

SINAMICS GM150 IGBT version

2



2/2 Overview

2/2 Benefits

2/3 Design

2/6 Function

Selection and ordering data

- 2/8 Air cooling, without sine-wave filter
- 2/9 Air cooling, with sine-wave filter
- 2/10 Water cooling, without sine-wave filter
- 2/11 Water cooling, with sine-wave filter

2/12 Options

2/17 Technical data

- 2/17 General technical data
- 2/18 Control properties
- 2/18 Ambient conditions
- 2/19 Installation conditions and derating data

Converter-related technical data

- 2/21 Air cooling, without sine-wave filter
- 2/35 Air cooling, with sine-wave filter
- 2/49 Water cooling, without sine-wave filter
- 2/62 Water cooling, with sine-wave filter



SINAMICS GM150

Medium-Voltage Converters

IGBT version

Overview



SINAMICS GM150 in IGBT version (air-cooled)

SINAMICS GM150 converters in 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 option, the converters offer the best conditions on the market for the operation of standard motors. This makes them ideally suited for the retrofitting of existing systems from fixed-speed drives to variable speed drives.

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

IGBT converters are available for the following voltages and power ranges:

Rated output voltage	Type rating	
kV	with air cooling	with water cooling
	MVA	MVA
2.3	1.0 to 2.4	2.0 to 3.2
3.3	1.0 to 6.3	2.0 to 8.0
4.16	1.3 to 7.9	2.0 to 10.1
6.0	0.8 to 5.0	1.8 to 7.3
6.6	0.9 to 5.5	1.9 to 8.0

Global use

SINAMICS GM150 converters in 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 marine version (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 design 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

Design

SINAMICS GM150 converters in 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.

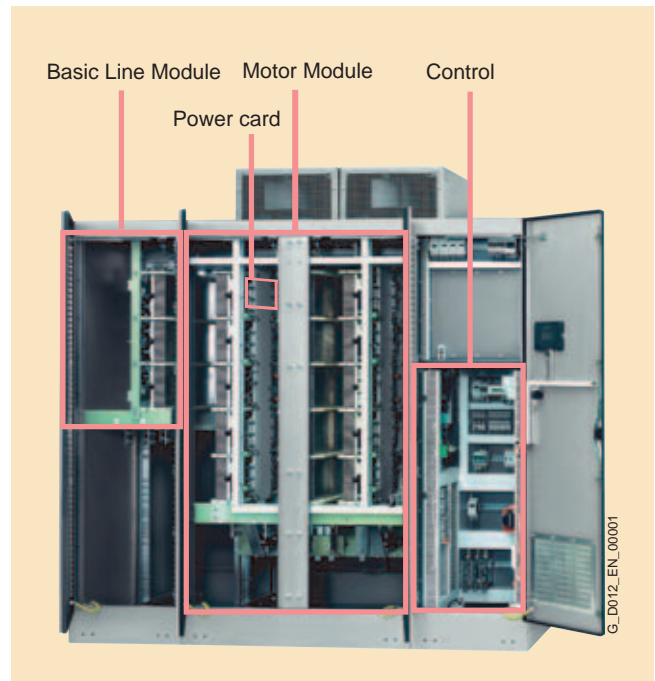
For higher output ratings and for voltages of 6.0 kV and 6.6 kV, two Basic Line Modules and two Motor Modules are connected in parallel with a common DC link or two Line Modules are connected in series (24-pulse Basic Line Modules).

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.

