

#### H-Max Series Drives

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### Product Overview

#### H-Max Family Introduction

Eaton’s H-Max™ Series VFD is the next generation of drives specifically engineered for HVAC pump and fluid control applications. The H-Max family of products boasts industry leading energy efficiency algorithms for your applications. Not only are the drives ultra-efficient—they contain software that minimizes motor winding energy losses in your applications. Designed for easy installation, simple startup, and long life; the H-Max Series drive family provides exceptional value to our customers,

#### Product Range

##### Open Style Drives:

- 0.75–125 hp at 230 Vac
- 1.5–250 hp at 480 Vac

**Note:** Available in NEMA 1 or NEMA 12 designs.

##### IntelliPass/IntelliDisconnect Drives:

- 1–30 hp at 208 Vac
- 1–30 hp at 230 Vac
- 1–75 hp at 480 Vac

**Note:** Available in NEMA 1, NEMA 12, or NEMA 3R enclosures.

#### Application Description

The H-Max Series drive was designed specifically for HVAC pump and fluid control applications. It is intended to be used on variable torque loads with the intent of moving air or liquids. With this in mind, the H-Max drive has onboard I/O pre-programmed to meet the common needs for these applications. The H-Max drive supports items such as standard speed control, PID functionality, as well as multi-motor applications. The drive easily supports interlock, second motor parameter set, as well as fire mode functionality.

#### Key Feature

##### Active Energy Control Algorithm

Eaton’s H-Max Series drives have been designed to provide industry leading energy saving solutions. Not only is the drive ultra-efficient, the drive seeks the most efficient operating point of the motor, minimizing energy loss in the windings per the given load requirements. This is an Eaton protected control algorithm exclusive to H-Max drives.

## H-Max Drives



## H-Max Drives

## Product Description

Eaton's H-Max Series VFD has software and hardware designed specifically for the HVAC, pump industry. The ultra-efficient DC capacitor and power structure allows the drive to consume less energy, lowering greenhouse gases.

The I/O configuration is designed with wiring ergonomics in mind by including removable terminal blocks. The main, easily removable, control board used for all drive frames with six digital IN, two analog IN, one analog OUT, three relay OUT accepts two additional I/O or communication board. In addition, the control board has built-in RS-485 and Ethernet communication.

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

In addition to the Active Energy Control Algorithm to maximize motor efficiency, the drive boasts an ultra-efficient DC capacitor and power structure to allow less energy consumption, lowering greenhouse gases.

## Features and Benefits

## Hardware

- Thin metal capacitor design—ultra-efficient drive operation and extended self life (up to five years without reforming)
- Integrated 5% DC link choke with Input surge protection—protects against voltage spikes and provides a clean wave form to the motor
- EMI/RFI filters standard on all drives—meets EMC Category 2 for commercial applications
- Real-time clock—supports calendaring and PLC functionality
- Graphic LCD display and keypad—supports simple menu navigation as well as on-screen diagnostics and troubleshooting
- HAND-OFF-AUTO and drive-bypass selector on keypad—simplifies control
- Standard I/O: 6DI, 2AI, 1AO, 2 Form C RO (NO/NC), 1 Form A RO (NO)—supports requirements for most installations

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## Standards and Certifications

## Product

- IEC 61800-5-1
- CE
- cUL

## Safety

- UL 508C
- EN 61800-5-1
- CE
- cUL



- C-Tick Mark



- Onboard RS 485: Modbus, N2, BACnet—meets needs of most communication requirements
- Onboard Ethernet: BACnet/IP, Modbus/TCP—meets needs of most communication requirements
- Two expansion slots—intended to support additional I/O or communication protocols as necessary
- Quick disconnect terminals for I/O connections—supports fast easy installation

## Software

- Active energy control—minimizes energy losses in your motor resulting in industry leading energy efficiency for your application
- Quick Start Wizard upon initial power up—supports fast easy installation
- Copy/paste functionality on drive keypad—allows for fast setup of multiple drives
- Pre-programmed I/O—supports fast easy installation for most applications

