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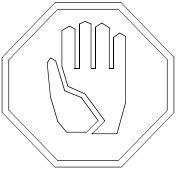
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# RULES FOR SAFETY

## Installation



- Read the whole Instruction manual before installing and putting the equipment into operation.
- The installation must be made by authorized personnel.
- General conditions and regulations for installation and operation of electrical equipment must be complied with.
- Measures must be made for personal safety according to local conditions and regulations.
- Motor cable between inverter and motor is allowed to have a maximum total length of 20 m for screened cable. Special arrangements, as adding output chokes, have to be made for longer cables.
- Install a breaker switch between the mains power supply and the frequency inverter for separate disconnection of the supply voltage to inverter and motor.
- Connection and disconnection of cables are not allowed during operation of the inverter, i.e. with connected supply voltage.
- Do not confuse mains power supply cable with motor cable.
- The frequency inverter must be properly earthed. (Use star-shaped earth wiring, avoid closed earth circuits, use shortest possible connection to the mains protective earth.)
- The DIGIFLUX should not be installed higher than 3,000 metres (10,000 ft) above sea level. Motor power is reduced by 1% with reference to the nominal power for every 100 m (330 ft) above 1,000 metres (3,300 ft).
- Before the equipment is put into service, check that it is properly wired according to chapter “**2. INSTALLATION**”.
- The warranty does not cover faults arising out of improper installation or operation.

## Operation

- Do not touch cable connectors while the inverter is connected to mains voltage.
- Do not make measurements in the inverter while it is operating, i.e. with connected mains supply voltage.
- The inverter must not be opened or taken apart while operating.
- The DIGIFLUX contains electrical components which remain live for a time after it has been shut down; the unit must therefore not be opened and touched inside for at least 5 minutes after switching off.
- Repeated frequent switching of the mains power supply on and off is not allowed.
- The DIGIFLUX should be operated under permissible conditions. Consider ambient temperature, humidity etc.

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# **1. INTRODUCTION**

DIGIFLUX CF frequency inverters are intended to control the speed of three phase asynchronous motors. The design is intended for multi purpose use. Typical applications are conveyor tables, packaging machines, pumps and fans.

## **1.1 How to use the instruction manual**

This instruction manual tells you how to install and operate the DIGIFLUX CF frequency inverter. Before starting to use the inverter, you should read the whole manual.

## **1.2 Inspection and unpacking at delivery**

The delivery includes the inverter itself, a dust cover for the top and this instruction manual.

Even though Emotron products are thoroughly controlled and carefully packed before delivery, transport damages may occur. When receiving the goods, always check that the delivery is complete according to the packing list. Compare the type label of the unit with the description found in the packing list. Also check that nothing has been damaged in transit. Any damages should be reported both to the shipping agent and the supplier, even if there is no visible damage to the packing material. Keep the packing material for possible inspection by the shipping agent or for returning the goods.

## **1.3 Functional description**

The frequency inverter rectifies the single or three phase AC input into DC, and by switching the output transistors, the DC voltage is transformed into a pulse width modulated, three phase AC voltage. By changing the switching pattern, both frequency and voltage can be controlled. The

speed of the motor is dependant of the frequency, and the torque of the motor is dependant of the current (indirect the voltage).

The inverter includes some built in functions and parameter settings which may be changed by using the optional display unit. Normally, the operator controls the inverter by remote signals connected to the terminals (1-16), but the inverter can also be controlled directly from the display unit.

## 1.4 Display unit

The display unit is a tool for setting inverter parameters or for direct operation of the unit. For parameter setting procedure, refer to chapter **“3. SETTINGS”**. Operation directly from the display unit can be performed if F010=0 (start/stop and fwd/rev), and F011=0 (frequency control via up/down-keykeys) or =1 (frequency control via the built-in potentiometer). When using the display unit as a control unit there is no need for any connections on the control terminals.

## 2. INSTALLATION

Installation and putting the device into operation has to be carried out by personal trained in electrical power installations and according to the safety instructions for these type of installations. Special care must be taken to avoid getting in contact with live parts.

### 2.1 Mounting

All DIGIFLUX frequency inverters must be mounted vertically in an upright position.

The unit must be mounted in a cool, dry place and must not be exposed to vibration. See to that the ambient conditions lie within the specified limits, see chapter “**6. TECHNICAL DATA**”. Also keep the minimum free space for adequate air circulation. There must be a free space of at least 100 mm above and below it and at least 50 mm at the sides.

When mounting the inverter in a cabinet, the following has to be considered for the cabinet dimensioning:

$$A = P_f / (K * dT)$$

$$V = 3,1 * P_f / dT$$

where

A = Outer surface area of the cabinet in m<sup>2</sup>

P<sub>f</sub> = Inverter power loss in W

K = Heat transfer factor, k-value, for steel cabinets appr. 5 W/(K\*m<sup>2</sup>).

dT = Temperature difference between ambient and the inside of the cabinet, standard value approx. 10-20 K. Consider the allowed inverter ambient temperature.

V = Air flow for cabinet cooling fan in m<sup>3</sup>/h.



## 2.2 Wiring

To access the terminals, the cover must be removed. Make sure that power is disconnected and that all LED's in the front are extinguished. The cover is secured by a screw. To make the access and connection easier, the metal plate can be removed. After making the necessary wiring, the metal plate and the cover should be replaced before switching the power on.

### 2.2.1 Mains supply

For CF23: connect the single phase supply 230 VAC to terminals L1 and L2. Remark: Three phase 230 VAC can be connected to L1, L2 and L3, but the standard EMC filter is designed for single phase connection only. For CF40: connect the three phase supply 400 VAC to terminals L1, L2 and L3.

Use an RFI filter to fulfil the european EMC standards. Refer to "**2.2.7 EMC guidelines**".

The recommended fuse ratings and cable sizes are based on the actual RMS current to the inverter during operation within the permitted range for a standard 3-phase induction motor. The given figures are valid for copper cables and should be seen as minimum recommendations. Larger wire cross areas are required for long cables.

*Table 1: Fuse ratings and cable sizes for CF23.*

CF23 Type	Fuse (A)	Cable (mm <sup>2</sup> )	CF40 Type	Fuse (A)	Cable (mm <sup>2</sup> )
CF23-05	16	2.5	CF40-003	16	2.5
CF23-07	16	2.5	CF40-006	16	2.5
CF23-11	32	4.0	CF40-008	16	2.5
CF23-16	32	4.0	CF40-013	16	2.5
			CF40-020	25	4.0
			CF40-026	32	4.0

## 2.2.2 Motor

Connect the motor to terminals T1, T2 and T3. For CF23: Make sure that the motor is made and connected for 230VAC.

Use a screened cable to fulfil the european EMC standards. Refer to "**2.2.7 EMC guidelines**". The cross wire area can be the same as for the mains supply cable. Maximum recommended cable length is 20 meters. If longer cables are to be used, please contact your distributor.

The order of wiring motor cables affects the direction of rotation for the motor.

**DO NOT** connect mains power to the inverter output terminals T1, T2 and T3. This will seriously damage the inverter.

**DO NOT** use power correction capacitors between the inverter and the motor.

**DO NOT** open or close the motor lines during operation.

**DO NOT** use a megger on the motor while it is connected to the inverter.

## 2.2.3 Brake resistors

A brake resistor, used to dissipate excessive energy during braking, can be connected to terminals P and R. Use screened cables to fulfill the european EMC standards. The resistor value can be calculated using the following formula:

$R(\text{ohms}) = U_{dc} \times U_{dc} / P_{max}$ , where

R=Resistance of the brake resistor. Not allowed to be lower than the value indicated in the following table.

P<sub>max</sub>=Maximum braking power desired, in Watts

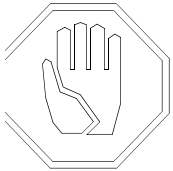
U<sub>dc</sub>=385V for CF23 and 770V for CF40

Table 2: Allowed values for brake resistors

CF23 Type	Min. Ohms	CF40 Type	Min. Ohms
CF23-05	100	CF40-003	100
CF23-07	100	CF40-006	65
CF23-11	20	CF40-008	50
CF23-16	15	CF40-013	30
		CF40-020	
		CF40-026	

## 2.2.4 Earthing

The frequency inverter must always be connected to protective earth. Avoid earth currents by earthing star-shaped with a well defined earth point.



### Use of earth fault breakers

**Warning!** Earth fault breakers may only be used with frequency inverters subject to special conditions.

An earth fault breaker may not function properly together with a frequency inverter. For this reason a ground fault breaker must not be used as the sole safety precaution. Additional safety measures such as safe distance and zeroing are required. The outputs of the inverter may however not be connected to zero. The tripping current must be 200 mA or higher to prevent false triggering when switching the inverter mains supply on and off.

## 2.2.5 Control signals

The inverter can be controlled by the optional display unit or by external control signals. **Note:** To control by external signals, F010 must be set to "1" and F011 must be set to "2" or "3".

When using the display unit as a control unit there is no need for any connections on the control terminal (TM2).

Use screened control cables to fulfil the european EMC standards. Refer to "**2.2.7 EMC guidelines**".

## 2.2.6 EMC guidelines

It is essential to use screened cables and a filter from the table below to fulfil the european EMC Directive. The installation must also be performed according to the recommendations listed below. Special care must be taken to the earthings and screenings. In multi drive installations, the earth connections should be made in a star shape to prevent from circulating currents.

**Note: Always make sure that all equipment is properly installed to earth according to safety standards**

- Mount the inverter to the filter. Make sure that the chassis of the inverter gets good electrical contact with the filter.
- The inverter with filter should be mounted on an unpainted cabinet backplane in such a way that the filter gets a good contact to the backplane.
- Screened motorcables, signal cables and cables to the brake resistor (if used) should be used. The screens should be clamped to the cabinet backplane, as close to the inverter as possible. Also here a good contact should be ensured. The screenes are also to be connected to the housing/chassis of the inverter, preferably by using metallic coupling nuts.
- The motor cable should have it's screen connected also to the motor housing.
- The earth connection of the filter should be connected to the earth connection of the inverter.
- The line earth is to be connected to the earth connection of the filter.

Table 3: EMC filters for DIGIFLUX CF

CF23 Type	Filter type	CF40 Type	Filter type
CF23-05	N2F-2102	CF40-003	N2F-4103A
CF23-07	N2F-2102	CF40-006	N2F-4103A
CF23-11	N2F-2202A	CF40-008	N2F-4103B
CF23-16	N2F-2202B	CF40-013	N2F-4103B
		CF40-020	N2F-4203
		CF40-026	N2F-4203

With these filters and an installation according to the recommendations given, the inverter will fulfill the standards EN50081-1 (Emission) and EN50082-2 (Immunity).

