

The Universal Single-Motor Drive

SINAMICS GM150 and SINAMICS SM150 Medium-Voltage
Drive Converters with HV-IGBT technology







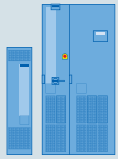



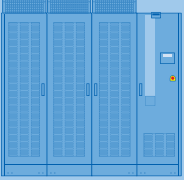

SINAMICS drives

Answers for industry.

SIEMENS

SINAMICS – the optimum drive for each and every application

The perfect basis for leading edge drive solutions

Low voltage						Medium voltage	DC					
For basic applications		For higher-performance applications			For basic servo applications	For advanced applications		For applications with high power ratings	For basic and advanced applications			
												
SINAMICS G110		SINAMICS G110D		SINAMICS G120	SINAMICS G120D	SINAMICS G130/G150		SINAMICS S110	SINAMICS S120	SINAMICS S150	SINAMICS GM150/SM150/GL150/SL150	SINAMICS DCM
V/f control	V/f control/FCC	V/f control/Vector control			Servo control	V/f control/Vector control/Servo control		V/f control/Vector control	Speed control/torque control			
0.12 – 3 kW	0.75 – 7.5 kW	0.37 – 250 kW	0.75 – 7.5 kW	75 – 1,500 kW	0.12–90 kW	0.12–4,500 kW	75 –1,200 kW	0.8–120 MW	6 kW – 30 MW			
Pumps, fans, conveyor belts	Conveyor technology	Pumps, fans, conveyor belts, compressors, mixers, crushers, extruders			Single-axis positioning, applications in machinery and plant construction	Production machines (packaging, textile and printing machines, paper machines, plastics machines) machine tools, plants, process lines and rolling mills	Test stands, cross-cutters, centrifuges	Pumps, fans, compressors, mixers, extruders, crushers, rolling mills, mine hoists	Rolling mill drives, wire-drawing machines, extruders and kneaders, cable cars and lifts, test stand drives			
Common engineering tools												
SIZER – for simple planning and engineering					STARTER – for fast commissioning, optimization and diagnostics							

The SINAMICS family offers the optimum drive for each and every drive application. A real highlight: All of the drives can be engineered, parameterized, commissioned and operated in the same standard way.

The innovative drive family at a glance

- Wide range of power ratings from 0.12 kW to 120 MW
- Available in low-voltage and medium-voltage versions
- Standard functionality using a common hardware and software platform
- Standard engineering using just two tools for all drives: SIZER for engineering and STARTER for parameterization and commissioning
- High degree of flexibility and combinability

Medium-voltage drives from Siemens

The reliable and complete range

Medium-voltage drive converter series	ROBICON Perfect Harmony	SINAMICS GM150 (IGBT/IGCT)	SINAMICS SM150 (IGBT/IGCT)	SINAMICS GL150	SINAMICS SL150
Power range	150 kW–120 MW	800 kW–17.5 MW	2.8 MW–30 MW	6 MW–120 MW	3 MW–36 MW
Application range	General-purpose applications	General-purpose applications	Sophisticated applications	General-purpose applications	Sophisticated applications
Motors	Induction and synchronous motors	Induction and synchronous motors	Induction and synchronous motors	Synchronous motors	Induction and synchronous motors
Energy recovery	–	–	Yes	Yes	Yes
Multi-motor drives	–	–	Yes	–	–
Semiconductor technology	LV-IGBT (cell topology)	HV-IGBT/IGCT (NPC topology)	HV-IGBT/IGCT (NPC topology)	Thyristor (LCI topology)	Thyristor (Cycloconverters)
Typical applications	Pumps, fans, compressors, extruders, kneaders, mixers, crushers, agitators, conveyor systems, presses, ESP, retrofit	Pumps, fans, compressors, extruders, kneaders, mixers, crushers, agitators, conveyor systems, marine drives, presses, wire rod mills	Rolling mills, mine hoists, conveyor systems, test stands	Compressors, fans, pumps, extruders, marine drives, starting converters for blast furnaces	Rolling mills, mine hoists, excavators, ore crushers and cement mills

The benchmark when it comes to medium-voltage drive systems

Siemens is the undisputed No. 1 in medium-voltage drives and around the globe sets the benchmark in this sector – and not only involving power ratings and market share. Our range of products is also unique worldwide:

- All voltage classes from 2.3 to 13.8 kV
- A seamless range of power ratings from 150 kW to 120 MW
- All levels of dynamic response and performance
- Single-motor drives and multi-motor systems
- Harmonized and coordinated systems with synchronous and induction motors
- Motor speeds from 10 to 15,000 rpm in the Megawatt range

The decisive plus when it comes to experience

Everywhere where it involves the highest degree of availability, an uncountable number of users have been depending on medium-voltage drive converters from Siemens since decades – and that worldwide.

