

The Rugged and Reliable Drive for the Highest Power Ratings

SINAMICS GL150 Medium-Voltage Drive






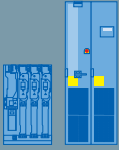


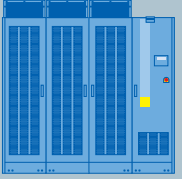
SINAMICS drives

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.

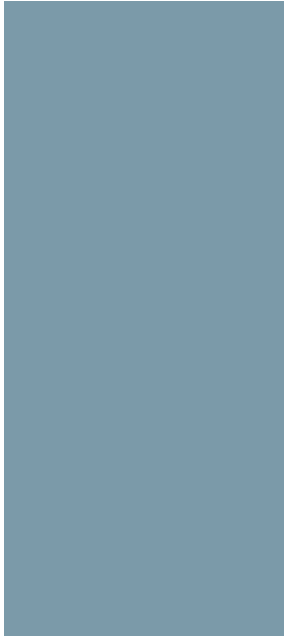
- From 1969: Variable-speed medium-voltage drive systems with current-source DC link converters
- 1994: The cell topology of ROBICON Perfect Harmony revolutionized medium-voltage drives
- 1996: "Pioneered" the use of high-rating voltage-source DC link converters in rolling mills
- 1998: "Pioneered" the 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 GL150 – LCI drives for large synchronous motors



Robust technology at a reasonable price

The SINAMICS GL150 drive is the cost-effective solution for large synchronous motors using LCI (Load Commutated Inverter) technology. There is no upper limit for the power rating – and the technology is extremely rugged and reliable. By using thyristors, the number of components has been reduced to an absolute minimum. Its simple and straightforward design makes the SINAMICS GL150 extremely reliable in operation, requires almost no maintenance and is compact. SINAMICS GL150 is designed for single-motor drives for applications with either square-law or constant load characteristics, as starting converter for soft starting or as continuous duty drive converter for variable-speed processes. Its circuitry means that it is suitable for 4-quadrant operation without any additional costs – i.e. it can be used for driving and braking in both directions of rotation.

Maximum efficiency: Up to 50% lower energy requirement

For pumps, fans and compressors with square-law load characteristic, the SINAMICS GL150 fully utilizes an important feature of variable-speed drive technology – the energy efficiency: It reduces the energy consumption by up to 50%.

Applications for large synchronous motors

SINAMICS GL150 is designed to feed large synchronous motors – up to 100 MW and above. The speed range extends up to 6,300 rpm for a speed control range of between 1:10 and 1:100. Variable-speed pumps, fans, blowers, compressors, extruders and kneaders are some of the main applications for these types of drives. In the double-digit megawatt power range, synchronous motors are especially found in the areas of oil and gas, petrochemical and chemical, water and power generation. These large synchronous motors are also used for large main ships' drives.

SINAMICS GL150 at a glance

- Air-cooled up to 19.4 MW
- Liquid-cooled up to over 100 MW
- For synchronous motors
- Compact design and high power density
- Can be simply integrated into plants
- Simple operator control and monitoring
- Extremely reliable
- Almost maintenance-free
- Can be seamlessly integrated into higher-level automation systems

SINAMICS GL150 – reliability and efficiency at the highest level



Liquid-cooled version of the SINAMICS GL150 power unit

Air-cooled version of the SINAMICS GL150 power unit

Perfect for high-speed synchronous motors with the highest ratings

SINAMICS GL150 is admirably suited for directly driven high-speed compressors and pumps. SIMOVERT S from Siemens – the predecessor of the SINAMICS GL150 – controls the speed of the highest-rating high-speed compressor drive ever built. Frequently, SINAMICS GL150 is used as starting converter to softly start large synchronous motors – for instance, for blast furnace blowers. In this case, a SINAMICS GL150 brings the multi-megawatt motors up to the line synchronous speed and then transfers them over to the line supply.

Three decades of reliability – LCI drives

The simple and rugged concept of LCIs from Siemens has been ensuring maximum availability with a high degree of cost-effectiveness for three decades now. The combination of extremely rugged thyristor technology in a fuseless design, combined with an intelligent response to external disturbances, makes these drive units extremely reliable requiring little maintenance. The LCI concept is based on a combination of synchronous motor and simple thyristor bridges on the line and motor sides. The two thyristor bridges are force-commutated and no forced commutation circuitry is required. This makes the power electronics extremely simple and rugged. We have continued to further develop this concept. Higher motor voltages can be achieved by using a high number of thyristors – with a high blocking capability – in a series circuit.

