

SINAMICS GM150 in IGBT version



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SINAMICS GM150

Medium-Voltage Converter

SINAMICS GM150 in IGBT version

Overview



SINAMICS GM150 as IGBT version (air-cooled)

SINAMICS GM150 converters as IGBT version can be optimally combined with Siemens converter motors. Sine-wave filters are not required in this case. This ensures that the drive solution is particularly cost-effective, compact and efficient.

With the sine-wave filter available as an optional extra, the converters offer the best conditions on the market for the operation of line motors. This makes them ideally suited for the retrofitting of existing systems from fixed-speed drives to speed-controlled drives.

SINAMICS GM150 converters as IGBT version offer economic drive solutions that can be matched to customers' specific requirements by adding from the wide range of available components and options.

IGBT converters are available for the following voltages and outputs:

Rated output voltage	Type rating with air cooling	Type rating with water cooling
2.3 kV	1.0 ... 3.2 MVA	2.0 ... 4.0 MVA
3.3 kV	1.0 ... 8.0 MVA	2.0 ... 10.3 MVA
4.16 kV	1.3 ... 10.1 MVA	2.0 ... 13.0 MVA

Global use

SINAMICS GM150 converters as IGBT version are manufactured to international standards and regulations, making them ideally suited for global use. These converters are also available in a UL-listed version and in a ship-going form (meeting the requirements of all major classification organizations).

Benefits

- Compact design and high flexibility in configuration ensures easy plant integration
- Easy operation and monitoring on the convenient operator panel
- Easy and reliable operation through integrated maintenance functions: the converter signals early and automatically if maintenance is required or components need to be exchanged
- High robustness and reliability due to the use of HV-IGBT technology and fuseless installation combined with intelligent reaction to external disturbances
- Can be easily integrated into automation solutions due to PROFIBUS interface supplied as standard and various analog and digital interfaces
- High level of service-friendliness through innovative power section design with plug-in power cards and easy access to all components

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Design

SINAMICS GM150 converters in the IGBT version are available with a 12-pulse or 24-pulse Basic Line Module.

The 12-pulse version is standard for smaller output ratings with voltages of 2.3 kV, 3.3 kV and 4.16 kV.

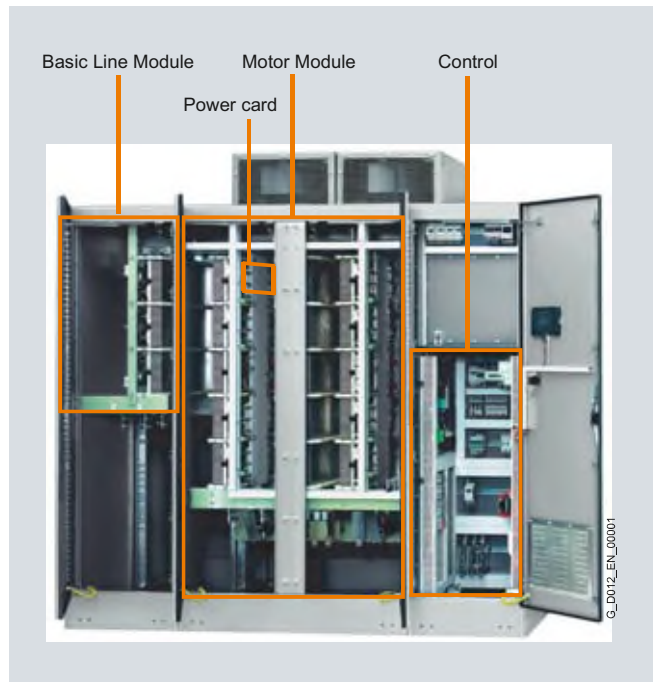
For higher output power ratings, two Basic Line Modules with a common DC link or two Line Modules (24-pulse Basic Line Modules) are connected in parallel.

The 24-pulse Basic Line Module is optionally available for smaller output ratings with voltages of 2.3 kV, 3.3 kV and 4.16 kV.

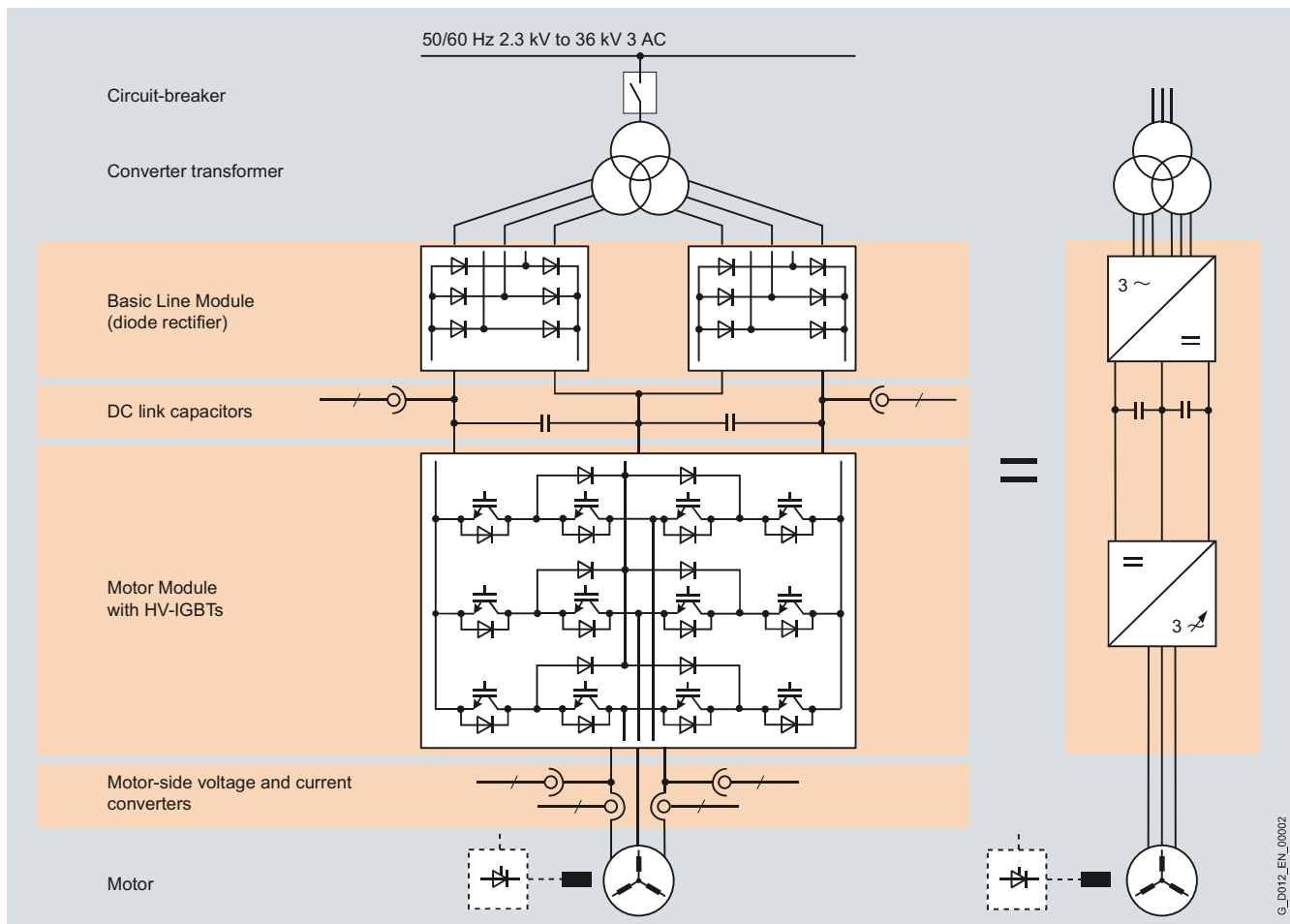
HV-IGBT power semiconductors are used in the Motor Modules – they are mounted on plug-in Power cards that are simple to replace.

Both line and motor connections can be optionally realized from underneath or above.

The converter cabinet unit consists of a section for the Basic Line Module, a section for the Motor Module and the control section.



