



SERIES



# EM16

IP 20 / NEMA 1 & IP 66 / NEMA 4X  
COMPACT VECTOR CONTROL DRIVE



**MOTOVARIO®**

HEART OF MOTION

a TECO Group company

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# 1 APPLICATIONS

## GENERAL MULTI-FUNCTION MODEL IP 20/NEMA 1

- Textiles
- Woodworking
- Small Handling Machine
- Simple Metal Processing
- Machine Tools
- Packaging & Labeling
- Food Processing
- Fan & Pumps
- HVAC



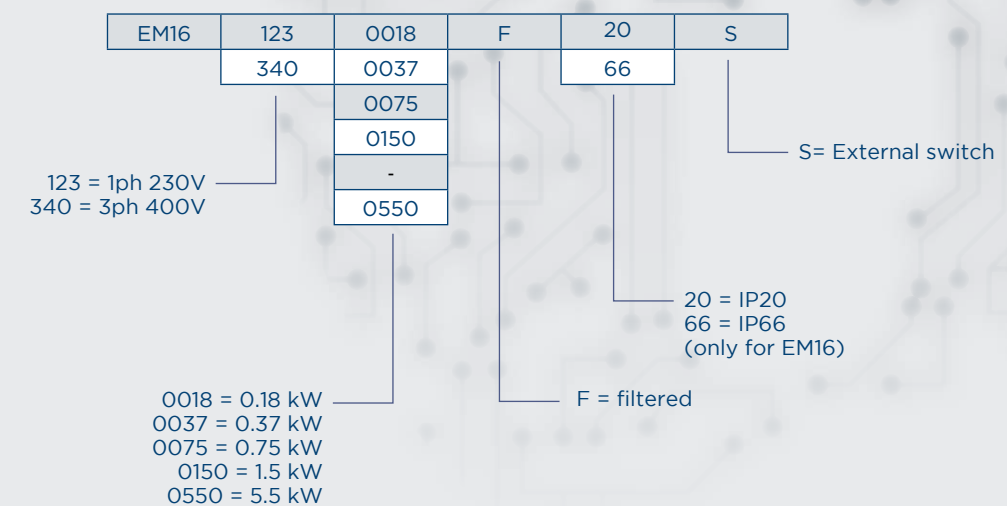
## TOUGH ENCLOSURE MODEL IP 66/NEMA 4X

- Food processing: against washdown environment
- Textiles: against high heat and humid environment, like dyeing process
- Petrochemical industry: against corrosive environment
- Livestock industry: against washdown environment
- Woodworking manufacturing: against dusty environment



Sealed Design High level of waterproof and dustproof

# 2 MODEL IDENTIFICATION



# 3 CAPACITY RANGE

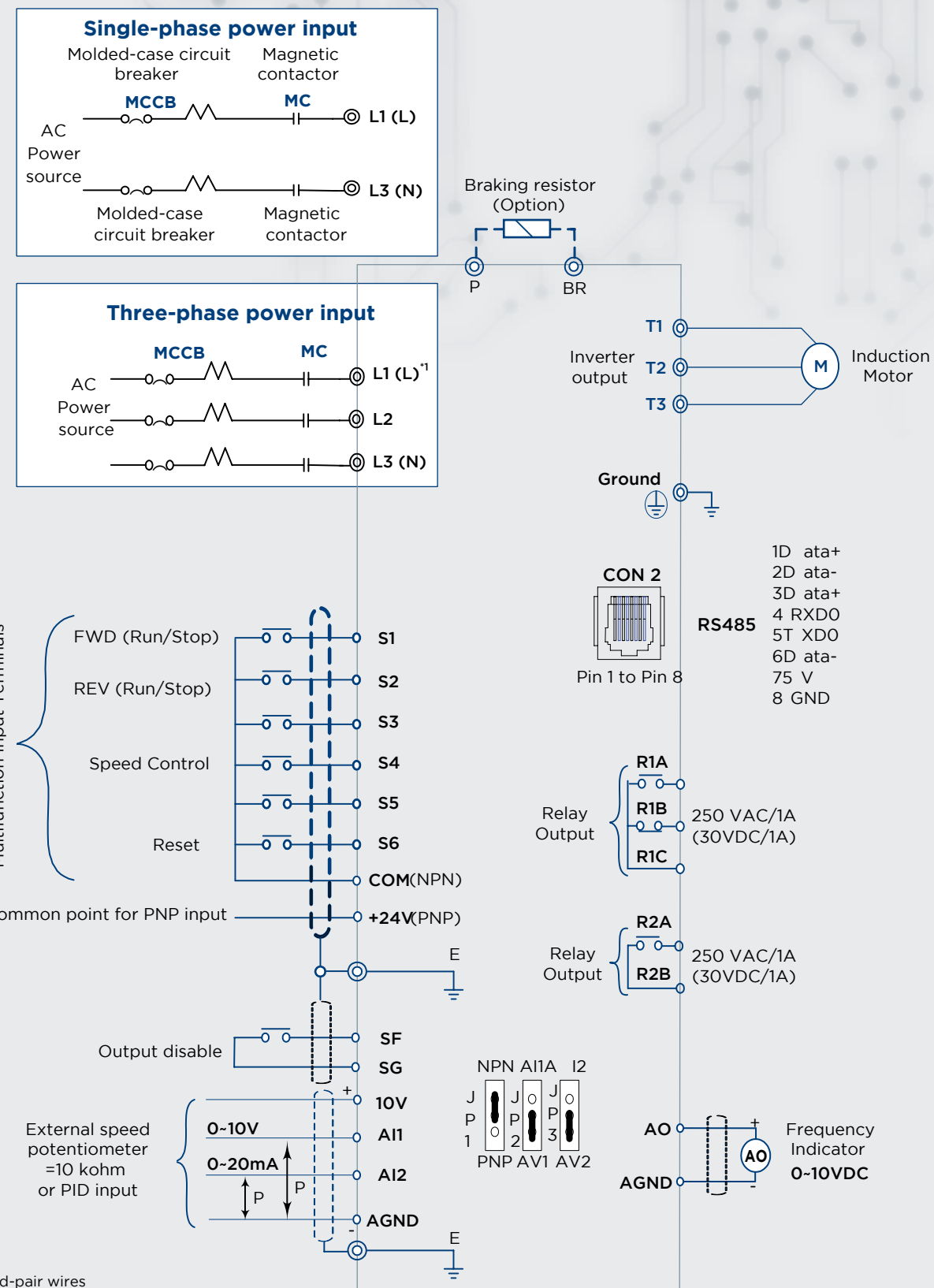
| Power Rating | 0.37kW                       | 0,75kW         | 1.5kW | 2.2kW | 4kW | 5.5kW | 7.5kW | 11kW | 15kW | 18.5kW |
|--------------|------------------------------|----------------|-------|-------|-----|-------|-------|------|------|--------|
| EM16         | 200V 1 - phase (with filter) |                |       |       |     |       |       |      |      |        |
|              |                              | 400V 3 - phase |       |       |     |       |       |      |      |        |

