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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: ± 0.01% of max. frequency
 - Analog: ± 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	—	—	—

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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%

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Wiring Diagrams

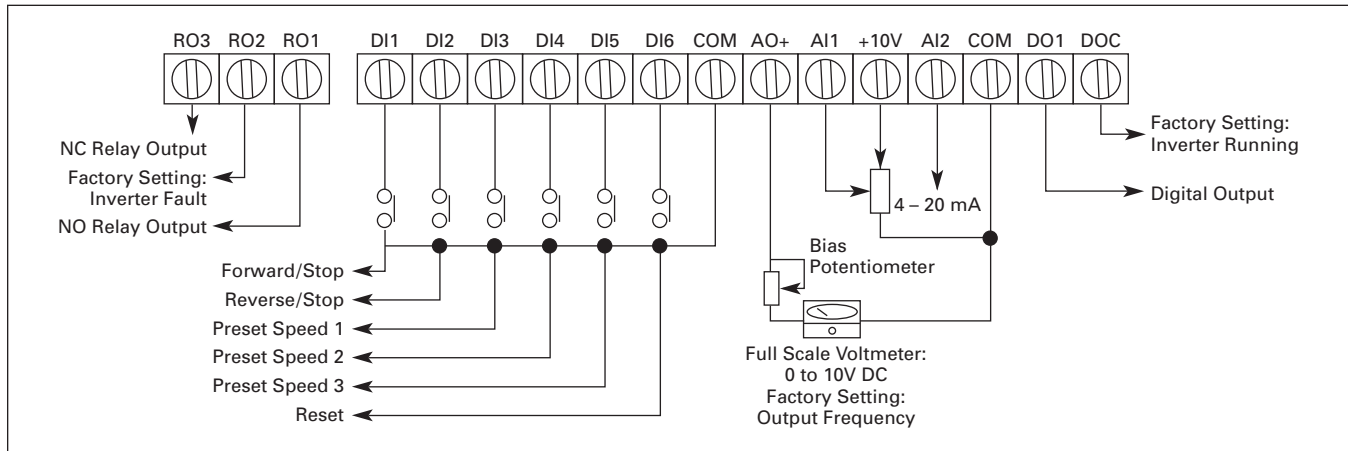


Figure 40-4. Control Terminal Wiring (Factory Settings)

