TOSVERT VF-A7/P7

Serial Communication Function Manual

Toshiba Schneider Inverter Corporation

NOTE

1. Make sure that this instruction manual is delivered to the end user of the inverter unit.
2. Read this manual before using the communication function.
   Keep this manual near at hand of the user so that it can be referred to for maintenance and inspection.

∗ Note that the contents of this manual are subject to change without prior notice.

Preface

Safety precautions

On the inverter and in its instruction manual, important information is contained for preventing injuries to users and damages to assets and for proper use of the device.

Read the instruction manual attached to the inverter along with this instruction manual for completely understanding the safety precautions and adhere to the contents of these manuals.

NOTE		See page
	▼ Equip a magnetic contactor or the like between the inverter and the power source to assure the emergency stop from outside. ▼ Do not write the same parameter to the EEPROM more than 10,000 times by using W command (the data is written to EEPROM and RAM) .The lifetime of EEPROM is approximately 10,000 times. When the data does not need to be recorded, use P command (the data is written only to RAM). ▼ Examples explained in this manual assume that the serial communication is carried out by one inverter unit. When plural inverters are used, designate an inverter number to be communicated with, or else the data will overlap and communication will fail. For handling of the inverter unit, follow the instructions of the inverter's manual.	Instruction manual of the inverter unit See "chapter 4. Command".

contents

1. Outline of communication function

This instruction manual describes the function of serial communication interface (listed below) equipped to Toshiba industrial inverter TOSVERT VF-A7/P7 series.

① Standard RS485 communication function used with RS485 communication port
② RS232C communication function used with optional RS232C communication converter unit (RS2001Z) that is connected to the common serial communication (logic signal) port
③ RS485 communication function used with optional RS485 communication converter unit (RS4001Z) that is connected to the common serial communication (logic signal) port

These communication functions enable computer link function for data communications among the inverter, host calculating machine, controllers (computers) and the like, also enable inter-drive communication function which allows proportional control without computers. As a result, it will realize a network construction in which data communications are possible among plural units of inverter.

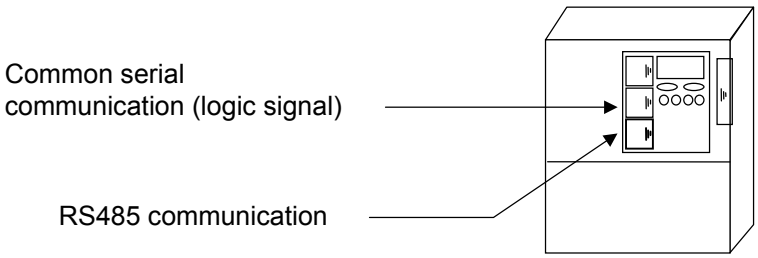
＜Computer link function＞

By preparing the program (explained later), the following information can be exchanged between the computer (host) and the inverter.

(1) Monitoring of inverter status (output frequency, current, voltage, and so forth)
(2) Command to the inverter (run, stop, and so forth)
(3) Reading out and changing of the inverter parameter settings

＜Inter-drive communication function＞

Master inverter sends the data, that is selected by the parameter, to all the slave inverters on the same network. This function enables a network construction in which a simple synchronous or proportional operation is possible among plural inverters (without the host computer).



2. Specification of transmission

Item	Specification
Transmission method	Half-duplex method
Synchronizing method	Start-stop synchronous ◎: Standard shipment setting
Transmission speed	Common serial option : 1200/2400/4800/9600◎ (parameter setting) *1 RS485 communication: 1200/2400/4800/9600◎/19200/38400 bps (parameter setting)*1
Transmission characters	<ASCII mode> JIS X 0201 8 bits (ASCII) <Binary mode> Binary code, fixed to 8 bits
Stop bit length	Reception at Inverter side: 1 bit, Sending from Inverter side: 2 bit
Error detecting method	Parity *2 Selection of even number◎/odd number/none (parameter setting) *1, Checksum
Type of transmission character	11 bits *3 (stop bit =1, Parity = when added)
Order of sending bit	Lower bit takes precedence.
Frame length	Variable (Maximum 22 bytes)

∗1: To validate the changing of baud rate and communication parity, turn off the power supply once or reset the inverter.

∗2: For all the messages for ASCII mode transmission, use 8-bit code of alphabet according to the JIS-X-0201(ANSI) and add vertical parity bits (even number) specified in JIS-X-5001. Odd number parity can be used for some parameter setting (possible after resetting).

∗3: Transmission characters are as follows. (Standard shipment setting)

Reception by inverter: 11 bits (1 start bit + 8 bits + parity + 1 stop bit)...Standard shipment setting

START BIT	BIT0	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	PARITY BIT	STOP BIT

Transmission character of 1 stop bit is received at inverter side.
(At computer side, data sending is possible with either of 1 or 1.5 or 2 setting of the stop bit.)

Sending from inverter: 12 bits (1 start bit + 8 bits + parity + 2 stop bits)...Standard shipment setting

START BIT	BIT0	BIT1	BIT2	BIT3	BIT4	BIT5	BIT6	BIT7	PARITY BIT	STOP BIT	STOP BIT

Transmission character of 2 stop bits is sent from the inverter side.
(At computer side, data receiving is possible with either of 1 or 1.5 or 2 setting of the stop bit.)

∗ Note that in the case of CPU version from V100 to V305, the STOP bit is regarded as one bit at time of transmission from the inverter as well as the reception by the inverter.

3.Data communication of inverter

3.1.Outline description of sequence

Inverters linked with computers and slave inverters linked with other ones are always in standby status for data reception, and they perform corresponding operation according to the command from the master inverter. The master inverter linked with other slave inverters always sends data and does not receive data from others.

Judgement of ASCII mode or binary mode is automatically recognized with the starting character. Inter-drive communication is carried out by the binary mode.

As for the transmission format used for the data communication, see "Transmission format" of chapter 5.

When the transmission format is wrong, the communication fails. For the contents of transmission error, see "Transmission error" of chapter 3.2 .

■ ASCII mode

(1) The heading code of the ASCII mode is “(“.
At the inverter side, all data prior to “(“ are abolished. When two or more “(“ are input, the last one will be effective and the other ones will be ignored.
When “(“ cannot be recognized because of the format error or the like, it will not be judged as the data and no error will be sent. At this status of transmission error, the inverter waits for the next “(“.

(2) When the inverter number is added after “(“, data communication will be effective only if the inverter number coincides. If it does not coincide, no response will be given.
And when only one digit of inverter number is specified, it will be judged as the format error and the reception data will be abolished. Then the inverter will wait for the next “(“.

(3) Data reception completes only when "CR" (Carriage Return) is received in the specified position. When "CR" is not received in the specified position after one second later, it will be judged as the transmission error, and the reception data will be abolished. Then the inverter will wait for the next “(“.

(4) At the computer link communication (some exceptions exist at time of broadcast communication), inverter returns the data to the computer after it processes the reception command.

■ **Binary mode**

(1) The heading code of the binary mode is “2FH(/)”.
At the inverter side, all data prior to “2FH(/)“ are abolished. When two or more “2FH(/)“ are input, the first one will be effective and the following ones will be ignored.
When “2FH(/)“ cannot be recognized because of the format error or the like, it will not be judged as the data and no error will be sent.

(2) When the inverter number is added after “2FH(/)“, data communication will be effective only if the inverter number coincides. If it does not coincide, no response will be given.

(3) Data reception completes only if the command and number of data specified by the command are received. When the command cannot be judged or when the specified number of data is not accepted after about one second, it will be judged as the transmission error and the reception data will be abolished. Then the inverter will wait for the next “2FH(/)“.

(4) At the computer link communication (there will be some exceptions at time of broadcast communication), inverter returns the data to the computer after it processes the reception command.

■ **Cautions**

(1) Communication is not possible for about one second after the power is supplied to the inverter until the initial setting is completed. If the control power is shut down due to an instantaneous voltage drop, communication is temporarily interrupted.

(2) In case the communication timer is set by the parameter and the communication is not carried out during the predetermined time period, an error takes place. As the results of the predetermined elapsed time, the inverter will perform the action that has been selected by the parameter of communication time-out. (The standard shipment setting of the timer is set to "OFF" and that of the communication time-out is set to "Er-5", that will trip the inverter.) See the chapter 7.1 "timer function" for details.

(3) Processing of communication in the VF-A7/P7 series employs a method to treat the residual time of the inverter control, and the response time is not assured. The guideline for the reference is approximately 15ms as the standard shipment setting, however this would be delayed depending on the operating condition. (See appendix 2 “response time”.)

3.2. Transmission error

■ **Table of error code**

Name of error	Detail	Error code
cannot execute	Communication is normal but it can not be executed. ① Data was written to the parameter that is prohibited to be changed during running (maximum frequency setting, etc.) .*1 ② Data was written to the parameter that is performing "ヒ ﾕﾛ". ③ Maintenance command is designated. *2	0000
Data error	Set data value is out of allowable range.	0001
Communication number error	There is no appropriate communication number. →(RO))))$_{CR}$ regards 0))) as the communication number.	0002
Command error	There is no appropriate command.	0003 (ASCII mode) No response (binary mode)
Checksum error	Checksum does not coincide.	0004
Format error	Transmission format does not coincide. ① Inverter number is one digit. (ASCII mode) ② "CR" code is not received in the designated position (ASCII mode). (EX.) Communication numbers are four digits or less. (R11)$_{CR}$ regards 11)$_{CR}$ as the communication number and judges that there is no "CR" and the format error occurs. ③ A code other than the termination code is received in the position of the termination code. (Ex.) (W00111F40)$_{CR}$ (LW00111F40)$_{CR}$ regards ")" as the data position and the data error occurs. ④ Designated number of data are not received within one minute.	No response
Access mode error	Invalid access mode ① A data exceeding 16 bits was tried to be read out with 16-bit mode. ② A data that cannot be treated with 16-bit mode was tried to be written in.	0006
Reception error	Parity, overrun or framing error occurs. *3	No response

∗1 :As for the parameters that are prohibited to be changed during running, see the "parameter table" in the instruction manual of the inverter.

∗2 :With the binary mode, the data is not returned in case of a command error, however when the Maintenance command (M) is used, "action impossible" error occurs and the comment of error is returned.

∗3 :Parity error :Parity is not right.
Overrun error :A new data is entered while the data is being written in.
Framing error :Position of the stop bit is wrong.

※ "No response" in the table means that a comment of error is not returned because the data may collide.

※ When the inverter number does not coincide, processing and returning is not carried out although it is not an error.

■ **Alarm for communication error**

When an error except for the "reception error" on the above table occurs during a broadcast communication or inter-drive communication, "ヒ " alarm is released.

4.Command

There are following types of command as the communication command. With a single command, the data access is 16-bit capacity. By adding "L" in front of the command, the data access will be 32-bit.

Type of command	Function
R command	Reading of designated communication number
W command	Writing to designated communication number (RAM, EEPROM)
P command	Writing to designated communication number (RAM)
S command	Inter-drive communication command (special for binary mode, no data response)
G command	Reading of designated communication number (special for binary mode, dummy data is necessary.)

■ W (57_H) (RAM*1 / EEPROM*2 Write)

This command rewrites the parameter into the specified data, that is designated by the communication number, to an arbitrary data. The data will be written to the RAM and EEPROM. Although the W(57H) command is used,
the data will be written only to the RAM in case the parameter is not applicable to the EEPROM (communication number FA00 and the like). Also the read-only parameter (communication number FD??, FE?? and the like) cannot be rewritten. At time of data writing, the data range of the parameter is checked at the inverter side. See "parameter list" in the inverter's instruction manual (E6580746).
If the data is out of the range, it will be invalid.

■ Explanation

*1 : RAM is the actual data to control the inverter. The data becomes invalid when the power is turned off, and when it is turned on the parameter data of EEPROM will be duplicated.

*2 : EEPROM contains the parameters and the like those are used for the inverter control. The data will be restored even after the power is turned off. When the power is recovered or reset, the data will be duplicated to the RAM.

◎Example: “Function OFF” (0) is set to “Automatic acceleration / deceleration parameter” (communication number: 0000).

<ASCII mode>

Computer to inverter
（WOOOOO）CR

Computer from inverter
（WOOOOOOOO）CR

CR: Carriage Return

<Binary mode>

Computer to inverter
2FH、57H、00H、00H、00H、00H、86H

Computer from inverter
2FH、57H、00H、00H、00H、00H、86H

NOTE	
	▼ The lifetime of EEPROM is approximately 10,000 times. When the data does not need to be recorded, use P command (the data is written only to RAM). Do not write the W command (the data is written to EEPROM and RAM) to the same parameter of the EEPROM more than 10,000 times.

■ P (50_H) (RAM*1 Write)

This command rewrites the parameter data, that is designated by the communication number, to an arbitrary data. The data is written to RAM only and the read-only parameter cannot be rewritten. At time of data writing, the data range of the parameter is checked, and if the data is out of the range, it will be invalid.

◎Example: Setting of automatic acceleration and deceleration parameter (communication number: 0000) and the setting of function OFF (0)

<ASCII mode>

Computer to inverter	Computer from inverter
(P00000)CR	(P00000000)CR

<Binary mode>

Computer to inverter	Computer from inverter
2FH、50H、00H、00H、00H、00H、7FH	2FH、50H、00H、00H、00H、00H、7FH

■ R (52_H) (Data read)

This command reads out the parameter data, that is designated by the communication number.
(When two or more inverters are used by the binary mode with the two-wire line of the RS485 communication system, use “G” command for data reading. If “R” command is used, communication may fail.)

◎Example: Read out of automatic acceleration and deceleration parameter (communication number 0000)

<ASCII mode>

Computer to inverter	Computer from inverter
(R0000)CR	(R00000000)CR : Data, 0000 = Set to off

<Binary mode>

Computer to inverter	Computer from inverter
2FH、52H、00H、00H、81H	2FH、52H、00H、00H、00H、00H、81H Data, 00H, 00H; Set to off

NOTE
▼ When two or more inverters are used by the binary mode with the two-wire line of the RS485 communication system, use “G” command for data reading.

■ G(47_H) (Data read)

This command reads out the parameter data, that is designated by the communication number.
To cope with the two-wire line communication, dummy data is necessary at time of commanding to the inverter (2 bytes for 16-bit access, 4 bytes for 32-bit access).This command is valid only for the binary mode.

◎Example: Read out of arbitrary acceleration and deceleration parameter (communication number 0000)

Computer to inverter	Computer from inverter
2FH、47H、00H、00H、00H、00H、76H	2FH、47H、00H、00H、00H、00H、76H

※Data “00H 00H” from computer to inverter is dummy data.

■ S(53_H)/s (73_H) Inter-drive communication command (RAM*1 Write)

This command is applicable to the inter-drive communication and also available to the manipulation of the proportional operation with use of the controller. Only the frequency command (FA01, FA04) and the torque command (FA30, FA32) are valid, and other commands are regarded as an error of invalid communication number and it will release the alarm. The data is written to RAM only, and at this time the data check such as an upper limit and lower limit checking is not carried out.

The measurement unit of a frequency parameter (frequency command value, output frequency) is expressed in %, not in Hz. It is converted from % to Hz at the reception (slave) side.

(For detail, see the chapter 7.3 "Inter-drive communication function".) When this command is being used, data is not returned from the inverter. When an "s" command (lower-case alphabet) is received, the master side is considered to have been tripped and the alarm (t) is displayed.

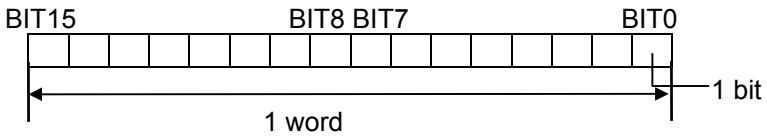
This command is valid only for the 16-bit binary mode.

◎Example: Writing to a frequency command parameter (communication number FA01)for common serial

Master inverter to slave inverter	Master inverter from slave inverter
2FH, 53H, FAH, 01H, 00H, 00H, 7DH	No return

■ Explanation

- A minimum unit of data information of the computer is bit that is expressed with 0 or 1. Data communication of the VF-A7/P7 series is based on 16-bit or 32-bit unit. 16-bit has a capacity from 0 to FFFFH (from 0 to 65535 by decimal notation) and 32-bit can deal with a data from 0 to FFFFFFFFH (from 0 to 4294967295 by decimal notation).



- A communication code supports a binary code (HEX) in addition to the JIS (ASCII) code. JIS(ASCII) code is intended to the communication with a computer including a personal computer, and the binary (HEX) code is intended to the communication with a micro computer such as a control device and the like. The data access is handled by the communication numbers.

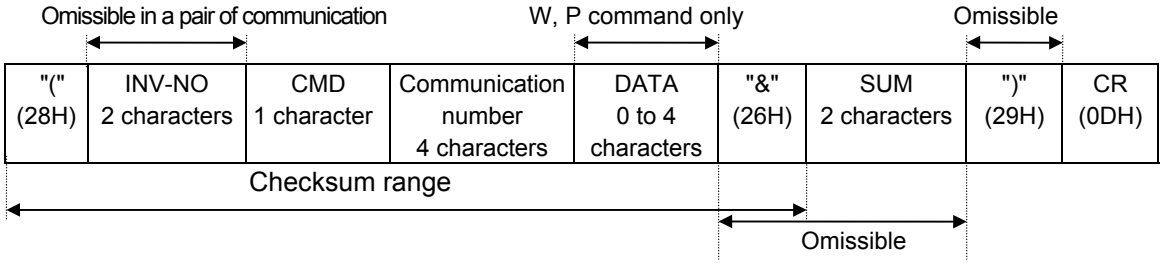
5.Transmission format

(Notes) The "trip" in this manual does not contain the trip during standby for auto re-start until auto re-starting from the trip which is selected by parameter(F301).

5.1. Transmission format for 16-bit ASCII mode

Data is designated by the communication number. Data type is expressed with a hexadecimal notation and transmission character is treated by JIS-X-0201 (ASCII<ANSI>) code.

