**P**lease read this manual carefully before you install and operate an L100 series inverter and observe all of the instructions given in there. This manual may also serve as a reference guide und therefore should always be kept at hand.

**Symbols used**

There are several safety instructions in this manual which are marked with a special hazard alert symbol (flash or exclamation mark in the center of a triangle). Additionally, either the word CAUTION or WARNING is added following the triangle with the exclamation mark.

⚠ This symbol means hazardous high voltage. It is used to call your attention to items or operations that could be dangerous to your or other persons life. Please read the safety message carefully and follow all the instructions given.

⚠ This symbol is used to call your attention to situations which are potentially dangerous to persons. Please read the safety message carefully and follow all the instructions given.

The safety messages given following this symbol are further divided into two categories:

⚠ WARNING This message indicates a situation which may lead to serious injury or even death if the instruction is not observed.

⚠ CAUTION This message indicates a situation which may lead to minor or moderate injury, or damage of product.

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⚠ HAZARDOUS HIGH VOLTAGE

Motor control equipment or electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers there migh exist exposed components with cases ore protrusions at or above line potential. Extreme care should be taken to protect against shock.

For these reasons, the following safety guidelines should be observed:

Stand on an insulating pad and make it a habit to use only one hand when checking components. Disconnect power before checking controllers or performing maintenance. Be sure that equipment is grounded properly. Wear safety glasses whenever working on an electronic controller or rotating electrical equipment.

⚠ WARNING This equipment should be installed, adjusted and serviced only by qualified electrical maintenace personell familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

⚠ WARNING The user is responsible that all driven machinery, drive train mechanism not supplied by Hitachi, Ltd., and process line material are capable of safe operation at an applied frequency of 150% of the maximum selected frequency range to the AC motor. Failure to do so can result in destruction of equipment and injury to personnell should a single point failure occur.

⚠ WARNING HAZARD OF ELECTRICAL SHOCK. DISCONNECT INCOMING POWER BEFORE WORKING ON THIS CONTROL.

⚠ WARNING SEPERATE MOTOR OVERLOAD AND OVERCURRENT PROTECTION DEVICES ARE REQUIRED TO BE PROVIDED IN ACCORDANCE WITH THE SAFETY CODES REQUIRED BY JURISDICTIONAL AUTHORITIES.

⚠ CAUTION These instructions should be read and clearly understood before working on L100 series equipment.

⚠ CAUTION Proper grounds, disconnecting devices (e.g. fuses) and other safety devices and their location are the responsibility of the user and are not provided by Hitachi, Ltd.

⚠ CAUTION DANGEROUS VOLTAGE EXISTS UNTIL THE POWER LIGHT ON THE DIGITAL OPERATOR IS OFF.

⚠ CAUTION Rotating shafts and electrical potentials above ground level can be hazardous. Therefore it is strongly recommended that all electrical work conform to the national

electrical codes and local regulations. Installation, maintenance and alignment should be performed by qualified personnell only.

Factory recommended test procedures included in this instruction manual should be followed. Always disconnect electrical power before working on the unit.

⚠ WARNING a) Any motor used must be of suitable rating.

b) Motors may have hazardous moving parts so that suitable protection must be provided in order to avoid injury.

⚠ CAUTION Alarm connections may have hazardous live voltages even when the inverter is disconnected. In case of removing the front cover for maintenance or inspection, confirm that incoming power for alarm connections is surely disconnected.

⚠ CAUTION Main terminals or other hazardous terminals for any interconnection (terminals for connecting the motor, contact breaker, filter etc.) must be inaccessible in end installation.

All of the above instructions, together with any other requirements, reccommendations, and safety messages highlighted in this manual must be strictly complied with.

## NOTES ON EMC (ELECTRO MAGNETICAL COMPATIBILITY)

⚠ WARNING This equipment should be installed, adjusted and serviced by qualified personnell familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

When using L100 series inverters in EU countries, the EMC directive 89/336/EEC must be observed. To satisfy the EMC directive and to comply with the standard, the following provisions should be obeyed:

A) Environmental conditions for the inverter:
- Ambient temperature: -10°C to 40°C.
- Relative Humidity: 20% to 90% (no dew condensation)
- Vibrations: max. 5,9m/s$^2$ (0.6 g) at 10–55Hz.
- Location: 1000 meter or less altitude, indoors (no corrosive gas or dust).

B) The power supply to the L100 inverter must conform to the conditions stated below. If one of the conditions mentioned is not satisfied then an appropriate L100 AC reactor will have to be installed.
- Voltage fluctuation +/-10% or less
- Voltage unbalance +/-3% or less
- Frequency variation +/-4% or less

C) Wiring
- Shielded wiring (screened cable) is required for motor wiring, and total length has to be kept to less than 50m. When using motor cables longer than 50m L100 motor filters should be installed. Directions for installing filters can be found in the L100 installation manual.
- Seperate the mains circuit wiring from the wiring used for signals or process circuit. Please refer to the L100 installation manual.

D) Installation
- For L100 series inverters, the filters described hereafter have to be used and the installation notes have to be observed.

If installed according to the following directions, the frequency inverters comply with the following standards:
Emmissions: EN 61800-3 (EN 55011 group 1, class B)
Immunity: EN 61800-3, industrial environments

For the best possible damping of interference, special line filters have been developed which guarantee you easy assembly and installation along with the necessary electrical reliability. However, effective EMC is only ensured if the suitable filter is selected for the particular drive and installed in accordance with these EMC recommendations. Please choose the appropriate filter using the table below:

| Inverter type | Input voltage | Filter type |
|---|---|---|
| L100-002 NFE | 1 ~ 220V -10% thru 240V +5% | FPF-L100N/2x2.6A |
| L100-004 NFE | | FPF-L100N/2x2.6A |
| L100-005 NFE | | FPF-L100N/2x4.0A |
| L100-007 NFE | | FPF-L100N/2x4.0A |
| L100-011 NFE | | FPF-L100N/2x10A |
| L100-015 NFE | | FPF-L100N/2x10A |
| L100-022 NFE | | FPF-L100N/2x10A |
| L100-004 HFE | 3 ~ 380 V -10% thru 460V +10% | FPF-L100H/3x3.8A |
| L100-007 HFE | | FPF-L100H/3x3.8A |
| L100-015 HFE | | FPF-L100H/3x3.8A |
| L100-022 HFE | | FPF-L100H/3x8.6A |
| L100-030 HFE | | FPF-L100H/3x8.6A |
| L100-040 HFE | | FPF-L100H/3x8.6A |
| L100-055 HFE | | FPF-L100H/3x16A |
| L100-075 HFE | | FPF-L100H/3x16A |

**Note:** All filters are designed for 50Hz/60Hz +/-5%.

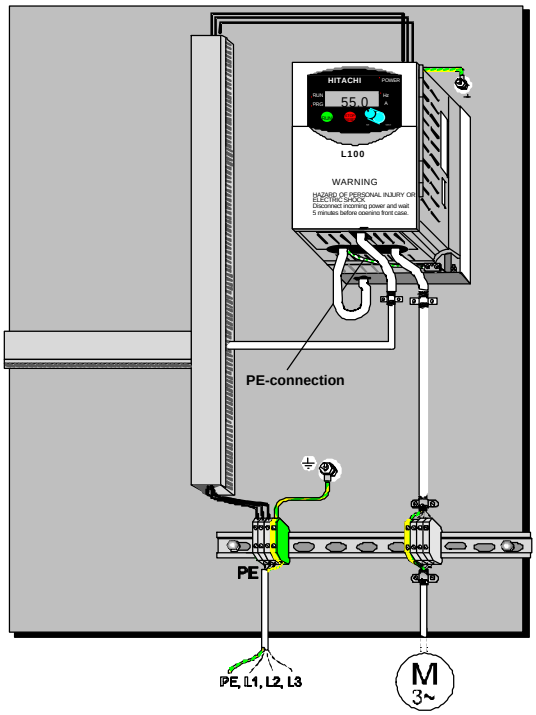
The amount of line-conducted interference also increases as motor cable length increases. Adherence to the interference limits for line-conducted interference is guaranteed on following way:

- If maximum motor cable length is 10 m at maximum elementary frequency:
  Class „B“.
- If maximum motor cable length is 20 m at elementary frequency 5 kHz:
  Class „B“.
- If maximum motor cable length is 50 m at maximum elementary frequency:
  Class „A“.

**Observe the following provisions for an electromagnetically compatible setup of your drive system:**

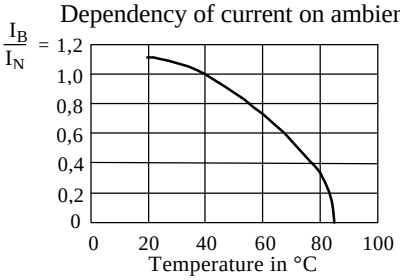
1. As user you must ensure that the HF impedance between frequency inverter, filter and ground is as small as possible.
   - See to it that the connections are metallic and have the largest possible areas (zink-plated mounting plates)
2. Conductor loops act like antennas, especially when they encompass large areas. Consequently:
   - Avoid unnecessary conductor loops
   - Avoid parallel arrangement of „clean“ and interference-prone conductors
3. Lay the motor cable and all analog and digital contol lines shielded.
   - You should allow the effective shield area of these lines to remain as large as possible; i.e., do not move the shield further away than absolutely necessary.
   - With compact systems, if for example the frequency inverter is communicating with the steering unit, in the same control cabinet connected at the same PE-potential, the screen of control lines should be put on, on both sides with PE. With branch systems, if for example the communicating steering unit is not in the same control cabinet and there is a distance between the systems, we recommend to put on the screen of control lines only on the side of the frequency inverter. If it is possible, direct in the cable entry section of the steering unit. The screen of Motor cabels always must be put on, on both sides with PE.
   - The large area contact between shield and PE-potential you can realise with a metal PG screw connection or a metallic mounting clip.
   - Use only copper mesh cable (CY) with 85% coverage
   - The shielding should not be interrupted at any point in the cable. If the use of reactors, contactors, terminals or safety switches in the motor output is necessary, the unshielded section should be kept as small as possible.
   - Some motors have a rubber gasket between terminal box and motor housing. Very often, the terminal boxes, and particularly the threads for the metal PG screw connections, are painted. Make sure there is always a good metallic connection between the shielding of the motor cable, the metal PG screw connection, the terminal box and the motor housing, and carefully remove this paint if necessary.
4. Very frequently, interference is coupled in through installation cables. This influence you can minimize:
   - Lay interfering cables separately, a minimum of 0.25 m from cables susceptible to interference.
   - A particularly critical point is laying cables parallel over larger distances. If two cables intersect, the interference is smallest if they intersect at an angle of 90°. Cables susceptible to interference should therefore only intersect motor cables, intermediate circuit cables, or the wiring of a rheostat at right angles and never be laid parallel to them over larger distances.
5. The distance between an interference source and an interference sink (interference-threatened device) essentially determines the effects of the emitted interference on the interference sink.
   - You should use only interference-free devices and maintain a minimum distance of 0.25 m from the drive.
6. Safety measures
   - Ensure that the protective conductor terminal (PE) of the filter is properly connected with the protective conductor terminal of the frequency inverter. An HF ground connection via metal contact between the housings of the filter and the frequency inverter, or solely via cable shield, is not permitted ***as*** protective conductor connection. The filter must be solidly and permanently connected with the ground potential so as to preclude the danger of electric shock upon touching the filter if a fault occurs. You can achieve this by connecting it with a grounding conductor of at least 10 mm² or connecting a second grounding conductor, connected with a separate grounding terminal, parallel to the protective conductor (the cross section of each single protective conductor terminal must be designed for the required nominal load).

**Technical specifications and dimensions of L100 foot print filter:**

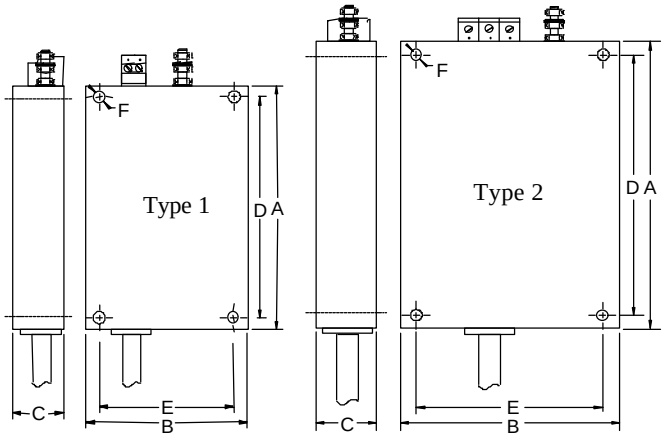



| | |
|---|---|
| Current | at 40°C ambient temperature |
| Overload | 1.5 x $I_N$ for 10min |
| Frequency | 50 / 60 Hz |
| Material | Steel, surface refined |
| Humidity class | C |
| Operation height | < 1000 m without derating;<br>> 1000 m, $I_N$-2%, for each 1000m |
| Temperature range | -25°C through +85°C |
| Enclosure | Input terminals IP 20<br>and PE-holder M5.<br>Load side: cable, unshielded. |

Dependency of current on ambient temperature:




| Dimensions (in mm) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model: FPF- | Type | A | B | C | D | E | F |
| L100N/2x2.6A | 1 | 120 | 80 | 25 | 110 | 67 | 2x6 |
| L100N/2x4.0A | 1 | 130 | 110 | 27 | 118 | 98 | 4x6 |
| L100N/2x10A | 1 | 180 | 140 | 29 | 168 | 128 | 4x6 |
| L100H/3x3.8A | 2 | 130 | 110 | 27 | 118 | 98 | 4x6 |
| L100H/3x8.6A | 2 | 180 | 140 | 29 | 168 | 128 | 4x6 |
| L100H/3x16A | 2 | 257 | 182 | 35 | 236 | 160 | 4x7 |




| Type: FPF- / Specification: | L100N 2x2.6A | L100N 2x4.0A | L100N 2x10A | L100H 3x3.8A | L100H 3x8.6A | L100H 3x16A |
|---|---|---|---|---|---|---|
| Voltage in V | 240 +5% | 240 +5% | 240 +5% | 460 +10% | 460 +10% | 460 + 10% |
| Current in A at 40°C | 2 x 6A | 2 x 10A | 2 x 23A | 3 x 6A | 3 x 11A | 3 x 20A |
| Leak. current in mA/Phase, 50Hz, worst case 1) | - | - | - | 32 | 62 | 120 |
| Leakage current in mA/ Phase, 50Hz, Un 2) | < 3.5 | < 3.5 | < 10 | < 3.5 | < 3.5 | <10 |
| Test voltage in V DC, 2s ph./ph., ph./ground | 1400 / 2800 | 1400 / 2800 | 1400 / 1400 | 1978 / 2800 | 1978 / 2800 | 1978 / 1978 |
| Dimensions single wire / litze | 4 / 4 mm² | 4 / 4 mm² | 4 / 4 mm² | 4 / 4 mm² | 4 / 4 mm² | 4 / 4 mm² |
| Output cable | 3x1.5mm² | 3x1.5mm² | 3x2.5mm² | 4x1.5mm² | 4x2.5mm² | 4x2.5mm² |
| Weight in kg (approx.) | 0.5 | 0.6 | 1.0 | 0.7 | 1.1 | 2.4 |
| Heat dissip. in W (approx.) | 6 | 7 | 9 | 7 | 10 | 14 |

1) "Worst case" states the leakage current for three-phase filters in the worst of cases. That means one phase is live and two phases of the feed-line lead-in are interrupted. These maximum values are based on an operating voltage of 460 V (ph./ph.).

2) The normal leakage current for three-phase filters is stated. This means the filter is operating on 460 V (ph./.ph.). The stated values are adhered to up to a neutral voltage of 5V to ground caused by line unbalance.

*Revision history table:*

| | Revision contents | Date of issue | Manual no. |
|---|---|---|---|
| **1** | Correction: Specification for RESET terminal<br>Correction: Initial data for *C 31* and *C 32* | September, 1997 | NB541XC |
| **2** | Addition of 5,5kW and 7,5kW models<br>Addition of insulating resistance test<br>Addition of the magnetizing current setting via *b 32* | July, 1998 | NB541XD |
| **3** | Revision and expansion of the section<br>"Notes on EMC (electro magnetical compatibility)" | | |

# C O N T E N T S

# Chapter 1 – Safety precautions

## Installation

The following safety precautions are to be observed when installing the frequency inverter:

⚠ CAUTION Be sure to install the inverter on flame resistant material such as metal. Otherwise, there is a danger of fire.

⚠ CAUTION Be shure not to place anything inflammable in the vicinity. Otherwise, there is a danger of fire.

⚠ CAUTION Be sure not to let foreign matter (such as cut wire refuse, spatter from welding, iron refuse, wires, dust etc.) enter the inverter. Otherwise, there is a danger of fire.

⚠ CAUTION Install the inverter in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or which have dew condensation, as well as places with dust, corrosive gas, explosive or inflammable gas, grinding-fluid mist, salt damage etc. Otherwise, there is a danger of fire.

⚠ CAUTION The wall surface on which the inverter is mounted must be of a nonflammable material, such as a steel plate.

## Wiring

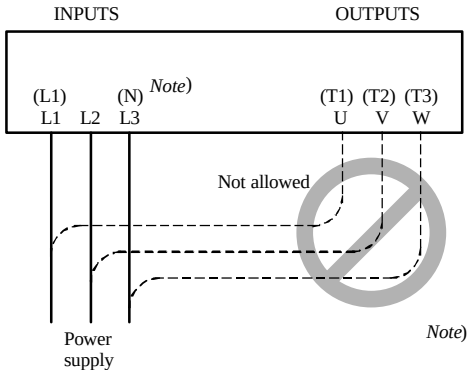
⚠ WARNING The inverter has to be grounded properly. Otherwise, there is a danger of fire.

⚠ WARNING Wiring work must only be carried out when the power supply is off. Otherwise, there is a danger of electric shock and/or fire.

⚠ WARNING Before carrying out the wiring work, the inverter has to be mounted properly. Otherwise, there is a danger of electric shock or injury.

⚠ CAUTION Make shure that the input voltage is as follows (please also refer to chapter 11):
Single/three phase: 200~240V, 50/60Hz (models up to 2,2kW)
Three phase: 200~240V, 50/60Hz
Three phase: 380~460V, 50/60Hz

⚠ CAUTION Don´t connect AC power supply to the inverter output terminals U, V, and W. Otherwise, there is a danger of injury and/or fire.




*Note*) Terminals L1, N: single phase power supply
Terminals L1, L2, L3: three phase power supply

⚠ CAUTION <u>Remarks for using earth leakage circuit breakers in the mains supply:</u>

Frequency inverters with CE-filters (RFI-filter) and screened motor cables have a higher leakage current against earth. Especially in the moment of switching this can

cause unintentional triggering of earth leakage circuit breakers. Because of the rectifier on the input side of the inverter there is the possibility to stall the switch-off function through amounts of DC current. For these reasons, the following items should be observed:

Only pulse current sensitive earth leakage circuit breakers which have a short term delay and a higher trigger current (500mA) should be used. Other components should be secured with separate earth leakage circuit breakers. Earth leakage circuit breakers in front of an inverter´s rectifier are not an absolute protection against direct touching.

⚠ CAUTION Each phase of the power supply has to be provided with a fuse. Otherwise, there is a danger of fire.

## Control and operation

⚠ WARNING Be sure to turn on the input power supply only after closing the front case. While being energized, don´t open the front case. Otherwise, there is a danger of electric shock.

⚠ WARNING Never operate the switches with wet hands. Otherwise, there is a danger of electric shock.

⚠ WARNING If the retry mode is selected, the inverter may suddenly restart during a stop which was caused by a trip. In such a case, be sure not to approach the machine. Provisions have to be taken that the driven motor or machine does not endanger personnell even in the case of a sudden restart. Otherwise, there is a danger of injury.

⚠ WARNING Even if the power supply is cut off for a short period of time, the inverter may restart operation after the power supply has recovered if the operation command is given. If this may incur danger to personnell, provisions have to be made in order to prevent a restart after power recovery. Otherwise, there is a danger of injury.

⚠ WARNING The STOP key is effective only if the corresponding parameters have been set. Otherwise, there is a danger of injury.

⚠ WARNING If a reset is carried out following a trip condition the motor will restart if the operation command has been given. Be sure to acknowledge this trip condition with a reset only after confirming that no operation command is active. Otherwise, there is a danger of injury.

⚠ WARNING When the power to the inverter is turned on while the operation command is active the motor starts immediately. So before turning power supply on be sure to confirm that no operation command is active.

⚠ WARNING If the inverter has been configured for the stop command not to be given using the STOP key, pressing the STOP key does not stop the motor. In this case a separate emergency stop switch is necessary.

⚠ CAUTION Operate the motor and machine connected to the inverter only within the manufacturer´s speed specifications. Otherwise, there is a danger of injury.

⚠ CAUTION If a motor is to be operated at a frequency higher than the standard setting value of 50 or 60Hz, be sure to check the allowable speed of the motor and the machine with each manufacturer, and operate them only after getting their consent.

⚠ CAUTION Check the following during and after the test run. Otherwise, there is a danger of machine breakage:

Was the short cut bar between terminals +1 and + removed by mistake?

Was the running direction of the motor correct?

Was the inverter tripped during acceleration or deceleration?

Were the indications of the rpm and the frequency meter correct?

Were there any abnormal motor vibrations or noise?

## Maintenance and inspection

⚠ WARNING Before carrying out maintenance and inspection wait for at least five minutes after having turned off the input power supply. Otherwise, there is a danger of electric shock.

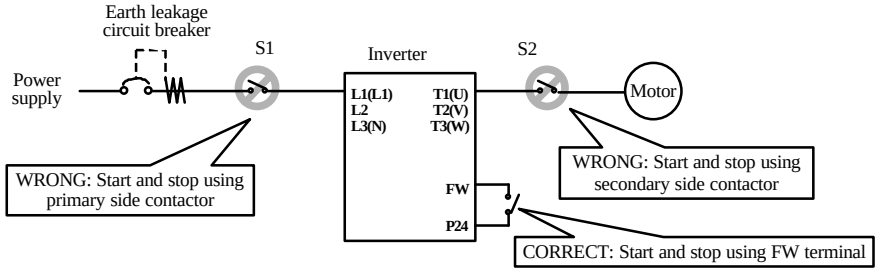
⚠ WARNING When removing connectors (e.g. from fans and printed circuit boards) never pull the attached wires. Otherwise, there is a danger of fire due to wire breakage and/or injury.

## Others

⚠ CAUTION Withstand voltage tests and insulation resistance tests (megger tests) are executed before the units are shipped, so that there is no need to conduct these tests before operation.

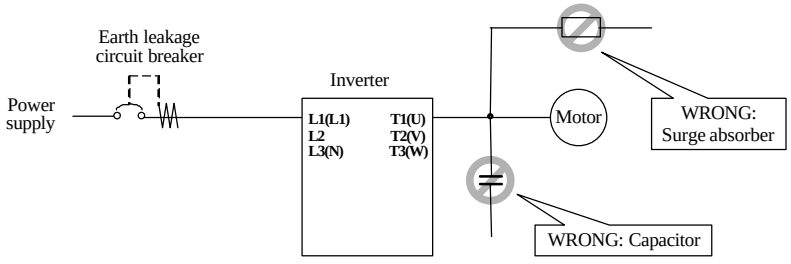
⚠ CAUTION Do not attach or remove wiring or connectors when power is applied. Also, do not check signals (e.g. using a multimeter) during operation.

⚠ CAUTION Never stop motor operation by switching off the electromagnetic contactors on the primary or secondary side of the inverter.




When there has been an instantaneous power failure, and if an operation instruction has been given, then the inverter may restart operation after the power failure has ended. If there is a possibility that such an occurrence may harm humans, then install an electromagnetic contactor on the primary (power supply) side of the inverter, so that the circuit does not allow automatic restarting after the power supply has recoverd. If the optional remote operator is used and the retry function has been selected, this will also cause automatic restarting when an operation instruction has been input, so please be careful.

⚠ CAUTION Do not insert leading power factor capacitors or surge absorbers between the output terminals of the inverter and the motor.



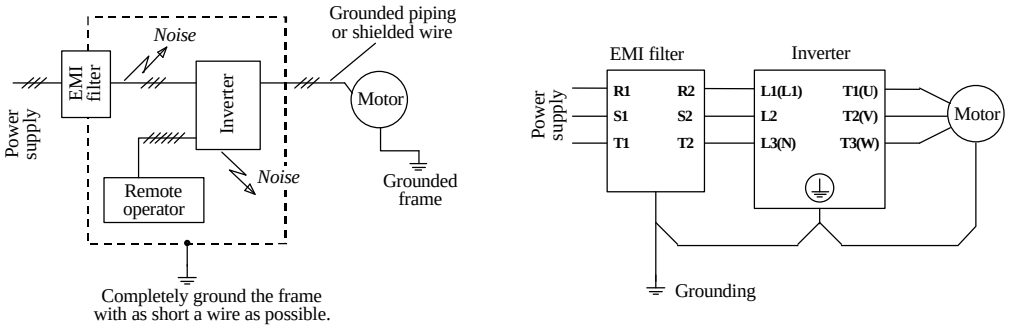

⚠ CAUTION Be sure to ground the grounding terminal ⏚ properly.

⚠ CAUTION Before inspecting the unit wait at least five minutes before opening the inverter .

⚠ CAUTION PROTECTION AGAINST NOISE INTERFERENCE FROM THE INVERTER

L100 series inverters use many semiconductor switching elements such as transistors and IGBTs. For this reason, a radio set or measuring instrument located near the inverter is susceptible to noise interference. To protect the instruments from erreneous operation due to noise interference produced by the inverter, they should be installed

well apart from the inverter. It is also effective to shield the whole inverter structure (refer to figure below, left part).




Addition of an EMI filter on the input side of the inverter also reduces the effect of noise from commercial power lines on external devices (refer to figure above).

⚠ CAUTION EFFECTS OF DISTRIBUTER LINES ON INVERTERS

In the cases mentioned below involving a general purpose inverter, a large peak current flows on the power supply side, sometimes destroying the converter module:

A) The unbalance factor of the power supply is 3% or higher.

B) The power supply capacity is set at least ten times greater than the inverter capacity (i.e. 500kVA or more)

C) When abrupt power supply changes are to be expected. Some examples:

1) Several inverters are interconnected using a short bus to the same power supply.

2) A thyristor converter and an inverter are interconnected using a short bus.

3) An installed power factor compensating device is connected or disconnected.

In the cases mentioned above we recommend installing an AC reactor of 3% voltage drop at rated current with respect to the supply voltage on the power supply side.

⚠ CAUTION When an EEPROM error occurs (trip *E 08*) all parameter values have to be checked for correctness (especially the RS input).

⚠ CAUTION When the intelligent digital inputs FW or RV are configured as normally closed contact (standard setting is normally open), then the inverter starts automatically. Do not configure these inputs as normally closed inputs unless absolutely necessary.

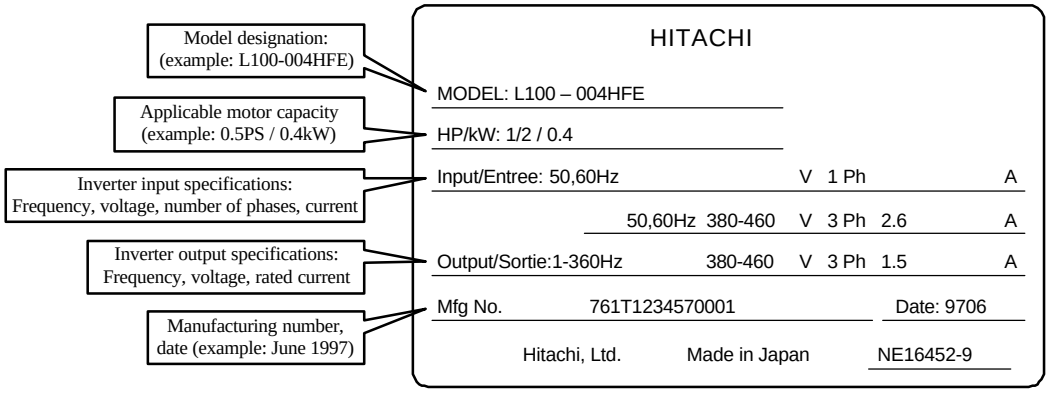
⚠ GENERAL NOTICE

In all the illustrations and figures in this manual, covers and safety devices are occasionally omitted in order to better describe the details. When the inverter is operated make shure that all the covers and safety devices are placed in their correct positions.

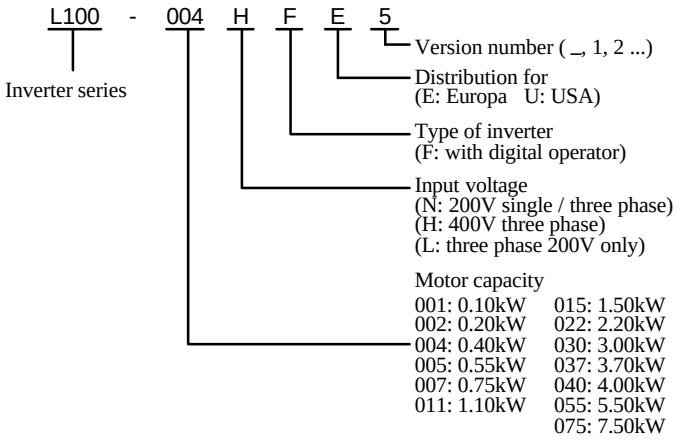
# Chapter 2 – Inspection upon unpacking

Please check the shipment by the time of delivery for damages and completeness. Check that the inverter and the accompanying instruction manual has been provided. Using the specification label attached to the side of inverter make sure that the inverter model delivered is the one you ordered.

