MAKING MODERN LIVING POSSIBLE

VLT® AutomationDrive FC 300 12-Pulse Instruction Manual

VLT® AutomationDrive FC 300

VLT®
THE REAL DRIVE

Contents

1 How to Read the Instruction Manual

The adjustable frequency drive is designed to provide high shaft performance on electrical motors. Please read this manual carefully for proper use. Incorrect handling of the adjustable frequency drive may cause improper operation of the adjustable frequency drive or related equipment, shorten lifetime or cause other problems.

This Instruction Manual will help you get started as well as install, program, and troubleshoot your adjustable frequency drive.

Chapter 1, **How to Read this Instruction Manual**, introduces the manual and informs you of the approvals, symbols and abbreviations used in this literature.

Chapter 2, **Safety Instructions and General Warnings**, contains instructions on how to handle the adjustable frequency drive correctly.

Chapter 3, **How to Install**, guides you through mechanical and technical installation.

Chapter 4, **How to Program**, shows how to operate and program the adjustable frequency drive via the LCP.

Chapter 5, **General Specifications**, contains technical data about the adjustable frequency drive.

Chapter 6, **Warnings and Alarms**, assists you in solving problems that may occur when using the adjustable frequency drive.

Available literature

- The *VLT AutomationDrive Instruction Manual - High Power, MG33UXYY* provides the necessary information for getting the adjustable frequency drive up and running.
- The *VLT AutomationDrive Design Guide MG33BXYY* provides all the technical information about the adjustable frequency drive and customer design and applications.
- The *VLT AutomationDrive Programming Guide MG33MXYY* provides information on how to program and includes complete parameter descriptions.
- The *VLT AutomationDrive Profibus Instruction Manual MG33CXYY* provides the information required for controlling, monitoring and programming the adjustable frequency drive via a Profibus serial communication bus.
- The *VLT AutomationDrive DeviceNet Instruction Manual MG33DXYY* provides the information required for controlling, monitoring and programming the adjustable frequency drive via a DeviceNet serial communication bus.

X = Revision number
YY = Language code

Danfoss technical literature is also available online at www.danfoss.com/drives.

Symbols

The following symbols are used in this manual.

⚠WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION

Indicates a situation that may result in equipment or property damage-only accidents.

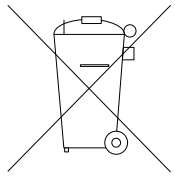
NOTE!

Indicates highlighted information that should be observed in order to avoid mistakes or operate equipment at less than optimal performance.

Approvals

Table 1.1

1.1.1 Disposal Instructions



Equipment containing electrical components may not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

Table 1.2

1.1.2 Abbreviations

Alternating current	AC
American wire gauge	AWG
Ampere/AMP	A
Automatic Motor Adaptation	AMA
Current limit	I_{LIM}
Degrees Celsius	°C
Direct current	DC
Drive Dependent	D-TYPE
Electro Magnetic Compatibility	EMC
Electronic Thermal Relay	ETR
Adjustable frequency drive	FC
Gram	g
Hertz	Hz
Horsepower	hp
Kilohertz	kHz
Local Control Panel	LCP
Meter	m
Millihenry Inductance	mH
Milliampere	mA
Millisecond	ms
Minute	min
Motion Control Tool	MCT
Nanofarad	nF
Newton Meters	Nm
Nominal motor current	$I_{M,N}$
Nominal motor frequency	$f_{M,N}$
Nominal motor power	$P_{M,N}$
Nominal motor voltage	$U_{M,N}$
Permanent Magnet motor	PM motor
Protective Extra Low Voltage	PELV
Printed Circuit Board	PCB
Rated Inverter Output Current	I_{INV}
Revolutions Per Minute	RPM
Regenerative terminals	Regen
Second	sec.
Synchronous Motor Speed	n_s
Torque limit	T_{LIM}
Volts	V
The maximum output current	$I_{VLT,MAX}$
The rated output current supplied by the Adjustable frequency drive	$I_{VLT,N}$

Table 1.3

2 Safety Instructions and General Warning

⚠CAUTION

The adjustable frequency drive DC link capacitors remain charged after power has been disconnected. To avoid the electrical shock hazard, disconnect the adjustable frequency drive from line power before carrying out maintenance. Before servicing the adjustable frequency drive, wait the minimum amount of time indicated below:

380–500 V	350–1,075 hp [250–800 kW]	40 minutes
525–690 V	500–1,900 hp [355–1,400 kW]	30 minutes

Table 2.1

VLT AutomationDrive Instruction Manual Software version: 6.5x
This Instruction Manual can be used for all VLT AutomationDrive adjustable frequency drives with software version 6.5x. The software version number can be seen from *15-43 Software Version*.

Table 2.2

2.1.1 High Voltage

⚠WARNING

The voltage of the adjustable frequency drive is dangerous whenever the Adjustable frequency drive is connected to line power. Incorrect installation or operation of the motor or adjustable frequency drive may cause damage to the equipment, serious personal injury or death. The instructions in this manual must therefore be observed, in addition to applicable local and national rules and safety regulations.

⚠WARNING

Installation at high altitudes
380–500 V: At altitudes above 10,000 feet [3 km], please contact Danfoss regarding PELV.
525–690 V: At altitudes above 6,600 feet [2 km], please contact Danfoss regarding PELV.

2.1.2 Safety Instructions

- Make sure the adjustable frequency drive is properly grounded.
- Protect users against supply voltage.
- Protect the motor against overloading according to national and local regulations.
- Motor overload protection is not included in the default settings. To add this function, set *1-90 Motor Thermal Protection* to value *ETR trip* or *ETR warning*. For the North American market: ETR functions provide class 20 motor overload protection, in accordance with NEC.
- The ground leakage current exceeds 3.5 mA.
- The [Off] key is not a safety switch. It does not disconnect the adjustable frequency drive from line power.

2.1.3 General Warning

⚠WARNING

Touching the electrical parts may be fatal - even after the equipment has been disconnected from line power.
Make sure that other voltage inputs have been disconnected, such as load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic backup.
When using the adjustable frequency drive: wait at least 40 minutes.
Shorter time is allowed only if indicated on the nameplate for the specific unit.

2

⚠CAUTION

The ground leakage current from the adjustable frequency drive exceeds 3.5 mA. To ensure that the ground cable has a good mechanical connection to the ground connection (terminal 95), the cable cross-section must be at least 0.016 in² [10 mm²] or two rated ground wires terminated separately. For proper grounding for EMC, see *3.3.3 Grounding*.

Residual Current Device

This product can cause DC current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also *RCD Application Note MN90GX02* (x=version number). Protective grounding of the adjustable frequency drive and the use of RCDs must always follow national and local regulations.

2.1.4 Before Commencing Repair Work

1. Disconnect the Adjustable frequency drive from line power
2. Disconnect DC bus terminals 88 and 89 from load share applications
3. Wait for the discharge of the DC link. See period of time on the warning label.
4. Remove motor cable

2.1.5 Avoid Unintended Start

While the adjustable frequency drive is connected to line power, the motor can be started/stopped using digital commands, bus commands, references or via the Local Control Panel (LCP):

- Disconnect the adjustable frequency drive from line power whenever personal safety considerations make it necessary to avoid an unintended start.
- To avoid unintended start, always activate the [Off] key before changing parameters.
- An electronic fault, temporary overload, a fault in the line power supply, or lost motor connection may cause a stopped motor to start. The adjustable frequency drive with safe stop provides protection against unintended start, if Safe Stop Terminal 37 is deactivated or disconnected.

2.1.6 Safe Stop

The FC 302 can perform the safety function *Safe Torque Off* (As defined by draft CD IEC 61800-5-2) or *Stop Category 0* (as defined in EN 60204-1).

It is designed and approved suitable for the requirements of Safety Category 3 in EN 954-1. This functionality is called Safe Stop. Before integrating and using Safe Stop in an installation, a thorough risk analysis on the installation must be carried out in order to determine whether the Safe Stop functionality and safety category are appropriate and sufficient. In order to install and use the Safe Stop function in accordance with the requirements of Safety Category 3 in EN 954-1, the related information and instructions of the *FC 300 Design Guide MG33BXYY* must be followed. The information and instructions of the Instruction Manual are not sufficient for a correct and safe use of the safe stop functionality.

2.1.7 Safe Stop Installation

To carry out an installation of a Category 0 Stop (EN60204) in conformity with Safety Category 3 (EN954-1), follow these instructions:

1. The bridge (jumper) between Terminal 37 and 24 V DC must be removed. Cutting or breaking the jumper is not sufficient. Remove it entirely to avoid short-circuiting. See jumper in *Figure 2.1*.
2. Connect terminal 37 to 24 V DC by a short circuit-protected cable. The 24 V DC voltage supply must be interruptible by an EN954-1 category 3 circuit interrupt device. If the interrupt device and the adjustable frequency drive are placed in the same installation panel, use an non-shielded cable instead of a shielded one.

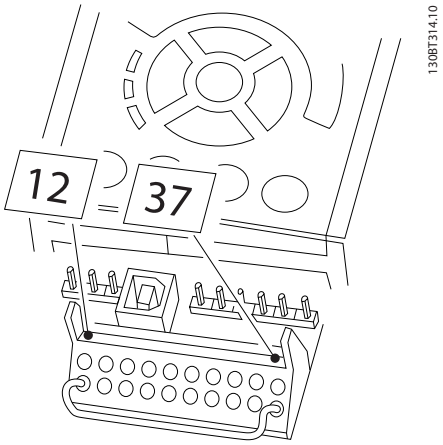


Figure 2.1 Bridge jumper between terminal 37 and 24 V DC

Figure 2.2 shows a Stopping Category 0 (EN 60204-1) with safety Category 3 (EN 954-1). The circuit interrupt is caused by an opening door contact. The figure also shows how to connect a non-safety related hardware coast.

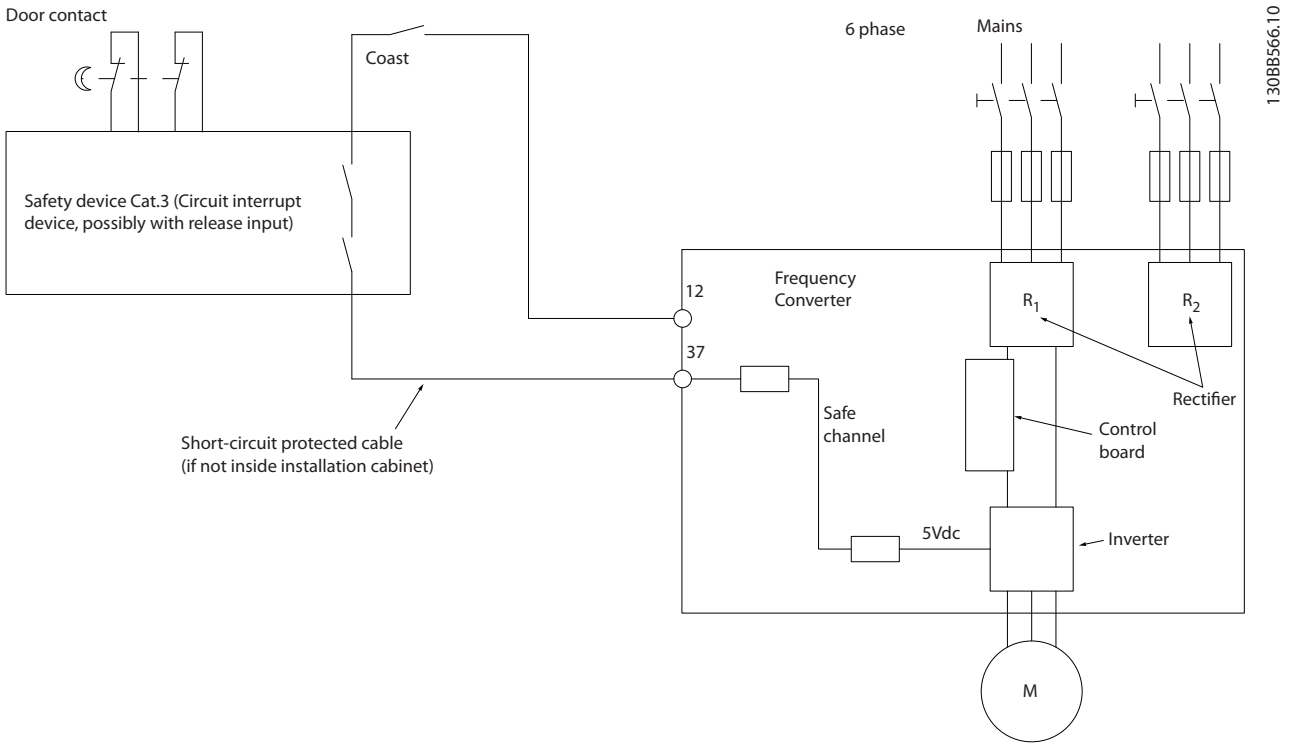


Figure 2.2 Essential aspects of an installation to achieve a Stopping Category 0 (EN 60204-1) with safety Category 3 (EN 954-1).

2.1.8 IT Line Power

14-50 RFI 1 can be used to disconnect the internal RFI capacitors from the RFI filter to ground in the 380–500V adjustable frequency drives. If this is done, it will reduce the RFI performance to A2 level. For the 525–690V adjustable frequency drives, *14-50 RFI 1* has no function. The RFI switch cannot be opened.

3 How to Install

3.1 Pre-installation

3.1.1 Planning the Installation Site

NOTE!

Before performing the installation, it is important to plan the installation of the adjustable frequency drive. Neglecting this may result in extra work during and after installation.

Select the best possible operation site by considering the following (see details on the following pages and in the respective Design Guides):

- Ambient operating temperature
- Installation method
- How to cool the unit
- Position of the adjustable frequency drive.
- Cable routing
- Ensure the power source supplies the correct voltage and necessary current.
- Ensure that the motor current rating is within the maximum current from the adjustable frequency drive.
- If the adjustable frequency drive is without built-in fuses, ensure that the external fuses are rated correctly.

3.1.2 Receiving the Adjustable Frequency Drive

When receiving the adjustable frequency drive make sure that the packaging is intact, and be aware of any damage that might have occurred to the unit during transport. If damage has occurred, immediately contact the shipping company to make a damage claim.

3.1.3 Transportation and Unpacking

Before unpacking the adjustable frequency drive, it is recommended to unload it as close as possible to the final installation site.
Remove the box and handle the adjustable frequency drive on the pallet, as long as possible.

3.1.4 Lifting

Always lift the adjustable frequency drive using the dedicated lifting holes.

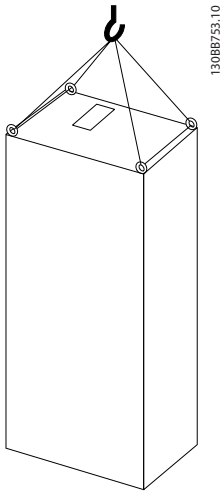


Figure 3.1 Recommended lifting method, frame size F8.

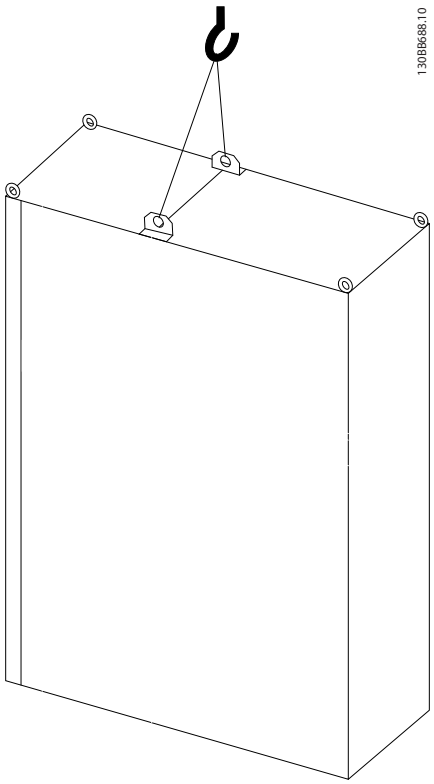


Figure 3.2 Recommended lifting method, frame size F9/F10.

3

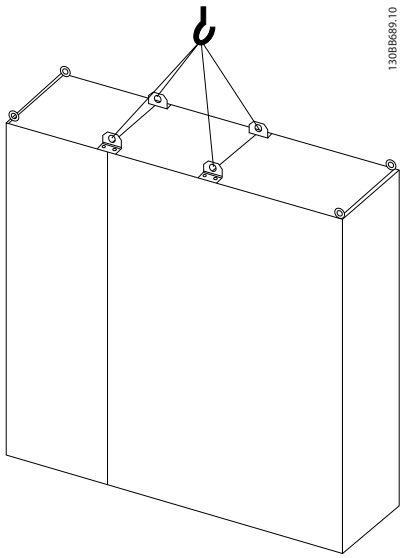


Figure 3.3 Recommended lifting method, frame size F11/F12/F13/F14.

NOTE!

The plinth is provided in the same packaging as the adjustable frequency drive but is not attached during shipment. The plinth is required to allow airflow to the adjustable frequency drive to provide proper cooling. The F frames should be positioned on top of the plinth in the final installation location. The angle from the top of the adjustable frequency drive to the lifting cable should be 60° or greater.
In addition to the drawings above, a spreader bar is an acceptable way to lift the F Frame.

3.1.5 Mechanical Dimensions

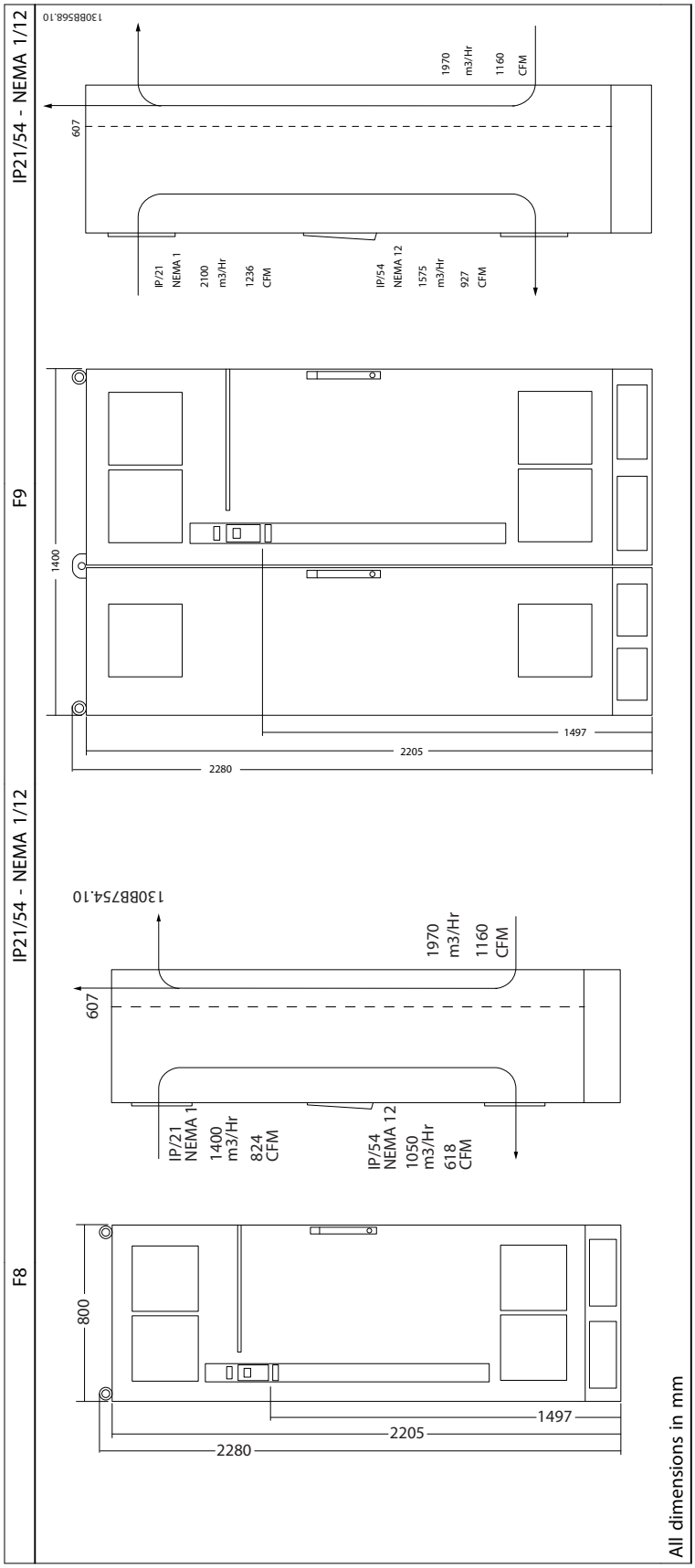


Table 3.1

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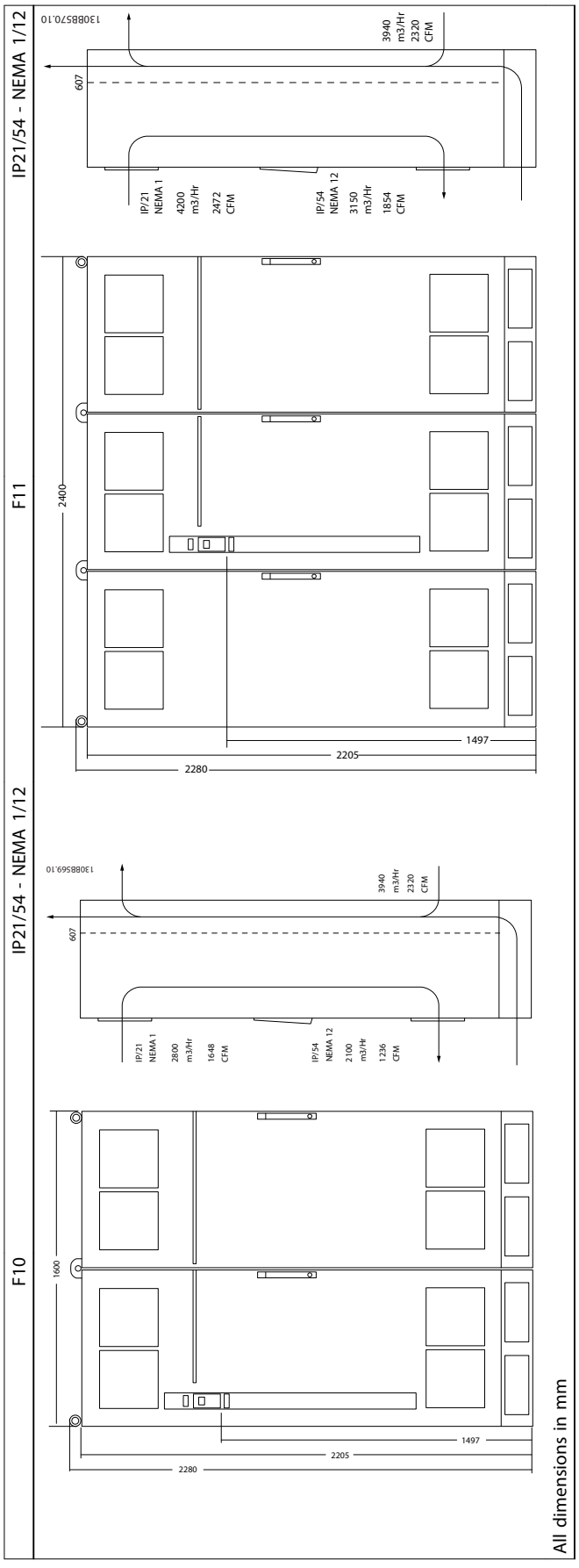

IP21/54 - NEMA 1/12
F11
IP21/54 - NEMA 1/12
F10
130BB570.10
3940 m3/Hr 2320 CFM
607
IP/21 NEMA 1
4200 m3/Hr
2472 CFM
IP/54 NEMA 12
3150 m3/Hr
1854 CFM
2400
1497
2205
2280
130BB569.10
3940 m3/Hr 2320 CFM
607
IP/21 NEMA 1
2800 m3/Hr
1648 CFM
IP/54 NEMA 12
2100 m3/Hr
1236 CFM
1600
1497
2205
2280
All dimensions in mm

Table 3.2

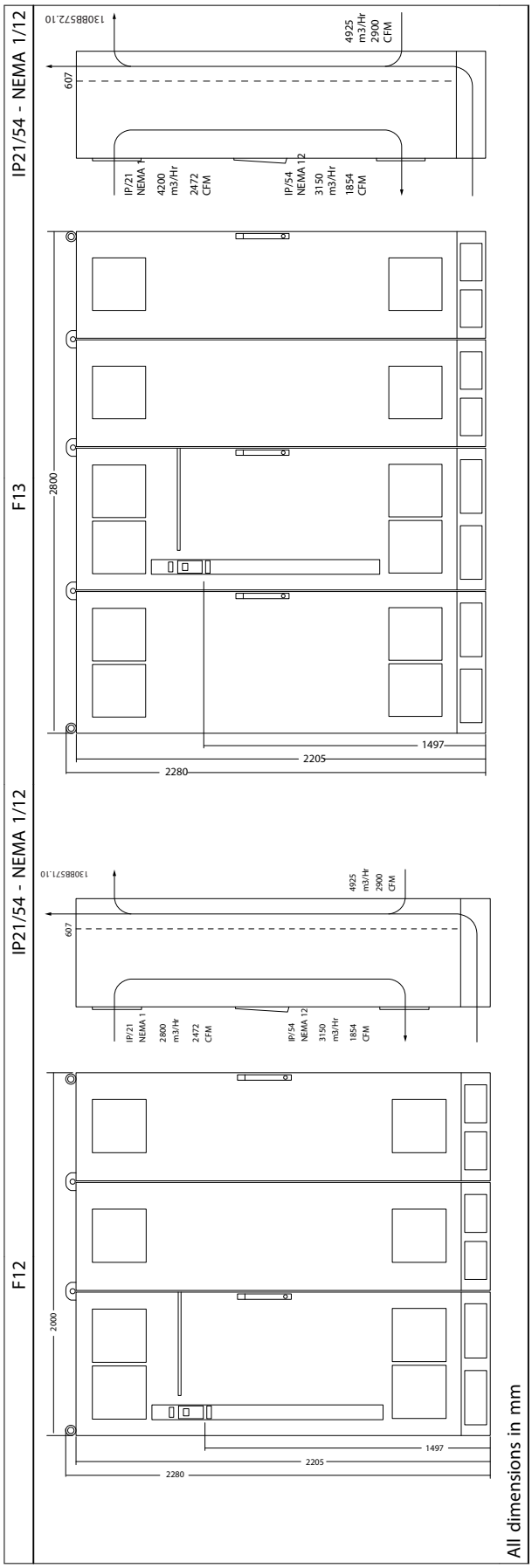
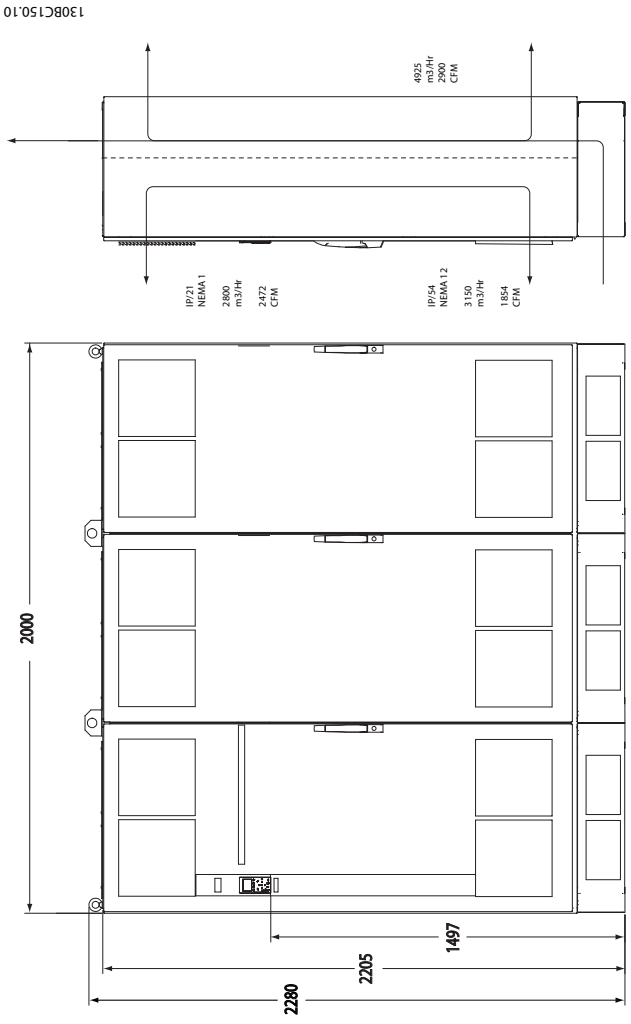

IP21/54 - NEMA 1/12
F13
130BB572.10
4925 m3/Hr 2900 CFM
607
IP/21 NEMA 1
4200 m3/Hr
2472 CFM
IP/54 NEMA 12
3150 m3/Hr
1854 CFM
2800
1497
2205
2280
IP21/54 - NEMA 1/12
130BB571.10
4925 m3/Hr 2900 CFM
607
IP/21 NEMA 1
2800 m3/Hr
2472 CFM
IP/54 NEMA 12
3150 m3/Hr
1854 CFM
F12
2000
1497
2205
2280
All dimensions in mm

Table 3.3

3

IP21/54 - NEMA 1/12



F14

All dimensions in mm

Table 3.4

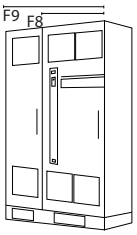
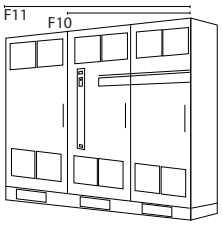
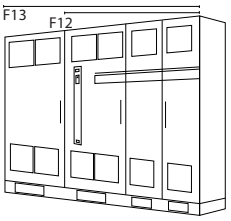
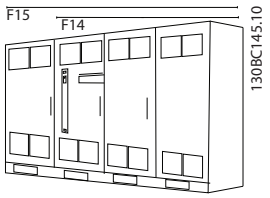
Mechanical dimensions, frame sizes E and F							
Frame size	**F8**	**F9**	**F10**	**F11**	**F12**	**F13**	**F14**
							
High overload rated power - 160% overload torque	**350–550 hp [250–400 kW] (380–500 V) 475–750 hp [355–560 kW] (525–690 V)**	**350–550 hp [250–400 kW] (380–500 V) 475–750 hp [355–560 kW] (525–690 V)**	**600–850 hp [450–630 kW] (380–500 V) 850–1,075 hp [630–800 kW] (525–690 V)**	**950–1,075 hp [710–800 kW] (380–500 V) 1,200–1,600 hp [900–1,200 kW] (525–690 V)**	**600–850 hp [450–630 kW] (380–500 V) 850–1,075 hp [630–800 kW] (525–690 V)**	**950–1,075 hp [710–800 kW] (380–500 V) 1,200–1,600 hp [900–1,200 kW] (525–690 V)**	**1,900 hp [1,400 kW] (525–690 V)**
IP NEMA	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12
Shipping dimensions ins [mm]							
Height	915 [2,324]	915 [2,324]	915 [2,324]	915 [2,324]	915 [2,324]	915 [2,324]	930 [2,362]
Width	382 [970]	617.3 [1,568]	693 [1,760]	1,007.5 [2,559]	850.4 [2,160]	1,165.4 [2,960]	1,015 [2,578]
Depth	445 [1,130]	445 [1,130]	445 [1,130]	445 [1,130]	445 [1,130]	445 [1,130]	445 [1,130]
Drive dimensions ins [mm]							
Height	86.8 [2,204]	86.8 [2,204]	86.8 [2,204]	86.8 [2,204]	86.8 [2,204]	86.8 [2,204]	89.1 [2,262]
Width	31.5 [800]	55.1 [1,400]	63 [1,600]	94.5 [2,400]	78.7 [2,000]	110.2 [2,800]	94.5 [2,400]
Depth	23.9 [606]	23.9 [606]	23.9 [606]	23.9 [606]	23.9 [606]	23.9 [606]	23.94 [608]
Max weight lbs [kg]	970 [440]	1,446.2 [656]	1,940.1 [880]	2,416.3 [1,096]	2,253.1 [1,022]	2,729.3 [1,238]	3,108.5 [1,410]

Table 3.5

NOTE!

The F frames have seven different sizes, F8, F9, F10, F11, F12, and F14. The F8, F10, F12, and F14 consist of an inverter cabinet on the right and rectifier cabinet on the left. The F9, F11 and F13 have an additional options cabinet left of the rectifier cabinet. The F9 is an F8 with an additional options cabinet. The F11 is an F10 with an additional options cabinet. The F13 is an F12 with an additional options cabinet.

3

3.2 Mechanical Installation

Preparation of the mechanical installation of the adjustable frequency drive must be done carefully to ensure proper results and to avoid additional work during installation. Start by taking a close look at the mechanical drawings at the end of this instruction manual to become familiar with the space demands.

3.2.1 Tools Needed

To perform the mechanical installation, the following tools are needed:

- Drill with 10 or 12 mm (approx. 0.4 to 0.5 in) drill
- Tape measure
- Wrench with relevant metric sockets (7–17 mm - approx. 0.3–0.75 in)
- Extensions to wrench
- Sheet metal punch for conduits or cable connectors in IP21/Nema 1 and IP54 units
- Lifting bar to lift the unit (rod or tube max. Ø1 in [25 mm], able to lift minimum 880 lbs [400 kg].
- Crane or other lifting aid to place the adjustable frequency drive in position

3.2.2 General Considerations

Space
Ensure proper space above and below the adjustable frequency drive to allow airflow and cable access. In addition space in front of the unit must be considered to enable opening the door of the panel.

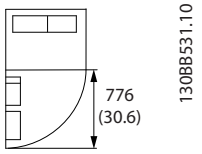


Figure 3.4 Space in front of IP21/IP54 enclosure type, frame size F8

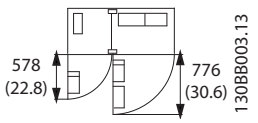


Figure 3.5 Space in front of IP21/IP54 enclosure type, frame size F9

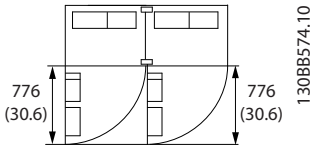


Figure 3.6 Space in front of IP21/IP54 enclosure type, frame size F10

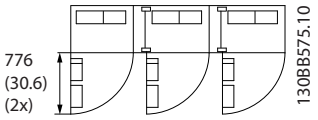


Figure 3.7 Space in front of IP21/IP54 enclosure type, frame size F11

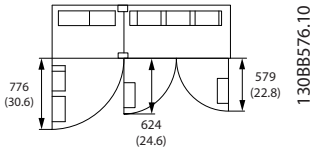


Figure 3.8 Space in front of IP21/IP54 enclosure type, frame size F12

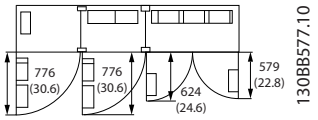


Figure 3.9 Space in front of IP21/IP54 enclosure type, frame size F13

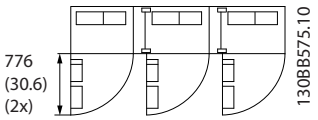


Figure 3.10 Space in front of IP21/IP54 enclosure type, frame size F14

Wire access
Ensure that proper cable access is present including the necessary bending allowance.

NOTE!

All cable lugs/shoes must mount within the width of the terminal bus bar.

3.2.3 Terminal Locations, F8-F14 - 12-Pulse

The 12-pulse F enclosures have seven different sizes, F8, F9, F10, F11, F12, F13, and F14. The F8, F10, F12, and F14 consist of an inverter cabinet on the right and rectifier cabinet on the left. The F9, F11 and F13 have an additional options cabinet left of the rectifier cabinet. The F9 is an F8 with an additional options cabinet. The F11 is an F10 with an additional options cabinet. The F13 is an F12 with an additional options cabinet.

