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You can read the recommendations in the user guide, the technical guide or the installation guide for HITACHI L100. You'll find the answers to all your questions on the HITACHI L100 in the user manual (information, specifications, safety advice, size, accessories, etc.). Detailed instructions for use are in the User's Guide.

User manual HITACHI L100
User guide HITACHI L100
Operating instructions HITACHI L100
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Instruction manual HITACHI L100



HITACHI L100 Series Inverter Instruction Manual

- Single-phase Input 200V Class
- Three-phase Input 200V Class
- Three-phase Input 400V Class



Manual Number: NB576XE
December 2003

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keep it handy for future reference.

Hitachi Industrial Equipment Systems Co., Ltd.



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Manual abstract:

WARNING: Indicates a potentially hazardous situation that, if not avoided, can result in serious injury or death. **CAUTION:** Indicates a potentially hazardous situation that, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING), so be sure to observe them. **1 Step 1:** Indicates a step in a series of action steps required to accomplish a goal. The number of the step will be contained in the step symbol. **NOTE:** Notes indicate an area or subject of special merit, emphasizing either the product's capabilities or common errors in operation or maintenance. **TIP:** Tips give a special instruction that can save time or provide other benefits while installing or using the product. The tip calls attention to an idea that may not be obvious to first-time users of the product. **Hazardous High Voltage HIGH VOLTAGE:** Motor control equipment and electronic controllers are connected to hazardous line voltages.

When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance.

Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery. **ii General Precautions - Read These First!** **WARNING:** This equipment should be installed, adjusted, and serviced by qualified electrical maintenance personnel 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 for ensuring that all driven machinery, drive train mechanism not supplied by Hitachi Industrial Equipment Systems Co.

, 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 personnel should a single-point failure occur. **WARNING:** For equipment protection, install a ground leakage type breaker with a fast response circuit capable of handling large currents. The ground fault protection circuit is not designed to protect against personal injury. **HIGH VOLTAGE: HAZARD OF ELECTRICAL SHOCK. DISCONNECT INCOMING POWER BEFORE WORKING ON THIS CONTROL.** **WARNING:** Wait at least five (5) minutes after turning OFF the input power supply before performing maintenance or an inspection. Otherwise, there is the danger of electric shock. **CAUTION:** These instructions should be read and clearly understood before working on L100 series equipment.

CAUTION: Proper grounds, disconnecting devices and other safety devices and their location are the responsibility of the user and are not provided by Hitachi Industrial Equipment Systems Co., Ltd. **CAUTION:** Be sure to connect a motor thermal disconnect switch or overload device to the L100 series controller to assure that the inverter will shut down in the event of an overload or an overheated motor. **HIGH VOLTAGE:** Dangerous voltage exists until power light is OFF. Wait at least five (5) minutes after input power is disconnected before performing maintenance. **WARNING:** This equipment has high leakage current and must be permanently (fixed) hard-wired to earth ground via two independent cables. L100 Inverter **iii WARNING:** Rotating shafts and above-ground electrical potentials can be hazardous. Therefore, it is strongly recommended that all electrical work conform to the National Electrical Codes and local regulations. Installation, alignment and maintenance should be performed only by qualified personnel. Factory-recommended test procedures included in the instruction manual should be followed.

Always disconnect electrical power before working on the unit. **CAUTION:** a) Class I motor must be connected to earth ground via low resistive path (< 0.1) b) Any motor used must be of a suitable rating. c) Motors may have hazardous moving parts. In this event suitable protection must be provided.

CAUTION: Alarm connection may contain hazardous live voltage even when inverter is disconnected. When removing the front cover for maintenance or inspection, confirm that incoming power for alarm connection is completely disconnected. **CAUTION:** Hazardous (main) terminals for any interconnection (motor, contact breaker, filter, etc.) must be inaccessible in the final installation. **CAUTION:** This equipment should be installed in IP54 or equivalent (see EN60529) enclosure.

The end application must be in accordance with BS EN60204-1. Refer to the section "Choosing a Mounting Location" on page 27. The diagram dimensions are to be suitably amended for your application. **CAUTION:** Connection to field wiring terminals must be reliably fixed having two independent means of mechanical support. Use a termination with cable support (figure below), or strain relief, cable clamp, etc. Terminal (ring lug) Cable support Cable **CAUTION:** A double-pole disconnection device must be fitted to the incoming main power supply close to the inverter. Additionally, a protection device meeting IEC947-1/IEC947-3 must be fitted at this point (protection device data shown in "Determining Wire and Fuse Sizes" on page 214). **NOTE:** The above instructions, together with any other requirements highlighted in this manual, must be followed for continued LVD (European Low Voltage Directive) compliance. **iv Index to Warnings and Cautions in This Manual Installation - Cautions for Mounting Procedures CAUTION:** The inverter is shipped with a plastic cover over the top vent grill. REMOVE this cover after the installation is complete.

Operation with this cover in place will not allow proper cooling, and damage to the inverter may result. **CAUTION:** Be sure to install the unit on flame-resistant material such as a steel plate. Otherwise, there is the danger of fire. **CAUTION:** Be sure not to place any flammable materials near the inverter. Otherwise, there is the danger of fire. **CAUTION:** Be sure not to let the foreign matter enter vent openings in the inverter housing, such as wire clippings, spatter from welding, metal shavings, dust, etc. Otherwise, there is the danger of fire. **CAUTION:** Be sure to install the inverter in a place that can bear the weight according to the specifications in the text (Chapter 1, Specifications Tables). Otherwise, it may fall and cause injury to personnel. **CAUTION:** Be sure to install the unit on a perpendicular wall that is not subject to vibration.

Otherwise, it may fall and cause injury to personnel. **CAUTION:** Be sure not to install or operate an inverter that is damaged or has missing parts.



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Otherwise, it may cause injury to personnel. CAUTION: Be sure to install the inverter in a well-ventilated room that does not have direct exposure to sunlight, a tendency for high temperature, high humidity or dew condensation, high levels of dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc. Otherwise, there is the danger of fire.

CAUTION: Be sure to maintain the specified clearance area around the inverter and to provide adequate ventilation. Otherwise, the inverter may overheat and cause equipment damage or fire. ...

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28 Wiring - Warnings for Electrical Practices and Wire Specifications WARNING: "Use 60/75°C Cu wire only" or equivalent. 213 WARNING: "Open Type Equipment." ...

.. 213 WARNING: "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum." For models with suffix N or L. 213 L100 Inverter v WARNING: "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480 V maximum.

" For models with suffix H. HIGH VOLTAGE: Be sure to ground the unit. Otherwise, there is a danger of electric shock and/or fire. HIGH VOLTAGE: Wiring work shall be carried out only by qualified personnel. Otherwise, there is a danger of electric shock and/or fire.