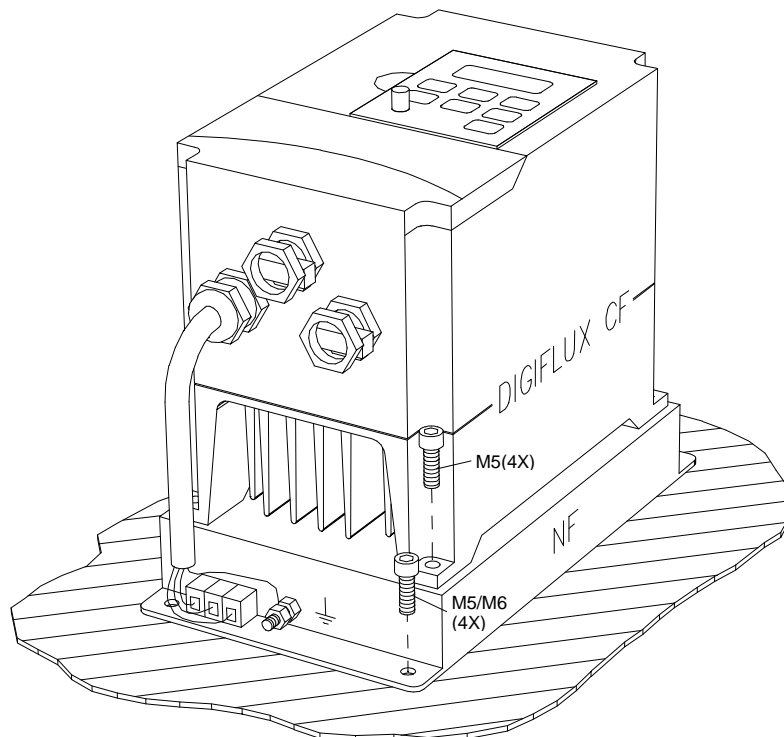


Fig. 1 Mounting of EMC filter

## 2.2.7 Wiring example

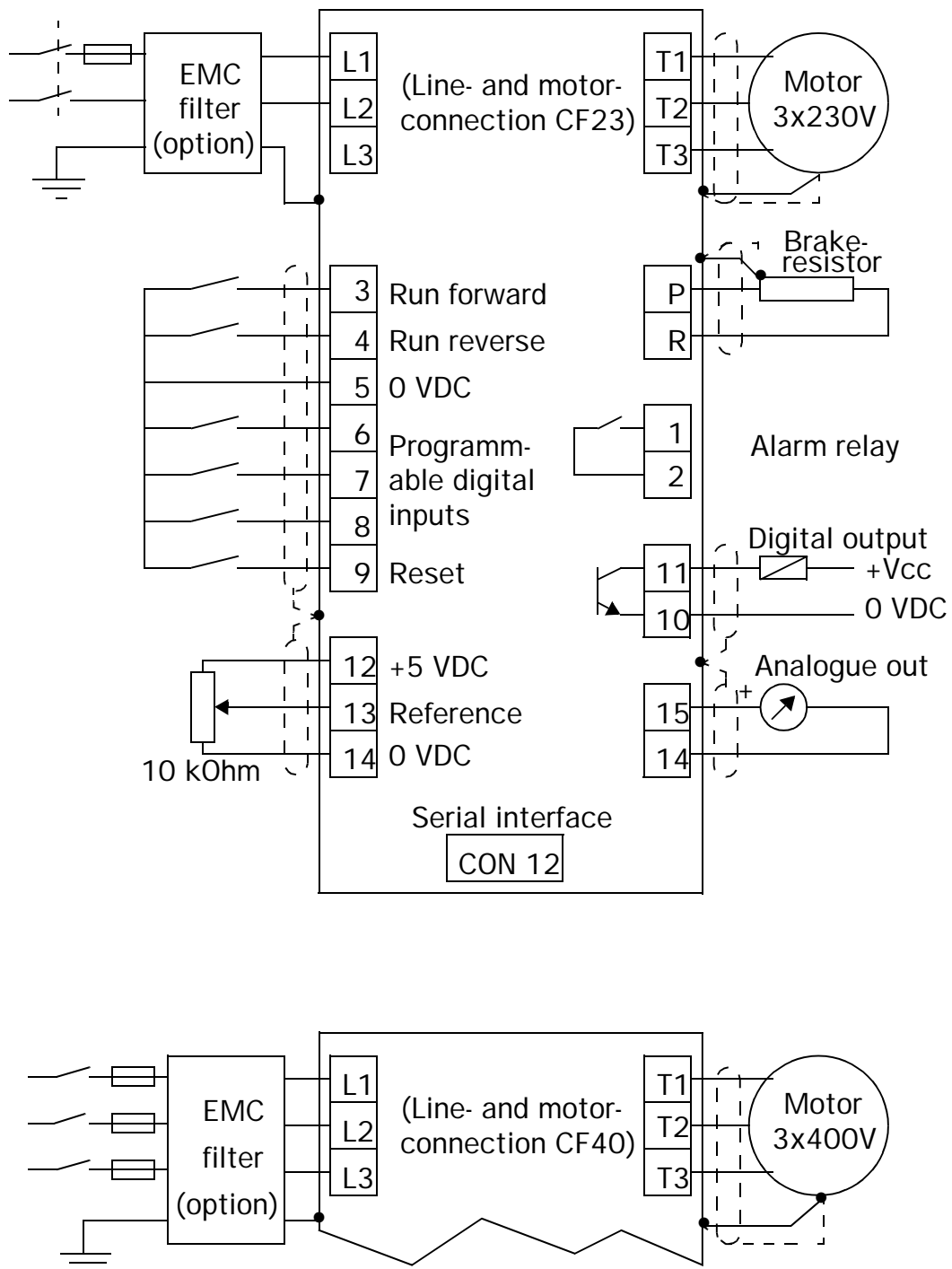


Fig. 2 Wiring example

Table 4: Control signal inputs and outputs.

Terminal	Function	Electrical characteristics
1	Alarm relay. See section 3.8.5	250 VAC / 1A or 30 VDC / 1A
2		
3	RUN FORWARD/STOP. See sections 3.4.1, 3.4.2, 3.4.3	Active low, closed to 0 VDC.
4	RUN REVERSE/STOP. See sections 3.4.1, 3.4.2, 3.4.3	
5	GND (0VDC) for terminals 3 - 9.	0 VDC
6	Multi purpose input 1. See section 3.8.1	Active low, closed to 0VDC.
7	Multi purpose input 2. See section 3.8.1	
8	Multi purpose input 3. See section 3.8.1	
9	RESET. See sections 3.8.1, 3.4.2, 3.4.11	
10	Programmable digital output. See section 3.8.3	Open collector out- put. Max. rating = 35 VDC, 50 mA.
11		
12	Reference voltage.	+5 VDC, max. 10 mA
13	Reference value input. See sections 3.3.1, 3.3.2, 3.3.3, 3.3.4	0-5 VDC, 0-10 VDC, 0(4)-20 mA
14	0 VDC for analogue signals.	0 VDC
15	Programmable analogue output. See section 3.8.4	0-10 VDC

## 3. SETTINGS

To change the settings of the frequency inverter, the display unit is required.

### 3.1 Display unit

The display unit is used to set parameters and functions in the inverter, but it can also be used to control the inverter.

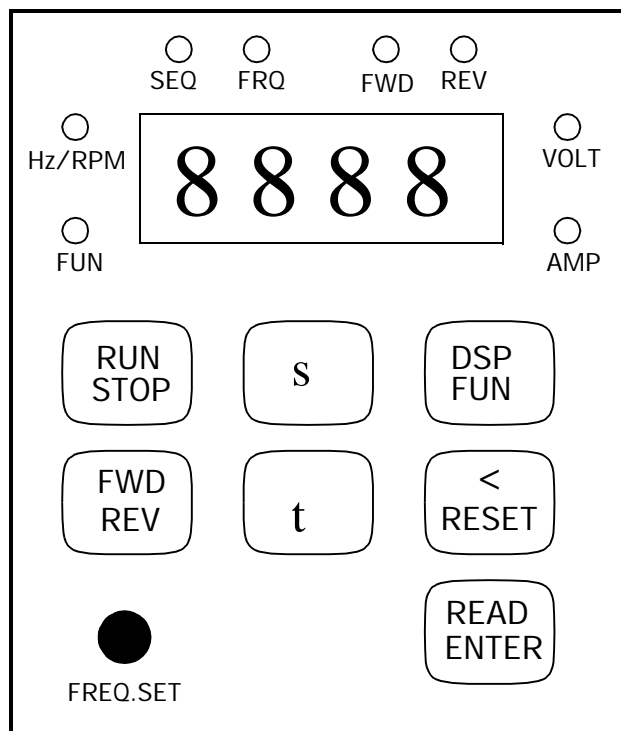


Fig. 3 Display unit

Description of the display unit:

- 4 x 7 segment LED: Displays parameter numbers, parameter values or operational data.
- LED “FUN”: Indicates programming mode.
- LED “Hz/RPM”: Indicates that the display shows frequency or speed.
- LED “SEQ”: Indicates RUN-command via external control.



- LED “FRQ”: Indicates that the reference value comes from the built-in potentiometer, via the analogue input or the motor potentiometer function.
- LED “FWD”: Indicates forward direction.
- LED “REV”: Indicates reverse direction.
- LED “VOLT”: Indicates that the display shows the output voltage.
- LED “AMP”: Indicates that the display shows the output current.
- Key “RUN/STOP”: Used to start and stop when the inverter is set up for control via the display unit.
- Key “FWD/REV”: Used to reverse the direction of rotation when the inverter is set up for control via the display unit.
- Key “S”: Used to increase a setting.
- Key “t”: Used to decrease a setting.
- Key “DSP/FUN”: Used to shift between programming mode and readout of operational data.
- Key “</RESET”: Used to move the cursor in the display or to reset a fail alarm.
- Key “READ/ENTER”: Used to read the value of a chosen parameter and to acknowledge changes in settings.
- Potentiometer “FREQ.SET”: Used to control the output frequency when the inverter is set for operation via the display unit.

## 3.2 General

To start the setting procedure, press the “DSP/FUN” key. The parameter number (F###) will be shown in the display. Press the “^” or “v” key to find the right parameter number. To find the right parameter more quickly, use the “</RESET” key. Press the “READ/ENTER” key, and the parameter value will be displayed. Press the “^” or “v” key to adjust the parameter to the desired value. Press “READ/ENTER” again to confirm the setting. **Note:** Some parameters can be changed during operation, while others require the inverter to be in “stop” mode.

**Recommendation for 50Hz systems: Start the set-up by setting F123=1110 (Factory default values according to 50Hz systems). See “3.10.6 Factory settings”.**

In this chapter, the parameters are divided according to their functionality – they are not described in numerical order. There is a list of parameters at the end of this instruction manual, with space for notes about your own settings. The functions are divided into the following sections:

### **3.2.1 Reference values**

Source of the reference value, Highest and lowest permitted frequencies, Analogue reference value type, Scale factors for the analogue reference value input, Pre-programmable reference values, Motor potentiometer, Jog frequency, Blocking frequency ranges.

### **3.2.2 Start/stop, forward/reverse, alarm acknowledgement**

Signal source for start/stop and forward reverse, External signals for start/stop and forward reverse, Blocking the reversing function, Start frequency, Speed search, Automatic restart after power failure, Automatic start at power-up, Automatic reset and start after an alarm, Alternatives for stopping, DC braking, Conditions for alarm reset.

### **3.2.3 Acceleration, deceleration**

Acceleration time 1, Deceleration time 1, S-form for acceleration & deceleration time 1, Acceleration time 2, Deceleration time 2, S-form for acceleration & deceleration time 2, Dynamic brake.

### **3.2.4 Protection and limitations**

Protection during acceleration, deceleration and operation, Electronic motor protection  $I^2t$ , Electronic inverter protection  $I^2t$ , Torque limit.

### **3.2.5 Voltage/frequency functions**

Preset V/Hz curves, Custom definition of V/Hz curves, Automatic  $I_xR$  compensation, Compensation for variations in mains voltage, Slip compensation, Energy-saving function.

### **3.2.6 Programmable inputs and outputs**

Programmable digital inputs, Adjustment of the inputs' sensitivity, Transistor output, Analogue output, Alarm relay.

### **3.2.7 Display functions**

Displaying values, Locking of the display panel, The panel's stop key, Indicators.

### **3.2.8 Special functions**

Switch frequency, Inverter type, Processor version, Stability adjustment, Serial communication, Factory settings, Sequence control.