Terminal locations - Inverter and Rectifier Frame size F8 and F9

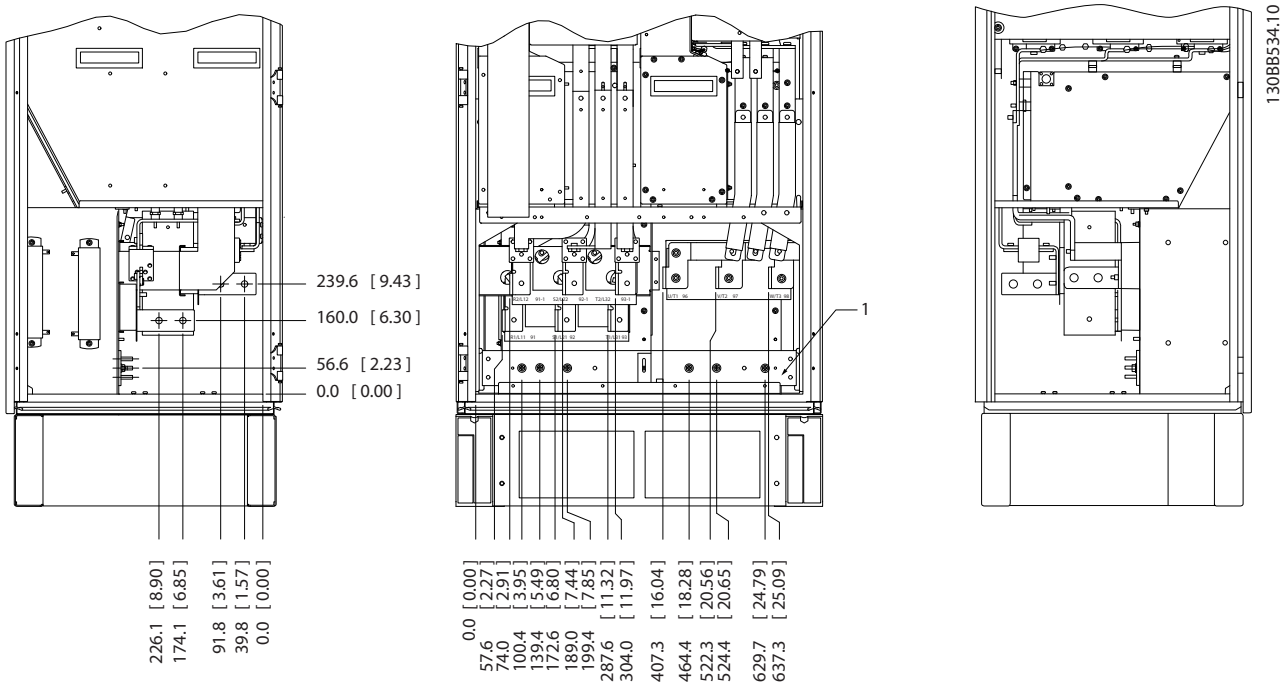


Figure 3.11 Terminal locations - Inverter and Rectifier Cabinet - F8 and F9 (front, left and right side view). The connector plate is 1.65 in [42 mm] below .0 level.
1) Ground bar

3

Terminal locations - Inverter Frame size F10 and F11

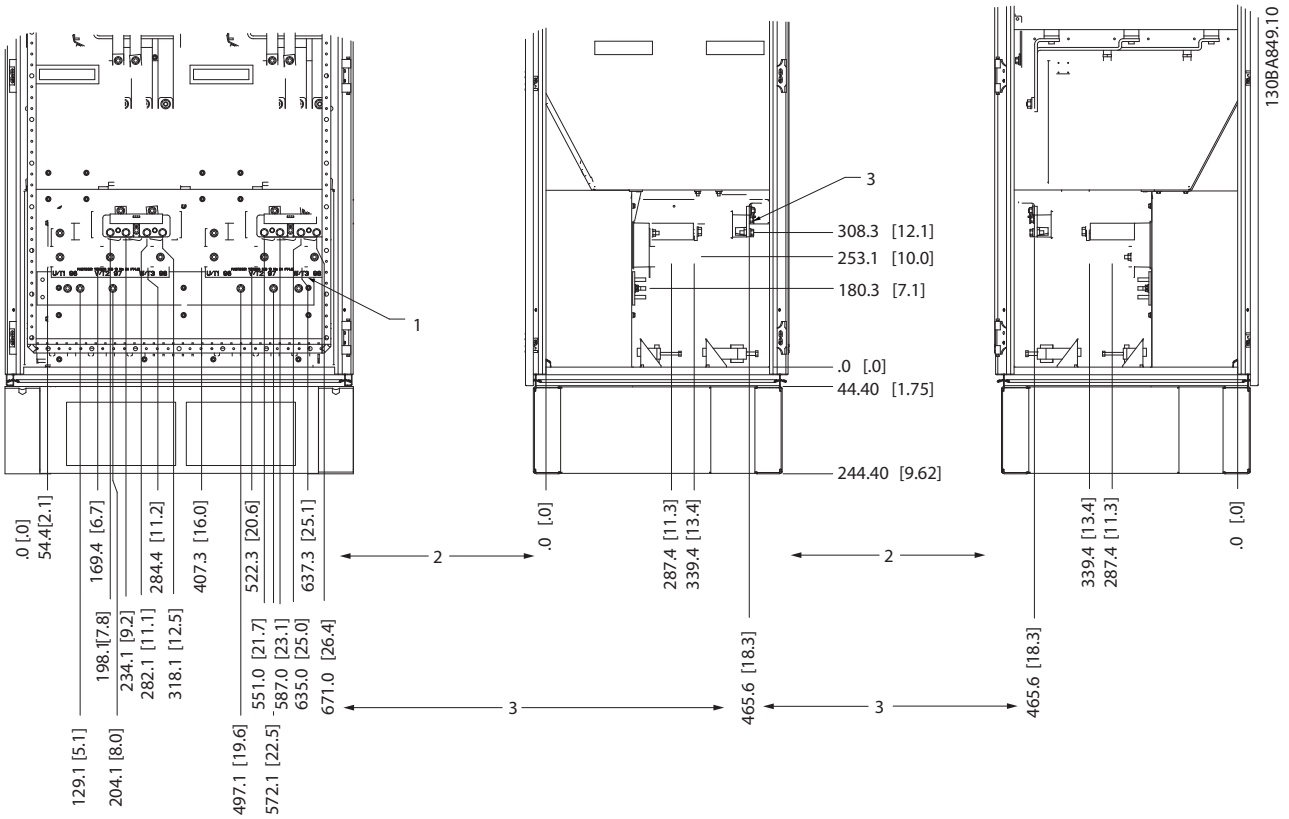


Figure 3.12 Terminal locations - Inverter Cabinet (front, left and right side view). The connector plate is 1.65 in [42 mm] below .0 level.

1) Ground bar

2) Motor terminals

3) Brake terminals

Terminal locations - Inverter Frame size F12 and F13

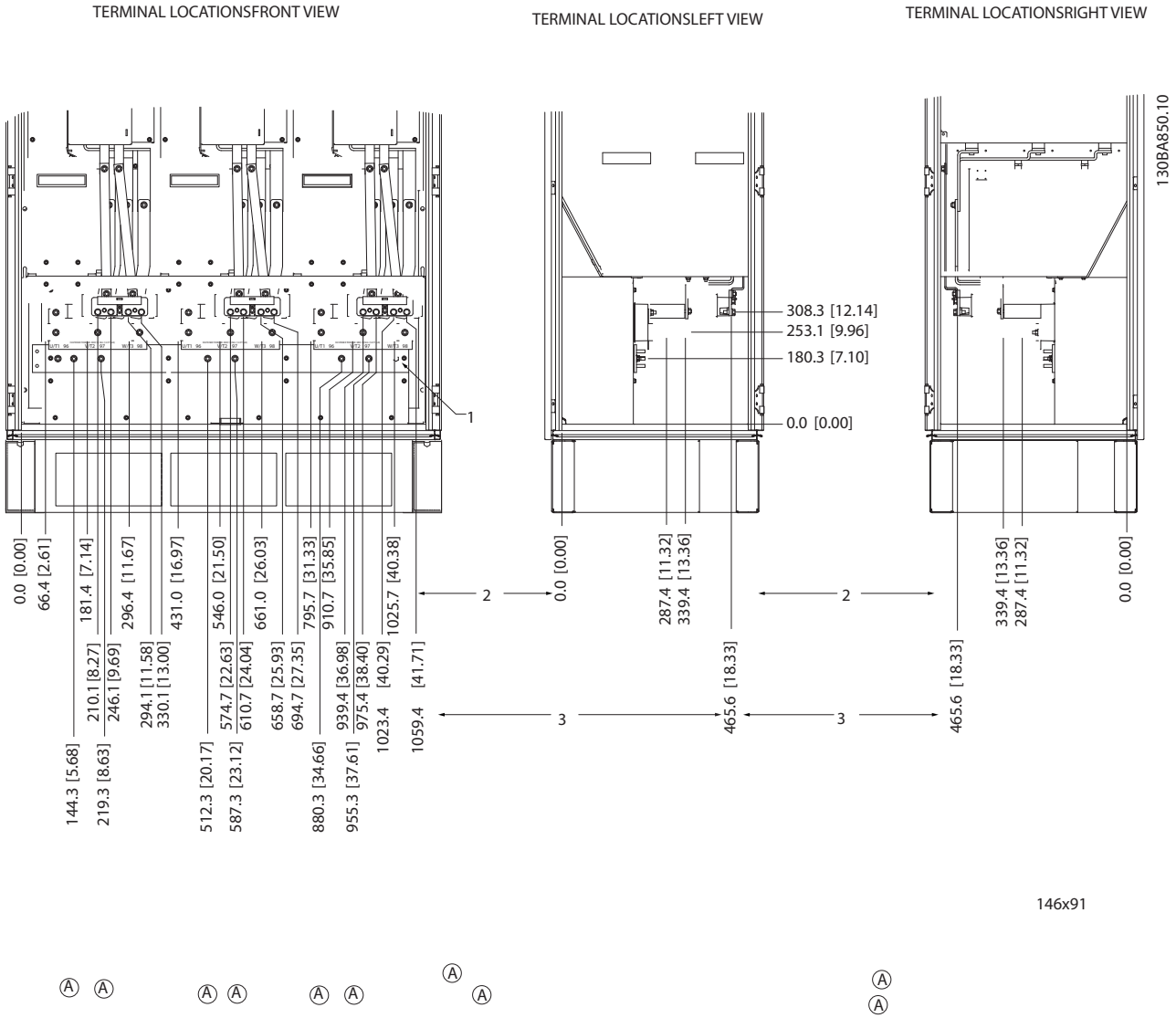


Figure 3.13 Terminal locations - Inverter Cabinet (front, left and right side view). The connector plate is 1.65 in [42 mm] below .0 level.
1) Ground bar

3

Terminal Locations - Inverter Frame Size F14

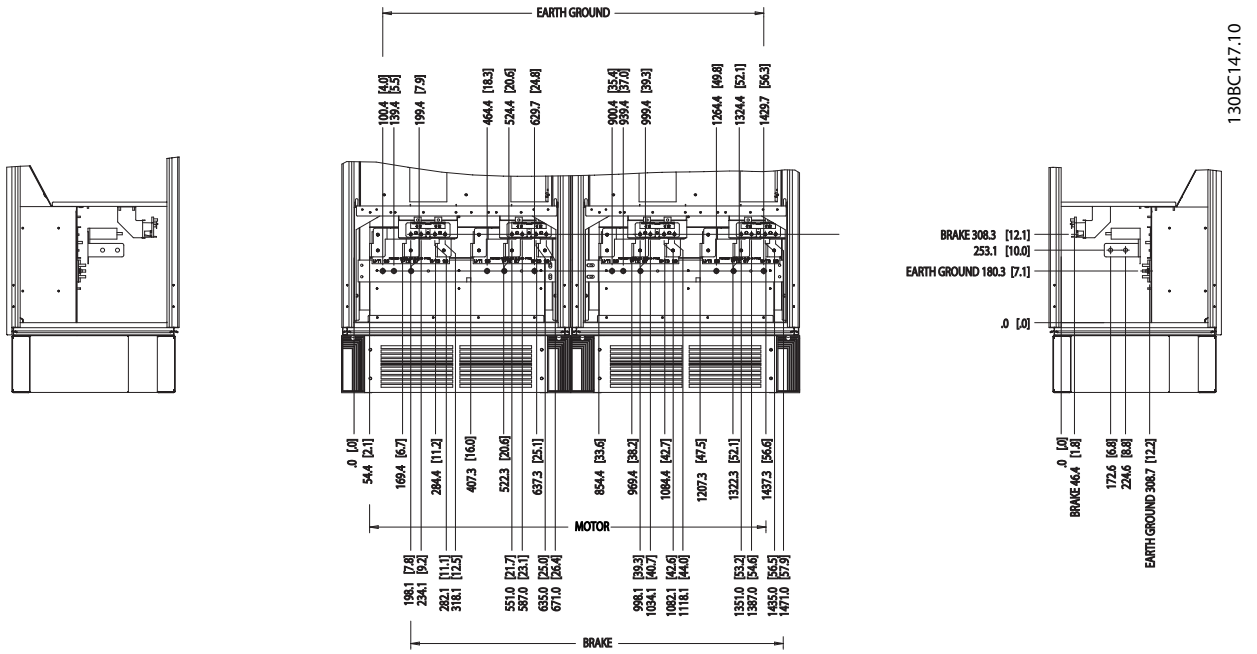


Figure 3.14 Terminal Locations - Inverter Cabinet (left, front, and right side view). The connector plate is 1.65 in [42 mm] below .0 level.

Terminal locations - Rectifier (F10, F11, F12 and F13)

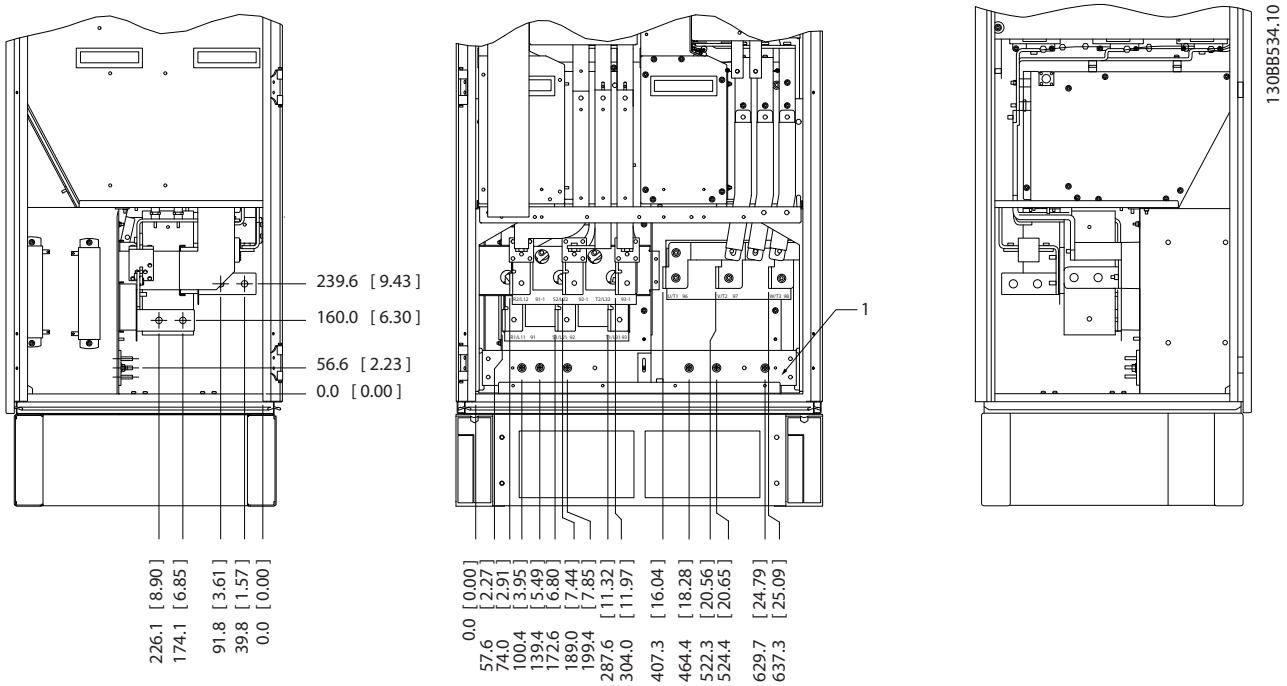


Figure 3.15 Terminal locations - Rectifier (left side, front and right side view). The connector plate is 1.65 in [42 mm] below .0 level.

1) Loadshare Terminal (-)

2) Ground bar

3) Loadshare Terminal (+)

Terminal Locations - Rectifier (F14)

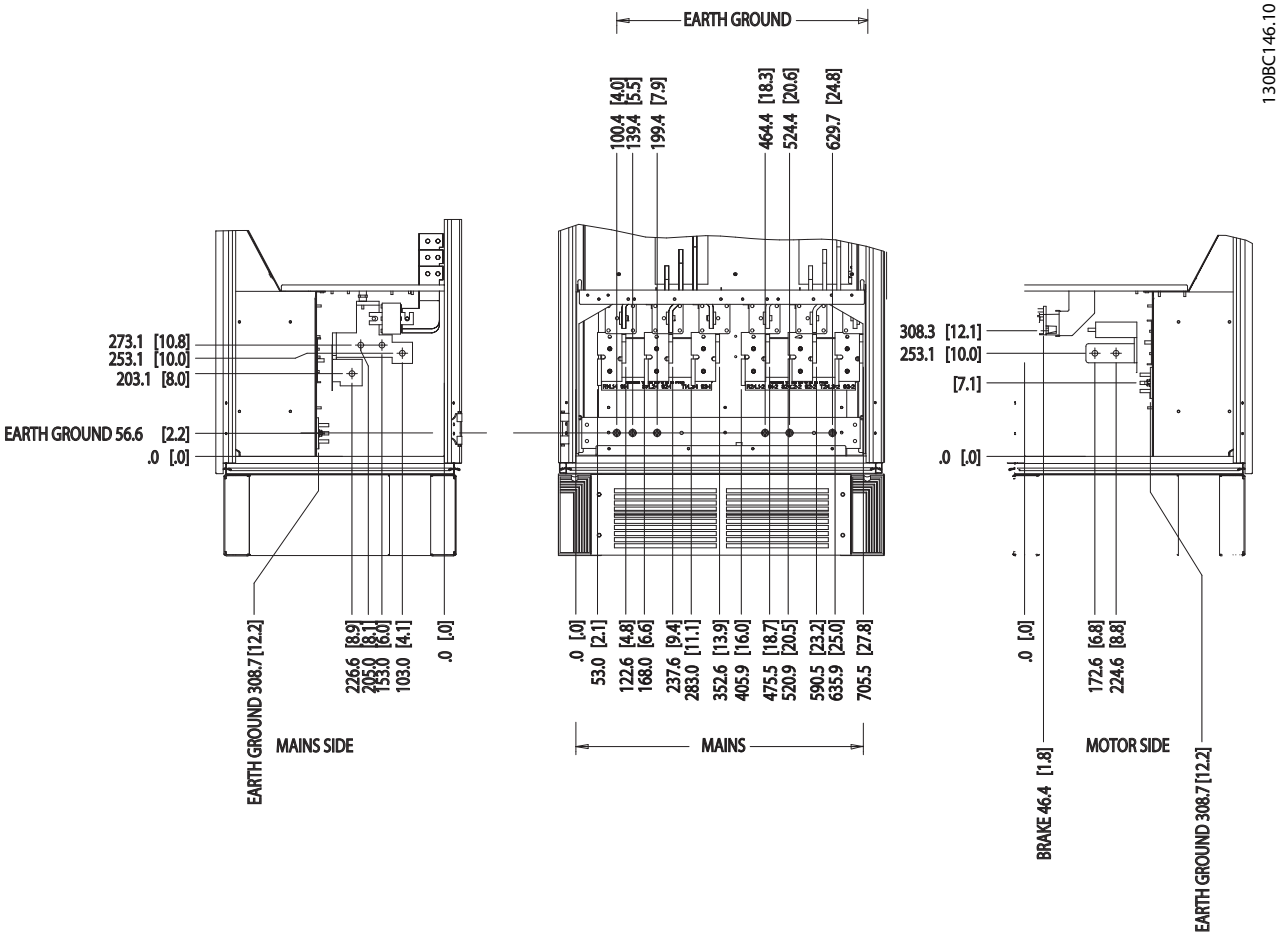


Figure 3.16 Terminal Locations - Rectifier (left side, front and right side view). The connector plate is 1.65 in [42 mm] below .0 level.

3

Terminal locations - Options Cabinet Frame Size F9

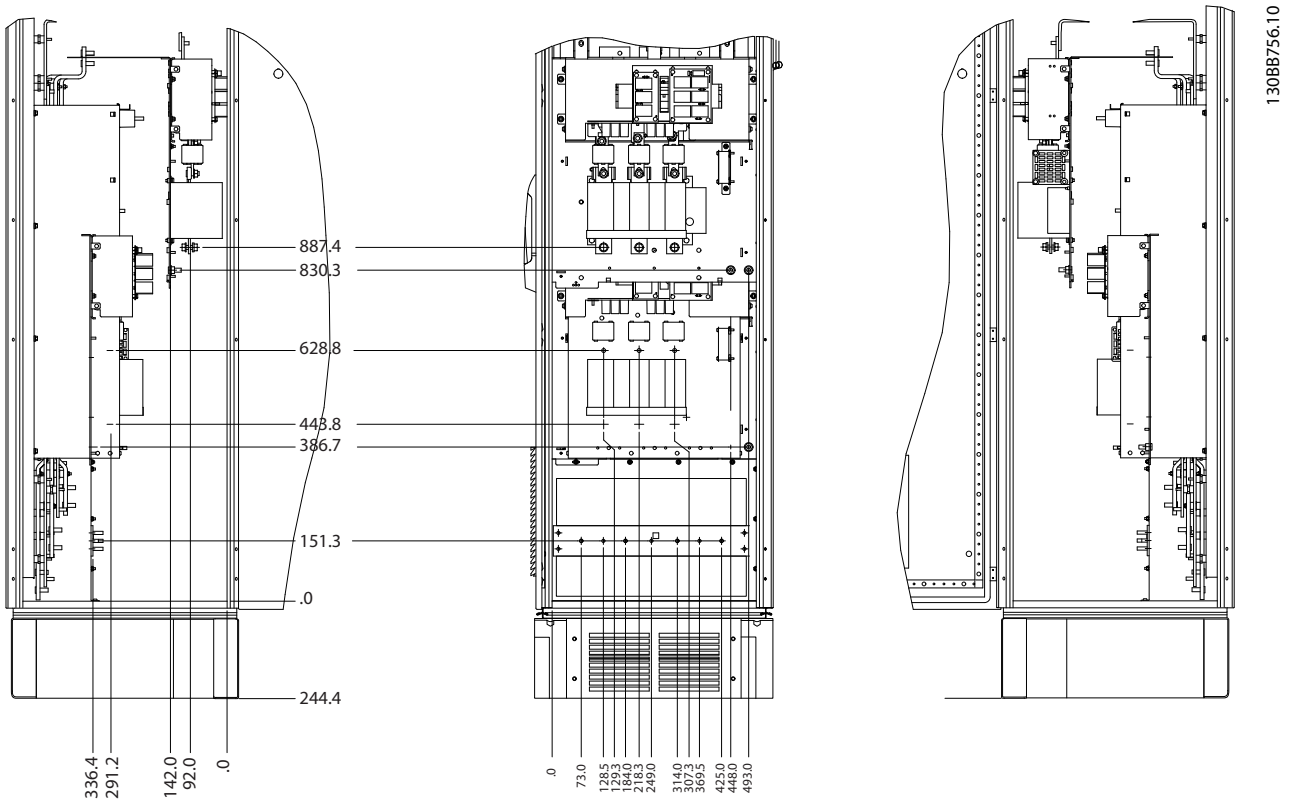


Figure 3.17 Terminal locations - Options cabinet (left side, front and right side view).

Terminal locations - Options Cabinet Frame Size F11/F13

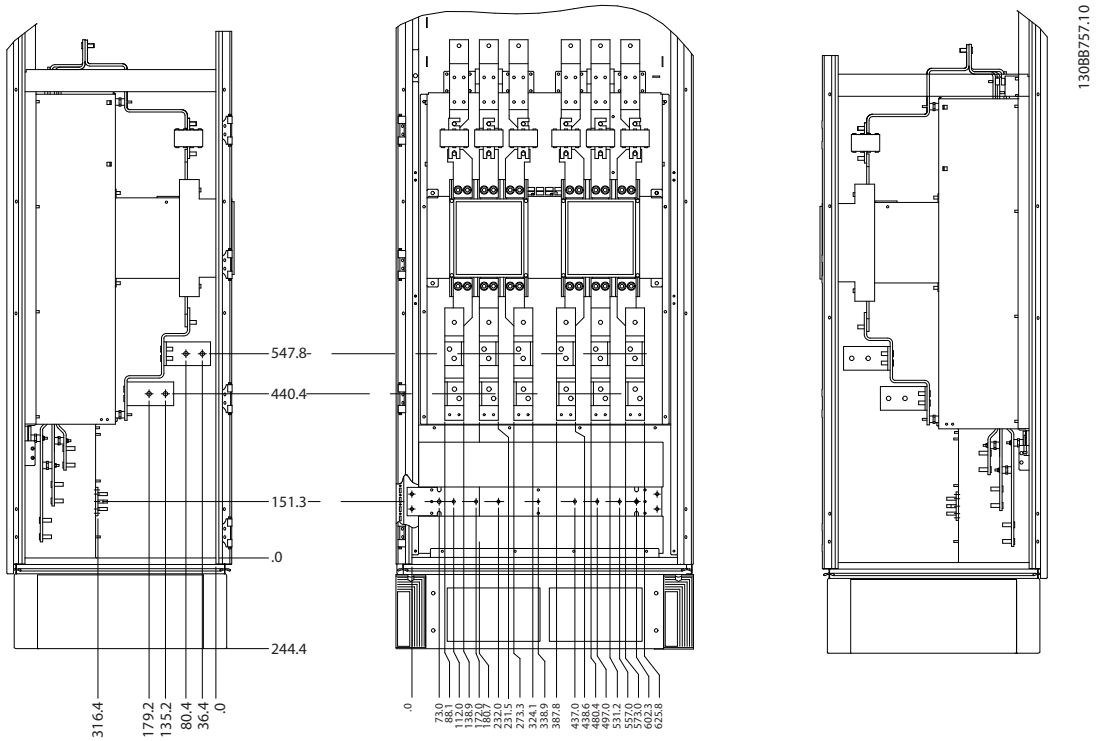


Figure 3.18 Terminal locations - Options cabinet (left side, front and right side view).

3

3.2.4 Cooling and Airflow

Cooling
Cooling can be obtained in different ways, by using the cooling ducts in the bottom and the top of the unit, by taking air in and out the back of the unit or by combining the cooling possibilities.

Duct cooling
A dedicated option has been developed to optimize installation of adjustable frequency drives in Rittal TS8 enclosures utilizing the fan of the adjustable frequency drive for forced air cooling of the backchannel. The air out the top of the enclosure could but ducted outside a facility so the heat loses from the backchannel are not dissipated within the control room reducing air-conditioning requirements of the facility.

Back cooling
The backchannel air can also be vented in and out the back of a Rittal TS8 enclosure. This offers a solution where the backchannel could take air from outside the facility and return the heat losses outside the facility thus reducing air-conditioning requirements.

Airflow
The necessary airflow over the heatsink must be ensured. The flow rate is shown below.

Enclosure protection	Door fan(s) / Top fan airflow	Heatsink fan(s)
IP21/NEMA 1	412 cfm (700 m^3/h)*	580 cfm (985 m^3/h)*
IP54/NEMA 12	309 cfm (525 m^3/h)*	580 cfm (985 m^3/h)*

Table 3.6 Heatsink Air Flow

** Airflow per fan. Frame size F contains multiple fans.*

NOTE!

The fan runs for the following reasons:

1. **AMA**
2. **DC Hold**
3. **Pre-Mag**
4. **DC Brake**
5. **60% of nominal current is exceeded**
6. **Specific heatsink temperature exceeded (power-size dependent).**

Once the fan is started, it will run for a minimum of 10 minutes.

External ducts
If additional duct work is added externally to the Rittal cabinet, the pressure drop in the ducting must be calculated. Use the charts below to derate the adjustable frequency drive according to the pressure drop.

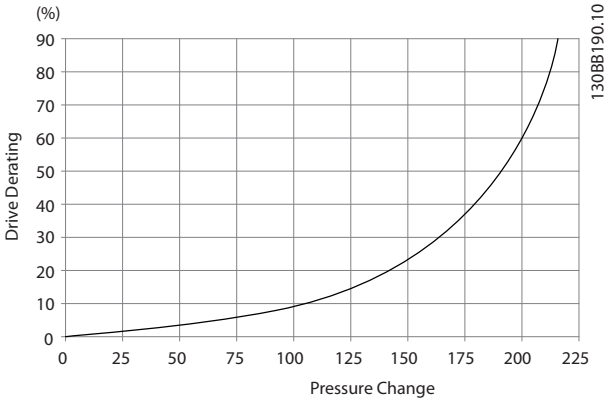


Figure 3.19 F frame Derating vs. Pressure Change (Pa)
Drive air flow: 985 m^3/h (580 cfm)

3.2.5 Connector/Conduit Entry - IP21 (NEMA 1) and IP54 (NEMA12)

Cables are connected through the connector plate from the bottom. Remove the plate and plan where to place the entry for the connectors or conduits. Prepare holes in the marked area on the drawing.

NOTE!

The connector plate must be fitted to the adjustable frequency drive to ensure the specified protection degree, as well as ensuring proper cooling of the unit. If the connector plate is not mounted, the adjustable frequency drive may trip on Alarm 69, Pwr. Card Temp

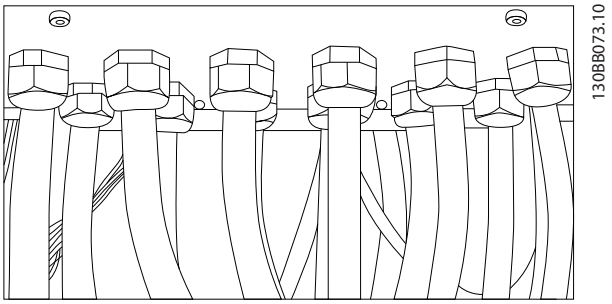
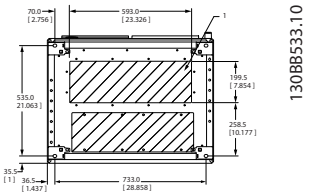


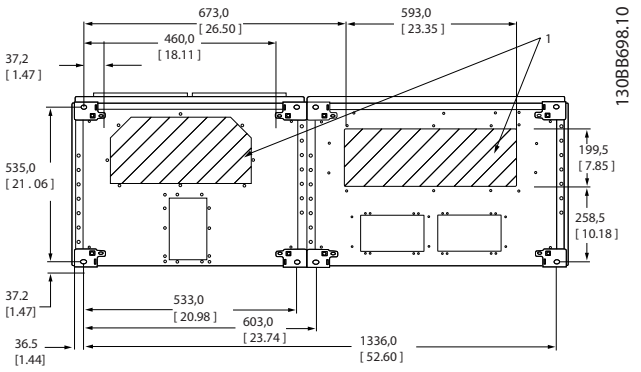
Figure 3.20 Example of Proper Installation of the connector plate.

3

Frame size F8



Frame size F9



Frame size F10

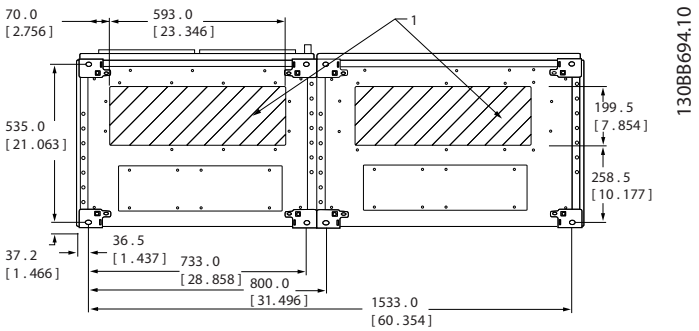
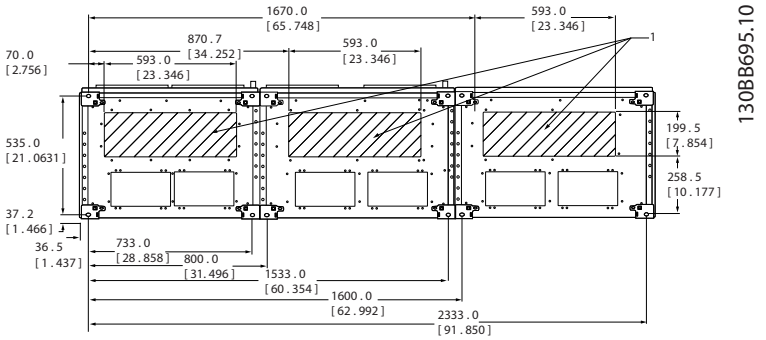


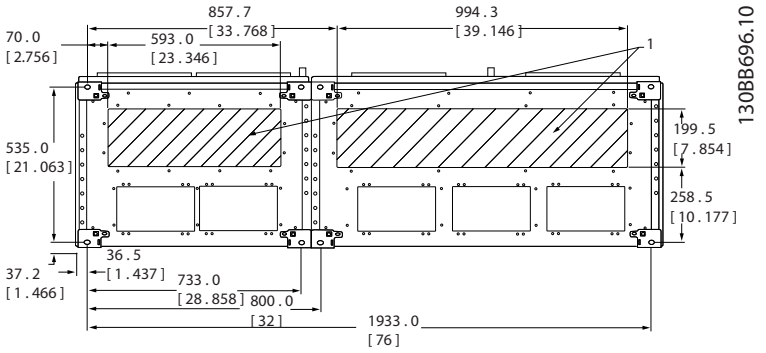
Table 3.7

3

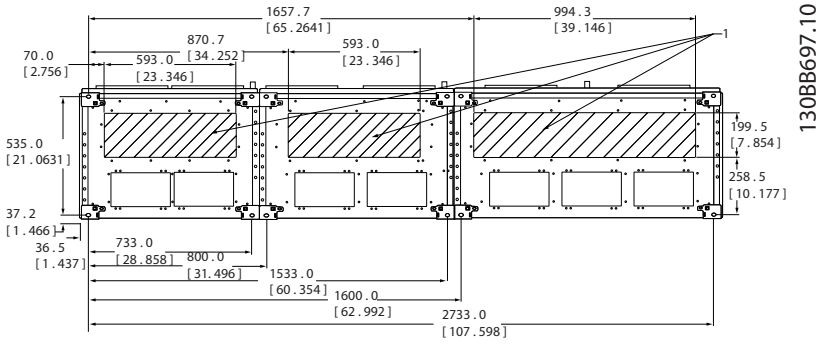
Frame size F11



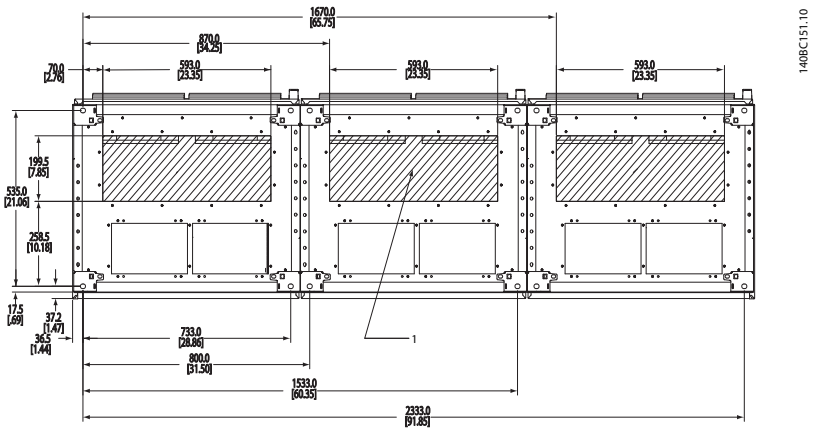
Frame size F12



Frame size F13



Frame size F 14



F8-F14: Cable entries viewed from the bottom of the adjustable frequency drive - 1) Place conduits in marked areas.

