VA TECH ELIN EBG Elektronik

Operating and Mounting instructions

>*pDRIVE*< CX ***single***

>*pDRIVE*< CX ***compact***

The Power Drives Company

ELIN EBG Elektronik

Safety instructions

General information, note exactly !

The requirements for a successfull commissioning are a correct selection of the unit, projection and mounting. In case of further questions, please contact the supplier or call the manufacturer of the unit directly.

Capacitor discharge !

Before any work on or in the unit, disconnect from the mains and wait at least 5 minutes until the D.C.link capacitors have been fully discharged. Check that the device is no longer alive by measuring the voltage at the D.C.link capacitor.

Automatic restart !

In case of certain parameter adjustments it may happen that the frequency inverter starts up automatically after switching on the mains again. You have to guarantee, that no person and no other equipment is in danger.

Commissioning and service !

Works on or in the unit must only be undertaken by properly qualified staff in full compliance of the appropriate instructions and pertinent regulations. Note that a fault may cause potential-free contacts and/or PCBs to carry mains potential. To avoid any risk to humans, obey the regulations concering "Work on Live Equipment" explicitly.

Delivery conditions:

Our deliveries and services are based on the "General Terms of Delivery of the Austrian Electrical Industries" latest edition.

Specifications in this instruction:

We are constantly striving to improve our products and adapt them to the latest state of technical development. We therefore reserve the right to modify the specifications given in this instruction at any time, particulary those refering to measures and dimensions. All planning hints and connecting samples are non-binding suggestions, for which we are unable to assume any liability, particulary since the regulations to be complied with depend on the type and location of the plant and on the use of the instruments.

Regulations:

It is the users responsibility to ensure that the instrument and its component parts are used in compliance with applicable regulations. It is not permitted to use these instruments in residential areas without special measures to supress radio frequency interferences.

Patent and Trade Marks:

Please note that we do not guarantee any connections, instruments or processes described herein to be free from patent or trademark right of third parties.

Keep this instruction near the unit to hand !

Operating and Mounting the Frequency inverter

>*pDRIVE*< *CX single* >*pDRIVE*< *CX compact*

0.4 up to 2.2 kW, 1 AC 200 up to 240 V
0.7 up to 7.5 kW, 3 AC 380 up to 460 V

This manual includes the topics operating, description of parameters and displays, projecting, mounting, connection and options.

Regulations for the observance of the CE-directive and the new Power-Drive-Standard (EN 61800-3) are described in chapter "CE Marking".

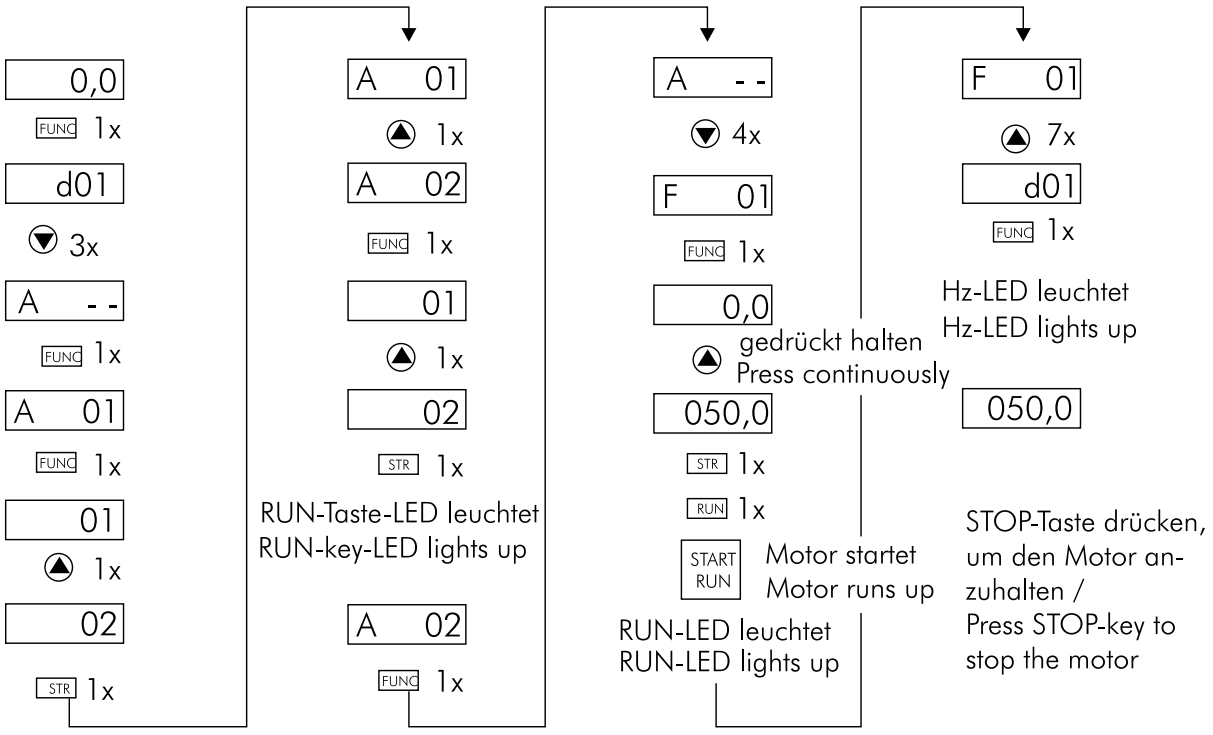
In case of damage or incomplete delivery, please inform the supplier or the insurance company.
The manufacturer declines responsibilitiy for faults occuring during transport or unpacking.

Notes

Operating using the control panel built-in

Description of the control panel

Example of programming to set the frequency and to start the inverter



Setzen der Sollwertquelle Setting of the value source	Setzen der Steuerquelle Setting of the control source	Setzen der Ausgangsfrequenz Setting of the output frequency	Anzeigeeinstellung Displayconfiguration

LEDs on the control panel

Power-LED:
lights up when the inverter is connected to mains supply, that means there is a voltage.

Hz-LED:
indicates that the value of the display shows frequency in hertz.

A-LED:
indicates that the value of the display shows motor current in amperes.

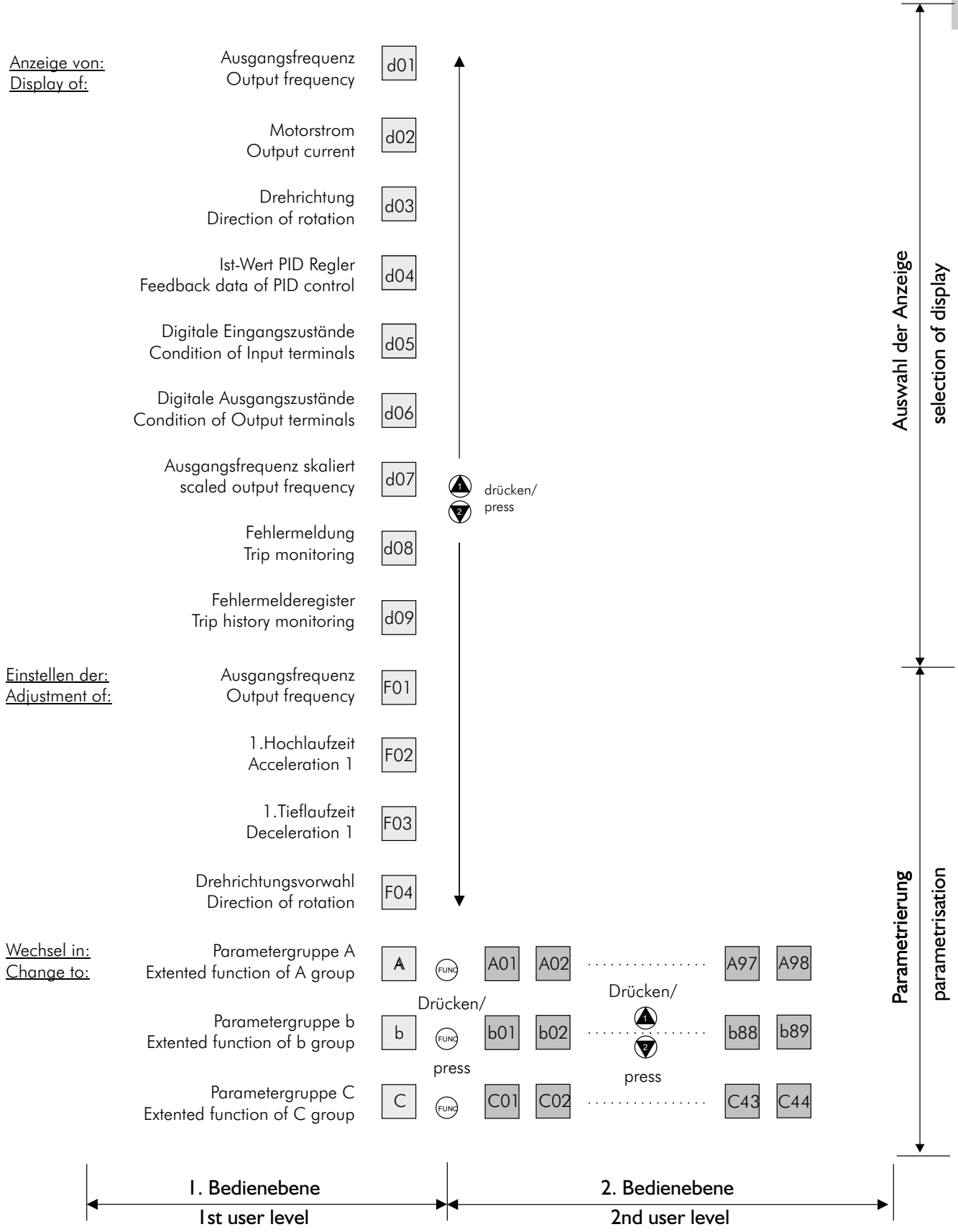
POTENTIOMETER-LED:
lights up if parameter A01 is set to 00; that means the frequency reference value is defined on the control panel by the potentiometer.

RUN-button-LED:
indicates that the motor can be started at any time by pressing the RUN button.
Lights up as soon as parameter A02 is set to 02.

PRG-LED:
lights up as soon as a parameter of the 2nd control level or one of parameters d01 or F01 to F04 is called.

RUN-LED:
lights up as soon as the motor exceeds the start-up frequency or runs up.

Overview of control levels



Changing the indication of the LED display:

1.) Switch to the 1st user level using the FUNC button.
2.) Use the UP/DOWN buttons to select the required display.
3.) Press the FUNC button to confirm the selection and to return to the display level.

Changing parameter settings on the 1st control level:

1.) Switch to the 1st control level using the FUNC button.
2.) Use the UP/DOWN buttons to select the required parameter.
3.) Press the FUNC button to switch to setting mode.
4.) Use the UP/DOWN buttons to enter the new setting.
5.) Press the STR button to confirm, save and return to 1st control level. Press the FUNC button to return to the 1st control level without saving.
6.) Select the required display (e.g. d01) and press the FUNC button to confirm.

Changing parameter settings on the 2nd control level:

1.) Switch to the 1st control level using the FUNC button.
2.) Use the UP/DOWN buttons to select the required parameter group A, b or C.
3.) Press the FUNC button to enter the selected parameter group (2nd control level).
4.) Use the UP/DOWN buttons to select the required parameter.
5.) Press the FUNC button to switch to setting mode.
6.) Use the UP/DOWN buttons to enter the new setting.
7.) Press the STR button to confirm, save and return to 2nd control level. Press the FUNC button to return to 2nd control level without saving.
8.) Press the FUNC button to return to the 1st control level.
9.) Select the required display (e.g. d01) and press the FUNC button to confirm.

Note:
If the software lock is activated, a reset to default is not possible.

Commissioning

Before working with the equipment check following points:

1.) Check that mains supply and motor cables are connected properly.
2.) Are the control lines properly connected to the right terminals ?
3.) Is the frequency inverter properly grounded and assembled ?
4.) Remove installation residues, such as cable residues, in order to avoid short circuits.
5.) Remove the protective cover from the top of the inverter.
6.) Are all screws and terminals tight ?
7.) Is the motor designed for the intended frequency range, in particular for the maximum frequency ?

Factory default (initialisation):

All >*pDRIVE*< *CX* frequency inverters are initialised on delivery, i.e. with the default settings (default) entered. The devices can be reset to these defaults settings at any time.

To reset the default settings, proceed as follows:

1.) Adjust parameter b84 to setting 01.
2.) Select the European configuration with parameter b85=01 (= default setting).
3.) Press the FUNC, UP and DOWN buttons at the same time.
4.) Hold these three buttons and press the STOP/Reset button to confirm.
5.) After approx. 2...3 seconds, the display starts flashing and you can release the 3 buttons. The inverter automatically starts initialisation. (The relevant country setting appears on the display). If "d01" appears on the display, the procedure has finished.

Note:
Remove the cover on the upper side of the inverter.

Commissioning via the built-in keypad:

The built-in control panel allows to control the frequency inverter without additional wiring of the control terminals.

1.) Switch on the mains supply; the Power LED on the control panel lights up.
2.) Set parameter A02 to 02.
3.) The LED above the RUN button lights up.
4.) Set parameter A01 to 00.
5.) The LED above the potentiometer lights up. Press the RUN button and turn the potentiometer. The motor starts turning and the RUN LED lights up.
6.) Press the STOP button to stop the motor.

Check the following points after commissioning:

1.) Did the motor turn in the right direction ?
2.) Was there an error message during acceleration or deceleration ?
If the error message Overcurrent or Overvoltage appeared, increase the acceleration or deceleration time.
3.) Were there any abnormal motor noises or vibrations ?

Note:
If the allocation of inverter and motor differs or if you use special motors, pay attention to the right setting of parameter b32 "Reactive current setting".

Overview of parameters

The following overview shows all parameters arranged according to their functions.

	Display actual value Parameter name	Adjusting range	Factory default	See page
d01	Output frequency	read only	–	13
d02	Output current	read only	–	13
d03	Direction of rotation	read only	–	13
d04	PID controller feedback	read only	–	13
d05	Condition of digital inputs	read only	–	13
d06	Condition of digital outputs	read only	–	13
d07	Output frequency scaled	read only	–	13

	Base settings Parameter name	Adjusting range	Factory default	See page
A03	Base frequency	50…360 Hz	50 Hz	14
A04	Maximum frequency	50…360 Hz	50 Hz	14
F02	Acceleration ramp	0.1...3000 s	10 s	14
F03	Deceleration ramp	0.1...3000 s	10 s	14
F01	Output frequency	0.0...360.0 Hz	–	14
A20	Internal pre-set speed if A01=02	(0.0) 0.5...360.0 Hz	0.0 Hz	14
A01	Method of speed command	00 to 02	01	14
A02	Method of run command	01 or 02	01	15

	Analog inputs Parameter name	Adjusting range	Factory default	See page
A11	External frequency start	0.0...360.0 Hz	0.0 Hz	15
A12	External frequency end	0.0...360.0 Hz	0.0 Hz	15
A13	Analog signal reference for Start	0...99 %	0 %	15
A14	Analog signal reference for End	1...100 %	0 %	15
A15	External frequency start pattern	00 or 01	01	15
A16	Time constant for analog signal	1 to 8	8	16

	Multispeeds Parameter name	Adjusting range	Factory default	See page
A21	Multi speed 1	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A22	Multi speed 2	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A23	Multi speed 3	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A24	Multi speed 4	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A25	Multi speed 5	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A26	Multi speed 6	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A27	Multi speed 7	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A28	Multi speed 8	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A29	Multi speed 9	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A30	Multi speed 10	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A31	Multi speed 11	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A32	Multi speed 12	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A33	Multi speed 13	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A34	Multi speed 14	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A35	Multi speed 15	(0.0) 0.5...360.0 Hz	0.0 Hz	16
A38	Jogging frequency	0.00...9.99 Hz	1.00 Hz	17
A39	Stop mode of jog function	00 to 02	00	17

V/f	**V/f characteristic** Parameter name	Adjusting range	Factory default	See page
A41	Torque boost method selection	00 or 01	00	17
A42	Manual torque boost setting	0...99	11	18
A43	Manual torque boost frequency point	0.0...50.0 %	10.0 %	18
A44	V/f characteristic setting	00 or 01	00	18
A45	Voltage gain setting	50...100 %	100 %	19

	DC brake Parameter name	Adjusting range	Factory default	See page
A51	Selection of DC braking	00 or 01	00	19
A52	DC braking: frequency	0.5...10.0 Hz	0.5 Hz	19
A53	DC braking: waiting time	0.0...5.0 s	0.0 s	19
A54	DC braking: braking torque	0...100 %	0 %	19
A55	DC braking: braking time	0.0...60.0 s	0.0 s	19

Hz	**Frequency limits** Parameter name	Adjusting range	Factory default	See page
A61	Frequency upper limit	(0.0) 0.5...360.0 Hz	0.0 Hz	20
A62	Frequency lower limit	(0.0) 0.5...360.0 Hz	0.0 Hz	20
A63	1st Jump frequency	0.0...360.0 Hz	0.0 Hz	21
A64	1st Jump frequency width	0.0...10.0 Hz	0.5 Hz	21
A65	2nd Jump frequency	0.0...360.0 Hz	0.0 Hz	21
A66	2nd Jump frequency width	0.0...10.0 Hz	0.5 Hz	21
A67	3rd Jump frequency	0.0...360.0 Hz	0.0 Hz	21
A68	3rd Jump frequency width	0.0...10.0 Hz	0.5 Hz	21

PID	**PID Configuration** Parameter name	Adjusting range	Factory default	See page
A71	Selection of PID function: ON/OFF	00 or 01	00	23
A72	PID controller: Proportional gain (kp)	0.2 to 5.0	1.0	23
A73	PID controller: Integral gain (Tn)	0.0...150.0 s	1.0 s	23
A74	PID controller: Differential gain (Tv)	0.0...100.0 s	0.0 s	23
A75	PID controller: Scale conversion	0.01...99.99	1.00	24
A76	PID controller: Feedback destination	00 or 01	00	24
C44	PID controller: Level of deviation	0...100 %	3.0 %	24

V/f	**Automatic voltage regulation** Parameter name		Adjusting range	Factory default	See page
A81	Selection of AVR function		00 to 02	02	25
A82	AVR: Motor voltage	*CX single:* *CX compact:*	200...240 V 380...460 V	230 V 400 V	25

2. Hz	**Ramp adjustment** Parameter name	Adjusting range	Factory default	See page
A92	2nd Acceleration ramp	0.1...3000 s	15.0 s	25
A93	2nd Deceleration ramp	0.1...3000 s	15.0 s	25
A94	Select method of 2nd stage	00 or 01	00	25
A95	Switch-over 1./2. acceleration ramp	0.0...360.0 Hz	0.0 Hz	26
A96	Switch-over 1./2. deceleration ramp	0.0...360.0 Hz	0.0 Hz	26
A97	Pattern of acceleration ramp	00 or 01	00	26
A98	Pattern of deceleration ramp	00 or 01	00	26

M	**Thermal protection** Parameter name	Adjusting range	Factory default	See page
b12	Electronic overload setting	0.5...1.2 x I_{FI}	FI-I_{NOM}	26
b13	Electronic overload characteristic	00 or 01	01	26

	Overload protection Parameter name	Adjusting range	Factory default	See page
b21	Selection of overload restriction	00 to 02	01	27
b22	Level of overload restriction	0.5...1.5 x I_{FI}	1.25 x I_N	27
b23	Rate of decel. at overload restriction	0.3...30.0 s	1.0 s	27

	Digital inputs Parameter name	Adjusting range	Factory default	See page
C01	Function of input 1	0 to 18	00	28
C02	Function of input 2	0 to 18	01	28
C03	Function of input 3	0 to 18	02	28
C04	Function of input 4	0 to 18	03	28
C05	Function of input 5	0 to 19	18	28
C11	Condition of input C01	00 or 01	00	32
C12	Condition of input C02	00 or 01	00	32
C13	Condition of input C03	00 or 01	00	32
C14	Condition of input C04	00 or 01	00	32
C15	Condition of input C05	00 or 01	00	32

	Digital outputs Parameter name	Adjusting range	Factory default	See page
C21	Function of terminal 11	00 to 05	01	32
C22	Function of terminal 12	00 to 05	00	32
C23	Condition of output FM	00 to 02	00	34
C31	Condition of output C21: Inversion	00 or 01	00	35
C32	Condition of output C22: Inversion	00 or 01	00	35
C33	Condition of terminal AL	00 or 01	01	35
b81	Analog meter adjustment	0...255	80	35

	Digital outputs Parameter name	Adjusting range	Factory default	See page
C41	Level of overload signal	0...2 x I_{NOM}	I_{NOM}	36
C42	Arrival signal for Acceleration	0.0...360.0 Hz	0.0 Hz	36
C43	Arrival signal for Deceleration	0.0...360.0 Hz	0.0 Hz	36

	Undervoltage / Autoreset Parameter name	Adjusting range	Factory default	See page
b01	Selection of restart mode	00 to 03	00	36
b02	Allowable undervoltage time	0.3...25.0 s	1.0 s	37
b03	Retry waiting time	0.3...100.0 s	1.0 s	37

f_x	**General functions** **Parameter name**	Adjusting range	Factory default	See page
F04	Running direction of RUN key	00 or 01	00	37
b32	Reactive current setting	0.1...1.0 x I_N	0.58 x I_N	37
b82	Start frequency adjustment	0.5...9.9 Hz	0.5 Hz	38
b83	Carrier frequency setting	0.5...16.0 kHz	5.0 kHz	38
b86	Frequency converted value setting	0.1...99.9	1.0	38
b87	Selection of STOP key	00 or 01	00	38
b88	After FRS cancelled	00 or 01	00	38
b89	Digital Operator Display	01 to 07	01	39

	Software lock. Factory default **Parameter name**	Adjusting range	Factory default	See page
b31	Software lock	00 to 03	01	39
b84	Factory default setting	00 or 01	00	39
b85	Kind of factory default	00 to 03	01	39

	Fault memory **Parameter name**	Adjusting range	Factory default	See page
d08	Trip message	read only	–	41
d09	Trip history	read only	–	41

Description of parameters

The parameters of the *>pDRIVE< CX* are arranged and described according to their functions.

The following example explains the attributes of parameters:

A38	Jogging frequency	VIC	0.00...9.99 Hz	1.00 Hz

Group of parameter

Parameter number

Parameter name

Adjusting range

Factory default

Parameter description:

adjustable parameter

adjustable in pulse lock state 2.)

adjustable only if software lock is open 1.)

1.) See parameter b31

2.) If such parameters are adjusted, no start command is accepted during adjustment. Impulse contacts and retained commands will be ignored as long as the inverter is still in setting mode.

Display actual value

d01	Output frequency	–	read only	–

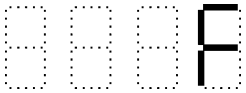
Displays the output frequency on the LED display.
If this display mode is selected, the Hz-LED right of the display lights up.

d02	Output current	–	read only	–

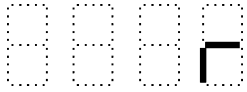
Displays the motor current on the LED display.
If this display mode is selected, the A-LED right of the display lights up.

d03	Direction of rotation	–	read only	–

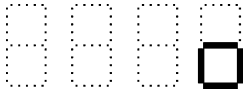
Displays the direction of rotation on the display.



Forward



Reverse

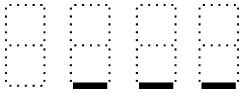


Stop

d04	PID controller feedback	–	read only	–

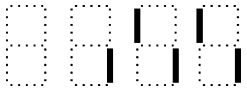
Displays the actual PID controller value scaled using parameter A75.
Display = Feedback PID controller x A75

If the PID controller is not active, the display shows:



d05	Condition of digital inputs	–	read only	–

Status display (ON/OFF) of digital inputs on the LED display.



ON (24V)
OFF (0V)

Input no. 5 4 3 2 1

d06	Condition of digital outputs	–	read only	–

Status display (ON/OFF) of digital outputs on the LED display.

ON (24V)
OFF (0V)

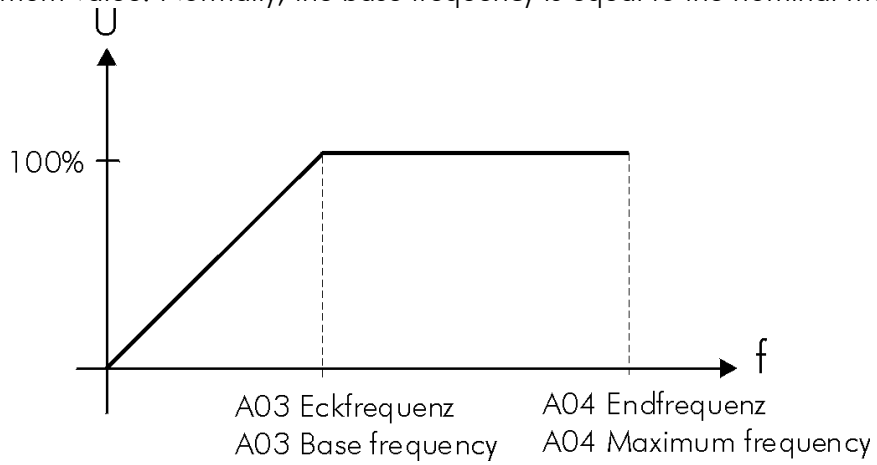
Output no. AL 12 11

d07	Output frequency scaled	–	read only	–

Displays the scaled output frequency on the LED display. The scaling factor can be set using parameter b86.
Display = Output frequency * b86
This function is used e.g. for converting the frequency into speed.

A03	Base frequency	VIC	50…360 Hz	50 Hz

Adjustment of the base frequency. The base frequency is the frequency at which the output voltage reaches its maximum value. Normally, the base frequency is equal to the nominal motor frequency.



A04	Maximum frequency	VIC	50…360 Hz	50 Hz

Adjustment of maximum frequency. Between base frequency and maximum frequency the output voltage is constant (field suppression).

F02	Acceleration ramp	VC	0.1...3000 s	10 s

Setting of required acceleration time. The time is in reference with the range from 0 Hz to maximum frequency (parameter A04).

F03	Deceleration ramp	VC	0.1...3000 s	10 s

Setting of required deceleration time. The time is in reference with the range from 0 Hz to maximum frequency (parameter A04).

F01	Output frequency	VC	0.0...360.0 Hz	–

Setting the reference value in MANUAL operation via the buttons at the keypad instead of the potentiometer. Therefore, parameter A01 must be set to position 02.

A20	Internal pre-set speed if A01=02	VC	(0.0) 0.5...360.0	0.0 Hz

Entry of frequency reference value, if function A01 is set to position 02. Allows the entry of a minimum frequency to which the inverter runs up without selecting a digital input "CF1...CF4" as soon as a Start-command is issued.
If the PID controller is active, the adjusting range changes into 0 to 100 %

A01	Method of speed command	VIC	00 to 02	01

Setting	Reference via
00	Potentiometer on the keypad
01	Control terminals (analog inputs or multispeeds)
02	Parameter F01 or A20

A02	Method of run command	VIC	01 or 02	01

Setting	Control command via
01	Control terminals (FW, REV inputs)
02	RUN button at keypad

Analog inputs
Analog Input

A11	External frequency start	VIC	0.0...360.0 Hz	0.0 Hz

This parameter adjust the output frequency at minimum reference value at the analog input (e.g. 0 V or 4 mA). Therefore, parameter A15 must be set to position 00. If the PID controller is activated, the adjusting range changes into 0 to 100 % or to the process sizes depending on parameter A75.