## 3.3 Reference values

### 3.3.1 Source of the reference value

The reference value is used to specify the frequency required. There are a number of ways of specifying a reference value:

- Via the up/down keys on the display, F011=0  
Note: The frequency set is stored in F025.
- Via the potentiometer on the display, F011=1  
Note: By setting F056, F057 or F058 (see “3.8.1 Programmable digital inputs”), inputs 6, 7, and 8 can be used for switching to the reference value type “external analogue signal” (local/remote).
- Via an external analogue signal connected to terminal 13, F011=2  
Note: By setting F056, F057 or F058 (see “3.8.1 Programmable digital inputs”), inputs 6, 7, and 8 can be used for switching to the reference value from the display’s potentiometer (local/remote).
- Via pre-programmable reference values or motor potentiometer function (external increase/decrease keys), F011=3.  
Inputs 6, 7, and 8 are used to activate preset frequencies, or to control the motor potentiometer function.

Default setting F011=0.

### 3.3.2 Highest and lowest permitted frequencies

- F006: Sets the highest frequency the inverter is permitted to operate at. Default setting: 50/60Hz.
- F007: Sets the lowest frequency the inverter is permitted to operate at. Default setting: 0Hz.

### 3.3.3 Analogue reference value type

The analogue input terminal 13 has a default setting of 0-5 V (for connection to a potentiometer), but can be configured for 0-10 V or 0(4\*)-20 mA. This can be done by moving a jumper at “JP1” or “JP2” above terminal 14 or 15 on the control board:

\*4mA is set by F027, see 3.3.4.

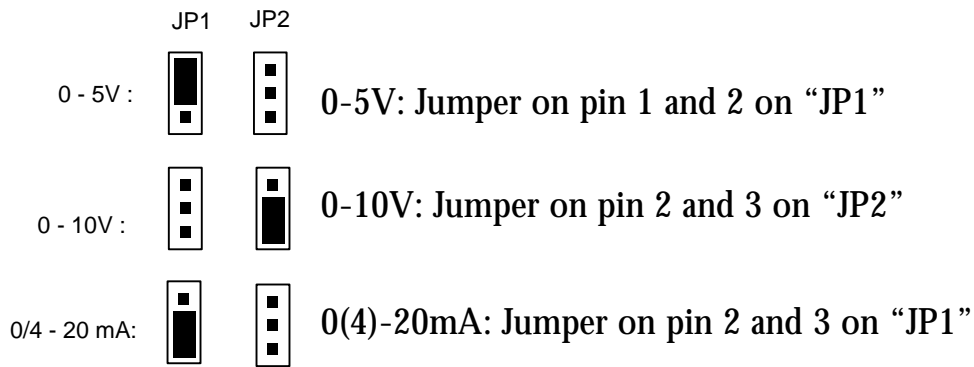


Fig. 4 Jumper positions

### 3.3.4 Scale factors for the analogue reference value input

The default setting means that 5V/10V/20mA will be equivalent to the set maximum frequency, F006. If necessary, the analogue input can be re-scaled, i.e. provided with an offset and reversed:

- F026: Frequency at reference value signal 0% if F029=0. Frequency at reference value signal 100 % if F029=1. Range: 0.0-400 Hz. Default setting: 0 Hz.
- F027: Dead band for the lower part of the reference value signal. Specified in % of the maximum reference value, e.g. 20 % (4/20) to change the reference value input from 0-20 mA to 4-20 mA. Range: 0-100 %. Default setting: 0 %. N.B. F027 may not be greater than F028.
- F028: Dead band for the upper part of the reference value signal. Specified in % of the maximum reference value, e.g. 80 % (8/10) to change the reference value input from 0-10 V to 0-8 V. Range: 0-999.9 %. Default setting: 100 %.
- F029: Setting for positive or negative characteristic for the reference value signal. If F029=0, the output frequency will increase when the reference value increases. If F029=1, the output frequency will decrease when the reference value increases. Default setting: F029=0.

Note: The settings of F026-F029 also apply to the display unit's built-in potentiometer if F011=2.

Following figures give some examples of the most common settings:

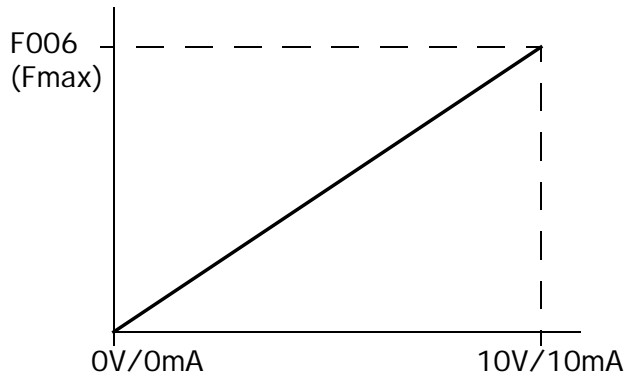


Fig. 5 Reference input, default setting

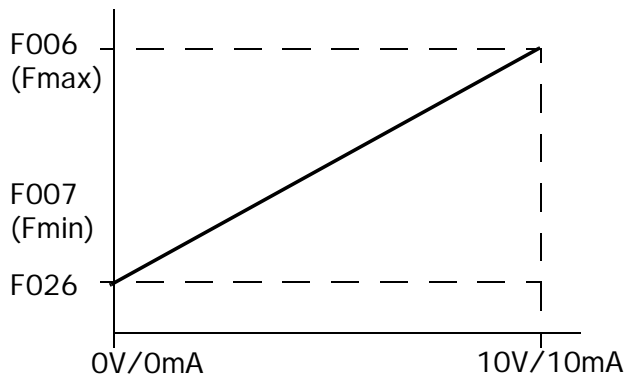


Fig. 6 Reference setting, example using F026

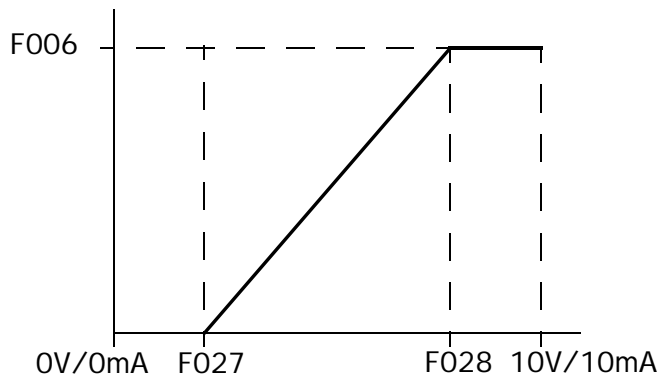


Fig. 7 Reference input, example using F027 and F028

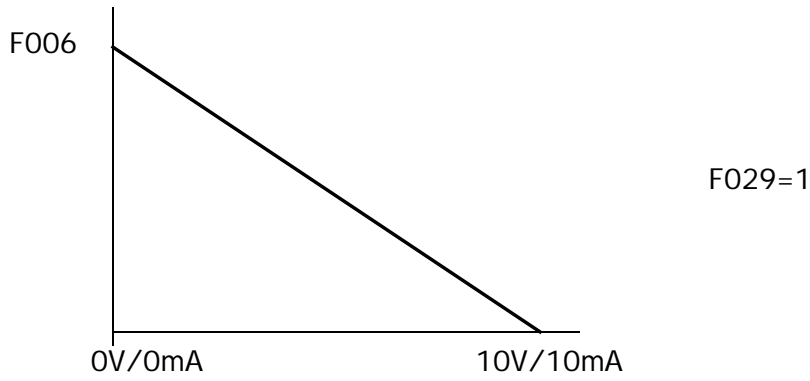


Fig. 8 Reference input, example using F029

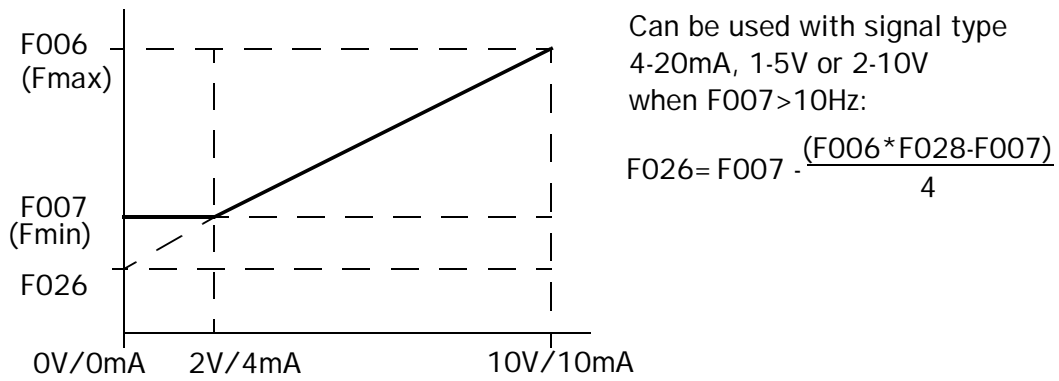


Fig. 9 Reference input, calculation formula 1

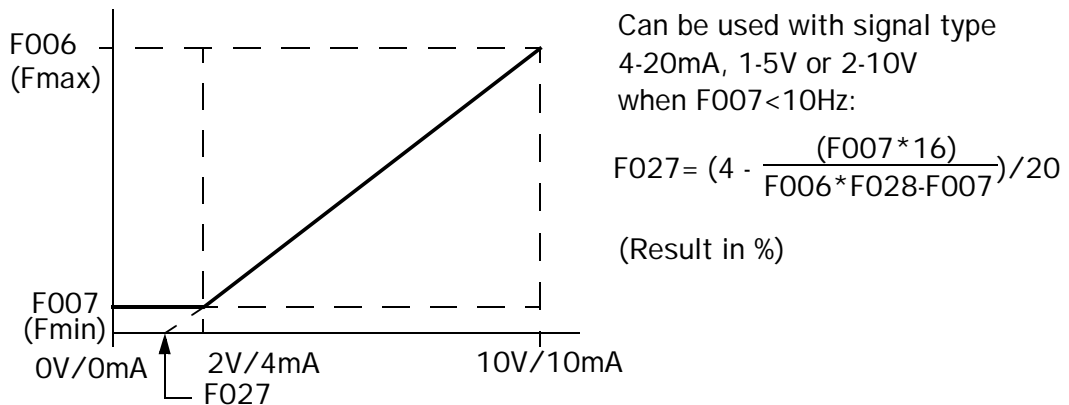


Fig. 10 Reference input, calculation formula 2

### 3.3.5 Pre-programmable reference values

Digital inputs 6, 7, and 8 can be programmed (see “3.8.1 Programmable digital inputs”) to activate preset reference values (which have priority over the analogue reference value and any reference value via the operator’s display). They are set in F017-F023. Range: 0-400Hz. Function as shown in the following table:

Table 5: Pre-programmable reference values

“SP3”	“SP2”	“SP1”	Output frequency as:
Off	Off	Off	Analogue reference value or setting via operators display.
Off	Off	On	F017
Off	On	Off	F018
Off	On	On	F019
On	Off	Off	F020
On	Off	On	F021
On	On	Off	F022
On	On	On	F023

### 3.3.6 Motor potentiometer

The motor potentiometer function allows the connection of two external push-buttons for increase/decrease signals. Two of the three programmable digital inputs (6, 7, and 8) must be set to obtain this function. See “3.8.1 Programmable digital inputs”. F011 must also = 3. If both the increase and decrease inputs are active at the same time, the output frequency will not be changed.

- F003=0xxx: The most recently set frequency will be kept as reference value after the stop signal.
- F003=1xxx: The motor potentiometer will start from 0Hz after the stop signal.

Default setting F003=0000



### **3.3.7 Jog frequency**

Digital inputs 6, 7 and 8 can be programmed (see “3.8.1 Programmable digital inputs”) to function as Jog inputs, which means that the inverter will start and use the set Jog frequency as long as the input is active. This is often used for manual running/positioning at low speed. The Jog speed is set in F024. The Jog input has highest priority of all reference value types. The range is 0-400 Hz, and the default setting is 2.00Hz.

### **3.3.8 Blocking frequency ranges**

If certain speeds/frequencies cause vibrations in the equipment being run, continuous operation on these frequencies can be blocked. Three frequency ranges with a common range can be blocked.

