

■ Contents

Quick Setup	3
General warning	3
Mechanical Installation	3
Electrical Installation, power	3
Electrical Installation, control cables	3
Programming	3
Motor start	4
AKD Lon card	4
Safety regulations	4
Warning against unintended start	5
Introduction to AKD 2800	7
Order form	7
High voltage warning	9
These rules concern your safety	9
Warning against unintended start	9
Control unit	10
Manual initialisation	10
Automatic motor tuning	11
Programming	12
Operation & Display	12
Load and Motor	18
References & Limits	24
Inputs and outputs	28
Special functions	34
Serial communication	38
Technical functions	42
Installation	46
Mechanical dimensions	46
Mechanical installation	47
General information about electrical installation	48
EMC-correct electrical installation	49
Electrical installation	50
Safety clamp	52
Pre-fuses	52
Mains connection	52
Motor connection	52
RFI switch	53
Direction of motor rotation	53
Parallel connection of motors	53
Motor cables	53
Motor thermal protection	54
Earth connection	54
Load sharing	54
Tightening Torque, Power Terminals	54
Access to control terminals	54
Electrical installation, control cables	55
Tightening torques, control cables	56

Electrical installation, control terminals	56
Relay connection	56
Connection examples	57
All about AKD 2800	58
Display readout	58
Warnings/alarm messages	58
Special conditions	62
Aggressive environments	62
Galvanic Isolation (PELV)	62
EMC emission	64
UL Standard	64
General technical data	65
Technical data, mains supply 1 x 220 - 240 V/3 x 200-240 V	69
Technical data, mains supply 3 x 380 - 480 V	70
Factory Settings	71

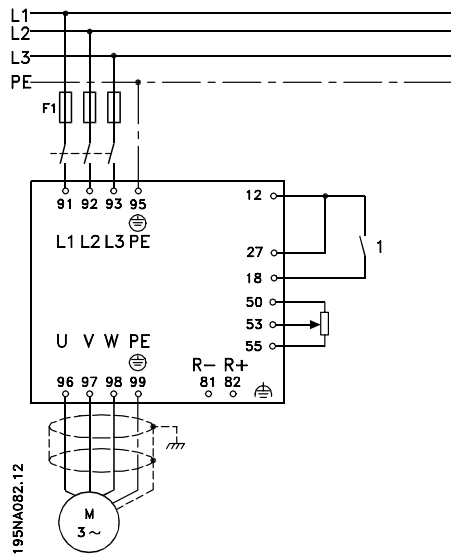
■ Quick Setup

■ General warning

Using this Quick Setup, you can carry out quick and EMC-correct installation of the frequency converter in five steps. The Operating Instructions, which are also enclosed, give other examples of installation and describe all functions in detail.



Read the safety instructions on the next page before installing the unit.



■ Mechanical Installation

Frequency converters allow side-by-side installation. Because of the need for cooling, there must be 10 cm free air passage above and below the frequency converter. Drill holes in accordance with the measurements given in section *Mechanical dimensions*. Retighten all four screws.

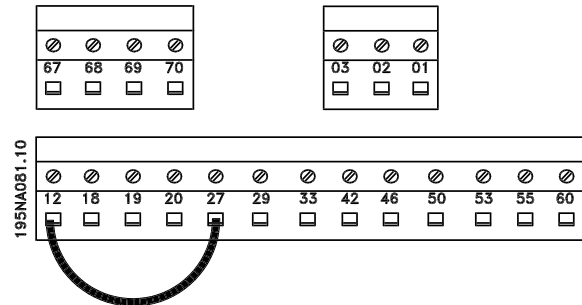
Fit the decoupling plate to the power cables and the earth screw (terminal 95).

■ Electrical Installation, power

Please note that the power terminals can be removed. Connect mains to the mains terminals of the frequency converter, i.e. 91, 92, 93 and the earth connection to terminal 95. Fit a screened/armoured cable from the motor to the motor terminals of the frequency converter, i.e. U, V, W. The screen ends in a screen connector.

■ Electrical Installation, control cables

Remove the front cover underneath the control panel. Place a jumper between terminals 12 and 27.



Quick Setup

■ Programming

Carry out programming on the control panel. Press the [QUICK MENU] key to enter the Quick menu. In this menu, parameters can be selected by means of the [+] and [-] keys. The parameter values can be changed by pressing [CHANGE DATA]. Changes are programmed using the [+] and [-] keys. Finish the change of a parameter setting by pressing [CHANGE DATA]. A change of parameter values is saved automatically after a mains failure. If the display shows three dots at the right, the parameter value has more than three digits. In order to see the value, activate [CHANGE DATA]. Press [QUICK MENU]: Set the motor parameters that are on the nameplate of the motor:

Motor power [kW]	parameter 102
Motor voltage [V]	parameter 103
Motor frequency [Hz]	parameter 104
Motor current [A]	parameter 105
Rated motor speed	parameter 106

Activate AMT:

Automatic motor tuning	parameter 107
------------------------	---------------

Set reference range

Min. reference, Ref _{MIN}	parameter 204
Max. reference, Ref _{MAX}	parameter 205

Ramp-up time [s]	parameter 207
Ramp-down time [s]	parameter 208

In parameter 002 Local/remote control, the frequency converter mode can be selected as Remote

operation [0], i.e. via the control terminals, or Local [1], i.e. via the control unit.

Set the control location to Local [1].

Local/remote operation = Local [1] Par. 002

Set the motor speed by adjusting the Local reference

Local reference Parameter 003

Motor start

Press [Start] to start the motor. Set the motor speed by adjusting parameter 003 Local reference.

Check whether the direction of rotation of the motor shaft is clockwise. If not, exchange any two phases on the motor cable. Press [STOP/RESET] to stop the motor. Press [QUICK MENU] to return to display mode. [QUICK MENU] + [+] keys must be pressed simultaneously to give access to all parameters.

AKD Lon card

Requirements:

AKD 2800 must have software version (par 624) **1.32 or higher**

AKD 5000 must have software version (par 624) **1.52 or higher**

The AKD Lon card is RS485 based and must connect to an RS485 Adap-Kool Lon network.

The card can be ordered as build-in with the AKD5000 and comes in an external box for the AKD2800.

AKD Lon connections:

The Lon card has two connections.

A 6-pole connector (only 1-4 is used) that connects to the AKD. Connections are as follows:

AKD-Connections:

Lon card terminals	1 (Red +24V)	2 (White or Yellow TX-, RX-)	3 (Black Com)	4 (Green TX+, RX+)
AKD terminals	12	69	39 or 20	68

The 3-pole connector for the Lon Communication:

Lon card terminals	1	2	3
Adap-Kool Lon	A	B	Shield

Connect the Adap-Kool Lon network to the removable 3-position connector. Be careful to route the network wires away from the AC power and motor wires.

Commissioning

Upon power up the lower red LED of the double LED's, next to the Lon connectors will initially be flashing red.

1. Set AKD address in parameter 500 in the AKD (1 to 60)
2. Wait for about 1 min until the red LED goes off. (card initialisation)
3. Press one of the service pin buttons
4. Wait for about 2 minutes (upload of parameters to gateway)
5. Perform a "Net configuration" upload in AKM and you should now find the AKD. Perform a "AKC description" upload in AKM
6. Go to menu AKC -> Controllers in AKM and you should find the AKD

Safety regulations



The voltage of the frequency converter can be fatal whenever it is connected to mains. Incorrect installation of the motor or the frequency converter may lead to damage to the equipment, serious personal injury or death.

Consequently, the provisions of this Quick Setup, as well as national and local rules and safety regulations, must be complied with.

Touching the electrical parts may be fatal, even after the equipment has been disconnected from mains: wait at least 4 min.

1. The mains supply to the frequency converter must be disconnected if repair work is to be carried out.
2. The [STOP/RESET] key on the control panel of the frequency converter does not disconnect the mains supply and is thus not to be used as a safety switch.

3. Correct protective earthing of the unit must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage current is higher than 3.5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is required, set parameter 128 Motor thermal protection to data value ETR Trip or ETR Warning.
6. Check that the mains supply has been disconnected before removing the motor and mains plugs.

■ Warning against unintended start

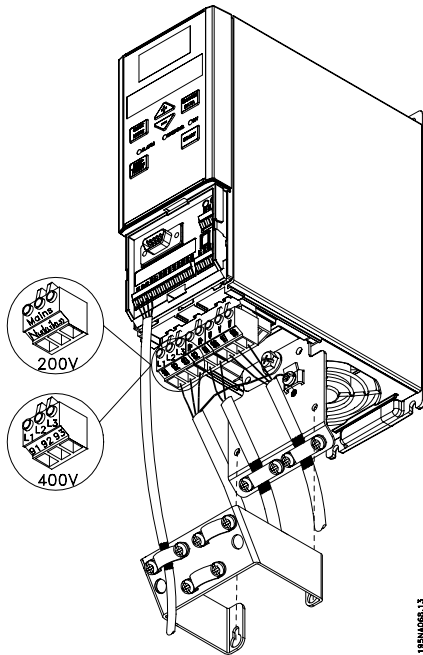


The motor can be brought to a stop by means of digital commands, bus commands, references or local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stops are not sufficient. While parameters are being programmed, the motor may start. Consequently, the stop key [STOP/RESET] must always be activated, following which data can be modified. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload, a fault in the supply mains or a fault in the motor connection ceases.

AKD 2800

AKD 2803-2815 200-240 V

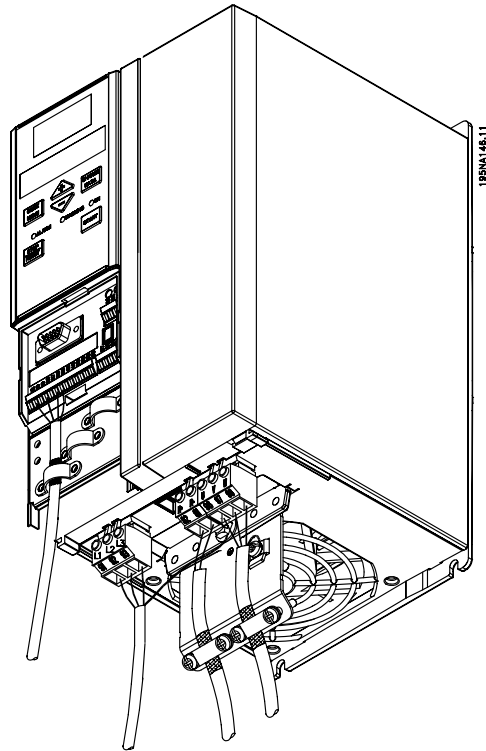
AKD 2805-2815 380-480 V



195NA06.13

AKD 2840 200-240 V

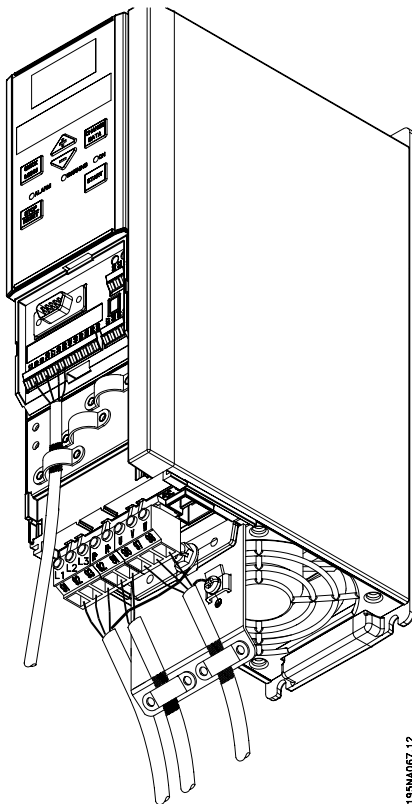
AKD 2855-2875 380-480 V



195NA148.11

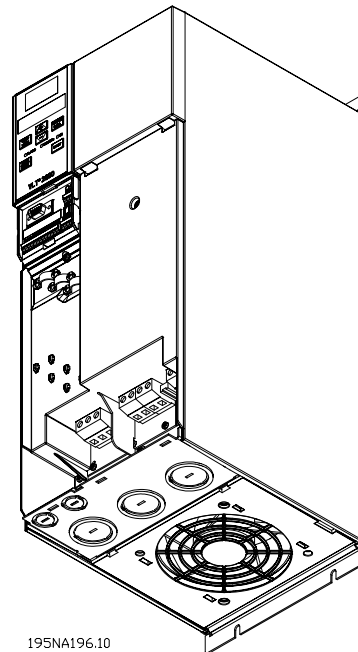
AKD 2822 200-240 V

AKD 2822-2840 380-480 V

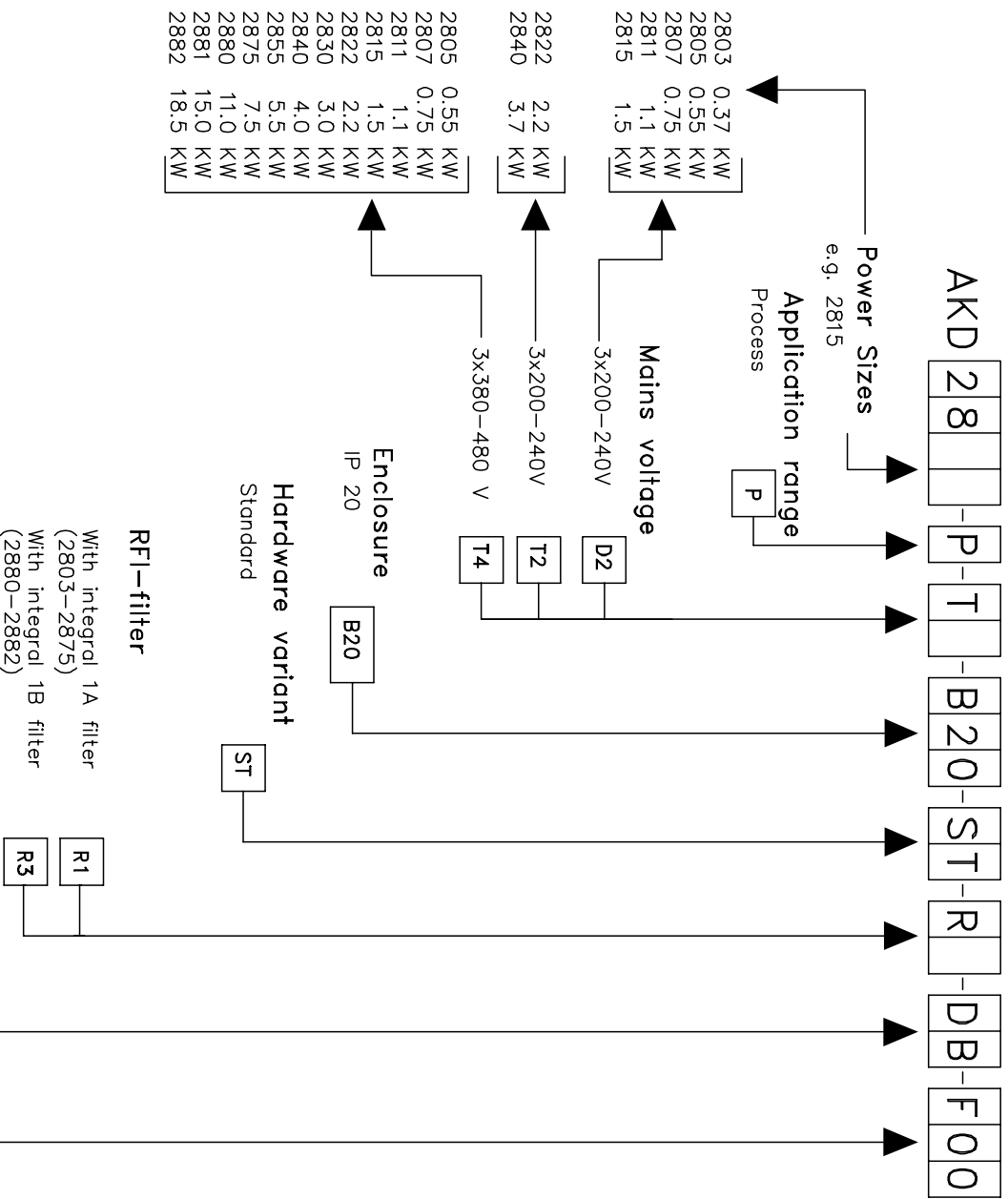


195NA067.12

AKD 2880-2882 380-480 V



195NA196.10



2803	0.37 kW
2805	0.55 kW
2807	0.75 kW
2811	1.1 kW
2815	1.5 kW
2822	2.2 kW
2840	3.7 kW
2805	0.55 kW
2807	0.75 kW
2811	1.1 kW
2815	1.5 kW
2822	2.2 kW
2830	3.0 kW
2840	4.0 kW
2855	5.5 kW
2875	7.5 kW
2880	11.0 kW
2881	15.0 kW
2882	18.5 kW

Introduction to AKD 2800

No. unit of this type

--	--	--	--	--	--

Required delivery date

--	--	--	--	--	--

Ordered by:

Display unit
With built-in display unit
LCP display unit is an option
Code no.: 175N0131
Cable for LCP – Code no.: 175Z0929

DB

Date: _____

Please take a copy of the ordering form.
Fill it in and send or fax your order
to the nearest Danfoss rep. office.

195NA303.10

AKD 2800

Operating instructions
Software version: 1.3x



These operating instructions can be used for all series frequency converters with software version 1.3x.

The software version number can be seen from parameter 640 Software version no.



NB!:

Indicates something to be noted by the reader.



Indicates a general warning.



Indicates a high-voltage warning.

■ High voltage warning



The voltage of the frequency converter is dangerous whenever the converter is connected to mains. Incorrect fitting of the motor or frequency converter may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations.

■ These rules concern your safety

1. The frequency converter must be disconnected from the mains if repair work is to be carried out. Check that the mains supply has been disconnected and that the prescribed time has passed before removing motor and mains plugs.
2. The [STOP/RESET] key on the control panel of the frequency converter does not disconnect the equipment from mains and is thus not to be used as a safety switch.
3. The unit must be properly connected to the earth, the user must be protected against the supply voltage and the motor must be protected against overloading pursuant to prevailing national and local regulations.
4. The earth leakage currents are higher than 3.5 mA.
5. Protection against motor overload is not included in the factory setting. If this function is required, set parameter 128 *Motor thermal protection* to data value *ETR trip* or data value *ETR warning*. For the North American market: The ETR functions

provide overload protection of the motor, class 20, in accordance with NEC.

6. Do not remove the plugs for the motor - and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the prescribed time has passed before removing motor and mains plugs.
7. Note that the frequency converter has more voltage inputs than L1, L2 and L3 when the DC bus terminals are used. Check that all voltage inputs are disconnected and that the prescribed time has passed before repair work is commenced.

■ Warning against unintended start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, the motor may start. Consequently, the stop key [STOP/RESET] must always be activated, following which data can be modified.
3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.



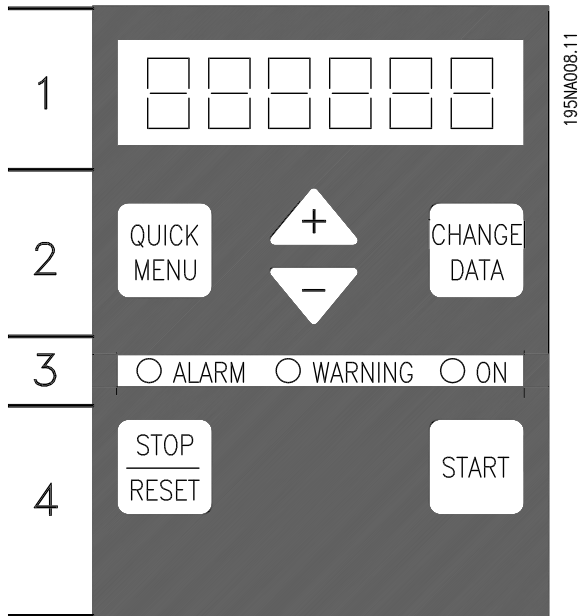
Warning:

It can be extremely dangerous to touch the electrical parts even when the mains supply has been disconnected. Also ensure that other voltage inputs are disconnected from load sharing through the DC bus. Wait at least 4 minutes after the input power has been removed before servicing the drive.

195NA300.10

■ Control unit

On the front of the frequency converter there is a control panel.



The control panel is divided into four function groups:

1. Six-digit LED display.
2. Keys for changing parameters and shifting display function.
3. Indicator lamps.
4. Keys for local operation.

All displays of data are in the form of a six-digit LED display capable of showing one item of operating data continuously during normal operation. As a supplement to the display, there are three indicator lamps for indication of mains connection (ON), warning (WARNING) and alarm (ALARM). Most of the frequency converter's parameter Setups can be changed immediately via the control panel, unless this function has been programmed as *Locked* [1] via parameter 018 *Lock for data changes*.

■ Control keys

[QUICK MENU] allows access to the parameters used for the Quick menu.

The [QUICK MENU] key is also used if a change to a parameter value is not to be implemented.

See also [QUICK MENU] + [+].

[CHANGE DATA] is used for changing a setting.

The [CHANGE DATA] key is also used for confirming a change of parameter settings.

[+] / [-] are used for selecting parameters and for changing parameter values.

These keys are also used in Display mode for selecting the display of an operating value.

The **[QUICK MENU] + [+]** keys must be pressed at the same time to give access to all parameters. See *Menu mode*.

[STOP/RESET] is used for stopping the connected motor or for resetting the frequency converter after a trip. Can be selected as *Active* [1] or *Not active* [0] via parameter 014 *Local stop/reset*. In Display mode, the display will flash if the stop function is activated.



NB!:

If the [STOP/RESET] key is set at *Not active* [0] in parameter 014 *Local stop/reset*, and there is no stop command via the digital inputs or serial communication, the motor can only be stopped by disconnecting the mains voltage to the frequency converter.

[START] is used for starting the frequency converter. It is always active, but the [START] key cannot override a stop command.

■ Manual initialisation

Disconnect mains voltage. Hold the [QUICK MENU] + [+] + [CHANGE DATA] keys down while simultaneously reconnecting the mains voltage. Release the keys; the frequency converter has now been programmed for the factory setting.

■ Display readout states

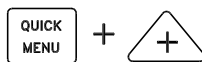
Display mode

Fr 50.3

In normal operation, one item of operating data can be displayed continuously at the operator's own choice. By means of the [+/-] keys the following options can be selected in Display mode:

- Output frequency [Hz]
- Output current [A]
- Output voltage [V]
- Intermediate circuit voltage [V]
- Output power [kW]
- Scaled output frequency $f_{out} \times p008$

Menu mode



In order to enter the Menu mode [QUICK MENU] + [+] must be activated at the same time. In Menu mode, most of the frequency converter parameters can be changed. Scroll through the parameters using the [+/-] keys. While scrolling in the Menu mode proceeds, the parameter number will flash.

1020.75

The display shows that the setting in parameter 102 *Motor power* $P_{M,N}$ is 0.75. In order to change the value of 0.75, [CHANGE DATA] must first be activated; the parameter value can then be changed using the [+/-] keys.

204...

If for a given parameter the display shows three dots at the right, it means that the parameter value has more than three digits. In order to see the value, activate [CHANGE DATA].

128 2

The display shows that in parameter 128 *Motor thermal protection* the selection made is *Thermistor trip* [2].

Quick menu

103 380

Using the [QUICK MENU] key, it is possible to access the 12 most important parameters of the frequency converter. After programming, the frequency converter is in most cases ready for operation. When the [QUICK MENU] key is activated in Display mode, the Quick menu starts. Scroll through the quick menu using the [+/-] keys and change the data values by first pressing [CHANGE DATA] and then changing the parameter value with the [+/-] keys.

The Quick menu parameters are:

- Par. 102 *Motor power* $P_{M,N}$
- Par. 103 *Motor voltage* $U_{M,N}$
- Par. 104 *Motor frequency* $f_{M,N}$
- Par. 105 *Motor current* $I_{M,N}$
- Par. 106 *Rated motor speed* $n_{M,N}$
- Par. 107 *Automatic motor adaption*
- Par. 204 *Minimum reference* Ref_{MIN}
- Par. 205 *Maximum reference* Ref_{MAX}
- Par. 207 *Ramp-up time*
- Par. 208 *Ramp-down time*
- Par. 002 *Local/remote operation*
- Par. 003 *Local reference*

Parameter 102 - 106 can be read out from the motor's nameplate.

