

Unidrive M: Drives for Industry

AC and Servo Drive Family for Industrial Applications

0.25 kW - 2.8 MW Heavy Duty (0.33 hp - 4,200 hp)
100 V | 200 V | 400 V | 575 V | 690 V



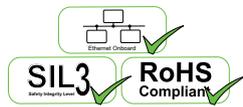
Control Techniques™


EMERSON™
Industrial Automation



Unidrive M – The drive for industrial applications

Unidrive M is a family of six variable speed drives designed specifically for industrial applications. Each Unidrive M model has been designed for specific application needs identified through extensive market research. Unidrive M is evolving the future of industry with the latest drive technology which includes 21 patents granted and 42 patents pending.



Unidrive M scalable industrial drive family

Each Unidrive M model offers an incremental level of functionality, designed to solve more advanced application needs. The family is designed to provide exactly the right drive feature-set for a specific industrial application, sharing a common software foundation and range of common click-in optional modules.



High performance

M700



Flexible Automation

Class leading automation drive providing the highest levels of universal performance with servo, AC and permanent magnet motors. With integrated Ethernet, flexible motion and advanced PLC control

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M600



Industrial Performance

High performance industrial drive for standard AC induction and high efficiency permanent magnet motors

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Programmable IEC61131-3 controller using Machine Control Studio software

Open loop vector or V/Hz induction motor control

Enhanced open loop Rotor Flux Control for induction motors (RFC-A)

Open loop permanent magnet motor control (RFC-S)

Closed loop Rotor Flux Control for induction motors (RFC-A)

Closed loop permanent magnet/servo motor control (RFC-S)

Active Front End (AFE) power quality converter*

*requires additional drive for Active Front End operation

Flexibility

M400



Diagnostics and PLC

Fast set-up and diagnostics with plain text display, integrated PLC and safety inputs

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M300



Safety

Open loop AC drive with flexible safety integration capabilities

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Value

M200



Communications

Open loop AC drive with easy communication integration options

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M100



Value

Value and quality for simple applications

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M700	M600	M400	M300	M200	M100
Up to 2.8 MW (4,200 hp)		Up to 110 kW (150 hp)			Up to 7.5 kW (10 hp)
✓	✓	✓			
✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	
✓	✓				
✓	Option				
✓					
✓	✓				

Unidrive M

Motor control performance

Unidrive M's unique motor control algorithms combined with the latest microprocessor technology ensure it offers the highest stability and bandwidth for all industrial motor types. This enables you to maximize machine throughput in every application and with every motor, from standard AC induction motors to dynamic linear motors and from energy saving permanent magnet motors to high performance servo motors.



Motor control options available include:

Control Mode	Features	Applies to
Open loop vector or V/Hz induction motor control	Open loop motor control for induction motors. Easiest configuration. V/Hz can be used for multiple motor control.	All
Open loop Rotor Flux Control for induction motors (RFC-A)	Vector algorithm utilizing closed loop current control to greatly enhance performance for all induction motor sizes.	M200 - M700
Open loop permanent magnet motor control (RFC-S)	Open loop control of compact, high efficiency, permanent magnet motors (including the Leroy-Somer Dyneo® LSRPM).	M600 - M700
Closed loop Rotor Flux Control for induction motors (RFC-A)	Speed and position control for induction motors, supporting a wide range of feedback devices (including quadrature, SinCos, EnDat, SSI encoders and resolvers).	M600 - M700 M600 + SI-Encoder / SI-Universal Encoder
Closed loop control of permanent magnet and servo motors (RFC-S)	Dynamic control of high efficiency and servo permanent magnet motors supporting a wide range of feedback devices (including quadrature, SinCos, EnDat, SSI encoders and resolvers).	M700
Active Front End for power quality and regeneration	Active Front End allows regeneration of energy back onto the power line. The Active Front End also provides power factor control for power quality management and greatly reduces unwanted power harmonics.	M600 - M700



Matched drives and motors maximize performance and energy efficiency

Energy efficiency

Unidrive M is designed to enhance the energy efficiency of all applications:

- Low power standby mode. In some applications, drives can sit idle for significant periods; Unidrive M's reduced standby power saves energy.
- Easy common DC bus configuration enables braking energy to be recycled within the drive system, reducing energy usage and eliminating external supply components.
- Unidrive M supports sensorless (open loop) control of compact high efficiency permanent magnet motors.
- Active Front End for regenerative AC drive systems.
- Dyneo®: perfectly synergized Permanent Magnet motor and Unidrive M solutions - optimized for performance and energy saving.
- Emerson's Dyneo® Unidrive M and Permanent Magnet motor solutions offer exceptional efficiency levels across all operating speeds, especially at lower speeds where the efficiency is much higher than induction motors.
- Low losses, up to 98% efficient.

