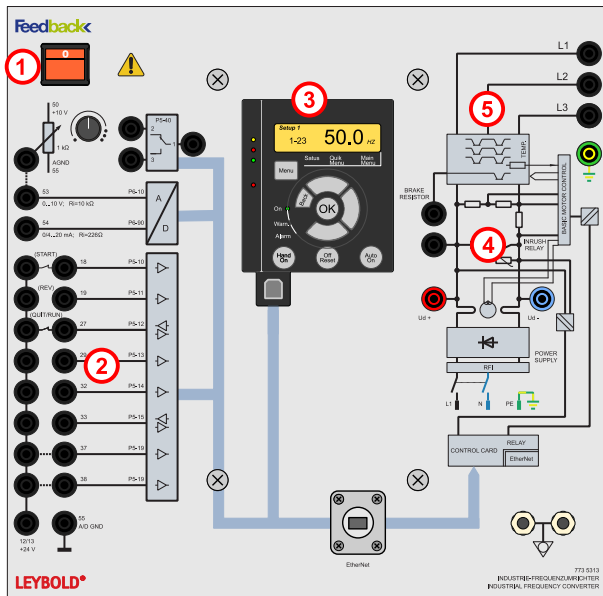


30/1120MH17

### Instruction Sheet 7735 313

Industrial frequency converter 230 V (735 313)



- 1 power switch
- 2 inputs and outputs for external controller
- 3 frequency converter Danfoss VLT 2815
- 4 block diagram of the frequency converter
- 5 power unit

### Safety Instructions

The device complies with the safety conditions for electronic measurement, control, and laboratory devices outlined by DIN EN 61010 part 1 (IEC 1010). It is meant to be operated in dry rooms suitable for the use of electronic equipment and facilities.

Safe operation of the device is ensured if it is used as intended. Safety is not ensured, however, if the device is handled incorrectly or carelessly.

The device must only be operated by persons who are able to recognise risks of contact and take appropriate safety precautions. If it can be assumed that the device can no longer be operated safely, the device should immediately be taken out of commission (e.g. if there is visible damage to the device)

Before first use:

- Check whether the value of the grid voltage printed on the nameplate agrees with the local value.
- Read the instructions for use carefully and follow all points.

Before start-up:

- Check the housing for damage and, in the event of malfunctions or visible damage, take the device out of operation and secure it against unintentional operation.

For every start-up:

- Only connect the device to sockets with a grounded neutral wire.
- Never exceed the maximum permissible input values.
- As a matter of principle, use only safety experiment cables in the experiment set-up.

- Before connecting experimental leads, test leads, and probes, check them for damaged insulation and bare wires.
- Always replace defective fuses with a fuse corresponding to the original value (see fuse plate).
- Never short-circuit the fuse or fuse holder.
- Never cover the vents on the housing; always ensure sufficient air circulation to cool the internal components.
- Keep metal objects, other foreign objects, and water away from vents.
- Do not operate the device if such objects have entered the inside of the device.
- Allow the device to be opened only by a qualified electrician.
- Avoid strong shocks to the device.
- Please observe the warnings on the device and the instructions for use of the device.
- Do not perform measurements directly with a grounded oscilloscope; use an isolation amplifier for this purpose.
- Integrate the device into the additional equipotential equalisation.

The safety sockets of the device are subject to dangerous voltages that are not separated from the mains. The power supply can only be switched off with the main switch, not by pressing the STOP/RESET button. However, the capacitor in the intermediate circuit will still carry a dangerous voltage for up to 4 minutes after switching off the device.

- Establish connection to protective conductor/PE.
- Make any changes to the test set-up only with the system powered off (switched off at the main switch).

### 1 Description

The industrial frequency converter 230 V is an industrial, micro-processor-controlled frequency converter with an intermediate DC circuit, mounted on a didactically prepared experiment panel. All measuring and connection points are led out to 4 mm experiment sockets within a block diagram. Three overlay screens (included) show the interaction of software and hardware and illustrate and simplify operation and programming.

For details on programming, download the DANFOSS VLT Converter Product Manual. The MCT 10 software facilitates programming and is available as a free download on the Danfoss website.

