FREQUENCY INVERTER

Series   L2500

MANUAL

WATT DRIVE worldwide

WATT DRIVE ANTRIEBSTECHNIK GMBH
A-2753 Markt Piesting
Wöllersdorferstraße 68
Austria, EUROPE
Tel.: +43 / 2633 / 404-0
Fax: +43 / 2633 / 404-220
e-mail: watt@wattdrive.com
Web: www.wattdrive.com

WATT DRIVE NORD GmbH
Eickelstraße 4
D-59759 Arnsberg
Germany, EUROPE
Tel.: +49 / 2932 / 96 81-0
Fax: +49 / 2932 / 96 81-81
e-mail: info@wattdrive.de
Web: www.wattdrive.de

WATT DRIVE SÜD GmbH
Walkenmühleweg 49
D-72379 Hechingen
Germany, EUROPE
Tel.: +49 / 7471 / 9865-0
Fax: +49 / 7471 / 9865-29
e-mail: info@wattdrive-sued.de
Web: www.wattdrive-sued.de

WATT EURO-DRIVE (Far East) Pte Ltd
67B, Joo Koon Circle
Singapore 629082
Tel.: +65 / 686 22 220
Fax: +65 / 686 23 330
e-mail: watteuro@pacific.net.sg
Web: www.wattdrive.com

WATT EURO-DRIVE (Malaysia) Sdn Bhd
No. 17 Jalan Bulan U5/8
Bandar Pinggiran Subang 2
40150 Shah Alam
Selangor Darul Ehsan
Malaysia
Tel.: +603 / 785 91626, 785 91613
Fax: +603 / 785 91623
e-mail: watt_kl@tm.net.my
Web: www.wattdrive.com

BA.FBE.UR.023.001.07.03
L2500 Kurzanleitung dt/engl.

Please read this manual carefully before you install and operate an L2500 series inverter and observe all of the instructions given in there. This manual may also serve as a reference guide and therefore should always be kept at hand.

⚠ **DANGER!**

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.

⚠ **HAZARDOUS HIGH VOLTAGE!**
Motor control equipment or electronic controllers are connected to hazardous line voltages.
When servicing drives and electronic controllers there might exist exposed components with cases or 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.

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

⚠ **CAUTION!**
These instructions should be read and clearly understood before working on L2500 series equipment.

⚠ **DANGER!**
The user is responsible that all driven machinery, drive train mechanism not supplied by WATT Drive Antriebstechnik 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 personnel should a single point failure occur.

⚠ **DANGER!**
HAZARD OF ELECTRICAL SHOCK. DISCONNECT INCOMING POWER BEFORE WORKING ON THIS CONTROL.
Do not connect or disconnect wires and connectors while power is applied to the circuit. Maintenance must be performed by qualified technicians.

⚠ **DANGER!**
A charge may still remain in the DC-link capacitor with hazardous voltages even if the power has been turned off. To avoid personal injury, please ensure that power has turned off before operating AC drive and wait ten minutes for capacitors to discharge to safe voltage levels.

⚠ **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 WATT Drive.

L2500

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

⚠ **DANGER!**
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!**
There are highly sensitive MOS components on the printed circuit boards. These components are especially sensitive to static electricity. To avoid damage to these components, do not touch these components or the circuit boards with metal objects or your bare hands.

.⚠ **CAUTION!**
Ground the L2500 using the ground terminal.   The grounding method must comply with the laws of the country where the AC drive is to be installed. Refer to Basic Wiring Diagram (Chapter 3).

⚠ **CAUTION!**
The final enclosures of the AC drive must comply with EN50178. (Live parts shall be arranged in enclosures or located behind barriers that meet at least the requirements of the Protective Type IP20 - Main terminals or other hazardous terminals for any interconnection (terminals for connecting the motor, contact breaker, filter etc.) must be inaccessible after installation.. The top surface of the enclosures or barrier that is easily accessible shall meet at least the requirements of the Protective Type IP40). (L2500 series corresponds with this regulation.)

⚠ **CAUTION!**
The rated voltage of power system that is installed on AC drive must be equal to or less than 240 Volts (460V model is 480 Volts) and the current must be equal to or less than 5000A RMS.

⚠ **DANGER!**
The AC drive may be destroyed beyond repair if incorrect cables are connected to the input/output terminals. Never connect the AC drive output terminals U/T1, V/T2, and W/T3 directly to the AC main circuit power supply.

⚠ **CAUTION!**
Turn power on only when the DC-link capacitors are fully discharged.

⚠ **CAUTION!**
Heat sink may heat up over 70°C (158°F), during the operation. Do not touch the heat sink.

All of the above instructions, together with any other requirements, recommendations, and safety messages highlighted in this manual must be strictly complied with.
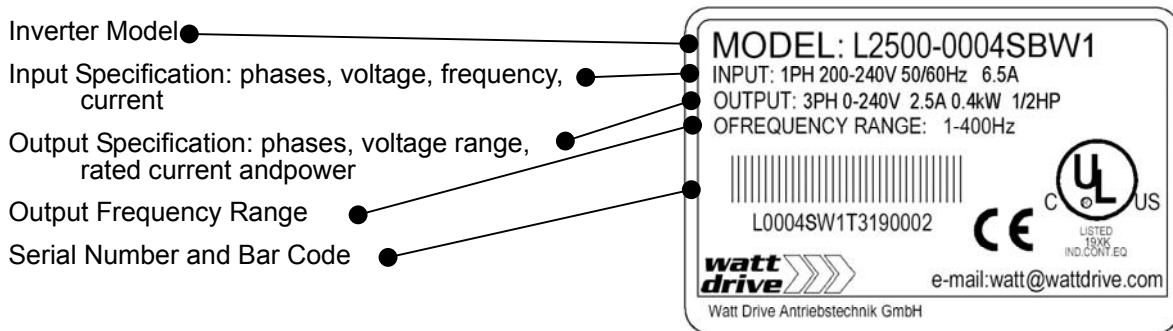
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CHAPTER 1   RECEIVING AND INSPECTION

This L2500 AC drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC motor drive, please check for the following:
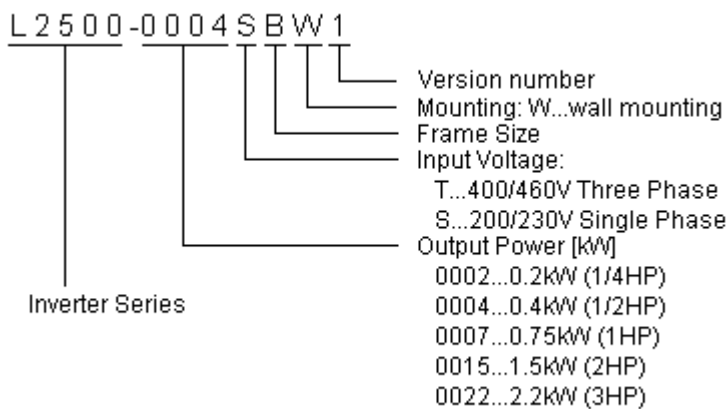
Receiving

✓ Check to make sure that the package includes an AC drive, the User Manual, and rubber bushings.

✓ Inspect the unit to insure it was not damaged during shipment.

✓ Make sure that the part number indicated on the nameplate corresponds with the part number of your order.

1.1 Nameplate Information   Example for 0.4kW / ½HP 200-240V AC drive

Inverter Model
Input Specification: phases, voltage, frequency, current
Output Specification: phases, voltage range, rated current and power
Output Frequency Range
Serial Number and Bar Code

MODEL: L2500-0004SBW1
INPUT: 1PH 200-240V 50/60Hz   6.5A
OUTPUT: 3PH 0-240V 2.5A 0.4kW 1/2HP
OFREQUENCY RANGE: 1-400Hz

L0004SW1T3190002

Watt Drive Antriebstechnik GmbH
e-mail:watt@wattdrive.com

1.2 Model Explanation

L 2 5 0 0 - 0 0 0 4 S B W 1

Version number
Mounting: W...wall mounting
Frame Size
Input Voltage:
   T...400/460V Three Phase
   S...200/230V Single Phase
Output Power [kW]
   0002...0.2kW (1/4HP)
   0004...0.4kW (1/2HP)
   0007...0.75kW (1HP)
   0015...1.5kW (2HP)
   0022...2.2kW (3HP)

Inverter Series

1.3 Serial Number Explanation

T 3 1 9 0 0 2

Production Number
Production Week
Production Year: 200**3**
Production Plant
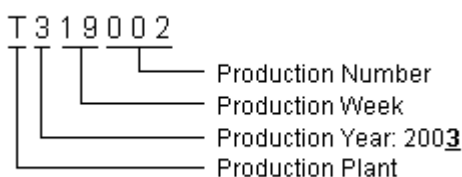
If there is any nameplate information not corresponding to your purchase order or any problem, please contact your supplier.

CHAPTER 2   STORAGE AND INSTALLATION

2.1 Storage

The AC drive should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC drive should be stored properly when it is not to be used over for an extended period of time. Some storage suggestions are:

Store in a clean and dry location free from direct sunlight or corrosive fumes.

Store within an ambient temperature range of -20°C to +60°C.

Store within a relative humidity range of 0% to 90% and non-condensing environment.

Store within an air pressure range of 86 kPa (0,86 bar) to 106kPa (1,06 bar).

2.2 Ambient Conditions

Operation

Air Temperature: -10°C to +40°C (14°F to 104°F),
Relative Humidity: 0% to 90%, no condensation allowed
Atmosphere pressure: 86 kPa (0,86 bar) to 106 kPa (1,06 bar).
Installation Site Altitude: below 1000m
Power de-rating at high Site Altitude:
        above 1.000m -1% per 100m (max. 3.000m)
Vibration: Maximum 9.80 m/s^2 (1G) at less than 20Hz

Maximum 5.88 m/s^2 (0.6G) at 20Hz to 50Hz

Storage

Temperature: -20°C to +60°C (-4°F to 140°F)
Relative Humidity: Less than 90%, no condensation allowed

Atmosphere pressure: 86 to 106 kPa

Transportation

Temperature: -20°C to +60°C (-4°F to 140°F)
Relative Humidity: Less than 90%, no condensation allowed
Atmosphere pressure: 86 kPa (0,86 bar) to 106 kPa (1,06 bar).
Vibration: Maximum 9.80 m/s^2 (1G) at less than 20Hz, Maximum 5.88 m/s^2 (0.6G) at 20Hz to 50Hz

Pollution Degree

2: good for a factory type environment.

2.3 Installation

Improper installation of the AC drive will greatly reduce its life.   Be sure to observe the following precautions when selecting a mounting location. **Failure to observe these precautions may void the warranty!**

* Do not mount the AC drive near heat-radiating elements or in direct sunlight.

* Do not install the AC drive in a place subjected to high temperature, high humidity, excessive vibration, corrosive gases or liquids, or airborne dust or metallic particles.

* Mount the AC drive vertically and do not restrict the air flow to the heat sink fins.

Non-Ventilated Enclosures

When selecting non-ventilated enclosures for the L2500 series, please consider the following minimum distance (L) from the drive sides (other than the front or back covers) to the enclosure internal surfaces or box internal volume. Estimated operating temperature of drive will be lower than 40° C. (Box depth assumed as 8 in.)

Drive model L2500	Power (kW)	L_1 (mm)	L_1 (inch)	L_2 (mm)	L_2 (inch)	Box Vol (m³)	Box Vol (ft³)
L2500-0002	0.2	50	2	250	10	0.085	3
L2500-0004	0.4	50	2	250	10	0.085	3
L2500-0007	0.75	50	2	250	10	0.085	3
L2500-0015	1.5	50	2	250	10	0.085	3
L2500-0022	2.2	50	2	250	10	0.133	4.7
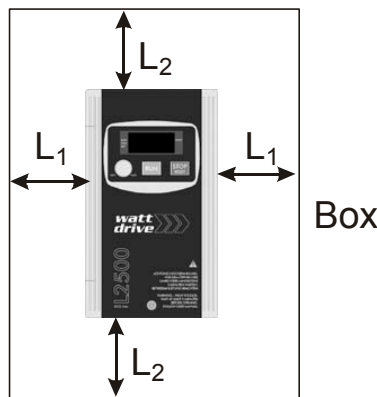
Distance L form Drive to enclosure

2.4 Connections

⚠	**DANGER**

Hazardous Voltage

Before accessing the AC drive:
- ◆ Disconnect all power to the AC drive.
- ◆ Wait ten minutes for DC bus capacitors discharge.

Any Electrical or mechanical modification to this equipment without prior written consent of WATT Drive GmbH. will void all warranties and may result in a safety hazard in addition to voiding the CE or UL listing.