Open Drives

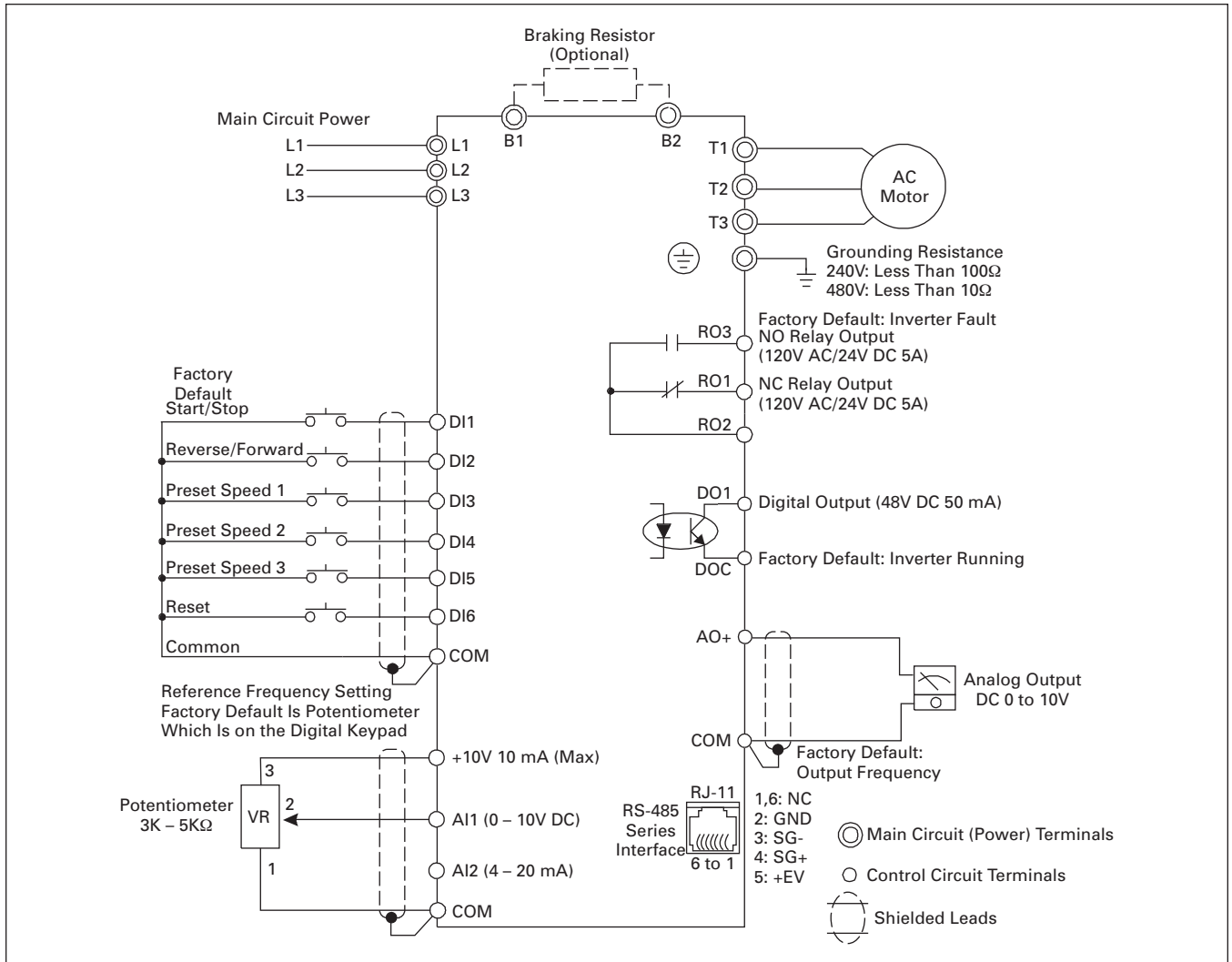


Figure 40-5. Basic Wiring Diagram

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 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			
		Horsepower	Volts	Lbs. (kg)	
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)