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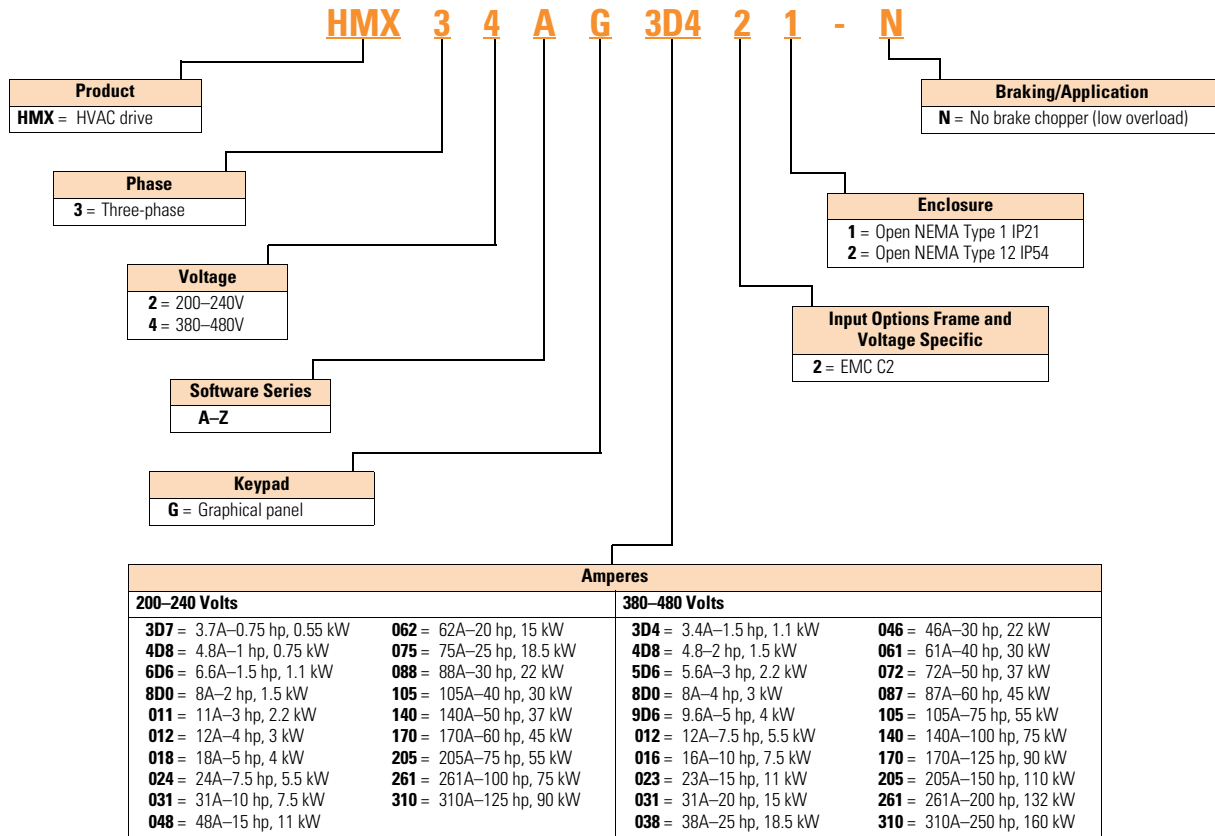
## Adjustable Frequency Drives

### H-Max Series Drives

#### Catalog Number Selection

#### H-Max Series Drives

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#### Notes

- All boards are varnished (conformed coated). Corrosion resistant.
- Battery included in all drives for real-time clock.
- Keypad kit includes HOA bypass.
- Keypad kit includes HOA, back reset for Europe application.
- EMI/RFI filters included.
- DC link choke included.