Short Circuit Withstand:
The rated voltage of power system that is installed on AC drive must be equal to or less than 240 Volts (400/460V model is 480 Volts) and the current must be equal to or less than 5000A RMS.

📖 **General Wiring Information**

Applicable Codes

For installation in compliance with CE standards you must follow the instructions provided the section "EMC-wiring" in chapter 3.

All L2500 drives are Underwriters Laboratories, Inc. (UL) and Canadian Underwriters Laboratories (cUL) listed, and therefore comply with the requirements of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).WATT Drive GmbH also declare the conformity of all L2500 drives to CE standards.

Installation intended to meet the UL and cUL requirements must follow the instructions provided in "**Wiring Notes**" as a minimum standard. Follow all local codes that exceed UL and cUL requirements. Refer to the technical data label affixed to the AC drive and the motor nameplate for electrical data.

The "Line Fuse Specification" in Appendix B, lists the recommended fuse part number for each L2500 Series part number. These fuses (or equivalent) must be used on all installations where compliance with U.L. standards is a requirement.

2.5 Environments
Avoid rain and moisture,
Avoid direct sunlight,
Avoid corrosive gases or liquids,
Avoid airborne dust or metallic particles,
Avoid vibration,
Avoid magnetic interference,
Environment temperature: -10 ~ 50°C,
Environment humidity: below 90% RH,
Environment air pressure: 86 kpa ~ 106 kpa.

CHAPTER 3   WIRING

Notes on EMC (electro magnetical compatibility)

⚠ WARNING

This equipment should be installed, adjusted and serviced by qualified personnel familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.
When using L2500 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 L2500 inverter must conform to the conditions stated below. If one of the conditions mentioned is not satisfied then an appropriate L2500 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, L2500 motor filters should be installed. Directions for installing filters can be found in the L2500 installation manual.
- Seperate the mains circuit wiring from the wiring used for signals or process circuit. Please refer to the L2500 installation manual.

D) Installation
- For L2500 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.

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 20 m: Class „B"
- If maximum motor cable length is 65 m (50 m at 3~400/460V inverters):
   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.
   - Take care 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 control 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).

Cabinet installation of L2500 foot print filter:
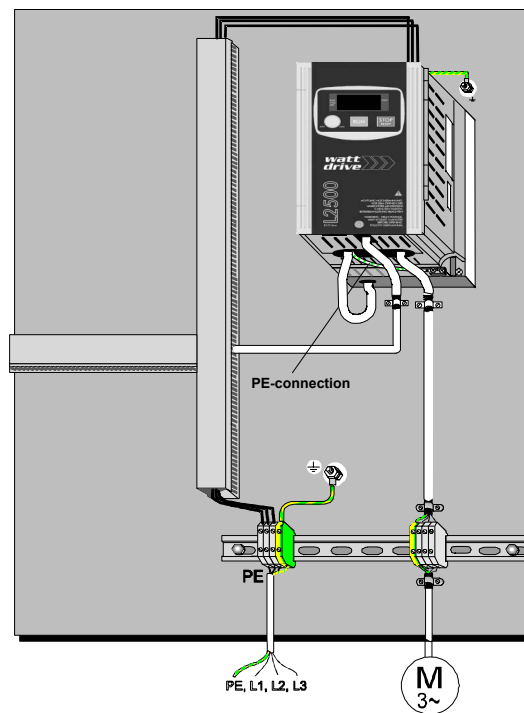
3.1 Basic Wiring Diagram

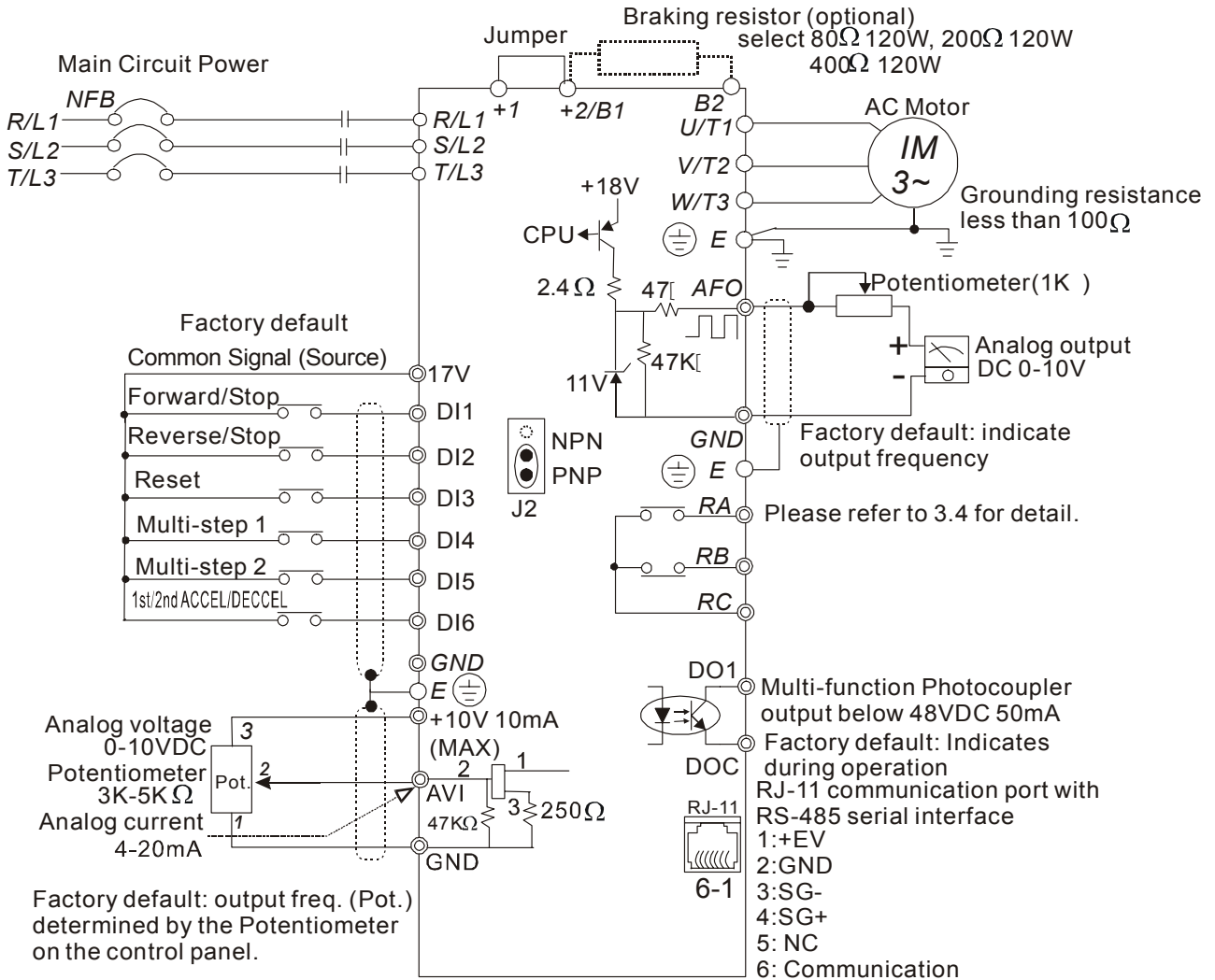Users must connect wiring according to the following circuit diagram shown below.
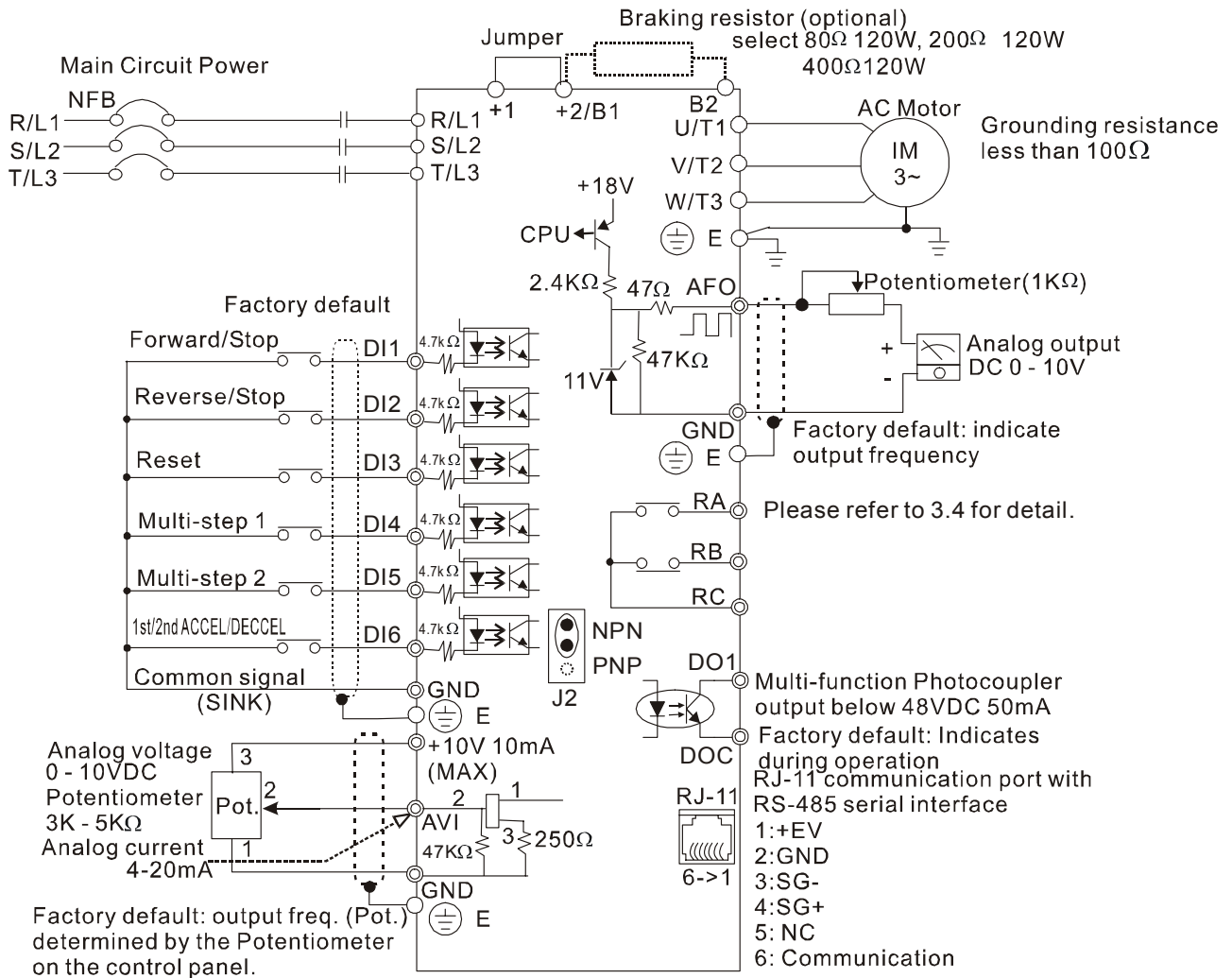
O Main circuit (power) terminals   ◎ Control circuit terminals   Shielded leads

NOTE: Do not plug in a Modem or telephone line to the RS-485 communication
port, permanent damage may result. Terminal 1 & 2 are the power
sources for the optional copy keypad and should not be used while
using RS-485 communication.
* If it is single phase model, please select any of the two input power
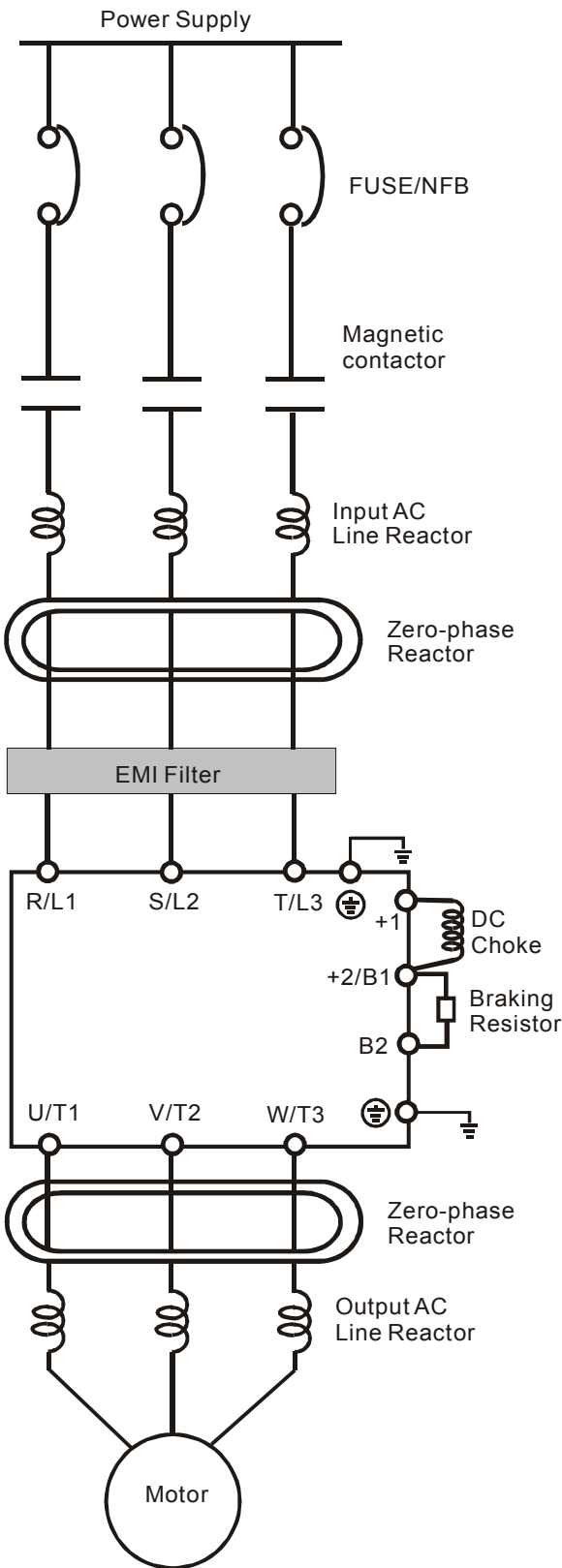terminals in main circuit power.

