Toshiba Tosvert RS485 Instruction Manual

Rs485 communication function

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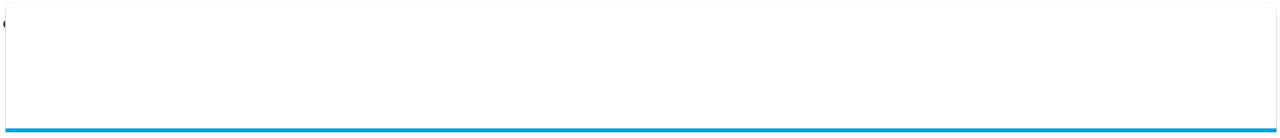

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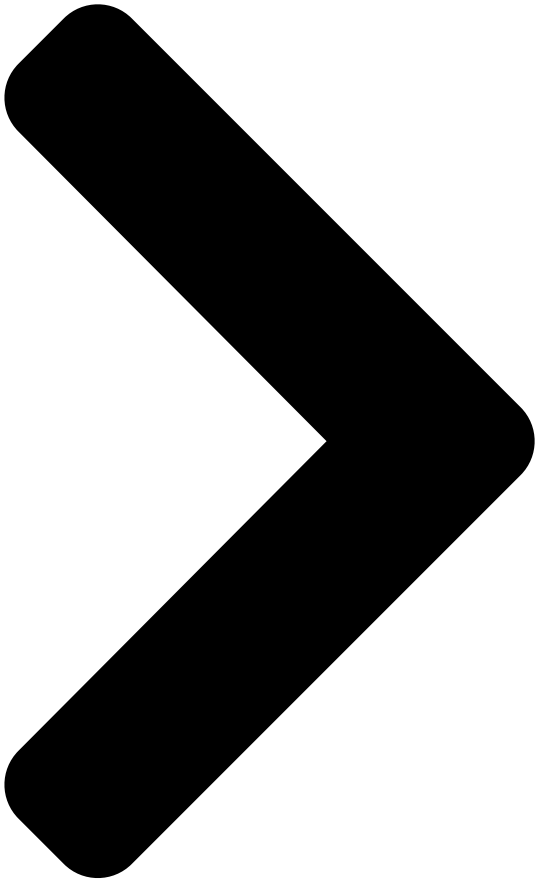

TOSVERT VF-AS1 Series

RS485 Communication Function

Instruction Manual

1. Make sure that this instruction manual is delivered to the end user of the inverter.

2. Read this manual before first using the communications function, and keep it handy as a

reference for maintenance and inspections.

* The contents of this manual are subject to change without notice.

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Accessories Toshiba RS-485 Operation Manual

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Summary of Contents for Toshiba Tosvert RS485

Page 1: Rs485 Communication Function

2. Read this manual before first using the communications function, and keep it handy as a reference for maintenance and inspections. * The contents of this manual are subject to change without notice. © TOSHIBA SCHNEIDER INVERTER CORPORATION 2005 Notice All rights reserved. E6581315②...

Page 2: Read First

EEPROM is approximately 10,000 times.(Some parameters are not limited, please refer to the

“9.Parameter data “) When using the TOSHIBA inverter protocol and the data does not need to be records, use P command (the data is written only to RAM).

Page 3: Table Of Contents

Data transmission specifications ... 4 Communication protocol... 5 3.1. About the handling of received frames... 5 TOSHIBA Inverter Protocol... 6 4.1. Data transmission format ... 7 4.1.1. Data transmission format used in ASCII mode... 7 4.1.2. Data transmission format used in binary mode ... 10 4.1.3.

Page 4: General Outlines Of The Communication Function

There are two communication protocols available: Toshiba Inverter Protocol and MODBUS-RTU Protocol (this command does not support all commands). To select a protocol, the communication protocol selection parameter f807 or f829 is used.