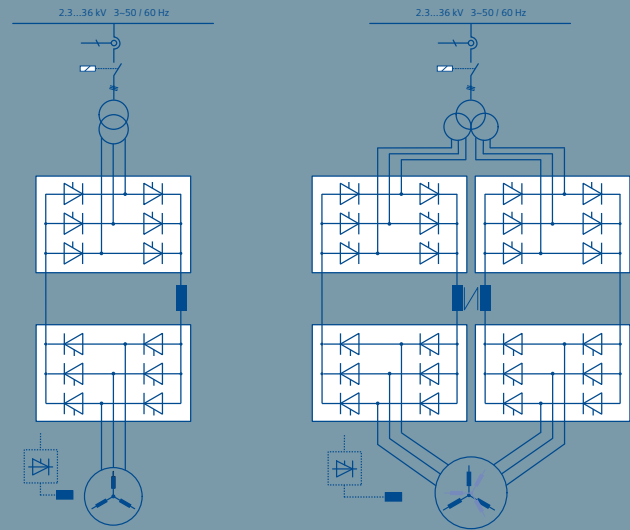
The series thyristor circuits for the highest power ratings can be optionally configured corresponding to an n+1 redundant design. This further increases the availability. One of the advantages of the patented arrangement of the DC link reactors is the insensitivity to a single ground fault. The power unit as well as the closed-loop control can be redundantly configured as option to achieve the highest availability.

Fuseless operation

Fuses can be completely eliminated in the power electronics. This is because the thyristors are dimensioned to ensure that they can handle overcurrent situations and the inherent system design that from the basic philosophy takes into account the line supply and motor in the same way. Overcurrents are detected both on the line supply and motor side and limited by the transformer on the line side.



Thyristor module



Design of the SINAMICS GL150 power units in a six- and twelve-pulse circuit configuration

No stress on the motor and line supply

The motor voltage is generated from a separately excited synchronous motor – and not by the drive. This principle means that there are no voltage gradients (dv/dt) that stress the motor. The motor insulation only has to be designed for the supply voltage – and increased insulation is not required as protective measure against steep voltage edges and peaks. On the motor side, the SINAMICS GL150 is available in a 12-pulse configuration to reduce the harmonics – and on the line side in a 24-pulse configuration. This allows even the most stringent specifications regarding the line quality to be fulfilled. Based on our many years of experience, we have been able to leverage the ongoing development in semiconductor technology to further reduce the number of components. The result: maximum availability values and on top of all this, the SINAMICS GL150 is almost maintenance-free!

Even more compact

By reducing the number of components, over the years, the drive units have become increasingly more compact. State-of-the-art thyristors with an 8 kV blocking voltage and with disk diameters of up to 5 inches are used, which results in an extremely compact SINAMICS GL150 design. This is complemented by the modular drive converter concept. The patented LCI design, where the DC link reactors of the two separate DC links are negatively coupled, is extremely compact and space saving. This circuit configuration means that significantly smaller DC link reactors can be used: In fact, the reactors only have to have a rating of 60% of those required for conventional circuits. Negatively coupled reactors are 40% smaller than non-coupled devices. The DC link reactors themselves have an extremely compact design and their enclosed iron core prevents the formation of leakage fields.

High efficiency

The LCI concept also increases the efficiency in other important areas: The drive efficiency is extremely high (99%) as a result of the low switching losses and the low-loss thyristor technology. This in turn reduces the demands placed on the cooling system and also the space required for the installation.

