

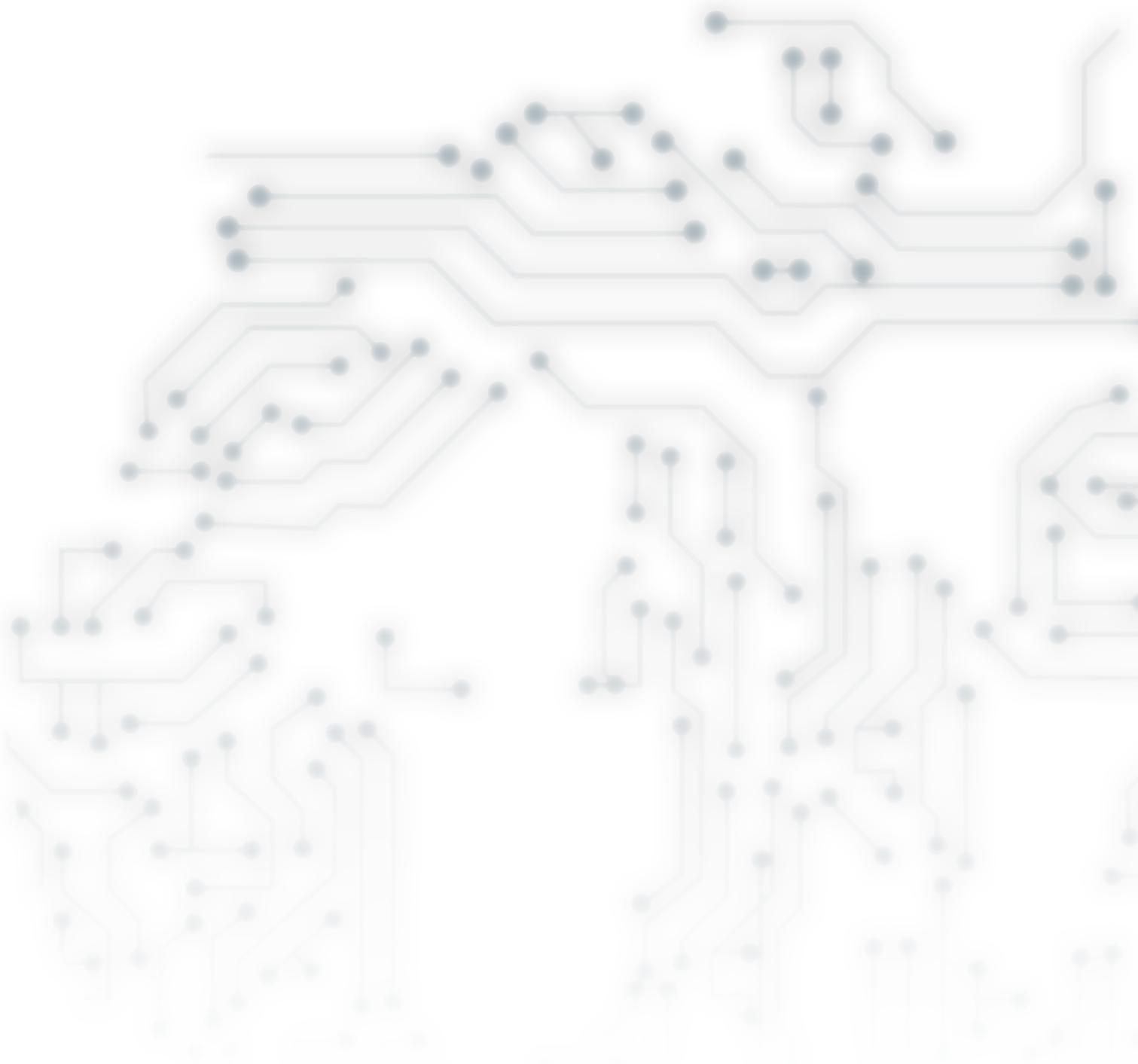


EM16

STANDARD DRIVE
SENSORLESS VECTOR
CONTROL



MOTOVARIO®
HEART OF MOTION
a TECO Group company





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INTRODUCTION

The EM16 inverter series is dedicated to the control of squirrel-cage three-phase asynchronous motors and is available both with single-phase and three-phase power supply. Compact, robust and versatile, the EM16 is equipped with a high performance sensorless vector control that allows for a dynamic management of the motor useful for many industrial applications.

The EM16 series is available with both IP20 and IP66 protection rating and is provided with a standard integrated Modbus communication interface in all versions.

The whole series is equipped with integrated EMC filter that complies with class C2.

All versions feature integrated PLC functions and Ladder language programming mode fully complying with standard IEC61131. Thanks to the standard integrated braking unit equipped on all units, the EM16 allows managing the motor also during braking through the use of optional braking resistors.

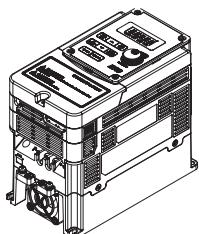


1

INTRODUCTION

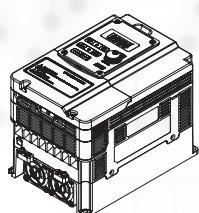
The different power ratings are distributed throughout four mechanical sizes and two possible housing versions: IP20 for installation inside the electric panel and IP66 for installation on board the machine.

Size 1



0,37 - 0,75 kW

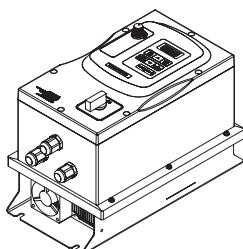
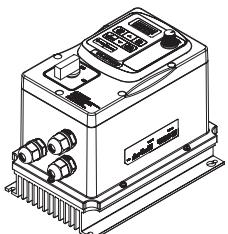
Size 2



1,5 - 2,2 kW

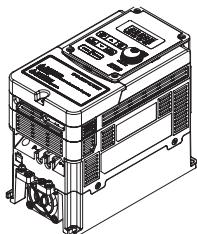
IP20/NEMA1

SINGLE-PHASE
230V



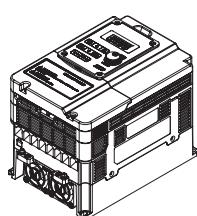
IP66/NEMA4

Size 1



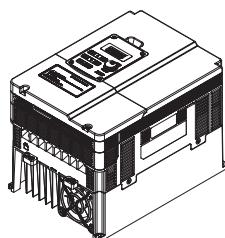
0,75 - 1,5 kW

Size 2



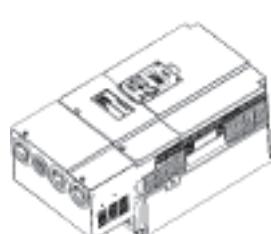
2,2 - 4,0 kW

Size 3



5,5 - 7,5 - 11 kW

Size 4

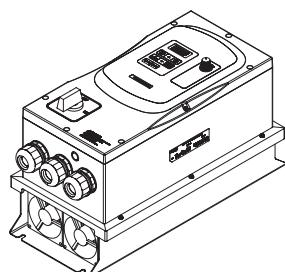
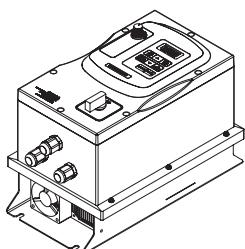
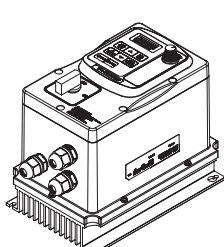


15 - 18,5 kW

IP20/NEMA1

THREE-PHASE
400V

IP66/NEMA4



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FIELDS OF APPLICATION

IP 20 / NEMA 1 VERSION

- TEXTILE INDUSTRY
- WOODWORKING
- GOODS HANDLING
- METAL PROCESSING
- MACHINE TOOLS
- PACKAGING AND LABELLING
- FOOD PROCESSING
- FANS AND PUMPS



IP 66 / NEMA 4 VERSION

- TEXTILE INDUSTRY:
protection against environments subject to high temperatures and humidity, such as dyeing process.
- WOODWORKING:
protection against dusty environments.
- FOOD PROCESSING:
protection against environments subject to washing.
- PETROCHEMICAL INDUSTRY:
protection against corrosive environments.
- LIVESTOCK INDUSTRY:
protection against environments subject to washing.