Automatic motor tuning

Automatic motor tuning (AMT) is performed as follows:

1. In parameter 107 *Automatic motor tuning* select data value [2]. "107" will now flash, and "2" will not flash.
2. AMT is activated by pressing start. "107" will now flash and dashes will move from left to right in the data value field.
3. When "107" appears once more with the data value [0], AMT is complete. Press [STOP/RESET] to save the motor data.
4. "107" will then continue to flash with the data value [0]. You can now proceed.

■ Operation & Display

001 Language

(LANGUAGE)

Value:

★English (ENGLISH)	[0]
German (DEUTSCH)	[1]
French (FRANCAIS)	[2]
Danish (DANSK)	[3]
Spanish (ESPANOL)	[4]
Italian (ITALIANO)	[5]

Function:

This parameter is used to choose the language to be shown in the display whenever the LCP control unit is connected.

Description of choice:

There is a choice of the languages shown. The factory setting may vary.

002 Local/remote operation

(OPERATION SITE)

Value:

★Remote operation (REMOTE)	[0]
Local operation (LOCAL)	[1]

Function:

There is a choice of two different modes of operation of the frequency converter; *Remote operation* [0] or *Local operation* [1]. See also parameter 013 *Local control* if *Local operation* [1] is selected.

Description of choice:

If *Remote operation* [0] is selected, the frequency converter is controlled via:

1. the control terminals or via serial communication.
2. the [START] key. This cannot, however, override stop commands transmitted via the digital inputs or via serial communication.
3. the [STOP/RESET] and [JOG] keys, on the condition that these are active.

If *Local operation* [1], is selected, the frequency converter is controlled via:

1. the [START] key. This cannot, however, override stop commands via the digital inputs (see parameter 013 *Local control*).
2. the [STOP/RESET] and [JOG] keys, on the condition that these are active.
3. the [FWD/REV] key, on the condition that is has been selected as active in parameter 016 *Local reversing*, and that parameter 013 *Local control*

★ = factory setting. () = display text [] = value for use in communication via serial communication port

is set at *Local control and open loop* [1] or *Local control as parameter 100* [3]. Parameter 200 *Output frequency range* is set at *Both directions*.

4. parameter 003 *Local reference* where the reference can be set using the [+] and [-] keys.
5. an external control command that can be connected to the digital inputs (see parameter 013 *Local control*).



NB!:

The [JOG] and [FWD/REV] keys are located on the LCP control unit.

003 Local reference

(LOCAL REFERENCE)

Value:

Par.013 *Local control* must be set to [1] or [2]:

0 - f_{MAX} (par. 202) ★ 000,000.000

Par. 013 *Local control* must be set to [3] or [4] and parameter 203 *Reference/feedback range* to [0]:

$Ref_{MIN} - Ref_{MAX}$ (par. 204-205) ★ 000,000.000

Par. 013 *Local control* must be set to [3] or [4] and parameter 203 *Reference/feedback range* to [1]:

- $Ref_{MAX} - + Ref_{MAX}$ (par. 204-205) ★ 000,000.000

Function:

In this parameter, the local reference can be set manually. The unit of the local reference depends on the configuration selected in parameter 100 *Configuration*.

Description of choice:

In order to protect the local reference, parameter 002 *Local/remote operation* must be set to *Local operation* [1]. Local reference cannot be set via serial communication.

004 Active Setup

(ACTIVE SETUP)

Value:

Factory Setup (FACTORY SETUP)	[0]
★Setup 1 (SETUP 1)	[1]
Setup 2 (SETUP 2)	[2]
Setup 3 (SETUP 3)	[3]
Setup 4 (SETUP 4)	[4]
Multi Setup (MULTI SETUP)	[5]

Function:

The active parameter Setup is selected here. All parameters can be programmed in four individual parameter Setups. Shifts between Setups can be made in this parameter via a digital input or via serial communication.

Description of choice:

Factory Setup [0] contains the factory-set parameter values. *Setup 1-4* [1]-[4] are four individual Setups which can be selected as required. *Multi Setup* [5] is used where remote-controlled shifts between the four Setups via a digital input or via serial communication is required.

Copy to Setup 2 from # (COPY TO SETUP 2)	[2]
Copy to Setup 3 from # (COPY TO SETUP 3)	[3]
Copy to Setup 4 from # (COPY TO SETUP 4)	[4]
Copy to all Setups from # (COPY TO ALL)	[5]

Function:

You can copy from the selected active Setup in parameter 005 *Programming setup* to the selected Setup or Setups in this parameter.



NB!:

Copying is only possible in Stop (motor stopped in connection with a stop command).

005 Programming Setup

(EDIT SETUP)

Value:

Factory Setup (FACTORY SETUP)	[0]
Setup 1 (SETUP 1)	[1]
Setup 2 (SETUP 2)	[2]
Setup 3 (SETUP 3)	[3]
Setup 4 (SETUP 4)	[4]
★Active Setup (ACTIVE SETUP)	[5]

Function:

You can select which Setup you want to programme during operation (applies both via the control panel and the serial communication port). It is, for example, possible to programme *Setup 2* [2], while the active Setup is set to *Setup 1* [1] in parameter 004 *Active Setup* .

Description of choice:

Factory Setup [0] contains the factory-set data and can be used as a source of data if the other Setups are to be reset to a known status. *Setup 1-4* [1]-[4] are individual Setups that can be programmed freely during operation. If *Active Setup* [5] is selected, the programming Setup will be equal to parameter 004 *Active Setup* .



NB!:

If data is modified or copied to the active Setup, the modifications have an immediate effect on the unit's operation.

Description of choice:

Copying begins when the required copying function has been selected and the [OK]/[CHANGE DATA] key has been pushed. The display indicates when copying is in progress.

007 LCP copy

(LCP COPY)

Value:

★No copying (NO COPY)	[0]
Upload all parameters (UPL. ALL PAR.)	[1]
Download all parameters (DWNL. ALL PAR.)	[2]
Download size-independent parameters (DWNL.OUTPIND.PAR.)	[3]

Function:

Parameter 007 *LCP copy* is used if you want to use the LCP 2 control panel's integral copy function. The function is used if you want to copy all parameter setups from one frequency converter to another by moving the LCP 2 control panel.

Description of choice:

Select *Upload all parameters* [1] if you want all parameter values to be transferred to the control panel. Select *Download all parameters* [2] if all parameter values transferred are to be copied to the frequency converter to which the control panel is attached. Select *Download size-independent par.* [3] if you only want to download the size-independent parameters. This is used when downloading to a frequency converter with a different rated power size than that from which the parameter setup originates.

006 Setup copying

(SETUP COPY)

Value:

★No copying (NO COPY)	[0]
Copy to Setup 1 from # (COPY TO SETUP 1)	[1]

★ = factory setting. () = display text [] = value for use in communication via serial communication port



NB!:

Upload/download can only be performed in stop mode. Download can only be performed to a frequency converter with the same software version number, see parameter 626 *Database identification no.*

008 Display scaling of output frequency (FREQUENCY SCALE)

Value:

0.01 - 100.00 ★ 1.00

Function:

In this parameter, the factor is selected by which the output frequency is to be multiplied. The value is shown in the display, provided parameters 009-012 *Display readout* have been set to *Output frequency x scaling* [5].

Description of choice:

Set the required scaling factor.

009 Large display readout (DISPLAY LINE 2)

Value:

No readout (NONE)	[0]
Resulting reference [%] (REFERENCE [%])	[1]
Resulting reference [unit] (REFERENCE [UNIT])	[2]
Feedback [unit] (FEEDBACK [UNIT])	[3]
★Frequency [Hz] (FREQUENCY [HZ])	[4]
Output frequency x scaling (FREQUENCY X SCALE)	[5]
Motor current [A] (MOTOR CURRENT [A])	[6]
Torque [%] (TORQUE [%])	[7]
Power [kW] (POWER [KW])	[8]
Power [HP] (POWER [HP][US])	[9]
Motor voltage [V] (MOTOR VOLTAGE [V])	[11]
DC link voltage [V] (DC LINK VOLTAGE [V])	[12]
Thermal load motor [%] (MOTOR THERMAL [%])	[13]
Thermal load [%] (FC. THERMAL[%])	[14]
Running hours [Hours] (RUNNING HOURS))	[15]
Digital input [Bin] (DIGITAL INPUT[BIN])	[16]
Analog input 53 [V] (ANALOG INPUT 53 [V])	[17]

★ = factory setting. () = display text [] = value for use in communication via serial communication port

Analog input 60 [mA] (ANALOG INPUT 60 [MA])	[19]
Pulse reference [Hz] (PULSE REF. [HZ])	[20]
External reference [%] (EXTERNAL REF. [%])	[21]
Status word [Hex] (STATUS WORD [HEX])	[22]
Heatsink temperature [°C] (HEATSINK TEMP [°C])	[25]
Alarm word [Hex] (ALARM WORD [HEX])	[26]
Control word [Hex] (CONTROL WORD [HEX])	[27]
Warning word [Hex] (WARNING WORD [HEX])	[28]
Extended status word [Hex] (EXT. STATUS [HEX])	[29]
Communication option card warning (COMM OPT WARN [HEX])	[30]
Pulse count (PULSE COUNTER)	[31]

Function:

In this parameter you can select the data value that you wish to display in the LCP control unit display line 2 when the frequency converter is switched on. The display will also be included in the scrollbar in display mode. In parameters 010-012 *Display readout* you can select a further three data values, which are displayed in display line 1.

Description of choice:

No readout can only be selected in parameters 010-012 *Small display readout*.

Resulting reference [%] gives, as a percentage, the resulting reference in the range from Minimum reference, Ref_{MIN} to Maximum reference, Ref_{MAX}.

Reference [unit] gives the resulting reference with unit Hz in *Open loop*. In *Closed loop* the reference unit is selected in parameter 416 *Process units*.

Feedback [unit] gives the resulting signal value using the unit/scaling selected in parameter 414 *Minimum feedback, FB_{LOW}*, 415 *Maximum feedback, FB_{HIGH}* and 416 *Process units*.

Frequency [Hz] gives the output frequency of the frequency converter.

Output frequency x scaling [-] equals the present output frequency f_M multiplied by the factor set in parameter 008 *Display scaling of output frequency* .

Motor current [A] gives the phase current of the motor measured as an effective value.

Torque [%] denotes the motor's present load in relation to the motor's rated torque.

Power [kW] gives the present power that the motor is absorbing in kW.

Power [HP] gives the present power that the motor is absorbing in HP.

Motor voltage[V] gives the voltage supplied to the motor.

DC link voltage [V] gives the intermediate circuit voltage of the frequency converter.

Thermal load motor [%] gives the calculated/estimated load on the motor. 100 % is the cut-out limit.

Thermal load [%] gives the calculated/estimated thermal load on the frequency converter. 100 % is the cut-out limit.

Running hours [Hours] gives the number of hours that the motor has run since the last reset in parameter 619 *Reset of running hours counter*.

Digital input [Binary code] gives the signal status from the 5 digital inputs (18, 19, 27, 29 and 33). Terminal 18 corresponds to the bit on the extreme left. '0' = no signal, '1' = signal connected.

Analog input 53 [V] gives the voltage value of terminal 53.

Analog input 60 [mA] gives the present value of terminal 60.

Pulse reference [Hz] gives the reference in Hz connected to terminal 33.

External reference [%] gives the sum of external references as a percentage (sum of analogue/pulse/serial communication) in the range from Minimum reference, Ref_{MIN} to Maximum reference, Ref_{MAX}.

Status word [Hex] gives one or several status conditions in a Hex code. See *Serial communication* in the *Design Guide* for further information.

Heatsink temp.[°C] gives the present heatsink temperature of the frequency converter. The cut-out limit is 90-100°C, while cutting back in occurs at 70 ± 5°C.

Alarm word [Hex] gives one or several alarms in hex code. See *Serial communication* in the *Design Guide* for further information.

Control word [Hex] gives the control word for the frequency converter. See *Serial communication* in the *Design Guide* for further information.

Warning word [Hex] gives one or several warnings in hex code. See *Serial communication* in the *Design Guide* for further information.

Extended status word [Hex] gives one or several status modes in Hex code. See *Serial communication* in the *Design Guide* for further information.

Communication option card warning [Hex] gives a warning word if there is a fault in the communication bus. Only active if communication options are installed. If there are no communication options 0 Hex is displayed.

Pulse count gives the number of pulses that the unit has registered.

010 Small display line 1.1

(DISPLAY LINE 1.1)

Value:

See par. 009 *Large display readout*

★ Reference [%] [1]

Function:

In this parameter, the first of three data values can be selected that is to be displayed in the LCP control unit display, line 1, position 1. This is a useful function, e.g. when setting the PID regulator, as it gives a view of process reactions to reference changes. The display readout is activated by pushing the [DISPLAY STATUS] key.

Description of choice:

See parameter 009 *Large display readout*.

011 Small display readout 1.2

(DISPLAY LINE 1.2)

Value:

See parameter 009 *Large display readout*

★ Motor current [A][6]

Function:

See the functional description given under parameter 010 *Small display readout*.

Description of choice:

See parameter 009 *Large display readout*.

012 Small display readout 1.3

(DISPLAY LINE 1.3)

Value:

See parameter 009 *Large display readout*

★ Power [kW][8]

Function:

See the functional description given under parameter 010 *Small display readout*.

Description of choice:

See parameter 009 *Large display readout*.

013 Local control

(LOC CTRL/CONFIG.)

Value:

Local not active (DISABLE)	[0]
Local control and open loop (LOC CTRL/OPEN LOOP)	[1]
Remote-operated control and open loop (LOC+DIG CTRL)	[2]
Local control as parameter 100 (LOC CTRL/AS P100)	[3]
★Remote-operated control as parameter 100 (LOC+DIG CTRL/AS P100)	[4]

Function:

This is where the required function is selected if, in parameter 002 *Local/remote operation*, *Local operation* [1] has been chosen.

Description of choice:

If *Local not active* [0] is selected, it is not possible to set a reference via parameter 003 *Local reference*. In order to enable a shift to *Local not active* [0], parameter 002 *Local/remote operation* must be set to *Remote operation* [0].

Local control and open loop [1] is used if the motor speed is to be set via parameter 003 *Local reference*. When this choice is made, parameter 100 *Configuration* automatically shifts to *Speed regulation, open loop* [0].

Remote-operated control and open loop [2] functions in the same way as *Local control and open loop* [1]; however, the frequency converter can also be controlled via the digital inputs.

Local control as parameter 100 [3] is used when the motor speed is to be set via parameter 003 *Local reference*, but without parameter 100 *Configuration* automatically shifting to *Speed regulation, open loop* [0].

Remote-operated control as parameter 100 [4] works the same way as *Local control as parameter 100* [3]; however, the frequency converter can also be controlled via the digital inputs.

Shifting from *Remote operation* to *Local operation* in parameter 002 *Local/remote operation*, while this parameter has been set to *Remote-operated control and open loop* [1]: The present motor frequency and direction of rotation will be maintained. If the present direction of rotation does not respond to the reversing signal (negative reference), the reference will be set to 0.

Shifting from *Local operation* to *Remote operation* in parameter 002 *Local/remote control*, while this parameter has been set to *Remote-operated control and open loop* [1]: The configuration selected in parameter 100 *Configuration* will be active. The shift will be smooth.

Shifting from *Remote control* to *Local control* in parameter 002 *Local/remote operation*, while this parameter has been set to *Remote-operated control as parameter 100* [4]: the present reference will be maintained. If the reference signal is negative, the local reference will be set to 0.

Shifting from *Local operation* to *Remote operation* in parameter 002 *Local/remote operation*, while this parameter has been set to *Remote operation*: The local reference will be replaced by the remote-operated reference signal.

014 Local stop

(LOCAL STOP)

Value:

Not active (DISABLE)	[0]
★Active (ENABLE)	[1]

Function:

In this parameter, the local [STOP]-key can be engaged or disengaged on the control panel and on the LCP control panel.

Description of choice:

If *Not active* [0] is selected in this parameter, the [STOP]-key will be inactive.



NB!:

If *Not active* [0] is selected, the motor cannot be stopped by means of the [STOP]-key.

017 Local reset of trip

(LOCAL RESET)

Value:

- Not active (DISABLE) [0]
- ★Active (ENABLE) [1]

Function:

In this parameter, the reset function on the control panel can be engaged/disengaged.

Description of choice:

If *Not active* [0] is selected in this parameter, the reset function will be inactive.



NB!:

Select *Not active* [0], only if an external reset signal has been connected via the digital inputs.

018 Lock for data changes

(DATA CHANGE LOCK)

Value:

- ★Not locked (NOT LOCKED) [0]
- Locked (LOCKED) [1]

Function:

In this parameter, it is possible to 'lock' the controls to disable data changes via the control keys.

Description of choice:

If *Locked* [1] is selected, data changes in the parameters cannot be made; however, it will still be possible to make data changes via serial communication. Parameter 009-012 *Display readout* can be changed via the control panel.

024 Userdefined Quick Menu

(USER QUICKMENU)

Value:

- ★Not active (DISABLE) [0]
- Active (ENABLE) [1]

Function:

In this parameter you can select the standard setup of the Quick menu key on the control panel and the LCP 2 control panel.

Using this function, in parameter 025 *Quick Menu setup* the user can select up to 20 parameters for the Quick Menu key.

Description of choice:

If *not active* [0] is selected, the standard setup of the Quick Menu key is active.

If *Active* [1] is selected, the user-defined Quick Menu is active.

025 Quick Menu setup

(QUICK MENU SETUP)

Value:

[Index 1 - 20] Value: 0 - 999 ★ 000

Function:

In this parameter you define which parameters are required in the Quick Menu when parameter 024 *User-defined Quick Menu* is set to *Active* [1]. Up to 20 parameters can be selected for the user-defined Quick Menu.



NB!:

Please note that this parameter can only be set using an LCP 2 control panel. See *Order form*.

Description of choice:

The Quick Menu is set up as follows:

1. Select parameter 025 *Quick Menu setup* and press [CHANGE DATA].
 2. Index 1 indicates the first parameter in Quick Menu. You can scroll between the index numbers using the [+ / -] keys. Select Index 1.
 3. Using [< >] you can scroll between the three figures. Press the [<] key once and the last number in the parameter number can be selected using the [+ / -] keys. Set Index 1 to 100 for parameter 100 *Configuration*.
 4. Press [OK] when Index 1 has been set to 100.
 5. Repeat steps 2 - 4 until all parameters required have been set to the Quick Menu key.
 6. Press [OK] to complete the Quick Menu setup.
- If parameter 100 *Configuration* is selected at Index 1, Quick Menu will start with this parameter every time Quick Menu is activated.

Please note that parameter 024 *User-defined Quick Menu* and parameter 025 *Quick Menu setup* are reset to the factory setting during initialisation.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

■ Load and Motor

100 Configuration

(CONFIGURATION)

Value:

- ★Speed control, open loop (SPEED OPEN LOOP) [0]
- Process control, closed loop (PROCESS CLOSED LOOP) [1]

Function:

This parameter is used to select the configuration to which the frequency converter is to be adapted. This makes adaptation to a given application simple, since the parameters not used in a given configuration are hidden (not active).

Description of choice:

If *Speed control, open loop* [0] is selected, normal speed control is obtained (without feedback signal) with automatic load and slip compensation to ensure a constant speed at varying loads. Compensations are active, but may be disabled in parameter 134 *Load compensation* and parameter 136 *Slip compensation* as required.

If *Process control, closed loop* [3] is selected, the internal process regulator is activated to enable precise control of a process in relation to a given process signal. The process signal can be set to the relevant process unit or as a percentage. A feedback signal must be added from the process and the process regulator must be set in parameter group 400 *Special functions*. Process closed loop is not active if a DeviceNet card is mounted and Instance 20/70 or 21/71 is chosen in parameter 904 *Instance types*.

101 Torque characteristic

(TORQUE CHARACT)

Value:

- ★Constant torque (CONSTANT TORQUE) [1]
- Variable torque high (TORQUE: HIGH) [2]
- Variable torque high with CT start (VT HIGH CT START) [3]
- Special motor mode (SPECIAL MOTOR MODE) [4]

CT = Constant torque

Function:

This parameter enables a choice of principle for adaptation of the U/f ratio of the frequency converter to the torque characteristic of the load.

Description of choice:

If *Constant torque* [1] is selected, a load-dependent U/f characteristic is obtained, in which output voltage and output frequency are increased at increasing loads in order to maintain constant magnetization of the motor.

Select *Variable torque high* [2], if the load is square (centrifugal pumps, fans).

High with CT start [3], are selected if you need a greater breakaway torque than can be achieved with the three first characteristics.



NB!:

Load and slip compensation are not active if variable torque or special motor mode have been selected.

Select *Special motor mode* [4], if a special U/f setting is needed that is to be adapted to the present motor. The break points are set in parameters 423-428 *Voltage/frequency*.

Select Constant Torque [1] for use with compressors. Select Variable torque high [2] for use with condenser fans or pumps. Use Special motor mode [4] if several fans are connected in parallel.



NB!:

Please note that if a value set in the nameplate parameters 102-106 is changed, there will be an automatic change of parameter 108 *Stator resistance* and 109 *Stator reactance*.

102 Motor power P_{M,N}

(MOTOR POWER)

Value:

0.25 - 22 kW ★ Depends on unit

Function:

Here you must set a power value [kW] P_{M,N}, corresponding to the motor's rated power. The factory sets a rated power value [kW] P_{M,N}, that depends on the type of unit.

Description of choice:

Set a value that matches the nameplate data on the motor. Settings between one size below and one size over the factory setting are possible.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

103 Motor voltage $U_{M,N}$ (MOTOR VOLTAGE)

Value:

For 200 V units: 50 - 999 V ★ 230 V

For 400 V units: 50 - 999 V ★ 400 V

Function:

This is where to set the rated motor voltage $U_{M,N}$ for either star Y or delta Δ .

Description of choice:

Select a value that corresponds to the nameplate data on the motor, regardless of the frequency converter's mains voltage.

104 Motor frequency $f_{M,N}$ (MOTOR FREQUENCY)

Value:

24-1000 Hz ★ 50 Hz

Function:

This is where to select the rated motor frequency $f_{M,N}$.

Description of choice:

Select a value that corresponds to the nameplate data on the motor.

105 Motor current $I_{M,N}$ (MOTOR CURRENT)

Value:

0,01 - I_{MAX} ★ Depends on choice of motor

Function:

The nominal, rated current of the motor $I_{M,N}$ forms part of the frequency converter calculation of features such as torque and motor thermal protection.

Description of choice:

Set a value that corresponds to the nameplate data on the motor. Set the motor current $I_{M,N}$ taking into account whether the motor is star-connected Y or delta-connected Δ .

106 Rated motor speed

(MOTOR NOM. SPEED)

Value:

100 - $f_{M,N} \times 60$ (max. 60000 rpm)

★ Depends on parameter 102 *Motor power*, $P_{M,N}$

Function:

This is where to set the value that corresponds to the rated motor speed $n_{M,N}$ that can be seen from the nameplate data.

Description of choice:

Select a value that corresponds to the nameplate data on the motor.



NB!:

The max. value equals $f_{M,N} \times 60$. $f_{M,N}$ to be set in parameter 104 *Motor frequency*, $f_{M,N}$.

107 Automatic motor tuning, AMT

(AUTO MOTOR TUN.)

Value:

★ Optimisation off (AMT OFF) [0]

Optimisation on (AMT START) [1]

NB!:

AMT is not possible on AKD 2880-82.

Function:

Automatic motor tuning is an algorithm that measures stator resistance R_S without the motor axle turning. This means that the motor is not delivering any torque. AMT can be used with benefit when initialising units where the user wishes to optimise adjustment of the frequency converter to the motor being used. This is used in particular when the factory setting does not sufficiently cover the motor.

For the best possible tuning of the frequency converter it is recommended that AMT is performed on a cold motor. It should be noted that repeated AMT runs can cause heating of the motor, resulting in an increase in the stator resistance R_S . As a rule, however, this is not critical.

AMT is performed as follows:

Start AMT:

1. Give a STOP signal.
2. Parameter 107 *Automatic motor tuning* is set at value [2] *Optimisation on*.
3. A START signal is given and parameter 107 *Automatic motor tuning* is reset to [0] when AMT has been completed.

Complete AMT:

AMT is completed by giving a RESET signal. Parameter 108 *Stator resistance*, R_S is updated with the optimised value.

Interrupting AMT:

AMT can be interrupted during the optimisation procedure by giving a STOP signal.

