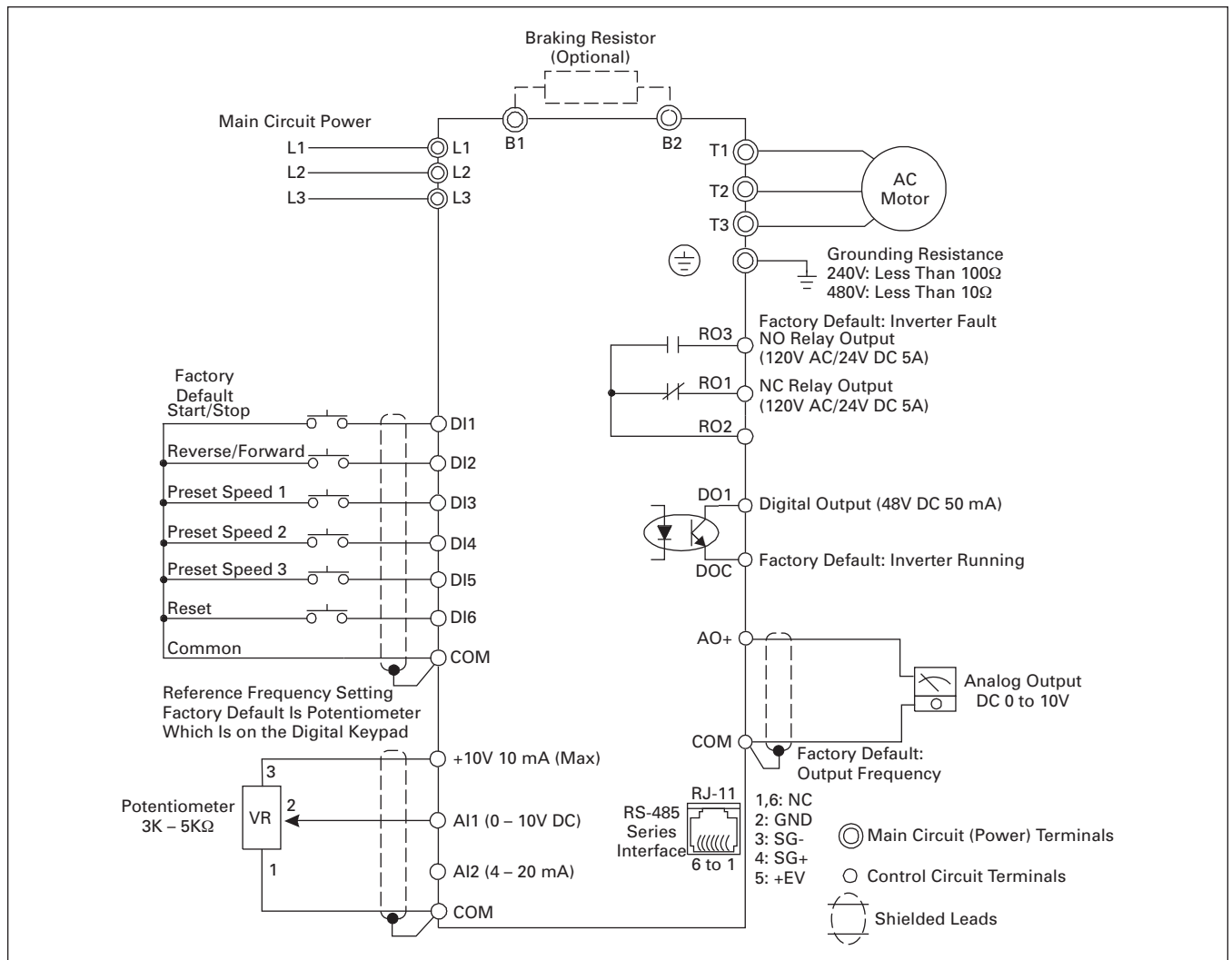


Figure 40-4. Control Terminal Wiring (Factory Settings)

Open Drives



40

Figure 40-5. Basic Wiring Diagram

Note: Do not plug a modem or telephone line to the RS-485 communication port, permanent damage may result. Terminals 2 and 5 are the power sources for the optional copy keypad and should not be used while using RS-485 communication.

■ For single-phase application select correct model, and select any of the two input terminals for main circuit power.

Open Drives

Dimensions

Table 40-8. Approximate Dimensions and Shipping Weights for Basic Controller

Description		Dimensions in Inches (mm)			Shipping Weight Lbs. (kg)
Horsepower	Volts	Width	Height	Depth	
1/4	100 – 120	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1/2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1/2	200 – 240	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
1		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		4.9 (100)	8.6 (220)	7.6 (193)	12.1 (5.5)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
1	380 – 480	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
10		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
1	500 – 600	3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
2		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
3		3.9 (100)	5.9 (151)	5.7 (145)	6.2 (2.8)
5		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
7-1/2		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)
10		4.9 (125)	8.6 (220)	7.6 (193)	12.1 (5.5)

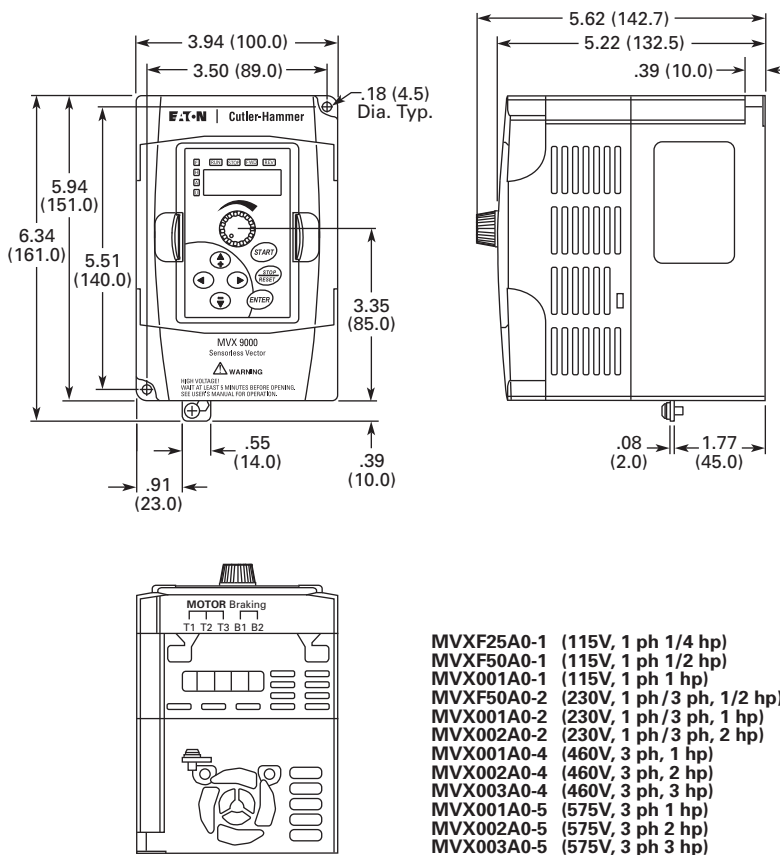


Figure 40-6. 1/4 to 3 hp Drive Approximate Dimensions in Inches (mm)

Open Drives

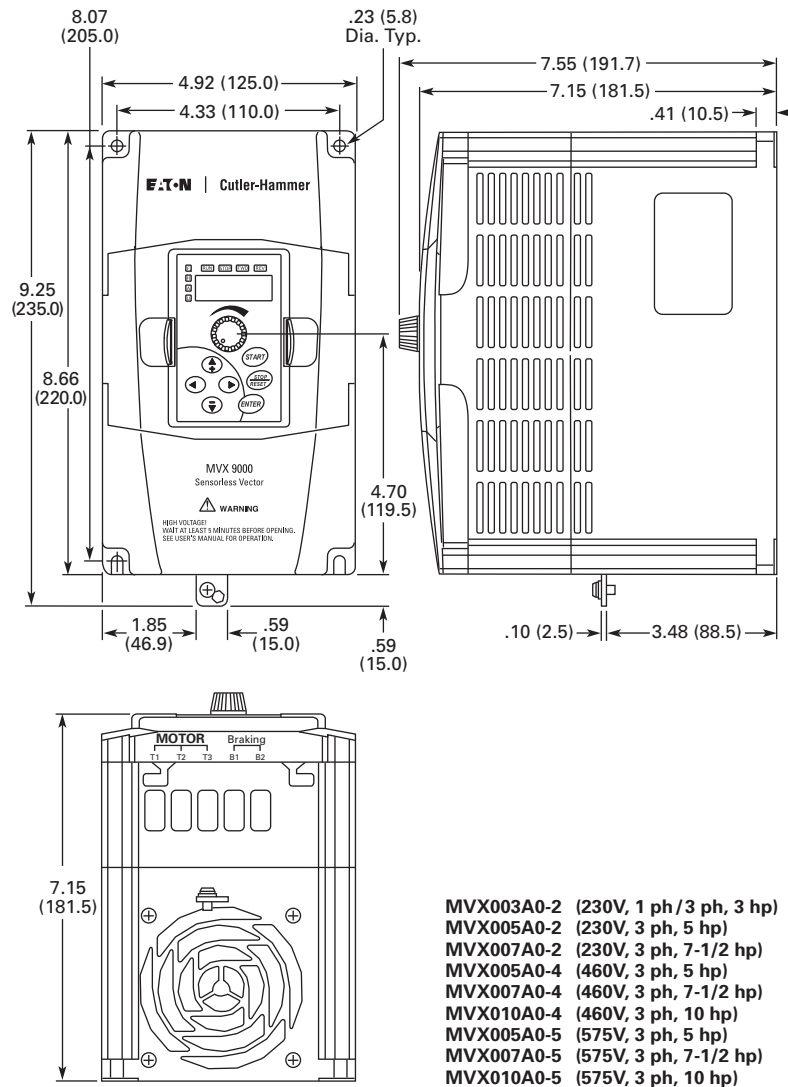


Figure 40-7. 3 to 10 hp Drive Approximate Dimensions in Inches (mm)

Open Drives

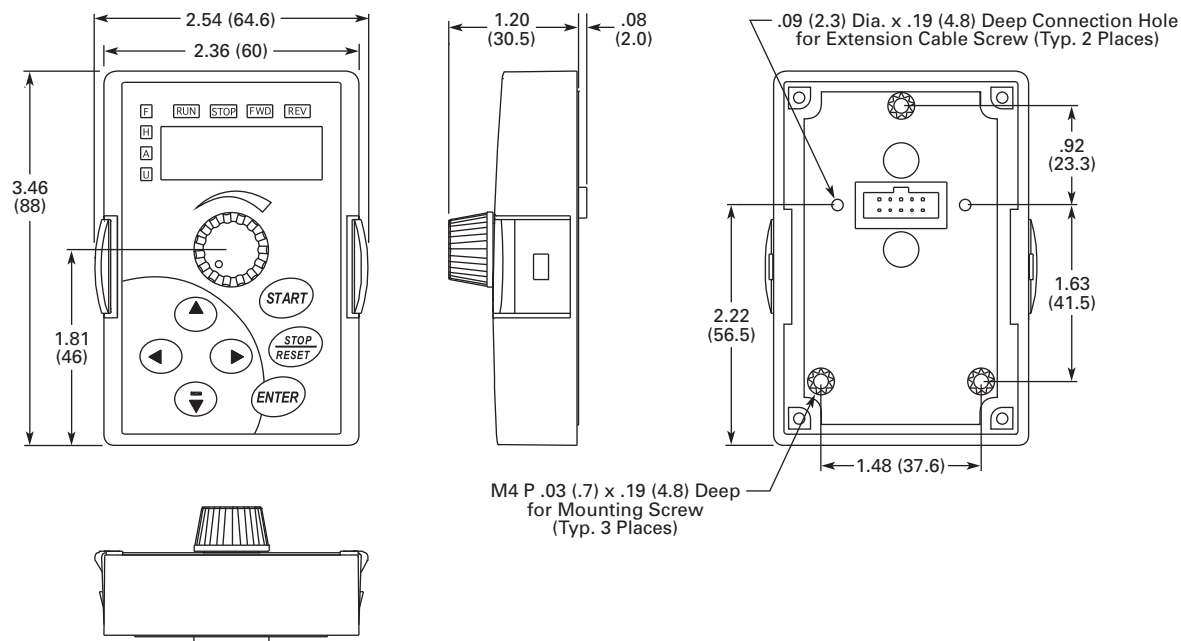


Figure 40-8. Digital Keypad Approximate Dimensions in Inches (mm)

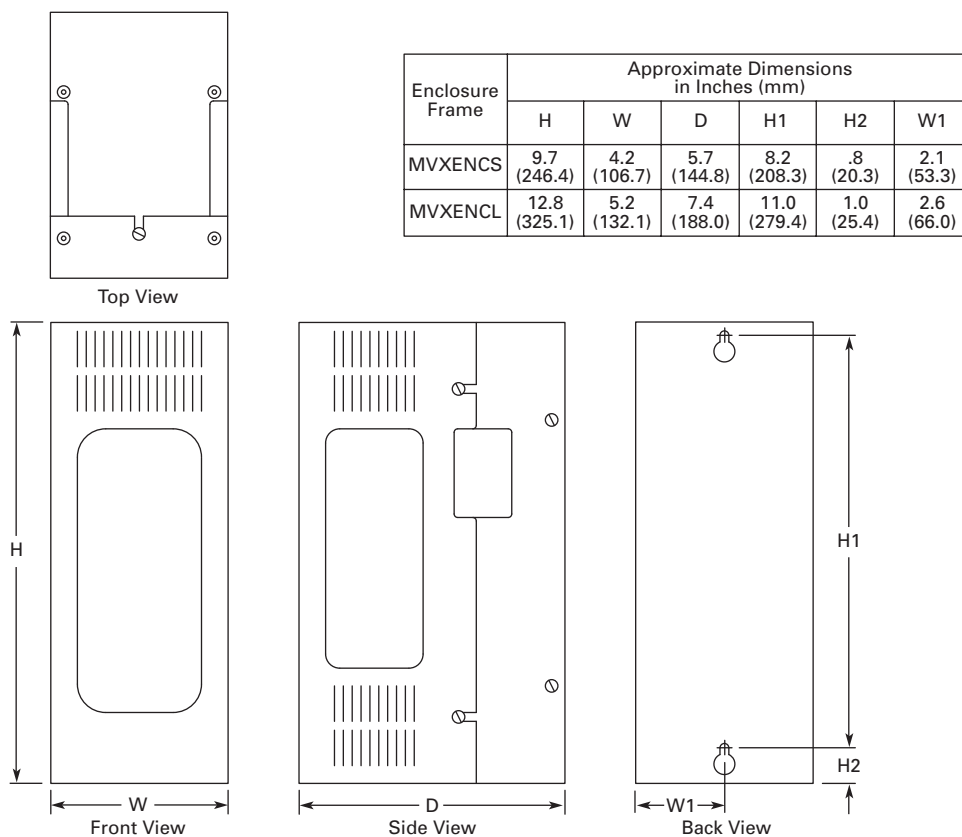
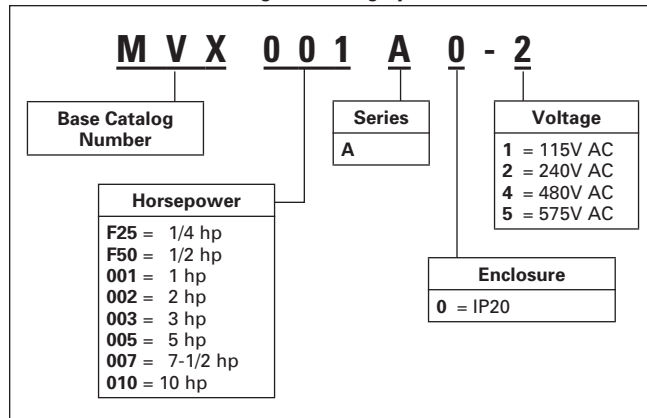


Figure 40-9. MVX9000 NEMA 1 Enclosure

Catalog Number Selection

Table 40-9. MVX9000 Catalog Numbering System



Product Selection

Table 40-10. MVX9000 Basic Controller IP20

Description		Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp Rating	Catalog Number	Price U.S. \$
Hp ①	Volts ②				
1/4 1/2 1	90 – 130	6.3/— 9.0/— 18.0/—	1.6 2.5 4.2	MVXF25A0-1 MVXF50A0-1 MVX001A0-1	
1/2 1 2 3 5 7-1/2	200 – 240	6.3/2.9 11.5/6.3 15.7/8.8 27.5/12.5 —/19.6 —/31.5	2.5 5.0 7.0 10 17 25	MVXF50A0-2 MVX001A0-2 MVX002A0-2 MVX003A0-2 MVX005A0-2 MVX007A0-2	
1 2 3 5 7-1/2 10	380 – 480	—/4.2 —/5.7 —/7.0 —/8.5 —/14 —/20.6	3.0 4.0 5.0 8.2 13 18	MVX001A0-4 MVX002A0-4 MVX003A0-4 MVX005A0-4 MVX007A0-4 MVX010A0-4	
1 2 3 5 7-1/2 10	500 – 600	—/2.4 —/4.2 —/5.9 —/7.0 —/10.5 —/12.9	1.7 3.0 4.2 6.6 9.9 12.2	MVX001A0-5 MVX002A0-5 MVX003A0-5 MVX005A0-5 MVX007A0-5 MVX010A0-5	

① Horsepower ratings are based on the use of a 240V or 480V NEMA B, 4- or 6-pole squirrel cage induction motor and are for reference only. Units are to be selected such that the motor current is less than or equal to the MVX9000 rated continuous output current.

② For 208V, 380V or 415V applications, select the unit such that the motor current is less than or equal to the MVX9000 rated continuous output current.

Options

Table 40-11. Field Options Kits

Description	Catalog Number	Price U.S. \$
Keypads Copy Keypad Normal Keypad Remote Kit	MVXCOPY MVXKPD MVXRM	
Miscellaneous Options Extension I/O DIN Rail	MVXEIO MVXDR	
Communications DeviceNet Module	MVXDN	
NEMA 1 Enclosure Small Frame Large Frame	MVXENCS MVXENCL	
3% Line Reactor, 1-phase 1/2 hp, 240V 1 hp, 240V 2 hp, 240V 3 hp, 240V	K64-000988-8091 K64-000988-0120 K64-000988-0180 K64-000988-0250	
3% Line Reactor, 3-phase 1 hp, 480V 2 hp, 480V 3 hp, 480V 5 hp, 480V 7-1/2 hp, 480V 10 hp, 480V	K64-000989-2091 K64-000989-4091 K64-000989-4091 K64-000989-8091 K64-000989-0180 K64-000989-0250	
1/2 hp, 240V 1 hp, 240V 2 hp, 240V 3 hp, 240V 5 hp, 240V 7-1/2 hp, 240V	K64-000988-2091 K64-000988-4091 K64-000988-8091 K64-000988-0120 K64-000988-0180 K64-000988-0250	
Output Line Reactor 1 hp, 480V 2 hp, 480V 3 hp, 480V 5 hp, 480V 7-1/2 hp, 480V 10 hp, 480V	K64-000989-2091 K64-000989-4091 K64-000989-4091 K64-000989-8091 K64-000989-0120 K64-000989-0180	
EMI Filter 1/2 hp, 240V AC, Single-Phase 1 hp, 240V AC, Single-Phase 2 hp, 240V AC, Single-Phase 3 hp, 240V AC, Single-Phase	K13-000034-0111 K13-000034-0111 K13-000034-0111 K13-000034-0112	
1/2 hp, 240V AC, Three-Phase 1 hp, 240V AC, Three-Phase 2 hp, 240V AC, Three-Phase 3 hp, 240V AC, Three-Phase 5 hp, 240V AC, Three-Phase 7-1/2 hp, 240V AC, Three-Phase	K13-000034-0113 K13-000034-0113 K13-000034-0113 K13-000034-0113 K13-000034-0115 K13-000034-0115	
1 hp, 480V AC, Three-Phase 2 hp, 480V AC, Three-Phase 3 hp, 480V AC, Three-Phase 5 hp, 480V AC, Three-Phase 7-1/2 hp, 480V AC, Three-Phase 10 hp, 480V AC, Three-Phase	K13-000034-0114 K13-000034-0114 K13-000034-0114 K13-000034-0116 K13-000034-0116 K13-000034-0117	
Dynamic Braking Resistor 1/2 – 1 hp, 240V 2 – 3 hp, 240V 5 hp, 240V 7-1/2 hp, 240V	K13-000034-0821 K13-000034-0824 K13-000034-0825 K13-000034-0826	
1 hp, 480V 2 – 3 hp, 480V 5 hp, 480V 7-1/2 hp, 480V 10 hp, 480V	K13-000034-0841 K13-000034-0843 K13-000034-0844 K13-000034-0845 K13-000034-0846	

Enclosed Drives

Contents

Description	Page
MVX9000 Enclosed Drives	
Product Description	40-16
Features	40-17
Standards and Certifications	40-17
Cover Control	40-19
Modification Codes	40-20
Catalog Number Selection	40-18
Product Selection	40-23



MVX Drive with 3-Contactor Bypass

Product Description

Eaton's Cutler-Hammer® MVX9000 is offered in a variety of enclosure options to provide protection for operator and equipment. Enclosure ratings include Type 1, 12, 3R and 4X. (Enclosure ratings are defined in **PG03300001E**.)

Model MVX9000 sensorless vector adjustable frequency AC drives are designed to provide adjustable speed control of three-phase motors. These microprocessor-based, sensorless vector drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements.

The MVX9000 sensorless vector product line utilizes a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) which provide quiet motor operation, high motor efficiency and smooth low speed performance. The size and simplicity of the MVX9000 make it ideal for hassle free installations where size is a primary concern.

Models rated at 575 and 480 volts, 3-phase, 50/60 Hz are available in sizes ranging from 1 to 10 hp. Models rated at 240 volts, single- or 3-phase, 50/60 Hz are available in sizes ranging from 1/2 to 7-1/2 hp.

The standard drive includes a digital display, operating and programming keys on a removable keypad. The display provides drive monitoring as well as adjustment and diagnostic information. The keys are utilized for digital adjustment and programming of the drive as well as for operator control. Separate terminal blocks for control and power wiring are provided for customer connections. Other features provided as standard include built-in DC braking, RS-485 serial communications and PID control.

The enclosed microdrives can be configured with standard modification codes including options for various cover controls, two- and three-contactor bypass, communications and traditional disconnect switch offerings.



Type 1/3R with Keypad Cover

Type 1 Enclosure

The Type 1 version of the MVX9000 sensorless vector product line utilizes a door-mountable (option) keypad. The keypad, with digital display, can be used for operating and programming the MVX9000 drive. Type 1 enclosed MVX9000s offer a standard gasketed cover in a ventilated enclosure.

Type 12 Enclosure

The Type 12 design uses a seam welded, dust-tight enclosure. These enclosures use the latest advances in cooling technology to offer space saving designs as well as providing ample space for modifications.



Type 12 Design

Type 3R Enclosure

The Type 3R design incorporates the MVX9000 technology into a compact, rainproof enclosure. Type 3R enclosures are available with a door mount keypad option utilizing a steel flange door to protect the keypad.

Type 4X Enclosure

The Type 4X enclosed MVX utilizes a seam-welded stainless steel enclosure. These enclosures use the latest advances in cooling technology to offer space saving designs as well as providing ample space for modifications.

Features

- **Drive Keypad Access** — Through-the-door access to STOP/START, speed potentiometer drive keys and programming available as an option on Type 1, 3R and 12
- Available as non-combination or combination with fusible or circuit breaker disconnect
- **Fusible Disconnect** — 30A or 60A with Class CC / J fuses or R fuses
- **Circuit Breaker** — Thermal magnetic circuit breaker with trip rating based on maximum drive FLA
- **Operating Mechanism** — Rotary or flange type with provisions for padlocking in the OFF position. An interlock defeater is built into the operating mechanism to permit the cover to be opened with the disconnect on
- **Cover Control** — Control devices available installed or in field assembly kits
- **Options** — Bus Choke, Bypass/Isolation Contactors, EMI Filter, Line Reactors, DeviceNet Interface and more

The compact design allows the controller to be located adjacent to the motor.

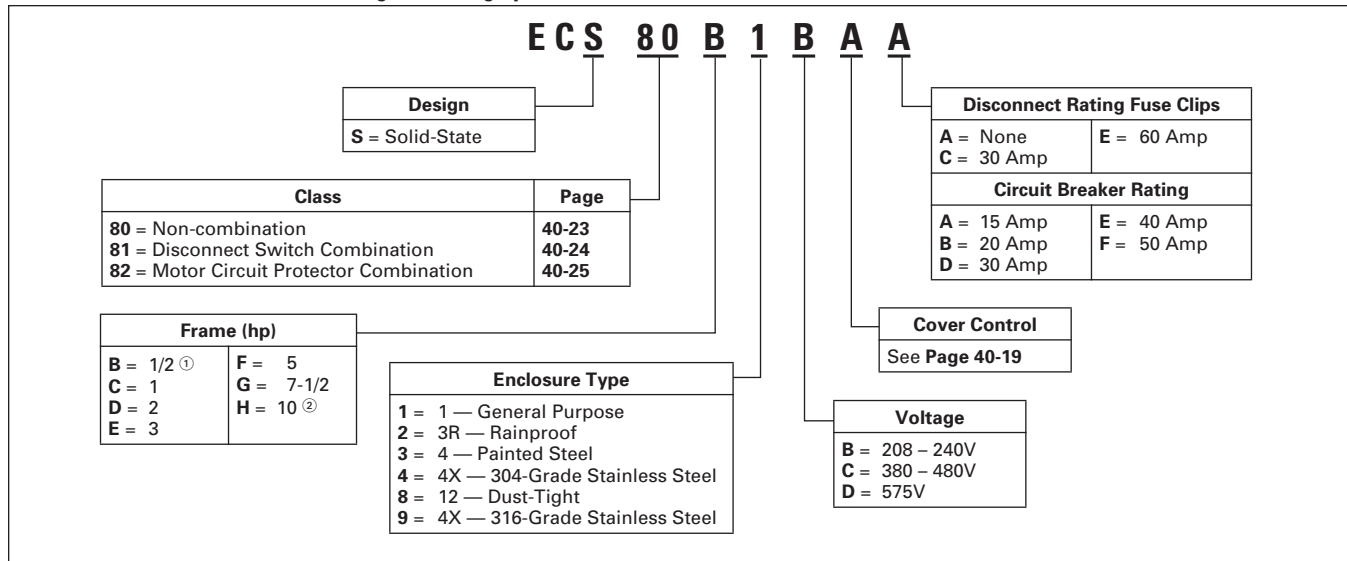
Standards and Certifications

Note: See Enclosed Control Product Guide PG03300001E for additional information on Standards and Certifications that apply to all Cutler-Hammer Enclosed Control products.

- UL Listed
- cUL Listed (indicates appropriate CSA Standard investigation)
- ABS Type Approval
- CE Mark available (Requires EMI filter)

Catalog Number Selection

Table 40-12. Enclosed Microdrive Catalog Numbering System

^① Frame (hp) only available at 208 – 240V.^② Frame (hp) only available at 380 – 480V.

Cover Control

Table 40-13. MVX Non-reversing Pilot Devices

Description	Factory Installed	Type 1, 3R Kits for Field Installation	Type 12, 4X Kits for Field Installation
	Position 9 Alpha	Catalog Number	Catalog Number
None	A	—	—
START/STOP Pushbuttons with Red RUN Pilot Light	B	C400T21	C400T1
with Red RUN/Green OFF Lights	C	C400T22 ^①	—
	D	C400T23 ^①	—
ON/OFF Pushbuttons with Red RUN Pilot Light	E	—	C400T2
with Red RUN/Green OFF Lights	F	—	—
	G	—	—
HAND/OFF/AUTO Selector Switch with Red RUN Pilot Light	H	C400T24	C400T12
with Red RUN/Green OFF Lights	J	C400T25 ^①	—
	K	C400T26 ^①	—
Red RUN Pilot Light	L	C400T10 ^①	C400T9 ^①
Green OFF Pilot Light	M	C400T11 ^①	C400T10 ^①
Red RUN/Green OFF Pilot Lights	N	C400T12 ^①	C400T11 ^①
START/STOP Selector Switch with Red RUN Pilot Light	P	—	C400T13
with Red RUN/Green OFF Lights	Q	—	—
	R	—	—
Speed Potentiometer	S	—	—

^① Add Code Letter from table below to Catalog Number for voltage — kits only. Example: C400T10A.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120V 60 Hz	A	240V 60 Hz	B	480V 60 Hz	C
208V 60 Hz	E	380V 50 Hz	L	600V 60 Hz	D

Table 40-14. MVX Reversing Pilot Devices

Description	Factory Installed	Type 1, 3R Kits for Field Installation	Type 12, 4X Kits for Field Installation
	Position 9 Alpha	Catalog Number	Catalog Number
None	A	—	—
FORWARD/REVERSE/STOP Pushbuttons with 2 Red Pilot Lights	T	C400T50	C400T6
with 2 Red/1 Green Lights	U	C400T51 ^②	—
	V	C400T52 ^②	—
UP/STOP/DOWN Pushbuttons with 2 Red Pilot Lights	W	—	—
with 2 Red/1 Green Lights	X	—	—
	Y	—	—
FORWARD/OFF/REVERSE Selector Switch with 2 Red Pilot Lights	Z	C400T53	C400T15
with 2 Red/1 Green Lights	1	C400T54 ^②	—
	2	C400T55 ^②	—
2 Red Pilot Lights	3	—	^③
Green OFF Pilot Light	4	C400T11 ^②	C400T10 ^②
2 Red/1 Green Pilot Lights	5	—	—
Speed Potentiometer	S	—	—

^② Add Code Letter from table below to Catalog Number for voltage — kits only. Example: C400T10A.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120V 60 Hz	A	240V 60 Hz	B	480V 60 Hz	C
208V 60 Hz	E	380V 50 Hz	L	600V 60 Hz	D

^③ Order 2 C400T9 ^②.

Modification Codes

Table 40-15. A — Auxiliary Contacts (when bypass contactor chosen)

Modification	Catalog Number Suffix	Description
Top Mounted Auxiliary Contacts (Unwired) ①	A13	1NO
	A14	1NC
	A15	1NO-1NC
	A16	2NO
	A17	2NC
	A18	2NO-1NC
	A19	1NO-2NC
	A20	3NO
	A21	3NC
	A22	3NO-1NC
	A23	2NO-2NC
	A24	1NO-3NC
	A25	4NO
	A26	4NC

① For drive only run contacts, see Mods C12 and C14.

Table 40-16. B — Breaker Modifications, Bell Alarm, DC Bus Choke

Modification	Catalog Number Suffix	Description
Breaker	B1	1NO-1NC Auxiliary Contacts
	B2	2NO-2NC Auxiliary Contacts
	B3	Shunt Trip on Circuit Breaker — 48 – 127V AC or DC
Bell Alarm	B16	Bell Alarm for GHC
Bus Choke	B20	240V or 480V DC Bus Choke, Open Core and Coil ②

② A DC bus choke may be used in place of an AC line reactor for line harmonic current reduction and for power source exceeding 500 kVA. The DC bus choke will not provide any protection for line voltage unbalance or transients.

Table 40-17. C — Control Power Transformers, Control Relays, Control Sources, Bypass Contactors

Modification	Catalog Number Suffix	Description
Control Power Transformer	C1	Standard Size CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C42	50 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C3	100 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C5 ③	200 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C7 ③	300 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
	C8 ③	400 VA Extra Capacity CPT, 120V/60 Hz, 110V/50 Hz Secondary with 2 Primary and 1 Secondary Fuse
Control Relay ④	C13	RUN Relay, 24V DC
Separate Control	C35	Wired for Separate Control
	C45	Separate Source Disc (Type 1/12 fusible only)
Customer Supplied	C36	Customer Supplied Components to Be Installed
	C37	Customer Supplied Wiring Diagram to Use
Bypass Contactors ⑤	C46/J1	Isolation Contactor
	C46/J2	Output Contactor
	C46/J3	Bypass Contactor ⑤
	C46/J4	Isolation/Output/Bypass Contactors ⑤
	C46/J5	3 Contactor Bypass Package — Includes CPT, Pilot Lights, Selector Switch, Auxiliary Contacts and Control Relay ⑤

③ Requires oversize enclosure.

④ Provides additional contacts for drive run indication.

⑤ Includes bimetallic overload.

Table 40-18. D — Device Labels, DIN Rail

Modification	Catalog Number Suffix	Description
Device Labels	D1	Device Labels — Specify
DIN Rail	D8	DIN Rail Installed

Table 40-19. E — Enclosure Modifications, Elapsed Time Meter

Modification	Catalog Number Suffix	Description
Enclosure	E3	Oversized Enclosure
Elapsed Time Meter	E9	Type 1, 3R, 12, 4X

Microdrives

Table 40-20. F — Fuse Clips, Fuse Blocks, EMI Filter

Modification	Catalog Number Suffix	Description
Fuse Blocks	F4	Power Fuses Included — Order by Description
	F5	30A Control Circuit Fuseholder (KTK) Mounted on Panel (unwired) Fuse Not Supplied
	F6	30A Control Circuit Fuseholder Mounted on Panel (unwired), 5A KTK Fuse Supplied
EMI Filter ^②	F22	240V or 480V 3-Phase ^①
	F23	240V 1-Phase ^①

^① The EMI filter is not necessary to meet the CE mark requirements for EMC when installing the MVX in an EC country.

^② Requires oversized enclosure.

Table 40-21. H — Space Heater, Heater Packs Installed

Modification	Catalog Number Suffix	Description			
Space Heater	H1	Space Heater and Thermostat			
	H2	Space Heater and NC Interlock (100 Watt)			
Install Heater Packs (Freedom Series) ③	H5	Class 20		Class 10	
		/D1	H2001B-3	/D25	H2101B-3
		/D2	H2002B-3	/D26	H2102B-3
		/D3	H2003B-3	/D27	H2103B-3
		/D4	H2004B-3	/D28	H2104B-3
		/D5	H2005B-3	/D29	H2105B-3
		/D6	H2006B-3	/D30	H2106B-3
		/D7	H2007B-3	/D31	H2107B-3
		/D8	H2008B-3	/D32	H2108B-3
		/D9	H2009B-3	/D33	H2109B-3
		/D10	H2010B-3	/D34	H2110B-3
		/D11	H2011B-3	/D35	H2111B-3
		/D12	H2012B-3	/D36	H2112B-3
		/D13	H2013B-3	/D37	H2113B-3
/D14	H2014B-3	/D38	H2114B-3		

^③ Use only when C46 or R7 modifications are required.

Table 40-22. K — Keypad

Modification	Catalog Number Suffix	Description
Keypad	K1	Door-Mounted AFD Keypad (Type 1 and 12)
	K2	Door-Mounted AFD Keypad (Type 3R)
	K3	AFD Copy Keypad (mounted on drive)
	K4	Door-Mounted AFD Copy Keypad (Type 1 and 12)
	K5	Door-Mounted AFD Copy Keypad (Type 3R)

Table 40-23. L — Lightning Arrestor, Carton Label, Line Reactor, Load Reactor

Modification	Catalog Number Suffix	Description
Lightning Arrestor ^④	L1	Lightning Arrestor
Label	L10	Carton Label — Customer Marking — Specify
Line Reactor (Type 1/12 design limited to either line or load reactor, not both)	L12	240V or 480V 3% Input Line Reactor, 3-Phase, Open Core and Coil ^⑤
	L13	240V 3% Input Line Reactor, 1-Phase, Open Core and Coil ^⑤
	L14	240V or 480V 5% Input Line Reactor, 3-Phase, Open Core and Coil ^⑤
	L15	240V 5% Input Line Reactor, 1-Phase, Open Core and Coil ^⑤
	L16	Line Reactor by Description
	L17	480V Output Line dv/dt Filter, Open Core and Coil ^⑥
Output Line Filter (Type 1/12 design limited to either line or load reactor, not both)	L18	Load Reactor by Description

^④ Requires oversized enclosure.

^⑤ If the power source exceeds 500 kVA, 3% line unbalance, or if transient voltages from power factor capacitor switching events are present, an input line reactor must be used. The input line reactor will also reduce line current harmonics.

^⑥ The output line dv/dt filter is required when the distance from the drive to the motor exceeds 33 feet (10.1m). The total cable run should not exceed 165 feet (50.3m).

Table 40-24. N — Nameplates

Modification	Catalog Number Suffix	Description
Nameplates	N1	Nameplate on Enclosure — Order Wording to Be Inscribed

Microdrives

Table 40-25. P — Pilot Lights, Pushbuttons, Phase Loss Relay, Phase Reversal Relay

Modification	Catalog Number Suffix	Description
Push-to-Test Pilot Lights	P1	Push-to-Test Pilot Light (Red RUN)
	P2	Push-to-Test Pilot Light (Green OFF)
	P3	Combination of P1 and P2 Above
	P4	Push-to-Test Pilot Light (Amber RUN)
	P54	Push-to-Test Pilot Light — Red BYPASS
	P55	Push-to-Test Pilot Light — Amber INVERTER ENABLE
	P56	Push-to-Test Pilot Light — Red INVERTER RUNNING
Pushbuttons	P57	Push-to-Test Pilot Light — Green STOPPED
	P5	EMERGENCY STOP — Mushroom Head
	P7	START/STOP
	P8	ON/OFF
	P9	START
	P10	ON
	P11	OFF
Pilot Lights	P12	FORWARD/REVERSE/STOP
	P52	UP/STOP/DOWN
	P18	Pushbutton with Legend Plate (Order by Description)
	P19	Amber Light "POWER AVAILABLE" Wired to Load Side of 2 Fuses or Circuit Breaker
	P20	Pilot Light (Amber) Wired to Coil
	P23	Pilot Light — Red RUN
	P24	Pilot Light — Red ON
	P25	Pilot Light — Green OFF
	P58	Pilot Light — Red BYPASS
	P59	Pilot Light — Amber INVERTER ENABLE
Illuminated Pushbutton	P60	Pilot Light — Red INVERTER RUNNING
	P61	Pilot Light — Green STOP
	P26	Pilot Light (Order by Description)
	P27	Illuminated Pushbutton (Order by Description)
Phase Loss Relay	P28	Phase Loss Relay
Phase Reversal Relay	P30	Phase Reversal Relay
Phase Unbalance Relay	P32	Phase Unbalance Relay
Phase Monitoring Relay	P34	Phase Monitoring Relay

Table 40-26. R — Relays, Overload Relay Modifications, DeviceNet™ Interface Mode

Modification	Catalog Number Suffix	Description
Relay	R2	Overvoltage Relay
	R7	Overload Relay (Order by Description)
Relay Modifications	R45	Auto Reset Only on Overload Relay
DeviceNet Interface Module	R69	DeviceNet Communication Interface

Table 40-27. S — Selector Switches, Suppressor, Surge Capacitor, Speed Pot

Modification	Catalog Number Suffix	Description
Selector Switches	S3	HAND-OFF-AUTO Selector Switch
	S10	OFF-AUTO Selector Switch
	S11	START-STOP Selector Switch
	S12	ON-OFF Selector Switch
	S16	FORWARD-REVERSE Selector Switch
	S38	INVERTER-OFF-BYPASS Selector Switch
	S40	Selector Switch (Order by Description)
Surge Capacitor	S37	Surge Capacitor Wired to Disconnect Line Side
Speed Pot	S39	Speed Potentiometer

Table 40-28. T — Timers, Terminal Blocks, Terminal Points, Ring Lug

Modification	Catalog Number Suffix	Description
Timers	T3	Pneumatic Timer Mounted in Enclosure, Unwired, 180 Seconds Maximum
	T4	Pneumatic Timer (Order by Description)
	T5	Solid-State Timer (Order by Description)
Terminal Blocks	T9	With 1 Single-Circuit Terminal Block, Unwired
	T10	With 2 Single-Circuit Terminal Blocks, Unwired
Terminal Points	T11	With 6 Terminal Points, Unwired
	T12	With 12 Terminal Points, Unwired
	T13	With 16 Terminal Points, Unwired
	T14	Terminal Point per Customer Specification, Unwired
	T15	Terminal Point per Customer Specification, Wired
Ring Lug	T16	Ring Lug Connections on Power Wires
	T17	Ring Lug Connections on Control Wires

Table 40-29. U — Undervoltage Relay

Modification	Catalog Number Suffix	Description
Undervoltage Relay	U2	Undervoltage Relay, Non-adjustable
Under and Over Relay	U7	Under and Overvoltage Relay

Table 40-30. W — Wiremarkers

Modification	Catalog Number Suffix	Description
Wiremarkers	W7	Wiremarkers

Product Selection

Table 40-31. Class ECS80 — Non-combination MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
			Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number
1/2 hp											
208 – 240	5.8/3.4	2.5	ECS80B1BAA		ECS80B2BAA		ECS80B4BAA		ECS80B8BAA		MVXF50A0-2
1 hp											
208 – 240	9/5.2	5	ECS80C1BAA		ECS80C2BAA		ECS80C4BAA		ECS80C8BAA		MVX001A0-2
380 – 480	—/3.3	3	ECS80C1CAA		ECS80C2CAA		ECS80C4CAA		ECS80C8CAA		MVX001A0-4
500 – 600	—/2.4	1.7	ECS80C1DAA		ECS80C2DAA		ECS80C4DAA		ECS80C8DAA		MVX001A0-5
2 hp											
208 – 240	16/9.3	7	ECS80D1BAA		ECS80D2BAA		ECS80D4BAA		ECS80D8BAA		MVX002A0-2
380 – 480	—/5	4	ECS80D1CAA		ECS80D2CAA		ECS80D4CAA		ECS80D8CAA		MVX002A0-4
500 – 600	—/4.2	3	ECS80D1DAA		ECS80D2DAA		ECS80D4DAA		ECS80D8DAA		MVX002A0-5
3 hp											
208 – 240	22.5/13	10	ECS80E1BAA		ECS80E2BAA		ECS80E4BAA		ECS80E8BAA		MVX003A0-2
380 – 480	—/7	5	ECS80E1CAA		ECS80E2CAA		ECS80E4CAA		ECS80E8CAA		MVX003A0-4
500 – 600	—/5.9	4.2	ECS80E1DAA		ECS80E2DAA		ECS80E4DAA		ECS80E8DAA		MVX003A0-5
5 hp											
208 – 240	—/20	17	ECS80F1BAA		ECS80F2BAA		ECS80F4BAA		ECS80F8BAA		MVX005A0-2
380 – 480	—/11	8.2	ECS80F1CAA		ECS80F2CAA		ECS80F4CAA		ECS80F8CAA		MVX005A0-4
500 – 600	—/7.0	6.6	ECS80F1DAA		ECS80F2DAA		ECS80F4DAA		ECS80F8DAA		MVX005A0-5
7-1/2 hp											
208 – 240	—/31	25	ECS80G1BAA		ECS80G2BAA		ECS80G4BAA		ECS80G8BAA		MVX007A0-2
380 – 480	—/17	13	ECS80G1CAA		ECS80G2CAA		ECS80G4CAA		ECS80G8CAA		MVX007A0-4
500 – 600	—/10.5	9.9	ECS80G1DAA		ECS80G2DAA		ECS80G4DAA		ECS80G8DAA		MVX007A0-5
10 hp											
380 – 480	—/21	18	ECS80H1CAA		ECS80H2CAA		ECS80H4CAA		ECS80H8CAA		MVX010A0-4
500 – 600	—/12.9	12.2	ECS80H1DAA		ECS80H2DAA		ECS80H4DAA		ECS80H8DAA		MVX010A0-5

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS80B4BAA-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.

Microdrives

Table 40-32. Class ECS81 — Combination Disconnect Switch MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	Fuse Clips	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
				Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number
1/2 hp												
208 – 240	5.8/3.4	2.6	30A	ECS81B1BAC		ECS81B2BAC		ECS81B4BAC		ECS81B8BAC		MVXF50A0-2
1 hp												
208 – 240	9/5.2	4	30A	ECS81C1BAC		ECS81C2BAC		ECS81C4BAC		ECS81C8BAC		MVX001A0-2
380 – 480	—/3.3	2.5	30A	ECS81C1CAC		ECS81C2CAC		ECS81C4CAC		ECS81C8CAC		MVX001A0-4
500 – 600	—/2.4	1.7	30A	ECS81C1DAC		ECS81C2DAC		ECS81C4DAC		ECS81C8DAC		MVX001A0-5
2 hp												
208 – 240	16/9.3	7.1	30A	ECS81D1BAC		ECS81D2BAC		ECS81D4BAC		ECS81D8BAC		MVX002A0-2
380 – 480	—/5	3.8	30A	ECS81D1CAC		ECS81D2CAC		ECS81D4CAC		ECS81D8CAC		MVX002A0-4
500 – 600	—/4.2	3	30A	ECS81D1DAC		ECS81D2DAC		ECS81D4DAC		ECS81D8DAC		MVX002A0-5
3 hp												
208 – 240	22.5/13	10	30A	ECS81E1BAC		ECS81E2BAC		ECS81E4BAC		ECS81E8BAC		MVX003A0-2
380 – 480	—/7	5.5	30A	ECS81E1CAC		ECS81E2CAC		ECS81E4CAC		ECS81E8CAC		MVX003A0-4
500 – 600	—/5.9	4.2	30A	ECS81E1DAC		ECS81E2DAC		ECS81E4DAC		ECS81E8DAC		MVX003A0-5
5 hp												
208 – 240	—/20	15.9	30A	ECS81F1BAC		ECS81F2BAC		ECS81F4BAC		ECS81F8BAC		MVX005A0-2
380 – 480	—/11	8.6	30A	ECS81F1CAC		ECS81F2CAC		ECS81F4CAC		ECS81F8CAC		MVX005A0-4
500 – 600	—/7.0	6.6	30A	ECS81F1DAC		ECS81F2DAC		ECS81F4DAC		ECS81F8DAC		MVX005A0-5
7-1/2 hp												
208 – 240	—/31	24	60A	ECS81G1BAE		ECS81G2BAE		ECS81G4BAE		ECS81G8BAE		MVX007A0-2
380 – 480	—/17	13	30A	ECS81G1CAC		ECS81G2CAC		ECS81G4CAC		ECS81G8CAC		MVX007A0-4
500 – 600	—/10.5	9.9	30A	ECS81G1DAC		ECS81G2DAC		ECS81G4DAC		ECS81G8DAC		MVX007A0-5
10 hp												
380 – 480	—/21	16	30A	ECS81H1CAC		ECS81H2CAC		ECS81H4CAC		ECS81H8CAC		MVX010A0-4
500 – 600	—/12.9	12.2	30A	ECS81H1DAC		ECS81H2DAC		ECS81H4DAC		ECS81H8DAC		MVX010A0-5

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS81B**4**BAC-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.



Type 3R Combination HMCPE MVX Drive

Type 1 MXV Drive with Disconnect
Switch and Bypass

Cover Controls **Page 40-19**
 Modifications **Pages 40-20 – 40-22**
 Dimensions **PG03300001E**
 Discount Symbol **SS-1**

Table 40-33. Class ECS82 — Combination HMCPE Circuit Breaker MVX9000 Drives

Volts	Input Amp. Single-/ 3-Phase Rating	Continuous Output Amp. Rating	HMCP Rating Amps.	Type 1 General Purpose		Type 3R Rainproof		Type 4X ① Watertight Stainless Steel		Type 12 Industrial Dust-Tight		Component Microdrive (Open)
				Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number
1/2 hp												
208 – 240	5.8/3.4	2.6	15	ECS82B1BAA		ECS82B2BAA		ECS82B4BAA		ECS82B8BAA		MVXF50A0-2
1 hp												
208 – 240	9/5.2	4	15	ECS82C1BAA		ECS82C2BAA		ECS82C4BAA		ECS82C8BAA		MVX001A0-2
380 – 480	—/3.3	2.5	15	ECS82C1CAA		ECS82C2CAA		ECS82C4CAA		ECS82C8CAA		MVX001A0-4
500 – 600	—/2.4	1.7	15	ECS82C1DAA		ECS82C2DAA		ECS82C4DAA		ECS82C8DAA		MVX001A0-5
2 hp												
208 – 240	16/9.3	7.1	15	ECS82D1BAA		ECS82D2BAA		ECS82D4BAA		ECS82D8BAA		MVX002A0-2
380 – 480	—/5	3.8	15	ECS82D1CAA		ECS82D2CAA		ECS82D4CAA		ECS82D8CAA		MVX002A0-4
500 – 600	—/4.2	3	15	ECS82D1DAA		ECS82D2DAA		ECS82D4DAA		ECS82D8DAA		MVX002A0-5
3 hp												
208 – 240	22.5/13	10	30	ECS82E1BAD		ECS82E2BAD		ECS82E4BAD		ECS82E8BAD		MVX003A0-2
380 – 480	—/7	5.5	15	ECS82E1CAA		ECS82E2CAA		ECS82E4CAA		ECS82E8CAA		MVX003A0-4
500 – 600	—/5.9	4.2	15	ECS82E1DAA		ECS82E2DAA		ECS82E4DAA		ECS82E8DAA		MVX003A0-5
5 hp												
208 – 240	—/20	15.9	30	ECS82F1BAD		ECS82F2BAD		ECS82F4BAD		ECS82F8BAD		MVX005A0-2
380 – 480	—/11	8.6	15	ECS82F1CAA		ECS82F2CAA		ECS82F4CAA		ECS82F8CAA		MVX005A0-4
500 – 600	—/7.0	6.6	15	ECS82F1DAA		ECS82F2DAA		ECS82F4DAA		ECS82F8DAA		MVX005A0-5
7-1/2 hp												
208 – 240	—/31	24	50	ECS82G1BAF		ECS82G2BAF		ECS82G4BAF		ECS82G8BAF		MVX007A0-2
380 – 480	—/17	13	30	ECS82G1CAD		ECS82G2CAD		ECS82G4CAD		ECS82G8CAD		MVX007A0-4
500 – 600	—/10.5	9.9	15	ECS82G1DAA		ECS82G2DAA		ECS82G4DAA		ECS82G8DAA		MVX007A0-5
10 hp												
380 – 480	—/21	16	30	ECS82H1CAD		ECS82H2CAD		ECS82H4CAD		ECS82H8CAD		MVX010A0-4
500 – 600	—/12.9	12.2	30	ECS82H1DAD		ECS82H2DAD		ECS82H4DAD		ECS82H8DAD		MVX010A0-5

① These are the Catalog Numbers for Type 4X 304-Grade Stainless Steel, as indicated by the seventh digit **4**. Example: ECS82B4BAA-C1. To order Type 4X 316-Grade Stainless Steel, change that digit to **9**. To order Type 4 Painted Steel, change that digit to **3**. To order Nonmetallic, change that digit to **5**. For details on these Alternate Enclosures, see **PG03300001E**.



Type 3R Combination HMCPE MVX Drive



**Type 1 MXV Drive with Disconnect
Switch and Bypass**

Wiring Diagrams

Wiring Diagrams

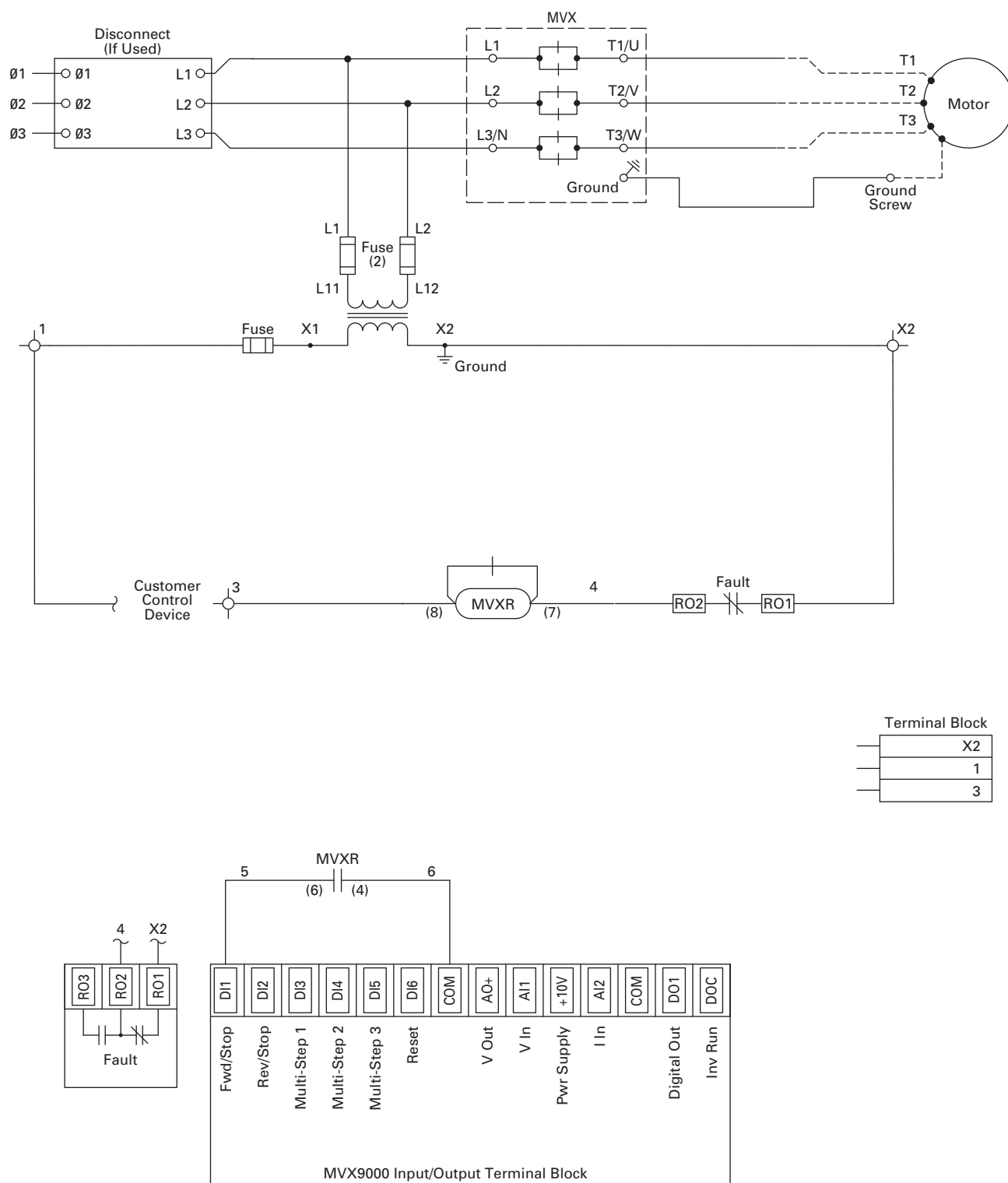


Figure 40-10. MVX9000 Wiring Diagram

Contents

<i>Description</i>	<i>Page</i>
SLX9000 Open Drives	
Product Description	40-27
Features	40-27
Technical Data and Specifications	40-28
Catalog Number Selection	40-29
Product Selection	40-30
Options	40-32
Accessories	40-33
Dimensions	40-34
Replacement Parts	40-36



SLX9000 Open Drive

Product Description

Cutler-Hammer® SLX9000 Series Adjustable Frequency Drives from Eaton's electrical business are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is compromised of option cards, each with its own input and output configuration.

The control module is designed to accept a total of two of these cards. The cards contain not only normal analog and digital inputs but also field-bus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard
- EMI/RFI Filters H standard

- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Keypad — LCD operation from keypad
- Standard NEMA Type 12 keypad on all drives
- The SLX9000 can be flexibly adapted to a variety of needs using our pre-installed "All-In-One Application" programs
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- The SLX9000 accommodates the standard I/O and an integrated RS-485 (Modbus) connection. There is room for two option cards with more I/O or other functionality
- UL Listed
- Hand-Held Auxiliary 24V Power Supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard
- NEMA Type 1 and NEMA Type 12 enclosures available

Technical Data and Specifications

Table 40-34. SLX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC

Output Ratings

Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C) I_L rated 100% at 104°F (40°C)
Overload Current (I_H/I_L)	150% I_H , 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds

Control Characteristics

Control Method	Frequency Control (V/f) Open Loop: Sensorless Vector Control
Switching Frequency	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% $\times T_n$ (without brake option)

Ambient Conditions

Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H 14°F (-10°C), no frost to 104°F (+40°C) I_L
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and ship- ping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity require- ments; Emissions: EN 61800-3, LEVEL H

Control Connections

Analog Input Voltage	0 to 10V, R = 200 k Ω (-10 to 10V joystick con- trol) Resolution .1%; accuracy $\pm 1\%$
Analog Input Current	0(4) to 20 mA; R_i - 250 Ω differential
Digital Inputs	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V $\pm 15\%$, max. 250 mA
Output Reference Volt- age	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy $\pm 2\%$
Relay Outputs	1 programmable Form C relay output Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A

Protections

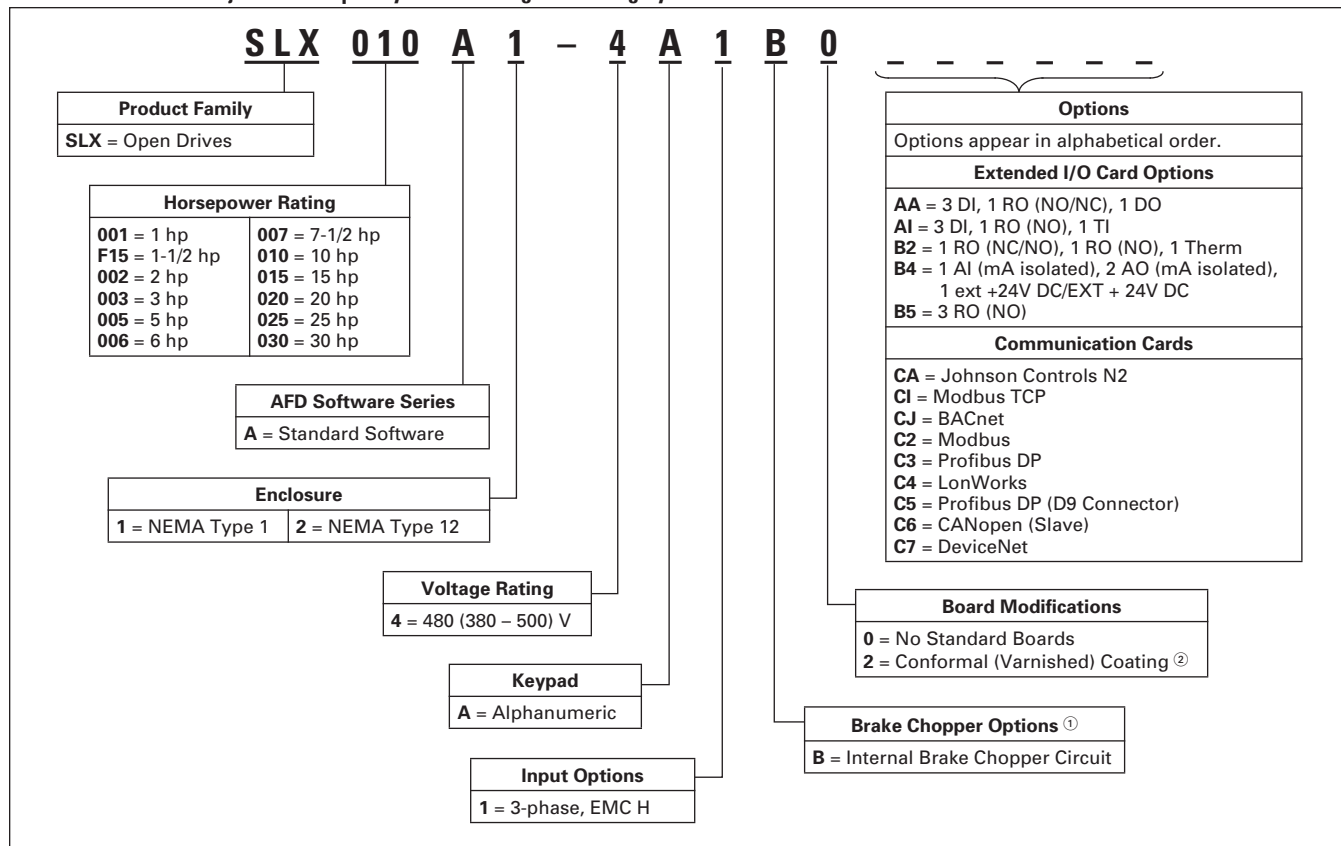
Overcurrent Protection	Trip limit 4.0 $\times I_H$ instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)

Table 40-35. Standard I/O Specifications

Description	Specification
3– Digital Input Programmable	24V: “0” $\leq 10V$, “1” $\geq 18V$; $R_i > 5 k\Omega$
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – $\pm 10V$, $R_i > 200 k\Omega$ Current: 0 (4) – 20 mA, $R_i = 250 k\Omega$
1 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC2 Amp resistive, 8 Amp switching
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, $R_L < 500 ohms$, resolution 10 Bits/0.1%
1 – RS-485 Serial	RS-485 Modbus Communication

Catalog Number Selection

Table 40-36. SLX9000 Adjustable Frequency Drive Catalog Numbering System



① 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option B.

② Factory promise delivery. Consult Sales Office for availability.

Open Drives

Product Selection

480V SLX9000 Drives

Table 40-37. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
MF4	W	1	2.2	1-1/2	3.3	SLX001A1-4A1B0	
		1-1/2	3.3	2	4.3	SLXF15A1-4A1B0	
		2	4.3	3	5.6	SLX002A1-4A1B0	
		3	5.6	5	7.6	SLX003A1-4A1B0	
		5	7.6	—	9	SLX005A1-4A1B0	
		—	9	7-1/2	12	SLX006A1-4A1B0	
MF5	W	7-1/2	12	10	16	SLX007A1-4A1B0	
		10	16	15	23	SLX010A1-4A1B0	
		15	23	20	31	SLX015A1-4A1B0	
MF6	W	20	31	25	38	SLX020A1-4A1B0	
		25	38	30	46	SLX025A1-4A1B0	
		30	46	40	61	SLX030A1-4A1B0	

Table 40-38. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
MF4	F1	1	2.2	1-1/2	3.3	SLX001A2-4A1B0	
		1-1/2	3.3	2	4.3	SLXF15A2-4A1B0	
		2	4.3	3	5.6	SLX002A2-4A1B0	
		3	5.6	5	7.6	SLX003A2-4A1B0	
		5	7.6	—	9	SLX005A2-4A1B0	
		—	9	7-1/2	12	SLX006A2-4A1B0	
MF5	F1	7-1/2	12	10	16	SLX007A2-4A1B0	
		10	16	15	23	SLX010A2-4A1B0	
		15	23	20	31	SLX015A2-4A1B0	
MF6	F1	20	31	25	38	SLX020A2-4A1B0	
		25	38	30	46	SLX025A2-4A1B0	
		30	46	40	61	SLX030A2-4A1B0	

Open Drives

SLX9000 Series Option Board Kits

The SLX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards (see **Figure 40-11**).

The SLX9000 Drive accommodates the standard I/O and an integrated RS-485 (Modbus) connector.

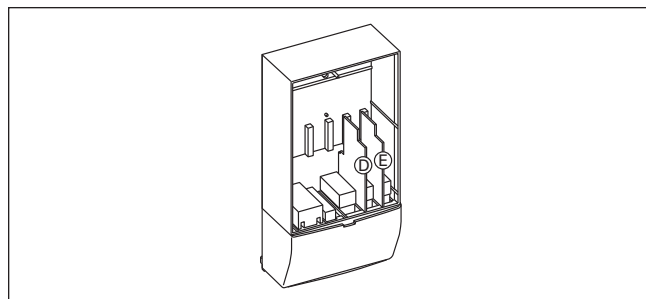


Figure 40-11. SLX9000 Series Option Boards

Table 40-39. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SLX9000 Programs
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$	
Extended I/O Card Options						
3 DI, 1 RO (NO/NC), 1 DO	D	OPTAA		AA		X
3 DI, 1 RO (NO), 1 TI	D	OPTAI		AI		X
1 RO (NC/NO), 1 RO (NO), 1 Therm	D, E	OPTB2		B2		X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	D, E	OPTB4		B4		X
3 RO (NO)	D, E	OPTB5		B5		X
Communication Cards						
Johnson Controls N2	D, E	OPTC2		CA		X
Modbus TCP	D, E	OPTCI		CI		X
BACnet	D, E	OPTCJ		CJ		X
Modbus	D, E	OPTC2		C2		X
Profibus DP	D, E	OPTC3		C3		X
LonWorks	D, E	OPTC4		C4		X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X
CanOpen (Slave)	D, E	OPTC6		C6		X
DeviceNet	D, E	OPTC7		C7		X
Keypad						
SLX9000 Series LCD Keypad (Replacement Keypad)		KEYPAD-LCD		—		X
SLX9000 Series Remote Mount Keypad Unit (Keypad not included, includes 6.5 ft. cable, keypad holder, mounting hardware)		OPTDRA-02L		—		X

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token

Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

Discount Symbol **SS-3**

Open Drives

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Options

Control Panel Options

Table 40-40. Control Panel Factory Options

Description	Factory Installed		Field Installed	
	Option Code	Adder U.S. \$	NEMA Type 1	
			Catalog Number	Price U.S. \$
SLX9000 Series LCD Keypad — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The seven pushbuttons on the panel are used for panel programming and monitoring of all SLX9000 parameters. The panel is detachable and isolated from the input line potential.	A		KEYPAD-LCD	
Keypad Remote Mounting Kit — This option is used to remote mount the SLX9000 keypad. Includes 6.5 ft. cable, keypad holder and mounting hardware.	—		OPTDRA-02L	

Table 40-41. Miscellaneous Options

Description	Catalog Number	Price U.S. \$
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. <i>Consult factory.</i>	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

Table 40-42. Conformal (Varnished) Coating Adder — 380 – 500V,
(See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. \$
MF4	FP	
MF5	FP	
MF6	FP	

Table 40-43. Conformal Coated Board Kits ②

Field Installed		Factory Installed	
Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$
OPT_V ④		③	

② See Option Catalog Numbers on Page 40-31.

③ Construct Catalog Numbers for factory installed per Table 40-36 on Page 40-29.

④ Replace “ ” with the correct Catalog Number from Page 40-31. Example: OPTC2V.

Discount Symbol..... SS-2

Accessories

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adapter plate and plugs.

Table 40-44. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. \$
		Length	Width	Height	Weight		
MF4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	OPTN12FR4	
MF5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	OPTN12FR5	
MF6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	OPTN12FR6	

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-45. Flange Kit Type 12 — MF4 – MF6 ^①

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
MF4	W	OPTTHRFR4	
MF5	W	OPTTHRFR5	
MF6	W	OPTTHRFR6	

^① For installation of an SLX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating are determined by rating of drive.

Table 40-46. Flange Kit Type 1 — MF4 – MF6 ^②

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
MF4	FP	OPTTHR4	
MF5	FP	OPTTHR5	
MF6	FP	OPTTHR6	

^② For installation of an SLX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating are determined by rating of drive.

Table 40-47. Flange Kit Type 12 — MF4 – MF6 ^③

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
MF4	FP	OPTTHR4	
MF5	FP	OPTTHR5	
MF6	FP	OPTTHR6	

^③ For installation of an SLX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Dimensions

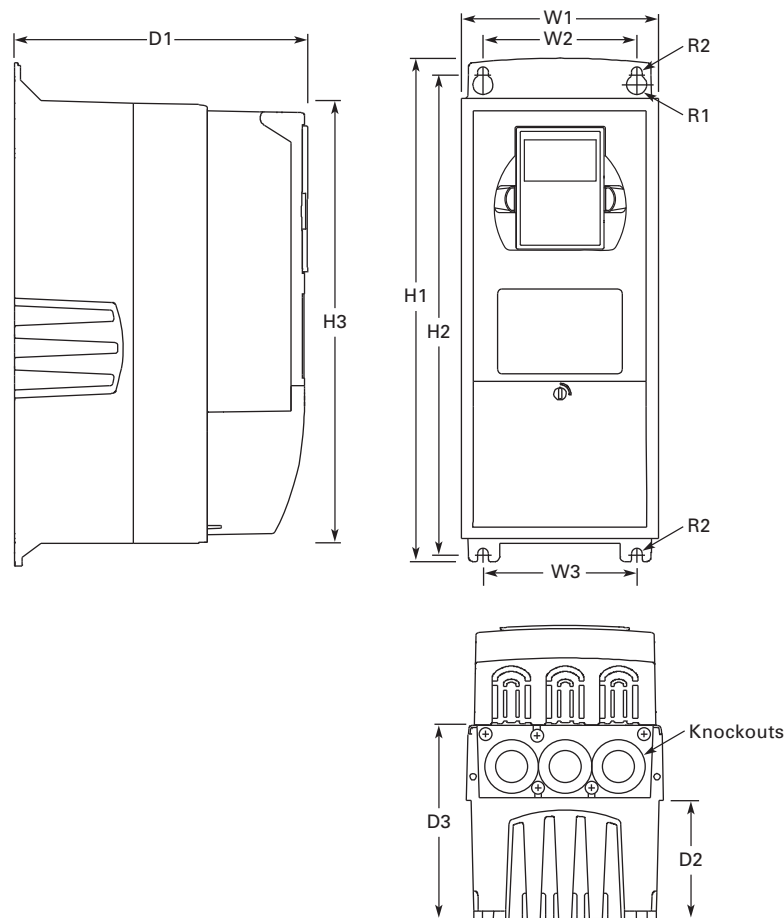


Figure 40-12. NEMA Type 1 and NEMA Type 12 SLX9000 Drive Dimensions, MF4 – MF6

Table 40-48. SLX9000 Drive Dimensions

Frame Size	Voltage	hp (l _H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)
MF4	480V	1 – 5	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)
MF5	480V	7-1/2 – 15	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37) 1 @ 1.1 (28)
MF6	480V	20 – 30	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)

Open Drives

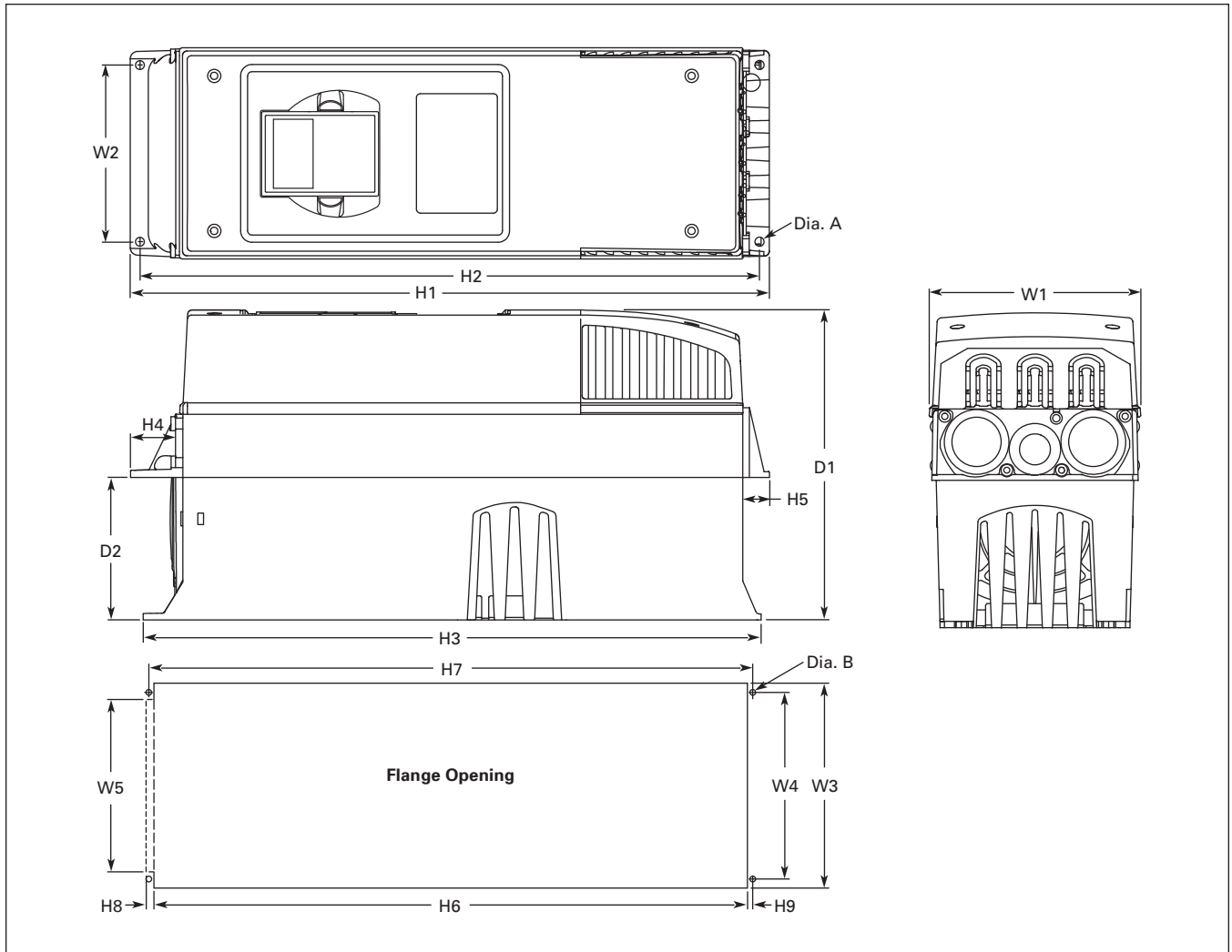


Figure 40-13. SLX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, MF4 – MF6

Table 40-49. Dimensions for SLX9000, MF4 – MF6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
MF4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
MF5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
MF6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-50. Dimensions for the Flange Opening, MF4 – MF6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
MF4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
MF5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
MF6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

Spare Units & Replacement Parts

Table 40-51. SLX9000 Spare Units & Replacement Parts

Frame	MF4						MF5			MF6			Delivery Code	Catalog Number	Price U.S. \$
hp (I _H)	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30			
Control Board															
1	1		1	1	1	1	1	1	1	1	1	1	W	VB00351	
Power Boards															
1													FB	VB00350-0003-5	
	1												FB	VB00350-0004-5	
			1										FB	VB00350-0005-5	
				1									FB	VB00350-0007-5	
					1								FB	VB00350-0009-5	
						1							FB	VB00350-0012-5	
							1						FB	VB00357-0016-5	
								1					FB	VB00357-0023-5	
									1				FB	VB00357-0031-5	
										1			FB	VB00358-0038-5	
											1		FB	VB00358-0046-5	
												1	FB	VB00358-0061-5	
Electrolytic Capacitors															
2	2		2	2									W	PP01000	
					2	2							W	PP01001	
							2	2					W	PP01002	
									2				W	PP01003	
										2	2	2	W	PP01004	
Cooling Fans															
1	1		1	1	1	1							W	PP01060	
							1	1	1				W	PP01061	
										1	1	1	W	PP01062	
1	1		1	1	1	1							W	PP01086	
							1	1	1				W	PP01088	
										1	1	1	W	PP01049	
IGBT Modules															
							1						W	CP01306	
								1					W	CP01307	
									1				W	CP01308	
										1	1		W	CP01367	
												1	W	CP01368	
										1	1		W	PP01022	
												1	W	PP01023	
1	1		1										FP	PP01032	
				1	1	1							FP	PP01033	
Capacitors															
1	1		1	1	1	1							FP	PP04051	
1	1		1	1	1	1							FP	PP04052	
							1	1	1				FP	PP05051	
							2	2	2				FP	PP00035	
										1	1	1	FP	PP06051	
										1	1	1	FP	PP06052	

① I_L only; has no corresponding I_H rated hp rating.

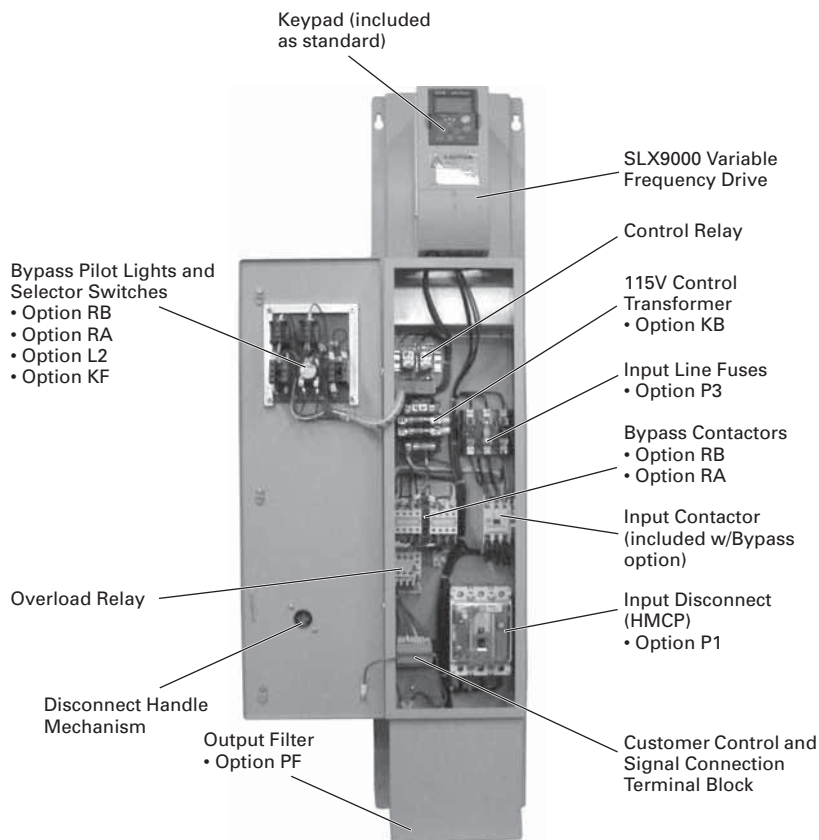
Contents

Description	Page
SLX9000 Enclosed Drives	
Product Description	40-37
Features	40-37
Standards and Certifications	40-37
Technical Data and Specifications	40-38
Catalog Number Selection	40-39
Product Selection	40-42
Dimensions	40-44

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

SLX9000 Enclosed Drives



Enclosed 9000X Series Drive

Features

- NEMA Type 1, Type 12 or Type 3R enclosures
- Input Voltage: 480V
- Complete range of control, network and power options
- Horsepower range:
 - 480V — 1 to 30 hp I_H ;
 - 1-1/2 to 40 hp I_L
- HMCP padlockable

Standards and Certifications

- UL Listed
- cUL Listed

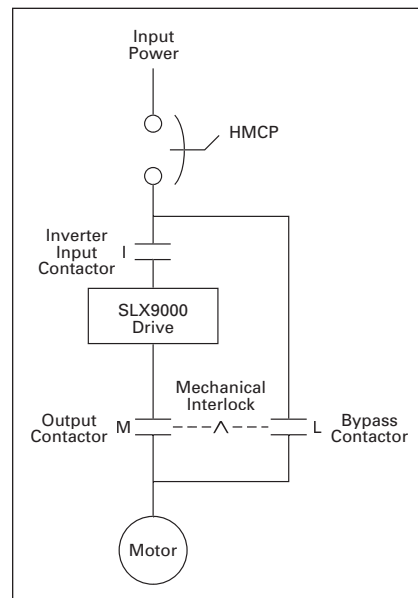


Figure 40-14. Power Diagram for Bypass Options RB and RA

Technical Data and Specifications

Table 40-52. Specifications

Feature Description	SLX9000 Enclosed Products — NEMA Type 1, NEMA Type 12 or NEMA Type 3R
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions: Remote Keypad/Display Personal Computer	Standard Standard
Operator Control Provisions: Drive Mounted Keypad/Display Remote Keypad/Display Conventional Control Elements Serial Communications 115V AC Control Circuit	Standard Standard Standard Optional Optional
Speed Setting Inputs: Keypad 0 – 10V DC Potentiometer/Voltage Signal 4 – 20 mA Isolated 4 – 20 mA Differential 3 – 15 psig	Standard Standard Configurable Configurable Optional
Analog Outputs: Speed/Frequency Torque/Load/Current Motor Voltage Kilowatts 0 – 10V DC Signals 4 – 20 mA DC Signals Isolated Signals	Standard Programmable Programmable Programmable Configurable w/Jumpers Standard Optional

Feature Description	SLX9000 Enclosed Products — NEMA Type 1, NEMA Type 12 or NEMA Type 3R
Input/Output Interface Features (Continued)	
Discrete Outputs: Fault Alarm Drive Running Drive at Set Speed Optional Parameters Dry Contacts Additional Discrete Outputs	Standard Standard Programmable 14 1 (Relay Form C) Optional
Communications: RS-232 RS-422/485 DeviceNet™ Modbus RTU CanOpen (Slave) Profibus-DP Lonworks® Johnson Controls Metasys™ N2	Standard Optional Optional Optional Optional Optional Optional Optional

Performance Features

Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Standard
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz

Standard Conditions for Application and Service

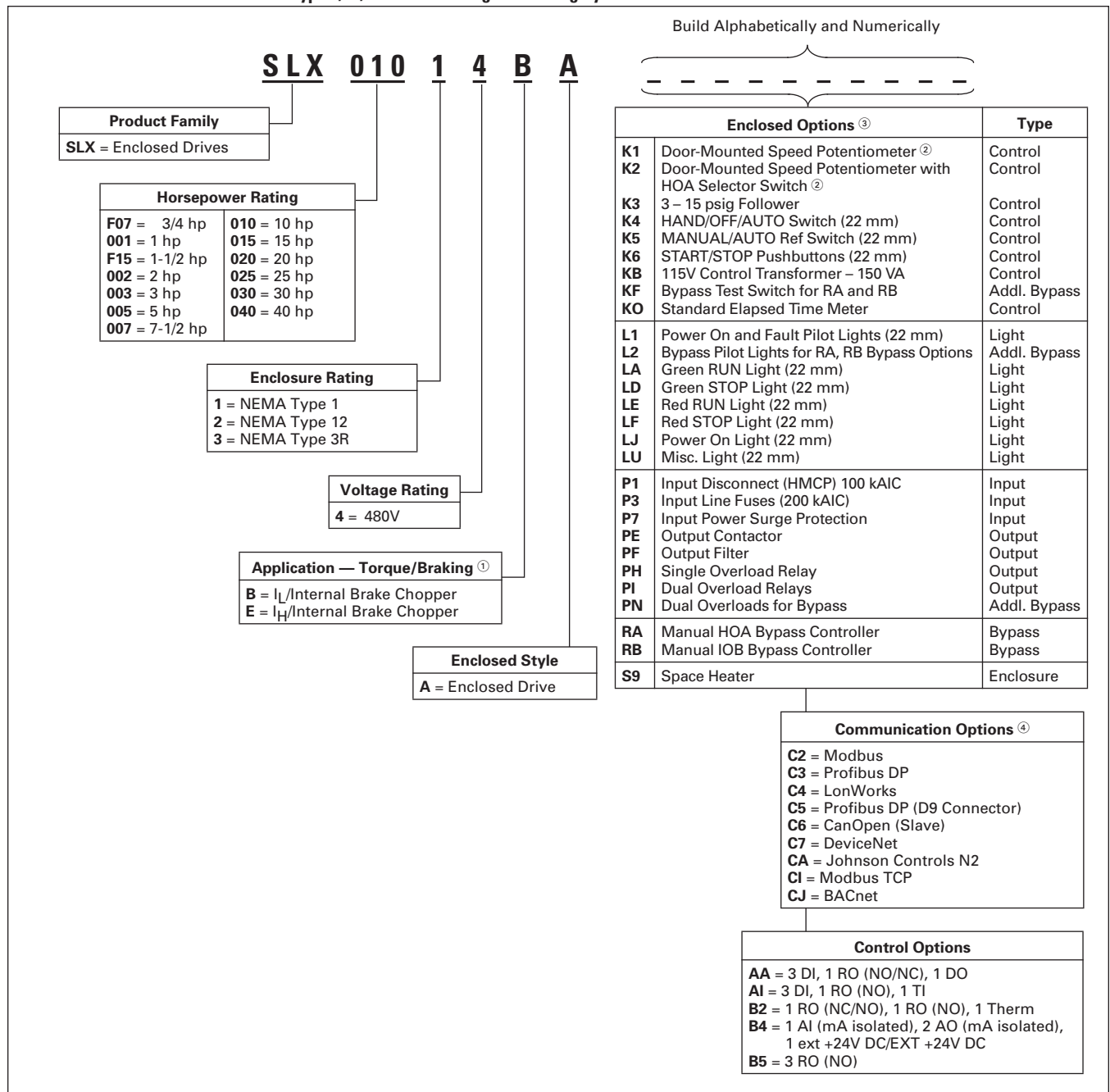
Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	>96

Table 40-53. Standard I/O Specifications

Description	Specification
3 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, $R_i > 5\text{ k}\Omega$
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, $R_i > 200\text{ k}\Omega$ Current: 0 (4) – 20 mA, $R_i = 250\text{ k}\Omega$
1 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive, 8 Amp switching
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, $R_L < 500\text{ ohms}$, resolution 10 Bits/0.1%
1 – RS-485 Serial	RS-485 Modbus Communication

Catalog Number Selection

Table 40-54. SLX9000 Enclosed NEMA Type 1/12/3R Drive Catalog Numbering System



① Brake Chopper is factory installed standard. **Note:** External dynamic braking resistors not included. Consult factory.

② Includes local/remote speed reference switch.

③ See **Pages 40-40** and **40-41** for descriptions.

④ See **Pages 40-41** and **40-42** for complete descriptions.

Enclosed Drives

Control/Communication Option Descriptions

Table 40-55. Available Control/Communications Options

Option	Description	Option Type
K1	Door-Mounted Speed Potentiometer — Provides the SLX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the SLX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	3 – 15 psig Follower — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the SLX9000.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
K5	MANUAL/AUTO Speed Reference Switch — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	START/STOP Pushbuttons — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KB	115V Control Transformer – 150 VA — Provides a fused control power transformer with 115V for customer use.	Control
KF	Bypass Test Switch for RB and RA — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	Standard Elapsed Time Meter — Provides a door-mounted elapsed run time meter.	Control
L1	Power On and Fault Pilot Lights (22 mm) — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	Bypass Pilot Lights for RB, RA Bypass Options — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LA	Green RUN Light (22 mm) — Provides a green run light that indicates the drive is running.	Light
LD	Green STOP Light (22 mm) — Provides a green stop light that indicates the drive is stopped.	Light
LE	Red Run Pilot Light (22 mm) — Provides a red run pilot light that indicates the drive is running.	Light
LF	Red STOP Light (22 mm) — Provides a red stop light that indicates the drive is stopped.	Light
LJ	Power On Light (22 mm) — Provides a white power on light that indicates the drive enclosure power is on.	Light
LU	Misc. Light (22 mm) — Provides a misc. “user defined” pilot light. User to define light function and color.	Light
P1	Input Disconnect Assembly Rated to 100 kAIC — High Interruption Circuit Breaker that provides a means of short circuit protection for the power cables between it and the SLX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SLX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	Input Line Fuses Rated to 200 kAIC — Provides high-level fault protection of the SLX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P5	5% Input Reactance — Add additional input reactance to increase total from 3% standard to optional 5%.	Input
P7	MOV Surge Suppressor — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
PE	Output Contactor — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options RB and RA include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	Output Filter — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PH	Single Overload Relay — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	Dual Overload Relays — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	Dual Overloads for Bypass — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Enclosed Drives

Table 40-55. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	Manual HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SLX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. A Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-37).	Bypass
RB	Manual IOB Bypass Controller — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SLX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. A Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-37).	Bypass
S9	Space Heater — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. Requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

SLX9000 Series Option Board Kits

The SLX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two option boards (see **Figure 40-15**).

The SLX9000 Drive accommodates the standard I/O and an integrated RS-485 (Modbus) connector.

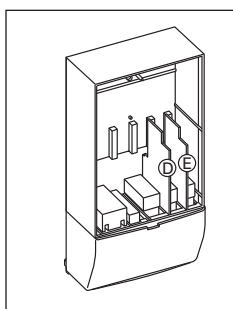


Figure 40-15. 9000X Series Option Boards

Table 40-56. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200 \text{ k}\Omega$
Analog current, input	0 (4) – 20 mA, $R_i = 250 \Omega$
Digital Input	24V: "0" $\leq 10\text{V}$, "1" $\geq 18\text{V}$, $R_i > 5 \text{ k}\Omega$
Aux. voltage	24V ($\pm 20\%$), max. 50 mA
Reference voltage	10V $\pm 3\%$, max. 10 mA
Analog current, output	0 (4) – 20 mA, $R_L = 500 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Relay output	300V DC, 250V AC
Max. switching voltage	8A/24V DC, .4A/300V DC, 2 kVA/250V AC
Max. switching load	2A rms
Thermistor input	$R_{trip} = 4.7 \text{ k}\Omega$

40

Table 40-57. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SLX9000 Programs
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$	
Extended I/O Card Options						
3 DI, 1 RO (NO/NC), 1 DO	D	OPTAA		AA		X
3 DI, 1 RO (NO), 1 TI	D	OPTAI		AI		X
1 RO (NC/NO), 1 RO (NO), 1 Therm	D, E	OPTB2		B2		X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	D, E	OPTB4		B4		X
3 RO (NO)	D, E	OPTB5		B5		X
Communication Cards						
Johnson Controls N2	D, E	OPTC2		CA		X
Modbus	D, E	OPTC2		C2		X
Modbus TCP	D, E	OPTCI		CI		X
BACnet	D, E	OPTCJ		CJ		X
Profibus DP	D, E	OPTC3		C3		X
LonWorks	D, E	OPTC4		C4		X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X
CanOpen (Slave)	D, E	OPTC6		C6		X
DeviceNet	D, E	OPTC7		C7		X
Keypad						
SLX9000 Series LCD Keypad (Replacement Keypad)		KEYPAD-LCD		—		X
SLX9000 Series Remote Mount Keypad Unit (Keypad not included, includes 6.5 ft. cable, keypad holder, mounting hardware)		OPTDRA-02L		—		X

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

Discount Symbol SS-3

Enclosed Drives

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the SLX9000 drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports

9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the SLX9000 as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the SLX9000 on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the SLX9000 to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the SLX9000 on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250k baud and 500K baud.

Product Selection**When Ordering**

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- **Read all Footnotes.**

480V Drives**Table 40-58. 480V AC Input Base Drive**

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12			NEMA Type 3R		
			Frame Size	Base Catalog Number ②	Price U.S. \$	Frame Size	Base Catalog Number ②	Price U.S. \$	Frame Size	Base Catalog Number ②	Price U.S. \$
High Overload Drive and Enclosure											
MF0	1	2.2	MF4	SLX00114EA		MF4	SLX00124EA		MF4	SLX00134EA	
	1-1/2	3.3	MF4	SLXF1514EA		MF4	SLXF1524EA		MF4	SLXF1534EA	
	2	4.3	MF4	SLX00214EA		MF4	SLX00224EA		MF4	SLX00234EA	
	3	5.6	MF4	SLX00314EA		MF4	SLX00324EA		MF4	SLX00334EA	
	5	7.6	MF4	SLX00514EA		MF4	SLX00524EA		MF4	SLX00534EA	
MF1	7-1/2	12	MF5	SLX00714EA		MF5	SLX00724EA		MF5	SLX00734EA	
	10	16	MF5	SLX01014EA		MF5	SLX01024EA		MF5	SLX01034EA	
	15	23	MF5	SLX01514EA		MF5	SLX01524EA		MF5	SLX01534EA	
MF2	20	31	MF6	SLX02014EA		MF6	SLX02024EA		MF6	SLX02034EA	
	25	38	MF6	SLX02514EA		MF6	SLX02524EA		MF6	SLX02534EA	
	30	46	MF6	SLX03014EA		MF6	SLX03024EA		MF6	SLX03034EA	
Low Overload Drive and Enclosure											
MF0	1-1/2	3.3	MF4	SLXF1514BA		MF4	SLXF1524BA		MF4	SLXF1534BA	
	2	4.3	MF4	SLX00214BA		MF4	SLX00224BA		MF4	SLX00234BA	
	3	5.6	MF4	SLX00314BA		MF4	SLX00324BA		MF4	SLX00334BA	
	5	7.6	MF4	SLX00514BA		MF4	SLX00524BA		MF4	SLX00534BA	
	7-1/2	12	MF4	SLX00714BA		MF4	SLX00724BA		MF4	SLX00734BA	
MF1	10	16	MF5	SLX01014BA		MF5	SLX01024BA		MF5	SLX01034BA	
	15	23	MF5	SLX01514BA		MF5	SLX01524BA		MF5	SLX01534BA	
	20	31	MF5	SLX02014BA		MF5	SLX02024BA		MF5	SLX02034BA	
MF2	25	38	MF6	SLX02514BA		MF6	SLX02524BA		MF6	SLX02534BA	
	30	46	MF6	SLX03014BA		MF6	SLX03024BA		MF6	SLX03034BA	
	40	61	MF6	SLX04014BA		MF6	SLX04024BA		MF6	SLX04034BA	

① Enclosure dimensions listed on **Pages 40-44 – 40-48.**

② Includes drive, keypad and enclosure.

Discount Symbol **SS-3**

Enclosed Drives

Table 40-59. 480V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 150 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 40								

Table 40-60. 480V Light Options




Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 40							

Table 40-61. 480V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller
	KF	L2	PN	RA	RB
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 20					
25					
30					
40					


^① See Pages 40-40 and 40-41 for details.

Table 40-62. 480V Enclosure Options

Catalog Number Suffix 	Space Heater ^②
	S9
Enclosure Size	Adder U.S. \$
MF0 – MF2	

^② Requires customer supplied 115V AC supply.

Table 40-63. 480V Power Options

Catalog Number Suffix 	Input				Output			
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	5% Input Reactance	Input Power Surge Protection	Output Contactor	Output Filter	Single Overload Relay ^③	Dual Overload Relays ^③
	P1	P3	P5	P7	PE	PF	PH	PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 2								
3 – 5								
7-1/2								
10								
15								
20								
25								
30								
40								

^③ Heater packs not included.

Dimensions

Enclosure Size MF0 without Filter

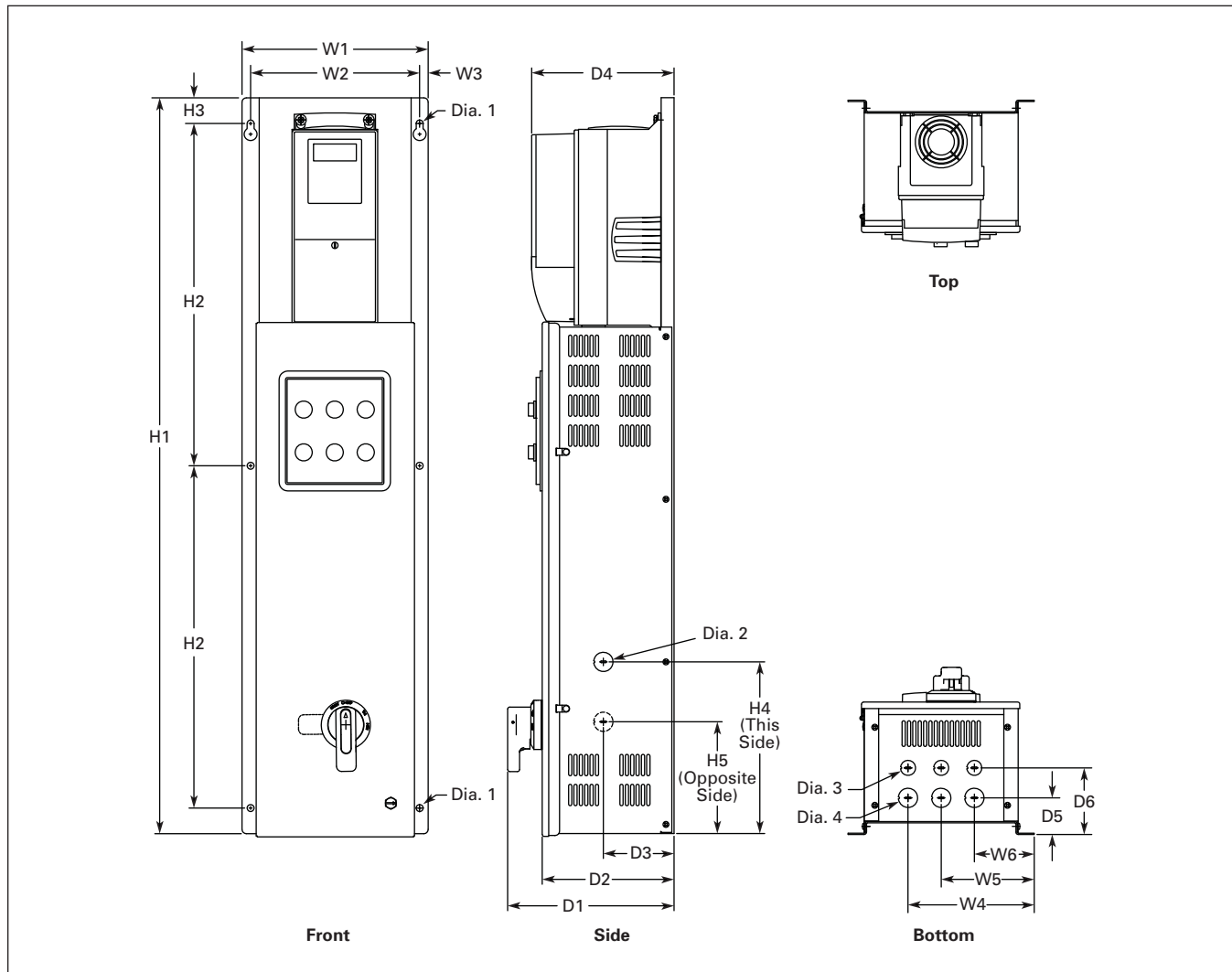


Figure 40-16. Approximate Dimensions

Table 40-64. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)										
			H1	H2	H3	H4	H5	W1	W2	W3	W4	W5	W6
480V	1 – 5	1-1/2 – 7-1/2	43.00 (1092)	20.00 (508)	1.50 (38)	10.03 (255)	6.53 (166)	10.88 (276)	9.87 (251)	.50 (13)	7.38 (187)	5.44 (138)	3.50 (89)

Table 40-64. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)										Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	D6	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	1 – 5	1-1/2 – 7-1/2	9.72 (247)	7.70 (195)	4.13 (105)	8.31 (211)	3.89 (99)	2.14 (54)	.41 (10)	1.12 (29)	.88 (22)	1.13 (29)	49 (22)

Enclosure Size MF0 with Filter

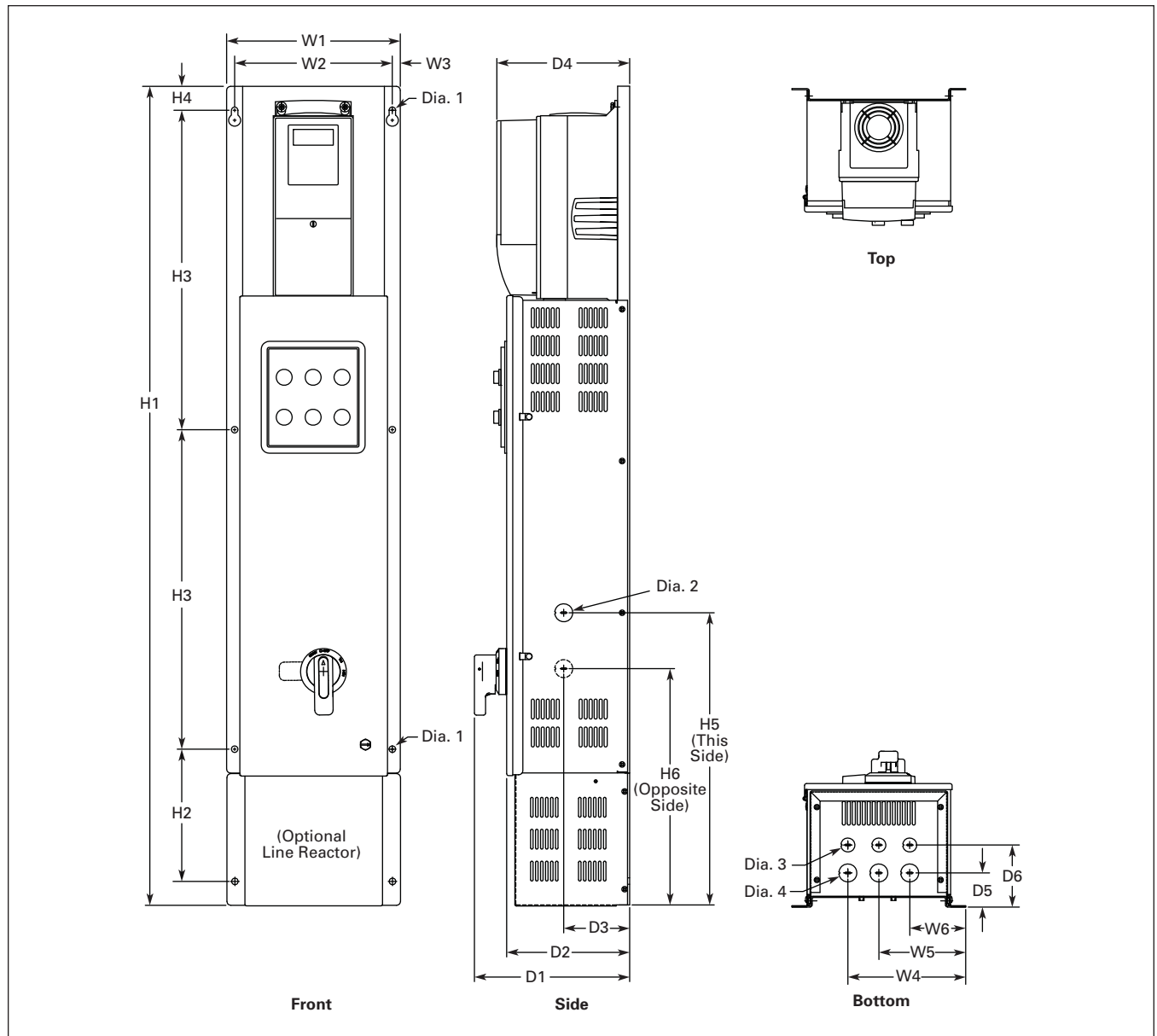


Figure 40-17. Approximate Dimensions

Table 40-65. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)											
			H1	H2	H3	H4	H5	H6	W1	W2	W3	W4	W5	W6
480V	1 – 5	1-1/2 – 7-1/2	51.28 (1303)	8.28 (210)	20.00 (508)	1.50 (38)	18.30 (465)	14.80 (378)	10.88 (276)	9.87 (251)	.50 (13)	7.38 (187)	5.44 (138)	3.50 (89)

Table 40-65. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)										Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	D6	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	1 – 5	1-1/2 – 7-1/2	9.72 (247)	77.70 (195)	4.13 (105)	8.31 (211)	3.89 (99)	2.14 (54)	.41 (10)	1.12 (29)	.88 (22)	1.13 (29)	49 (22)

Enclosed Drives

Enclosure Size MF1 without Filter

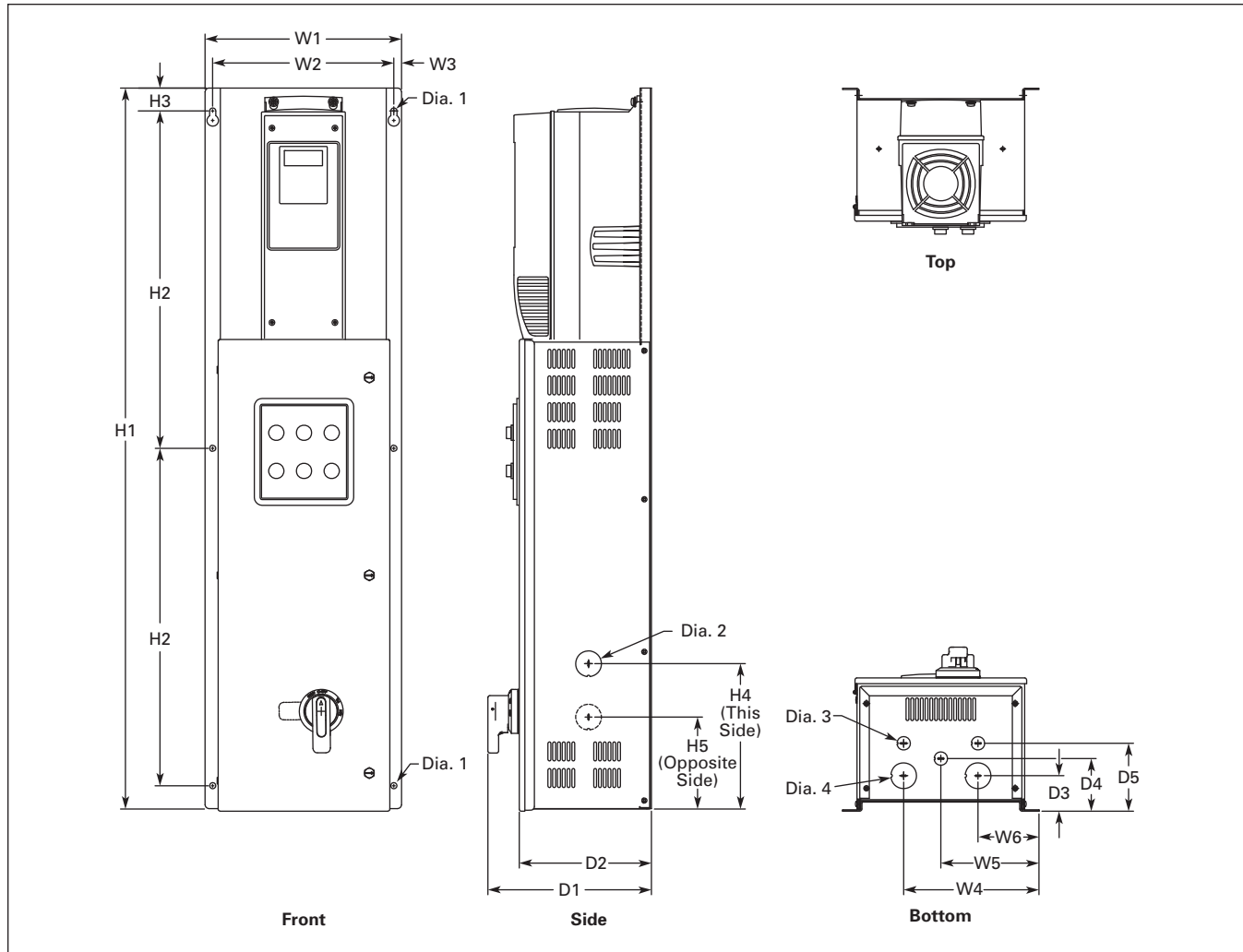


Figure 40-18. Approximate Dimensions

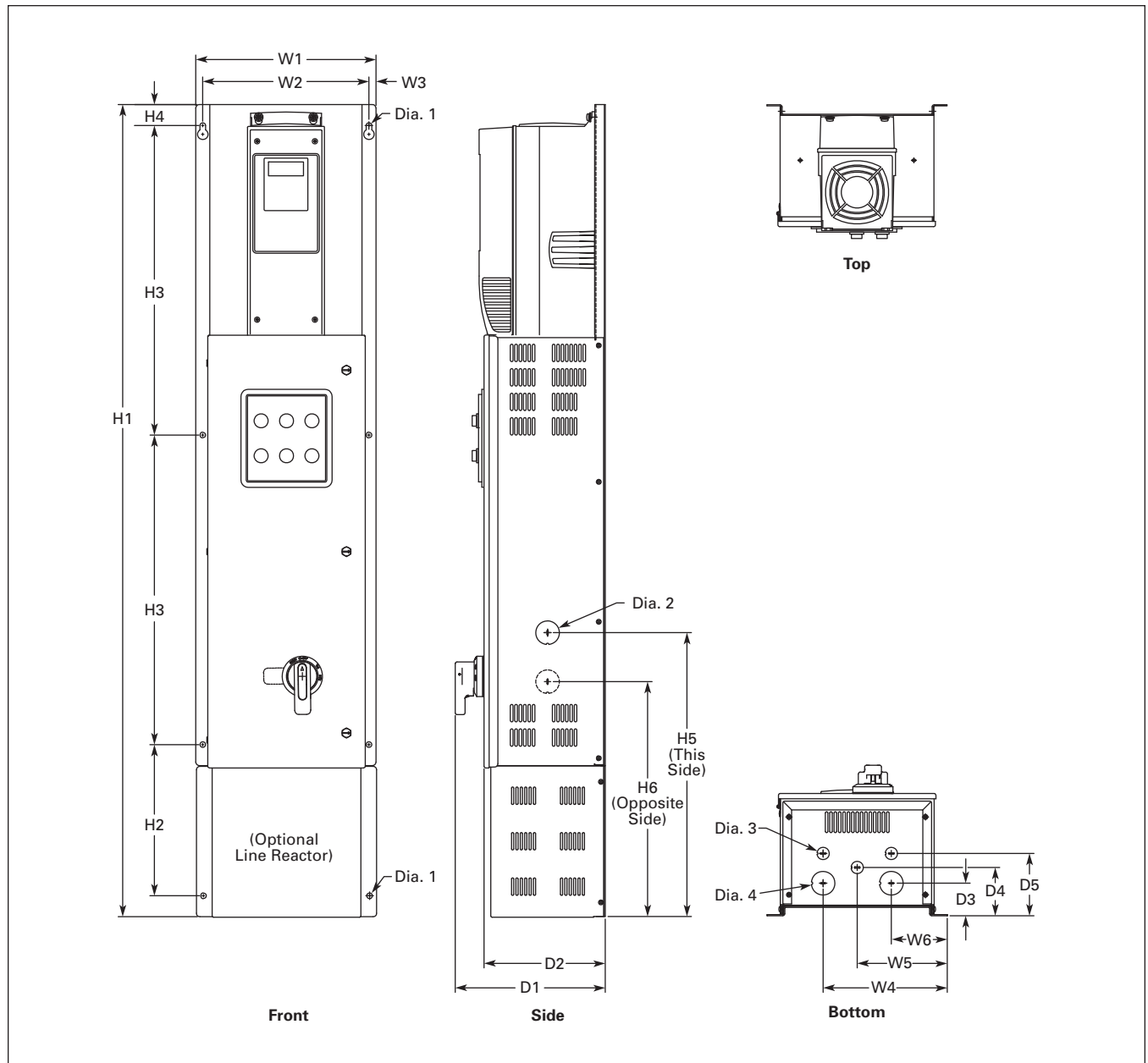
Table 40-66. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)										
			H1	H2	H3	H4	H5	W1	W2	W3	W4	W5	W6
480V	7-1/2 – 15	10 – 20	47.25 (1200)	22.13 (562)	1.50 (38)	9.50 (241)	6.00 (152)	12.87 (327)	11.87 (302)	.50 (13)	8.88 (225)	6.44 (164)	4.00 (102)

Table 40-66. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)									Max. Approx. Wt. Lbs. (kg)
			D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
480V	7-1/2 – 15	10 – 20	10.72 (272)	8.67 (220)	2.51 (64)	3.64 (92)	4.64 (118)	.41 (10)	1.69 (43)	.88 (22)	1.69 (43)	67 (30)

Enclosure Size MF1 with Filter



40

Figure 40-19. Approximate Dimensions

Table 40-67. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)											
			H1	H2	H3	H4	H5	H6	W1	W2	W3	W4	W5	W6
480V	7-1/2 – 15	10 – 20	58.05 (1475)	10.80 (274)	22.13 (562)	1.50 (38)	20.28 (515)	16.78 (426)	12.87 (327)	11.87 (302)	.50 (13)	8.88 (225)	6.44 (164)	4.00 (102)

Table 40-67. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)								Max. Approx. Wt. Lbs. (kg)	
			D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3		Dia. 4
480V	7-1/2 – 15	10 – 20	10.72 (272)	8.67 (220)	2.32 (59)	3.45 (88)	4.45 (113)	.41 (10)	1.69 (43)	.88 (22)	1.69 (43)	67 (30)

Enclosure Size MF2

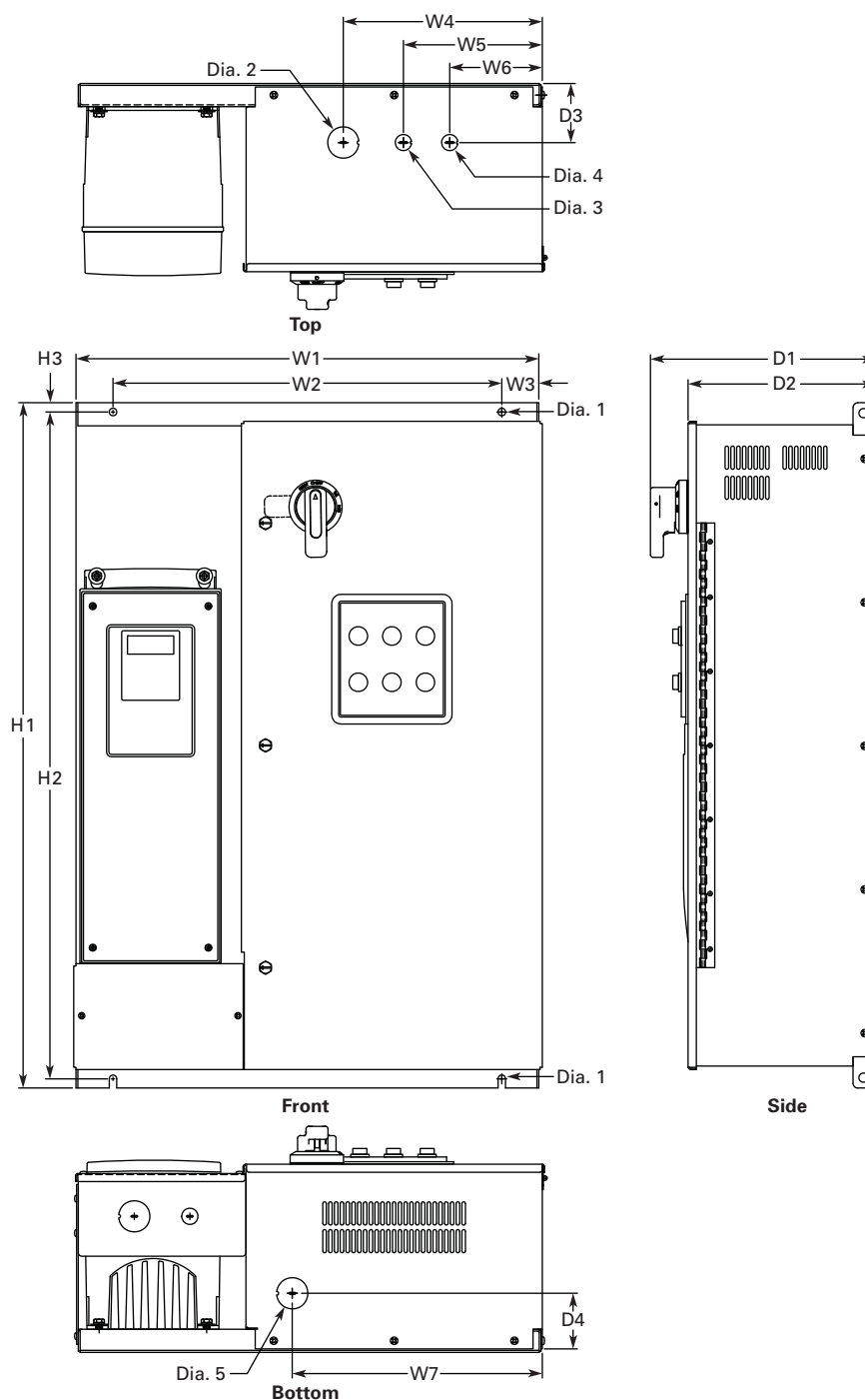


Figure 40-20. Approximate Dimensions

Table 40-68. Approximate Dimensions and Shipping Weight — Enclosed Products

Voltage AC	hp		Approximate Dimensions in Inches (mm)																		Max. Approx. Wt. Lbs. (kg)	
	(I _H)	(I _L)	H1	H2	H3	W1	W2	W3	W4	W5	W6	W7	D1	D2	D3	D4	Dia. 1	Dia. 2	Dia. 3	Dia. 4		Dia. 5
480V	20 – 30	25 – 40	37.00 (940)	36.00 (914)	.50 (13)	25.00 (635)	21.00 (533)	2.00 (51)	10.69 (271)	7.44 (189)	4.94 (125)	13.44 (341)	12.19 (310)	10.16 (258)	3.19 (81)	3.12 (79)	.41 (10)	1.69 (43)	.87 (22)	.88 (22)	1.69 (43)	126 (57)

Contents

Description Page

SVX9000 Open Drives

Product Description	40-51
Features	40-51
Technical Data and Specifications	40-52
Catalog Number Selection	40-53
Product Selection	40-54
Options	40-60
Accessories	40-61
Dimensions	40-62
Spare Units & Replacement Parts	40-79

SVX9000 Enclosed Drives

Product Description	40-85
Features	40-85
Standards and Certifications	40-85
Technical Data and Specifications	40-86
Catalog Number Selection	40-87
Product Selection	40-92
Dimensions	40-101

SVX9000 VFD Pump Panels

Product Description	40-112
Features	40-112
Standards and Certifications	40-112
Technical Data and Specifications	40-113
Catalog Number Selection	40-114
Product Selection	40-118
Dimensions	40-124
Wiring Diagrams	40-130

Overview

With the SVX9000 series sensorless vector control, Eaton's expanded Cutler-Hammer® drive offering now covers a complete line of PWM adjustable frequency (speed) drives in ratings from:

- 208V — 3/4 to 100 hp I_H ;
1 to 100 hp I_L
- 230V — 3/4 to 100 hp I_H ;
1 to 100 hp I_L
- 480V — 1 to 1900 hp I_H ;
1-1/2 to 2200 hp I_L
- 575V — 2 to 2000 hp I_H ;
3 to 2300 hp I_L

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000 drives. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

A full range of enclosure types and options are available to meet a wide array of applications — from simple variable torque to more complex industrial applications such as conveyors, mixers and machine controls.

