

System configuration

SINAMICS G120P and SINAMICS G120P Cabinet pump, fan, compressor converters

Integrated Drive Systems

Overview

The core elements of a fully integrated drive system are frequency converters/inverters, motors, couplings and gear units. Siemens offers all the required components in top manufacturing quality from a single source, perfectly integrated – operating perfectly together, for all performance classes.

As a standard solution or tailored to individual requirements: no other provider on the market is able to offer a comparable portfolio. All Siemens drive components are optimally tuned to each other so that they interact ideally in every application.

Siemens Integrated Drive Systems turn simple drive components into real systems. Drive technology based on IDS ensures maximum productivity, energy efficiency and reliability in every automation environment and over the entire product lifecycle.

SINAMICS G120P frequency converters

SINAMICS G120P is an important element of an integrated drive system. The core elements of a fully integrated drive system are SINAMICS G120P frequency converters, motor types SIMOTICS SD and GP (VSD10 Line) and SIMOTICS FD, as well as couplings. Vertical integration is achieved by the CU230P-2 Control Unit.

Drives with a quadratic load torque ($M \sim n^2$), such as drives for pumps and fans, require the full torque at rated speed. Generally, increased starting torques or load surges do not occur.

The following applies to selection of a suitable converter for drives with a quadratic load torque: The rated current of the converter must be at least as large as the motor current at full torque in the required load point.

SIMOTICS GP and SIMOTICS SD – VSD10 Line motors

VSD10 Line motors are based on the 1LE1 platform and are available in the following versions:

- General Purpose Motors, shaft heights from 100 to 160, aluminum
- Severe Duty Motors, shaft heights from 100 to 315, cast iron

These motors are optimized for operation on a SINAMICS G120 converter. They are intended solely for converter operation. They must not be connected directly to a mains supply.

Functions integrated as standard for converter operation:

- Insulation system optimized for converter operation
- Built-in temperature sensor
- Bearing insulation NDE (shaft height 280/315)

The VSD10 Line provides the link to the SIMOTICS FD series for converter-fed motors.

SIMOTICS FD motors

The new generation of SIMOTICS FD (Flexible Duty) low-voltage motors will be available in four shaft heights with output ratings ranging from 200 kW to 1600 kW and higher. SIMOTICS FD motors are based on an innovative modular system. These air-cooled and water-cooled converter motors are available in numerous different versions and therefore suitable for a wide variety of applications in a host of different industries.

SIMOTICS FD in shaft heights 315 to 400 is designed for operation on SINAMICS G120P converters with output ratings ranging from 200 kW to 630 kW.

FLENDER couplings as part of the drive system

A drive system comprises individual machines, including the motor and gear unit. Couplings combine these components and frequently also establish the connection to the driven machine.

The coupling can perform other tasks in addition to the transmission of rotary motion and torque, such as:

- Compensation for **shaft misalignment** with low restorative forces
- Influencing of intrinsic torsional frequency and **damping**
- Torque interruption or limitation in response to **overload**
- Electrical **insulation**, noise insulation
- Function in **explosive environments**

Overview of relevant coupling types

Design	Description
N-EUPEX	Flexible cam coupling • Universally implementable coupling for compensation of shaft misalignment • Suitable for plug-in installation and easy assembly with three-part design Rated torque: 19 ... 62000 Nm
RUPEX	Flexible pin and bush coupling • Fail-safe, universal coupling for medium to very high torques with a good misalignment range • Compact design, low weights and mass moments of inertia • Suitable for plug-in assembly Rated torque: 200 ... 1300000 Nm
ARPEX	All-steel couplings • Zero-backlash, torsionally rigid coupling • For compensating radial, angular, and axial shaft misalignment by means of two flexible lamella packages made of stainless spring steel • Easy assembly thanks to compact lamella packages Rated torque: 92 ... 1450000 Nm

Overview (continued)

SINAMICS G120P Power Modules for use in building technology for heating, air-conditioning and ventilation applications, with degree of protection IP55, 380 to 480 V 3 AC