When using the AMT function the following points should be observed:

- For AMT to be able to define the motor parameters as well as possible, the correct type plate data for the motor connected to the frequency converter must be keyed into parameters 102 to 106.
- Alarms will appear in the display if faults arise during tuning of the motor.
- As a rule the AMT function will be able to measure the R_S values for motors that are 1-2 times larger or smaller than the frequency converter's nominal size.
- If you wish to interrupt automatic motor tuning, press the [STOP/RESET] key.



NB!:

AMT may not be performed on motors connected in parallel, nor may setup changes be made while AMT is running.

The procedure for AMT controlled from the SLCP: See section entitled *Control unit*.

Description of choice:

Select *Optimisation on* [2] if you want the frequency converter to perform automatic motor tuning.

108 Stator resistance R_S (STATOR RESISTANCE)

Value:

0.000 - X.XXX Ω

★ Depends on choice of motor

Function:

After setting of parameters 102-106 *Nameplate data*, a number of adjustments of various parameters is carried out automatically, including stator resistance R_S . A manually entered R_S must apply to a cold motor. The shaft performance can be improved by fine-tuning R_S and X_S , see procedure below.



NB!:

Parameters 108 *Stator resistance* R_S and 109 *Stator reactance* X_S are normally not to be changed if nameplate data has been set.

Description of choice:

R_S can be set as follows:

1. Use the factory settings of R_S which the frequency converter itself chooses on the basis of the motor nameplate data.
2. The value is stated by the motor supplier.
3. The value is obtained through manual measurements: R_S can be calculated by measuring the resistance $R_{PHASE-PHASE}$ between two phase terminals. Where $R_{PHASE-PHASE}$ is lower than 1-2 Ohms (typical for motors > 5.5 kW, 400 V), a special Ohm-meter should be used (Thomson-bridge or similar). **$R_S = 0.5 \times R_{PHASE-PHASE}$** .
4. R_S is set automatically when AMT has been completed. See parameter 107 *Auto motor adaption*.

109 Stator reactance X_S (STATOR REACTANCE)

Value:

0.00 - X,XX Ω

★ Depends on choice of motor

Function:

After setting of parameters 102-106 *Nameplate data*, a number of adjustments of various parameters are made automatically, including stator reactance X_S . The shaft performance can be improved by fine-tuning R_S and X_S , see procedure below.

Description of choice:

X_S can be set as follows:

1. The value is stated by the motor supplier.
2. The value is obtained through manual measurements X_S is obtained by connecting a motor to mains and measuring the phase-phase voltage U_M and the idle current I_ϕ .
$$X_S = \frac{U_M}{\sqrt{3} \times I_\phi}$$
3. Use the factory settings of X_S which the frequency converter itself chooses on the basis of the motor nameplate data.

122 Function at stop

(FUNCTION AT STOP)

Value:

- ★Coasting (COAST) [0]
- DC hold (DC HOLD) [1]

Function:

This is where to choose the function of the frequency converter after the output frequency has become lower than the value in parameter 123 *The min. frequency for activation of function at stop* or after a stop command and when the output frequency has been ramped down to 0 Hz.

Description of choice:

Select *Coasting* [0] if the frequency converter is to 'let go' of the motor (inverter turned off).

Select DC hold [1] if parameter 137 *DC hold voltage* is to be activated.

ETR warning 2 (ETR WARNING 2)	[5]
ETR trip 2 (ETR TRIP 2)	[6]
ETR warning 3 (ETR WARNING 3)	[7]
ETR trip 3 (ETR TRIP 3)	[8]
ETR warning 4 (ETR WARNING 4)	[9]
ETR trip 4 (ETR TRIP 4)	[10]

Function:

The frequency converter can monitor the motor temperature in two different ways:

- Via a PTC thermistor that is mounted on the motor. The thermistor is connected between terminal 50 (+10V) and one of the digital input terminals 18, 19, 27 or 29. See parameter 300 *Digital inputs*.
- Thermal load calculation (ETR - Electronic Thermal Relay), based on present load and time. This is compared with the rated motor current $I_{M,N}$ and rated motor frequency $f_{M,N}$. The calculations take into account the need for lower loading at low speeds due to the motor's internal ventilation being reduced.

126 DC brake time

(DC BRAKING TIME)

Value:

0 - 60 sec. ★ 10 sec

Function:

In this parameter, the DC brake time is set at which parameter 132 *DC brake voltage* is to be active.

Description of choice:

Set the required time.

127 DC brake cut-in frequency

(DC BRAKE CUT-IN)

Value:

0.0 (OFF) - par. 202
Output frequency high limit, f_{MAX} ★ OFF

Function:

In this parameter, the DC brake cut-in frequency is set at which the DC brake is to be activated in connection with a stop command.

Description of choice:

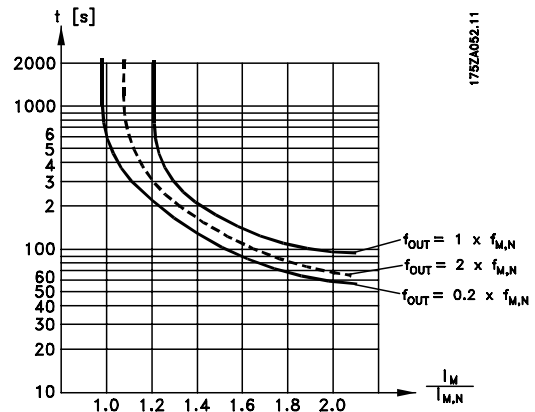
Set the required frequency.

128 Thermal motor protection

(MOT.THERM PROTEC)

Value:

★ No protection (NO PROTECTION)	[0]
Thermistor warning (THERMISTOR WARN)	[1]
Thermistor trip (THERMISTOR TRIP)	[2]
ETR warning 1 (ETR WARNING 1)	[3]
ETR trip 1 (ETR TRIP 1)	[4]



ETR functions 1-4 do not begin to calculate the load until you switch to the Setup in which they have been selected. This means that you can use the ETR function even when changing between two or more motors.

Description of choice:

Select *No protection* [0] if you do not want a warning or trip when a motor is overloaded.

Select *Thermistor warning* [1] if you want a warning when the connected thermistor becomes too hot.

Select *Thermistor trip* [2] if you want a trip when the connected thermistor becomes too hot.

Select *ETR Adv.* if you want a warning when the motor is overloaded according to the calculations.

You can also programme the frequency converter to give a warning signal via the digital output.

Select *ETR Trip* if you want a trip when the motor is overloaded according to the calculations.

Select *ETR warning 1-4* if you want a warning when the motor is overloaded according to the calculations.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

You can also programme the frequency converter to give a warning signal via one of the digital outputs. Select *ETR Trip 1-4* if you want a trip when the motor is overloaded according to the calculations.



NB!

This function cannot protect the individual motors in the case of motors linked in parallel.

132 DC brake voltage

(DC BRAKE VOLTAGE)

Value:

0 - 100% of max. DC brake voltage ★ 0%

Function:

In this parameter, the DC brake voltage is set which is to be activated at stop when the DC brake frequency set in parameter 127 *DC brake cut-in frequency* is reached, or if *DC braking inverse* is active via a digital input or via serial communication. Subsequently, the DC brake voltage will be active for the time set in parameter 126 *DC brake time*.

Description of choice:

To be set as a percentage value of the max. DC brake voltage, which depends on the motor.

133 Start voltage

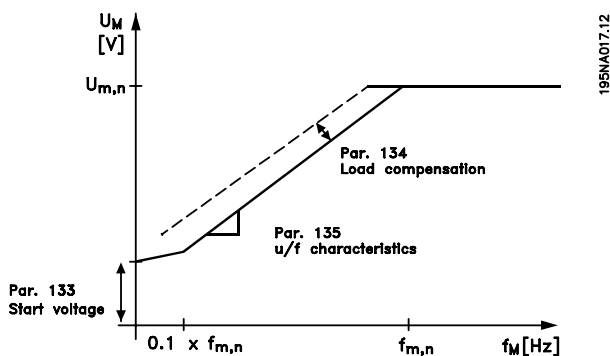
(START VOLTAGE)

Value:

0.00 - 100.00 V ★ Depends on unit

Function:

A higher start torque can be obtained by increasing the start voltage. Small motors (< 1.0 kW) normally require a high start voltage.



Description of choice:

The factory setting will be suitable for most applications, the value may need to be increased gradually for high torque application.



Warning: If the use of start voltage is exaggerated, this may lead to over-energizing and overheating of the motor and the frequency converter may cut out.

134 Load compensation

(LOAD COMPENSATION)

Value:

0.0 - 300.0% ★ 100.0%

Function:

In this parameter, the load characteristic is set. By increasing the load compensation, the motor is given an extra voltage and frequency supplement at increasing loads. This is used e.g. in motors/applications in which there is a big difference between the full-load current and idle-load current of the motor.



NB!

If this value is set too high, the frequency converter may cut out because of overcurrent.

Description of choice:

If the factory setting is not adequate, load compensation must be set to enable the motor to start at the given load.



Warning: Should be set to 0% in connection with synchronous and parallel-coupled motors and in the case of quick load changes. Too high load compensation may lead to instability.

136 Slip compensation

(SLIP COMP.)

Value:

-500 - +500% of rated slip compensation ★ 100%

Function:

Slip compensation is calculated automatically, on the basis of such data as the rated motor speed $n_{M,N}$. In this parameter, the slip compensation can be fine-tuned, thereby compensating for tolerances on the value for $n_{M,N}$. Slip compensation is only active if a selection has been made of *Speedregulation, open loop* [0] in parameter 100 *Configuration* and *Constant torque* [1] in parameter 101 *Torque characteristic*.

Description of choice:

Key in a % value.

137 DC hold voltage

(DC HOLD VOLTAGE)

Value:

0 - 100% of max. DC hold voltage ★ 0%

Function:

This parameter is used to keep the motor (holding torque) at start/stop.

Description of choice:

This parameter can only be used if a selection has been made of *DC hold* in parameter 121 *Start function* or 122 *Function at stop* . To be set as a percentage value of the max. DC hold voltage, which depends on the choice of motor.

■ References & Limits

201 Output frequency low limit, f_{MIN} (MIN OUTPUT FREQ)

Value:

0.0 - f_{MAX} ★ 30.0 Hz

Function:

In this parameter, a minimum motor frequency limit can be selected that corresponds to the minimum speed at which the motor is allowed to run.

Description of choice:

The value chosen can range from 0.0 Hz to the frequency set in parameter 202 *Output frequency high limit, f_{MAX}* .

202 Output frequency high limit, f_{MAX} (MAX. OUTPUT FREQUENCY)

Value:

f_{MIN} - 132 Hz ★ 60.0 Hz

Function:

In this parameter, a maximum output frequency limit can be selected that corresponds to the highest speed at which the motor is allowed to run.

Description of choice:

A value can be selected from f_{MIN} to 132 Hz.

204 Minimum reference, Ref_{MIN} (MIN.REFERENCE)

Value:

Par. 100 *Config.* = *Open loop* [0].
0 - par. 205 Ref_{MAX} ★ 30.0 Hz

Par. 100 *Config.* = *Closed loop* [1].
-Par. 414 *Minimum feedback* - par. 205 Ref_{MAX}
★ 0.000 bar/par 416

Function:

Minimum reference is an expression of the minimum possible value of the total of all references. If in parameter 100 *Configuration* or *Process regulation, closed loop* [1] is selected, the minimum reference is limited by parameter 414 *Minimum feedback*. Minimum reference is ignored if the local reference is active.

The reference unit can be defined from the following table:

Par. 100 <i>Configuration</i>	Unit
Open loop [0]	Hz
Process reg, closed loop [1]	Par. 416

Description of choice:

The minimum reference is preset if the motor has to run at a minimum speed, regardless of whether the resulting reference is 0.

205 Maximum reference, Ref_{MAX} (MAX.REFERENCE)

Value:

Par. 100 *Config.* = *Open loop* [0].
Par. 204 Ref_{MIN} - 1000.000 Hz ★ 60.0 Hz

Par. 100 *Config.* = *Closed loop* [1].
Par. 204 Ref_{MIN} - Par. 415 *Max. feedback*
★ 32.000 bar/par 416

Function:

The maximum reference gives the highest value that can be assumed by the sum of all references. If *Closed loop* [1] is selected in parameter 100 *Configuration* the maximum reference cannot exceed the value in parameter 415 *Maximum feedback*. Maximum reference is ignored if the local reference is active.

The reference unit can be defined from the following table:

Par. 100 <i>Configuration</i>	Unit
Open loop [0]	Hz
Process reg, closed loop [1]	Par. 416

Description of choice:

Maximum reference is set, if the speed of the motor is to be max. the set value, regardless of whether the resulting reference is greater than the maximum reference.

207 Ramp-up time 1 (RAMP-UP TIME 1)

Value:

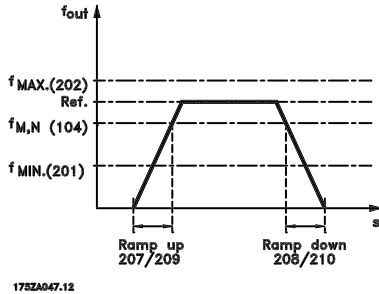
0.02 - 3600.00 sec ★ 0.70 sec

Function:

The ramp-up time is the acceleration time from 0 Hz to the rated motor frequency $f_{M,N}$ (parameter

★ = factory setting. () = display text [] = value for use in communication via serial communication port

104 *Motor frequency, $f_{M,N}$*). It is assumed that the output current will not reach the current limit (set in parameter 221 *Current limit I_{LIM}*).



Description of choice:

Set the required ramp-up time.

208 Ramp-down time 1

(RAMP DOWN TIME 1)

Value:

0.02 - 3600.00 sec ★ 1.00 sec

Function:

The ramp-down time is the deceleration time from the rated motor frequency $f_{M,N}$ (parameter 104 *Motor frequency, $f_{M,N}$*) to 0 Hz, provided no overvoltage arises in the inverter because of generating operation of the motor.

Description of choice:

Set the required ramp-down time.

214 Reference function

(REF FUNCTION)

Value:

★Sum (SUM) [0]
Relative (RELATIVE) [1]
External/preset (EXTERNAL/PRESET) [2]

Function:

It is possible to define how preset references are to be added to the other references; for this purpose, use *Sum* or *Relative*. It is also possible by using the *External/preset* to select whether a shift between external references and preset references is required. External reference is the sum of the analogue references, pulse references and any references from serial communication.

Description of choice:

If *Sum* [0] is selected, one of the adjusted preset references (parameters 215-218 *Preset*

★ = factory setting. () = display text [] = value for use in communication via serial communication port

reference) is summarized as a percentage of the reference range ($Ref_{MIN} - Ref_{MAX}$), added to the other external references.

If *Relative* [1] is selected, one of the added preset references (parameters 215-218 *Preset reference*) is summarized as a percentage of the sum of present external references.

If *External/preset* [2] is selected, it is possible via a digital input to shift between external references or preset references. Preset references will be a percentage value of the reference range.



NB!:

If *Sum* or *Relative* is selected, one of the preset references will always be active. If the preset references are to be without influence, they must be set to 0% (factory setting).

215 Preset reference 1 (PRESET REF. 1)

216 Preset reference 2 (PRESET REF. 2)

217 Preset reference 3 (PRESET REF. 3)

218 Preset reference 4 (PRESET REF. 4)

Value:

-100.00% - +100.00% ★ 0.00%
of the reference range/external reference

Function:

Four different preset references can be programmed in parameters 215-218 *Preset reference*. The preset reference is stated as a percentage of the reference range ($Ref_{MIN} - Ref_{MAX}$) or as a percentage of the other external references, depending on the choice made in parameter 214 *Reference function*. The choice between preset references can be made via the digital inputs or via serial communication.

Preset ref., msb	Preset ref. lsb	
0	0	Preset ref. 1
0	1	Preset ref. 2
1	0	Preset ref. 3
1	1	Preset ref. 4

Description of choice:

Set the preset reference(s) that is/are to be the options.

224 Warning: High current, I_{HIGH}

(WARN.CURRENT HI)

Value:

0 - I_{MAX} ★ I_{MAX}

Function:

If the output current exceeds the preset limit I_{HIGH} a warning is given. Parameters 223-228 *Warning functions* do not work during ramp-up after a start command and after stop command or during stop. The warning functions are activated when the output frequency has reached the resulting reference. The signal outputs can be programmed to give a warning signal via terminal 46 and via the relay output.

Description of choice:

The output current's upper signal limit I_{HIGH} must be programmed within the frequency converter's normal operating range. See drawing at parameter 223 *Warning: Low current, I_{LOW}* .

225 Warning: Low frequency, f_{LOW}

(WARN.FREQ. LOW)

Value:

0.0 - par. 226 *Warn.: High frequency, f_{HIGH}* ★ 0.0 Hz

Function:

If the output frequency falls below the preset limit f_{LOW} , a warning is given. The signal outputs can be programmed to give a warning signal via terminal 46 and via the relay output.

Description of choice:

The lower signal limit of the output frequency f_{LOW} must be programmed within the normal operating range of the frequency converter.

226 Warning: High frequency f_{HIGH}

(WARN.FREQ.HIGH)

Value:

Par. 225 f_{LOW} - 132 Hz ★ 132.0 Hz

Function:

If the output frequency exceeds the preset limit f_{HIGH} a warning is given. The signal outputs can be programmed to give a warning signal via terminal 46 and via the relay output.

Description of choice:

The output frequency's upper signal limit f_{HIGH} must be programmed within the frequency converter's normal operating range.

227 Warning: Low feedback, FB_{LOW}

(WARN.FEEDB. LOW)

Value:

-100,000.000 - par. 228 *Warn.: FB_{HIGH}* ★ -4000.000

Function:

If the feedback signal falls below the preset limit FB_{LOW} , a warning is given. Parameters 223-228 *Warning functions* are out of function during ramp-up after a start command and after a stop command or during stop. The warning functions are activated when the output frequency has reached the resulting reference. The signal outputs can be programmed to give a warning signal via terminal 46 and via the relay output. The unit for feedback in Closed loop is programmed in parameter 416 *Process units*.

Description of choice:

Set the required value within the feedback range (parameter 414 *Minimum feedback, FB_{MIN}* and 415 *Maximum feedback, FB_{MAX}*).

228 Warning: High feedback, FB_{HIGH}

(WARN.FEEDB HIGH)

Value:

Par. 227 *Warn.: FB_{LOW}* - 100,000.000 ★ 4000.000

Function:

If the feedback signal gets above the preset limit FB_{HIGH} , a warning is given. Parameters 223-228 *Warning functions* are out of function during ramp-up after a start command and after a stop command or during stop. The warning functions are activated when the output frequency has reached the resulting reference. The signal outputs can be programmed to give a warning signal via terminal 46 and via the relay output. The unit for feedback in Closed loop is programmed in parameter 416 *Process units*.

Description of choice:

Set the required value within the feedback range (parameter 414 *Minimum feedback, FB_{MIN}* and 415 *Maximum feedback, FB_{MAX}*).

229 Frequency bypass, bandwidth

(FREQ. BYPASS B.W.)

Value:

0 (OFF) - 100 Hz ★ 0 Hz

Function:

Some systems call for some output frequencies to be avoided because of mechanical resonance problems in the system. In parameters 230-231 *Frequency bypass* these output frequencies can be programmed. In this parameter a bandwidth can be defined on either side of these frequencies.

Description of choice:

The frequency set in this parameter will be centered around parameters 230 *Frequency bypass 1* and 231 *Frequency bypass 2*.

230 Frequency bypass 1 (FREQ. BYPASS 1)

231 Frequency bypass 2 (FREQ. BYPASS 2)

Value:

0 - 1000 Hz ★ 0.0 Hz

Function:

Some systems call for some output frequencies to be avoided because of mechanical resonance problems in the system.

Description of choice:

Enter the frequencies to be avoided. See also parameter 229 *Frequency bypass, bandwidth*.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

■ Inputs and outputs

Digital inputs	Term. no.	18 ¹	19 ¹	27	29	33
	par. no.	302	303	304	305	307
Value:						
No function	(NO OPERATION)	[0]	[0]	[0]	[0]	★[0]
Reset	(RESET)	[1]	[1]	[1]	[1]	[1]
Coasting stop inverse	(MOTOR COAST INVERSE)	[2]	[2]	[2]	[2]	[2]
Reset and coasting inverse	(RESET AND COAST INV.)	[3]	[3]	★[3]	[3]	[3]
Quick-stop inverse	(QUICK-STOP INVERSE)	[4]	[4]	[4]	[4]	[4]
DC braking inverse	(DC-BRAKE INVERSE)	[5]	[5]	[5]	[5]	[5]
Stop inverse	(STOP INVERSE)	[6]	[6]	[6]	[6]	[6]
Start	(START)	★[7]	[7]	[7]	[7]	[7]
Pulse start	(LATCHED START)	[8]	[8]	[8]	[8]	[8]
Reversing	(REVERSING)	[9]	★[9]	[9]	[9]	[9]
Reversing and start	(START REVERSING)	[10]	[10]	[10]	[10]	[10]
Start clockwise	(ENABLE FORWARD)	[11]	[11]	[11]	[11]	[11]
Start anti-clockwise	(ENABLE REVERSE)	[12]	[12]	[12]	[12]	[12]
Jog	(JOGGING)	[13]	[13]	[13]	★[13]	[13]
Freeze reference	(FREEZE REFERENCE)	[14]	[14]	[14]	[14]	[14]
Freeze output frequency	(FREEZE OUTPUT)	[15]	[15]	[15]	[15]	[15]
Speed up	(SPEED UP)	[16]	[16]	[16]	[16]	[16]
Speed down	(SPEED DOWN)	[17]	[17]	[17]	[17]	[17]
Catch-up	(CATCH-UP)	[19]	[19]	[19]	[19]	[19]
Slow-down	(SLOW-DOWN)	[20]	[20]	[20]	[20]	[20]
Ramp 2	(RAMP 2)	[21]	[21]	[21]	[21]	[21]
Preset ref, LSB	(PRESET REF, LSB)	[22]	[22]	[22]	[22]	[22]
Preset ref, MSB	(PRESET REF, MSB)	[23]	[23]	[23]	[23]	[23]
Preset reference on	(PRESET REFERENCE ON)	[24]	[24]	[24]	[24]	[24]
Thermistor	(THERMISTOR)	[25]	[25]	[25]	[25]	
Precise stop, inverse	(PRECISE STOP INV.)	[26]	[26]			
Precise start/stop	(PRECISE START/STOP)	[27]	[27]			
Pulse reference	(PULSE REFERENCE)					[28]
Pulse feedback	(PULSE FEEDBACK)					[29]
Pulse input	(PULSE INPUT)					[30]
Selection of Setup, lsb	(SETUP SELECT LSB)	[31]	[31]	[31]	[31]	[31]
Selection of Setup, msb	(SETUP SELECT MSB)	[32]	[32]	[32]	[32]	[32]
Reset and start	(RESET AND START)	[33]	[33]	[33]	[33]	[33]
Pulse counter start	(PULSE COUNTER START)	[34]	[34]			

1. All functions on terminal 18 and 19 are controlled by an interrupter, which means that the repetitive accuracy of the response time is constant. Can be used for start/stop, setup switch and especially for changing digital preset, i.e. to obtain a reproducible stop point when using creep speed.

Function:

In these parameters 302-307 *Digital inputs* it is possible to choose between the different enabled functions related to the digital inputs (terminals 18-33).

Description of choice:

No operation is selected if the frequency converter is not to react to signals transmitted to the terminal.

Reset resets the frequency converter after an alarm; however, a few alarms cannot be reset (trip locked) without first disconnecting the mains supply and reconnecting it. See table under *List of warnings and alarms*. Reset is activated on the leading edge of the signal.

Coasting stop inverse is used for making the frequency converter "let go" of the motor immediately (output transistors are "turned off"), which means that the motor runs freely to stop. Logic '0' leads to coasting to stop.

Reset and coasting inverse are used to activate motor coast simultaneously with reset. Logical '0' means motor coast stop and reset. Reset is activated on the falling edge of the signal.

Quick stop inverse is used for activating the quick-stop ramp down set in parameter 212 *Quick stop ramp-down time*. Logic '0' leads to quick stop.

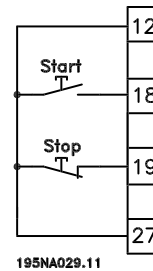
DC-braking inverse is used for stopping the motor by energizing it with a DC voltage for a given time, see parameters 126, 127 and 132 *DC brake*. Please note that this function is only active if the value in parameter 126 *DC braking time* and 132 *DC brake voltage* is different from 0. Logic '0' leads to DC braking.