## Product Selection

## H-Max Series Drives—230 Vac

## NEMA Type 1



## NEMA Type 1/IP21

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40°C	Horsepower	Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	
4	3.7	0.75	0.55	3.2	2.6	HMX32AG3D721-N
	4.8	1	0.75	4.2	3.7	HMX32AG4D821-N
	6.6	1.5	1.1	6.6	4.8	HMX32AG6D621-N
	8	2	1.5	6.8	6.6	HMX32AG8D021-N
	11	3	2.2	9.6	8	HMX32AG01121-N
	12.5	4	3	N/A	11	HMX32AG01221-N
5	18	5	4	15.2	12.5	HMX32AG01821-N
	24	7.5	5.5	22	18	HMX32AG02421-N
	31	10	7.5	28	24	HMX32AG03121-N
6	48	15	11	42	31	HMX32AG04821-N
	62	20	15	54	48	HMX32AG06221-N
7	75	25	18.5	68	62	HMX32AG07521-N
	88	30	22	80	75	HMX32AG08821-N
	105	40	30	104	88	HMX32AG10521-N
8	140	50	37	130	105	HMX32AG14021-N
	170	60	45	154	140	HMX32AG17021-N
	205	75	55	192	170	HMX32AG20521-N
9	261	100	75	248	205	HMX32AG26121-N
	310	125	90	N/A	261	HMX32AG31021-N

## NEMA Type 12



## NEMA Type 12/IP54

FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40°C	Horsepower	Drive kW 230 Vac/50 Hz	230 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	
4	3.7	0.75	0.55	3.2	2.6	HMX32AG3D722-N
	4.8	1	0.75	4.2	3.7	HMX32AG4D822-N
	6.6	1.5	1.1	6.6	4.8	HMX32AG6D622-N
	8	2	1.5	6.8	6.6	HMX32AG8D022-N
	11	3	2.2	9.6	8	HMX32AG01122-N
	12.5	4	3	N/A	11	HMX32AG01222-N
5	18	5	4	15.2	12	HMX32AG01822-N
	24	7.5	5.5	22	18	HMX32AG02422-N
	31	10	7.5	28	24	HMX32AG03122-N
6	48	15	11	42	31	HMX32AG04822-N
	62	20	15	54	48	HMX32AG06222-N
7	75	25	18.5	68	62	HMX32AG07522-N
	88	30	22	80	75	HMX32AG08822-N
	105	40	30	104	88	HMX32AG10522-N
8	140	50	37	130	105	HMX32AG14022-N
	170	60	45	154	140	HMX32AG17022-N
	205	75	55	192	170	HMX32AG20522-N
9	261	100	75	248	205	HMX32AG26122-N
	310	125	90	N/A	261	HMX32AG31022-N

**Note**

① For sizing reference.

## H-Max Series Drives—480 Vac

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## NEMA Type 1

## NEMA Type 1/IP21



FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40°C	Horsepower	Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	
4	3.4	1.5	1.1	2.1	2.6	HMX34AG3D421-N
	4.8	2	1.5	3.4	3.4	HMX34AG4D821-N
	5.6	3	2.2	5.6	4.8	HMX34AG5D621-N
	8.0	4	3.0	N/A	5.6	HMX34AG8D021-N
	9.6	5	4	7.6	8	HMX34AG9D621-N
	12	7.5	5.5	11	9.6	HMX34AG01221-N
5	16	10	7.5	14	12	HMX34AG01621-N
	23	15	11	21	16	HMX34AG02321-N
	31	20	15	27	23	HMX34AG03121-N
6	38	25	18.5	34	31	HMX34AG03821-N
	46	30	22	40	38	HMX34AG04621-N
	61	40	30	52	46	HMX34AG06121-N
7	72	50	37	65	61	HMX34AG07221-N
	87	60	45	77	72	HMX34AG08721-N
	105	75	55	96	87	HMX34AG10521-N
8	140	100	75	124	105	HMX34AG14021-N
	170	125	90	156	140	HMX34AG17021-N
	205	150	110	180	170	HMX34AG20521-N
9	261	200	132	240	205	HMX34AG26121-N
	310	250	160	302	261	HMX34AG31021-N