PNP (in source mode)

Main Circuit Power

Jumper

Braking resistor (optional)
select 80Ω 120W, 200Ω 120W
400Ω 120W

NFB

R/L1
S/L2
T/L3

R/L1   +1   +2/B1   B2
S/L2
T/L3

AC Motor

U/T1
V/T2
W/T3

IM
3~

Grounding resistance
less than 100Ω

+18V

CPU ◄

2.4Ω   47[AFO

11V   47K[

Factory default

Common Signal (Source)

Forward/Stop

Reverse/Stop

Reset

Multi-step 1

Multi-step 2

1st/2nd ACCEL/DECCEL

17V
DI1
DI2
DI3
DI4
DI5
DI6
GND
E

Potentiometer(1K)

+
−

Analog output
DC 0-10V

NPN
PNP
J2

GND
E

Factory default: indicate
output frequency

RA
RB
RC

Please refer to 3.4 for detail.

Analog voltage
0-10VDC
Potentiometer
3K-5KΩ
Analog current
4-20mA

3
Pot. 2
1

+10V 10mA
(MAX)

2   1
AVI
47KΩ   3 250Ω
GND

DO1

DOC

Multi-function Photocoupler
output below 48VDC 50mA

Factory default: Indicates
during operation

RJ-11 communication port with
RS-485 serial interface
1:+EV
2:GND
3:SG-
4:SG+
5: NC
6: Communication

RJ-11

6-1

Factory default: output freq. (Pot.)
determined by the Potentiometer
on the control panel.

○ Main circuit (power) terminals   ◎ Control circuit terminals   ⬚ Shielded leads

NOTE: Do not plug in a Modem or telephone line to the RS-485 communication
port, permanent damage may result. Terminal 1 & 2 are the power
sources for the optional copy keypad and should not be used while
using RS-485 communication.
* If it is single phase model, please select any of the two input power
terminals in main circuit power.

3.2 External Wiring

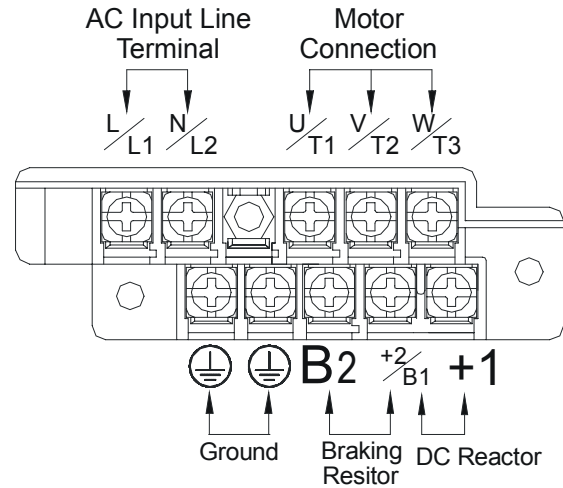| Items	Explanations
Power supply	Please follow the specific power supply requirement shown in APPENDIX-A.
Fuse/NFB (Optional)	There may be inrush current during power up. Please check the chart of APPENDIX B and select the correct fuse with rated current. NFB is optional.
Magnetic contactor (Optional)	Please do not use a Magnetic contactor as the I/O switch of the AC drive, this will reduce the operating life cycle of the AC drive.
Input AC Line Reactor (Optional)	In order to improve the input power factor, reduces harmonics and protection from AC line disturbances. (Surge, switching spike, power flick, etc.) AC line reactor should be installed when the power supply capacity is 500kVA or more and exceeds 6 times of the inverter capacity, or the wiring distance within 10m.
Zero-phase Reactor (Ferrite Core Common Choke) (Optional)	Zero phase reactors are used to reduce radio noise specify when the audio equipments installed near the inverter. Good effective for noise reduction on both the input and output sides. Attenuation quality is good in a wide range from AM band to 10Mhz.
EMI filter (Optional)	To reduce the electromagnetic interference. Please refer to Appendix B for detail.
DC Choke (Optional)	Please wire to the manufacturer's specification to avoid damage to the AC drive.
Braking Resistor (Optional)	Used to reduce stopping time of the motor. Please refer to the chart on Appendix B for specific Braking Resistors.
Output AC Line Reactor (Optional)	Motor surge voltage amplitudes depending on the motor cable length. For long motor cable application, it is necessary installed

3.3 Main Circuit Wiring

1. Main Circuit Terminals

Power terminal
(3x460V Series)
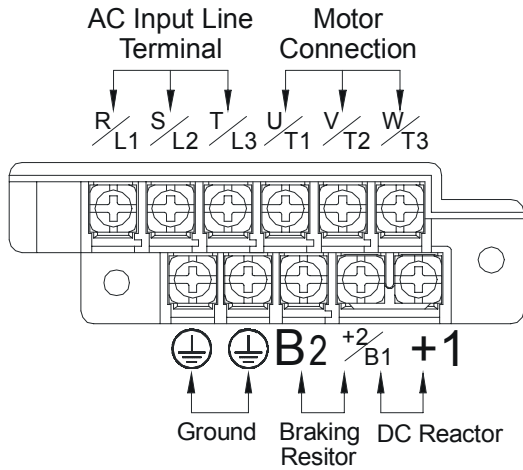
Power terminal
(1~230V Series)

2. Terminal Explanations

Terminal Symbol	Explanation of Terminal Function
R/L1, S/L2, T/L3	AC line input terminals (three phase)
L/L1, N/L2	AC line input terminals (single phase)
U/T1, V/T2, W/T3	Motor connections
+2/B2 – B1	Connections for Braking Resistor (optional)
+2/+1 – B1	Connections for DC Link Reactor (optional)
⏚	Earth Ground

3. Terminal Dimensions

Model L2500	1 ~ 0.2 kW; 0.4 kW;0.75 kW; 3 ~ 0.4 kW; 0.75 kW;	1 ~ 1.5 kW; 2.2 kW; 3 ~ 1.5 kW; 2.2 kW;
Terminal Specification (Terminal φ)	M3.5	M4

3.4 Control Terminal Wiring (Factory Setting)

1.   Terminal Explanations:

Wire Gauge: 16-24 AWG
Wire Type: Copper Only
Torque: 0,2Nm (1.7in-lbf)
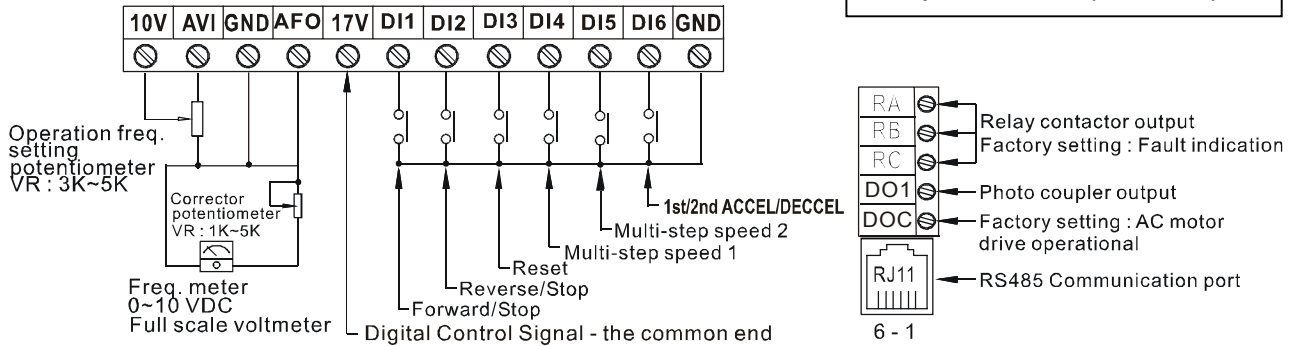
Terminal symbols	Terminal name	Remarks
RA-RC	Multi-Function Indication Output Contact	Refer to Pr.3-06 Relay output contact Resistor Load
RB-RC	Multi-Function Indication Output Contact	5A(N.O.)/3A(N.C.) 240VAC 5A(N.O.)/3A(N.C.) 24VAC Inductive Load 1.5A(N.O.)/0.5A(N.C.) 240VAC 1.5A(N.O.)/0.5A(N.C.) 24VDC Refer to Pr.3-01 to Pr.03-03
DO1-DOC	Multi-function photo coupler output	Refer to Pr.3-05
RJ-11	Serial communication port	RS-485 serial communication interface
10V-GND		Power Supply (+10 V)
AVI-GND	Analog voltage/current freq. command	0 to +10 V (Max. Output Frequency) Input or 4 to 20mA (Max. Output Frequency) Input
AF0-GND	Analog frequency/current meter	0 to +10 V (Max. output Frequency) Output
DI1-GND	Multi-function auxiliary input	Refer to Pr.4-04 to Pr.4-08
DI2-GND	Multi-function input 1	
DI3-GND	Multi-function input 2	
DI4-GND	Multi-function input 3	
DI5-GND	Multi-function input 4	
DI6-GND	Multi-function input 5	
17V	Digital Control Signal – the common end	

Note: Use twisted-shielded, twisted-pair or shielded-lead wires for the control signal wiring. It is recommended to run all signal wiring in a separate steel conduit. The shield wire should only be connected at the drive. Do not connect shield wire on both ends.

3.5 Wiring Notes

1. ⚠ **CAUTION:** Do not connect the AC input to any of the U/T1, V/T2, W/T3 terminals, as it will damage the AC drive.

2. ⚠ **WARNING:** Ensure all screws are tightened to the proper torque rating.

3. During installation, follow all local electrical, construction, and safety codes for the country the drive is to be installed in.

4. Ensure that the appropriate protective devices (circuit breaker or fuses) are connected between the power supply and AC drive.

5. Make sure that the leads are connected correctly and the AC drive is properly grounded. (Ground resistance should not exceed 100 Ω.   For 460V-class AC drive, the ground resistance should not exceed 10 Ω.)

6. Use ground leads that comply with EN and/or AWG/DOC standards and keep them as short as possible.

7. Multiple L2500 units can be installed in one location.   All the units should be grounded directly to a common ground terminal. The L2500 ground terminals may also be connected in parallel, as shown in the figure below.   **Ensure there are no ground loops.**
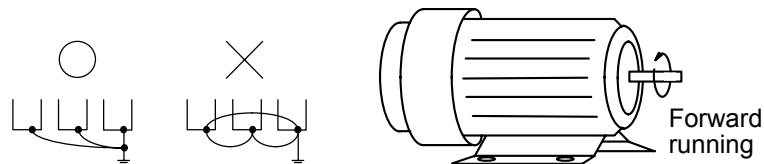
8. When the AC drive output terminals U/T1, V/T2, and W/T3 are connected to the motor terminals U/T1, V/T2, and W/T3, respectively, the motor will rotate counterclockwise (as viewed from the shaft ends of the motor) when a forward operation command is received. To reverse the direction of motor rotation, switch over any of the two motor leads.

9. Make sure that the power source is capable of supplying the correct voltage and required current to the AC drive.

10. Do not attach or remove wiring when power is applied to the AC drive.

11. Do not monitor the signals on the circuit board while the AC drive is in operation.

12. For the single-phase applications, the AC input line can be connected to any two of the three input terminals R/L1, S/L2, T/L3.

    Note: This drive is not intended for the use with single-phase motors.