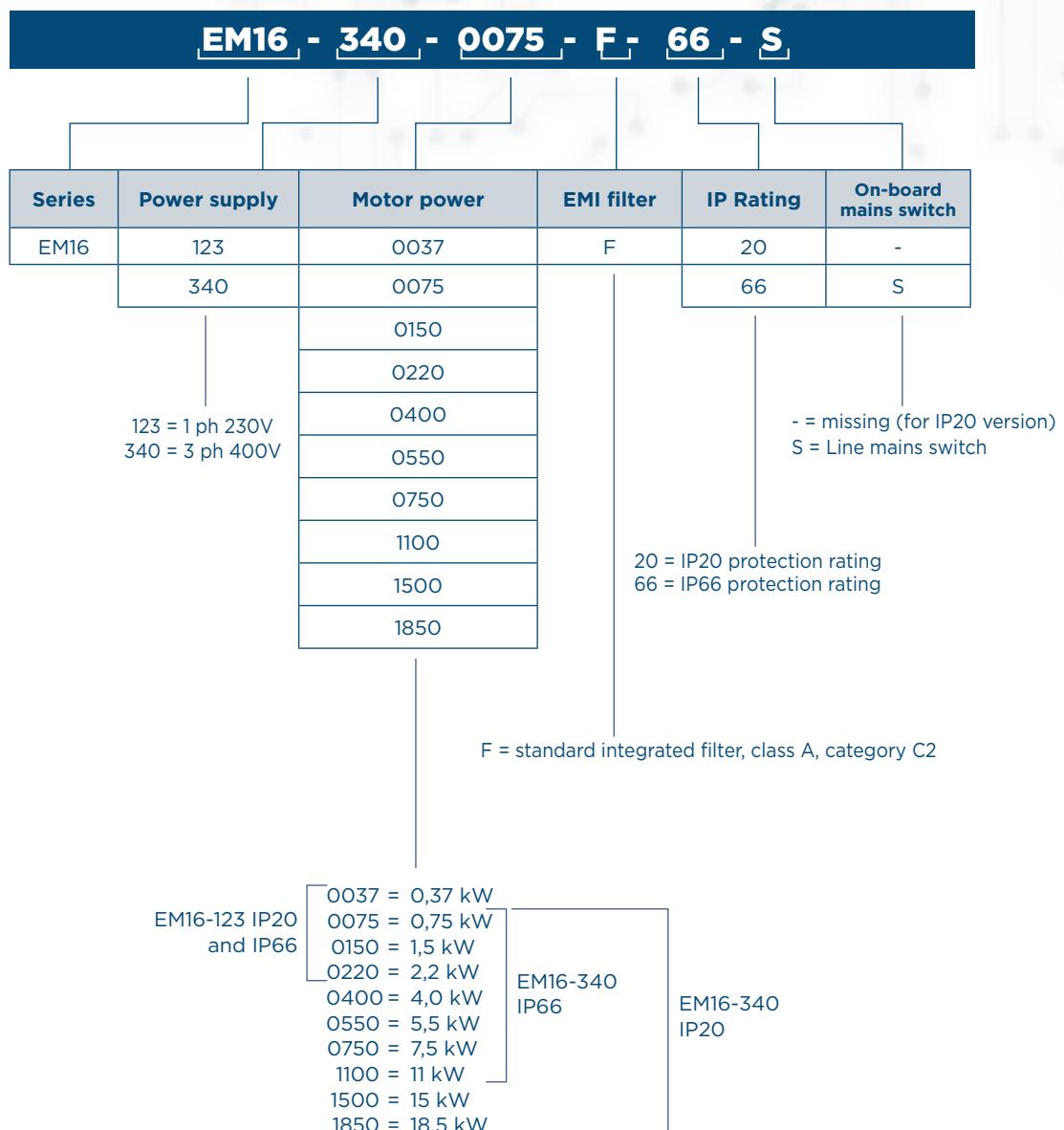


3

DESIGNATION

The designation string defines the inverter identification rules for a correct selection of its main structural features.

It consists of an ordered sequence of alpha-numerical values according to what listed in the diagram below:



4 PRODUCT OFFER

Coherently with the previous designation structure, the EM16 series will be completely described in the following table which lists all possible product configurations:

Inverter	Power supply	Power (kW)	EMI filter	IP Rating	Mains switch
EM16-123-0037-F-20	1ph 230V	0,37	Integrated	20	-
EM16-123-0075-F-20		0,75			-
EM16-123-0150-F-20		1,5			-
EM16-123-0220-F-20		2,2			-
EM16-340-0075-F-20		0,75			-
EM16-340-0150-F-20		1,5			-
EM16-340-0220-F-20		2,2			-
EM16-340-0400-F-20		4			-
EM16-340-0550-F-20		5,5			-
EM16-340-0750-F-20		7,5			-
EM16-340-1100-F-20	3ph 400V	11	Integrated	66	-
EM16-340-1500-F-20		15			-
EM16-340-1850-F-20		18,5			-
EM16-123-0037-F-66-S	1ph 230V	0,37	Integrated	66	Integrated
EM16-123-0075-F-66-S		0,75			
EM16-123-0150-F-66-S		1,5			
EM16-123-0266-S-F-66-S		2,2			
EM16-340-0075-F-66-S	3ph 400V	0,75			
EM16-340-0150-F-66-S		1,5			
EM16-340-0266-S-F-66-S		2,2			
EM16-340-0400-F-66-S		4			
EM16-340-0550-F-66-S		5,5			
EM16-340-0750-F-66-S		7,5			
EM16-340-1100-F-66-S		11			

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MAIN FUNCTIONS

- Sensorless vector and V/f control
- Motor Auto-tuning function
- 150% of the torque at 1Hz
- Braking torque 20% without resistance
- Integrated braking transistor on the whole series
- Braking torque 100% with optional resistance
- RTU Modbus RS485 interface through RJ45
- Removable EMI filter
- 3 types of PWM modulation available
- Motor noise reduction function
- 2/3 wire wiring
- 6 Multifunction inputs
- 2 Multifunction outputs
- Motor enabling control contact
- Input and output phase loss control
- Auto-tuning of the modulation frequency according to the temperature
- Parameter protection with password
- 16 programmable fixed speeds
- 16 acceleration/deceleration ramps for each fixed speed
- 16 programmable cyclic speed sequences
- Pulse train frequency reference (speed)
- 4 acc/dec independent S-ramps
- Internal PLC functions with Ladder language (Timers, Counters, Comparators, ...)
- PID function that can be monitored on display
- Electromechanical brake control logic
- Input and output values that can be displayed
- IP66/Nema4 protection rating up to 11 kW
- Controlled motor stop with no power supply
- Energy-saving function
- Predictive maintenance functions on main components.

6 STRUCTURE

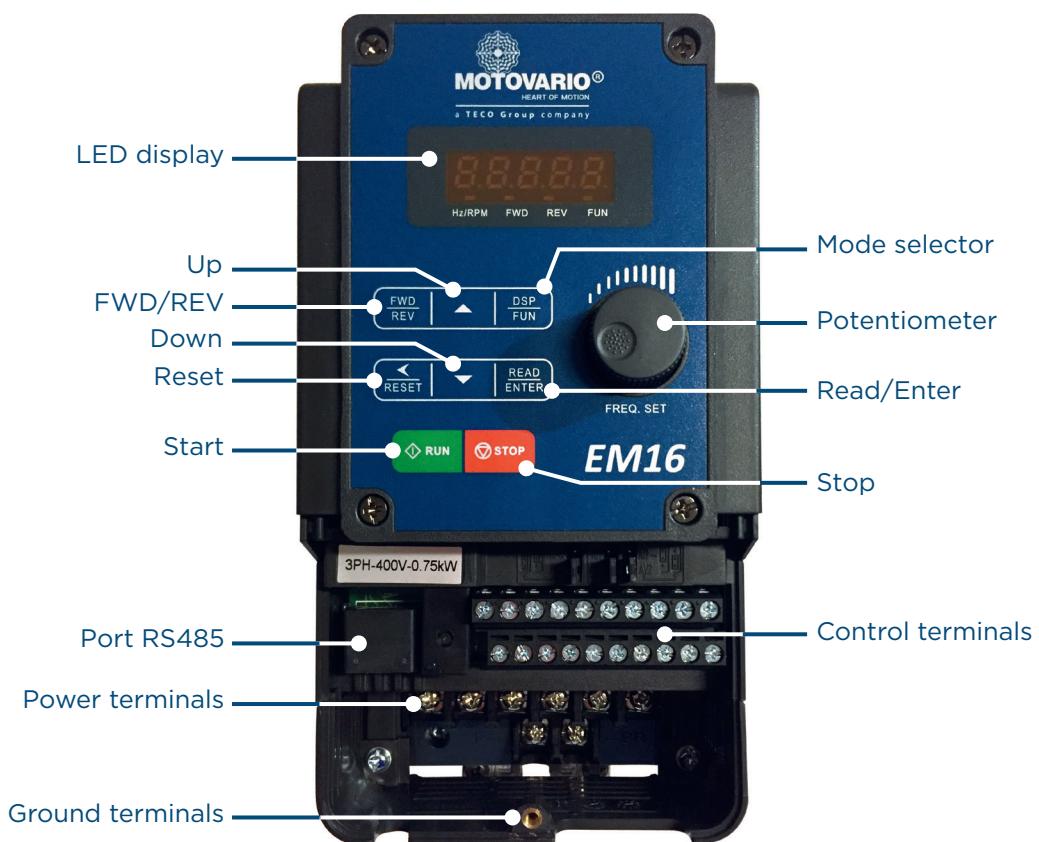
The whole EM16 series, regardless of the size, is characterised by a simple and practical front panel where each interface provides an easy access for the user.

