


352 739 GB

**Lenze**

*Antriebstechnik*

*Operating instructions*

**8100 E Series**  
**Version 6x.2x**



Part. no. 352 739

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This technical description is valid for the types

8101\_E.6x.2x

8102\_E.6x.2x

8103\_E.6x.2x

8104\_E.6x.2x

8105\_E.6x.2x

8106\_E.6x.2x

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## SAFETY INFORMATION

The equipment described is intended for use in industrial electrical drive systems.



**This equipment can endanger life through rotating machinery and high voltages, therefore it is essential that guards for both electrical and mechanical parts are not removed.**

The following points should be observed for the safety of the personnel:

- Only qualified personnel familiar with the equipment are permitted to install, operate and maintain the devices.
- System documentation must be available and observed at all times.
- All non-qualified personnel are kept at a safe distance from the equipment.
- The system must be installed in accordance with local regulations.

A qualified person, is someone who is familiar with all safety notes and established safety practices, with the installation, operation and maintenance of this equipment and the hazards involved. For more detailed definitions see IEC 364.

It is recommended that anyone who operates or maintains electrical or mechanical equipment should have a basic knowledge of First Aid. As a minimum, they should know where the First Aid equipment is kept and the identity of the official First Aiders.

These safety notes do not represent a complete list of the steps necessary to ensure safe operation of the equipment. If you wish further information, please contact your nearest Lenze representative.

The information in this technical description applies only to the hardware and software versions that are indicated on the cover page. If the version of your equipment is not listed, then this manual must not be used. Lenze cannot be held responsible for any malfunction resulting from the above.

The specifications, processes and circuitry described in this manual are for guidance only and must be adapted to your own specific applications. Lenze does not guarantee the suitability of the processes and circuitry described in this technical description for individual applications.

The specifications in this manual describe the features of the products, without guarantee.

Lenze personnel have carefully checked this manual and the equipment it describes, but cannot be held responsible for its accuracy.

Technical alterations reserved.

The 8100\_E series comprises six frequency inverters within a power range from 0.25kW to 2.2kW.

## 1. FEATURES

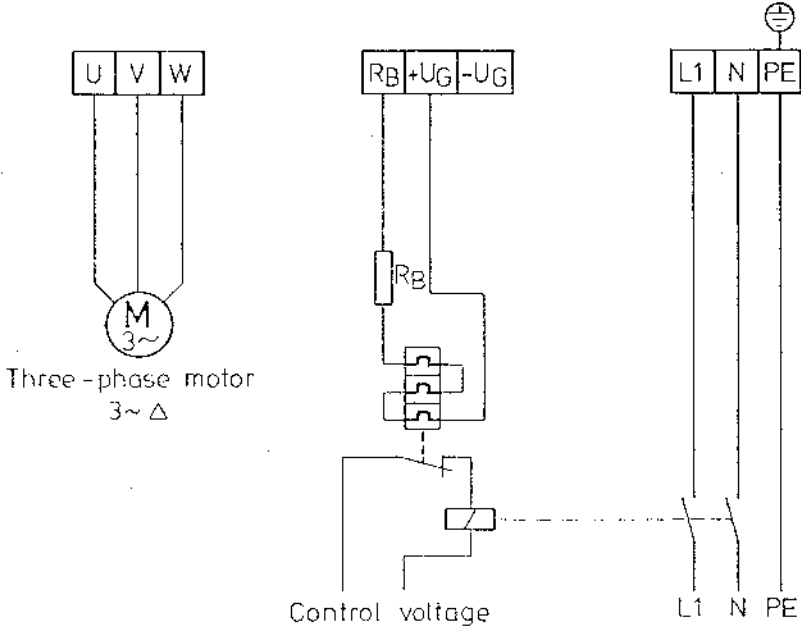
- Digital microprocessor control unit
- Space pulse width modulation technique
- Improved smooth running due to an optimized modulation technique
- 160 % overcurrent capacity for short-term operation,  
120% overcurrent capacity for Clamp peak current limitation for continuous operation
- Inverter outputs protected against short circuits
- Integrated brake chopper for regenerative braking, external resistors
- DC brake
- Up to three programmable jog speeds
- U/f-characteristic control, adjustable to suit motor voltage
- Control parameters can be modified on-line
- Digital inputs and output for 24V-PLC level
- Standard inverter in IP20 enclosure
- Connection for DC network, energy sharing
- Serial interface RS 232 C available as option

## 1.1 TECHNICAL DATA

Inverter type		8101	8102	8103	8104	8105	8106
Output power	$S_N/\text{kVA}$	0.76	1.0	1.3	1.5	2.7	3.6
Rated motor power (4-pole)	$P_N/\text{W}$	250	370	550	750	1500	2200
Mains voltage	$V_{\text{mains}}$	190...260V $\pm 0\%$ 50...60Hz					
Rated mains current	$I_{\text{mains}}/\text{A}$	4.5	5.0	7.0	9.0	15	17
Output voltage	$V$	$3 \times 0 \dots V_{\text{mains}}$					
Rated output current	$I_N/\text{A}$	2.0	2.6	3.4	4.0	7.0	9.5
Maximum current without Clamp with Clamp	$I_{\text{max}}/\text{A}$	3.2 2.4	4.2 3.1	5.4 4.1	6.4 4.8	11.2 8.4	15.2 11.4
Power loss $f_d = 50\text{Hz}$ , $I = I_N$	$P_V/\text{W}$	25	35	50	70	90	150
Output frequency	$f_d$	0...199Hz					
Master voltage	$V_L$	0...10V					
Master current	$I_L$	0...20mA or 4...20mA					
Ambient temperature	$T_a$	0...45°C					
Permissible humidity		Class G acc. to DIN 40040					
Dimensions	$H \times W \times D/\text{mm}$	205x162x136		205x162x149		245x200x156	
Part no.		355 562	355 563	355 564	355 565	355 567	355 570