The reason for this lies in the reliability of our drive systems that has become almost legendary. And all of this didn't just happen by chance – it is the result of our many years of experience, our power of innovation and our extensive know-how.

- From 1969: Variable-speed medium-voltage drive systems with current-source DC link converters
- From 1970: Cycloconverters – with more than 700 drives, Siemens is the global market leader
- 1994: The cell topology of ROBICON Perfect Harmony revolutionized medium-voltage drives
- 1996: "Pioneered" the use of high-rating voltage-source DC link converters in rolling mills
- 1998: "Pioneered" the use of high-voltage IGBTs for medium-voltage drive converters
- 2003: Worldwide the highest rating high-speed drives (65 MW) with LCI for compressors of a gas liquification plant
- 2005: Highest rating drive with voltage-source DC link converters in a cell-type topology (65/45 MW) used in an LNG plant (LNG = Liquefied Natural Gas)

Well-proven as basis

Based on well-proven technological concepts, we are continually developing our medium-voltage drives. The result: Increasingly higher reliability and operational reliability and safety, continually more compact types of construction, continually lower energy requirement and service and maintenance costs as well as increasingly simpler handling: from engineering through installation, integration and commissioning up to operator control.

Always the optimum solution

No matter which medium-voltage drive task is involved: We can always offer the optimum solution. We consequentially utilize the strengths of various technologies to implement these solutions. We have the widest range of converter technologies available: From cycloconverters and load-commutated converters using thyristors through voltage-source DC link converters equipped with HV-IGBTs or IGCTs up to cell topology converters. With the latter, a medium voltage is obtained at the output by connecting low-voltage cells in series.

SINAMICS medium-voltage drives – high power ratings with maximum security against failure



Power and voltage ranges, SINAMICS GM150		
Air-cooled	2.3–4.16 kV	850–10,100 kVA
Water-cooled	2.3–4.16 kV	2,000–13,000 kVA
Water-cooled with IGCTs	3.3 kV	10,000–21,000 kVA
Power and voltage ranges, SINAMICS SM150 with HV-IGBTs		
Air-cooled	3.3–4.16 kV	3,400–5,800 kVA
Water-cooled	3.3–4.16 kV	4,600–7,200 kVA

Simple and straightforward – from the very beginning

SINAMICS GM150 and SM150 medium-voltage drive converters make medium-voltage technology simple. This starts with standard engineering using the SIZER engineering tool with straightforward plant and system integration. It continues with fast and user-friendly commissioning using STARTER and simple operator control. In operation, SINAMICS GM150 is convincing as a result of the high degree of ruggedness and high level of service friendliness.

SINAMICS GM150: The general-purpose drive

SINAMICS GM150 is the compact solution for all medium-voltage drive applications without regenerative feedback into the line supply. For applications with a square-law load torque – which means positive displacement machines such as pumps, fans and compressors –, up to 50% of the energy can be saved through variable-speed operation. However also for constant-torque drives – such as extruders, mixers, kneaders, crushers and wire rod mills – SINAMICS GM150 is an extremely versatile drive as a result of its high performance.

Easy as it's a standard feature: Integration into higher-level communication systems

The advantages of the SINAMICS drive family with its standard, higher-level technological concept are now also available in the medium-voltage area. The SINAMICS closed-loop control makes it easy to flexibly integrate the drive into the overall plant as a result of the seamless integration into the SINAMICS and TIA environment. Further, technological functions can be integrated in the drive using SIMOTION so that automation solutions can be very simply generated using SINAMICS. This shortens the total automation project, reduces the operating costs and increases the productivity.

SINAMICS GM150

- Favorably priced from planning through to service
- Simple integration and installation
- Straightforward operator control
- Intelligent maintenance functions
- Power unit up to 13 MVA using HV-IGBTs (up to 21 MVA using IGCTs)
- Wide range of voltages and power ratings



Security against failure for all sectors

Oil and gas, water/wastewater, power generation, mining, cement, marine, metals ... SINAMICS GM150 and SM150 continue to perform uninfluenced by environmental effects such as dust, corrosion and vibration.