# 4 FEATURES AND BENEFITS

| Features              |                                                                        | Benefit                                                                                                                                             |
|-----------------------|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Capability            | 32 bit RISC Processor with an advanced IGBT power switching technology | Advanced sensorless vector control, providing a powerful starting torque at low frequency with high performance operation at the highest efficiency |
|                       | Output frequency range is 0-650Hz                                      |                                                                                                                                                     |
|                       | Power range:<br>200V 0.37-15kW<br>400V 0.75-18.5kW                     |                                                                                                                                                     |
| H / W Function        | The latest generation of IGBT power module                             | New generation of IPM/ PIM power module can reach higher efficiency of switching and compact design of inverters                                    |
|                       | With 7-segment *5 display panel                                        | Useful for reading information                                                                                                                      |
|                       | Standard built-in VR knob                                              | Directly frequency setting and simple to adjust speed                                                                                               |
|                       | Built-in EMC filter in compliance with IEC/ EN 61800-3 & 61800-5-1     | Lower electromagnetic interference effectively                                                                                                      |
|                       | Fan control (set by parameter)                                         | Fan control is based on the ambient temperature of key components to lower noise and avoid unnecessary energy wasted                                |
| S / W Function        | Soft-PWM modulation                                                    | Reduce audible motor noise at low carrier frequency                                                                                                 |
|                       | Integrated safety stop and fire mode functions                         | Provide advanced application functions under the circumstance of emergency or fire                                                                  |
|                       | Auto carrier frequency switching                                       | Built-in sensors detection on operation temperature to avoid the probability of inverter tripping in too high temperature.                          |
|                       | Built-in PID controller                                                | Provide constant control requirements of frequency, pressure, flow, air volume in applications, such as HVAC                                        |
|                       | Built-in PLC function                                                  | Simple process control to save the cost of external PLC                                                                                             |
| Expansion Flexibility | Built-in Modbus Communication (RS485)                                  | Fast parameters copying to reduce time of installation, maintenance and replacement                                                                 |
|                       | PC-software/ Copy unit                                                 |                                                                                                                                                     |
| Quality               | External cooling heatsink                                              | Reduce the possibility of unknown objects entering to avoid damaging components and improve product reliability                                     |

# 5 WIRING DIAGRAM

## SINGLE-PHASE / THREE-PHASE



Shield wires

Shielded twisted-pair wires

\*1: Power input terminal is L1, L2, L3 in models of 200V 7.5HP-20HP/ 400V 7.5HP-25HP.

