

Options (continued)

Description of options

B00, B02, B03

Options in accordance with NAMUR requirements

Exclusion list to other options:

The following limitations and exclusions resulting together with the **B00** NAMUR terminal block must be observed with regard to the other available options.

Not permissible with option	Reason
L45, L57, L59, L60	An EMERGENCY STOP of category 0 is already included in the NAMUR version. The forced line disconnection is accessed at terminals -A1-X2: 17, 18.
L83, L84	Option B00 already provides a thermistor motor protection unit (shutdown) as standard.
L19	Alternatively, option B03 can be selected. This provides a reduced scope for external auxiliaries.
L87	The insulation monitor monitors the complete network which is electrically connected together. An insulation monitor must therefore be provided on the plant side.

With options such as **L50, L55, L86**, the connection is as described in the standard. There is no wiring to the NAMUR terminal block.

Attention: In case of line disconnection, option **L13** for currents < 800 A or option **L26** for currents > 800 A have to be ordered additionally to option **B00**.

B00

NAMUR terminal block

The terminal block has been configured in accordance with the requirements and guidelines of the Standards Working Group for Instrumentation and Control in the Chemicals Industry (NAMUR Recommendation NE37), i.e. certain functions of the device are assigned to specified terminals. The inputs and outputs connected to the terminals comply with the requirements of "Protective extra-low voltage, PELV".

The terminal block and the associated functions are reduced to a required amount. In comparison to the NAMUR recommendation, optional terminals are not listed.

Terminal -A1-X2:	Meaning	Preassignment	Comments
10	DI	ON (dynamic)/ ON/OFF (static)	The effective mode can be coded using a wire jumper on the terminal -A1-400:9; 10.
11	DI	OFF (dynamic)	
12	DI	Faster	
13	DI	Slower	
14	DI	RESET	
15	DI	Lock	
16	DI	Counterclockwise	"0" signal for CW phase sequence "1" signal for CCW phase sequence
17, 18		Line disconnection	EMERGENCY STOP sequence
30, 31		Ready to run	Relay output (NO contact)
32, 33		Motor rotates	Relay output (NO contact)
34	DO (NO)	Fault	Relay output (change-over contact)
35	DO (COM)		
36	DO (NC)		
50, 51	AI 0/4-20 mA	Speed setpoint	
60, 61	AO 0/4-20 mA	Motor frequency	
62, 63	AO 0/4-20 mA	Motor current	Motor current is default setting; can be reparameterized for other variables

The 24 V supply is provided at the customer end via terminals -A1-X2:1-3 (fused inside the converter with 1 A). It must be ensured that the safety requirements "Protective extra-low voltage, PELV" are complied with.

Terminal -A1-X2:	Meaning	
1	M	Reference conductor
2	P24	Incoming supply 24 V DC
3	P24	Outgoing circuit 24 V DC

For temperature monitoring of explosion-proof motors, option **B00** contains a PTC thermistor with PTB approval. A switch-off is carried out if the limit is exceeded. The associated PTC sensor is connected to terminal -A1-X3:90, 91.

Terminal -A1-X3:	Meaning	
90, 91	AI	Connection of PTC sensor

In parallel to operation via the NAMUR terminal block, there is also the option to operate the converter via the PROFIBUS interface provided as standard on the CU320 Control Unit. The PROFIdrive profile "process technology" used in the chemical industry can be selected via macros.

SINAMICS G150

Drive converter cabinet units

75 kW to 1500 kW

Options (continued)

B02

Protective separation for 24 V supply (PELV)

If no protective separation for 24 V supply (PELV) is available at the customer end, this option is used to fit a second power supply to guarantee the PELV. (Terminal assignments as for option **B00**, 24 V supply at terminals -A1-X1:1, 2, 3 are omitted.)

Attention: Option **B02** is only possible together with **B00**.

B03

Separate output for external auxiliaries (uncontrolled)

If a motor fan has to be supplied on the plant, option **B03** provides an uncontrolled separate output with a 10 A fuse. As soon as the supply voltage is present at the converter input, a voltage is also present at these terminals. This corresponds to the converter input voltage ($V = V_{\text{line}}$). This should be observed when planning the external fans.