Stop inverse, a logic '0' means that the motor speed is ramped down to stop via the selected ramp.



None of the stop commands mentioned above are to be used as repair switches.
Note that the frequency converter has more voltage inputs than L1, L2 and L3 when the DC bus terminals are used. Check that all voltage inputs are disconnected and that the prescribed time (4 mins.) has passed before repair work is commenced.

Start is selected if a start/stop command is required. Logic '1' = start, logic '0' = stop.



195NA029.11

Latched start, if a pulse is applied for min. 14 ms, the frequency converter will start the motor, provided no stop command has been given. The motor can be stopped by briefly activating *Stop inverse*.

Reversing: Not used in AKD.

Reversing and start: Not used in AKD.

Start clockwise is used if you want the motor shaft only to be able to rotate clockwise when started. Should not be used for *Process regulation, closed loop*.

Start anticlockwise: Not used in AKD.

Jog: Not used in AKD.

Freeze reference freezes the present reference. The reference can now only be changed via *Speed up* and *Speed down*. If *freeze reference* is active, it will be saved after a stop command and in the event of mains failure.

Freeze output freezes the present output frequency (in Hz). The output frequency can now only be changed via *Speed up* and *Speed down*.



NB!:

If *Freeze output* is active the frequency converter can only be stopped if you select *Motor coast*, *Quick stop* or *DC braking* via a digital input.

Speed up and *Speed down* are selected if digital control of the up/down speed is required. This function is only active if *Freeze reference* or *Freeze output frequency* has been selected.

If *Speed up* is active the reference or output frequency will be increased, and if *Speed down* is active the reference or output frequency will be reduced. The output frequency is changed via the preset ramp times of 3 sec.

One pulse (logic '1' minimum high for 14 ms and a minimum break time of 14 ms) will lead to a speed change of 0.1 % (reference) or 0.1 Hz (output frequency). Example:

Term.	Term.	Freeze ref/ freeze outp.	Function
29	33		
0	0	1	No speed change
0	1	1	Speed up
1	0	1	Speed down
1	1	1	Speed down

Freeze reference can be changed even if the frequency converter has stopped. The reference will also be saved if the mains are disconnected.

Catch-up/Slow-down is selected if the reference value is to be increased or reduced by a programmable percentage value set in parameter 219 *Catch-up/Slow-down reference*.

Slow-down	Catch-up	Function
0	0	Unchanged speed
0	1	Increase by % value
1	0	Reduce by % value
1	1	Reduce by % value

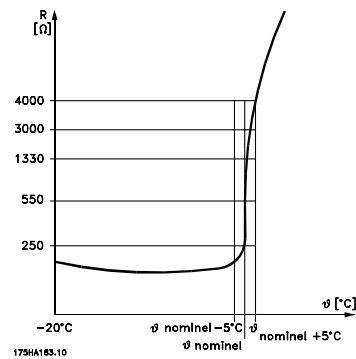
Ramp 2 is selected if a shift between ramp 1 (parameters 207-208) and ramp 2 (3 sec.) is required. Logic '0' leads to ramp 1 and logic '1' leads to ramp 2.

Preset reference, lsb and *Preset reference, msb* makes it possible to select one of the four preset references, see the table below:

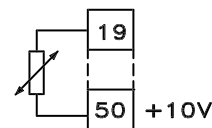
Preset ref. msb	Preset ref. lsb	Function
0	0	Preset ref. 1
0	1	Preset ref. 2
1	0	Preset ref. 3
1	1	Preset ref. 4

Preset reference on is used for shifting between remote-controlled reference and preset reference. It is assumed that External/preset [2] has been selected in parameter 214 *Reference function*. Logic '0' = remote-controlled references are active, logic '1' = one of the four preset references is active, as can be seen from the table above.

Thermistor is to be selected if a possibly integrated thermistor in the motor is to be able to stop the frequency converter if the motor overheats. The cut-out value is 3 k Ω .



If a motor features a Klaxon thermal switch instead, this can also be connected to the input. If motors operate in parallel, the thermistors/thermal switches can be connected in series (total resistance lower than 3 k Ω). Parameter 128 *Motor thermal protection* must be programmed for *Thermistor warning* [1] or *Thermistor trip* [2] and the thermistor is to be connected between a digital input and terminal 50 (+ 10 V supply).



195NA077.10

Precise stop, inverse is selected to obtain a high degree of accuracy when a stop command is repeated. A logic 0 means that the motor speed is ramped down to stop via the selected ramp.

Precise start/stop is selected to obtain a high degree of accuracy when a start and stop command is repeated.

Pulse reference: Not used in AKD.

Pulse feedback: Not used in AKD.

Pulse input: Not used in AKD.

Selection of Setup, lsb and *Selection of Setup, msb* gives the possibility to select one of the four setups. It is, however, a condition that parameter 004 is set to *Multisetup*.

Reset and start can be used as a start function. If 24 V are connected to the digital input, this will cause the frequency converter to reset and the motor will ramp up to the preset reference.

Pulse counter start: Not used in AKD.

308 Terminal 53, analogue input voltage

(AI [V]53FUNCT.)

Value:

No function (NO OPERATION)	[0]
★Reference (REFERENCE)	[1]
Feedback (FEEDBACK)	[2]

Function:

In this parameter it is possible to select the function required to be connected to terminal 53. Scaling of the input signal is made in parameter 309 *Terminal 53, min. scaling* and parameter 310 *Terminal 53, max. scaling*.

Description of choice:

No function [0]. Is selected if the frequency converter is not to react to signals connected to the terminal. *Reference* [1]. If this function is selected, the reference can be changed by means of an analogue reference signal. If reference signals are connected to more than one input, these reference signals must be added up. If a voltage feedback signal is connected, select *Feedback* [2] on terminal 53.

309 Terminal 53 Min. scaling

(AI 53 SCALE LOW)

Value:

0.0 - 10.0 Volt ★ 0.0 Volt

Function:

This parameter is used for setting the signal value that is to correspond to the minimum reference or the minimum feedback, parameter 204 *Minimum reference, Ref_{MIN}* / 414 *Minimum feedback, FB_{MIN}*.

Description of choice:

Set the required voltage value. For reasons of accuracy, compensation should be made for voltage loss in long signal cables. If the Time out function is to be used (parameter 317 *Time out* and 318 *Function after time out*), the value set must be higher than 1 Volt.

310 Terminal 53 Max. scaling

(AI 53 SCALE HIGH)

Value:

0 - 10.0 Volt ★ 10.0 Volt

Function:

This parameter is used for setting the signal value that is to correspond to the maximum reference value or maximum feedback, parameter 205 *Maximum reference, Ref_{MAX}* / 414 *Maximum feedback, FB_{MAX}*.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

Description of choice:

Set the required voltage value. For reasons of accuracy, compensation should be made for voltage losses in long signal cables.

314 Terminal 60, analogue input current

(AI [MA] 60 FUNCT)

Value:

★No function (NO OPERATION)	[0]
Reference (REFERENCE)	[1]
Feedback (FEEDBACK)	[2]

Function:

This parameter allows a choice between the different functions available for the input, terminal 60. Scaling of the input signal is effected in parameter 315 *Terminal 60, min. scaling* and parameter 316 *Terminal 60, max. scaling*.

Description of choice:

No function [0]. Is selected if the frequency converter is not to react to signals connected to the terminal. *Reference* [1]. If this function is selected, the reference can be changed by means of an analogue reference signal. If reference signals are connected to more than one input, these reference signals must be added up. If one current feedback signal is connected, select *Feedback* [2] on terminal 60.

315 Terminal 60 Min. scaling

(AI 60 SCALE LOW)

Value:

0.0 - 20.0 mA ★ 0.0 mA

Function:

In this parameter you can set the signal value that will correspond to the minimum reference or minimum feedback, parameter 204 *Minimum reference, Ref_{MIN}* / 414 *Minimum feedback, FB_{MIN}*.

Description of choice:

Set the required current value. If the Time out function is to be used (parameter 317 *Time out* and 318 *Function after time out*) the value set must be higher than 2 mA.

316 Terminal 60 Max. scaling

(AI 60 SCALE HIGH)

Value:

0.0 - 20.0 mA ★ 20.0 mA

Function:

This parameter is used for setting the signal value that is to correspond to the maximum reference value, parameter 205 *Maximum reference value, Ref_{MAX}*.

Description of choice:

Set the required current value.

317 Time out

(LIVE ZERO TIME O)

Value:

1 - 99 sec. ★ 10 sec.

Function:

If the signal value of the reference or feedback signal connected to one of the input terminals 53 or 60 falls below 50 % of the minimum scaling for a period longer than the time set, the function selected in parameter 318 *Function after time out* will be activated. This function is only active if in parameter 309 *Terminal 53, min. scaling* a value higher than 1 Volt has been selected, or if in parameter 315 *Terminal 60, min. scaling* a value higher than 2 mA has been selected.

Description of choice:

Set the required time.

318 Function after time out

(LIVE ZERO FUNCT.)

Value:

- ★No operation (NO OPERATION) [0]
- Freeze output frequency (FREEZE OUTPUT FREQ.) [1]
- Stop (STOP) [2]
- Jog (JOG) [3]
- Max. speed (MAX SPEED) [4]
- Stop and trip (STOP AND TRIP) [5]

Function:

This parameter allows a choice of the function to be activated after the expiry of the Time out (parameter 317 *Time out*). If a time-out function occurs at the same time as a bus time-out function (parameter 513 *Bus time interval function*), the time-out function in parameter 318 will be activated.

Description of choice:

The output frequency of the frequency converter can be:

★ = factory setting. () = display text [] = value for use in communication via serial communication port

- frozen at the present frequency [1]
- overruled to stop [2]
- overruled to jog frequency [3]
- overruled to max. output frequency [4]
- overruled to stop with subsequent trip [5]

319 Analogue output terminal 42

(AO 42 FUNCTION)

Value:

- No function (NO OPERATION) [0]
- External reference min.-max. 0-20 mA
(REF MIN-MAX = 0-20 MA) [1]
- External reference min.-max. 4-20 mA
(REF MIN-MAX = 4-20 MA) [2]
- Feedback min.-max. 0-20 mA
(FB MIN-MAX = 0-20 MA) [3]
- Feedback min.-max. 4-20 mA
(FB MIN-MAX = 4-20 MA) [4]
- Output frequency 0-max 0-20 mA
(O-FMAX = 0-20 MA) [5]
- Output frequency 0-max 4-20 mA
(O-FMAX = 4-20 MA) [6]
- ★Output current 0-I_{MAX}. 0-20 mA
(0-IMAX = 0-20 MA) [7]
- Output current 0-I_{MAX}. 4-20 mA
(0-IMAX = 4-20 MA) [8]
- Output power 0-P_{M,N} 0-20 mA
(0-PNOM = 0-20 MA) [9]
- Output power 0-P_{M,N} 4-20 mA
(0-PNOM = 4-20 MA) [10]
- Inverter temperature 20-100 °C 0-20 mA
(TEMP 20-100 C=0-20 MA) [11]
- Inverter temperature 20-100 °C 4-20 mA
(TEMP 20-100 C=4-20 MA) [12]

Function:

The analogue output can be used for stating a process value. It is possible to choose two types of output signals 0 - 20 mA or 4 - 20 mA.

If used as a voltage output (0 - 10 V), a pull-down resistor of 500 Ω must be fitted to common (terminal 55). If the output is used as a current output the resulting resistance from the equipment connected may not exceed 500 Ω.

Description of choice:

No function. Is selected if the analogue output is not to be used.

External Ref_{MIN} - Ref_{MAX} 0-20 mA/4-20 mA.
An output signal is obtained, which is proportional to the resulting reference value in the interval

Minimum reference, Ref_{MIN} - Maximum reference, Ref_{MAX} (parameters 204/205).

FB_{MIN} - FB_{MAX} 0-20 mA/ 4-20 mA.

An output signal is obtained, which is proportional to the feedback value in the interval Minimum feedback, FB_{MIN} - Maximum feedback, FB_{MAX} (parameter 414/415).

0- f_{MAX} 0-20 mA/4-20 mA.

An output signal is obtained, which is proportional to the output frequency in the interval 0 - f_{MAX} (parameter 202 Output frequency, high limit, f_{MAX}).

0 - I_{MAX} . 0-20 mA/4-20 mA.

An output signal is obtained, which is proportional to the output current in the interval 0 - I_{MAX} .

0 - $P_{M,N}$ 0-20 mA/4-20 mA.

An output signal is obtained, which is proportional to the present output power. 20 mA corresponds to the value set in parameter 102 Motor power, $P_{M,N}$.

0 - $Temp_{MAX}$ 0-20 mA/4-20 mA.

An output signal is obtained, which is proportional to the present heatsink temperature. 0/4 mA corresponds to a heatsink temperature of less than 20 °C, and 20 mA corresponds to 100 °C.

■ Special functions

405 Reset function (RESET MODE)

Value:

Manual reset (MANUAL RESET)	[0]
Automatic reset x 1 (AUTOMATIC X 1)	[1]
★Automatic reset x 3 (AUTOMATIC X 3)	[2]
Automatic reset x 10 (AUTOMATIC X 10)	[3]
Reset at power-up (RESET AT POWER UP)	[4]

Function:

This parameter makes it possible to select whether reset and restart after a trip are to be manual or whether the frequency converter is to be reset and restarted automatically. Furthermore, it is possible to select the number of times a restart is to be attempted. The time between each attempt is set in parameter 406 *Automatic restart time*.

Description of choice:

If *Manual reset* [0] is selected, reset is to be carried out via the [STOP/RESET] key, a digital input or serial communication. If the frequency converter is to carry out an automatic reset and restart after a trip, select data value [1], [2] or [3].

If *Reset at power-up* [4] is selected, the frequency converter will carry out a reset if there has been a fault in connection with the mains failure



The motor may start without warning.

406 Automatic restart time (AUTORESTART TIME)

Value:

0 - 10 min. ★ 5 min.

Function:

This parameter allows setting of the time from tripping until the automatic reset function begins. It is assumed that automatic reset has been selected in parameter 405 *Reset function*.

Description of choice:

Set the required time.

412 Variable switching frequency (VAR CARRIER FREQ.)

Value:

★Without LC-filter (WITHOUT LC-FILTER)	[0]
LC-filter connected (LC-FILTER CONNECTED)	[1]

Function:

The parameter must be set to *LC-filter connected* if an LC-filter is connected between the frequency converter and the motor.

Description of choice:

The LC-filter connected [3] must be used if an LC-filter is connected between the frequency converter and the motor, as otherwise the frequency converter cannot protect the LC-filter.



NB!:

When the LC filter is selected the switching frequency is changed to 4.5 kHz.

414 Minimum feedback, FB_{MIN} (MIN. FEEDBACK)

Value:

-100,000.000 - par. 415 FB_{MAX} ★ 0.000

Function:

Parameter 414 *Minimum feedback*, FB_{MIN} and 415 *Maximum feedback*, FB_{MAX} are used to scale the display text to make it show the feedback signal in a process unit proportionally to the signal on the input.

Description of choice:

Set the value to be shown on the display as the minimum feedback signal value on the selected feedback input (parameters 308/314 *Analogue inputs*).

415 Maximum feedback, FB_{MAX} (MAX. FEEDBACK)

Value:

FB_{MIN} - 100,000.000 ★ 1500.000

Function:

See description of parameter 414 *Minimum feedback*, FB_{MIN} .

Description of choice:

Set the value to be shown on the display when the maximum feedback has been obtained on the selected feedback input (parameter 308/314 *Analogue inputs*).

416 Process units

(REF/FEEDB. UNIT)

Value:

No unit (NO UNIT)	[0]
% (%)	[1]
ppm (PPM)	[2]
rpm (RPM)	[3]
★bar (BAR)	[4]
Cycles/min (CYCLE/MI)	[5]
Pulses/s (PULSE/S)	[6]
Units/s (UNITS/S)	[7]
Units/min. (UNITS/MI)	[8]
Units/h (UNITS/H)	[9]
°C (°C)	[10]
Pa (PA)	[11]
l/s (L/S)	[12]
m ³ /s (M ³ /S)	[13]
l/min. (L/M)	[14]
m ³ /min. (M ³ /MIN)	[15]
l/h (L/H)	[16]
m ³ /h (M ³ /H)	[17]
Kg/s (KG/S)	[18]
Kg/min. (KG/MIN)	[19]
Kg/hour (KG/H)	[20]
Tons/min. (T/MIN)	[21]
Tons/hour (T/H)	[22]
Metres (M)	[23]
Nm (NM)	[24]
m/s (M/S)	[25]
m/min. (M/MIN)	[26]
°F (°F)	[27]
In wg (IN WG)	[28]
gal/s (GAL/S)	[29]
Ft ³ /s (FT ³ /S)	[30]
Gal/min. (GAL/MIN)	[31]
Ft ³ /min. (FT ³ /MIN)	[32]
Gal/h (GAL/H)	[33]
Ft ³ /h (FT ³ /H)	[34]
Lb/s (LB/S)	[35]
Lb/min. (LB/MIN)	[36]
Lb/hour (LB/H)	[37]
Lb ft (LB FT)	[38]
Ft/s (FT/S)	[39]
Ft/min. (FT/MIN)	[40]

Function:

Select among different units to be shown on the display. The unit is read out if an LCP control unit can be connected, and if *Reference [unit]* [2] or *Feedback [unit]* [3] has been selected in one of parameters 009-012 *Display read-out*, and in Display mode. The unit is used in *Closed loop* also as a unit for Minimum/Maximum reference and Minimum/Maximum feedback.

Description of choice:

Select the required unit for the reference/feedback signal.

423 U1 voltage

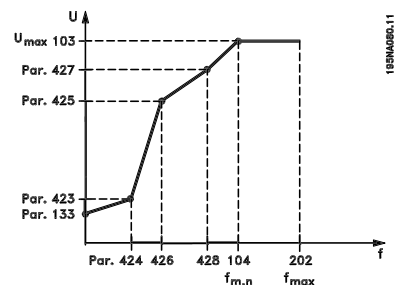
(U1 VOLTAGE)

Value:

0.0 - 999.0 V ★ par. 103

Function:

Parameters 423-428 are used when in parameter 101 *Torque characteristic* a selection has been made of *Special motor characteristic* [8]. It is possible to determine a U/f characteristic on the basis of four definable voltages and three frequencies. The voltage at 0 Hz is set in parameter 133 *Start voltage*.



Description of choice:

Set the output voltage (U1) that is to match the first output frequency (F1), parameter 424 *F1 frequency*.

424 F1 frequency

(F1 FREQUENCY)

Value:

0.0 - par. 426 *F2 frequency*
★ Par. 104 *Motor frequency*

Function:

See parameter 423 *U1 voltage* .

Description of choice:

Set the output frequency (F1) that is to match the first output voltage (U1), parameter 423 *U1 voltage* .

425 U2 voltage

(U2 VOLTAGE)

Value:

0.0 - 999.0 V ★ par. 103

Function:

See parameter 423 *U1 voltage*.

Description of choice:

Set the output voltage (U2) that is to match the second output frequency (F2), parameter 426 *F2 frequency*.

426 F2 frequency

(F2 FREQUENCY)

Value:

Par. 424 *F1 frequency* - par. 428 *F3 frequency*
★ Par. 104 *Motor frequency*

Function:

See parameter 423 *U1 voltage*.

Description of choice:

Set the output frequency (F2) that is to match the second output voltage (U2), parameter 425 *U2 voltage* .

427 U3 voltage

(U3 VOLTAGE)

Value:

0.0 - 999.0 V ★ par. 103

Function:

See parameter 423 *U1 voltage*.

Description of choice:

Set the output voltage (U3) that is to match the third output frequency (F3), parameter 428 *F3 frequency* .

428 F3 frequency

(F3 FREQUENCY)

Value:

Par. 426 *F2 frequency* - 1000 Hz
★ Par. 104 *Motor frequency*

Function:

See parameter 423 *U1 voltage*.

Description of choice:

Set the output frequency (F3) that is to match the third output voltage (U3), parameter 427 *U3 voltage* .



NB!:

Parameters 437-444 are only used if in parameter 100 *Configuration* a selection has been made of *Process regulation, closed loop*. [1].

437 Process PID normal/inverse control

(PROC NO/INV CTRL)

Value:

★Normal (NORMAL) [0]
Inverse (INVERSE) [1]

Function:

It is possible to choose whether the process regulator is to increase/reduce the output frequency if there is a deviation between the reference/setpoint and the actual process mode.

Description of choice:

If the frequency converter is to reduce the output frequency in case the feedback signal increases, select *Normal* [0].
If the frequency converter is to increase the output frequency in case the feedback signal increases, select *Inverse* [1].

438 Proces PID anti windup

(PROC ANTI WINDUP)

Value:

Not active (DISABLE) [0]
★Active (ENABLE) [1]

Function:

It is possible to select whether the process regulator is to continue regulating on a deviation even if it is not possible to increase/reduce the output frequency.

Description of choice:

The factory setting is *Enable* [1], which means that the integration link is initialised in relation to the actual output frequency if either the current limit, the voltage limit or the max./min. frequency has been reached. The process regulator will not engage again until either the error is zero or its sign has changed. Select *Disable* [0] if the integrator is to continue integrating on the deviation, even if it is not possible to remove the fault by such control.



NB!:

If *Disable* [0] is selected, it will mean that when the deviation changes its sign, the integrator will first have to integrate down from the level obtained as a result of the former error, before any change in output frequency occurs.

439 Process PID start frequency

(PROC START VALUE)

Value:

$f_{MIN} - f_{MAX}$ (parameter 201/202)

★ Par. 201 *Output frequency, low limit, f_{MIN}*

Function:

When the start signal comes, the frequency converter will react in the form of *Open loop* and will not change to *Closed loop* until the programmed start frequency is reached. This makes it possible to set a frequency that corresponds to the speed at which the process normally runs, which will enable the required process conditions to be reached sooner.

Description of choice:

Set the required start frequency.



NB!:

If the frequency converter is running at the current limit before the required start frequency is obtained, the process regulator will not be activated. For the regulator to be activated anyway, the start frequency must be lower to the required output frequency. This can be done during operation.

440 Process PID proportional gain

(PROC. PROP. GAIN)

Value:

0.0 - 10.00

★ 0.01

Function:

The proportional gain indicates the number of times the deviation between the setpoint and the feedback signal is to be applied.

★ = factory setting. () = display text [] = value for use in communication via serial communication port

Description of choice:

Quick regulation is obtained by a high gain, but if the gain is too high, the process may become unstable due to overshoot.

441 Process PID integration time

(PROC. INTEGR. T.)

Value:

0.01 - 9999.99 (OFF)

★ OFF

Function:

The integrator provides an increasing gain at a constant error between the reference/setpoint and the feedback signal. The greater the error, the quicker the integrator frequency contribution will increase. The integral time is the time needed by the integrator to make the same change as the proportional gain.

Description of choice:

Quick regulation is obtained at a short integral time. However, this time may become too short, which can make the process unstable due to overshoot. If the integral time is long, major deviations from the required setpoint may occur, since the process regulator will take a long time to regulate in relation to a given error.

444 Process PID lowpass filter time

(PROC FILTER TIME)

Value:

0.02 - 10.00

★ 0.02

Function:

Noise in the feedback signal is dampened by a first order lowpass filter to reduce the noise's impact on the process regulation. This can be an advantage e.g. if there is a lot of noise on the signal.

Description of choice:

Select the required time constant (t). If a time constant (t) of 0.1 s is programmed, the cut-off frequency for the lowpass filter will be $1/0.1 = 10 \text{ RAD/sec.}$, corresponding to $(10 / 2 \times \pi) = 1.6 \text{ Hz.}$ The process regulator will thus only regulate a feedback signal that varies by a frequency lower than 1.6 Hz. If the feedback signal varies by a higher frequency than 1.6 Hz, it will be dampened by the lowpass filter.

Serial communication

500 Address

(BUS ADDRESS)

Value:

0 - 126 ★ 1

Function:

This parameter allows the allocation of an address to each frequency converter in a serial communication network.

Description of choice:

The individual frequency converter must be allocated a unique address.
 If the number of units connected (frequency converters + master) is higher than 31, a repeater must be used.
 Parameter 500 Address cannot be selected via the serial communication, but must be preset via the control unit.