# 6 GENERAL SPECIFICATIONS

| Item                  |                                                               | EM16                                                                                                                                                                                                                  |
|-----------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control Mode          |                                                               | V / F Control, Vector Control                                                                                                                                                                                         |
| Frequency             | Output Frequency                                              | 0.01-599.00Hz                                                                                                                                                                                                         |
|                       | Starting Torque                                               | 150% / 3Hz (V/F) - 150% / 1Hz (Vector)                                                                                                                                                                                |
|                       | Speed Control Ratio                                           | 1:50                                                                                                                                                                                                                  |
|                       | Setting Resolution                                            | Digital input: 0.01Hz                                                                                                                                                                                                 |
|                       |                                                               | Analog input: 0.06Hz / 60Hz                                                                                                                                                                                           |
|                       | Setting                                                       | Keypad: Set directly with ▲▼ keys or the VR on the keypad                                                                                                                                                             |
|                       |                                                               | External Input Terminlas:<br>AI1(0/2-10V), AI2(0/4-20mA)input<br>Multifunction input up/down function(Group3)                                                                                                         |
|                       |                                                               | Setting frequency by communication method                                                                                                                                                                             |
| Frequency Limit       | Lower and upper frequency limits<br>3 jump frequency settings |                                                                                                                                                                                                                       |
| Run                   | Operation Set                                                 | Keypad run, stop button                                                                                                                                                                                               |
|                       |                                                               | External terminals:<br>Multi-function operation mode (2 or 3 wire selection)<br>Jog operation                                                                                                                         |
|                       |                                                               | Run signal by communication method                                                                                                                                                                                    |
| Main Control Features | V/F Curve Setting                                             | 18 fixed curves and one customized curve                                                                                                                                                                              |
|                       | Carrier Frequency                                             | 1-16KHz                                                                                                                                                                                                               |
|                       | Acceleration and Deceleration Control                         | 2 sections of acceleration / deceleration time setting (0.1-3600.0 Sec.)<br>4 sections of S curve setting                                                                                                             |
|                       | Multifunction Input                                           | 29 functions (refer to group 3 in the manual)                                                                                                                                                                         |
|                       | Multifunction Output                                          | 21 functions (refer to group 3 in the manual)                                                                                                                                                                         |
|                       | Multifunction Analog Output                                   | 5 functions (refer to group 4 in the manual)                                                                                                                                                                          |
|                       | Main Features                                                 | Overload Detection, 16 preset speeds, Auto-run, Acc/Dec Switch, Main/Alt Run Command Select, Main/Alt Frequency Command Select, PID control, Torque Compensation, V/F Start Frequency, Slip Compensation, Fault Reset |

# 6 GENERAL SPECIFICATIONS

| Item                                |                               | EM16                                                                                                                                                                                                                    |
|-------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Display                             | LED                           | Display: parameter / parameter value / frequency / line speed / DC voltage / output voltage / output current / PID feedback / input and output terminal status / Heat sink temperature / Program version / Fault Log    |
|                                     | LED Status Indicator          | Run / Stop / Forward / Reverse and etc.                                                                                                                                                                                 |
| Protective Functions                | Overload Protection           | The relays to protect the motor and the inverter (150% / 1min)                                                                                                                                                          |
|                                     | Over Voltage                  | 200V class: >410V - 400V class: >820V                                                                                                                                                                                   |
|                                     | Under Voltage                 | 200V class: <190V - 400V class: <380V                                                                                                                                                                                   |
|                                     | Momentary Power Loss Restart  | Inverter auto-restart after a momentary power loss                                                                                                                                                                      |
|                                     | Stall Prevention              | Stall prevention for Acceleration/ Deceleration/ Operation                                                                                                                                                              |
|                                     | Short-circuit Output Terminal | Electronic Circuit Protection                                                                                                                                                                                           |
|                                     | Grounding Fault               | Electronic Circuit Protection                                                                                                                                                                                           |
|                                     | Other Protection Functions    | Protection for overheating of heat sink, the carrier frequency decreasing with the temperature function, fault output, reverse prohibit, prohibit for direct start after power up and error recovery, parameter lock up |
| All frames include brake transistor |                               |                                                                                                                                                                                                                         |
| Communication control               |                               | Standard built-in RS485 communication (Modbus), One to one or One to many control                                                                                                                                       |
| Environment                         | Operating temperature         | IP 20 / NEMA 1:<br>-10-50°C (without dustproof paster) / -10-40°C (with dustproof paster)<br>IP 66 / NEMA 4X: -10-50°C                                                                                                  |
|                                     | Storage temperature           | -20-60°C                                                                                                                                                                                                                |
|                                     | Humidity                      | 95% RH or less (no condensation) (Compliance with IEC 60068 - 2-78)                                                                                                                                                     |
|                                     | Shock                         | 1.0G, in compliance with IEC 60068-2-6                                                                                                                                                                                  |
|                                     | Enclosure                     | IP 20 / NEMA 1 and IP 66 / NEMA 4X                                                                                                                                                                                      |

