

RS-485 USER'S MANUAL

FRENIC Mini SERIES

FRENIC Eco SERIES

FRENIC Multi SERIES

FRENIC MEGA SERIES

FRENIC ACE SERIES

FRENIC HVAC SERIES

FRENIC AQUA SERIES

FRENIC-Mini (C1, C2)

FRENIC-Eco

FRENIC-Multi

FRENIC - MEGA (G1, G2)

FRENIC-Ace(E2, E3)

FRENIC-HVAC

FRENIC-AQUA

**User's Manual
for RS-485 Communications**

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Preface

The inverter can be connected with the keypad through RJ-45 connector (modular jack) *1, RS-485 communications card (option) *2, control circuit terminal base *3 and RJ-45 connector (modular jack) for RS-485 communications *4. Using these connection methods, the inverter function can be expanded to such a level where RS-485 communications can be used. Use of RJ-45 connector for connection with the keypad permits remote operation from the keypad.

*1 FRENIC-Eco/Multi/Ace/MEGA/HVAC/AQUA

*2 FRENIC-Mini(C1)/Eco/Multi/Ace

*3 FRENIC-Ace(E3)/MEGA(G1,G2)/HVAC/AQUA

*4 FRENIC-Mini(C2)/Ace(E2)

This manual describes the functional expansion. For the handling of the inverter, see each User's Manual and Instruction Manual.

Please read through this user's manual to familiarize yourself with proper use. Improper handling or misuse may result in malfunction, shorter service life or failure.

This user's manual describes RS-485 communications function commonly used for FRENIC-Mini, FRENIC-Eco, FRENIC-Multi, FRENIC-HVAC/AQUA, FRENIC-Ace(E2,E3) and FRENIC-MEGA(G1,G2) (FRENIC series).

If necessary, refer to "CHAPTER 8 MODEL DEPENDENT CONTENT" for information on the differences between each model.

■ Safety Precautions

Prior to installation, connection (wiring), operation, maintenance or inspection, read through this user's manual as well as the instruction and installation manuals to ensure proper operation of the product. Familiarize yourself with all information required for proper use, including knowledge relating to the product, safety information, and precautions.

This user's manual classifies safety precautions as shown below according to the severity of the accident that may occur if you fail to observe the precaution:

 WARNING	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in death or serious bodily injuries.
 CAUTION	Failure to heed the information indicated by this symbol may lead to dangerous conditions, possibly resulting in minor or light bodily injuries and/or substantial property damage.

Failure to heed the information contained under the CAUTION title can also result in serious consequences. These safety precautions are of utmost importance and must be observed at all times.

 CAUTION
Our inverters are not designed for use in appliances and machinery on which lives depend. Consult Fuji before considering our inverters for equipment and machinery related to nuclear power control, aerospace uses, medical uses or transportation. When the product is to be used with any machinery or equipment on which lives depend or with machinery or equipment which could cause serious loss or damage should this product malfunction or fail, ensure that appropriate safety devices and/or equipment are installed.

Wiring

WARNING

- Before starting wiring, confirm that the power is turned OFF (open).
An electric shock may result.

CAUTION

- The product cannot be connected directly to an RS-232C interface of a personal computer.
- Before connecting wiring to the RJ-45 connector (modular jack) for connecting the keypad, equipped on the inverter (FRENIC-Eco) or the RJ-45 connector (modular jack) on the RS-485 communications card (option) (FRENIC-Mini), confirm the wiring of the device to be connected. For further information, see "2.2 Connections" under CHAPTER 2 of this manual.
- If connecting to the FVR-E11S series, a power supply short circuit or signal line collision will occur, resulting in possible damage. Refer to "2.2.2 Connection procedures" for details.
Failure may result.

Operation

WARNING

- Note that the inverter starts to supply power to the motor and the motor runs upon resetting of an alarm with the operation command ON (closed).
An accident may result.

Icons

The following icons are used in this instruction manual.



Incorrect handling due to negligence of the description accompanying this icon may undermine the true performance of the inverters, and incorrect operation or settings may result in an accident.



Indicates reference items helpful for operation and data entry for the inverter.

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CHAPTER 1

OVERVIEW

This chapter describes the functions that can be realized by performing RS-485 communications.

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1.1 Features

The functions listed below can be implemented using RS-485 communications.

- The keypad can be mounted on the easy-to-access front of control panel with an extension cable (option).
- The function code data of the inverter can be edited and the operation status of the inverter can be monitored by connecting it to a personal computer on which inverter support software runs (see the "FRENIC Loader Instruction Manual").
- The inverter can be controlled as a subordinate device (slave) by connecting it to an upper level device (host (master)) such as a PLC or personal computer.

As the communications protocols for controlling inverter, the Modbus RTU widely used by a variety of appliances, and the Fuji general-purpose inverter protocol common to Fuji's inverters are available.

Modbus RTU protocol

The Modbus RTU protocol is a set of communications specifications defined to connect Modicon's PLCs (Programmable Logic Controllers) in a network. A network is established between PLCs or between a PLC and another slave unit(s) (inverter(s), etc.). The main functions include:

- supporting both a query-response format and a broadcast format for messages.
- enabling the host unit as the master to transmit queries to each inverter as a slave, and each slave to send back responses to the queries to the master.
- supporting two modes, RTU mode and ASCII mode, as transmission mode for the standard Modbus Protocol. FRENIC-Mini/Eco/Multi supports the RTU mode only, which provides a high transmission density.
- performing an error check through a CRC (cyclic redundancy check) to ensure accurate data transmission.

Fuji general-purpose inverter protocol

This protocol is commonly used for all models of Fuji's general-purpose inverters. The main functions include:

- enabling, as a common protocol, operation of all models of Fuji's general-purpose inverters with the same host program (function codes cannot be generally edited because specifications are different among models).
- adopting fixed-length transmission frames as standard frames to facilitate developing communications control programs for hosts.
- reducing the communications time in response to operation commands and frequency setting which are required quick response by using optional transmission frames.
- Metasys N2 protocol

The Metasys N2 protocol is a protocol for total building management systems, and was developed by Johnson Controls. Refer to the documentation issued by Johnson Controls for details on Metasys N2.

- BACnet protocol

BACnet protocol is a communication protocol for building automation and control networks defined by ASHRAE. The BACnet protocol conforms to ASHRAE/ANSI/ISO. Refer to the standards for details.



- Since the protocol switches to the keypad dedicated protocol automatically by connecting the keypad, it is not necessary to set up the communications- related functions.
- Although the FRENIC Loader uses a dedicated protocol for loader commands, part of the communications conditions must be set. (For further information, see the " FRENIC Loader Instruction Manual.")
- With regard to a FRENIC-Mini(C1) that uses inverter ROM 0399 or earlier version, part of the RTU protocol functions are restricted. Contact us for these restrictions. Please refer to "8.7 Differences Between Functions" for the detail.).

1.2 List of Functions

The functions listed below become available by operating the appropriate function codes from the host controller.

The chapters that follow describe these functions in detail.

Table 1.1 List of RS-485 communications functions

Function	Description	Related function code
Operation	The functions equivalent to the terminal functions shown below can be executed through communications: -Forward operation command "FWD" and reverse operation command "REV" -Digital input commands ([FWD], [REV], [X1] - [X9] terminals) (The number of X terminals varies with the inverter model.) -Alarm reset command ("RST")	S codes (dedicated to communications)
Frequency setting	Either of the following three setting methods can be selected: -Set up as "±20000/maximum frequency." -Frequency (adjustable unit: 0.01 Hz) without polarity -Rotation speed (adjustable unit: 1r/min) Only MEGA(G1). MEGA(G2), Ace have a polarity.	
PID command	-Set up as "±20000/100%."	
Torque command/ torque current command	-Set in the "-327.68% to 327.67%" range.	
Torque bias		
Operation monitor	The items below can be monitored: -Frequency command -Actual values (frequency, current, voltage, etc.) -Operation status, information on general-purpose output terminals, etc.	M codes W codes X codes Z codes (dedicated to communications)
Maintenance monitor	The items below can be monitored: -Cumulative operation time, DC link voltage -Information to determine the service life of parts to be periodically replaced (main circuit capacitor, PC board capacitor, cooling fan) -Model codes, capacity codes, ROM version, etc.	
Alarm monitor	The items below can be monitored: -Monitoring alarm history (last four alarms) On the FRENIC-MEGA (G2) only, history can be checked for the latest to ninth last alarm. -Monitoring information when an alarm occurs (last four alarms) Operation information (output/set frequencies, current, voltage, etc.) Operation status, information on general-purpose output terminals Maintenance information (cumulative operation time, DC link voltage, heat sink temperature, etc.)	
Function code	All types of function code data can be monitored and changed.	

CHAPTER 2

COMMON SPECIFICATIONS

This chapter describes the specifications common to the Modbus RTU protocol, Fuji general-purpose inverter protocol, and loader protocol. For further information about the specific specifications of each protocol, see CHAPTER 3 "Modbus RTU PROTOCOL" and CHAPTER 4 "FUJI GENERAL-PURPOSE INVERTER PROTOCOL."

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2.1 Specifications of RS-485 Communications

Table 2.1 shows the specifications of RS-485 communications. The connection configuration and compatible protocols differ for each model. Please refer to "8.2 Connection Configuration and Compatible Protocols" if wishing for details on compatibility for each model.

Table 2.1 RS-485 communications specifications

Item	Specification		
Protocol	FGI-BUS	Modbus RTU	Loader commands
Complying with	Fuji general-purpose inverter protocol	Modicon Modbus RTU-compliant (only in RTU mode only)	Special commands dedicated to inverter support loader software (not disclosed)
No. of supporting stations	Host device: 1 Inverters: up to 31		
Physical level	EIA /RS-485		
Connection to RS-485	Connect using an 8-wire RJ-45 connector or terminal block		8-wire RJ-45 connector
Synchronization method of character	Start-Stop system		
Transmission mode	Half-duplex		
Transmission speed (bps)	2400, 4800, 9600, 19200 , 38400, 57600, 76800 and 115200 *		
Maximum transmission cable length	500m		
No. of available station addresses	1 to 31	1 to 247	1 to 255
Message frame format	FGI-BUS	Modbus RTU	Loader command
Synchronization method of transmission frames	Detection SOH (Start Of Header) character (SOH 01 _H)	Detection of no-data transmission time for 3 byte period	Start code 96H detection
Frame length	Normal transmission: 16 bytes (fixed) High-speed transmission: 8 or 12 bytes	Variable length	Variable length
Maximum transfer data	Write: 1 words Read: 1 words	Write: 50 words Read: 50 words FRENIC-MEGA Write: 100 words Read: 100 words	Write: 41 words Read: 41 words
Messaging system	Polling/Selecting/Broadcast		Command message
Transmission character format	ASCII	Binary	Binary
Character length	8 or 7 bits (selectable by the function code)	8 bits (fixed)	8 bits (fixed)
Parity	Even, Odd, or None (selectable by the function code)		Even
Stop bit length	1 or 2 bits (selectable by the function code)	No parity: 2 bits Even or Odd parity: 1 bit	1 bit (fixed)
Error checking	Sum-check	CRC-16	Sum-check

* Compatible settings differ for each model. Refer to "8.7 Differences Between Functions" for details.

Table 2.1 RS-485 communications specifications (Continued)

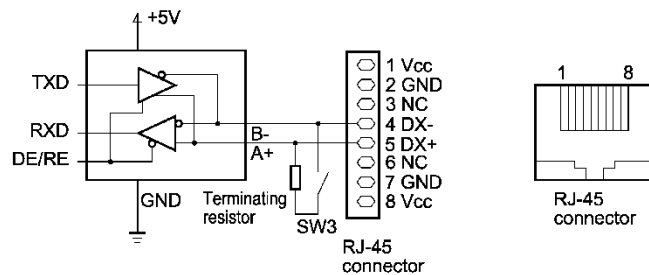
Item	Specification	
Protocol	Metasys N2	BACnet
Compliance	Metasys N2 developed by Johnson Controls	ANSI/ASHRAE standard 135-1995
No. of connected units	Host device: 1, Inverters: Up to 31	
Electrical specifications	EIA RS-485	
Connection method	RJ-45 connector or terminal block	
Synchronization method	Start-stop synchronization	
Communication system	Half-duplex	
Bus topology	Master-slave	Master-slave/token passing (MS/TP)
Baud rate (bps)	9600	9600, 19200, 38400, 76800
Max. transmission cable length	500m	
Station No.	1 to 255	1 to 127
Message frame format	Metasys N2	BACnet
Frame synchronization method	Timing synchronization	
Frame length	Variable length	Max. 501 octets
Messaging system	Polling/selecting/broadcast	
Transmission character format	ASCII, fixed at 7 bits	
Character length	8 bit (fixed)	
Parity	No parity (fixed)	
Stop bit length	1 bit (fixed)	
Error checking	Check sum	CRC

2.1.1 Specification of the RJ-45 connector for RS-485 communications (modular jack)

The RS-485 communications port of the FRENIC-Mini's RS-485 communications card (option) and the RS-485 communications port for connecting the keypad equipped on the FRENIC-Eco/Multi are the RJ-45 connectors with the pin assignment shown below.

Pin No.	Signal name	Function	Remarks
1, 8	Vcc	Power source for the keypad	5 V
2, 7	GND	Reference voltage level	Ground (0V)
3, 6	NC	No connection	—
4	DX-	RS-485 communications data (-)	A terminating resistor of 112Ω is incorporated. Connection/cut off is selected by a switch*1.
5	DX+	RS-485 communications data (+)	

*1 For the details of the switch, refer to 8.4 "Terminating Resistors".



- A power supply for the keypad is connected to the RJ-45 connector for RS-485 communications (via pins 1, 2, 7, and 8). Note that the pins assigned to the power supply must not be connected when connecting the inverter with another device.
- If connecting to the FVR-E11S series, a power supply short circuit or signal line collision will occur, resulting in possible damage. Refer to "8.3 Precautions with Combinations or Replacements from E11S" for details.
- The wire connections differ for the FRENIC-Ace/Multi RS-485 communication card (option) and FRENIC-Ace inverter unit RS-485 communication RJ-45 connector. Refer to "8.5 Function Expansion RJ-45 Connector (Modular jack) Specifications" and "8.6 Specifications for Dedicated RJ-45 Connector (Modular jack) for RS-485 Communication" for details.

Failure to observe this could result in a failure.

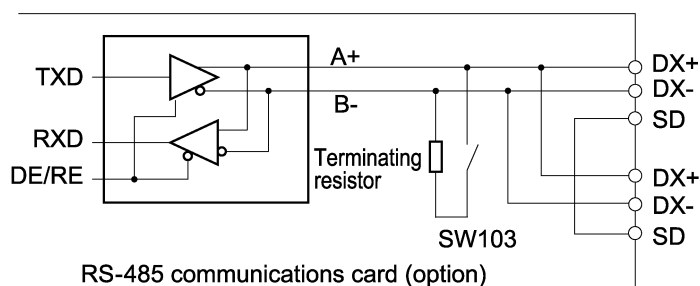
2.1.2 Specification of the terminal for RS-485 communications

- RS-485 communications card for FRENIC-Eco (option)

FRENIC-Eco/Multi's RS-485 communications card is equipped with two pairs of terminals for multidrop. The terminal symbols, terminal names, and functions of the respective terminals are as shown in the table below.

Terminal symbol		Terminal name	Function description
1	DX+	RS-485 communications data (+) terminal	This is the (+) terminal of RS-485 communications data.
	DX-	RS-485 communications data (-) terminal	This is the (-) terminal of RS-485 communications data.
	SD	Communications cable shield terminal	This is the terminal for relaying the shield of the shielded cable, insulated from other circuits.
2	DX+	DX+ relay terminal for multidrop	This is the relay terminal of RS-485 communications data (+).
	DX-	DX- relay terminal for multidrop	This is the relay terminal of RS-485 communications data (-).
	SD	SD relay terminal for multidrop	This is the terminal for relaying the shield of the shielded cable, insulated from other circuits.
Internal switch		Terminating resistor switching	A terminating resistor of 112Ω is incorporated. Connection/release is switched by this switch*1.

*1 For the details of the switch, see "2.2.2 Connection procedures [2] About terminating resistors."



- FRENIC-MEGA(G1,G2)

The terminal for RS-485 communications port 2 is provided in the control circuit terminals of the inverter. The table below shows the code, name, and function of each terminal. These terminals can be easily connected with the multi-drop circuit.

Terminal symbol	Terminal name	Function description
DX+	RS-485 communications data (+) terminal	This is the relay terminal of RS-485 communications data (+).
DX-	RS-485 communications data (-) terminal	This is the relay terminal of RS-485 communications data (-).
SD	Communications cable shield terminal	This is the terminal for relaying the shield of the shielded cable, insulated from other circuits.
Internal switch	Terminating resistor switching	A terminating resistor of 112Ω is incorporated. Connection/release is switched by this switch*1.

*1 For the details of the switch, see "2.2.2 Connection procedures [2] About terminating resistors."

2.1.3 Specification of connection cable for RS-485 terminal

[1] RJ-45 connector

The specification of the connection cable is as follows to ensure the reliability of connection.

	Specifications
Common specification	Straight cable for 10BASE-T/100BASE-TX, satisfying the US ANSI/TIA/EIA-568A category 5 standard (commercial LAN cable)
Extension cable for remote operations (CB-5S)	Same as above, 8-core, 5m long, RJ-45 connector (both ends)
Extension cable for remote operations (CB-3S)	Same as above, 8-core, 3m long, RJ-45 connector (both ends)
Extension cable for remote operations (CB-1S)	Same as above, 8-core, 1m long, RJ-45 connector (both ends)

To connect a keypad, use an 8-core straight cable. Use an extension cable for remote operations (CB-5S, CB-3S, or CB-1S) or a commercial LAN cable (20m max.).

Recommended LAN cable

Maker: Sanwa Supply (JAPAN)

Type: KB-10T5-01K (1 m)

KB-STP-01K (1-m shielded cable: Compliant with EMC Directives)

[2] Cable specifications for connection with terminals

To secure the reliability in connection, use the twisted pair shielded cable AWG16 to 26 for long-distance transmission.

Recommended cable

Maker: Furukawa Electric's AWM2789 long-distance cable

2.2 Connections

2.2.1 Basic connection

When connecting the keypad with the inverter or connecting the inverter with a host such as personal computer or PLC, use a standard LAN cable (straight for 10BASE-T). A converter is necessary to connect a host not equipped with RS-485 interface.

- (1) Example of typical connection other than above (Multidrop connection using the RJ-45 connector)

The figure below shows a connecting example to the multi-drop circuit with RJ-45 connector. RJ-45 needs a multi-drop branch adaptor as an external device for relaying. The adaptor for relaying is not necessary for the inverter with RJ-45 connector for function expansion. Set the terminator insertion switch of the terminating inverter to ON. For the terminator insertion switch ON/OFF switch, see "2.2.2 Connection procedures [2] About terminating resistors."

