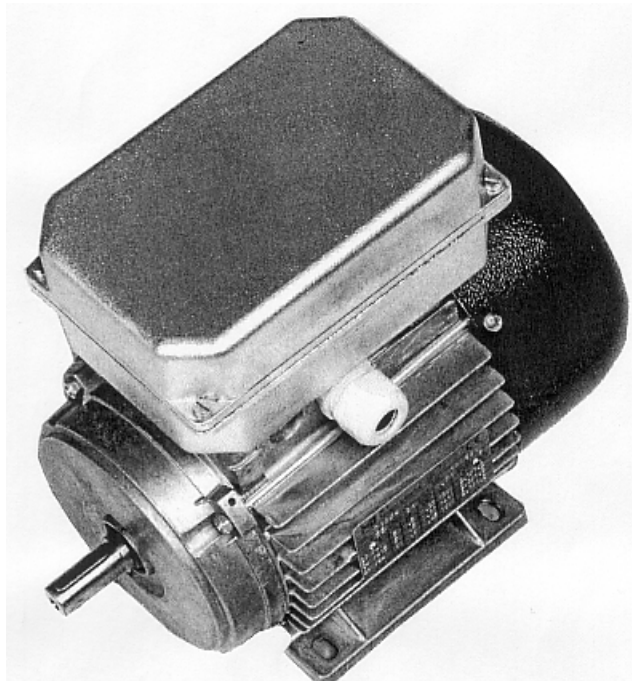Technical documentation for:

FREQUENCY-CONVERTER MFR 22 / 600 / 1500

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1. General description

The frequency converter MFR 600 / MFR 1500 are designed for the speed - variation of standard 3-phase
asynchronious induction motors from zero up to an adjustable maximum speed.
The unit has a universal serial interface providing the connection of a control unit (PG 1) or a bus-interface.
Setting and changing of all parameeters must be made by the control-unit or by the connected bus. The
prameters are stored in a non volatile memory .

The mechanical design provides the assembling instead of the normal terminal case of a standard motor.
By use of corresponding sealings protection levels up to IP68 are possible. The main advantage of the assembling
on the motor is the fact, that the connections to the motor are inside of the closed metal case.
This is very important because the radiation of this connections is prohibited and there is also no capacitive
load for the inverter to drive. This reduces both the power losses and the RFI level on the mains.

The drives are working with a chopper frequency of appr. 10 kHz, providing smooth running of the motor also in
the low speed region.

The drives are designed for 2-quadrant operation (driving in both directions). Braking is possible up to a power
level equal to the power losses of the motor. While braking the induction of the motor is increased
and therefore also the power losses of the motor.

The setting of the parameters include the selection of the following operation modes:

In the **'Normal - operation'** the frequency range reaches up to 150 Hz. In the low speed range the motor voltage can be increased by the setting of a boost-value (0…99%). The increase of the motor voltage causes at zero speed a DC-current in the motor. This DC-current provides braking down to zero speed and is automatically switched off 4 seconds after reaching zero frequency. This switch off is necessary to avoid heat-up of the motor at zero speed.

In the **'High - frequency - operation'** - mode the maximum frequency - range reaches up to 300 Hz.

In the operation - mode **' long ramp '** the ramp - time - adjustment - range is switched from 0.2-15 sec to 4 - 300 sec (for a frequency - step of 150 Hz / 300 Hz).

The operation - mode **'Motorpot'** enables to control the speed of the drive by 2 keys (see 4.5).

Selection of the **'Enable'** – function in addition to any operation mode prevent the inverter from self – starting. After switch on or an error the inverter must be enabled by switching the enable input.

The selection of the required operation - mode and the parameters must be done in the presence of mains-voltage. After disconnection of the mains the parameters are stored in the non-volatile memory of the inverter.

For the connections of the mains, motor and control lines there are plug - in - terminals used. To protect the drive against dust, humidity, mechanical shock and vibrations the electronic unit is embedded in a soft casting resin inside an aluminium case.

The control - imputs of the drive are protection - isolated (in accordance with VDE 0884). The drives are also protected against a direct short between motor - lines or between motor - line and earth.