507 Selection of Setup

(SETUP SELECT)

Value:

Digital input (DIGITAL INPUT) [0]
 Serial communication (SERIAL PORT) [1]
 Logic and (LOGIC AND) [2]
 ★Logic or (LOGIC OR) [3]

Function:

Parameter 507 allows a choice between controlling the frequency converter via the digital inputs and/or via the serial port.
 If *Serial port* [1] is selected, the relevant command can only be activated if a command is given via the serial port.
 In the case of *Logic and* [2] the function must also be activated via a digital input.

Description of choice:

The table below shows which Setup (parameter 004 Active Setup) is selected for each of the following: *Digital input* [0], *Serial communication* [1], *Logic and* [2] or *Logic or* [3].

Digital input [0]		
Setup msb	Setup lsb	Function
0	0	Setup 1
0	1	Setup 2
1	0	Setup 3
1	1	Setup 4

Serial communication [1]		
Setup msb	Setup lsb	Function
0	0	Setup 1
0	1	Setup 2
1	0	Setup 3
1	1	Setup 4

Logic and [2]				
Bus Setup msb	Bus Setup lsb	Dig. Setup msb	Dig. Setup lsb	Setup no.
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	2
0	1	1	0	1
0	1	1	1	2
1	0	0	0	1
1	0	0	1	1
1	0	1	0	3
1	0	1	1	3
1	1	0	0	1
1	1	0	1	2
1	1	1	0	3
1	1	1	1	4

★ = factory setting. () = display text [] = value for use in communication via serial communication port

Logic or [3]				
Bus Setup msb	Bus Setup lsb	Dig. Setup msb	Dig. Setup lsb	Setup no.
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	2
0	1	0	1	2
0	1	1	0	4
0	1	1	1	4
1	0	0	0	3
1	0	0	1	4
1	0	1	0	3
1	0	1	1	4
1	1	0	0	4
1	1	0	1	4
1	1	1	0	4
1	1	1	1	4

Jogging (JOGGING) [3]
 Max. speed (MAX SPEED) [4]
 Stop and trip (STOP AND TRIP) [5]

Function:

In this parameter you can select the required reaction for the frequency converter when the preset time in parameter 513 *Bus time interval* has been exceeded. If choices [1] to [5] are activated the output relay will be deactivated.

Description of choice:

The output frequency of the frequency converter can be frozen at the present value, stop the motor, be frozen at *Jogging frequency* (10 Hz), be frozen at parameter 202 *Output frequency, high limit* f_{MAX} or stop and activate a cut out.

513 Bus time interval (BUS TIMEOUT TIME)

Value:

1 - 99 sec. ★ 1 sec.

Function:

In this parameter it is possible to preset the maximum time expected to elapse between receipt of two consecutive telegrams. If this time is exceeded, the serial communication is assumed to have stopped and the desired reaction is preset in parameter 514 *Bus time interval function*.

Description of choice:

Preset the required time.

514 Bus time interval function (BUS TIMEOUT FUNC)

Value:

★Off (OFF) [0]
 Freeze output frequency (FREEZE OUTPUT) [1]
 Stop (STOP) [2]

★ = factory setting. () = display text [] = value for use in communication via serial communication port

515-541 Data readout				
Value:				
Par. no.	Description	Display text	Unit	Update interval
515	Res. reference	(REFERENCE %)	%	
516	Res. reference [Unit]	(REFERENCE [UNIT])	Hz, rpm	
517	Feedback [Unit]	(FEEDBACK [UNIT])	Par. 416	
518	Frequency	(FREQUENCY)	Hz	
520	Motor current	(MOTOR CURRENT)	Amp	
522	Power[kW]	(POWER (KW))	kW	
523	Power[HP]	(POWER (HP))	HP	
524	Motor voltage	(MOTOR VOLTAGE)	V	
525	DC-link voltage	(DC LINK VOLTAGE)	V	
526	Thermal load motor	(MOTOR THERMAL)	%	
527	Thermal load inverter	(INV. THERMAL)	%	
528	Digital input	(DIGITAL INPUT)	Bin	
529	Term.53, analogue input	(ANALOG INPUT 53)	V	
531	Term.60, analogue input	(ANALOG INPUT 60)	mA	
533	External ref.	(EXT. REF.%)	%	
534	Status word, Hex	(STATUS WORD)	Hex	
537	Inverter temperature	(INVERTER TEMP.)	°C	
538	Alarm word	(ALARM WORD)	Hex	
539	Control word	(CONTROL WORD)	Hex	
540	Warning word	(WARN. WORD)	Hex	
541	Extended status word	(STATUS WORD)	Hex	

Function:

These parameters can be read out via the serial communication port and the LCP display. See also parameters 009-012 *Display readout*.



NB!:

Parameters 515-541 can only be read out via an LCP control unit.

Description of choice:

Resulting reference %, parameter 515:

Gives the resulting reference as a percentage in the range from Minimum reference, Ref_{MIN} to Maximum reference, Ref_{MAX}. See also *Dealing with references*.

Resulting reference [unit], parameter 516:

Gives the resulting reference in Hz in Open loop (parameter 100). In a closed loop the reference unit is selected in parameter 416 *Process units*.

Feedback [unit], parameter 517:

Gives the resulting feedback value with the unit/scaling selected in parameters 414, 415 and 416. See also dealing with feedback.

Frequency [Hz], parameter 518:

Gives the output frequency from the frequency converter.

Motor current [A], parameter 520:

Gives the motor's phase current measured as an effective value.

Power [kW], parameter 522:

Gives the present power absorbed by the motor in kW.

Power [HP], parameter 523:

Gives the present power absorbed by the motor in HP.

Motor voltage, parameter 524:

Gives the voltage being supplied to the motor.

DC link voltage, parameter 525:

Gives the intermediate circuit voltage in the frequency converter.

Thermal load, motor [%], parameter 526:

Gives the calculated/estimated thermal load on the motor. 100% is the cut-out limit. See also parameter 128 *Thermal motor protection*.

Thermal load INV [%], parameter 527:

Gives the calculated/estimated thermal load on the frequency converter. 100% is the cut-out limit.

Digital input, parameter 528:

Gives the signal status from the 5 digital inputs (18, 19, 27, 29 and 33). Input 18 corresponds to the bit on the extreme left. '0' = no signal, '1' = connected signal.

Terminal 53 analogue input [V], parameter 529:

Gives the voltage value for the signal on terminal 53.

Terminal 60 analogue input [mA], parameter 531:

Gives the present value for the signal on terminal 60.

External reference, parameter 533:

Gives the sum of external references as a percentage (sum of analogue/pulse/serial communication) in the range from Minimum reference, Ref_{MIN} to Maximum reference, Ref_{MAX}.

Status word, parameter 534:

Gives the present status word for the frequency converter in Hex. See *Serial communication for the AKD 2800*.

Inverter temperature, parameter 537:

Gives the present inverter temperature on the frequency converter. The cut-out limit is 90-100 °C, with cut back in at 70 ± 5 °C.

Alarm word, parameter 538:

Gives in Hex code which alarm is on the frequency converter. See *Warning word, extended status word and alarm word*.

Control word, parameter 539:

Gives the present control word on the frequency converter in Hex. See *Serial communication for the AKD 2800*.

Warning word, parameter 540:

States whether there is a warning on the frequency converter in Hex. See *Warning word, extended status word and alarm word*.

Extended status word, parameter 541:

States whether there is a warning on the frequency converter in Hex code. See *Warning word, extended status word and alarm word*.

■ Technical functions

600-605 Operating Data

Value:

Par. no.	Description	Display text	Unit	Range
600	Operating hours	(OPERATING HOURS)	Hours	0-130,000.0
601	Hours run	(RUNNING HOURS)	Hours	0-130,000.0
602	kWh counter	(KWH COUNTER)	kWh	Depends on unit
603	Number of power-up's	(POWER UP'S)	Number of times	0-9999
604	Number of overtemperatures	(OVER TEMP'S)	Number of times	0-9999
605	Number of overvoltages	(OVER VOLT'S)	Number of times	0-9999

Function:

These parameters can be read out via the serial communication port and the LCP control unit.

Description of choice:

Parameter 600, Operating hours:

Gives the number of hours the frequency converter has been operating. The value is saved every hour and when there is a mains failure. This value cannot be reset.

Parameter 601, Hours run:

Gives the number of hours the motor has been operating since the reset in parameter 619 *Reset of hours-run counter*. The value is saved every hour and when there is a mains failure.

Parameter 602, kWh counter:

Gives the frequency converter's output energy in kWh. The calculation is based on the mean kW value over one hour. This value can be reset using parameter 618 *Reset of kWh counter*.

Range: 0 - depends on unit.

Parameter 603, Number of power-ups:

Gives the number of power-ups of the supply voltage undertaken on the frequency converter.

Parameter 604, Number of overtemperatures:

Gives the number of overtemperature faults that have been registered on the frequency converter's heat sink.

Parameter 605, Number of overvoltages:

Gives the number of overvoltages of the intermediate circuit voltage in the frequency converter. This is only counted when Alarm 7 *Overvoltage* is active.

NB!:

Parameters 615-617 *Fault log* cannot be read out via the integral control unit.

615 Fault log: Error code

(F.LOG: ERROR COD)

Value:

[Index 1 - 10] Error code: 0 - 99

Function:

In this parameter it is possible to see the reason for a trip (cut-out of the frequency converter) occurring. 10 [1-10] log values are defined.

The lowest log number [1] contains the latest/most recently saved data value. The highest log number [10] contains the oldest data value saved. If a trip occurs, it is possible to see the cause, time and a possible value of the output current or output voltage.

Description of choice:

Given as a fault code, in which the number refers to a table. See the table in *Warnings/alarm messages*.

616 Fault log: Time

(F.LOG: TIME)

Value:

[Index 1 - 10] Hours: 0 - 130,000.0

Function:

In this parameter it is possible to see the total number of operating hours in connection with the last 10 trips. 10 [1-10] log values are denoted. The lowest log number [1] contains the latest/most recently saved data value, and the highest log number [10] contains the oldest data value.

Description of choice:

Read out as one value.

617 Fault log: Value

(F.LOG: VALUE)

Value:

[Index 1 - 10] Value: 0 - 9999

Function:

In this parameter it is possible to see at which value a trip occurred. The unit of the value depends on which alarm is active in parameter 615 *Fault log: Fault code*.

Description of choice:

Read out as one value.

618 Reset of kWh counter

(RESET KWH COUNT)

Value:

★No reset (DO NOT RESET) [0]
Reset (RESET COUNTER) [1]

Function:

Resetting parameter 602 *kWh counter* to zero.

Description of choice:

If *Reset* [1] is selected and you press the [OK] key, the frequency converter's kWh counter is reset to zero. This parameter cannot be selected via serial communication.



NB!:

When the [OK] key is activated, the counter is reset to zero.

619 RESET RUNNING HOURS COUNTER

(RESET RUN. HOUR)

Value:

★No reset (DO NOT RESET) [0]
Reset (RESET COUNTER) [1]

Function:

Resetting of parameter 601 *Hours run* to zero.

Description of choice:

If *Reset* [1] is selected and you press the [OK] key, the frequency converter's parameter 601 is reset to zero *Hours run*. This parameter cannot be selected via serial communication.



NB!:

When the [OK] key is activated the parameter is reset to zero.

620 Operation Mode

(OPERATION MODE)

Value:

★Normal operation (NORMAL OPERATION) [0]
Control card test (CONTROL CARD TEST) [1]
Initialise (INITIALIZE) [2]

Function:



NB!:

Please note, that the control card will be different on DeviceNet units.

In addition to its normal function, this parameter can be used to test the control card.

There is also the opportunity to perform an initialisation at the factory setting for all parameters in all Setups, with the exception of parameters 500 *Address*, 501 *Baudrate*, 600-605 *Operating data* and 615-617 *Fault log*.

Description of choice:

Normal function [0] is used for normal operation of the motor.

Control card test [2] is selected if you wish to check the control card's analog/digital inputs, analog/digital outputs, relay outputs and 10 V and 24 V voltages.

The test is performed as follows:

27 - 29 - 33 - 46 are connected.

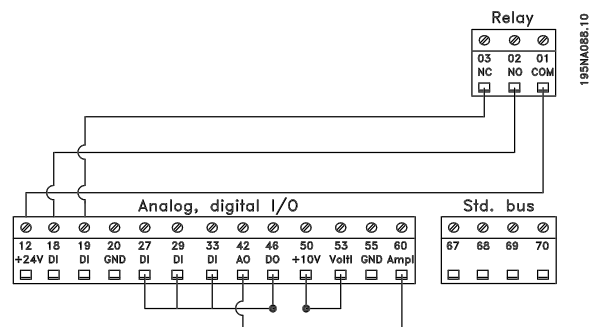
50 - 53 are connected.

42 - 60 are connected.

12 - relay terminal 01 is connected.

18 - relay terminal 02 is connected.

19 - relay terminal 03 is connected.



Use the following procedure for the control card test:

1. Select control card test.
2. Disconnect the mains voltage and wait until the light in the display has disappeared.
3. Mount according to drawing and description.
4. Connect the mains voltage.

5. The frequency converter automatically undertakes a test of the control card.

If the frequency converter displays a fault code from 37-45, the control card test has failed. Change the control card to start up the frequency converter.

If the frequency converter comes into Display mode, the test is OK. Remove the test connector and the frequency converter is ready for operation. Parameter 620 *Operating mode* is automatically set to *Normal operation* [0].

Initialisation [3] is selected if you wish to use the unit's factory setting.

Procedure for initialisation:

1. Select *Initialisation* [3].
 2. Disconnect the mains voltage and wait until the light in the display has disappeared.
 3. Connect the mains voltage.
 4. An initialisation is performed in all parameters in all Setups, with the exception of parameters 500 *Address*, 501 *Baudrate*, 600-605 *Operating data* and 615-617 *Fault log*.
-

621-642 Nameplate		
Value:		
Par. no	Description Nameplate	Display text
621	Unit type	(DRIVE TYPE)
624	Software version	(SOFTWARE VERSION)
625	LCP identification no.	(LCP VERSION)
626	Database identification no.	(DATABASE VER.)
627	Power parts version	(POWER UNIT DB ID)
628	Application option type	(APP. OPTION)
630	Communication option type	(COM. OPTION)
632	BMC software identification	(BMC-SOFTWARE ID)
634	Unit identification for communication	(UNIT ID)
635	Software parts no.	(SW. PART NO.)
640	Software version	(SOFTWARE VERSION)
641	BMC-software identification	(BMC2 SW)
642	Power card identification	(POWER ID)

Function:

The unit's main data can be read out from parameters 621 to 635 *Nameplate* using the LCP 2 control unit or serial communication. Parameters 640 - 642 can also be seen on the unit's integral display.

Description of choice:

Parameter 621 Nameplate: Unit type:

Gives unit size and mains voltage.

Example: AKD2811 380-480 V.

Parameter 624 Nameplate: Software version no.

The unit's present software version number appears here.

Example: V 1.00

Parameter 625 Nameplate: LCP 2 ID number:

The ID number of the unit's LCP 2 appears here.

Example: ID 1.42 2 kB

Parameter 626 Nameplate: Database ID number:

The ID number of the software's database appears here.

Example: ID 1.14.

Parameter 627 Nameplate: Power section version:

The ID number of the unit's power section appears here.

Example: ID 1.15.

Parameter 628 Nameplate: Application option type:

Here you can see which types of application options are installed in the frequency converter.

Parameter 630 Nameplate: Communication option type:

Here you can see which types of communication options are installed in the frequency converter.

Parameter 632 Nameplate: BMC software identification:

The ID number of the BMC software appears here.

Parameter 634 Nameplate: Unit identification for communication:

The ID number for communication appears here.

Parameter 635 Nameplate: Software section no.:

The software section number appears here.

Parameter 640 Nameplate: Software version:

The unit's present software version number appears here. Example: 1.00

Parameter 641 Nameplate: BMC software identification:

The ID number of the BMC software appears here.

Parameter 642 Nameplate: Power card identification:

The ID number of the unit's power part appears here. Example: 1.15

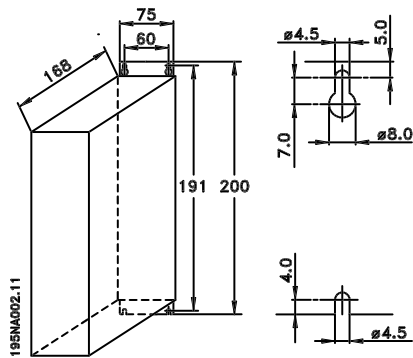
AKD 2800

■ Mechanical dimensions

The drawings below give the mechanical dimensions.
All dimensions are in mm.

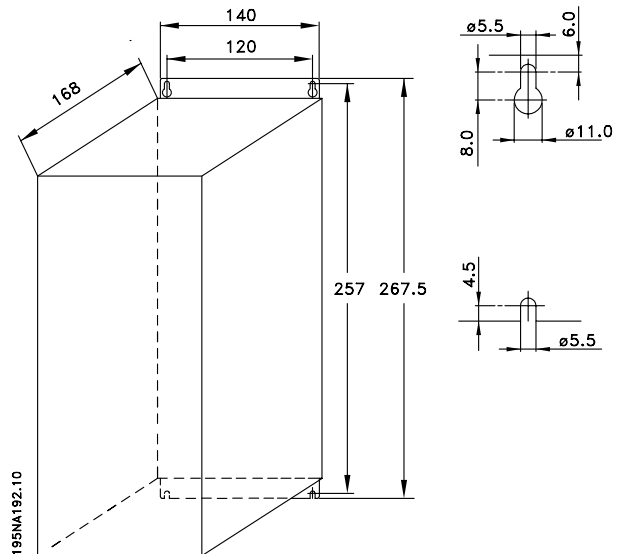
AKD 2803-2815 200-240 Volt

AKD 2805-2815 380-480 Volt



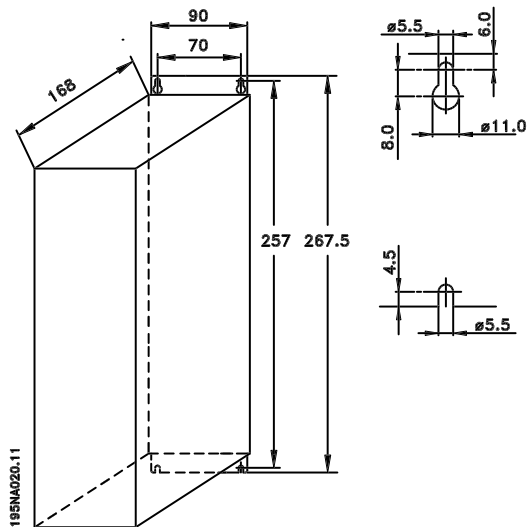
AKD 2840 200-240 Volt

AKD 2855-2875 380-480 Volt

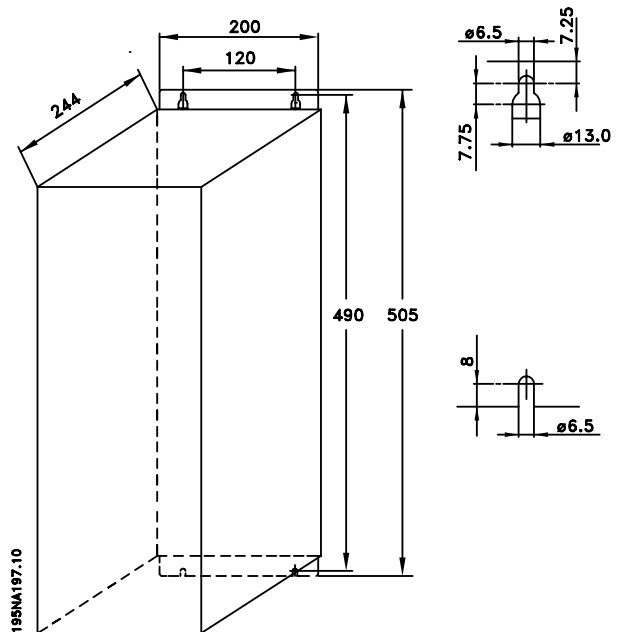


AKD 2822 200-240 Volt

AKD 2822-2840 380-480 Volt



AKD 2880-2882 380-480 V

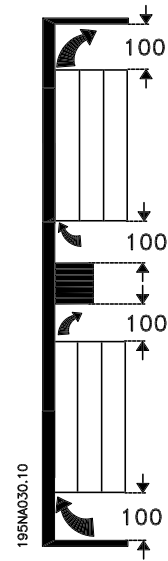


■ Mechanical installation



Please pay attention to the requirements that apply to installation.

The frequency converter is cooled by means of air circulation. For the unit to be able to release its cooling air, the minimum free distance above and below the unit must be minimum 100 mm. To protect the unit from overheating, it must be ensured that the ambient temperature does not rise above the max. temperature stated for the frequency converter and that the 24-hour average temperature is not exceeded. The max. temperature and 24-hour average can be seen in *General technical data*. If the ambient temperature is in the range of 45 °C - 55 °C, derating of the frequency converter is to be carried out. See *Derating for ambient temperature*. Please note that the service life of the frequency converter will be reduced if no allowance is made for the derating for ambient temperature.



■ Integration

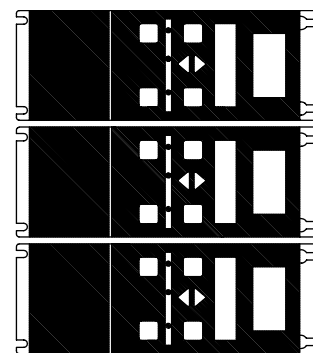
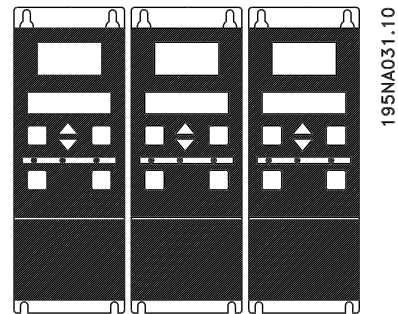
All units with enclosure IP 20 must be integrated in cabinets and panels. IP 20 is not suitable for remote mounting. In some countries, e.g. in the USA, units with enclosure NEMA 1 are approved for remote mounting.

■ Spacing for mechanical installation

All units require a minimum of 100 mm air between other components and vents of the enclosure.

■ Side-by-side

All units can be installed side-by-side and in any position, as the units do not require ventilation on the side.



195NA0147.10

■ General information about electrical installation

■ High voltage warning



The voltage of the frequency converter is dangerous whenever the equipment is connected to mains. Incorrect installation of the motor or frequency converter may cause damage to the equipment, serious injury or death. Comply with the instructions in this manual, as well as national and local rules and safety regulations. Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains: Wait at least 4 minutes for current dissipate.



NB!:

It is the responsibility of the user or installer to ensure correct earthing and protection in accordance with national and local standards.

■ Extra protection

RCD relays, multiple protective earthing or earthing can be used as extra protection, provided that local safety regulations are complied with. In the case of an earth fault, a DC content may develop in the faulty current. Never use an RCD (ELCB relay), type A, as it is not suitable for DC faulty currents. If RCD relays are used, local regulations must be complied with. If RCD relays are used, they must be:

- Suitable for protecting equipment with a DC content in the faulty current (3-phase bridge rectifier).
- Suitable for a pulse-shaped, brief discharge on power-up.
- Suitable for a high leakage current.

N must be connected before L1 for single phase 200 V reduced leakage current units (type code R4).