A12	External frequency end	VIC	0.0...360.0 Hz	0.0 Hz

This parameter adjust the output frequency at maximum reference value at the analog input (e.g. 10 V or 20 mA). If the PID controller is activated, the adjusting range changes into 0 to 100 % or to the process sizes depending on parameter A75.

A13	Analog signal reference for Start	VIC	0...99 %	0 %

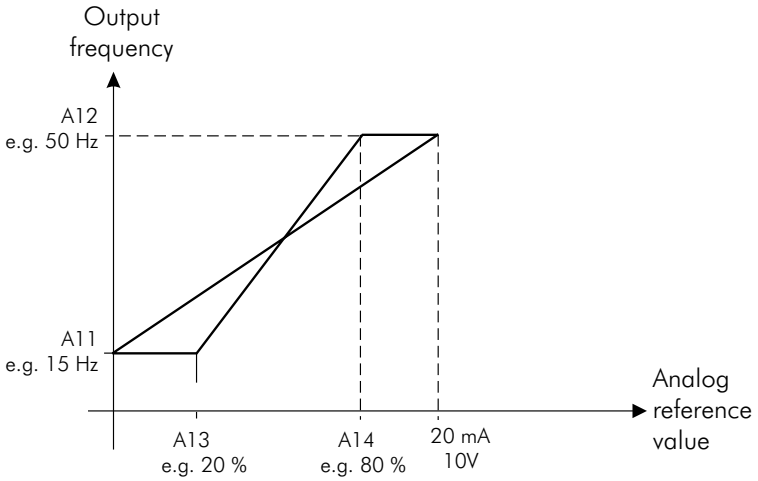
This parameter defines the minimum reference value if it should be other than 0 V or 4 mA. 100 % are equivalent to 10 V or 20 mA.

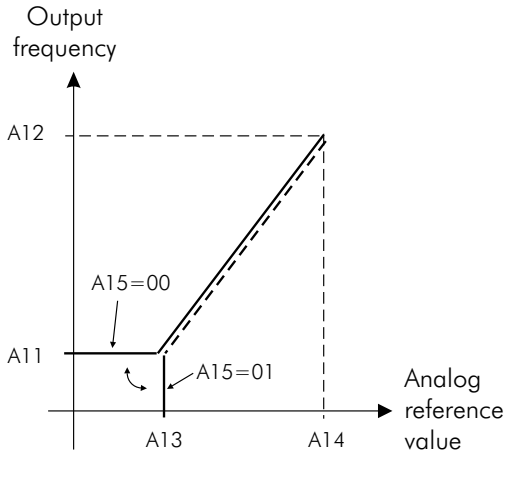
A14	Analog signal reference for End	VIC	1...100 %	0 %

This parameter defines the maximum reference value if it should be other than 10 V or 20 mA. 100 % are equivalent to 10 V or 20 mA.

A15	External frequency start pattern	VIC	00 or 01	01

Setting	Function
00	Motor starts-up with external frequency start setting
01	Motor does not start-up until a reference > A13





A16	Time constant for analog signal	VIC	1 to 8	8

In order to realize shorter reaction times to changes of the reference values, the set value for this function can be reduced. However, the smaller this value, the smaller the filter effect for interfering residual frequency on the reference signal is.

Setting	1 8
Filter effect for interfering frequency	low ..... high
Reaction time to changes in reference	fast ..... slow

Multispeeds
Multi Speeds

A21	Multi speed 1	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A22	Multi speed 2	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A23	Multi speed 3	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A24	Multi speed 4	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A25	Multi speed 5	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A26	Multi speed 6	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A27	Multi speed 7	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A28	Multi speed 8	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A29	Multi speed 9	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A30	Multi speed 10	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A31	Multi speed 11	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A32	Multi speed 12	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A33	Multi speed 13	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A34	Multi speed 14	VC	(0.0) 0.5...360.0 Hz	0.0 Hz
A35	Multi speed 15	VC	(0.0) 0.5...360.0 Hz	0.0 Hz

The multispeeds are selected using the digital commands CF1, CF2, CF3 and CF4, which must be programmed on the terminals first. See Digital inputs.

Multispeeds are pure reference values. The ON and OFF commands are not influenced by the selection of multispeeds, that means that an additional Start command is necessary for operation.

Note:
Multispeeds always override the actual reference value, independent from the setting of parameter A01.
If no digital input is selected at parameter A01 = 01, the reference value is set using the analog inputs.

Digital commands				Adjusted value	Parameter
CF1	CF2	CF3	CF4		
0	0	0	0	Internal preset speed if A01=02	A20
1	0	0	0	Multispeed 1	A21
0	1	0	0	Multispeed 2	A22
1	1	0	0	Multispeed 3	A23
0	0	1	0	Multispeed 4	A24
1	0	1	0	Multispeed 5	A25
0	1	1	0	Multispeed 6	A26
1	1	1	0	Multispeed 7	A27
0	0	0	1	Multispeed 8	A28
1	0	0	1	Multispeed 9	A29
0	1	0	1	Multispeed 10	A30
1	1	0	1	Multispeed 11	A31
0	0	1	1	Multispeed 12	A32
1	0	1	1	Multispeed 13	A33
0	1	1	1	Multispeed 14	A34
1	1	1	1	Multispeed 15	A35

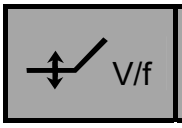
A38	Jogging frequency	VC	0.00...9.99 Hz	1.00 Hz

The jog function is used for checking, setting or adjusting the application. For this purpose, the digital command "Jog mode" (see Digital inputs) is available.

Note:
The jog mode is only possible if the drive is in stop state.

A39	Stop mode of jog function	VIC	00 to 02	00

Setting	Function
00	Idle stop after jog mode
01	Normal deceleration after jog mode
02	DC braking after jog mode



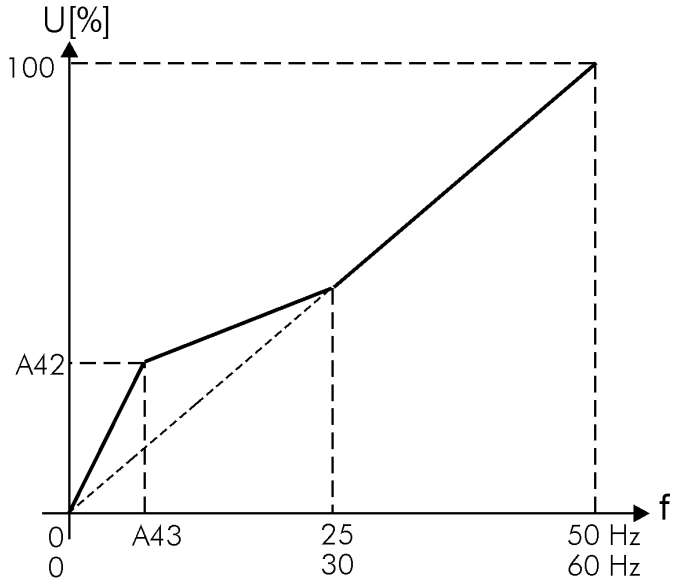
V/f characteristic
V/f

A41	Torque boost method selection	VIC	00 or 01	00

Setting	Function
00	Manual boost
01	Automatic boost

A42	Manual torque boost setting	VC	0...99 %	11
A43	Manual torque boost frequency point	VC	0.0...50.0 %	10.0 %

For applications which require higher starting torque, the standard starting torque can be increased by up to 50 %. Use parameter A41 to select between automatic and manual boost. Parameter A42 defines the value by which the torque has to be boosted. The range in which this boost takes effect is defined by parameter A43.



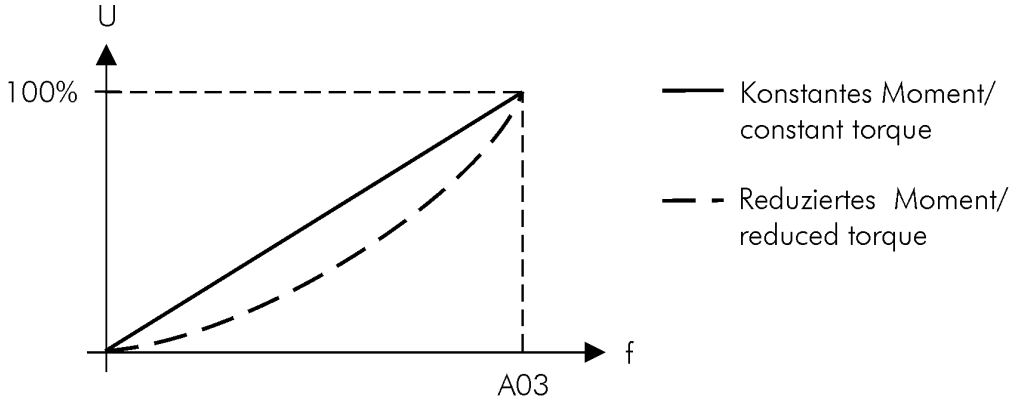
At manual boost, the torque is increased between 0 Hz and 50 % of the base frequency.
At automatic boost, this process depends on the load.

Note:
Beware of overloading the motor.

A44	V/f characteristic setting	VIC	00 or 01	00

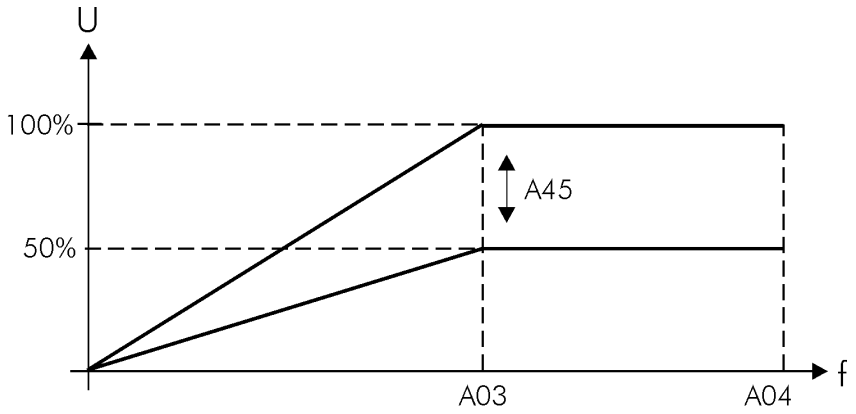
Parameter to set one of two possible V/f characteristics.

Setting	Function
00	Constant torque
01	Reduced torque (Economy mode)



A45	Voltage gain setting	VC	50...100 %	100 %

The output voltage can be set within the range of 50...100 % of the input voltage.



DC brake
Braking

The frequency inverters *>pDRIVE< CX* have an adjustable DC brake. By locking a clocked DC rotor voltage onto the base of the motor, the rotor produces a braking torque that counteracts the rotation. With the help of the DC brake, braking a drive to minimum speed is possible, before the mechanical brake is activated.

A51	Selection of DC braking	VIC	00 or 01	00

Setting	Function
00	not active
01	active

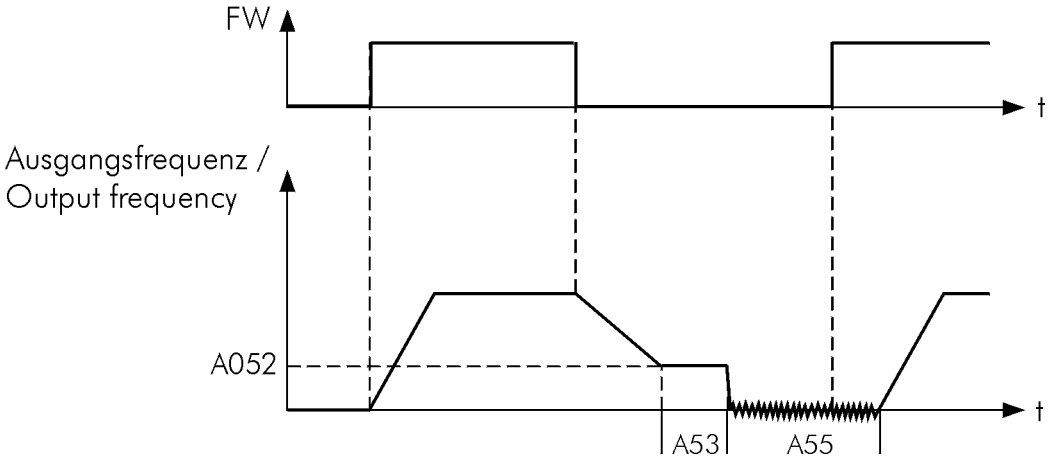
A52	DC braking: frequency	VIC	0.5...10.0 Hz	0.5 Hz
A53	DC braking: waiting time	VIC	0.0...5.0 s	0.0 s
A54	DC braking: braking torque	VIC	0...100 %	0 %
A55	DC braking: braking time	VIC	0.0...60.0 s	0.0 s

When the DC braking function is activated (A51=1), the frequency inverter runs low during the rundown time set for F03, and starts d.c. injection braking at the frequency set with A52.

Parameter A53 defines, when d.c. injection braking is activated one the frequency set in A52 is reached. During this time, the motor is running idle.

Parameter A54 defines the output value with which d.c. injection braking is carried out. 0% means "very low" and 100% "very high".

Parameter A55 defines the duration of d.c. injection braking.



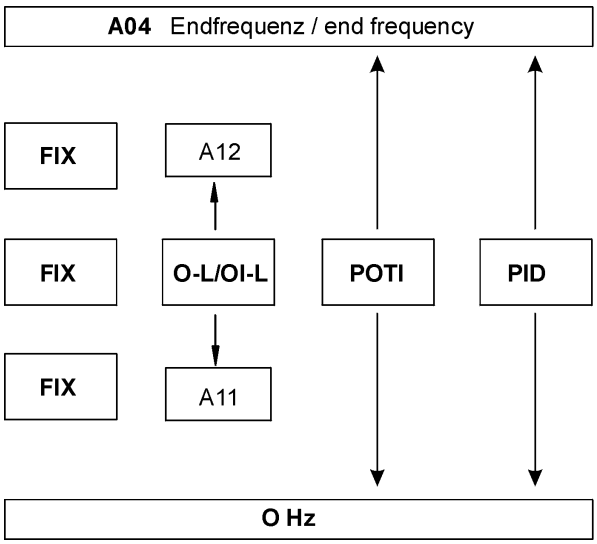
Note:
The DC brake causes a heating of the connected motor.
Be sure that the motor does not get too warm.

Frequency limits
Limits

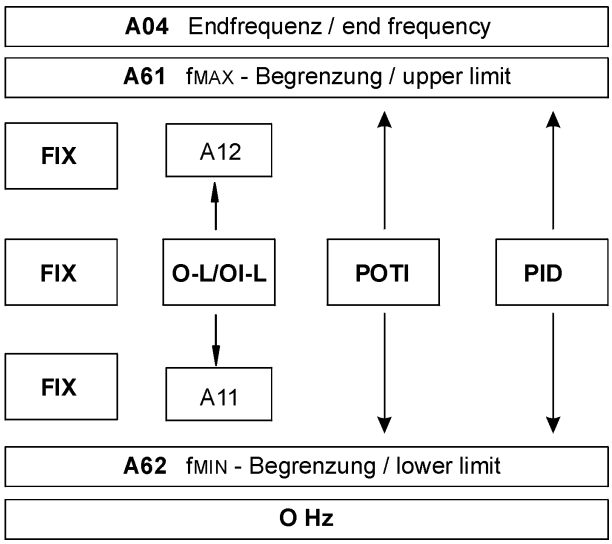
A61	Frequency upper limit	VIC	(0.0) 0.5...360.0 Hz	0.0 Hz
A62	Frequency lower limit	VIC	(0.0) 0.5...360.0 Hz	0.0 Hz

Defining the frequency range within a range from 0 to parameter A04 (max. 360 Hz). If the values are set to 0.0 Hz, their function is cancelled.

Without parameter A61 and A62

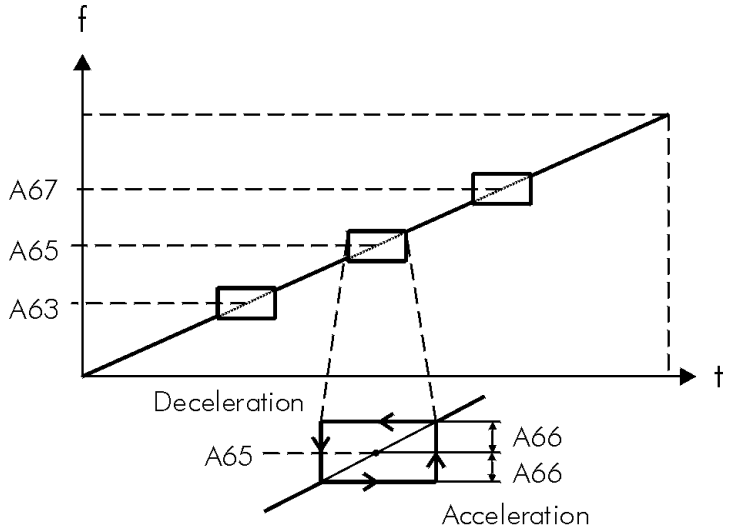


With parameter A61 and A62



A63	1st Jump frequency	VIC	0.0...360.0 Hz	0.0 Hz
A64	1st Jump frequency width	VIC	0.0...10.0 Hz	0.5 Hz
A65	2nd Jump frequency	VIC	0.0...360.0 Hz	0.0 Hz
A66	2nd Jump frequency width	VIC	0.0...10.0 Hz	0.5 Hz
A67	3rd Jump frequency	VIC	0.0...360.0 Hz	0.0 Hz
A68	3rd Jump frequency width	VIC	0.0...10.0 Hz	0.5 Hz

To avoid possible resonance in the drive system, it is possible to program three jump frequency ranges using functions A63...A68.



The jump frequency defines the frequency at which the drive should not be operated in steady-state. The adjustable jump frequency range determines the frequency range faded out and actions symmetrical to the jump frequency.

General

The PID controller is designed as a process controller with the variable "Frequency [Hz]", whereby P (kp), I (TN) and D (Tv) can be adjusted individually. The reverence and actual value are standardised in % (range 0...100 %). For better presentation, they can be converted to the individual plant value using A75 (e.g. flow 0...30 l/h).

The PID controller output is limited with 0 Hz (or A62) at the bottom and with the maximum frequency A04 (or A61) at the top end. As a result, there is no reversal of the motor in the event of negative deviation.

In order to optimize the disturbance behaviour of the controller, it is advisable to set the acceleration and deceleration ramps as small as possible.

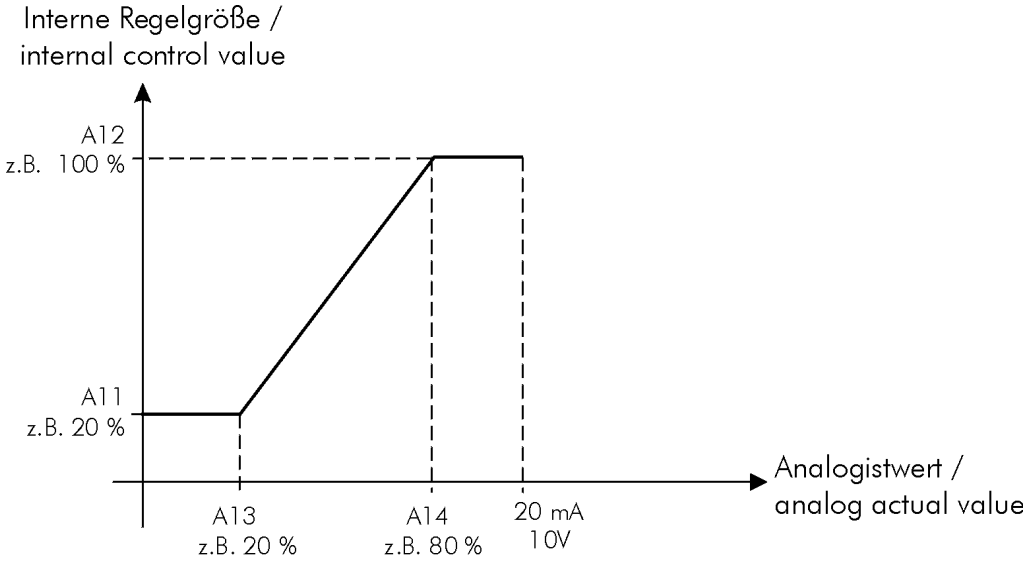
PID reference value

The reference value is selected using parameter A01. The following values can be used as reference source:

Reference value	Settings	Standardization
Potentiometer built-in	A01 = 00	0...100 %
Parameter value F01	A01 = 02	0...100 % x Parameter A75
Multispeeds A20...A35	A01 = 01	0...100 % x Parameter A75
Analog input O (0...10 V)	A01 = 01	0...100 % (independent from A11...A14)
Analog input OI (4...20 mA)	A01 = 01	0...100 % (independent from A11...A14)

Actual value

One of the two analog inputs (O and OI) can be used as actual value input. The actual value registration is adjusted using the analog input function. See parameters A11...A14.
The settings of parameters A11 and A12 are changed by activating the PID controller (A71) from Hz to % and by setting parameter A75 to process values.

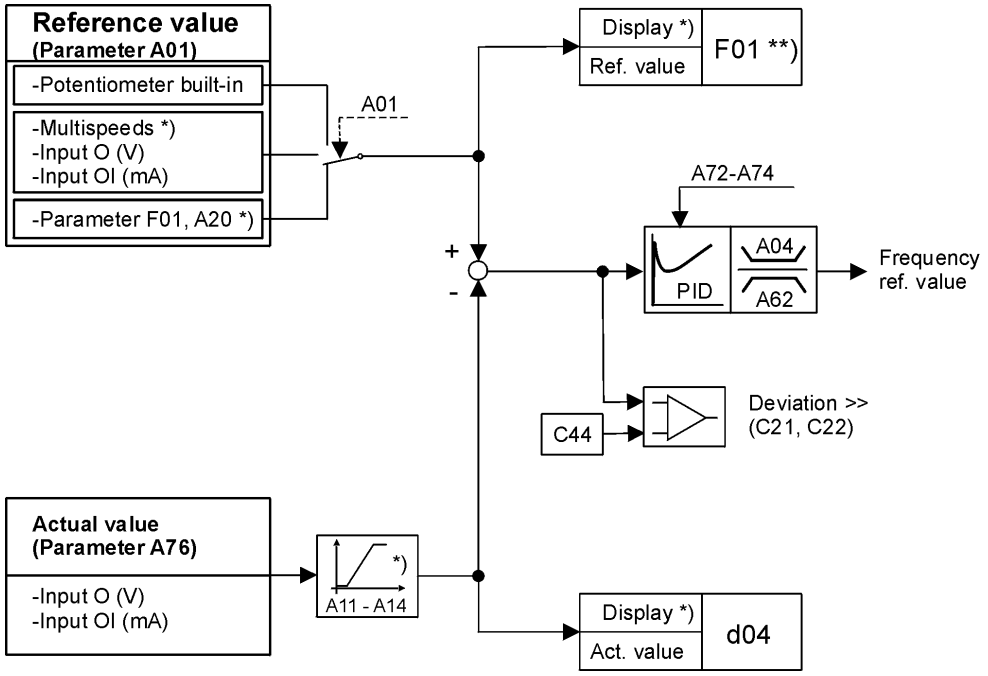


Note:
By using the PID controller, the digital function "Automatic reference value (4..20 mA)" is not available!

Note:
Because of the influence of parameter A71 to the scaling of the reference and actual value, it is important to change this parameter before changing any other!

Displays

Parameter d04 allows the display of the actual value, parameter F01 displays the reference value on the LED. This values can be converted to process values using the display factor A75.
If parameter F01 is selected, the current PID reference value is displayed. It is not updated continuously.
The actual value display (parameter d04) is updated continuously.



*) Parametrizing in process values; that means 0...100 % x A75
**) Display is not updated ongoing

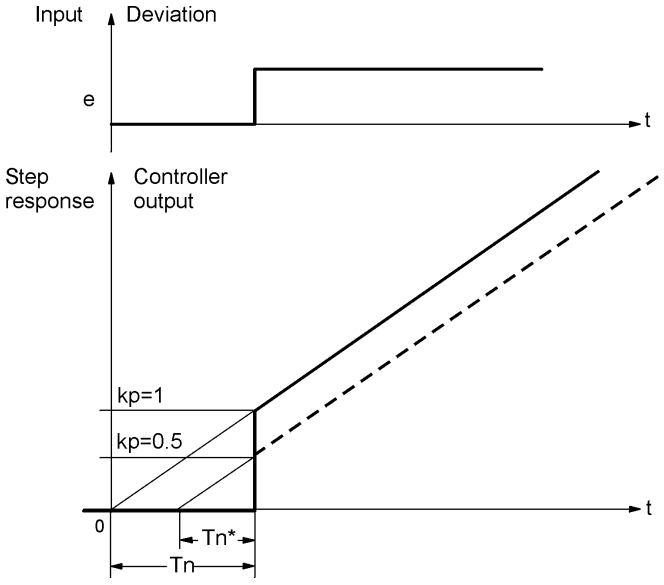
A71	Selection of PID function: ON/OFF	VIC	00 or 01	00

With parameter A71 the PID controller can be activated or deactivated.

Setting	Function
00	PID controller not active
01	PID controller always active

A72	PID controller: Proportional gain (kp)	VIC	0.2 to 5.0	1.0
A73	PID controller: Integral gain (Tn)	VIC	0.0...150.0 s	1.0 s
A74	PID controller: Differential gain (Tv)	VIC	0.0...100.0 s	0.0 s

Parameters A72, A73 and A74 are used to set the PID controller factors.
Please note, that the individual factors can be set separately, but that they have an influence on each other. if P (kp) is changed, Tn also changes.



Generally is:
T_N is right at kp = 1
kp $\neq$ 1 $\rightarrow$ $T_N = T_N$ x kp

T_N = selected reset time (A73) at kp = 1

T_N* = effective reset time at kp = 0.5
T_N* = T_N x 0.5

A75	PID controller: Scale conversion	VIC	0.01...99.99	1.00

Parameter A075 allows the setting of a conversion factor for the proper process presentation of the PID reference and actual value on the LED display.
Parameters A11, A12, d04, F01 and A20...A35 are converted in accordance with the setting of A75.

A76	PID controller: Feedback destination	VIC	00 or 01	00

Parameter A76 defines the type of feedback signal.