Siemens – the first to offer HV-IGBTs – is already using these reliable power semi-conductors in the second generation.

SINAMICS SM150 – regenerative feedback using Active Infeed

SINAMICS SM150 is especially at home in small rolling mills and test stands. These include applications where the motors operate in the regenerative mode sometimes as a result of the frequent transition between braking and accelerating. 4-quadrant operation with regenerative feedback into the line supply is required for these types of applications.

This requirement is perfectly fulfilled using the Active Infeed infeed/regenerative feedback unit – a standard feature for SINAMICS SM150 drives. Fast vector control in conjunction with the optimized switching technique ensures an almost sinusoidal line current. This applies both when motoring as well as when regenerating.

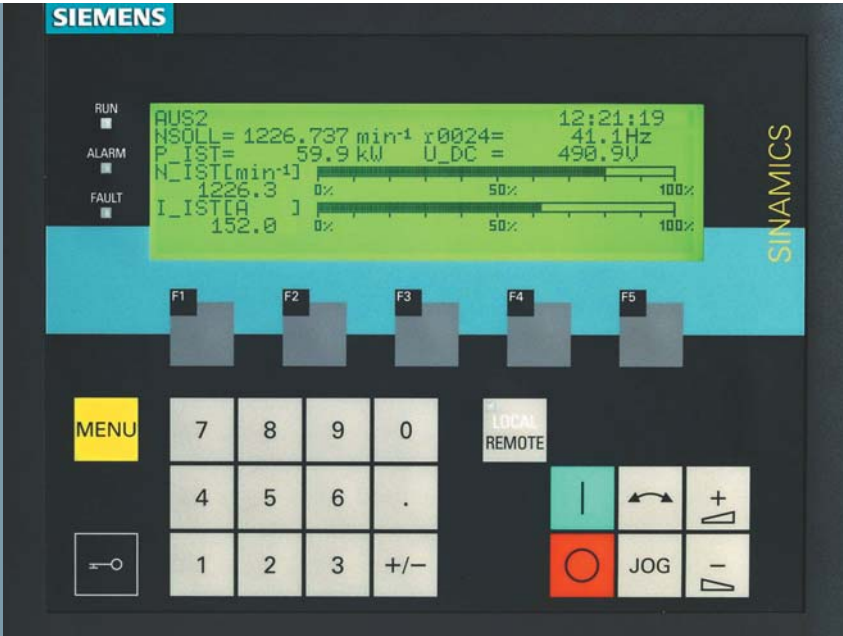


**Simply intelligent:
Integrated maintenance functions**

The intelligent maintenance functions of the SINAMICS GM150 and SM150 avoid non-scheduled plant and system downtimes with the associated production failure and costly repair service calls. This is because the components automatically output a message if maintenance is required. For instance, a differential pressure function determines how dirty the dust filter is. Another example is the ion exchanger used in water-cooled SINAMICS GM150 drives: The analog conductivity measurement continually checks the mode of operation of the ion exchanger and outputs a signal at an early stage if its ion exchanging capacity diminishes. The fans for air-cooled units and the pumps for water-cooled units are equipped with operating hour counters. When a certain number of operating hours has been reached, they recommend that the components are checked.

Less is more with SINAMICS GM150 and SM150 with HV-IGBTs

Lower energy costs – less expensive – simply easier



Up to 50% lower energy costs than fixed-speed motors

SINAMICS GM150 drives permit enormous amounts of energy to be saved as the drive power can be flexibly adapted to the actual demand of the plant or system. This is because pumps and fans frequently operate in the partial-load mode due to fluctuations in the demanded flow rate. The maximum flow rate is only infrequently required. As a consequence, with fixed-speed drives, the quantity of medium being transported or pumped must be reduced for most of the time – e.g. using a throttle. A large proportion of the drive power is simply wasted if flexible variable-speed control is not used. When using a drive such as the SINAMICS GM150, the motor only draws the power that is actually required.