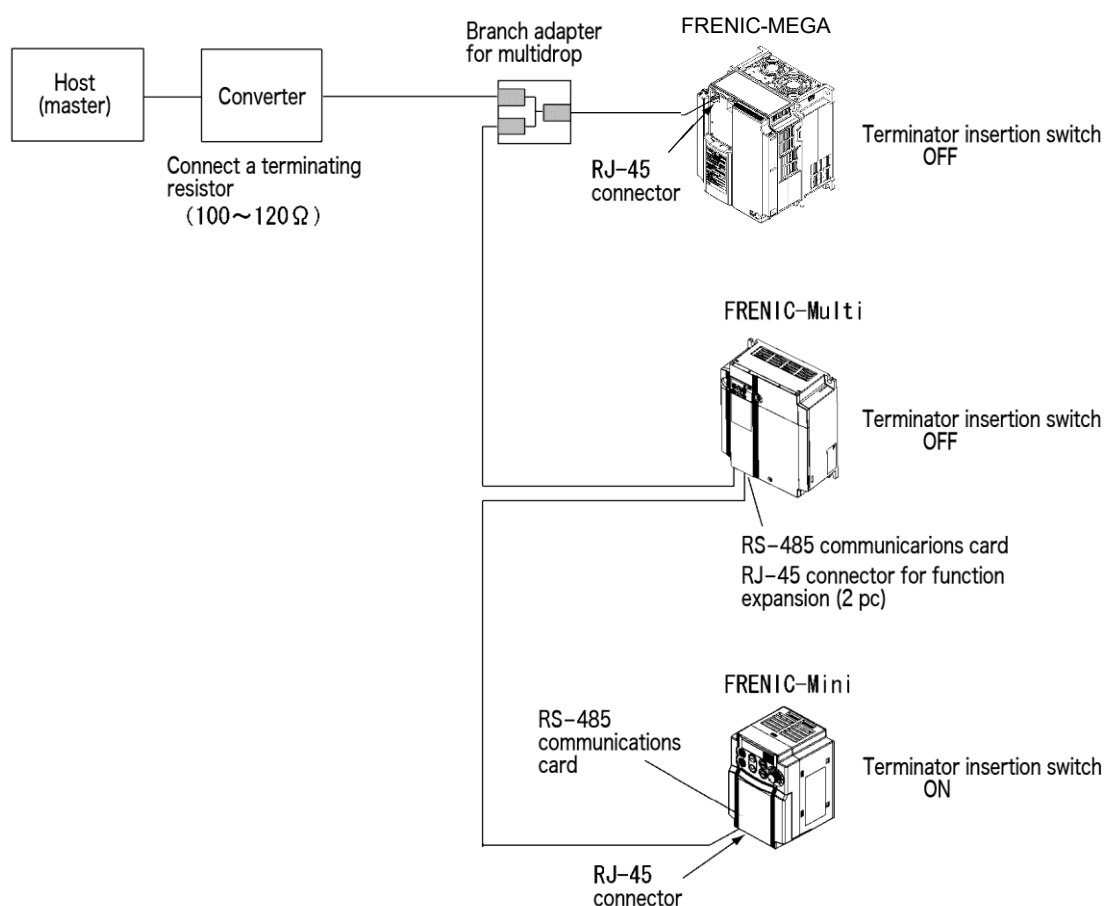


Figure 2.1 Multidrop connection diagram (connection via the RJ-45 connector)

- Converter: Not necessary if the host is equipped with RS-485 interface.
- Branch adapter for multidrop: Useful when implementing 1:n multidrop configuration using a cable with a RJ-45 connector.
- Cable: Use a connection cable meeting the specification. (Refer to 2.1.4.)

- CAUTION** - A power supply for the keypad is connected to the RJ-45 connector of the inverter (via pins 1, 2, 7, and 8). When connecting the inverter with another device, do not use the pins assigned to the power supply but use the signal pins (pins 4 and 5).
- When selecting additional devices to prevent the damage or malfunction of the control PCB caused by external noises or eliminate the influence of common mode noises, be sure to see section 2.2.3 "Devices for connection."
 - Keep the total wiring length 500m max.
 - For FRENIC-Mini, the RS-485 communications card (option) is necessary for connection.

(2) Multidrop connection using terminal block

When using terminal block by multidrop connection, connect them as shown in the figure below. Turn on the switch for inserting a terminating resistance mounted on the inverter used as the terminator.

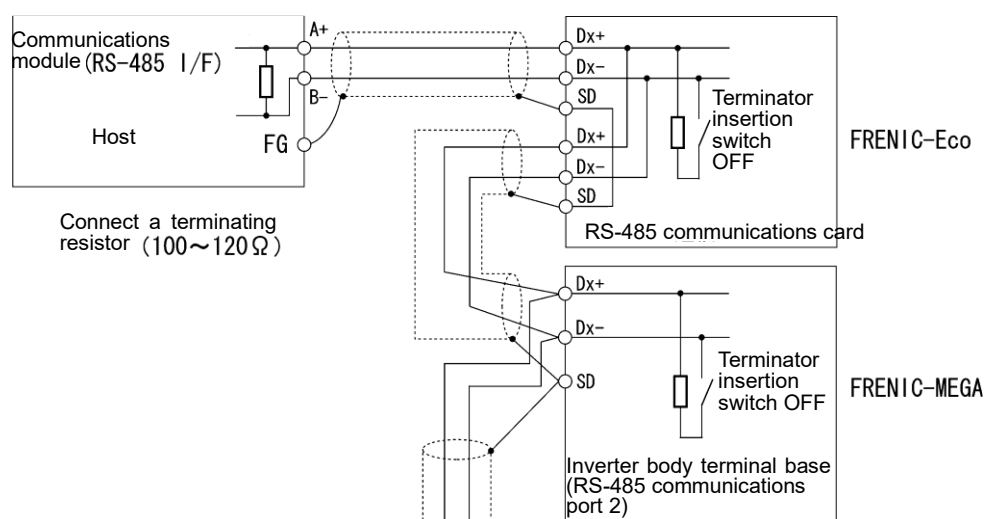


Figure 2.2 Multidrop connection diagram (terminal block connection)

- NOTE** For the switch used to insert the terminal resistance, refer to [2] About terminating resistors in "2.2.2 Connection procedures."

- CAUTION** - When selecting additional devices to prevent the damage or malfunction of the control PCB caused by external noises or eliminate the influence of common mode noises, be sure to see section 2.2.3 "Devices for connection."
- Keep the total wiring length 500m max.
 - When mixing with devices using the RJ-45 connector connection method, it is necessary to use a branch connector, and connect the LAN cable Dx+ and Dx- wires only to the wiring on the terminal block side. Refer to "2.1.1 Specification of the RJ-45 connector for RS-485 communications (modular jack)" for details on the pin assignment.

2.2.2 Connection procedures

This section describes the knowledge necessary for connecting with a host.

[1] RJ-45 connector (modular jack) pin layout

To facilitate connection with a typical RS232C to RS-485 converter, the Inverter assigned pin No. 4 to DX- signals and pin No. 5 to DX+ signals.



- Pins 1, 2, 7, and 8 are assigned to the power supply for the keypad. Do not use these pins when connecting the inverter with another device via the RJ-45 connector but use signal pins (pins 4 and 5) only.

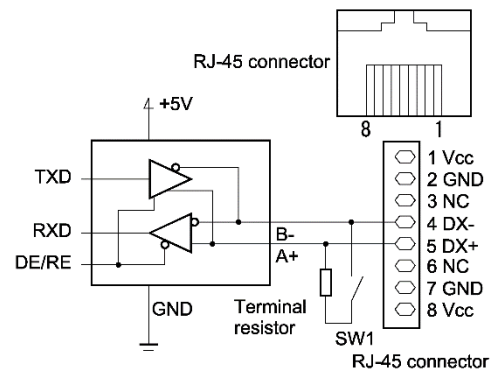


Figure 2.3 Pin layout of RJ-45 connector

- If connecting to the FVR-E11S series, a power supply short circuit or signal line collision will occur, resulting in possible damage. Refer to "Table 8.2 FRENIC series and FVR-E11S series pin assignment comparison" for details. Failure to observe this could result in a failure.

WARNING

- RJ-45 connector for communications through RS-485 is connected with the keypad power (pin No. 1, 2, 7, and 8). When connecting with the other equipment, be careful not to connect with the pins assigned as the power supply.
- If the communications circuit is connected with FVR-E11S series, there is a possibility that the power circuit is shorted or the signal wires collide with each other, resulting in the damage to the circuit. For details, see "Table 8.2 FRENIC series and FVR-E11S series pin assignment comparison"

Failure may occur.

[2] About terminating resistors

Insert a terminating resistor (100 to 120Ω) into both the ends of the connection cable. This allows controlling signal reflection and reducing noises.

Be sure to insert a terminating resistor into the terminating host side and the side of the device connected to the final stage, in short, both the terminating devices configuring the network. Terminating resistors are inserted into total two positions. Note that the current capacity of signals may be insufficient if terminating resistors are inserted into three or more devices.

Refer to "8.4 Terminating Resistors" for details on the difference between terminating resistors built into each model.

[3] Connection with a four-wire host

Although FRENIC-Mini/Eco uses two-wire cables, some hosts adopt only four-wire cables. Connect to such a host by connecting the driver output with the receiver input with a crossover cable on the host side to change the wiring method to two-wire.

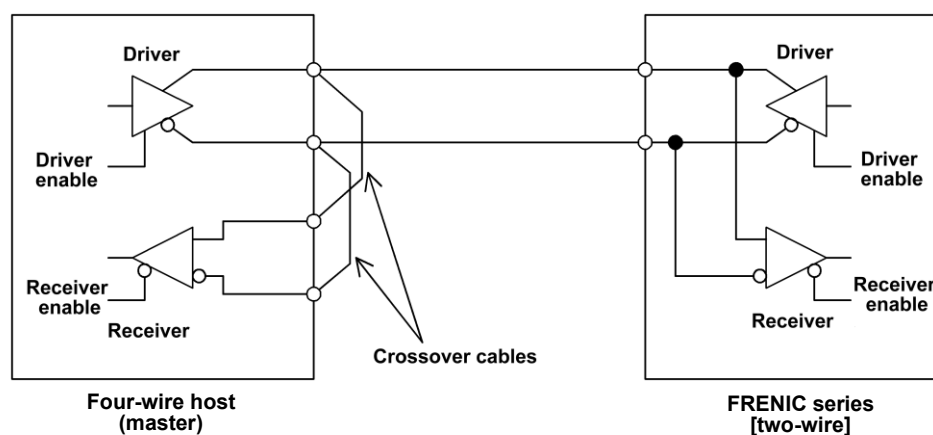


Figure 2.4 Connection with a four-wire host



- The driver circuit on the host side must have a function to set the driver output to high impedance (driver enable: OFF). Though products conforming to RS-485 normally has this function, check the specifications of the host.
- Keep the output of the driver circuit on the host side in the status of high impedance except when the host is transmitting data (driver enable: OFF).
- Keep the receiver circuit of the host device deactivated (receiver enable: OFF) while the host is transmitting data to prevent the host from receiving the data it transmitted. If the receiver cannot be deactivated, program the host so that the data transmitted by the host is discarded.

2.2.3 Devices for connection

This section describes the devices necessary for connecting a host not equipped with RS-485 interface, such as a personal computer, or for multidrop connection.

[1] Converter

In general, personal computers are not equipped with an RS-485 port. An RS-232C to RS-485 converter or USB to RS-485 converter is therefore required. Use a converter meeting the following recommended specifications for proper operation. Note that proper performance may not be expected from a converter other than the recommended one.

Specifications of the recommended converter

Transmission/receiving switching system: Automatic switching by monitoring transmission data on the personal computer side (RS-232C)

Isolation: The RS-232C side of the converter must be isolated from the RS-485 side.

Failsafe: Equipped with a failsafe function (*1)

Other requirements: The converter must have enough noise immunity for successful communications.

*1 The failsafe function means a function that keeps the RS-485 receiver's output at high logic level even when the RS-485 receiver's input is open or short-circuited or when all the RS-485 drivers are inactive.

Recommended converter

System Sacom Sales Corporation (Japan) : KS-485PTI (RS-232C to RS-485 converter)

: USB-485I RJ45-T4P (USB to RS-485 converter)

Transmission/receiving switching system

Since RS-485 communications adopts the half-duplex system (two-wire system), the converter must have a transmission/receiving switching function. The following two systems are available as the switching system.

(1) Automatic turnaround of the transceiver buffer

(2) Switching with the flow control signal (RTS or DTR) from the personal computer

In the case of FRENIC Loader, the operating system released before Microsoft Windows98 or an older version does not support the switching system described in (2) above. Use the converter described in (1).

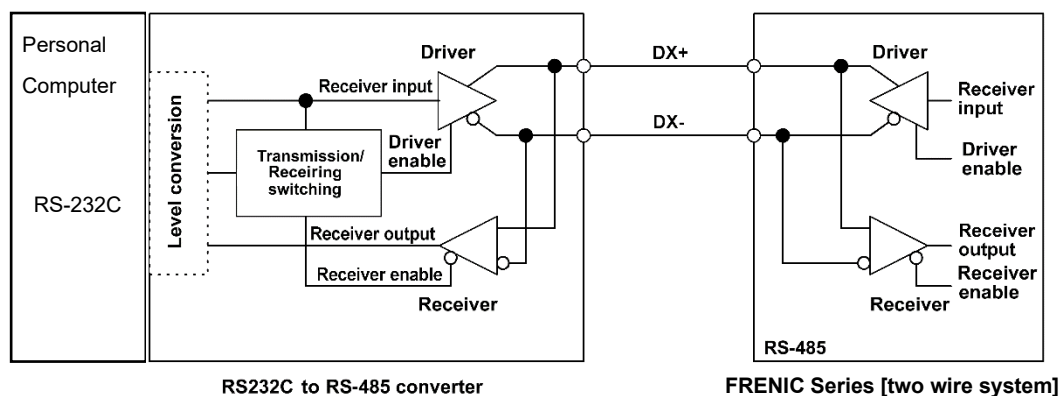


Figure 2.5 Communications level conversion

[2] Branch adapter for multidrop

When a slave unit has only 1 port of RJ-45 connector (modular jack), a branch adaptor is necessary for multidrop connection using standard LAN cables.

Recommended branch adapter

SK Kohki (Japan): MS8-BA-JJJ

2.2.4 Measures against noise

Depending on the operating environment, normal communications cannot be performed or instruments and converters on the host side may malfunction due to the noise generated by the inverter. This section describes measures to be taken against such problems. Consult Appendix A "Advantageous Use of Inverters (Notes on electrical noise)" in User's Manual of each inverter type.

[1] Measures for devices subjected to noise

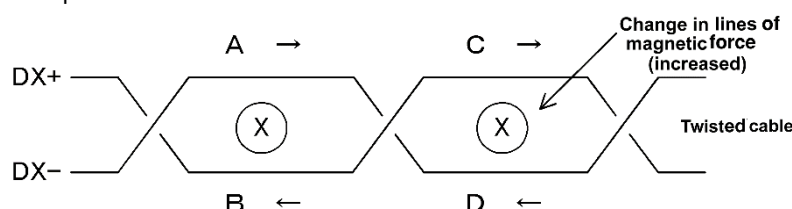
Using an isolated converter

An isolated converter suppresses common mode noise that exceeds the specified operating voltage range of the receiver in case of long-distance wiring. However, since the isolated converter itself may malfunction, use a converter insusceptible to noise.

Using a category 5 compliant LAN cable

Category 5 compliant LAN cables are generally used for RS-485 communications wiring. To obtain an improved preventive effect on electromagnetically induced noise, use Category 5 conformed LAN cables with four twisted-pair-cores and apply one twisted pair, DX+ and DX-. To ensure a high preventive effect on electrostatically induced noise, use Category 5 conformed LAN cables with four shielded-and-twisted-pair-cores, and ground the shield at the master-side end.

Effect of twisted pair cables



A uniform magnetic flux directing from the face to back of the paper exists, and if it increases, electromotive force in the direction of $\rightarrow$ is generated. The electromotive forces of A to D are the same in intensity, and their directions are as shown in the above figure. In the cable DX+, the direction of electromotive forces B is reverse to that of electromotive force C, then the electromotive forces B and C offset each other, and so do electromotive forces A and D in the cable DX-. So, normal mode noise caused by electromagnetic induction does not occur. However, noise cannot be completely suppressed under such conditions as an uneven twist pitch. In the case of twisted cables, the normal mode noise is considerably reduced. But in the case of parallel cables, there may be a case where noises are not sufficiently reduced.

Shield effect

- 1) When the shield is not grounded,
the shield functions as an antenna and receives noise.
- 2) When the shield is grounded at both ends,
if the grounding points are separated from each other, the ground potential may be different between them, and the shield and the ground form a loop circuit in which a current flows and may cause noise. Additionally, the magnetic flux within the loop may vary and generate noise.
- 3) When the shield is grounded at either end,
the effect of electrostatic induction can be completely eliminated within the shielded section.

Connecting terminating resistors

Insert a resistor equivalent to the characteristic impedance of the cables (100 to 120Ω) into both end terminals of the wiring (network) to prevent ringing due to the reflection of signals.

Separating the wiring

Separate the power lines (input L1/R, L2/S, and L3/T and output U, V, and W) from the RS-485 communications line, because induced noise can be prevented.

Separating the grounding

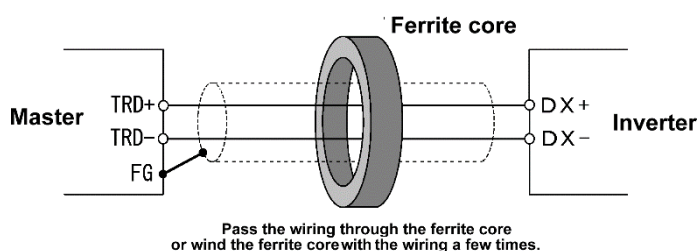
Do not ground instruments and the inverter together. Noise may conduct through the grounding wire. Use as a thick wire as possible for grounding.

Isolating the power supply

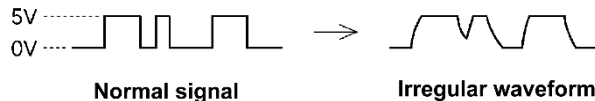
Noise may carry through the power supply line to instruments. It is recommended that the distribution system be separated or a power isolation transformer (TRAFY) or noise suppression transformer be used to isolate the power supply for such instruments from the power supply for the inverter.

Adding inductance

Insert a chalk coil in series in the signal circuit, or pass the signal wiring through a ferrite core, as shown in the figure below. This provides the wiring higher impedance against high-frequency noise, and suppresses the propagation of high-frequency noise.



If an inductance is added, the signal waveform may become irregular and a transmission error may result during communications at a high baud rate. In this case, reduce the baud rate by changing the setting of function code y04.



[2] Measures against noise sources

Reducing carrier frequency

By lowering data of function code F26 "motor sound (carrier frequency)," the noise level can be reduced. However, reducing the carrier frequency increases the motor sound.

Installing and wiring an inverter

Passing the power lines through metal conduit or adopting metal control panels can suppress radiation or induction noise.