SINAMICS GM150 as air-cooled IGBT version, internal design



Block diagram

SINAMICS GM150

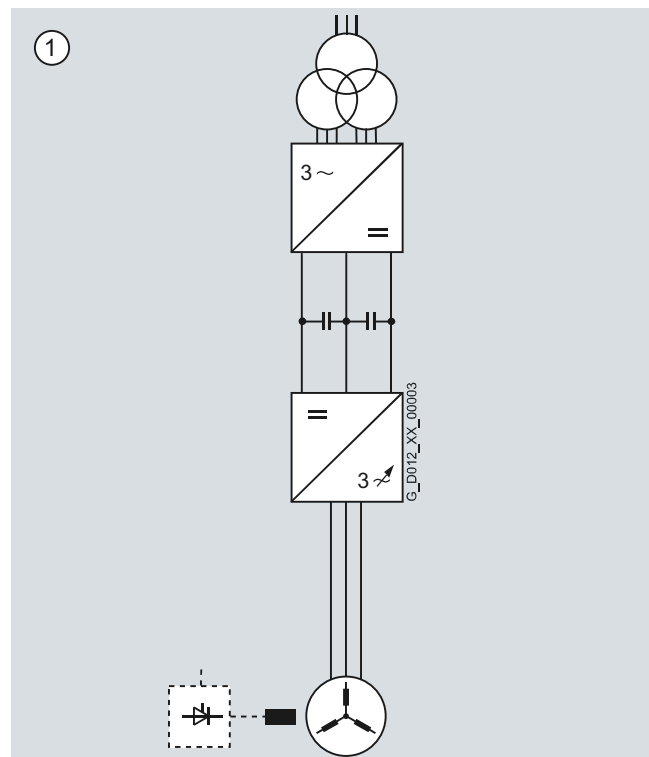
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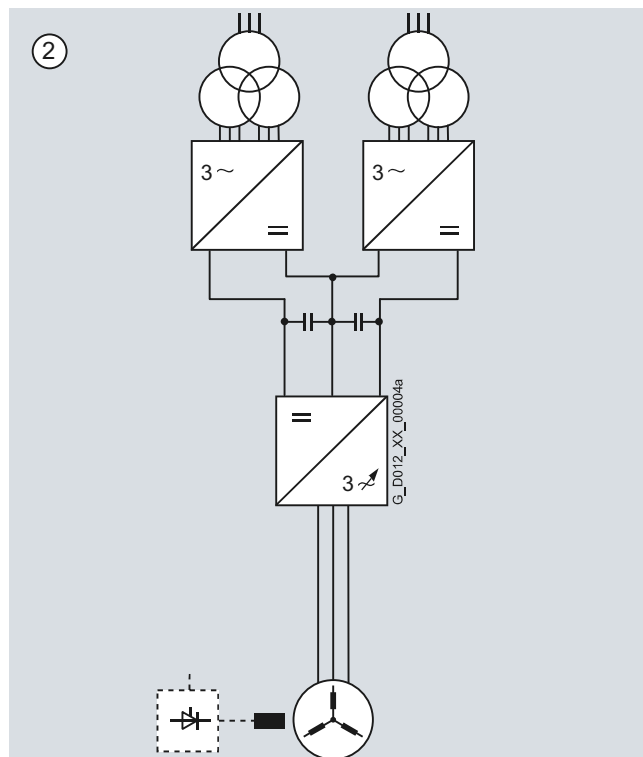
Design

The following wiring versions are available for SINAMICS GM150 as IGBT version.

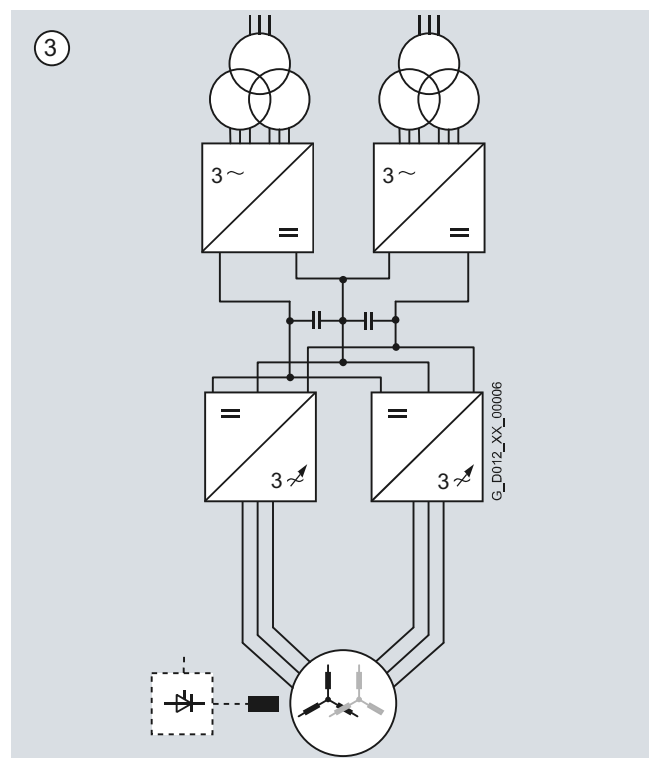
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Basic circuit, 12-pulse infeed, diode rectifier in the Basic Line Module connected in series



24-pulse infeed by connecting two Basic Line Modules in parallel (option **N15**), diode rectifier connected in parallel in the Basic Line Module



Increased power rating by connecting Basic Line Modules and Motor Modules in parallel on a common DC bus for 3.3 kV and 4.16 kV (24-pulse infeed as standard), diode rectifier connected in parallel in the Basic Line Module

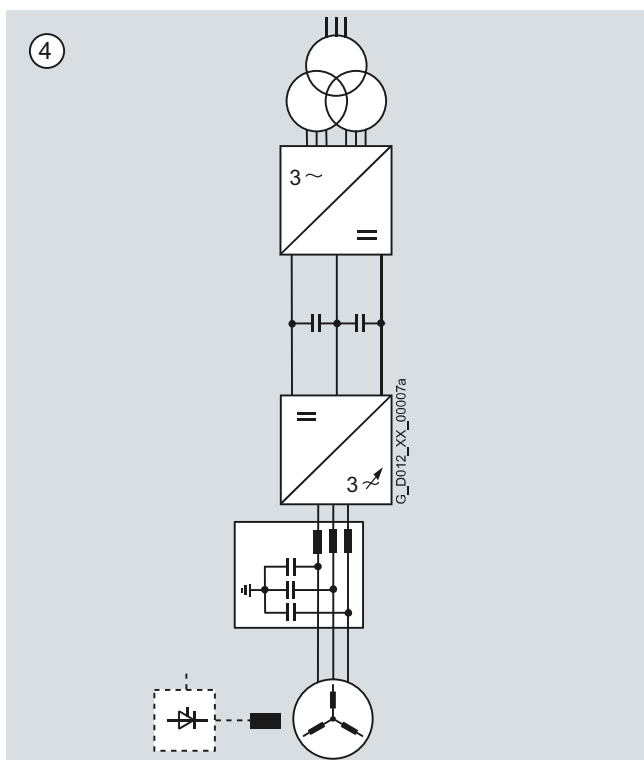
SINAMICS GM150

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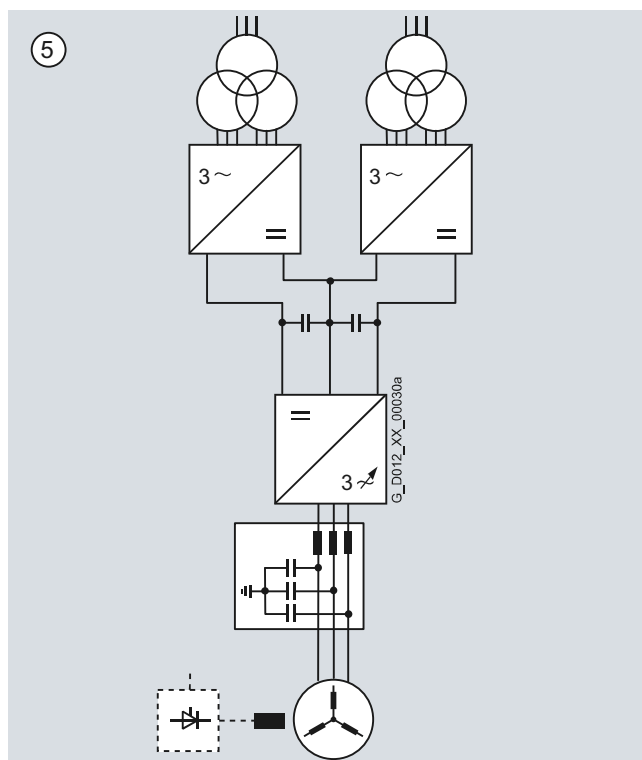
SINAMICS GM150 in IGBT version