13. Route the power and control wires separately, or at 90°angle to each other.

14. If a filter is required for reducing EMI (Electro Magnetic Interference), install it as close as possible to AC drive. EMI can also be reduced by lowering the Carrier Frequency.

15. If the AC drive is installed in the place where a load reactor is needed, install the filter close to U/T1, V/T2, W/T3 side of AC drive. Do not use a Capacitor or L-C Filter (Inductance-Capacitance) or R-C Filter (Resistance-Capacitance).

16. When using a GFCI (Ground Fault Circuit Interrupt), select current sensor with not less than 200mA, and not less than 0.1-second detection to avoid nuisance tripping
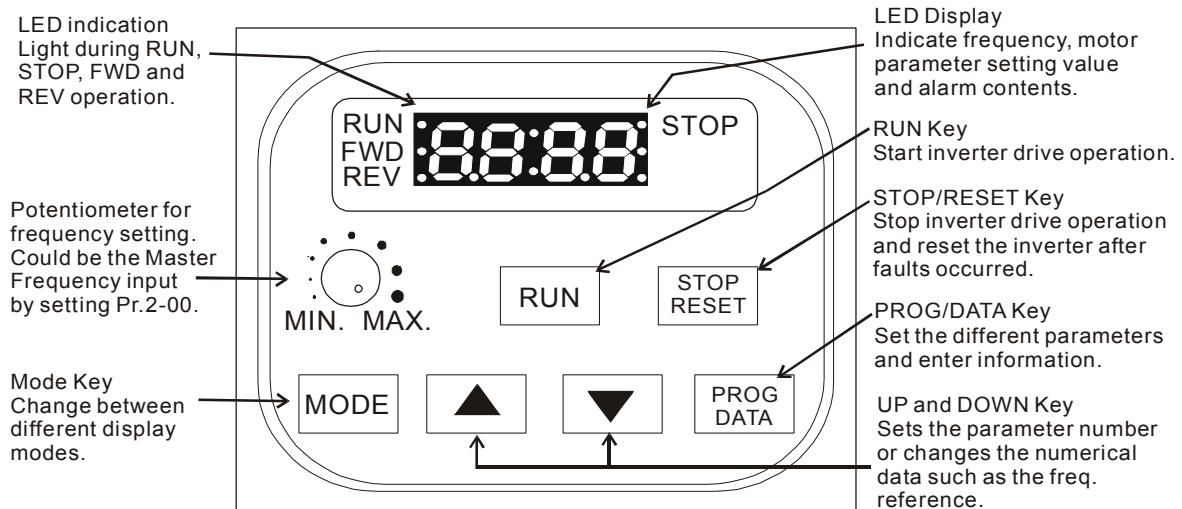
3.6 Motor Operation Precautions

1. When using the AC drive to operate a standard 3-phase induction motor, notice that the energy loss is greater than an inverter duty motor.

2. While using the standard induction motor at low speed, the temperature of the motor may rise, so do not operate the motor at low speed for a long period of time.

3. When the standard motor operates at low speed, the motor output torque will decrease, please decrease the load during the operation.

4. If 100% output torque is desired at low speed operation, it may be necessary to use a special motor that can handle this load (inverter duty).

CHAPTER 4   DIGITAL KEYPAD OPERATION

4.1 Description of Digital Keypad

This digital keypad includes two parts: Display panel and keypad.   Display panel provides the parameter display and shows operation status of the AC drive. Keypad provides programming interface between users and AC drives.

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LED indication Light during RUN, STOP, FWD and REV operation.

LED Display Indicate frequency, motor parameter setting value and alarm contents.

RUN FWD REV   STOP

Potentiometer for frequency setting. Could be the Master Frequency input by setting Pr.2-00.

MIN. MAX.

RUN Key Start inverter drive operation.

STOP/RESET Key Stop inverter drive operation and reset the inverter after faults occurred.

RUN   STOP RESET

Mode Key Change between different display modes.

MODE   ▲   ▼   PROG DATA

PROG/DATA Key Set the different parameters and enter information.

UP and DOWN Key Sets the parameter number or changes the numerical data such as the freq. reference.

MODE

Mode
By pressing the "mode" key repetitively, the display will show status at the AC drive such as the reference frequency, output frequency, and output current.

PROG DATA

PROG/ DATA
Pressing the "PROG/DATA" key will store entered data or can show factory stored data.

RUN

Run
Start the AC drive operation.   This key has no function when the drive is controlled by the External Control Terminals.

STOP RESET

Stop / Reset
Stop AC drive operation. If the drive stops due to a fault, correct the fault first, then press this key to reset the drive.

▲
▼

Up / Down
Press the "Up" or "Down" keys momentarily to change parameter settings. These keys may also be used to scroll through different operating values or parameters. Pressing the "Up" or "Down" key momentarily, will change the parameter settings in single-unit increments. To quickly run through the range of settings, press down and hold the key.

4.2 Explanations of Display Messages

Display Message	Descriptions
F60.0	The AC drive Master Frequency
H60.0	The Actual Operation Frequency present at terminals U/T1, V/T2, and W/T3.
A 5.0	The output current present at terminals U/T1, V/T2, and W/T3
ub00.	The custom unit (u), where u = H x Pr 0-05.
C 999	The counter value (C)
I=5.0	The internal PLC process step currently being performed.
U3 10	The DC−BUS voltage
E220	The output voltage
0-	The specified parameter group
0-00	The specified parameter
d 0	The actual value stored within the specified parameter.
Frd	AC drive forward run status
rEu	AC drive reverse run status
End	"End" displays for approximately 0.5 second if input has been accepted. After a parameter value has been set, the new value is automatically stored in memory. To modify an entry, use the ▲ and ▼ keys.
Err	"Err" displays, if the input is invalid.

4.3 Explanation of LED Indicators

Stop AC drive when STOP
button has been pressed.

RUN
FWD
REV
STOP

REV LED lights during reverse operation.
FWD LED lights during forward operation.
RUN LED lights during RUN operation.
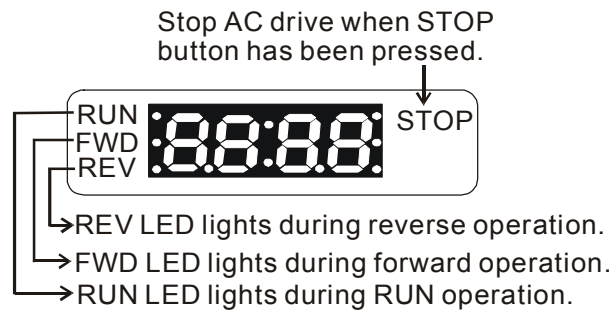
1. Description of LED functions of RUN and STOP

Output frequency
of the AC motor
drive

STOP
RESET KEY

RUN KEY

STOP
RESET KEY

Frequency
command

RUN Indication	●	☼	☼	◐	●
STOP Indication	☼	◐	●	☼	☼

☼ Light   ◐ Flash   ● Dark
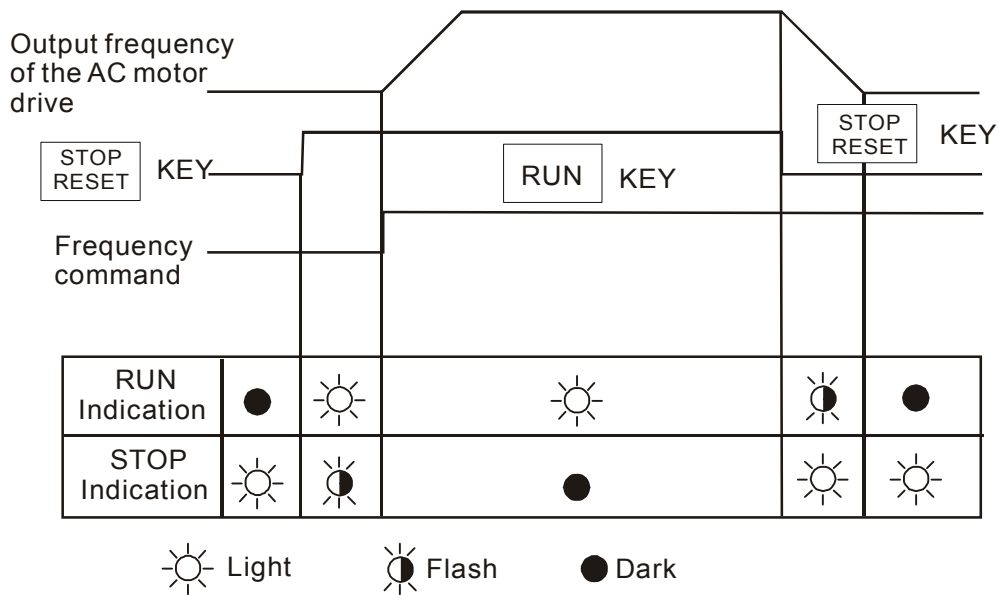
2. Description of LED functions of FWD and REV.

Output frequency
of the AC drive

FWD

REV

RUN

FWD

REV

RUN Indication	☼	☼	◐	●	☼	☼
STOP Indication	●	●	☼	☼	◐	◐

☼ Light   ◐ Flash   ● Dark
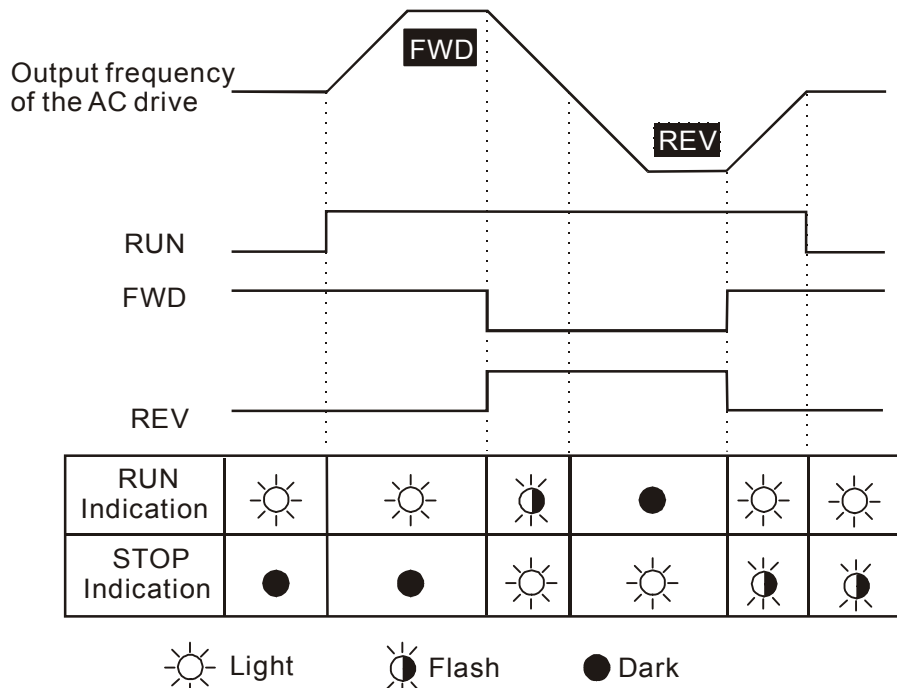
4.4 Keypad Operation
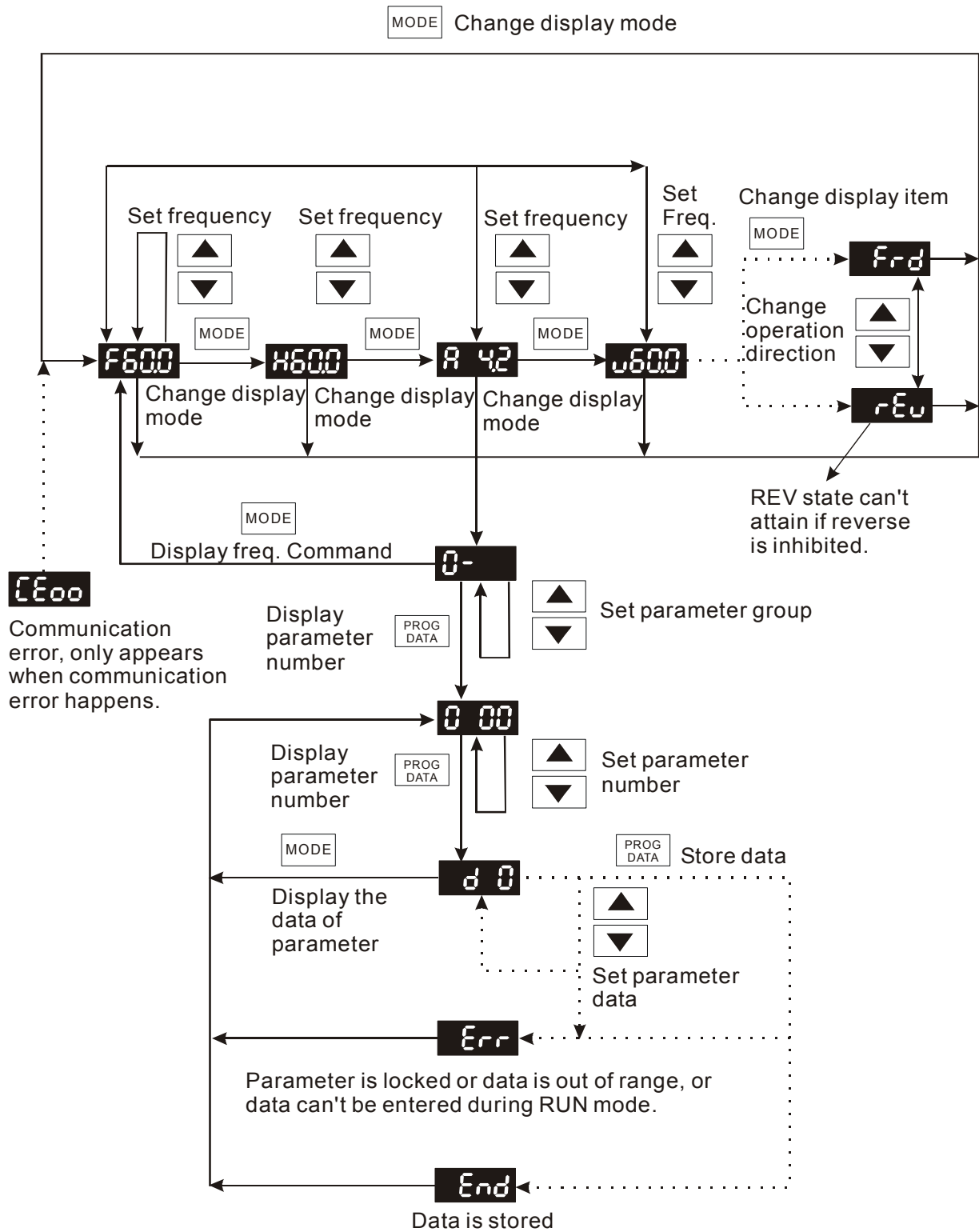
CHAPTER 5' – Quick Start Guide