Isolating the power supply

Using a power isolation transformer on the line side of the inverter can cut off the propagation (transmission) of noise.

[3] Additional measures to reduce the noise level

Consider using a zero-phase reactor or EMC compliance filter. The measures described in [1] and [2] above can generally prevent noise. However, if the noise does not decrease to the permissible level, consider additional measures to reduce the noise level. For details, see the User's Manual of each inverter model. (Chapter 6, 6.4.1 for FRENIC-Mini/Eco/Multi, and Chapter 4, 4.4.1 for FRENIC-MEGA)

2.3 Switching to Communications

2.3.1 Functions for the switching

Figure 2.6 below shows a block diagram via communications for frequency setting and operation commands.

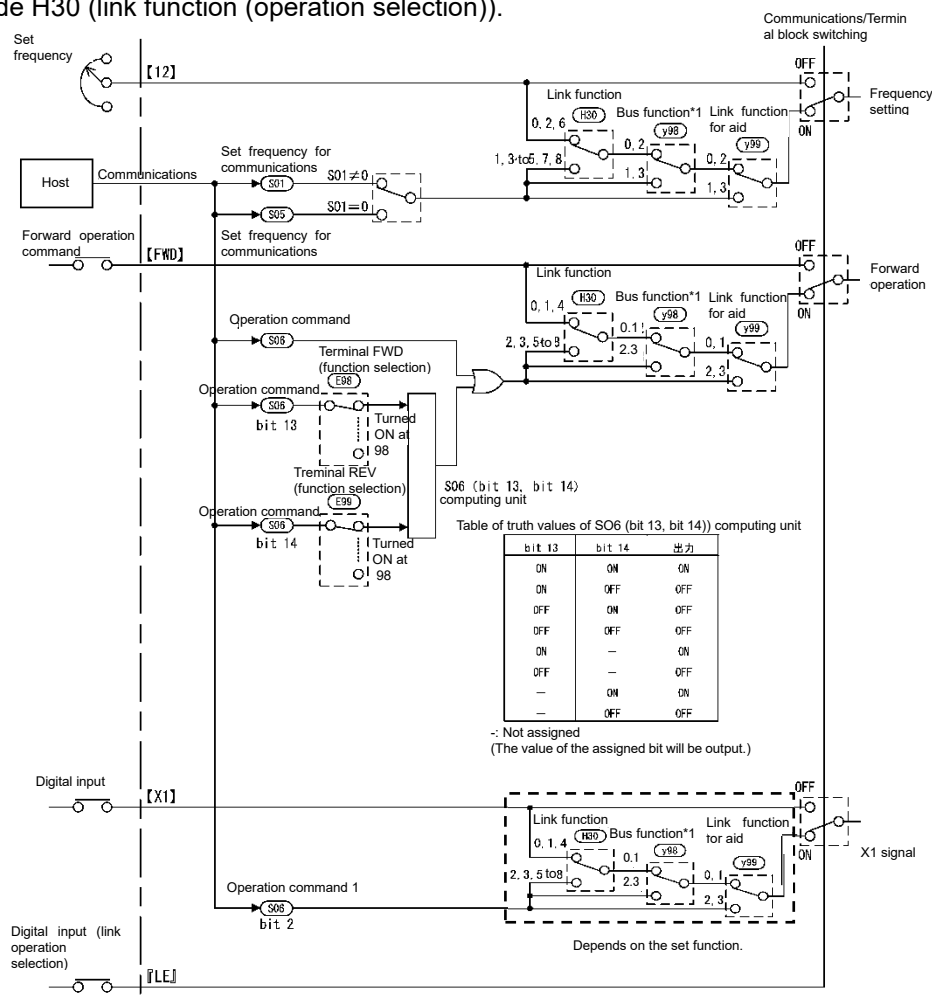
This block diagram indicates only the base of the switching section, and some settings may be given higher priority than the blocks shown in this diagram or details may be different due to functional expansion and so on. For details, see the User's Manual of each inverter model.

CAUTION Operation commands herein include digital input signals via communications.

According to the setting of function code H30 link function (operation selection), the command system when communications is valid is selected.

Even if digital input is set to link enable (LE), when the link becomes invalid ("LE" = OFF), the command system switches from communications to other settings including digital input signal. In short, the frequency setting, forward operation command, and X1 signal in Figure 2.9 switch from communications dedicated function codes S01, S05, and S06 to terminals [12], [FWD], and [X1], respectively.

Function code data can be read and written through communications regardless of the setting function code H30 (link function (operation selection)).



*1 The code y98 (bus function: operation selection) is not available in FRENIC-Mini.

Figure 2.6 Operation command block diagram via communications

2.3.2 Link functions (operation selection)

According to the setting of function code H30: Serial link (function select), the frequency setting and the operation command source (via-communications command or command selected by function codes F01/C30 and F02 when communications is valid can be selected.

Frequency setting done when the communications is valid and selection of operation source are influenced by the settings at y98, y99. For details, see Figure 2.6.

Table 2.2 Link function H30 (operation selection)

Data of link function H30	When communications are valid		Support	
	Frequency setting PID command Torque command/torque current command Torque bias command	Operation command	Mini(C1)/(C2)	Eco/Multi Ace(E2,E3)/HVAC/ AQUA MEGA (G1, G2)
0	Inverter itself	Inverter itself	○	○
1	RS-485 communications (via standard RJ-45 or port 1)*1	Inverter itself		
2	Inverter itself	RS-485 communications (via standard RJ-45 or port 1)*1		
3	RS-485 communications (via standard RJ-45 or port 1)*1	RS-485 communications (via standard RJ-45 or port 1)*1		
4	RS-485 communications (via option or port 2)*2	Inverter itself	✕	
5	RS-485 communications (via option or port 2)*2	RS-485 communications (via standard RJ-45 or port 1)*1		
6	Inverter itself	RS-485 communications (via option or port 2)*2		
7	RS-485 communications (via standard RJ-45 or port 1)*1	RS-485 communications (via option or port 2)*2		
8	RS-485 communications (via option or port 2)*2	RS-485 communications (via option or port 2)*2		

*1 FRENIC-Mini(C1) requires RS-485 communications card (option).

*2 FRENIC-Eco/Multi requires RS-485 communications card (option). FRENIC-MEGA(G1) is equipped with RS-485 communications port 2 (terminal base) as standard equipment.

HINT By selecting continuous communications valid without setting any digital input terminal, and switching the data of H30 to communications valid/invalid (external signal input valid), communications valid/invalid can be switched in the same manner as switching at the digital input terminal. See the next section or later.

2.3.3 How to switch communications enabled/disabled

To issue a frequency setting or operation command through communications to control the inverter, select "Through RS-485 communications" by function code H30: link function (operation selection).

In addition, when switching control through communications with control from the terminal block (frequency setting from terminal [12], operation command from terminal [FWD] and so on) to switch remote operations with operations on the inverter body, assign "link operation selection" (data = 24: "LE") to the function code related to the digital input terminal (one of E01-E05: terminals [X1] to [X5], E98: terminal [FWD], or E99: terminal [REV]). (FRENIC-Mini does not support E04, E05, [X4], and [X5].) Control can be switched by the terminal to which "link operation selection" (data = 24: "LE") is assigned.

Communications automatically becomes valid when link operation selection is not assigned to any digital input terminal.

Table 2.3 Digital input terminal settings and communications statuses

Input terminal	Status
OFF	Communications invalid
ON (short-circuited to the terminal [CM])	Communications valid



- Via-communications command data and operation data must be rewritten from the host (controller) because the memory is initialized when the power is turned ON.
- Although command data and operation data can be written even if communications is invalid, they will not be validated because the switch is made invalid by link operation selection. If communications is made valid with no operation data written (operation command OFF, frequency setting = 0Hz) during operation, the running motor decelerates to a stop and may exert impact on the load depending on the set deceleration time. Operation can be switched without causing impact to the load by setting data in communications invalid mode in advance and then switching the mode to valid.
- If negative logic is set as Link enable (data 1024), the logical value corresponding to the ON/OFF status of the command "LE" will be reversed.
- FRENIC-Eco/Multi/Ace/MEGA(G1,G2) has the field bus option other than RS-485 communications. The field bus option is handled prior to RS-485 communications depending on the setting of it in some cases. For details, see the function code "y98 Bus function (function selection)" of each inverter type. When unable to run the inverter with commands via RS-485 communication, check whether y98 is set to "0".

2.3.4 Link functions for supporting data input (operation select)

According to the setting of function code y99: link function for supporting data input (operation select), the frequency setting and the operation command source (via-communications command or command specified by function code H30 and y98) when communications is valid can be selected individually.



- This function code is designed for inverter support software such as for FRENIC Loader, and forcibly makes communications valid without changing the setting of H30. Do not change the current setting unless otherwise required.
- FRENIC-Mini operates in the same way as y99 is set to 0 even if y99 is set 1, 2, or 3 when this function code is changed from the keypad. When setting a value other than 0, the value of y99 must be written through communications.
- The data of this function code cannot be saved in the inverter and will return to 0 when the power supply is turned off.

Table 2.4 Link functions for supporting data input

Link function y99	When communications is valid	
	Frequency setting	Operation command
0	Frequency setting specified by H30 and y98	Operation command specified by H30 and y98
1	Communications valid (S01, S05)	
2	Frequency setting specified by H30 and y98	Communications valid (S06)
3	Communications valid (S01, S05)	

2.4 Making RS-485-related Settings

2.4.1 Link function (RS-485 setting)

Use function codes (y01 to y10 and y11 to y20) to make settings for RS-485 communications functions. Use the codes y01 to 10 for port 1 and the codes y11 to 20 for port 2.

Station address (y01, y11)

Set a station address for RS-485 communications. The setting range depends on the protocol.

Table 2.5 RS-485 setting (station addresses)

Protocol	Range	Broadcast
Modbus RTU protocol	1 to 247	0
Protocol for loader commands	1 to 255	–
Fuji general-purpose inverter protocol	1 to 31	99



- No response is expected if an address number out of the specified range is set.
- Match the station address with that of the personal computer when FRENIC Loader is connected.

Operation made selection when an error occurs (y02, y12)

Set the operation performed when an RS-485 communications error occurs.

RS-485 communications errors are logical errors such as an address error, parity error, or framing error, transmission error, and communications disconnection error set by y08 and y18. In any case, error is detected only while the inverter is running in the link operation made for both the operation command and frequency setting. If neither the operation command nor frequency setting is sent through RS-485 communications or the inverter is not running, error is ignored.

Table 2.6 RS-485 setting (operations when an error has occurred)

y02, y12 data	Function
0	Indicates an RS-485 communications error ($\overline{\text{ER}}\text{-}\overline{\text{B}}$ for port 1 and $\overline{\text{ER}}\text{-}\overline{\text{P}}$ for port 2), and stops operation immediately (alarm stop).
1	Runs during the time set on the error processing timer (y03, y13), and then displays an RS-485 communications error ($\overline{\text{ER}}\text{-}\overline{\text{B}}$ for port 1 and $\overline{\text{ER}}\text{-}\overline{\text{P}}$ for port 2) and stops operation (alarm stop).
2	Runs during the time set on the error processing timer (y03, y13). If communications are recovered, continues operation. Otherwise, displays an RS-485 communications error ($\overline{\text{ER}}\text{-}\overline{\text{B}}$ for port 1 and $\overline{\text{ER}}\text{-}\overline{\text{P}}$ for port 2) and stops operation (alarm stop).
3	Continues operation even after a communications error has occurred.

Timer for y02 and y12 (y03, y13)

Set a timer for error detection.

It is judged as an error that the response to a request is not received within time set because of no response of the other end and so on. See the section of "Communications disconnection detection time (y08, y18)."

- Data input range: 0.0 to 60.0 (s)

Baud rate (y04, y14)

Set a baud rate.

- 38400 bps is not supported on the FRENIC-Mini(C1).
- 57600 bps and faster is supported on the FRENIC-MEGA (G2)only.
- The setting range is restricted depending on the protocol type.

Refer to the protocol specifications in CHAPTER 3 to CHAPTER 6.

Table 2.7 Baud rate

Data	Baud rate
0	2400 bps
1	4800 bps
2	9600 bps
3	19200 bps
4	38400 bps
5	57600 bps
6	76800 bps
7	115200 bps

Data length (y05, y15)

Set a character length.

Table 2.8 Data length

Data	Function
0	8 bits
1	7 bits

Parity check (y06, y16)

Set a parity bit.

Table 2.9 Parity check

Data	Function	RTU Stop bits (auto setting)
0	No parity bit	2 bits
1	Even parity	1 bit
2	Odd parity	1 bit
3	No parity bit (Not supported for FRENIC-Mini/Eco) For the detailed method of use, see "CHAPTER 3 Modbus RTU PROTOCOL"	1 bit

Stop bits (y07, y17)

Set a stop bit.

- In the Modbus RTU protocol, this code does not need to be set because it is automatically determined in conjunction with the parity bit.

Table 2.10 Stop bits

Data	Function
0	2 bits
1	1 bit

No response error detection time (y08, y18)

In a system designed to be sure to access a station (inverter) managed by a host within a specific period of time, access may be lost during RS-485 communications due to wire disconnections. In such a case, the inverter starts the operation of communications error set up by y02 and y12 if the inverter detects the symptom and access is still lost even after the communications disconnection detection time has passed.

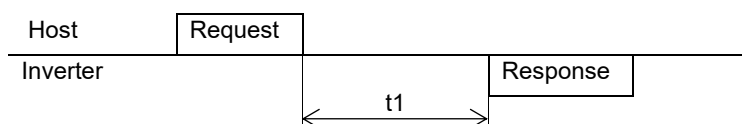
Table 2.11 No response error detection time

Data	Function
0	No response error detection disabled
1 to 60	Detecting time from 1 to 60 seconds

Response interval (y09, y19)

Set the time from the completion of receipt of a request from the host, to the return of response to it. Even in a slow processing device, timing can be adjusted by changing the response interval time.

- Data setting range: 0.00 to 1.00 (second)



$$t1 = \text{Response interval time} + \alpha$$

α : The processing time within the inverter. It depends on the timing and command given.

For further information, see the procedure for each protocol on the host below:

Modbus RTU protocol → CHAPTER 3 "3.2 Host Side Procedures"

Fuji general-purpose inverter protocol → CHAPTER 4 "4.2 Host Side Procedures"

- Setting when FRENIC Loader is connected

Set the response interval time according to the performance and conditions of the personal computer and converter (RS-232C TO RS-485 converter, etc.).

(Some converters monitor the communications status and use a timer to switch transmission/receiving.)

Protocol select (y10, y20)

Select a communications protocol.

- Setting when FRENIC Loader is connected
Select the protocol for FRENIC Loader commands (y10 = 1).
- Supported protocols differ depending on the inverter model.

Refer to "8.2 Connection Configuration and Compatible Protocols".

Table 2.12 Protocol select

Data	Protocol
0	Modbus RTU
1	FRENIC Loader (supported by y10 only)
2	Fuji general-purpose inverter
3*1	N2 Protocol
5	BACnet MS/TP protocol
50	Pump control (communication link)

*1 Applicable only with FRN□□F1□-□A, FRN□□F1□-□C, FRN□□F1□-□E and FRN□□F1□-□U

2.5 Selecting the Method of Storing Communications Data

The times of data writing onto the inverter memory are limited (100 thousand to 1 million times). If the data is overwritten too many times, data change or storage may be disabled. If you frequently rewrite the data obtained via communications, the data can be temporarily stored without being written in the memory by y97 setting. Doing so prevents increase of data rewriting times and memory failure.

As a means of storing temporarily stored data onto the memory, the inverter is provided with the function for transferring the temporarily stored data to a nonvolatile memory (by the ALL SAVE command).

To change the data of function code y97, perform the double-key operation; (STOP) key + (↗) / (↘) key.

y97 data	Functions
0	Data is stored in the nonvolatile memory (with the limit in the number of data writing times).
1	Data is stored in the temporary memory (without the limit in the number of data writing times.)
2	Data is transferred from the temporary memory to the nonvolatile memory. (After execution of ALL SAVE command, data storage method returns to the state where data 1 is set at y97.

Refer to the manual for each model to see whether y97 is supported on your model.

2.6 Data Erasure Selection When Communication Errors Occur

If an inverter alarm is issued due to a communication error* (incl. bus link errors), data specified at y95 can be cleared to zero.

* Alarm codes: Er8, ErP, Er4, Er5

y95 data	Function
0	Data is not cleared when a communication error occurs.
1	Speed command data (S01, S05, S19) is cleared when a communication error occurs.
2	Run command data (relevant bit in S06) is cleared when a communication error occurs.
3	Speed command data and run command data is cleared when a communication error occurs.
4	All command data, including speed command data and run command data, is cleared when a communication error occurs. (S01, S02, S03, S05, S06, S13, S15, S19, S20, S21)

Refer to the manual for each model to see whether y95 is supported on your model.

CHAPTER 3

Modbus RTU PROTOCOL

This chapter describes the Modbus RTU protocol, as well as the host side procedure for using this protocol and error processing.

The Modbus RTU protocol was a set of specifications developed in the United States.

Certain restrictions apply depending on the model. Refer to "8.7 Differences Between Functions" for details on the differences between models.

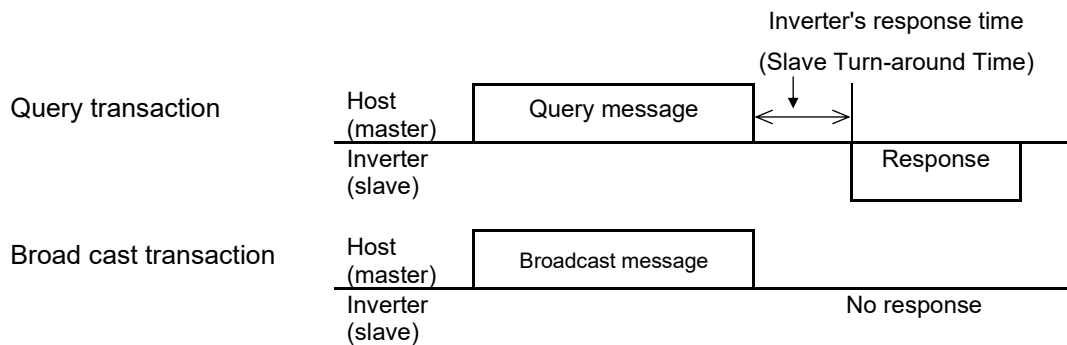
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3.1 Messages

3.1.1 Message formats

The regular formats for transmitting RTU messages are shown below:



If the inverter receives from the host a message in the standby status and considers it properly received, it executes a transaction in response to the request and sends back normal response. If the inverter judges that the message has not been received properly, it returns error response. The inverter does not send back any response in the case of broadcast transactions.

3.1.2 Message types

Message types are classified into four types; query, normal response, error response, and broadcast.

Query

The host sends messages to an inverter.

Normal response

After the inverter received a query from the host, the inverter executes a transaction in response to the request, and sends back corresponding normal response.

Error response

If the inverter receives a query but cannot execute the requested function because an invalid function code is specified or for other reasons, it sends back error response.