Design

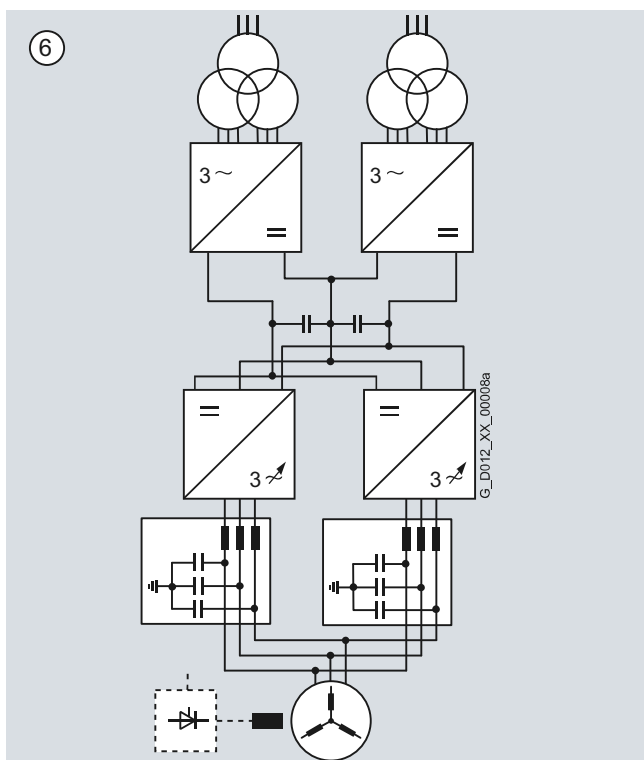
2



Basic circuit with sine-wave filter for operating line motors (option **Y15**), diode rectifier connected in series in the Basic Line Module



24-pulse infeed by connecting two Basic Line Modules in parallel (option **N15**), diode rectifier connected in parallel in the Basic Line Module here, with sine-wave filter for operating line motors (option **Y15**)



Parallel circuit with sine-wave filter for operating line motors for 3.3 kV and 4.16 kV (option **Y15**), diode rectifier connected in parallel in the Basic Line Module

Note: The motor cables are combined in the motor terminal box.

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Function

Characteristic features

SINAMICS GM150 in IGBT version		
Line Module (rectifier on mains side)		
Basic Line Module, 12-pulse (two-quadrant operation)	Standard	
Basic Line Module, 24-pulse (two-quadrant operation)	Option Standard for a parallel circuit configuration	
Motor Module (rectifier on motor side)		
Voltage range	2.3 ... 4.16 kV	
Power range (typ.)	1 ... 13 MVA	
Cooling method		
• Air cooling	Standard	
• Water cooling	Standard	
Control modes	<u>Without encoder</u>	<u>With encoder</u>
• Induction motor	Standard	Standard
• Synchronous motor, separately excited, with slip-ring excitation	On request	Option
• Synchronous motor, separately excited, with brushless (RG) excitation system	On request	On request
• Synchronous motor, separately excited	Option	On request
Sine-wave filter	Option	

Software and protection functions

SINAMICS GM150 in IGBT version	Description
Closed-loop control	<p>The motor-side closed-loop control is realized as a field-oriented closed-loop vector control that can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamic performance of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely independently of each other. Prescribed torques can thus be observed and limited accurately. In the speed range from 1:10, the field-oriented closed-loop control does not require an actual speed value encoder.</p> <p>An actual speed value encoder is required in the following scenarios:</p> <ul style="list-style-type: none"> • High dynamics requirements • Torque control/constant torque drives with a control range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed setpoint, motorized potentiometer setpoint or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal strip. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all of the interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with variable smoothing times in the lower and upper speed ranges, improves the control response and therefore prevents mechanical overloading of the drive train. The ramp-down ramps can be parameterized separately for emergency stop.
V_{dc max} controller	The V _{dc max} controller automatically prevents overvoltages in the DC link if the down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Power supply failures are bridged to the extent permitted by the kinetic energy of the drive train. The speed drops depending on the moment of inertia and the load torque. The current speed setpoint is resumed when the power supply returns. This function can cause fast load cycles changes which may have a negative effect on the infeed line (in particular on weak lines e.g. on ships).
Automatic restart (option L32)	The automatic restart switches the drive on again when the power is restored after a power failure or a general fault, and ramps up to the current speed setpoint.
Flying restart	The flying restart function permits smooth connection of the converter to a rotating motor.
Diagnostics functions	<ul style="list-style-type: none"> • Self-diagnosis of control hardware • Non-volatile memory for reliable diagnosis when the power supply fails • Monitoring of HV IGBTs with individual messages for each slot • User-friendly on-site operator panel with plain text messages
Operating hours and switching cycle counter	The operating hours of the non-redundant fans, which are located on the roof section of the cabinets, are detected and logged so that preventive maintenance can be performed or equipment replaced as a preventive measure. The switching cycles of the circuit breaker are recorded and added together, to form the basis of preventive maintenance work.

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Software and protection functions

SINAMICS GM150 in IGBT version	Description
Detecting the actual motor speed (option)	The SMC30 encoder module can be used to record the actual motor speed. The signals from the rotary pulse encoder are converted here and made available to the closed-loop control for evaluation via the DRIVE-CLiQ interface.
Operator protection	The cabinet doors of the power units are fitted with electromagnetic locks. This prevents the cabinet doors being opened while hazardous voltages are connected inside the cabinet.
EMERGENCY-OFF button	The converters are equipped as standard with an EMERGENCY-OFF button with protective collar which is fitted in the cabinet door. The contacts of the button are connected in parallel to the terminal strip so they can be integrated in a protection concept on the plant side. EMERGENCY-OFF stop category 0 is set as standard for an uncontrolled shutdown (DIN EN 60204-1/VDE 0113-1 (IEC 60204-1)). The function includes voltage disconnection of the converter output through the circuit breaker. The motor coasts in the process. EMERGENCY-STOP category 1 is optionally available for a controlled shutdown (option L60).
Insulation monitoring	The converters feature insulation monitoring of the complete electrical circuit from the secondary side of the transformer to the stator windings of the motor.
Monitoring of the peripherals	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available.
Thermal overload protection	<p>An alarm message is issued first when the overtemperature threshold is reached. If the temperature rises further, either a shutdown is carried out or automatic influencing of the output current so that a reduction in the thermal load is achieved. Following elimination of the cause of the fault (e.g. improvement in the ventilation), the original operating values are automatically resumed.</p> <p>For instance, for air-cooled converters and when filter mats are used, the amount of pollution of the filter mats is monitored by measuring the differential pressure which is then signaled. In the case of water-cooled converters, the water temperature and flow rate are recorded at several points in the cooling circuit and evaluated. Extensive self-diagnostic functions signal faults and therefore protect the converter.</p>
Grounding switch (option)	<p>If grounding on the infeed or motor side is required for safety and protection reasons, a motorized grounding switch can be ordered.</p> <p>For safety reasons, the converter controller locks these grounding switches against activation while voltage is still present. The control is integrated into the protection and monitoring chain of the converter. The grounding switches are inserted automatically when the standard grounding switches of the DC link are inserted.</p>
Capacitor tripping device (option)	<p>For applications in which the existing circuit breaker has no undervoltage coil and cannot be retrofitted there are capacitor tripping devices for 110 V to 120 V DC and for 220 V DC.</p> <p>The capacitor tripping device ensures that the circuit breaker on the plant side can still be reliably opened even if there is a power failure or the normal OFF command is not effective, e.g. because of a wire break.</p>

AOP30 operator panel



The AOP30 operator panel is fitted into the cabinet door of the SINAMICS GM150 to enable operation, monitoring and commissioning.

It has the following features and characteristics:

- Graphical LCD display with backlighting for plain-text display and a bar display of process variables
- LEDs for displaying the operational status
- Help function describing causes of and remedies for faults and alarms
- Membrane keyboard with keypad for operational control of a drive
- Local/remote switchover to select the operator control location (priority assigned to operator panel or customer's terminal strip/PROFIBUS)
- Numeric keypad for input of setpoint or parameter values
- Function keys for prompted navigation in the menu
- Two-stage safety strategy to protect against accidental or unauthorized changes to settings. The keyboard lock disables operation of the drive from the operator panel, so that only parameter values and process variables can be displayed. A password can be used to prevent the unauthorized modification of converter parameters.