HIGH VOLTAGE: Implement wiring after checking that the power supply is OFF. Otherwise, you may incur electric shock and/or fire. HIGH VOLTAGE: Do not connect wiring to an inverter or operate an inverter that is not mounted according the instructions given in this manual. Otherwise, there is a danger of electric shock and/or injury to personnel. WARNING: Make sure the input power to the inverter is OFF.

If the drive has been powered, leave it OFF for five minutes before continuing. 213 213 .

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219 Wiring - Cautions for Electrical Practices CAUTION: Fasten the screws with the specified fastening torque in the table below. Check for any loosening of screws. Otherwise, there is the danger of fire. CAUTION: Be sure that the input voltage matches the inverter specifications: · Single/Three phase 200 to 240 V 50/60 Hz (up to 2.2kW) · Three phase 200 to 230V 50/60Hz (above 2.

2kW) · Three phase 380 to 460 V 50/60Hz CAUTION: Be sure not to power a three-phase-only inverter with single phase power. Otherwise, there is the possibility of damage to the inverter and the danger of fire. CAUTION: Be sure not to connect an AC power supply to the output terminals. Otherwise, there is the possibility of damage to the inverter and the danger of injury and/or fire. Power Input (L) (N) Power Output T1 T2 T3 U V W 215 ..

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217 L1 L2 L3 NOTE: L, N: Single-phase 200 to 240V 50/60 Hz L1, L2, L3: Three-phase 200 to 240V 50/60 Hz Three-phase 380 to 460V 50/60 Hz vi CAUTION: Remarks for using ground fault interrupter breakers in the main power supply: Adjustable frequency inverters with CE-filters (RFIfilter) and shielded (screened) motor cables have a higher leakage current toward Earth GND. Especially at the moment of switching ON this can cause an inadvertent trip of ground fault interrupters. Because of the rectifier on the input side of the inverter there is the possibility to stall the switch-off function through small amounts of DC current. Please observe the following: · Use only short time-invariant and pulse current-sensitive ground fault interrupters with higher trigger current. · Other components should be secured with separate ground fault interrupters.

· Ground fault interrupters in the power input wiring of an inverter are not an absolute protection against electric shock. CAUTION: Be sure to install a fuse for each phase of the main power supply to the inverter. Otherwise, there is the danger of fire. CAUTION: For motor leads, ground fault interrupter breakers and electromagnetic contactors, be sure to size these components properly (each must have the capacity for rated current and voltage). Otherwise, there is the danger of fire.

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217 217 Powerup Test Caution Messages CAUTION: The heat sink fins will have a high temperature. Be careful not to touch them. Otherwise, there is the danger of getting burned. CAUTION: The operation of the inverter can be easily changed from low speed to high speed. Be sure to check the capability and limitations of the motor and machine before operating the inverter.

Otherwise, there is the danger of injury power, confirm that the RUN command is not present. WARNING: When the Stop key function is disabled, pressing the Stop key does not stop the inverter, nor will it reset a trip alarm. WARNING: Be sure to provide a separate, hard-wired emergency stop switch when the application warrants it. WARNING: If the power is turned ON and the Run command is already active, the motor starts rotation and is dangerous! Before turning power ON, confirm that the Run command is not active. WARNING: After the Reset command is given and the alarm reset occurs, the motor will restart suddenly if the Run command is already active.

Be sure to set the alarm reset after verifying that the Run command is OFF to prevent injury to personnel.

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... 419 Cautions for Operations and Monitoring CAUTION: The heat sink fins will have a high temperature. Be careful not to touch them. Otherwise, there is

the danger of getting burned. CAUTION: The operation of the inverter can be easily changed from low speed to high speed. Be sure check the capability and limitations of the motor and machine before operating the inverter. Otherwise, it may cause injury to personnel. CAUTION: If you operate a motor at a frequency higher than the inverter standard default setting (50Hz/60Hz), be sure to check the motor and machine specifications with the respective manufacturer.

Only operate the motor at elevated frequencies after getting their approval. Otherwise, there is the danger of equipment damage. CAUTION: It is possible to damage the inverter or other devices if your application exceeds the maximum current or voltage characteristics of a connection point. ..

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42 42 ...

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. 44 L100 Inverter ix Warnings and Cautions for Troubleshooting and Maintenance WARNING: Wait at least five (5) minutes after turning OFF the input power supply before performing maintenance or an inspection. Otherwise, there is the danger of electric shock. WARNING: Make sure that only qualified personnel will perform maintenance, inspection, and part replacement. Before starting to work, remove any metallic objects from your person (wristwatch, bracelet, etc.

). Be sure to use tools with insulated handles. Otherwise, there is a danger of electric shock and/or injury to personnel.



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WARNING: Never remove connectors by pulling on its wire leads (wires for cooling fan and logic P.C. board). Otherwise, there is a danger of fire due to wire breakage and/or injury to personnel. **CAUTION:** Do not connect the megger to any control circuit terminals such as intelligent I/O, analog terminals, etc. Doing so could cause damage to the inverter. **CAUTION:** Never test the withstand voltage (HIPOT) on the inverter. The inverter has a surge protector between the main circuit terminals above and the chassis ground. **HIGH VOLTAGE:** Be careful not to touch wiring or connector terminals when working with the inverters and taking measurements. Be sure to place the measurement circuitry components above in an insulated housing before using them. ..

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610 610 614 General Warnings and Cautions **WARNING:** Never modify the unit. Otherwise, there is a danger of electric shock and/ or injury.

CAUTION: Withstand voltage tests and insulation resistance tests (HIPOT) are executed before the units are shipped, so 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 during operation. **CAUTION:** Be sure to connect the grounding terminal to earth ground. **CAUTION:** When inspecting the unit, be sure to wait five minutes after tuning OFF the power supply before opening the cover. x **CAUTION:** Do not stop operation by switching OFF electromagnetic contactors on the primary or secondary sides of the inverter. Ground fault interrupter Power Input L1, L2, L3 Inverter P24 U, V, W Motor FW When there has been a sudden power failure while an operation instruction is active, then the unit may restart operation automatically after the power failure has ended. If there is a possibility that such an occurrence may harm humans, then install an electromagnetic contactor (Mgo) on the power supply side, so that the circuit does not allow automatic restarting after the power supply recovers. If the optional remote operator is used and the retry function has been selected, this will also cause automatic restarting when a Run command is active. So, please be careful.

CAUTION: Do not insert leading power factor capacitors or surge absorbers between the output terminals of the inverter and motor. Ground fault interrupter Power Input L1, L2, L3 Inverter U, V, W Surge absorber Motor GND lug Leading power factor capacitor **CAUTION: MOTOR TERMINAL SURGE VOLTAGE SUPPRESSION FILTER (For the 400 V CLASS)** In a system using an inverter with the voltage control PWM system, a voltage surge caused by the cable constants such as the cable length (especially when the distance between the motor and inverter is 10 m or more) and cabling method may occur at the motor terminals. A dedicated filter of the 400 V class for suppressing this voltage surge is available. Be sure to install a filter in this situation. L100 Inverter xi **CAUTION: SUPPRESSION FOR NOISE INTERFERENCE FROM INVERTER** The inverter uses many semiconductor switching elements such as transistors and IGBTs.