The error response is accompanied by a message describing the reason the request cannot be executed.

The inverter cannot send back any response in case of a CRC or physical transmission error (parity error, framing error, overrun error).

Broadcast

The host uses address 0 to send messages to all slaves. All slaves, which receive a broadcast message, execute the requested function. This transaction will be terminated upon timeout of the host.

In the broadcast communications, only S01, S05, S06, S13, S14, or S19 can be selected from the standard frame.

3.1.3 Message frames

As shown below, a transmission frame consists of four blocks, which are called fields. Details depend on FC (RTU function codes). To make a clear distinction between RTU function codes and the inverter's function codes, the former will be hereinafter referred to as 'FC'.

1 byte	1 byte	Up to 105 bytes*1	2 bytes
Station address	FC (RTU function code)	Information	Error check

*1 Max 205 bytes for FRENIC-MEGA

Station address

The station address field is one byte long, in which a station address between 0 and 247 can be selected.

Selecting address 0 means the selection of all slave stations and a broadcast message.

'FC' (RTU function code)

The 'FC' field is one byte long, in which a function code is defined with a number from 0 to 255. The 'FCs' in the shaded rows are available. Do not use any unavailable (unused) 'FC'. Failure to observe this rule results in error response.

Table 3.1 List of 'FC'

'FC'	Description	Support	
		Mini	Mini(C2)/Eco/Multi/MEGA(G1)/(G2)/Ace(E2,E3)/HVAC/AQUA
0	Unused	—	—
1	Read Coil Status (80 coils maximum)	×	○
2	Unused	—	—
3	Read Holding Registers (50 registers maximum)	○	○
4	Unused	—	—
5	Force Single Coil	×	○
6	Preset Single Register	○	○
7	Unused	—	—
8	Diagnostics	○	○
9 to 14	Unused	—	—
15	Force Multiple Coils (16 coils maximum)	×	○
16	Preset Multiple Registers (50 registers maximum*1)	○	○
17 to 127	Unused	—	—
128 to 255	Reserved for exception response	—	—

*1 Max 100 data for FRENIC-MEGA(G1,G2)/Ace(E2,E3)/HVAC/AQUA

Information

The information field contains all information (function code, byte count, number of data, data, etc.). For further information about the information field for each message type (broadcast, query, normal response, error response), see "3.1.4 Message categories."

Error check

The error check field is a CRC-16 check system and two bytes long. Since the length of the information field is variable, the frame length required for calculating the CRC-16 code is calculated based on the 'FC' and the byte count data.

For further information about CRC-16 calculations and algorithm, see "3.4 CRC-16."

For byte counts, see "3.1.4 Message categories."

Character format

Each byte of a message is transmitted as a character. Character formats are described on the following page.

A character comprises a start bit (logical value 0), 8-bit data, an additional (optional) parity bit, and a stop bit (logical value 1).

A character always consists of eleven bits, and the number of stop bits varies depending on whether parity exists.

Without parity

LSB								MSB	
0	1	2	3	4	5	6	7	8	9 10
Start	Data							Stop	

With parity

LSB								MSB	
0	1	2	3	4	5	6	7	8	9 10
Start	Data							Parity (optional)	Stop



- Modbus RTU protocol has the above character format as specified by the rule. But, some devices use the format "No parity + Stop bit: 1 bit." For connection with these devices, FRENIC- Multi/MEGA support the parity bit selection: y06, y16=3. When y06, y16=3 are selected, the protocol is given the following character format.

LSB								MSB	
0	1	2	3	4	5	6	7	8	9
Start	Data							Stop	

3.1.4 Message categories

There are eight RTU message categories; read holding registers, preset single register, preset multiple registers, diagnostics, read coil status, force single coil, force multiple coils and error response.

Each category is described below:

[1] Read holding registers

Query

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	03 _H	Function code	Number of read data	Error check
		Hi Lo	Hi Lo	

Normal response

1 byte	1 byte	1 byte	2 to 100 bytes*1	2 bytes
Station address	03 _H	Byte count	Read data	Error check

Hi, Lo (data 0); Hi, Lo (data 1); ·····

*1 From 2 to 200 bytes for FRENIC-MEGA

How to set a query

- This request is not available for broadcast transactions. Station address 0 will become invalid (no response).
- 'FC' = 3 (03_H)
- The function code is two bytes long. The Hi byte indicates the function code group (see Table 3.2), and the Lo byte represents a function code identification number (0 to 99).

(Example) When the function code is E15, the Hi byte is 01_H and the Lo byte is 0F_H.

- Each inverter function code is assigned to the holding register area (40001 to 49999) and extended holding register area (50000 to 59999). The address equation for each function code is shown below. (The same applies for both single function writing and consecutive function writing.)

Address equation

40001 + (Table 3.2 Code No.) x 256 + function code No.

Example) J60

J	60
↓	↓
13	60

Function code J60 holding register address:

$$\begin{aligned} &40001 + (\text{Table 3.2 Code No.: } 13) \times 256 + \text{function code No. } 60 \\ &= 43389 \end{aligned}$$

Table 3.2 Function code group/code conversion table

Group	Code		Name	Group	Code		Name
F	0	00 _H	Fundamental function	U	11	0B _H	Application function 3
E	1	01 _H	Extension terminal function	U1	39	27 _H	Application function 3
C	2	02 _H	Control function of frequency	y	14	0E _H	Link function
P	3	03 _H	Motor1 parameter	o	6	06 _H	Operational function
H	4	04 _H	High performance function	o1	37	25 _H	Operational function
H1	31	1F _H	High performance function	o2	38	26 _H	Operational function
A	5	05 _H	Motor2 parameter	T	29	1D _H	Timer function
b	18	12 _H	Motor3 parameter	K	28	1C _H	Keypad function
r	10	0A _H	Motor4 parameter	S	7	07 _H	Command data
J	13	0D _H	Application function 1	M	8	08 _H	Monitor data 1
J1	48	30 _H	Application function 1	M1	35	23 _H	Monitor data 1
J2	49	31 _H	Application function 1	W	15	0F _H	Monitor data 2
J4	51	33 _H	Application function 1	W1	22	16 _H	Monitor data 2
J5	52	34 _H	Application function 1	W2	23	17 _H	Monitor data 2
J6	53	35 _H	Application function 1	W3	24	18 _H	Monitor data 2
d	19	13 _H	Application function 2	X	16	10 _H	Alarm 1
d1	54	36 _H	Application function 2	X1	25	19 _H	Alarm 1
d2	55	37 _H	Application function 2	Z	17	11 _H	Alarm 2

- The length of the read data is up to 50 words (2 byte each)*.
- If the read data contains an unused function code, 0 will be read, which will not result in an error.
- Data does not extend over two or more function code groups. If, for example, reading of 40 words is specified from F40 but only function codes up to F40 are available, the data of F40 will be set at the first word, and the other 49 words will be 0.

Interpretation of normal response

- The data range of byte counts is between 2 and 100*. A byte count is double the number of read data (1 - 50 data)* of the response.
- The read data contains each word data in order of Hi byte and Lo byte, and each word data is sent back in order of the data of the function code (address) requested by the query, the data of that address number plus 1, the data of that number address number plus 2 ... If two or more function data are read and the second or any of the following data contains an unused function code (F19, etc.), the read data will become 0.

* This is dependent on the model. Refer to "8.7 Differences Between Functions" for details.

[2] Preset single register

Query

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	06 _H	Function code	Write data	Error check
		Hi Lo	Hi Lo	

Normal response

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	06 _H	Function code	Write data	Error check

How to set a query

- When address 0 is selected, broadcast is available. In this case, all inverters do not respond even if a broadcast request is executed.
- 'FC' = 6 (06_H)
- The function code is two bytes long. The Hi byte indicates the function code group (see Table 3.2), and the Lo byte represents a function code identification number (0 to 99).
- The written data field is fixed two bytes long. Set the data on the function code to be written.

Interpretation of normal response

The frame is the same as the query.

[3] Preset multiple registers

Query

1 byte	1 byte	2 bytes	2 bytes	1 byte	2 to 100 bytes*1	2 bytes
Station address	10 _H	Function code	Number of write data	Byte count	Write data	Error check
		Hi Lo	Hi Lo		Hi, Lo; Hi, Lo...	

*1 This is dependent on the model. Refer to "8.7 Differences Between Functions" for details.

Normal response

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	10 _H	Function code	Number of write data	Error check

How to set a query

- When the station address 0 is selected, broadcast is available. In this case, all inverters do not respond even if a broadcast request is executed.
- 'FC' = 16 (10_H)
- The function code is two bytes long. The Hi byte indicates the function code group (see Table 3.2), and the Lo byte represents a function code identification number (0 to 99).
- The number of write data is two bytes long, and the setting range is from 1 to 50*. If 51 or a higher value (101 or a higher value for FRENIC-MEGA) is set, error response will result.
- The byte count field is one byte long, and the setting range is from 2 to 100* . Set a value equivalent to the double of the number of write data.
- Set the lowest order code (the data on the function code requested by the query) at the first two bytes of the write data, and the higher order data (address plus 1, address plus 2 ...) at the following bytes.
- If the write data contains an unused function code, the writing will be ignored, which will not result in an error.

*This is dependent on the model. Refer to "8.7 Differences Between Functions" for details.

Interpretation of normal response

- With regard to the function code and the number of write data, the same values as those of the query will be sent back.

[4] Diagnostics**Query**

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	08 _H	Sub function code 0000 _H	Write data	Error check
		Hi Lo	Hi Lo	

Normal response

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	08 _H	Sub function code 0000 _H	Write data	Error check

How to set a query

- This request cannot use broadcast. Station address 0 will become invalid (no response).
- 'FC' = 8 (08_H)
- Set the sub function code field to be 2 bytes long fixed 0000_H. Error response will result if data other than 0000_H is set.
- The write data field is two bytes long, and any contents of data can be set.

Interpretation of normal response

- The frame is the same as the query.

[5] Read coil status

* This is not supported on certain models. Refer to "8.7 Differences Between Functions" for details.

Query

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	01 _H	Coil address	No. of coils	Error check
		Hi Lo	Hi Lo	

Normal response

1 byte	1 byte	1 byte	1 to 10 bytes	2 bytes
Station address	01 _H	Byte count	Read data	Error check

How to set a query

- Broadcast with station address 0 is not usable. If this address is used, no response is returned.
- 'FC'=1 (01_H)
- Read out a coil (bit data) by specifying the top address of the coil to be read out and the number of points read out (number of coils).
- For the assignment of a coil (bit data), see Table 3.3. For each content, refer to the S and M codes in the remarks column.

Table 3.3 Description of coil (bit data)

Coil number	+7	+6	+5	+4	+3	+2	+1	+0	Remarks
1	X6	X5	X4	X3	X2	X1	REV	FWD	S06: Run operation command (Read/Write)
9	RST	XR	XF	—	—	X9	X8	X7	
17	VL	TL	NUV	BRK	INT	EXT	REV	FWD	M14: Run status (Read only)
25	BUSY	WR		RL	ALM	DEC	ACC	IL	
33	FAN	KP	OL	IPF	SWM2	RDY	FDT	FAR	M70: Run status 2 (Read only)
41	—	—	IDL	ID	OPL	LIFE	OH	TRY	
49	X6	X5	X4	X3	X2	X1	REV	FWD	M13: Run operation command (final command) (Read only)
57	RST	XR	XF	—	—	X9	X8	X7	
65	—	—	—	Y5	Y4	Y3	Y2	Y1	M15: General-purpose output terminal information (Read only)
73	—	—	—	—	—	—	—	30	

- The "—" symbols in the table mean that the bit is reserved and always zero.
- Coil addresses are 0 to 79, calculated by subtracting one from coil numbers. If a coil address is 80 or more, an error occurs because of an incorrect address.
- The number of coils is 1 to 80. If the number of coils exceeds the range, an error occurs because of an incorrect address.
- No error occurs even if the sum of the numbers of coil addresses and coils exceeds the coil range.

Interpretation of normal response

- Data are stored from the LSB (the rightmost bit in the table above) in ascending order of coil number. When a coil is turned on, the data becomes one, and all the remaining bits are changed to zero.
- The byte length of the read data is filled in the byte count field.
- For a data example, see Table 3.4.

Table 3.4 Example of coil address = 13 and the number of coils = 9

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Data's 1st byte	BRK	INT	EXT	REV	FWD	RST	XR	XF
Data's 2nd byte	0	0	0	0	0	0	0	NUV

[6] Force single coil

* This is not supported on certain models. Refer to "8.7 Differences Between Functions" for details.

Query

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	05 _H	Coil address	Data	Error check
		Hi Lo	Hi Lo	

Normal response

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	05 _H	Coil address	Data	Error check

How to set a query

- Broadcast with station address 0 is not usable. If used, no response is returned.
- 'FC' = 5 (05_H)
- Turn on/off a coil (bit data) by specifying only a bit.
- For the assignment of a coil (bit data), see Table 3.5. For each content, refer to the S and M codes in the remarks column.

Table 3.5 Description of coil (bit data)

Coil number	+7	+6	+5	+4	+3	+2	+1	+0	Remarks
1	X6	X5	X4	X3	X2	X1	REV	FWD	S06: Run operation command (Read/Write)
9	RST	XR	XF	—	—	X9	X8	X7	

- The "—" symbol in the table means that the bit is reserved, and writing is ignored.
- The coil address is 0 to 15, calculated by subtracting one from the coil number. If a coil address is 16 or more, an error occurs because of an incorrect address.
- When a coil is turned off, data are 0000_H. When a coil is turned on, data are FF00_H.

Interpretation of normal response

- The format of normal response is the same as that of inquiry.
- No response is returned to the broadcast command.

[7] Force multiple coils

* This is not supported on certain models. Refer to "8.7 Differences Between Functions" for details.

Query

1 byte	1 byte	2 bytes	2 bytes	1 byte	1 to 2 bytes	2 bytes
Station address	0FH	Coil address	No. of coils	Byte account	Write data	Error check
		Hi Lo	Hi Lo		Hi Lo	

Normal response

1 byte	1 byte	2 bytes	2 bytes	2 bytes
Station address	0FH	Coil address	No. of coils	Error check
		Hi Lo	Hi Lo	

How to set a query

- Broadcast with station address 0 is not usable. If is used, no response is returned.
- 'FC' = 15 (0FH)
- Write a coil (bit data) by specifying the top address of the coil to be written, the number of points written (number of coils), and data to be written.
- For the assignment of a coil (bit data), see Table 3.6. For each content, refer to the S and M codes in the remarks column.

Table 3.6 Description of coil (bit data)

Coil number	+7	+6	+5	+4	+3	+2	+1	+0	Remarks
1	X6	X5	X4	X3	X2	X1	REV	FWD	S06: Run operation command (Read/Write)
9	RST	XR	XF	—	—	X9	X8	X7	

- The "-" symbol in the table means that the bit is reserved and always zero.
- The coil address is 0 to 15, calculated by subtracting one from the coil number. If a coil address is 16 or more, an error occurs because of an incorrect address.
- If the byte count is 0 or 3 or more, an error occurs because of an incorrect data.
- The number of coils is 1 to 16. If 0 or 17 or more, an error occurs because of an incorrect address.
- No error occurs even if the coil address plus number of coils exceeds the coil range.
- If the number of coils is 9 or more and the byte count is 1 or less, an error occurs because of an incorrect data.
- If the number of coils is 8 or less and the byte count is 2, no error occurs.
- Data are stored from the LSB (the rightmost bit in the table above) in ascending order of coil number. When a coil is turned on, the data becomes one. When a coil is turned off, the data becomes zero. All the remaining bits are ignored.
- The byte count field indicates the byte length of the write data.
- For a data example, see Table 3.7.

Table 3.7 Example of coil address = 2 and the number of coils = 9

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Data's 1st byte	X8	X7	X6	X5	X4	X3	X2	X1
Data's 2nd byte	0	0	0	0	0	0	0	X9

Interpretation of normal response

- The forms of coil address and number of coils are the same as the forms of query.
- No response is returned to the broadcast command.

[8] Error response

If the inverter receives an improper query, it will not execute it, which will result in error response.

Error response

1 byte	1 byte	1 byte	2 bytes
Station address	Exception function	Subcode	Error check

Interpretation of error response

- The station address is the same as that of the query.
- The exception function is a value obtained by adding 80_H to the 'FC' of the query message (or the value of the 'FC' if the 'FC' is larger than 80_H).
For example, when the 'FC' is 3, the exception function is 3 + 128 = 131 (83_H).
- The subcode represents the code of the reason for the improper query.

Table 3.8 Subcodes

Subcode	Item		Description	Order of priority
1	Improper 'FC'		The inverter received an unsupported FC. (See Table 3.1.)	1
2	Improper address	Improper function code	An unused function code or a function code out of range was received. When the read/write data (except the first one) containing an unused function code. - During function reading Zero (0) will be read, which will not result in an error. - During continuous function writing The writing will be ignored, which will not result in an error.	2
		Improper number of data	- When the number of read/write data is not between 1 and 50. (from 1 to 100 for FRENIC-MEGA) - No error will result when the value of the function code plus the number of data is beyond the setting range of the function code.	
		Diagnostic code error (maintenance code)	A value other than 0 was received although the subfunction code as the diagnostics was fixed to 0.	
3	Improper data	Data range error	The write data is beyond the permissible write range.	3*1
7	NAK	No right of writing	No right of writing by H30/y98/y99 FRENIC-Mini: This error does not occur.	
		Write disable	- Writing was attempted to the functions to which writing from RTU is prohibited or to which writing is disabled during operation. - Writing was attempted to a function code (other than S01, S05, S06, S13, and S14) that could not be written when the voltage was insufficient.	

*1 The priority between sub code 3 and 7 depending on a cause of sub code 7.

- If response is sent back to an improper query, a subcode will be set in an error code (that can be referred to with M26).

3.1.5 Communications examples

Typical communications examples are shown below (the station address is 5 in all cases).

(Example 1) M06: Reading actual frequency and speed

Query (host $\Rightarrow$ inverter)

05	03	08	06	00	01	67	EF
----	----	----	----	----	----	----	----

Normal response (inverter $\Rightarrow$ host)

05	03	02	27	10	A3	B8
----	----	----	----	----	----	----

The detected speed value is 2710_H, or 10000_d. The actual frequency is 30 Hz according to the expression shown below:

$$10000 \times \frac{\text{Maximum frequency}}{20000} = 30 \text{ (Hz)} \quad (\text{Maximum frequency: 60 Hz})$$

(Example 2) S01: The value of 15Hz will be written to frequency command (maximum frequency: 60 Hz).