Table 3.8

3.3 Field Installation of Options

Space Heaters and Thermostat
Mounted on the cabinet interior of frame size F10-F14 adjustable frequency drives, space heaters controlled via automatic thermostat help control humidity inside the enclosure, extending the lifetime of adjustable frequency drive components in damp environments. The thermostat default settings turn on the heaters at 10°C (50°F) and turn them off at 15.6°C (60°F).

Cabinet Light with Power Outlet
A light mounted on the cabinet interior of frame size F10-F14 adjustable frequency drives increase visibility during servicing and maintenance. The housing light includes a power outlet for temporarily powering tools or other devices, available in two voltages:

- 230 V, 50 Hz, 2.5 A, CE/ENEC
- 120 V, 60 Hz, 5 A, UL/cUL

Transformer Tap Set-up
If the cabinet light and outlet and/or the space heaters and thermostat are installed, Transformer T1 requires the taps to be set to the proper input voltage. A 380–480/500 V unit is initially set to the 525 V tap and a 525–690 V unit is set to the 690 V tap to insure that no overvoltage of secondary equipment occurs if the tap is not changed before power is applied. See *Table 3.9* to set the proper tap at terminal T1 located in the rectifier cabinet. For location in the adjustable frequency drive, see figure of rectifier in *Figure 3.21*.

Input Voltage Range [V]	Tap to Select [V]
380–440	400
441–490	460
491–550	525
551–625	575
626–660	660
661–690	690

Table 3.9

NAMUR Terminals
NAMUR is an international association of automation technology users in process industries, primarily in the chemical and pharmaceutical industries, in Germany. Selection of this option provides terminals organized and labeled to the specifications of the NAMUR standard for adjustable frequency drive input and output terminals. This requires MCB 112 PTC Thermistor Card and MCB 113 Extended Relay Card.

RCD (Residual Current Device)
Uses the core balance method to monitor ground fault currents in grounded and high-resistance grounded systems (TN and TT systems in IEC terminology). There is a pre-warning (50% of main alarm setpoint) and a main alarm setpoint. Associated with each setpoint is an SPDT alarm relay for external use. Requires an external "window-type" current transformer (supplied and installed by customer).

- Integrated into the adjustable frequency drive's safe-stop circuit
- IEC 60755 Type B device monitors AC, pulsed DC, and pure DC ground fault currents
- LED bar graph indicator of the ground fault current level from 10–100% of the setpoint
- Fault memory
- TEST/RESET button

Insulation Resistance Monitor (IRM)
Monitors the insulation resistance in ungrounded systems (IT systems in IEC terminology) between the system phase conductors and ground. There is an ohmic pre-warning and a main alarm setpoint for the insulation level. Associated with each setpoint is an SPDT alarm relay for external use.

NOTE!

Only one insulation resistance monitor can be connected to each ungrounded (IT) system.

- Integrated into the adjustable frequency drive's safe-stop circuit
- LCD display of the ohmic value of the insulation resistance
- Fault Memory
- [Info], [Test], and [Reset] keys

Manual Motor Starters
Provide 3-phase power for electric blowers often required for larger motors. Power for the starters is provided from the load side of any supplied contactor, circuit breaker, or disconnect switch. Power is fused before each motor starter, and is off when the incoming power to the adjustable frequency drive is off. Up to two starters are allowed (one if a 30 A, fuse-protected circuit is ordered). Integrated into the adjustable frequency drive's safe-stop circuit.
Unit features include:

- Operation switch (on/off)
- Short-circuit and overload protection with test function
- Manual reset function

3

30 Ampere, Fuse-protected Terminals

- 3-phase power matching incoming AC line voltage for powering auxiliary customer equipment
- Not available if two manual motor starters are selected
- Terminals are off when the incoming power to the adjustable frequency drive is off.
- Power for the fused protected terminals is provided from the load side of any supplied circuit breaker or disconnect switch.

24 V DC Power Supply

- 5 A, 120 W, 24 V DC
- Protected against output over-current, overload, short circuits, and over-temperature
- For powering customer-supplied accessory devices such as sensors, PLC I/O, contactors, temperature probes, LEDs and/or other electronic hardware
- Diagnostics include a dry DC-ok contact, a green DC-ok LED, and a red overload LED

External Temperature Monitoring
Designed for monitoring temperatures of external system components, such as the motor windings and/or bearings. Includes eight universal input modules plus two dedicated thermistor input modules. All ten modules are integrated into the adjustable frequency drive's safe-stop circuit and can be monitored via a serial communication bus network (requires the purchase of a separate module/bus coupler).

Universal inputs (8)
Signal types:

- RTD inputs (including Pt100), 3-wire or 4-wire
- Thermocouple
- Analog current or analog voltage

Additional features:

- One universal output, configurable for analog voltage or analog current
- Two output relays (N.O.)
- Dual-line LC display and LED diagnostics
- Sensor lead wire break, short-circuit, and incorrect polarity detection
- Interface set-up software

Dedicated thermistor inputs (2)
Features:

- Each module is capable of monitoring up to six thermistors in a series
- Fault diagnostics for wire breakage or short-circuits of sensor leads
- ATEX/UL/CSA certification
- A third thermistor input can be provided by the PTC thermistor option card MCB 112, if necessary.

3.3 Electrical Installation

3.3.1 Transformer Selection

The adjustable frequency drive must be used with a 12-pulse isolation transformer.

3.3.2 Power Connections 12-Pulse Drives

Cabling and Fusing

NOTE!

Cables General

All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. UL applications require 167° F [75°C] copper conductors. 167° F [75°C] and 194° F [90°C] copper conductors are thermally acceptable for the adjustable frequency drive to use in non-UL applications.

The power cable connections are situated as in *Figure 3.21*. Dimensioning of cable cross-section must be done in accordance with the current ratings and local legislation. See *5.1 General Specifications* for details.

For protection of the adjustable frequency drive, the recommended fuses must be used or the unit must be with built-in fuses. Recommended fuses can be seen in *3.3.13 Fuses* . Always ensure that proper fusing is done according to local regulations.

The AC line input connection is fitted to the line power switch if this is included.

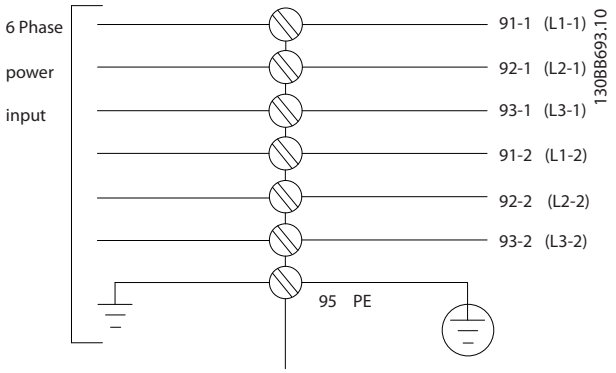


Figure 3.21

NOTE!

The motor cable must be shielded/armored. If a non-shielded/unarmored cable is used, some EMC requirements are not complied with. Use a shielded/armored motor cable to comply with EMC emission specifications. For more information, see *EMC Specifications* in the *Design Guide, MG11BXYY* and the *FC 300 Design Guide, MG33BXYY*.

See *5.1 General Specifications* for correct dimensioning of motor cable cross-section and length.

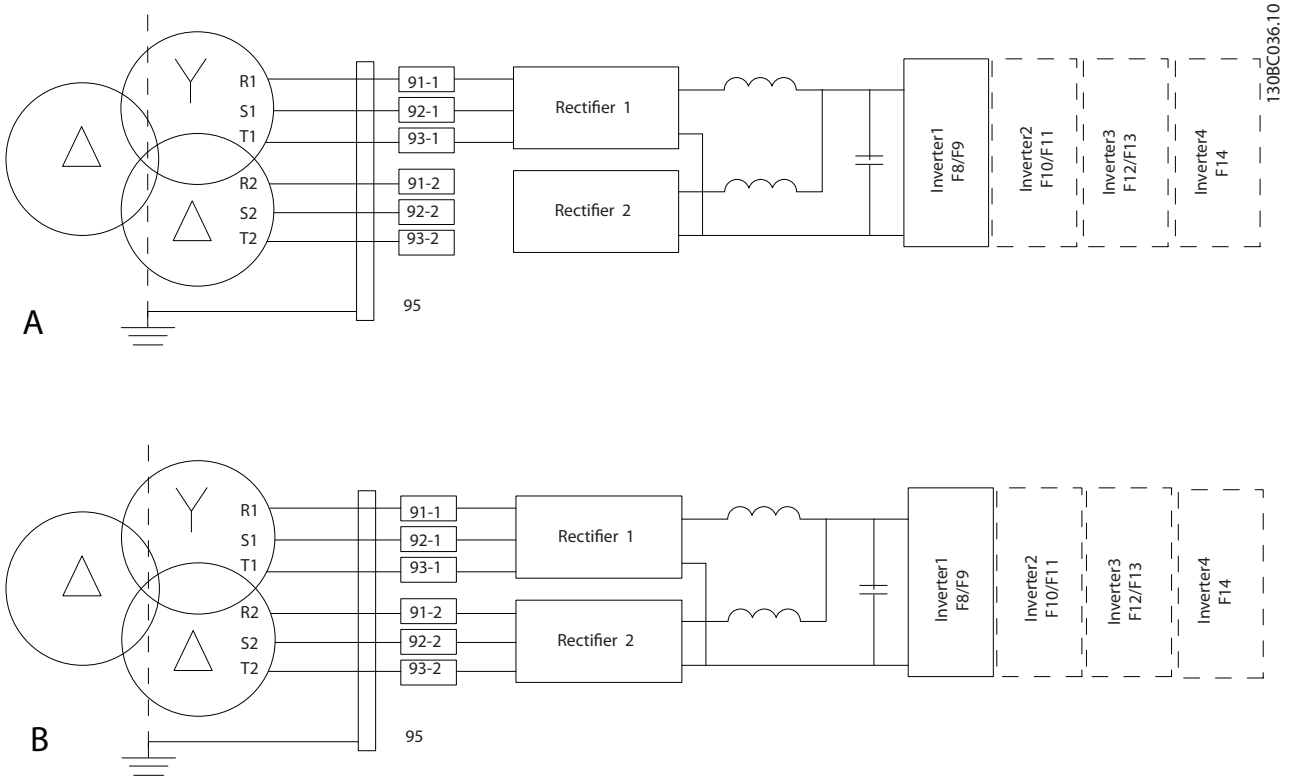


Figure 3.22
A) Modified 6-Pulse Connection[1), 2), 3)]
B) 12-Pulse Connection[2), 4)]

Notes:
1) 6-pulse connection eliminates the harmonics reduction benefits of the 12-pulse rectifier.
2) Suitable for IT and TN AC line input connections.
3) In the unlikely event that one of the 6-pulse modular rectifiers becomes inoperable, it is possible to operate the

adjustable frequency drive at reduced load with a single 6-pulse rectifier. Contact factory for reconnection details.
4) No paralleling of line power cabling is shown here.

3

Shielding of cables:
Avoid installation with twisted shield ends (pigtails). They spoil the shielding effect at higher frequencies. If it is necessary to break the shield to install a motor isolator or motor contactor, the shield must be continued at the lowest possible HF impedance.

Connect the motor cable screen to both the de-coupling plate of the adjustable frequency drive and to the metal housing of the motor.

Make the shield connections with the largest possible surface area (cable clamp). This is done by using the supplied installation devices within the adjustable frequency drive.

Cable-length and cross-section:
The adjustable frequency drive has been EMC tested with a given length of cable. Keep the motor cable as short as possible to reduce the noise level and leakage currents.

Switching frequency:
When adjustable frequency drives are used together with sine-wave filters to reduce the acoustic noise from a motor, the switching frequency must be set according to the instructions in *14-01 Switching Frequency*.

Term. no.	96	97	98	99	
	U	V	W	PE[1)]	Motor voltage 0–100% of AC line voltage. 3 wires out of motor
	U1	V1	W1	PE[1)]	Delta-connected
	W2	U2	V2		6 wires out of motor
	U1	V1	W1	PE[1)]	Star-connected U2, V2, W2 U2, V2 and W2 to be interconnected separately.

Table 3.10

[1)]Protected Ground Connection

In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a adjustable frequency drive), fit a sine-wave filter on the output of the adjustable frequency drive.

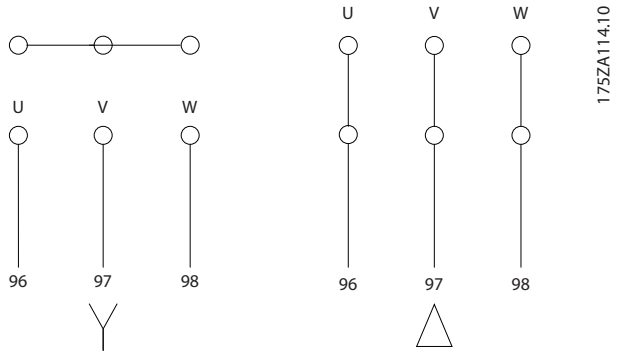


Figure 3.23

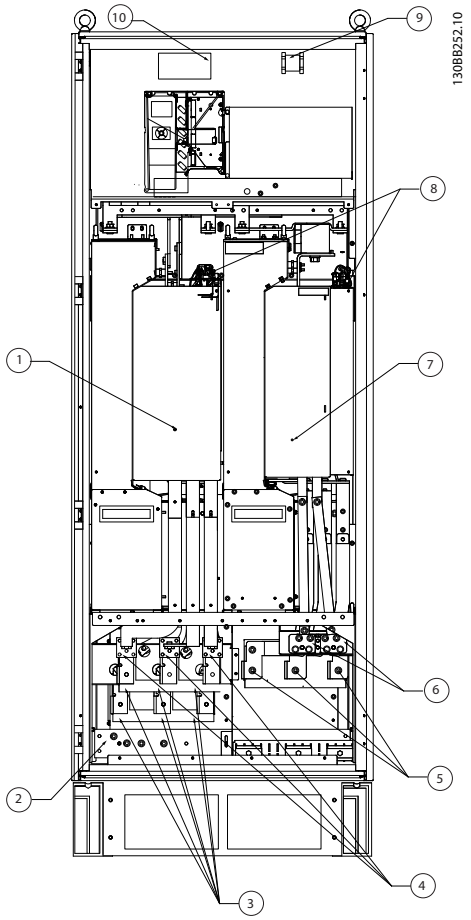


Figure 3.24 Rectifier and Inverter Cabinet, frame size F8 and F9

1)	12-pulse rectifier module	5)	Motor connection
2)	Ground PE Terminals		U V W
3)	Line power / Fuses		T1 T2 T3
	R1 S1 T1		96 97 98
	L1-1 L2-1 L3-1	6)	Brake Terminals
	91-1 92-1 93-1		-R +R
4)	Line power / Fuses		81 82
	R2 S2 T2	7)	Inverter Module
	L2-1 L2-2 L3-2	8)	SCR Enable / Disable
	91-2 92-2 93-2	9)	Relay 1 Relay 2
			01 02 03 04 05 06
		10)	Auxiliary Fan
			104 106

Table 3.11

3

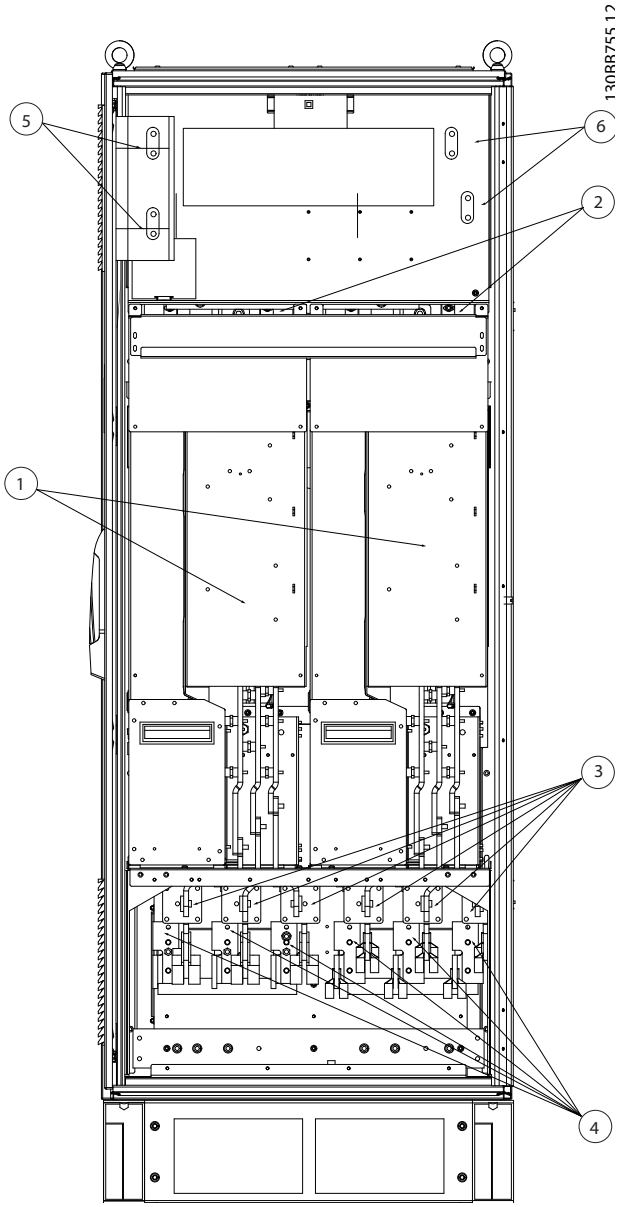


Figure 3.25 Rectifier Cabinet, frame size F10 and F12

1)	12-pulse rectifier module	4)	Line power
2)	AUX Fan		R1 S1 T1 R2 S2 T2
	100 101 102 103		L1-1 L2-1 L3-1 L1-2 L2-2 L3-2
	L1 L2 L1 L2	5)	DC Bus Connections for common DC Bus
3)	Electrical Fuses F10/F12 (6 Pieces)		DC+ DC-
		6)	DC Bus Connections for common DC Bus
			DC+ DC-

Table 3.12

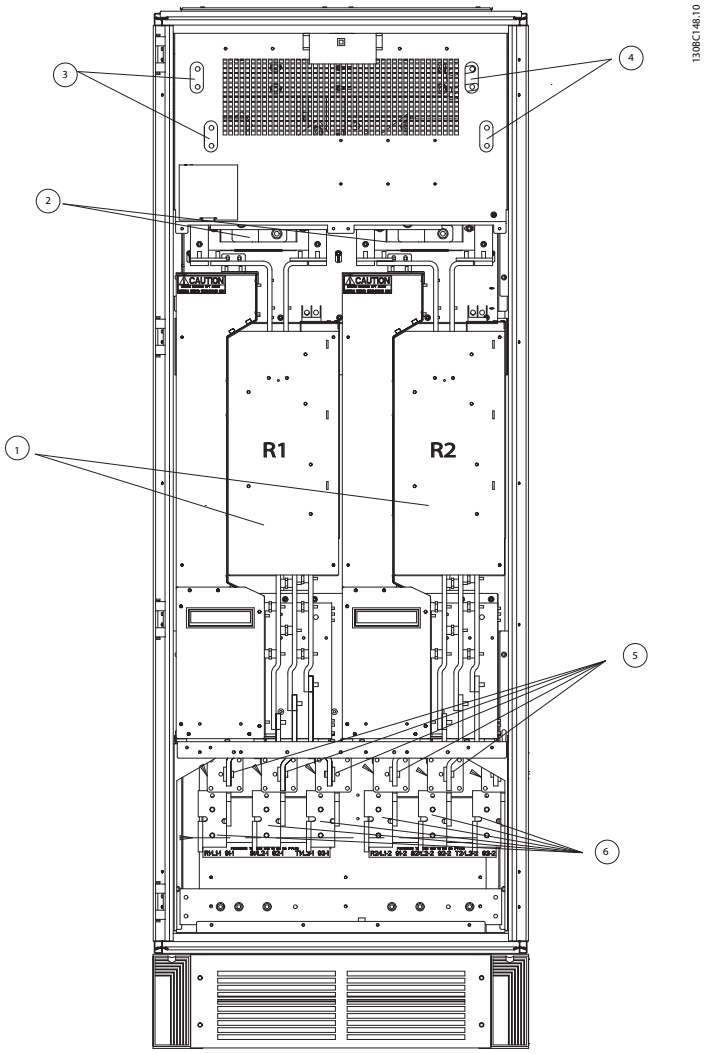


Figure 3.26 Rectifier Cabinet, frame size F14

1)	12-pulse Rectifier Modules	6)	Line power
2)	N/A		R1 S1 T1 R2 S2 T2
			L1-1 L2-1 L3-1 L1-2 L2-2 L3-2
3)	DC Busbar Access		
4)	DC Busbar Access		
	100 101 102 103		
	L1 L2 L1 L2		
5)	Electrical Fuses (6 pieces)		
	-R +R		
	81 82		

Table 3.13

3

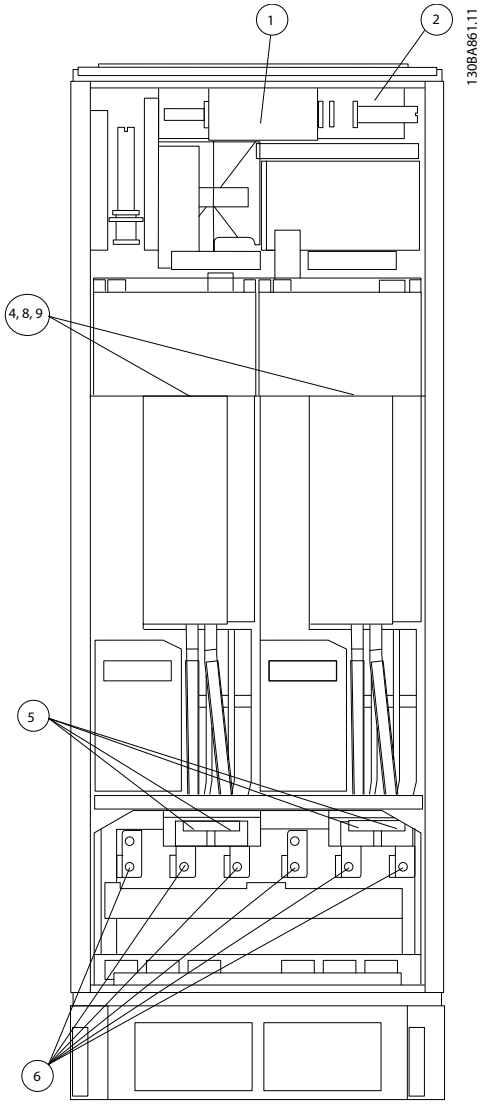


Figure 3.27 Inverter Cabinet, frame size F10 and F11

1)	External Temperature Monitoring	6)	Motor
2)	AUX Relay		U V W
	01 02 03		96 97 98
	04 05 06		T1 T2 T3
3)	NAMUR	7)	NAMUR Fuse. See fuse tables for part numbers
4)	AUX Fan	8)	Fan Fuses. See fuse tables for part numbers
	100 101 102 103	9)	SMPS Fuses. See fuse tables for part numbers
	L1 L2 L1 L2		
5)	Brake		
	-R +R		
	81 82		

Table 3.14

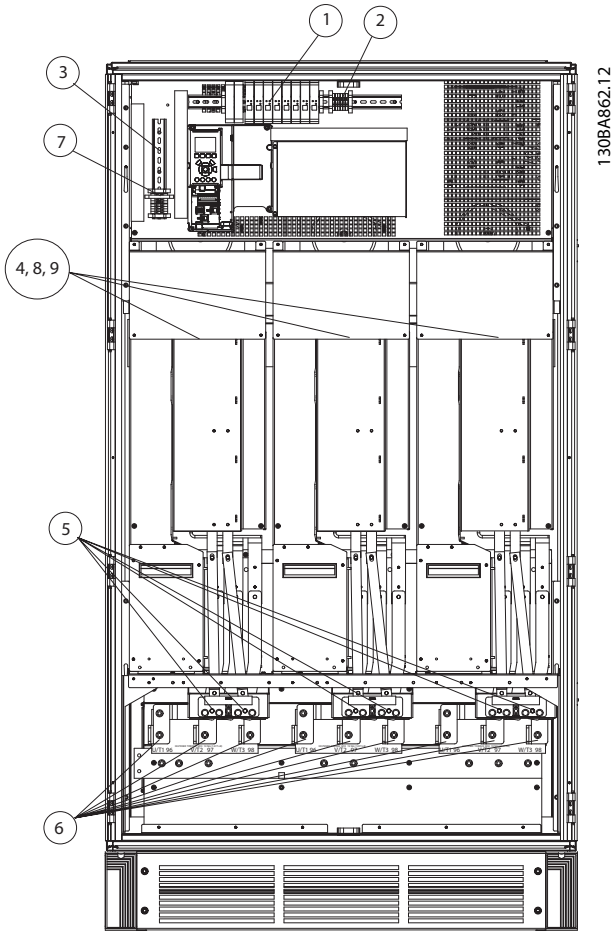


Figure 3.28 Inverter Cabinet, frame size F12 and F13

1)	External Temperature Monitoring	6)	Motor
2)	AUX Relay		U V W
	01 02 03		96 97 98
	04 05 06		T1 T2 T3
3)	NAMUR	7)	NAMUR Fuse. See *3.3.13 Fuses* for part numbers
4)	AUX Fan	8)	Fan Fuses. See *3.3.13 Fuses* for part numbers
	100 101 102 103	9)	SMPS Fuses. See *3.3.13 Fuses* for part numbers
	L1 L2 L1 L2		
5)	Brake		
	-R +R		
	81 82		

Table 3.15

3

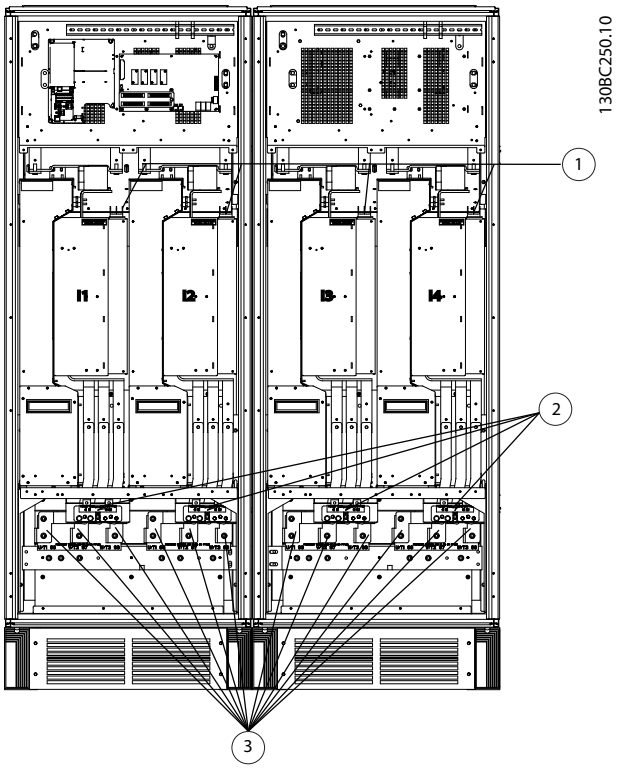


Figure 3.29 Inverter Cabinet, frame size F14

4)	AUX Fan					6)	Motor		
	100	101	102		103		U	V	W
	L1	L2	L1		L2		96	97	98
5)	Brake						T1	T2	T3
	-R	+R							
	81	82							

Table 3.16

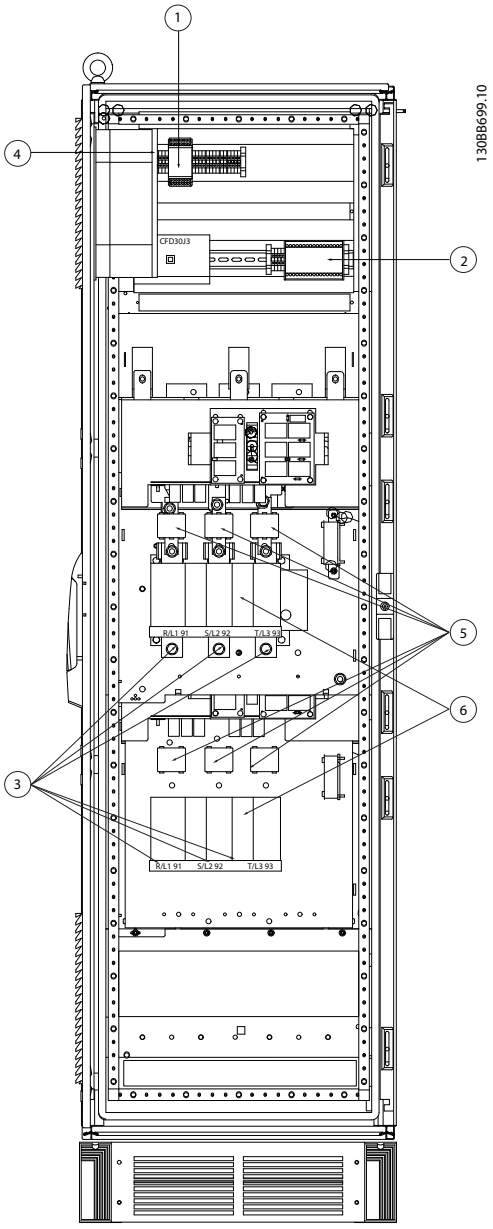


Figure 3.30 Options Cabinet, frame size F9

1)	Pilz Relay Terminal	4)	Safety Relay Coil Fuse with Pilz Relay
2)	RCD or IRM Terminal		See fuse tables for part numbers
3)	Line power/6-phase	5)	Electrical Fuses, (6 pieces)
	R1 S1 T1 R2 S2 T2		See fuse tables for part numbers
	91-1 92-1 93-1 91-2 92-2 93-2	6)	2 x 3-phase manual disconnect
	L1-1 L2-1 L3-1 L1-2 L2-2 L3-2		

Table 3.17

3

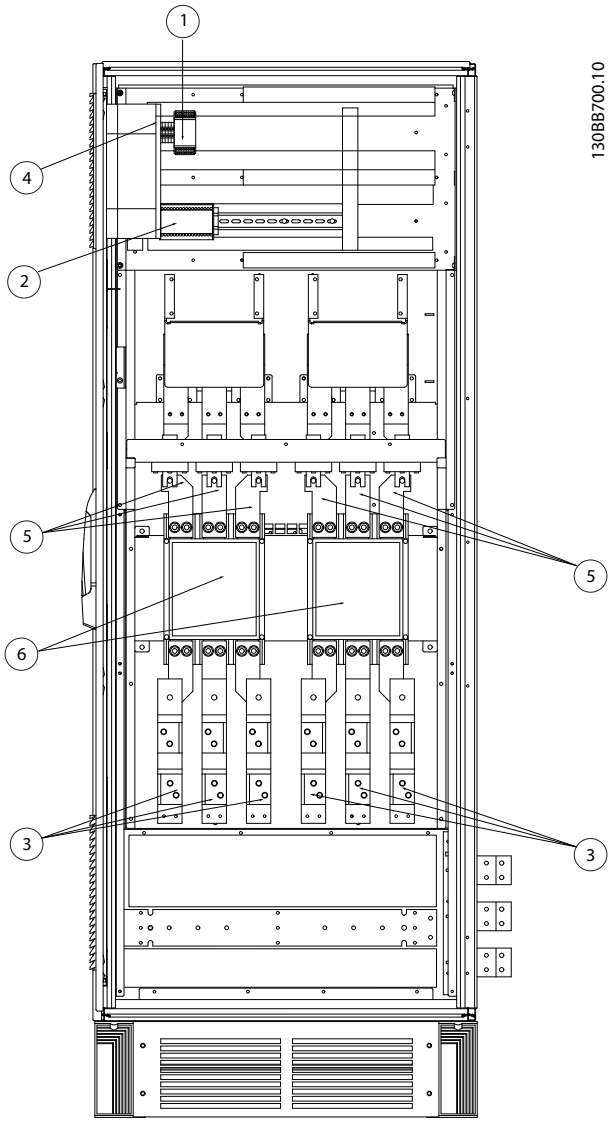


Figure 3.31 Options Cabinet, frame size F11 and F13

1)	Pilz Relay Terminal	4)	Safety Relay Coil Fuse with Pilz Relay
2)	RCD or IRM Terminal		See fuse tables for part numbers
3)	Line power/6-phase	5)	Electrical Fuses, (6 pieces)
	R1 S1 T1 R2 S2 T2		See fuse tables for part numbers
	91-1 92-1 93-1 91-2 92-2 93-2	6)	2 x 3-phase manual disconnect
	L1-1 L2-1 L3-1 L1-2 L2-2 L3-2		

Table 3.18

3.3.3 Grounding

The following basic issues need to be considered when installing an adjustable frequency drive, so as to obtain electromagnetic compatibility (EMC).

- Safety grounding: The adjustable frequency drive has a high leakage current and must be grounded appropriately for safety reasons. Always follow local safety regulations.
- High-frequency grounding: Keep the ground wire connections as short as possible.

Connect the different ground systems at the lowest possible conductor impedance. The lowest possible conductor impedance is obtained by keeping the conductor as short as possible and by using the greatest possible surface area.
The metal cabinets of the different devices are mounted on the cabinet rear plate using the lowest possible HF impedance. This prevents having different HF voltages for the individual devices and prevents the risk of radio interference currents running in connection cables that may be used between the devices, as radio interference is reduced.
In order to obtain a low HF impedance, use the fastening bolts of the devices as HF connections to the rear plate. It is necessary to remove insulating paint and the like from the fastening points.

3.3.4 Extra Protection (RCD)

ELCB relays, multiple protective grounding or grounding can be used as extra protection, provided that local safety regulations are complied with.

In the case of a ground fault, a DC component may develop in the fault current.

If ELCB relays are used, local regulations must be observed. Relays must be suitable for protection of 3-phase equipment with a bridge rectifier and for a brief discharge on power-up.

See also *Special Conditions* in the Design Guide, MG33BXYY.

3.3.5 RFI Switch

Line power supply isolated from ground
If the adjustable frequency drive is supplied from an isolated line power source (IT line power, floating delta and grounded delta) or TT/TN-S line power with grounded leg, the RFI switch is recommended to be turned off (OFF) [1] via *14-50 RFI 1* on the adjustable frequency drive and *14-50 RFI 1* on the filter. For further reference, see IEC 364-3. In case optimum EMC performance is needed, parallel motors are connected or the motor cable length is above 80 ft [25 m], it is recommended to set *14-50 RFI 1* to [ON].
[1] Not available for 525–600/690 V adjustable frequency drives.
In OFF, 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 ground capacity currents (according to IEC 61800-3).
Please also refer to the application note *VLT on IT line power, MN90CX02*. It is important to use isolation monitors that are capable for use together with power electronics (IEC 61557-8).

3.3.6 Torque

When tightening all electrical connections it is important to tighten with the correct torque. Too low or too high torque results in a poor electrical connection. Use a torque wrench to ensure correct torque.

