

SINAMICS G120 standard inverters

0.37 kW to 250 kW (0.5 hp to 400 hp)

Power Modules

Overview

PM240-2 Power Modules – 0.55 kW to 132 kW (0.75 hp to 200 hp), IP20 degree of protection



PM240-2 Power Modules, frame sizes FSA to FSF (with Control Unit and Operator Panel)

The PM240-2 Power Modules are based on a new hardware platform. This permits an increase in power density as well as the application of innovative cooling concepts (push-through technology) with especially high requirements in terms of control cabinet cooling.

Furthermore, the PM240-2 Power Module is also suitable for use in safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated Drive (see section Control Units).

The PM240-2 Power Modules are available both with and without an integrated line filter class A of compact design for 200 V, 400 V and 690 V line voltages (except PM240-2 frame sizes FSD to FSF: 200 V). In addition, a DC link reactor is integrated in the PM240-2 Power Modules, frame sizes FSD to FSF, and therefore no line reactor is required.

The PM240-2 Power Modules with integrated line filter class A are suitable for connection to TN supply systems. Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

The PM240-2 Power Module has an integrated braking chopper. In generating mode, the excess energy of the DC link can be dissipated by means of an optional braking resistor.

The permissible cable lengths between inverter and motor are limited (for max. permissible cable lengths, see Integration). Longer cables can be used if output reactors are connected (see section Load-side power components).

Push-through variant



Example: PM240-2 Power Modules, degree of protection IP20, push-through variant, frame sizes FSD to FSF (with Control Unit and Operator Panel)

The push-through variants in the frame sizes FSA to FSF allow the cooling fins of the Power Modules to be pushed through the rear panel of the control cabinet. Push-through variants should be used in applications where the amount of power loss generated inside the control cabinet itself must be minimized.

Shield plates and shield connection kits are available for use in the wiring installation of Control Units and Power Modules to ensure that it complies with EMC guidelines.

For more information, see Shield connection kits for Control Units and Power Modules in section Supplementary system components.

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Power Modules**Overview** (continued)

**PM240 Power Modules – 160 kW to 250 kW
(250 hp to 400 hp), IP20 degree of protection**



PM240 Power Modules, frame size FSGX

PM240 Power Modules frame size FSGX optionally have a braking chopper (four-quadrant applications) and are suitable for a large number of applications in general machinery construction.

For Power Modules frame size FSGX, an optional plug-in Braking Module can be ordered ([see section DC link components](#)).

The permissible cable lengths between inverter and motor are limited (for max. permissible cable lengths, [see Integration](#)). Longer cables can be used if output reactors are connected ([see section Load-side power components](#)).

Line reactors are available to minimize line harmonics as well as voltage and current peaks ([see section Line-side components](#)).

The PM240 Power Module is suitable for safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated Drive ([see section Control Units](#)).

PM240 Power Modules, frame size FSGX (i.e. 160 kW/250 hp and higher) are approved only for the Basic Safety functions (STO, SS1, and SBC).

Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

Note:

Shield plates and shield connection kits are available for use in the wiring installation of Control Units and Power Modules to ensure that it complies with EMC guidelines.

[For more information, see Shield connection kits for Control Units and Power Modules in section Supplementary system components.](#)

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Power Modules

Overview (continued)

PM250 Power Modules – 7.5 kW to 90 kW (10 hp to 125 hp), IP20 degree of protection



PM250 Power Modules, frame sizes FSC to FSF

PM250 Power Modules are suitable for a large number of applications in general mechanical engineering. Any braking energy is directly fed back into the line supply (four-quadrant applications – a braking chopper is not required).

The PM250 Power Module features an absolutely unique technology – Efficient Infeed Technology. This feature provides the ability to feed energy back into the supply system in the generator mode (electronic braking) so that the energy is not converted into heat in a braking resistor. This saves space in the control cabinet. The time-consuming process of dimensioning the braking resistor and the expense of the extra wiring are eliminated. Furthermore, heat losses in the control cabinet are reduced.

Further, the innovative circuit design reduces the line harmonics. There is no need to use an optional line reactor at the supply infeed. This saves space and costs for engineering and procurement.