Thus, a radio receiver or measuring instrument located near the inverter is susceptible to noise interference. To protect the instruments from erroneous operation due to noise interference, they should be used well away from the inverter. It is also effective to shield the whole inverter structure. The addition of an EMI filter on the input side of the inverter also reduces the effect of noise from the commercial power line on external devices. Note that the external dispersion of noise from the power line can be minimized by connecting an EMI filter on the primary side of inverter.

EMI Filter R1 S1 T1 R2 S2 T2 Inverter L1 L2 L3 U V W Motor noise EMI Filter Inverter Motor Completely ground the enclosed panel, metal screen, etc. with as short a wire as possible. Remote Operator Grounded frame Conduit or shielded cable--to be grounded **CAUTION: EFFECTS OF POWER DISTRIBUTION SYSTEM ON INVERTER** In the cases below involving a general-purpose inverter, a large peak current can flow on the power supply side, sometimes destroying the converter module: 1. The unbalance factor of the power supply is 3% or higher. 2. The power supply capacity is at least 10 times greater than the inverter capacity (or the power supply capacity is 500 kVA or more). 3. Abrupt power supply changes are expected, due to conditions such as: a. Several inverters are interconnected with a short bus. b.

A thyristor converter and an inverter are interconnected with a short bus. c. An installed phase advance capacitor opens and closes. Where these conditions exist or when the connected equipment must be highly reliable, you **MUST** install an input-side AC reactor of 3% (at a voltage drop at rated current) with respect to the supply voltage on the power supply side. Also, where the effects of an indirect lightning strike are possible, install a lightning conductor. xii **CAUTION:** When the EEPROM error E08 occurs, be sure to confirm the setting values again. **CAUTION:** When using normally closed active state settings (C_11 to C_15) for externally commanded Forward or Reverse terminals [FW] or [RV], the inverter may start automatically when the external system is powered OFF or disconnected from the inverter! So, do not use normally closed active state settings for Forward or Reverse terminals [FW] or [RV] unless your system design protects against unintended motor operation. **CAUTION:** In all the illustrations in this manual, covers and safety devices are occasionally removed to describe the details. While operating the product, make sure that the covers and safety devices are placed as they were specified originally and operate it according to the instruction manual. UL® Cautions, Warnings, and Instructions Wiring Warnings for Electrical Practices and Wire Sizes The Cautions, Warnings, and instructions in this section summarize the procedures necessary to ensure an inverter installation complies with Underwriters Laboratories® guidelines.

WARNING: "Use 60/75°C Cu wire only" or equivalent. **WARNING:** "Open Type Equipment." **WARNING:** "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 240 V maximum." For models with suffix N or L. **WARNING:** "Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes, 480 V maximum.

" For models with suffix H. L100 Inverter xiii Terminal Tightening Torque and Wire Size The wire size range and tightening torque for field wiring terminals are presented in the table below. Input Voltage Motor Output Inverter Model kW 0.2 0.4 0.55 0.75 200V 1.1 1.5 2.2 3.7 5.5 7.5 0.4 0.75 1.

5 400V 2.2 3.0 4.0 5.5 7.5 HP 1/4 1/2 3/4 1 1 1/2 2 3 5 7 1/2 10 1/2 1 2 3 4 5 7 1/2 10 L100-002NFE/NFU L100-004NFE/NFU L100-005NFE L100-007NFE/NFU L100-011NFE L100-015NFE/NFU L100-022NFE/NFU L100-037LFU L100-055LFU L100-075LFU L100-004HFE/HFU L100-007HFE/HFU L100-015HFE/HFU L100-022HFE/HFU L100-030HFE L100-040HFE/HFU L100-055HFE/HFU L100-075HFE/HFU 14 16 0.



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9 1.2 14 12 10 12 10 8 1.5 2.0 0.

9 1.2 16 Wiring Size Range (AWG) Torque ft-lbs 0.6 (N-m) 0.8 12 1.5 2.

0 Wire Connectors WARNING: Field wiring connections must be Terminal (ring lug) made by a UL Listed and CSA Certified ring lug terminal connector sized for the wire gauge being used. The connector must be fixed using the crimping tool specified by the connector manufacturer. Cable support Cable xiv Circuit Breaker and Fuse Sizes The inverter's connections to input power must include UL Listed inverse time circuit breakers with 600V rating, or UL Listed fuses as shown in the table below. Input Voltage Motor Output Inverter Model kW 0.2 0.

4 0.55 0.75 1.1 200V 1.5 2.2 3.7 5.5 7.5 0.4 0.

75 1.5 400V 2.2 3.0 4.0 5.5 7.5 HP 1/4 1/2 3/4 1 1 1/2 2 3 5 7 1/2 10 1/2 1 2 3 4 5 7 1/2 10 L100-002NFE/NFU L100-004NFE/NFU L100-005NFE

L100-007NFE/NFU L100-011NFE L100-015NFE/NFU L100-022NFE/NFU L100-037LFU L100-055LFU L100-075LFU L100-004HFE/HFU

L100-007HFE/HFU L100-015HFE/HFU L100-022HFE/HFU L100-030HFE L100-040HFE/HFU L100-055HFE/HFU L100-075HFE/HFU 15 (single ph.) 10

(three ph.) 20 (single ph.) 15 (three ph.)

) 30 (single ph.) 20 (three ph.) 30 40 50 3 6 10 10 15 15 20 25 Fuse (A) (UL-rated, class J, 600V) 10 (single ph.) 7 (three ph.) Motor Overload Protection Hitachi L100 inverters provide solid state motor overload protection, which depends on the proper setting of the following parameters: · B₁₂ "electronic overload protection" Set the rated current [Amperes] of the motor(s) with the above parameters.

The setting range is 0.5 * rated current to 1.2 * rated current. WARNING: When two or more motors are connected to the inverter, they cannot be protected by the electronic overload protection. Install an external thermal relay on each motor.