■ High voltage test

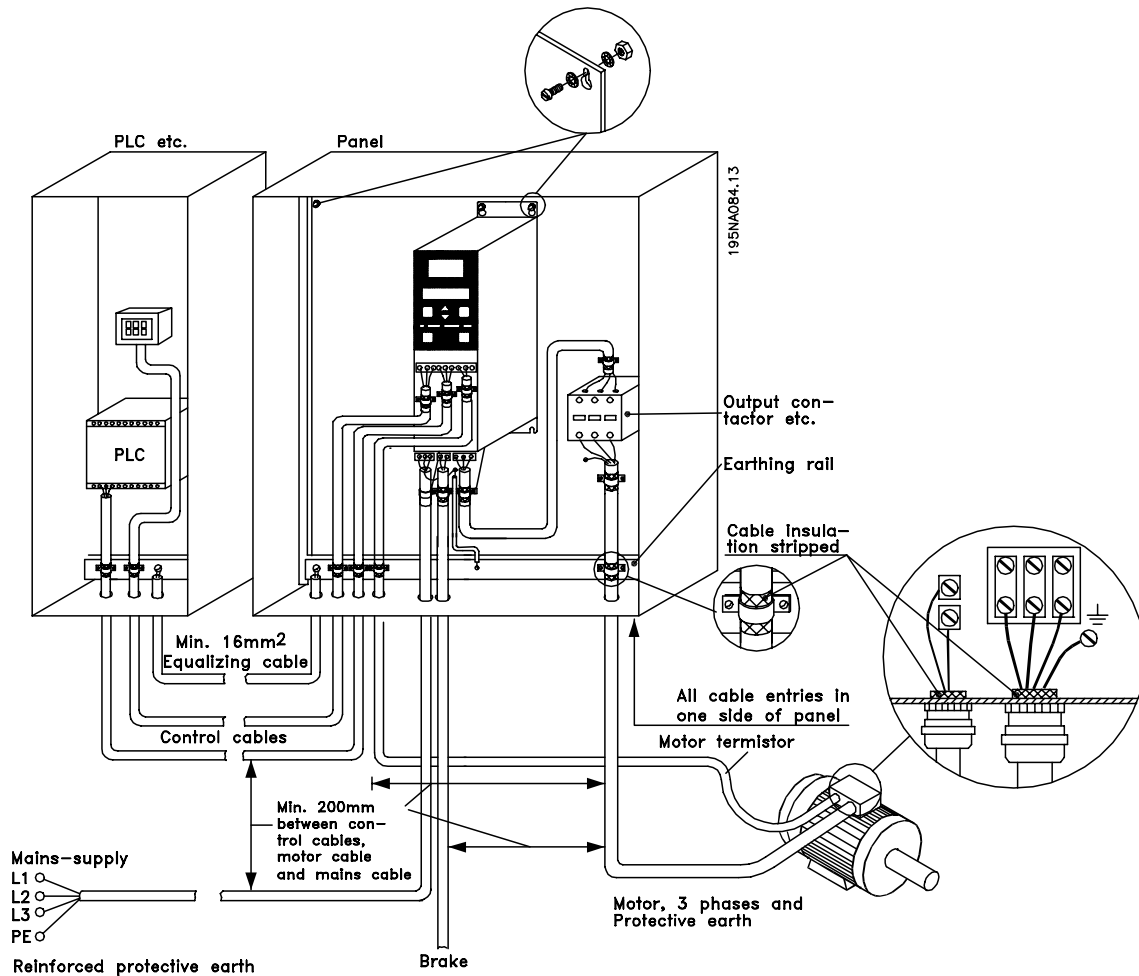
A high voltage test can be performed by short-circuiting terminals U, V, W, L1, L2 and L3, and applying max. 2160 V DC in 1 sec. between this short-circuit and terminal 95.

■ EMC-correct electrical installation

General points to be observed to ensure EMC-correct electrical installation.

- Use only screened/armoured motor cables and screened/armoured control cables.
- Connect the screen to earth at both ends.
- Avoid installation with twisted screen ends (pigtails), since this ruins the screening effect at high frequencies. Use cable clamps instead.
- It is important to ensure good electrical contact from the installation plate through the installation screws to the metal cabinet of the frequency converter.
- Use starwashers and galvanically conductive installation plates.
- Do not use unscreened/unarmoured motor cables in the installation cabinets.

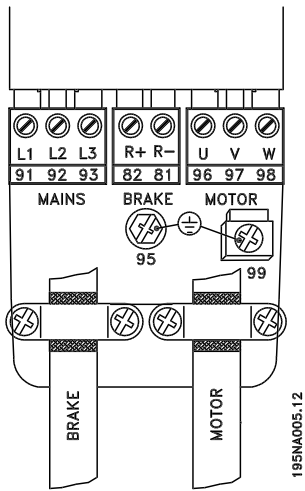
The illustration below shows EMC-correct electrical installation, in which the frequency converter has been fitted in an installation cabinet and connected to a PLC.



AKD 2800

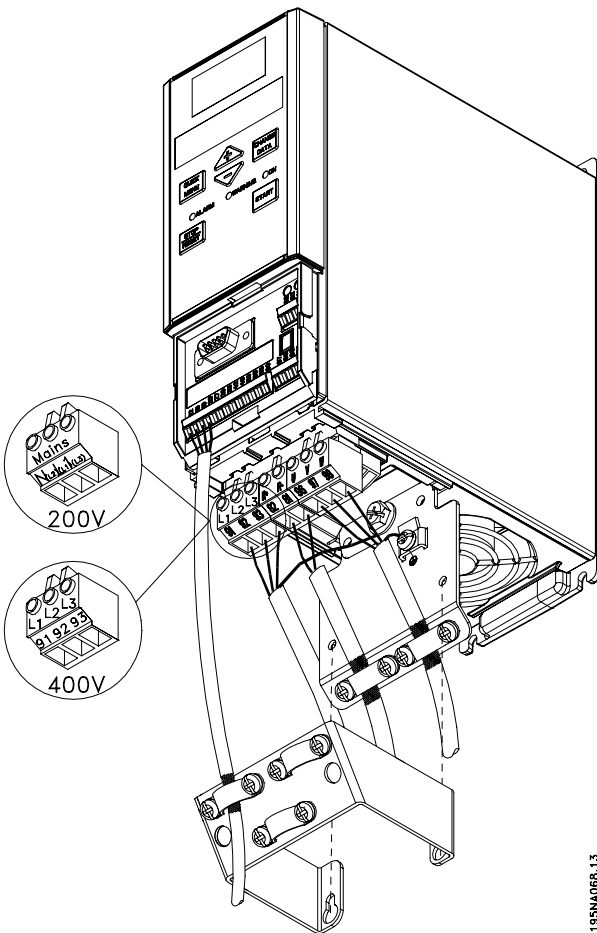
■ Electrical installation

AKD 2822 200-240 V, 2822-2840 380-480 V

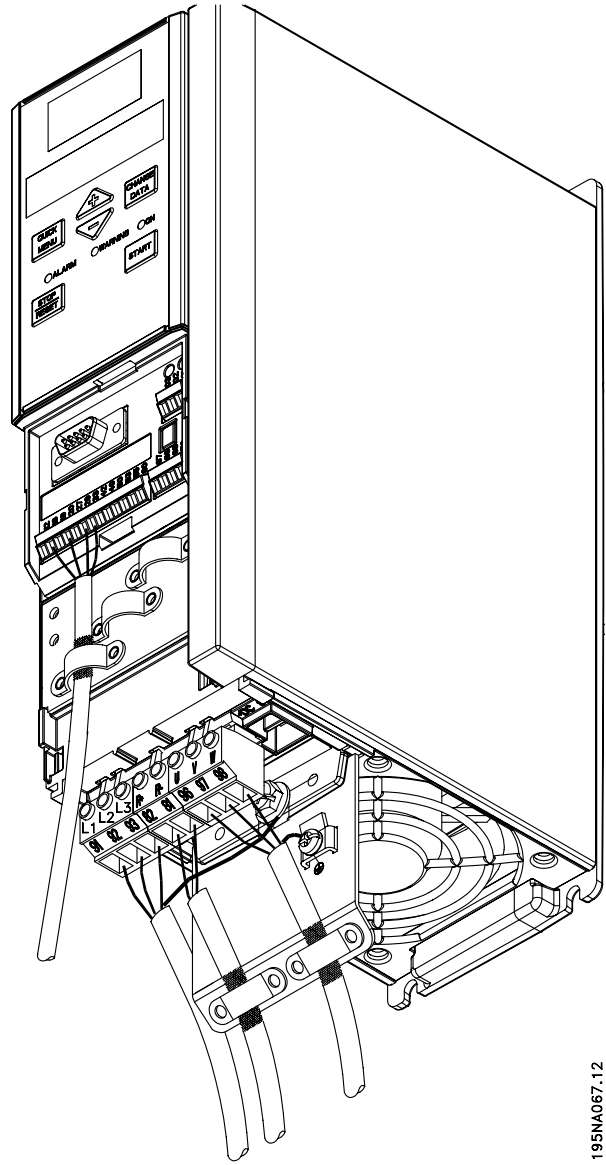


195NA005.12

AKD 2803-2815 200-240 V, 2805-2815 380-480 V

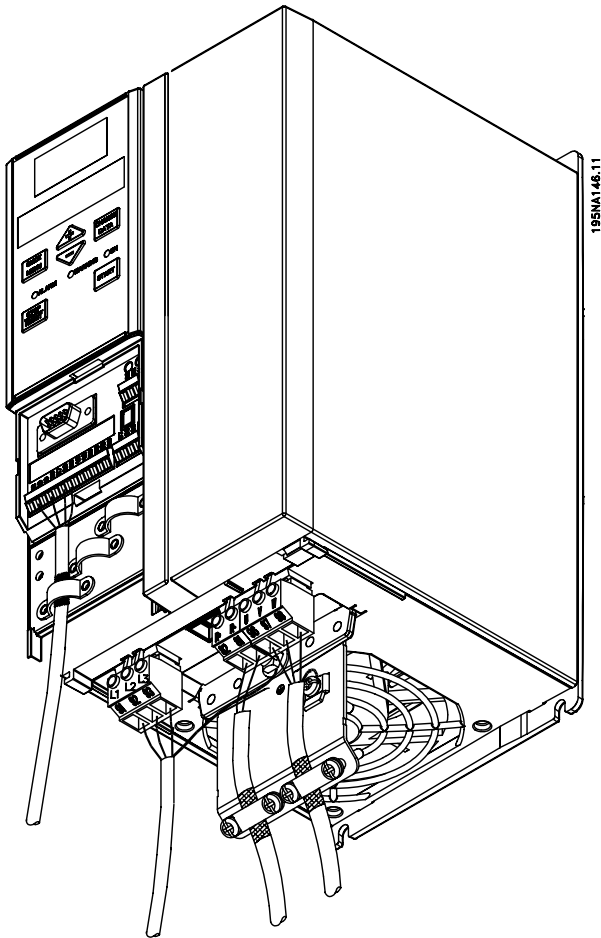


195NA065.13

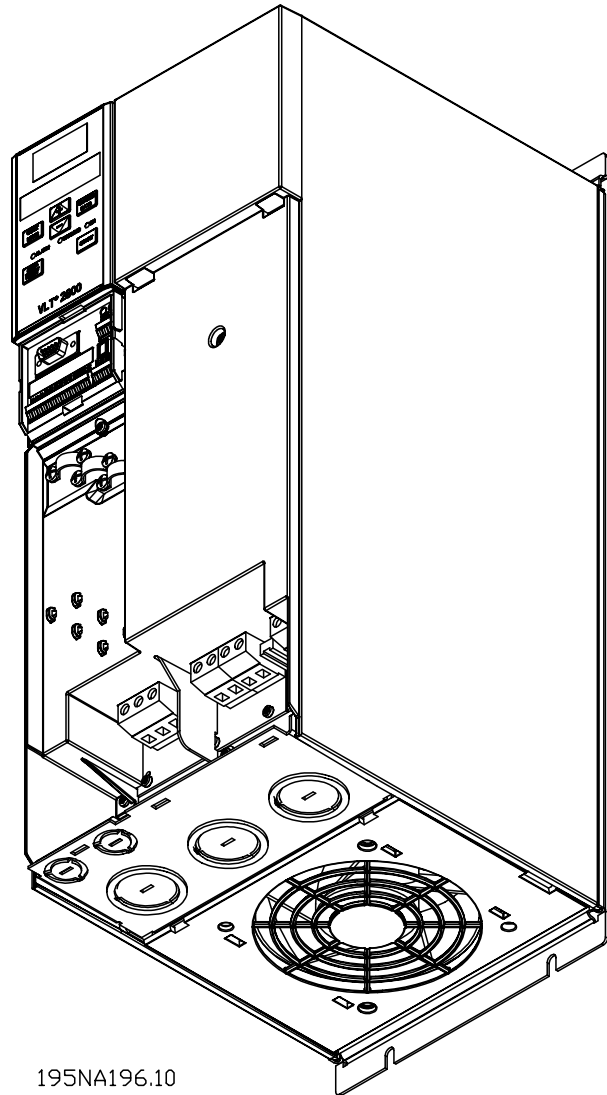


195NA067.12

AKD 2840 200-240 V, 2855-2875 380-480 V

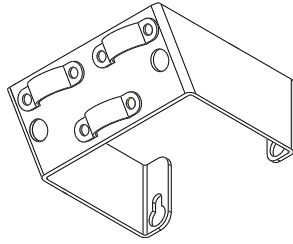


AKD 2880-2882 380-480 V



Please note, that the units will be supplied with two bottom plates; one for metric glands and one for conduits.

■ Safety clamp



195NA112.10



If the galvanic isolation (PELV) between control terminals and high-voltage terminals is to be maintained, the accompanying safety clamp must be fitted to AKD 2803-2815, 200-240 V, and AKD 2805-2815, 380-480 V.

■ Pre-fuses

For all unit types, external pre-fuses must be fitted in the mains supply to the frequency converter. For UL/cUL applications with a mains voltage of 200-240 Volt, use pre-fuses type Bussmann KTN-R (200-240 Volt) or Ferraz Shawmut type ATMR (max. 30A). For UL/cUL applications with a mains voltage of 380-480 Volt, use pre-fuses type Bussmann KTS-R (380-480 Volt). See *Technical data* for correct dimensioning of pre-fuses.

■ Mains connection

Please note that at 1 x 220-240 Volt the neutral wire must be attached to terminal N (L₂) and the phase wire must be connected to terminal L1 (L₁).

No.	N(L ₂) N	L1(L ₁) L1	(L ₃)	Mains voltage 1 x 220-240 V
No.	95	Earth connection		

No.	N(L ₂) L2	L1(L ₁) L1	(L ₃) L3	Mains voltage 3 x 220-240 V
No.	95	Earth connection		

No.	91 L1	92 L2	93 L3	Mains voltage 3 x 380-480 V
No.	95	Earth connection		



NB!:

Please check that the mains voltage fits the mains voltage of the frequency converter, which can be seen from the nameplate.



400-Volt units with RFI-filters may not be connected to mains supplies in which the voltage between phase and earth is more than 300 Volts. Please note that for the IT mains and the delta earth the mains voltage can exceed 300 Volts between phase and earth. Units with type code R5 can be connected to mains supplies with up to 400 V between phase and earth.

See *Technical data* for correct dimensioning of cable cross-section. See also the section entitled *Galvanic isolation* for further details.

■ Motor connection

Connect the motor to terminals 96, 97, 98. Connect earth to terminal 99.

No.	96 U	97 V	98 W	Motor voltage 0-100% of mains voltage. 3 wires of motor
	U1 W2	V1 U2	W1 V2	6 wires out of motor, Delta connected
	U1	V1	W1	6 wires out of motor, Star connected U2, V2, W2 to be interconnected separately (optional terminal block)
No.	PE			Earth connection

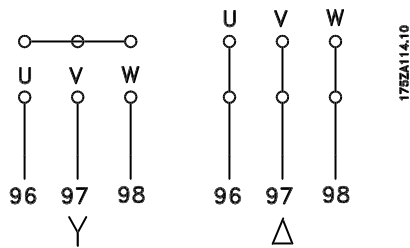
See *Technical data* for correct dimensioning of cable cross-section.

All types of three-phase asynchronous standard motors can be connected to a frequency converter. Normally, small motors are star-connected (230/400 V, Δ/ Y). Large motors are delta-connected (400/690 V, Δ/ Y). The correct connection mode and voltage can be read from the motor nameplate.



NB!:

In motors without phase insulation paper, an LC filter should be fitted on the output of the frequency converter.



Terminal 96 connected to U-phase.

Terminal 97 connected to V-phase.

Terminal 98 connected to W-phase.

The direction of rotation can be changed by switching two phases on the motor terminals.

■ RFI switch

Mains supply isolated from earth:

If the frequency converter is supplied from an isolated mains source (IT mains), the RFI switch can be turned off (OFF). In OFF position, the internal RFI capacities (filter capacitors) between the chassis and the intermediate circuit are cut off to avoid damage to the intermediate circuit and to reduce the earth capacity currents (according to IEC 61800-3).



NB!:

The RFI switch is not to be operated with mains connected to the unit. Check that the mains supply has been disconnected before operating the RFI switch.



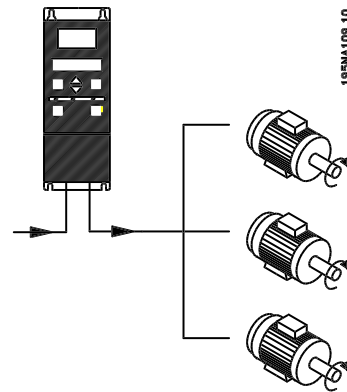
NB!:

The RFI switch disconnects the capacitors galvanically from ground.

The switch Mk9, placed next to terminal 96, should be removed to disconnect the RFI-filter.

The RFI switch is only available on AKD 2880-2882.

■ Parallel connection of motors



The frequency converter is able to control several motors connected in parallel. If the motors are to have different rpm values, use motors with different rated rpm values. Motor rpm is changed simultaneously, which means that the ratio between the rated rpm values is maintained across the range. The total current consumption of the motors is not to exceed the maximum rated output current I_{INV} for the frequency converter.

Problems may arise at the start and at low rpm values if the motor sizes are widely different. This is because the small motors' relatively high ohmic resistance in the stator calls for a higher voltage at the start and at low rpm values.

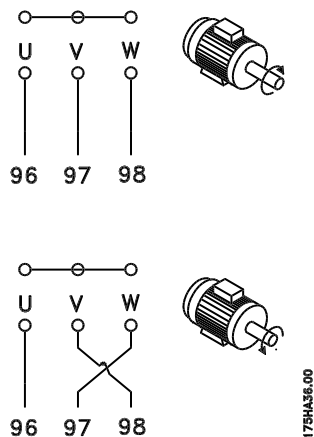
In systems with motors connected in parallel, the electronic thermal relay (ETR) of the frequency converter cannot be used as motor protection for the individual motor. For this reason further motor protection must be used, e.g. thermistors in each motor or an individual thermal relay. (Circuit breakers are not suitable as protection).



NB!:

Parameter 107 *Automatic motor adaption, AMT* cannot be used when motors are connected in parallel. Parameter 101 *Torque characteristic* must be set to *Special motor characteristics* [8] when motors are connected in parallel.

■ Direction of motor rotation



The factory setting is for clockwise rotation with the frequency converter transformer output connected as follows:

■ Motor cables

See Technical data for correct dimensioning of motor cable cross-section and length. Always comply with national and local regulations on cable cross-section.



NB!:

If an unscreened/unarmoured cable is used, some EMC requirements are not complied with.

If the EMC specifications regarding emission are to be complied with, the motor cable must be screened/armoured, unless otherwise stated for the RFI filter in question. It is important to keep the motor cable as short as possible so as to reduce the noise level and leakage currents to a minimum. The motor cable screen must be connected to the metal cabinet of the frequency converter and to the metal cabinet of the motor. The screen connections are to be made with the biggest possible surface area (cable clamp). This is enabled by different installation devices in different frequency converters. Mounting with twisted screen ends (pigtailed) is to be avoided, since these spoil the screening effect at high frequencies. If it is necessary to break the screen to install a motor isolator or motor relay, the screen must be continued at the lowest possible HF impedance.

■ Motor thermal protection

The electronic thermal relay in UL-approved frequency converters has received the UL-approval for single motor protection, when parameter 128 *Motor thermal protection* has been set for *ETR Trip* and parameter 105 *Motor current*, $I_{M, N}$ has been programmed to the rated motor current (see motor nameplate).

■ Earth connection

As leak current to the earth is higher than 3.5 mA, the frequency converter must always be earthed according to prevailing national and local regulations. To guarantee that the earth cable has a good mechanical connection to terminal 95, the cable cross section must be at least 10 mm² or 2 rated earth wires that are terminated separately. To increase safety you can install an RCD (Residual Current Device), which guarantees that the frequency converter trips when leak current becomes too high. See also RCD Application Note MN.90.GX.02.

■ Load sharing

Load sharing provides the facility to connect several frequency converters' DC intermediate circuits.

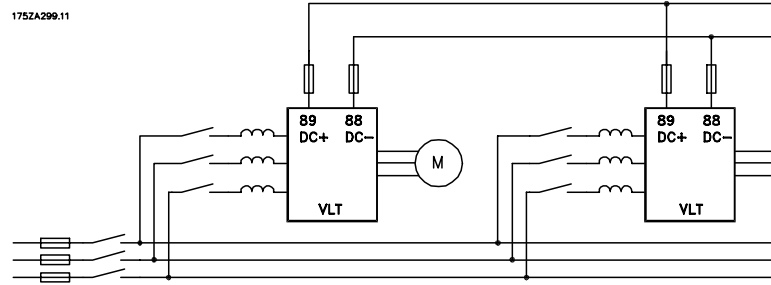
This requires that the installation is extended using extra fuses and AC coils (see drawing below).

For load sharing parameter 400 *Brake function* must be set to *Load sharing* [5].

Use 6.3 mm Faston Plugs for DC (Load Sharing).

Contact Danfoss or see instructions no. MI.50.NX.02 for further information.

No.	88	89	Loadsharing
	-	+	



Note that voltage levels of up to 850 V DC may occur between terminals 88 and 89.

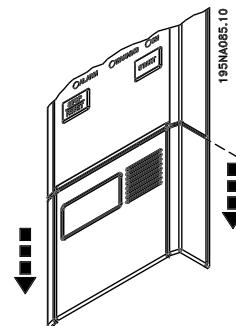
■ Tightening Torque, Power Terminals

Power and earth terminals must be tightened with the following torques:

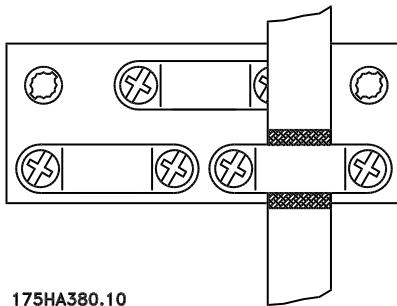
AKD	Terminals	Torque [Nm]
2803-	Power mains brake	0.5-0.6
2875	Earth	2-3
2880-	Power mains brake	1.2-1.5
2882	Earth	2-3

■ Access to control terminals

All terminals to the control cables are located underneath the protective plate on the front of the frequency converter. Remove the protective plate by pulling it downwards (see drawing).

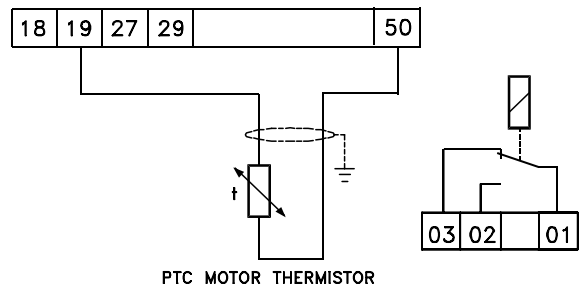
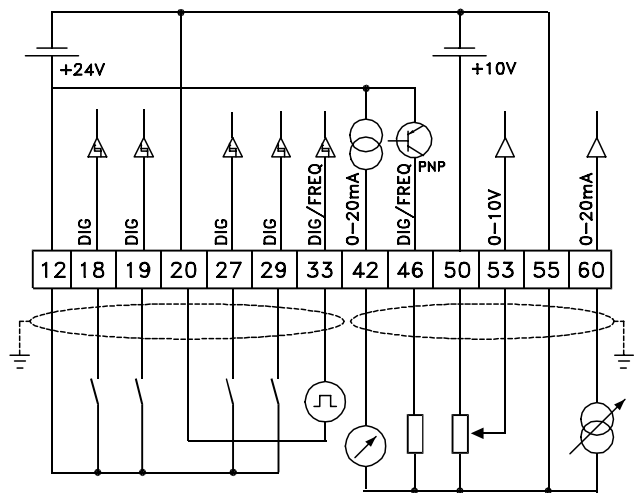


■ Electrical installation, control cables



175HA380.10

Control cables must be screened/armoured. The screen must be connected to the frequency converter chassis by means of a clamp. Normally, the screen must also be connected to the chassis of the controlling unit (use the instructions for the unit in question). In connection with very long control cables and analogue signals, in rare cases depending on the installation, 50/60 Hz earth loops may occur because of noise transmitted from mains supply cables. In this connection, it may be necessary to break the screen and possibly insert a 100 nF capacitor between the screen and the chassis.