The parameters of the inverter drives V2500 are pre-set by factory to application based values that usually occur in standard environment.

When following the Warnings in the Introduction of this manual and the storage and installation guidelines in chapter 2 as well as the wiring notes in chapter 3, the start-up will usually be executed in very short time because of the parameters factory settings.

Some parameters that maybe are still necessary to have an eye on are listed right here below. The complete list of parameters for preparing the inverter for your special applications' requirements can be found in chapter 8 of this manual or – as detailed description - in the long version of the manual, available for download at www.wattdrive.com.

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Groupe 0: User Parameters

Groupe 1: Basic Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
1-00	Maximum Output Freq.	d50.0 to d400 Hz	d50.0	
1-01	Maximum Voltage Frequency (Base Freq)	d10.0 to d400 Hz	d50.0	
1-02	Maximum Output Voltage	d2.0V to d255V*	d230 / d400	
1-09	Acceleration Time 1 (Tacc1) ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-10	Deceleration Time 1 (Tdec1) ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	

Groupe 2: Operation Method Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
2-00	Source of Frequency Command	d0: Master Frequency input determined by digital keypad. (record the frequency of power loss and it can do analog overlap plus) d1: Master Frequency determined by analog signal DC 0V-10V (external terminal AVI). (won't record the frequency of power loss and it can't do analog overlap plus) d2: Master Frequency determined by analog signal DC 4mA - 20mA (external terminal AVI). (won't record the frequency of power loss and it can't do analog overlap plus) d3: Master Frequency determined by Potentiometer on the digital keypad. (won't record the frequency of power loss and it can do analog overlap plus) d4: Master Frequency operated by RS-485 serial communication interface. (record the frequency of power loss and it can do analog overlap plus) d5: Master Frequency operated by RS-485 serial communication interface. (won't record the frequency of power loss and it can do analog overlap plus)	d1	
2-01	Source of Operation Command	d0: by Digital Keypad d1: by external terminals, keypad STOP enabled d2: by external terminals, keypad STOP disabled d3: by RS-485 communication interface, keypad STOP enabled d4: by RS-485 communication interface, keypad STOP disabled	d1	

Groupe 3: Output Function Parameters

Groupe 4: Input Function Parameters

Para-meter	Explanation		Settings	Factory Setting	Actual Setting
4-00	Potentiometer Bias Frequ.	◈	d 0.0 to d 100.0%	d0.0	
4-01	Potentiometer Bias Polarity	◈	d0: Positive Bias d1: Negative Bias	d0	
4-02	Potentiometer Frequency Gain	◈	d1 to d200 %	d100	

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
4-03	Potentiometer Reverse Motion Enable	d0: Forward Motion Only d1: Reverse Motion enabled	d0	
4-04	Multi-Function Digital Input Terminal 1 (DI1, DI2)	d0: Parameter Disable d1: DI1=FWD/STOP, DI2=REV/STOP d2: DI1=FWD/REV, DI2=RUN/STOP d3: 3-wire Operation Control Mode	d1	
4-05	Multi-Function Digital Input Terminal 2 (DI3)	d4: E.F. External Fault Input (N.O.) d5: E.F. External Fault Input (N.C.) d6: Reset d7: Multi-Step Speed Command 1 d8: Multi-Step Speed Command 2	d6	
4-06	Multi-Function Digital Input Terminal 3 (DI4)	d9: Multi-Step Speed Command 3 d10: Jog Operation d11: Acceleration/deceleration Speed Inhibit (Suspend Acc./Dec.) d12: First or Second Acceleration/ deceleration Time Selection	d7	
4-07	Multi-Function Digital Input Terminal 4 (DI5)	d13: Base-Block (B.B.) (N.O.) d14: Base-Block (B.B.) (N.C.) d15: Increase Master Frequency d16: Decrease Master Frequency d17: Run PLC Program	d8	
4-08	Multi-Function Digital Input Terminal 5(DI6)	d18: Pause PLC Program d19: Counter Trigger Signal d20: Counter Reset d21: Select ACI / Deselect AVI d22: Disable PID function d23: JOG FWD d24: JOG REV d25: The source of master frequency is AVI. d26: The source of master frequency is ACI.	d12	

Groupe 5: Multi-Step Speed and PLC Parameters

Groupe 6: Protection Parameters

Groupe 7: Motor Parameters

7-00	Motor Rated Current	◈d30 to d120% (% of Drive's Rated Current)	d85	
7-01	Motor No-Load Current	d0 to d90% (% of Drive's Rated Current)	d50	

Groupe 8: Special Parameters

Groupe 9: Communication Parameters

Groupe A: PID Control Parameters

CHAPTER 6   MAINTENANCE AND INSPECTIONS

Modern AC drives are based on solid state electronics technology, preventive maintenance is required to operate this AC drive in its optimal condition, and to ensure a long life.   It is recommended to perform a monthly check up of the AC drive by a qualified technician.   Before the check up, always turn off the AC Input Power to the unit.   Wait at least 10 minutes after all display lamps have gone out, and then confirm that the capacitors have fully discharged by measuring the voltage between B1 and Ground using a multimeter set to measure DC.

6.1 Periodic Inspection

Basic check up items to detect if there were any abnormality during the operation.

1.   Whether the motors are operating as expected.

2.   Whether the installation environment is abnormal.

3.   Whether the cooling system is operating as expected.

4.   Whether any irregular vibration or sound occurred during the operation.

5.   Whether the motors are overheated during the operation.

6.   Always check the input voltage of the AC drive with Voltmeter.

6.2 Periodic Maintenance

⚠ **WARNING!** Disconnecting AC power before processing!

1.   Tighten and reinforce the screws of the AC drive if necessary, cause it may loose due to the vibration or changing of temperatures.

2.   Whether the conductors or insulators were corroded and damaged.

3.   If use of the AC drive is discontinued for a long period of time, turn the power on at least once every two years and confirm that it still functions properly. To confirm functionality, disconnect the motor and energize the AC drive for 5 hours or more before attempting to run a motor with it.

4.   Clean off any dust and dirt with a vacuum cleaner.   Place special emphasis on cleaning the ventilation ports and PCBs.   Always keep these areas clean, as accumulation of dust and dirt can cause unforeseen failures.

CHAPTER 7   TROUBLESHOOTING AND FAULT INFORMATION

The L2500 AC drive has a comprehensive fault diagnostic system that includes several different alarms and fault messages. Once a fault is detected, the corresponding protective functions will be activated. The following faults are displayed as shown on the AC drive digital keypad panel.   The three most recent faults can be read on the digital keypad display by viewing Pr.6-08 to Pr.6-10.

NOTE: faults can be cleared by a reset from the keypad or Input Terminal.

Common Problems and Solutions:

Fault Name	Fault Descriptions	Corrective Actions
OC	The AC drive detects an abnormal increase in current.	1. Check whether the motors horsepower corresponds to the AC drive output power. 2. Check the wiring connections between the AC drive and motor for possible short circuits. 3. Increase the Acceleration time (Pr.1-09, Pr.1-11). 4. Check for possible excessive loading conditions at the motor. 5. If there are any abnormal conditions when operating the AC drive after short-circuit being removed, it should be sent back to manufacturer.
Ou	The AC drive detects that the DC bus voltage has exceeded its maximum allowable value.	1. Check whether the input voltage falls within the rated AC drive input voltage. 2. Check for possible voltage transients. 3. Bus over-voltage may also be caused by motor regeneration. Either increase the decel time or add an optional braking resistor. 4. Check whether the required braking power is within the specified limits.
oH	The AC drive temperature sensor detects excessive heat.	1. Ensure that the ambient temperature falls within the specified temperature range. 2. Make sure that the ventilation holes are not obstructed. 3. Remove any foreign objects on the heatsinks and check for possible dirty heat-sink fins. 4. Provide enough spacing for adequate ventilation.
Lu	The AC drive detects that the DC bus voltage has fallen below its minimum value.	Check whether the input voltage falls within the rated AC drive's input voltage.

Fault Name	Fault Descriptions	Corrective Actions
oL	The AC drive detects excessive drive output current. Note: The AC drive can withstand up to 150% of the rated current for a maximum of 60 seconds.	1. Check whether the motor is overloaded. 2. Reduce torque compensation setting as set in Pr.7-02. 3. Change to an AC drive of higher output power.
oL 1	Internal electronic overload trip	1. Check for possible motor overload. 2. Check electronic thermal overload setting. 3. Increase motor capacity. 4. Reduce the current level so that the drive output current does not exceed the value set by the Motor Rated Current Pr.7-00.
oL 2	Motor overload.	1. Reduce the motor load. 2. Adjust the over-torque detection setting to an appropriate setting. 3. Check the parameter settings (Pr.6-03 to Pr.6-05)
ocA	Over-current during acceleration: 1. Short-circuit at motor output. 2. Torque boost too high. 3. Acceleration time too short. 4. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Decrease the torque boost setting in Pr.7-02. 3. Increase the acceleration time. 4. Replace with the AC drive with one that has a higher output capacity (next HP size).
ocd	Over-current during deceleration: 1. Short-circuit at motor output. 2. Deceleration time too short. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Increase the deceleration time. 3. Replace with the AC drive with one that has a higher output capacity (next HP size).
ocn	Over-current during steady state operation: 1. Short-circuit at motor output. 2. Sudden increase in motor loading. 3. AC drive output capacity is too small.	1. Check for possible poor insulation at the output line. 2. Check for possible motor stall. 3. Replace with the AC drive with one that has a higher output capacity (next HP size).
EF	External Fault: The external terminal EF-GND goes from OFF to ON.	When external terminal EF-GND is closed, the output will be turned off. (under N.O. E.F.)

Fault Name	Fault Descriptions	Corrective Actions
cF1	Internal memory IC can not be programmed.	1. Switch off power supply. 2. Check whether the input voltage falls within the rated AC drive input voltage. 3. Switch the AC drive back on.
cF2	Internal memory IC can not be read.	1. Check the connections between the main control board and the power board. 2. Reset drive to factory defaults.
cF3	Drive's internal circuitry abnormal.	1. Switch off power supply. 2. Check whether the input voltage falls within the rated AC drive input voltage. 3. Switch on the AC drive.
HPF	Hardware protection failure	Return to the factory.
codE	Software protection failure	Return to the factory.
cFA	Auto accel/decel failure	Don't use the function of auto acceleration / deceleration.
GF	Ground fault: The AC drive output is abnormal. When the output terminal is grounded (short circuit current is 50% more than the AC drive rated current), the AC drive power module may be damaged. The short circuit protection is provided for AC drive protection, not user protection.	Ground fault : 1. Check whether the IGBT power module is damaged. 2. Check for possible poor insulation at the output line.
cE1	Communication Error	1. Check the connection between the AC drive and computer for loose wires. 2. Check if the communication protocol is properly set.
bb	External Base Block. AC drive output is turned off.	1. When the external input terminal (B.B) is active, the AC drive output will be turned off. 2. Disable this connection and the AC drive will begin to work again.

