

The Universal Single-Motor Drive

SINAMICS GM150 Medium-Voltage Drive






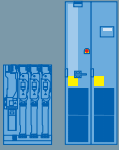

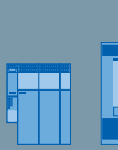
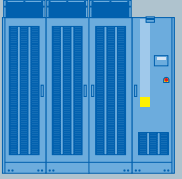
SINAMICS drives

Answers for industry.

SIEMENS

SINAMICS – the optimum drive for each and every application

The drive family for drive solutions that are fit for the future

Low voltage						Medium voltage
For basic applications	For demanding applications			For sophisticated applications		For applications with high power ratings
						
SINAMICS G110	SINAMICS G120	SINAMICS G120D	SINAMICS G130/G150	SINAMICS S120	SINAMICS S150	SINAMICS GM150/SM150/GL150
V/f control	V/f control/vector control			V/f control/vector control/servo control		V/f control/vector control
0.12–3 kW	0.37–90 kW	0.75–7.5 kW	75–1,500 kW	0.12–4,500 kW	75–1,200 kW	0.8–120 MW
Pumps, fans, conveyor belts	Pumps, fans, conveyor belts, compressors, mixers, crushers, extruders			Production machines – e.g. packaging, textile and printing machines, paper machines, plastics machines, machine tools, plants and process lines		Test stands, crosscutters, centrifuges
Standard 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 – and all of the drives can be engineered, parameterized, commissioned and operated in a standard fashion.

SINAMICS – can tackle any drive application

- 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)	SINAMICS GM150 (IGCT)	SINAMICS SM150	SINAMICS GL150
Power range	150 kW–120 MW	800 kW–9 MW	10 MW–27 MW	5 MW–30MW	6 MW–120 MW
Application range	General-purpose applications	General-purpose applications	General-purpose applications	Sophisticated applications	General-purpose applications
Motors	Induction and synchronous motors	Induction and synchronous motors	Induction and synchronous motors	Induction and synchronous motors	Synchronous motors
Energy recovery	–	–	–	Yes (Active Infeed)	Yes (LCI)
Multi-motor drives	–	–	–	Yes	–
Semiconductor technology	LV-IGBT (cell topology)	HV-IGBT	IGCT	IGCT	Thyristor (LCI)
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, ships' drives, starting converters for blast furnaces

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 portfolio is also second to none around the globe:

- 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
- 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

We offer you the optimum solution for any conceivable drive application in the medium-voltage range. We have the widest range of drive converter technology that we can draw on: from load-commutated drive converters using thyristors through voltage-source DC link converters with HV-IGBTs or IGCTs up to cell topology drive converters. For the latter, medium voltage is generated at the output by connecting low-voltage cells in series.

SINAMICS GM150 – high power and performance with maximum security against failure



Power and voltage ranges,
SINAMICS GM150

Air-cooled	2.3–7.2 kV	600–7,900 kVA
Water-cooled	2.3–7.2 kV	2,000–10,000 kVA
Water-cooled with IGCTs	3.3 kV	8,000–28,000 kVA

Simple and straightforward – from the very beginning

The SINAMICS GM150 drive is simplicity itself in the medium-voltage range. This starts with the standard engineering using the SIZER engineering tool and continues with the straightforward integration into the overall plant or system. All of this is complemented by fast and user-friendly commissioning using STARTER and the simple operator control. And finally, in operation, the SINAMICS GM150 is convincing thanks to its high degree of ruggedness and high 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 drawing drives –, 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 new family of SINAMICS drives with their higher-level, standard technical concept are now 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.