Application Description

Application Engineering

Proper selection and application of all drive system components is essential to assure that an adjustable frequency drive system will safely and reliably provide the performance required for any given application. The party responsible for the overall design and operation of the facility must make sure that qualified personnel are employed to select all components of the drive system, including appropriate safety devices. Eaton's Cutler-Hammer AF Drives Application Engineering Department is prepared to provide assistance to answer any questions about the technical capabilities of Cutler-Hammer drives.

Motor Selection

The basic requirement of motor selection is to match the torque vs. speed capability of the motor to the torque vs. speed requirement of the driven load.

Motor Torque vs. Speed Capability

As the speed of a motor is reduced below its 60 Hz base speed, motor cooling becomes less effective because of the reduced speed of the self-cooling fan. This limitation determines the maximum torque for continuous operation at any operating speed. The maximum intermittent operating torque is determined by the motor's torque vs. current characteristics and the output current capability of the adjustable frequency controller.

Multiple Motor Operation

A number of motors can be connected in parallel to a single controller. Since the frequency of the power supplied by the controller is the same for each motor, the motors will always operate at the same speed. Application Engineering assistance must be requested for all multiple motor applications to assure compliance with all controller design limitations.

Special Types of Motors

Standard NEMA Designs A and B three-phase motors are the only motors recommended for use in the majority of applications, but other types of motors are occasionally used. If the existing motor used in the application or the motor proposed for use with the drive system is a type other than NEMA Design A or B, Application Engineering assistance must be requested to make certain that the drive is properly applied.

Controller Selection

The basic requirement of controller selection is to match the output current, voltage and frequency capabilities of the controller with the requirements of the connected motor.

Output Current

The controller must be selected and applied such that the average operating motor current and horsepower do not exceed the continuous current and horsepower ratings of the controller. The intermittent operating current must not exceed the intermittent current rating of the controller.

Motor Protection

Cutler-Hammer adjustable frequency drives include electronic motor overload protection circuits that are designed to meet the requirements of NEC article 430-2 provided that only one motor is connected to the output of the controller.

Output Voltage and Frequency

When they are shipped, AF controllers are adjusted to provide a maximum output voltage and frequency equivalent to the input line voltage and frequency. The controllers can be adjusted to operate above line frequency, but a hazard of personal injury or equipment damage may exist when the motor is operated above base speed. Before adjusting the drive to operate above line frequency, make sure that the motor and the driven machinery can safely be operated at the resulting speed.

Product Family Overview

Controller Features

Operator Control and Interface Requirements

Since there are many possible configurations and many ways of achieving a specific end result, it pays to consider the operator control and interface requirements carefully. A simplified and more economical drive package can often be achieved by selecting from standard product offerings rather than specifying a custom designed configuration.

Installation Compatibility

The successful application of an AC drive requires the assurance that the drive will be compatible with the environment in which it will be installed. In planning the installation, be sure to carefully consider the heat produced by the drive, the altitude and temperature limits and the need for clean cooling air. Other important considerations include acoustical noise, vibration, electromagnetic compatibility, power quality, controller input harmonic current and power distribution equipment requirements.

Auxiliary Equipment and Accessories

Adjustable drives are generally designed to have a motor directly connected to the controller output terminals with no other equipment connected in series or parallel. Motor starters, disconnect switches, surge absorbers, dv/dt suppression circuits, output chokes, output transformers and any other equipment under consideration for installation on the output of the controller should not be installed without first requesting Application Engineering assistance. Power factor correction capacitors must never, under any circumstances, be connected at the output of the controller. They would serve no useful purpose, and they may damage the controller.

Enclosure Definitions

■ **NEMA Type 1** — Enclosures are intended for indoor use primarily to provide a degree of protection against contact with enclosed equipment and provide a degree of protection against a limited amount of falling dirt in locations where unusual service conditions do not exist. Top or side openings in the NEMA Type 1 enclosure allow for the free exchange of inside and outside air while meeting the UL rod entry and rust resistance design tests.

■ **NEMA Type 12** — Enclosures are intended for indoor use primarily to provide a degree of protection against circulating dust, falling dirt and dripping noncorrosive liquids. To meet UL drip, dust and rust resistance tests, NEMA Type 12 enclosures have no openings to allow for the exchange of inside and outside air.

■ **Chassis IP00** — Similar to Protected Chassis IP20 except power terminals are protected by plastic shielding only. Primarily intended to be mounted inside a surrounding protective enclosure.

■ **NEMA 3R** — Similar in design to NEMA Type 12 except with more stringent design and test requirements.

Motor Protection

DV/DT and Peak Motor Voltage Solutions

Today's AFD products offer significantly improved performance, but at the potential cost of motor insulation stress. The fast switching time of the IGBT devices used in newer AFDs can

cause a transmission line effect in the output power leads to the motor, leading to possibly damaging voltage levels. To meet this need, NEMA has introduced a motor in MG1, Part 31, which provides an insulation system designed to maintain normal motor life in AFD applications. For existing motors, a motor protection scheme is required for longer cable runs. Eaton offers three standard solutions for existing systems.

■ **MotoR_x**

This patented Cutler-Hammer solution provides an energy recovery system which clamps the peak motor voltage to a safe level for standard motors. This option is used when the distance between a single motor and the drive is 600 feet or less.

■ **Output Line Reactor**

This option provides an output line reactor, reducing the DV/DT of the AFD output voltage and lessening the transmission line effect, to lower the peak voltage at the motor terminals.

Product Availability Codes

The product availability codes indicate the type of facility (warehouse, Mod Center or factory) that the product will ship from and, if it is not in stock, the number of working days needed to assemble the product from receipt of the order to shipment from the designated facility. Please note that this lead-time does not include any in-transit time from our facility to your facility.

Table 40-69. Product Availability Codes

Codes	Description
W	Warehouse stocked item. Shipped on customer request date. If item is backordered, please check Vista/VISTALINE or contact your Customer Support Center for product availability.
F1	Factory assemble-to-order. Shipped from factory within 1 working day after receipt of order on Vista.
FA	Factory assemble-to-order. Shipped from factory within 2 – 3 working days after receipt of order on Vista.
FB	Factory assemble-to-order. Shipped from factory within 4 – 10 working days after receipt of order on Vista.
FC	Factory assemble-to-order. Shipped from factory within 11 – 15 working days after receipt of order on Vista.
FD	Factory assemble-to-order. Shipped from factory within 16 – 20 working days after receipt of order on Vista.
FP	Factory assemble-to-order. Shipped from factory on negotiated promise date.
MA	Mod Center assemble-to-order. Shipped from Mod Center within 1 – 3 working days after receipt of order on Vista.
MB	Mod Center assemble-to-order. Shipped from Mod Center within 4 – 10 working days after receipt of order on Vista.
MP	Mod Center assemble-to-order. Shipped from Mod Center on negotiated promise date.

Product availability codes contained herein for a given product may be quantity sensitive and are subject to change without notice. For the most current information, refer to the Product Identification Inquiry (PIN) screen on Vista.

SVX9000 Open Drives



SVX9000 Open Drives

Product Description

Cutler-Hammer® SVX9000 Series Adjustable Frequency Drives from Eaton's electrical business are the next generation of drives specifically engineered for today's commercial and industrial applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is comprised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

Features

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12 keypad on all drives

- The SVX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" Precision application programs consisting of:
 - Basic
 - Standard
 - Local/Remote
 - Multi Step Speed Control
 - PID Control
 - Multi-Purpose Control
 - Pump and Fan Control with Auto Change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- UL Listed
- Hand-Held Auxiliary 240 Power Supply allows programming/monitoring of control module without applying full power to the drive
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard from:
 - 1 – 30 hp/380 – 500V
 - 3/4 – 15 hp/208 – 230V
- NEMA Type 1 and NEMA Type 12 enclosures available, Frame Sizes FR4 – FR9
- Open Chassis FR10 and greater
- NEMA Type 1 and NEMA Type 12 available in FR10 Freestanding design; NEMA Type 1 available in FR11 Freestanding design
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

Table 40-70. SVX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC

Output Ratings

Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload Current (I_H/I_L)	150% I_H , 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds

Control Characteristics

Control Method	Frequency Control (V/f) Open Loop: Sensorless Vector Control, Closed Loop: SPX9000 Drives Only
Switching Frequency Frame 4 – 6 Frame 7 – 12	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy \pm 1% V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% \times T_n (without brake option)

Ambient Conditions

Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H (FR4 – FR9) 14°F (-10°C), no frost to 104°F (+40°C) I_H (FR10 and up) 14°F (-10°C), no frost to 104°F (+40°C) I_L (all frames)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and ship- ping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54, Open Chassis/IP20

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity require- ments; Emissions: EN 61800-3, LEVEL H

Control Connections

Analog Input Voltage	0 to 10V, R = 200 k Ω (-10 to 10V joystick con- trol) Resolution .1%; accuracy \pm 1%
Analog Input Current	0(4) to 20 mA; R_i - 250 Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V \pm 15%, max. 250 mA
Output Reference Volt- age	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy \pm 2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A

Protections

Overcurrent Protection	Trip limit 4.0 \times I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)

Table 40-71. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: “0” \leq 10V, “1” \geq 18V, R_i > 5 k Ω
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – \pm 10V, R_i > 200 k Ω Current: 0 (4) – 20 mA, R_i = 250 k Ω
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R_L < 500 ohms, resolution 10 Bits/0.1%

Catalog Number Selection

Table 40-72. Adjustable Frequency Drive Catalog Numbering System

SVX		010		A		1		-		4		A		1		B		1		- - - - -									
Product Family																													
SVX = Open Drives																													
SPX = Open Drives																													
FR10 & greater																													
Horsepower Rating																													
F07 = 3/4 hp										800 = 800 hp																			
F15 = 1-1/2 hp										900 = 900 hp																			
007 = 7-1/2 hp										H10 = 1000 hp																			
010 = 10 hp										H12 = 1200 hp																			
050 = 50 hp										H13 = 1350 hp																			
125 = 125 hp										H15 = 1500 hp																			
350 = 350 hp										H16 = 1600 hp																			
700 = 700 hp										H20 = 2000 hp																			
AFD Software Series																													
A = Standard Software																													
Enclosure ③④																													
0 = Chassis										2 = NEMA Type 12																			
1 = NEMA Type 1																													
										Voltage Rating																			
										2 = 230 (208 – 240) V																			
										4 = 480 (380 – 500) V																			
										5 = 575 (525 – 690) V																			
										Keypad																			
										A = Alphanumeric																			
																				Brake Chopper Options ②									
																				N = No Brake Chopper Circuit									
																				B = Internal Brake Chopper Circuit									
																				Input Options ①									
																				1 = 3-phase, EMC H									
																				2 = 3-phase, EMC N									
																				4 = 3-phase, EMC L									
																				Options									
																				Options appear in alphabetical order.									
																				Extended I/O Card Options									
																				B1 = 6 DI, 1 ext +24V DC/EXT +24V DC									
																				B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm									
																				B4 = 1 AI (mA isolated), 2 AO (mA isolated),									
																				1 ext +24V DC/EXT + 24V DC									
																				B5 = 3 RO (NO)									
																				B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100									
																				B9 = 1 RO (NO), 5 DI 42 – 240V AC Input									
																				Communication Cards									
																				CA = Johnson Controls N2									
																				CI = Modbus TCP									
																				CJ = BACnet									
																				CK = Ethernet IP									
																				C2 = Modbus									
																				C3 = Profibus DP									
																				C4 = LonWorks									
																				C5 = Profibus DP (D9 Connector)									
																				C6 = CanOpen (Slave)									
																				C7 = DeviceNet									
																				C8 = Modbus (D9 Type Connector)									
																				D3 = RS-232 with D9 Connection									
																				Board Modifications									
																				1 = Standard Boards									
																				2 = Conformal (Varnished) Coating ⑤									

- ① All 230V Drives and 480V Drives up to 200 hp (I_H) are only available with Input Option 1 (EMC Level H). 480V Drives 250 hp (I_H) or larger are available with Input Option 2 (EMC Level N). 480V Drives are available with Input Option 4 (EMC Level L). 575V Drives 200 hp (I_H) or larger are only available with Input Option 2. 575V Drives up to 150 hp (I_H) are only available with Input Option 4 (EMC Level L).
- ② 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option B. 480V Drives 40 hp (I_H) or larger come standard with Brake Chopper Option N. 230V Drives up to 15 hp (I_H) are only available with Brake Chopper Option B. 230V Drives 20 hp or larger come standard with Brake Chopper Option N. All 575V Drives come standard without Brake Chopper Option (N). **Note:** N = No Brake Chopper.
- ③ 480V Drives 250 hp (I_H) and larger are available with enclosure style 0 (Chassis); 690V Drives 200 hp (I_H) and larger are available with enclosure style 0 (Chassis).
- ④ 480V and 690V FR10 Freestanding Drives are available with enclosure style 1 (NEMA Type 1) and enclosure style 2 (NEMA Type 12). FR11 Freestanding Drives only available with enclosure style 1 (NEMA Type 1).
- ⑤ Factory promise delivery. Consult Sales Office for availability.

Open Drives

Product Selection

230V SVX9000 Drives

Table 40-73. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	W	3/4	3.7	1	4.8	SVXF07A1-2A1B1	
		1	4.8	1-1/2	6.6	SVX001A1-2A1B1	
		1-1/2	6.6	2	7.8	SVXF15A1-2A1B1	
		2	7.8	3	11	SVX002A1-2A1B1	
		3	11	—	12.5	SVX003A1-2A1B1	
FR5	W	—	12.5	5	17.5	SVX004A1-2A1B1	
		5	17.5	7-1/2	25	SVX005A1-2A1B1	
		7-1/2	25	10	31	SVX007A1-2A1B1	
FR6	W	10	31	15	48	SVX010A1-2A1B1	
		15	48	20	61	SVX015A1-2A1B1	
FR7	W	20	61	25	75	SVX020A1-2A1N1	
		25	75	30	88	SVX025A1-2A1N1	
		30	88	40	114	SVX030A1-2A1N1	
FR8	W	40	114	50	140	SVX040A1-2A1N1	
		50	140	60	170	SVX050A1-2A1N1	
		60	170	75	205	SVX060A1-2A1N1	
FR9	W	75	205	100	261	SVX075A1-2A1N1	
		100	261	—	—	SVX100A1-2A1N1	

Table 40-74. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	3/4	3.7	1	4.8	SVXF07A2-2A1B1	
		1	4.8	1-1/2	6.6	SVX001A2-2A1B1	
		1-1/2	6.6	2	7.8	SVXF15A2-2A1B1	
		2	7.8	3	11	SVX002A2-2A1B1	
		3	11	—	12.5	SVX003A2-2A1B1	
FR5	F1	—	12.5	5	17.5	SVX004A2-2A1B1	
		5	17.5	7-1/2	25	SVX005A2-2A1B1	
		7-1/2	25	10	31	SVX007A2-2A1B1	
FR6	F1	10	31	15	48	SVX010A2-2A1B1	
		15	48	20	61	SVX015A2-2A1B1	
FR7	W	20	61	25	75	SVX020A2-2A1N1	
		25	75	30	88	SVX025A2-2A1N1	
		30	88	40	114	SVX030A2-2A1N1	
FR8	FP	40	114	50	140	SVX040A2-2A1N1	
		50	140	60	170	SVX050A2-2A1N1	
		60	170	75	205	SVX060A2-2A1N1	
FR9	FP	75	205	100	261	SVX075A2-2A1N1	
		100	261	—	—	SVX100A2-2A1N1	

480V SVX9000 Drives

Table 40-75. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	W	1	2.2	1-1/2	3.3	SVX001A1-4A1B1	
		1-1/2	3.3	2	4.3	SVXF15A1-4A1B1	
		2	4.3	3	5.6	SVX002A1-4A1B1	
		3	5.6	5	7.6	SVX003A1-4A1B1	
		5	7.6	—	9	SVX005A1-4A1B1	
		—	9	7-1/2	12	SVX006A1-4A1B1	
		7-1/2	12	10	16	SVX007A1-4A1B1	
FR5	W	10	16	15	23	SVX010A1-4A1B1	
		15	23	20	31	SVX015A1-4A1B1	
		20	31	25	38	SVX020A1-4A1B1	
FR6	W	25	38	30	46	SVX025A1-4A1B1	
		30	46	40	61	SVX030A1-4A1B1	
		40	61	50	72	SVX040A1-4A1N1	
FR7	W	50	72	60	87	SVX050A1-4A1N1	
		60	87	75	105	SVX060A1-4A1N1	
		75	105	100	140	SVX075A1-4A1N1	
FR8	W	100	140	125	170	SVX100A1-4A1N1	
		125	170	150	205	SVX125A1-4A1N1	
		150	205	200	261	SVX150A1-4A1N1	
FR9	W	200	245	250	300	SVX200A1-4A1N1	
		245	300	—	—	SVX200A1-4A1N1	

Discount Symbol..... SS-2

Open Drives

Table 40-76. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	W	250	330	300	385	SPX250A1-4A4N1	
	FP	300	385	350	460	SPX300A1-4A4N1	
	W	350	460	400	520	SPX350A1-4A4N1	
FR11	FP	400	520	500	590	SPX400A1-4A4N1	
	FP	500	590	550	650	SPX500A1-4A4N1	
	FP	550	650	600	730	SPX550A1-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-77. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	1	2.2	1-1/2	3.3	SVX001A2-4A1B1	
		1-1/2	3.3	2	4.3	SVXF15A2-4A1B1	
		2	4.3	3	5.6	SVX002A2-4A1B1	
		3	5.6	5	7.6	SVX003A2-4A1B1	
		5	7.6	—	9	SVX005A2-4A1B1	
		—	9	7-1/2	12	SVX006A2-4A1B1	
FR5	F1	7-1/2	12	10	16	SVX007A2-4A1B1	
		10	16	15	23	SVX010A2-4A1B1	
		15	23	20	31	SVX015A2-4A1B1	
FR6	F1	20	31	25	38	SVX020A2-4A1B1	
		25	38	30	46	SVX025A2-4A1B1	
		30	46	40	61	SVX030A2-4A1B1	
FR7	W	40	61	50	72	SVX040A2-4A1N1	
		50	72	60	87	SVX050A2-4A1N1	
		60	87	75	105	SVX060A2-4A1N1	
FR8	W	75	105	100	140	SVX075A2-4A1N1	
		100	140	125	170	SVX100A2-4A1N1	
		125	170	150	205	SVX125A2-4A1N1	
FR9	W	150	205	200	261	SVX150A2-4A1N1	
		200	245	250	300	SVX200A2-4A1N1	

Table 40-78. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	250	330	300	385	SPX250A2-4A4N1	
	FP	300	385	350	460	SPX300A2-4A4N1	
	FP	350	460	400	520	SPX350A2-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-79. 480V 380 – 500, Open Chassis Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10 ①	W	250	330	300	385	SPX250A0-4A2N1	
		300	385	350	460	SPX300A0-4A2N1	
		350	460	400	520	SPX350A0-4A2N1	
FR11	W	400	520	500	590	SPX400A0-4A2N1	
		500	590	—	650	SPX500A0-4A2N1	
		—	650	600	730	SPX550A0-4A2N1	
FR12	FP	600	730	—	820	SPX600A0-4A2N1	
	W	—	820	700	920	SPX650A0-4A2N1	
	FP	700	920	800	1030	SPX700A0-4A2N1	
FR13	FP	800	1030	900	1150	SPX800A0-4A2N1	
		900	1150	1000	1300	SPX900A0-4A2N1	
		1000	1300	1200	1450	SPXH10A0-4A2N1	
FR14	FP	1200	1600	1500	1770	SPXH12A0-4A2N1	
		1600	1940	1800	2150	SPXH16A0-4A2N1	
		1900	2300	2200	2700	SPXH19A0-4A2N1	

① FR10 – FR14 includes 3% line reactor, but it is not integral to chassis.

Open Drives

575V SVX9000 Drives

Table 40-80. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	W	2	3.33	3	4.5	SVX002A1-5A4N1	
		3	4.5	—	5.5	SVX003A1-5A4N1	
		—	5.5	5	7.5	SVX004A1-5A4N1	
		5	7.5	7-1/2	10	SVX005A1-5A4N1	
		7-1/2	10	10	13.5	SVX007A1-5A4N1	
		10	13.5	15	18	SVX010A1-5A4N1	
		15	18	20	22	SVX015A1-5A4N1	
		20	22	25	27	SVX020A1-5A4N1	
		25	27	30	34	SVX025A1-5A4N1	
FR7	W	30	34	40	41	SVX030A1-5A4N1	
		40	41	50	52	SVX040A1-5A4N1	
FR8	W	50	52	60	62	SVX050A1-5A4N1	
		60	62	75	80	SVX060A1-5A4N1	
		75	80	100	100	SVX075A1-5A4N1	
FR9	W	100	100	125	125	SVX100A1-5A4N1	
		125	125	150	144	SVX125A1-5A4N1	
		150	144	—	170	SVX150A1-5A4N1	
		—	170	200	208	SVX175A1-5A4N1	

Table 40-81. 525 – 690V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A1-5A4N1	
		250	261	300	325	SPX250A1-5A4N1	
		300	325	400	385	SPX300A1-5A4N1	
FR11	FP	400	385	450	460	SPX400A1-5A4N1	
		450	460	500	502	SPX450A1-5A4N1	
		500	502	550	590	SPX500A1-5A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-82. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	F1	2	3.33	3	4.5	SVX002A2-5A4N1	
		3	4.5	—	5.5	SVX003A2-5A4N1	
		—	5.5	5	7.5	SVX004A2-5A4N1	
		5	7.5	7-1/2	10	SVX005A2-5A4N1	
		7-1/2	10	10	13.5	SVX007A2-5A4N1	
		10	13.5	15	18	SVX010A2-5A4N1	
		15	18	20	22	SVX015A2-5A4N1	
		20	22	25	27	SVX020A2-5A4N1	
		25	27	30	34	SVX025A2-5A4N1	
FR7	FP	30	34	40	41	SVX030A2-5A4N1	
		40	41	50	52	SVX040A2-5A4N1	
FR8	FP	50	52	60	62	SVX050A2-5A4N1	
		60	62	75	80	SVX060A2-5A4N1	
		75	80	100	100	SVX075A2-5A4N1	
FR9	FP	100	100	125	125	SVX100A2-5A4N1	
		125	125	150	144	SVX125A2-5A4N1	
		150	144	—	170	SVX150A2-5A4N1	
		—	170	200	208	SVX175A2-5A4N1	

Open Drives

Table 40-83. 525 – 690V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A2-5A4N1	
		250	261	300	325	SPX250A2-5A4N1	
		300	325	400	385	SPX300A2-5A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Enclosed 480V option selection.

Table 40-84. 525 – 690V, Open Chassis Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A0-5A2N1	
		250	261	300	325	SPX250A0-5A2N1	
		300	325	400	385	SPX300A0-5A2N1	
FR11	FP	400	385	450	460	SPX400A0-5A2N1	
		450	460	500	502	SPX450A0-5A2N1	
		500	502	—	590	SPX500A0-5A2N1	
FR12	FP	—	590	600	650	SPX550A0-5A2N1	
		600	650	700	750	SPX600A0-5A2N1	
		700	750	800	820	SPX700A0-5A2N1	
FR13	FP	800	820	900	920	SPX800A0-5A2N1	
		900	920	1000	1030	SPX900A0-5A2N1	
		1000	1030	1250	1180	SPXH10A0-5A2N1	
FR14	FP	1350	1300	1500	1500	SPXH13A0-5A2N1	
		1500	1500	2000	1900	SPXH15A0-5A2N1	
		2000	1900	2300	2250	SPXH20A0-5A2N1	

Open Drives

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see Figure 40-21).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

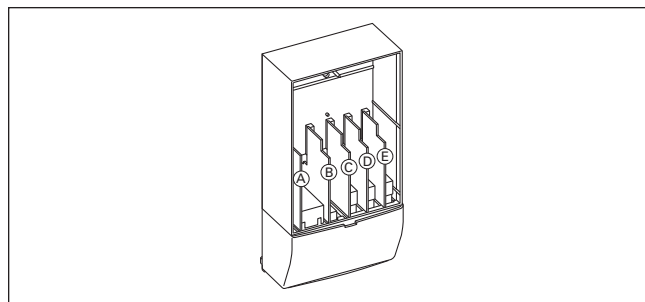


Figure 40-21. 9000X Series Option Boards

Table 40-85. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-21)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm — SPX Only	B	OPTA3		A3		—	X	X	X	X	X	X
Encoder low volt +5V/15V/24V — SPX Only	C	OPTA4		A4		—	X	X	X	X	X	X
Encoder high volt +15V/24V — SPX Only	C	OPTA5		A5		—	X	X	X	X	X	X
Double encoder — SPX Only	C	OPTA7		A7		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO — SPX Only	A	OPTA8		A8		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	OPTAE		AE		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
42 – 240V AC Input												
Communication Cards												
Modbus ③	D, E	OPTC2		C2		X	X	X	X	X	X	X
Johnson Controls N2 ③	D, E	OPTC2		CA		—	—	—	—	—	—	—
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave) ④	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD1		D1		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD2		D2		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X
Keypad												
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	KEYPAD-LOC/ REM		—		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMT-KIT- 9000X		—		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

④ SPX9000 Drives only (FR10 and larger).

Discount Symbol SS-2

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Options

Control Panel Options

Table 40-86. Control Panel Factory Options

Description	Factory Installed		Field Installed	
	Option Code	Adder U.S. \$	NEMA Type 1	
			Catalog Number	Price U.S. \$
Local/Remote Keypad SVX9000 Control Panel — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SVX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	A		KEYPAD-LOC/REM	
Keypad Remote Mounting Kit — This option is used to remote mount the SVX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft. cable, keypad holder and mounting hardware.	—		OPTRMT-KIT-9000X	

Table 40-87. Miscellaneous Options

Description	Catalog Number	Price U.S. \$
9000XDrive — A PC-based tool for controlling and monitoring of the SVX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDivecable must be used.	9000XDRIVE	
SVDivecable — 6 ft. (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000X Drive option to avoid damage to the SVX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	SVDIVECABLE	
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. <i>Consult factory.</i>	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors are not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors are not UL Listed.

Table 40-88. Brake Chopper Circuit Adder — NEMA Type 1, NEMA Type 12, Chassis

hp (l _H)	Adder U.S. \$		
	208 – 240V	380 – 500V	525 – 690V
2			
3			
5vt			
5ct			
7-1/2vt			
7-1/2ct			
10			
15			
20			
25			
30			
40			
50			
60			
75			
100			
125			
150			

hp (l _H)	Adder U.S. \$		
	208 – 240V	380 – 500V	525 – 690V
200vt			
200ct			
250			
300			
350			
400			
450			
500			
550			
600vt			
600ct			
700vt			
700ct			
800			
900			
1000			
1200			
1350			
1500			
1600			
2000			

Note: Delivery code is FP.

Table 40-89. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V, 525 – 690V (See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. \$
FR4	FP	
FR5	FP	
FR6	FP	
FR7	FP	
FR8	FP	
FR9	FP	
FR10	FP	
FR11	FP	
FR12	FP	
FR13	FP	
FR14	FP	

Table 40-90. Conformal Coated Board Kits ②

Field Installed		Factory Installed	
Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$
OPT_V ④		③	

② See Option Catalog Numbers on Page 40-58.

③ Construct Catalog Numbers for factory installed per Table 40-72 on Page 40-53.

④ Replace “ ” with the correct Catalog Number from Page 40-58. Example: OPTC2V.

Discount Symbol..... SS-2

Accessories

Demo Drive and Power Supply

Table 40-91. Demo Drive and Power Supply

Description	Catalog Number	Price U.S. \$
9000X Drive Demo	9000XDEMO	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	9000XAUX24V	

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

Table 40-92. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. \$
		Length	Width	Height	Weight		
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	OPTN12FR4	
FR5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	OPTN12FR5	
FR6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	OPTN12FR6	

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-93. Flange Kit Type 12 —
Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	W	OPTTHRFR4	
FR5	W	OPTTHRFR5	
FR6	W	OPTTHRFR6	

① For installation of an SVX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating are determined by rating of drive.

Table 40-94. Flange Kit Type 1 —
Frames 4 – 9 ②

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

② For installation of an SVX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating are determined by rating of drive.

Table 40-95. Flange Kit Type 12 —
Frames 4 – 9 ③

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

③ For installation of an SVX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Dimensions

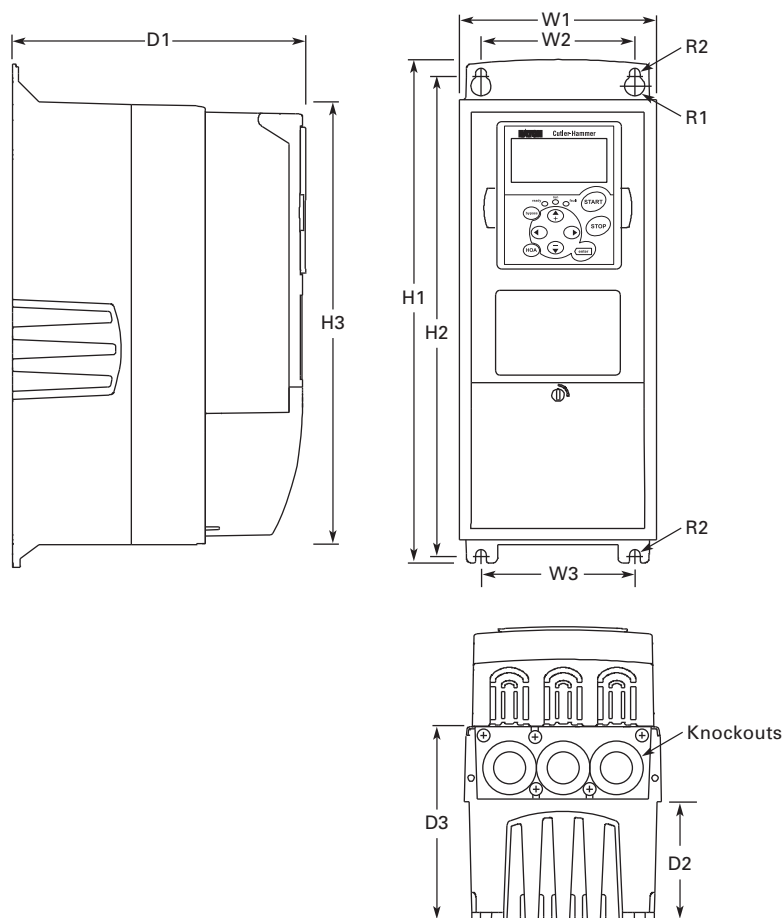


Figure 40-22. NEMA Type 1 and NEMA Type 12 9000X Drive Dimensions, FR4, FR5 and FR6

Table 40-96. 9000X Drive Dimensions

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm) N1 (O.D.)
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		
FR4	230V	3/4 – 3	12.9	12.3	11.5	7.5	3.0	5.0	5.0	3.9	—	.5	.3	11.0	3 @ 1.1
	480V	1 – 5	(327)	(313)	(292)	(190)	(77)	(126)	(128)	(100)	—	(13)	(7)	(5)	(28)
FR5	230V	5 – 7-1/2	16.5	16.0	15.3	8.4	3.9	5.8	5.6	3.9	—	.5	.3	17.9	2 @ 1.5
	480V	7-1/2 – 15	(419)	(406)	(389)	(214)	(100)	(148)	(143)	(100)	—	(13)	(7)	(8)	(37) 1 @ 1.1 (28)
FR6	230V	10 – 15	22.0	21.3	20.4	9.3	4.2	6.5	7.6	5.8	—	.6	.4	40.8	3 @ 1.5
	480V	20 – 30	(558)	(541)	(519)	(237)	(105)	(165)	(195)	(148)	—	(15.5)	(9)	(19)	(37)
	575V	2 – 25													

Open Drives

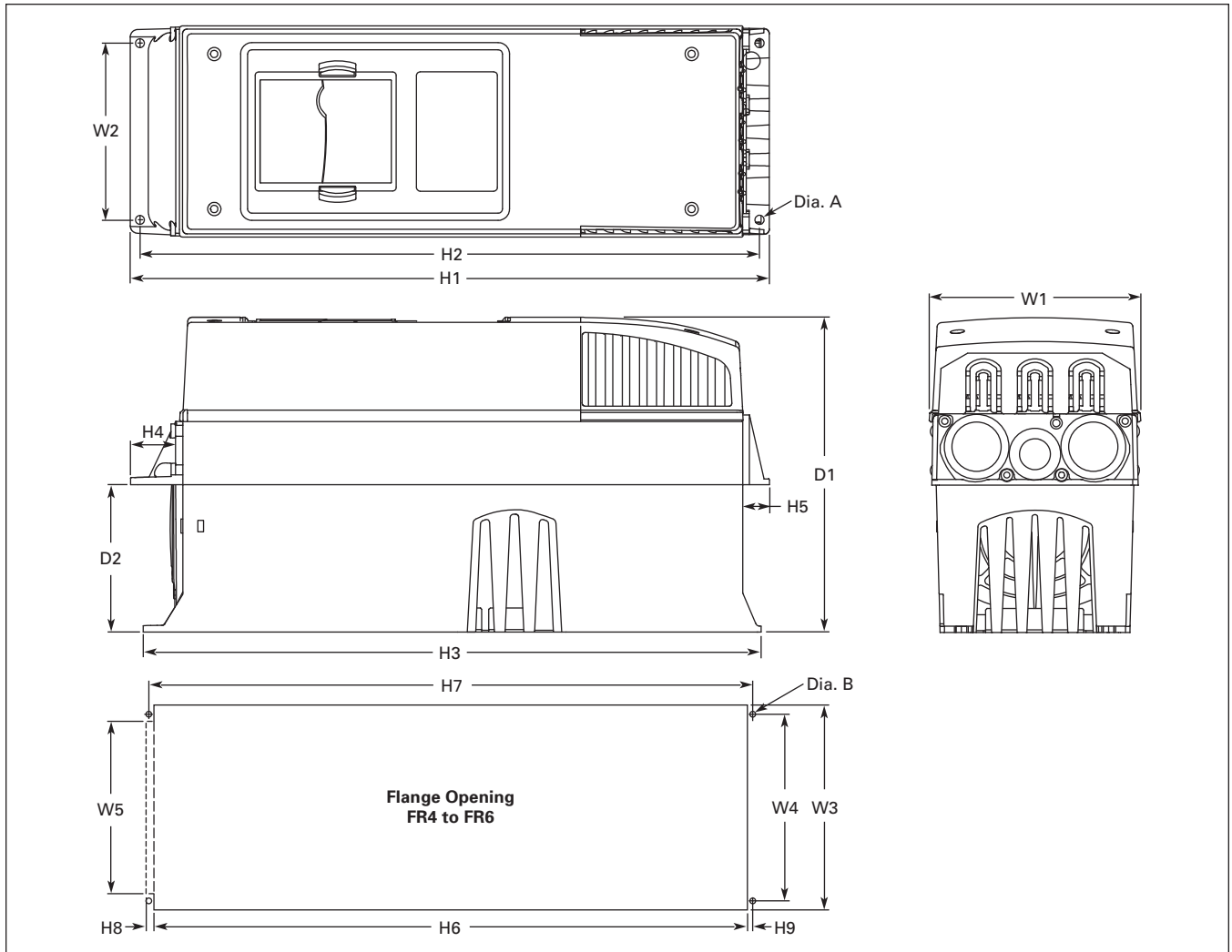


Figure 40-23. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-97. Dimensions for 9000X, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-98. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

Open Drives

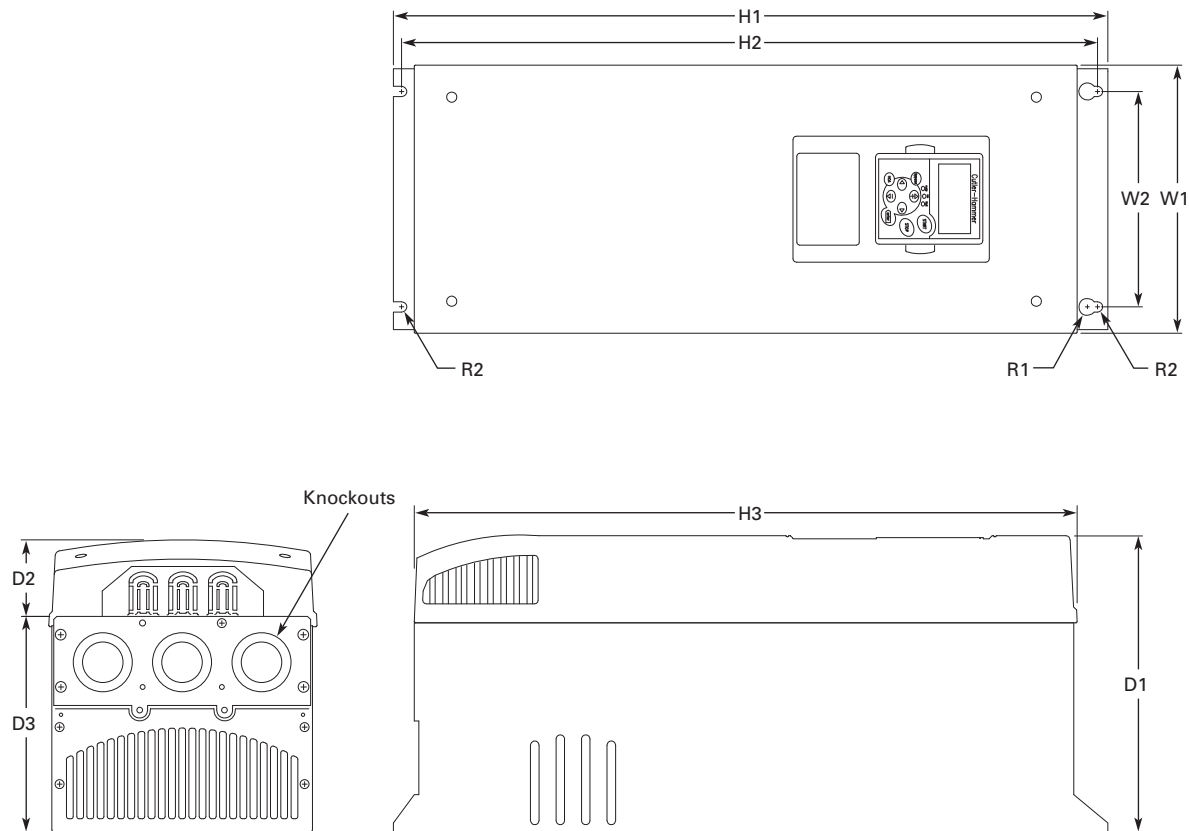
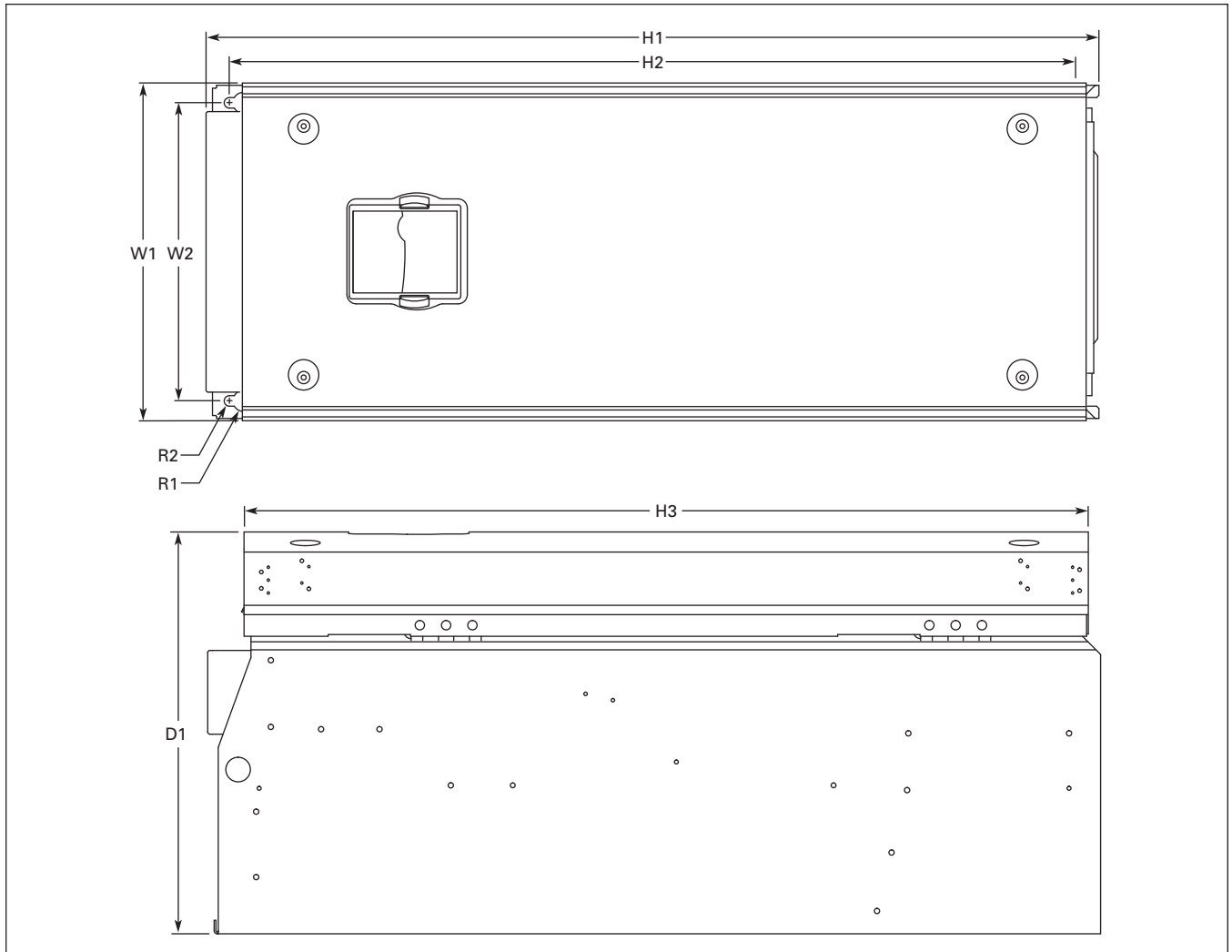


Figure 40-24. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-99. 9000X Drive Dimensions, FR7

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)										Weight lbs. (kg)	Knockouts @ Inches (mm)	
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)	
FR7	230V	20 – 30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)	
	480V	40 – 60													
	575V	30 – 40													

Open Drives



40

Figure 40-25. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-100. 9000X Drive Dimensions, FR8

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)								Weight lbs. (kg)
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.	
FR8	230V	40 – 60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)	127 (58)
	480V	75 – 125									
	575V	50 – 75									

Open Drives

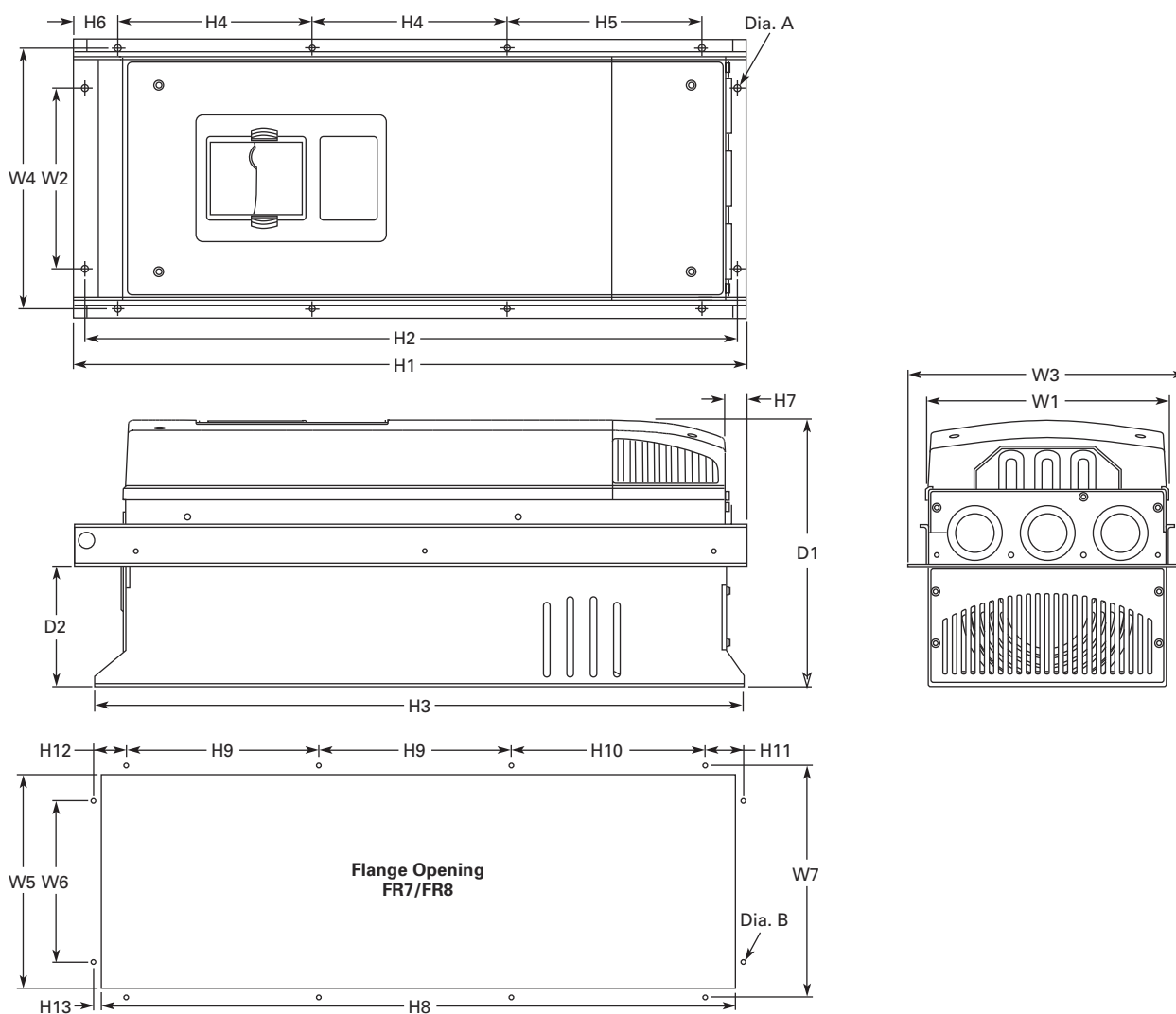


Figure 40-26. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-101. Dimensions for 9000X, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-102. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	.4 (9)

Open Drives

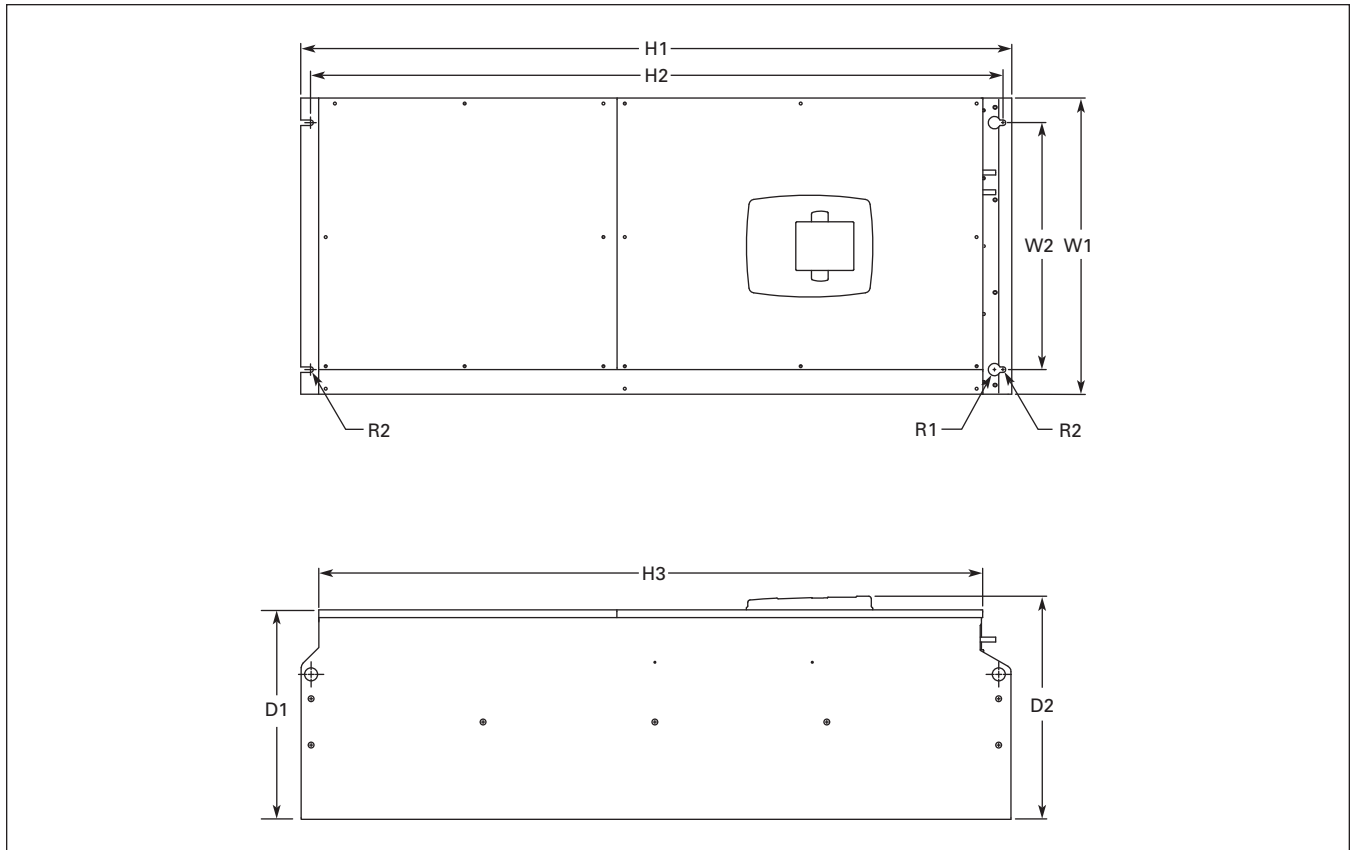


Figure 40-27. 9000X Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-103. 9000X Drive Dimensions, FR9

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.	
FR9	230V	75 – 100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	.8 (20)	.4 (9)	321.9 (146)
	480V	150 – 200										
	575V	100 – 175										

Open Drives

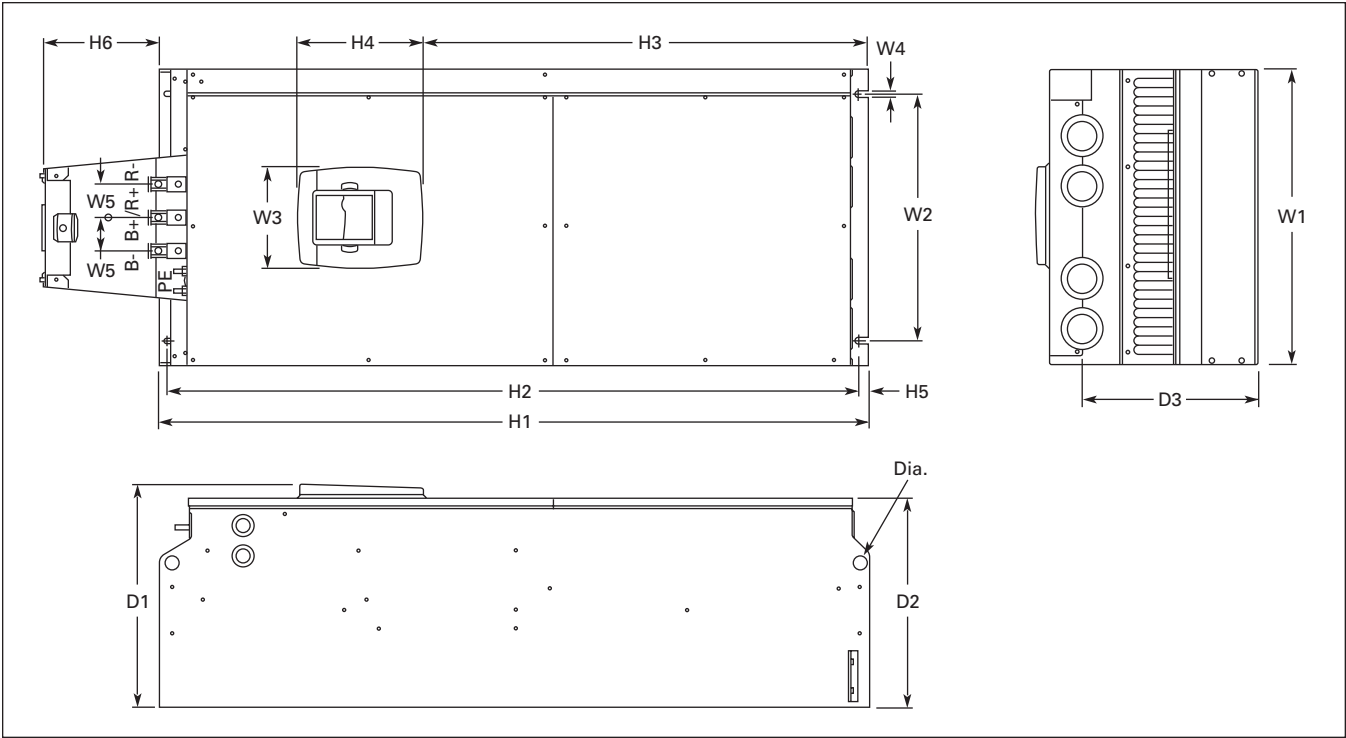


Figure 40-28. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-104. Dimensions for 9000X, FR9

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

Open Drives

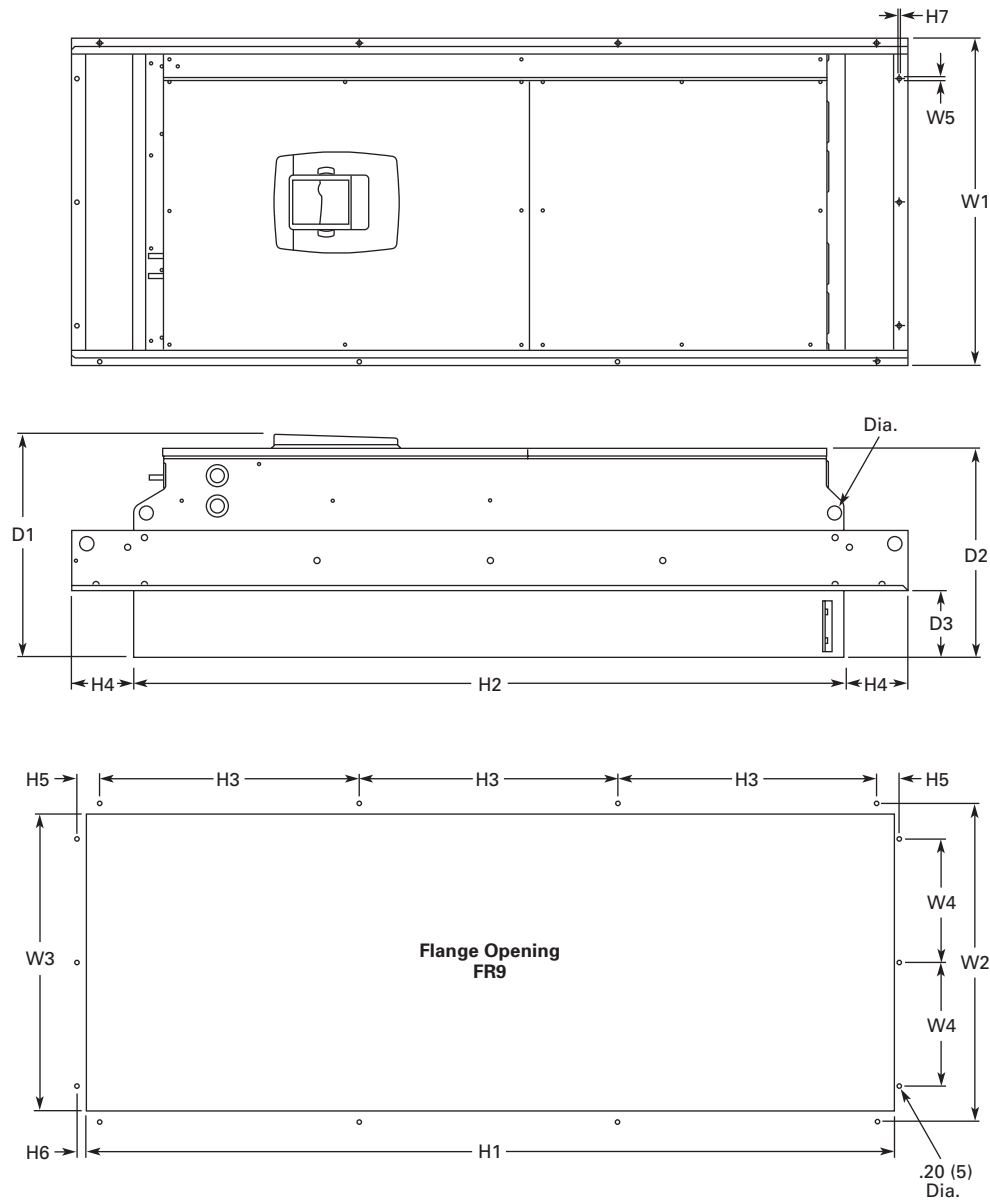


Figure 40-29. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-105. Dimensions for 9000X, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)															
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

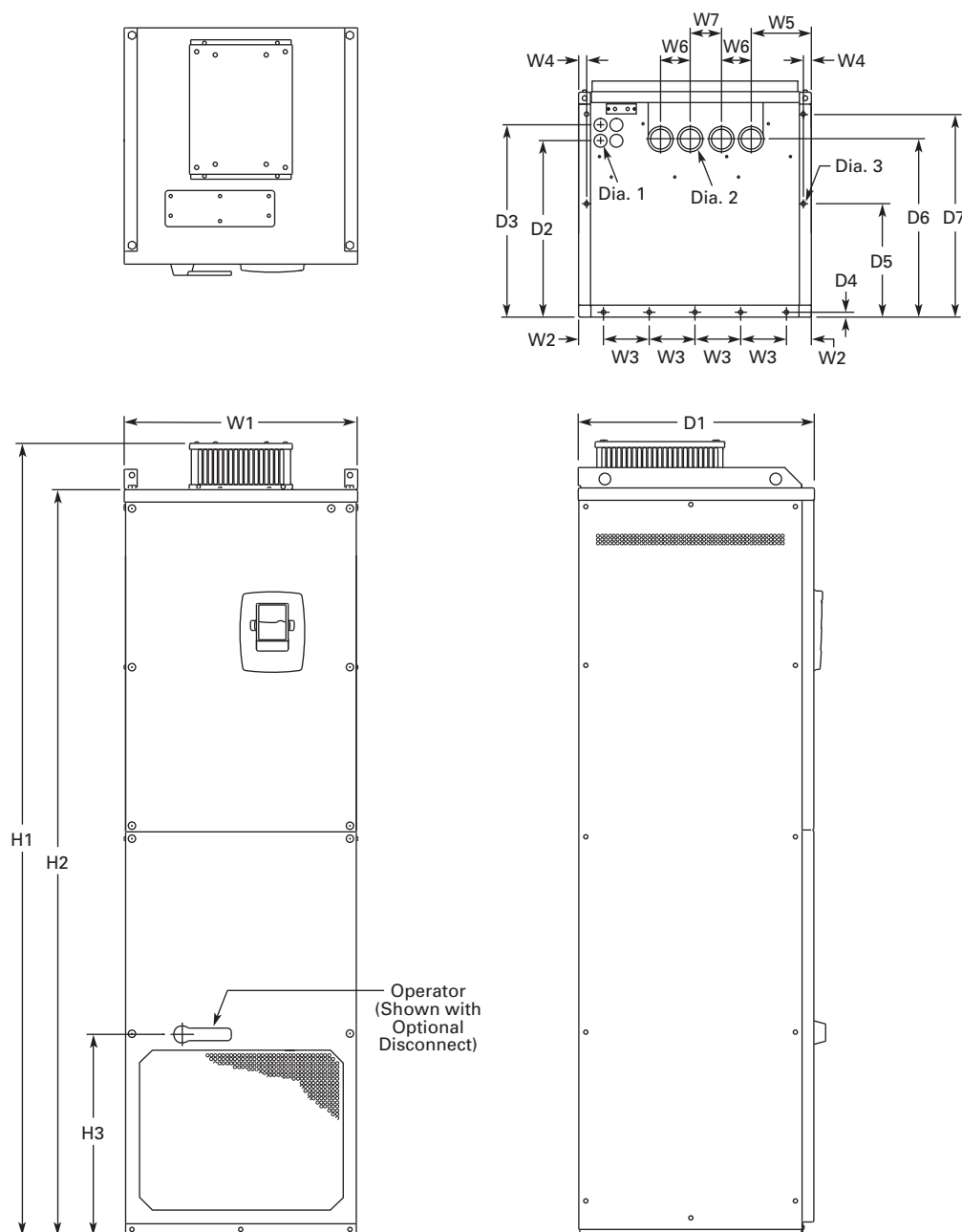


Figure 40-30. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-106. Dimensions for 9000X, FR10 Freestanding Drive

Frame Size	Approximate Dimensions in Inches (mm)																				Weight lbs. (kg)
	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	
FR10	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)

Open Drives

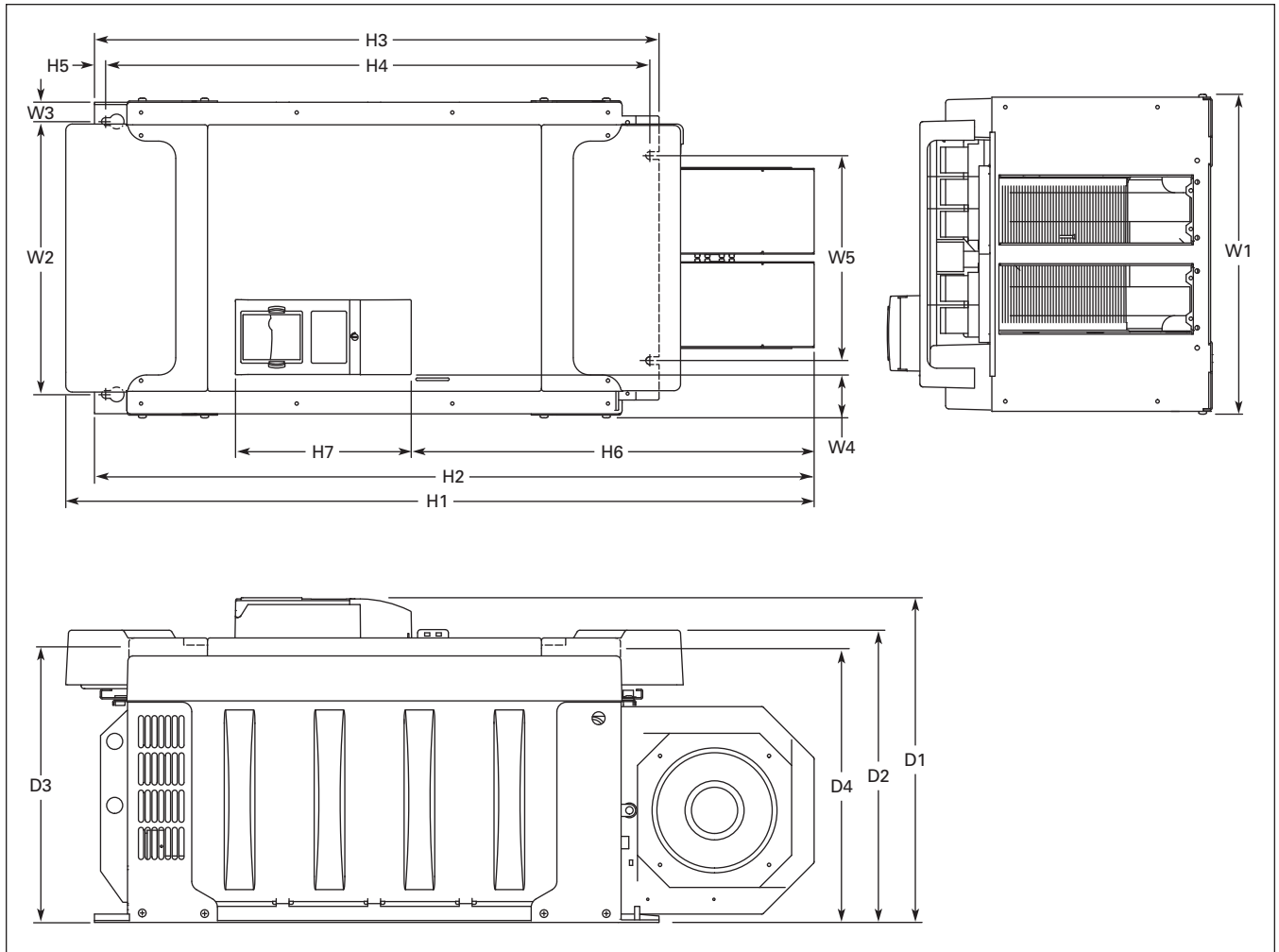


Figure 40-31. 9000X Dimensions, FR10 Open Chassis

Table 40-107. Dimensions for 9000X, FR10 Open Chassis

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)																Weight lbs. (kg)
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	
FR10	480V	250 – 350	19.7	16.7	1.2	2.6	12.8	45.9	44.1	34.6	33.5	.7	24.7	10.8	19.9	17.9	16.7	16.6	518
	575V	200 – 300	(500)	(425)	(30)	(67)	(325)	(1165)	(1121)	(879)	(850)	(17)	(627)	(275)	(506)	(455)	(423)	(421)	(235)

Note: 9000X FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

Open Drives

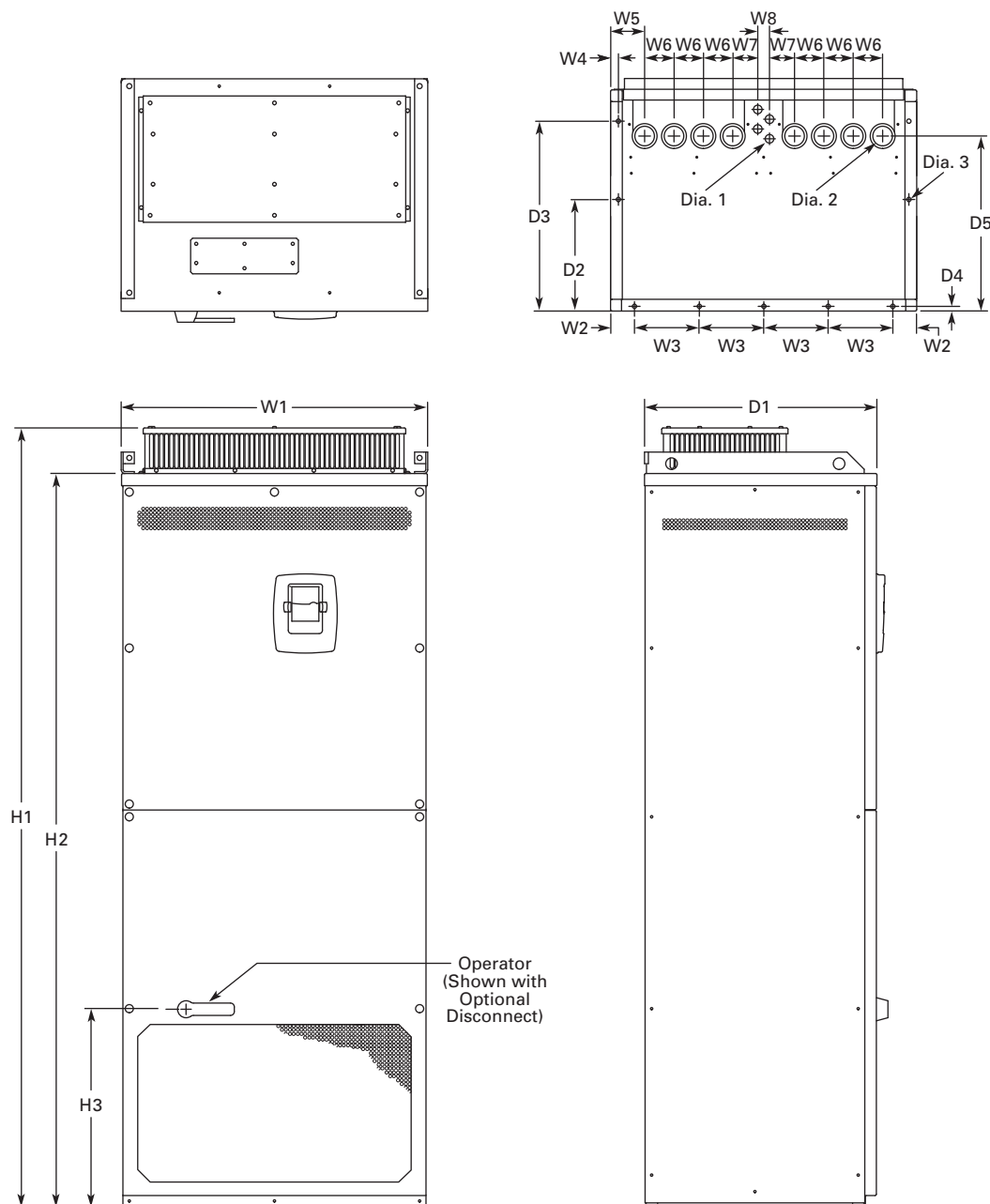


Figure 40-32. 9000X Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-108. Dimensions for 9000X, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)																		Weight lbs. (kg)	
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2		Dia. 3
FR11	480	400 – 550	31.26 (794)	2.40 (61)	6.50 (165)	.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	.47 (12)	17.60 (447)	.83 (21)	1.89 (48)	.35 x .43 (9 x 11)	526 (239)

Open Drives

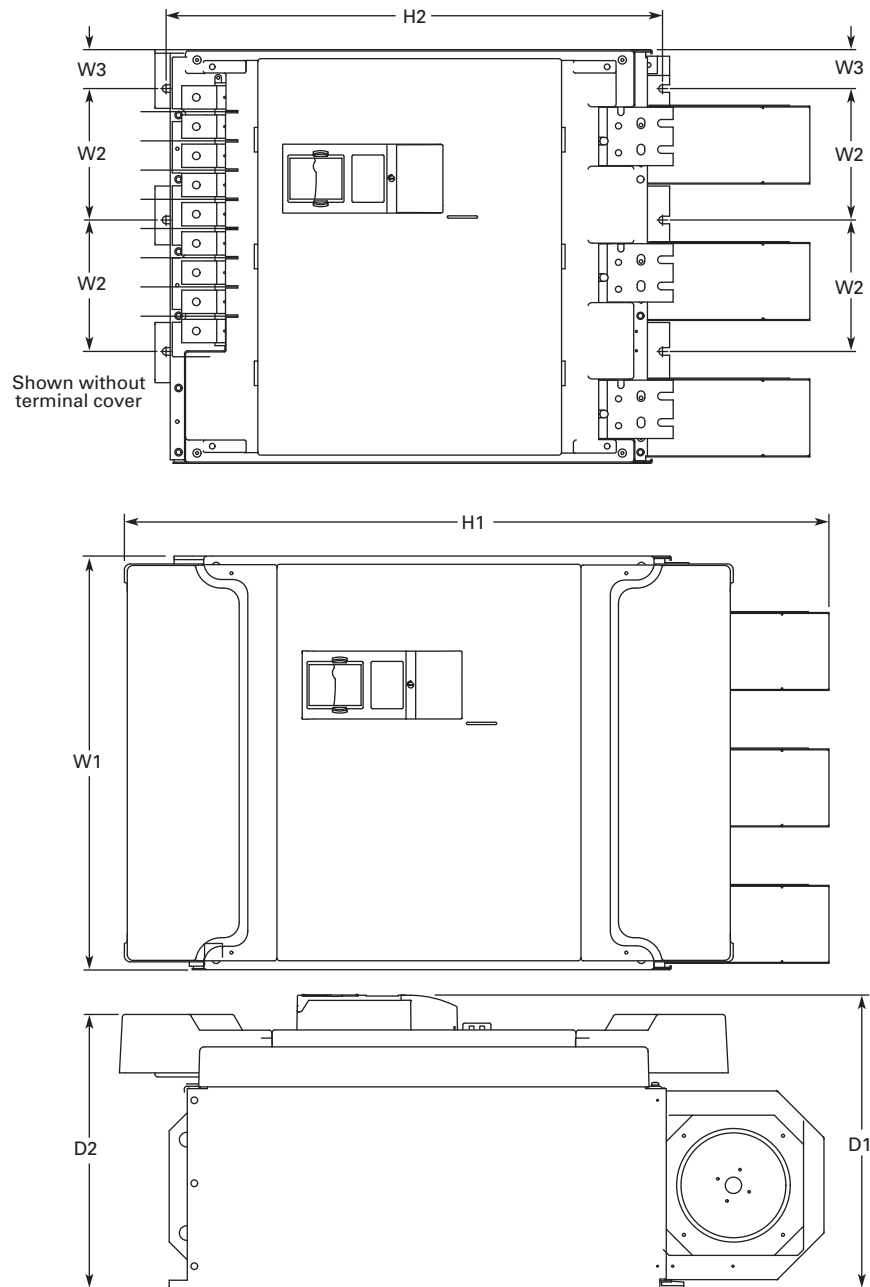


Figure 40-33. 9000X Dimensions, FR11 Open Chassis

Table 40-109. Dimensions for 9000X, FR11 Open Chassis

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	400 – 550	27.9	8.86	2.6	45.5	33.5	19.8	18.4	833
	575V	400 – 500	(709)	(225)	(67)	(1155)	(850)	(503)	(468)	(378)

Open Drives

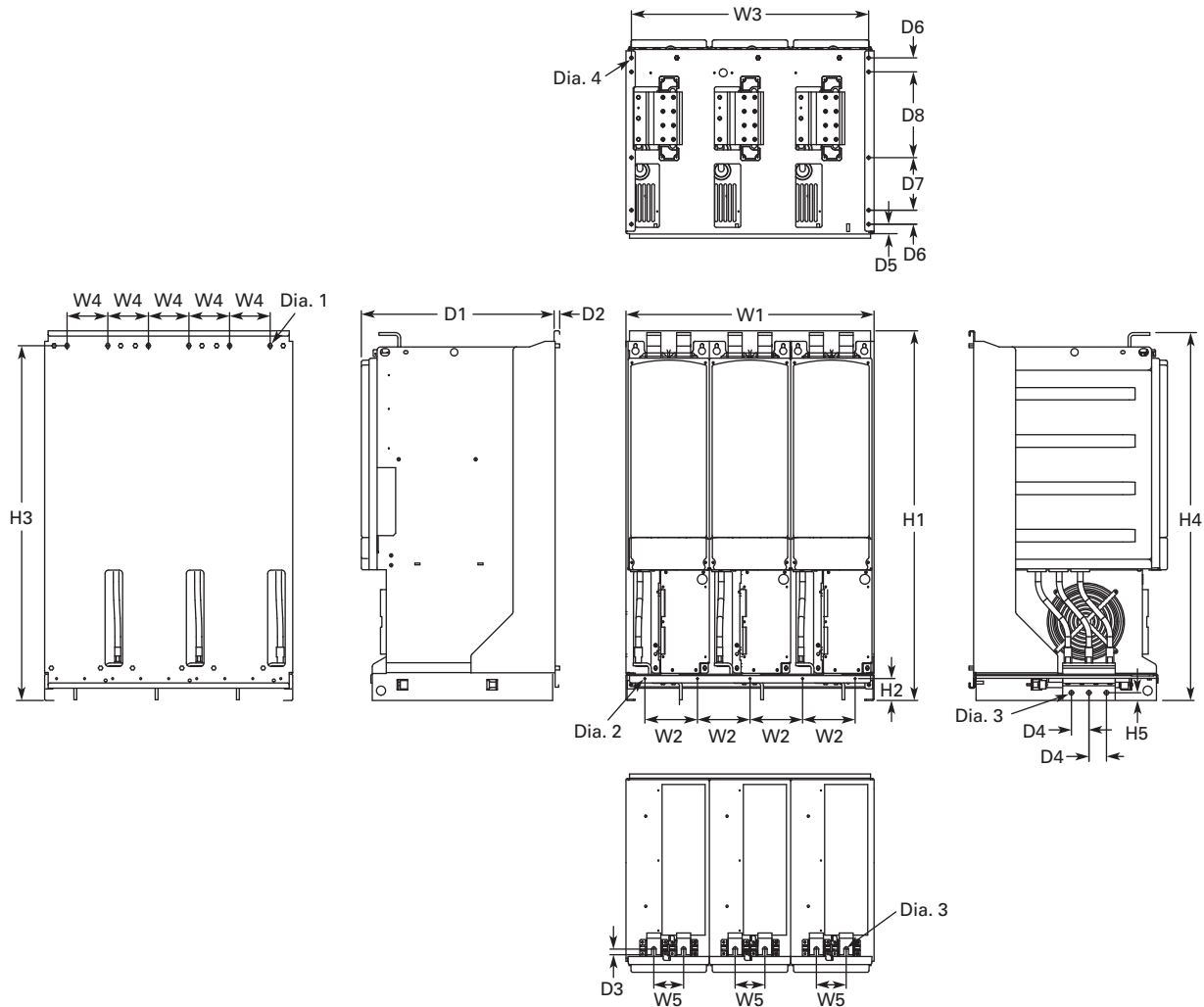


Figure 40-34. 9000X Dimensions, FR13 Open Chassis Inverter

Table 40-110. Dimensions for 9000X, FR13 Open Chassis Inverter

Frame Size	Approximate Dimensions in Inches (mm)																				Weight lbs. (kg)		
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2		Dia. 3	Dia. 4
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.79 (20)	21.77 (553)	.51 (13)	.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	683 (310)

Note: 9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

Note: FR13 is built from an inverter module and a converter module. Please refer to SPX9000 installation manual for mounting instructions.

Open Drives

40

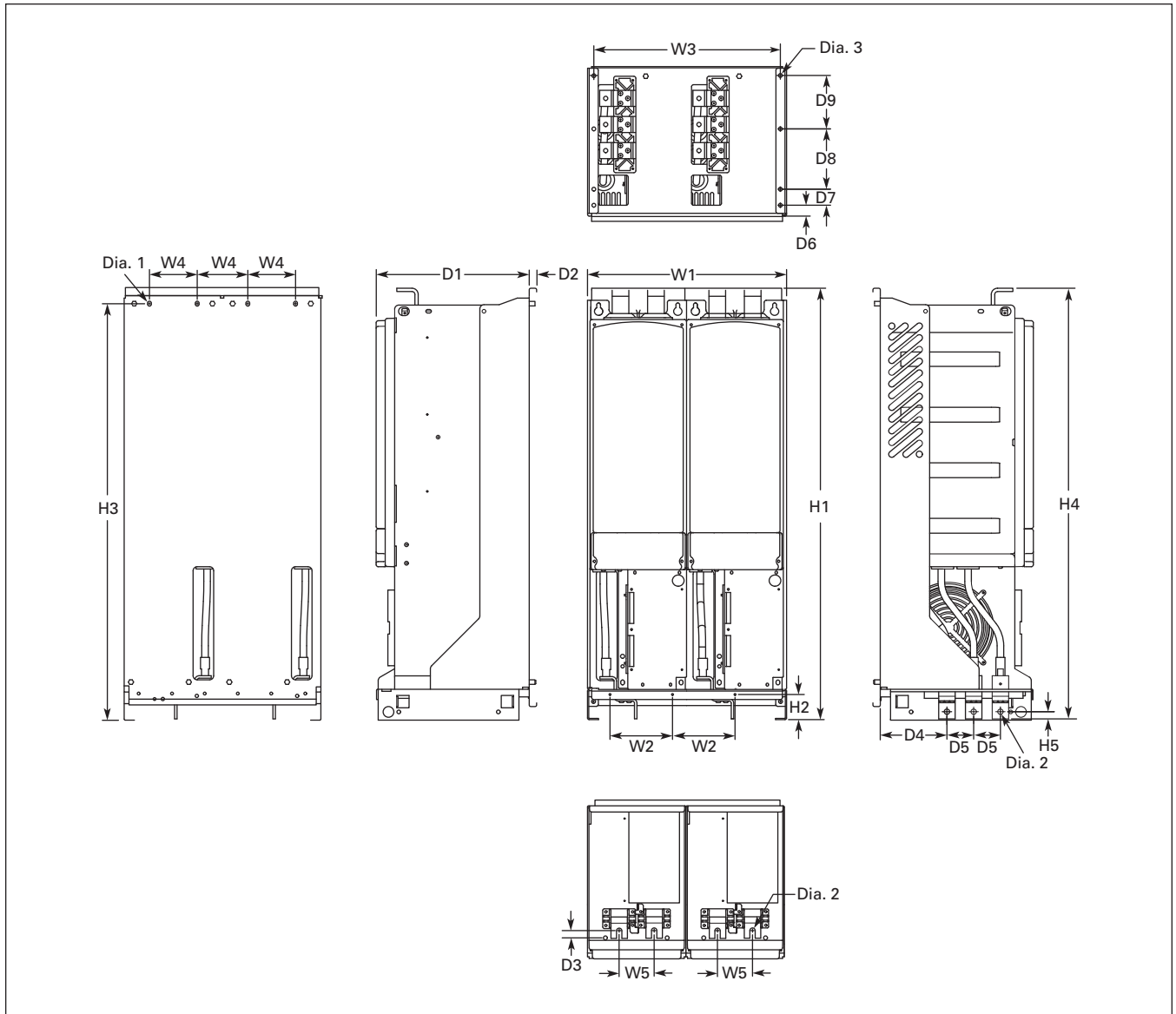


Figure 40-35. 9000X Dimensions, FR13 Open Chassis Converter

Table 40-111. FR13 — Number of Input Units

480V	hp	Input Modules	690V	hp	Input Modules
SPX800A0-4A2N1	800	2	SPX800A0-5A2N1	800	2
			SPX900A0-5A2N1	900	2
			SPXH10A0-5A2N1	1000	2

Table 40-112. Dimensions for 9000X, FR13 Open Chassis Converter

Frame Size	Approximate Dimensions in Inches (mm)																						Weight lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	
FR13	18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.51 (13)	.37 (9.5)	295 (134)

Open Drives

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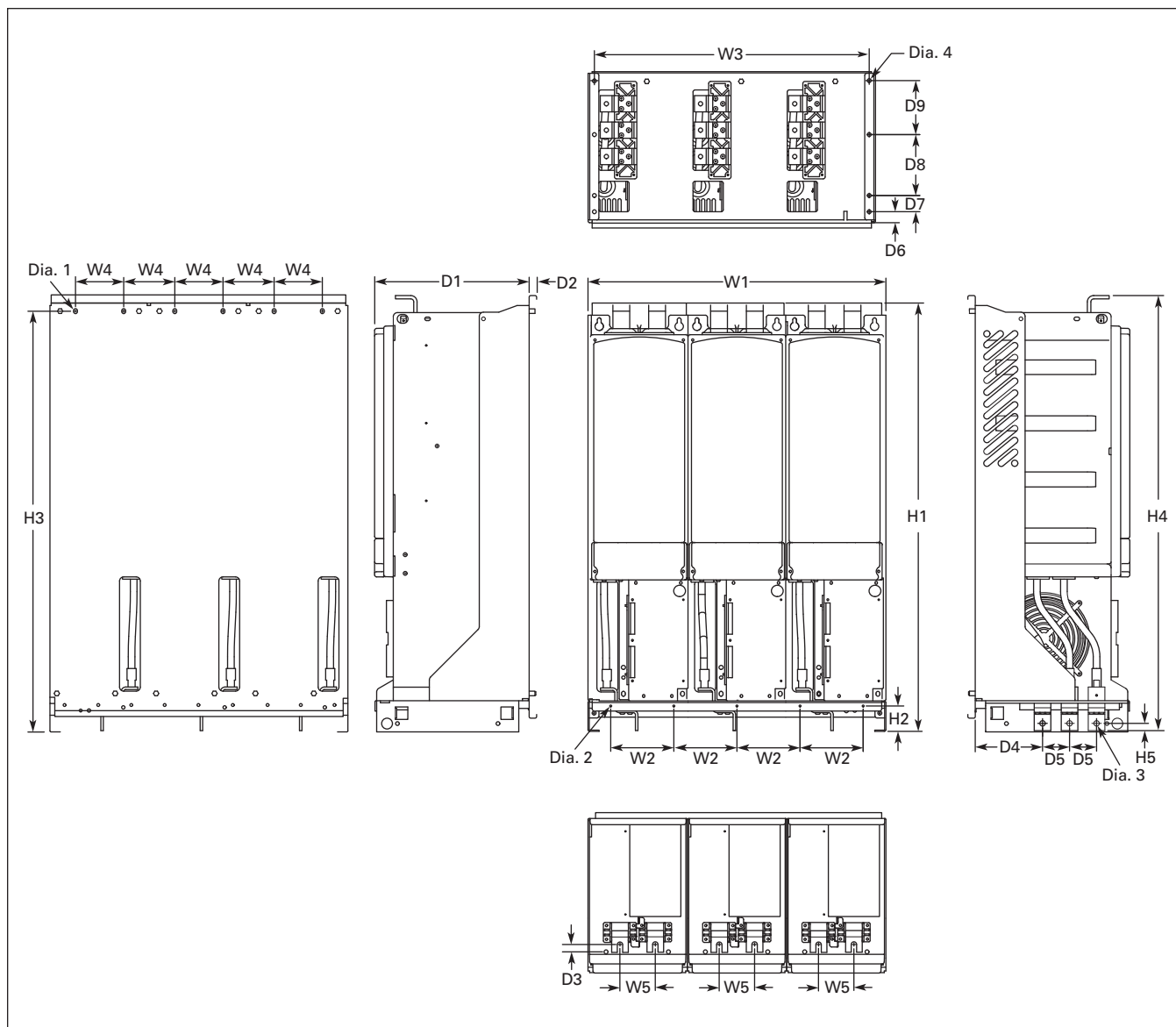


Figure 40-36. 9000X Dimensions, FR13 Open Chassis Converter — 900/1000 hp 480V

Table 40-113. FR13 — Number of Input Units

480V	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Table 40-114. Dimensions for 9000X, FR13 Open Chassis Converter — 900/1000 hp 480V

Frame Size	Approximate Dimensions in Inches (mm)																							Weight lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	443 (201)

Open Drives

Table 40-115. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380 – 500V		
SPX 250 4	FR10	CHK0400
SPX 300 4	FR10	CHK0520
SPX 350 4	FR10	CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4	FR11	2 x CHK0400
SPX 550 4	FR11	2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4	FR12	2 x CHK0520
SPX 700 4	FR12	2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4	FR13	3 x CHK0520
SPX H10 4	FR13	3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4	FR14	6 x CHK0400
Voltage Range 525 – 690V		
SPX 200 5	FR10	CHK0261
SPX 250 5	FR10	CHK0400
SPX 300 5	FR10	CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5	FR11	CHK0520
SPX 500 5	FR11	2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5	FR12	2 x CHK0400
SPX 700 5	FR12	2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5	FR13	2 x CHK0400
SPX H10 5	FR13	2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5	FR14	6 x CHK0400

① Chokes are provided with all FR10 – FR14 drives.

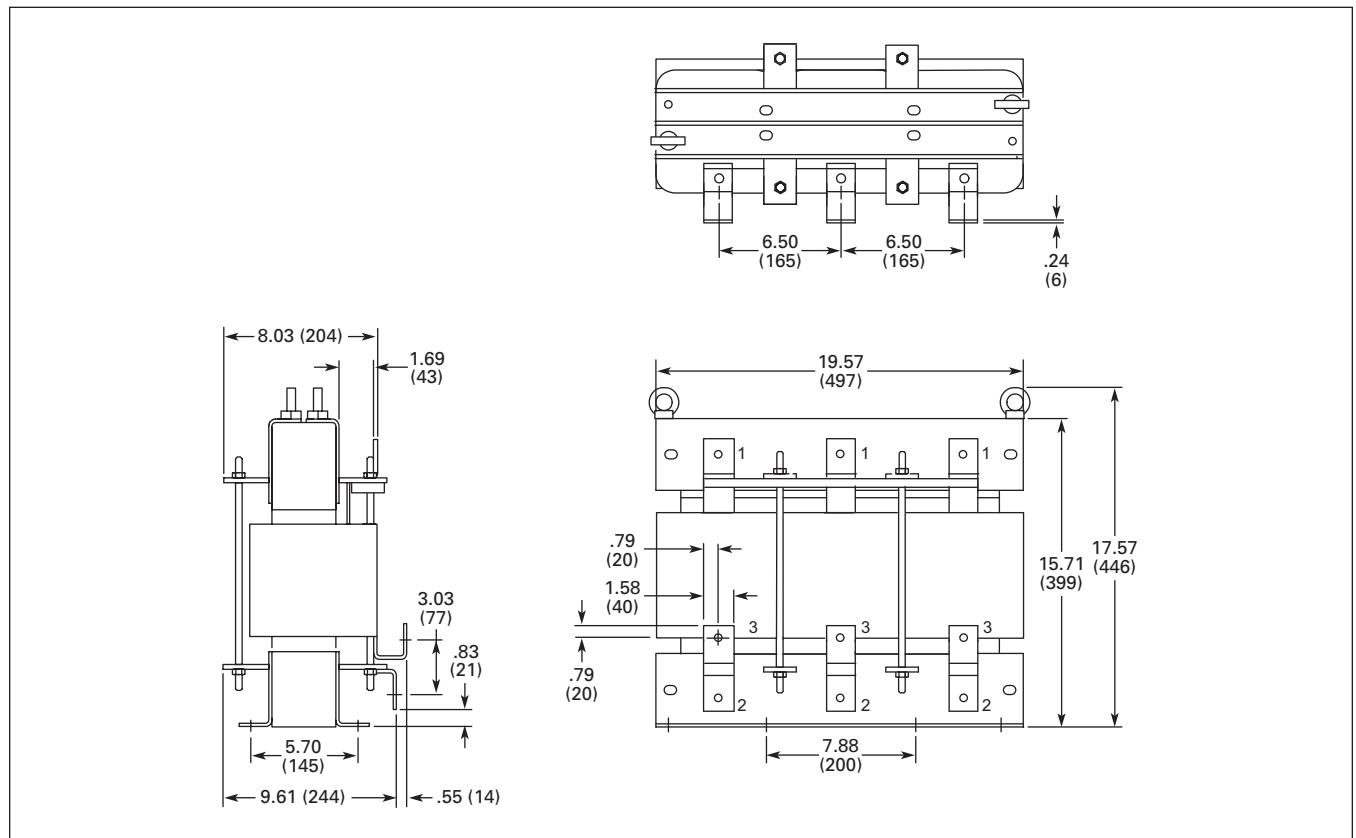


Figure 40-37. Dimensions of AC Choke CHK0520 in Inches (mm)

Open Drives

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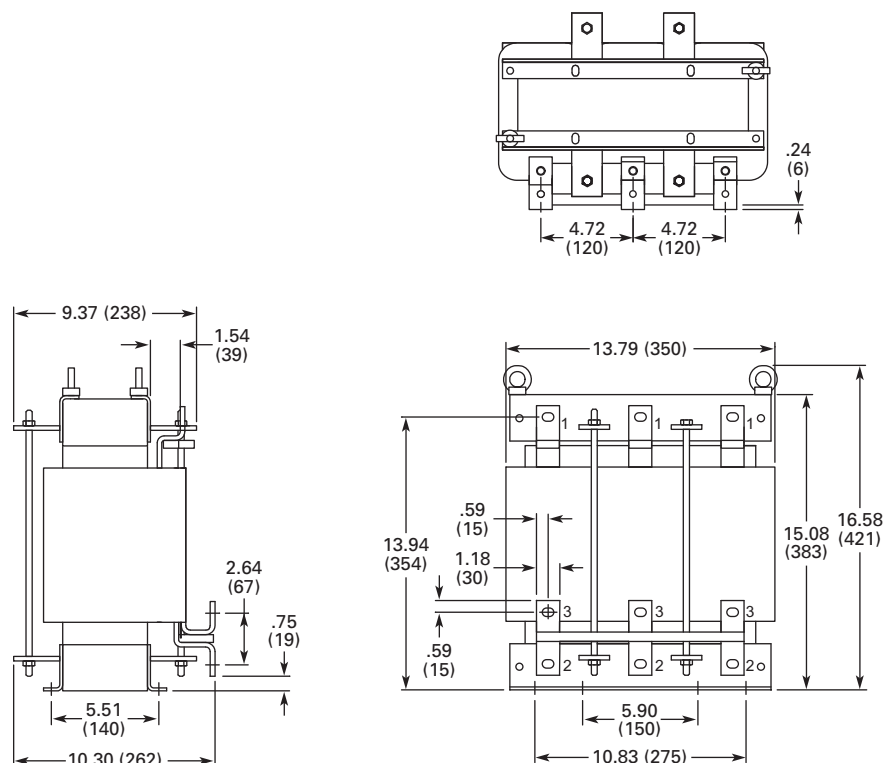


Figure 40-38. Dimensions of AC Choke CHK0400 in Inches (mm)

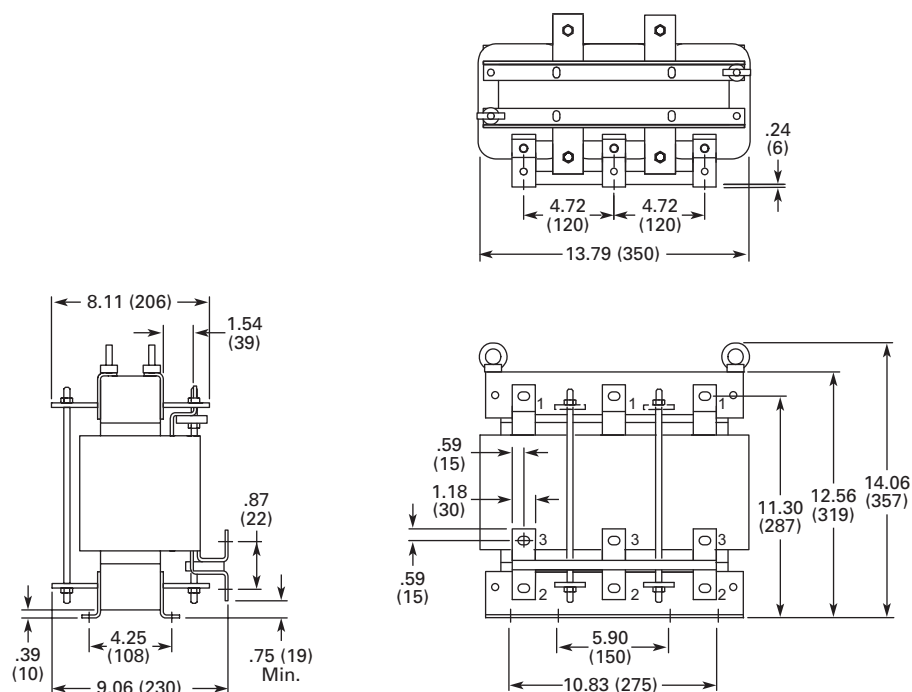


Figure 40-39. Dimensions of AC Choke CHK0261 in Inches (mm)

Spare Units & Replacement Parts

Table 40-116. 9000X Spare Units – SVX9000, 208 – 690V, Frames 4 – 12

Description	Catalog Number	Price U.S. \$
Control Unit – Includes the control board, blue base housing, installed SVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See Figure 40-21 and Table 40-85 (Page 40-58) for standard and option boards and keypad.	CSBS0000000000	

Table 40-117. 9000X Series Replacement Parts — SVX9000 Drives, 208 – 240V

Frame:	4	5					6					7					8			Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60						
Control Board																						
1	1	1		1	1	1		1	1		1	1	1	1	1	1	1	W	VB00252			
Power Boards																						
1																		FB	VB00308-0004-2			
	1																	FB	VB00308-0007-2			
		1																FB	VB00308-0008-2			
				1														FB	VB00310-0011-2			
					1													FB	VB00310-0012-2			
						1												FB	VB00313-0017-2			
							1											FB	VB00313-0025-2			
								1										FB	VB00313-0031-2			
									1									FB	VB00316-0048-2			
										1								FB	VB00316-0061-2			
											1							FB	VB00319-0075-2			
												1						FB	VB00319-0088-2			
													1					FB	VB00319-0114-2			
														1				FB	VB00322-0140-2			
															1			FB	VB00322-0170-2			
																1		FB	VB00322-0205-2			
Electrolytic Capacitors																						
2	2	2																W	PP01000			
				2	2													W	PP01001			
						2		2										W	PP01002			
									2									W	PP01003			
										2	2							W	PP01004			
												2	2	2	4	4		W	PP01005			
																	4	W	PP01099			
Cooling Fans																						
1	1	1		1	1													W	PP01060			
						1		1	1									W	PP01061			
										1	1							W	PP01062			
												1	1	1				W	PP01063			
															1	1	1	FC	PP01123 ②			
1	1	1		1	1													W	PP01086			
						1		1	1									FC	PP01088			
											1	1	1					W	PP01049			
															1	2	2	FC	CP01180			
															1	1	1	FC	PP08037			

① I_L only; has no corresponding I_H rated hp rating.

② PP00061 capacitor not included in main fan; please order separately.

Open Drives

Table 40-117. 9000X Series Replacement Parts — SVX9000 Drives, 208 – 240V (Continued)

Frame:	4				5				6				7				8				Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60							
IGBT Modules																							
1	1																	W	CP01304				
		1																W	CP01305				
			1	1	1													W	CP01306				
							1											W	CP01307				
								1										W	CP01308				
									1									W	PP01022				
										1								W	PP01023				
											1							W	PP01024				
												1						W	PP01025				
													1					W	PP01029				
														1				W	PP01026				
															1	1		W	PP01027				
Choppers/Rectifiers																							
									1									W	CP01367				
										1								W	CP01368				
Diode/Thyristor Modules																							
											3	3	3					W	PP01035				
														3	3	3		W	CP01268				
Rectifying Boards																							
											1	1	1					W	VB00242				
														1	1	1		W	VB00227				

① I_L only; has no corresponding I_H rated hp rating.

Table 40-118. 9000X Series Replacement Parts — FR4 – FR9 SVX9000 Drives, 380 – 500V

Frame:	4						5						6						7						8						9			Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	1	1-1/2	2	3	5	7-1/2 ②	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200																
Control Board																																				
1	1			1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	VB00252					
Power Boards																																				
1																														FB	VB00208-0003-5					
	1																													FB	VB00208-0004-5					
		1																												FB	VB00208-0005-5					
			1																											FB	VB00208-0007-5					
				1																										FB	VB00208-0009-5					
					1																									FB	VB00210-0012-5					
						1																								FB	VB00213-0016-5					
							1																							FB	VB00213-0022-5					
								1																						FB	VB00213-0031-5					
									1																					FB	VB00216-0038-5					
										1																				FB	VB00216-0045-5					
											1																			FB	VB00216-0061-5					
1														1																FB	VB00219-0072-5					
															1															FB	VB00219-0087-5					
																1														FB	VB00219-0105-5					
																	1													FB	VB00236-0140-5					
																		1												FB	VB00236-0168-5					
																				1									FB	VB00236-0205-5						
Electrolytic Capacitors																																				
2	2		2	2											2														W	PP01000						
					2	2																								W	PP01001					
							2		2																					W	PP01002					
								2																						W	PP01003					
										2	2	2																		W	PP01004					
													2	2	2	4	4	4	8	8									W	PP01005						

② I_L only; has no corresponding I_H rated hp rating.

Discount Symbol..... SS-2

Open Drives

Table 40-118. 9000X Series Replacement Parts — FR4 – FR9 SVX9000 Drives, 380 – 500V (Continued)

Frame:	4	5	6	7	8	9	Delivery	Catalog	Price
hp (I _H):	1 1-1/2 2 3 5 7-1/2 ①	7-1/2 10 15	20 25 30	40 50 60	75 100 125	150 200	Code	Number	U.S. \$
Cooling Fans									
1 1	1 1 1 1						W	PP01060	
		1 1 1					W	PP01061	
			1 1 1				W	PP01062	
				1 1 1			W	PP01063	
					1 1 1		FC	PP01123 ②	
1 1	1 1 1 1					1 1	FC	PP01080 ③	
		1 1 1					W	PP01086	
			1 1 1	1 1 1			FC	PP01088	
					1 1 1		W	PP01049	
						1 ④ 2	FC	CP01180	
						1 1	W	PP01068	
							FC	PP09051	
IGBT Modules									
1 1	1						W	CP01304	
	1 1						W	CP01305	
		1					W	CP01306	
			1				W	CP01307	
				1			W	CP01308	
					1		W	PP01020	
				1			W	PP01022	
					1		W	PP01023	
						1	W	PP01024	
					1		W	PP01025	
						1	W	PP01029	
						1	W	PP01026	
						1 1	W	PP01027	
Chopper/Rectifiers									
			1 1				W	CP01367	
				1			W	CP01368	
Diode/Thyristor Modules									
					3 3 3		W	PP01035	
						3 3 3	W	CP01268	
							3 3	W	PP01037
Rectifying Boards									
				1 1 1			W	VB00242	
					1 1 1		W	VB00227	
						1 1	W	VB00459	
Rectifying Module Sub-assembly									
						1 1	W	FR09810	
Power Module Sub-assemblies									
						1	W	FR09-150-4-ANS ⑤	
							1	W	FR09-200-4-ANS ⑤

① I_L only; has no corresponding I_H rated hp rating.

② PP00061 capacitor not included in main fan; please order separately.

③ PP00011 capacitor not included in main fan; please order separately.

④ For FR9 NEMA Type 12 you need two PP01068 internal fans.

⑤ See Table 40-122 for details.

Open Drives

Table 40-119. 9000X Series Replacement Parts — FR10 – FR12 SVX9000 Drives, 380 – 500V

Frame: 10		11				12			Delivery Code	Catalog Number	Price U.S. \$	
hp (I _H):	250	300	350	400	500	550	600	650				700
Control Board												
1	1	1	1	1	1	1	1	1	1	W	VB00561 ①	
Shunt Boards												
6										FC	VB00537	
	6									FC	VB00497	
		6					12	12	12	FC	VB00498	
			9							FC	VB00538	
				9						FC	VB00513	
					9					FC	VB00514	
Driver Boards												
			3	3	3					FC	VB00489	
1	1	1				2	2	2		FC	VB00487	
Driver Adapter Board												
1	1	1				2	2	2		FC	VB00330	
ASIC Board												
1	1	1	1	1	1	2	2	2		FC	VB00451	
Feedback Interface Board												
						2	2	2		FC	VB00448	
Star Coupler Board												
						1	1	1		FC	VB00336	
Power Modules												
1	1	1	2	2	2	2	2	2		FC	FR10820 ②	
2	2	2								FC	FR10828	
1										FC	FR10-250-4-ANS ③	
	1									FC	FR10-300-4-ANS ③	
		1				2	2	2		FC	FR10-350-4-ANS ③	
			3							FC	FR11-400-4-ANS ③	
				3						FC	FR11-500-4-ANS ③	
					3					FC	FR11-550-4-ANS ③	
Electrolytic Capacitors												
2	2	2	3	3	3	4	4	4		FC	PP00060	
12	12	12	18	18	18	24	24	24		FC	PP01005	
Fuses												
1	1	1	1	1	1	2	2	2		FC	PP01094	
2	2	2	2	2	2	4	4	4		FC	PP01095	
Cooling Fans and Isolation Transformers												
2	2	2	3	3	3	4	4	4		FC	VB00299	
2	2	2	3	3	3	4	4	4		FC	PP01080 ④	
2	2	2				4	4	4		FC	PP01068	
1	1	1	1	1	1	2	2	2		FC	PP01096	
1	1	1				2	2	2		FC	FR10844	
1	1	1	3	3	3	2	2	2		FC	FR10845	
1	1	1				2	2	2		FC	FR10846	
1	1	1	3	3	3	2	2	2		FC	FR10847	
Rectifying Board												
1	1	1	2	2	2	2	2	2		FC	VB00459	

① SPX9000 Drives only (FR10 and larger).

② Rectifying board not included.

③ See Table 40-122 for details.

④ PP00060 capacitor not included in main fan; please order separately.

Discount Symbol..... SS-2

Open Drives

Table 40-120. 9000X Series Replacement Parts — FR6 – FR9 SVX9000 Drives, 525 – 690V

Frame:	6										7					8					9					Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①										
Control Board																												
1	1	1		1	1	1	1	1	1	1	1					1	1	1		W	VB00252							
Driver Board																												
1																				FB	VB00404-0004-6							
	1																			FB	VB00404-0005-6							
		1																		FB	VB00404-0007-6							
			1																	FB	VB00404-0010-6							
				1																FB	VB00404-0013-6							
					1															FB	VB00404-0018-6							
						1														FB	VB00404-0022-6							
							1													FB	VB00404-0027-6							
								1												FB	VB00404-0027-6							
									1											FB	VB00404-0034-6							
Power Boards																												
										1										FB	VB00419-0041-6							
											1									FB	VB00419-0052-6							
												1								FB	VB00422-0062-6							
													1							FB	VB00422-0080-6							
														1						FB	VB00422-0100-6							
Power Modules																												
															1					FC	FR09-100-5-ANS ②							
																1				FC	FR09-125-5-ANS ②							
																	1			FC	FR09-150-5-ANS ②							
																		1		FC	FR09-175-5-ANS ②							
Electrolytic Capacitors																												
2	2	2		2	2	2	2	2	2											FC	PP01093							
										2	2	4	4		8	8	8	8		FC	PP01041							
														4						FC	PP01040							
Fuses																												
												1	1	1	1	1	1	1		W	PP01094							
												2	2	2	2	2	2	2		W	PP01095							
Cooling Fans																												
1	1	1		1	1															W	PP01061							
						1	1	1	1											W	PP01062							
										1	1									W	PP01063							
												1	1	1						FC	PP01123							
1	1	1		1	1	1	1	1	1	1	1									W	PP01049							
												1	1	1						FC	CP01180							
															1	1	1	1 ③		W	PP01068							
															1	1	1	1		FC	PP01080							
Fan Power Supply																												
																1	1	1		FC	VB00299							
IGBT Modules																												
3	3	3		3	3	3	3	3	3											FC	PP01091							
										1	1									FC	PP01089							
												1	1	1						FC	PP01127							
IGBT/Diode (Brake)																												
1	1	1		1	1	1	1	1	1	1	1	2	2	2	2	2	2	2		FC	PP01040							
Diode Module																												
1	1	1		1	1	1	1	1	1											FC	PP01092							
Diode/Thyristor Modules																												
										3	3									FC	PP01071							
															3	3	3	3		FC	PP01072							
Rectifying Boards																												
										1	1									FC	VB00442							
															1	1	1	1		FC	VB00460							
Rectifying Module Sub-assemblies																												
																1	1	1		W	FR09810							
																1	1	1		FC	FR09811							

① I_L only; has no corresponding I_H rated hp rating.

② See Table 40-122 for details.

③ For NEMA Type 12, two PP01068 internal fans are needed.

Open Drives

Table 40-121. 9000X Series Replacement Parts — FR10 – FR12 SVX9000 Drives, 525 – 690V

Frame: 10 hp (I _H):	200	250	300	11 400	450	500	12 550	600	700	Delivery Code	Catalog Number	Price U.S. \$
Component Boards												
1	1	1	1	1	1	1	1	1	1	W	VB00561 ^①	
1	1	1	1	1	1	1	2	2	2	FC	VB00451	
6										FC	VB00545	
	6									FC	VB00510	
		6					12	12	12	FC	VB00511	
1	1	1					2	2	2	FC	VB00330	
1	1	1					2	2	2	FC	VB00487	
				3	3	3				FC	VB00489	
				9						FC	VB00546	
					9					FC	VB00547	
						9				FC	VB00512	
							2	2	2	FC	VB00448	
							1	1	1	FC	VB00336	
Power Modules												
1	1	1	2	2	2	2	2	2	2	FC	FR10821 ^②	
2	2	2								FC	FR10829	
1										FC	FR10-200-5-ANS ^③	
	1									FC	FR10-250-5-ANS ^③	
		1					2	2	2	FC	FR10-300-5-ANS ^③	
			3							FC	FR11-400-5-ANS ^③	
				3						FC	FR11-450-5-ANS ^③	
					3					FC	FR11-500-5-ANS ^③	
Electrolytic Capacitors												
2	2	2	3	3	3	4	4	4	4	FC	PP00060	
12	12	12	18	18	18	24	24	24	24	FC	PP01099	
Fuses												
1	1	1	1	1	1	2	2	2	2	FC	PP01094	
2	2	2	2	2	2	4	4	4	4	FC	PP01095	
Cooling Fans and Isolation Transformers												
2	2	2	3	3	3	4	4	4	4	FC	VB00299	
2	2	2	3	3	3	4	4	4	4	FC	PP01080 ^④	
2	2	2				4	4	4	4	FC	PP01068	
1	1	1	1	1	1	2	2	2	2	FC	PP01096	
1	1	1				2	2	2	2	FC	FR10844	
1	1	1	3	3	3	2	2	2	2	FC	FR10845	
1	1	1				2	2	2	2	FC	FR10846	
1	1	1	3	3	3	2	2	2	2	FC	FR10847	
Fan Power Supply												
						1	1	1	1	FC	VB00299	
Rectifying Boards												
1	1	1	2	2	2	2	2	2	2	FC	VB00460	

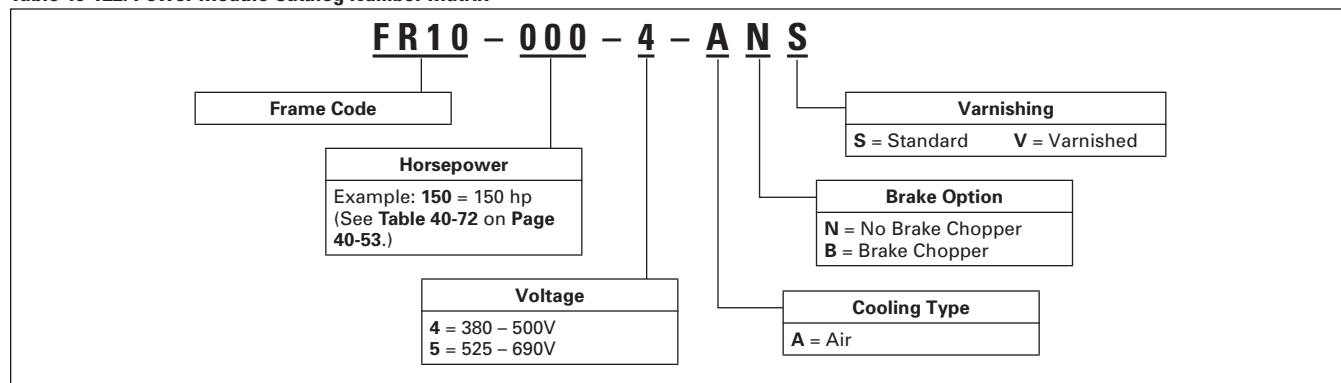
① SPX9000 Drives only (FR10 and larger).