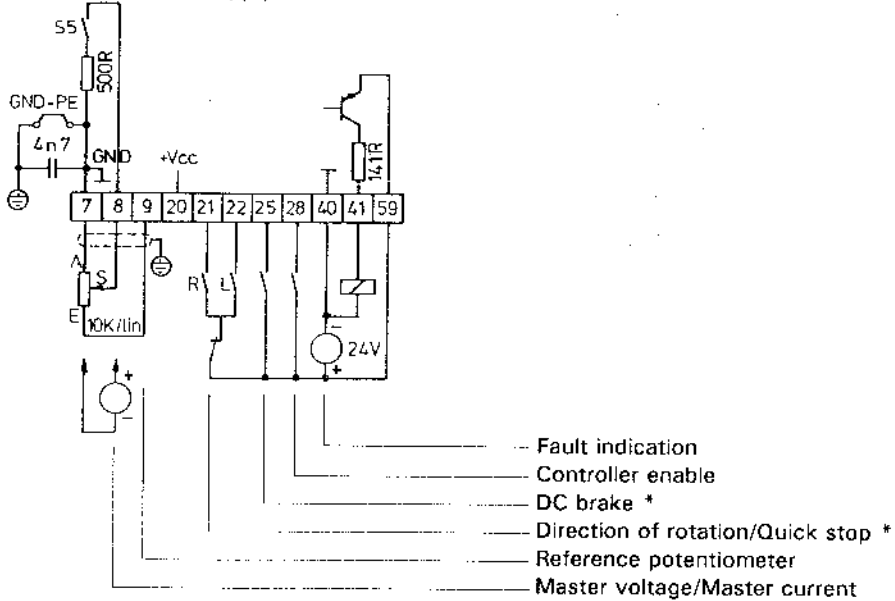
## 2. INVERTER CONNECTIONS

### 2.1 OUTLINE OF POWER CONNECTIONS

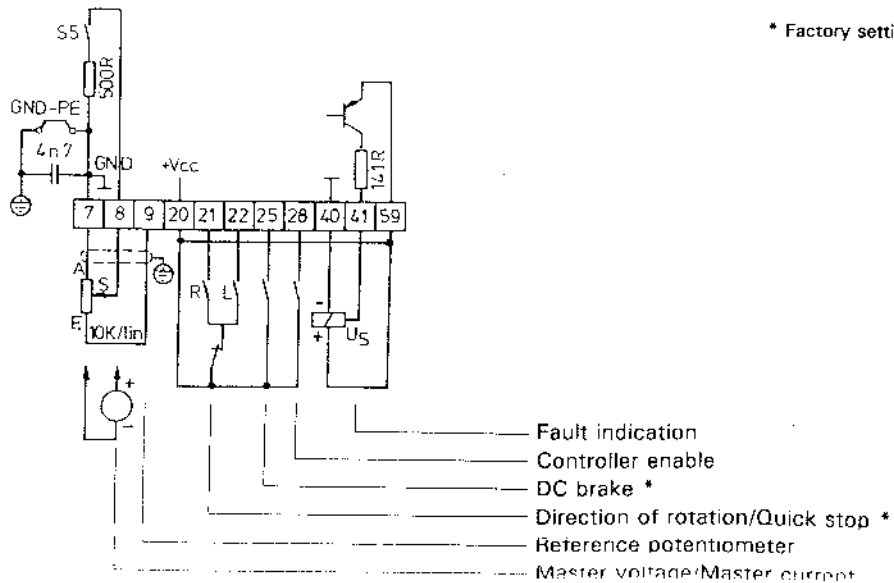


## 2.2 OUTLINE OF CONTROL CONNECTIONS

with external 24V-supply



without external 24V-supply



\* Factory setting



## 2.3 COMMISSIONING

The inverters of the 8100\_E series are factory-set such that a suitable four-pole three-phase standard motor with 220 V rated voltage and 50 Hz rated frequency can be operated without any further settings. If adjustments are required, the inverter parameters must be set. These "parameters" are listed under the codes C00 to c06. (see 3.2)

To run the drive, only the following settings must be done:

### - Direction of rotation

For the factory-set terminal configuration apply a voltage between 13 and 30V either

- at terminal 21 for CW rotation or
- at terminal 22 for CCW rotation

(see 2.6.2).

No connection at 21 or 22 activates the quick stop function.

### - Controller enable

To enable the controller, apply a voltage between 13 to 30 V at terminals 28 (RFR). This also applies for keypad operation or operation via the serial interface (see 3.5.1).

### - Input of reference value

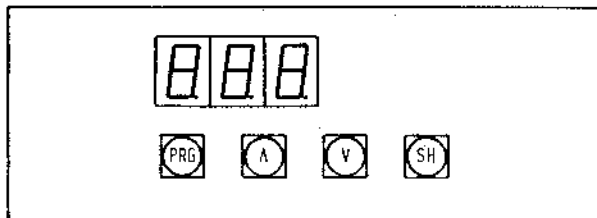
The motor speed is fixed via the frequency reference value, either

- analogue via terminals 7 and 8 (see 2.6.1) or
- digital via the keys of the keypad or
- the RS 232 interface.

For the digital input of the reference value change the operating mode (see 3.3.1) correspondingly.

## 2.4 OPERATION

Display



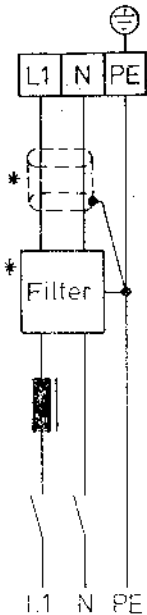
Operating keys

### Key functions

Key	Function
PRG	Change between code and parameter level
SH + PRG	To confirm parameter change In case of fault: reset fault
^	Increase displayed value
^ + SH	Increase displayed value fast (scroll up)
v	Reduce displayed value
v + SH	Reduce displayed value fast (scroll down)

## 2.5 POWER CONNECTIONS

### 2.5.1 MAINS CONNECTION

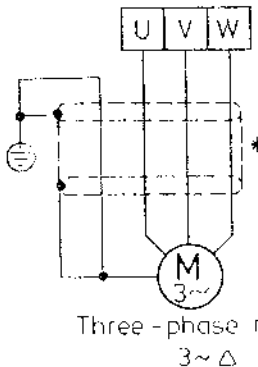


L1, N, 190 - 260 V  $\pm 0\%$ , 50/60Hz

The 8106 inverter may only be operated with suitable mains choke.

The PE-connection can, in addition to the power plug, be bolted to the right terminal clamp at the front of the device.

### 2.5.2 MOTOR CONNECTION



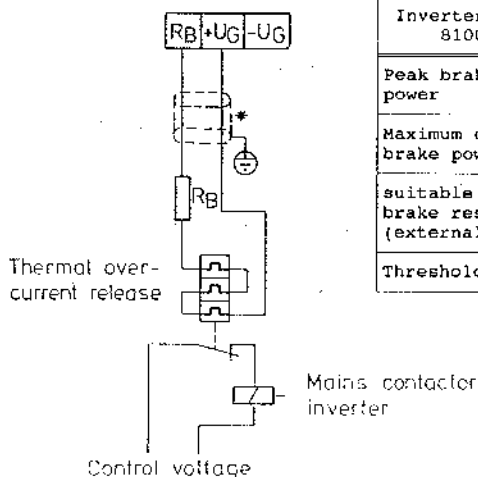
Outputs protected against short circuits

Output voltage 3 x 0 to  $V_{\text{mains}}$

Three -phase motor  
3~ $\Delta$

\* Screened lines and mains filters are required to obtain radio interference suppression to VDE 0871, class B.

### 2.5.3 CONNECTION OF BRAKE RESISTOR



Inverter series 8100_E	8101 8102	8103 8104	8105 8106
Peak brake power	300 W	640 W	1700 W
Maximum contin. brake power	120 W	250 W	450 W
suitable brake resistor (external)	470 $\Omega$	200 $\Omega$	82 $\Omega$
Threshold	375V in DC bus		

\* Screened lines are required to obtain radio interference suppression to VDE 0871, class B.

#### Overcurrent release

$R_{BR}/P_N$	Overcurrent release	
	Setting **	Part no.
470 $\Omega$ /120W 305 062	0.5 A	325 692
200 $\Omega$ /250W 2x 309 163	1.0 A	325 693
82 $\Omega$ /450W 345 394	2.3 A	325 695

\*\* The setting of the overcurrent release results from the maximum permissible brake current of the resistor.

Base for thermal overcurrent release:  
Part no. Nr. 325 701

Overcurrent release and base are not supplied with the inverter.

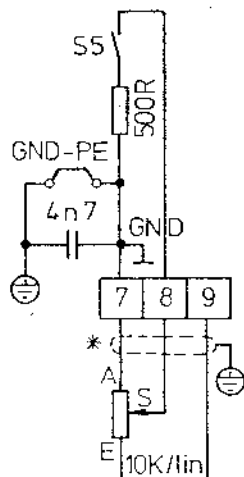
**Warning:** In case of mains overvoltage, the brake chopper may be released. When using resistors without overload protection, the resistors may burn. Therefore, only resistors with integrated or external temperature surveillance may be used. Since the surface of the brake resistors may heat up to 350°C, the resistors must be built into a fire-proof housing.

## 2.6 CONTROL CONNECTIONS

Some of the inputs and outputs are parameter-set using codes. These codes are marked with Cxx (see chapter 3.2 ff).

