



# Unidrive M: High Power Modular AC Drives

Highly reliable drive modules, flexible  
system design and rapid global support

Unidrive M600 | Unidrive M700/ M701/ M702  
90 kW to 2.8 MW / 125 to 4,200 hp  
200 V | 400 V | 575 V | 690 V



**Control Techniques™**

  
**EMERSON™**  
Industrial Automation

# Emerson

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**115,000**  
EMPLOYEES  
WORLDWIDE



**220**  
MANUFACTURING  
LOCATIONS  
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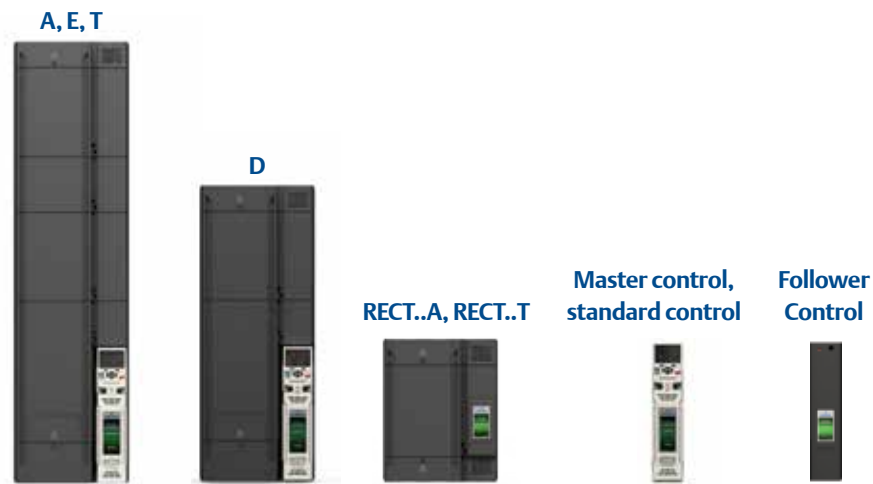
With facilities across Europe, the Middle East and Africa, the Americas and Asia, we can offer local technical sales, service and design expertise to customers around the world.

# Unidrive M High Power Modular Drives

Unidrive M's modular offering provides a flexible method of building compact, reliable high-power solutions. Paralleled together, Unidrive M can control asynchronous and permanent magnet motors in systems up to 2.8 MW (4,200 hp). The frame 11 is a 250 kW (400 hp) module that allows system builders to create high power solutions with the smallest number of components, keeping both footprint and costs to a minimum.

Unidrive M differentiates itself on performance with extremely fast current control algorithms and high switching frequencies. Active Front End (AFE) solutions deliver unparalleled torque precision and power quality.

The Unidrive M modules can be paralleled into a wide range of flexible solutions to solve all system needs including Active Front End and multi-pulse rectifier configurations. They can be controlled by M600, M700, M701 and M702 controllers.



| Format           |  |
|------------------|--|
| A                | AC in AC out module with integrated rectifier and line choke. Available in frame size 9 and can be paralleled up to 1.9 MW (Unidrive SPMA replacement) |
| E                | AC in AC out module with integrated rectifier. Available in frame sizes 9, 10 & 11 and can be paralleled up to 2.8 MW                                  |
| T                | AC in AC out module with 12 pulse integrated rectifier. Available in frame size 9, 10 & 11 and can be paralleled up to 2.8 MW                          |
| D                | DC in AC out module. Available in frame size 9, 10 & 11 and can be paralleled up to 2.8 MW (Unidrive SPMD replacement)                                 |
| RECT..A          | AC in DC out rectifier 6 pulse module (Unidrive SPMC replacement)  |
| RECT..T          | AC in DC out rectifier 12 pulse module (Unidrive SPMC2 replacement)  |
| Standard Control | M700, M701, M702, M600 controller for single module systems  |
| Master Control   | M700, M701, M702, M600 master controller for systems with more than one module   |
| Follower Control | Follower controller for all paralleled modules   |



# Reliable, Flexible and High Performance Solutions

## Minimize downtime for critical operations

We know how important reliability is to our customers and that every second of system downtime can be costly. Unidrive M high power modules have exceptional build quality based on over 40 years of drive knowledge, expertise and development. Built using world leading manufacturing processes, the modules are packed with features proven to keep Unidrive M running in the most testing of environments. Emerson Automation Centers are situated in all global regions to provide local design consultation and rapid specialist technical support wherever your business is located.

## Reliability assured

- Every Unidrive M power module has been thoroughly tested in environmental chambers that cycle a wide range of load and thermal conditions
- PCBs have conformal coating to further increase resilience to harsh environmental conditions
- Trip avoidance features take intelligent action instead of interrupting critical processes. For example:

- ◊ Active thermal monitoring reduces switching frequency as the drive approaches thermal limits
- ◊ Load shedding reduces speed at current limits
- ◊ Supply loss ride-through keeps the drive running during supply brown outs

- Protection alarms safeguard the wider system (e.g. over current, over temperature, over voltage and short circuit protection)
- Intelligent variable speed fans ensure operating temperature stays within limits. They are easily replaceable as part of routine maintenance
- Wide supply voltage tolerance keeps drive operation smooth in areas where supplies are variable



## Create flexible systems easily

The modular approach to building high power systems provides machine builders with flexibility while keeping complexity low. Modules with integrated rectifiers and / or line chokes can be easily paralleled keeping installation time and component count to a minimum. Separate inverter and rectifier modules (D, RECT..A and RECT..T) can be paralleled into more flexible common DC bus and regenerative configurations where power management and system design efficiency are key.