The permissible cable lengths between inverter and motor are limited (for max. permissible cable lengths, [see Integration](#)). Longer cables can be used if output reactors are connected ([see section Load-side power components](#)).

Frame sizes FSD to FSF of the PM250 Power Modules are available both with as well as without integrated line filter class A.

For frame size FSC of the PM250 Power Module with an integrated line filter class A, an additional base filter of class B is available for achieving class B ([see section Line-side components](#)).

The PM250 Power Module is also designed for safety-oriented applications. In conjunction with a fail-safe Control Unit, the drive can be transformed into a Safety Integrated Drive ([see section Control Units](#)).

The PM250 Power Modules with integrated line filter class A are suitable for connection to TN supply systems. Power Modules without integrated line filter can be connected to grounded TN/TT systems and non-grounded IT systems.

Note:

Shield plates and shield connection kits are available for use in the wiring installation of Control Units and Power Modules to ensure that it complies with EMC guidelines.

[For more information, see Shield connection kits for Control Units and Power Modules in section Supplementary system components.](#)

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Power Modules

Integration (continued)

Power and DC link components that are optionally available depending on the Power Module used

The following line-side components, DC link components and load-side power components are optionally available in the appropriate frame sizes for the Power Modules:

	Frame size						
	FSA	FSB	FSC	FSD	FSE	FSF	FSGX
PM240-2 Power Module with integrated braking chopper							
Available frame sizes							
• 200 V versions	✓	✓	✓	✓ ¹⁾	✓ ¹⁾	✓ ¹⁾	–
• 400 V versions	✓	✓	✓	✓	✓	✓	–
• 690 V versions	–	–	–	✓ ²⁾	✓ ²⁾	✓	–
Line-side components							
Line filter class A	F	F	F	F ¹⁾	F ¹⁾	F ¹⁾	–
Line filter class B (only for 400 V versions)	U ³⁾	U ³⁾	U ³⁾	–	–	–	–
Line reactor (only for 3 AC versions ⁴⁾)	S ⁵⁾	S ⁵⁾	S ⁵⁾	I	I	I	–
DC link components							
Braking resistor	S	S	S	S	S	S	–
Load-side power components							
Output reactor	S	S	S	S ²⁾	S ²⁾	S	–
dv/dt filter plus VPL (690 V versions only ⁹⁾)	–	–	–	S	S	S	–
PM240 Power Module without integrated braking chopper							
Available frame sizes	–	–	–	–	–	–	✓
Line-side components							
Line filter class A	–	–	–	–	–	–	S ⁶⁾
Line reactor	–	–	–	–	–	–	S
DC link components							
Braking resistor	–	–	–	–	–	–	S
Braking Module	–	–	–	–	–	–	I (option)
Load-side power components							
Output reactor	–	–	–	–	–	–	S
Sine-wave filter	–	–	–	–	–	–	S
PM250 Power Module with line-commutated energy recovery							
Available frame sizes	–	–	✓	✓	✓	✓	–
Line-side components							
Line filter class A	–	–	I	F	F	F	–
Line filter class B	–	–	U	–	–	–	–
Line reactor ⁷⁾	–	–	– ⁷⁾	– ⁷⁾	– ⁷⁾	– ⁷⁾	–
DC link components							
Braking resistor ⁸⁾	–	–	– ⁸⁾	– ⁸⁾	– ⁸⁾	– ⁸⁾	–
Load-side power components							
Output reactor	–	–	U	S	S	S	–
Sine-wave filter	–	–	U	S	S	S	–

U = Base component

S = Lateral mounting

I = Integrated

F = Power Modules available with and without integrated filter class A

– = Not possible

¹⁾ The 200 V versions of the PM240-2 Power Modules, frame sizes FSD to FSF, are only available without integrated line filter.

²⁾ There are no optional output reactors available for 690 V versions of PM240-2 Power Modules, frame sizes FSD and FSE.

³⁾ Lateral mounting is the only possible option for push-through variants.