- F065: Frequency blocking 1. Range: 0-400Hz. Default setting: 0Hz.
- F066: Frequency blocking 2. Range: 0-400Hz. Default setting: 0Hz.
- F067: Frequency blocking 3. Range: 0-400Hz. Default setting: 0Hz.
- F068: Range for frequency blocking 1-3. Range: 0-10Hz. Default setting: 0Hz. For example: F065=30 and F068=5 give blocking of the frequency range 25-35Hz.

## 3.4 Start/stop, forward/reverse, alarm reset

### 3.4.1 Signal source for start/stop and forward/reverse

- F010=0 Start/stop and forward/reverse are selected via the operator's display. Default setting=0.
- F010=1 Start/stop and forward/reverse are selected via external signals on the control terminal.

Note: It is still possible to use the Stop key on the operators panel if F048=xx0x, see "3.9.3 The display panel's stop key"

### 3.4.2 External signals for start/stop and forward/reverse

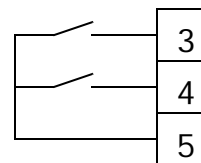
Applies to the function for connection terminals 3, 4 and 6.

Applies only if F010=1.

- F003=xx00

Terminal 3=Run forward,

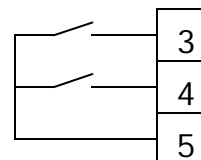
Terminal 4=Run reverse



- F003=xx01

Terminal 3=Run (forward),

Terminal 4=Reversing



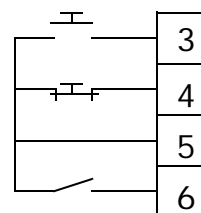
- F003=xx10

Terminal 3=Start (forward) at momentary closing

Terminal 4=Stop - at momentary opening

Terminal 6=Reversing

Note: If STOP (term.4) is open, still a START can be made with terminal 3.



### 3.4.3 Blocking the reversing function

- F003=x0xx  
Reversing allowed
- F003=x1xx  
Reversing blocked

### 3.4.4 Start frequency

A separate start frequency can be specified in F042. N.B. The start frequency does not constitute a limit for the minimum frequency. After starting, the frequency can be altered to below the start frequency, provided the minimum frequency setting (F007) allows it. Range: 0.1-10 Hz.

Default setting 1 Hz.

### 3.4.5 Speed search

When starting a motor that is already rotating, such as for fans for example, this function must be used to avoid overvoltage or overcurrent alarms. When a start signal is obtained, the motor's frequency is measured, after which a start takes place immediately at this frequency, without ramping.

- F048=x0xx: The speed search function is activated by an input, see the “3.8.1 Programmable digital inputs”.
- F048=x1xx: The speed search function is activated at each start signal.

Default setting F048=0000

### 3.4.6 Automatic restart after a power failure

The inverter can cope with temporary power failures of up to 2 seconds, depending on the model. If voltage returns within the time specified in F031, and F032=xxx1, the inverter will restart automatically. The function for automatic restart after alarms (F034, F035) is not affected.

- F031: Permitted length of time for a power failure. Range 0-2s. (type-dependent). Default setting: 0.5s.
- F032: =xxx0: Function shut off. =xxx1: Function switched on. Default setting: F032=0000.

### 3.4.7 Automatic start at power-up

When the inverter is controlled via the control terminal, it can be programmed to start immediately when voltage is supplied, provided the operating command is active. This function is obtained by setting F016=xxx0. If F016=xxx1, the operating input needs to be switched for the inverter to start. Default setting: F016=0000.

### 3.4.8 Automatic reset and start after an alarm

In the event of an alarm, the inverter can be set to reset the alarm and restart automatically. The number of restart attempts can be set (F035) with an adjustable time delay (F034). The function is not active during deceleration to stop or during DC braking.

- F034: Time delay. 0-800s. Default setting: 0s. If F034=0 s, the inverter will, within 0.5s, return to the frequency it had at the time of the alarm, and then return to the relevant reference value. If F034>0s, the inverter will restart from the specified start frequency (F042) after the set time delay.
- F035: Number of restart attempts. 0-10 No. Default setting: 0. If F035=0, the restart function is not active. If the set number of restart attempts is exceeded, the inverter will remain in alarm mode. The counter is reset when no faults are detected within a 10-minute period, or if acknowledgement takes place via the operator's display or control terminal.

### 3.4.9 Alternatives for stopping

- F044=xxx0: The inverter ramps to a stop according to the selected deceleration ramp for stopping.
- F044=xxx1: The inverter lets the motor freewheel to a stop.

Default setting F044=0000

### 3.4.10 DC braking

DIGIFLUX CF has a built-in DC brake for distinct stopping. This braking function is intended only to prevent the last rolling, which can otherwise occur. In other words, it has no function at higher frequencies. The braking time, engagement level, and current can be set with the settings F053, F054 and F055.

- F053: Setting of braking time. Specifies how long DC braking will be active. The setting 0 seconds means that the DC brake is disconnected. Range: 0-25.5s. Default setting: 0.5s.
- F054: Setting of engagement level. When ramping to stop occurs, the inverter will automatically activate the DC brake at the set frequency. Range: 0.1-10 Hz. Default setting: 1.5 Hz.
- F055: Setting of brake current, i.e. braking torque: 0-20%. Default setting: 8%.

### **3.4.11 Conditions for Alarm reset**

If F016=xx0x, alarm resets can only take place when the inverter is not in operation. If F016=xx1x, resets can also take place during operation.

Note: This is valid only if Run/Stop command is remote.

Default setting: F016=0000.

## **3.5 Acceleration/deceleration**

### **3.5.1 Acceleration time 1.**

F001: Acceleration time is defined as the time it takes to accelerate from 0 Hz to 60 Hz. Range: 0.1-3600 s. Default setting: 10 s.

### **3.5.2 Deceleration time 1.**

F002: Deceleration time is defined as the time it takes to decelerate from 60 Hz to 0 Hz. Range: 0.1-3600 s. Default setting: 10 s.

### **3.5.3 S-form for acceleration & deceleration time 1.**

F080: S-formed ramps give softer transitions but also increase the total ramping time. Range: 0-4 seconds, in which 0 seconds means an entirely linear ramp. Default setting: 0 s.

### **3.5.4 Acceleration time 2.**

F049: Acceleration time 2 can be selected externally using one of the inputs 6, 7 or 8 – see “3.8.1 Programmable digital inputs”. Acceleration time is defined as the time it takes to accelerate from 0Hz to 60Hz. Range: 0.1-3600 s. Default setting: 10 s.

### **3.5.5 Deceleration time 2:**

F050: Deceleration time 2 can be selected externally using one of the inputs 6, 7 or 8 – see “3.8.1 Programmable digital inputs”. Deceleration time is defined as the time it takes to retard from 60Hz to 0Hz. Range: 0.1-3600 s. Default setting: 10 s.

### **3.5.6 S-form for acceleration and deceleration time 2.**

F081: S-formed ramps give softer transitions but also increase the total ramping time. Range: 0-4 seconds, in which 0 seconds means an entirely linear ramp. Default setting: 0 s.

### **3.5.7 Dynamic brake**

If F048 is set to xxx0, the output voltage will be increased in the event of braking to increase the losses in the motor, which leads to shorter braking time when no braking resistor is connected.

## 3.6 Protective functions

### 3.6.1 Protection during acceleration, deceleration and operation

To protect against operating disturbances caused by excessive acceleration or deceleration, or excessively high loading during operation, the frequency inverter can extend ramp times or reduce the frequency. Bear in mind that these functions can give longer ramp times than necessary. In many cases, it may be better to adjust the ramps instead.

- F012=xxx0: The overcurrent protection during acceleration is switched on.

When the current during acceleration becomes too high, the ramp will be extended to prevent an alarm due to overcurrent. The engagement level can be adjusted with F013, see below.

- F012=xxx1: The overcurrent protection during acceleration is switched off.
- F012=xx0x: The overvoltage protection during deceleration is switched on.

When the DC voltage in the inverter's intermediate stage becomes too high during braking, the ramp will be extended to prevent an alarm due to overvoltage.

- F012=xx1x: The overvoltage protection during deceleration is switched off.
- F012=x0xx: The overcurrent protection during operation is switched on.

When the current becomes too high during operation, the frequency will be reduced to prevent an alarm due to overcurrent. The engagement level can be adjusted with F014 and the ramp time can be adjusted with F002 or F015, see below. When the current has been reduced, the inverter will return to the set frequency.

- F012=x1xx: The overcurrent protection during operation is switched off.
- F012=0xxx: Ramp time for the overcurrent protection during operation = F002.
- F012=1xxx: Ramp time for the overcurrent protection during operation = F015.

The default setting for F012=0000.

- F013: Engagement level for overcurrent protection during acceleration. The range is 30-200% of the inverter's rated current. The default setting is 110%.
- F014: Engagement level for overcurrent protection during operation. The range is 30-200% of the inverter's rated current. The default setting is 160%.
- F015: Ramp time for overcurrent protection during operation. N.B. Applies only if F012=1xxx. The range is 0.1-3600 s. The default setting is 3 s.

### 3.6.2 Electronic motor protection $I^2t$

A function for the protection of the motor against overloading/overheating. Similar to motor protection circuit breakers or bimetallic relays. However, the function does not take into account deteriorated cooling at lower speeds. To achieve full motor protection, a sensor (thermostat) is required, installed in the motor.

- F069=xxx0:  $I^2t$  protection active.
- F069=xxx1:  $I^2t$  protection not active.
- F069=xx0x: Characteristic adjusted for standard motors.
- F069=xx1x: Characteristic adjusted for special motors with improved cooling at low speeds.
- F069=x0xx: Characteristic adjusted for operation with constant torque. Allows 103% of the set motor rated current (F070) continuously, and 150 % for 1 minute.
- F069=x1xx: Characteristic adjusted for operation with quadratic torque. Allows 113 % of the set motor rated current (F070) continuously, and 123 % for 1 minute.
- F069=0xxx: Freewheeling to stop takes place when  $I^2t$ -protection is activated. The operator's display indicates "OL1". The alarm must be acknowledged before restart can take place.
- F069=1xxx: The inverter continues to operate when  $I^2t$ -protection is activated. The operator's display indicates "OL1" until the current drops below 103 % (or 113 % if F069=x1xx).

Default setting: F069=0000

- F070: Sets the motor's rated current (according to information on the



motor's marking plate) to obtain the correct function in  $I^2t$ -protection.

### 3.6.3 Electronic inverter protection $I^2t$

A function similar to electronic motor protection, but with the task of protecting the frequency inverter. The protection allows 110 % of the inverter's rated current in continuous operation and 150 % for 1 minute.

- F071=xxx0: Freewheeling to stop takes place when  $I^2t$ -protection is activated. The operator's display indicates "OL2". Alarm acknowledgement must take place before a restart is possible.
- F071=xxx1: The inverter continues to operate when  $I^2t$ -protection is activated. The operator's display indicates "OL2" until the current drops below 110 %.

Default setting: F071=0000

### 3.6.4 Torque limit

The inverter can be set for alternative behaviour when it reaches its torque limit, which is itself adjustable. An external indication of the torque limit being reached can be obtained via the programmable digital output – see "3.8.3 Transistor output".

- F077=xxx0: Torque limit function switched off.
- F077=xxx1: Torque limit function switched on.
- F077=xx0x: Torque limit connected only when reference value reached.
- F077=xx1x: Torque limit connected only during operation.
- F077=x0xx: Operation is not interrupted when the torque limit is reached. The display indicates "OL3" until loading has dropped below the set level.
- F077=x1xx: Operation is interrupted immediately when the torque limit is reached. The display indicates "OL3". Alarm acknowledgement is required for a restart to be possible.

Default setting: F077=0000.