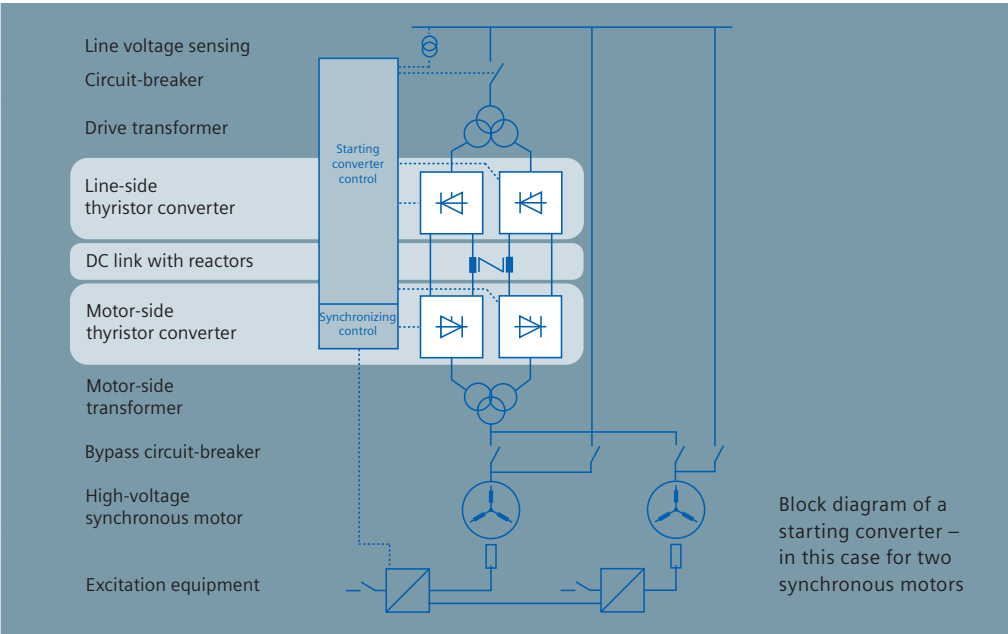


Technology based on the latest drive generation

Three decades – but always representing state-of-the-art technology: SINAMICS GL150 is the latest generation of our LCI drives and is an ultramodern drive unit from the Siemens SINAMICS family of drives: Fully digital, including transvector control, state-of-the-art software tools for commissioning and PROFIBUS interface. The latter allows these drive units to be seamlessly integrated into Totally Integrated Automation – the higher-level automation environment of Siemens – as well as additional analog and digital interfaces. The thyristor modules are optoelectronically gated and the thyristors are individually monitored.

SINAMICS GL150 medium-voltage drives:

Leading-edge technology that is easy to handle



drive family. One example is the simple operator control and visualization at the user-friendly SINAMICS AOP30 cabinet unit operator panel. Information and data in the navigation menu is displayed as plain text on the graphics display. The operator always has the operating data in his field of view and can make changes, perform diagnostics and output status messages at any time.

SINAMICS GL150 as starting converter – for soft and reliable starting

When used as starting converter, SINAMICS GL150 can bring a maximum of four multi-Megawatt motors up to the synchronous line supply frequency and then transfer them over to the line supply. The transfer is bumpless – which reduces the stress on the line supply and the complete mechanical transmission line. The consequence – less wear and a longer equipment lifetime. Using SINAMICS GL150, even blast furnace blowers with power ratings above 50 MW can be started from standstill and transferred over to the line supply within one to two minutes. With this starting technique, the rotor is not thermally stressed as the motor is already operated in synchronism with the supply voltage starting from zero speed. This is quite a different situation than when using either a reactor or auto-transformer start. The rate of successful starts lies above 99% and is therefore significantly higher than when using conventional starting techniques. This represents a decisive step in achieving higher availability and good cost-effectiveness of blast furnace systems. This is because an interrupted start, under worse case conditions, can mean that the furnace cools down charged with ore and is therefore unusable for up to 10 days.

Medium-voltage drives – the simple way

Not only is the technological concept of the SINAMICS GL150 simple and rugged. Installation, integration into the plant and operator control are also simple and straightforward. All of the closed-loop control functions, the power supply, the signal adaptation elements and the terminals for external signals are accommodated in a system cabinet – thus eliminating several integration steps.

Simple integration into the plant

Integration into the plant is simplified as a result of the low envelope dimensions of the unit – referred to any power rating – and its high degree of flexibility when it comes to the configuration. Further, all of the open-loop control and power electronics, the excitation supply, the incoming switchgear and all of the auxiliaries can be installed in special prefabricated

containers. This reduces construction and installation costs. But this isn't all, the drive system arrives on site already tested. This significantly reduces project and commissioning times.

Commissioning made easy

STARTER is the standard commissioning tool for all drives belonging to the SINAMICS family. Without requiring any special system know-how, the commissioning engineer can configure even the most complex systems in a short time thanks to the simple, menu-prompted operator interface. Functions can be checked and parameters optimized using integrated test routines. Trace functions graphically show signal characteristics therefore simplifying drive optimization and diagnostics.

Operator control: "Easy to use" with the maximum amount of information

Just like all of the SINAMICS drive units, the SINAMICS GL150 also benefits from the standard operator concept of this

Synchronous motors and drives from Siemens

Best prerequisites for maximum security against failure



65-MW compressor motor running at 3,600 rpm for the first completely electric gas liquefaction system in the world in Hammerfest/Norway



Soon to be winging its way to site: A 24-MW motor for the West-to-East Pipeline in China



One of the two 21-MW motors for the main drive of a cruise ship

Siemens synchronous motors at a glance	
Power ratings	5–100 MW and more
Voltages	6–13.2 kV
Shaft heights	710–1,250 mm
Speed	up to 6,300 rpm
No. of poles	2–8
Degree of protection	IP55
Explosion protection	Ex p
Cooling	Air-to-water heat exchanger
Bearings	Sleeve bearings, active magnetic bearings

Unbeatable range of drive products

Siemens is globally the No. 1 for medium-voltage drives. The range of units covers all conceivable medium-voltage applications in industry and the infrastructure – in all performance levels as well as in all voltage classes and power ratings. This also applies to our LCI drives for large synchronous motors.