⁴⁾ With the appropriate wiring, the line reactors for 200 V 3 AC can be used for the 200 V versions for 200 V 1 AC. Further information can be found on the Internet at:

<https://support.industry.siemens.com/cs/document/109486005>

<https://support.industry.siemens.com/cs/document/109482011>

⁵⁾ For frame sizes FSA to FSC, for lines with $u_k < 1\%$, it is recommended that you use a line reactor or the next more powerful Power Module. Further information can be found on the Internet at:

<https://support.industry.siemens.com/cs/document/109482011>

⁶⁾ PM240 Power Modules, frame size FSGX, are available only without an integrated filter class A. An optional line filter class A for lateral mounting is available instead.

⁷⁾ A line reactor is not required and must not be used in conjunction with a PM250 Power Module.

⁸⁾ A PM250 Power Module is capable of line-commutated energy feedback. A braking resistor cannot be connected and is not necessary.

⁹⁾ The 690 V versions of the PM240-2 Power Modules require motors with a suitable isolating system for 690 V inverter operation (IVIC-C premium). The VSD10 Line with corresponding SIMOTICS GP 1LE109 General Purpose motors or SIMOTICS SD 1LE159 Severe Duty motors is ideally suited for inverter operation at 690 V.

More information is available in Catalog D 81.1.

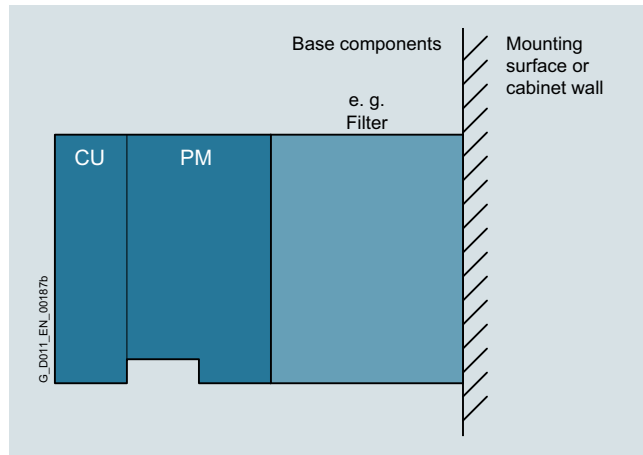
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Power Modules

Integration (continued)

General design information



Inverter comprising a Power Module (PM), a Control Unit (CU), and base components (side view)

- If at all possible, the line filter should be mounted directly below the inverter ¹⁾.
- With lateral mounting, the line-side components have to be mounted on the left side of the inverter, and the load-side components on the right side.
- Braking resistors have to be mounted directly on the control cabinet wall due to heating issues.

Recommended installation combinations of the inverter and optional power and DC link components

Power Module Frame size	Base	Lateral mounting	
		Left of the inverter (for line-side components)	Right of the inverter (for load-side power components and DC link components)
FSA and FSB	Line filter	Line reactor	Output reactor and/or braking resistor
FSC	Line filter ¹⁾	Line reactor	Output reactor and/or braking resistor
FSD and FSE	–	Line filter	Output reactor or sine-wave filter or dv/dt filter plus VPL and/or braking resistor
FSF	–	Line filter	Output reactor or sine-wave filter or dv/dt filter plus VPL and/or braking resistor
FSGX	–	Line filter and/or line reactor	Output reactor or sine-wave filter and/or braking resistor

¹⁾ With the PM250 Power Module, frame size FSC, the output reactor and sine-wave filter can be installed as base components. The output reactor or sine-wave filter should be mounted under the line filter.

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Power Modules

Selection and ordering data (continued)

PM240 Power Modules

Rated power ¹⁾		Rated output current I_{rated} ²⁾	Power based on the base-load current ³⁾		Base-load current I_H ³⁾	Frame size	PM240 Power Module without integrated line filter	PM240 Power Module with integrated line filter class A
kW	hp	A	kW	hp	A		Article No.	Article No.
380 ... 480 V 3 AC								
160	250	302	132	200	250	FSGX	6SL3224-0XE41-3UA0	–
200	300	370	160	250	302	FSGX	6SL3224-0XE41-6UA0	–
250	400	477	200	300	370	FSGX	6SL3224-0XE42-0UA0	–