## NEMA Type 12

## NEMA Type 12/IP54



FS Frame Size	Drive Output Current		Assigned Motor Ratings			Catalog Number
	Low Overload Full Load Amps at 40°C	Horsepower	Drive kW 400 Vac/50 Hz	480 Vac NEC Amps ①	Low Overload Full Load Amps at 50°C	
4	3.4	1.5	1.1	2.1	2.6	HMX34AG3D422-N
	4.8	2	1.5	3.4	3.4	HMX34AG4D822-N
	5.6	3	2.2	5.6	4.8	HMX34AG5D622-N
	8.0	4	3.0	N/A	5.6	HMX34AG8D022-N
	9.6	5	4	7.6	8	HMX34AG9D622-N
	12	7.5	5.5	11	9.6	HMX34AG01222-N
5	16	10	7.5	14	12	HMX34AG01622-N
	23	15	11	21	16	HMX34AG02322-N
	31	20	15	27	23	HMX34AG03122-N
6	38	25	18.5	34	31	HMX34AG03822-N
	46	30	22	40	38	HMX34AG04622-N
	61	40	30	52	46	HMX34AG06122-N
7	72	50	37	65	61	HMX34AG07222-N
	87	60	45	77	72	HMX34AG08722-N
	105	75	55	96	87	HMX34AG10522-N
8	140	100	75	124	105	HMX34AG14022-N
	170	125	90	156	140	HMX34AG17022-N
	205	150	110	180	170	HMX34AG20522-N
9	261	200	132	240	205	HMX34AG26122-N
	310	250	160	302	261	HMX34AG31022-N

**Note**

① For sizing reference.

**Onboard Network Communications****Johnson Controls Metasys N2**

H-Max Series provides communication between the drive and a Johnson Controls Metasys™ N2 network. With this connection, the drive can be controlled, monitored and programmed from the Metasys system. N2 can be selected and programmed by the drive keypad.

**BACnet**

H-Max Series provides communication to BACnet networks. Data transfer is master-slave/token passing (MS/TP) RS-485.

**BACnet IP**

100 base T interface.

**Modbus TCP**

Ethernet based protocol.

**Modbus RTU**

H-Max Series provides communication to Modbus RTU RS-485 as a slave on a Modbus network. Other communication parameters include an address range from 1–247; a parity of None, Odd or Even; and the stop bit is 1.

**H-Max Series Option Board Kits Available for Slot B**

The factory issued relay option board can be replaced with the following option

boards to customize the drive for your application needs.

The standard board provides 2 Form C RO (NO/NC) and 1 Form A RO (NO).

**Option Boards Mounted in Slot B**

Option Kit Description	Option Kit Catalog Number
I/O expander card, 2 RO and thermistor input	Relay Board 2

**H-Max Series Option Board Kits Available for Slots D and E**

The H-Max 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.

The H-Max Series factory-installed standard board configuration includes an I/O board and a relay output board.

**Option Boards Mounted in Slots D and E**

Option Kit Description	Option Kit Catalog Number
6 x DI /DO, each digital input can be individually programmed as digital output	XXM-IO-B1-A
1RO Form C (NO/NC), 1RO Form A (NO), 1 thermistor	XXM-IO-B2-A
1 x AI, 2 x AO (isolated)	XXM-IO-B4-A
3 x RO Form A (NO)	XXM-IO-B5-A
1RO Form A (NO), 5DI 42–240 Vac input	XXM-IO-B9-A
1 x AO, 1 x DO, 1 x RO	XXM-IO-BF-A
LonWorks®	XXM-COM-C4-A

**NEMA Type 1 to NEMA Type 12/IP54 Conversion Kit**

The NEMA Type 12/IP54 option kit is used to convert a NEMA Type 1 to a NEMA Type 12 drive.

Kit consists of a drive cover, fan kit and plugs.