### Flexible and easy system design

- Unidrive M high power modules are designed to fit in standard 600 mm deep x 400 mm wide (23.6 x 15.7 in) cubicles
  - 6, 12, 18 and 24 pulse input and Active Front End configurations are easy to achieve
  - Integrated cooling fan power supply means no additional power supplies are required
  - Output current ratings have been increased to use fewer modules per system
- A common control interface ensures a consistent programming method and feature set across the whole Unidrive M range. Familiarity reduces the need for training:
    - ⇨ Identical parameter structure with Smartcard and SD card cloning support
    - ⇨ Unidrive M Connect software for monitoring, diagnostics and advanced parameter file management
    - ⇨ Engineering Control Studio for application programming in IEC61131-3 environment
    - ⇨ SI-option module support for additional I/O and fieldbus (e.g. Ethernet/IP, PROFINET RT, EtherCAT, PROFIBUS)
    - ⇨ MCI and SI-Applications modules for advanced application solutions



## Make compact, easily maintainable systems

Unidrive M high power modules are incredibly compact given the impressive amount of power they can deliver. For example, the powerful AC in AC out 250 kW (400 hp) module measures only 310 x 1242 x 312 mm (12.2 x 48.9 x 12.3 in) - a power density unrivalled in the market place and almost half the size of other leading suppliers.

- Overall system size and footprint is kept to a minimum
- Manageable small and light modules are maintained and replaced rapidly and easily

## Reduce spares inventory

Unidrive M's modular approach gives customers the opportunity to standardize their solutions in order to keep spares holding to a minimum as different systems can be serviced using one common spare. Additionally, large volumes of standard product modules are stocked at local distribution hubs in convenient locations around the world meaning that rapid delivery is always available to all customers.

## Upgrade Unidrive SP modular systems painlessly

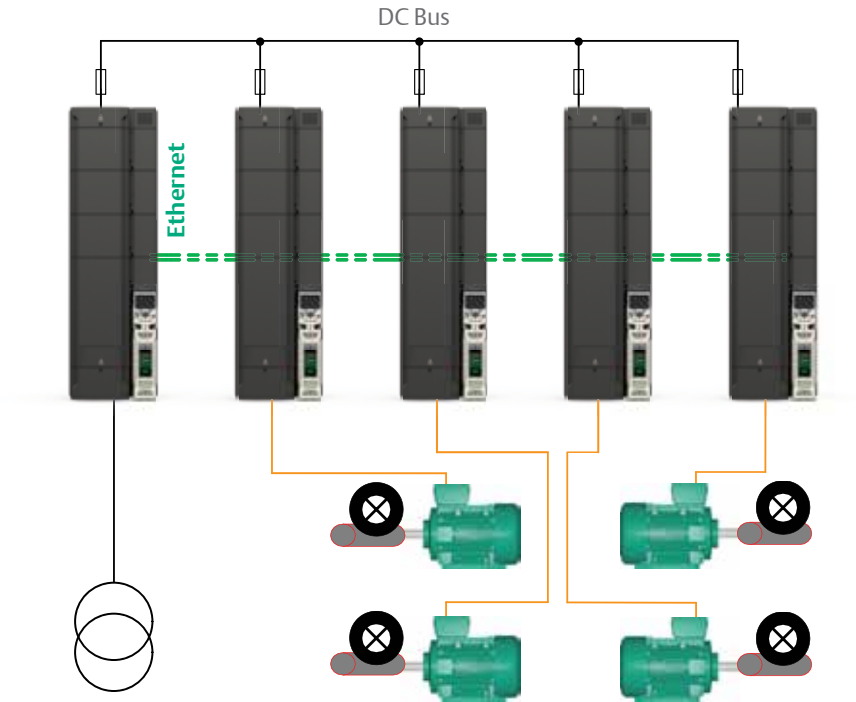
Migration of Unidrive SP modular systems to Unidrive M is fast and easy with many conversion tools available:

- Parameter porting tools such as M Connect and Smartcard are available
- SyptPro can recompile SM-Applications programs for SI-Applications and connect to existing CNet networks
- Identical width and depth dimensions, along with retrofit kits, mean that Unidrive M modules can easily fit into SP modular locations using existing fittings

## Environmental safety and electrical conformance

- UL listed
- Electromagnetic immunity complies with EN 61800-3 and EN 61000-6-2
- Electromagnetic emissions comply with EN 61800-3
  - ⇒ On-board EMC filter, category C3
  - ⇒ Optional external EMC filter, category C2 depending on power rating
  - ⇒ Compliance with EN 61000-3-12 with external line reactor