PM250 Power Modules

Rated power ¹⁾		Rated output current I_{rated} ²⁾	Power based on the base-load current ³⁾		Base-load current I_H ³⁾	Frame size	PM250 Power Module without integrated line filter	PM250 Power Module with integrated line filter class A
kW	hp	A	kW	hp	A		Article No.	Article No.
380 ... 480 V 3 AC								
7.5	10	18	5.5	7.5	13.2	FSC	–	6SL3225-0BE25-5AA1
11	15	25	7.5	10	19	FSC	–	6SL3225-0BE27-5AA1
15	20	32	11	15	26	FSC	–	6SL3225-0BE31-1AA1
18.5	25	38	15	20	32	FSD	6SL3225-0BE31-5UA0	6SL3225-0BE31-5AA0
22	30	45	18.5	25	38	FSD	6SL3225-0BE31-8UA0	6SL3225-0BE31-8AA0
30	40	60	22	30	45	FSD	6SL3225-0BE32-2UA0	6SL3225-0BE32-2AA0
37	50	75	30	40	60	FSE	6SL3225-0BE33-0UA0	6SL3225-0BE33-0AA0
45	60	90	37	50	75	FSE	6SL3225-0BE33-7UA0	6SL3225-0BE33-7AA0
55	75	110	45	60	90	FSF	6SL3225-0BE34-5UA0	6SL3225-0BE34-5AA0
75	100	145	55	75	110	FSF	6SL3225-0BE35-5UA0	6SL3225-0BE35-5AA0
90	125	178	75	100	145	FSF	6SL3225-0BE37-5UA0	6SL3225-0BE37-5AA0

¹⁾ Rated power based on the rated output current I_{rated} . The rated output current I_{rated} is based on the duty cycle for low overload (LO).

²⁾ The rated output current I_{rated} is based on the duty cycle for low overload (LO). These current values are valid for 400 V and are specified on the rating plate of the Power Module.

³⁾ The base-load current I_H is based on the duty cycle for high overload (HO).

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Power Modules

Technical specifications

General technical specifications

Power Modules	PM240-2	PM240	PM250
System operating voltage	FSA to FSC: 200 ... 240 V 1 AC/3 AC ± 10 % 380 ... 480 V 3 AC ± 10 % FSD to FSF: 200 ... 240 V 3 AC ± 10 % (in operation -20 % < 1 min) 380 ... 480 V 3 AC ± 10 % (in operation -20 % < 1 min) 500 ... 690 V 3 AC ± 10 % (in operation -20 % < 1 min)	380 ... 480 V 3 AC ± 10 %	380 ... 480 V 3 AC ± 10 %
Line supply requirements Short-circuit power ratio R_{SC}	>25 200 V: With $R_{SC} > 50$ it is advisable for FSA to FSC to install a line reactor, or alternatively, to select a Power Module with the next-higher power rating. 400 V: With $R_{SC} > 100$ it is advisable to install a line reactor, or alternatively, to select a Power Module with the next-higher power rating.	>25 A line reactor is recommended with $R_{SC} > 100$	>100
Input frequency	47 ... 63 Hz		
Output frequency • Control mode V/f • Control type Vector	0 ... 550 Hz 0 ... 240 Hz		
Pulse frequency	200 V: 4 kHz 400 V: <75 kW: 4 kHz; ≥ 75 kW: 2 kHz 690 V: 2 kHz For higher pulse frequencies, see derating data	2 kHz For higher pulse frequencies, see derating data	4 kHz For higher pulse frequencies, see derating data
Power factor λ	FSA to FSC: 0.7 ... 0.85 FSD to FSF: - 200 V: >0.95 - 400 V and 690 V: >0.9	0.7 ... 0.85	0.9
Offset factor $\cos \phi$	FSA to FSC: >0.96 FSD to FSF: 0.98 ... 0.99	0.95	0.95 capacitive
Inverter efficiency	200 V: >96 % 400 V: >97 % 690 V: >98 %	>98 %	95 ... 97 %
Output voltage, max. as % of input voltage	95 %	95 %	87 %
Overload capability • Low overload (LO) Note: No reduction in base-load current I_L for use of overload • High overload (HO) Note: No reduction in base-load current I_H for use of overload	1.5 $\times$ base-load current I_L (i.e. 150 % overload) for 3 s plus 1.1 $\times$ base-load current I_L (i.e. 110 % overload) for 57 s within a cycle time of 300 s 2 $\times$ base-load current I_H (i.e. 200 % overload) for 3 s plus 1.5 $\times$ base-load current I_H (i.e. 150 % overload) for 57 s within a cycle time of 300 s	1.5 $\times$ base-load current I_L (i.e. 150 % overload) for 1 s plus 1.1 $\times$ base-load current I_L (i.e. 110 % overload) for 59 s within a cycle time of 300 s 1.6 $\times$ base-load current I_H (i.e. 160 % overload) for 3 s plus 1.36 $\times$ base-load current I_H (i.e. 136 % overload) for 57 s within a cycle time of 300 s	1.5 $\times$ base-load current I_L (i.e. 150 % overload) for 3 s plus 1.1 $\times$ base-load current I_L (i.e. 110 % overload) for 57 s within a cycle time of 300 s 2 $\times$ base-load current I_H (i.e. 200 % overload) for 3 s plus 1.5 $\times$ base-load current I_H (i.e. 150 % overload) for 57 s within a cycle time of 300 s