Terminal	Meaning
-A1-X1:	

1, 2, 3, PE Separate output for motor of external fan

Attention: Option **B03** is only possible together with **B00**.

D02

Plant-specific documentation in DXF format

This option can be used to order documents such as circuit diagrams, terminal diagrams, arrangement diagrams, and dimension drawings in DXF format, in order to process them further in CAD systems, for example. They are supplied on the documentation CD in the desired language (standard is English/German, for other languages, see options **D58**, **D60**, **D80**).

D14

Plant-specific advance documentation

If documents such as circuit diagrams, terminal diagrams, arrangement diagrams, and dimension drawings are required in advance for system engineering, advance documentation can be ordered when ordering the converter. These documents are then supplied electronically a few working days after the order has been entered. The plant-specific documentation is supplied to the ordering party via e-mail in the desired language (standard is English/German, for other languages, see options **D58**, **D60**, **D80**). The recipient's e-mail address should be provided when the order is placed. If option **D02** is selected at the same time, the documents are sent out in DXF format, otherwise they are sent in PDF format. In the e-mail, the recipient is also provided with a link for downloading general advance documentation such as Operating Instructions, Manuals and Commissioning Manuals.

D58

Language English/French

With option **D58**, the documentation will be supplied with the converter in English and French on CD-ROM and in a printed version (standard: English/German).

D60

Language English/Spanish

With option **D60**, the documentation will be supplied with the converter in English and Spanish on CD-ROM and in a printed version (standard: English/German).

D80

Language English/Italian

With option **D80**, the documentation will be supplied with the converter in English and Italian on CD-ROM and in a printed version (standard: English/German).

E11 to E71

Individual certification of the converter

The individual certification of the converter by the relevant certification body contains the expansions described in option **M66**.

E11 Individual certificate from Germanische Lloyd (GL)

E21 Individual certificate from Lloyds Register (LR)

E31 Individual certificate from Bureau Veritas (BV)

E51 Individual certificate from Det Norske Veritas (DNV)

E61 Individual certificate from American Bureau of Shipping (ABS)

E71 Individual certificate from Chinese Classification Society (CCS)

Note: A combination of several individual certificates is not provided.

Options (continued)

F03, F71, F75, F77, F97

Converter acceptance in the presence of the customer

Order code	Description	
F03	Visual inspection	<p>The scope of the acceptance comprises:</p> <ul style="list-style-type: none"> • Checking the degree of protection • Checking the equipment (components) • Checking the equipment identifier • Checking the clearance and creepage distances • Checking the cables • Checking the customer documentation • Submitting the acceptance report. <p>The checks are carried out with the converter deenergized.</p>
F71	Function test of the converter without motor connected	<p>The scope of the acceptance comprises:</p> <ul style="list-style-type: none"> • Visual inspection as described for option F03 • Checking the power supply • Checking the protection and monitoring equipment (simulation) • Checking the fans • Testing the precharging • Function test without connected motor • Submitting the acceptance report. <p>Following the visual inspection in the deenergized state, the converter is connected to the rated voltage. No current flows at the converter output.</p>
F75	Function test of the converter with test bay motor (no load)	<p>The scope of the acceptance comprises:</p> <ul style="list-style-type: none"> • Visual inspection as described for option F03 • Checking the power supply • Checking the protection and monitoring equipment (simulation) • Checking the fans • Testing the precharging • Function test with test bay motor (no load) • Submitting the acceptance report. <p>Following the visual inspection in the deenergized state, the converter is connected to the rated voltage.</p> <p>A small current flows at the converter's output in order to operate the test bay motor (no load).</p>
F77	Insulation test of converter	<p>The scope of the acceptance comprises:</p> <ul style="list-style-type: none"> • High-voltage test • Measurement of insulation resistance.
F97	Customized acceptance (on request)	<p>If acceptances are desired which are not covered by options F03, F71, F75 or F77, customized acceptances/supplementary tests can be ordered using the order code F97 on request and following technical clarification.</p>

G61

TM31 customer's terminal block expansion

The standard version of the SINAMICS G150 drive converter cabinet units already contains an Interface Module (TM31 Terminal Module). With a second module, the number of available digital inputs/outputs and the number of analog inputs/outputs within the drive system can be expanded.