SINAMICS G120P										
Rated power ¹⁾		Rated output current I_{rated} ²⁾	Power based on the base-load current I_H ³⁾		Base-load current I_H ³⁾	Power Module				
400 V	460 V		400 V	460 V		Frame size	Type	With integrated line filter class A (Category C2)	With integrated line filter class B (Category C1)	
kW	hp	A	kW	hp	A			Article No.	Article No.	
0.37	0.5	1.3	0.25	0.33	0.9	FSA	PM230	6SL3223-0DE13-7AG1	6SL3223-0DE13-7BG1	
0.55	0.5	1.7	0.37	0.33	1.3			6SL3223-0DE15-5AG1	6SL3223-0DE15-5BG1	
0.75	0.75	2.2	0.55	0.5	1.7			6SL3223-0DE17-5AG1	6SL3223-0DE17-5BG1	
1.1	1	3.1	0.75	0.75	2.2			6SL3223-0DE21-1AG1	6SL3223-0DE21-1BG1	
1.5	2	4.1	1.1	1	3.1			6SL3223-0DE21-5AG1	6SL3223-0DE21-5BG1	
2.2	3	5.9	1.5	1.5	4.1			6SL3223-0DE22-2AG1	6SL3223-0DE22-2BG1	
3	3	7.7	2.2	3	5.9			6SL3223-0DE23-0AG1	6SL3223-0DE23-0BG1	
4	5	10.2	3	3	7.7	FSB		6SL3223-0DE24-0AG1	6SL3223-0DE24-0BG1	
5.5	7.5	13.2	4	5	10.2			6SL3223-0DE25-5AG1	6SL3223-0DE25-5BG1	
7.5	10	18	5.5	5	13.2			6SL3223-0DE27-5AG1	6SL3223-0DE27-5BG1	
11	15	26	7.5	10	18	FSC		6SL3223-0DE31-1AG1	6SL3223-0DE31-1BG1	
15	15	32	11	15	26			6SL3223-0DE31-5AG1	6SL3223-0DE31-5BG1	
18.5	20	38	15	15	32			6SL3223-0DE31-8AG1	–	
						FSD		–	6SL3223-0DE31-8BA0	
22	25	45	18.5	20	38	FSE		6SL3223-0DE32-2AA0	6SL3223-0DE32-2BA0	
30	30	60	22	25	45			6SL3223-0DE33-0AA0	6SL3223-0DE33-0BA0	
37	40	75	30	30	60			6SL3223-0DE33-7AA0	6SL3223-0DE33-7BA0	
45	50	90	37	40	75	FSF		6SL3223-0DE34-5AA0	6SL3223-0DE34-5BA0	
55	60	110	45	50	90			6SL3223-0DE35-5AA0	6SL3223-0DE35-5BA0	
75	75	145	55	60	110			6SL3223-0DE37-5AA0	6SL3223-0DE37-5BA0	
90	100	178	75	75	145			6SL3223-0DE38-8AA0	6SL3223-0DE38-8BA0	

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).

SINAMICS G120P built-in and wall-mounted units

PM230 Power Modules, 0.37 kW to 90 kW

PM230 Power Modules

Selection and ordering data

To ensure that a suitable Power Module is selected, the following currents should be used for applications:

- **Rated output current for applications with low overload (LO)**
- **Base-load current for applications with high overload (HO)**

With reference to the rated output current, the modules support at least 2-pole to 6-pole low-voltage motors, e.g. the SIMOTICS GP and SIMOTICS SD 1LE1 motor series. The rated power is merely a guide value. For a description of the overload performance, please refer to the general technical specifications of the Power Modules.

PM230 Power Modules degree of protection IP55/UL Type 12

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	PM230 Power Module degree of protection IP55/UL Type 12 with integrated line filter class <u>A</u>	PM230 Power Module degree of protection IP55/UL Type 12 with integrated line filter class <u>B</u>
400 V	460 V		400 V	460 V				
kW	hp	A	kW	hp	A		Article No.	Article No.
380 ... 480 V 3 AC								
0.37	0.5	1.3	0.25	0.33	0.9	FSA	6SL3223-0DE13-7AG1	6SL3223-0DE13-7BG1
0.55	0.5	1.7	0.37	0.33	1.3	FSA	6SL3223-0DE15-5AG1	6SL3223-0DE15-5BG1
0.75	0.75	2.2	0.55	0.5	1.7	FSA	6SL3223-0DE17-5AG1	6SL3223-0DE17-5BG1
1.1	1	3.1	0.75	0.75	2.2	FSA	6SL3223-0DE21-1AG1	6SL3223-0DE21-1BG1
1.5	2	4.1	1.1	1	3.1	FSA	6SL3223-0DE21-5AG1	6SL3223-0DE21-5BG1
2.2	3	5.9	1.5	1.5	4.1	FSA	6SL3223-0DE22-2AG1	6SL3223-0DE22-2BG1
3	3	7.7	2.2	3	5.9	FSA	6SL3223-0DE23-0AG1	6SL3223-0DE23-0BG1
4	5	10.2	3	3	7.7	FSB	6SL3223-0DE24-0AG1	6SL3223-0DE24-0BG1
5.5	7.5	13.2	4	5	10.2	FSB	6SL3223-0DE25-5AG1	6SL3223-0DE25-5BG1
7.5	10	18	5.5	5	13.2	FSB	6SL3223-0DE27-5AG1	6SL3223-0DE27-5BG1
11	15	26	7.5	10	18	FSC	6SL3223-0DE31-1AG1	6SL3223-0DE31-1BG1
15	15	32	11	15	26	FSC	6SL3223-0DE31-5AG1	6SL3223-0DE31-5BG1
18.5	20	38	15	15	32	FSC	6SL3223-0DE31-8AG1	–
						FSD	–	6SL3223-0DE31-8BA0
22	25	45	18.5	20	38	FSD	6SL3223-0DE32-2AA0	6SL3223-0DE32-2BA0
30	30	60	22	25	45	FSD	6SL3223-0DE33-0AA0	6SL3223-0DE33-0BA0
37	40	75	30	30	60	FSE	6SL3223-0DE33-7AA0	6SL3223-0DE33-7BA0
45	50	90	37	40	75	FSE	6SL3223-0DE34-5AA0	6SL3223-0DE34-5BA0
55	60	110	45	50	90	FSF	6SL3223-0DE35-5AA0	6SL3223-0DE35-5BA0
75	75	145	55	60	110	FSF	6SL3223-0DE37-5AA0	6SL3223-0DE37-5BA0
90	100	178	75	75	145	FSF	6SL3223-0DE38-8AA0	6SL3223-0DE38-8BA0