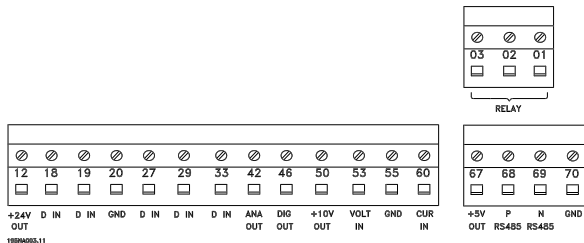
195NA301.10

PTC MOTOR THERMISTOR

■ Tightening torques, control cables

Control wires must be connected with a tightening torque of 0.22-0.25 Nm.

■ Electrical installation, control terminals



No.	Function
01-03	Relay outputs 01-03 can be used for indicating status and alarms/warnings.
12	24 V DC voltage supply.
18-33	Digital inputs.
20, 55	Common frame for input and output terminals.
42	Analogue output for displaying frequency, reference, current or torque.
46	Digital output for displaying status, warnings or alarms, as well as frequency output.
50	+10 V DC supply voltage for potentiometer or thermistor.
53	Analogue voltage input 0 - 10 V DC.
60	Analogue current input 0/4 - 20 mA.
67	+ 5 V DC supply voltage to Profibus.
68, 69	RS 485, Serial communication.
70	Frame for terminals 67, 68 and 69. Normally this terminal is not to be used.

■ Relay connection

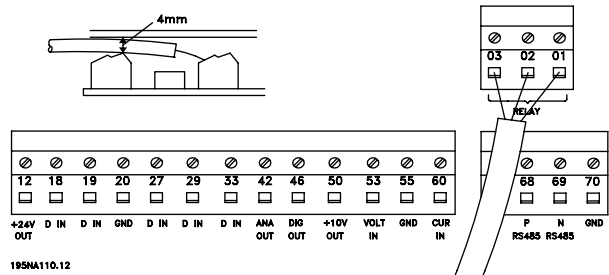
See parameter 323 *Relay output* for programming of relay output.

Nr.	01 - 02	1 - 2 make (normally open)
	01 - 03	1 - 3 break (normally closed)



NB!:

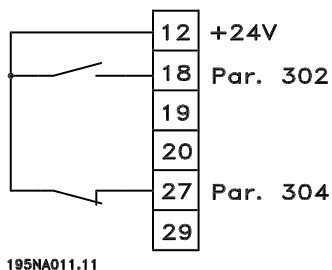
Please note that the cable jacket for the relay must cover the first row of control card terminals - otherwise the galvanic isolation (PELV) cannot be maintained. Max. cable diameter: 4 mm. See drawing.



■ Connection examples

■ Start/stop

Start/stop using terminal 18 and coasting stop using terminal 27.



Par. 302 Digital input = Start [7]

Par. 304 Digital input = Coasting stop inverted [2]

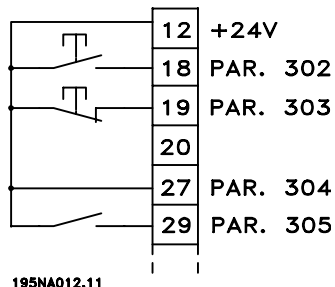
For Precise start/stop the following settings are made:

Par. 302 Digital input = Precise start/stop [27]

Par. 304 Digital input = Coasting stop inverted [2]

■ Pulse start/stop

Pulse start using terminal 18 and pulse stop using terminal 19. In addition, the jog frequency is activated via terminal 29.



Par. 302 Digital input = Pulse start [8]

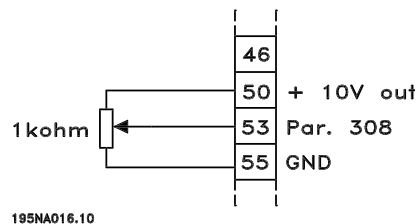
Par. 303 Digital input = Stop inverted [6]

Par. 304 Digital input = Coasting stop inverted [2]

Par. 305 Digital input = Jog [13]

■ Potentiometer reference

Voltage reference via a potentiometer.



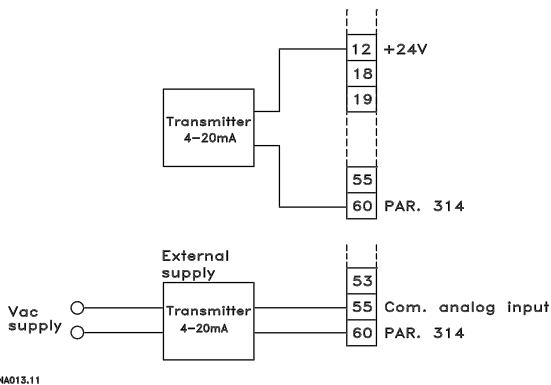
Par. 308 Analog input = Reference [1]

Par. 309 Terminal 53, min. scaling = 0 Volt

Par. 310 Terminal 53, max. scaling = 10 Volt

■ Connection of a 2-wire transmitter

Connection of a 2-wire transmitter as feedback to terminal 60.



Par. 314 Analog input = Feedback [2]

Par. 315 Terminal 60, min. scaling = 4 mA

Par. 316 Terminal 60, max. scaling = 20 mA

■ Display readout
Fr

The frequency converter shows the present output frequency in Hertz [Hz].

Io

The frequency converter shows the present output current in Amps [A].

Uo

The frequency converter shows the present output voltage in Volt [V].

Ud

The frequency converter shows the intermediate circuit voltage in Volt [V].

Po

The frequency converter shows the calculated output in kilowatt [kW].

notrun

This message is shown if an attempt is made to change a parameter value while the motor is running. Stop the motor to change the parameter value.

■ Warnings/alarm messages

A warning or an alarm will appear in the display as a numerical code **Err. xx**. A warning will be shown on the display until the fault has been corrected, while an alarm will continue to flash until the [STOP/RESET] key is activated.

The table shows the various warnings and alarms, and whether the fault locks the frequency converter. After a *Trip locked* the mains supply is cut off and the fault is corrected. The mains supply is reconnected and the frequency converter is reset. The frequency converter is now ready. A *Trip* can be reset manually in three ways:

1. Via the operating key [STOP/RESET].
2. Via a digital input.
3. Via serial communication.

It is also possible to choose an automatic reset in parameter 405 *Reset function*. When a cross appears in both warning and alarm, this can mean that a warning comes before an alarm. It can also mean that it is possible for the user to programme whether a warning or an alarm will appear for a given fault. For example, this is possible in parameter 128 *Motor thermal protection*. After a trip the motor will coast, and alarm and warning will blink on the frequency converter, but if the fault disappears only the alarm will blink. After a reset the frequency converter will be ready to start operation again.

No.	Description	Warning	Alarm	Trip locked
2	Live zero error (LIVE ZERO ERROR)	X	X	X
4	Mains phase loss (MAINS PHASE LOSS)	X	X	X
5	Voltage warning high (DC LINK VOLTAGE HIGH)	X		
6	Voltage warning low (DC LINK VOLTAGE LOW)	X		
7	Overvoltage (DC LINK OVERVOLT)	X	X	X
8	Undervoltage (DC LINK UNDERVOLT)	X	X	X
9	Inverter overload (INVERTER TIME)	X	X	
10	Motor overloaded (MOTOR, TIME)	X	X	
11	Motor thermistor (MOTOR THERMISTOR)	X	X	
12	Current limit (CURRENT LIMIT)	X	X	
13	Overcurrent (OVERCURRENT)	X	X	X
14	Earth fault (EARTH FAULT)		X	X
15	Switch mode fault (SWITCH MODE FAULT)		X	X
16	Short-circuit (CURR. SHORT CIRCUIT)		X	X
17	Serial communication timeout (STD BUS TIMEOUT)	X	X	
33	Out of frequency range (OUT FREQ RNG/ROT LIM)	X		
35	Inrush fault (INRUSH FAULT)		X	X
36	Overtemperature (OVERTEMPERATURE)	X	X	
37-45	Internal fault (INTERNAL FAULT)		X	X
50	AMT not possible		X	
51	AMT fault re. nameplate data (AMT TYPE.DATA FAULT)		X	
54	AMT wrong motor (AMT WRONG MOTOR)		X	
55	AMT timeout (AMT TIMEOUT)		X	
56	AMT warning during AMT (AMT WARN. DURING AMT)		X	
99	Locked (LOCKED)	X		

LED indication	
Warning	yellow
Alarm	red
Trip locked	yellow and red

WARNING/ALARM 2: Live zero fault

The voltage or current signal on terminal 53 or 60 is below 50% of the preset value in parameter 309 or 315 *Terminal, min. scaling*.

WARNING/ALARM 4: Mains phase fault

No phase on mains supply side. Check the supply voltage to the frequency converter. This fault is only active in 3-phase mains supply. The alarm can also occur when the load is pulsing. In this instance the pulses must be dampened, e.g. using an inertia disc.

WARNING 5: Voltage warning high

If the intermediate circuit voltage (UDC) is higher than *Voltage warning high* the frequency converter will give a warning and the motor will continue to run unchanged. If the UDC remains above the voltage warning limit, the inverter will trip after a set time. The time depends on the device, and is set at 5 - 10 sec. Note: The frequency converter will trip with an alarm 7 (overvoltage). A voltage warning can occur when the connected mains voltage is too high. Check whether the supply voltage is suitable for the frequency converter, see *Technical data*. A voltage warning can also occur if the motor frequency is reduced too quickly due to ramp down time being too short.

WARNING 6: Voltage warning low

If the intermediate circuit voltage (UDC) is lower than *Voltage warning low* the frequency converter will give a warning and the motor will continue to run unchanged. A voltage warning can occur when the connected mains voltage is too low. Check whether the supply voltage is suitable for the frequency converter, see *Technical data*. When the frequency converter is switched off a brief warning 6 (and warning 8) appears.

WARNING/ALARM 7: Overvoltage

If the intermediate voltage (UDC) goes over the inverter's *Overvoltage limit* the inverter will be switched off until the UDC has once more fallen below the overvoltage limit. If the UDC remains above the overvoltage limit the inverter will trip after a set time. The time depends on the device, and is set at 5 - 10 sec. An overvoltage in the UDC can occur when the motor frequency is reduced too quickly due to ramp down time being too short. When the inverter is switched off a trip reset is generated. Note: *Voltage warning high* (warning 5) will thus also be able to generate an alarm 7.

WARNING/ALARM 8: Undervoltage

If the intermediate circuit voltage (UDC) is lower than the inverter's *Undervoltage limit* the inverter will be switched off until the UDC once more goes above the undervoltage limit. If the UDC remains under the *undervoltage limit*, the inverter will trip after a set time. The time depends on the device, and is set at 2 - 15 sec. An undervoltage can occur when the connected mains voltage is too low. Check whether the supply voltage is suitable for the frequency converter, see *Technical data*. When the frequency converter is switched off a alarm 8 (and alarm 6) is displayed briefly and a trip reset is generated. Note: *Voltage warning low* (warning 6) will thus also be able to generate an alarm 8.

WARNING/ALARM 9: Inverter overload

Electronic thermal inverter protection indicates that the frequency converter is close to tripping due to overloading (output current too high for too long). The counter for electronic thermal inverter protection gives a warning at 98% and trips at 100% accompanied by an alarm. The frequency converter cannot be reset until the counter drops below 90%. This fault arises because the frequency converter has been overloaded for too long.

WARNING/ALARM 10: Motor overloaded

According to the electronic thermal inverter protection the motor is too hot. In parameter 128 the user can select whether the frequency converter should emit a warning or an alarm when the counter reaches 100%. This fault is due to the motor being overloaded by more than 100% for too long. Check that motor parameters 102-106 are set correctly.

WARNING/ALARM 11: Motor thermistor

The motor is too hot or the thermistor/thermistor connection has been disconnected. In parameter 128 *Thermal motor protection* the user can select whether the frequency transformer emits a warning or an alarm. Check that the PTC thermistor is correctly connected between terminals 18, 19, 27 or 29 (digital input) and terminal 50 (+ 10 V supply).

WARNING/ALARM 12: Current limit

The output current is greater than the value in parameter 221 *Current Limit LIM*, and the frequency converter will trip after a set time, selected in parameter 409 *Trip delay overcurrent*.

WARNING/ALARM 13: Overcurrent

The inverter's peak current limit (approx. 200% of rated output current) has been exceeded. The warning will last approx. 1-2 sec, and the frequency converter will then trip and emit an alarm. Switch

off the frequency converter and check whether the motor shaft can be turned, and whether the size of the motor is suitable for the frequency converter.

ALARM 14: Earth fault

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor, or in the motor. Turn off the frequency converter and remove the earth fault.

ALARM 15: Switch mode fault

Fault in switch mode power supply (internal supply). Contact your Danfoss supplier.

ALARM: 16: Short-circuit

There is a short-circuit on the motor terminals or in the motor. Disconnect the mains supply to the frequency converter and remove the short-circuit.

WARNING/ALARM 17: Serial communication timeout

There is no serial communication to the frequency converter. The warning will only be active when 514 *Bus timeout function* is set to a value other than OFF. If parameter 514 *Bus timeout function* is set to *Stop and trip* [5], it will first give a warning and then ramp down and trip out accompanied by an alarm. Parameter 513 *Bus timeout* can if required be increased.

WARNING 33: Out of frequency range

This warning is active if the output frequency has reached *Output frequency low limit* (parameter 201) or *Output frequency high limit* (parameter 202). If the frequency converter is in *Process regulation, closed loop* (parameter 100) the warning will be active in the display. If the frequency converter is in another mode than *Process regulation, closed loop*, bit 008000 *Out of frequency range* in extended status word will be active, but there will not be a warning in the display.

ALARM 35: Inrush fault

This alarm occurs when the frequency converter has been connected to the mains supply too many times within 1 minute.

WARNING/ALARM 36: Overtemperature

If the temperature inside the power module rises above 75 - 85 °C (depending on the device) the frequency converter will emit a warning, and the motor will continue to run unchanged. If the temperature continues to rise, the switch frequency is reduced automatically. See *Temperature-dependent switching frequency*.

If the temperature inside the power module rises above 92 - 100 °C (depending on the unit) the frequency converter will cut out. The temperature fault cannot be reset until the temperature has dropped to below

70 °C. The tolerance is ± 5 °C. The temperature can be caused by the following:

- The ambient temperature too high.
- Motor cable too long.
- Too high mains voltage.

ALARM 37-45: Internal fault

If one of these failures occurs, please contact Danfoss.

Alarm 37, internal fault number 0: Communication fault between control card and BMC.

Alarm 38, internal fault number 1: Flash EEPROM fault on control card.

Alarm 39, internal fault number 2: RAM fault on control card.

Alarm 40, internal fault number 3: Calibration constant in EEPROM.

Alarm 41, internal fault number 4: Data values in EEPROM.

Alarm 42, internal fault number 5: Fault in motor parameter database.

Alarm 43, internal fault number 6: General power card fault.

Alarm 44, internal fault number 7: Minimum software version of control card or BMC.

Alarm 45, internal fault number 8: I/O fault (digital input/output, relay or analog input/output).



NB!

When restarting after an alarm 38-45, the frequency converter will display an alarm 37. In parameter 615 the actual alarm code can be read.

ALARM 50: AMT not possible

One of the following three possibilities can occur:

- The calculated R_s value falls outside permitted limits.
- The motor current in at least one of the motor phases is too low.
- The motor in use is too small for AMT calculations to be performed.

ALARM 51: AMT Fault regarding nameplate data

There is inconsistency between the registered motor data. Check the motor data for the relevant setup.

ALARM 52: AMT missing motor phase

The AMT function has detected a missing motor phase.

ALARM 55: AMT timeout

AKD 2800

Calculations are taking too long, possibly due to noise on the motor cables.

A frequency converter warning is given while AMT is being performed.

ALARM 56: AMT warning during AMT

WARNING 99: Locked

See parameter 18.

Alarm/warning limits:

	Without brake	With brake	Without brake	With brake
AKD 2800	1 / 3 x 200 - 240 V	1 / 3 x 200 - 240 V	3 x 380 - 480 V	3 x 380 - 480 V
	[VDC]	[VDC]	[VDC]	[VDC]
Undervoltage	215	215	410	410
Voltage warning low	230	230	440	440
Voltage warning high	385	400	765	800
Overvoltage	410	410	820	820

The voltages stated are the intermediate circuit voltage of the frequency converter with a tolerance

of $\pm 5\%$. The corresponding line voltage is the intermediate circuit voltage divided by 1,35.

■ Special conditions

■ Aggressive environments

As all other electronic equipment, a frequency converter contains a number of mechanical and electronic components, which to a varying extent are vulnerable to environmental impact.



Consequently, the frequency converter is not to be installed in environments, where liquids, particles or gases are in the air that would impact and damage the electronics. Unless the necessary measures are taken to protect the frequency converter, there is a risk of stoppages, which reduce the service life of the frequency converter.

Liquids can be carried through the air and condense in the frequency converter. In addition, liquids may facilitate galvanic corrosion of components and metal parts. Steam, oil and brine may cause corrosion of components and metal parts. In these areas, it is recommended to fit units in cabinets. As a minimum, cabinets should be enclosure IP 54.

Particles in the air, such as dust particles, may lead to mechanical, electrical and thermal faults on the frequency converter. Typical indicators that there are too many particles in the air are dust particles around the frequency converter fan. In very dusty areas, cabinet fitting of units is recommended. As a minimum, cabinets should be enclosure IP 54.

Aggressive gases, such as sulphur, nitrogen and chlorine compounds, together with high humidity and temperature, facilitate possible chemical processes on the components of the frequency converter. These chemical processes quickly impact and damage the electronics. In these areas, cabinet fitting with fresh-air circulation in the cabinet is recommended, thereby ensuring that aggressive gases are kept away from the frequency converter.



NB!:

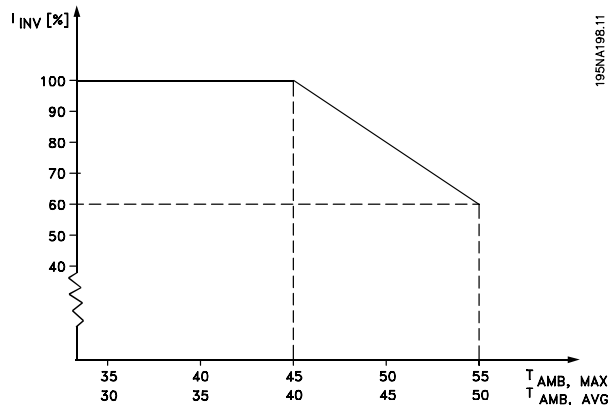
Fitting of frequency converters in aggressive environments increases the risk of stoppages, in addition to considerably reducing the service life of the unit.

Before the frequency converter is installed, it must be checked whether there are liquids, particles or gases in the air. This can be done by looking at existing installations in the same environment. Typical indicators of harmful airborne liquids are water or oil on metal parts or corrosion of metal parts. Too many dust particles are typically observed on top of installation cabinets and on existing electrical installations. Indicators that there are

aggressive gases in the air are copper rails and cable ends that are black on existing electrical installations.

■ Derating for ambient temperature

The ambient temperature ($T_{AMB,MAX}$) is the maximum temperature allowed. The average ($T_{AMB,AVG}$) measured over 24 hours, must be at least 5 °C lower. If the frequency converter operates at temperatures above 45 °C, a derating of the rated output current is necessary.



■ Galvanic Isolation (PELV)

PELV (Protective Extra Low Voltage) insulation is achieved by inserting galvanic isolators between the control circuits and circuits that are connected to the mains potential. The frequency converter is designed to meet the requirements for protective separation by means of having the necessary creepage and clearance distances. These requirements are described in standard EN 50 178. It is also a requirement that the installation is carried out as described in local/national regulations regarding PELV.

All control terminals, terminals for serial communication and relay terminals are safely separated from the mains potential, i.e. they comply with the PELV requirements. Circuits that are connected to control terminals 12, 18, 19, 20, 27, 29, 33, 42, 46, 50, 53, 55 and 60 are galvanically connected to one another. Serial communication connected to fieldbus is galvanically insulated from the control terminals, although this is only a functional insulation. The relay contacts on terminals 1 - 3 are insulated from the other control circuits with reinforced/double insulation, i.e. PELV is observed for these, even though there is mains potential at the relay terminals.

The circuit elements described below form the safe electric separation. They fulfill the requirements for reinforced/double insulation and associated testing pursuant to EN 50 178.

1. Transformer and optical separation in voltage supply.
2. Optical insulation between Basic Motor Control and control card.
3. Insulation between the control card and the power part.
4. Relay contacts and terminals relating to other circuits on the control card.

PELV insulation of the control card is guaranteed under the following conditions:

- TT network with maximum 300 Vrms between phase and earth.
- TN network with maximum 300 Vrms between phase and earth.
- IT network with maximum 400 Vrms between phase and earth.

In order to maintain PELV all connections made to the control terminals must be PELV, e.g. thermistor must be reinforced/double insulated.

■ EMC emission

The following system results are achieved on a system consisting of a AKD Series 2800 with

screened/armoured control cable, control box with potentiometer, screened/armoured motor cable and screened/armoured brake.

AKD 2803-2875	Emission			
	Industrial environment		Residential, commercial and light industry	
	EN 55011 class 1A		EN 55011 class 1B	
Setup	Cable-borne 150 kHz- 30 MHz	Radiated 30 MHz - 1 GHz	Cable-borne 150 kHz - 30 MHz	Radiated 30 MHz - 1 GHz
400 V version with 1A RFI filter	Yes 25 m screened/armoured	Yes 25 m screened/armoured	No	No
400 V version with 1A RFI filter (R5: For IT mains)	Yes 5 m screened/armoured	Yes 5 m screened/armoured	No	No
200 V version with 1A RFI filter ^{1.}	Yes 40 m screened/armoured	Yes 40 m screened/armoured	Yes 15 m screened/armoured	No
200 V version with 1A RFI filter (R4: For use with RCD)	Yes 20 m screened/armoured	Yes 20 m screened/armoured	Yes 7 m screened/armoured	No
400 V version with 1A+1B RFI filter	Yes 50 m screened/armoured	Yes 50 m screened/armoured	Yes 25 m screened/armoured	No
200 V version with 1A+1B RFI filter ^{1.}	Yes 100 m screened/armoured	Yes 100 m screened/armoured	Yes 40 m screened/armoured	No

AKD 2880-2882	Emission			
	Industrial environment		Residential, commerce and light industry	
	EN 55011 class 1A		EN 55011 class 1B	
Setup	Cable-borne 150 kHz- 30 MHz	Radiated 30 MHz - 1 GHz	Cable-borne 150 kHz - 30 MHz	Radiated 30 MHz - 1 GHz
400 V version with 1B RFI filter	Yes 50 m	Yes 50 m	Yes 50 m	No

1. For AKD 2822-2840 3 x 200-240 V the same values apply as for the 400 V version with 1A RFI filter.

• EN 55011: Emission

Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) high-frequency equipment.

Class 1A:

Equipment used in an industrial environment.

Class 1B:

Equipment used in areas with a public supply network (residential, commerce and light industry).


NB!:

This is a product of the restricted sales distribution class according to IEC61800-3. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

■ UL Standard

This device is UL-approved.

■ General technical data

Mains supply (L1, L2, L3):

Supply voltage AKD 2803-2815 220-240 V (N, L1)	1 x 220/230/240 V ±10%
Supply voltage AKD 2803-2840 200-240 V	3 x 200/208/220/230/240 V ±10%
Supply voltage AKD 2805-2882 380-480 V	3 x 380/400/415/440/480 V ±10%
Supply frequency	50/60 Hz
Max. imbalance on supply voltage	± 2.0% of rated supply voltage
True Power Factor (λ)	0.90 nominal at rated load
Displacement Power Factor ($\cos \phi$)	near unity (> 0.98)
Number of connections at supply input L1, L2, L3	2 times/min.
Max. short-circuit value	100,000 A

Output data (U, V, W):

Output voltage	0 - 100% of supply voltage
Output frequency	0.2 - 132 Hz, 1 - 1000 Hz
Rated motor voltage, 200-240 V units	200/208/220/230/240 V
Rated motor voltage, 380-480 V units	380/400/415/440/460/480 V
Rated motor frequency	50/60 Hz
Switching on output	Unlimited
Ramp times	0.02 - 3600 sec.

Torque characteristics:

Starting torque (parameter 101 Torque characteristic = Constant torque)	160% in 1 min.*
Starting torque (parameter 101 Torque characteristics = Variable torque)	160% in 1 min.*
Starting torque (parameter 119 <i>High starting torque</i>)	180% for 0.5 sec.*
Overload torque (parameter 101 Torque characteristic = Constant torque)	160%*
Overload torque (parameter 101 Torque characteristic = Variable torque)	160%*

*Percentage relates to frequency converter's nominal current.