**Caution:** Reference potential GND is connected to PE. For more information see chapter 5.7

### 2.6.1 ANALOG INPUT



Input resistance:

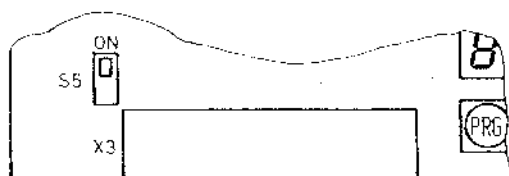
- a) 104 k $\Omega$  for master voltage
  - b) 500  $\Omega$  for master current
- (minimum source voltage for  $f_{dmax}$  of the master current source: 10V)

Setting:

Reference input via	S5	Code C34
Potentiometer	OFF *	-0- *
Master voltage 0...10V	OFF *	-0- *
Master current 0...20mA	ON	-0-
Master current 4...20mA	ON	-1-

\* Factory setting (see 3.4.6)

\* see chapter 5.6



Position of S5 on the control stage

**10V reference voltage terminal 9**

Used as:

Supply voltage for reference input via potentiometer

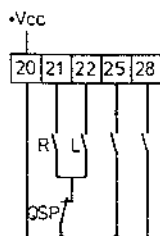
(10 k $\Omega$ , included in accessory kit)

Reference potential is terminal 7

maximum current capacity: 2mA

## 2.6.2 DIGITAL INPUTS

without external 24V-supply



**Internal supply terminal 20**

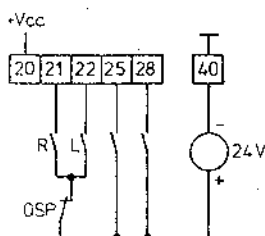
Used as:

- Auxiliary voltage to control digital inputs via contacts
- supply of the digital output terminal 41

maximum current capacity: 50mA

internal resistance of terminals 21 to 28:  $R_i = 3400 \Omega$

with external 24V-supply



**Terminals 21, 22, 25, 28**

LOW signal: 0 to 5V

HIGH signal: 13 to 30V

**Factory setting:**

Controller enable

DC brake

Direction of rotation/Quick stop (QSP)

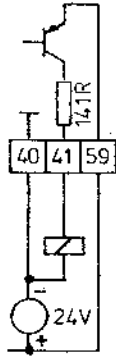
The assignment of the digital inputs (terminals 21 to 28) is changed using code C07 (see 3.3.5).

Possible assignment of the digital inputs

	C07 = 0	C07 = 1	C07 = 2
term. 21	CW rotation, quick stop deactivated	CW rotation, quick stop deactivated	CW rotation = Low CCW rotation = High
term. 22	CCW rotation, quick stop deactivated	CCW rotation, quick stop deactivated	JOG speed selection (see 3.4.8)
term. 25	DC brake	JOG reference 1	
term. 28	Controller enable	Controller enable	Controller enable

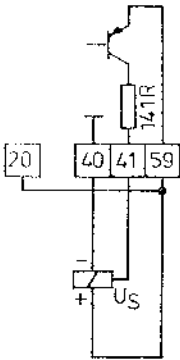
**Warning:** With setting C07 = "2" in case of wire breakage at terminal 21, CW rotation is selected.

## 2.6.3 DIGITAL OUTPUT



Used as: Trip output for external relay  
 Signal: Fault indication with LOW signal at term. 41. (HIGH signal is healthy.)  
 Connection: when used with external 24V supply:  
 Relay 24V,  $R_i \geq 1k\Omega$ , part no.: 326 005

maximum current capacity: 25 mA



when used without 24V-supply:  
 Relay 15V,  $R_i \geq 600\Omega$ , part no.: 321 351

maximum current capacity: 25 mA

### 3. PARAMETER SETTING

The inverters of the 8100\_E series are factory-set such that a suitable four-pole three-phase AC standard motor with 220 V rated voltage and 50 Hz rated frequency can be operated without any further settings. If adjustments are required, the inverter parameters must be set. These "parameters" are listed under the codes C00 to c06. (see 3.2)

The setting is done on a code level and a parameter level. The PRG key is used to change between the two levels.

Any changes to parameters are permanently saved using code C03, otherwise all settings are lost on power down.

After mains connection, the actual running frequency is shown. If another value is wished to be displayed, this must be set under code C04.

#### 3.1 PARAMETER ENTRY

According to the selected code, parameters are entered in three different ways.

a) Immediate entry

The device immediately accepts the set parameters.

b) Entry after pressing SH + PRG

The device only accepts the set parameters after pressing SH + PRG. First press the SH key and then the PRG key.

c) Entry with controller inhibited

The device only accepts the set parameters with the controller inhibited (LOW signal at terminal 28) and after pressing SH + PRG.

The way of parameter entry can be obtained from the information given in the code table. If the setting is accepted, "---" is displayed for about 1s in the display (except for parameters with immediate entry).



## 3.2 CODE TABLE

Code level	PRG <==>	Parameter level	Factory setting	Customer setting
<b>INITIALIZING PARAMETERS</b>				
C 0 1 Operating mode		- 0 - SH + PRG Terminal control/ Parameter set. via keys	- 0 -	
		- 1 - SH + PRG Keypad operation		
		- 2 - SH + PRG Terminal control/Paramet. setting via interface		
		- 3 - SH + PRG Interface operation		
C 0 2 Load parameter set		- 0 - SH + PRG Factory setting		
		- 1 - SH + PRG Parameter setting after mains connection  Loading only possible when controller inhibited!		
C 0 3 Store parameter set		- 1 - SH + PRG To permanently store parameter set		
C 0 4 Switch-on display		- x x SH + PRG Code no for display after mains connection	- 5 0	
C 0 6 Control mode		- 0 - SH + PRG Trip	- 1 -	
		- 1 - SH + PRG Clamp  Changing only possible when controller inhibited!		
C 0 7 Terminal configuration		- 0 - SH + PRG Term. 21 - CW rotation Term. 22 - CCW rotation Term. 25 - DC brake	- 0 -	
		- 1 - SH + PRG Term. 21 - CW rotation Term. 22 - CCW rotation Term. 25 - JOG 1		
		- 2 - SH + PRG Term. 21 - CW/CCW rotat. Term. 22 - JOG release Term. 25 - JOG release  Changing only possible when controller inhibited!		
C 0 9 Controller address		SH + PRG 1 to 99 "x0" not possible {1} {1}	- 0 1	
		Controller address can only be changed in operating modes C01 = -0- and -1-.		

Code level	PRG <==>	Parameter level	Factory setting	Customer setting
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## OPERATING PARAMETERS

C10		xxx Hz 0 to 30Hz {0.1Hz} {0.2Hz}	0.0 Hz	
minimum field frequency $f_{dmin}$				
C11		xxx Hz 30 to 199Hz 30 to 100Hz {0.1Hz} 100 to 199Hz {0.2Hz} {1Hz} {0.2Hz}	50.0 Hz	
Max. field frequency $f_{dmax}$				
C12		xxx s 0.02 to 1s {10ms} 1 to 10s {100ms}	5.0 s	
Acceleration $T_{ir}$		0.02 to 990s		
C13		xxx s 10 to 100s {1s} 100 to 990s {10s}	5.0 s	
Deceleration $T_{if}$				
C15		xxx Hz 45 to 960Hz For steps and resolution see 3.4.3	50.0 Hz	
U/f nom. frequency $f_{dN}$				
C16		xxx % 0 to 30% $V_N$ {0.1%} {0.4%}	5.0 % $V_N$	
Voltage boost $U_{min}$				
C19		xxx Hz 0 to 2Hz {0.1Hz} {0.2Hz}	0.0 Hz	
Standstill frequency				
C34		-0- SH + PRG Master voltage 0 to 10V Master current 0 to 20mA	-0-	
Analogue reference		-1- SH + PRG Master current 4 to 20mA		
C36		xxx % 0 to 20% $U_N$ {0.1%} {0.8%}	0.0 % $U_N$	
Standstill voltage during DC braking				
C3B		-1- SH + PRG selection JOG 1	-1-	
JOG selection		-2- SH + PRG selection JOG 2		
		-3- SH + PRG selection JOG 3		
C39		xxx Hz 0 to $f_{dmax}$ 0 to 100Hz {0.1Hz} {0.2Hz} 100 to 199Hz {1Hz} {0.2Hz}	20.0 Hz 30.0 Hz 40.0 Hz	
JOG reference frequency				

