

Adjustable Frequency Drives

M-Max Series



40.1 M-Max Series Adjustable Frequency AC Drive

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M-Max Series Drives for Machinery Applications



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Product Description

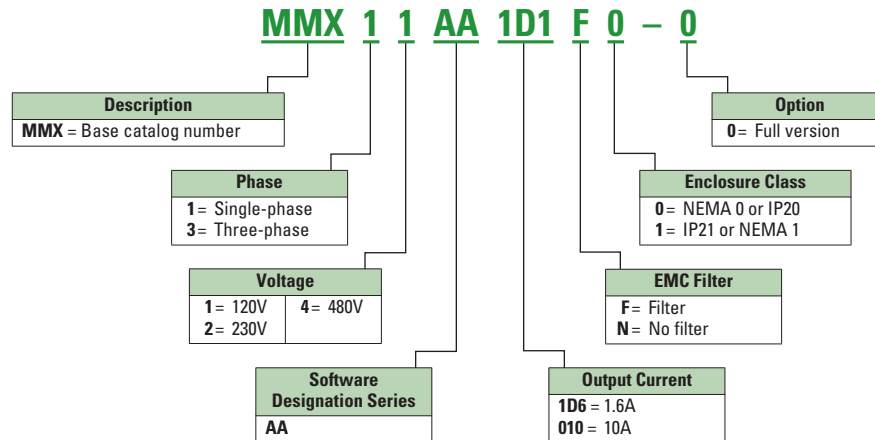
Eaton's M-Max™ Series sensorless vector adjustable frequency AC drives are the next generation of drives specifically engineered for today's machinery applications. These micro-processor-based drives have standard features that can be programmed to tailor the drive's performance to suit a wide variety of application requirements. The 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 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.

Features of Eaton's M-Max Drive

- Ease of use—plug-and-play, startup wizard, diagnostic capabilities
- Compact, space-saving design
- Rugged and reliable—thoroughly tested with a number of built-in protections
- DIN rail and screw mountable
- Side-by-side installation
- Parameter upload and download without the need for a main power supply
- 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
- Conformal-coated boards as standard
- Brake chopper as standard in three-phase, 480V, 2 hp and higher
- Temperature-controlled fan
- RS-485/Modbus® as standard
- PI controller as standard
- Several fieldbus options
- RoHS compliant

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 ^{③④} |
|-----------------|--|--|---------------------------|------------|------------------------------|
| 1/4 | 100–120V single-phase in 230V three-phase out | 1.7 | 9.2 | FS2 | MMX11AA1D7N0-0 ^④ |
| 1/2 | | 2.4 | 11.6 | FS2 | MMX11AA2D4N0-0 ^④ |
| 3/4 | | 2.8 | 12.4 | FS2 | MMX11AA2D8N0-0 ^④ |
| 1 | | 3.7 | 15 | FS2 | MMX11AA3D7N0-0 ^④ |
| 1-1/2 | | 4.8 | 16.5 | FS3 | MMX11AA4D8N0-0 ^④ |
| 1/4 | 200–240V single-phase in 230V three-phase out | 1.7 | 4.2 | FS1 | MMX12AA1D7F0-0 |
| 1/2 | | 2.4 | 5.7 | FS1 | MMX12AA2D4F0-0 |
| 3/4 | | 2.8 | 6.6 | FS1 | MMX12AA2D8F0-0 |
| 1 | | 3.7 | 8.3 | FS1 | MMX12AA3D7F0-0 |
| 1-1/2 | | 4.8 | 11.2 | FS2 | MMX12AA4D8F0-0 |
| 2 | | 7 | 14.1 | FS2 | MMX12AA7D0F0-0 |
| 3 | | 9.6 | 15.8 | FS3 | MMX12AA9D6F0-0 |
| 1/4 | 200–240V three-phase in 230V three-phase out | 1.7 | 2.7 | FS1 | MMX32AA1D7N0-0 ^④ |
| 1/2 | | 2.4 | 3.5 | FS1 | MMX32AA2D4N0-0 ^④ |
| 3/4 | | 2.8 | 3.8 | FS1 | MMX32AA2D8N0-0 ^④ |
| 1 | | 3.7 | 4.3 | FS1 | MMX32AA3D7N0-0 ^④ |
| 1-1/2 | | 4.8 | 6.8 | FS2 | MMX32AA4D8N0-0 ^④ |
| 2 | | 7 | 8.4 | FS2 | MMX32AA7D0N0-0 ^④ |
| 3 | | 11 | 13.4 | FS3 | MMX32AA011N0-0 ^④ |
| 1/2 | 380–480V three-phase in 460V three-phase out | 1.3 | 2.2 | FS1 | MMX34AA1D3F0-0 |
| 3/4 | | 1.9 | 2.8 | FS1 | MMX34AA1D9F0-0 |
| 1 | | 2.4 | 3.2 | FS1 | MMX34AA2D4F0-0 |
| 1-1/2 | | 3.3 | 4 | FS1 | MMX34AA3D3F0-0 |
| 2 | | 4.3 | 5.6 | FS2 | MMX34AA4D3F0-0 |
| 3 | | 5.6 | 7.3 | FS2 | MMX34AA5D6F0-0 |
| 4 | | 7.6 | 9.6 | FS3 | MMX34AA7D6F0-0 |
| 5 | | 9 | 11.5 | FS3 | MMX34AA9D0F0-0 |
| 7-1/2 | | 12 | 14.9 | FS3 | MMX34AA012F0-0 |
| 10 | | 14 | 18.7 | FS3 | MMX34AA014F0-0 |