**NEMA Type 12/IP54 Cover**

Option Kit Description	Option Kit Catalog Number
FS4-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS4-N12KIT
FS5-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS5-N12KIT
FS6-branded N12/IP54 cover with gasket, plastic plug, fans, Eaton logos	FS6-N12KIT

**Accessories**

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**Flange Kits**

The flange kit is used when the power section heat sink is mounted through the back panel of an enclosure.

**Flange Kit NEMA Type 1/IP21**

Includes flange, mounting brackets, and screws.

**Flange Kit NEMA Type 12/IP54**

Includes flange, mounting brackets, NEMA Type 12 fan components, air shroud screws and plugs.

**Frames FS4–FS9** <sup>①②</sup>

Description	Catalog Number
<b>NEMA Type 12/IP54</b>	
FS4 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS4-Flange-N12KIT</b>
FS5 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS5-Flange-N12KIT</b>
FS6 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS6-Flange-N12KIT</b>
FS7 N12/IP54 flange kit (mounting N1 drive into N12 enclosure)	<b>FS7-Flange-N12KIT</b>

**Keypad Accessories****Remote Mounting Keypad Kit****Frames FS4–FS9**

Description	Catalog Number
Remote mounting keypad kit—bezel and cable	<b>OPTRMT-BP-HMAX</b>

**Drive Demo****H-Max Series Drive Demo****Demos and Power Supply**

Description	Catalog Number
H-Max Series drive demo	<b>H-MAX-DEMO</b>
H-Max Series bypass demo	<b>H-MAX-BYPASS-DEMO</b>
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	<b>9000XAUX24V</b>

**Notes**

- ① For installation of a NEMA Type 1 drive into a NEMA Type 12 oversized enclosure.
- ② Frame size 8 and 9 must be ordered from the factory as a flange mount unit.

## Replacement Parts

### Control Board/Keypad

Description	Current Catalog Number
H-Max Series graphic bypass, HOA	KeypadbypassHOA
H-Max Series graphic back, HOA	KeypadbackHOA

### PC Cable

Description	Catalog Number
Remote download USB to RJ-45 cable with software driver disk	REM-USB-Down

### Replacement Relay Board in Slot B

Description	Catalog Number
Replacement relay board qty 2 Form C relay, qty 1 Form A relay	Relay board 1

### Main Fan

Description	Catalog Number
FS4 main fan	FS4-Main Fan
FS5 main fan	FS5-Main Fan
FS6 main fan	FS6-Main Fan
FS7 main fan	FS7-Main Fan

### Internal Fan

Description	Catalog Number
FS4 internal fan (IP54/NEMA 12)	FS4-Internal Fan
FS5 internal fan (IP54/NEMA 12)	FS5-Internal Fan
FS6 internal fan (IP54/NEMA 12)	FS6-Internal Fan
FS7 internal fan (IP54/NEMA 12)	FS7-Internal Fan