Code level	PRG <==>	Parameter level	Factory setting	Customer setting
<b>CONTROL PARAMETERS</b>				
C 4 0 Controller enable	- 0 -	SH + PRG Controller inhibited		
	- 1 -	SH + PRG Controller enabled If the controller is inhibited, the decimal point of the right display element is flashing		
C 4 1 CW/CCW rotation	- 0 -	SH + PRG CW rotation		
	- 1 -	SH + PRG CCW rotation		
	- 2 -	Display quick stop (only for terminal control)		
C 4 2 Quick stop	- 0 -	SH + PRG not active		
	- 1 -	SH + PRG active		
C 4 5 JOG enable	- 0 -	SH + PRG Frequency reference active via C46	- 0 -	
	- 1 -	SH + PRG JOG 1 active		
	- 2 -	SH + PRG JOG 2 active		
	- 3 -	SH + PRG JOG 3 active		
C 4 6 Frequency reference	x x x	Hz $f_{dmin} \dots f_{dmax}$ 0 to 100Hz {0.2Hz} 100 to 199Hz {1Hz} {0.2Hz}		
C 4 8 DC braking	- 0 -	SH + PRG not active		
	- 1 -	SH + PRG active Only possible in Clamp operation		
<b>DISPLAY VALUES</b>				
C 5 0 Actual running frequency $f_d$	x x x	Hz 0...199Hz 0 to 100Hz {0.2Hz} 100 to 199Hz {1Hz} {0.2Hz}		
C 5 2 Motor voltage	x x x	% 0 to 100% $U_{mains}$ {1%} {1%}		

Code level	PRG <====>	Parameter level	Factory setting	Customer setting
<b>C 6 7</b> TRIP Fault indication		TRIP active: fault indication flashing  - - - No momentary TRIP  O C 1 Short circuit, overload  O C 3 Overcurrent during acceleration  O C 4 Overcurrent during deceleration  O H Overheat (heatsink)  U 1 5 ± 15 V-supply defective  C C r System failure  P r Parameter reset (factory setting)  H x x Fault during self test  Reset fault indication: SH + PRG  Prior faults can be viewed by pressing the keys A and V  - x - Number of fault stored (1 to 8) for 1 sec. displayed  x x x then automatic display of the fault  - - - No prior faults		
Surveillance functions		L U Undervoltage - Inverter inhibited  Keypad operation is not possible! Inverter inhibited is reset automatically!		
<b>OPERATING PARAMETERS</b>				
<b>c 0 6</b> Holding time when quick stop		<b>x x x</b> s 0 to 50s  (0.2s) [0.2s]	<b>5. 0</b> s	
<b>- - -</b>	after SH + PRG: Command is performed	(xxx) = Steps (xxx) = Resolution		

### 3.3 INITIALIZING PARAMETERS

#### 3.3.1 OPERATING MODE C01

The control functions are, according to the selected operating mode, provided via the control terminals, the keypad or LECOM interface (option). The device is parameter-set depending on the operating mode, either via keypad or LECOM interface. Code C01 can only be changed via keypad and not via LECOM interface.

**Warning:** If the operating mode is changed to terminal control, the drive may accelerate, if the device was not inhibited via terminal 28.

#### 3.3.2 LOAD PARAMETER SET C02

C02 is used to load the switch-on parameter set or the factory settings. Loading is only possible when controller is inhibited.

#### STORE PARAMETER SET C03

A modified parameter set is stored using C03. Such a stored parameter set is active after mains connection (switch-on parameter set).

#### 3.3.3 SWITCH-ON DISPLAY C04

Code C04 is used to determine which parameter is to be displayed after switching on. For this, the code number of the desired parameter is entered under code C04. Code C04 can only be changed in the operating modes C01 = -0- or -1-.

#### 3.3.4 CONTROL MODE C06

Either Trip or Clamp can be selected as control modes.

In the control mode Trip, the inverter is inhibited, when 160% of the rated current is exceeded. A fault indication is displayed (see chapter 4). A high torque can be obtained for a short time in this mode.

In the control mode Clamp the motor current is limited to 120% of the rated current ( $I_{Mot.} \leq 1.2 \cdot I_N$ ) due to a permanent peak current limitation. In case of a shock load, the controller will set trip.

**Caution:** If the motor is stalled, the machine may be overheated in the control mode "Clamp".

### 3.3.5 TERMINAL CONFIGURATION C07

The functions of the digital input terminals 21, 22 and 25 are changed via code C07.

	C07 = 0	C07 = 1	C07 = 2
K1.21	CW rotation, quick stop deactivated	CW rotation quick stop deactivated	Change direction of rotation
K1.22	CCW rotation, quick stop deactivated	CCW rotation, quick stop deactivated	JOG 1, JOG 2, JOG 3 (see 3.4.8)
K1.25	DC brake	JOG 1	

### 3.3.6 CONTROLLER ADDRESS C09

Number of bus participant for communication via LECOM 1 interface. The addresses from 1 to 99 can be assigned, but "10", "20", "30", ... "90" are reserved. The controller address can only be changed in the operating modes C01 = -0- or -1-.

## 3.4 OPERATING PARAMETERS

### 3.4.1 MINIMUM FIELD FREQUENCY C10

### MAXIMUM FIELD FREQUENCY C11

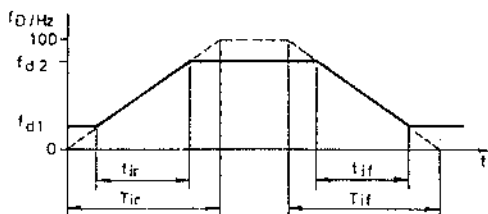
The reference range is determined via  $f_{dmin}$  and  $f_{dmax}$ . With reference 0, the drive accelerates to the minimum speed  $f_{dmin}$  after controller enable.

With direct reference input, e.g. via LECOM interface or via JOG references,  $f_{dmax}$  acts as override limitation.

### 3.4.2 ACCELERATION TIME $T_{ir}$ C12

### DECELERATION TIME $T_{if}$ C13

The acceleration and deceleration times refer to a field frequency change of 100 Hz. The  $T_{ir}$  and  $T_{if}$  times are calculated as follows:



$$T_{ir} = t_{ir} \cdot \frac{100\text{Hz}}{f_{d2} - f_{d1}}$$

$$T_{if} = t_{if} \cdot \frac{100\text{Hz}}{f_{d2} - f_{d1}}$$

Here,  $t_{ir}$  and  $t_{if}$  are the desired times for the change between  $f_{d1}$  and  $f_{d2}$ ;  $T_{ir}$  and  $T_{if}$  must be set under C12/C13.