- F078: Setting of torque limit level. The torque limit is related to the inverter's nominal current. Range: 30-200 %. Default setting: 160 %
- F079: Setting of time delay. Specifies how long the set torque limit may be exceeded. Range: 0-25 s. Default setting: 0.1 s.

## 3.7 Voltage/frequency functions

Under this heading, we discuss not only settings that affect the voltage/frequency ratio, but also slip compensation and the energy-saving function. All of these functions affect the performance of the system, the noise level of the motor, motor heating, and power consumption. In general, the motor should have a constant V/Hz ratio based on the motor's rated data (e.g. 230 V / 50 Hz = 4.6 V/Hz) throughout the speed range. To compensate for the drop in voltage at low frequencies, it is possible to raise the V/Hz ratio (IxR-compensation/"Boost"). This gives increased torque, but also higher current and increased motor heating. Similarly, it is possible to reduce the V/Hz ratio to save energy during the operation of pumps and fans.

### 3.7.1 Preset V/Hz curves

F005: To simplify the setting and adjustment of the V/Hz ratio, there are a number of preset curves for motors with 50 or 60 Hz as the basic frequency.

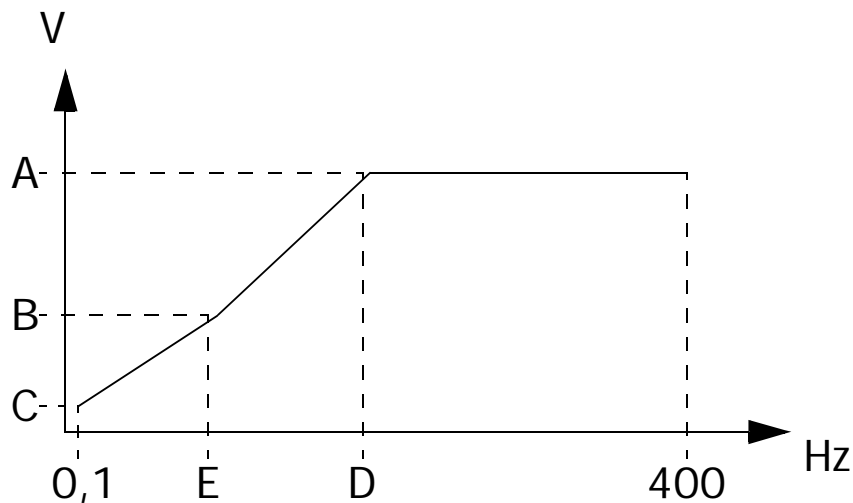


Fig. 11 V/Hz curve

The table below shows the three reference points that apply for each setting of F005. The voltage is shown in per cent of the relevant mains voltage. The factory default settings of "D" and "E" depend on the setting of F123 (Factory defaults for 50 or 60 Hz), see "3.10.6 Factory settings".

Table 6: Voltage/frequency settings

Application	F005 for 50Hz/ 60Hz motors	A (%)	B (%)	C (%)	D (Hz)	E (Hz)
General	0/9	100	7.5	7.5	50/60	2.5/3
High starting torque level 1	1/10	100	10	7.5	50/60	2.5/3
High starting torque level 2	2/11	100	15	7.5	50/60	2.5/3
High starting torque level 3	3/12	100	20	7.5	50/60	2.5/3
Pump/fan curve level 1	4/13	100	17.5	7.5	50/60	25/30
Pump/fan curve level 2	5/14	100	25	7.5	50/60	25/30
Constant output level 1	6/15	100	15	7.5	50/60	5/6
Constant output level 2	7/16	100	20	7.5	50/60	5/6
Constant output level 3	8/17	100	25	7.5	50/60	5/6
Custom definition	18	F038	F040	F041	F037	F039

### 3.7.2 Custom definition of V/Hz curves

If none of the preset curves are suitable, you can define your own by setting F005=18. The curve can then be set by specifying the appropriate value in F037-F041. Compare with the table and curve above.

N.B. An excessively high V/Hz ratio can cause the inverter to issue an alarm for overcurrent, or the motor can overheat.

### 3.7.3 Automatic IxR compensation

To obtain better torque at lower speeds, the voltage must be increased. This can be done automatically by the inverter itself increasing the voltage when the load increases. This reduces the risk of the motor overheating.

- F071=x0xx: Automatic IxR compensation is connected.
- F071=x1xx: Automatic IxR compensation is disconnected.

Default setting: F071=0000

- F072: Setting of manual IxR compensation. Increases voltage in the lower frequency range in per cent of the set V/Hz ratio in accordance with F005. Range: 0-10 % Default setting: 0 %.

### 3.7.4 Compensation for variations in mains voltage

F048=0xxx: Prevents variation in the voltage supply to the motor due to variations in mains voltage. When this function is used, the V/Hz curve will be related to the setting of F030. If this function is switched off (F048=1xxx), the V/Hz curve will be related to mains voltage.

F030: Specifies nominal supply voltage.

### 3.7.5 Slip compensation

Better speed stability under varying loads can be obtained by slip compensation, which automatically increases output frequency during increased loads.

- F075: Sets the motor's no-load current. Can be calculated using the formula:  $I_{\text{rated}} \times \sqrt{1 - (\cos\phi)^2}$ , in which  $I_{\text{rated}}$  = the motor's rated current.
- F076: Sets the motor's slip frequency. Can be calculated using the formula:  $f_{\text{rating}} \times (n_{\text{synchronous}} - n_{\text{asynchronous}}) / n_{\text{synchronous}}$ , in which  $f_{\text{rating}}$  = the motor's rated frequency, normally 50Hz.  
 $n_{\text{synchronous}}$  = the motor's synchronous speed, e.g. 1500 rpm for a 4-pole motor.  
 $n_{\text{asynchronous}}$  = the motor's asynchronous speed, e.g. 1420 rpm for a 4-pole motor.

### **3.7.6 Energy-saving function**

This function can be used to reduce the consumption of current in pump and fan applications. By activating one of the digital programmable inputs (see the section “3.8.1 Programmable digital inputs”), voltage is reduced and current drops. This assumes that the motor is not fully loaded.

- F082=xx00: The energy-saving function is switched off.
- F082=xx01: The energy-saving function is switched on when the input is active.
- F083: Setting of level. Specifies to what level the voltage is reduced when the energy-saving function is active. Range: 0-100% of the original voltage. Default setting: 80%.

## 3.8 Programmable inputs and outputs

### 3.8.1 Programmable digital inputs

Inputs 6, 7, and 8 can be programmed for various functions. The setting F056 determines the function for input 6, F057 for input 7, and F058 for input 8. The setting options are the same for all inputs, as shown in the description below. The settings in brackets provide the same function, but the logic is reversed, that is, the input is considered active when the input is open.

Note: F056 will have no function if the three-wire control of start/stop/forward/reverse is selected (F003=xx10).

Default settings:

F056=00

F057=01

F058=02

Setting of F056-F058:

- 00 (16): Input “SP1” for the activation of pre-programmable speed. See “3.3.1 Source of the reference value” and “3.3.5 Pre-programmable reference values”.
- 01 (17): Input “SP2” for the activation of pre-programmable speed. See “3.3.1 Source of the reference value” and “3.3.5 Pre-programmable reference values”.
- 02 (18): Input “SP3” for the activation of pre-programmable speed. See “3.3.1 Source of the reference value” and “3.3.5 Pre-programmable reference values”.
- 03 (19): Input for the activation of Jog frequency. See “3.3.1 Source of the reference value” and “3.3.7 Jog frequency”
- 04 (20): Input for the selection of ramp time. When the input is active, acceleration time 2 will be used.
- 05 (21): Input for external (emergency) stop. When the input is activated, the inverter will ramp to stop, and the display will indicate “E.S.”. The input has a holding function, that is, the stop will be completed even if the input is opened before completion. A restart can only take place if a new start signal is received.
- 06 (22): Input for freewheel stop. When the input is activated, the

inverter will shut off the power stage, the display will indicate “b.b.”, and the motor will freewheel to a stop. A restart can only take place if a new start signal is received.

- 07 (23): Input for external activation of the function “Speed search”. N.B. F048 must be set to x0xx, see the “3.4.5 Speed search”.
- 08 (24): Input for external activation of the energy-saving function. N.B. F082 must be set to x0xx, see “3.7.6 Energy saving function”.
- 09 (25): Input for control via the operator’s display (Local/Remote switching). When the input is activated, control of start/stop, forward/reverse and reference value changes to the built-in operator’s display.
- 10 (26): Input for the blocking of control signals via serial communication. When the input is active, serial communication can only be used to read the value from the inverter.
- 11 (27): Input for blocking of ramps. When the input is active, ramping is interrupted. The function is only active when the RUN command is active.
- 12 (28): Input for the increasing of the reference value (motor potentiometer). Applies only if F011=3, see “3.3.1 Source of the reference value” and “3.3.6 Motor potentiometer”.
- 13 (29): Input for reduction of the reference value (motor potentiometer). Applies only if F011=3, see “3.3.1 Source of the reference value” and “3.3.6 Motor potentiometer”.
- 14 (30): Input for sequence control, see “3.10.7 Sequence control”.
- 15 (31): Input for selection of reference value source. With this input, switching can take place between the potentiometer on the operator’s display and the analogue input on terminal 13. Applies if F011=1 or 2, see “3.3.1 Source of the reference value”.

### **3.8.2 Adjustment of the inputs’ sensitivity.**

By using F016, the sensitivity of the digital inputs (3, 4, 6, 7, 8, 9) can be set. This is done by specifying how many times the inverter must read the same status at the input before the value is accepted. Several readings give better protection against disturbances such as contact bounces, etc., but also contribute to a greater reading delay. One reading cycle takes 2ms. Default setting: F016=0000.

- F016=00xx: 10 readings.
- F016=01xx: 5 readings.
- F016=10xx: 3 readings.
- F016=11xx: 1 reading.

The sensitivity of the analogue input can be adjusted in a similar way by setting the number of readings in F033. Range: 1-100.

Default setting: F033=100.

### 3.8.3 Transistor output

F061 determines the function for the digital transistor output, terminal 10-11. The output is activated when the condition shown below is fulfilled. The setting options in brackets provide the same function, although the output will go from active to inactive mode when the condition is fulfilled.

00 (06): Operating indication.

01 (07): Reference value reached.

02 (08): Output frequency = F008 ± F009 (see below)

03 (09): Output frequency > F008 (see below)

04 (10): Output frequency < F008 (see below)

05 (11): Indication of excessive torque.

F008 = User-defined adjustable threshold frequency for indication as above. Setting range: 0-400 Hz, default value: 0 Hz.

F009 = Margin for F008. Setting range: 0-30 Hz, default value: 0 Hz.

### 3.8.4 Analogue output

The analogue output (terminals 14-15) issues a 0-10 VDC signal according to the following conditions:

- F045: Scale factor for the analogue output. Used to adjust the size of the output signal. Range: 1-200 %. The default setting gives 100% as shown below.
- F046: Setting of the value to be indicated by the analogue output:
  - F046=0: Output frequency. 10 VDC = Max. frequency (F006)
  - F046=1: Reference value. 10 VDC = Max. frequency (F006)
  - F046=2: Output voltage. 10 VDC = Mains voltage (F030)
  - F046=3: DC link voltage. 10 VDC = 450 VDC for CF23 and 900 VDC for CF40.



### 3.8.5 Alarm relay

The alarm relay's function can be set as shown below:

- F097=xxx0: Not normally activated at an “Automatic restart”. When the number of restart attempts reaches the set value, the relay will be activated.
- F097=xxx1: Activated at an “Automatic restart”
- F097=xx0x: Not activated during temporary power failures.
- F097=xx1x: Activated during temporary power failures.
- F097=x0xx: Not activated when the input for “External (emergency) stop” is used.
- F097=x1xx: Activated when the input for “External (emergency) stop” is used.
- F097=0xxx: Not activated when the input for “freewheel stop” is used.
- F097=1xxx: Activated when the input for “freewheel stop” is used.

