

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)

Overview tables

The tables on the following pages provide an overview of all converters with associated line-side and load-side components, DC link components and the available Control Units with operator panels.

SINAMICS G120P Power Modules for use in building technology for heating, air-conditioning and ventilation applications, with degree of protection IP20, 380 to 480 V 3 AC

SINAMICS G120P									
Rated power ¹⁾		Rated out-put current ²⁾ <i>I</i> _{rated}	Power based on the base-load current <i>I</i> _H ³⁾		Base-load current ³⁾ <i>I</i> _H	Power Module			
400 V	460 V		400 V	460 V		Frame size	Type	Without integrated line filter	With integrated line filter class A (Category C2)
kW	hp	A	kW	hp	A			Article No.	Article No.
0.37	0.5	1.3	0.25	0.33	0.9	FSA	PM230	6SL3210-1NE11-3UG1	6SL3210-1NE11-3AG1
0.55	0.5	1.7	0.37	0.33	1.3			6SL3210-1NE11-7UG1	6SL3210-1NE11-7AG1
0.75	0.75	2.2	0.55	0.5	1.7			6SL3210-1NE12-2UG1	6SL3210-1NE12-2AG1
1.1	1	3.1	0.75	0.75	2.2			6SL3210-1NE13-1UG1	6SL3210-1NE13-1AG1
1.5	2	4.1	1.1	1	3.1			6SL3210-1NE14-1UG1	6SL3210-1NE14-1AG1
2.2	3	5.9	1.5	1.5	4.1			6SL3210-1NE15-8UG1	6SL3210-1NE15-8AG1
3	3	7.7	2.2	3	5.9			6SL3210-1NE17-7UG1	6SL3210-1NE17-7AG1
4	5	10.2	3	3	7.7			6SL3210-1NE21-0UG1	6SL3210-1NE21-0AG1
5.5	7.5	13.2	4	5	10.2			6SL3210-1NE21-3UG1	6SL3210-1NE21-3AG1
7.5	10	18	5.5	5	13.2			6SL3210-1NE21-8UG1	6SL3210-1NE21-8AG1
11	15	26	7.5	10	18	FSC		6SL3210-1NE22-6UG1	6SL3210-1NE22-6AG1
15	15	32	11	15	26			6SL3210-1NE23-2UG1	6SL3210-1NE23-2AG1
18.5	20	38	15	15	32			6SL3210-1NE23-8UG1	6SL3210-1NE23-8AG1
22	25	45	18.5	20	38	FSD		6SL3210-1NE24-5UL0	6SL3210-1RN24-5AL0
30	30	60	22	25	45			6SL3210-1NE26-0UL0	6SL3210-1NE26-0AL0
37	40	75	30	30	60	FSE		6SL3210-1NE27-5UL0	6SL3210-1NE27-5AL0
45	50	90	37	40	75			6SL3210-1NE28-8UL0	6SL3210-1NE28-8AL0
55	60	110	45	50	90	FSF		6SL3210-1NE31-1UL0	6SL3210-1NE31-1AL0
75	75	145	55	60	110			6SL3210-1NE31-5UL0	6SL3210-1NE31-5AL0
Push Through									
3	3	7.7	2.2	3	5.9	FSA	PM230	6SL3211-1NE17-7UG1	6SL3211-1NE17-7AG1
7.5	10	18	5.5	5	13.2	FSB		6SL3211-1NE21-8UG1	6SL3211-1NE21-8AG1
18.5	20	38	15	15	32	FSC		6SL3211-1NE23-8UG1	6SL3211-1NE23-8AG1

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 (continued)