■ Computer to VF-A7/P7 (16-bit ASCII mode)



1) "(" (1 character) : Heading code of ASCII mode
2) INV-NO (2 characters)
   : Inverter number (omissible in a pair of communication) ...00(30H,30H) - 99(30H,39H), ∗(2AH)
   Command is executed only when the inverter number coincides with that of the panel setting.
   (In case that " ∗ " is specified in the broadcast communication, the number is recognized to be matched when the numbers excluding " ∗ " are consistent. In case two asterisks " ∗ " are specified concurrently, all the connected inverters are considered to be consistent.) If the inverter number does not coincide or there is only one character of inverter number, the command will be invalid and the data is not returned.
3) CMD (1 character) : Command (see notes below.)
4) Communication number (4 characters)
   : Communication number (See the description on "parameter table" in the inverter's instruction manual.)
5) DATA (0 to 4 characters) : Write-in data (valid only for W and P command)
6) "&" (1 character)
   : Checksum judgement code (omissible) When this is omitted, also exclude checksum.
7) SUM (2 characters)
   : Checksum (omissible) Lower two digits (4-bit per a digit) of the total sum from the heading code to the checksum judgement code (addition of ASCII code) is converted to the ASCII code, and it will be added. Example: (R0000&??)CR 28H+52H+30H+30H+30H+30H+26H=160H
   Checksum is the lower two digits (??) = 60
   When this code is omitted, also exclude checksum.
8) ")" (1 character) : Final code (omissible)
9) CR (1 character) : Carriage return code

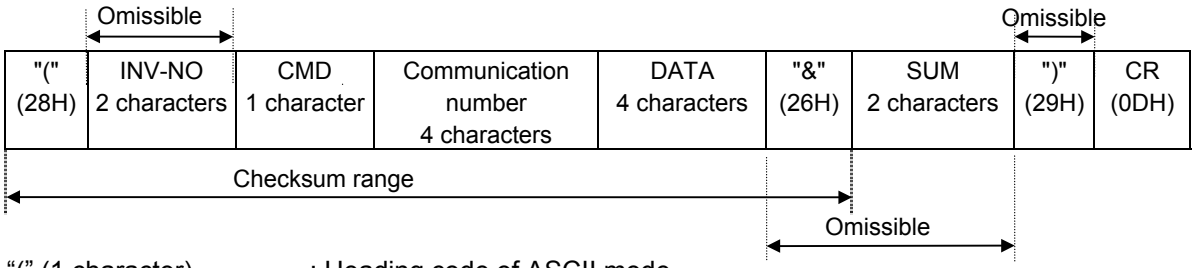
■ Details of command and data

CMD(1 character)	Write-in data (0 to 4 character) Hexadecimal. notation
R(52H):RAM data read command	No data
W(57H):RAM/EEPROM data write command	Write-in data (0 to FFFF)
P(50H):RAM data write command	Write-in data (0 to FFFF)

■ **VF-A7/P7 to computer (16-bit ASCII mode)**

At time of broadcast communication, returning of data is not executed except for the inverter concerned and 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.

a) Normal processing



1) "(" (1 character) : Heading code of ASCII mode

2) INV-NO (2 characters) : Inverter number ...00(30H, 30H) to 99(39H, 39H)
...This is excluded when it was omitted at time of reception.
Only when inverter number coincides with the one specified by the panel setting, or only when designating the inverter number which is targeted to the reply of data (the number coincides with the smallest value of the valid numbers) at time of broadcast communication, data is returned from the inverter.
(Example: (＊2R0000)CR to (02R00000000)CR)
Data is returned only when the inverter number is 02, but not when it is 12, 22 or the like.

3) CMD (1 character)
: Command..... This is also used for the checking of inverter trip.
During normal running..... Reception command "R", "W" or "P" is returned.
During trip..... Reception command "r", "w" or "p" is returned with lower-case.
(Reception command to which 20H was added is returned.)
※When the resetting command is issued during inverter trip, returning is executed as well by lower-case.

4) Communication number (4 characters)
:Communication number...This returns the received communication number.

5) DATA (4 characters)
: Data... Command R returns the read data, and the command W or P returns the received data.
If a received data is shorter than four letters, it will be converted to four letters and will be returned.
(Example: $(W123412)_{CR}$ to $(W12340012)_{CR}$)

6) "&" (1 character)
: Checksum judgement code... This is excluded when it was omitted at time of reception.

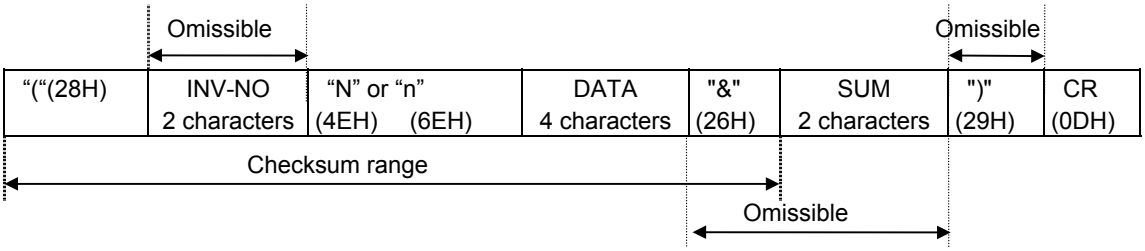
7) SUM (2 characters)
: Checksum... Lower two digits (4-bit per a digit) of the total sum from the heading code of the returned data to the checksum judgement code (addition of ASCII code) is converted to the ASCII code.
(This is excluded when the checksum judgement code was omitted at time of reception.)

8) ")" (1 character) : Final code (This is excluded when it was omitted at time of reception.)

9) CR (1 character) : Carriage return code

b) Error processing (16-bit ASCII mode)

In case an error occurs, communication error command (N or n) and the error type number is returned to the computer. At time of broadcast communication, returning of data is not executed except for the inverter concerned and 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.



1) "(" (1 character) : Heading code of ASCII mode

2) "N" or "n" (1 character)
: Communication error command... This is also used for the checking of inverter trip. "N" for the normal running and "n" for the inverter trip.

3) DATA (4 characters)
: Error code (0000 to 0006)
0000... Execution impossible (Communication is completely normal but cannot be executed.: Writing-in was attempted to the change-prohibited parameter during running (maximum frequency and the like), or during the EEPROM error)
0001... Data error (Set value of data is out of range, or too many data digits)
0002... Communication number error (There is no applicable communication number.)
0003... Command error (There is no applicable command.)
0004... Checksum error (Checksum does not coincide.)
0006... Error of access mode command (The range that cannot be handled by 16-bit mode is accessed wrong.)

4) ")" (1 character) : Final code... This is excluded when it was omitted at time of reception.

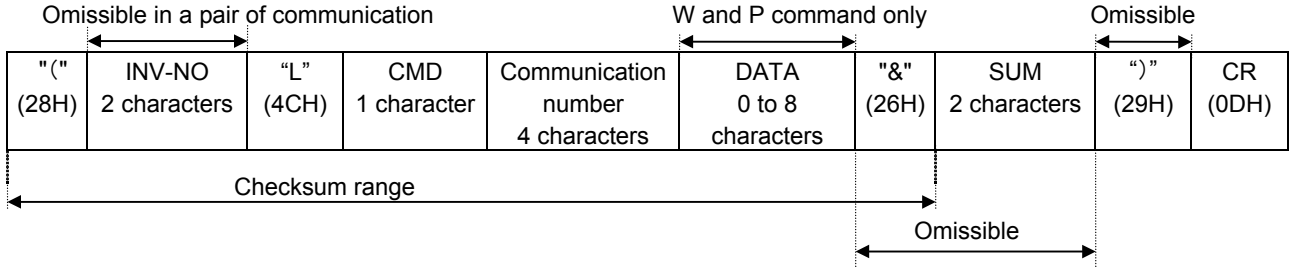
■ **Example**

(N0000&5C)CR.....Execution impossible
(The maximum frequency data was changed during running, or other reasons.)
(N0001&5D) CR.....Data error (Set value of data is out of range.)
(N0002&5E) CR.....No communication number (There is no applicable communication number.)
(N0003&5F) CR.....There is no applicable command (commands other than R, W and P)
(Example: L, S, G, a, b, m, r, w, t...)
(N0004&60) CR.....Checksum error (Checksum data does not coincide.)
(N0006&62) CR.....Access mode error (The range that cannot be handled by 16-bit access command is accessed by 16-bit mode.)
(Example: Setting of -400Hz was designated to the point frequency.)
No return of data.....Format error, Wrong inverter number
(Example: Data other than ")" was placed to the position of the final code.
(for example, when "}" is used, or there is not CR code.)

5.2. Transmission format for 32-bit ASCII mode

Description refers only to the different contents from the 16-bit ASCII mode, those are the addition of L command and the 32-bit (8 characters) range of data capacity.

■ Computer to VF-A7/P7 (ASCII mode)

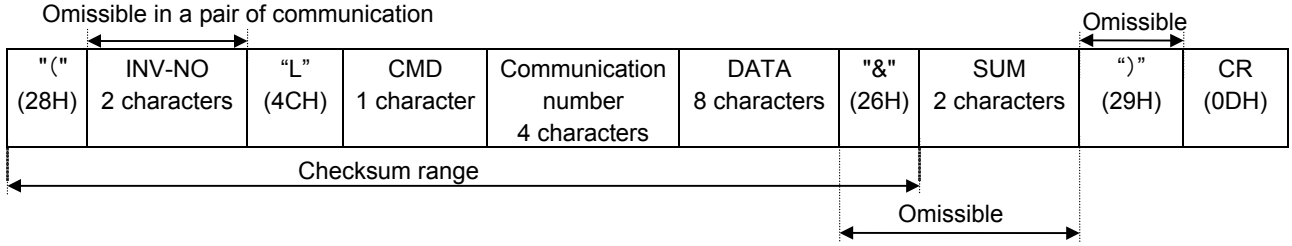


"L" (1 character) : 32-bit access judgment code

DATA (0 to 8 characters) : Write-in data (valid only for W and P command)

■ VF-A7/P7 to computer (32-bit ASCII mode)

a) Normal processing



1) "L" (1 character)
   : 32-bit access judgment code (this is returned by capital letters even in case of an inverter trip.)
2) DATA (8 characters)
   : Data... Command R returns the read data, and the command W or P returns the written data. If a received data is shorter than eight characters, it will be converted to eight characters and will be returned.
   (Example: $(W123412)_{CR}$ is converted to $(123400000012)_{CR}$)

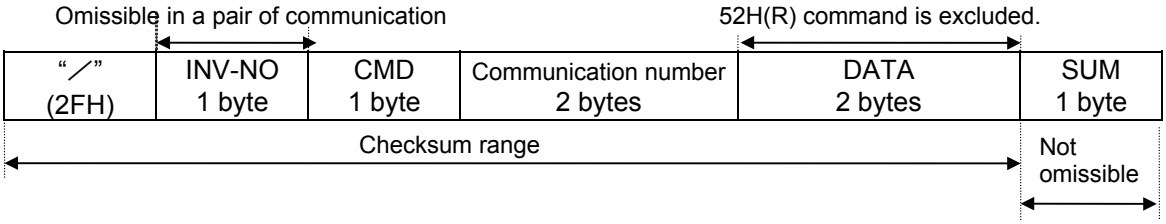
b) Error processing (ASCII mode)

Same to the returning format of error processing of 16-bit ASCII mode.

5.3. Transmission format for 16-bit binary mode

Data is designated by the communication number. Data type is expressed with a hexadecimal notation and data in the transmission character is treated by binary code (HEX code).

■ **Computer to VF-A7/P7 (binary mode)**



1) 2FH("/")(1 byte) : Heading code of binary mode
2) INV-NO (1 byte)
   : Inverter number (omissible in a pair of communication) ...00H to 3FH, FFH
   In case the inverter number is other than FFH(broadcast communication), command is executed only when the inverter number coincides with the one designated with the panel. If the inverter number is not matched, it will be judged invalid and the data is not returned.
3) CMD (1 byte)
   : Command (see details below.)
   When the command is "52H(R)", data following CMD is fixed to 3 bytes. (2 bytes for communication number and 1 byte for checksum)
   When the commands are "57H(W)", "50H(P)" and "47H(G)", data following CMD is fixed to 5 bytes. (2 bytes for communication number, 2 bytes for data and 1 byte for checksum) When another command is specified, it will be invalid and also the error is not returned.
4) Communication number (2 bytes)
   : Communication number (See the description on "parameter table" in the inverter's instruction manual.)
5) DATA (2 bytes)
   : 0000H to FFFFH
   - Write-in data for "57H(W)" and "50H(P)" commands (data range is checked.)
   - Dummy data (ex. 0000) is necessary for "47H(G)".
   - DATA is invalid (addition is prohibited) for "52H(R)".
6) SUM (1 byte)
   : Checksum (not omissible) 00H to FFH
   Value of lower 2 digits (1 byte) of the total sum from the heading code of the returned data to the data (communication number at time of 52H(R) command)
   Example: 2F 52 00 00 ?? ... 2FH + 52H + 00H + 00H = 81H
   Lower two digits (??) will be the checksum = 81

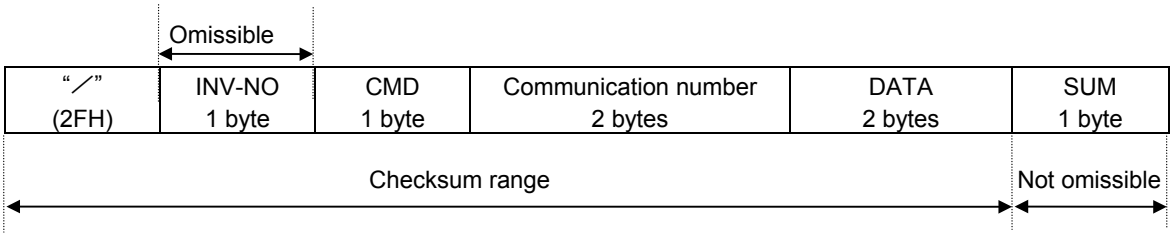
■ **Detail of command and data**

CMD (1 byte)	Write-in data (2 bytes) Hexadecimal notation
52H(R): RAM read command	No data
57H(W): RAM/EEPROM write command	Write-in data (0000H to FFFFH)
50H(P): RAM write command	Write-in data (0000H to FFFFH)
47H(G): RAM read command (for two-wire line)	Dummy data (0000H to FFFFH)

■ **VF-A7/P7 to computer (16-bit 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.

a) Normal processing



1) 2FH("/")(1 byte) : Heading code of binary mode

2) INV-NO(1 byte) : Inverter number
...00H to 3FH...This is excluded when it was omitted at time of reception.
Data is returned from the inverter only when the inverter number coincides with the one that was designated on the panel or when it is the same inverter number to be returned (matched with the smallest value (00) of the valid number) at time of broadcast communication.
Data is not returned from the other inverter except for the inverter number 00 at time of broadcast communication. If the inverter number does not coincide, it will be judged invalid and the data is not returned.

3) CMD (1 byte) : Command..... This is also used for the checking of inverter trip.
At normal status.. Reception command (either of 52H(R), 47H(G), 57H(W), or 50H(P)) will be returned.
At inverter trip.....Reception command is converted into the lower-case (either of 72H(r), 67H(g), 77H(w) or 70H(p)) and will be returned (20H is added to the reception command).

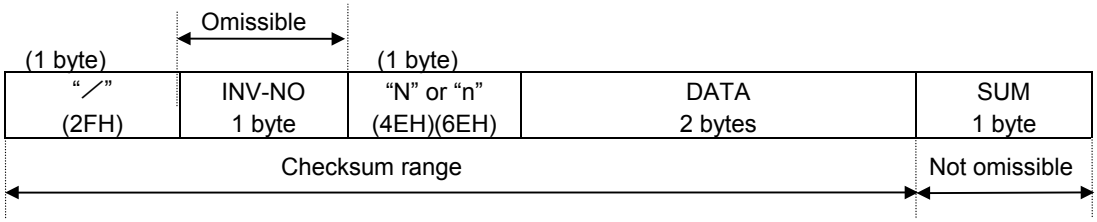
4) Communication number (2 bytes)
: Communication number... Received number is returned.

5) DATA (2 bytes) : Data... 0000H to FFFFH
Commands "52H(R)" and "47H(G)" return the read data, and commands "57H(W)" and "50H(P)" return the written data.

6) SUM (1 byte) : Checksum (not omissible) 00H to FFH
Value of lower two digits (1 byte) of the total sum from the heading code of the returned data to the data

b) Error processing (16-bit binary mode)

In case an error occurs, communication error command (4EH(N) or 6EH(n)) and the error type number 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. This is because there will be a risk that the returned data may be deformed.



1) or "n" (1 byte) : Communication error command... This is also used for the checking of inverter trip.
"4EH(N)" for the normal communication and "6EH(n)" during the inverter trip.

2) DATA (2 bytes) : Error code (0000 to 0006)

0000... Execution impossible (Communication is completely normal but cannot be executed.:
Writing-in was attempted to the change-prohibited parameter during running (maximum frequency and the like), or during the EEPROM error)

0001... Data abnormality (Set value of data is out of range, or too many data digits)

0002... Communication number error
(There is no applicable communication number.)

0004... Checksum error (Checksum does not coincide.)

0006... Mode error (The range that cannot be handled by 16-bit mode is accessed wrong.)