The control and power terminals are placed on the front area of the inverter, at the bottom under the keyboard, and can be accessed after the removal of the plastic safety guard.

Regardless of the inverter size and the casing protection rating, the whole EM16 series features the same front layout of the user interfaces.

IP 20 VERSION

The keyboard, always supplied and housed on the inverter front side, can be used in remote through an accessory extension cable (JN5-CB...).



6

STRUCTURE

IP 66 VERSION

The IP66 protection rating is possible through a single front panel that integrates the keyboard, the potentiometer and the line mains switch, whose removal allows accessing the control and power terminals.



6 STRUCTURE

The product offers a wide range of optional devices dedicated to fieldbus network connections and connections with local data exchange units.

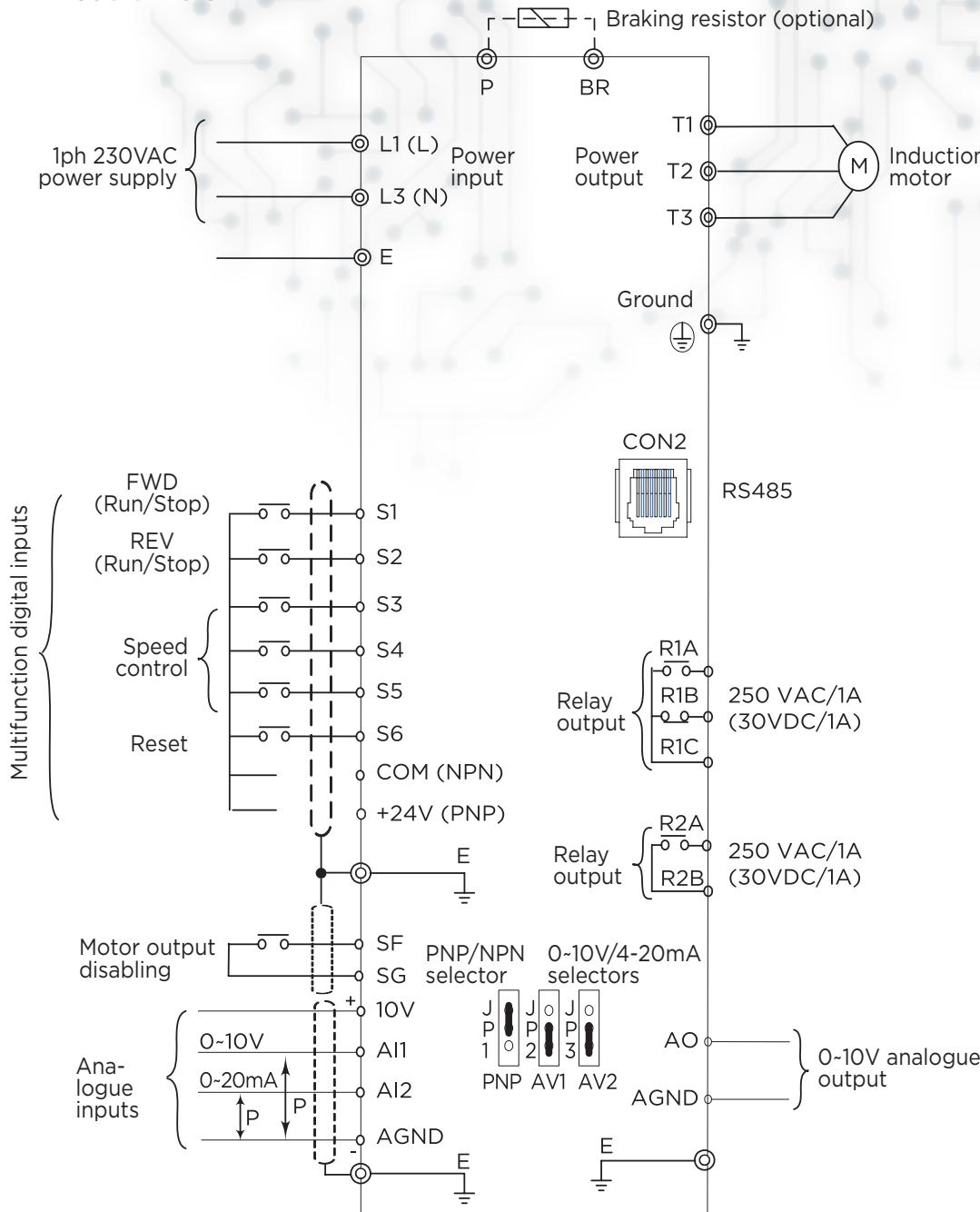


7

CONNECTIONS

The EM16 series offers different connection modes according to the power supply and nominal power versions.

1PH 230V VERSION



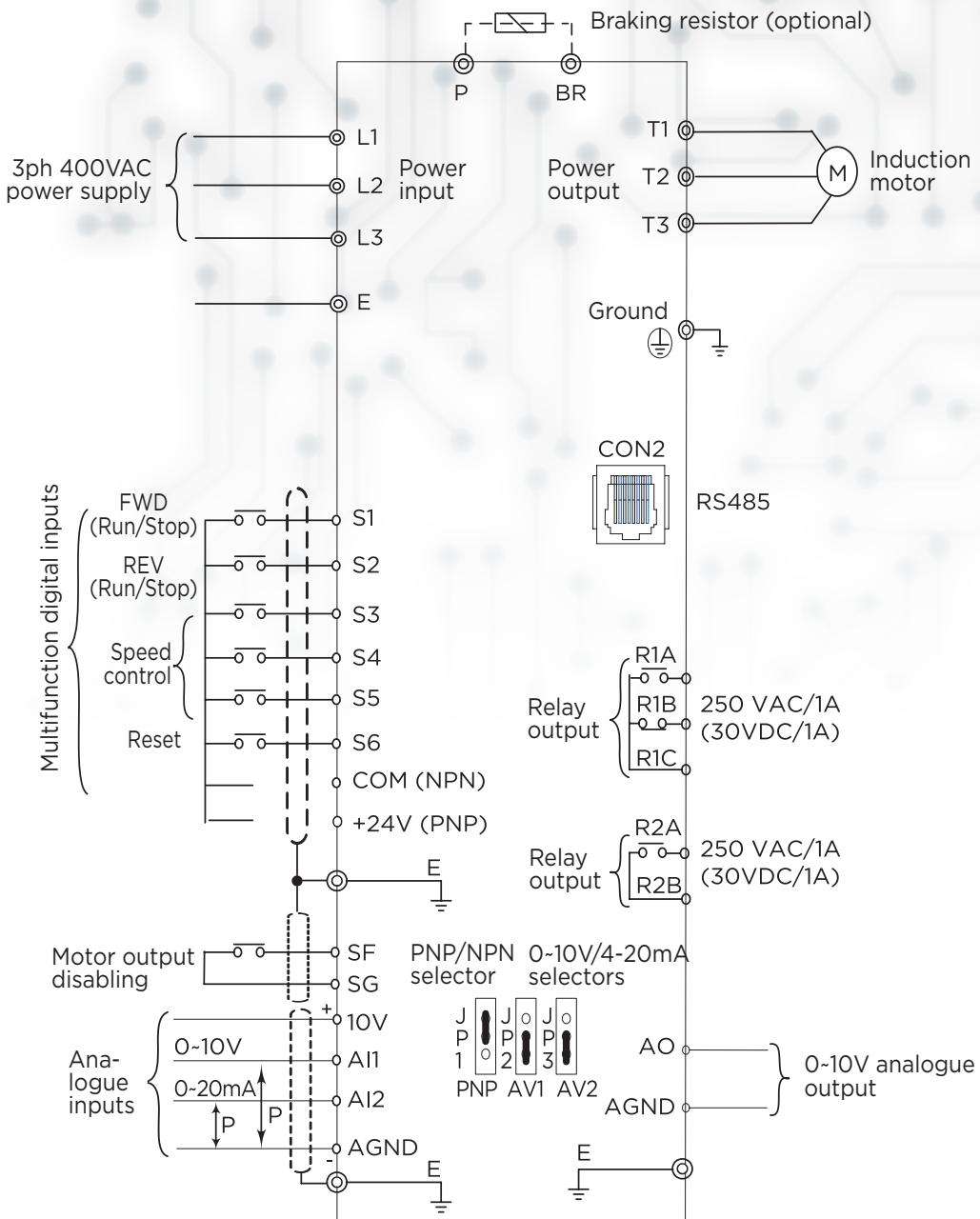
The following models fall within this category:

Inverter
EM16-123-0037-F-...
EM16-123-0075-F-...
EM16-123-0150-F-...
EM16-123-0220-F-...