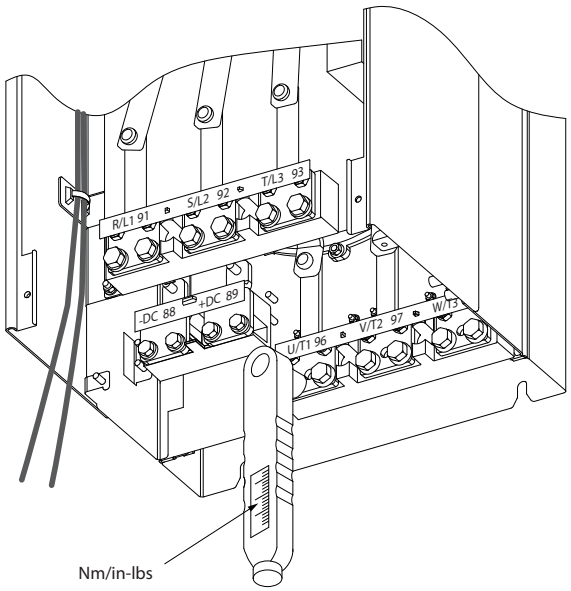


Figure 3.32 Always use a torque wrench to tighten the bolts.

3

Frame size	Terminal	Torque	Bolt size
F8-F14	Line power Motor	19–40 Nm (168–354 in-lbs)	M10
	Brake Regen	8.5–20.5 Nm (75–181 in-lbs) 8.5–20.5 Nm (75–181 in-lbs)	M8 M8

Table 3.19 Tightening torques

3.3.7 Shielded Cables

⚠WARNING

Danfoss recommends to use shielded cables between the LCL filter and the AFE unit. Non-shielded cables can be used between transformer and LCL filter input side.

It is important that shielded and armored cables are connected in a proper way to ensure the high EMC immunity and low emissions.

The connection can be made using either cable connectors or clamps:

- EMC cable connectors: generally available cable connectors can be used to ensure an optimum EMC connection.
- EMC cable clamp: Clamps allowing for easy connection are supplied with the adjustable frequency drive.

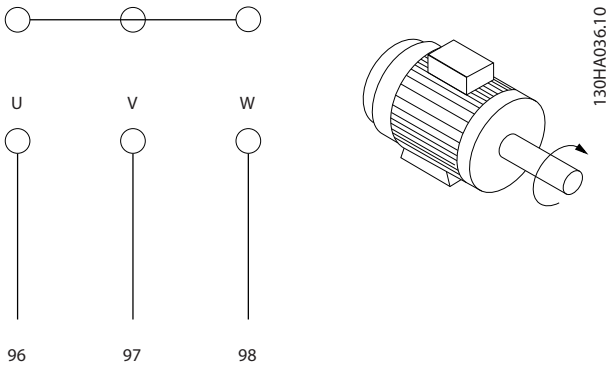
3.3.8 Motor Cable

The motor must be connected to terminals U/T1/96, V/T2/97, W/T3/98. Ground to terminal 99. All types of three-phase asynchronous standard motors can be used with an adjustable frequency drive unit. The factory setting is for clockWise rotation with the adjustable frequency drive output connected as follows:

Terminal No.	Function
96, 97, 98, 99	Line power U/T1, V/T2, W/T3 Ground

Table 3.20

- Terminal U/T1/96 connected to U-phase
- Terminal V/T2/97 connected to V-phase
- Terminal W/T3/98 connected to W-phase



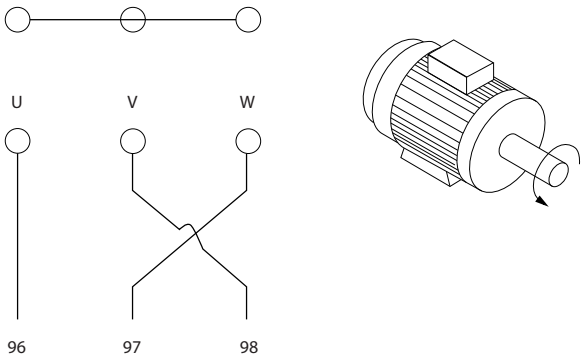


Figure 3.33

The direction of rotation can be changed by switching two phases in the motor cable or by changing the setting of *4-10 Motor Speed Direction*.

Motor rotation check can be performed using *1-28 Motor Rotation Check* and following the steps shown in the display.

F frame Requirements

F8/F9 requirements: The cables are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

F10/F11 requirements: Motor phase cable quantities must be multiples of 2, resulting in 2, 4, 6, or 8 (1 cable is not allowed) to obtain equal amount of wires attached to both inverter module terminals. The cables are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

F12/F13 requirements: Motor phase cable quantities must be multiples of 3, resulting in 3, 6, 9, or 12 (1, 2, or 3 cables are not allowed) to obtain an equal amount of wires

attached to each inverter module terminal. The wires are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

F14 requirements: Motor phase cable quantities must be multiples of 4, resulting in 4, 8, 12, or 16 (1, 2, or 3 cables are not allowed) to obtain an equal amount of wires attached to each inverter module terminal. The wires are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

Output junction box requirements: The length, a minimum of 8 ft [2.5 m], and quantity of cables must be equal from each inverter module to the common terminal in the junction box.

NOTE!

If a retrofit application requires unequal amounts of wires per phase, consult the factory for requirements and documentation or use the top/bottom entry side cabinet option.

3.3.9 Brake Cable Drives with Factory Installed Brake Chopper Option

(Only standard with letter B in position 18 of typecode).

The connection cable to the brake resistor must be shielded and the max. length from adjustable frequency drive to the DC bar is limited to 82 ft [25 m].

Terminal No.	Function
81, 82	Brake resistor terminals

Table 3.21

The connection cable to the brake resistor must be shielded. Connect the shield by means of cable clamps to the conductive backplate at the adjustable frequency drive and to the metal cabinet of the brake resistor.
Size the brake cable cross-section to match the brake torque. See also *Brake Instructions, MI.90.Fx.yy* and *MI. 50.Sx.yy* for further information regarding safe installation.

⚠WARNING

Note that voltages up to 1,099 V DC, depending on the supply voltage, may occur on the terminals.

F Frame Requirements
The brake resistor(s) must be connected to the brake terminals in each inverter module.

3.3.10 Shielding against Electrical Noise

Before mounting the line power cable, mount the EMC metal cover to ensure best EMC performance.

NOTE!

The EMC metal cover is only included in units with an RFI filter.

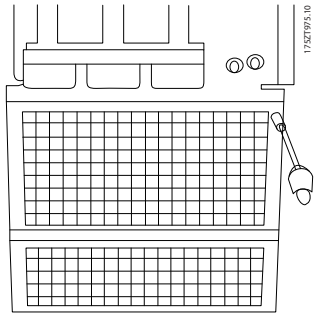


Figure 3.34 Mount the EMC shield.

3.3.11 AC line input connections

Line power must be connected to terminals 91-1, 92-1, 93-1, 91-2, 92-2 and 93-2 (see *Table 3.22*). Ground is connected to the terminal to the right of terminal 93.

Terminal No.	Function
91-1, 92-1, 93-1	Line power R1/L1-1, S1/L2-1, T1/ L3-1
91-2, 92-2, 93-2	Line power R2/L1-2, S2/L2-2, T2/ L3-2
94	Ground

Table 3.22

NOTE!

Check the nameplate to ensure that the AC line voltage of the adjustable frequency drive matches the power supply of your plant.

Ensure that the power supply can supply the necessary current to the adjustable frequency drive.

If the unit is without built-in fuses, ensure that the appropriate fuses have the correct current rating.

3.3.12 External Fan Supply

3

If the adjustable frequency drive is supplied by DC or if the fan must run independently of the power supply, an external power supply can be applied. The connection is made on the power card.

Terminal No.	Function
100, 101	Auxiliary supply S, T
102, 103	Internal supply S, T

Table 3.23

The connector located on the power card provides the AC line voltage connection for the cooling fans. The fans are factory-equipped to be supplied from a common AC line (jumpers between 100-102 and 101-103). If an external supply is needed, the jumpers are removed and the supply is connected to terminals 100 and 101. A 5A fuse should be used for protection. In UL applications, this should be a LittleFuse KLK-5 or equivalent.

3.3.13 Fuses

Branch circuit protection:
In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines, etc., must be short-circuited and overcurrent protected according to national/international regulations.

Short-circuit protection:
The adjustable frequency drive must be protected against short-circuit to avoid electrical or fire hazard. Danfoss recommends using the fuses mentioned below to protect service personnel and equipment in case of an internal failure in the adjustable frequency drive. The adjustable frequency drive provides full short-circuit protection in case of a short-circuit on the motor output.

Overcurrent protection
Provide overload protection to avoid fire hazard due to overheating of the cables in the installation. The adjustable frequency drive is equipped with internal overcurrent protection that can be used for upstream overload protection (UL applications excluded). See *4-18 Current Limit*. Moreover, fuses or circuit breakers can be used to provide the overcurrent protection in the installation. Overcurrent protection must always be carried out according to national regulations.

UL compliance

The fuses below are suitable for use on a circuit capable of delivering 100,000 Arms (symmetrical), 240 V, or 480 V, or 500 V, or 600 V depending on the adjustable frequency drive voltage rating. With the proper fusing, the adjustable frequency drive Short-Circuit Current Rating (SCCR) is 100,000 Arms.

Power size	Frame	Rating		Bussmann	Spare Bussmann	Est. Fuse Power Loss [W]	
FC 302	Size	Voltage (UL)	Amperes	P/N	P/N	400 V	460 V
P250T5	F8/F9	700	700	170M4017	176F8591	25	19
P315T5	F8/F9	700	700	170M4017	176F8591	30	22
P355T5	F8/F9	700	700	170M4017	176F8591	38	29
P400T5	F8/F9	700	700	170M4017	176F8591	3,500	2,800
P450T5	F10/F11	700	900	170M6013	176F8592	3,940	4,925
P500T5	F10/F11	700	900	170M6013	176F8592	2,625	2,100
P560T5	F10/F11	700	900	170M6013	176F8592	3,940	4,925
P630T5	F10/F11	700	1,500	170M6018	176F8592	45	34
P710T5	F12/F13	700	1,500	170M6018	176F9181	60	45
P800T5	F12/F13	700	1,500	170M6018	176F9181	83	63

Table 3.24 Line Fuses, 380–500 V

Power size	Frame	Rating		Bussmann	Spare Bussmann	Est. Fuse Power Loss [W]	
FC 302	Size	Voltage (UL)	Amperes	P/N	P/N	600 V	690 V
P355T7	F8/F9	700	630	170M4016	176F8335	13	10
P400T7	F8/F9	700	630	170M4016	176F8335	17	13
P500T7	F8/F9	700	630	170M4016	176F8335	22	16
P560T7	F8/F9	700	630	170M4016	176F8335	24	18
P630T7	F10/F11	700	900	170M6013	176F8592	26	20
P710T7	F10/F11	700	900	170M6013	176F8592	35	27
P800T7	F10/F11	700	900	170M6013	176F8592	44	33
P900T7	F12/F13	700	1,500	170M6018	176F9181	26	20
P1M0T7	F12/F13	700	1,500	170M6018	176F9181	37	28
P1M2T7	F12/F13	700	1,500	170M6018	176F9181	47	36
P1M4T7	F14	700	1,500	170M6018	176F9181	47	36

Table 3.25 Line Fuses, 525–690 V

3

Size/Type	Bussmann PN*	Rating	Siba
P450	170M8611	1,100 A, 1,000 V	20 781 32.1000
P500	170M8611	1,100 A, 1,000 V	20 781 32.1000
P560	170M6467	1,400 A, 700 V	20 681 32.1400
P630	170M6467	1,400 A, 700 V	20 681 32.1400
P710	170M8611	1,100 A, 1,000 V	20 781 32.1000
P800	170M6467	1,400 A, 700 V	20 681 32.1400

Table 3.26 Inverter module DC Link Fuses, 380–500 V

Size/Type	Bussmann PN*	Rating	Siba
P630	170M8611	1,100 A, 1,000 V	20 781 32. 1000
P710	170M8611	1,100 A, 1,000 V	20 781 32. 1000
P800	170M8611	1,100 A, 1,000 V	20 781 32. 1000
P900	170M8611	1,100 A, 1,000 V	20 781 32. 1000
P1M0	170M8611	1,100 A, 1,000 V	20 781 32. 1000
P1M2	170M8611	1,100 A, 1,000 V	20 781 32.1000
P1M4	170M8611	1,100 A, 1,000 V	20 781 32.1000

Table 3.27 Inverter Module DC Link Fuses, 525–690 V

**170M fuses from Bussmann shown use the -/80 visual indicator; -TN/80 Type T, -/110 or TN/110 Type T indicator fuses of the same size and amperage may be substituted for external use.*

Supplementary fuses

	Size/Type	Bussmann PN*	Rating	Alternative Fuses
2.5–4.0 A Fuse	P450-P800, 380–500 V	LPJ-6 SP or SPI	6 A, 600 V	Any listed Class J Dual Element, Time Delay, 6 A
	P630-P1M2, 525–690 V	LPJ-10 SP or SPI	10 A, 600 V	Any listed Class J Dual Element, Time Delay, 10 A
4.0–6.3 A Fuse	P450-P800, 380–500 V	LPJ-10 SP or SPI	10 A, 600 V	Any listed Class J Dual Element, Time Delay, 10 A
	P630-P1M2, 525–690 V	LPJ-15 SP or SPI	15 A, 600 V	Any listed Class J Dual Element, Time Delay, 15 A
6.3–10 A Fuse	P450-P800, 380–500 V	LPJ-15 SP or SPI	15 A, 600 V	Any listed Class J Dual Element, Time Delay, 15 A
	P630-P1M2, 525–690 V	LPJ-20 SP or SPI	20 A, 600 V	Any listed Class J Dual Element, Time Delay, 20 A
10–16 A Fuse	P450-P800, 380–500 V	LPJ-25 SP or SPI	25 A, 600 V	Any listed Class J Dual Element, Time Delay, 25 A
	P630-P1M2, 525–690 V	LPJ-20 SP or SPI	20 A, 600 V	Any listed Class J Dual Element, Time Delay, 20 A
	P630-P1M4, 525–690 V	LPJ-20 SP or SPI	20 A, 600 V	Any listed Class J Dual Element, Time Delay, 20 A

Table 3.28 Manual Motor Controller Fuses

Frame size	Bussmann PN*	Rating
F8-F14	KTK-4	4 A, 600 V

Table 3.29 SMPS Fuse

Size/Type	Bussmann PN*	LittelFuse	Rating
P315-P800, 380–500 V		KLK-15	15 A, 600 V
P500-P1M2, 525–690 V		KLK-15	15 A, 600 V
P500-P1M4, 525–690 V		KLK-15	15 A, 600 V

Table 3.30 Fan Fuses

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F14	LPJ-30 SP or SPI	30 A, 600 V	Any listed Class J Dual Element, Time Delay, 30 A

Table 3.31 30 A Fuse Protected Terminal Fuse

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F14	LPJ-6 SP or SPI	6 A, 600 V	Any listed Class J Dual Element, Time Delay, 6 A

Table 3.32 Control Transformer Fuse

Frame size	Bussmann PN*	Rating
F8-F14	GMC-800MA	800 mA, 250 V

Table 3.33 NAMUR Fuse

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F14	LP-CC-6	6 A, 600 V	Any listed Class CC, 6 A

Table 3.34 Safety Relay Coil Fuse with Pilz Relay

3

3.3.14 Line Power Disconnectors, 12-Pulse

Frame size	Power	Type
380–500 V		
F9	P250	ABB OETL-NF600A
F9	P315	ABB OETL-NF600A
F9	P355	ABB OETL-NF600A
F9	P400	ABB OETL-NF600A
F11	P450	ABB OETL-NF800A
F11	P500	ABB OETL-NF800A
F11	P560	ABB OETL-NF800A
F11	P630	ABB OT800U21
F13	P710	Merlin Gerin NPJF36000S12AAYP
F13	P800	Merlin Gerin NPJF36000S12AAYP
525–690 V		
F9	P355	ABB OT400U12-121
F9	P400	ABB OT400U12-121
F9	P500	ABB OT400U12-121
F9	P560	ABB OT400U12-121
F11	P630	ABB OETL-NF600A
F11	P710	ABB OETL-NF600A
F11	P800	ABB OT800U21
F13	P900	ABB OT800U21
F13	P1M0	Merlin Gerin NPJF36000S12AAYP
F13	P1M2	Merlin Gerin NPJF36000S12AAYP

Table 3.35

3.3.15 Motor Insulation

For motor cable lengths ≤ the maximum cable length listed in the General Specifications tables, *5.1.1 Cable Lengths and Cross–sections*, the following motor insulation ratings are recommended because the peak voltage can be up to twice the DC link voltage, 2.8 times the AC line voltage, due to transmission line effects in the motor cable. If a motor has lower insulation rating, it is recommended to use a dU/dt or sine-wave filter.

Nominal AC Line Voltage [V]	Motor Insulation [V]
$U_N \leq 420$	Standard $U_{LL} = 1300$
$420 < U_N \leq 500$	Reinforced $U_{LL} = 1600$
$500 < U_N \leq 600$	Reinforced $U_{LL} = 1800$
$600 < U_N \leq 690$	Reinforced $U_{LL} = 2000$

Table 3.36

3.3.16 Motor Bearing Currents

All motors installed with FC 302 125 hp [250 kW] or higher power drives should have NDE (Non-Drive End) insulated bearings installed to eliminate circulating bearing currents. To minimize DE (Drive End) bearing and shaft currents proper grounding of the adjustable frequency drive, motor, driven machine, and motor to the driven machine is required.

Standard Mitigation Strategies:

1. Use an insulated bearing
2. Apply rigorous installation procedures
   - Ensure the motor and load motor are aligned
   - Strictly follow the EMC Installation guideline
   - Reinforce the PE so the high frequency impedance is lower in the PE than the input power leads.
   - Provide a good high frequency connection between the motor and the adjustable frequency drive for instance by shielded cable which has a 360° connection in the motor and the adjustable frequency drive
   - Make sure that the impedance from adjustable frequency drive to building ground is lower that the grounding impedance of the machine. This can be difficult for pumps.
   - Make a direct ground connection between the motor and load motor.
3. Lower the IGBT switching frequency
4. Modify the inverter waveform, 60° AVM vs. SFAVM
5. Install a shaft grounding system or use an isolating coupling.
6. Apply conductive lubrication
7. Use minimum speed settings, if possible.
8. Try to ensure the line voltage is balanced to ground. This can be difficult for IT, TT, TN-CS or Grounded leg systems
9. Use a dU/dt or sinus filter

3.3.17 Brake Resistor Temperature Switch

Torque: 0.5–0.6 Nm (5 in-lbs)
Screw size: M3

This input can be used to monitor the temperature of an externally connected brake resistor. If the input between 104 and 106 is established, the adjustable frequency drive will trip on warning/alarm 27, “Brake IGBT”. If the connection is closed between 104 and 105, the adjustable frequency drive will trip on warning/alarm 27, “Brake IGBT”. A KLIXON switch must be installed that is 'normally closed'. If this function is not used, 106 and 104 must be short-circuited together.
Normally closed: 104-106 (factory installed jumper)
Normally open: 104-105

Terminal No.	Function
106, 104, 105	Brake resistor temperature switch.

Table 3.37

If the temperature of the brake resistor gets too high and the thermal switch drops out, the adjustable frequency drive will stop braking. The motor will start coasting.

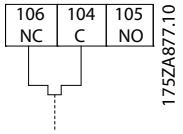


Figure 3.35

3

3.3.18 Control Cable Routing

Tie down all control wires to the designated control cable routing as shown in the picture. Remember to connect the shields in a proper way to ensure optimum electrical immunity.

Serial communication bus connection
Connections are made to the relevant options on the control card. For details, see the relevant serial communication bus instructions. The cable must be placed in the provided path inside the adjustable frequency drive and tied down together with other control wires.

Installation of 24 V external DC Supply
Torque: 0.5–0.6 Nm (5 in-lbs)
Screw size: M3

No.	Function
35 (-), 36 (+)	24 V external DC supply

Table 3.38

24 V DC external supply can be used as low-voltage supply to the control card and any option cards installed. This enables full operation of the LCP (including parameter setting) without connection to line power. A warning of low voltage is given when 24 V DC has been connected; however, there is no tripping.

⚠WARNING

Use a 24 V DC supply of type PELV to ensure correct galvanic isolation (type PELV) on the control terminals of the adjustable frequency drive.

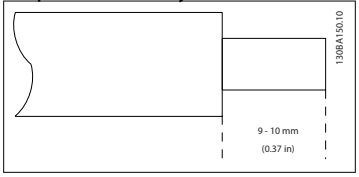
3.3.19 Access to Control Terminals

All terminals to the control cables are located beneath the LCP. They are accessed by opening the door of the IP21/ 54 version or removing the covers of the IP00 version.

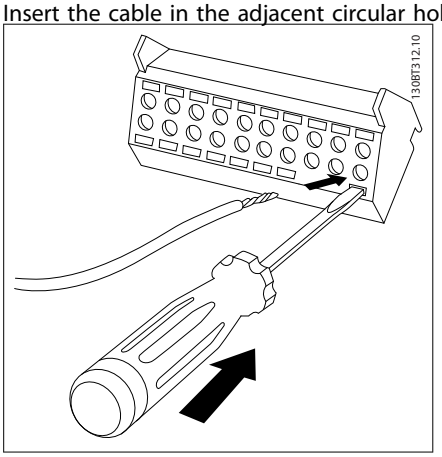
3.3.20 Electrical Installation, Control Terminals

To connect the cable to the terminal:

1. Strip insulation by about 0.3–0.4 in [9–10 mm].



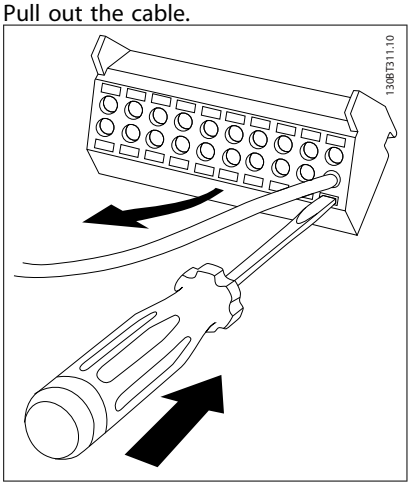
2. Insert a screwdriver[1)] in the square hole.
3. Insert the cable in the adjacent circular hole.



4. Remove the screwdriver. The cable is now mounted in the terminal.

To remove the cable from the terminal:

1. Insert a screwdriver[1)] in the square hole.
2. Pull out the cable.



[1)] Max. 0.015 x 0.1 in [0.4 x 2.5 mm]

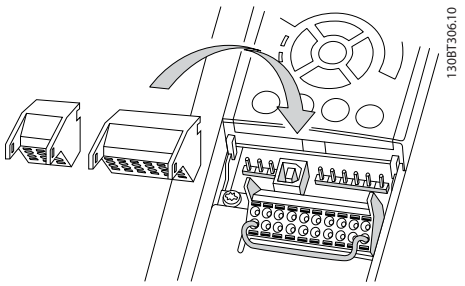
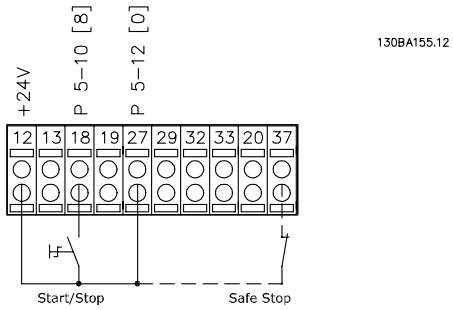


Figure 3.36

3.4 Connection Examples

3.4.1 Start/Stop

Terminal 18 = *5-10 Terminal 18 Digital Input* [8] *Start*
Terminal 27 = *5-12 Terminal 27 Digital Input* [0] *No operation* (Default *coast inverse*)
Terminal 37 = Safe stop



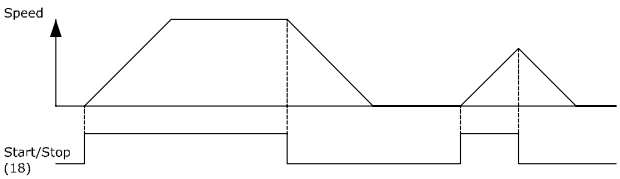
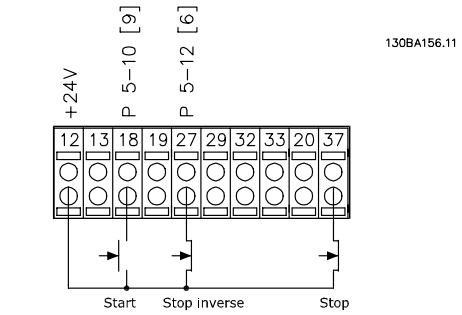


Figure 3.37

3.4.2 Pulse Start/Stop

Terminal 18 = *5-10 Terminal 18 Digital Input* [9] *Latched start*
Terminal 27= *5-12 Terminal 27 Digital Input* [6] *Stop inverse*
Terminal 37 = Safe stop



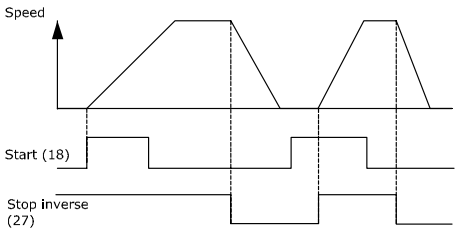


Figure 3.38

3.4.3 Speed Up/Down

Terminals 29/32 = Speed up/down

Terminal 18 = *5-10 Terminal 18 Digital Input* Start [9] (default)

Terminal 27 = *5-12 Terminal 27 Digital Input* Freeze reference [19]

Terminal 29 = *5-13 Terminal 29 Digital Input* Speed up [21]

Terminal 32 = *5-14 Terminal 32 Digital Input* Slow [22]

NOTE!

Terminal 29 only in FC x02 (x=series type).

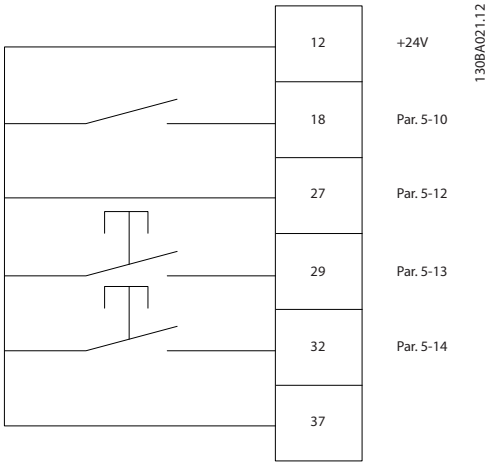


Figure 3.39

3.4.4 Potentiometer Reference

Voltage reference via a potentiometer

Reference Source 1 = [1] *Analog input 53* (default)

Terminal 53, Low Voltage = 0 V

Terminal 53, High Voltage = 10 V

Terminal 53, Low Ref./Feedback = 0 RPM

Terminal 53, High Ref./Feedback = 1500 RPM

Switch S201 = OFF (U)

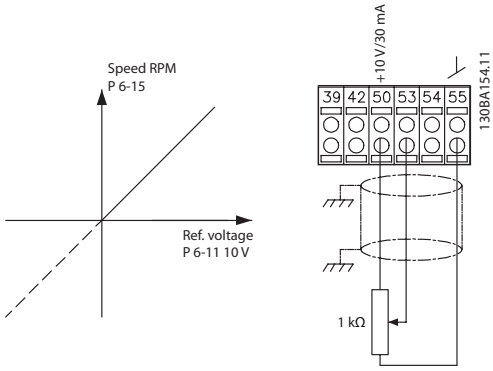


Figure 3.40

3.5.1 Electrical Installation, Control Cables

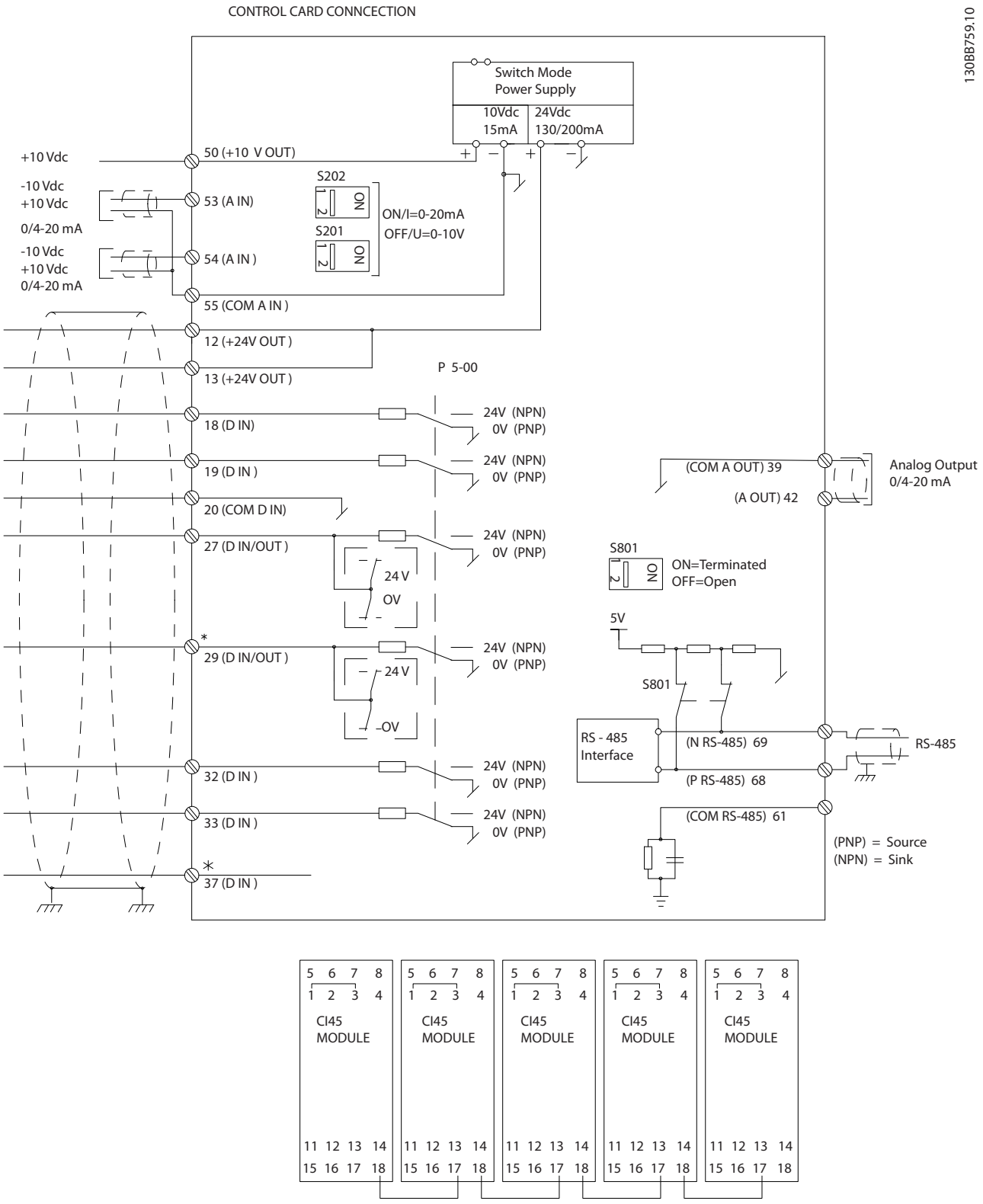


Figure 3.41

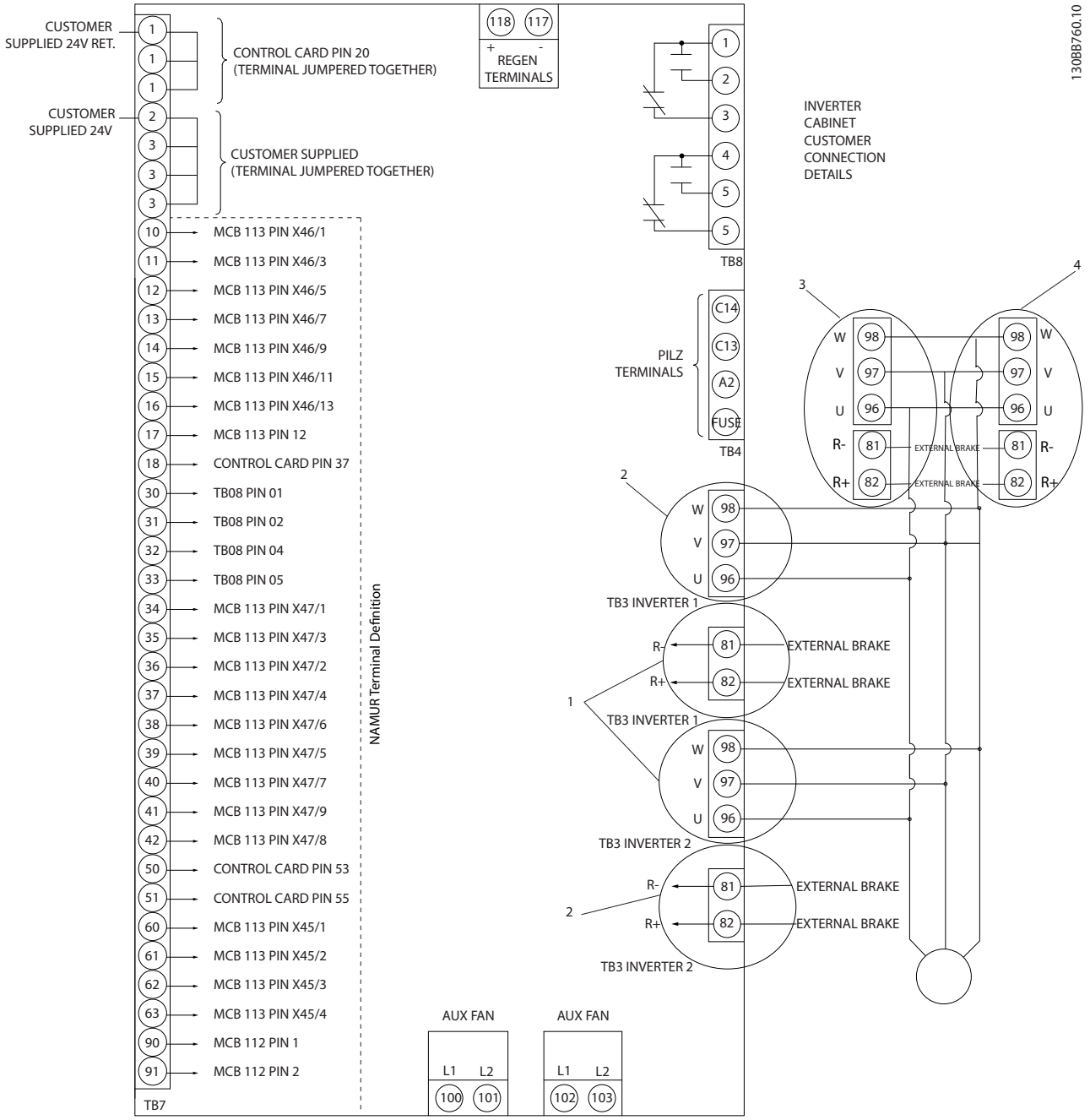


Figure 3.42 Diagram showing all electrical terminals with NAMUR option shown in dotted line box.

Terminal 37 is the input to be used for Safe Stop. For instructions on Safe Stop installation, please refer to the section *Safe Stop Installation* in the Design Guide. See also sections Safe Stop and Safe Stop Installation.

1) F8/F9 = (1) set of terminals.

2) F10/F11 = (2) sets of terminals.

3) F12/F13 = (3) sets of terminals.

4) F14 = (4) sets of terminals.

In rare cases, very long control cables and analog signals may, depending on installation, result in 50/60 Hz ground loops due to noise from line power supply cables.

If this occurs, it may be necessary to break the shield or insert a 100 nF capacitor between shield and chassis.

The digital and analog inputs and outputs must be connected separately to the adjustable frequency drive common inputs (terminal 20, 55, 39) to avoid ground currents from both groups to affect other groups. For example, switching on the digital input may disturb the analog input signal.