## 7

## BASIC SPECIFICATIONS

## IP 20 / NEMA 1

| Single-phase                               |                                 |      |      |      |
|--------------------------------------------|---------------------------------|------|------|------|
| Model                                      | EM16 - 123 - .... - F-20        |      |      |      |
|                                            | 0037                            | 0075 | 0150 | 0220 |
| Suitable Motor Capacity (kW)               | 0.37                            | 0.75 | 1.5  | 2.2  |
| Rated Output Current (A)                   | 3.1                             | 4.5  | 7.5  | 10.5 |
| Rated Capacity (kVA)                       | 1.2                             | 1.7  | 2.9  | 4.0  |
| Input Voltage Range (V)                    | Single-phase 200-240V - 50/60HZ |      |      |      |
| Allowable Voltage Fluctuation              | -15%~+10%                       |      |      |      |
| Output Voltage Range (V)                   | Three-phase 0-240V              |      |      |      |
| Input Current (A)                          | 8.5                             | 12   | 16   | 23.9 |
| Allowable Momentary Power Loss Time (Sec.) | 2.0                             |      | 2.0  |      |
| Enclosure                                  | IP 20 / NEMA 1                  |      |      |      |
| Frame Size                                 | 1                               |      | 2    |      |

## IP 20 / NEMA 1

| Three-phase                                |                                |      |      |      |      |      |      |      |      |
|--------------------------------------------|--------------------------------|------|------|------|------|------|------|------|------|
| Model                                      | EM16 - 340 - .... - F-20-S     |      |      |      |      |      |      |      |      |
|                                            | 0075                           | 0150 | 0220 | 0400 | 0550 | 0750 | 1100 | 1500 | 1850 |
| Suitable Motor Capacity (kW)               | 0.75                           | 1.5  | 2.2  | 4.0  | 5.5  | 7.5  | 11   | 15   | 18.5 |
| Rated Output Current (A)                   | 2.3                            | 3.8  | 5.2  | 8.8  | 13.0 | 17.5 | 24   | 32   | 40   |
| Rated Capacity (kVA)                       | 1.7                            | 2.9  | 4.0  | 6.7  | 9.9  | 13.3 | 19.1 | 24   | 30.5 |
| Input Voltage Range (V)                    | Three-phase 380-480V - 50/60HZ |      |      |      |      |      |      |      |      |
| Allowable Voltage Fluctuation              | -15%~+10%                      |      |      |      |      |      |      |      |      |
| Output Voltage Range (V)                   | Three-phase 0-480V             |      |      |      |      |      |      |      |      |
| Input Current (A)                          | 4.2                            | 5.6  | 7.3  | 11.6 | 17   | 23   | 31   | 38   | 48   |
| Allowable Momentary Power Loss Time (Sec.) | 2.0                            |      | 2.0  |      | 2.0  |      |      |      |      |
| Enclosure                                  | IP 20 / NEMA 1                 |      |      |      |      |      |      |      |      |
| Frame Size                                 | 1                              |      | 2    |      | 3    |      |      | 4    |      |

## 7

## BASIC SPECIFICATIONS

## IP 66 / NEMA 4X

| Single-phase                               |                                 |      |      |      |
|--------------------------------------------|---------------------------------|------|------|------|
| Model                                      | EM16 - 123 - .... - F-66        |      |      |      |
|                                            | 0037                            | 0075 | 0150 | 0220 |
| Suitable Motor Capacity (kW)               | 0.37                            | 0.75 | 1.5  | 2.2  |
| Rated Output Current (A)                   | 3.1                             | 4.5  | 7.5  | 10.5 |
| Rated Capacity (kVA)                       | 1.2                             | 1.7  | 2.9  | 4.0  |
| Input Voltage Range (V)                    | Single-phase 200-240V - 50/60HZ |      |      |      |
| Allowable Voltage Fluctuation              | -15%~+10%                       |      |      |      |
| Output Voltage Range (V)                   | Three-phase 0-240V              |      |      |      |
| Input Current (A)                          | 8.5                             | 12   | 16   | 23.9 |
| Allowable Momentary Power Loss Time (Sec.) | 2.0                             |      | 2.0  |      |
| Enclosure                                  | IP 66 / NEMA 4X                 |      |      |      |
| Frame Size                                 | 1                               |      | 2    |      |