7

CONNECTIONS

3PH 400V VERSION



The following models fall within this category:

Inverter
EM16-340-0075-F-...
EM16-123-0150-F-...
EM16-123-0220-F-...
EM16-123-0400-F-...
EM16-123-0550-F-...
EM16-123-0750-F-...
EM16-123-1100-F-...
EM16-123-1500-F-...
EM16-123-1850-F-...

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GENERAL SPECIFICATIONS

Motor control	V/f (scalar) control and Sensorless vector control
Current overload	150% for 60s
Starting torque	V/f mode: 150% of nominal torque starting from 3Hz
	SVC mode: 150% of nominal torque starting from 1Hz
Frequency range	0,00-599,00Hz
Speed precision	V/f mode: 3Hz (100% torque)
	SVC mode: 1Hz (100% torque)
Adjustment frequency resolution	Up/Down digital inputs: 0,01Hz
	Analogue input: 0,06Hz
Frequency reference sources	Keyboard: adjustment through buttons ▲▼
	On-board potentiometer
	0/2-10V analogue input
	0/4-20mA analogue input
	Multifunction digital inputs in Up/Down mode
	Field bus/serial communication channels
Frequency limits	3 settable upper and lower frequency limits
Start/stop sources	Keyboard through RUN and STOP buttons
	Multifunction digital inputs in 2 or 3 wire mode
	Jog mode through digital inputs
	Field bus/serial communication channels
Predefined V/f curves	18 selectable predefined curves and 1 curve defined by the user
Carrier frequency	1-16kHz
Control in acceleration/deceleration	2 linear independent acceleration ramps and 2 independent deceleration ramps
	2 independent acceleration S-ramps and 2 independent deceleration S-ramps
Multifunction digital inputs	6 PNP or NPN inputs (NPN default)
	29 different functions for each input
	PNP/NPN logic selection through jumper (NPN default)
Multifunction digital outputs	1 single-contact relay output + 1 SPDT relay output
	21 different settable functions
Multifunction analogue inputs	1 0-10V input
	1 0-10V / 0 ~ 20mA input
Multifunction analogue output	1 0-10V output
	5 different settable functions
LED display	Display: parameter number/ parameter value/ frequency/ speed/ DC voltage/ output AC voltage/ output current/ PID feedback value/ inputs and outputs status/ heat sink temperature/ alarm in progress/ firmware version
Status LEDs	Run/stop/forward/reverse, etc. signalling.
Main features	Overload management, 16 predefined speeds, auto-run, ramp selection via digital input, reference and run selection via digital input, PID control, torque boost, alarm reset

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GENERAL SPECIFICATIONS

Integrated protections	Motor and inverter overload (150% for 60sec), overvoltage, undervoltage, output short-circuit, short-circuit to the ground, stall prevention in transient mode and in standard operation, short power supply interruption compensation
Other integrated protections	Heat sink overtemperature, carrier frequency automatic adjustment according to the temperature, fault at output, rotation inversion not permitted, alarm self-reset, parameter block
Certifications	CE/UL/cUL/RCM
Communication interfaces	On-board RS485 (Modbus RTU) On-board BacNet Profibus DP, DeviceNet, CANbus, Ethernet TCP/IP through optional gateways
Dynamic braking	Standard braking unit integrated in the whole range (external optional resistance)
Operating temperature	-10-50°C ⁽¹⁾
Storage temperature	-20-60°C
Humidity	Lower than 95% RH (non-condensing)
Vibration resistance	1G (9,81m/s ²) up to 20 Hz; 0,6G (5,88m/ s ²) from 20 to 50 Hz In compliance with standard IEC 60068-2-6
EMC Conformity	EN61800-3, first environment Category C1 using the grounding kit
LVD Conformity	EN 61800-5-1
UL electric safety	UL508C
Protection rating	IP20/Nema1 - IP66/Nema4

¹: IP20 → -10 ÷ 50°C without dust protection cover (Nema1 kit)

-10 ÷ 40°C with dust protection cover (Nema1 kit)

IP66 → -10 ÷ 50°C

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TECHNICAL DATA

1PH 230V VERSION

	EM16-123-....-F20/F66	0037	0075	0150	0220		
Motor side output	Recommended motor power (kW)	0,37	0,75	1,5	2,2		
	Output nominal power (kVA)	1,2	1,7	2,9	4,00		
	Output nominal current (A)	2,3	4,5	7,5	10,5		
	Overload current 60s (A)	4,65	6,75	11,25	15,75		
	Output voltage (V)	3x (0-V mains)					
	Output frequency (Hz)	0....599					
Mains side input	Mains nominal voltage (V)	1 x (170...265)					
	Mains nominal frequency (Hz)	50...60					
	Input nominal current (A)	8,5	12	16	23,9		
	Power supply temporary interruption (s)	2,0	2,0	2,0	2,0		
General	Weight (kg)	1,65		2,5			
	Size	1		2			
	Protection rating	IP20 / IP66					
Options and accessories	Braking module	Integrated					
	Braking resistor	Optional					
	Line inductance	Optional					
	Motor inductance	Optional					
	EMI filter	Integrated					
	Control keyboard	Integrated					
	Communication interfaces	Integrated RTU Modbus- optional Profibus DP DeviceNet CANbus Ethernet TCP/IP					

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TECHNICAL DATA

3PH 400V VERSION - 0,75÷4KW

	EM16-340-....-F20/F66	0075	0150	0220	0400		
Motor side output	Recommended motor power (kW)	0,75	1,5	2,2	4		
	Output nominal power (kVA)	1,7	2,9	4,0	6,7		
	Output nominal current (A)	2,3	3,8	5,2	8,8		
	Overload current 60s (A)	3,45	5,7	7,8	13,2		
	Output voltage (V)	3x (0-V mains)					
	Output frequency (Hz)	0...599					
Mains side input	Mains nominal voltage (V)	3 x (323...528)					
	Mains nominal frequency (Hz)	50...60					
	Input nominal current (A)	4,2	5,6	7,3	11,6		
	Power supply temporary interruption (s)	2,0	2,0	2,0	2,0		
General	Weight (kg)	1,7		2,5			
	Size	1		2			
	Protection rating	IP20 / IP66					
Options and accessories	Braking module	Integrated					
	Braking resistor	Optional					
	Line inductance	Optional					
	Motor inductance	Optional					
	EMI filter	Integrated					
	Control keyboard	Integrated					
	Communication interfaces	Integrated RTU Modbus- optional Profibus DP DeviceNet CANbus Ethernet TCP/IP					