Input polarity of control terminals

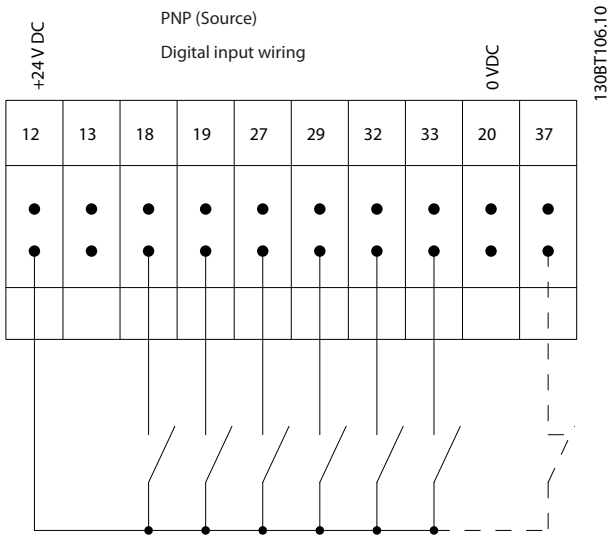


Figure 3.43

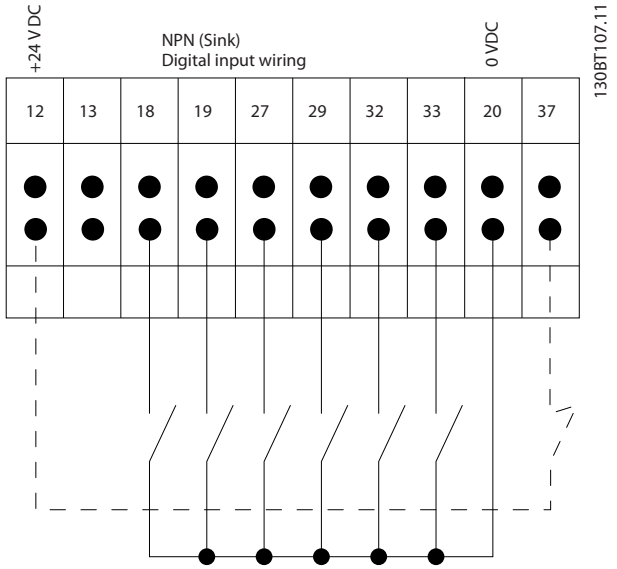


Figure 3.44

NOTE!

Control cables must be shielded/armored.

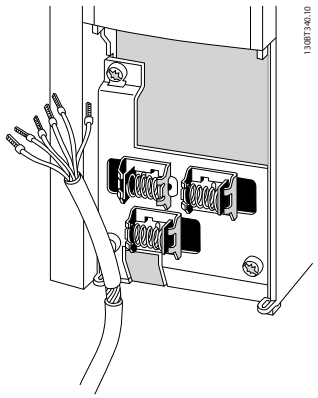


Figure 3.45

Connect the wires as described in the *VLT® AutomationDrive FC 300 Instruction Manual, MG33AXYY*. Remember to connect the shields in a proper way to ensure optimum electrical immunity.

3

3.5.2 Switches S201, S202 and S801

Switches S201 (A53) and S202 (A54) are used to select a current (0-20mA) or a voltage (-10 to 10V) configuration of the analog input terminals 53 and 54 respectively.

Switch S801 (BUS TER.) can be used to enable termination on the RS-485 port (terminals 68 and 69).

See drawing *Diagram showing all electrical terminals* in section *Electrical Installation.*

Default setting:

S201 (A53) = OFF (voltage input)

S202 (A54) = OFF (voltage input)

S801 (Bus termination) = OFF

NOTE!

When changing the function of S201, S202 or S801, be careful not to force the switch over. It is recommended to remove the LCP fixture (cradle) when operating the switches. The switches must not be operated while the adjustable frequency drive is powered.

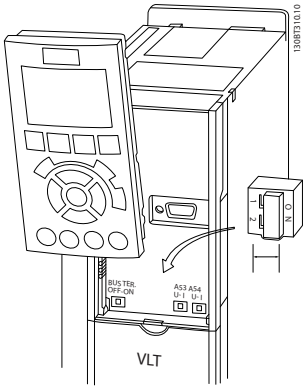


Figure 3.46

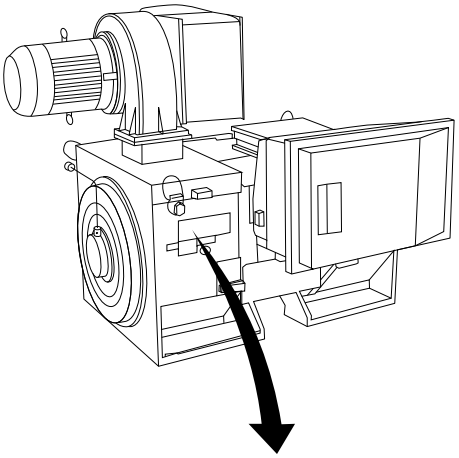
3.6 Final Set Up and Test

To test the set-up and ensure that the adjustable frequency drive is running, follow these steps.

Step 1. Locate the motor nameplate

NOTE!

The motor is either star- (Y) or delta-connected (Δ). This information is located on the motor nameplate data.



THREE PHASE INDUCTION MOTOR						
MOD MCV 315E	Nr. 135189 12 04				IL/IN 6.5	
kW 400	PRIMARY				SF 1.15	
HP 536	V 690	A 410.6	CONN Y		COS f 0.85	40
mm 1481	V	A	CONN		AMB 40	°C
Hz 50	V	A	CONN		ALT 1000	m
DESIGNN	SECONDARY				RISE 80	°C
DUTY S1	V	A	CONN		ENCLOSURE IP23	
INSUL I	EFFICIENCY %	95.8%	100%	95.8%	75%	WEIGHT 1.83 ton
⚠ CAUTION						

Figure 3.47

Step 2. Enter the motor nameplate data in this parameter list.

To access this list, first press the [QUICK MENU] key, then select "Q2 Quick Set-up".

1.	*1-20 Motor Power [kW]* *1-21 Motor Power [HP]*
2.	*1-22 Motor Voltage*
3.	*1-23 Motor Frequency*
4.	*1-24 Motor Current*
5.	*1-25 Motor Nominal Speed*

Table 3.39

Step 3. Activate the Automatic Motor Adaptation (AMA)

Performing an AMA will ensure optimum performance. The AMA measures the values from the motor model equivalent diagram.

1. Connect terminal 37 to terminal 12 (if terminal 37 is available).
2. Connect terminal 27 to terminal 12 or set *5-12 Terminal 27 Digital Input* to 'No function' (*5-12 Terminal 27 Digital Input* [0])
3. Activate the AMA *1-29 Automatic Motor Adaptation (AMA)*.

4. Choose between complete or reduced AMA. If a sine-wave filter is mounted, run only the reduced AMA, or remove the sine-wave filter during the AMA procedure.
5. Press the [OK] key. The display shows “Press [Hand on] to start”.
6. Press the [Hand on] key. A progress bar indicates if the AMA is in progress.

Stop the AMA during operation

1. Press the [OFF] key. The adjustable frequency drive enters into alarm mode and the display shows that the AMA was terminated by the user.

Successful AMA

1. The display shows “Press [OK] to finish AMA”.
2. Press the [OK] key to exit the AMA state.

Unsuccessful AMA

1. The adjustable frequency drive enters into alarm mode. A description of the alarm can be found in the *Warnings and Alarms* chapter.
2. "Report Value” in the [Alarm Log] shows the last measuring sequence carried out by the AMA before the adjustable frequency drive entered alarm mode. This number along with the description of the alarm will assist you in trouble-shooting. If you contact Danfoss for service, make sure to mention the number and alarm description.

NOTE!

Unsuccessful AMA is often caused by incorrectly registered motor nameplate data or a difference that is too large between the motor power size and the adjustable frequency drive power size.

Step 4. Set speed limit and ramp time

3-02 Minimum Reference

3-03 Maximum Reference

Set up the desired limits for speed and ramp time

4-11 Motor Speed Low Limit [RPM] or *4-12 Motor Speed Low Limit [Hz]*

4-13 Motor Speed High Limit [RPM] or *4-14 Motor Speed High Limit [Hz]*

3-41 Ramp 1 Ramp-up Time

3-42 Ramp 1 Ramp-down Time

3.7 Additional Connections

3.7.1 Mechanical Brake Control

In hoisting/lowering applications, it is necessary to be able to control an electro-mechanical brake:

- Control the brake using any relay output or digital output (terminal 27 or 29).
- Keep the output closed (voltage-free) as long as the adjustable frequency drive is unable to ‘support’ the motor, such as when the load is too heavy, for example.
- Select *Mechanical brake control* [32] in parameter group 5-4* for applications with an electro-mechanical brake.
- The brake is released when the motor current exceeds the preset value in *2-20 Release Brake Current*.
- The brake is engaged when the output frequency is less than the frequency set in *2-21 Activate Brake Speed [RPM]*or *2-22 Activate Brake Speed [Hz]*, and only if the adjustable frequency drive carries out a stop command.

If the adjustable frequency drive is in alarm mode or in an overvoltage situation, the mechanical brake immediately cuts in.

3

3.7.2 Parallel Connection of Motors

The adjustable frequency drive can control several motors connected in parallel. The total current consumption of the motors must not exceed the rated output current $I_{M,N}$ for the adjustable frequency drive.

NOTE!

Installations with cables connected in a common joint as in *Figure 3.48*, is only recommended for short cable lengths.

NOTE!

When motors are connected in parallel, *1-29 Automatic Motor Adaptation (AMA)* cannot be used.

NOTE!

The electronic thermal relay (ETR) of the adjustable frequency drive cannot be used as motor protection for the individual motor of systems with motors connected in parallel. Provide further motor protection with, for example, thermistors in each motor or individual thermal relays (circuit breakers are not suitable for protection).

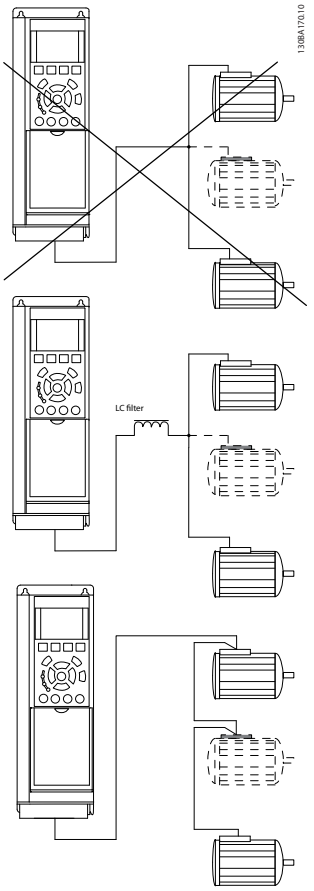


Figure 3.48

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

3.7.3 Motor Thermal Protection

The electronic thermal relay in the adjustable frequency drive has received UL-approval for single motor protection, when *1-90 Motor Thermal Protection*is set for *ETR Trip* and *1-24 Motor Current* is set to the rated motor current (see motor nameplate).
For thermal motor protection, it is also possible to use the MCB 112 PTC thermistor card option. This card provides an ATEX certificate to protect motors in explosion hazard areas, Zone 1/21 and Zone 2/22. When *1-90 Motor Thermal Protection* is set to [20] ATEX ETR is combined with the use of MCB 112, it is possible to control an Ex-e motor in explosion hazardous areas. Consult the programming guide for details on how to set up the drive for safe operation of Ex-e motors.

4 How to Program

4.1.1 How to Program on the Graphical LCP

The following instructions are valid for the graphical LCP(LCP 102)

The control panel is divided into four functional groups.

1. Graphical display with Status lines.
2. Menu keys and LEDs - changing parameters and switching between display functions.
3. Navigation keys and LEDs (LEDs).
4. Operation keys and LEDs.

All data is displayed in a graphical LCP display, which can show up to five items of operating data while displaying [Status].

Display lines

a. **Status line:** Status messages displaying icons and graphic.

b. **Line 1-2:** Operator data lines displaying data defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.

c. **Status line:** Status messages displaying text.

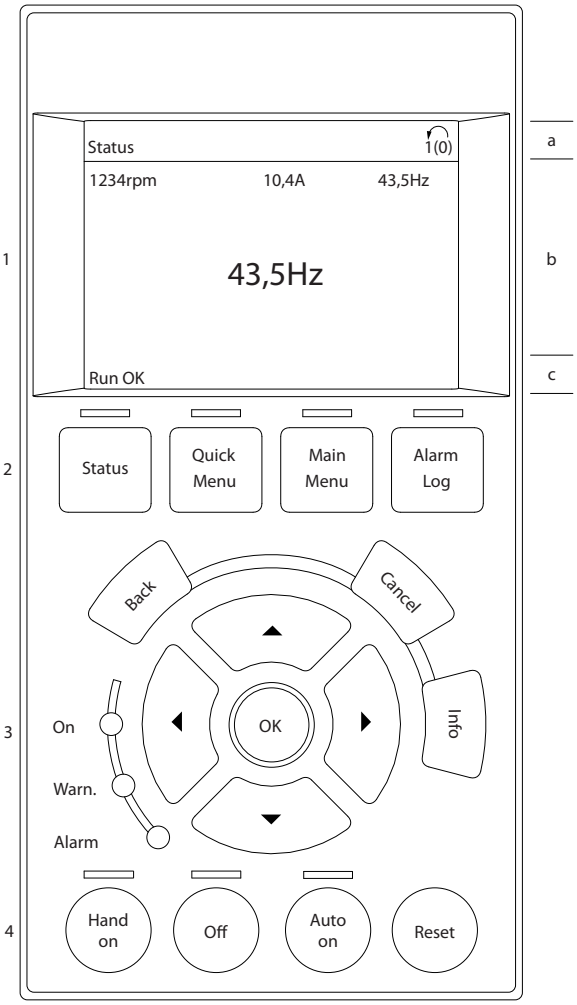


Figure 4.1

4.1.2 Initial Commissioning

The easiest way of carrying out the initial commissioning is by using the [Quick Menu] key and following the quick set-up procedure using LCP 102 (read table from left to right). The example applies to open-loop applications.

4

Press				
Quick Menu	↓	Q2 Quick Menu	OK	↓
0-01 Language	OK	Set language	↓	
1-20 Motor Power [kW]	OK	Set motor nameplate power	↓	
1-22 Motor Voltage	OK	Set nameplate voltage	↓	
1-23 Motor Frequency	OK	Set nameplate frequency	↓	
1-24 Motor Current	OK	Set nameplate current	↓	
1-25 Motor Nominal Speed	OK	Set nameplate speed in RPM	↓	
5-12 Terminal 27 Digital Input	OK	If terminal default is *Coast inverse,* it is possible to change this setting to *No function*. No connection to terminal 27 is then needed for running AMA	↓	
1-29 Automatic Motor Adaptation (AMA)	OK	Set desired AMA function. Enabling complete AMA is recommended	↓	
3-02 Minimum Reference	OK	Set the minimum speed of the motor shaft	↓	
3-03 Maximum Reference	OK	Set the maximum speed of the motor shaft	↓	
3-41 Ramp 1 Ramp-up Time	OK	Set the ramping-up time with reference to synchronous motor speed, ns.	↓ ↓	
3-42 Ramp 1 Ramp-down Time	OK	Set the ramping-down time with reference to synchronous motor speed, ns.	↓	
3-13 Reference Site	OK	Set the site from where the reference must work	↓	

Table 4.1

4.2 Quick Set-up

0-01 Language		
Option:		**Function:**
		Defines the language to be used in the display. The adjustable frequency drive can be delivered with 4 different language packages. English and German are included in all packages. English cannot be erased or manipulated.
[0]	English	Part of Language packages 1 - 4
[1]	Deutsch	Part of Language packages 1 - 4
[2]	Francais	Part of Language package 1
[3]	Dansk	Part of Language package 1
[4]	Spanish	Part of Language package 1
[5]	Italiano	Part of Language package 1
	Svenska	Part of Language package 1
[7]	Nederlands	Part of Language package 1
[10]	Chinese	Part of Language package 2
	Suomi	Part of Language package 1
[22]	English US	Part of Language package 4
	Greek	Part of Language package 4
	Bras.port	Part of Language package 4
	Slovenian	Part of Language package 3
	Korean	Part of Language package 2
	Japanese	Part of Language package 2
	Turkish	Part of Language package 4
	Trad.Chinese	Part of Language package 2
	Bulgarian	Part of Language package 3
	Srpski	Part of Language package 3
	Romanian	Part of Language package 3
	Magyar	Part of Language package 3
	Czech	Part of Language package 3
	Polski	Part of Language package 4
	Russian	Part of Language package 3
	Thai	Part of Language package 2
	Bahasa Indonesia	Part of Language package 2
[52]	Hrvatski	

1-20 Motor Power [kW]		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. This parameter is visible in LCP if *0-03 Regional Settings* is *International* [0]. **NOTE! Four sizes down, one size up from nominal unit rating.**

1-22 Motor Voltage		
Range:		**Function:**
Size related*	[10. - 1000. V]	Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running.

1-23 Motor Frequency		
Range:		**Function:**
Application dependent*	[20 - 1000 Hz]	Min - Max motor frequency: 20–1,000 Hz. Select the motor frequency value from the motor nameplate data. If a value different from 50 Hz or 60 Hz is selected, it is necessary to adapt the load independent settings in *1-50 Motor Magnetization at Zero Speed* to *1-53 Model Shift Frequency*. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt *4-13 Motor Speed High Limit [RPM]* and *3-03 Maximum Reference* to the 87 Hz application.

1-24 Motor Current		
Range:		**Function:**
Size related*	[0.10 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. This data is used for calculating motor torque, motor thermal protection, etc.

4

NOTE!

This parameter cannot be changed while the motor is running.

1-25 Motor Nominal Speed

Range:		Function:
Size related*	[100 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. This data is used for calculating automatic motor compensations.

NOTE!

This parameter cannot be changed while the motor is running.

5-12 Terminal 27 Digital Input

Option: Function:

Select the function from the available digital input range.

No operation	[0]
Reset	[1]
Coast inverse	[2]
Coast and reset inverse	[3]
Quick stop inverse	[4]
DC brake inverse	[5]
Stop inverse	[6]
Start	[8]
Latched start	[9]
Reversing	[10]
Start reversing	[11]
Enable start forward	[12]
Enable start reverse	[13]
Jog	[14]
Preset ref bit 0	[16]
Preset ref bit 1	[17]
Preset ref bit 2	[18]
Freeze reference	[19]
Freeze output	[20]
Speed up	[21]
Slow	[22]
Set-up select bit 0	[23]
Set-up select bit 1	[24]
Catch up	[28]
Slow-down	[29]
Pulse input	[32]
Ramp bit 0	[34]
Ramp bit 1	[35]
Line failure inverse	[36]

5-12 Terminal 27 Digital Input

Option: Function:

DigiPot Increase	[55]
DigiPot Decrease	[56]
DigiPot Clear	[57]
Reset Counter A	[62]
Reset Counter B	[65]

Table 4.2

1-29 Automatic Motor Adaptation (AMA)

Option:		Function:
		The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (par. 1-30 to par. 1-35) during motor standstill. Activate the AMA function by pressing [Hand on] after selecting *[1] Enable complete AMA* or *[2] Enable reduced AMA*. See also the section *Automatic Motor Adaptation*. After a normal sequence, the display will read: "Press [OK] to finish AMA". After pressing [OK], the adjustable frequency drive is ready for operation. This parameter cannot be adjusted while the motor is running.
[0] *	OFF	
[1]	Enable complete AMA	Performs AMA of the stator resistance R_S, the rotor resistance R_r, the stator leakage reactance X_1, the rotor leakage reactance X_2 and the main reactance X_h . **FC 301:** The complete AMA does not include X_h measurement for FC 301. Instead, the X_h value is determined from the motor database. *1-35 Main Reactance (Xh)* may be adjusted to obtain optimal start performance.
[2]	Enable reduced AMA	Performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the adjustable frequency drive and the motor.

Note:

- For the best adaptation of the adjustable frequency drive, run the AMA on a cold motor.
- AMA cannot be performed while the motor is running.
- AMA cannot be performed on permanent magnet motors.

It is important to set motor parameter group 1-2* correctly, since these form part of the AMA algorithm. An AMA must be performed to achieve optimum dynamic motor performance. It may take up to 10 min, depending on the power rating of the motor.

Avoid generating external torque during AMA.

If one of the settings in parameter group 1-2* is changed, par. 1-30 to par. 1-39 in the advanced motor parameters will return to the default setting.

3-02 Minimum Reference		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. Minimum Reference is active only when *3-00 Reference Range* is set to *Min.- Max.* [0]. The minimum reference unit matches: • The choice of configuration in *1-00 Configuration Mode Configuration Mode*: for *Speed closed-loop* [1], RPM; for *Torque* [2], Nm. • The unit selected in *3-01 Reference/Feedback Unit*.

3-03 Maximum Reference		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the maximum reference. The maximum reference is the highest value obtainable by adding all references together. **The Maximum Reference unit matches:** • The choice of configuration in *1-00 Configuration Mode*: for *[1] Speed closed-loop*, RPM; for *[2] Torque*, Nm. • The unit selected in *3-00 Reference Range*.

3-41 Ramp 1 Ramp-up Time		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the ramp-up time, i.e., the acceleration time from 0RPM to the synchronous motor speed n_S. Choose a ramp-up time such that the output current does not exceed the current limit in *4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See ramp-down time in *3-42 Ramp 1 Ramp-down Time*. $Par.\ 3-41 = \frac{t_{acc}[s] \times n_s[RPM]}{ref[RPM]}$

3-42 Ramp 1 Ramp-down Time		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the ramp-down time, i.e., the deceleration time from the synchronous motor speed n_s to 0 RPM. Choose a ramp-down time such that no overvoltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in *4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *3-41 Ramp 1 Ramp-up Time*. $Par.\ 3-42 = \frac{t_{dec}[s] \times n_s[RPM]}{ref[RPM]}$

4.3 Parameter Lists

Changes during operation
"TRUE" means that the parameter can be changed while the adjustable frequency drive is in operation and "FALSE" means that it must be stopped before a change can be made.

4-Set-up
'All set-up': the parameters can be set individually in each of the four set-ups, i.e., one single parameter can have four different data values.
'1 set-up': the data value will be the same in all set-ups.

Conversion index
This number refers to a conversion figure used when writing or reading to and from the adjustable frequency drive.

Conv. index	100	67	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6
Conv. factor	1	1/60	1,000,000	100,000	10,000	1,000	100	10	1	0.1	0.01	0.001	0.0001	0.00001	0.000001

Table 4.3

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 Boolean variables	V2
54	Time difference w/o date	TimD

Table 4.4

See the *VLT® AutomationDrive FC 300 Design Guide, MG33BXYY* for further information about data types 33, 35 and 54.

4.3.1 Parameter Selection

Parameters for the adjustable frequency drive are grouped into various parameter groups for easy selection of the correct parameters for optimized operation of the adjustable frequency drive.

0-** Operation and display parameters for basic adjustable frequency drive settings

1-** Load and motor parameters, includes all load and motor related parameters

2-** Brake parameters

3-** References and ramping parameters, includes DigiPot function

4-** Limits/warnings, setting of limits and warning parameters

5-** Digital inputs and outputs, includes relay controls

6-** Analog inputs and outputs

7-** Controls, setting parameters for speed and process controls

8-** Communication and option parameters, setting of Adjustable Frequency Drive RS485 and Adjustable Frequency Drive USB port parameters.

9-** Profibus parameters

10-** DeviceNet and CAN Serial communication bus parameters

12-** Ethernet parameters

13-** Smart Logic Control parameters

14-** Special function parameters

15-** Drive information parameters

16-** Readout parameters

17-** Encoder Option parameters

18-** Data Readouts 2

30-** Special Features

32-** MCO 305 Basic parameters

33-** MCO 305 Advanced parameters

34-** MCO Data Readout parameters

35-** Sensor Input Option

4.3.2 0-** Operation/Display

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
0-0* Basic Settings							
0-01	Language	[0] English	1 set-up		TRUE	-	Uint8
0-02	Motor Speed Unit	[0] RPM	2 set-ups		FALSE	-	Uint8
0-03	Regional Settings	[0] International	2 set-ups		FALSE	-	Uint8
0-04	Operating State at Power-up (Hand)	[1] Forced stop, ref=old	All set-ups		TRUE	-	Uint8
0-09	Performance Monitor	0.0 %	All set-ups		TRUE	-1	Uint16
0-1* Set-up Operations							
0-10	Active Set-up	[1] Set-up 1	1 set-up		TRUE	-	Uint8
0-11	Edit Set-up	[1] Set-up 1	All set-ups		TRUE	-	Uint8
0-12	This Set-up Linked to	[0] Not linked	All set-ups		FALSE	-	Uint8
0-13	Readout: Linked Set-ups	0 N/A	All set-ups		FALSE	0	Uint16
0-14	Readout: Edit Set-ups / Channel	0 N/A	All set-ups		TRUE	0	Int32
0-15	Readout: actual setup	0 N/A	All set-ups		FALSE	0	Uint8
0-2* LCP Display							
0-20	Display Line 1.1 Small	1617	All set-ups		TRUE	-	Uint16
0-21	Display Line 1.2 Small	1614	All set-ups		TRUE	-	Uint16
0-22	Display Line 1.3 Small	1610	All set-ups		TRUE	-	Uint16
0-23	Display Line 2 Large	1613	All set-ups		TRUE	-	Uint16
0-24	Display Line 3 Large	1602	All set-ups		TRUE	-	Uint16
0-25	My Personal Menu	ExpressionLimit	1 set-up		TRUE	0	Uint16
0-3* LCP Cust. Readout							
0-30	Unit for User-defined Readout	[0] None	All set-ups		TRUE	-	Uint8
0-31	Min Value of User-defined Readout	0.00 CustomReadoutUnit	All set-ups		TRUE	-2	Int32
0-32	Max Value of User-defined Readout	100.00 CustomReadoutUnit	All set-ups		TRUE	-2	Int32
0-37	Display Text 1	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-4* LCP Keypad							
0-40	[Hand on] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-41	[Off] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-42	[Auto on] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-43	[Reset] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-44	[Off/Reset] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-45	[Drive Bypass] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-5* Copy/Save							
0-50	LCP Copy	[0] No copy	All set-ups		FALSE	-	Uint8
0-51	Set-up Copy	[0] No copy	All set-ups		FALSE	-	Uint8
0-6* Password							
0-60	Main Menu Password	100 N/A	1 set-up		TRUE	0	Int16
0-61	Access to Main Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8
0-65	Quick Menu Password	200 N/A	1 set-up		TRUE	0	Int16
0-66	Access to Quick Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8
0-67	Bus Password Access	0 N/A	All set-ups		TRUE	0	Uint16

Table 4.5

4.3.3 1-** Load/Motor

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
1-0* General Settings							
1-00	Configuration Mode	null	All set-ups		TRUE	-	Uint8
1-01	Motor Control Principle	null	All set-ups		FALSE	-	Uint8
1-02	Flux Motor Feedback Source	[1] 24V encoder	All set-ups	x	FALSE	-	Uint8
1-03	Torque Characteristics	[0] Constant torque	All set-ups		TRUE	-	Uint8
1-04	Overload Mode	[0] High torque	All set-ups		FALSE	-	Uint8
1-05	Local Mode Configuration	[2] As mode par 1-00	All set-ups		TRUE	-	Uint8
1-06	Clockwise Direction	[0] Normal	All set-ups		FALSE	-	Uint8
1-1* Motor Selection							
1-10	Motor Construction	[0] Asynchron	All set-ups		FALSE	-	Uint8
1-2* Motor Data							
1-20	Motor Power [kW]	ExpressionLimit	All set-ups		FALSE	1	Uint32
1-21	Motor Power [HP]	ExpressionLimit	All set-ups		FALSE	-2	Uint32
1-22	Motor Voltage	ExpressionLimit	All set-ups		FALSE	0	Uint16
1-23	Motor Frequency	ExpressionLimit	All set-ups		FALSE	0	Uint16
1-24	Motor Current	ExpressionLimit	All set-ups		FALSE	-2	Uint32
1-25	Motor Nominal Speed	ExpressionLimit	All set-ups		FALSE	67	Uint16
1-26	Motor Cont. Rated Torque	ExpressionLimit	All set-ups		FALSE	-1	Uint32
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All set-ups		FALSE	-	Uint8
1-3* Addl. Motor Data							
1-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups		FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups		FALSE	-4	Uint32
1-33	Stator Leakage Reactance (X1)	ExpressionLimit	All set-ups		FALSE	-4	Uint32
1-34	Rotor Leakage Reactance (X2)	ExpressionLimit	All set-ups		FALSE	-4	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All set-ups		FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All set-ups		FALSE	-3	Uint32
1-37	d-axis Inductance (Ld)	ExpressionLimit	All set-ups	x	FALSE	-4	Int32
1-39	Motor Poles	ExpressionLimit	All set-ups		FALSE	0	Uint8
1-40	Back EMF at 1000 RPM	ExpressionLimit	All set-ups	x	FALSE	0	Uint16
1-41	Motor Angle Offset	0 N/A	All set-ups		FALSE	0	Int16
1-5* Load-Indep. Setting							
1-50	Motor Magnetization at Zero Speed	100 %	All set-ups		TRUE	0	Uint16
1-51	Min Speed Normal Magnetizing [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
1-52	Min Speed Normal Magnetizing [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
1-53	Model Shift Frequency	ExpressionLimit	All set-ups	x	FALSE	-1	Uint16
1-54	Voltage reduction in fieldweakening	0 V	All set-ups		FALSE	0	Uint8
1-55	U/f Characteristic - U	ExpressionLimit	All set-ups		TRUE	-1	Uint16
1-56	U/f Characteristic - F	ExpressionLimit	All set-ups		TRUE	-1	Uint16
1-58	Flystart Test Pulses Current	30 %	All set-ups		FALSE	0	Uint16
1-59	Flystart Test Pulses Frequency	200 %	All set-ups		FALSE	0	Uint16
1-6* Load-Depend. Settg.							
1-60	Low Speed Load Compensation	100 %	All set-ups		TRUE	0	Int16
1-61	High Speed Load Compensation	100 %	All set-ups		TRUE	0	Int16
1-62	Slip Compensation	ExpressionLimit	All set-ups		TRUE	0	Int16
1-63	Slip Compensation Time Constant	ExpressionLimit	All set-ups		TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All set-ups		TRUE	0	Uint16

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Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
1-65	Resonance Dampening Time Constant	5 ms	All set-ups		TRUE	-3	Uint8
1-66	Min. Current at Low Speed	100 %	All set-ups	x	TRUE	0	Uint32
1-67	Load Type	[0] Passive load	All set-ups	x	TRUE	-	Uint8
1-68	Minimum Inertia	ExpressionLimit	All set-ups	x	FALSE	-4	Uint32
1-69	Maximum Inertia	ExpressionLimit	All set-ups	x	FALSE	-4	Uint32
1-7* Start Adjustments							
1-71	Start Delay	0.0 s	All set-ups		TRUE	-1	Uint8
1-72	Start Function	[2] Coast/delay time	All set-ups		TRUE	-	Uint8
1-73	Flying Start	null	All set-ups		FALSE	-	Uint8
1-74	Start Speed [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
1-75	Start Speed [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
1-76	Start Current	0.00 A	All set-ups		TRUE	-2	Uint32
1-8* Stop Adjustments							
1-80	Function at Stop	[0] Coast	All set-ups		TRUE	-	Uint8
1-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
1-83	Precise Stop Function	[0] Precise ramp stop	All set-ups		FALSE	-	Uint8
1-84	Precise Stop Counter Value	100000 N/A	All set-ups		TRUE	0	Uint32
1-85	Precise Stop Speed Compensation Delay	10 ms	All set-ups		TRUE	-3	Uint8
1-9* Motor Temperature							
1-90	Motor Thermal Protection	[0] No protection	All set-ups		TRUE	-	Uint8
1-91	Motor External Fan	[0] No	All set-ups		TRUE	-	Uint16
1-93	Thermistor Resource	[0] None	All set-ups		TRUE	-	Uint8
1-94	ATEX ETR cur.lim. speed reduction	0.0 %	2 set-ups	x	TRUE	-1	Uint16
1-95	KTY Sensor Type	[0] KTY Sensor 1	All set-ups	x	TRUE	-	Uint8
1-96	KTY Thermistor Resource	[0] None	All set-ups	x	TRUE	-	Uint8
1-97	KTY Threshold level	80 °C	1 set-up	x	TRUE	100	Int16
1-98	ATEX ETR interpol. points freq.	ExpressionLimit	1 set-up	x	TRUE	-1	Uint16
1-99	ATEX ETR interpol points current	ExpressionLimit	2 set-ups	x	TRUE	0	Uint16

Table 4.6

4.3.4 2-** Brakes

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
2-0* DC Brake							
2-00	DC Hold Current	50 %	All set-ups		TRUE	0	Uint8
2-01	DC Brake Current	50 %	All set-ups		TRUE	0	Uint16
2-02	DC Braking Time	10.0 s	All set-ups		TRUE	-1	Uint16
2-03	DC Brake Cut-in Speed [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
2-04	DC Brake Cut-in Speed [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
2-05	Maximum Reference	MaxReference (P303)	All set-ups		TRUE	-3	Int32
2-1* Brake Energy Funct.							
2-10	Brake Function	null	All set-ups		TRUE	-	Uint8
2-11	Brake Resistor (ohm)	ExpressionLimit	All set-ups		TRUE	0	Uint16
2-12	Brake Power Limit (kW)	ExpressionLimit	All set-ups		TRUE	0	Uint32

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
2-13	Brake Power Monitoring	[0] Off	All set-ups		TRUE	-	Uint8
2-15	Brake Check	[0] Off	All set-ups		TRUE	-	Uint8
2-16	AC brake Max. Current	100.0 %	All set-ups		TRUE	-1	Uint32
2-17	Over-voltage Control	[0] Disabled	All set-ups		TRUE	-	Uint8
2-18	Brake Check Condition	[0] At Power-up	All set-ups		TRUE	-	Uint8
2-19	Over-voltage Gain	100 %	All set-ups		TRUE	0	Uint16
2-2* Mechanical Brake							
2-20	Release Brake Current	ImaxVLT (P1637)	All set-ups		TRUE	-2	Uint32
2-21	Activate Brake Speed [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
2-22	Activate Brake Speed [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
2-23	Activate Brake Delay	0.0 s	All set-ups		TRUE	-1	Uint8
2-24	Stop Delay	0.0 s	All set-ups		TRUE	-1	Uint8
2-25	Brake Release Time	0.20 s	All set-ups		TRUE	-2	Uint16
2-26	Torque Ref	0.00 %	All set-ups		TRUE	-2	Int16
2-27	Torque Ramp Time	0.2 s	All set-ups		TRUE	-1	Uint8
2-28	Gain Boost Factor	1.00 N/A	All set-ups		TRUE	-2	Uint16

Table 4.7

4.3.5 3-** Reference / Ramps

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
3-0* Reference Limits							
3-00	Reference Range	null	All set-ups		TRUE	-	Uint8
3-01	Reference/Feedback Unit	null	All set-ups		TRUE	-	Uint8
3-02	Minimum Reference	ExpressionLimit	All set-ups		TRUE	-3	Int32
3-03	Maximum Reference	ExpressionLimit	All set-ups		TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All set-ups		TRUE	-	Uint8
3-1* References							
3-10	Preset Reference	0.00 %	All set-ups		TRUE	-2	Int16
3-11	Jog Speed [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
3-12	Catch up/slow-down Value	0.00 %	All set-ups		TRUE	-2	Int16
3-13	Reference Site	[0] Linked to Hand / Auto	All set-ups		TRUE	-	Uint8
3-14	Preset Relative Reference	0.00 %	All set-ups		TRUE	-2	Int32
3-15	Reference Resource 1	null	All set-ups		TRUE	-	Uint8
3-16	Reference Resource 2	null	All set-ups		TRUE	-	Uint8
3-17	Reference Resource 3	null	All set-ups		TRUE	-	Uint8
3-18	Relative Scaling Reference Resource	[0] No function	All set-ups		TRUE	-	Uint8
3-19	Jog Speed [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
3-4* Ramp 1							
3-40	Ramp 1 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-41	Ramp 1 Ramp-up Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-42	Ramp 1 Ramp-down Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-45	Ramp 1 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-46	Ramp 1 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-47	Ramp 1 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-48	Ramp 1 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8