## IP 66 / NEMA 4X

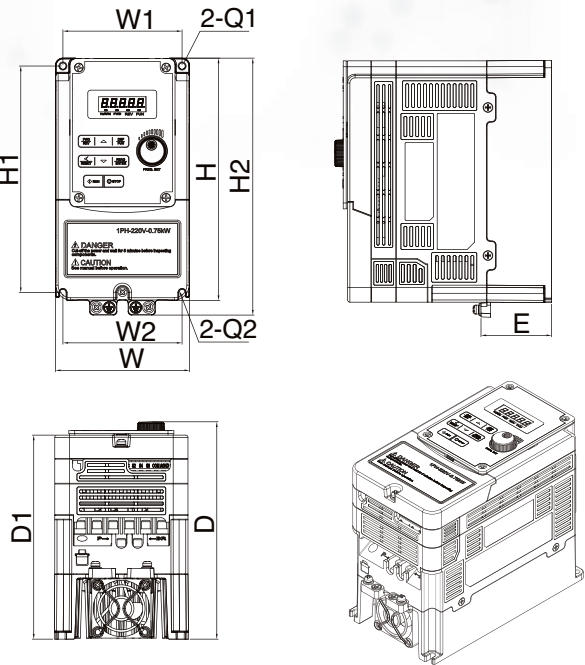
| Three-phase                                |                                |      |      |      |      |      |      |      |      |
|--------------------------------------------|--------------------------------|------|------|------|------|------|------|------|------|
| Model                                      | EM16 - 340 - .... - F-66-S     |      |      |      |      |      |      |      |      |
|                                            | 0075                           | 0150 | 0220 | 0400 | 0550 | 0750 | 1100 | 1500 | 1850 |
| Suitable Motor Capacity (kW)               | 0.75                           | 1.5  | 2.2  | 4.0  | 5.5  | 7.5  | 11   | 15   | 18.5 |
| Rated Output Current (A)                   | 2.3                            | 3.8  | 5.2  | 8.8  | 13.0 | 17.5 | 24   | 32   | 40   |
| Rated Capacity (kVA)                       | 1.7                            | 2.9  | 4.0  | 6.7  | 9.9  | 13.3 | 19.1 | 24   | 30.5 |
| Input Voltage Range (V)                    | Three-phase 380-480V - 50/60HZ |      |      |      |      |      |      |      |      |
| Allowable Voltage Fluctuation              | -15%~+10%                      |      |      |      |      |      |      |      |      |
| Output Voltage Range (V)                   | Three-phase 0-480V             |      |      |      |      |      |      |      |      |
| Input Current (A)                          | 4.2                            | 5.6  | 7.3  | 11.6 | 17   | 23   | 31   | 38   | 48   |
| Allowable Momentary Power Loss Time (Sec.) | 2.0                            |      | 2.0  |      | 2.0  |      |      |      |      |
| Enclosure                                  | IP 66 / NEMA 4X                |      |      |      |      |      |      |      |      |
| Frame Size                                 | 1                              |      | 2    |      |      | 3    |      |      |      |

# 8 DIMENSIONS

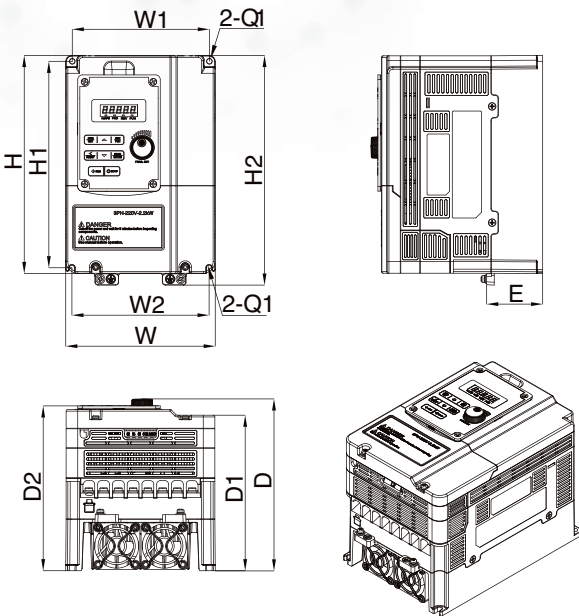
IP 20 / NEMA 1

|         |       |      |      |       |       |       |       |       | Unit: mm |      |     |     |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|------|-----|-----|
| Frame   | W     | W1   | W2   | H     | H1    | H2    | D     | D1    | D2       | E    | Q1  | Q2  |
| Frame 1 | 90.6  | 80.5 | 80.5 | 163.6 | 153   | 173.5 | 149   | 137.8 | -        | 48   | 4.3 | 4.3 |
| Frame 2 | 128.7 | 118  | 118  | 187.6 | 177.6 | 197.5 | 150   | 133.8 | 141.8    | 48.2 | 4.5 | 4.5 |
| Frame 3 | 186.9 | 175  | 176  | 260.9 | 249.8 | 273   | 184   | 90.6  | 189      | 76.7 | 4.5 | 4.5 |
| Frame 4 | 224.6 | 207  | 207  | 321.6 | 303.5 | 330.9 | 200.7 | 187.5 | 192.5    | 94   | 6   | 6   |

FRAME 1 (weight: 1.7 Kg)



FRAME 2 (weight: 2.5 Kg)