## Example of a highly demanding automotive test stand application



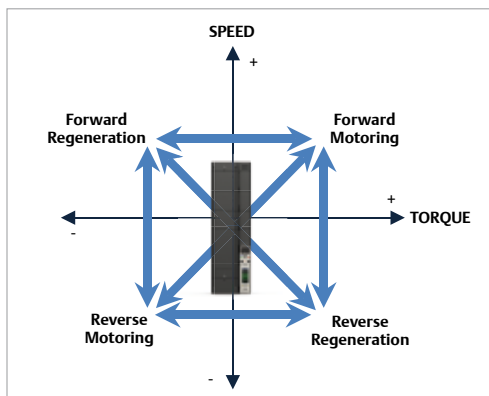
### Create high performance solutions

Unidrive M delivers market leading control performance at high powers with extremely fast current control algorithms, advanced thermal monitoring and high switching frequencies. When Unidrive M power modules are configured with an Active Front End, dynamic torque response can be effectively demanded across all power quadrants.

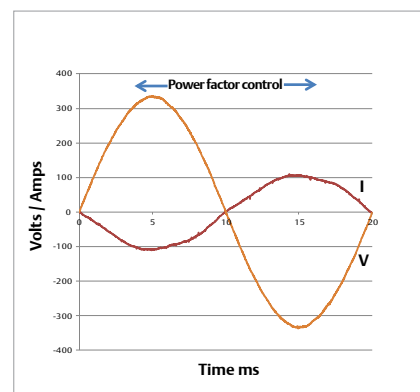
- Switching frequencies of up to 16 kHz in systems up to 160 kW (250 hp) and 8 kHz in systems up to 250 kW (400 hp) allow Unidrive M to provide precision torque. This is effective in demanding applications such as test stands, where our ETPS solution (engine torque pulsation system) can precisely simulate dynamic engine torque profiles.

- Highly accurate thermal model ensures:
  - ⇨ High overload capability – 150% Heavy Duty
  - ⇨ Impressive low derating requirement in applications that demand high torque at low speeds. Power device temperature is intelligently managed meaning smaller lower priced systems can be specified and product life is extended.
- Dynamic Active Front End configurations provide:
  - ⇨ Precision torque linearity across quadrants
  - ⇨ Corrective power factor operation (lagging, unity or leading) for high quality power
  - ⇨ Harmonic mitigation

### Dynamic response across 4 quadrants



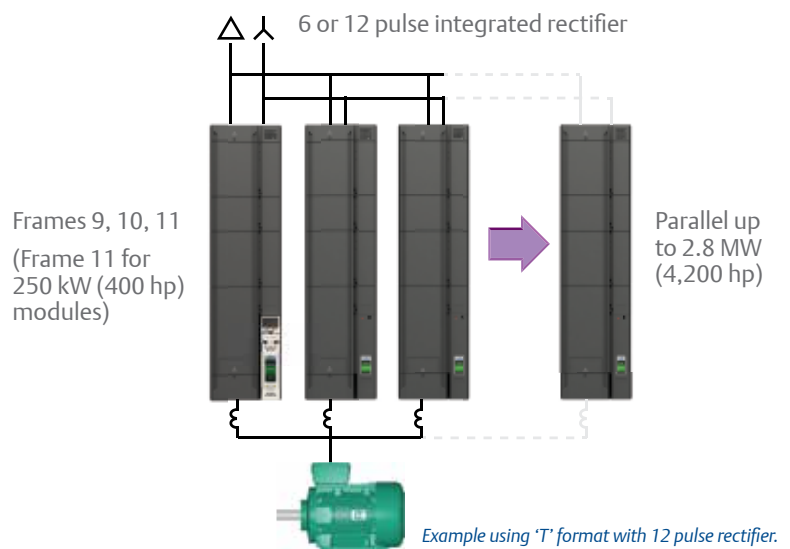
### Superb power quality management



# Module configurations and order information

## 'A', 'E' & 'T' – AC in AC out modules

Unidrive M's AC in AC out modules are available in 3 frame sizes (9, 10, & 11) and comprise an integrated 6 or 12 pulse rectifier with an inverter. 'A', 'E' and 'T' formats can be paralleled together to reach powers of 2.8 MW (4,200 hp) and can be supplied with an optional braking transistor. Frame 9 has an internal choke version that can be paralleled to 1.9 MW (6 pulse only).



The above system is simply configured by ordering:

| Component   | Quantity  | Part number                |
|---|---|----------------------------|
| 'T' format power module (integrated 12 pulse rectifier with inverter) | Quantity of frame 11 modules required is: total power required / 250 kW – derating (see technical manual) | M000-114040640T10100AB100  |
| Control standard  | In systems with only 1 'A' 'E' or 'T' module, use 1 standard control                                      | M700-STANDARD00011100A0100 |
| Control master  | In systems with >1 'A' 'E' or 'T' module, use 1 master control  | M700-MASTER00011100A0100   |
| Control follower  | 1 for each paralleled module (1 less than the total number of modules)                                    | M000-FOLLOWER00011100A0100 |