L100 Inverter xv Table of Contents Safety Messages Hazardous High Voltage General Precautions - Read These First! Index to Warnings and Cautions in This Manual General Warnings and Cautions UL® Cautions, Warnings, and Instructions i ii iv ix xii Table of Contents Revisions Contact Information xvii xviii Chapter 1: Getting Started Introduction L100 Inverter Specifications Introduction to Variable-Frequency Drives Frequently Asked Questions 12 15 118 123 Chapter 2: Inverter Mounting and Installation Orientation to Inverter Features Basic System Description Step-by-Step Basic Installation Powerup Test Using the Front Panel Keypad 22 25 26 219 221 Chapter 3: Configuring Drive Parameters Choosing a Programming Device Using Keypad Devices "D" Group: Monitoring Functions "F" Group: Main Profile Parameters "A" Group: Standard Functions "B" Group: Fine Tuning Functions "C" Group:

Intelligent Terminal Functions 32 33 36 38 39 322 332 xvi Chapter 4: Operations and Monitoring Introduction Connecting to PLCs and Other Devices Example Wiring Diagram Using Intelligent Input Terminals Using Intelligent Output Terminals Analog Input Operation Analog and Digital Monitor Output PID Loop Operation Configuring the Inverter for Multiple Motors 42 44 45 48 421 429 430 432 433 Chapter 5: Inverter System Accessories Introduction Component Descriptions Dynamic Braking 52 53 55 Chapter 6: Troubleshooting and Maintenance Troubleshooting Monitoring Trip Events, History, & Conditions Restoring Factory Default Settings Maintenance and Inspection Warranty 62 65 68 69 616 Appendix A: Glossary and Bibliography Glossary Bibliography A2 A8 Appendix B: Drive Parameter Settings Tables Introduction Parameter Settings for Keypad Entry B2 B2 Appendix C: CEEMC Installation Guidelines CEEMC Installation Guidelines Hitachi EMC Recommendations C2 C6 Index L100 Inverter xvii Revisions Revision History Table No. Revision

Comments Initial Release of Manual NB576X 1 Revision A Pages 1-4 Specs tables: added row for input current, changed rated input voltage tolerance, corrected dynamic braking %torque, corrected product weight (lbs) Page 2-8 Corrected H dimension for -002 models Revision B Updated company name on cover, contact page, and nameplate photo Updated text, figures, and tables throughout manual per technical corrections or usability improvements Pages xii to xiv Added UL Instructions Page xviii Contact page update Pages 1-5 to 1-8 Added watt loss, efficiency data to tables Pages 1-10 to 1-15 Added derating graphs Page 2-16 Added power terminal diagrams Page 4-5 Added system wiring diagram Page 4-7 Added terminal index listing Page 4-8 Added input terminal wiring diagrams Page 4-21 Added output terminal wiring diagrams Pages 5-5 to 5-7 Added braking tables and figures Page 6-10 Added megger test procedure and figure Page 6-15 Added IGBT test method, figure, and table Pages C-1 to C-6 Added appendix on CE-EMC Removed DOP+ info from Ch3 and Appendix B Revision C Minor corrections throughout Revision D Minor corrections throughout Revision E Minor corrections throughout Date of Issue May 1999 August 1999 Operation Manual No. NB576X NB576XA 2 May 2002 NB576XB 3 4 5 Nov. 2002 July 2003 Dec. 2003 NB576XC NB576XD NB576XE xviii Contact Information Hitachi America, Ltd. Power and Industrial Division 50 Prospect Avenue Tarrytown, NY 10591 U.S.A. Phone: +1-914-631-0600 Fax: +1-914-631-3672 Hitachi Europe GmbH Am Seestern 18 D-40547 Düsseldorf Germany Phone: +49-211-5283-0 Fax: +49-211-5283-649 Hitachi Australia Ltd. Level 3, 82 Waterloo Road North Ryde, N.

S.W. 2113 Australia Phone: +61-2-9888-4100 Fax: +61-2-9888-4188 Hitachi Industrial Equipment Systems Co, Ltd. International Sales Department WBG MARIVE WEST 16F 6, Nakase 2-chome Mihama-ku, Chiba-shi, Chiba 261-7116 Japan Phone: +81-43-390-3516 Fax: +81-43-390-3810 Hitachi Industrial Equipment Systems Co, Ltd. Narashino Division 1-1, Higashi-Narashino 7-chome Narashino-shi, Chiba 275-8611 Japan Phone: +81-47-474-9921 Fax: +81-47-476-9517 Hitachi Asia Ltd. 16 Collyer Quay #20-00 Hitachi Tower, Singapore 049318 Singapore Phone: +65-538-6511 Fax: +65-538-9011 Hitachi Asia (Hong Kong) Ltd. 7th Floor, North Tower World Finance Centre, Harbour City Canton Road, Tsimshatsui, Kowloon Hong Kong Phone: +852-2735-9218 Fax: +852-2735-6793 NOTE: To receive technical support for the Hitachi inverter you purchased, contact the Hitachi inverter dealer from whom you purchased the unit, or the sales office or factory contact listed above. Please be prepared to provide the following inverter nameplate information:

1. Model 2. Date of purchase 3.

Manufacturing number (MFG No.) 4. Symptoms of any inverter problem If any inverter nameplate information is illegible, please provide your Hitachi contact with any other legible nameplate items.



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To reduce unpredictable downtime, we recommend that you stock a spare inverter. Getting Started 1 page In This Chapter.

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..... 5 -- Introduction to Variable-Frequency Drives .

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..... 23 12 Getting Started Introduction Introduction Main Features Congratulations on your purchase of an L100 Series Hitachi inverter! This inverter drive features state-of-the-art circuitry and components to provide high performance. The housing footprint is exceptionally small, given the size of the corresponding motor.

The Hitachi L100 product line includes more than a dozen inverter models to cover motor sizes from 1/4 horsepower to 10 horsepower, in either 230 VAC or 460 VAC power input versions. The main features are: · 200V and 400V Class inverters · UL or CE version available · V/f (volts-per-hertz) control algorithm, selectable for either constant or reduced torque loads · Convenient keypad for parameter settings · Built-in RS-422 communications interface to allow configuration from a PC and for field bus external modules. · Sixteen programmable speed levels · Two-step acceleration and deceleration curves · PID control adjusts motor speed automatically to maintain a process variable value The design in Hitachi inverters overcomes many of the traditional trade-offs between speed, torque and efficiency. The performance characteristics are: · Output frequency range from 0.5 to 360 Hz · Continuous operation at 100% torque within a 1:10 speed range (6/60 Hz / 5/50 Hz) without motor derating Model L100-002NFU L100 Inverter A full line of accessories from Hitachi is available to complete your application: · Digital remote operator keypad · Dynamic braking unit · Radio noise filters, CE compliance filters, and EMI filters (shown below) · DIN rail mounting adapter (35mm rail size) 13 Getting Started EMI Filter Operator Interface Options The optional SRW-0EX digital operator / copy unit is shown to the right.

It has the additional capability of reading (uploading) the parameter settings in the inverter into its memory. Then you can connect the copy unit on another inverter and write (download) the parameter settings into that inverter. OEMs will find this unit particularly useful, as one can use a single copy unit to transfer parameter settings from one inverter to many. Other digital operator interfaces may be available from your Hitachi distributor for particular industries or international markets. Contact your Hitachi distributor for further details.

Digital Operator / Copy Unit 14 Getting Started Introduction Inverter Specifications Label The Hitachi L100 inverters have product labels located on the right side of the housing, as pictured below. Be sure to verify that the specifications on the labels match your power source, motor, and application safety requirements. Regulatory agency approvals Specifications label Inverter model number Motor capacity for this model Power Input Rating: frequency, voltage, phase, current Output Rating: Frequency, voltage, current Manufacturing codes: Lot number, date, etc. Model Number Convention The model number for a specific inverter contains useful information about its operating characteristics. Refer to the model number legend below: L100 004 H F U 5 Version number (_ , 1, 2, ...) Restricted distribution: E=Europe, U=USA Series name Configuration type F = with digital operator (keypad) Input voltage: N = single or three-phase 200V class H = three-phase 400V class L = three phase only, 200V class Applicable motor capacity in kW 022 = 2.2 kW 002 = 0.2 kW 030 = 3.