No return of data
... Command error, format error (specified number of bytes are not received after a second), parity, overrun, framing error), incorrect inverter number, inverter not to be returned (inverter number is 00H) at time of broadcast communication of the binary mode)

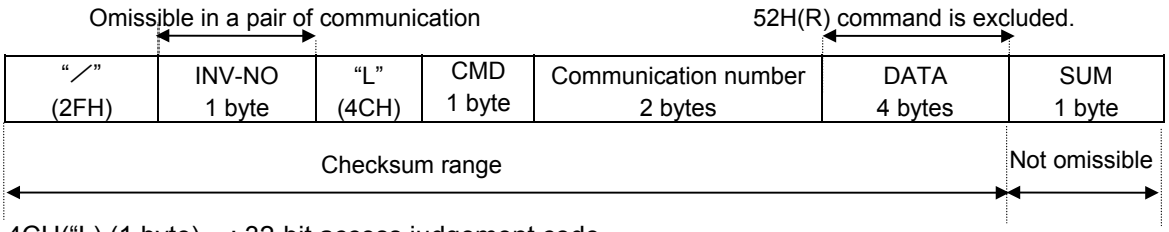
■ **Example**

2FH, 4EH, 00H, 00H, 7DH... Not executed
(The maximum frequency data is changed during running and similarly.)
2FH, 4EH, 00H, 01H, 7EH... Setting error of modified data (Data is set beyond the applicable range)
2FH, 4EH, 00H, 02H, 7FH... No communication number (There is no applicable communication number.)
2FH, 4EH, 00H, 04H, 81H... Checksum error (Checksum data is not correct.)
2FH, 4EH, 00H, 06H, 83H... Mode error
(The range that cannot be handled by 16-bit mode is accessed wrong.)

5.4. Transmission format for 32-bit binary mode

Description refers only to the different contents from the 16-bit ASCII mode, those are the addition of L command and the 32-bit of data capacity.

■ Computer to VF-A7/P7 (Binary mode)

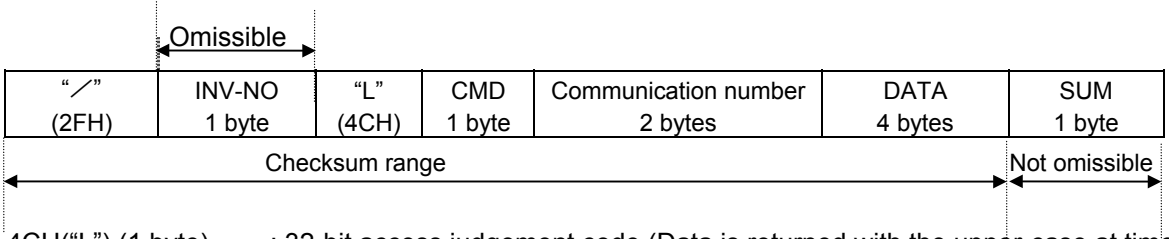


1) 4CH("L) (1 byte) : 32-bit access judgement code

2) DATA (4 bytes) : Write-in data (valid only for 57H(W) and 50H(P) command)
... 00000000H to FFFFFFFFH (Data range is checked.)

■ VF-A7/P7 to computer (32-bit binary mode)

a) Normal processing



1) 4CH("L") (1 byte) : 32-bit access judgement code (Data is returned with the upper-case at time of an inverter trip.)

1) DATA (2 bytes) : Data... 00000000H to FFFFFFFFH
Command "52H(R)" returns the read data and commands "57H(W)" and "50H(P)" return the written data.

b) Error processing (binary mode)

Same to the returning format of error processing of 16-bit binary mode.

5.5. Attention to 16-bit mode

The following attention is necessary for the 16-bit mode communication.

① In the 16-bit mode, data access beyond the range of 16 bits (FFFFH) brings about an access mode error. If the point frequency parameter with code (F217, F219, etc.) is set outside the range between -327.68Hz and 327.67Hz, the access mode error happens, too. And when the accumulating time monitor (FE14) counts 65,536 hours (about 7.4 years) and over, it generates an error.

② When accessing to the “motor constant parameter” (F402, F403, etc.) in the 16-bit mode, the data type is expressed with an index even if the parameter is within the 16-bit data range.

③ When accessing to the "acceleration/deceleration time parameter" (ACC, dEC, F500, etc.) in the 16-bit mode, the minimal setting unit is 0.1 second even if the parameter is within the 16-bit data range. For the parameters, see the parameter list of the inverter's instruction manual.

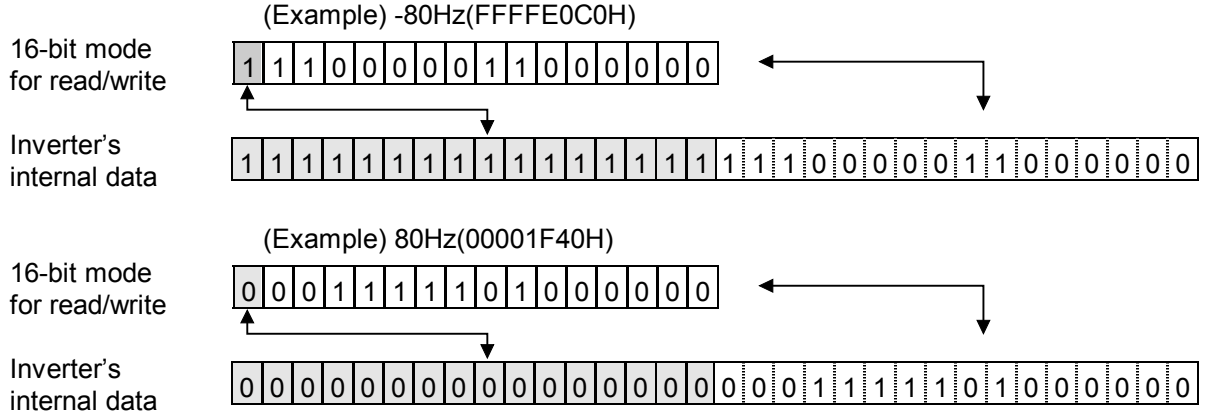
※The parameters concerning to the descriptions of 1, 2 and 3 mentioned above are recommended to be used in the 32-bit mode communication.

5.5.1. 32-bit parameters excluding “acceleration/deceleration time” and "motor constants 1 & 2"

When trying to write or read out the parameter exceeding the 16-bit range (FFFFH), a mode error takes place. When the setting range of the parameter to be read out or written to is attached with the sign and it exceeds the 16-bit range, the inverter undertakes the conversion process at time of accessing from the communication function as follows.

When the data for writing is a minus data (the top bit is 1), the upper word will be expanded to “1”. When it is a plus data (the top bit is 0), the upper word is expanded to “0”. As for the data for reading, the conversion is reversed (expansion factor is removed and set to the top bit).

(EX.) When the frequency with sign is communicated in 16-bit mode, the valid range is restricted between 0Hz and 327.6Hz (from 0000H to 7FFFH) and between -0.01Hz and -327.68Hz (from FFFFH to 8000H).



5.5.2. Acceleration/deceleration time parameter

Acceleration/deceleration time parameter is treated in a unit of 0.01 second as the inverter's internal data, but as the 16-bit mode data, "1" is handled as 0.1 second. As the 32-bit mode data, "1" is handled as 0.01 second.

■ "R, G" (reading out of 16-bit data) at time of command reception

A result of [(Internal data + 9) ÷10] will be returned (the second decimal place is rounded off).
(Note) An error (deviation) generates in the second decimal place.

■ "W, P" (writing in of 16-bit data) at time command reception

A result of [received data x 10] is set to the internal data.

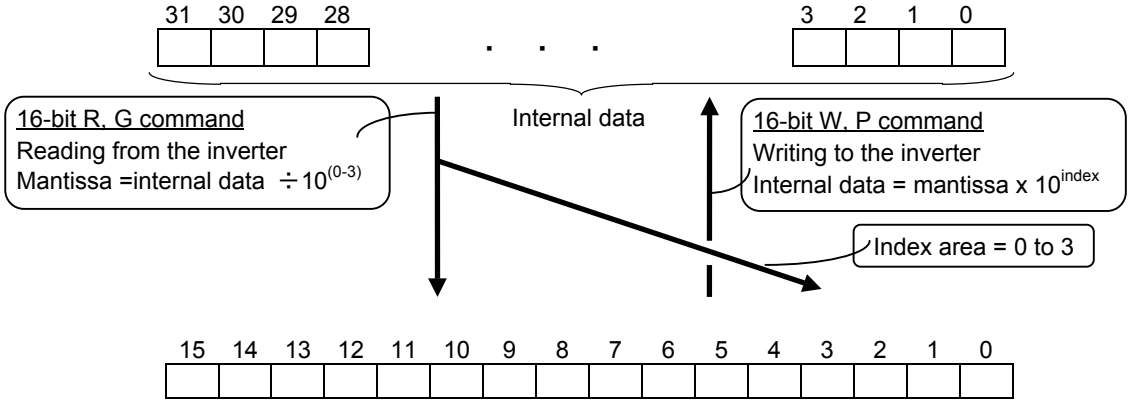
5.5.3.Expression by 16-bit data index for the parameter of "motor constant 1 & 2"

When writing and reading the data of the parameters (motor constant parameter F402 and F403) by using 16-bit mode, whereat cautionary notes about an index expression for accessing in 16-bit mode are given to the parameters in the list of parameters on the inverter's instruction manual, data should be handled as follows. When the data is expressed by an index, an error is generated, and in some cases, the index is expressed in two ways for a single data (a lapping range in the table on the next page). When the comparing process and the like is executed by creating a program at the application side, pay attention to the processing, because the written data and the readout data does not sometimes coincide as shown in the example below. (When the data read out from the inverter will be directly written, the data is matched.) When the data is written to the inverter, the inverter will accept both expressions inside the lapping range.

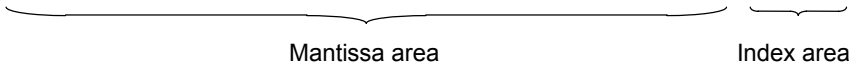
< Example > Conversion data (internal value)
When data is read out after writing FFF0H (16380d), the index will be FFF0H (16380d).
When data is read out after writing 1999H (16380d), the index will be FFF0H (16380d).
Therefore both in the cases of FFF0H and 1999H, the internal data 16380d will be written as the index expression.

■ Specification for conversion

Mantissa data range : 2^{14}-1 ... (16,383d)
Index data range : 10^3 ... (the maximum error will be 10^3.)
Expression range : $(2^{14}-1) \times 10^3$ = 16,383,000d



■


Mantissa area
Index area

Specification for conversion

Conversion should be based on the formulae shown in the column of internal data, however the lapping range will generate.

Internal data	Mantissa area	Index area	Conversion data of floating point	Lapping range
0 to $(2^{14}\times10^{0})$-1 (0d to 16383d)	Internal data $\div 10^{0}$	0	0000H to FFFCH (0d to 16383d)	16380d to 16383d
$2^{14}\times10^{0}$ to $(2^{14}\times10^{1})$-1 (16384d to 163839d)	Internal data $\div 10^{1}$	1	1999H to FFFDH (16380d to 163830d) (16380d to 16389d → 16380d(1999H))	163800d to 163830d
$2^{14}\times10^{1}$ to $(2^{14}\times10^{2})$-1 (163840d to 1638399d)	Internal data $\div 10^{2}$	2	199AH to FFFEH (163800d to 1638300d) (163800d to163899d → 163830d(199AH))	1638000d to 1638300d
$2^{14}\times10^{2}$ to $(2^{14}\times10^{3})$-1 (1638400d to 16383999d)	Internal data $\div 10^{3}$	3	199BH to FFFFH (1638000d to 16383000d) (1638000d to 1638999d →1638300d(199BH))	

■ **Conversion at inverter side for R command (readout)**

Either one of the data of the lapped area (ex. internal data: "16380d to 16383d") should be read out. When reading out the data from the lapping range, conversion is always targeted to the one with a less error (smaller index area).

<Example> When the internal data is 16380d, it will be read as the index expression FFF0H.

INV internal data	Mantissa area	Index area	Valid digits	Conversion data
0d to 16389d	Internal data $\div 10^{0}$	0	No error	0000H to FFFCH (0d to 16383d) (16384d to 16389d→16383d(FFFCH))
16390d to163899d	Internal data $\div 10^{1}$	1	Lowest digit is invalid. =0H	199DH to FFFDH (16390d to 163830d) (163831d to 163899d→163830d(FFFDH))
163900d to 1638399d	Internal data $\div 10^{2}$	2	Lower two digits are invalid. =00H	199EH to FFFEH (163900d to 1638300d) (1638301d to 1638999d→1638300d(FFFEH))
1639000d to16383999d	Internal data $\div 10^{3}$	3	Lower three digits are invalid. =000H	199FH to FFFFH (1639000d to 16383000d) (16383001d to 16389999d→16383000d(FFFFH))

■ **Conversion at inverter side for writing**

Internal data = mantissa area x 10^{index}

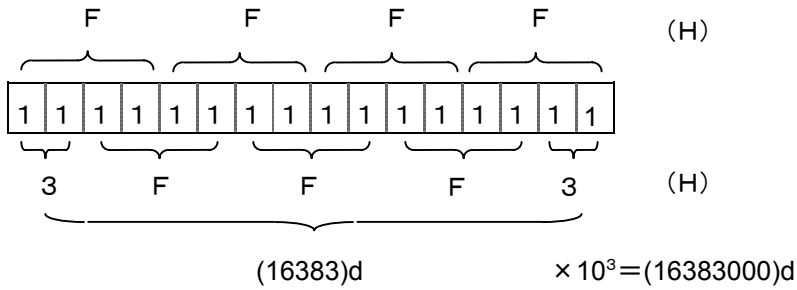
When writing data to the inverter, both complex data in the lapping range is accepted.

<Example> Both index expression FFF0H and 1999H will be written as 16380d as the internal data.

To prevent a generation of different comparison result, when the readout data is compared to the written data for example, conversion method used for readout should be applied to writing in.

■ **Example of conversion**

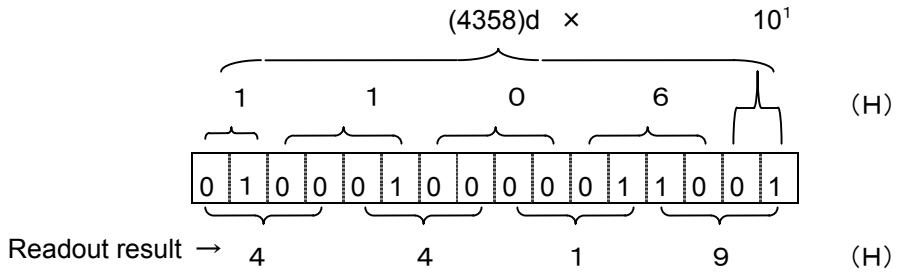
< Largest expression > (16383000)d→(FFFF)H



< Example 1 > Internal data “45380d(AA3CH)” is read out in 16-bit mode.

Mantissa are : 43580 ÷10^1 = 4358(1106H)

Index area : 1(01H)

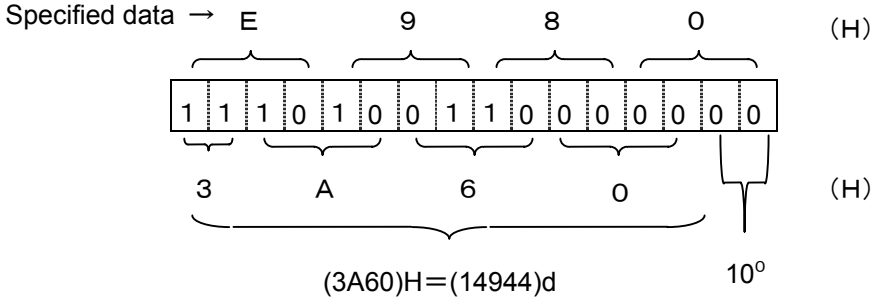


< Example 2 > When 14944d is written to the internal data in 16-bit mode.

Specified data → (converted to) 59776d(E980H) is written.

Mantissa area : 3A60H

Index area : 0



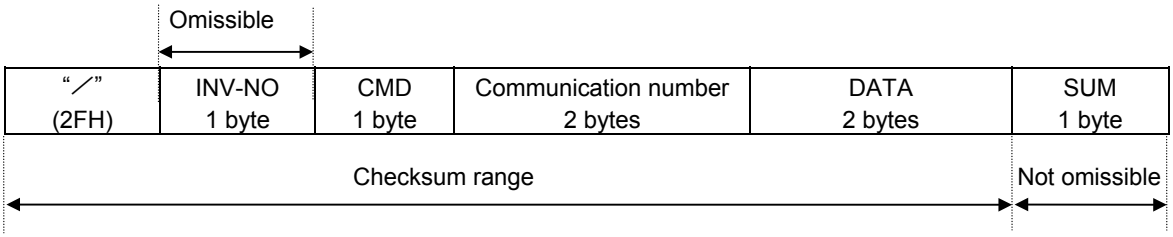
Written result →14944d

5.6.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 16-bit binary mode. S command is used and the slave inverters do not return the data.

■ **Master inverter (VF-A7/P7) to slave inverter (VF-A7/P7) (Binary mode)**



1) INV-NO (1 byte) : Inverter number
   This is always excluded at the master inverter side at time of inter-drive communication, and can be added when the user utilize this data for the purpose of proportional operation.
   (When this code is added, only the inverter concerned will accept the data.)
2) CMD (1 byte) : Command
   53H("S") or 73("s") command ... command for inter-drive communication
   When the master inverter is not tripping, this will be 53H("S").
   When the master inverter is tripping, this will be 73H("s").
3) Communication number (2 bytes) :
   Communication number of selected parameter (frequency command value or torque command value) will be designated.
4) DATA (2 bytes) : Data of frequency command value or torque command value
   (0000H to FFFFH (no range check))

As for the S command, see chapter 4. "Command", and see chapter "7.3 Inter-drive communication function" for the communication of inverters.

6.Communication parameter

Setting of communication parameters can be changed by the operation of the panel and from the communication function. Some of the parameter setting is changed swiftly right after the alteration, and some are changed by the resetting of power supply.

(1) Communication baud rate (common serial option (LOGIC))

[Parameter name F800, communication number 0800]

- Data range: 0 - 3 (Initial setting: 3)
  0: 1200bps, 1: 2400bps, 2: 4800bps, 3: 9600bps
- Communication baud rate should be uniform inside the same network.
- This parameter is validated by resetting the power supply.

(2) Communication baud rate (RS485)

[Parameter name F820, communication number 0820]

- Data range: 0 - 5 (Initial setting: 3)
  0: 1200bps, 1: 2400bps, 2: 4800bps, 3: 9600bps, 4: 19200bps, 5: 38400bps
- Communication baud rate should be uniform inside the same network.
- This parameter is validated by resetting the power supply.