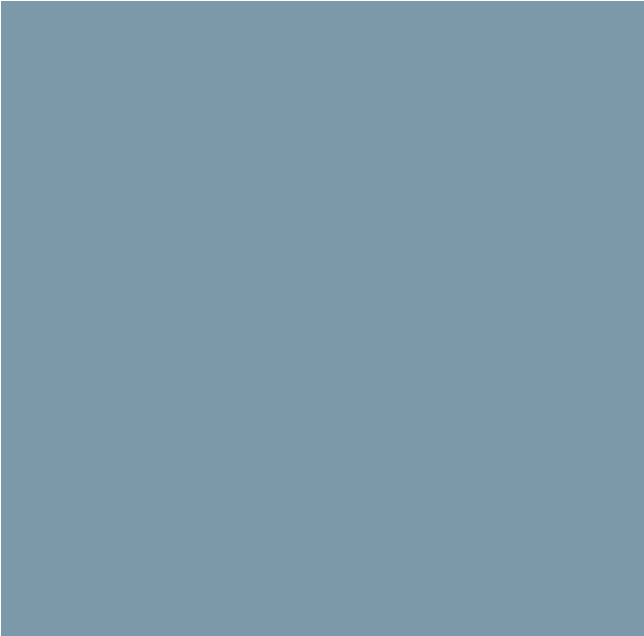
SINAMICS GM150

- Favorably priced from planning through to service
- Simple integration and installation
- Straightforward operator control
- Intelligent maintenance functions
- Power unit up to 10 MVA using HV-IGBTs (up to 28 MVA using IGCTs)
- Wide range of voltages and power ratings

Security against failure across all sectors

Oil and gas, water/wastewater, power generation, mining, cement, shipbuilding, metal ... no matter what the sector, a SINAMICS GM150 continues to operate uninfluenced by environmental effects such as dust, corrosion and vibration. Siemens – the first to offer HV-IGBTs – is already using these reliable power semiconductors in its second generation of drives! One of the most important innovative features is the use of 6.5-kV IGBT semiconductor modules – the first time in the world. This allows the incoming supply voltage to be increased from 6 kV to 7.2 kV.



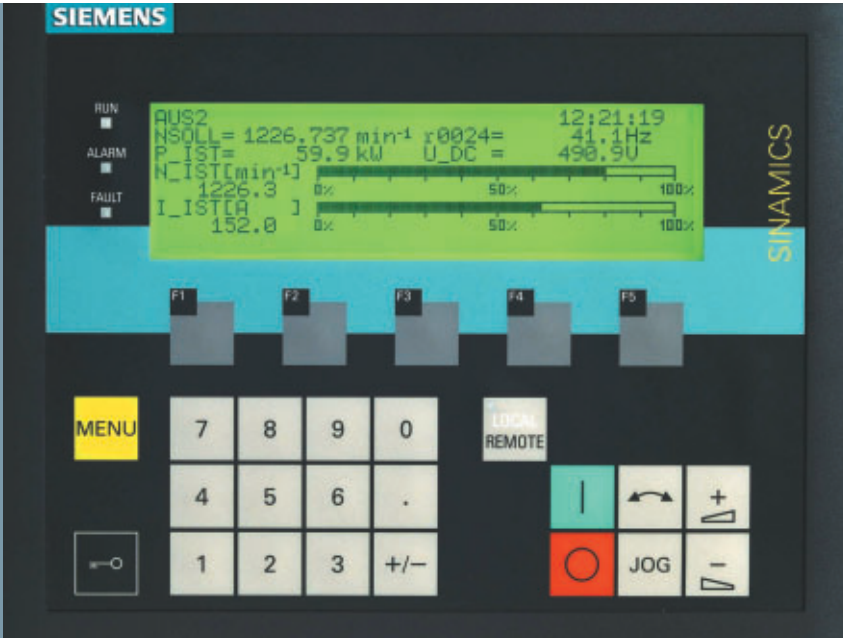


**Simply intelligent:
Integrated maintenance functions**

The intelligent maintenance functions of the SINAMICS GM150 prevent unscheduled plant downtimes with resulting loss of production and costly repair 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

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 allows a power unit to be constructed with the lowest number of components and with an extremely simple design. This allows the SINAMICS GM150 to achieve one of the highest reliability values in its class. For air-cooled drives, a redundant fan can be used, which further increases the degree of availability. For water-cooled versions, redundant pumps are used as standard. Maintenance-free and self-healing capacitors are used in the DC link: These capacitors are extremely reliable, do not leak and are safe.