Simply reliable: Rugged and low maintenance

The use of simple and rugged HV-IGBT power semiconductors means that power units can be constructed with fewer components and with an remarkable simple design. This allows SINAMICS GM150 and SM150 drives to achieve one of the highest reliability values in their class. For air-cooled drive converters, a redundant operating fan can be used that further increases the degree of availability. For the water-cooled versions, redundant pumps are used as standard. Maintenance-free and self-healing capacitors are used in the DC link: They are extremely reliable, leak-proof and safe.

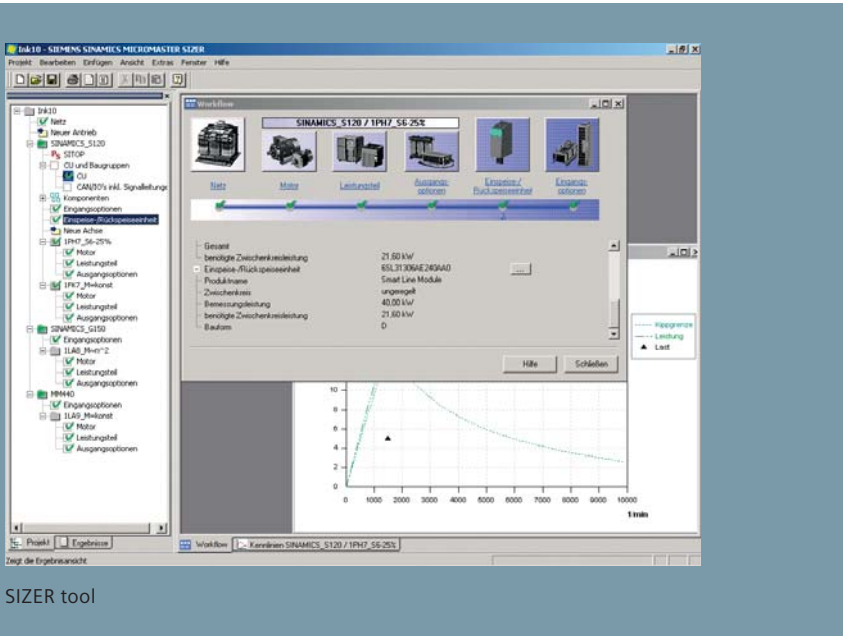
Makes a lot of things easier: Service-friendly concept

All of the essential SINAMICS GM150 and SM150 components and their connections are accessible from the front. This saves a lot of time in the unlikely event of a problem as the drive does not have to be dismantled – a costly, time-consuming affair. The components are arranged so that they can be replaced with just a few manual operations. Just one person can easily withdraw the new, light Powercards towards the front without requiring any special tools. Service personnel can remotely access the drive using a tele-service module so that experts in the central Customer Support department can easily support local service personnel.

Intuitive operator control

For SINAMICS GM150 and for SINAMICS SM150, user-friendly operator panels permit simple operator control and visualization. Integration into the overall plant or system is also simple – as a result of the high degree of flexibility when it comes to the connections and installation.

Straightforward planning and fast commissioning



SIZER tool

Speeds up commissioning: STARTER tool

STARTER is the standard commissioning tool for the complete family of SINAMICS drives. The commissioning engineer can configure even the most complex drive systems in a short period of time without requiring any special system know-how thanks to the simple, menu-prompted interface. Functions can be checked and parameters optimized using integrated test routines. Trace functions graphically display signal characteristics thus simplifying drive optimization and diagnostics. Data can be imported from electronic type plates. This significantly simplifies the parameterization as engineering personnel no longer have to transfer individual parameters – a time-consuming affair.

Minimizes time and costs: SIZER engineering tool

The Siemens SIZER engineering tool includes all of the SINAMICS components that can be used so that a drive system can be quickly and reliably engineered. This allows users to engineer a very wide range of drive systems. SIZER is easy to get to know as the graphic interface means that the tool can be intuitively handled. Once understood, any SINAMICS drive system can be quickly and reliably engineered using SIZER.