### 3.4.3 U/F-NOMINAL FREQUENCY $f_{dN}$ C15

The slope of the U/f characteristic is set using the U/f nominal frequency. It is calculated from the rated motor voltage and the rated motor frequency as follows:

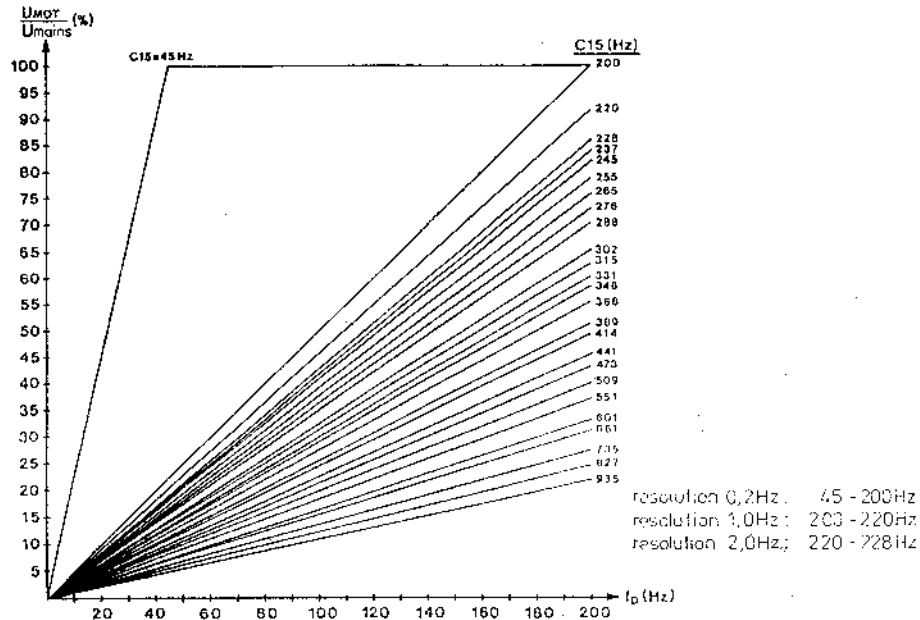
$$f_{dN} [\text{Hz}] = \frac{U_{N \text{ mains}} [\text{V}]}{U_{N \text{ motor}} [\text{V}]} \cdot f_{N \text{ motor}} [\text{Hz}]$$

The settings of the U/f nominal frequency for the most common mains and motor combinations can be obtained from the table below. Please note that the maximum output voltage of the inverter can only be as high as the mains supply voltage.

$U_{N \text{ mains}}$ [V]	$U_{N \text{ motor}}$ [V]	$f_{N \text{ motor}}$ [Hz]	$f_{dN}$ [Hz]
220	220	50	50.0
230	220	50	52.3
230	230	50	50.0
230	230	60	60.0
240	220	50	54.5
240	240	50	50.0

**Caution:** During commissioning always check that the current in idle running does not exceed the rated motor current. If necessary, the current consumption during idle running can be reduced by increasing the U/f nominal frequency and therefore the U/f characteristic.

The effective resolution of the U/f nominal frequencies is reduced with increasing values. The effective U/f nominal frequency can be obtained from the following diagram.



### 3.4.4 VOLTAGE BOOST $U_{MIN}$ C16

The  $U_{min}$  parameter must be adapted to the asynchronous motor used, otherwise the motor will be damaged due to overheat. We can say from experience that self-ventilated standard asynchronous motors of insulation class B can be operated with their rated current in the lower frequency range ( $f_d = 0$  to 25Hz) for a short time.

Adapt the  $U_{min}$  parameter as follows:

- Connect effective current meter to one motor phase
- operate motor in idle running at  $f_d = 5$ Hz
- set  $U_{min}$ :

a) For short-time operation in the lower frequency range, set  $U_{min}$  such that the motor current does not exceed its rating ( $I_{motor} \leq I_{N motor}$ )



- b) For continuous operation in the lower frequency range, set  $U_{\min}$  such that the motor current does not exceed 80 % of its rating ( $I_{\text{motor}} \leq 0,8 \cdot I_{N \text{ motor}}$ ) or use a forced-ventilated motor or a motor with higher insulation class and set  $U_{\min}$  as under a).

Exact settings can be requested from the motor manufacturer.

Please note: The output voltage of the inverters changes to the same ratio as the mains voltage. Consider possible mains voltage oscillations when setting  $U_{\min}$ .

### 3.4.5 STANDSTILL FREQUENCY C19

The standstill frequency activates the DC brake, when the actual running frequency (C50) does not reach the set standstill frequency. When entering 0.0 Hz, the standstill frequency is not active.

Set the standstill voltage under C36.

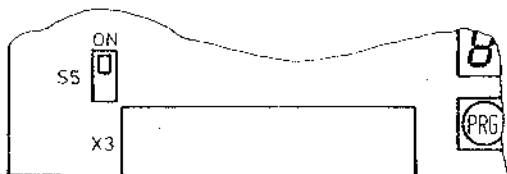
### 3.4.6 ANALOG REFERENCE INPUT C34

If the analog reference is to be entered as master current via terminal 8, select under C34:

0 to 20mA : C34 = -0-

4 to 20mA : C34 = -1-

Switch S5 on the control stage is used to change from master voltage to master current. For this, disconnect mains supply and remove the cover of the device.



Master voltage/Potentiometer: S5 = OFF

Master current: S5 = ON

### 3.4.7 STANDSTILL VOLTAGE DURING DC BRAKING C36

The standstill voltage is used to set the DC component flowing in the motor. For activation of the DC brake see C48 (3.5.6).

### 3.4.8 JOG SELECTION C38

#### JOG FREQUENCY REFERENCE C39

JOG frequency references are set using codes C38 and C39:

- Select JOG value under C38.
- Assign a frequency to this JOG value under C39. If, for example, C38 = -2- was selected, enter the frequency for JOG 2 under C39.
- If, after parameter setting of the JOG references, the maximum field frequency  $f_{dmax}$  (C11) is reduced such that  $f_{dmax}$  is smaller than the JOG reference,  $f_{dmax}$  (C11) does not limit the field frequency when the JOG reference is activated.

For the activation of the JOG references see 3.5.4.

### 3.5 CONTROL PARAMETERS

Depending on the operating mode C01 (see 3.3.1), the control parameter are changed via LECOM interface or via keypad.

#### 3.5.1 CONTROLLER ENABLE C40

The controller is enabled or inhibited via

- control terminal 28
- code C40.

To enable the controller, apply a voltage between 13 and 30 V across terminal 28 in all operating modes.

#### Controller enable after mains connection

Operating mode	C01	Activating of controller enable after mains connection
Terminal control/ Keypad operation	-0-	
Keypad operation	-1-	Controller enable via terminal 28
Terminal control/ Parameter setting via interface	-2-	
Operation via interface	-3-	Enable controller first via terminal 28 and then via interface (C40)

Controller enable in case of terminal control (C01 = -0-) or keypad operation (C01 = -1-)

Controller can be enabled via terminal 28 or via keypad (C40).

Controller can only be enabled or inhibited via keypad, if the controller has been enabled via terminal 28 first (see figure 1).

Controller enable in case of terminal control/parameter setting via interface (C01 = -2-) or operation via interface (C01 = -3-).

Controller inhibit can always be activated via terminals 28 and interface (C40).