PM230 Power Modules degree of protection IP20 Standard variant

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 IP20 Standard variant <u>without</u> integrated line filter	PM230 Power Module degree of protection IP20 Standard variant <u>with</u> integrated line filter class A
400 V	460 V		400 V	460 V				
kW	hp		kW	hp				
Article No.								
Article No.								
380 ... 480 V 3 AC								
0.37	0.5	1.3	0.25	0.33	0.9	FSA	6SL3210-1NE11-3UG1	6SL3210-1NE11-3AG1
0.55	0.5	1.7	0.37	0.33	1.3	FSA	6SL3210-1NE11-7UG1	6SL3210-1NE11-7AG1
0.75	0.75	2.2	0.55	0.5	1.7	FSA	6SL3210-1NE12-2UG1	6SL3210-1NE12-2AG1
1.1	1	3.1	0.75	0.75	2.2	FSA	6SL3210-1NE13-1UG1	6SL3210-1NE13-1AG1
1.5	2	4.1	1.1	1	3.1	FSA	6SL3210-1NE14-1UG1	6SL3210-1NE14-1AG1
2.2	3	5.9	1.5	1.5	4.1	FSA	6SL3210-1NE15-8UG1	6SL3210-1NE15-8AG1
3	3	7.7	2.2	3	5.9	FSA	6SL3210-1NE17-7UG1	6SL3210-1NE17-7AG1
4	5	10.2	3	3	7.7	FSB	6SL3210-1NE21-0UG1	6SL3210-1NE21-0AG1
5.5	7.5	13.2	4	5	10.2	FSB	6SL3210-1NE21-3UG1	6SL3210-1NE21-3AG1
7.5	10	18	5.5	5	13.2	FSB	6SL3210-1NE21-8UG1	6SL3210-1NE21-8AG1
11	15	26	7.5	10	18	FSC	6SL3210-1NE22-6UG1	6SL3210-1NE22-6AG1
15	15	32	11	15	26	FSC	6SL3210-1NE23-2UG1	6SL3210-1NE23-2AG1
18.5	20	38	15	15	32	FSC	6SL3210-1NE23-8UG1	6SL3210-1NE23-8AG1
22	25	45	18.5	20	38	FSD	6SL3210-1NE24-5UL0	6SL3210-1NE24-5AL0
30	30	60	22	25	45	FSD	6SL3210-1NE26-0UL0	6SL3210-1NE26-0AL0
37	40	75	30	30	60	FSE	6SL3210-1NE27-5UL0	6SL3210-1NE27-5AL0
45	50	90	37	40	75	FSE	6SL3210-1NE28-8UL0	6SL3210-1NE28-8AL0
55	60	110	45	50	90	FSF	6SL3210-1NE31-1UL0	6SL3210-1NE31-1AL0
75	75	145	55	60	110	FSF	6SL3210-1NE31-5UL0	6SL3210-1NE31-5AL0

PM230 Power Modules degree of protection IP20 Push Through variant

Rated power ¹⁾		Rated output current <i>I</i> _{rated} ²⁾	Power based on the base-load current ³⁾		Base-load current <i>I</i> _H ³⁾	Frame size	PM230 Power Module degree of protection IP20 Push Through variant <u>without</u> integrated line filter	PM230 Power Module degree of protection IP20 Push Through variant with integrated line filter class <u>A</u>
400 V	460 V		400 V	460 V				
kW	hp		A	kW				
380 ... 480 V 3 AC								
3	3	7.7	2.2	3	5.9	FSA	6SL3211-1NE17-7UG1	6SL3211-1NE17-7AG1
7.5	10	18	5.5	5	13.2	FSB	6SL3211-1NE21-8UG1	6SL3211-1NE21-8AG1
18.5	20	38	15	15	32	FSC	6SL3211-1NE23-8UG1	6SL3211-1NE23-8AG1

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 (continued)

PM230 Power Modules degree of protection IP20 Push Through variant

Line voltage 380 ... 480 V 3 AC		PM230 Power Modules degree of protection IP20 Push Through variant		
Without integrated line filter		6SL3211-1NE17-7UG1	6SL3211-1NE21-8UG1	6SL3211-1NE23-8UG1
With integrated line filter class A		6SL3211-1NE17-7AG1	6SL3211-1NE21-8AG1	6SL3211-1NE23-8AG1
Output current at 50 Hz 400 V 3 AC				
• Rated current $I_{rated}^{1)}$	A	7.7	18	38
• Base-load current $I_L^{1)}$	A	7.7	18	38
• Base-load current $I_H^{2)}$	A	5.9	13.2	32
• Maximum current I_{max}	A	11.8	27	64
Rated power				
• Based on I_L	kW	3	7.5	18.5
• Based on I_H	kW	2.2	5.5	15
Rated pulse frequency	kHz	4	4	4
Efficiency η	%	96	97	98
Power loss ³⁾ at rated current	kW	0.102	0.224	0.423
Cooling air requirement	m ³ /s (ft ³ /s)	0.005 (0.2)	0.009 (0.3)	0.019 (0.7)
Sound pressure level L_{pA} (1 m)	dB	<56	<62	<65
24 V DC power supply for Control Unit	A	1	1	1
Input current ⁴⁾				
• Rated current	A	8	19	39
• Based on I_H	A	6.1	14	33
Line supply connection U1/L1, V1/L2, W1/L3		Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in
• Conductor cross-section	mm ²	1.5 ... 2.5	4 ... 6	6 ... 16
Motor connection U2, V2, W2		Screw-type terminals, plug-in	Screw-type terminals, plug-in	Screw-type terminals, plug-in
• Conductor cross-section	mm ²	1 ... 2.5	4 ... 6	10 ... 16
Motor cable length, max. ⁵⁾				
• Shielded	m (ft)	25 (82)	25 (82)	25 (82)
• Unshielded	m (ft)	100 (328)	100 (328)	100 (328)
Degree of protection		IP20	IP20	IP20
Dimensions				
• Width	mm (in)	126 (4.96)	154 (6.06)	200 (7.87)
• Height	mm (in)	238 (9.37)	345 (13.58)	411 (16.18)
• Depth				
- Without operator panel	mm (in)	171 (6.73)	171 (6.73)	171 (6.73)
- With operator panel, max.	mm (in)	251 (9.88)	251 (9.88)	251 (9.88)
Frame size		FSA	FSB	FSC
Weight, approx. With integrated line filter				
• Without integrated line filter	kg (lb)	1.7 (3.75)	3.4 (7.50)	5.4 (11.91)
• With integrated line filter	kg (lb)	1.9 (4.19)	3.6 (7.94)	6 (13.23)