Simplicity itself: Mechanical integration into the plant

- The front access allows the drive unit to be mounted against walls and panels
- Simple transport as a result of the integrated base frame
- Available as air-cooled and water-cooled versions over a wide power range
- Compact design allows simple integration into existing plants
- Space-saving cabinet version reduces the costs for the electrical room
- The transformer location can be freely selected: Oil-filled transformers for outdoors or dry-type transformers for indoors

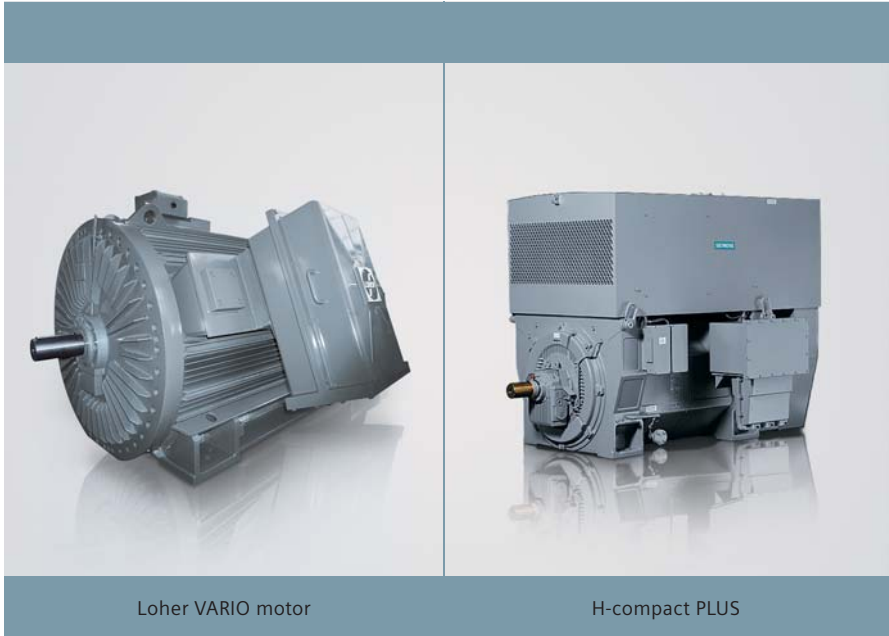
Individual and fast: Electrical integration into the plant

A comprehensive range of electrical options allows the drive unit to be flexibly adapted to the specific requirements:

- Connection either at the top or bottom
- The motor is connected at the front
- Without output filters as standard for new plants with drive motors from Siemens
- An optional sinusoidal filter so that motors that are normally connected to the line supply can be used
- Very line-friendly using the 12-pulse diode infeed, a 24-pulse diode infeed module is optionally available
- SINAMICS GM150 is exceptionally line-friendly as a result of the 12-pulse diode infeed – a 24-pulse diode infeed module is optionally available
- SINAMICS GM150 (IGBT) is UL-listed – significantly simplifying applications around the globe, specifically for OEMs and system integrators
- When motors are equipped with active magnetic bearings, a braking chopper can be installed so that the motor can be quickly brought to a standstill if a bearing develops a fault

For new plants – the matching motors

Motors for SINAMICS GM150 and SM150 (HV-IGBT)	
Power rating	Up to 12 MW (above this, SINAMICS GM150 with IGCTs)
Voltages	2.3–4.16 kV
Shaft heights	315–710 mm
Speed	Up to 4,500 rpm
No. of poles	2–12
Degree of protection	IP55, IP23
Explosion protection	Ex n, Ex e, Ex d, Ex p, Dust Ex, double protection
Cooling	Rib-cooled, air-to-air heat exchanger, air-to-water heat exchanger or open-circuit cooling



Loher VARIO motor

H-compact PLUS

Solutions for all SINAMICS GM150 and SM150 HV-IGBT applications

For the new plant business with SINAMICS GM150 and SM150 equipped with IGBTs, Siemens offers the matching motors to create a coordinated and harmonized system with the maximum degree of availability. Siemens standard H-compact and H-compact PLUS high-voltage motors are perfectly matched to SINAMICS drives so that an output filter is not required. For the motors themselves, the enclosure, bearings, active parts, ventilation and cooling system are perfectly harmonized and coordinated with one another to achieve maximum availability. The materials and components used as well as the production technology are also carefully selected to achieve this goal. The Micalastic insulating system is used for all our high-voltage motors with a high power rating. This has proven itself over many years in operation around the globe. An important component is the VPI (Vacuum Pressure Impregnation) technique that is harmonized with the insulation design. This insulation technique

allows the motor to be connected directly to the line supply or to a drive. The insulation has a high switching and reversing strength as a result of the high winding overhang stiffness and excellent corona shielding. All of this – together with the extremely high mechanical strength and thermal endurance – ensures an extremely long winding lifetime. The bearings also have extremely long lifetimes and require hardly any maintenance.