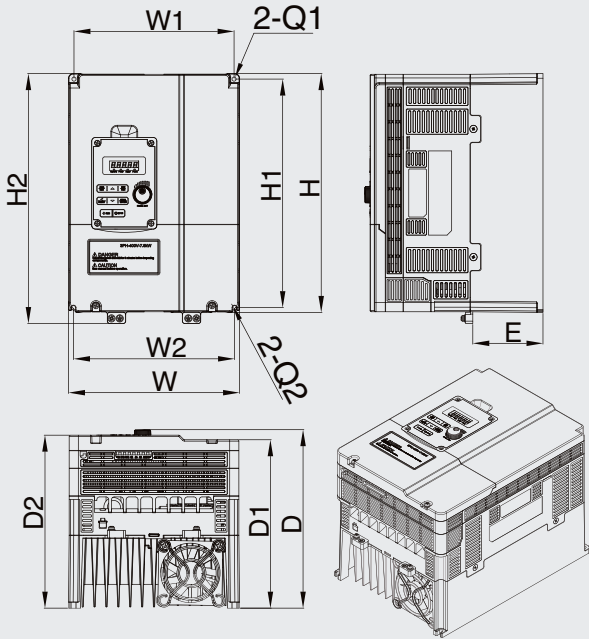


# 8 DIMENSIONS

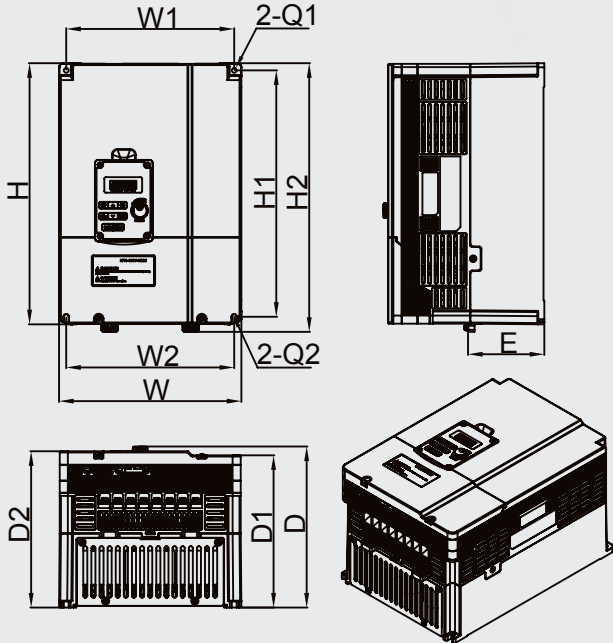
IP 20 / NEMA 1

|         |       |      |      |       |       |       |       |       | Unit: mm |      |     |     |
|---------|-------|------|------|-------|-------|-------|-------|-------|----------|------|-----|-----|
| Frame   | W     | W1   | W2   | H     | H1    | H2    | D     | D1    | D2       | E    | Q1  | Q2  |
| Frame 1 | 90.6  | 80.5 | 80.5 | 163.6 | 153   | 173.5 | 149   | 137.8 | -        | 48   | 4.3 | 4.3 |
| Frame 2 | 128.7 | 118  | 118  | 187.6 | 177.6 | 197.5 | 150   | 133.8 | 141.8    | 48.2 | 4.5 | 4.5 |
| Frame 3 | 186.9 | 175  | 176  | 260.9 | 249.8 | 273   | 184   | 90.6  | 189      | 76.7 | 4.5 | 4.5 |
| Frame 4 | 224.6 | 207  | 207  | 321.6 | 303.5 | 330.9 | 200.7 | 187.5 | 192.5    | 94   | 6   | 6   |

FRAME 3 (weight: 6.5 Kg)



FRAME 4 (weight: 10.5 Kg)