(3) RS485 connection system (RS485)

[Parameter name F821, communication number 0821]

- Data range: 0 -1 (Initial setting: 1)
  0: 2-wire line, 1: 4-wire line
- Connection system should be uniform inside the same network.
- This parameter is validated by resetting the power supply.

(4) Parity bit (RS485, common serial option...Common setting)

[Parameter name F801, communication number 0801]

- Data range: 0 -2 (Initial setting: 1)
  0: No parity, 1: Even number parity, 2: Odd number parity
- Parity setting should be uniform inside the same network.
- This parameter is validated by resetting the power supply.

(5) Inverter number (RS485, common serial option, common bus option... Common setting)

[Parameter name F802, communication number 0802]

→An independent name (number) is designated to the inverter.

- Data range: 0 - 255 (Initial setting: 0)
  (The valid range is from 0 to 99 in the ASCII mode, and in the binary mode it is from 0 to 63. The range between 100 and 255 is for the bus option.)
- Inverter numbers should not duplicate inside the same network.
- This parameter is validated from the communication after the change.
- If the different setting is determined between the computer and the inverter, the reception data will be canceled.

<Note> When S20 option unit is used, the inverter number should be designated by the switch on the board of S20 option unit, and in this case this parameter is used as the monitor for the switch on the board.

(6) Communication time-out (RS485, common serial option... Common setting)

[Parameter name F803, communication number 0803]

→This parameter is for detecting the occurrence when none of the normal data can be received within the arbitrarily predetermined time.
In case of a time-out, the predetermined action set by the parameter "Communication time-out act" (F804) will be carried out. For details, see chapter “7.1 Timer function".

- Data range: 0 - 100 (Initial setting: 0)
  0: Timer function OFF,
  Setting is possible in the range from 1 to 100 (in a unit of approximately 1 second).
- This parameter is validated from the communication after the change.

(7) Communication time-out act (RS485, common serial option...Common setting)

[Parameter name F804, communication number 0804]

→This parameter is for selecting the action of the inverter when none of the normal data can be received within the time set by the "Communication time-out (F803)".
For details, see chapter “7.1 Timer function”.

- Data range: 0 - 8 (Initial setting: 8)

Setting value	RS485	Common serial
0	No action	No action
1	Alarm	No action
2	Inverter trip	No action
3	No action	Alarm
4	Alarm	Alarm
5	Inverter trip	Alarm
6	No action	Inverter trip
7	Alarm	Inverter trip
8	Inverter trip	Inverter trip

※Alarm:
When the communication time-out occurs, an alarm is released. On the left side of the panel, “Lt” blinks.
※Inverter trip:
When the communication time-out occurs, inverter trips. On the panel, “Err5” blinks.

- This parameter is validated from the communication after the change.

(8) Communication interval (RS485, common serial option... Independent setting)

[Parameter name F805, communication number 0805] ... Common serial
[Parameter name F825, communication number 0825] ... RS485

As for the inverter whose CPU version is Ver.100, the same parameter (0805) is applied to both RS485 and the common serial.

→When the preset interval time before sending data elapses after the inverter has received the data, the data will be transmitted.
For details, see chapter "7.4 Setting function for communication interval time".

- Data range: 0 - 200 (Initial setting: 0)
  0: Normal communication, 1 - 200 (unit = Approx. (1 - 200) ∗ 10ms)
- This parameter is validated from the communication after the change.

(9) Inter-drive communication

[Parameter name F806, communication number 0806] ... Common serial
[Parameter name F826, communication number 0826] ... RS485
→The master inverter for inter-drive communication is designated.
For details, see chapter "7.3 Inter-drive communication function".

- Data range: 0 - 4 (Initial setting: 0)

0: Normal communication (slave action)
1: Master (frequency reference)
2: Master (output frequency)
3: Master (torque command)
4: Master (output torque command)

- Only one master inverter can be designated in the same network. If two or more master inverters are assigned, the data will collide and the malfunction occurs.
- This parameter is validated by resetting the power supply.

■ Relating parameters

(10)Operation command mode selection [Parameter name CMOd, communication number 0003]
(11)Speed setting mode selection [Parameter name FMOd, communication number 0004]
(12)Torque command selection [Parameter name F420, communication number 0420]
(13)Frequency point selection [Parameter name F810, communication number 0810]
(14)Point 1 setting [Parameter name F811, communication number 0811]
(15)Point 1 frequency [Parameter name F812, communication number 0812]
(16)Point 2 setting [Parameter name F813, communication number 0813]
(17)Point 2 frequency [Parameter name F814, communication number 0814]

7.Function

7.1.Timer function

Timer function is for detecting a cable disconnection and for other purposes at time of communication. When no data is transmitted to the inverter in a preset time, the inverter will be tripped (Err5) or an alarm (t) will be released. “Tripping”, “alarm” or “no action” is selected by the parameter "communication time-out act (F804)".

■ Timer setting method

Standard shipment setting of timer(F803) is “0” (timer OFF).

◎Setting range of the timer

About 1 second (01H) to 100 seconds (64H) / timer OFF (0H)

■ Method for selecting the inverter’s action in the case of time-out

Shipment setting for the time-out action (F804) is “8” (both common serial (logic) and RS485 will be tripped).

◎Selection of time-out action

(Range: 0 - 8 ... See the description of “6. communication parameter” for details.)

“No action”, “tripping (Err5)” or “alarm (t)” can be selected independently for RS485 and the common serial (logic).

■ Method for starting timer

When the timer is set from the panel, it will be actuated from the first communication after the setting. When the timer is set by the communication, it will be actuated by the communication after the setting of the timer. When the timer is predetermined by the EEPROM, it will be actuated by the first data communication after switching on the power supply. In case of an error, however, for example when the inverter number is wrong, or when there is no reply from the inverter because of a format error or other reasons, communication will not be established and the timer will not be actuated.

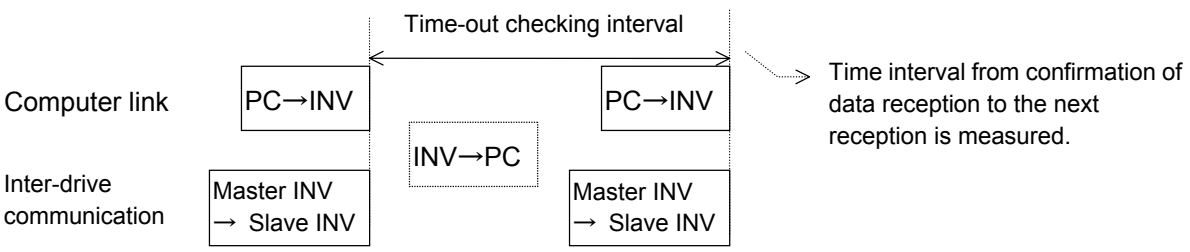
■ Method for canceling timer

Set timer setting to “0”.

Ex.) To cancel the timer by communication. (Setting on the EEPROM)

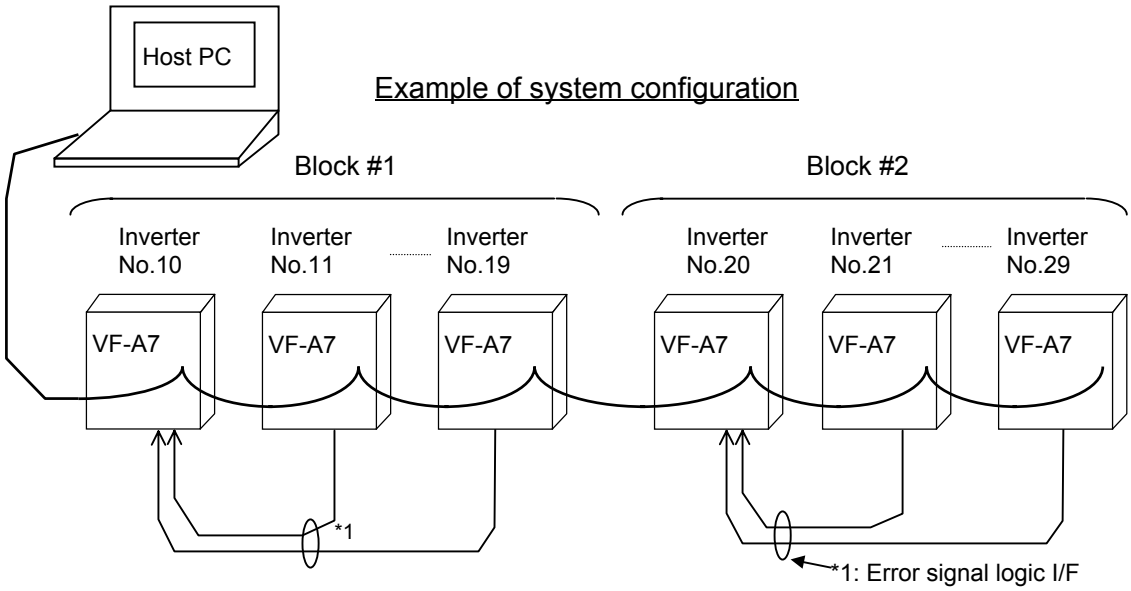
Computer to inverter	Inverter to computer
(W08030)CR	(W08030000)CR ... Bring the timer setting to 0, and the timer is canceled.

■ Timer



7.2.Broadcast communication function

Broadcast communication function can transmit the command (write the data) to multiple inverters by one try of communication. Only the write (W, P) command is valid and the read (R, G) command is invalid. The inverters subject to the broadcast communication are same to the independent communication; 0 to 99 (00H - 63H) in the ASCII mode, and 0 to 63 (00H - 3FH) in the binary mode. As for the returning of data from the inverter, the inverters are confined to prevent the collision of transmission data (see the explanation below). In case the inverters that have the identical number are connected inside the same network, the data from the inverter will collide each other. Never overlap the inverter number in the same network.



In the case of an ASCII mode, broadcast communication can be executed by adding ＊ mark to the inverter number counted from the host PC. ＊ mark plays a role of a wild card that can assign arbitrary number from 0 to 9. To return the data, ＊ is converted to "0" and the inverter unit that has the identical number will take the priority and will return the data. To transmit the error signal to the host PC, that representative inverter has to be given the information about an error status by means of the terminal block signal, because the other units do not return the data to the host PC.

The detail information about an error status can be confirmed by designating an individual inverter number, while the host PC suspends the action. For transmitting data to all the units in the block #1, give an inverter number (1＊) to all the units from the host PC in the block #1, and assign (2＊) to the units in the block #2. In this case, data is returned by the unit No.10 in the block #1, and No.20 in the block #2.

For batch broadcast-communication, assign the number (＊＊). The unit with an inverter number 00 returns the data at this case. To improve the communication baud time further, number of characters can be decreased by using a binary code in place of an ASCII code, however ＊ mark can not be used. In the binary mode, batch broadcast-communication is possible by assigning the number (FF) to the inverter number. At this case the unit with an inverter number 00 carries out the returning of data.

※ If the setting of the parameter “communication time-out act” is determined to trip the inverter in case of an error, the error information is output as the terminal signal and it can be transmitted as a trip signal to the representative unit.

■ Batch broadcast-communication (ASCII mode / Binary mode)

◎ASCII mode

To put "＊＊" to the specified place of the inverter number in the communication format validates the broadcast communication and the command is transmitted to all the applicable inverters in the network (inverter numbers from 0 to 99 (00 to 63H)).

◎Binary mode

To put "FF" to the specified place of the inverter number in the communication format validates the broadcast communication and the command is transmitted to all the applicable inverters in the network (inverter numbers from 0 to 63 (00 to 3FH)).

< Inverter that returns the data >

Only the inverters with the number 00 returns the data.

To avoid returning of data, exclude the inverter that has the number 00 inside the network.

■ Group broadcast-communication (Only for the ASCII mode)

To the designated place for the inverter number in the communication format:

In case the code "∗?" is placed to the inverter number, and when the same value as "?" is assigned to the lowest digit of the decimal notation of the inverter number, the broadcast communication command is transmitted only to that inverter.

In case the code “?∗” is placed to the inverter number, and when the same value as “?” is assigned to the second digit of the decimal notation of the inverter number, the broadcast communication command is transmitted only to that inverter.

(?: either one from 0 to 9)

< Inverter that returns the data >

Data is returned only to the inverters that have smaller inverter number inside the group communication domain (inverter that has the identical number when "＊" is replaced with "0").

To avoid returning of data, exclude the inverter that has the identical number in which “＊” had been replaced with “0” inside the network.

■ Example of broadcast communication

Example : Frequency is set to 60Hz.

① Master inverter to multiple inverters: Broadcast communication (ASCII mode)

Example of communication from master inverter to the INV : (＊＊W12341234)CR

Example of returning the data from INV to the master inverter : (00W12341234) CR

Returning is possible only for the INV that has the number 00, and the command is transmitted to all the applicable INV connected in the network.

② Master inverter to the specific inverter group: Group communication(ASCII mode)

Example of communication from master inverter to the INV : (∗9W12341234) CR

Example of returning the data from INV to the master inverter : (09W12341234) CR

Returning is possible only for the INV with the number 09, and the command is transmitted to ten inverters with the number 09, 19, 29, 39, 49, 59, 69, 79, 89, 99 in the network.

③ Master inverter to multiple inverters: Broadcast communication (Binary mode)

Example of communication from master inverter to the INV : 2F FF 50 FA 01 17 70 00

Example of returning the data from INV to the master inverter : 2F 00 50 FA 01 17 70 01

Returning is possible only for the INV that has the number 00, and the command is transmitted to all the applicable INV connected in the network.

7.3. Inter-drive communication

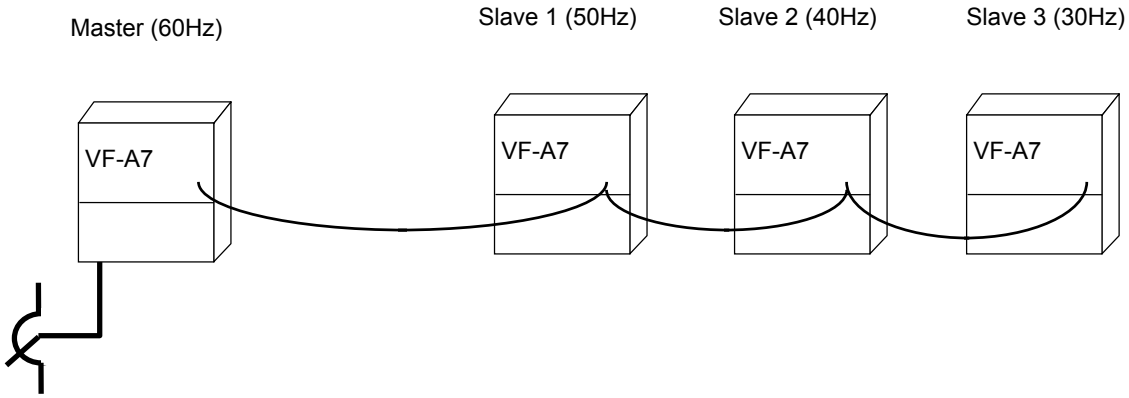
Inter-drive communication function enables manipulation of multiple inverters without using the host computer such as the PLC and the PC. This function is utilized for "speed proportional control" or "load sharing torque control". The command is instructed by the operation from the master inverter's panel or analog input, etc. With the Inter-drive communication function, the master inverter continues to transmit the data selected by the parameters to all the slave inverters on the same network. The master inverter uses the S command for outputting instructions to the slave inverters, and the slave inverters do not return the data. (See chapter 4 "Command".) Network construction for a simple synchronized operation and speed-proportional operation can be created by this function.

※ In the case that the master invereter tripped the slave invertrer flickers the alarm "t" on the display and stop

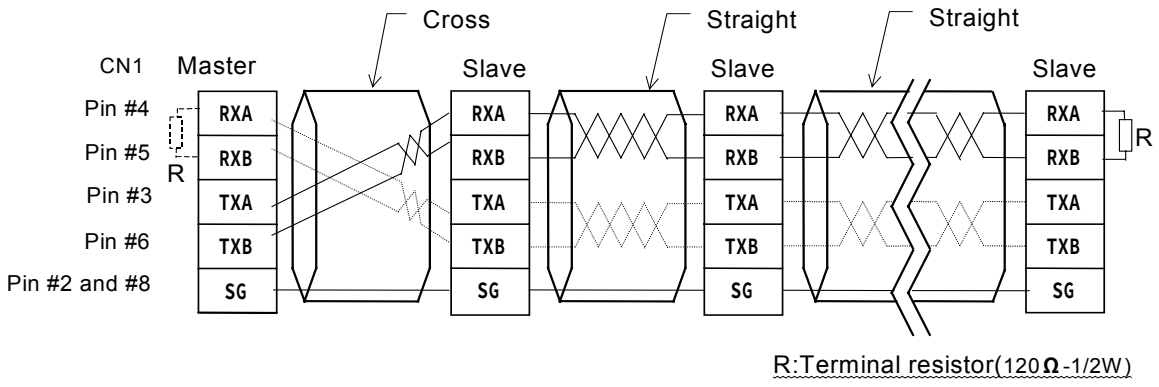
0Hz. The slave inverter is revival by the trip cancellation from the master inverter.

※ Use the timer function(F803,F804) for selection of the slave inverter operation when the cable is disconnected or the master inverter is off.

<Conceptual illustration>



■ Connection (RS485 communication)



∗Do not connect pin #1 (P24) and pin #7 (P5).

∗Receiving line of master station (pins #4 and #5) and transmission line of slave station (pins #3 and #6) do not have to be connected.

■ **Setting of parameter**

Assign one master inverter in the network. Other inverters should be the slave inverters. Specify only one inverter as the master. In case two or more inverters are designated for the master inverter in the same network, data will collide.

- Inter-drive communication (Common serial: F806, RS485: F826) ... Shipment setting = 0 (slave)
  ◎Setting to the master inverter
  From the parameter settings 1 to 4, select data that is sent from the master to the slave.
  (1: Frequency reference, 2: Output frequency, 3: Torque command, 4: Output torque command)
  With VF-A7/P7, slave inverters are suspended even when the "frequency reference" is being selected during the master trip.
  ◎Setting to the slave inverters
  Select the slave action (= 0 ... shipment setting).
  ※ This parameter is validated after resetting the inverter or rebooting the power supply.