According to the expression shown below, the value to be written is 1388_H.

$$15\text{Hz} \times \frac{20000}{60 \text{ (Hz)}} = 5000_{\text{d}} = 1388_{\text{H}}$$

Query (host $\Rightarrow$ inverter)

05	06	07	01	13	88	D5	AC
----	----	----	----	----	----	----	----

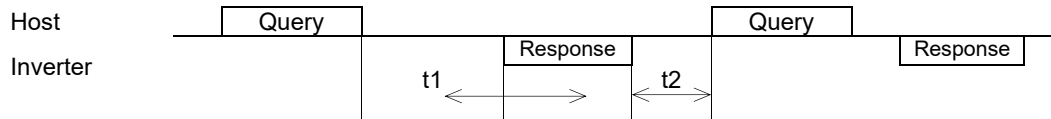
Normal response (inverter $\Rightarrow$ host)

05	06	07	01	13	88	D5	AC
----	----	----	----	----	----	----	----

3.2 Host Side Procedures

3.2.1 Inverter's response time

Upon receipt of a query from the host, the inverter executes the queried transaction and sends back response after the response time shown below:



t1: Response interval time

The response interval time is the longest time out of the time setting by a function code(1), 3-character time(2), or inverter's processing time(3).

(1) y09/y19: setting of response interval time

0.00-1.00(s), factory shipment setting: 0.01(s)

You can set the time from receiving a request issued from a host to starting to send a response. By setting a response interval time, even the host side which is slower than the inverter can meet timing.

(2) 3-character time (maximum value)

Table 3.9 3-character time (maximum time)

Baud rate (bps)	2400	4800	9600	19200	38400 (Not supported by FRENIC-Mini)
3-character time (ms)	15	10	5	5	5

(3) Inverter processing time (The data volume shown below indicates the number of words.)

1) Read holding registers, read coil status, multiple read holding registers

Table 3.10 Inverter processing time

Data count	Inverter processing time (minimum to maximum)
1 to 7	5 to 10 (ms)
8 to 16	10 to 15 (ms)
n	$\text{Int}((n-1)/8) \times 5$ to $\text{int}((n-1)/8) \times 5 + 5$ (ms)

2) Preset single register, preset multiple registers, force single coil, and force multiple coils

Table 3.11 Inverter processing time

Data count	Inverter processing time (minimum to maximum)
1	25 to 30 (ms)
2	45 to 50 (ms)
3	65 to 70 (ms)
4	85 to 90 (ms)
n	$n \times 20 + 5$ to $n \times 20 + 10$ (ms)

However, up to 5 s is required to write H03/P02/A16/b16/r16.

3) Maintenance code: 10 (ms)

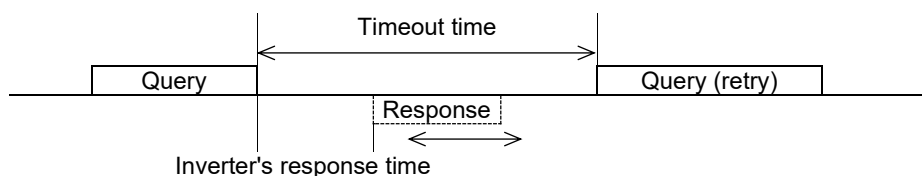
t2: Receiving preparation time

See section 3.2.3 "Receiving preparation complete time and message timing from the host."

3.2.2 Timeout processing

To read/write data from/to the host, transmit the next frame after confirming response. If response is not transmitted from the inverter for more than a specified period of time (timeout time), it is a timeout, and perform a retry. (If a retry begins before a timeout time elapses, the requested frame cannot be received properly.)

The timeout time must be set longer than the response time of the inverter. In case of a timeout, retransmit the same frame or read details of the error (M26) to confirm whether the inverter sends back normal response. If normal response is returned, this indicates that some transient transmission error occurred due to noise or for other reasons, and subsequent communications is normal. (However, if this phenomenon frequently occurs even when normal response is sent back, some problem may exist. Perform a close investigation.) In case of no response, perform another retry. If the number of retries exceeds the set value (generally about three times), there may be a problem with the hardware and the software of the host. Investigate and correct the cause.



3.2.3 Receiving preparation complete time and message timing from the host

The time from the return of response by the inverter until the completion of receiving preparation of the communications port (switching from transmission to receiving) is called a receiving preparation complete time.

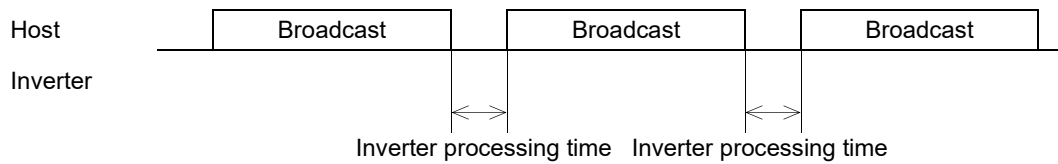
Transmit the following messages after the receiving preparation complete time:

Receiving preparation complete time: 3-character time

In the case of broadcast

Upon receipt of a query message from the host by broadcast, the inverter executes the query and enters the receiving enabled status.

When sending a message from the host after broadcast is performed, send the message after the inverter processing time shown in section 3.2.1 "Inverter's response time" has passed.

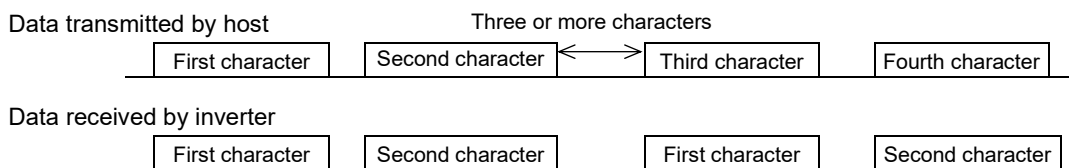


3.2.4 Frame synchronization method

Since the RTU transmits and receives binary data without using header characters for frame synchronization, a frame synchronization system is defined as a time without data to identify the head of the frame.

If data communications does not occur for a period equal to three characters (33 bits including the start and stop bits) at the current transmission speed during receiving standby, initialize the frame information, and consider the first received data the first byte of the frame. If a character interval reaches the length of three characters or more while a frame is received, the frame is discarded.

For this reason, the host must transmit data at a time interval of three or less characters between two characters.



With regard to data to another station, messages from the host and response from that station will be received. In response transmission to identify the head of the frame, a waiting time of three characters (33 bits including the start and stop bits) is required between the completion of data receipt by the station and the start of transmission.

Any devices multidropped also requires such a waiting time.

3.3 Communications Errors

3.3.1 Categories of communications errors

The communications-related errors the inverter detects are listed below:

Table 3.12 Communications errors detected by inverter

Error category	Error name	Description	Error code (M26 or M67)
Logical error	Improper 'FC'	See "Table 3.8 Subcodes" shown in 3.1.4 [8].	1(01 _H)
	Improper address		2(02 _H)
	Improper data		3(03 _H)
	NAK		7(07 _H)
Transmission error	CRC error	The frame to the local station is found unmatched in CRC collation.	71(47 _H)
	Parity error	The parity is unmatched.	72(48 _H)
	Other errors	Receiving errors other than the abovementioned (framing error, overrun error)	73(49 _H)
Communications disconnection error	Communications disconnection error	The inverter did not receive a normal frame addressed to local or to other stations within the communications disconnection time set with the function code.	-

Logical error (error codes 1 to 7)

When a logical error is detected, an error response frame reports it. For further information, see "3.1.4 [8] Error response."

Transmission error (error codes 71 to 73)

When a transmission error occurs eight straight times, it is handled as a communications error. However, the inverter does not return response in order to avoid overlapping of response from multiple inverters. The count of eight straight times will be cleared upon normal receipt of a frame to another station or to the local inverter (station) itself.

Communications disconnection error

If the inverter in operation does not receive a normal frame to itself or to other stations when it has received a normal frame more than once and is operating via communications (frequency command or operation command), this status is considered disconnected.

If the status of disconnection continues for the communications disconnection time set up by function code (y08, y18), error processing is performed as a communications error.

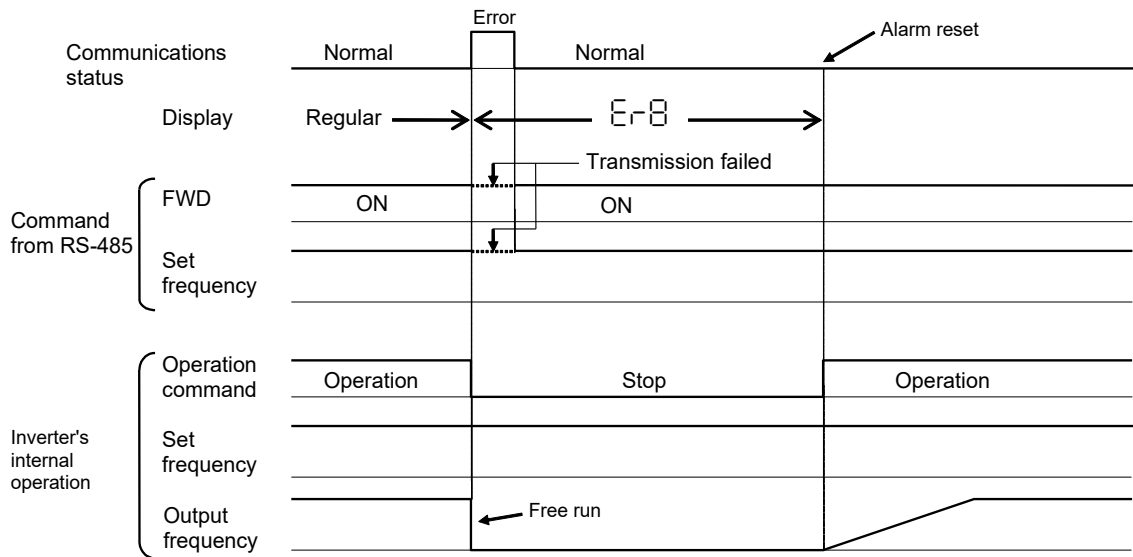
- 1) Communications disconnection detection time (y08, y18): 0 (without detection), 1 to 60 (seconds)
- 2) Condition to clear communications disconnection detection timer:
It will be cleared in a status other than disconnection.

When it is necessary to take action against errors by factor, the factor can be identified by reading M26 or M67. (M26 or M67 stores the latest communications error codes.)

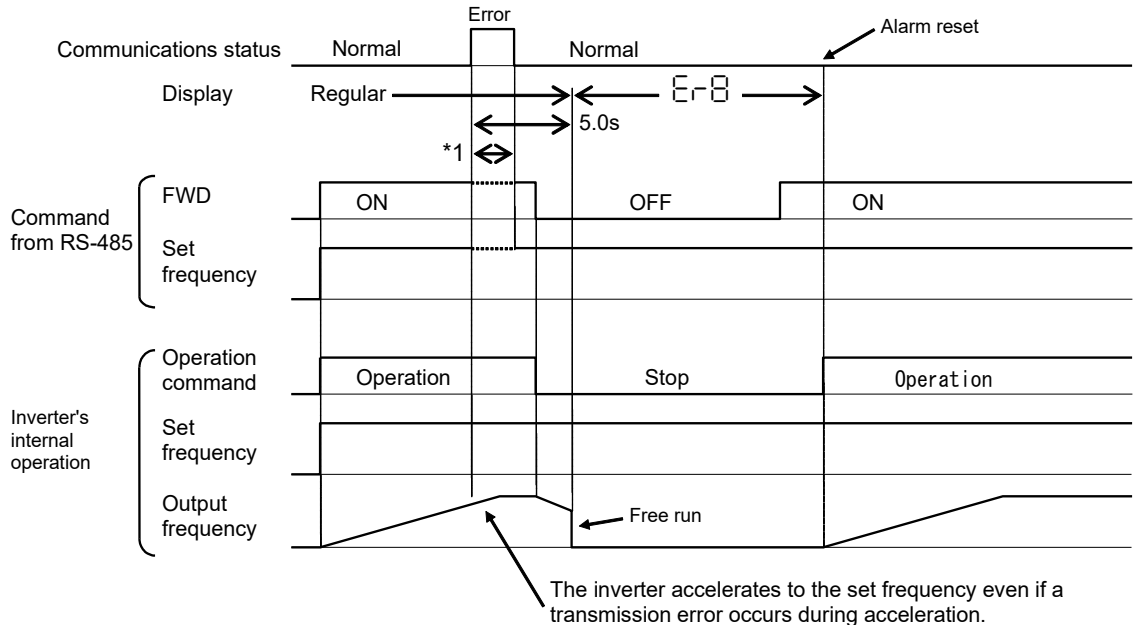
3.3.2 Operations in case of errors

The action when a transmission or communications disconnection error occurs can be selected with function code y02, y12. (For further information, see "2.4 Making RS-485-related Settings.") This section shows specific examples of action by different settings of function code y02. (The same operation is performed for y12 as well. In this case, the y02 and y03 in the figure are replaced with y12 and y13, and the error indication becomes ErP.

When y02 = 0 (mode in which the inverter is forced to immediately stop in case of communications error)



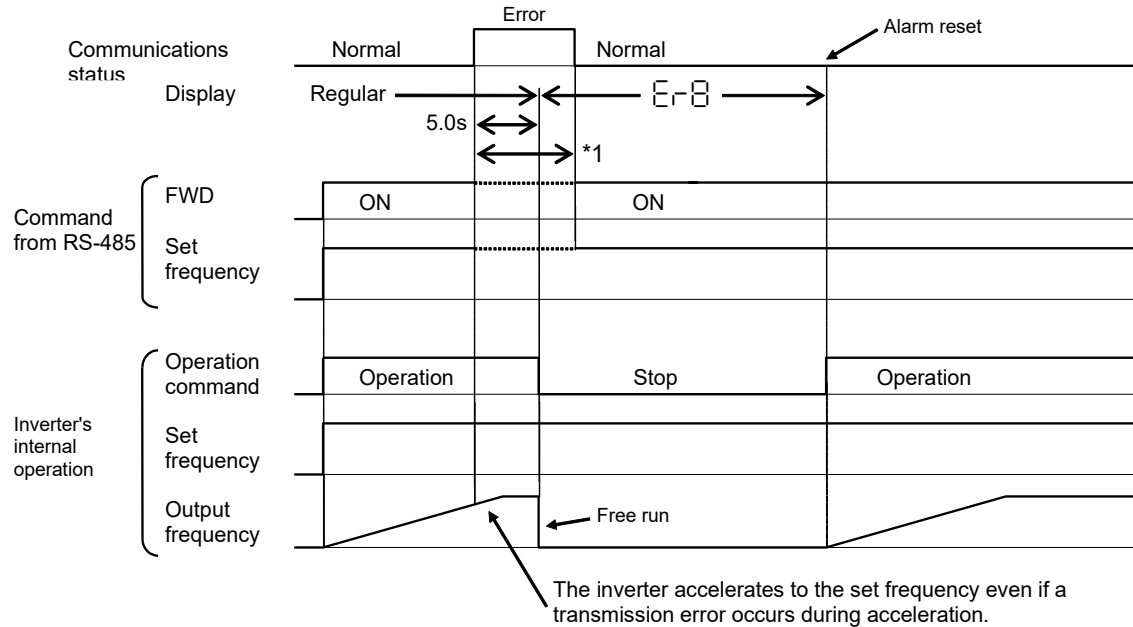
When y02 = 1 and y03 = 5.0 (seconds) (mode in which the inverter is forced to stop five seconds after a communications error occurred)



*1 For the period until communications is recovered, the command (command data, operation data) executed just before the communications error had occurred is retained.

When y02 = 2 and y03 = 5.0 (seconds)

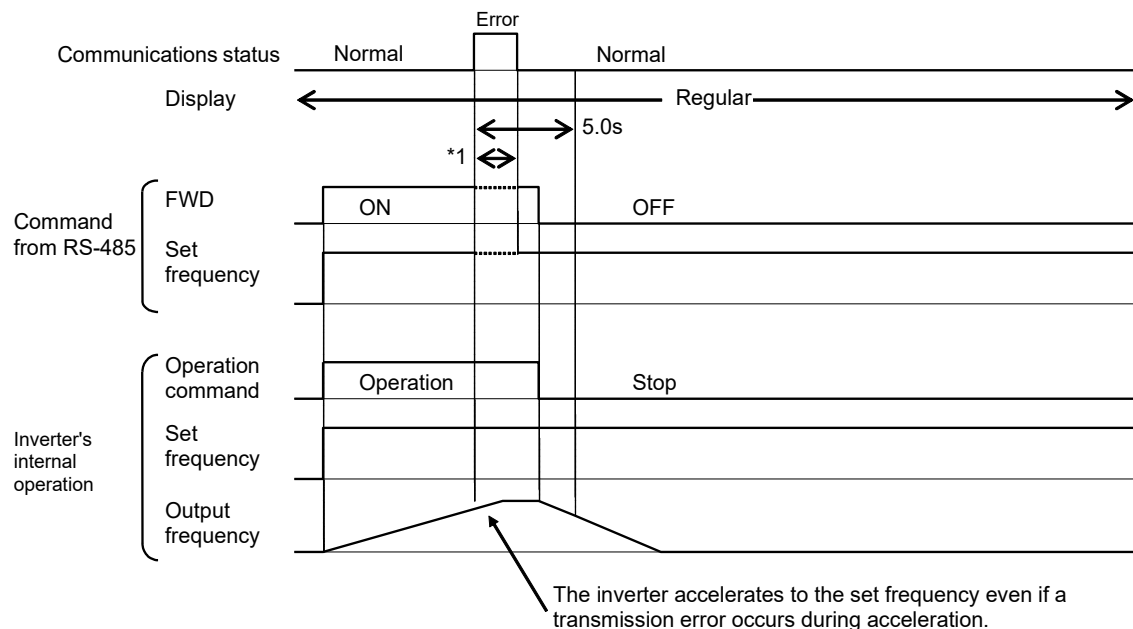
(when communications is not recovered although five seconds elapsed from the occurrence of a communications error, and an $\varepsilon\rho\delta$ trip occurs)



*1 For the period until communications is recovered, the command (command data, operation data) executed just before the communications error had occurred is retained.