0 kW 004 = 0.4 kW 037 = 3.7 kW 005 = 0.55 kW 040 = 4.0 kW 007 = 0.75 kW 055 = 5.5 kW 011 = 1.1 kW 075 = 7.5 kW 015 = 1.5 kW L100 Inverter 15 Getting Started L100 Inverter Specifications Model-specific tables for 200V and 400V class inverters The following tables are specific to L100 inverters for the 200V and 400V class model groups.

Note that "General Specifications" on page 19 apply to both voltage class groups. Footnotes for all specifications tables follow the table below. Item L100 inverters, 200V models CE version UL version kW HP Rated capacity (240V) kVA *10 Rated input voltage 002NFE 002NFU 0.2 1/4 0.5 200V Class Specifications 004NFE 004NFU 0.

4 1/2 1.0 005NFE -- 0.55 3/4 1.2 007NFE 007NFU 0.75 1 1.

6 011NFE -- 1.1 1 1/2 2.0 Applicable motor size *2 1-phase: 200 to 240V +5/-10%, 50/60 Hz ±5%, 3-phase: 200 to 240V +5/-10%, 50/60 Hz ±5%, (037LFU, 055LFU & 075LFU 3-phase only) 3.1 1.8 5.8 3.4 6.7 3.9 9.0 5.

2 11.2 6.5 Rated input current (A) 1-phase 3-phase Rated output voltage *3 Rated output current (A) Efficiency at 100% rated output (%) Watt loss, at 70% output approximate (W) at 100% output Braking Dynamic braking, approx. % torque, (short time stop from 50 / 60 Hz) *5 DC braking Weight kg lb 3-phase: 200 to 240V (corresponding to input voltage) 1.4 91.5 13 17 2.6 92.8 21 29 3.0 93.6 25 32 100%: 50 Hz, 50%: 60 Hz Capacitive feedback type, dynamic braking unit and braking resistor optional, individually installed Variable operating frequency, time, and braking force 0.

85 1.87 0.85 1.87 1.3 2.

87 1.3 2.87 2.2 4.85 4.

0 94.1 31 41 5.0 95.4 38 51 16 Getting Started L100 Inverter Specifications Footnotes for the preceding table and the tables that follow: The protection method conforms to JEM 1030. The applicable motor refers to Hitachi standard 3-phase motor (4-pole). When using other motors, care must be taken to prevent the rated motor current (50/60 Hz) from exceeding the rated output current of the inverter. Note 3: The output voltage decreases as the main supply voltage decreases (except when using the AVR function). In any case, the output voltage cannot exceed the input power supply voltage. Note 4: To operate the motor beyond 50/60 Hz, consult the motor manufacturer for the maximum allowable rotation speed. Note 5: The braking torque via capacitive feedback is the average deceleration torque at the shortest deceleration (stopping from 50/60 Hz as indicated).

It is not continuous regenerative braking torque. The average deceleration torque varies with motor loss. This value decreases when operating beyond 50 Hz. Note that a braking unit is not included in the inverter. If a large regenerative torque is required, the optional regenerative braking unit should be used. Note 6: The frequency command is the maximum frequency at 9.8V for input voltage 0 to 10 VDC, or at 19.6 mA for input current 4 to 20 mA. If this characteristic is not satisfactory for your application, contact your Hitachi sales representative. Note 7: If operating the inverter in an ambient temperature of 4050° C, reduce the carrier frequency to 2.

1 kHz, derate the output current by 80%, and remove the top housing cover. Note that removing the top cover will nullify the NEMA rating for the inverter housing.



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Note 8: The storage temperature refers to the short-term temperature during transport. Note 9: Conforms to the test method specified in JIS C0911 (1984).

For the model types excluded in the standard specifications, contact your Hitachi sales representative.

Note 10: The input voltage of xxLFU is 230V. Note 1: Note 2: L100 Inverter L100 Inverter Specifications, continued... 17 Getting Started Item L100 inverters, 200V models CE version UL version kW HP Rated capacity (240V) kVA *10 Rated input voltage 015NFE 015NFU 1.

5 2 2.9 200V Class Specifications, continued 022NFE 022NFU 2.2 3 4.1 -- 037LFU 3.7 5 6.3 -- 055LFU 5.5 7.5 9.6 -- 075LFU 7.5 10 12.

7 Applicable motor size *2 1-phase: 200 to 240V +5%/10%, 50/60 Hz \pm 5%, 3-phase: 200 to 240V +5%/10%, 50/60 Hz \pm 5%, (037LFU, 055LFU & 075LFU 3-phase only) 16.0 9.3 22.5 13.0 -- 20.0 -- 30.0 -- 40.0 Rated input current (A) 1-phase 3-phase Rated output voltage *3 Rated output current (A) Efficiency at 100% rated output (%) Watt loss, at 70% output approximate (W) at 100% output Braking Dynamic braking, approx. % torque, (short time stop from 50 / 60 Hz) *5 DC braking Weight kg lb 3-phase: 200 to 240V (corresponding to input voltage) 7.1 95.

3 50 70 100%: 50Hz 50%: 60Hz 10.0 95.6 71 97 15.9 95.5 118 166 24 96.

1 152 216 32 96.2 204 288 40%: 50Hz 20%: 60Hz 20%: 50Hz 20%: 60Hz Capacitive feedback type, dynamic braking unit and braking resistor optional, individually installed Variable operating frequency, time, and braking force 2.2 4.85 2.8 6.

17 2.8 6.17 5.5 12.13 5.7 12.57 18 Getting Started L100 Inverter Specifications Item L100 inverters, 400V models CE version UL version kW HP Rated capacity (460V) kVA *10 Rated input voltage Rated input current (A) Rated output voltage *3 Rated output current (A) Efficiency at 100% rated output (%) Watt loss, at 70% output approximate (W) at 100% output Braking Dynamic braking, approx. % torque, (short time, stopping from 50 / 60 Hz) *5 DC braking Weight kg lb 2.0 004HFE 004HFU 0.4 1/2 1.

1 400V Class Specifications 007HFE 007HFU 0.75 1 1.9 015HFE 015HFU 1.5 2 3.0 022HFE 022HFU 2.2 3 4.3 Applicable motor size *2 3-phase: 380 to 460V \pm 10%, 50/60 Hz \pm 5% 3.3 5.0 7.0 3-phase: 380 to 460V (corresponding to input voltage) 1.

5 92.0 25 32 2.5 93.7 33 44 100%: 50Hz 50%: 60Hz 3.8 95.

