

M-Max Series Drives for Machinery Applications

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Product Description

Eaton's M-Max™ Series Sensorless Vector Adjustable Frequency AC Drives are the next generation of drives specifically engineered for today's machinery applications. These microprocessor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements. The M-Max product line uses a 32-bit microprocessor and insulated gate bipolar transistors (IGBTs) that provide quiet motor operation, high motor efficiency, and smooth low-speed performance. The size and simplicity of the M-Max make it ideal for hassle-free installation. Models rated at 575 volts, three-phase, 50/60 Hz are available in sizes ranging from 1 to 7-1/2 hp. Models rated at 480 volts, three-phase, 50/60 Hz are available in sizes ranging from 1/2 to 10 hp. Models rated at 240 volts, single- or three-phase, 50/60 Hz are available in sizes ranging from 1/4 to 3 hp. Models rated at 115 volts, single-phase, 50/60 Hz are available in the 1/4 to 1-1/2 hp size range.

The standard drive includes a digital display, and operating and programming keys on a visually appealing, efficient application programming interface. The display provides drive monitoring, as well as adjustment and diagnostic information. The keys are used 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.

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Features

- Ease of use—preset application macros, startup wizard, diagnostic capabilities
- Compact, space-saving design
- Rugged and reliable—150% for one minute, 50C rated, conformal coated boards
- DIN rail and screw mountable
- Side-by-side installation
- Industry leading efficiency delivers energy savings to the customer
- Integrated EMC filters make the unit suitable for commercial and industrial networks
- Available in the enclosure class IP20 as standard, options for IP21 and NEMA® 1
- Brake chopper as standard in three-phase, applications of frames 2 (FS2) and larger
- Temperature-controlled fan
- RS-485/Modbus® as standard
- PID controller as standard
- Several fieldbus options

Standards and Certifications

Product

- Complies with EN61800-3 (2004)

Safety ①

- 61800-5-1
- EN60204-1
- CE
- UL
- cUL
- IEC
- RoHS compliant

EMC (At Default Settings)

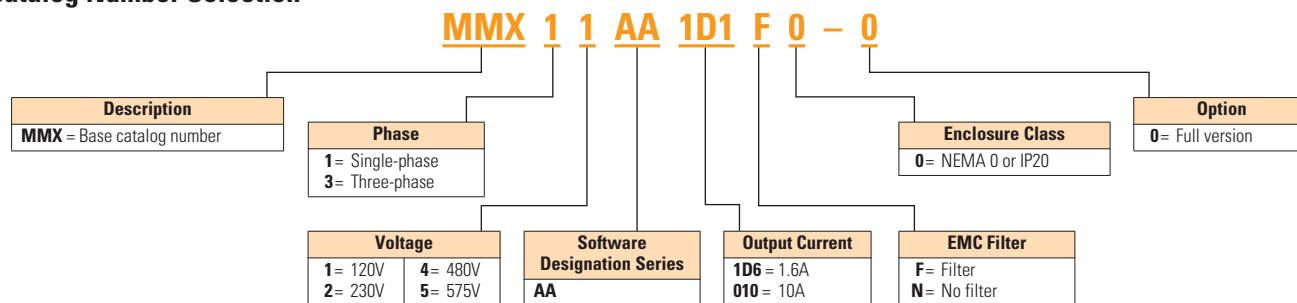
- EMC Category C2, C3, and C4 (Level H): With an internal RFI filter option



Note

① See unit nameplate for more detailed approvals.