K50

SMC30 Sensor Module Cabinet-Mounted for the acquisition of the actual motor speed

The SMC30 Sensor Module can be used to acquire the actual motor speed. The signals emitted by the rotary pulse encoder are converted here and made available via the DRIVE-CLiQ interface of the closed-loop control for evaluation purposes.

The following encoders are supported by the SMC30:

- TTL encoders
- HTL encoders.

L00

Line filter for use in the first environment, category C2 (TN/TT systems)

To limit the emitted interference, the drive converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in category C3. Optional filters are available for use in the first environment (category C2).

The drive converters conform to the noise immunity requirements defined in EN 61800-3 for the second environment, and thus also with the lower noise immunity requirements in the first environment.

Used in conjunction with the line reactor, the line filters reduce the radio interference voltage that occurs at the converter. Option **L23** should be ordered in addition for converter outputs > 500 kW.

To allow the power cable shield to be connected in conformance with EMC requirements, an additional EMC shield bus (option **M70**) is factory fitted at the converter input and output. A separate order is not required in this case.

L08

Motor reactor

Motor reactors reduce the voltage load on the motor windings by reducing the voltage gradients on the motor terminals generated when the converter is used. At the same time, the capacitive charge/discharge currents that occur at the converter output when long motor cables are used are reduced. The maximum permissible output frequency when a motor reactor is used is 150 Hz.

A motor reactor can be supplied on request for drive converter cabinet units with power units connected in parallel.

Option **L08** is only available with version A and cannot be combined with option **M78** (motor connection from above).



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Options (continued)

L10 dv/dt filter plus VPL

The dv/dt filter plus VPL consists of two components: the dv/dt reactor and the VPL (Voltage Peak Limiter), which limits voltage peaks and returns the energy to the DC link.

The dv/dt filters plus VPL are to be used for motors for which the voltage endurance of the insulation system is unknown or insufficient. Standard motors of the 1LA5, 1LA6 and 1LA8 series only require them at supply voltages $> 500\text{ V} + 10\%$.

The dv/dt filters plus VPL limit the rate of voltage rise to values $< 500\text{ V}/\mu\text{s}$ and the typical voltage peaks to the values below (with motor cable lengths $< 150\text{ m}$):

$$< 1000\text{ V at } V_{\text{line}} < 575\text{ V}$$

$$< 1250\text{ V at } 660\text{ V} < V_{\text{line}} < 690\text{ V}$$

Depending on the converter output, option **L10** can be accommodated in the drive converter cabinet unit or an additional cabinet of width 400 mm is required.

Voltage range	Installation of the dv/dt filter plus VPL within the drive converter cabinet unit	Installation of the VPL in an additional cabinet
V	kW	kW
380 to 480	110 to 250	315 to 560
500 to 600	110 to 200	250 to 560
660 to 690	75 to 315	400 to 800

The dv/dt filter plus VPL is available on request for drive converter cabinet units with power units connected in parallel.

Option **L10** is only available with version A and cannot be combined with option **M78** (motor connection from above).

L13 Main contactor (for currents $< 800\text{ A}$)

The SINAMICS G150 drive converter cabinet units are provided as standard without a line contactor. Option **L13** is needed if a switching element is required for disconnecting the cabinet from the supply (needed for EMERGENCY STOP). The contactor is energized and powered inside the converter.

Terminal -X50:	Meaning
4	Checkback contact (NO contact) contactor closed
5	Checkback contact (NC contact) contactor closed
6	Root

L15 Sinusoidal filter

Sinusoidal filters are available in voltage ranges from 380 V to 480 V and 500 V to 600 V for a converter output up to 200 kW.