It is essential to plug on an operator panel or the blanking cover in order to achieve degree of protection IP55/UL Type 12.

For more information, see [Operator panels and Blanking cover for PM230 Power Modules](#) in section Supplementary system components.

Note:

The power data in hp units are based on the NEC/CEC standards for the North American market.

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).

SINAMICS G120P built-in and wall-mounted units

PM230 Power Modules, 0.37 kW to 90 kW

PM230 Power Modules

Technical specifications

General technical specifications

	PM230 Power Modules	
Degree of protection	IP55 (with IOP-2, BOP-2 or blanking cover)	IP20/UL Open Type (Standard or Push Through variants)
Power (low overload LO)	0.37 ... 90 kW	0.37 ... 75 kW
Rated output current (low overload LO)	1.3 ... 178 A	1.3 ... 145 A
Power (high overload HO)	0.25 ... 75 kW	0.25 ... 55 kW
Rated output current (high overload HO)	0.9 ... 145 A	0.9 ... 110 A
System operating voltage	380 ... 480 V $\pm 10\%$ 3 AC	
Grid requirement	>100	
Short-circuit power R_{SC}		
Input frequency	47 ... 63 Hz	
Output frequency		
• Control mode V/f	0 ... 550 Hz	
• Control type Vector	0 ... 240 Hz	
Pulse frequency	4 kHz for higher pulse frequencies up to 16 kHz, see derating data	
Power factor λ	0.9	
Offset factor $\cos \varphi$	0.95	
Inverter efficiency	$\leq 97\%$	
Output voltage, max. as % of input voltage	95 %	
Overload capability		
• Low overload (LO)	<u>Note:</u> When the overload capability is used, the base-load current I_L is not reduced. - Frame sizes FSA to FSC 1.5 × base-load current I_L (i. e. 150 % overload) for 3 s plus 1.1 × base-load current I_L (i. e. 110 % overload) for 57 s within a cycle time of 300 s - Frame sizes FSD to FSF 1.1 × base-load current I_L (i. e. 110 % overload) for 60 s within a cycle time of 300 s	
• High overload (HO)	<u>Note:</u> When the overload capability is used, the base-load current I_H is not reduced. - Frame sizes FSA to FSC 2 × base-load current I_H (i. e. 200 % overload) for 3 s plus 1.5 × base-load current I_H (i. e. 150 % overload) for 57 s within a cycle time of 300 s - Frame sizes FSD to FSF 1.5 × base-load current I_H (i. e. 150 % overload) for 60 s within a cycle time of 300 s	
Electromagnetic compatibility	• Devices with line filter class A for applications according to Categories C3 and C2 • Devices with line filter class B for applications according to Category C2 and compliance with conducted interference requirements of Category C1	
Possible braking methods	• Devices without line filter • Devices with line filter class A for applications according to Categories C3 and C2 • Devices with line filter class B for applications according to Category C2 and compliance with conducted interference requirements of Category C1	
Operating temperature	DC braking	
• Low overload (LO)	Frame sizes FSA to FSC: -10 ... +40 °C (14 ... 104 °F) without derating Frame sizes FSD to FSF: 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 Frame sizes FSD to FSF: 0 ... 50 °C (32 ... 122 °F) without derating >50 ... 60 °C (122 ... 140 °F) see derating characteristics	
Relative humidity	<95 %, condensation not permissible	
Storage temperature	-40 ... +70 °C (-40 ... +158 °F)	
Cooling	Power units with increased air cooling using integrated 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 • Overcurrent/overload • Overtemperature • Ground fault • Short-circuit • Stall protection • Motor blocking protection • Motor overtemperature • Inverter overtemperature • Parameter locking	
Rated short-circuit current $SCCR$ (Short-Circuit Current Rating) ¹⁾	Frame sizes FSA to FSC: 40 kA	65 kA
Compliance with standards	UL, cUL ²⁾ , CE, 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 acc. to NEC Article 409 or UL 508A/508C.