Matched servo motors for maximum performance

Emerson offers two ranges of AC brushless servo motors to match diverse application needs.

Unimotor fm

Flexible performance AC brushless servo motor
0.72 Nm – 136 Nm (408 Nm Peak) | 6.37 lb-in - 1,203 lb-in
(3,611 lb-in peak)

Unimotor fm is a flexible performance AC brushless servo motor range optimized for use with Unidrive M. The motors are available in six frame sizes with various mounting arrangements, motor lengths and a wide range of feedback options.

Unimotor hd

Compact servo motor for demanding applications
0.72 Nm - 85.0 Nm (255 Nm peak) | 6.37 lb-in - 752 lb-in
(2,256 lb-in peak)

Unimotor hd is a high dynamic servo motor range, designed for maximum torque density. This AC brushless servo motor range provides an exceptionally compact, low inertia solution for applications where rapid acceleration and deceleration is required.

Performance

Unidrive M700 AC drive

0.75 kW - 2.8 MW (1.0 hp - 4,200 hp)
200 V / 400 V / 575 V / 690 V



Class leading induction, permanent magnet and servo motor performance, with onboard real-time Ethernet

Unidrive M700 provides high performance motor control and ultimate control flexibility in order to satisfy the requirements of machine builders and high specification industrial and hoisting applications. M700 offers an enhanced upgrade for existing Unidrive SP users.

Unidrive M700 benefits:

Maximize throughput with superior motor control

- High bandwidth motor control algorithm for closed-loop induction, permanent magnet and servo motors - 3,000 Hz current loop bandwidth and 250 Hz speed loop bandwidth
- Flexible speed and position feedback interface supports a wide range of feedback technologies from robust resolvers to high resolution encoders
 - ⇨ Up to three encoder channels simultaneously e.g. 1 feedback encoder, 1 reference encoder and 1 simulated output
 - ⇨ Quadrature, SinCos (including absolute), SSI, EnDat (up to 4 Mb with EnDat 2.2 and 100 m of cable as line compensation is supported) and resolvers
 - ⇨ Simulated encoder output can provide position reference for CAMs, digital lock and electronic gearbox applications

Optimize system performance with onboard Advanced Motion Controller

- M700 incorporates an Advanced Motion Controller capable of controlling 1.5 axis. The motion functions are carried out 'on the drive' so that system performance is maximized

Design flexible centralized and decentralized control systems

- Onboard PLC for logic programs
- MCI modules can be added to execute larger programs for advanced system control capability
- Machine Control Studio is an industry standard IEC61131-3 programming environment for efficient system design and configuration
- Integrated dual port Ethernet switch provides simple connectivity using standard connections
- Onboard real-time Ethernet (IEEE 1588 V2) uses RTMoE (Real Time Motion over Ethernet) to provide fast communication and accurate axis synchronization
- Three System Integration ports are available to fit additional fieldbus, position feedback and I/O options

Conform to safety standards, maximize uptime and reduce costs by integrating directly with safety systems

- M700 has an integrated Safe Torque Off (STO) input and can accommodate an SI-Safety module for safe motion functions

Typical applications

Speed and position control for gearing and ratio control, winding (coilers), web handling, metal cutting, flying shear, rotary knife, test stands, printing, packaging machines, textiles, woodworking, tire manufacturing, theater hoists, cranes.

Unidrive M701 - Unidrive SP replacement

Unidrive M701 has 2 x RS485 ports onboard instead of Ethernet making an ideal upgrade path for Unidrive SP. SP Parameter sets can be ported to Unidrive M using a Smartcard or the Unidrive M connect PC tool. SM-Applications programs can be recompiled for SI-Applications on Unidrive M.

Unidrive M702 – Enhanced Safety

M702 has an additional STO input for applications that require onboard Ethernet and dual STO to comply with SIL 3 or PLe.