The operator panel languages – English, German, Spanish and Chinese – are stored on the CompactFlash card of the Control Unit.

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Selection and ordering data

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, air cooling, without sine-wave filter	Circuit version (page 2/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
1000	820	1000	250	6SL3810-2LM32-5AA0	①
1200	1000	1250	300	6SL3810-2LM33-0AA0	①
1400	1150	1500	350	6SL3810-2LM33-5AA0	①
1600	1300	1750	400	6SL3810-2LM34-0AA0	①
1800	1500	2000	460	6SL3810-2LM34-6AA1	①
2100	1750	2400	530	6SL3810-2LM35-3AA1	①
2400	2000	2750	600	6SL3810-2LM36-0AA0	①
2700	2250	3100	700	6SL3810-2LM37-0AA1	①
3200	2650	3600	800	6SL3810-2LM38-0AA1	①
Output voltage 3.3 kV					
1000	850	1000	180	6SL3810-2LN31-8AA0	①
1300	1050	1250	220	6SL3810-2LN32-2AA0	①
1500	1250	1500	260	6SL3810-2LN32-6AA0	①
1700	1400	2000	300	6SL3810-2LN33-0AA0	①
2000	1650	2250	350	6SL3810-2LN33-5AA0	①
2300	1900	2500	400	6SL3810-2LN34-0AA0	①
2600	2150	3000	460	6SL3810-2LN34-6AA1	①
3000	2500	3380	530	6SL3810-2LN35-3AA1	①
3400	2850	3750	600	6SL3810-2LN36-0AA0	①
4000	3300	4500	700	6SL3810-2LN37-0AA1	①
4600	3800	5000	800	6SL3810-2LN38-0AA1	①
5300	4450	6200	2 × 465	6SL3810-2LN38-8AA1	③
6300	5300	7000	2 × 550	6SL3810-2LN41-1AA0	③
7100	6000	8000	2 × 625	6SL3810-2LN41-2AA1	③
8000	6700	9500	2 × 700	6SL3810-2LN41-4AA1	③
Output voltage 4.16 kV					
1300	1000	1500	180	6SL3810-2LP31-8AA0	①
1600	1300	1750	220	6SL3810-2LP32-2AA0	①
1900	1550	2000	260	6SL3810-2LP32-6AA0	①
2200	1800	2500	300	6SL3810-2LP33-0AA0	①
2500	2100	3000	350	6SL3810-2LP33-5AA0	①
2900	2400	3250	400	6SL3810-2LP34-0AA0	①
3300	2800	3800	460	6SL3810-2LP34-6AA1	①
3800	3100	4100	530	6SL3810-2LP35-3AA1	①
4300	3600	5000	600	6SL3810-2LP36-0AA0	①
5000	4150	5650	700	6SL3810-2LP37-0AA1	①
5800	4800	6600	800	6SL3810-2LP38-0AA1	①
6700	5650	7600	2 × 465	6SL3810-2LP38-8AA1	③
7900	6600	9000	2 × 550	6SL3810-2LP41-1AA0	③
9000	7600	10250	2 × 625	6SL3810-2LP41-2AA1	③
10100	8500	11500	2 × 700	6SL3810-2LP41-4AA1	③

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, air cooling, with sine-wave filter	Circuit version (page 2/5)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
850	700	900	210	6SL3810-2LM32-5AA0-Z Y15	④
1000	800	1000	250	6SL3810-2LM33-0AA0-Z Y15	④
1150	950	1250	290	6SL3810-2LM33-5AA0-Z Y15	④
1300	1100	1500	330	6SL3810-2LM34-0AA0-Z Y15	④
1450	1200	1600	390	6SL3810-2LM34-6AA1-Z Y15	④
1650	1350	1850	420	6SL3810-2LM35-3AA1-Z Y15	④
2000	1650	2250	500	6SL3810-2LM36-0AA0-Z Y15	④
–	–	–	–	–	–
–	–	–	–	–	–
Output voltage 3.3 kV					
850	700	900	150	6SL3810-2LN31-8AA0-Z Y15	④
1100	900	1150	190	6SL3810-2LN32-2AA0-Z Y15	④
1250	1050	1250	220	6SL3810-2LN32-6AA0-Z Y15	④
1450	1200	1500	250	6SL3810-2LN33-0AA0-Z Y15	④
1700	1400	1750	300	6SL3810-2LN33-5AA0-Z Y15	④
1950	1600	2000	340	6SL3810-2LN34-0AA0-Z Y15	④
2350	1850	2500	410	6SL3810-2LN34-6AA1-Z Y15	④
2600	2100	2850	440	6SL3810-2LN35-3AA1-Z Y15	④
2900	2450	3250	510	6SL3810-2LN36-0AA0-Z Y15	④
–	–	–	–	–	–
–	–	–	–	–	–
4750	3650	5100	830	6SL3810-2LN38-8AA1-Z Y15	⑥
5350	4500	6000	940	6SL3810-2LN41-1AA0-Z Y15	⑥
–	–	–	–	–	–
–	–	–	–	–	–
Output voltage 4.16 kV					
1100	900	1250	150	6SL3810-2LP31-8AA0-Z Y15	④
1350	1150	1500	190	6SL3810-2LP32-2AA0-Z Y15	④
1600	1300	1750	220	6SL3810-2LP32-6AA0-Z Y15	④
1850	1550	2000	260	6SL3810-2LP33-0AA0-Z Y15	④
2100	1750	2250	290	6SL3810-2LP33-5AA0-Z Y15	④
2450	2000	2750	340	6SL3810-2LP34-0AA0-Z Y15	④
2950	2400	3250	410	6SL3810-2LP34-6AA1-Z Y15	④
3250	2600	3600	480	6SL3810-2LP35-3AA1-Z Y15	④
3600	3000	4000	500	6SL3810-2LP36-0AA0-Z Y15	④
–	–	–	–	–	–
–	–	–	–	–	–
6000	5100	6800	830	6SL3810-2LP38-8AA1-Z Y15	⑥
6650	5500	7500	920	6SL3810-2LP41-1AA0-Z Y15	⑥
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Special version "-Z"

The order code **Y15** (sine-wave filter) must be additionally specified and requires plain text (see [Description of the options, Page 6/42](#)).

SINAMICS GM150

Medium-Voltage Converter

SINAMICS GM150 in IGBT version

Selection and ordering data

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, water cooling, without sine-wave filter	Circuit version (page 2/4)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
2000	1650	2250	500	6SL3815-2LM35-0AA0	①
2200	1800	2500	550	6SL3815-2LM35-5AA0	①
2400	2000	2750	600	6SL3815-2LM36-0AA1	①
2600	2150	2950	660	6SL3815-2LM36-6AA1	①
2900	2450	3250	740	6SL3815-2LM37-4AA0	①
3200	2650	3500	800	6SL3815-2LM38-0AA0	①
3500	2900	3850	880	6SL3815-2LM38-8AA1	①
4000	3300	4400	1000	6SL3815-2LM41-0AA1	①
Output voltage 3.3 kV					
2000	1650	2250	350	6SL3815-2LN33-5AA0	①
2300	1900	2500	400	6SL3815-2LN34-0AA0	①
2600	2150	3000	450	6SL3815-2LN34-5AA0	①
2900	2400	3250	500	6SL3815-2LN35-0AA0	①
3100	2650	3500	550	6SL3815-2LN35-5AA0	①
3400	2800	3800	600	6SL3815-2LN36-0AA1	①
3800	3150	4200	660	6SL3815-2LN36-6AA1	①
4200	3500	4500	740	6SL3815-2LN37-4AA0	①
4600	3800	5000	800	6SL3815-2LN38-0AA0	①
5100	4250	6000	880	6SL3815-2LN38-8AA1	①
5700	4700	6150	1000	6SL3815-2LN41-0AA1	①
6300	5300	7000	2 × 550	6SL3815-2LN41-1AA1	③
6800	5600	7400	2 × 600	6SL3815-2LN41-2AA1	③
7400	6200	8000	2 × 650	6SL3815-2LN41-3AA0	③
8000	6700	9000	2 × 700	6SL3815-2LN41-4AA0	③
9100	7600	10200	2 × 800	6SL3815-2LN41-6AA1	③
10300	8600	11500	2 × 900	6SL3815-2LN41-8AA1	③
Output voltage 4.16 kV					
2000	1700	2250	280	6SL3815-2LP32-8AA0	①
2200	1850	2500	310	6SL3815-2LP33-1AA0	①
2500	2100	2750	350	6SL3815-2LP33-5AA0	①
2900	2400	3000	400	6SL3815-2LP34-0AA0	①
3200	2700	3500	450	6SL3815-2LP34-5AA0	①
3600	3000	4000	500	6SL3815-2LP35-0AA0	①
4000	3300	4500	550	6SL3815-2LP35-5AA0	①
4300	3600	4850	600	6SL3815-2LP36-0AA1	①
4800	4000	5450	660	6SL3815-2LP36-6AA1	①
5300	4500	6000	740	6SL3815-2LP37-4AA0	①
5800	4800	6500	800	6SL3815-2LP38-0AA0	①
6400	5300	7150	880	6SL3815-2LP38-8AA1	①
7200	5900	8000	1000	6SL3815-2LP41-0AA1	①
7900	6600	9000	2 × 550	6SL3815-2LP41-1AA1	③
8600	7150	9500	2 × 600	6SL3815-2LP41-2AA1	③
9400	7900	10000	2 × 650	6SL3815-2LP41-3AA0	③
10100	8500	11000	2 × 700	6SL3815-2LP41-4AA0	③
11500	9600	13000	2 × 800	6SL3815-2LP41-6AA1	③
13000	11250	15300	2 × 900	6SL3815-2LP41-8AA1	③