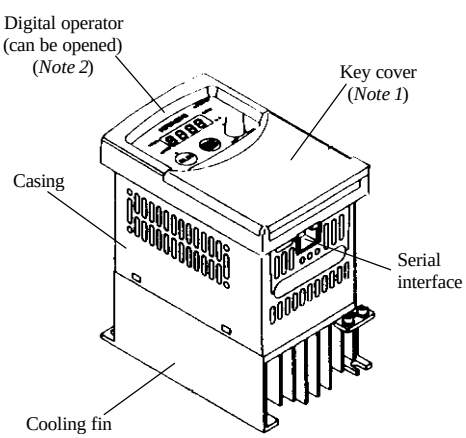
The specifications included on the specification label are described below:

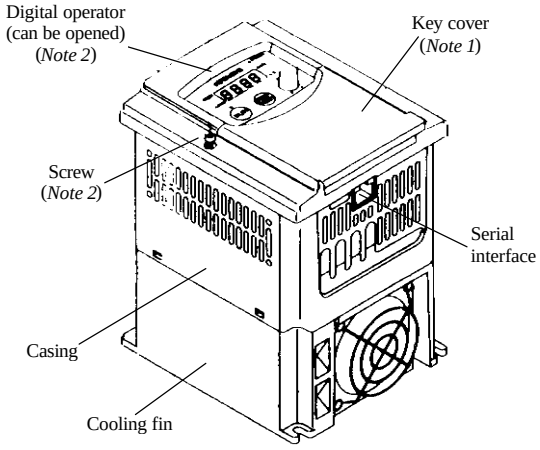


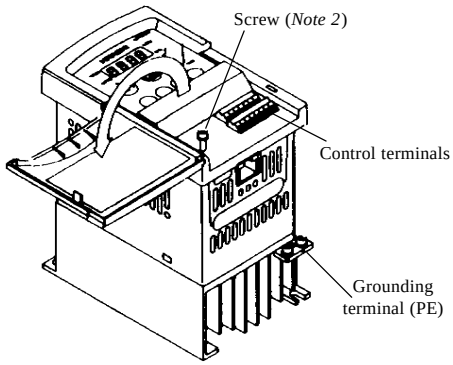

In the illustration below, the contents of the model designation used for L100 series inverters is explained:

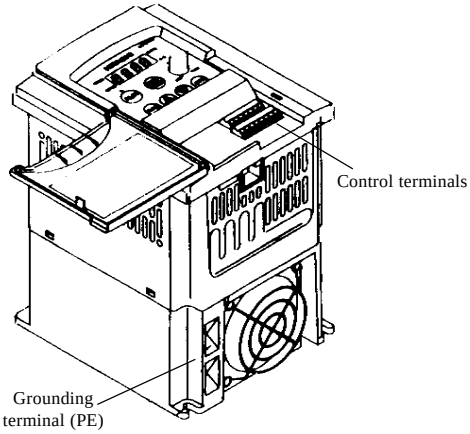


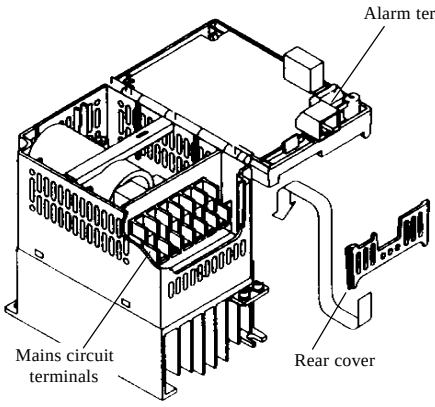
# Chapter 3 – Appearance and names of parts

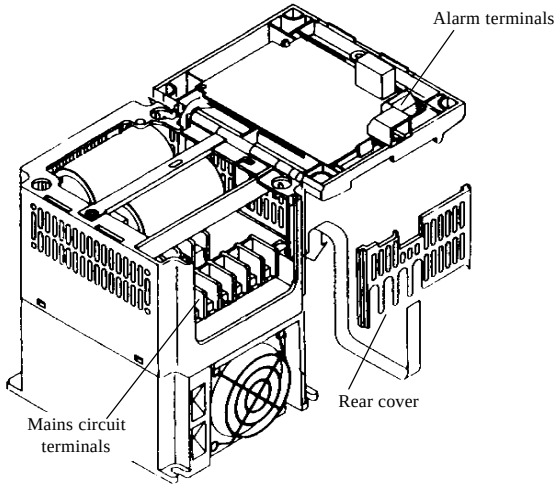


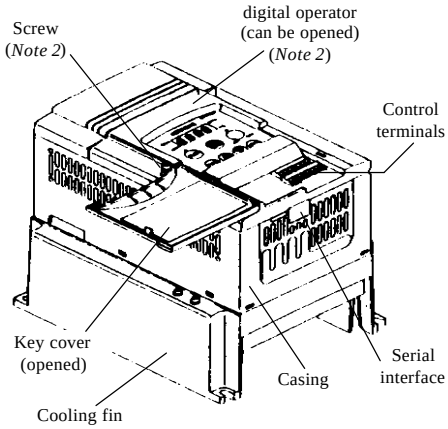



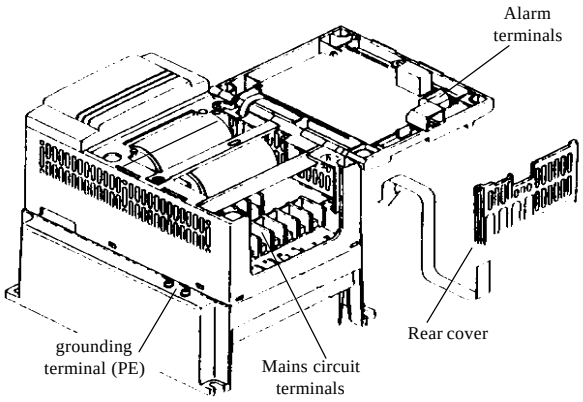



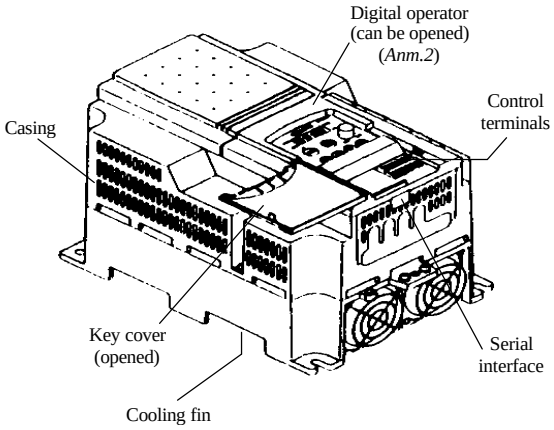



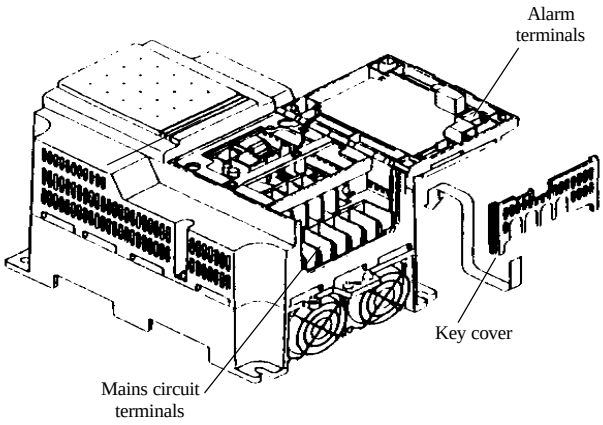

*Note 1*: The key cover can be opened by hand without any additional tool.

*Note 2*: The screw must be loosened before the digital operator can be opened.



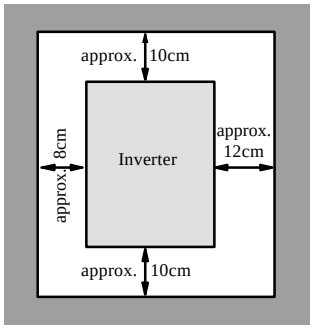

*Note 1*: The key cover can be opened by hand without any additional tool.

*Note 2*: The screw must be loosened before the digital operator can be opened.

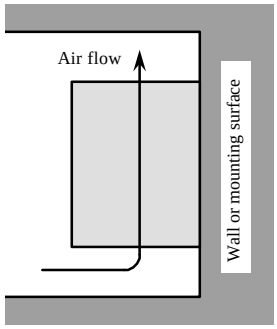
# Chapter 4 – Installation

The inverter must be mounted vertically on a non-flammable wall in order to prevent from overheating and fire. The minimum clearances to the surrounding walls shown in the figure below must be complied with to ensure a good ventilation. Foreign matter (especially conductive objects) must nut be dropped into the inverter since they not only cause malfunction and damage but may also lead to electrical and fire hazards.

Cover all ventilation holes on the inverter during installation so that no foreign objects can enter the inverter. Be sure to remove those covers from the inverter before you put the inverter to work.




The inverter must be installed vertically
(do not install it on the floor or horizontally)



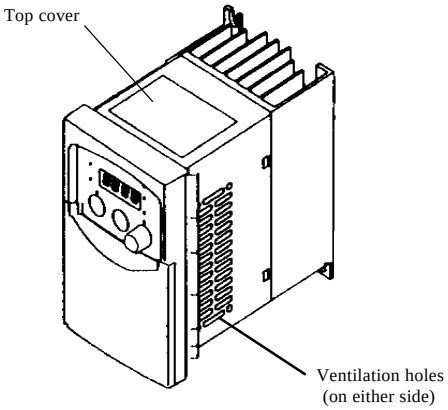

⚠ The mounting base must be a non-flammable material (e.g. metal)

The minimum clearances to the surrounding walls shown in the figure are only meant for reference. A more compact installation (back to back) may well be possible and should be discussed with Hitachi. Please always leave enough room for the key cover to be opened without problems in order to connect wires to the control terminals.

The ambient temperature should be in the range of -10°C to 50°C. At a temperature of 40~50°C the carrier frequency has to be reduced to 2kHz, the output current must be kept below 80% of the rated current, and the top cover (see figure below) has to be removed. Higher ambient temperature causes shorter inverter life. So if there is hot equipment in the vicinity of the inverter, keep it away from the inverter as far as possible.

If the inverter is to be installed in a cabinet, ambient temperature is considered to be the temperature prevailing withing this cabinet. Fans have to be provided if necessary so that ambient temperature remains within the limits specified above.

For safety reasons the digital operator must be closed and not be opened during inverter operation. The end application must be in accordance with the BS EN 60204-1 standard.



# Chapter 5 – Wiring

⚠ CAUTION Fasten the screws with the specified fastening torque so that they will not loosen unintentionally. Check all terminals for loose screws. Otherwise there is a danger of fire.

⚠ CAUTION <u>Remarks for using earth leakage circuit breakers in the mains supply</u>

Frequency inverters with CE-filters (RFI-filter) and screened motor cables have a higher leakage current against earth. Especially in the moment of switching this can cause unintentional triggering of earth leakage circuit breakers. Because of the rectifier on the input side of the inverter there is the possibility to stall the switch-off function through amounts of DC current. For these reasons, the following items should be observed:

Only pulse current sensitive earth leakage circuit breakers which have a short term delay and a higher trigger current (500mA) should be used. Other components should be secured with separate earth leakage circuit breakers. Earth leakage circuit breakers in front of an inverter´s rectifier are not an absolute protection against direct touching.

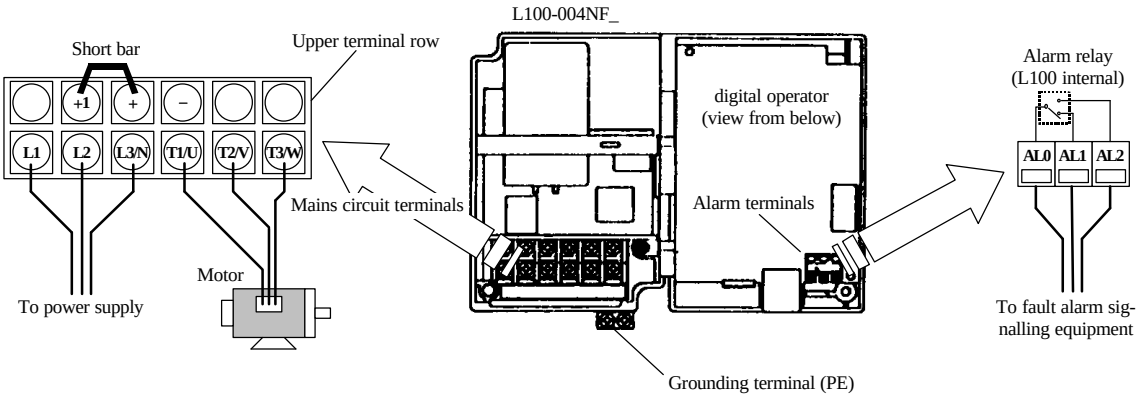
⚠ CAUTION Each phase of the power supply has to be provided with a fuse. Otherwise, there is a danger of fire.

⚠ CAUTION As for motor leads, earth leakage breakers, and electromagnetic contactors, be sure to use the ones that have the correct rating. Otherwise, there is a danger of fire.

⚠ CAUTION Make sure that the mains supply leads are reliably fixed.

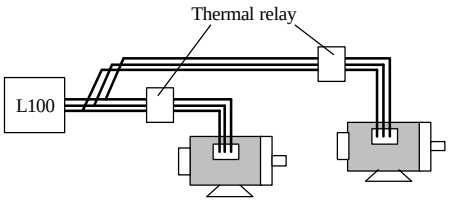
## Wiring the power supply and motor

In order to connect cables to the power supply or alarm terminals the digital operator has to be opened. For this, first of all the corresponding screw has to be loosened. The location of the terminals is depicted in the figure below:




When connecting cables, the following details have to be considered:

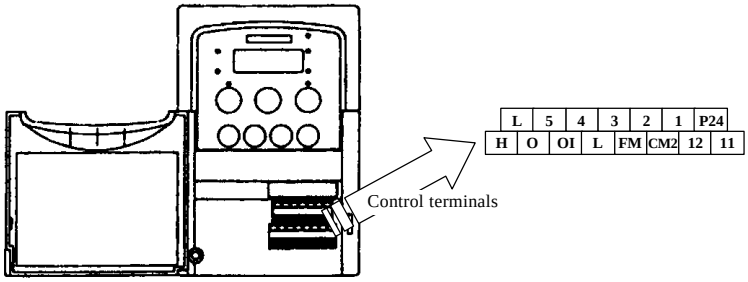
1) Power supply cables must only be connected to the terminals L1, L2, and L3/N.
2) Do not connect any cables to the non-designated terminals in the upper terminal row (refer to figure above) as these terminals are reserved for L100 internal purposes.
3) If more than one motor is to be driven by a single inverter, thermal relays have to be provided for each motor.



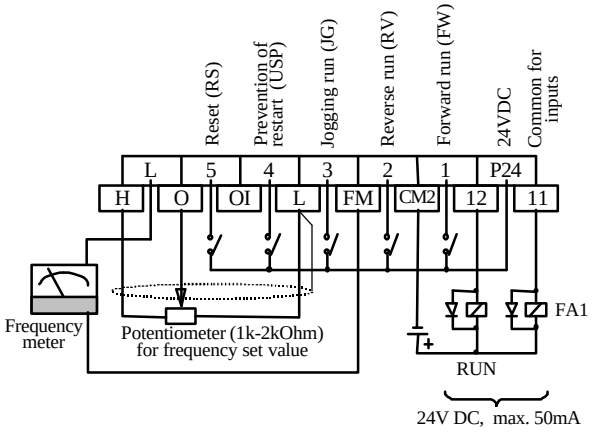

4) The leads from the power supply must be connected to the mains circuit terminals as follows:
   Connect single phase power supply (50/60Hz) to terminals L1, L3/N.
   Connect three phase power supply (50/60Hz) to terminals L1, L2, L3/N.
5) Don´t remove the short bar between the terminals +1 and +.

## Wiring the control terminals

The following figure shows the location of the control terminals. The exact use of each of the control terminals is described later in this chapter.



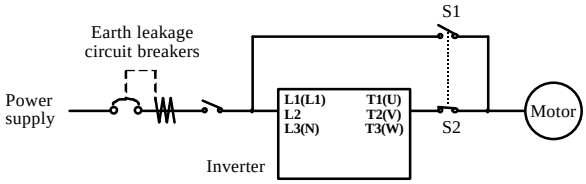

The figure below contains an example for control terminal wiring:



## General remarks

When connecting cables, the following items must be observed:

- When changing the power supply of the motor between the inverter and commercial power line, be sure to install mechanically interlocked switches (S1 and S2) as shown in the figure below:

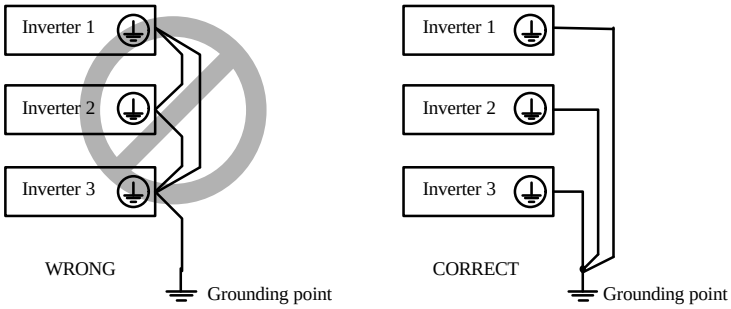



- Install an earth leakage breaker at the input of the inverter. Select an earth leakage breaker which has a short term delay and a higher trigger current.

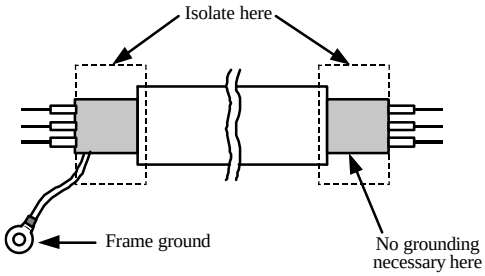
  When the cable between the inverter and the motor is more than 10 meters long, the thermal relay may malfunction due to high-frequency waves. To prevent this, install an AC reactor on the output side of the inverter or use a current sensor rather than a thermal relay.

- In case a relay is connected to the digital output terminals 11 or 12 be sure to install a surge absorbing diode in parallel to the relay. Otherwise the surge voltage created when the relay goes on or off may damage the output circuit.

- Be sure that the specified grounding is carried out. Separate the inverter´s grounding pole from those of other heavy electric machinery and avoid using common grounding poles when multiple inverters are employed.

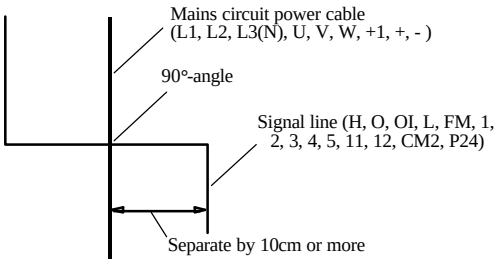



- Use a twisted and shielded wire when connecting signal lines to the control terminals and cut the shielded covering as shown in the figure below. Make sure that the length of the signal line is 20 m or less. If the line must be longer than 20 m then an appropriate signal amplifier should be used.



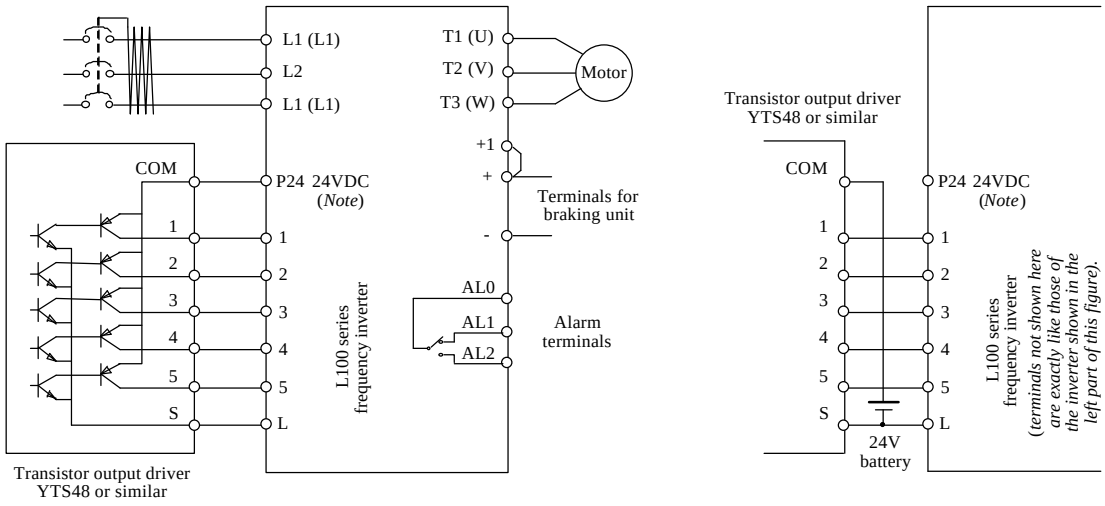

- Use relays which are capable of reliably switching at a voltage of 24VDC and a current of 3mA.

- Install the mains circuit cables at a safe distance from the control circuit cables. If the mains circuit cables and the control circuit cables have to cross each other, this should be done at an angle of 90 degrees because interference can be minimized in this case.




- Do not short circuit the terminals P24 and L, H, OI, or FM by mistake, because this may cause a malfunction.
- Do not short circuit the terminals H and L because this may cause a malfunction.

The following figure shows an example for connecting a driver-IC to the digital inputs when using the inverter´s internal 24VDC power supply terminal (left half of figure below) and when using a separate external 24VDC power supply (right half of figure below).




*Note*: Do not short circuit the terminals P24 and L by mistake because this may lead to a malfunction.

# Wiring equipment and options

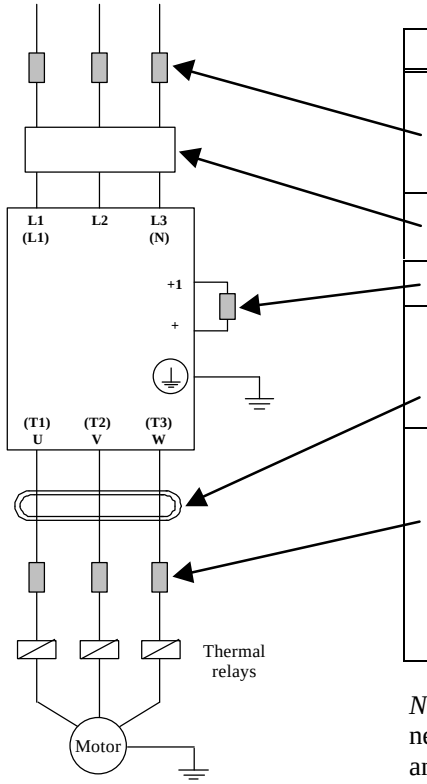
⚠ CAUTION Provide the wiring equipment in accordance with the safety codes required by jurisdictional authorities. If specified in standards or laws and regulations, follow their istructions. In the following table some guidelines for choosing an appropriate wire gauge are presented:

| Motor output (kW) | Inverter model | Cable specifications | | 600V fuse to be used (rated current / A) |
|---|---|---|---|---|
| | | Power lines | Signal lines | |
| 0.2 | L100-002NFE<br>L100-002NFU | 1.5 mm$^2$ (AWG 15) | Shielded wire (max. 0.75mm$^2$ *) | 10 A |
| 0.4 | L100-004NFE<br>L100-004NFU | | | |
| 0.55 | L100-005NFE | | | |
| 0.75 | L100-007NFE<br>L100-007NFU | 2.5 mm$^2$ (AWG 13) | | 16 A |
| 1.1 | L100-011NFE | | | |
| 1.5 | L100-015NFE<br>L100-015NFU | 4.0 mm$^2$ (AWG 11) | | 25 A (single phase)<br>16 A (three phase) |
| 2.2 | L100-022NFE<br>L100-022NFU | 4.0 mm$^2$ (AWG 11) | | 40 A (single phase)<br>25 A (three phase) |
| 3.7 | L100-037LFU | 4.0 mm$^2$ (AWG 11) | | 40 A |
| 5.5 | L100-055LFE<br>L100-055LFU | 6.0 mm$^2$ (AWG 9) | | 40 A |
| 7.5 | L100-075LFE<br>L100-075LFU | 10 mm$^2$ (AWG 8) | | 60 A |
| 0.4 | L100-004HFE<br>L100-004HFU | 1.5 mm$^2$ (AWG 15) | | 10 A |
| 0.75 | L100-007HFE<br>L100-007HFU | | | |
| 1.5 | L100-015HFE<br>L100-015HFU | | | |
| 2.2 | L100-022HFE<br>L100-022HFU | | | |
| 3.0 | L100-030HFE | 2.5 mm$^2$ (AWG 13) | | 16 A |
| 4.0 | L100-040HFE<br>L100-040HFU | | | |
| 5.5 | L100-055HFE<br>L100-055HFU | 4.0 mm$^2$ (AWG 11) | | 25 A |
| 7.5 | L100-075HFE<br>L100-075HFU | | | |

Notes:

- Field wiring connections must be made by a UL listed and CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector must be fixed using the crimp tool specified by the connector manufacturer.
- Only use a fuse that has the appropriate rated current.
- Be sure to use bigger wires for mains circuit cables and motor cables if the distance exceeds 20m.

***)** Use 0,75mm$^2$ for the alarm signal wire. The wire stripping length should be approximately 5–6 mm. The wire sleeve diameter except for the alarm signal wire should not be greater than 2mm.

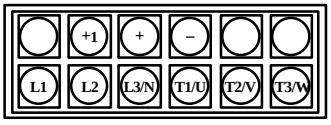
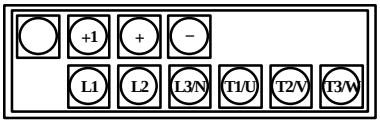
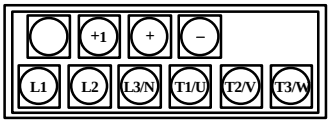



| Part description | Function |
|---|---|
| AC reactor | This part is used when the unbalance ratio is 3% or more and the power supply is 500kVA or more, and there are rapid changes in the power supply. This part also improves the power factor. |
| EMI filter (*Note*) | This part ist used to conform with the applicable EMC standards. |
| DC reactor | This part is used to improve the power factor. |
| Radio noise filter | This part reduces noise generated at the output of the inverter (this type of filter supplies an almost perfect sine shaped output voltage between phase-pase and phase-PE). |
| Motor filter | Motors that are driven by an inverter are to a larger extent subject to voltage fluctuations than motors directly driven (without inverter) by power lines. An AC reactor installed between inverter output and motor smoothens motor run and so reduces torque ripple. When the cable between the inverter and the motor is too long, this part also forces the voltage dv/dt to be limited and so protects the isolation of the motor. |

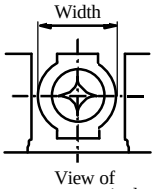
*Note:* Usage of an EMI filter (e.g. one from the FPFL100 series) is necessary for the European EMC directive, for the Australian C-TICK and others. In comparison, the other parts mentioned in the table above are not intended for this special use.