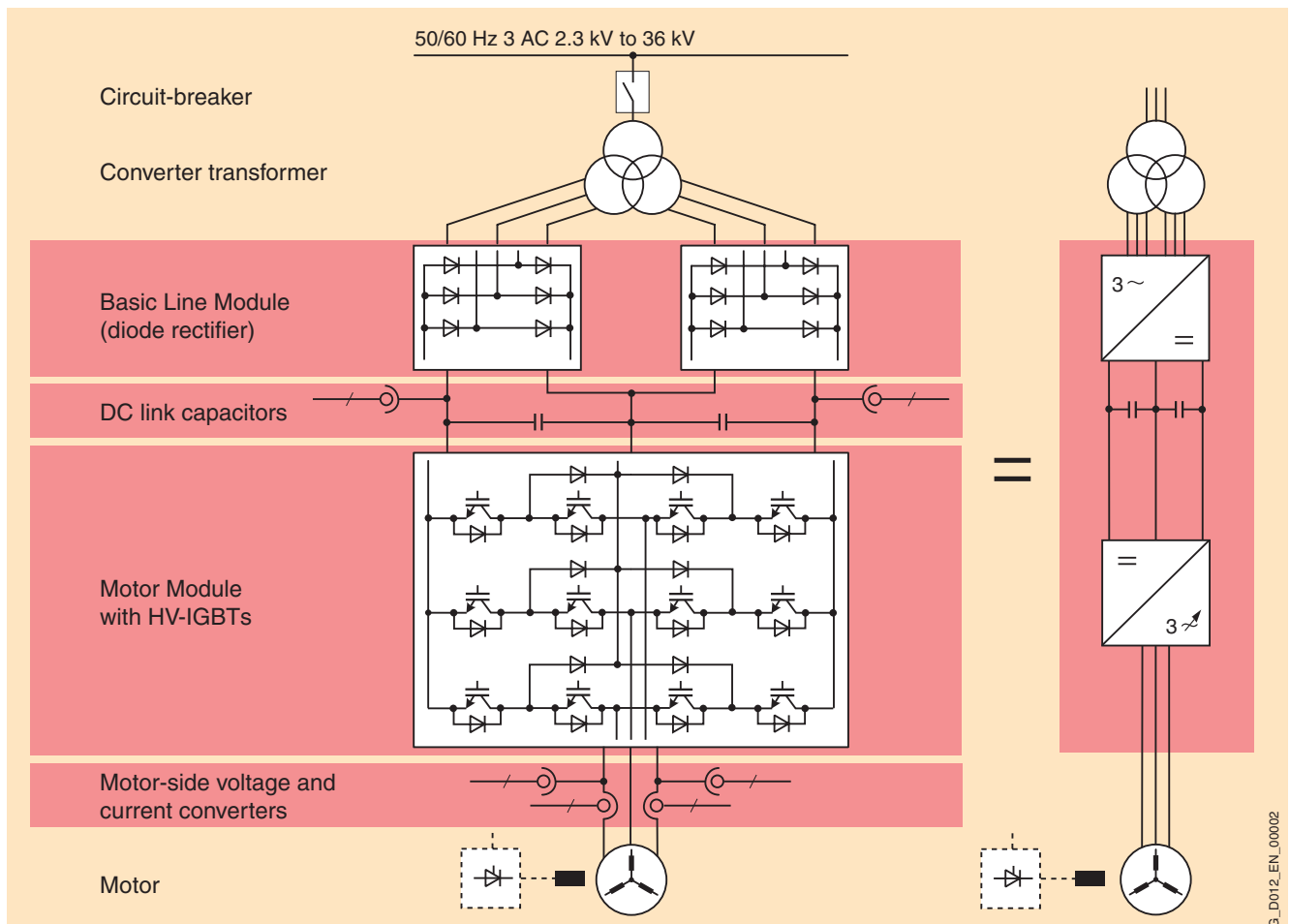
HV-IGBT power semiconductors mounted on plug-in, easy to change power cards are used in the Motor Modules.

Both line and motor connections can be optionally realized from bottom or top.