A frequency converter is an electronic device, used for stepless speed control and regulation of asynchronous machines. For this to be possible, the single-phase mains voltage must be converted into a DC voltage, which in turn is converted into a new, three-phase voltage with variable amplitude and frequency.

Any squirrel-cage rotor or wound rotor machines of the power classes 0.3 kW with a rated voltage of 230 V / 400 V at 50 or 60 Hz are suitable for connection to the frequency converter. Even though machines with a rated voltage of 400 V / 690 V can also be used, they will not reach their rated torque.

### 2 Scope of Delivery

- 1 industrial frequency converter (basic unit) including LCP 101
- 1 DANFOSS Product Manual for VLT converter (CD-ROM)
- 1 USB cable
- 1 power cord

### 3 Technical specifications

See the DANFOSS VLT Converter Product Manual

Mains voltage: 220...240 V / 50 ... 60 Hz

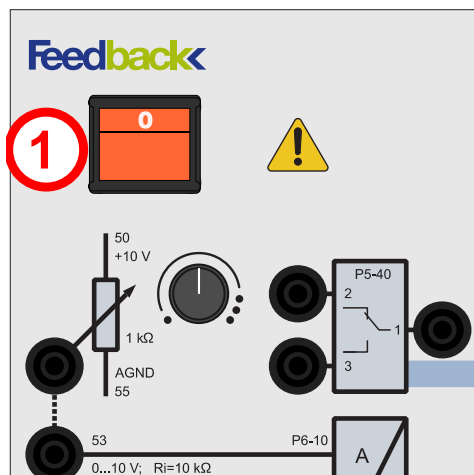
Dimensions: 30 cm x 12 cm x 3 cm

Mass: 3.5 kg

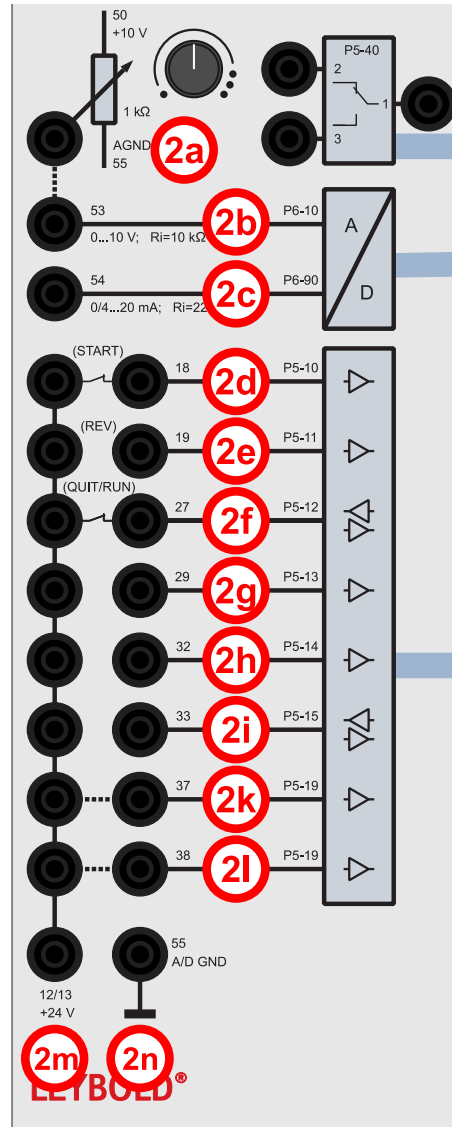
### 4 Components

#### 4.1 Power switch:

1 power switch for the entire power supply.