Page 5: Data Transmission Specifications

Start-stop synchronization Communication baud rate 9600/19200*/38400 bps (selectable using a parameter) Communication protocol TOSHIBA Inverter Protocol * / MODBUS-RTU (selectable using a parameter) Character transmission <ASCII mode> JIS X 0201 8-bit (ASCII) <Binary mode, MODBUS-RTU> Binary codes fixed to 8 bits...

Page 6: Communication Protocol

3. Communication protocol This communication protocol supports the TOSHIBA Inverter Protocol and part of MODBUS-RTU protocol. Select the desired protocol from in the following communication protocol selection parameters (□□□□, □□□□). “Parameter Name □□□□□ and □□□□, Communication Number. 0807 and 0829”...

Page 7: Toshiba Inverter Protocol

4. TOSHIBA Inverter Protocol Select “TOSHIBA” (□□□□, □□□□=□) in the communication protocol selection parameters. “TOSHIBA” (□□□□, □□□□=□) is set for initial communication protocol selection of shipment setting. (See “3. Communication protocol.”) Exchange of data between the computer and the inverter...

Page 8: Data Transmission Format

4.1. Data transmission format Note: The term “trip status” used in this manual includes retry waiting status and trip retention status. 4.1.1. Data transmission format used in ASCII mode A communication number is used to specify a data item, all data is written in hexadecimal, and JIS- X-0201 (ASCII (ANSI))-compliant transmission characters are used.

Page 9

Inverter → computer At time of broadcast communication, returning of data is not executed, except for the inverters to be returned, when the inverter number is not matched, and the inverter number has only one character. This is because there will be a risk of that the returned data may be deformed. Data returned when data is processed normally (ASCII mode) Omissible in one-to-one communication (3.5bytes...

Page 10

• Data returned when data is not processed normally (ASCII mode) In case an error occurs, communication error command (4EH(N) or 6EH(n)) and the error type num- ber is returned to the computer in addition to the checksum. At time of broadcast communication of the binary mode, returning of data is not executed except for the inverter to be returned (inverter number 00H) and when the inverter number is not matched.

Page 11: Data Transmission Format Used In Binary Mode

4.1.2. Data transmission format used in binary mode A communication number is used to specify a data item, data is written in hexadecimal form, and data in transmission characters are represented by binary codes (HEX codes). Computer → Inverter (binary mode) Omissible in one-to-one communication ...

Page 12

Inverter → computer (binary mode) At time of broadcast communication of the binary mode, returning of data is not executed except for the inverter to be returned (inverter number 00H) and when the inverter number is not matched. This is because there will be a risk that the returned data may be deformed. •...

Page 13

2) Error Processing (Binary mode) In case an error occurs, communication error

command (4EH(N) or 6EH(n)) and the error type num- ber is returned to the computer in addition to the checksum. At time of broadcast communication of the binary mode, returning of data is not executed except for the inverter to be returned (inverter number 00H) and when the inverter number is not matched.

Page 14: Transmission Format Of Block Communication

4.1.3. Transmission format of Block Communication What is block communication? Data can be written in and read from several data groups set in one communication by setting the type of data desired for communication in the block communication parameters (□□□□, □□□□, □□□□...

Page 15 Block Write 1, 2 Select data, which is desired to be written in block communication, in block write Data 1 and 2 Pa- rameters (□□□□, □□□□). This parameter becomes effective when the system is reset, such as when power is turned off. When the setting is completed, turn off and then on the power. Block Write Data Deselect Command information 1 (FA00)

Page 16 Inverter → Computer At time of broadcast communication of the binary mode, returning of data is not executed except for the inverter to be returned (inverter number 00H) and when the inverter number is not matched. This is because there will be a risk that the returned data may be deformed. 1) Normal processing Omissible (3.5...

Page 17 2) Error Processing (Binary mode) In case an error occurs, communication error command (4EH(N) or 6EH(n)) and the error type num- ber is returned to the computer in addition to the checksum. Omissible (3.5bytes “/” INV-NO Blank) (2FH) 1 byte ...