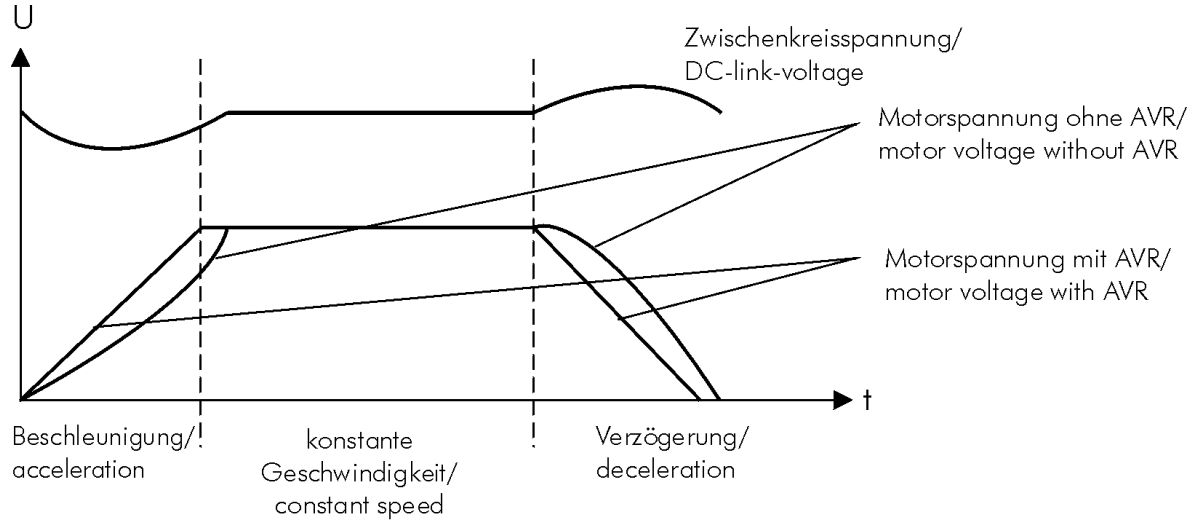
Setting	Function
00	Current signal at terminals OI – L
01	Voltage signal at terminals O – L

C44	PID controller: Level of deviation	VIC	0...100 %	3.0 %

Adjusting the difference between reference and actual value in percent, at which a signal is to be issued. The setting can be done in a range from 0.0 to 100.0 % with a resolution of 0.1 % (bipolar).

V/f	**Automatic voltage regulation AVR**

The AVR function (Automatic Voltage Regulation) stabilises the motor voltage in case of fluctuating intermediate circuit voltage (e.g. due to unstable mains supply or because of intermediate circuit voltage drops or surges due to short acceleration or deceleration times) in order to maintain such a high torque - especially during acceleration.



During the delay phase (generatoric operation) the DC link voltage increases (as shown above). This leads to an increase of the motor voltage. This higher motor voltage causes a higher braking torque. Therefore, the AVR function for deceleration can be deactivated with function A81.

A81	Selection of AVR function	VIC	00 to 02	02

Parameter A081 switches the "Automatic Voltage Regulation" for the motor on and off.

Setting	Function
00	AVR function active
01	AVR function not active
02	AVR function not active during deceleration

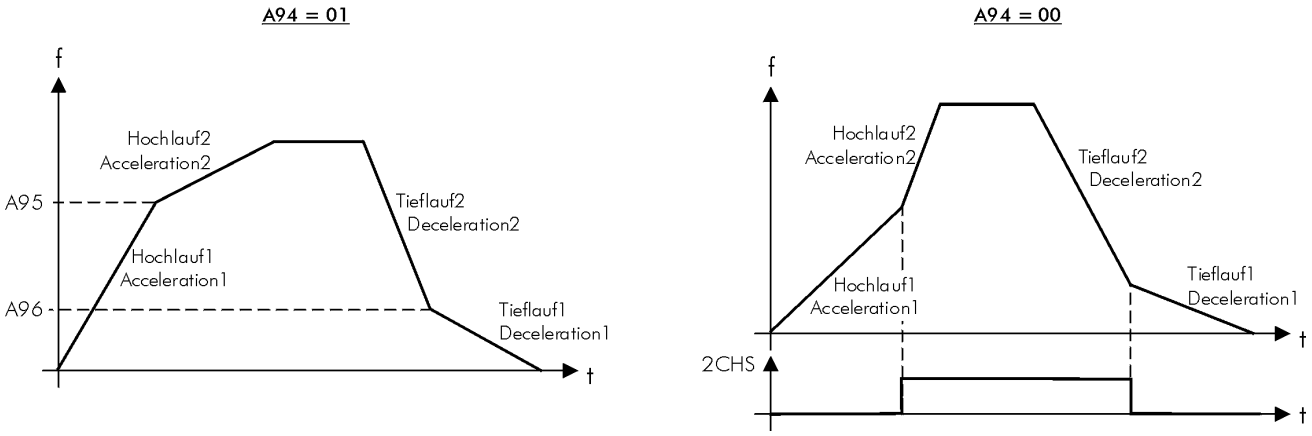
A82	AVR: Motor voltage	*CX single:* *CX compact:*	VIC	200...240 V 380...460 V	230 V 400 V

With parameter A82 the motor voltage is adjusted. (Output voltages higher than the mains voltage are generally not possible.)

>pDRIVE< CX single:	200/220/230/240V
>pDRIVE< CX compact:	380/400/415/440/460V

Ramp adjustment Speed ramps

Allows to switch the time ramps adjusted with F02 and F03 to the ramps adjusted with A92 and A93 during operation. This can be done either at any time using an external signal or when exact, set frequencies are reached.



A92	2nd Acceleration ramp	VIC	0.1...3000 s	15.0 s
A93	2nd Deceleration ramp	VIC	0.1...3000 s	15.0 s
A94	Select method of 2nd stage	VIC	00 or 01	00

Setting	Function
00	Switch-over via an external signal on a digital input (setting: 09)
01	Switch-over when the frequencies set at parameter A095 and A096 are reached

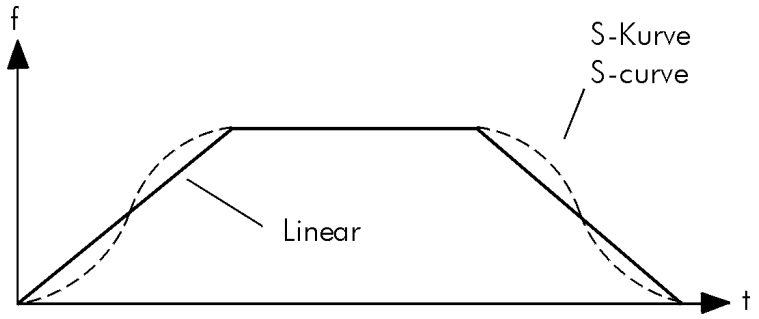
A95	Switch-over 1./2. acceleration ramp	VIC	0.0...360.0 Hz	0.0 Hz
A96	Switch-over 1./2. deceleration ramp	VIC	0.0...360.0 Hz	0.0 Hz

Particularly, this switch-over is used for EMERGENCY STOP functions and speed-related acceleration and deceleration times. The adjusted acceleration/deceleration time is related to the maximum frequency A04.

A97	Pattern of acceleration ramp	VIC	00 or 01	00
A98	Pattern of deceleration ramp	VIC	00 or 01	00

These two parameters determine whether the acceleration (A97) and/or deceleration (A98) are linear or follow an S ramp.

Setting	Function
00	linear
01	S ramp



Thermal protection
Electronic overload

b12	Electronic overload setting	VIC	0.5...1.2 x I_{FI}	FI-I_{NOM}

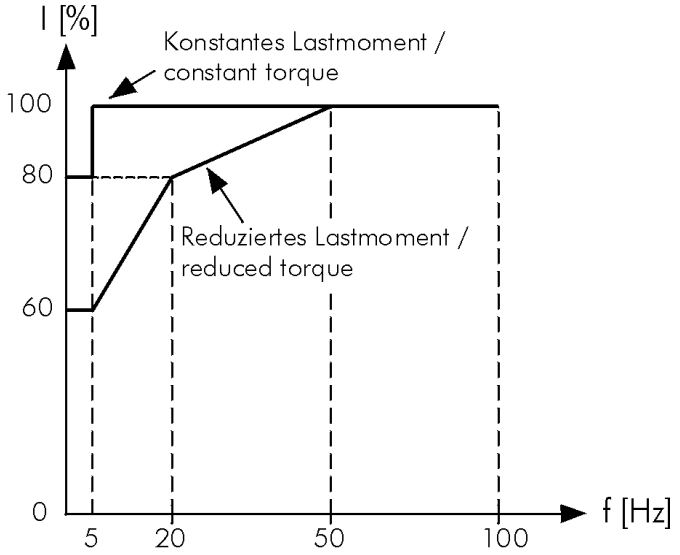
A thermal motor contactor ("maximum continuous current") can be set by entering the nominal motor current in A.

Note:
If the value is higher than the nominal motor current, the motor cannot be protected by an electronic motor contactor. In this case, thermistors or similar mechanism are required.
After a power cut, the thermal motor model always starts up again with a "cold" machine !!

b13	Electronic overload characteristic	VIC	00 or 01	01

Defines the characteristic curve of the thermal motor contactor.

Setting	Function
00	reduced load torque (self-ventilated)
01	constant load torque (force-ventilated)



+ A / 0	**Overload protection** **Overload restriction**

b21	Selection of overload restriction	VIC	00 to 02	01

This parameter defines when the current limitation is active.

Setting	Function
00	not active
01	during acceleration and constant speed
02	only at constant speed

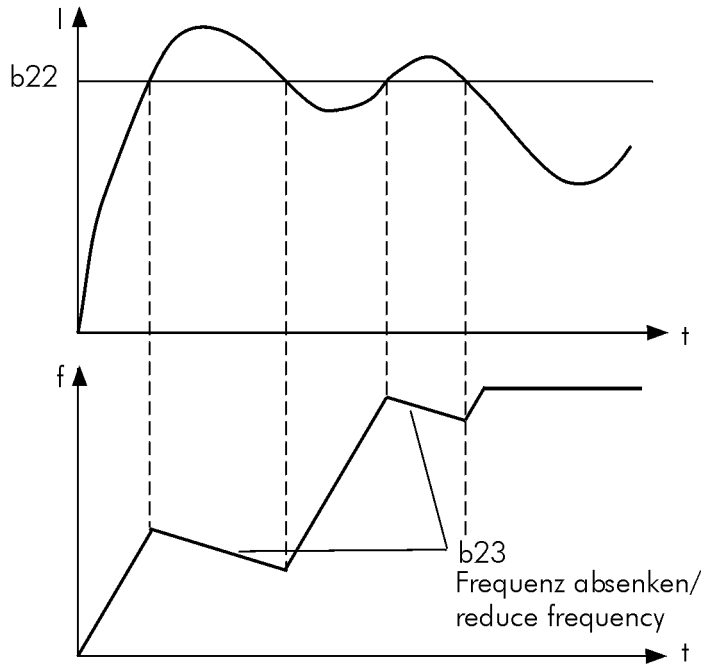
Note:
The overload restriction is not active during deceleration.

b22	Level of overload restriction	VIC	0.5...1.5 x I_{FI}	1.25 x I_N

Defines the value in amperes at which the inverter tries to reduce the load by decreasing the output frequency.

b23	Rate of decel. at overload restriction	VIC	0.3...30.0 s	1.0 s

When reaching the adjusted current limit, the frequency is reduced according to the set ramp.



	Digital inputs Input terminals

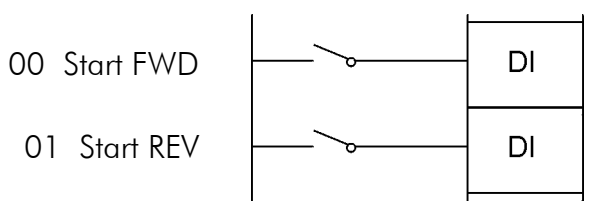
C01	Function of input 1	VIC	0 to 18	00
C02	Function of input 2	VIC	0 to 18	01
C03	Function of input 3	VIC	0 to 18	02
C04	Function of input 4	VIC	0 to 18	03
C05	Function of input 5	VIC	0 to 19	18

Parameter	Control terminal	Default
C01	1	00 Start forward
C02	2	01 Start reverse
C03	3	02 Fix A
C04	4	03 Fix B
C05	5	18 External reset

The programmable inputs (control terminals 1 to 5) can be allocated to the parameters in accordance with the following table:

Setting	Short-cut	Function
00	FWD	Start forward
01	REV	Start reverse
02	CF1	Fix A
03	CF2	Fix B
04	CF3	Fix C
05	CF4	Fix D
06	JG	Jog mode
09	2CH	2nd acceleration/deceleration ramp
11	FRS	Impulse lock - free run
12	EXT	External fault
13	USP	Restart lock at undervoltage (USP)
15	SFT	Software lock
16	AT	Switch-over to automatic ref. value 4...20 mA
18	RS	External reset
19	PTC	Thermistor (only available at input 5)

Explanations of the functions for the digital inputs

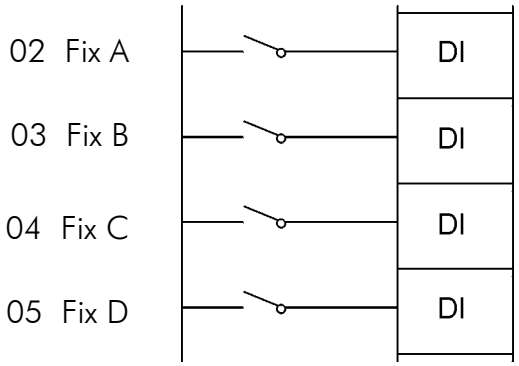


Start/Stop via switch contacts

When the contacts are closed, a Start command is issued in the right direction (acceleration on gradient), when open, a stop command is issued (deceleration on gradient). The simultaneous closing of Start forward and Start reverse also issues a Stop command to the inverter.

Multispeeds

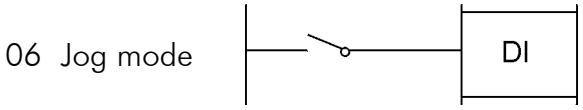
The multispeeds (maximum 15) are selected via the signals CF1...4 according to the table:



CF1	CF2	CF3	CF4	Ref. value
0	0	0	0	analog value
1	0	0	0	1 (A21)
0	1	0	0	2 (A22)
1	1	0	0	3 (A23)
0	0	1	0	4 (A24)
1	0	1	0	5 (A25)
0	1	1	0	6 (A26)
1	1	1	0	7 (A27)
0	0	0	1	8 (A28)
1	0	0	1	9 (A29)
0	1	0	1	10 (A30)
1	1	0	1	11 (A31)
0	0	1	1	12 (A32)
1	0	1	1	13 (A33)
0	1	1	1	14 (A34)
1	1	1	1	15 (A35)

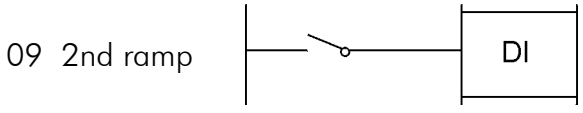
The number of digital inputs to be programmed depends on the number of multispeeds actually needed. The multispeeds are programmed in parameter group A. The multispeeds are pure reference values without any Start/Stop commands.
Therefore, Parameter A01 "Method of speed command" must be set to 01 "control terminals" !

Jog mode



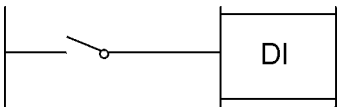
If the Jog command is activated, the inverter accelerates the motor with the fastest possible acceleration time to the set jog frequency A38.
The jog mode consists no Start/Stop commands.

Switch-over of ramps



Two sets of acceleration and deceleration ramps are available. The signal "2nd ramp" is used to switch between these two ramp sets. The values of acceleration and deceleration time must be set in parameter group A.
Contact closed: 2nd set of ramps active

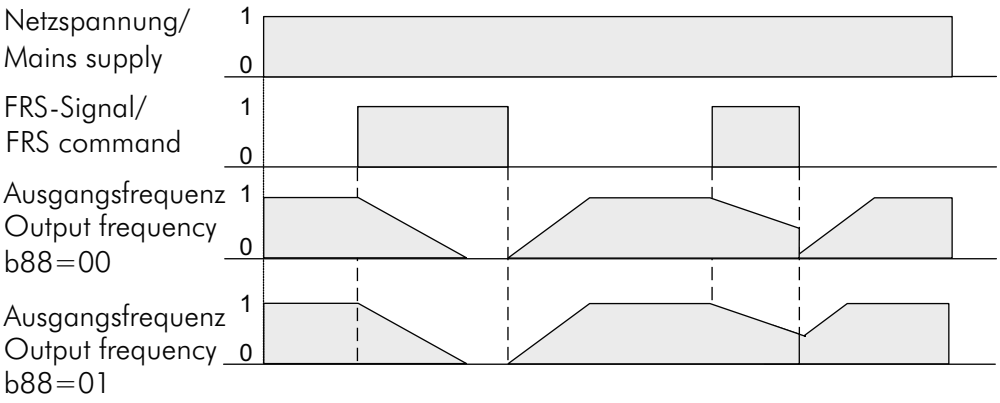
11 Impulse lock



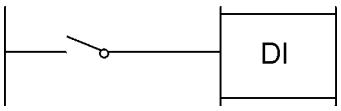
Impulse lock

If this command is activated, the inverter is locked immediately, allowing the motor to come to standstill freely. The function can be inverted (parameters C11 to C15). By setting parameter b88 to position 00, the inverter starts from 0 Hz once the FRS signal is cancelled.
However, if parameter b88 is set to position 01, the inverter starts with the actual frequency of the motor ("interception of the motor").

In both cases, the inverter starts after the waiting time set with parameter b03.



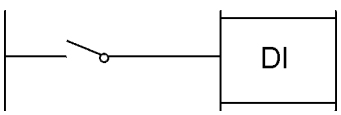
12 Ext. fault



External fault

The activated command leads to immediate fault shut-down with the error message "E12 - Ext. fault". Using this input, plant errors can be integrated in the control of the frequency inverter. The error message can be realised using the break or make contact (parameter C11 to C15).

13 USP

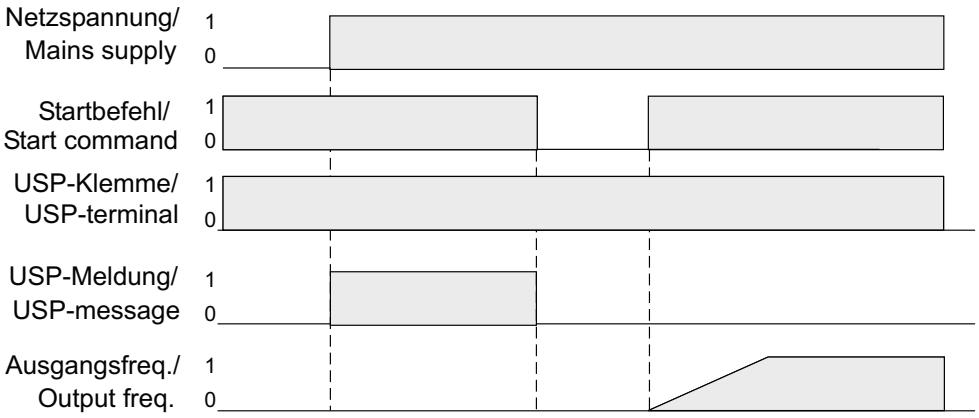


Restart lock for undervoltage (USP)

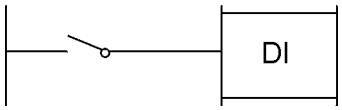
This function prevents an automatic motor start when the voltage returns after a power cut or undervoltage. A restart is only possible after resetting the error or by switching the Start command on/off.

Notes:

If the USP function is activated and the power supply comes back or is switched-on during a Start-command, the inverter trips with E13.
The USP function is also executed after an undervoltage trip E9.



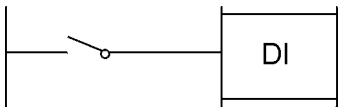
15 Software lock



Software lock

This function allows an additional lock for parameter changes via the terminals. Thus, it is possible e.g. to lock the parameter editing function via an external key switch.
Contact open: parametrization enabled,
Contact closed: parametrization locked.

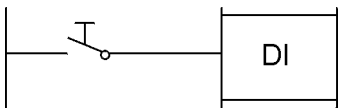
16 Automatic ref. value (4…20 mA)



Switch-over to automatic reference value (4..20 mA)

By closing the contact, it is possible to define the frequency ref. value using a current input signal (4...20mA). When the contact is open, the frequency is defined via a voltage input signal (0...10V). If the contact is closed, the frequency is defined via the 4...20 mA analog input (terminals OI – L). If the contact is open, the analog signal 0...10 V (terminals O – L) is conductive. If no digital input is parametrized for this function, the two reference values are added (f-correction).

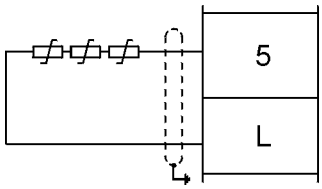
18 External reset



External reset

Allows you to confirm an error via the terminals. If an external Reset-command is given during operation, the inverter comes to standstill freely !! The signal must not be inverted and must not be issued for more than 4 seconds.
A permanent reset is not possible. If the inverter is running without problems, it comes to standstill freely when an RS signal is issued! If a start-command is given then, the inverter starts again at 0 Hz (only if there is no reset-command). This is particularly important for plant where a common reset signal is used for all devices.

19 Thermistor



Motor thermistor PTC

This function is only possible for digital input terminal 5 (parameter C05). If the total resistance of the thermistors exceeds 3 kΩ ± 10 % due to inadmissible heating of the motor, the inverter switches off and reports E35 "Reaction by thermistor trip".
If the thermistor connection is interrupted or not connected, an error message is also issued.

Notes:

You cannot use the same value for parameters C01 to C05.
If a parameter is to be shifted to another terminal, the "from" terminal must be set first, then the old value set for the "to" terminal.

C11	Condition of input C01	VIC	00 or 01	00
C12	Condition of input C02	VIC	00 or 01	00
C13	Condition of input C03	VIC	00 or 01	00
C14	Condition of input C04	VIC	00 or 01	00
C15	Condition of input C05	VIC	00 or 01	00

This parameters define the status of the programmable digital inputs C01 to C05.

Setting	State
00	N.O.
01	N.C.

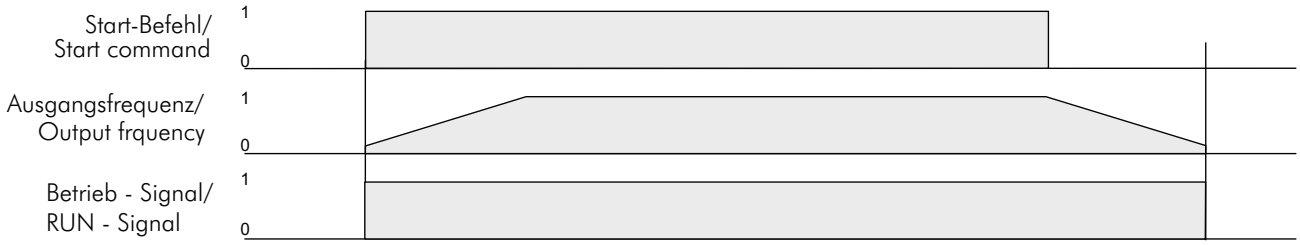
Digital outputs
Output terminals

C21	Function of terminal 11	VIC	00 to 05	01
C22	Function of terminal 12	VIC	00 to 05	00

The programmable relay outputs (terminals 11 and 12) can be programmed using parameters C21 and C22. The following functions can be programmed:

Setting	Short-cut	Function
00	RUN	Operation
01	FA1	"Reference value arrival" – signal
02	FA2	"Frequency exceeded"– signal
03	OL	Overload message
04	OD	PID deviation too high
05	AL	Error message

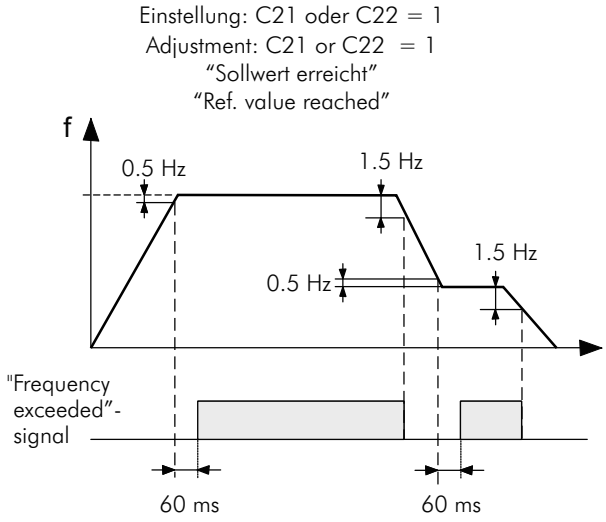
Function: RUN	C21 or C22 = 00	RUN "Operation"

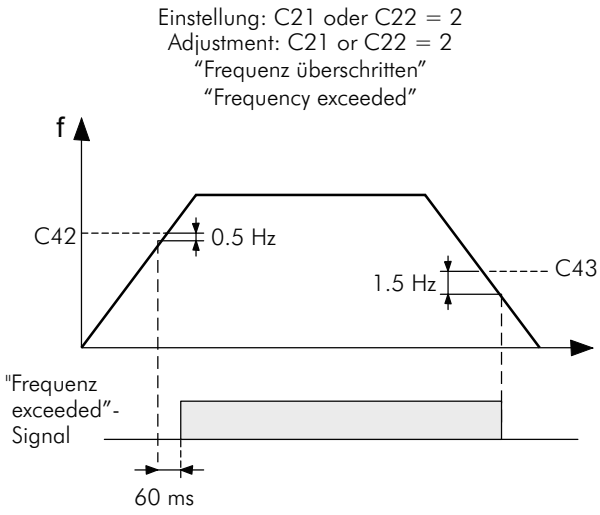


Note:
If the frequency value of the inverter is smaller than the start frequency (which is set with parameter b82), there is no "Operation"-signal (RUN).

Function: FA1	C21 or C22 = 01	FA1 "Ref. value arrival"
Function: FA2	C21 or C22 = 02	FA2 "Frequency exceeded"

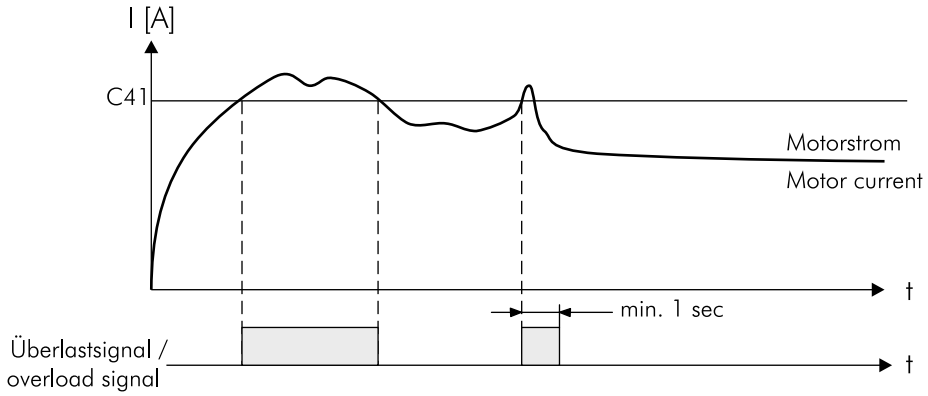
The frequency at which the signal is to be issued during acceleration is set using parameter C42 (hysteresis –0.5 Hz to +1.5 Hz).
The frequency at which the signal is to be issued during deceleration is set using parameter C43 (hysteresis +0.5 Hz to –1.5 Hz).





Function: OL	C21 or C22 = 03	OL "Overload message"

This message is issued as soon as the motor current exceeds the value set for parameter C41, both during motor and generator operation.



Function: OD	C21 or C22 = 04	OD "PID deviation too high"

This message is issued as soon as the difference between reference value and actual value exceeds the value set for parameter C44 (bipolar).