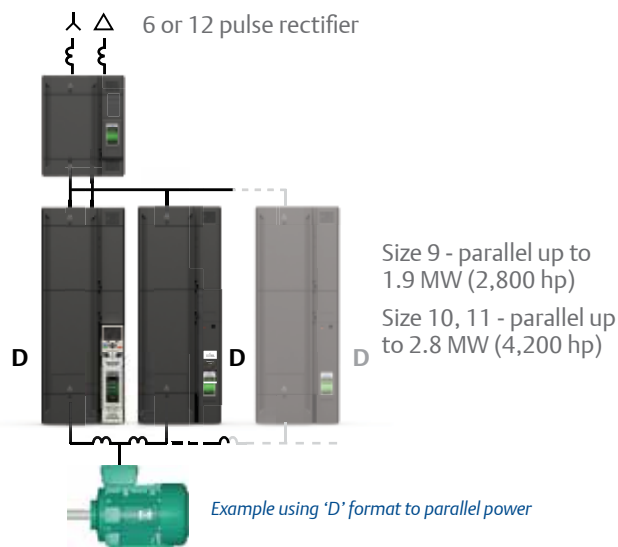


## 'D' – DC in AC out modules with RECT..A and RECT..T Rectifiers

Unidrive M's DC in AC out modules are available in 3 frame sizes (9, 10, & 11) and can be configured as either output or active input stages of a system. 'D' modules can be paralleled together using a common DC bus to reach powers of 2.8 MW (4,200 hp).

RECT..A or RECT..T  
Size 10 or 11  
(depending on power requirement)

'D' inverter  
Size 9, 10 or 11  
(depending on power requirement)

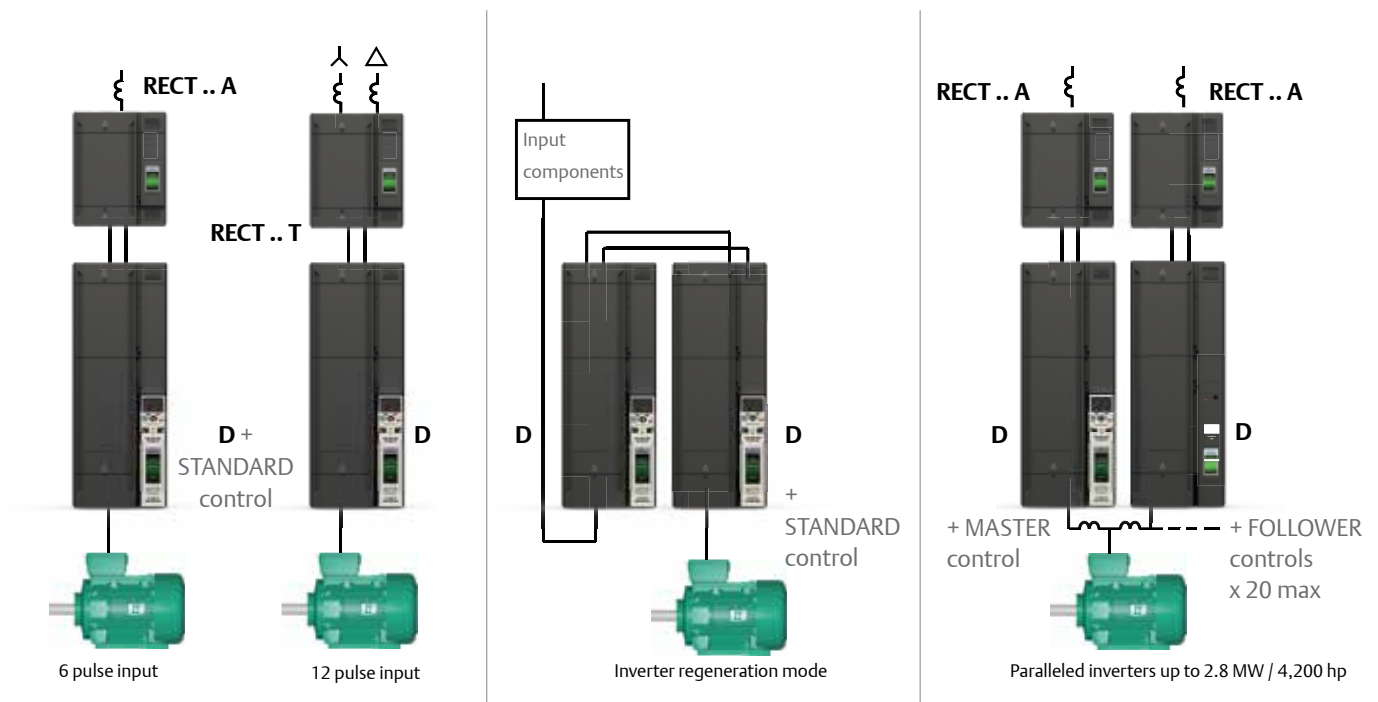


The above system is simply configured by ordering:

| Component  | Quantity   | Part number                |
|--|--|----------------------------|
| Rectifier<br>RECT..A or RECT..T<br>size 10 or 11 depending on power required | 1 (add more as system power increases)                                 | RECT-114042x406T10100AB100 |
| 'D' format inverter module size 9, 10 or 11 depending on power required      | 1 (add more as system power increases)                                 | M000-114040640D10100AB100  |
| Control standard   | In systems with only 1 'D' inverter, use 1 standard control            | M700-STANDARD00011100A0100 |
| Control master   | In systems with >1 'D' inverter, use 1 master control                  | M700-MASTER00011100A0100   |
| Control follower   | 1 for each paralleled module (1 less than the total number of modules) | M000-FOLLOWER00011100A0100 |