The sinusoidal filter at the converter output delivers practically sinusoidal voltages on the motor so that standard motors can be used without special cables and without any power reduction. Standard cables can be used. The maximum permitted motor incoming cable length is 300 m.

Note: The pulse frequency of the converter must be increased when used in conjunction with option **L15**. This reduces the power available at the converter output (derating factor 0.88). The control factor of the output voltage returns to approximately 85% (380 V to 480 V) or 81% (500 V to 600 V). It should be noted that the reduced voltage at the motor terminals compared to the rated motor voltage means that the motor switches to field weakening mode earlier.

L19 Connection for external auxiliary equipment

An outgoing circuit fused at max. 10 A for external auxiliary equipment (for example, separately driven motor fan).

The voltage is tapped at the converter input and, therefore, has the same level as the supply voltage.

The outgoing circuit can be controlled internally by the converter or externally.

Terminal -X155:	Meaning	Range
1	L1	380 V AC to 690 V
2	L2	380 V AC to 690 V
3	L3	380 V AC to 690 V
11	Contactor control	230 V AC
12	Contactor control	230 V AC
13	Circuit-breaker checkback	230 V AC/0.5 A; 24 V DC/2 A
14	Circuit-breaker checkback	230 V AC/0.5 A; 24 V DC/2 A
15	Contactor checkback	230 V AC/6 A
16	Contactor checkback	230 V AC/6 A
PE	PE	

L22 Without line reactor

If the converter is powered by a separate transformer or if the ratio between the line short-circuit power at the point of connection to the converter's rated output is low, the line reactor supplied as standard can be omitted for converters $< 500\text{ kW}$ (see Configuration). This line reactor will be needed, however, if a line filter is used (option **L00**).

Available on request for drive converter cabinet units with power units connected in parallel.

L23 Line reactor $u_k = 2\%$

The line reactor is included in the converter as standard for converters up to 500 kW and for those with power units connected in parallel. The line reactor ($u_k = 2\%$) is optional for converter outputs $> 500\text{ kW}$, because converters in this power range are often connected to the medium-voltage supply using transformers adapted to the converter output.

L26 Main switch incl. fuses/circuit-breakers

For up to 800 A, a switch disconnecter with fuses is offered as main switch. Cabinets with an output current greater than 800 A are fitted with a circuit-breaker instead of a switch disconnecter. The circuit-breaker is energized and supplied within the converter.

Terminal -X50:	Meaning
1	Checkback contact (NO contact) Main switch/circuit-breaker closed
2	Checkback contact (NC contact) Main switch/circuit-breaker closed
3	Root

Options (continued)

L45

EMERGENCY STOP button in the cabinet door

The EMERGENCY STOP button with protective collar is fitted in the converter cabinet door and its contacts are connected to the terminal block. The EMERGENCY STOP functions of category 0 or 1 can be activated in conjunction with options **L57**, **L59** and **L60**.

Terminal -X120:	Meaning
1	Checkback contact of EMERGENCY STOP button in cabinet door
2	Checkback contact of EMERGENCY STOP button in cabinet door
3	Checkback contact of EMERGENCY STOP button in cabinet door ^{*)}
4	Checkback contact of EMERGENCY STOP button in cabinet door ^{*)}

*) Used inside the converter with options **L57** to **L60**

Attention: By pressing the EMERGENCY STOP button, the motor is stopped either uncontrolled or controlled depending on the selected category 0 or 1, and the main voltage disconnected from the motor, in accordance with IEC 60204-1 (VDE 0113). Auxiliary voltages (e.g. for separately-driven fans or anti-condensation heating) may still be present. Certain areas within the converter also remain under voltage, e.g. the control function or auxiliaries. If complete disconnection of all voltages is required, the EMERGENCY STOP button must be incorporated into a protection function to be provided on the plant side. An NC contact is available at terminal -X120 for this purpose.

L50

Cabinet illumination with service socket

One universal lamp with an integrated service socket is installed for each cabinet panel.