Confidence-building experience

For many decades now, Siemens has been one of the leading suppliers of LCI drives that have ratings extending up into the high double-digit megawatt range. They have been running for years – in some instances for decades – around the world, driving compressors, pumps, blowers, extruders, kneaders and crushers with some of the highest power ratings. All of these applications require little maintenance and are energy-saving.



35-MW motor running at 5,040 rpm for a compressor station of a gas pipeline from Great Britain to Belgium



23-MW motor running at 6,300 rpm to pump gas south of Groningen/The Netherlands



42-MW motor for the blast furnace blower in the Anshan steelworks, China

Unified drive platform

The load-commutated SINAMICS GL150 drive is based on the SINAMICS drive platform. As a consequence, the GL150 also profits from the advantages of this unified family of drives. This technology is used across all power ratings and performance levels and not only reduces the costs for training and stocking spare parts. All of this is complemented by the SINAMICS engineering, commissioning and diagnostic tools.

The system partner on the motor side – more than just reliable

Together with SINAMICS GL150, Siemens synchronous motors form a perfectly coordinated system: Whether for high-speed compressors with the highest power rating for transporting or liquefying gas, for large extruders and water pumps or for main ships' drives, these rugged synchronous motors with ratings extending beyond 100 MW are

the basis for maximum reliability.

The enclosure, bearings, active parts, ventilation and cooling system are perfectly harmonized with one another. The materials, components and production techniques used have been carefully selected with this objective in mind.

The Micalastic insulating system is used for all our high-rating high-voltage motors. This has proven itself over many years in operation around the globe. An important component is the VPI technique (Vacuum Pressure Impregnation) that is harmonized with the insulation design. This insulation technique allows the motor to be connected directly to the line supply and to a drive converter. 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 ensure an extremely long winding lifetime. The bearings also have extremely long lifetimes and require hardly any maintenance.

Motors with integrated safety

Siemens synchronous motors are equipped as standard with bearing and winding monitoring devices to cope with even the most extreme situations. It goes without saying that all of the synchronous motors are available in explosion-protected versions: With pressurized enclosure Ex p for gas explosion protection, Zone 1. Here, pure air, free of any other gases, is maintained at a pressure inside the motor to prevent the ingress of explosive gases. For high-speed synchronous motors as an alternative, we offer oil-lubricated sleeve bearings or active magnetic bearings. When using magnetic bearings, an extremely wide speed control range can be implemented – for instance, 600–6,300 rpm at 23 MW when fed from a SINAMICS GL150.