Type rating	Shaft output		Rated output current	SINAMICS GM150 as IGBT version, water cooling, with sine-wave filter	Circuit version (page 2/5)
kVA	kW	hp	A	Order No.	Fig. No.
Output voltage 2.3 kV					
1500	1250	1500	380	6SL3815-2LM35-0AA0-Z Y15	④
1650	1350	1750	410	6SL3815-2LM35-5AA0-Z Y15	④
2150	1790	2400	540	6SL3815-2LM36-0AA1-Z Y15	④
2200	1850	2500	550	6SL3815-2LM37-4AA0-Z Y15	④
2350	1950	2550	590	6SL3815-2LM36-6AA1-Z Y15	④
2400	2000	2750	600	6SL3815-2LM38-0AA0-Z Y15	④
Output voltage 3.3 kV					
1550	1300	1750	270	6SL3815-2LN33-5AA0-Z Y15	④
1750	1450	2000	310	6SL3815-2LN34-0AA0-Z Y15	④
2000	1650	2250	350	6SL3815-2LN34-5AA0-Z Y15	④
2150	1800	2500	380	6SL3815-2LN35-0AA0-Z Y15	④
2350	1950	2750	410	6SL3815-2LN35-5AA0-Z Y15	④
3100	2550	3400	540	6SL3815-2LN36-0AA1-Z Y15	④
3200	2700	3500	560	6SL3815-2LN37-4AA0-Z Y15	④
3400	2800	3700	590	6SL3815-2LN36-6AA1-Z Y15	④
3500	2900	4000	610	6SL3815-2LN38-0AA0-Z Y15	④
5500	4550	6000	960	6SL3815-2LN41-1AA1-Z Y15	⑥
5600	4700	6250	980	6SL3815-2LN41-3AA0-Z Y15	⑥
6050	5100	6500	1060	6SL3815-2LN41-4AA0-Z Y15	⑥
6100	5100	7000	1080	6SL3815-2LN41-2AA1-Z Y15	⑥
Output voltage 4.16 kV					
1600	1300	1750	220	6SL3815-2LP32-8AA0-Z Y15	④
1750	1450	2000	240	6SL3815-2LP33-1AA0-Z Y15	④
1950	1600	2250	270	6SL3815-2LP33-5AA0-Z Y15	④
2250	1850	2500	310	6SL3815-2LP34-0AA0-Z Y15	④
2500	2100	2750	350	6SL3815-2LP34-5AA0-Z Y15	④
2800	2350	3000	390	6SL3815-2LP35-0AA0-Z Y15	④
3100	2600	3500	430	6SL3815-2LP35-5AA0-Z Y15	④
3900	3250	4450	540	6SL3815-2LP36-0AA1-Z Y15	④
4100	3450	4500	570	6SL3815-2LP37-4AA0-Z Y15	④
4250	3550	4750	590	6SL3815-2LP36-6AA1-Z Y15	④
4500	3800	5000	625	6SL3815-2LP38-0AA0-Z Y15	④
7150	5900	7950	960	6SL3815-2LP41-1AA1-Z Y15	⑥
7350	6200	8000	1020	6SL3815-2LP41-3AA0-Z Y15	⑥
7700	6350	8600	1080	6SL3815-2LP41-2AA1-Z Y15	⑥
7950	6600	9000	1100	6SL3815-2LP41-4AA0-Z Y15	⑥

The order code **Y15** (sine-wave filter) must be additionally specified and requires plain text (see [Description of the options, Page 6/42](#)).

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Options

When ordering a converter with options, add **"-Z"** to the order number of the converter, followed by the order code(s) for the desired option(s).

Example:

6SL3810-2LM32-5AA0-Z
+N15+L60+...

In the following tables, related options are arranged in groups. Whether the options can be combined or are mutually exclusive is indicated within these groups. A detailed description of the options can be found in Chapter 6.

Input-side options		N15	N20	N21	N13
24-pulse Basic Line Module	N15		✓	✓	–
Capacitor tripping device 110 V to 120 V DC	N20	✓		–	✓
Capacitor tripping device 230 V DC	N21	✓	–		✓
Circuit breaker at converter input (for 24-pulse Basic Line Module on request)	N13	–	✓	✓	

Output-side options		L08	Y15	L29	L52	L72	Y73
Output reactor	L08		–	✓	✓	✓	✓
Sine-wave filter (plain text required)	Y15	–		✓	✓	✓	✓
Bidirectional synchronized bypass operation	L29	✓	✓		✓	✓	✓
Circuit breaker at converter output ¹⁾	L52	✓	✓	✓		✓	✓
Braking Module	L72	✓	✓	✓	✓		✓
Braking resistor	Y73	✓	✓	✓	✓	✓	

¹⁾ Option **L52** cannot be combined with option **L51** (disconnecter at converter output).

Protective functions		K80	L48	L49	L51	L60	M10
Control of "Safe Torque Off" function (on request)	K80		✓	✓	✓	✓	✓
Make-proof grounding switch at converter input (motor-operated)	L48	✓		✓	✓	✓	✓
Make-proof grounding switch at converter output (motor-operated)	L49	✓	✓		✓	✓	✓
Disconnecter at converter output ¹⁾	L51	✓	✓	✓		✓	✓
EMERGENCY-STOP, Stop Category 1 for controlled stopping	L60	✓	✓	✓	✓		✓
Safety interlocking system	M10	✓	✓	✓	✓	✓	

¹⁾ Option **L51** cannot be combined with option **L52** (circuit breaker at converter output).



Options can be combined



Options are mutually exclusive

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Options

Temperature sensing and evaluation (standard: 3 Pt100 inputs)		L80	L81	L82	L90	L91	L93	L95
2 thermistor motor protection relays for alarm and fault ¹⁾	L80		–	–	✓	✓	✓	✓
2 x 2 thermistor protection relays for alarm and fault ¹⁾	L81	–		–	✓	✓	✓	✓
3 x 2 thermistor protection relays for alarm and fault ¹⁾	L82	–	–		✓	✓	✓	✓
Pt100 evaluation unit with 3 inputs ¹⁾	L90	✓	✓	✓		–	–	–
2 Pt100 evaluation units with 3 inputs each ¹⁾	L91	✓	✓	✓	–		–	–
Pt100 evaluation unit with 6 inputs and 2 analog outputs (outputs for display connected to the control system) ¹⁾	L93	✓	✓	✓	–	–		–
Pt100 evaluation unit with 6 inputs for explosion-protected motors and 2 analog outputs ¹⁾	L95	✓	✓	✓	–	–	–	

¹⁾ Options **L..** cannot be combined with option **G61** (additional TM31 Terminal Module).

Increased degree of protection of the control cabinets in the air-cooled version (standard: IP22)		M11	M42
Dust protection	M11		✓
IP42 degree of protection	M42	✓	

Increased degree of protection of the control cabinets in the water-cooled version (standard: IP43)	
IP54 degree of protection	M54

Improvement in dust protection before commissioning in the water-cooled version	
Extended dust protection	M16

Controlled motor feeder for auxiliaries ¹⁾		N30	N31	N32	N33
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 4/4.8 kW	N30		–	–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 7/8 kW	N31	–		–	–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 11/12.7 kW	N32	–	–		–
Controlled motor feeder for auxiliaries 440/480 V 3 AC, max. 15/17.5 kW	N33	–	–	–	

¹⁾ With the ON command at the converter, the contactor is **closed**, and with the OFF command, the contactor is **opened** (example: external fan on the motor). The supply voltage for the auxiliaries must be provided externally.