## Terminals

In the table below the location and dimensions of the power terminals (terminals for power supply and motor) are listed:

| Location of power terminals | Inverter model | Screw size | Width in mm |
|---|---|---|---|
|  | 002NF<br>004NF | M3,5 | 7,1 |
|  | 007NF~022NF<br>037LF<br>004HF~040HF | M4 | 9 |
|  | 055LF, 075LF<br>055HF, 075HF | M5 | 13 |





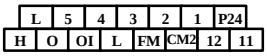

View of power terminals

View of grounding terminal

The following table shows the location and dimensions of all terminals:

| Terminal type | 002NF, 004NF | | 007NF~022NF<br>037LF<br>004HF~040HF | | 055LF, 075LF<br>055LF, 075HF | |
|---|---|---|---|---|---|---|
| | Screw | Width (in mm) | Screw | Width (in mm) | Screw | Width (in mm) |
| Power terminal | M3.5 | 7.1 | M4 | 9 | M5 | 13 |
| Control terminal | M2 | - | M2 | - | M2 | - |
| Alarm terminal | M3 | - | M3 | - | M3 | - |
| Grounding terminal | M4 | - | M4 | - | M5 | - |

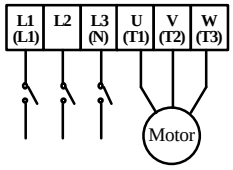
Location of control terminals




Location of alarm terminals


In the following table the purpose of the power terminals is shown:

| Terminal symbol | Purpose | Description |
|---|---|---|
| L1(L1), L2, L3(N) | Mains supply | Single phase supply: connect to L1, N<br>Three phase supply: connect to: L1, L2, L3 |
| U, V, W bzw. T1, T2, T3 | Inverter output | Connect a three phase motor |
| +1, + | External DC reactor | Normally a short bar is attached between terminals +1 and +. When a DC reactor is to be connected, remove the short bar first. |
| +, - | Braking unit | Connect the optional braking unit (when high braking torque is required). |
| ⏚ | Grounding | Ground must be connected to prevent electric shock should the inverter case carry dangerous voltages due to a malfunction. |

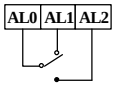



The following table lists the tightening torque values for tightening the screws:

| Screw | Torque in Nm |
|---|---|
| M2 | Typ. 0.20 Max. 0.25 |
| M3 | Typ. 0.50 Max. 0.60 |
| M3.5 | Typ. 0.80 Max. 0.90 |
| M4 | Typ. 1.20 Max. 1.30 |
| M5 | Typ. 2.00 Max. 2.20 |

The next table describes the purpose of each control terminal: (*To be continued on next page*)

| Terminal categorie | Sym bol | Purpose | Initial setting | Remarks |
|---|---|---|---|---|
| Digital Inputs | 5 | These inputs have different purposes depending on the user programmed configuration:<br>Forward and reverse running command, up to 4 multistage speed settings, jogging run, 2nd stage acceleration/decel., free run stop, external trip, USP function, terminal software lock, reset, PTC, input for choosing current as analog set value | Reset input | Input closed (ON): Function active<br>Input opened (OFF): Function not active<br>Input must be ON for a minimum of 12ms |
| | 4 | | Multistage frequency input / USP function | |
| | 3 | | Multistage frequency input / use 4-20mA input | |
| | 2 | | Reverse run | |
| | 1 | | Forward run | |
| | P24 | Common for input signals | | 24V DC; max. 30mA |
| Monitor signal | FM | Connection of an analog or digital meter for measuring frequency;<br>connection of an analog meter for current measurement | Frequency monitor (analog) | |
| | L | Common for monitor signal | | |

<table>
<tr><th>Terminal categorie</th><th>Sym bol</th><th>Purpose</th><th>Initial setting</th><th>Remarks</th></tr>
<tr><td rowspan="4">Frequency command input</td><td>H</td><td>Reference for frequency command input</td><td></td><td>10V DC; max. 10mA</td></tr>
<tr><td>O</td><td>Voltage frequency command</td><td></td><td>Set value 0-10V;<br>Input impedance 10kOhm</td></tr>
<tr><td>OI</td><td>Current frequency command</td><td></td><td>Set value 4-20mA;<br>Input impedance 250Ohm</td></tr>
<tr><td>L</td><td>Common for frequency command input</td><td></td><td></td></tr>
<tr><td rowspan="3">Digital output</td><td>11</td><td rowspan="2">The digital outputs can be user programmed to provide different signals for the following situations:<br>Signal when reaching set value or passing a configurable frequency;<br>signal during motor run;<br>overload signal;<br>PID deviation signal; alarm signal</td><td>Frequency arrival signal (signal when reaching set value)</td><td rowspan="2">Outputs of open collector type for connection to a relay<br>(max. 27V DC and max. 50mA)</td></tr>
<tr><td>12</td><td>Signal during motor run</td></tr>
<tr><td>CM2</td><td>Common for digital outputs</td><td></td><td></td></tr>
<tr><td rowspan="3">Fault alarm output</td><td>AL0</td><td rowspan="3"> 
</td><td colspan="2" rowspan="3">Initial setting: During normal operation AL0-AL1 is closed; during a trip condition or cut off power supply AL0-AL1 is opened (i.e. AL0-AL2 is closed).<br>Ratings of relay contacts:<br>Max. 250VAC / 2.5A (resistive) or 0.2A (cos phi = 0.4); Min. 100VAC / 10mA<br>Max. 30VDC / 3.0A (resistive) or 0.7A (cos phi = 0.4); Min. 5VDC / 100mA</td></tr>
<tr><td>AL1</td></tr>
<tr><td>AL2</td></tr>
</table>

# Chapter 6 – General operation notes

## Before starting operation

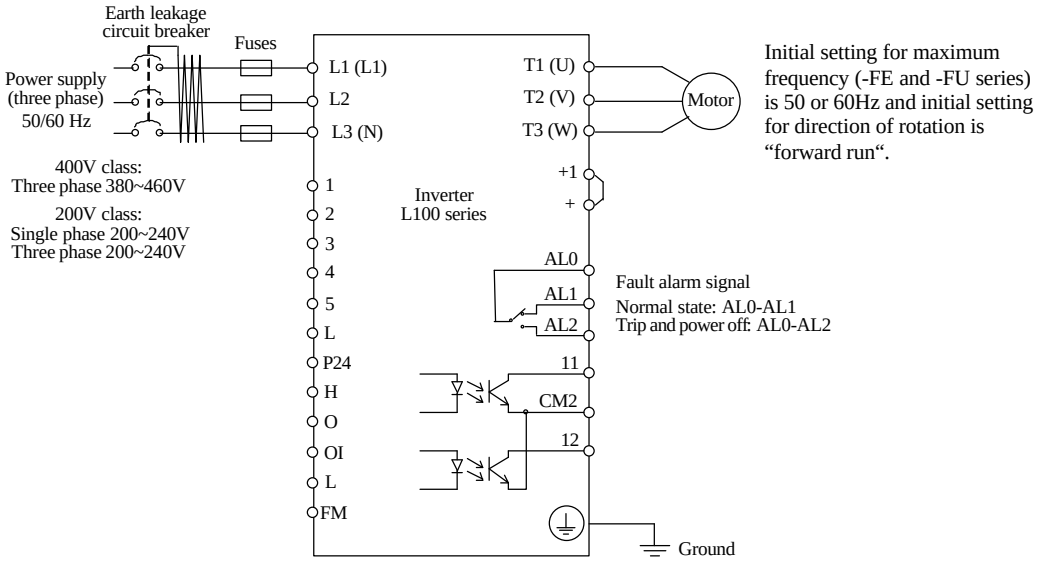
Prior to the test run, the following items should be checked:

1) Make sure that the power lines (input power supply terminals L1(L1), L2, and L3(N)) and output terminals (U(T1), V(T2) und W(T3)) are connected correctly.
2) Make sure that there are no mistakes in the signal line connections.
3) The grounding terminal must be grounded.
4) Terminals other than those marked as grounding terminals must not be grounded.
5) The inverter must be installed vertically on a non-flammable mounting surface (e.g. steel).
6) Remove any residue from wiring work like stray pieces of wire and others. Also, make sure that no tolls are left behind.
7) Make shure that the wires connected to the output terminals are not short-circuited or grounded.
8) All the terminal screws must be sufficiently tightened.
9) The configurable maximum output frequency parameter must be chosen in accordance with the maximum frequency of the connected motor and machine.
10) Do not operate the inverter with the front case opened. Make sure the front case is completely closed and locked with the screw.

Do not carry out any withstand voltage tests because the inverter has a surge absorber between the mains circuit terminals and the ground.

## Test run

Below an example for an inverter connection is shown. For the initial tests, frequency adjustment and forward and reverse running commands should be carried out via the digital operator in order to check the inverter's correct functioning.



In order to test the inverter, follow the procedure described below:

1) Turn on power supply to the inverter. The power LED on the digital operator will light up.
2) Set function *A 02* to 02.
3) Set function *A 01* to 00. Now the inverter can be operated using the built in potentiometer which is indicated by the lit lamp above the potentiometer.
4) After pressing the RUN key the motor starts to run and the the RUN lamp lights up.
5) The actual frequency can be monitored using function *d 01*.
6) You can stop the test run by pressing the STOP key.

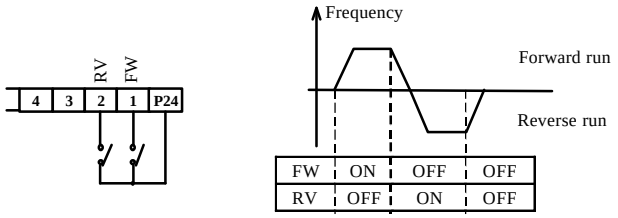
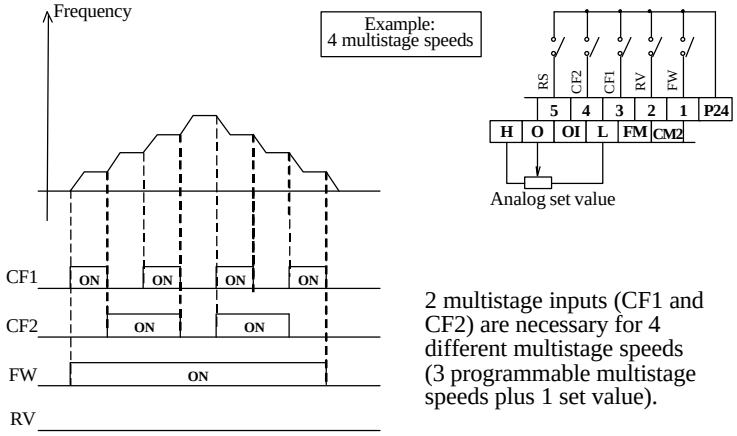
⚠ CAUTION After the test run has been completed, check the following items to ensure that the motor will not be damaged:

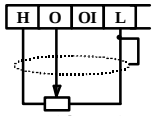
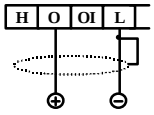
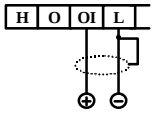
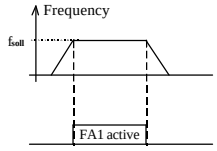
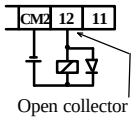
Was the direction of the motor run correct? Was there any trip condition during acceleration or deceleration? Were there any unusual motor sounds or vibrations?

When a trip occured during the test run due to overcurrent or overvoltage, increase acceleration or deceleration time.

# Chapter 7 – Control circuit terminal functions

## Overview

<table>
<tr><th colspan="2">Terminal symbol</th><th colspan="2">Terminal function</th><th>Description</th></tr>
<tr><td rowspan="11">Programmable digital inputs 1 through 5</td><td>FW<br>(00)</td><td colspan="2">Forward run<br>(Start/Stop)</td><td rowspan="2"> 
<br>Input FW closed: Motor starts with forward running direction.<br>Input FW open: Motor decelerates from forward running.<br>(same for reverse run using input RV)<br>Inputs FW and RV both closed: motor decelerates.</td></tr>
<tr><td>RV<br>(01)</td><td colspan="2">Reverse run<br>(Start/Stop)</td></tr>
<tr><td>CF1<br>(02)</td><td rowspan="4">Programmable multistage speeds</td><td>1</td><td rowspan="4"> 
<br>2 multistage inputs (CF1 and CF2) are necessary for 4 different multistage speeds (3 programmable multistage speeds plus 1 set value).</td></tr>
<tr><td>CF2<br>(03)</td><td>2</td></tr>
<tr><td>CF3<br>(04)</td><td>3</td></tr>
<tr><td>CF4<br>(05)</td><td>4</td></tr>
<tr><td>JG<br>(06)</td><td colspan="2">Jogging run</td><td>The jogging run activated using the terminal JG may serve for setting up a machine in manual operation mode. When a forward or reverse run command is given, the frequency configured using A 38 is then sent to the motor. For motor stop, one of three operating modes can be chosen by configuring A 39.</td></tr>
<tr><td>PTC<br>(19)</td><td colspan="2">Connection of external PTC thermistor</td><td>Only digital input 5 can be programmed as a PTC thermistor input (using C 05). The terminal L serves as common for the thermistor input.</td></tr>
<tr><td>AT<br>(16)</td><td colspan="2">Activate input OI (current set value 4-20mA)</td><td>When the AT input is activated, then the set value will be a 4-20mA current that has to be supplied at the terminals OI and L.</td></tr>
<tr><td>2CH<br>(09)</td><td colspan="2">2. stage acceleration/deceleration</td><td>Using this input the second stage acceleration and deceleration time configured using A 92 and A 93 is activated.</td></tr>
<tr><td>FRS<br>(11)</td><td colspan="2">Free run stop function</td><td>When the terminal FRS is turned on, frequency to the motor is switched off and the motor runs free.</td></tr>
<tr><td>EXT<br>(12)</td><td colspan="2">External trip</td><td>When the terminal EXT is turned on, the inverter enters the trip state, stops output to the motor, and displays E 12. The trip condition can be acknowledged, among others, using the RS input.</td></tr>
<tr><td>USP<br>(13)</td><td colspan="2">Prevention of restart</td><td>When the USP input is on, the motor does not restart when power supply recovers following a power supply failure and a running command is active at the same time.</td></tr>
<tr><td>RS<br>(18)</td><td colspan="2">Reset</td><td>A trip can be acknowledged by activating the RS input. If a reset is given during normal inverter operation, the motor runs free. The RS input is always a normally open contact and cannot be configured as normally closed input.</td></tr>
<tr><td>SFT<br>(15)</td><td colspan="2">Software lock</td><td>When the SFT input is turned on, the configured parameters are protected from being overwritten.</td></tr>
</table>

<table>
<tr><th colspan="2">Terminal symbol</th><th>Terminal function</th><th colspan="2">Description</th></tr>
<tr><td colspan="2">P24</td><td>24V DC common for digital inputs</td><td colspan="2">Common terminal for the intelligent digital inputs</td></tr>
<tr><td rowspan="4">Frequency command</td><td>H</td><td>10V reference voltage for analog set value (using potentiometer)</td><td colspan="2" rowspan="4">Set value configured using potentiometer:<br>  <br><br>Pot (1k – 2K)<br>Set value configured using voltage input:<br>  <br><br>0 - 9,6V DC (rated value 10V)<br>Input impedance 10k Ohms<br>Set value configured using current input:<br>  <br><br>4 - 19,6mA DC (rated value 20mA)<br>Input impedance 250 Ohms<br>The OI input (set value using analog current 4..20mA) will only be used if the input configured as AT has been closed before. If no digital input has been configured as an AT input then the set values that are present at terminals O and OI will be added.</td></tr>
<tr><td>O</td><td>Frequency set value analog input (0-10V)</td></tr>
<tr><td>OI</td><td>Frequency set value analog input (4-20mA)</td></tr>
<tr><td>L</td><td>Common terminal for analog set value inputs</td></tr>
<tr><td rowspan="2">Monitor</td><td>FM</td><td>Frequency monitor</td><td colspan="2">Using the FM output the output frequency can be monitored and displayed using an external analog or digital meter. If needed, the motor current can be displayed instead of the frequency.</td></tr>
<tr><td>L</td><td>0V</td><td colspan="2">Common terminal for the FM output</td></tr>
<tr><td rowspan="6">Programmable digital outputs 11 and 12</td><td>FA1 (01)<br>FA2 (02)</td><td>Frequency arrival signals</td><td>  <br><br>When a digital output is configured as FA1 then a signal is output as long as the output frequency is held constant at set value. With a digital output being configured as FA2, a signal will be output as long as the actual output frequency is above the values set under C 42 and C 43.</td><td rowspan="5">Connection of a signal relay to digital output 11 or 12:<br>  <br><br>Open collector type output (max. 27VDC, 50mA)</td></tr>
<tr><td>RUN (00)</td><td>RUN signal</td><td>The RUN signal is active as long as the motor is running.</td></tr>
<tr><td>OL (03)</td><td>Overload signal</td><td>The OL signal will be output when the actual motor current is above the threshold set under C 41.</td></tr>
<tr><td>OD (04)</td><td>PID deviation signal</td><td>The OD signal will be output when the threshold set under C 44 (level of PID deviation) is being passed.</td></tr>
<tr><td>AL (05)</td><td>Alarm signal</td><td>The alarm signal is output in case a trip condition occurs.</td></tr>
<tr><td colspan="2">CM2</td><td>0V</td><td colspan="2">This is the 0V common for the programmable digital outputs 11 and 12. These open collector type outputs are isolated using photocouplers and are separated from L common.</td></tr>
<tr><td colspan="2">AL0</td><td rowspan="3">Alarm terminals</td><td colspan="2" rowspan="3">During normal trouble-free operation the terminals AL0 and AL1 are shorted. During a trip condition or while power to the inverter is off the terminals AL0 and AL2 are shorted instead.<br>Absolute maximum relay contact ratings:<br>250VAC; max. load of 2.5A (purely resistive) or 0.2A (at an cos phi of 0.4)<br>30VDC; max. load of 3.0A (purely resistive) or 0.7A (at an cos phi of 0.4)<br>Minimum relay contact ratings:<br>100VAC at a load of 10mA or 5VDC at a load of 100mA</td></tr>
<tr><td colspan="2">AL1</td></tr>
<tr><td colspan="2">AL2</td></tr>
</table>

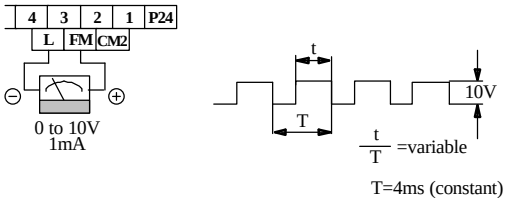
# FM terminal

## Terminal function

This terminal is used for connecting an analog voltmeter or a digital frequency meter and thus to monitor and display output frequency. Alternatively, motor current can be monitored instead (when output current is selected the FM terminal can only supply an analog signal).

1) Frequency display using analog output signal

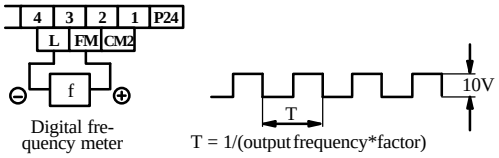
   The analog output signal is a pulse train whose period remains constant. The width of the pulses ist proportional to the actual output frequency (0 to 10V represent 0Hz to maximum frequency):




   Adjustment of this signal is done using function *b 81*. The signal accuracy following adjustment is +/-5%

2) Frequency display using digital output signal

   The frequency of this signal is proportional to the output frequency. The duty cycle is approximately 50%:




   The signal frequency equals the actual output frequency multiplied by the factor configured under *b 86*.

3) Motor current display using analog output signal

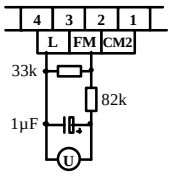
   This signal is identical to the one described under 1). The width of the pulses is proportional to the actual motor current. The maximum voltage of 10V is reached when the motor current is two times the inverter rated current. The signal accuracy is +/-20%. The connection to a meter is described under 1). A moving iron type amperemeter should be used.

## Configuration

| *C 23* *b 81* *b 86* |
|---|

1) In order to select analog frequency, digital frequency, or analog motor current, use function *C 23*.
2) When an analog output signal is used (frequency or current), the signal can be adjusted to the special meter used by specifying a factor under *b 81*.
3) When the digital output signal (frequency only) is selected, the output signal can be adjusted to the special meter used by specifying a factor under *b 86*.

Example of a terminal connection using a low pass filter:



# Terminals 1 - 5 (programmable digital inputs)

## General notes

Several functions can be assigned to the terminals 1 through 5. Depending on the application these terminals can be configured to be forward (FW) or reverse run (RV) inputs, multistage speed setting inputs (CF1-CF4), reset input (RS), and so on. The terminal function configuration of inputs 1 - 5 is done using *C 01 – C 05*, i.e. *C 01* is used to set the function of digital input 1, *C 02* is used to set the function of digital input 2, etc. However, two inputs can not be assigned to an identical function at the same time.

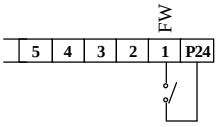
The programmable digital inputs 1 - 5 are factory set as normally open contacts. So when a terminal's function is to be activated, the digital input configured for this function has to be closed (i.e. the input terminal must be connected to terminal P24). Likewise, deactivating of an input means opening this input.

Alternatively, the digital inputs can also be configured as normally closed contacts. To do this, the parameter 01 must be configured under functions *C 11 – C 15* (corresponding to digital input 1 - 5). But there is an exception for inputs configured as reset input (RS) or thermistor input (PTC). Those inputs can only be configured as normally open contacts.

## FW: Start/stop forward run

**Terminal function**

When a digital input configured as FW is activated the motor starts running in the forward direction. When it is deactivated the motor stops.




The motor stops if both the FW and the RV inputs are activated.

**Configuration**

| *A 02* *C 01 – C 05* |
|---|

1) The initial factory setting determines that the running command is given using digital inputs configured as FW or RV. If the running command is currently given using the RUN key on the digital operator, you have to first set the parameter 01 under function *A 02* (run command source is FW/RV terminal).
2) Configure one of the digital inputs 1 – 5 as FW input by entering the parameter 00 under *C 01 – C 05*.

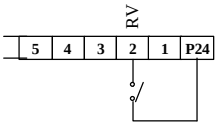
⚠ WARNING If the power supply to the inverter is switched on and a running command is active at the same time, the motor starts immediately. So take care that the run command is not active prior to switching the power supply on.

⚠ WARNING If the FW input is opened (inactive state if FW is configured as normally open contact) and is subsequently configured as a normally closed contact, the motor starts as soon as the reconfiguration is complete.

## RV: Start/stop reverse run

**Terminal function**

When a digital input configured as RV is activated the motor starts running in the reverse direction. When it is deactivated the motor stops.




The motor stops if both the FW and the RV inputs are activated.

**Configuration**

| *A 02* *C 01 – C 05* |
|---|

1) The initial factory setting determines that the running command is given using digital inputs configured as FW or RV. If the running command is currently given using the RUN key on the digital operator, you have to first set the parameter 01 under function *A 02* (run command source is FW/RV terminal).
2) Configure one of the digital inputs 1 – 5 as RV input by entering the parameter 01 under *C 01 – C 05*.

⚠ WARNING If the power supply to the inverter is switched on and a running command is active at the same time, the motor starts immediately. So take care that the run command is not active prior to switching the power supply on.

⚠ WARNING If the RV input is opened (inactive state if RV is configured as normally open contact) and is subsequently configured as a normally closed contact, the motor starts as soon as the reconfiguration is complete.

## CF1 – CF4: Multistage speed settings

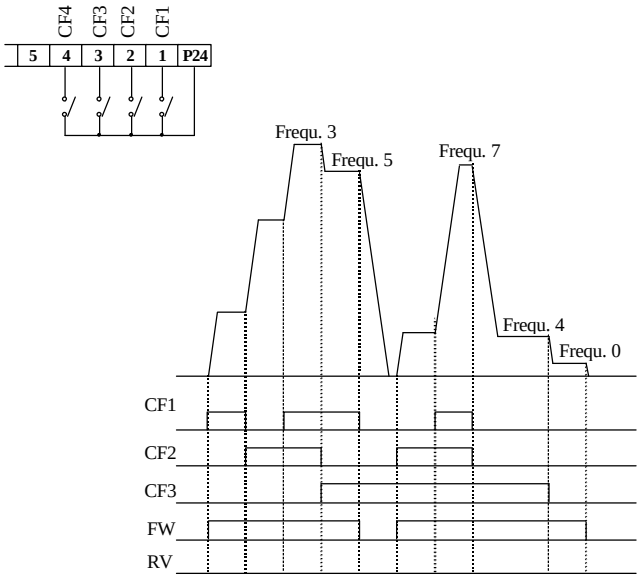
### Terminal function

Using the digital inputs configured as CF1 – CF4 one of up to 16 freely selectable frequencies (including the set value) can be sent to the motor depending on which terminals are activated or deactivated (refer to table below). It is not necessary to use all four multistage speed setting terminals at the same time. If you need for example only up to eight different frequencies it is sufficient to configure only CF1 – CF3; if only up to four different frequencies are needed only 2 multistage speed setting terminals have to be configured.

The multistage speed settings have a higher priority than most of the other means of providing the set value. Only when the jogging run is activated the jogging frequency priority is even higher than the priority of the multistage speed settings. The multistage frequencies can be activated using the inputs CF1 – CF4 at any time and need not be enabled in any way.

| Multi-stage speed # | Input configured as | | | |
|---|---|---|---|---|
| | CF4 | CF3 | CF2 | CF1 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 0 | 1 | 1 | 1 |
| 8 | 1 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 |
| 10 | 1 | 0 | 1 | 0 |
| 11 | 1 | 0 | 1 | 1 |
| 12 | 1 | 1 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 |
| 15 | 1 | 1 | 1 | 1 |

Note: 0 = Input deactivated
1 = Input activated




### Configuration

| *A 21 – A 35  C 01 – C 05  F 01* |
|---|

Configure one or more of the digital inputs 1 – 5 as CF1 – CF4 input by entering one or more parameters under *C 01 – C 05* (parameter setting range is 02 – 05).

Following this, the multistage frequencies can be programmed by one of two ways:

A) Enter the multistage frequencies under *A 21 – A 35*.

B) Activate those multistage speed inputs that are necessary for the desired frequency to be configured (refer to table above) and enter the desired frequency under *F 01* (note that the motor must be stopped first e.g. using the STOP key or deactivating the FW input). The entered frequency value must be stored using the STR key.

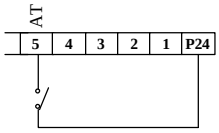
### Remarks

- If you want one ore more of the multistage frequencies to be greater than 50Hz the maximum frequency has to be raised first using *A 04*.
- A multistage speed setting of 0 (inputs CF1 – CF4 are all deactivated) corresponds to the frequency set value. This set value can be configured either using the built-in potentiometer, the terminals O respectively OI, or by configuring *F 01* and *A 20*.

## AT: Analog set value using current 4-20mA

### Terminal function

When a digital input configured as AT is activated then the frequency set value will be represented by the current (4-20mA) fed into the OI terminal. When the AT input is not active then the frequency set value will be represented by the voltage (0-10V) present at the O terminal.




### Configuration

| *A 01* | *C 01 – C 05* |
|---|---|

1) First the frequency source setting must be configured under function *A 01*. The factory setting of 01 means that the voltage at the O terminal or the current into the OI terminal are used for setting the frequency (depending on whether the AT input is activated or not). Set the parameter to 01 if it has not already been set to this value.
2) Configure one of the digital inputs 1 – 5 as AT input by entering the parameter 16 under *C 01 – C 05*.

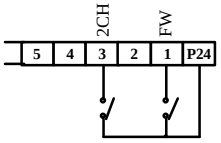
### Remarks

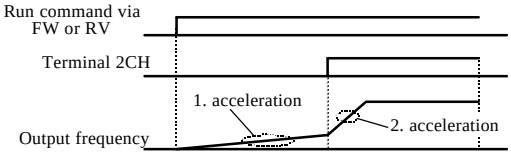
- If none of the programmable digital inputs has been programmed as AT input then the voltage resp. current set values present on terminal O resp. OI are added.

## 2CH: Second stage acceleration/deceleration

### Terminal function

When a digital input configured as 2CH is activated then the motor is accelerated or decelerated using the 2. stage acceleration or deceleration time. When the 2CH input is deactivated again the inverter is switched back to acceleration respectively deceleration time 1.




### Configuration

| *A 92 – A 94* | *C 01 – C 05* |
|---|---|

1) Configure the desired value for 2. acceleration or deceleration time under functions *A 92* and *A 93*. Then enter the parameter 00 under *A 94* so that the switchover to the 2. stage acceleration/deceleration can be activated using the 2CH terminal (this is the factory setting).
2) Configure one of the digital inputs 1 – 5 as 2CH input by entering the parameter 09 under *C 01 – C 05*.

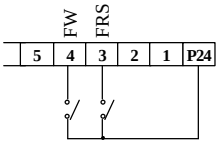
### Remarks

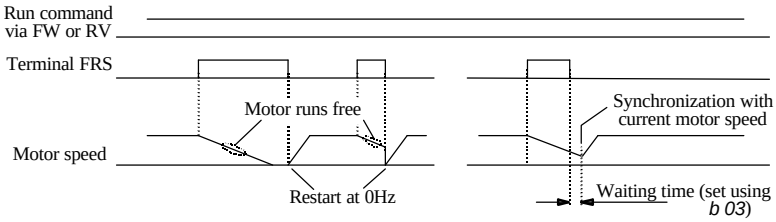
- When a parameter of 01 is entered under *A 94* then an automatic switchover to the 2. stage acceleration/deceleration is possible as soon as the frequencies set under *A 95* resp. *A 96* are being passed.
- The value for the 1. stage acceleration/deceleration time can be configured using *F 02* and *F 03*.

## FRS: Free run stop

### Terminal function

When a digital input configured as FRS is activated, then the inverter stops output and the motor enters the free run state (e.g. emergency stop). When the FRS input is deactivated again, the inverter either synchronizes to the free running motor´s current speed or it restarts with an output of 0 Hz depending on inverter configuration.




### Configuration

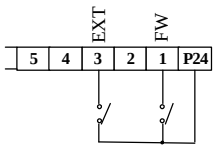
| *b 03* | *b 88* | *C 01 – C 05* |
|---|---|---|

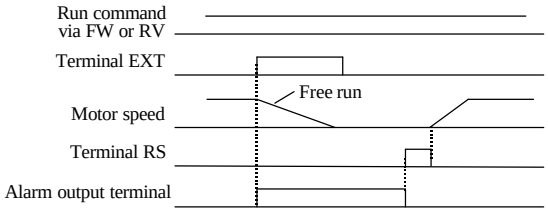
1) Use function *b 88* to configure if the motor is to restart at 0 Hz after the FRS input has been deactivated (parameter 00, this is the default setting) or if synchronization to the current motor speed should take place after a certain waiting time (parameter 01). The waiting time can be set using *b 03*.
2) Configure one of the digital inputs 1 – 5 as FRS input by entering the parameter 11 under *C 01 – C 05*.

## EXT: External trip

### Terminal function

When a digital input configured as EXT (can be used as an input for e.g. thermo contacts) is activated, then the inverter enters the trip state with an error indication of *E 12* and stops output. Even when the EXT input is deactivated again, the trip condition remains. The trip has to be acknowledged by resetting the inverter (using the RS input or the STOP/RESET key; alternatively the inverter power supply can be switched off and on).