9

TECHNICAL DATA

3PH 400V VERSION - 5,5÷18,5kW

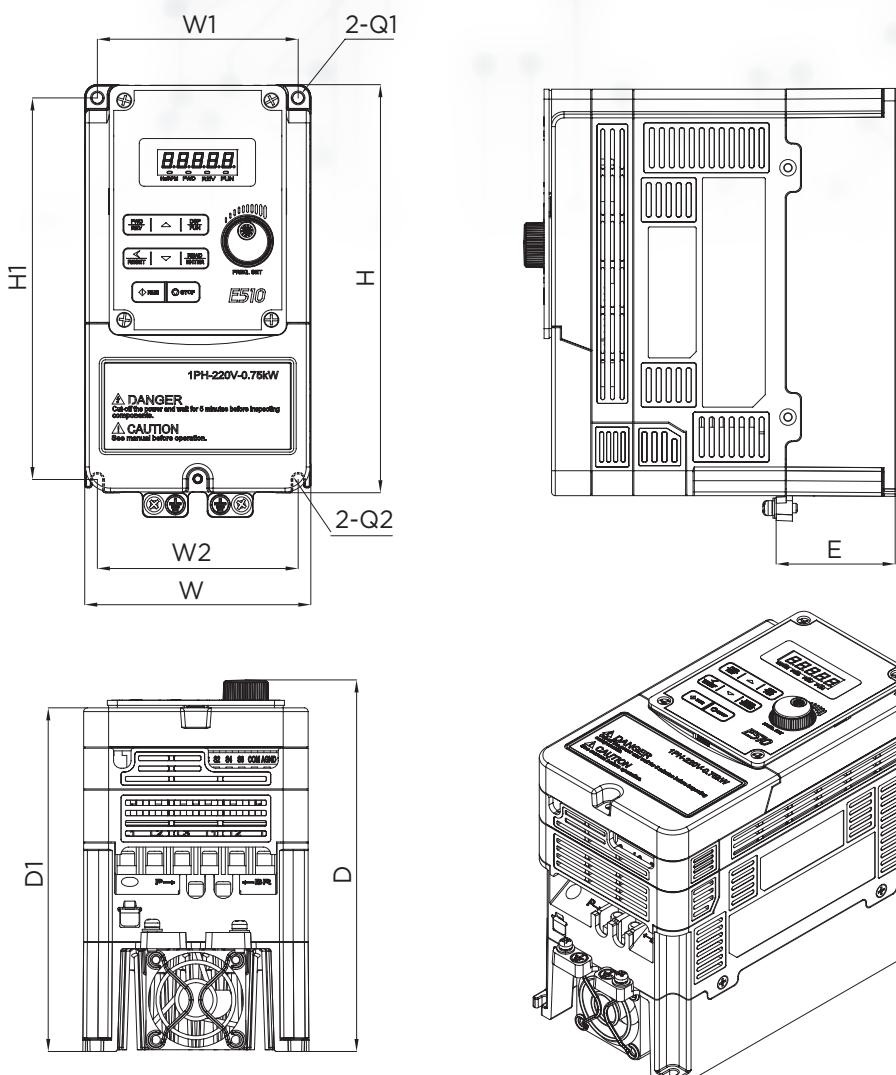
	EM16-340-....-F20/F66	0550	0750	1100	1500	1850		
Motor side output	Recommended motor power (kW)	5,5	7,5	11	15	18,5		
	Output nominal power (kVA)	9,9	13,3	19,1	24	30,5		
	Output nominal current (A)	13,0	17,5	24	32	40		
	Overload current 60s (A)	19,5	26,25	36	48	60		
	Output voltage (V)	3x (0~V mains)						
	Output frequency (Hz)	0...599						
Mains side input	Mains nominal voltage (V)	3 x (323...528)						
	Mains nominal frequency (Hz)	50...60						
	Input nominal current (A)	17	23	31	38	48		
	Power supply temporary interruption (s)	2,0	2,0	2,0	2,0	2,0		
General	Weight (kg)	6,7			13,7			
	Size	3			4			
	Protection rating	IP20 / IP66			IP20			
Options and accessories	Braking module	Integrated						
	Braking resistor	Optional						
	Line inductance	Optional						
	Motor inductance	Optional						
	EMI filter	Integrated						
	Control keyboard	Integrated						
	Communication interfaces	Integrated RTU Modbus - optional Profibus DP DeviceNet CANbus Ethernet TCP/IP						

10 DIMENSIONS

SIZE 1 (IP20)

SINGLE-PHASE: 230V 0,37~0,75 KW / THREE-PHASE: 400V 0,75~1,5 KW

Model	Dimensions (mm)											Weight (kg)
	W	W1	W2	H	H1	D	D1	E	Q1	Q2		
EM16-123-0037-F-20	90,6	80,5	80,5	163,6	153	149	137,8	48	4,3	4,3	1,7	
EM16-123-0075-F-20												
EM16-340-0075-F-20												
EM16-340-0150-F-20												

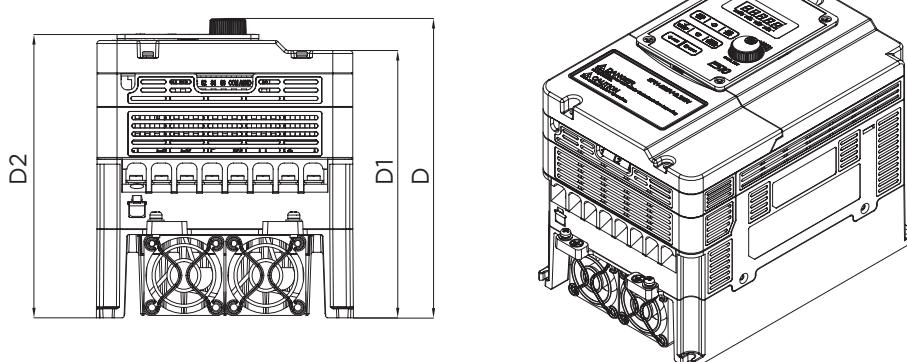
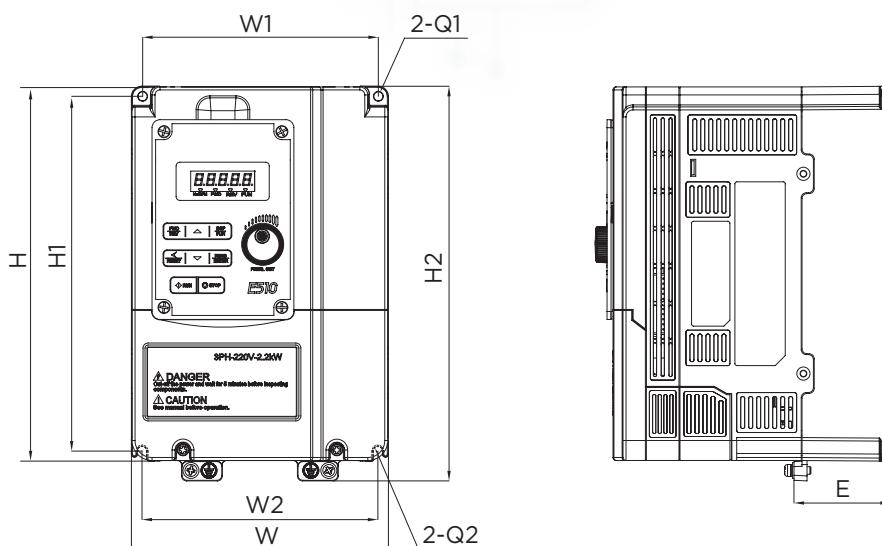


10 DIMENSIONS

SIZE 2 (IP20)

SINGLE-PHASE: 230V 1,5~2,2 KW / THREE-PHASE: 400V 2,2~4 KW

Model	Dimensions (mm)													Weight (kg)
	W	W1	W2	H	H1	H2	D	D1	D2	E	Q1	Q2		
EM16-123-0150-F-20	128,7													
EM16-123-0220-F-20		118	118	187,6	177,6	197,5	150	133,8	141,8	48,2	4,5	4,5	2,5	
EM16-340-0220-F-20														
EM16-340-0400-F-20														