Control card, digital inputs:

Number of programmable digital inputs	5
Terminal number	18, 19, 27, 29, 33
Voltage level	0 - 24 V DC (PNP positive logic)
Voltage level, logic '0'	< 5 V DC
Voltage level, logic '1'	> 10 V DC
Maximum voltage on input	28 V DC
Input resistance, R_i (terminals 18, 19, 27, 29)	approx. 4 k Ω
Input resistance, R_i (terminal 33)	approx. 2 k Ω

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, analog inputs:

Number of analog voltage inputs	1 pcs.
Terminal number	53
Voltage level	0 - 10 V DC (scaleable)
Input resistance, R_i	approx. 10 k Ω
Max. voltage	20 V
Number of analog current inputs	1 pcs.
Terminal number	60
Current level	0/4 - 20 mA (scaleable)
Input resistance, R_i	approx. 300 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit
Accuracy of analog inputs	Max. error 1% of full scale
Scan interval	13.3 msec

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, pulse inputs:

Number of programmable pulse inputs	1
Terminal number	33
Max. frequency at terminal 33	67.6 kHz (Push-pull)
Max. frequency at terminal 33	5 kHz (open collector)
Min. frequency at terminal 33	4 Hz
Voltage level	0 - 24 V DC (PNP positive logic)
Voltage level, logic '0'	< 5 V DC
Voltage level, logic '1'	> 10 V DC
Maximum voltage on input	28 V DC
Input resistance, R_i	approx. 2 k Ω
Scan interval	13.3 msec
Resolution	10 bit
Accuracy (100 Hz- 1 kHz) terminal 33	Max. error: 0.5% of full scale
Accuracy (1 kHz - 67.6 kHz) terminal 33	Max. error: 0.1% of full scale

The pulse input (terminal 33) is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, digital/frequency output:

Number of programmable digital/pulse outputs	1 pcs.
Terminal number	46
Voltage level at digital/frequency output	0 - 24 V DC (O.C PNP)
Max. output current at digital/frequency output	25 mA.
Max. load at digital/frequency output	1 k Ω
Max. capacity at frequency output	10 nF
Minimum output frequency at frequency output	16 Hz
Maximum output frequency at frequency output	10 kHz
Accuracy on frequency output	Max. error: 0.2 % of full scale
Resolution on frequency output	10 bit

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, analog output:

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20 mA
Max. load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 1.5 % of full scale
Resolution on analog output	10 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, 24 V DC output:

Terminal number	12
Max. load	130 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV) , but has the same potential as the analogue and digital inputs and outputs. See section entitled Galvanic Isolation.

Control card, 10 V DC output:

Terminal number	50
Output voltage	10.5 V \pm 0.5 V
Max. load	15 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See section entitled Galvanic Isolation.

Control card, RS 485 serial communication:

Terminal number	68 (TX+, RX+), 69 (TX-, RX-)
Terminal number 67	+ 5 V
Terminal number 70	Common for terminals 67, 68 and 69

Full galvanic isolation. See section entitled Galvanic Isolation.

Relay outputs:

Number of programmable relay outputs	1
Terminal number, control card	1-3 (break), 1-2 (make)
Max. terminal load (AC) on 1-3, 1-2, control card	240 V AC, 2 A
Min. terminal load on 1-3, 1-2, control card	24 V DC 10 mA, 24 V AC 100 mA

The relay contact is separated from the rest of the circuit by strengthened isolation. See section entitled Galvanic Isolation.

Cable lengths and cross sections:

Max. motor cable length, screened/armoured cable	40 m
Max. motor cable length, unscreened/unarmoured cable	75 m
Max. motor cable length, screened/armoured cable and motor coil	100 m
Max. motor cable length, unscreened/unarmoured cable and motor coil	200 m
Max. motor cable length, screened/armoured cable and RFI/1B filter	200 V, 100 m
Max. motor cable length, screened/armoured cable and RFI/1B filter	400 V, 25 m
Max. motor cable length, screened/armoured cable and RFI 1B/LC filter	400 V, 25 m

Max. cross section to motor, see next section.

Max. cross section to control wires, rigid wire	1.5 mm ² /16 AWG (2 x 0.75 mm ²)
Max. cross section to control cables, flexible cable	1 mm ² /18 AWG
Max. cross section to control cables, cable with enclosed core	0.5 mm ² /20 AWG

When complying with EN 55011 1A and EN 55011 1B the motor cable must in certain instances be reduced. See EMC emission.

Control characteristics:

Frequency range	0.2 - 132 Hz, 1 - 1000 Hz
Resolution of output frequency	0.013 Hz, 0.2 - 1000 Hz
Repeat accuracy of <i>Precise start/stop</i> (terminals 18, 19)	≤ ± 0.5 msec
System response time (terminals 18, 19, 27, 29, 33)	≤ 26.6 msec
Speed control range (open loop)	1:15 of synchronous speed
Speed control range (closed loop)	1:120 of synchronous speed
Speed accuracy (open loop)	90 - 3600 rpm: Max. error of ±23 rpm
Speed accuracy (closed loop)	30 - 3600 rpm: Max. error of ±7.5 rpm

All control characteristics are based on a 4-pole asynchronous motor

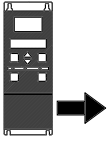
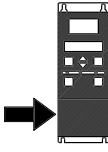
Surroundings:

Enclosure	IP 20
Vibration test	0.7 g
Max. relative humidity	5% - 85% during operation
Ambient temperature	Max. 45 °C (24-hour average max. 40 °C)
<i>Derating for high ambient temperature, see special conditions in the Design Guide</i>	
Min. ambient temperature during full-scale operation	0 °C
Min. ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Max. altitude above sea level	1000 m
<i>Derating for high air pressure, see special conditions in the Design Guide</i>	
EMC standards, Emission	EN 50081-2, EN 61800-3, EN 55011
EMC standards, Immunity	EN 50082-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61800-3

Safeguards:

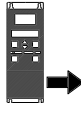

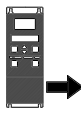

- Electronic thermal motor protection against overload.
- Temperature monitoring of the power module ensures that the frequency converter cuts out if the temperature reaches 100 °C. An overload temperature cannot be reset until the temperature of the power module is below 70 °C.
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter will cut out.
- Monitoring of the intermediate circuit voltage ensures that the frequency converter cuts out if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth fault on motor terminals U, V, W.

■ Technical data, mains supply 1 x 220 - 240 V/3 x 200-240 V

According to . international standards		Type	2803	2805	2807	2811	2815	2822	2840
	Output current (3 x 200-240V)	I_{INV} [A]	2.2	3.2	4.2	6.0	6.8	9.6	16
		I_{MAX} (60s) [A]	3.5	5.1	6.7	9.6	10.8	15.3	25.6
	Output power (230 V)	S_{INV} [KVA]	0.9	1.3	1.7	2.4	2.7	3.8	6.4
	Typical shaft output	$P_{M,N}$ [kW]	0.37	0.55	0.75	1.1	1.5	2.2	3.7
	Typical shaft output	$P_{M,N}$ [HP]	0.5	0.75	1.0	1.5	2.0	3.0	5.0
	Max. cable cross section, motor	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	4/10	4/10	4/10	4/10
	Input current (1 x 220-240 V)	$I_{L,N}$ [A]	5.9	8.3	10.6	14.5	15.2	-	-
		$I_{L,MAX}$ (60s) [A]	9.4	13.3	16.7	23.2	24.3	-	-
	Input current (3 x 200-240 V)	$I_{L,N}$ [A]	2.9	4.0	5.1	7.0	7.6	8.8	14.7
		$I_{L,MAX}$ (60s) [A]	4.6	6.4	8.2	11.2	12.2	14.1	23.5
	Max. cable cross section, power	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	4/10	4/10	4/10	4/10
	Max. pre-fuses	[A]/UL ²⁾ [A]	20/20	20/20	20/20	20/20	20/20	20/20	25/25
	Efficiency ³⁾	[%]	95	95	95	95	95	95	95
	Power loss at 100% load	[W]	24	35	48	69	94	125	231
	Weight	[kg]	2.0	2.0	2.0	2.0	2.0	3,7	6.0
	Enclosure ⁴⁾	type	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20

1. American Wire Gauge. Max. cable cross section is the largest cable cross section that can be attached to the terminals. Always observe national and local regulations.
2. Type gG pre-fuses must be used. If you want to maintain UL/cUL you must use pre-fuses of the type Bussmann KTN-R 200 V, KTS-R 500 V or Ferraz Shawmut, type ATMR (max. 30A). The fuses must be placed for protection in a circuit that is capable of supplying a maximum of 100,000 amps RMS (symmetrical), 500 V maximum.
3. Measured using a 25 m screened/armoured motor cable with a rated load and rated frequency.
4. IP20 is standard for AKD 2805-2875, whereas NEMA 1 is an option.

■ Technical data, mains supply 3 x 380 - 480 V

According to international standards		Type	2805	2807	2811	2815	2822	2830
	Output current (3 x 380-480V)	I_{INV} [A]	1.7	2.1	3.0	3.7	5.2	7.0
		I_{MAX} (60s) [A]	2.7	3.3	4.8	5.9	8.3	11.2
	Output power (400 V)	S_{INV} [KVA]	1.1	1.7	2.0	2.6	3.6	4.8
	Typical shaft output	$P_{M,N}$ [kW]	0.55	0.75	1.1	1.5	2.2	3.0
	Typical shaft output	$P_{M,N}$ [HP]	0.75	1.0	1.5	2.0	3.0	4.0
	Max. cable cross section, motor	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	4/10	4/10	4/10
<hr/>								
	Input current (3 x 380-480 V)	$I_{L,N}$ [A]	1.6	1.9	2.6	3.2	4.7	6.1
		$I_{L,MAX}$ (60s)[A]	2.6	3.0	4.2	5.1	7.5	9.8
	Max. cable cross section, power	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	4/10	4/10	4/10
	Max. pre-fuses	[A]/UL ²⁾ [A]	20/20	20/20	20/20	20/20	20/20	20/20
	Efficiency ³⁾	[%]	96	96	96	96	96	96
	Power loss at 100% load	[W]	28	38	55	75	110	150
	Weight	[kg]	2.1	2.1	2.1	2.1	3.7	3.7
	Enclosure ⁴⁾	type	IP 20	IP 20	IP 20	IP 20	IP 20	IP 20
	<hr/>							
According to international standards		Type	2840	2855	2875	2880	2881	2882
	Output current (3 x 380-480V)	I_{INV} [A]	9.1	12	16	24	32.0	37.5
		I_{MAX} (60s) [A]	14.5	19.2	25.6	38.4	51.2	60.0
	Output power (400 V)	S_{INV} [KVA]	6.3	8.3	11.1	16.6	22.2	26.0
	Typical shaft output	$P_{M,N}$ [kW]	4.0	5.5	7.5	11.0	15.0	18.5
	Typical shaft output	$P_{M,N}$ [HP]	5.0	7.5	10.0	15.0	20.0	25.0
	Max. cable cross section, motor	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	16/6	16/6	16/6
<hr/>								
	Input current (3 x 380-480 V)	$I_{L,N}$ [A]	8.1	10.6	14.9	24.0	32.0	37.5
		$I_{L,MAX}$ (60s)[A]	13.0	17.0	23.8	38.4	51.2	60
	Max. cable cross section, power	[mm ² /AWG] ¹⁾	4/10	4/10	4/10	16/6	16/6	16/6
	Max. pre-fuses	[A]/UL ²⁾ [A]	20/20	25/25	25/25	50/50	50/50	50/50
	Efficiency ³⁾	[%]	96	96	96	97	97	97
	Power loss at 100% load	[W]	200	275	372	412	562	693
	Weight	[kg]	3.7	6.0	6.0	18.5	18.5	18.5
	Enclosure ⁴⁾	type	IP20	IP20	IP20	IP20/ NEMA 1	IP20/ NEMA 1	IP20/ NEMA 1

1. American Wire Gauge. Max. cable cross section is the largest cable cross section that can be attached to the terminals. Always observe national and local regulations.

2. Type gG pre-fuses must be used. If you want to maintain UL/cUL you must use pre-fuses of the type Bussmann KTN-R 200 V, KTS-R 500 V or Ferraz Shawmut, type ATMR (max. 30A). The fuses must be placed for protection in a circuit that is capable of supplying a maximum of 100,000 amps RMS (symmetrical), 500 V maximum.

3. Measured using a 25 m screened/armoured motor cable with a rated load and rated frequency.

4. IP20 is standard for AKD 2805-2875, whereas NEMA 1 is an option.

■ Factory Settings

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
001	Language	English	No	0	5
002	Local/remote operation	Remote-controlled	Yes	0	5
003	Local reference	000,000.000	Yes	-3	4
004	Active Setup	Setup 1	No	0	5
005	Programming Setup	Active Setup	No	0	5
006	Setup copying	No copying	No	0	5
007	LCP copy	No copying	No	0	5
008	Display scaling	1.00	Yes	-2	6
009	Large display readout	Frequency [Hz]	Yes	0	5
010	Small display line 1.1	Reference [%]	Yes	0	5
011	Small display line 1.2	Motor current [A]	Yes	0	5
012	Small display line 1.3	Power [kW]	Yes	0	5
013	Local control	Remote control as par. 100	Yes	0	5
014	Local stop/reset	Active	Yes	0	5
017	Local reset of trip	Active	Yes	0	5
018	Data change lock	Not locked	Yes	0	5
024	User-defined Quick Menu	Not active	No	0	5
025	Quick Menu Setup	000	No	0	6

4-Setup:

'Yes' means that the parameter can be programmed individually in each of the four Setups, i.e. one single parameter can have four different data values. 'No' means that the data value will be the same in all Setups.

Conversion index:

This number refers to a conversion figure to be used when writing or reading via serial communication with a frequency converter.

See *Data character* in *Serial communication*.

Data type:

Data type shows the type and length of the telegram.

Data type	Description
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
9	Text string

AKD 2800

PNU #	Parameter-description	Factory setting	4-setup	Conv. index	Data-type
100	Configuration	Speed reg., open loop	Yes	0	5
101	Torque characteristics	Constant torque	Yes	0	5
102	Motor power $P_{M,N}$	depends on unit	Yes	1	6
103	Motor voltage $U_{M,N}$	depends on unit	Yes	0	6
104	Motor frequency $f_{M,N}$	50 Hz	Yes	-1	6
105	Motor current $I_{M,N}$	depends on motor selected	Yes	-2	7
106	Rated motor speed	depends on par. 102	Yes	0	6
107	Automatic motor adjustment	Optimisation off	Yes	0	5
108	Stator resistance R_S	depends on motor selected	Yes	-3	7
109	Stator reactance X_S	depends on motor selected	Yes	-2	7
122	Function at stop	Coast	Yes	0	5
126	DC braking time	10 sec.	Yes	-1	6
127	DC brake engaging frequency	OFF	Yes	-2	6
128	Thermal motor protection	No protection	Yes	0	5
132	DC brake voltage	0%	Yes	0	5
133	Start voltage	depends on unit	Yes	-2	6
134	Load compensation	100%	Yes	-1	6
136	Slip compensation	100%	Yes	-1	3
137	DC hold voltage	0%	Yes	0	5

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
201	Output frequency, low limit f_{MIN}	30 Hz	Yes	-1	6
202	Output frequency, high limit f_{MAX}	60 Hz	Yes	-1	6
204	Minimum ref Ref_{MIN}	30 Hz	Yes	-3	4
205	Maximum ref Ref_{MAX}	60 Hz	Yes	-3	4
207	Ramp-up time 1	0.70 sec.	Yes	-2	7
208	Ramp-down time 1	1.00 sec.	Yes	-2	7
214	Reference function	Sum	Yes	0	5
215	Preset reference 1	0.00%	Yes	-2	3
216	Preset reference 2	0.00%	Yes	-2	3
217	Preset reference 3	0.00%	Yes	-2	3
218	Preset reference 4	0.00%	Yes	-2	3
224	Warn. High current	I_{MAX}	Yes	-1	6
225	Warn. Low frequency	0.0 Hz	Yes	-1	6
226	Warn. High frequency	132.0 Hz	Yes	-1	6
227	Warn. Low Feedback	-4000.000	Yes	-3	4
228	Warn. High Feedback	4000.000	Yes	-3	4
229	Frequency bypass, bandwidth	0 Hz (OFF)	Yes	0	6
230	Frequency bypass 1	0.0 Hz	Yes	-1	6
231	Frequency bypass 2	0.0 Hz	Yes	-1	6

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
302	Digital input, term. 18	Start	Yes	0	5
303	Digital input, term. 19	Reversing	Yes	0	5
304	Digital input, term. 27	Reset and coast inverse	Yes	0	5
305	Digital input, term. 29	Jog	Yes	0	5
307	Digital input, term. 33	No function	Yes	0	5
308	Term. 53, analogue input voltage	Reference	Yes	0	5
309	Term. 53, min scaling	0.0 V	Yes	-1	6
310	Term. 53, max scaling	10.0 V	Yes	-1	6
314	Term. 60, analogue input current	No function	Yes	0	5
315	Term. 60, min scaling	0.0 mA	Yes	-1	6
316	Term. 60, max scaling	20.0 mA	Yes	-1	6
317	Time out	10 sec.	Yes	0	5
318	Function after timeout	Nofunction	Yes	0	5
319	Term. 42, analogue output	$0-I_{MAX} = 0-20$ mA	Yes	0	5

4-Setup:

'Yes' means that the parameter can be programmed individually in each of the four Setups, i.e. one single parameter can have four different data values. No' means that the data value will be the same in all Setups.

Conversion index:

This number refers to a conversion figure to be used when writing or reading via serial communication with a frequency converter.

See *Data character* in *Serial communication*.

Data type:

Data type shows the type and length of the telegram.

Data type	Description
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
9	Text string

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
405	Reset function	Manual reset	Yes	0	5
406	Aut. restart time	5 sec.	Yes	0	5
412	Var. carrier frequency	No LC-filter	Yes	0	5
414	Min. feedback	0.000	Yes	-3	4
415	Max. feedback	1500.000	Yes	-3	4
416	Process units	bar	Yes	0	5
423	U1 voltage	par. 103	Yes	-1	6
424	F1 frequency	Par. 104	Yes	-1	6
425	U2 voltage	par. 103	Yes	-1	6
426	F2 frequency	par. 104	Yes	-1	6
427	U3 voltage	par. 103	Yes	-1	6
428	F3 frequency	par. 104	Yes	-1	6
437	Proc. PID no/inv.	Normal	Yes	0	5
438	Proc. PID anti wind.	Active	Yes	0	5
439	Proc. PID start frequency	Par. 201	Yes	-1	6
440	Proc. PID start proportional ampl.	0.01	Yes	-2	6
441	Proc. PID integration time	Off (9999.99)	Yes	-2	7
444	Proc. PID lowpass filter time	0.02 s	Yes	-2	6

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
500	Address	1	No	0	5
507	Selection of Setup	Logic or	Yes	0	5
513	Bus time interval	1 sec.	Yes	0	5
514	Bus time interval function	Off	Yes	0	5
515	Data readout: Reference %		No	-1	3
516	Data readout: Reference [unit]		No	-3	4
517	Data readout: Feedback [unit]		No	-3	4
518	Data readout: Frequency		No	-1	3
520	Data readout: Motor current		No	-2	7
522	Data readout: Power [kW]		No	1	7
523	Data readout: Power [HP]		No	-2	7
524	Data readout: Motor voltage [V]		No	-1	6
525	Data readout: DC Link voltage		No	0	6
526	Data readout: Motor thermal load		No	0	5
527	Data readout: Inverter thermal load		No	0	5
528	Data readout: Digital input		No	0	5
529	Data readout: Analogue input, term. 53		No	-1	5
531	Data readout: Analogue input, term. 60		No	-4	5
533	Data readout: External reference		No	-1	6
534	Data readout: Status word		No	0	6
537	Data readout: Inverter temperature		No	0	5
538	Data readout: Alarm word		No	0	7
539	Data readout: Control word		No	0	6
540	Data readout: Warning word		No	0	7
541	Data readout: Extended status word		No	0	7

PNU #	Parameter description	Factory setting	4-setup	Conv. index	Data type
600	Operating hours		No	73	7
601	Hours run		No	73	7
602	kWh counter		No	2	7
603	Number of cut ins		No	0	6
604	Number of overtemperatures		No	0	6
605	Number of overvoltages		No	0	6
615	Fault log: Error code		No	0	5
616	Fault log: Time		No	0	7
617	Fault log: Value		No	0	3
618	Reset of kWh counter	No reset	No	0	7
619	Reset of running hours counter	No reset	No	0	5
620	Operation mode	Normal operation	No	0	5
621	Nameplate: Unit type		No	0	9
624	Nameplate: Software version		No	0	9
625	Nameplate: LCP identification no.		No	0	9
626	Nameplate: Database identification no.		No	-2	9
627	Nameplate: Power parts version		No	0	9
628	Nameplate: Application option type		No	0	9
630	Nameplate: Communication option type		No	0	9
632	Nameplate: BMC software identification		No	0	9
633	Nameplate: Motor database identification		No	0	9
634	Nameplate: Unit identification for communication		No	0	9
635	Nameplate: Software parts no.		No	0	9
640	Software version		No	-2	6
641	BMC software identification		No	-2	6
642	Power card identification		No	-2	6

4-Setup:

'Yes' means that the parameter can be programmed individually in each of the four Setups, i.e. one single parameter can have four different data values. 'No' means that the data value will be the same in all Setups.

Conversion index:

This number refers to a conversion figure to be used when writing or reading via serial communication with a frequency converter.

See *Data character* in *Serial communication*.

Data type:

Data type shows the type and length of the telegram.

Data type	Description
3	Integer 16
4	Integer 32
5	Unsigned 8
6	Unsigned 16
7	Unsigned 32
9	Text string

A

Address	38
Aggressive environments	62
Analogue input	31
Analogue output	32
Automatic motor tuning	11, 19

B

Bus time interval	39
-------------------------	----

C

control panel.....	10
CHANGE DATA	10
Configuration	18
Connection of a 2-wire transmitter	57
Constant torque	18
Control cables.....	55, 56
Control keys	10
Control terminals	54

D

DC brake time.....	21
DC brake voltage.....	22
DC hold voltage.....	23
Derating for ambient temperature	62
Digital inputs.....	29
Direction of motor rotation	53
Display	10
Display mode.....	11
Display readout	11, 58

E

Earth connection	54
Electrical installation, control cables.....	55
Electrical installation, control terminals	56
EMC emission.....	64
ETR - Electronic Thermal Relay	21
Extra protection.....	48

F

Fault log	42
Feedback,	34
Four Setups.....	13

G

Galvanic Isolation (PELV).....	62
--------------------------------	----

H

High voltage warning	9, 48
----------------------------	-------

I

Initialise	43
Integration.....	47

L

Language.....	12
Load compensation.....	22
Load sharing.....	54
Local reference.....	12
Lon.....	4

M

Mains connection	52
Manual initialisation	10
Maximum reference.....	24
Mechanical dimensions	46
Mechanical installation	47
Menu mode.....	11, 11
Minimum reference.....	24
Motor cables	53
Motor connection	52
Motor current.....	19
Motor frequency	19
Motor power.....	18
Motor thermal protection	54
Motor voltage.....	19

O

Order form	7
------------------	---

P

Parallel connection of motors.....	53
Potentiometer reference	57
Pre-fuses	52
Preset reference	25
Process control, closed loop	18
Process PID	36
Process units	35
Pulse start/stop	57

Q

Quick menu.....	11
QUICK MENU	10, 11
Quick menu, userdefined	17

R

Ramp-down time.....	25
Ramp-up time.....	24
Rated motor speed	19

RCD	54
RCD relays	48
Reference	24
Reference function	25
Relative	25
Relay connection	56
Reset function	34
RFI switch	53

S

Slip compensation	22
Special motor mode	18
Speed control, open loop	18
Start voltage	22
Start/stop	57
Stator reactance	20
Stator resistance	20
STOP/RESET	10
Sum	25

T

Terminal 53	31
Terminal 60	31
Thermal motor protection	21
Thermistor	21, 30
Time out	32
Torque characteristic	18

U

UL Standard	64
-------------------	----

W

Warnings/alarm messages	58
-------------------------------	----