② Rectifying board not included.

③ See Table 40-122 for details.

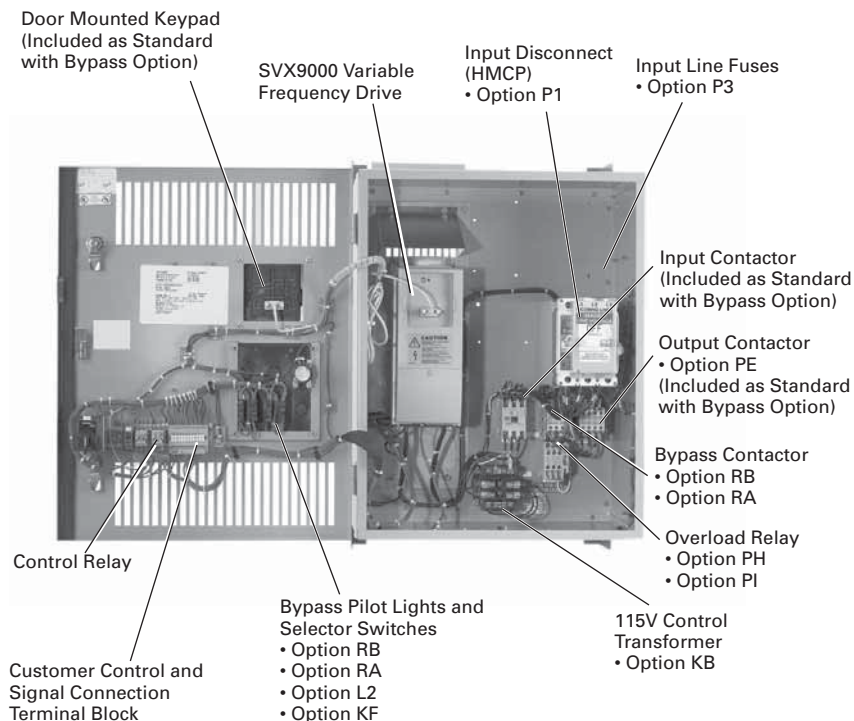
④ PP00060 capacitor not included in main fan; please order separately.

Table 40-122. Power Module Catalog Number Matrix



Discount Symbol..... SS-2

SVX9000 Enclosed Drives



Enclosed 9000X Series Drive

Standards and Certifications

- UL Listed
- cUL Listed

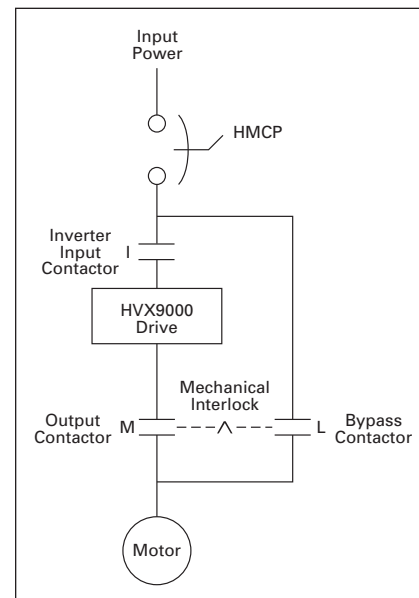


Figure 40-40. Power Diagram for Bypass
Options RB and RA

40

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 1 or Type 12 enclosures
- Input Voltage: 208V, 230V, 480V and 575V (Consult Factory)
- Complete range of control, network and power options
- Horsepower range:
 - 208V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
 - 230V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
 - 480V — 1 to 700 hp I_H; 1-1/2 to 800 hp I_L
- HMCP padlockable

Enclosed Drives

Technical Data and Specifications

Table 40-123. Specifications

Feature Description	9000X Enclosed Products — NEMA Type 1 or NEMA Type 12
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I _H)	250% for 2 seconds
Overload: 1 Minute (I _H /I _L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
3 – 15 psig	Optional
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

Feature Description	9000X Enclosed Products — NEMA Type 1 or NEMA Type 12
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	1 (2 Relays Form C)
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional

Performance Features

Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional ①
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz

Standard Conditions for Application and Service

Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	>.94

① Some horsepower units include dynamic braking chopper as standard — refer to individual drive sections.

Table 40-124. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, R _i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R _i > 200 kΩ Current: 0 (4) – 20 mA, R _i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

Catalog Number Selection

Table 40-125. SVX9000 Enclosed NEMA Type 1/12 Drive Catalog Numbering System

Build Alphabetically and Numerically

SVX F07 1 4 A A

Product Family
SVX = Enclosed Drives

Horsepower Rating

F07 = 3/4 hp	025 = 25 hp	250 = 250 hp
001 = 1 hp	030 = 30 hp	300 = 300 hp
F15 = 1-1/2 hp	040 = 40 hp	350 = 350 hp
002 = 2 hp	050 = 50 hp	400 = 400 hp
003 = 3 hp	060 = 60 hp	500 = 500 hp
005 = 5 hp	075 = 75 hp	550 = 550 hp
007 = 7-1/2 hp	100 = 100 hp	600 = 600 hp
010 = 10 hp	125 = 125 hp	650 = 650 hp
015 = 15 hp	150 = 150 hp	700 = 700 hp
020 = 20 hp	200 = 200 hp	800 = 800 hp

Enclosure Rating

1 = NEMA Type 1
2 = NEMA Type 12
6 = NEMA 12 Filtered

Voltage Rating

1 = 208V
2 = 230V
4 = 480V

Application — Torque/Braking ②

A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_H/No Brake Chopper
E = I_H/Internal Brake Chopper

Enclosed Style

A = Enclosed Drive

Enclosed Options ①④⑤

	Description	Type
K1	Door-Mounted Speed Potentiometer ③	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ③	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Ref Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KB	115V Control Transformer – 550 VA	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB Bypass Options	Addl. Bypass
LA	Green RUN Light (22 mm)	Light
LD	Green STOP Light (22 mm)	Light
LE	Red RUN Light	Light
LF	Red STOP Light (22 mm)	Light
LJ	White Power On Light (22 mm)	Light
LU	Misc. Light (22 mm)	Light
P1	Input Disconnect (HMCP) 100 kAIC	Input
P2	Disconnect Switch ⑦	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/μS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
S5	Floor Stand 22"	Enclosure
S6	Floor Stand 12"	Enclosure
S7	10" Expansion	Enclosure
S8	20" Expansion	Enclosure
S9	Space Heater	Enclosure

Communication Options ⑥

C2 = Modbus	C6 = CanOpen (Slave)	CA = Johnson Controls N2
C3 = Profibus DP	C7 = DeviceNet	CI = Modbus TCP
C4 = LonWorks	C8 = Modbus (D9 Connector)	CJ = BACnet
C5 = Profibus DP (D9 Connector)		CK = Ethernet IP
		D3 = RS-232 with D9 Connection

Control Options

B1 = 6 DI, 1 ext +24V DC/EXT +24V DC	B5 = 3 RO (NO)
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm	B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

Engineered Options

HT	High Temperature rating for 50°C (FR10 and above) ⑧
VB	Varnished Boards

① Local/Remote keypad is included as the standard Control Panel.

② Brake Chopper is a factory installed option only, see drive option tables on Pages 40-92 – 40-100. Note: External dynamic braking resistors not included. Consult factory.

③ Includes local/remote speed reference switch.

④ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.

⑤ See Pages 40-88 and 40-89 for descriptions.

⑥ See Pages 40-90 and 40-91 for complete descriptions.

⑦ Applicable only with FR10 and FR11 Freestanding designs.

⑧ Consult Eaton for availability.

Control/Communication Option Descriptions

Table 40-126. Available Control/Communications Options

Option	Description	Option Type
K1	Door-Mounted Speed Potentiometer — Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	3 – 15 psig Follower — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the SVX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
K5	MANUAL/AUTO Speed Reference Switch — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	START/STOP Pushbuttons — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KB	115V Control Transformer – 550 VA — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
KF	Bypass Test Switch for RB and RA — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	Standard Elapsed Time Meter — Provides a door-mounted elapsed run time meter.	Control
L1	Power On and Fault Pilot Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	Bypass Pilot Lights for RB, RA Bypass Options — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LA	Green RUN Light (22 mm) — Provides a green run light that indicates the drive is running.	Light
LD	Green STOP Light (22 mm) — Provides a green stop light that indicates the drive is stopped.	Light
LE	Red Run Pilot Light (22 mm) — Provides a red run pilot light that indicates the drive is running.	Light
LF	Red STOP Light (22 mm) — Provides a red stop light that indicates the drive is stopped.	Light
LJ	White Power On Light (22 mm) — The 22 mm white light that illuminates when the drive assembly is powered.	Light
LU	Misc. Light (22 mm) — Provides a misc. “user defined” pilot light. User to define light function and color.	Light
P1	Input Disconnect Assembly Rated to 100 kAIC — High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P2	Disconnect Switch — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the SVX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input
P3	Input Line Fuses Rated to 200 kAIC — Provides high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	MOV Surge Suppressor — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
PE	Output Contactor — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options RB and RA include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	Output Filter — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a .5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option PF), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m). <i>This option can not be used with the Brake Chopper Circuit. The Output Filter (option PF) should be investigated as an alternative.</i>	Output
PH	Single Overload Relay — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output

Enclosed Drives

Table 40-126. Available Control/Communications Options (Continued)

Option	Description	Option Type
PI	Dual Overload Relays — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	Dual Overloads for Bypass — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass
RA	Manual HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-85).	Bypass
RB	Manual IOB Bypass Controller — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-85).	Bypass
RC	Auto Transfer HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-85). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	Auto Transfer IOB Bypass Controller — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-85). Door-mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
S5	Floor Stand 22" — Converts a Size 1 or 2, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S6	Floor Stand 12" — Converts a Size 2, normally wall mounted enclosure to a floor standing enclosure with a height of 12" (304.8 mm).	Enclosure
S7	10" Expansion — In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. NOTE: Enclosure expansion rated NEMA Type 1 only.	Enclosure
S8	20" Expansion — In a Size 5 enclosure, the extension allows for bottom cable entry and additional space for customer mounted components. When the Output Filter (option PF) is selected for a drive using a Size 5 enclosure, this expansion box is required and included in the option pricing. NOTE: Enclosure expansion rated NEMA Type 1 only.	Enclosure
S9	Space Heater — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures 0 and 1, and a 400W heater is installed in enclosures 2 – 5. Requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

Enclosed Drives

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-41**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

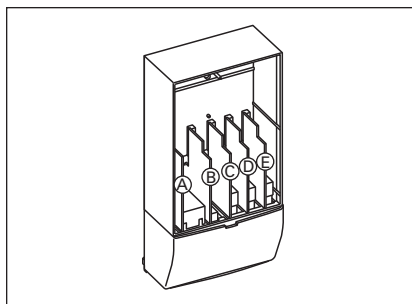


Figure 40-41. 9000X Series Option Boards

Table 40-127. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-41)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm — SPX Only	B	OPTA3		A3		—	X	X	X	X	X	X
Encoder low volt +5V/15V/24V — SPX Only	C	OPTA4		A4		—	X	X	X	X	X	X
Encoder high volt +15V/24V — SPX Only	C	OPTA5		A5		—	X	X	X	X	X	X
Double encoder — SPX Only	C	OPTA7		A7		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO — SPX Only	A	OPTA8		A8		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	OPTAE		AE		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Modbus TCP	D, E	OPTCI		C1		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD1		D1		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD2		D2		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X
Keypad												
9000X Series Local Remote Keypad	—	KEYPAD-LOC/REM		—		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Kit (Keypad not included)	—	OPTRMT-KIT-9000X		—		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Discount Symbol..... **SS-2**

Enclosed Drives

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus

protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive

parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-128. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200 \text{ k}\Omega$
Analog current, input	0 (4) – 20 mA, $R_i = 250 \Omega$
Digital Input	24V: "0" $\leq 10\text{V}$, "1" $\geq 18\text{V}$, $R_i > 5 \text{ k}\Omega$
Aux. voltage	24V ($\pm 20\%$), max. 50 mA
Reference voltage	10V $\pm 3\%$, max. 10 mA
Analog current, output	0 (4) – 20 mA, $R_L = 500 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Analog voltage, output	0 (2) – 10V, $R_L \geq 1 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Relay output	
Max. switching voltage	300V DC, 250V AC
Max. switching load	8A/24V DC, .4A/300V DC, 2 kVA/250V AC
Max. continuous load	2A rms
Thermistor input	$R_{trip} = 4.7 \text{ k}\Omega$
Encoder input	24V: "0" $\leq 10\text{V}$, "1" $\geq 18\text{V}$, $R_i = 2.2 \text{ k}\Omega$ 5V: "0" $\leq 2\text{V}$, "1" $\geq 3\text{V}$, $R_i = 330 \Omega$

SVX Conversion Kit**Table 40-129. SVX Conversion Kit Frame 4 – 7**

Frame Size	Enclosure Size	Catalog Number	Delivery Code	Price U.S. \$
FR4	0	OPTCON-SVXFR4-SZ00	FB10	
FR4	1	OPTCON-SVXFR4-SZ01	FB10	
FR5	0	OPTCON-SVXFR5-SZ00	FB10	
FR5	1	OPTCON-SVXFR5-SZ01	FB10	
FR6	1	OPTCON-SVXFR6-SZ01	FB10	
FR6	2	OPTCON-SVXFR6-SZ02	FB10	
FR7	2	OPTCON-SVXFR7-SZ02	FB10	

Note: The kit consists of a flange kit, adapter plate(s), hardware, remote keypad kit and SVX9000 decal.

Table 40-130. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V ①

Frame	Delivery Code	Adder U.S. \$
FR4	FP	
FR5	FP	
FR6	FP	
FR7	FP	
FR8	FP	
FR9	FP	
FR10	FP	
FR11	FP	
FR12	FP	
FR13	FP	
FR14	FP	

① See catalog number description to order.

Discount Symbol..... **SS-2**

Product Selection

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- Read all Footnotes.

208V Drives

Table 40-131. 208V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12		
			Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②
208V High Overload Drive and Enclosure								
0	3/4	3.7	4	SVXF0711EA		4	SVXF0721EA	
0	1	4.8	4	SVX00111EA		4	SVX00121EA	
0	1-1/2	6.6	4	SVXF1511EA		4	SVXF1521EA	
0	2	7.8	4	SVX00211EA		4	SVX00221EA	
0	3	11	4	SVX00311EA		4	SVX00321EA	
0	5	17.5	5	SVX00511EA		5	SVX00521EA	
0	7-1/2	25	5	SVX00711EA		5	SVX00721EA	
1	10	31	6	SVX01011EA		6	SVX01021EA	
1	15	48	6	SVX01511EA		6	SVX01521EA	
2	20	61	7	SVX02011DA		7	SVX02021DA	
2	25	75	7	SVX02511DA		7	SVX02521DA	
2	30	88	7	SVX03011DA		7	SVX03021DA	
3	40	114	8	SVX04011DA		8	SVX04021DA	
4	50	143	8	SVX05011DA		8	SVX05021DA	
5	60	170	8	SVX06011DA		8	SVX06021DA	
5	75	211	9	SVX07511DA		9	SVX07521DA	
5	100	273	9	SVX10011DA		9	SVX10021DA	

208V Low Overload Drive and Enclosure

0	1	4.8	4	SVX00111BA		4	SVX00121BA	
0	1-1/2	6.6	4	SVXF1511BA		4	SVXF1521BA	
0	2	7.8	4	SVX00211BA		4	SVX00221BA	
0	3	11	4	SVX00311BA		4	SVX00321BA	
0	5	17.5	5	SVX00511BA		5	SVX00521BA	
0	7-1/2	25	5	SVX00711BA		5	SVX00721BA	
0	10	31	5	SVX01011BA		5	SVX01021BA	
1	15	48	6	SVX01511BA		6	SVX01521BA	
1	20	61	6	SVX02011BA		6	SVX02021BA	
2	25	75	7	SVX02511AA		7	SVX02521AA	
2	30	88	7	SVX03011AA		7	SVX03021AA	
2	40	114	7	SVX04011AA		7	SVX04021AA	
3	50	—	8	SVX05011AA		8	SVX05021AA	
4	60	170	8	SVX06011AA		8	SVX06021AA	
5	③	205 ③	8	SVX07511AA		8	SVX07521AA	
5	③	261 ③	9	SVX10011AA		9	SVX10021AA	

① Enclosure dimensions listed on Pages 40-101 – 40-108.

② Includes drive, Local/Remote Keypad and enclosure.

③ These units are current rated (75 I_L hp 205 Amps, 100 I_L hp 261 Amps). They are not hp rated.

Table 40-132. 208V Brake Chopper Adder ④

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 1/12		NEMA Type 1/12
3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

④ External dynamic braking resistors not included. Consult factory.

Discount Symbol..... SS-3

Enclosed Drives

Table 40-133. 208V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100								

Table 40-134. 208V Light Options




Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100							

Table 40-135. 208V Bypass Options

Catalog Number Suffix 	Bypass Test Switch for RA, RB	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 7-1/2							
10							
15							
20							
25							
30							
40							
50							
60							
75							
100							


Enclosed Drives

Table 40-136. 208V Enclosure Options

Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion	20" (508 mm) Expansion	Space Heater ^①
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
0					
1					
2					
3					
4					
5					

^① Requires customer supplied 115V AC supply.

Table 40-137. 208V Power Options

Catalog Number Suffix 	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ^②	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter ^②	Single Overload Relay	Dual Overload Relays
hp	P1	P3	P7	PE	PF	PG	PH	PI
	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 5								
7-1/2								
10								
15								
20								
25								
30								
40								
50								
60								
75								
100								

^② Not required for 208V applications.

Enclosed Drives

230V Drives

Table 40-138. 230V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12		
			Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②
230V High Overload Drive and Enclosure								
0	3/4	3.7	4	SVXF0712EA		4	SVXF0722EA	
0	1	4.8	4	SVX00112EA		4	SVX00122EA	
0	1-1/2	6.6	4	SVXF1512EA		4	SVXF1522EA	
0	2	7.8	4	SVX00212EA		4	SVX00222EA	
0	3	11	4	SVX00312EA		4	SVX00322EA	
0	5	17.5	5	SVX00512EA		5	SVX00522EA	
0	7-1/2	25	5	SVX00712EA		5	SVX00722EA	
1	10	31	6	SVX01012EA		6	SVX01022EA	
1	15	48	6	SVX01512EA		6	SVX01522EA	
2	20	61	7	SVX02012DA		7	SVX02022DA	
2	25	75	7	SVX02512DA		7	SVX02522DA	
2	30	88	7	SVX03012DA		7	SVX03022DA	
3	40	114	8	SVX04012DA		8	SVX04022DA	
4	50	140	8	SVX05012DA		8	SVX05022DA	
5	60	170	8	SVX06012DA		8	SVX06022DA	
5	75	205	9	SVX07512DA		9	SVX07522DA	
5	100	261	9	SVX10012DA		9	SVX10022DA	

230V Low Overload Drive and Enclosure

0	1	4.8	4	SVX00112BA		4	SVX00122BA	
0	1-1/2	6.6	4	SVXF1512BA		4	SVXF1522BA	
0	2	7.8	4	SVX00212BA		4	SVX00222BA	
0	3	11	4	SVX00312BA		4	SVX00322BA	
0	5	17.5	5	SVX00512BA		5	SVX00522BA	
0	7-1/2	25	5	SVX00712BA		5	SVX00722BA	
0	10	31	5	SVX01012BA		5	SVX01022BA	
1	15	48	6	SVX01512BA		6	SVX01522BA	
1	20	61	6	SVX02012BA		6	SVX02022BA	
2	25	75	7	SVX02512AA		7	SVX02522AA	
2	30	88	7	SVX03012AA		7	SVX03022AA	
2	40	114	7	SVX04012AA		7	SVX04022AA	
3	50	140	8	SVX05012AA		8	SVX05022AA	
4	60	170	8	SVX06012AA		8	SVX06022AA	
5	75	205	8	SVX07512AA		8	SVX07522AA	
5	③	261 ③	9	SVX10012AA		9	SVX10022AA	

① Enclosure dimensions listed on **Pages 40-101 – 40-108.**

② Includes drive, Local/Remote Keypad and enclosure.

③ This unit is current rated (100 I_L hp 261 Amps). It is not hp rated.

Table 40-139. 230V Brake Chopper Adder ④

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 1/12		NEMA Type 1/12
3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

④ External dynamic braking resistors not included. Consult factory.

Enclosed Drives

Table 40-140. 230V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100								

Table 40-141. 230V Light Options



Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100							


Table 40-142. 230V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 10							
15							
20							
25							
30							
40							
50							
60							
75							
100							

^① See Pages 40-88 and 40-89 for details.


Enclosed Drives

Table 40-143. 230V Enclosure Options

Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion	20" (508 mm) Expansion	Space Heater ^①
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
0					
1					
2					
3					
4					
5					

^① Requires customer supplied 115V AC supply.

Table 40-144. 230V Power Options

Catalog Number Suffix 	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ^②	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter	Single Overload Relay	Dual Overload Relays
	P1	P3	P7	PE	PF	PG	PH	PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 5								
7-1/2								
10								
15								
20								
25								
30								
40								
50								
60								
75								
100								

^② Not required for 230V applications.

Enclosed Drives

480V Drives

Table 40-145. 480V AC Input Base Drive

Enclosure Size ①	hp	Current (A)	NEMA Type 1			NEMA Type 12		
			Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②
High Overload Drive and Enclosure								
0	1	2.2	4	SVX00114EA		4	SVX00124EA	
0	1-1/2	3.3	4	SVXF1514EA		4	SVXF1524EA	
0	2	4.3	4	SVX00214EA		4	SVX00224EA	
0	3	5.6	4	SVX00314EA		4	SVX00324EA	
0	5	7.6	4	SVX00514EA		4	SVX00524EA	
0	7-1/2	12	5	SVX00714EA		5	SVX00724EA	
0	10	16	5	SVX01014EA		5	SVX01024EA	
0	15	23	5	SVX01514EA		5	SVX01524EA	
1	20	31	6	SVX02014EA		6	SVX02024EA	
1	25	38	6	SVX02514EA		6	SVX02524EA	
1	30	46	6	SVX03014EA		6	SVX03024EA	
2	40	61	7	SVX04014DA		7	SVX04024DA	
2	50	72	7	SVX05014DA		7	SVX05024DA	
2	60	87	7	SVX06014DA		7	SVX06024DA	
3	75	105	8	SVX07514DA		8	SVX07524DA	
3	100	140	8	SVX10014DA		8	SVX10024DA	
4	125	170	8	SVX12514DA		8	SVX12524DA	
5	150	205	9	SVX15014DA		9	SVX15024DA	
5	200	245	9	SVX20014DA		9	SVX20024DA	
6, 8 ④⑥	250	300	10	SVX25014DA		10	SVX25064DA	
6, 8 ④⑥	300	385	10	SVX30014DA		10	SVX30064DA	
6, 8 ④⑥	350	460	10	SVX35014DA		10	SVX35064DA	
8, 9 ⑤⑥	400	520	11	SVX40014DA		11	SVX40064DA	
8, 9 ⑤⑥	500	590	11	SVX50014DA		11	SVX50064DA	
8, 9 ⑤⑥	550	650	11	SVX55014DA		11	SVX55064DA	
③	600	730	12	SVX60014DA		12	SVX60064DA	
③	650	820	12	SVX65014DA		12	SVX65064DA	
③	700	920	12	SVX70014DA		12	SVX70064DA	

Table 40-146. 480V Brake Chopper Adder ⑦

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 1/12		NEMA Type 1/12
1		—	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	
125		125	
150		150	
200		200	
250		250	
300		300	
350		350	
400		400	
500		500	
550		550	
600		600	
650		650	
700		700	
		800	

⑦ External dynamic braking resistors not included. Consult factory.

① Enclosure dimensions listed on Pages 40-101 – 40-111.

② Includes drive, Local/Remote keypad and enclosure.

③ Consult Eaton.

④ The smaller Enclosure Size 6 accommodates only power options, Input Disconnect (P1) and Input Line Fuses (P3). Bypass and other options require Size 8. Adding any standard control option will not require the larger enclosure.

⑤ The smaller Enclosure Size 8 accommodates only power options, Input Disconnect (P1) and Input Line Fuses (P3). Bypass and other options require Size 9. Adding any standard control option will not require the larger enclosure.

⑥ For other options, consult factory.

Discount Symbol SS-3

Enclosed Drives

Table 40-147. 480V Light Options


Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Green RUN Light (22 mm)	Green STOP Light (22 mm)	Red RUN Light (22 mm)	Red STOP Light (22 mm)	Power On Light (22 mm)	Misc Light (22 mm)
	L1	LA	LD	LE	LF	LJ	LU
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 800							

Table 40-148. 480V Control Options




Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/ AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	115 Volt Control Transformer 550 VA	Standard Elapsed Time Meter
	K1	K2	K3	K4	K5	K6	KB	KO
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 800								

Table 40-149. 480V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller
	KF	L2	PN	RA	RB	RC	RD
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 20							
25							
30							
40							
50							
60							
75							
100							
125							
150							
200							
250							
300							
350							
400							
500							
550							
600							
650							
700							
800							

^① See Pages 40-88 and 40-89 for details.

Table 40-150. 480V Enclosure Options

Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	10" (254 mm) Expansion ^③	20" (508 mm) Expansion ^④	Space Heater ^②
	S5	S6	S7	S8	S9
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
0					
1					
2					
3					
4					
5					
6					
8					
9					

^② Requires customer supplied 115V AC supply.


^③ See Enclosure 5-1P on Page 40-107 for dimensions.

^④ See Enclosure 5-2P on Page 40-108 for dimensions.

Discount Symbol SS-3

Enclosed Drives


Table 40-151. 480V Power Options

Catalog Number Suffix 	Input			Output				
	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	Output Contactor	Output Filter ^①	MotoRx (300 – 600 Ft.) 1000 V/ μ S DV/DT Filter ^①	Single Overload Relay ^②	Dual Overload Relays ^②
	P1	P3	P7	PE	PF	PG	PH	PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 2								
3 – 5								
7-1/2								
10								
15								
20								
25								
30								
40								
50								
60								
75								
100								
125								
150								
200								
250								
300								
350								
400								
500								
550								
600								
650								
700								
800								

^① Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.

^② Heater packs not included.

Table 40-152. Input Options

Catalog Number Suffix 	Load Switch
	P2 ^③
hp	Adder U.S. \$
250	
300	
350	
400	
500	
550	

^③ Applicable with FR10 and FR11 Freestanding designs only.

Dimensions

Enclosure Size 0

Table 40-153. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
0	19.9 (504)	29.0 (737)	16.4 (416)	18.3 (465)	—	—	—	27.4 (695)	—	—	25.4 (644)	4.0 (102)	3.0 (76)

Table 40-153. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)										Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	
	L	M	N	P	R						
0	5.0 (127)	—	—	6.0 (152)	9.6 (245)	26.4 (669)	1.5 (38)	6.3 (160)	4.3 (108)	5.3 (134)	200 (91)

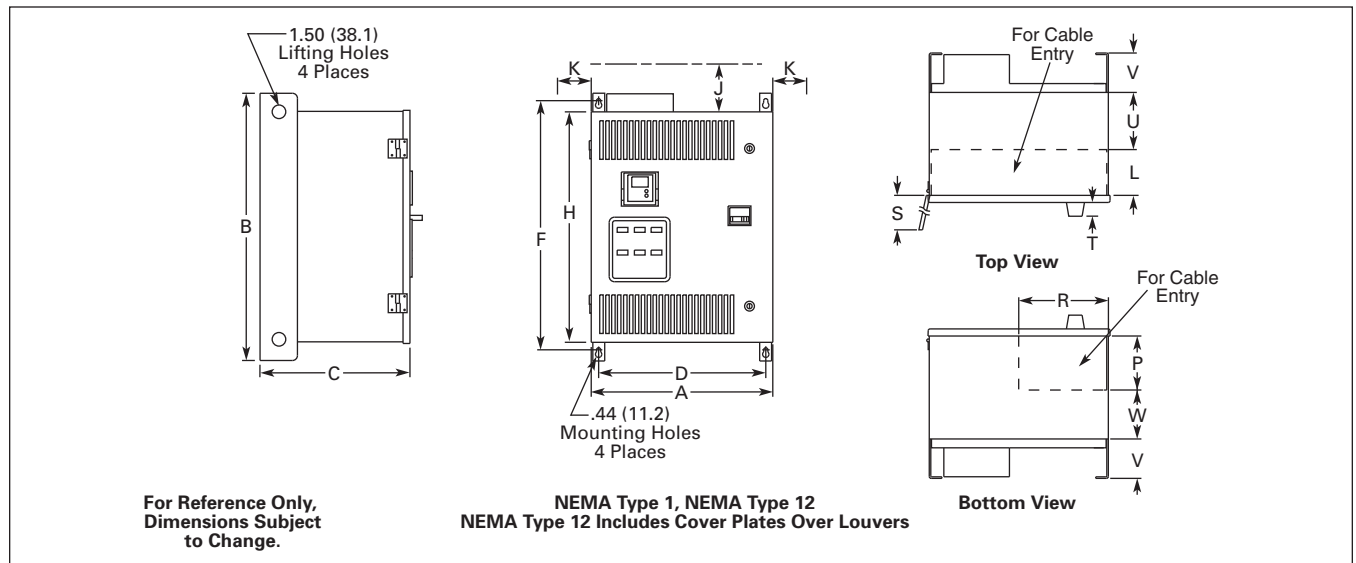


Figure 40-42. Approximate Dimensions

Enclosed Drives

Enclosure Size 1

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)			Mounting							H	Min. Air Space	
	Wide A	High B	Deep C	D	D1	E	E1	F	G	G1		J	K
1	26.4 (669)	36 (914)	16.3 (414)	24.8 (630)	—	—	—	34.0 (864)	—	—	32.4 (822)	4.0 (102)	3.0 (76)

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														
	Cable Entry					Door Clearance S	T	U	V	W	Floor Stand				
	L	M	N	P	R						X	Y	Z	AA	BB
1	11.0 (279)	6.0 (152)	9.0 (229)	10.0 (254)	6.5 (165)	26.4 (669)	1.5 (38)	4.3 (108)	—	—	56.0 (1422)	4.3 (108)	11.1 (281)	1.8 (46)	0.8 (19)

Table 40-154. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														
	Floor Stand														
	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	RR	SS	TT	UU
1	26.0 (660)	3.5 (90)	5.5 (141)	3.0 (76)	6.0 (152)	2.0 (51)	5.4 (136)	1.1 (28)	8.8 (224)	5.4 (137)	—	—	—	—	—

Max. Approx. Ship. Wt. lbs. (kg)

230 (104)

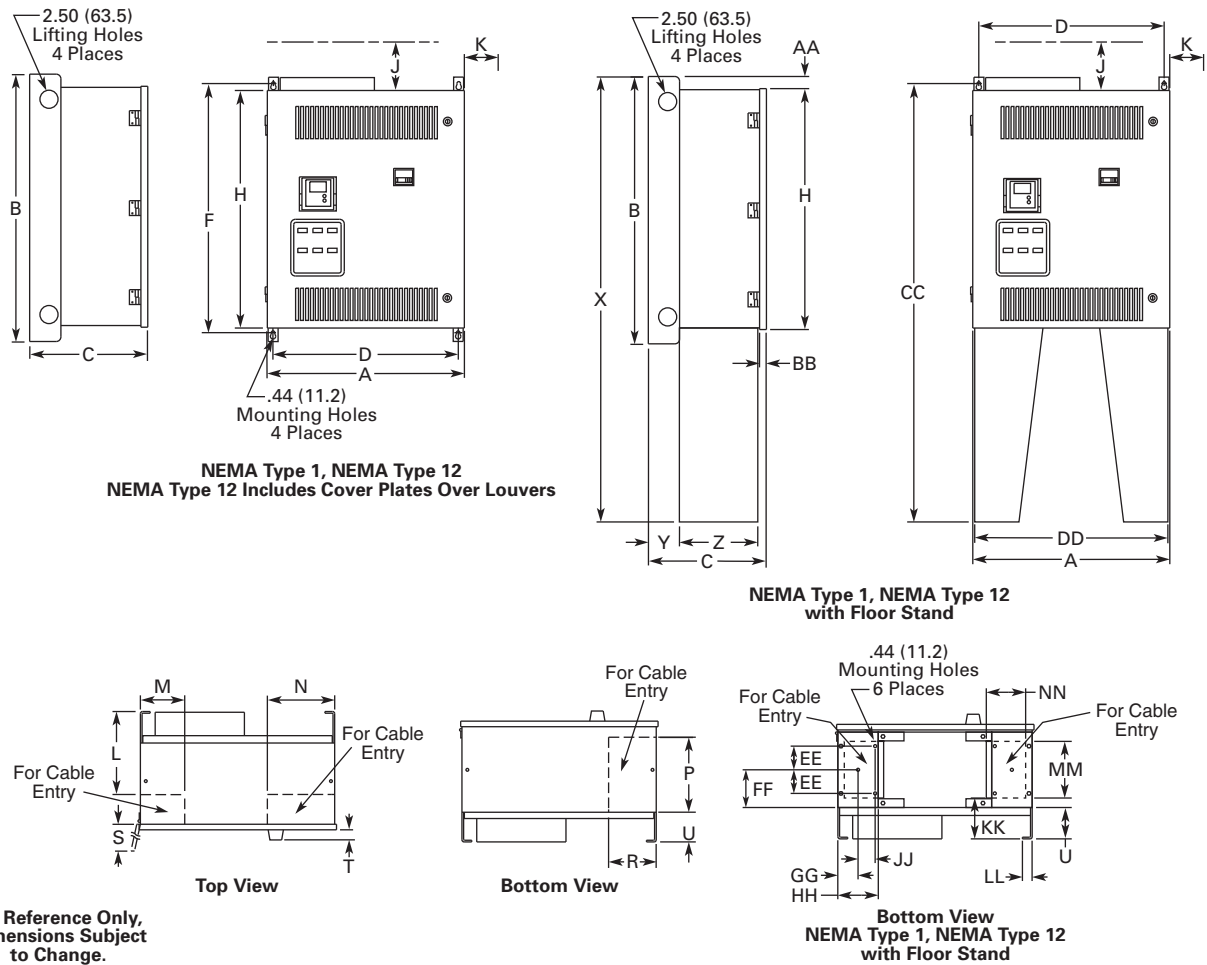


Figure 40-43. Approximate Dimensions

Enclosure Size 2

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
2	26.4 (669)	59.0 (1499)	19.4 (492)	24.8 (630)	—	—	—	57.0 (1448)	—	—	55.4 (1406)	4.0 (102)	3.0 (76)

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															
	Cable Entry					Door Clearance S	T	U	V	W	Floor Stand					
	L	M	N	P	R						X	Y	Z	AA	BB	CC
2	5.9 (149)	—	—	12.4 (315)	9.5 (241)	26.4 (669)	1.5 (38)	4.8 (121)	5.9 (151)	—	69.0 (1753)	4.8 (121)	13.6 (344)	1.8 (46)	.8 (19)	68.2 (1732)

Table 40-155. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt lbs. (kg)	
	Floor Stand											RR	SS	TT	UU		VV
	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP						
2	26.0 (660)	4.8 (121)	6.8 (172)	3.0 (76)	6.0 (152)	2.0 (51)	5.0 (127)	1.1 (28)	11.3 (288)	79.0 (2007)	78.2 (1986)	—	—	—	—	—	380 (173)

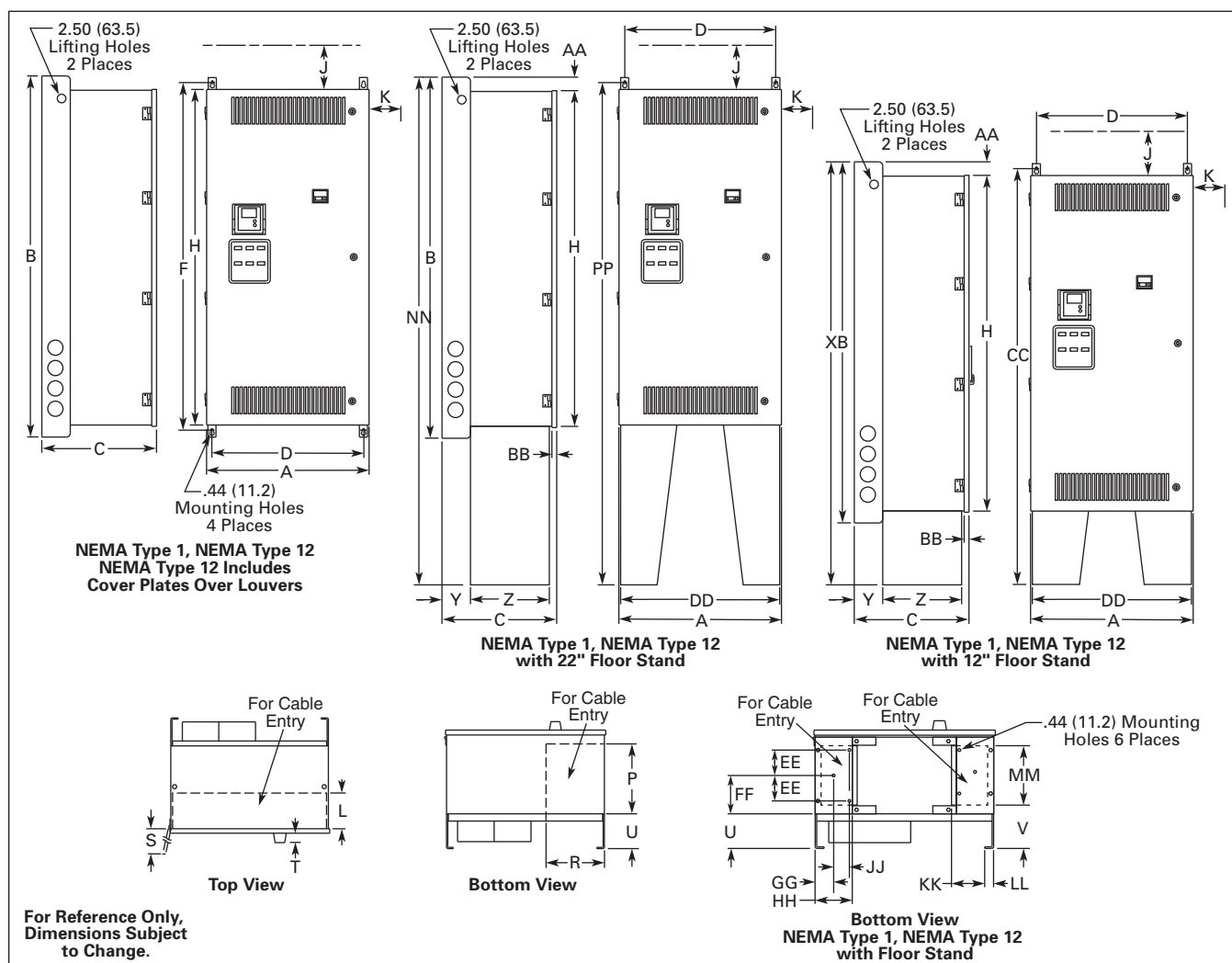


Figure 40-44. Approximate Dimensions

Enclosed Drives

Enclosure Size 3

Table 40-156. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
3	26.4 (671)	77.0 (1956)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140.)	.9 (24)	76.4 (1939)	4.0 (102)	3.0 (76)

Table 40-156. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R											
3	5.3 (133)	23.4 (594)	10.0 (254)	1.3 (32)	12.9 (328)	26.4 (669)	1.5 (38)	8.0 (203)	4.8 (121)	6.8 (173)	79.5 (2018)	13.4 (340)	.8 (19)	1.3 (32)	26.0 (660)	690 (313)

40

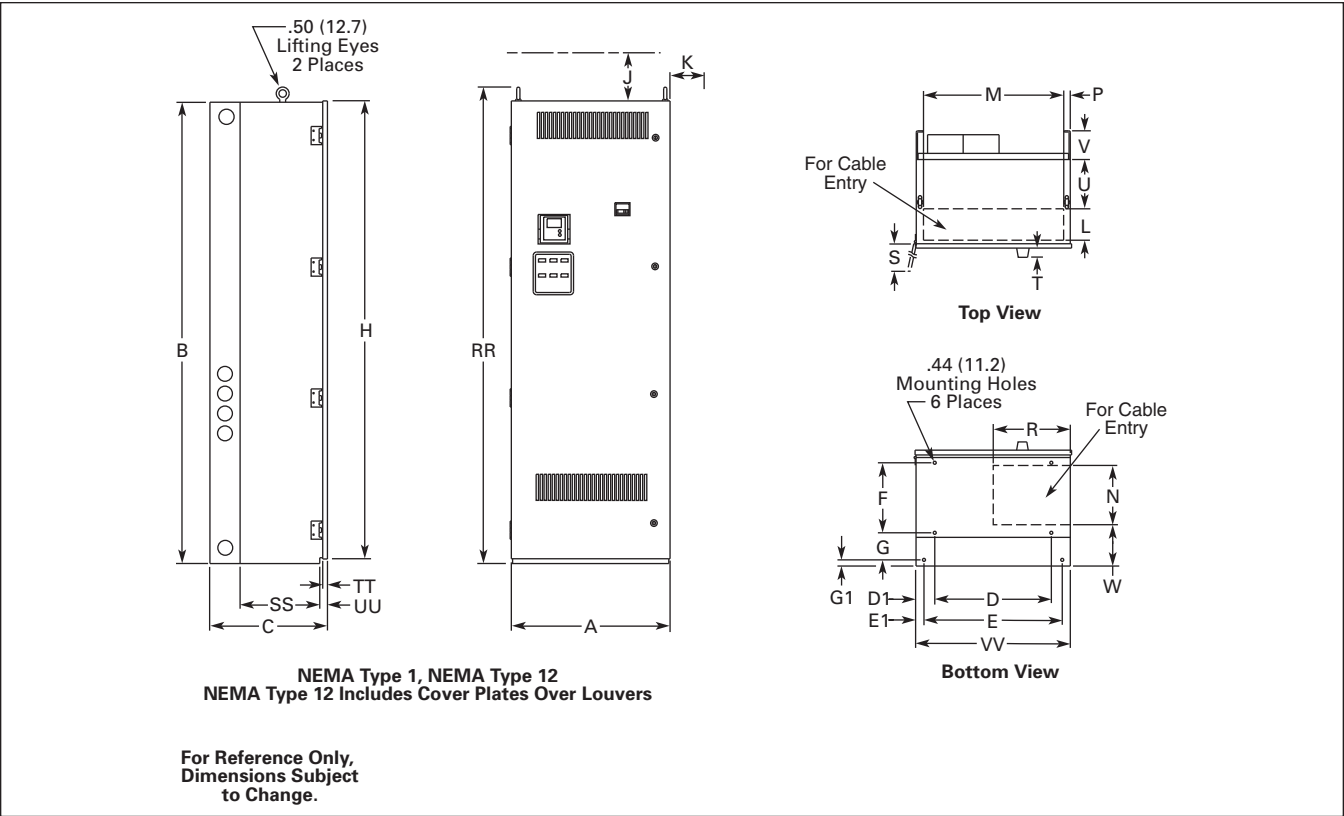


Figure 40-45. Approximate Dimensions

Enclosure Size 4

Table 40-157. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
4	26.4 (671)	90.0 (2286)	19.4 (493)	19.5 (495)	3.3 (83)	23.0 (584)	1.5 (38)	11.7 (298)	5.5 (140)	.9 (24)	89.4 (2270)	4.0 (102)	3.0 (76)

Table 40-157. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R											
4	5.3 (133)	23.4 (594)	13.8 (351)	1.0 (25)	11.2 (286)	26.4 (669)	1.5 (38)	8.0 (204)	4.8 (121)	—	92.5 (2349)	.8 (19)	1.3 (32)	—	—	825 (375)

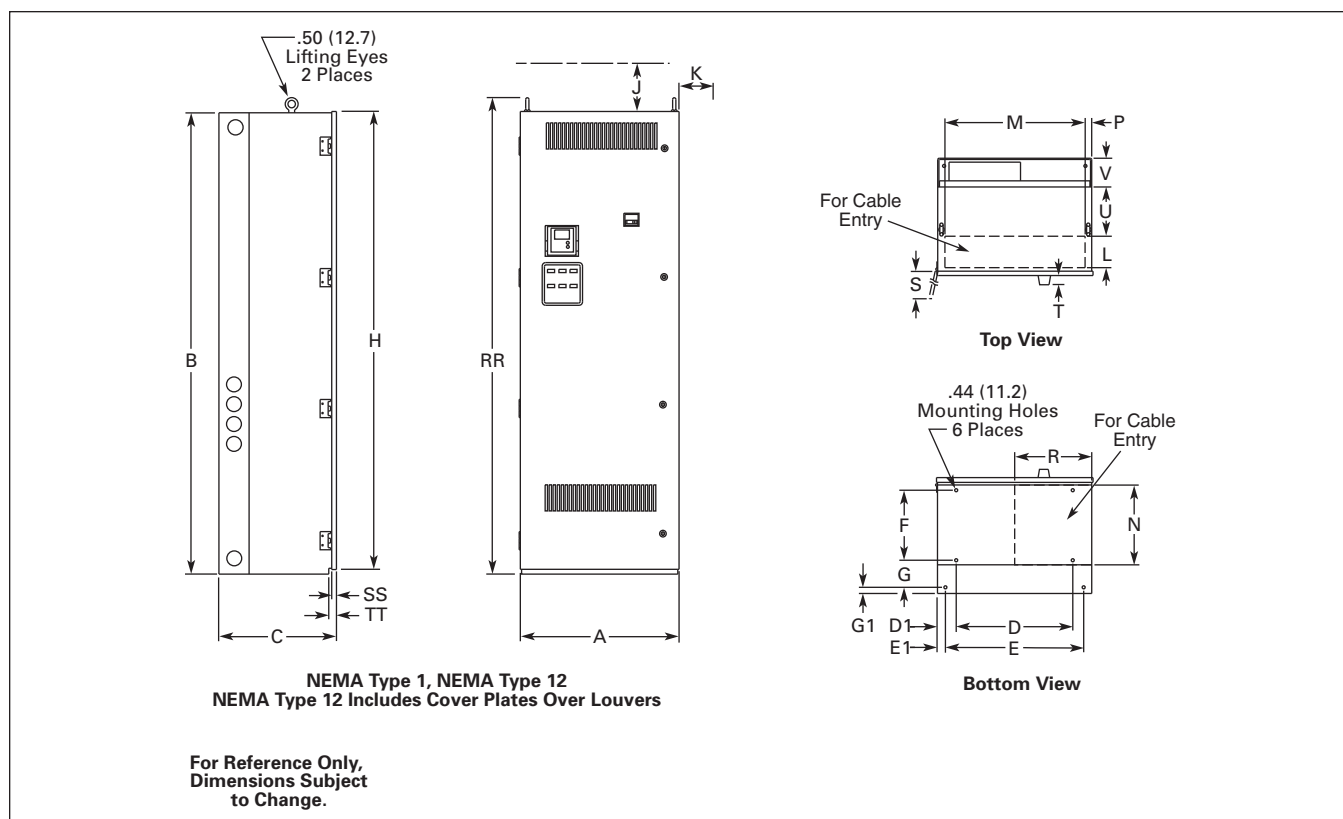


Figure 40-46. Approximate Dimensions

Enclosed Drives

Enclosure Size 5

Table 40-158. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
5	40.0 (1016)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-158. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														Max.	
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	Approx.
	L	M	N	P	R											Ship. Wt. lbs. (kg)
5	15.0 (381)	10.0 (254)	4.8 (122)	2.0 (51)	—	36.3 (921)	20.0 (508)	—	—	—	94.0 (2387)	15.5 (394)	—	—	—	1275 (579)

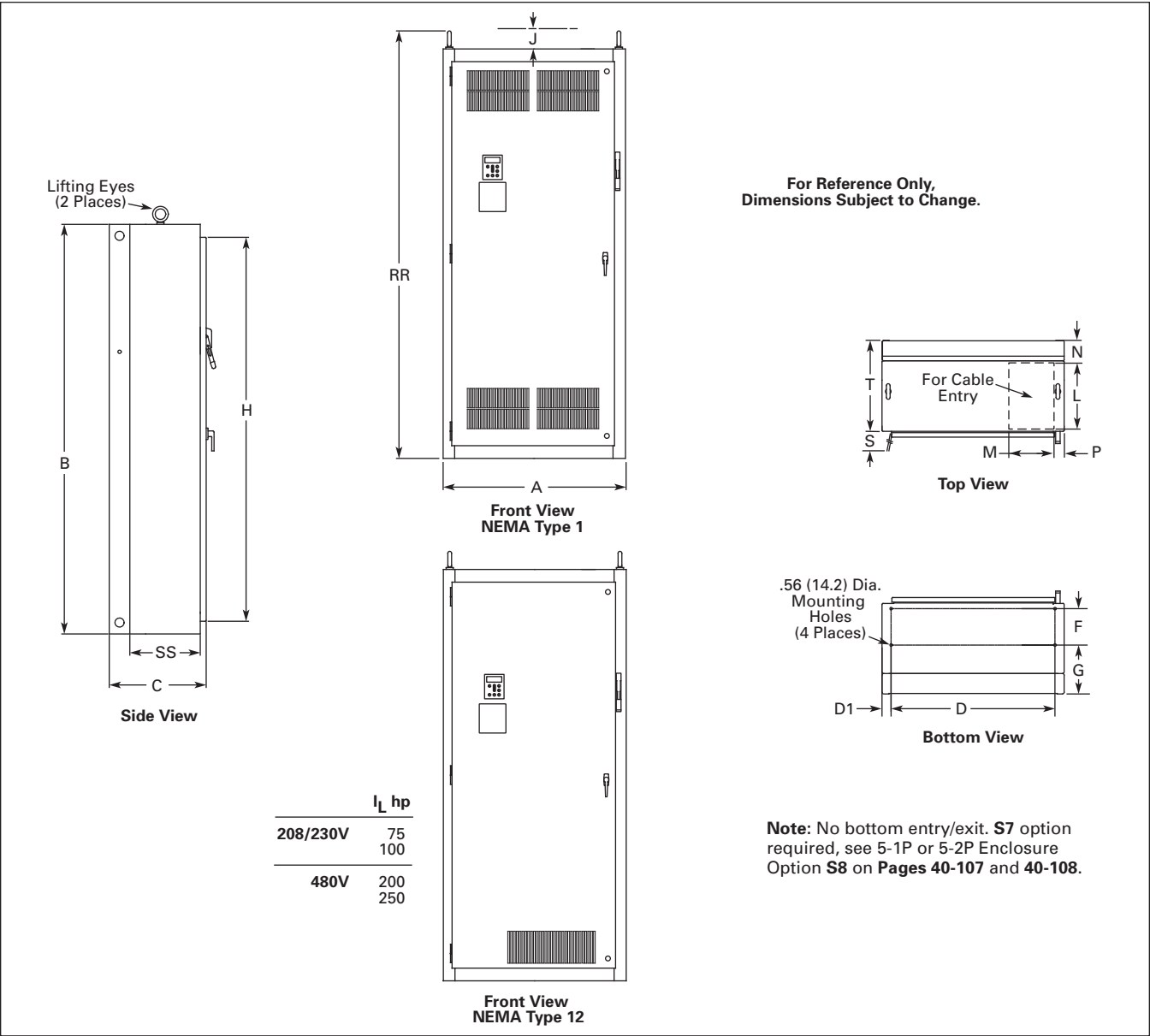


Figure 40-47. Approximate Dimensions

Enclosure Size 5-1P

Table 40-159. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)											Min. Air Space	
	Wide A	High B	Deep C	Mounting							H	J	K
5-1P	50.0 (1270)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-159. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														Max. Approx. Ship. Wt. lbs. (kg)	
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU		VV
	L	M	N	P	R											
5-1P	17.1 (435)	8.0 (203)	1.3 (33)	1.0 (25)	—	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1375 (624)

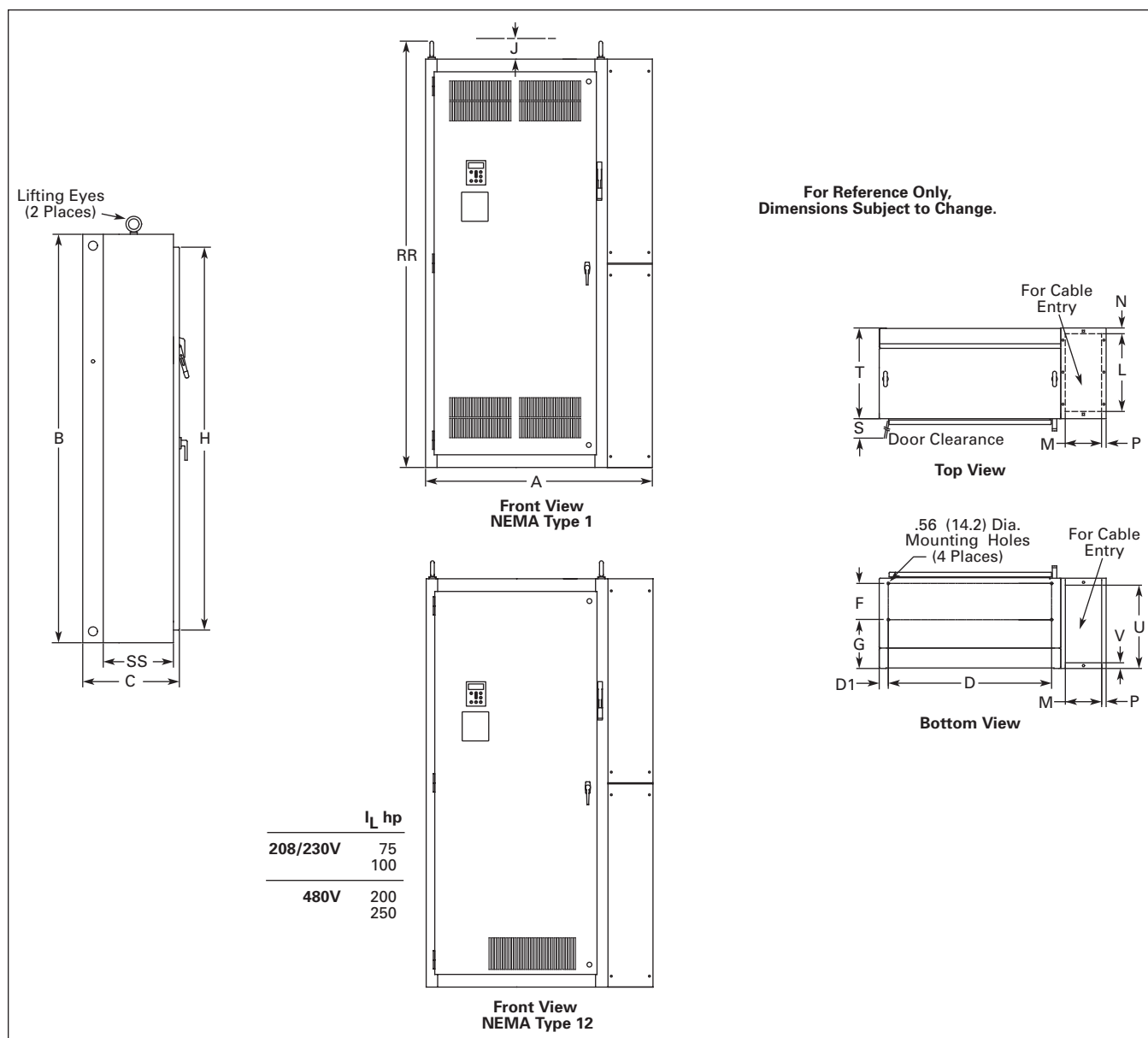


Figure 40-48. Approximate Dimensions

Enclosed Drives

Enclosure Size 5-2P

Table 40-160. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)												
	Wide A	High B	Deep C	Mounting							H	Min. Air Space	
				D	D1	E	E1	F	G	G1		J	K
5-2P	60.0 (1524)	90.0 (2286)	21.3 (541)	36.0 (914)	2.0 (51)	—	—	8.0 (203)	10.8 (273)	—	84.4 (2143)	4.0 (102)	—

Table 40-160. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance S	T	U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R											
5-2P	17.0 (432)	18.0 (457)	1.5 (38)	1.0 (25)	.9 (23)	36.3 (921)	20.0 (508)	18.4 (466)	1.3 (32)	—	94.0 (2387)	15.5 (394)	—	—	—	1585 (720)

40

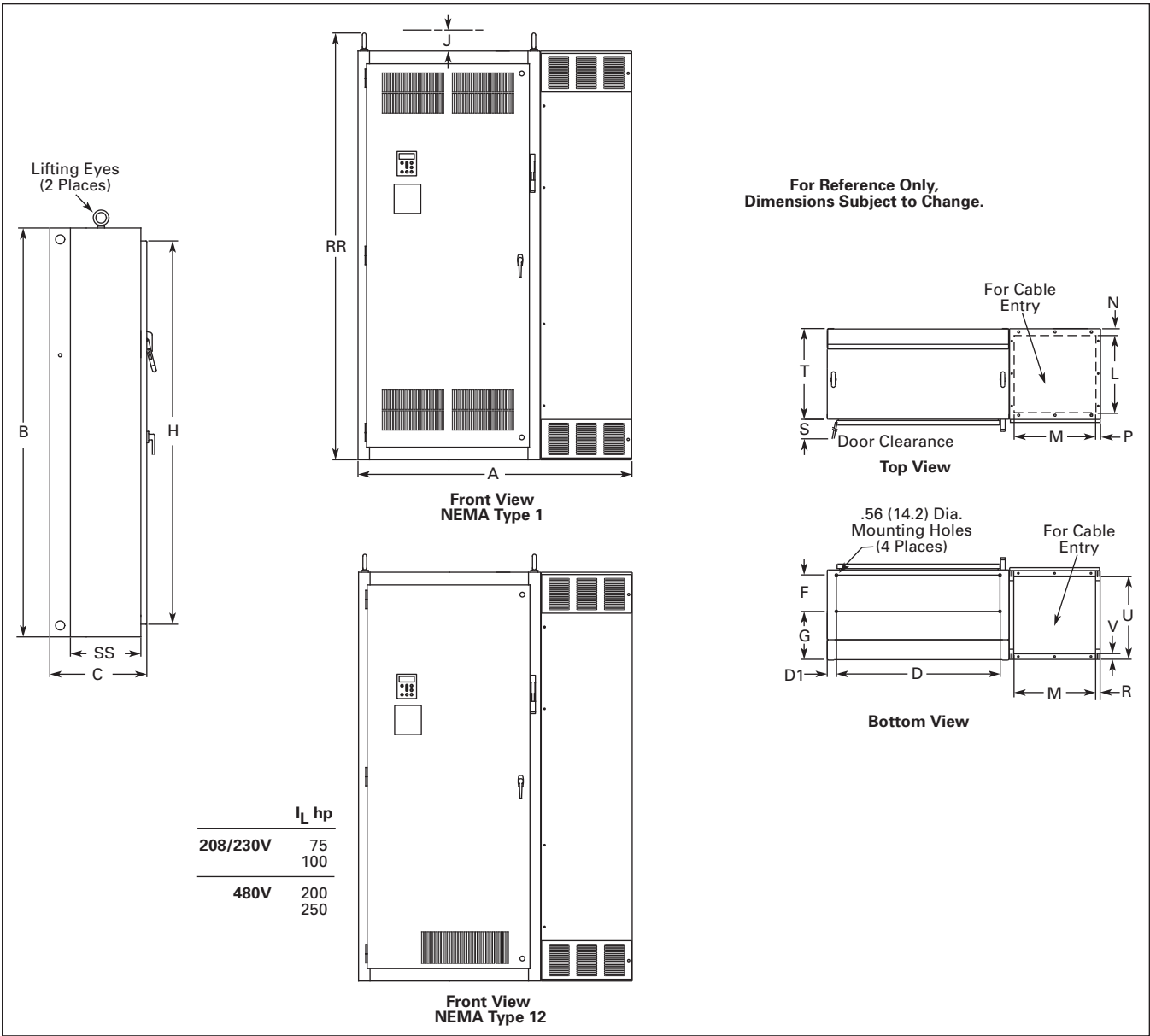


Figure 40-49. Approximate Dimensions

Enclosure Size 6

Table 40-161. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)			Mounting							H	Min. Air Space	
	Wide A	High B	Deep C	D	D1	D2	E	F	G	G1		J	K
6	30.0 (762)	90.0 (2286)	26.0 (660)	26.5 (673)	1.8 (46)	—	—	17.3 (438)	5.5 (140)	—	84.4 (2143)	4.0 (102)	—

Table 40-161. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry					Door Clearance		T	U	V	W	RR	SS	TT	
	L	M	N	P	R	S									
6	23.5 (597)	3.3 (84)	4.5 (114)	19.3 (490)	—	26.2 (667)		24.8 (629)	—	—	—	93.9 (2386)	—	—	1500 (681)

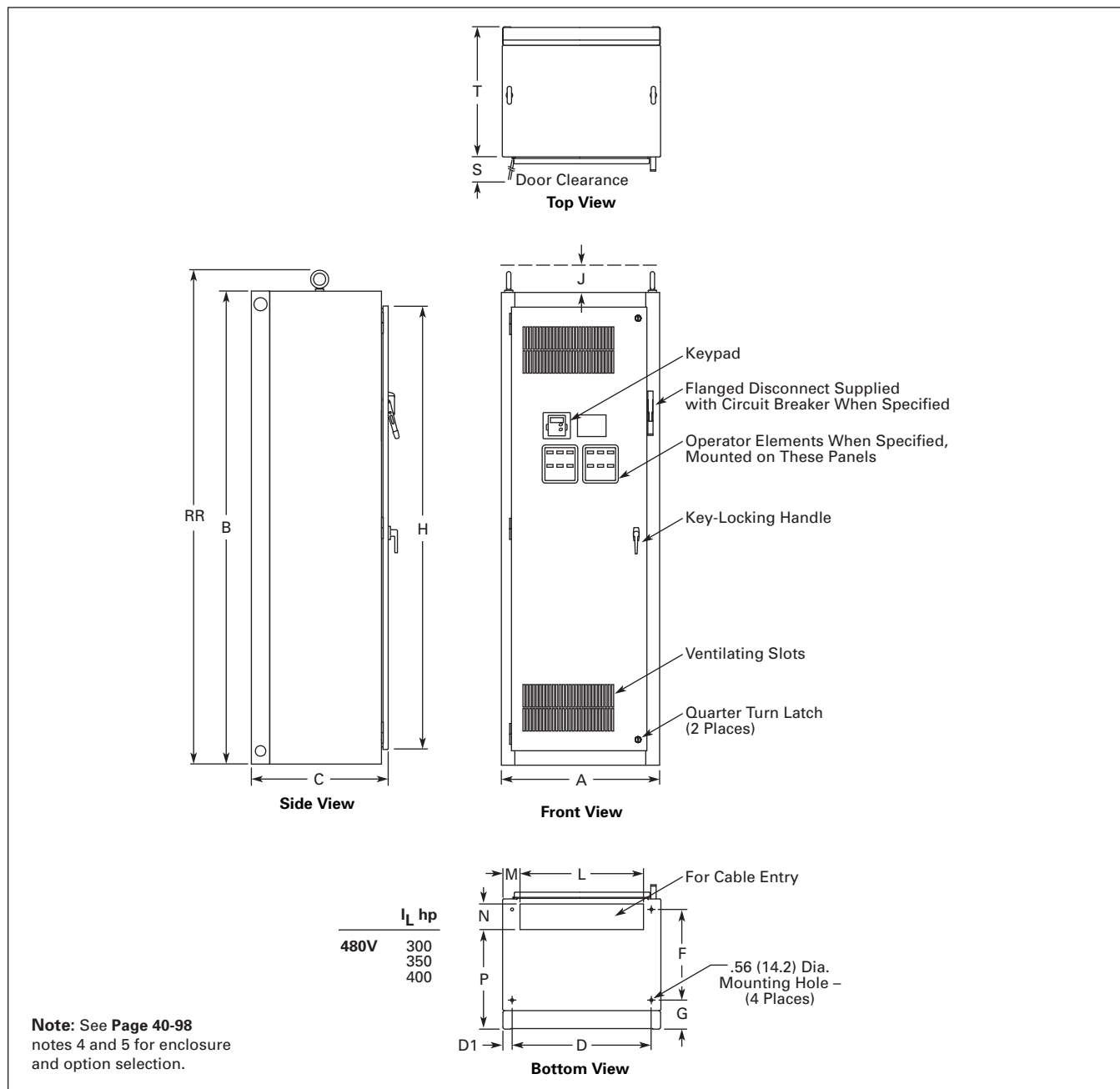


Figure 40-50. Approximate Dimensions

Enclosed Drives

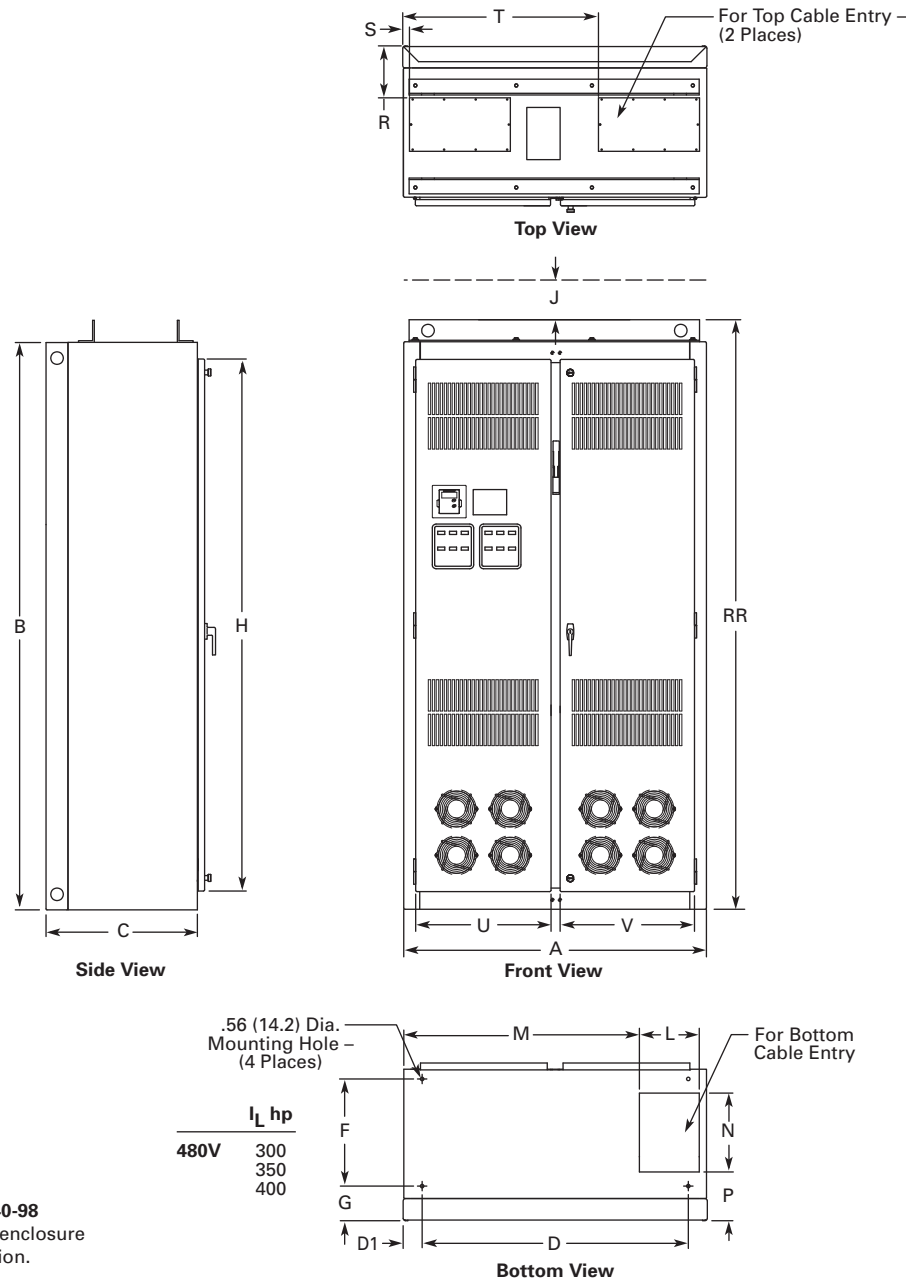
Enclosure Size 8

Table 40-162. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)											Min. Air Space	
	Wide A	High B	Deep C	Mounting							H	J	K
8	48.0 (1219)	90.0 (2286)	24.0 (610)	42.2 (1072)	3.0 (77)	—	—	—	5.5 (139)	—	84.4 (2143)	4.0 (102)	—

Table 40-162. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)															Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry							U	V	W	RR	SS	TT	UU	VV	
	L	M	N	P	R	S	T									
8	9.5 (241)	37.5 (952)	12.5 (318)	7.7 (196)	8.3 (210)	1.3 (32)	31.0 (787)	21.5 (545)	21.3 (541)	—	93.5 (2375)	—	—	—	—	2000 (908)



Note: See Page 40-98
notes 4 and 5 for enclosure
and option selection.

Figure 40-51. Approximate Dimensions

Enclosure Size 9

Table 40-163. Approximate Dimensions and Shipping Weight — Enclosed Products

Enclosure Size	Dimensions in Inches (mm)											Min. Air Space	
	Wide A	High B	Deep C	Mounting							H	J	K
9	60.0 (1524)	90.0 (2286)	26.1 (664)	22.9 (582)	2.0 (51)	30.0 (762)	44.3 (1125)	10.6 (270)	10.6 (270)	8.2 (208)	—	4.0 (102)	—

Table 40-163. Approximate Dimensions and Shipping Weight — Enclosed Products (Continued)

Enclosure Size	Dimensions in Inches (mm)														Max. Approx. Ship. Wt. lbs. (kg)
	Cable Entry										W	RR	SS	TT	
	L	M	N	P	R	S	T	U	V						
9	8.5 (216)	32.7 (831)	12.0 (305)	11.9 (303)	9.8 (249)	1.5 (38)	43.5 (1105)	15.0 (381)	7.5 (191)	25.0 (635)	93.5 (2375)	27.4 (696)	29.1 (738)	27.1 (687)	2500 (1135)

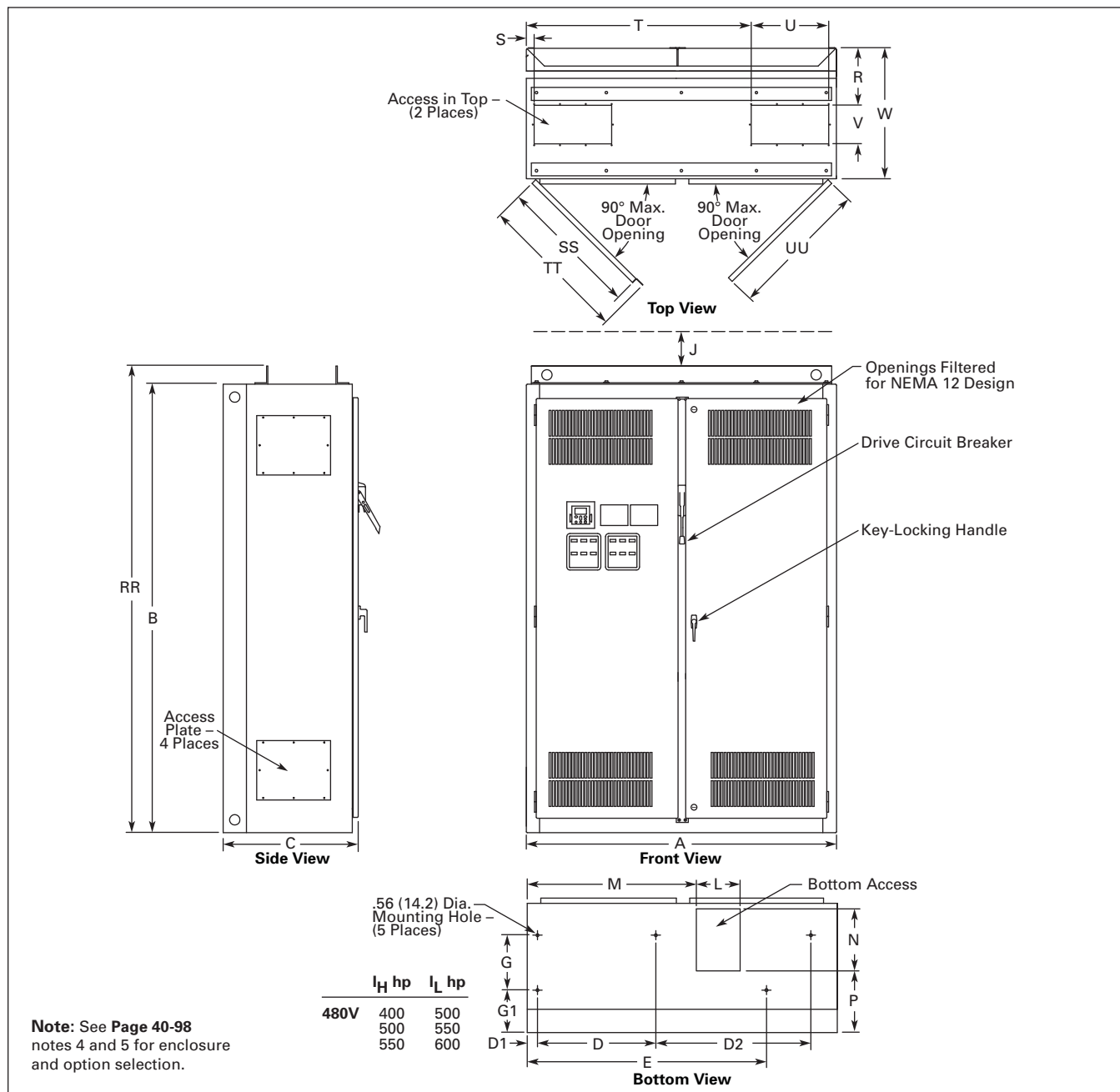
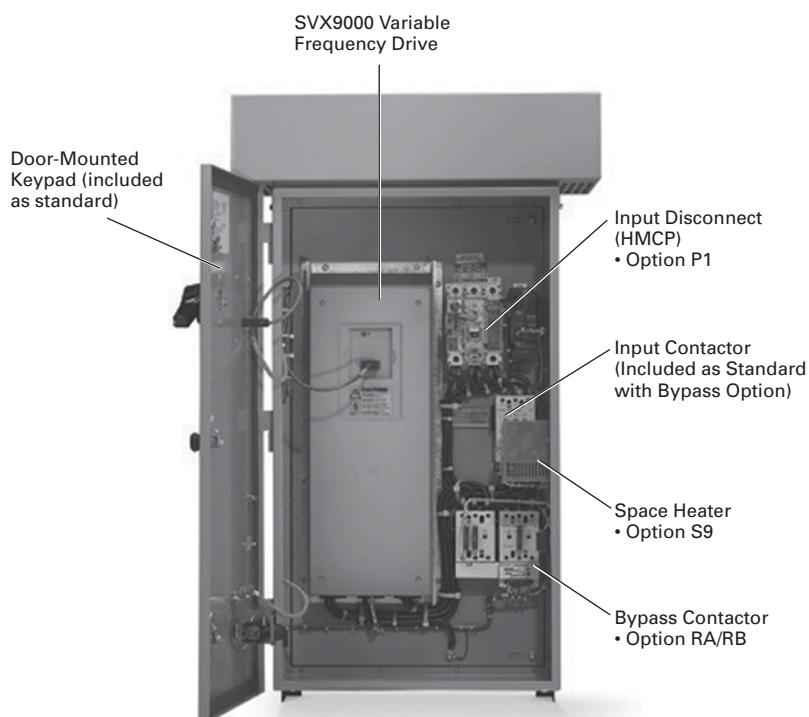


Figure 40-52. Approximate Dimensions

SVX9000 Pump Application



NEMA 3R Enclosed 9000X Series Drive

Standards and Certifications

- UL Listed
- cUL Listed

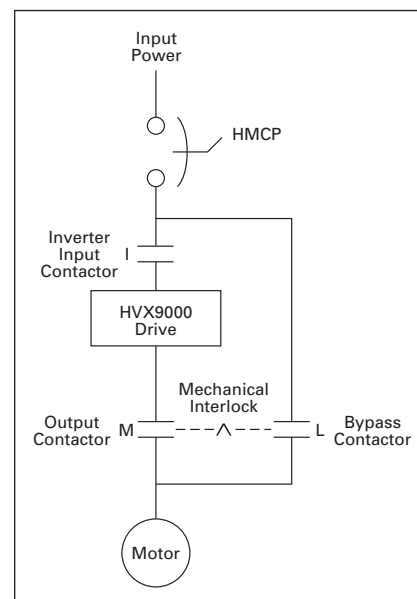


Figure 40-53. Power Diagram for Bypass Option RA

Product Description

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Consult your Eaton representative for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Consult your Eaton representative for assistance in pricing and lead time.*

Features

- NEMA Type 12 or Type 3R enclosures
- Input Voltage: 208V, 230V, 480V and 575V (Consult Factory)
- Complete range of control, network and power options
- Horsepower range:
 - 208V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
 - 230V — 3/4 to 100 hp I_H; 1 to 100 hp I_L
 - 480V — 1 to 350 hp I_H; 1-1/2 to 400 hp I_L
- HMCP padlockable
- Single Phase input available — Consult factory

Technical Data and Specifications

Table 40-164. Specifications

Feature Description	9000X Enclosed Products — NEMA Type 12 or NEMA Type 3R
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I _H)	250% for 2 seconds
Overload: 1 Minute (I _H /I _L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Line Reactors	Standard
Phase Rotation Insensitive	Standard
EMI Filter	Standard — Thru Frame 9
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/ Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

Feature Description	9000X Enclosed Products — NEMA Type 12 or NEMA Type 3R
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	1 (2 Relays Form C)
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional

Performance Features

Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional ①
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz

Standard Conditions for Application and Service

Operating Ambient Temperature	0 – 40°C
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	.96

① Some horsepower units include dynamic braking chopper as standard — refer to individual drive sections.

Table 40-165. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: "0" ≤ 10V, "1" ≥ 18V, R _i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R _i > 200 kΩ Current: 0 (4) – 20 mA, R _i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

Catalog Number Selection

Table 40-166. SVX9000 Enclosed NEMA Type 12/3R Drive Catalog Numbering System

Build Alphabetically and Numerically					
<div>-----</div>					
Product Family					
SVX = Enclosed Drives					
Horsepower Rating					
F07 = 3/4 hp	010 = 10 hp	060 = 60 hp			
001 = 1 hp	015 = 15 hp	075 = 75 hp			
F15 = 1-1/2 hp	020 = 20 hp	100 = 100 hp			
002 = 2 hp	025 = 25 hp	125 = 125 hp			
003 = 3 hp	030 = 30 hp	150 = 150 hp			
005 = 5 hp	040 = 40 hp	200 = 200 hp			
007 = 7-1/2 hp	050 = 50 hp				
Consult Factory ^①					
250 = 250 hp	350 = 350 hp				
300 = 300 hp	400 = 400 hp				
Enclosure Rating					
2 = NEMA Type 12					
3 = NEMA Type 3R					
Voltage Rating					
Three-Phase	Single-Phase				
1 = 208V	J = 230V				
2 = 230V	K = 480V				
4 = 480V					
Application — Torque/Braking ^③					
A = I _L /No Brake Chopper					
B = I _L /Internal Brake Chopper					
D = I _H /No Brake Chopper					
E = I _H /Internal Brake Chopper					
Enclosed Style					
P = Pumping Application					
Enclosed Options ^{②⑤⑥}		Type			
K1	Door-Mounted Speed Potentiometer ^④			Control	
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ^④			Control	
K5	Manual/Auto Reference Switch (22 mm)			Control	
K6	Start & Stop Pushbuttons (22 mm)			Control	
K9	(2) Factory Installed Auxiliary Contacts			Power	
L1	Power On and Fault Pilot Lights			Light	
L2	Bypass Pilot Lights for RA Bypass Option ^⑥			Addl. Bypass	
LD	Green Stop Light			Light	
LE	Red Run Light			Light	
LU	Light (22 mm)			Light	
LW	PTT Light (22 mm)			Light	
LY	Adder for LED Each			Light	
P1	Input Disconnect (HMCP) 100 kAIC			Input	
P3	Input Line Fuses (200 kAIC)			Input	
P7	Input Power Surge Protection			Input	
P8	TVSS Transient Voltage Surge Suppressor			Input	
PE	Output Contactor			Output	
RA	Manual HOA Bypass Controller ^⑥			Bypass	
S5	Floor Stand 22"			Enclosure	
S9	Space Heater w/out CPT			Enclosure	
SA	Space Heater w/CPT			Enclosure	
SB	Socket Type Control Relay			Enclosure	
SE	On-Delay Timer			Enclosure	
SF	Off-Delay Timer			Enclosure	
Communication Options ^⑦					
C2 = Modbus					
C3 = Profibus DP					
C4 = LonWorks					
C5 = Profibus DP (D9 Connector)					
C6 = CanOpen (Slave)					
C7 = DeviceNet					
C8 = Modbus (D9 Type Connector)					
CA = Johnson Controls N2					
CI = Modbus TCP					
CJ = BACnet					
CK = Ethernet IP					
D3 = RS-232 with D9 Connection					
Control Options					
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC					
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm					
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC					
B5 = 3 RO (NO)					
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100					
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input					

^① Consult factory.

^② Local/Remote keypad is included as the standard Control Panel.

^③ Brake Chopper is a factory installed option only, see drive option tables on **Pages 40-118 – 40-123**. **Note:** External dynamic braking resistors not included. Consult factory.

^④ Includes local/remote speed reference switch.

^⑤ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.

^⑥ See **Page 40-115** for descriptions.

^⑦ See **Pages 40-116 and 40-117** for complete descriptions.

^⑧ Bypass options applicable only in the Pump Panel three-phase design.

Control/Communication Option Descriptions

Table 40-167. Available Control/Communications Options

Option	Description	Option Type
K1	Door-Mounted Speed Potentiometer — Provides the SVX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the SVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K5	Manual/Auto Speed Reference Switch — Provides a door-mounted selector switch for Manual/Auto speed reference.	Control
K6	Start & Stop Pushbuttons (22 mm) — Start (green) and Stop (red). Provides door-mounted Start and Stop pushbuttons for either bypass or non-bypass configurations.	Control
K9	(2) Factory Installed Auxiliary Contacts — Provides two NO/NC auxiliary contacts.	Power
L1	Power On and Fault Pilot Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
L2	Bypass Pilot Lights for RB, RA Bypass Options — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LD	Green Stop Light (22 mm) — Provides a green light that indicates the drive is stopped.	Light
LE	Run Pilot Light (22 mm) — Provides a red run light that indicates the drive is running.	Light
LU	Misc. Light (22 mm) — Provides misc. “user defined” pilot light. User to define light function and color.	Light
LW	PTT (Push-To-Test) Light (22 mm) — Provides misc. “user defined” PTT pilot light. User to define light function and color.	Light
LY	Adder for LED Each — Changes light packages from standard incandescent bulb to LED style bulb.	Light
P1	Input Disconnect Assembly Rated to 100 kAIC — High Interrupting Motor Circuit Protector (HMCP) that provides a means of short circuit protection for the power cables between it and the SVX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the SVX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	Input Line Fuses Rated to 200 kAIC — Provides high-level fault protection of the SVX9000 input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	MOV Surge Suppressor — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	TVSS Transient Voltage Surge Suppressor — Provides transient voltage surge suppression of the unit. Consult factory for ratings.	Input
PE	Output Contactor — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Option RA includes an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
RA	Manual HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the SVX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 100 hp, a Freedom Series IEC input contactor, a Freedom Series IEC output contactor, and a Freedom Series IEC starter with a bimetallic overload relay is included. For applications above 100 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-112).	Bypass
S5	Floor Stand 22" — Converts a Size A or B, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S9	Space Heater without CPT — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C – D. Requires a customer supplied 115V remote supply source.	Enclosure
SA	Space Heater with CPT — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. A 200W heater is installed in enclosures A and B, and 400W heater is installed in enclosures C – D. Provided with CPT connected to load side of input disconnect.	Enclosure
SB	Ice Cube Style Control Relay — Provides misc. “user defined” 4PDT control relay. Requires user to define functionality.	Enclosure
SE	On-Delay Timer (Delay on Make) — Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure
SF	Off-Delay Timer (Delay on Break) — Provides misc. “user defined” time delay relay. Requires user to define functionality and time setting requirement.	Enclosure

Note: For availability, see Product Selection for base drive voltage required.

VFD Pump Panels

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-54**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

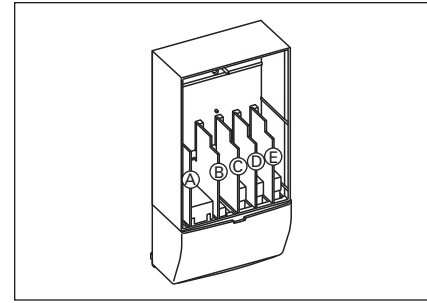


Figure 40-54. 9000X Series Option Boards

Table 40-168. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-54)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B, C, D, E	OPTB9		B9		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X
Keypad												
9000X Series Local Remote Keypad	—	KEYPAD-LOC/ REM		—		—	—	—	—	—	—	—
9000X Series Remote Mount Keypad Kit (Keypad not included)	—	OPTRMT -KIT- 9000X		—		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

VFD Pump Panels

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value

Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is "Common Industrial Protocol", the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-169. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200 \text{ k}\Omega$
Analog current, input	0 (4) – 20 mA, $R_i = 250 \Omega$
Digital Input	24V: "0" $\leq 10\text{V}$, "1" $\geq 18\text{V}$, $R_i > 5 \text{ k}\Omega$
Aux. voltage	24V ($\pm 20\%$), max. 50 mA
Reference voltage	10V $\pm 3\%$, max. 10 mA
Analog current, output	0 (4) – 20 mA, $R_L = 500 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Analog voltage, output	0 (2) – 10V, $R_L \geq 1 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Relay output	300V DC, 250V AC
Max. switching voltage	8A/24V DC, .4A/300V DC, 2 kVA/250V AC
Max. switching load	2A rms
Max. continuous load	
Thermistor input	$R_{trip} = 4.7 \text{ k}\Omega$

VFD Pump Panels

Product Selection

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating (the enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating). The base enclosed package includes a standard drive, door mounted Local/Remote Keypad and enclosure.
- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.
- Read all Footnotes.

208V Drives

Table 40-170. 208V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②

208V High Overload Drive and Enclosure

A	3/4	4	SVXF0721EP		4	SVXF0731EP	
A	1		SVX00121EP			SVX00131EP	
A	1-1/2		SVXF1521EP			SVXF1531EP	
A	2		SVX00221EP			SVX00231EP	
A	3	5	SVX00321EP		5	SVX00331EP	
A	5		SVX00521EP			SVX00531EP	
A	7-1/2		SVX00721EP			SVX00731EP	
A	10	6	SVX01021EP		6	SVX01031EP	
B	15		SVX01521EP			SVX01531EP	
B	20	7	SVX02021DP		7	SVX02031DP	
B	25		SVX02521DP			SVX02531DP	
C	30		SVX03021DP			SVX03031DP	
C	40	8	SVX04021DP		8	SVX04031DP	
C	50		SVX05021DP			SVX05031DP	
D	60		SVX06021DP			SVX06031DP	
D	75	9	SVX07521DP		9	SVX07531DP	
D	100		SVX10021DP			SVX10031DP	

208V Low Overload Drive and Enclosure

A	1	4	SVX00121BP		4	SVX00131BP	
A	1-1/2		SVXF1521BP			SVXF1531BP	
A	2		SVX00221BP			SVX00231BP	
A	3		SVX00321BP			SVX00331BP	
A	5	5	SVX00521BP		5	SVX00531BP	
A	7-1/2		SVX00721BP			SVX00731BP	
A	10		SVX01021BP			SVX01031BP	
A	15	6	SVX01521BP		6	SVX01531BP	
B	20		SVX02021BP			SVX02031BP	
B	25	7	SVX02521AP		7	SVX02531AP	
B	30		SVX03021AP			SVX03031AP	
C	40		SVX04021AP			SVX04031AP	
C	50	8	SVX05021AP		8	SVX05031AP	
C	60		SVX06021AP			SVX06031AP	
D	75		SVX07521AP			SVX07531AP	
D	100	9	SVX10021AP		9	SVX10031AP	

① Enclosure dimensions listed on Pages 40-124 – 40-129.

② Includes drive, Local/Remote Keypad and enclosure.

Table 40-171. 208V Brake Chopper Adder ③

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 12/3R		NEMA Type 12/3R

3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

③ External dynamic braking resistors not included. Consult factory.

VFD Pump Panels

Table 40-172. 208V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
	K1	K2	K5	K6
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100				

Table 40-173. 208V Light Options


Catalog Number Suffix 	Power On/ Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
	L1	LD	LE	LU	LW	LY
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100						

Table 40-174. 208V Enclosure Options


Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
	S5	S9	SA	SB	SE	SF
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
A						
B						
C						
D						

Table 40-175. 208V Power Options



Catalog Number Suffix 	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 5						
7-1/2						
10						
15						
20						
25 – 30						
40						
50 – 60						
75						
100						

Table 40-176. 208V Bypass Options

Catalog Number Suffix 	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
	L2	RA
hp	Adder U.S. \$	Adder U.S. \$
3/4 – 7-1/2		
10		
15 – 20		
25 – 30		
40		
50 – 60		
75		
100		

VFD Pump Panels

230V Drives

Table 40-177. 230V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②
230V High Overload Drive and Enclosure							
A	3/4	4	SVXF0722EP		4	SVXF0732EP	
A	1		SVX00122EP			SVX00132EP	
A	1-1/2		SVXF1522EP			SVXF1532EP	
A	2		SVX00222EP			SVX00232EP	
A	3	5	SVX00322EP		5	SVX00332EP	
A	5		SVX00522EP			SVX00532EP	
A	7-1/2		SVX00722EP			SVX00732EP	
A	10	6	SVX01022EP		6	SVX01032EP	
B	15		SVX01522EP			SVX01532EP	
B	20	7	SVX02022DP		7	SVX02032DP	
B	25		SVX02522DP			SVX02532DP	
C	30		SVX03022DP			SVX03032DP	
C	40	8	SVX04022DP		8	SVX04032DP	
C	50		SVX05022DP			SVX05032DP	
D	60		SVX06022DP			SVX06032DP	
D	75	9	SVX07522DP		9	SVX07532DP	
D	100		SVX10022DP			SVX10032DP	

① Enclosure dimensions listed on Pages 40-124 – 40-129.

② Includes drive, Local/Remote Keypad and enclosure.

Table 40-178. 230V Pump Panel Style (Single-Phase)

Enclosure Size ③	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ④	Price U.S. \$ ④	Frame Size	Base Catalog Number ④	Price U.S. \$ ④
230V Low Overload Drive and Enclosure							
A	3/4	4	SVXF072JBP		4	SVXF073JBP	
A	1		SVX0012JBP			SVX0013JBP	
A	2	5	SVX0022JBP		5	SVX0023JBP	
A	3		SVX0032JBP			SVX0033JBP	
A	5		SVX0052JBP			SVX0053JBP	
A	7-1/2	6	SVX0072JBP		6	SVX0073JBP	
A	10		SVX0102JBP			SVX0103JBP	
B	15	7	SVX0152JBP		7	SVX0153JBP	
B	20		SVX0202JAP			SVX0203JAP	
C	25	8	SVX0252JAP		8	SVX0253JAP	
C	30		SVX0302JAP			SVX0303JAP	
C	40		SVX0402JAP			SVX0403JAP	

③ Enclosure dimensions listed on Pages 40-124 – 40-129.

④ Includes drive, Local/Remote Keypad and enclosure.

Table 40-179. 230V Brake Chopper Adder ⑤

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 12/3R		NEMA Type 12/3R
3/4		—	
1		1	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	

⑤ External dynamic braking resistors not included. Consult factory.

VFD Pump Panels

Table 40-180. 230V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
K1	K2	K5	K6	
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100				

Table 40-181. 230V Light Options


Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
L1	LD	LE	LU	LW	LY	
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100						

Table 40-182. 230V Enclosure Options


Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
S5	S9	SA	SB	SE	SF	
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
A						
B						
C						
D						

Table 40-183. 230V Power Options



Catalog Number Suffix 	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 5						
7-1/2 – 10						
15						
20 – 25						
30 – 40						
50						
60 – 75						
100						

Table 40-184. 230V Bypass Options ^①

Catalog Number Suffix 	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
L2 ^②	RA ^②	
hp	Adder U.S. \$	Adder U.S. \$
3/4 – 10		
15		
20 – 25		
30 – 40		
50		
60 – 75		
100		

^① See Page 40-115 for details.^② Bypass options applicable only in the Pump Panel three-phase design.

VFD Pump Panels

480V Drives

Table 40-185. 480V Pump Panel Style (Three-Phase)

Enclosure Size ①	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ②	Price U.S. \$ ②	Frame Size	Base Catalog Number ②	Price U.S. \$ ②
480V High Overload Drive and Enclosure							
A	1	4	SVX00124EP		4	SVX00134EP	
A	1-1/2		SVXF1524EP			SVXF1534EP	
A	2		SVX00224EP			SVX00234EP	
A	3		SVX00324EP			SVX00334EP	
A	5		SVX00524EP			SVX00534EP	
A	7-1/2	5	SVX00724EP		5	SVX00734EP	
A	10		SVX01024EP			SVX01034EP	
A	15		SVX01524EP			SVX01534EP	
A	20	6	SVX02024EP		6	SVX02034EP	
A	25		SVX02524EP			SVX02534EP	
B	30		SVX03024EP			SVX03034EP	
B	40	7	SVX04024DP		7	SVX04034DP	
B	50		SVX05024DP			SVX05034DP	
B	60		SVX06024DP			SVX06034DP	
C	75	8	SVX07524DP		8	SVX07534DP	
C	100		SVX10024DP			SVX10034DP	
C	125		SVX12524DP			SVX12534DP	
D	150	9	SVX15024DP		9	SVX15034DP	
D	200		SVX20024DP			SVX20034DP	
TBD	250	10	SVX25024DP		10	SVX25034DP	
TBD	300		SVX30024DP			SVX30034DP	
TBD	350		SVX35024DP			SVX35034DP	

① Enclosure dimensions listed on Pages 40-124 – 40-129.
② Includes drive, Local/Remote keypad and enclosure.

Table 40-186. 480V Pump Panel Style (Single-Phase)

Enclosure Size ③	hp	NEMA Type 12			NEMA Type 3R		
		Frame Size	Base Catalog Number ④	Price U.S. \$ ④	Frame Size	Base Catalog Number ④	Price U.S. \$ ④
480V Low Overload Drive and Enclosure							
A	3/4	4	SVXF072KBP		4	SVXF073KBP	
A	1		SVX0012KBP		SVX0013KBP		
A	2		SVX0022KBP		SVX0023KBP		
A	3		SVX0032KBP		SVX0033KBP		
A	5	5	SVX0052KBP		5	SVX0053KBP	
A	7-1/2		SVX0072KBP			SVX0073KBP	
A	10		SVX0102KBP			SVX0103KBP	
A	15	6	SVX0152KBP		6	SVX0153KBP	
A	20		SVX0202KBP			SVX0203KBP	
B	25	7	SVX0252KBP		7	SVX0253KBP	
B	30		SVX0302KBP			SVX0303KBP	
C	40	8	SVX0402KBP		8	SVX0403KBP	
C	50		SVX0502KBP			SVX0503KBP	
C	60		SVX0602KBP			SVX0603KBP	

③ Enclosure dimensions listed on Pages 40-124 – 40-129.
④ Includes drive, Local/Remote keypad and enclosure.

Table 40-187. 480V Brake Chopper Adder ⑤

I _H hp	Adder U.S. \$	I _L hp	Adder U.S. \$
	NEMA Type 12/3R		NEMA Type 12/3R
1		—	
1-1/2		1-1/2	
2		2	
3		3	
5		5	
7-1/2		7-1/2	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
50		50	
60		60	
75		75	
100		100	
125		125	
150		150	
200		200	
250		250	
300		300	
350		350	
400		400	

⑤ External dynamic braking resistors not included. Consult factory.

VFD Pump Panels

Table 40-188. 480V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	Manual/Auto Reference Switch (22 mm)	Start & Stop Pushbuttons (22 mm)
K1	K2	K5	K6	
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100				

Table 40-189. 480V Light Options


Catalog Number Suffix 	Power On/ Fault Pilot Lights (22 mm)	Green Stop Light (22 mm)	Red Run Light (22 mm)	Misc. Light (22 mm)	PTT Light (22 mm)	Adder for LED Each
L1	LD	LE	LU	LW	LY	
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
3/4 – 100						

Table 40-190. 480V Enclosure Options


Catalog Number Suffix 	Floor Stand 22" (558.8 mm)	Space Heater w/out CPT	Space Heater w/CPT	Socket Type Control Relay	On-Delay Timer	Off-Delay Timer
S5	S9	SA	SB	SE	SF	
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
A						
B						
C						
D						

Table 40-191. 480V Power Options



Catalog Number Suffix 	Input					Output
	Two Auxiliary Contacts Installed	Input Disconnect (HMCP) 100 kAIC	Input Line Fuses 200 kAIC	Input Power Surge Protection	TVSS Transient Voltage Surge Suppressor	Output Contactor
	K9	P1	P3	P7	P8	PE
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
1 – 10						
15 – 20						
25 – 30						
40 – 50						
60 – 75						
100						
125 – 150						
200						
250						
300 – 350						
400						

Table 40-192. 480V Bypass Options ^①

Catalog Number Suffix 	Bypass Pilot Lights for RA Option	Manual HOA Bypass Controller
L2 ^②	RA ^②	
hp	Adder U.S. \$	Adder U.S. \$
1 – 20		
25		
30		
40 – 50		
60 – 75		
100		
125 – 150		
200		
250 – 350		
400		

^① See **Page 40-115** for details.

^② Bypass options applicable only in the Pump Panel three-phase design.

Dimensions

Enclosure Box A NEMA Type 12

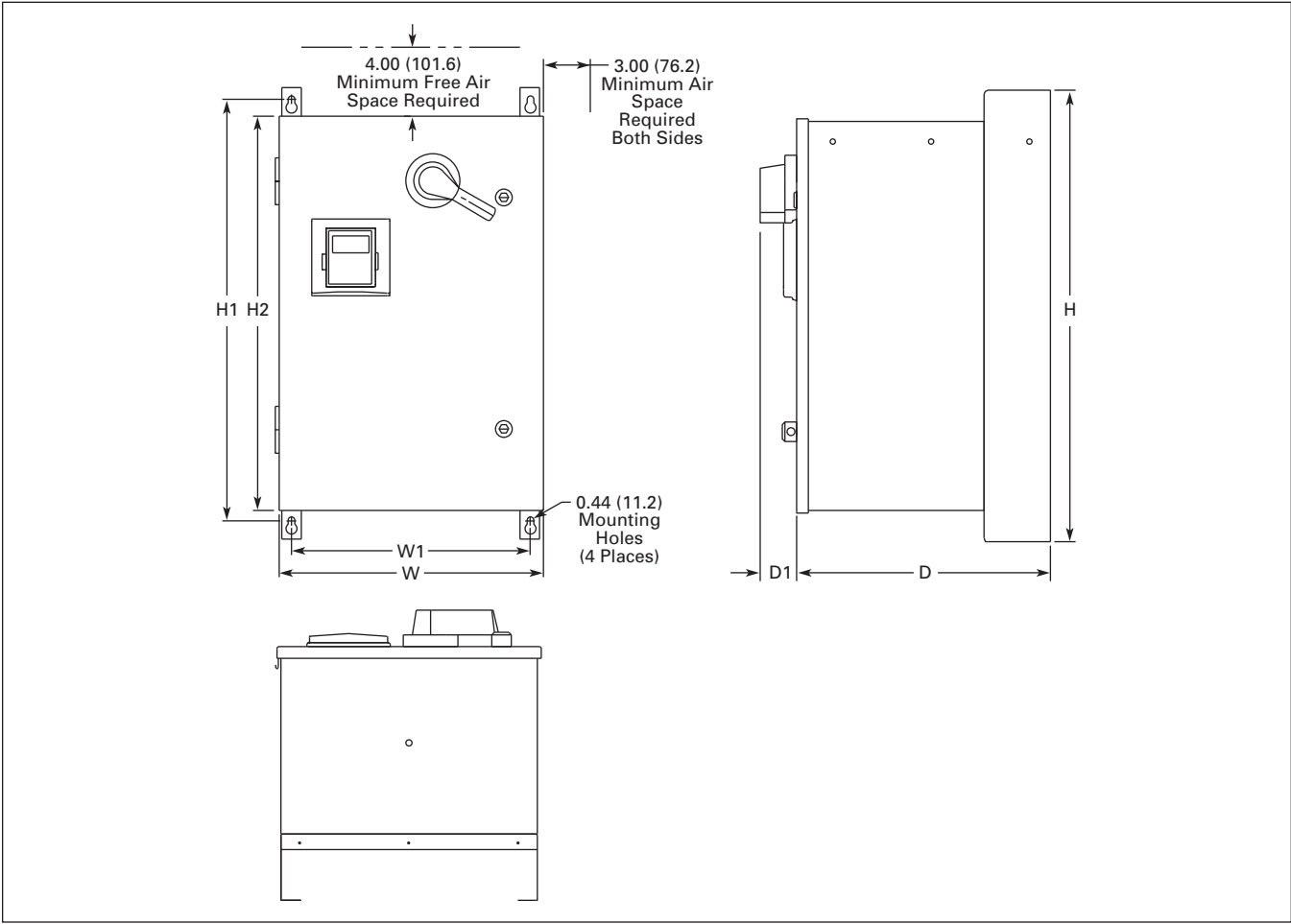
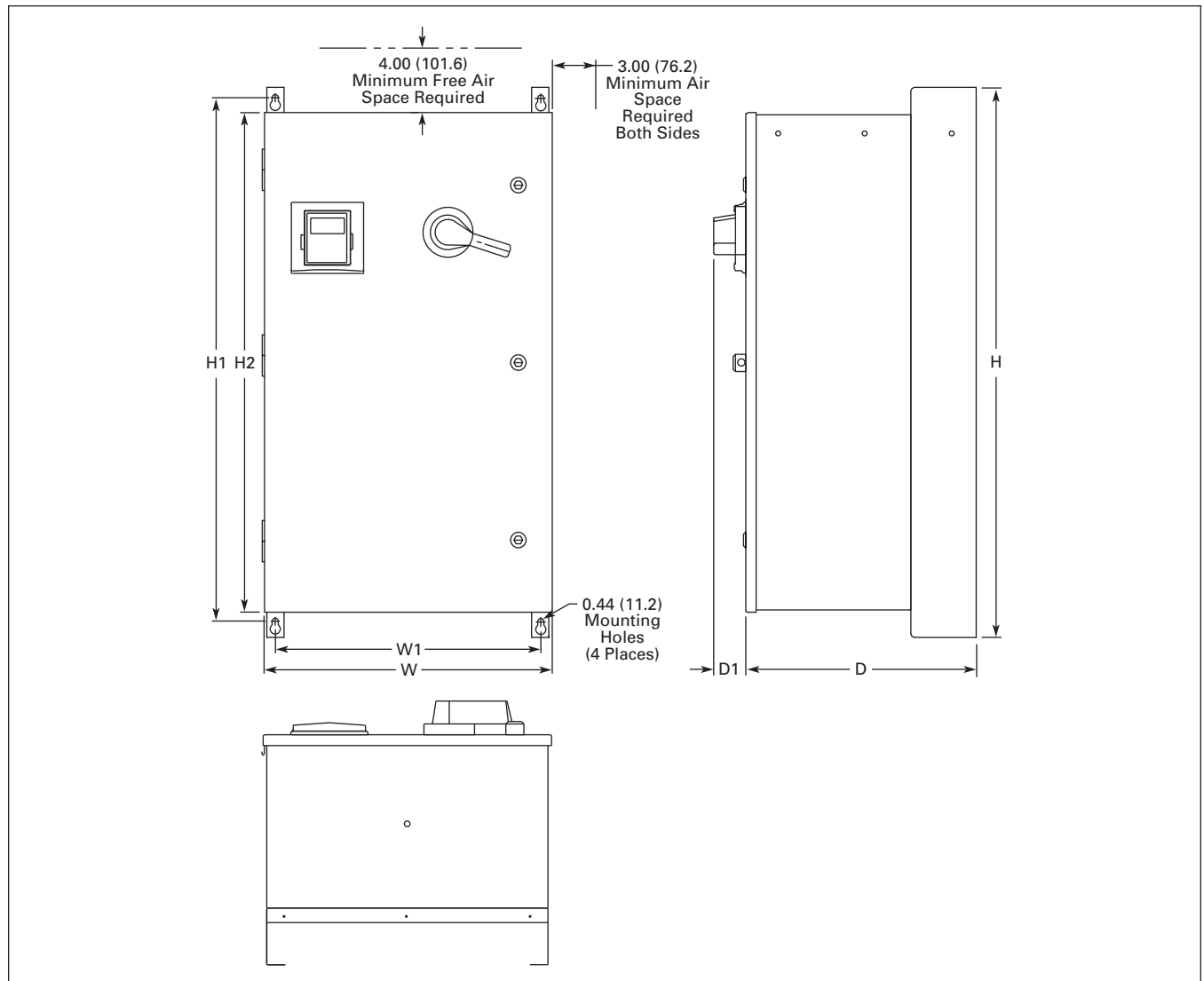


Figure 40-55. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-193. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	W	W1	D	D1		
Three-Phase											
208V	3/4 – 10	1 – 15	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
230V	3/4 – 10	1 – 15									
480V	1 – 25	1 – 30									
Single-Phase											
230V	—	3/4 – 10	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
480V	—	3/4 – 20									

Enclosure Box B NEMA Type 12



40

Figure 40-56. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-194. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	W	W1	D	D1		
Three-Phase											
208V	15 – 25	20 – 30	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
230V	15 – 25	20 – 30									
480V	30 – 60	40 – 75									
Single-Phase											
230V	—	15 – 20	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
480V	—	25 – 30									

Enclosure Box C NEMA Type 12

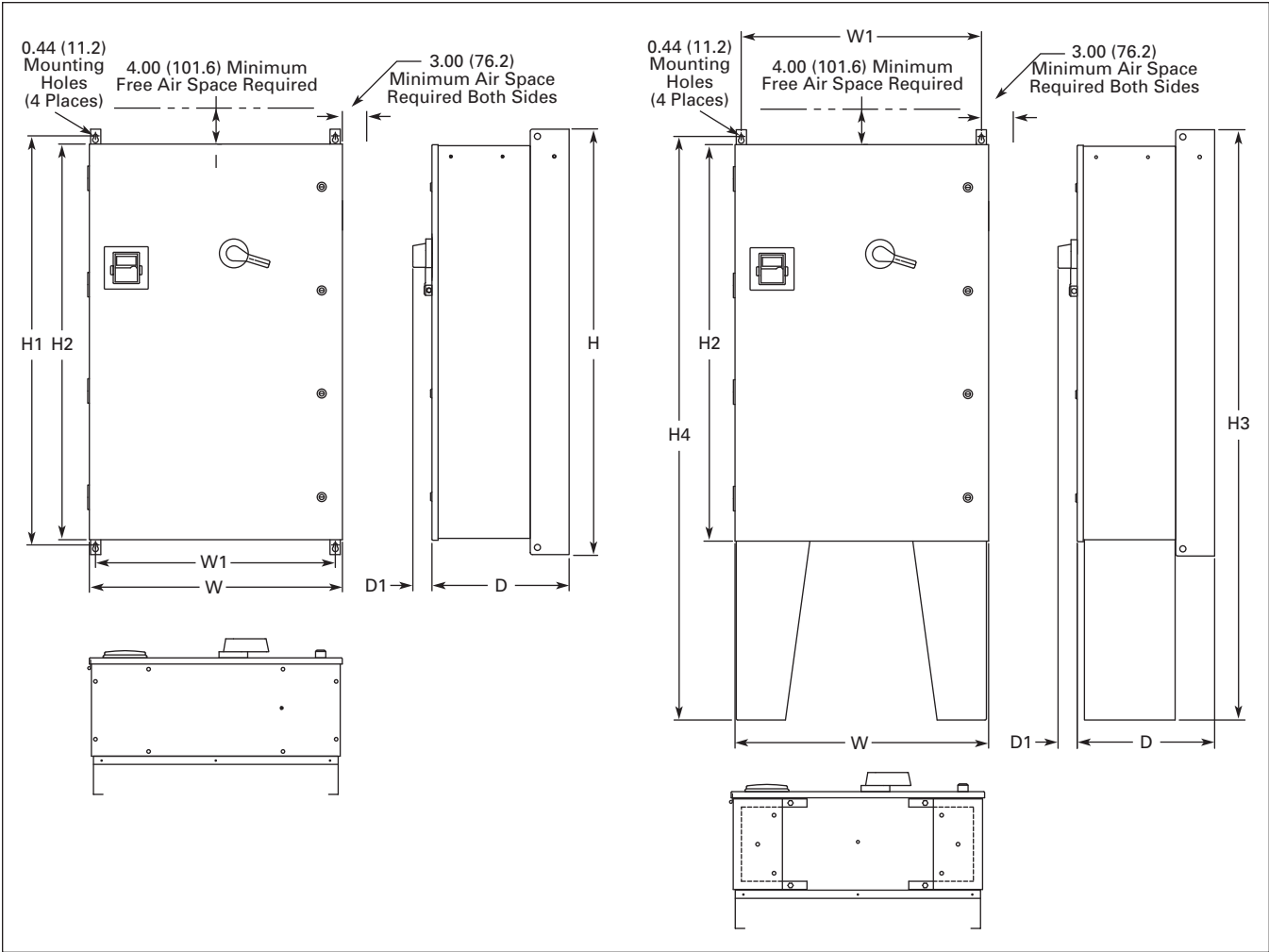


Figure 40-57. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Table 40-195. NEMA Type 12 SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)									Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	H4	W	W1	D	D1	
Three-Phase												
208V	30 – 50	40 – 60	52.00	50.00	48.35	72.00	71.19	30.92	29.30	16.78	2.34	①
230V	30 – 50	40 – 60	(1320.8)	(1270.0)	(1228.1)	(1828.8)	(1808.2)	(785.4)	(744.2)	(426.2)	(59.4)	
480V	75 – 125	100 – 150										
Single-Phase												
230V	—	25 – 40	52.00	50.00	48.35	72.00	71.19	30.92	29.30	16.78	2.34	①
480V	—	40 – 60	(1320.8)	(1270.0)	(1228.1)	(1828.8)	(1808.2)	(785.4)	(744.2)	(426.2)	(59.4)	

① Consult factory.