Page 18: Commands

10,000 times.(Some parameters are not limited, please refer to the “9.Parameter data “) The lifetime of EEPROM is approximately 10,000 times. When using the TOSHIBA inverter protocol and the data does not need to be records, use P command (the data is written only to RAM).

Page 19 P (50 (RAM write) This command is used to rewrite data into the parameter specified using a communication number. It writes data into the RAM only. It cannot be used to write data into any read-only parameters. Each time an attempt to write data is made the inverter checks whether the data falls within the specified range.

Page 20 When Command “s” (lowercase letter) is received, the slave side judges that the master side is tripped and operates in accordance with the inter-drive communication parameter (□□□□, □□□□). For detail, see "7. Communication parameters ". - Examples: 50% frequency command (2-wire RS485 communication) (If maximum frequency = Frequency for operation at 80Hz = 40Hz: 50% = 5000d = 1388H) <Binary mode>...

Page 21: Transmission Errors

4.3. Transmission errors Table of error codes Error name Impossible to exe- The command is impossible to execute, though communication was cute established normally. 1 Writing data into a parameter whose setting cannot be changed during operation (e.g., maximum frequency) 2 Writing data into a parameter while “□□□□”...

Page 22: Broadcast Communication Function

4.4. Broadcast communication function Broadcast communication function can transmit the command (write the data) to multiple inverters by one communication. Only the write (W, P) command is valid and the read (R, G) command is in- valid. The inverters subject to the broadcast communication are the same to the independent com- munication;...

Page 23 Host computer Block 1 Inverter No. 10 Inverter No.11 Inverter No.19 VF-AS1 VF-AS1 VF-AS1 In broadcast communication, only the representative inverter in each block returns data to the host computer. However, you can make the representative inverter in each block report the occurrence of a problem in the block.

Page 24: Examples Of The Use Of Communication Commands

4.5. Examples of the use of communication commands Here are some examples of the use of communication commands provided for the VF-AS1 series of inverters. Inverter numbers and checksum used in ASCII mode are omitted from these examples. Examples of communication - To run the motor in forward direction with the frequency set to 60 Hz from the computer <ASCII

mode>...

Page 25: Examples Of Communication Programs

Output frequency = 80 Hz ... Output frequency = 79.95Hz Output frequency = 0Hz (Toshiba version of Advanced BASIC-86 Ver. 3.01.05J) --- 9600 baud, even parity, 8-bit length, 1 stop bit --- Specifies the communication number for monitoring the output frequency.

Page 26

Receive Data= (W00111770&36) Send Data=? R0011 Receive Data= (R00111770&31) (Toshiba version of Advanced BASIC-86 Ver. 3.01.05J) --- 9600 baud, even parity, 8-bit length, 1 stop bit --- Reads in data to be sent to the inverter. --- Adds “(“ and “&” to the read data in.

Page 27

!!! There is no data to return. !!! Send data? (R0011) Return data= (R00111770) Send data? (Toshiba version of Advanced BASIC-86 Ver. 3.01.05J) ---- Selects a baud rate. ---- Selects parity. ---- Enters a command. ---- Prevents an increase in the number of digits.

Page 28

Ex. 4 A VisualBaisc program for the ASCII mode communication (VisualBaisc is the registered trademark of the U.S. microsoft company.) ◊ Accessing a parameter 1) Sample program executive example (Monitor of the output frequency (FD00)) Transmission and reception of the optional data like in the following example can be done by do- ing "the arrangement of the form control"...

Page 29

3)The description of the code Private Sub Form_Load() Form1.Show '********** ' Setting the labels (Initialization) '********** Label1.Caption = "Data for transmission" Label2.Caption = "Received data" Command1.Caption = "Transmit" Command2.Caption = "Clear" Command3.Caption = "Exit" '********** ' Setup of communication (Initialization) '********** MSComm1.RThreshold = 0 MSComm1.InputLen = 1...