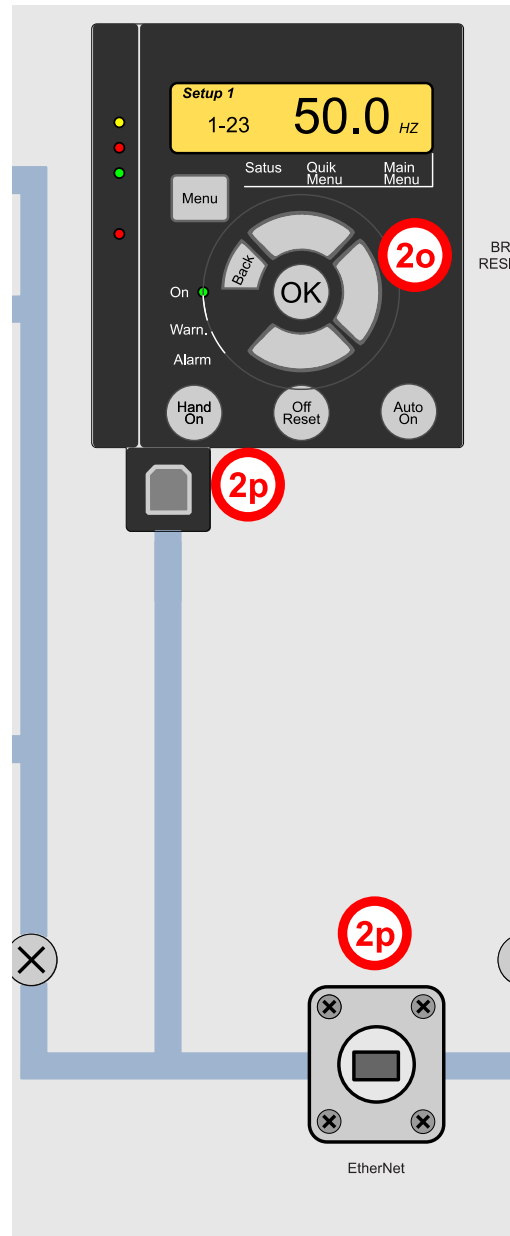
#### 4.2 Inputs:



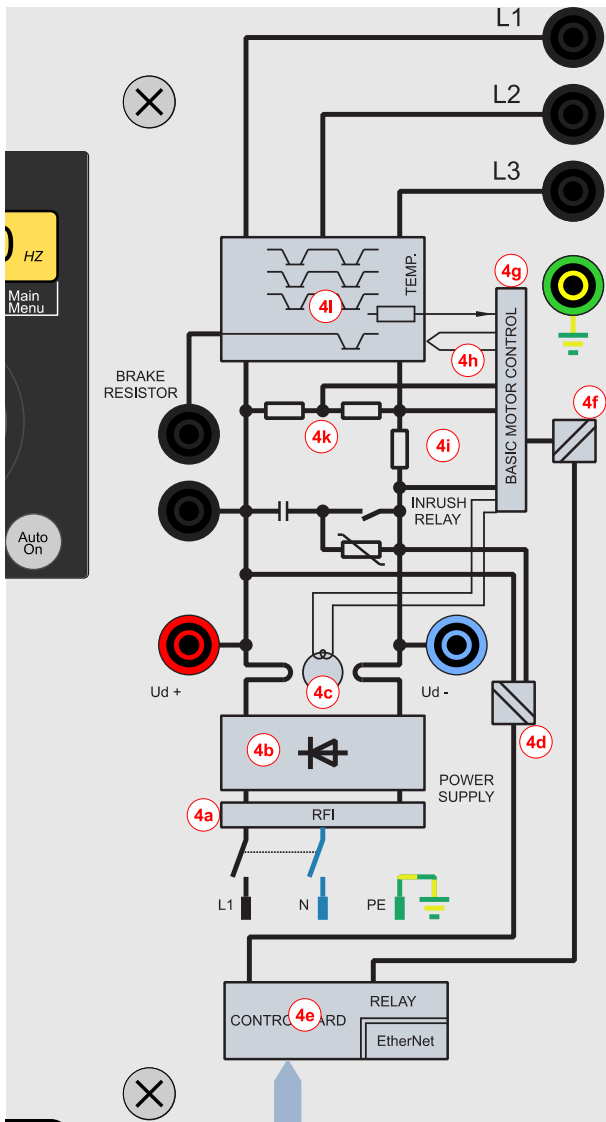
- 2a actuator for analogue output
- 2b analogue input 0 ... 10 V
- 2c analogue input or output 0 ... 10 V / 0 ... 20 mA
- 2d digital input or output START at factory setting
- 2e digital input or output REV at factory setting
- 2f digital input or output QUIT/RUN at factory setting
- 2g digital input or output JOG at factory setting
- 2h digital input or output
- 2i digital input or output
- 2k loop for safe start-up 1
- 2l loop for safe start-up 2
- 2m output +24V
- 2n digital ground / digital ground
- 2o control panel LCP 101 with display
- 2p USB port
- 2q Ethernet