### Configuration

| *C 01 – C 05* |
|---|

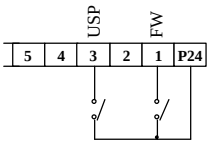
Configure one of the digital inputs 1 – 5 as EXT input by entering the parameter 12 under *C 01 – C 05*.

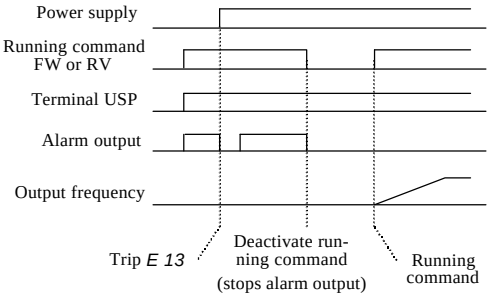
⚠ CAUTION After resetting the inverter, the motor starts immediately if a run command (FW or RV) is being active.

## USP: Prevention of restart upon power recovery

### Terminal function

When a digital input configured as USP is activated, then the inverter won´t restart when power to the inverter recovers and a running command (activated FW or RV input) is being active at the same time. The trip *E 13* is output in this case which dissapears when the trip is acknowledged by pressing the RESET key, activating the RS input, or releasing the running signal again.




### Configuration

*C 01 – C 05*

Configure one of the digital inputs 1 – 5 as USP input by entering the parameter 13 under *C 01 – C 05*.

⚠ WARNING In case of an USP condition (indicated by trip *E 13*), resetting the trip while the running command (activated FW or RV input) is still active will cause the motor to restart immediately.

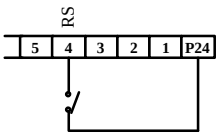
### Remarks

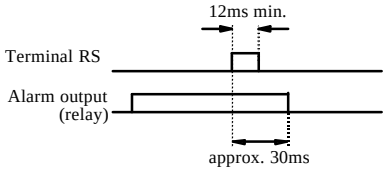
- When a running command is issued within 3 seconds after turning on the power supply with the USP function being active, the inverter will enter the USP condition and display the trip *E 13* mentioned above. Consequentely, if the USP function is to be used wait at least 3 seconds before sending a running command to the inverter.
- The USP function can even be used when a reset command is given via the RS input following an undervoltage trip (*E 09*).

## RS: Reset

### Terminal function

A trip can be acknowledged using a sequence of activation and subsequent deactivation of an input configured as RS.




### Configuration

*C 01 – C 05*

Configure one of the digital inputs 1 – 5 as RS input by entering the parameter 18 under *C 01 – C 05*.

⚠ WARNING When a trip condition is acknowledged with a reset, the motor will restart immediately when a running command is being active at the same time. Consequentely, be sure to acknowledge the trip only after having made sure that the running command is not currently active. Otherwise there is a danger of injury to personnell.

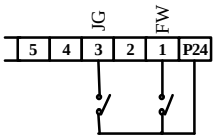
### Remarks

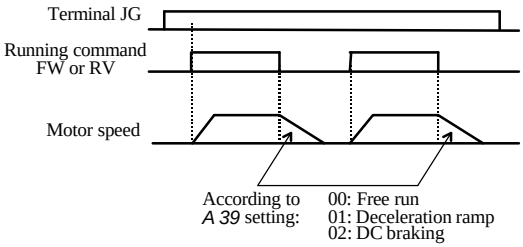
- The STOP key on the digital operator functions as RESET key when a trip condition has occured. So in this case it can be used for resetting the inverter instead of the RS input.
- If the RS input is held active for more than 4 seconds this may produce a false trip.
- The RS input is always a normally open contact and can not be configured a normally closed contact.
- A trip condition can alternatively be acknowledged by switching the power supply off and then on again.
- If a reset is given during normal motor operation, the motor will then be running free.

## JG: Jogging run

### Terminal function

When a digital input configured as JG is activated, then the motor can be driven in jogging mode. This is useful for example when preparing a machine in manual operation mode. In this case a low frequency (without the usual acceleration ramp) is sent to the motor when the FW or RV input is activated along with the JG input.




### Configuration

| *A 02* | *A 38* | *A 39* | *C 01 – C 05* |
|---|---|---|---|

1) Configure *A 38* first to set the frequency that is to be sent to the motor when jogging mode is activated. Please remember not to use a too high frequency since the frequency is directly sent to the motor without an acceleration ramp which may lead to a trip. You should set a frequency that is less than 5Hz.
2) Since in jogging mode the running command is issued using inputs FW or RV you have to set *A 02* to 01.
3) *A 39* determines the way the motor decelerates. The parameters 00 (free run stop, this is the default), 01 (deceleration using deceleration ramp) and 02 (deceleration using DC braking) are available.
4) Configure one of the digital inputs 1 – 5 as JG input by entering the parameter 06 under *C 01 – C 05*.

⚠ CAUTION Please make shure that the motor has completely stopped before activating the JG input.

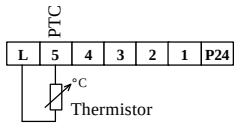
### Remarks

- The jogging mode can not be executed when the jogging frequency set under *A 38* is less than the start frequency set under *b 82*.
- The jogging mode can only be activated when the motor has stopped.

## PTC: Thermistor input

### Terminal function

When the programmable digital input 5 is configured as PTC, motor temperature can be monitored when a thermistor with a positive temperature coefficient is connected to terminals 5 and L. When the thermistor resistance rises to above 3000 Ohms (+/-10%), operation of the motor is stopped and the trip is *E 35* displayed.




### Configuration

| *C 05* |
|---|

Configure digital input 5 as PTC input by entering the parameter 19 under *C 05*.

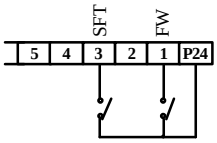
### Remarks

- Only digital input 5 can be used for connecting a PTC thermistor, the digital inputs 1 through 4 can not be used for this purpose.
- If digital input 5 has been configured as PTC without a thermistor being connected to input 5, trip *E 35* will be displayed.
- The PTC input is always a normally open contact and can not be configured a normally closed contact.

## SFT: Software lock

### Terminal function

When a digital input configured as SFT is activated, then the configured parameters can not be overwritten by mistake.




### Configuration

| *b 31* *C 01 – C 05* |
|---|

1) First *b 31* must be configured to determine if the software lock should also include the frequency setting (set parameter to 00) or not (set parameter to 01).
2) Configure one of the digital inputs 1 – 5 as SFT input by entering the parameter 15 under *C 01 – C 05*.

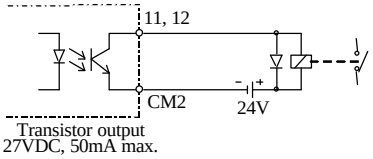
### Remarks

- There is a second alternative way to activate a software lock which does not even use a digital input. For this, the parameter 02 or 03 must be set under *b 31* depending if the software lock will also include the parameter set under *F 01* or not.

# Terminals 11, 12 (programmable digital outputs)

## General notes

The programmable digital outputs 11 and 12 are transistor outputs with open collector (refer to the figure below) which can be used to connect relays. Various functions can be assigned to these two outputs according to user demands. Among these functions are signalling when a predefined frequency value is reached, or when a trip occurs.




The programming of the desired terminal function for each of the two digital outputs 11 and 12 is carried out using *C 21* and *C 22*, i.e. *C 21* is used to set the function of digital output 11, and *C 22* is used to set the function of digital output 12.

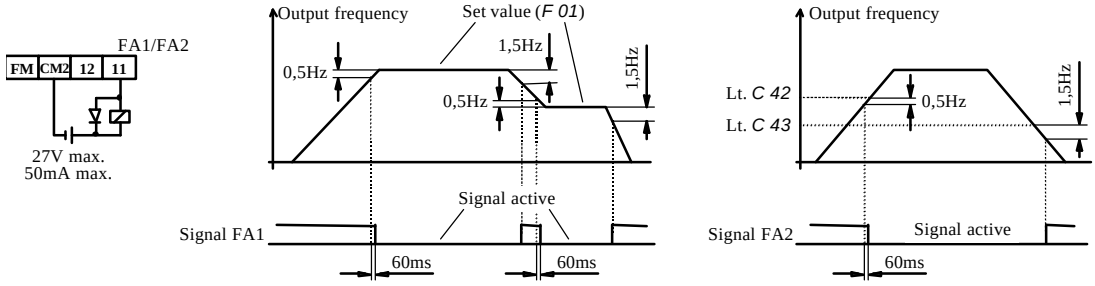
The programmable digital outputs are factory preconfigured as normally closed contacts. So if the configured function of an output terminal is to be activated, the corresponding output will be opened. Deactivation of an output terminal means that the output is closed.

The digital outputs can alternatively be programmed as normally open contacts. To do this, enter a 00 under *C 32* and *C 33* (corresponding to digital output 11 and 12).

## FA1, FA2: Frequency arrival signals

### Terminal function

A digital output configured as FA1 will be activated as soon as the set frequency has been reached. A digital output configured as FA2 will stay activated at frequencies above those set under *C 42* and *C 43*. In order to provide for a certain amount of hysteresis during switching on and off, the FA1 and FA2 signals are activated 0.5Hz before the current frequency reaches the set value or the frequency set under *C 42*, respectively. The FA1 and FA2 signals are then again deactivated 1.5Hz after the current frequency has passed the frequency set under *C 43*.




### Configuration

| *C 21* | *C 22* | *C 42* | *C 43* |
|---|---|---|---|

1) If a programmable digital output is to be configured with FA2 output function, first of all a frequency has to be set using *C 42* at which the FA2 signal is to be activated during acceleration. Next a frequency has to be set at which the FA2 signal is to be deactivated again, this is done using *C 43*.
2) Then configure under *C 21* or *C 22* one of the digital outputs 11 or 12 as FA1 or FA2 by entering the parameter 01 for FA1 or 02 for FA2.

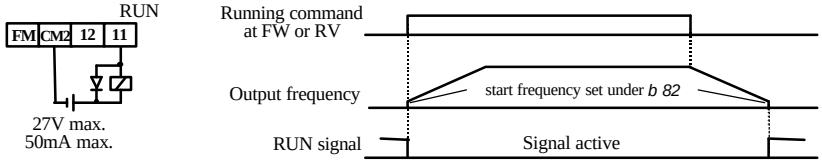
### Remarks

- The transition of an FA1 or FA2 signal from the inactive to the active state is carried out with a delay of approximately 60ms.

## RUN: Motor running

### Terminal function

A digital output configured as RUN stays activated as long as a frequency not equal to zero is sent to the motor (i.e. as long as the motor is running in forward or reverse direction).




### Configuration

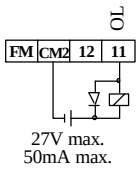
| *C 21* | *C 22* |
|---|---|

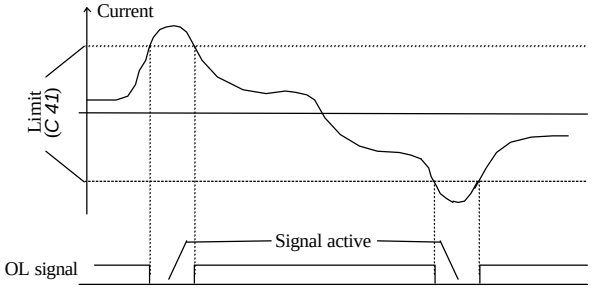
Program one of the digital outputs 11 or 12 as RUN output by entering the parameter 00 under *C 21* or *C 22*.

## OL: Overload signal

### Terminal function

A digital output configured as OL is activated as soon as a user definable overload limit is exceeded. The OL output remains active as long as the motor current lies above this limit.




### Configuration

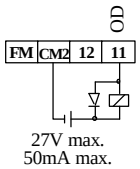
| C 21 | C 22 | C 41 |
|---|---|---|

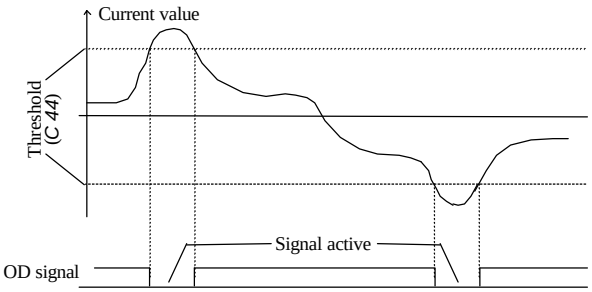
1) If a digital output is to be configured as OL then first the current limit has to be set at which the OL signal is to be activated.
2) Program one of the digital outputs 11 or 12 as OL output by entering the parameter 03 under *C 21* or *C 22*.

## OD: PID deviation

### Terminal function

A digital output configured as OL is activated when a user definable PID deviation threshold (current value - set value) is exceeded. The OD output remains activated as long as this deviation is greater than the predetermined level.




### Configuration

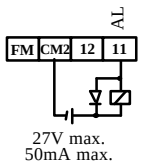
| C 21 | C 22 | C 44 |
|---|---|---|

1) Before a programmable digital output is configured as OD, a threshold must be set using *C 44* to determine when the OD signal will get activated.
2) Program one of the digital outputs 11 or 12 as OD output by entering the parameter 04 under *C 21* or *C 22*.

## AL: Alarm signal

### Terminal function

A digital output configured as AL is activated when an alarm condition exists and the inverter trips.




### Configuration

| *C 21* | *C 22* |
|---|---|

Program one of the digital outputs 11 or 12 as AL output by entering the parameter 05 under *C 21* or *C 22*.

### Remarks

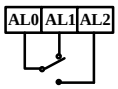
- When the AL output is configured as normally closed contact (i.e. no alarm signal when output is closed) it is important to remember that a time delay exists from the time the input power is switched on until the AL output is closed (deactivated) and thus a trip condition is indicated for a short time.
- The programmable digital outputs (including an output configured as AL) are of open collector type and so have different electrical characteristics compared with the alarm relay output (terminals AL0, AL1, and AL2). Especially the maximum voltage and current load ratings are much more restrictive than is the case with relay outputs.
- After the inverter power supply has been switched off, the AL output remains active until the DC bus voltage has dropped below a certain level. This time is depending, among others, on the load applied to the inverter.
- The delay from the time a trip occurs until the AL output is activated is about 300ms.

# Terminals AL0, AL1, AL2 (alarm relay)

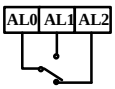
## Terminal function

When a trip occurs the alarm relay (double throw switch) is activated. The user can choose which terminal is to function as normally open and which as normally closed contact. A trip message is displayed on the digital operator's display.

Normal operation:

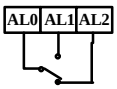



Alarm or inverter is switched off:

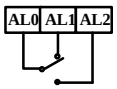



| Configu-red as | Power supply | State | AL0-AL1 | AL0-AL2 |
|---|---|---|---|---|
| n.c. contact *C 33*=01 | ON | Normal | Closed | Geöffnet |
| | ON | Störung | Open | Open |
| | OFF | - | Open | Open |

Normal operation or inverter switched off




Trip condition:




| Configu-red as | Power supply | State | AL0-AL1 | AL0-AL2 |
|---|---|---|---|---|
| n.o. contact *C 33*=00 | ON | Normal | Open | Closed |
| | ON | Störung | Closed | Open |
| | OFF | - | Open | Closed |

Relay contacts electrical characteristics:

| | | |
|---|---|---|
| Operation with DC voltage: | 5V/100mA min., | 30V/3.0A max. (resistive) or 0.7A (cos phi = 0.4) |
| Operation with AC voltage: | 100V/10mA min., | 250V/2.5A max. (resistive) or 0.2A (cos phi = 0.4) |

## Configuration

*C 33*

Refer to the above table to configure the contacts AL0/AL1 and AL0/AL2 as normally closed or normally open contacts using *C 33*.

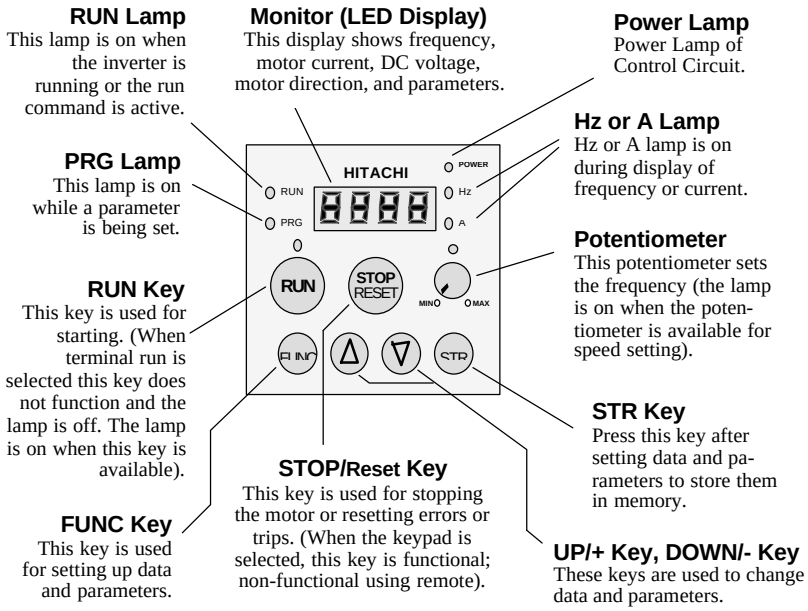
## Remarks

- After a trip has occured the trip message displayed is conserved even when the power to the inverter is switched off. For this reason, this trip message can be displayed again when the inverter is switched on afterwards. However, the inverter will be reset when it is switched off which means that the existance of a trip message will not be indicated by the alarm relay contacts when the inverter is switched on again. If the trip signalling must be kept even after the inverter has been switched on again, use external circuitry to hold the alarm signal.
- When the alarm relay output is configured as normally closed contact (i.e. no alarm signal when output is closed, this is the factory default) it is important to remember that a time delay exists from the time the input power is switched on until the alarm output is closed (deactivated) and thus a trip condition is indicated for a short time after switching on the input power.

# Chapter 8 – Using the digital operator

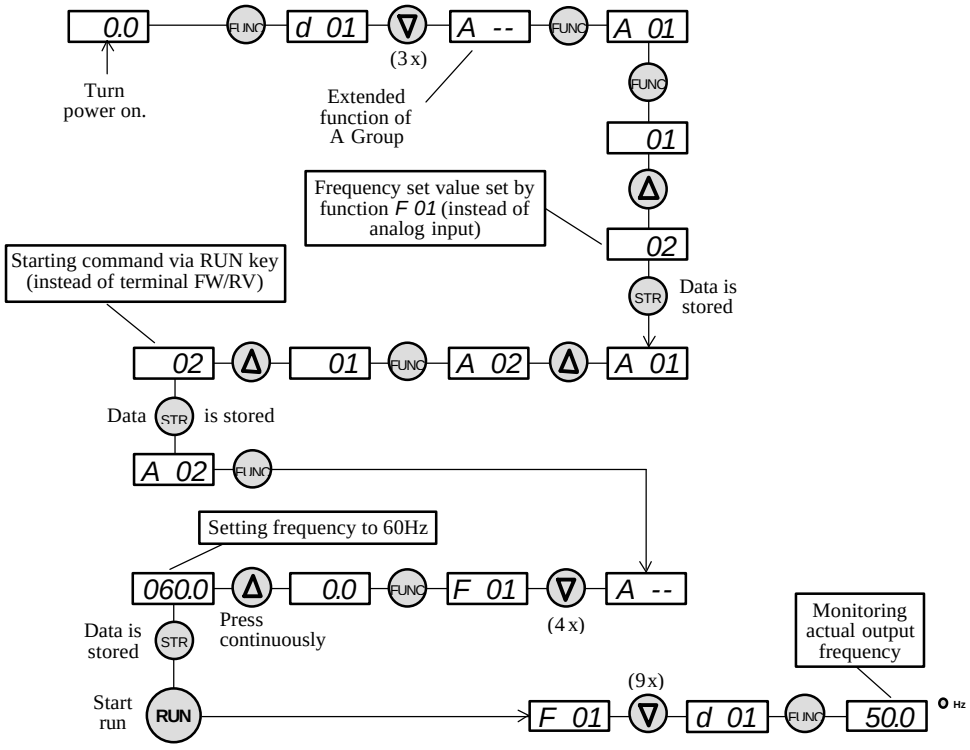
## The digital operator control panel

The following figure shows the digital operator of an L100 series inverter. The keys and displays (lamps and LED display) are shown with the names that are used throughout this manual:

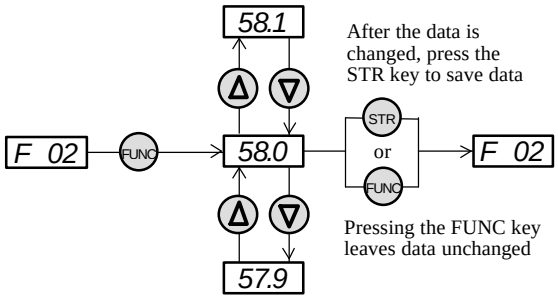


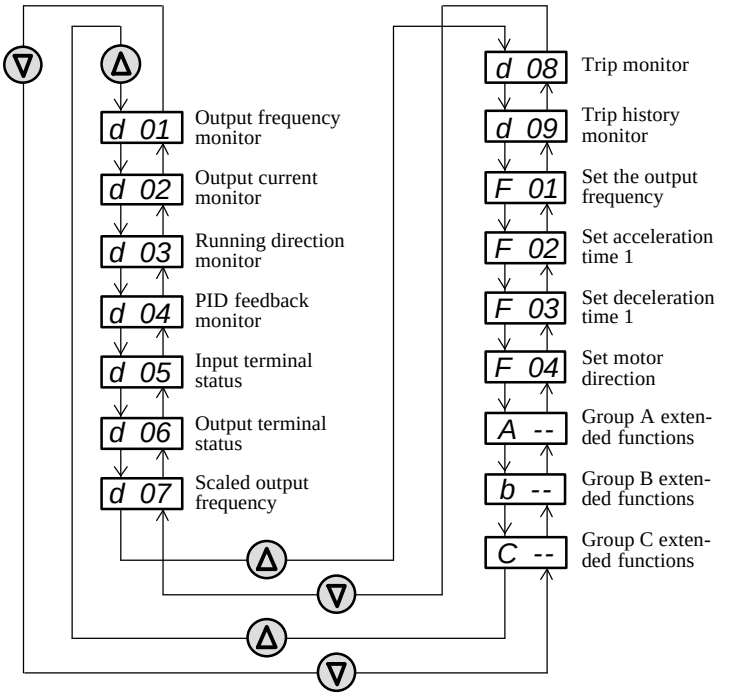

## Operating procedure example

The following figure shows an operation sequence using the digital operator for changing several inverter parameters:



## Digital operator keys




[UP key, DOWN key] ... These keys change parameter values.


[FUNC key] ... This key switches between the parameter area and extended function area.

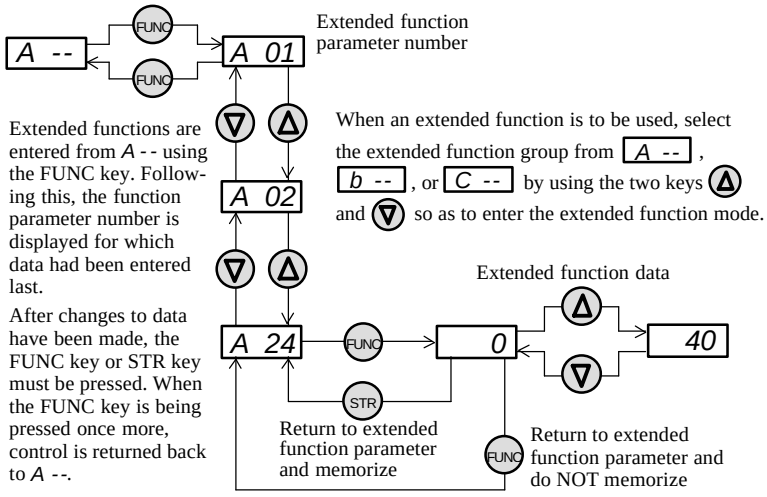

[START key] ... This key starts the L100 inverter.

The set value of *F 04* determines forward or reverse run.


[STOP key] ... This key stops the L100 inverter.

When a trip occurs, this key becomes the RESET key

**Setting parameters for extended functions (example for extended functions of group A ):**




**Explanation of display after power on:**

When the inverter is turned on, the display returns to what was displayed when the power was last turned off (except in the extended function mode).

# Overview of parameter settings

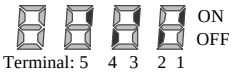
In the following chapters all parameters that can be set using the digital operator are described and listed in tables. Starting with chapter “Basic functions” the column “Standard setting” lists the factory preconfigured parameter settings.

All the settings listed in the following tables are grouped by function groups so that all functions belonging to the same group (e.g. function group “DC brake” with functions *A 51* to *A 55*, chapter “Extended functions of group A”) can be viewed as a whole.

The use of the functions listed in column “Display” have already been described in the previous chapters “Operating procedure example” and “Digital operator keys”. Functions *d 01* through *d 09* are only designed for displaying data, no parameters can be configured here.

Note: Starting with chapter “Basic functions” the ⋆) marked column indicates whether parameters can be changed during inverter operation (Y) or not (N).

## Display functions

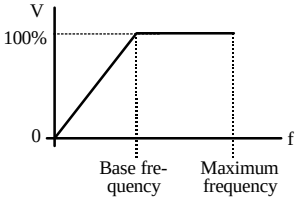
| Display function | Display | Function description / parameter setting range |
|---|---|---|
| Output frequency monitor (Hz) | *d 01* | Displays output frequency 0,5Hz–360Hz.<br>The “Hz” lamp on the digital operator lights up. |
| Motor current monitor (A) | *d 02* | Displays motor current 0,01A–999,9A.<br>The “A” lamp on the digital operator lights up. |
| Running direction monitor | *d 03* | Display:<br>*F* for forward run; *r* for reverse run; *0* for stop |
| PID feedback monitor | *d 04* | Only when PID control is activated. The factor is set using *A 75* (0.01 through 99.99; standard setting = 1.0). |
| Input terminals 1–5 status | *d 05* |  Example: Digital inputs 1, 3, and 5 are activated. Digital inputs 2 and 4 are deactivated. |
| Status of output terminals 11, 12 and alarm output | *d 06* |  Example: Digital output 1 and alarm output are activated. Digital output 12 is deactivated. |
| Scaled output frequency | *d 07* | Displays the product of factor (settable using *b 86*) and output frequency from 0.01 through 99990.<br>Examples: Display *11.11* means 11.11; *111.1* means 111.1; *1111.* means 1111; *1111* means 11110. |
| Trip monitor (last trip) | *d 08* | Displays the last trip that occured and (after pressing the FUNC key each time) also displays output frequency, motor current, and DC voltage at the time the trip occured.<br>Displays --- if no trip is currently active. |
| Trip history monitor | *d 09* | Displays the last trip but one and (after pressing the FUNC key) the last trip but two.<br>If these trips are not available, displays --- instead. |

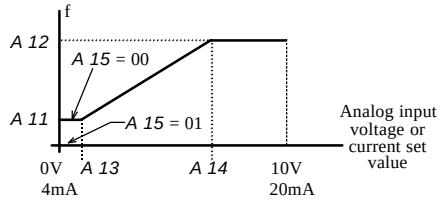
## Basic functions

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| Set / display frequency set value | *F 01* | Y | Setting range 0.5Hz–360Hz (resolution +/-0.1Hz).<br>The frequency can be set using the following methods:<br>Using *F 01* and *A 20*: Enter the parameter 02 under *A 01*.<br>Using the potentiometer on the digital operator. Enter the parameter 00 under *A 01*.<br>By means of a voltage of 0–10 V or a current of 4–20mA at input terminals O or OI. Enter the parameter 01 under *A 01*.<br>Using the digital input terminals configured as CF1–CF4. After selecting the desired frequency stage by applying logic levels to the digital inputs, the frequency for the selected stage can be entered. (Note: Multistage speed settings can also be entered using *A21-A35*).<br>The frequency set value display is independent of the method with which the set value was entered. | 0.0 |
| Acceleration time 1 | *F 02* | Y | Setting range 0.1s–3000s. (Resolution 0.1s in the range of 0.1 through 999.9. Resolution 1s in the range of 1000 through 3000). | 10.0 |
| Deceleration time 1 | *F 03* | Y | Setting range 0.1s–3000s. (Resolution 0.1s in the range of 0.1 through 999.9. Resolution 1s in the range of 1000 through 3000). | 10.0 |
| Motor direction | *F 04* | N | After pressing the RUN key the motor starts in forward running mode (parameter 00) or in reverse running mode (parameter 01). | 00 |

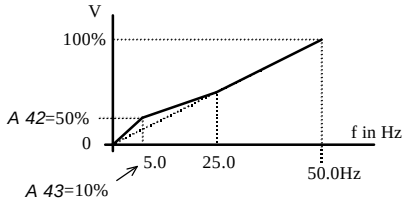
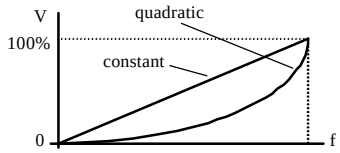
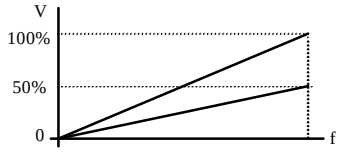
## Extended functions of group A

Group A comprises a variety of functions, among them functions for adjusting the frequency set value, functions for setting up multistage speed settings, as well as functions for configuring parameters for a DC brake, etc.