Page 30: Modbus-Rtu Protocol

Parameter Setting • Protocol selection (□□□□, □□□□) Select “MODBUS□RTU (□□□□, □□□□ = □) in the communication selection parameters. “TOSHIBA” (□□□□, □□□□=□) is set for communication protocol selection in initial shipment set- ting. (See “3. Communication protocol.”) * Caution when selecting MODBUS-RTU Note that selecting this protocol disables the inter-drive communication functions set with parame- ters □□□□...

Page 31: Modbus-Rtu Transmission Format

5.1. MODBUS-RTU transmission format MODBUS-RTU sends and receives binary data without a frame-synchronizing start code and de- fines the blank time to recognize the start of a frame. MODBUS-RTU decides the data that is first received subsequently as the first byte of a frame after a blank time for 3.5 bytes at the on-going communication speed.

Page 32: Write Command (06)

5.1.2. Write command (06) Computer → Inverter *The text size is 8 bytes fixed. Inverter (3.5bytes Command Blank) 1) Inverter No. (1 byte) : Specify an inverter number between 0 and 247 (00H to F7H). Command processing will be executed only broadcast communication “0” and with those inverters that match set inverter numbers.

Page 33: Crc Generation

5.2. CRC Generation “CRC” is a system to check errors in communication frames during data transmission. CRC is composed of two bytes and has hexadecimal-bit binary values. CRC values are generated by the transmission side that adds CRC to messages. The receiving side regenerates CRC of received messages and compares generation results of CRC regeneration with CRC values actually received.

Page 34: Inter-Drive Communication

(continue to operate, issue an alarm or trip) if a cable is broken or the master inverter is turned off during operation. * To use the inter-drive communication function, select “TOSHIBA Inverter Protocol” (□□□□, □□□□=□) in the communication protocol selection parameters. “TOSHIBA Inverter Protocol”...

Page 35 Wiring (2-wire RS485 communication) Straight Master Pin-4 RXD+/TXD+ RXD-/TXD- Pin-5 Pin-8 (Pin-3) * Never use pin-7 (P11). Wiring (4-wire RS485 communication)□ Master Pin-4 Pin-5 Pin-3 Pin-6 Pin-8 (Pin-2) * Never use pin-1 (Open) and pin-7 (P11). * You do not need to connect the master receive lines (pins 4 and 5) or the slave send lines (pins 3 and 6).

Page 36 Select an option other than RS485 communication (fm0d≠5 or 6). - Setting to the slave inverters Select from between: fm0d=5: 2-wire RS485 communication input fm0d=6: 4-wire RS485 communication input □□□□) Shipment setting: 0 (TOSHIBA) □□□□) ... Shipment setting = □ E6581315...

Page 37 Setting example of parameters (2-wire RS485 communication) Parameters relating to the master side (example) □□□□□□ Master (transmission of output frequency (%) (100% at FH)) □□□□□□ Selection of communication protocol (Toshiba inverter protocol) Communication baud rate □□□□□□ (ex. 19200bps) Parity (even parity) □□□□□□ Example: Panel □□□□□□...

Page 38: Proportional Control Of Speed

6.1. Proportional control of speed Proportional control of frequency can be performed in two ways: control by selecting frequency points and control by adjusting the ratio to the maximum frequency. This section explains propor- tional control of inverters by means of a master inverter (inter-drive communication), although the AS1 series inverters are ready for proportional control by means of the “S”...

Page 39 • If the “Frequency point selection” function is disabled (□□□□=□) The operation frequency (frequency command value) of the inverters are calculated using the fol- lowing equations, with the received data in the following equation used as the data received from the master inverter when inverters are operated under the control of a master inverter (inter-drive communication), or with the received data in the following equation used as the data received from the computer when inverters are operated under the control of a computer (computer-linked opera-...

Page 40: Transmission Format For Inter-Drive Communication

6.2. Transmission format for inter-drive communication Data type is handled in hexadecimal notation and the transmission characters are treated with the binary (HEX) code. The transmission format is basically the same to the case of binary mode. S command is used and the slave inverters do not return the data.