Performance drive summary: choose the right feature-set to match your application

Feature	M700	M701	M702	M600
Open loop vector or V/Hz	•	•	•	•
Open loop rotor flux control (RFC-A)	•	•	•	•
Closed loop rotor flux control	•	•	•	• (with SI-Encoder / SI-Universal Encoder)
Active Front End regeneration capability	•	•	•	•
Closed loop control of permanent magnet and servo motors	•	•	•	
Open loop permanent magnet (RFC-S)	•	•	•	•
Analog Inputs / Outputs	3/2	3/2	0/0*	3/2
Digital Inputs / Outputs/ Bidirectional I/O	4/1/3	4/1/3	3/3/0	4/1/3
Relay Output	1	1	1	1
Safe Torque Off Inputs	1	1	2	1
Ethernet	Onboard	SI Option	Onboard	SI Option
Onboard RS485 comms		•		•
Onboard IEC 61131-3	•	•	•	•
MCI/ SI-Applications support	•	•	•	
On-board motion (AMC)	•	•	•	
Digital lock control	•	•	•	•
SI option module slots	3	3	3	3
Onboard Encoder Channels	Up to 3 depending on type	Up to 3 depending on type	Up to 3 depending on type	None (use SI Options)
Cloning via smartcard	•	•	•	•
Cloning via SD card	•	•	•	•

* Analog I/O can be added using SI-I/O modules

Unidrive M600 AC drive

0.75 kW - 2.8 MW (1.0 hp - 4,200 hp)
200 V / 400 V / 575 V / 690 V



High performance drive for induction and sensorless permanent magnet motors

The M600 is the perfect choice for applications that require high performance open-loop control of induction or permanent magnet motors. SI-Encoder / SI-Universal Encoder option modules are available for applications that require more precise closed-loop velocity and digital lock / frequency following of induction motors.

Unidrive M600 benefits:

Enhance throughput with high performance open-loop control of induction and permanent magnet motors

- Advanced Rotor Flux Control (RFC) algorithm gives maximum stability and control of induction and permanent magnet motors
- Up to 200% motor overload suitable for heavy industrial machinery applications

Reduce system costs by directly integrating with applications

- M600 incorporates an onboard PLC which can execute Machine Control Studio (IEC61131-3) programs for logic control, sequencing, speed following and digital lock - removing the need for additional PLCs
- Fit up to three SI modules to add safe motion, speed feedback, additional I/O and fieldbus communications

Typical applications

Speed control with high starting torque for extruders, slitters, material transport, compressors, manufacturing, cranes, hydraulic replacement, ratio control, gearing, winding (coilers), web handling and metal cutting. PM sensorless can be used for additional energy saving in fan and pump applications.

Flexibility

Unidrive M400 AC drive

0.25 kW - 110 kW (0.33 hp - 150 hp)
100 V / 200 V / 400 V / 575 V / 690 V



Fast set-up and diagnosis with real-text display, integrated PLC and safety inputs

Unidrive M400 minimizes downtime with an intuitive LCD keypad offering a real-text, multi-language display for rapid set-up and clear diagnostic help. The integrated PLC can execute a substantial range of sequencing and logic programs. Coupled with an impressive I/O count complete with two STO inputs and an SI interface for a fieldbus option or extended I/O, this feature set ensures M400's flexible integration with any system.

Unidrive M400 benefits:

Minimize downtime and system set-up time with advanced keypad options

- Informative, multi-language, 3 line display aids set up and provides diagnostic information
- 4 navigation buttons facilitate intuitive navigation and programming
- Keypad options available:
 - ⇒ CI-Keypad - Drive mounted LCD Keypad
 - ⇒ Remote IP66 Keypad – Rapid panel mount (1 x 32mm Ø hole)
 - ⇒ No keypad – Control/programming performed by PC or fieldbus

Reduce system costs by directly integrating with applications

- M400 incorporates an onboard PLC which can execute Machine Control Studio (IEC61131-3) programs for logic and sequencing with real-time tasks - removing the need for additional PLCs
- Fit an SI module to add fieldbus communications or additional I/O

Improve throughput with advanced open-loop motor control algorithms

- Rotor Flux Control (RFC-A) gives maximum stability and control of induction motors at all powers
- 180% motor overload suitable for heavy industrial machinery applications
- Precise frequency following is possible from an encoder or frequency/direction inputs

Conform to safety standards, maximize uptime and reduce costs by integrating directly with safety systems

- M400 has integrated dual STO inputs for SIL3 / PLc conformity, eliminating the need for external components.

Typical applications

Speed control for conveyors, positive displacement pumps, material handling, cutting, woodworking, applications where fast diagnostics are required.

Onboard PLC enables intelligent operation for applications such as pumps, traffic barriers and industrial washing machines.