- Speed setting mode selection (FMOd) ... Shipment setting = 2: RR (Variable / voltage input)
  Designate a target of speed command input for the inverter to the parameter FMOd.
  ◎Setting to the master inverter
  When the common serial is used, designate a number except for "7: common serial communication option" (FMOd ≠ 7).
  When the RS485 communication is used, designate a number except for "8: serial communication RS485" (FMOd ≠8).
  ◎Setting to the slave inverters
  When the common serial is used, designate "7: common serial communication option" (FMOd = 7).
  When the RS485 communication is used, designate "8: serial communication RS485" (FMOd = 8).

- Operation command mode selection (CMOd) ... Shipment setting = 0: Terminal input
  Designate a target of command input for the inverter to the parameter CMOd. (To both master and slave inverters)
  When the common serial is used, designate a number except for "2: common serial communication option" (CMOd ≠2).
  When the RS485 communication is used, designate a number except for "3: serial communication RS485" (CMOd ≠3)

- Transmission waiting time (common serial: F805, RS485: F825) ... Shipment setting = 0
  ◎Setting to the master inverter
  Set up more than 0.02 seconds as a transmitting interval on the master side to wait for the processing time on the slave side(F805= 0.02).

<Notes>

- When the slave inverter outputs an alarm "E " frequently even though the master inverter is not tripping, provide an interval for the data sending (F805,F825) at the master side.
- Speed command and torque command can be transmitted but the run / stop signal is not issued. Slave station should have an individual stop signal or the function to stop the action by the frequency reference. (Setting is necessary for F241: run frequency setting, F242: run frequency hysteresis and F243: End frequency setting.)

For continuing the operation by the last received command value in the case of a communication breakdown, provide a communication time-out interval (F803,F804) to trip the slave inverters. The master inverter does not trip even though the communication breakdown happens. To trip the master inverter, provide an interlock mechanism by installing an FL fault relay point or the like from the slave side.

■ Relating communication parameters

Following parameters should be set or changed if necessary.

- Communication baud rate (common serial: F800 , RS485: F820)
  ... Shipment setting = 3: 9600bps
  Baud rate of all inverters in the network (master and slave) should be same network.
- Parity (F801) ... Shipment setting = 1: Even parity
  Parity of all inverters in the network (master and slave) should be same network.
- Communication time-out (F803) ... Shipment setting = 0
- Communication time-out act (F804) ... Shipment setting = 8
  Operation is continued by the last received command value in the case of a communication breakdown. To stop the operation of inverter, provide a communication time-out interval (ex. F803= 1) to the slave inverters, and select to trip them with the communication time-out act (F804=8). The master inverter does not trip even though the communication breakdown happens. To trip the master inverter, provide an interlock mechanism by installing an FL fault relay point or the like from the slave side.
- Frequency point selection (F810) ... Shipment setting = 0 (no point selectable)
  To carry out a speed proportional control, enable the point selection (F810 = 1 (common serial), 2 (RS485)). See chapter "7.3.1 Speed proportional control" for details.

■ Setting example of parameters (for RS485 communication)

Parameters relating to the master side (example)

F826:1	Frequency reference (%) (100% at FH)
	(4 Output torque command %)
F820:5	Communication baud rate
	(ex. 38400bps)
F801:1	Parity check (even parity)
CMOd:1	Example: Panel
FMOd: 0	Example: Terminal block (analog input)
F825:0.02	Transmission waiting time
	(ex. 20m SEC)

Parameters relating to the slave side (example)

F826: 0	Slave
F803: 1	Communication time-out (ex. 1 second)
F804: 8	Communication time-out act (trip)
F820: 5	Communication baud rate (same to the master side)
F801: 1	Parity check (same to the master side)
CMOd: 0	Terminal block (ex. Driven by F, ST)

(F241: Run and stop of operation is controlled with the frequency reference value by setting the "run frequency".)

< For speed control >

FMOd: 8	Serial communication RS485 % (100% at FH)	
F810: 2	Frequency point selection (RS485)	

(For only the ratio adjustment between the master and slave, only the FH setting is necessary. Standard setting of F810=0 enables the adjustment.)

F811: ?	Adjusted to the system	Point 1 setting (%)
F812: ?	Ditto	Point 2 frequency (Hz)
F813: ?	Ditto	Point 2 setting (%)
F814: ?	Ditto	Point 2 frequency (Hz)

< For torque control >

F421: 8	Serial communication RS485 (Torque command from the master side %)
F424: 5	Input selection of load sharing gain (ex. Panel parameter)
F728: 50	Panel load sharing gain %
	(ex. Half of the command load is shared.)

7.3.1. Speed proportional control

There are two types of proportional method for controlling the frequency, those are the “frequency point selection” and the “maximum frequency ratio”. The explanation assumes the case of inter-drive communication here. As for VF-A7/P7, proportional operation for computer-link communication is possible by the S command (for understanding the explanation, replace the "master" with the "computer").
Also the normal write command (W, P command) is capable of proportional operation in units of Hz (only for frequency point selection). Use S command for proportional control in units of %.

∗ In the case of a proportional control by the frequency point selection, slope (inclination) can be set freely according to the application. And in the case of the maximum frequency ratio, a setting method is simple and arbitrarily specified no matter how the acceleration and deceleration is until reaching the targeted frequency value.

- Sent data contents at master side in inter-drive communication (frequency command value)

$$fc(\%) = \frac{\text{Frequency reference at master side} \times 10000}{\text{Maximum frequency at master side}} \quad (1=0.01\%)$$

※ The result below 1 (0.01%) is cut out, that may generate an error of 0.01% at maximum.

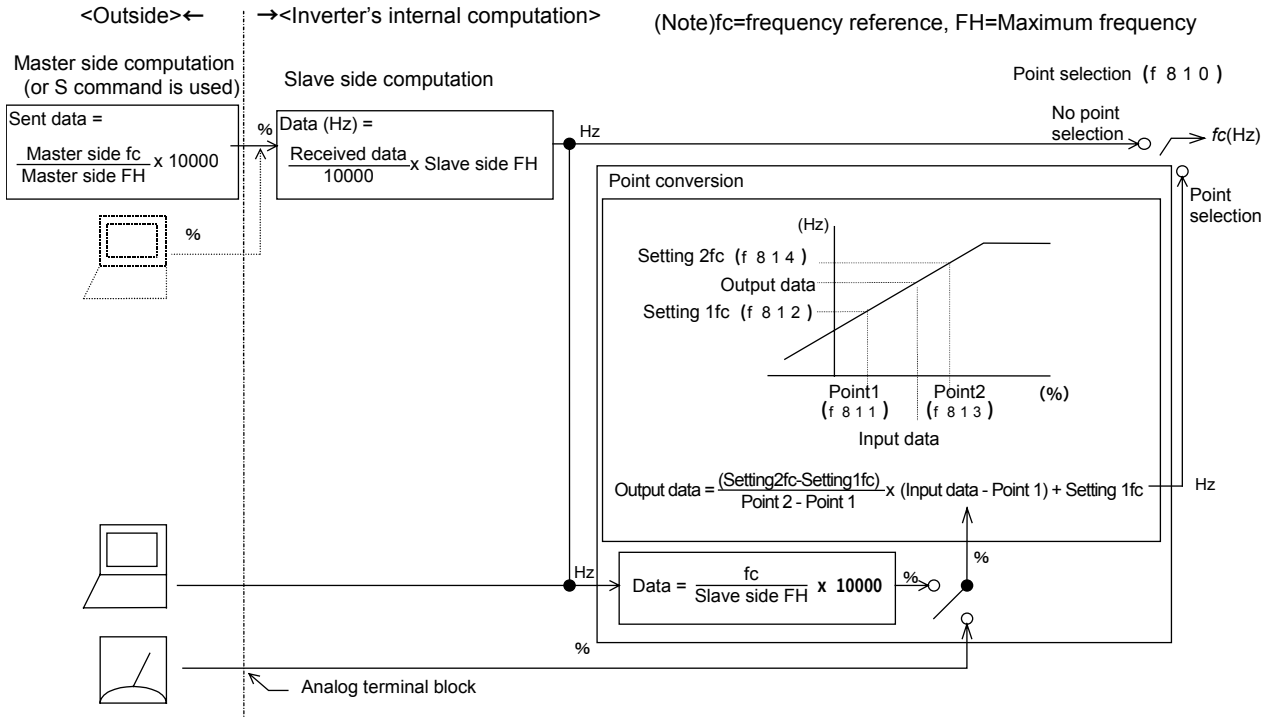
- Converted contents of frequency command value after received at slave side (without frequency point selection)

Converted value obtained as calculated below is written to the RAM as the frequency command value.

$$fc(Hz) = \frac{\text{Received data}(\%) \times \text{Maximum frequency at slave side}}{10000} \quad (1=0.01Hz)$$

※ The result below 1 (0.01Hz) is cut out, that may generate an error of 0.01Hz at maximum.

【Diagram of speed proportional control】



- When frequency point selection is not carried out (F810 = 0)

  At time of inter-drive communication, the received data (%) in the following expression is the data that is sent from the master side. At time of computer link, the received data (%) in the following expression is the data that is sent from the PC or the like, and the calculated result will be the frequency command value of the inverter.

$$fc(Hz) = \frac{\text{Received data (\%) x maximum frequency at slave side}}{10000} \quad (Hz)$$

(Ex.) < unit > Frequency unit : 1=0.01(Hz)

	Maximum frequency	Frequency command value
Master (Fc)	100.00Hz (10000)	50.00Hz (5000)
Slave 1	90.00Hz (9000)	45.00Hz (4500)
Slave 2	80.00Hz (8000)	40.00Hz (4000)

$$\text{Sent data from mster side:fc(\%)} = \frac{\text{Master side fc} \times 10000}{\text{Master side FH}} = \frac{5000 \times 10000}{10000} = 5000 = 50\%$$

$$\text{Slave 1:: } fc(Hz) = \frac{5000 \times 9000}{10000} = 4500 = 45Hz$$

$$\text{Slave 2:: } fc(Hz) = \frac{5000 \times 8000}{10000} = 4000 = 40Hz$$

- When frequency point selection is carried out (F810 ≠ 0)

  At time of inter-drive communication, calculated result obtained from the following expression will be the frequency command value at the slave side. At time of computer link, the master command (%) in the following expression should be replaced with the data sent from the PC or the like.

$$fc(Hz) = \frac{\text{Point 2 frequency - Point 1 frequency}}{\text{Point 2 - point 1}} \text{ x (Master command (\%) - Point 1) + Point 1 frequency}$$

(Ex.) < unit > Frequency unit : 1=0.01(Hz), point setting unit : 1=0.01%

	Maximum frequency (FH)	Point 1 setting (F811)	Point 1 frequency (F812)	Point 2 setting (F813)	Point 2 frequency (F814)	Frequency (Fc)
Master (Fc)	100.00Hz (10000)	—	—	—	—	50.00Hz (5000)
Slave 1	100.00Hz (10000)	0.00% (0)	0.00Hz (0)	100.00% (10000)	90.00Hz (9000)	45.00Hz (4500)
Slave 2	100.00Hz (10000)	0.00% (0)	0.00Hz (0)	100.00% (10000)	80.00Hz (8000)	40.00Hz (4000)

Sending data from the master:

$$\text{mster send fc(\%)} = \frac{\text{Master side fc} \times 10000}{\text{Master side FH}} = \frac{5000 \times 10000}{10000} = 5000 = 50\%$$

Both slave 1 and 2: By the conversion at slave side,

$$fc(Hz) = \frac{\text{receive data(\%)} \times \text{Slave side FH}}{10000} = \frac{5000 \times 10000}{10000} = 5000 = 50Hz$$

Both slave 1 and 2: By the preprocess (% conversion) by the point conversion,

$$fc(\%) = \frac{fc(Hz) \times 10000}{\text{Slave side FH}} = \frac{5000 \times 10000}{10000} = 5000 = 50\%$$

By the point conversion process,

$$\text{Slave 1: } fc(Hz) = \frac{9000 - 0}{10000 - 0} \times (5000 - 0) + 0 = 4500 = 45Hz$$

$$\text{Slave 2: } fc(Hz) = \frac{8000 - 0}{10000 - 0} \times (5000 - 0) + 0 = 4000 = 40Hz$$

7.4.Setting function of transmission 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 RS485/RS232C converter is used, changeover of sending and receiving data takes much time in the converter process, or when the slave side is not ready for data reception at time of inter-drive communication.

The case of " Inter-drive communication ", set up more than 0.02 seconds as a transmitting interval on the master side to wait for the processing time on the slave side(F805= 0.02).

[Parameter name F805, communication number 0805] ... Common serial

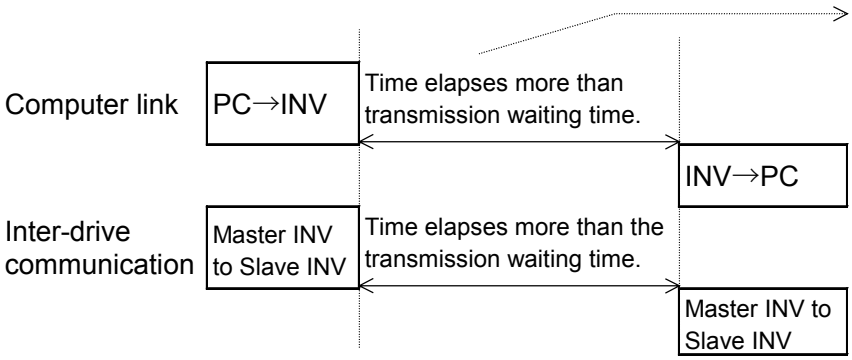
[Parameter name F825, communication number 0825] ... RS485

Functional specification:

A time for sending data is prolonged longer than the preset time, until the inverter returns the data to the PC, after it finishes receiving the data (in case of an inter-drive communication, until the inverter returns the next data to the PC, after it has sent the data.) In case the inverter's processing capacity requires longer setting time, the value more than this time will be the set value. (The parameter makes the inverter wait for more than the set time.)

Setting range: 0.01 to 2.00 seconds (10ms to 2000ms)

If the set value is 0, this function becomes invalid and the interval time for sending data is set to the maximum capacity of the inverter. To obtain a quick response for sending data, set value 0.



Time from the confirmation of the data reception (transmission, in the case of inter-drive communication) to the transmission of data, is adjusted.
If the inverter's processing time requires longer time than the transmission waiting time, the time is prolonged.

8. Commanding and monitoring through the communication

Communication command transmits the instruction (command or frequency instruction) to the inverter and the status information of the inverter can be obtained.

8.1.Commanding through the communication

■Communication command 1 [Common serial (logic): FA00, RS485: FA04]

Command “1” directs the manipulation of the inverter operation. This command will be effective only when the communication command is validated.

To put the communication command into effect, designate the parameter setting “operation command mode selection” (CMOd: communication number 0003, select either 2 for common serial or 3 for RS485 communication), otherwise select a position of the bit switch 15 “communication command 1” (for common serial: FA00, for RS485: FA04) to 1 (valid). When the communication command becomes effective with the serial “communication command 1”, the communication command becomes valid regardless of the selection of the parameter of mode selection (CMOd). Once this setting is put into effect, communication command continues to be validated unless it is cancelled (bit position to 0) or the power supply is turned off and reset or the "standard setting mode selection" parameter (tYP) is selected.

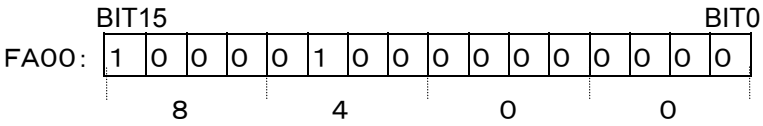
The arrangement of the “command 1” for VF-A7/P7 series is equivalent to that of the VF-S7 series, however the "selection of acceleration or deceleration" function has been moved to the command "2" because this function in VF-A7/P7 series has four patterns of selection. When the VF-S7's program that uses this function of "selection of acceleration or deceleration" is shifted to VF-A7/P7, modify the program at the PC side.

Table 1 List of data in serial communication command 1 (communication number FA00, FA04)

Bit	Function	0	1	Notes
0	Multi-step speed 1	A combination of selection 1 to 4 of the multi-step speed: Multi-step speed OFF or steps can be specified from 1 to 15. (0000:Multi-step speed OFF, 0001 - 1111: Selectable from 1 to 15 steps)		Bit combination of selection 1 to 4 enables the multi-step speed OFF or multi-step speed from 1 to 15.
1	Multi-step speed 2			
2	Multi-step speed 3			
3	Multi-step speed 4			
4	(Spare)	—	—	
5	PI control	Normal operation	PI OFF	
6	Reserved (S7: Acc/dec 1, 2 selection)	- (S7: Acc/dec 1)	- (S7: Acc/dec 2)	As for S7 series, bit 6 is for the selection of acc/dec 1 or 2. The function for A7/P7 has been shifted to the command "2".
7	Forced DC braking	OFF	Forced DC braking	
8	JOG operation	OFF	JOG operation	
9	Forward / reverse	Forward	Reverse	
10	Run / stop	Stop	Run	
11	Free run instruction	Operation ready	Free run	
12	Emergency stop	OFF	Emergency stop	Follow the contents of the parameter F603 for emergency stop method.
13	Error reset	OFF	Reset	Reset after the return of data
14	Frequency priority	OFF	Priority	Valid regardless of FMOd
15	Command priority	OFF	Priority	Valid regardless of CMOd

(Note) When the resetting is instructed from the serial communication, the reset command is executed after the data is returned.

[Example] Forward operation command (PFA008400)$_{CR}$
Designate “1” to bit 15 (command priority) and bit 10 (run or stop).