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CHAPTER 8 SUMMARY OF PARAMETER SETTINGS

◈ : The parameter can be set during operation,

*: Twice and/or adapted value for 400/460V class.

Group 0: User Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
0-00	Identity Code of AC Drive	Read-only	d #	
0-01	Rated Current Display	Read-only	d##.#	
0-02	Parameter Reset	d9: Reset Parameter to Factory Setting(50Hz base) d10: Reset Parameter to Factory Setting(60Hz base)	d0	
0-03	Start-up Display Selection ◈	d0: F (setting frequency) d1: H (actual output frequency) d2: (user-defined unit) d3: A (output current)	d1	
0-04	Content of Multi-Function Display ◈	d0: Display User-Defined Unit (u) d1: Display Counter Value (C) d2: Display Process Operation (1= tt) d3: Display DC-BUS Voltage (U) d4: Display output voltage (E) d5: Display frequency commands of PID (P) d6: Display PID feedback (after multiplying by Gain) (b)	d0	
0-05	User-Defined Coefficient K ◈	d0.1 to d160 – Multiplier for User-Defined Unit.	d1.0	
0-06	Software Version	Read-only	d#.#	
0-07	Password Decode	d0 to d999	d0	
0-08	Password Setting	d0 to d999 – d0: No Password	d0	

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Group 1 Basic Parameters

Parameter	Explanation	Settings	Factory Setting	Actual Setting
1-00	Maximum Output Freq.	d50.0 to d400 Hz	d50.0	
1-01	Maximum Voltage Frequency (Base Freq)	d10.0 to d400 Hz	d50.0	
1-02	Maximum Output Voltage	d2.0V to d255V*	d230 / d400	
1-03	Mid-Point Frequency	d1.0 to d400 Hz	d1.0	
1-04	Mid-Point Voltage	d2.0V to d255V*	d12*	
1-05	Minimum Output Frequency	d1.0 to d60.0 Hz	d1.0	
1-06	Minimum Output Voltage	d2.0V to d255V*	d12*	
1-07	Upper Bound of freq.	d1 to d110% (% of Pr.1-00)	d110	
1-08	Lower Bound of freq.	d0 to d100% (% of Pr.1-00)	d0	
1-09	Acceleration Time 1 (Tacc1) ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-10	Deceleration Time 1 (Tdec1) ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-11	Acceleration Time 2 ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-12	Deceleration Time 2 ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-13	Jog Acceleration / Deceleration Time ◈	d0.1 to d600 sec (0Hz to Pr-1-00)	d10.0	
1-14	Jog Frequency ◈	d1.0 Hz to d400 Hz	d6.0	
1-15	Auto Acceleration / Deceleration	d0: Linear Acceleration/Deceleration d1: Auto Acceleration, Linear Deceleration d2: Linear Acceleration, Auto Deceleration d3: Auto Acceleration/Deceleration d4: Linear Acceleration; Auto Deceleration, Stall Prevention during Deceleration d5: Auto Deceleration; Auto Acceleration, Stall Prevention during Deceleration	d0	
1-16	S-Curve in Acceleration	d0 to d7 (d0 = no S; d7 = smoothest)	d0	
1-17	S-Curve in Deceleration	d0 to d7 (d0 = no S; d7 = smoothest)	d0	
1-18	Jog Decelerating Time	Jog Decelerating Time Determined by Pr. 1-13 d0.1 to d600	d0.0	

Group 2 Operation Method Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
2-00	Source of Frequency Command	d0: Master Frequency input determined by digital keypad. (record the frequency of power loss and it can do analog overlap plus) d1: Master Frequency determined by analog signal DC 0V-10V (external terminal AVI). (won't record the frequency of power loss and it can't do analog overlap plus) d2: Master Frequency determined by analog signal DC 4mA - 20mA (external terminal AVI). (won't record the frequency of power loss and it can't do analog overlap plus) d3: Master Frequency determined by Potentiometer on the digital keypad. (won't record the frequency of power loss and it can do analog overlap plus) d4: Master Frequency operated by RS-485 serial communication interface. (record the frequency of power loss and it can do analog overlap plus) d5: Master Frequency operated by RS-485 serial communication interface. (won't record the frequency of power loss and it can do analog overlap plus)	d1	
2-01	Source of Operation Command	d0: by Digital Keypad d1: by external terminals, keypad STOP enabled d2: by external terminals, keypad STOP disabled d3: by RS-485 communication interface, keypad STOP enabled d4: by RS-485 communication interface, keypad STOP disabled	d1	
2-02	Stop Method	d0: Ramp Stop d1: Coast Stop	d0	
2-03	PWM Carrier Frequency	d3: 3KHz d4: 4KHz d5: 5KHz d6: 6KHz d7: 7KHz d8: 8KHz d9: 9KHz d10: 10KHz	d5	
2-04	Reverse Operation	d0: Enable REV d1: Disable REV	d0	
2-05	Loss of ACI Signal	d0: 0 Hz reference, no error stop d1: Stop the frequency output – error "EF" d2: Last ACI input command	d1	
2-06	Analog Auxiliary Frequency Operation	d0: Disable d1: Enable + AVI d2: Enable + ACI NOTE: Set Jumper J1 accordingly!	d0	

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Group 3 Output Function Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
3-00	Analog Output Signal	d0: analog frequency (0 to Max. Output Frequ.: Pr-1-00) d1: analog current (0 to 250% of Rated Drive Output Current	d0	
3-01	Analog Output Gain ◈	d1 to d200%	d100	
3-02	Desired Freq. Attained	d1.0 to d400 Hz	d1.0	
3-03	Terminal Count Value	d0 to d999 (triggered by Pr-4-04 to 4-08 set to d19)	d0	
3-04	Preliminary Count Value	d0 to d999	d0	
3-05	Multi-Function Digital Output1 (Photocoupler Output)	d0: Not Used d1: AC Drive Operational d2: Max. Output Freq. Attained d3: Zero Speed d4: Over Torque d5: Base-Block (B.B.) d6: Low Voltage Detection d7: AC Drive Operation Mode d8: Fault Indication	d1	
3-06	Multi-Function Digital Output2 (Relay Output)	d9: Desired Freq. Attained d10: PLC Program Running d11: PLC Program Step Complete d12: PLC Program Complete d13: PLC Program Operation Pause d14: Terminal Count Value Attained d15: Preliminary Count Value Attained d16: Ready State Indicator d17: FWD command indication d18: REV command indication	d8	

Group 4: Input Function Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
4-00	Potentiometer Bias Frequ. ◈	d 0.0 to d 100.0%	d0.0	
4-01	Potentiometer Bias Polarity ◈	d0: Positive Bias d1: Negative Bias	d0	
4-02	Potentiometer Frequency Gain ◈	d1 to d200 %	d100	
4-03	Potentiometer Reverse Motion Enable	d0: Forward Motion Only d1: Reverse Motion enabled	d0	
4-04	Multi-Function Digital Input Terminal 1 (DI1, DI2)	d0: Parameter Disable d1: DI1=FWD/STOP, DI2=REV/STOP d2: DI1=FWD/REV, DI2=RUN/STOP d3: 3-wire Operation Control Mode	d1	
4-05	Multi-Function Digital Input Terminal 2 (DI3)	d4: E.F. External Fault Input (N.O.) d5: E.F. External Fault Input (N.C.) d6: Reset d7: Multi-Step Speed Command 1 d8: Multi-Step Speed Command 2	d6	
4-06	Multi-Function Digital Input Terminal 3 (DI4)	d9: Multi-Step Speed Command 3 d10: Jog Operation d11: Acceleration/deceleration Speed Inhibit (Suspend Acc./Dec.) d12: First or Second Acceleration/deceleration Time Selection	d7	
4-07	Multi-Function Digital Input Terminal 4 (DI5)	d13: Base-Block (B.B.) (N.O.) d14: Base-Block (B.B.) (N.C.) d15: Increase Master Frequency d16: Decrease Master Frequency d17: Run PLC Program	d8	
4-08	Multi-Function Digital Input Terminal 5(DI6)	d18: Pause PLC Program d19: Counter Trigger Signal d20: Counter Reset d21: Select ACI / Deselect AVI d22: Disable PID function d23: JOG FWD d24: JOG REV d25: The source of master frequency is AVI. d26: The source of master frequency is ACI.	d12	
4-09	Line Start Lockout	d0: Disable d1: Enable Enable = Start Drive only with 0 to 1 change of Run signal Input	d0	
4-10	Up/down frequency command mode	d0: Up/down frequency by acceleration/deceleration time d1: Up frequency according to constant speed, down frequency according to deceleration time d2: Up frequency according to acceleration time, down frequenc according to constant speed d3: Up/down frequency by constant speed	d3	

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Para-meter	Explanation	Settings	Factory Setting	Actual Setting
4-11	Acceleration /Deceleration speed of constant up/down frequency	d0 to d1000 Hz/sec	d1	

Group 5: Multi-Step Speed and PLC Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
5-00	1st Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-01	2nd Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-02	3rd Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-03	4th Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-04	5th Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-05	6th Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-06	7th Step Speed Freq.	d0.0 to d400 Hz	d0.0	
5-07	PLC Mode	d0: Disable PLC Operation d1: Execute one program cycle d2: Continuously execute program cycles d3: Execute one program cycle step by step d4: Continuously execute one program cycle step by step d5: Disable PLC operation, but can set direction of 1st speed to 7th speed	d0	
5-08	PLC Forward/ Reverse Motion	d0 to d255 (0: FWD 1: REV; binary coded!)	d0	
5-09	Time Duration Step 0	d0 to d65500 Sec	d0	
5-10	Time Duration Step 1	d0 to d65500 Sec	d0	
5-11	Time Duration Step 2	d0 to d65500 Sec	d0	
5-12	Time Duration Step 3	d0 to d65500 Sec	d0	
5-13	Time Duration Step 4	d0 to d65500 Sec	d0	
5-14	Time Duration Step 5	d0 to d65500 Sec	d0	
5-15	Time Duration Step 6	d0 to d65500 Sec	d0	
5-16	Time Duration Step 7	d0 to d65500 Sec	d0	

Group 6: Protection Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
6-00	Over-Voltage Stall Prevention	d0: Disable d1: Enable	d1	
6-01	Over-Voltage Prevention Level	230V series: d350 to d410V	d390	
		460V series: d700 to d820V	d780	
6-02	Over-Current Stall Prevention Level	d20 to d150%	d130	
6-03	Over-Torque Detection Mode	d0: Disabled d1: Enabled during constant speed operation and continue to run to OL1 or OL. d2: Enabled during Constant Speed Operation and halted after detection d3: Enabled during running and continues before Continuous Output Time Limit (Pr.6-05) is reached d4: Enabled during running and halted after Over-Torque detection	d0	
6-04	Over-Torque Detection Level	d30 to d200%	d150	
6-05	Time setting for Over-torque Detection	d0.1 to d10.0 Sec	d0.1	
6-06	Electronic Thermal Overload Relay Selection	d0: Reduced Motor Torque (at low speed) d1: Constant Motor Torque (at low speed) d2: Inactive	d0	
6-07	Electronic Thermal Characteristic ◈	d30 to d600 Sec (sets t in I²t calculation)	d60	
6-08	Present Fault Record	d0: No Fault occurred d1: Over Current (oc) d2: Over Voltage (ov) d3: Over Heat (oH) d4: Over Load (oL) d5: Over Load (oL1) d6: External Fault (EF) d7: Not used d8: Not used d9: Current exceed during Acceleration (ocA) d10: Current exceed during Deceleration (ocd) d11: Current exceed during Steady State (ocn) d12: Ground Fault (GF)	d0	
6-09	Second Most Recent Fault Record			
6-10	Third Most Recent Fault Record			

8

Group 7 Motor Parameters

Para-meter	Explanation		Settings	Factory Setting	Actual Setting
7-00	Motor Rated Current	◈	d30 to d120% (% of Drive's Rated Current)	d85	
7-01	Motor No-Load Current	◈	d0 to d90% (% of Drive's Rated Current)	d50	
7-02	Torque Compensation	◈	d0 to d10	d01	
7-03	Slip Compensation	◈	d0.0 to d10.0 (% of Max. Voltage Frequ. Pr. 1-01)	d0.0	