Page 41: Communication Parameters

3:Master (sends a frequency command) 4:Master (sends an output frequency) 5.Master (sends a torque command) 6.Master (sends an output torque com- mand) 0: TOSHIBA 1:MODBUS-RTU 0:Disabled 1:2-wire RS485 2:4-wire RS485 3:Communication add option 0-100% 0-□□Hz...

Page 42 3:Master (sends a frequency command) RS485) 4:Master (sends an output frequency) 5.Master (sends a torque command) 6.Master (sends an output torque com- mand) Protocol selection 0: TOSHIBA 0829 □□□□ (4-wire RS485) 1: MODBUS-RTU 0: Deselect 0870 □□□□ Block write data 1...

Page 43: Baud Rate(□□□□, □□□□) , Parity (□□□□)

Parameters can be selected between 0 and 247. Note that the communication protocols limit in- verter numbers as follows: ● TOSHIBA Inverter Protocol ASCII mode: 0 to 99 ● TOSHIBA Inverter Protocol Binary mode: 0 to 63 ● MODBUS Protocol: 0 to 247 (0: Broadcast communication)

Page 44: Communication Time-Out Time (□□□□), Communication Time-Out Action (F804)

7.3. Communication time-out time (□□□□), Communication time-out action (f804) The timer function is mainly used to detect a break in a cable during communication, and if no data is sent to an inverter within the preset time, this function makes the inverter trip (□□□□) or issue an alarm (□).

Page 45: Send Waiting Time (□□□□, □□□□)

7.4. Send waiting time (□□□□, □□□□) Use this function for the following case: When the data response from the inverter is too quick after the PC had sent the data to the inverter, PC process cannot get ready to receive the data, or when the USB/RS485, RS485/RS232C con-

verter is used, changeover of sending and receiving data takes much time in the converter process.

Page 46: Commands And Monitoring From The Computer

8. Commands and monitoring from the computer Across the network, instructions (commands and frequency) can be sent to each inverter and the operating status of each inverter can be monitored. 8.1. Communication commands (commands from the computer) Communication command (Communication number: FA00, FA04) Commands can be executed on inverter frequencies and operation stop through communication.

Page 47 Communication command2 This command is enabled only when the communication command is enabled. Set Bit 15 of Com- munication Command 1 (communication Number: FA00, FA04) to “1” (enable). When enabling the communication command by Communication Command 1, commands by communication can be given the priority irrespective of the setting of the command mode selection parameter (□□□□).

Page 48 Frequency setting from the computer Setting range: 0 to maximum frequency (fh) This frequency command is enabled only when the frequency command by communication is en- abled. To make frequency commands from the computer valid, set the frequency setting mode se- lection parameter (fmod) to RS485 communication (communication No.

Page 49 Terminal board output data (FA50) The output terminal board on each inverter can be directly controlled with the computer. To use this function, select functions 92 to 105 in advance for the output terminal function selection parameters f130 to f138, f168□and□f169. If bit 0 through bit 6 of terminal board output data (FA50) are set with the computer, data specified (0 or 1) can be sent to any output ter- minal.

Page 50: Monitoring From The Computer

8.2. Monitoring from the computer This section explains how to monitor the operating status of the inverter from the computer. Monitoring of the output frequency from the computer (FD00, FE00) Output frequency (current status): “Communication Number FD00” (minimum unit: 0.01Hz) Output frequency (status immediately before the occurrence of a trip): “Communication Number FE00”...

Page 51 Input terminal board status (FD06, FE06) Input terminal board status (current status): “Communication Number FD06” Input terminal board status (status immediately before the occurrence of a trip): “Communication Number FE06” Using terminal function selection parameters, functions can be assigned individually to the termi- nals on the input terminal board.

Page 52 Output terminal board status (FD07, FE07) Output terminal board status (current status): “Communication Number FD07” Output terminal board status (status immediately before the occurrence of a trip): “Communication Number FE07” Using terminal function selection parameters, functions can be assigned individually to the termi- nals on the output terminal board.