When y02 = 2 and y03 = 5.0 (seconds)

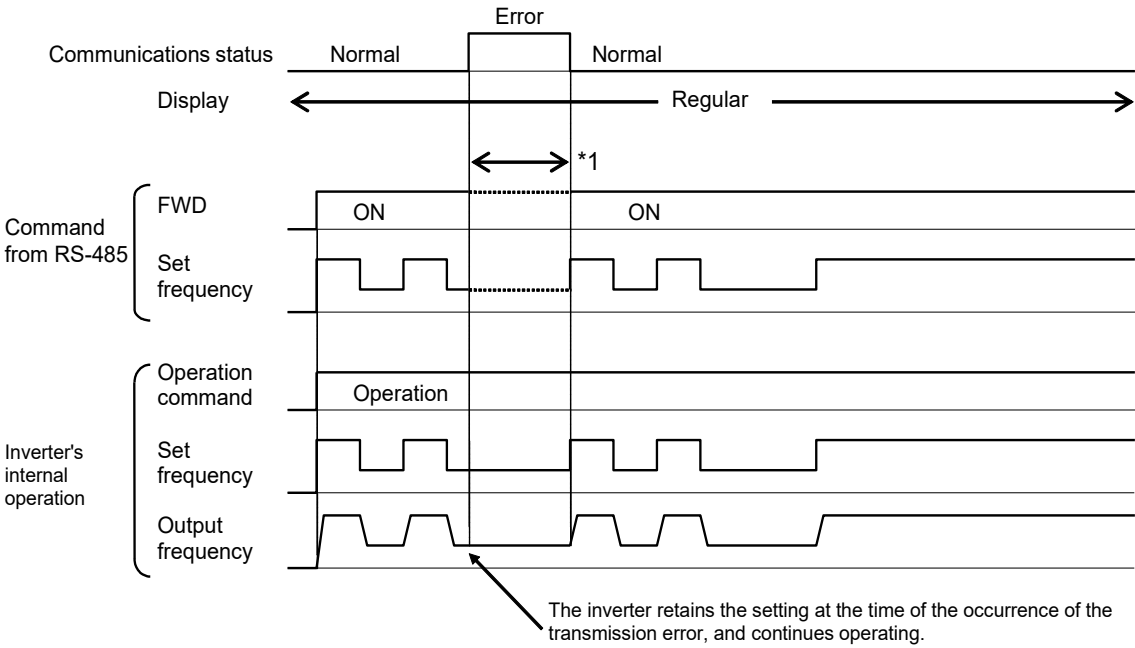
(when a communications error occurred but communications was recovered within five seconds)



*1 For the period until communications is recovered, the command (command data, operation data) executed just before the communications error had occurred is retained.

When y02 = 3

(mode in which the inverter continues operating when a communications error occurs)



*1 For the period until communications is recovered, the command (command data, operation data) executed just before the communications error had occurred is retained.

3.4 CRC-16

3.4.1 Overview of the CRC-16

The CRC (cyclic redundancy check) is a system to confirm whether there is any error in the communications frame during data transmission.

The CRC is among the most effective error check systems. The transmission station calculates and adds CRC data to the last block of the frame, and the receiving station also calculates CRC data against the data received, and compares them with each other.

Steps to calculate CRC data

- Divide data expressed as a polynomial (for example, 0000 0001 0000 0011 0000 0011 0000 0010 0000 0000 0001 0100, the 48-bit data shown in section 3.4.3 "Calculation example" → $X^{40}+X^{33}+X^{32}+X^{25}+X^{24}+X^{17}+X^4+X^2$) by a generative polynomial expression (17 bits; $X^{16}+X^{15}+X^2+1$). CRC data is the remainder (16 bits) of this division.
- Ignore the quotient, and send a message with the remainder added to the final two characters of the data.
- The receiving station divides this message (with the CRC added) by the generative polynomial expression, and considers the transmitted message to have been received without any error if the "remainder" is 0.

CRC-16

The generative polynomial expression is expressed as a multiplier of X, such as $X^3 + X^2 + 1$, in place of the description of binary code 1101. Although any prime polynomial expression is acceptable as the generative polynomial expression, some standard generative polynomial expressions for optimizing error detection are defined and proposed. The RTU protocol uses the generative polynomial expression ($X^{16} + X^{15} + X^2 + 1$) corresponding to binary code 1 (1000 0000 0000 0101). In this case, the CRC generated is well known as CRC-16.

3.4.2 Algorithm

Figure 3.1 on the following page shows the algorithm for calculating CRC-16. Consult it together with the calculation example that follows.

In this figure, the transmission station calculates CRC data and finally adds it to the transmission frame as a check code.

The receiving station uses the same algorithm to perform a transaction. However, it collates the CRC data it calculated with the transmitted CRC data.

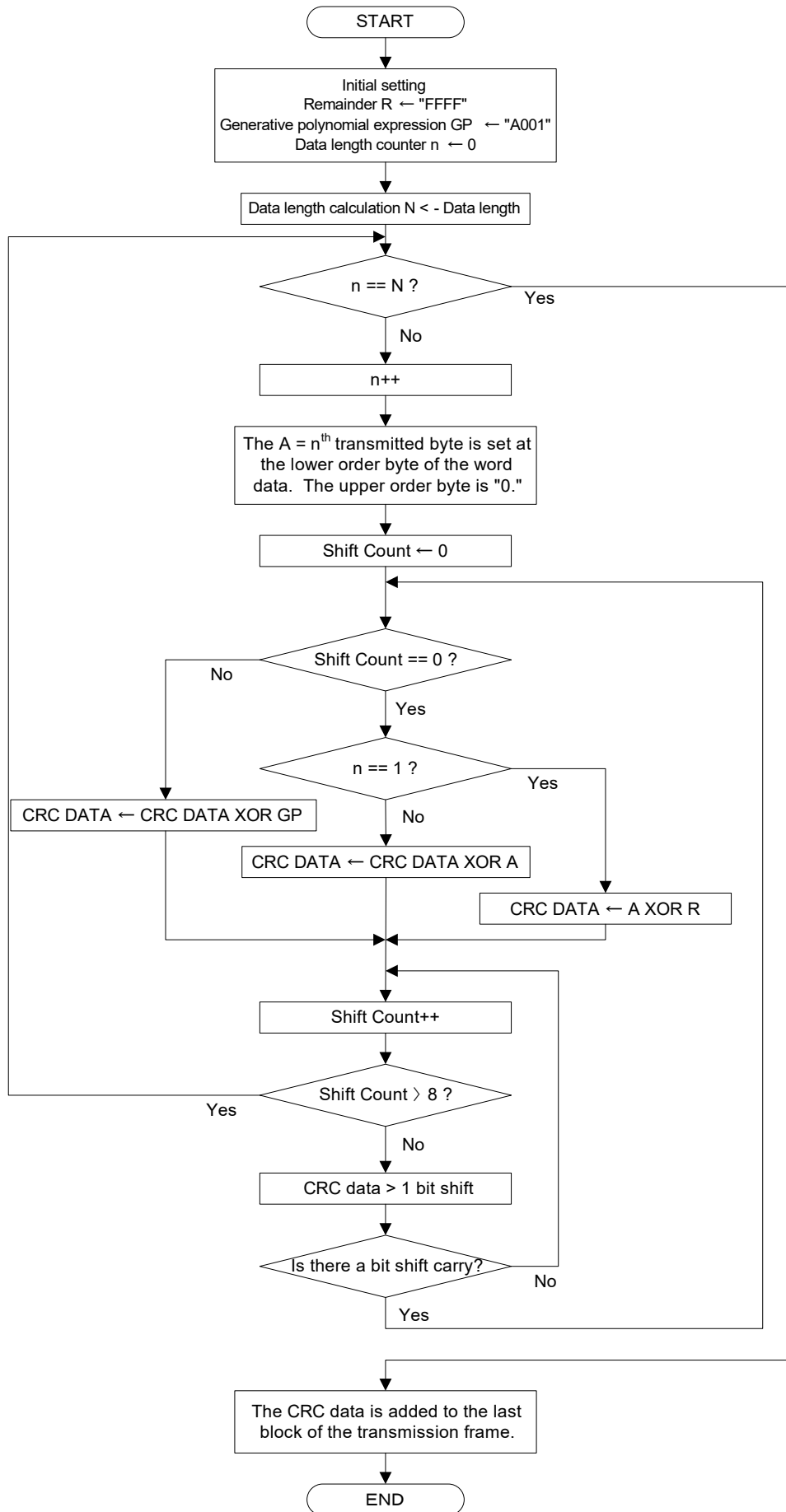


Figure 3.1 CRC algorithm

3.4.3 Calculation example

Example of transmitting read data

Station address = 1, 'FC' = 3, function code = P02 (P = 03_H, 02 = 02_H), number of read data = 20, GP = generative polynomial expression(1010 0000 0000 0001)

Station address	'FC'	Function code		Number of read data	
01 _H	03 _H	03 _H	02 _H	00 _H	14 _H

Table 3.13 CRC data calculation table

N	PROCESS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Flag
1	Initial data R = "FFFF"	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
2	1 st data byte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
3	CRC = No.1 Xor No.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	
4	Shift > 2 (up to flag = 1)	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	CRC = No.4 Xor GP	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	
6	Shift > 2	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1
7	CRC = No.6 Xor GP	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	
8	Shift > 2	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1
9	CRC = No.8 Xor GP	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	
10	Shift > 2 (shift of No. 8 terminated)	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1
11	CRC = No.10 Xor GP	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
12	2 nd data byte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
13	CRC = No.11 Xor No.12	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	
14	Shift > 1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
15	CRC = No.14 Xor GP	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	
16	Shift > 1	0	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1
17	CRC = No.16 Xor GP	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1	0	
18	Shift > 2	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1
19	CRC = No.18 Xor GP	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	
20	Shift > 2	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	1
21	CRC = No.20 Xor GP	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	
22	Shift > 2 (shift of No. 8 terminated)	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0
23	3 rd data byte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
24	CRC = No.22 Xor No.23	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1	
25	Shift > 1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1
26	CRC = No.25 Xor GP	1	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	
27	Shift > 6	0	0	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1
28	CRC = No.27 Xor GP	1	0	1	0	0	0	1	0	1	1	0	0	0	0	1	1	
29	Shift > 1	0	1	0	1	0	0	0	1	0	1	1	0	0	0	0	1	1
30	CRC = No.29 Xor GP	1	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	
31	4 th data byte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
32	CRC = No.30 Xor No.31	1	1	1	1	0	0	0	1	0	1	1	0	0	0	1	0	
33	Shift > 2	0	0	1	1	1	1	0	0	0	1	0	1	1	0	0	0	1
34	CRC = No.33 Xor GP	1	0	0	1	1	1	0	0	0	1	0	1	1	0	0	1	
35	Shift > 1	0	1	0	0	1	1	1	0	0	0	1	0	1	1	0	0	1
36	CRC = No.35 Xor GP	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1	
37	Shift > 1	0	1	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1

(To be continued)

Table 3.13 CRC data calculation table (Continued)

N	PROCESS	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Flag
38	CRC = No.37 Xor GP	1	1	0	1	0	1	1	1	0	0	0	1	0	1	1	1	
39	Shift > 1	0	1	1	0	1	0	1	1	1	0	0	0	1	0	1	1	1
40	CRC = No.39 Xor GP	1	1	0	0	1	0	1	1	1	0	0	0	1	0	1	0	
41	Shift > 2	0	0	1	1	0	0	1	0	1	1	1	0	0	0	1	0	1
42	CRC = No.41 Xor GP	1	0	0	1	0	0	1	0	1	1	1	0	0	0	1	1	
43	Shift > 1	0	1	0	0	1	0	0	1	0	1	1	1	0	0	0	1	1
44	CRC = No.43 Xor GP	1	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	
45	5 th data byte	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
46	CRC = No.44 Xor No.45	1	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	
47	Shift > 5	0	0	0	0	0	1	1	1	0	1	0	0	1	0	1	1	1
48	CRC = No.47 Xor GP	1	0	1	0	0	1	1	1	0	1	0	0	1	0	1	0	
49	Shift > 2	0	0	1	0	1	0	0	1	1	1	0	1	0	0	1	0	1
50	CRC = No.49 Xor GP	1	0	0	0	1	0	0	1	1	1	0	1	0	0	1	1	
51	Shift > 1	0	1	0	0	0	1	0	0	1	1	1	0	1	0	0	1	1
52	CRC = No.51 Xor GP	1	1	1	0	0	1	0	0	1	1	1	0	1	0	0	0	
53	6 th data byte	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	
54	CRC = No.52 Xor No.53	1	1	1	0	0	1	0	0	1	1	1	1	1	1	0	0	
55	Shift > 3	0	0	0	1	1	1	0	0	1	0	0	1	1	1	1	1	1
56	CRC = No.55 Xor GP	1	0	1	1	1	1	0	0	1	0	0	1	1	1	1	0	
57	Shift > 2	0	0	1	0	1	1	1	1	0	0	1	0	0	1	1	1	1
58	CRC = No.57 Xor GP	1	0	0	0	1	1	1	1	0	0	1	0	0	1	1	0	
59	Shift > 2	0	0	1	0	0	0	1	1	1	1	0	0	1	0	0	1	1
60	CRC = No.59 Xor GP	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0	
61	Shift > 1 (shift of No. 8 terminated)	0	1	0	0	0	0	0	1	1	1	1	0	0	1	0	0	0
	Transmitted CRC data	4				1				E				4				

From the above calculation, the transmitted data is as shown below:

Station address	'FC'	Function code		Number of read data		CRC check	
01 _H	03 _H	03 _H	02 _H	00 _H	14 _H	E4 _H	41 _H

3.4.4 Frame length calculation

To calculate CRC-16, it is necessary to know the length of variable length messages. The length of all types of messages can be determined according to Table 3.14 Lengths of response messages.

Table 3.14 Length of response messages

'FC'	Description	Query/Broadcast message length (except CRC code)	Length of response message (except CRC code)
1	Read coil status	6 bytes	3+(3 rd) bytes*1
3	Read holding registers	6 bytes	3 + (3 rd) bytes*1
5	Force single coil	6 bytes	6 bytes
6	Preset single register	6 bytes	6 bytes
8	Diagnostics	6 bytes	6 bytes
15	Force multiple coils	7 + (7 th) bytes*1	6 bytes
16	Preset multiple registers	7 + (7 th) bytes*1	6 bytes
128 to 255	Exception function	Unused	3 bytes

*1 7th, 3rd: The 7th and 3rd byte count values stored in the frame.

CHAPTER 4

FUJI GENERAL-PURPOSE INVERTER

PROTOCOL

This chapter describes the Fuji general-purpose inverter protocol, a common protocol to Fuji general-purpose inverters, as well as the host side procedure to use this protocol and error processing.

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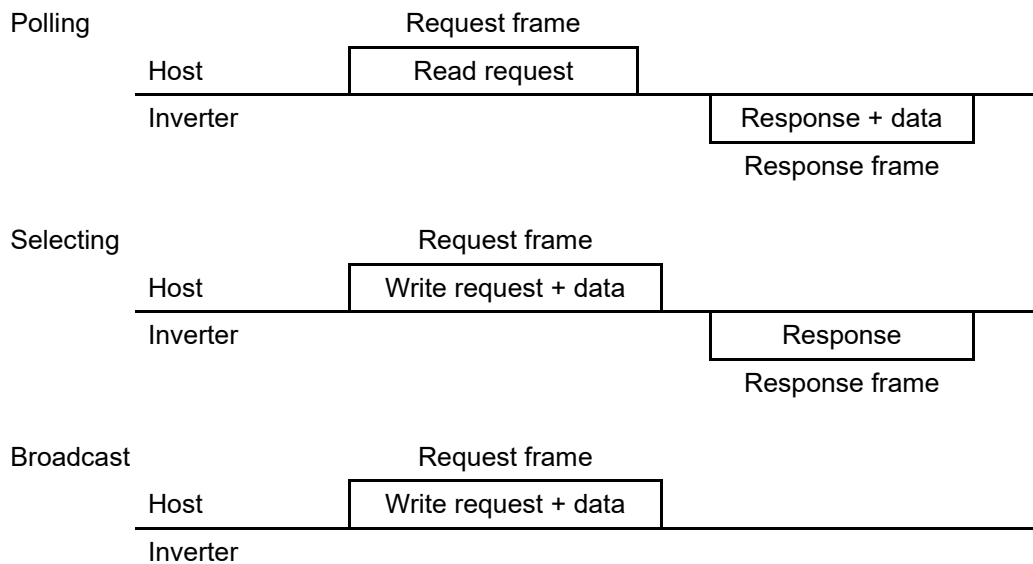
4.1 Messages

4.1.1 Message formats

The polling/selecting system is used to transmit and receive messages. The inverter always waits for selecting (write requests) or polling (read requests) from a host such as a personal computer or PLC.

When the inverter in the standby status receives a request frame from the host addressed to itself (local station) and considers the request frame to have been normally received, the inverter executes the transaction in response to the request, and sends back an acknowledgement (ACK) frame (or response and data in the case of polling). If the inverter judges that the receiving failed, it returns negative acknowledgment (NAK) frame. In the case of broadcast (all station batch selecting), the inverter does not send back response.

(Each frame is described in "4.1.2 Transmission frames.")



Broadcast (all station batch selecting)

A frame with the station address set to 99 is treated by all inverters as broadcast.

By using broadcast, operation or frequency commands can be simultaneously assigned to all inverters.

In broadcast communications, only selecting of S01, S05, S06, S13, S14, and S19 in the standard frame, and commands (W, E, a, e, f, and m) in the optional frame are valid.

4.1.2 Transmission frames

Transmission frames are classified into two types; standard frames with which all communications functions are available, and optional frames, allowing high-speed communications, but whose function is limited to issuing commands to and monitoring the inverter.

All characters (including BCC) comprising both standard and optional frames are represented by ASCII codes. The lengths of standard and optional frames are as shown in Table 4.1 below:

Table 4.1 Lengths of transmission frames

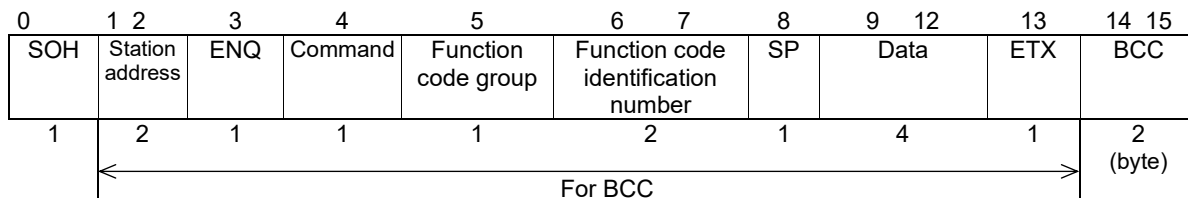
Frame type			Frame length
Standard frame	Selecting	Request	16 bytes
		Response	16 bytes
	Polling	Request	16 bytes
		Response	16 bytes
Optional frame	Selecting	Request	12 bytes
		Response	8 bytes
	Polling	Request	8 bytes
		Response	12 bytes

[1] Standard frame

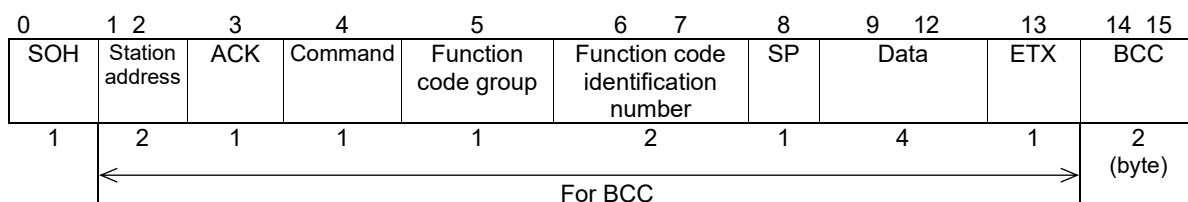
Standard frames are classified into request frame, ACK frame, and NAK frame, and their frame configurations are as shown below.

For the meanings of the fields comprising each frame, see the tables shown on the pages that follow.