Function: AL	C21 or C22 = 05	AL "Error message"

If one of the outputs C21 or C22 is set to position 05, an error signal is issued if an error occurs. During mains failure the error signal will continue only as long as there is still power in the inverter.

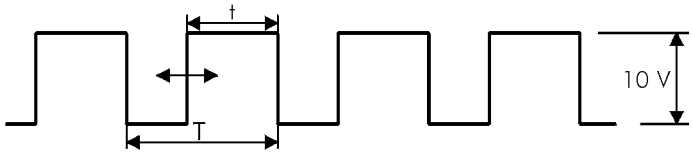
C23	Condition of output FM	VIC	00 to 02	00

Programming the condition of the analog/digital output FM.

Setting	Short-cut	Function
00	AF	analog display of frequency
01	AI	analog display of current
02	DF	digital display of frequency

Function: AF	C23 = 00 "Analog actual frequency"

There is a pulse-width modulated signal at the output, which is proportional to the output frequency with reference to the maximum frequency A04. The precision is approx. ±5 %, the output supplies 0...10 V, 1 mA. (an adjustment is possible with parameter b81.)

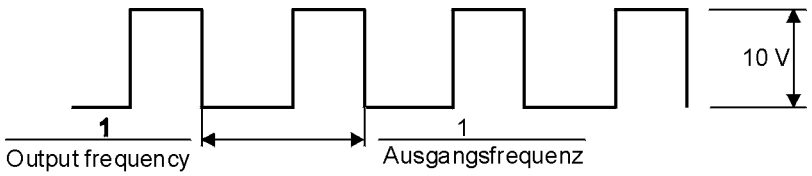


Function: AI	C23 = 01 "Analog actual motor current"

There is a pulse-width modulated signal at the output, which is proportional to the output current with reference to 200 % I_{NOM}. The output supplies 0...10 V, 1 mA with a precision of ±20 %.
(an adjustment is possible with parameter b81.)

Function: DF	C23 = 02 "Digital actual frequency"

There is a digital frequency signal corresponding to the output frequency. The output delivers a 1:1 square signal with 10 V amplitude. (a different multiplication factor, max. 3.6 kHz, can be set using parameter b86).

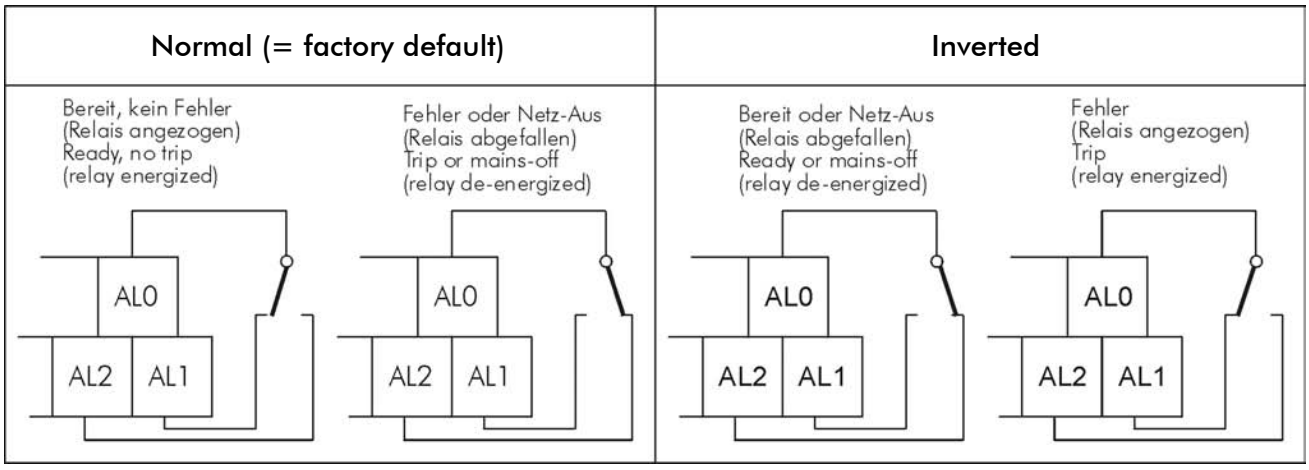


C31	Condition of output C21: Inversion	VIC	00 or 01	00
C32	Condition of output C22: Inversion	VIC	00 or 01	00

These parameters change the status of the programmable outputs.

Setting	Function
00	normal
01	inverted

C33	Condition of terminal AL	VIC	00 or 01	01

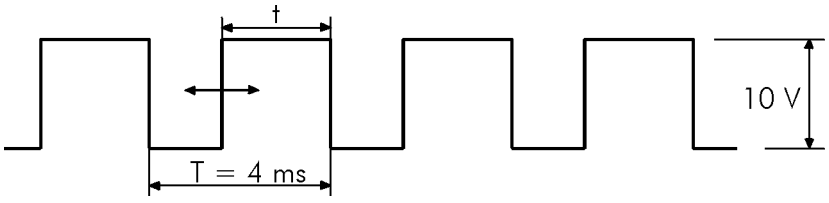


Function	Mains	State	Relay	AL0-AL1	AL0-AL2
"normal" (factory default)	ON	Ready	energized	closed	open
	ON	Trip	de-energized	open	closed
	OFF	----	de-energized	open	closed

Function	Mains	State	Relay	AL0-AL1	AL0-AL2
"inverted"	ON	Ready	de-energized	open	closed
	ON	Trip	energized	closed	open
	OFF	----	de-energized	open	closed

b81	Analog meter adjustment	VC	0...255	80

The voltage on terminal FM can be adjusted. By changing the impulse-pause ratio, the connected test device can be set to have its full amplitude at maximum output.



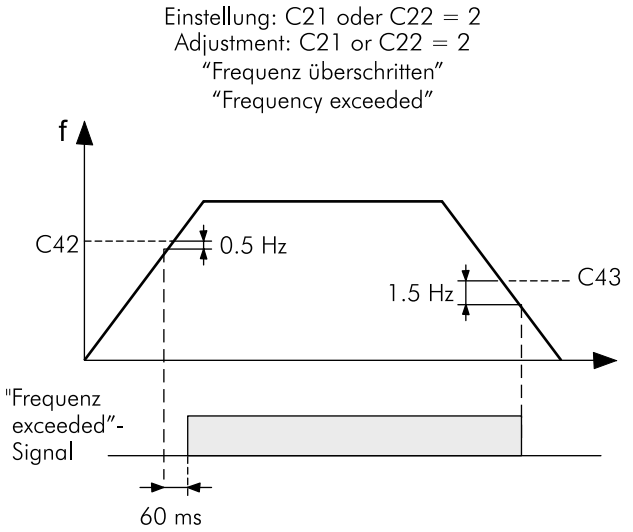
Output functions
Output functions

C41	Level of overload signal	VIC	0...2 x I_{NOM}	I_{NOM}

Setting the parameter within a range of 0 to 200 % with reference to the nominal current of the inverter. If the motor current exceeds the value of parameter C41, an overload signal is issued.

C42	Arrival signal for Acceleration	VIC	0.0...360.0 Hz	0.0 Hz
C43	Arrival signal for Deceleration	VIC	0.0...360.0 Hz	0.0 Hz

C42 defines the frequency at which the signal "Frequency exceeded" is issued during acceleration. The frequency at which the "Frequency exceeded" signal should go off again during deceleration is set using parameter C43.



Undervoltage / Autoreset
Re-Start method

b01	Selection of restart mode	VIC	00 to 03	00

Influences the behaviour of the frequency inverter in the event of an error.

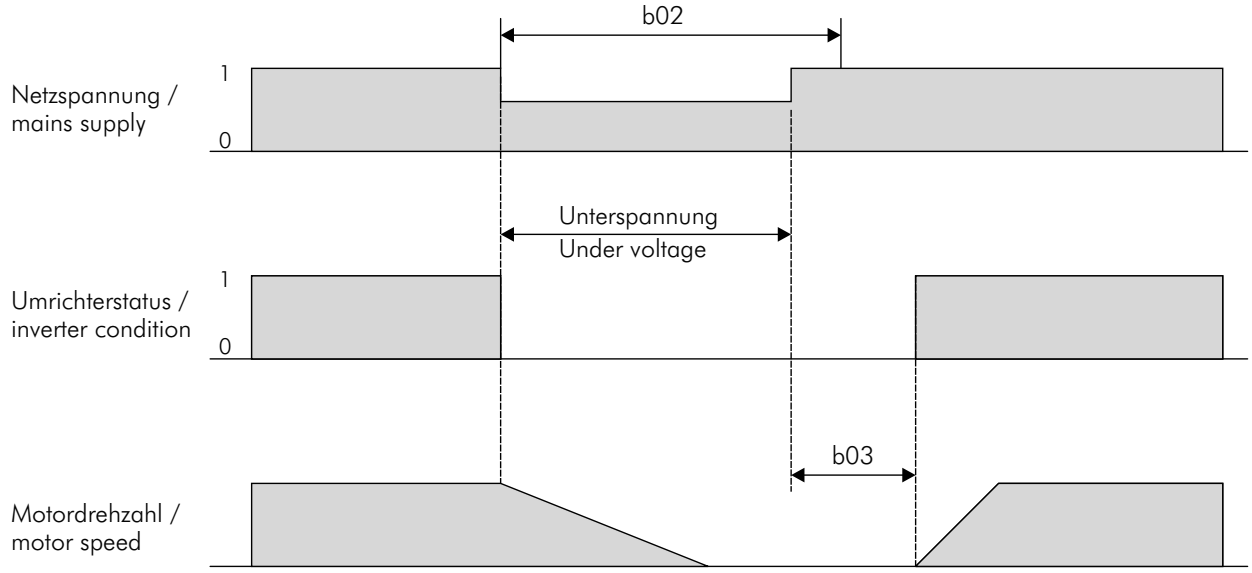
Setting	Function
00	Error message immediately
01	Autoreset with 0 Hz after the waiting time b03
02	Autoreset with "interception" of the motor after the waiting time b03
03	Autoreset with "interception" of the motor after the waiting time b03 with following deceleration to 0 Hz and output of an error message signal

The inverter tries to reset 3x on I>> and U>>. At U<< the inverter tries to reset 16 times.

Note:
Attention! Synchronisation to the motor speed is only possible if the speed is less than 40% of the nominal speed and if the remanent motor voltage has not decreased too much (approx. 2...3 seconds).

b02	Allowable undervoltage time	VIC	0.3...25.0 s	1.0 s
b03	Retry waiting time	VIC	0.3...100.0 s	1.0 s

In the event of a low-voltage trip during operation, e.g. mains failure, the inverter switches to impulse lock and comes to standstill freely. If the voltage returns within the time set with b02, the inverter can be started again. Otherwise, the unit shuts down with the message undervoltage.
If parameter b01 is set to 01, the time period b03 can be set after which the frequency inverter tries to start-up again (after return of power). Of course, this will only happen if the power returns within the set time.



f_X General functions
Miscellaneous

F04	Running direction of RUN key	–	00 or 01	00

Setting for direction of motor when controlling the motor via the RUN button on the control panel:

Setting	Function
00	Forward
01	Reverse

b32	Reactive current setting	VIC	0.1...1.0 x I_N	0.58 x I_N

The parameter adjusts the reactive current (no-load current) of the motor in ampere.
The right setting (especially at small motors, multi-motor operation, at motors with nominal power smaller than the inverter or at motors in 400V / 87Hz operation) improves the current display, the motor protection and the overload limitation.

At small motors a wrong setting leads to an early trip caused by the internal motor protection function.

b82	Start frequency adjustment	VIC	0.5...9.9 Hz	0.5 Hz

The devices start with a minimum of 0.5 Hz.
The value can be increased to a maximum of 9.9 Hz in increments of 0.1 Hz.

Note:
The acceleration and deceleration time is shorter, if the start frequency is increased.
Too high start frequency may cause a sweep (breakover) of the motor. Therefore, the starting frequency should not be set higher than the slip frequency.

b83	Carrier frequency setting	VIC	0.5...16.0 kHz	5.0 kHz

Setting the switching frequency of the IPM module.

Note:
A lower switching frequency will reduce the disturbances and earth currents caused by the cables, but will increase the motor noise on the other hand.
If the carrier frequency is higher than 12 kHz, the nominal current of the inverter must be decreased by min. 20%.

b86	Frequency converted value setting	VC	0.1...99.9	1.0

Conversion factor for the frequency display (see parameter d07).

d07 = frequency * b86

This factor is also used to adjust the "digital actual frequency" signal, which can optionally be issued via the analog output FM up to a max. frequency of 3.6 Hz in proportion to the current frequency.

b87	Selection of STOP key	VIC	00 or 01	00

Defines the function of the STOP button on the control panel.

Setting	Function
00	STOP key always active
01	STOP key only in local operation active

b88	After FRS cancelled	VIC	00 or 01	00

Defines the behaviour of the inverter after resetting the idle command (FRS).

Setting	Function
00	Restart at 0 Hz
01	Restart at the actual frequency ("interception")

b89	Digital Operator Display	VC	01 to 07	01

Using the control panel of the ELVOvert PX or SX, which can be connected to the frequency inverter using an external cable, one of the following operating data can be displayed externally.

Setting	Function
01	Output frequency (d01)
02	Motor current (d02)
03	Running direction (d03)
04	Feedback of PID controller (d04)
05	Condition of digital inputs (d05)
06	Condition of digital outputs (d06)
07	Output frequency x Frequency converted value (d07)

Software lock, Factory default

b31	Software lock	VIC	00 to 03	01

Locks or releases adjustment of parameters.

Setting	Function
00	All parameters locked (excepted parameter b31) as long as there is a lock signal at the control terminals (set one of the parameters C01...C05 to position 15)
01	All parameters locked (excepted parameter b31 and frequency reference value F01) as long as there is a lock signal at the control terminals (set one of the parameters C01...C05 to position 15)
02	All parameters locked (excepted parameter b31) as long as parameter b31 is set to position 02
03	All parameters locked (excepted parameter b31 and frequency reference value F01) as long as parameter b31 is set to position 03

b84	Factory default setting	VIC	00 or 01	00

Setting	Function
00	Delete error message
01	Reset to factory default (see "Commissioning")

b85	Kind of factory default	VIC	00 to 03	01

Selection of factory default.

Setting	Function
00	–
01	Factory default of parameters for Europe
02	Factory default of parameters for USA
03	–

Notes:

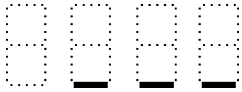
Fault memory

d08	Trip message	–	read only	–

Displays the last error message with output frequency, motor current and DC link voltage during fault at the display.

Sequence:

"d08" is displayed
↓
1* FUNC button
↓
Error message
↓
1* FUNC button
↓
Output frequency during fault
↓
1* FUNC button
↓
Motor current during fault
↓
1* FUNC button
↓
DC link voltage during fault
↓
1* FUNC button
↓
"d08" is displayed

If no trip has occurred, the display indicates: 

d09	Trip history	–	read only	–

Displays 2nd and 3rd last error message on the LED display.

Sequence:

"d09" is displayed
↓
1* FUNC button
↓
2nd last error message is displayed
↓
1* FUNC button
↓
3rd last error message is displayed
↓
1* FUNC button
↓
"d09" is displayed

Error messages

The frequency inverters have protection functions against e.g. overcurrent, overvoltage, undervoltage,... In case of a trip, the output voltage is switched off, the motor stops idle and the inverter stays in trip state until the trip is resetted.

No.	Trip	Possible cause	Remedy actions
E1	Overcurrent or overvoltage of the IPMs in static operation	Sudden load spikes, stalling motor, short circuit on the motor terminals, earth fault, nominal motor current is higher than nominal current of inverter	Avoid sudden overloads, select inverter and motor with higher power capacity, check motor cable and motor for short circuit or earth fault, decrease parameter A45
E2	Overcurrent or over-temperature during deceleration	Set deceleration time is too short, short circuit at motor terminals, earth fault, nominal motor current is higher than nominal current of inverter	Increase deceleration time, check motor cable and motor for short circuit or earth fault, decrease parameter A45
E3	Overcurrent or over-temperature of the IPMs during acceleration	Set acceleration time too short, short circuit at motor terminals, earth fault, set voltage boost too high, stalling motor, nominal motor current is higher than nominal current of inverter	Increase acceleration time check motor cable and motor for short circuit or earth fault, check the load and starting torque, decrease parameter A42
E4	Overcurrent or over-temperature during stand-still	Too high ambient temperature	Check ambient temperature, decrease parameter A45
E5	Triggering of the int. motor protection	Motor overload Wrong setting of b12 or b13 Wrong setting of b32	Select an inverter and motor with higher power capacity Set correct values and applications Set b32 to "No-load motor current"!
E7	DC link overvoltage	Set deceleration time is too short, motor is in generator-mode	Increase deceleration time, use a braking resistor, do not activate AVR during deceleration, adjust higher motor voltage (A82)
E8	EEPROM error	Above-average high data storage, power supply failure during data storage, high electromagnetic fields, or too high ambient temperature	The life time of the EEPROM is about 10000 storages(related to 10 years with a few storages a day)

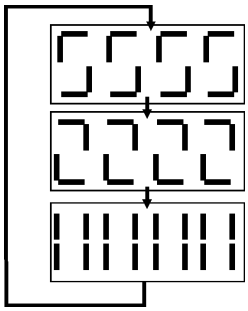
No.	Trip	Possible cause	Remedy actions
E9	Mains undervoltage	Wrong mains voltage, short mains losses	Check input voltage
E11 E22	Trip of calculator	Electromagnetic fields, frequency inverter defect	Check of possible external disturbances, contact the customer service
E12	External fault	An external fault is send via a digital input of the inverter	Check the reason of the trip and solve the problem
E13	Trip by restart lock	Switch-on of mains voltage at active lock or mains failure at active lock	The corresponding terminal must not be interconnected before switching on mains, check mains voltage supply
E14	Earth fault on the motor terminals	Earth fault	Remove earth fault and check the motor
E15	Mains overvoltage	Mains voltage is higher than the nominal voltage of the inverter	Check the mains voltage
E21	Overtemperature in power part	Inverter overload, ambient temperature too high	Check the motor current, check ambient temperature, check fans
E30	Current consumption of internal voltage supply is too high	Fan defective, IPM defective	Exchange fan, change device
E35	Motor thermistor activated	Motor overload, Is the self-ventilation of the motor - especially at low speed - to less, built-in distance to short	Check load of the motor, check built-in distances

Error messages can be removed with Reset. There are several possibilities:

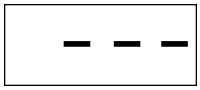
- Link the programmed input for short time with P24
- Press the STOP/RESET key on the keypad
- Switch-off the power supply

Note:
An inverter which operates without any failure, will decelerate to 0 Hz if an reset signal is released !!
If the error message stays after reset was released, please call your customer service department or the supplier of the unit.

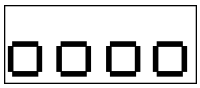
Further displays



Is displayed during initialisation, when switching on and if a reset signal is issued.

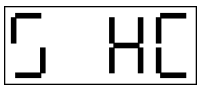


Is displayed in the event of low voltage or mains failure.



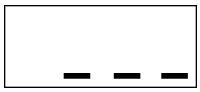
The waiting time for automatic restart expires.
(see parameter b01 to b03)

Is displayed during initialisation of parameters and indicates the initialisation version:
EU ... European version
USA ... American version



Is displayed during deleting the error list.

Is displayed during copying.



No data available (e.g. display under d08, d09 if the fault memory is empty or display under d04 if the PID controller is not active).

Special safety instructions

Short mains failure

During a mains failure, the *>pDRIVE< CX* frequency inverter continues operating until the intermediate circuit voltage drops below the minimum working level (approx. 20 % below the lowest supply voltage). The time depends on the mains voltage before switching off, and on the load.
If a Start command is issued, the motor runs up again as soon as the power supply returns. This can be blocked with the function "USP". If a digital input is parametrised for the function 13 USP "Restart lock" and this signal is also issued, an error message (E13) is issued whenever the mains supply is switched on, if a Start command has already been issued. (See description of parameters C01 to C05)

Automatic restart

- After low mains voltage:
  If a Start command is issued, there is an automatic restart every time the mains supply returns.
- After confirming an error
- After autoreset (parameter b01)

Frequencies > 60 Hz

When operating motors with frequencies over 60 Hz, the suitability of the corresponding components must be checked first. An inquiry with the motor or machine manufacturer is important. 4-8 pole motors are usually suitable for operation up to 100 Hz.

Insulation tests

All *>pDRIVE< CX* frequency inverters are tested for voltage stability and insulating resistance in accordance with EN 50178. Insulating resistance measurements, e.g. within the scope of an inspection, must be carried out between the short-circuited power terminals and earth only. For a correct, complete insulation test, the CE filters must be disconnected.

Do not carry out any insulation resistance tests with the control terminals !!

Installation rules for compliance with CE regulations

The *>pDRIVE< CX* frequency inverters together with the available filter options CE-0 and CE-DR comply with the EMV directive 89/336/EEC and the low-voltage directive 73/23/EEC, i.e. conformity with EN 61800-3 and EN 50178

- Use of the option "CE-0 Filter" and "CE-DR Filter" or use of an equivalent filter solution Assembly on a properly grounded metal assembly plate with good HF connection between the motor cable screen and filter.
- Use and proper connection (bipolar !!) of screened motor cables
- Use of an AMF (Output Motor Filter) for greater motor cable lengths
- Use and proper connection of screened control cables
- Grounding the frequency inverter with at least 10 mm2 personal safety
  (only at *>pDRIVE< CX compact* devices)
- Separate installation of motor cables and other cables, especially control wires

Technical Data

>*pDRIVE*< *CX single*	0,4	0,7	1,5	2,2

Power data				
Motor rating (recommended)	0.4 kW	0.75 kW	1.5 kW	2.2 kW
Continuous output power	1.0 kVA	1.6 kVA	2.8 kVA	4.0 kVA
Continuous output current	2.6 A	4.0 A	7.1 A	10.0 A
Nominal input current				
without line choke	5.8 A	9.0 A	16.0 A	22.5 A
with line choke	5.0 A	8.0 A	13.0 A	17.0 A
Maximum current	150 % I_N (>60 s / 10 min; max. 220 %)			
Starting torque	> 150% T_N			

General data					
Input voltage		1 or 3 AC 220 -10% ... 240V +5%; 50/60 Hz ±5%			
Output voltage		3 AC, 0...100 % of mains voltage			
Output frequency		0.5...360 Hz, adjustable			
Base frequency		50...360 Hz, adjustable			
Losses	at 5 kHz	30 W	45 W	65 W	85 W
	at 12 kHz	35 W	55 W	75 W	100 W
Weight	approx.	0.8 kg	1.3 kg	2.3 kg	2.8 kg
Dimensions	Height	120 mm	130 mm	180 mm	180 mm
	Width	80 mm	110 mm	140 mm	140 mm
	Depth	115 mm	140 mm	160 mm	175 mm
Design / Protection degree		Built-in unit for vertical mounting / IP20			
Operating / Storage temp.		-10...+40°C / -20...+65°C			
Temperature increase		+50°C with max. 2 kHz carrier frequency and 80 % I_N			
Pollution degree		2 according to EN 50178			
Cooling		natural			
Humidity		20...90%, non-condensing			
Altitude		≤1000 m (above: power reduction of 1% per 100 m; max. 2000 m)			

Braking function			
Braking torque	100% without option	70% without option	20% without option
DC braking	f, t and I adjustable		

>*pDRIVE*< *CX compact*	0,7	1,5	2,2	3,0	4,0	5,5	7,5

Power data							
Motor rating (recomm.)	0.75 kW	1.5 kW	2.2 kW	3.0 kW	4.0 kW	5.5 kW	7.5 kW
Contin. output power	1.7 kVA	2.6 kVA	3.8 kVA	5.4 kVA	5.9 kVA	10.3 kVA	12.7 kVA
Contin. output current	2.5 A	3.8 A	5.5 A	7.8 A	8.6 A	13 A	16 A
Nominal input current without line choke	3.3 A	5.0 A	7.0 A	10.0 A	11.0 A	17.0 A	20.0 A
with line choke	3.0 A	4.0 A	6.0 A	8.0 A	9.0 A	14.0 A	18.0 A
Maximum current	150 % I_N (>60 s / 10 min; max. 220 %)						
Starting torque	> 150% T_N						

General data								
Input voltage	3 AC 380...460V ±10%; 50/60 Hz ±5%							
Output voltage	3 AC, 0...100 % of mains voltage							
Output frequency	0.5...360 Hz, adjustable							
Base frequency	50...360 Hz, adjustable							
Losses at 5 kHz	52 W	75 W	105 W	130 W	155 W	260 W	320 W	
at 12 kHz	60 W	90 W	120 W	150 W	185 W	300 W	360 W	
Weight approx.	1.7 kg		2.8 kg			6.0 kg		
Dimensions Height	130 mm		180 mm			257 mm		
Width	110 mm		140 mm			182 mm		
Depth	165 mm		175 mm			175 mm		
Design / Protection degree	Built-in unit for vertical mounting / IP20							
Operating/Storage temp.	-10...+40°C / -20...+65°C							
Temperature increase	+50°C with max. 2 kHz carrier frequency and 80 % I_N							
Pollution degree	2 according to EN 50178							
Cooling	natural	forced						
Humidity	20...90%, non-condensing							
Altitude	≤1000 m (above: power reduction of 1% per 100 m; max. 2000 m)							

Braking function			
Braking torque	100% without option	70% without option	20% without option
DC braking	f, t and I adjustable		

General technical data	
Standards	CE-EMC directive in connection with optional RFI filters and under consideration of the installation remarks CE low voltage directive, UL
Product standard	EN 61 800-3 "Power drive system"
NSR directive	73/23 EWG
Vibration / Shock	5.9 m/s^2 (0.6 G) 10...55 Hz
Protection class	class 1 in accordance with EN 50178
Environmental class	3K3 in accordance with DIN IEC 721-3-3
Overvoltage class	III in accordance with EN 50178
Frequency resolution	digital: 0.1 Hz, analog: f_{MAX}/1000
Frequency stability	digital ±0.01 % of f_{MAX}; analog ±0.2 % of f_{MAX}
Reference voltage	+10 V, max. 10 mA
Auxiliary voltage	+24 V, max. 50 mA
Control method	V/f-characteristic, PWM sine modulated
V/f-characteristic	V/f-characteristics for constant and squared increasing torque; output voltage, base and maximum frequency base frequency adjustable
Carrier frequency	5 kHz, 0.5...16 kHz adjustable
Control	Keypad or terminals
Analog inputs	0...+10 V / 4...20 mA, Ri = 10 kΩ / 250 Ω
Digital inputs	5; +24 V, positive logic, 1 PTC input adjustable
Analog output	0...10 V, 1 mA, pulse modulated
Digital outputs	2; max. 27V DC, 50 mA, Open-Collector
Relay output	Changer, 250 V AC; 2.5A or 30V DC; 3.0 A
Protection functions	for overcurrent, over- and undervoltage, earth fault, trip of fan, overload, electronic motor protection
Options	RFI footprint filter with line choke, output motor filter AMF, isolating amplifier TV5 / TV6
Bus option	GW-PBO2 Gateway for Profibus DP

Remarks on power supply

Mains impedance

Virtually all frequency inverters produce harmonic oscillation when connected to the mains, which can interfere with other devices due to the voltage distortions thus caused.
Please note that all converters with connected intermediate circuit voltage (diode rectifier at input) are a load on the mains supply in their total output. The use of a line choke (integrated in the CE-DR filter) is therefore highly recommended, even when using an industrial supply network.