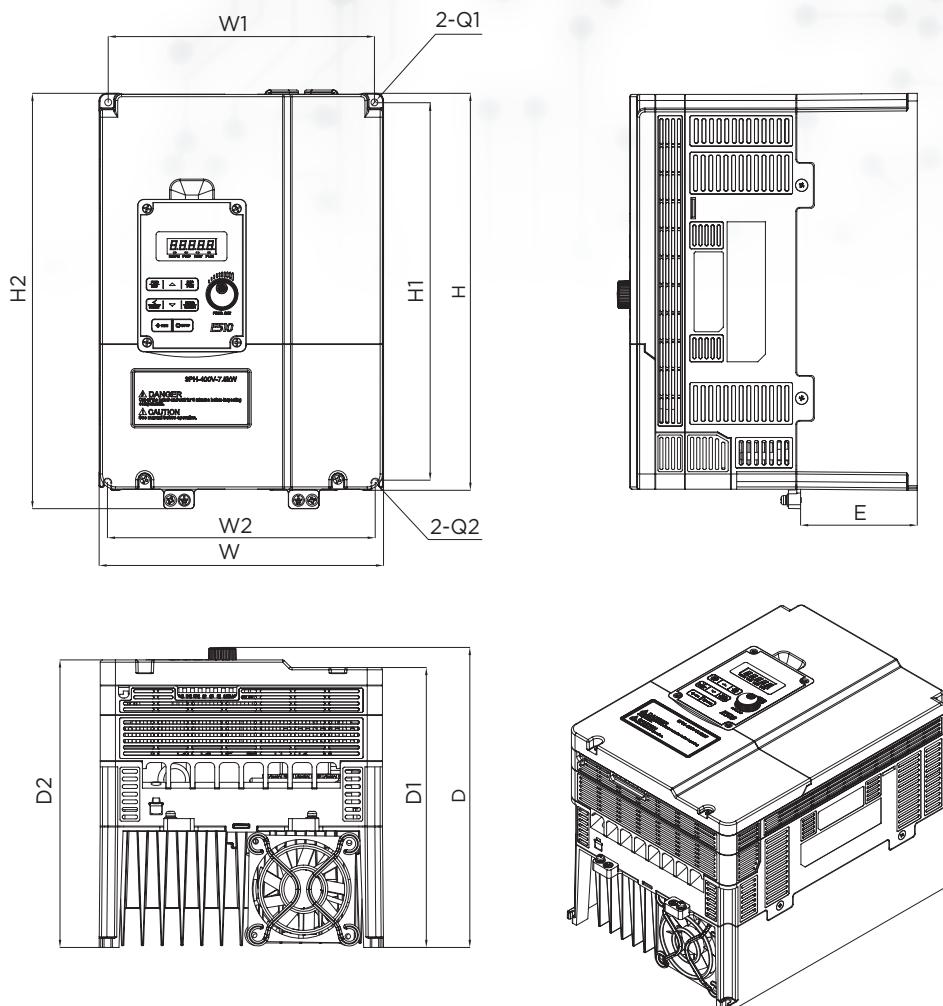


10 DIMENSIONS

SIZE 3 (IP20)

THREE-PHASE: 400V 5,5~11 KW

Model	Dimensions (mm)													Weight (kg)
	W	W1	W2	H	H1	H2	D	D1	D2	E	Q1	Q2		
EM16-340-0550-F-20	186,9	175	176	260,9	249,8	273	197,2	184	189	76,7	4,5	4,5	6,7	
EM16-340-0750-F-20														
EM16-340-1100-F-20														

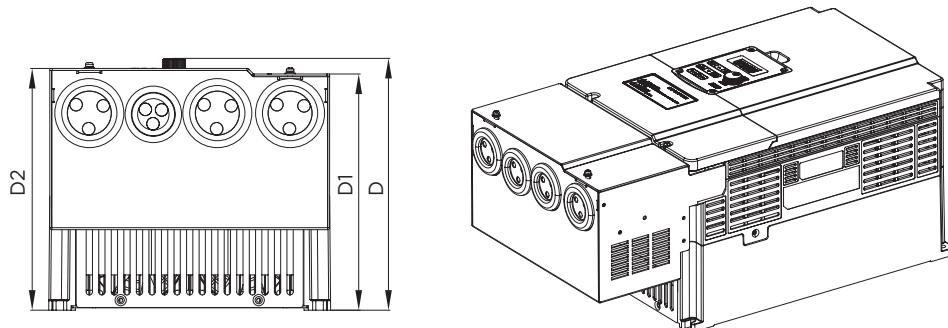
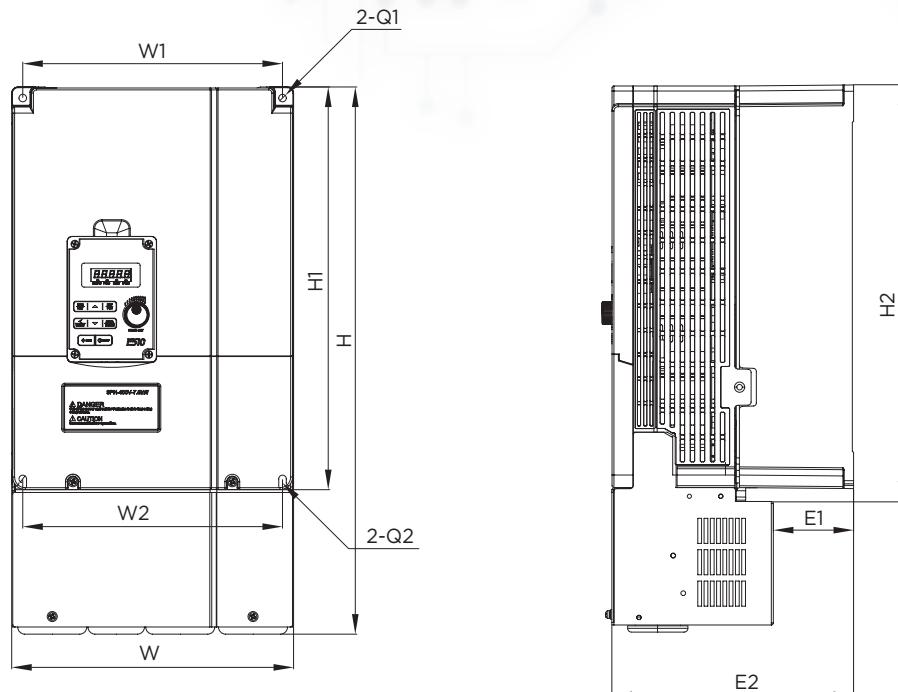


10 DIMENSIONS

SIZE 4 (IP20)

THREE-PHASE: 400V 15~18,5 KW

Model	Dimensions (mm)														Weight (kg)
	W	W1	W2	H	H1	H2	D	D1	D2	E1	E2	Q1	Q2		
EM16-340-1500-F-20	224,6	207	207	436	303,5	330,9	200,7	187,5	192,5	64	192,5	6	6	13,7	
EM16-340-1850-F-20															

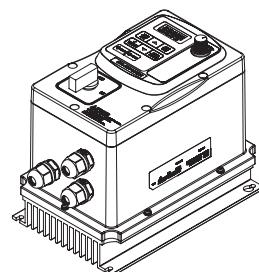
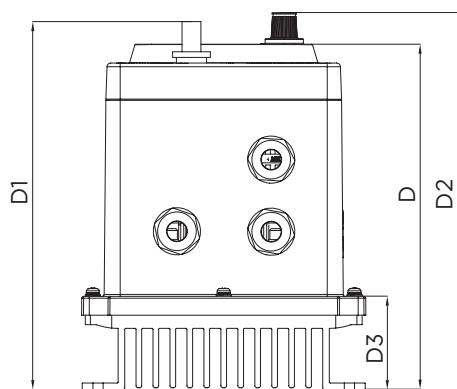
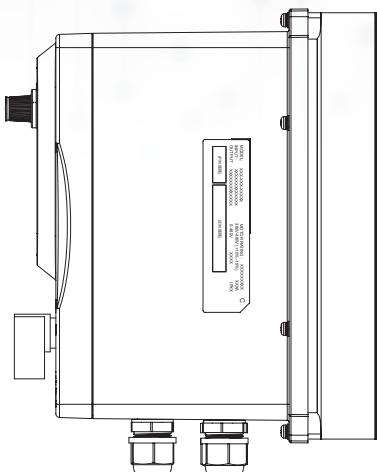
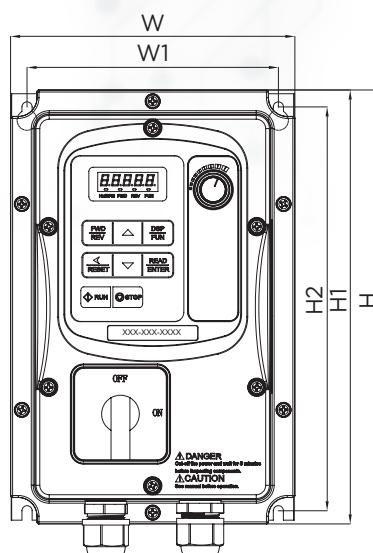


10 DIMENSIONS

SIZE 1 (IP66)

SINGLE-PHASE: 230V 0,37~0,75 KW / THREE-PHASE: 400V 0,75~1,5 KW

Model	Dimensions (mm)													Weight (kg)
	W	W1	H	H1	H2	D	D1	D2	D3	Q1	Q2	Q3		
EM16-123-0037-F-66-S														
EM16-123-0075-F-66-S	150,8	133,3	248,7	230,2	214,2	183	200	200	49,5	5,4	5,4	10,6		2,9
EM16-340-0075-F-66-S														
EM16-340-0150-F-66-S														