## Other flexible configurations with 'D' modules



Frame 9: 90 to 110 kW / 125 to 150 hp HD  
 Frame 10: 132 to 160 kW / 200 to 250 hp HD  
 Frame 11: 185 to 250 kW / 300 to 400 hp HD

## Integrate, automate, communicate with Unidrive M options

Unidrive M drives support a wide range of optional click-in System Integration (SI) modules that allow them to integrate seamlessly with existing automation systems and other vendor supplied equipment. These include communications, I/O, feedback devices, enhanced safety features and onboard PLCs.

| Option                            |   | Description   |
|-----------------------------------|---|---|
| <b>System Integration Modules</b> |   |   |
| MCi200                            |    | Second processor, providing advanced machine control using Engineering Control Studio.  |
| MCi210                            |    | Adds to the MCi200 with a dual port Ethernet interface directly on the processor and additional I/O.  |
| SI-Applications                   |    | Second processor module, which allows SyPTPro application programs to be re-compiled for Unidrive M700.   |
| SI-Safety                         |    | An intelligent, programmable module to meet the IEC 61800-5-2/ISO 13849-1 functional safety standard up to SIL3/PLe.                            |
| SI-Ethernet                       |    | Ethernet module supports EtherNet/IP and Modbus TCP/IP.   |
| SI-EtherCAT                       |    | EtherCAT interface module.  |
| SI-PROFINET RT                    |   | PROFINET RT interface module.   |
| SI-PROFIBUS                       |  | PROFIBUS interface module.  |
| SI-CANopen                        |  | CANopen interface module.   |
| SI-DeviceNet                      |  | DeviceNet interface module.   |
| SI-Universal Encoder              |  | Encoder input and output interface supporting Quadrature, SinCos, HIPERFACE, EnDat and SSI encoders.  |
| SI-Encoder                        |  | Quadrature encoder input interface module.  |
| SI-I/O                            |  | Extended I/O interface module to increase the number of I/O analog and digital points on a drive.   |
| <b>Drive interface units</b>      |   |   |
| Smartcard                         |  | Smartcard memory device to back-up and copy parameter sets and basic PLC programs.  |
| SD Card Adaptor                   |  | Allows an SD card to be inserted into the Smartcard slot, for parameter back-up cloning and application programs.                               |
| KI-485 Adaptor                    |  | Allows the drive to communicate via RS485.  |
| CT USB Comms cable                |  | The USB Comms cable allows the drive's RS485 port to connect to a PC for use with Unidrive M's PC tools.  |
| <b>Keypads</b>                    |   |   |
| KI-Keypad                         |  | Plain text, multilingual LCD keypad with up to 4 lines of text for in depth parameter and data descriptions, for an enhanced user experience.   |
| KI-Keypad RTC                     |  | All the features of the KI-Keypad, but with battery operated real-time clock. This allows accurate time stamping of events, aiding diagnostics. |

# Unidrive M frame sizes and ratings

## MODULAR DRIVES

### INTEGRATED INVERTER & RECTIFIER



| Frame size  |             | 9A                                  | 9E   9T                             | 10E   10T                            | 11E   11T                            |
|---|-------------|-------------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| Frame sizes available                             | M600 → M700 | •                                   | •                                   | •                                    | •                                    |
| Dimensions<br>(H x W x D)                         | mm          | 1108 x 310 x 290                    | 1069 x 310 x 290                    | 1069 x 310 x 290                     | 1242 x 310 x 312                     |
|   | in          | 43.6 x 12.2 x 11.4                  | 42.1 x 12.2 x 11.4                  | 42.1 x 12.2 x 11.4                   | 48.9 x 12.2 x 12.3                   |
| Weight  | kg (lb)     | 66.5 (146.6)                        | 46 (101.4)   60 (132.3)             | 46 (101.4)   60 (132.3)              | 63 (138.9)   65 (143.3)              |
| AC line choke                                     | Internal    | •                                   |                                     |                                      |                                      |
|   | External    |                                     | •                                   | •                                    | •                                    |
| Max continuous heavy<br>duty kW rating / A rating | @ 200 V     | 45 kW – 55 kW<br>(60 hp – 75 hp)    | 45 kW - 55 kW<br>(60 hp - 75 hp)    | 75 kW - 90 kW<br>(100 hp - 125 hp)   | N/A                                  |
|   | @ 400 V     | 90 kW – 110 kW<br>(125 hp - 150 hp) | 90 kW - 110 kW<br>(150hp)           | 132 kW - 160 kW<br>(200 hp - 250 hp) | 185 kW - 250 kW<br>(300 hp - 400 hp) |
|   | @ 575 V     | 75 kW – 90 kW<br>(100 hp - 125 hp)  | 75 kW - 90 kW<br>(100 hp - 125 hp)  | 110 kW - 132 kW<br>(150 hp - 200 hp) | 150 kW - 225 kW<br>(200 hp - 300 hp) |
|   | @ 690 V     | 90 kW – 110 kW<br>(125 hp – 150 hp) | 90 kW - 110 kW<br>(125 hp - 150 hp) | 132 kW - 160 kW<br>(175 hp - 200 hp) | 185 kW - 250 kW<br>(250 hp - 300 hp) |

Modular ratings up to 2.8 MW (4,200 hp) through parallel connected inverters.