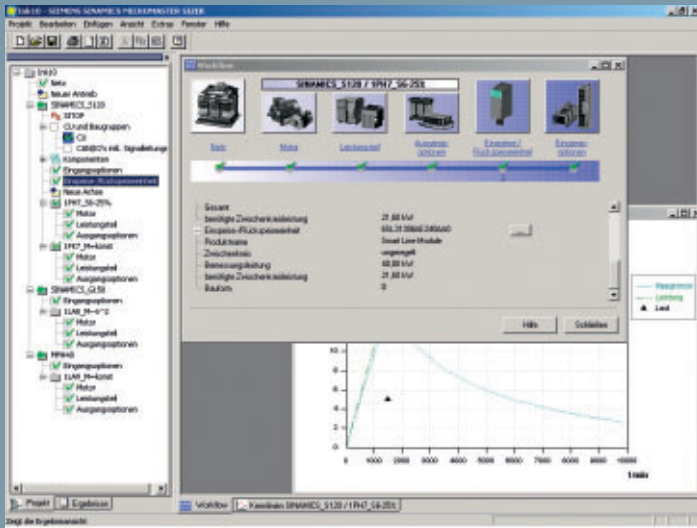
Makes a lot of things easier: Service-friendly concept

All of the essential SINAMICS GM150 components and its connections can be accessed 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 Power-cards 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

The user-friendly SINAMICS GM150 operator panel has a menu-prompted display with plain text. This makes operator control easier and more dependable. Analog setpoints and actual values can be displayed in a bar-type diagram using the graphics-capable display. Important operating parameters can be seen at a glance. The user-friendly AOP30 panel includes a help function that flags faults – including their causes – and instructions on how to resolve them. The AOP30 also has a keypad to operationally control the drive.

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

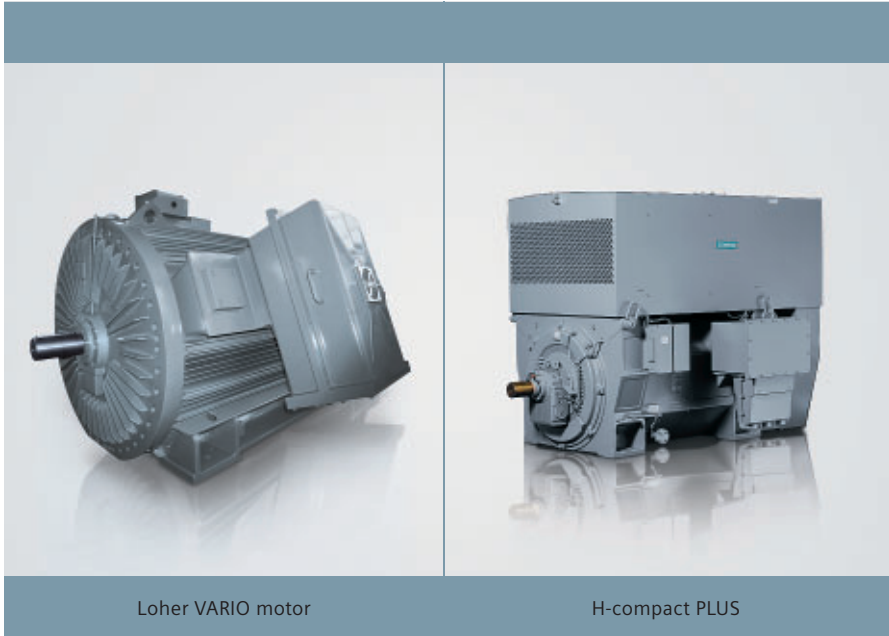
Individual and fast: Electrical integration into the plant

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
- Extremely line-friendly using 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 GM 150 (IGBT)	
Power rating	Up to 10 MW (above this, SINAMICS GM150 with IGCTs)
Voltages	2.3–7.2 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 GM150 IGBT applications

For the new plant business with SINAMICS GM150 equipped with IGBTs, Siemens offers the matching motors to create a harmonized system with the maximum degree of availability. Siemens standard H-compact and H-compact PLUS high-voltage motors are completely 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 with this purpose in mind. 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

In extreme situations, even the most technically sophisticated motor 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 just in the unlikely case that a fault does develop. 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 – technical data