Default setting: F097=0000.

- F098=xxx0: Not activated when the set torque limit is exceeded.
- F098=xxx1: Activated when the set torque limit is exceeded.
- F098=xx0x: Not activated when “Electronic motor protection  $I^2t$ ” has been triggered.
- F098=xx1x: Activated when “Electronic motor protection  $I^2t$ ” has been triggered.
- F098=x0xx: Relay contact normally open.
- F098=x1xx: Relay contact normally closed.
- F098=0xxx: Not activated when “Electronic inverter protection  $I^2t$ ” has been triggered.
- F098=1xxx: Activated when “Electronic inverter protection  $I^2t$ ” has been triggered.

Default setting F098=0000.

## 3.9 Display functions

### 3.9.1 Displaying values

The operator's panel can display a number of different values. You can switch between the different values by pressing the "DSP/FUN" key on the display. Each time you press the key, the display switches between: one of the values selected in F051, display of parameter number (Fxxx), and display of the value(s) selected according to F047.

For F051, one of the following options can be selected. The default setting is 0.

- F051=0: Frequency display. The output frequency is displayed during operation; the reference value frequency is displayed in stop mode.
- F051=1: Speed display. Displays the motor's synchronous speed at the current output frequency. This assumes that the motor's number of poles has been set in F036.
- F051=2: Line speed without decimals. See also F052 below.
- F051=3: Line speed with one decimal. See also F052 below.
- F051=4: Line speed with two decimals. See also F052 below.
- F051=5: Line speed with three decimals. See also F052 below.
  
- F036: Specifies the motor's number of poles. (2 for a 3000rpm motor, 4 for a 1500rpm motor etc.). Range: 2-8. Default setting: 4
- F052: Specifies the scale factor for the line speed. The following formula applies:  
Displayed value =  $F052 \times \text{output frequency} / F006$  (max. frequency).  
N.B. The decimal place is determined by F051 as shown above.  
Range: 0-9999. Default setting: 1800.

For F047, 0-3 extra values can be added to the loop. The default setting is F047=0000.

- F047=xxx1: Output voltage (Vac) is displayed. F047=xxx0: Output voltage is not displayed.
- F047=xx1x: Intermediate voltage (Vdc) is displayed. F047=xx0x: Intermediate voltage is not displayed.
- F047=x1xx: Output current (Iac) is displayed. F047=x0xx: Output current is not displayed.

### 3.9.2 Locking of the display panel

F004: The display panel can be locked to prevent unauthorised changes to settings. The lock is divided into two groups for F017-25 (preset reference values, jog frequency, and reference value from the display panel) and F000-024/F026-125:

- F004=xxx0: No locking of F017-025.
- F004=xxx1: Locking of F017-025.
- F004=xx0x: No locking of other functions.
- F004=xx1x: Locking of other functions.

Default setting: F004=0000.

### 3.9.3 The display panel's stop key

F048: If the external control of start/stop is selected (F010=1), the display panel's stop key can still be used if F048=xx0x. Default setting: 0000.

### 3.9.4 Indicators

In addition to the selected display of frequency, current, speed, etc. and error messages, messages for the indication of certain functions are also available. See the table below.

Table 7: Indicators

Code	Meaning	Cause
StP0	Automatic stand-by at low reference value	When the min.-frequency setting is <1% of the max.-frequency and the reference value is < min.-frequency a stand-by command will be generated automatically.
StP1	Control error	Voltage switched on when "Auto start" is blocked (F016=1) and the start input is active.

Table 7: Indicators

<b>Code</b>	<b>Meaning</b>	<b>Cause</b>
StP2	"Emergency stop" from the programming unit.	The stop key on the operators panel has been pressed during operation via terminals or via serial communications. Valid only if F048=xx0x.
E.S.	"Ramp stop" signal from the control terminal.	An input programmed for external (emergency) stop has been activated.
b.b.	"Freewheel stop" signal from the control terminal.	An input programmed for external freewheel stop has been activated.

## 3.10 Special functions

### 3.10.1 Switch frequency

By adjusting the inverter's switch frequency, the motor's noise level can be reduced. The default setting is F043=14, i.e. 10 kHz. F043 can have the following settings:

Table 8: Setting of switch frequency.

F043	Switch frequency	F043	Switch frequency
0	1 kHz	8	4.8 kHz
1	1.2 kHz	9	5 kHz
2	1.8 kHz	10	6 kHz
3	2 kHz	11	7.2 kHz
4	2.4 kHz	12	8 kHz
5	3 kHz	13	9 kHz
6	3.6 kHz	14	10 kHz
7	4 kHz	15	12 kHz

### 3.10.2 Inverter type

The inverter's type designation can be read in F000, see table below:

Table 9: Inverter types

F000	Type	F000	Type
01	CF23-05	11	CF40-005
02	CF23-07	12	CF40-008
03	CF23-11	13	CF40-013
04	CF23-16	14	CF40-020
10	CF40-03	15	CF40-026

### 3.10.3 Processor version

F124: Reading of the processor's version.

### 3.10.4 Stability adjustment

Under certain circumstances, vibrations can occur in the motor. With this function, the vibrations can be trimmed. Procedure:

If the motor doesn't vibrate when F093=0 but vibrates when F093>0, adjust F094 from 0 up till vibration stops.

If the motor vibrates when F093=0, adjust F093 from 0 up till vibration is reduced to a minimum. If vibration cannot be reduced, set F093=10%.

Adjust F092 (higher or lower) to reduce vibration to a minimum.

Adjust F093 again (higher or lower) to reduce vibration to a minimum or stop vibrations completely.

- F092: Sets the vibrations' cycle time divided by four (4). Range: 1-100 (ms x 2). Default setting: 5 (10 ms).
- F093: Amplification factor. Adjusted to suit the vibrations' amplitude. Range: 0-100 %. Default setting: 0 %.
- F094: Bias factor. Range: 0-30 %, default setting: 0 %.

### 3.10.5 Serial communication

Setting of serial communication parameters. To use serial communication, certain accessories are required. The following parameters must be adjusted to suit the PLC or PC connected. Additional information is provided with the accessories.

- F100: The inverter's address. Range: 1-32. Default setting: 1  
N.B. If the address 33 is called, all inverters connected will react.
- Transfer rate.
  - F101=0 gives 4800 baud
  - F101=1 gives 9600 baud
  - F101=2 gives 19200 baud
  - F101=3 gives 38400 baud
- Transfer format.
  - F102=xxx0: 1 stop bit
  - F102=xxx1: 2 stop bits
  - F102=xx0x: Even parity
  - F102=xx1x: Odd parity
  - F102=x0xx: No parity

F102=x1xx: Parity

F102=0xxx: 8 data bits

F102=1xxx: 7 data bits

### 3.10.6 Factory settings

The restoration of factory-set values for all parameters can be obtained with F123:

F123=1111: Resetting to factory values intended for 60Hz motors.

F123=1110: Resetting to factory values intended for 50Hz motors.

After resetting, F123 will return to the value 0000.

### 3.10.7 Sequence control

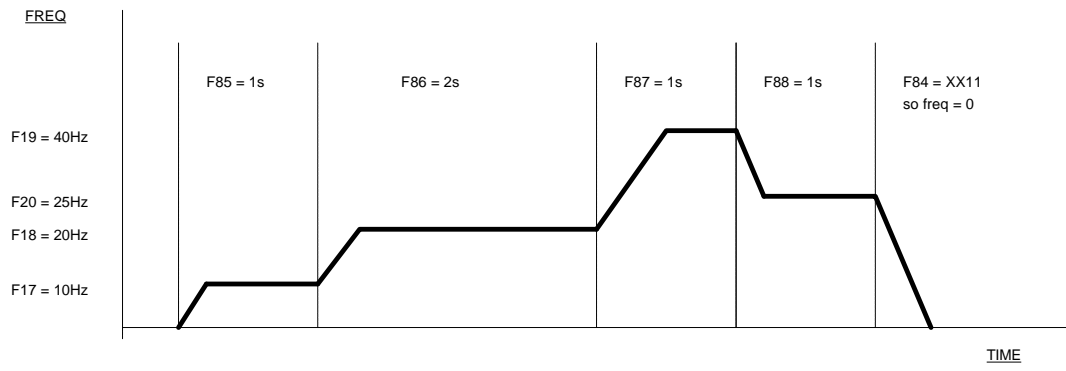
With F84 it is possible to put the 8 pre-programmed reference values (see "3.3.5 Pre-programmable reference values") in a time controlled sequence (process timer). For each reference value a corresponding process time can be set with F085 to F091.

When the process timer is enabled, one of the digital inputs (F056-F058) must be set to function 14 "sequence control", see "3.8.1 Programmable digital inputs". After a normal RUN command a pulse on the digital input will trigger the sequence.

If one of the digital inputs (F056-F058) is set to function 0-2 "SP1, SP2, SP3" (see "3.8.1 Programmable digital inputs"), then the set process time is valid for the reference value according to the SP1 to SP3 setting.

When the sequence is ended it can be selected to continue with the normal reference value or to jump back to zero speed.

- F084=xxx0 : process timer disabled
- F084=xxx1 : process timer enabled
- F084=xx0x : Normal reference value after process timer finished counting
- F084=xx1x : Zero speed after process timer finished counting.

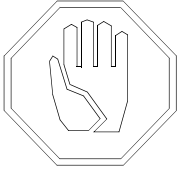


*Fig. 12 Sequence control*



## 4 . MAINTENANCE AND TROUBLESHOOTING

The DIGIFLUX frequency inverter is designed to require no servicing or maintenance. There are however some things which should be checked regularly.



**Warning! Do not touch parts inside the enclosure of the frequency inverter when the power supply is switched on. Some components of the inverter remain live for a time after power has been switched off. Wait at least 5 minutes before touching anything inside the inverter.**

### 4.1 Regular maintenance

- Check that nothing in the inverter has been damaged by vibration (loose screws or connections).
- Check external wiring, connections and control signals. Tighten terminal screws if necessary.
- Check that circuit boards and components are free from dust. Clean with compressed air if necessary. Make sure that circuit boards and components are undamaged.
- Check for signs of overheating (changes in colour on circuit boards, oxidation of solder points etc.). Check that the temperature is within permissible limits.

### 4.2 Troubleshooting

In the event of a fault, you should first find out whether the fault occurred as a result of incorrect use, or whether it is a system fault. It is also important to find out whether the fault is of a temporary or permanent nature. The DIGIFLUX frequency inverter is equipped with functions designed to protect the inverter, motor and load. The protective functions indicate the occurrence of a fault situation. Problems and faults can be divided into two types:

- Faults indicated by the frequency inverter via the fault relay and programming unit. Most of them are registered in the alarm list.

- The desired performance or functions are not obtained, but the inverter does not give any alarm.

By thinking through the application and going through the connections and parameter settings, it is often possible to remedy this problem.

## 4.3 Alarm list

F125: The three most recent alarm causes are saved and can be read subsequently.

Table 10: Alarms that cannot be reset.