7 48 65 5.5 95.8 68 92 40%: 50Hz, 20%: 60Hz Capacitive feedback type, dynamic braking unit and braking resistor optional, individually installed Variable operating frequency, time, and braking force 1.3 2.87 1.

7 3.75 1.7 3.75 2.8 6.17 L100 Inverter 19 Getting Started Item L100 inverters, 400V models CE version UL version kW HP Rated capacity (460V) kVA *10 Rated input voltage Rated input current (A) Rated output voltage *3 Rated output current (A) Efficiency at 100% rated output (%) Watt loss, at 70% output approximate (W) at 100% output Braking Dynamic braking, approx. % torque, (short time stop from 50 / 60 Hz) *5 DC braking Weight kg lb 10.0 030HFE -- 3.0 4 6.2 400V Class Specifications, continued 040HFE 040HFU 4.

0 5 6.8 055HFE 055HFU 5.5 7.5 10.4 075HFE 075HFU 7.5 10 12.7 Applicable motor size *2 3-phase: 380 to 460V \pm 10%, 50/60 Hz \pm 5% 11.0 16.5 20.0 3-phase: 380 to 460V (corresponding to input voltage) 7.

8 95.4 100 138 8.6 96.2 108 151 13 96.0 156 219 16 96.

5 186 261 20%: 50Hz 20%: 60Hz 40%: 50Hz, 20%: 60Hz Capacitive feedback type, dynamic braking unit and braking resistor optional, individually installed Variable operating frequency, time, and braking force 2.8 6.17 2.8 6.17 5.

5 12.13 5.7 12.57 General Specifications The following table applies to all L100 inverters. Item Protective housing *1 Control method Output frequency range *4 Frequency accuracy Frequency setting resolution Volt./Freq. characteristic Overload current rating Acceleration/deceleration time IP20 Sine wave pulse-width modulation (PWM) control 0.5 to 360 Hz Digital command: 0.01% of the maximum frequency Analog command: 0.1% of the maximum frequency (25°C \pm 10°C) Digital: 0.

1 Hz; Analog: max. frequency/1000 V/f optionally variable, V/f control (constant torque, reduced torque) 150%, 60 seconds 0.1 to 3000 sec., (linear accel/decel), second accel/decel setting available General Specifications 110 Getting Started Input signal L100 Inverter Specifications Item General Specifications Freq. Operator panel Up and Down keys / Value settings setting Potentiometer Analog setting External signal 0 to 10 VDC (input impedance 10k Ohms), 4 to 20 mA (input *6 impedance 250 Ohms), Potentiometer (1k to 2k Ohms, 2W) FWD/ REV Run Operator panel Run/Stop (Forward/Reverse run change by command) External signal Forward run/stop, Reverse run/stop FW (forward run command), RV (reverse run command), CF1~CF4 (multi-stage speed setting), JG (jog command), 2CH (2-stage accel./ decel. command), FRS (free run stop command), EXT (external trip), USP (startup function), SFT (soft lock), AT (analog current input select signal), RS (reset), PTC (thermal protection) RUN (run status signal), FA1,2 (frequency arrival signal), OL (overload advance notice signal), OD (PID error deviation signal), AL (alarm signal) PWM output; Select analog output frequency monitor, analog output current monitor or digital output frequency monitor ON for inverter alarm (1C contacts, both normally open or closed avail.) AVR function, curved accel/decel profile, upper and lower limiters, 16-stage speed profile, fine adjustment of start frequency, carrier frequency change (0.5 to 16 kHz) frequency jump, gain and bias setting, process jogging, electronic thermal level adjustment, retry function, trip history monitor Over-current, over-voltage, under-voltage, overload, extreme high/ low temperature, CPU error, memory error, ground fault detection at startup, internal communication error, electronic thermal Operating (ambient): -10 to 50°C (*7) / Storage: -25 to 70°C (*8) 20 to 90% humidity (non-condensing) 5.9 m/s² (0.

6G), 10 to 55 Hz Altitude 1,000 m or less, indoors (no corrosive gasses or dust) Light purple, cooling fins in base color of aluminum Remote operator unit, copy unit, cables for the units, dynamic braking unit, braking resistor, AC reactor, DC reactor, noise filter, DIN rail mounting Intelligent input terminal Output signal Intelligent output terminal Frequency monitor Alarm output contact Other functions Protective function Operat- Temperature ing Environ Humidity ment Vibration *9 Location Coating color Options L100 Inverter 111 Getting Started Signal Ratings Detailed ratings are in "Specifications of Control and Logic Connections" on page 46. Signal / Contact Built-in power for inputs Discrete logic inputs Discrete logic outputs PWM (analog/digital) output Analog input, current Analog input, voltage +10V analog reference Alarm relay contacts 24VDC, 30 mA maximum 27VDC maximum 50mA maximum ON state current, 27 VDC maximum OFF state voltage 0 to 10VDC, 1 mA, PWM and 50% duty digital 4 to 19.



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6 mA range, 20 mA nominal 0 to 9.6 VDC range, 10VDC nominal, input impedance 10 k 10VDC nominal, 10 mA maximum 250 VAC, 2.5A (R load) max., 0.2A (I load, P.F.=0.4) max.
100 VAC, 10mA min. 30 VDC, 3.0A (R load) max., 0.7A (I load, P.F.=0.4) max. 5 VDC, 100mA min. Ratings 112 Getting Started L100 Inverter Specifications Derating Curves The maximum available inverter current output is limited by the carrier frequency and ambient temperature.

The carrier frequency is the inverter's internal power switching frequency, settable from 0.5 kHz to 16 kHz. Choosing a higher carrier frequency tends to decrease audible noise, but it also increases the internal heating of the inverter, thus decreasing (derating) the maximum current output capability. Ambient temperature is the temperature just outside the inverter housing--such as inside the control cabinet where the inverter is mounted. A higher ambient temperature decreases (derates) the inverter's maximum current output capacity. Use the following derating curves to help determine the optimal carrier frequency setting for your inverter, and to find the output current derating. Be sure to use the proper curve for your particular L100 inverter model number. Legend: Standard ratings at 40°C Ratings at 50°C max. with top cover removed Ratings at 55°C max. with top cover removed L100002NFE/NFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.

5 L100004NFE/NFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency L100 Inverter Derating curves, continued... L100007NFE/NFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 L1000022NFE/NFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 113 Getting Started kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency 114 Getting Started L100 Inverter Specifications Derating curves, continued...

L100037LF/LFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 L100055LFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 L100075LFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency L100 Inverter Derating curves, continued... L100004HFE/HFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 L100007HFE/HFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 L100015HFE/HFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 115 Getting Started kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency 116 Getting Started L100 Inverter Specifications Derating curves, continued.