Specification	
Power connection	Closed-loop control
<ul style="list-style-type: none"> Line supply voltages: 2.3–36 kV, +/- 10 % Frequency: 50/60 Hz, +/- 3 % Line supply power factor: 0.96 From the top or the bottom 	<ul style="list-style-type: none"> Vector control with or without speed encoder Induction and separately excited or permanent-magnet 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 (induction motors) 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 7.2 kV Connected at the top or bottom 	<ul style="list-style-type: none"> IEC, EN, CE, UL
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 Kinetic buffering Automatic restart Operating hours counter for the 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"> 12-pulse or optionally 24-pulse diode rectifier without regenerative feedback 	<ul style="list-style-type: none"> Analog inputs: 2¹ Analog outputs: 2¹ Digital inputs: 4¹ Digital inputs/outputs (bidirectional): 24¹ Digital outputs (relay): 2¹ Inputs for PT100: 3¹ 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 an NPC (Neutral Point Clamped) topology with 3.3 or 6.5 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 drives) 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 output Control of auxiliaries Various cooling unit versions
Efficiency	
<ul style="list-style-type: none"> GM150: typical 98.5 % 	
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: +5–40 °C (41–104 °F), up to 45 °C (113 °F) with derating Installation altitude: up to 1,000 m (3,300 ft), up to 4,000 m (13,200 ft) with derating Humidity: < 85 % (moisture condensation not permissible) 	
Noise	
<ul style="list-style-type: none"> < 80 dB (A) at a distance of 1 m (3.3 ft) from the drive 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 and motor) Overspeed protection, anti-stall protection (motor) Cooling circuit monitoring Self-diagnostics for the closed-loop control and power unit 	

¹ Others using optional expansion modules

Air cooling SINAMICS GM150

Output voltage kV	Rated power kVA	Shaft output ²		Rated output current	Configuration
		kW	hp		
2.3	1,000–2,400	820–2,000	1,000–2,750	250–600	A
3.3	1,000–3,400	850–2,850	1,000–3,750	180–600	A
	3,700–6,300	3,100–5,300	4,000–7,000	2 x 330–2 x 550	B
4.16	1,300–4,300	1,000–3,600	1,500–5,000	180–600	A
	4,800–7,900	4,000–6,600	5,500–9,000	2 x 330–2 x 550	B
6.0	800–2,800	700–2,350	900–3,000	80–270	C
	3,100–5,000	2,550–4,200	3,500–5,500	2 x 148–2 x 240	B
6.6	900–3,100	750–2,600	1,000–3,500	80–270	C
	3,400–5,500	2,800–4,600	3,750–6,000	2 x 148–2 x 240	B
7.2	1,000–3,400	840–2,800	1,000–3,500	80–270	C
	3,700–6,000	3,010–5,000	4,000–6,500	2 x 148–2 x 240	B

Water cooling SINAMICS GM150

Output voltage kV	Rated power kVA	Shaft output ²		Rated output current	Configuration
		kW	hp		
2.3	2,000–3,200	1,650–2,650	2,250–3,500	500–800	D
3.3	2,000–4,600	1,650–3,800	2,550–5,000	350–800	D
	5,100–8,000	4,250–6,700	6,000–9,000	2 x 445–2 x 700	E
	10,000	9,000	12,000	1,750	G
	16,000	13,000	18,000	2 x 1,400	H
	20,000	18,000	24,000	2 x 1,750	H
	24,000	20,000	27,000	3 x 1,400	J
	30,000	27,000	36,000	3 x 1,750	J
4.16	2,000–5,800	1,700–4,800	2,250–6,500	280–800	D
	6,400–10,100	5,400–8,500	7,000–11,000	2 x 445–2 x 700	E
6.0	1,800–4,100	1,450–3,400	2,000–4,500	170–390	F
	4,500–7,300	3,700–6,100	5,000–8,000	2 x 215–2 x 350	E
6.6	1,900–4,500	1,600–3,700	2,000–5,000	170–390	F
	4,900–8,000	4,100–6,700	5,500–9,000	2 x 215–2 x 50	E
7.2	2,100–4,900	1,750–4,100	2,250–5,500	170–390	F
	5,400–8,700	4,500–7,300	6,000–10,000	2 x 215–2 x 350	E

Dimensions SINAMICS GM150

Configuration	Width		Height		Depth		Weight kg
	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	2,300–2,350
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	3,050–3,150
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	14,800	582.7	2,540	100	1,600	63	15,400

² hp and kW power ratings are approximate values that were determined based on a typical induction motor.

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