Group 8: Special Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
8-00	DC Braking Voltage Level	d0 to d30% (% of Max. Outp. Voltage Pr. 1-02)	d0	
8-01	DC Braking Time during Start-Up	d0.0 to d60.0 Sec	d0.0	
8-02	DC Braking time during Stopping	d0.0 to d60.0 Sec	d0.0	
8-03	Start-Point for DC Braking	d0.0 to d400 Hz	d0.0	
8-04	Momentary Power Loss Operation Selection	d0: Stop Operation after Momentary Power Loss d1: Continues after Momentary Power Loss, speed search starts with Master Frequency d2: Continues after Momentary Power Loss, speed search starts with Minimum Output Frequency	d0	
8-05	Maximum Allowable Power Loss Time	d0.3 to d5.0 Sec	d2.0	
8-06	B.B. Time for Speed Search	d0.3 to d5.0 Sec	d0.5	
8-07	Maximum Speed Search Current Level	d30 to d200%	d150	
8-08	Skip Frequency 1 Upper Bound	d0.0 to d400 Hz	d0.0	
8-09	Skip Frequency 1 Lower Bound	d0.0 to d400 Hz	d0.0	
8-10	Skip Frequency 2 Upper Bound	d0.0 to d400 Hz	d0.0	
8-11	Skip Frequency 2 Lower bound	d0.0 to d400 Hz	d0.0	
8-12	Skip Frequency 3 Upper bound	d0.0 to d400 Hz	d0.0	
8-13	Skip Frequency 3 Lower Bound	d0.0 to d400 Hz	d0.0	
8-14	Auto Restart After Fault	d0 to d10 (number of Restarts)	d0	
8-15	AVR Function	d0: AVR Function Enable d1: AVR Function Disable d2: AVR Function Disable when Deceleration (higher deceleration torque)	d2	
8-16	Dynamic Braking Voltage	d350 to d450V*	d380*	
8-17	DC Braking Lower Bound Limit	d0.0 to d400 Hz – Inhibit DC Braking when reference lower than Pr.8-17	d0.0	

Group 9: Communication Parameters

Para-meter	Explanation		Settings	Factory Setting	Actual Setting
9-00	Communication Address	◈	d1 to d254	d1	
9-01	Transmission Speed	◈	d0: Baud Rate 4800 bps d1: Baud Rate 9600 bps d2: Baud Rate 19200 bps d3: Baud Rate 38400 bps	d1	
9-02	Transmission Fault Treatment	◈	d0: Warn and Keep Operating d1: Warn and Ramp to Stop d2: Warn and Coast to Stop d3: Keep Operating without Warning	d0	
9-03	Modbus Communication Watchdog Timer	◈	d0: Disable d1 to d20: time setting (1 sec increment)	d0	
9-04	Communication Protocol	◈	d0: 7,N,2 (Modbus, ASCII) d1: 7,E,1 (Modbus, ASCII) d2: 7,O,1 (Modbus, ASCII) d3: 8,N,2 (Modbus, ASCII) d4: 8,E,1 (Modbus, ASCII) d5: 8,O,1 (Modbus, ASCII) d6: 8,N,2 (Modbus, RTU) d7: 8,E,1 (Modbus, RTU) d8: 8,O,1 (Modbus, RTU)	d0	

8

Group A: PID Control Parameters

Para-meter	Explanation	Settings	Factory Setting	Actual Setting
A-00	PID Feedback Terminal Selection	d0: Disable PID function d1: Negative feedback 0~10V AVI d2: Negative feedback 4~20mA ACI d3: Positive feedback 0~10V AVI d4: Positive feedback 4~20mA ACI	d0	
A-01	Feedback Signal Gain	d0 to d999%	d100	
A-02	Proportional Gain (P)	d0 to d999%	d100	
A-03	Integral Time (I)	d0 to d999 (100 = 1 sec)	d100	
A-04	Differential Time (D)	d0 to d100 (100 = 1 sec)	d0	
A-05	Integration's Upper Bound Frequency	d0 to d100% (% of Max. Output Frequ. Pr. 1-00)	d100	
A-06	One-Time Delay	d0 to d999 (unit: 2msec)	d0	
A-07	PID Frequency Output Command Limit	d0 to d110% (% of Max. Output Frequ. Pr. 1-00)	d100	
A-08	Detection Time of the Feedback Error	d0.0 to d650 seconds	d0.0	
A-09	Feedback Signal Fault Treatment	d0: warn and RAMP to stop d1: warn and COAST to stop	d0	
A-10	Dwell (sleep) Frequency	d0.0 to d400Hz	d0.0	
A-11	Revival Frequency	d0.0 to d400Hz	d0.0	
A-12	Dwell (sleep) Period	d0.0 to d650 seconds	d0.0	
A-13	PID User Defined	d0.0 to d400	d0.0	

APPENDIX A: TECHNICAL SPECIFICATIONS

Voltage Class			230V Class					400/460V Class			
ECO-line L2500-00_ _ _xW1			02S	04S	07S	15S	22S	04T	07T	15T	22T
Max. Applicable Motor Output (kW)			0.2	0.4	0.75	01.Mai	02.Feb	0.4	0.75	01.Mai	02.Feb
Max. Applicable Motor Output (HP)			1/4	1/2	1	2	3	1/2	1	2	3
Output Rating	Rated Output Capacity (kVA)		0.6	1.0	1.6	2.9	4.2	1.2	2.0	3.3	4.4
	Rated Output Current (A)		1.6	2.5	4.2	7.5	11.0	1.5	2.5	4.2	5.5
	Recommended	50 Hz	72K4	72N4	81N4	91L4	101L4	72N4	81N4	91L4	101L4
	WATT motor type *)	87/100 Hz						72K4	72N4	81N4	91S4
	Maximum Output Voltage (V)		Proportional to Input Voltage: 3 ~ 0 - 200...240V (380...480V)								
	Rated Frequency (Hz)		1.0 to 400 Hz								
Input Rating	Rated Input Current (A)		Single-phase					3-phase			
			4.9	6.5	9.7	15.7	24	1.7	2.9	5.1	6.9
	Rated Voltage/Frequency		200/208/220/240VAC 50/60Hz					380/400/415/480VAC 50/60Hz			
	Voltage/Freq. Tolerance		Voltage: ±10%, Frequency: ±5%								
Control Characteristics	Control System		SPWM (Sinusoidal Pulse Width Modulation, carrier frequency 3k-10kHz)								
	Output Frequency Resolution		0.1Hz								
	Torque Characteristics		Including auto-torque boost, auto-slip compensation; starting torque up to 150% at 5Hz								
	Overload Endurance		150% of rated current for 1 minute (every 10 min.)								
	Accel/Decel Time		0.1to 600 second (2 Independent settings for Accel/Decel Time)								
	V/F Pattern		V/F pattern adjustable								
	Stall Prevention Level		20 to 200%, Setting of Rated Current								
Operating Characteristics	Frequency Setting	Keypad	Setting by ▲ ▼ or Potentiometer								
		External Signal	Potentiometer - 5kΩ/0.5W, DC 0 to +10V or 0 to +5V (Input impedance 47kΩ), RS-485 interface, 4 to 20mA (Input impedance 250Ω); Multi-Function Inputs 1 to 6 (8 steps, Jog, up/down)								
	Operation Setting Signal	Keypad	Setting by RUN, STOP								
		External Signal	DI1 to DI6 can be combined to offer various modes of operation, RS-485 serial interface (MODBUS)								
	Multi-Function Input Signal		Multi-step selection 0 to7, Jog, accel/decel inhibit, first/second accel/decel switch, counter, PLC operation, external Base Block (NC, NO), etc.								
	Multi-Function Output Indication		AC Drive Operating, Frequency Attained, Non-zero, Base Block, Fault Indication, Local/Remote indication, PLC Operation indication, etc.								
	Analog Output Signal		Analog frequency/current signal output.								
Other Function			PID-control, AVR, S-Curve, Over-Voltage, Over-Current Stall Prevention, Fault Records, Adjustable Carrier Frequency, DC Braking, Braking Chopper, Momentary Power Loss restart, Frequency Limits, Parameter Lock/Reset, PLC-function, Reverse Inhibition, etc.								
Protection			Self-testing, Over Voltage, Over Current, Under Voltage, Overload, Overheating, External Fault, Electronic thermal, Ground Fault, etc.								
Cooling Methods			Con-vection	Forced Air Cooling							
Enviroment	Installation Location		Altitude 1,000 m or below, keep from corrosive gasses, liquid and dust								
	Pollution Degree		2								
	Ambient Temperature		-10°C to 40°C (Non-Condensing and not frozen)								
	Storage/Transportation Temp.		-20°C to 60°C								
	Ambient Humidity		Below 90% RH (non-condensing)								
	Vibration		9.80665m/s² (1G) less than 20Hz, 5.88m/s² (0.6G) at 20 to 50Hz								
Dimensions (mm)		W	85	85	85	100	100	85	85	100	100
		H	148	148	148	186	186	148	148	186	186
		D	126	126	126	129.3	129.3	124	126	129	129
	L2500-00xyz_W1	size	A	B	B	E	E	C	D	F	F
Weight		kg	1.3	1.5	1.5	2.2	2.5	1.5	1.5	2	2.2
EMC	EMC-conformity		internal EMC-filter according to EN61800-3 amendment A11					optional external EMC-filter according to EN61800-3 amendment A11			
	cable length (2nd envir.)	m	65	65	65	65	70	50	50	50	50
	cable length (1st envir.)	m	20	20	20	20	25	20	20	20	20

APPENDIX B - ACCESSORIES

B.1 Non-fuse Circuit Breaker Chart

Recommended by WATT DRIVE Antriebstechnik GmbH (UL 508C, paragraph 45.8.4, part a)

1. For 1-phase drives, the current rating of the breaker shall be four times maximum of input current rating.
2. For 3-phase drives, the current rating of the breaker shall be four times maximum of output current rating.

(Note: According to our experience, we suggest to use 1.5 – 2 times maximum of current rating.)

(Note: Please select enough current capacity of NFB.)

Fuse Specification Chart

1-phase		3-phase	
Model	Input Current (A)	Model	Output Current (A)
UDGL2500-0002SAW1	4.9	UDGL2500-0004TCW1	1.5
UDGL2500-0004SBW1	6.5	UDGL2500-0007TDW1	2.5
UDGL2500-0007SBW1	9.7	UDGL2500-0015TFW1	4.2
UDGL2500-0015SEW1	15.7	UDGL2500-0022TFW1	5.5
UDGL2500-0022SEW1	24		

Smaller fuses than those shown in the table are permitted.

Model	I (input) (A)	I (output) (A)	Line Fuse	
			I (A) *1)	I (A) *2)
UDGL2500-0002SAW1	4.9	1.6	15	6
UDGL2500-0004SBW1	6.5	2.5	20	10
UDGL2500-0007SBW1	9.7	4.2	30	16
UDGL2500-0015SEW1	15.7	7.5	50	20
UDGL2500-0022SEW1	24	11	50	25
UDGL2500-0004TCW1	1.7	1.5	6	4
UDGL2500-0007TDW1	2.9	2.5	10	6
UDGL2500-0015TFW1	5.1	4.2	15	10
UDGL2500-0022TFW1	6.9	5.5	20	10

B

***1) Use "ultra rapid fuses" when working according to uL and CuL standards
(e.g. Bussmann Type JJN/JJS)**

*2) Fuse characteristics - "gL" for European standard environment

B.2 Braking Resistors

WATT Drive recommends the following braking resistors for use with the according inverters of the L2500 series:

| Inverter	Resistor	Dimensions W/H/D (mm³)
UDGL2500-0002SAW1	UDZBW-200/00080	140/20/60
UDGL2500-0004SBW1	UDZBW-200/00080	140/20/60
UDGL2500-0007SBW1	UDZBW-200/00080	140/20/60
UDGL2500-0015SEW1	UDZBW-100/00300	155/36/28
UDGL2500-0022SEW1	UDTBW-070/00300	155/36/28
UDGL2500-0004TCW1	UDZBW-750/00080	140/20/60
UDGL2500-0007TDW1	UDZBW-750/00080	140/20/60
UDGL2500-0015TFW1	UDZBW-400/00300	155/36/28
UDGL2500-0022TFW1	UDZBW-250/00300	155/36/28

Note:

1. Please select the factory default resistance value (Watt) and the frequency value (ED%).
2. If damage resulted in the drive or other equipments due to the fact that the braking resistors and the braking modules in use are not provided by Watt, the warranty will be void.
3. Take into consideration the safety of the environment when installing the braking resistors.
4. If the minimum resistance value is to be utilized, consult local dealers for the calculation of the Watt figures.
5. Please select thermal relay trip contact to prevent resistor over load.