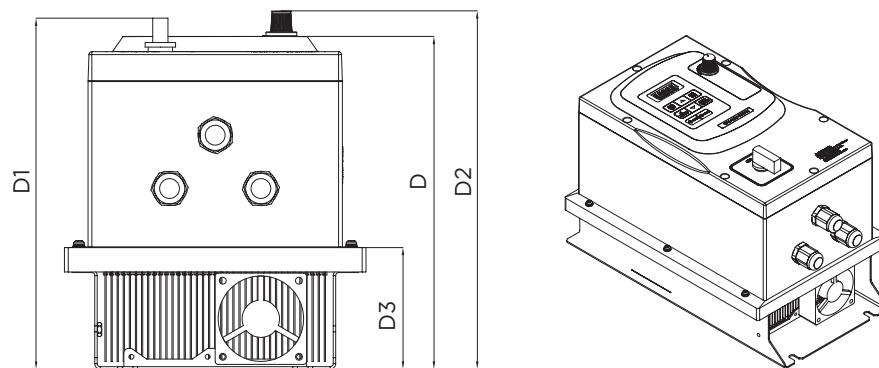
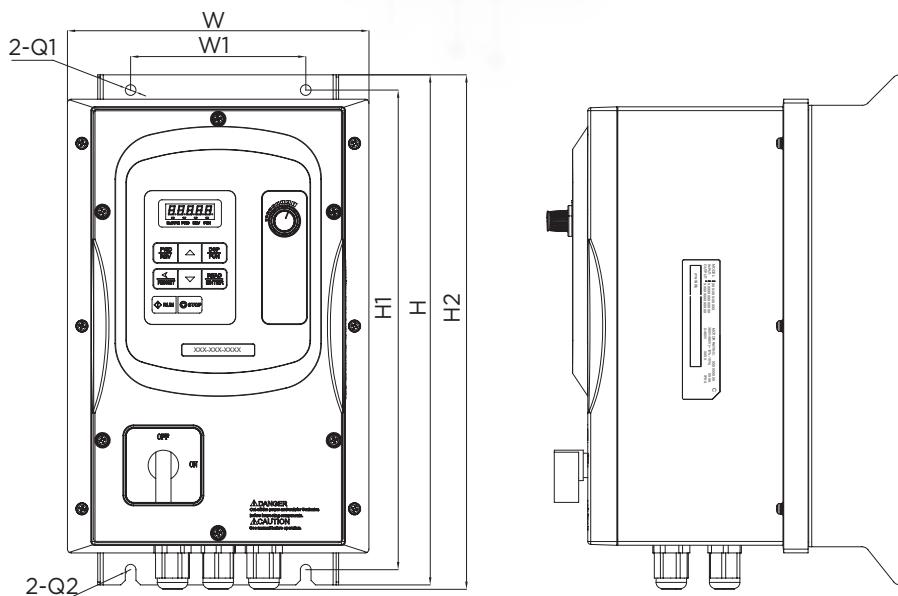


10 DIMENSIONS

SIZE 2 (IP66)

SINGLE-PHASE: 230V 1,5~2,2 KW / THREE-PHASE: 400V 2,2~4 KW

Model	Dimensions (mm)												Weight (kg)
	W	W1	H	H1	H2	D	D1	D2	D3	Q1	Q2		
EM16-123-0150-F-66-S	198	115	335	315	337,9	218,4	235,2	235,2	79,8	7	7	5,98	
EM16-123-0220-F-66-S													
EM16-340-0220-F-66-S													
EM16-340-0400-F-66-S													

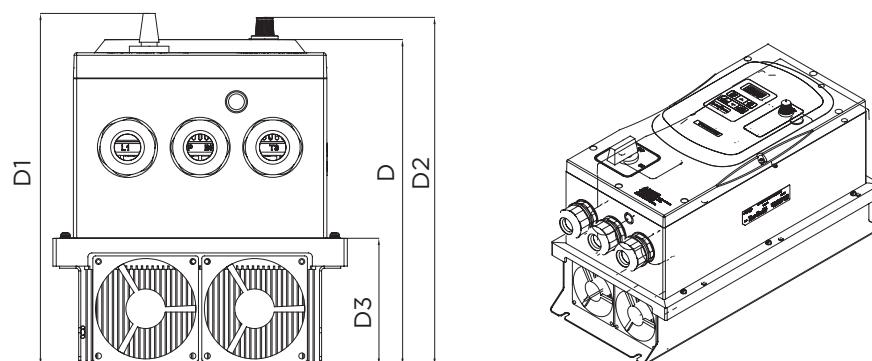
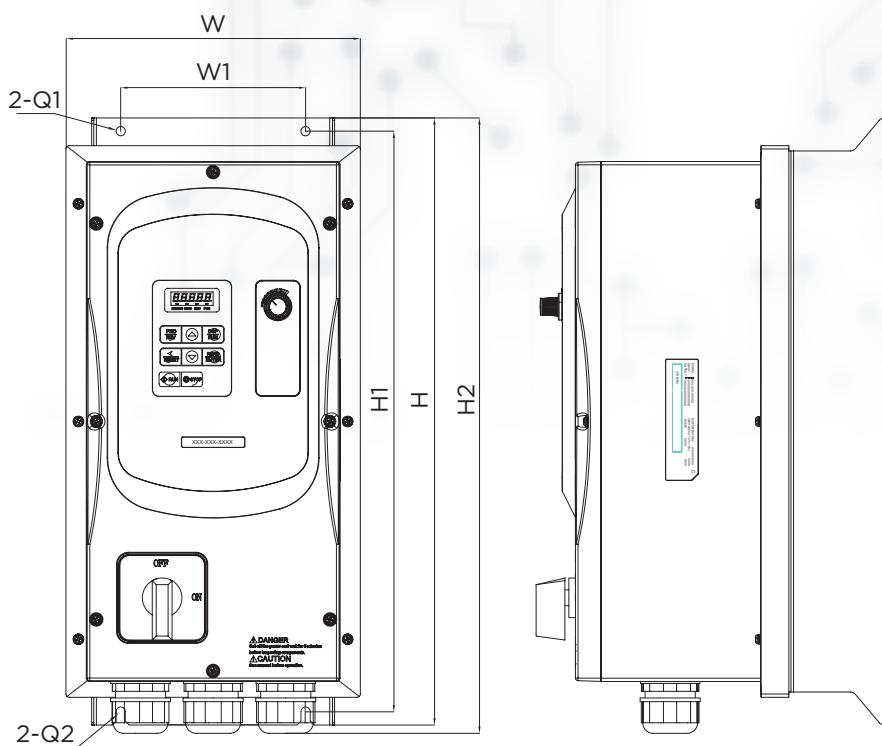


10 DIMENSIONS

SIZE 3 (IP66)

THREE-PHASE: 400V 5,5~11 KW

Model	Dimensions (mm)												Weight (kg)
	W	W1	H	H1	H2	D	D1	D2	D3	Q1	Q2		
EM16-340-0550-F-66-S													
EM16-340-0750-F-66-S	222,8	140	460	440	466,3	246,6	266,5	263,5	96	7	7	12,68	
EM16-340-1100-F-66-S													



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OPTIONS AND ACCESSORIES

The EM16 inverter can be equipped with a range of accessories listed in the table below:

CABLES

Type	Description
JN5-CM-USB	RJ45-USB cable for programming via PC - 1,8m
JN5-CM-USB-3	RJ45-USB cable for programming via PC - 3m
JN5-CB-01M	Extension cable for keypad - 1m
JN5-CB-02M	Extension cable for keypad - 2m
JN5-CB-03M	Extension cable for keypad - 3m
JN5-CB-05M	Extension cable for keypad - 5m

KEYPADS

Type	Description
JN5-CU	Parameter Copy Device with JN5-CB-02M cable

INSTALLATION KIT

Type	Description
JN5-NK-E01	NEMA1 kit for size_1
JN5-NK-E02	NEMA1 kit for size_2
JN5-NK-E03	NEMA1 kit for size_3
JN5-NK-E04	NEMA1 kit for size_4

COMMUNICATION MODULES

Type	Description
JN5-CM-PDP	Profibus DP gateway
JN5-CM-TCP/IP	Ethernet TCP/IP Gateway
JN5-CM-DNET	DeviceNet Gateway
JN5-CM-CAN	CANbus Gateway