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Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
3-5* Ramp 2							
3-50	Ramp 2 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-51	Ramp 2 Ramp-up Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-52	Ramp 2 Ramp-down Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-55	Ramp 2 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-56	Ramp 2 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-57	Ramp 2 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-58	Ramp 2 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-6* Ramp 3							
3-60	Ramp 3 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-61	Ramp 3 Ramp-up Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-62	Ramp 3 Ramp-down Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-65	Ramp 3 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-66	Ramp 3 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-67	Ramp 3 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-68	Ramp 3 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-7* Ramp 4							
3-70	Ramp 4 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-71	Ramp 4 Ramp-up Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-72	Ramp 4 Ramp-down Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-75	Ramp 4 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-76	Ramp 4 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-77	Ramp 4 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-78	Ramp 4 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-8* Other Ramps							
3-80	Jog Ramp Time	ExpressionLimit	All set-ups		TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	ExpressionLimit	2 set-ups		TRUE	-2	Uint32
3-82	Quick Stop Ramp Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-83	Quick Stop S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-84	Quick Stop S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-9* Digital Pot. meter							
3-90	Step Size	0.10 %	All set-ups		TRUE	-2	Uint16
3-91	Ramp Time	1.00 s	All set-ups		TRUE	-2	Uint32
3-92	Power Restore	[0] Off	All set-ups		TRUE	-	Uint8
3-93	Maximum Limit	100 %	All set-ups		TRUE	0	Int16
3-94	Minimum Limit	-100 %	All set-ups		TRUE	0	Int16
3-95	Ramp Delay	ExpressionLimit	All set-ups		TRUE	-3	TimD

Table 4.8

4.3.6 4-** Limits / Warnings

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
4-1* Motor Limits							
4-10	Motor Speed Direction	null	All set-ups		FALSE	-	Uint8
4-11	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
4-12	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	ExpressionLimit	All set-ups		TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100.0 %	All set-ups		TRUE	-1	Uint16
4-18	Current Limit	ExpressionLimit	All set-ups		TRUE	-1	Uint32
4-19	Max Output Frequency	132.0 Hz	All set-ups		FALSE	-1	Uint16
4-2* Limit Factors							
4-20	Torque Limit Factor Source	[0] No function	All set-ups		TRUE	-	Uint8
4-21	Speed Limit Factor Source	[0] No function	All set-ups		TRUE	-	Uint8
4-3* Motor Speed Mon.							
4-30	Motor Feedback Loss Function	[2] Trip	All set-ups		TRUE	-	Uint8
4-31	Motor Feedback Speed Error	300 RPM	All set-ups		TRUE	67	Uint16
4-32	Motor Feedback Loss Timeout	0.05 s	All set-ups		TRUE	-2	Uint16
4-34	Tracking Error Function	null	All set-ups		TRUE	-	Uint8
4-35	Tracking Error	10 RPM	All set-ups		TRUE	67	Uint16
4-36	Tracking Error Timeout	1.00 s	All set-ups		TRUE	-2	Uint16
4-37	Tracking Error Ramping	100 RPM	All set-ups		TRUE	67	Uint16
4-38	Tracking Error Ramping Timeout	1.00 s	All set-ups		TRUE	-2	Uint16
4-39	Tracking Error After Ramping Timeout	5.00 s	All set-ups		TRUE	-2	Uint16
4-5* Adj. Warnings							
4-50	Warning Current Low	0.00 A	All set-ups		TRUE	-2	Uint32
4-51	Warning Current High	ImaxVLT (P1637)	All set-ups		TRUE	-2	Uint32
4-52	Warning Speed Low	0 RPM	All set-ups		TRUE	67	Uint16
4-53	Warning Speed High	outputSpeedHighLimit (P413)	All set-ups		TRUE	67	Uint16
4-54	Warning Reference Low	-999999.999 N/A	All set-ups		TRUE	-3	Int32
4-55	Warning Reference High	999999.999 N/A	All set-ups		TRUE	-3	Int32
4-56	Warning Feedback Low	-999999.999 Reference-FeedbackUnit	All set-ups		TRUE	-3	Int32
4-57	Warning Feedback High	999999.999 Reference-FeedbackUnit	All set-ups		TRUE	-3	Int32
4-58	Missing Motor Phase Function	null	All set-ups		TRUE	-	Uint8
4-6* Speed Bypass							
4-60	Bypass Speed From [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16
4-62	Bypass Speed to [RPM]	ExpressionLimit	All set-ups		TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	ExpressionLimit	All set-ups		TRUE	-1	Uint16

Table 4.9

4.3.7 5-** Digital In/Out

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
5-0* Digital I/O mode							
5-00	Digital I/O Mode	[0] PNP	All set-ups		FALSE	-	Uint8
5-01	Terminal 27 Mode	[0] Input	All set-ups		TRUE	-	Uint8

4

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
5-02	Terminal 29 Mode	[0] Input	All set-ups	x	TRUE	-	Uint8
5-1* Digital Inputs							
5-10	Terminal 18 Digital Input	null	All set-ups		TRUE	-	Uint8
5-11	Terminal 19 Digital Input	null	All set-ups		TRUE	-	Uint8
5-12	Terminal 27 Digital Input	null	All set-ups		TRUE	-	Uint8
5-13	Terminal 29 Digital Input	null	All set-ups	x	TRUE	-	Uint8
5-14	Terminal 32 Digital Input	null	All set-ups		TRUE	-	Uint8
5-15	Terminal 33 Digital Input	null	All set-ups		TRUE	-	Uint8
5-16	Terminal X30/2 Digital Input	null	All set-ups		TRUE	-	Uint8
5-17	Terminal X30/3 Digital Input	null	All set-ups		TRUE	-	Uint8
5-18	Terminal X30/4 Digital Input	null	All set-ups		TRUE	-	Uint8
5-19	Terminal 37 Safe Stop	null	1 set-up		TRUE	-	Uint8
5-20	Terminal X46/1 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-21	Terminal X46/3 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-22	Terminal X46/5 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-23	Terminal X46/7 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-24	Terminal X46/9 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-25	Terminal X46/11 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-26	Terminal X46/13 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-3* Digital Outputs							
5-30	Terminal 27 Digital Output	null	All set-ups		TRUE	-	Uint8
5-31	Terminal 29 digital Output	null	All set-ups	x	TRUE	-	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	null	All set-ups		TRUE	-	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	null	All set-ups		TRUE	-	Uint8
5-4* Relays							
5-40	Function Relay	null	All set-ups		TRUE	-	Uint8
5-41	On Delay, Relay	0.01 s	All set-ups		TRUE	-2	Uint16
5-42	Off Delay, Relay	0.01 s	All set-ups		TRUE	-2	Uint16
5-5* Pulse Input							
5-50	Term. 29 Low Frequency	100 Hz	All set-ups	x	TRUE	0	Uint32
5-51	Term. 29 High Frequency	100 Hz	All set-ups	x	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups	x	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	ExpressionLimit	All set-ups	x	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All set-ups	x	FALSE	-3	Uint16
5-55	Term. 33 Low Frequency	100 Hz	All set-ups		TRUE	0	Uint32
5-56	Term. 33 High Frequency	100 Hz	All set-ups		TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0.000 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	ExpressionLimit	All set-ups		TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All set-ups		FALSE	-3	Uint16
5-6* Pulse Output							
5-60	Terminal 27 Pulse Output Variable	null	All set-ups		TRUE	-	Uint8
5-62	Pulse Output Max Freq #27	ExpressionLimit	All set-ups		TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	null	All set-ups	x	TRUE	-	Uint8
5-65	Pulse Output Max Freq #29	ExpressionLimit	All set-ups	x	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	null	All set-ups		TRUE	-	Uint8
5-68	Pulse Output Max Freq #X30/6	ExpressionLimit	All set-ups		TRUE	0	Uint32

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
5-7* 24V Encoder Input							
5-70	Term 32/33 Pulses per Revolution	1024 N/A	All set-ups		FALSE	0	Uint16
5-71	Term 32/33 Encoder Direction	[0] Clockwise	All set-ups		FALSE	-	Uint8
5-8* I/O Options							
5-80	AHF Cap Reconnect Delay	25 s	2 set-ups	x	TRUE	0	Uint16
5-9* Bus Controlled							
5-90	Digital & Relay Bus Control	0 N/A	All set-ups		TRUE	0	Uint32
5-93	Pulse Out #27 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
5-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
5-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	x	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	x	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16

Table 4.10

4.3.8 6-** Analog In/Out

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
6-0* Analog I/O Mode							
6-00	Live Zero Timeout Time	10 s	All set-ups		TRUE	0	Uint8
6-01	Live Zero Timeout Function	[0] Off	All set-ups		TRUE	-	Uint8
6-1* Analog Input 1							
6-10	Terminal 53 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-11	Terminal 53 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16
6-12	Terminal 53 Low Current	0.14 mA	All set-ups		TRUE	-5	Int16
6-13	Terminal 53 High Current	20.00 mA	All set-ups		TRUE	-5	Int16
6-14	Terminal 53 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All set-ups		TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-2* Analog Input 2							
6-20	Terminal 54 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-21	Terminal 54 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16
6-22	Terminal 54 Low Current	0.14 mA	All set-ups		TRUE	-5	Int16
6-23	Terminal 54 High Current	20.00 mA	All set-ups		TRUE	-5	Int16
6-24	Terminal 54 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	ExpressionLimit	All set-ups		TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-3* Analog Input 53							
6-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	ExpressionLimit	All set-ups		TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-4* Analog Input 4							
6-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16

4

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
6-44	Term. X30/12 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	ExpressionLimit	All set-ups		TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-5* Analog Output 1							
6-50	Terminal 42 Output	null	All set-ups		TRUE	-	Uint8
6-51	Terminal 42 Output Min Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-52	Terminal 42 Output Max Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-53	Terminal 42 Output Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
6-55	Terminal 42 Output Filter	[0] Off	1 set-up		TRUE	-	Uint8
6-6* Analog Output 2							
6-60	Terminal X30/8 Output	null	All set-ups		TRUE	-	Uint8
6-61	Terminal X30/8 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-63	Terminal X30/8 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
6-7* Analog Output 3							
6-70	Terminal X45/1 Output	null	All set-ups		TRUE	-	Uint8
6-71	Terminal X45/1 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-72	Terminal X45/1 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-73	Terminal X45/1 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-74	Terminal X45/1 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
6-8* Analog Output 4							
6-80	Terminal X45/3 Output	null	All set-ups		TRUE	-	Uint8
6-81	Terminal X45/3 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-82	Terminal X45/3 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-83	Terminal X45/3 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-84	Terminal X45/3 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16

Table 4.11

4.3.9 7-** Controllers

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
7-0* Speed PID Ctrl.							
7-00	Speed PID Feedback Source	null	All set-ups		FALSE	-	Uint8
7-02	Speed PID Proportional Gain	ExpressionLimit	All set-ups		TRUE	-3	Uint16
7-03	Speed PID Integral Time	ExpressionLimit	All set-ups		TRUE	-4	Uint32
7-04	Speed PID Differentiation Time	ExpressionLimit	All set-ups		TRUE	-4	Uint16
7-05	Speed PID Diff. Gain Limit	5.0 N/A	All set-ups		TRUE	-1	Uint16
7-06	Speed PID Lowpass Filter Time	ExpressionLimit	All set-ups		TRUE	-4	Uint16
7-07	Speed PID Feedback Gear Ratio	1.0000 N/A	All set-ups		FALSE	-4	Uint32
7-08	Speed PID Feed Forward Factor	0 %	All set-ups		FALSE	0	Uint16
7-09	Speed PID Error Correction w/ Ramp	300 RPM	All set-ups		TRUE	67	Uint32
7-1* Torque PI Ctrl.							
7-12	Torque PI Proportional Gain	100 %	All set-ups		TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
7-13	Torque PI Integration Time	0.020 s	All set-ups		TRUE	-3	Uint16
7-2* Process Ctrl. Feedb							
7-20	Process CL Feedback 1 Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-22	Process CL Feedback 2 Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-3* Process PID Ctrl.							
7-30	Process PID Normal/Inverse Control	[0] Normal	All set-ups		TRUE	-	Uint8
7-31	Process PID Anti Windup	[1] On	All set-ups		TRUE	-	Uint8
7-32	Process PID Controller Start Value	0 RPM	All set-ups		TRUE	67	Uint16
7-33	Process PID Proportional Gain	0.01 N/A	All set-ups		TRUE	-2	Uint16
7-34	Process PID Integral Time	10000.00 s	All set-ups		TRUE	-2	Uint32
7-35	Process PID Differentiation Time	0.00 s	All set-ups		TRUE	-2	Uint16
7-36	Process PID Differentiation Gain Limit	5.0 N/A	All set-ups		TRUE	-1	Uint16
7-38	Process PID Feed Forward Factor	0 %	All set-ups		TRUE	0	Uint16
7-39	On Reference Bandwidth	5 %	All set-ups		TRUE	0	Uint8
7-4* Adv. Process PID I							
7-40	Process PID I-part Reset	[0] No	All set-ups		TRUE	-	Uint8
7-41	Process PID Output Neg. Clamp	-100 %	All set-ups		TRUE	0	Int16
7-42	Process PID Output Pos. Clamp	100 %	All set-ups		TRUE	0	Int16
7-43	Process PID Gain Scale at Min. Ref.	100 %	All set-ups		TRUE	0	Int16
7-44	Process PID Gain Scale at Max. Ref.	100 %	All set-ups		TRUE	0	Int16
7-45	Process PID Feed Fwd Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-46	Process PID Feed Fwd Normal/ Inv. Ctrl.	[0] Normal	All set-ups		TRUE	-	Uint8
7-48	PCD Feed Forward	0 N/A	All set-ups	x	TRUE	0	Uint16
7-49	Process PID Output Normal/ Inv. Ctrl.	[0] Normal	All set-ups		TRUE	-	Uint8
7-5* Adv. Process PID II							
7-50	Process PID Extended PID	[1] Enabled	All set-ups		TRUE	-	Uint8
7-51	Process PID Feed Fwd Gain	1.00 N/A	All set-ups		TRUE	-2	Uint16
7-52	Process PID Feed Fwd Ramp-up	0.01 s	All set-ups		TRUE	-2	Uint32
7-53	Process PID Feed Fwd Ramp-down	0.01 s	All set-ups		TRUE	-2	Uint32
7-56	Process PID Ref. Filter Time	0.001 s	All set-ups		TRUE	-3	Uint16
7-57	Process PID Fb. Filter Time	0.001 s	All set-ups		TRUE	-3	Uint16

Table 4.12

4.3.10 8-** Comm. and Options

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
8-0* General Settings							
8-01	Control Site	[0] Digital and ctrl. word	All set-ups		TRUE	-	Uint8
8-02	Control Word Source	null	All set-ups		TRUE	-	Uint8
8-03	Control Word Timeout Time	1.0 s	1 set-up		TRUE	-1	Uint32
8-04	Control Word Timeout Function	null	1 set-up		TRUE	-	Uint8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up		TRUE	-	Uint8
8-06	Reset Control Word Timeout	[0] Do not reset	All set-ups		TRUE	-	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups		TRUE	-	Uint8
8-08	Readout Filtering	null	All set-ups		TRUE	-	Uint8
8-1* Ctrl. Word Settings							

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
8-10	Control Word Profile	[0] FC profile	All set-ups		TRUE	-	Uint8
8-13	Configurable Status Word STW	null	All set-ups		TRUE	-	Uint8
8-14	Configurable Control Word CTW	[1] Profile default	All set-ups		TRUE	-	Uint8
8-3* FC Port Settings							
8-30	Protocol	[0] FC	1 set-up		TRUE	-	Uint8
8-31	Address	1 N/A	1 set-up		TRUE	0	Uint8
8-32	FC Port Baud Rate	null	1 set-up		TRUE	-	Uint8
8-33	Parity / Stop Bits	[0] Ev. Par. 1 Stop Bit	1 set-up		TRUE	-	Uint8
8-34	Estimated cycle time	0 ms	2 set-ups		TRUE	-3	Uint32
8-35	Minimum Response Delay	10 ms	All set-ups		TRUE	-3	Uint16
8-36	Max Response Delay	ExpressionLimit	1 set-up		TRUE	-3	Uint16
8-37	Max Inter-Char Delay	ExpressionLimit	1 set-up		TRUE	-5	Uint16
8-4* FC MC protocol set							
8-40	Telegram selection	[1] Standard telegram 1	2 set-ups		TRUE	-	Uint8
8-41	Parameters for signals	0	All set-ups		FALSE	-	Uint16
8-42	PCD write configuration	ExpressionLimit	All set-ups		TRUE	0	Uint16
8-43	PCD read configuration	ExpressionLimit	All set-ups		TRUE	0	Uint16
8-5* Digital/Bus							
8-50	Coasting Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-51	Quick Stop Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-52	DC Brake Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-53	Start Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-54	Reverse Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-55	Set-up Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-56	Preset Reference Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-57	Profidrive OFF2 Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-58	Profidrive OFF3 Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-8* AFD Port Diagnostics							
8-80	Bus Message Count	0 N/A	All set-ups		TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	All set-ups		TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	All set-ups		TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	All set-ups		TRUE	0	Uint32
8-9* Bus Jog							
8-90	Bus Jog 1 Speed	100 RPM	All set-ups		TRUE	67	Uint16
8-91	Bus Jog 2 Speed	ExpressionLimit	All set-ups		TRUE	67	Uint16

Table 4.13

4.3.11 9-** Profibus

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
9-00	Setpoint	0 N/A	All set-ups		TRUE	0	Uint16
9-07	Actual Value	0 N/A	All set-ups		FALSE	0	Uint16
9-15	PCD Write Configuration	ExpressionLimit	1 set-up		TRUE	-	Uint16
9-16	PCD Read Configuration	ExpressionLimit	2 set-ups		TRUE	-	Uint16
9-18	Node Address	126 N/A	1 set-up		TRUE	0	Uint8

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
9-22	Telegram Selection	[100] None	1 set-up		TRUE	-	Uint8
9-23	Parameters for Signals	0	All set-ups		TRUE	-	Uint16
9-27	Parameter Edit	[1] Enabled	2 set-ups		FALSE	-	Uint16
9-28	Process Control	[1] Enable cyclic master	2 set-ups		FALSE	-	Uint8
9-44	Fault Message Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-45	Fault Code	0 N/A	All set-ups		TRUE	0	Uint16
9-47	Fault Number	0 N/A	All set-ups		TRUE	0	Uint16
9-52	Fault Situation Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-53	Profibus Warning Word	0 N/A	All set-ups		TRUE	0	V2
9-63	Actual Baud Rate	[255] No baud rate found	All set-ups		TRUE	-	Uint8
9-64	Device Identification	0 N/A	All set-ups		TRUE	0	Uint16
9-65	Profile Number	0 N/A	All set-ups		TRUE	0	OctStr[2]
9-67	Control Word 1	0 N/A	All set-ups		TRUE	0	V2
9-68	Status Word 1	0 N/A	All set-ups		TRUE	0	V2
9-71	Profibus Save Data Values	[0] Off	All set-ups		TRUE	-	Uint8
9-72	ProfibusDriveReset	[0] No action	1 set-up		FALSE	-	Uint8
9-75	DO Identification	0 N/A	All set-ups		TRUE	0	Uint16
9-80	Defined Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-81	Defined Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-82	Defined Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-83	Defined Parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-84	Defined Parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16
9-90	Changed Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-91	Changed Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-92	Changed Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-93	Changed Parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-94	Changed parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16
9-99	Profibus Revision Counter	0 N/A	All set-ups		TRUE	0	Uint16

Table 4.14

4.3.12 10-** CAN Ser. Com. Bus

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
10-0* Common Settings							
10-00	CAN Protocol	null	2 set-ups		FALSE	-	Uint8
10-01	Baud Rate Select	null	2 set-ups		TRUE	-	Uint8
10-02	MAC ID	ExpressionLimit	2 set-ups		TRUE	0	Uint8
10-05	Readout Transmit Error Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-06	Readout Receive Error Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-07	Readout Bus Off Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-1* DeviceNet							
10-10	Process Data Type Selection	null	All set-ups		TRUE	-	Uint8
10-11	Process Data Config Write	ExpressionLimit	All set-ups		TRUE	-	Uint16
10-12	Process Data Config Read	ExpressionLimit	All set-ups		TRUE	-	Uint16
10-13	Warning Parameter	0 N/A	All set-ups		TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
10-14	Net Reference	[0] Off	2 set-ups		TRUE	-	Uint8
10-15	Net Control	[0] Off	2 set-ups		TRUE	-	Uint8
10-2* COS Filters							
10-20	COS Filter 1	0 N/A	All set-ups		FALSE	0	Uint16
10-21	COS Filter 2	0 N/A	All set-ups		FALSE	0	Uint16
10-22	COS Filter 3	0 N/A	All set-ups		FALSE	0	Uint16
10-23	COS Filter 4	0 N/A	All set-ups		FALSE	0	Uint16
10-3* Parameter Access							
10-30	Array Index	0 N/A	2 set-ups		TRUE	0	Uint8
10-31	Store Data Values	[0] Off	All set-ups		TRUE	-	Uint8
10-32	Devicenet Revision	ExpressionLimit	All set-ups		TRUE	0	Uint16
10-33	Store Always	[0] Off	1 set-up		TRUE	-	Uint8
10-34	DeviceNet Product Code	ExpressionLimit	1 set-up		TRUE	0	Uint16
10-39	Devicenet F Parameters	0 N/A	All set-ups		TRUE	0	Uint32
10-5* CANopen							
10-50	Process Data Config Write.	ExpressionLimit	2 set-ups		TRUE	-	Uint16
10-51	Process Data Config Read.	ExpressionLimit	2 set-ups		TRUE	-	Uint16

Table 4.15

4.3.13 12-** Ethernet

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
12-0* IP Settings							
12-00	IP Address Assignment	null	2 set-ups		TRUE	-	Uint8
12-01	IP Address	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-02	Subnet Mask	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-03	Default Gateway	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-04	DHCP Server	0 N/A	2 set-ups		TRUE	0	OctStr[4]
12-05	Lease Expires	ExpressionLimit	All set-ups		TRUE	0	TimD
12-06	Name Servers	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-07	Domain Name	0 N/A	1 set-up		TRUE	0	VisStr[48]
12-08	Host Name	0 N/A	1 set-up		TRUE	0	VisStr[48]
12-09	Physical Address	0 N/A	1 set-up		TRUE	0	VisStr[17]
12-1* Eth link par							
12-10	Link Status	[0] No Link	All set-ups		TRUE	-	Uint8
12-11	Link Duration	ExpressionLimit	All set-ups		TRUE	0	TimD
12-12	Auto Negotiation	[1] On	2 set-ups		TRUE	-	Uint8
12-13	Link Speed	[0] None	2 set-ups		TRUE	-	Uint8
12-14	Link Duplex	[1] Full Duplex	2 set-ups		TRUE	-	Uint8
12-2* Process Data							
12-20	Control Instance	ExpressionLimit	1 set-up		TRUE	0	Uint8
12-21	Process Data Config Write	ExpressionLimit	All set-ups		TRUE	-	Uint16
12-22	Process Data Config Read	ExpressionLimit	All set-ups		TRUE	-	Uint16
12-23	Process Data Config Write Size	16 N/A	All set-ups		TRUE	0	Uint32
12-24	Process Data Config Read Size	16 N/A	All set-ups		TRUE	0	Uint32

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
12-27	Master Address	0 N/A	2 set-ups		FALSE	0	OctStr[4]
12-28	Store Data Values	[0] Off	All set-ups		TRUE	-	Uint8
12-29	Store Always	[0] Off	1 set-up		TRUE	-	Uint8
12-3* EtherNet/IP							
12-30	Warning Parameter	0 N/A	All set-ups		TRUE	0	Uint16
12-31	Net Reference	[0] Off	2 set-ups		TRUE	-	Uint8
12-32	Net Control	[0] Off	2 set-ups		TRUE	-	Uint8
12-33	CIP Revision	ExpressionLimit	All set-ups		TRUE	0	Uint16
12-34	CIP Product Code	ExpressionLimit	1 set-up		TRUE	0	Uint16
12-35	EDS Parameter	0 N/A	All set-ups		TRUE	0	Uint32
12-37	COS Inhibit Timer	0 N/A	All set-ups		TRUE	0	Uint16
12-38	COS Filter	0 N/A	All set-ups		TRUE	0	Uint16
12-4* Modbus TCP							
12-40	Status Parameter	0 N/A	All set-ups		TRUE	0	Uint16
12-41	Slave Message Count	0 N/A	All set-ups		TRUE	0	Uint32
12-42	Slave Exception Message Count	0 N/A	All set-ups		TRUE	0	Uint32
12-5* EtherCAT							
12-50	Configured Station Alias	0 N/A	1 set-up		FALSE	0	Uint16
12-51	Configured Station Address	0 N/A	All set-ups		TRUE	0	Uint16
12-59	EtherCAT Status	0 N/A	All set-ups		TRUE	0	Uint32
12-8* Oth. Eth. services							
12-80	FTP Server	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-81	HTTP Server	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-82	SMTP Service	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-89	Transparent Socket Channel Port	ExpressionLimit	2 set-ups		TRUE	0	Uint16
12-9* Adv. Eth. services							
12-90	Cable Diagnostic	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-91	MDI-X	[1] Enabled	2 set-ups		TRUE	-	Uint8
12-92	IGMP Snooping	[1] Enabled	2 set-ups		TRUE	-	Uint8
12-93	Cable Error Length	0 N/A	1 set-up		TRUE	0	Uint16
12-94	Broadcast Storm Protection	-1 %	2 set-ups		TRUE	0	Int8
12-95	Broadcast Storm Filter	[0] Broadcast only	2 set-ups		TRUE	-	Uint8
12-96	Port Config	null	2 set-ups		TRUE	-	Uint8
12-98	Interface Counters	4000 N/A	All set-ups		TRUE	0	Uint32
12-99	Media Counters	0 N/A	All set-ups		TRUE	0	Uint32

Table 4.16

4.3.14 13-** Smart Logic

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
13-0* SLC Settings							
13-00	SL Controller Mode	null	2 set-ups		TRUE	-	Uint8
13-01	Start Event	null	2 set-ups		TRUE	-	Uint8
13-02	Stop Event	null	2 set-ups		TRUE	-	Uint8
13-03	Reset SLC	[0] Do not reset SLC	All set-ups		TRUE	-	Uint8
13-1* Comparators							

4

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
13-10	Comparator Operand	null	2 set-ups		TRUE	-	Uint8
13-11	Comparator Operator	null	2 set-ups		TRUE	-	Uint8
13-12	Comparator Value	ExpressionLimit	2 set-ups		TRUE	-3	Int32
13-1* RS Flip Flops							
13-15	RS-FF Operand S	null	2 set-ups		TRUE	-	Uint8
13-16	RS-FF Operand R	null	2 set-ups		TRUE	-	Uint8
13-2* Timers							
13-20	SL Controller Timer	ExpressionLimit	1 set-up		TRUE	-3	TimD
13-4* Logic Rules							
13-40	Logic Rule Boolean 1	null	2 set-ups		TRUE	-	Uint8
13-41	Logic Rule Operator 1	null	2 set-ups		TRUE	-	Uint8
13-42	Logic Rule Boolean 2	null	2 set-ups		TRUE	-	Uint8
13-43	Logic Rule Operator 2	null	2 set-ups		TRUE	-	Uint8
13-44	Logic Rule Boolean 3	null	2 set-ups		TRUE	-	Uint8
13-5* States							
13-51	SL Controller Event	null	2 set-ups		TRUE	-	Uint8
13-52	SL Controller Action	null	2 set-ups		TRUE	-	Uint8

Table 4.17

4.3.15 14-** Special Functions

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
14-0* Inverter Switching							
14-00	Switching Pattern	[1] SFAVM	All set-ups		TRUE	-	Uint8
14-01	Switching Frequency	null	All set-ups		TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups		FALSE	-	Uint8
14-04	PWM Random	[0] Off	All set-ups		TRUE	-	Uint8
14-1* Line Power On/Off							
14-10	Line Failure	[0] No function	All set-ups		FALSE	-	Uint8
14-11	AC Line Voltage at Line Fault	SR	All set-ups		TRUE	0	Uint16
14-12	Function at Line Imbalance	[0] Trip	All set-ups		TRUE	-	Uint8
14-2* Trip Reset							
14-20	Reset Mode	[0] Manual reset	All set-ups		TRUE	-	Uint8
14-21	Automatic Restart Time	10 s	All set-ups		TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All set-ups		TRUE	-	Uint8
14-23	Typecode Setting	null	2 set-ups		FALSE	-	Uint8
14-24	Trip Delay at Current Limit	60 s	All set-ups		TRUE	0	Uint8
14-25	Trip Delay at Torque Limit	60 s	All set-ups		TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	SR	All set-ups		TRUE	0	Uint8
14-28	Production Settings	[0] No action	All set-ups		TRUE	-	Uint8
14-29	Service Code	0 N/A	All set-ups		TRUE	0	Int32
14-3* Current Limit Ctrl.							
14-30	Current Lim Cont, Proportional Gain	100 %	All set-ups		FALSE	0	Uint16
14-31	Current Lim. Contr., Integration Time	0.020 s	All set-ups		FALSE	-3	Uint16
14-4* Energy Optimizing							

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
14-40	VT Level	66 %	All set-ups		FALSE	0	Uint8
14-41	AEO Minimum Magnetization	SR	All set-ups		TRUE	0	Uint8
14-42	Minimum AEO Frequency	10 Hz	All set-ups		TRUE	0	Uint8
14-43	Motor Cos-Phi	SR	All set-ups		TRUE	-2	Uint16
14-5* Environment							
14-50	RFI Filter	[1] On	1 set-up	x	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	All set-ups		TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	All set-ups		TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	1 set-up		FALSE	-	Uint8
14-56	Capacitance Output Filter	2.0 uF	1 set-up		FALSE	-7	Uint16
14-57	Inductance Output Filter	7.000 mH	1 set-up		FALSE	-6	Uint16
14-59	Actual Number of Inverter Units	SR	1 set-up		FALSE	0	Uint8
14-7* Compatibility							
14-72	VLT Alarm Word	0 N/A	All set-ups		FALSE	0	Uint32
14-73	VLT Warning Word	0 N/A	All set-ups		FALSE	0	Uint32
14-74	VLT Ext. Status Word	0 N/A	All set-ups		FALSE	0	Uint32
14-8* Options							
14-80	Option Supplied by External 24 V DC	[1] Yes	2 set-ups		FALSE	-	Uint8

Table 4.18

4.3.16 15-** Drive Information

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
15-0* Operating Data							
15-00	Operating Hours	0 h	All set-ups		FALSE	74	Uint32
15-01	Running Hours	0 h	All set-ups		FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All set-ups		FALSE	75	Uint32
15-03	Power-ups	0 N/A	All set-ups		FALSE	0	Uint32
15-04	Over Temps	0 N/A	All set-ups		FALSE	0	Uint16
15-05	Over Volts	0 N/A	All set-ups		FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All set-ups		TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All set-ups		TRUE	-	Uint8
15-1* Data Log Settings							
15-10	Logging Source	0	2 set-ups		TRUE	-	Uint16
15-11	Logging Interval	ExpressionLimit	2 set-ups		TRUE	-3	TimD
15-12	Trigger Event	[0] FALSE	1 set-up		TRUE	-	Uint8
15-13	Logging Mode	[0] Log always	2 set-ups		TRUE	-	Uint8
15-14	Samples Before Trigger	50 N/A	2 set-ups		TRUE	0	Uint8
15-2* Historic Log							
15-20	Historic Log: Event	0 N/A	All set-ups		FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	All set-ups		FALSE	0	Uint32
15-22	Historic Log: Time	0 ms	All set-ups		FALSE	-3	Uint32
15-3* Fault Log							
15-30	Fault Log: Error Code	0 N/A	All set-ups		FALSE	0	Uint8
15-31	Fault Log: Value	0 N/A	All set-ups		FALSE	0	Int16
15-32	Fault Log: Time	0 s	All set-ups		FALSE	0	Uint32

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Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
15-4* Drive Identification							
15-40	FC Type	0 N/A	All set-ups		FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All set-ups		FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-46	Adj Freq Dr Ordering No.	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-47	Power Card Ordering No.	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-48	LCP ID Num.	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-51	Adj Freq Dr Serial No.	0 N/A	All set-ups		FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All set-ups		FALSE	0	VisStr[19]
15-58	Smart Setup Filename	ExpressionLimit	1 set-up		FALSE	0	VisStr[16]
15-59	CSIV Filename	ExpressionLimit	1 set-up		FALSE	0	VisStr[16]
15-6* Option Ident							
15-60	Option Mounted	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-62	Option Ordering No	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-63	Option Serial No	0 N/A	All set-ups		FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-72	Option in Slot B	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-73	Slot B Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-74	Option in Slot C0	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-75	Slot C0 Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-76	Option in Slot C1	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-77	Slot C1 Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-9* Parameter Info							
15-92	Defined Parameters	0 N/A	All set-ups		FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All set-ups		FALSE	0	Uint16
15-98	Drive Identification	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-99	Parameter Metadata	0 N/A	All set-ups		FALSE	0	Uint16

Table 4.19

4.3.17 16-** Data Readouts

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
16-0* General Status							
16-00	Control Word	0 N/A	All set-ups		FALSE	0	V2
16-01	Reference [Unit]	0.000 ReferenceFeed-backUnit	All set-ups		FALSE	-3	Int32
16-02	Reference %	0.0 %	All set-ups		FALSE	-1	Int16
16-03	Status Word	0 N/A	All set-ups		FALSE	0	V2

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
16-05	Main Actual Value [%]	0.00 %	All set-ups		FALSE	-2	N2
16-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups		FALSE	-2	Int32
16-1* Motor Status							
16-10	Power [kW]	0.00 kW	All set-ups		FALSE	1	Int32
16-11	Power [hp]	0.00 hp	All set-ups		FALSE	-2	Int32
16-12	Motor voltage	0.0 V	All set-ups		FALSE	-1	Uint16
16-13	Frequency	0.0 Hz	All set-ups		FALSE	-1	Uint16
16-14	Motor Current	0.00 A	All set-ups		FALSE	-2	Int32
16-15	Frequency [%]	0.00 %	All set-ups		FALSE	-2	N2
16-16	Torque [Nm]	0.0 Nm	All set-ups		FALSE	-1	Int16
16-17	Speed [RPM]	0 RPM	All set-ups		FALSE	67	Int32
16-18	Motor Thermal	0 %	All set-ups		FALSE	0	Uint8
16-19	KTY sensor temperature	0 °C	All set-ups		FALSE	100	Int16
16-20	Motor Angle	0 N/A	All set-ups		TRUE	0	Uint16
16-21	Torque [%] High Res.	0.0 %	All set-ups		FALSE	-1	Int16
16-22	Torque [%]	0 %	All set-ups		FALSE	0	Int16
16-25	Torque [Nm] High	0.0 Nm	All set-ups		FALSE	-1	Int32
16-3* Drive Status							
16-30	DC Link Voltage	0 V	All set-ups		FALSE	0	Uint16
16-32	Brake Energy /s	0.000 kW	All set-ups		FALSE	0	Uint32
16-33	Brake Energy /2 min	0.000 kW	All set-ups		FALSE	0	Uint32
16-34	Heatsink Temp.	0 °C	All set-ups		FALSE	100	Uint8
16-35	Inverter Thermal	0 %	All set-ups		FALSE	0	Uint8
16-36	Inv. Nom. Current	ExpressionLimit	All set-ups		FALSE	-2	Uint32
16-37	Inv. Max. Current	ExpressionLimit	All set-ups		FALSE	-2	Uint32
16-38	SL Controller State	0 N/A	All set-ups		FALSE	0	Uint8
16-39	Control Card Temp.	0 °C	All set-ups		FALSE	100	Uint8
16-40	Logging Buffer Full	[0] No	All set-ups		TRUE	-	Uint8
16-41	LCP Bottom Statusline	0 N/A	All set-ups		TRUE	0	VisStr[50]
16-49	Current Fault Source	0 N/A	All set-ups	x	TRUE	0	Uint8
16-5* Ref. & Feedb.							
16-50	External Reference	0.0 N/A	All set-ups		FALSE	-1	Int16
16-51	Pulse Reference	0.0 N/A	All set-ups		FALSE	-1	Int16
16-52	Feedback [Unit]	0.000 ReferenceFeedbackUnit	All set-ups		FALSE	-3	Int32
16-53	Digi Pot Reference	0.00 N/A	All set-ups		FALSE	-2	Int16
16-57	Feedback [RPM]	0 RPM	All set-ups		FALSE	67	Int32
16-6* Inputs & Outputs							
16-60	Digital Input	0 N/A	All set-ups		FALSE	0	Uint16
16-61	Terminal 53 Switch Setting	[0] Current	All set-ups		FALSE	-	Uint8
16-62	Analog Input 53	0.000 N/A	All set-ups		FALSE	-3	Int32
16-63	Terminal 54 Switch Setting	[0] Current	All set-ups		FALSE	-	Uint8
16-64	Analog Input 54	0.000 N/A	All set-ups		FALSE	-3	Int32
16-65	Analog Output 42 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All set-ups		FALSE	0	Int16
16-67	Freq. Input #29 [Hz]	0 N/A	All set-ups	x	FALSE	0	Int32
16-68	Freq. Input #33 [Hz]	0 N/A	All set-ups		FALSE	0	Int32