It is absolutely necessary if:

- the mains unsymmetry can be >3%
- the output of the upstream transformer is ≥500 kVA
- there are strong mains voltage drops
- the inverter is operated on a generator
- the inverter is used in residential areas
- several inverters connected via a short bus bar are supplied by the mains network

Without a line choke, the above operating conditions can cause damage to the inverter !!

Safety remarks / FI safety switch

Frequency inverters, particularly those with CE filters (RFI filters) and screened motor cables, conduct an increased leakage current to earth. This depends on:

- the length of the motor cable
- the type of installation and whether the motor cable is screened or not
- the set clock frequency
- the use of a radio interference suppression filters (yes or no)
- the grounding of the motor on location (grounded or not)

Especially at the moment of switching on the filter's capacitors and during operation, the earth capacities can lead to an unwanted FI safety switch trip. On the other hand, it is possible to block this trip function through mains rectification at the input of the inverter with d.c. components.

Therefore, please note the following:

- Use only short-time delayed and clock-sensitive FI safety switches with considerably higher rated trip current.
- Protect other consumers with a separate FI safety switch.
- FI safety switches upstream from a inverter are not an absolute safeguard against direct contact!! Therefore, they should always be used in conjunction with other protective measures.
- The *>pDRIVE< CX* frequency inverters do not have a current-limiting effect (with fault currents), and thus do not violate the grounding conditions.

In plants with cables of medium length, the leakage current can easily be greater than 300 mA, depending on the conditions !!

Remarks to the inverter output side

Motor cable lengths

The distances between inverter and motor indicated in the table in the chapter "CE-0 and CE-DR Options" must be complied with. Too long motor cables can damage the inverters!

Option: AMF (output motor filter)

To reduce the voltage rate of rise on the inverter output and the effects on parallel lines thus possible, it is of advantage to use the AMF.
With long motor cables, the AMF protects the inverter and motor, and is absolutely imperative. See table "Allocation Inverter Options Motor Cable Motor".
Especially with multimotor drives and the respective parallel motor cables, non-compliance with the cable lengths can lead to destruction of the inverter.

Compensation capacitors

Compensation capacitors, mains filters and overvoltage protection equipment must never be connected to the output of the inverters !!!

Switching at the inverter's output

Operational switching between the inverter and the motor is not permissible. This would cause stress load on the power semiconductor, and possible safety shut-down of the inverter !! This would shorten the inverter's life !!!

Exception: A revision switch that is only used in very rare cases. Here, too, the CX should be locked first, if possible (digital input programmed to 11 FRS "Impulse lock - idle").

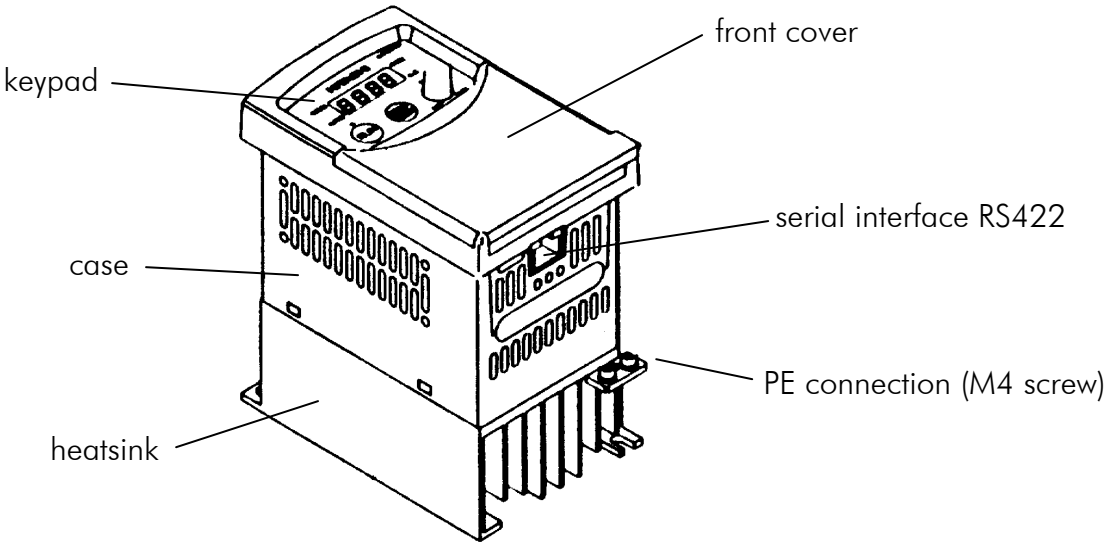
Change of direction

Reversal protection switches for change in direction must not be used (see "Switching at the inverter's output"). In order to change the direction of rotation, a digital input on the control terminal strip or a parameter for direction selection (parameter F04) is provided.

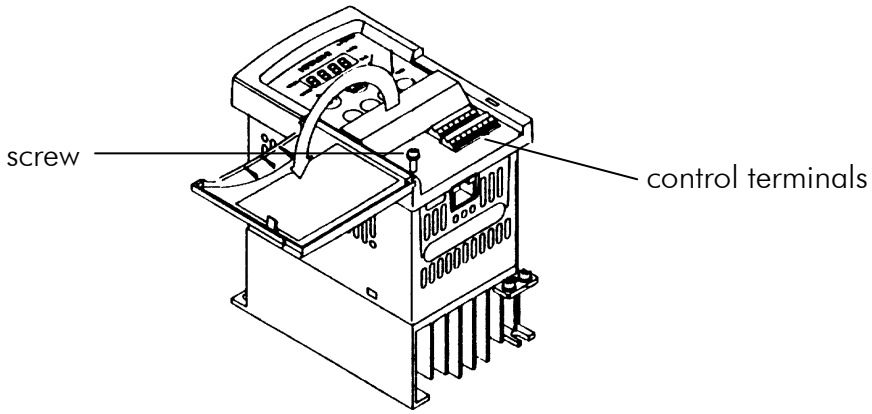
Note:
Too long motor cables may damage the inverter.

Mechanical Construction

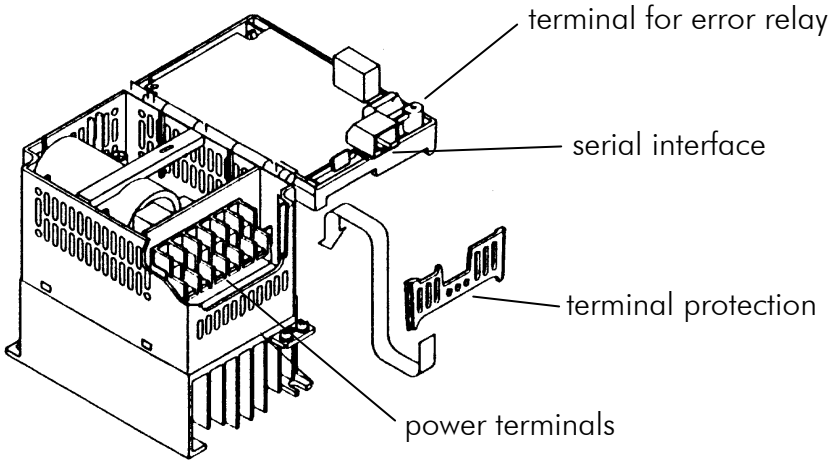
Designation of components



The keys for programming the frequency inverter and the control terminals are under the front cover. For programming and for wiring the control terminals, the front cover must be opened to the left.



In order to wire the power terminals and the fault message relays, loosen the screw and open the control unit to the right.



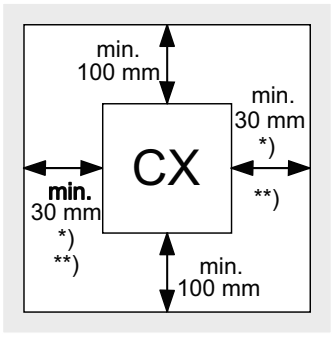
General Mounting Information

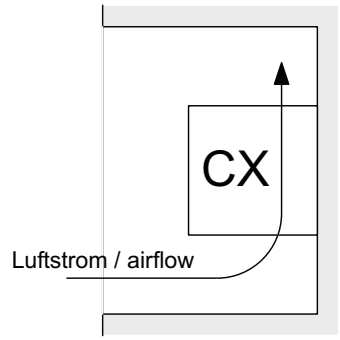
Make sure, that the input voltage is 1 AC 220...240 V or 3 AC 380...460 V, ± 10 %, 50/60 Hz ±5 %. Ambient factors such as high temperatures, high humidity, dust, dirt and aggressive gases must be avoided. The inverter should be installed in a well ventilated place that is protected against direct sunlight. Install the inverter on a fire-proof, vertical wall that does not transmit vibrations.

Warning! Do not apply mains power to the output terminals U, V, W.

Issue the operating signals START/STOP via the control terminals or the control panel, not by switching the mains or the motor contactor. Do not install capacitors or surge absorbers in the motor wires.

Distances from other devices or against the wall





*) The CE-DR filters can be mounted next to each other without distance.

**) For opening the front cover or the control unit a distance of 80 mm on the left side and 120 mm on the right side is necessary.

Because of thermal convection, the frequency inverters *>pDRIVE< CX* are designed for vertical wall assembly. Especially when installing the inverter in a niche, you must comply with the specified minimum distance from side wall or other equipment. Objects that penetrate the interior of the inverter can cause damage.

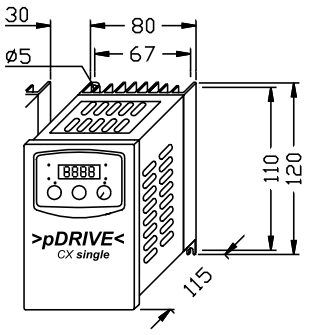
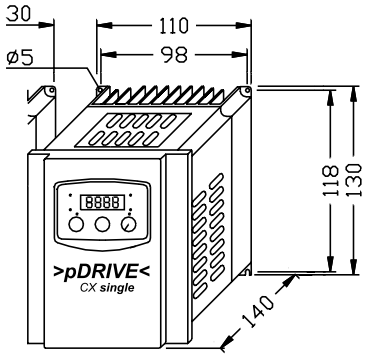
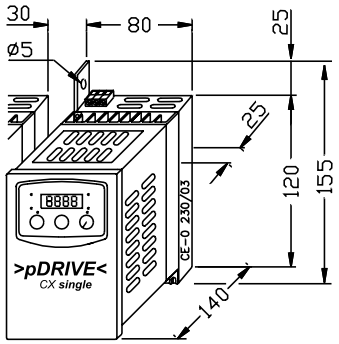
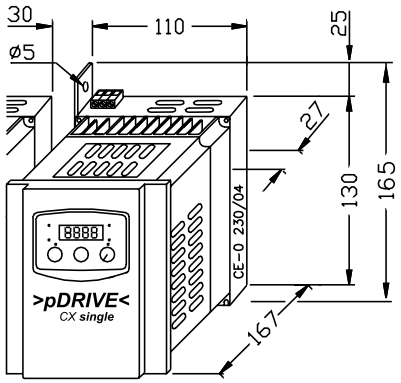
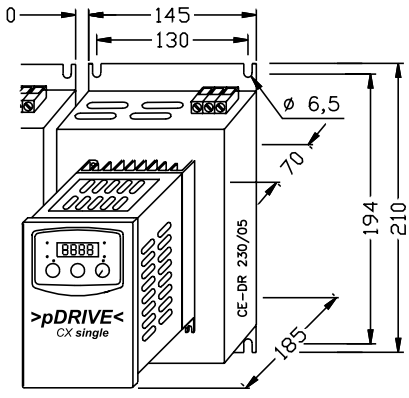
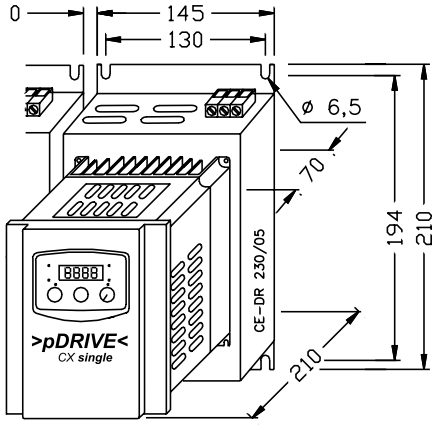
The *>pDRIVE< CX* are delivered with a top cover to protect against falling components during assembly. **This cover must be removed before operation !!!**

The permissible temperature range (-10°C to +40°C, +50°C with 2 kHz clock frequency and 80 % I_N) must not be undercut or exceeded. The higher the ambient temperature, the shorter the lifetime of the inverter.

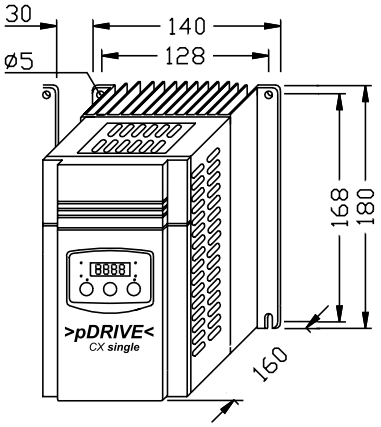
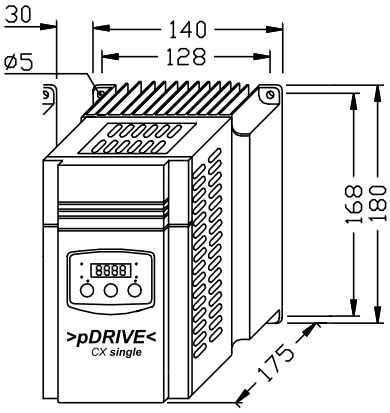
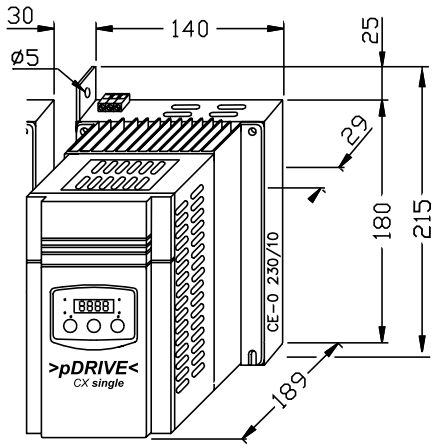
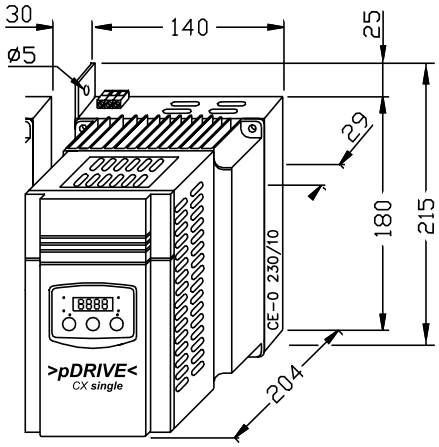
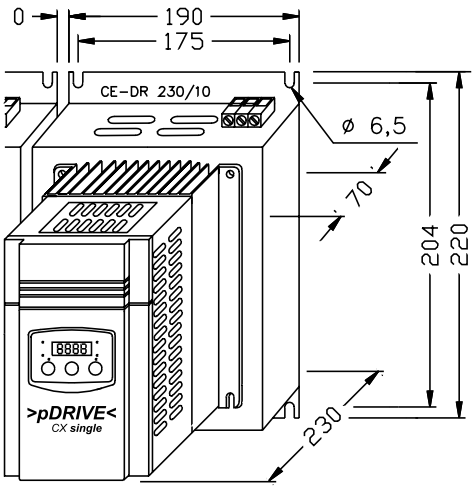
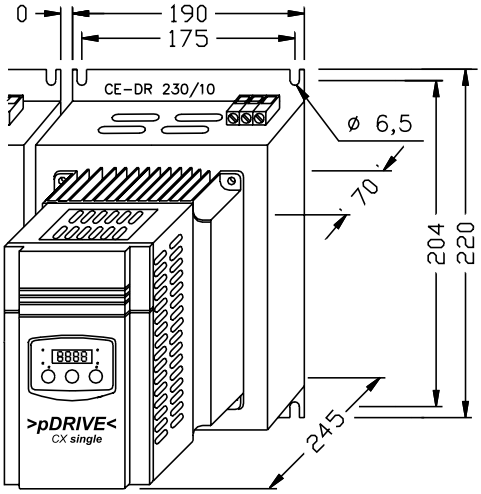
Do not install the inverter near heat-radiating equipment.

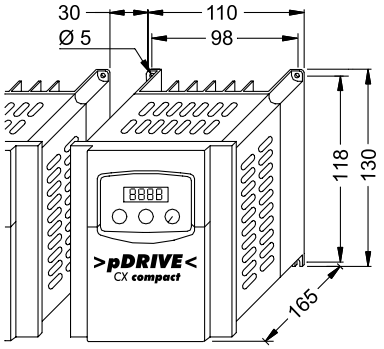
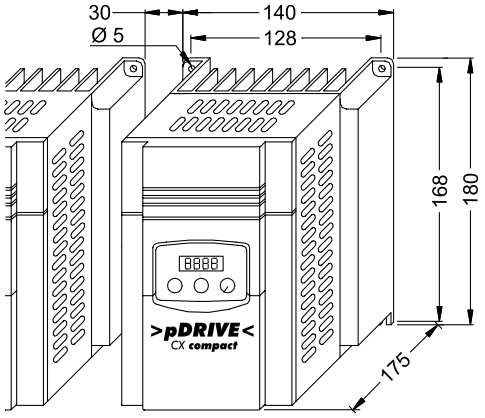
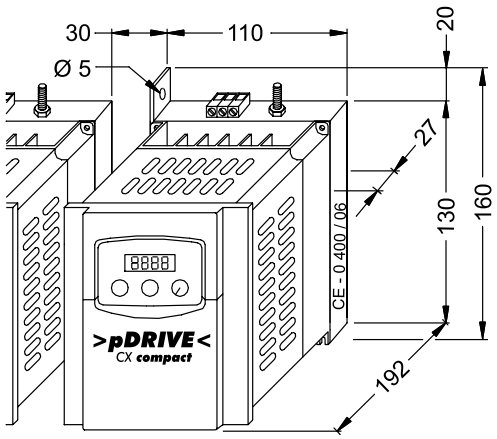
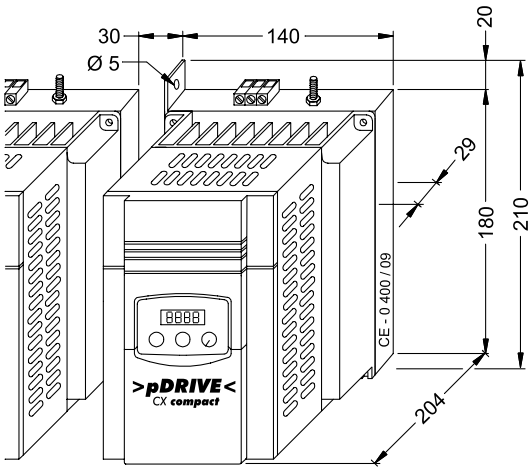
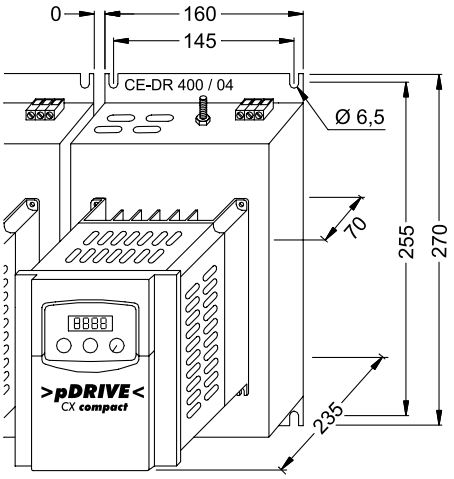
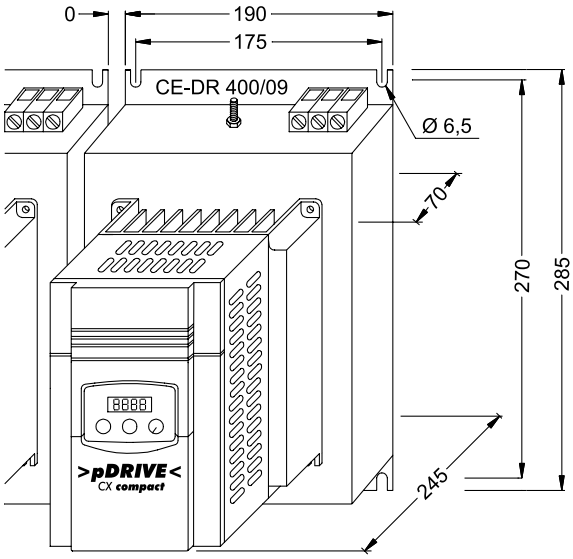
When installing the inverter in a cubicle, please note the size and heat elimination capacity of the cubicle. Provide ventilation, if necessary.

Dimensions

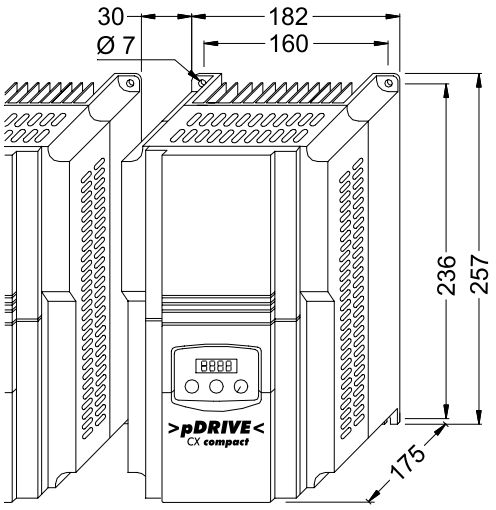
>pDRIVE< CX single 0,4	>pDRIVE< CX single 0,7
	
with CE-0 230/03 filter	with CE-0 230/04 filter
	
with CE-DR 230/05 filter incl. line choke	with CE-DR 230/05 filter incl. line choke
	

Mounting

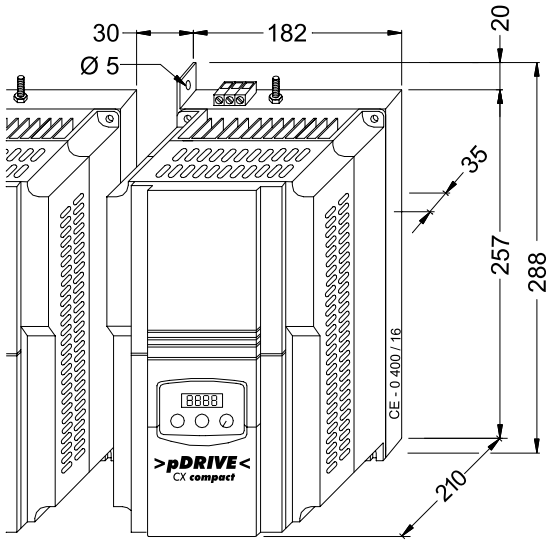
>pDRIVE< CX single 1,5	>pDRIVE< CX single 2,2
	
with CE-0 230/10 filter	with CE-0 230/10 filter
	
with CE-DR 230/10 filter incl. line choke	with CE-DR 230/10 filter incl. line choke
	

>pDRIVE< CX compact 0,7 and 1,5	>pDRIVE< CX compact 2,2 to 4,0
	
with CE-0 400/06 filter	with CE-0 400/09 filter
	
with CE-DR 400/04 filter incl. line choke	with CE-DR 400/09 filter incl. line choke
	

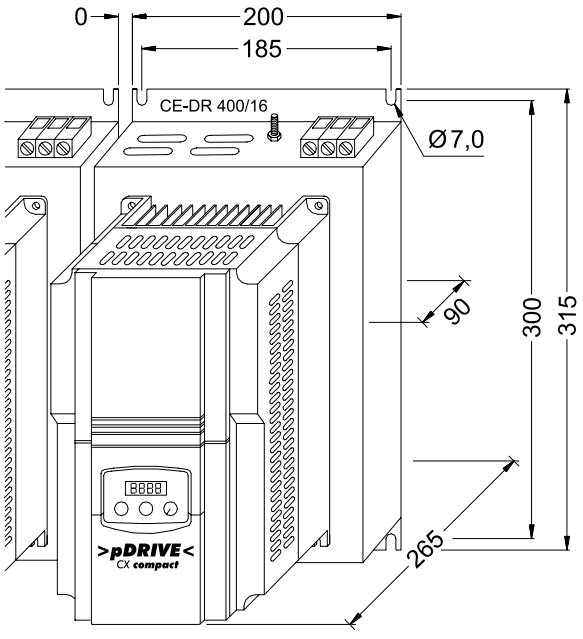
>pDRIVE< CX compact 5,5 and 7,5



with CE-0 400/16 filter



with CE-DR 400/16 filter incl. line choke

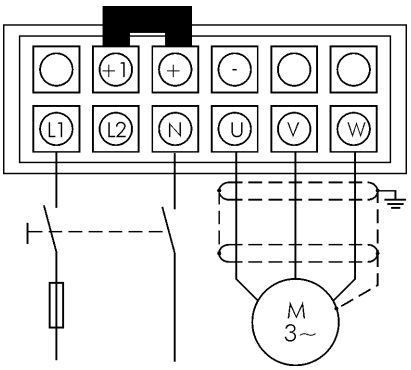
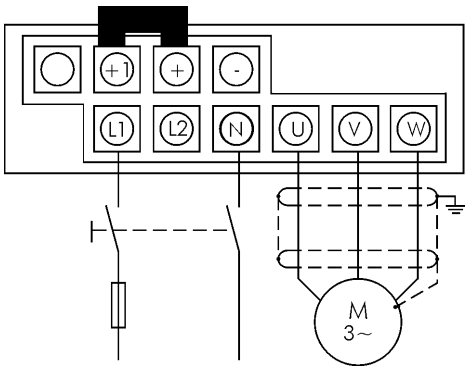
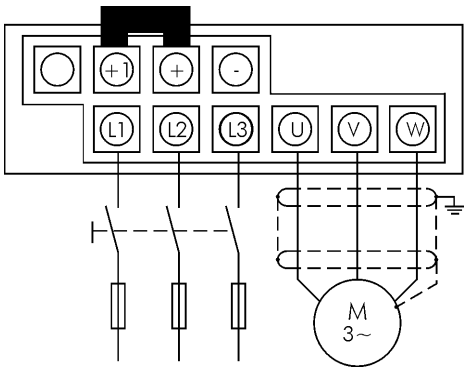
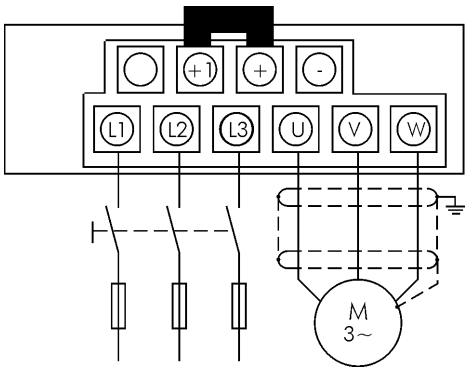


Power connections

For wiring the power and control terminals, the front cover must be removed. Do not apply mains power to the motor terminals U, V, W, since this can cause damage to the frequency inverter.