Controller inhibit can only be cancelled via interface if controller enable has been activated via terminal 28 (see figure 2)

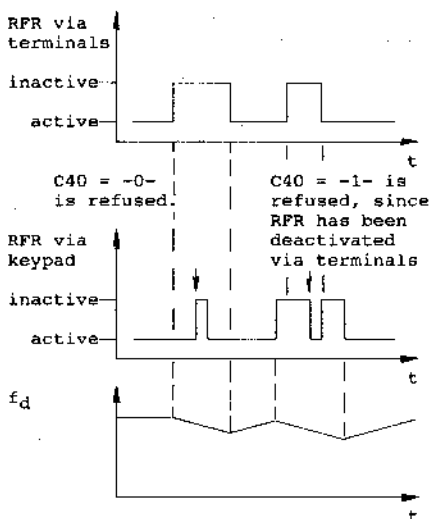


Figure 1  
Controller enable when C01 = -0- or -1-

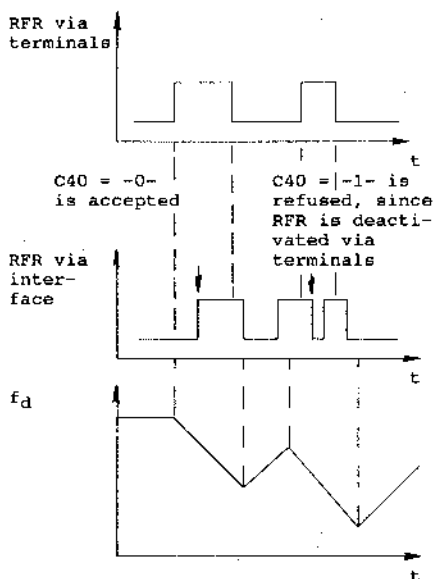


Figure 2  
Controller enable when C01 = -2- or -3-

**Caution:** The same input channel (e.g. keypad) which has been used to inhibit the controller must be also used to enable the controller again. When changing the operating mode (C01) to terminal control and when loading the factory settings (C02 = 0-), the drive may accelerate if it has not been inhibited via terminal 28 first.

### 3.5.2 CW/CCW ROTATION C41

#### QUICK STOP C42

Codes C41 and C42 are provided for the functions

- "Change direction of rotation" and
- "Activate quick stop".

Depending on the operating mode C01, the codes have a direct effect on the functions or display the state of the control terminals 21 and 22. Also, in case of terminal control, the function of the terminals 21 and 22 can be changed using code C07 (see 3.3.5).

#### Keypad or LECOM operation:

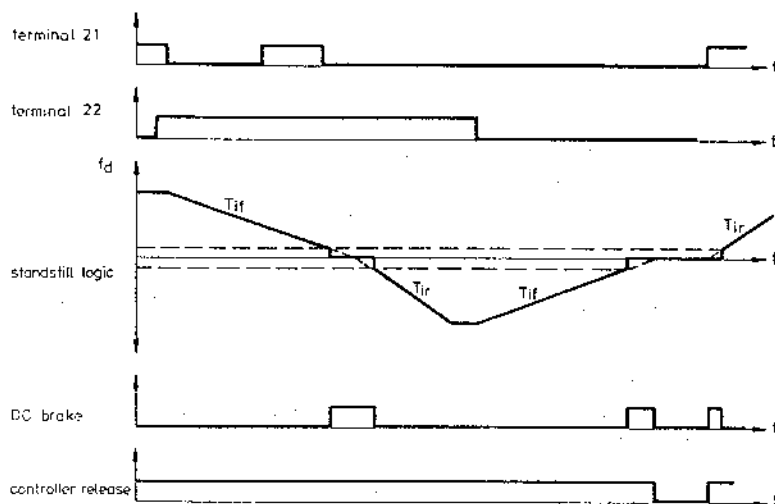
For keypad or LECOM operation (C01 = -1- or -3-) set C41 = -0- for CW rotation and C41 = -1- for CCW rotation. Activate quick stop using C42.

#### Terminal control:

For terminal control (C01 = -0- or -2-), the momentary state of terminals 21 and 22 according to the terminal configuration C07 is detected and displayed under C41 and C42.

Configuration of input terminals with C07 = -0- or -1-				
term. 21	term 22	Display C41	Display C42	Meaning
High	Low	- 0 -	- 0 -	CW rotating field
Low	High	- 1 -	- 0 -	CCW rotating field
Low	Low	- 2 -	- 1 -	Quick stop

If a voltage between 13 and 30 V (HIGH signal) is applied across terminals 21 and 22 both, the direction of rotation is provided by the terminal signal, which was active first. If a HIGH signals are applied before mains connection, the controller is set to "CW rotation".



With selected terminal configuration C07 = -2-, the actual direction of rotation depends on the input level at terminal 21.

Quick stop cannot be activated via terminal in this configuration.

**Caution:** With C07 = "-2-" in case of wire breakage at terminal 21, the drive will change its direction of rotation.

### Activating quick stop

If quick stop is selected, the drive is decelerated to standstill along the pre-set deceleration ramp  $T_{if}$  (C13). In addition, a DC brake can be activated via the standstill frequency using a holding time to be set under c06.

After the holding time, the inverter is inhibited.

Quick stop can be activated via terminals 21 and 22, independently of the selected operating mode (C01) (except for C07 = -2-).

### Quick stop for terminal control/parameter setting via keypad (C01 = -0-)

Quick stop is activated by a LOW signal across terminal 21 and 22.

### Quick stop in case of keypad operation (C01 = -1-)

In case of keypad operation, quick stop can be activated via terminals 21/22 and via keypad (C42) (comparable to figure 1, page 25).

### Quick stop in case of terminal control/parameter setting via interface (C01 = -2-)

Quick stop is activated by a LOW signal across terminals 21/22.

**Quick stop in case of interface operation (C01 = -3-)**

In case of interface operation, quick stop can be activated via terminals 21/22 and via interface.

Quick stop can only be deactivated via interface, if quick stop has been deactivated via terminals first (comparable to figure 2, page 25).

**3.5.3 HOLDING TIME DURING QUICK STOP c06**

Together with quick stop, a holding torque can be provided for an adjustable length of time once the set frequency is reached. For this, the following settings are necessary:

- Under C19, enter the starting point, from which the holding torque is to be generated. Enter at least 0.2 Hz so that the function "holding torque with variable holding time" is activated.
- Enter the value of the holding torque under code C36 (standstill voltage).
- Enter holding time under c06. Once the output of the ramp function generator has achieved zero, the holding time begins. After the holding time, the controller is inhibited.

**3.5.4 RELEASE JOG REFERENCE C45****Terminal control:**

In case of terminal configuration C07 = -1- (see 3.3.5), JOG 1 is entered with a HIGH signal at terminal 25. The JOG references with terminal configuration C07 = -2- are activated according to the following table:

Function with C07 = -2-	term. 22	term. 25
Main reference (term. 8)	0	0
JOG 1 active	1	0
JOG 2 active	0	1
JOG 3 active	1	1

Code C45 indicates which JOG reference is active, and if the main reference is active, see (C46) for set frequency.

**Operation via keypad or LECOM interface:**

Activate the desired JOG under C45.

**3.5.5 FREQUENCY REFERENCE C46**

Code C46 shows the momentary main reference. In case of operation via keypad or LECOM interface, the reference is entered under C46.

### 3.5.6 DC BRAKE C48

The DC brake is activated:

- with terminal control via terminal 25 (only with terminal configuration C07 = -0-, see 3.3.5)
- with keypad or interface operation using C48 = -1-
- automatically via standstill frequency (see 3.4.5)
- automatically via standstill frequency together with quick stop (see 3.5.2)

Enter the amount of the standstill voltage with activated DC brake under C36 (see 3.4.7).

**Caution:** Long-term operation of the DC brake may result in overheating the motor.

## 3.6 DISPLAY VALUES

### 3.6.1 ACTUAL RUNNING FREQUENCY C50

Under C50, the actual running frequency is displayed.

### 3.6.2 MOTOR VOLTAGE C52

Code C52 displays the momentary motor voltage as a percentage of mains voltage.

**Warning:** Even if the display shows "0%" the motor terminals may carry mains potential. When touching the motor terminals, always disconnect the inverter from the mains and wait at least for 30s.

### 3.6.3 TRIP FAULT INDICATION C67

see chapter 4.

## 4. MONITORING FUNCTIONS

### 4.1 FAULT INDICATION

The occurrence of a fault causes Trip setting. This is displayed automatically under C67. The fault indication flashes as long as the fault is not reset.