Motors with integrated safety

Even if a motor is designed down to the finest detail: In extreme situations, it can be subject to stressing for which it was not originally designed. This is the reason that our motors are equipped as standard with bearing and winding monitoring devices. Up to 3,000 kW, Siemens high-voltage motors are predominantly rib-cooled; above this rating, they are equipped with air-to-air heat exchangers or air-to-water heat exchangers – or they are open-circuit-cooled. The high-voltage motors are generally in compliance with IEC and ANEMA for the North American market.

They are also available according to standards such as API.

For special requirements: Special motors from Siemens

However, there are always requirements that require a special motor design that deviates significantly from the standard. Customer-specific and sector-specific motors are used in this case. Here, we have rounded off our portfolio with motors from Loher GmbH – considered to be the technology leader when it comes to drive solutions for extreme locations. This means that in addition to special motors – for example, for use above deck on ships, offshore platforms or for deep-sea applications –, Siemens can now offer a seamless range of explosion-protected motors. These have all types of protection – even up into the Megawatt range. These include dust explosion protection, non-sparking Ex n, increased safety Ex e, flameproof enclosure Ex d and pressurized enclosure Ex p. Double protection in Ex e plus Ex e and dust explosion protection with gas Ex is even possible in the form of double protection.

SINAMICS GM150 and SM150 with HV-IGBTs – technical data

Specification	
Power connection	Closed-loop control
<ul style="list-style-type: none"> Line supply voltage: 2.3 to 36 kV, +/- 10% Frequency: 50/60 Hz, +/- 3% Power factor: 0.96 (GM150), 1.0 (SM150) From the top or bottom 	<ul style="list-style-type: none"> Vector control with or without speed encoder Induction motors and separately excited or permanent-magnetic synchronous motors can be used (excitation equipment is separately available) Speed accuracy: +/- 0.01% with speed encoder, +/- 0.2% without speed encoder Torque accuracy: +/- 5% Field weakening range 1:3 without output filter, 1:1.1 with output filter Maximum output frequency: 250 Hz (without output filter)
Motor connection	Standards
<ul style="list-style-type: none"> Motor voltages: 2.3 to 4.16 kV At the top or bottom 	<ul style="list-style-type: none"> IEC, EN, CE UL (for selected types)
Auxiliary power supply	Standard features
<ul style="list-style-type: none"> 400 V / 50 Hz or 460 V / 60 Hz, other voltages optionally available 	<ul style="list-style-type: none"> Flying restart Automatic restart Operating hour counter for fans and circuit-breaker Maintenance functions STARTER software for user-friendly commissioning and diagnostics at the PC
Line-side rectifier	Closed-loop control I/O
<ul style="list-style-type: none"> GM150: 12-pulse or optional 24-pulse diode rectifier without regenerative feedback SM150: Line-side converter capable of regenerative feedback 	<ul style="list-style-type: none"> Analog inputs: 2 Analog outputs: 2 Others using optional expansion modules Digital inputs: 4 Digital inputs/outputs (bidirectional): 24 Digital outputs (relay): 2 Others using optional expansion modules PT100 monitoring: 3 Others using optional expansion modules Speed encoder (optional) Communication: PROFIBUS-DP, others on request
Motor-side inverter	Selection of additional options
<ul style="list-style-type: none"> 3-level inverter (PWM) in NPC (Neutral Point Clamped) topology with 3.3 kV HV-IGBTs for a minimum number of components Plug-in Powercards for fast maintenance and repair Optional sinusoidal output filter for absolutely sinusoidal motor currents 	<ul style="list-style-type: none"> Output reactors Bidirectional synchronized bypass Increased degree of protection (up to IP54) Marine duty (for water-cooled drive converters) Braking module Teleservice module Anti-condensation heating Additional I/O modules Additional PT100 monitoring Grounding breaker at the input and output Circuit-breaker at the drive converter output Control of auxiliaries Various different versions of the cooling unit
Efficiency	
<ul style="list-style-type: none"> GM150 with HV-IGBT: typically 98.5% SM150 with HV-IGBT: typically 97.5% 	
Cooling	
<ul style="list-style-type: none"> Air cooling with optional redundant fans Water cooling with integrated cooling unit and redundant pumps as standard 	
Degrees of protection	
<ul style="list-style-type: none"> Air cooling: IP21, optional up to IP42 Water cooling: IP23, optional up to IP54 	
Ambient conditions	
<ul style="list-style-type: none"> Temperature: +5 to 40 °C (41–104 °F), to 45 °C (113 °F) with reduced power Installation altitude: up to 1,000 m (3,300 ft), up to 4,000 m (13,200 ft) with reduced power Humidity: < 85 % (moisture condensation is not permissible) 	
Noise	
<ul style="list-style-type: none"> < 80 dB (A) at a distance of 1 m (3.3 ft) from the unit 	
Safety functions (this list is not complete)	
<ul style="list-style-type: none"> Integrated grounding breaker to safely and reliably ground the DC link Automatic door interlocking Short-circuit, ground fault monitoring Overcurrent, overvoltage and undervoltage monitoring Line supply failure monitoring Overtemperature monitoring (drive converter and motor) Overspeed protection, anti-stall protection (motor) Cooling circuit monitoring Self-diagnostics for the closed-loop control and power unit 	