Request frame [host ⇒ inverter]



ACK frame [inverter ⇒ host]



NAK frame [inverter ⇒ host]

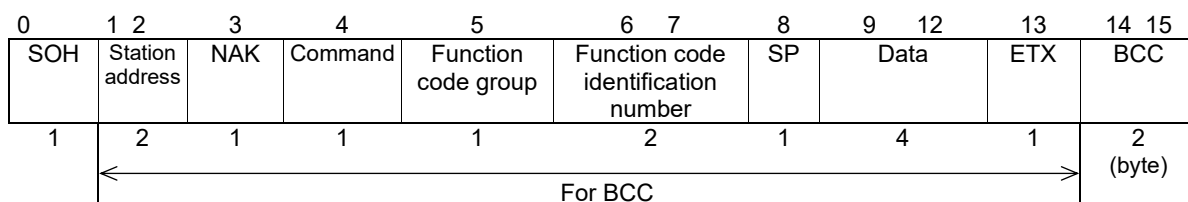


Table 4.2 Request frame

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3, 9	30 _H to 33 _H 39 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ENQ	ENQ	05 _H	Transmission request
4	Command	R W A E	52 _H 57 _H 41 _H 45 _H	Request command Polling (read) Selecting (write) High-speed response selecting (write) *2 Alarm reset
5	Function code group *1			See Table 4.3
6	Function code identification number *1	0 to 9	30 _H to 39 _H	Function code identification number (decimal: ten's figure)
7		0 to 9	30 _H to 39 _H	Function code identification number (decimal: one's figure)
8	Special additional data	SP	20 _H	Unused (space fixed)
9	Data	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Data's first character (hexadecimal: thousand's figure)
10				Data's second character (hexadecimal: hundred's figure)
11				Data's third character (hexadecimal: ten's figure)
12				Data's fourth character (hexadecimal: one's figure)
13	ETX	ETX	03 _H	End of message
14	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
15				Checksum 2 (hexadecimal: one's figure)

*1 A space (SP = 20_H) will be set for an alarm reset command.

*2 Use high-speed response selecting to read the monitor when a command, which takes time for selecting (see Table 3.14 in "4.2 Host Side Procedures"), is written. The inverter does not respond to the regular write command W until writing is completed. With regard to high-speed response command A, the inverter sends back response upon receipt of a write request and communications can, therefore, continue even during writing. To confirm whether writing is completed in this case, read the BUSY flag (M14: 15 bits). If additional writing is performed during writing, NAK (error during writing) will result.

Table 4.3 Function code group, code conversion table

Function codes that can be edited from keypad				Dedicated communication function codes			
Group	Code		Name	Group	Code		Name
F	'F'	46 _H	Fundamental function	S	'S'	53 _H	Command data
E	'E'	45 _H	Extension terminal function	M	'M'	4D _H	Monitor data 1
C	'C'	43 _H	Control function of frequency	M1	-	8B _H	Monitor data 1
P	'P'	50 _H	Motor1 parameter	W	'W'	57 _H	Monitor data 2
H	'H'	48 _H	High performance function	W1	-	A0 _H	Monitor data 2
H1	-	81 _H	High performance function	W2	-	A1 _H	Monitor data 2
A	'A'	41 _H	Motor2 parameter	W3	-	A2 _H	Monitor data 2
b	'B'	42 _H	Motor3 parameter	X	'X'	58 _H	Alarm 1
r	'R'	52 _H	Motor4 parameter	X1	-	A3 _H	Alarm 1
J	'J'	4A _H	Application function 1	Z	'Z'	5A _H	Alarm 2
J1	-	A6 _H	Application function 1				
J2	-	A7 _H	Application function 1				
J4	-	A9 _H	Application function 1				
J5	-	AA _H	Application function 1				
J6	-	AB _H	Application function 1				
d	'D'	44 _H	Application function 2				
d1	-	AC _H	Application function 2				
d2	-	AD _H	Application function 2				
U	'U'	55 _H	Application function 3				
U1	-	89 _H	Application function 3				
y	'Y'	59 _H	Link function				
o	'o'	4F _H	Operational function				
o1	-	87 _H	Operational function				
o2	-	88 _H	Operational function				
T	'T'	54 _H	Timer function				
K	'K'	4B _H	Keypad function				

- Binary codes are used when setting function code groups to which no ASCII characters have been assigned.
- If using codes 80H or higher, it is necessary to set "0" for function code y05 or y15, and select 8 bits for the data length.

For the contents of function codes, see CHAPTER 2 , 2.4 Making RS-485-related Settings , User's Manual of each inverter model and CHAPTER 7 "FUNCTION CODES AND DATA FORMATS".

Table 4.4 ACK frame

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ACK	ACK	06 _H	Transmission response Acknowledgement: There was no receiving or logical error.
4	Command	R W A E	52 _H 57 _H 41 _H 45 _H	Answerback of request command Polling (read) Selecting (write) High-speed response selecting (write) Alarm reset
5	Function code group *1			Table 4.3 See.
6	Function code identification number *1	0 to 9	30 _H to 39 _H	Function code identification number (decimal: ten's figure)
7		0 to 9	30 _H to 39 _H	Function code identification number (decimal: one's figure)
8	Special additional data	SP -	20 _H 2D _H	Fixed to "sp (space)" normally. "-" for negative data
9	Data	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Data's first character (hexadecimal: thousand's figure)
10				Data's second character (hexadecimal: hundred's figure)
11				Data's third character (hexadecimal: ten's figure)
12				Data's fourth character (hexadecimal: one's figure)
13	ETX	ETX	03 _H	End of message
14	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
15				Checksum 2 (hexadecimal: one's figure)

*1 A space (SP = 20_H) will be set for an alarm reset command.

Table 4.5 NAK frame

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	NAK	NAK	15 _H	Transmission response Negative acknowledgement: There was a logical error in the request.
4	Command *1	R W A E	52 _H 57 _H 41 _H 45 _H	Answerback of request command Polling (read) Selecting (write) High-speed response selecting (write) Alarm reset
5	Function code group *1			Table 4.3 See .
6	Function code identification number *1	0 to 9	30 _H to 39 _H	Function code identification number (decimal: ten's figure)
7		0 to 9	30 _H to 39 _H	Function code identification number (decimal: one's figure)
8	Special additional data	SP	20 _H	Unused (space fixed)
9	Data	SP	20 _H	Unused (space fixed)
10		SP	20 _H	Unused (space fixed)
11		0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Communications error code higher order (hexadecimal: ten's figure)
12				Communications error code lower order (hexadecimal: one's figure)
13	ETX	ETX	03 _H	End of message
14	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
15				Checksum 2 (hexadecimal: one's figure)

*1 The field contents of command type, function code group, function code identification number vary at the format error or command error.

[2] Optional frame

This section describes the structure and meaning of each optional frame.

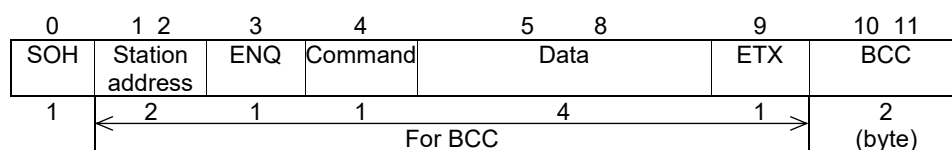
Selecting request frame [host ⇒ inverter]

Table 4.6 Selecting request frame

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3, 9	30 _H to 33 _H 39 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ENQ	ENQ	05 _H	Transmission request
4	Command	a e f m	61 _H 65 _H 66 _H 6D _H	Request command Speed setting (S01) Frequency command (S05) Operation command (S06) Reset command (The data part is all zero)
5	Data	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Data's first character (hexadecimal: thousand's figure)
6				Data's second character (hexadecimal: hundred's figure)
7				Data's third character (hexadecimal: ten's figure)
8				Data's fourth character (hexadecimal: one's figure)
9	ETX	ETX	03 _H	End of message
10	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
11				Checksum 2 (hexadecimal: one's figure)

Selecting response frame [inverter ⇒ host]

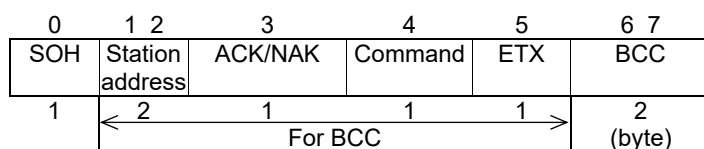


Table 4.7 Selecting response frame (ACK/NAK)

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ACK/NAK	ACK NAK	06 _H 15 _H	Transmission response Acknowledgement: There was no receiving or logical error. Negative acknowledgment: There was a logical error in the request.
4	Command	a e f m	61 _H 65 _H 66 _H 6D _H	Request command Speed setting (S01) Frequency command (S05) Operation command (S06) Reset command
5	ETX	ETX	03 _H	End of message
6	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
7				Checksum 2 (hexadecimal: one's figure)

Polling request frame [host ⇒ inverter]

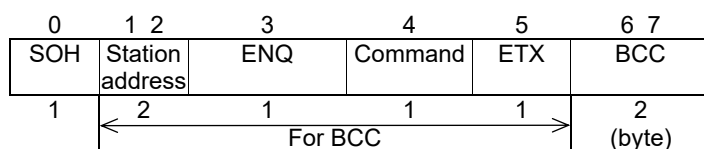


Table 4.8 Polling request frame

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ENQ	ENQ	05 _H	Transmission request
4	Command	g j k h i	67 _H 6A _H 6B _H 68 _H 69 _H	Request command Actual frequency, actual speed (M06) Output frequency monitor (M09) Operation status monitor (M14) Torque monitor (M07) (not supported by FRENIC-Mini) Torque current monitor (M08) (Usable only for FRENIC-MEGA)
5	ETX	ETX	03 _H	End of message
6	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
7				Checksum 2 (hexadecimal: one's figure)

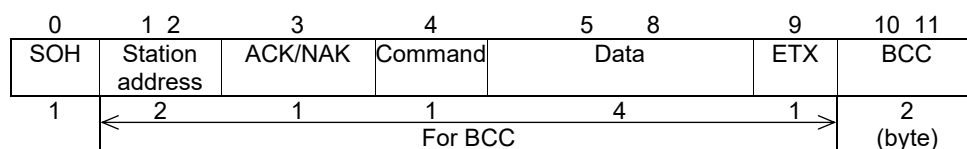
Polling response frame [inverter ⇒ host]

Table 4.9 Polling response frame (ACK)

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ACK/NAK	ACK	06 _H	Transmission request Acknowledgement: There was no receiving or logical error.
4	Command	g j k h i	67 _H 6A _H 6B _H 68 _H 69 _H	Request command Actual frequency, actual speed (M06) Output frequency monitor (M09) Operation status monitor (M14) Torque monitor (M07) (not supported by FRENIC-Mini) Torque current monitor (M08) (Usable only for FRENIC-MEGA)
5	Data	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Data's first character (hexadecimal: thousand's figure)
6				Data's second character (hexadecimal: hundred's figure)
7				Data's third character (hexadecimal: ten's figure)
8				Data's fourth character (hexadecimal: one's figure)
9	ETX	ETX	03 _H	End of message
10	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
11				Checksum 2 (hexadecimal: one's figure)

Table 4.10 Polling response frame (NAK)

Byte	Field	Value		Description
		ASCII format	Hexadecimal format	
0	SOH	SOH	01 _H	Start of message
1	Station address	0 to 3	30 _H to 33 _H	Station address of the inverter (decimal: ten's figure)
2		0 to 9	30 _H to 39 _H	Station address of the inverter (decimal: one's figure)
3	ACK/NAK	NAK	15 _H	Transmission request Negative acknowledgment: There was a logical error in the request.
4	Command	g j k h i	67 _H 6A _H 6B _H 68 _H 69 _H	Request command Actual frequency, actual speed (M06) Output frequency monitor (M09) Operation status monitor (M14) Torque monitor (M07) (not supported by FRENIC-Mini) Torque current monitor (M08) (Usable only for FRENIC-MEGA)
5	Data	SP	20 _H	Unused (fixed space)
		SP	20 _H	Unused (fixed space)
		0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Communications error code high-order digit (hexadecimal: ten's figure)
				Communications error code low-order digit (hexadecimal: one's figure)
9	ETX	ETX	03 _H	End of message
10	BCC	0 to 9, A to F	30 _H to 39 _H 41 _H to 46 _H	Checksum 1 (hexadecimal: ten's figure)
11				Checksum 2 (hexadecimal: one's figure)

[3] NAK frame

When the response frame length is determined by the command type and the command type character is correctly identified, response will be given according to the frame length specified by the command in principle. Concerning all the request frames, if the inverter failed to detect ETX after detecting request-to-send character with the specified 3-byte position until reaching the 15-byte position, the inverter returns no response.

Table 4.11 Negative acknowledgment (NAK) frame

No.	Frame/ Command type	Cause of error	NAK response frame	Error code (M26)
1	Standard frame Optional frame	The ENQ was not detected in the specified position.	Standard frame (16 bytes long)	Format error [74]
2	Selecting command (a, e, f, m)	The ETX was not detected in the specified position.	Optional frame (8 bytes long)	Format error [74]
3	Polling command (g, j, k, h, i)	The ETX was not detected in the specified position.	Optional frame (12 bytes long)	Format error [74]
4	Other than specified commands	A command other than the specified commands (R, W, A, E, a, e, f, g, j, k, h, i, m) was detected.	Standard frame (16 bytes long)	Command error [75]



When negative acknowledgement (NAK) for a format or command error is returned with the standard format as in the case of No. 1 and No. 4, the contents of the command type, function code group, and function code identification number fields will be undefined.

4.1.3 Descriptions of fields

[1] Command field

The table below shows command types. The applicable frame is different among the command types.

Table 4.12 Command formats

Command	Description	Applicable frame
ASCII R	Reads function code data (polling).	Standard frame
ASCII W	Writes function code data (selecting).	
ASCII A	Writes function code data at high speed (writing that does not wait for writing to be completed).	
ASCII E	Resets an alarm.	
ASCII a	Gives a frequency command (S01). *1	Optional frame
ASCII e	Gives a frequency command (S05). *1	
ASCII f	Gives an operation command (S06). *1	
ASCII g	Reads the output frequency (M06). *1	
ASCII h	Reads the torque monitor (M07). *1 (not supported by FRENIC-Mini)	
ASCII i	Reads the torque current monitor (M08) *1 (Usable only for FRENIC-MEGA)	
ASCII j	Reads the output frequency (M09). *1	
ASCII k	Reads the operation status monitor (M14). *1	
ASCII m	Resets an alarm.	

*1 The above commands "a" to "k" are used to read or write data in the function code data format specified in parentheses.

[2] Data field

Standard frame

8	9	10	11	12
Special additional data	Data's first character	Data's second character	Data's third character	Data's fourth character

Optional frame

9	10	11	12
Data's first character	Data's second character	Data's third character	Data's fourth character

All data, except for some special ones, are treated as 16 bits long. In the data field of the communications frame, data is hexadecimal (0000_H – FFFF_H), and each digit is represented by an ASCII code. Negative integer data (signed data) is treated as a complement of 2 of the integer data without the sign.



- The alphabetic characters A to F of hexadecimal data must be uppercase.
- Set 0 in all the data fields of the request frame for polling.
- In selecting, the data field of the ACK frame will be undefined.

(Example) When setting 20Hz with function code S01 (speed setting 1) (maximum frequency = 60Hz)

- 1) Calculate the set value according to the data format of S01 ($\pm 20000/\text{maximum frequency}$).

$$\begin{aligned}\text{Data} &= 20\text{Hz} \times \pm 20000/60\text{Hz} \text{ (+ for forward rotation, - for reverse rotation)} \\ &= \pm 6666.6 \\ &\approx \pm 6667\end{aligned}$$

- 2) Convert the data into hexadecimal (a complement of 2 in the case of negative data).

$$\begin{aligned}\text{Data} &= 6667 \text{ (forward rotation)} \\ &= 1A0B_H\end{aligned}$$

$$\begin{aligned}\text{Data} &= -6667 \text{ (reverse rotation)} \\ &= 0 - 6667\end{aligned}$$

Thus,

$$65536 - 6667 = 58869 = E5F5_H$$

- 3) Set the data.

Position	Set value (forward rotation)	Set value (reverse rotation)
Data's first character	ASCII 1	ASCII E
Data's second character	ASCII A	ASCII 5
Data's third character	ASCII 0	ASCII F
Data's fourth character	ASCII B	ASCII 5

[3] Checksum field

The data in this field is intended to check whether there is any error in the communications frame at the time of data transmission. Calculate the data by adding one byte to all fields, except for S0H and the checksum field, treating the last byte of the result as a two-digit hexadecimal value, and converting each digit into an ASCII code.

(Example) When the result of addition is 0123_H

Position	Set value (forward rotation)
Checksum 1	ASCII 2
Checksum 2	ASCII 3

4.1.4 Communications examples

Typical communications examples are shown below (the station number is 12 in all cases):

[1] Standard frame

(Example 1) Selecting S01: speed setting 1 (write)

10Hz command $\times$ 20,000/maximum frequency 50Hz = 4000d = 0FA0_H

Request frame (host $\Rightarrow$ inverter)

SOH	1	2	ENQ	W	S	0	1	SP	0	F	A	0	ETX	7	D
-----	---	---	-----	---	---	---	---	----	---	---	---	---	-----	---	---

ACK frame (inverter $\Rightarrow$ host)

SOH	1	2	ACK	W	S	0	1	SP	0	F	A	0	ETX	7	E
-----	---	---	-----	---	---	---	---	----	---	---	---	---	-----	---	---

NAK frame (inverter $\Rightarrow$ host) ... Link priority error

SOH	1	2	NAK	W	S	0	1	SP	SP	SP	4	C	ETX	5	D
-----	---	---	-----	---	---	---	---	----	----	----	---	---	-----	---	---

(Example 2) Polling of M09: output frequency (read)

Request frame (host $\Rightarrow$ inverter)

SOH	1	2	ENQ	R	M	0	9	SP	0	0	0	0	ETX	5	3
-----	---	---	-----	---	---	---	---	----	---	---	---	---	-----	---	---

ACK frame (inverter $\Rightarrow$ host)

SOH	1	2	ACK	R	M	0	9	SP	0	B	B	8	ETX	8	0
-----	---	---	-----	---	---	---	---	----	---	---	---	---	-----	---	---

[2] Optional frame

(Example 1) Selecting of operation command (write)

Request frame (host $\Rightarrow$ inverter) ... FWD command

SOH	1	2	ENQ	f	0	0	0	1	ETX	9	2
-----	---	---	-----	---	---	---	---	---	-----	---	---

ACK frame (inverter $\Rightarrow$ host)

SOH	1	2	ACK	f	ETX	D	2
-----	---	---	-----	---	-----	---	---

NAK frame (inverter $\Rightarrow$ host)

The cause of the error can be confirmed with function code M26 (transmission error transaction code).

SOH	1	2	NAK	f	ETX	E	1
-----	---	---	-----	---	-----	---	---

(Example 2) Selecting of operation command in broadcast (write)

Request frame (host $\Rightarrow$ inverter) ... REV command

SOH	9	9	ENQ	f	0	0	0	2	ETX	A	2
-----	---	---	-----	---	---	---	---	---	-----	---	---

The inverter does not respond to broadcast.