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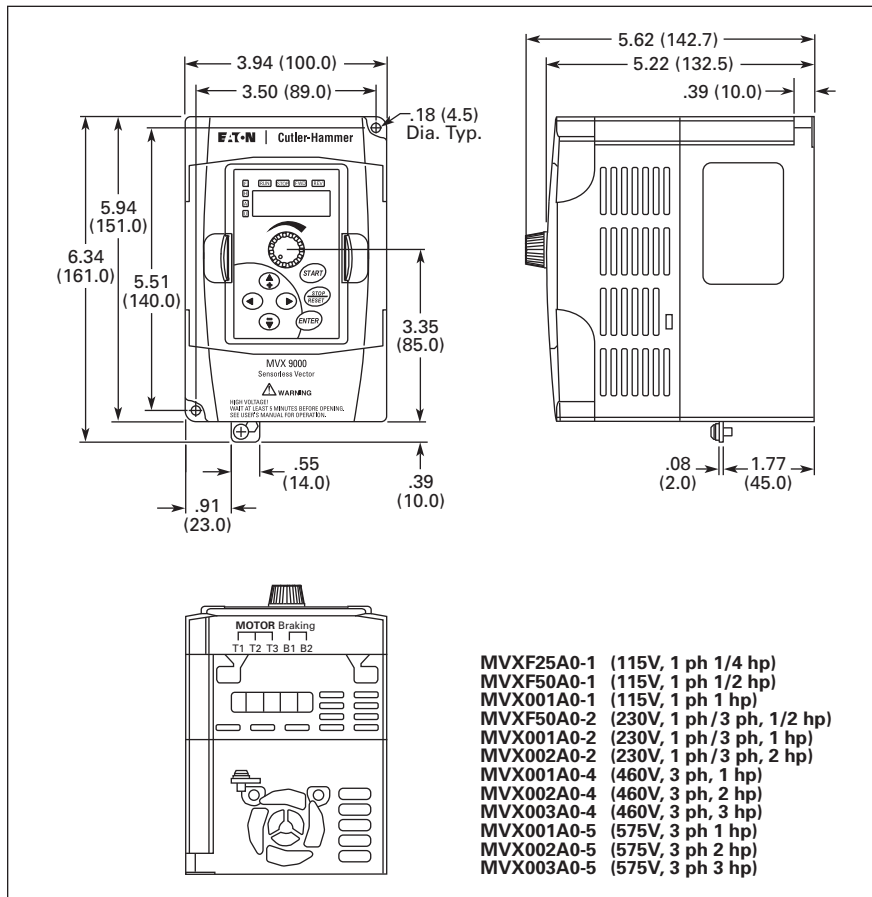
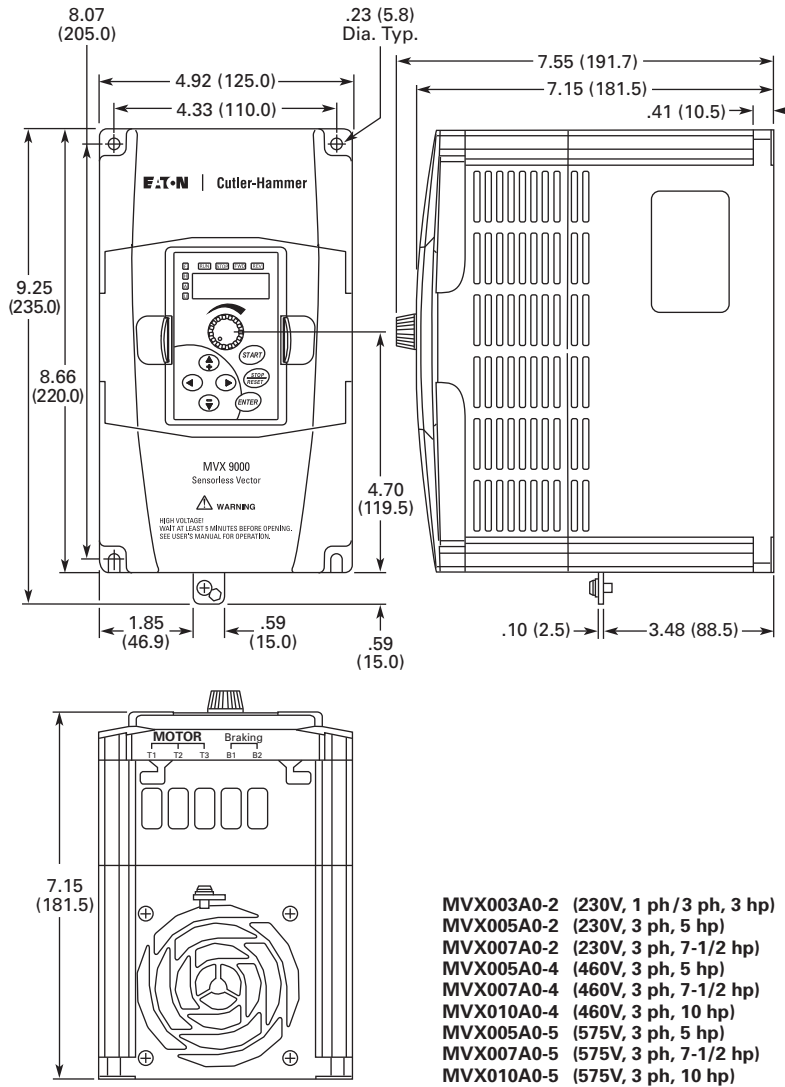


Figure 40-6. 1/4 to 3 hp Drive Approximate Dimensions in Inches (mm)

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- MVX003A0-2 (230V, 1 ph / 3 ph, 3 hp)
- MVX005A0-2 (230V, 3 ph, 5 hp)
- MVX007A0-2 (230V, 3 ph, 7-1/2 hp)
- MVX005A0-4 (460V, 3 ph, 5 hp)
- MVX007A0-4 (460V, 3 ph, 7-1/2 hp)
- MVX010A0-4 (460V, 3 ph, 10 hp)
- MVX005A0-5 (575V, 3 ph, 5 hp)
- MVX007A0-5 (575V, 3 ph, 7-1/2 hp)
- MVX010A0-5 (575V, 3 ph, 10 hp)