- 2.a Actuator for analogue output:  
potentiometer 1 k, wired to terminal 50 (+10 V) and terminal 55 (DGNG / AGND) of the frequency converter.
- 2.b Analogue / digital input / digital  
0...10 V; 0...4...20 mA; 24 V DC: terminal 53; parameter P6-10; input for analogue setpoint
- 2.c Analogue/digital input or output  
0...10 V / 0...4...20 mA / 24 VDC: terminal 54; parameter P6-90; freely programmable input; or output; digital or analogue
- 2.d Digital input:  
terminal 18; parameter P5-10; multifunctional input of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting 'START' starts the motor
- 2.e Digital input:  
terminal 19; parameter P5-11; multifunctional input of the frequency converter, programmable.  
Activation by means of a jumper plug to the 24 VDC voltage source, factory setting 'REV' reverses the direction of rotation, but must be set to - MAX to Max in parameter 3-00, which it is not in the factory setting.
- 2.f Digital input and output:  
terminal 27; parameters P5-12, 5-30; multifunctional input or output of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting 'Quit/Run' starts the motor
- 2.g Digital input:  
terminal 29; parameter P5-13; multifunctional input of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting "JOG" starts the motor
- 2.h Digital input:  
terminal 32; parameter P5-14; multifunctional input of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting 'No function' starts the motor
- 2.i Digital input:  
terminal 33; parameter P5-15; multifunctional input of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting 'No function' starts the motor
- 2.j Digital input:  
terminal 37; parameter P5-19; multifunctional input of the frequency converter, programmable.  
Activation by means of jumper plug to the 24 VDC voltage source, factory setting 'Stop Alarm' starts the motor

- 2.k Loop for safe start-up 1  
Functional safety inputs
- 2.l Loop for safe start-up 2  
Functional safety inputs
- 2.m Output +24V  
24 VDC supply voltage. Maximum output current of 100 mA for all 24 V loads.
- 2.n Digital ground / digital ground  
Reference potential for digital and analogue inputs.
- 2.o Control panel LCP 101 with display  
Numerical control panel (LCP 101)
- 2.p USB port  
USB Standard 1.1 (full speed)  
USB socket USB plug type B
- 2.q Ethernet



**4.3 Block diagram of the frequency converter**



- 4a radio interference suppression filter
- 4b rectifier
- 4c differential current meter
- 4d operating voltage supply
- 4e microprocessor system with data bus
- 4f signal transmission
- 4g VVC modulator
- 4h monitoring of the operating parameters
- 4i current measurement in the intermediate circuit
- 4k voltage measurement of the intermediate circuit
- 4l power module

**(4a) Radio interference suppression filter**  
Radio interference suppression filter for reducing mains-related radio-frequency interference in the range from 10 kHz to 30 MHz.

**(4b) Rectifier:**  
The rectifier converts the mains AC voltage into DC voltage.

**(4c) Differential current meter:**  
Differential current meter for detection of fault currents. If the difference between the intermediate circuit currents is not equal to zero, there must be a fault and the frequency converter switches off with a corresponding message.

**(4d) Operating voltage supply:**  
Operating voltage supply, potential-isolated operating voltage supply of the controller unit.

**(4e) Microprocessor system with data bus.**  
Management of the incoming and outgoing data flow to and from the bus system and to the external LCP2 operating unit; monitoring of the operating voltage supply and the motor control.

**(4f) Signal transmission:**  
Potential-isolated signal transmission between controller and modulator.

**(4g) VVC modulator:**  
The frequency converter includes an inverter control method based on the Danfoss VVC (Voltage Vector Control) principle. The VVC principle has the following advantages over the traditional PWM (Pulse Width Modulation) method: Full rated motor voltage at nominal motor frequency, no reduced motor power compared to mains operation, high efficiency due to low switching frequency.