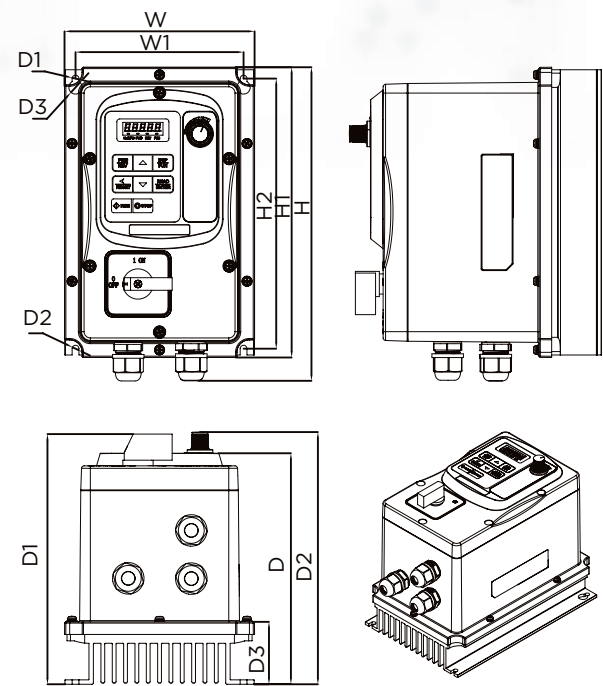


# 8 DIMENSIONS

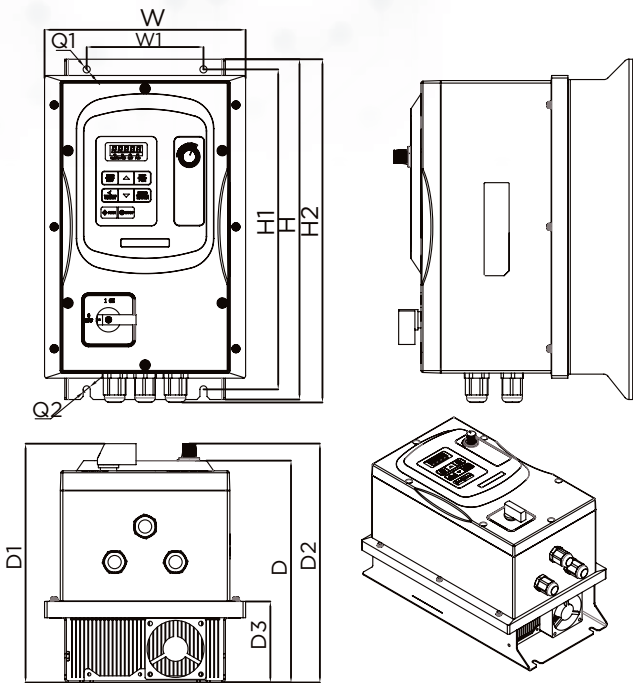
IP 66 / NEMA 4X

| Unit: mm |       |       |       |       |       |       |       |       |      |     |     |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-----|-----|-------|
| Frame    | W     | W1    | H     | H1    | H2    | D     | D1    | D2    | D3   | Q1  | Q2  | Q3    |
| Frame 1  | 150.8 | 133.3 | 248.7 | 230.2 | 214.2 | 183   | 200   | 200   | 49.5 | 5.4 | 5.4 | 10.6  |
| Frame 2  | 198   | 115   | 337.9 | 335   | 315   | 218.4 | 235.2 | 235.2 | 79.8 | 7   | 7   | 5.98  |
| Frame 3  | 222.8 | 140   | 466.3 | 460   | 440   | 246.6 | 266.5 | 263.5 | 96   | 7   | 7   | 12.68 |

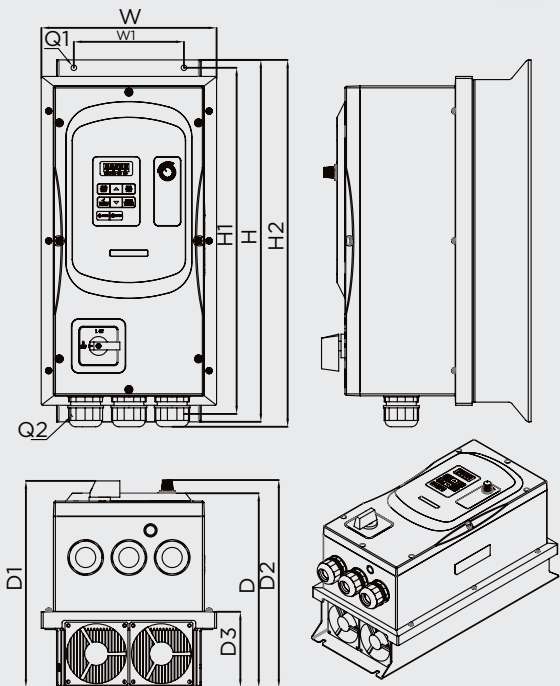
FRAME 1 (weight: 2.9 Kg)



FRAME 2 (weight: 5.98 Kg)



FRAME 3 (weight: 12.68 Kg)



# 8 DIMENSIONS

IP 20 / NEMA 1 (WITHOUT FILTER SERIES)