In multimotor operation, a motor protection relay must be provided for each motor.

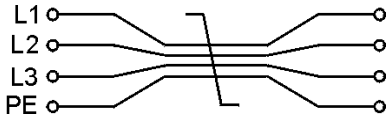
Power connections

>pDRIVE< CX single 0,4	*>pDRIVE< CX single 0,7...2,2*
 connection diameter: max. 2.5 mm^2	 connection diameter: max. 6 mm^2
>pDRIVE< CX compact 0,7...4,0	***>pDRIVE< CX compact 5,5...7,5***
 connection diameter: max. 6 mm^2	 connection diameter: max. 6 mm^2

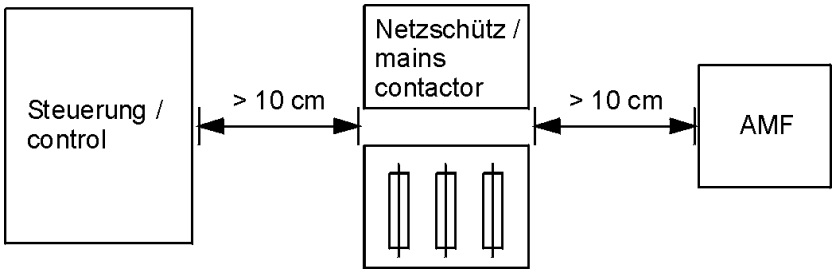
Terminal	Function	Description
L1, N or L1, L2, L3	Mains connection	*CX single*: 1 AC 220...240 V -10 +5%, 50/60Hz ±5 % *CX compact*: 3 AC 380...460 V ±10%, 50/60Hz ±5 %
U, V, W	Motor connection	*CX single*: 0...mains voltage (typ.: 3 AC 230 V) *CX compact*: 0...mains voltage (typ.: 3 AC 400 V)
+, -	Braking unit (Option)	Connection for braking unit
+1, +	Connection for DC choke	Linked (factory default) !!
⏚	PE connection	Min. 10 mm^2 or 2 wires electronically parallel via separated terminals.

General connecting information

1.) Power wiring with individual wires should always be installed close to the corresponding PE conductor.

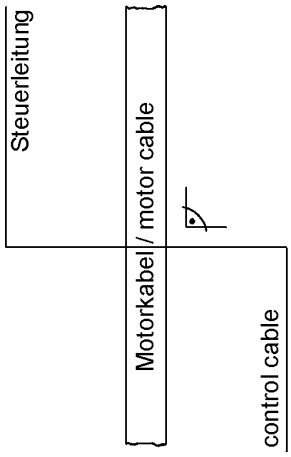


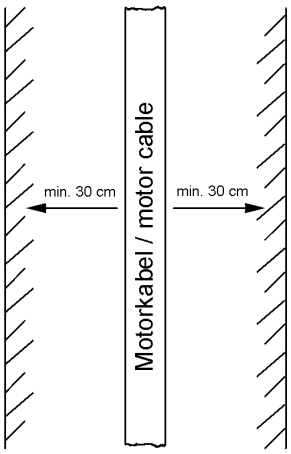
2.) Control, mains supply and motor discharge should be separated, if possible



3.) Never install control lines, mains wires or motor cable in a common cable conduit!!

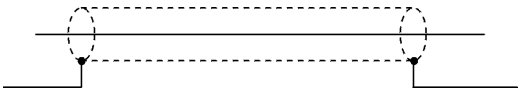
If control lines have to cross power cables, they should do so at right angles.



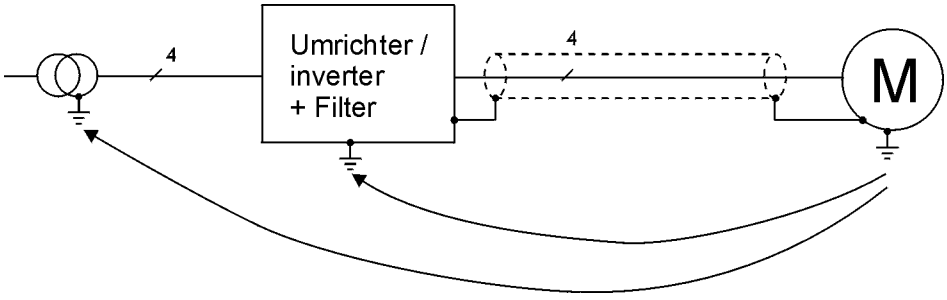


Control lines should be separated from motor cables by a distance of at least 30 cm.

4.) Use only screened control lines (**exception:** relay contacts and digital inputs, if installed completely separate from the power cables). The screen must always be grounded bilaterally (**exception:** in case of earth circuit problems due to transient currents that heat the screen, only the signal input side is grounded or a parallel compensating wire is installed).

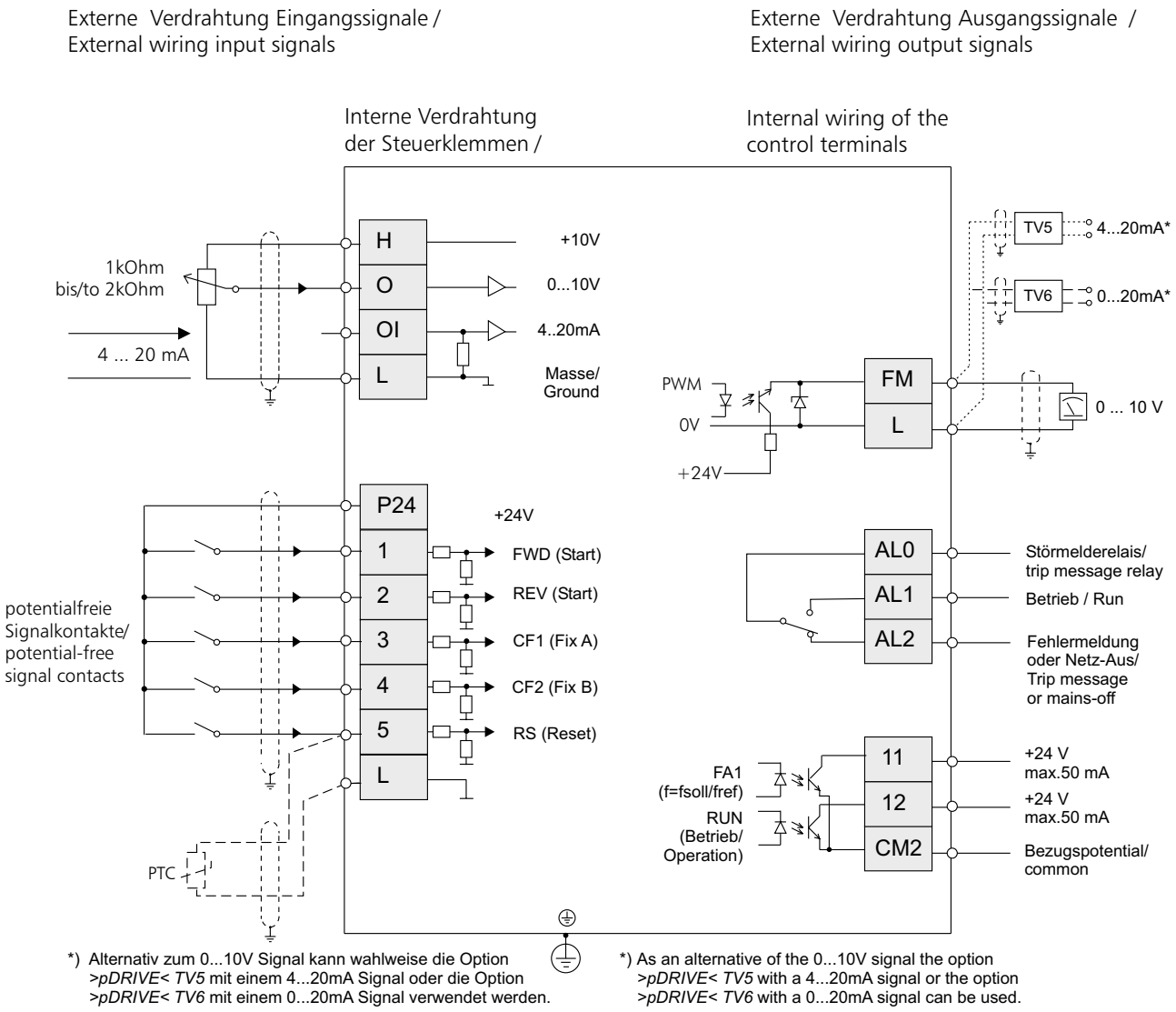


5.) The primary function of the motor cable screen is to improve the connection between motor and inverter, so that as little interfering current as possible flows past the filter to the mains earth.
Therefore, a screened 4-pole motor cable must be used and the screen must be connected at both ends in accordance with the valid HF rules. The screening material (copper or steel) is less important than good at both ends connection.

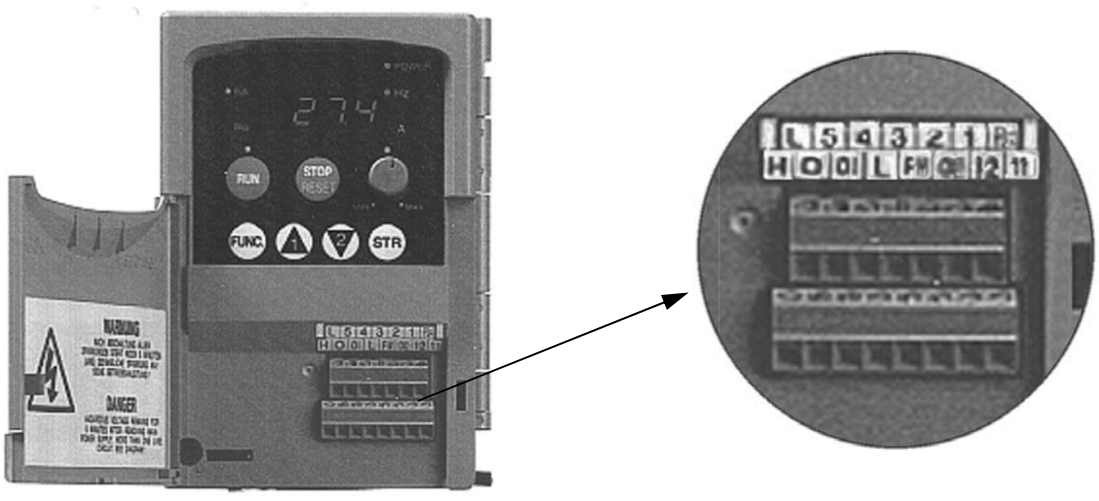


Control terminals

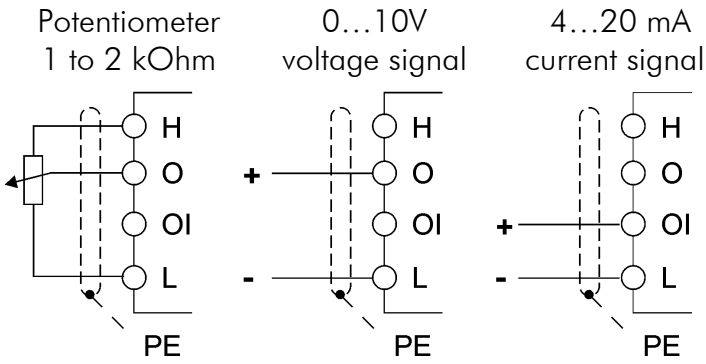
The control lines must be installed separately from the mains and motor cables. They should not exceed a length of 20m and must be screened. If the control lines have to cross mains or motor cables, they must cross at right angles.



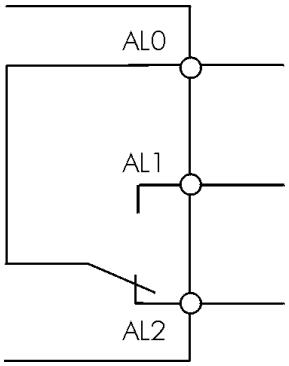
Position of the control terminals in the unit



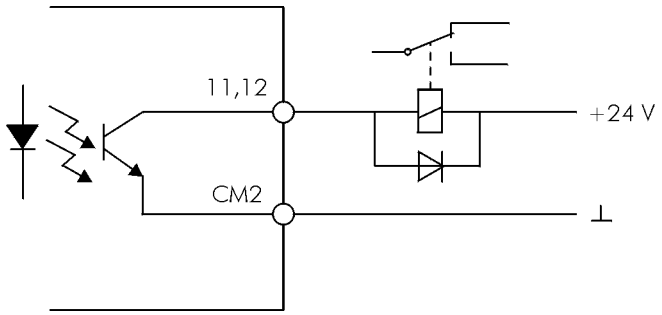
Specification of control terminals

<table>
<tr><th>Terminal</th><th colspan="2">Function</th><th>Description</th></tr>
<tr><td>P24</td><td colspan="2">24V</td><td>24V potential for digital inputs 1, 2, ... , 5; max. load 50 mA</td></tr>
<tr><td>5
4
3
2</td><td>Programmable digital inputs</td><td></td><td>+24V positive logic, approx. 5 mA per input
The digital inputs 1...5 can be programmed with parameters C01 to C05 as follows (in addition, the inputs can be inverted with parameters C11 to C15):
00 FWD Starts the inverter with clockwise field
01 REV Starts the inverter with anti-clockwise field
02...05 CF1 to CF4 Definition of multispeeds
06 JG Jog mode
09 2CH Activates the 2nd acceleration/decel. time
11 FRS Impulse lock - idle run
12 EXT Shut-down due to external fault
13 USP Prevents restart after undervoltage trip
15 SFT Prevents the editing of parameters
16 AT Analog input signal
18 RS Resets a fault
19 PTC Thermistor: protection of motor against overload
(ATTENTION: Only possible at terminal 5 !!!)</td></tr>
<tr><td>H</td><td colspan="2">10V reference voltage for definition of frequency</td><td rowspan="4"> 

If the output frequency is not 0 Hz (e.g. 0.6 Hz) for 4mA-ref. value, the start-up frequency (parameter b82) should be increased to an accordingly higher value.
Input OI for 4...20mA is activated via digital input AT (see parameter C01...C05).
If no digital input is programmed to 16 AT (switch-over of ref. value 0...10V / 4...20mA), the ref. value for O and OI are added.</td></tr>
<tr><td>O</td><td colspan="2">Analog voltage input frequency ref. value 0...10V or PID controller ref. value/actual value</td></tr>
<tr><td>OI</td><td colspan="2">Analog current input frequency ref. value 4...20mA or PID controller ref. value/actual value</td></tr>
<tr><td>L</td><td colspan="2">0V reference potential</td></tr>
</table>

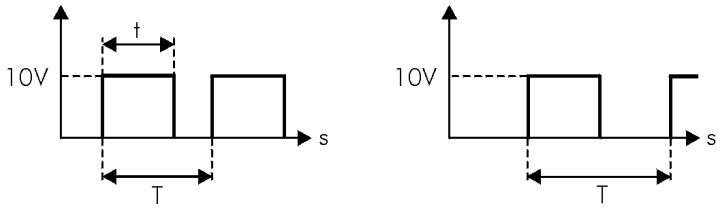
<table>
<tr><th>Terminal</th><th>Function</th><th colspan="2">Description</th></tr>
<tr><td>AL0
AL1
AL2</td><td>Relay output
Summation error</td><td colspan="2"> 

250V AC, 2.5 A
30 V DC, 3.0 A
Minimum:
100 V AC, 10 mA
5 V DC, 100 mA

Operation: AL0-AL1 closed; Error and mains off: AL0 – AL2 closed (function C33).
The error message relay is set with a time delay of approx. 2 s after switching on the mains supply.</td></tr>
<tr><td>CM2</td><td>Reference potential for output 11, 12</td><td colspan="2" rowspan="2">Transistor output, max. 27 V DC, 50 mA
 
</td></tr>
<tr><td>11</td><td>Programmable digital output

Factory default:
FA1</td><td rowspan="2">The outputs can be programmed as digital output break or make contacts using parameters C31 and C32 digital output (factory setting: break contacts).
The following functions can be programmed using parameters C21 and C22:
01 FA1 Signal on reaching the set reference value
02 FA2 Signal on output frequencies ≥ the frequencies set with parameters C42 and C43
00 RUN Signal if output frequency > start-up frequency
03 OL Signal if motor current exceeds value set for parameter C41
04 OD Signal if difference between set ref. value and actual value is greater than the value set with parameter C44 (only available if PID controller is active, parameter A71).
05 AL Signal if there is an error message (see function C10, C21)</td></tr>
<tr><td>12</td><td>Programmable digital output

Factory default:
RUN</td></tr>
</table>

Terminal	Function	Description
FM	Programmable output Act. frequency analog Motor current analog Act. frequency digital	The actual frequency value is available optionally as an impulse signal. In default setting, the actual frequency value is available as an analog signal. (0...10V, corresponding to 0 Hz to maximum frequency signal adjustment under parameter C23) T = 4 ms (const.)  **Analog signal: (0-10V, 1 mA)** The ratio t/T changes inproportion to the frequency (or current). The max. voltage of 10 V is reached at the maximum frequency (or 200 % nom. inverter current) (100 % $I_N \rightarrow$ 5 V, 200 % $I_N \rightarrow$ 10 V, accuracy approx. ±5% for the frequency display and 20% for the motor current display. **Impulse signal:** frequency = output frequency x factor of multiplied frequency display (parameter b86, default setting = 1), max. frequency 3.6kHz.
L	Electronic ground	0V potential for output FM

Wiring examples

Manual operation via the built-in keypad

Following parameters have to be changed:

A01	=	00	Reference value via potentiometer on the keypad
A02	=	02	Control commands via RUN/STOP buttons
F02	=	10 s	Adjust acceleration time
F03	=	10 s	Adjust deceleration time
A04	=	50 Hz	Increase max. frequency
A41	=	01	Automatic torque boost

Wiring of the terminals is not necessary!!

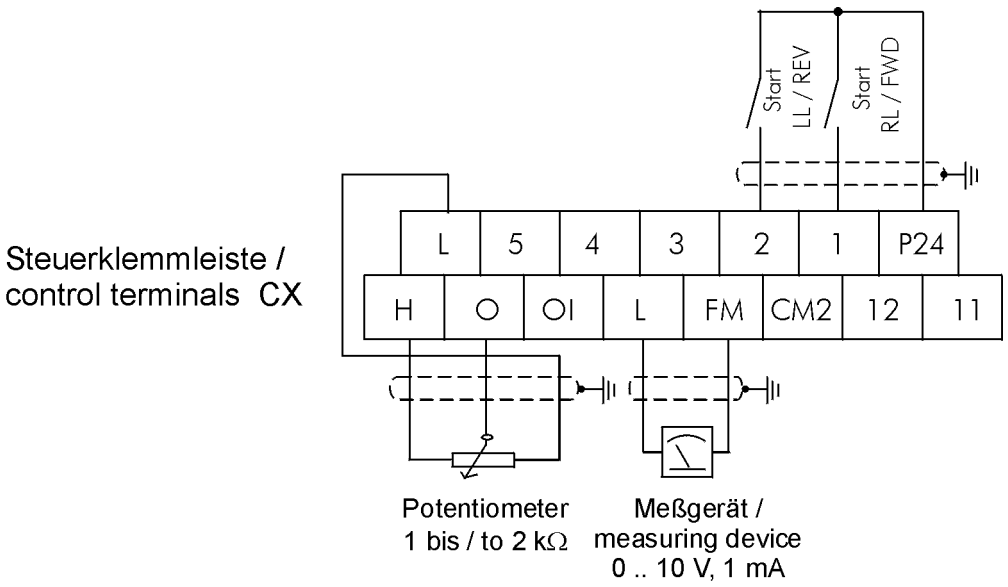
After setting the parameters above, the frequency inverter can be started by pressing the RUN button, the green LED above is already on. Only the frequency ref. value can be defined using the potentiometer integrated in the control panel As soon as the RUN button is pressed, the green RUN LED to the left of the display lights up, that means that a start command is issued. The STOP button stops the motor or confirms an error. Alternatively, the speed definition with parameter F01 is possible using the UP and DOWN buttons (saved in case of mains-off). Thereby, A01 must be set to 02.

Operation via analogue reference value 0...10 V

Following parameters have to be changed:

A01	=	01	Reference value via terminal
A02	=	01	Control command via digital input
F02	=	10 s	Adjust acceleration time
F03	=	10 s	Adjust deceleration time
C01	=	00	FWD Start forward on digital input 1
C02	=	01	REV Start reverse on digital input 2
b81	=	80 %	Adjustment of analog display

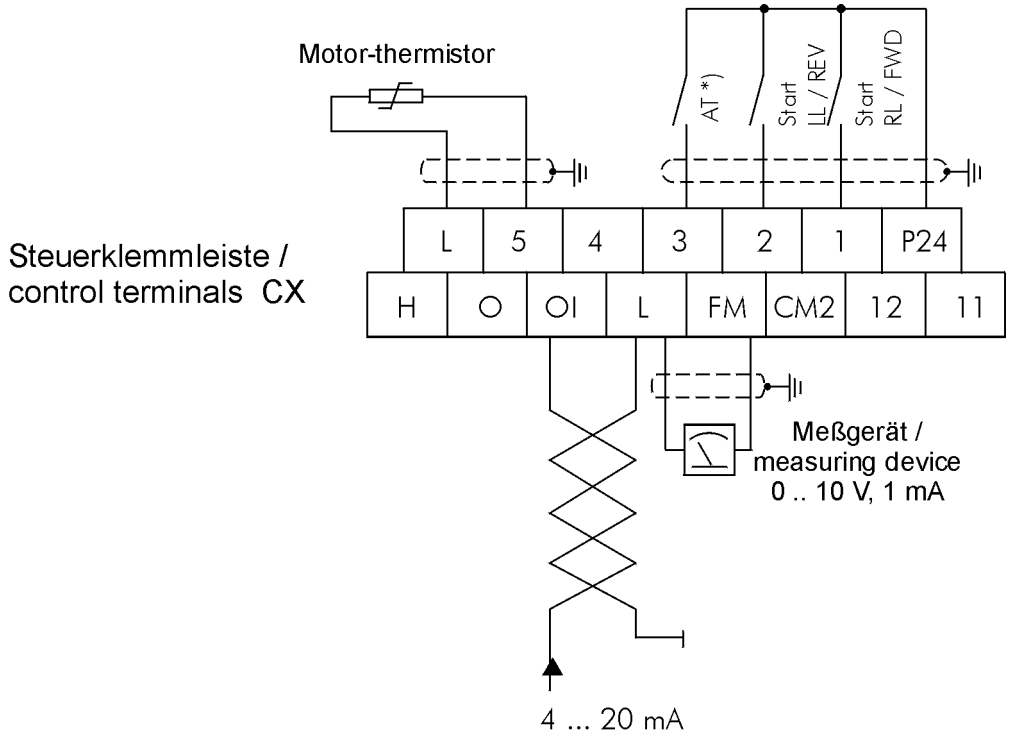
By rotating the external potentiometer the desired frequency is given.
Start/Stop is realised via the digital inputs 1 and 2. If both terminals 1 and 2 are closed at the same time, a Stop command is issued to the frequency inverter.
In addition, a test device to display the actual frequency value was also built into this example on the analog output FM. If parameter C23 is set to 01, the motor current is displayed on the test device.
The output signal can be adjusted using parameter b81.



Operation via analog reference value 4...20 mA

Following parameters have to be changed:

A01	=	01	Reference value via control terminals
A02	=	01	Control command via digital input
F02	=	10 s	Adjust acceleration time
F03	=	10 s	Adjust deceleration time
C01	=	00	FWD Start forward on digital input 1
C02	=	01	REV Start reverse on digital input 2
C03	=	16	AT Switch-over to 4...20 mA reference value
C05	=	19	PTC PTC on digital input 5



After setting the parameters, the inverter can be started with clockwise rotation field using terminal 1 or with anti-clockwise rotation field using terminal 2. If both terminals 1 and 2 are closed at the same time, a Stop command is issued to the frequency inverter.
The digital input terminals 3 (parameter setting 16 AT) switches from voltage ref. value to current ref. value. If no digital input is programmed for this function, current and voltage reference values at the same time are added.

*) Instead of fixed or switched wiring to terminal 3, parameter C13 can be set to position 01 (input for break contact).

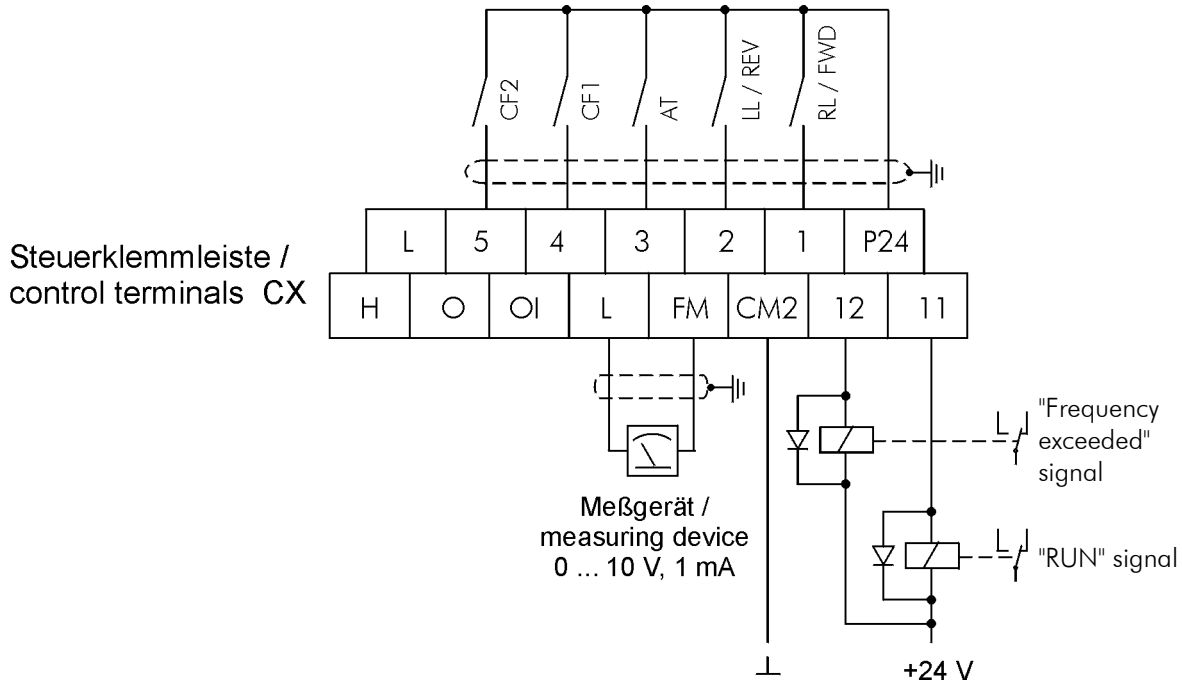
The wiring example also includes the integration of a motor PTC protection. Thereby, the use of a screened control line and separate installation of the motor cable is important!
(Earth the screen on the inverter side only!)