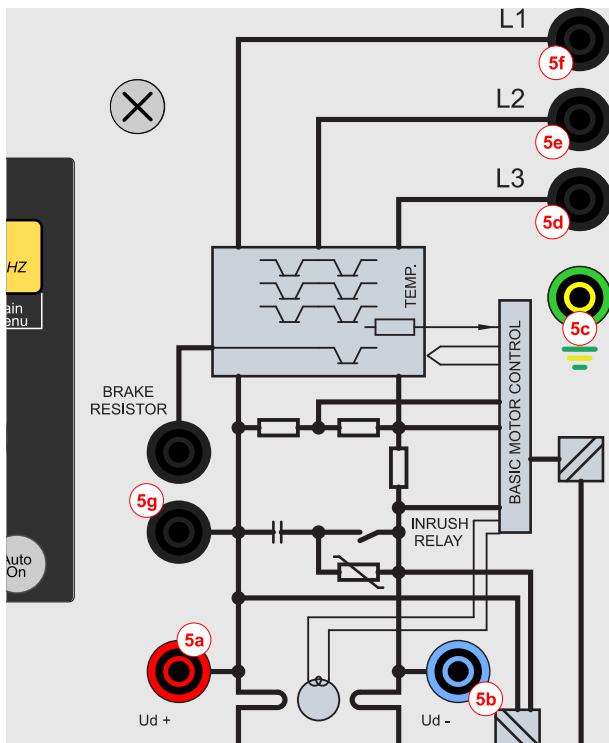
**(4h) Monitoring of the operating parameters:**  
Continuous monitoring of the operating parameters of the inverter

**(4i) Current measurement in the intermediate circuit**  
Accurate current measurement in the intermediate circuit with a measuring resistance. The dynamically adaptive U/f control characteristic requires accurate current measurement.

**(4k) Voltage measurement of the intermediate circuit**  
Accurate voltage measurement of the intermediate circuit.

**(4l) Power module**  
Conversion of the intermediate circuit DC voltage into a variable frequency AC voltage

**5. Power unit:**



- 5a positive pole of the intermediate circuit voltage
- 5b negative pole of the intermediate circuit voltage
- 5c socket PE
- 5d output W of the frequency converter
- 5e output V of the frequency converter
- 5f output U of the frequency converter
- 5g connection for braking resistor

(5a) Positive pole of the intermediate circuit voltage:  
Not safeguarded against overcurrent.

(5b) Negative pole of the intermediate circuit voltage:  
Not electrically safeguarded.

(5c) Socket PE:  
Connection for protective conductor of the motor

(5d) Output W of the frequency converter:  
Connection for motor.

(5e) Output V of the frequency converter:  
Connection for motor.

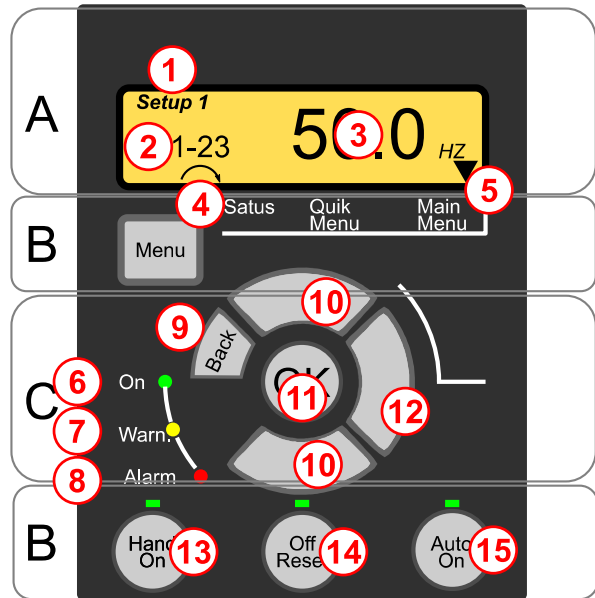
(5f) Output U of the frequency converter:  
Connection for motor.

(5g) Connection for braking resistor  
Nominal value of the resistance:  
300 W machine            50 Ω at 300 W.  
1000 W machine        50 Ω at 900 W.