The fault is reset by pressing SH + PRG

The history of faults are stored under C67 and displayed by pressing the ▲-key. A maximum of eight faults are stored; the last fault is displayed first, then the one before and so on.

With interface operation, the fault is also displayed under C67, but as fault number (see table). Historical faults are stored under C161 to C168.

The fault is reset by:

- C43 = -0-

In case of low voltage (LU), pulse inhibit is set (decimal point flashing). Pulse inhibit is reset automatically, when the mains voltage reaches its permissible value again.

### 4.2 TROUBLESHOOTING

Fault indic.	LECOM fault	Fault	Cause	Remedy
---	0	no fault		
OC1	11	Overcurrent	Trip control mode: - $I_{\text{Motor}} > 1.6 I_N$ or - terminal short circuit  Clamp control mode: - terminal short circuit	In case of overload, reduce load or switch on Clamp control mode (C06 = -1-).  In case of short circuit, check motor line and motor for short circuit (between windings).
OC3	13	Overcurrent during acceleration	Trip control mode: - $I_{\text{Motor}} > 1.6 I_N$ or - terminal short circuit  Clamp control mode: - terminal short circuit during acceleration	In case of overload - increase acceleration time - or switch on Clamp control mode. - check dimensioning of drive.  In case of short circuit, check motor line and motor for short circuit (between windings).



Fault indic.	LECOM fault	Fault	Cause	Remedy
OC4	14	Overcurrent during deceleration	Control mode Trip: - $I_{Motpr} > 1.6 I_N$ or - terminal short circuit  Control mode Clamp: - terminal short circuit during deceleration	In case of overload - increase deceleration time - or switch on Clamp control mode or - use brake chopper.  In case of short circuit, check motor line and motor for short circuit (between windings).
OH	50	Overheat heatsink	Heatsink too hot, because e.g. - Ambient temperature $> 45^\circ\text{C}$ - Heatsink strongly polluted - Wrong mounting	Allow inverter to cool and ensure better ventilation - Clean heatsink - Check ambient temperature of control cabinet
U15	70	$\pm 15\text{V}$ supply defective	$\pm 15\text{V}$ supply of control is less than $\pm 12\text{V}$  $\pm 15\text{V}$ supply defective	Reduce load at terminal 20.  Return device to factory
CCr	71	System failure	Strong interferences ( $> 4\text{ kV}$ ) on control lines  PE-loops in cabling	Screen control lines (see 5.6)  Check PE-cabling
Pr	72	Parameter reset	After mains connection faulty parameters or modified software Version was found. <b>Factory settings were loaded automatically.</b>	Set desired parameters again and save under C03.
H00	100	General hardware fault	Hardware defective	Return device to factory
H02	102	EEPROM faulty	EEPROM defective	Replace control board 8101 MP
LU	31	Low voltage	DC bus voltage is smaller than $140\text{ V}$	Check mains voltage.

## 5. INSTALLATION AND OPERATION

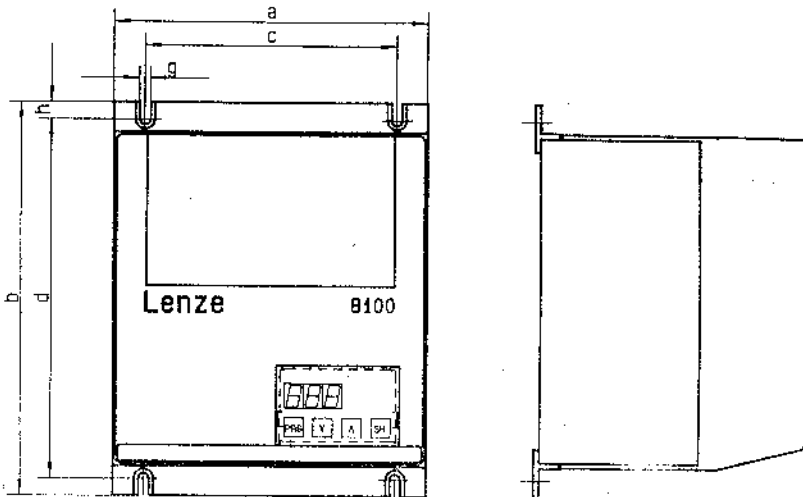
- Install device vertically with terminal board at the bottom.
- Ensure a free space of 100 mm at the top and bottom and 50 mm at either side.
- Connect the fixing screw of the reference potentiometer to PE.
- The inverters must not be connected to mains with an earth-leakage current breaker, without additional measures (e.g. zeroing) (see VDE 0160/5.88). In case of an earth fault, a DC component in the fault current can prevent the release of the earth leakage current breaker.
- Between mains disconnection and reconnection maintain a time of 3 minutes. Internal components to limit the switch-on current limitation must cool in order to prevent a rupture of internal or connected fuses.
- Types 8106\_E may only be operated with specified mains fuse.
- The connected motor may not be switched via a contactor when the drive is enabled, except for emergency situations.
- Replace defective fuses only with the specified type when the device is switched off.
- Plug terminals for control and power connections may only be connected or disconnected when the device is without voltage.

**Warning:** The device carries potential up to 30s after mains disconnection.

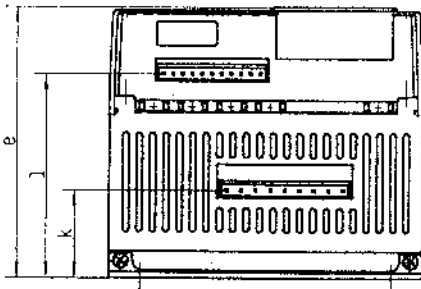
- The ambient temperature may not exceed 45°C. If the cooling air contains pollutions (dust, flakes, aggressive gases) which may impair the inverter function, ensure sufficient protective measures, such as separate air ducts, installation of filters, periodical cleaning). In case of condensation, disconnect the device from the mains and wait until the visible humidity has evaporated.
- The types 8101\_E to 8105\_E are designed for a continuous thermal current limit of  $1.2 \cdot I_N$  and type 8106\_E for  $1.0 \cdot I_N$ . In case of load changes make sure that these values are not exceeded, otherwise the temperature surveillance may be monitored. The effective continuous current is permissible, if  $I_{\text{eff}} \leq 1.2 \cdot I_N$  (for 8106\_E:  $I_{\text{eff}} \leq 1.0 \cdot I_N$ ) and the connected motor is not overheated.

**Warning:** With corresponding settings, this device generates an output frequency up to 199 Hz. If connected to an unsuitable motor, a dangerous overspeed may result.

## 5.1 INVERTER DIMENSIONS



"A"



View from direction "A"

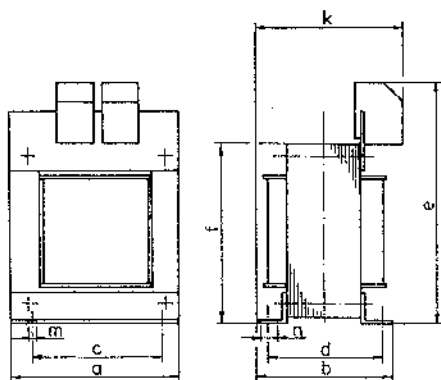
	a mm	b mm	c mm	d mm	e mm	g mm	h mm	k mm	l mm	Weight kg
8101/8102	162	205	130	190	136	5.5	7.5	47	107	1.8
8103/8104	162	205	130	190	149	5.5	7.5	60	120	2.5
8105/8106	200	245	165	230	156	5.5	7.5	70	130	4.2

## 5.2 MAINS CHOKES

Advantages when using a mains choke:

- Compliance with surge strength class I according to VDE 0160
- Reduction of mains feedback
- Increasing the inverter life
- Reduction of radio interference

Mains chokes are not supplied with the inverter.