BRAKING RESISTORS

Inverter type	Inverter power (kW)	Resistor type	Description
EM16-123-0037-F-20/66	0,37 (1ph230V)	JTTLKEB-150W200	200 Ω / 150W / IP20
EM16-123-0075-F-20/66	0,75 (1ph230V)	JTTLKEB-150W200	200 Ω / 150W / IP20
EM16-123-0150-F-20/66	1,5 (1ph230V)	JTTLKEB-150W100	100 Ω / 150W / IP20
EM16-123-0220-F-20/66	2,2 (1ph230V)	JTTLKEB-300W70	70 Ω / 300W / IP20
EM16-340-0075-F-20/66	0,75 (3ph400V)	JTTLKEB-150W750	750 Ω / 150W / IP20
EM16-340-0150-F-20/66	1,5 (3ph400V)	JTTLKEB-150W400	400 Ω / 150W / IP20
EM16-340-0220-F-20/66	2,2 (3ph400V)	JTTLKEB-300W250	250 Ω / 300W / IP20
EM16-340-0400-F-20/66	4,0 (3ph400V)	JTTLKEB-400W150	150 Ω / 400W / IP20
EM16-340-0550-F-20/66	5,5 (3ph400V)	JTTLKEB-600W130	130 Ω / 600W / IP20
EM16-340-0750-F-20/66	7,5 (3ph400V)	JTTLKEB-800W100	100 Ω / 800W / IP20
EM16-340-1100-F-20/66	11 (3ph400V)	JTTLKEB-1600W50	50 Ω / 1600W / IP20
EM16-340-1500-F-20	15 (3ph400V)	JTTLKEB-1500W40	40 Ω / 1500W / IP20
EM16-340-1850-F-20	18,5 (3ph400V)	BW155-2000W32	32 Ω / 2000W / IP20

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OPTIONS AND ACCESSORIES

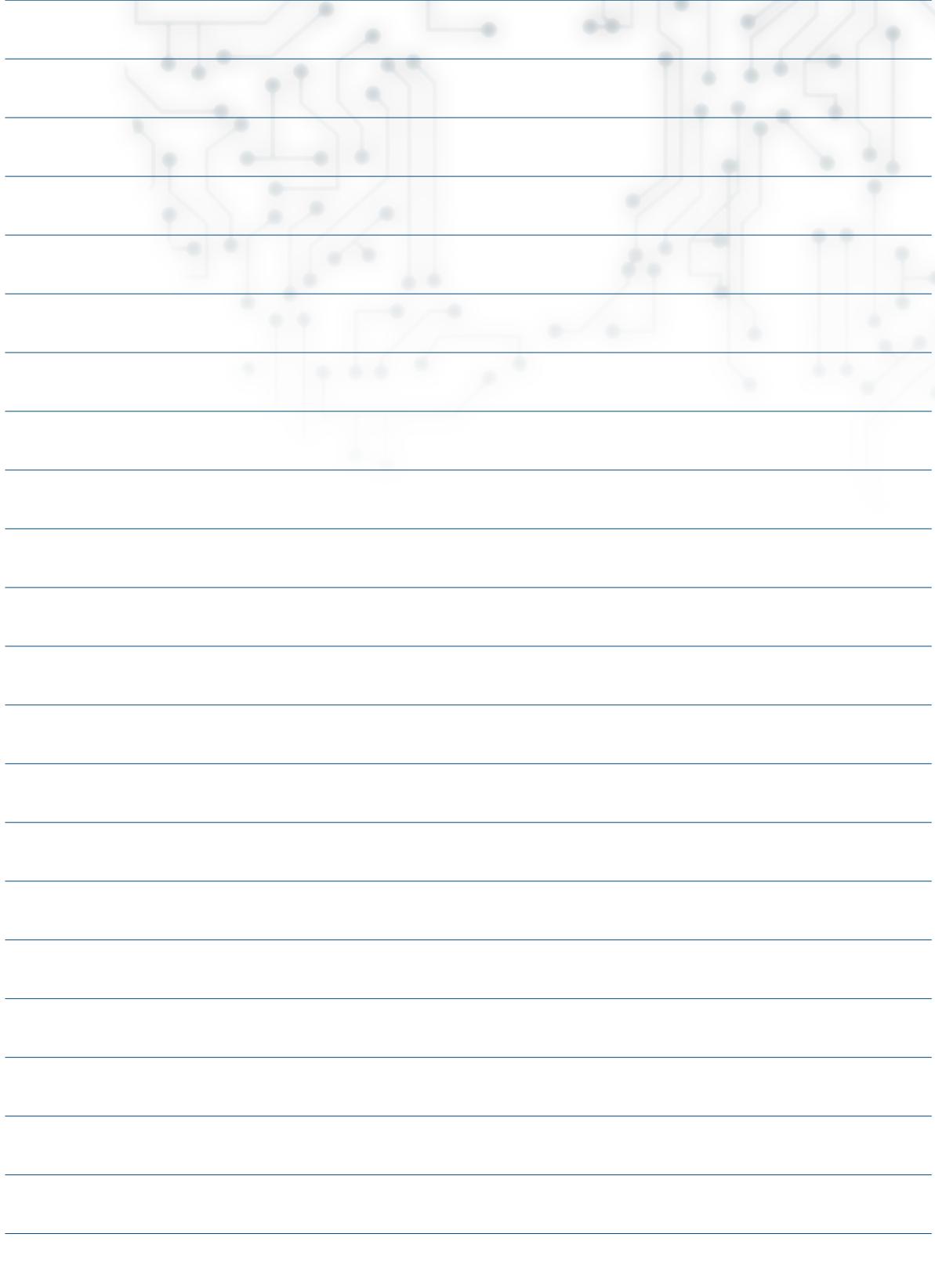
LINE INDUCTANCE

Inverter type	Inverter power (kW)	Inductance type (mains)	Description
EM16-123-0037-F-20/66	0,37 (1ph230V)	CNW-901/10	2,1 mH / 8,5A / 4%
EM16-123-0075-F-20/66	0,75 (1ph230V)	CNW-901/16	2,1 mH / 12A / 4%
EM16-123-0150-F-20/66	1,5 (1ph230V)	CNW-901/16	1,1 mH / 19A / 4%
EM16-123-0220-F-20/66	2,2 (1ph230V)	CNW-901/25	0,71 mH / 25A / 4%
EM16-340-0075-F-20/66	0,75 (3ph400V)	CNW-905/6	8,4 mH / 4,5A / 2%
EM16-340-0150-F-20/66	1,5 (3ph400V)	CNW-905/6	4,2 mH / 6A / 2%
EM16-340-0220-F-20/66	2,2 (3ph400V)	CNW-905/8	3,6 mH / 7,5A / 2%
EM16-340-0400-F-20/66	4,0 (3ph400V)	CNW-905/12	2,2 mH / 12A / 2%
EM16-340-0550-F-20/66	5,5 (3ph400V)	CNW-905/25	1,42 mH / 17A / 2%
EM16-340-0750-F-20/66	7,5 (3ph400V)	CNW-905/25	1,06 mH / 23A / 2%
EM16-340-1100-F-20/66	11 (3ph400V)	CNW-905/36	0,7 mH / 31A / 2%
EM16-340-1500-F-20	15 (3ph400V)	CNW-905/50	0,53 mH / 40A / 2%
EM16-340-1850-F-20	18,5 (3ph400V)	CNW-905/50	0,42 mH / 50A / 2%

MOTOR INDUCTANCE

Inverter type	Inverter power (kW)	Inductance type (motor)	Description
EM16-123-0037-F-20/66	0,37 (1ph230V)	CNW-854/8	-
EM16-123-0075-F-20/66	0,75 (1ph230V)	CNW-854/8	-
EM16-123-0150-F-20/66	1,5 (1ph230V)	CNW-854/8	-
EM16-123-0220-F-20/66	2,2 (1ph230V)	CNW-854/12	-
EM16-340-0075-F-20/66	0,75 (3ph400V)	CNW-854/8	-
EM16-340-0150-F-20/66	1,5 (3ph400V)	CNW-854/8	-
EM16-340-0220-F-20/66	2,2 (3ph400V)	CNW-854/8	-
EM16-340-0400-F-20/66	4,0 (3ph400V)	CNW-854/10	-
EM16-340-0550-F-20/66	5,5 (3ph400V)	CNW-854/16	-
EM16-340-0750-F-20/66	7,5 (3ph400V)	CNW-854/24	-
EM16-340-1100-F-20/66	11 (3ph400V)	CNW-854/24	-
EM16-340-1500-F-20	15 (3ph400V)	CNW-854/37	-
EM16-340-1850-F-20	18,5 (3ph400V)	CNW-854/48	-

NOTES



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