SINAMICS GM150 air cooling					
Output voltage	Rated power	Shaft output ¹		Rated output current	Size
		kV	kVA		
2.3	1,000–3,200	820–2,650	1,000–3,600	250–800	A
3.3	1,000–4,600	850–4,100	1,000–5,000	180–800	A
	5,300–8,000	4,450–6,700	6,200–9,500	2 x 465–2 x 700	B
4.16	1,300–5,800	1,000–4,800	1,500–6,600	180–800	A
	6,700–10,100	5,650–8,500	7,600–11,500	2 x 465–2 x 700	B

SINAMICS GM150 water cooling					
Output voltage	Rated power	Shaft output ¹		Rated output current	Size
		kV	kVA		
2.3	2,000–4,000	1,650–3,300	2,250–4,400	500–1,000	D
3.3	2,000–5,700	1,650–4,700	2,250–6,150	350–1,000	D
	6,300–10,300	5,300–8,600	7,000–11,500	2 x 550–2 x 900	E
	10,000	9,000	12,000	1,750	G
	15,500	12,500	18,000	2 x 1,360	H
	18,000	16,000	22,000	2 x 1,570	H
	21,000	17,500	24,000	3 x 1,220	J
4.16	2,000–7,200	1,700–5,900	2,250–8,000	280–1,000	D
	7,900–13,000	6,600–11,250	9,000–15,300	2 x 550–2 x 900	E

SINAMICS SM150 with HV-IGBT air cooling					
Output voltage	Rated power	Shaft output ¹		Rated output current	Size
		kV	kVA		
3.3	3,400–4,600	2,800–3,800	3,600–4,950	600–800	C
4.16	4,300–5,800	3,600–4,800	4,700–6,500	600–800	C

SINAMICS SM150 with HV-IGBT water cooling					
Output voltage	Rated power	Shaft output ¹		Rated output current	Size
		kV	kVA		
3.3	4,600–5,700	3,800–4,700	4,950–6,350	800–1,000	F
4.16	5,800–7,200	4,800–5,900	6,500–8,000	800–1,000	F

Dimensions							
Size	Width		Height		Depth		Weight
	mm	inch	mm	inch	mm	inch	
A	2,420	95.3	2,570	101.2	1,275	50.2	1,750~2,000
B	4,220	166.2	2,570	101.2	1,275	50.2	3,500~3,700
C	3,020	118.9	2,570	101.2	1,275	50.2	2,850
D	3,620	142.6	2,280	89.8	1,275	50.2	2,600~2,850
E	5,420	213.4	2,280	89.8	1,275	50.2	4,100~4,300
F	4,220	166.2	2,280	89.8	1,275	50.2	3,500
G	5,300	208.7	2,540	100	1,600	63	5,400
H	9,400	370.1	2,540	100	1,600	63	9,800
J	14,300	563.0	2,540	100	1,600	63	15,000

¹The power data in hp and kW are approximate values that were determined based on a typical induction motor.

Optional components such as output reactor, sinusoidal output filter, braking module or excitation equipment for synchronous motors are not included in the specified dimensions.

Additional information on SINAMICS is provided under
www.siemens.com/sinamics

The addresses and contact partners are provided under
www.siemens.com/automation/partner

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