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

Open Drives

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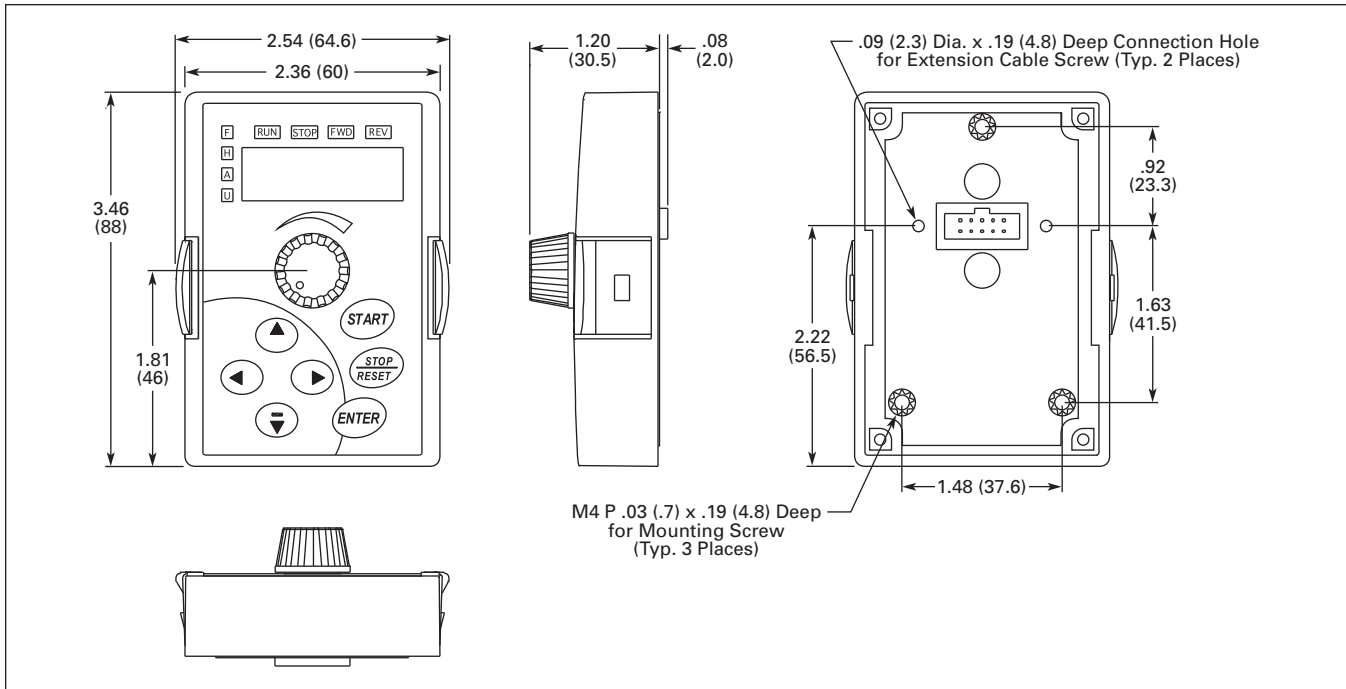


Figure 40-8. Digital Keypad Approximate Dimensions in Inches (mm)