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 acc. to EN 61800-3 Category C2. With unshielded cables, Category C2 is not achieved.

SINAMICS G120P built-in and wall-mounted units

PM230 Power Modules, 0.37 kW to 90 kW

Line filter

Technical specifications

Line voltage 380 ... 480 V 3 AC		Line filter class B					
		6SL3203-0BE17-7BA0	6SL3203-0BE21-8BA0	6SL3203-0BE23-8BA0	6SL3203-0BE27-5BA0	6SL3203-0BE31-1BA0	6SL3203-0BE31-8BA0
Rated current	A	11.4	23.5	49.4	72	105	204
Pulse frequency	kHz	4 ... 16	4 ... 16	4 ... 16	4 ... 16	4 ... 16	4 ... 8
Line supply connection L1, L2, L3		Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals	Screw-type terminals
• Conductor cross-section	mm ²	1 ... 2.5	2.5 ... 6	6 ... 16	16 ... 50	16 ... 50	35 ... 150
Load connection U, V, W		Shielded cable	Shielded cable	Shielded cable	Shielded cable	Shielded cable	Shielded cable
• Cable cross-section	mm ²	1.5	4	10	16	35	50
• Length	m (ft)	0.45 (1.48)	0.5 (1.64)	0.54 (1.77)	1 (3.28)	1 (3.28)	1.1 (3.61)
PE connection		On housing via M5 screw stud	On housing via M5 screw stud	On housing via M6 screw studs	On housing via M6 screw studs	On housing via M8 screw studs	On housing via M10 screw studs
• Conductor cross-section	mm ²	1 ... 2.5	2.5 ... 6	6 ... 16	16 ... 50	35 ... 50	50 ... 150
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions							
• Width	mm (in)	73 (2.87)	100 (3.94)	140 (5.51)	100 (3.94)	110 (4.33)	150 (5.91)
• Height	mm (in)	202 (7.95)	297 (11.7)	359 (14.1)	400 (15.7)	480 (18.9)	517
• Depth	mm (in)	65 (2.56)	85 (3.35)	95 (3.74)	140 (5.51)	140 (5.51)	230 (9.06)
Possible as base component		Yes	Yes	Yes	No	No	No
Weight, approx.	kg (lb)	1.75 (3.86)	4 (8.82)	7.3 (16.1)	7.6 (16.8)	11.9 (26.2)	21.7 (47.8)
Suitable for PM230 Power Module degree of protection IP20 standard variant	Type	6SL3210-1NE11-3UG1 6SL3210-1NE11-7UG1 6SL3210-1NE12-2UG1 6SL3210-1NE13-1UG1 6SL3210-1NE14-1UG1 6SL3210-1NE15-8UG1 6SL3210-1NE17-7UG1	6SL3210-1NE21-0UG1 6SL3210-1NE21-3UG1 6SL3210-1NE21-8UG1	6SL3210-1NE22-6UG1 6SL3210-1NE23-2UG1 6SL3210-1NE23-8UG1	6SL3210-1NE24-5UL0 6SL3210-1NE26-0UL0	6SL3210-1NE27-5UL0 6SL3210-1NE28-8UL0	6SL3210-1NE31-1UL0 6SL3210-1NE31-5UL0
Suitable for PM230 Power Module degree of protection IP20 Push Through variant (lateral mounting only)	Type	6SL3211-1NE17-7UG1	6SL3211-1NE21-8UG1	6SL3211-1NE23-8UG1	—	—	—
• Frame size		FSA	FSB	FSC	FSD	FSE	FSF