4

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
16-69	Pulse Output #27 [Hz]	0 N/A	All set-ups		FALSE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	x	FALSE	0	Int32
16-71	Relay Output [bin]	0 N/A	All set-ups		FALSE	0	Int16
16-72	Counter A	0 N/A	All set-ups		TRUE	0	Int32
16-73	Counter B	0 N/A	All set-ups		TRUE	0	Int32
16-74	Prec. Stop Counter	0 N/A	All set-ups		TRUE	0	Uint32
16-75	Analog In X30/11	0.000 N/A	All set-ups		FALSE	-3	Int32
16-76	Analog In X30/12	0.000 N/A	All set-ups		FALSE	-3	Int32
16-77	Analog Out X30/8 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-78	Analog Out X45/1 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-79	Analog Out X45/3 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-8* Fieldbus & FC Port							
16-80	Fieldbus CTW 1	0 N/A	All set-ups		FALSE	0	V2
16-82	Fieldbus REF 1	0 N/A	All set-ups		FALSE	0	N2
16-84	Comm. Option Status	0 N/A	All set-ups		FALSE	0	V2
16-85	FC Port CTW 1	0 N/A	All set-ups		FALSE	0	V2
16-86	FC Port REF 1	0 N/A	All set-ups		FALSE	0	N2
16-9* Diagnosis Readouts							
16-90	Alarm Word	0 N/A	All set-ups		FALSE	0	Uint32
16-91	Alarm word 2	0 N/A	All set-ups		FALSE	0	Uint32
16-92	Warning Word	0 N/A	All set-ups		FALSE	0	Uint32
16-93	Warning word 2	0 N/A	All set-ups		FALSE	0	Uint32
16-94	Ext. Status Word	0 N/A	All set-ups		FALSE	0	Uint32

Table 4.20

4.3.18 17-** Motor Feedb.Option

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
17-1* Inc. Enc. Interface							
17-10	Signal Type	[1] TTL (5V, RS4222)	All set-ups		FALSE	-	Uint8
17-11	Resolution (PPR)	1024 N/A	All set-ups		FALSE	0	Uint16
17-2* Abs. Enc. Interface							
17-20	Protocol Selection	[0] None	All set-ups		FALSE	-	Uint8
17-21	Resolution (Positions/Rev)	ExpressionLimit	All set-ups		FALSE	0	Uint32
17-24	SSI Data Length	13 N/A	All set-ups		FALSE	0	Uint8
17-25	Clock Rate	ExpressionLimit	All set-ups		FALSE	3	Uint16
17-26	SSI Data Format	[0] Gray code	All set-ups		FALSE	-	Uint8
17-34	HIPERFACE Baud rate	[4] 9600	All set-ups		FALSE	-	Uint8
17-5* Resolver Interface							
17-50	Poles	2 N/A	1 set-up		FALSE	0	Uint8
17-51	Input Voltage	7.0 V	1 set-up		FALSE	-1	Uint8
17-52	Input Frequency	10.0 kHz	1 set-up		FALSE	2	Uint8
17-53	Transformation Ratio	0.5 N/A	1 set-up		FALSE	-1	Uint8
17-56	Encoder Sim. Resolution	[0] Disabled	1 set-up		FALSE	-	Uint8
17-59	Resolver Interface	[0] Disabled	All set-ups		FALSE	-	Uint8

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
17-6* Monitoring and App.							
17-60	Feedback Direction	[0] Clockwise	All set-ups		FALSE	-	Uint8
17-61	Feedback Signal Monitoring	[1] Warning	All set-ups		TRUE	-	Uint8

Table 4.21

4.3.19 18-** Data Readouts 2

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
18-3* Analog Readouts							
18-36	Analog Input X48/2 [mA]	0.000 N/A	All set-ups		TRUE	-3	Int32
18-37	Temp. Input X48/4	0 N/A	All set-ups		TRUE	0	Int16
18-38	Temp. Input X48/7	0 N/A	All set-ups		TRUE	0	Int16
18-39	Temp. Input X48/10	0 N/A	All set-ups		TRUE	0	Int16
18-6* Inputs & Outputs 2							
18-60	Digital Input 2	0 N/A	All set-ups		FALSE	0	Uint16
18-9* PID Readouts							
18-90	Process PID Error	0.0 %	All set-ups		FALSE	-1	Int16
18-91	Process PID Output	0.0 %	All set-ups		FALSE	-1	Int16
18-92	Process PID Clamped Output	0.0 %	All set-ups		FALSE	-1	Int16
18-93	Process PID Gain Scaled Output	0.0 %	All set-ups		FALSE	-1	Int16

Table 4.22

4.3.20 30-** Special Features

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conver-sion index	Type
30-0* Wobbler							
30-00	Wobble Mode	[0] Abs. Freq., Abs. Time	All set-ups		FALSE	-	Uint8
30-01	Wobble Delta Frequency [Hz]	5.0 Hz	All set-ups		TRUE	-1	Uint8
30-02	Wobble Delta Frequency [%]	25 %	All set-ups		TRUE	0	Uint8
30-03	Wobble Delta Freq. Scaling Resource	[0] No function	All set-ups		TRUE	-	Uint8
30-04	Wobble Jump Frequency [Hz]	0.0 Hz	All set-ups		TRUE	-1	Uint8
30-05	Wobble Jump Frequency [%]	0 %	All set-ups		TRUE	0	Uint8
30-06	Wobble Jump Time	ExpressionLimit	All set-ups		TRUE	-3	Uint16
30-07	Wobble Sequence Time	10.0 s	All set-ups		TRUE	-1	Uint16
30-08	Wobble Up/Down Time	5.0 s	All set-ups		TRUE	-1	Uint16
30-09	Wobble Random Function	[0] Off	All set-ups		TRUE	-	Uint8
30-10	Wobble Ratio	1.0 N/A	All set-ups		TRUE	-1	Uint8
30-11	Wobble Random Ratio Max.	10.0 N/A	All set-ups		TRUE	-1	Uint8
30-12	Wobble Random Ratio Min.	0.1 N/A	All set-ups		TRUE	-1	Uint8
30-19	Wobble Delta Freq. Scaled	0.0 Hz	All set-ups		FALSE	-1	Uint16
30-2* Adv. Start Adjust							
30-20	High Starting Torque Time [s]	0.00 s	All set-ups	x	TRUE	-2	Uint16
30-21	High Starting Torque Current [%]	100.0 %	All set-ups	x	TRUE	-1	Uint32

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
30-22	Locked Rotor Protection	[0] Off	All set-ups	x	TRUE	-	Uint8
30-23	Locked Rotor Detection Time [s]	0.10 s	All set-ups	x	TRUE	-2	Uint8
30-8* Compatibility (I)							
30-80	d-axis inductance (Ld)	ExpressionLimit	All set-ups	x	FALSE	-6	Int32
30-81	Brake Resistor (ohm)	ExpressionLimit	1 set-up		TRUE	-2	Uint32
30-83	Speed PID Proportional Gain	ExpressionLimit	All set-ups		TRUE	-4	Uint32
30-84	Process PID Proportional Gain	0.100 N/A	All set-ups		TRUE	-3	Uint16

Table 4.23

4.3.21 32-** MCO Basic Settings

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
32-0* Encoder 2							
32-00	Incremental Signal Type	[1] TTL (5V, RS4222)	2 set-ups		TRUE	-	Uint8
32-01	Incremental Resolution	1024 N/A	2 set-ups		TRUE	0	Uint32
32-02	Absolute Protocol	[0] None	2 set-ups		TRUE	-	Uint8
32-03	Absolute Resolution	8192 N/A	2 set-ups		TRUE	0	Uint32
32-04	Absolute Encoder Baudrate X55	[4] 9600	All set-ups		FALSE	-	Uint8
32-05	Absolute Encoder Data Length	25 N/A	2 set-ups		TRUE	0	Uint8
32-06	Absolute Encoder Clock Frequency	262.000 kHz	2 set-ups		TRUE	0	Uint32
32-07	Absolute Encoder Clock Generation	[1] On	2 set-ups		TRUE	-	Uint8
32-08	Absolute Encoder Cable Length	0 m	2 set-ups		TRUE	0	Uint16
32-09	Encoder Monitoring	[0] Off	2 set-ups		TRUE	-	Uint8
32-10	Rotational Direction	[1] No action	2 set-ups		TRUE	-	Uint8
32-11	User Unit Denominator	1 N/A	2 set-ups		TRUE	0	Uint32
32-12	User Unit Numerator	1 N/A	2 set-ups		TRUE	0	Uint32
32-13	Enc.2 Control	[0] No soft changing	2 set-ups		TRUE	-	Uint8
32-14	Enc.2 node ID	127 N/A	2 set-ups		TRUE	0	Uint8
32-15	Enc.2 CAN guard	null	2 set-ups		TRUE	-	Uint8
32-3* Encoder 1							
32-30	Incremental Signal Type	[1] TTL (5V, RS4222)	2 set-ups		TRUE	-	Uint8
32-31	Incremental Resolution	1024 N/A	2 set-ups		TRUE	0	Uint32
32-32	Absolute Protocol	[0] None	2 set-ups		TRUE	-	Uint8
32-33	Absolute Resolution	8192 N/A	2 set-ups		TRUE	0	Uint32
32-35	Absolute Encoder Data Length	25 N/A	2 set-ups		TRUE	0	Uint8
32-36	Absolute Encoder Clock Frequency	262.000 kHz	2 set-ups		TRUE	0	Uint32
32-37	Absolute Encoder Clock Generation	[1] On	2 set-ups		TRUE	-	Uint8
32-38	Absolute Encoder Cable Length	0 m	2 set-ups		TRUE	0	Uint16
32-39	Encoder Monitoring	[0] Off	2 set-ups		TRUE	-	Uint8
32-40	Encoder Termination	[1] On	2 set-ups		TRUE	-	Uint8
32-43	Enc.1 Control	[0] No soft changing	2 set-ups		TRUE	-	Uint8
32-44	Enc.1 node ID	127 N/A	2 set-ups		TRUE	0	Uint8
32-45	Enc.1 CAN guard	null	2 set-ups		TRUE	-	Uint8
32-5* Feedback Source							
32-50	Source Slave	[2] Encoder 2	2 set-ups		TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
32-51	MCO 302 Last Will	[1] Trip	2 set-ups		TRUE	-	Uint8
32-52	Source Master	[1] Encoder 1 X56	2 set-ups		TRUE	-	Uint8
32-6* PID Controller							
32-60	Proportional factor	30 N/A	2 set-ups		TRUE	0	Uint32
32-61	Derivative factor	0 N/A	2 set-ups		TRUE	0	Uint32
32-62	Integral factor	0 N/A	2 set-ups		TRUE	0	Uint32
32-63	Limit Value for Integral Sum	1000 N/A	2 set-ups		TRUE	0	Uint16
32-64	PID Bandwidth	1000 N/A	2 set-ups		TRUE	0	Uint16
32-65	Velocity Feed-Forward	0 N/A	2 set-ups		TRUE	0	Uint32
32-66	Acceleration Feed-Forward	0 N/A	2 set-ups		TRUE	0	Uint32
32-67	Max. Tolerated Position Error	20000 N/A	2 set-ups		TRUE	0	Uint32
32-68	Reverse Behavior for Slave	[0] Reversing allowed	2 set-ups		TRUE	-	Uint8
32-69	Sampling Time for PID Control	1 ms	2 set-ups		TRUE	-3	Uint16
32-70	Scan Time for Profile Generator	1 ms	2 set-ups		TRUE	-3	Uint8
32-71	Size of the Control Window (Activation)	0 N/A	2 set-ups		TRUE	0	Uint32
32-72	Size of the Control Window (Deactiv.)	0 N/A	2 set-ups		TRUE	0	Uint32
32-73	Integral limit filter time	0 ms	2 set-ups		TRUE	-3	Int16
32-74	Position error filter time	0 ms	2 set-ups		TRUE	-3	Int16
32-8* Velocity & Accel.							
32-80	Maximum Velocity (Encoder)	1500 RPM	2 set-ups		TRUE	67	Uint32
32-81	Shortest Ramp	1.000 s	2 set-ups		TRUE	-3	Uint32
32-82	Ramp Type	[0] Linear	2 set-ups		TRUE	-	Uint8
32-83	Velocity Resolution	100 N/A	2 set-ups		TRUE	0	Uint32
32-84	Default Velocity	50 N/A	2 set-ups		TRUE	0	Uint32
32-85	Default Acceleration	50 N/A	2 set-ups		TRUE	0	Uint32
32-86	Acc. up for limited jerk	100 ms	2 set-ups		TRUE	-3	Uint32
32-87	Acc. down for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-88	Dec. up for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-89	Dec. down for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-9* Development							
32-90	Debug Source	[0] Controlcard	2 set-ups		TRUE	-	Uint8

Table 4.24

4.3.22 33-** MCO Adv. Settings

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
33-0* Home Motion							
33-00	Force HOME	[0] Home not forced	2 set-ups		TRUE	-	Uint8
33-01	Zero Point Offset from Home Pos.	0 N/A	2 set-ups		TRUE	0	Int32
33-02	Ramp for Home Motion	10 N/A	2 set-ups		TRUE	0	Uint32
33-03	Velocity of Home Motion	10 N/A	2 set-ups		TRUE	0	Int32
33-04	Behavior during Home Motion	[0] Reverse and index	2 set-ups		TRUE	-	Uint8
33-1* Synchronization							
33-10	Synchronization Factor Master (M:S)	1 N/A	2 set-ups		TRUE	0	Int32
33-11	Synchronization Factor Slave (M:S)	1 N/A	2 set-ups		TRUE	0	Int32
33-12	Position Offset for Synchronization	0 N/A	2 set-ups		TRUE	0	Int32

4

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
33-13	Accuracy Window for Position Sync.	1000 N/A	2 set-ups		TRUE	0	Int32
33-14	Relative Slave Velocity Limit	0 %	2 set-ups		TRUE	0	Uint8
33-15	Marker Number for Master	1 N/A	2 set-ups		TRUE	0	Uint16
33-16	Marker Number for Slave	1 N/A	2 set-ups		TRUE	0	Uint16
33-17	Master Marker Distance	4096 N/A	2 set-ups		TRUE	0	Uint32
33-18	Slave Marker Distance	4096 N/A	2 set-ups		TRUE	0	Uint32
33-19	Master Marker Type	[0] Encoder Z positive	2 set-ups		TRUE	-	Uint8
33-20	Slave Marker Type	[0] Encoder Z positive	2 set-ups		TRUE	-	Uint8
33-21	Master Marker Tolerance Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-22	Slave Marker Tolerance Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-23	Start Behavior for Marker Sync	[0] Start Function 1	2 set-ups		TRUE	-	Uint16
33-24	Marker Number for Fault	10 N/A	2 set-ups		TRUE	0	Uint16
33-25	Marker Number for Ready	1 N/A	2 set-ups		TRUE	0	Uint16
33-26	Velocity Filter	0 us	2 set-ups		TRUE	-6	Int32
33-27	Offset Filter Time	0 ms	2 set-ups		TRUE	-3	Uint32
33-28	Marker Filter Configuration	[0] Marker filter 1	2 set-ups		TRUE	-	Uint8
33-29	Filter Time for Marker Filter	0 ms	2 set-ups		TRUE	-3	Int32
33-30	Maximum Marker Correction	0 N/A	2 set-ups		TRUE	0	Uint32
33-31	Synchronization Type	[0] Standard	2 set-ups		TRUE	-	Uint8
33-32	Feed Forward Velocity Adaptation	0 N/A	2 set-ups		TRUE	0	Uint32
33-33	Velocity Filter Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-34	Slave Marker filter time	0 ms	2 set-ups		TRUE	-3	Uint32
33-4* Limit Handling							
33-40	Behavior at End Limit Switch	[0] Call error handler	2 set-ups		TRUE	-	Uint8
33-41	Negative Software End Limit	-500000 N/A	2 set-ups		TRUE	0	Int32
33-42	Positive Software End Limit	500000 N/A	2 set-ups		TRUE	0	Int32
33-43	Negative Software End Limit Active	[0] Inactive	2 set-ups		TRUE	-	Uint8
33-44	Positive Software End Limit Active	[0] Inactive	2 set-ups		TRUE	-	Uint8
33-45	Time in Target Window	0 ms	2 set-ups		TRUE	-3	Uint8
33-46	Target Window LimitValue	1 N/A	2 set-ups		TRUE	0	Uint16
33-47	Size of Target Window	0 N/A	2 set-ups		TRUE	0	Uint16
33-5* I/O Configuration							
33-50	Terminal X57/1 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-51	Terminal X57/2 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-52	Terminal X57/3 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-53	Terminal X57/4 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-54	Terminal X57/5 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-55	Terminal X57/6 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-56	Terminal X57/7 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-57	Terminal X57/8 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-58	Terminal X57/9 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-59	Terminal X57/10 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-60	Terminal X59/1 and X59/2 Mode	[1] Output	2 set-ups		FALSE	-	Uint8
33-61	Terminal X59/1 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-62	Terminal X59/2 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-63	Terminal X59/1 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-64	Terminal X59/2 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-65	Terminal X59/3 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
33-66	Terminal X59/4 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-67	Terminal X59/5 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-68	Terminal X59/6 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-69	Terminal X59/7 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-70	Terminal X59/8 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-8* Global Parameters							
33-80	Activated Program Number	-1 N/A	2 set-ups		TRUE	0	Int8
33-81	Power-up State	[1] Motor ON	2 set-ups		TRUE	-	Uint8
33-82	Drive Status Monitoring	[1] On	2 set-ups		TRUE	-	Uint8
33-83	Behavior After Error	[0] Coast	2 set-ups		TRUE	-	Uint8
33-84	Behavior afterEsc.	[0] Controlled stop	2 set-ups		TRUE	-	Uint8
33-85	MCO Supplied by External 24VDC	[0] No	2 set-ups		TRUE	-	Uint8
33-86	Terminal at alarm	[0] Relay 1	2 set-ups		TRUE	-	Uint8
33-87	Terminal state at alarm	[0] Do nothing	2 set-ups		TRUE	-	Uint8
33-88	Status word at alarm	0 N/A	2 set-ups		TRUE	0	Uint16
33-9* MCO Port Settings							
33-90	X62 MCO CAN node ID	127 N/A	2 set-ups		TRUE	0	Uint8
33-91	X62 MCO CAN baud rate	[20] 125 Kbps	2 set-ups		TRUE	-	Uint8
33-94	X60 MCO RS485 serial termination	[0] Off	2 set-ups		TRUE	-	Uint8
33-95	X60 MCO RS485 serial baud rate	[2] 9600 Baud	2 set-ups		TRUE	-	Uint8

Table 4.25

4.3.23 34-** MCO Data Readouts

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
34-0* PCD Write Par.							
34-01	PCD 1 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-02	PCD 2 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-03	PCD 3 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-04	PCD 4 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-05	PCD 5 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-06	PCD 6 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-07	PCD 7 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-08	PCD 8 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-09	PCD 9 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-10	PCD 10 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-2* PCD Read Par.							
34-21	PCD 1 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-22	PCD 2 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-23	PCD 3 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-24	PCD 4 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-25	PCD 5 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-26	PCD 6 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-27	PCD 7 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-28	PCD 8 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-29	PCD 9 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
34-30	PCD 10 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-4* Inputs & Outputs							
34-40	Digital Inputs	0 N/A	All set-ups		TRUE	0	Uint16
34-41	Digital Outputs	0 N/A	All set-ups		TRUE	0	Uint16
34-5* Process Data							
34-50	Actual Position	0 N/A	All set-ups		TRUE	0	Int32
34-51	Commanded Position	0 N/A	All set-ups		TRUE	0	Int32
34-52	Actual Master Position	0 N/A	All set-ups		TRUE	0	Int32
34-53	Slave Index Position	0 N/A	All set-ups		TRUE	0	Int32
34-54	Master Index Position	0 N/A	All set-ups		TRUE	0	Int32
34-55	Curve Position	0 N/A	All set-ups		TRUE	0	Int32
34-56	Track Error	0 N/A	All set-ups		TRUE	0	Int32
34-57	Synchronizing Error	0 N/A	All set-ups		TRUE	0	Int32
34-58	Actual Velocity	0 N/A	All set-ups		TRUE	0	Int32
34-59	Actual Master Velocity	0 N/A	All set-ups		TRUE	0	Int32
34-60	Synchronizing Status	0 N/A	All set-ups		TRUE	0	Int32
34-61	Axis Status	0 N/A	All set-ups		TRUE	0	Int32
34-62	Program Status	0 N/A	All set-ups		TRUE	0	Int32
34-64	MCO 302 Status	0 N/A	All set-ups		TRUE	0	Uint16
34-65	MCO 302 Control	0 N/A	All set-ups		TRUE	0	Uint16
34-7* Diagnosis readouts							
34-70	MCO Alarm Word 1	0 N/A	All set-ups		FALSE	0	Uint32
34-71	MCO Alarm Word 2	0 N/A	All set-ups		FALSE	0	Uint32

Table 4.26

4.3.24 35-** Sensor Input Option

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
35-0* Temp. Input Mode							
35-00	Term. X48/4 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-01	Term. X48/4 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-02	Term. X48/7 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-03	Term. X48/7 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-04	Term. X48/10 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-05	Term. X48/10 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-06	Temperature Sensor Alarm Function	[5] Stop and trip	All set-ups		TRUE	-	Uint8
35-1* Temp. Input X48/4							
35-14	Term. X48/4 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-15	Term. X48/4 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-16	Term. X48/4 Low Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16
35-17	Term. X48/4 High Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16
35-2* Temp. Input X48/7							
35-24	Term. X48/7 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-25	Term. X48/7 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-26	Term. X48/7 Low Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16

Par. No. #	Parameter description	Default value	4 set-up	FC 302 only	Change during operation	Conversion index	Type
35-27	Term. X48/7 High Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16
35-3* Temp. Input X48/10							
35-34	Term. X48/10 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-35	Term. X48/10 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-36	Term. X48/10 Low Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16
35-37	Term. X48/10 High Temp. Limit	ExpressionLimit	All set-ups		TRUE	0	Int16
35-4* Analog Input X48/2							
35-42	Term. X48/2 Low Current	4.00 mA	All set-ups		TRUE	-5	Int16
35-43	Term. X48/2 High Current	20.00 mA	All set-ups		TRUE	-5	Int16
35-44	Term. X48/2 Low Ref./Feedb. Value	0.000 N/A	All set-ups		TRUE	-3	Int32
35-45	Term. X48/2 High Ref./Feedb. Value	100.000 N/A	All set-ups		TRUE	-3	Int32
35-46	Term. X48/2 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16

Table 4.27

4

5 General Specifications

Line power supply (L1-1, L2-1, L3-1, L1-2, L2-2, L3-2)	
Supply voltage	FC 302: 380–500 V ±10%
Supply voltage	FC 302: 525–690 V ±10%

AC line voltage low / line drop-out:
During low mains voltage or a line drop-out, the adjustable frequency drive continues until the intermediate circuit voltage drops below the minimum stop level, which corresponds typically to 15% below the lowest rated supply voltage. Power-up and full torque cannot be expected at AC line voltage lower than 10% below the lowest rated supply voltage.

Supply frequency	50/60 Hz ±5%
Max. temporary imbalance between line phases	3.0% of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cos ϕ) near unity	(> 0.98)
Switching on input supply L1-1, L2-1, L3-1, L1-2, L2-2, L3-2 (power-ups)	maximum 1 time/2 min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 500/600/690V maximum.

Motor output (U, V, W)	
Output voltage	0–100% of supply voltage
Output frequency	0–800* Hz
Switching on output	Unlimited
Ramp times	0.01–3,600 s

** Voltage and power dependent*

Torque characteristics	
Starting torque (Constant torque)	maximum 160% for 60 s[1)]
Starting torque	maximum 180% up to 0.5 s[1)]
Overload torque (Constant torque)	maximum 160% for 60 s[1)]
Starting torque (Variable torque)	maximum 110% for 60 s[1)]
Overload torque (Variable torque)	maximum 110% for 60 s
Torque rise time in (independent of fsw)	10 ms
Torque rise time in FLUX (for 5 kHz fsw)	1 ms

[1)] Percentage relates to the nominal torque.
[2)] The torque response time depends on application and load but as a general rule, the torque step from 0 to reference is 4–5 x torque rise time.

Digital inputs	
Programmable digital inputs	4 (6)
Terminal number	18, 19, 27[1)], 29, 32, 33,
Logic	PNP or NPN
Voltage level	0–24 V DC
Voltage level, logic'0' PNP	< 5 V DC
Voltage level, logic'1' PNP	> 10 V DC
Voltage level, logic '0' NPN[2)]	> 19 V DC
Voltage level, logic '1' NPN[2)]	< 14 V DC
Maximum voltage on input	28 V DC
Pulse frequency range	0–110 kHz
(Duty cycle) Min. pulse width	4.5 ms
Input resistance, R_i	approx. 4 kΩ

Safe stop Terminal 37[3] (Terminal 37 is fixed PNP logic)	
Voltage level	0–24 V DC
Voltage level, logic'0' PNP	< 4 V DC
Voltage level, logic'1' PNP	>20 V DC
Nominal input current at 24 V	50 mA rms
Nominal input current at 20 V	60 mA rms
Input capacitance	400 nF

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.
1) Terminals 27 and 29 can also be programmed as output.

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2) Except safe stop input Terminal 37.
3) Terminal 37 can only be used as safe stop input. Terminal 37 is suitable for category 3 2006/42/EC installations according to EN 954-1,PL d acc. EN ISO 13849-1 and SIL 2 acc. EN 62061 (safe stop according to category 0 EN 60204-1) as required by the EU Machinery Directive 98/37/EC. Terminal 37 and the Safe Stop function are designed in conformance with EN 60204-1, EN 50178, EN 61800-5-2, EN 62061, EN ISO 1384 and EN 954-1. For correct and safe use of the Safe Stop function follow the related information and instructions in the VLT AutomationDrive Design Guide, MG33BXYY.

Analog inputs	
Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	-10 to +10 V (scaleable)
Input resistance, R_i	approx. 10 kΩ
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance, R_i	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	100 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

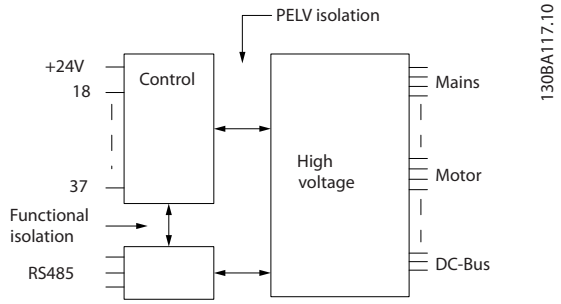

Figure 5.1

Pulse/encoder inputs	
Programmable pulse/encoder inputs	2/1
Terminal number pulse/encoder	29[1], 33[2] / 32[3], 33[3]
Max. frequency at terminal 29, 32, 33	110 kHz (push-pull driven)
Max. frequency at terminal 29, 32, 33	5 kHz (open collector)
Min. frequency at terminal 29, 32, 33	4 Hz
Voltage level	see
Maximum voltage on input	28 V DC
Input resistance, R_i	approx. 4 kΩ
Pulse input accuracy (0.1–1 kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1–11 kHz)	Max. error: 0.05% of full scale

The pulse and encoder inputs (terminals 29, 32, 33) are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

[1] FC 302 only

[2] Pulse inputs are 29 and 33

[3] Encoder inputs: 32 = A, and 33 = B

Digital output	
Programmable digital/pulse outputs	2
Terminal number	27, 29 [1]
Voltage level at digital/frequency output	0–24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 kΩ
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1% of full scale
Resolution of frequency outputs	12 bit

[1] Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Analog output	
Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4–20mA
Max. load GND - analog output	500Ω
Accuracy on analog output	Max. error: 0.5% of full scale
Resolution on analog output	12 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control card, 24 V DC output	
Terminal number	12, 13
Output voltage	24 V +1, -3V
Max. load	200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Control card, 10V DC output	
Terminal number	50
Output voltage	10.5V ±0.5V
Max. load	15mA

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

Control card, RS-485 serial communication	
Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Control card, USB serial communication	
USB standard	1.1 (Full speed)
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.
The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.
The USB ground connection is not galvanically isolated from protection ground. Use only an isolated laptop as PC connection to the USB connector on the adjustable frequency drive.

Relay outputs	
Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1)[1)] on 1-3 (NC), 1-2 (NO) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)[1)] (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 1-2 (NO), 1-3 (NC) (Resistive load)	60 V DC, 1 A
Max. terminal load (DC-13)[1)] (Inductive load)	24 V DC, 0.1 A
Relay 02 (FC 302 only) Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1)[1)] on 4-5 (NO) (Resistive load)	400 V AC, 2 A
Max. terminal load (AC-15)[1)] on 4-5 (NO) (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 4-5 (NO) (Resistive load)	80 V DC, 2 A
Max. terminal load (DC-13)[1)] on 4-5 (NO) (Inductive load)	24 V DC, 0.1 A
Max. terminal load (AC-1)[1)] on 4-6 (NC) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)[1)] on 4-6 (NC) (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1)] on 4-6 (NC) (Resistive load)	50 V DC, 2 A
Max. terminal load (DC-13)[1)] on 4-6 (NC) (Inductive load)	24 V DC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5
The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

Cable lengths and cross-sections	
Max. motor cable length, shielded/armored	500 ft [150 m]
Max. motor cable length, unshielded/unarmored	1,000 ft [300 m]
Maximum cross-section to control terminals, flexible/ rigid wire without cable end sleeves	1.5 mm^2/16 AWG
Maximum cross-section to control terminals, flexible wire with cable end sleeves	1 mm^2/18 AWG
Maximum cross-section to control terminals, flexible wire with cable end sleeves with collar	0.5 mm^2/20 AWG
Minimum cross-section to control terminals	0.25 mm^2/24 AWG
Control card performance	
Scan interval	1 ms

Control characteristics	
Resolution of output frequency at 0–1000Hz	± 0.003Hz
Repeat accuracy of *Precise start/stop* (terminals 18, 19)	≤± 0.1ms
System response time (terminals 18, 19, 27, 29, 32, 33)	≤ 2ms
Speed control range (open-loop)	1:100 of synchronous speed
Speed control range (closed-loop)	1:1000 of synchronous speed
Speed accuracy (open-loop)	30–4000 rpm: error ±8rpm
Speed accuracy (closed-loop), depending on resolution of feedback device	0–6000 rpm: error ±0.15 rpm
Torque control accuracy (speed feedback)	max error±5% of rated torque

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

Surroundings	
Enclosure	IP21/Type 1, IP54/Type 12
Vibration test	0.7 g
Max. relative humidity	5%–95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 60068-2-43	class H_25
Ambient temperature (with SFAVM switching mode)	
- with derating	Max. 131° F [55° C][1)]
- at full continuous drive output current	Max. 113° F [45° C][1)]

1) For more information on derating, see special conditions in the VLT AutomationDrive Design Guide, MG33BXYY

Minimum ambient temperature during full-scale operation	32° F [0° C]
Minimum ambient temperature at reduced performance	14° F [-10° C]
Temperature during storage/transport	-15°–+150°/160° F [-25–+65/70° C]
Maximum altitude above sea level without derating	3,300 ft [1,000 m]

Derating for high altitude, see special conditions in the VLT AutomationDrive Design Guide, MG33BXYY

EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011
EMC standards, Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

See section on special conditions in the VLT AutomationDrive Design Guide, MG33BXYY.

Protection and Features

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the Adjustable frequency drive trips if the temperature reaches a predefined level. An overload temperature cannot be reset until the temperature of the heatsink is below the values stated in the tables on the following pages (guideline - these temperatures may vary for different power sizes, frame sizes, enclosure ratings, etc.).
- The Adjustable frequency drive is protected against short-circuits on motor terminals U, V, W.
- If a line phase is missing, the Adjustable frequency drive trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the Adjustable frequency drive trips if the intermediate circuit voltage is too low or too high.
- The Adjustable frequency drive constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the Adjustable frequency drive can adjust the switching frequency and/ or change the switching pattern in order to ensure the performance of the Adjustable frequency drive.