Enclosure Box A NEMA Type 3R

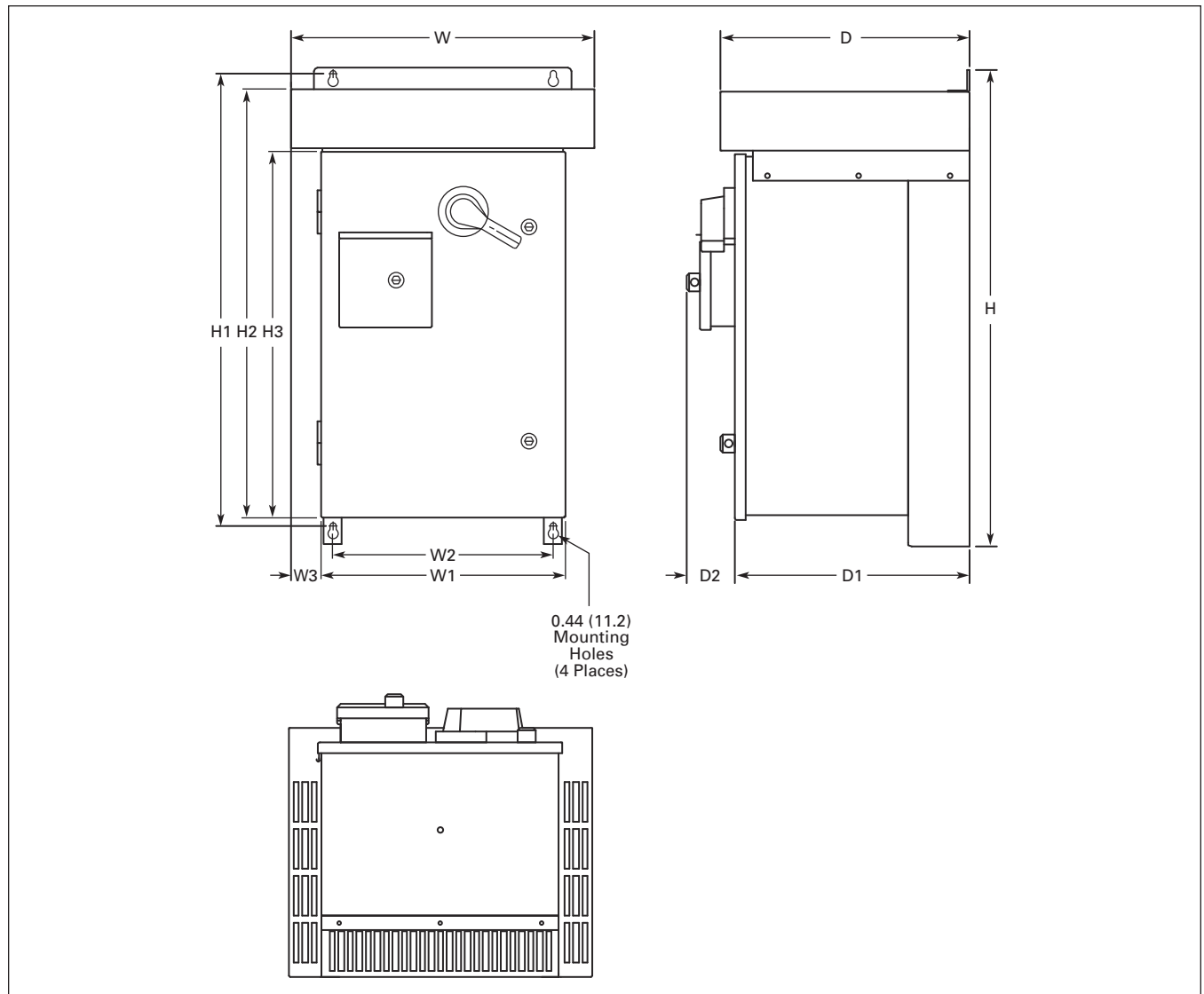


Figure 40-58. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-196. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
Three-Phase															
208V	3/4 – 10	1 – 15	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (84.1)	170 (77)	215 (98)
230V	3/4 – 10	1 – 15													
480V	1 – 25	1 – 30													
Single-Phase															
230V	—	3/4 – 10	33.00 (838.2)	31.36 (796.5)	29.67 (753.6)	25.35 (643.9)	21.05 (534.7)	16.92 (429.8)	15.30 (388.6)	2.07 (52.6)	17.24 (437.9)	16.26 (413.0)	3.31 (84.1)	170 (77)	215 (98)
480V	—	3/4 – 20													

Enclosure Box B NEMA Type 3R

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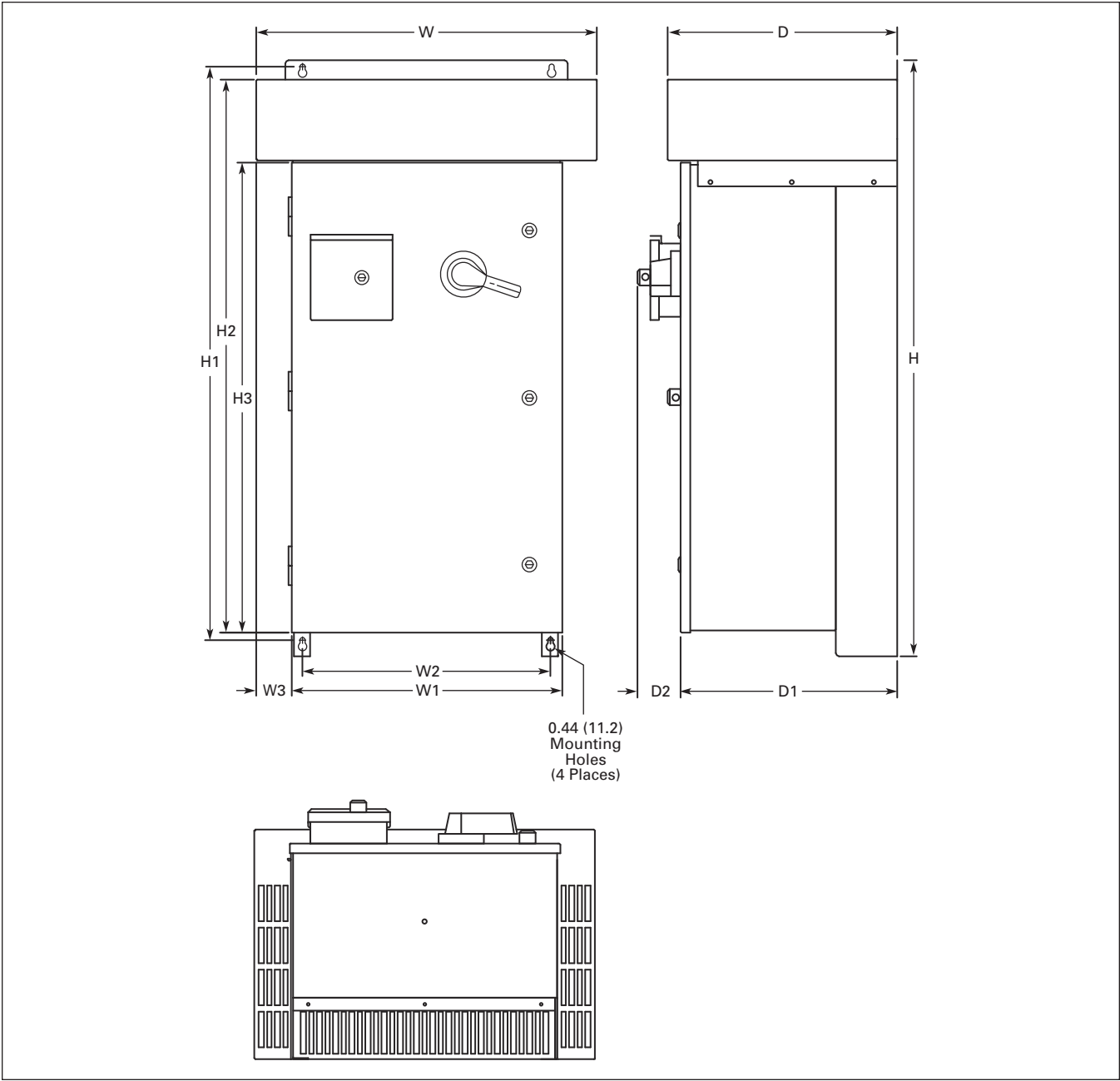
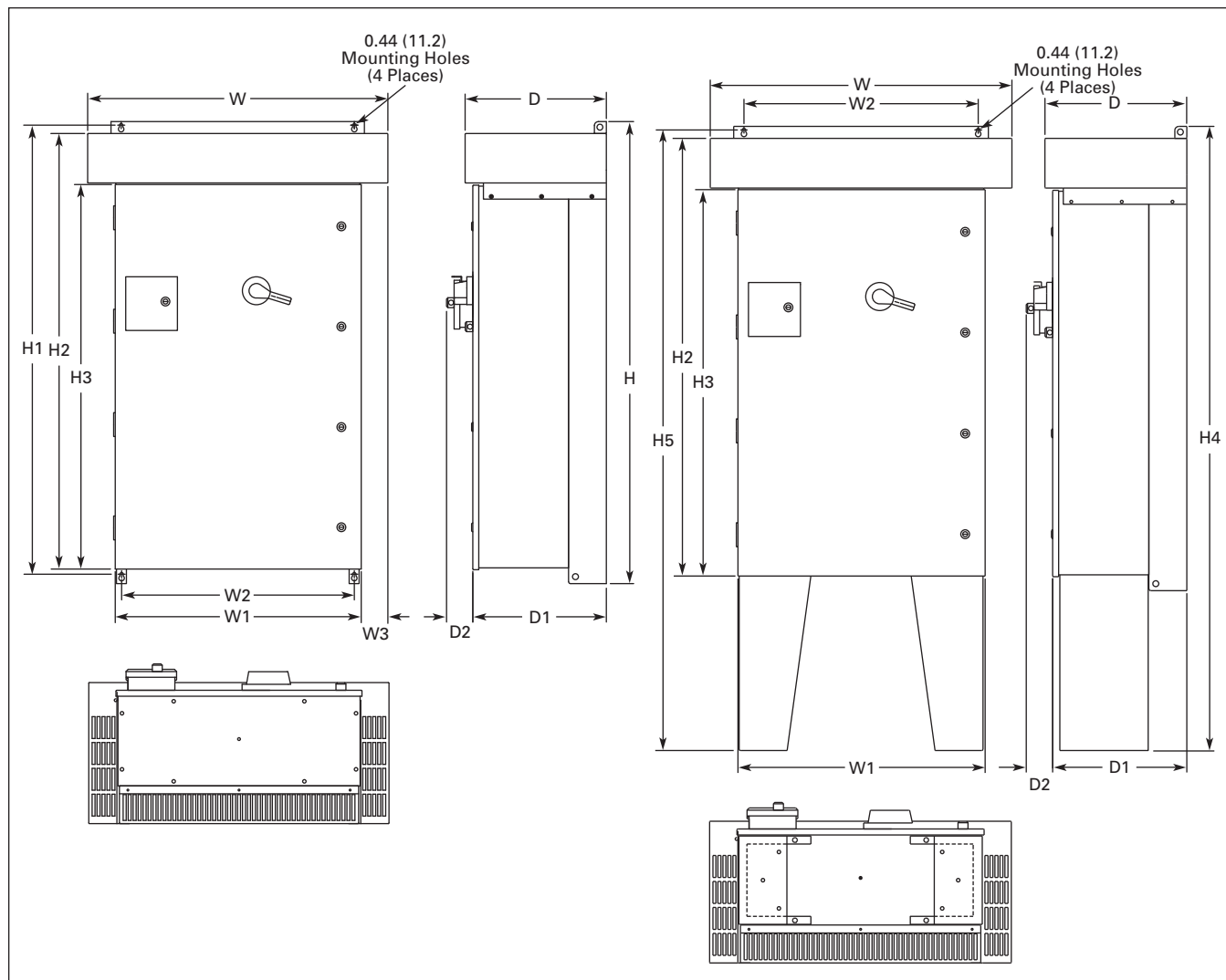


Figure 40-59. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-197. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
			H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
Three-Phase															
208V	15 – 25	20 – 30	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
230V	15 – 25	20 – 30													
480V	30 – 60	40 – 75													
Single-Phase															
230V	—	15 – 20	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
480V	—	25 – 30													

Enclosure Type C NEMA Type 3R



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Figure 40-60. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Table 40-198. NEMA Type 3R SVX9000 Pump Application Drive Dimensions

Voltage AC	hp (I _H)	hp (I _L)	Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)
			H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	
Three-Phase																
208	30 – 50	40 – 60	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
230	30 – 50	40 – 60														
480	75 – 125	100 – 150														
Single-Phase																
230V	—	25 – 40	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
480V	—	40 – 60														

① Consult factory.

Wiring Diagrams

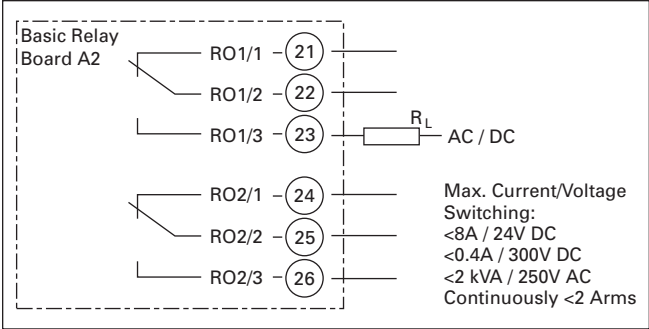


Figure 40-61. A2 Board Control Wiring

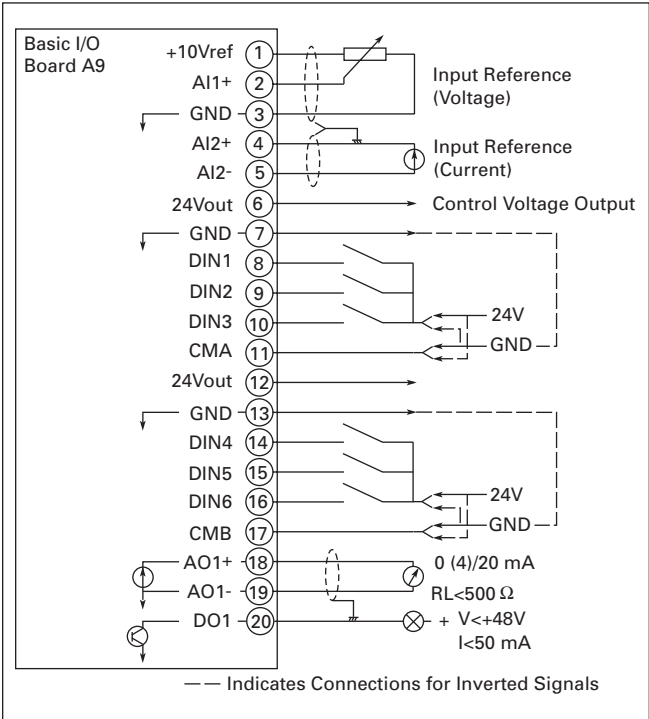


Figure 40-62. A9 Board Control Wiring

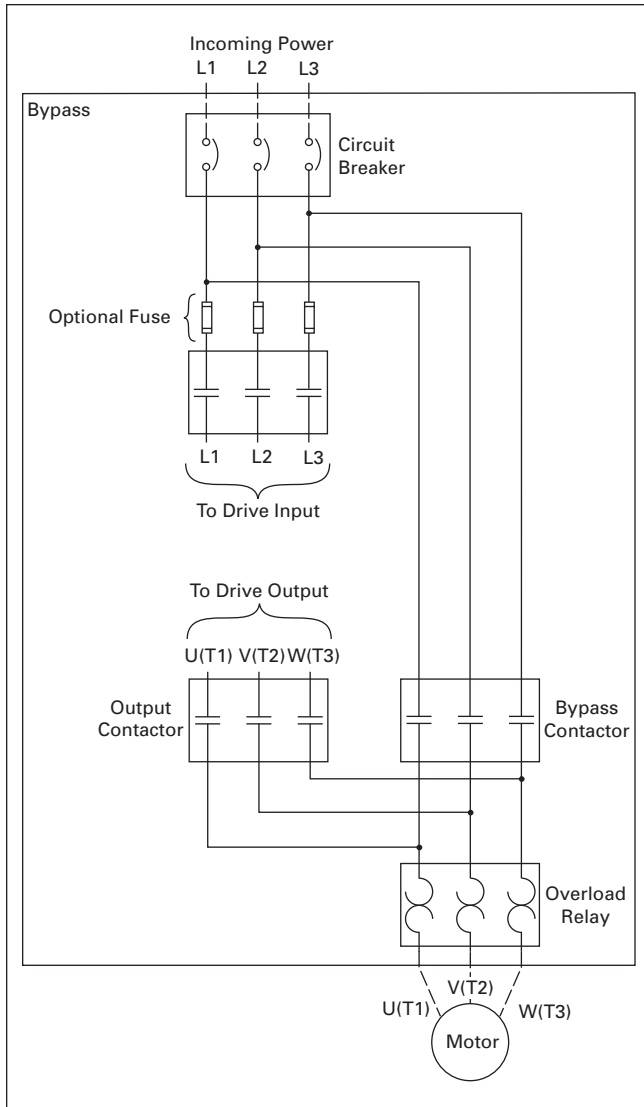


Figure 40-63. SVX9000 Pump Panel Bypass Power Wiring

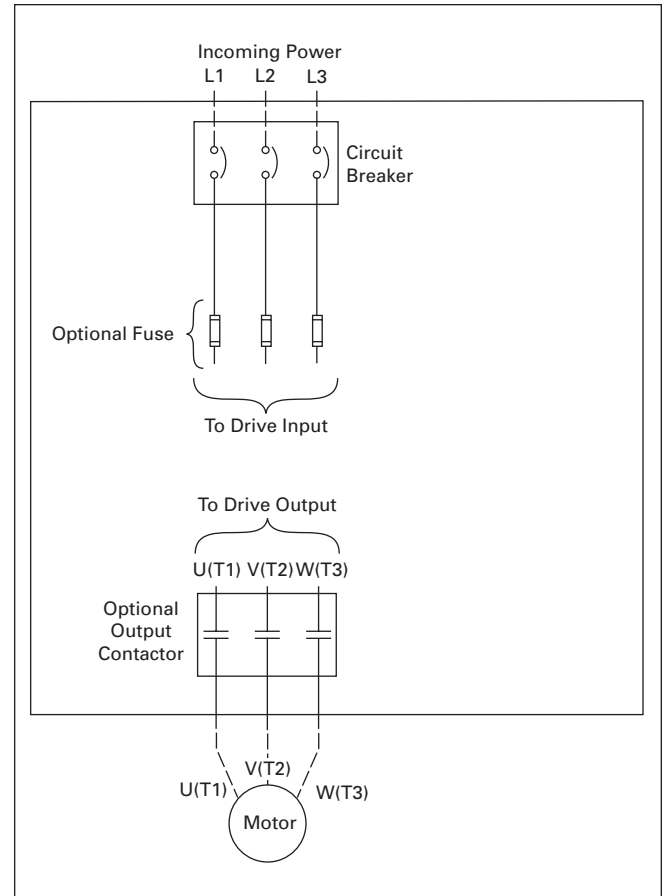


Figure 40-64. SVX9000 Pump Panel Disconnect Power Wiring

Contents

Description	Page
SPX9000 Drives	
Product Description	40-132
Features and Benefits	40-132
Technical Data and Specifications	40-133
Catalog Number Selection	40-134
Product Selection	40-135
Options	40-140
Accessories	40-142
Dimensions	40-144
Spare Units & Replacement Parts	40-161



SPX9000 Drives

Product Description

The Cutler-Hammer® SPX9000 Series Adjustable Frequency Drives from Eaton's electrical business are specifically designed for high performance applications. Equipped with high processing power, the SPX9000 can use information from an encoder or a resolver in order to provide very precise motor control. Sensorless vector and simple frequency control are also supported. Typical applications requiring high performance are: master-slave drives, positioning applications, winder tension control and synchronization.

The core of the SPX9000 is a fast micro-processor, providing high dynamic performance for applications where good motor handling and reliability are required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The SPX9000 supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Simultaneous fast monitoring of several drives can be done by using the 9000Xdrive tool and CAN communication. In applications where reliability and quality are essential for high-performance, the Cutler-Hammer SPX9000 is the logical choice.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

Features and Benefits

- Speed error < 0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5V (RS-422), 15V or 24V, depending on the option card
- Full torque control at all speeds, including zero
- Torque accuracy < 2%; < 5% down to zero speed
- Starting torque > 200%, depending on motor and drive sizing
- Integrated datalogger for system analysis
- Fast multiple drive monitoring with PC
- Full capability for master/slave configurations
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7200 Hz) possible
- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- Line reactor is included but is separated from chassis
- EMI/RFI Filters H standard up to 200 hp I_H 480V, 100 hp I_H 230V
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Quick Start Wizard built into the programming of the drive ensures a smooth start-up
- Keypad can display up to three monitored parameters simultaneously
- LOCAL/REMOTE operation from keypad
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Standard NEMA Type 12 keypad on all drives
- Hand-Held Auxiliary 240 Power Supply allows programming/monitoring of control module without applying full power to the drive
- The SPX can be flexibly adapted to a variety of needs using our pre-installed "Seven in One" Precision application programs consisting of:
 - Basic
 - Standard
 - Local/Remote
 - Multi Step Speed Control
 - PID Control
 - Multi-Purpose Control
 - Pump and Fan Control with Auto Change
- Additional I/O and communication cards provide plug and play functionality
- I/O connections with simple quick connection terminals
- UL Listed
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Brake Chopper standard from:
 - 1 – 30 hp/380 – 500V
 - 3/4 – 15 hp/208 – 230V
- NEMA Type 1 enclosures available Frame Sizes FR4 – FR11, NEMA Type 12 enclosures available Frame Sizes FR4 – FR10 (FR10 and FR11 Free-standing Drives)
- Open Chassis FR10 and greater
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

Table 40-199. SPX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
High Withstand Rating	100 kAIC

Output Ratings

Output Voltage	0 to V_{in}
Continuous Output Current	I_H rated 100% at 122°F (50°C), FR9 and below I_L rated 100% at 104°F (40°C), FR9 and below I_H/I_L 100% at 104°F (40°C), FR10 and above
Overload Current (I_H/I_L)	150% I_H , 110% I_L for 1 min.
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz
Initial Output Current (I_H)	250% for 2 seconds

Control Characteristics

Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control Closed Loop Frequency Control Closed Loop Vector Control
Switching Frequency Frame 4 – 6 Frame 7 – 12	Adjustable with Parameter 2.6.9 1 to 16 kHz; default 10 kHz 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% x T_n (without brake option)

Ambient Conditions

Ambient Operating Temperature	14°F (-10°C), no frost to 122°F (+50°C) I_H (FR4 – FR9) 14°F (-10°C), no frost to 104°F (+40°C) I_L (FR10 and up) 14°F (-10°C), no frost to 104°F (+40°C) I_L (All Frames)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA 1/IP21 or NEMA 12/IP54, Open Chassis/IP20

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

Control Connections

Analog Input Voltage	0 to 10V, R = 200 k Ω (-10 to 10V joystick control) Resolution .1%; accuracy $\pm 1\%$
Analog Input Current	0(4) to 20 mA; R_i - 250 Ω differential
Digital Inputs (6)	Positive or negative logic; 18 to 30V DC
Auxiliary Voltage	+24V $\pm 15\%$, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy $\pm 2\%$
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / .4A

Protections

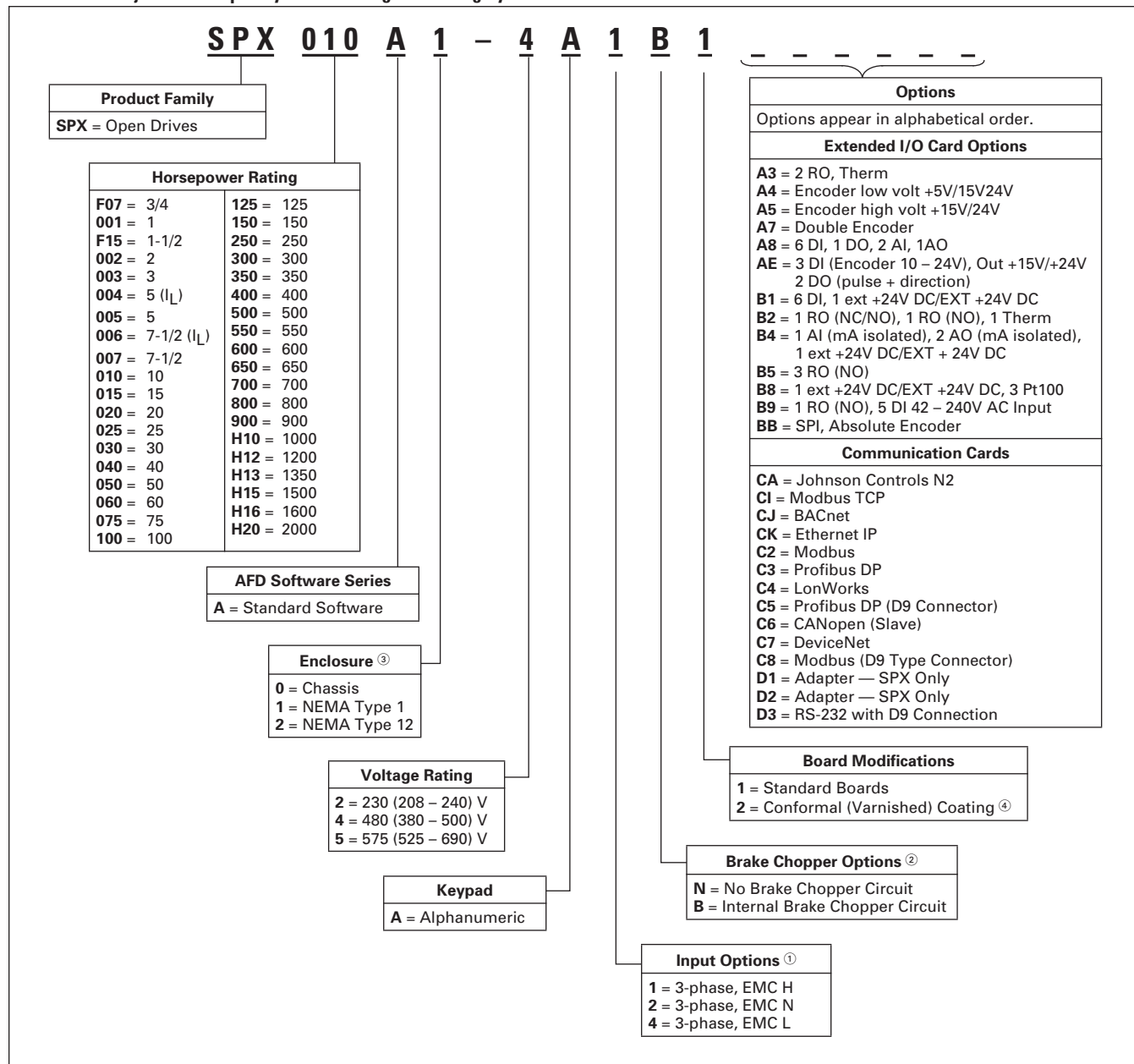
Overcurrent Protection	Trip limit 4.0 x I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (+24V and +10V Reference Voltages)

High Performance Features

Speed Error	<0.01%, depending on the encoder
Encoder Support	Incremental or absolute
Encoder Voltages	5V (RS-422), 15V or 24V, depending on the option card
Torque Control	Full torque control at all speeds, including zero
Torque Accuracy	<2%; <5% down to zero speed
Starting Torque	>200%, depending on motor and drive sizing
Master/Slave Configurations	Full capability
System Analysis	Integrated data logger
PC Communication	Fast multiple drive monitoring with PC
Inter-Drive Communication	High-speed bus (12 Mbits/s)
High-Speed Applications	Up to 7200 Hz

Catalog Number Selection

Table 40-200. Adjustable Frequency Drive Catalog Numbering System



- ① All 230V Drives and 480V Drives up to 200 hp (I_H) are only available with Input Option 1 (EMC level H). 480V Drives 250 hp (I_H) or larger are available with Input Option 2 (EMC level N). 575V Drives 200 hp (I_H) or larger are available with Input Option 2. 575V Drives up to 150 hp (I_H) are available with Input Option 4 (EMC level L). 480V and 690V Freestanding Drives are available with Input Option 4 (EMC level L).
- ② 480V Drives up to 30 hp (I_H) are only available with Brake Chopper Option B. 480V Drives 40 hp (I_H) or larger come standard with Brake Chopper Option N. 230V Drives up to 15 hp (I_H) are only available with Brake Chopper Option B. 230V Drives 20 hp and larger come standard with Brake Chopper Option N. All 575V Drives come standard without Brake Chopper Option (N). Note: N = No Brake Chopper.
- ③ 480V Drives 250 – 350 hp (I_H) and 690V Drives 200 – 300 hp (I_H) are available with enclosure style 0 (Chassis). 480V and 690V FR10 Freestanding Drives are available with 1 (NEMA Type 1) or 2 (NEMA Type 12). FR11 Freestanding Drives are only available with enclosure style 1 (NEMA Type 1).
- ④ Factory promise delivery. Consult Sales Office for availability.

Product Selection

230V SPX9000 Drives

Table 40-201. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	FP	3/4	3.7	1	4.8	SPXF07A1-2A1B1	
		1	4.8	1-1/2	6.6	SPX001A1-2A1B1	
		1-1/2	6.6	2	7.8	SPXF15A1-2A1B1	
		2	7.8	3	11	SPX002A1-2A1B1	
		3	11	—	12.5	SPX003A1-2A1B1	
FR5	FP	—	12.5	5	17.5	SPX004A1-2A1B1	
		5	17.5	7-1/2	25	SPX005A1-2A1B1	
		7-1/2	25	10	31	SPX007A1-2A1B1	
FR6	FP	10	31	15	48	SPX010A1-2A1B1	
		15	48	20	61	SPX015A1-2A1B1	
FR7	FP	20	61	25	75	SPX020A1-2A1N1	
		25	75	30	88	SPX025A1-2A1N1	
		30	88	40	114	SPX030A1-2A1N1	
FR8	FP	40	114	50	140	SPX040A1-2A1N1	
		50	140	60	170	SPX050A1-2A1N1	
		60	170	75	205	SPX060A1-2A1N1	
FR9	FP	75	205	100	261	SPX075A1-2A1N1	
		100	261	—	—	SPX100A1-2A1N1	

Table 40-202. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	FP	3/4	3.7	1	4.8	SPXF07A2-2A1B1	
		1	4.8	1-1/2	6.6	SPX001A2-2A1B1	
		1-1/2	6.6	2	7.8	SPXF15A2-2A1B1	
		2	7.8	3	11	SPX002A2-2A1B1	
		3	11	—	12.5	SPX003A2-2A1B1	
FR5	FP	—	12.5	5	17.5	SPX004A2-2A1B1	
		5	17.5	7-1/2	25	SPX005A2-2A1B1	
		7-1/2	25	10	31	SPX007A2-2A1B1	
FR6	FP	10	31	15	48	SPX010A2-2A1B1	
		15	48	20	61	SPX015A2-2A1B1	
FR7	FP	20	61	25	75	SPX020A2-2A1N1	
		25	75	30	88	SPX025A2-2A1N1	
		30	88	40	114	SPX030A2-2A1N1	
FR8	FP	40	114	50	140	SPX040A2-2A1N1	
		50	140	60	170	SPX050A2-2A1N1	
		60	170	75	205	SPX060A2-2A1N1	
FR9	FP	75	205	100	261	SPX075A2-2A1N1	
		100	261	—	—	SPX100A2-2A1N1	

480V SPX9000 Drives

Table 40-203. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	W	1	2.2	1-1/2	3.3	SPX001A1-4A1B1	
	FP	1-1/2	3.3	2	4.3	SPXF15A1-4A1B1	
	FP	2	4.3	3	5.6	SPX002A1-4A1B1	
	W	3	5.6	5	7.6	SPX003A1-4A1B1	
	W	5	7.6	—	9	SPX005A1-4A1B1	
	FP	—	9	7-1/2	12	SPX006A1-4A1B1	
FR5	W	7-1/2	12	10	16	SPX007A1-4A1B1	
		10	16	15	23	SPX010A1-4A1B1	
		15	23	20	31	SPX015A1-4A1B1	
FR6	W	20	31	25	38	SPX020A1-4A1B1	
		25	38	30	46	SPX025A1-4A1B1	
		30	46	40	61	SPX030A1-4A1B1	
FR7	FP	40	61	50	72	SPX040A1-4A1N1	
	W	50	72	60	87	SPX050A1-4A1N1	
	W	60	87	75	105	SPX060A1-4A1N1	
FR8	FP	75	105	100	140	SPX075A1-4A1N1	
	W	100	140	125	170	SPX100A1-4A1N1	
	W	125	170	150	205	SPX125A1-4A1N1	
FR9	W	150	205	200	261	SPX150A1-4A1N1	
		200	245	250	300	SPX200A1-4A1N1	

Table 40-204. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	W	250	330	300	385	SPX250A1-4A4N1	
	FP	300	385	350	460	SPX300A1-4A4N1	
	W	350	460	400	520	SPX350A1-4A4N1	
FR11	FP	400	520	500	590	SPX400A1-4A4N1	
	FP	500	590	550	650	SPX500A1-4A4N1	
	FP	550	650	600	730	SPX550A1-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Free-standing Option selection on **Page 40-143**.

Table 40-205. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	W	1	2.2	1-1/2	3.3	SPX001A2-4A1B1	
	FP	1-1/2	3.3	2	4.3	SPXF15A2-4A1B1	
	FP	2	4.3	3	5.6	SPX002A2-4A1B1	
	W	3	5.6	5	7.6	SPX003A2-4A1B1	
	W	5	7.6	—	9	SPX005A2-4A1B1	
	FP	—	9	7-1/2	12	SPX006A2-4A1B1	
FR5	W	7-1/2	12	10	16	SPX007A2-4A1B1	
		10	16	15	23	SPX010A2-4A1B1	
		15	23	20	31	SPX015A2-4A1B1	
FR6	W	20	31	25	38	SPX020A2-4A1B1	
		25	38	30	46	SPX025A2-4A1B1	
		30	46	40	61	SPX030A2-4A1B1	
FR7	FP	40	61	50	72	SPX040A2-4A1N1	
		50	72	60	87	SPX050A2-4A1N1	
		60	87	75	105	SPX060A2-4A1N1	
FR8	FP	75	105	100	140	SPX075A2-4A2N1	
		100	140	125	170	SPX100A2-4A1N1	
		125	170	150	205	SPX125A2-4A1N1	
FR9	FP	150	205	200	261	SPX150A2-4A1N1	
		200	245	250	300	SPX200A2-4A1N1	

Table 40-206. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	250	330	300	385	SPX250A2-4A4N1	
	FP	300	385	350	460	SPX300A2-4A4N1	
	FP	350	460	400	520	SPX350A2-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option selection on **Page 40-143**.

Table 40-207. 480V 380 – 500, Open Chassis Drive

Frame Size ①	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	W	250	330	300	385	SPX250A0-4A2N1	
		300	385	—	460	SPX300A0-4A2N1	
		350	460	400	520	SPX350A0-4A2N1	
FR11	FP	400	520	500	590	SPX400A0-4A2N1	
		500	590	—	650	SPX500A0-4A2N1	
		—	650	600	730	SPX550A0-4A2N1	
FR12	FP	600	730	—	820	SPX600A0-4A2N1	
		—	820	700	920	SPX650A0-4A2N1	
		700	920	800	1030	SPX700A0-4A2N1	
FR13	FP	800	1030	900	1150	SPX800A0-4A2N1	
		900	1150	1000	1300	SPX900A0-4A2N1	
		1000	1300	1200	1450	SPXH10A0-4A2N1	
FR14	FP	1200	1600	1500	1770	SPXH12A0-4A2N1	
		1600	1940	1800	2150	SPXH16A0-4A2N1	

① FR10 – FR14 includes 3% line reactor, but it is not integral to chassis.

575V SPX9000 Drives

Table 40-208. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	W	2	3.33	3	4.5	SPX002A1-5A4N1	
		3	4.5	—	5.5	SPX003A1-5A4N1	
		—	5.5	5	7.5	SPX004A1-5A4N1	
		5	7.5	7-1/2	10	SPX005A1-5A4N1	
		7-1/2	10	10	13.5	SPX007A1-5A4N1	
		10	13.5	15	18	SPX010A1-5A4N1	
		15	18	20	22	SPX015A1-5A4N1	
		20	22	25	27	SPX020A1-5A4N1	
		25	27	30	34	SPX025A1-5A4N1	
		—	—	—	—	—	
FR7	W	30	34	40	41	SPX030A1-5A4N1	
		40	41	50	52	SPX040A1-5A4N1	
FR8	W	50	52	60	62	SPX050A1-5A4N1	
		60	62	75	80	SPX060A1-5A4N1	
		75	80	100	100	SPX075A1-5A4N1	
FR9	W	100	100	125	125	SPX100A1-5A4N1	
		125	125	150	144	SPX125A1-5A4N1	
		150	144	—	170	SPX150A1-5A4N1	
		—	170	200	208	SPX175A1-5A4N1	

Table 40-209. 525 – 690V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A1-5A4N1	
		250	261	300	325	SPX250A1-5A4N1	
		300	325	400	385	SPX300A1-5A4N1	
FR11	FP	400	385	450	460	SPX400A1-5A4N1	
		450	460	500	502	SPX450A1-5A4N1	
		500	502	550	590	SPX500A1-5A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option selection on **Page 40-143**.

Table 40-210. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	F1	2	3.33	3	4.5	SPX002A2-5A4N1	
		3	4.5	—	5.5	SPX003A2-5A4N1	
		—	5.5	5	7.5	SPX004A2-5A4N1	
		5	7.5	7-1/2	10	SPX005A2-5A4N1	
		7-1/2	10	10	13.5	SPX007A2-5A4N1	
		10	13.5	15	18	SPX010A2-5A4N1	
		15	18	20	22	SPX015A2-5A4N1	
		20	22	25	27	SPX020A2-5A4N1	
		25	27	30	34	SPX025A2-5A4N1	
FR7	FP	30	34	40	41	SPX030A2-5A4N1	
		40	41	50	52	SPX040A2-5A4N1	
FR8	FP	50	52	60	62	SPX050A2-5A4N1	
		60	62	75	80	SPX060A2-5A4N1	
		75	80	100	100	SPX075A2-5A4N1	
FR9	FP	100	100	125	125	SPX100A2-5A4N1	
		125	125	150	144	SPX125A2-5A4N1	
		150	144	—	170	SPX150A2-5A4N1	
		—	170	200	208	SPX175A2-5A4N1	

Table 40-211. 525 – 690V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A2-5A4N1	
		250	261	300	325	SPX250A2-5A4N1	
		300	325	400	385	SPX300A2-5A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option selection on **Page 40-143**.

Table 40-212. 525 – 690V, Open Chassis Drive

Frame Size ①	Delivery Code	hp (I _H)	Current (I _H)	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	200	208	250	261	SPX200A0-5A2N1	
		250	261	300	325	SPX250A0-5A2N1	
		300	325	400	385	SPX300A0-5A2N1	
FR11	FP	400	385	450	460	SPX400A0-5A2N1	
		450	460	500	502	SPX450A0-5A2N1	
		500	502	—	590	SPX500A0-5A2N1	
FR12	FP	—	590	600	650	SPX550A0-5A2N1	
		600	650	700	750	SPX600A0-5A2N1	
		700	750	800	820	SPX700A0-5A2N1	
FR13	FP	800	820	900	920	SPX800A0-5A2N1	
		900	920	1000	1030	SPX900A0-5A2N1	
		1000	1030	1250	1180	SPXH10A0-5A2N1	
FR14	FP	1350	1300	1500	1500	SPXH13A0-5A2N1	
		1500	1500	2000	1900	SPXH15A0-5A2N1	
		2000	1900	2300	2250	SPXH20A0-5A2N1	

① FR10 – FR14 includes a 3% line reactor but it is not integral to chassis.

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-65**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

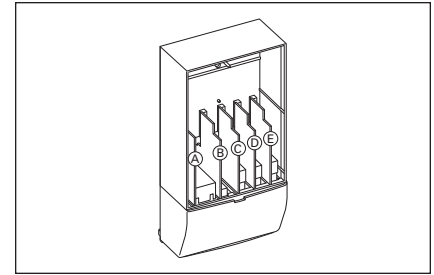


Figure 40-65. 9000X Series Option Boards

Table 40-213. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.\$	Option Designator	Adder U.S.\$	Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-65)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	OPTA3		A3		—	X	X	X	X	X	X
Encoder low volt +5V/15V24V	C	OPTA4		A4		—	X	X	X	X	X	X
Encoder high volt +15V/24V	C	OPTA5		A5		—	X	X	X	X	X	X
Double encoder — SPX Only	C	OPTA7		A7		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	OPTA8		A8		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	OPTAE		AE		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		—	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	OPTBB		BB		—	—	—	—	—	—	—
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD1		D1		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD2		D2		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X

Keypad

9000X Series Local/ Remote Keypad (Replacement Keypad)	—	KEYPAD-LOC/REM		—		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMT-KIT-9000X		—		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Discount Symbol..... **SS-2**

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6,

19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates

range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Options

Control Panel Options

Table 40-214. Control Panel Factory Options

Description	Factory Installed		Field Installed	
	Option Code	Adder U.S. \$	NEMA Type 1	
			Catalog Number	Price U.S. \$
Local/Remote Keypad SVX9000 Control Panel — This option is standard on all drives and consists of an RS-232 connection, backlit alphanumeric LCD display with nine indicators for the RUN status and two indicators for the control source. The nine pushbuttons on the panel are used for panel programming and monitoring of all SPX9000 parameters. The panel is detachable and isolated from the input line potential. Include LOC/REM key to choose control location.	A		KEYPAD-LOC/REM	
Keypad Remote Mounting Kit — This option is used to remote mount the SPX9000 keypad. The footprint is compatible to the SV9000 remote mount kit. Includes 10 ft. cable, keypad holder and mounting hardware.	—		OPTRMT-KIT-9000X	
Keypad Blank — 9000X Series select keypad for use with special and custom applications.	—		KEYPAD-BLANK	

Discount Symbol..... SS-2

Table 40-215. Miscellaneous Options

Description	Catalog Number	Price U.S. \$
9000XDrive — A PC-based tool for controlling and monitoring of the SPX9000. Features include: loading parameters that can be saved to a file or printed, setting references, starting and stopping the motor, monitoring signals in graphical or text form, and real-time display. To avoid damage to the drive or computer, SVDriveable must be used.	9000XDRIVE	
SVDriveable — 6 ft. (1.8m) RS-232 cable (22 gauge) with a 7-pin connector on each end. Should be used in conjunction with the 9000X Drive option to avoid damage to the SPX9000 or computer. The same cable can be used for downloading specialized applications to the drive.	SVDRIVECABLE	
External Dynamic Braking Resistors — Used with the Dynamic Braking Chopper Circuit to absorb motor regenerative energy for stopping the load and to dissipate the energy flowing back into the drive. Resistors are separated into Standard Duty and Heavy-Duty. Standard Duty is defined as 20% duty or less with 100% braking torque, while Heavy-Duty is defined as 50% duty or less with 150% braking torque. <i>Consult factory.</i>	①	

① Consult factory.

Brake Chopper Options

The Brake Chopper Circuit option is used for applications that require dynamic braking. Dynamic Braking resistors not included with drive purchase. Consult the factory for dynamic braking resistors which are supplied separately. Resistors not UL Listed.

Table 40-216. Brake Chopper Circuit Adder —
NEMA Type 1, NEMA Type 12, Chassis

hp (l _H)	Adder U.S. \$		
	208 – 240V	380 – 500V	525 – 690V
2			
3			
5vt			
5ct			
7-1/2vt			
7-1/2ct			
10			
15			
20			
25			
30			
40			
50			
60			
75			
100			
125			
150			
200vt			
200ct			
250			
300			
350			
400			

hp (l _H)	Adder U.S. \$		
	208 – 240V	380 – 500V	525 – 690V
450			
500			
550			
600vt			
600ct			
700vt			
700ct			
800			
900			
1000			
1200			
1350			
1500			
1600			
1900			
2000			

Note: Delivery code is FP.

Table 40-217. Conformal (Varnished) Coating Adder — 208 – 240V, 380 – 500V, 525 – 690V (See Catalog Number Description to order.)

Frame	Delivery Code	Adder U.S. \$
FR4	FP	
FR5	FP	
FR6	FP	
FR7	FP	
FR8	FP	
FR9	FP	
FR10	FP	
FR11	FP	
FR12	FP	
FR13	FP	
FR14	FP	

Table 40-218. Conformal Coated Board Kits ①

Field Installed		Factory Installed	
Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$
OPT_V ③		②	

- ① See Option Catalog Numbers on **Page 40-139**.
② Construct Catalog Numbers for factory installed per **Table 40-200** on **Page 40-134**.
③ Replace “_” with the correct Catalog Number from **Page 40-139**. Example: OPTC2V.

Accessories

Demo Drive and Power Supply

Table 40-219. Demo Drive and Power Supply

Description	Catalog Number	Price U.S. \$
9000X Drive Demo	9000XDEMO	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	9000XAUX24V	

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adaptor plate and plugs.

Table 40-220. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. \$
		Length	Width	Height			
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	OPTN12FR4	
FR5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	OPTN12FR5	
FR6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	OPTN12FR6	

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-221. Flange Kit Type 12 — Frames 4, 5 and 6 ④

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	W	OPTTHRFR4	
FR5	W	OPTTHRFR5	
FR6	W	OPTTHRFR6	

- ④ For installation of an SPX9000 NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA 1 enclosure drive rating determined by rating of drive.

Table 40-222. Flange Kit Type 1 — Frames 4 – 9 ⑤

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

- ⑤ For installation of an SPX9000 NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA 12 enclosure drive rating determined by rating of drive.

Table 40-223. Flange Kit Type 12 — Frames 4 – 9 ⑥

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

- ⑥ For installation of an SPX9000 NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Discount Symbol..... SS-2

Control/Communication Option Descriptions

Table 40-224. Available Control/Communications Options

Option	Description	Option Type
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the SPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
KB	115V Control Transformer – 550 VA — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
L1	Power On and Fault Pilot Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
P2	Disconnect Switch — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the SPX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

SPX Freestanding Options

Table 40-225. 480V and 690V Control Options


Catalog Number Suffix 	Door-Mounted Speed Potentiometer with HOA Selector Switch	HAND/OFF/AUTO Switch (22 mm)	115 Volt Control Transformer 550 VA
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
200 – 550			

Table 40-226. 480V and 690V Light Options



Catalog Number Suffix 	Power On/ Fault Pilot Lights
hp	Adder U.S. \$
200 – 550	

Table 40-227. Input Options

Catalog Number Suffix 	Disconnect Switch
hp	P2 ^① Adder U.S. \$
200 250 300 350	
400 500 550	

^① Applicable with FR10 and FR11 Freestanding designs only.

Dimensions

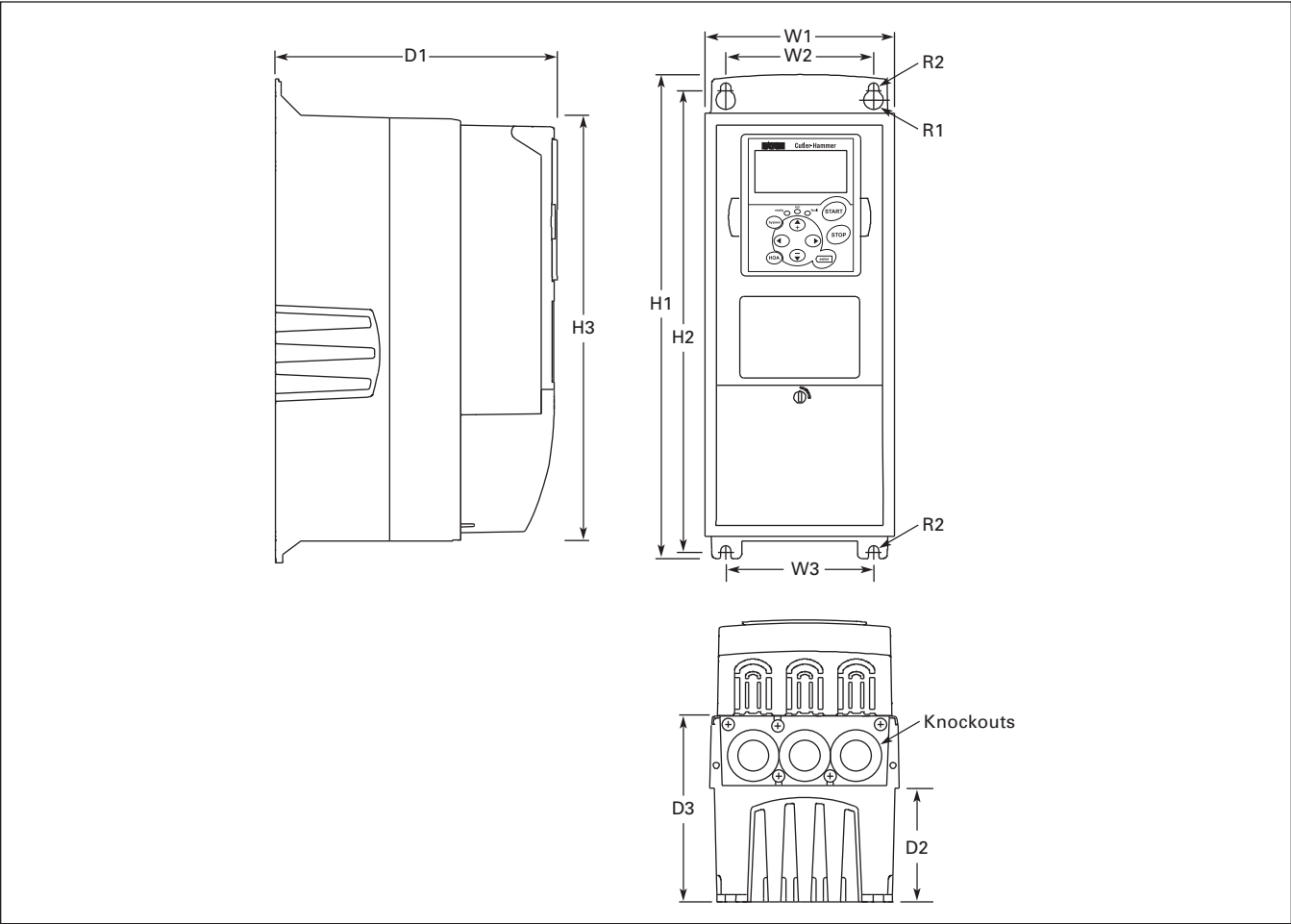


Figure 40-66. NEMA Type 1 and NEMA Type 12 SPX9000 Drive Dimensions, FR4, FR5 and FR6

Table 40-228. SPX9000 Drive Dimensions

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)	
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)	
FR4	230V	3/4 – 3	12.9	12.3	11.5	7.5	3.0	5.0	5.0	3.9	—	.5	.3	11.0	3 @ 1.1	
	480V	1 – 5	(327)	(313)	(292)	(190)	(77)	(126)	(128)	(100)		(13)	(7)	(5)	(28)	
FR5	230V	5 – 7-1/2	16.5	16.0	15.3	8.4	3.9	5.8	5.7	3.9	—	.5	.3	17.9	2 @ 1.5	
	480V	7-1/2 – 15	(419)	(406)	(389)	(214)	(100)	(148)	(144)	(100)		(13)	(7)	(8)	1 @ 1.1	
FR6	230V	10 – 15	22.0	21.3	20.4	9.3	4.2	6.5	7.6	5.8	—	.6	.4	40.8	3 @ 1.5	
	480V	20 – 30	(558)	(541)	(519)	(237)	(105)	(165)	(195)	(148)		(15.5)	(9)	(19)	(37)	
	575V	2 – 25														

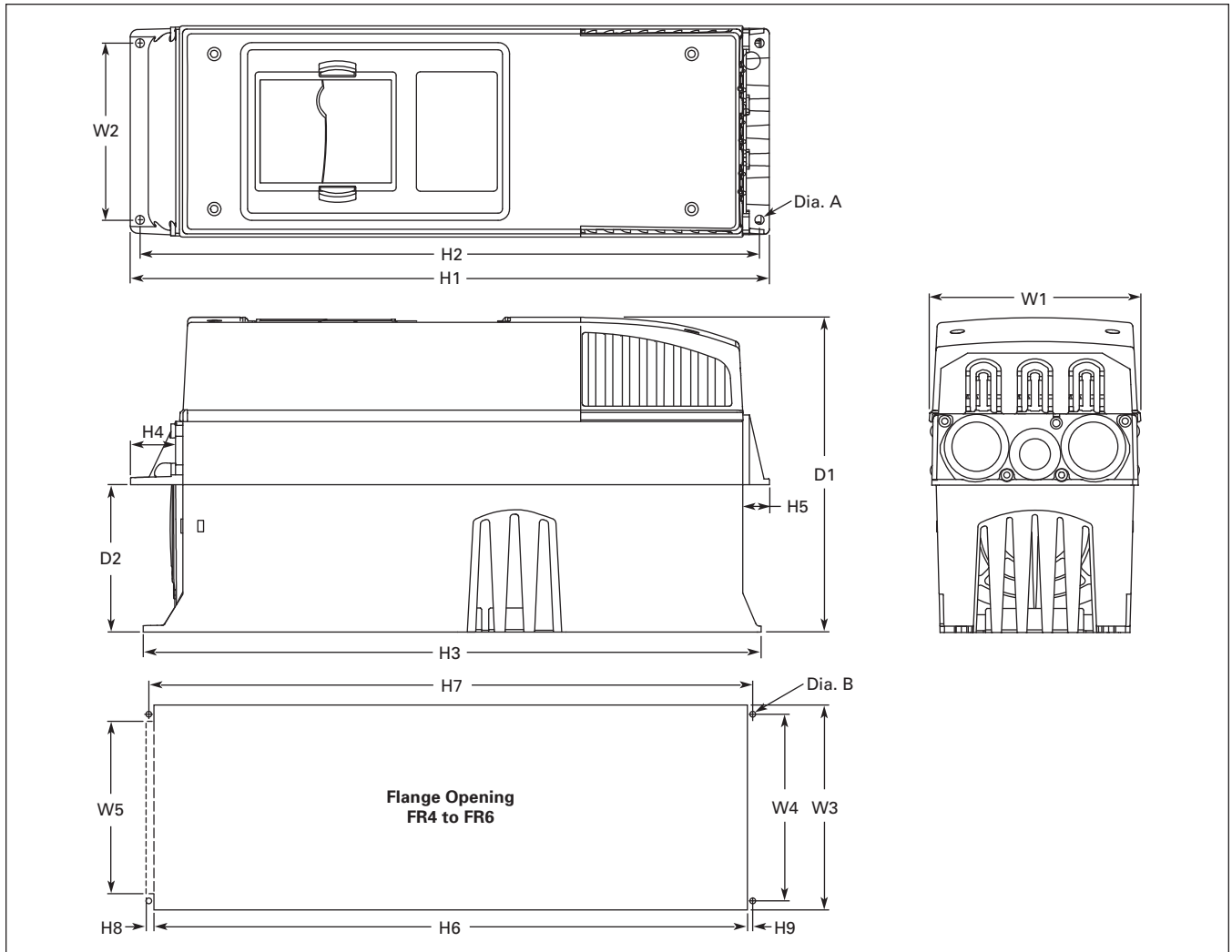


Figure 40-67. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-229. Dimensions for SPX9000, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-230. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

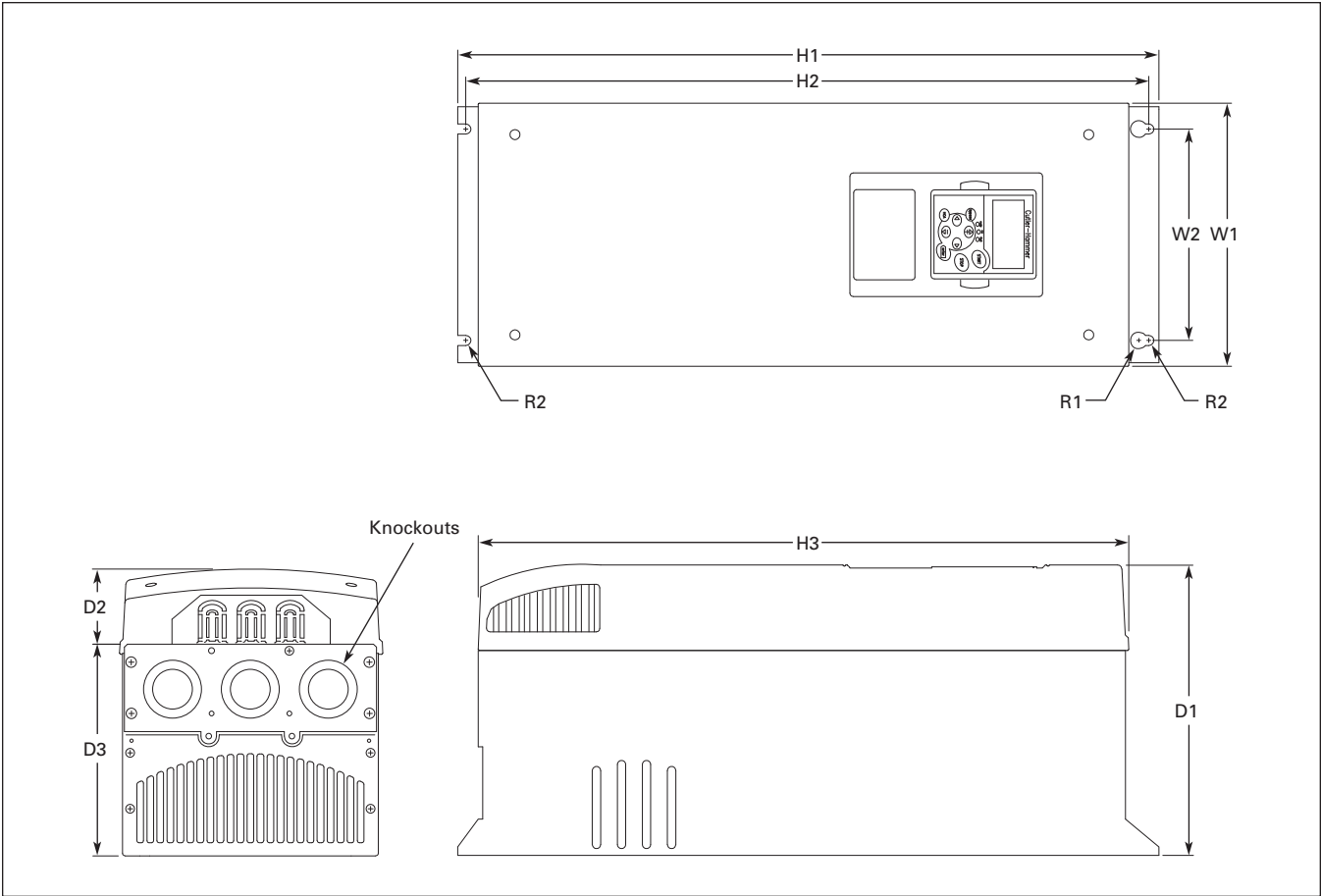


Figure 40-68. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-231. SPX9000 Drive Dimensions, FR7

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)	Knockouts @ Inches (mm)	
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)	
FR7	230V	20 – 30	24.8 (630)	24.2 (614)	23.2 (590)	10.1 (257)	3.0 (77)	7.3 (184)	9.3 (237)	7.5 (190)	.7 (18)	.4 (9)	77.2 (35)	3 @ 1.5 (37)	
	480V	40 – 60													
	575V	30 – 40													

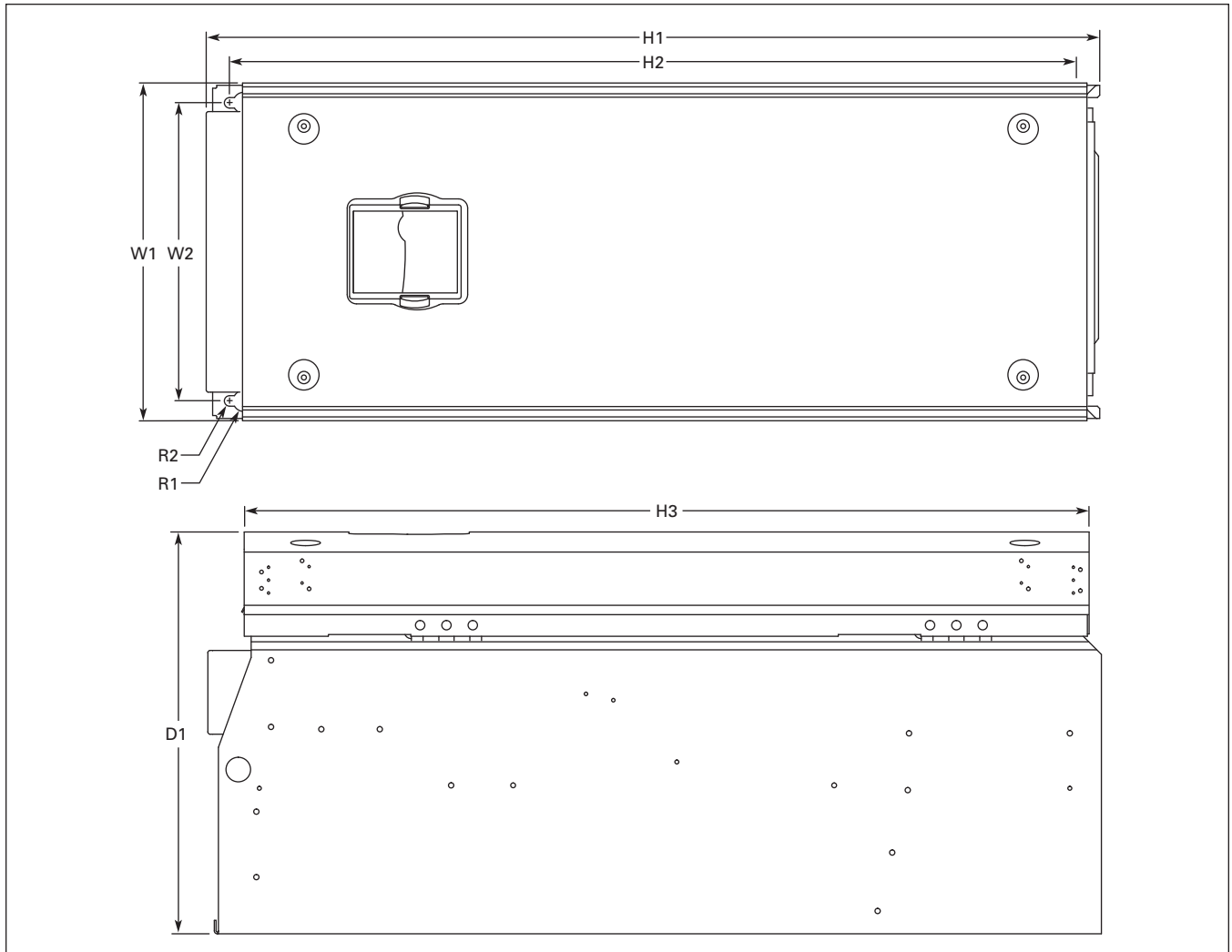


Figure 40-69. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-232. SPX9000 Drive Dimensions, FR8

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)								Weight Lbs. (kg)
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.	
FR8	230V	40 – 60	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)	127 (58)
	480V	75 – 125									
	575V	50 – 75									

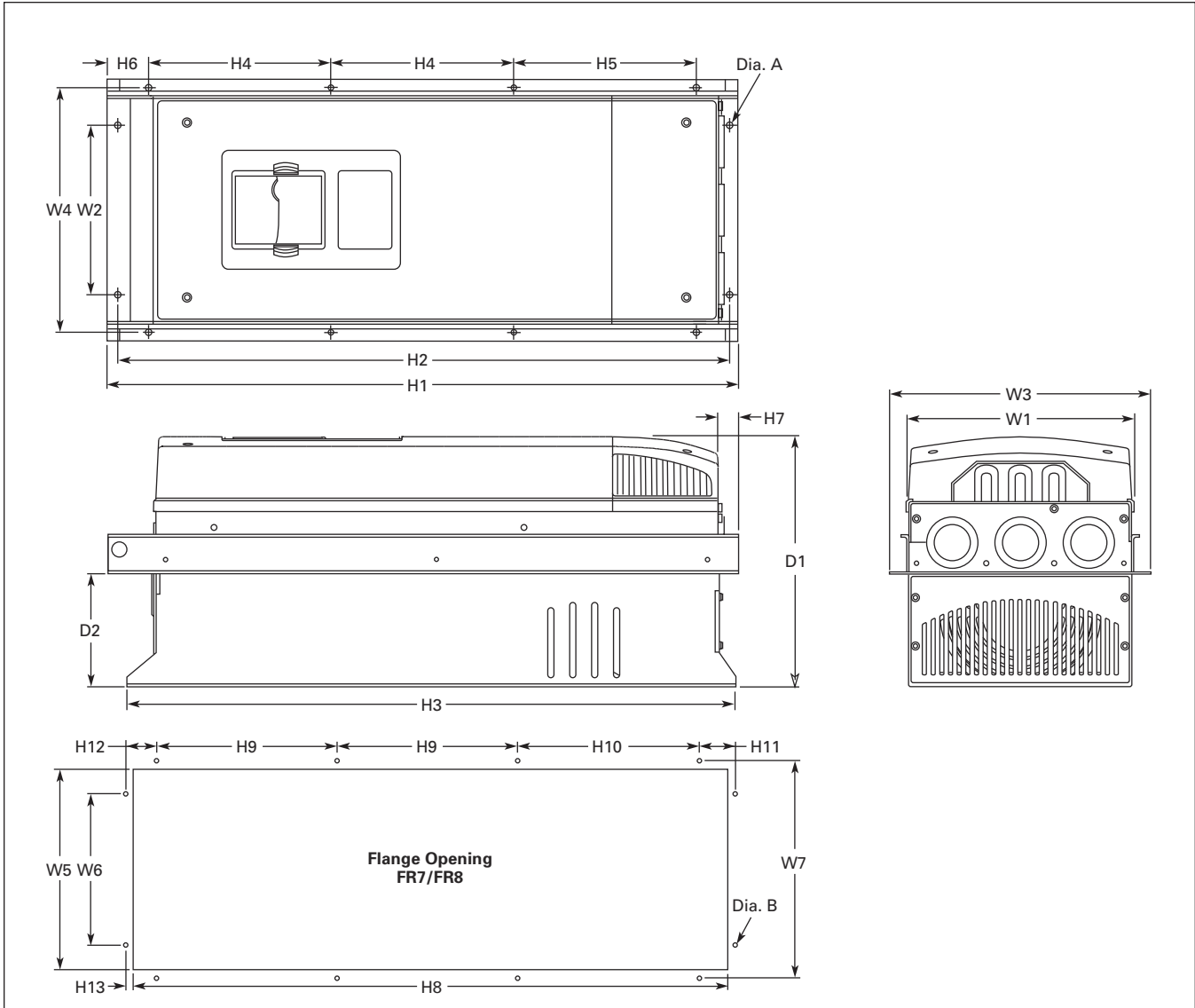


Figure 40-70. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-233. Dimensions for SPX9000, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-234. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	1.0 (25)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	1.3 (33)	.4 (9)

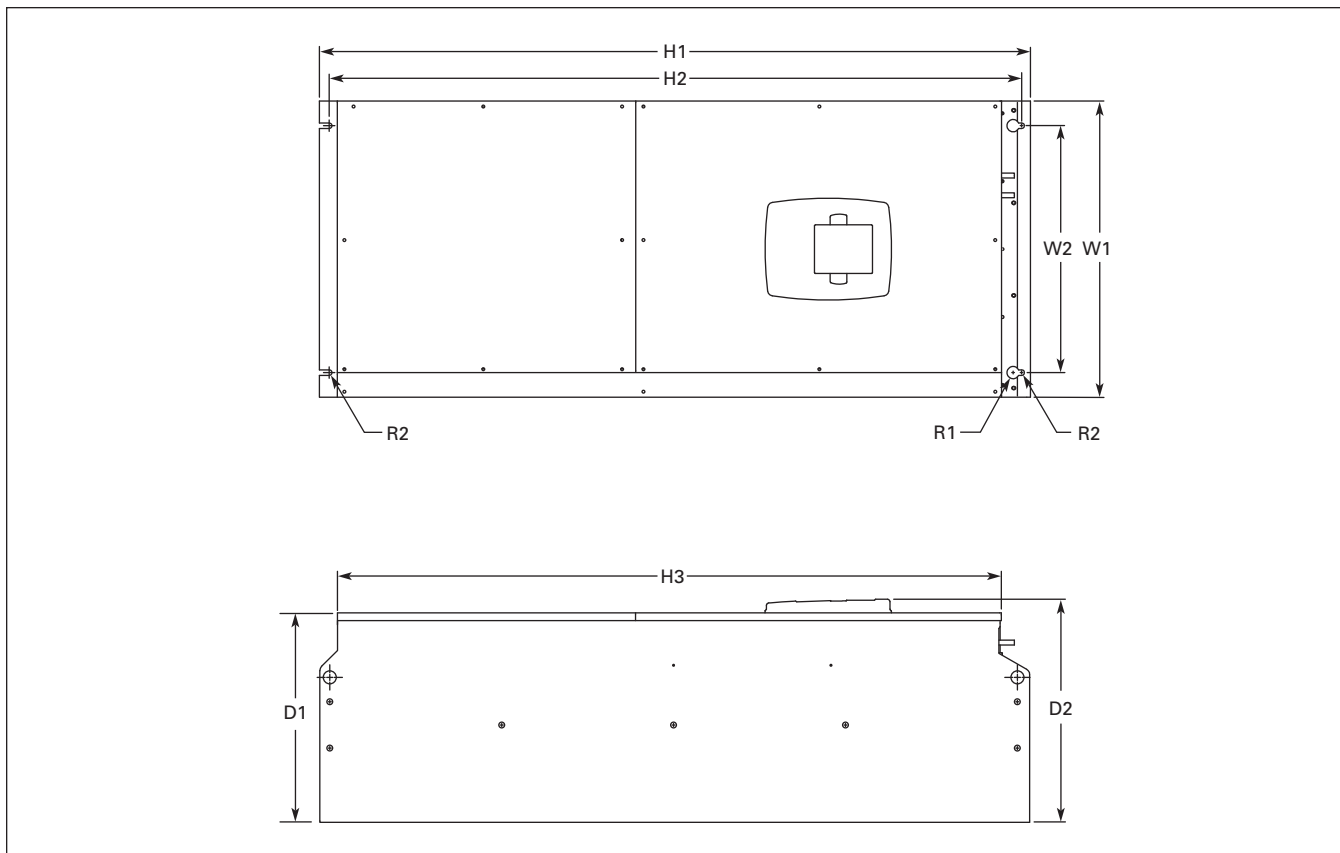


Figure 40-71. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-235. SPX9000 Drive Dimensions, FR9

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)									Weight Lbs. (kg)
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.	
FR9	230V	75 – 100	45.3 (1150)	44.1 (1120)	42.4 (1076)	13.4 (340)	14.3 (362)	18.9 (480)	15.7 (400)	.8 (20)	.4 (9)	322 (146)
	480V	150 – 200										
	575V	100 – 175										

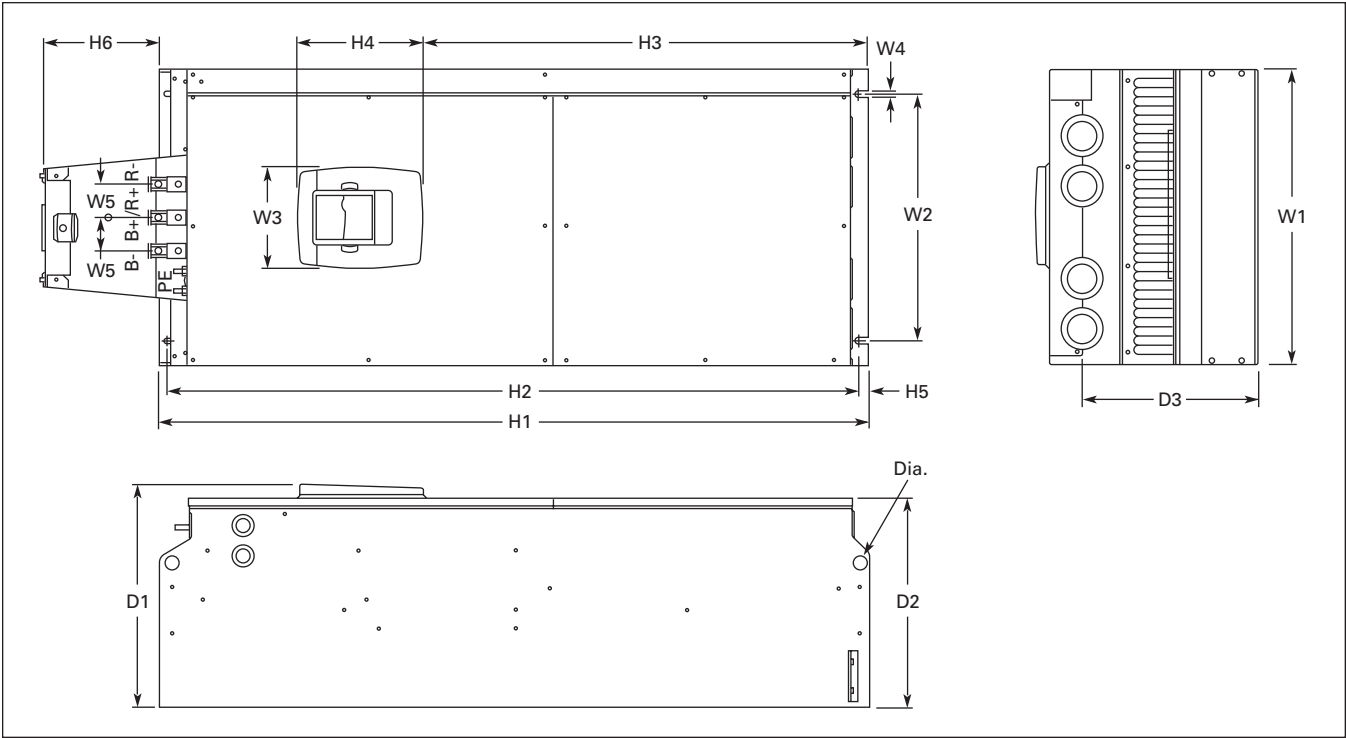


Figure 40-72. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-236. Dimensions for SPX9000, FR9

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

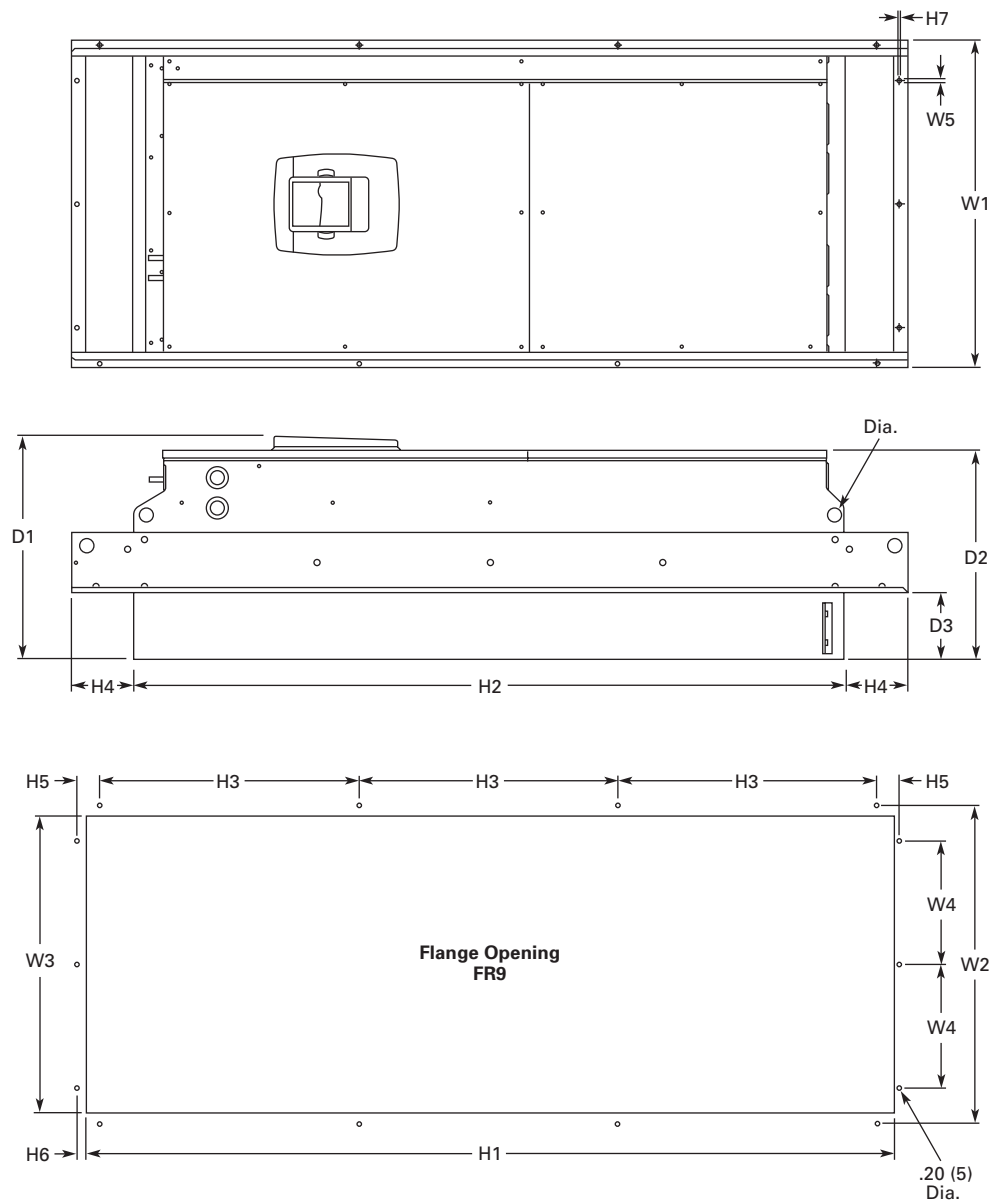


Figure 40-73. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-237. Dimensions for SPX9000, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)															
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

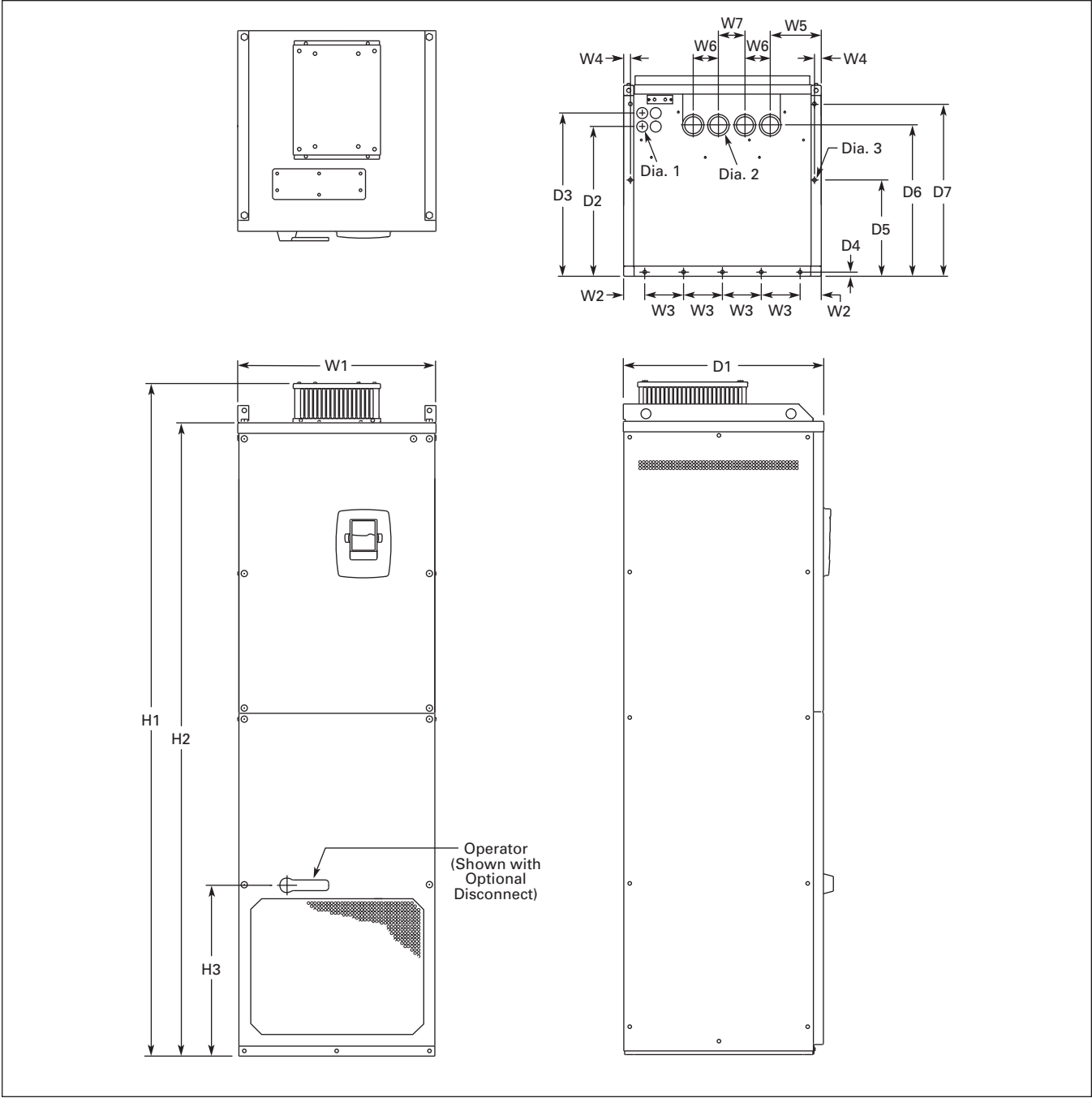


Figure 40-74. SPX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-238. Dimensions for SPX9000, FR10 Freestanding Drive

Frame Size	Volt.	hp (l _H)	Approximate Dimensions in Inches (mm)																			Wt. Lbs. (kg)	
			W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2		Dia. 3
FR10	480V	250 – 350	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)
	690V	200 – 300																					

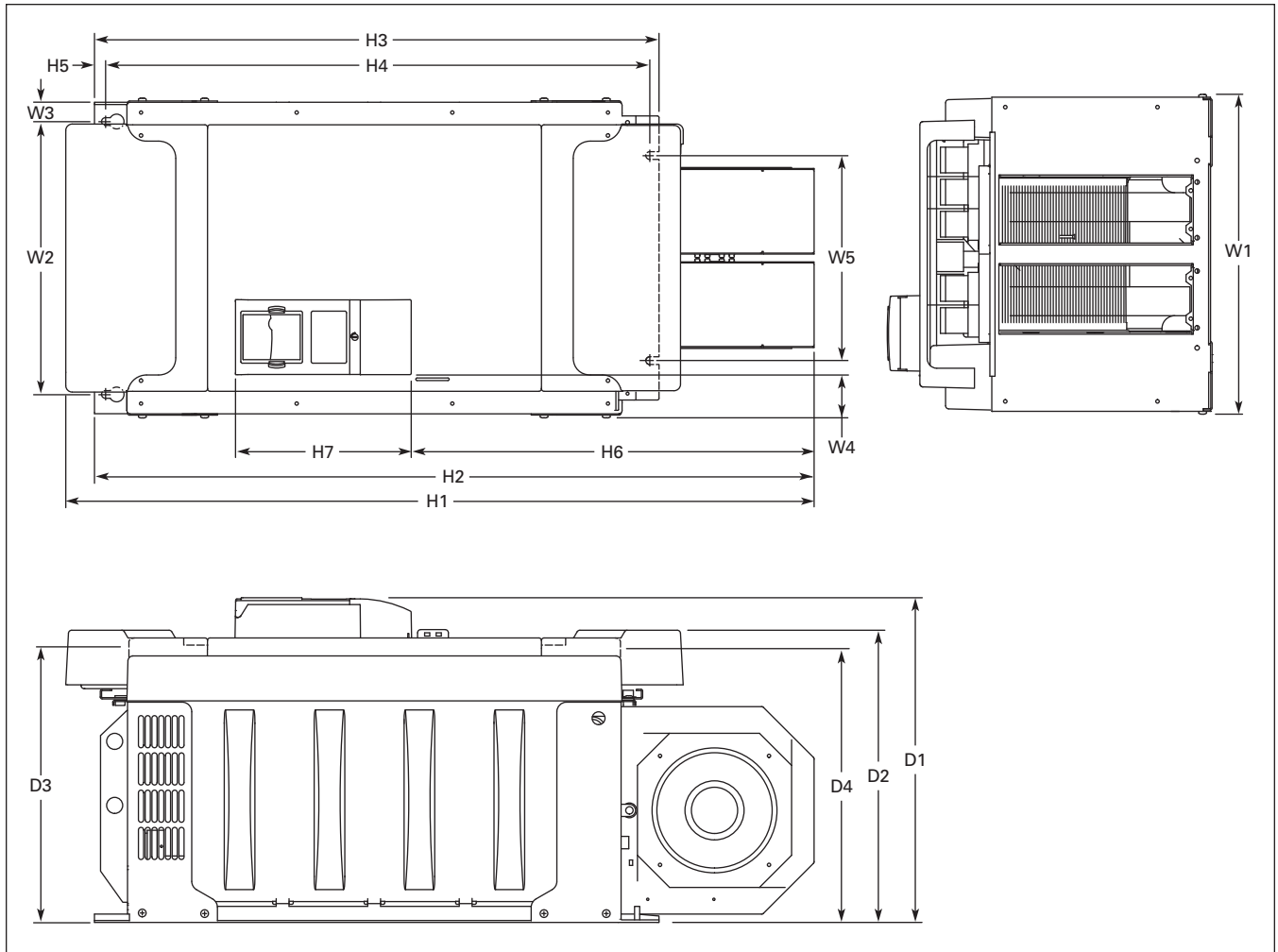


Figure 40-75. SPX9000 Dimensions, FR10 Open Chassis

Table 40-239. Dimensions for SPX9000, FR10 Open Chassis

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)																Weight Lbs. (kg)
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	
FR10	480V	250 – 350	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)	518 (235)
	575V	200 – 300																	

Note: SPX9000 FR12 is built of two FR10 modules. Please refer to SPX9000 installation manual for mounting instructions.

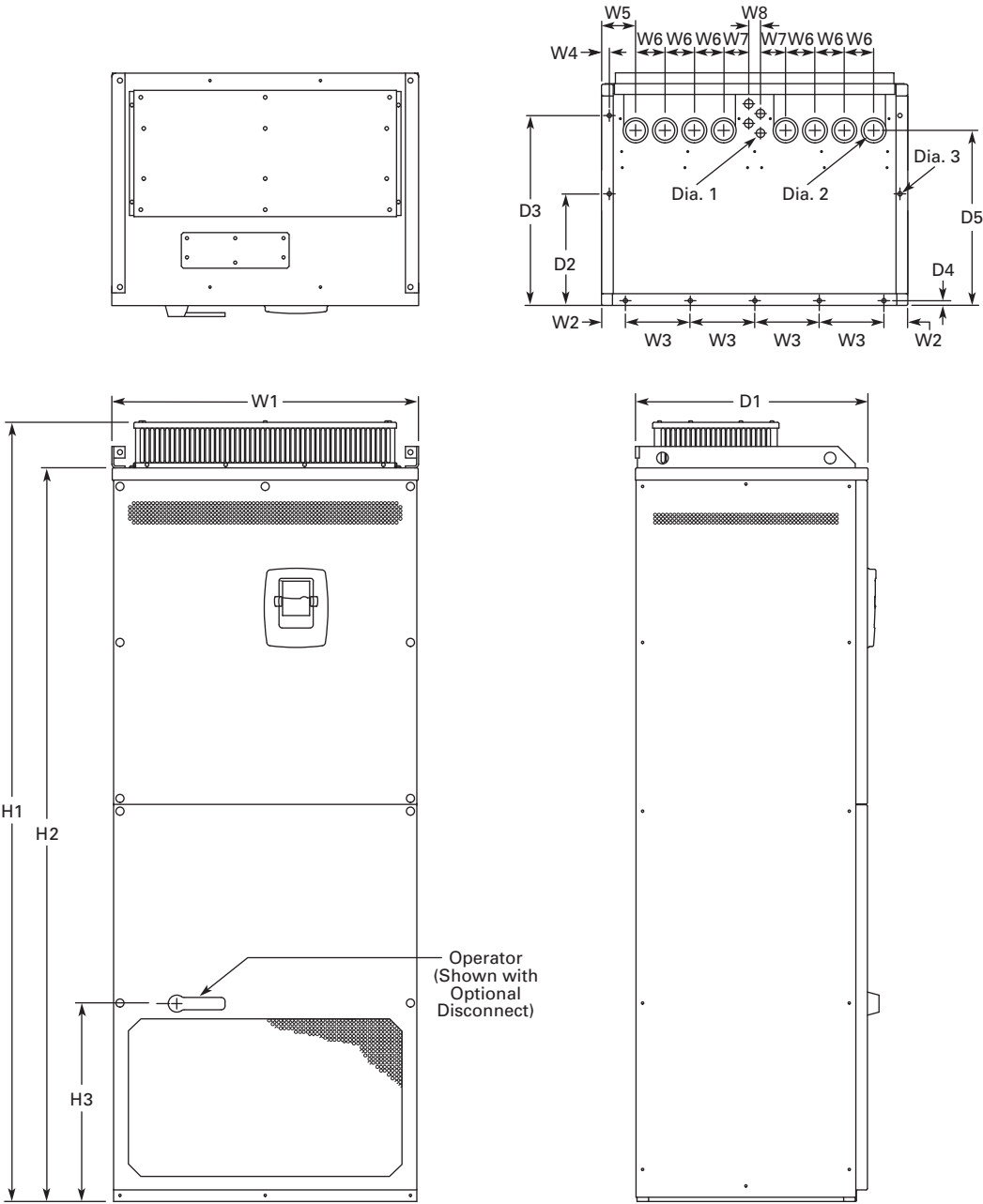


Figure 40-76. SPX9000 Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-240. Dimensions for SPX9000, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (H)	Approximate Dimensions in Inches (mm)																			Weight Lbs. (kg)
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2	Dia. 3	
FR11	480V	400 – 550	31.26	2.40	6.50	.79	3.43	2.95	2.52	1.18	79.45	74.80	20.18	23.70	11.22	19.09	.47	17.60	.83	1.89	.35 x .43	526
	690V	400 – 500	(794)	(61)	(165)	(20)	(87)	(75)	(64)	(30)	(2018)	(1900)	(512.5)	(602)	(285)	(485)	(12)	(447)	(21)	(48)	(9 x 11)	(239)

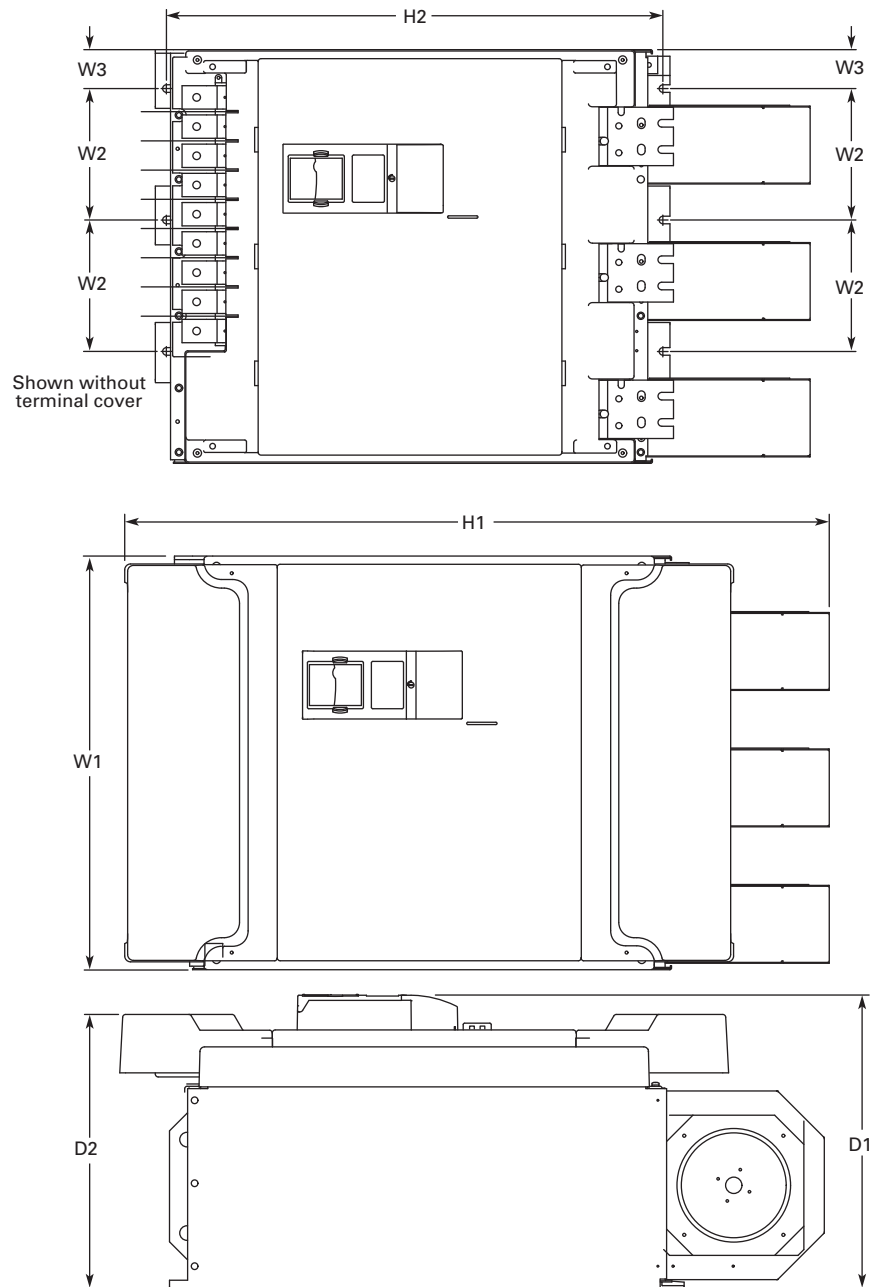


Figure 40-77. SPX9000 Dimensions, FR11 Open Chassis

Table 40-241. Dimensions for SPX9000, FR11 Open Chassis

Frame Size	Voltage	hp (I _H)	Approximate Dimensions in Inches (mm)							Weight Lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	400 – 550	27.9	8.6	2.6	45.5	33.5	19.8	18.4	833
	575V	400 – 500	(709)	(225)	(67)	(1155)	(850)	(503)	(468)	(378)

40

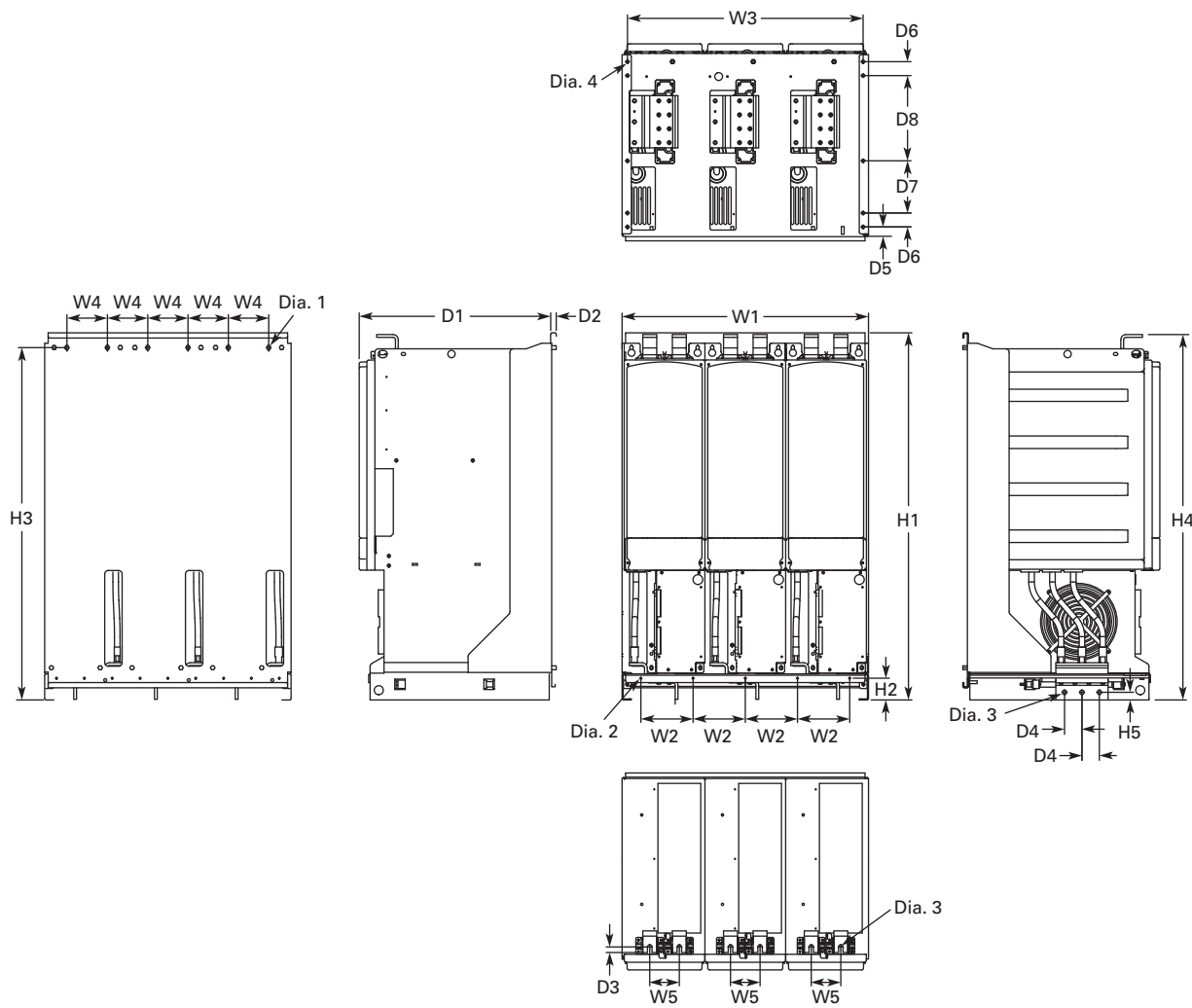


Figure 40-78. SPX9000 Dimensions, FR13 Open Chassis Inverter

Table 40-242. Dimensions for SPX9000, FR13 Open Chassis Inverter

Frame Size	Approximate Dimensions in Inches (mm)																					Weight Lbs. (kg)	
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	Dia. 1	Dia. 2	Dia. 3		Dia. 4
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.79 (20)	21.77 (553)	.51 (13)	.63 (16)	1.97 (50)	1.06 (27)	1.57 (40)	5.91 (150)	9.64 (244.8)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	683 (310)

Note: 9000X FR14 is built of two FR13 modules. Please refer to SPX9000 installation manual for mounting instructions.

Note: FR13 is built from an inverter module and a converter module. Please refer to the SPX9000 installation manual for mounting instructions.

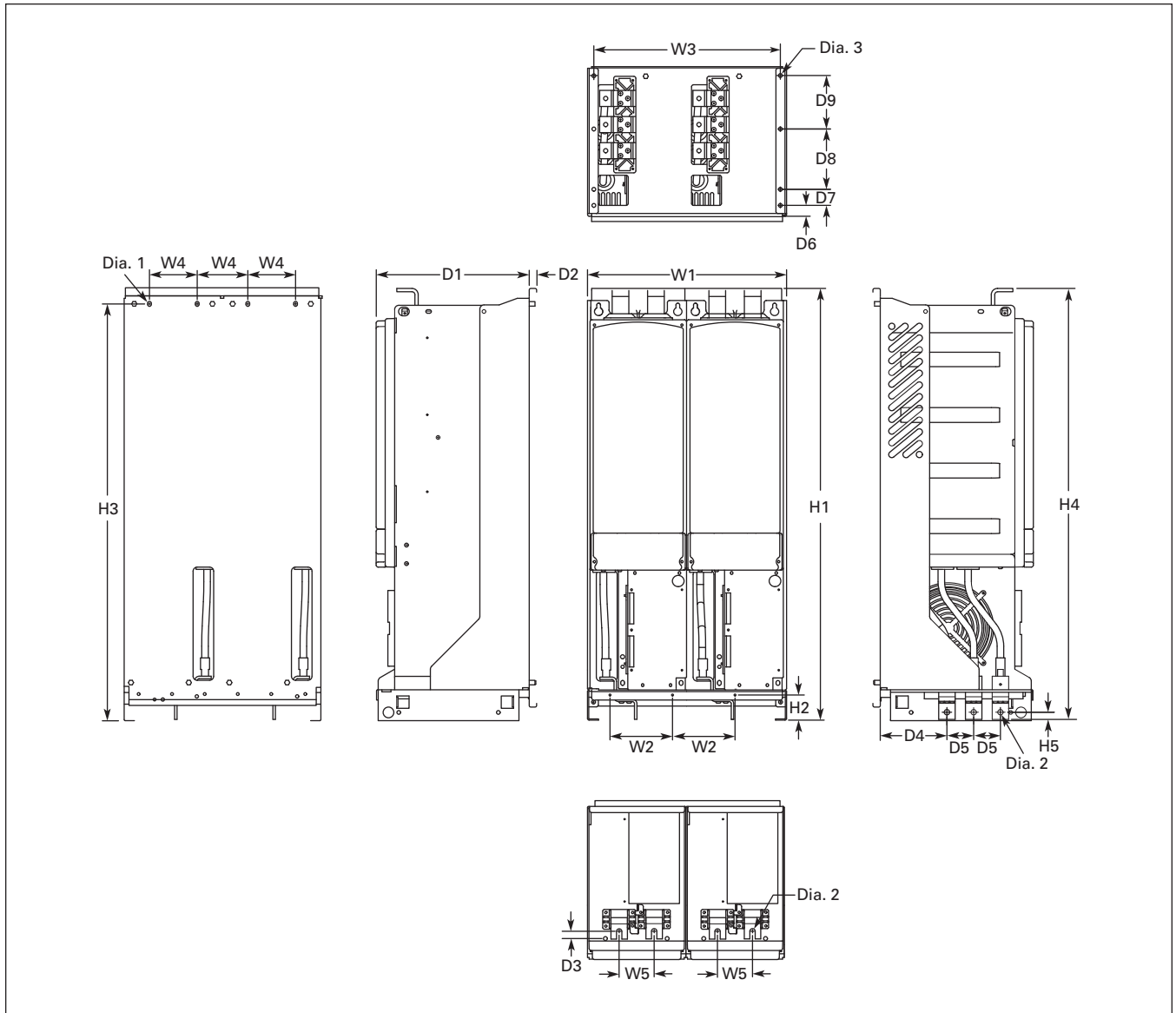


Figure 40-79. SPX9000 Dimensions, FR13 Open Chassis Converter

Table 40-243. FR13 — Number of Input Units

480V	hp	Input Modules	690V	hp	Input Modules
SPX800A0-4A2N1	800	2	SPX800A0-5A2N1	800	2
			SPX900A0-5A2N1	900	2
			SPXH10A0-5A2N1	1000	2

Table 40-244. Dimensions for SPX9000, FR13 Open Chassis Converter

Frame Size	Approximate Dimensions in Inches (mm)																					Weight Lbs. (kg)	
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2		Dia. 3
FR13	18.74 (476)	5.91 (150)	17.52 (445)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.51 (13)	.37 (9.5)	295 (134)

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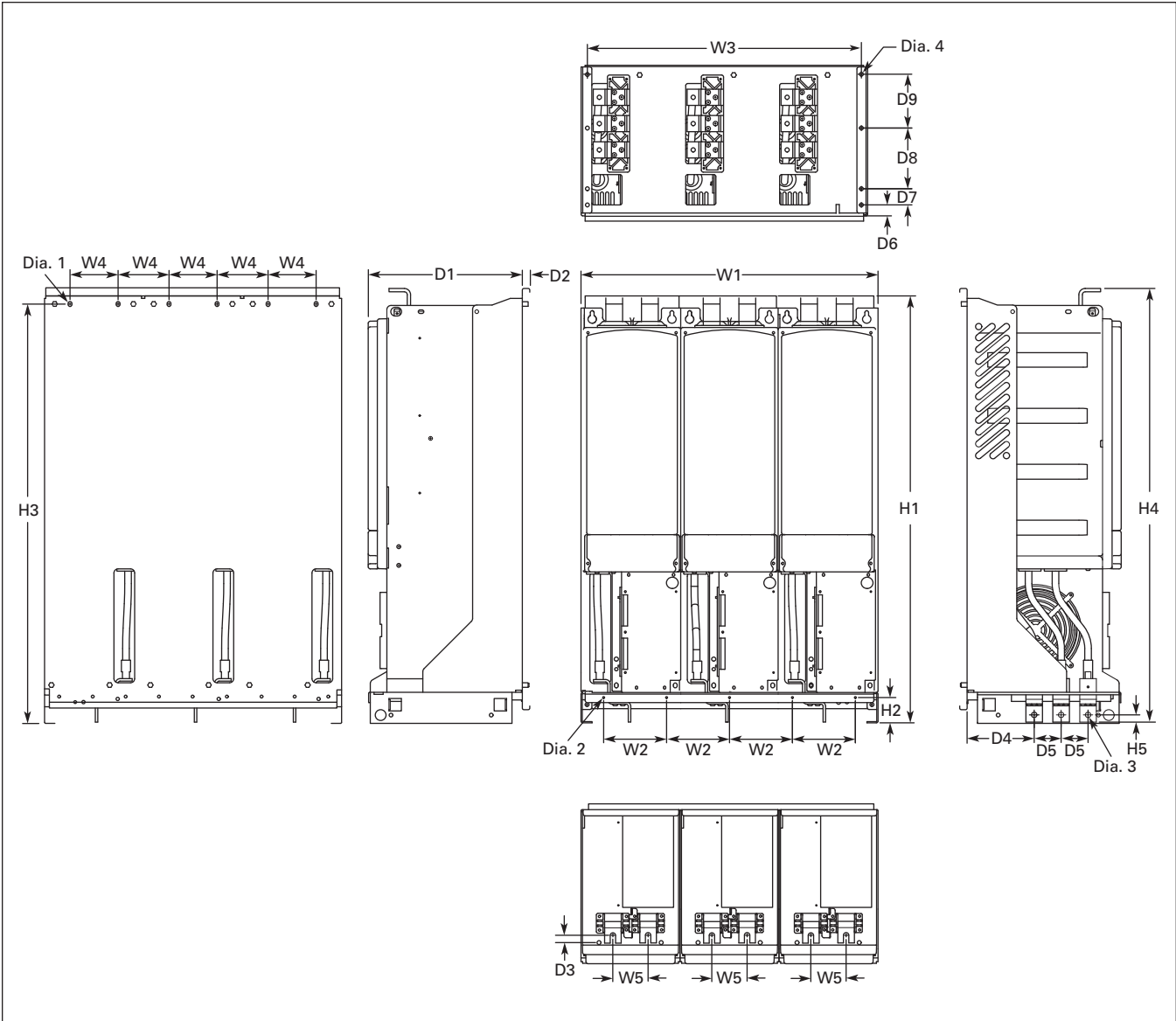


Figure 40-80. SPX9000 Dimensions, FR13 Open Chassis Converter — 900/1000 hp 480V

Table 40-245. FR13 — Number of Input Units

480V	hp	Input Modules
SPX900A0-4A2N1	900	3
SPXH10A0-4A2N1	1000	3

Table 40-246. Dimensions for SPX9000, FR13 Open Chassis Converter — 900/1000 hp 480V

Frame Size	Approximate Dimensions in Inches (mm)																							Weight Lbs. (kg)
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	D1	D2	D3	D4	D5	D6	D7	D8	D9	Dia. 1	Dia. 2	Dia. 3	Dia. 4	
FR13	27.87 (708)	5.91 (150)	26.65 (677)	4.57 (116)	3.35 (85)	41.54 (1055)	2.46 (62.5)	39.86 (1012.5)	41.34 (1050)	.69 (17.5)	14.69 (373)	.51 (13)	.73 (18.5)	6.42 (163)	2.56 (65)	1.06 (27)	1.57 (40)	5.91 (150)	5.24 (133)	.35x.59 (9x15)	.18 (4.6)	.51 (13)	.37 (9.5)	443 (201)

Table 40-247. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380 – 500V		
SPX 250 4	FR10	CHK0400
SPX 300 4	FR10	CHK0520
SPX 350 4	FR10	CHK0520
SPX 400 4	FR11	2 x CHK0400
SPX 500 4	FR11	2 x CHK0400
SPX 550 4	FR11	2 x CHK0400
SPX 600 4	FR12	2 x CHK0520
SPX 650 4	FR12	2 x CHK0520
SPX 700 4	FR12	2 x CHK0520
SPX 800 4	FR13	2 x CHK0400
SPX 900 4	FR13	3 x CHK0520
SPX H10 4	FR13	3 x CHK0520
SPX H12 4	FR14	4 x CHK0520
SPX H16 4	FR14	6 x CHK0400
Voltage Range 525 – 690V		
SPX 200 5	FR10	CHK0261
SPX 250 5	FR10	CHK0400
SPX 300 5	FR10	CHK0400
SPX 400 5	FR11	CHK0520
SPX 450 5	FR11	CHK0520
SPX 500 5	FR11	2 x CHK0400
SPX 550 5	FR12	2 x CHK0400
SPX 600 5	FR12	2 x CHK0400
SPX 700 5	FR12	2 x CHK0400
SPX 800 5	FR13	2 x CHK0400
SPX 900 5	FR13	2 x CHK0400
SPX H10 5	FR13	2 x CHK0400
SPX H13 5	FR14	4 x CHK0400
SPX H15 5	FR14	6 x CHK0400

① Chokes are provided with all FR10 – FR14 drives.

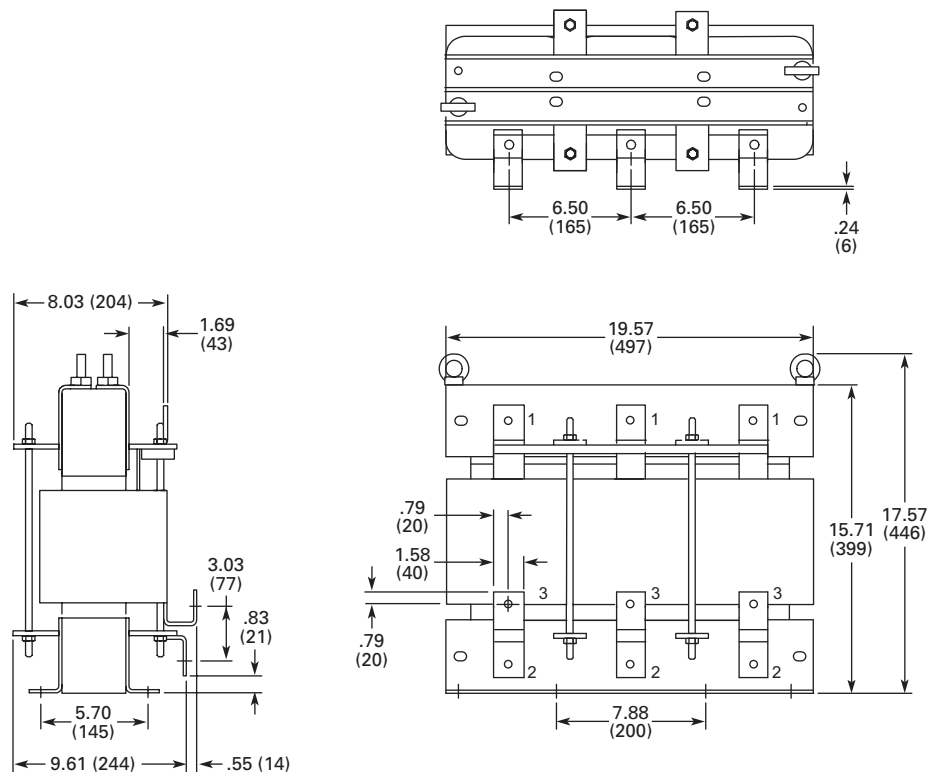


Figure 40-81. Dimensions of AC Choke CHK0520 in Inches (mm)

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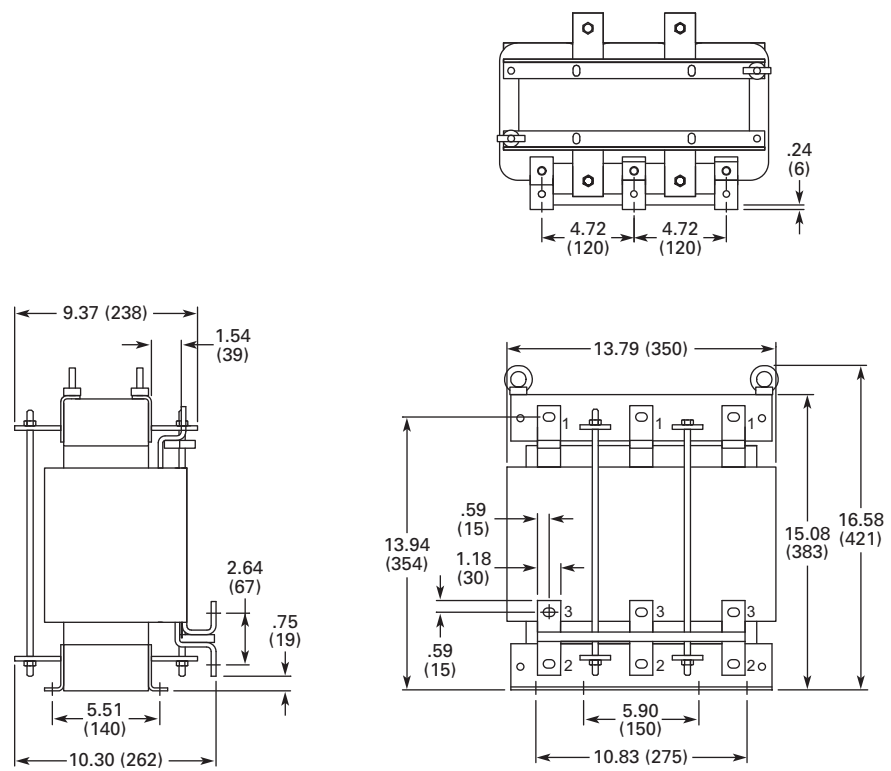


Figure 40-82. Dimensions of AC Choke CHK0400 in Inches (mm)

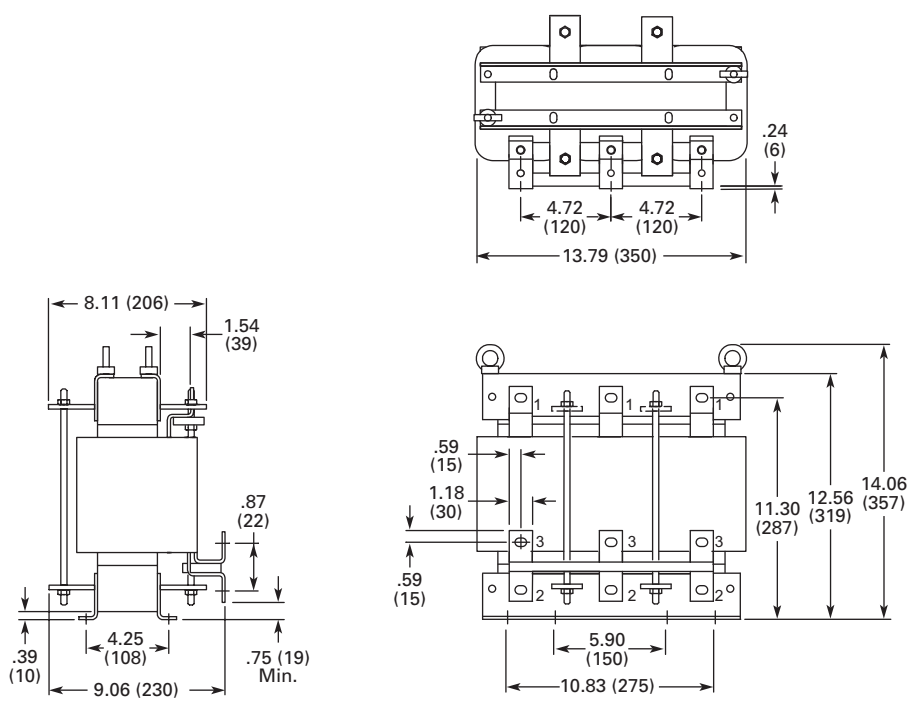


Figure 40-83. Dimensions of AC Choke CHK0261 in Inches (mm)

Spare Units & Replacement Parts

Table 40-248. 9000X Spare Units – SPX9000, 208 – 690V, Frames 4 – 12

Description	Catalog Number	Price U.S. \$
Control Unit – Includes the control board, blue base housing, installed SPX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See Figure 40-65 and Table 40-213 (Page 40-139) for standard and option boards and keypad.	CPBS0000000000	

Table 40-249. 9000X Series Replacement Parts — SPX9000 Drives, 208 – 240V

Frame:	4	5					6					7					8					Delivery	Catalog	Price
hp (I _H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	Code	Number	U.S. \$					
Control Board																								
1	1	1		1	1	1		1	1	1	1	1	1	1	1	1	W	VB00561						
Power Boards																								
1																	FB	VB00308-0004-2						
	1																FB	VB00308-0007-2						
		1															FB	VB00308-0008-2						
			1														FB	VB00310-0011-2						
				1													FB	VB00310-0012-2						
					1												FB	VB00313-0017-2						
						1											FB	VB00313-0025-2						
							1										FB	VB00313-0031-2						
								1									FB	VB00316-0048-2						
									1								FB	VB00316-0061-2						
										1							FB	VB00319-0075-2						
											1						FB	VB00319-0088-2						
												1					FB	VB00319-0114-2						
														1			FB	VB00322-0140-2						
															1		FB	VB00322-0170-2						
																1	FB	VB00322-0205-2						
Electrolytic Capacitors																								
2	2	2															W	PP01000						
				2	2												W	PP01001						
						2	2										W	PP01002						
								2									W	PP01003						
									2	2							W	PP01004						
											2	2	2	4	4		W	PP01005						
																4	W	PP01099						
Cooling Fans																								
1	1	1		1	1												W	PP01060						
						1	1	1									W	PP01061						
									1	1							W	PP01062						
											1	1	1				W	PP01063						
														1	1	1	FC	PP01123 ②						
1	1	1		1	1												W	PP01086						
						1	1	1	1	1							FC	PP01088						
											1	1	1				W	PP01049						
														1	2	2	FC	CP01180						
														1	1	1	FC	PP08037						
IGBT Modules																								
1	1																W	CP01304						
		1															W	CP01305						
				1	1	1											W	CP01306						
							1										W	CP01307						
								1									W	CP01308						
									1								W	PP01022						
										1							W	PP01023						
											1						W	PP01024						
												1					W	PP01025						
													1				W	PP01029						
														1			W	PP01026						
															1	1	W	PP01027						

① I_L only; has no corresponding I_H rated hp rating.