Catalog Number Selection



Product Selection

M-Max

M-Max Basic Controller



hp ^①	Volts ^②	100% Continuous Current I _N (A)	Nominal Input Current (A)	Frame Size	Catalog Number		
1/4	100–120V single-phase in 230V three-phase out	1.7	9.2	FS2	MMX11AA1D7N0-0 ^③		
1/2		2.4	11.6		MMX11AA2D4N0-0 ^③		
3/4		2.8	12.4		MMX11AA2D8N0-0 ^③		
1		3.7	15		MMX11AA3D7N0-0 ^③		
1-1/2		4.8	16.5		MMX11AA4D8N0-0 ^③		
1/4	200–240V single-phase in 230V three-phase out	1.7	4.2	FS1	MMX12AA1D7F0-0		
1/2		2.4	5.7		MMX12AA2D4F0-0		
3/4		2.8	6.6		MMX12AA2D8F0-0		
1		3.7	8.3		MMX12AA3D7F0-0		
1-1/2		4.8	11.2		MMX12AA4D8F0-0		
2		7	14.1		MMX12AA7D0F0-0		
3		9.6	15.8		MMX12AA9D6F0-0		
1/4		200–240V three-phase in 230V three-phase out	1.7		2.7	FS1	MMX32AA1D7N0-0 ^③
1/2			2.4		3.5		MMX32AA2D4N0-0 ^③
3/4			2.8		3.8		MMX32AA2D8N0-0 ^③
1	3.7		4.3	MMX32AA3D7N0-0 ^③			
1-1/2	4.8		6.8	MMX32AA4D8N0-0 ^③			
2	7		8.4	MMX32AA7D0N0-0 ^③			
3	11		13.4	MMX32AA011N0-0 ^③			
1/2	380–480V three-phase in 460V three-phase out	1.3	2.2	FS1	MMX34AA1D3F0-0		
3/4		1.9	2.8		MMX34AA1D9F0-0		
1		2.4	3.2		MMX34AA2D4F0-0		
1-1/2		3.3	4		MMX34AA3D3F0-0		
2		4.3	5.6		MMX34AA4D3F0-0		
3		5.6	7.3		MMX34AA5D6F0-0		
4		7.6	9.6		MMX34AA7D6F0-0		
5		9	11.5		MMX34AA9D0F0-0		
7-1/2		12	14.9		MMX34AA012F0-0		
10		14	18.7		MMX34AA014F0-0		
1		575V three-phase in 575V three-phase out	1.7		2.0	FS3	MMX35AA1D7N0-0 ^③
2			2.7		3.6		MMX35AA2D7N0-0 ^③
3			3.9		5.0		MMX35AA3D9N0-0 ^③
5	6.1		7.6	MMX35AA6D1N0-0 ^③			
7-1/2	9.0		10.4	MMX35AA9D0N0-0 ^③			

Notes

- ① Horsepower ratings are based on the use of a 240V, 460V, and 575V NEMA B, four- or six-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 MMX 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 MMX rated continuous output current.
- ③ For MMX11_, MMX32_, and MMX35_, there are no options for units with filters.

Accessories

M-Max Copy/Paste Module

Description	Catalog Number
Module is plugged onto the front of the drive to provide: upload/download of all parameters, direct link to a PC via USB interface for parameter assignment via MaxConnect software, and copying of parameters for a series of devices or when exchanging devices. No PC required	MMX-COM-PC

Kits ①

Description	Catalog Number
Type 1 and IP21 kit for frame 1	MMX-IP21-FS1
Type 1 and IP21 kit for frame 2	MMX-IP21-FS2
Type 1 and IP21 kit for frame 3	MMX-IP21-FS3

Optional Communication Modules

Description	Catalog Number
Communication adapter kit	MMX-NET-XA
CANopen network card	XXM-NET-CO-A
PROFIBUS DP network card with serial connection	XXM-NET-PS-A
PROFIBUS DP network card with Sub-D connection	XXM-NET-PD-A
DeviceNet network card	XXM-NET-DN-A

Line Reactors ②

Description	Catalog Number
3% Line Reactor, Single-Phase	
1/2 hp, 240V	K64-000988-8091
1 hp, 240V	K64-000988-0120
2 hp, 240V	K64-000988-0180
3 hp, 240V	K64-000988-0250
3% Line Reactor, Three-Phase	
1/2 hp, 240V	K64-000989-2091
1 hp, 240V	K64-000989-4091
2 hp, 240V	K64-000989-8091
3 hp, 240V	K64-000989-0120
1 hp, 480V	K64-000989-2091
2 hp, 480V	K64-000989-4091
3 hp, 480V	K64-000989-8091
5 hp, 480V	K64-000989-8091
7-1/2 hp, 480V	K64-000989-0180
10 hp, 480V	K64-000989-0250
1 hp, 575V	K64-000989-2091
2 hp, 575V	K64-000989-8091
3 hp, 575V	K64-000989-8091
5 hp, 575V	K64-000989-4091
7-1/2 hp, 575V	K64-000989-0180
10 hp, 575V	K64-000989-0180

Notes

- ① Type 1 kit provides conduit entry plate.
- ② Additional input and output reactors are available. Consult Eaton representative for a complete listing.