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



SINAMICS GM150 in air-cooled IGBT version, internal arrangement



Block diagram

SINAMICS GM150

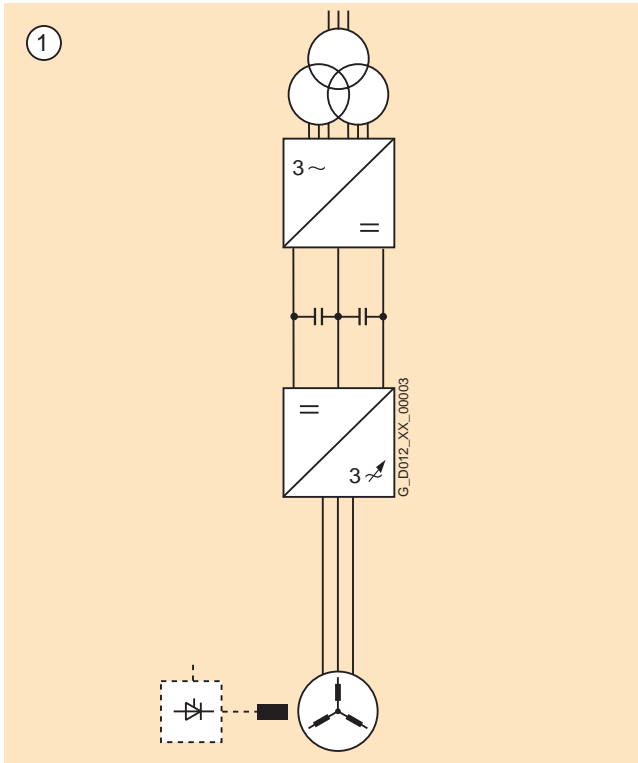
Medium-Voltage Converters

IGBT version

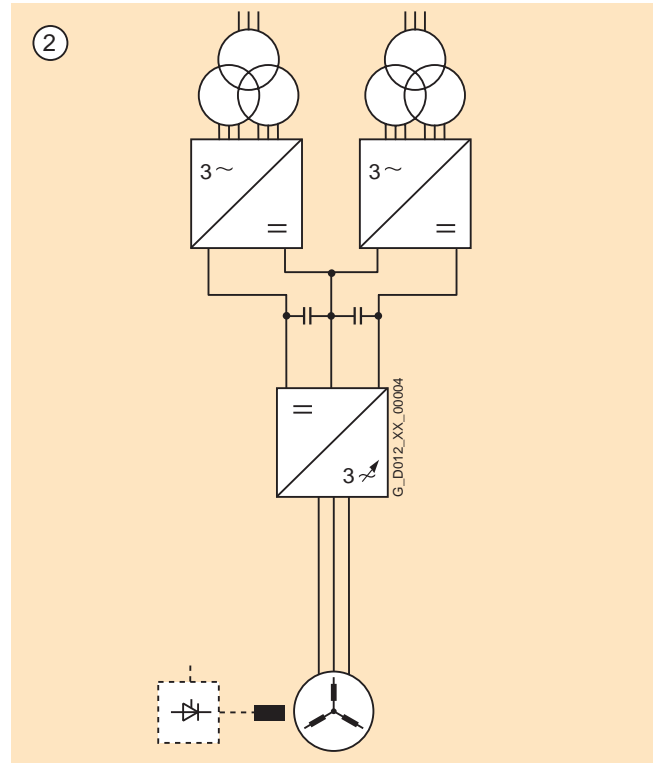
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Design (continued)

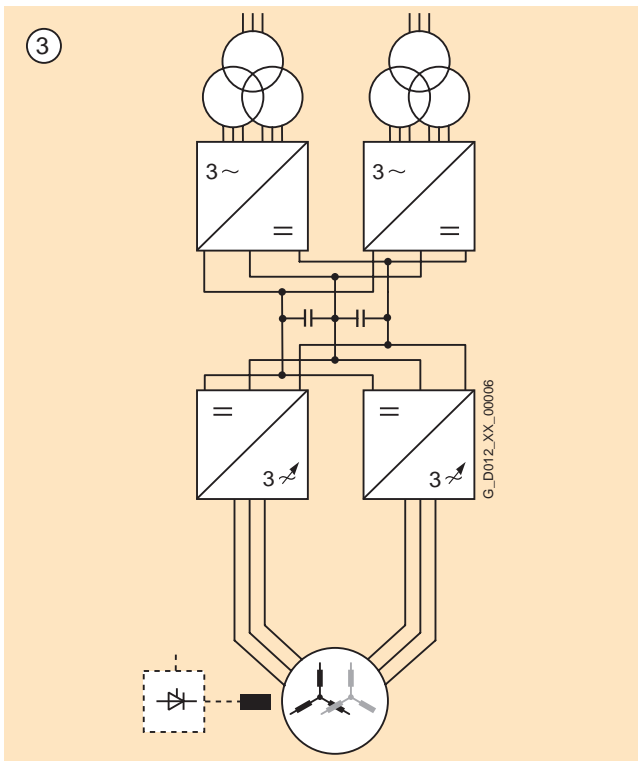
The following circuit designs are available for SINAMICS GM150 in IGBT version.