The power supply (on terminal block -X390) for the cabinet illumination and socket must be provided externally and fused at max. 10 A. The cabinet illumination is switched on manually via a switch or automatically by an integrated motion detector. The mode is switch-selected.

Terminal -X390:	Meaning
1	L1 (230 V AC)
2	N
3	PE

L55

Anti-condensation heating for cabinet

The anti-condensation heating is recommended at low ambient temperatures and high levels of humidity to prevent condensation forming. 100 W cabinet heating unit is installed for each cabinet element (two heating units are installed for each element for cabinet element widths from 800 mm to 1200 mm).

The power supply to the anti-condensation heating (110 V AC to 230 V, on terminal block -X240) must be provided externally and fused at max. 16 A.

Terminal -X240:	Meaning
1	L1 (110 V AC to 230 V)
2	N
3	PE

L57

EMERGENCY STOP category 0 (230 V AC or 24 V DC)

EMERGENCY STOP category 0 for uncontrolled stop in accordance with EN 60204.

The function includes voltage disconnection of the converter via the line contactor with bypassing of the microprocessor controller by means of a safety combination in accordance with EN 60204-1. The motor coasts in the process. When delivered, the button circuit is preset to 230 V AC. Jumpers must be set when using 24 V DC.

Attention: Option **L57** always assumes that the converter can be electrically isolated from the supply; i.e. option **L13** for converter currents ≤ 800 A and option **L26** for converter currents > 800 A.

Terminal -X120:	Meaning
7	Looping in the EMERGENCY STOP button from the plant side; remove jumper 7-8!
8	Looping in the EMERGENCY STOP button from the plant side; remove jumper 7-8!
15	"On" for monitored start; remove jumper 15-16!
16	"On" for monitored start; remove jumper 15-16!
17	Checkback "Triggering safety combination"
18	Checkback "Triggering safety combination"

L59

EMERGENCY STOP category 1 (230 V AC)

EMERGENCY STOP category 1 for controlled stop in accordance with EN 60204.

The function includes rapid shutdown of the drive via fast stop using a ramp-down ramp to be parameterized by the user. This is followed by voltage disconnection as described in EMERGENCY STOP category 0.

A braking unit may be necessary to achieve the required shutdown times.

Attention: Option **L59** always assumes that the converter can be electrically isolated from the supply; i.e. option **L13** for converter currents ≤ 800 A and option **L26** for converter currents > 800 A.

Terminal -X120:	Meaning
7	Looping in the EMERGENCY STOP button from plant side; remove jumper 7-8!
8	Looping in EMERGENCY STOP button from plant side; remove jumper 7-8!
15	"On" for manual start; remove jumper 15-16!
16	"On" for manual start; remove jumper 15-16!
17	Checkback "Triggering safety combination"
18	Checkback "Triggering safety combination"

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Options (continued)

L60

EMERGENCY STOP category 1 (24 V DC)

EMERGENCY STOP category 1 for controlled stop in accordance with EN 60204.

The function includes rapid shutdown of the drive via fast stop using a ramp-down ramp to be parameterized by the user. This is followed by voltage disconnection as described in EMERGENCY STOP category 0.

A braking unit may be necessary to achieve the required shutdown times.

Attention: Option **L60** always assumes that the converter can be electrically isolated from the supply; i.e. option **L13** for converter currents ≤ 800 A and option **L26** for converter currents > 800 A.

Terminal -X120:	Meaning
7	Looping in the EMERGENCY STOP button from plant side; remove jumper 7–8!
8	Looping in the EMERGENCY STOP button from plant side; remove jumper 7–8!
15	"On" for manual start; remove jumper 15–16!
16	"On" for manual start; remove jumper 15–16!
17	Checkback "Triggering safety combination"
18	Checkback "Triggering safety combination"

L61, L62

Braking units

It may be necessary to use braking units for drives that allow regenerative braking.