Technical Data and Specifications

Ratings

M-Max Basic Controller IP20 Standard Ratings

Description	Specification
Protections	
Overcurrent protection	Trip limit $4.0 \times I_H$ instantaneously
Overvoltage protection	115/230V series: 437 Vdc; 400V series: 874 Vdc; 575V series: 1048 Vdc trip level
Undervoltage protection	115/230V series: 183 Vdc; 400V series: 333 Vdc; 575V series: 460 Vdc trip level
Ground fault protection	Ground fault is tested before every start. In case of ground fault in motor or motor cable, only the frequency converter is protected
Overtemperature protection	Yes
Motor overload protection	Yes
Motor stall protection	Yes
Motor underload protection	Yes

Programmable Parameters

Description
Application macros: basic, pump, fan and high load (hoist)
Programmable start/stop and reverse signal logic (sinking or sourcing)
Reference scaling
Programmable start and stop functions
DC-brake at start and stop
Programmable V/Hz curve
Adjustable switching frequency
Autorestart function after fault
Protections and supervisions (all fully programmable; off, warning, fault)
Current signal input fault
External fault
Fieldbus communication
Eight preset speeds
Analog input range selection, signal scaling and filtering
PID controller
Skip frequencies

Specifications

M-Max Series Drives

Description	Specification
Input Ratings	
Input voltage (V_{in})	+10%/–15% (575V units: +15%/–15%)
Input frequency (f_{in})	50/60 Hz (variation up to 45–66 Hz)
Connection to power	Once per minute or less (typical operation)
Output Ratings	
Output voltage	0 to V_{in} ①
Continuous output current	Continuous rated current I_N at ambient temperature max. 122°F (50°C), overload $1.5 \times I_N$ max. 1 min/10 min
Output frequency	0 to 320 Hz
Frequency resolution	0.01 Hz
Initial output current (I_H)	Current $2 \times I_N$ for 2 seconds in every 20-second period Torque depends on motor
Control Characteristics	
Control method	Frequency control (V/Hz) open loop or sensorless vector control
Switching frequency	1.5 to 16 kHz; default 6 kHz
Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy $\pm 1\%$ V/Hz Panel reference: resolution 0.01 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)
Brake Resistor (Minimum Values) ②	
230V Series	FS2 35 ohms and FS3 26 ohms
400V Series	FS2 75 ohms and FS3 54 ohms
575V Series	FS3 103 ohms
Ambient Conditions	
Ambient operating temperature	14°F (–10°C), no frost to 122°F (+50°C): Rated loadability I_N
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. 6560 ft (2000m)
Vibration	EN 60068-2-6; 3 to 150 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, IEC 68-2-27 UPS Drop test (for applicable UPS weights); storage and shipping: max. 15G, 11 ms (in package)
Enclosure class	IP20

Notes

① Exception: 115V single-phase in, 230V three-phase out.

② Only three-phase FS2 and FS3 drives are equipped with brake chopper circuit.

Standards

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I/O Specifications

- Digital inputs DI1–DI6 are freely programmable. The user can assign multiple functions to a single input
- Digital, relay, and analog outputs are freely programmable

Includes:

- Six digital inputs
- Two analog inputs
 - 4–20 mA
 - 0–10V
- One analog output
- One digital output
- Two relay outputs
- RS-485 interface

Reliability

- Pretested components: standard
- Computerized testing: standard
- Final test with full load: standard
- Conformal-coated boards
- 50°C rated
- 150% for one minute/10 mm
- 200% for two seconds/20 sec.
- Eaton Electrical Services and Systems: national network of AF drive specialists

M-Max I/O Interface

Terminal	Signal	Factory Preset	Description
1	+10V	—	Ref. output voltage Maximum load 10 mA
2	AI1	Freq. reference ^{P1}	Analog signal in 1 0–+10V Ri = 200k ohms [min.]
3	GND	—	I/O signal ground
6	24V	—	24V output for DI's ±20%, max. load 50 mA
7	GND	—	I/O signal ground
8	DI1	Start forward ^{P1}	Digital input 1 0–+30V Ri = 12k ohms min.
9	DI2	Start reverse ^{P1}	Digital input 2
10	DI3	Preset speed ^{P1}	Digital input 3
A	A	FB communication	RS-485 signal A
B	B	FB communication	RS-485 signal B
4	AI2	PI actual value ^{P1}	Analog signal in 2 0[4]–20 mA, Ri = 200k ohms
5	GND	—	I/O signal ground
13	GND	—	I/O signal ground
14	DI4	Preset speed B1 ^{P1}	Digital input 4 0–+30V Ri = 12k ohms min.
15	DI5	Fault reset ^{P1}	Digital input 5 0–+30V Ri = 12k ohms min.
16	DI6	Disable PI contr. ^{P1}	Digital input 6 0–+30V Ri = 12k ohms min.
18	A0	Output frequency ^{P1}	Analog output 0(2)–10V, RL = 500 ohms
20	DO	Active = READY ^{P1}	Digital signal out Open collector, max. load 48V/50 mA
22	R011	Relay out 1 Active = RUN ^{P1}	Max. switching load: 250 Vac/2A or 250 Vdc/0.4A
23	R012		
24	R021	Relay out 2 Active = FAULT ^{P1}	Max. switching load: 250 Vac/2A or 250 Vdc/0.4A
25	R022		
26	R023		