Flexible drive summary: choose the right feature-set to match your application

Feature	M400	M300
Open loop vector or V/Hz	•	•
Open loop rotor flux control (RFC-A)	•	•
Analog Inputs / Outputs	2/2	2/1
Digital Inputs / Outputs/Bidirectional I/O	5/0/2	4/0/1
Relay Output	1	1
Safe Torque Off	2	2
Onboard PLC	•	
RS485 comms Modbus RTU	With comms cable and CI-485 Adaptor or AI-485 Adaptor	With comms cable and AI-485 Adaptor
Cloning via SD card	AI-Back-up Adaptor required	AI-Back-up Adaptor required
SI option module slots	1	1
Frequency following with incremental encoder	1	
Removable LCD keypad	•	
LED keypad		•

Unidrive M300 AC drive

0.25 kW - 110 kW (0.33 hp - 150 hp)
100 V / 200 V / 400 V / 575 V / 690 V

Flexible integration with safety and communications

Unidrive M300 is ideal for applications that require cost effective integration into safety systems and advanced RFC-A open-loop induction motor control.

Unidrive M300 benefits:

Conform to machinery standards, maximize uptime and reduce costs by integrating directly with safety systems

- M300 has integrated dual STO inputs for SIL3, PLe conformity, eliminating the need for external safety components

Improve throughput with advanced open-loop motor control algorithms

- Rotor Flux Control (RFC-A) gives maximum stability and control of induction motors at all powers
- 180% motor overload suitable for heavy industrial machinery applications

Flexible system integration with SI communications options

- M300's SI interface enables integration with a wide range of available industry standard fieldbuses and I/O

Install and configure quickly and easily

- Simple fixed LED keypad
- Useful parameter guide located on the front of the drive
- Use Unidrive M Connect or an SD card with AI-Backup adaptor to clone and transfer parameter sets
- DIN Rail mounting is supported below 1.5 kW*

Typical applications

Speed control for material transport, cutting, woodworking, machine tools, applications where protection of people or assets is required

*Additional fixings required to maximize security



Value

Unidrive M200 AC drive

0.25 kW - 110 kW (0.33 hp - 150 hp)
100 V / 200 V / 400 V / 575 V / 690 V



Flexible integration through communications

Unidrive M200 has been designed for applications that require flexible integration with systems via industrial Ethernet protocols and fieldbuses together with advanced RFC-A open-loop motor control.

Unidrive M200 benefits:

Flexible system integration with communications options

- M200's SI Interface enables integration with a wide range of available industry standard fieldbuses or extended I/O such as SI-Ethernet, SI-EtherCAT, SI-PROFINET RT, SI-PROFIBUS, SI-CANopen and SI-DeviceNet
- AI-485 Adaptor option permits connection to RS485 networks using Modbus RTU

Improve throughput with advanced open-loop motor control algorithms

- Rotor Flux Control (RFC-A) utilizes closed-loop current control to give maximum stability of induction motors at all powers

Install and configure quickly and easily

- Easy-to-use fixed LED keypad
- Useful parameter guide located on the front of the drive
- Use Unidrive M Connect PC tool or SD card with AI-Back-up adaptor to clone and transfer parameter sets
- DIN Rail mounting is supported below 1.5 kW*

Typical applications

Speed control for conveyors, fans, positive displacement pumps and mixers, instances where application functions are controlled remotely via fieldbus or Ethernet communications

Unidrive M201 variant

Integrated speed reference potentiometer enhances customer choice and ease of use

*Additional fixings required to maximize security

Value drive summary: choose the right feature-set to match your application

Feature	M200	M100
Open loop vector or V/Hz	•	•
Open loop rotor flux control (RFG-A)	•	
Analog Inputs / Outputs	2/1	1/0
Digital Inputs / Outputs / Bidirectional I/O	4/0/1	3/0/1
Relay Output	1	1
RS485 comms	With comms cable and AI-485 Adaptor	
SI option module slots	1	
Cloning via SD card	AI-Back up Adaptor required	AI-Back up Adaptor required

Unidrive M100 AC drive

0.25 kW - 7.5 kW (0.33 hp - 10 hp)
100 V / 200 V / 400 V



Value, quality and performance for open-loop applications

Unidrive M100 is a high quality drive designed for general open-loop industrial applications below 7.5 kW (10hp).