## DC-AC INVERTER

## RECTIFIER

### Single or 6 pulse

### Twin or 12 pulse



| 9D                                  | 10D                                  | 11D                                  | 10A                | 11A                | 11T                |
|-------------------------------------|--------------------------------------|--------------------------------------|--------------------|--------------------|--------------------|
| •                                   | •                                    | •                                    |                    |                    |                    |
| 773 x 310 x 290                     | 773 x 310 x 290                      | 863 x 310 x 312                      | 355 x 310 x 290    | 415 x 310 x 290    | 415 x 310 x 290    |
| 30.4 x 12.2 x 11.4                  | 30.4 x 12.2 x 11.4                   | 34 x 12.2 x 12.3                     | 13.9 x 12.2 x 11.4 | 16.3 x 12.2 x 11.4 | 16.3 x 12.2 x 11.4 |
| 34 (75)                             | 34 (75)                              | 42 (92.6)                            | 12 (26.5)          | 21 (46.3)          | 23 (50.7)          |
|                                     |                                      |                                      |                    |                    |                    |
|                                     |                                      |                                      | •                  | •                  | •                  |
| 45 kW - 55 kW<br>(60 hp - 75 hp)    | 75 kW - 90 kW<br>(100 hp - 125 hp)   | N/A                                  | 410 A              | N/A                | N/A                |
| 90 kW - 110 kW<br>(150 hp)          | 132 kW - 160 kW<br>(200 hp - 250 hp) | 185 kW - 250 kW<br>(300 hp - 400 hp) | 452 A              | 684 A              | 2 x 400 A          |
| 75 kW - 90 kW<br>(100 hp - 125 hp)  | 110 kW - 132 kW<br>(150 hp - 200 hp) | 150 kW - 225 kW<br>(200 hp - 300 hp) | 248 A              | 406 A              | 2 x 380 A          |
| 90 kW - 110 kW<br>(125 hp - 150 hp) | 132 kW - 160 kW<br>(175 hp - 200 hp) | 185 kW - 250 kW<br>(250 hp - 300 hp) |                    |                    |                    |

# Hardware selection 90 to 250 kW / 150 to 400 hp

Unidrive M high power AC drives provide market-leading current ratings to maximize system capability