## Technical Data and Specifications

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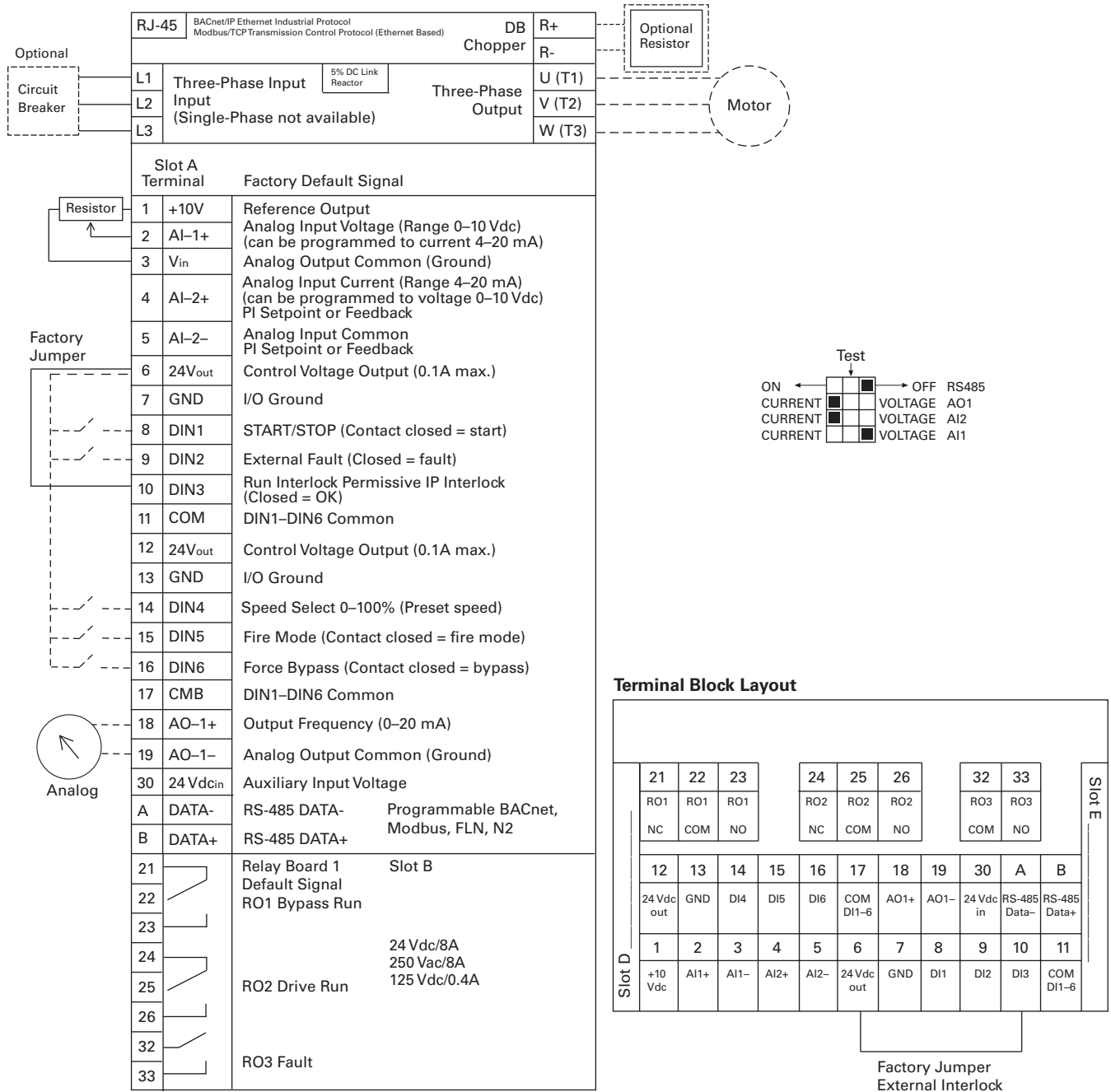
## H-Max Series Drives