Alarm code	Fault	Possible cause	Remedy
CPF	Control board failure.	High electrical noise.	Install RC type suppressors on all contactors/brake coils.
EPr	EEPROM error.	Component failure.	Contact your distributor.
-OU-	Oversvoltage in STOP mode.	Supply voltage too high.	Check the supply voltage
-LU-	Undervoltage	<ol style="list-style-type: none"> <li>1. Supply voltage too low.</li> <li>2. Current limit resistor (R1) or fuse blown (only CF40).</li> <li>3. The measuring circuit is defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Connect the correct supply voltage.</li> <li>2. Check resistors and fuses.</li> <li>3. Contact your distributor.</li> </ol>
OH	Heatsink overheat in STOP mode.	<ol style="list-style-type: none"> <li>1. Ambient temperature is too high.</li> <li>2. Poor ventilation.</li> <li>3. The measuring circuit is defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the heatsink and ambient temperature.</li> <li>2. Check the ventilation.</li> <li>3. Contact your distributor.</li> </ol>

*Table 11: Alarms that can be reset manually or automatically*

<b>Alarm code</b>	<b>Fault</b>	<b>Possible cause</b>	<b>Remedy</b>
OC-S	Overcurrent at start.	<ol style="list-style-type: none"> <li>1. Earth fault or short circuit in motor or motor cable.</li> <li>2. Output transistor damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Find the short circuit or earth fault and exchange the faulty part.</li> <li>2. Contact your distributor.</li> </ol>
OC-A	Overcurrent during acceleration.	<ol style="list-style-type: none"> <li>1. Acceleration time is set too short.</li> <li>2. Incorrect V/Hz ratio.</li> <li>3. Inverter rating is too small.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase F001 (or F049).</li> <li>2. Select another V/Hz ratio (F005).</li> <li>3. Change to a larger inverter.</li> </ol>
OC-C	Overcurrent during constant frequency.	<ol style="list-style-type: none"> <li>1. Excessive load changes.</li> <li>2. Excessive supply voltage fluctuations.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check load condition.</li> <li>2. Check supply voltage.</li> </ol>
OC-d	Overcurrent during deceleration.	Deceleration time is set too short.	Increase the deceleration time.
OC-b	Overcurrent during DC braking.	<ol style="list-style-type: none"> <li>1. The DC brake's engagement frequency is too high.</li> <li>2. The DC brake's voltage level is too high.</li> <li>3. The DC braking time is too long.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce the engagement frequency.</li> <li>2. Reduce the voltage level.</li> <li>3. Reduce the braking time.</li> </ol>
OU-C	Overvoltage during constant speed.	<ol style="list-style-type: none"> <li>1. Deceleration time is set too short.</li> <li>2. Supply voltage fluctuates.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the deceleration time.</li> <li>2. Check mains connections and contactors.</li> </ol>
LU-C	Undervoltage during constant speed.	Supply voltage too low.	Correct supply voltage. Check mains connections and contactors.
OH-C	Heatsink overheat at constant speed.	<ol style="list-style-type: none"> <li>1. Ambient temperature is too high.</li> <li>2. Load is too heavy.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the heatsink and ambient temperature.</li> <li>2. Check the load.</li> </ol>

*Table 12: Alarms that can only be reset manually*

<b>Alarm code</b>	<b>Fault</b>	<b>Possible cause</b>	<b>Remedy</b>
-OC-	Overcurrent in stop mode.	Inverter fault.	Contact your distributor.
OL1	The motor is overloaded.	<ol style="list-style-type: none"> <li>1. The load is too great.</li> <li>2. Incorrect V/Hz ratio.</li> <li>3. Incorrect setting in F069 and F070.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the load.</li> <li>2. Adjust the V/Hz setting.</li> <li>3. Adjust F069 and F070.</li> </ol>
OL2	The inverter is overloaded.	<ol style="list-style-type: none"> <li>1. The load is too great.</li> <li>2. Incorrect V/Hz ratio.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the load.</li> <li>2. Adjust the V/Hz setting.</li> </ol>
OL3	Torque limit exceeded.	<ol style="list-style-type: none"> <li>1. The load is too great.</li> <li>2. Incorrect V/Hz ratio.</li> <li>3. F078 and F079 are set too low.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the load.</li> <li>2. Adjust the V/Hz setting.</li> <li>3. Adjust F078 and F079.</li> </ol>

Table 13: Operating errors

Alarm code	Fault	Possible cause	Remedy
LOC	The desired function is blocked.	<ol style="list-style-type: none"> <li>1. Attempt to use a blocked function.</li> <li>2. Reverse command when reverse run is prohibited</li> </ol>	<ol style="list-style-type: none"> <li>1. Set F004=xxx0 or xx0x.</li> <li>2. Set F003=x0xx.</li> </ol>
Err1	Operation error.	<ol style="list-style-type: none"> <li>1. Attempt to change frequency by pressing "up" or "down" key when Fn11=1.</li> <li>2. Attempt to change CPU version by pressing "up" or "down" key.</li> <li>3. Attempt to change parameter setting during operation by pressing "up" or "down" key.</li> </ol>	<ol style="list-style-type: none"> <li>1. Set F011=0.</li> <li>2. CPU version (F124) cannot be changed.</li> <li>3. Change possible in STOP mode only.</li> </ol>
Err2	Setting error.	F006 (max. freq.) is set lower than F007 (min. freq.)	Set F006>F007.
Err3	Setting error.	When F005=18: V/Hz curve is set too steep.	Change the setting of F038-F040 to a lower V/Hz curve.
Err4	Setting error.	Incorrect sequence of F037-F041.	Set F037>F039>0.1Hz and F038>F040>F041.
Err5	Serial communication error.	Refer to the serial communications manual.	Refer to the serial communications manual.
Err6	Serial communication error.	Refer to the serial communications manual.	Refer to the serial communications manual.
Err7	Setting error.	An attempt has been made to change F000 or F096.	Restore factory settings.

## 4.4 Help from Emotron or a distributor

If serious faults occur, or the cause of a problem cannot be found, contact Emotron or your Emotron distributor. Be ready to provide the following information when you call:

- Type of frequency inverter and serial number (on the marking plate).
- Type of motor and motor data.
- Type of application – connection and mounting of motor and inverter.
- Any accessories used
- Detailed description of the problem.
- Data from the alarm list.

## 5. ACCESSORIES

### 5.1 Extension cable for display unit

The display unit can be mounted remotely, i.e. in the door of the cabinet or in a separate control box near the operator. The extension cables are supplied in lengths of 1, 2 or 3 meters. Two adaptors are also supplied, one for the inverter and one for the display unit.

Note: CF40-020 and CF026 do not use the display unit adapter.

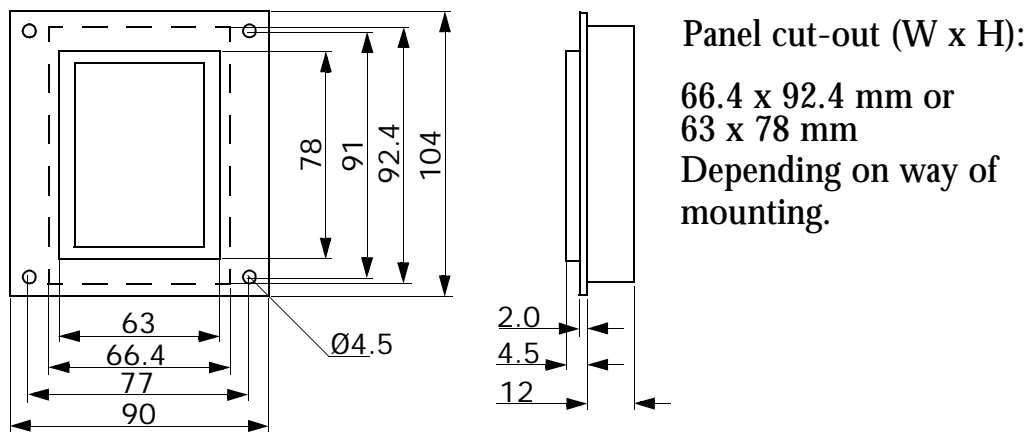


Fig. 13 Display unit adapter

### 5.2 Earth fault protection ZCT

The DIGIFLUX CF is not earth fault safe\*, and it could be destroyed in the event of an earth fault. This option, a current transformer through which the output motor leads should be thread, will protect the inverter in case of an earth fault. Connect it to CON4, placed in the right lower part of the control board.

\*Exception: CF40-020 and CF40-026 are earth fault protected. (ZCT built in).

## **5.3 RFI filter**

An RFI filter is needed to comply with the european standards for EMC (ElectroMagnetic Compatibility). Refer to “2.2.6 EMC Guidelines” for further information and for a list of recommended filters.

## **5.4 RS232 Serial link**

The option kit contains a convertor cable with one connector for the inverter and another (9 pole D-sub) for the RS232 communication port of a PC. A 3,5” diskette with a program for the PC is also included. With this tool it is possible to set inverter parameters on-line, store parameter sets in the PC and load settings from the PC or the inverter itself. It is also possible to control the inverter directly from the PC.

## **5.5 RS485 Serial link**

The option kit contains an RS485 converter, a cable with one connector for the inverter and another (9-pole D-sub) for the RS485 converter and a 3,5” diskette with a small demo and the RS485 protocol.



## 6. TECHNICAL DATA

### 6.1 General Specifications

Table 14: General specifications of DIGIFLUX CF

Parameter	Specification
Supply voltage CF23	1(3) x 230 VAC (180 - 264 VAC), 50/60 Hz
Supply voltage CF40	3 x 400 VAC (342 - 506 VAC), 50/60 Hz
Output voltage	0 - supply voltage
Output frequency	0 - 400 Hz
V/Hz characteristics	18 preset V/Hz patterns + one programmable pattern (in 3 points).
Control mode	Frequency control.
Reference value setting	By display unit; digitally via serial communication interface; by I/O via analog input (potentiometer, 0-10 VDC, 0(4)-20 mA, all with scaling and reversible functions); 7 pre-programmed values selectable via digital inputs; motor potentiometer.
Configuration/set-up	By keyboard or via serial communications.
Acceleration/deceleration	Individually adjustable times. Two different times can be set for each mode (acc. and dec.). Linear or "S" ramp shape.
I/O	2 digital inputs for RUN FWD, RUN REV 1 digital input for RESET 3 programmable digital inputs. 1 analogue reference value input (0-10 VDC / 0(4)-20 mA). 1 programmable digital output 1 analogue output, 0-10 VDC. 1 dedicated alarm relay output.
Dynamic (active) braking	Brake chopper built in.
Static (passive) braking	DC braking with adjustable time, current and ingress level.

Table 14: General specifications of DIGIFLUX CF

Parameter	Specification
Protection/limitation	Stall preventive frequency control.
Serial comm. interface	RS232 or RS485 with optional interface.
Ambient temperature	0-40 °C
Storing temperature	-10 - +60 °C
Max relative humidity	95 %, non condensing
Max altitude	3000 m (1000 m without derating)
Encapsulation	IP 20
Emission	According to EN50081-2/-1 with optional filter and installation as recommended.
Immunity	According to EN50082-2 with installation according to recommendations.

## 6.2 Type specific data

Table 15: Type specific data for DIGIFLUX CF23-40

Type	Motor size (kW)	I <sub>CONT</sub> (A)	I <sub>MAX</sub> (A)	P <sub>f</sub> (W)
CF23-05	0.37	3.1	5	35
CF23-07	0.75	4.5	7	45
CF23-11	1.5	7.5	11	65
CF23-16	2.2	10.5	16	90
CF40-003	0.75	2.3	3.4	40
CF40-006	1.5	3.8	5.7	60
CF40-008	2.2	5.2	7.8	70
CF40-013	4.0	8.8	13.2	135
CF40-020	5.5	13.0	19.5	?
CF40-026	7.5	17.5	26.2	?