²⁾ Applies to PM230 Power Modules, frame sizes FSA to FSC.

SINAMICS G120P built-in and wall-mounted units

PM230 Power Modules, 0.37 kW to 90 kW

PM230 Power Modules

Technical specifications (continued)

PM230 Power Modules, degree of protection IP55

Line voltage 380 ... 480 V 3 AC		PM230 Power Modules, degree of protection IP55/UL Type 12				
With integrated line filter class A		6SL3223-ODE13-7AG1	6SL3223-ODE15-5AG1	6SL3223-ODE17-5AG1	6SL3223-ODE21-1AG1	6SL3223-ODE21-5AG1
With integrated line filter class B		6SL3223-ODE13-7BG1	6SL3223-ODE15-5BG1	6SL3223-ODE17-5BG1	6SL3223-ODE21-1BG1	6SL3223-ODE21-5BG1
Output current at 50 Hz 400 V 3 AC						
• Rated current $I_{rated}^{1)}$	A	1.3	1.7	2.2	3.1	4.1
• Base-load current $I_L^{1)}$	A	1.3	1.7	2.2	3.1	4.1
• Base-load current $I_H^{2)}$	A	0.9	1.3	1.7	2.2	3.1
• Maximum current I_{max}	A	2	2.6	3.4	4.7	6.2
Rated power						
• Based on I_L	kW	0.37	0.55	0.75	1.1	1.5
• Based on I_H	kW	0.25	0.37	0.55	0.75	1.1
Rated pulse frequency	kHz	4	4	4	4	4
Efficiency η	%	86	90	92	94	95
Power loss ³⁾ at rated current	kW	0.04	0.043	0.047	0.055	0.064
Cooling air requirement	m ³ /s (ft ³ /s)	0.007 (0.25)	0.007 (0.25)	0.007 (0.25)	0.007 (0.25)	0.007 (0.25)
Sound pressure level L_{pA} (1 m)	dB	61.9	61.9	61.9	61.9	61.9
24 V DC power supply for Control Unit	A	1	1	1	1	1
Input current ⁴⁾						
• Rated current	A	1.3	1.8	2.3	3.2	4.2
• Based on I_H	A	0.9	1.3	1.8	2.3	3.2
Line supply connection U1/L1, V1/L2, W1/L3		Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in
• Conductor cross-section	mm ²	1 ... 2.5	1 ... 2.5	1 ... 2.5	1 ... 2.5	1 ... 2.5
Motor connection U2, V2, W2		Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in
• Conductor cross-section	mm ²	1 ... 2.5	1 ... 2.5	1 ... 2.5	1 ... 2.5	1 ... 2.5
Motor cable length, max. ⁵⁾						
• Shielded	m (ft)	25 (82)	25 (82)	25 (82)	25 (82)	25 (82)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)	100 (328)	100 (328)
Degree of protection ⁶⁾		IP55/UL Type 12	IP55/UL Type 12	IP55/UL Type 12	IP55/UL Type 12	IP55/UL Type 12
Dimensions						
• Width	mm (in)	154 (6.06)	154 (6.06)	154 (6.06)	154 (6.06)	154 (6.06)
• Height	mm (in)	460 (18.11)	460 (18.11)	460 (18.1)	460 (18.11)	460 (18.1)
• Depth						
- Without operator panel	mm (in)	249 (9.80)	249 (9.80)	249 (9.80)	249 (9.80)	249 (9.80)
- With operator panel, max.	mm (in)	266 (10.47)	266 (10.47)	266 (10.47)	266 (10.47)	266 (10.47)
Frame size		FSA	FSA	FSA	FSA	FSA
Weight, approx.		kg (lb)	4.3 (9.48)	4.3 (9.48)	4.3 (9.48)	4.3 (9.48)

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 PM230 Power Modules with integrated line filter to maintain the limit values of EN 61800-3 Category C2 (filter A) or C1 table 14 (filter B). With unshielded cables, Categories C2 and C1 are not achieved.

⁶⁾ It is essential to plug on an operator panel or the blanking cover in order to achieve degree of protection IP55/UL Type 12.
For more information, see Operator panels and blanking cover for PM230 Power Modules in section Supplementary system components.