The electronic limiter of the motor - current allows at case - temperatures below 30°C a maximum motor - power of appr. 150 % of nominal power. At higher temperatures the maximum power is reduced to appr. 120 % of nominal power at 80°C case - temperature. The thermal - protection is switching off the drive at appr. 85°C. The reset of the thermal switch off must be done by switch off the mains for at least 10 sec.

To control the drive signals from potentiometer, ext. voltage 0...10V, ext. current 0...20 mA or 4...20 mA are possible. The adaption of the input - circuit to correspond to the control - signal is made by the jumper B1 and B2.
Attention! If the input - circuit is set for control from a potentiometer or with 0...10 V, a disconnection of the control - input (terminal 2) causes a control signal of half the adjusted maximum! Open control - input is therefore to be avoided.

To enable the drive a closed loop must be connected to the enable - input. The circuit is designed to accept loops with up to 1 kohm as closed loops, higher resistance values as open loops. This makes it possible to include a PTC - sensor of the motor in the enable - loop.

Control - lines with a length of more than 2 meters must be shielded. The shield should be connected to terminal 4. Below the length of 2 meters shielding is recommanded if a high disturbance - level is present in the surrounding.

2. Technical data

	MFR 22/600	MFR 22/1500
Mains - voltage	230 VAC	230 VAC
	115 VAC on requ.	115 VAC on requ.
Tolerance of the mains-voltage	+- 15%	+- 15%
Frequence of the mains-voltage	50 - 60 Hz	50 - 60 Hz
recommanded fuse in the mains	6.3 A slow	10 A slow
rec. max. motor size	375 W	750 W
Nominal voltage of the motor	3 X 230 VAC	3 X 230 VAC
Motor - current (max. at 30°C case-temp.)	3 A RMS	5.5 A RMS
(max. at 80°C case-temp.)	2,4 A RMS	4.4 A RMS
Temperature - range (case - temperature)	0...80°C	0...80°C
Mechanical size	150 X 100 X 70 mm	150 X 100 X 70 mm
Weight	0.85 kg	0.88 kg

Output - frequency - ranges:

    - Normal - operation   0...150 Hz

    - High - frequency - operation   0...300 Hz

Adjustment - range of the min. frequency (trimpot P4)   0...50% of the preadjusted maximum

Ramp - times:

Normal - operation, frequency - step = 150 Hz

    - with short rampe   0.2 ... 15 sec

    - with long rampe   4 ... 300 sec

High - frequency - mode, frequency step = 300 Hz

    - with short rampe   0.2 ... 15 sec

    - with long rampe   4 ...300 sec

Control - signals:

    B1 and B2 open   Poetentiometer or ext. voltage 0...10 VDC

    B1 closed, B2 open   0 ... 20 mA DC

    B1 and B2 closed   4 ... 20 mA DC

Input - resistance of the control - input:

    B1 open   > 500 kohm

    B1 closed   470 ohm

Enalble - signal:

    current in the enable - loop   closed loop with less than 1 kohm

                                          1 mA

Reversing - signal: open / closed loop, 10 V / 1 mA DC

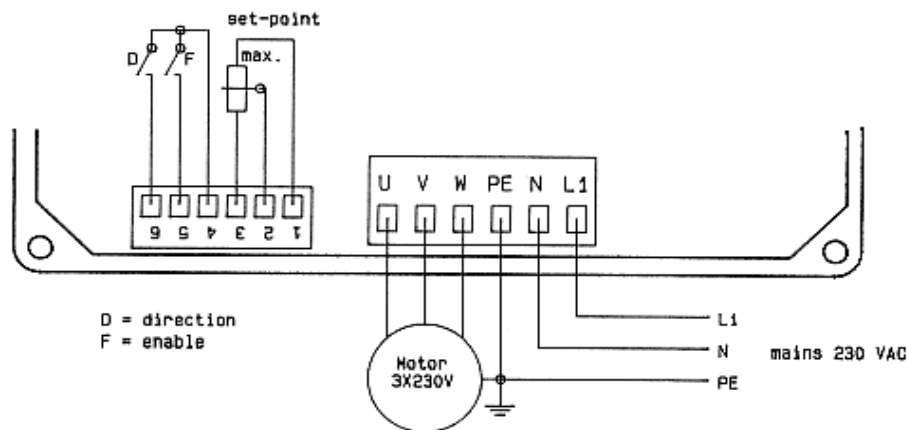### 3. Function of the ramp - generator:

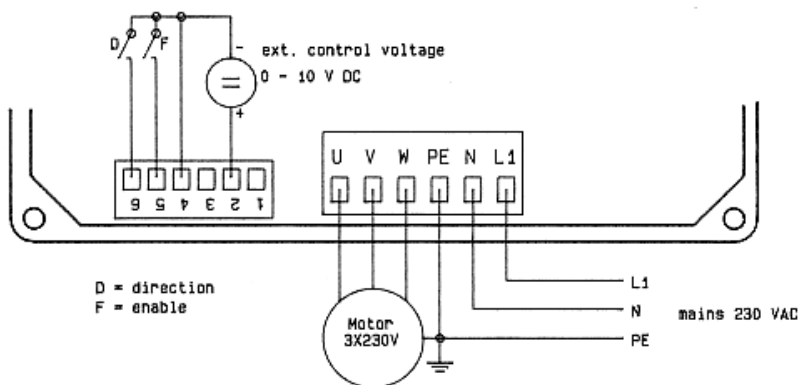3.1 Normal - or high - frequency - operation - mode:
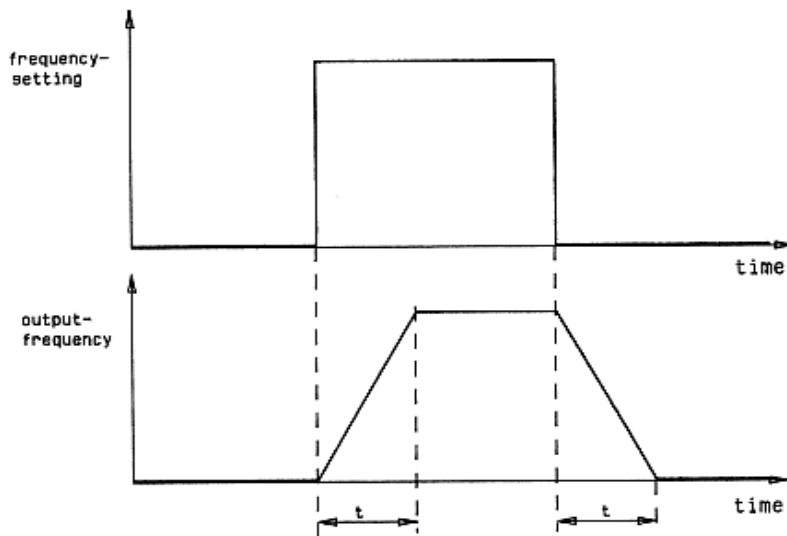
Acceleration time and deceleration time can be programmed individual.

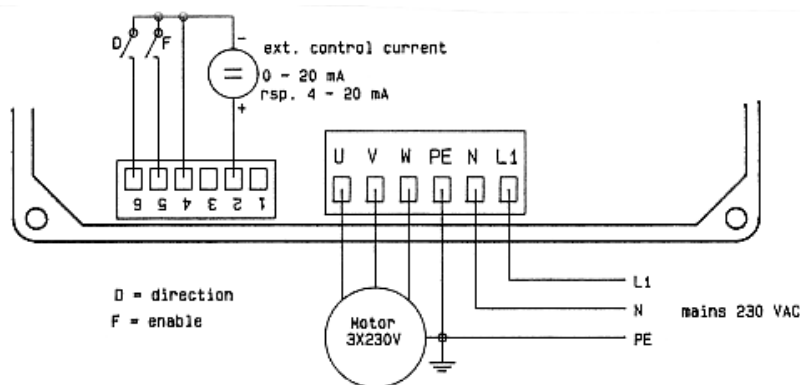### 4. Electrical connection and examples for the control of the drive:
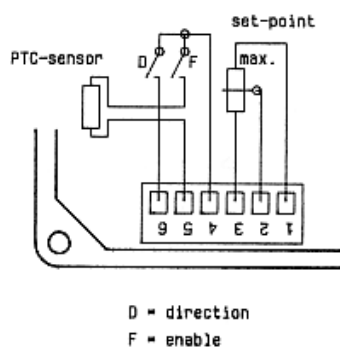
4.1 Control by potentiometer:
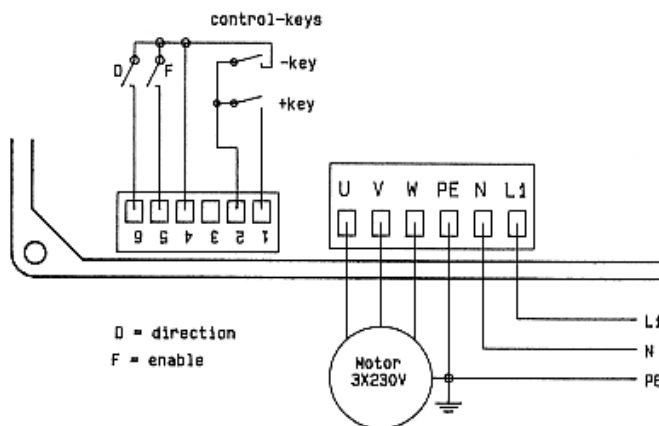
4.2 Control by external voltage 0...10 V DC:

D = direction
F = enable

4.3 Control by external current 0...20 mA DC (4 ... 20 mA DC):

D = direction
F = enable

4.4 Use of the enable-loop to provide thermal protection of the motor:

D = direction
F = enable

4.5 Control by 2 keys in the mode 'Motorpot':

D = direction
F = enable

5. Mechanical dimensions, assembling on the motor:

(Drawn is one possible assembling. In accordance to the requirements the drive can also be assembled in different modes)
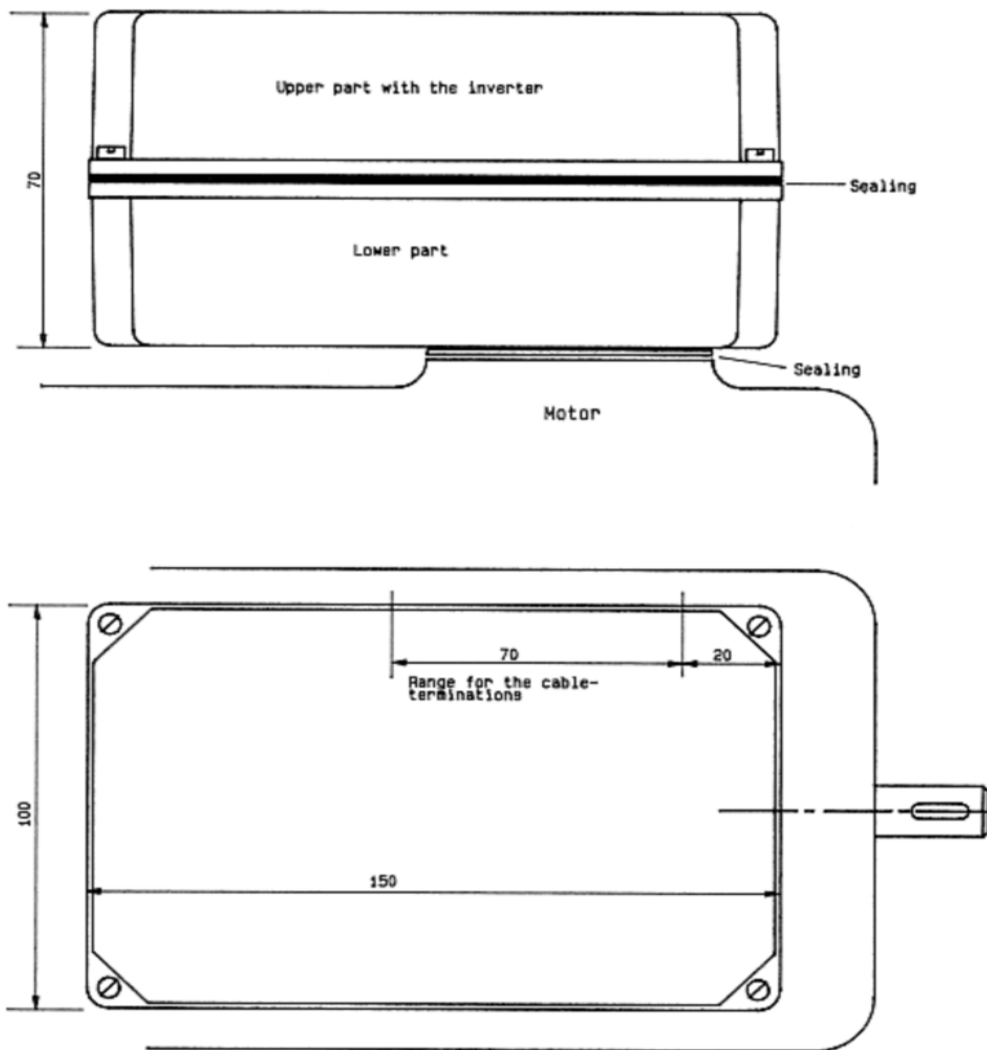
Assembling - steps:

1. Drilling and milling of the lower part of the case in accordance to the flange of the motor - terminal - case. Drilling the holes for the cable - terminations.

Caution! Take care that the capacitors of the drive do not bump into the terminals of the motor!

2. Assembling of the lower part of the case on the motor.

3. Assembling of the cable - terminations.

4. Assembling and fastening of the cables.

5. Connecting of the plug-in - terminals to the wires of the cables and the motor.

6. Placing the seal.

7. Plug - in the connectors to the converter.

9. Fixing of the upper case on the lower case.

6. Start of operation, adjustments:

The selection of the operation mode and the parameters can be made in the assembled state of the drive, mains must be switched on. For the connection of the control unit PG1 the plastic screw (PG11) at the side of the inverter must be opened.

For the programming of the unit follow the detailled description of the control unit PG1.

6.1 Position of the jumpers:
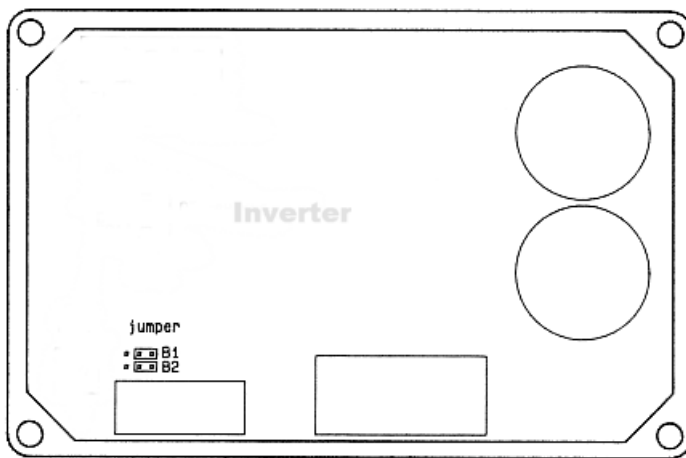
Prior to the assembling there is only the selection of the desired control signal necessary:

B1 inserted, B2 not inserted:
      Control by current 0…20 mA DC

B1 and B2 not inserted:
      Control by voltage 0…10V DC or potentiometer

B1 and B2 inserted:
      Control by current 4…20 mA DC

7. Safety considerations

The following safety considerations must be observed during all phases of operation, service and repair of this device. Failure to comply with this precautions violates the intended use of this device.

To minimize the shock - hazard the drive must be connected to an electrical ground. Terminal PE or the metal-case must be connected to the electrical ground (safety - ground) of the power - outlet.

Do not operate in an explosive atmosphere!
Operation of this device in the presence of flammable gases, fumes or dusts may cause of an ignition of this atmosphere and is to prevent.

CAUTION!
To prevent potential shock hazards do not expose this device in the open state to moisture, rain or wetness. Wetness inside the case may cause an electrical connection between mains and the inputs.

Installation, ajustment and service of this device must be made by qualified personal. Works at the electrical parts of the device are very dangerous because of the high voltage the device is working with. This high voltage is capable of causing death and is present even after disconnecting mains. Before starting of service it is necessary to wait at least 30 sec. after disconnecting mains.

This device must not used as an electrical disconnection. It is not allowed to work at the output lines without a mechanical disconnection from mains, even if the driven motor does not carry voltage or current.

Do not attempt internal service or adjustment unless another person, capable of disconnecting mains and rendering first aid is present.

Do not touch the electrical parts of this device. During operation the electrical parts are carrying dangerous voltages. Out of operation a touch may cause a defect by electrostatic discharge.

To prevent additional hazards, do not make modifications at this device.