Description	Specification
<b>Input Ratings</b>	
Input voltage ( $V_{in}$ )	200–240 Vac, 380–480 Vac, –10%/+10%
Input frequency ( $f_{in}$ )	50/60 Hz (variation up to 47–66 Hz)
Connection to power	Once per minute or less (typical operation)
Short circuit withstand rating	100 kAIC
<b>Output Ratings</b>	
Output voltage	0 to $V_{in}/U_{in}$ line voltage in
Continuous output current	Ambient temperature max. 104°F (40°C)
$I_L$ overload	1.1 x $I_L$ (1 min./10 min.)
Overload current	110% (1 min./10 min.)
Initial output current	150% for two seconds
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
<b>Control Characteristics</b>	
Control method	Frequency control (V/f) open loop sensorless vector control
Switching frequency	1–310 amps FS4–9: default 6 kHz
Frequency reference	Analog input: Resolution 0.1% (10-bit), accuracy $\pm 1\%$ Panel reference: Resolution 0.01 Hz
Field weakening point	8 to 320 Hz
Acceleration time	0.1 to 3000 seconds
Deceleration time	0.1 to 3000 seconds
Braking torque	DC brake: 30% x $T_n$
<b>Ambient Conditions</b>	
Ambient operating temperature	FS4–FS9: 14°F (–10°C), no frost to 104°F (40°C) (Drive can operate at 122°F (50°C), see <b>Pages V6-T2-141 and V6-T2-142</b> )
Storage temperature	–40° to 158°F (–40° to 70°C)
Relative humidity	0 to 95% RH, noncondensing, non-corrosive, no dripping water
Air quality	Chemical vapors: IEC 60721-3-3, unit in operation, Class 3C2; Mechanical particles: IEC 60721-3-3, 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); 380–480V
Vibration	FS4–FS9: EN 61800-5-1, EN 60068-2-6; 5 to 150 Hz, displacement amplitude 1 mm (peak) at 5 to 15.8 Hz, max. acceleration amplitude 1G at 15.8 to 150 Hz
Shock	EN 61800-5-1, 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 (keypad required for IP54/Type 12)
<b>Standards</b>	
EMC	Immunity: Fulfills all EMC immunity requirements; Emissions: EN 61800-3, LEVEL H (EMC C2)
Emissions	EMC level dependent— +EMC 2: EN61800-3 (2004) Category C2 Delivered with Class C2 EMC filtering as default.

Description	Specification
<b>Control Connections</b>	
Analog input voltage	0 to 10V, R = 200 kohms differential Resolution 0.1%; Accuracy $\pm 1\%$ Dip switch selection (voltage/current)
Analog input current	0(4) to 20 mA; $R_i$ –250 ohms differential
Digital inputs (6)	Positive or negative logic; 18 to 30 Vdc
Auxiliary voltage	+24V $\pm 10\%$ , max. 250 mA
Output reference voltage	+10V +3%, max. load 10 mA
Analog output	0–10V, 0(4) to 20 mA; $R_L$ max. 500 ohms; Resolution 10 bit; Accuracy $\pm 2\%$ Dip switch selection (voltage/current)
Relay outputs	3 programmable, 2 Form C, 1 Form A relay outputs Switching capacity: 24 Vdc/8A, 250 Vac/8A, 125 Vdc/0.4A
Hard wire jumper	Between terminal 6 and 10 factory default
Dip switch setting default	RS485 = off A01 = current A12 = current A11 = voltage
<b>Protections</b>	
Overcurrent protection	Yes
Overvoltage protection	Yes
DC bus regulation anti-trip	Yes (accelerates or decelerates the load)
Undervoltage protection	Yes
Earth fault protection	Yes (in case of earth fault in motor or motor cable, only the frequency converter is protected)
Input phase supervision	Yes (trips if any of the input phases are missing)
Motor phase supervision	Yes (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
Surge protection	Yes (varistor input)
Conformed coated (varnished) boards	Yes (prevents corrosion)

## Wiring Diagram

## Control Input/Output, PID Application

**Standards**

- Digital inputs D1–D6, relay out, analog in/out are freely programmed
- The user can assign a single input to multiple functions

**Includes**

- Six digital input
- Two analog input
- One analog output
- Three relay output
- RS-485
- Ethernet (BACnet and Modbus)

**Reliability**

- Pretested components
- Conformal coated (varnished) boards
- 40°C rated
- 110% overload for one minute
- Eaton Electrical Services & Systems national network of AF drive specialists

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## Adjustable Frequency Drives