② PP00061 capacitor not included in main fan; please order separately.

Table 40-249. 9000X Series Replacement Parts — SPX9000 Drives, 208 – 240V (Continued)

Frame:	4					5			6		7			8			Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	3/4	1	1-1/2	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60			
Choppers/Rectifiers																			
									1								W	CP01367	
										1							W	CP01368	
Diode/Thyristor Modules																			
											3	3	3				W	PP01035	
														3	3	3	W	CP01268	
Rectifying Boards																			
											1	1	1				W	VB00242	
														1	1	1	W	VB00227	

① 5 hp I_L only; has no corresponding I_H rated hp rating.

Table 40-250. 9000X Series Replacement Parts — FR4 – FR9 SPX9000 Drives, 380 – 500V

Frame:	4				5				6				7				8				9				Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	1	1-1/2	2	3	5	7-1/2 ②	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200							
Control Board																											
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	VB00252	
Power Boards																											
1																									FB	VB00208-0003-5	
	1																								FB	VB00208-0004-5	
		1																							FB	VB00208-0005-5	
			1																						FB	VB00208-0007-5	
				1																					FB	VB00208-0009-5	
					1																				FB	VB00210-0012-5	
						1																			FB	VB00213-0016-5	
							1																		FB	VB00213-0022-5	
								1																	FB	VB00213-0031-5	
									1																FB	VB00216-0038-5	
										1															FB	VB00216-0045-5	
											1														FB	VB00216-0061-5	
												1													FB	VB00219-0072-5	
													1												FB	VB00219-0087-5	
														1											FB	VB00219-0105-5	
															1										FB	VB00236-0140-5	
																1									FB	VB00236-0168-5	
																	1								FB	VB00236-0205-5	
Electrolytic Capacitors																											
2	2	2	2																						W	PP01000	
				2	2																				W	PP01001	
						2	2																		W	PP01002	
								2																	W	PP01003	
									2	2	2														W	PP01004	
												2	2	2	4	4	4	8	8					W	PP01005		
Cooling Fans																											
1	1	1	1	1	1																				W	PP01060	
						1	1	1																	W	PP01061	
									1	1	1														W	PP01062	
												1	1	1											W	PP01063	
															1	1	1								FC	PP01123 ③	
																		1	1						FC	PP01080 ④	
1	1	1	1	1	1																				W	PP01086	
						1	1	1																	FC	PP01088	
									1	1	1	1	1	1											W	PP01049	
															1	1	1								FC	CP01180	
																		1 ⑤	2						W	PP01068	
																			1	1					FC	PP09051	

② I_L only; has no corresponding I_H rated hp rating.

③ PP00061 capacitor not included in main fan; please order separately.

④ PP00011 capacitor not included in main fan; please order separately.

⑤ For FR9 NEMA Type 12 you need two PP01068 internal fans.

Table 40-250. 9000X Series Replacement Parts — FR4 – FR9 SPX9000 Drives, 380 – 500V (Continued)

Frame:	4						5						6						7						8						9	Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	1	1-1/2	2	3	5	7-1/2 ①	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200														
IGBT Modules																																		
	1	1	1																						W	CP01304								
				1	1																				W	CP01305								
						1		1																	W	CP01306								
									1																W	CP01307								
										1															W	CP01308								
											1	1													W	PP01022								
													1												W	PP01023								
														1											W	PP01024								
															1										W	PP01025								
																	1								W	PP01029								
																		1							W	PP01026								
																			1	1					W	PP01027								
Chopper/Rectifiers																																		
											1	1													W	CP01367								
												1													W	CP01368								
Diode/Thyristor Modules																																		
														3	3	3									W	PP01035								
																	3	3	3						W	CP01268								
																				3	3			W	PP01037									
Rectifying Boards																																		
														1	1	1									W	VB00242								
																	1	1	1						W	VB00227								
																				1	1			W	VB00459									
Rectifying Module Sub-assembly																																		
																				1	1			W	FR09810									
Power Module Sub-assemblies																																		
																				1				W	FR09-150-4-ANS ②									
																					1			W	FR09-200-4-ANS ②									

① I_L only; has no corresponding I_H rated hp rating.

② See Table 40-254 for details.

Table 40-251. 9000X Series Replacement Parts — FR10 – FR12 SPX9000 Drives, 380 – 500V

Frame:	10	11	12	Delivery	Catalog	Price						
hp (I _H):	250	300	350	400	500	550	600	650	700	Code	Number	U.S. \$
Control Board												
1	1	1	1	1	1	1	1	1	1	W	VB00561	
Shunt Boards												
6										FC	VB00537	
	6									FC	VB00497	
		6					12	12	12	FC	VB00498	
			9							FC	VB00538	
				9						FC	VB00513	
					9					FC	VB00514	
Driver Boards												
			3	3	3					FC	VB00489	
1	1	1					2	2	2	FC	VB00487	
Driver Adapter Board												
1	1	1					2	2	2	FC	VB00330	
ASIC Board												
1	1	1	1	1	1		2	2	2	FC	VB00451	
Feedback Interface Board												
							2	2	2	FC	VB00448	
Star Coupler Board												
							1	1	1	FC	VB00336	
Power Modules												
1	1	1	2	2	2		2	2	2	FC	FR10820 ①	
2	2	2								FC	FR10828	
1										FC	FR10-250-4-ANS ②	
	1									FC	FR10-300-4-ANS ②	
		1					2	2	2	FC	FR10-350-4-ANS ②	
			3							FC	FR11-400-4-ANS ②	
				3						FC	FR11-500-4-ANS ②	
					3					FC	FR11-550-4-ANS ②	
Electrolytic Capacitors												
2	2	2	3	3	3		4	4	4	FC	PP00060	
12	12	12	18	18	18		24	24	24	FC	PP01005	
Fuses												
1	1	1	1	1	1		2	2	2	FC	PP01094	
2	2	2	2	2	2		4	4	4	FC	PP01095	
Cooling Fans and Isolation Transformers												
2	2	2	3	3	3		4	4	4	FC	VB00299	
2	2	2	3	3	3		4	4	4	FC	PP01080 ③	
2	2	2					4	4	4	FC	PP01068	
1	1	1	1	1	1		2	2	2	FC	PP01096	
1	1	1					2	2	2	FC	FR10844	
1	1	1	3	3	3		2	2	2	FC	FR10845	
1	1	1					2	2	2	FC	FR10846	
1	1	1	3	3	3		2	2	2	FC	FR10847	
Rectifying Board												
1	1	1	2	2	2		2	2	2	FC	VB00459	

① Rectifying board not included.

② See Table 40-254 for details.

③ PP00060 capacitor not included in main fan; please order separately.

Table 40-252. 9000X Series Replacement Parts — FR6 – FR9 SPX9000 Drives, 525 – 690V

Frame: 6	7										8	9										Delivery Code	Catalog Number	Price U.S. \$
hp (I _H):	2	3	5 ①	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200 ①						
Control Board																								
	1	1	1		1	1		1	1	1	1	1				1	1	1		W	VB00561			
Driver Board																								
	1																			FB	VB00404-0004-6			
		1																		FB	VB00404-0005-6			
			1																	FB	VB00404-0007-6			
				1																FB	VB00404-0010-6			
					1															FB	VB00404-0013-6			
						1														FB	VB00404-0018-6			
							1													FB	VB00404-0022-6			
								1												FB	VB00404-0027-6			
									1											FB	VB00404-0034-6			
Power Boards																								
	1	1	1		1	1		1	1	1	1									FB	VB00414			
											1									FB	VB00419-0041-6			
												1								FB	VB00419-0052-6			
													1							FB	VB00422-0062-6			
														1						FB	VB00422-0080-6			
															1					FB	VB00422-0100-6			
Power Modules																								
															1					FC	FR09-100-5-ANS ②			
																1				FC	FR09-125-5-ANS ②			
																	1			FC	FR09-150-5-ANS ②			
																		1		FC	FR09-175-5-ANS ②			
Electrolytic Capacitors																								
	2	2	2		2	2		2	2	2	2									FC	PP01093			
											2	2	4	4		8	8	8	8	FC	PP01041			
														4						FC	PP01040			
Fuses																								
												1	1	1	1	1	1	1		W	PP01094			
												2	2	2	2	2	2	2		W	PP01095			
Cooling Fans																								
	1	1	1		1	1														W	PP01061			
						1	1	1	1											W	PP01062			
										1	1									W	PP01063			
												1	1	1						FC	PP01123			
	1	1	1		1	1		1	1	1	1	1								W	PP01049			
												1	1	1						FC	CP01180			
															1	1	1	1	③	W	PP01068			
															1	1	1	1		FC	PP01080			
Fan Power Supply																								
																1	1	1		FC	VB00299			
IGBT Modules																								
	3	3	3		3	3		3	3	3										FC	PP01091			
										1	1									FC	PP01089			
												1	1	1						FC	PP01127			
IGBT/Diode (Brake)																								
	1	1	1		1	1		1	1	1	1	1	2	2	2	2	2	2	2	FC	PP01040			
Diode Module																								
	1	1	1		1	1		1	1	1	1									FC	PP01092			
Diode/Thyristor Modules																								
										3	3									FC	PP01071			
															3	3	3	3		FC	PP01072			
Rectifying Boards																								
										1	1									FC	VB00442			
															1	1	1	1		FC	VB00460			
Rectifying Module Sub-assemblies																								
																1	1	1		W	FR09810			
																1	1	1		FC	FR09811			

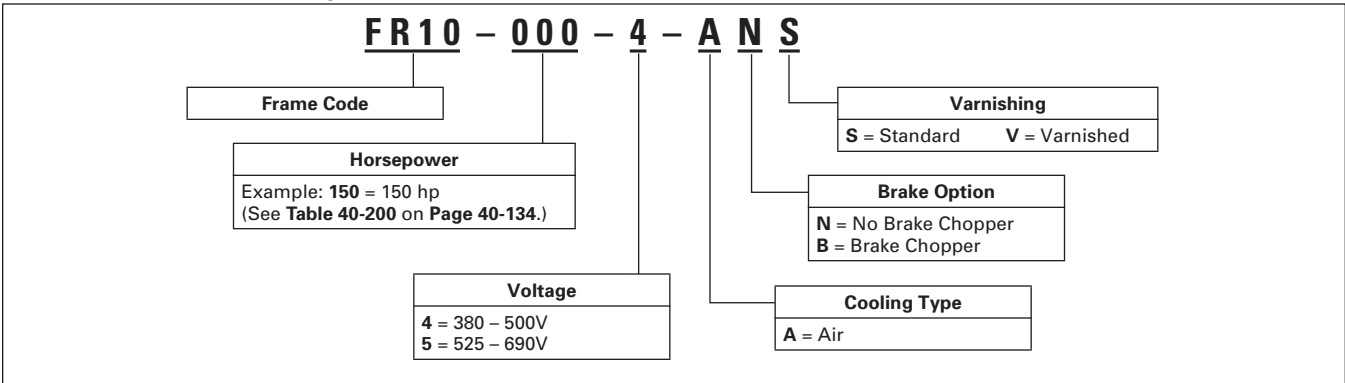
- ① I_L only; has no corresponding I_H rated hp rating.
 ② See Table 40-254 for details.
 ③ For NEMA Type 12, two PP01068 internal fans are needed.

Table 40-253. 9000X Series Replacement Parts — FR10 – FR12 SPX9000 Drives, 525 – 690V

Frame: 10 hp (l _H):			11			12			Delivery Code	Catalog Number	Price U.S. \$
200	250	300	400	450	500	550	600	700			
Component Boards											
1	1	1	1	1	1	1	1	1	W	VB00561	
1	1	1	1	1	1	2	2	2	FC	VB00451	
6									FC	VB00545	
	6								FC	VB00510	
		6				12	12	12	FC	VB00511	
1	1	1				2	2	2	FC	VB00330	
1	1	1				2	2	2	FC	VB00487	
			3	3	3				FC	VB00489	
			9						FC	VB00546	
				9					FC	VB00547	
					9				FC	VB00512	
						2	2	2	FC	VB00448	
						1	1	1	FC	VB00336	
Power Modules											
1	1	1	2	2	2	2	2	2	FC	FR10821 ①	
2	2	2							FC	FR10829	
1									FC	FR10-200-5-ANS ②	
	1								FC	FR10-250-5-ANS ②	
		1				2	2	2	FC	FR10-300-5-ANS ②	
			3						FC	FR11-400-5-ANS ②	
				3					FC	FR11-450-5-ANS ②	
					3				FC	FR11-500-5-ANS ②	
Electrolytic Capacitors											
2	2	2	3	3	3	4	4	4	FC	PP00060	
12	12	12	18	18	18	24	24	24	FC	PP01099	
Fuses											
1	1	1	1	1	1	2	2	2	FC	PP01094	
2	2	2	2	2	2	4	4	4	FC	PP01095	
Cooling Fans and Isolation Transformers											
2	2	2	3	3	3	4	4	4	FC	VB00299	
2	2	2	3	3	3	4	4	4	FC	PP01080 ③	
2	2	2				4	4	4	FC	PP01068	
1	1	1	1	1	1	2	2	2	FC	PP01096	
1	1	1				2	2	2	FC	FR10844	
1	1	1	3	3	3	2	2	2	FC	FR10845	
1	1	1				2	2	2	FC	FR10846	
1	1	1	3	3	3	2	2	2	FC	FR10847	
Fan Power Supply											
						1	1	1	FC	VB00299	
Rectifying Boards											
1	1	1	2	2	2	2	2	2	FC	VB00460	

- ① Rectifying board not included.
② See Table 40-254 for details.
③ PP00060 capacitor not included in main fan; please order separately.

Table 40-254. Power Module Catalog Number Matrix



Contents

Description	Page
HVX9000 Open Drives	
Product Description	40-167
Features and Benefits	40-167
Technical Data and Specifications	40-168
Catalog Number Selection	40-169
Product Selection	40-170
Accessories	40-173
Dimensions	40-175
Replacement Parts	40-189



HVX9000 Open Drives

Product Description

Cutler-Hammer® HVX9000 Series Adjustable Frequency Drives by Eaton's electrical business are the next generation of drives specifically engineered for HVAC, pump and fluid control applications. The power unit makes use of the most sophisticated semiconductor technology and a highly modular construction that can be flexibly adapted to the customer's needs.

The input and output configuration (I/O) is designed with modularity in mind. The I/O is comprised of option cards, each with its own input and output configuration. The control module is designed to accept a total of five of these cards. The cards contain not only normal analog and digital inputs but also fieldbus cards.

These drives continue the tradition of robust performance, and raise the bar on features and functionality, ensuring the best solution at the right price.

Features and Benefits

- Robust design — proven 500,000 hours MTBF
- Integrated 3% line reactors standard on drives from FR4 through FR9
- EMI/RFI Filters standard on all drives from FR4 through FR9
- HAND/OFF/AUTO and DRIVE/BYPASS selector on keypad simplifies control

- Additional I/O and communication cards provide plug and play functionality
- Copy/Paste function allows transfer of parameter settings from one drive to the next
- Keypad can display up to three monitored parameters simultaneously
- Hand-held Auxiliary Power Supply allows programming/monitoring of control module without applying power to the drive
- NEMA Type 1 and NEMA Type 12 enclosures available
- Standard NEMA Type 12 keypad on all drives
- Simplified operating menu allows for typical programming changes, while programming mode provides control of everything
- Accommodates a wide selection of expander boards and adapter boards
- UL Listed
- Quickstart wizard built into programming of drive ensures a smooth start-up
- The HVX can be flexibly adapted to a variety of needs using our pre-installed program
- I/O connections with simple quick connection terminals
- Control logic can be powered from an external auxiliary control panel, internal drive functions and fieldbus if necessary
- Standard option board configuration includes an A9 I/O board and an A2 relay output board installed in slots A and B

Technical Data and Specifications

Table 40-255. HVX9000 Specifications

Description	Specification
Input Ratings	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
Short Circuit Withstand Rating	100 kAIC

Output Ratings

Output Voltage	0 to V_{in}
Continuous Output Current	Ambient temperature max. +104°F(+40°C)
Overload Current	110% (1 min./10 min.)
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz

Control Characteristics

Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control
Switching Frequency	Adjustable with Parameter 2.6.9 1 – 40 hp: 1 to 16 kHz; default 10 kHz 50 – 75 hp: 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy $\pm 1\%$ Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% $\times T_n$ (without brake option)

Ambient Conditions

Ambient Operating Temperature	14°F (-10°C), no frost to 104°F (+40°C)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Vibration	EN 50178, EN 60068-2-6; 5 to 50 Hz, Displacement amplitude 1 mm (peak) at 3 to 15.8 Hz, Max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 50178, EN 60068-2-27 UPS Drop test (for applicable UPS weights) Storage and shipping: max. 15G, 11 ms (in package)
Enclosure Class	NEMA Type 1/IP21 or NEMA Type 12/IP54

Description	Specification
Standards	
Product	IEC 61800-2
Safety	UL 508C
EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H

Control Connections

Analog Input Voltage	0 to 10V, $R = 200\Omega$ differential (-10 to 10V joystick control) Resolution .1%; accuracy $\pm 1\%$
Analog Input Current	0(4) to 20 mA; $R_i = 250\Omega$ differential
Digital Inputs (6)	Positive or negative logic; 18 to 24V DC
Auxiliary Voltage	+24V $\pm 15\%$, max. 250 mA
Output Reference Voltage	+10V $\pm 3\%$, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy $\pm 2\%$
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A

Protections

Overcurrent Protection	Yes
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (Of the +24V and +10V Reference Voltages)

Catalog Number Selection

Table 40-256. Adjustable Frequency Drive Catalog Numbering System

HVX		010		A	1	-	4	A	1	B	1	Options	
Product Family												Options appear in alphabetical order.	
HVX = HVAC Drive Family												Extended I/O Card Options	
Horsepower Rating (I_L)												B1 = 6 DI, 1 ext +24V DC/EXT +24V DC B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm B4 = 1 AI (mA isolated), 2 AO (mA isolated) B5 = 1 ext +24V DC/EXT +24V DC, 3 RO (NO) B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100 B9 = 1 RO (NO), 5 DI 42 – 240V AC Input	
001 = 1	020 = 20	125 = 125										Communication Cards	
F15 = 1-1/2	025 = 25	150 = 150										CA = Johnson Controls N2 CB = Siemens Apogee FLN CJ = BACnet C2 = Modbus C4 = LonWorks C8 = Modbus (D9 Type Connector) D3 = RS-232 with D9 Connection	
002 = 2	030 = 30	200 = 200											
003 = 3	040 = 40	250 = 250											
005 = 5	050 = 50	300 = 300											
007 = 7-1/2	060 = 60	400 = 400											
010 = 10	075 = 75												
015 = 15	100 = 100												
				Software Series									
				A = Standard Software									
						Enclosure ③							
						0 = Chassis 1 = NEMA Type 1		2 = NEMA Type 12					
												Board Modifications	
												1 = Standard Boards	

- ① All 230V Drives and 480V Drives up to 250 hp (I_L) are only available with Input Option 1. 480V Freestanding Drives are available with Input Option 4 (EMC Level L). 2. 575V Drives up to 200 hp (I_L) are only available with Input Option 4 (EMC Level L).
- ② 480V Drives up to 40 hp (I_L) are only available with Brake Chopper Option B. 480V Drives 50 hp (I_L) or larger are only available with Brake Chopper Option N. 230V Drives up to 20 hp (I_L) are only available with Brake Chopper Option B. 575V Drives are standard without Brake Chopper Option (N).
- ③ 480V Drives 300 – 600 hp (I_L) are available with enclosure style 0 (Chassis). 480V FR10 Freestanding Drives are available with enclosure style 1 (NEMA Type 1) or 2 (NEMA Type 12). FR11 Freestanding Drives are only available with enclosure style 1 (NEMA Type 1).

Open Drives

Product Selection

230V HVX9000 Drives

Table 40-257. 208 – 240V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	1	4.8	HVX001A1-2A1B1	
		1-1/2	6.6	HVXF15A1-2A1B1	
		2	7.8	HVX002A1-2A1B1	
		3	11	HVX003A1-2A1B1	
FR5	F1	5	17.5	HVX005A1-2A1B1	
		7-1/2	25	HVX007A1-2A1B1	
		10	31	HVX010A1-2A1B1	
FR6	F1	15	48	HVX015A1-2A1B1	
		20	61	HVX020A1-2A1B1	
FR7	F1	25	75	HVX025A1-2A1N1	
		30	88	HVX030A1-2A1N1	
		40	114	HVX040A1-2A1N1	
FR8	F1	50	140	HVX050A1-2A1N1	
		60	170	HVX060A1-2A1N1	
		75	205	HVX075A1-2A1N1	

Table 40-258. 208 – 240V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	1	4.8	HVX001A2-2A1B1	
		1-1/2	6.6	HVXF15A2-2A1B1	
		2	7.8	HVX002A2-2A1B1	
		3	11	HVX003A2-2A1B1	
FR5	F1	5	17.5	HVX005A2-2A1B1	
		7-1/2	25	HVX007A2-2A1B1	
		10	31	HVX010A2-2A1B1	
FR6	F1	15	48	HVX015A2-2A1B1	
		20	61	HVX020A2-2A1B1	
FR7	F1	25	75	HVX025A2-2A1N1	
		30	88	HVX030A2-2A1N1	
		40	114	HVX040A2-2A1N1	
FR8	FP	50	140	HVX050A2-2A1N1	
		60	170	HVX060A2-2A1N1	
		75	205	HVX075A2-2A1N1	

480V HVX9000 Drives

Table 40-259. 380 – 500V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	1-1/2	3.3	HVXF15A1-4A1B1	
		2	4.3	HVX002A1-4A1B1	
		3	5.6	HVX003A1-4A1B1	
		5	7.6	HVX005A1-4A1B1	
		7-1/2	12	HVX007A1-4A1B1	
FR5	F1	10	16	HVX010A1-4A1B1	
		15	23	HVX015A1-4A1B1	
		20	31	HVX020A1-4A1B1	
FR6	F1	25	38	HVX025A1-4A1B1	
		30	46	HVX030A1-4A1B1	
		40	61	HVX040A1-4A1B1	
FR7	F1	50	72	HVX050A1-4A1N1	
		60	87	HVX060A1-4A1N1	
		75	105	HVX075A1-4A1N1	
FR8	F1	100	140	HVX100A1-4A1N1	
		125	170	HVX125A1-4A1N1	
		150	205	HVX150A1-4A1N1	
FR9	F1	200	261	HVX200A1-4A1N1	
		250	300	HVX250A1-4A1N1	

Discount Symbol..... SS-6

Open Drives

Table 40-260. 380 – 500V, NEMA Type 1 Freestanding Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	W	300	385	HVX300A1-4A4N1	
	FP	350	460	HVX350A1-4A4N1	
	W	400	520	HVX400A1-4A4N1	
FR11	FP	500	590	HVX500A1-4A4N1	
	FP	550	650	HVX550A1-4A4N1	
	FP	600	730	HVX600A1-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option Selection on **Page 40-174**.

Table 40-261. 380 – 500V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR4	F1	1-1/2	3.3	HVXF15A2-4A1B1	
		2	4.3	HVX002A2-4A1B1	
		3	5.6	HVX003A2-4A1B1	
		5	7.6	HVX005A2-4A1B1	
		7-1/2	12	HVX007A2-4A1B1	
FR5	F1	10	16	HVX010A2-4A1B1	
		15	23	HVX015A2-4A1B1	
		20	31	HVX020A2-4A1B1	
FR6	F1	25	38	HVX025A2-4A1B1	
		30	46	HVX030A2-4A1B1	
		40	61	HVX040A2-4A1B1	
FR7	F1	50	72	HVX050A2-4A1N1	
		60	87	HVX060A2-4A1N1	
		75	105	HVX075A2-4A1N1	
FR8	F1	100	140	HVX100A2-4A1N1	
		125	170	HVX125A2-4A1N1	
		150	205	HVX150A2-4A1N1	
FR9	F1	200	261	HVX200A2-4A1N1	
		250	300	HVX250A2-4A1N1	

Table 40-262. 380 – 500V, NEMA Type 12 Freestanding Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10	FP	300	385	HVX300A2-4A4N1	
	FP	350	460	HVX350A2-4A4N1	
	FP	400	520	HVX400A2-4A4N1	

Note: Integrated fuses as standard. Limited option selection available; 115V Transformer (KB), Light Kit (L1), HOA (K4), Speed Potentiometer w/HOA (K2), Disconnect Switch (P2). See Freestanding Option Selection on **Page 40-174**.

Table 40-263. 380 – 500V, Open Chassis Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR10 ①	F1	300	385	HVX300A0-4A2N1	
		350	460	HVX350A0-4A2N1	
		400	520	HVX400A0-4A2N1	
FR11	F1	500	590	HVX500A0-4A2N1	
	F1	550	650	HVX550A0-4A2N1	
	F1	600	1300	HVX600A0-4A2N1	

① FR10 includes 3% line reactor, but it is not integrated to chassis.

Open Drives

575V HVX9000 Drives

Table 40-264. 525 – 690V, NEMA Type 1 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	F1	3	4.5	HVX003A1-5A4N1	
		5	7.5	HVX005A1-5A4N1	
		7-1/2	10	HVX007A1-5A4N1	
		10	13.5	HVX010A1-5A4N1	
		15	18	HVX015A1-5A4N1	
		20	22	HVX020A1-5A4N1	
		25	27	HVX025A1-5A4N1	
		30	34	HVX030A1-5A4N1	
FR7	F1	40	41	HVX040A1-5A4N1	
		50	52	HVX050A1-5A4N1	
FR8	F1	60	62	HVX060A1-5A4N1	
		75	80	HVX075A1-5A4N1	
		100	100	HVX100A1-5A4N1	
FR9	F1	125	125	HVX125A1-5A4N1	
		150	144	HVX150A1-5A4N1	
		200	208	HVX200A1-5A4N1	

Table 40-265. 525 – 690V, NEMA Type 12 Drive

Frame Size	Delivery Code	hp (I _L)	Current (I _L)	Catalog Number	Price U.S. \$
FR6	F1	3	4.5	HVX003A2-5A4N1	
		5	7.5	HVX005A2-5A4N1	
		7-1/2	10	HVX007A2-5A4N1	
		10	13.5	HVX010A2-5A4N1	
		15	18	HVX015A2-5A4N1	
		20	22	HVX020A2-5A4N1	
		25	27	HVX025A2-5A4N1	
		30	34	HVX030A2-5A4N1	
FR7	MP28	40	41	HVX040A2-5A4N1	
		50	52	HVX050A2-5A4N1	
FR8	MP28	60	62	HVX060A2-5A4N1	
		75	80	HVX075A2-5A4N1	
		100	100	HVX100A2-5A4N1	
FR9	MP28	125	125	HVX125A2-5A4N1	
		150	144	HVX150A2-5A4N1	
		200	208	HVX200A2-5A4N1	

40

9000X Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-84**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

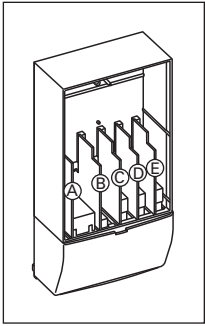


Figure 40-84. 9000X Series Option Boards

Table 40-266. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed	
		Catalog Number	Price U.S. \$	Option Designator	Adder U.S. \$
Standard I/O Cards (See Figure 40-84)					
2 RO (NC/NO) 6 DI, 1 DO, 2 AI, 1 AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	B A	OPTA2 OPTA9		— —	
Extended I/O Card Options					
6 DI, 1 ext +24V DC/EXT +24V DC 1 RO (NC/NO), 1 RO (NO), 1 Therm 1 AI (mA isolated), 2 AO (mA isolated) 1 ext +24V DC/ EXT +24V DC, 3 RO (NO) 1 ext +24V DC/EXT +24V DC, 3 Pt100 1 RO (NO), 5 DI 42 – 240V AC Input	B, C, D, E B, C, D, E C, D C, D B, C, D, E B, C, D, E	OPTB1 OPTB2 OPTB4 OPTB5 OPTB8 OPTB9		B1 B2 B4 B5 B8 B9	
Communication Cards ③④					
Modbus Johnson Controls N2 LonWorks Modbus (D9 Type Connector) Siemens Apogee FLN BACnet RS-232 with D9 Connection	D, E D, E D, E D, E D, E D, E	OPTC2 OPTC2 OPTC4 OPTC8 OPTCB OPTCJ OPTD3		C2 CA C4 C8 CB CJ D3	
Keypad					
9000X Series HAND/OFF/AUTO Keypad	—	KEYPAD-HOA		—	
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMT-KIT- 9000X		—	

① Option card must be installed in one of the slots listed for that card. Slot indicated in **Bold** is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ Only one Communication Module can be installed at a time.

④ OPTC2 is a multi-protocol option card.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm plug-gable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Accessories**Drive Demo and Power Supply****Table 40-267. Drive Demo and Power Supply**

Description	Catalog Number	Price U.S. \$
HVX9000 Drive Demo	9000HVXDEMO	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	9000XAUX24V	

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Open Drives

NEMA Type 12 Conversion Kit

The NEMA Type 12 kit option is used to convert a NEMA Type 1 to a NEMA Type 12 drive. The NEMA Type 12 Kit consists of a metal drive shroud, fan kit for some frames, adapter plate and plugs.

Flange Kits

Flange Kit Type 12

The flange kit is utilized when the power section is mounted through the back panel of an enclosure. Includes flange mount brackets and NEMA Type 12 fan components. Metal shroud not included.

Table 40-268. Flange Kit Type 12 —
Frames 4, 5 and 6 ①

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	W	OPTTHRFR4	
FR5	W	OPTTHRFR5	
FR6	W	OPTTHRFR6	

① For installation of a NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.

Flange Kit Type 1

Flange kits for NEMA Type 1 enclosure drive rating determined by rating of drive.

Table 40-269. Flange Kit Type 1 —
Frames 4 – 9 ②

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

② For installation of a NEMA Type 1 drive into a NEMA Type 1 oversized enclosure.

Flange Kit Type 12

Flange kits for NEMA Type 12 enclosure drive rating determined by rating of drive.

Table 40-270. Flange Kit Type 12 —
Frames 4 – 9 ③

Frame Size	Delivery Code	Catalog Number	Price U.S. \$
FR4	FP	OPTTHR4	
FR5	FP	OPTTHR5	
FR6	FP	OPTTHR6	
FR7	FP	OPTTHR7	
FR8	FP	OPTTHR8	
FR9	FP	OPTTHR9	

③ For installation of a NEMA Type 12 drive into a NEMA Type 12 oversized enclosure.

Table 40-271. NEMA Type 12 Conversion Kit

Frame Size	Delivery Code	Approximate Dimensions in Inches (mm)			Approximate Weight in Lb. (kg)	Catalog Number	Price U.S. \$
		Length	Width	Height	Weight		
FR4	W	13 (330)	7 (178)	4 (102)	4 (1.8)	OPTN12FR4	
FR5	W	16 (406)	8 (203)	7 (178)	5 (2.3)	OPTN12FR5	
FR6	W	21 (533)	10 (254)	5 (127)	7 (3.2)	OPTN12FR6	

Control/Communication Option Descriptions

Table 40-272. Available Control/Communications Options

Option	Description	Option Type
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the HVX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and FieldBus.	Control
KB	115V Control Transformer – 550 VA — Provides a fused control power transformer with additional 550 VA at 115V for customer use.	Control
L1	Power On and Fault Pilot Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light indicates a drive fault has occurred.	Light
P2	Disconnect Switch — Disconnect switch option is applicable only with NEMA Type 1 and NEMA Type 12 Freestanding drives. Allows a convenient means of disconnecting the HVX9000 from the line, and the operating mechanism can be padlocked in the OFF position. This is factory-mounted in the enclosure.	Input

HVX Freestanding Options

Table 40-273. 480V and 690V Control Options




Catalog Number Suffix 	Door-Mounted Speed Potentiometer with HOA Selector Switch	HAND/OFF/AUTO Switch (22 mm)	115 Volt Control Transformer 550 VA
	K2	K4	KB
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
300 – 600			

Table 40-274. Input Options

Catalog Number Suffix 	Disconnect Switch
	P2 ④
hp	Adder U.S. \$
300	
350	
400	
500	
550	
600	

④ Applicable with FR10 and FR11 Freestanding designs only.

Table 40-275. 480V and 690V Light Options

Catalog Number Suffix 	Power On/Fault Pilot Lights
	L1
hp	Adder U.S. \$
300 – 600	

Dimensions

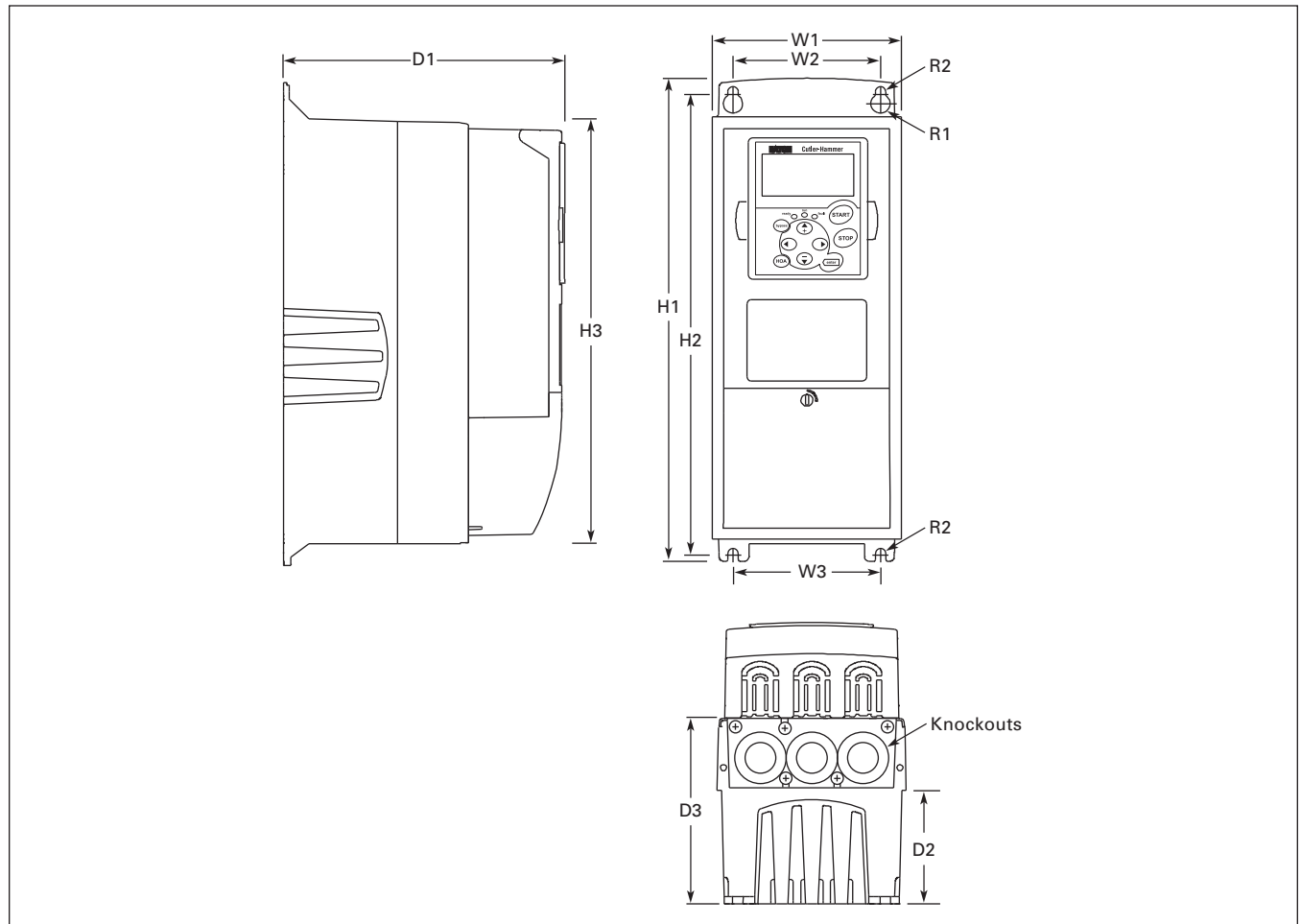


Figure 40-85. NEMA Type 1 and NEMA Type 12 HVX9000 Drive Dimensions, FR4, FR5 and FR6

Table 40-276. HVX9000 Drive Dimensions

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)											Weight Lbs. (kg)	Knockouts @ Inches (mm)	
			H1	H2	H3	D1	D2	D3	W1	W2	W3	R1 dia.	R2 dia.		N1 (O.D.)	
FR4	230V	1 – 3	12.9 (327)	12.3 (313)	11.5 (292)	7.5 (190)	3.0 (77)	5.0 (126)	5.0 (128)	3.9 (100)	—	.5 (13)	.3 (7)	11.0 (5)	3 @ 1.1 (28)	
	480V	1-1/2 – 7-1/2														
FR5	230V	5 – 10	16.5 (419)	16.0 (406)	15.3 (389)	8.4 (214)	3.9 (100)	5.8 (148)	5.6 (143)	3.9 (100)	—	.5 (13)	.3 (7)	17.9 (8)	2 @ 1.5 (37)	
	480V	10 – 20													1 @ 1.1 (28)	
FR6	230V	15 – 20	22.0 (558)	21.3 (541)	20.4 (519)	9.3 (237)	4.2 (105)	6.5 (165)	7.6 (195)	5.8 (148)	—	.6 (15.5)	.4 (9)	40.8 (19)	3 @ 1.5 (37)	
	480V	25 – 40														

Open Drives

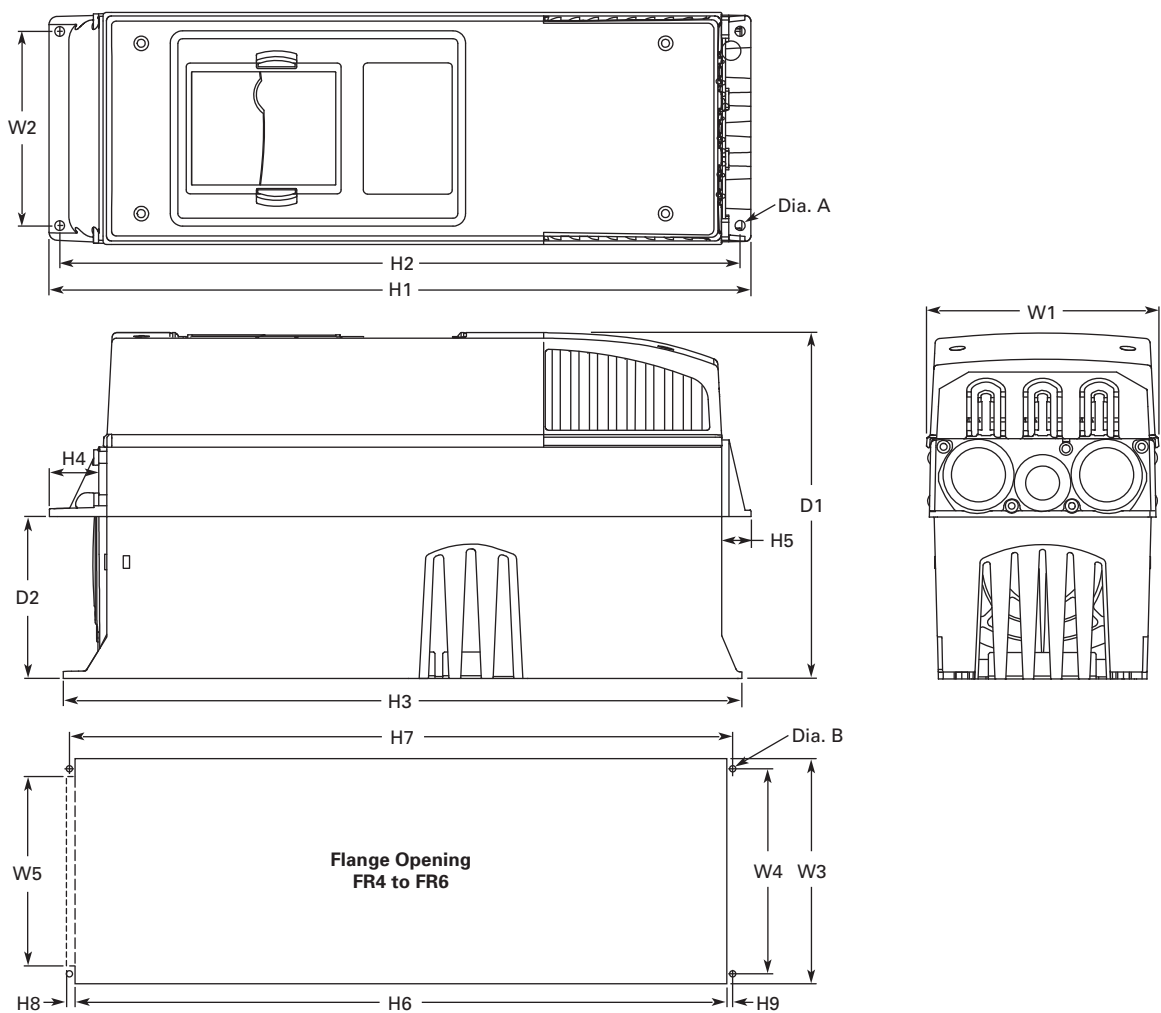


Figure 40-86. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 with Flange Kit, FR4, FR5 and FR6

Table 40-277. Dimensions for HVX9000, FR4, FR5 and FR6 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)									
	W1	W2	H1	H2	H3	H4	H5	D1	D2	Dia. A
FR4	5.0 (128)	4.5 (113)	13.3 (337)	12.8 (325)	12.9 (327)	1.2 (30)	.9 (22)	7.5 (190)	3.0 (77)	.3 (7)
FR5	5.6 (143)	4.7 (120)	17.0 (434)	16.5 (420)	16.5 (419)	1.4 (36)	.7 (18)	8.4 (214)	3.9 (100)	.3 (7)
FR6	7.7 (195)	6.7 (170)	22.0 (560)	21.6 (549)	22.0 (558)	1.2 (30)	.8 (20)	9.3 (237)	4.2 (106)	.3 (7)

Table 40-278. Dimensions for the Flange Opening, FR4 to FR6

Frame Size	Approximate Dimensions in Inches (mm)							
	W3	W4	W5	H6	H7	H8	H9	Dia. B
FR4	4.8 (123)	4.5 (113)	—	12.4 (315)	12.8 (325)	—	.2 (5)	.3 (7)
FR5	5.3 (135)	4.7 (120)	—	16.2 (410)	16.5 (420)	—	.2 (5)	.3 (7)
FR6	7.3 (185)	6.7 (170)	6.2 (157)	21.2 (539)	21.6 (549)	.3 (7)	.2 (5)	.3 (7)

Open Drives

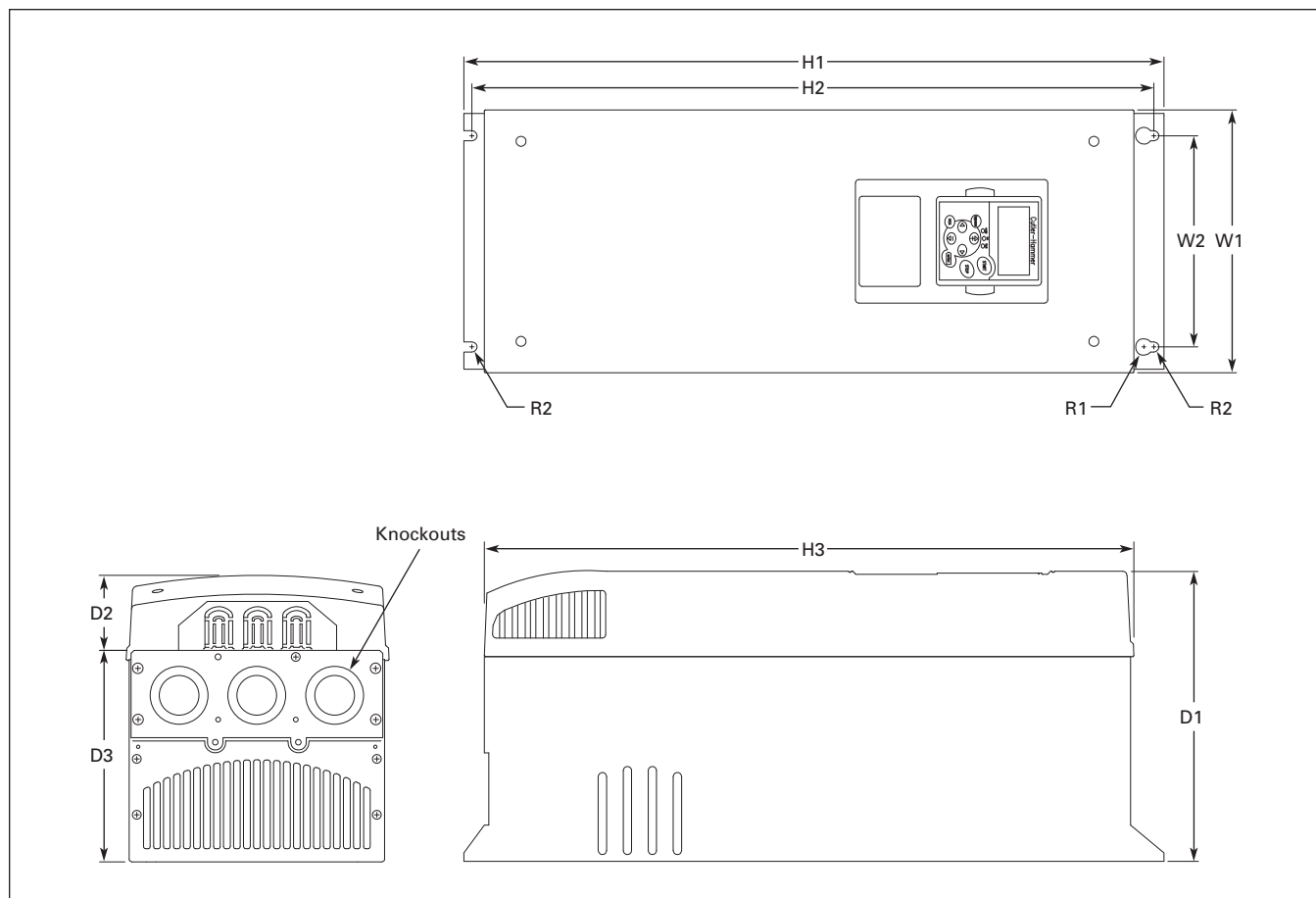


Figure 40-87. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR7

Table 40-279. HVX9000 Drive Dimensions, FR7

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)										Weight Lbs. (kg)	Knockouts @ Inches (mm)	
			H1	H2	H3	D1	D2	D3	W1	W2	R1 dia.	R2 dia.		N1 (O.D.)	
FR7	230V	25 – 40	24.8	24.2	23.2	10.1	3.0	7.3	9.3	7.5	.7	.4	77.2 (35)	3 @ 1.5 (37)	
	480V	50 – 75	(630)	(614)	(590)	(257)	(77)	(184)	(237)	(190)	(18)	(9)			
	575V	40 – 50													

Open Drives

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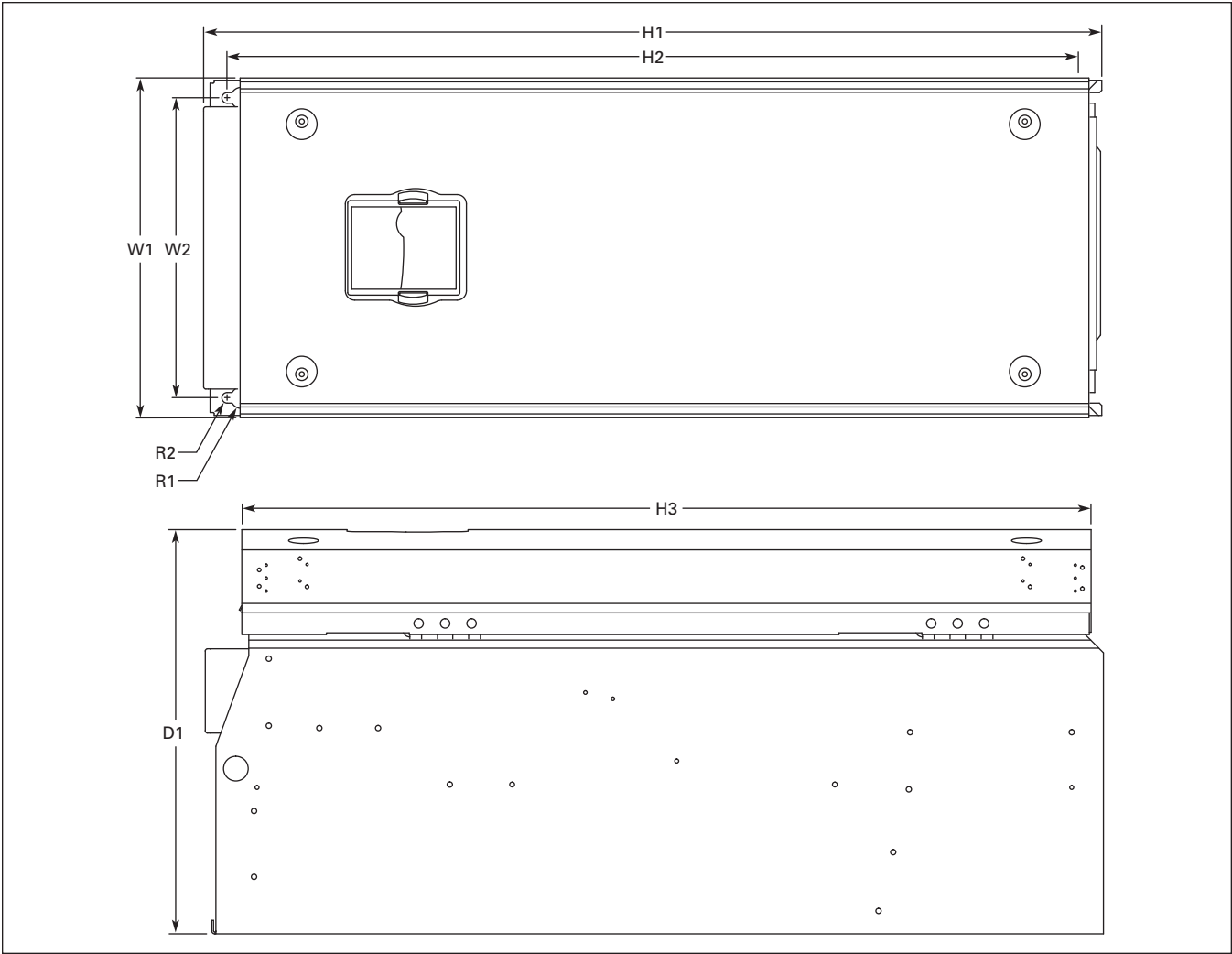


Figure 40-88. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR8

Table 40-280. HVX9000 Drive Dimensions, FR8

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)							
			D1	H1	H2	H3	W1	W2	R1 dia.	R2 dia.
FR8	230V	50 – 75	13.5 (344)	30.1 (764)	28.8 (732)	28.4 (721)	11.5 (291)	10 (255)	.7 (18)	.4 (9)
	480V	100 – 150								
	575V	60 – 100								

Open Drives

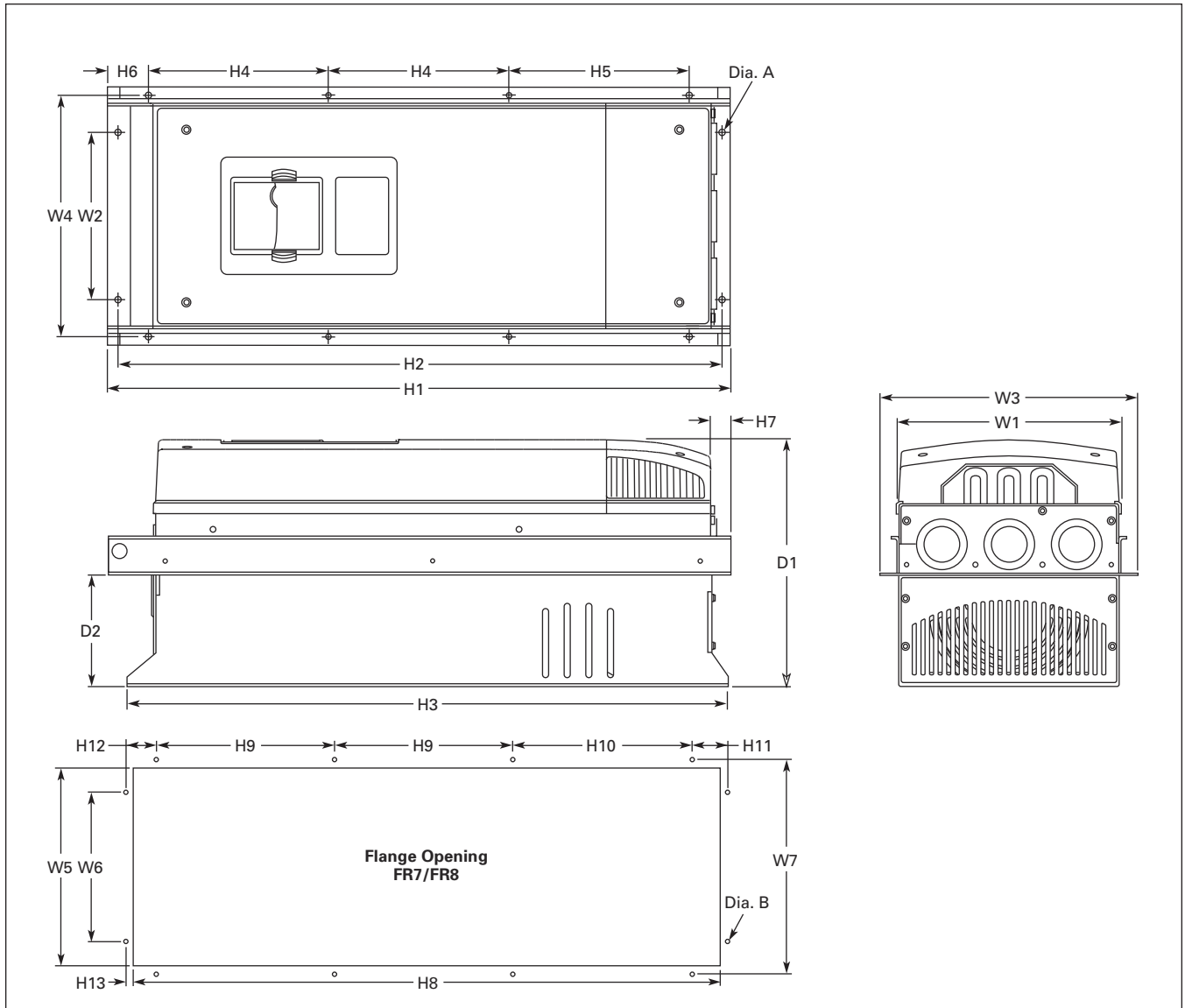


Figure 40-89. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, with Flange Kit, FR7 and FR8

Table 40-281. Dimensions for HVX9000, FR7 and FR8 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)													
	W1	W2	W3	W4	H1	H2	H3	H4	H5	H6	H7	D1	D2	Dia. A
FR7	9.3 (237)	6.8 (175)	10.6 (270)	10.0 (253)	25.6 (652)	24.8 (632)	24.8 (630)	7.4 (189)	7.4 (189)	.9 (23)	.8 (20)	10.1 (257)	4.6 (117)	.3 (6)
FR8	11.2 (285)	—	14.0 (355)	13.0 (330)	32.8 (832)	—	29.3 (745)	10.2 (258)	10.4 (265)	1.7 (43)	2.2 (57)	13.5 (344)	4.3 (110)	.4 (9)

Table 40-282. Dimensions for the Flange Opening, FR7/FR8

Frame Size	Approximate Dimensions in Inches (mm)									
	W5	W6	W7	H8	H9	H10	H11	H12	H13	Dia. B
FR7	9.2 (233)	6.9 (175)	10.0 (253)	24.4 (619)	7.4 (189)	7.4 (189)	1.4 (35)	1.3 (32)	.3 (7)	.3 (6)
FR8	11.9 (301)	—	13.0 (330)	31.9 (810)	10.2 (258)	10.4 (265)	—	—	—	.4 (9)

Open Drives

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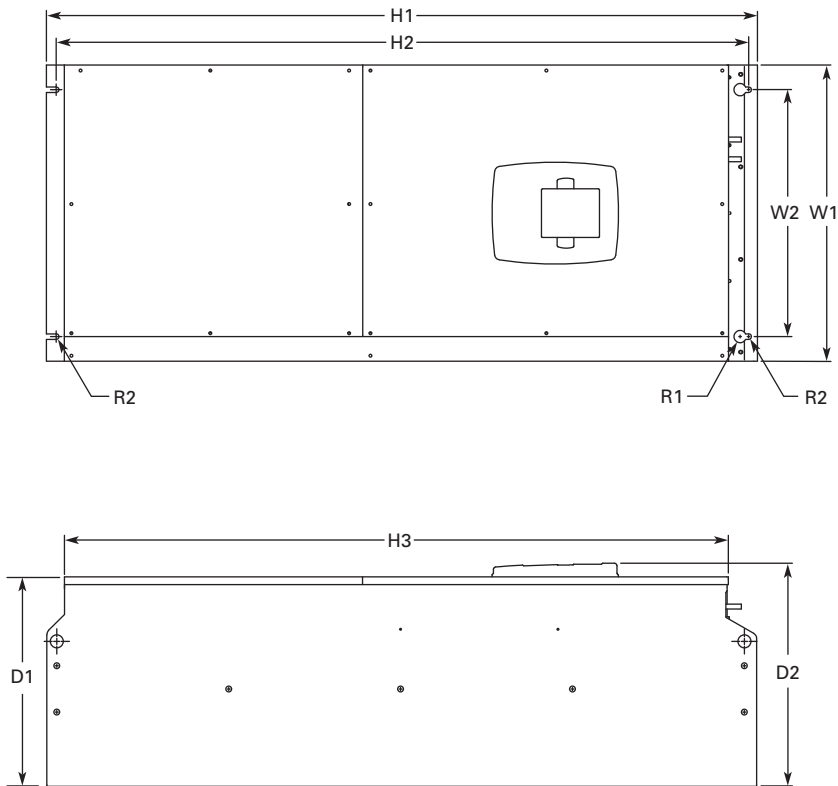


Figure 40-90. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12, FR9

Table 40-283. HVX9000 Drive Dimensions, FR9

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)								
			H1	H2	H3	D1	D2	W1	W2	R1 dia.	R2 dia.
FR9	480	200 – 250	45.3	44.1	42.4	13.4	14.3	18.9	15.7	.8	.4
	575	125 – 200	(1150)	(1120)	(1076)	(340)	(362)	(480)	(400)	(20)	(9)

Open Drives

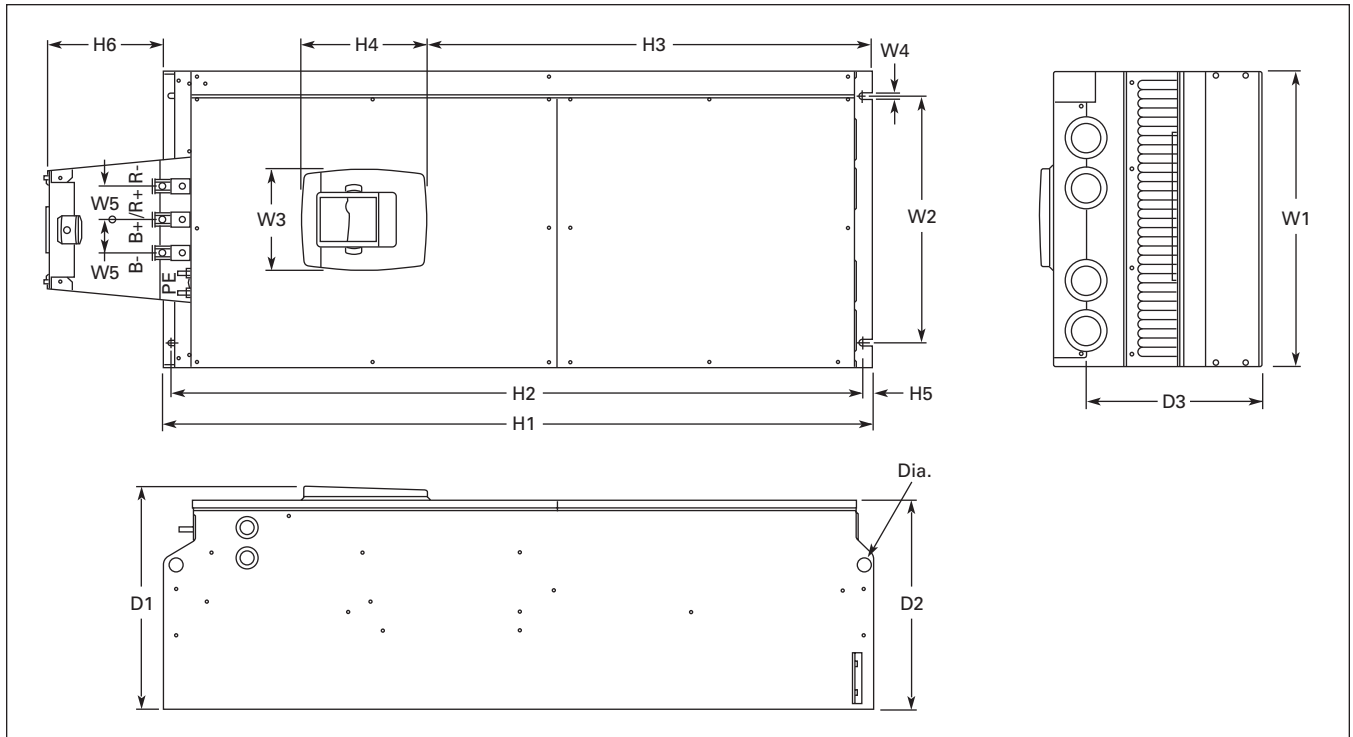


Figure 40-91. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9

Table 40-284. Dimensions for HVX9000, FR9

Frame Size	Approximate Dimensions in Inches (mm)														
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6 ①	D1	D2	D3	Dia.
FR9	18.9 (480)	15.7 (400)	6.5 (165)	.4 (9)	2.1 (54)	45.3 (1150)	44.1 (1120)	28.3 (721)	8.0 (205)	.6 (16)	7.4 (188)	14.2 (361.5)	13.4 (340)	11.2 (285)	.8 (21)

① Brake resistor terminal box (H6) included when brake chopper ordered.

Open Drives

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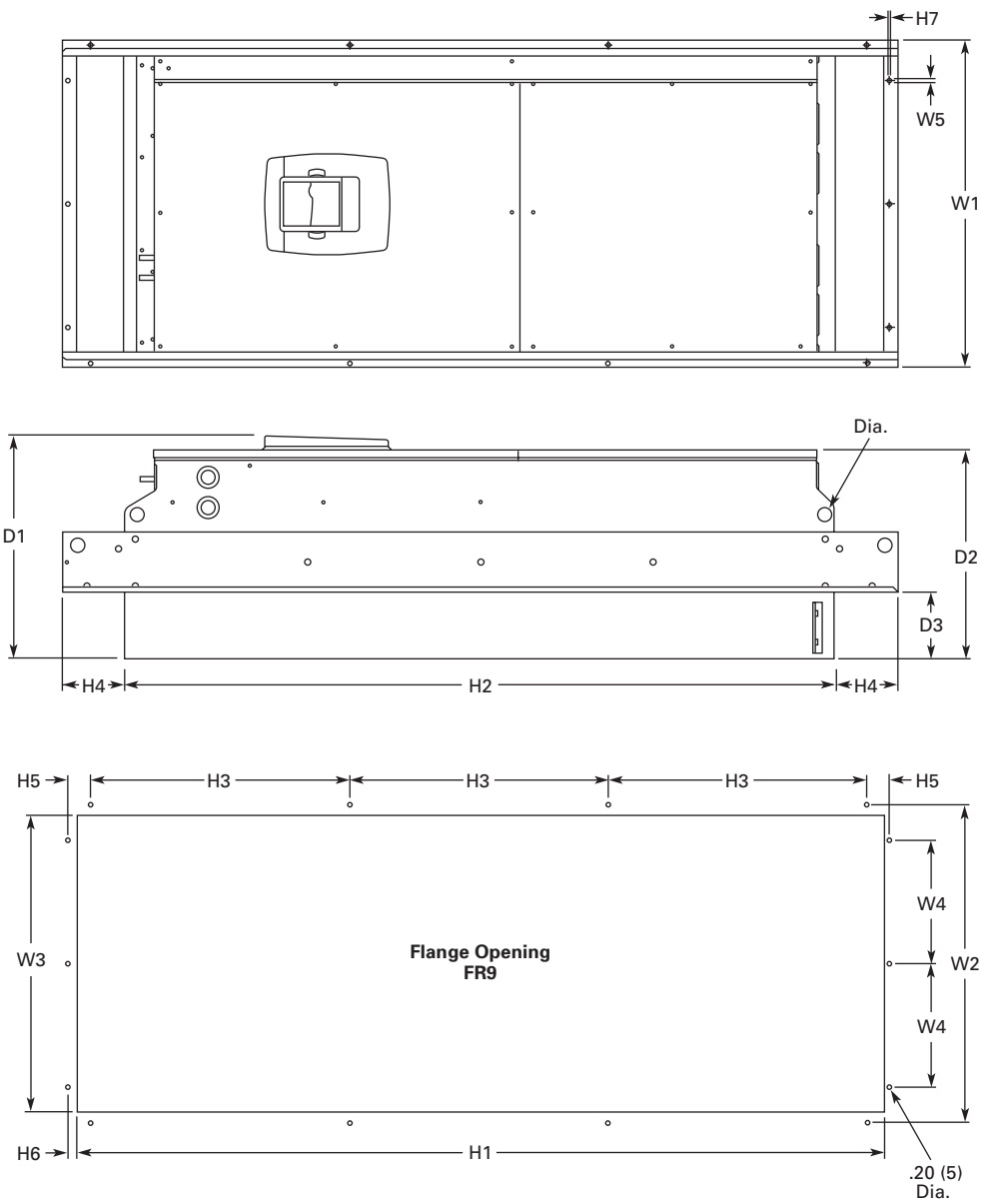


Figure 40-92. HVX9000 Dimensions, NEMA Type 1 and NEMA Type 12 FR9 with Flange Kit

Table 40-285. Dimensions for HVX9000, FR9 with Flange Kit

Frame Size	Approximate Dimensions in Inches (mm)															
	W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	Dia.
FR9	20.9 (530)	20.0 (510)	19.1 (485)	7.9 (200)	.2 (5.5)	51.7 (1312)	45.3 (1150)	16.5 (420)	3.9 (100)	1.4 (35)	.4 (9)	.1 (2)	24.9 (362)	13.4 (340)	4.3 (109)	.8 (21)

Open Drives

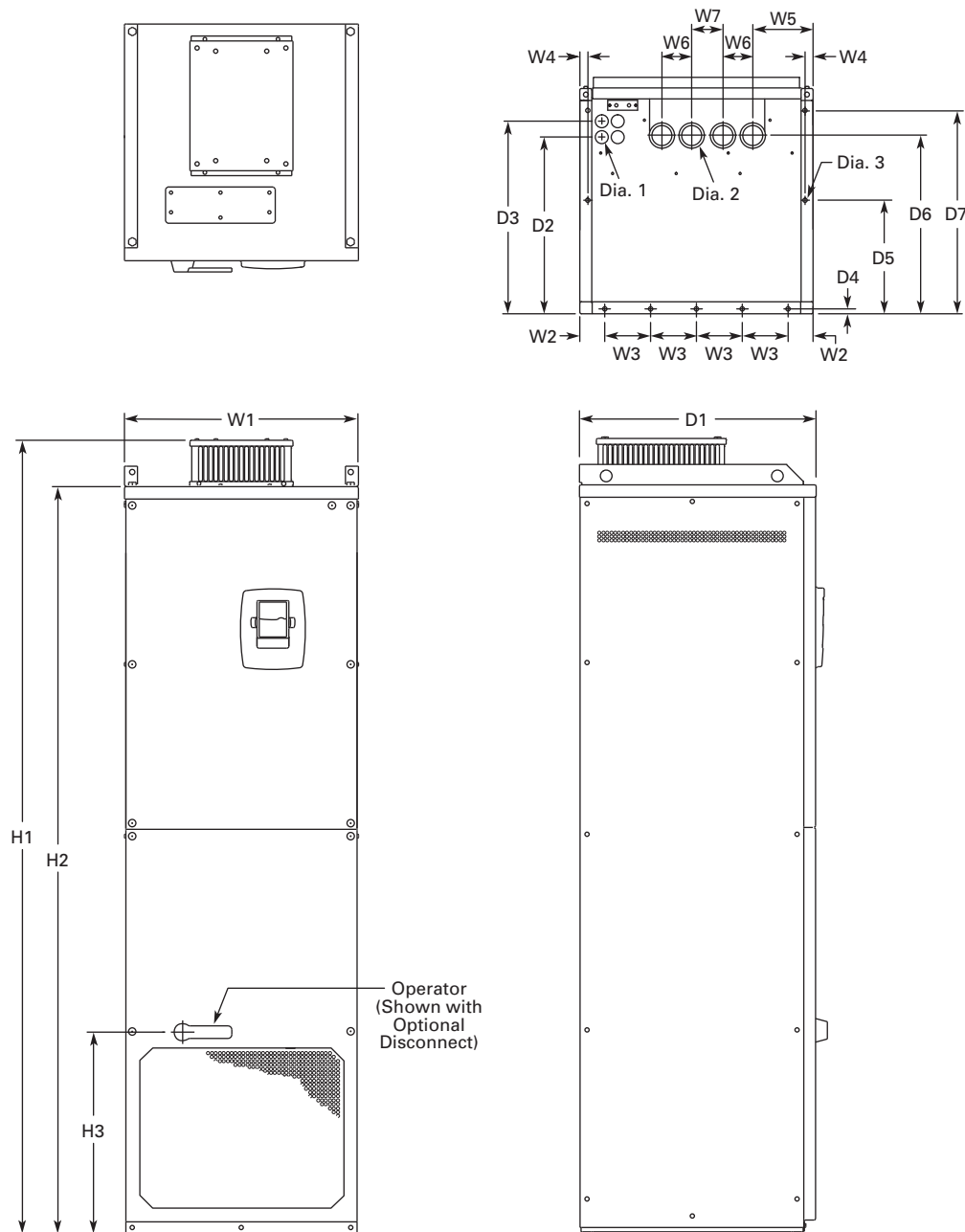


Figure 40-93. 9000X Dimensions, NEMA Type 1 and NEMA Type 12 FR10 Freestanding Drive

Table 40-286. Dimensions for 9000X, FR10 Freestanding Drive

Frame Size	Approximate Dimensions in Inches (mm)																				Weight lbs. (kg)
	W1	W2	W3	W4	W5	W6	W7	H1	H2	H3	D1	D2	D3	D4	D5	D6	D7	Dia. 1	Dia. 2	Dia. 3	
FR10	23.43 (595)	2.46 (62.5)	4.53 (115)	.79 (20)	5.95 (151)	2.95 (75)	3.11 (79)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	17.44 (443)	19.02 (483)	.47 (12)	11.22 (285)	17.60 (447)	20.08 (510)	.83 (21)	1.89 (48)	.43 (11)	857 (389)

Open Drives

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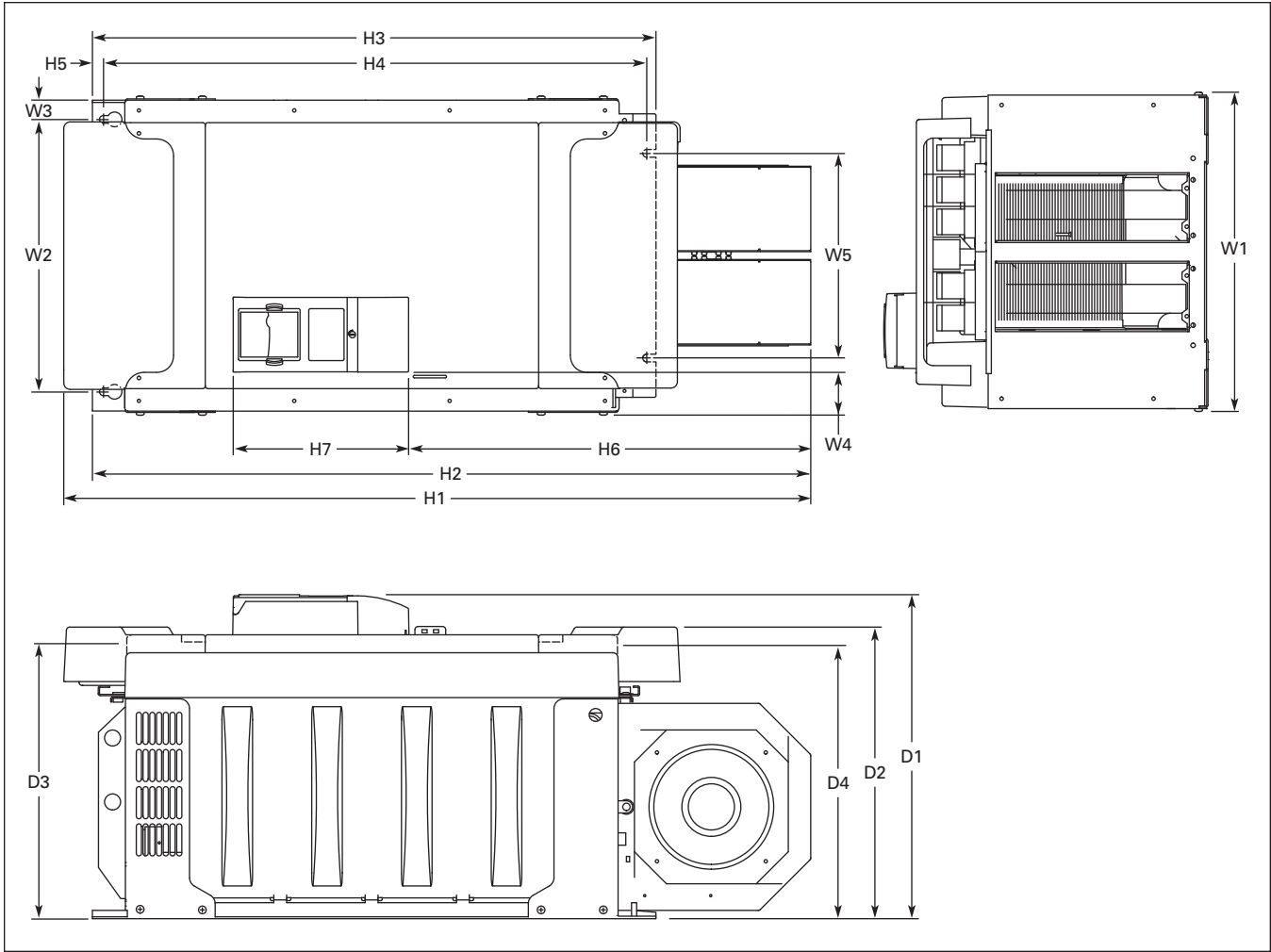


Figure 40-94. HVX9000 Dimensions, FR10 Open Chassis

Table 40-287. Dimensions for HVX9000, FR10 Open Chassis

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)															
			W1	W2	W3	W4	W5	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4
FR10	480V	300 – 400	19.7 (500)	16.7 (425)	1.2 (30)	2.6 (67)	12.8 (325)	45.9 (1165)	44.1 (1121)	34.6 (879)	33.5 (850)	.7 (17)	24.7 (627)	10.8 (275)	19.9 (506)	17.9 (455)	16.7 (423)	16.6 (421)

Open Drives

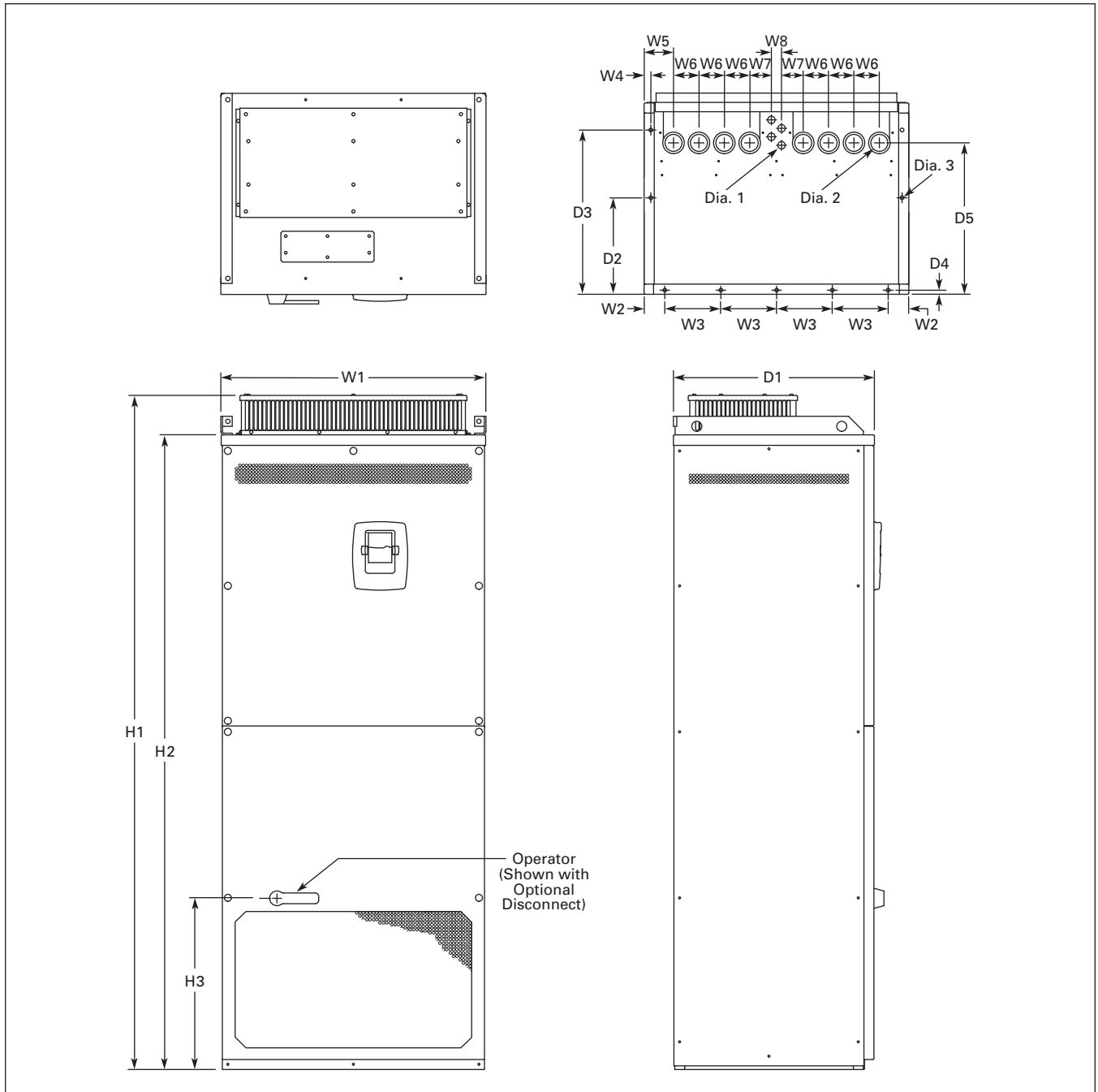


Figure 40-95. HVX9000 Dimensions, NEMA Type 1 FR11 Freestanding Drive

Table 40-288. Dimensions for HVX9000, NEMA Type 1 FR11 Freestanding Drive

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)																		Weight Lbs. (kg)	
			W1	W2	W3	W4	W5	W6	W7	W8	H1	H2	H3	D1	D2	D3	D4	D5	Dia. 1	Dia. 2		Dia. 3
FR11	480V	500 – 600	31.26 (794)	2.40 (61)	6.50 (165)	.79 (20)	3.43 (87)	2.95 (75)	2.52 (64)	1.18 (30)	79.45 (2018)	74.80 (1900)	20.18 (512.5)	23.70 (602)	11.22 (285)	19.09 (485)	.47 (12)	17.60 (447)	.83 (21)	1.89 (48)	.35 x .43 (9 x 11)	526 (239)

Open Drives

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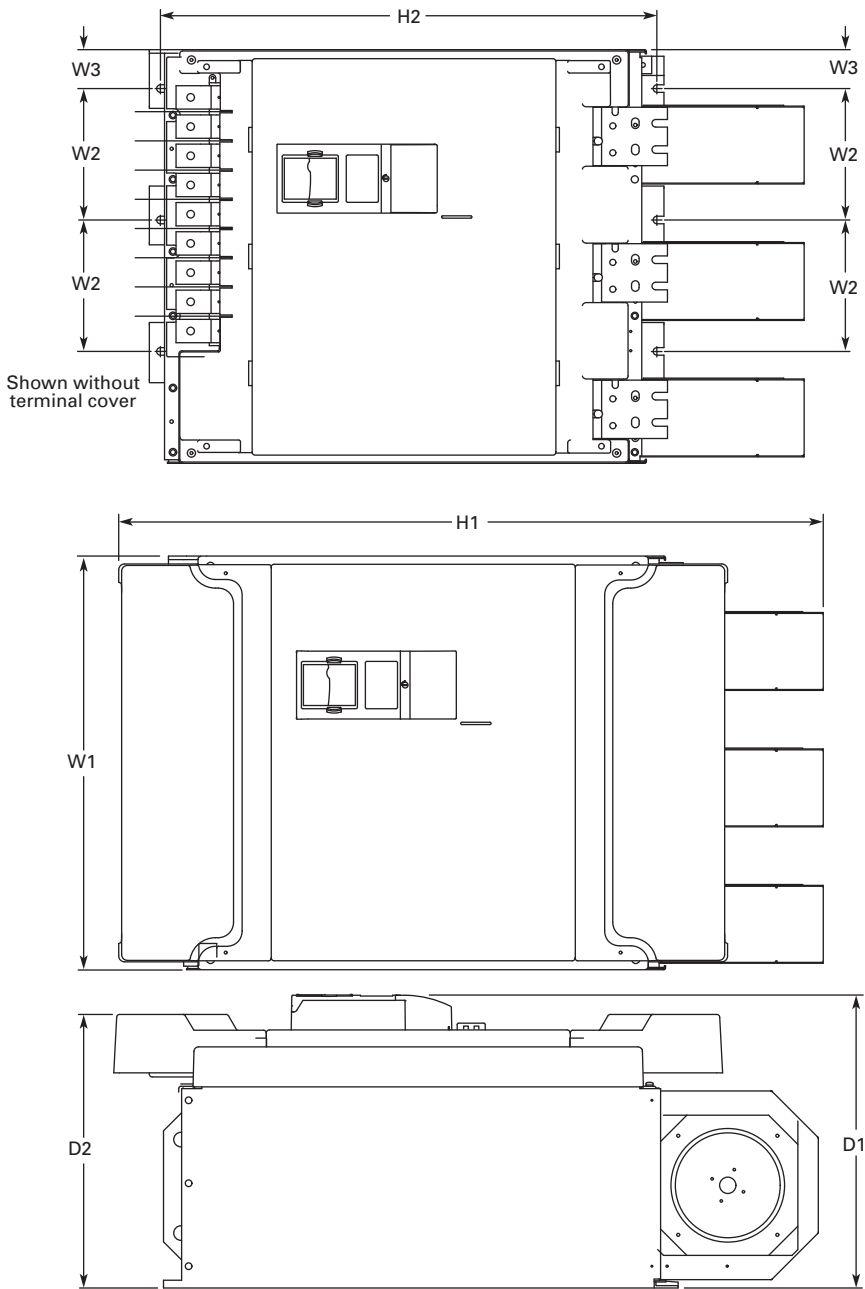


Figure 40-96. HVX9000 Dimensions, FR11 Open Chassis

Table 40-289. Dimensions for HVX9000, FR11 Open Chassis

Frame Size	Voltage	hp (I _L)	Approximate Dimensions in Inches (mm)							Weight Lbs. (kg)
			W1	W2	W3	H1	H2	D1	D2	
FR11	480V	500 – 600	27.9 (709)	8.6 (225)	2.6 (67)	45.5 (1155)	33.5 (850)	19.8 (503)	18.4 (468)	833 (378)

Open Drives

Table 40-290. Choke Types

Catalog Number	Frame Size	Choke Type ①
Voltage Range 380-500V		
HVX 300 4	FR10	CHK0400
HVX 350 4	FR10	CHK0520
HVX 400 4	FR10	CHK0520
HVX 500 4	FR11	2 x CHK0400
HVX 550 4	FR11	2 x CHK0400
HVX 600 4	FR11	2 x CHK0400

① Chokes are provided with all FR10 and FR11 drives.

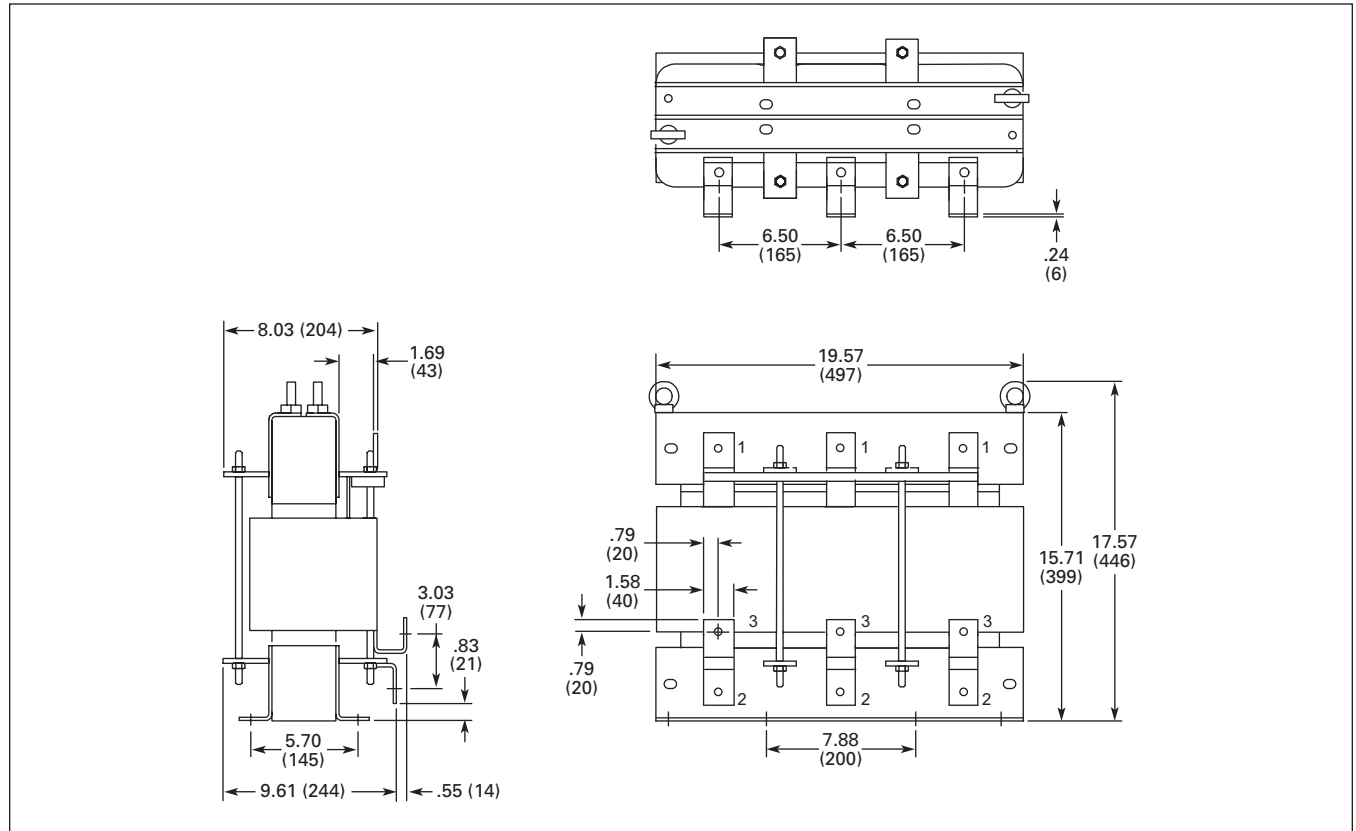


Figure 40-97. Dimensions of AC Choke CHK0520 in Inches (mm)

Open Drives

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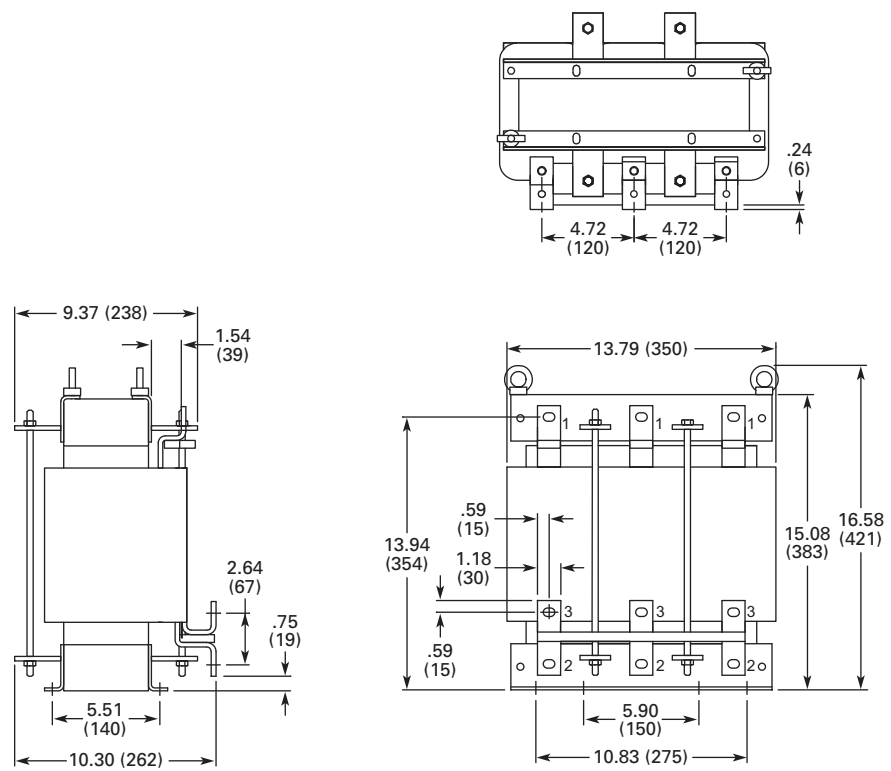


Figure 40-98. Dimensions of AC Choke CHK0400 in Inches (mm)

Replacement Parts

Table 40-291. 9000X Spare Units – HVX9000, 208 – 690V, Frames 4 – 11

Description	Catalog Number	Price U.S. \$
Control Unit – Includes the control board, blue base housing, installed HVX9000 software program and blue flip cover. Does not include any OPT boards or keypad. See Figure 40-84 and Table 40-266 (Page 40-172) for standard and option boards and keypad.	CSBH0000000000	

Table 40-292. 9000X Series Replacement Parts — HVX9000 Drives, 208 – 240V

Frame:	4	5				6			7			8			Delivery Code	Catalog Number	Price U.S. \$
hp (l _t):	1	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75		
Control Board																	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	VB00252
Power Boards																	
1																FB	VB00308-0004-2
1																FB	VB00308-0007-2
		1														FB	VB00308-0008-2
			1													FB	VB00310-0011-2
				1												FB	VB00313-0017-2
					1											FB	VB00313-0025-2
						1										FB	VB00313-0031-2
							1									FB	VB00316-0048-2
								1								FB	VB00316-0061-2
									1							FB	VB00319-0075-2
										1						FB	VB00319-0088-2
											1					FB	VB00319-0114-2
												1				FB	VB00322-0140-2
													1			FB	VB00322-0170-2
														1		FB	VB00322-0205-2
Electrolytic Capacitors																	
2	2	2														W	PP01000
			2													W	PP01001
				2	2											W	PP01002
						2										W	PP01003
							2	2								W	PP01004
									2	2	2	4	4			W	PP01005
														4		W	PP01099
Cooling Fans																	
1	1	1	1													W	PP01060
				1	1		1									W	PP01061
								1	1							W	PP01062
									1	1	1					W	PP01063
												1	1	1		FC	PP01123 ①
1	1	1	1													W	PP01086
				1	1		1	1								FC	PP01088
									1	1	1					W	PP01049
												1	2	2		FC	CP01180
												1	1	1		FC	PP08037

① PP00061 capacitor not included in main fan; please order separately.

Open Drives

Table 40-292. 9000X Series Replacement Parts — HVX9000 Drives, 208 – 240V (Continued)

Frame:	4				5				6				7				8				Delivery Code	Catalog Number	Price U.S. \$
hp (I _L):	1	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75								
IGBT Modules																							
1	1																W	CP01304					
		1															W	CP01305					
			1	1													W	CP01306					
					1												W	CP01307					
						1											W	CP01308					
							1										W	PP01022					
								1									W	PP01023					
									1								W	PP01024					
										1							W	PP01025					
											1						W	PP01029					
												1					W	PP01026					
													1	1			W	PP01027					
Choppers/Rectifiers																							
								1									W	CP01367					
									1								W	CP01368					
Diode/Thyristor Modules																							
										3	3	3					W	PP01035					
													3	3	3		W	CP01268					
Rectifying Boards																							
										1	1	1					W	VB00242					
													1	1	1		W	VB00227					

Table 40-293. 9000X Series Replacement Parts — FR4 – FR9 HVX9000 Drives, 380 – 500V

Frame:	4	5					6				7				8				9		Delivery Code	Catalog Number	Price U.S. \$
hp (I _L):	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	250				
Control Board																							
1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	W	VB00252		
Power Boards																							
1																				FB	VB00208-0003-5		
	1																			FB	VB00208-0004-5		
		1																		FB	VB00208-0005-5		
			1																	FB	VB00208-0007-5		
				1																FB	VB00210-0012-5		
					1															FB	VB00213-0016-5		
						1														FB	VB00213-0022-5		
							1													FB	VB00213-0031-5		
								1												FB	VB00216-0038-5		
									1											FB	VB00216-0045-5		
										1										FB	VB00216-0061-5		
											1									FB	VB00219-0072-5		
												1								FB	VB00219-0087-5		
													1							FB	VB00219-0105-5		
														1						FB	VB00236-0140-5		
															1					FB	VB00236-0168-5		
																1				FB	VB00236-0205-5		
Electrolytic Capacitors																							
2	2	2	2																	W	PP01000		
				2																W	PP01001		
					2	2														W	PP01002		
							2													W	PP01003		
								2	2	2										W	PP01004		
										2	2	2	4	4	4	8	8			W	PP01005		

Open Drives

Table 40-293. 9000X Series Replacement Parts — FR4 – FR9 HVX9000 Drives, 380 – 500V (Continued)

Frame:	4						5					6					7					8					9	Delivery Code	Catalog Number	Price U.S. \$
hp (l _L):	1-1/2	2	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200	250											
Cooling Fans																														
1		1	1	1	1																		W	PP01060						
						1	1	1														W	PP01061							
									1	1	1											W	PP01062							
												1	1	1								W	PP01063							
															1	1	1					FC	PP01123 ①							
																		1	1			FC	PP01080 ②							
1		1	1	1	1																	W	PP01086							
						1	1	1														FC	PP01088							
									1	1	1	1	1	1								W	PP01049							
															1	1	1					FC	CP01180							
																			1 ③	2		W	PP01068							
																			1	1		FC	PP09051							
IGBT Modules																														
1		1	1																			W	CP01304							
				1																		W	CP01305							
					1		1															W	CP01306							
							1															W	CP01307							
								1														W	CP01308							
									1													W	PP01020							
										1												W	PP01022							
											1											W	PP01023							
												1										W	PP01024							
													1									W	PP01025							
														1								W	PP01029							
															1							W	PP01026							
																1	1					W	PP01027							
Chopper/Rectifiers																														
									1	1												W	CP01367							
											1											W	CP01368							
Diode/Thyristor Modules																														
												3	3	3								W	PP01035							
															3	3	3					W	CP01268							
																		3	3			W	PP01037							
Rectifying Boards																														
												1	1	1								W	VB00242							
															1	1	1					W	VB00227							
																		1	1			W	VB00459							
Rectifying Module Sub-assembly																														
																		1	1			W	FR09810							
Power Module Sub-assemblies																														
																		1				W	FR09-150-4-ANS ④							
																				1		W	FR09-200-4-ANS ④							

- ① PP00061 capacitor not included in main fan; please order separately.
 ② PP00011 capacitor not included in main fan; please order separately.
 ③ For FR9 NEMA Type 12 you need two PP01068 internal fans.
 ④ See **Table 40-297** for details.

Open Drives

Table 40-294. 9000X Series Replacement Parts — FR10 and FR11 HVX9000 Drives, 380 – 500V

Frame: 10 hp (L):	300	350	400	11 500	550	600	Delivery Code	Catalog Number	Price U.S. \$
Control Board									
1	1	1	1	1	1	1	W	VB00561 ①	
Shunt Boards									
6							FC	VB00537	
	6						FC	VB00497	
		6					FC	VB00498	
			9				FC	VB00538	
				9			FC	VB00513	
					9		FC	VB00514	
Driver Boards									
			3	3	3		FC	VB00489	
1	1	1					FC	VB00487	
Driver Adapter Board									
1	1	1					FC	VB00330	
ASIC Board									
1	1	1	1	1	1		FC	VB00451	
Feedback Interface Board									
							FC	VB00448	
Star Coupler Board									
							FC	VB00336	
Power Modules									
1	1	1	2	2	2		FC	FR10820 ②	
2	2	2					FC	FR10828	
1							FC	FR10-250-4-ANS ③	
	1						FC	FR10-300-4-ANS ③	
		1					FC	FR10-350-4-ANS ③	
			3				FC	FR11-400-4-ANS ③	
				3			FC	FR11-500-4-ANS ③	
					3		FC	FR11-550-4-ANS ③	
Electrolytic Capacitors									
2	2	2	3	3	3		FC	PP00060	
12	12	12	18	18	18		FC	PP01005	
Fuses									
1	1	1	1	1	1		FC	PP01094	
2	2	2	2	2	2		FC	PP01095	
Cooling Fans and Isolation Transformers									
2	2	2	3	3	3		FC	VB00299	
2	2	2	3	3	3		FC	PP01080 ④	
2	2	2					FC	PP01068	
1	1	1	1	1	1		FC	PP01096	
1	1	1					FC	FR10844	
1	1	1	3	3	3		FC	FR10845	
1	1	1					FC	FR10846	
1	1	1	3	3	3		FC	FR10847	
Rectifying Board									
1	1	1	2	2	2		FC	VB00459	

① FR10 and larger drives only.

② Rectifying board not included.

③ See Table 40-297 for details.

④ PP00060 capacitor not included in main fan; please order separately.

Open Drives

Table 40-295. 9000X Series Replacement Parts — FR6 – FR9 HVX9000 Drives, 525 – 690V

Frame:	6			7			8			9			Delivery Code	Catalog Number	Price U.S. \$				
hp (L):	3	5	7-1/2	10	15	20	25	30	40	50	60	75	100	125	150	200			
Control Board																			
1	1	1		1	1	1	1	1	1	1					1	1	W	VB00252	
Driver Board																			
1																	FB	VB00404-0004-6	
																	FB	VB00404-0005-6	
	1																FB	VB00404-0007-6	
		1															FB	VB00404-0010-6	
			1														FB	VB00404-0013-6	
				1													FB	VB00404-0018-6	
					1												FB	VB00404-0022-6	
						1											FB	VB00404-0027-6	
							1										FB	VB00404-0034-6	
Power Boards																			
									1								FB	VB00419-0041-6	
										1							FB	VB00419-0052-6	
											1						FB	VB00422-0062-6	
												1					FB	VB00422-0080-6	
													1				FB	VB00422-0100-6	
Power Modules																			
														1			FC	FR09-100-5-ANS ①	
															1		FC	FR09-125-5-ANS ①	
																1	FC	FR09-175-5-ANS ①	
Electrolytic Capacitors																			
2	2	2		2	2	2	2	2									FC	PP01093	
									2	2	4	4		8	8	8	FC	PP01041	
													4				FC	PP01040	
Fuses																			
											1	1	1	1	1	1	W	PP01094	
											2	2	2	2	2	2	W	PP01095	
Cooling Fans																			
1	1	1		1													W	PP01061	
					1	1	1	1									W	PP01062	
									1	1							W	PP01063	
										1	1	1					FC	PP01123	
1	1	1		1	1	1	1	1	1	1							W	PP01049	
										1	1	1					FC	CP01180	
														1	1	1 ②	W	PP01068	
														1	1	1	FC	PP01080	
Fan Power Supply																			
															1	1	FC	VB00299	
IGBT Modules																			
3	3	3		3	3	3	3	3									FC	PP01091	
									1	1							FC	PP01089	
										1	1	1					FC	PP01127	
IGBT/Diode (Brake)																			
1	1	1		1	1	1	1	1	1	1	2	2	2	2	2	2	FC	PP01040	
Diode Module																			
1	1	1		1	1	1	1	1									FC	PP01092	
Diode/Thyristor Modules																			
									3	3							FC	PP01071	
														3	3	3	FC	PP01072	
Rectifying Boards																			
									1	1							FC	VB00442	
														1	1	1	FC	VB00460	
Rectifying Module Sub-assemblies																			
															1	1	W	FR09810	
															1	1	FC	FR09811	

① See Table 40-297 for details.

② For NEMA Type 12, two PP01068 internal fans are needed.

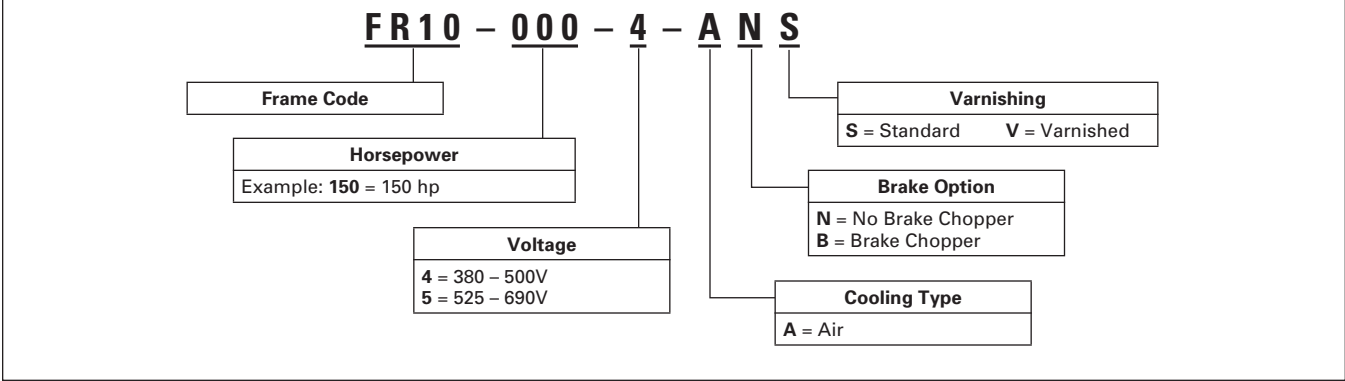
Open Drives

Table 40-296. 9000X Series Replacement Parts — FR10 and FR11 HVX9000 Drives, 525 – 690V

Frame:	10	11				Delivery Code	Catalog Number	Price U.S. \$
hp (hp):	250	300	400	450	500			
Component Boards								
1	1	1	1	1	1	W	VB00561 ①	
1	1	1	1	1	1	FC	VB00451	
6						FC	VB00545	
	6					FC	VB00510	
		6				FC	VB00511	
1	1	1				FC	VB00330	
1	1	1				FC	VB00487	
			3	3	3	FC	VB00489	
			9			FC	VB00546	
				9		FC	VB00547	
					9	FC	VB00512	
						FC	VB00448	
						FC	VB00336	
Power Modules								
1	1	1	2	2	2	FC	FR10821 ②	
2	2	2				FC	FR10829	
1						FC	FR10-200-5-ANS ③	
	1					FC	FR10-250-5-ANS ③	
		1				FC	FR10-300-5-ANS ③	
			3			FC	FR11-400-5-ANS ③	
				3		FC	FR11-450-5-ANS ③	
					3	FC	FR11-500-5-ANS ③	
Electrolytic Capacitors								
2	2	2	3	3	3	FC	PP00060	
12	12	12	18	18	18	FC	PP01099	
Fuses								
1	1	1	1	1	1	FC	PP01094	
2	2	2	2	2	2	FC	PP01095	
Cooling Fans and Isolation Transformers								
2	2	2	3	3	3	FC	VB00299	
2	2	2	3	3	3	FC	PP01080 ④	
2	2	2				FC	PP01068	
1	1	1	1	1	1	FC	PP01096	
1	1	1				FC	FR10844	
1	1	1	3	3	3	FC	FR10845	
1	1	1				FC	FR10846	
1	1	1	3	3	3	FC	FR10847	
Fan Power Supply								
						FC	VB00299	
Rectifying Boards								
1	1	1	2	2	2	FC	VB00460	

- ① FR10 and larger drives only.
② Rectifying board not included.
③ See Table 40-297 for details.
④ PP00060 capacitor not included in main fan; please order separately.

Table 40-297. Power Module Catalog Number Matrix



Contents

Description	Page
HVX9000 IntelliPass and IntelliDisconnect Drives	
Product Description	40-195
Features and Benefits	40-195
Technical Data and Specifications	40-196
Catalog Number Selection	40-197
Product Selection	40-198
Accessories	40-201
Dimensions	40-201
Wiring Diagrams	40-208

Product Description

The Cutler-Hammer® IntelliDisconnect Drive from Eaton's electrical business combines a premier quality drive with a circuit breaker disconnect integrated into the design. Eaton's IntelliPass Drive continues the Cutler-Hammer tradition of providing a premier intelligent drive integrated with a reliable bypass configuration, by taking advantage of the Cutler-Hammer Intelligent Technologies (IT), enclosed control and circuit breaker expertise.

The IntelliPass bypass is a two- or three-contactor design utilizing the 24V DC IT series of contactors and power supplies. The IT features, function and form allow the drive and bypass to become an integrated design, enabling Eaton to manufacture the world's smallest drive and bypass package. The IntelliPass comes standard with a Cutler-Hammer circuit breaker integrated into the drive and bypass design.

Features and Benefits

IntelliPass/IntelliDisconnect

- Circuit breaker provides flexible drive isolation configurations to meet customers' needs
- Reliable drive with over 500,000 hours MTBF
- Weighs up to 70% less than other designs which simplifies and speeds up the installation process, lowering contractors' costs
- Serial communication interface enables control of the motor operated by the drive or bypass
- Plenum rated
- Designed and tested to UL 508C specifications
- Standard 3% line reactors for enhanced transient and harmonic distortion protection
- EMI/RFI Filters standard on all drives
- Top and bottom conduit entry for installation ease
- Standard drive current with standard rating of 100 kAIC
- Upgradeable software extends product life
- Pass-through I/O capability
- Additional I/O and communication cards provide plug and play functionality
- Copy/Paste keypad function allows transfer of parameter settings from one drive to the next
- Optional Fusing —
 - Fuse rating 200 kAIC

- Keypad can display up to three monitored parameters simultaneously
- Hand-held Power Supply option allows programming/monitoring of control module without applying power to the drive
- NEMA Type 1, 12 or 3R
- Standard NEMA Type 12 keypad on all drives
- Simplified operating menu allows for typical programming changes
- Accommodates a wide selection of expander boards and adapter boards
- Control logic can be powered from an external auxiliary control panel
- Standard I/O boards include 6 DI, 2AI, 1 DO, 1 AO, 2 form C RO and a bypass control board installed in slots A, B and C

IntelliPass

- Fully rated, mechanically and electrically interlocked contacts
- Solid-state motor overload relay provides motor protection while in bypass
- HAND/OFF/AUTO and DRIVE/BYPASS selector on keypad simplifies control
- Two power sources for control ensure redundancy and provide additional ride-through capability
- Self-healing power supplies
- Bypass circuit current interrupting rating up to 65 kAIC



NEMA Type 1



NEMA Type 12



NEMA Type 3R

Technical Data and Specifications

Table 40-298. HVX9000 Specifications

Description	Specification
Power Connections	
Input Voltage (V_{in})	+10% / -15%
Input Frequency (f_{in})	50/60 Hz (variation up to 45 – 66 Hz)
Connection to Power	Once per minute or less (typical operation)
Short Circuit Withstand Rating	65 k AIC ^①

Motor Connections

Output Voltage	0 to V_{in}
Continuous Output Current	Ambient temperature max. +104°F(+40°C)
Overload Current	110% (1 min./10 min.)
Output Frequency	0 to 320 Hz
Frequency Resolution	.01 Hz

Control Characteristics

Control Method	Frequency Control (V/f) Open Loop Sensorless Vector Control
Switching Frequency	Adjustable Parameter 1 – 40 hp: 1 to 16 kHz; default 10 kHz 50 – 75 hp: 1 to 10 kHz; default 3.6 kHz
Frequency Reference	Analog Input: Resolution .1% (10-bit), accuracy \pm 1% Panel Reference: Resolution .01 Hz
Field Weakening Point	30 to 320 Hz
Acceleration Time	0 to 3000 sec.
Deceleration Time	0 to 3000 sec.
Braking Torque	DC brake: 30% \times T_n (without brake option)

Ambient Conditions

Ambient Operating Temperature	14°F (-10°C), no frost to 104°F (+40°C)
Storage Temperature	-40°F (-40°C) to 158°F (70°C)
Relative Humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2; Mechanical particles: IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Enclosure Class	NEMA Type 1/IP21; NEMA Type 12, NEMA Type 3R

Standards

EMC (at default settings)	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H
Safety	UL 508C
Product	IEC 61800-2

^① 65kAIC on Type 1 units operating at a line input voltage of 480V or less.