Line Power Supply 6x380–500 V AC, 12-Pulse								
FC 302	**P250**		**P315**		**P355**		**P400**	
High/ Normal Load*	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 400 V [kW]	250	315	315	355	355	400	400	450
Typical Shaft output at 460 V [HP]	350	450	450	500	500	600	550	600
Typical shaft output at 500 V [kW]	422 hp [315 kW]	476 hp [355 kW]	476 hp [355 kW]	536 hp [400 kW]	536 hp [400 kW]	671 hp [500 kW]	671 hp [500 kW]	711 hp [530 kW]
Enclosure IP21	F8/F9		F8/F9		F8/F9		F8/F9	
Enclosure IP54	F8/F9		F8/F9		F8/F9		F8/F9	
Output current								
Continuous (at 400 V) [A]	480	600	600	658	658	745	695	800
Intermittent (60 s overload) (at 400 V) [A]	720	660	900	724	987	820	1,043	880
Continuous (at 460/500 V) [A]	443	540	540	590	590	678	678	730
Intermittent (60 s overload) (at 460/500 V) [A]	665	594	810	649	885	746	1,017	803
Continuous KVA (at 400 V) [KVA]	333	416	416	456	456	516	482	554
Continuous KVA (at 460 V) [KVA]	353	430	430	470	470	540	540	582
Continuous KVA (at 500 V) [KVA]	384	468	468	511	511	587	587	632
Max. input current								
Continuous (at 400 V) [A]	472	590	590	647	647	733	684	787
Continuous (at 460/500 V) [A]	436	531	531	580	580	667	667	718
Max. cable size, line power [mm² (AWG[2)])]	4x90 (3/0)		4x90 (3/0)		4x240 (500 mcm)		4x240 (500 mcm)	
Max. cable size, motor [mm² (AWG[2)])]	4x240 (4x500 mcm)		4x240 (4x500 mcm)		4x240 (4x500 mcm)		4x240 (4x500 mcm)	
Max. cable size, brake [mm² (AWG[2)])	2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)	
Max. external electrical fuses [A] 1	700							
Estimated power loss at 400 V [hp, W] [4)]	6.925 hp [5,164 W]	9.106 hp, [6,790 W]	9.334 hp, [6,960 W]	10.327 hp, [7,701 W]	10.314 hp [7,691 W]	11.907 hp, [8,879 W]	10.967 hp, [8,178 W]	12.967 hp, [9,670 W]
Estimated power loss at 460 V [W]	6.466 hp, [4,822 W]	8.156 hp, [6,082 W]	8.509 hp, [6,345 W]	9.324 hp, [6,953 W]	9.312 hp, [6,944 W]	10.847 hp, [8,089 W]	10.842 hp, [8,085 W]	11.805 hp, [8,803 W]
Weight, enclosure IP21, IP54 (lb [kg])	970/1,446 [440/656]							
Efficiency[4)]	0.98							
Output frequency	0–600 Hz							
Heatsink overtemp. trip	203° F [95° C]							
Power card ambient trip	167° F [75° C]							
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s								

Table 5.1

Line Power Supply 6x380–500 V AC, 12-Pulse												
FC 302	**P450**		**P500**		**P560**		**P630**		**P710**		**P800**	
High/ Normal Load *	HO	NO	HO	NO	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 400 V [kW]	450	500	500	560	560	630	630	710	710	800	800	1,000
Typical Shaft output at 460 V [HP]	600	650	650	750	750	900	900	1,000	1,000	1,200	1,200	1,350
Typical Shaft output at 500 V [hp, kW]	711 hp [530 kW]	750 [560]	750 [560]	845 [630]	845 [630]	950 [710]	710	1,075 [800]	1,075 [800]	1,340 [1,000]	1,340 [1,000]	1,475 [1,100]
Enclosure IP21, 54 without/ with options cabinet	F10/F11		F10/F11		F10/F11		F10/F11		F12/F13		F12/F13	
Output current												
Continuous (at 400 V) [A]	800	880	880	990	990	1,120	1,120	1,260	1,260	1,460	1,460	1,720
Intermittent (60 s overload) (at 400 V) [A]	1,200	968	1,320	1,089	1,485	1,232	1,680	1,386	1,890	1,606	2,190	1,892
Continuous (at 460/500 V) [A]	730	780	780	890	890	1,050	1,050	1,160	1,160	1,380	1,380	1,530
Intermittent (60 s overload) (at 460/500 V) [A]	1,095	858	1,170	979	1,335	1,155	1,575	1,276	1,740	1,518	2,070	1,683
Continuous KVA (at 400 V) [KVA]	554	610	610	686	686	776	776	873	873	1,012	1,012	1,192
Continuous KVA (at 460 V) [KVA]	582	621	621	709	709	837	837	924	924	1,100	1,100	1,219
Continuous KVA (at 500 V) [KVA]	632	675	675	771	771	909	909	1,005	1,005	1,195	1,195	1,325
Max. input current												
Continuous (at 400 V) [A]	779	857	857	964	964	1,090	1,090	1,227	1,227	1,422	1,422	1,675
Continuous (at 460/500 V) [A]	711	759	759	867	867	1,022	1,022	1,129	1,129	1,344	1,344	1,490
Max. cable size, motor [mm² (AWG[2])]	8x150 (8x300 mcm)								12x150 (12x300 mcm)			
Max. cable size, line power [mm² (AWG[2])]	6x120 (6x250 mcm)											
Max. cable size, brake [mm² (AWG[2])	4x185 (4x350 mcm)								6x185 (6x350 mcm)			
Max. external electrical fuses [A] 1	900						1,500					
Estimated power loss at 400 V [hp, W] [4]	12.729 hp, [9,492 W]	14.278 hp, [10,647 W]	14.256 hp, [10,631 W]	16.546 hp [12,338 W]	15.104 hp, [11,263 W]	17.703 hp, [13,201 W]	17.664 hp, [13,172 W]	20.700 hp, [15,436 W]	20.071 hp, [14,967 W]	24.251 hp, [18,084 W]	21.982 hp, [16,392 W]	27.300 hp, [20,358 W]
Estimated power loss at 460 V [hp, W]	11.707 hp, [8,730 W]	12.624 hp, [9,414 W]	12.603 hp, [9,398 W]	14.760 hp, [11,006 W]	13.495 hp, [10,063 W]	16.566 hp, [12,353 W]	16.537 hp, [12,332 W]	18.829 hp, [14,041 W]	18.532 hp, [13,819 W]	22.981 hp, [17,137 W]	20.889 hp, [15,577 W]	23.806 hp, [17,752 W]
F9/F11/F13 max. added losses A1 RFI, CB or Disconnect, & contactor F9/F11/F13	1.198 [893]	1.291 [963]	1.275 [951]	1.413 [1,054]	1.312 [978]	1.466 [1,093]	1.464 [1,092]	1.649 [1,230]	2.772 [2,067]	3.058 [2,280]	2.999 [2,236]	3.408 [2,541]
Max. panel options losses	536 hp [400 kW]											
Weight, enclosure IP21, IP54 [lb, kg]	2434/2864 [1004/1299]		2434/2864 [1004/1299]		2434/2864 [1004/1299]		2434/2864 [1004/1299]		2747/3397 [1246/1541]		2747/3397 [1246/1541]	
Weight Rectifier Module (lb [kg])	224.9 [102]		224.9 [102]		224.9 [102]		224.9 [102]		299.8 [136]		299.8 [136]	
Weight Inverter Module (lb [kg])	224.9 [102]		224.9 [102]		224.9 [102]		299.8 [136]		224.9 [102]		224.9 [102]	
Efficiency[4]	0.98											
Output frequency	0–600 Hz											
Heatsink overtemp. trip	203° F [95° C]											
Power card ambient trip	167° F [75° C]											
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s												

Table 5.2

Line Power Supply 6x525–690 V AC, 12-Pulse								
FC 302	**P355**		**P400**		**P500**		**P560**	
High/ Normal Load	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550 V [kW]	315	355	315	400	400	450	450	500
Typical Shaft output at 575 V [HP]	400	450	400	500	500	600	600	650
Typical Shaft output at 690 V [hp, kW]	476 hp [355 kW]	603.46 hp [450 kW]	536 hp [400 kW]	671 hp [500 kW]	671 hp [500 kW]	750 hp [560 kW]	750 hp [560 kW]	845 hp [630 kW]
Enclosure IP21	F8/F9		F8/F9		F8/F9		F8/F9	
Enclosure IP54	F8/F9		F8/F9		F8/F9		F8/F9	
Output current								
Continuous (at 550 V) [A]	395	470	429	523	523	596	596	630
Intermittent (60 s overload) (at 550 V) [A]	593	517	644	575	785	656	894	693
Continuous (at 575/690 V) [A]	380	450	410	500	500	570	570	630
Intermittent (60 s overload) (at 575/690 V) [A]	570	495	615	550	750	627	855	693
Continuous KVA (at 550 V) [KVA]	376	448	409	498	498	568	568	600
Continuous KVA (at 575 V) [KVA]	378	448	408	498	498	568	568	627
Continuous KVA (at 690 V) [KVA]	454	538	490	598	598	681	681	753
Max. input current								
Continuous (at 550 V) [A]	381	453	413	504	504	574	574	607
Continuous (at 575 V) [A]	366	434	395	482	482	549	549	607
Continuous (at 690 V) [A]	366	434	395	482	482	549	549	607
Max. cable size, line power [mm^2 (AWG)]	4x85 (3/0)							
Max. cable size, motor [mm^2 (AWG)]	4x250 (500 mcm)							
Max. cable size, brake [mm^2 (AWG)]	2x185 (2x350 mcm)		2x185 (2x350 mcm)		2x185 (2x350 mcm)		2x185 (2x350 mcm)	
Max. external electrical fuses [A] 1	630							
Estimated power loss at 600 V [W] 4)	5107	6132	5538	6903	7336	8343	8331	9244
Estimated power loss at 690 V [W] 4)	5383	6449	5818	7249	7671	8727	8715	9673
Weight, enclosure IP21, IP54 (lb [kg])	970/1,446 [440/656]							
Efficiency4)	0.98							
Output frequency	0–500 Hz							
Heatsink overtemp. trip	185° F [85° C]							
Power card ambient trip	167° F [75° C]							
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s								

Table 5.3

Line Power Supply 6x525–690 V AC, 12-Pulse						
FC 302	**P630**		**P710**		**P800**	
High/ Normal Load	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550 V [kW]	500	560	560	670	670	750
Typical Shaft output at 575 V [HP]	650	750	750	950	950	1,050
Typical Shaft output at 690 V [hp, kW]	845 hp [630 kW]	950 hp [710 kW]	950 hp [710 kW]	1,075 hp [800 kW]	1,075 hp [800 kW]	1,207 hp [900 kW]
Enclosure IP21, IP54 without/with options cabinet	F10/F11		F10/F11		F10/F11	
Output current						
Continuous (at 550 V) [A]	659	763	763	889	889	988
Intermittent (60 s overload) (at 550 V) [A]	989	839	1,145	978	1334	1087
Continuous (at 575/690 V) [A]	630	730	730	850	850	945
Intermittent (60 s overload) (at 575/690 V) [A]	945	803	1,095	935	1,275	1,040
Continuous KVA (at 550 V) [KVA]	628	727	727	847	847	941
Continuous KVA (at 575 V) [KVA]	627	727	727	847	847	941
Continuous KVA (at 690 V) [KVA]	753	872	872	1,016	1,016	1,129
Max. input current						
Continuous (at 550 V) [A]	642	743	743	866	866	962
Continuous (at 575 V) [A]	613	711	711	828	828	920
Continuous (at 690 V) [A]	613	711	711	828	828	920
Max. cable size, motor [mm^2 (AWG[2)])]	8x150 (8x300 mcm)					
Max. cable size, line power [mm^2 (AWG[2)])]	6x120 (6x250 mcm)					
Max. cable size, brake [mm^2 (AWG[2)])	4x185 (4x350 mcm)					
Max. external electrical fuses [A] 1	900					
Estimated power loss at 600 V [W] [4)]	12.339 hp, [9,201 W]	14.444 hp, [10,771 W]	13.968 hp, [10,416 W]	16.457 hp, [12,272 W]	16.441 hp, [12,260 W]	18.553 hp, [13,835 W]
Estimated power loss at 690 V [W] [4)]	12.973 hp. [9,674 W]	15.174 hp, [11,315 W]	14.704 hp, [10,965 W]	17.303 hp, [12,903 W]	17.286 hp, [12,890 W]	19.489 hp, [14,533 W]
F3/F4 Max added losses CB or Disconnect & Contactor	0.459 [342]	0.573 [427]	0.562 [419]	0.713 [532]	0.696 [519]	0.825 [615]
Max panel options losses	536 hp [400 kW]					
Weight, enclosure IP21, IP54 (lb [kg])	2213/2864 [1004/1299]		2213/2864 [1004/1299]		2213/2864 [1004/1299]	
Weight, Rectifier Module (lb [kg])	224.9 [102]		224.9 [102]		224.9 [102]	
Weight, Inverter Module (lb [kg])	224.9 [102]		224.9 [102]		299.8 [136]	
Efficiency[4)]	0.98					
Output frequency	0–500 Hz					
Heatsink overtemp. trip	185° F [85° C]					
Power card ambient trip	167° F [75° C]					
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s						

Table 5.4

Line Power Supply 6x525–690 V AC, 12-Pulse								
FC 302	P900		P1M0		P1M2		P1M4	
High/ Normal Load*	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550 V [kW]	750	850	850	1,000	1,000	1,100	1,100	1,250
Typical Shaft output at 575 V [HP]	1,050	1,150	1,150	1,350	1,350	1,550	1,550	1,700
Typical Shaft output at 690 V [hp, kW]	1,207 hp [900 kW]	1,340 hp [1,000 kW]	1,340 hp [1,000 kW]	1,610 hp [1,200 kW]	1,610 hp [1,200 kW]	1,875 hp [1,400 kW]	1,875 hp [1,400 kW]	2,145 hp [1,600 kW]
Enclosure IP21, IP54 without/ with options cabinet	F12/F13		F12/F13		F12/F13		F14	
Output current								
Continuous (at 550 V) [A]	988	1,108	1,108	1,317	1,317	1,479	1,479	1,652
Intermittent (60 s overload) (at 550 V) [A]	1,482	1,219	1,662	1,449	1,976	1,627	2,218.5	1,817.2
Continuous (at 575/690 V) [A]	945	1,060	1,060	1,260	1,260	1,415	1,415	1,580
Intermittent (60 s overload) (at 575/690 V) [A]	1,418	1,166	1,590	1,386	1,890	1,557	2,122	1,738
Continuous KVA (at 550 V) [KVA]	941	1,056	1,056	1,255	1,255	1,409	1,409	1,574
Continuous KVA (at 575 V) [KVA]	941	1,056	1,056	1,255	1,255	1,409	1,409	1,574
Continuous KVA (at 690 V) [KVA]	1,129	1,267	1,267	1,506	1,506	1,691	1,348	1,505
Max. input current								
Continuous (at 550 V) [A]	962	1,079	1,079	1,282	1,282	1,440	1,440	1,608
Continuous (at 575 V) [A]	920	1,032	1,032	1,227	1,227	1,378	1,378	1,538
Continuous (at 690 V) [A]	920	1,032	1,032	1,227	1,227	1,378	1,378	1,538
Max. cable size, motor [mm^2 (AWG[2)])]	12x150 (12x300 mcm)							
Max. cable size, line power F12 [mm^2 (AWG[2)])]	8x240 (8x500 mcm)							
Max. cable size, line power F13 [mm^2 (AWG[2)])]	8x400 (8x900 mcm)							
Max. cable size, brake [mm^2 (AWG[2)])	6x185 (6x350 mcm)							
Max. external electrical fuses [A] 1	1,600		2,000		2,500			
Estimated power loss at 600 V [hp, W] [4)]	18,445 hp, [13,755 W]	20.909 hp, [15,592 W]	20.259 hp, [15,107 W]	24.515 hp, [18,281 W]	24.381 hp, [18,181 W]	27.927 hp, [20,825 W]	25.269 hp, [18,843 W]	28.784 hp, [21,464 W]
Estimated power loss at 690 V [W] [4)]	19.387 hp, [14,457 W]	21.959 hp, [16,375 W]	21.321 hp, [15,899 W]	25.757 hp, [19,207 W]	25.620 hp, [19,105 W]	29.311 hp, [21,857 W]	25.736 hp, [19,191 W]	29.276 hp, [21,831 W]
F3/F4 Max added losses CB or Disconnect & Contactor	556	665	634	863	861	1,044	1,016	1,267
Max panel options losses	536 hp [400 kW]							
Weight, enclosure IP21, IP54 (lb [kg])	2747/3397 [1246/1541]		2747/3397 [1246/1541]		2822/3472 [1280/1575]		6784/7434 [3077/3372]	
Weight, Rectifier Module (lb [kg])	299.8 [136]							
Weight, Inverter Module (lb [kg])	224.9 [102]				299.8 [136]			
Efficiency[4)]	0.98							
Output frequency	0–500 Hz							
Heatsink overtemp. trip	185° F [85° C]							
Power card ambient trip	167° F [75° C]							
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s								

Table 5.5

1) For type of fuse, see section Fuses.

2) American Wire Gauge.

3) Measured using 16 ft [5 m] shielded motor cables at rated load and rated frequency.

4) The typical power loss is at nominal load conditions and expected to be within ±15% (tolerence relates to variety in voltage and cable conditions).
Values are based on a typical motor efficiency. Motors with lower efficiency will also add to the power loss in the adjustable frequency drive and vice-versa.
If the switching frequency is increased compared to the default setting, the power losses may rise significantly.
LCP and typical control card power consumptions are included. Further options and customer load may add up to 0.004 hp [30 W] to the losses. (Though typical only 4 W extra for a fully loaded control card, or options for slot A or slot B each).
Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (±5%).

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6 Warnings and Alarms

6.1 Warning and Alarm Definitions

The warning/alarm information below defines each warning/alarm condition, provides the probable cause for the condition, and details a remedy or troubleshooting procedure.

WARNING 1, 10 Volts low
The control card voltage is below 10 V from terminal 50. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting
Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error
This warning or alarm will only appear if programmed by the user in *6-01 Live Zero Timeout Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or faulty device sending the signal.

Troubleshooting

Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

Check that the Adjustable frequency drive programming and switch settings match the analog signal type.

Perform Input Terminal Signal Test.

WARNING/ALARM 3, No motor
No motor has been connected to the output of the adjustable frequency drive.

WARNING/ALARM 4, Mains phase loss
A phase is missing on the supply side, or the line voltage imbalance is too high. This message also appears for a fault in the input rectifier on the adjustable frequency drive. Options are programmed at *14-12 Function at Mains Imbalance*.

Troubleshooting
Check the supply voltage and supply currents to the adjustable frequency drive.

WARNING 5, DC link voltage high
The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the adjustable frequency drive voltage rating. The unit is still active.

WARNING 6, DC link voltage low
The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the adjustable frequency drive voltage rating. The unit is still active.

WARNING/ALARM 7, DC overvoltage
If the intermediate circuit voltage exceeds the limit, the adjustable frequency drive trips after a time.

Troubleshooting

Connect a brake resistor

Extend the ramp time

Change the ramp type

Activate the functions in *2-10 Brake Function*

Increase *14-26 Trip Delay at Inverter Fault*

WARNING/ALARM 8, DC undervoltage
If the intermediate circuit voltage (DC link) drops below the under voltage limit, the adjustable frequency drive checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the adjustable frequency drive trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting

Make sure that the supply voltage matches the adjustable frequency drive voltage.

Perform input voltage test.

Perform soft charge circuit test.

WARNING/ALARM 9, Inverter overload
The Adjustable frequency drive is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. The Adjustable frequency drive *cannot* be reset until the counter is below 90%.
The fault is that the Adjustable frequency drive is overloaded by more than 100% for too long.

Troubleshooting

Compare the output current shown on the LCP with the Adjustable frequency drive rated current.

Compare the output current shown on the LCP with measured motor current.

Display the Thermal Drive Load on the LCP and monitor the value. When running above the Adjustable frequency drive continuous current rating, the counter should increase. When running below the Adjustable frequency drive continuous current rating, the counter should decrease.

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See the derating section in the *Design Guide* for more details if a high switching frequency is required.

WARNING/ALARM 10, Motor overload temperature

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the adjustable frequency drive gives a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. The fault occurs when the motor is overloaded by more than 100% for too long.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

Check that the motor current set in *1-24 Motor Current* is correct.

Ensure that Motor data in parameters 1-20 through 1-25 are set correctly.

If an external fan is in use, check in *1-91 Motor External Fan* that it is selected.

Running AMA in *1-29 Automatic Motor Adaptation (AMA)* tunes the adjustable frequency drive to the motor more accurately and reduces thermal loading.

WARNING/ALARM 11, Motor thermistor over temp

The thermistor might be disconnected. Select whether the adjustable frequency drive gives a warning or an alarm in *1-90 Motor Thermal Protection*.

Troubleshooting

Check for motor overheating.

Check if the motor is mechanically overloaded.

Check that the thermistor is connected correctly between either terminal 53 or 54 (analog voltage input) and terminal 50 (+10 V supply) and that the terminal switch for 53 or 54 is set for voltage. Check *1-93 Thermistor Source* selects terminal 53 or 54.

When using digital inputs 18 or 19, check that the thermistor is connected correctly between either terminal 18 or 19 (digital input PNP only) and terminal 50.

If a KTY sensor is used, check for correct connection between terminals 54 and 55

If using a thermal switch or thermistor, check that the programming if *1-93 Thermistor Resource* matches sensor wiring.

If using a KTY sensor, check the programming of *1-95 KTY Sensor Type, 1-96 KTY Thermistor Resource*, and *1-97 KTY Threshold level* match sensor wiring.

WARNING/ALARM 12, Torque limit

The torque has exceeded the value in *4-16 Torque Limit Motor Mode* or the value in *4-17 Torque Limit Generator Mode*. *14-25 Trip Delay at Torque Limit* can change this from a warning only condition to a warning followed by an alarm.

Troubleshooting

If the motor torque limit is exceeded during ramp-up, extend the ramp-up time.

If the generator torque limit is exceeded during ramp-down, extend the ramp-down time.

If torque limit occurs while running, possibly increase the torque limit. Be sure the system can operate safely at a higher torque.

Check the application for excessive current draw on the motor.

WARNING/ALARM 13, Over current

The inverter peak current limit (approximately 200% of the rated current) is exceeded. The warning lasts about 1.5 secs., then the Adjustable frequency drive trips and issues an alarm. This fault may be caused by shock loading or fast acceleration with high inertia loads. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting

Remove power and check if the motor shaft can be turned.

Check that the motor size matches the Adjustable frequency drive.

Check parameters 1-20 through 1-25. for correct motor data.

ALARM 14, Ground fault

There is current from the output phases to ground, either in the cable between the adjustable frequency drive and the motor or in the motor itself.

Troubleshooting:

Remove power to the adjustable frequency drive and repair the ground fault.

Check for ground faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.

Perform current sensor test.

ALARM 15, Hardware mismatch

A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your Danfoss supplier:

15-40 FC Type

15-41 Power Section

15-42 Voltage

15-43 Software Version

15-45 Actual Typecode String

15-49 SW ID Control Card

15-50 SW ID Power Card

15-60 Option Mounted

15-61 Option SW Version (for each option slot)

ALARM 16, Short circuit

There is short-circuiting in the motor or motor wiring.

Remove power to the adjustable frequency drive and repair the short circuit.

WARNING/ALARM 17, Control word timeout

There is no communication to the adjustable frequency drive.
The warning will only be active when *8-04 Control Word Timeout Function* is NOT set to *OFF*.
If *8-04 Control Word Timeout Function* is set to *Stop* and *Trip*, a warning appears and the adjustable frequency drive ramps down until it trips then displays an alarm.

Troubleshooting:

Check connections on the serial communication cable.

Increase *8-03 Control Word Timeout Time*

Check the operation of the communication equipment.

Verify a proper installation based on EMC requirements.

WARNING/ALARM 22, Hoist mechanical brake

Report value shows what kind it is.
0 = The torque ref. was not reached before timeout.
1 = There was no brake feedback before timeout.

WARNING 23, Internal fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor* ([0] Disabled).

For the D, E, and F Frame filters, the regulated voltage to the fans is monitored.

Troubleshooting

Check fan resistance.

Check soft charge fuses.

WARNING 24, External fan fault

The fan warning function is an extra protective function that checks if the fan is running/mounted. The fan warning can be disabled in *14-53 Fan Monitor* ([0] Disabled).

Troubleshooting

Check fan resistance.

Check soft charge fuses.

WARNING 25, Brake resistor short circuit

The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The adjustable frequency drive is still operational but without the brake function. Remove power to the adjustable frequency drive and replace the brake resistor (see *2-15 Brake Check*).

WARNING/ALARM 26, Brake resistor power limit

The power transmitted to the brake resistor is calculated as a mean value over the last 120 s of run time. The calculation is based on the intermediate circuit voltage and the brake resistance value set in *2-16 AC Brake Max. Current*. The warning is active when the dissipated braking is higher than 90% of the brake resistance power. If *Trip* [2] is selected in *2-13 Brake Power Monitoring*, the adjustable frequency drive will trip when the dissipated braking energy reaches 100%.

⚠WARNING

There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

WARNING/ALARM 27, Brake chopper fault

The brake transistor is monitored during operation and if a short circuit occurs, the brake function is disabled and a warning is issued. The adjustable frequency drive is still operational but, since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.
Remove power to the adjustable frequency drive and remove the brake resistor.

This alarm/warning could also occur should the brake resistor overheat. Terminals 104 and 106 are available as brake resistors Klixon inuputs, see section Brake Resistor Temperature Switch.

WARNING/ALARM 28, Brake check failed
The brake resistor is not connected or not working. Check *2-15 Brake Check*.

ALARM 29, Heatsink temp
The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the frequency converter power size.

Troubleshooting
Check for the following conditions.

Ambient temperature too high.

Motor cable too long.

Incorrect airflow clearance above and below the frequency converter

Blocked airflow around the frequency converter.

Damaged heatsink fan.

Dirty heatsink.

For the D, E, and F Frame sizes, this alarm is based on the temperature measured by the heatsink sensor mounted inside the IGBT modules. For the F Frame sizes, this alarm can also be caused by the thermal sensor in the Rectifier module.

Troubleshooting

Check fan resistance.

Check soft charge fuses.

IGBT thermal sensor.

ALARM 30, Motor phase U missing
Motor phase U between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase U.

ALARM 31, Motor phase V missing
Motor phase V between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase V.

ALARM 32, Motor phase W missing
Motor phase W between the adjustable frequency drive and the motor is missing.

Remove power from the adjustable frequency drive and check motor phase W.

ALARM 33, Inrush fault
Too many power-ups have occurred within a short time period. Let the unit cool to operating temperature.

WARNING/ALARM 34, communication fault
The serial communication bus on the communication option card is not working.

WARNING/ALARM 36, Mains failure
This warning/alarm is only active if the supply voltage to the adjustable frequency drive is lost and *14-10 Mains Failure* is NOT set to [0] *No Function*. Check the fuses to the adjustable frequency drive and line power supply to the unit.

ALARM 38, Internal fault
When an internal fault occurs, a code number defined in the table below is displayed.

Troubleshooting

Cycle power

Check that the option is properly installed

Check for loose or missing wiring

It may be necessary to contact your Danfoss supplier or service department. Note the code number for further troubleshooting directions.

No.	Text
0	Serial port cannot be initialized. Contact your Danfoss supplier or Danfoss Service Department.
256-258	Power EEPROM data is defective or too old
512	Control board EEPROM data is defective or too old.
513	Communication time out reading EEPROM data
514	Communication time out reading EEPROM data
515	Application oriented control cannot recognize the EEPROM data.
516	Cannot write to the EEPROM because a write command is on progress.
517	Write command is under timeout
518	Failure in the EEPROM
519	Missing or invalid barcode data in EEPROM
783	Parameter value outside of min/max limits
1024-1279	A CAN message that has to be sent couldn't be sent.
1281	Digital signal processor flash timeout
1282	Power micro software version mismatch
1283	Power EEPROM data version mismatch
1284	Cannot read digital signal processor software version
1299	Option SW in slot A is too old
1300	Option SW in slot B is too old
1301	Option SW in slot C0 is too old
1302	Option SW in slot C1 is too old
1315	Option SW in slot A is not supported (not allowed)
1316	Option SW in slot B is not supported (not allowed)
1317	Option SW in slot C0 is not supported (not allowed)
1318	Option SW in slot C1 is not supported (not allowed)
1379	Option A did not respond when calculating platform version

No.	Text
1380	Option B did not respond when calculating platform version
1381	Option C0 did not respond when calculating platform version.
1382	Option C1 did not respond when calculating platform version.
1536	An exception in the application oriented control is registered. Debug information written in LCP
1792	DSP watchdog is active. Debugging of power part data, motor oriented control data not transferred correctly.
2049	Power data restarted
2064-2072	H081x: option in slot x has restarted
2080-2088	H082x: option in slot x has issued a power-up wait
2096-2104	H983x: option in slot x has issued a legal power-up wait
2304	Could not read any data from power EEPROM
2305	Missing SW version from power unit
2314	Missing power unit data from power unit
2315	Missing SW version from power unit
2316	Missint lo_statepage from power unit
2324	Power card configuration is determined to be incorrect at power-up
2325	A power card has stopped communicating while main power is applied
2326	Power card configuration is determined to be incorrect after the delay for power cards to register.
2327	Too many power card locations have been registered as present.
2330	Power size information between the power cards does not match.
2561	No communication from DSP to ATACD
2562	No communication from ATACD to DSP (state running)
2816	Stack overflow control board module
2817	Scheduler slow tasks
2818	Fast tasks
2819	Parameter thread
2820	LCP stack overflow
2821	Serial port overflow
2822	USB port overflow
2836	cfListMempool too small
3072-5122	Parameter value is outside its limits
5123	Option in slot A: Hardware incompatible with control board hardware
5124	Option in slot B: Hardware incompatible with control board hardware.
5125	Option in slot C0: Hardware incompatible with control board hardware.
5126	Option in slot C1: Hardware incompatible with control board hardware.
5376-6231	Out of memory

Table 6.1

ALARM 39, Heatsink sensor
No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of digital output terminal 27
Check the load connected to terminal 27 or remove short-circuit connection. Check *5-00 Digital I/O Mode* and *5-01 Terminal 27 Mode*.

WARNING 41, Overload of digital output terminal 29
Check the load connected to terminal 29 or remove short-circuit connection. Check *5-00 Digital I/O Mode* and *5-02 Terminal 29 Mode*.

WARNING 42, Overload of digital output on X30/6 or overload of digital output on X30/7
For X30/6, check the load connected to X30/6 or remove the short-circuit connection. Check *5-32 Term X30/6 Digi Out (MCB 101)*.

For X30/7, check the load connected to X30/7 or remove the short-circuit connection. Check *5-33 Term X30/7 Digi Out (MCB 101)*.

ALARM 46, Power card supply
The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24 V, 5 V, ±18 V. When powered with 24 V DC with the MCB 107 option, only the 24 V and 5 V supplies are monitored. When powered with three phase AC line voltage, all three supplies are monitored.

WARNING 47, 24V supply low
The 24 V DC is measured on the control card. The external 24 V DC backup power supply may be overloaded, otherwise contact your Danfoss supplier.

WARNING 48, 1.8V supply low
The 1.8 V DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card. Check for a defective control card. If an option card is present, check for an overvoltage condition.

WARNING 49, Speed limit
When the speed is not within the specified range in *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]*, the adjustable frequency drive shows a warning. When the speed is below the specified limit in

1-86 Trip Speed Low [RPM] (except when starting or stopping), the adjustable frequency drive will trip.

ALARM 50, AMA calibration failed
Contact your Danfoss supplier or Danfoss Service Department.

ALARM 51, AMA check Unom and Inom
The settings for motor voltage, motor current, and motor power are wrong. Check the settings in parameters 1-20 to 1-25.

ALARM 52, AMA low I_{nom}
The motor current is too low. Check the settings.

ALARM 53, AMA motor too big
The motor is too big for the AMA to operate.

ALARM 54, AMA motor too small
The motor is too small for the AMA to operate.

ALARM 55, AMA Parameter out of range
The parameter values of the motor are outside of the acceptable range. AMA will not run.

56 ALARM, AMA interrupted by user
The user has interrupted the AMA.

ALARM 57, AMA internal fault
Try to restart AMA again a number of times until the AMA is carried out. Note that repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical.

ALARM 58, AMA internal fault
Contact your Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *4-18 Current Limit*. Ensure that Motor data in parameters 1-20 through 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit.

WARNING 60, External interlock
External interlock has been activated. To resume normal operation, apply 24 V DC to the terminal programmed for external interlock and reset the adjustable frequency drive (via serial communication, digital I/O, or by pressing [Reset]).

WARNING/ALARM 61, Tracking error
An error between calculated motor speed and speed measurement from feedback device. The function Warning/ Alarm/Disable is set in *4-30 Motor Feedback Loss Function*. Accepted error setting in *4-31 Motor Feedback Speed Error* and the allowed time the error occur setting in *4-32 Motor Feedback Loss Timeout*. During a commissioning procedure the function may be effective.

WARNING 62, Output frequency at maximum limit
The output frequency is higher than the value set in *4-19 Max Output Frequency*.

ALARM 64, Voltage Limit
The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM 65, Control card over temperature
The cutout temperature of the control card is 176° F [80°C].

Troubleshooting

- Check that the ambient operating temperature is within limits.
- Check for clogged filters.
- Check fan operation.
- Check the control card.

WARNING 66, Heatsink temperature low
The adjustable frequency drive is too cold to operate. This warning is based on the temperature sensor in the IGBT module.
Increase the ambient temperature of the unit. Also, a trickle amount of current can be supplied to the adjustable frequency drive whenever the motor is stopped by setting *2-00 DC Hold/Preheat Current* at 5% and *1-80 Function at Stop*

Troubleshooting
The heatsink temperature measured as 32° F [0°C] could indicate that the temperature sensor is defective, causing the fan speed to increase to the maximum. If the sensor wire between the IGBT and the gate drive card is disconnected, this warning would result. Also, check the IGBT thermal sensor.

ALARM 67, Option module configuration has changed
One or more options have either been added or removed since the last power-down. Check that the configuration change is intentional and reset the unit.

ALARM 68, Safe stop activated
Safe stop has been activated. To resume normal operation, apply 24 V DC to terminal 37, then send a reset signal (via Bus, Digital I/O, or by pressing the reset key).

ALARM 69, Power card temperature
The temperature sensor on the power card is either too hot or too cold.

Troubleshooting

Check the operation of the door fans.

Make sure that the filters for the door fans are not blocked.

Check that the connector plate is properly installed on IP21/IP 54 (NEMA 1/12) adjustable frequency drives.

ALARM 70, Illegal adjustable frequency drive configuration
The control card and power card are incompatible. Contact your supplier with the type code of the unit from the nameplate and the part numbers of the cards to check compatibility.

ALARM 71, PTC 1 safe stop
Safe Stop has been activated from the PTC Thermistor Card (motor too warm). Normal operation can be resumed when the applies 24 V DC to T-37 again (when the motor temperature reaches an acceptable level) and when the Digital Input from the is deactivated. When that happens, a reset signal must be is be sent (via Bus, Digital I/O, or by pressing [Reset]). Note that if automatic restart is enabled, the motor may start when the fault is cleared.

ALARM 72, Dangerous failure
Safe Stop with Trip Lock. Unexpected signal levels on safe stop and digital input from the PTC thermistor card.

WARNING 73, Safe stop auto restart
Safe stopped. With automatic restart enabled, the motor may start when the fault is cleared.

WARNING 76, Power unit set-up
The required number of power units does not match the detected number of active power units.

Troubleshooting:
When replacing an F-frame module, this will occur if the power specific data in the module power card does not match the rest of the adjustable frequency drive. Please confirm the spare part and its power card are the correct part number.

77 WARNING, Reduced power mode
This warning indicates that the adjustable frequency drive is operating in reduced power mode (i.e., less than the allowed number of inverter sections). This warning will be generated on power cycle when the adjustable frequency drive is set to run with fewer inverters and will remain on.

ALARM 79, Illegal power section configuration
The scaling card is the incorrect part number or not installed. Also MK102 connector on the power card could not be installed.

ALARM 80, Drive initialized to default value
Parameter settings are initialized to default settings after a manual reset. Reset the unit to clear the alarm.

ALARM 81, CSIV corrupt
CSIV file has syntax errors.

ALARM 82, CSIV par. err.
CSIV failed to init a parameter.

ALARM 85, Dang fail PB:
Profibus/Profisafe Error.

ALARM 91, Analogue input 54 wrong settings
Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

ALARM 243, Brake IGBT
This alarm is only for F Frame adjustable frequency drives. It is equivalent to Alarm 27. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

ALARM 244, Heatsink temperature
This alarm is only for F Frame adjustable frequency drives. It is equivalent to Alarm 29. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

ALARM 245, Heatsink sensor
This alarm is only for F Frame adjustable frequency drives. It is equivalent to Alarm 39. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

ALARM 246, Power card supply
This alarm is only for F Frame adjustable frequency drive. It is equivalent to Alarm 46. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

ALARM 247, Power card temperature
This alarm is only for F Frame adjustable frequency drive. It is equivalent to Alarm 69. The report value in the alarm log indicates which power module generated the alarm.

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

ALARM 248, Illegal power section configuration
This alarm is only for F Frame adjustable frequency drives. It is equivalent to Alarm 79. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 frame sizes.

2 = right inverter module in F10 or F11 frame sizes.

2 = second drive from the left inverter module in F14 frame size.

3 = right inverter module in F12 or F13 frame sizes.

3 = third drive from the left inverter module in F14 frame size.

4 = far right inverter module in F14 frame size.

5 = rectifier module.

6 = right rectifier module in F14 frame size.

WARNING 250, New spare part
A component in the adjustable frequency drive has been replaced. Reset the adjustable frequency drive for normal operation.

WARNING 251, New type code
The power card or other components have been replaced and the type code changed. Reset to remove the warning and resume normal operation.

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Danfoss Drives
4401 N. Bell School Rd.
Loves Park IL 61111 USA
Phone: 1-800-432-6367
1-815-639-8600
Fax: 1-815-639-8000
www.danfossdrives.com

Danfoss Drives
8800 W. Bradley Rd.
Milwaukee, WI 53224 USA
Phone: 1-800-621-8806
1-414-355-8800
Fax: 1-414-355-6117
www.danfossdrives.com

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