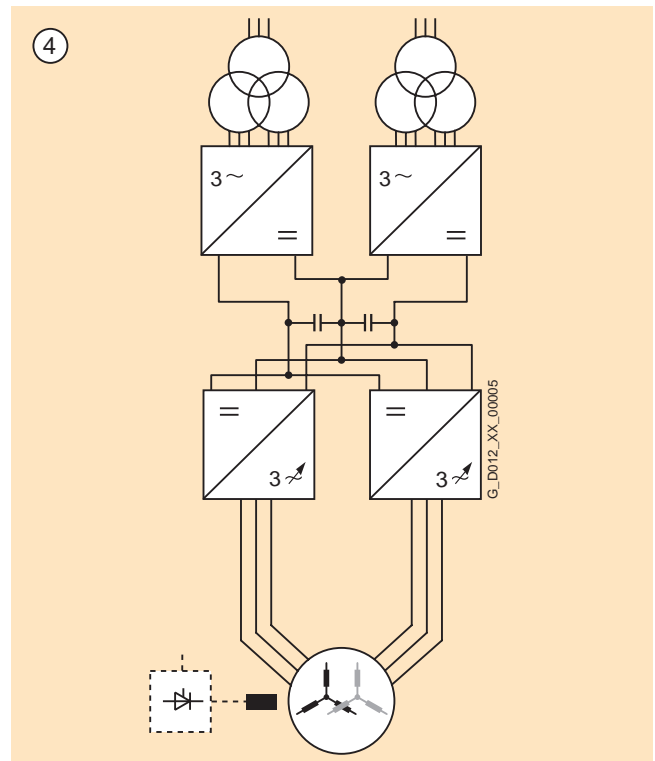
Basic circuit, 12-pulse infeed



24-pulse infeed through series connection of two Basic Line Modules: option **N15**, standard for 6.0 kV and 6.6 kV

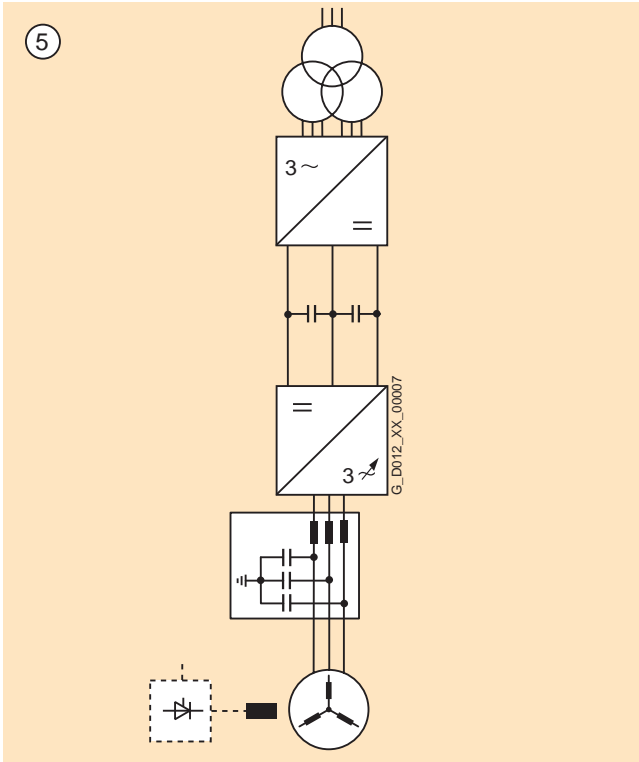


Power increased by parallel connection of Basic Line Modules and Motor Modules on a common DC bus for 3.3 kV and 4.16 kV (24-pulse infeed as standard)

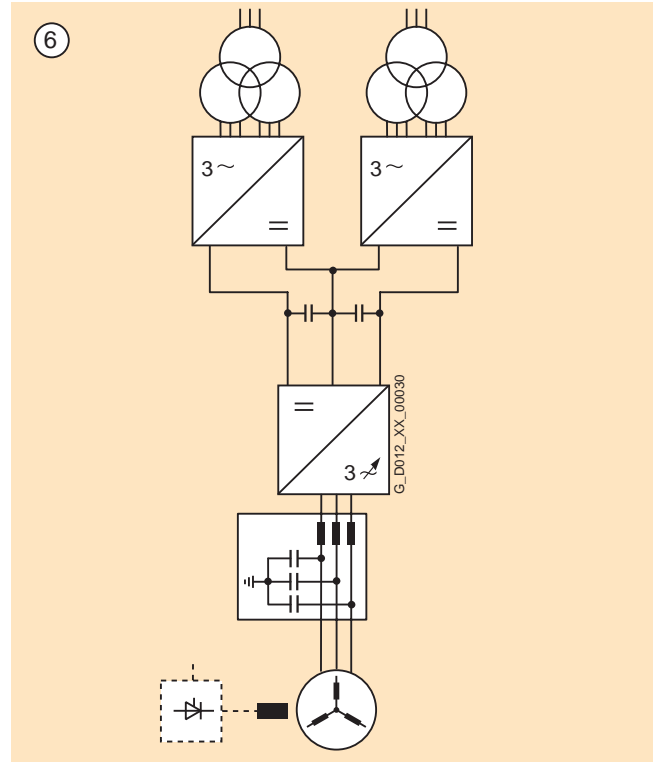


Power increased by parallel connection of Motor Modules on a common DC bus for 6.0 kV and 6.6 kV (24-pulse infeed as standard)