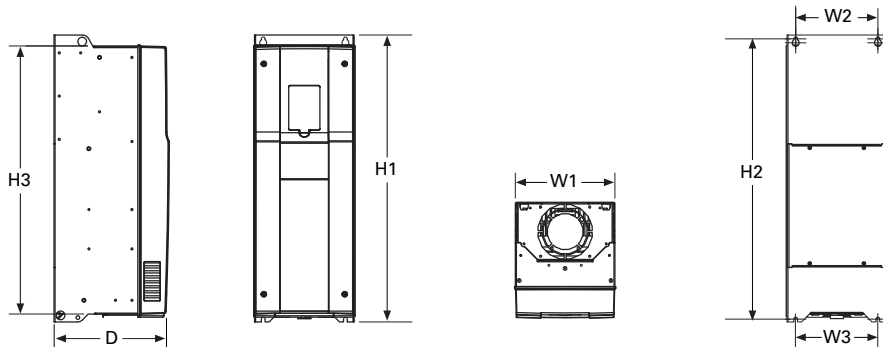
### H-Max Series Drives

#### Dimensions

Approximate Dimensions in Inches (mm)

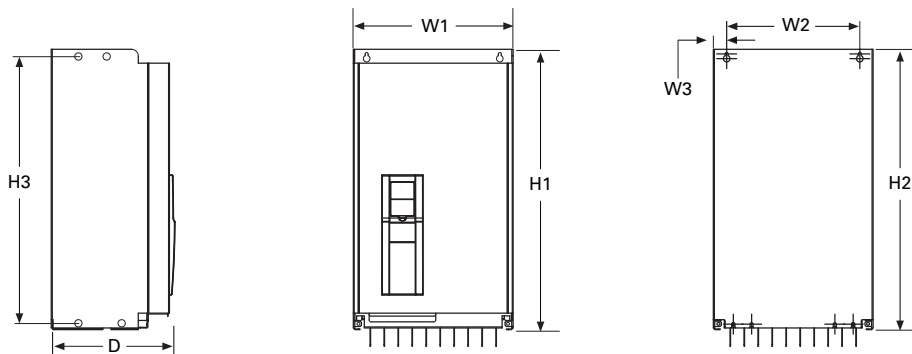
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#### H-Max Series Frames FS4-FS7



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
<b>FS4</b>											
230 Vac	0.75-4	0.55-3.0	3.7-12.5	7.77 (197.3)	12.89 (327.5)	12.32 (313.0)	11.22 (285.0)	5.04 (128.0)	3.94 (100.0)	3.94 (100.0)	13.2 (6)
480 Vac	1.5-7.5	1.1-5.5	3.4-12								
<b>FS5</b>											
230 Vac	5-10	4-7.5	18-31	8.73 (221.6)	16.50 (419.0)	15.98 (406.0)	15.04 (382.0)	5.67 (144.0)	4.53 (115.0)	3.94 (100.0)	22.0 (10)
480 Vac	10-20	7.5-15	16-31								
<b>FS6</b>											
230 Vac	15-20	11-15	48-62	9.29 (236.0)	21.93 (557.0)	21.28 (540.5)	20.24 (514.0)	7.68 (195.0)	5.83 (148.0)	5.83 (148.0)	44.1 (20)
480 Vac	25-40	18.5-30	38-61								
<b>FS7</b>											
230 Vac	25-30	18.5-30	75-105	10.49 (266.5)	25.98 (660.0)	25.39 (645.0)	24.29 (617.0)	9.06 (230.0)	7.48 (190.0)	7.48 (190.0)	82.6 (37.5)
480 Vac	50-75	37-55	72-105								

#### H-Max Series Frames FS8 and FS9



Voltage	hp	kW	Amps	D	H1	Hole Center-to-Center H2	H3	W1	W2	W3	Weight in Lbs (kg)
<b>FS8</b>											
230 Vac	50-75	37-55	140-205	13.76 (349.6)	38.02 (965.7)	37.26 (946.4)	37.26 (946.4)	11.42 (290.1)	9.29 (236.0)	1.42 (36.0)	154.3 (70)
480 Vac	100-150	75-110									
<b>FS9</b>											
230 Vac	100-120	75-90	261-310	14.63 (371.6)	33.09 (890.4)	31.89 (810.0)	31.89 (810.0)	18.90 (480.0)	15.75 (400.0)	1.57 (40.0)	238.1 (108)
480 Vac	200-250	132-160									

**Note:** For flange dimension, please reference User Manual.