Page 53 Inverter operating status 1 (FD01, FE01) Inverter status 1 (current status): Communication Number FD01 Inverter status 1 (status immediately before the occurrence of a trip): Communication Number FE01 Specifications Failure FL Failure Alarm Reserved Motor section (1 or 2) (THR 2 selection) PI control OFF Accelera- tion/deceleration...

Page 54 Inverter operating status 2 (FD42, FE42) Inverter status 2 (current status): Communication Number FD42 Inverter status 2 (status immediately before the occurrence of a trip): Communication Number FE42 Function Control mode switching Electric Power Counting (FE76,FE77) status (Reserved) (Reserved) Preliminary excitation (Reserved) (Reserved) Maximum deceleration forced...

Page 55 Inverter operating command mode status (FD45, FE45) The monitor of the command mode that the present condition is enabled Command mode status (current status): “Communication Number FD45” Command mode status (status immediately before the occurrence of a trip): “Communication Num- Data Enabled command Terminal input enabled...

Page 56 Alarm information monitor (FC91) Specifications Over-current alarm Inverter overload alarm Motor overload alarm Overheat alarm Overvoltage alarm Main circuit

undervoltage alarm (Reserved) Low current alarm Over-torque alarm Braking resistor overload alarm Cumulative operation hours alarm (Reserved) (Reserved) (Reserved) At the time of the instant black- out, Forced deceleration/stop An automatic stop during the lower limit frequency continu-...

Page 57 Trip code monitor (current status: Data (hexadeci- Code mal number) nerr ocai oca2 oca3 ephi epho eep1 eep2 eep3 err2 err3 err4 err5 err6 err7 err8 oc1p oc2p oc3p etyp e-10 e-11 e-12 e-13 sout e-18 e-19 e-20 e-21 e-22 e-23 FC90:...

Page 58 e-24 e-25 e-26 etn1 etn2 etn3 Inverter model (capacity) code (FB05) Model VFAS1-2004P VFAS1-2007P VFAS1-2015P VFAS1-2022P VFAS1-2037P VFAS1-2055P VFAS1-2075P VFAS1-2110P VFAS1-2150P VFAS1-2185P VFAS1-2200P VFAS1-2300P VFAS1-2370P VFAS1-2450P VFAS1-2550P VFAS1-2750P VFAS1-4007P VFAS1-4015P VFAS1-4022P VFAS1-4037P VFAS1-4055P VFAS1-4075P VFAS1-4110P VFAS1-4150P VFAS1-4185P VFAS1-4220P VFAS1-4300P VFAS1-4370P VFAS1-4450P VFAS1-4550P VFAS1-4750P...

Page 59: Utilizing Panel (Leds And Keys) By Communication

8.3. Utilizing panel (LEDs and keys) by communication The VF-AS1 can display data that is not related to the inverters through an external controller or other means. Input by key operations can also be executed. The use of inverter resources re- duces the cost for the entire system.

Page 60 Block Communication Function for LED Display To display LED data for ASCII display that is synchronized to each digit, set data for each digit and validate this set data by display selection by communication (Communication Number FA65). Synchronization can also be achieved by batch writing LED data parameters after changing the fol- lowing block communication mode parameters and by sending data by block communication.

Page 61 ■ ASCII LED display data code (00H-1FH are blank.) Hex Code Display Char. Hex Code BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK BLANK 31HT BLANK BLANK *Dots to show decimal points and other uses can be added by setting (80H) Bit 7 (highest bit). Example: “0.”...

Page 62: Key Utilization By Communication

8.3.2. Key utilization by communication The VF-AS1 can use the panel keys on the inverters through external communication. Key Monitoring Procedure Set panel key selection (Communication Number: FA10) to “1” to set the external key mode. How- ever, if communication duration is less than 1sec to avoid an inverter operation shutdown in com- munication disruption, communication must always be maintained, such as monitoring key data and LED data to automatically reset inverter operations to inverter key operation (FA10 = 0).