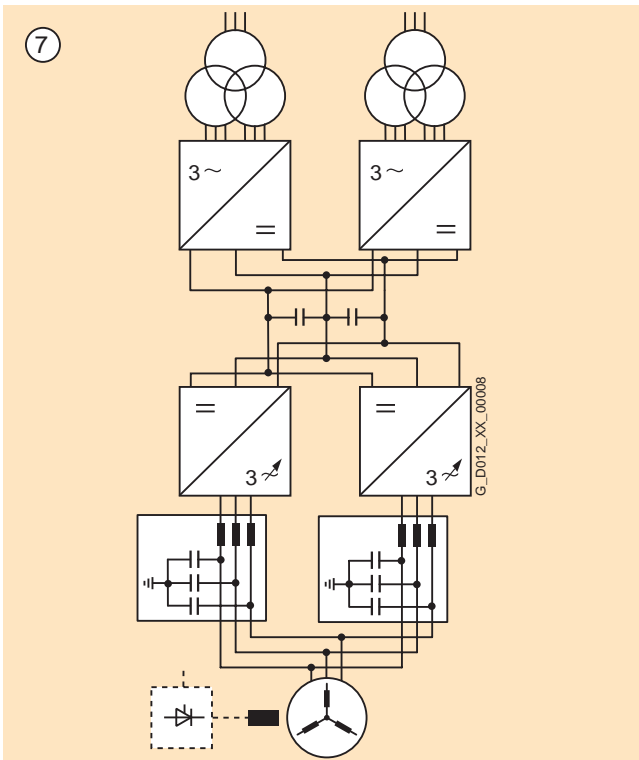
Design (continued)



Basic circuit with sine-wave filter for operating standard motors (option **Y15**)

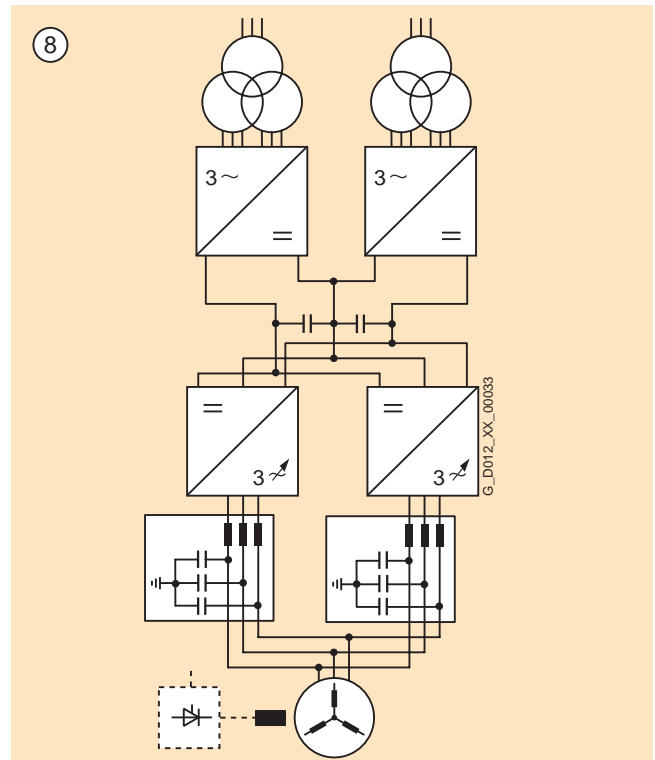


24-pulse infeed through series connection of two Basic Line Modules: option **N15**, standard for 6.0 kV and 6.6 kV; in this case with sine-wave filter for operating standard motors (option **Y15**)



Parallel connection with sine-wave filter for operating standard motors for 3.3 kV and 4.16 kV (option **Y15**)

Note: The motor cables are brought together in the motor terminal box.



Parallel connection with sine-wave filter for operating standard motors for 6.0 kV and 6.6 kV (option **Y15**)

Note: The motor cables are brought together in the motor terminal box.