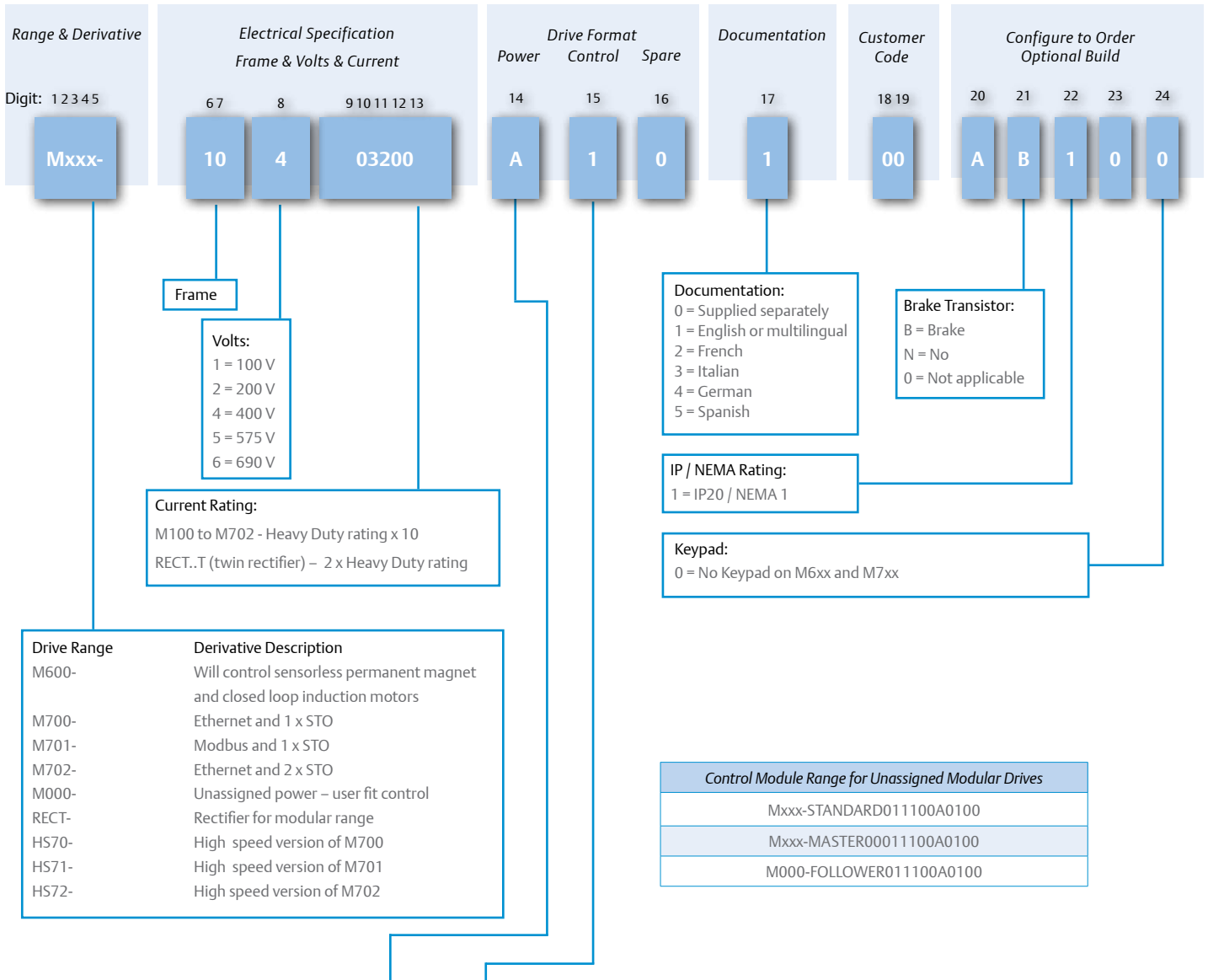
| Vac<br>±10% | M600<br>M700<br>M701<br>M702 | Order Code<br>Frame &<br>Format<br>Identifiers | Heavy Duty               |                         |     |                                   |   | Normal Duty              |                         |     |                   |                              | Rectifier for<br>Modular '..D'<br>Inverters | Input Choke |        | Output Choke |        |
|-------------|------------------------------|--|--------------------------|-------------------------|-----|-----------------------------------|---|--------------------------|-------------------------|-----|-------------------|------------------------------|---|-------------|--------|--------------|--------|
|             |                              |  | I <sub>CONT</sub><br>MAX | Motor<br>Shaft<br>Power |     | I <sub>PEAK</sub><br>Open<br>Loop | I <sub>PEAK</sub><br>Rotor<br>Flux<br>Control | I <sub>CONT</sub><br>MAX | Motor<br>Shaft<br>Power |     | I <sub>PEAK</sub> | RECT-..A/J/T                 |   | Single      | Dual   | Single       | Dual   |
|             |                              |  | A                        | kW                      | hp  | A                                 | A   | A                        | kW                      | hp  | A                 |                              |   |             |        |              |        |
| 200/240     | '-09201760'                  | 09..A/E/T/D                                    | 176                      | 45                      | 60  | 264                               | 308   | 216                      | 55                      | 75  | 238               | '-10204100A'                 | INL401                                      | INL411      | OTL401 | OTL411       |        |
|             | '-09202190'                  | 09..A/E/T/D                                    | 219                      | 55                      | 75  | 328                               | 383   | 266                      | 75                      | 100 | 293               |                              |   |             | OTL402 | OTL412       |        |
|             | '-10202830'                  | 10..E/T/D                                      | 283                      | 75                      | 100 | 424                               | 495   | 325                      | 90                      | 125 | 358               |                              | INL402                                      | INL412      | OTL403 | OTL413       |        |
|             | '-10203000'                  | 10..E/T/D                                      | 300                      | 90                      | 125 | 450                               | 525   | 360                      | 110                     | 150 | 396               |                              |   |             | OTL404 | OTL414       |        |
| 380/480     | '-09402000'                  | 09..A/E/T/D                                    | 200*                     | 90                      | 150 | 300                               | 350   | 221                      | 110                     | 150 | 243               | '-10404520A'                 | INL401                                      | INL411      | OTL401 | OTL411       |        |
|             | '-09402240'                  | 09..A/E/T/D                                    | 224*                     | 110                     | 150 | 336                               | 392   | 266*                     | 132                     | 200 | 293               |                              |   |             | OTL402 | OTL412       |        |
|             | '-10402700'                  | 10..E/T/D                                      | 270                      | 132                     | 200 | 405                               | 472   | 320                      | 160                     | 250 | 352               |                              | INL402                                      | INL412      | OTL403 | OTL413       |        |
|             | '-10403200'                  | 10..E/T/D                                      | 320*                     | 160                     | 250 | 480                               | 560   | 361                      | 200                     | 300 | 397               |                              |   |             | OTL404 | OTL414       |        |
|             | '-11403770'                  | 11..E/T/D                                      | 377*                     | 185                     | 300 | 566                               | 659   | 437*                     | 225                     | 350 | 480               | '-11406840A'                 | INL403L                                     | **          | OTL405 | **           |        |
|             | '-11404170'                  | 11..E/T/D                                      | 417*                     | 200                     | 350 | 626                               | 729   | 487*                     | 250                     | 400 | 535               |                              |   |             | INL403 | **           | OTL407 |
|             | '-11404640'                  | 11..E/T/D                                      | 464*                     | 250                     | 400 | 696                               | 812   | 507*                     | 280                     | 450 | 558               | '-1142X400T'                 | INL403                                      | **          |        |              | OTL407 |
| 500/575     | '-09501040'                  | 09..A/E/T/D                                    | 104                      | 75                      | 100 | 156                               | 182   | 125                      | 110                     | 125 | 138               | '-10502430A'                 | INL601                                      | INL611      | OTL601 | OTL611       |        |
|             | '-09501310'                  | 09..A/E/T/D                                    | 131                      | 90                      | 125 | 196                               | 229   | 150                      | 110                     | 150 | 165               |                              |   |             | OTL602 | OTL612       |        |
|             | '-10501520'                  | 10..E/T/D                                      | 152                      | 110                     | 150 | 228                               | 266   | 200                      | 130                     | 200 | 220               |                              | INL602                                      | INL612      | OTL603 | OTL613       |        |
|             | '-10501900'                  | 10..E/T/D                                      | 190                      | 132                     | 200 | 285                               | 332   | 200                      | 150                     | 200 | 220               |                              |   |             | OTL604 | OTL614       |        |
|             | '-11502000'                  | 11..E/T/D                                      | 200*                     | 150                     | 200 | 300                               | 350   | 248*                     | 185                     | 250 | 273               | '-11503840A'<br>'-1162X380T' | INL603                                      | **          | OTL605 | **           |        |
|             | '-11502540'                  | 11..E/T/D                                      | 254*                     | 185                     | 250 | 381                               | 444   | 288*                     | 225                     | 300 | 317               |                              |   |             | OTL607 | **           |        |
|             | '-11502850'                  | 11..E/T/D                                      | 285*                     | 225                     | 300 | 428                               | 498   | 315*                     | 250                     | 350 | 346               |                              |   |             | OTL607 | **           |        |
| 500/690     | '-09601040'                  | 09..A/E/T/D                                    | 104                      | 90                      | 125 | 156                               | 182   | 125                      | 110                     | 150 | 138               | '-10602480A'                 | INL601                                      | INL611      | OTL601 | OTL611       |        |
|             | '-09601310'                  | 09..A/E/T/D                                    | 131                      | 110                     | 150 | 196                               | 229   | 155                      | 132                     | 175 | 171               |                              |   |             | OTL602 | OTL612       |        |
|             | '-10601500'                  | 10..E/T/D                                      | 150                      | 132                     | 175 | 225                               | 262   | 172                      | 160                     | 200 | 189               |                              | INL602                                      | INL612      | OTL603 | OTL613       |        |
|             | '-10601780'                  | 10..E/T/D                                      | 178                      | 160                     | 200 | 267                               | 311   | 197                      | 185                     | 250 | 217               |                              |   |             | OTL604 | OTL614       |        |
|             | '-11602100'                  | 11..E/T/D                                      | 210*                     | 185                     | 250 | 315                               | 367   | 225*                     | 200                     | 250 | 248               | '-11604060A'<br>'-1162X380T' | INL603                                      | **          | OTL605 | **           |        |
|             | '-11602380'                  | 11..E/T/D                                      | 238*                     | 200                     | 250 | 357                               | 416   | 275*                     | 250                     | 300 | 303               |                              |   |             | OTL607 | **           |        |
|             | '-11602630'                  | 11..E/T/D                                      | 263*                     | 250                     | 300 | 394                               | 460   | 305*                     | 280                     | 400 | 335               |                              |   |             | OTL607 | **           |        |