Description	Specification
Control Connections	
Analog Input Voltage	0 to 10V, $R = 200\Omega$ differential (-10 to 10V joystick control) Resolution .1%; accuracy \pm 1%
Analog Input Current	0(4) to 20 mA; $R_i - 250\Omega$ differential
Digital Inputs (6)	Positive or negative logic; 18 to 24V DC
Auxiliary Voltage	+24V \pm 15%, max. 250 mA
Output Reference Voltage	+10V +3%, max. load 10 mA
Analog Output	0(4) to 20 mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy \pm 2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable Form C relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / .4A

Protections

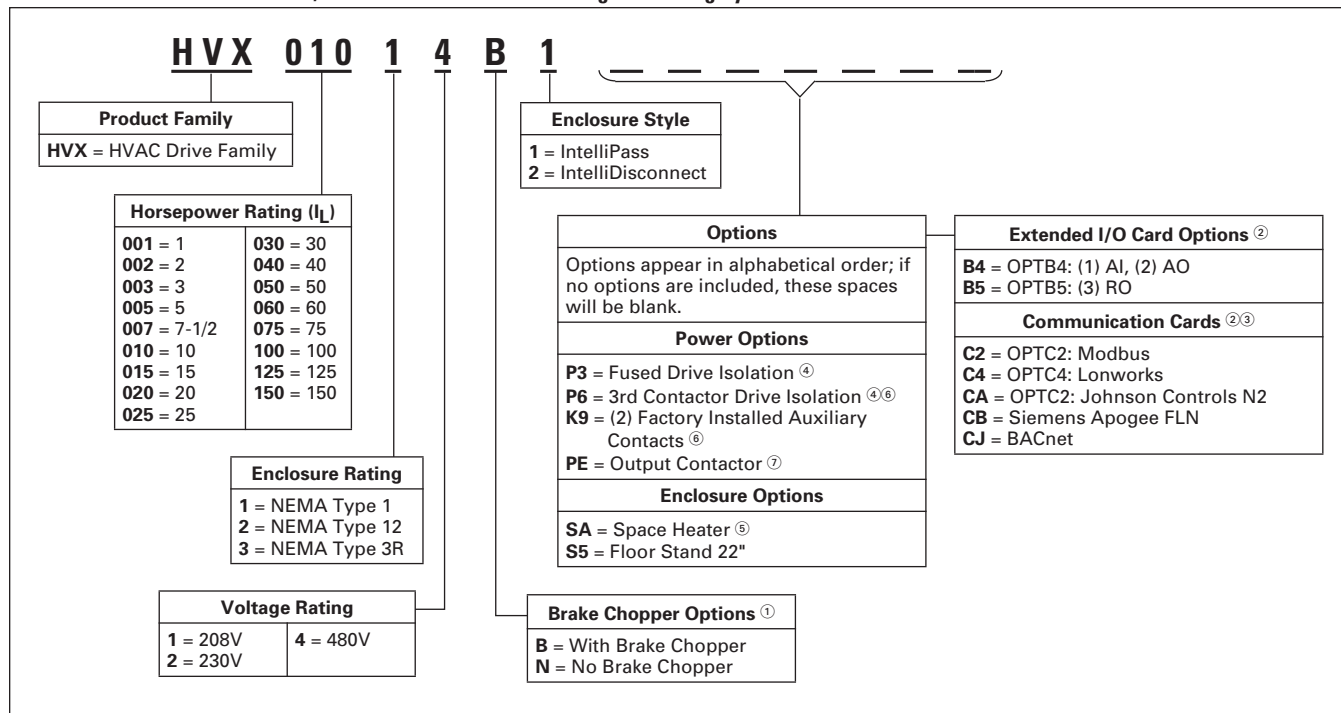
Overcurrent Protection	Trip limit 4.0 \times I_H instantaneously
Overvoltage Protection	Yes
Undervoltage Protection	Yes
Earth Fault Protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
Input Phase Supervision	Trips if any of the input phases are missing
Motor Phase Supervision	Trips if any of the output phases are missing
Overtemperature Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short Circuit Protection	Yes (Of the +24V and +10V Reference Voltages)

General

Line Voltage	208/230/480V
Drive Efficiency	>95%
Power Factor (Displacement)	.96
Ratings	UL Listed, File No. E134360
Warranty	Standard Terms

Catalog Number Selection

Table 40-299. HVX9000 IntelliPass/IntelliDisconnect Drive Catalog Numbering System



- ① 480V Drives, 1 – 40 hp are only available with Brake Chopper Option **B**.
 480V Drives, 50 – 150 hp are only available with Brake Chopper Option **N**.
 208/230V Drives, 1 – 20 hp are only available with Brake Chopper Option **B**.
 208/230V Drives, 25 – 75 hp are only available with Brake Chopper Option **N**.
- ② Two slots (D, E) available for expansion cards.
- ③ Only one communication card can be installed at a time.
- ④ Fused Drive Isolation (**P3**) and 3rd Contactor Drive Isolation (**P6**) cannot be installed together in NEMA Type 1 Design.
- ⑤ Space Heater (**SA**) option only applicable in NEMA Type 12/3R enclosures.
- ⑥ IntelliPass Only.
- ⑦ IntelliDisconnect Only.

Product Selection

Table 40-300. HVX9000 IntelliPass Base Unit Pricing

Frame Size	Delivery Code	Voltage	hp (h _L)	Current (NEC)	NEMA Type 1		NEMA Type 12		NEMA Type 3R			
					Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$		
FR4	FB10	208V AC	1	4.6	HVX00111B1		HVX00121B1		HVX00131B1			
			2	7.5	HVX00211B1		HVX00221B1		HVX00231B1			
			3	10.6	HVX00311B1		HVX00321B1		HVX00331B1			
		230V AC	1	4.2	HVX00112B1		HVX00122B1		HVX00132B1			
			2	6.8	HVX00212B1		HVX00222B1		HVX00232B1			
			3	9.6	HVX00312B1		HVX00322B1		HVX00332B1			
		480V AC	1	3	HVX00114B1		HVX00124B1		HVX00134B1			
			2	3.4	HVX00214B1		HVX00224B1		HVX00234B1			
			3	4.8	HVX00314B1		HVX00324B1		HVX00334B1			
5	7.6	HVX00514B1		HVX00524B1		HVX00534B1						
7-1/2	11	HVX00714B1		HVX00724B1		HVX00734B1						
FR5	FB10	208V AC	5	16.7	HVX00511B1		HVX00521B1		HVX00531B1			
			7-1/2	24.2	HVX00711B1		HVX00721B1		HVX00731B1			
			10	30.8	HVX01011B1		HVX01021B1		HVX01031B1			
		230V AC	5	15.2	HVX00512B1		HVX00522B1		HVX00532B1			
			7-1/2	22	HVX00712B1		HVX00722B1		HVX00732B1			
			10	28	HVX01012B1		HVX01022B1		HVX01032B1			
		480V AC	10	14	HVX01014B1		HVX01024B1		HVX01034B1			
			15	21	HVX01514B1		HVX01524B1		HVX01534B1			
			20	27	HVX02014B1		HVX02024B1		HVX02034B1			
FR6	FB10	208V AC	15	46.2	HVX01511B1		HVX01521B1		HVX01531B1			
			20	59.4	HVX02011B1		HVX02021B1		HVX02031B1			
		230V AC	15	42	HVX01512B1		HVX01522B1		HVX01532B1			
			20	54	HVX02012B1		HVX02022B1		HVX02032B1			
		480V AC	25	34	HVX02514B1		HVX02524B1		HVX02534B1			
			30	40	HVX03014B1		HVX03024B1		HVX03034B1			
			40	52	HVX04014B1		HVX04024B1		HVX04034B1			
		FR7	FB10	208V AC	25	74.8	HVX02511N1		HVX02521N1		HVX02531N1	
					30	88	HVX03011N1		HVX03021N1		HVX03031N1	
230V AC	25			68	HVX02512N1		HVX02522N1		HVX02532N1			
	30			80	HVX03012N1		HVX03022N1		HVX03032N1			
480V AC	50			65	HVX05014N1		HVX05024N1		HVX05034N1			
	60			77	HVX06014N1		HVX06024N1		HVX06034N1			
	75			96	HVX07514N1		HVX07524N1		HVX07534N1			
FR8	FB10			208V AC	40	114	—		HVX04021N1 ^①		HVX04031N1 ^①	
					50	140	—		HVX05021N1		HVX05031N1	
		60	170		—		HVX06021N1		HVX06031N1			
		230V AC	40	104	—		HVX04022N1 ^①		HVX04032N1 ^①			
			50	130	—		HVX05022N1		HVX05032N1			
			60	154	—		HVX06022N1		HVX06032N1			
			75	192	—		HVX07522N1		HVX07532N1			
		480V AC	100	124	—		HVX10024N1		HVX10034N1			
			125	156	—		HVX12524N1		HVX12534N1			
150	180		—		HVX15024N1		HVX15034N1					

① 40 hp 208V and 230V supplied as a FR7 drive, but in a C-Box.

Table 40-301. HVX9000 IntelliDisconnect Base Unit Pricing

Frame Size	Delivery Code	Voltage	hp (I _L)	Current	NEMA Type 1		NEMA Type 12		NEMA Type 3R	
					Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$	Catalog Number	Price U.S. \$
FR4	FB10	208V AC	1	4.8	HVX00111B2		HVX00121B2		HVX00131B2	
			2	7.8	HVX00211B2		HVX00221B2		HVX00231B2	
			3	11	HVX00311B2		HVX00321B2		HVX00331B2	
		230V AC	1	4.8	HVX00112B2		HVX00122B2		HVX00132B2	
			2	7.8	HVX00212B2		HVX00222B2		HVX00232B2	
			3	11	HVX00312B2		HVX00322B2		HVX00332B2	
		480V AC	1	3.3	HVX00114B2		HVX00124B2		HVX00134B2	
			2	4.3	HVX00214B2		HVX00224B2		HVX00234B2	
			3	5.6	HVX00314B2		HVX00324B2		HVX00334B2	
5	7.6	HVX00514B2		HVX00524B2		HVX00534B2				
7-1/2	12	HVX00714B2		HVX00724B2		HVX00734B2				
FR5	FB10	208V AC	5	17.5	HVX00511B2		HVX00521B2		HVX00531B2	
			7-1/2	25	HVX00711B2		HVX00721B2		HVX00731B2	
			10	31	HVX01011B2		HVX01021B2		HVX01031B2	
		230V AC	5	17.5	HVX00512B2		HVX00522B2		HVX00532B2	
			7-1/2	25	HVX00712B2		HVX00722B2		HVX00732B2	
			10	31	HVX01012B2		HVX01022B2		HVX01032B2	
		480V AC	10	16	HVX01014B2		HVX01024B2		HVX01034B2	
			15	23	HVX01514B2		HVX01524B2		HVX01534B2	
			20	31	HVX02014B2		HVX02024B2		HVX02034B2	
FR6	FB10	208V AC	15	48	HVX01511B2		HVX01521B2		HVX01531B2	
			20	61	HVX02011B2		HVX02021B2		HVX02031B2	
		230V AC	15	48	HVX01512B2		HVX01522B2		HVX01532B2	
			20	61	HVX02012B2		HVX02022B2		HVX02032B2	
		480V AC	25	38	HVX02514B2		HVX02524B2		HVX02534B2	
			30	46	HVX03014B2		HVX03024B2		HVX03034B2	
40	61	HVX04014B2		HVX04024B2		HVX04034B2				
FR7	FB10	208V AC	25	75	HVX02511N2		HVX02521N2		HVX02531N2	
			30	88	HVX03011N2		HVX03021N2		HVX03031N2	
		230V AC	25	75	HVX02512N2		HVX02522N2		HVX02532N2	
			30	88	HVX03012N2		HVX03022N2		HVX03032N2	
		480V AC	50	72	HVX05014N2		HVX05024N2		HVX05034N2	
			60	87	HVX06014N2		HVX06024N2		HVX06034N2	
75	105	HVX07514N2		HVX07524N2		HVX07534N2				
FR8	FB10	208V AC	40	114	—		HVX04021N2 ①		HVX04031N2 ①	
			50	143	—		HVX05021N2		HVX05031N2	
			60	169	—		HVX06021N2		HVX06031N2	
		230V AC	40	104	—		HVX04022N2 ①		HVX04032N2 ①	
			50	130	—		HVX05022N2		HVX05032N2	
			60	154	—		HVX06022N2		HVX06032N2	
			75	192	—		HVX07522N2		HVX07532N2	
			480V AC	100	124	—		HVX10024N2		HVX10034N2
		125		156	—		HVX12524N2		HVX12534N2	
150	180	—		HVX15024N2		HVX15034N2				

① 40 hp 208V and 230V supplied as a FR7 drive, but in a C-Box.

IntelliPass and IntelliDisconnect Drives

40

Table 40-302. Option Pricing

Voltage	hp (I _L)	Description	Suffix Number	Adder U.S. \$
208V	1 – 7-1/2 10 15 20 30 ① 40 50 60	Drive Isolation Fusing	P3 ②	
230V	1 – 7-1/2 10 15 20 30 40 50 60 75	Drive Isolation Fusing	P3 ②	
480V	1 – 15 20 25 30 40 50 60 75 ① 100 125 150	Drive Isolation Fusing	P3 ②	
208/230V AC	1 – 3 5 – 7-1/2 10 15 20 25 30 40 50 60 75 ④	3rd Contactor Drive Isolation	P6 ②③	
480V AC	1 – 7-1/2 10 – 15 20 25 30 40 50 60 75 100 125 150	3rd Contactor Drive Isolation	P6 ②③	

- ① Fused Drive Isolation (P3) is not available in NEMA Type 1 Design in 208V 30 hp and 480V 75 hp.
 ② Fused Drive Isolation (P3) and 3rd Contactor Drive Isolation (P6) cannot be installed together in NEMA Type 1 Design.
 ③ P6 option only available with IntelliPass Drives.
 ④ 75 hp only available on 230V units.

Table 40-302. Option Pricing (Continued)

Voltage	hp (I _L)	Description	Suffix Number	Adder U.S. \$
208/230V AC	1 – 3 5 – 7-1/2 10 15 20 25 30 40 50 60 75 ⑤	Output Contactor	PE ⑦	
480V AC	1 – 7-1/2 10 – 15 20 25 30 40 50 60 75 100 125 150	Output Contactor	PE ⑦	
208/230V AC	1 – 30	Auxiliary Contacts, (2) Factory Installed	K9 ⑧	
480V AC	1 – 75	Auxiliary Contact, (1) Not Installed	⑥	
		Auxiliary Contacts, (2) Factory Installed	K9 ⑧	

- ⑤ 75 hp only available on 230V units.
 ⑥ Catalog Number EMA13.
 ⑦ PE option only available with IntelliDisconnect Drives.
 ⑧ K9 option only available with IntelliPass Drives.

Table 40-303. Enclosure Option

Description	Factory Installed	
	Suffix Number	Adder U.S. \$
Space Heater ⑨	SA	
Floor Stand 22" ⑩	S5	

- ⑨ Space Heater (SA) only applicable in NEMA Type 12/3R enclosures.
 ⑩ S5 option only available in enclosure size C in Type 12/3R enclosures.

HVX9000 IntelliPass Option Boards

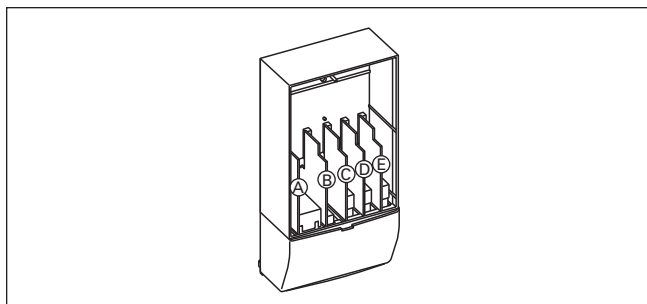


Figure 40-99. HVX9000 IntelliPass Option Boards

The HVX9000 IntelliPass Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards. See **Figure 40-99**.

The HVX9000 IntelliPass factory installed standard option board configuration includes an A9I/O board, A2 relay output board and a B5 output board which are installed in slots A, B and C respectively. Two slots (D, E) for extended I/O and communication cards.

Table 40-304. Option Board Kits

Option Kit Description ①	Allowed Slot Locations ②	Catalog Number	Kit Price U.S. \$	Factory Installed	
				Suffix Number	Adder U.S. \$
Basic I/O Cards					
2 RO	B	OPTA2		Standard	
6 DI, 1 DO 2 AI, 1 AO	A	OPTA9		Standard	
small terminal block					
3 RO	C	OPTB5		Standard	
Extended I/O Cards					
1 AI, 2 AO	C, D	OPTB4		B4	
3 RO	C, D	OPTB5		B5	
Communication Cards ③					
Modbus	D, E	OPTC2		C2	
Lonworks	D, E	OPTC4		C4	
Johnson Controls N2	D, E	OPTC2		CA	
Siemens Apogee FLN	D, E	OPTCB		CB	
BacNet	D, E	OPTCJ		CJ	

^① AI = Analog Input; AO = Analog Output; DI = Digital Input; DO = Digital Output; RO = Relay Output.

^② Option card must be installed in one of the slots listed for that card. Slot indicated in bold is the preferred location.

^③ Only one communication card can be installed.

Accessories

Table 40-305. HVX9000 Drive Accessories

Description	Catalog Number	Price U.S. \$
9000X Drive Demo	9000XDEMO	
Hand Held 24V Auxiliary Power Supply — used to supply power to the control module in order to perform keypad programming before the drive is connected to line voltage	9000XAUX24V	

Dimensions

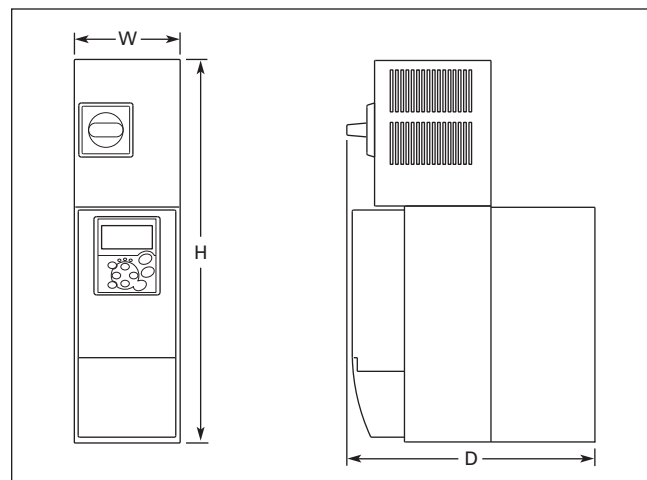


Figure 40-100. NEMA Type 1 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-306. NEMA Type 1 IntelliPass/IntelliDisconnect Drive Dimensions

Frame Size	Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)			Weight Lbs. (kg)
			H	W	D	
4	208 230 480	1 – 3 1 – 3 1 – 7-1/2	18.32 (465)	5.05 (128)	12.45 (316)	21.0 (10.0)
5	208 230 480	5 – 10 5 – 10 10 – 20	23.68 (601)	5.40 (137)	15.34 (390)	35.0 (16.0)
6	208 230 480	15, 20 15, 20 25 – 40	30.25 (768)	7.5 (191)	15.02 (382)	67.0 (30.0)
7	208 230 480	25, 30 25, 30 50 – 75	38.27 (972)	9.1 (231)	15.02 (382)	108 (49)

Enclosure Box A NEMA Type 12

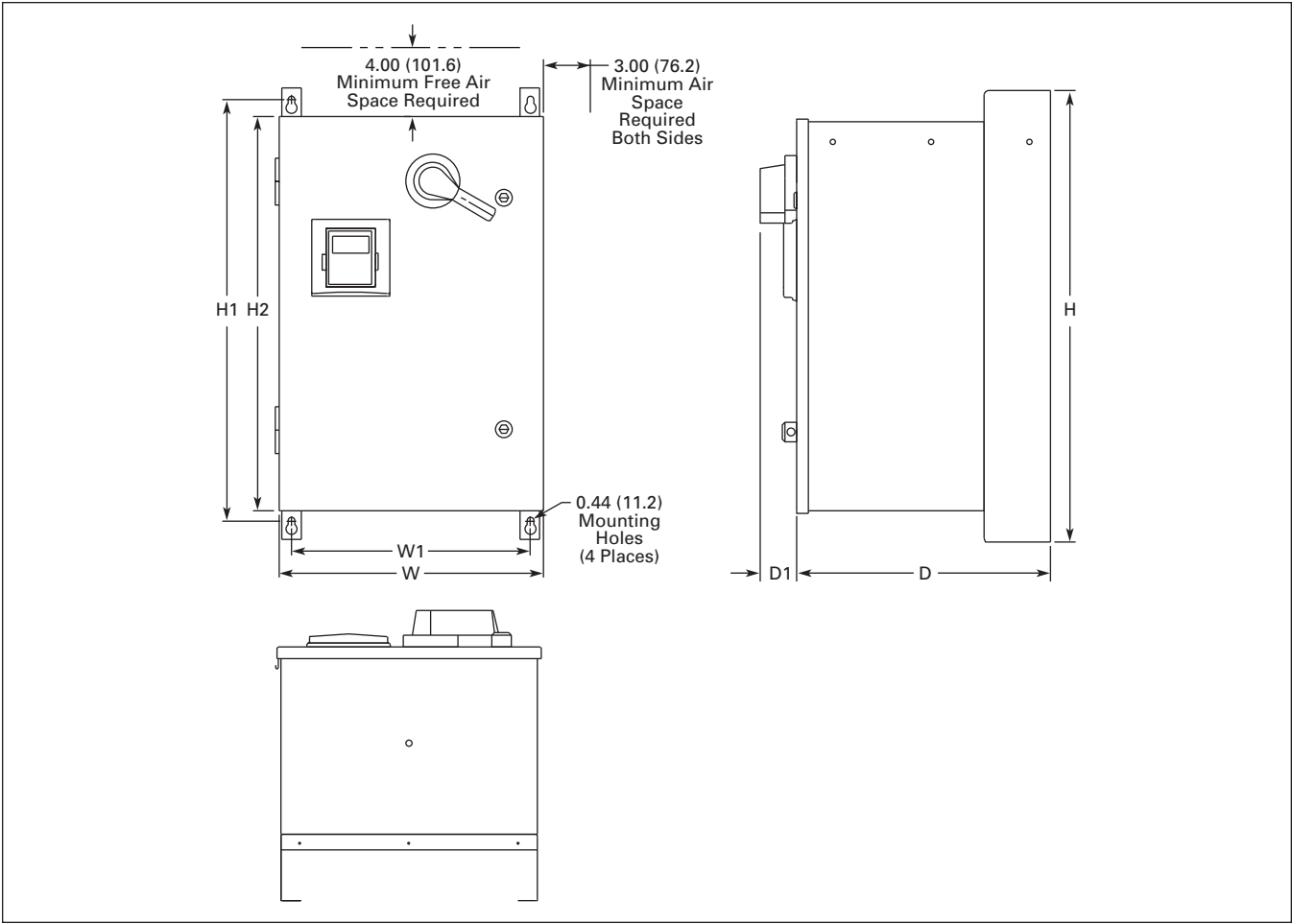
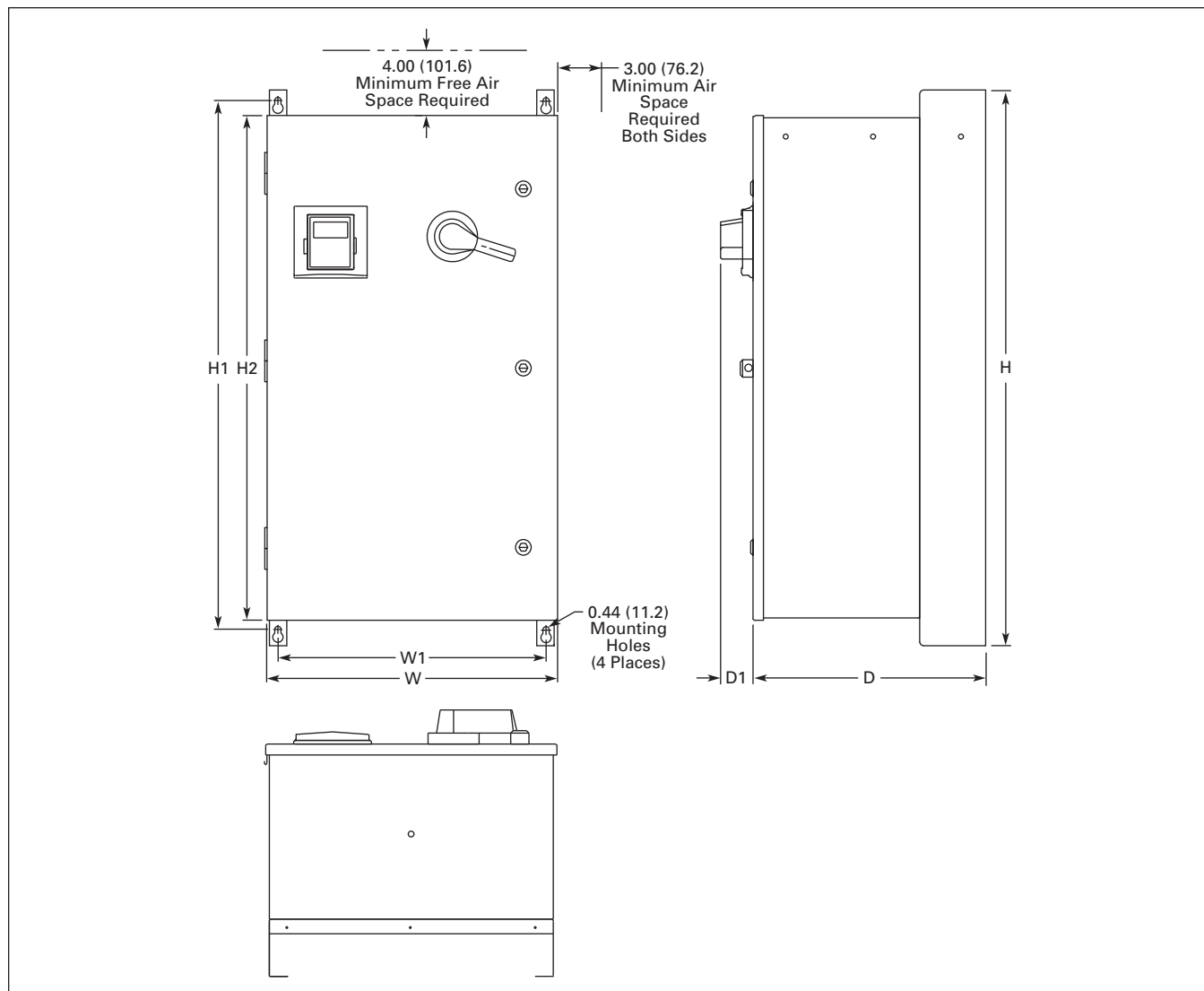


Figure 40-101. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-307. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	W	W1	D	D1		
208V	1 – 15	29.00 (736.6)	27.00 (685.8)	25.35 (643.9)	16.92 (429.8)	15.30 (388.6)	16.26 (413.0)	2.34 (59.4)	120 (54)	160 (73)
230V	1 – 15									
480V	1 – 30									

Enclosure Box B NEMA Type 12



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Figure 40-102. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-308. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	W	W1	D	D1		
208V	20 – 30	40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)
230V	20 – 30									
480V	40 – 75									

Enclosure Box C NEMA Type 12

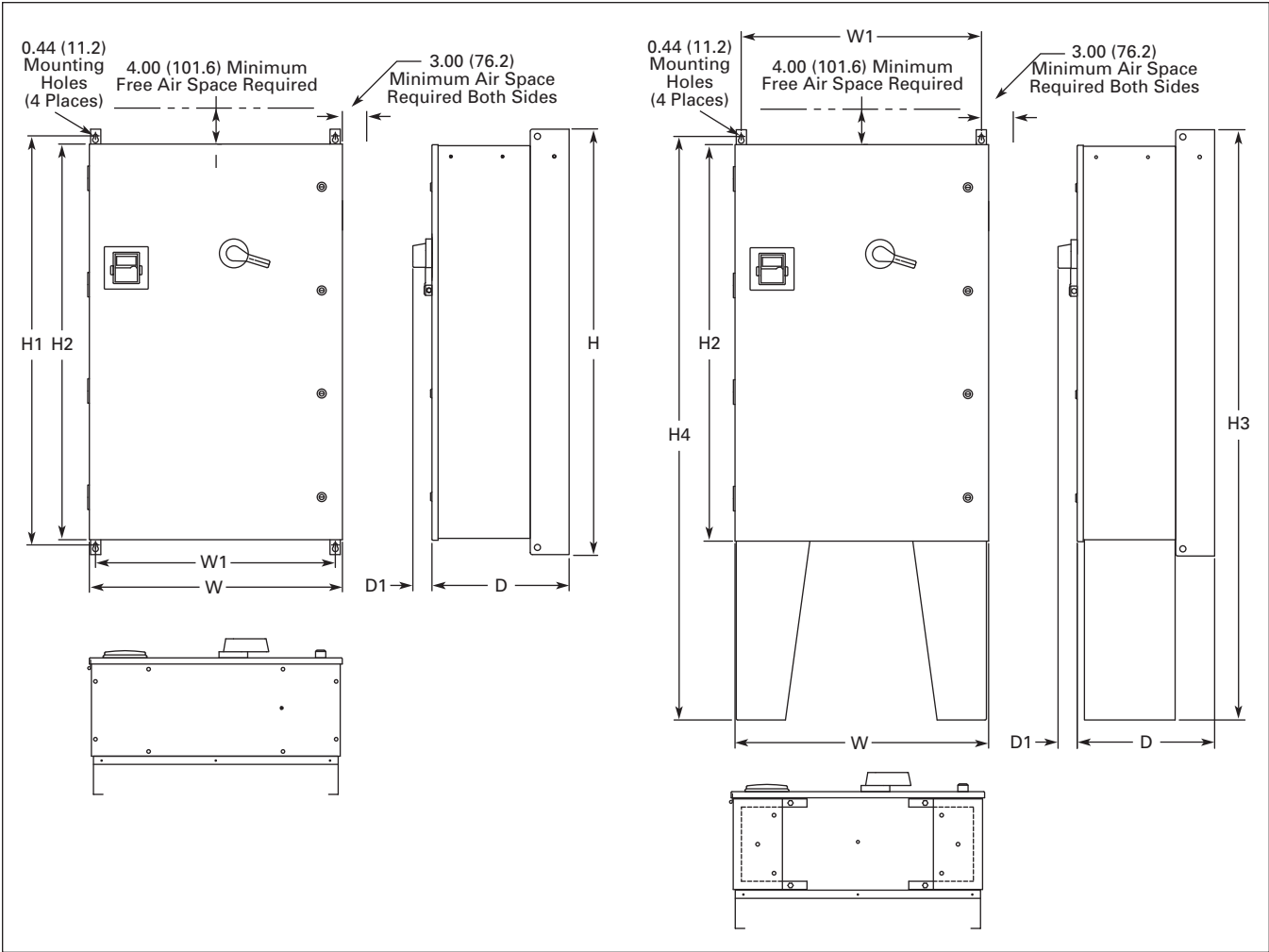


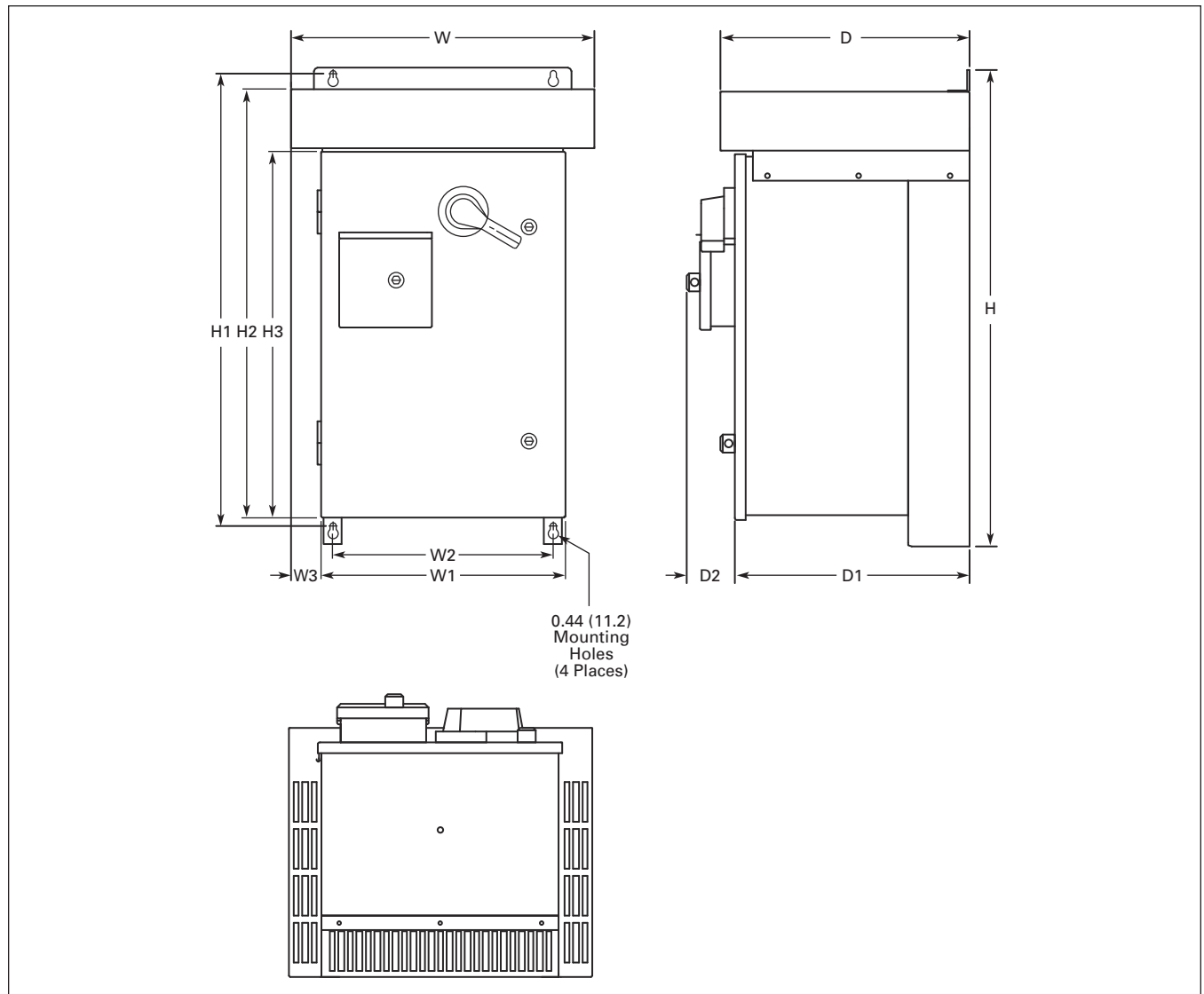
Figure 40-103. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-309. NEMA Type 12 IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)									Approx. Weight Lbs. (kg)
		H	H1	H2	H3	H4	W	W1	D	D1	
208V	40 – 60	52.00	50.00	48.35	72.00	71.19	30.92	29.30	16.78	2.34	①
230V	40 – 75	(1320.8)	(1270.0)	(1228.1)	(1828.8)	(1808.2)	(785.4)	(744.2)	(426.2)	(59.4)	
480V	100 – 150										

① Consult Factory.

Enclosure Box A NEMA Type 3R



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Figure 40-104. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-310. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
208V	1 – 15	33.00	31.36	29.67	25.35	21.05	16.92	15.30	2.07	17.24	16.26	3.31	170	215
230V	1 – 15	(838.2)	(796.5)	(753.6)	(643.9)	(534.7)	(429.8)	(388.6)	(52.6)	(437.9)	(413.0)	(84.1)	(77)	(98)
480V	1 – 30													

Enclosure Box B NEMA Type 3R

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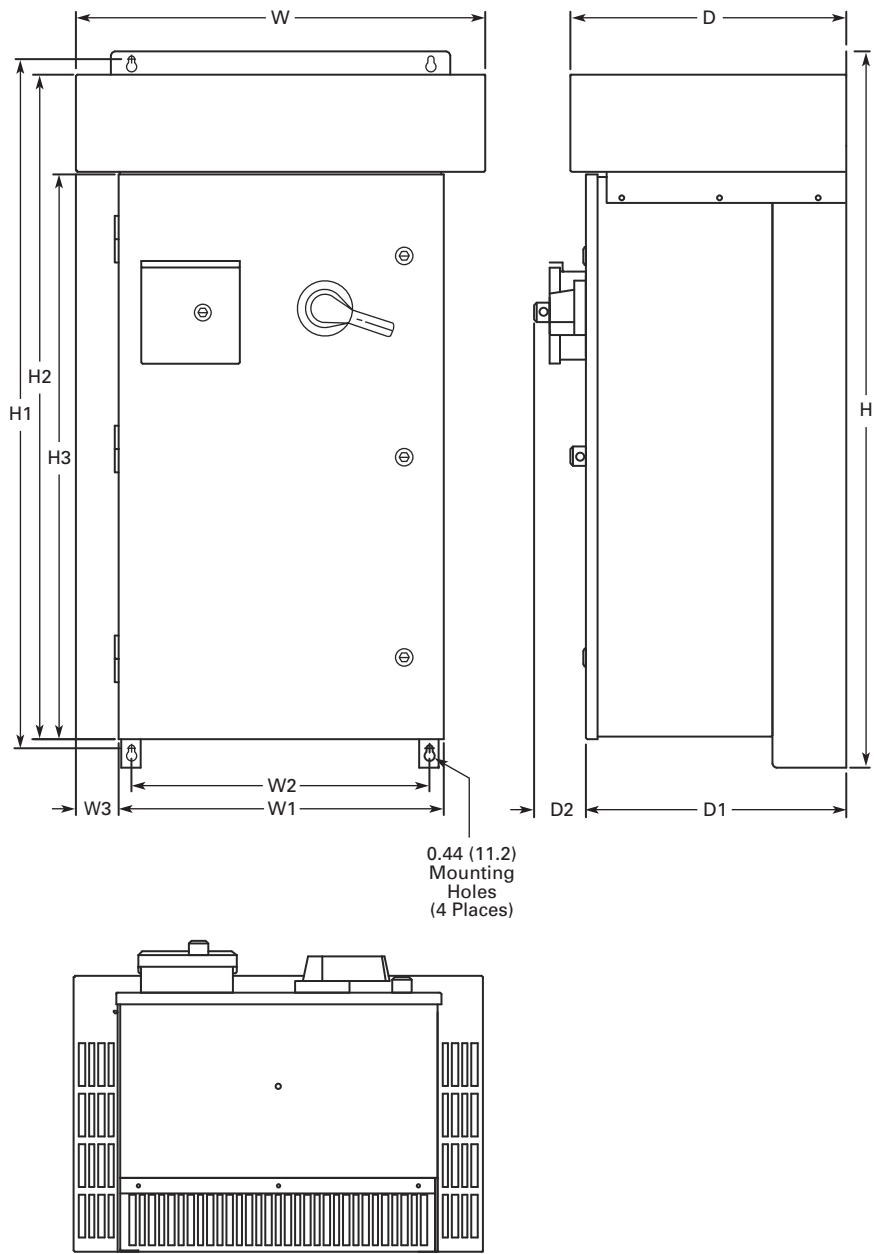
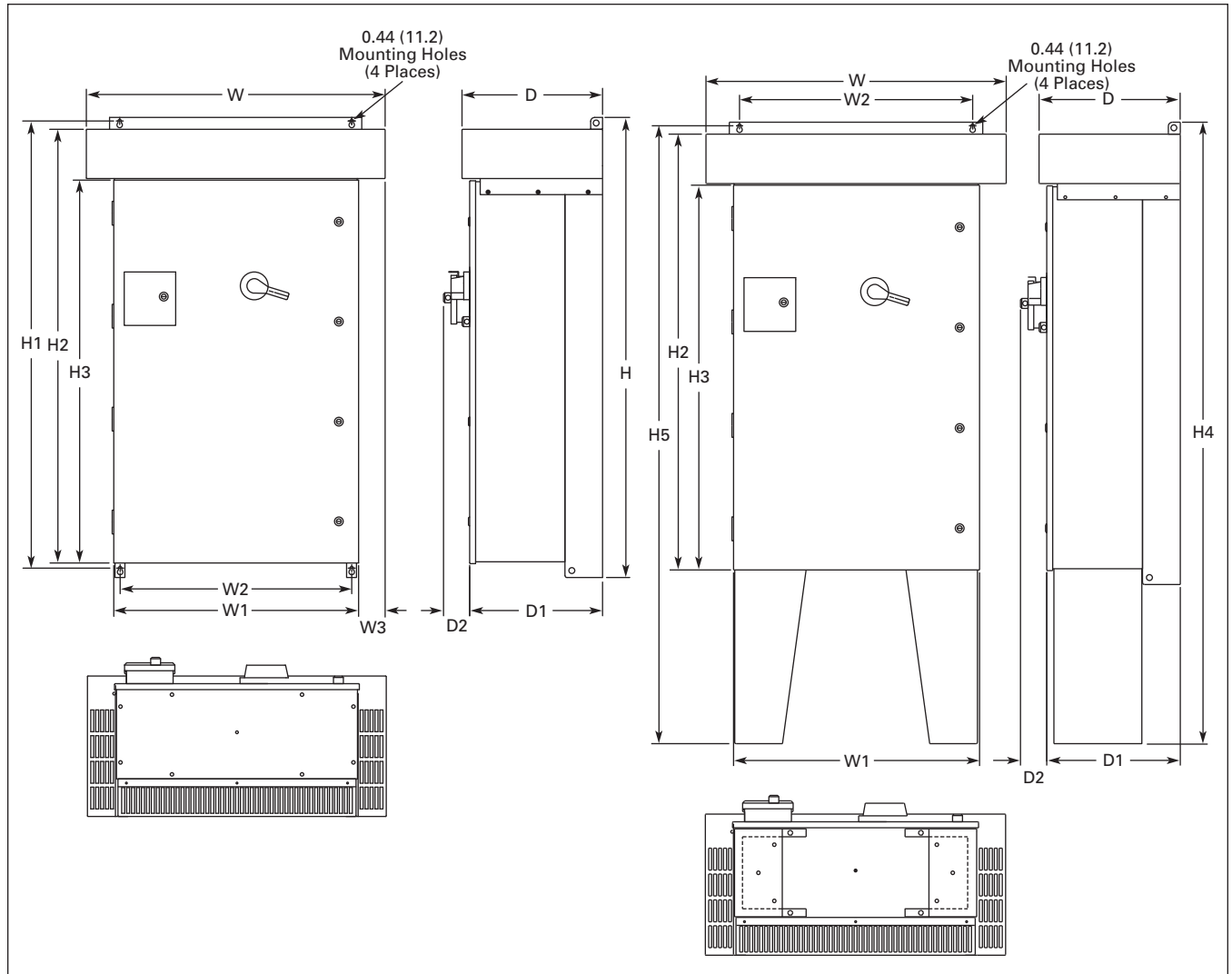


Figure 40-105. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-311. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
		H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
208V	20 – 30	46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)
230V	20 – 30													
480V	40 – 75													

Enclosure Box C NEMA Type 3R



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Figure 40-106. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Table 40-312. NEMA Type 3R IntelliPass/IntelliDisconnect Drive Dimensions

Voltage AC	hp (I _L)	Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)
		H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2	
208V	40 – 60	58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	①
230V	40 – 75														
480V	100 – 150														

① Consult Factory.

Wiring Diagrams

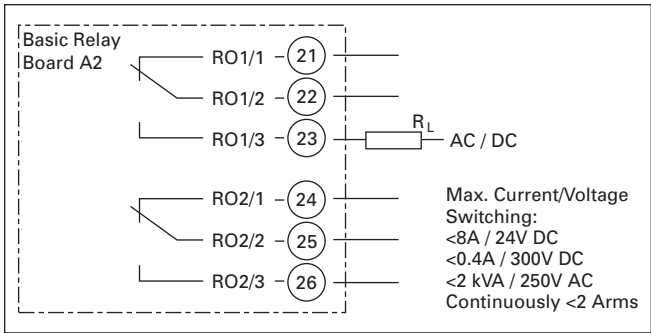


Figure 40-107. A2 Board Control Wiring

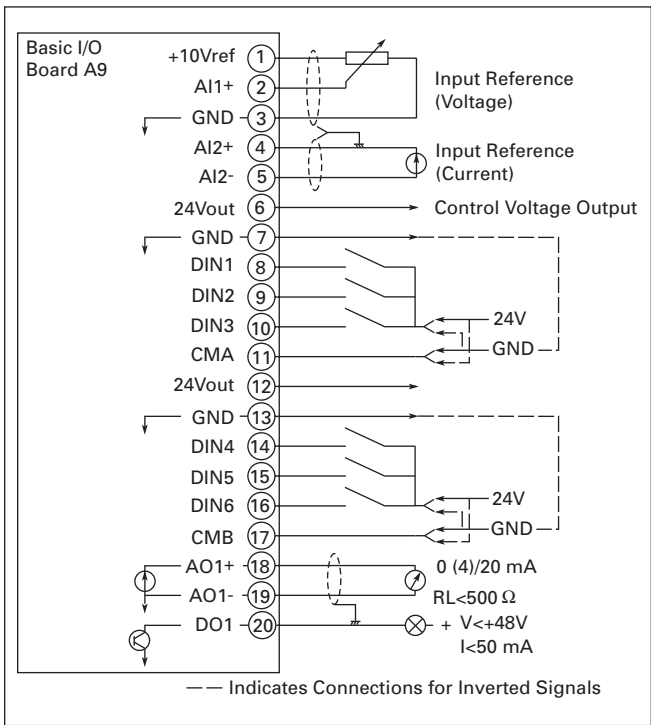


Figure 40-108. A9 Board Control Wiring

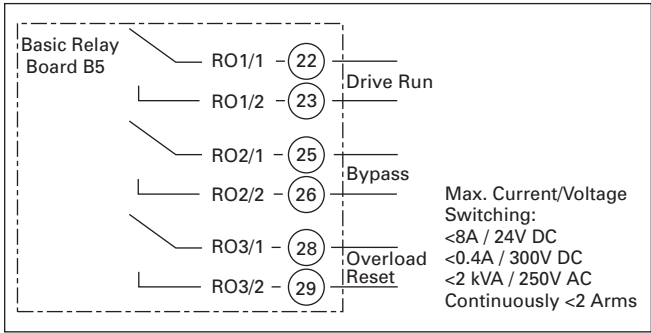


Figure 40-109. B5 Board Control Wiring

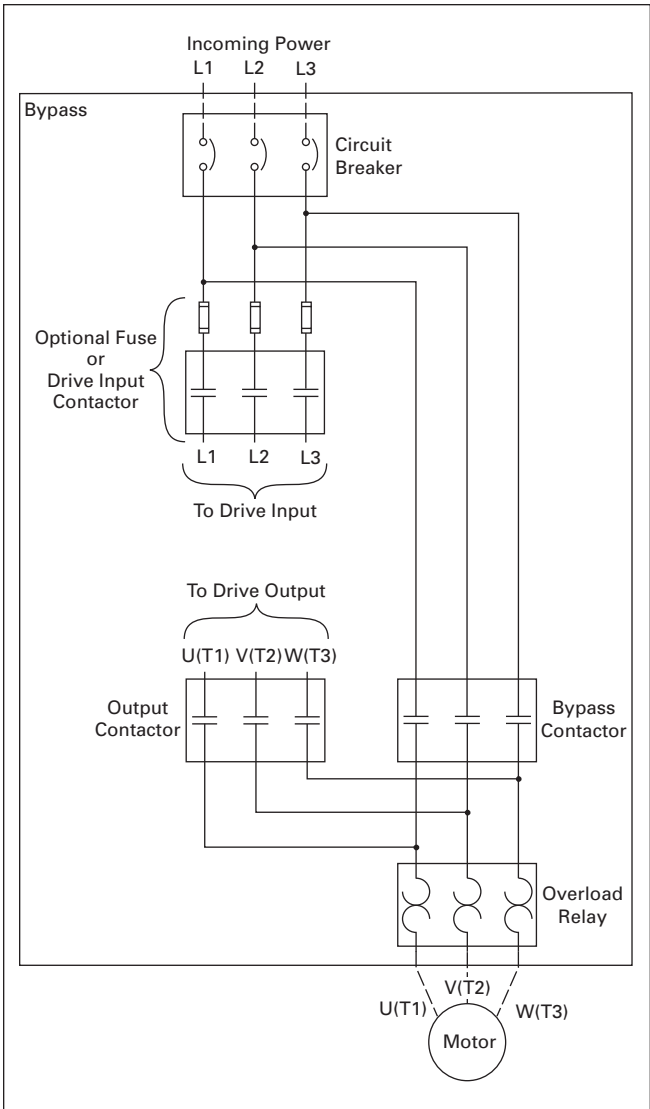


Figure 40-110. HVX9000 IntelliPass Power Wiring

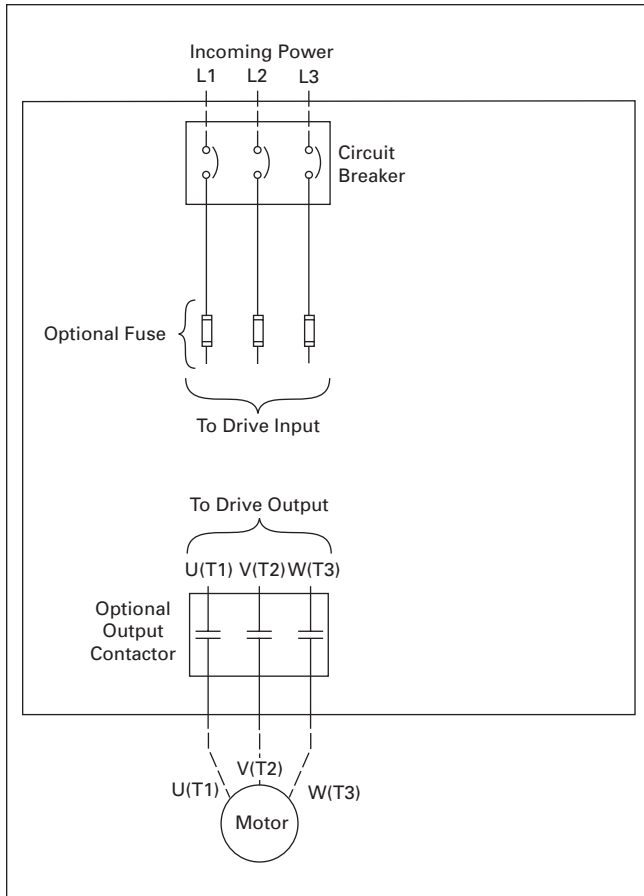


Figure 40-111. HVX9000 IntelliDisconnect Power Wiring

Enclosed Drives

Contents

Description	Page
CFX9000 Enclosed Drives	
Product Description	40-210
Features and Benefits	40-210
Application Description	40-211
Technical Data and Specifications	40-217
Catalog Number Selection	40-218
Product Selection	40-219
Options	40-224
Dimensions	40-231
Wiring Diagram	40-239

Product Description

The Cutler-Hammer® CFX9000 Clean Power Drives from Eaton's electrical business use tuned passive filters to significantly reduce line harmonics at the drive input terminals.

The CFX9000 drive also delivers True Power Factor — in addition to reducing harmonic distortion, the CFX9000 drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

CFX9000 Enclosed Products Program

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages 40-219 – 40-228**.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for pricing and lead time.*

Features and Benefits

New CFX9000 Integrated Filter Clean Power Drive features include (at 480V):

- 7-1/2 – 40 hp I_L drives available in 21" (W) x 40" (H) enclosure
- 50 – 75 hp I_L drives available in 31" (W) x 52" (H) enclosure
- 100 – 150 hp I_L drives available in 30" (W) x 90" (H) enclosure
- 200 and 250 hp I_L drives available in 48" (W) x 90" (H) enclosure
- 300 – 400 hp I_L drives available in 60" (W) x 90" (H) enclosure
- UL Type 1, UL Type 12, UL Type 3R and NEMA 12 with Gaskets and Filters
- Input Voltage: 480V, 230V, 575V
- Complete range of control, network and power options
- Horsepower range:
 - 480V, 7-1/2 – 400 hp I_L
 - 230V, 7-1/2 – 100 hp I_L ; consult factory for details
 - 575V, 15 – 400 hp I_L ; consult factory for details
- Single enclosure for both drive and filter reduces field wiring and enables convenient bypass installation
- Packaged solution ensures optimal coordination of drive and filter



CFX9000 —
UL Type 1, 150 hp I_L



CFX9000 —
UL Type 3R, 40 hp I_L

Application Description

Designed to meet the IEEE 519-1992 requirements for harmonic distortion, the CFX9000 is an excellent choice for small and midsize drives applications where harmonics are a concern.

What Are Harmonics?

Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

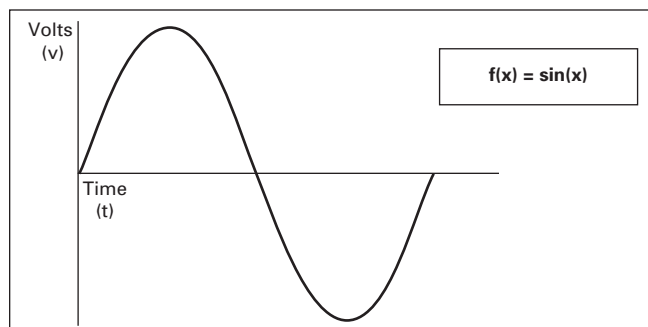


Figure 40-112. Perfect Wave

Add a second wave that is five times the fundamental frequency — 300 Hz (Typical of frequency added to the line by a fluorescent light).

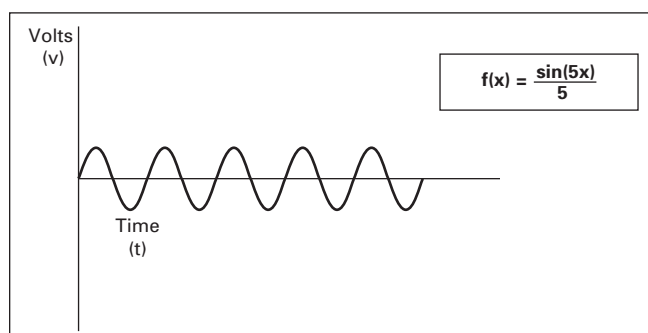


Figure 40-113. Second Wave

Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

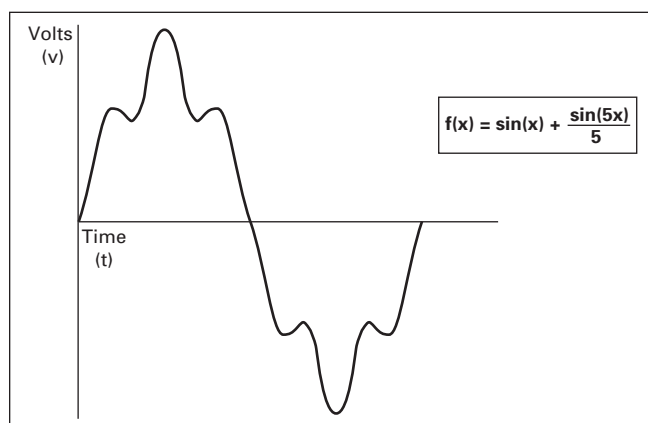


Figure 40-114. Resulting Supply

What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By applying drives from the Eaton Clean Power Drives Family; The HCX9000, CFX9000 and CPX9000.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

1. **Installation and utility costs increase.** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant (from 16.6 – 21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. **Downtime and loss of productivity.** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. **Downtime and nuisance trips of drives and other equipment.** Emergency generators have up to (3) three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. **Larger motors must be used.** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. **Higher installation costs.** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

How Does a VFD Convert 3-Phase AC to a Variable Output Voltage and Frequency?

The 6-pulse VFD: The majority of all conventional drives that are built consist of a 6-pulse configuration. **Figure 40-115** represents a 6-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0 – 400 Hz.

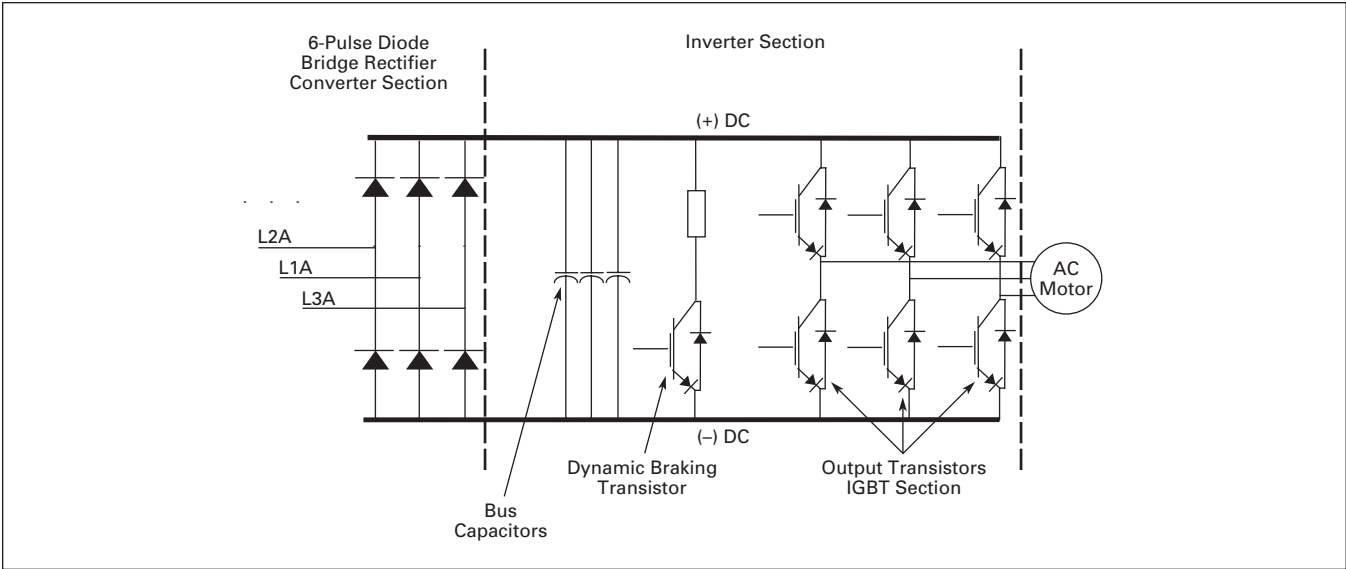


Figure 40-115. 6-Diode Rectifier Design

The 6-Pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. **Figure 40-116** is a 100 hp drive with 45A of damaging harmonic current.

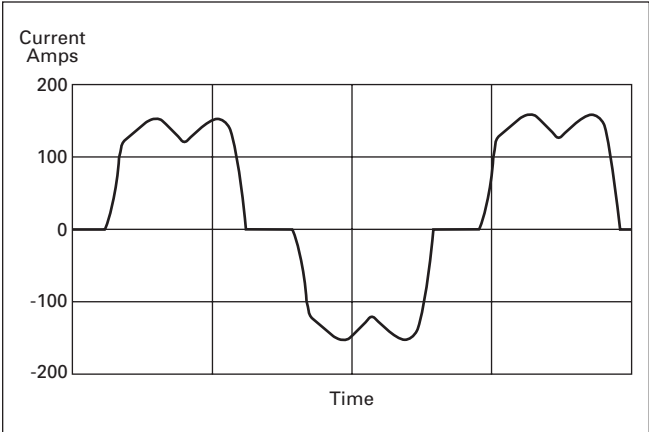


Figure 40-116. 6-Pulse Nonproductive Harmonic Current

Table 40-313. 6-Pulse Nonproductive Harmonic Current

6-Pulse Circuit		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 6.10\%$	$I_{19} = 1.77\%$
$I_5 = 22.5\%$	$I_{13} = 4.06\%$	$I_{23} = 1.12\%$
$I_7 = 9.38\%$	$I_{17} = 2.26\%$	$I_{25} = 0.86\%$
Power = 100 hp		
Harmonic Current = 45 Amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Table 40-314. Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

I_{SC}/I_L	Harmonic Order (Odd Harmonics)					TDD
	$h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h$	
< 20	4.0	2.0	1.5	0.6	0.3	5.0
$20 < 50$	7.0	3.5	2.5	1.0	0.5	8.0
$50 < 100$	10.0	4.5	4.0	1.5	0.7	12.0
$100 < 1000$	12.0	5.5	5.0	2.0	1.0	15.0
> 1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio I_{SC}/I_L is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

Notes:

TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC.

All of the limits are measured at a point of common coupling.

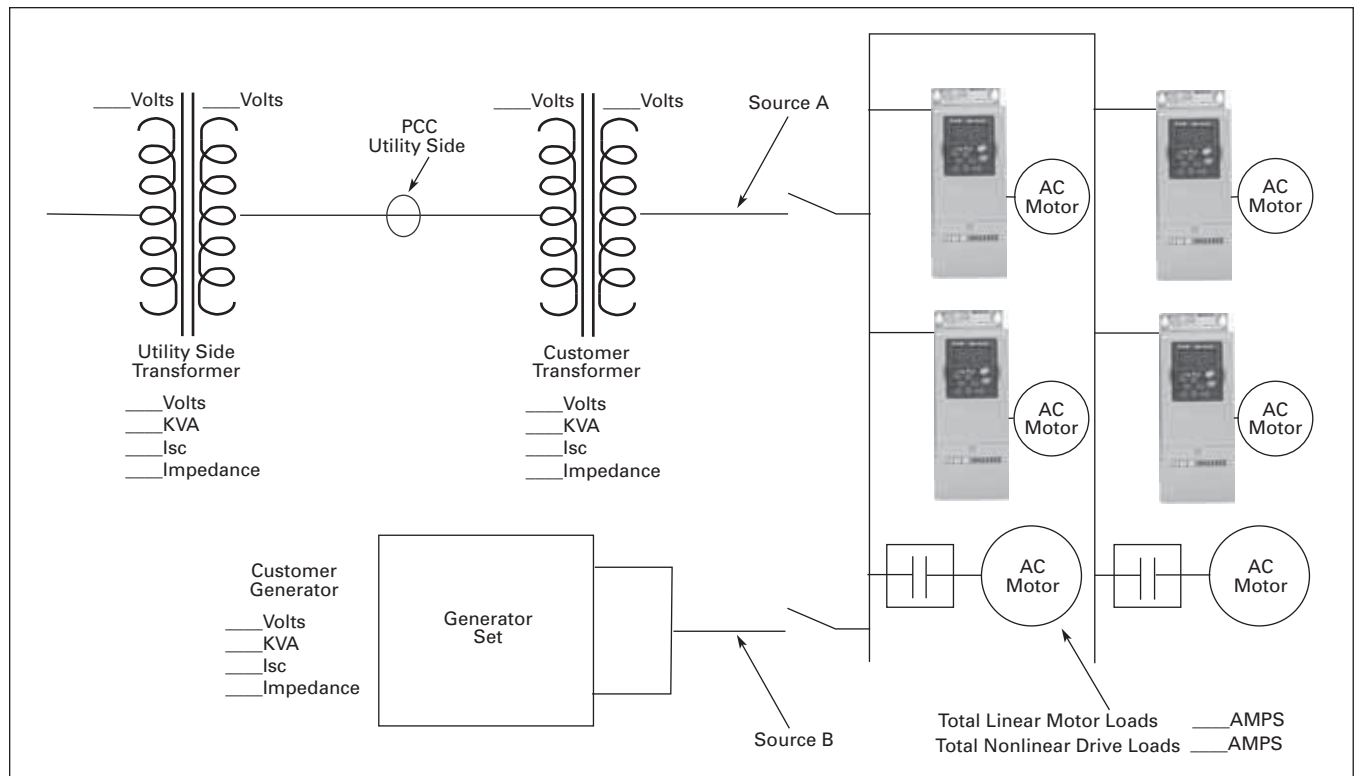


Figure 40-117. Oneline Diagram for Harmonic Analysis

The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The oneline in this Figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519.
- POA (Point of Analysis) is defined as where the harmonic calculations are taken.

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a 3-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10 – 25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of percent impedance, most typically 1 – 1.5%, 3% and 5%. (Note: the 9000X drives come standard with a nominal 3% input impedance.)

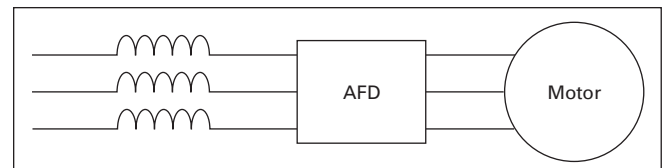


Figure 40-118. Line Reactor

Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of percent impedance
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

Enclosed Drives

2. Passive Filters

Tuned harmonic filters involve the series connection of an inductor with the shunt connection of an inductor and capacitor to form a low impedance path to ground for a specific

range of frequencies. This path presents an alternative to the flow of harmonic currents back into the utility source.

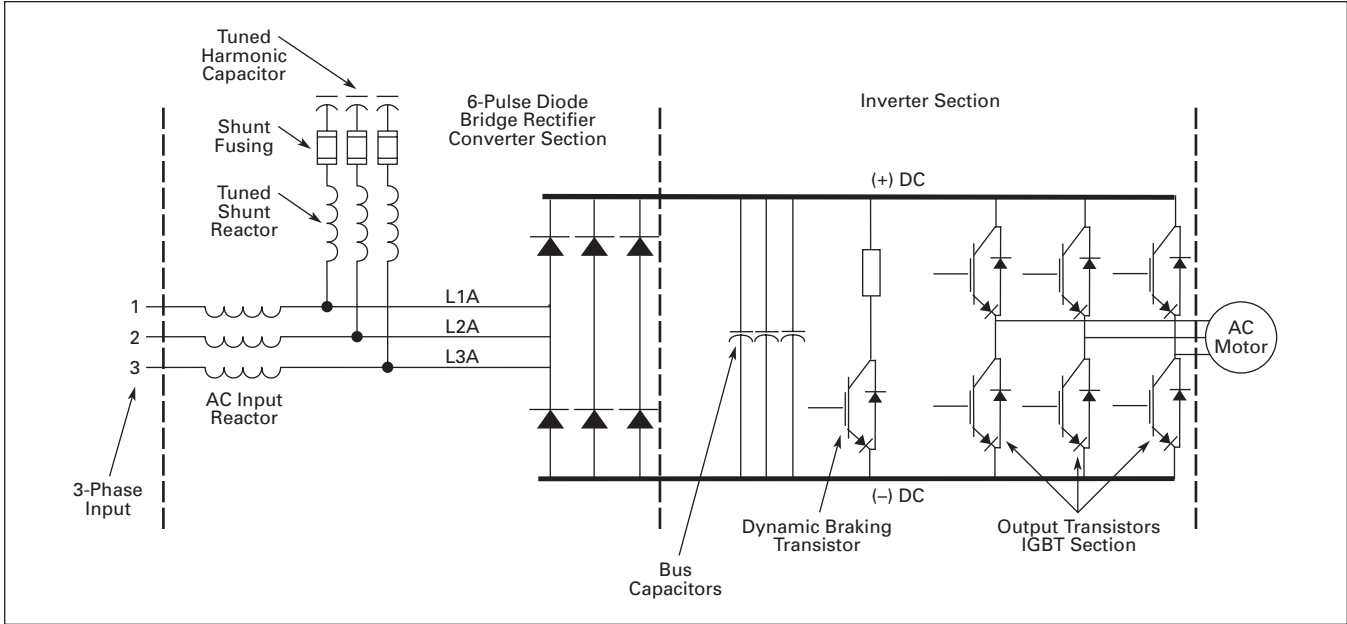


Figure 40-119. CFX9000 Drive with Integrated Passive Filter

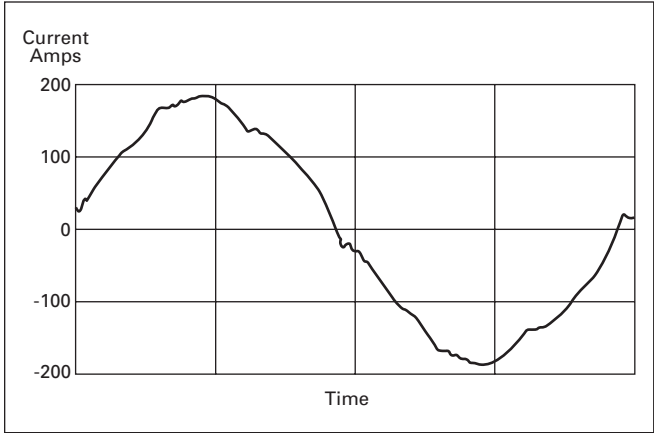


Figure 40-120. 100 hp CFX9000 480V Drive with Integrated Passive Filter

Table 40-315. 100 hp CFX9000 480V Drive with Integrated Passive Filter

Passive Filter		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = .24\%$	$I_{19} = .50\%$
$I_5 = 3.76\%$	$I_{13} = 1.1\%$	$I_{23} = .55\%$
$I_7 = 1.65\%$	$I_{17} = .80\%$	$I_{25} = 0.8\%$
Power = 74.6 kW		
$H_c = 8.6$ Amps		

Advantages

- Low cost for smaller horsepower applications
- More effective harmonic attenuation than 12-pulse drives
- Provides increased input protection for AFD from line transients

Disadvantages

- Capacitors age over time, unlike magnetics
- Not as effective as 18-pulse drives
- Challenging to retrofit with bypass applications

3. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately

85% reduction of harmonic current and voltage distortion may be achieved (over standard 6-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

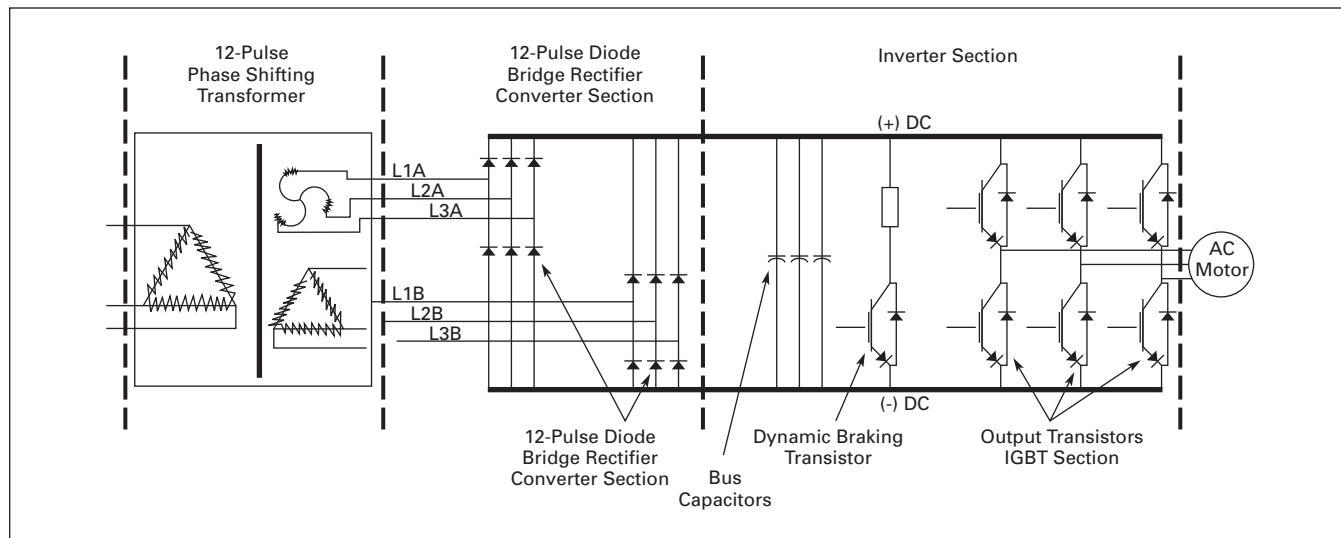


Figure 40-121. Basic 12-Pulse Rectifier with "Phase Shifting" Transformer

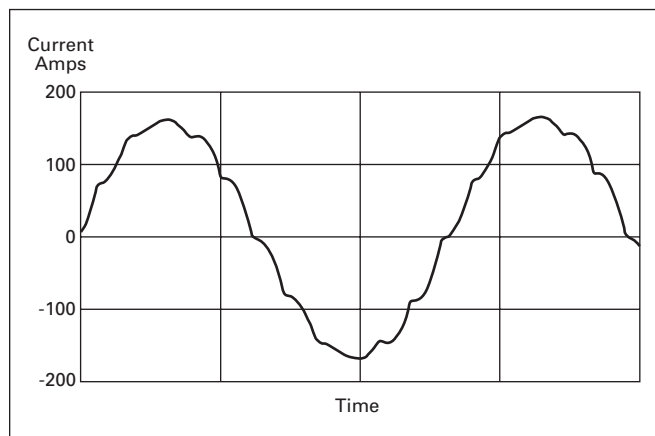


Figure 40-122. 100 hp 480V Drive with 12-Pulse Rectifier

Table 40-316. 100 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 4.19\%$	$I_{19} = 0.06\%$
$I_5 = 1.25\%$	$I_{13} = 2.95\%$	$I_{23} = 0.87\%$
$I_7 = 0.48\%$	$I_{17} = 0.21\%$	$I_{25} = 0.73\%$
Power = 100 hp		
$H_c = 20$ Amps		

Advantages

- Reasonable cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

Enclosed Drives

4. Clean Power 18-Pulse Drives

When the total load is comprised of non-linear load such as drives and the ratio is I_{sc}/I_L , the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and “clean” such that system interference and additional losses are negligible. The Cutler-Hammer CFX9000 Clean Power Drive uses a phase-shifting auto transformer with delta-connected winding that carries only the ampere-turns caused by the difference in load currents. This results in nine separate phases. In this type of configuration, the total KVA rating of the transformer

magnetic system was only 48% that of the motor load. A traditional isolated transformer system, with multipulse windings, would require the full KVA rating to be supported, which is more common in a MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with 6-pulse, passive filter and 12-pulse, systems are shown in **Figures 40-116, 40-120, 40-122 and 40-124.**

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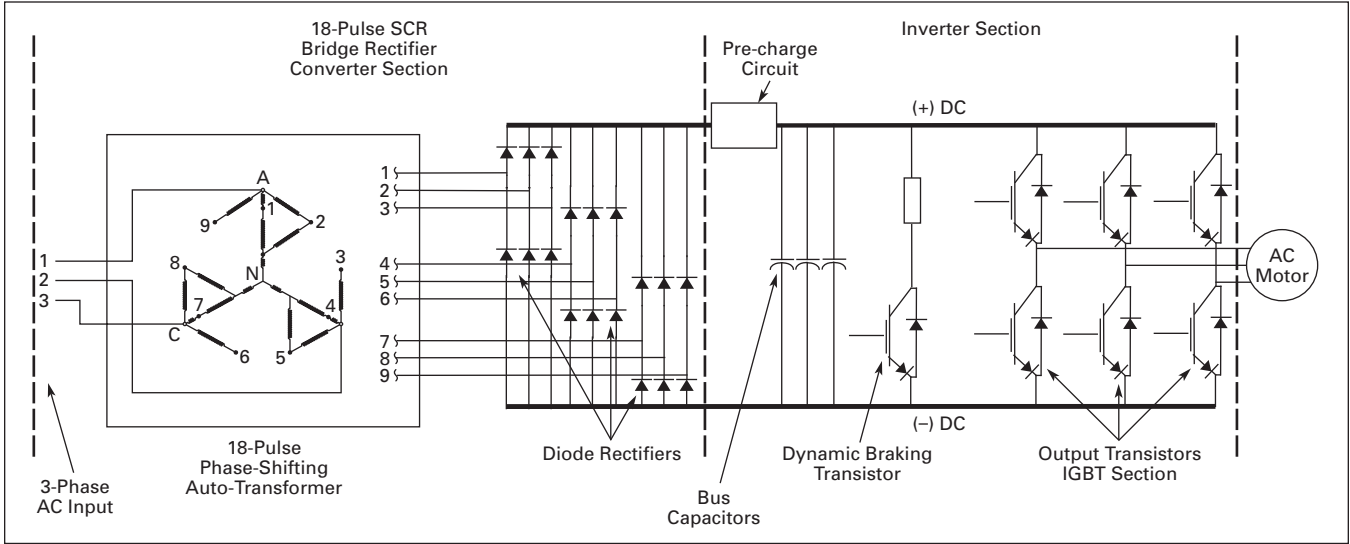


Figure 40-123. Basic 18-Pulse Rectifier with Phase-Shifting Auto-Transformer

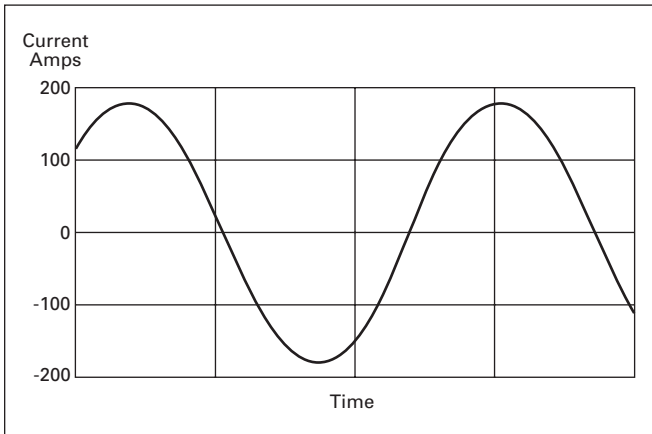


Figure 40-124. 100 hp 480V Drive with 18-Pulse Rectifiers

Table 40-317. 100 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 1.00\%$
$I_5 = 0.16\%$	$I_{13} = 0.10\%$	$I_{23} = 0.01\%$
$I_7 = 0.03\%$	$I_{17} = 0.86\%$	$I_{25} = 0.01\%$
Power = 100 hp		
$H_c = 5.9$ Amps		

Advantages

- Effectively guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semi-conductors from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter
- Minimizes ripple current in capacitors, doubling expected capacitor life

Disadvantages

- Larger and heavier magnetics than some other methods

Technical Data and Specifications

Table 40-318. Specifications

Feature Description	CFX9000 Enclosed Products — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 320
Initial Output Current (I_H)	250% for 2 seconds
Overload: 1 Minute (I_H/I_L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Optional
AC Input Circuit Disconnect	Optional
Phase Rotation Insensitive	Standard
EMI Filter	FR6 – FR9 ①
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
MOV	Optional
Input/Output Interface Features	
Setup Adjustment Provisions:	
Remote Keypad/Display	Standard
Personal Computer	Standard
Operator Control Provisions:	
Drive Mounted Keypad/Display	Standard
Remote Keypad/Display	Standard
Conventional Control Elements	Standard
Serial Communications	Optional
115V AC Control Circuit	Optional
Speed Setting Inputs:	
Keypad	Standard
0 – 10V DC Potentiometer/Voltage Signal	Standard
4 – 20 mA Isolated	Configurable
4 – 20 mA Differential	Configurable
3 – 15 psig	Optional
Analog Outputs:	
Speed/Frequency	Standard
Torque/Load/Current	Programmable
Motor Voltage	Programmable
Kilowatts	Programmable
0 – 10V DC Signals	Configurable w/Jumpers
4 – 20 mA DC Signals	Standard
Isolated Signals	Optional

① The EMI filter is optional in FR10.

Feature Description	CFX9000 Enclosed Products — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered
Input/Output Interface Features (Continued)	
Discrete Outputs:	
Fault Alarm	Standard
Drive Running	Standard
Drive at Set Speed	Programmable
Optional Parameters	14
Dry Contacts	2 Relays Form C
Open Collector Outputs	1
Additional Discrete Outputs	Optional
Communications:	
RS-232	Standard
RS-422/485	Optional
DeviceNet™	Optional
Modbus RTU	Optional
CanOpen (Slave)	Optional
Profibus-DP	Optional
Lonworks®	Optional
Johnson Controls Metasys™ N2	Optional
Ethernet IP	Optional
BACnet	Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional

Standard Conditions for Application and Service	
Maximum Operating Ambient Temperature	0 – 50°C ②
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude	100% load capacity (no derating) up to 3280 ft. (1000m); 1% derating for each 328 ft. (100m) above 3280 ft. (1000m); max. 9842 ft. (3000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>96%
Power Factor (Displacement)	.99

② See Table 40-321 for specific ratings.

Table 40-319. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: “0” ≤ 10V, “1” ≥ 18V, R_i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R_i > 200 kΩ Current: 0 (4) – 20 mA, R_i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, impedance 500 ohms, resolution 106 ±3%

Enclosed Drives

Catalog Number Selection

Table 40-320. CFX9000 Enclosed Drive Catalog Numbering System

CFX 050 1 4 A A

Product Family

CFX = Integrated Filter Clean Power Drive

Horsepower Rating

007 = 7-1/2 hp	040 = 40 hp	150 = 150 hp
010 = 10 hp	050 = 50 hp	200 = 200 hp
015 = 15 hp	060 = 60 hp	250 = 250 hp
020 = 20 hp	075 = 75 hp	300 = 300 hp
025 = 25 hp	100 = 100 hp	350 = 350 hp
030 = 30 hp	125 = 125 hp	400 = 400 hp

Enclosure Rating

1 = UL Type 1
2 = UL Type 12
3 = UL Type 3R
6 = NEMA 12 Filtered

Voltage Rating

1 = 208V
2 = 230V
4 = 480V
5 = 575V (575 – 600V)

Application — Torque/Braking

A = I_L/No Brake Chopper
B = I_L/Internal Brake Chopper
D = I_M/No Brake Chopper
E = I_M/Internal Brake Chopper

Enclosed Style

A = Enclosed Drive

Build options alphabetically and numerically.

— — — — —

Enclosed Options ②③④		Type
K1	Door-Mounted Speed Potentiometer ⑤	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ⑤	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Reference Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB, Bypass Options	Addl. Bypass
LE	Red RUN Light	Light
P1	Input Disconnect	Input
P3	Input Line Fuses (200 kAIC)	Input
P7	Input Power Surge Protection	Input
P8	TVSS Transient Voltage Surge Suppressor	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/μS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
RG	Reduced Voltage Starter for Bypass	Bypass
S4	Floor Stand 6"	Enclosure
S5	Floor Stand 22"	Enclosure
S6	Floor Stand 12"	Enclosure
S9	Space Heater	Enclosure

Communication Options ⑥	
C2 = Modbus C3 = Profibus DP C4 = LonWorks C5 = Profibus DP (D9 Connector) C6 = CanOpen (Slave) C7 = DeviceNet C8 = Modbus (D9 Type Connector)	CA = Johnson Controls N2 CI = Modbus TCP CJ = BACnet CK = Ethernet IP D3 = RS-232 with D9 Connection

Control Options

B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

Engineered Options

HT High Temperature rating for 50°C ⑦
VB Varnished Boards

① Brake Chopper is standard in 208V, 230V and 480V drives up to FR6; optional in all other drives.

② Local/remote keypad is included as the standard Control Panel.

③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.

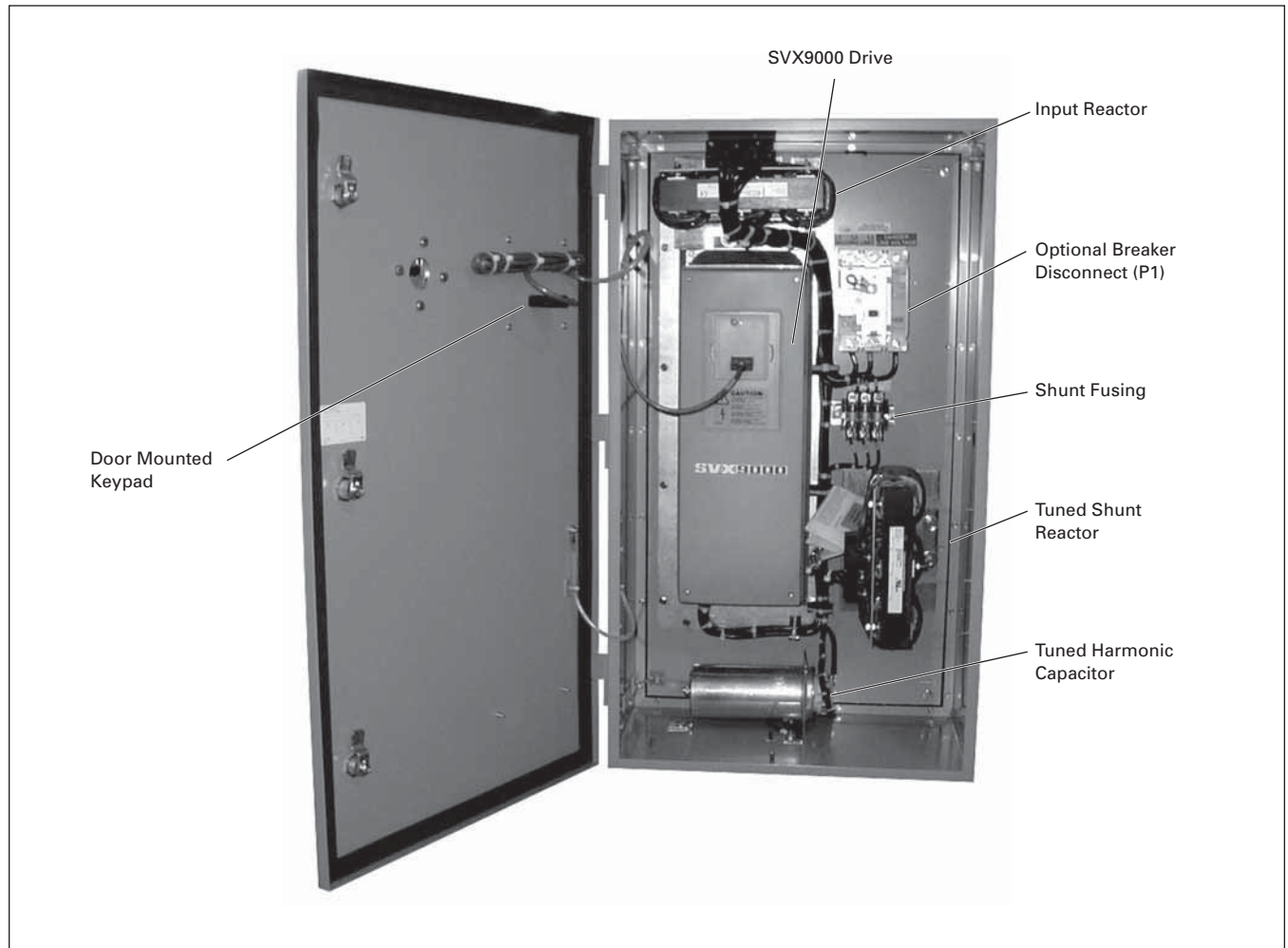
④ See **Pages 40-224 and 40-225** for descriptions.

⑤ Includes local/remote speed reference switch.

⑥ See **Pages 40-226 and 40-227** for complete descriptions.

⑦ Consult Eaton for availability.

Product Selection



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Figure 40-125. UL Type 12, 40 hp

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base enclosed package includes a standard drive, door-mounted alphanumeric keypad and enclosure.
- The CFX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating.

The older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in **Table 40-321**.

Table 40-321. Ambient Temperature Ratings

Enclosure Size	I_H	I_L
B, C, 9 ①	40°C	40°C
7, 8	50°C	50°C

① For high temperature rating, select HT option code and consult factory for pricing.

- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- **Note:** All of the programming is exactly the same as the standard SVX9000 drive.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.

Enclosed Drives

Table 40-322. 208V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$
Low Overload Drive								
7-1/2	24.2	FR5	①		CFX00721BA		CFX00731BA	
10	30.8	FR5	①		CFX01021BA		CFX01031BA	
15	46.2	FR6	①		CFX01521BA		CFX01531BA	
20	59.4	FR6	①		CFX02021BA		CFX02031BA	
25	74.8	FR7	①		CFX02521AA		CFX02531AA	
30	88	FR7	①		CFX03021AA		CFX03031AA	
40	114	FR7	①		CFX04021AA		CFX04031AA	
50	143	FR8	CFX05011AA		CFX05061AA		CFX05031AA	
60	169	FR8	CFX06011AA		CFX06061AA		CFX06031AA	
75	211	FR8	CFX07511AA		CFX07561AA		CFX07531AA	
100	273	FR9	CFX10011AA		CFX10061AA		CFX10031AA	
High Overload Drive								
7-1/2	24.2	FR5	①		CFX00721EA		CFX00731EA	
10	30.8	FR6	①		CFX01021EA		CFX01031EA	
15	46.2	FR6	①		CFX01521EA		CFX01531EA	
20	59.4	FR7	①		CFX02021DA		CFX02031DA	
25	74.8	FR7	①		CFX02521DA		CFX02531DA	
30	88	FR7	①		CFX03021DA		CFX03031DA	
40	114	FR8	CFX04011DA		CFX04061DA		CFX04031DA	
50	143	FR8	CFX05011DA		CFX05061DA		CFX05031DA	
60	169	FR8	CFX06011DA		CFX06061DA		CFX06031DA	
75	211	FR9	CFX07511DA		CFX07561DA		CFX07531DA	
100	273	FR9	CFX10011DA		CFX10061DA		CFX10031DA	

① FR5 – FR7 drives not available in UL Type 1.

Table 40-323. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	

Table 40-324. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	Page 40-231	Page 40-233
C	Page 40-232	Page 40-234
E	N/A	Page 40-235
7	Page 40-236	②
8	Page 40-237	②
9	Page 40-238	②

② Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Enclosed Drives

Table 40-325. 230V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$
Low Overload Drive								
7-1/2	22	FR5	①		CFX00722BA		CFX00732BA	
10	28	FR5	①		CFX01022BA		CFX01032BA	
15	42	FR6	①		CFX01522BA		CFX01532BA	
20	54	FR6	①		CFX02022BA		CFX02032BA	
25	68	FR7	①		CFX02522AA		CFX02532AA	
30	80	FR7	①		CFX03022AA		CFX03032AA	
40	104	FR7	①		CFX04022AA		CFX04032AA	
50	130	FR8	CFX05012AA		CFX05062AA		CFX05032AA	
60	154	FR8	CFX06012AA		CFX06062AA		CFX06032AA	
75	192	FR8	CFX07512AA		CFX07562AA		CFX07532AA	
100	248	FR9	CFX10012AA		CFX10062AA		CFX10032AA	

High Overload Drive

7-1/2	22	FR5	①		CFX00722EA		CFX00732EA	
10	28	FR6	①		CFX01022EA		CFX01032EA	
15	42	FR6	①		CFX01522EA		CFX01532EA	
20	54	FR7	①		CFX02022DA		CFX02032DA	
25	68	FR7	①		CFX02522DA		CFX02532DA	
30	80	FR7	①		CFX03022DA		CFX03032DA	
40	104	FR8	CFX04012DA		CFX04062DA		CFX04032DA	
50	130	FR8	CFX05012DA		CFX05062DA		CFX05032DA	
60	154	FR8	CFX06012DA		CFX06062DA		CFX06032DA	
75	192	FR9	CFX07512DA		CFX07562DA		CFX07532DA	
100	248	FR9	CFX10012DA		CFX10062DA		CFX10032DA	

① FR5 – FR7 drives not available in UL Type 1.

Table 40-326. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	

Table 40-327. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	Page 40-231	Page 40-233
C	Page 40-232	Page 40-234
E	N/A	Page 40-235
7	Page 40-236	②
8	Page 40-237	②
9	Page 40-238	②

② Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Enclosed Drives

Table 40-328. 480V AC CFX9000 Base Drive Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number ①	Price U.S. \$	Base Catalog Number ①	Price U.S. \$	Base Catalog Number ①	Price U.S. \$
Low Overload Drive								
7-1/2	11	FR4	③		CFX00724BA		CFX00734BA	
10	14	FR5	③		CFX01024BA		CFX01034BA	
15	21	FR5	③		CFX01524BA		CFX01534BA	
20	27	FR5	③		CFX02024BA		CFX02034BA	
25	34	FR6	③		CFX02524BA		CFX02534BA	
30	40	FR6	③		CFX03024BA		CFX03034BA	
40	52	FR6	③		CFX04024BA		CFX04034BA	
50	65	FR7	CFX05014AA ④		CFX05024AA		CFX05034AA	
60	77	FR7	CFX06014AA ④		CFX06024AA		CFX06034AA	
75	96	FR7	CFX07514AA ④		CFX07524AA		CFX07534AA	
100	124	FR8	CFX10014AA		CFX10064AA		CFX10034AA	
125	156	FR8	CFX12514AA		CFX12564AA		CFX12534AA	
150	180	FR8	CFX15014AA		CFX15064AA		CFX15034AA	
200	240	FR9	CFX20014AA		CFX20064AA		CFX20034AA	
250	302	FR9	CFX25014AA		CFX25064AA		CFX25034AA	
300	361	FR10	CFX30014AA		CFX30064AA		②	
350	414	FR10	CFX35014AA		CFX35064AA		②	
400	477	FR10	CFX40014AA		CFX40064AA		②	

High Overload Drive

7-1/2	11	FR5	③		CFX00724EA		CFX00734EA	
10	14	FR5	③		CFX01024EA		CFX01034EA	
15	21	FR5	③		CFX01524EA		CFX01534EA	
20	27	FR6	③		CFX02024EA		CFX02034EA	
25	34	FR6	③		CFX02524EA		CFX02534EA	
30	40	FR6	③		CFX03024EA		CFX03034EA	
40	52	FR7	CFX04014DA ④		CFX04024DA		CFX04034DA	
50	65	FR7	CFX05014DA ④		CFX05024DA		CFX05034DA	
60	77	FR7	CFX06014DA ④		CFX06024DA		CFX06034DA	
75	96	FR8	CFX07514DA		CFX07564DA		CFX07534DA	
100	124	FR8	CFX10014DA		CFX10064DA		CFX10034DA	
125	156	FR8	CFX12514DA		CFX12564DA		CFX12534DA	
150	180	FR9	CFX15014DA		CFX15064DA		CFX15034DA	
200	240	FR9	CFX20014DA		CFX20064DA		CFX20034DA	
250	302	FR10	CFX25014DA		CFX25064DA		②	
300	361	FR10	CFX30014DA		CFX30064DA		②	
350	414	FR10	CFX35014DA		CFX35064DA		②	

① The Integrated Filter Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

② Consult factory.

③ FR4 – FR6 drives not available in UL Type 1.

④ This catalog number is used only with power options.

Table 40-329. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4	N/A		B		B	C
FR5	N/A		B	C	B	C
FR6	N/A		B	C	B	C
FR7	N/A	7	C	7	C	E
FR8	7				E	
FR9	8				E	
FR10	9				⑤	

⑤ Consult factory.

Table 40-330. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	Page 40-231	Page 40-233
C	Page 40-232	Page 40-234
E	N/A	Page 40-235
7	Page 40-236	⑥
8	Page 40-237	⑥
9	Page 40-238	⑥

⑥ Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Enclosed Drives

Table 40-331. 575V — UL Type 1, UL Type 12, UL Type 3R and NEMA 12 Filtered Product Selection

hp	NEC Current (A)	Chassis Frame	UL Type 1		UL Type 12 and NEMA 12 Filtered		UL Type 3R	
			Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$	Base Catalog Number	Price U.S. \$
Low Overload Drive								
15	17	FR6	①		CFX01525AA		CFX01535AA	
20	22	FR6	①		CFX02025AA		CFX02035AA	
25	27	FR6	①		CFX02525AA		CFX02535AA	
30	32	FR6	①		CFX03025AA		CFX03035AA	
40	41	FR7	①		CFX04025AA		CFX04035AA	
50	52	FR7	①		CFX05025AA		CFX05035AA	
60	62	FR8	CFX06015AA		CFX06065AA		CFX06035AA	
75	77	FR8	CFX07515AA		CFX07565AA		CFX07535AA	
100	99	FR8	CFX10015AA		CFX10065AA		CFX10035AA	
125	125	FR9	CFX12515AA		CFX12565AA		CFX12535AA	
150	144	FR9	CFX15015AA		CFX15065AA		CFX15035AA	
200	192	FR9	CFX20015AA		CFX20065AA		CFX20035AA	
250	242	FR10	CFX25015AA		CFX25065AA		②	
300	289	FR10	CFX30015AA		CFX30065AA		②	
400	382	FR10	CFX40015AA		CFX40065AA		②	

High Overload Drive

10	14	FR6	①		CFX01025DA		CFX01035DA	
15	17	FR6	①		CFX01525DA		CFX01535DA	
20	22	FR6	①		CFX02025DA		CFX02035DA	
25	27	FR6	①		CFX02525DA		CFX02535DA	
30	32	FR7	①		CFX03025DA		CFX03035DA	
40	41	FR7	①		CFX04025DA		CFX04035DA	
50	52	FR8	CFX05015DA		CFX05065DA		CFX05035DA	
60	62	FR8	CFX06015DA		CFX06065DA		CFX06035DA	
75	77	FR8	CFX07515DA		CFX07565DA		CFX07535DA	
100	99	FR9	CFX10015DA		CFX10065DA		CFX10035DA	
125	125	FR9	CFX12515DA		CFX12565DA		CFX12535DA	
150	144	FR9	CFX15015DA		CFX15065DA		CFX15035DA	
200	192	FR10	CFX20015DA		CFX20065DA		②	
250	242	FR10	CFX25015DA		CFX25065DA		②	
300	289	FR10	CFX30015DA		CFX30065DA		②	

① FR6 – FR7 drives not available in UL Type 1.

② Consult factory.

Table 40-332. CFX9000 Enclosure Selection

Chassis Frame	UL Type 1		UL Type 12		UL Type 3R	
	Disconnect Only	With Power Options	Disconnect Only	With Power Options	Disconnect Only	With Power Options
FR4		N/A		B	B	C
FR5		N/A	B	C	B	C
FR6		N/A	B	C	B	C
FR7	N/A	7	C	7	C	E
FR8		7				E
FR9		8				E
FR10		9				③

③ Consult factory.

Table 40-333. Enclosure Dimension Drawings

Enclosure Size	UL Type 1 & UL Type 12 Drawings	UL Type 3R Drawings
B	Page 40-231	Page 40-233
C	Page 40-232	Page 40-234
E	N/A	Page 40-235
7	Page 40-236	④
8	Page 40-237	④
9	Page 40-238	④

④ Not available for UL Type 3R.

Note: Enclosures 7 and 8 are NEMA 12 Filtered.

Options

Control/Communication Option Descriptions

Table 40-334. Available Control/Communications Options

Option	Description	Option Type
K1	Door-Mounted Speed Potentiometer — Provides the DRIVE with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the DRIVE with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	3 – 15 psig Follower — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the DRIVE. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and Fieldbus.	Control
K5	MANUAL/AUTO Speed Reference Switch — Provides door-mounted selector switch for Manual/Auto speed reference.	Control
K6	START/STOP Pushbuttons — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	Bypass Test Switch for RB and RA — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	Standard Elapsed Time Meter — Provides a door-mounted elapsed run time meter.	Control
L1	Power On and Fault Power Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	Bypass Pilot Lights for RB, RA Bypass Options — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LE	Red Run Pilot Light (22 mm) — Provides a red run pilot light that indicates the drive is running.	Light
P1	Input Disconnect Assembly Rated to 100 kAIC — High Interrupting Motor Circuit Protector (HMCP) or Circuit Breaker that provides a means of short circuit protection for the power cables between it and the DRIVE, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the DRIVE from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.	Input
P3	Input Line Fuses Rated to 200 kAIC — Provides high-level fault protection of the DRIVE input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses, which are factory mounted in the enclosure.	Input
P7	MOV Surge Suppressor — Provides a Metal Oxide Varistor (MOV) connected to the line side terminals and is designed to clip line side transients.	Input
P8	TVSS Transient Voltage Surge Suppressor — Provides transient voltage surge suppression of the unit. Consult factory for ratings.	Input
PE	Output Contactor — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options RB and RA include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	Output Filter — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a .5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option PF), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m). <i>This option can not be used with the Brake Chopper Circuit. The Output Filter (option PF) should be investigated as an alternative.</i>	Output
PH	Single Overload Relay — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	Dual Overload Relays — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	Dual Overloads for Bypass — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Enclosed Drives

Table 40-334. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	Manual HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-239).	Bypass
RB	Manual IOB Bypass Controller — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-239).	Bypass
RC	Auto Transfer HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-239). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	Auto Transfer IOB Bypass Controller — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the DRIVE, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-239). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	Reduced Voltage Starter for Bypass — Used in conjunction with bypass option RA, RB, RC or RD. This option adds <i>IT</i> . Series reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S4	Floor Stand 6" — Raises “E” box off the ground 6" (152.4 mm). Recommended when box is not installed on an appropriate concrete pad.	Enclosure
S5	Floor Stand 22" — Converts a Size B or C, normally wall mounted enclosure to a floor standing enclosure with a height of 22" (558.8 mm).	Enclosure
S6	Floor Stand 12" — Converts a Size C, normally wall mounted enclosure to a floor standing enclosure with a height of 12" (304.8 mm).	Enclosure
S9	Space Heater — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. Heater requires a customer supplied 115V remote supply source.	Enclosure

Enclosed Drives

CFX9000 Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-126**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

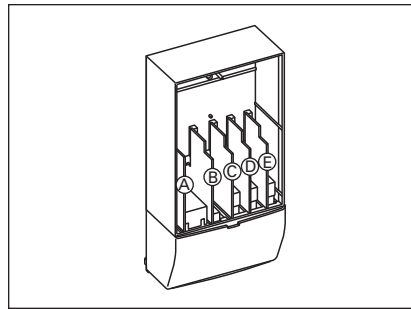


Figure 40-126. 9000X Series Option Boards

Table 40-335. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.\$	Option Designator	Adder U.S.\$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-126)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Discount Symbol..... **SS-3**

Enclosed Drives

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTCI is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of

30 Binary Value Objects (BVOs) and 35 Analog Value Objects (AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-336. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, $R_i \geq 200 \text{ k}\Omega$
Analog current, input	0 (4) – 20 mA, $R_i = 250\Omega$
Digital Input	24V: “0” $\leq 10V$, “1” $\geq 18V$, $R_i > 5 \text{ k}\Omega$
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4) – 20 mA, $R_L = 500 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Analog voltage, output	0 (2) – 10V, $R_L \geq 1 \text{ k}\Omega$, resolution 10 bit, accuracy $\leq \pm 2\%$
Relay output Max. switching voltage Max. switching load Max. continuous load	300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	$R_{trip} = 4.7 \text{ k}\Omega$

Table 40-337. Conformal (Varnished) Coating Adder — VB Option 208V, 230V, 480V and 575V ①

Chassis Frame	Delivery Code	Adder U.S. \$	Chassis Frame	Delivery Code	Adder U.S. \$
FR6 FR7 FR8	FP FP FP		FR9 FR10	FP FP	

① See catalog number description to order.

Enclosed Options**Table 40-338. 208V and 230V Light Options**




Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Red RUN Light (22 mm)
	L1	LE
hp	Adder U.S. \$	Adder U.S. \$
7-1/2 – 100		

Table 40-339. 208V and 230V Control Options

Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	Standard Elapsed Time Meter	Input Power Surge Protection MOV	TVSS Transient Voltage Surge Suppressor
	K1	K2	K3	K4	K5	K6	KO	P7	P8
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2 – 100									


Enclosed Drives

Table 40-340. 208V and 230V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller	Reduced Volt Starter for Bypass
	KF	L2	PN	RA	RB	RC	RD	RG
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2 10 15 20								
25 30 40 50								
60 75 100								


^① See Pages 40-224 and 40-225 for details.

Table 40-341. 208V and 230V Enclosure Options

Catalog Number Suffix 	Floor Stand 6" (152.4 mm)	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	Space Heater ^②
	S4	S5	S6	S9
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7 8 9				
B				
C				
E				

^② Requires customer supplied 115V AC supply.

Table 40-342. 208V and 230V Power Options

Catalog Number Suffix 	Input		Output		
	Input Disconnect (HMCP) 65 kAIC	Input Line Fuses 200 kAIC	Output Contactor	Single Overload Relay ^③	Dual Overload Relays ^③
	P1	P3	PE	PH	PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2 10 15 20					
25 30 40 50					
60 75 100					

^③ Heater packs not included.

Enclosed Drives

Table 40-343. 480V and 575V Light Options


Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm)	Red RUN Light (22 mm)
	L1	LE
hp	Adder U.S. \$	Adder U.S. \$
7-1/2 – 400		

Table 40-344. 480V and 575V Control Options




Catalog Number Suffix 	Door-Mounted Speed Potentiometer	Door-Mounted Speed Potentiometer with HOA Selector Switch	3 – 15 psig Follower	HAND/OFF/AUTO Switch (22 mm)	MANUAL/AUTO Ref Switch (22 mm)	START/STOP Pushbuttons (22 mm)	Standard Elapsed Time Meter	Input Power Surge Protection MOV	TVSS Transient Voltage Surge Suppressor
	K1	K2	K3	K4	K5	K6	KO	P7	P8
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2 – 400									

Table 40-345. 480V and 575V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB, RC, RD	Bypass Pilot Lights for RA, RB Options	Dual Overloads for Bypass	Manual HOA Bypass Controller	Manual IOB Bypass Controller	Auto Transfer HOA Bypass Controller	Auto Transfer IOB Bypass Controller	Reduced Volt Starter for Bypass
	KF	L2	PN	RA	RB	RC	RD	RG
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2								
10								
15								
20								
25								
30								
40								
50								
60								
75								
100								
125								
150								
200								
250								
300								
350								
400								

^① See Pages 40-224 and 40-225 for details.


Table 40-346. 480V and 575V Enclosure Options

Catalog Number Suffix 	Floor Stand 6" (152.4 mm)	Floor Stand 22" (558.8 mm)	Floor Stand 12" (304.8 mm)	Space Heater ^②
	S4	S5	S6	S9
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7				
8				
9				
B				
C				
E				

^② Requires customer supplied 115V AC supply.

Enclosed Drives

Table 40-347. 480V and 575V Power Options

Catalog Number Suffix 	Input		Output				
	Input Disconnect Thermo-mag Breaker 65 kAIC	Input Line Fuses 200 kAIC	Output Contactor	Output Filter ^①	MotoRx (300 – 600 Ft.) 1000 V/ μ S DV/DT Filter ^①	Single Overload Relay ^②	Dual Overload Relays ^②
	P1	P3	PE	PF	PG	PH	PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7-1/2							
10							
15							
20							
25							
30							
40							
50							
60							
75							
100							
125							
150							
200							
250							
300							
350							
400							

^① Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.
^② Heater packs not included.