[Example] Reverse operation (PFA008600)$_{CR}$, (PFA00C600)$_{CR}$
8600H: When setting frequency mode for other purpose, not for the communication
C600H: When making frequency mode valid for the communication

■ Communication command 2 (common serial: FA20, RS485: FA22)

Command "2" handles the instructions of control: for example, the changeover of control mode, selection of motor, braking sequence, and the like. To put the communication command into effect, designate the parameter setting “operation command mode selection” (CMOd: communication number 0003), select either [2] for common serial or [3] for RS485 communication), otherwise select a position of the bit switch 15 “communication command 1” (for common serial: FA00, for RS485: FA04) to 1 (valid). When the communication command becomes effective with the serial communication command "1", the communication command becomes valid regardless of the selection of the parameter of mode selection (CMOd). Once this setting is put into effect, communication command continues to be validated unless it is cancelled (bit position to 0) or the power supply is turned off and reset or the "standard setting mode selection" parameter (tYP) is selected.
See the inverter’s instruction manual or the manual for the special functions for details of each function.

Table 2 Data construction of serial communication command 2(FA20,FA22)

	Bit	Function	0	1	Notes
Valid from Ver.300	0	Control selection	Speed control	Torque control, position control	PT =7,8: Torque control PT =9: Position control PT =0 - 6: Invalidated
	1	(Spare)	—	—	
	2	Deviation counter clear (position control)	Normal	Clear	Valid only for position control
	3	Brake close command (BC)	Normal	Forced to close	See the instruction manual of special function.
	4	Spare excitation	Normal	Action	Valid only when PT =8,9
	5	Brake release (B)	Brake closed	Brake open	See the instruction manual of special function.
	6	Brake answer (BA)	Brake closed	Brake open	
	7	Brake test (BT)	Brake closed	Brake open	
	8	Acceleration/deceleration selection 1	00: Acceleration/deceleration 1 01: Acceleration/deceleration 2 10: Acceleration/deceleration 3 11: Acceleration/deceleration 4		Acceleration/deceleration 1 - 4 is selected in combination of 2 bits.
	9	Acceleration/deceleration selection 2			
	10	V/F selection 1	00: V/F 1, 01: V/F 2 10: V/F 3, 11: V/F 4		V/F 1 - 4 is selected in combination of 2 bits.
	11	V/F selection 2			
Valid from Ver.300	12	Torque limit selection 1	00:Torque limit 1, 01:Torque limit 2 10:Torque limit 3, 11:Torque limit 4		Torque limit 1 - 4 is selected in combination of 2 bits.
	13	Torque limit selection 2			
	14	Forced JOG forward run	OFF	ON	JOG operation is carried out even when the frequency is over the JOG frequency or when the run command is set to OFF.
	15	Forced JOG reverse run	OFF	ON	

■ **Frequency setting through the communication [common serial: FA01, RS485: FA05]**

Value of the frequency command to the inverter is specified. This command will be effective only when the communication frequency command is validated while the speed control for the inverter is selected with the parameter “motor control mode selection” (speed control is selected by the input terminal block or with the communication command or the like in case the PE setting is adjusted to 7 and 8).

To put the communication frequency command into effect, designate the parameter setting “speed setting mode selection” ($FMOd$: communication number 0004, select either [7] for common serial or [8] for RS485 communication), otherwise select a position of the bit switch 14 “communication command 1” (for common serial: FA00, for RS485: FA04) to 1 (valid). When the communication frequency command becomes effective with the serial communication command "1", the communication frequency command becomes valid regardless of the selection of the parameter of mode selection ($FMOd$). Once this setting is put into effect, communication frequency command continues to be validated unless it is cancelled (bit position to 0) or the power supply is turned off and reset or the "standard setting mode selection" parameter (tYP) is selected. (FA01 and FA05 do not comply with the EEPROM. The data will be cleared by turning the power OFF or resetting the power supply.)

For setting the frequency command via the communication, designate a value of the operation frequency command in hexadecimal notation (1 = a unit of 0.01Hz).

[Example] Operation frequency command 80Hz (PFA011F40)CR

80Hz = 80 ÷0.01 = 8000 = 1F40H

<Relating parameters for frequency command>

When the selection of “frequency point setting” parameter ($FB\ 10$) is 1 (common serial) or 2 (RS485), the designated communication frequency command is converted into the contents specified to the parameters of point setting ($FB\ 11$ to $FB\ 14$).

(See chapter “7.3.1 Speed proportional control” for the point conversion.)

■ **Torque command setting through the communication [common serial: FA30, RS485: FA32]**

Value of the torque command to the inverter is specified. This command will be effective only when the communication torque command is validated while the speed control for the inverter is selected with the parameter “motor control mode selection” (speed control is selected by the input terminal block or with the communication command or the like in case the PE setting is adjusted to 7 and 8).

To put the communication torque command into effect, designate the parameter setting “torque command selection” ($F420$: communication number 0420, select either [7] for common serial or [8] for RS485 communication). Once this setting is put into effect, communication torque command continues to be validated unless it is changed or the power supply is turned off and reset or the "standard setting mode selection" parameter (tYP) is selected. (FA30 and FA32 do not comply with the EEPROM. The data will be cleared by turning the power OFF or resetting the power supply.)

For setting the torque command via the communication, designate a value of the torque command (common serial: FA30, RS485: FA32) in hexadecimal notation (1 = a unit of 0.01%).

[Example] 50% torque command (PFA321388)

50% = 50 ÷ 0.01 = 5000 = 1388H

■ Terminal Output Data (FA50)

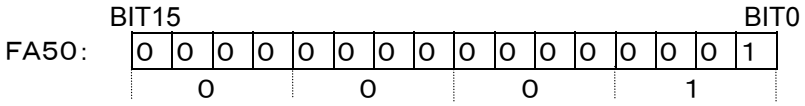
The output terminal of the inverter can be controlled directly through the communication.
Before using, set the function number (92～105) to the output terminal function selection (F130～F136).
By setting up the data of bit 0～bit 6 of terminal output data (FA50) through the communication,the inverter outputs setting data (0 or 1) to the output terminal.

List of data for Terminal Output Data (FA50)

Bit	Terminal name	Function (parameter name)	0	1
0	OUT1	Output terminal selection 1 (F130)	OFF	ON
1	OUT2	Output terminal selection 2 (F131)	OFF	ON
2	FL	Output terminal selection 3 (F132)	OFF	ON
3	R1	Output terminal selection 4 (F133)	OFF	ON
4	R2	Output terminal selection 5 (F134)	OFF	ON
5	OUT3	Output terminal selection 6 (F135)	OFF	ON
6	OUT4	Output terminal selection 7 (F136)	OFF	ON
7	—	—	—	—
8	—	—	—	—
9	—	—	—	—
10	—	—	—	—
11	—	—	—	—
12	—	—	—	—
13	—	—	—	—
14	—	—	—	—
15	—	—	—	—

<Note>Terminals OUT3, OUT4 are in the optional vector unit.

[Example] In the case that the OUT1 terminal is controlled through the communication.
By settngi 92 to the output terminal function selection 1（F130 =92） and setting 0001H to FA50, the OUT1 terminal turns on.



■ Analog Output Data (FA51)

The analog output terminal (ex. FM terminal) of the inverter can be controlled directly through the communication. Set the function number 31(Analog output for communication) to an analog terminal meter selection parameter (ex. FM terminal meter selection (FM5L)).
The data of analog output data (FA51) is output, to the selected analog terminal.
The adjustment range of data is 0 to 10,000 (0 to 100%) and the unit is 1 = 0.01%.
For details, see the “setting and calibrating meters” on inverter's instruction manual.

8.2. Monitoring through the communication

Status of the inverter monitored through the communication function is explained here.

As for the other status which are not shown in this manual, see the inverter's instruction manual about "monitoring of the operation status".

■ Operation frequency monitor through the communication

Operation frequency (data just before the trip is retained.)

: [Communication number FE00] (minimum unit: 0.01Hz)

Operation frequency (status at present)

: [Communication number FD00] (minimum unit: 0.01Hz)

[Example] Monitoring of operation frequency (at 50H operation)

Computer to inverter	Inverter to computer
$(RFD00)_{CR}$	$(RFD001388)_{CR}$

(1388H = 5000d, 5000 x 0.1 = 50Hz)

■ Status 1 (FE01)

At occurrence of a trip, status before the trip is retained.

Bit	Specification	0	1	Notes
0	(Reserved)	—	—	—
1	(Reserved)	—	—	—
2	(Reserved)	—	—	—
3	(Reserved)	—	—	—
4	(Reserved)	—	—	—
5	(Reserved)	—	—	—
6	(Reserved)	—	—	As for S7 series, bit 6 is for the selection of acc/dec 1 or 2. Acceleration / deceleration selection of A7/P7 has been moved to FE42.
7	DC braking	OFF	Forced DC braking	—
8	JOG operation	OFF	JOG operation	—
9	Forward / reverse run	Forward	Reverse run	—
10	(During operation)	Stop	Forward run	—
11	(Reserved)	—	—	—
12	(Reserved)	—	—	—
13	(Reserved)	—	—	—
14	(Reserved)	—	—	—
15	(Reserved)	—	—	—

(Note 1) DC braking at finish of operation, and the zero-speed operation are regarded as the operation undertaking.

(Note 2) Please do not use bit of (reservation).

■ Status 2 (FE41)

This status is valid for the version 301 and later.

Bit	Specification	0	1	Notes
0	Lower frequency (LL) limit	f<LL	f≧LL	
1	Upper frequency (UL) limit	f<UL	f≧UL	
2	Slow speed signal	f<F100	f>F100	F100: Output frequency for slow speed signal
3	Acceleration / deceleration completion signal	Ongoing acceleration or deceleration	Completed	<Relation parameter:> F102: Speed reach detection band
4	Targeted speed achievement signal	Not achieved	Achieved	<Relation parameter:> F101: Speed reach setting frequency F102: Speed reach detection band
5	Positive (or power factor) torque limit	Torque limit not working	Torque limit working	
6	Negative (or regenerative) torque limit	Torque limit not working	Torque limit working	
7	(Reserved)	—	—	
8	(Reserved)	—	—	
9	Pattern operation changeover output	Ongoing pattern operation	Pattern operation completed	
10	PID deviation limit	Limitter not working	Limitter working	
11	Inverter utility power operation	Inverter not running	Inverter running	
12	Commercial utility power operation	Operation not with a utility power	Operation with a utility power	
13	Cooling fan	Not working	Working	
14	Brake output signal	Open	Closed	
15	(Spare)	—	—	

*f: Standard frequency before compensation

■ **Status 3 (FE42)**

This status is valid for the version 301 and later.

Bit	Function	0	1	Notes
0	Multi-step speed 1	Multi-step speed can be set to OFF or selected from 1 to 15 depending on the bit position of 1 to 4. (0000: OFF, 0001 - 1111: 1 - 15)		Combination of bit switches 1 - 4 of multi-step speed designates OFF or multi-step speed from 1 to 15
1	Multi-step speed 2			
2	Multi-step speed 3			
3	Multi-step speed 4			
4	(Spare)	—	—	
5	(Spare)	—	—	
6	(Spare)	—	—	
7	(Spare)	—	—	
8	Changeover of acceleration / deceleration 1	00: Acceleration/deceleration 1 01: Acceleration/deceleration 2 10: Acceleration/deceleration 3 11: Acceleration/deceleration 4		Combination of 2 bits designates four patterns of acceleration and deceleration.
9	Changeover of acceleration / deceleration 2			
10	Changeover of V/F 1	00: V/F 1, 01: V/F 2 10: V/F 3, 11: V/F 4		Combination of 2 bits designates four patterns of V/F setting.
11	Changeover of V/F 2			
12	Changeover of torque limit 1	00: Torque limit 1, 01: Torque limit 2 10: Torque limit 3, 11: Torque limit 4		Combination of 2 bits designates four patterns of torque limit setting.
13	Changeover of torque limit 2			
14	Forward speed limit (torque control)	Not effective	Limiting effective	
15	Reverse speed limit (torque control)	Not effective	Limiting effective	

■ Status of input terminal block (FE06)

Functions of input terminal block can be selected with the parameters of the terminal function selection.
For monitoring the status, see the list of parameters and confirm what function is assigned to each terminal block.

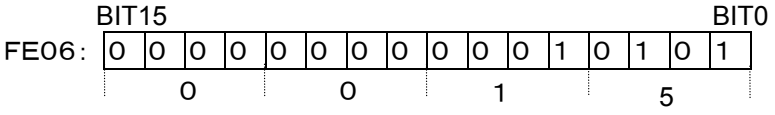
List of data for input terminal (FE06)

Bit	Terminal name (expansion)	Function (parameter name)	0	1
0	F	Input terminal selection 1 (F 1 1 1)	OFF	ON
1	R	Input terminal selection 2 (F 1 1 2)	OFF	ON
2	ST	Input terminal selection 3 (F 1 1 3)	OFF	ON
3	RES	Input terminal selection 4 (F 1 1 4)	OFF	ON
4	S1	Input terminal selection 5 (F 1 1 5)	OFF	ON
5	S2	Input terminal selection 6 (F 1 1 6)	OFF	ON
6	S3	Input terminal selection 7 (F 1 1 7)	OFF	ON
7	S4	Input terminal selection 8 (F 1 1 8)	OFF	ON
8	(B8)	Input terminal selection 9 (F 1 1 9)	OFF	ON
9	(B9)	Input terminal selection 10 (F 1 2 0)	OFF	ON
10	(B10)	Input terminal selection 11 (F 1 2 1)	OFF	ON
11	(B11)	Input terminal selection 12 (F 1 2 2)	OFF	ON
12	(B12)	Input terminal selection 13 (F 1 2 3)	OFF	ON
13	(B13)	Input terminal selection 14 (F 1 2 4)	OFF	ON
14	(B14)	Input terminal selection 15 (F 1 2 5)	OFF	ON
15	(B15)	Input terminal selection 16 (F 1 2 6)	OFF	ON

(Note)

(Note) When "binary/BCD" input (F 1 0 7= 1-8) of optional expansion terminal block is used, terminals equivalent to B8-B15 will have the information of B0-B7 terminals of "binary/BCD" input terminals. For details, see the instruction manual of expansion TB option unit (E6580769).

[Example] When terminals F, ST and SI are set ON, data of FE06 will be 0015H.



■ Status of output terminal block (FE07)

Functions of output terminal block can be selected with the parameters of the terminal function selection. For monitoring the status, see the list of parameters and confirm what function is assigned to each terminal block.

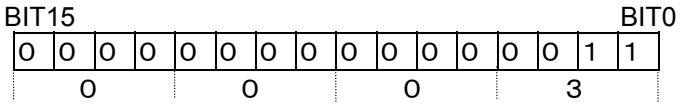
Note that the function for error code output is fixed and it cannot be modified by the parameters.

List of data for output terminals (FE07)

Bit	Terminal name	Function (parameter name)	0	1
0	OUT1	Output terminal selection 1 (F130)	OFF	ON
1	OUT2	Output terminal selection 2 (F131)	OFF	ON
2	FL	Output terminal selection 3 (F132)	OFF	ON
3	R1	Output terminal selection 4 (F133)	OFF	ON
4	R2	Output terminal selection 5 (F134)	OFF	ON
5	OUT3	Output terminal selection 6 (F135)	OFF	ON
6	OUT4	Output terminal selection 7 (F136)	OFF	ON
7	ALM0	Error code output 1	OFF	ON
8	ALM1	Error code output 2	OFF	ON
9	ALM2	Error code output 3	OFF	ON
10	ALM3	Error code output 4	OFF	ON
11	—	—	—	—
12	—	—	—	—
13	—	—	—	—
14	—	—	—	—
15	—	—	—	—

<Note> Terminals R1 and R2 are on the optional expansion terminal block.
Terminals OUT3, OUT4, ALM0 - 3 are for the optional vector unit.

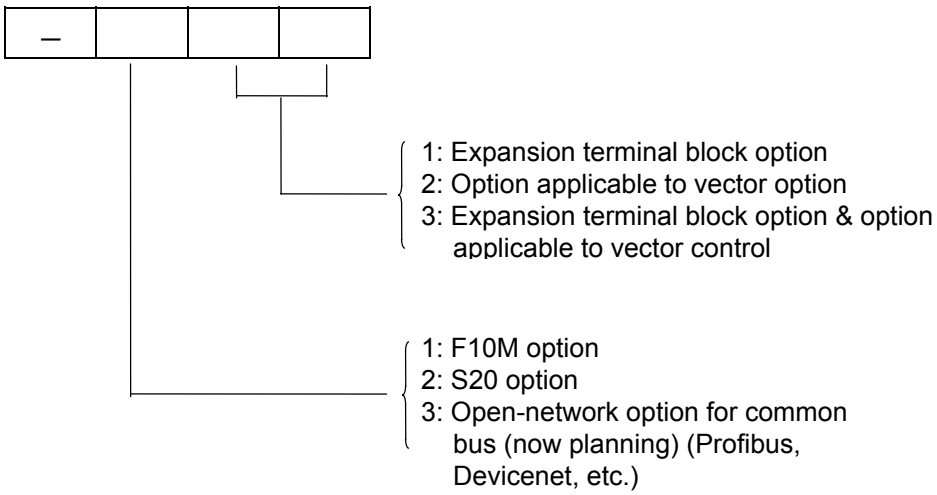
[Example] When both OUT1 and OUT2 terminals are ON, data of FE07 will be 0003H.



■ Status for each optional add-on cassette connected (FE47)

Type of connected optional add-on cassette is monitored.

Convert the obtained data into the decimal code and judge the type.



[Example] When FE47 is monitored with the F10M and expansion terminal block connected,

the data will be:

0065h (hexadecimal), 101d (decimal).