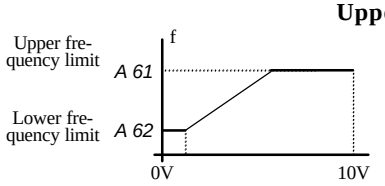
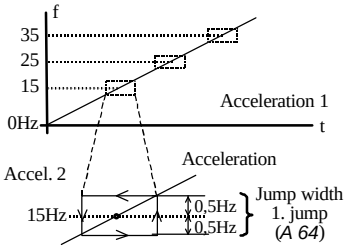
| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Main functions** | | | | |
| Frequency source | *A 01* | N | There are three different ways to set the output frequency:<br>00: using the potentiometer on the digital operator<br>01: using analog input terminals O (0-10V) or OI (4-20mA)<br>02: using functions *F 01* or *A 20* | 01 |
| Run command source | *A 02* | N | The command for starting the motor can be issued via:<br>01: the digital inputs configured as FW or RV<br>02: the RUN key on the digital operator | 01 |
| Base frequency | *A 03* | N | The base frequency is the frequency where the output voltage has its maximum value. Setting range 50Hz–360Hz. | 50 |
| Maximum frequency | *A 04* | N |  If there is a need for a frequency range with a constant voltage that lies beyond the base frequency entered using *A 03*, this range can be configured using *A 04*. The maximum frequency must not be smaller than the base frequency (Setting range 50Hz–360Hz). | 50 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Analog set value adjustment**<br>  <br>The external frequency set value can be individually adjusted using functions *A 11* to *A 16*. A configurable voltage or current set value range can be assigned to a configurable frequency range.<br>Furthermore, the analog input signal filtering can be adjusted using function *A 16*. | | | | |
| External frequency start point | *A 11* | N | Here the frequency is set that corresponds to the external frequency start point bias set under *A 13*.<br>Setting range 0Hz–360Hz. | 0.0 |
| External frequency end point | *A 12* | N | Here the frequency is set that corresponds to the external frequency end point bias set under *A 13*.<br>Setting range 0Hz–360Hz. | 0.0 |
| External frequency start point bias | *A 13* | N | The value enterd here is based on the maximum voltage set value or current set value of 10V or 20mA, respectively.<br>Setting range 0%–100%. | 0 |
| External frequency end point bias | *A 14* | N | The value enterd here is based on the maximum voltage set value or current set value of 10V or 20mA, respectively.<br>Setting range 0%–100%. | 100 |
| External frequency start pattern | *A 15* | N | Inverter behaviour for set values < external frequency start point:<br>00: The frequency configured under *A 11* is sent to the motor<br>01: A frequency of 0Hz is sent to the motor | 01 |
| Analog input filter time constant | *A 16* | N | A value between 1 and 8 can be entered to configure the inverter's reaction speed to changes in analog set value at the O or OI terminal and thus determine the amount of filtering for harmonics that may be present with the analog signal:<br>1: Little filtering / fast reaction to changes in set value<br>8: Extensive filtering / slow reaction to changes in set value | 8 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Multistage frequency settings and jogging mode**<br>Up to 15 multistage frequency settings can be selected using the digital inputs configured as CF1 through CF4. Alternatively to setting the multistage frequencies under functions *A 21* through *A 35* they can be set using function *F 01*.<br>Jogging mode can be used to set up a machine manually and is activated using a digital input configured as JG. Since the acceleration ramp is not active during jogging mode, there might be an overcurrent trip (especially when a too high jogging frequency is chosen). Jogging mode can not be used when the jogging frequency is smaller than the start frequency configured under *b 82*.<br>Multistage frequency settings have a higher priority than other frequency set values. Only the jogging frequency's priority is even higher. | | | | |
| Frequency set value | *A 20* | Y | A frequency set value between 0.5Hz and 360Hz can be entered here (a 02 must have been configured under *A 01* beforehand). | 0 |
| Multistage frequency settings | *A 21* thru *A 35* | Y | Any one of the 15 multistage frequency settings from *A 21* through *A 35* can be assigned a frequency in the range of 0.5Hz to 360Hz. | 0 (any one) |
| Jogging frequency | *A 38* | Y | The frequency that is sent to the motor when jogging mode is activated can be chosen from 0.5Hz to 9.99Hz. | 1.0 |
| Jogging stop mode | *A 39* | N | When a stop command is issued during activated jogging mode, the motor stops by:<br>00: running free<br>01: decelerating using configured deceleration time<br>02: decelerating using DC brake | 00 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Voltage/frequency characteristics, boost**<br>  <br><br>Parameter settings:<br>*A 41*=00 *A 42*=50<br>*A 43*=10.0 *A 44*=00<br>*A 45*=100 | | | The boost causes a higher voltage (and consequently higher torque) in the lower frequency range. The manual boost raises voltage in the frequency range from start frequency (standard setting of 0.5Hz) to half of the base frequency (25Hz at a standard setting of 50Hz) in any one of the operating stages (acceleration, normal operation, deceleration) independently of motor load.<br>In contrast to this, the automatic boost is activated depending on motor load. A voltage rise can cause a trip due to the higher current involved. | |
| Boost selection method | *A 41* | N | Selection of:<br>00: manual boost or 01: automatic boost | 00 |
| Voltage rise, manual boost | *A 42* | Y | The amount of voltage rise in manual boost mode can be set in the range of 0% to 99%. | 11 |
| Manual boost frequency adjustment | *A 43* | Y | The frequency where the highest voltage rise exists can be set in the range of 0% to 50% of the base frequency. | 10.0 |
| Voltage/frequency characteristic | *A 44* | N |  <br><br>A variable (quadratic) or constant V/F characteristic can be chosen for accelerating and decelerating the motor.<br>00: Constant V/F characteristic (constant torque)<br>01: Quadratic V/F characteristic (reduced torque) | 00 |
| Output voltage gain | *A 45* | Y |  <br><br>Output voltage can be set in the range of von 50% to 100% of the input voltage. | 100 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **DC braking**<br>L100 series inverters have a configurable DC brake that is activated as soon as the stop command is issued. By applying a strobed DC voltage to the motor's stator a braking torque is induced into the rotor that effectively works against the rotation of the motor. Usage of the DC brake makes possible high registration accuracy when carrying out positioning work.<br>⚠ CAUTION Usage of the DC brake causes an additional heating of the motor. For this reason the DC brake should be configured with as short a braking torque and braking time as possible. | | | | |
| DC brake active / not active | *A 51* | N | 00: DC brake is not used (not)<br>01: DC brake is used (active) | 00 |
| DC brake frequency | *A 52* | N | The DC brake will be activated as soon as the actual output frequency falls below the frequency entered here. Setting range 0.5Hz–10Hz. | 0.5 |
| DC brake waiting time | *A 53* | N | When the frequency set under *A 52* is reached the motor runs free for the duration entered here. Only after this duration the DC brake is activated. Setting range 0.0s–5s. | 0.0 |
| DC brake braking torque | *A 54* | N | The amount of braking force can be entered here. Setting 0%–100%. | 0 |
| DC brake braking time | *A 55* | N | The time during which the DC brake is activated can be configured from 0.0s through 60s. | 0.0 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Upper/lower limiter, jump frequency** | | | | |
|  | | | The frequency range set by *b 82* (start frequency) and *A 04* (maximum frequency) can be further limited using functions *A 61* and *A 62* (refer to the upper figure on the left). When a start command is issued the inverter will output the frequency set under *A 62*. | |
|  | | | In order to avoid resonances withhin the drive system three jump frequencies can be configured using the functions *A 63* through *A 68*. In the example (refer to the lower figure on the left) the first jump frequency (configurable using *A 63*) is positioned at 15Hz, the second (*A 65*) at 25Hz, and the third (*A 67*) at 35Hz. The jump frequency widths (configurable using *A 64*, *A 66*, and *A 68*) were chosen to be 1Hz each in the example. | |
| Frequency upper limit | *A 61* | N | Setting range 0.5Hz–360Hz.<br>(When 0.0 is entered, this function is not active). | 0.0 |
| Frequency lower limit | *A 62* | N | Setting range 0.5Hz–360Hz<br>(When 0.0 is entered, this function is not active). | 0.0 |
| 1. jump frequency | *A 63* | N | Setting range 0.1Hz–360Hz<br>(When 0.0 is entered, this function is not active). | 0.0 |
| 1. jump frequency width | *A 64* | N | Setting range 0.1Hz–10Hz<br>(When 0.0 is entered, this function is not active). | 0.5 |
| 2. jump frequency | *A 65* | N | Setting range 0.1Hz–360Hz<br>(When 0.0 is entered, this function is not active). | 0.0 |
| 2. jump frequency width | *A 66* | N | Setting range 0.1Hz–10Hz<br>(When 0.0 is entered, this function is not active). | 0.5 |
| 3. jump frequency | *A 67* | N | Setting range 0.1Hz–360Hz<br>(When 0.0 is entered, this function is not active). | 0.0 |
| 3. jump frequency width | *A 68* | N | Setting range 0.1Hz–10Hz<br>(When 0.0 is entered, this function is not active). | 0.5 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|

**PID control**

Introduction

The PID closed loop control has been designed with a control variable of "frequency in Hz" where the proportional gain ($k_P$), the integral gain ($T_N$), and the differential gain ($T_V$) of the control algorithm can be set independently from each other. The set value and the actual value are scaled in % (setting range 0–100%). For a better presentation of these values they can be scaled and displayed in the desired physical engineering unit (e.g. flow or throughput of 0 to 30l/h).

The PID control output is limited to a lower limit of 0 Hz (or the frequency set under *A 62*) and to the frequency set under *A 04* (or *A 61*, respectively) as an upper limit. This ensures that the motor running direction will not be reversed when a negative deviation is present.

In order to optimize the PID control's behaviour it is advisable to keep acceleration and deceleration times as short as possible.

Set value

Function *A 01* is used to configure the method by which the set value is input and also the terminal where it is input:

| Set value | Parameter | Scaling |
|---|---|---|
| Built-in potentiometer | 00 | 0–100% |
| Function *F 01* | 02 | (0–100%) * (parameter value of function *A 75*) |
| Multistage frequencies *A 20... A 35* | - | (0–100%) * (parameter value of function *A 75*) |
| Analog input O (0–10V) | 01 | 0–100% (independant of *A 11* thru *A 14*) |
| Analog input OI (4–20mA) | 01 | 0–100% (independant of *A 11* thru *A 14*) |

Actual value

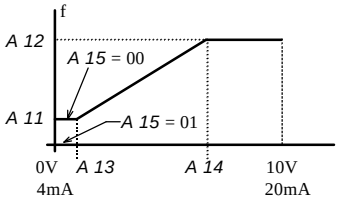
For input of the actual value, one of the two analog inputs available (O or OI) can be used. The adjustment of the actual value is done using functions *A 11* through *A 14*. (This adjustment of the actual value has already been described as "set value adjustment" earlier in this manual. However, this description is only correct when the PID

(*To be continued on next page*)

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|

(C*ontinued from previous page*)

control is not used, in this case it is really the set value that gets adjusted. So when the PID control is activated, the functions *A 11* through *A 14* do not adjust the set value but the actual value instead).




x axis:
Voltage or current **actual** value into analog input (when PID control is used)
Voltage or current **set** value into analog input (when PID control is not used)

The parameters of functions *A 11* through *A 14* are changed from Hz to % due to the PID control's activation (done using *A 71*) and to engineering units by setting function *A 75*. For this reason, function *A 71* must be set to 01 ***before*** the other functions are configured.

Displayed values

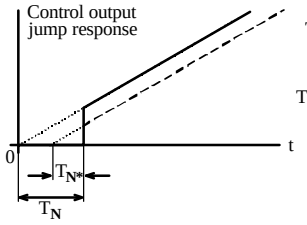
Function *d 04* enables the display of the actual value while *F 01* enables the display of the set value. These values can be displayed in engineering units by setting function *A 75*.

When function *F 01* is activated the PID set value will be displayed, but there is no permanent update of the displayed value. When function *d 04* is activated the actual value will be displayed which in contrast to the set value does get permanently updated.

P, I and D gain

Although these gains can be set independently of each other, there are interactions between them. When the P gain ($k_p$) is changed, the effective I gain ($T_{N*}$) also. Only when $k_p = 1$, the effective I gain ($T_{N*}$) is equal to the I gain that had been entered ($T_N$). When $k_p$ is not equal to 1, $T_{N*}$ can be calculated as follows:

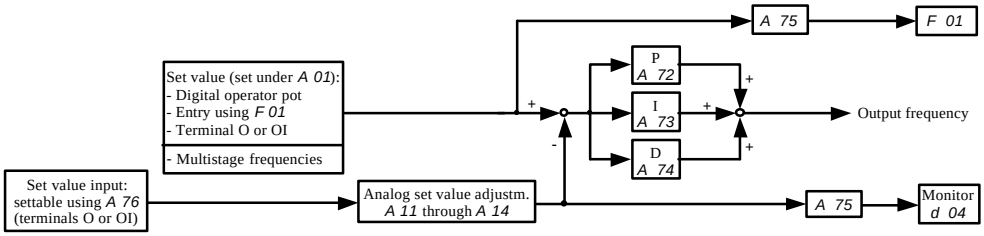
$T_{N*} = T_N * k_p$ (refer to the figure on the right).




$T_N$: Set readjustment time (kp = 1)

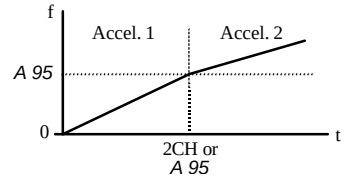
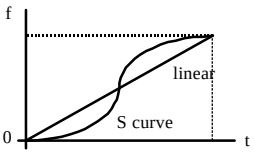
$T_{N*}$: Effective readjustment time (kp = 0,5)

PID block diagram




| | | | | |
|---|---|---|---|---|
| PID control active / not active | *A 71* | N | 00: PID control is not used (not active)<br>01: PID control is used (active) | 00 |
| P (proportional) gain of PID control | *A 72* | Y | The proportional gain of PID control can be set in the range of 0.2 through 5.0. | 1.0 |
| I (integral) gain of PID control | *A 73* | Y | The integral gain of PID control can be set in the range of 0.0s through 150s. | 1.0 |
| D (differential) gain of PID control | *A 74* | Y | The differential gain of PID control can be set in the range of 0.0s through 100s. | 0.0 |
| Scale conversion of PID control | *A 75* | N | The set value or actual value to be displayed on the LED display can be multiplied by a factor in the range of 0.01 through 99.99 so that engineering units (e.g. flow or throughput) can be displayed instead of the frequency. | 1.00 |
| Feedback signal location | *A 76* | N | The set value can be fed into one of two different analog inputs:<br>00: analog input OI 01: analog input O<br>(The set value can also be set using the potentiometer or the multistage frequencies). | 00 |

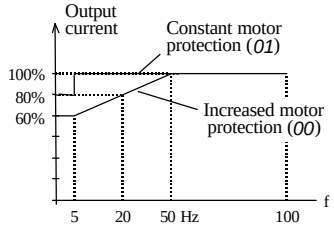
| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Automatic Voltage Regulation (AVR)**<br>The AVR function causes motor voltage stabilization when DC voltage is fluctuating (e.g. due to an instable mains supply or a dropping or excessive DC voltage as a result of too short acceleration or deceleration times) and thus ensures a high torque (especially during acceleration).<br>Dynamic braking (without the use of the AVR function) cauese a rise in DC voltage during deceleration (especially when very short deceleration times have been set) which in turn causes a rise in motor voltage. This raised motor voltage causes a higher braking torque. For this reason, the AVR function can be deactivated for deceleration using *A 81*. | | | | |
| Charcteristics of AVR function | *A 81* | N | 00: AVR function active in every operation mode<br>01: AVR function is not active<br>02: AVR function is active in all operation modes except deceleration | 02 |
| Motor voltage for AVR function | *A 82* | N | The settable parameters depend on the inverter model used:<br>200V models: 200, 220, 230, 240 V<br>400V models: 380, 400, 415, 440, 460 V<br>If the mains supply voltage is higher than the rated motor voltage, then the supply voltage must be entered here and the output voltage must be reduced under *A 45* to the rated motor voltage.<br>Example: With a mains supply voltage of 440V and a motor rated voltage of 400V the parameter 440 has to be entered under *A 82* and 91 (=400/440*100%) has to be entered under *A 45*. | FE models 230/400<br>FU models 230/460 |

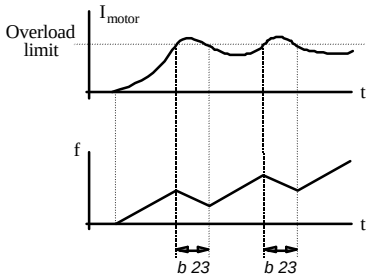
| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Time ramps**<br>  <br>During operation the user can switch over from the time ramps configured under *F 02* and *F 03* to those configured under *A 92* and *A 93*. This can either be done at any time using an external signal on input 2CH or when the frequencies configured under *A 95* und *A 96* are reached. | | | | |
| 2. Acceleration time | *A 92* | Y | Setting range: 0.1s–999,9s (Resolution 0.1s)<br>1000s–3000s (Resolution 1s) | 15.0 |
| 2. Deceleration time | *A 93* | Y | Setting range: 0.1s–999,9s (Resolution 0.1s)<br>1000s–3000s (Resolution 1s) | 15.0 |
| Method to switch over from 1. to 2. accel/decel time | *A 94* | N | The switchover from the 1. acceleration / deceleration time to the 2. acceleration / deceleration time is initiated by:<br>00: an active signal at a digital input configured as 2CH<br>01: the reaching of the frequencies set under *A 95* or *A 96* | 00 |
| Accel.1 / Accel.2 switchover frequency | *A 95* | N | Here the frequency is set at which the switchover from 1. to 2. acceleration time must take place. Setting range: 0.0Hz–360.0Hz. | 0.0 |
| Decel.1 / Decel.2 switchover frequency | *A 96* | N | Here the frequency is set at which the switchover from 1. to 2. deceleration time must take place. Setting range: 0.0Hz–360.0Hz. | 0.0 |
| Acceleration characteristic | *A 97* | N |  <br>A linear or an S curve characteristic can be chosen for motor acceleration (1. and 2. acceleration times):<br>00: Linear 01: S curve | 00 |
| Deceleration characteristic | *A 98* | N | A linear or an S curve characteristic can be chosen for motor deceleration (1. and 2. deceleration times):<br>00: Linear 01: S curve (also refer to *A 97*) | 00 |

## Extended functions of group B

Most of the functions of group B serve safety purposes or are used to protect the inverter from damages.

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Automatic restart after inverter trip**<br>⚠ WARNING On occurance of a trip condition this function causes an automatic inverter restart if a running command is being active at the same time. Additional precautions must be taken for personnell not to get endangered in case of a motor restart.<br>In standard setting any inverter failure will cause a trip condition. An automatic motor restart following an inverter trip is possible with:<br>Overcurrent (*E 01* – *E 04*, with a maximum of 4 retries within 10 minutes, after 4 retries the inverter trips)<br>Overvoltage (*E 07*, *E 15*, with a maximum of 3 retries within 10 minutes, after 3 retries the inverter trips)<br>Undervoltage (*E 09*, with a maximum of 16 retries within 10 minutes, after 16 retries the inverter trips) | | | | |
| Restart mode | *b 01* | N | Here the inverter reaction to trips *E 01* through *E 04*, *E 07*, *E 09*, and *E 15* is selected:<br>00: Trip messages are displayed on occurrance of the above trips (retry is not active).<br>01: Restart with start frequency after the time set under *b 03* has elapsed.<br>02: After the time set under *b 03* has elapsed the inverter synchroni zes to the motor's current speed and the motor is accelerated using the configured acceleration time.<br>03: After the time set under *b 03* has elapsed the inverter synchroni zes to the motor's current speed and the motor is decelerated using the configured deceleration time. Afterwards the corresponding trip will be displayed. | 00 |
| Allowable under-voltage failure time | *b 02* | N | Here the time is entered during which the undervoltage condition is met while the corresponding trip *E 09* is not being displayed.<br>Setting range: 0.3s–25s. | 1.0 |
| Waiting time until retry | *b 03* | N | Here the time is entered that must elapse following one of the above mentioned trip conditions before automatic retry is initiated. During the waiting time the message ▫▫▫▫ is displayed on the LED display.<br>Setting range: 0.3s–100s. | 1.0 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Electronic motor protection**<br>The L100 series inverters have a an electronic facility that is able to monitor the driven motor's thermal load. This electronic thermal motor protection facility is matched to the motor's rated current using function *b 12*. However, the motor temperature can not be monitored if values are entered that are above the rated current of the motor. In this case you will have to install PTC thermistors or thermo contacts into the motor windings. | | | | |
| Electronic thermal protection current | *b 12* | N | The setting range lies between 0.5 times and 1.2 times of the inverter rated current (i.e. the entered value has a unit of A). | Inverter rated current |
| Electronic thermal characteristic | *b 13* | N |  <br>For a better electronic protection of the motor at lower motor speeds the electronic thermal protection can be intensified when low frequencies are used.<br>00: Increased motor protection<br>01: Constant motor protection | 01 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Overload restriction** | | | | |
|  | | | The overload restriction function is used to limit motor current.<br>During acceleration, the rise in frequency is stopped as soon as the output current exceeds the configured overload limit. During normal static operation the output frequency is reduced instead in order to reduce the load current (the time constant for control near the overload limit can be entered under *b 23*). When the output current falls below the configured overload limit, the frequency is raised again to the configured set value. The overload limit can be deactivated during acceleration (refer to *b 21*) so that larger currents are allowed for a short time.<br>It must be noted however, that the overload limit can not prevent an inverter trip and an inverter shutdown due to a sudden overcurrent (caused for example by a short circuit condition). | |
| Overload limit characteristic | *b 21* | N | Three different overload limit characteristics are available that can be chosen from:<br>00: Overload limit is not active<br>01: Overload limit is active in any state of operation<br>02: Overload limit is not active during acceleration | 01 |
| Overload limit current | *b 22* | N | The setting range lies between 0.5 times and 1.2 times of the inverter rated current (i.e. the value is entered with a unit of A). | 1,25* inverter rated current |
| Deceleration time | *b 23* | N | When the configured overload limit is reached the frequency will be reduced within the time entered here (setting range: 0.1s/Hz–30s/Hz).<br>Important note: Do not enter values below 0.3 ! | 1.0 |

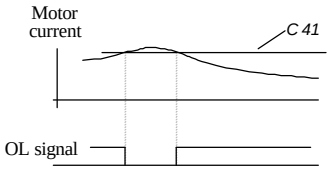
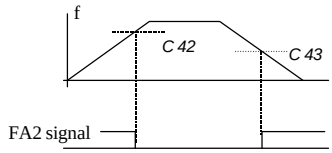
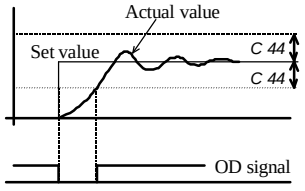
| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Software lock mode; magnetizing current** | | | | |
| Software lock mode | *b 31* | N | The following 4 methods of locking entered parameters are available:<br>00: Software lock initiated by input SFT; all functions locked<br>01: Software lock initiated by input SFT; function *F 01* still usable<br>02: Software lock; all functions locked<br>03: Software lock; function *F 01* still usable | 01 |
| Magnetizing current | *b 32* | N | *This function will be available from July 1998.*<br>*(The date on the name plate must read „9807“ or later.)*<br>Magnetizing current can be configured when smaller motors are used or when driving multiple motors. | 0.58 * inverter rated current |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Other functions** | | | | |
| Analog meter adjustment | *b 81* | Y | The analog signal output on terminal FM (representing frequency set value or output current) can be adjusted using this function. However, adjustment of the pulse signal (digital frequency set value) is not possible here. (Setting range: 0–255). | 80 |
| Start frequency adjustment | *b 82* | N | A higher start frequency results in shorter acceleration and deceleration times (e.g. for overcoming increased static friction). When a too high frequency is configured here this may result in the trip *E 02*. (Setting range: 0.5Hz–9,9Hz). | 0.5 |
| Carrier frequency | *b 83* | N | High carrier frequencies result in less motor noise and less motor power dissipation but on the other hand cause higher dissipation within the power amplifier and more noise in the motor and mains supply cables. For this reasons the carrier frequency should be configured as small as possible. (Note: During DC braking the carrier frequency will automatically be reduced to 1kHz). (Setting range: 0.5kHz–16kHz). | 5 |
| Initializing mode | *b 84* | N | Two different methods for initializing the inverter can be chosen from:<br>00: Clearing the trip history register<br>01: Reinstalling the factory standard settings<br>For clearing the trip history register or reinstalling the factory standard settings do the following:<br>- Make sure that the parameter 01 has been entered under function *b 85* (European version).<br>- Enter 00 or 01 under *b 84*.<br>- On the digital operator, press the two arrow keys and the FUNC key simultaneously.<br>- While holding down the keys mentioned above press the STOP key shortly and wait about 3 seconds for the LED display to show the message *d 00* in a blinking manner.<br>- Now release the keys again. The initialization has now been completed.<br>Note: This function can not be configured while the remote operator is being connected. | 00 |
| National version | *b 85* | N | The national parameter set that will be loaded during initialization (also refer to *b 84*) can be selected. The L100-...NFE/HFE inverter series models need the parameter 01 to be configured here.<br>00: Japan 01: Europe 02: USA 03: not used yet | FE models: 01<br>FU models: 02 |
| Frequency value for display using *d 07* | *b 86* | Y | The product of the value displayed under *d 01* and the factor configured here will be displayed using *d 07*. (Setting range: 0.1–99.9). | 1.0 |
| STOP key locking | *b 87* | N | Using this function the STOP key on the digital operator or the remote operator can be locked.<br>00: STOP key always active<br>01: STOP key not active when terminals FW/RV are used | 00 |
| Operation method when FRS signal is cancelled | *b 88* | N | Activating a digital input configured as FRS causes the inverter to be shutdown and the motor to run free. Two methods are available for deactivating the FRS input:<br>00: 0Hz restart after FRS has been deactivated<br>01: Motor synchronization to the current motor speed following the waiting time configured under *b 03*. | 00 |
| Remote display contents | *b 89* | Y | When using a remote operator OPE-J one of the following values can be displayed externally:<br>01: Current frequency 02: Motor current 03: Running direction<br>04: PID actual value 05: State of digital inputs<br>06: State of digital outputs<br>07: Scaled actual frequency<br>With the exception of the STOP key, all keys of the OPE-J are inactive. | 01 |

## Extended functions of group C

The functions of group C are used for configuring the programmable digital inputs and outputs.

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Programmable digital inputs**<br>Digital inputs 1, 2, 3, 4, and 5 can be assigned 15 different input functions. Every input can be assigned to any of the 15 input functions with the exception of the thermistor input function (parameter 19) which can only be assigned to input 5. However, two different digital inputs can not be assigned the same input function.<br>The inputs can be programmed either as normally closed contacts or as normally open contacts (the only exception is the digital input configured as RS, this input can not be programmed as normally closed contact). | | | | |
| Function of digital input 1 | *C 01* | N | The programmable digital inputs (control terminals 1 through 5) can be assigned one of the following functions:<br>00: FW (start/stop forward run)<br>01: RV (start/stop reverse run)<br>02: CF1 (1. multistage frequency input)<br>03: CF2 (2. multistage frequency input)<br>04: CF3 (3. multistage frequency input)<br>05: CF4 (4. multistage frequency input)<br>06: JG (jogging run)<br>09: 2CH (2. acceleration/deceleration)<br>11: FRS (free run stop)<br>12: EXT (external trip)<br>13: USP (restart prevention function)<br>15: SFT (software lock)<br>16: AT (use input OI)<br>18: RS (reset)<br>19: PTC thermistor input (only digital input 5) | 00 |
| Function of digital input 2 | *C 02* | N | Refer to *C 01* for possible parameters | 01 |
| Function of digital input 3 | *C 03* | N | Refer to *C 01* for possible parameters | FE model 02<br>FU model 16 |
| Function of digital input 4 | *C 04* | N | Refer to *C 01* for possible parameters | FE model 03<br>FU model 13 |
| Function of digital input 5 | *C 05* | N | Refer to *C 01* for possible parameters | 18 |
| Type of digital input 1 | *C 11* | N | 00: Normally open contact 01: Normally closed contact | 00 |
| Type of digital input 2 | *C 12* | N | Refer to *C 11* for possible parameters | 00 |
| Type of digital input 3 | *C 13* | N | Refer to *C 11* for possible parameters | 00 |
| Type of digital input 4 | *C 14* | N | Refer to *C 11* for possible parameters | FE model 00<br>FU model 01 |
| Type of digital input 5 | *C 15* | N | Refer to *C 11* for possible parameters | 00 |

| Function | Display | *) | Function description / parameter setting range | Standard setting |
|---|---|---|---|---|
| **Programmable digital outputs**<br>Digital outputs can be assigned one of 6 different signalling functions. Both outputs may also be assigned to the same function. The oututs can be programmed either as normally closed contacts or as normally open contacts. | | | | |
| Function of digital output 11 | *C 21* | N | One of the following signalling functions can be assigned:<br>00: RUN signal (signal active during motor run)<br>01: FA1 signal (frequency arrival)<br>02: FA2 signal (frequency exceeded)<br>03: OL signal (overload)<br>04: OD signal (PID-deviation exceeded)<br>05: AL signal (alarm signal) | 01 |
| Function of digital output 12 | *C 22* | N | Refer to *C 21* for possible parameters | 00 |
| Function of FM terminal | *C 23* | N | The FM output terminal can be used to output one of the following values:<br>00: Output frequency display (analog signal 0–10VDC)<br>01: Motor current display (analog signal 0–10VDC; 100% of the rated current corresponds to 5VDC)<br>02: Output frequency (digital pulse signal) | 00 |
| Digital output 11 type | *C 31* | N | 00: Normally open contact 01: Normally closed contact | 01 |
| Digital output 12 type | *C 32* | N | Refer to *C 31* for possible parameters | 01 |
| Type of alarm relay output | *C 33* | N | Refer to *C 31* for possible parameters | 01 |
| Level for overload signal | *C 41* | N |  If digital output terminals 11 or 12 have been configured for output of the overload signal then the current value entered here determines when the overload signal will be activated.<br>(Setting range: 0A–2* Inverter rated current) | Inverter rated current |
| Arrival frequency FA2 for acceleration | *C 42* | N |  The digital output terminal 11 or 12 configured as FA2 will be activated when the frequency entered here is exceeded during acceleration.<br>(Setting range: 0Hz–360Hz) | 0.0 |
| Arrival frequency FA2 for deceleration | *C 43* | N | (The digital output terminal 11 or 12 configured as FA2 will remain activated during deceleration as long as the actual frequency is above the frequency entered here (also refer to the figure under *C 42*).<br>(Setting range: 0Hz–360Hz) | 0.0 |
| Level of PID deviation | *C 44* | N |  The digital output terminal 11 or 12 configured as OD will be activated when the difference between the set value and actual value exceeds the value entered here (when PID control is activated). (Setting range: 0–100% of the maximum set value). | 3.0 |

# Chapter 9 – Messages

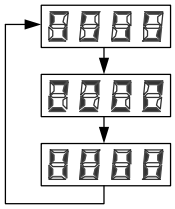
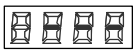
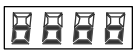
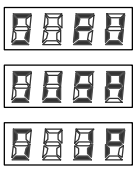
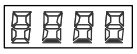
## Trip messages

L100 series inverters will trip on overcurrent, overvoltage and undervoltage to protect the inverter.The output is shut down and the motor runs free. This condition is held until the trip state is reset using the RESET key or the RS input.