The braking unit comprises two components: a Braking Module fitted in the converter cabinet and a braking resistor, which must be provided externally (IP20 degree of protection). The braking unit functions as an autonomous unit, and does not require an external power supply. During the braking process, the kinetic energy is converted into heat in the externally installed braking resistor. A max. cable length of 50 m is permissible between the Braking Module and the braking resistor. It is therefore possible to release the heat outside the converter room.

Braking units are available on request for drive converter cabinet units with power units connected in parallel.

The braking resistor is connected to terminal block -X5 on the drive converter cabinet unit:

Terminal -X5:	Meaning
1	Connection of braking resistor
2	Connection of braking resistor

Option	Rated power	Peak power	Drive converter cabinet units		
	P_{DB}	P_{15}	380 V to 480 V	500 V to 600 V	660 V to 690 V
L61	25 kW	125 kW	110 kW to 132 kW	–	75 kW to 132 kW
L62	50 kW	250 kW	160 kW to 560 kW	110 kW to 560 kW	160 kW to 800 kW

P_{DB} : Rated power (continuous braking power)

P_{15} : Permitted peak power for a period of 15 s, cycle time 90 s

If greater braking powers are required in addition to the braking units listed here, then braking units may be connected in parallel for greater converter outputs (on request). In this case, a Braking Module is assigned to each braking resistor.

L83

Thermistor motor protection unit (alarm)

Thermistor motor protection unit (with PTB approval) for PTC thermistors type A for alarm. The power supply for the thermistor motor protection unit and the evaluation is provided within the converter.

Terminal -F127:	Meaning
T1	Connection of sensor loop
T2	Connection of sensor loop

L84

Thermistor motor protection unit (shutdown)

Thermistor motor protection unit (with PTB approval) for PTC thermistors type A for shutdown. The power supply for the thermistor motor protection unit and the evaluation is provided within the converter.

Terminal -F125:	Meaning
T1	Connection of sensor loop
T2	Connection of sensor loop

Options (continued)

L86

PT100 evaluation unit

The PT100 evaluation unit can monitor up to 6 sensors. The sensors can be connected using a two-wire or three-wire system. The limit values can be programmed by the user for each channel.

In the factory setting, the measurement channels are divided into two groups of three channels. With motors, for example, three PT100 units can, therefore, be monitored in the stator windings and two PT100 units in the motor bearings. Channels that are not used can be suppressed using appropriate parameter settings.

The output relays are integrated in the internal fault and shutdown train of the converter. The signals can also be picked up by the customer via two spare fault signaling relays. Two user-programmable analog outputs are also available (0/4 mA to 20 mA and 0/2 V to 10 V) for integration in a higher-level controller.

Terminal -A1-A140:	Meaning
T11 to T13	PT100; sensor 1; group 1
T21 to T23	PT100; sensor 2; group 1
T31 to T33	PT100; sensor 3; group 1
T41 to T43	PT100; sensor 1; group 2
T51 to T53	PT100; sensor 2; group 2
T61 to T63	PT100; sensor 3; group 2
The sensors can be connected to the PT100 evaluation unit using a two-wire or three-wire system.	
The inputs Tx1 and Tx3 must be used for a two-wire system. With a three-wire system, input Tx2 must also be connected (x = 1, 2, ..., 6)	
51, 52, 54	Relay output Limit for group 1 reached; (changeover contact)
61, 62, 64	Relay output Limit for group 2 reached; (changeover contact)
Ground (OUT 1)	Analog output OUT 1; Group 1 sensors
U1 (OUT 1)	Analog output OUT 1; Group 1 sensors
I1 (OUT 1)	Analog output OUT 1; Group 1 sensors
Ground (OUT 2)	Analog output OUT 2; Group 2 sensors
U2 (OUT 2)	Analog output OUT 2; Group 2 sensors
I2 (OUT 2)	Analog output OUT 2; Group 2 sensors

L87

Insulation monitoring

An insulation monitor must be used if the converter is operated on an insulated network. This device monitors the complete electrically connected circuit for insulation faults.

An alarm is output in the event of a fault.

Attention: Only **one** insulation monitor can be used in an electrically connected network.