Typical applications

Frequency control for conveyors, fans, pumps and mixers

Unidrive M100 benefits:

Install and configure quickly and easily

- Easy-to-use fixed LED keypad
- Concise parameter set for ease of use with useful parameter guide located on the front of the drive
- Use SD card with AI-Back-up adaptor to clone and transfer parameter sets
- Open loop vector or V/Hz mode is quick to configure and has autotuning
- Easy DIN Rail mounting up to 1.5 kW*

*Additional fixings required to maximize security



M201 and M101 - potentiometer version

Unidrive M101 variant

Integrated speed reference potentiometer to enhance customer choice and ease of use

Machine Controllers: MCI200, MCI210 and SI-Applications



Second processor for PLC programs and multi-axis control

MCI modules add a powerful processor to Unidrive M700 which can execute comprehensive application programs to extend system and machine control capability. As a result of the highly flexible plug-in option module format, system design is streamlined by removing the need for PLCs and other external components. Programs are fast and easy to develop thanks to the user-friendly Machine Control Studio software which uses industry standard IEC 61131-3 programming languages to build highly flexible and productive systems. MCI programs can access and manage Unidrive M's embedded Advanced Motion Controller across a wide range of networks to provide perfectly synchronized multi-axis machine performance and throughput.

Save costs and streamline machine design

- MCI modules eliminate the need for external PLCs and motion controllers
- Plug-in option modules powered from the drive's internal power supply mean less wiring and less physical space is required
- Simple integration with external components such as I/O, HMIs and other networked drives can be achieved using Unidrive M's integrated standard Ethernet ports (with RTMoE or standard protocols), or fieldbuses supported by SI option modules (EtherCAT, PROFINET, PROFIBUS, CANopen)
- MCI210 has two additional Ethernet ports with an internal switch

Increasing Control Capabilities of Unidrive M



Unidrive M feature and specification table

Feature		Unidrive					
		M100	M200	M300	M400	M600	M700
Performance	Current loop update	166 µs				62 µs	
	Heavy Duty peak ratings from cold	150 % (60 s)	180 % (3 s)			200 % (28 s)	
	Normal Duty peak ratings from cold	110 % (165 s)					
	Maximum output frequency	550 Hz**					
	Switching frequency range	0.67, 1, 2, 3, 4, 6, 8, 12, 16 kHz - 3 kHz default				2, 3, 4, 6, 8, 12, 16 kHz - 3 kHz default	
	High performance current controller						•
Drive status	Status LED				•	•	•
Mechanical attributes	Tile mounting					Frame sizes 3,4,5	
	DIN rail mounting on frame sizes 1 / 2	•	•	•	•		
	Mechanical retrofit capabilities	Commander SK compatible mechanical footprint either as standard or with conversion plates				Unidrive SP compatible (for surface mounting) mechanical footprint either as standard or with conversion plates	
	Common DC bus connections					Frame sizes 3,4,5,6	
Power and motor control	Stationary autotune for permanent magnet motors					•	•
	Wide operating range back-up DC supply					•	•
	24 V control back-up	Opt	Opt	Opt	Opt	•	•
Other	Fan operation	Temperature controlled with standby (off)				Temperature controlled with user adjustable speed limit	
	User replaceable fan(s)	•	•	•	•	•	•
	Conformal coating	•	•	•	•	•	•
	Heatsink mounted braking resistor support (up to frame size 5)					•	•
	Standby mode (energy saving)	•	•	•	•	•	•
Environmental safety and electrical conformance	Can survive environments as described by IEC60721-3-3 3C3	•	•	•	•		
	Can survive environments as described by EN60068-2-60 Meth. 4	•	•	•	•		
	Ingress rating	IP21 / NEMA 1 / UL open class				IP20/ NEMA 1 / UL TYPE 1 UL open class as standard, additional kit needed to achieve Type 1 IP65 / NEMA4 / UL TYPE 12 rating is achieved on the rear of the drive when through panel mounted (IP55 for frame 9 to 11)	

* Power modules can be paralleled up to 2.8 MW/ 4,200 hp

** For higher frequency refer to HS30 and HS70 documentation

Type	Applicable to					
	M100	M200	M300	M400	M600	M700
Applications						•
Safety					•	•
Communications		•	•	•	•	•
		•	•	•	•	•
		•	•	•	•	•
		•	•	•	•	•
		•	•	•	•	•
Feedback					•	•
Additional I/O		•	•	•	•	•
	M100	M200	M300	M400	M600	M700
Back-up	•	•	•	•		
	•	•	•	•		
Communications		•	•	•		
				•	•	•
		• †	• †	• †	•	For M701 only



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