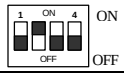
| Type of trip | Description | Trip display |
|---|---|---|
| Overcurrent protection | When the output of the inverter is short circuited, the motor is locked, or a heavy load is suddenly applied, and the inverter output current exceeds a pre-determined level, the inverter is shut off. | During constant speed: *E 01*<br>At decele-ration: *E 02*<br>At accele-ration: *E 03*<br>at the others: *E 04* |
| Overload protection | When a motor overload is detected by the electronic thermal function, the inverter is shut off. | *E 05* |
| Overvoltage protection | When the inverter DC bus voltage exceeds a predetermined level due to regenerative energy from the motor, this trip occures and the inverter is shut off. | *E 07* |
| EEPROM error (*Note*) | When the inverter memory has a problem due to noise or excessive temperature rise, this trip occurs and the inverter is shut off. | *E 08* |
| Undervoltage protection | A decrease of DC bus voltage may result in improper function of the control unit. It may also cause motor heating and low torque. The inverter is shut off when the DC bus voltage goes below a certain level. | *E 09* |
| CPU error | Malfunction or abnormality of the CPU. The inverter is shut off. | *E 11*<br>*E 22* |
| External trip | A trip signal from external equipment shuts off the inverter. It is necessary to assign the external trip to an intelligent terminal. | *E 12* |
| USP error | Indicates an error when power is turned on while the inverter run is enabled (when USP function is selected). | *E 13* |
| Ground fault protection | The inverter is protected by detection of ground faults between the drive output and the motor at power on. Protection is for the inverter only and not for humans. | *E 14* |
| Input overvoltage | When the input voltage is higher than a specified value, it is detected and 100 seconds after power is turned on, the inverter is shut off. | *E 15* |
| Thermal protection | When the temperature of the inverter module is beyond specification, the thermal sensor in the inverter module detects the temperature and the inverter is shut off. | *E 21* |
| PTC error | When the resistance value of the external thermistor is too large, the equipment detects the abnormal condition of the thermistor and then shuts off the inverter (when PTC function is selected). | *E 35* |

*Note*: If an EEPROM error occurs, be sure to observe ist value. If power is turned off while the RS input terminal is held ON, the EEPROM error occurs when power is turned back on.

## Other messages

| Cause | Display |
|---|---|
| The inverter is currently in standby mode<br>or<br>There is an active reset signal. |  |
| The mains power supply has been switched off. |  |
| The waiting time prior to automatic inverter restart is coming to an end (refer to functions *b 01* and *b 03*). |  |
| The factory standard settings have been selected and the inverter currently is in its initializing phase (refer to functions *b 84* and *b 85*). The parameters for the European market (EU) are loaded. For non-European inverter models there are versions for North America (USA) and Japan (JP). |  |
| The trip history register is being initialized. |  |
| The copy unit is carrying out a copy operation. |  |
| No data available<br>(this may be displayed under functions *d 08* and *d 09* when the trip history register is empty, or under *d 04* when PID control is not active). |  |

# Chapter 10 – Trouble shooting

| Error | Condition | Possible cause | Remedy |
|---|---|---|---|
| The motor won't start | No voltage can be measured at outputs U, V, and W | Does a voltage exist at the terminals L1, N (NFE models) or L1, L2 and L3 (HFE models)? If this is the case, is the power lamp also lit? | Check terminals L1, L2, L3 (U, V, W). Switch on the power supply afterwards. |
| | | Does the LED display on the digital operator show a trip message (*E _ _*)? | Analyze the cause of the trip message (also refer to chapter 9 - Messages). Acknowledge the trip condition by re-setting the inverter (e.g. by pressing the RESET key). |
| | | Has a run command been issued? | Issue a run command by using the RUN key or the digital inputs FW or RV. |
| | | Has a frequency set value been entered using function *F 01* (only when inverter is operated using the digital operator)? | Enter a frequency set value under *F 01*. |
| | | Have the terminals H, O, and L been wired correctly when set value is given by means of a potentiometer? | Check for errors in potentiometer wiring. |
| | | Have the terminals O and OI been wired correctly if an external set value is used? | Check for correct connection of the wires carrying the set value signal. |
| | | Are the digital inputs configured as RS or FRS still active? | Deactivate RS or FRS.<br>Check the signal on digital input 5 (standard setting = RS). |
| | | Has the correct frequency set value source (*A 01*) been selected? | Correct the *A 01* parameter setting, if necessary. |
| | | Has the correct source for the running command (*A 02*) been selected? | Correct the *A 02* parameter setting, if necessary. |
| | No voltage can be measured at outputs U, V, and W | Is the motor blocked or is the motor load too high? | Reduce the load that the motor drives. Operate the motor without any load for testing purposes. |
| | An optional remote operator is used. | Are the dip switches set correctly? | Check if the dip switches are set correctly if a DOP or DRW is used.<br>  |
| The motor runs in the wrong direction | | Have the output terminals U, V, and W been wired correctly?<br>Does the connection scheme of the terminals U, V, and W match the motor's running direction? | Connect the output terminals U, V, and W to the motor corresponding to the desired running direction (generally U, V, and W in this order cause the motor to run in forward direction). |
| | | Have the control terminals been wired correctly? | Use terminal FW for forward run and RV for reverse run. |
| | | Has the function *F 04* been configured correctly? | Configure the desired running direction under *F 04*. |
| The motor won't reach its normal speed | | No set value signal is present on terminals O and OI. | Check the potentiometer or the external set value origin and if necessary replace them. |
| | | Is one of the multistage frequency settings being activated? | Note that there is a priority order with the multistage frequency settings having higher priority than the set value at inputs O and OI. |
| | | Is the motor load too high? | Reduce the motor load because the overload restriction functions prevents the motor from reaching its normal speed in case an overload exists. |

| Error | Condition | Possible cause | Remedy |
|---|---|---|---|
| The motor run is unstable | | Are the motor load fluctuations too great? | Choose an inverter and motor of a higher rating.<br>Reduce load fluctuations to a minimum. |
| | | Are there motor resonating frequencies? | Avoid critical frequencies by using jump frequencies (*A 63* – *A 68*) or change the carrier frequency (*b 83*). |
| The motor's rpm does not match frequency. | | Has the correct maximum frequency been set? | Check the configured operating frequency range and the V/F characteristics. |
| | | Have the nominal rpm of the motor and the gear reduction ratio been set correctly? | Check the nominal rpm of the motor and the gear reduction ratio. |
| The saved parameters are not the same as the parameters that had been entered. | The entered parameters have not been saved. | The inverter power supply had been shut off before the entered parameter settings were saved by pressing the STR key. | Enter the parameter settings once more and save each input made. |
| | | After switching off the power supply the entered values are copied into the internal EEPROM. The power off duration should at least be 6 seconds or more. | Enter the parameter settings once more and then turn off the power supply for more than 6 seconds. |
| | The copy unit parameter settings have not been copied to the inverter. | After copying the parameters from the copy unit DRW into the inverter the power supply was left in the on state for only less than 6 seconds. | Copy the parameter settings once more and then keep the power supply turned on for more than 6 seconds. |
| No data entries can be made. | The motor won't start or stop and also no set value can be entered. | Have the functions *A 01* and *A 02* been configured correctly? | Check if the settings made under *A 01* and *A 02* are correct. |
| | Parameters can neither be set nor changed. | Has the software lock function been activated? | Deactivate the software lock using *b 31* so that all parameters can be changed again. |
| | | Has the hardware lock been activated? | Deactivate the digital input configured as SFT. |
| | | Has position 4 of the dip switch (on the back of the copy unit) been set to ON? | Set position 4 of the dip switch to OFF so that the remote operator can be read out. |
| The electronic thermal protection is activated (trip *E 05*). | | Has a too high manual boost been configured?<br>Have the correct settings been made in conjunction with the electronic thermal protection function? | Check the settings for boost and electronic thermal protection. |

**Important note for saving changed parameters:**

After changed parameters have been saved with the STR key (when parameters are changed using the L100 digital operator) or with the COPY key (when parameters are copied into the inverter using the DRW copy unit) no entry must be made using the inverter's digital operator for at least 6 seconds. However, when a key is pressed within this time, or a reset command is issued, or the inverter is switched off, the data may not be saved correctly.

# Chapter 11 – Technical specifications

| Inverter L100- (200V series) | | | 002 NFE | 004 NFE | 005 NFE | 007 NFE | 011 NFE | 015 NFE | 022 NFE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 002 NFU | 004 NFU | | 007 NFU | | 015 NFU | 022 NFU | 037 LFU | 055 LFU | 075 LFU |
| Protective structure (*Note 1*) | | | IP20 | | | | | | | | | |
| Overvoltage category | | | III | | | | | | | | | |
| Maximum motor size (4P) in kW (*Note 2*) | | | 0.2 | 0.4 | 0.55 | 0.75 | 1.1 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 |
| Maximum capacity in kVA | | 230V | 0.5 | 1.0 | 1.1 | 1.5 | 1.9 | 2.8 | 3.9 | 6.3 | 9.5 | 12.7 |
| | | 240V | 0.5 | 1.0 | 1.2 | 1.6 | 2.0 | 2.9 | 4.1 | 6.6 | 9.9 | 13.3 |
| Input supply phase | | | 002 ~ 022NFE/U: Single phase / 3 phase 037 ~ 075LFU: 3 phase | | | | | | | | | |
| Rated input voltage | | | 200VAC –10% ~ 240VAC +5% 50/60Hz +/-5% | | | | | | | | | |
| Rated output voltage (*Note 3*) | | | Three phase 200 ~ 240VAC (Corresponds to input voltage) | | | | | | | | | |
| Rated input current in A Single phase (Three phase) | | | 3.1 (1.8) | 5.8 (3.4) | 6.7 (3.9) | 9.0 (5.2) | 11.2 (6.5) | 16.0 (9.3) | 22.5 (13.0) | - (20.0) | - (30.0) | - (40.0) |
| Rated output current in A (*Note 4a*) | | | 1.4 | 2.6 | 3.0 | 4.0 | 5.0 | 7.1 | 10.0 | 15.9 | 24.0 | 32.0 |
| Output frequency range | | | 0.5 ~ 360 Hz (*Note 5*) | | | | | | | | | |
| Frequency accuracy (at 25°C +/-10°C) | | | Digital command: +/-0.01% of maximum frequency Analog command: +/-0.2% of maximum frequency | | | | | | | | | |
| Frequency setting resolution | | | Digital setting: 0.1 Hz Analog setting: maximum frequency /1000 | | | | | | | | | |
| Voltage/frequency characterist. | | | Constant or reduced torque with any variable voltage/frequency | | | | | | | | | |
| Overload current capacity | | | 150% during 60 seconds (once per 10 minutes) | | | | | | | | | |
| Acceleration/deceleration time | | | 0.1 ~ 3000 s in selectable linear and non-linear mode (second acceleration/deceleration usable) | | | | | | | | | |
| Starting torque | | | 100% ore more (when torque boost has been set) | | | | | | | | | |
| Braking torque | Dynam. braking, feedback to capacitor (*Note 6*) | | ca. 100% | | | | ca. 70% | | ca. 20% | | | |
| | DC injection braking | | Braking is on at the minimum frequency or less (minimum frequency, braking time and braking force can be set) | | | | | | | | | |
| Inputs | Frequency setting | Dig. operator | Settings using keys ▲ ▼ or potentiometer | | | | | | | | | |
| | | External signals | 0-10VDC (input impedance 10k Ohm); 4-20mA (input impedance 250 Ohm); Potentiometer 1k-2k Ohm, 1W | | | | | | | | | |
| | Forward / Reverse run (Start/Stop) | Dig. operator | Via keys RUN (for start) and STOP/RESET (for stop) (Default setting: forward run) | | | | | | | | | |
| | | Ext. signals | Intelligent input terminals configurable as FW and RV | | | | | | | | | |
| | Intelligent input terminals programmable as | | FW: Forward run start/stop<br>CF1–CF4: Multistage speed<br>AT: Analog current input selection<br>FRS: Free run stop<br>USP: USP function<br>SFT: Software lock | | | | | RV: Reverse run start/stop<br>JG: Jogging command<br>2CH: 2.Accel./decel. time<br>EXT: External trip<br>RS: Reset<br>PTC: Thermal protection | | | | |
| Outputs | Intelligent output terminals programmable as | | FA1/FA2: Frequ. arrival signal RUN: Motor running signal<br>OL: Overload signal OD: PID deviation signal AL: Alarm signal | | | | | | | | | |
| | Frequency and current monitoring | | Connection of external analog meter (0-10VDC, max. 1mA) for frequency or current; connection of external digital frequency meter | | | | | | | | | |
| Fault alarm contact | | | On when the inverter trips (1c contact) | | | | | | | | | |
| Other functions | | | Automatic voltage regulation, retry;<br>analog gain/vias adjustment, frequency jump,<br>upper/lower limiter, output frequency display,<br>trip history monitoring, carrier frequency setting,<br>PID control, automatic torque boost,<br>and many more | | | | | | | | | |
| Protection functions | | | Overcurrent, overvoltage, undervoltage, electronic thermal, temperature abnormality, ground fault upon starting, overload limit | | | | | | | | | |
| Environmental | Ambient temp. (*Note 7*) | | -10 ~ 50°C | | | | | | | | | |
| | Storage temperature and humidity | | -25 ~ 70°C (during short term transportation period only) 20 ~ 90% RH (no dew condensation) | | | | | | | | | |
| | Vibration | | Max. 5.9m/s² (=0.6g) at 10-55Hz | | | | | | | | | |
| | Installation location | | 1000m or less altitude indoors (IP54 or equivalent) | | | | | | | | | |
| External color | | | Blue | | | | | | | | | |
| Options | | | Remote operator, copy unit, cable for digital operator, reactor for improving power factor, noise filter, OPE-J | | | | | | | | | |
| Overall weight (approx.) | | | 0.85 | | 1.3 | | 2.2 | | 2.8 | | 5.5 | 5.7 |

| Inverter L100- (400V series) | | | 004 HFE / 004 HFU | 007 HFE / 007 HFU | 015 HFE / 015 HFU | 022 HFE / 022 HFU | 030 HFE | 040 HFE / 040 HFU | 055 HFE / 055 HFU | 075 HFE / 075 HFU |
|---|---|---|---|---|---|---|---|---|---|---|
| Protective structure (*Note 1*) | | | IP20 | | | | | | | |
| Overvoltage category | | | III | | | | | | | |
| Maximum motor size (4P) in kW (*Note 2*) | | | 0.4 | 0.75 | 1.5 | 2.2 | 3.0 | 4.0 | 5.5 | 7.5 |
| Maximum capacity in kVA | 460V | | 1.1 | 1.9 | 3.0 | 4.3 | 6.2 | 6.8 | 10.3 | 12.7 |
| Input supply phase | | | 004 ~ 075HF: 3 phase | | | | | | | |
| Rated input voltage | | | 380VAC –10% ~ 460VAC +10% 50/60Hz +/-5% | | | | | | | |
| Rated output voltage (*Note 3*) | | | Three phase 380 ~ 460VAC (Corresponds to input voltage) | | | | | | | |
| Rated input current in A | | | 2.0 | 3.3 | 5.0 | 7.0 | 10.0 | 11.0 | 16.5 | 20.0 |
| Rated output current in A (*Note 4b*) | | | 1.5 | 2.5 | 3.8 | 5.5 | 7.8 | 8.6 | 13.0 | 16.0 |
| Output frequency range | | | 0.5 ~ 360 Hz (*Note 5*) | | | | | | | |
| Frequency accuracy (at 25°C +/-10°C) | | | Digital command: +/-0.01% of maximum frequency<br>Analog command: +/-0.2% of maximum frequency | | | | | | | |
| Frequency setting resolution | | | Digital setting: 0.1 Hz Analog setting: maximum frequency /1000 | | | | | | | |
| Voltage/frequency characterist. | | | Constant or reduced torque with any variable voltage/frequency | | | | | | | |
| Overload current capacity | | | 150% during 60 seconds (once per 10 minutes) | | | | | | | |
| Acceleration/deceleration time | | | 0.1 ~ 3000 s in selectable linear and non-linear mode (second acceleration/deceleration usable) | | | | | | | |
| Starting torque | | | 100% ore more (when torque boost has been set) | | | | | | | |
| Braking torque | Dynam. braking, feedback to capacitor (*Note 6*) | | ca. 100% | | ca.70% | ca. 20% | | | | |
| Braking torque | DC injection braking | | Braking is on at the minimum frequency or less (minimum frequency, braking time and braking force can be set) | | | | | | | |
| Inputs | Frequency setting | Dig. operator | Settings using keys ▲ ▼ or potentiometer | | | | | | | |
| Inputs | Frequency setting | External signals | 0-10VDC (input impedance 10k Ohm)<br>4-20mA (input impedance 250 Ohm)<br>Potentiometer 1k-2k Ohm, 1W | | | | | | | |
| Inputs | Forward / Reverse run (Start/Stop) | Dig. operator | Via keys RUN (for start) and STOP/RESET (for stop) (Default setting: forward run) | | | | | | | |
| Inputs | Forward / Reverse run (Start/Stop) | Ext. signals | Intelligent input terminals configurable as FW and RV | | | | | | | |
| Inputs | Intelligent input terminals programmable as | | FW: Forward run start/stop<br>CF1–CF4: Multistage speed<br>AT: Analog current input selection<br>FRS: Free run stop<br>USP: USP function<br>SFT: Software lock<br>RV: Reverse run start/stop<br>JG: Jogging command<br>2CH: 2.Accel./decel. time<br>EXT: External trip<br>RS: Reset<br>PTC: Thermal protection | | | | | | | |
| Outputs | Intelligent output terminals programmable as | | FA1/FA2: Frequ. arrival signal RUN: Motor running signal<br>OL: Overload signal OD: PID deviation signal AL: Alarm signal | | | | | | | |
| Outputs | Frequency and current monitoring | | Connection of external analog meter (0-10VDC, max. 1mA) for frequency or current; connection of external digital frequency meter | | | | | | | |
| Fault alarm contact | | | On when the inverter trips (1c contact) | | | | | | | |
| Other functions | | | Automatic voltage regulation, retry;<br>analog gain/vias adjustment, frequency jump,<br>upper/lower limiter, output frequency display,<br>trip history monitoring, carrier frequency setting,<br>PID control, automatic torque boost,<br>and many more | | | | | | | |
| Protection functions | | | Overcurrent, overvoltage, undervoltage, electronic thermal, temperature abnormality, ground fault upon starting, overload limit | | | | | | | |
| Environmental | Ambient temperature (*Note 7*) | | -10 ~ 50°C | | | | | | | |
| Environmental | Storage temperature and humidity | | -25 ~ 70°C (during short term transportation period only)<br>20 ~ 90% RH (no dew condensation) | | | | | | | |
| Environmental | Vibration | | Max. 5.9m/s² (=0.6g) at 10-55Hz | | | | | | | |
| Environmental | Installation location | | 1000m or less altitude indoors (IP54 or equivalent) | | | | | | | |
| External color | | | Blue | | | | | | | |
| Options | | | Remote operator, copy unit, cable for digital operator, reactor for improving power factor, noise filter, OPE-J | | | | | | | |
| Overall weight (approx.) | | | 1.3 | 1.7 | | 2.8 | | | 5.5 | 5.7 |

**Notes on technical specifications:**

*Note 1*: Protective structure is based upon EN60529

*Note 2*: The applicable motor is a Hitachi standard four-pole motor. When using another motor, make sure that the rated motor current does not exceed the rated inverter current.

*Note 3*: The output voltage will decrease if input voltage decreases.

*Note 4a*: The initial data setting values of 005N/011N are same as 007N/015N. So be sure to set the correct values under *b 12* and *b 22* of 005N/007N for each motor first.

*Note 4b*: The initial data setting value of 030H is same as 040H. So be sure to set the values under *b 12* and *b 22* of 030H for the motor first.

*Note 5*: Confirm with the motor manufacturer the motors maximum rpm when using a motor running at frequencies higher than 50/60Hz

*Note 6*: Torque will be reduced when the base frequency exceeds 50Hz.

*Note 7*: In the range of 40 to 50°C reduce the carrier frequency to 2kHz and derate the output current to 80% of the rated current, and remove the top cover.

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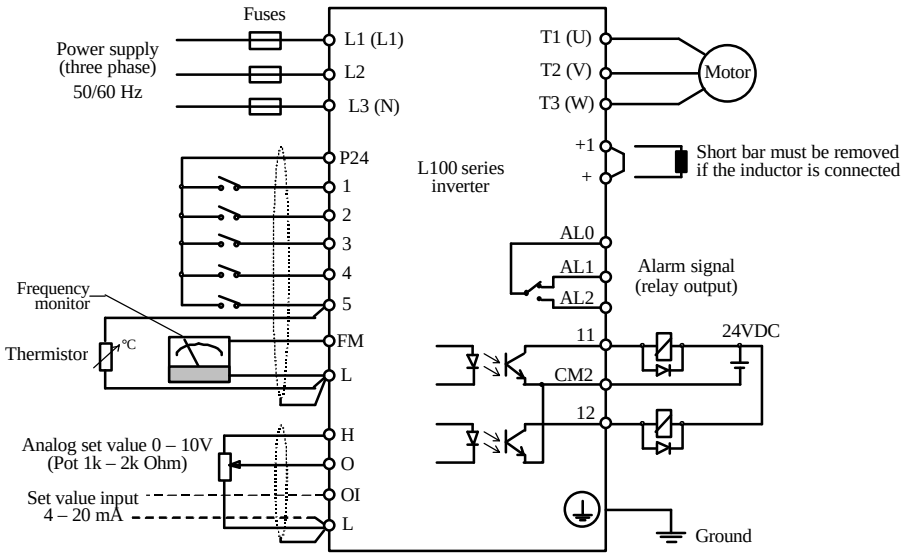
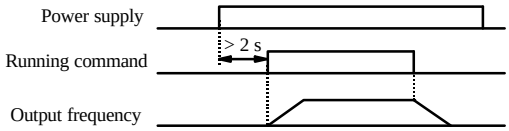



**Notes:**

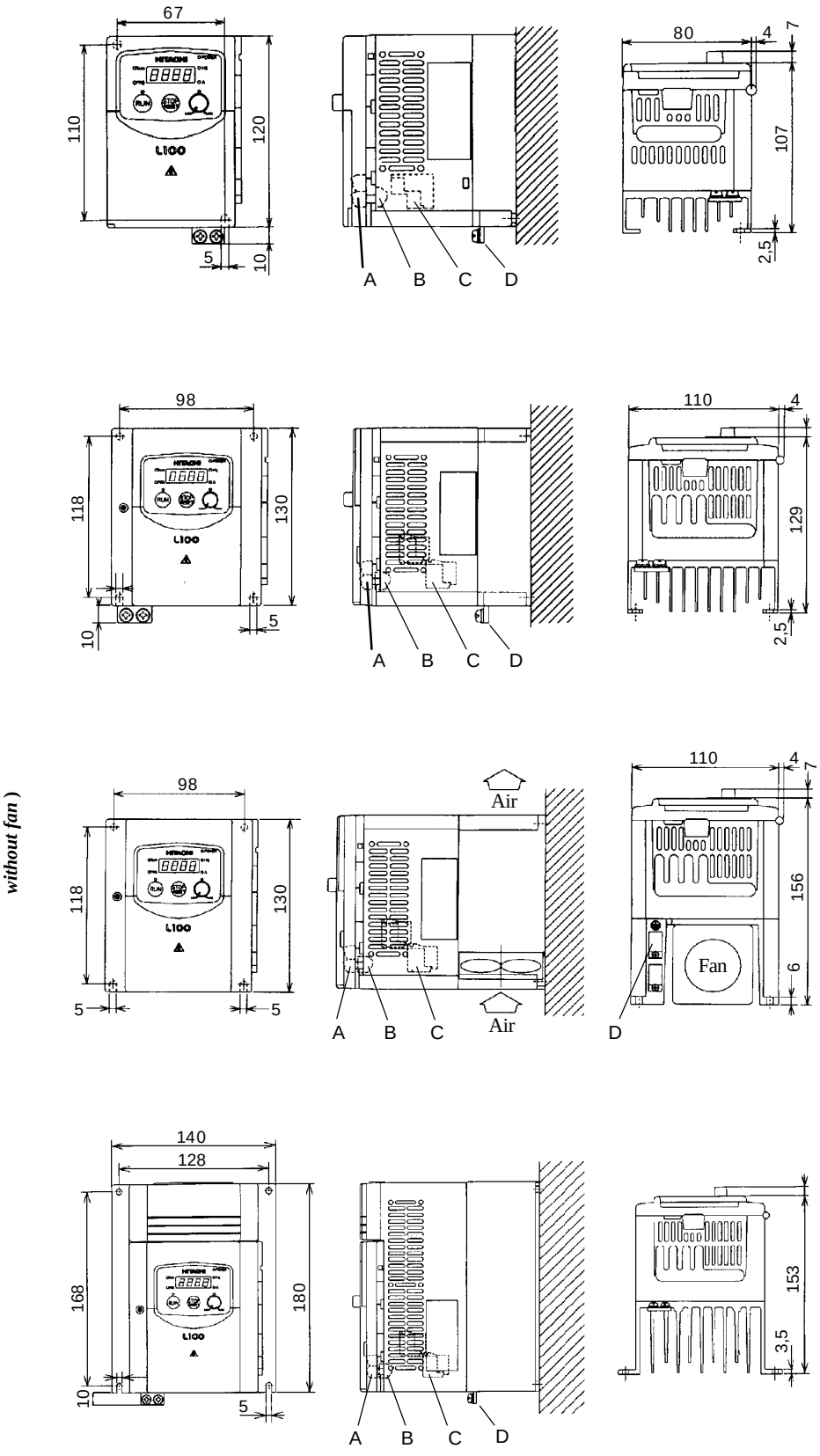
The common potential depends on the terminals used:

| Terminals | Common potential |
|---|---|
| 1, 2, 3, 4, 5 | P24 |
| FM, H, O, OI | L |
| 11, 12 | CM2 |



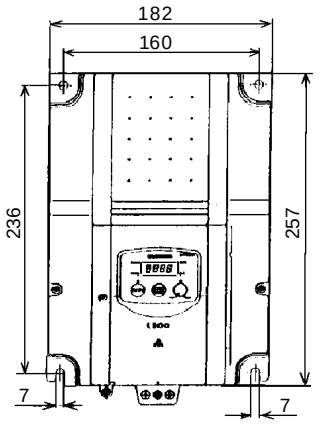

A trip will occur when a running command is active at the time the power supply is switched on. The power supply should not be switched on simultaneously with the running command; instead there should be a time delay of about 2 seconds from the time the power supply is switched on until the running command is activated (refer to time diagram). Also the power supply must not be switched off while the running command is being active (motor is running).