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Technical specifications (continued)

Power Modules	PM240-2	PM240	PM250
Possible braking methods	DC braking Compound braking Dynamic braking with integrated braking chopper	DC braking Compound braking Dynamic braking with integrated braking chopper (optional for frame size FSGX)	Regenerative feedback in generator mode
Degree of protection	IP20 (standard or push-through)	IP20	IP20
Operating temperature			
• Low overload (LO)	Frame sizes FSA to FSC: -10 ... +40 °C (14 ... 104 °F) without derating >40 ... 60 °C (>104 ... 140 °F) see derating characteristics	Frame size FSGX: 0 ... 40 °C (32 ... 104 °F) without derating >40 ... 55 °C (>104 ... 131 °F) see derating characteristics	0 ... 40 °C (32 ... 104 °F) without derating >40 ... 60 °C (>104 ... 140 °F) see derating characteristics
• High overload (HO)	Frame sizes FSA to FSC: -10 ... +50 °C (14 ... 122 °F) without derating >50 ... 60 °C (>122 ... 140 °F) see derating characteristics Frame sizes FSD to FSF: -20 ... +50 °C (-4 ... +122 °F) without derating >50 ... 60 °C (>122 ... 140 °F) see derating characteristics	Frame size FSGX: 0 ... 40 °C (32 ... 104 °F) without derating >40 ... 55 °C (>104 ... 131 °F) see derating characteristics	0 ... 50 °C (32 ... 122 °F) without derating >50 ... 60 °C (>122 ... 140 °F) see derating characteristics
Storage temperature	-40 ... +70 °C (-40 ... +158 °F)		
Relative humidity	<95 % RH, condensation not permissible		
Cooling	Internal air cooling, power units with increased air cooling by built-in fans	Internal air cooling, power units with increased air cooling by built-in fans	Internal air cooling, power units with increased air cooling by built-in fans
Installation altitude	Up to 1000 m (3281 ft) above sea level without derating, > 1000 m (3281 ft) see derating characteristics		
Protection functions	• Undervoltage • Overvoltage • Overload • Ground fault • Short-circuit • Stall protection • Motor blocking protection • Motor overtemperature • Inverter overtemperature • Parameter locking		
Short-Circuit Current Rating SCCR according to UL (Short Circuit Current Rating) ¹⁾	200 V: 100 kA 400 V: 100 kA 690 V: 100 kA	65 kA	FSC: 40 kA FSD to FSF: 42 kA
Compliance with standards	FSA ... FSC: CE, UL, cUL, RCM, SEMI F47 FSD ... FSF: CE, UL, cUL, RCM, SEMI F47, WEEE, RoHS, EAC	CE, UL, cUL, RCM, SEMI F47	CE, UL ²⁾ , cUL ²⁾ , RCM, SEMI F47
CE marking	According to Low Voltage Directive 2014/35/EU, EMC Directive 2014/30/EU		

¹⁾ Applies to industrial control panel installations to NEC article 409 or UL 508A.

²⁾ Applies to all PM250 Power Modules with integrated line filter class A.