■ Alarm code monitor (FC91)

List of alarm code

Bit	Specification	0	1	Notes (panel display)
0	Over-current alarm	Normal	Alarming	E
1	Inverter overload alarm	Normal	Alarming	L
2	Motor overload alarm	Normal	Alarming	L
3	Overheat alarm	Normal	Alarming	H
4	Over-voltage alarm	Normal	Alarming	P
5	Main circuit insufficient-voltage alarm	Normal	Alarming	nOFF
6	Control circuit insufficient-voltage alarm	Normal	Alarming	POFF
7	Under-current alarm	Normal	Alarming	
8	Excess-torque alarm	Normal	Alarming	
9	Brake resistor overload alarm	Normal	Alarming	
10	Accumulated time alarm	Normal	Alarming	
11	Communication error alarm (scan transmission)	Normal	Alarming	E
12	Communication error alarm (RS485 / common serial / message transmission)	Normal	Alarming	E
13	(Reserved)	—	—	
14	(Reserved)	—	—	
15	(Reserved)	—	—	

■ Trip code monitor (FC90, FE10 - FE13)

List of trip code (status at present: FC90, history: FE10 to FE13)

Display	Data (Hexadecimal)	Data (Decimal)	Contents
nErr	0	0	No error
OC 1	1	1	Over-current during acceleration
OC2	2	2	Over-current during deceleration
OC3	3	3	Over-current during constant speed running
OCL	4	4	Over-current at startup on load side
OCA1	5	5	Over-current of U-phase arm
OCA2	6	6	Over-current of V-phase arm
OCA3	7	7	Over-current of W-phase arm
EPH1	8	8	Input phase failure
EPHO	9	9	Output phase failure
OP1	A	10	Over-voltage during acceleration
OP2	B	11	Over-voltage during deceleration
OP3	C	12	Over-voltage during constant speed running
OL 1	D	13	Inverter overload
OL2	E	14	Motor overload
OLr	F	15	Overload of generative brake resistor
OH	10	16	Trip of overheat
E	11	17	Emergency stop
EEP1	12	18	EEPROM error (write error)
EEP2	13	19	Initial read error of control EEPROM
EEP3	14	20	Initial read error of main circuit EEPROM
Err2	15	21	RAM error
Err3	16	22	ROM error
Err4	17	23	CPU error
Err5	18	24	Trip of communication error
Err6	19	25	Gate array error
Err7	1A	26	Current detector error
Err8	1B	27	Option unit error
Err9	1C	28	Flash memory error
UC	1D	29	Trip of under-current
UP1	1E	30	Trip of insufficient voltage at main circuit
UP2	1F	31	Trip of insufficient voltage at control circuit
Ot	20	32	Trip of excess torque
EF1	21	33	Trip of ground fault (software detection)
EF2	22	34	Trip of ground fault (hardware detection)
EFU	23	35	Fuse error
OCr	24	36	Over-current of generative brake resistor
OC 1P	25	37	DC section over-current during acceleration
OC2P	26	38	DC section over-current during deceleration
OC3P	27	39	DC section over-current during constant speed running
Etn	28	40	Auto tuning error
EtyP	29	41	Inverter type error
E-10	2A	42	Sink / source selection error
E-11	2B	43	Magnetic brake error (applicable to system sequence)
E-12	2C	44	Encoder disconnection
E-13	2D	45	Speed error
E-14	2E	46	Excess positional deviation
E-17	31	49	Key error

■ **Inverter model (capacity) code**

model	Data (Hexadecimal)	Data (Decimal)
A7-2004PL	24	36
A7-2007PL	25	37
A7-2015PL	26	38
A7-2022PL	27	39
A7-2037PL	29	41
A7-2055PL	2B	43
A7-2075PL	2C	44
A7-2110P	2D	45
A7-2150P	2E	46
A7-2185P	2F	47
A7-2220P	30	48
A7-2300P	31	49
A7-2370P	32	50
A7-2450P	33	51
A7-2550P	34	52
A7-2750P	35	53
A7-2900P	36	54
A7-2370P1	132	306
A7-2450P1	133	307
A7-2550P1	134	308
A7-2750P1	135	309
A7-2900P1	136	310
A7-4007PL	45	69
A7-4015PL	46	70
A7-4022PL	47	71
A7-4037PL	49	73
A7-4055PL	4B	75
A7-4075PL	4C	76
A7-4110PL	4D	77
A7-4150PL	4E	78
A7-4185P	4F	79
A7-4220P	50	80
A7-4300P	51	81
A7-4370P	52	82
A7-4450P	53	83
A7-4550P	54	84
A7-4750P	55	85
A7-4110KP	57	87
A7-4132KP	58	88
A7-4160KP	59	89
A7-4220KP	5A	90
A7-4280KP	5B	91
A7-4370P1	152	338
A7-4450P1	153	339
A7-4550P1	154	340
A7-4750P1	155	341
A7-4110KP1	157	343
A7-4132KP1	158	344
A7-4160KP1	159	345
A7-4220KP1	15A	346
A7-4280KP1	15B	347

model	Data (Hexadecimal)	Data (Decimal)
VFP7-2185P	22F	559
VFP7-2220P	230	560
VFP7-2300P	231	561
VFP7-2370P	232	562
VFP7-2450P	233	563
VFP7-2550P	234	564
VFP7-2750P	235	565
VFP7-2900P	236	566
VFP7-2110KP	237	567
VFP7-4185P	24F	591
VFP7-4220P	250	592
VFP7-4300P	251	593
VFP7-4370P	252	594
VFP7-4450P	253	595
VFP7-4550P	254	596
VFP7-4750P	255	597
VFP7-4900P	256	598
VFP7-4110KP	257	599
VFP7-4132KP	258	600
VFP7-4160KP	259	601
VFP7-4200KP	25D	605
VFP7-4220KP	25A	602
VFP7-4280KP	25B	603
VFP7-4315KP	25C	604

9. Application example of communication

Example of communication using the communication command for VF-A7/P7 series targeting the common serial communication is described here. Checksum of the inverter numbers and ASCII mode is omitted.

■ Concrete example of communication

◎Frequency is set to 60Hz through the communication for forward operation.

<ASCII mode>

Computer to inverter	Inverter to computer	
(PFA01177O)CR	(PFA01177O)CR	..... Frequency is set to 60Hz. (60÷0.01Hz=6000=1770H)
(PFA00C400)CR	(PFA00C400)CR	..... Command and frequency are effective through the communication for forward operation

<Binary mode>

Computer to inverter	Inverter to computer
2F 50 FA 01 17 70 01	21 50 FA 01 17 70 01
2F 50 FA 00 C4 00 3D	2F 50 FA 00 C4 00 3D

◎Jogging operation

<ASCII mode>

Computer to inverter	Inverter to computer	
(W02600064)CR	(W02600064)CR	..... Jogging frequency is set to 1Hz. (1÷0.01=100=64H)
(PFA008500)CR	(PFA008500)CR	..... Jogging operation command

<Binary mode>

Computer to inverter	Inverter to computer
2F 57 02 60 00 64 4C	2F 57 02 60 00 64 4C
2F 50 FA 00 85 00 FE	2F 50 FA 00 85 00 FE

◎Monitoring of operation frequency (During 60Hz operation)

<ASCII mode>

Computer to inverter	Inverter to computer	
(RFD00)CR	(RFD001770)CR	..... Operation frequency is set to 60Hz (60÷0.01Hz=6000=1770H)

<Binary mode>

Computer to inverter	Inverter to computer
2F 52 FD 00 7E	2F 52 FD 00 17 70 05

◎Monitoring of inverter status

<ASCII mode>

Computer to inverter	Inverter to computer	
(RFE01)CR	(rFE010000)CR.....	During halt or trip (r command)

<Binary mode>

Computer to inverter	Inverter to computer
2F 52 FE 01 80	2F 72 FE 01 00 40 A0

◎Monitoring of trip code (Tripping "Err5" at present)..... For details of data contents, see inverter's instruction manual on trip display.

<ASCII mode>

Computer to inverter	Inverter to computer	
(RFC90)CR	(rFC900018)CR.....	18H=24d Tripping "Err5"

<Binary mode>

Computer to inverter	Inverter to computer
2F 52 FC 90 0D	2F 72 FC 90 00 18 45

◎Monitoring of amperage

<ASCII mode>

Computer to inverter	Inverter to computer	
(RFE03)CR	(RFE03077B)CR.....	Amperage is obtained by 1915÷100=19.15%.

<Binary mode>

Computer to inverter	Inverter to computer
2F 52 FE 03 82	2F 52 FE 03 07 7B 04

◎Setting of deceleration time (10 seconds)

<16-bit ASCII mode>

Computer to inverter	Inverter to computer	
(W00100064)CR	(W00100064)CR.....	(10÷0.1=100=0064H)

<32-bit ASCII mode>

Computer to inverter	Inverter to computer	
(LW001003E8)CR	(LW00100000003E8)CR.....	(10÷0.01＝1000＝03E8H)

<16-bit binary mode>

Computer to inverter	Inverter to computer	
2F 57 00 10 00 64 FA	2F 57 00 10 00 64 FA.....	(10÷0.1=100=0064H)

10.Example of RS232C communication program

Example 1: Basic program of J3100 (RS232C ASCII mode) for continuous monitoring of operation frequency (when a trip occurs, frequency before the trip is retained).

(Advanced BASIC-86 Ver.3.01. 05J, Toshiba's edition)

1) Program example

```
10 OPEN "COM1:9600,E,8,1" AS #1          ... Setting of 9600 baud, EVEN parity, 8-bit and 1STOPBIT
20 A$="FE00"                             ... Communication number of operation frequency
                                             monitor is set.
30 PRINT #1,"("+"R"+A$+")"               ... Transmission to inverter
                                         ... (Note) Carriage return code is automatically added.
40 INPUT#1,B$                            ... Reply from inverter is received.
50 AAA$="&H"+MID$(B$,7,4)                ... Only the data contents of the returned data is taken out.
60 F$=LEFT$(STR$(VAL(AAA$)/100),6)       ... Data unit is converted to decimal notation.
70 PRINT "Operation frequency = ";F$ +"Hz" ... Operation frequency data is displayed.
80 GOTO 20                               ... Repetition
```

2) Example of execution result (when stop command is issued during 80Hz operation)

```
Operation frequency = 80Hz
Operation frequency = 79.95Hz
                :
                :
Operation frequency = 0Hz
```

Example 2: BASIC program of input command execution added with checksum data

(RS232C ASCII mode)

(Advanced BASIC-86 Ver.3.01. 05J Toshiba edition)

◇Setting change of the maximum frequency is confirmed.

1)Program example

```
 10 OPEN "COM1:9600,E,8,1" AS #1 ... Setting of 9600 baud, EVEN parity, 8-bit, 1STOPBIT
 20 INPUT "Send Data =";A$       ... Data transmitted to the inverter is taken in.
 30 S$="("+A$+"&"                .. "(" and "&" are suffixed to the captured data.
 40 S=0
 50 L=LEN(S$)
 60 FOR I=1 TO L                 ... Calculation of checksum
 70 S=S+ASC(MID$(S$,I,1))
 80 NEXT I
 90 CHS$=RIGHT$(HEX$(S),2)
100 PRINT #1,"("+A$+"&"+CHS$+")" ... Data is transmitted to the inverter together with checksum
110 INPUT #1,B$                  ... Reply from the inverter is received.
120 PRINT "Receive data = ";B$   ... Display of received data
130 GOTO 20                      ... Repetition
```

2)Example of execution result

```
Send Data =? R0011               ... Maximum frequency (0011) is read.
Receive Data = (R00111F40&3D)    ... 1F40 (maximum frequency = 80Hz)
Send Data =? W00111770           ... Maximum frequency is changed to 60Hz (1770).
Receive Data = (W00111770&36)
Send Data =? R0011               ... Maximum frequency (0011) is read.
Receive Data = (R00111770&31)    ... 1770 (maximum frequency = 60Hz)
```

Example 3: BASIC program for communication test (RS232C ASCII mode)

(Advanced BASIC-86 Ver.3.01. 05J Toshiba edition)

1)Program example

```
100 INPUT "Baud rate = 9600/4800/2400/1200";SPEED$        ... Selection of baud rate
110 INPUT "Parity = even(E)/odd(O)";PARITY$           ... Selection of parity
120 OPEN "COM1:"+SPEED$+","+PARITY$+",8,1"AS #1
130 INPUT "Send data ";B$                             ... Command input
140 PRINT #1,B$
150 C$=""
160 T=TIMER
170 COUNT=(TIMER-T)
180 IF COUNT >3 THEN 270
190 IF COUNT <0 THEN T=TIMER                          .. Shift up of digit is protected.
200 IF LOC(1)= 0 THEN A$="":GOTO 220
210 A$=INPUT$(1,#1)
220 IF A$ <>CHR$(13) THEN 240                         ... Reading finishes by carriage return (CR).
230 GOTO 290
240 IF A$="" THEN 160
250 C$=C$+A$
260 GOTO 160
270 COLOR @0,7:PRINT    “!!! No returning data !!!”;:COLOR @7,0:PRINT
280 GOTO 130                                          ... Repetition
290 PRINT A$;
300 C$=C$+A$
310 PRINT "Return data =";c$;
320 GOTO 130                                           ... Repetition
```

2)Example of execution result (when inverter number is “00”)

```
Baud rate=9600/4800/2400? 9600   ... 9600-baud is selected.
Parity =even(E)/odd(O)? E        ... E (even) is selected.
Send data? (00R0011)             ... Test communication
Return data = (00R00111770)
Send data? ()                    ... Error
!!! No returning data !!!        ... No returning data
Send data? (R0011)
Return data = (R00111770)
Send data?
          :
          :
```

11.Parameter data

Explanation of parameters for VF-A7/P7 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>

*The minimum setting unit is 0.1 when 16-bit accessing is processed by the parameter writer (PW001Z) and the communication.

Title	Communication number	Function	Adjustment range	Minimum setup unit (panel/ communication)	Default value	Write during running		Reference section
AU1	0000	Automatic acceleration and deceleration	0: Manual 1: Automatic	—	0	Disabled		
AU2	0001	Automatic V/f mode setting		—	0	Disabled	...	
CMOd	0003	Operation command mode selection		—	0	Disabled		
				:				
ACC	0009	Acceleration time 1	F508 - 6000 sec	0.01/0.01 *	Depending on models	Enabled		
				:				
F217	0217	RX point 1 frequency	-FH - FH (Note 3)	0.01/0.01	0.0	Enabled		

(Note 3) When 16-bit accessing is processed by the parameter writer (PWU001Z) and the communication, value of frequency below -327.68Hz or over +327.68Hz can not be designated.

◎The summary of parameter list relating to the communication is as follows.

(1) "Title" means the display on the inverter panel.

(2) "Communication number" is affixed to each parameter that is necessary for designating the parameter for communication.

(3) "Adjustment range" means a data range adjustable for a parameter, and the data cannot be written outside the range. The data have been expressed in the decimal notation. For writing the data through the communication function, take the minimum setting unit into consideration, and use hexadecimal system. When an annotation is suffixed to the adjustment range (ex. "Note 3" added to F217), some of the adjustment range is prohibited to be handled, and there will be restrictions in adjustment range for the 16-bit accessing. Pay attention to the adjustment range for 16-bit accessing. The restrictions for 16-bit accessing have no relations for 32-bit accessing. Pay attention to the adjustment range at time of 16-bit accessing.

(4) "Minimum setup unit" is the unit of a single data (when the minimum unit is "-", 1 is equal to 1).
For example, the "minimum setup unit" of acceleration time (ACC) is 0.01, and 1 is equal to 0.01s. For setting a data to 10 seconds, transmit 03E8h [10÷0.01=1000d=03E8h] by communication.
When an annotation is suffixed to the "minimum setup unit" (ex. * added to ACC), the unit is changed when accessing in 16-bit. For example, acceleration and deceleration time "1" will be equal to "0.1 second." For setting a data to 10 seconds, transmit 0064h [10÷0.1=100d=0064h] by communication.
In addition to the acceleration and deceleration time, there are some parameters which are subject to change in the setup unit. (For example, the data of motor constant "1" (F402) is handled as an exponent.)

(5) When changing of parameter setting is disabled as explained in the column of "writing during running", parameters cannot be rewritten during the time when the inverter is running. Changing should be attempted when the inverter is in halt.

■ List of communication number (command)

Command parameters except the operation frequency command (this is treated on the panel) can be written only to the RAM. When the power supply is shut off or when the inverter is reset, data is initialized. For writing parameters, use P command.

■ Command parameters <Note> Data is expressed in decimal notation.

Communication number	Function	Adjustment range	Minimum setup unit	Initial value	Write during running
FA00	Command 1 (common serial) *1	0～65536	—	0	Enable
FA01	Operation frequency command value (common serial) *1	Lower limit frequency (LL) - Upper limit frequency (UL)	0.01Hz	0	Enable
FA03	Operation frequency command value (panel) *2	Lower limit frequency (LL) - Upper limit frequency (UL)	0.01Hz	0	Enable
FA04	Command 1 (RS485)	0～65536	—	0	Enable
FA05	Operation frequency command value (RS485) *1	Lower limit frequency (LL) - Upper limit frequency (UL)	0.01Hz	0	Enable
FA20	Command 2 (common serial) *1	0～65536	—	0	Enable
FA22	Command 2 (RS485) *1	0～65536	—	0	Enable
FA30	Torque command value (common serial) *1	-25000～25000	0.01%	0	Enable
FA32	Torque command value (RS485) *1	-25000～25000	0.01%	0	Enable
FA34	Absolute value torque limit *3	0～25000	—	25000	Enable
FA35	Inertia moment ratio *3	100～10000	—	10000	Enable
FA50	Terminal output data *4	0～65536	1	0	Enable
FA51	Analog output data *4	0～10000	0.01%	0	Enable

*1: Before adjusting the parameter, validate the setting of communication command or communication frequency as explained in the chapter "8.1 command through the communication."

*2: Pay attention that the communication number of the operation frequency value (panel) is assigned to "FA02" in VF-S7 series, while it is assigned to "FA03" in VF-A7/P7 series.

*3: For details, see the instruction manual of the special function.

*4: For details, see the "8.1. Commanding through the communication".

■ List of communication number (monitor)

Monitoring parameters are for read-out only.

Respective monitor which are detailed in chapter “8.2 monitoring through the communication" is tabulated here. Regarding the communication numbers and particulars of monitors not listed in this table, consult the inverter's instruction manual on the descriptions of "monitoring of operation status" or read the "display contents of monitor" on the parameter list.