**6.1. The numerical control unit (LCP 101)**

The numerical control unit (LCP 101) is divided into the following 4 functional areas.

- A. Numeric display
- B. Menu key.
- C. Navigation keys and indicator lights (LED).
- D. Control buttons with control displays (LED).



**A Numeric display**

The LCD display is backlit and includes a numeric line. The LCP 101 displays all data.

- (1) The set number indicates the active parameter set and the editable parameter set. If the active set and the programming set match, only this set number is shown (factory setting). If the active set and editable parameter set differ, the display shows both set numbers (eg set 12). The flashing number indicates the editable parameter set.
- (2) Parameter number.
- (3) Parameter value.
- (4) The running direction of the motor is displayed in the lower section of the display. A small arrow indicates the running direction.
- (5) The triangle indicates whether the LCP is in the status display, in the quick menu, or in the main menu.

**B. Menu key**

Press the [Menu] key to toggle between Status, Quick Menu, and Main Menu.

**C. Indicator lights (LED) and navigation keys**

- (6) On, green LED  
The 'On' LED lights up when the frequency converter is connected to the mains voltage or powered by a intermediate DC bus circuit or an external 24 V supply.
- (7) Warn., yellow LED  
The yellow 'Warn' LED lights up when a warning occurs. The display also shows text indicating the problem.
- (8) Alarm, red LED  
The red 'Alarm' LED flashes in the event of a fault. The display also shows text providing more detail about the alarm.
- (9) [BACK]

Navigate back to the previous step or previous level in the navigation tree.

(10) [▲▼]

Switch between parameter groups, parameters, and within parameters or increase/decrease the parameter values. You can also set the local set point using the arrow keys.

(11) [OK]

Press this button to access parameter groups or to confirm the selection of a parameter.

(12) [▶]

Move from left to right within the parameter value to change the individual digits.

#### D. Control buttons with control displays (LED)

(13) Hand On

Press this button to start the frequency converter in manual mode (local control).

- An external stop signal via control signals or serial communication deactivates manual operation.

(14) Off/Reset

This key is used to stop the motor, but without interrupting the power supply to the frequency converter, or to manually reset the frequency converter after a fault has been rectified.

(15) Auto on

This key switches the system to remote mode (auto mode).

- It responds to an external start command via control terminals or serial communication.

#### Warning!

##### ELECTRICAL HAZARD

Even after pushing the [Off/Reset] button, voltage will still be present at the frequency converter terminals. Pressing the [Off/Reset] key does not disconnect the frequency converter from the mains supply. Touching live parts may cause serious injury or death!

## 6.2 Menu navigation

### 6.2.1 Quick Menu:

- To enter the *Quick Menu*, press the [Menu] key until the indicator on the display is on *Quick Menu*.
- Use the [▲] [▼] buttons to select either QM1 or QM2, then press [OK].
- Use the [▲] [▼] buttons to navigate through the parameters in the *Quick Menu*.
- Press [OK] to select a parameter.
- Press [▲] [▼] to change the value of a parameter setting.
- Press [OK] to accept the change.
- To exit, press [Back] twice (or three times if in QM2 and QM3) to access the status, or press [Menu] once to enter the main menu.

An overview of the complete *Quick Menu* can be found in the appendix.

### 6.3 Main Menu

The main menu provides access to all parameters. A more detailed description can be found in the programming manual by Danfoss or on the website, [www.Danfoss.de/VLT](http://www.Danfoss.de/VLT).

- Select the main menu by pressing the [Menu] key repeatedly until the arrow on the display is above Main Menu.
- [▲] [▼]: Navigate through the parameter groups.
- Press [OK] to select a parameter group.
- [▲] [▼]: Navigate through the parameters of the respective group.
- Press [OK] to select the parameter.
- [▶] and [▲] [▼]: Set/change the parameter value.
- Accept the value with [OK].
- To exit, press [Back] twice (or three times for array parameters) until the main menu is opened, or press [Menu] once to access the status.

### 6.4 Entering parameters via the USB connection, using the MCT10 software

Please read the instructions by Danfoss in the appendix:

This software enables convenient programming of frequency converters via the USB cable. Prepared files by LD can also be loaded.



Appendix 1 Quick Menu