Controlled outgoing feeder for auxiliaries ¹⁾		N35	N36	N37	N38
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 1.2/1 kW	N35		–	–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 2.2/1.5 kW	N36	–		–	–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 3.5/2.1 kW	N37	–	–		–
Controlled outgoing feeder for auxiliaries 230/120 V 1 AC, max. 4.5/2.8 kW	N38	–	–	–	

¹⁾ With the ON command at the converter, the contactor is **opened**, and with the OFF command, the contactor is **closed** (example: heater). The supply voltage for the auxiliaries must be provided externally.



Options can be combined



Options are mutually exclusive

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Options

Air cooling design		M61	M64
Redundant fan in the power unit	M61		—
Converter prepared for connection to an external air discharge system, with internal cabinet fans	M64	—	

Connection of power and signal cables (standard: power cable connected from below, signal cable connected directly to the terminals of the Terminal Modules)		M13	M78	M32	M33	M34	M36
Power cable connected at the converter input from the top	M13		✓	✓	✓	✓	✓
Power cable connected at the converter output from the top	M78	✓		✓	✓	✓	✓
Customer's terminal strip with spring-loaded terminals for signal cables up to 2.5 mm ²	M32	✓	✓		—	✓	✓
Customer's terminal strip with screw terminals for signal cables up to 2.5 mm ²	M33	✓	✓	—		✓	✓
Auxiliary voltage and signal cables connected from the top ¹⁾	M34	✓	✓	✓	✓		✓
Cable entry, brass for power cables	M36	✓	✓	✓	✓	✓	

¹⁾ Option **M34** can only be ordered in combination with one of the options **M32** or **M33**.

Operator control and display instruments in the door of the control cabinet		K20	K21	K22
Indicator lights in the cabinet door	K20		—	—
Display instruments in the cabinet door for voltage, current, speed and power as well as indicator lights	K21	—		—
Display instruments in the cabinet door for current, speed, power and winding temperature as well as indicator lights	K22	—	—	

Interface modules for connection to external bus systems (standard: PROFIBUS (slave))		G20	G21	G22	G23	G24	G25	G35
CAN bus interface (CANopen, on request)	G20		—	—	—	—	—	—
Modbus Plus interface (on request)	G21	—		—	—	—	—	—
Modbus RTU slave interface (on request)	G22	—	—		—	—	—	—
DeviceNet interface (on request)	G23	—	—	—		—	—	—
PROFINET interface (via CBE20) (on request)	G24	—	—	—	—		—	—
TeleService connection, TS Adapter II, analog modem	G25	—	—	—	—	—		—
TeleService connection, TS Adapter II, ISDN modem	G35	—	—	—	—	—	—	

✓ Options can be combined

— Options are mutually exclusive

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Options

Interface modules for additional customer connections and speed encoders		G61	G62	G63	K50
Additional TM31 Terminal Module ¹⁾	G61		✓	✓	✓
Second additional TM31 Terminal Module ¹⁾	G62	✓		✓	✓
Additional TM15 Terminal Module	G63	✓	✓		✓
Sensor Module Cabinet-Mounted SMC30	K50	✓	✓	✓	

¹⁾ For the exclusions for options **G61** and **G62** see the description of the options, Page 6/16.

Other interface modules		G70	G71
Pulse distributor for transferring the speed encoder signal (on request) ¹⁾	G70		✓
Optical bus terminal (OBT) for PROFIBUS (on request) ²⁾	G71	✓	

¹⁾ Option **G70** can only be ordered in combination with option **K50** (Sensor Module Cabinet-Mounted SMC30).

²⁾ Option **G71** cannot be combined with options **G20 to G24** and **G34** (access to other bus systems), as well as **G25** and **G35** (Teleservice).

Additional analog inputs/outputs (isolated)		E86	E87
Additional analog inputs (isolated) ¹⁾	E86		✓
Additional analog outputs (isolated) ¹⁾	E87	✓	

¹⁾ Options **E86** and **E87** cannot be combined with option **G62** (additional TM31 Terminal Module).

Industry-specific options		B00	M66
NAMUR terminal strip	B00		✓
Suitable for marine applications	M66	✓	
The following option is <u>included</u> as standard in option M66 :			
Cabinet anti-condensation heating	L55	✓	✓
The following options are <u>required</u> for safety-relevant drives in addition to option M66 :			
Individual certification of the converter by the relevant certification societies ¹⁾	E11 to E71	✓	✓

¹⁾ An inquiry is required for options **M66** and **E11 to E71** in conjunction with option **Y15** (sine-wave filter).



Options can be combined



Options are mutually exclusive

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Options

Individual certification of the converters for use on ships (includes option M66) ¹⁾		E11	E21	E31	E51	E61	E71
Suitable for marine use with individual certificate from Germanische Lloyd (GL)	E11		–	–	–	–	–
Suitable for marine use with individual certificate from Lloyds Register (LR)	E21	–		–	–	–	–
Suitable for marine use with individual certificate from Bureau Veritas (BV)	E31	–	–		–	–	–
Suitable for marine use with individual certificate from Det Norske Veritas (DNV)	E51	–	–	–		–	–
Suitable for marine use with individual certificate from the American Bureau of Shipping (ABS)	E61	–	–	–	–		–
Suitable for marine use with individual certificate from the Chinese Classification Society (CCS)	E71	–	–	–	–	–	

¹⁾ An inquiry is required for options **M66** and **E11 to E71** in conjunction with option **Y15** (sine-wave filter).

Functional options		E01	E02	E03	L32
Control for separately excited synchronous motors with slipring excitation (on request)	E01		–	–	✓
Control for separately excited synchronous motors with brushless excitation system (on request)	E02	–		–	✓
Closed-loop control of permanent-magnet synchronous motors (on request) ¹⁾	E03	–	–		✓
Automatic restart	L32	✓	✓	✓	

¹⁾ Option **E03** can only be ordered in combination with option **L52** (circuit breaker at the converter output).

Documentation (standard: PDF format in English on CD-ROM)		B43	B44	B45	D02	D15	Y10
Production flowchart: Generated once	B43		–	–	✓	✓	✓
Production flowchart: Updated every two weeks	B44	–		–	✓	✓	✓
Production flowchart: Updated every month	B45	–	–		✓	✓	✓
Circuit diagrams, terminal diagrams and dimension drawings in DXF format ¹⁾	D02	✓	✓	✓		✓	✓
One set of printed documentation (multiple orders possible)	D15	✓	✓	✓	✓		✓
Circuit diagrams with customer-specific text field (plain text required) ¹⁾	Y10	✓	✓	✓	✓	✓	

¹⁾ The equipment-specific documents (circuit diagrams etc.) are only available in English/German.



Options can be combined



Options are mutually exclusive

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Options

Documentation in languages (standard: PDF format in English on CD-ROM)		D00	D55	D56	D57	D72	D76	D77	D78	D79	D84
Documentation in German	D00		–	–	–	–	✓	–	–	–	–
Documentation in Polish	D55	–		–	–	–	✓	–	–	–	–
Documentation in Russian	D56	–	–		–	–	✓	–	–	–	–
Documentation in Japanese (on request)	D57	–	–	–		–	✓	–	–	–	–
Documentation in Italian (on request)	D72	–	–	–	–		✓	–	–	–	–
Documentation in English (additional CD-ROM in English, irrespective of the selected language)	D76	✓	✓	✓	✓	✓		✓	✓	✓	✓
Documentation in French	D77	–	–	–	–	–	✓		–	–	–
Documentation in Spanish	D78	–	–	–	–	–	✓	–		–	–
Documentation in Portuguese (Brazil)	D79	–	–	–	–	–	✓	–	–		–
Documentation in Chinese	D84	–	–	–	–	–	✓	–	–	–	