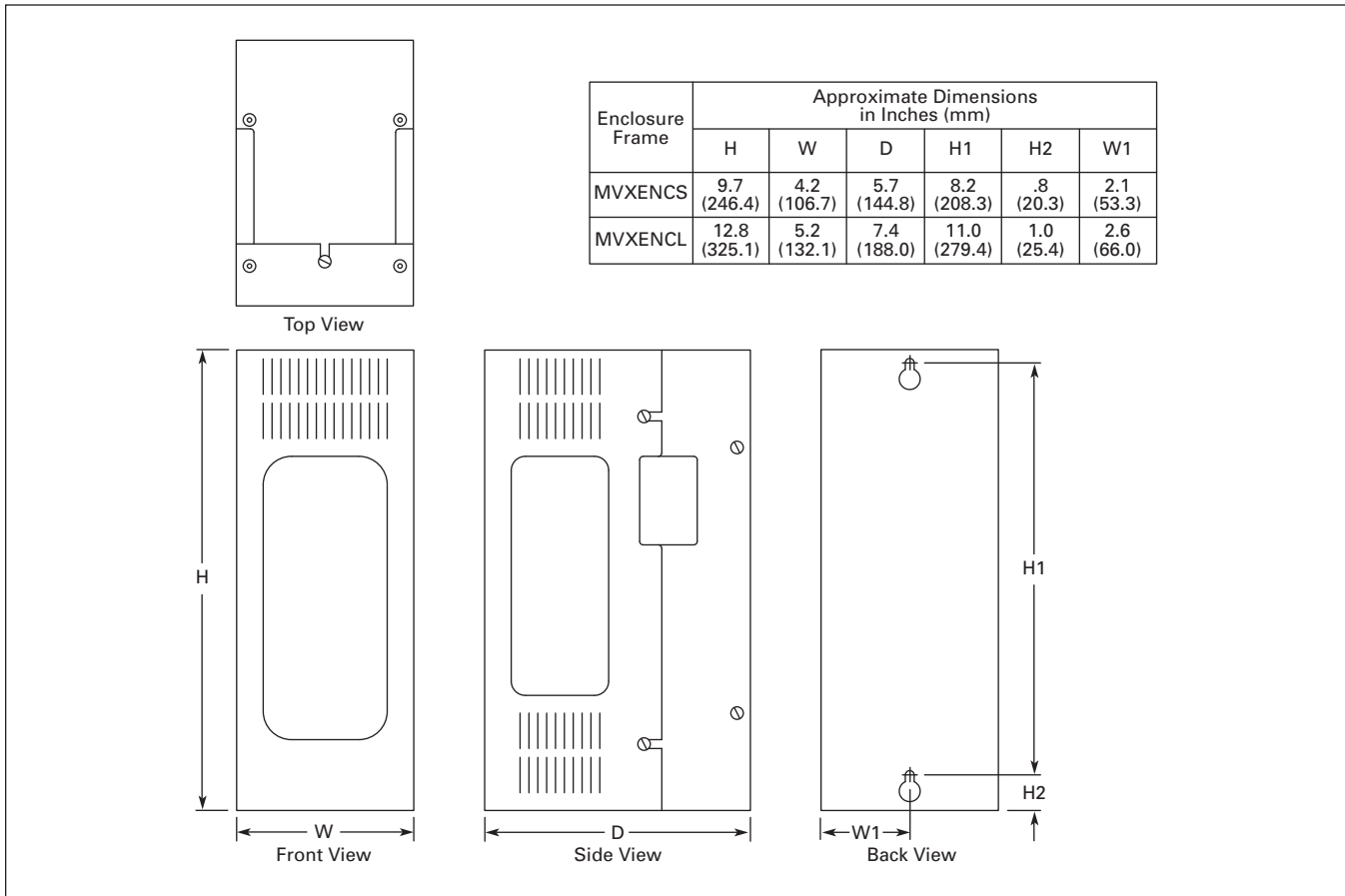
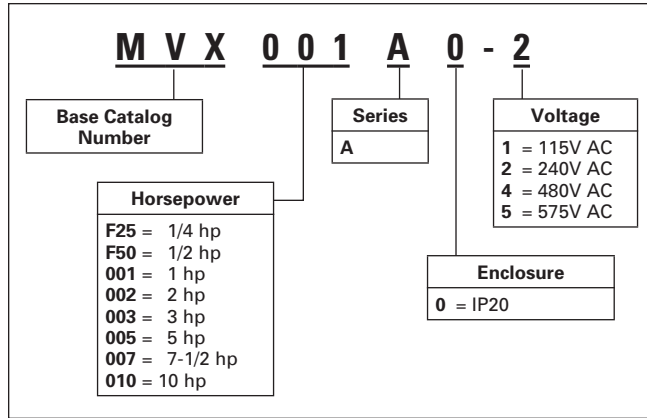


Figure 40-9. MVX9000 NEMA 1 Enclosure

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	

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