Type	L mH	I A	Part no.	a mm	b mm	c mm	d mm	e mm	f mm	k mm	m mm	n mm
8101	5	9	323 330	96	77	84	61	96	87	91	5.8	9
8102	5	9	323 330	96	77	84	61	96	87	91	5.8	9
8103	5	9	323 330	96	77	84	61	96	87	91	5.8	9
8104	5	9	323 330	96	77	84	61	96	87	91	5.8	9
8105	3.5	14	323 331	96	77	84	61	96	87	91	5.8	9
8106	1.6	17	323 361	96	77	84	61	96	87	91	5.8	9

## 5.3 FUSES

Type	8101	8102	8103	8104	8105	8106
Mains fuses F1 (internal)	M12A			FF25A		FF30A
Part no.	331 113			307 308		321 554

Replace defective fuses only with the specified type when voltage is off.  
Device carries potential up to 30 seconds after mains disconnection!

#### 5.4 OPERATION WITH BRAKE CHOPPER

When operating three-phase AC motors with static frequency inverters, the motor feeds back energy to the DC bus when braking, i.e. generating. If the DC bus voltage exceeds a permissible value, the inverter sets trip, unless it is operating in the Clamp mode, where the braking effect will be limited. The reason for the overvoltage is the rate of deceleration of the load inertia.

When using a brake chopper, the excessive DC bus voltage is switched across a resistor which dissipates the regenerated energy as heat until the DC bus voltage falls below the switching threshold.

R Ohm	Pn kW	Part no.	H x W x D mm
82 Ω	450 W	345 394	448 x 47 x 100
2*100 Ω in series	100 W	309 163	170 x 33 x 48
470 Ω	120 W	305 062	170 x 33 x 48

The following constraints apply to the above brake resistors:

- maximum permissible braking time: 15 s
- maximum permissible duty cycle: 25 %

Brake resistors are not supplied with the inverter.

#### 5.5 RADIO INTERFERENCE SUPPRESSION

Radio interference suppression to VDE 0871, class B

##### a) Mains filter

Type	8101_E - 8104_E	8105_E - 8106_E
Mains filter part no.	332 705	333 228

##### b) Screening

- Motor line
- Mains line between filter and inverter

## 5.6 SCREENING

Mains inputs and control terminals of the inverters are noise immune up to severity class 4 to IEC 801-4 without screenings.

Screening is only required, if the inverter is operated where severity class 4 is not sufficient, e.g. if power and control lines cannot be laid separately.

Interferences may cause faults in the program, which immediately stop the operation, via a trip fault.

### Screening lines of analog control signals (reference input)

In order to avoid signal faults, we recommend to screen analog signals in all cases.

To avoid PE-loops, connect the screens of the control lines at one end to PE, either via

- the provided inverter terminals or
- via insulated central points, which are connected to PE at one point (e.g. PE terminals).

In case of interruptions (terminal boards, relays, fuses), keep connections of control line screens as short as possible.

To screen the control line of the serial LECOM interface see technical description of LECOM A/B.

### Screening motor lines and brake chopper lines

Connect the screen of the motor line directly to one central PE connection in the control cabinet, for lines longer than 3m, also directly at the motor, if possible.

**Note:** If sensitive equipment is installed close to the device, we recommend the screening of motor and brake resistor lines.

## 5.7 GROUNDING CONTROL ELECTRONICS

### Single drives

**Caution!** The reference potential GND (terminals 7 and 40) of the control electronics is connected to PE internally.

This connection between GND and PE is required, if the interface option is connected (see chapter 6).

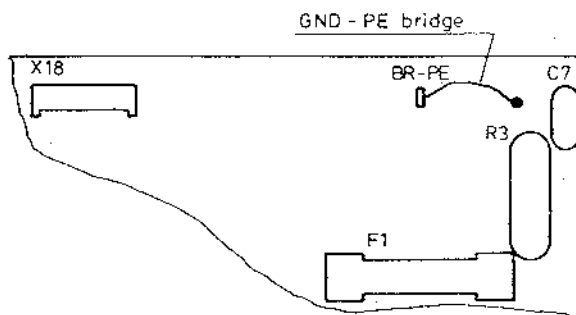
For computer networks with fixed installation, an additional potential separation between computer and inverter (e.g. Lenze Converter 2101) is necessary.

### Network of several drives

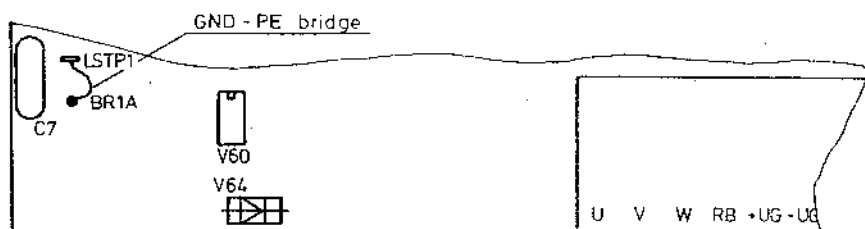
In a drive network, it is necessary to remove the GND-PE connection from every controller, to avoid GND-loops. Lead all GND-lines to external, insulated central points, centralize again from there and connect to PE in the central supply.

In a computer network, make sure that the voltage between GND and PE does not exceed 50 V. In case of a fixed computer installation, a mains isolation must also be provided (e.g. Lenze Converter type 2101).

### Inverters 8101\_E - 8104\_E



### Inverters 8105\_E - 8106\_E



## 6. OPTION

### 6.1 SERIAL INTERFACE

The serial interface is used for digital control, parameter setting and monitoring of the frequency inverters 8100\_E via a host or a PLC. It corresponds to the RS 232-C standard. This interface is used to achieve direct point-to-point connections with a cable length of maximum 15 m. Using the Lenze Converter with mains isolation, a serial bus system with 32 participants and a line length of maximum 1200 m can be installed. The LECOM A/B protocol recognizes faults and therefore avoids the transmission of faulty data. It supports up to 90 controllers and is based on the ISO 1745 standard.

Data of the serial interface:

- Baud rate: 9600 Baud
- Characters
  - 7 bit ASCII
  - 1 stop bit
  - 1 start bit
  - 1 parity bit (even)

Pin assignment of the 9-pole Sub-D plug:

Pin	1	2	3	4	5	6	7	8	9
Signal	+Vcc15	RxD	TxD	DTR	GND		RTS	CTS	+Vcc5

Pins 7 and 8 are linked inside the device.

Further information about serial communication can be obtained from the technical description LECOM A/B.

The serial interface for the inverters 8101 to 8106 is available under part no. 350 566.

### 6.2 LECOM-CODE NUMBERS

The following code numbers have a special meaning for the serial communication. The codes C43, C68, C69, C161 to C168 cannot be read on the display of the inverter.

#### **C09** LECOM1 controller address

Numbers of bus participants for communication via LECOM1 interface.  
Addresses from 1 to 99 can be assigned, but "10", "20", "30" ... "90" are reserved.



**C43 Display and reset of a fault.**

Parameter 0 = no fault

Parameter 1 = fault

When entering parameter 0, the fault is reset.

**C68 Display of operating state**

Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Signal	TRIP	n.c.	0	OSP	IMP	Rot.	0	RFR	Communication fault				Operating fault			

**C69 Display of controller state**

Bit no.	7	6	5	4	3	2	1	0
Signal	RFR	n.c.	RESET	AUTO	REMOT	PCHG	CALARM	BALARM

**C99 Display of software version**

**C161** History of fault indications (latest fault indication under C161).

:

**C168**

Further information about the serial interface can be obtained from the technical description LECOM-A/B.