Notes

- ① Horsepower ratings are based on the use of a 240V or 480V 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 There is a discount to this published list price for units without filters:
for FS1, subtract \$25; for FS2, subtract \$33; for FS3, subtract \$45. This does not apply to MMX11... catalog numbers.
- ④ For MMX11... and MMX32..., there are no options for units with filters.
- ⑤ Discount Symbol: **SS-1**.

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Adjustable Frequency Drives

M-Max Series Adjustable Frequency AC Drive

Accessories

MMX-COM-PC

M-Max 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 |

①

Note

① Discount Symbol: **SS-1**.

Technical Data and Specifications

Ratings

M-Max Basic Controller IP20 Standard Ratings

| Description | Specification |
|----------------------------|---|
| Standards | |
| Product | Complies with EN61800-3 (2004) |
| Safety | 61800-5-1, EN60204-1, CE, UL®, cUL®, IEC (see unit nameplate for more detailed approvals) |
| EMC (at default settings) | EMC level H: with an internal RFI filter option |
| Protections | |
| Overcurrent Protection | Trip limit $4.0 \times I_H$ instantaneously |
| Overvoltage Protection | 115/230V series: 437 Vdc; 400V series: 874 Vdc trip level |
| Undervoltage Protection | 115/230V series: 183 Vdc; 400V series: 333 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

- 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
- PI controller

Specifications

M-Max Series Drives

| Description | Specification |
|----------------------------------|--|
| Input Ratings | |
| Input Voltage (V_{in}) | +10% / -15% |
| Input Frequency (f_{in}) | 50/60 Hz (variation up to 45 to 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) |
| 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 |

Note

- ① Exception: 115V in, 230V out.

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Adjustable Frequency Drives

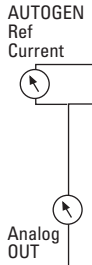
M-Max Series Adjustable Frequency AC Drive

M-Max I/O Interface

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

Note

P) Parameter-selectable function.



Standards

I/O Specifications

- Digital inputs DI1 ... DI6 are freely programmable. The user can assign a single input to many functions
- 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

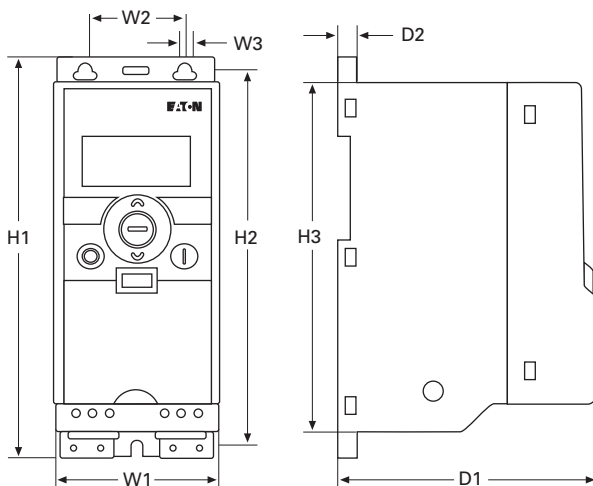
Reliability

- Pretested components: standard
- Computerized testing: standard
- Final test with full load: standard
- Conformal-coated boards
- 50°C rated
- 150% for 1 minute
- Eaton Electrical Services & Systems: national network of AF drive specialists

Dimensions

Approximate dimensions in inches (mm)

M-Max Series 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) | 4.02 (102.0) | 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) | 4.13 (105.0) | 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) | 4.41 (112.0) | 0.27 (7.0) | 2.183 (0.990) |