.. L100022HFE/HFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 L100040HFE/HFU 100% 90% 80% % of rated output current 70% 60% 50% 40% 0.5 L100055HFE/HFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency L100 Inverter Derating curves, continued... L100075HFE/HFU 100% 95% 90% % of rated output current 85% 80% 75% 70% 0.5 117 Getting Started kHz 2 4 6 8 10 12 14 16 Carrier frequency kHz 2 4 6 8 10 12 14 16 Carrier frequency 118 Getting Started Introduction to Variable-Frequency Drives Introduction to Variable-Frequency Drives The Purpose of Motor Speed Control for Industry Hitachi inverters provide speed control for 3-phase AC induction motors.

You connect AC power to the inverter, and connect the inverter to the motor. Many applications benefit from a motor with variable speed, in several ways: · Energy savings - HVAC · Need to coordinate speed with an adjacent process--textiles and printing presses · Need to control acceleration and deceleration (torque) · Sensitive loads - elevators, food processing, pharmaceuticals What is an Inverter? The term inverter and variable-frequency drive are related and somewhat interchangeable. An electronic motor drive for an AC motor can control the motor's speed by varying the frequency of the power sent to the motor. An inverter, in general, is a device that converts DC power to AC power. The figure below shows how the variable-frequency drive employs an internal inverter.

The drive first converts incoming AC power to DC through a rectifier bridge, creating an internal DC bus voltage. Then the inverter circuit converts the DC back to AC again to power the motor. The special inverter can vary its output frequency and voltage according to the desired motor speed. Power Input L1 L2 L3 Rectifier Variable-frequency Drive Converter Internal DC Bus + Inverter + U/T1 V/T2 W/T3 Motor The simplified drawing of the inverter shows three double-throw switches. In Hitachi inverters, the switches are actually IGBTs (isolated gate bipolar transistors).

Using a commutation algorithm, the microprocessor in the drive switches the IGBTs on and off at a very high speed to create the desired output waveforms. The inductance of the motor windings helps smooth out the pulses. L100 Inverter 119 Getting Started Torque and Constant Volts/Hertz Operation In the past, AC variable speed drives used an open loop (scalar) technique to control speed. The constant-volts-per-hertz operation maintains a constant ratio between the applied voltage and the applied frequency. With these conditions, AC induction motors inherently delivered constant torque across the operating speed range. For some applications, this scalar technique was adequate. Output voltage V Constant torque 0 100% f Output frequency Today, with the advent of sophisticated microprocessors and digital signal processors (DSPs), it is possible to control the speed and torque of AC induction motors with unprecedented accuracy. The L100 utilizes these devices to perform complex mathematical calculations required to achieve superior performance. You can choose various torque curves to fit the needs of your application. Constant torque applies the same torque level across the frequency (speed) range.

Variable torque, also called reduced torque, lowers the torque delivered at mid-level frequencies. A torque boost setting will add additional torque in the lower half of the frequency range for the constant and variable torque curves. With the free-setting torque curve feature, you can specify a series of data points that will define a custom torque curve to fit your application. Inverter Input and Three-Phase Power The Hitachi L100 Series of inverters includes two sub-groups: the 200V class and the 400V class inverters. The drives described in this manual may be used in either the United States or Europe, although the exact voltage level for commercial power may be slightly different from country to country.



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Accordingly, a 200V class inverter requires (nominal) 200 to 240VAC, and a 400V class inverter requires from 380 to 460VAC. Some 200V class inverters will accept single-phase or three-phase power, but all 400V class inverters require a three-phase power supply. TIP: If your application only has single phase power available, refer to L100 inverters of 3HP or less; they can accept single phase input power. The common terminology for single phase power is Line (L) and Neutral (N). Three-phase power connections are usually labeled Line 1 (L1), Line 2 (L2) and Line 3 (L3).

In any case, the power source should include an earth ground connection. That ground connection will need to connect to the inverter chassis and to the motor frame (see "Wire the Inverter Output to Motor" on page 218). 120 Getting Started Introduction to Variable-Frequency Drives Inverter Output to the Motor The AC motor must be connected only to the inverter's 3-Phase AC Motor output terminals. The output terminals are uniquely V/T2 labeled (to differentiate them from the input terminals) U/T1 with the designations U/T1, V/T2, and W/T3. This corresponds to typical motor lead connection designations T1, T2, and T3.

It is often not necessary to connect Earth a particular inverter output to a particular motor lead for GND a new application. The consequence of swapping any W/T3 two of the three connections is the reversal of the motor direction. In applications where reversed rotation could cause equipment damage or personnel injury, be sure to verify direction of rotation before attempting full-speed operation. For safety to personnel, you must connect the motor chassis ground to the ground connection at the bottom of the inverter housing. Notice the three connections to the motor do not include one marked "Neutral" or "Return."

"The motor represents a balanced "Y" impedance to the inverter, so there is no need for a separate return. In other words, each of the three "Hot" connections serves also as a return for the other connections, because of their phase relationship. The Hitachi inverter is a rugged and reliable device. The intention is for the inverter to assume the role of controlling power to the motor during all normal operations. Therefore, this manual instructs you not to switch off power to the inverter while the motor is running (unless it is an emergency stop). Also, do not install or use disconnect switches in the wiring from the inverter to the motor (except thermal disconnect). Of course, safety-related devices such as fuses must be in the design to break power during a malfunction, as required by NEC and local codes. L100 Inverter 121 Getting Started Intelligent Functions and Parameters Much of this manual is devoted to describing how to use inverter functions and how to configure inverter parameters. The inverter is microprocessor-controlled, and has many independent functions. The microprocessor has an on-board EEPROM for parameter storage.

The inverter's front panel keypad provides access to all functions and parameters, which you can access through other devices as well. The general name for all these devices is the digital operator, or digital operator panel. Chapter 2 will show you how to get a motor running, using a minimal set of function commands or configuring parameters. The optional read/write programmer will let you read and write inverter EEPROM contents from the programmer. This feature is particularly useful for OEMs who need to duplicate a particular inverter's settings in many other inverters in assembly-line fashion. Braking In general, braking is a force that attempts to slow or stop motor rotation. So it is associated with motor deceleration, but may also occur even when the load attempts to drive the motor faster than the desired speed (overhauling). If you need the motor and load to decelerate quicker than their natural deceleration during coasting, we recommend installing an optional dynamic braking unit. See "Introduction" on page 52 and "Dynamic Braking" on page 55 for more information on the BRDE2 and BRDEZ2 braking units. The L100 inverter sends excess motor energy into a resistor in the dynamic braking unit to slow the motor and load.

For loads that continuously overhaul the motor for extended periods of time, the L100 may not be suitable (contact your Hitachi distributor). The inverter parameters include acceleration and deceleration, which you can set to match the needs of the application. For a particular inverter, motor, and load, there will be a range of practically achievable accelerations and decelerations. 122 Getting Started Introduction to Variable-Frequency Drives Velocity Profiles The L100 inverter is capable of sophisticated speed control. A graphical representation of Speed that capability will help you understand and configure the associated parameters.