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Power Modules

Technical specifications (continued)

Line voltage 380 ... 480 V 3 AC		PM250 Power Modules				
Without integrated line filter		6SL3225-0BE33-0UA0	6SL3225-0BE33-7UA0	6SL3225-0BE34-5UA0	6SL3225-0BE35-5UA0	6SL3225-0BE37-5UA0
With integrated line filter		6SL3225-0BE33-0AA0	6SL3225-0BE33-7AA0	6SL3225-0BE34-5AA0	6SL3225-0BE35-5AA0	6SL3225-0BE37-5AA0
Output current at 50 Hz 400 V 3 AC						
• Rated current I_{rated} ¹⁾	A	75	90	110	145	178
• Base-load current I_L ¹⁾	A	75	90	110	145	178
• Base-load current I_H ²⁾	A	60	75	90	110	145
• Maximum current I_{max}	A	120	150	180	220	290
Rated power						
• Based on I_L	kW (hp)	37 (50)	45 (60)	55 (75)	75 (100)	90 (125)
• Based on I_H	kW (hp)	30 (40)	37 (50)	45 (60)	55 (75)	75 (100)
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η	%	>97	>97	>97	>97	>97
Power loss ³⁾ At rated current	kW	1.01	1.217	1.605	2.234	2.638
Cooling air requirement	m ³ /s (ft ³ /s)	0.022 (0.78)	0.039 (1.38)	0.094 (3.32)	0.094 (3.32)	0.117 (4.13)
Sound pressure level L_{pA} (1 m)	dB	<60	<62	<60	<60	<65
Input current ⁴⁾						
• Rated input current	A	70	84	102	135	166
• Based on I_H	A	56	70	84	102	135
Line supply connection U1/L1, V1/L2, W1/L3		M6 screw studs	M6 screw studs	M8 screw studs	M8 screw studs	M8 screw studs
• Conductor cross-section, max.	mm ²	10 ... 50	10 ... 50	25 ... 120	25 ... 120	25 ... 120
Motor connection U2, V2, W2		M6 screw studs	M6 screw studs	M8 screw studs	M8 screw studs	M8 screw studs
• Conductor cross-section, max.	mm ²	10 ... 50	10 ... 50	25 ... 120	25 ... 120	25 ... 120
PE connection		On housing with M6 screw	On housing with M6 screw	On housing with M8 screw	On housing with M8 screw	On housing with M8 screw
Motor cable length ⁵⁾ , max.						
• Shielded	m (ft)	50 (164)	50 (164)	50 (164)	50 (164)	50 (164)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20	IP20	IP20
Dimensions						
• Width	mm (in)	275 (10.83)	275 (10.83)	350 (13.78)	350 (13.78)	350 (13.78)
• Height						
- Without integrated line filter	mm (in)	499 (19.65)	499 (19.65)	634 (24.96)	634 (24.96)	634 (24.96)
- With integrated line filter	mm (in)	635 (25.0)	635 (25.0)	934 (36.77)	934 (36.77)	934 (36.77)
• Depth						
- Without operator panel	mm (in)	204 (8.03)	204 (8.03)	316 (12.44)	316 (12.44)	316 (12.44)
- With operator panel, max.	mm (in)	268 (10.55)	268 (10.55)	380 (14.96)	380 (14.96)	380 (14.96)
Frame size		FSE	FSE	FSF	FSF	FSF
Weight, approx.						
• Without integrated line filter	kg (lb)	14 (30.9)	14 (30.9)	35 (77.2)	35 (77.2)	35 (77.2)
• With integrated line filter	kg (lb)	21 (46.3)	21 (46.3)	51 (112.5)	51 (112.5)	51 (112.5)

¹⁾ The rated output current I_{rated} and the base-load current I_L are based on the duty cycle for low overload (LO).

²⁾ The base-load current I_H is based on the duty cycle for high overload (HO).

³⁾ Typical values. You can find more information on the Internet at: <https://support.industry.siemens.com/cs/document/94059311>

⁴⁾ The input current depends on the motor load and line impedance and applies for a line impedance corresponding to $u_K = 1\%$. The rated input currents apply for a load at rated power (based on I_{rated}) – these current values are specified on the rating plate.

⁵⁾ Max. motor cable length 25 m (82 ft) (shielded) for PM250 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2.