Since the response philosophy when a ground fault occurs in the insulated network can be different, the output relays are available for integration into a control system on the plant side. It is also possible to integrate the outputs into the converter monitoring on the plant side.

Terminal -A1-A101:	Meaning
11	Signaling relay ALARM 1
12	Signaling relay ALARM 1
14	Signaling relay ALARM 1
21	Signaling relay ALARM 2
22	Signaling relay ALARM 2
24	Signaling relay ALARM 2
M+	External kΩ display 0 μA to 400 μA
M-	External kΩ display 0 μA to 400 μA
R1	External reset key (NC contact or wire jumper otherwise the fault code is not stored)
R2	External reset key (NC contact or wire jumper)
T1	External test button
T2	External test button

Insulation monitoring can be supplied on request for drive converter cabinet units with power units connected in parallel.

M06

Base 100 mm high, RAL 7022

The additional cabinet base allows greater bending radii for cables (inlet from below) and the routing of them within the cabinet base.

The cabinet base is always colored RAL 7022. A special color is not possible. It is delivered completely fitted with the cabinet. The height of the operator panel changes accordingly.

M07

Cable wiring compartment 200 mm high, RAL 7035

The cable wiring compartment is made of stable sheet steel and increases the flexibility for the cable connection (inlet from below) and allows routing of cables within the wiring compartment. It is delivered completely fitted with the cabinet. The height of the operator panel changes accordingly.

Attention: The cable wiring compartment is colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the cable wiring compartment is also painted in this color.



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M13

Line connection from above

The control cabinet is provided with an additional hood in the case of a line connection from above. This hood contains the terminal links for the power cables as well as the cable clamping rail for mechanical support of the cables, an EMC shield bus and a PE rail.

The cabinet height is increased by 405 mm. The rails for the connection from above are delivered completely fitted. For transport reasons, the hoods are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used. However, these must be removed on site in order to fit the hoods. Use of cable braces should be considered in the case of small crane hook heights.

A non-drilled mounting plate made of aluminum (5 mm thick) should be provided on the top of the hood for feeding in the cables. Depending on the number of cables and the cable cross-sections used, holes must be provided in this mounting plate on the plant side for fitting cable glands for introduction of the cables.

Note: The control cables are still connected from below. With option **M13**, the standard line connection from below is not used.

The hoods have IP21 degree of protection. In combination with options **M23** and **M54**, additional plastic ventilation grilles and filter pads are provided.

Attention: The hoods are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the hoods are also painted in this color. Ventilation grilles used with IP23 and IP54 degrees of protection are colored RAL 7035 and cannot be painted.

The covers used with option **M60** are included in the scope of supply.

Option **M13** cannot be combined with option **L50** (cabinet illumination with service socket) for drive converter cabinet units with power units connected in parallel.

M21

IP21 degree of protection

Cabinet version in IP20, but with additional top cover or canopy. The cabinet height is then increased by 250 mm.

For transport reasons, the top covers or canopies are delivered separately and must be fitted on site.

Attention: The top covers or canopies are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the top covers or canopies are also painted in this color.

M23

IP23 degree of protection

Drive converter cabinet units with degree of protection IP23 are supplied with additional hoods and plastic ventilation grilles in the air inlet and outlet. The cabinet height is increased by 400 mm. The covers used with option **M60** are included in the scope of supply. They are a standard part of the cabinet internal air routing and are adapted accordingly.

For transport reasons, the hoods are delivered separately and must be fitted on site.

Attention: The hoods are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the hoods are also painted in this color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.

M54

IP54 degree of protection

Drive converter cabinet units with degree of protection IP54 are supplied with additional hoods, plastic ventilation grilles, and a filter medium in the air inlet and outlet. The cabinet height is increased by 400 mm. The covers used with option **M60** are included in the scope of supply. They are a standard part of the cabinet internal air routing and are adapted accordingly. Maintenance of the filters must be carried out according to the local ambient conditions.

For transport reasons, the hoods are delivered separately and must be fitted on site.

Attention: With IP54 degree of protection, the derating factors for the output current must be observed.