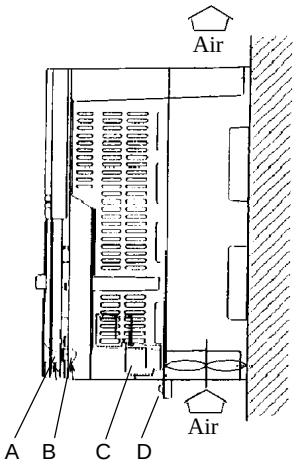
**External dimensions and terminal positions of L100 series inverters**

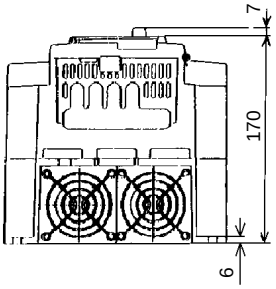



Legend:

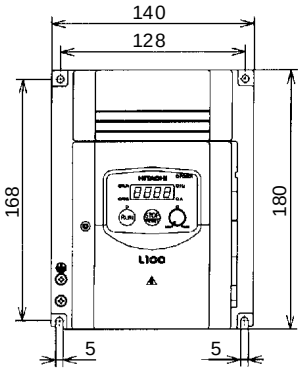
A Control terminals B Alarm terminals
C Main terminals D Grounding terminals (All dimensions are in millimeters)

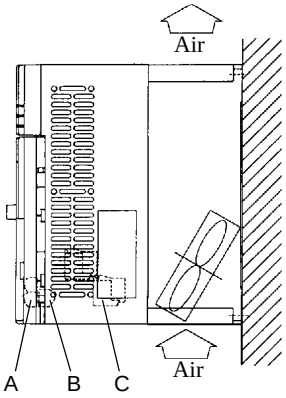


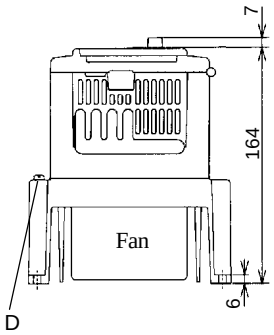




**L100-**
**055 LFU/HFE/HFU**
**075 LFU/HFE/HFU**




**L100-**
**022 NFE/NFU 022 HFE/HFU**
**030 HFE 037 LFU**
**040 HFE/HFU**

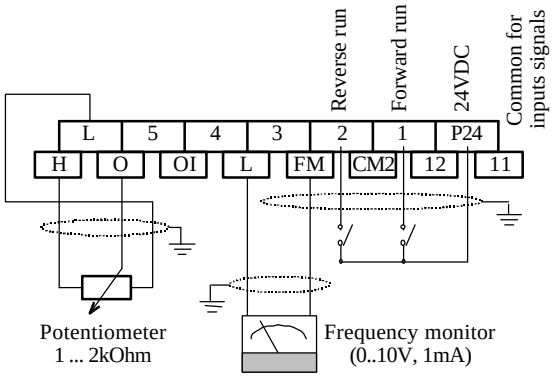
Legend:

A Control terminals B Alarm terminals
C Main terminals D Grounding terminals (All dimensions are in millimeters)

# Chapter 12 – Wiring examples

## Set value supplied by external potentiometer

Connection diagram




Configuration of parameters

| Function | Configurable parameters | Description |
|---|---|---|
| *A 01* | 01 | Set value input using control terminals |
| *A 02* | 01 | Running command using terminals FW/RV |
| *F 02* | 10 | Acceleration time in s |
| *F 03* | 10 | Deceleration time in s |
| *C 01* | 00 | FW: Forward running command on digital input 1 |
| *C 02* | 01 | RV: Reverse running command on digital input 2 |
| *C 23* | 00 | Monitoring of output frequency (analog) using the meter connected to terminals L and FM. |
| *b 81* | 80 | Adjustment of the frequency meter connected to terminals L and FM |

Function description

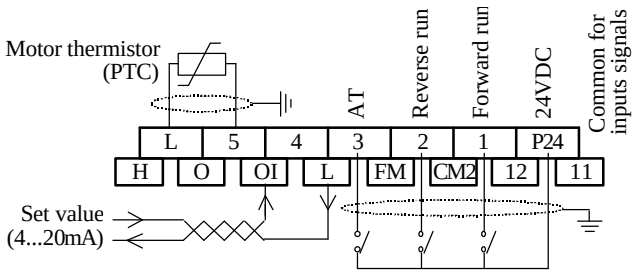
The inverter can now be started via input 1 (forward run) or input 2 (reverse run). If the inputs RV and FW are both closed, the inverter is stopped.

By adjusting the external potentiometer the desired frequency set value (voltage set value) can be set.

The analog meter can be used to display the frequency (parameter 00 must be set under *C 23*) or the motor current (parameter 01 must be set under *C 23*). With function *b 81* the displayed frequency or current value can be adjusted to the measuring range of the special meter used.

# Inverter operation using analog set value

Connection diagram




Configuration of parameters

| Function | Configurable parameters | Description |
|---|---|---|
| *A 01* | 01 | Set value input using control terminals |
| *A 02* | 01 | Running command using terminals FW/RV |
| *F 02* | 10 | Acceleration time in s |
| *F 03* | 10 | Deceleration time in s |
| *C 01* | 00 | FW: Forward running command on digital input 1 |
| *C 02* | 01 | RV: Reverse running command on digital input 2 |
| *C 03* | 16 | AT: Use current input for set value (4 – 20mA) |
| *C 05* | 19 | PTC: Thermistor on digital input 5 |

Function description

The inputs 1 and 2 are used exactly the way as described in the previous example.

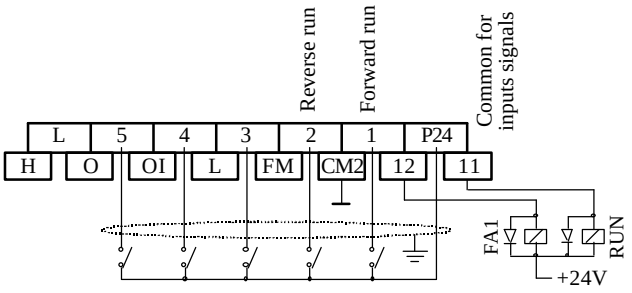
Digital input 3 (configured as AT) can be used to switch from voltage set value (0–10V) to current set value (4–20mA). If none of the digital inputs has been configured as AT then the voltage set value present on terminal O and the current set value present on terminal OI will be added.

Instead of a fixed wiring or one that uses a switch connected to terminal 3 function *A 13* can be set to 01 (digital input 3 will then be configured as normally closed contact).

This wiring example also incorporates a thermal motor protection using a thermistor. It is important here that a screened control cable is used and that the thermistor cables are installed at a safe distance from the motor cables. However, the screening must only be grounded on the inverter side.

# Inverter operation using fixed set values

Connection diagram




Configuration of parameters

| Function | Configurable parameters | Description |
|---|---|---|
| *A 01* | 01 | Set value input using control terminals |
| *A 02* | 01 | Running command using terminals FW/RV |
| *F 02* | 10 | Acceleration time in s |
| *F 03* | 10 | Deceleration time in s |
| *C 01* | 00 | FW: Forward running command on digital input 1 |
| *C 02* | 01 | RV: Reverse running command on digital input 2 |
| *C 03* | 16 | AT: Use current input for set value (4 – 20mA) |
| *C 04* | 02 | CF1: Multistage frequency input 1 |
| *C 05* | 03 | CF2: Multistage frequency input 2 |
| *C 21* | 00 | RUN signal output on terminal 11 |
| *C 22* | 01 | FA signal output on terminal 12 |
| *A 21* | Multistage frequency 1 | Here the fixed frequency is entered that will be output when CF1 and CF2 are both inactive. |
| *A 22* | Multistage frequency 2 | Here the fixed frequency is entered that will be output when CF1 is inactive and CF2 is active. |
| *A 23* | Multistage frequency 3 | Here the fixed frequency is entered that will be output when CF1 and CF2 are both active. |

Function description

The inputs 1 and 2 are used exactly the way as described in the previous example.

When one or both of the multistage frequency inputs CF1 and CF2 are activated then the current active frequency output is superseded by the fixed frequency set by the combination of inputs CF1 and CF2. Consequently the motor is accelerated or decelerated until the new frequency is reached. When none of the inputs CF1 and CF2 is activated, then the frequency set value can be set by the terminals O (voltage set value) or OI (current set value). In this example, the wiring of terminals O or OI has not been included for simplicity.

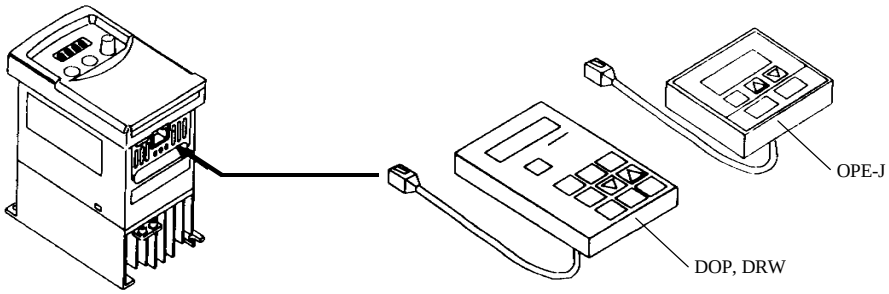
The logical levels necessary for the various multistage frequency inputs to produce a certain frequency are described under functions *F 01* and *A 20* through *A 35*.

This wiring example also contains the parameters that must be entered so that the described signals will be output on terminals 11 and 12. The output signal type (normally open or normally closed) can be set using function *C 21* for ditital output 11 and function *C 22* for ditital output 12.

# Chapter 13 – The optional remote operators

## Connection of the remote operator

Before the optional remote operators DOP, DRW, or OPE-J can be connected the power supply to the inverter has to be switched off. Then the cable must be plugged into the inverter as shown in the figure. Now the power supply can be switched on again. The inverter is now in monitor mode and on the remote operator's LCD display the message *FS000.0...* is shown.

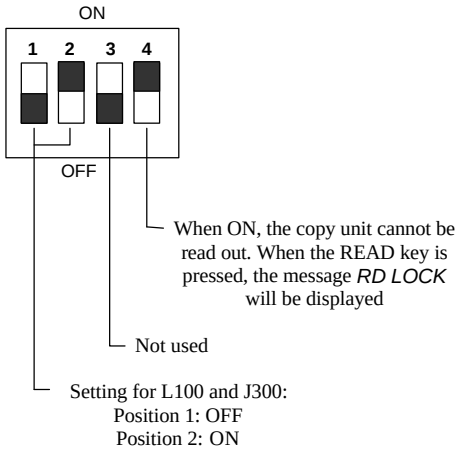



The parameters that have been configured using L100 series inverters can now be copied to other inverters using the copy unit DRW-0A2. The old model DRW-0A can not be used for this purpose.

When inverters are operated with a remote operator connected, the following items must be noted:

- The remote operator's cable must not be attached or removed during operation (i.e. if the power supply to the inverter is switched on).
- The digital operator of the inverter can not be used while the remote operators DOP or DRW are being connected.
- All remote operator keys are inactive except the STOP/RESET key while the remote operator OPE-J is being connected (also refer to the description of function *b 89* in chapter 8 under "Extended functions of group B").

Set the dip switches on the back of the remote operator as follows:



# The monitor mode

The following table describes the display contents. The *) marked column indicates whether parameters can be changed during inverter operation (Y) or not (N).

| Function | Display contens | Standard setting | Parameter range | *) | Notes | Refer to |
|---|---|---|---|---|---|---|
| Frequency set value<br>Set value via O/OI<br>Set value via pot<br>Jogging mode<br>Multistage frequ. 1<br>...<br>Multistage frequ. 15 | *FS000.0 0.0Hz*<br>*TM000.0 0.0Hz*<br>*VR000.0 0.0Hz*<br>*JG000.0 0.0Hz*<br>*1S000.0 0.0Hz*<br>...<br>*15S000.0 0.0Hz* | 0.0Hz | 0.0~360.0Hz | Y | Set value is displayed on the left, actual value on the right. In the center an *F* indicates forward run and an *R* indicates reverse run.<br>*FS*: Now the set value can be entered.<br>*TMP*, *FSP*, *VRP*, *1P~15P*: PID control active | *d 01*<br>*F 01* |
| 1. Acceleration time | *ACC1 0010.0S* | 10.0s (15.0s) | 0.1~3000.0s | Y | | *F 02* |
| 1. Deceleration time | *DEC1 0010.0S* | | | | | *F 03* |
| Frequency source | *F-SET-SELECT TRM* | TRM | VR, TRM, REM | N | VR: Potentiometer<br>TRM: Input O/OI<br>REM: Remote operator | *A 01* |
| Run command source | *F/R-SELECT TRM* | TRM | TRM, REM | N | | *A 02* |
| Scaled output frequency | */Hz01.0 01.0* | 1.0 | 0.1~99.9 | Y | Display only | *d 07*<br>*b 86* |
| Motor current | *Im 0.0A 0.0%* | *Display only* | | - | Displays current in A (*left*) and % of rated current (*right*) | *d 02* |
| Magnetizing current | *I0 A* | Rated current * 0.58 | 0~32A | N | | *b 32* |
| Manual boost | *V-Boost Code<11>* | 11 | 00~99 | Y | | *A 42* |
| Manual boost frequency adjustment | *V-Boost F 10.0%* | 10% | 0.0~50% | Y | | *A 43* |
| Boost method | *V-Boost Mode 0* | 0 | 0. 1 | N | | *A 41* |
| Output voltage gain | *V-Gain 100%* | 100 | 50~100% | Y | | *A 45* |
| Jogging frequency | *Jogging 1.00Hz* | 1.0Hz | 0.5~9.99Hz | Y | | *A 38* |
| Jogging stop mode | *Jog Mode 0* | 0 | 0~2 | N | | *A 39* |
| Analog meter adjustm. | *ADJ 80* | 80 | 0~255 | Y | | *b 81* |
| Remote OPE-J display contents | *PANEL d01* | d 01 | 01~07 | Y | | *b 89* |
| Status of input and output terminals | *TERM LLL LLLLL* | *Display only* | | - | | *d 05*<br>*d 06* |
| Trip history register:<br>*ERR1*: Last trip<br>*ERR2*: Last trip but one<br>*ERR3*: Last trip but two | *ERR1 #*<br>*ERR1 OVER.V*<br>*ERR1 31.0Hz*<br>*ERR1 12.5A*<br>*ERR1 787.0Vdc*<br>*ERR1 RUN 000001H*<br>*ERR2 #*<br>*ERR3 #* | *Display only* | | - | No last trip message available<br>Displays type of trip (e.g. overvoltage)<br>Frequency at time of trip<br>Current at time of trip<br>Voltage between P and N at time of trip<br>Hours of operation at time of trip<br>Last trip but one / last trip but two not available (For other displays refer to *ERR1*) | *d 08* |
| Trip counter | *ERROR COUNT 25* | *Display only* | | - | Number of trips so far | - |

## The function mode

When the remote operator DOP or the copy unit DRW is connected to an L100 series inverter the parameters listed in the following table can be configured.

| Funct. No. | Function | Display | Standard setting -FE | Standard setting -FU | Parameter range | Refer to |
|---|---|---|---|---|---|---|
| F-00 | Base frequency | F-BASE 050Hz | 50Hz | 60Hz | 50~360 | A 03 |
| F-01 | Maximum frequency | F-MAX 050Hz | 50Hz | 60Hz | 50~360 | A 04 |
| F-02 | Start frequency | Fmin 0.5Hz | 0.5Hz | 0.5Hz | 0.5~9.9 | b 82 |
| F-03 | Motor voltage for AVR function | AVR AC 200V | 230/400V | 230/460V | 200, 220, 230, 240/380, 400, 415, 440, 460 | A 82 |
| | AVR function charcteristic | AVR MODE DOFF | DOFF | DOFF | ON, OFF, DOFF | A 81 |
| F-04 | Voltage/frequency characteristic | CONTROL VC | VC | VC | VC, VPI | A 44 |
| F-06 | 1. Acceleration time | ACC1 0010.0s | 10.0s | 10.0s | 0.1~3000 | F 02 |
| | Method to switch over from 1. to 2. accel/decel time | ACC CHG TM | TM | TM | TM, FRE | A 94 |
| | 2. Acceleration time | ACC2 0015.0s | 15.00s | 15.00s | 0.1~3000 | A 92 |
| | Accel.1 / Accel.2 switchover frequency | ACC CHFr 000.0Hz | 0.0Hz | 0.0Hz | 0~360 | A 95 |
| | Acceleration characteristic | ACC LINE L | L | L | L, S | A 97 |
| F-07 | 1. Deceleration time | DEC1 0010.0s | 10.0s | 10.0s | 0.1~3000 | F 03 |
| | 2. Deceleration time | DEC2 0015.0s | 15.0s | 15.0s | 0.1~3000 | A 93 |
| | Decel.1 / Decel.2 switchover frequency | DEC CHFr 000.0Hz | 0.0Hz | 0.0Hz | 0~360 | A 96 |
| | Deceleration characteristic | DEC LINE L | L | L | L, S | A 98 |
| F-10 | Operation method after FRS cancelled | RUN FRS ZST | ZST | ZST | fST, ZST | b 88 |
| F-11 | Multistage frequency setting 1 | SPD 1 005.0Hz | 0Hz | 0Hz | 0~360 | A 21 |
| | Multistage frequency setting 2 | SPD 2 005.0Hz | 0Hz | 0Hz | 0~360 | A 22 |
| | Same for multistage frequency settings 3 – 14 | | | | | A 23 ... A 34 |
| | Multistage frequency setting 15 | SPD15 005.0Hz | 0Hz | 0Hz | 0~360 | A 35 |
| F-20 | DC brake active / not active | DCB SW OFF | OFF | OFF | ON, OFF | A 51 |
| | DC brake frequency | DCB F 00.5Hz | 0.5Hz | 0.5Hz | 0.5~10 | A 52 |
| | DC brake waiting time | DCB WAIT 0.0s | 0.0s | 0.0s | 0~5 | A 53 |
| | DC brake braking torque | DCB V 000 | 0 | 0 | 0~100 | A 54 |
| | DC brake braking time | DCB T 00.0s | 0.0s | 0.0s | 0~60 | A 55 |
| F-22 | Allowable undervoltage failure time | IPS UVTIME 01.0s | 1.0s | 1.0s | 0.3~25 | b 02 |
| | Waiting time until retry | IPS WAIT 010.0s | 1.0s | 1.0s | 0.3~100 | b 03 |
| | Restart mode | IPS POWR ALM | ALM | ALM | ALM, FTP, RST, ZST | b 01 |
| F-23 | Electronic thermal characteristic | E-THM CHAR SUB | CRT | CRT | CRT, SUB | b 13 |
| | Electronic thermal protection current | E-THM LVL 16.50A | Rated current | Rated current | 50~120% of rated current | b 12 |

| Funct. No. | Function | Display | Standard setting -FE | Standard setting -FU | Parameter range | Refer to |
|---|---|---|---|---|---|---|
| F-24 | Overload limit current | OLOAD LVL 20.63A | Rated current *1,25 | Rated current *1,25 | 50~150% of rated current | b 22 |
| | Deceleration rate | OLOAD CONST 01.0 | 1.0 | 1.0 | 0.1~30 | b 23 |
| | Overload limit characteristic | OLOAD MODE ON | ON | ON | OFF, ON, CRT | b 21 |
| F-25 | Software lock mode | S-LOCK MD1 | MD1 | MD1 | MD0, MD1, MD2, MD3 | b 31 |
| F-26 | Frequency lower limit | LIMIT L 000.0Hz | 0Hz | 0Hz | 0~360 | A 62 |
| | Frequency upper limit | LIMIT H 000.0Hz | 0Hz | 0Hz | 0~360 | A 61 |
| F-27 | 1. jump frequency | JUMP F1 000.0Hz | 0Hz | 0Hz | 0~360 | A 63 |
| | 2. jump frequency | JUMP F2 000.0Hz | 0Hz | 0Hz | 0~360 | A 65 |
| | 3. jump frequency | JUMP F3 000.0Hz | 0Hz | 0Hz | 0~360 | A 67 |
| | 1. jump frequency width | JUMP W1 00.5Hz | 0.5Hz | 0.5Hz | 0~10 | A 64 |
| | 2. jump frequency width | JUMP W2 00.5Hz | 0.5Hz | 0.5Hz | 0~10 | A 66 |
| | 3. jump frequency width | JUMP W3 00.5Hz | 0.5Hz | 0.5Hz | 0~10 | A 68 |
| F-28 | STOP key locking | STOP-SW ON | ON | ON | ON, OFF | b 87 |
| F-31 | External frequency start point | IN EXS 000.0Hz | 0Hz | 0Hz | 0~360 | A 11 |
| | External frequency end point | IN EXE 000.0Hz | 0Hz | 0Hz | 0~360 | A 12 |
| | External frequency start point bias | IN EX%S 000% | 0% | 0% | 0~100 | A 13 |
| | External frequency end point bias | IN EX%E 100% | 100% | 100% | 0~100 | A 14 |
| | External frequency start pattern | IN LEVEL 0Hz | 0Hz | 0Hz | 0Hz/EXS | A 15 |
| | Analog input filter time constant | IN F-SAMP 8 | 8 | 8 | 1~8 | A 16 |
| F-32 | Arrival frequency FA2 for acceleration | ARV ACC 000.0Hz | 0Hz | 0Hz | 0~360 | C 42 |
| | Arrival frequency FA2 for deceleration | ARV DEC 000.0Hz | 0Hz | 0Hz | 0~360 | C 43 |
| F-33 | Level for overload signal | OV Load 16.50A | Rated current | Rated current | Rated current * 0~200% | C 41 |
| | Level of PID deviation | OV PID 003.0% | 3% | 3% | 0~100 | C 44 |
| F-34 | Function of digital input 1 | IN-TM 1 FW | FW | FW | For a description of parameters please refer to chapter 7 | C 01 |
| | Function of digital input 2 | IN-TM 2 RV | RV | RV | | C 02 |
| | Function of digital input 3 | IN-TM 3 CF1 | CF1 | AT | | C 03 |
| | Function of digital input 4 | IN-TM 4 CF2 | CF2 | USP | | C 04 |
| | Function of digital input 5 | IN-TM 5 RS | RS | RS | | C 05 |
| | Type of digital input 1 | IN-TM O/C-1 NO | NO | NO | NO, NC | C 11 |
| | Type of digital input 2 | IN-TM O/C-2 NO | | | | C 12 |
| | Type of digital input 3 | IN-TM O/C-3 NO | | | | C 13 |
| | Type of digital input 4 | IN-TM O/C-4 NO | | | | C 14 |
| | Type of digital input 5 | IN-TM O/C-5 NO | | | | C 15 |
| F-35 | Function of digital output 11 | OUT-TM 1 FA1 | FA1 | FA1 | RUN, FA1, FA2, OL, OD, AL | C 21 |
| | Function of digital output 12 | OUT-TM 2 RUN | RUN | RUN | | C 22 |
| | Type of alarm relay output | OUT-TM O/C-A NC | NC | NC | NO, NC | C 33 |
| | Digital output 11 type | OUT-TM O/C-1 NC | NC | NC | NO, NC | C 31 |
| | Digital output 12 type | OUT-TM O/C-2 NC | | | | C 32 |

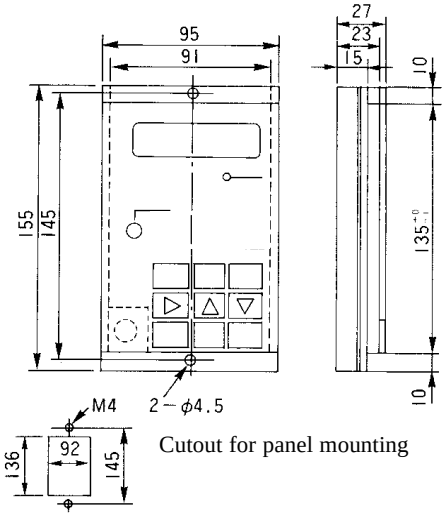
| Funct. No. | Function | Display | Standard setting -FE | Standard setting -FU | Parameter range | Refer to |
|---|---|---|---|---|---|---|
| F-36 | Carrier frequency | CARRIER 12.0kHz | 5.0kHz | 5.0kHz | 0.5~16 | *b 83* |
| F-37 | Function of FM terminal | MONITOR A-F | A-F | A-F | A-F, A, D-F | *C 23* |
| F-38 | National version | INIT SEL EUR | EUR | USA | EUR, USA | *b 85* |
| | Motor direction | INIT DOPE FWD | FWD | FWD | FWD, REV | *F 04* |
| | Initializing mode | INIT MODE TRP | TRP | TRP | TRP, DATA | *b 84* |
| F-43 | PID control active / not active | PID SW OFF | OFF | OFF | OFF, ON | *A 71* |
| | P (proportional) gain of PID control | PID P 1.0 | 1.0 | 1.0 | 0.2~5 | *A 72* |
| | I (integral) gain of PID control | PID I 001.0 | 1.0 | 1.0 | 0~150 | *A 73* |
| | D (differential) gain of PID control | PID D 000.0 | 0.0 | 0.0 | 0~100 | *A 74* |
| | Scale conversion of PID control | PID CONV 01.00 | 1.00 | 1.00 | 0.01~99.9 | *A 75* |
| | Feedback signal location | PID INPT CUR | CUR | CUR | CUR, VOL | *A 76* |

## Protective functions

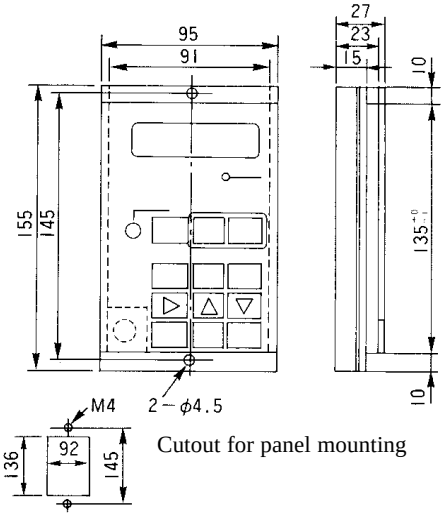
| Cause | Description | | Message |
|---|---|---|---|
| Overcurrent protection | When the output of the inverter is short circuited, the motor is locked, or a heavy load is suddenly applied, and the inverter output current exceeds a predetermined level, the inverter is shut off. | During constant speed | *OC. Drive* |
| | | Deceleration | *OC. Decel* |
| | | Acceleration | *OC. Accel* |
| | | At the others | *Over. C* |
| Overload protection | When a motor overload is detected by the electronic thermal function, the inverter is shut off | | *Over. L* |
| Overvoltage protection | When the inverter DC bus voltage exceeds a predetermined level due to regenerative energy from the motor, this trip occures and the inverter is shut off. | | *Over. V* |
| | 100s after the input power supply voltage has exceeded the allowable voltage limit, the output voltage will be switched off. | | *OV. SRC* |
| EEPROM error | When the inverter memory has a problem due to noise or excessive temperature rise, this trip occurs and the inverter is shut off. | | *EEPROM* |
| Undervoltage protection | A decrease of DC bus voltage may result in improper function of the control unit. It may also cause motor heating and low torque. The inverter is shut off when the DC bus voltage goes below a certain level. | | *Under. V* |
| CPU error | Malfunction or abnormality of the CPU. The inverter is shut off. | | *CPU1*<br>*CPU2* |
| External trip | A trip signal from external equipment shuts off the inverter. It is necessary to assign the external trip to an intelligent input terminal. | | *EXTERNAL* |
| USP error | Indicates an error when power is turned on while the inverter run is enabled (when USP function is selected). | | *USP* |
| Ground fault protection | The inverter is protected by detection of ground faults between the drive output and the motor at power on. Protection is for the inverter only and not for humans. | | *GND. Flt* |
| Thermal protection | When the temperature of the inverter module is beyond specification, the thermal sensor in the inverter module detects the temperature and the inverter is shut off. | | *OH FIN* |
| PTC error | When the resistance value of the external thermistor is too large, the equipment detects the abnormal condition of the thermistor and then shuts off the inverter (when PTC function is selected). | | *PTC* |

# Dimensions of accessories

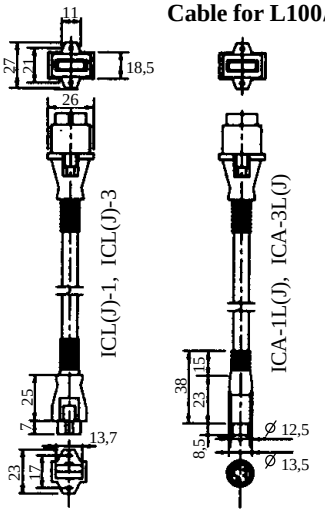
**Remote operator DOP-0A**



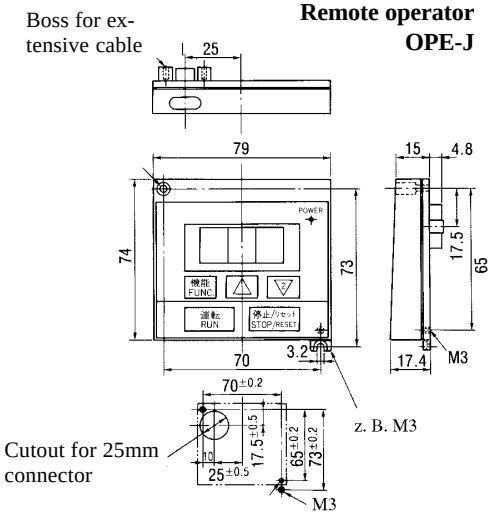

**Copy unit DRW-0A2**




**Cable for L100/J100/J300**



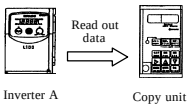
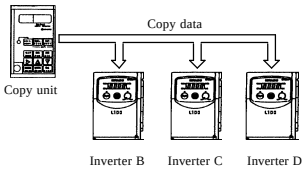

**Remote operator OPE-J**




The cables ICL(J)-1 and ICL(J)-3 are designed for connection to the remote operator OPE-J and the cables ICA-1L(J) and ICA-3L(J) are used for connection of a remote operator or copy unit to L100 and J100/J300 series inverters. The remote operator OPE-J can only be used for displaying data when connected to an L100 series inverter (also refer to the description of function *b 89* in chapter 8 of this manual). In this case only the STOP key of the OPE-J is available to the user while the rest of the keys do not have any function.