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Function

Characteristic features

SINAMICS GM150 in IGBT version	
Line Module (line-side rectifier)	
• Basic Line Module, 12-pulse (two-quadrant operation)	Standard
• Basic Line Module, 24-pulse (two-quadrant operation)	Option for 2.3 kV to 4.16 kV Standard for 6 kV and 6.6 kV and parallel connection
Motor Module (motor-side inverter)	
Voltage range	2.3 kV to 6.6 kV
Power range (typ.)	0.8 MVA to 10 MVA
Cooling method	
• Air cooling	Standard
• Water cooling	Standard
Control modes	
• Induction motor	Standard
• Synchronous motor, separately excited	Option
Sine-wave filter	Option

Software and protection functions

SINAMICS GM150 in IGBT version	Description
Closed-loop control	The motor-side closed-loop control is realized as a field-oriented closed-loop vector control which can be operated as a speed or torque control as required. The closed-loop vector control achieves the dynamics of a DC drive. This is made possible by the fact that the current components forming the torque and flux can be controlled precisely and 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. An actual speed value encoder is required in the following cases: <ul style="list-style-type: none"> • High dynamics requirements • Torque control/constant torque drives with setting range > 1:10 • Very low speeds • Very high speed accuracy
Setpoint input	The setpoint can be defined internally or externally; internally as a fixed, motorized potentiometer or jog setpoint, externally via the PROFIBUS interface or an analog input of the customer's terminal block. The internal fixed setpoint and the motorized potentiometer setpoint can be switched over or adjusted using control commands via all interfaces.
Ramp-function generator	A user-friendly ramp-function generator with separately adjustable ramp-up and ramp-down times, together with adjustable rounding 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 set ramp-down ramp is too short, for example. This can also extend the set ramp-down time.
Kinetic buffering (KIP)	Line voltage 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 line voltage returns.
Automatic restart (option)	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 bumpless connection of the converter to a rotating motor.
Diagnostics functions	<ul style="list-style-type: none"> • Self-diagnostics of control hardware • Non-volatile memory for reliable diagnostics 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 fans are detected and logged so that preventive maintenance or replacements can be performed. The switching cycles of the circuit-breaker are detected and added up, to form the basis of preventive maintenance work.
Detection of actual motor speed (option)	The SMC30 Sensor Module Cabinet-Mounted can be used to detect the actual motor speed. The signals from the rotary pulse encoder are converted here and made available for evaluation via the DRIVE-CLiQ interface of the controller.
Operator protection	The cabinet doors of the power sections are fitted with electromagnetic locks. This prevents the cabinet doors from being opened while hazardous voltages are present inside the cabinet.

Function (continued)

Software and protection functions

SINAMICS GM150 in IGBT version	Description
EMERGENCY STOP button	The converters are equipped as standard with an EMERGENCY STOP button with protective collar which is fitted in the cabinet door. The contacts of the pushbutton are connected in parallel to the terminal block so they can be integrated in a protection concept on the plant side. EMERGENCY 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. Consequently the motor coasts down. EMERGENCY STOP category 1 is optionally available for a controlled shutdown.
Insulation monitoring	The converters feature insulated monitoring of the whole galvanic network from the secondary side of the transformer to the stator windings of the motor.
I/O monitoring	An extensive package of options for I/O monitoring (from the transformer and the motor through to the auxiliaries) is available. In addition it is possible to monitor the temperature with thermocouples or PT100 resistors.
Thermal overload protection	A warning message is issued first when the overtemperature threshold responds. 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 of the ventilation), the original operating values are automatically resumed. For example, if air-cooled converters with filter mats are used, the pollution of the filter mats is monitored and reported by differential pressure measurement. In the case of water-cooled converters, the water temperature and flow rate are detected at several points in the cooling circuit and evaluated. An extensive self-diagnostics protects the converter and reports faults.
Grounding switch (option)	If grounding on the line or motor side is required for safety and protection reasons, a motor-operated grounding switch can be ordered. 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.
Capacitor trip device	For applications in which the existing circuit-breaker has no undervoltage coil and cannot be retrofitted there are capacitor trip devices available for 110 to 120 V DC and for 230 V DC. They ensure that the circuit-breaker on the plant side can still be safely disconnected even if there is a power failure or the normal OFF command is not effective, e.g. because of a wire break.

AOP30 operator panel



The AOP30 operator panel is fitted into the cabinet door of the SINAMICS GM150 for 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
- keypad for operational control of a drive
- local/remote switchover for selecting the input point (priority assigned to operator panel or customer's terminal block/ 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. Operation of the drive from the operator panel can be disabled by a password, ensuring that only parameter values and process variables can be displayed in the panel. 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.