Operation via multispeeds

Following parameters have to be changed:

A01	=	01	Reference value via control terminals
A02	=	01	Control command via digital input
F02	=	10 s	Adjust acceleration time
F03	=	10 s	Adjust deceleration time
C01	=	FWD	Start forward on digital input 1
C02	=	REV	Start reverse on digital input 2
C03	=	16	AT Switch-over to 4...20 mA reference value
C04	=	02	CF1 Multispeed A
C05	=	03	CF2 Multispeed B
A21	=	Multispeed 1	if Fix A is 1 and Fix B is 0
A22	=	Multispeed 2	if Fix A is 0 and Fix B is 1
A23	=	Multispeed 3	if Fix A and Fix B are 1

After setting the parameters, the inverter can be started with clockwise rotation field using terminal 1 or with anti-clockwise rotation field using terminal 2. If both terminals 1 and 2 are closed at the same time, a Stop command is issued to the frequency inverter.
If one of the multispeed inputs is activated, the actual ref. value is overruled and the frequency inverter is accelerated or the motor is slowed down to the new reference setting. If no digital input is selected, the speed can be defined using the analog inputs.
For the combination of the individual multispeeds, please see the description of parameters F01 and A20 to A35.

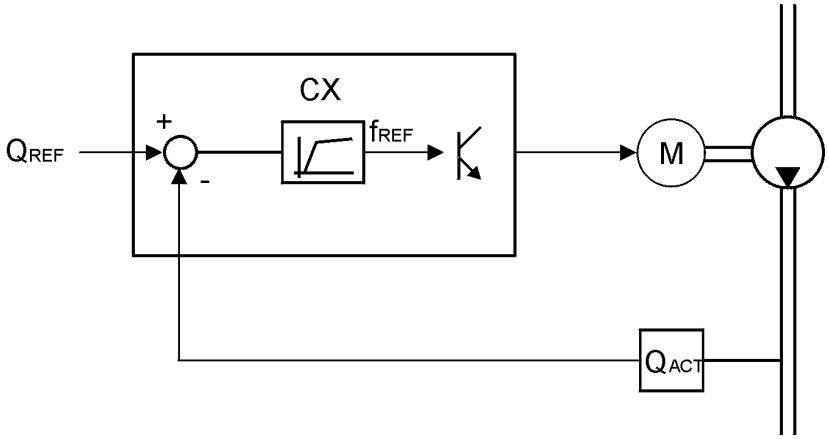


The wiring example also includes the parametrization of the relay outputs for terminal 11 and 12 for external messages.

Operation via integrated PID controller

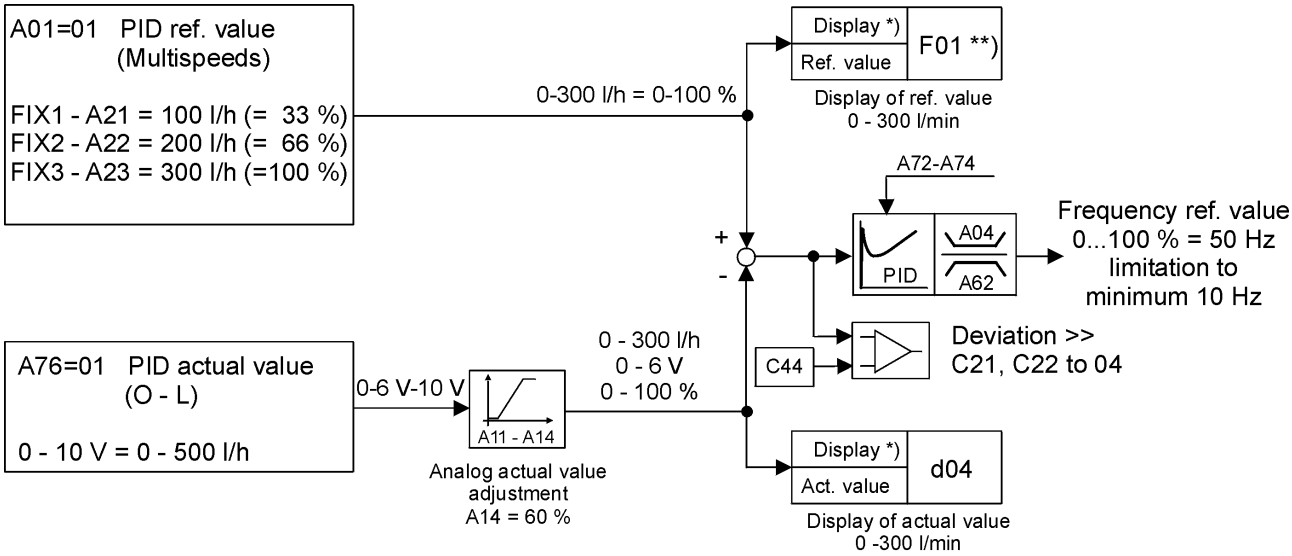
Setting example: rate control

A flow rate control should be set up with the internal PID controller of the >*pDRIVE*< *CX*.



The reference value can be set in fix steps: 100, 200, 300 l/h
The actual value is recorded by a data recorder 0...500 l/h = 0...10 V.
In the event of discrepancies greater than 20 %, a warning signal must be generated.
The minimum frequency of 10 Hz must not be undercut.
The reference and actual values for the controller must be displayed in process sizes:
300 l/h =100 % control size

Control diagram



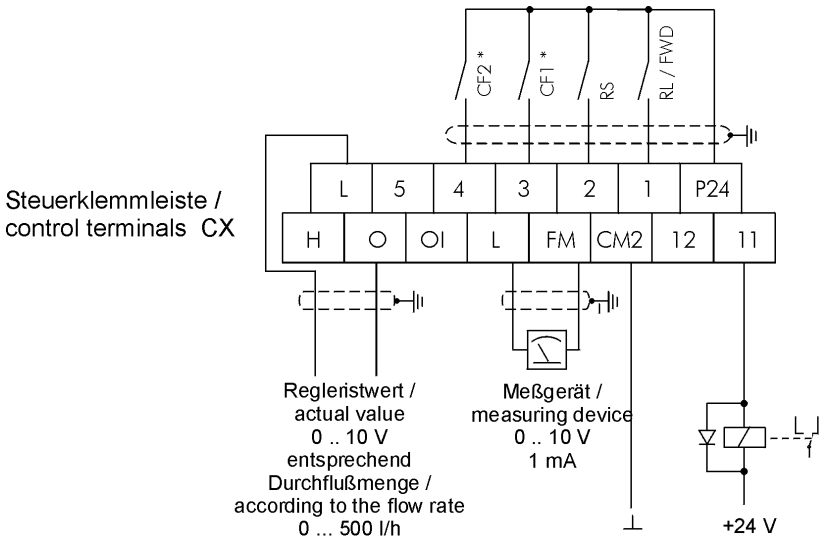
For the proper setting of the reference value, A75 = 3.00 is selected. Thus, 100 % PID ref. value is represented as 300 l/h flow rate.

In order to adjust the actual value input (0...500 l/h) to the ref. value input (0...300 l/h), is necessary to adjust the actual value using parameter A11...A014. That means A14 must be set to 60 % so that 300 l/h process size correspond with 100 % PID actual value.

Parameter adjustments:

A01	=	01	Reference value via multispeeds
A02	=	01	Control command via digital input
A71	=	01	PID controller active
A75	=	3.0	Factor for display
F02	=	appr. 3 s	Adjust acceleration time (as short as possible)
F03	=	appr. 5 s	Adjust deceleration time (as short as possible)
C01	=	00	FWD Start forward on digital input 1
C02	=	18	RS Reset on digital input 2 (set C05 to 12 before)
C03	=	02	CF1 Fix A on digital input 3
C04	=	03	CF2 Fix B on digital input 4
A14	=	60 %	Adaptation of the analog actual value
A21	=	100 l/h	Multispeed 2
A22	=	200 l/h	Multispeed 3
A23	=	300 l/h	Multispeed 4
A62	=	10 Hz	Minimum frequency
A72	=	1.0	P - gain
A73	=	1.0 s	I - gain
A74	=	0.0 s	D - gain
A76	=	01	PID actual value as voltage signal on terminals O - L
C21	=	04	PID deviation signal on terminal 11
C44	=	20 %	maximum controller deviation as warning signal 20 %

Terminals:



* reference value:

CF1	CF2		
0	0	Min. frequency	
1	0	100 l/h	(33 %)
0	1	200 l/h	(66 %)
1	1	300 l/h	(100 %)

After setting the parameters, the inverter can be started with clockwise rotation field using terminal 1.

The example for defining the ref. value via multispeeds is only one configuration example. It is also possible to define the reference value using the built-in potentiometer, using parameter F01 with the UP and DOWN buttons or using the 2nd analog input.

RFI-filters CE-DR

All devices and equipment in electric power engineering can cause electromagnetic interference and be disturbed by electromagnetic interference. Therefore, they are subject to the provisions of the **EMV directive 89/336/EEC** since 1.1.1996.

However, frequency inverters cannot be regarded as machines with at least one mechanically moving component. Therefore, the **Machine Directive 98/37/EC** does **not** apply.

The frequency inverters *>pDRIVE< CX* have a CE mark on the rating plate. However, in order to reach the relevant limits, it is necessary to comply with the installation instructions.

In conjunction with the available CE-DR filter options, the CX frequency inverters comply with the EMV Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC, i.e. conformity with: EN 61800-3 and EN 50178

Installation rules

- Use of the option CE footprint-filters or use of an equivalent filter solution
- Assembly on a properly grounded metal assembly plate.
- Use and proper connection (at both ends !!) of screened motor cables
- Reduce clock frequency to ≤ 5 kHz
- Use and proper connection of screened control cables
- Grounding the frequency inverter with at least 10 mm^2 for personal safety
- Separate installation of motor cables and other cables, especially control wires

Important remarks

Motor cable lengths
The specifications regarding the permissible distance between the inverter and the motor must be complied with. Too long motor cables can damage the inverter!

Protective measure FI safety switch
Radio interference suppression filters contain conduction capacitors to earth, i.e. the leakage current of the entire drive is increased and there is a short charging current when the inverter is switched on.

REMEDY: Use FI safety switches with short-time delay and higher trigger level.

WARNING: FI safety switches do not provide absolute protection against direct contact!! Therefore, they should always be used in conjunction with other protective measures.

Line choke (built-in into the CE-DR RFI-filter)
The CE-DR filters contain a line choke with min. 4% u_K related to the nom. current. Therefore, an additional external choke is not required.
The line choke is used to reduce the harmonic oscillation caused by the intermediate circuit and the commutation drops caused by the rectifier.

Technical Data CE-0

Filtertype CE-0	230/03	230/04	230/10	400/06	400/09	400/16
Inverter >*pDRIVE*<	*CX single 04*	*CX single 07*	*CX single 1,5* *CX single 2,2*	*CX compact 0,7* *CX compact 1,5*	*CX compact 2,2* *CX compact 3,0* *CX compact 4,0*	*CX compact 5,5* *CX compact 7,5*
Mains connection						
Phases	1 AC			3 AC		
Voltage	220…240V -10% +5%			380…460V ±10%		
Nominal current	6 A	10 A	23 A	7 A	11 A	20 A
Leakage current (max.)	< 3.5 mA	< 3.5 mA	< 10 mA	< 3.5 (32) mA	< 3.5 (62) mA	<10 (120)mA
Overload	50 % for 60 s			50 % for 60 s		
Frequency	50…60 Hz ±5 %			50…60 Hz ±5 %		
Ambient conditions						
Ambient temperature	-20°C…+40°C					
Pollution degree	2 in accordance with EN50178					
Protection	IP20					
Altitude	max. 1000m, above reduction 2% per 100m (max. 2000 m)					
Humidity	20% to 90% rel. humidity, non-condensing					
Mounting	vertically to mounting plate					
Connections						
Input terminals	4 mm^2	4 mm^2	4 mm^2	4 mm^2	4 mm^2	4 mm^2
Connection to inverter	1.5 mm^2	1.5 mm^2	2.5 mm^2	1.5 mm^2	2.5 mm^2	2.5 mm^2
Mains fuses max.	10 A	16 A	25 A	10 A	16 A	25 A
Grounding diameter	1.5 mm^2	1.5 mm^2	2.5 mm^2	10 mm^2	10 mm^2	10 mm^2
General						
Losses	5 W	5 W	9 W	6 W	10 W	14 W
Weight filter	0.7 kg	1 kg	1.5 kg	1 kg	1.5 kg	3 kg
Cooling	self-convection					
Motor cable – screen	well-conductive connection to mounting plate					

For CE-0 filters no choke to reduce the low-harmonic current harmonics exist !
Please note the remarks in chapter "Mains impedance".

Filtertype CE-DR	230/05	230/10	400/04	400/09	400/16
Inverter >*pDRIVE*<	*CX single 04* *CX single 07*	*CX single 1,5* *CX single 2,2*	*CX compact 0,7* *CX compact 1,5*	*CX compact 2,2* *CX compact 3,0* *CX compact 4,0*	*CX compact 5,5* *CX compact 7,5*
Mains connection					
Phases	1 AC		3 AC		
Voltage	220…240V ±10%		380…460V ±10%		
Nominal current	8 A	17 A	4 A	9 A	16 A
Leakage current (max.)	2 mA	2 mA	80 mA	80 mA	80 mA
Overload	50 % for 60 s		50 % for 60 s		
Frequency	50…60 Hz ±5 %		50…60 Hz ±5 %		
Ambient conditions					
Ambient temperature	-20°C…+45°C				
Pollution degree	2 in accordance with EN50178				
Protection	IP20				
Altitude	max. 2000m, above reduction				
Humidity	20% to 90% rel. humidity, non-condensing				
Mounting	vertically to mounting plate (back side of the filter is open !)				
Connections					
Input terminals	2.5 mm^2	2.5 mm^2	2.5 mm^2	4 mm^2	6 mm^2
Connection to inverter	2.5 mm^2	2.5 mm^2	2.5 mm^2	2.5 mm^2	4 mm^2
Mains fuses max.	13 A	20 A	10 A	16 A	25 A
Grounding diameter	1.5 mm^2	2.5 mm^2	10 mm^2	10 mm^2	10 mm^2
General					
Choke inductivity	3 % u_k at 8A	3 % u_k at 17A	3 % u_k at 4A	3 % u_k at 9A	3 % u_k at 16A
Losses (approx.)	25 W	40 W	28 W	50 W	80 W
Weight filter	2.5 kg	3.5 kg	3.5 kg	5.5 kg	6.5 kg
Cooling	self-convection				
Material	Sheet steel galvanized				
Motor cable – screen	Connection with clip on the bottom				

Options

Inverter	>pDRIVE<	CX single 04	CX single 07	CX single 1,5	CX single 2,2	CX compact 0,7	CX compact 1,5
Filter (alternatively to CE-DR)	CE-0	230/03	230/04	230/10	230/10	400/06	400/06
Filter (incl. line choke)	CE-DR	230/05	230/05	230/10	230/10	400/04	400/04
AMF (output motor filter)	AMF	450/12	450/12	450/12	450/12	450/12	450/12
Typical motor cable	mm^2	$3x1.5^2$	$3x1.5\ (2.5)^2$	$3x1.5\ (2.5)^2$	$3x2.5\ (4.0)^2$	$3x1.5^2$	$3x1.5^2$
Maximum allowed distance (single motor cable length) Frequency inverter – Motor							
1st environment (domestic premises) unrestricted to every person							
CE-DR / CX (AMF) M	without AMF	20 m	20 m	20 m	20 m	20 m	20 m
	with AMF	35 m	35 m	35 m	35 m	35 m	35 m
1st environment (domestic premises) restricted to qualified persons							
CE-DR / CX (AMF) M	without AMF	40 m	40 m	40 m	40 m	30 m	30 m
	with AMF	80 m	80 m	80 m	80 m	70 m	70 m
2nd environment (industrial premises)							
CE-DR / CX (AMF) M	without AMF	60 m	60 m	60 m	60 m	40 m	40 m
	with AMF	150 m	150 m	150 m	150 m	80 m	80 m
Maximum distance without observing the standards							
screened							
(CE-DR) / CX (AMF) M	without AMF	75 m	75 m	75 m	75 m	45 m	45 m
	with AMF	150 m	150 m	150 m	150 m	80 m	80 m
	with AMF (one type bigger)	250 m	250 m	250 m	250 m	120 m	120 m
unscreened							
(CE-DR) / CX (AMF) M	without AMF	100 m	100 m	100 m	100 m	60 m	60 m
	with AMF	300 m	300 m	300 m	300 m	120 m	120 m
	with AMF (one type bigger)	400 m	400 m	400 m	400 m	200 m	200 m

Multiplication factors

8 kHz instead of 5 kHz switching frequency	all values x 0.7	2 motors parallel with 2 long cables	all values x 0.4
16 kHz instead of 5 kHz switching frequency	all values x 0.5	3 motors parallel with 3 long cables	all values x 0.25
		4 motors parallel with 4 long cables	all values x 0.15
2 motors parallel with 1 long cable (distribution near the motor)	all values x 0.8	5 motors parallel with 5 long cables	all values x 0.10

Inverter >pDRIVE<		CX compact 2,2	CX compact 3,0	CX compact 4,0	CX compact 5,5	CX compact 7,5
Filter (alternatively to CE-DR)	CE-0	400/09	400/09	400/09	400/16	400/16
Filter (incl. line choke)	CE-DR	400/09	400/09	400/09	400/16	400/16
AMF (output motor filter)	AMF	450/12	450/12	450/12	450/48	450/48
Typical motor cable	mm^2	$3x1.5^2$	$3x1.5\ (2.5)^2$	$3x1.5\ (2.5)^2$	$3x2.5^2$	$3x2.5\ (4.0)^2$
Maximum allowed distance (single motor cable length) Frequency inverter – Motor						
1st environment (domestic premises) unrestricted to every person						
CE-DR CX (AMF) M	without AMF	20 m	20 m	20 m	20 m	20 m
	with AMF	35 m	35 m	35 m	35 m	35 m
1st environment (domestic premises) restricted to qualified persons						
CE-DR CX (AMF) M	without AMF	30 m	30 m	30 m	30 m	30 m
	with AMF	70 m	80 m	80 m	80 m	80 m
2nd environment (industrial premises)						
CE-DR CX (AMF) M	without AMF	40 m	40 m	40 m	40 m	40 m
	with AMF	80 m	80 m	80 m	80 m	80 m
Maximum distance without observing the standards						
screened						
(CE-DR) CX (AMF) M	without AMF	45 m	45 m	45 m	45 m	45 m
	with AMF	80 m	80 m	80 m	80 m	80 m
	with AMF (one type bigger)	120 m	120 m	120 m	120 m	120 m
unscreened						
(CE-DR) CX (AMF) M	without AMF	60 m	60 m	60 m	60 m	60 m
	with AMF	120 m	120 m	120 m	120 m	120 m
	with AMF (one type bigger)	200 m	200 m	200 m	200 m	200 m

Multiplication factors			
8 kHz instead of 5 kHz switching frequency	all values x 0.7	2 motors parallel with 2 long cables	all values x 0.4
16 kHz instead of 5 kHz switching frequency	all values x 0.5	3 motors parallel with 3 long cables	all values x 0.25
		4 motors parallel with 4 long cables	all values x 0.15
2 motors parallel with 1 long cable (distribution near the motor)	all values x 0.8	5 motors parallel with 5 long cables	all values x 0.10

Options

Regulations

To satisfy the EMC directive 89/336/EEC, the following points should be kept:

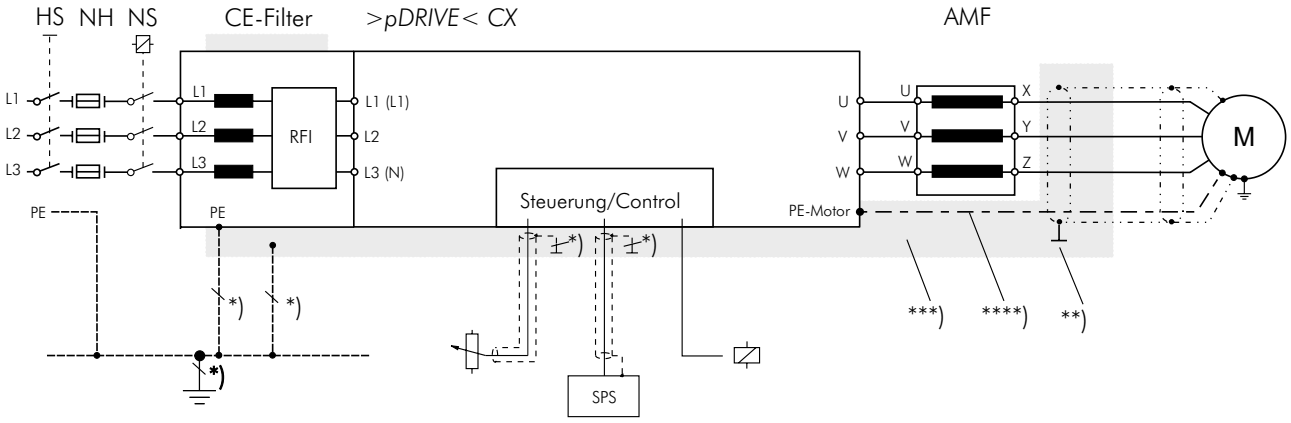
1.) Mains voltage

- Voltage fluctuation ≤ ±10 %
- Voltage unbalance ≤ ±3 %
- Frequency variations ≤ ±5 %
- Voltage distortion (THD) ≤ 10 %

2.) Wiring

- For complying with the EMC-directive screened motor cables are required.
- For getting higher lengths of motor cable, it is necessary to connect an output motor filter AMF to the output of the inverter, to reduce the stress of the inverter and the line filter caused by the higher earth leakage currents.
- Separate main circuit wiring from control circuit wiring.

3.) Wiring diagram



HS ... Main switch
NH ... Mains fuses
NS ... Mains contactor
CE-Filter ... RFI-filter (with integrated line choke at CE-DR)
AMF ... Output-Motor-Filter

*) EMC earthing (earth connection on a large area to drain off the high-frequent disturbances; maybe in parallel to the yellow/green wire) !!

**) Connect the screen on a large area on the mounting panel or directly on the CE-DR!!

***) Important: Well conductive mounting plate (i.e. precious steel or galvanized)

****) The PE conductor should be wired to the inverter as directly as possible, so that there is good conduction of the interference signals to the filter, i.e. the PE terminal should be insulated in the case of intermediate terminals.

ATTENTION: Important for EMC corresponding installation of the drive is the good (HF) connection of the motor cable to the CE-filter.

Mounting and Connecting

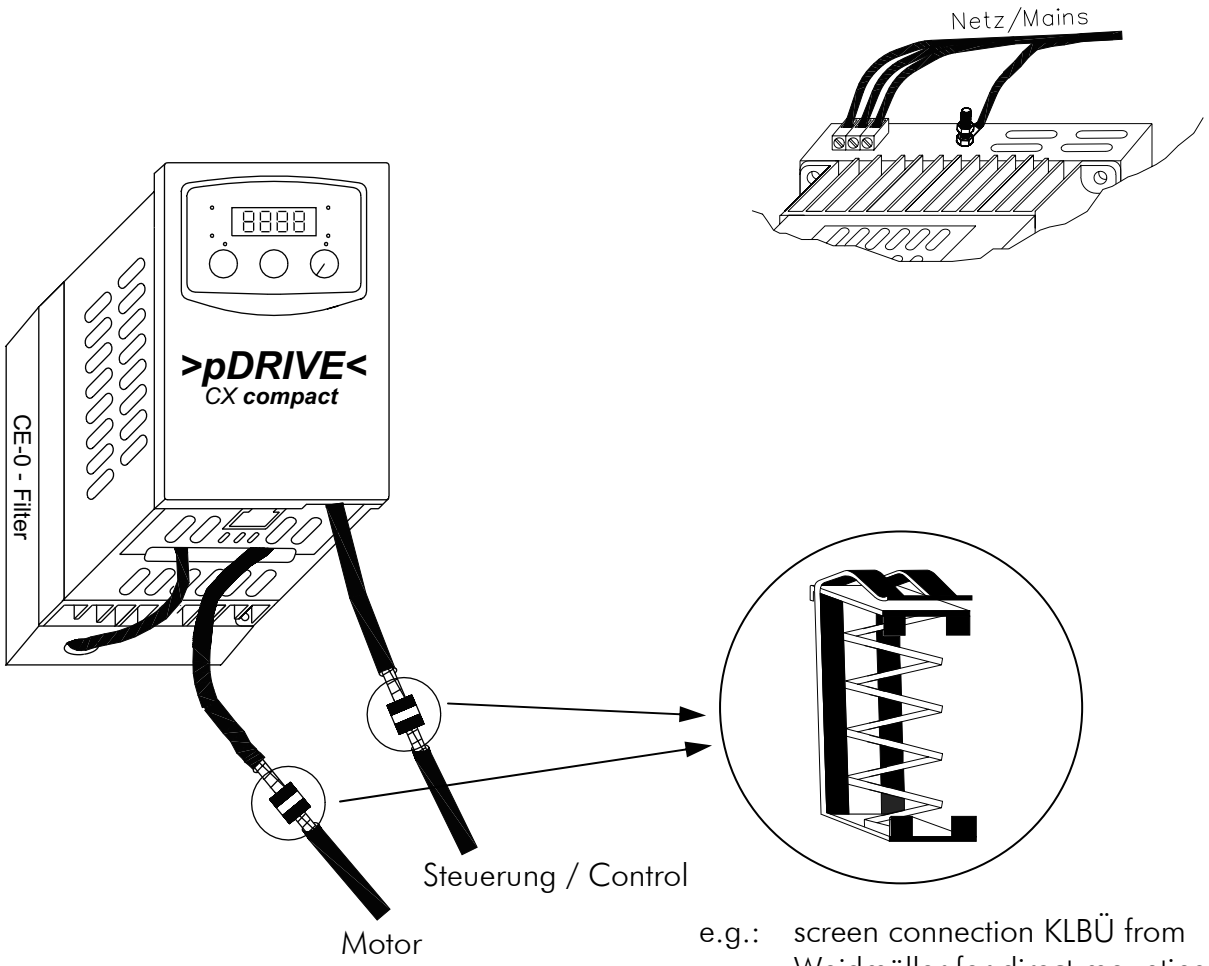
Once the filter has been assembled on an assembly plate, the frequency inverter is fixed using the 4(2) drill holes on the filter.

The electric connection between the filter and the frequency inverter is then made using the cable from the filter, whereby the phase-sequence is irrelevant.

The motor cable is bared in the region of the clamp, so that the screen is contacted with the filter via the clamp. This guarantees good HF connection of the screen and the CE-0 filter.

The mains connection is provided at the top of the filter, on terminals L1, N or L1, L2 and L3. To do this, the PE cable is connected to the provided bolts.