Attention: The hoods are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the hoods are also painted in this color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.

M60

Additional shock-hazard protection

The drive converter cabinet units are designed as standard in accordance with BGV A3. Option **M60** provides additional covers (outside normal arm's reach) in the vicinity of the AC rails and above the power unit (can only be selected as an option with converters up to 250 kW in the 400 V range, with converters up to 200 kW in the 500 V range and with converters up to 315 kW in the 690 V range, with degrees of protection IP20 and IP21; otherwise supplied as standard).

Options (continued)

M66 *Marine version*

In accordance with the requirements of the classification company:

- Lloyds Register
- American Bureau of Shipping
- Germanische Lloyd
- Bureau Veritas
- Det Norske Veritas
- Chinese Classification Society

This option includes a strengthened mechanical version of the cabinet, handles (handrail) below the operator panel and a mechanical locking of the cabinet doors. The cabinet is provided in the IP23 degree of protection (option **M23**) and includes a cabinet anti-condensation heating (option **L55**). To attach the converter to the bulge, a welding frame (height 5 mm) is supplied separately.

Note: A combination of options **M21**, **M23** and **L55** is not possible. If the converter is used for a safety-relevant drive on the ship, individual certification is necessary (see options **E11** to **E71**).

M70 *EMC shield bus (cable connection from below)*

The EMC shield bus is used to connect shielded power cables for line and motor feeder cables. The EMC shield bus is included as standard with option **L00** (radio interference suppression filter).

M75 *PE busbar (cable connection from below)*

The PE busbar is used to run the PE conductor for the supply and motor infeed cables.

This can be ordered as an option for converters with low power and currents $I < 700$ A. The PE busbar is supplied as standard for output currents $I > 700$ A or groups of cabinets consisting of several cabinet elements.

M78 *Motor connection from above*

The control cabinet is provided with an additional hood in the case of a motor connection from above. Within this hood, there are the connection lugs for the power cable and the cable-clamping bar for the mechanical attachment of the cable, an EMC shield bus and a PE busbar.

The cabinet height is increased by 405 mm. The rails for the connection from above are delivered completely fitted. For transport reasons, the hoods are delivered separately and must be fitted on site. Crane transport assemblies (option **M90**) can still be used. However, these must be removed on site in order to fit the hoods. Use of cable braces should be considered in the case of small crane hook heights.

A non-drilled mounting plate made of aluminum (5 mm thick) should be provided on the top of the hood for feeding in the cables. Depending on the number of cables and the cable cross-sections used, holes must be provided in this mounting plate on the plant side for fitting cable glands for introduction of the cables.

Note: The control cables are still connected from below. With option **M78**, the standard motor connection from below is not used. A combination of motor-side options **L08**, **L10** and **L15** is not possible. If option **L61** or **L62** is selected at the same time as option **M78**, the braking resistor should also be connected from above.

The hoods have IP21 degree of protection. In combination with options **M23** and **M54**, additional plastic ventilation grilles and filter pads are provided.

Attention: The hoods are colored RAL 7035 as standard. If a special color is requested for the cabinet (order code **Y09**), the hoods are also painted in this color. Ventilation grilles used with IP23 and IP54 degrees of protection are colored RAL 7035 and cannot be painted.

The covers used with option **M60** are included in the scope of delivery.

M90 *Top-mounted crane transport assembly for cabinets*

In the case of single cabinets up to a width of 600 mm, the crane transport assembly has transport eye bolts. With a cabinet width of 800 mm or more, transport rails are used.

Y09 *Special cabinet paint coating*

The drive converter cabinet units are colored RAL 7035 as standard. The special color must be specified in plain text when ordering. All RAL colors can be selected which are available as powdered coatings. If options such as cable wiring compartment (order code **M07**), top covers or canopies (order code **M21**), hoods (order codes **M23/M54**) or cable connection from above (order codes **M13/M78**) are required for the drive converter cabinet units, these are provided in the ordered cabinet color. The molded plastic parts (e.g. ventilation grilles) are colored RAL 7035 and cannot be painted.