SINAMICS GL150 – technical data

Specifications	
Power connection	Closed-loop control
<ul style="list-style-type: none"> Line supply voltage Air cooling: up to 5.2 kV +/- 10 % Water cooling: up to 12 kV +/- 10 % Frequency: 50/60 Hz +/- 3 % Line supply power factor: approx. 0.85 at rated speed and load Either from the top or bottom 	<ul style="list-style-type: none"> Vector control with and without speed encoder Separately excited synchronous motors can be connected (excitation equipment is available separately) Operation as starting converter Operation as continuous duty drive Speed accuracy: +/- 0.01 % with speed encoder, +/- 1 % without speed encoder Torque accuracy: +/- 3 % Field-weakening operation Starting converter: 1:8 Continuous duty drive: 1:1.15 Maximum output frequency: 125 Hz
Motor connection	Standards
<ul style="list-style-type: none"> Motor voltage Air cooling: up to 4.8 kV Water cooling: up to 11 kV Either from the top or bottom 	<ul style="list-style-type: none"> IEC, EN, CE
Auxiliary power supply	Standard features
<ul style="list-style-type: none"> 1-ph. 230 V AC 50/60 Hz and 3-ph. 400 V AC 50/60 Hz 	<ul style="list-style-type: none"> Flying restart Automatic restart Operating hours counter for fans and circuit-breaker Maintenance functions STARTER software for user-friendly commissioning and diagnostics at the PC
Line-side rectifier	Control I/O
<ul style="list-style-type: none"> LCI (Load Commutated Inverter), thyristor rectifier in a B6C-circuit, 6-pulse, 12-pulse or 24-pulse, regenerative feedback into the line supply 	<ul style="list-style-type: none"> Analog inputs: 2/4 Analog outputs: 0/4 Digital inputs: 6/6 Digital outputs: 4/16 Others through optional expansion modules Speed encoder Communications: PROFIBUS-DP or PROFINET
Motor-side inverter	Selection of additional options
<ul style="list-style-type: none"> LCI (Load Commutated Inverter), thyristor inverter in a B6C-circuit, 6-pulse or 12-pulse 	<ul style="list-style-type: none"> Increased degree of protection Suitable for marine duty Teleservice module Anti-condensation heating Additional I/O modules Additional PT100 temperature relay Output transformer (starting converter) Bypass control for up to 4 motors (starting converter) Demagnetizing equipment for the output transformer (starting converter) Redundant configurations Grounding breaker at the input and output Circuit-breaker at the converter output Various versions of the heat exchanger
Efficiency	
<ul style="list-style-type: none"> > 99,0% at rated speed and load 	
Cooling	
<ul style="list-style-type: none"> Air cooling with top-mounted cabinet fan Water cooling using heat exchanger with redundant pumps as standard 	
Degrees of protection	
<ul style="list-style-type: none"> Air cooling: IP20 Water cooling: IP41 	
Ambient conditions	
<ul style="list-style-type: none"> Temperature: +5–40 °C (41–104 °F), up 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 derating Humidity: < 85 % (condensation not permissible) 	
Safety functions (this is only a selection of those available)	
<ul style="list-style-type: none"> Short-circuit and ground fault monitoring Overcurrent, overvoltage and undervoltage monitoring Line supply voltage failure monitoring Overtemperature monitoring (drive converter and motor) Overspeed protection, anti-stall protection (motor) Cooling circuit monitoring Self-diagnostics of the control and power unit 	

GL150 air-cooled

Rated output current	Output voltage	Shaft output ¹		No. of pulses, line side	No. of pulses, motor side	Order No. (MLFB)	Configuration
		kW	hp				
A	V						
1,700	2,600	6,200	8,300	6/12 ²	6	6SL3850-3UN1[-][[]]A0	A
1,500	4,600	9,700	13,000	6/12 ²	6	6SL3850-3UP2[-][[]]A0	B
2 x 1,700	2 x 2,600	12,400	1,660	12/24 ²	12	6SL3850-5UN2[-][[]]A0	B
2 x 1,500	2 x 4,600	19,400	26,000	12/24 ²	12	6SL3850-5UP3[-][[]]A0	C

GL150 liquid-cooled

Rated output current	Output voltage	Shaft output ¹		No. of pulses, line side	No. of pulses, motor side	Order No. (MLFB)	Configuration
		kW	hp				
A	V						
2 x 2,400	2 x 2,400	16,000	21,500	12/24 ²	12	6SL3855-5UM4[-][[]]0	D
2 x 2,350	2 x 4,800	32,000	42,900	12/24 ²	12	6SL3855-5UP5[-][[]]0	E
2 x 2,350	2 x 7,200	48,000	64,400	12	12	6SL3855-5US6[-][[]]0	F
2 x 2,350	2 x 9,600	64,000	85,800	12/24 ²	12	6SL3855-5UU7[-][[]]0	G
2 x 2,350	2 x 11,000	74,000	99,200	12	12	6SL3855-5UW7[-][[]]0	H

Dimensions (power unit)

Configuration	Width		Height		Depth		Weight
	mm	inch	mm	inch	mm	inch	kg
A	2,400	94.5	2,670	105.2	1,290	50.8	3,300
B	3,600	141.8	2,670	105.2	1,290	50.8	4,600
C	6,000	236.3	2,670	105.2	1,290	50.8	6,700
D	4,000	157.5	2,680	105.6	1,700	67	5,400
E	5,500	216.6	2,680	105.6	1,700	67	7,000
F	7,000	275.6	2,680	105.6	1,700	67	12,000
G	9,000	354.4	2,680	105.6	1,700	67	16,000

Dimensions (drive cabinet)

Width		Height		Depth		Weight
mm	inch	mm	inch	mm	inch	kg
1200	47.3	2385	93.9	635	25	300

¹ Values are referred to the data of typical synchronous motor

² Please inquire, modified frame size

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

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

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Subject to change without prior notice
Order No.: E20001-A110-P570-X-7600
DISPO 21503
MK.LD.XX.SIGM.52.8.03 WS 04082.
Printed in Germany
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