This manual makes use of the velocity profile 0 graph used in industry (shown at right). In the example, acceleration is a ramp to a set speed, and deceleration is a decline to a stop. Set speed Accel Decel t Velocity Profile Acceleration and deceleration settings specify Speed Maximum speed the time required to go from a stop to maximum frequency (or visa versa). The resulting slope (speed change divided by time) is the acceleration or deceleration. An increase in output frequency uses the acceleration 0 slope, while a decrease uses the deceleration t Acceleration slope.

The accel or decel time a particular (time setting) speed change depends on the starting and ending frequencies. However, the slope is constant, corresponding to the full-scale accel or decel time setting. For example, the full-scale acceleration setting (time) may be 10 seconds--the time required to go from 0 to 60 Hz. The L100 inverter can store up to 16 preset speeds. And, it can apply separate acceleration Speed Speed 2 and deceleration transitions from any preset to Speed 1 any other preset speed. A multi-speed profile (shown at right) uses two or more preset 0 speeds, which you can select via intelligent t input terminals. This external control can Multi-speed Profile apply any preset speed at any time. Alternatively, the selected speed is infinitely variable across the speed range. You can use the potentiometer control on the keypad for manual control. The drive accepts analog 0-10V signals and 4-20 mA control signals as well.

The inverter can drive the motor in either Speed direction. Separate FW and RV commands select the direction of rotation. The motion 0 profile example shows a forward motion followed by a reverse motion of shorter duration. The speed presets and analog signals control the magnitude of the speed, while the FWD and REV commands determine the direction before the motion starts. Forward move t Reverse move Bi-directional Profile NOTE: The L100 can move loads in both directions. However, it is not designed for use in servo-type applications that use a bipolar velocity signal that determines direction.



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L100 Inverter 123 Getting Started Frequently Asked Questions Q. What is the main advantage in using an inverter to drive a motor, compared to alternative solutions? A. An inverter can vary the motor speed with very little loss of efficiency, unlike mechanical or hydraulic speed control solutions. The resulting energy savings usually pays for the inverter in a relatively short time.

Q. The term "inverter" is a little confusing, since we also use "drive" and "amplifier" to describe the electronic unit that controls a motor. What does "inverter" mean? A. The terms inverter, drive, and amplifier are used somewhat interchangeably in industry. Nowadays, the terms drive, variable-frequency drive, variable speed drive, and inverter are generally used to describe electronic, microprocessor-based motor speed controllers.

In the past, variable-speed drive also referred to various mechanical means to vary speed. Amplifier is a term almost exclusively used to describe drives for servo or stepper motors. Q. Although the L100 inverter is a variable speed drive, can I use it in a fixed-speed application? A. Yes, sometimes an inverter can be used simply as a "soft-start" device, providing controlled acceleration and deceleration to a fixed speed.

Other functions of the L100 may be useful in such applications, as well. However, using a variable speed drive can benefit many types of industrial and commercial motor applications, by providing controlled acceleration and deceleration, high torque at low speeds, and energy savings over alternative solutions. That depends on the required precision, and the slowest speed the motor will must turn and still deliver torque. If you set the torque boost, the L100 can develop starting torque at 100% of its rating. However, DO NOT use an inverter if you need the motor to stop and hold the load position without the aid of a mechanical brake (use a servo or stepper motion control system). Q. Can I use an inverter and AC induction motor in a positioning application? A. Q. Does the optional digital operator interface or the PC software (DOP Professional) provide features beyond what is available from the keypad on the unit? A. Yes.

However, note first that the same set of parameters and functions are equally accessible from either the unit's keypad or from remote devices. The DOP Professional PC software lets you save or load inverter configurations to or from a disk file. And, the hand-held digital operator provides hardwired terminals, a safety requirement for some installations. 124 Getting Started Frequently Asked Questions Q. Why does the manual or other documentation use terminology such as "200V class" instead of naming the actual voltage, such as "230 VAC?" A. A specific inverter model is set at the factory to work across a voltage range particular to the destination country for that model. The model specifications are on the label on the side of the inverter. A European 200V class inverter ("EU" marking) has different parameter settings than a USA 200V class inverter ("US" marking). The initialization procedure (see "Restoring Factory Default Settings" on page 68) can set up the inverter for European or US commercial voltage ranges. The motor theoretically represents a "balanced Y" load if all three stator windings have the same impedance.

The Y connection allows each of the three wires to alternately serve as input or return on alternate half-cycles. Yes, for several reasons. Most importantly, this provides protection in the event of a short in the motor that puts a hazardous voltage on its housing. Secondly, motors exhibit leakage currents that increase with aging. Lastly, a grounded chassis generally emits less electrical noise than an ungrounded one.

Motor type It must be a three-phase AC induction motor. Use an invertergrade motor that has 800V insulation for 200V class inverters, or 1600V insulation for 400V class. Motor size In practice, it's better to find the right size motor for your application; then look for the inverter to match the motor. Q. Why doesn't the motor have a neutral connection as a return to the inverter? A.

Q. Does the motor need a chassis ground connection? A. Q. What type of motor is compatible with the Hitachi inverters? A. NOTE: There may be other factors that will affect motor selection, including heat dissipation, motor operating speed profile, enclosure type, and cooling method. Q. How many poles should the motor have? A. Hitachi inverters can be configured to operate motors with 2, 4, 6, or 8 poles. The greater the number of poles, the slower the top motor speed will be, but it will have higher torque at the base speed. Q.

Will I be able to add dynamic (resistive) braking to my Hitachi L100 drive after the initial installation? A. Yes. You can connect a dynamic braking unit to the L100 inverter. The resistor in the braking unit must be sized to meet the braking requirements. More information on dynamic braking is located in Chapter 5.

L100 Inverter Q. How will I know if my application will require resistive braking? A. 125 Getting Started For new applications, it may be difficult to tell before you actually test a motor/drive solution. In general, some applications can rely on system losses such as friction to serve as the decelerating force, or otherwise can tolerate a long deceleration time. These applications will not need dynamic braking.

However, applications with a combination of a high-inertia load and a required short decel time will need dynamic braking. This is a physics question that may be answered either empirically or through extensive calculations. Q. Several options related to electrical noise suppression are available for the Hitachi inverters. How can I know if my application will require any of these options? A.

The purpose of these noise filters is to reduce the inverter electrical noise so the operation of nearby electrical devices is not affected. Some applications are governed by particular regulatory agencies, and noise suppression is mandatory. In those cases, the inverter must have the corresponding noise filter installed. Other applications may not need noise suppression, unless you notice electrical interference with the operation of other devices. Q.

The L100 features a PID loop feature. PID loops are usually associated with chemical processes, heating, or process industries in general. How could the PID loop feature be useful in my application? A. You will need to determine the particular main variable in your application the motor affects. That is the process variable (PV) for the motor. Over time, a faster motor speed will cause a faster change in the PV than a slow motor speed will. By using the PID loop feature, the inverter commands the motor to run at the optimal speed required to maintain the PV at the desired value for current conditions.



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