**Notes:**

\* At F<sub>'switching frequency'</sub> = 2 kHz

\*\* Future release

For paralleling, a 5 % derating should be applied. For ratings at F<sub>'switching frequency'</sub> > 3 kHz (or 2 kHz for F11) refer to User Guide  
Refer to electrical specification of the part number (page 15, digits 6-13)



|       | Power Ident. | Control Ident. | Description   | Frame      | Power Range (Heavy Duty)  | Access to DC bus |
|-------|--------------|----------------|---|------------|---|------------------|
| M000- | A            | U              | Integrated Rectifier and Inverter<br>Internal Line Choke        | 9          | 90 to 110 kW<br>125 to 150 hp<br>Up to 1.9 MW / 2,800 hp<br>in Parallel | Yes              |
|       | E            | U              | Integrated Single Rectifier and Inverter<br>External Line Choke | 09, 10, 11 | 90 to 250 kW<br>125 to 400 hp<br>Up to 2.8 MW / 4,200 hp<br>in Parallel | No               |
|       | T            | U              | Integrated Twin Rectifier and Inverter<br>External Line Choke   |            |   |                  |
|       | D            | U              | DC to AC Inverter   | 09, 10, 11 |   | Yes              |
| RECT- | A            | 1              | AC to DC Single Rectifier                                       | 10, 11     | 90 to 250 kW / 125 to<br>400 hp   | Yes              |
|       | T            | 1              | AC to DC Twin Rectifier   | 10, 11     |   |                  |

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