## 6.3 Dimensions CF

Table 16: Dimensions and weights for DIGIFLUX CF

Type	H (mm)	W (mm)	D (mm)	h1 (mm)	w1 (mm)	Weight (kg)
CF23-05 CF23-07	162	107	136	150	96	1.4
CF23-11 CF40-003 CF40-006	184	149	153	174	138	2.5
CF23-16 CF40-008 CF40-013	215	185	163	205	174	3.8
CF40-020 CF40-026	300	200	199	286	186	6.3

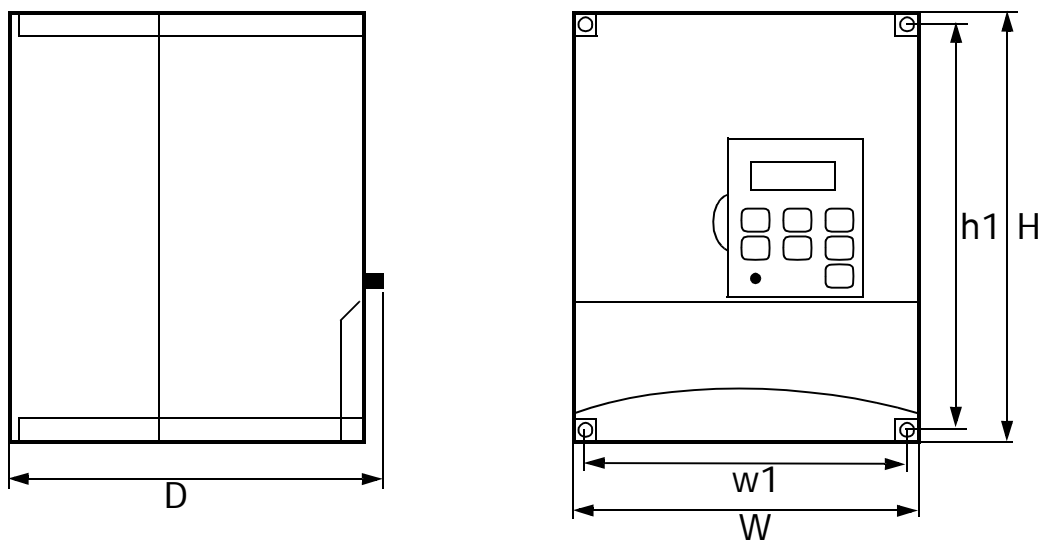


Fig. 14 Inverter dimensions

## 6.4 Dimensions filter

Table 17: Dimensions and weights of filters

Filter type N2F-	For CF type	H (mm)	W (mm)	D (mm)	w1 (mm)	b1 (mm)	Weight (kg)
2102	23-05 23-07	199	114	30	183	96	0.9
2202A	23-11	228	159	45	208	138	1.8
4103A	40-003 40-006	228	159	45	208	138	1.9
2202B	23-16	265	195	45	245	174	2.4
4103B	40-008 40-013	265	195	45	245	174	2.4
4203	40-020 40-026	360	210	70	335	185	?

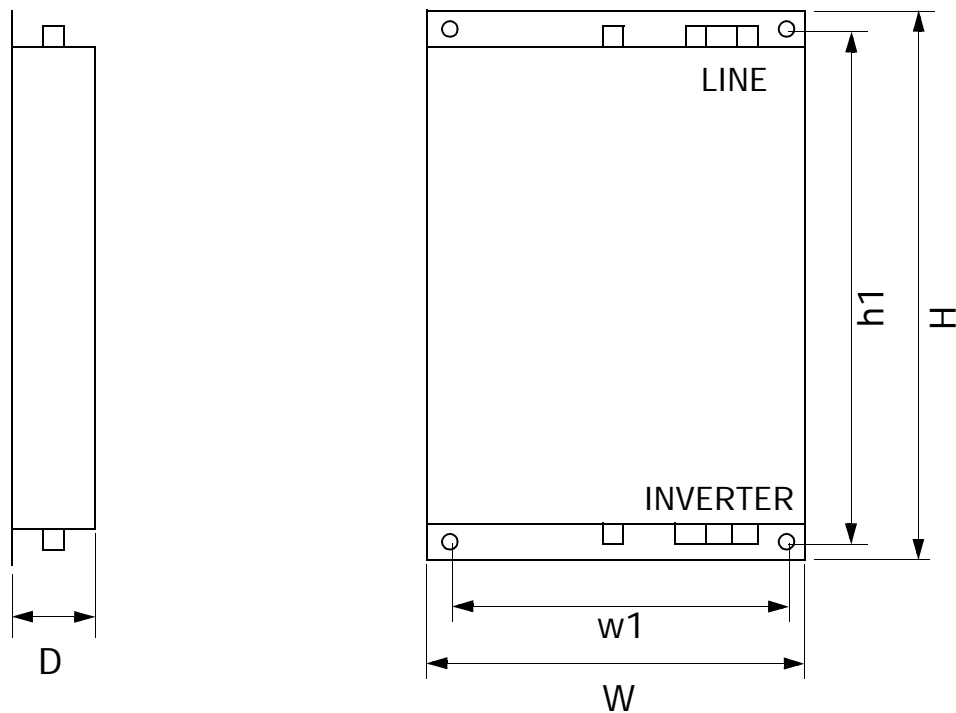


Fig. 15 Filter dimensions

# 7. PARAMETER SETTING RECORD

Table 18: Parameter setting record table 1

Func.	Description	Ref. to	Default	Change
F000	Inverter type	3.10.2		-----
F001 <sup>1</sup>	Acceleration time 1	3.5	10.0	
F002 <sup>1</sup>	Deceleration time 1	3.5	10.0	
F003	Start/stop, fwd/rev signal type Blocking the reversing function Motor potentiometer start point	3.4.2 3.4.3 3.3.6	0000	
F004	Keyboard lock	3.9.2	0000	
F005 <sup>4</sup>	V/Hz pattern	3.7.1	0/9	
F006 <sup>4</sup>	Max. frequency	3.3.2	50/60	
F007	Min. frequency	3.3.2	0.00	
F008	Freq. threshold for digital output	3.8.3	0.00	
F009	Threshold detection width	3.8.3	0.00	
F010	Source of start/stop, fwd/rev	3.4.1	0	
F011	Source of reference value	3.3.1	0	
F012	Protection during acc/dec/run	3.6.1	0000	
F013	Protection level during acc.	3.6.1	110	
F014	Protection level during running	3.6.1	160	
F015 <sup>1</sup>	Protection deceleration time	3.6.1	3.0	
F016	Autostart at power-up Alarm reset Sensitivity of digital inputs	3.4.7 3.4.11 3.8.2	0000	
F017 <sup>1</sup>	Pre-set frequency 1	3.3.5	5.00	
F018 <sup>1</sup>	Pre-set frequency 2	3.3.5	10.00	
F019 <sup>1</sup>	Pre-set frequency 3	3.3.5	20.00	
F020 <sup>1</sup>	Pre-set frequency 4	3.3.5	30.00	
F021 <sup>1</sup>	Pre-set frequency 5	3.3.5	40.00	

Table 19: Parameter setting record table 2

<b>Func.</b>	<b>Description</b>	<b>Ref. to</b>	<b>Default</b>	<b>Change</b>
F022 <sup>1</sup>	Pre-set frequency 6	3.3.5	50.00	
F023 <sup>1</sup>	Pre-set frequency 7	3.3.5	60.00	
F024 <sup>1</sup>	Jog frequency	3.3.7	2.00	
F025 <sup>1</sup>	Reference from keypad	3.3.1	5.00	
F026 <sup>1</sup>	Scaling of analogue input	3.3.4	0.00	
F027 <sup>1</sup>	Scaling of analogue input	3.3.4	0.0	
F028 <sup>1</sup>	Scaling of analogue input	3.3.4	100.0	
F029 <sup>1</sup>	Scaling of analogue input	3.3.4	0	
F030	Voltage of power supply	3.7.4	220	
F031	Power loss ride through time	3.4.6	0.5	
F032	Power loss ride through on/off	3.4.6	0	
F033	Analogue input sensitivity	3.8.2	100	
F034	Auto restart delay	3.4.8	0.0	
F035	Auto restart attempts	3.4.8	0	
F036	Motor poles	3.9.1	4	
F037 <sup>4</sup>	V/Hz custom definition, Fmax	3.7.1/2	50/60	
F038	V/Hz custom definition, Umax	3.7.1/2	100.0	
F039 <sup>4</sup>	V/Hz custom definition, Fmid	3.7.1/2	2.5/3.0	
F040	V/Hz custom definition, Umid	3.7.1/2	7.5	
F041	V/Hz custom definition, Umin	3.7.1/2	7.5	
F042	Start frequency	3.4.4	1.00	
F043	Switching frequency	3.10.1	14	
F044	Stop mode	3.4.9	0000	
F045 <sup>1</sup>	Analogue output scaling	3.8.4	100	
F046 <sup>1</sup>	Analogue output value	3.8.4	0	
F047 <sup>1</sup>	Display value	3.9.1	0000	

Table 20: Parameter setting record table 3

Func.	Description	Ref. to	Default	Change
F048	Dynamic brake Stop key on operators panel Speed search Mains voltage compensation	3.5.7 3.9.3 3.4.5 3.7.4	0000	
F049 <sup>1</sup>	Acceleration time 2	3.5.4	10.0	
F050 <sup>1</sup>	Deceleration time 2	3.5.5	10.0	
F051 <sup>1</sup>	Display value	3.9.1	0	
F052 <sup>1</sup>	Line speed display scaling	3.9.1	1800	
F053	DC braking time	3.4.10	0.5	
F054	DC braking ingress threshold	3.4.10	1.5	
F055	DC braking current	3.4.10	8	
F056	Programmable digital input (6)	3.8.1	00	
F057	Programmable digital input (7)	3.8.1	01	
F058	Programmable digital input (8)	3.8.1	02	
F061	Programmable digital output	3.8.3	00	
F065	Blocked frequency 1	3.3.8	0.00	
F066	Blocked frequency 2	3.3.8	0.00	
F067	Blocked frequency 3	3.3.8	0.00	
F068	Range of blocked frequencies	3.3.8	0.00	
F069	Motor I <sup>2</sup> t protection	3.6.2	0000	
F070	Motor I <sup>2</sup> t protection current	3.6.2		
F071	Inverter I <sup>2</sup> t protection IxR compensation auto/man	3.6.3 3.7.3	0000	
F072 <sup>1</sup>	IxR compensation level (manual)	3.7.3	0.0	
F075	No load current (Slip comp)	3.7.5		
F076 <sup>1</sup>	Motor slip (Slip comp)	3.7.5	0.00	
F077	Torque limit type	3.6.4	0000	
F078	Torque limit level	3.6.4	160	
F079	Torque limit delay	3.6.4	0.1	

Table 21: Parameter setting record table 4

Func.	Description	Ref. to	Default	Change
F080	S-form for acc/dec-time 1	3.5.3	0.2	
F081	S-form for acc/dec-time 2	3.5.6	0.2	
F082	Energy saving	3.7.6	0000	
F083 <sup>1</sup>	Energy saving gain	3.7.6	80	
F084	Process timer function	3.10.7	0000	
F085	Process timer 1	3.10.7	0	
F086	Process timer 2	3.10.7	0	
F087	Process timer 3	3.10.7	0	
F088	Process timer 4	3.10.7	0	
F089	Process timer 5	3.10.7	0	
F090	Process timer 6	3.10.7	0	
F091	Process timer 7	3.10.7	0	
F092 <sup>1</sup>	Stability adjustment, cycles	3.10.4	5	
F093 <sup>1</sup>	Stability adjustment, gain	3.10.4	0.0	
F094 <sup>1</sup>	Stability adjustment, bias	3.10.4	0	
F095	Factory adjustment only!	-----		-----
F096	Factory adjustment only!	-----		-----
F097	Alarm relay function	3.8.5	0000	
F098	Alarm relay function	3.8.5	0000	
F100 <sup>2</sup>	Serial communication adress	3.10.5	0001	
F101 <sup>2</sup>	Serial communication baud rate	3.10.5	0001	
F102 <sup>2</sup>	Serial communication set-up	3.10.5	1100	
F123	Factory defaults for 50 or 60Hz	3.10.6	0000	
F124	CPU version	3.10.3		-----
F125	Alarm list (3 alarms)	4.3	-----	

<sup>1</sup> Setting can be changed during run.

<sup>2</sup> Setting can't be changed in communication mode.

<sup>3</sup> Setting will not change when using F123.

<sup>4</sup> Setting depends on usage of F123.