Rating plate language (standard: English/German)		T58	T60	T80	T82	T85	T86	T90	T91	
Rating plate in English/French	T58		–	–	–	–	–	–	–	
Rating plate in English/Spanish	T60	–		–	–	–	–	–	–	
Rating plate in English/Italian	T80	–	–		–	–	–	–	–	
Rating plate in English/Portuguese (on request)	T82	–	–	–		–	–	–	–	
Rating plate in English/Russian (on request)	T85	–	–	–	–		–	–	–	
Rating plate in English/Polish (on request)	T86	–	–	–	–	–		–	–	
Rating plate in English/Japanese (on request)	T90	–	–	–	–	–	–		–	
Rating plate in English/Chinese (on request)	T91	–	–	–	–	–	–	–		

Auxiliary voltage supply		
Auxiliary voltage other than N/400 V/3 AC	C30 to C55	



Options can be combined



Options are mutually exclusive

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Options

Converter acceptance inspections in presence of customer		F03	F29	F73	F77	F79	F97
Visual acceptance of converter	F03		–	–	–	–	–
Noise measurement under no-load conditions	F29	–		✓	✓	✓	–
Functional acceptance of converter with inductive load	F73	–	✓		✓	✓	–
Acceptance of the converter insulation test ¹⁾	F77	–	✓	✓		✓	–
Test of the interface between the converter and customer equipment (5 hours) ¹⁾	F79	–	✓	✓	✓		–
Customer-specific system acceptance tests (on request)	F97	–	–	–	–	–	

¹⁾ Options **F77** and **F79** can only be ordered in conjunction with option **F73**.

Cooling unit (water-cooled converters, standard: Cooling unit with redundant pumps and a stainless steel plate-type heat exchanger)		W02	W11	W12	W14	W20	Y40
Cooling unit with redundant stainless steel plate-type heat exchangers	W02		–	–	–	✓	–
Cooling unit with titanium plate-type heat exchanger	W11	–		–	–	✓	–
Cooling unit with redundant titanium plate-type heat exchangers	W12	–	–		–	✓	–
Converter without cooling unit (provided on the system side)	W14	–	–	–		–	–
Raw-water connection from the bottom	W20	✓	✓	✓	–		✓
Raw water data that deviates from the technical data (on request) ¹⁾	Y40	–	–	–	–	✓	

¹⁾ Option **Y40** includes a cooling system which is adapted to the raw water data according to the customer's specifications.



Options can be combined



Options are mutually exclusive

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Options

Extension of the liability for defects		Q80	Q81	Q82	Q83	Q84	Q85	
Extension of the liability for defects period by 12 months to a total of 24 months	Q80		—	—	—	—	—	
Extension of the liability for defects period by 18 months to a total of 30 months	Q81	—		—	—	—	—	
Extension of the liability for defects period by 24 months to a total of 36 months	Q82	—	—		—	—	—	
Extension of the liability for defects period by 30 months to a total of 42 months	Q83	—	—	—		—	—	
Extension of the liability for defects period by 36 months to a total of 48 months	Q84	—	—	—	—		—	
Extension of the liability for defects period by 48 months to a total of 60 months	Q85	—	—	—	—	—		

Miscellaneous options		L50	L53	L55	Y05	Y09	
Cabinet lighting and service socket in the control section	L50		✓	✓	✓	✓	
UPS for the power supply of the open-loop and closed-loop control (on request)	L53	✓		✓	✓	✓	
Anti-condensation heating for the cabinet	L55	✓	✓		✓	✓	
Customer-specific rating plate	Y05	✓	✓	✓		✓	
Special paint finish according to RAL.... (in a color other than RAL 7035; plain text required)	Y09	✓	✓	✓	✓		



Options can be combined



Options are mutually exclusive

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Technical specifications

General technical data	
Power components	Diodes, 3.3 kV IGBTs
Line-side converter	
• Standard	Lower power ratings at 2.3 ... 4.16 kV: 12-pulse diode rectifier (Basic Line Module) Higher power ratings at 2.3 ... 4.16 kV: 24-pulse diode rectifier (Basic Line Module)
• Option	Lower power ratings at 2.3 ... 4.16 kV: 24-pulse diode rectifier (Basic Line Module)
Line-side converter	Inverter (Motor Module)
Closed-loop control	Closed-loop vector control
Drive quadrants	2 (driving 2 directions of rotation)
Electrical isolation, power unit/ open-loop and closed-loop control	Fiber-optic cable, insulating transformer
Auxiliary power supply (for fans, coolant pumps, precharging the DC link capacitors, open-loop and closed-loop control)	230 V 1 AC $\pm 10\%$, 50/60 Hz $\pm 3\%$ and 400 V 3 AC $\pm 10\%$, 50/60 Hz $\pm 3\%$ or another auxiliary voltage (options C30 to C55)
Installation altitude	≤ 1000 m above sea level: 100 % load capability > 1000 ... 4000 m above sea level: current derating required > 2000 ... 4000 m above sea level: voltage derating required in addition
Insulation	According to EN 50178/VDE 0160 (IEC 62103): Pollution degree 2 (without conductive pollution), condensation not permissible
Degree of protection	According to EN 60529/VDE 0470 T1 (IEC 60529):
• Standard	IP22 (air cooling), IP43 (water cooling)
• Option	IP42 (air cooling), IP54 (water cooling)
Protection class	I according to EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1)
Shock-hazard protection	EN 50274/VDE 0660 T514 and BGV A3 when used for the intended application
Interference transmission	This drive unit is part of a PDS, Category C4 according to EN 61800-3/VDE 0160 T103 (IEC 61800-3). It has not been designed to be connected to the public line supply. EMC disturbances can occur when connected to these line supplies. The essential requirements placed on EMC protection for the drive system should be secured using an EMC plan on the customer side.
Paint finish/color	Indoor requirements/RAL 7035, light gray
Applicable standards and directives	
• Standards	EN 61800-3/VDE 0160 T103 (IEC 61800-3) EN 61800-4/VDE 0160 T104 (IEC 61800-4), however, only if referenced in the standards EN 61800-3 or EN 61800-5-1 EN 61800-5-1/VDE 0160 T105 (IEC 61800-5-1) EN 60146-1-1/VDE 0558 T11 (IEC 60146-1-1) EN 50178/VDE 0160 (IEC 62103) EN 60204-11/VDE 0113 T11 (IEC 60204-11), however, structuring principles and reference marking according to EN 61346-1 instead of EN 81346-1
• EU directives	2006/95/EC + amendments (Low Voltage Directive) 2004/108/EC + amendments (Electromagnetic Compatibility)
Air cooling	Forced air cooling with integrated fans
Water cooling	Water-water cooling unit, internal circuit, deionized water
Permissible coolant temperature (raw water)	
• Inlet	5 ... 35 °C
• Discharge, max.	40 °C

Rated data			
Output voltage	2.3 kV	3.3 kV	4.16 kV
Input voltage	2×1.2 kV	2×1.7 kV	2×2.2 kV
Tolerance of input voltage	$\pm 10\%$	$\pm 10\%$	$\pm 10\%$
Line frequency	50/60 Hz $\pm 3\%$	50/60 Hz $\pm 3\%$	50/60 Hz $\pm 3\%$
Line power factor fundamental mode	> 0.96	> 0.96	> 0.96