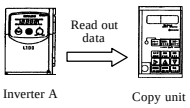
## Using the copy unit

The following table lists the steps that are necessary to copy the configuration (i.e. the parameters) to three other inverters B, C, and D:

| No. | Action | Key(s) | Result |
|---|---|---|---|
| 1 | The data stored in inverter A must be read out first of all. | READ |  |
| 2 | Switch off the input power to inverter A and remove the cable. | | |
| 3 | Connect the cable to inverter B and switch the power supply on. | | |
| 4 | The data stored in the copy unit will be copied to inverter B. | COPY *) |  |
| 5 | Switch off the input power to inverter B. *) | | |
| 6 | Carry out the actions described under items 3, 4, and 5 and use inverters C and D instead of inverter B. | | |

*) After having pressed the COPY key, wait for at least 6 seconds before pressing another key on the operator or before sending a reset command to the inverter. If an operator key is pressed or if a reset is sent to the inverter before this time has elapsed then the data may not be stored correctly.

The example described in the following table somewhat resembles the previous one, but here first a few parameters of inverter A are changed using the copy unit before the changed data are transferred to three other inverters B, C, and D.

| No. | Action | Key(s) | Result |
|---|---|---|---|
| 1 | Connect the cable and press the REMT key. Now change some inverter parameters using the copy unit. | MON, FUN, STR, Arrow keys |  |
| 2 bis 6 | Read out the data of inverter A (the data will then be stored into the copy unit). Now proceed as described in the previous example under items 2 through 6. You may also change some parameters beforehand if desired. | READ |  |

Notes:

- Data from L100 series inverters can only be copied using the copy unit DRW-0A2. The previous copy unit version DRW-0A can not be used for this purpose.
- The trip history monitor contents and the software lock configuration (F-25) cannot be copied using the copy unit.
- Never copy parameter settings of 200V series inverters to those from the 400V series (or the other way round). If settings are copied by mistake to inverters of a different input voltage rating then correct F-03.
- Never copy parameter settings from Japanese series inverters to those of the European or American version series (or the other way round)
- If the V/F characteristic parameter is copied to an inverter with a different maximum capacity (e.g. from L100-004NFE to L100-022NFE) so the parameters of functions F-23, F-24, and F-33 will have to be changed according to the maximum motor size.

# Chapter 14 – Service and warranty

Should you encounter any problems with your Hitachi inverter, please consult your local sales representative.

Please provide the following information about your inverter:

1) The exact inverter model name (this information can be found on the inverter nameplate next to *Model:*)
2) Date of purchase
3) Serial number (this information can be found on the inverter nameplate next to *MFG. No:*)
4) Exact description of the problems that occured in conjunction with the inverter.

If some of the information on the nameplate should be illegible please only supply the information that can be clearly read. To reduce non-operation time it is recommended to stock a spare inverter.

## Warranty

The warranty period for Hitachi inverters shall be under normal inverter installation and handling conditions twelve (12) months from the date of installation and eighteen (18) months from the date of production.

This warranty will not cover the following cases, even when the date the problem arises lies within the warranty period. In these cases the costs for service that the purchaser has ordered will be charged to the purchaser himself:

Inverter damage or malfunction which can be attributed to misoperation, inverter modifications done by the purchaser, improper repair, or excessively high power supply voltages.

Inverter damage or malfunction which were caused by the inverter falling down after its purchase.

Inverter damage or malfunction which were caused by fire, earthquake, water damages, lightning, pollution, or other natural disasters.

If service has been ordered by the purchaser at the inverter installation site, then all costs that arise will have to be taken over by the purchaser.

Please always keep this manual at hand.

# Appendix A – Printed form for user defined parameter settings

L100 series inverters provide many functions whose parameters can be set by the user. It is recommended that the parameters that have been set by the user be recorded to speed the investigation and repair in the event of a failure. You can use one of the “Set value” columns that have been provided in this chapter for your convenience.

If the information in the column “Function” should not provide a sufficient explanation you can still use the extensive function descriptions contained in chapter 8 “Using the digital operator”.

L100 ☐
Mfg.No ☐

} This information is written on the nameplate located on the right side of the L100 inverter.

| Display | Function | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| *F 01* | Frequency set value | 0.0 | | | | |
| *F 02* | Acceleration time 1 (in s) | 10.0 | | | | |
| *F 03* | Deceleration time 1 (in s) | 10.0 | | | | |
| *F 04* | Motor direction | 00 (forward) | | | | |

| Display | Function | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| *A 01* | Frequency set value source<br>00-Potentiometer 01-Input O/OI<br>02-Functions *F 01* / *A 20* | 01 | | | | |
| *A 02* | Run command source<br>01-Input FW/RV 02-RUN key | 01 | | | | |
| *A 03* | Base frequency | -FE: 50<br>-FU: 60 | | | | |
| *A 04* | Maximum frequency | | | | | |
| *A 11* | External frequency start point | 0 | | | | |
| *A 12* | External frequency end point | 0 | | | | |
| *A 13* | External frequency start point bias (in %) | 0 | | | | |
| *A 14* | External frequency end point bias (in %) | 100 | | | | |
| *A 15* | External frequency start pattern<br>00-According to *A 11* and *A 13* 01-0Hz | 01 | | | | |
| *A 16* | Analog input filter time constant | 8 | | | | |
| *A 20* | Frequency set value (*A 01* must be = 02) | 0.0 | | | | |
| *A 21* | 1. Multistage frequency setting | 0.0 | | | | |
| *A 22* | 2. Multistage frequency setting | 0.0 | | | | |
| *A 23* | 3. Multistage frequency setting | 0.0 | | | | |
| *A 24* | 4. Multistage frequency setting | 0.0 | | | | |
| *A 25* | 5. Multistage frequency setting | 0.0 | | | | |
| *A 26* | 6. Multistage frequency setting | 0.0 | | | | |
| *A 27* | 7. Multistage frequency setting | 0.0 | | | | |
| *A 28* | 8. Multistage frequency setting | 0.0 | | | | |
| *A 29* | 9. Multistage frequency setting | 0.0 | | | | |
| *A 30* | 10. Multistage frequency setting | 0.0 | | | | |
| *A 31* | 11. Multistage frequency setting | 0.0 | | | | |
| *A 32* | 12. Multistage frequency setting | 0.0 | | | | |
| *A 33* | 13. Multistage frequency setting | 0.0 | | | | |
| *A 34* | 14. Multistage frequency setting | 0.0 | | | | |
| *A 35* | 15. Multistage frequency setting | 0.0 | | | | |

| Display | Function | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| A 38 | Jogging frequency | 1.0 | | | | |
| A 39 | Jogging stop mode<br>00-Free run 01-Deceleration using decel. ramp<br>02-Deceleration using DC brake | 00 | | | | |
| A 41 | Boost selection method<br>00-Manual 01-Automatic | 00 | | | | |
| A 42 | Voltage rise with manual boost | 11 | | | | |
| A 43 | Manual boost frequency adjustment | 10.0 | | | | |
| A 44 | V/F characteristic<br>00-Constant torque<br>01-Reduced torque | 00 | | | | |
| A 45 | Output voltage gain (in %) | 100 | | | | |
| A 51 | DC brake active / not active<br>00-No, brake not used 01-Yes, brake used | 00 | | | | |
| A 52 | DC brake frequency | 0.5 | | | | |
| A 53 | DC brake waiting time | 0.0 | | | | |
| A 54 | DC brake braking torque | 0 | | | | |
| A 55 | DC brake braking time | 0.0 | | | | |
| A 61 | Frequency upper limit | 0.0 | | | | |
| A 62 | Frequency lower limit | 0.0 | | | | |
| A 63 | 1. Jump frequency | 0.0 | | | | |
| A 65 | 2. Jump frequency | 0.0 | | | | |
| A 67 | 3. Jump frequency | 0.0 | | | | |
| A 64 | 1. Jump frequency width | 0.5 | | | | |
| A 66 | 2. Jump frequency width | 0.5 | | | | |
| A 68 | 3. Jump frequency width | 0.5 | | | | |
| A 71 | PID control active 00-No 01-Yes | 00 | | | | |
| A 72 | P-gain of PID control | 1.0 | | | | |
| A 73 | I-gain of PID control | 1.0 | | | | |
| A 74 | D-gain of PID control | 0.0 | | | | |
| A 75 | Scale conversion of PID control | 1.00 | | | | |
| A 76 | Feedback signal location of PID control<br>00-Input OI 01-Input O | 00 | | | | |
| A 81 | AVR function 00-Active 01-Inactive<br>02-Inactive during deceleration | 02 | | | | |
| A 82 | Motor voltage for AVR function | -FE: 230/400<br>-FU: 230/460 | | | | |
| A 92 | 2. Acceleration time | 15.0 | | | | |
| A 93 | 2. Deceleration time | 15.0 | | | | |
| A 94 | Switchover from 1. to 2. accel/decel time method<br>00-Input 2CH 01-*A 95* / *A 96* | 00 | | | | |
| A 95 | Accel.1/Accel.2 switchover frequency | 0.0 | | | | |
| A 96 | Decel.1/Decel.2 switchover frequency | 0.0 | | | | |
| A 97 | Acceleration characteristic<br>00-Linear 01-S-curve | 00 | | | | |
| A 98 | Deceleration characteristic<br>00-Linear 01-S-curve | 00 | | | | |

| Display | Function | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| *b 01* | Restart mode<br>00-Trip message 01-0Hz start / start frequ. start<br>02-Synchronization to motor speed + acceleration<br>03-Synchronization to motor speed + deceleration | 00 | | | | |
| *b 02* | Allowable undervoltage failure time | 1.0 | | | | |
| *b 03* | Waiting time until retry | 1.0 | | | | |
| *b 12* | Electronic thermal protection current | Inverter rated current | | | | |
| *b 13* | Electronic thermal characteristic<br>00-Increased 01-Normal protection | 01 | | | | |
| *b 21* | Overload limit characteristic<br>00-Inactive 01-Active in any operating state<br>02-Inactive during acceleration, else active | 01 | | | | |
| *b 22* | Overload limit current | Rated current * 1,25 | | | | |
| *b 23* | Overload limit deceleration time | 1.0 | | | | |
| *b 31* | Software lock mode<br>00-initiated by input SFT; all functions locked<br>01-initiated by input SFT; function *F 01* usable<br>02-without input SFT; all functions locked<br>03- without input SFT; function *F 01* usable | 01 | | | | |
| *b 32* | Magnetizing current (*This function will be available from July 1998. The date on the name plate must read „9807“ or later.*) | Rated current * 0.58 | | | | |
| *b 81* | Analog meter adjustment on FM terminal | 80 | | | | |
| *b 82* | Start frequency | 0.5 | | | | |
| *b 83* | Carrier frequency (in kHz) | 5.0 | | | | |
| *b 84* | Initializing mode 00-Clears trip history register-<br>01-Reinstall factory parameter settings | 00 | | | | |
| *b 85* | National version (L100-...NFE/HFE = 01: Europe) | -FE:01 -FU:02 | | | | |
| *b 86* | frequency value for display using *d 07* | 1.0 | | | | |
| *b 87* | STOP key locking<br>00- STOP key always active 01- STOP key not active when terminals FW/RV are used | 00 | | | | |
| *b 88* | Operation method when FRS signal is cancelled<br>00-0 Hz restart 01-Using actual motor speed | 00 | | | | |
| *b 89* | Remote display contents<br>01-Actual frequency 02-Motor current<br>03-Running direction 04-PID-actual value<br>05-State of digital inputs 06-State of digital outputs 07-Scaled actual frequency | 01 | | | | |

| Display | Function | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| *C 01* | Function of digital input 1<br>00: FW (start/stop forward run) 01: RV (start/stop reverse run) 02: CF1 (1. multispeed)<br>03: CF2 (2. multispeed) 04: CF3 (3. multispeed)<br>05: CF4 (4. multispeed) 06: JG (jogging run)<br>09: 2CH (2. acceleration/deceleration)<br>11: FRS (free run stop) 12: EXT (external trip)<br>13: USP (restart prevention) 15: SFT (software lock) 16: AT (use input OI) 18: RS (reset)<br>19: PTC thermistor input (only digital input 5) | 00 | | | | |
| *C 02* | Funct. of digital input 2 (for params refer to *C 01*) | 01 | | | | |
| *C 03* | Funct. of digital input 3 (for params refer to *C 01*) | -FE:02 -FU:16 | | | | |
| *C 04* | Funct. of digital input 4 (for params refer to *C 01*) | -FE:03 -FU:13 | | | | |
| *C 05* | Funct. of digital input 5 (for params refer to *C 01*) | 18 | | | | |
| *C 11* | Type of digital input 1 00-n.o. contact 01-n.c. | 00 | | | | |
| *C 12* | Type of digital input 2 (for params refer to *C 11*) | 00 | | | | |
| *C 13* | Type of digital input 3 (for params refer to *C 11*) | 00 | | | | |
| *C 14* | Type of digital input 4 (for params refer to *C 11*) | -FE:00 -FU:01 | | | | |
| *C 15* | Type of digital input 5 (for params refer to *C 11*) | 00 | | | | |
| *C 21* | Function of digital output 11 00: RUN signal<br>01: FA1 (frequency arrival) 02: FA2 (frequency exceeded) 03: OL (overload) 04: OD (PID-de viation exceeded) 05: AL (alarm signal) | 01 | | | | |
| *C 22* | Function of digital output 12<br>(for parameters refer to *C 21*) | 00 | | | | |
| *C 23* | Function of FM terminal<br>00-Frequency (analog) 01-Motor current (analog)<br>02-Frequency (digital pulse signal) | 00 | | | | |
| *C 31* | Type of digital output 11 00-n.o. contact 01-n.c. | 01 | | | | |
| *C 32* | Type of digital output 12 00-n.o. contact 01-n.c. | 01 | | | | |
| *C 33* | Type of alarm relay output AL0/AL1<br>00-norm. open contact 01-norm. closed contact | 01 | | | | |
| *C 41* | Level for overload signal on outputs 11 and 12 | Rated current | | | | |
| *C 42* | Arrival frequency FA2 for acceleration | 0.0 | | | | |
| *C 43* | Arrival frequency FA2 for deceleration | 0.0 | | | | |
| *C 44* | Level of PID deviation (in % of max. set value) | 3.0 | | | | |

# Appendix B – Printed form for user defined parameter settings (remote operator)

L100 series inverters provide many functions whose parameters can be set by the user. It is recommended that the parameters that have been set by the user be recorded to speed the investigation and repair in the event of a failure. You can use one of the “Set value” columns that have been provided in this chapter for your convenience.

L100 ____

Mfg.No ____

This information is written on the nameplate located on the right side of the L100 inverter.

| Function (monitor mode) | Display | Standard setting | Set value | | | |
|---|---|---|---|---|---|---|
| Frequency set value | FS000.0 0.0Hz | 0.0Hz | | | | |
| Set value via O/OI | TM000.0 0.0Hz | - | *Display only, no params can be entered* | | | |
| Set value via potentiometer | VR000.0 0.0Hz | - | *Display only, no params can be entered* | | | |
| Jogging mode | JG000.0 0.0Hz | - | *Display only, no params can be entered* | | | |
| 1. Multistage frequency setting | 1S000.0 0.0Hz | 0.0Hz | | | | |
| 2. Multistage frequency setting | 2S000.0 0.0Hz | 0.0Hz | | | | |
| 3. Multistage frequency setting | 3S000.0 0.0Hz | 0.0Hz | | | | |
| 4. Multistage frequency setting | 4S000.0 0.0Hz | 0.0Hz | | | | |
| 5. Multistage frequency setting | 5S000.0 0.0Hz | 0.0Hz | | | | |
| 6. Multistage frequency setting | 6S000.0 0.0Hz | 0.0Hz | | | | |
| 7. Multistage frequency setting | 7S000.0 0.0Hz | 0.0Hz | | | | |
| 8. Multistage frequency setting | 8S000.0 0.0Hz | 0.0Hz | | | | |
| 9. Multistage frequency setting | 9S000.0 0.0Hz | 0.0Hz | | | | |
| 10. Multistage frequency setting | 10S000.0 0.0Hz | 0.0Hz | | | | |
| 11. Multistage frequency setting | 11S000.0 0.0Hz | 0.0Hz | | | | |
| 12. Multistage frequency setting | 12S000.0 0.0Hz | 0.0Hz | | | | |
| 13. Multistage frequency setting | 13S000.0 0.0Hz | 0.0Hz | | | | |
| 14. Multistage frequency setting | 14S000.0 0.0Hz | 0.0Hz | | | | |
| 15. Multistage frequency setting | 15S000.0 0.0Hz | 0.0Hz | | | | |
| 1. Acceleration time | ACC1 0010.0S | 10.0s (15.0s) | | | | |
| 1. Deceleration time | DEC1 0010.0S | 10.0s (15.0s) | | | | |
| Frequency source | F-SET-SELECT TRM | TRM | | | | |
| Run command source | F/R-SELECT TRM | TRM | | | | |
| Scaled output frequency | /Hz01.0 01.0 | 1.0 | | | | |
| Motor current | Im 0.0A 0.0% | - | *Display only, no params can be entered* | | | |
| Magnetizing current | I0 A | Rated current * 0.58 | | | | |
| Manual boost | V-Boost Code<11> | 11 | | | | |
| Manual boost frequency adjustment | V-Boost F 10.0% | 10% | | | | |
| Boost method | V-Boost Mode 0 | 0 | | | | |
| Output voltage gain | V-Gain 100% | 100% | | | | |
| Jogging frequency | Jogging 1.00Hz | 1.0Hz | | | | |
| Jogging stop mode | Jog Mode 0 | 0 | | | | |
| Analog meter adjustment | ADJ 80 | 80 | | | | |

| Function (monitor mode) | Display | Standard setting | Set value |
|---|---|---|---|
| Remote OPE-J display contents | *PANEL d01* | d01 | |
| Status of input and output terminals | *TERM LLL LLLLL* | - | *Display only, no params can be entered* |
| Trip history register: Last trip | *ERR1 #* | - | *Display only, no params can be entered* |
| | *ERR1 OVER.V* | - | |
| | *ERR1 31.0Hz* | - | |
| | *ERR1 12.5A* | - | |
| | *ERR1 787.0Vdc* | - | |
| | *ERR1 RUN 000001H* | - | |
| Trip counter | *ERROR COUNT 25* | - | *Display only, no params can be entered* |
| Trip history register: Last trip but one | *ERR2 #* | - | *Display only, no params can be entered* |
| | *ERR2 OC.Accel* | - | |
| | *ERR2 5.0Hz* | - | |
| | *ERR2 20.1A* | - | |
| | *ERR2 560.0Vdc* | - | |
| | *ERR2 RUN 000002H* | - | |
| Trip history register: Last trip but two | *ERR3 #* | - | *Display only, no params can be entered* |
| | *ERR3 EXTERNAL* | - | |
| | *ERR3 5.0Hz* | - | |
| | *ERR3 20.1A* | - | |
| | *ERR3 560.0Vdc* | - | |
| | *ERR3 RUN 000001H* | - | |

| Func. No. | Function (Function mode) | Display | Standard setting -FE | Standard setting -FU | Set value | | |
|---|---|---|---|---|---|---|---|
| F-00 | Base frequency | F-BASE 050Hz | 50Hz | 60Hz | | | |
| F-01 | Maximum frequency | F-MAX 050Hz | 50Hz | 60Hz | | | |
| F-02 | Start frequency | Fmin 0.5Hz | 0.5Hz | 0.5Hz | | | |
| F-03 | Motor voltagefor AVR function | AVR AC 200V | 230/400V | 230/460V | | | |
| | AVR function charcteristic | AVR MODE DOFF | DOFF | DOFF | | | |
| F-04 | Voltage/frequency characteristic | CONTROL VC | VC | VC | | | |
| F-06 | 1. Acceleration time | ACC1 0010.0s | 10.0s | 10.0s | | | |
| | Method to switch over from 1. to 2. accel/decel time | ACC CHG TM | TM | TM | | | |
| | 2. Acceleration | ACC2 0015.0s | 15.00s | 15.00s | | | |
| | Accel.1 / Accel.2 switchover frequency | ACC CHFr 000.0Hz | 0.0Hz | 0.0Hz | | | |
| | Acceleration characteristic | ACC LINE L | L | L | | | |
| F-07 | 1. Deceleration time | DEC1 0010.0s | 10.0s | 10.0s | | | |
| | 2. Deceleration time | DEC2 0015.0s | 15.0s | 15.0s | | | |
| | Decel.1 / Decel.2 switchover frequency | DEC CHFr 000.0Hz | 0.0Hz | 0.0Hz | | | |
| | Deceleration characteristic | DEC LINE L | L | L | | | |
| F-10 | Operation method after FRS cancelled | RUN FRS ZST | ZST | ZST | | | |
| F-11 | 1. Multistage frequency setting | SPD 1 005.0Hz | 0Hz | 0Hz | | | |
| | 2. Multistage frequency setting | SPD 2 005.0Hz | 0Hz | 0Hz | | | |
| | 3. Multistage frequency setting | SPD 3 005.0Hz | 0Hz | 0Hz | | | |
| | 4. Multistage frequency setting | SPD 4 005.0Hz | 0Hz | 0Hz | | | |
| | 5. Multistage frequency setting | SPD 5 005.0Hz | 0Hz | 0Hz | | | |
| | 6. Multistage frequency setting | SPD 6 005.0Hz | 0Hz | 0Hz | | | |
| | 7. Multistage frequency setting | SPD 7 005.0Hz | 0Hz | 0Hz | | | |
| | 8. Multistage frequency setting | SPD 8 005.0Hz | 0Hz | 0Hz | | | |
| | 9. Multistage frequency setting | SPD 9 005.0Hz | 0Hz | 0Hz | | | |
| | 10. Multistage frequency setting | SPD10 005.0Hz | 0Hz | 0Hz | | | |
| | 11. Multistage frequency setting | SPD11 005.0Hz | 0Hz | 0Hz | | | |
| | 12. Multistage frequency setting | SPD12 005.0Hz | 0Hz | 0Hz | | | |
| | 13. Multistage frequency setting | SPD13 005.0Hz | 0Hz | 0Hz | | | |
| | 14. Multistage frequency setting | SPD14 005.0Hz | 0Hz | 0Hz | | | |
| | 15. Multistage frequency setting | SPD15 005.0Hz | 0Hz | 0Hz | | | |
| F-20 | DC brake active / not active | DCB SW OFF | OFF | OFF | | | |
| | DC brake frequency | DCB F 00.5Hz | 0.5Hz | 0.5Hz | | | |
| | DC brake waiting time | DCB WAIT 0.0s | 0.0s | 0.0s | | | |
| | DC brake braking torque | DCB V 000 | 0 | 0 | | | |
| | DC brake braking time | DCB T 00.0s | 0.0s | 0.0s | | | |
| F-22 | Allowable undervoltage failure time | IPS UVTIME 01.0s | 1.0s | 1.0s | | | |
| | Waiting time until retry | IPS WAIT 010.0s | 1.0s | 1.0s | | | |
| | Restart mode | IPS POWR ALM | ALM | ALM | | | |
| F-23 | Electronic thermal characteristic | E-THM CHAR SUB | CRT | CRT | | | |
| | Electronic thermal protection current | E-THM LVL 16.50A | Rated current | Rated current | | | |
| F-24 | Overload limit current | OLOAD LVL 20.63A | Rated current *1,25 | Rated current *1,25 | | | |
| | Deceleration rate | OLOAD CONST 01.0 | 1.0 | 1.0 | | | |
| | Overload limit characteristic | OLOAD MODE ON | ON | ON | | | |
| F-25 | Software lock mode | S-LOCK MD1 | MD1 | MD1 | | | |

| Func. No. | Function (Function mode) | Display | Standard setting -FE | Standard setting -FU | Set value | | |
|---|---|---|---|---|---|---|---|
| F-26 | Frequency lower limit | LIMIT L 000.0Hz | 0Hz | 0Hz | | | |
| | Frequency upper limit | LIMIT H 000.0Hz | 0Hz | 0Hz | | | |
| F-27 | 1. jump frequency | JUMP F1 000.0Hz | 0Hz | 0Hz | | | |
| | 2. jump frequency | JUMP F2 000.0Hz | 0Hz | 0Hz | | | |
| | 3. jump frequency | JUMP F3 000.0Hz | 0Hz | 0Hz | | | |
| | 1. jump frequency width | JUMP W1 00.5Hz | 0.5Hz | 0.5Hz | | | |
| | 2. jump frequency width | JUMP W2 00.5Hz | 0.5Hz | 0.5Hz | | | |
| | 3. jump frequency width | JUMP W3 00.5Hz | 0.5Hz | 0.5Hz | | | |
| F-28 | STOP key locking | STOP-SW ON | ON | ON | | | |
| F-31 | External frequency start point | IN EXS 000.0Hz | 0Hz | 0Hz | | | |
| | External frequency end point | IN EXE 000.0Hz | 0Hz | 0Hz | | | |
| | External frequency start point bias | IN EX%S 000% | 0% | 0% | | | |
| | External frequency end point bias | IN EX%E 100% | 100% | 100% | | | |
| | External frequency start pattern | IN LEVEL 0Hz | 0Hz | 0Hz | | | |
| | Analog input filter time constant | IN F-SAMP 8 | 8 | 8 | | | |
| F-32 | Arrival frequency FA2 for acceleration | ARV ACC 000.0Hz | 0Hz | 0Hz | | | |
| | Arrival frequency FA2 for deceleration | ARV DEC 000.0Hz | 0Hz | 0Hz | | | |
| F-33 | Level for overload signal | OV Load 16.50A | Rated current | Rated current | | | |
| | Level of PID deviation | OV PID 003.0% | 3% | 3% | | | |
| F-34 | Function of digital input 1 | IN-TM 1 FW | FW | FW | | | |
| | Function of digital input 2 | IN-TM 2 RV | RV | RV | | | |
| | Function of digital input 3 | IN-TM 3 CF1 | CF1 | AT | | | |
| | Function of digital input 4 | IN-TM 4 CF2 | CF2 | USP | | | |
| | Function of digital input 5 | IN-TM 5 RS | RS | RS | | | |
| | Type of digital input 1 | IN-TM O/C-1 NO | NO | NO | | | |
| | Type of digital input 2 | IN-TM O/C-2 NO | NO | NO | | | |
| | Type of digital input 3 | IN-TM O/C-3 NO | NO | NO | | | |
| | Type of digital input 4 | IN-TM O/C-4 NO | NO | NO | | | |
| | Type of digital input 5 | IN-TM O/C-5 NO | NO | NO | | | |
| F-35 | Function of digital output 11 | OUT-TM 1 FA1 | FA1 | FA1 | | | |
| | Function of digital output 12 | OUT-TM 2 RUN | RUN | RUN | | | |
| | Type of alarm relay output | OUT-TM O/C-A NC | NC | NC | | | |
| | Digital output 11 type | OUT-TM O/C-1 NC | NC | NC | | | |
| | Digital output 12 type | OUT-TM O/C-2 NC | NC | NC | | | |
| F-36 | Carrier frequency | CARRIER 12.0kHz | 5.0kHz | 5.0kHz | | | |
| F-37 | Function of FM terminal | MONITOR A-F | A-F | A-F | | | |
| F-38 | National version | INIT SEL EUR | EUR | USA | | | |
| | Motor direction | INIT DOPE FWD | FWD | FWD | | | |
| | Initializing mode | INIT MODE | TRP | TRP | | | |
| F-43 | PID control active / not active | PID SW OFF | OFF | OFF | | | |
| | P (proportional) gain of PID control | PID P 1.0 | 1.0 | 1.0 | | | |
| | I (integral) gain of PID control | PID I 001.0 | 1.0 | 1.0 | | | |
| | D (differential) gain of PID control | PID D 000.0 | 0.0 | 0.0 | | | |
| | Scale conversion of PID control | PID CONV 01.00 | 1.00 | 1.00 | | | |
| | Feedback signal location | PID INPT CUR | CUR | CUR | | | |

# Appendix C – Initializing the inverter

If it becomes necessary to initialize the inverter (i.e. reset the inverter to the factory standard settings or just clearing the trip history register) you will have to do the following:

First refer to the nameplate to find out if the inverter is a European version (L100-####F**E**) or an American version (L100-####F**U**).

Then set the correct national version under *b 85* by entering the parameter 01 for the American version and parameter 02 for the European version.

Use function *b 84* to determine whether only the trip history register is to be cleared (parameter 00) or whether the inverter is to be reset to the factory standard settings (parameter 01). Then you will have to proceed as follows:

1) Simultaneously press the FUNC key and both direction (arrow) keys on the digital operator.
2) While holding down the mentioned keys press the STOP key for a short time and wait for about 3 seconds until the blinking message *d 00* is shown on the display.
3) Now release all keys again. The initializing phase that now begins will be complete as soon as the display *00* appears (output frequency display).

The inverter power supply must not be switched off before the initializing phase has been completed. Furthermore it is important to know that inverter initializing cannot be carried out with the remote operator, the copy unit, or the OPE-J operator being connected.