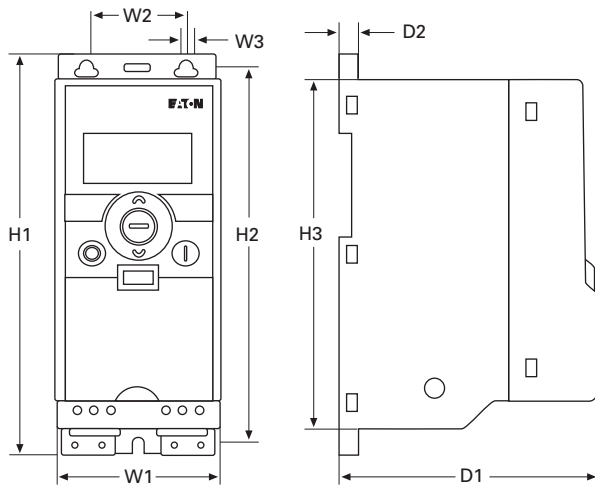
Note

^{P1} Parameter-selectable function.

Dimensions

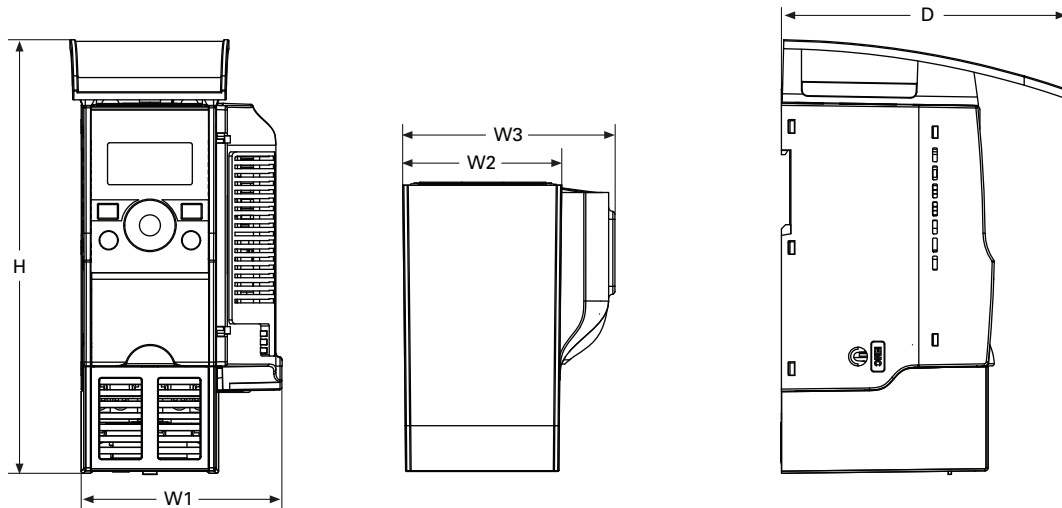
Approximate Dimensions in Inches (mm)

M-Max Drives



Frame Type	H1	H2	H3	W1	W2	W3	D1	D2	Weight Lbs (kg)
FS1	6.16 (156.5)	5.79 (147.0)	5.40 (137.3)	2.58 (65.5)	1.49 (37.8)	0.17 (4.5)	3.88 (98.5)	0.27 (7.0)	1.213 (0.550)
FS2	7.68 (195.0)	7.20 (183.0)	6.69 (170.0)	3.54 (90.0)	2.46 (62.5)	0.22 (5.5)	4.00 (101.5)	0.27 (7.0)	1.543 (0.699)
FS3	10.33 (262.5)	9.93 (252.3)	9.50 (241.3)	3.94 (100.0)	2.95 (75.0)	0.22 (5.5)	4.27 (108.5)	0.27 (7.0)	2.183 (0.990)

NEMA 1/IP21 M-Max Drives and Communication Adapter Kit



Frame Type	H	W1	W2	W3	D
FS1	8.14 (206.7)	3.77 (95.7)	2.99 (75.9)	3.98 (101.2)	5.41 (137.5)
FS2	9.90 (251.5)	4.72 (120.0)	3.97 (100.8)	4.94 (125.5)	5.68 (144.2)
FS3	12.26 (311.5)	5.12 (130.1)	4.36 (110.8)	5.33 (135.3)	6.32 (160.5)