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Technical specifications

	Operation of induction motors				Operation of separately excited synchronous motors	
	Without speed encoder		With speed encoder		With speed encoder	
	Without sine-wave filter	With sine-wave filter	Without sine-wave filter	With sine-wave filter	Without sine-wave filter	With sine-wave filter
Control properties						
Operating range						
• Lower limit of speed control range (% of rated motor speed)	5 %	5 %	0 %	0 %	0 %	0 %
• Max. permissible output frequency	250 Hz	66 Hz	250 Hz	66 Hz	90 Hz	66 Hz
• Field-shunting range	1:3	1:1.1	1:3	1:1.1	1:4	1:1.1
Stationary operation						
• Speed accuracy (% of rated motor speed)	±0.2 % (from 5 % of rated speed)	±0.2 % (from 5 % of rated speed)	±0.01 %	±0.01 %	±0.01 %	±0.01 %
• Torque accuracy (% of rated torque)	±5 % (from 5 % of rated speed)	±5 % (from 5 % of rated speed)	±5 %	±5 %	±2 %	±5 %
Dynamic operation						
• Torque rise time	5 ms	20 ms	5 ms	20 ms	5 ms	20 ms
	Storage		Transport		Operation	
Climatic ambient conditions						
Ambient temperature	-25 ... +70 °C		-25 ... +70 °C		5 ... 40 °C (air cooling) 5 ... 45 °C (water cooling)	
Relative air humidity	5 ... 95 % (only slight condensation permitted; converter must be completely dry before commissioning)		5 ... 75 %		5 ... 85 % (condensation not permissible)	
Other climatic conditions in accordance with Class	1K3 according to EN 60721-3-1 (IEC 60721-3-1) (icing not permitted)		2K2 according to EN 60721-3-2 (IEC 60721-3-2)		3K3 according to EN 60721-3-3 (IEC 60721-3-3)	
Degree of pollution	2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)		2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)		2 without conductive pollution according to EN 50178/VDE 0160 (IEC 62103)	
Mechanical ambient conditions						
Dynamic stress						
• Deflection	1.5 mm at 2 ... 9 Hz		3.5 mm at 2 ... 9 Hz		0.3 mm at 2 ... 9 Hz	
• Acceleration	5 m/s ² at 9 ... 200 Hz		10 m/s ² at 9 ... 200 Hz 15 m/s ² at 200 ... 500 Hz		1 m/s ² at 9 ... 200 Hz	
Other mechanical conditions in accordance with Class (increased strength for marine duty)	1M2 according to EN 60721-3-1 (IEC 60721-3-1)		2M2 according to EN 60721-3-2 (IEC 60721-3-2)		3M1 according to EN 60721-3-3 (IEC 60721-3-3)	
Other ambient conditions						
Biological ambient conditions in accordance with Class	1B1 according to EN 60721-3-1 (IEC 60721-3-1)		2B1 according to EN 60721-3-2 (IEC 60721-3-2)		3B2 according to EN 60721-3-3 (IEC 60721-3-3) (without harmful flora)	
Chemically active substances in accordance with Class	1C1 according to EN 60721-3-1 (IEC 60721-3-1)		2C1 according to EN 60721-3-2 (IEC 60721-3-2)		3C2 according to EN 60721-3-3 (IEC 60721-3-3) (no occurrence of salt mist)	
Mechanically active substances in accordance with Class	1S1 according to EN 60721-3-1 (IEC 60721-3-1)		2S1 according to EN 60721-3-2 (IEC 60721-3-2)		3S1 according to EN 60721-3-3 (IEC 60721-3-3) (3S3 with water cooling and degree of protection IP54)	

Note:

The values specified under storage and transport apply to suitably packed converters.

SINAMICS GM150

Medium-Voltage Converter

SINAMICS GM150 in IGBT version

Technical specifications

Derating for special installation conditions

Current derating

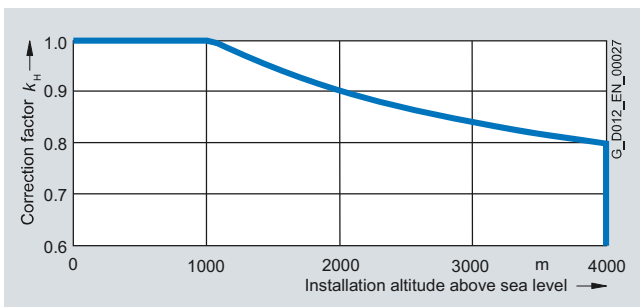
If the converters are operated at installation altitudes from 1000 m above sea level or at ambient/coolant temperatures > 40 °C for air cooling or with intake temperatures in the cooling unit > 35 °, derating factors k_H or k_T must be taken into account for the rated current (DIN 43671). For the permitted continuous current I :

$$I \leq I_N \times k_H \times k_T$$

I : permitted continuous current

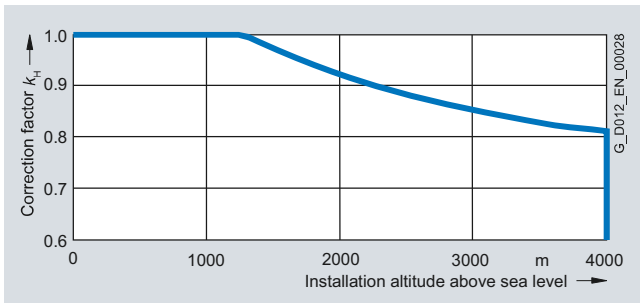
I_N : rated current

Current derating as a function of the installation altitude (air cooling)



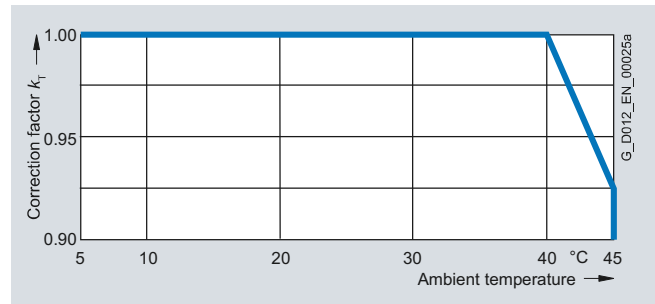
Derating factor k_H for air cooling

Current derating as a function of the installation altitude (water cooling)



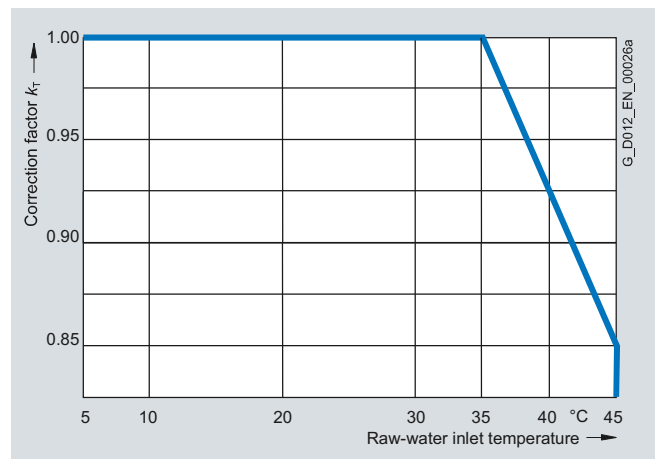
Derating factor k_H for water cooling

Current derating as a function of ambient temperature



Derating factor k_T (ambient temperature)

Current derating as a function of the raw water intake temperature

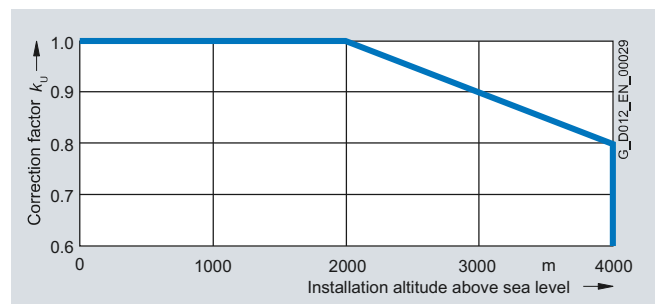


Derating factor k_T (raw water intake temperature)

Voltage derating

For installation altitudes >2000 m, according to DIN EN 60664-1/VDE 0110 (IEC 60664-1) in addition to a current derating, a voltage derating is also required. This depends on the air and creepage distances in the unit.

Voltage derating as a function of installation altitude



Derating factor k_U

SINAMICS GM150

Medium-Voltage Converter

SINAMICS GM150 in IGBT version

Technical specifications

Example 1 (air-cooled converter)

Derating data SINAMICS GM150 in IGBT version

Drive unit	6SL3810-2LP33-0AA0
Output voltage	4.16 kV
Input voltage	2 × 2.2 kV
Type rating	2200 kVA, 300 A
Installation altitude	3000 m
Ambient temperature, max.	30 °C
k_H (air cooling)	0.84
k_T (ambient temperature)	1.0
k_U	0.9

For the current, the following applies:

$$I \leq I_N \times 0.84 \times 1.0 = I_N \times 0.84$$

A current derating of 16 % and a voltage derating of 10 % are required. The converter may still be connected to a line supply voltage of 2 × 1.98 kV 3 AC.

The maximum available output current is 252 A.

Example 2 (water-cooled converter)

Derating data SINAMICS GM150 in IGBT version

Drive unit	6SL3815-2LN33-5AA0
Output voltage	3.3 kV
Input voltage	2 × 1.7 kV
Type rating	2000 kVA, 350 A
Installation altitude	2000 m
Raw water intake temperature	40 °C
k_H (water cooling)	0.925
k_T (raw water intake temperature)	0.925
k_U	1.0

For the current, the following applies:

$$I \leq I_N \times 0.925 \times 0.925 = I_N \times 0.856$$

A current derating of 14.4 % is required.

The maximum available output current is 299 A.