The filters for >*pDRIVE*< *CX* have leakage currents >3.5 mA. Therefore, they must be grounded with a protective conductor of at least 10 mm^2. (Personal safety!)



e.g.: screen connection KLBÜ from Weidmüller for direct mounting on the mounting plate

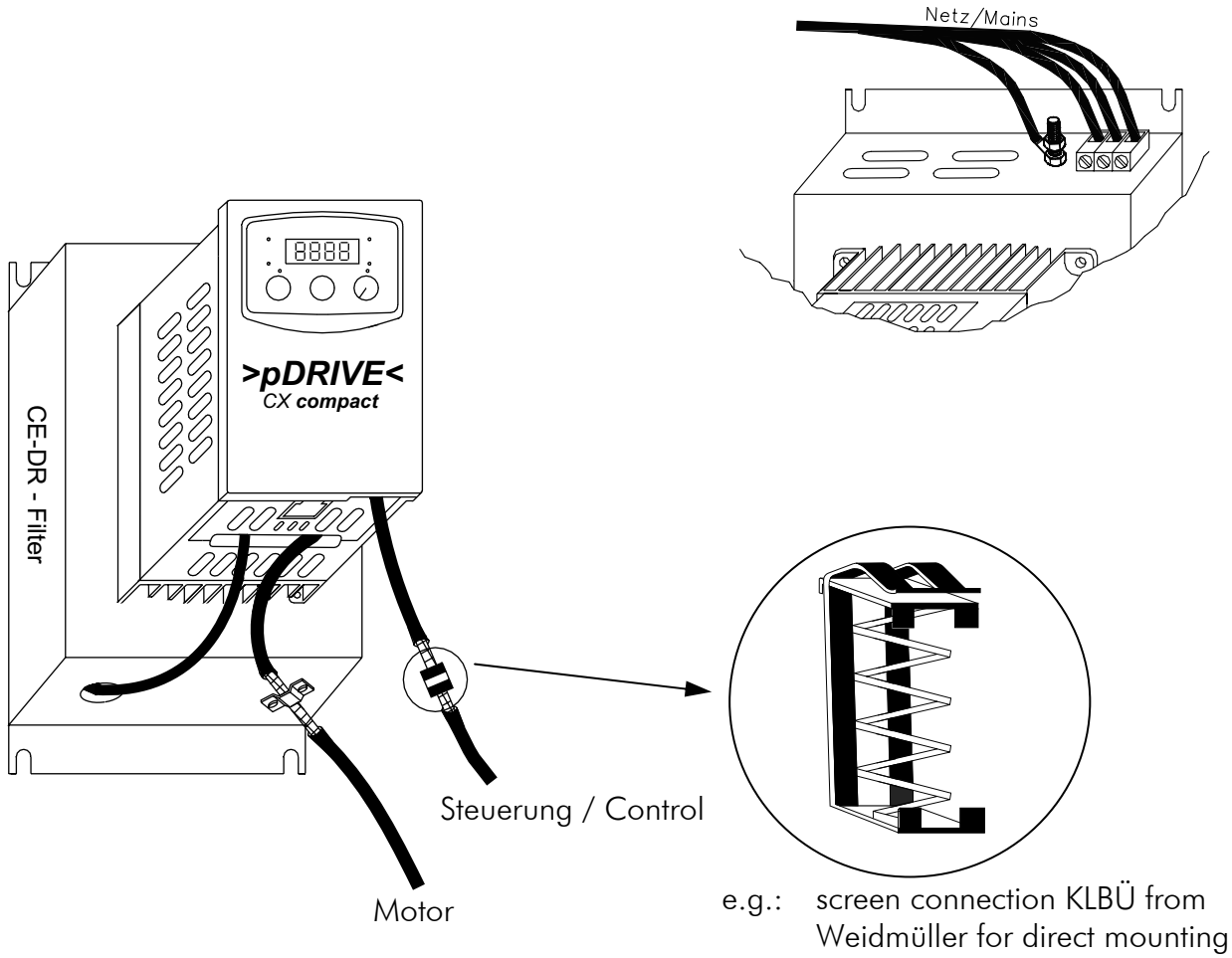
Once the filter has been assembled on an assembly plate, the frequency inverter is fixed using the 4 drill holes on the filter.

The electric connection between the filter and the frequency inverter is then made using the cable from the filter, whereby the phase-sequence is irrelevant.

The motor cable is bared in the region of the clamp, so that the screen is contacted with the filter via the clamp. This guarantees good HF connection of the screen.

The mains connection is provided at the top of the filter, on terminals L1, N or L1, L2 and L3. To do this, the PE cable is connected to the provided bolts.

The filters for *>pDRIVE< CX compact* have leakage currents >3.5 mA. Therefore, they must be grounded with a protective conductor of at least 10 mm^2. (Personal safety!)



e.g.: screen connection KLBÜ from Weidmüller for direct mounting on the mounting plate

Output-Motor-Filter AMF

Modern frequency inverters are using IGBT power modules, by which it is possible to build compact and cheap units.

Because of the higher switching frequency it was possible to refine the principle of a pulse-wide modulated (triggered) output voltage.

Disadvantageous are the high-frequently earth leakage currents caused by the motor cable and it's capacitance against earth.

Furthermore the high slew rate (du/dt) causes couplings to parallel lines and voltage spikes on the motor terminals.

The real effects are depending on several influences:

- A low switching frequency reduces the leakage current and the losses in the choke.
- A screened motor cable reduces the couplings to parallel lines but increases the leakage current and the losses in the choke very high.
- A long motor cable increases the leakage current and the losses in the choke very high.
- The kind of laying the cable, e.g. under water, increases the leakage current and the losses in the choke like a screened cable.

By using an output motor filter AMF and paying attention to the cable lengths in the table, it is possible to keep the following limits:

Slew rate (du/dt) $\leq$ 500 V/μs
Peak voltage (U_{Peak}) $\leq$ 1000 V

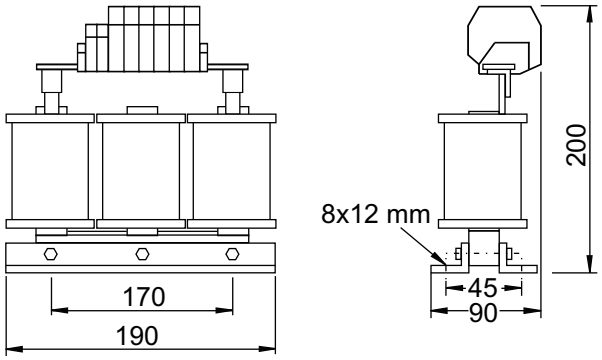
AMF specification

The output-motor-filter AMF can be mounted in any position.
Because of the losses caused by high switching frequencies or high cable lengths it is recommended to place the filter above the inverter. In that case it will be forced cooled and the inverters cooling air will not be preheated.

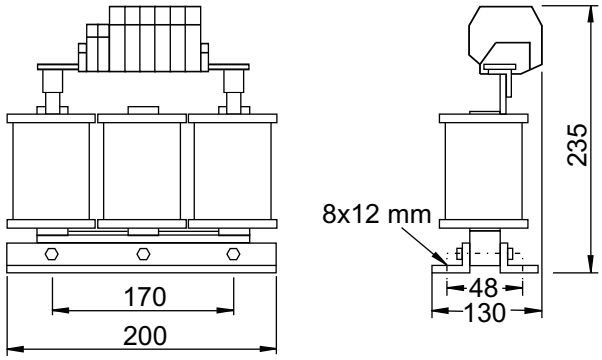
Due to the magnetic stray field of the AMF filter the recommended minimum distances above and on the sides must be observed, that means no mounting plates, steel bars, control lines, electronic ...

	AMF 450/12	AMF 450/48
Mains voltage	3 x 380...500 V	3 x 380...500 V
Nominal current	12 A	48 A
Overload capacity	20 % for 60 s	20 % for 60 s
Losses	max. 150 W	max. 250 W
Protection degree	IP00	IP00
Terminals	VBG4	VBG4
Cable diameter	max. 10 mm^2	max. 16 mm^2
Weight	approx. 5.5 kg	approx. 8.0 kg
Protection	Thermoclixon 120°	Thermoclixon 120°
Contact	N.C.	N.C.

AMF 450/12:

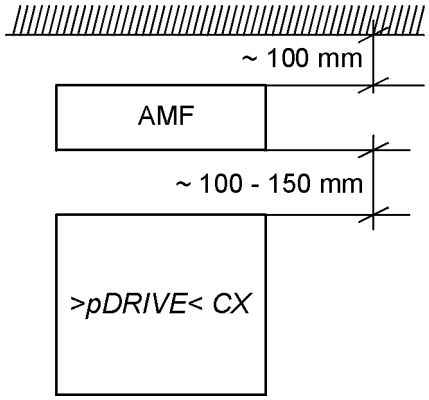


AMF 450/48:



The choke has to be connected directly to the output terminals (U, V, W) of the frequency inverter.
In case of overtemperature of the choke caused by too high switching frequencies and/or too long cables, the inverter will trip with "external trip".

To prevent the cooling air of the frequency inverter against pre-heating and to cool the choke, it is recommended to place the choke appr. 100...150 mm above the frequency inverter.



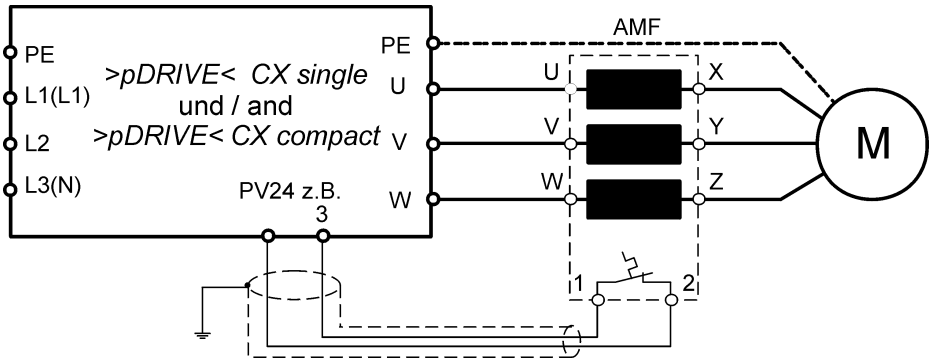
Remarks

- The switching frequencies of >*pDRIVE*< *CX* must be set to a value of 5 kHz or less in accordance to the table "allowed cable length"
- Because of the higher earth capacitances, parallel motor cables should only be used for short distances (see table "allowed cable length")
- The kind of laying the cable influences the losses of the choke. The table refers to laying the cable into a cable location line. Laying under ground or in water increases the leakage current. The switching frequency has to be reduced furthermore.
- It is not allowed to operate the frequency inverter without an effective connection to earth. The connection has to be in accordance to the local regulations for high leakage current (> 3.5 mA).
- It is not allowed to operate the frequency inverter with a standard earth-leakage breaker, if the local regulations don't permit this because of a possible D.C. amount in the leakage current.

Overtemperature protection

1.) Set the switching frequency in accordance to the table.
Low switching frequencies mean less losses of the choke and reduce the leakage current. Set parameter b83 to 5 kHz or less.

2.) Integrate the thermoclixon of the choke for switchoffs in case of overtemperature
e.g. use of terminal 3 as external trip
Parameter C13 = 01 (Inversion of terminal 3)
Parameter C03 = 12 (=EXT, "external trip")

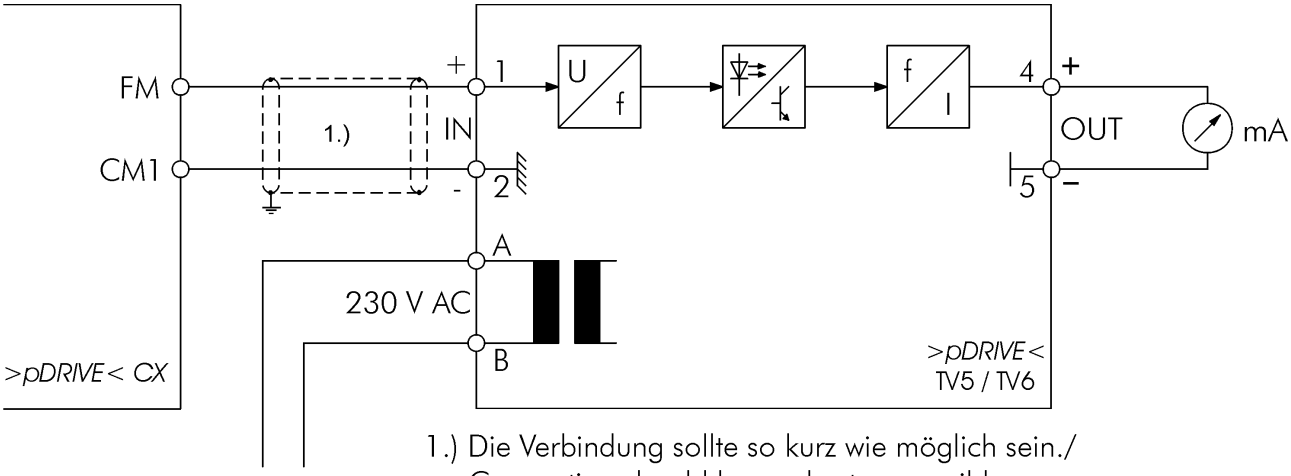


Options

Isolated amplifier TV5, TV6

The >*pDRIVE*< *TV5* is an active isolating amplifier which transforms the input signal (0...10 V) to an output signal (4...20 mA).
The >*pDRIVE*< *TV6* is an active isolating amplifier which transforms the input signal (0...10 V) to an output signal (0...20 mA).
It operates according to the principle of optoelectronic potential separation and has three-way separation between input, output and supply.
The unit requires an auxiliary voltage of 230 V AC and is mounted on a TS35 rail.

The unit works unipolar and should not be operated with open input.



1.) Die Verbindung sollte so kurz wie möglich sein./
Connection should be as short as possible

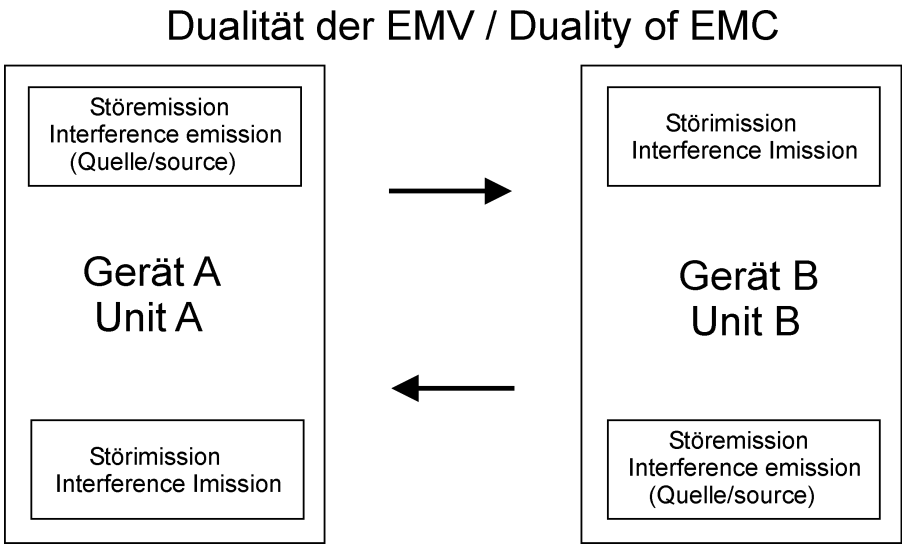
Technical Data	
Auxiliary supply	230 V ±10 %, 50…60 Hz
Power consumption	3 VA
Voltage input	0 ... 10 V / R_{IN} = 100 kΩ
Overload	max. 50 V
Current output TV5	4 ... 20 mA
Current output TV6	0 ... 20 mA
Output burden	max. 500 Ω
Max. isolating voltage	750 V
Transmission frequency	25 Hz
Linear fault	0.15 %
Ambient temperature	0 ... 50°C
Weight	270 g
Dimensions (H x W x D)	117mm x 45mm x 80mm

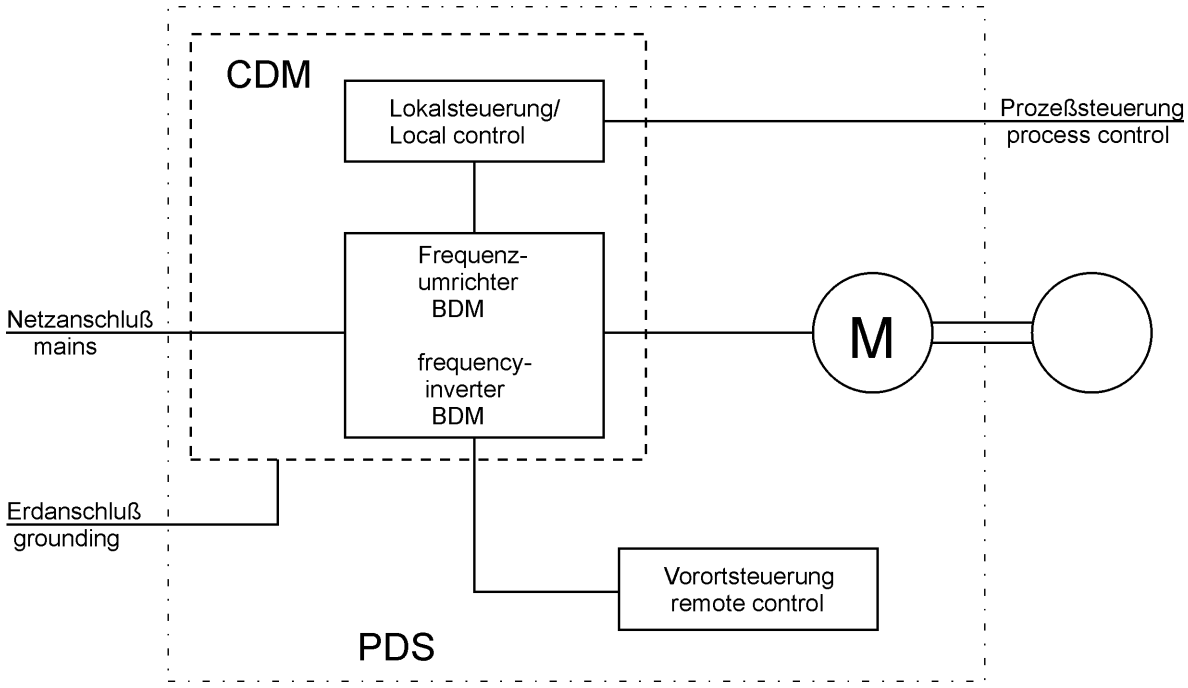
EMC product standard for PDS (Power-Drive-Systems) EN 61800-3

In June 1996 the product standard EN 61800-3 for frequency inverter based drives was released. It has priority over the existing general standards (generic standards). If a drive is build-in into another unit for which exists an own EMC-standard then this standard has to be considered.

Objective of the EMC-standard 89/336/EEC is the ability of electrical and electronical installations to be well functional in their electromagnetic environment, without any influence to itself or any other installation within it.

Due to this objective the PDS product standard consists of limitation values for allowed interferences as well as of requirements for the necessary suppression measurements.
The Power-Drive-Standard EN 61800-3 covers the complete drive, from the mains supply to the motor shaft.





Options

BDM: Base-Drive-Module

Basic drive unit consisting of the power part and the control electronic. i.e. frequency inverter – build-in unit

CDM: Complete-Drive-Module

Drive module consisting of: BDM (basic unit) and possible extensions i.e. cubicle including RFI-Filter, AMF, line contactor, ...)

PDS: Power-Drive-System

Drive system consisting of CDM (drive module), the motor, motor cable on site controlling, mains transformer, ... i.e. the complete electrical drive of a machine

The main differences for the use of frequency inverters result in difference regarding to the sales method and the area of duty:

1.) *Use in domestic premises where the sale is generally done (unrestricted to every person)*
For drives < 25 A the allowed interference limits are likely the same as to the standard EN 55011 class B, that means: 66-56/56/60 dB(µV) quasi-peak and 30/37 dB(µV/m) at 10 m distance.
For drives ≥ 25 A the limits are related to the class A, that means: 79/73/73 dB(µV) quasi-peak and 30/37 dB(µV/m) at 30 m distance.

2.) *Use in domestic premises where the sales is restricted to qualified and trained EMC resellers*
All drives must keep the interference limit of the so far used class A,
that means: 79/73/73 dB(µV) quasi-peak and 30/37 dB(µV/m) at 30 m distance

3.) *Use in industrial premises with quiet enough noise suppression*
For drives with a size of ≤100 A, the admissible interference limits are 100/86/90-70 dB (µV) quasi-peak and 40/50 dB (µV/m) at 30 m distance.
For drives with a size of >100 A, the admissible interference limits are 130/125/115 dB (µV) quasipeak and 40/50 dB (µV/m) at 30 m distance.

Domestic premises: The standard calls those establishments "first environment". Drives that are connected without an intermediate transformer to the public power network supplying residential areas. The valid interference limits are very low and can only be observed by keeping all installation requirements.

Industrial premises: The standard refers to such environments as "second environment".
These are areas that are separated from the public power network by separate transformers.
The user must ensure that the suppression elements recommended by the manufacturer are used, and that the manufacturer's recommendations are followed. Moreover, the user must ensure that strong interferences do not couple into neighbouring low-voltage supply networks.
If the neighbouring network is a public network for residential areas, the stricter limits 66-56 / 56 / 60 dB(µV) quasi-peak must be complied with. In industrial networks, the higher limits 79 / 73 / 73 dB(µV) quasi-peak can be used.

Moreover, in the case of an influence on other devices, suppression of the interference is required. This suppression is the plant owner's responsibility.
The limits for immunity are much stricter, since a higher level of interference has the be assumed.

The basic requirement for compliance with the relevant limits is the observance and compliance with the installation requirements and the use of the recommended options.

Notes:

>*pDRIVE*< *CX single/compact* Frequency inverters

Start-up Log

General Data of the Frequency Inverter			
Inverter type:	❑ *CX single 0,4*	❑ *CX single 0,7*	❑ *CX single 1,5*
	❑ *CX single 2,2*		
	❑ *CX compact 0,7*	❑ *CX compact 1,5*	❑ *CX compact 2,2*
	❑ *CX compact 3,0*	❑ *CX compact 4,0*	❑ *CX compact 5,5*
	❑ *CX compact 7,5*		
Serial number:		Code:	
Customer / Company:		Supplier / Company:	
Delivery date:		Start-up date:	

Parameter adjustments

F-Parameter

No.	Parameter name	Default	Setting	Page
F01	Output frequency	–		14
F02	Acceleration ramp	10 s		14
F03	Deceleration ramp	10 s		14
F04	Running direction of RUN key	00		37

A-Parameter

No.	Parameter name	Default	Setting	Page
A01	Method of speed command	01		14
A02	Method of run command	01		15
A03	Base frequency	50 Hz		14
A04	Maximum frequency	50 Hz		14
A11	External frequency start	0.0 Hz		15
A12	External frequency end	0.0 Hz		15

No.	Parameter name	Default	Setting	Page
A13	Analog signal reference for Start	0 %		15
A14	Analog signal reference for End	0 %		15
A15	External frequency start pattern	01		15
A16	Time constant for analog signal	8		16
A20	Internal pre-set speed if A01=02	0.0 Hz		14
A21	Multi speed 1	0.0 Hz		16
A22	Multi speed 2	0.0 Hz		16
A23	Multi speed 3	0.0 Hz		16
A24	Multi speed 4	0.0 Hz		16
A25	Multi speed 5	0.0 Hz		16
A26	Multi speed 6	0.0 Hz		16
A27	Multi speed 7	0.0 Hz		16
A28	Multi speed 8	0.0 Hz		16
A29	Multi speed 9	0.0 Hz		16
A30	Multi speed 10	0.0 Hz		16
A31	Multi speed 11	0.0 Hz		16
A32	Multi speed 12	0.0 Hz		16
A33	Multi speed 13	0.0 Hz		16
A34	Multi speed 14	0.0 Hz		16
A35	Multi speed 15	0.0 Hz		16
A38	Jogging frequency	1.00 Hz		17
A39	Stop mode of jog function	00		17
A41	Torque boost method selection	00		17
A42	Manual torque boost setting	11		18
A43	Manual torque boost frequency point	10.0 %		18
A44	V/f characteristic setting	00		18
A45	Voltage gain setting	100 %		19
A51	Selection of DC braking	00		19
A52	DC braking: frequency	0.5 Hz		19
A53	DC braking: waiting time	0.0 s		19
A54	DC braking: braking torque	0 %		19
A55	DC braking: braking time	0.0 s		19
A61	Frequency upper limit	0.0 Hz		20
A62	Frequency lower limit	0.0 Hz		20
A63	1st Jump frequency	0.0 Hz		21
A64	1st Jump frequency width	0.5 Hz		21

No.	Parameter name	Default	Setting	Page
A65	2nd Jump frequency	0.0 Hz		21
A66	2nd Jump frequency width	0.5 Hz		21
A67	3rd Jump frequency	0.0 Hz		21
A68	3rd Jump frequency width	0.5 Hz		21
A71	Selection of PID function: ON/OFF	00		23
A72	PID controller: Proportional gain (kp)	1.0		23
A73	PID controller: Integral gain (Tn)	1.0 s		23
A74	PID controller: Differential gain (Tv)	0.0 s		23
A75	PID controller: Scale conversion	1.00		24
A76	PID controller: Feedback destination	00		24
A81	Selection of AVR function	02		25
A82	AVR: Motor voltage *CX single:* / *CX compact:*	230 V / 400 V		25
A92	2nd Acceleration ramp	15.0 s		25
A93	2nd Deceleration ramp	15.0 s		25
A94	Select method of 2nd stage	00		25
A95	Switch-over 1./2. acceleration ramp	0.0 Hz		26
A96	Switch-over 1./2. deceleration ramp	0.0 Hz		26
A97	Pattern of acceleration ramp	00		26
A98	Pattern of deceleration ramp	00		26

b-Parameter

No.	Parameter name	Default	Setting	Page
b01	Selection of restart mode	00		36
b02	Allowable undervoltage time	1.0 s		37
b03	Retry waiting time	1.0 s		37
b12	Electronic overload setting	FI-I_{NOM}		26
b13	Electronic overload characteristic	01		26
b21	Selection of overload restriction	01		27
b22	Level of overload restriction	1.25 x I_N		27
b23	Rate of decel. at overload restriction	1.0 s		27
b31	Software lock	01		39
b32	Reactive current setting	0.58 x I_N		37
b81	Analog meter adjustment	80		35
b82	Start frequency adjustment	0.5 Hz		38

No.	Parameter name	Default	Setting	Page
b83	Carrier frequency setting	5.0 kHz		38
b84	Factory default setting	00		39
b85	Kind of factory default	01		39
b86	Frequency converted value setting	1.0		38
b87	Selection of STOP key	00		38
b88	After FRS cancelled	00		38
b89	Digital Operator Display	01		39

C-Parameter

No.	Parameter name	Default	Setting	Page
C01	Function of input 1	00		28
C02	Function of input 2	01		28
C03	Function of input 3	02		28
C04	Function of input 4	03		28
C05	Function of input 5	18		28
C11	Condition of input C01	00		32
C12	Condition of input C02	00		32
C13	Condition of input C03	00		32
C14	Condition of input C04	00		32
C15	Condition of input C05	00		32
C21	Function of terminal 11	01		32
C22	Function of terminal 12	00		32
C23	Condition of output FM	00		34
C31	Condition of output C21: Inversion	00		35
C32	Condition of output C22: Inversion	00		35
C33	Condition of terminal AL	01		35
C41	Level of overload signal	I_{NOM}		36
C42	Arrival signal for Acceleration	0.0 Hz		36
C43	Arrival signal for Deceleration	0.0 Hz		36
C44	PID controller: Level of deviation	3.0 %		24

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Due to ongoing product modifications, data subject to change without notice.