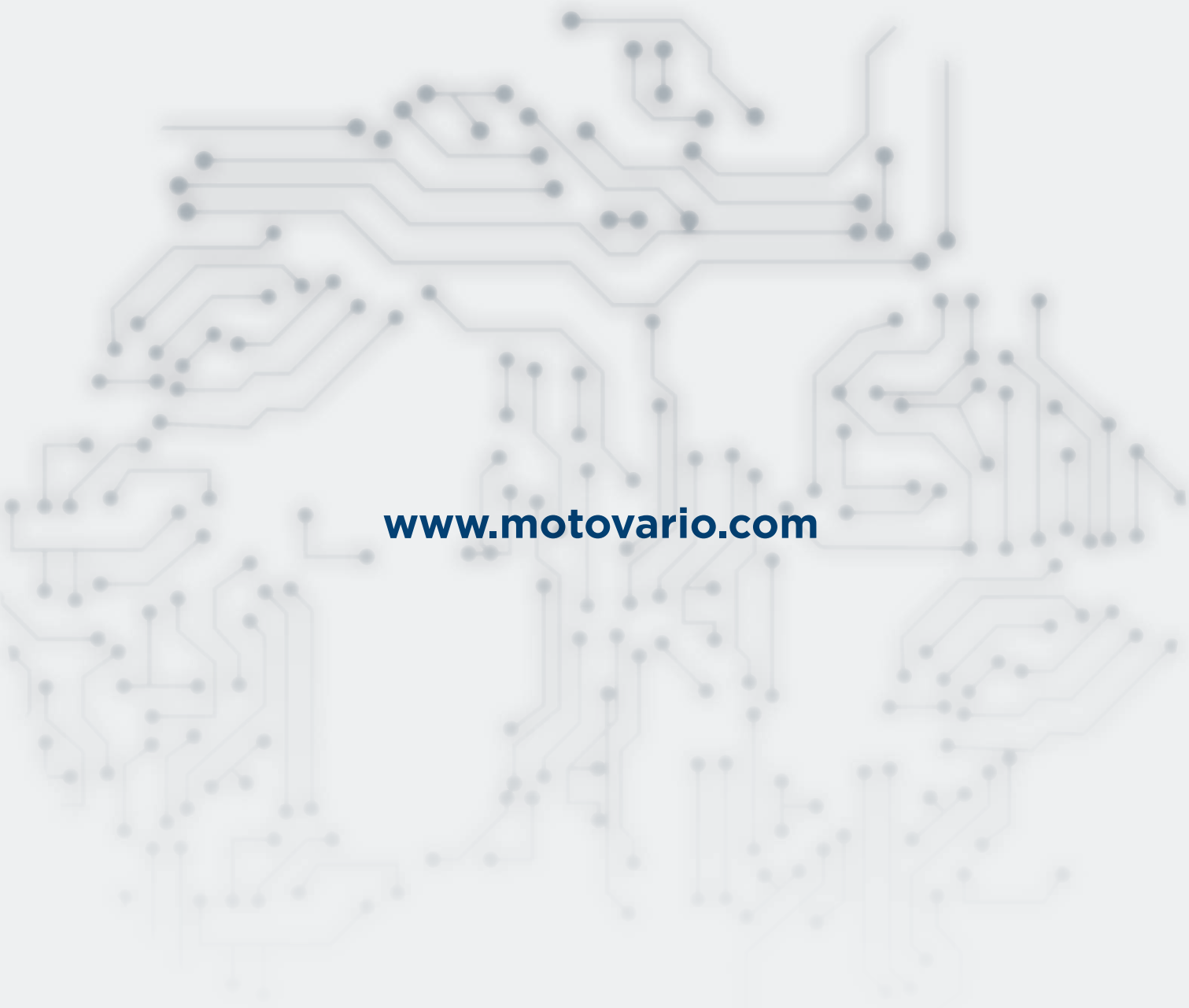
| Unit: mm |       |       |       |       |       |       |       |       |      |     |     |       |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|------|-----|-----|-------|
| Frame    | W     | W1    | H     | H1    | H2    | D     | D1    | D2    | D3   | Q1  | Q2  | Q3    |
| Frame 1  | 150.8 | 133.3 | 248.7 | 230.2 | 214.2 | 183   | 200   | 200   | 49.5 | 5.4 | 5.4 | 10.6  |
| Frame 2  | 198   | 115   | 337.9 | 335   | 315   | 218.4 | 235.2 | 235.2 | 79.8 | 7   | 7   | 5.98  |
| Frame 3  | 222.8 | 140   | 466.3 | 460   | 440   | 246.6 | 266.5 | 263.5 | 96   | 7   | 7   | 12.68 |

## 9 ACCESSORIES

| Accessories                  | Model        | Function                                                                                                                                            | Notes            |
|------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Keypad extension cable       | JN5-CB-01M   | Keypad extension cable for M16 series                                                                                                               | 1 m              |
|                              | JN5-CB-02M   |                                                                                                                                                     | 2 m              |
|                              | JN5-CB-03M   |                                                                                                                                                     | 3 m              |
|                              | JN5-CB-05M   |                                                                                                                                                     | 5 m              |
| NEMA Kits                    | JN5-NK-E01   | Mechanical device consisting of anti-dust cover on the upper part and wiring box on the bottom to meet NEMA 1                                       | Only for frame 1 |
|                              | JN5-NK-E02   |                                                                                                                                                     | Only for frame 2 |
|                              | JN5-NK-E03   |                                                                                                                                                     | Only for frame 3 |
|                              | JN5-NK-E04   |                                                                                                                                                     | Only for frame 4 |
| Copy module                  | JN5-CU       | 1. Duplicating parameters setting in one inverter to another inverter<br>2. As a remote keypad to be used<br>3. Using RJ45 line to connect inverter |                  |
| Communication modules        | JN5-CM-PDP   | For connection of Profibus-DP communication protocol                                                                                                | For M16 series   |
|                              | JN5-CM-TCPIP | For connection of TCP-IP communication protocol                                                                                                     |                  |
|                              | JN5-CM-DNET  | For connection of DeviceNet communication protocol                                                                                                  |                  |
|                              | JN5-CM-CAN   | For connection of CANopen communication protocol                                                                                                    |                  |
| RJ45 to USB connection cable | JN5-CM-USB   | Using the MOTOVARIO exclusive PC-software line                                                                                                      | 1.8 m            |

## NOTES





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