Dimensions

Enclosure Box B — UL Type 12

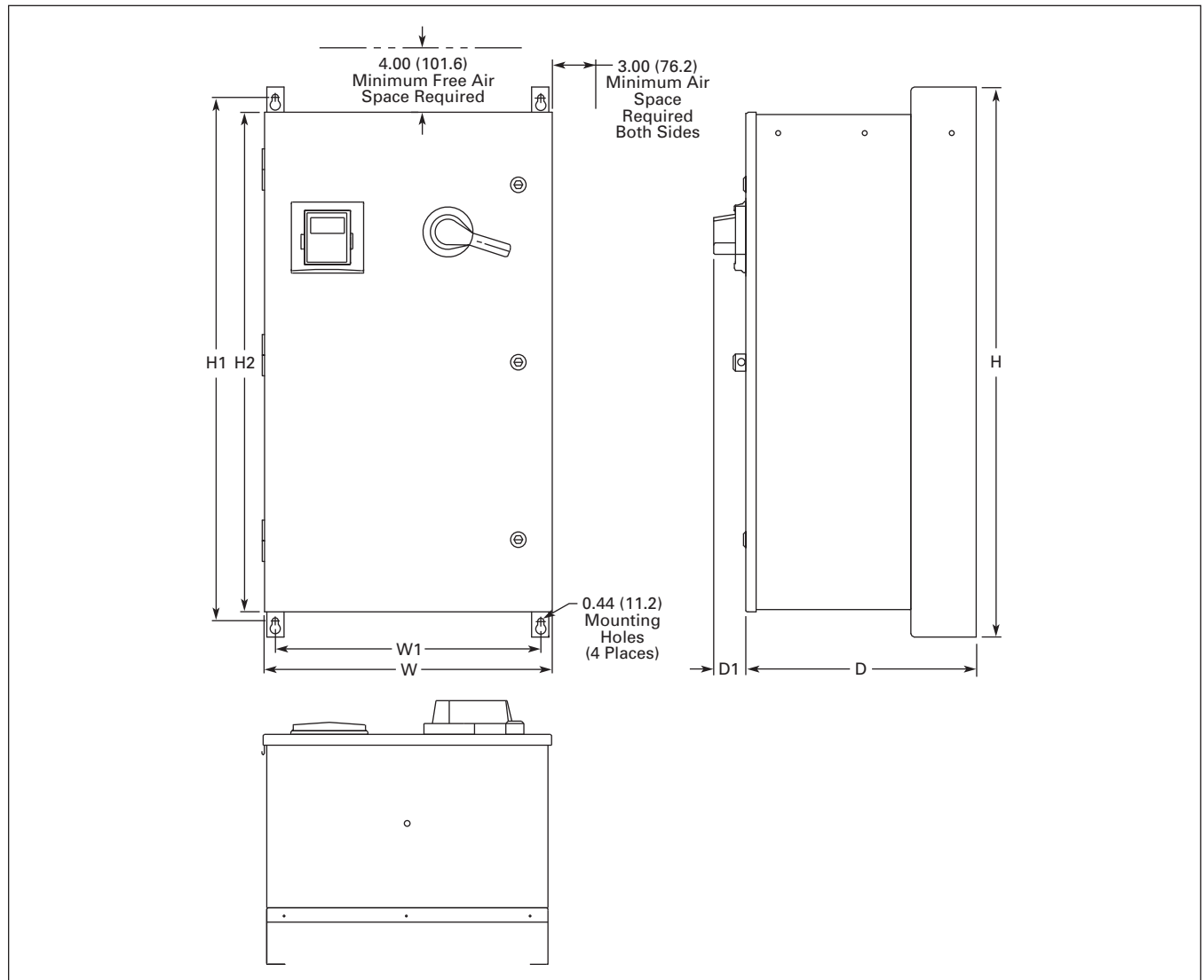


Figure 40-127. Enclosure Box B — UL Type 12 Dimensions

Table 40-348. Enclosure Box B — UL Type 12 Dimensions

Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	W	W1	D	D1		
40.00 (1016.0)	38.00 (965.2)	36.35 (923.3)	20.92 (531.4)	19.30 (490.2)	16.76 (425.7)	2.34 (59.4)	185 (84)	229 (104)

Enclosed Drives

Enclosure Box C — UL Type 12

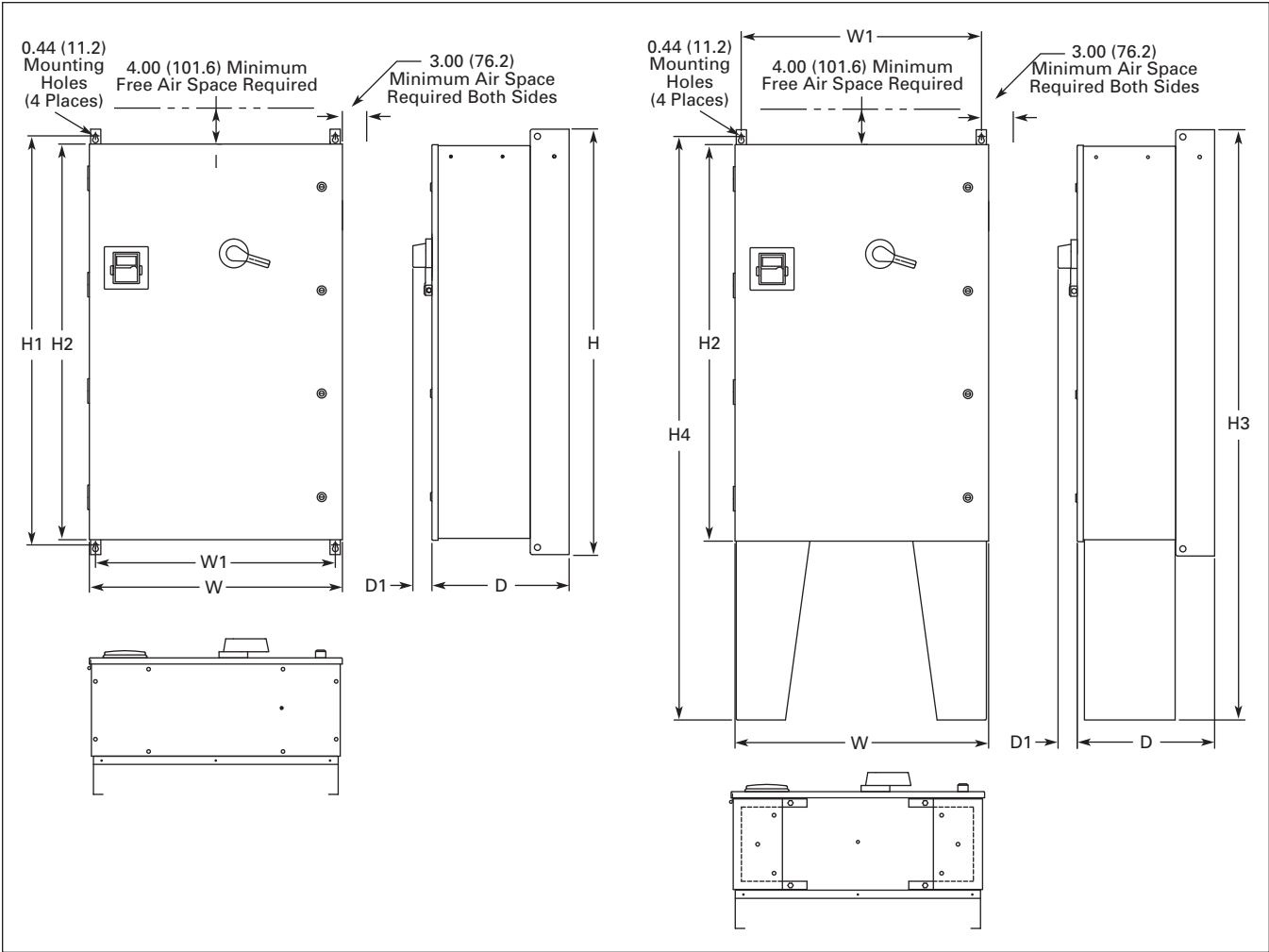


Figure 40-128. Enclosure Box C — UL Type 12 Dimensions

Table 40-349. Enclosure Box C — UL Type 12 Dimensions

Approximate Dimensions in Inches (mm)									Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	H4	W	W1	D	D1		
52.00 (1320.8)	50.00 (1270.0)	48.35 (1228.1)	72.00 (1828.8)	71.19 (1808.2)	30.92 (785.4)	29.30 (744.2)	16.78 (426.2)	2.34 (59.4)	320 (145)	435 (197)

Enclosure Box B — UL Type 3R

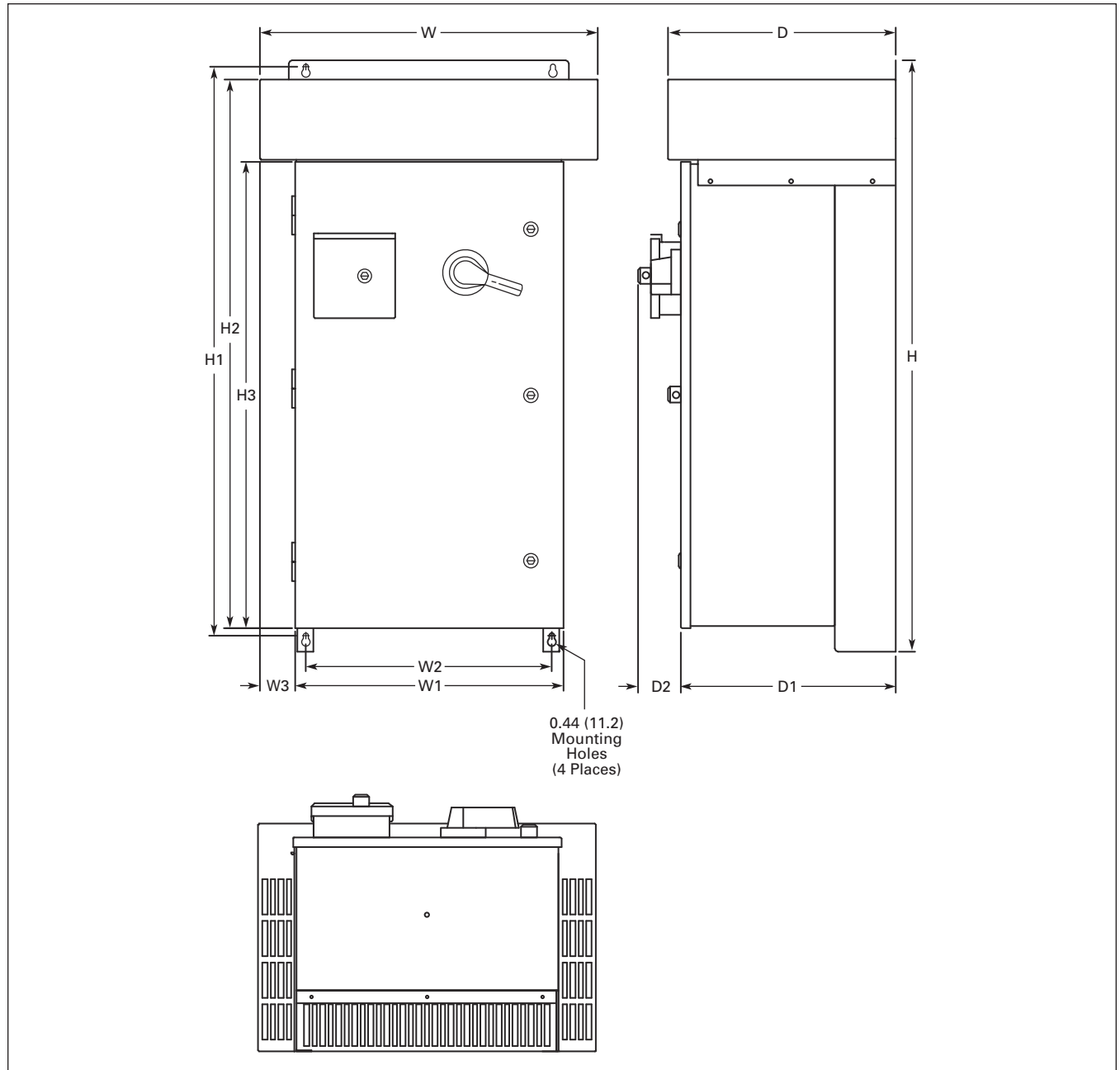


Figure 40-129. Enclosure Box B — UL Type 3R Dimensions

Table 40-350. Enclosure Box B — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)											Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	W	W1	W2	W3	D	D1	D2		
46.09 (1170.7)	44.45 (1129.0)	42.77 (1086.4)	36.35 (923.3)	26.31 (668.3)	20.92 (531.4)	19.30 (490.2)	2.69 (68.3)	17.74 (450.6)	16.76 (425.7)	3.31 (84.1)	235 (107)	290 (132)

Enclosed Drives

Enclosure Type C — UL Type 3R

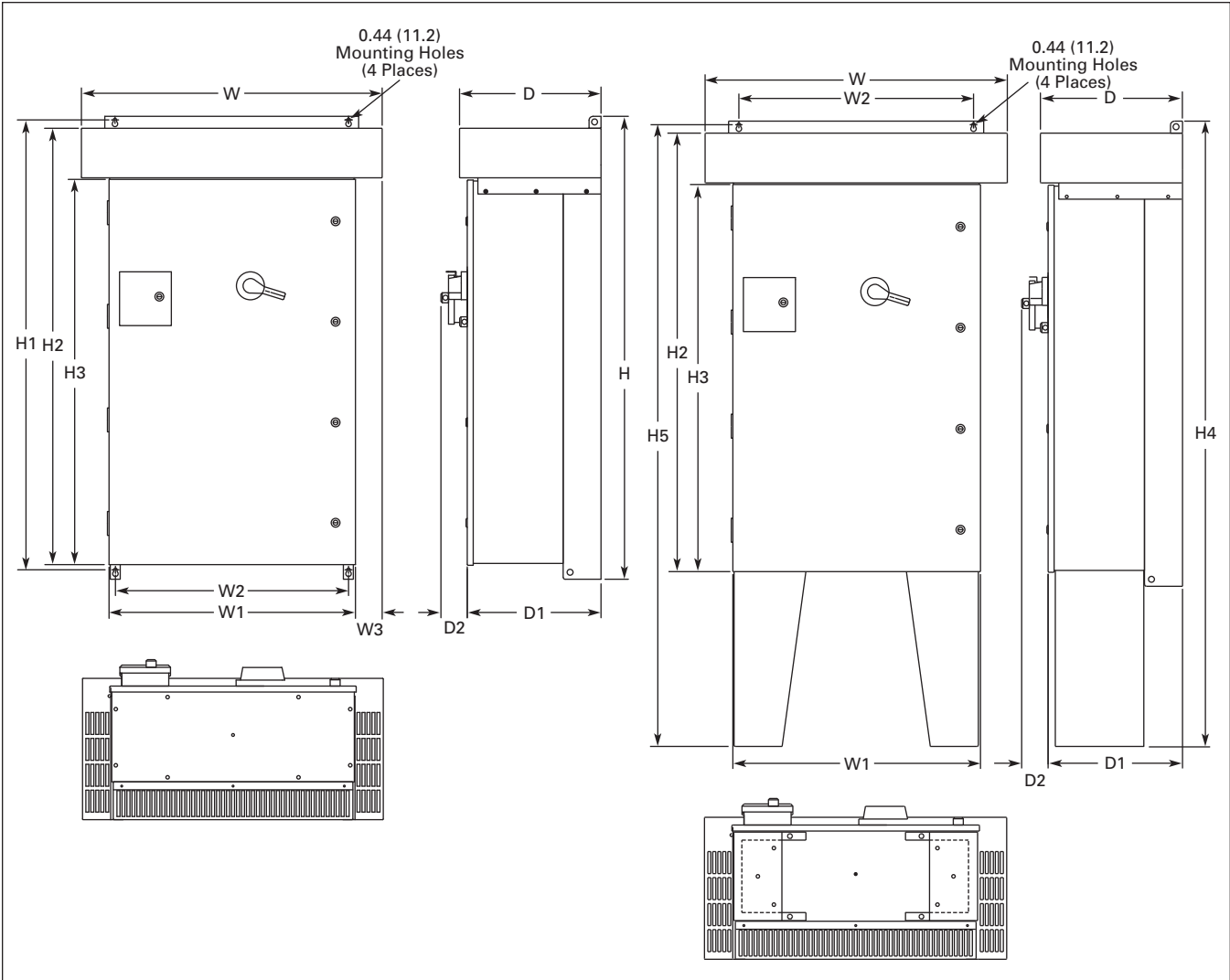


Figure 40-130. Enclosure Box C — UL Type 3R Dimensions

Table 40-351. Enclosure Box C — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)													Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	H3	H4	H5	W	W1	W2	W3	D	D1	D2		
58.09 (1475.5)	56.45 (1433.8)	54.77 (1391.2)	48.35 (1228.1)	78.09 (1983.5)	77.64 (1972.1)	37.73 (958.3)	30.92 (785.4)	29.30 (744.2)	3.34 (84.8)	17.74 (450.6)	16.77 (426.0)	3.31 (84.1)	370 (168)	485 (220)

Enclosure Size E

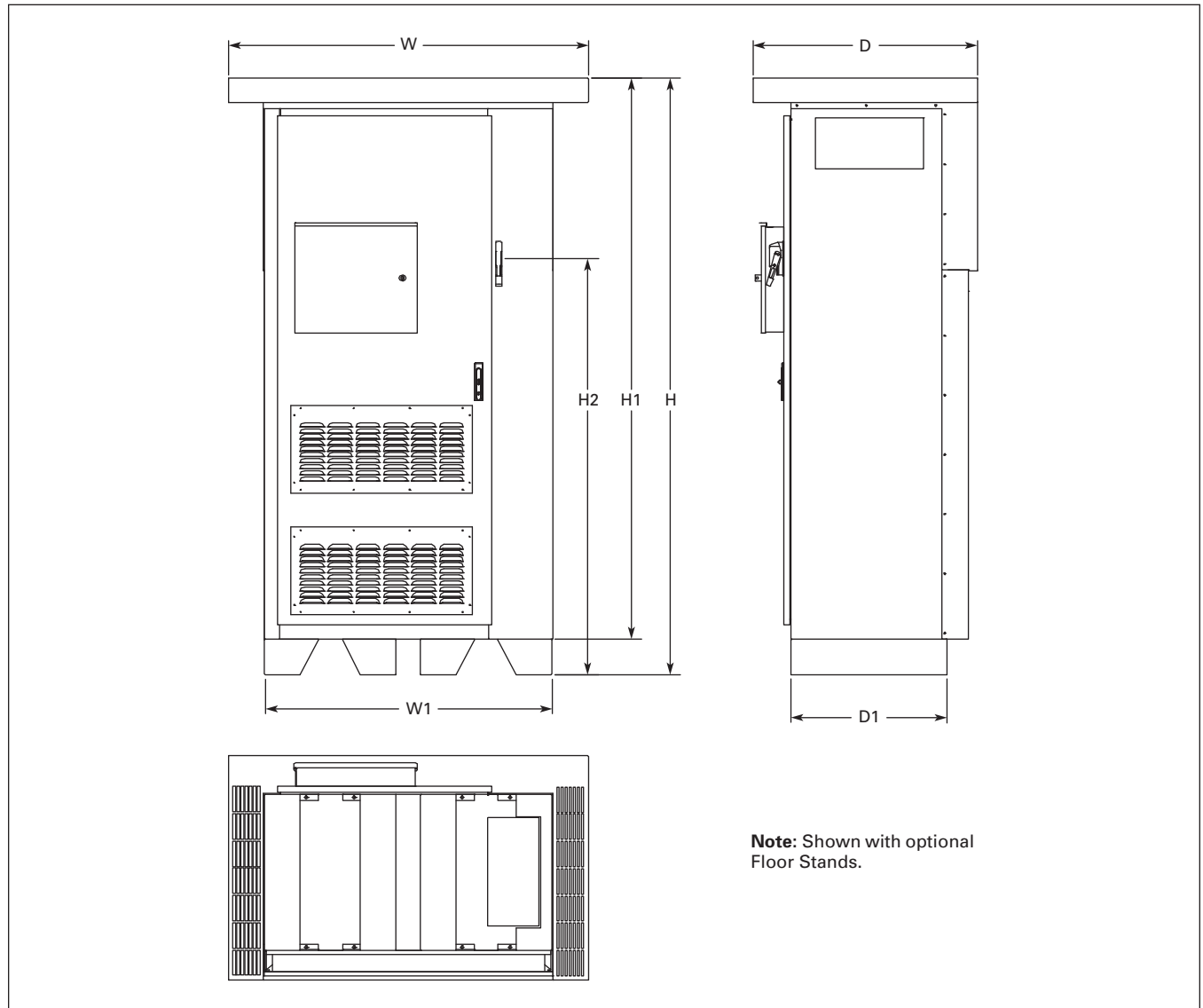


Figure 40-131. Enclosure Box E — UL Type 3R Dimensions

Table 40-352. Enclosure Box E — UL Type 3R Dimensions

Approximate Dimensions in Inches (mm)							Approx. Weight Lbs. (kg)	Approx. Ship Weight Lbs. (kg)
H	H1	H2	W	W1	D	D1		
99.58 (2529.3)	93.58 (2376.9)	69.51 (1765.6)	60.00 (1524.0)	48.00 (1219.2)	37.50 (952.5)	26.00 (660.4)	1,700 (771)	1,850 (839)

Enclosed Drives

Enclosure Size 7

40

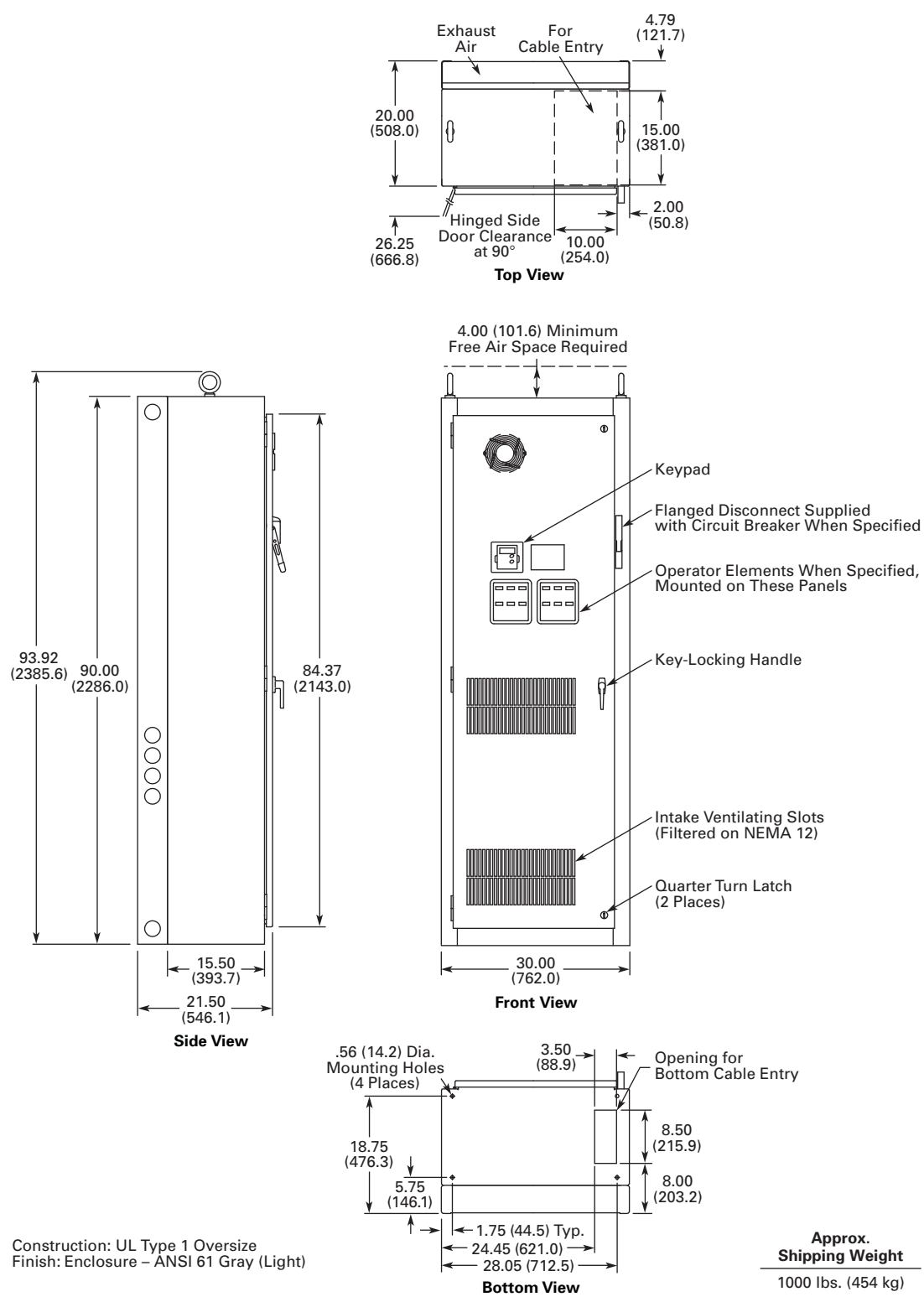


Figure 40-132. Approximate Dimensions in Inches (mm)

Enclosure Size 8

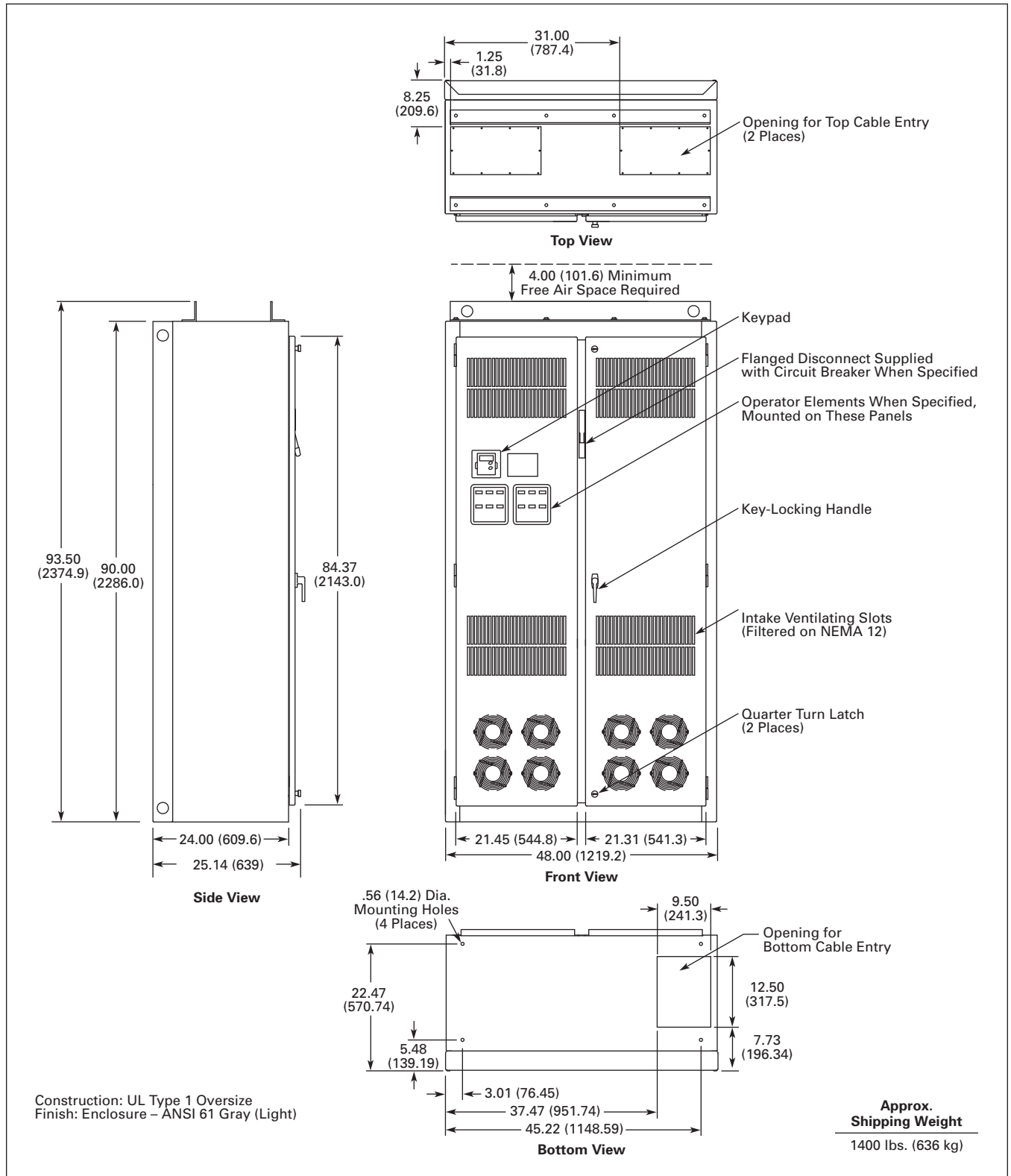


Figure 40-133. Approximate Dimensions in Inches (mm)

Enclosed Drives

Enclosure Size 9

40

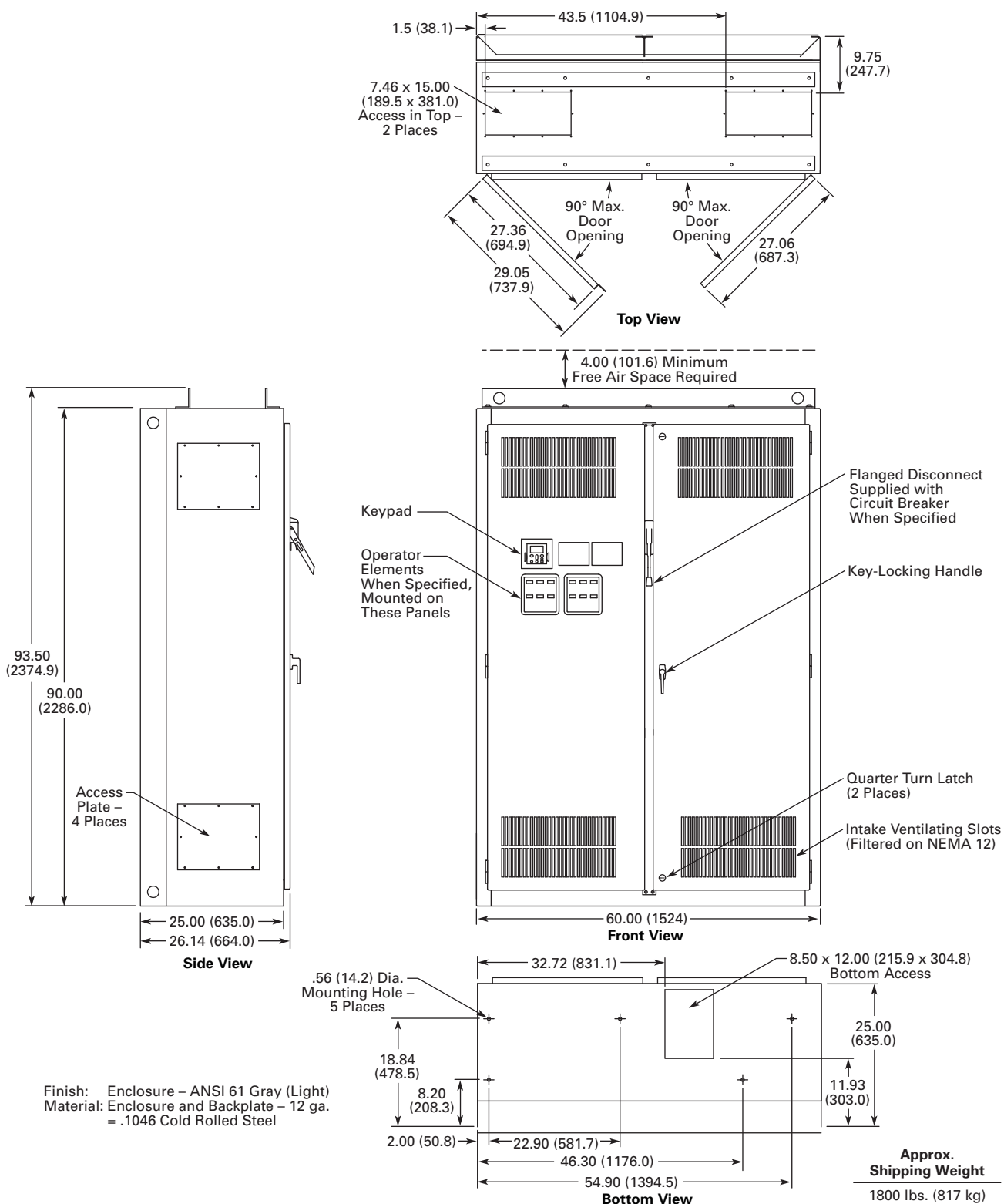
















Figure 40-134. Approximate Dimensions in Inches (mm)

Wiring Diagram

Control Input/Output

Table 40-353. Basic Application Default I/O Configuration

Reference potentiometer 1 – 10 k Ω	Terminal	Signal	Description
	OPTA9		
	1	+10V _{ref}	Reference output Voltage for potentiometer, etc.
	2	AI1+	Analog input, voltage range 0 – 10V DC Voltage input frequency reference
	3	AI1-	I/O Ground Ground for reference and controls
	4	AI2+	Analog input, current range 0 – 20 mA Current input frequency reference
	5	AI2-	I/O Ground Ground for reference and controls
	6	+24V	Control voltage output Voltage for switches, etc. max 0.1A
	7	GND	I/O ground Ground for reference and controls
	8	DIN1	Start forward Contact closed = start forward
	9	DIN2	Start reverse Contact closed = start reverse
	10	DIN3	External fault input (programmable) Contact open = no fault Contact closed = fault
	11	CMA	Common for DIN 1 – DIN 3 Connect to GND or +24V
	12	+24V	Control voltage output Voltage for switches (see terminal 6)
	13	GND	I/O ground Ground for reference and controls
	14	DIN4	Multi-step speed select 1
	15	DIN5	Multi-step speed select 2
	16	DIN6	Fault reset Contact open = no action Contact closed = fault reset
	17	CMB	Common for DIN4 – DIN6 Connect to GND or +24V
	18	AO1+	Output frequency Analog output Programmable Range 0 – 20 mA, R _L max. 500 Ω
	19	AO1-	I/O Ground Ground for reference and controls
	20	DO1	Digital output READY Programmable Open collector, I _L \leq 50 mA, V _L \leq 48V DC
	OPTA2		
	21	RO1	Relay output 1 RUN
	22	RO1	Relay output 1 RUN
	23	RO1	Relay output 1 RUN
	24	RO2	Relay output 2 FAULT
	25	RO2	Relay output 2 FAULT
	26	RO2	Relay output 2 FAULT

Contents

Description	Page
CPX9000 Enclosed Drives	
Product Description	40-240
Features and Benefits	40-240
Application Description	40-241
Technical Data and Specifications	40-246
Catalog Number Selection	40-247
Product Selection	40-248
Options	40-251
Dimensions	40-256
Wiring Diagrams	40-261



CPX9000 — 150 hp I_L

Product Description

The Cutler-Hammer® CPX9000 Clean Power Drives from Eaton's electrical business use advanced 18-pulse, clean power technology that significantly reduces line harmonics at the drive input terminals, resulting in one of the purest sinusoidal waveforms available.

Enhancements to the CPX9000 Clean Power Drives include smaller enclosures and higher temperature ratings than CP9000 for selected drives.

The CPX9000 drive also delivers True Power Factor — in addition to reducing harmonic distortion, the CPX9000 drive prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

The 9000X Family of Drives includes HVX9000, SVX9000, SLX9000 and SPX9000. 9000X Series drive ratings are rated for either high overload (I_H) or low overload (I_L). I_L indicates 110% overload capacity for 1 minute out of 10 minutes. I_H indicates 150% overload capacity for 1 minute out of 10 minutes.

CPX9000 Enclosed Products Program

- **Standard Enclosed** — covers a wide range of the most commonly ordered options. Pre-engineering eliminates the lead time normally associated with customer specific options. Available configurations are listed on **Pages 40-248 – 40-255**.
- **Modified Standard Enclosed** — applies to specific customer requirements that vary from the Standard Enclosed offering, such as the need for an additional indicating light or minor modifications to drawings. *Contact your local sales office for assistance in pricing and lead time.*
- **Custom Engineered** — for those applications with more unique or complex requirements, these are individually engineered to the customer's needs. *Contact your local sales office for pricing and lead time.*

Features and Benefits

New CPX9000 Clean Power Drive features include:

- Space optimized enclosure
- Simple layout for power options
- NEMA Type 1, NEMA 12 with Gaskets and Filters, NEMA Type 3R
- Input Voltage: 480V, 208/230V, 575V
- Complete range of control, network and power options
- Horsepower range:
 - 480V, 25 – 700 hp I_H ; 25 – 800 hp I_L ; consult factory for larger sizes
 - 208/230V, 25 – 100 hp I_L ; consult factory for details and pricing
 - 575V, 25 – 500 hp I_L ; consult factory for larger sizes
- Over ten years of 18-pulse Clean Power experience
- UL 508C tested, listed and approved
- 65 KAIC Standard at 480V and 208V
- 100 KAIC optional

Application Description

Designed to exceed the IEEE 519-1992 requirements for harmonic distortion, the CPX9000 is the clear choice for applications in the water, wastewater, HVAC, industrial and process industries where harmonics are a concern.

What Are Harmonics?

Take a perfect wave with a fundamental frequency of 60 Hz, which is close to what is supplied by the power company.

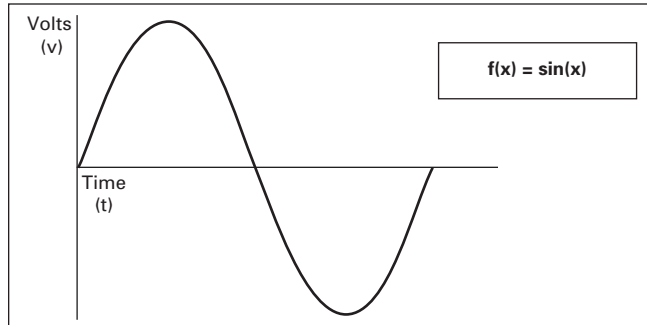


Figure 40-135. Perfect Wave

Add a second wave that is five times the fundamental frequency — 300 Hz (Typical of frequency added to the line by a fluorescent light).

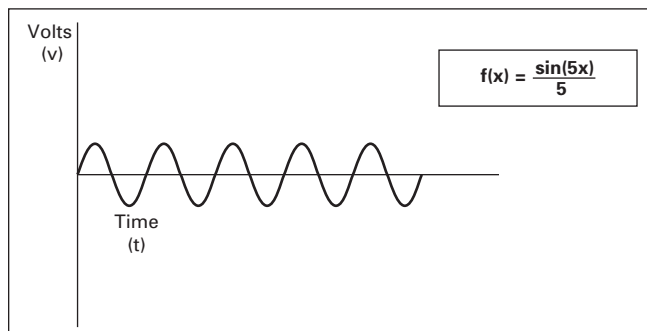


Figure 40-136. Second Wave

Combine the two waves. The result is a 60 Hz supply rich in fifth harmonics.

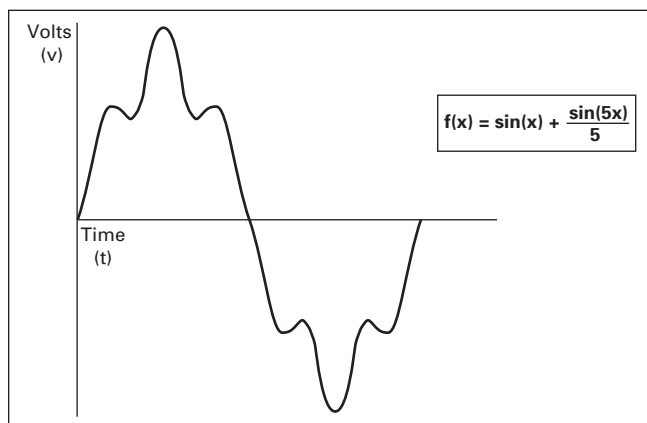


Figure 40-137. Resulting Supply

What Causes Harmonics?

Harmonics are the result of nonlinear loads that convert AC line voltage to DC. Examples of equipment that are non-linear loads are listed below:

- AC variable frequency drives
- DC drives
- Fluorescence lighting, computers, UPS systems
- Industrial washing machines, punch presses, welders, etc.

How Can Harmonics Due to VFDs Be Diminished?

By purchasing Eaton's patented 18-Pulse Cutler-Hammer drive that is guaranteed to meet IEEE Std. 519-1992 Harmonic Distortion Limits.

What Are Linear Loads?

Linear loads are primarily devices that run across the line and do not add harmonics. Motors are prime examples. The downside to having large motor linear loads is that they draw more energy than a VFD, because of their inability to control motor speed. In most applications there is a turn down valve used with the motor which will reduce the flow of the material, without significantly reducing the load to the motor. While this provides some measure of speed control, it is extremely inefficient.

Why Be Concerned About Harmonics?

1. **Installation and utility costs increase.** Harmonics cause damage to transformers and lower efficiencies due to the IR loss. These losses can become significant (from 16.6 – 21.6%) which can have a dramatic effect on the HVAC systems that are controlling the temperatures of the building where the transformer and drive equipment reside.
2. **Downtime and loss of productivity.** Telephones and data transmissions links may not be guaranteed to work on the same power grids polluted with harmonics.
3. **Downtime and nuisance trips of drives and other equipment.** Emergency generators have up to (3) three times the impedance that is found in a conventional utility source. Thus the harmonic voltage can be up to three times as large, causing risk of operation problems.
4. **Larger motors must be used.** Motors running across the line that are connected on polluted power distribution grids can overheat or operate at lower efficiency due to harmonics.
5. **Higher installation costs.** Transformers and power equipment must be oversized to accommodate the loss of efficiencies. This is due to the harmonic currents circulating through the distribution without performing useful work.

How Does a VFD Convert 3-Phase AC to a Variable Output Voltage and Frequency?

The 6-pulse VFD: The majority of all conventional drives that are built consist of a 6-pulse configuration. **Figure 40-138** represents a 6-diode rectifier design that converts three-phase utility power to DC. The inverter section uses IGBTs to convert DC power to a simulated AC sine wave that can vary in frequency from 0 – 400 Hz.

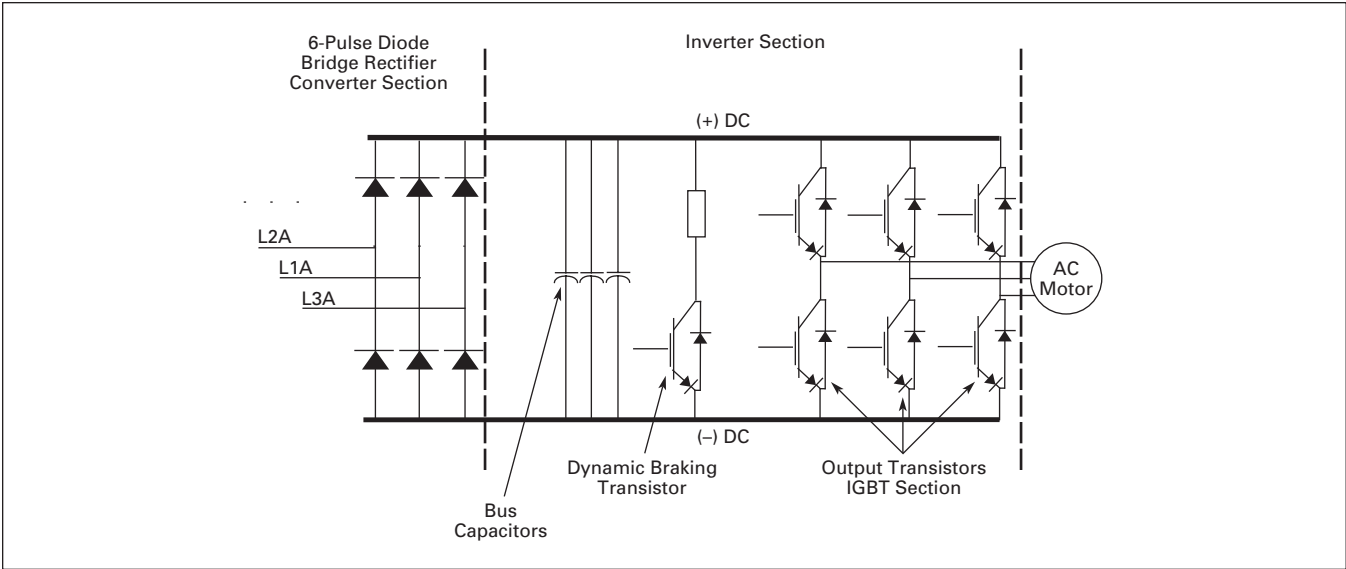


Figure 40-138. 6-Diode Rectifier Design

The 6-Pulse VFD drive creates harmonic current distortion. The harmonic current that is created is energy that can not be used by customers and causes external heat and losses to all components including other drives that are on the same power distribution. **Figure 40-139** is a 500 hp drive with 167A of damaging harmonic current.

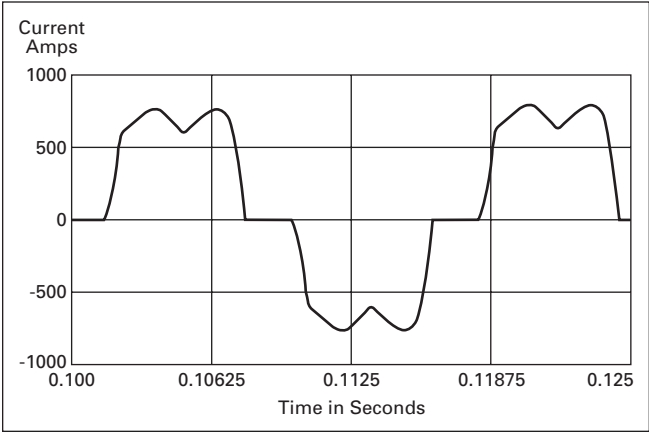


Figure 40-139. 6-Pulse Nonproductive Harmonic Current

Table 40-354. 6-Pulse Nonproductive Harmonic Current

6-Pulse Circuit		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 6.10\%$	$I_{19} = 1.77\%$
$I_5 = 22.5\%$	$I_{13} = 4.06\%$	$I_{23} = 1.12\%$
$I_7 = 9.38\%$	$I_{17} = 2.26\%$	$I_{25} = 0.86\%$
Power = 500 hp		
Harmonic Current = 167 Amps		

Guidelines of Meeting IEEE Std. 519-1992 Harmonic Distortion Limits

The IEEE 519-1992 Specification is a standard that provides guidelines for commercial and industrial users that are implementing medium and low voltage equipment.

Table 40-355. Maximum Harmonic Current Distortion in % of the Fundamental (120V through 69,000V)

I_{SC}/I_L	Harmonic Order (Odd Harmonics)					TDD
	$h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$35 \leq h$	
< 20	4.0	2.0	1.5	0.6	0.3	5.0
$20 < 50$	7.0	3.5	2.5	1.0	0.5	8.0
$50 < 100$	10.0	4.5	4.0	1.5	0.7	12.0
$100 < 1000$	12.0	5.5	5.0	2.0	1.0	15.0
> 1000	15.0	7.0	6.0	2.5	1.4	20.0

The ratio I_{SC}/I_L is the ratio of the short-circuit current available at the point of common coupling (PCC), to the maximum fundamental load current. Consequently, as the size of the user load decreases with respect to the size of the system, the percentage of harmonic current that the user is allowed to inject into the utility system increases.

Notes:

TDD = Total demand distortion is the harmonic current distortion in percent of the maximum demand load current (15 or 30 minute demand).

I_{SC} = Maximum short circuit current at the PCC not counting motor contribution.

I_L = Maximum demand load current for all of the connected loads (fundamental frequency component) at the PCC.

All of the limits are measured at a point of common coupling.

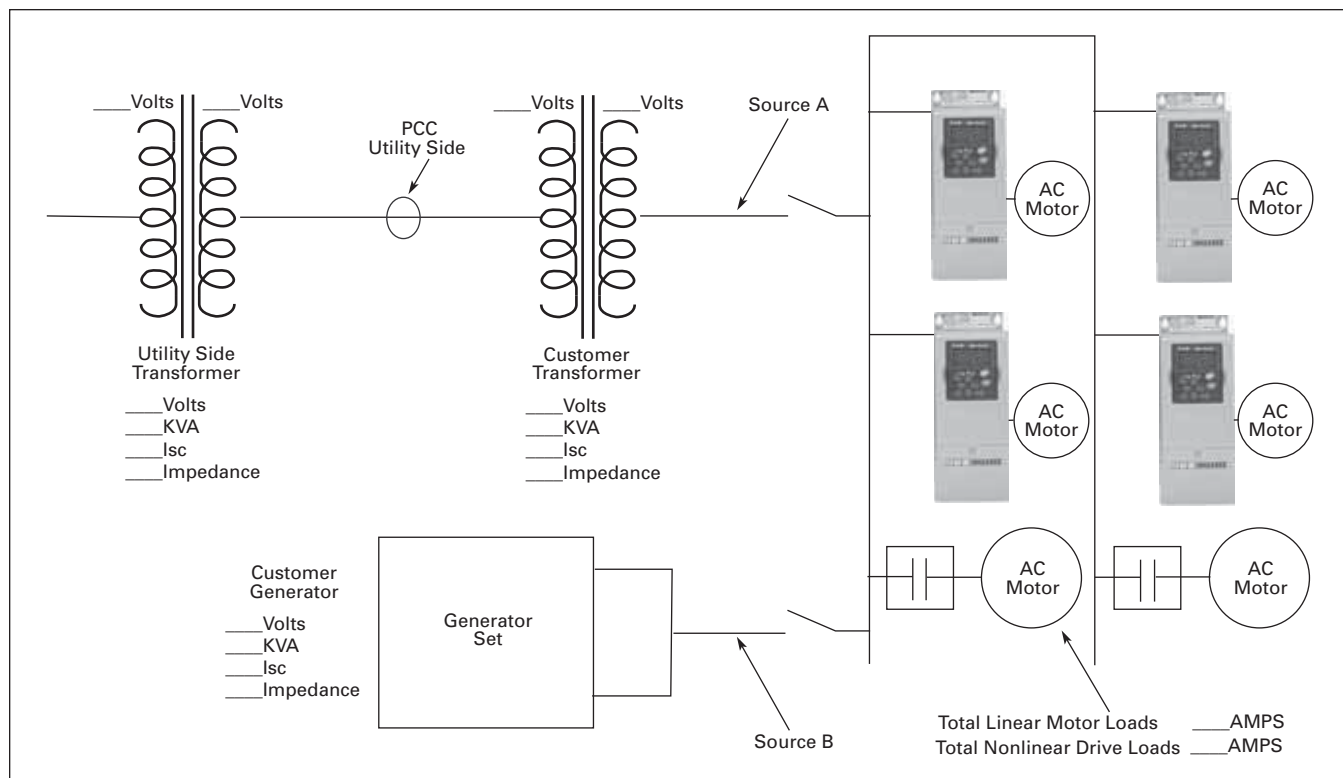


Figure 40-140. Oneline Diagram for Harmonic Analysis

The best way to estimate AFD harmonic contribution to an electrical system is to perform a harmonic analysis based on known system characteristics. The oneline in this Figure would provide the data to complete the calculations.

Terms

- PCC (Point of Common Coupling) is defined as the electrical connecting point between the utility and multiple customers per the specifications in IEEE 519.
- POA (Point of Analysis) is defined as where the harmonic calculations are taken.

An oscilloscope can make all measurements at the PCC or POA to do an on-site harmonic evaluation.

Harmonic Reduction Methods to Meet IEEE 519

1. Line Reactor

A line reactor is a 3-phase series inductance on the line side of an AFD. If a line reactor is applied on all AFDs, it is possible to meet IEEE guidelines where 10 – 25% of system loads are AFDs, depending on the stiffness of the line and the value of line reactance. Line reactors are available in various values of impedance, most typically 1 – 1.5%, 3% and 5%.

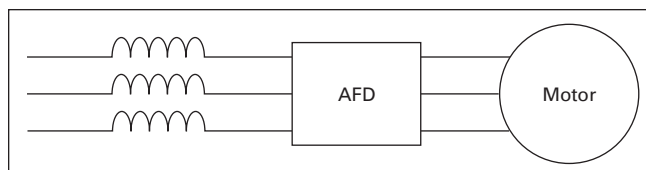


Figure 40-141. Line Reactor

Advantages

- Low cost
- Can provide moderate reduction in voltage and current harmonics
- Available in various values of impedance
- Provides increased input protection for AFD and its semi-conductors from line transients

Disadvantages

- May not reduce harmonic levels to below IEEE 519-1992 guidelines
- Voltage drop due to IR loss

2. 12-Pulse Converters

A 12-pulse converter incorporates two separate AFD input semiconductor bridges, which are fed from 30° phase shifted power sources with identical impedance. The sources may be two isolation transformers, where one is a delta/wye design (which provides the phase shift) and the second a delta/delta design (which does not phase shift). The 12-pulse arrangement allows the harmonics from the first converter to cancel the harmonics of the second. Up to approximately

85% reduction of harmonic current and voltage distortion may be achieved (over standard 6-pulse converter). This permits a facility to use a larger percentage of AFD loads under IEEE 519-1992 guidelines than allowable using line reactors or DC chokes. A harmonic analysis is required to guarantee compliance with guidelines.

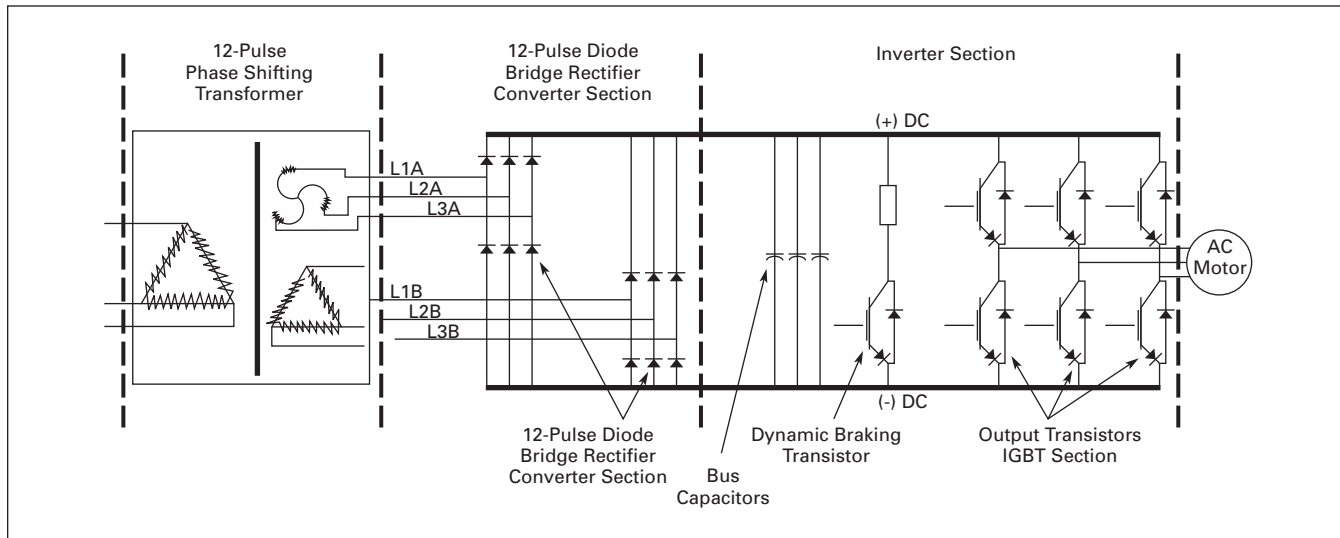


Figure 40-142. Basic 12-Pulse Rectifier with "Phase Shifting" Transformer

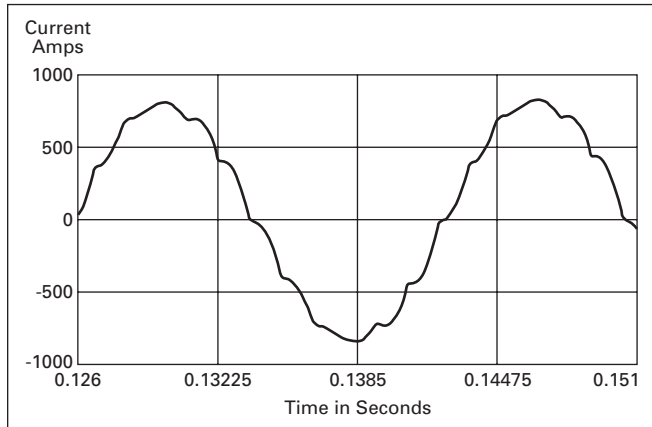


Figure 40-143. 500 hp 480V Drive with 12-Pulse Rectifier

Table 40-356. 500 hp 480V Drive with 12-Pulse Rectifier

12-Pulse Circuit		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 4.19\%$	$I_{19} = 0.06\%$
$I_5 = 1.25\%$	$I_{13} = 2.95\%$	$I_{23} = 0.87\%$
$I_7 = 0.48\%$	$I_{17} = 0.21\%$	$I_{25} = 0.73\%$
Power = 500 hp		
$H_C = 66.2$ Amps		

Advantages

- Moderate cost, although significantly more than reactors or chokes
- Substantial reduction (up to approx. 85%) in voltage and current harmonics
- Provides increased input protection for AFD and its semiconductors from line transients

Disadvantages

- Impedance matching of phase shifted sources is critical to performance
- Transformers often require separate mounting or larger AFD enclosures
- May not reduce distribution harmonic levels to below IEEE 519-1992 guidelines
- Cannot retrofit for most AFDs

3. Clean Power Drives

When the total load is of non-linear, the greatest harmonic mitigation is required. Under these conditions, the currents drawn from the supply need to be sinusoidal and “clean” such that system interference and additional losses are negligible. The Cutler-Hammer CPX9000 Clean Power Drive uses a phase-shifting auto transformer with delta-connected winding. Three of the output phases are advanced and three are retarded. The remaining three phases of this nine-phase supply are in phase with the incoming line. This results in nine separate phases. In this type of configuration, the total

required KVA rating of the transformer is only 48% of a drive rate isolation transformer. A traditional isolated transformer system, with multipulse windings, would require the full KVA rating to be supported, which is more common in an MV step-down transformer.

The integrated 18-pulse clean power drive, with near sine wave input current and low harmonics will meet the requirements of IEEE 519-1992 under all practical operating conditions. The comparisons with 6-pulse and 12-pulse systems are shown in **Figures 40-139, 40-143 and 40-145.**

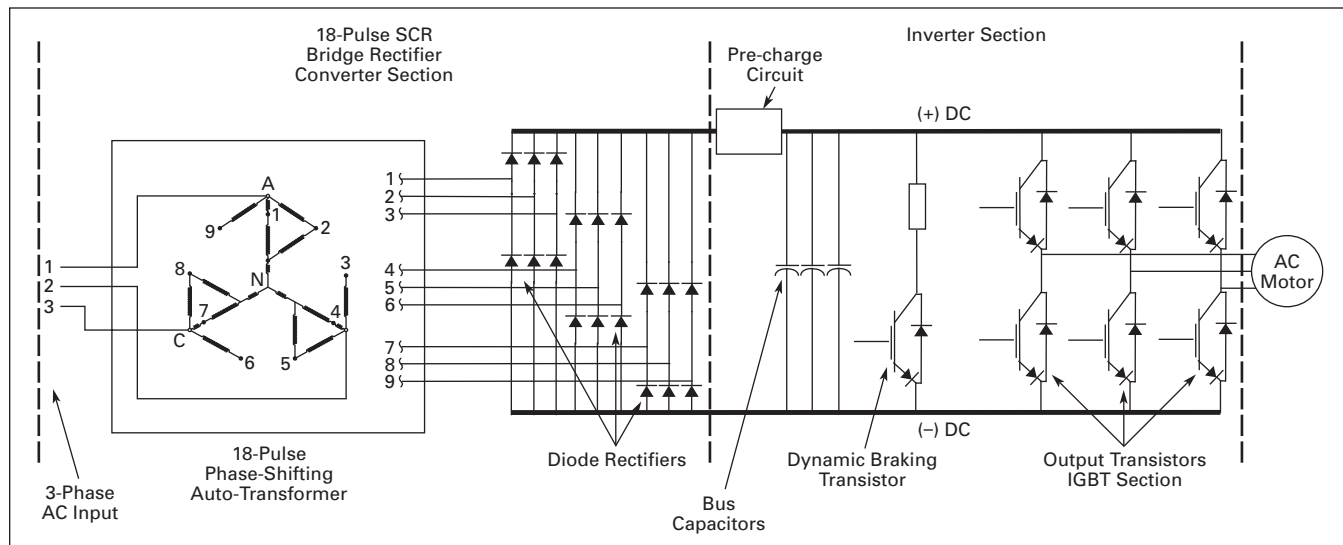


Figure 40-144. Basic 18-Pulse Rectifier with “Differential Delta” Transformer

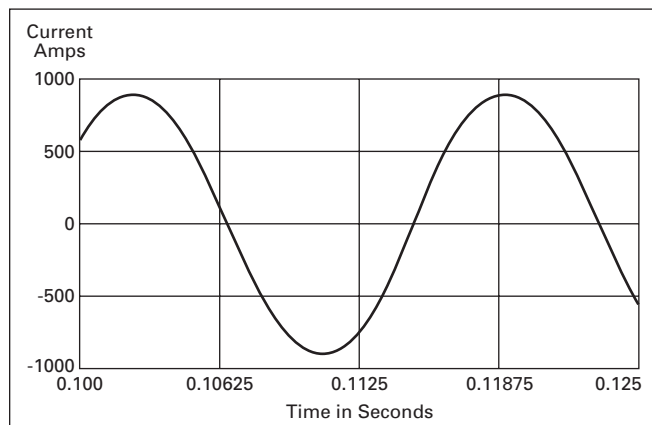


Figure 40-145. 500 hp 480V Drive with 18-Pulse Rectifiers

Advantages

- Virtually guarantees compliance with IEEE 519-1992
- Provides increased input protection for AFD and its semiconductor components from line transients
- Up to 4 times the harmonic reduction of 12-pulse methods
- Smaller transformer than isolation transformer used in 12-pulse converter

Disadvantages

- Larger and heavier magnetics than some other methods

Table 40-357. 500 hp 480V Drive with 18-Pulse Rectifiers

18-Pulse Clean Power		
Current Harmonics		
$I_1 = 100\%$	$I_{11} = 0.24\%$	$I_{19} = 1.00\%$
$I_5 = 0.16\%$	$I_{13} = 0.10\%$	$I_{23} = 0.01\%$
$I_7 = 0.03\%$	$I_{17} = 0.86\%$	$I_{25} = 0.01\%$
Power = 500 hp		
$H_C = 24$ Amps		

Technical Data and Specifications

Table 40-358. Specifications

Feature Description	CPX9000 Enclosed Products — NEMA Type 1 & NEMA 12 Filtered
Primary Design Features	
45 – 66 Hz Input Frequency	Standard
Output: AC Volts Maximum	Input Voltage Base
Output Frequency Range: Hz	0 – 400
Initial Output Current (I _H)	250% for 2 seconds
Overload: 1 Minute (I _H /I _L)	150%/110%
Enclosure Space Heater	Optional
Oversize Enclosure	Standard
Output Contactor	Optional
Bypass Motor Starter	Optional
Listings	UL, cUL
Protection Features	
Incoming Line Fuses	Standard 200 KAIC Rating
AC Input Circuit Disconnect	Optional
Phase Rotation Insensitive	Standard
EMI Filter	FR6 – FR9 ①
Input Phase Loss Protection	Standard
Input Overvoltage Protection	Standard
Line Surge Protection	Standard
Output Short Circuit Protection	Standard
Output Ground Fault Protection	Standard
Output Phase Protection	Standard
Overtemperature Protection	Standard
DC Overvoltage Protection	Standard
Drive Overload Protection	Standard
Motor Overload Protection	Standard
Programmer Software	Optional
Local/Remote Keypad	Standard
Keypad Lockout	Standard
Fault Alarm Output	Standard
Built-In Diagnostics	Standard
MOV	Standard
Input/Output Interface Features	
Setup Adjustment Provisions: Remote Keypad/Display Personal Computer	Standard Standard
Operator Control Provisions: Drive Mounted Keypad/Display Remote Keypad/Display Conventional Control Elements Serial Communications 115V AC Control Circuit	Standard Standard Standard Optional Standard
Speed Setting Inputs: Keypad 0 – 10V DC Potentiometer/Voltage Signal 4 – 20 mA Isolated 4 – 20 mA Differential 3 – 15 psig	Standard Standard Configurable Configurable Optional
Analog Outputs: Speed/Frequency Torque/Load/Current Motor Voltage Kilowatts 0 – 10V DC Signals 4 – 20 mA DC Signals Isolated Signals	Standard Programmable Programmable Programmable Configurable w/Jumpers Standard Optional

① The EMI filter is optional in FR10 and larger.

Feature Description	CPX9000 Enclosed Products — NEMA Type 1 & NEMA 12 Filtered
Input/Output Interface Features (Continued)	
Discrete Outputs: Fault Alarm Drive Running Drive at Set Speed Optional Parameters Dry Contacts Open Collector Outputs Additional Discrete Outputs	Standard Standard Programmable 14 2 Form C Contacts Available 1 Optional
Communications: RS-232 RS-422/485 DeviceNet™ Modbus RTU CanOpen (Slave) Profibus-DP Lonworks® Johnson Controls Metasys™ N2 Ethernet IP	Standard Optional Optional Optional Optional Optional Optional Optional Optional
Performance Features	
Sensorless Vector Control	Standard
Volts/Hertz Control	Standard
IR and Slip Compensation	Standard
Electronic Reversing	Standard
Dynamic Braking	Optional
DC Braking	Standard
PID Setpoint Controller	Programmable
Critical Speed Lockout	Standard
Current (Torque) Limit	Standard
Adjustable Acceleration/Deceleration	Standard
Linear or S Curve Accel/Decel	Standard
Jog at Preset Speed	Standard
Thread/Preset Speeds	7
Automatic Restart	Selectable
Coasting Motor Start	Standard
Coast or Ramp Stop Selection	Standard
Elapsed Time Meter	Optional
Carrier Frequency Adjustment	1 – 16 kHz
Standard Conditions for Application and Service	
Maximum Operating Ambient Temperature	0 – 50°C up to FR9 0 – 40°C FR10 and larger, consult factory for 50°C rating above FR9
Storage Temperature	-40 – 60°C
Humidity (Maximum), Non-condensing	95%
Altitude (Maximum without Derate)	3300 ft. (1000m)
Line Voltage Variation	+10/-15%
Line Frequency Variation	45 – 66 Hz
Efficiency	>95%
Power Factor (Displacement)	0.99

Table 40-359. Standard I/O Specifications

Description	Specification
6 – Digital Input Programmable	24V: “0” ≤ 10V, “1” ≥ 18V, R _i > 5 kΩ
2 – Analog Input Configurable w/Jumpers	Voltage: 0 – ±10V, R _i > 200 kΩ Current: 0 (4) – 20 mA, R _i = 250 kΩ
2 – Digital Output Programmable	Form C Relays 250V AC 2 Amp or 30V DC 2 Amp resistive
1 – Digital Output Programmable	Open collector 48V DC 50 mA
1 – Analog Output Programmable Configurable w/Jumper	0 – 20 mA, R _L max. 500 ohms 10 bits ±2%

Catalog Number Selection

Table 40-360. CPX9000 Enclosed NEMA Type 1 Drive Catalog Numbering System

CPX 100 1 4 A A

Build options alphabetically and numerically.

Product Family	
CPX = Clean Power 18-Pulse Enclosed Drives	

Horsepower Rating		
025 = 25 hp	100 = 100 hp	350 = 350 hp
030 = 30 hp	125 = 125 hp	400 = 400 hp
040 = 40 hp	150 = 150 hp	500 = 500 hp
050 = 50 hp	200 = 200 hp	600 = 600 hp
060 = 60 hp	250 = 250 hp	700 = 700 hp
075 = 75 hp	300 = 300 hp	800 = 800 hp

Enclosure Rating
1 = NEMA Type 1
3 = NEMA Type 3R
6 = NEMA 12 Filtered

Voltage Rating
2 = 230V (208 – 240V)
4 = 480V
5 = 575V (575 – 600V)

Application — Torque/Braking ^①
A = I _L /No Brake Chopper
B = I _L /Internal Brake Chopper
D = I _H /No Brake Chopper
E = I _H /Internal Brake Chopper

Enclosed Style
A = Enclosed Drive

Enclosed Options ^{②③④}		Type
K1	Door-Mounted Speed Potentiometer ^⑤	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch ^⑤	Control
K3	3 – 15 psig Follower	Control
K4	HAND/OFF/AUTO Switch (22 mm)	Control
K5	MANUAL/AUTO Reference Switch (22 mm)	Control
K6	START/STOP Pushbuttons (22 mm)	Control
KF	Bypass Test Switch for RA and RB	Addl. Bypass
KO	Standard Elapsed Time Meter	Control
L1	Power On and Fault Pilot Lights	Light
L2	Bypass Pilot Lights for RA, RB, Bypass Options	Addl. Bypass
LE	Red RUN Light	Light
P1	Input Disconnect	Input
PE	Output Contactor	Output
PF	Output Filter	Output
PG	MotoRx (Up to 600 Ft.) 1000 V/μS DV/DT Filter	Output
PH	Single Overload Relay	Output
PI	Dual Overload Relays	Output
PN	Dual Overloads for Bypass	Addl. Bypass
RA	Manual HOA Bypass Controller	Bypass
RB	Manual IOB Bypass Controller	Bypass
RC	Auto Transfer HOA Bypass Controller	Bypass
RD	Auto Transfer IOB Bypass Controller	Bypass
RG	Reduced Voltage Starter for Bypass	Bypass
S7	10" Expansion	Enclosure
S8	20" Expansion	Enclosure
S9	Space Heater	Enclosure

Communication Options ^⑥	
C2 = Modbus	CA = Johnson Controls N2
C3 = Profibus DP	CI = Modbus TCP
C4 = LonWorks	CJ = BACnet
C5 = Profibus DP (D9 Connector)	CK = Ethernet IP
C6 = CanOpen (Slave)	D3 = RS-232 with D9 Connection
C7 = DeviceNet	
C8 = Modbus (D9 Type Connector)	

Control Options
B1 = 6 DI, 1 ext +24V DC/EXT +24V DC
B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm
B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC
B5 = 3 RO (NO)
B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100
B9 = 1 RO (NO), 5 DI 42 – 240V AC Input

Engineered Options
HT High Temperature rating for 50°C (FR10 and above) ^⑦
VB Varnished Boards

^① Brake Chopper is standard in drives up to 30 hp I_H or 40 hp I_L. It is optional in larger drives.

^② Local/remote keypad is included as the standard Control Panel.

^③ Some options are voltage and/or horsepower specific. Consult your Eaton representative for details.

^④ See Pages 40-251 and 40-252 for descriptions.

^⑤ Includes local/remote speed reference switch.

^⑥ See Pages 40-253 and 40-254 for complete descriptions.

^⑦ Consult Eaton for availability.

Product Selection

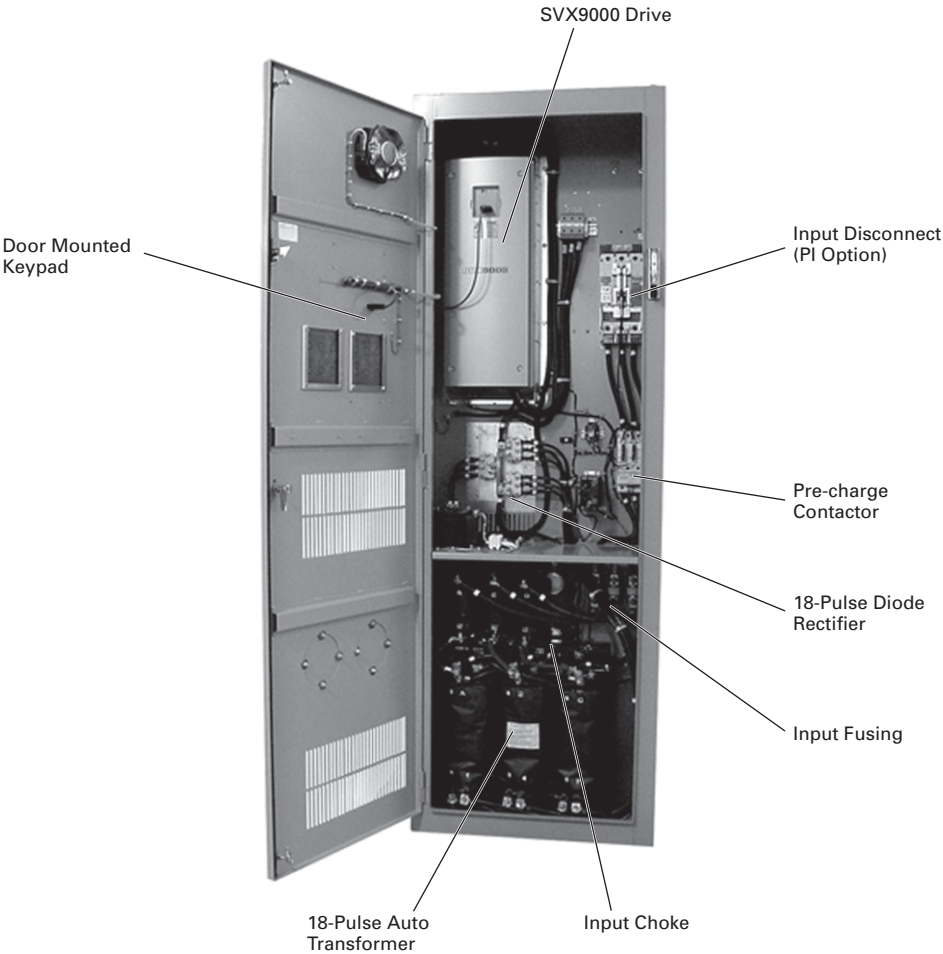


Figure 40-146. NEMA Type 1, 25 – 150 hp (30 x 90 x 21.5)

When Ordering

- Select a Base Catalog Number that meets the application requirements — nominal horsepower, voltage and enclosure rating. (The enclosed drive's continuous output amp rating should be equal to or greater than the motor's full load amp rating.) The base enclosed package includes a standard drive, door-mounted alphanumeric panel and enclosure.
- The CPX9000 product uses the term High Overload (I_H) in place of the term Constant Torque (CT). Likewise, Low Overload (I_L) is used in place of the term Variable Torque (VT). The new terms are a more precise description of the rating. The

older terms included ambient temperature ratings in addition to overload ratings. In order to minimize enclosure size and offer the highest ambient temperature rating, overload and temperature ratings are now treated separately. Ambient temperature ratings are shown in **Table 40-361**. Consult the factory for 50°C ratings of FR10 and above.

Table 40-361. Ambient Temperature Ratings

Frame Size	I_H	I_L
FR4 – FR9	50°C	50°C
FR10 and above	40°C	40°C

- If Dynamic Brake Chopper or Control/Communication option is desired, change the appropriate code in the Base Catalog Number.
- **Note:** All of the programming is exactly the same as the standard SVX9000 drive.
- Select Enclosed Options. Add the codes as suffixes to the Base Catalog Number in alphabetical and numeric order.

Enclosed Drives

480V Drives

Table 40-362. 480V AC CPX9000 Base Drive Product Selection

Enclosure Size ①	hp	Current (A)	Chassis Frame	NEMA Type 1		NEMA 12 Filtered		NEMA 3R ③	
				Base Catalog Number ②	Price U.S. \$	Base Catalog Number ②	Price U.S. \$	Base Catalog Number ②	Price U.S. \$
Low Overload Drive									
7	25	38	FR6	CPX02514BA		CPX02564BA		CPX02534AA	
	30	46	FR6	CPX03014BA		CPX03064BA		CPX03034AA	
	40	61	FR6	CPX04014BA		CPX04064BA		CPX04034AA	
7	50	72	FR7	CPX05014AA		CPX05064AA		CPX05034AA	
	60	87	FR7	CPX06014AA		CPX06064AA		CPX06034AA	
	75	105	FR7	CPX07514AA		CPX07564AA		CPX07534AA	
7	100	140	FR8	CPX10014AA		CPX10064AA		CPX10034AA	
	125	170	FR8	CPX12514AA		CPX12564AA		CPX12534AA	
	150	205	FR8	CPX15014AA		CPX15064AA		CPX15034AA	
8	200	261	FR9	CPX20014AA		CPX20064AA		CPX20034AA	
	250	300	FR9	CPX25014AA		CPX25064AA		CPX25034AA	
9	300	385	FR10	CPX30014AA		CPX30064AA		—	
	350	460	FR10	CPX35014AA		CPX35064AA			
	400	520	FR10	CPX40014AA		CPX40064AA			
10	500	590	FR11	CPX50014AA		CPX50064AA		—	
	550	650	FR11	CPX55014AA		CPX55064AA			
	600	730	FR11	CPX60014AA		CPX60064AA			
11	650	820	FR11	CPX65014AA		CPX65064AA		—	
	700	920	FR12	CPX70014AA		CPX70064AA			
	800	1030	FR12	CPX80014AA		CPX80064AA			
High Overload Drive									
7	25	38	FR6	CPX02514EA		CPX02564EA		CPX02534DA	
	30	46	FR6	CPX03014EA		CPX03064EA		CPX03034DA	
	40	61	FR7	CPX04014DA		CPX04064DA		CPX04034DA	
7	50	72	FR7	CPX05014DA		CPX05064DA		CPX05034DA	
	60	87	FR7	CPX06014DA		CPX06064DA		CPX06034DA	
	75	105	FR8	CPX07514DA		CPX07564DA		CPX07534DA	
7	100	140	FR8	CPX10014DA		CPX10064DA		CPX10034DA	
	125	170	FR8	CPX12514DA		CPX12564DA		CPX12534DA	
8	150	205	FR9	CPX15014DA		CPX15064DA		CPX15034DA	
	200	245	FR9	CPX20014DA		CPX20064DA		CPX20034DA	
9	250	300	FR10	CPX25014DA		CPX25064DA		—	
	300	385	FR10	CPX30014DA		CPX30064DA			
	350	460	FR10	CPX35014DA		CPX35014DA			
10	400	520	FR11	CPX40014DA		CPX40064DA		—	
	500	590	FR11	CPX50014DA		CPX50064DA			
	550	650	FR11	CPX55014DA		CPX55064DA			
11	600	720	FR12	CPX60014DA		CPX60064DA		—	
	650	820	FR12	CPX65014DA		CPX65064DA			
	700	840	FR12	CPX70014DA		CPX70064DA			

① See enclosure dimensions in Table 40-364.

② The 18-pulse Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

③ All NEMA 3R drives use the Box F Enclosure.

Enclosed Drives

575V Drives

Table 40-363. 575V AC CPX9000 Base Drive Product Selection

Enclosure Size ①	hp	Current (A)	Chassis Frame	NEMA Type 1		NEMA 12 Filtered		NEMA 3R ③	
				Base Catalog Number ②	Price U.S. \$	Base Catalog Number ②	Price U.S. \$	Base Catalog Number ②	Price U.S. \$

Low Overload Drive

7	25	27	FR6	CPX02515BA		CPX02565BA		CPX02535BA	
	30	34	FR6	CPX03015BA		CPX03065BA		CPX03035BA	
7	40	41	FR7	CPX04015BA		CPX04065BA		CPX04035BA	
	50	52	FR7	CPX05015AA		CPX05065AA		CPX05035AA	
7	60	62	FR8	CPX06015AA		CPX06065AA		CPX06035AA	
	75	80	FR8	CPX07515AA		CPX07565AA		CPX07535AA	
	100	100	FR8	CPX10015AA		CPX10065AA		CPX10035AA	
8	125	125	FR9	CPX12515AA		CPX12565AA		CPX12535AA	
	150	144	FR9	CPX15015AA		CPX15065AA		CPX15035AA	
	200	208	FR9	CPX20015AA		CPX20065AA		CPX20035AA	
9	250	261	FR10	CPX25015AA		CPX25065AA		—	
	300	325	FR10	CPX30015AA		CPX30065AA		—	
	400	385	FR10	CPX40015AA		CPX40065AA		—	
10	500	502	FR11	CPX50015AA		CPX50065AA		—	
	600	590	FR11	CPX60015AA		CPX60065AA		—	
11	650	650	FR12	CPX65015AA		CPX65065AA		—	
	700	750	FR12	CPX70015AA		CPX70065AA		—	
	800	820	FR12	CPX80015AA		CPX80065AA		—	

High Overload Drive

7	25	27	FR6	CPX02515EA		CPX02565EA		CPX02535EA	
7	30	34	FR7	CPX03015EA		CPX03065EA		CPX03035EA	
	40	41	FR7	CPX04015DA		CPX04065DA		CPX04035DA	
7	50	52	FR8	CPX05015DA		CPX05065DA		CPX05035DA	
	60	62	FR8	CPX06015DA		CPX06065DA		CPX06035DA	
	75	80	FR8	CPX07515DA		CPX07565DA		CPX07535DA	
8	100	100	FR9	CPX10015DA		CPX10065DA		CPX10035DA	
	125	125	FR9	CPX12515DA		CPX12565DA		CPX12535DA	
	150	144	FR9	CPX15015DA		CPX15065DA		CPX15035DA	
9	200	208	FR10	CPX20015DA		CPX20065DA		—	
	250	261	FR10	CPX25015DA		CPX25065DA		—	
	300	325	FR10	CPX30015DA		CPX30065DA		—	
10	400	385	FR11	CPX40015DA		CPX40065DA		—	
	450	460	FR11	CPX45015DA		CPX45065DA		—	
	500	502	FR11	CPX50015DA		CPX50065DA		—	
11	600	590	FR12	CPX60015DA		CPX60065DA		—	
	650	650	FR12	CPX65015DA		CPX65065DA		—	
	700	750	FR12	CPX70015DA		CPX70065DA		—	

① See enclosure dimensions in Table 40-364.

② The 18-pulse Clean Power assembly includes a standard drive, door-mounted local/remote keypad and enclosure.

③ All NEMA 3R drives use the Box F Enclosure.

Table 40-364. CPX9000 Enclosure Dimensions

Enclosure Size ④	Approximate Dimensions in Inches (mm)			Approx. Shipping Weight in lbs (kg)
	Width	Height	Depth	
7	30.00 (762.0)	90.00 (2286.0)	21.50 (546.1)	1,000 (454)
8	48.00 (1219.2)	90.00 (2286.0)	26.14 (664.0)	1,400 (636)
9	60.00 (1524.0)	90.00 (2286.0)	25.74 (653.8)	1,800 (817)
10	80.00 (2032.0)	90.00 (2286.0)	31.75 (806.5)	2,100 (953)
11 ⑤⑥	120.00 (3048.0)	90.00 (2286.0)	25.74 (653.8)	2,500 (1,135)
Box F ⑦	60.00 (1524.0)	93.50 (2374.9)	37.50 (952.5)	2,500 (1,135)

④ Enclosure sizes accommodate drive and options, including bypass and disconnect.

For other power options, consult your Eaton representative.

⑤ Consult factory. Limited power options available.

⑥ Enclosure size 11 consists of two of the enclosure size 9.

⑦ All NEMA 3R drives use the Box F Enclosure.

Options

Control/Communication Option Descriptions

Table 40-365. Available Control/Communications Options

Option	Description	Option Type
K1	Door-Mounted Speed Potentiometer — Provides the CPX9000 with the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10V DC reference to generate a 0 – 10V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the hand position. Without the HOA bypass option, a 2-position switch (labeled local/remote) is provided on the keypad to select speed reference from the Speed Potentiometer or a remote speed signal.	Control
K2	Door-Mounted Speed Potentiometer with HOA Selector Switch — Provides the CPX9000 with the ability to start/stop and adjust the speed reference from door-mounted control devices or remotely from customer supplied inputs. In HAND position, the drive will start and the speed is controlled by the door-mounted speed potentiometer. The drive will be disabled in the OFF position. When AUTO is selected, the drive run and speed control commands are via user-supplied dry contact and 4 – 20 mA signal.	Control
K3	3 – 15 psig Follower — Provides a pneumatic transducer which converts a 3 – 15 psig pneumatic signal to either 0 – 8V DC or a 1 – 9V DC signal interface with the CPX9000. The circuit board is mounted on the inside of the front enclosure panel and connects to the user's pneumatic control system via 6 ft. (1.8m) of flexible tubing and a 1/4 inch (6.4 mm) brass tube union.	Control
K4	HAND/OFF/AUTO Switch for Non-bypass Configurations — Provides a three-position selector switch that allows the user to select either a Hand or Auto mode of operation. Hand mode is defaulted to keypad operation, and Auto mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and Fieldbus.	Control
K5	MANUAL/AUTO Speed Reference Switch — Provides door-mounted selector switch for Manual/Auto speed reference.	Control
K6	START/STOP Pushbuttons — Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.	Control
KF	Bypass Test Switch for RB and RA — Allows the user to energize the AF drive for testing while operating the motor on the bypass controller. The Test Switch is mounted on the inside of the enclosure door.	Addl. Bypass
KO	Standard Elapsed Time Meter — Provides a door-mounted elapsed run time meter.	Control
L1	Power On and Fault Power Lights — Provides a white power on light that indicates power to the enclosed cabinet and a red fault light that indicates a drive fault has occurred.	Light
L2	Bypass Pilot Lights for RB, RA Bypass Options — A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. The lights are mounted on the enclosure door, above the switches.	Addl. Bypass
LE	Red Run Pilot Light (22 mm) — Provides a red run pilot light that indicates the drive is running.	Light
P1	Input Circuit Breaker — High Interrupting Circuit Breaker that provides a means of short circuit protection for the power cables between it and the CPX9000, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the CPX9000 from the line and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure. Standard rating is 65 KAIC at 208/480V. 100 KAIC is available as an option.	Input
PE	Output Contactor — Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10A, 600V AC are provided for customer use. Bypass Options RB and RA include an Output Contactor as standard. This option includes a low VA 115V AC fused Control Power Transformer and is factory mounted in the enclosure.	Output
PF	Output Filter — Used to reduce the transient voltage (DV/DT) at the motor terminals. The Output Filter is recommended for cable lengths exceeding 100 ft. (30m) with a drive of 3 hp and above, for cable lengths of 33 ft. (10m) with a drive of 2 hp and below, or for a drive rated at 525 – 690V. This option is mounted in the enclosure, and may be used in conjunction with a Brake Chopper Circuit.	Output
PG	MotoRx (300 – 600 Ft.) 1000 V/μS DV/DT Filter — Used to reduce transient voltage (DV/DT) and peak voltages at the motor terminals. This option is comprised of a 0.5% line reactor, followed by capacitive filtering and an energy recovery/clamping circuit. Unlike the Output Filter (See option PF), the MotoRx recovers most of the energy from the voltage peaks, resulting in a lower voltage drop to the motor, and therefore conserving power. This option is used when the distance between a single motor and the drive is 300 – 600 feet (91 – 183m).	Output
PH	Single Overload Relay — Uses a bimetallic overload relay to provide additional overload current protection to the motor on configurations without bypass options. It is included with the Bypass Configurations for overload current protection in the bypass mode. The Overload Relay is mounted within the enclosure, and is manually resettable. Heater pack included.	Output
PI	Dual Overload Relays — This option is recommended when a single drive is operating 2 motors and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable. Heater packs not included.	Output
PN	Dual Overloads for Bypass — This option is recommended when a single drive is operating 2 motors in the bypass mode and overload current protection is needed for each of the motors. The standard configuration includes two bimetallic overload relays, each sized to protect a motor with 50% of the drive hp rating. For example, a 100 hp drive would include two overload relays sized to protect two 50 hp motors. The relays are mounted within the enclosure, and are manually resettable.	Addl. Bypass

Enclosed Drives

40

Table 40-365. Available Control/Communications Options (Continued)

Option	Description	Option Type
RA	Manual HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in the inverter mode. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-261).	Bypass
RB	Manual IOB Bypass Controller — The Manual INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-261).	Bypass
RC	Auto Transfer HOA Bypass Controller — The Manual HAND/OFF/AUTO (HOA) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted HOA selector switch and an INVERTER/BYPASS switch. The HOA switch provides the ability to start and stop the drive in either mode. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-261). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RD	Auto Transfer IOB Bypass Controller — The Auto INVERTER/OFF/BYPASS (IOB) — 3-contactor — bypass option provides a means of bypassing the CPX9000, allowing the AC motor to be operated at full speed directly from the AC supply line. The circuitry provides an automatic transfer of the load to “across the line” operation after a drive trip. This option consists of an input disconnect, a fused control power transformer, and a full voltage bypass starter with a door mounted IOB selector switch. For applications up to 250 hp, an <i>IT</i> . Series IEC input contactor, an <i>IT</i> . Series IEC output contactor, and an <i>IT</i> . Series IEC starter with an electronic overload relay is included. For applications above 250 hp, an Advantage input contactor, an Advantage output contactor and an Advantage starter with electronic overload protection is included. The contactors are mechanically and electrically interlocked (see power diagram on Page 40-261). Door mounted pilot lights are provided which indicate bypass or inverter operation. A green light indicates when the motor is running in inverter mode and an amber light indicates when the motor is running in bypass mode. WARNING: The motor may restart when the overcurrent relay is reset when operating in bypass, unless the IOB selector switch is turned to the OFF position.	Bypass
RG	Reduced Voltage Starter for Bypass — Used in conjunction with bypass option RA, RB, RC or RD. This option adds <i>IT</i> . Series reduced voltage soft starter to bypass assembly for soft starting in bypass mode.	Bypass
S7	10" Expansion — Expansion cabinet allows for special components, customer-supplied components or oversized cables. NOTE: Enclosure expansion rated NEMA Type 1 only.	Enclosure
S8	20" Expansion — Expansion cabinet allows for special components, customer-supplied components or oversized cables. NOTE: Enclosure expansion rated NEMA Type 1 only.	Enclosure
S9	Space Heater — Prevents condensation from forming in the enclosure when the drive is inactive or in storage. Includes a thermostat for variable temperature control. The 400W heater requires a customer supplied 115V remote supply source.	Enclosure

Note: For availability, see **Pages 40-254** and **Page 40-255** for base drive voltage required.

Table 40-366. Dissipated Watt Losses

Horsepower	40	50	60	75	100	125	150	200	250	300	350	400	450	500	600	700	800
Watts	1844	2170	2540	3040	4011	4940	5730	8020	9383	11600	13600	15700	16250	17976	20393	27200	31400

Enclosed Drives

CPX9000 Series Option Board Kits

The CPX9000 Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-147**).

The CPX9000 Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

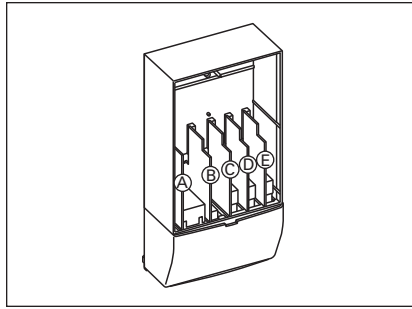


Figure 40-147. CPX9000 Series Option Boards

Table 40-367. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.\$	Option Designator	Adder U.S.\$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-147)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		X	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Modbus RTU Network Communications

The Modbus Network Card OPTC2 is used for connecting the 9000X Drive as a slave on a Modbus network. The interface is connected by a 9-pin DSUB connector (female) and the baud rate ranges from 300 to 19200 baud. Other communication parameters include an address range from 1 to 247; a parity of None, Odd or Even; and the stop bit is 1.

Profibus Network Communications

The Profibus Network Card OPTC3 is used for connecting the 9000X Drive as a slave on a Profibus-DP network. The interface is connected by a 9-pin DSUB connector (female). The baud rates range from 9.6K baud to 12M baud, and the addresses range from 1 to 127.

LonWorks Network Communications

The LonWorks Network Card OPTC4 is used for connecting the 9000X Drive on a LonWorks network. This interface uses Standard Network Variable Types (SNVT) as data types. The channel connection is achieved using a FTT-10A Free Topology transceiver via a single twisted transfer cable. The communication speed with LonWorks is 78 kBits/s.

Discount Symbol..... **SS-3**

Enclosed Drives

CanOpen (Slave) Communications

The CanOpen (Slave) Network Card OPTC6 is used for connecting the 9000X Drive to a host system. According to ISO11898 standard cables to be chosen for CAN bus should have a nominal impedance of 120Ω, and specific line delay of nominal 5 nS/m. 120Ω line termination resistors required for installation.

DeviceNet Network Communications

The DeviceNet Network Card OPTC7 is used for connecting the 9000X Drive on a DeviceNet Network. It includes a 5.08 mm pluggable connector. Transfer method is via CAN using a 2-wire twisted shielded cable with 2-wire bus power cable and drain. The baud rates used for communication include 125K baud, 250K baud and 500K baud.

Johnson Controls Metasys™ N2 Network Communications

The OPTC2 fieldbus board provides communication between the 9000X Drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. The N2 fieldbus is available as a factory installed option and as a field installable kit.

Modbus/TCP Network Communications

The Modbus/TCP Network Card OPTC1 is used for connecting the 9000X Drive to Ethernet networks utilizing Modbus protocol. It includes an RJ-45 pluggable connector. This interface provides a selection of standard and custom register values to communicate drive parameters. The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable over Ethernet using a supplied software tool.

BACnet Network Communications

The BACnet Network Card OPTCJ is used for connecting the 9000X Drive to BACnet networks. It includes a 5.08 mm pluggable connector. Data transfer is Master-Slave/Token Passing (MS/TP) RS-485. This interface uses a collection of 30 Binary Value Objects (BVOs) and 35 Analog Value Objects

(AVOs) to communicate drive parameters. The card supports 9.6, 19.2 and 38.4 Kbaud communication speeds and supports network addresses 1 – 127.

Ethernet/IP Network Communications

The Ethernet/IP Network Card OPTCK is used for connecting the 9000X Drive to Ethernet/Industrial Protocol networks. It includes an RJ-45 pluggable connector. The interface uses CIP objects to communicate drive parameters (CIP is “Common Industrial Protocol”, the same protocol used by DeviceNet). The board supports 10 Mbps and 100 Mbps communication speeds. The IP address of the board is configurable by Static, BOOTP and DHCP methods.

Table 40-368. I/O Specifications for the Control/Communication Options

Description	Specifications
Analog voltage, input	0 – ±10V, R _i ≥ 200 kΩ
Analog current, input	0 (4) – 20 mA, R _i = 250Ω
Digital Input	24V: “0” ≤ 10V, “1” ≥ 18V, R _i > 5 kΩ
Aux. voltage	24V (±20%), max. 50 mA
Reference voltage	10V ±3%, max. 10 mA
Analog current, output	0 (4) – 20 mA, R _L = 500 kΩ, resolution 10 bit, accuracy ≤ ±2%
Analog voltage, output	0 (2) – 10V, R _L ≥ 1 kΩ, resolution 10 bit, accuracy ≤ ±2%
Relay output Max. switching voltage Max. switching load Max. continuous load	300V DC, 250V AC 8A/24V DC, .4A/300V DC, 2 kVA/250V AC 2A rms
Thermistor input	R _{trip} = 4.7 kΩ

Table 40-369. Conformal (Varnished) Coating Adder —
208 – 240V, 380 – 500V ①

Chassis Frame	Delivery Code	Adder U.S. \$	Chassis Frame	Delivery Code	Adder U.S. \$
FR6 FR7 FR8	FP FP FP		FR9 FR10 FR11 FR12	FP FP FP FP	

① See catalog number description to order.

Enclosed Options

Table 40-370. 480V Light Options




Catalog Number Suffix 	Power On/Fault Pilot Lights (22 mm) L1	Red RUN Light (22 mm) LE
hp	Adder U.S. \$	Adder U.S. \$
25 – 800		

Table 40-371. 480V Control Options

Catalog Number Suffix 	Door-Mounted Speed Potentiometer K1	Door-Mounted Speed Potentiometer with HOA Selector Switch K2	3 – 15 psig Follower K3	HAND/OFF/AUTO Switch (22 mm) K4	MANUAL/AUTO Ref Switch (22 mm) K5	START/STOP Pushbuttons (22 mm) K6	Standard Elapsed Time Meter KO
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
25 – 800							


Enclosed Drives

Table 40-372. 480V Bypass Options ^①

Catalog Number Suffix 	Bypass Test Switch for RA, RB, RC, RD KF	Bypass Pilot Lights for RA, RB Options L2	Dual Overloads for Bypass PN	Manual HOA Bypass Controller RA	Manual IOB Bypass Controller RB	Auto Transfer HOA Bypass Controller RC	Auto Transfer IOB Bypass Controller RD	Reduced Volt Starter for Bypass RG
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
25								
30								
40								
50								
60								
75								
100								
125								
150								
200								
250								
300								
350								
400								
500								
550								
600								
650								
700								
800								


^① See Pages 40-251 and 40-252 for details.

Table 40-373. 480V Enclosure Options

Catalog Number Suffix 	10" Expansion S7	20" Expansion S8	Space Heater ^② S9
Enclosure Size	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
7			
8			
9			
10			
11			

^② Requires customer supplied 115V AC supply.

Table 40-374. 480V Power Options

Catalog Number Suffix 	Input	Output				
	Input Circuit Breaker (65 KAIC) P1	Output Contactor PE	Output Filter ^③ PF	MotoRx (300 – 600 Ft.) 1000 V/ μ S DV/DT Filter ^③ PG	Single Overload Relay ^④ PH	Dual Overload Relays ^④ PI
hp	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$	Adder U.S. \$
25						
30						
40						
50						
60						
75						
100						
125						
150						
200						
250						
300						
350						
400						
500						
550						
600						
650						
700						
800						

^③ Output filter may be required whenever the distance from the drive to the motor exceeds 100 feet (30m). Refer to Application Notes for further details.^④ Heater packs not included.

Dimensions

Enclosure Size 7

40

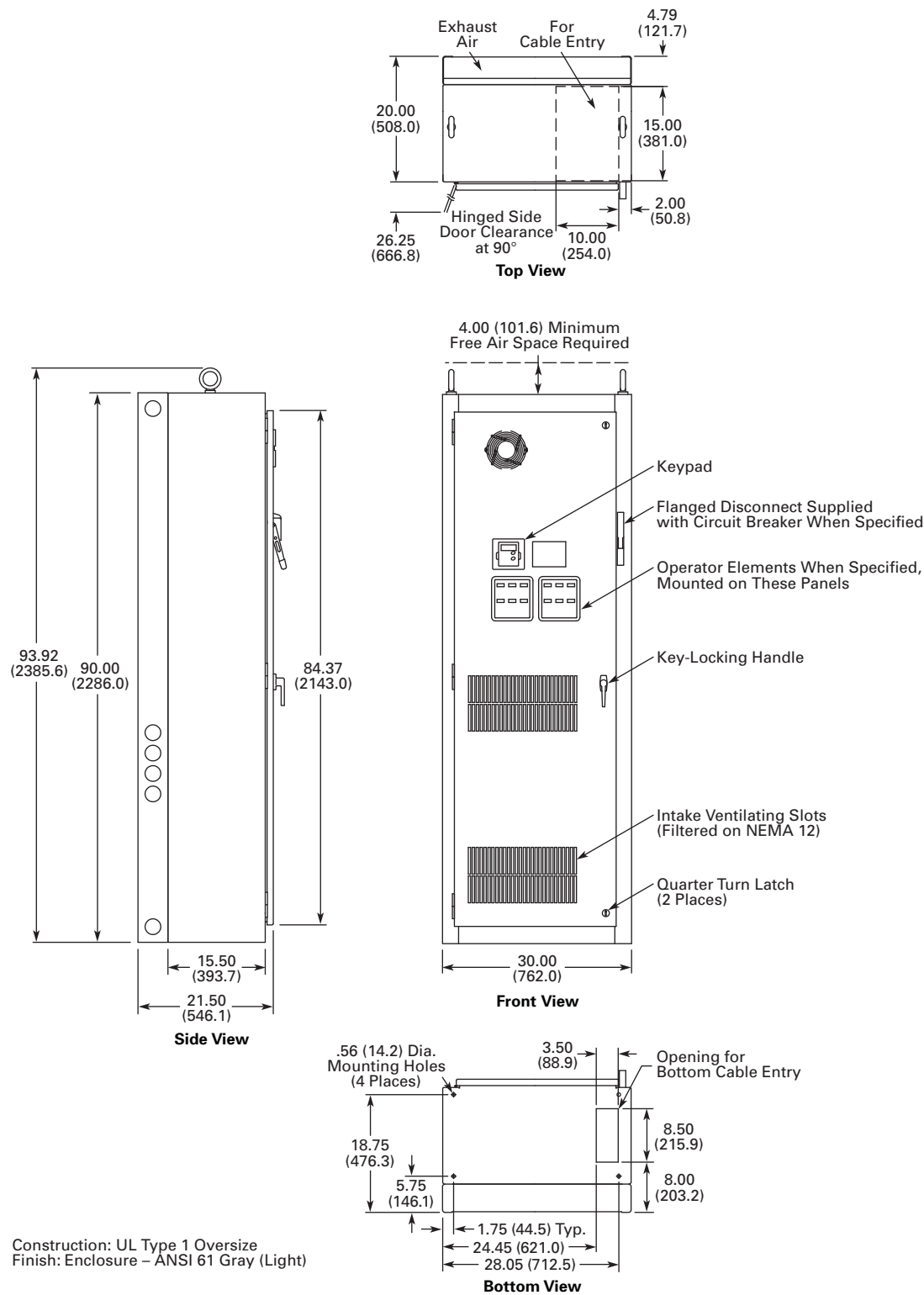


Figure 40-148. 25 – 150 hp I_L and 25 – 125 hp I_H 480V, 25 – 100 hp I_L and 25 – 75 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 8

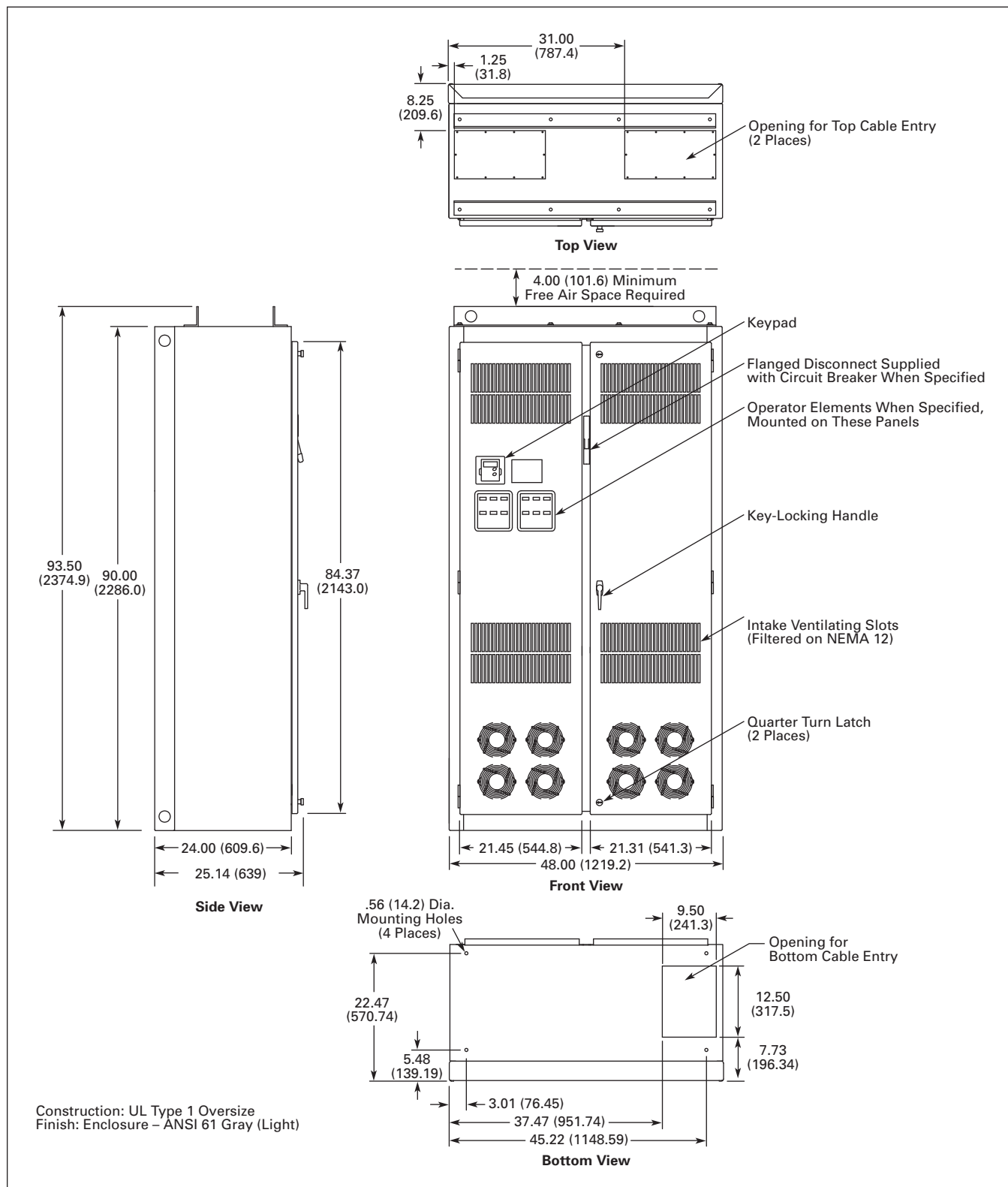


Figure 40-149. 200 – 250 hp I_L and 150 – 200 hp I_H 480V, 125 – 200 hp I_L and 100 – 150 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 9

40

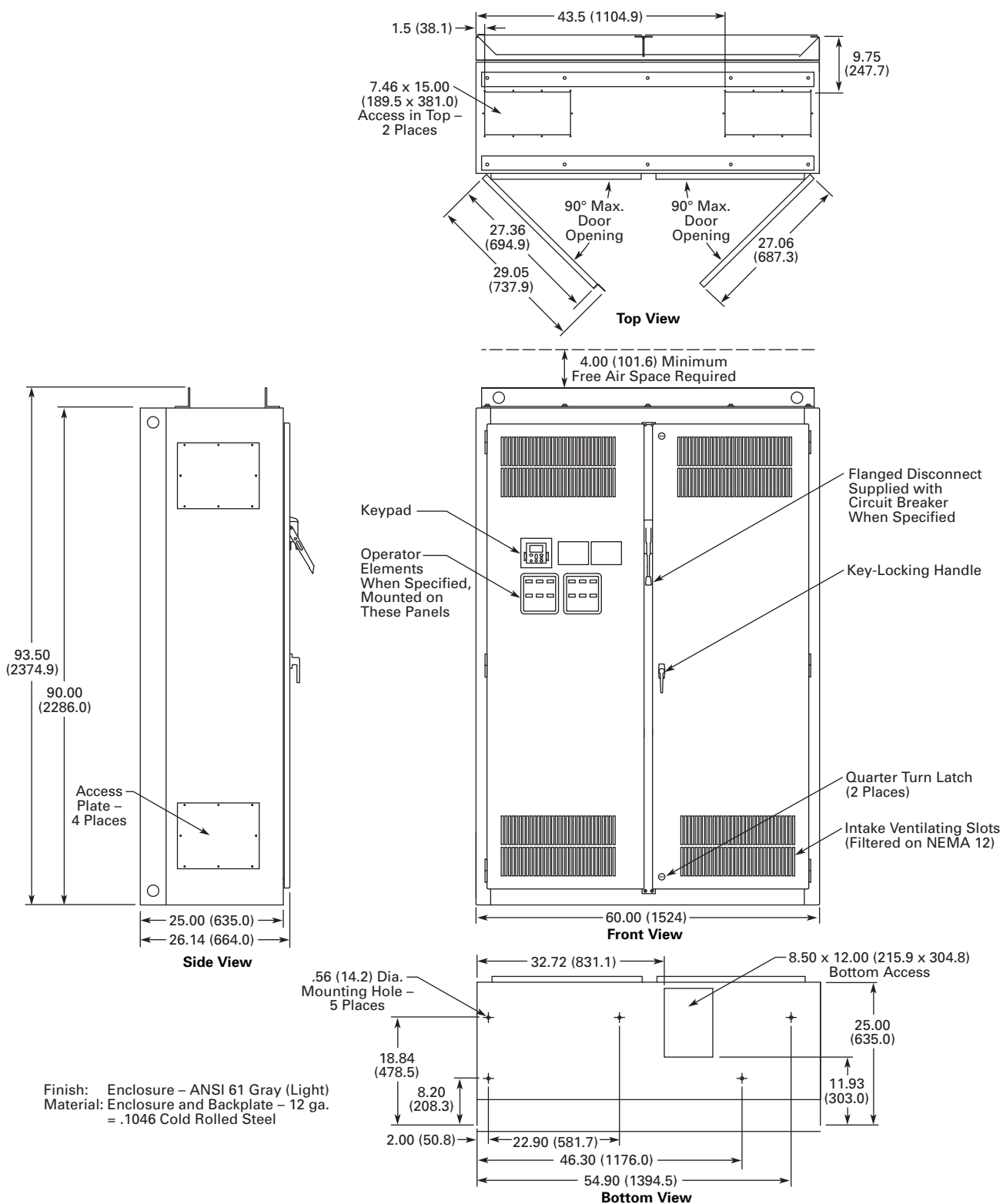


Figure 40-150. 300 – 400 hp I_L and 250 – 350 hp I_H 480V, 250 – 400 hp I_L and 200 – 300 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Size 10

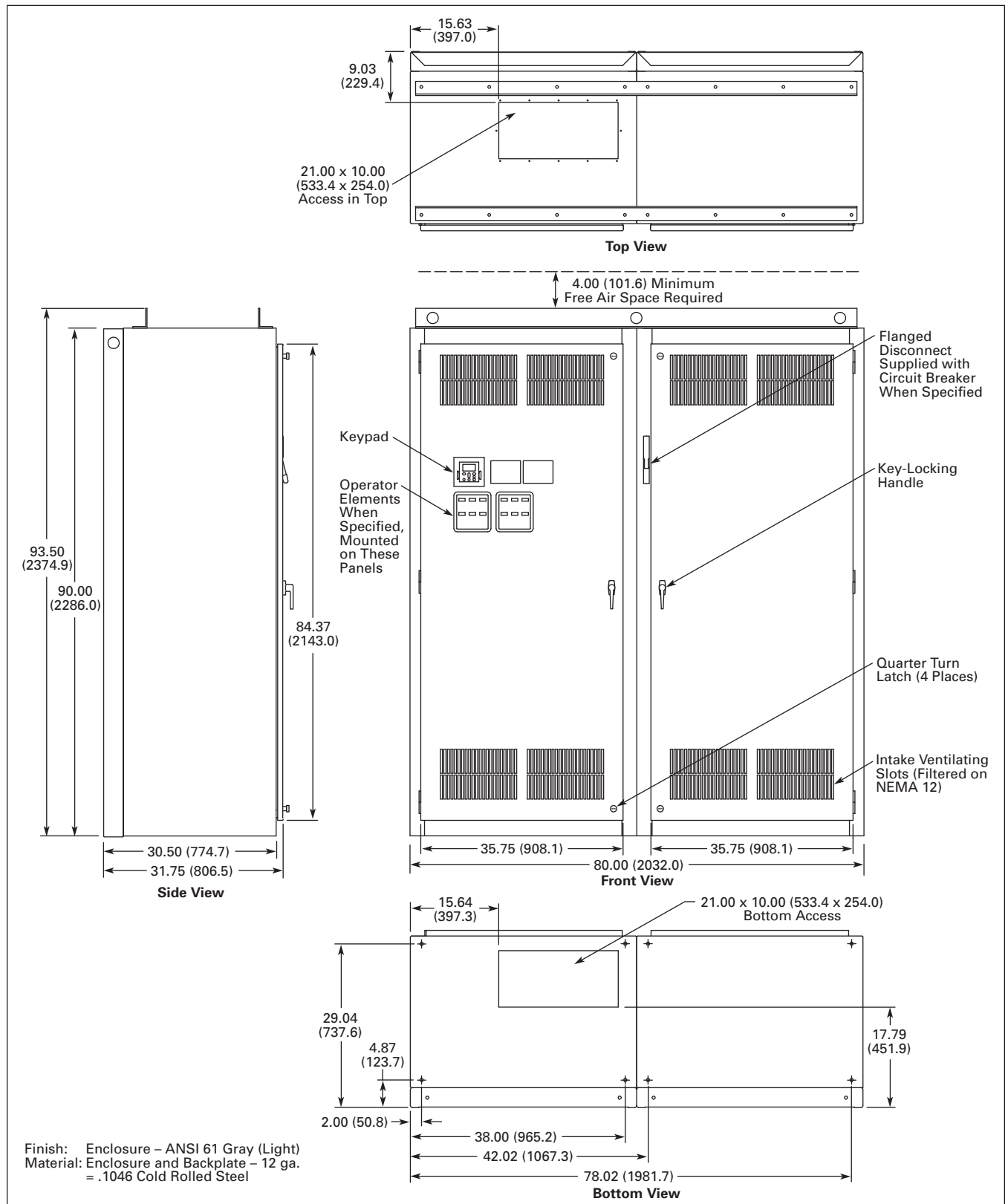


Figure 40-151. 500 – 600 hp I_L and 400 – 500 hp I_H 480V, 500 – 600 hp I_L and 400 – 500 hp I_H 575V — Approximate Dimensions in Inches (mm)

Enclosure Box F NEMA Type 3R Drives

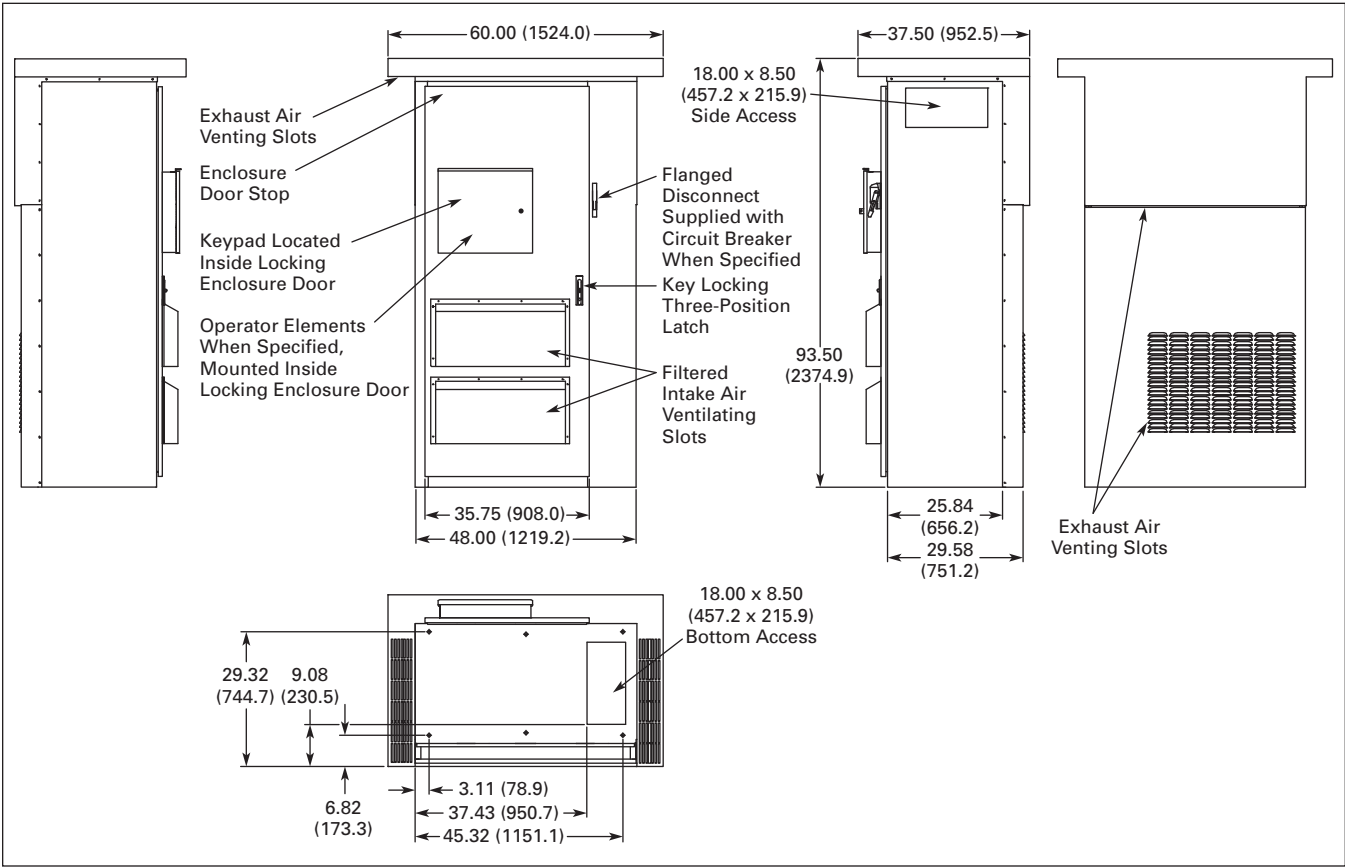


Figure 40-152. 25 – 250 hp I_L and 25 – 200 hp I_H 480V, 25 – 200 hp I_L and 25 – 150 hp I_H 575V NEMA 3R Drives — Approximate Dimensions in Inches (mm)

Wiring Diagrams

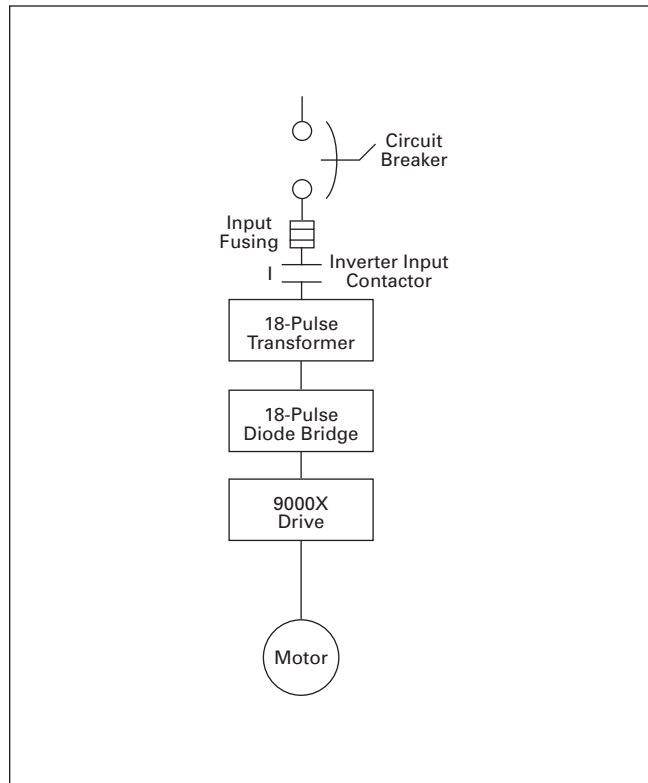


Figure 40-153. Power Diagram 25 – 250 hp I_L and 25 – 200 hp I_H

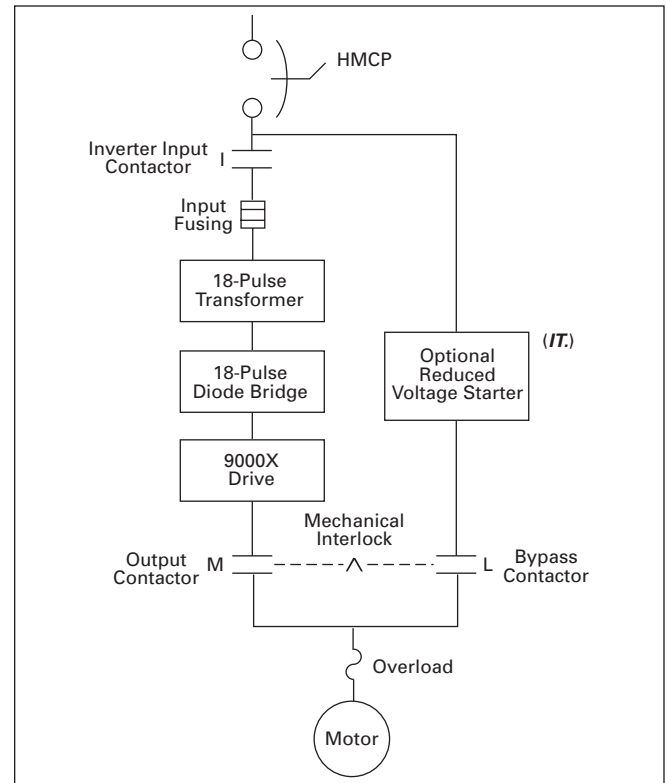


Figure 40-155. Power Diagram 25 – 250 hp I_L and 25 – 200 hp I_H with Bypass

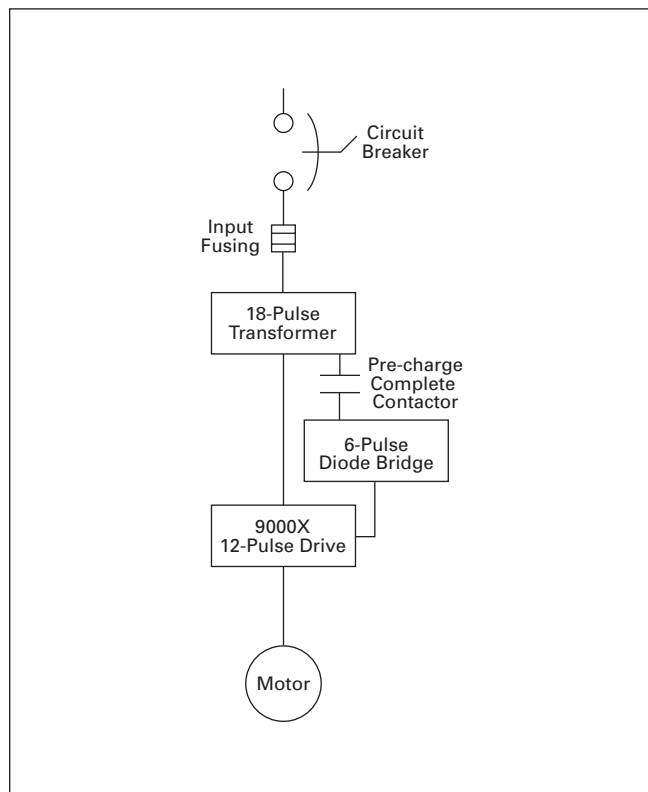


Figure 40-154. Power Diagram 300+ hp I_L and 250+ hp I_H

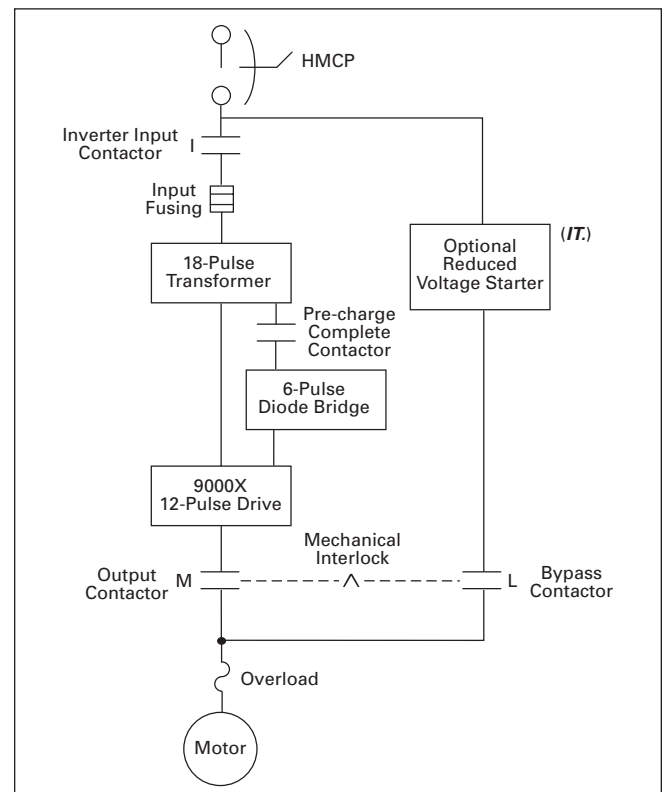


Figure 40-156. Power Diagram 300+ hp I_L /250+ hp I_H with Bypass

Contents

Description	Page
LCX9000 Liquid Cooled Adjustable Frequency Drives	
Product Description	40-262
Features and Benefits	40-262
Technical Data and Specifications	40-262
Catalog Number Selection	40-264
Product Selection	40-265
Dimensions	40-269
Cooling System Diagrams	40-278
I/O Board Wiring Diagrams	40-279



LCX9000 Liquid Cooled Drive

Product Description

The LCX9000 Liquid Cooled Drive family continues Eaton’s tradition of providing state-of-the-industry Cutler-Hammer® products, by taking advantage of liquid cooling technology in lieu of air-cooling techniques.