B.3 EMI Filters

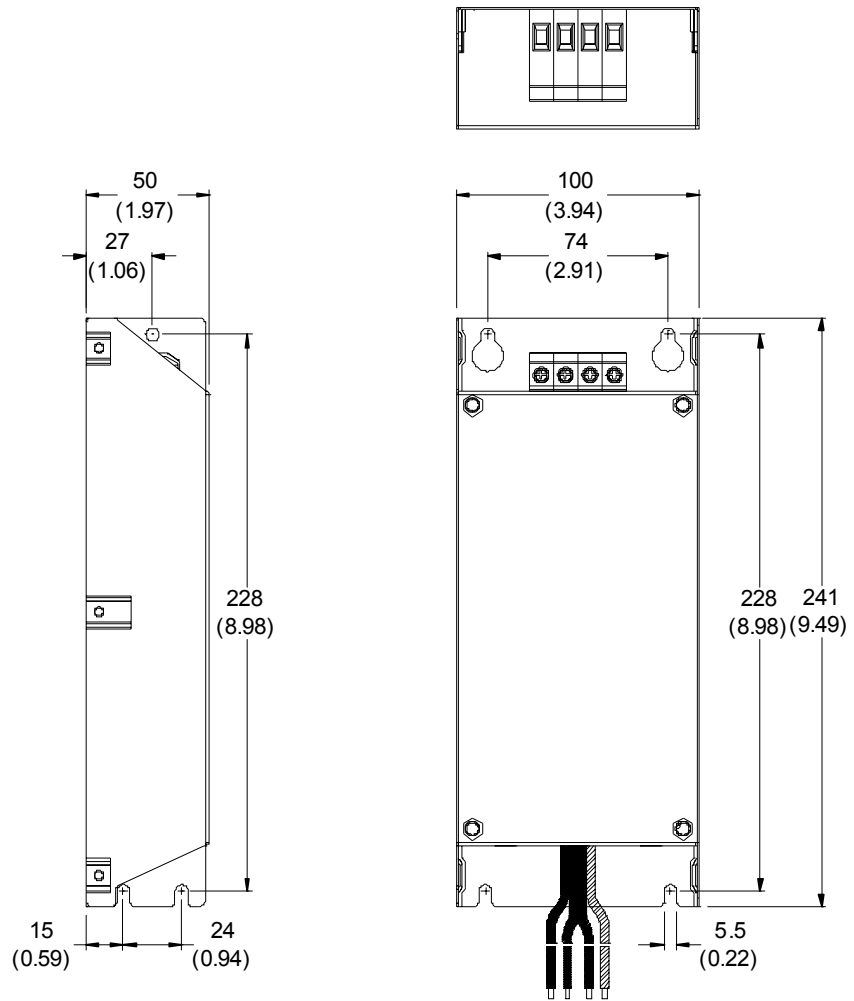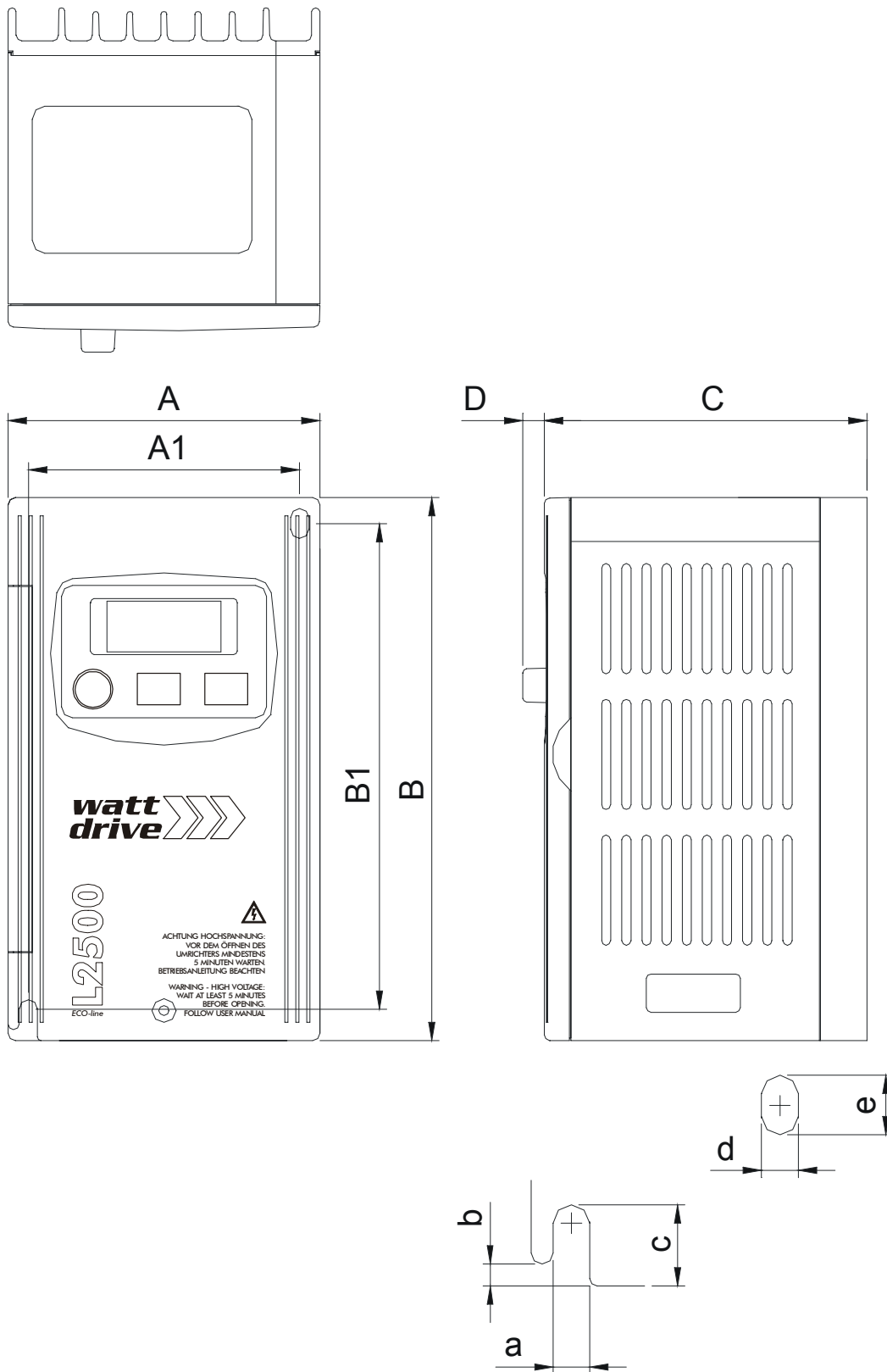| Model of AC Motor Drive	EMI Filter
UDGL2500-0002SAW1 UDGL2500-0004SBW1 UDGL2500-0007SBW1	Standard
UDGL2500-0015SEW1	Standard
UDGL2500-0022SEW1	Standard
UDGL2500-0004TCW1 UDGL2500-0007TDW1	UDZNFL-007T
UDGL2500-0015TFW1 UDGL2500-0022TFW1	UDZNFL-022T

Dimensions

mm (inch)

50
(1.97)

27
(1.06)

85
(3.35)

60
(2.36)

200
(7.87)

200   213
(7.87)(8.39)

15
(0.52)

24
(0.94)

4.5
(0.18)
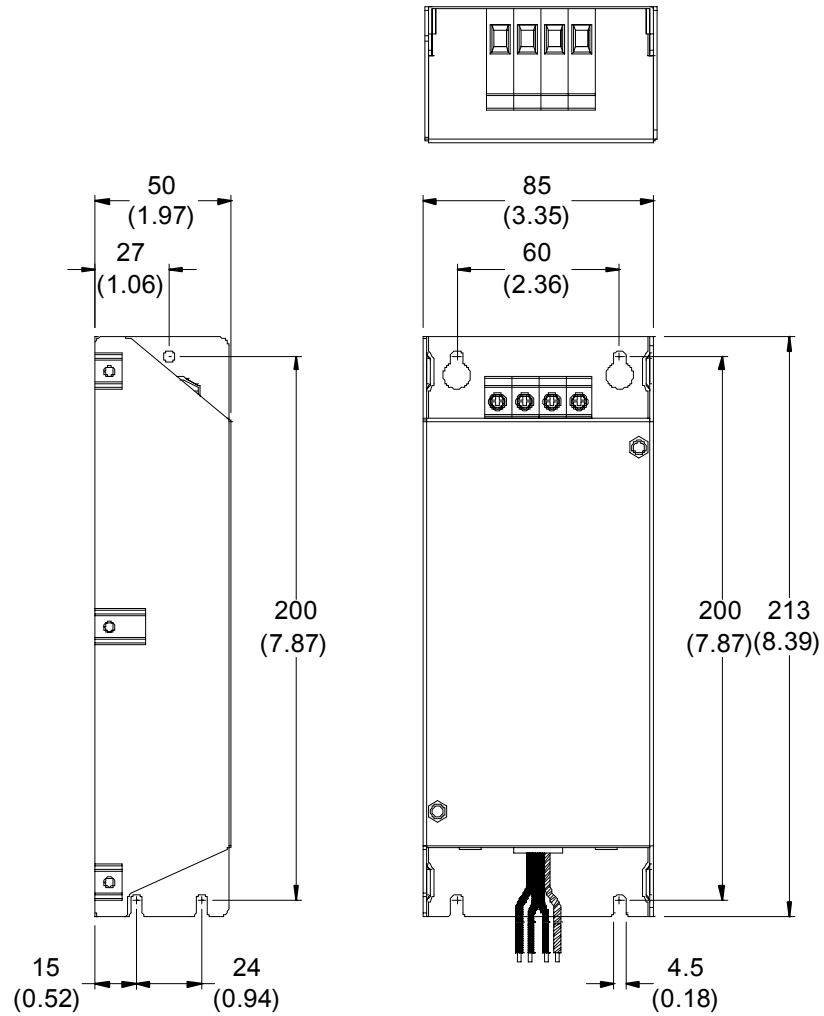
UDZNFL-007T

B

UDZNFL-022T

APPENDIX C - DIMENSIONS

L2500

	A mm (inch)	A1 mm (inch)	B mm (inch)	B1 mm (inch)	C mm (inch)	D mm (inch)	a mm (inch)	b mm (inch)	c mm (inch)	d mm (inch)	e mm (inch)
UDGL2500-0002SAW1	85 (3.35)	74 (2.92)	148 (5.83)	133.7 (5.27)	127 (5.0)	5.8 (0.23)	–	–	–	5 (0.32)	8.3 (0.33)
UDGL2500-0004SBW1	85 (3.35)	74 (2.92)	148 (5.83)	133.7 (5.27)	127 (5.0)	5.8 (0.23)	–	–	–	5 (0.32)	8.3 (0.33)
UDGL2500-0007SBW1	85 (3.35)	74 (2.92)	148 (5.83)	133.7 (5.27)	127 (5.0)	5.8 (0.23)	–	–	–	5 (0.32)	8.3 (0.33)
UDGL2500-0015SEW1	100 (3.94)	86.5 (3.41)	186 (7.33)	173 (6.82)	129.3 (5.09)	5.4 (0.21)	5.5 (0.22)	1 (0.04)	9.5 (0.38)	5.5 (0.22)	6.5 (0.26)
UDGL2500-0022SEW1	100 (3.94)	86.5 (3.41)	186 (7.33)	173 (6.82)	129.3 (5.09)	5.4 (0.21)	5.5 (0.22)	1 (0.04)	9.5 (0.38)	5.5 (0.22)	6.5 (0.26)
UDGL2500-0004TCW1	85 (3.35)	74 (2.92)	148 (5.83)	132.2 (5.21)	124 (4.89)	5.8 (0.23)	5 (0.20)	3 (0.12)	11.1 (0.44)	5 (0.32)	8.1 (0.32)
UDGL2500-0007TDW1	85 (3.35)	74 (2.92)	148 (5.83)	132.2 (5.21)	126 (4.96)	5.8 (0.23)	5 (0.20)	3 (0.12)	11.1 (0.44)	5 (0.32)	8.1 (0.32)
UDGL2500-0015TFW1	100 (3.94)	86.5 (3.41)	186 (7.33)	173 (6.82)	129 (5.08)	5.4 (0.21)	5.5 (0.22)	1 (0.04)	9.5 (0.38)	5.5 (0.22)	6.5 (0.26)
UDGL2500-0022TFW1	100 (3.94)	86.5 (3.41)	186 (7.33)	173 (6.82)	129 (5.08)	5.4 (0.21)	5.5 (0.22)	1 (0.04)	9.5 (0.38)	5.5 (0.22)	6.5 (0.26)