■ Monitoring parameters

Communication number	Function	Minimum setup unit	Notes
FB05	Inverter model (capacity) code	−	See chapter 8.2.
FB57 FE71	Rating Voltage (*1)	0.1V	See the following (*1)
FB58 FE70	Rating Current (*1)	0.1A	See the following (*1)
FC90	Trip code	−	See chapter 8.2.
FC91	Alarm code	−	See chapter 8.2.
FD00	Operation frequency (present value)	0.01Hz	See chapter 8.2.
FE00	Operation frequency (retained when tripping)	0.01Hz	See chapter 8.2.
FE01	Status	−	See chapter 8.2.
FE02	Operation frequency command	0.01Hz	
FE03	Display of amperage	0.01%	
FE04	Voltage at DC section	0.01%	
FE05	Output voltage	0.01%	
FE06	Input terminal information	−	See chapter 8.2.
FE07	Output terminal information	−	See chapter 8.2.
FE08	CPU version	−	
FE09	EEPROM version	−	
FE10	Past trip 1	−	See chapter 8.2.
FE11	Past trip 2	−	See chapter 8.2.
FE12	Past trip 3	−	See chapter 8.2.
FE13	Past trip 4	−	See chapter 8.2.
FE14	Accumulated operation time	1H	
FE22	PID feedback value	0.01Hz	
FE35	RR input	0.01%	
FE36	VI / II input	0.01%	
FE37	RX input	0.01%	
FE38	RX2 input	0.01%	
FE41	Status 2	−	See chapter 8.2.
FE42	Status 3	−	See chapter 8.2.
FE47	Type of connected option	−	See chapter 8.2.

(*1): The communication number of rating voltage (FB57) and rating current (FB58) are only for the VF-A7/P7. Use rating voltage (FE71) and rating current (FE70), when the VF-A7/P7 and other inveters are used in the same communication line.

However, FE71 and FE70 cannot be used with the VF-A7/P7 inverter before the CPU version V311.

In this case, use FB57 and FB58 as a substitute.

Appendix 1 Data code list

■ JIS (ASCII) code

Higher / Lower	0	1	2	3	4	5	6	7
0	NUL	TC7(DLE)	(SP)	0	@	P	、	p
1	TC_1(SOH)	DC_1	!	1	A	Q	a	q
2	TC_2(STX)	DC_2	”	2	B	R	b	r
3	TC_3(ETX)	DC_3	#	3	C	S	c	s
4	TC_4(EOT)	DC_4	$	4	D	T	d	t
5	TC_5(ENQ)	TC_8(NAK)	%	5	E	U	e	u
6	TC_6(ACK)	TC_9(SYN)	&	6	F	V	f	v
7	BEL	TC_{10}(ETB)	’	7	G	W	g	w
8	FE_0(BS)	CAN	(	8	H	X	h	x
9	FE_1(HT)	EM	)	9	I	Y	i	y
A	FE_2(LF)	SUB	*	:	J	Z	j	z
B	FE_3(VT)	ESC	+	;	K	[	k	{
C	FE_4(FF)	IS_4(FS)	,	<	L	¥	l	|
D	FE_5(CR)	IS_3(GS)	−	=	M	]	m	}
E	SO	IS_2(RS)	.	>	N	^	n	¯
F	SI	IS_1(US)	/	?	O	_	o	DEL

CR: Carriage Return

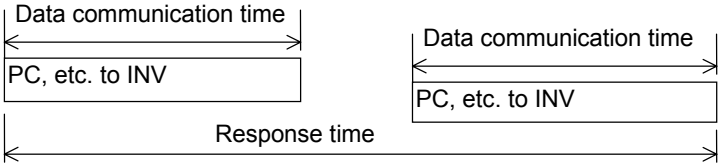
[Ex.] Code “41” = a character “A”

Appendix 2 Response time

Because the communication process of VF-A7/P7 series inverter uses a residual time of the master control, the response time is not assured. Response time written here is the guideline assuming the parameters have been fixed to the factory shipment setting. The response time explained below is merely for the reference. When using the applications with higher response time and when accurate timing is required, communication device or terminal block for the TOSLINE-F10 and S-20 is recommended.

■ Guideline for response time

When the setting value of PWM carrier frequency (F300) is outside the frequency range between 1.4kHz and 1.7kHz, 2.8kHz and 3.4kHz, 4.2kHz and 5kHz, 8.5kHz and 10kHz, 14.2kHz and 15kHz :
Response time of single communication is; Data communication time plus approximately 15ms.
Response time of simultaneous communication is; Data communication time plus approximately 25ms.



$$\text{Data communication time} = \frac{1}{\text{Communication speed}} \times \text{number of communicated bytes} \times \text{number of bits}$$

- Number of bits = Start bit + Data length + Parity bit + Stop bit
- Minimal bits = 1 + 8 + 0 + 1 = 10 bits
- Maximal bits = 1 + 8 + 1 + 2 = 12 bits

<Calculation example of communication time: the case of 9600bps, 14 characters and 11 bits>

$$\text{Data communication time} = \frac{1}{9600} \times 14 \times 11 = 16\text{ms}$$

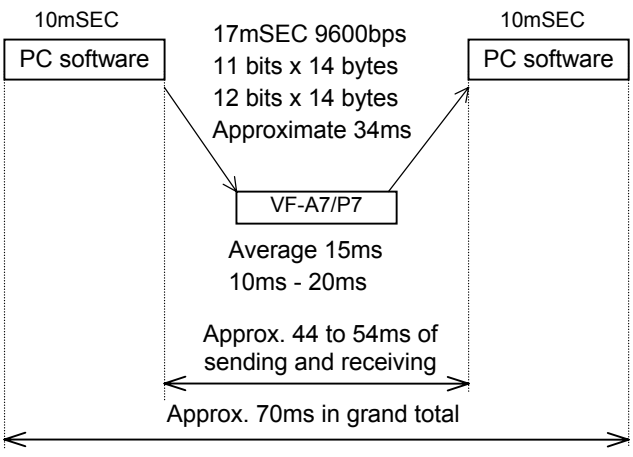
■ Calculation example of response time

When attempting to rewrite one "motor constant parameter" (1 word) to ten inverters which are connected in the network by the processing from the host unit such as PC and the like, the response time using the RS485 communication will be as follows.

RS485 (9600bps) ---- Approximately 0.7 seconds (70ms x 10 inverters)

(This example assumes 14 characters for communication and the process at PC side is 10ms.)

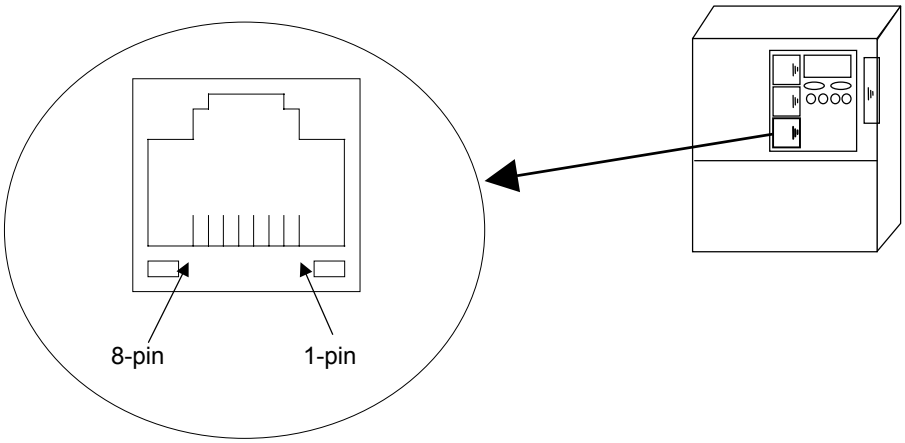
Processing time chart of one parameter writing



<In case of 38400bps communication speed>
11 bits x 14 bytes = 4ms
12 bits x 14 bytes = 4.4ms
Transmission time 8.4ms
Approx. 18 to 28ms of sending and receiving
Approx. 48ms in grand total
(When common serial RS485 option is used, the maximal communication speed is 9600bps as shown in the left diagram.)

Appendix 3 Wiring of RS485 communication line

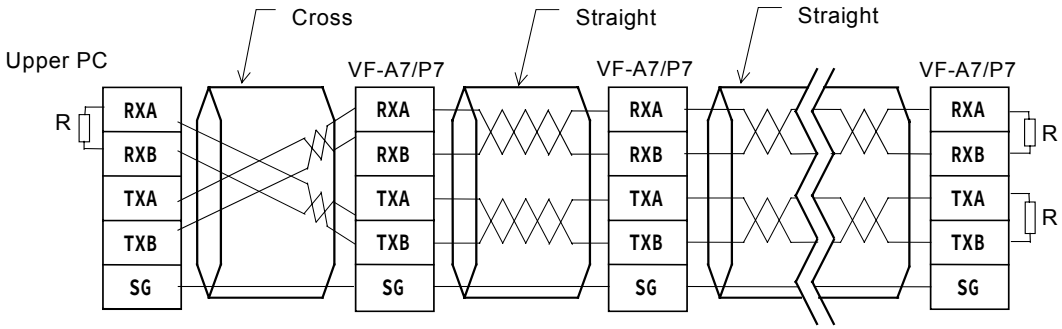
■ Connector for serial RS485 communication



Signal name	Pin assignment	Purpose
RXA	4	In-phase receiving data (positive line)
RXB	5	Opposite-phase receiving data (negative line)
TXA	3	In-phase transmission data (positive line)
TXB	6	Opposite-phase transmission data (negative line)
SG	2 , 8	Ground of signal lines
P24	1	24V(Connection prohibited)
P5	7	5V(Connection prohibited)

Signal line seen from the inverter side (Ex. RXA is received at inverter side.)

■ Connection of RS485 communication



* For 2-wire line connection, short-circuit a line between RXA and TXA, and between RXB and TXB.
Follow the cautionary explanation described in appendix 4 when using the 2-wire line connection.

∗ Do not connect pin #1 (P24) and pin #7 (P5).

Appendix 4 Precautions for 2-wire line connection

Follow the cautionary explanation described here when using the 2-wire line connection.

(1) When using 2-wire line for the standard RS485 communication, specify the connection method of RS485 (F821 = 0).
This parameter is validated by resetting the power supply, etc. Reset the power supply after designating the parameter.
In the case of RS485 conversion unit (RS4001Z) of the common serial option, parameter setting is not necessary because the transmission and receiving is switched over by the operation at hardware side.

(2) For using 2-wire line system, be sure to carry out handshaking (the host sends the next data to the inverter after it confirms the reply from the inverter).

(3) For using 2-wire line system, stop bit should be 1 bit.
If the stop bit is transmitted in 2-bit or 1.5-bit signal, data may be possibly transmitted within the receiving time of the last one bit.

(4) When the converter and the like that requires a certain time for switching transmission and reception is used, provide an transmission waiting time (See chapter 7.4.). Otherwise, the data from the inverter cannot be accepted in some cases while the inverter may return the data immediately after receiving the data because the changeover of transmission by the converter, etc. takes time.

(5) When using binary mode for the multiple-unit control in 2-wire line system, use read-out command "47H(G)" especial for 2-wire line for reading the data. G command is applicable to V300 or later version. For the former versions of V300, use ASCII mode for 2-wire line system.

Appendix 5 Compatibility to VF-S7 communication function

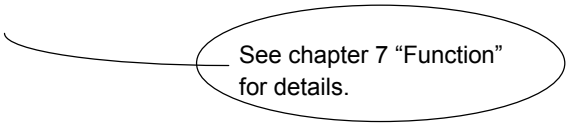
Communication function of VF-A7/P7 series is based on the protocol of Toshiba VF-S7 series. The continuity of communication procedure is maintained, however some cautions should be paid for the compatibility. The users of the VF-S7 series are requested to read the following precautions.

■ For the users of VF-S7 series

As for the particulars of inverter's parameter, the meanings of data may differ even if the parameter title and the communication number are identical. (For example when the function of input terminal selection (F 1 1 1) is designated to "4", it indicates "reverse operation command" for VF-A7/P7, but it contrary stands for "JOG operation command" for VF-S7.) In case a specific parameter is used for the inverter control, see the inverter's instruction manual to confirm the parameter is identical to both VF-A7/P7 and VF-S7. If it is different, modify the program of the computer in accordance with the type. In addition, never duplicate the parameter between the different series of inverters.
Read "comparison table of communication function" and confirm the detail.

■ Functions newly added to VF-A7/P7

- Selection of inverter action in case of communication time-out
- Setting of response interval time
- Broadcast communication function
- Inter-drive communication
- Alarm (t)



NOTE	
	▼ Do not use the program for communication of different series of inverter. As comparing the parameter specifications of the inverter, the meanings of data may differ even if the parameter title and the communication number are identical. Be sure to confirm the detail of parameter. If it is different, modify the program of the computer in accordance with the type. ▼ Never duplicate the parameter between the different series of inverters. As comparing the parameter specifications of the inverter, the meanings of data may differ even if the parameter title and the communication number are identical.

■ Comparison table for communication function

The contents of this table assume that VF-S7 is replaced with VF-A7/P7, or that two types of inverter are used together in the same network. The same data between VF-A7/P7 and VF-S7, and the newly added data are not explained.

Item \ Model	VF-S7	VF-A7/P7	Compatibility	Reference
Baud rate	Common serial (RS232C/RS485): 1200/2400/4800/9600bps (Fixed to 1200bps for only S7e.)	Common serial (RS232C/RS485): 1200/2400/4800/9600bps	○	Chapter 2 Chapter 6
		RS485 (standard): 1200/2400/4800/9600/19200 /38400bps	☆	
Maximum frame length	Max. 17 bytes	Max. 22 bytes	△	Chapter 2 Chapter 5
RS485 wiring	4-wire line	4-wire line / 2-wire line	☆	Chapter 6 Appendix 3
Value of data	Hex. 16-bit data	Hex. 16-bit/32-bit data (Add “L” to the head of command of 32-bit data.)	△	Chapter 5
Assignment of inverter number	・ASCII: Decimal notation Setting range 00 -63 Binary: Hex. notation Setting range 00H - 3FH (00 - 63)	・ASCII: Decimal notation Setting range 00 -99 Binary: Hex. notation Setting range 00H - 3FH (00 - 63)	☆	Chapter 5
The trip state data of the inverter against the command of return data.	The trip state data indicates the trip during standby for auto re-start until auto re-starting from the trip which is selected by parameter(F301).	The trip state data does not indicates the trip during standby for auto re-start until auto re-starting from the trip which is selected by parameter(F301).	△	Chapter 5
Type of error	Six types	7 types (Access mode error is added)	△	Chapter 3.2
Reset command	Returning of data may be interrupted by the reset timing at time of inverter resetting.	Reset command is issued after the data is returned.	☆	Chapter 4
Selective command of acceleration or deceleration 1, 2 (common serial)	6th bit of command 1 (communication number: FA00)	8th and 9th bit of command 2 (communication number: FA20)	△	Chapter 4

[Meaning of symbols for “compatibility”]

△: Program should be modified depending on the application purpose of user side.

○: Same contents of VF-A7/P7 and VF-S7 series

☆: Features are improved, or scope of application is enlarged for VF-A7/P7 series.

Appendix 6 Troubleshooting

In case when trouble occurs, diagnose the problem according to the table before calling for a service. If the trouble can not be removed by the countermeasures, and when the problems are not listed in the table, ask for your retailer.

■ **Trip of communication factor, alarm, and communication failure**

Detail of trouble	Check items and countermeasures	Reference
Communication fails.	・Are power supply of PC and the inverter turned ON? ・Is cable connection proper? ・Are baud rate, parity bit and bit length uniform in the communication line?	Chapter 6
Error is returned.	・Is transmission format proper? ・Is written data within a set range?	Chapter 5 Chapter 3.2
"Err5" trip occurs.	・Confirm the connection and timer setting.	Chapter 7.1
"E" alarm occurs. (At time of computer link and individual communication)	・Confirm the connection and timer setting.	Chapter 7.1
"E" alarm occurs. (At time of computer link and broadcast communication)	・Confirm the connection and timer setting. ・Communication error is suspected. Confirm the data contents.	Chapter 7.1 Chapter 5 Chapter 3.2
"E" alarm occurs. (Inter-drive communication, slave side)	・Confirm the connection and timer setting. ・Remove the cause of trip at the master side. ・Prolong the transmission interval time.	Chapter 7.1 Chapter 7.3 Chapter 7.4
Frequency command from communication is not validated.	・Is frequency mode is adjusted for communication?	Chapter 8.1
Run/stop command, etc. from communication is not validated.	・Is command mode is adjusted for communication?	Chapter 8.1
Response from inverter is returned endlessly at time of 2-wire line RS485 communication	・Is connection method of RS485 specified to 2-wire line system (F82 1=0)? ・Was the power supply reset after the above parameter setting?	Appendix 4
Response from inverter is returned endlessly at time of 4-wire line RS485 communication	・Is wiring and connection proper? ・Is there any contacting of receiving line and transmission line?	Appendix 2
Data is transmitted from inverter right after the power supply, and command to inverter is not accepted.	・Is inter-drive communication is designated to the master? Set a slave for commanding to the inverter.	Chapter 6
Modification to parameter is not reflected.	・Some communication parameters are validated by resetting the power supply. Reboot the power of the inverter once.	Chapter 6

Appendix 7 CPU version information

CPU has some distinct functions in respective version. This manual complies with the version 306. Different functions of versions are explained here.

- Version 100 to version 1XX
  - Inter-drive communication function is not provided.
    (The function is applicable from version 200 and later.)
  - Same parameter (F805) is used for the function of transmission interval time for both of common serial communication and RS485 communication.
    (Parameters are independently set for the common serial (F805) and RS485 (F825) after the version 200.)

- Version 100 to version 2XX
  - When using RS485 communication with 2-wire line system, only the ASCII code is applicable. Do not use binary mode. (Not applicable to G command)
    (Binary mode for RS485 communication with 2-wire line system is applicable to the version 300 and later.)

- Version 100 to version 305
  - The stop bit is regarded as 1 bit for both reception and transmission by the inverter.
    (From version 306, the inverter receives the data with 1 stop bit, and sends the data with 2 stop bits.)
  - Use 32 bit mode at setting negative data.

- Version 306 and later
  - Detailed in this manual.