Page 63: Parameter Data

9. Parameter data Explanation of parameters for VF-AS1 series is described here. For communication purposes, see the parameter list on inverter's instruction manual regarding the communication number, adjustment range and so forth. Referring to the parameter list <Example of excerpts from the inverter’s instruction manual> Communi- Title Function...

Page 64 Command parameters For those parameters that contain data only in the RAM and not in the EEPROM, their data return to initial values when the power is turned off, in failure resetting, or when standard shipment settings are set. Note that parameters without data storage in the EEPROMs will be written in the RAM only even if the command W (writing in EEPROMs and RAM) is executed.

Page 65 □ : Enable the communication command or communication frequency setting before setting these parameters are set. Otherwise, the parameters will not function. See “8.1 Command by communication” for the method to enable them. □ : Note that the Communication Number for operation panel operation frequency is FA02 in the VF-S7 and VF-S9 series.

Page 66 Monitor parameters *These Parameters are read-only (monitor-only) parameters. Communication No. Current Trip data held value FC00 − FC01 − FC90 − FC91 − FD00 FE00 FD01 FE01 FD02 FE02 FD03 FE03 FD04 FE04 FD05 FE05 FD06 FE06 FD07 FE07 FE08 −...

Page 67 FD50 − Light-load high-speed torque 1 FD51 Light-load high-speed torque 2 − − FE60 MY monitor 1 FE61 MY monitor 2 − FE62 MY monitor 3 − − FE63 MY monitor 4 FE70 Rated

current − − FE71 Rated voltage FE73 CPU version 2 (motor) −...

Page 68: Appendix 1 Table Of Data Codes

Appendix 1 Table of data codes • JIS (ASCII) codes Higher orde Lower order (SOH) (STX) (ETX) (EOT) (ENQ) (ACK) (BS) (HT) (LF) (VT) (FF) (CR) CR: Carriage return Ex.: Code 41 = Character A (DLE) (SP) □ □ □ □...

Page 69: Appendix 2 Response Time

Appendix 2 Response time The communication response time can be calculated from data communication time and inverter processing time. When wishing to know the communication response time, calculate using the following as a reference Data transmission time PC → Inverter Response time Data transmission time Data...

Page 70: Appendix 3 Compatibility With The Communication Function Of The Vf-A7

To provide consistency in communication procedures, the communication function of the VF-AS1 series of inverters has been designed based on the protocols used for the Toshiba VF-A7 series of inverters. With regard to compatibility, however, VF-A7 users should check the items described be- low before using the communication function of their inverters.

Page 71: Appendix 4 Troubleshooting

The setting of a parameter was When using the TOSHIBA Inverter Protocol, use the W command to changed, but it returns to its write data into the EEPROM. If you use the P command that writes data original setting when the inverter into the RAM only, the data will be cleared when the inverters are reset.

Page 72: Appendix 5 Connecting For Rs485 Communication

Appendix 5 Connecting for RS485 communication Connector diagram for 2-wire RS485 communication Signal name RXD+/TXD+ RXD-/TXD- PRG(TX) PRG(RX) Connecting diagram for 2-wire RS485 communication * Never use pin-7 (P11). Straight Master Pin-4 RXD+/TXD+ Pin-5 RXD-/TXD- Pin-8 (Pin-3) Pin-8 Pin-1 Pin number Same phase reception data (positive line)

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Connector diagram for 4-wire RS485 communication Signal name − *This table shows signal line of inverter side. (Example: RXA signal is received by inverter.) Connecting diagram for 4-wire RS485 communication Master Pin-4 Pin-5 Pin-3 Pin-6 Pin-8 (Pin-2) * When using 2-wire type, short RXB to TXB and RXA to TXA. * Never use pin-1 (Open) and pin-7 (P11).

This manual is also suitable for:

Tosvert vf-as1 series