The LCX9000 drives are liquid-cooled products that utilize potable water or a water-glycol mixture as a cooling medium.

Features and Benefits

- Compact size and low heat transfer rates allow enclosure size to be greatly reduced, which is especially beneficial in NEMA Type 4X applications

- Design is modular, with control and power modules independent of each other. Connection between power and control modules can be direct or extended via a fiber optic cable
- Same reliable control module and operating system as the SPX9000 air-cooled drives.
- CE mark ensures compliance with the Electromagnetic Compatibility Directive (EMC) and the Low Voltage Directive (LVD)
- Reliable drive with over 500,000 hours MTBF based on MIL 217
- Currently supports DeviceNet, PROFIBUS-DP, Modbus RTU and Modbus TCP communication protocols
- Separately mounted line reactor included with AC fed models

Technical Data and Specifications

Table 40-375. LCX9000 Specifications

Description	Specification
Line Voltage	400 – 500V AC; 525 – 690V AC; (-10% – 10%) 465 – 800V DC; 640 – 1100V DC; (-0 – 0%)
Frequency	50/60 Hz
Line Voltage Variation	-10% to 10%
Input Frequency Variation	45 – 66 Hz
Continuous Output Current	Rated current at incoming cooling liquid temperature of 30°C
Output Frequency	0 – 320 Hz
Drive Efficiency	> 95%
Power Factor (Displacement)	.96
Liquid Coolant Pressure	87 psi (6 bar) maximum
Liquid Coolant Flow Rate	1.3 to 7.9 gal./min. (5 to 30 liter/min.) minimum depending on drive size
Liquid Coolant Fittings	Standard quick connect, NPT
Operating Ambient Temperature	-10/+50°C
Storage Temperature	-40/+70°C
Humidity	95% maximum (non-condensing)
Altitude	3300 ft (1000 m) maximum without derating
Enclosure	IP00
Ratings	CE Mark
Warranty	Standard terms, 3 years with certified start-up

Table 40-376. Technical Information

Description	Specification
Mains Connection	
Input Voltage (V_{in})	400 – 500V AC; 525 – 690V AC; (-10% – 10%) 465 – 800V DC; 640 – 1100V DC; (-0 – 0%)
Input Frequency (f_{in})	45 – 66Hz
Connection to Mains	Once per minute or less (normal case)
Motor Connection	
Output Voltage	0 – V_{in}
Continuous Output Current	Rated current at nominal inflow cooling water temperature of 30°C; Overload 2 sec./20 sec.
Starting Current	Rated current at 2 sec./20 sec. if output frequency <30 Hz and temperature of heat-sink <149°F (65°C)
Output Frequency	0 – 320 Hz (standard); 7200 Hz (special software)
Frequency Resolution	Application dependent
Control Characteristics	
Control Method	Frequency control (V/f) Open loop: Sensorless vector control Closed loop: Frequency control Closed loop: Vector control
Switching Frequency (see parameter 2.6.9)	480V: Up to and including 61-Amp size: 1 – 16 kHz (factory default, 10 kHz) From 72-Amp size: 1 – 12 kHz (factory default, 3.6 kHz) 575V: 1 – 6kHz (factory default, 1.5kHz) Note: Derating required if higher switching frequency than the default is used.
Frequency Reference	Analog input: Resolution .1% (10 bits); Accuracy \pm 1% Panel reference: Resolution .01 Hz
Field Weakening Point	30 – 320 Hz
Acceleration Time	.1 – 3000 sec.
Deceleration Time	.1 – 3000 sec.
Braking Torque	DC brake: 30% \times T_n (without brake option)
Ambient Conditions	
Ambient Operating Temperature	14°F (-10°C), no frost to +122°F (+50°C) at I_{th} 122 – 158°F (50 – 70°C), derating required
Storage Temperature	-40°F to +158°F (-40 to +70°C) No liquid in heatsink under 32°F (0°C)
Relative Humidity	5 – 96% RH, noncondensing, no dripping water
Air Quality	Chemical vapors: IEC 721-3-3, unit in operation, class 3C2 Mechanical particles: IEC 721-3-3, unit in operation, class 3S2 (no conductive dust allowed); No corrosive gases
Altitude	Up to 1,000m: 100% load capacity (no derating) Above 1,000m: Derating of 1% per each 100m required
Vibration	EN 50178, EN 60068-2-6; 5 – 150 Hz Displacement amplitude: .25 mm (peak) at 3 – 31 Hz Max. acceleration amplitude: 1G at 31 – 150 Hz
Shock	EN 50178, EN 60068-2-27, UPS drop test (for applicable UPS weights) Storage and shipping: Max. 15G, 11 mS (in package)
Enclosure Class	IP00 open frame standard in entire kW/hp range

Description	Specification
EMC	
Immunity	Fulfills all EMC immunity requirements
Emissions	EMC level N; EMC level T for IT networks
Safety	
Approvals	EN 50178, EN 60204-1, CE, UL, CUL, FI, GOST R, IEC 61800-5 (See unit nameplate for more detailed approvals.)
Control Connections	
Analog Input Voltage	0 to +10V, R_i = 200 k Ω (-10V to +10V joystick control) Resolution .1%; Accuracy \pm 1%
Analog Input Current	0(4) – 20 mA, R_i = 250 Ω differential
Digital Inputs	6 positive or negative logic; 18 – 24V DC
Auxiliary Voltage	+24V, \pm 15%, max. 250 mA
Output Reference Voltage	+10V, +3%, max. load 10 mA
Analog Output	0(4) – 20 mA, R_L max. 500 Ω Resolution 10 bits; Accuracy \pm 2%
Digital Outputs	Open collector output, 50 mA/48V
Relay Outputs	2 programmable change-over relay outputs Switching capacity: 24V DC/8A, 250V AC/8A, 125V DC/4A Min. switching load: 5V/10 mA
Protections	
Overvoltage Protection	480V: 911V; 575V: 1200V
Undervoltage Protection	480V: 333V; 575V: 461V
Ground Fault Protection	In case of ground fault in motor or motor cable, only the drive is protected.
Mains Supervision	Trips if any of the input phases are missing (drives only).
Motor Phase Supervision	Trips if any of the output phases are missing
Unit Overtemperature Protection	Alarm limit: 149°F (65°C) for heatsink, 158°F (70°C) for circuit boards Trip limit: 158°F (70°C) for heatsink, 185°F (85°C) for circuit boards
Overcurrent Protection	Yes
Motor Overload Protection	Yes
Motor Stall Protection	Yes
Motor Underload Protection	Yes
Short-Circuit Protection	Yes (+24V and +10V reference voltages)
Liquid Cooling	
Allowed Cooling Agents	Drinking water Water-glycol mixture
Temperature of Cooling Agent	32 – 86°F (0 – 30°C) at I_{th} for input; 86 – 149°F (30 – 65°C) Max. temperature rise during circulation: 9°F (5°C), no condensation allowed
System Max. Working Pressure	87 psi (6 bar)
System Max. Peak Pressure	580 psi (40 bar)
Pressure Loss (at nominal flow)	Varies according to size

Catalog Number Selection

Table 40-377. LCX9000 Liquid Cooled Adjustable Frequency Drive Catalog Numbering System

LCX 016 A 0 - 4 A 2 B 1											
Product Family LCX = High Performance, Liquid-Cooled Drive		Current Rating 480V 016 = 16A 385 = 385A 022 = 22A 460 = 460A 031 = 31A 520 = 520A 038 = 38A 590 = 590A 045 = 45A 650 = 650A 061 = 61A 730 = 730A 072 = 72A 820 = 820A 087 = 87A 920 = 920A 105 = 105A H10 = 1030A 140 = 140A H11 = 1150A 168 = 168A H13 = 1370A 205 = 205A H16 = 1640A 261 = 261A H20 = 2060A 300 = 300A H23 = 2300A 690V 170 = 170A 590 = 590A 208 = 208A 650 = 650A 261 = 261A 750 = 750A 325 = 325A 820 = 820A 385 = 385A H10 = 1030A 416 = 416A H11 = 1180A 460 = 460A H13 = 1300A 502 = 502A H15 = 1500A		Software Series A = Standard		Enclosure Rating 0 = Open Chassis		Board Modifications 1 = Standard Boards 2 = Varnished Boards		Options List options in alphabetical order. Extended I/O Card Options A3 = 2 RO, Therm A4 = Encoder Low Volt +5V/15V/24V A5 = Encoder High Volt +15V/24V A7 = Dual Encoder +15V/24V A8 = 6 DI, 1 DO, 2 AI, 1AO AE = Encoder with 2 DOs B1 = 6 DI, 1 ext +24V DC/EXT +24V DC B2 = 1 RO (NC/NO), 1 RO (NO), 1 Therm B4 = 1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT + 24V DC B5 = 3 RO (NO) B8 = 1 ext +24V DC/EXT +24V DC, 3 Pt100 B9 = 1 RO (NO), 5 DI 42 – 240V AC Input BB = SPI, Absolute Encoder Communication Cards CA = Johnson Controls N2 CI = Modbus TCP C2 = Modbus C3 = Profibus DP C4 = LonWorks C5 = Profibus DP (D9 Connector) C6 = CANopen (Slave) C7 = DeviceNet C8 = Modbus (D9 Type Connector) D1 = Adapter D2 = Adapter D3 = RS-232 with D9 Connection	
						Brake Chopper Options ① N = No Brake Chopper Circuit B = Internal Brake Chopper					
						Input Options 2 = 3-Phase, EMC N 7 = DC Input					
						Keypad A = Alphanumeric					
						Voltage Rating 4 = 380 – 500V 5 = 520 – 690V					

① Brake Chopper is only available in 480V CH3 Drives.

Product Selection

Table 40-378. 380 – 500V AC Liquid Cooled Drive Product Selection

Motor Output				Chassis	Catalog Number	Price U.S. \$
Current			kW			
Thermal, I _{th} (A)	I _L (A)	I _H (A)				
16	15	11	7.5	CH3	LCX016A0-4A2B1	
22	20	15	11	CH3	LCX022A0-4A2B1	
31	28	21	15	CH3	LCX031A0-4A2B1	
38	35	25	18.5	CH3	LCX038A0-4A2B1	
45	41	30	22	CH3	LCX045A0-4A2B1	
61	55	41	30	CH3	LCX061A0-4A2B1	
72	65	48	37	CH4	LCX072A0-4A2N1	
87	79	58	45	CH4	LCX087A0-4A2N1	
105	95	70	55	CH4	LCX105A0-4A2N1	
140	127	93	75	CH4	LCX140A0-4A2N1	
168	153	112	90	CH5	LCX168A0-4A2N1	
205	186	137	110	CH5	LCX205A0-4A2N1	
261	237	174	132	CH5	LCX261A0-4A2N1	
300	273	200	160	CH61	LCX300A0-4A2N1	
385	350	257	200	CH61	LCX385A0-4A2N1	
460	418	307	250	CH72	LCX460A0-4A2N1	
520	473	347	250	CH72	LCX520A0-4A2N1	
590	536	393	315	CH72	LCX590A0-4A2N1	
650	591	433	355	CH72	LCX650A0-4A2N1	
730	664	487	400	CH72	LCX730A0-4A2N1	
820	745	547	450	CH63	LCX820A0-4A2N1	
920	836	613	500	CH63	LCX920A0-4A2N1	
1030	936	687	560	CH63	LCXH10A0-4A2N1	
1150	1045	766	600	CH63	LCXH11A0-4A2N1	
1370	1245	913	700	CH74	LCXH13A0-4A2N1	
1640	1491	1093	900	CH74	LCXH16A0-4A2N1	
2060	1873	1373	1100	CH74	LCXH20A0-4A2N1	
2300	2091	1533	1200	CH74	LCXH23A0-4A2N1	

Table 40-379. 525 – 690V AC Liquid Cooled Drive Product Selection

Motor Output				Chassis	Catalog Number	Price U.S. \$
Current			kW			
Thermal, I _{th} (A)	I _L (A)	I _H (A)				
170	155	113	110	CH61	LCX170A0-5A2N1	
208	189	139	132	CH61	LCX208A0-5A2N1	
261	237	174	160	CH72	LCX261A0-5A2N1	
325	295	217	200	CH72	LCX325A0-5A2N1	
385	350	257	250	CH72	LCX385A0-5A2N1	
416	378	277	250	CH72	LCX416A0-5A2N1	
460	418	307	300	CH72	LCX460A0-5A2N1	
502	456	335	355	CH72	LCX502A0-5A2N1	
590	536	393	400	CH63	LCX590A0-5A2N1	
650	591	433	450	CH63	LCX650A0-5A2N1	
750	682	500	500	CH63	LCX750A0-5A2N1	
820	745	547	560	CH74	LCX820A0-5A2N1	
920	836	613	650	CH74	LCX920A0-5A2N1	
1030	936	687	700	CH74	LCXH10A0-5A2N1	
1180	1073	787	800	CH74	LCXH11A0-5A2N1	
1300	1182	867	900	CH74	LCXH13A0-5A2N1	
1500	1364	1000	1000	CH74	LCXH15A0-5A2N1	

Discount Symbol SS-2

Table 40-380. 540 – 675V DC Liquid Cooled Inverter Unit Product Selection

Drive Output					Power Loss c/a/T (kW)	Chassis	Catalog Number	Price U.S. \$
Current			Motor Output Power					
Thermal I _{th} (A)	Rated Cont. I _L (A)	Rated Cont. I _H (A)	Optimum Motor at I _{th} 400V (kW)	Optimum Motor at I _{th} 500V (kW)				
16	15	11	7.5	11	0.4/0.2/0.6	CH3	LCX016A0-4A7B1	
22	20	15	11	15	0.5/0.2/0.7	CH3	LCX022A0-4A7B1	
31	28	21	15	18.5	0.7/0.2/0.9	CH3	LCX031A0-4A7B1	
38	35	25	18.5	22	0.8/0.2/1.0	CH3	LCX038A0-4A7B1	
45	41	30	22	30	1.0/0.3/1.3	CH3	LCX045A0-4A7B1	
61	55	41	30	37	1.3/0.3/1.5	CH3	LCX061A0-4A7B1	
72	65	48	37	45	1.2/0.3/1.5	CH4	LCX072A0-4A7N1	
87	79	58	45	55	1.5/0.3/1.8	CH4	LCX087A0-4A7N1	
105	95	70	55	75	1.8/0.3/2.1	CH4	LCX105A0-4A7N1	
140	127	93	75	90	2.3/0.3/2.6	CH4	LCX140A0-4A7N1	
168	153	112	90	110	2.5/0.3/2.8	CH5	LCX168A0-4A7N1	
205	186	137	110	132	3.0/0.4/3.4	CH5	LCX205A0-4A7N1	
261	237	174	132	160	4.0/0.4/4.4	CH5	LCX261A0-4A7N1	
300	273	200	160	200	4.5/0.4/4.9	CH61	LCX300A0-4A7N1	
385	350	257	200	250	5.5/0.5/6.0	CH61	LCX385A0-4A7N1	
460	418	307	250	315	5.5/0.5/6.0	CH62	LCX460A0-4A7N1	
520	473	347	250	355	6.5/0.5/7.0	CH62	LCX520A0-4A7N1	
590	536	393	315	400	7.5/0.6/8.1	CH62	LCX590A0-4A7N1	
650	591	433	355	450	8.5/0.6/9.1	CH62	LCX650A0-4A7N1	
730	664	487	400	500	10.0/0.7/10.7	CH62	LCX730A0-4A7N1	
820	745	547	450	560	12.5/0.8/13.3	CH63	LCX820A0-4A7N1	
920	836	613	500	600	14.4/0.9/15.3	CH63	LCX920A0-4A7N1	
1030	936	687	560	700	16.5/1.0/17.5	CH63	LCXH10A0-4A7N1	
1150	1045	766	600	750	18.4/1.1/19.5	CH63	LCXH11A0-4A7N1	
1370	1245	913	700	900	15.5/1.0/16.5	CH64	LCXH13A0-4A7N1	
1640	1491	1093	900	1100	19.5/1.2/20.7	CH64	LCXH16A0-4A7N1	
2060	1873	1373	1100	1400	26.5/1.5/28.0	CH64	LCXH20A0-4A7N1	
2300	2091	1533	1250	1500	29.6/1.7/31.3	CH64	LCXH23A0-4A7N1	
2470	2245	1647	1300	1600	36.0/2.0/38.0	2*CH64	LCXH24A0-4A7N1	
2950	2681	1967	1550	1950	39.0/2.4/41.4	2*CH64	LCXH29A0-4A7N1	
3710	3372	2473	1950	2450	48.0/2.7/50.7	2*CH64	LCXH37A0-4A7N1	
4140	3763	2760	2150	2700	53.0/3.0/66.0	2*CH64	LCXH41A0-4A7N1	

Table 40-381. 710 – 930V DC Liquid Cooled Inverter Unit Product Selection

Drive Output					Power Loss c/a/T (kW)	Chassis	Catalog Number	Price U.S. \$
Current			Motor Output Power					
Thermal I _{th} (A)	Rated Cont. I _L (A)	Rated Cont. I _H (A)	Optimum Motor at I _{th} 400V (kW)	Optimum Motor at I _{th} 500V (kW)				
170 208 261 325	155 189 237 295	113 139 174 217	110 132 160 200	160 200 250 300	4.5/0.2/4.7 5.5/0.3/5.8 5.5/0.3/5.8 6.5/0.3/6.8	CH61 CH61 CH61 CH62	LCX170A0-5A7N1 LCX208A0-5A7N1 LCX261A0-5A7N1 LCX325A0-5A7N1	
385 416 460 502	350 378 418 456	257 277 307 335	250 250 300 355	355 355 400 450	7.5/0.4/7.9 8.0/0.4/8.4 8.5/0.4/8.9 10.0/0.5/10.5	CH62 CH62 CH62 CH62	LCX385A0-5A7N1 LCX416A0-5A7N1 LCX460A0-5A7N1 LCX502A0-5A7N1	
590 650 750 820	536 591 682 745	393 433 500 547	400 450 500 560	560 600 700 800	10.0/0.5/10.5 13.5/0.7/14.2 16.0/0.8/16.8 16.0/0.8/16.8	CH63 CH63 CH63 CH64	LCX590A0-5A7N1 LCX650A0-5A7N1 LCX750A0-5A7N1 LCX820A0-5A7N1	
920 1030 1180 1300	836 936 1073 1182	613 687 787 867	650 700 800 900	850 1000 1100 1200	18.0/0.9/18.9 19.0/1.0/20.0 21.0/1.1/22.1 27.0/1.4/28.4	CH64 CH64 CH64 CH64	LCX920A0-5A7N1 LCXH10A0-5A7N1 LCXH11A0-5A7N1 LCXH13A0-5A7N1	
1500 1700 1850 2120	1364 1545 1682 1927	1000 1133 1233 1413	1050 1150 1250 1450	1400 1550 1650 1900	32.0/1.6/33.6 NA 34.2/1.8/36.0 37.8/2.0/39.8	CH64 CH64 2*CH64 2*CH64	LCXH15A0-5A7N1 LCXH17A0-5A7N1 LCXH18A0-5A7N1 LCXH21A0-5A7N1	
2340 2700 3100	2127 2455 2818	1560 1800 2066	1600 1850 2150	2100 2450 2800	48.6/2.5/51.1 57.6/3.0/60.6 NA	2*CH64 2*CH64 2*CH64	LCXH23A0-5A7N1 LCXH27A0-5A7N1 LCXH31A0-5A7N1	

Discount Symbol SS-2

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-157**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

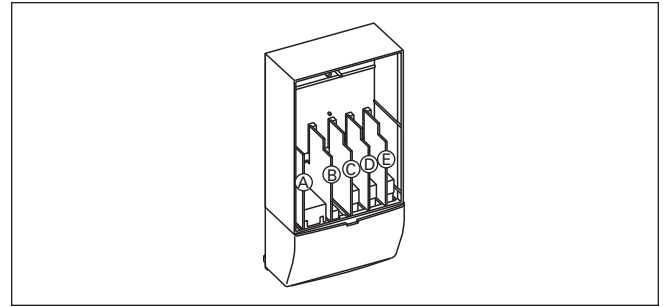


Figure 40-157. 9000X Series Option Boards

Table 40-382. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.\$	Option Designator	Adder U.S.\$	Basic	Local/Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-157)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	OPTA3		A3		—	X	X	X	X	X	X
Encoder Low Volt +5V/15V/24V	C	OPTA4		A4		—	X	X	X	X	X	X
Encoder High Volt +15V/24V	C	OPTA5		A5		—	X	X	X	X	X	X
Dual Encoder +15V/24V	C	OPTA7		A7		—	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	OPTA8		A8		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction) — SPX Only	C	OPTAE		AE		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		—	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	OPTBB		BB		—	—	—	—	—	—	—
Communication Cards												
Modbus	D, E	OPTC2 ③		C2		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2 ③		CA		—	—	—	—	—	—	—
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD1		D1		X	X	X	X	X	X	X
Adapter — SPX Only	D, E	OPTD2		D2		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X
Keypad												
9000X Series Standard Keypad	—	KEYPAD-STD		—		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMT-KIT-9000X		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Line Reactors

The line reactor carries out several functions in the Liquid Cooled Drive. Connection of the line reactor is necessary except if you have a component in your system that performs the same tasks (e.g. a transformer). The line reactor is needed as an essential component for motor control, to protect

the input and DC-link components against abrupt changes of current and voltage as well as to function as a protection against harmonics. The line reactors are included in the standard delivery of liquid-cooled drives (not inverters). However, you can also order your drive without a line reactor.

Table 40-383. Line Reactor Specifications

Drive Rating 480V	Drive Rating 690V	Thermal Current (A)	Nominal Inductance (μH) A/B ①	Calculated Loss (W)	Choke Catalog Number (690V AC)
16 to 22A	12 to 23A	23	1900	145	CHK0023N6A0
31 to 38A	31 to 38A	38	1100	170	CHK0038N6A0
45 to 61A	46 to 62A	62	700	210	CHK0062N6A0
72 to 87A	72 to 87A	87	480	250	CHK0087N6A0
105 to 140A	105 to 140A	145	290	380	CHK0145N6A0
168 to 261A	170 to 261A	261	139/187	460	CHK0261N6A0
300 to 385A	325 to 385A 820 to 1180A ②	400	90/126	570	CHK0400N6A0
460 to 520A 1370A ②	416 to 502A 1300 to 1500A ②	520	65/95	610	CHK0520N6A0
590 to 650A 1640A ②	590 to 650A	650	51/71	840	CHK0650N6A0
730A 2060A ②	—	730	45/61	850	CHK0730N6A0
820A 2300A ②	750A	N/A	N/A	N/A	CHK0820N6A0
920 to 1030A	—	1000	30/41	950	CHK1030N6A0
1150A	—	1150	26/36	1000	CHK1150N6A0

① Inductances for different supply voltages: A = 400 – 480V AC; B = 500 – 690V AC.

② Drives require three chokes of the designated catalog number with 6-pulse supply.

Table 40-384. Line Reactor Dimensions

Catalog Number	H1 Inches (mm)	W1 Inches (mm)	D1 Inches (mm)	Weight Lbs. (kg)
CHK0023N6A0	7.01 (178)	9.06 (230)	4.76 (121)	22 (10)
CHK0038N6A0	8.23 (209)	10.63 (270)	5.71 (145)	33 (15)
CHK0062N6A0	8.39 (213)	11.81 (300)	6.30 (160)	44 (20)
CHK0087N6A0	9.13 (232)	11.81 (300)	6.69 (170)	57 (26)
CHK0145N6A0	11.50 (292)	11.81 (300)	7.28 (185)	82 (37)
CHK0220N6A0	12.05 (306)	13.86 (352)	7.28 (185)	119 (54)
CHK0325N6A0	13.66 (347)	13.86 (352)	7.28 (185)	132 (60)
CHK0460N6A0	16.54 (423)	13.70 (348)	9.41 (239)	203 (92)
CHK0520N6A0	17.60 (447)	15.51 (394)	10.71 (272)	231 (105)
CHK0590N6A0	20.43 (519)	15.51 (394)	10.71 (272)	276 (125)
CHK0650N6A0	20.51 (521)	15.51 (394)	10.71 (272)	276 (125)
CHK0750N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK0820N6A0	24.72 (628)	15.51 (394)	11.10 (282)	331 (150)
CHK1000N6A0	22.68 (576)	19.57 (497)	11.85 (301)	441 (200)
CHK1150N6A0	22.83 (580)	19.57 (497)	11.85 (301)	441 (200)

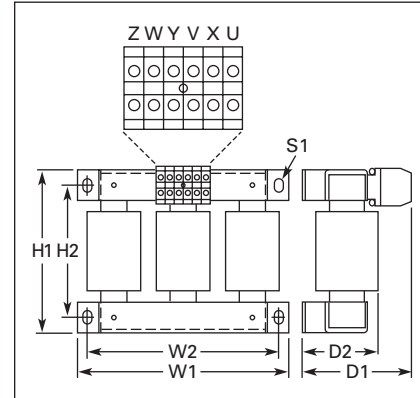


Figure 40-158. Line Reactor Dimensions for LCX9000 Drives Sizes up to 61A

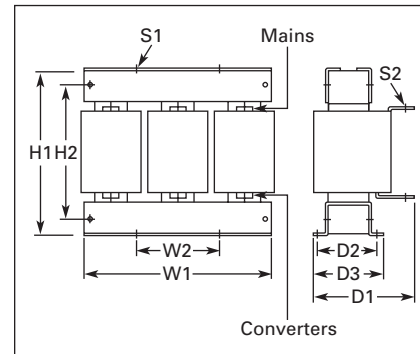


Figure 40-159. Line Reactor Dimensions for LCX9000 Drives Sizes larger than 61A

Dimensions

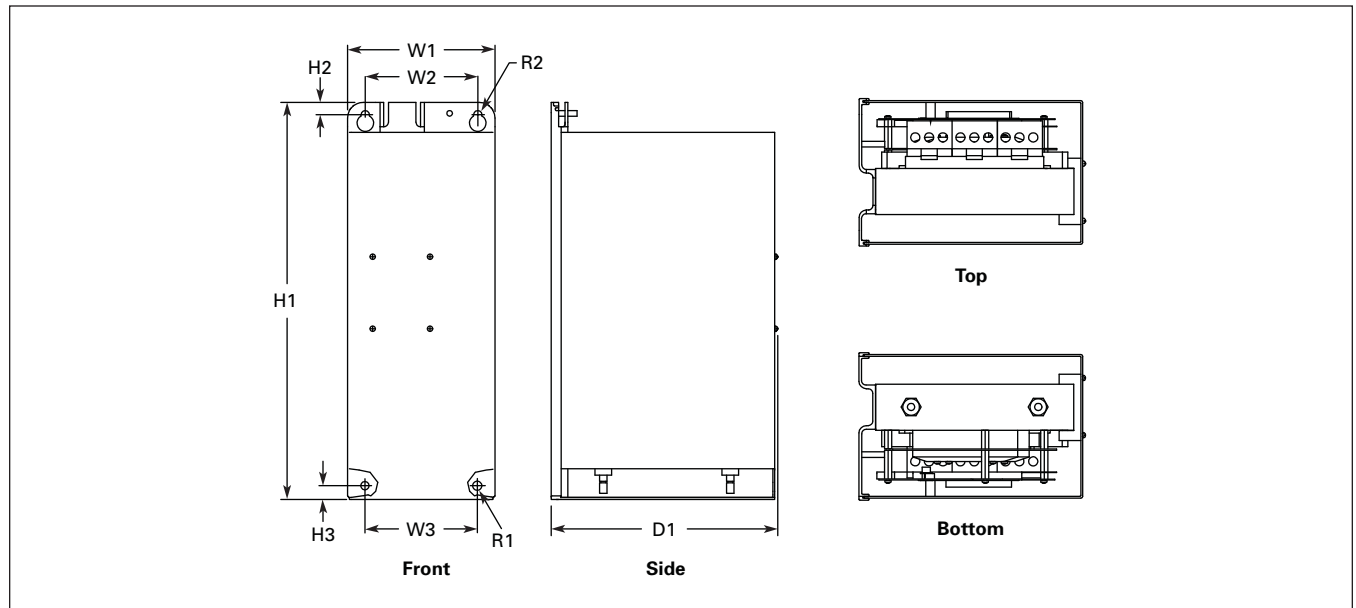


Figure 40-160. Approximate Dimensions, CH3

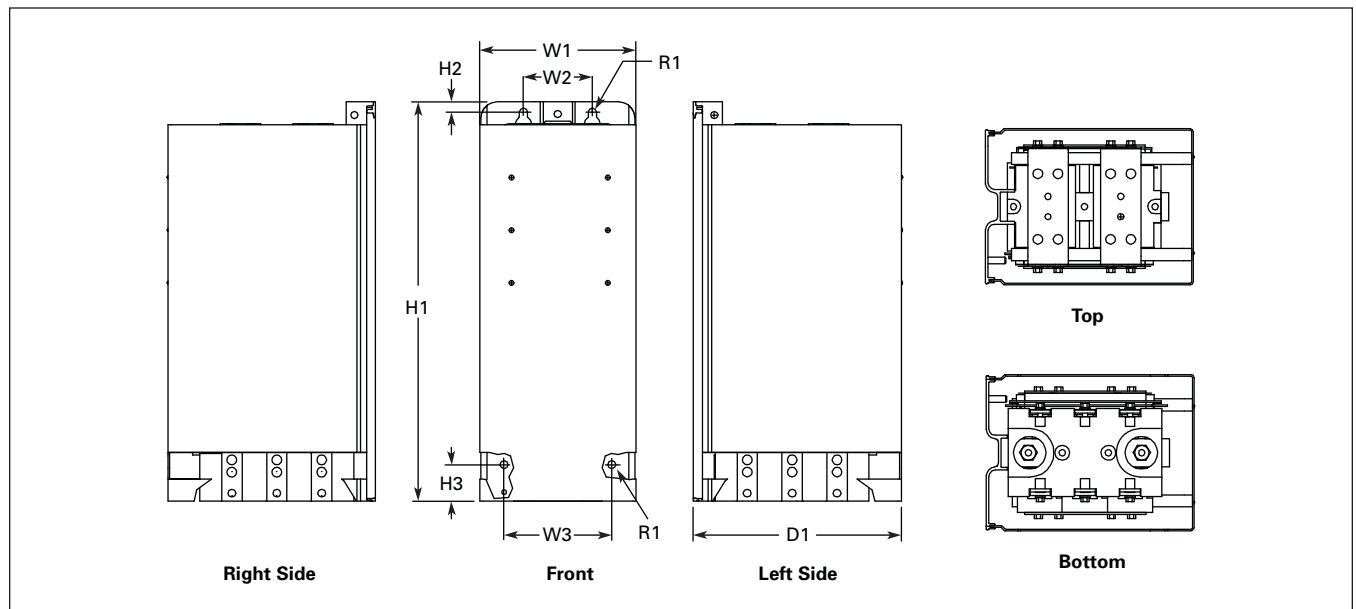


Figure 40-161. Approximate Dimensions, CH4

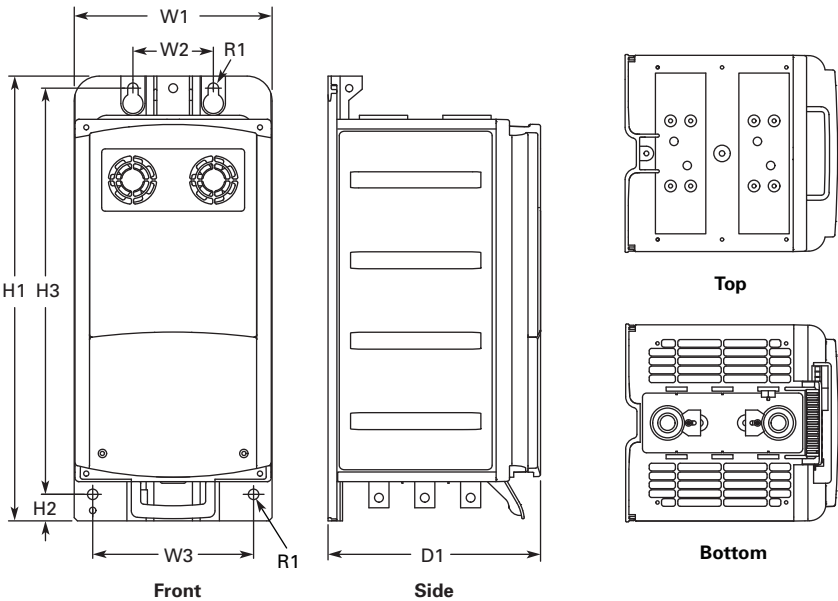


Figure 40-162. Approximate Dimensions, CH5

Table 40-385. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.	
CH3	380 – 500V AC	16 – 61	16.97 (431.0)	.53 (13.5)	.59 (15.0)	9.69 (246.0)	6.30 (160.0)	4.80 (122.0)	4.80 (122.0)	.39 (10.0)	.35 (9.0)	66 (30)
CH4	380 – 500V AC	72 – 140	19.41 (493.0)	.49 (12.5)	1.77 (45.0)	10.14 (257.5)	7.60 (193.0)	3.35 (85.0)	5.24 (133.0)	.39 (10.0)	—	77 (35)
CH5	380 – 500V AC	168 – 261	21.77 (553.0)	1.30 (33.0)	19.88 (505.0)	10.39 (264.0)	9.69 (246)	3.94 (100.0)	7.87 (200.0)	.51 (13.0)	—	88 (40)

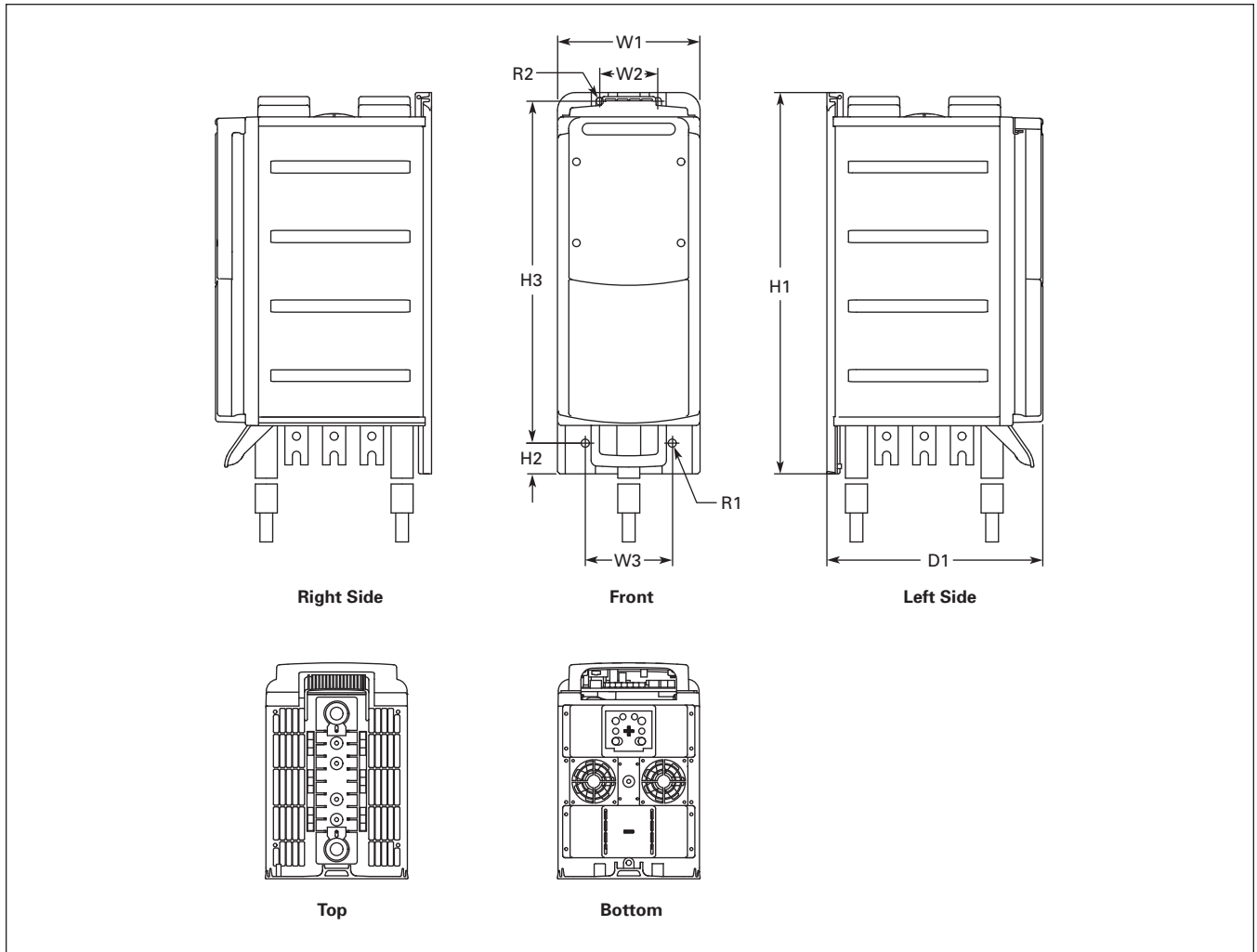


Figure 40-163. Approximate Dimensions, CH61

Table 40-386. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)									Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.	
CH61	380 – 500V AC	300 – 385	25.91 (658.0)	2.09 (53.0)	23.23 (590.0)	14.69 (373.0)	9.69 (246.0)	3.94 (100.0)	5.91 (150.0)	.55 (14.0)	.51 (13.0)	121 (55)
	525 – 690V AC	170 – 208										

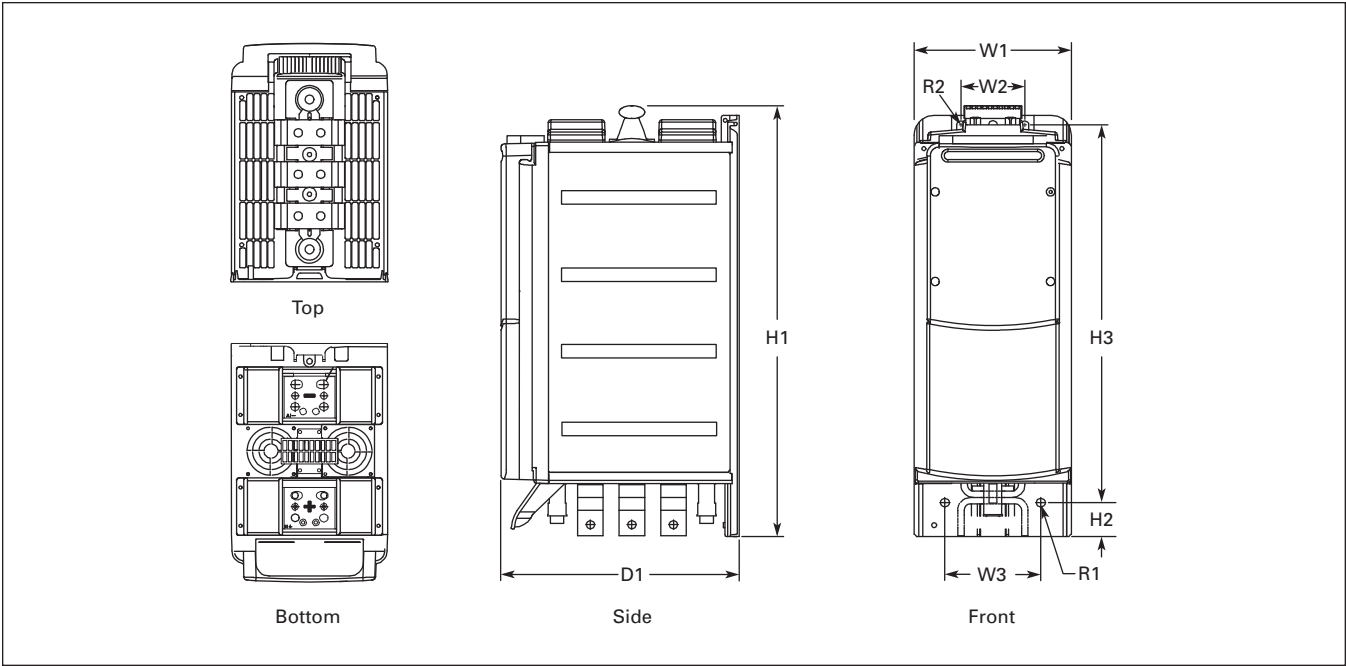


Figure 40-164. Approximate Dimensions, LCX9000 Liquid-Cooled Inverter, CH62

Table 40-387. LCX9000 Liquid-Cooled Inverter, CH62 Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)								
			H1	H2	H3	D1	W1	W2	W3	R1 dia.	R2 dia.
CH62	540 – 675V DC	460 – 730	26.50	2.0	23.23	14.69	9.69	3.94	5.91	.55	.51
	710 – 930V DC	325 – 502	(673)	(53)	(590)	(373)	(246)	(100)	(150)	(14)	(13)

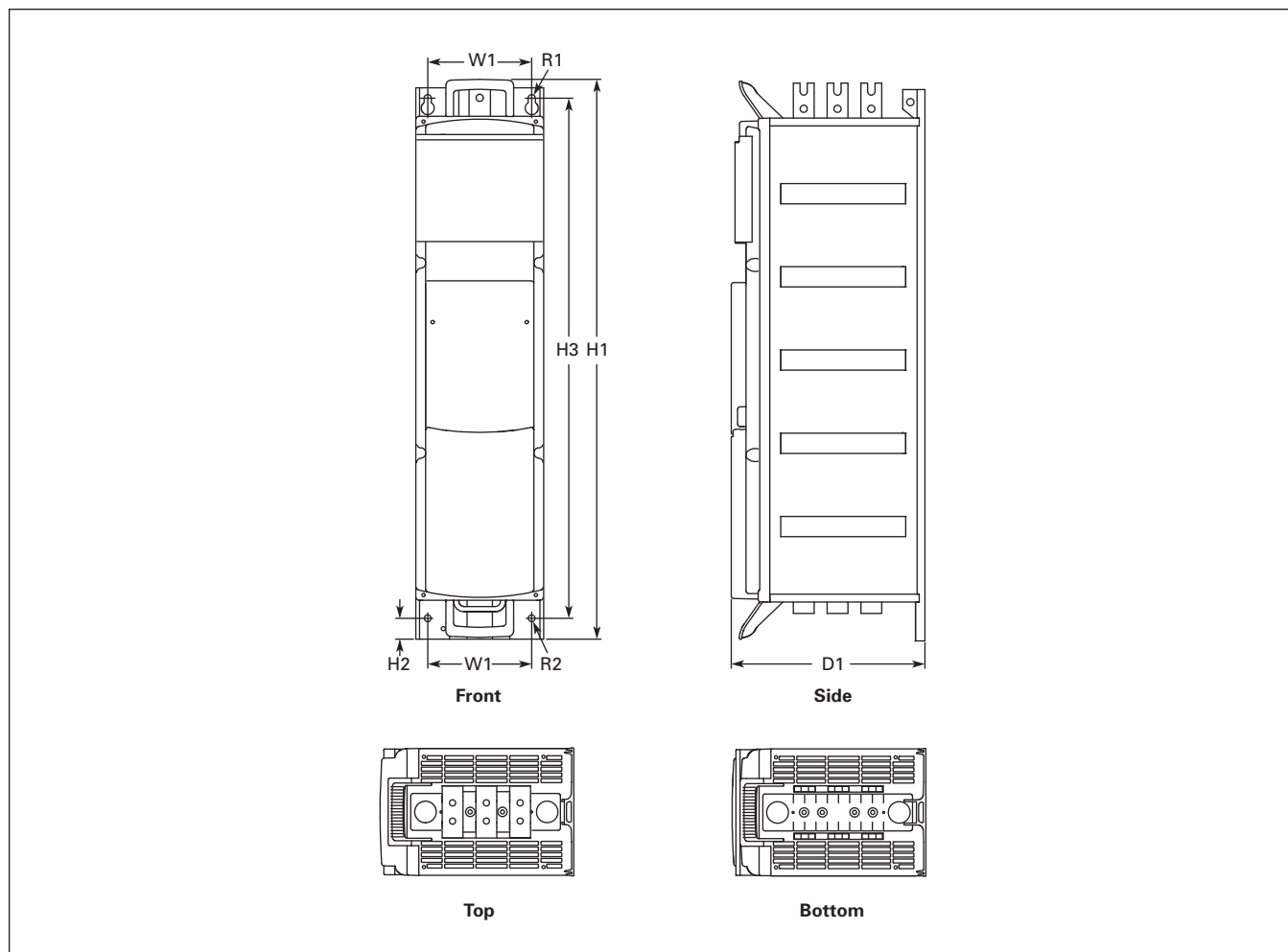


Figure 40-165. Approximate Dimensions, CH72

Table 40-388. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			H1	H2	H3	D1	W1	R1 dia.	R2 dia.	
CH72	380 – 500V AC	460 – 730	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	7.87 (200.0)	.55 (14.0)	.51 (13.0)	198 (90)
	525 – 690V AC	261 – 502								

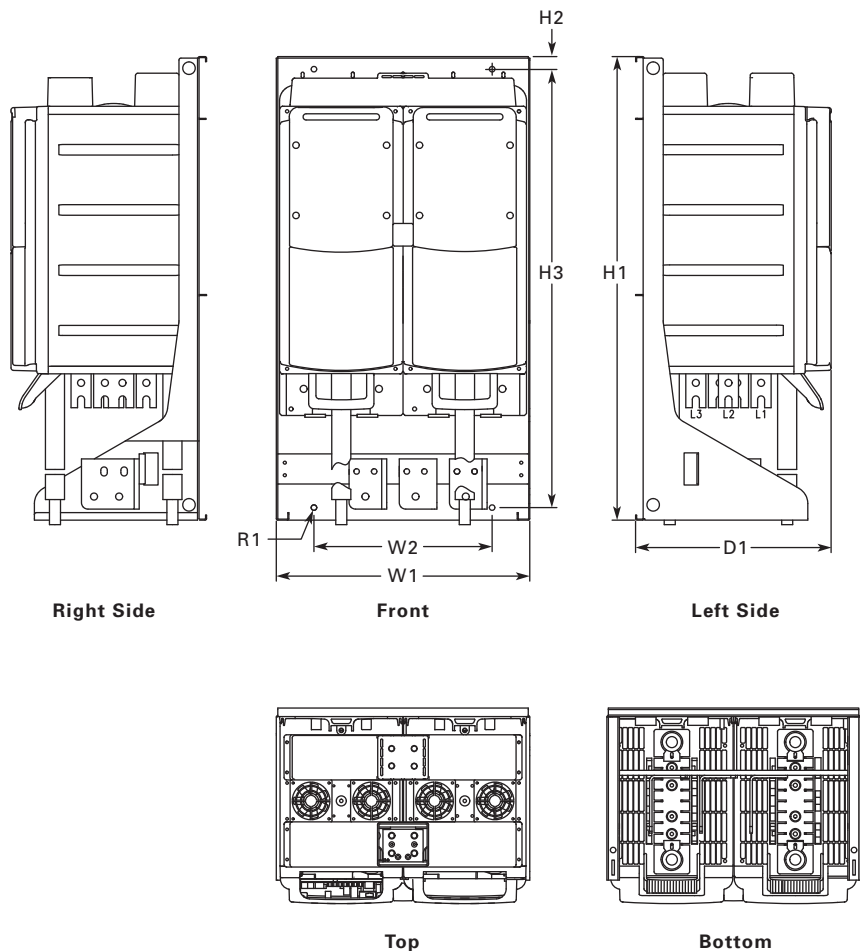


Figure 40-166. Approximate Dimensions, CH63

Table 40-389. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)							Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	R1 dia.	
CH63	380 – 500V AC	820 – 1030	36.36	.91	34.39	15.35	19.88	13.98	.43	264
	525 – 690V AC	590 – 750	(923.5)	(23.0)	(873.5)	(390.0)	(505.0)	(355.0)	(11.0)	(120)

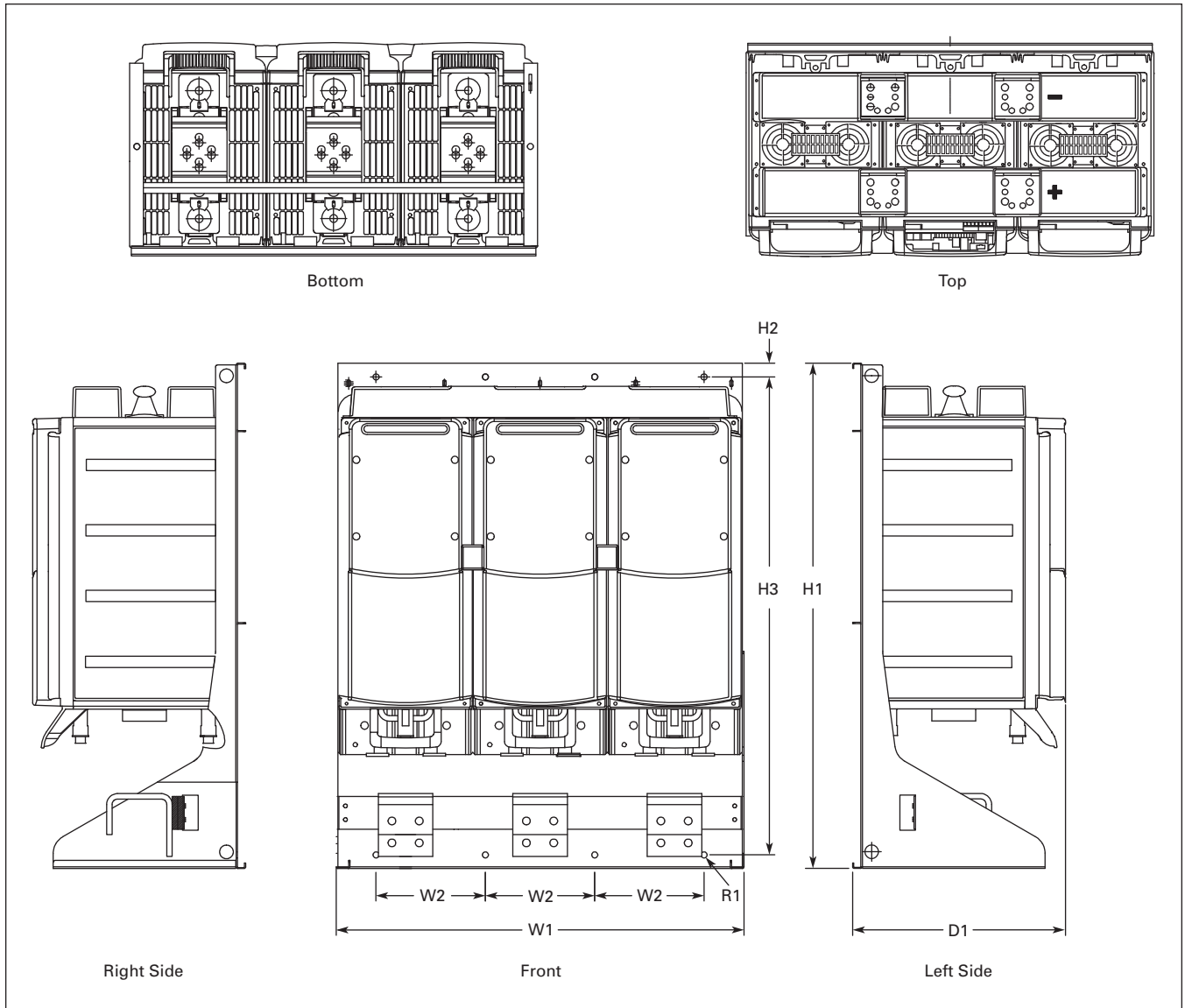


Figure 40-167. Approximate Dimensions, LCX9000 Liquid-Cooled Inverter with Mounting Bracket, CH64, IP90

Table 40-390. LCX9000 Liquid-Cooled Inverter with Mounting Bracket, CH64, IP90 Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)						
			H1	H2	H3	D1	W1	W2	R1 dia.
CH64	540 – 675V DC	1370 – 4140	36.38	1.03	34.37	15.35	29.37	7.87	.43
	710 – 930V DC	820 – 3100	(924)	(26)	(873)	(390)	(746)	(200)	(11)

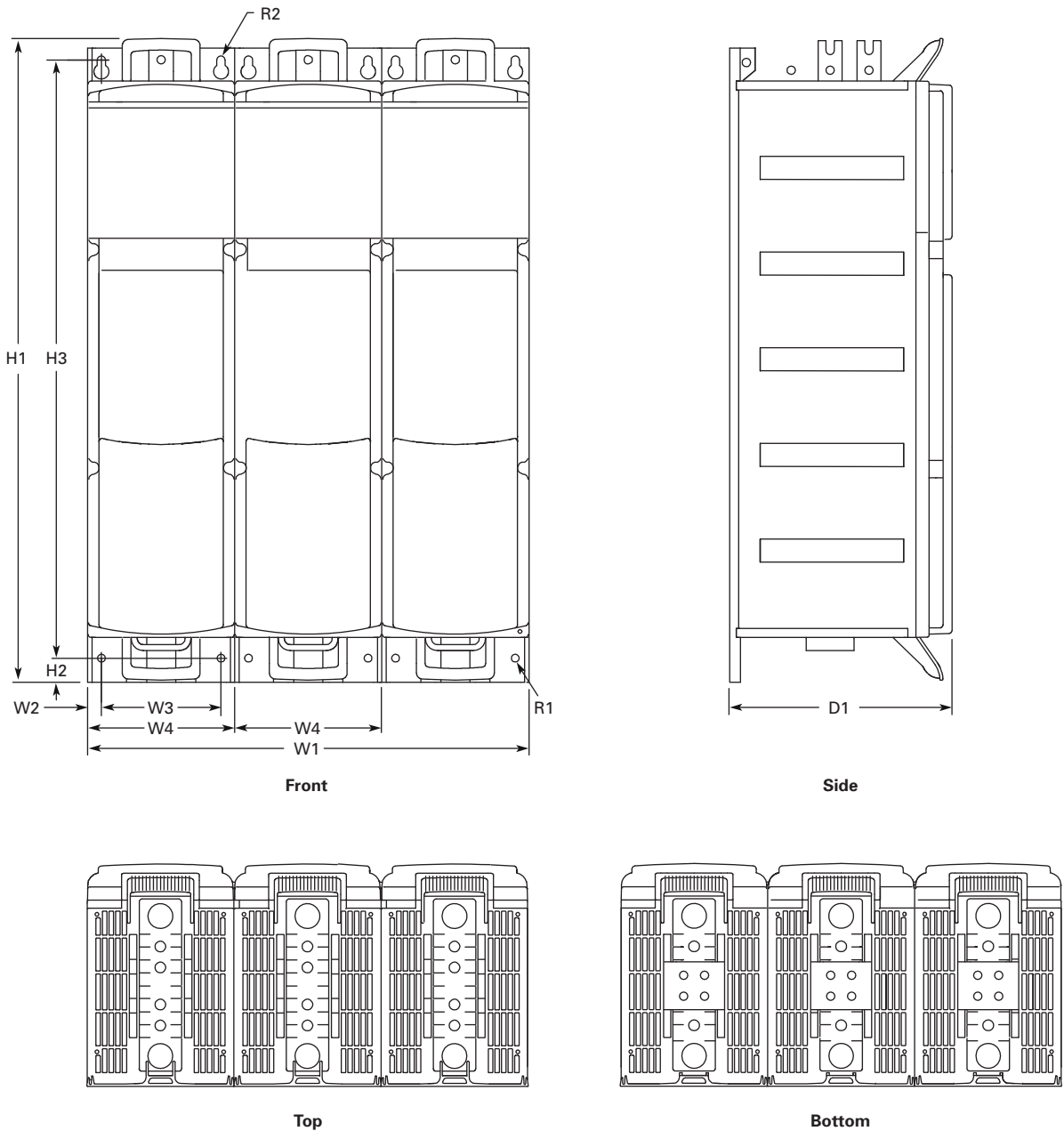


Figure 40-168. Approximate Dimensions, CH74

Table 40-391. LCX9000 Chassis Dimensions

Chassis Size	Voltage	Amps	Approximate Dimensions in Inches (mm)										Weight lbs. (kg)
			H1	H2	H3	D1	W1	W2	W3	W4	R1 dia.	R2 dia.	
CH74	380 – 500V AC	1370 – 2300	42.38 (1076.5)	1.57 (40.0)	39.37 (1000.0)	14.65 (372.0)	29.06 (738.0)	.91 (23.0)	7.87 (200.0)	9.69 (246)	.51 (13.0)	.55 (14.0)	617 (280)
	525 – 690V AC	820 – 1500											

Control Unit Dimensions

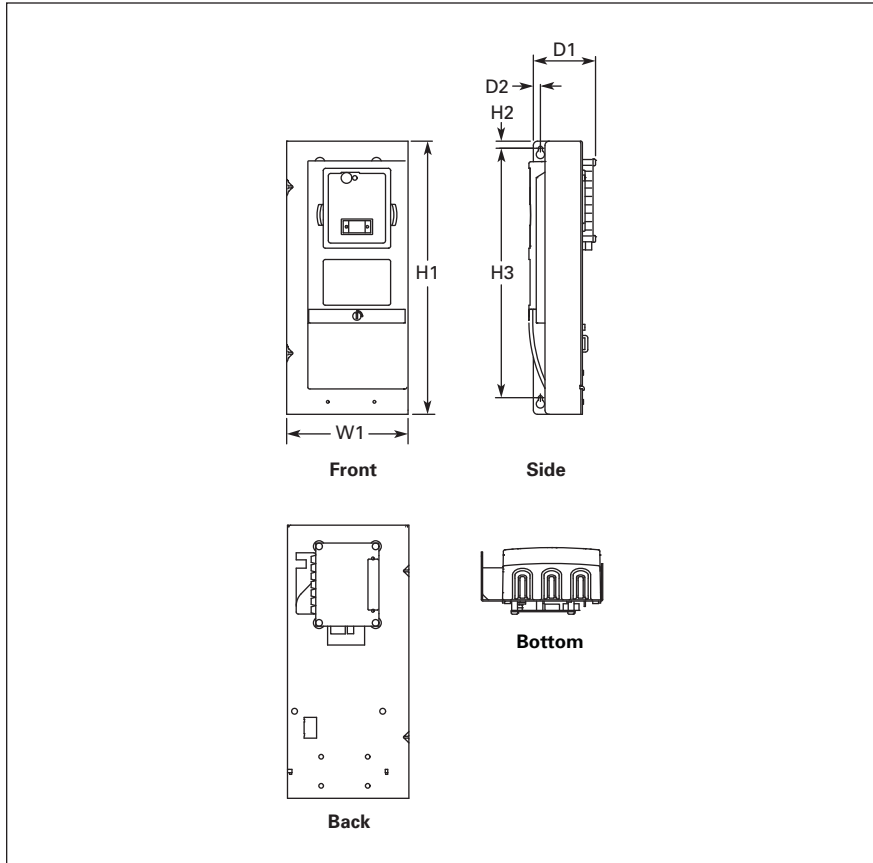


Figure 40-169. Approximate Dimensions, Control Unit

Table 40-392. LCX9000 Control Unit Dimensions

Approximate Dimensions in Inches (mm)					
H1	H2	H3	D1	D2	W1
12.93 (328.5)	.33 (8.5)	11.81 (300.0)	2.95 (75.0)	.33 (8.5)	5.75 (146.0)

Cooling System Diagrams

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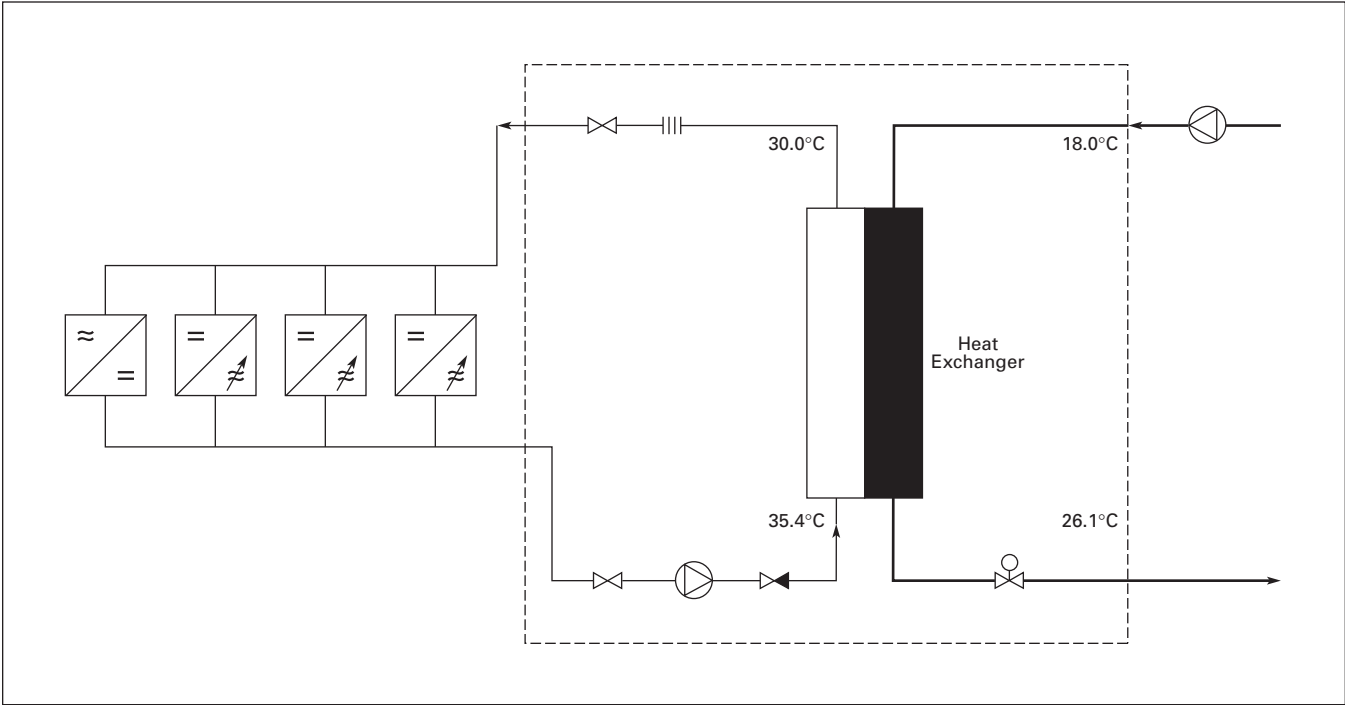


Figure 40-170. Example of a Typical Cooling System

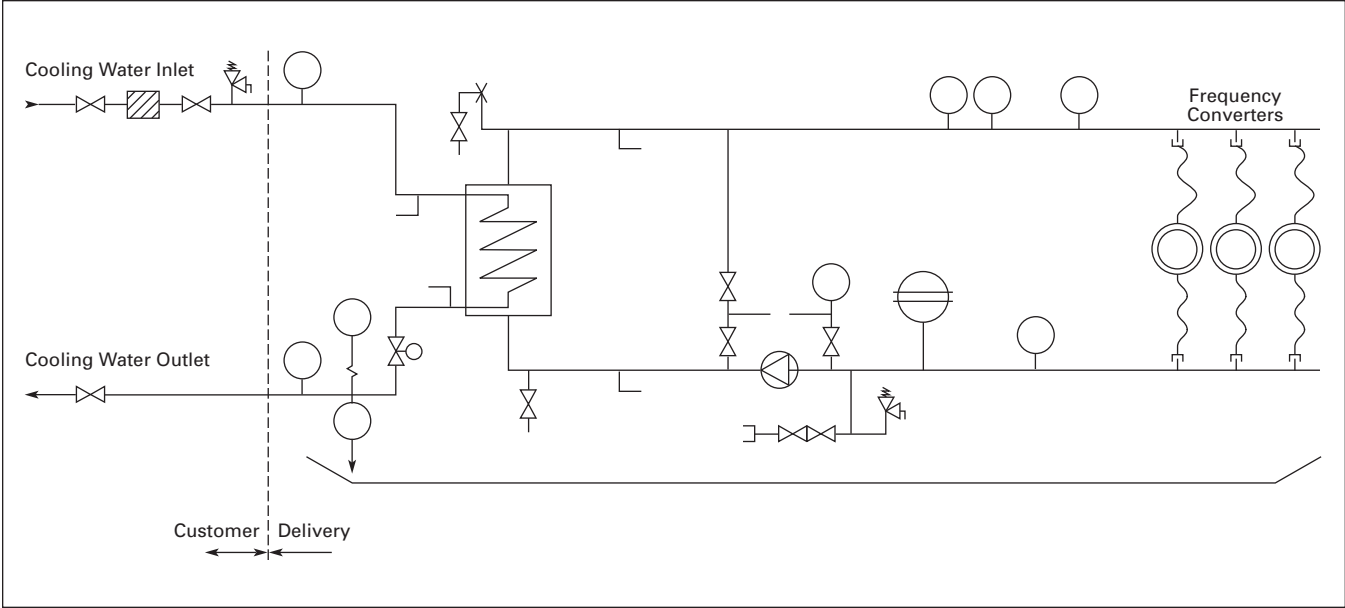


Figure 40-171. Example PI-Diagram of a Typical Cooling System and Connections

I/O Board Wiring Diagrams

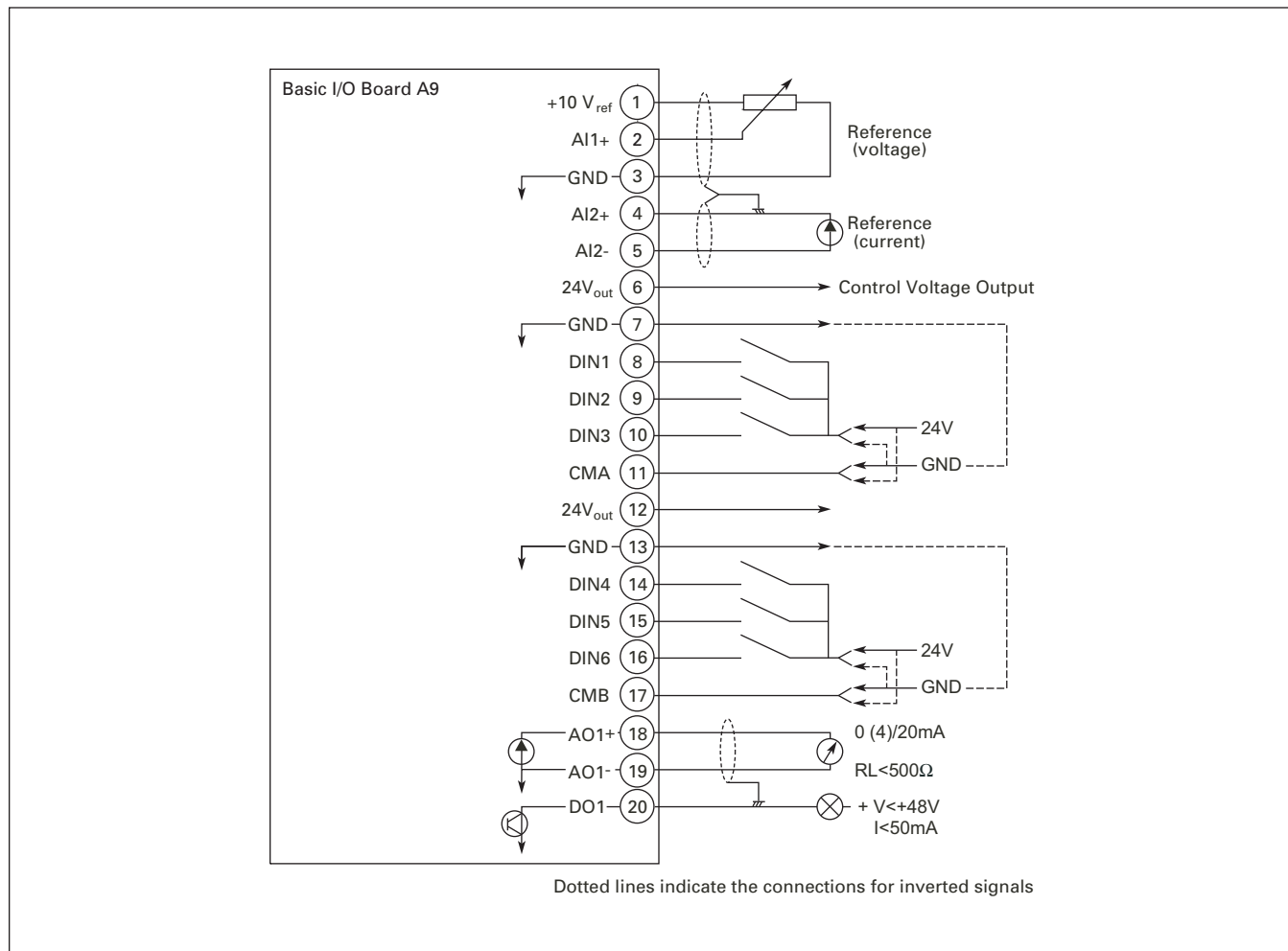


Figure 40-172. A9 Option Board Control Wiring

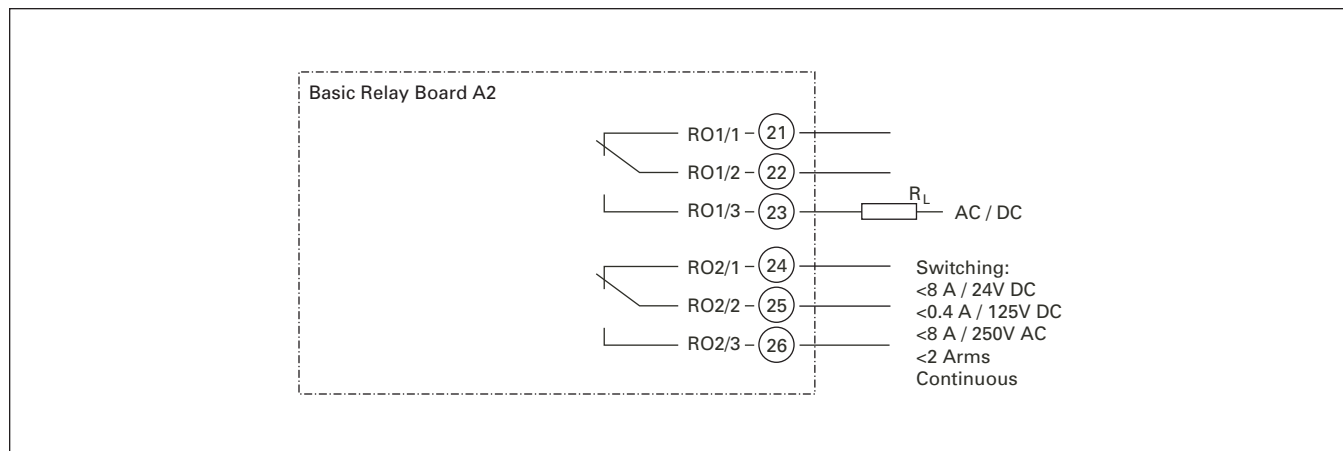


Figure 40-173. A2 Option Board Wiring

Contents

Description	Page
SPI Common DC Bus Drive Products	
Product Description	40-280
Application Description . . .	40-280
Features and Benefits	40-282
Technical Data and Specifications	40-282
Catalog Number Selection	40-284
Product Selection	40-286
Dimensions	40-289
Wiring Diagrams	40-290

40



SPI9000 Products

Product Description

Eaton offers a comprehensive range of Cutler-Hammer® common DC bus drive products. The product family covers a number of front-end units and inverter units in the entire power range from 1-1/2 to 2000 horsepower at 460V and 690V. The drive components are built on the SPX9000 technology.

Front-End Units

The front-end units convert a mains AC voltage and current into a DC voltage and current. The power is transferred from the mains to a common DC bus (and, in certain cases, vice versa).

The SPA (active front-end) unit is a bidirectional (regenerative) power converter for the front end of a common DC bus drive line up. An external LCL filter is used at the input. This unit is suitable in applications where low mains harmonics are required.

The SPN (non-regenerative front-end) unit is a unidirectional (motoring) power converter for the front-end of a common DC bus drive line-up. The device operates as a diode bridge using diode/thyristor components. A dedicated external choke is used at the input. The unit has the capacity to charge a common DC bus. This unit is suitable as a rectifying device when a "normal" level of harmonics is accepted and no regeneration to the mains is required.

Inverter Unit

The SPI9000 Inverter Unit is a bidirectional DC-fed power inverter for the supply and control of AC motors. The inverter is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC side charging circuit is integrated up to 75 kW (FR4 – FR8) and external for higher power ratings (FI9 – FI14).

Application Description

The Cutler-Hammer common DC bus product portfolio fulfills all solution demands with a flexible architecture.

Front end units are selected according to the level of harmonics and power requirements. Typical drive system configurations are illustrated in **Figures 40-174 – 40-175.**

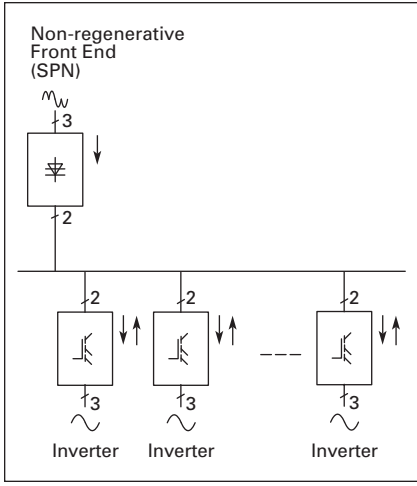


Figure 40-174. SPN + Inverters

- Low total mains power, $P_{mains} \leq \sum P_{INU}$
- Suitable e.g. for small processing line with un- and recoiler, em-stop coasting

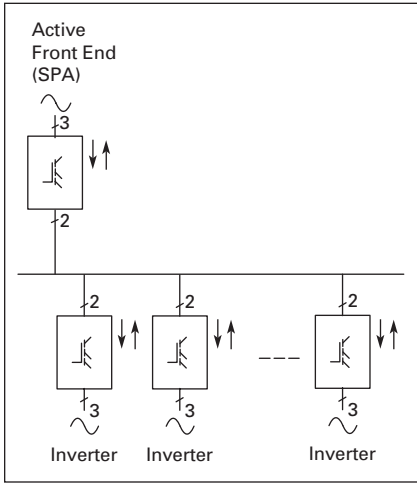


Figure 40-175. SPA + Inverters

- Low harmonics, $-P_{mains} \approx +P_{mains} / P_{mains} \leq \sum P_{INU}$
- Suitable for almost every application

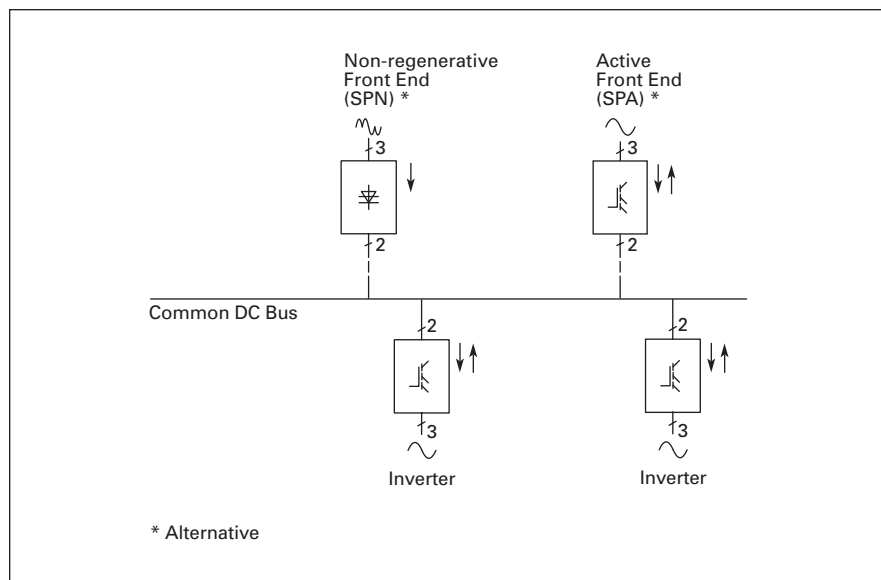


Figure 40-176. Combination Configuration

Common DC bus components are used in a multitude of combinations. Drives which are braking can transfer the energy directly to the drives in motoring mode.

Advantages over Conventional Front Ends

Table 40-393. Cutler-Hammer Front Ends vs. Conventional

	Non-regenerative Front End	Active Front End	Conventional Regenerative Front End ①
Input device	Choke (L)	Filter (LCL)	Choke or auto-transformer (L)
Bridge type	Diode/thyristor bridge	IGBT bridge, two-level type	Anti-parallel connected thyristor bridge
Type of operation	Controlled half-bridge	High frequency modulation (1.5 to 3.6 kHz)	Firing angle controlled
Direction of power	Motoring	Motoring and regenerating	Motoring and regenerating
Charging	Constant current	External required	Usually internal
DC voltage	Nominal (approx. $1.35 * U_N$)	Stable at +10% of nominal (approx. 110% of $1.35 * U_N$)	Lowered DC voltage for commutation margin (e.g. 17% fi approx. 83% of $1.35 * U_N$) or autotransformer on regenerative bridge
THD	Similar to 6-pulse bridge normal < 40%	Very low	Similar to six-pulse bridge or worse

① Conventional regenerative front end (a.k.a. "anti-parallel thyristor bridge") is not available from Eaton.

Features and Benefits

Table 40-394. Standard Features

Feature	SPI9000			SPA	SPN
	FR4, 6, 7	FR8	FI9 – FI14	FI9 – FI14	FI9
IP00		●	●	●	●
IP21	●				
Air cooling	●	●	●	●	●
Standard board	●	●	●	●	
Varnished board					●
Alphanumeric keypad	●	●	●	●	
EMC class T (EN 61800-3 for IT networks)	●	●	●	●	●
Safety CE / UL	●	●	●	●	●
Input choke					●
LCL filter				●	
No integrated charging			●	●	
Integrated charging (DC side)	●	●			●
Diode/thyristor rectifier					●
IGBT	●	●	●	●	

Technical Data and Specifications

Table 40-395. Specifications

Description	Specifications
Supply Connection	
Input voltage U_{in} (AC) Front End modules	380 – 500V AC / 525 – 690V AC -10% to +10%
Input voltage U_{in} (DC) Inverter	465 – 800V DC / 640 – 1100V DC -0% to +0%, The waviness of the inverter supply voltage, formed in rectification of the electric network's alternating voltage in basic frequency, must be less than 50V peak-to-peak
Output voltage U_{out} (AC) Inverter	$3 \sim 0 - U_{in} / 1.4$
Output voltage U_{out} (DC) Active Front End module	$1.10 \times 1.35 \times U_{in}$ (Factory default)
Output voltage U_{out} (DC) Non-regenerative Front End module	$1.35 \times U_{in}$
Ambient Conditions	
Ambient operating temperature	14 (no frost) to 122°F (-10 to 50°C): I_H 14 (no frost) to 104°F (-10 to 40°C): I_L
Storage temperature	-40 to 158°F (-40 to 70°C)
Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
Air quality: – chemical vapors – mechanical particles	IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
Altitude	100% load capacity (no derating) up to 1000m 1% derating for each 100m above 1000m; max. 3000m
Vibration	5 – 150 Hz
EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3 – 15.8 Hz Max acceleration amplitude 1G at 15.8 – 150 Hz
Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15G, 11 mS (in package)
Cooling capacity required	approximately 2%
Cooling air required	FR4 41 cfm, FR6 250 cfm, FR7 250 cfm, FR8 383 cfm FI9 677 cfm, FI10 824 cfm, FI12 1648 cfm, FI13 2472 cfm
Unit enclosure class	FR4 – FR7 NEMA Type 1 (IP21); FR8, FI9 – FI14 Chassis (IP00)
EMC (at fault settings)	
Immunity	Fulfill all EMC immunity requirements
Safety	
Approvals	CE, UL, CUL, EN 61800-5-1 (2003), see unit nameplate for more detailed approvals
Control Connections	
Analog input voltage	0 – 10V, $R_i = 200 \text{ k}\Omega$, (-10V – 10V joystick control) Resolution 0.1%, accuracy $\pm 1\%$
Analog input current	0(4) – 20 mA, $R_i = 250\Omega$ differential
Digital inputs	6, positive or negative logic; 18 – 30V DC

Table 40-395. Specifications (Continued)

Description	Specifications
Control Connections (Continued)	
Auxiliary voltage	+24V, $\pm 15\%$, max. 250 mA
Output reference voltage	+10V, $\pm 3\%$, max. load 10 mA
Analog output	0(4) – 20 mA; RL max. 500 Ω ; resolution 10 bits Accuracy $\pm 2\%$
Digital outputs	Open collector output, 50 mA / 48V
Relay outputs	2 programmable change-over relay outputs Switching capacity: 24V DC / 8A, 250V AC / 8A, 125V DC / 0.4A Min. switching load: 5V / 10 mA

Protections

Overvoltage protection	480V / 911V DC, 575V / 1200V DC
Undervoltage protection	480V / 333V DC, 575V / 460V DC
Ground fault protection	In case of ground fault in motor or motor cable, only the inverter is protected
Motor phase supervision	Trips if any of the output phases is missing
Overcurrent protection	Yes
Unit overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes
Short circuit protection of 24V and 10V reference voltages	Yes

40

Table 40-396. Input Fuses

Module		Bussman Fuse Type (aR)	Size	U _N (V)	I _N (A)	Qty.
Component	Frame					
Inverter Units						
SPI003A1-4	FR4	170M1560	000	690	20	2
SPI007A1-4	FR4	170M1562	000	690	63	2
SPI009A1-4	FR4	170M1562	000	690	63	2
SPI012A1-4	FR6	170M1565	000	690	63	2
SPI016A1-4	FR6	170M1565	000	690	63	2
SPI023A1-4	FR6	170M1565	000	690	63	2
SPI031A1-4	FR6	170M1567	000	690	100	2
SPI038A1-4	FR6	170M1567	000	690	100	2
SPI061A1-4	FR7	170M1570	000	690	200	2
SPI072A1-4	FR7	170M1570	000	690	200	2
SPI087A1-4	FR7	170M1571	000	690	250	2
SPI105A0-4	FR8	170M3819	DIN1	690	400	2
SPI140A0-4	FR8	170M3819	DIN1	690	400	2
SPI170A0-4	FR8	170M3819	DIN1	690	400	2
SPI205A0-4	FI9	170M6812	DIN3	690	800	2
SPI245A0-4	FI9	170M6812	DIN3	690	800	2
SPI300A0-4	FI10	170M8547	3SHT	690	1250	2
SPI385A0-4	FI10	170M8547	3SHT	690	1250	2
SPI460A0-4	FI10	170M8547	3SHT	690	1250	2
SPI520A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI590A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI650A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI730A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI820A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPI920A0-4	FI12	170M8547	3SHT	690	1250	2 x 2
SPIH10A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH11A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH13A0-4	FI13	170M8547	3SHT	690	1250	6
SPIH16A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH19A0-4	FI14	170M8547	3SHT	690	1250	2 x 6
SPIH23A0-4	FI14	170M8547	3SHT	690	1250	2 x 6

Active Front Ends

SPA205A0-4	FI9	170M6202	3SHT	1250	500	3
SPA385A0-4	FI10	170M6277	3SHT	1250	1000	3
SPAH10A0-4	FI13	170M6277	3SHT	1250	1000	3 x 3

Non-regenerative Front Ends

SPN468A0-4	FI9	170M8547	3SHT	690	1250	3
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Note: SHT fuses can be assembled into same-size DIN fuse base.

Catalog Number Selection

Table 40-397. Active Front End Catalog Numbering System

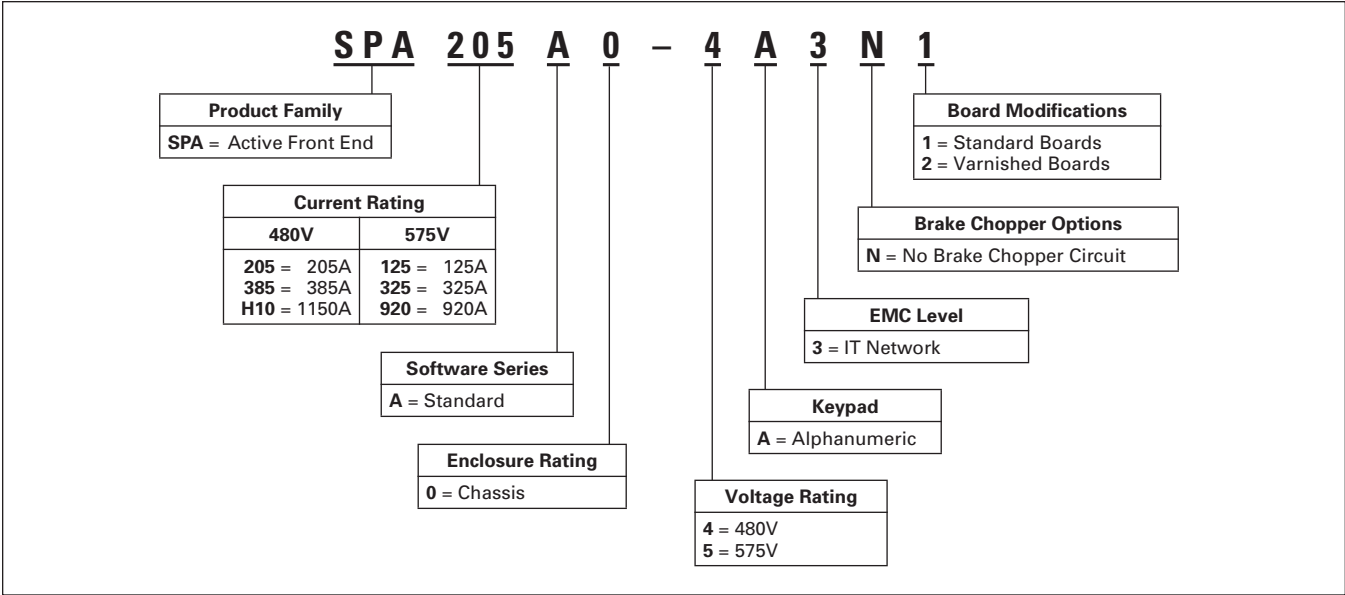


Table 40-398. Non-regenerative Front End Catalog Numbering System

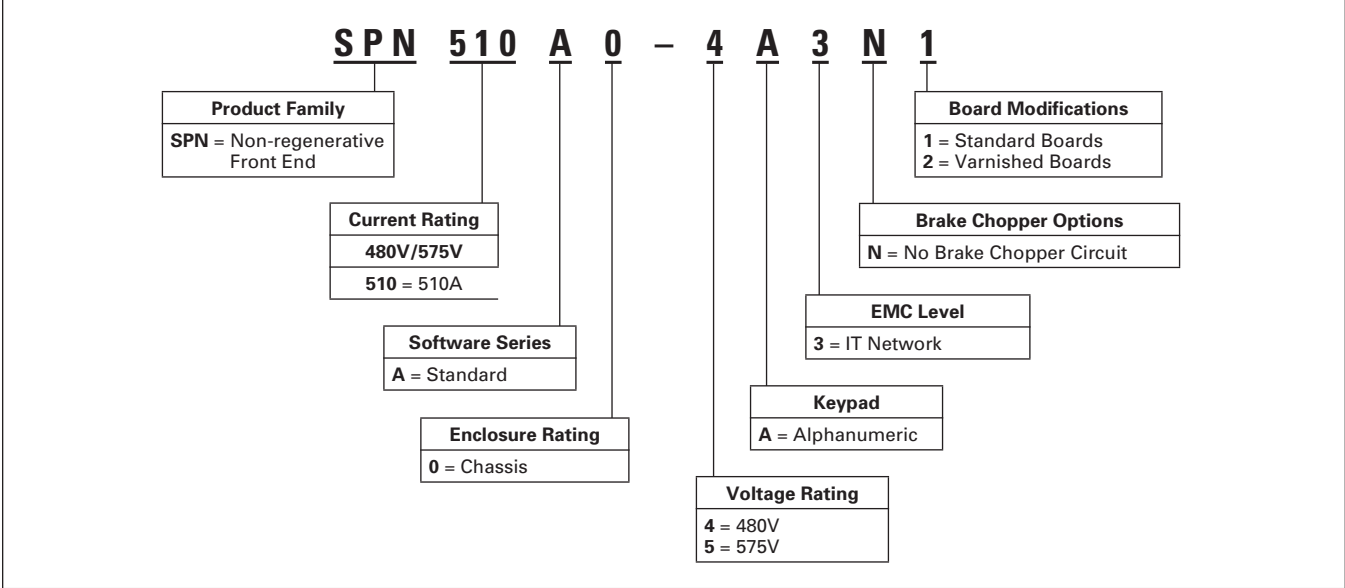
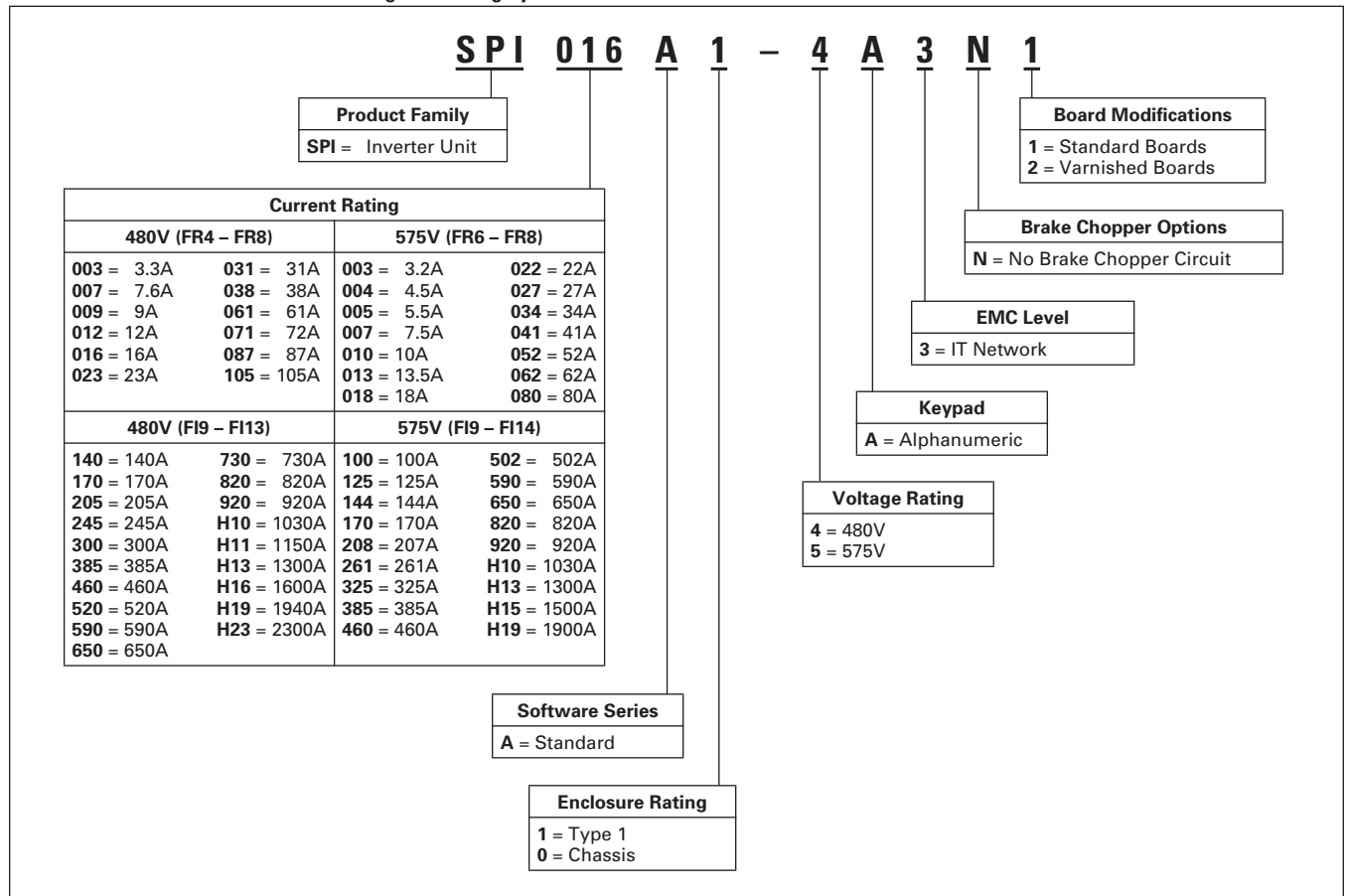


Table 40-399. SPI9000 Inverter Unit Catalog Numbering System



Product Selection

Table 40-400. Active Front End 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FI9	261	287	205	308	349	SPA205A0-4A3N1	
FI10	460	506	385	578	693	SPA385A0-4A3N1	
FI13	1300	1430	1150	1725	2070	SPA111A0-4A3N1	

Table 40-401. Non-regenerative Front End 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FI9	520	572	460	690	828	SPN460A0-4A3N1	

Table 40-402. SPI9000 Inverter Unit 480V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FR4	4.3	4.7	3.3	5.0	6.2	SPI003A1-4A3N1	
FR4	9	9.9	7.6	11.4	14	SPI007A1-4A3N1	
FR4	12	13.2	9	13.5	18	SPI009A1-4A3N1	
FR6	16	17.6	12	18	24	SPI012A1-4A3N1	
FR6	23	25.3	16	24	32	SPI016A1-4A3N1	
FR6	31	34	23	35	46	SPI023A1-4A3N1	
FR6	38	42	31	47	62	SPI031A1-4A3N1	
FR6	46	51	38	57	76	SPI038A1-4A3N1	
FR7	72	79	61	92	122	SPI061A1-4A3N1	
FR7	87	96	72	108	144	SPI072A1-4A3N1	
FR7	105	116	87	131	174	SPI087A1-4A3N1	
FR8	140	154	105	158	210	SPI105A0-4A3N1	
FI9	170	187	140	210	280	SPI140A0-4A3N1	
FI9	205	226	170	255	336	SPI170A0-4A3N1	
FI9	261	287	205	308	349	SPI205A0-4A3N1	
FI9	300	330	245	379	444	SPI245A0-4A3N1	
FI10	385	424	300	450	540	SPI300A0-4A3N1	
FI10	460	506	385	578	693	SPI385A0-4A3N1	
FI10	520	572	460	690	828	SPI460A0-4A3N1	
FI12	590	649	520	780	936	SPI520A0-4A3N1	
FI12	650	715	590	885	1062	SPI590A0-4A3N1	
FI12	730	803	650	975	1170	SPI650A0-4A3N1	
FI12	820	902	730	1095	1314	SPI730A0-4A3N1	
FI12	920	1012	820	1230	1476	SPI820A0-4A3N1	
FI12	1030	1133	920	1380	1656	SPI920A0-4A3N1	
FI13	1150	1265	1030	1545	1854	SPIH10A0-4A3N1	
FI13	1300	1430	1150	1720	2070	SPIH11A0-4A3N1	
FI13	1450	1595	1300	1950	2340	SPIH13A0-4A3N1	
FI14	1770	1947	1600	2400	2880	SPIH16A0-4A3N1	
FI14	2150	2365	1940	2910	3492	SPIH19A0-4A3N1	

Table 40-403. LCL Filters for Active Front End (480V)

Catalog Number	Amps	Price U.S. \$
REG 10 5 0	10	
REG 18 5 0	18	
REG 32 5 0	32	
REG 48 5 0	48	
REG 75 5 0	75	
REG 110 5 0	110	
REG 180 5 0	180	
REG 270 5 0	270	
REG 410 5 0	410	
REG 580 5 0	580	
REG 840 5 0	840	
REG 1160 5 0	1160	
REG 1480 5 0	1480	

Table 40-404. Line Reactor for Non-regenerative Front End (480/575V)

Catalog Number	Amps	Watts Losses	Price U.S. \$
CHK600	600	493	

Table 40-405. Active Front End 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FI9	144	158	125	188	213	SPA125A0-5A3N1	
FI10	385	424	325	488	585	SPA325A0-5A3N1	
FI13	1030	1133	920	1380	1656	SPA920A0-5A3N1	

Table 40-406. Non-regenerative Front End 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FI9	600	660	510	732	888	SPN510A0-5A3N1	

Table 40-407. SPI9000 Inverter Unit 575V Product Selection

Frame	Low Overload (AC Current)		High Overload (AC Current)		Imax	Catalog Number	Price U.S. \$
	I _{L-cont} (A)	I _{1min} (A)	I _{H-cont} (A)	I _{1min} (A)	I _{2s} (A)		
FR6	4.5	5	3.2	5	6.4	SPI003A1-5A3N1	
FR6	5.5	6	4.5	7	9	SPI004A1-5A3N1	
FR6	7.5	8	5.5	8	11	SPI005A1-5A3N1	
FR6	10	11	7.5	11	15	SPI007A1-5A3N1	
FR6	13.5	15	10	15	20	SPI010A1-5A3N1	
FR6	18	20	13.5	20	27	SPI013A1-5A3N1	
FR6	22	24	18	27	36	SPI018A1-5A3N1	
FR6	27	30	22	33	44	SPI022A1-5A3N1	
FR6	34	37	27	41	54	SPI027A1-5A3N1	
FR7	41	45	34	51	68	SPI034A1-5A3N1	
FR7	52	57	41	62	82	SPI041A1-5A3N1	
FR8	62	68	52	78	104	SPI052A0-5A3N1	
FR8	80	88	62	93	124	SPI062A0-5A3N1	
FR8	100	110	80	120	160	SPI080A0-5A3N1	
FI9	125	138	100	150	200	SPI100A0-5A3N1	
FI9	144	158	125	188	213	SPI125A0-5A3N1	
FI9	170	187	144	216	245	SPI144A0-5A3N1	
FI9	208	229	170	255	289	SPI170A0-5A3N1	
FI10	261	287	208	312	375	SPI208A0-5A3N1	
FI10	325	358	261	392	470	SPI261A0-5A3N1	
FI10	385	424	325	488	585	SPI325A0-5A3N1	
FI12	460	506	385	578	693	SPI385A0-5A3N1	
FI12	502	552	460	690	828	SPI460A0-5A3N1	
FI12	590	649	502	753	904	SPI502A0-5A3N1	
FI12	650	715	590	885	1062	SPI590A0-5A3N1	
FI12	750	825	650	975	1170	SPI650A0-5A3N1	
FI13	920	1012	820	1230	1476	SPI820A0-5A3N1	
FI13	1030	1133	920	1380	1656	SPI920A0-5A3N1	
FI13	1180	1298	1030	1464	1755	SPIH10A0-5A3N1	
FI14	1500	1650	1300	1950	2340	SPIH13A0-5A3N1	
FI14	1900	2090	1500	2250	2700	SPIH15A0-5A3N1	
FI14	2250	2475	1900	2782	3335	SPIH19A0-5A3N1	

Table 40-408. LCL Filters for Active Front End (690V)

Catalog Number	Amps	Price U.S. \$
REG 14 6 0	14	
REG 23 6 0	23	
REG 35 6 0	35	
REG 52 6 0	52	
REG 85 6 0	85	
REG 122 6 0	122	
REG 185 6 0	185	
REG 287 6 0	287	
REG 390 6 0	390	
REG 460 6 0	460	
REG 620 6 0	620	
REG 780 6 0	780	
REG 920 6 0	920	
REG 1180 6 0	1180	

Table 40-409. Line Reactor for Non-regenerative Front End (480/575V)

Catalog Number	Amps	Watts Losses	Price U.S. \$
CHK600	600	493	

Series Option Board Kits

The 9000X Series drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of five option boards (see **Figure 40-177**).

The 9000X Series factory installed standard board configuration includes an A9 I/O board and an A2 relay output board, which are installed in slots A and B.

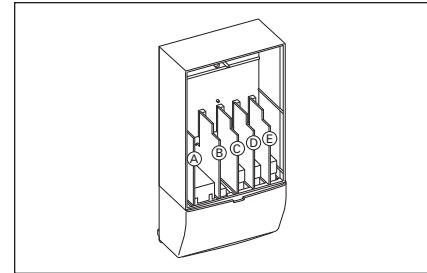


Figure 40-177. 9000X Series Option Boards

Table 40-410. Option Board Kits

Option Kit Description ②	Allowed Slot Locations ①	Field Installed		Factory Installed		SVX Ready Programs						
		Catalog Number	Price U.S.\$	Option Designator	Adder U.S.\$	Basic	Local/ Remote	Standard	MSS	PID	Multi-P.	PFC
Standard I/O Cards (See Figure 40-177)												
2 RO (NC/NO)	B	OPTA2		—		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO, 1 +10V DC ref, 2 ext +24V DC/ EXT +24V DC	A	OPTA9		—		X	X	X	X	X	X	X
Extended I/O Card Options												
2 RO, Therm	B	OPTA3		A3		—	X	X	X	X	X	X
Encoder low volt +5V/15V24V	C	OPTA4		A4		—	X	X	X	X	X	X
Encoder high volt +15V/24V	C	OPTA5		A5		—	X	X	X	X	X	X
Double encoder	C	OPTA7		A7		X	X	X	X	X	X	X
6 DI, 1 DO, 2 AI, 1 AO	A	OPTA8		A8		—	X	X	X	X	X	X
3 DI (Encoder 10 – 24V), Out +15V/+24V, 2 DO (pulse+direction)	C	OPTAE		AE		X	X	X	X	X	X	X
6 DI, 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB1		B1		—	—	—	—	—	X	X
1 RO (NC/NO), 1 RO (NO), 1 Therm	B, C, D, E	OPTB2		B2		—	—	—	—	—	X	X
1 AI (mA isolated), 2 AO (mA isolated), 1 ext +24V DC/EXT +24V DC	B, C, D, E	OPTB4		B4		—	X	X	X	X	X	X
3 RO (NO)	B, C, D, E	OPTB5		B5		—	—	—	—	—	X	X
1 ext +24V DC/EXT +24V DC, 3 Pt100	B, C, D, E	OPTB8		B8		—	—	—	—	—	—	—
1 RO (NO), 5 DI 42 – 240V AC Input	B,C, D, E	OPTB9		B9		—	—	—	—	—	X	X
SPI, Absolute Encoder	C	OPTBB		BB		—	—	—	—	—	—	—
Communication Cards ③												
Modbus	D, E	OPTC2		C2		X	X	X	X	X	X	X
Johnson Controls N2	D, E	OPTC2		CA		—	—	—	—	—	—	—
Modbus TCP	D, E	OPTCI		CI		X	X	X	X	X	X	X
BACnet	D, E	OPTCJ		CJ		X	X	X	X	X	X	X
Ethernet IP	D, E	OPTCK		CK		X	X	X	X	X	X	X
Profibus DP	D, E	OPTC3		C3		X	X	X	X	X	X	X
LonWorks	D, E	OPTC4		C4		X	X	X	X	X	X	X
Profibus DP (D9 Connector)	D, E	OPTC5		C5		X	X	X	X	X	X	X
CanOpen (Slave)	D, E	OPTC6		C6		X	X	X	X	X	X	X
DeviceNet	D, E	OPTC7		C7		X	X	X	X	X	X	X
Modbus (D9 Type Connector)	D, E	OPTC8		C8		X	X	X	X	X	X	X
Adapter	D, E	OPTD1		D1		X	X	X	X	X	X	X
Adapter	D, E	OPTD2		D2		X	X	X	X	X	X	X
RS-232 with D9 Connection	D, E	OPTD3		D3		X	X	X	X	X	X	X
Keypad												
9000X Series Local/ Remote Keypad (Replacement Keypad)	—	KEYPAD-LOC/ REM		—		—	—	—	—	—	—	X
9000X Series Remote Mount Keypad Unit (Keypad not included, includes 10 ft. cable, keypad holder, mounting hardware)	—	OPTRMT-KIT-9000X		—		—	—	—	—	—	—	—
9000X Series RS-232 Cable, 13 ft.	—	PP00104		—		—	—	—	—	—	—	—

① Option card must be installed in one of the slots listed for that card. Slot indicated in Bold is the preferred location.

② AI = Analog Input; AO = Analog Output, DI = Digital Input, DO = Digital Output, RO = Relay Output

③ OPTC2 is a multi-protocol option card.

Discount Symbol..... **SS-2**

Dimensions

Table 40-411. Approximate Dimensions in Inches (mm)

Frame	Height	Width	Depth	Weight in Lbs. (kg)
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Inverter Units

FR4	11.5 (292)	5.0 (128)	7.5 (190)	11 (5)
FR6	20.4 (519)	7.7 (195)	9.3 (237)	35 (16)
FR7	23.3 (591)	9.3 (237)	10.1 (257)	64 (29)
FR8	29.8 (758)	11.4 (289)	13.5 (344)	106 (48)
FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)

Active Front Ends

FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
FI10	40.6 (1032)	9.4 (239)	21.7 (552)	220 (100)
FI12	40.6 (1032)	2 x 9.4 (2 x 239)	21.7 (552)	441 (200)
FI13	40.6 (1032)	27.9 (708)	21.8 (553)	674 (306)
FI14	40.6 (1032)	2 x 27.9 (2 x 708)	21.8 (553)	1348 (612)

Non-regenerative Front Ends

FI9	40.6 (1030)	9.4 (239)	14.6 (372)	148 (67)
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Wiring Diagrams

40

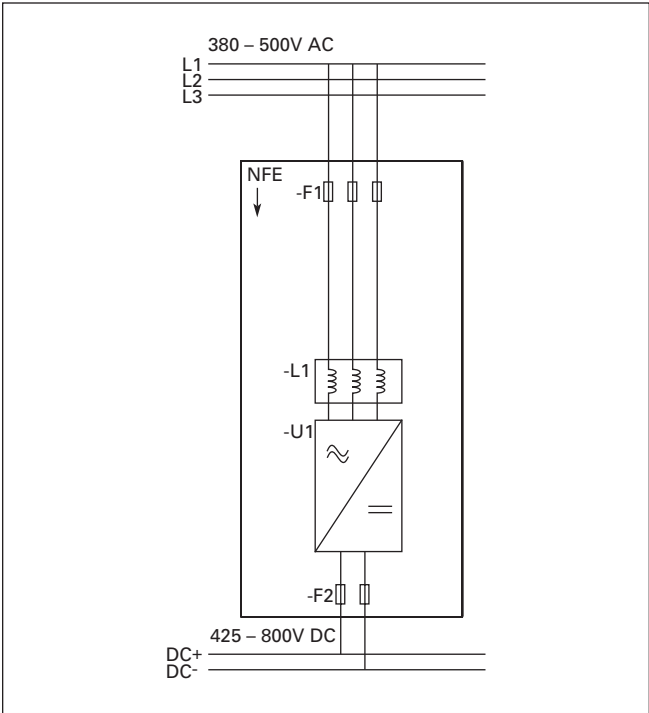


Figure 40-178. Non-regenerative Front End

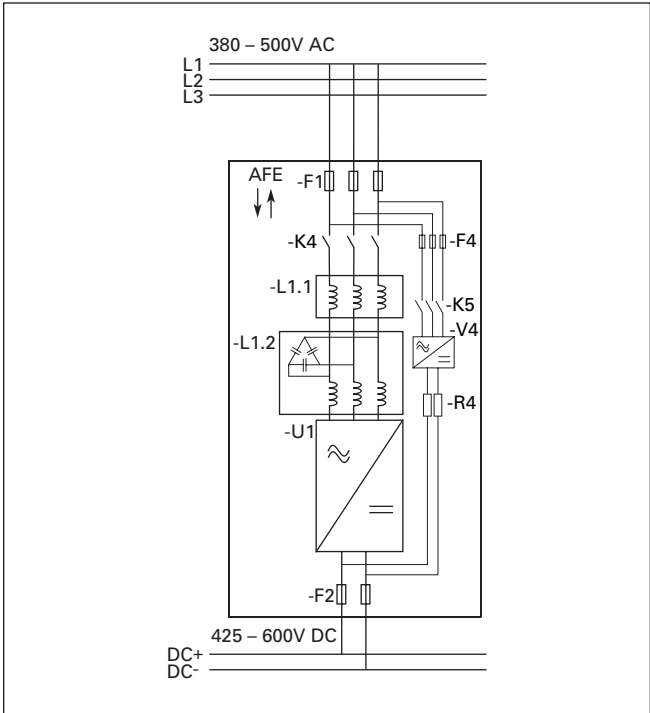


Figure 40-180. Active Front End

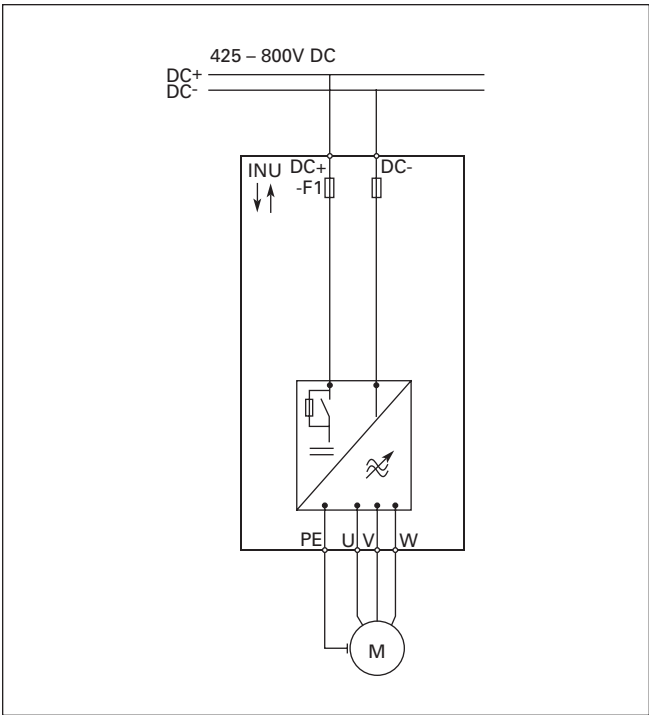


Figure 40-179. Inverter Unit (FR4 – FR8)

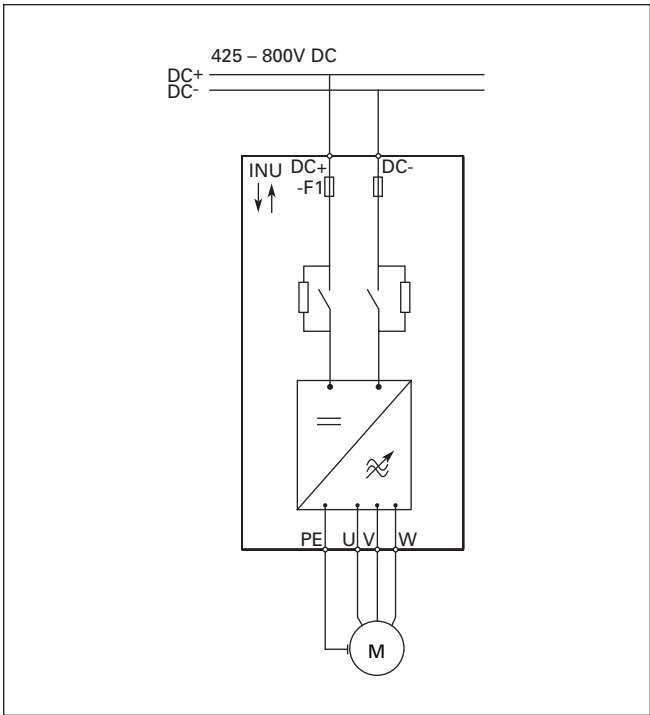


Figure 40-181. Inverter Unit (FI9 – FI14)