Table 4.13 ASCII code table

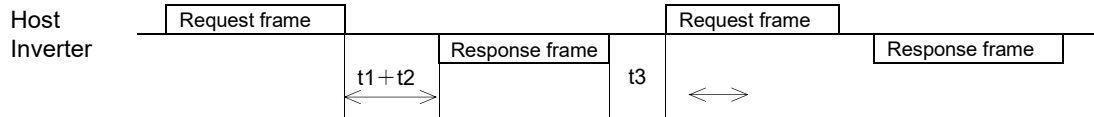
	00 _H	10 _H	20 _H	30 _H	40 _H	50 _H	60 _H	70 _H
0 _H	NUL	DLE	SP	0	@	P	`	p
1 _H	SOH	DC1	!	1	A	Q	a	q
2 _H	STX	DC2	"	2	B	R	b	r
3 _H	ETX	DC3	#	3	C	S	c	s
4 _H	EOT	DC4	\$	4	D	T	d	t
5 _H	ENQ	NAK	%	5	E	U	e	u
6 _H	ACK	SYN	&	6	F	V	f	v
7 _H	BEL	ETB	'	7	G	W	g	w
8 _H	BS	CAN	(	8	H	X	h	x
9 _H	HT	EM	)	9	I	Y	i	y
A _H	LF	SUB	*	:	J	Z	j	z
B _H	VT	ESC	+	;	K	[	k	{
C _H	FF	FS	,	<	L	\	l	
D _H	CR	GS	-	=	M	]	m	}
E _H	SO	RS	.	>	N	-	n	to
F _H	SI	US	/	?	O	_	o	DEL

The shaded codes are used for this communications protocol.

4.2 Host Side Procedures

4.2.1 Inverter's response time

Upon receipt of a query request from the host, the inverter executes the requested command, and sends back response after the response time shown below:



$t1 + t2$: Inverter's response time

$t1$: Response interval time (function code: y09)

The time until the inverter starts to send response to the request from the host can be set. Setting the response interval time enables even the host side with a slow transaction execution speed to adjust timing.

$t2$: Inverter's transaction time

This is the time until the inverter executes the request and sends back response as shown in Table 4.14 below.

$t3$: See "4.2.3 Receiving preparation complete time and message timing from the host ."

Table 4.14 Inverter's transaction time

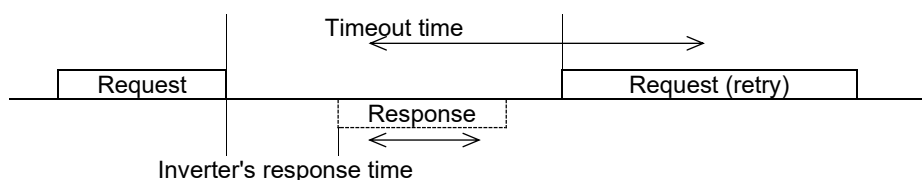
Command	Transaction	Description	$t2$	Timeout time (recommended)
R	Function code read data		≤ 10 ms	0.1 sec
W	Function code write data	S code commands other than S08 or S09	≤ 10 ms	0.1 sec
		Motor parameter initialization H03 = 2, 3, 4, 5	≤ 500 ms	1.0 sec
		Data initialization: H03 = 1	≤ 5 s	10.0 sec
		Function code other than above	≤ 100 ms	0.5 sec
A	Function code data high-speed writing		≤ 10 ms	0.1 sec
E, m	Alarm reset		≤ 10 ms	0.1 sec
a, e, f	Specific function code write data		≤ 10 ms	0.1 sec
g, h, i, j, k	Specific function code read data		≤ 10 ms	0.1 sec

4.2.2 Timeout processing

To read/write data from/to the host, transmit the next frame after confirming response. If response is not transmitted from the inverter for more than a specified period of time (timeout time), it is a timeout, and perform a retry. (If a retry begins before a timeout, the requested frame cannot be received properly.)

The timeout time must be set longer than the response time of the inverter. Table 4.14 above mentioned shows recommended timeout times when no response interval time is set.

In case of a timeout, retransmit the same frame or perform polling (M26) for reading details of an error to confirm whether the inverter sends back normal response. If normal response is returned, this indicates that some transient transmission error occurred due to noise or other reasons, and subsequent communications is normal. (However, if this phenomenon frequently occurs even when normal response is sent back, some problem may exist. Perform a close investigation.) In case of no response, perform another retry. If the number of retries exceeds the set value (generally about three times), there may be a problem with the hardware and the software for the host controller. Investigate and correct the cause.



4.2.3 Receiving preparation complete time and message timing from the host

The time from the return of response by the inverter to the completion of receiving preparation of the communications port (switching from transmission to receiving) is called a receiving preparation complete time.

Transmit the following messages after the receiving preparation complete time:

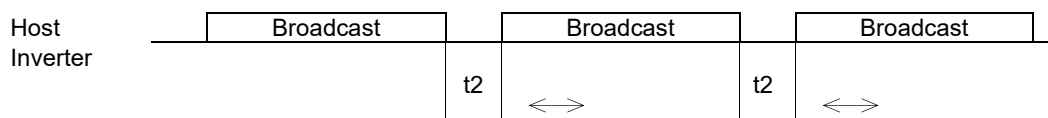
Receiving preparation complete time: 5ms or less

Message timing from the host (t3): $t3 > 5\text{ms}$

In the case of broadcast

Upon receipt of a request for a query message from the host by broadcast, the inverter executes the command and enters the receiving enabled status.

Transmit the next message from the host following broadcast after the transaction time (t2) of the inverter.



4.3 Communications Errors

4.3.1 Categories of communications errors

The communications-related errors the inverter detects are listed below:

Table 4.15 Communications errors detected by inverter

Error category	Error name	Description	Error code (M26)	Order of priority
Transmission error	Checksum error	The frame to the local station is found unmatched in checksum collation.	71(47 _H)	–
	Parity error	The parity is unmatched.	72(48 _H)	–
	Other errors	Receiving errors other than the abovementioned (framing error, overrun error)	73(49 _H)	–
Logical error	Format error	- The characters of the transmission request are incorrect. - The last character of the message is not in the specified position.	74(4A _H)	1
	Command error	A command that does not exist was transmitted.	75(4B _H)	2
	Link priority error (does not occur for FRENIC-Mini)	A frequency command, PID command, or change command of the run command (writing request to S01, S05, S06, and S13) are sent through the communications route other than that specified with H30.	76(4C _H)	3
	Function code error	A function code that does not exist was requested.	78(4E _H)	4
	Write disabled error	An attempt was made during operation to write the function code for write disabled or for write disabled during operation.	79(4F _H)	5
	Data error	The write data is beyond the writable range.	80(50 _H)	6
	Error during writing	An attempt was made to write another function data during function writing with command A.	81(51 _H)	7
	Communications disconnection error	The inverter did not receive a normal frame addressed to local station or to other stations within the communications disconnection detection time set with the function code.	–	–

Transmission error (error codes 71 to 73)

When a transmission error occurs eight straight times, it is handled as a communications error. However, the inverter does not return response in order to avoid overlapping of response from multiple inverters. The count of eight straight times will be cleared upon normal receipt of a frame to another station or to the local inverter (station) itself.

Logical error (error codes 74 to 81)

When a logical error is detected, a negative acknowledgment (NAK) frame reports it. For further information, see the NAK response of each frame. The Table 4.15 shows the order of priority of logical error. If the alarm is caused by two or more factors, the factor with the highest priority (smallest number) is indicated as an error code.

Concerning all the request frames, if the inverter failed to detect ETX after detecting request-to-send character with the specified 3-byte position until reaching the 15-byte position, the inverter returns no response.

Communications disconnection error

If the inverter in operation does not receive a normal frame to itself (local station) or to another station when it has received a normal frame more than once and is operating via communications (frequency command or operation command), this status is considered disconnected.

When a disconnection status is set and remains over the setting time of function code y08, y18 (communications disconnection detection time), it is treated as a communications error.

- 1) Communications disconnection detection time (y08, y18): 0 (without detection), 1 to 60 (seconds)
- 2) Condition to clear communications disconnection detection timer: It will be cleared in a status other than disconnection.

When it is necessary to take action against errors by factor, the factor can be identified by reading M26. (M26 stores the latest communications error codes.)

4.3.2 Operations in case of communications errors

Operations in case of a transmission or communications disconnection error are the same as those of the Modbus RTU protocol. See "3.3.2 Operations in case of errors" in CHAPTER 3 Modbus RTU PROTOCOL.

CHAPTER 5

Metasys N2

(N2 PROTOCOL)

This chapter describes Metasys N2 protocol.

Metasys N2 is a serial communications protocol developed by Johnson Controls. It is used in building automation.

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5.3	Point Mapping Tables	5-3
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5.1 Messages

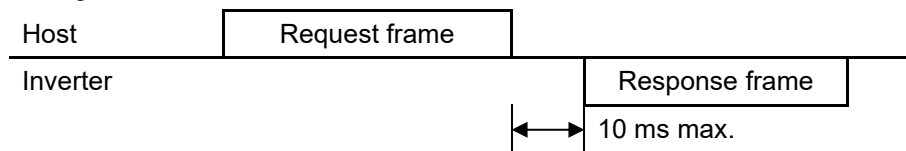
5.1.1 Communications specifications

Item	Specifications
Physical level	EIA RS-485
Wiring distance	1640 ft (500 m) max.
Number of nodes	Total of 255
Transmission speed	9600 bits/s (fixed)
Transmission mode	Half duplex
Bus topology	Master-Slave
Character code	ASCII 7 bits (fixed)
Character length	8 bits (fixed)
Stop bit	1 bit (fixed)
Frame length	Variable length
Parity	None (fixed)
Error checking	Checksum

5.1.2 Polling/selecting

When the inverter receives a request frame from the host, it sends back a response frame.

Polling/ Selecting



5.2 Setting up the inverter

Run command and reference frequency

To start or stop the inverter or set the reference frequency from Metasys, it is necessary to enable commands given through the appropriate channel using function code H30. For details, refer to Section 2.3.2.

Protocol

Select Metasys N2 (y10 or y20 = 3).

Baud rate

The baud rate on a Metasys N2 network is always 9600 bits/s (y04 or y14 = 2).

Terminating resistors

The end nodes on a Metasys N2 network must be terminated to avoid reflections on the bus line. The FRENIC-HVAC/AQUA is equipped with a termination switch to set a terminating resistor easily. If it serves as a terminating device in a network, the termination switch should be in the ON position. Otherwise the switch should be in the OFF position.



If an external termination connector is used, the switch should be in the OFF position.

Station address

The station address should be set using function code y01 or y11. For details, refer to CHAPTER 2.



The station address can not be changed when the inverter is in operation.

5.3 Point Mapping Tables

Accessing the inverter through a Metasys N2 network requires registering point maps to the Metasys.

AI: Analog input

BI: Bit input

AO: Analog output

BO: Bit output

AI and BI point mapping table

NPT	NPA	Units	Description	Range	Notes
AI	1	Hz	Output frequency	0 to 655.35	M09
AI	2	%	Output torque	-327.68 to 327.67	M07
AI	3	%	Output current	0 to 399.99	M11
AI	4	%	Motor output	-327.68 to 327.67	M64
AI	5	Vrms	Output voltage	0.0 to 1000.0	M12
AI	6	-	Alarm history (Latest)	0 to 255	M16
AI	7	-	Alarm history (Last)	0 to 255	M17
AI	8	-	PID output value	-32768 to 32767	M73, 20000 = 100%
AI	9	-	PID feedback value	-32768 to 32767	M72, 20000 = 100%
AI	10	h	Cumulative run time	0 to 65535	M20
AI	11	kWh	Watt-hour	0.001 to 9999	W81
AI	12	-	Control terminal [12] Input voltage	-32768 to 32767	M49, 20000 = 10 V
AI	13	-	Control terminal [C1] Input current	0 to 32767	M50, 20000 = 20 mA
AI	14	-	Control terminal [V2] Input voltage	-32768 to 32767	M54, 20000 = 10 V
AI	15	-	Parameter data read	float	
AI	16	A	Output current	0.00 to 9999	W05
AI	17	kW	Motor output	0.00 to 9999	W22
BI	1	-	FWD	0/1 = Off/On	M14 bit 0
BI	2	-	REV	0/1 = Off/On	M14 bit 1
BI	3	-	Trip	0/1 = Off/On	M14 bit 11
BI	4	-	Frequency arrival signal FAR	0/1 = Off/On	M70 bit 0
BI	5	-	Frequency detection FDT	0/1 = Off/On	M70 bit 1
BI	6	-	Inverter ready to run RDY	0/1 = Off/On	M70 bit 2
BI	7	-	Reserved.	-	
BI	8	-	Reserved.	-	
BI	9	-	Current limiter active	0/1 = Off/On	M14 bit 8
BI	10	-	In acceleration	0/1 = Off/On	M14 bit 9
BI	11	-	In deceleration	0/1 = Off/On	M14 bit 10
BI	12	-	Remote/local	0/1 = Local/remote	
BI	13	-	Y1 terminal	0/1 = Off/On	Defined by E20
BI	14	-	Y2 terminal	0/1 = Off/On	Defined by E21
BI	15	-	Y3 terminal	0/1 = Off/On	Defined by E22
BI	16	-	Y4 terminal	0/1 = Off/On	Defined by E23
BI	17	-	Y5 terminal	0/1 = Off/On	Defined by E24
BI	18	-	30ABC terminal	0/1 = Off/On	Defined by E25

AO point mapping table

NPT	NPA	Units	Description	Range	Notes
AO	1	Hz	Reference frequency	0 to 655.35	S05
AO	2	-	Universal AO	-32768 to 32767	S12, FMA (F31 = 10), 20000 = 100%
AO	3	-	Reserved.	-	
AO	4	-	Reserved.	-	
AO	5	-	Reserved.	-	
AO	6	-	Reserved.	-	
AO	7	s	Acceleration time	0.0 to 3600.0	S08
AO	8	s	Deceleration time	0.0 to 3600.0	S09
AO	9	-	PID command value	-32768 to 32767	S13, 20000 = 100%
AO	10	Hz	Frequency limiter, High	0.0 to 120.0	F15
AO	11	Hz	Frequency limiter, Low	0.0 to 120.0	F16
AO	12		PID mode selection	0 to 2	J01
AO	13	times	PID P-gain	0.000 to 30.000	J03
AO	14	s	PID I-time	0.0 to 3600.0	J04
AO	15		Function code number to read	0 to 65535	See Section 6.4.
AO	16		Function code number to write	0 to 65535	See Section 6.4.
AO	17		Function code data to write	float	

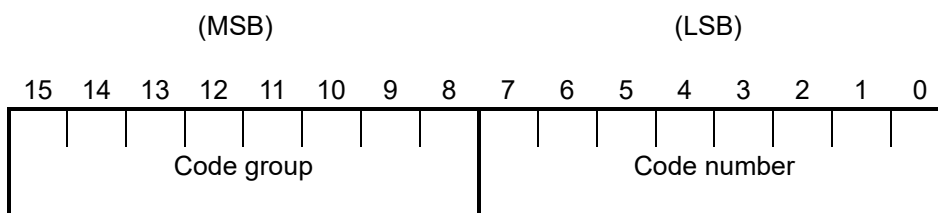
BO point mapping table

NPT	NPA	Units	Description	Range	Notes
BO	1	-	FWD	0/1 = Off/On	S06 bit 0
BO	2	-	REV	0/1 = Off/On	S06 bit 1
BO	3	-	X1	0/1 = Off/On	S06 bit 2
BO	4	-	X2	0/1 = Off/On	S06 bit 3
BO	5	-	X3	0/1 = Off/On	S06 bit 4
BO	6	-	X4	0/1 = Off/On	S06 bit 5
BO	7	-	X5	0/1 = Off/On	S06 bit 6
BO	8	-	X6	0/1 = Off/On	S06 bit 7
BO	9	-	X7	0/1 = Off/On	S06 bit 8
BO	10	-	Reserved.	-	
BO	11	-	Reserved.	-	
BO	12	-	Reserved.	-	
BO	13	-	Reset	0/1 = Off/On	S06 bit 15
BO	14	-	Universal DO Y1	0/1 = Off/On	S07 bit 0, E20 = 27
BO	15	-	Universal DO Y2	0/1 = Off/On	S07 bit 1, E21 = 27
BO	16	-	Universal DO Y3	0/1 = Off/On	S07 bit 2, E22 = 27
BO	17	-	Universal DO Y4	0/1 = Off/On	S07 bit 3, E23 = 27
BO	18	-	Universal DO Y5	0/1 = Off/On	S07 bit 4, E24 = 27
BO	19	-	Universal DO 30ABC	0/1 = Off/On	S07 bit 8, E25 = 27
BO	20		Data protection	0/1 = Off/On	F00

5.4 Reading and Writing from/to Function Codes

Function Code Numbers to Read and Write

Code group			Code name
0	0x00	-	Reserved.
2	0x02	S	Command data
3	0x03	M	Monitor data 1
4	0x04	F	Fundamental functions
5	0x05	E	Extension terminal functions
6	0x06	C	Control functions
7	0x07	P	Motor 1 parameters
8	0x08	H	High performance functions
9	0x09	A	Reserved.
10	0x0A	o	Option functions
11	0x0B	-	Reserved.
12	0x0C	r	Reserved.
13	0x0D	U	Application functions 3
14	0x0E	J	Application functions 1
15	0x0F	y	Link functions
16	0x10	W	Monitor 2
17	0x11	X	Alarm 1
18	0x12	Z	Alarm 2
19	0x13	b	Reserved.
20	0x14	d	Application functions 2
23	0x17	W1	Monitor 2
24	0x18	W2	Monitor 2
25	0x19	W3	Monitor 2
26	0x1A	X1	Alarm 3
29	0x1D	K	Keypad functions
30	0x1E	T	Clock timer functions
31	0x1F	-	Reserved
32	0x20	H1	High performance 1
33	0x21	o1	Option functions
34	0x22	U1	Application functions 3
35	0x23	M1	Monitor data 1
36	0x24	J1	Application functions J1
37	0x25	J2	Application functions J2
38	0x26	-	Reserved
39	0x27	J4	Application functions J4
40	0x28	J5	Application functions J5
41	0x29	J6	Application functions J6
42	0x2A	d1	Application functions 2
55	0x37	d2	Application functions 2
62	0x3E	o2	Option functions



5.5 Support Command Lists

Access to a Metasys system uses commands. In the support command lists given below, the inverter supports commands that respond with ACK.

Support Command List 1

Message	Command	Sub command	Region	NPA	Attribute number	Attribute type	Response	Error code	Note
Synch Time	0	0	-	-	-	-	ACK		No action.
Read Memory	0	1	-	-	-	-	NAK	01	
Poll Without ACK	0	4	-	-	-	-	ACK		
Poll With ACK	0	5	-	-	-	-	ACK		
Warm Start	0	8	-	-	-	-	NAK	01	
Status Update Request	0	9	-	-	-	-	ACK		See *1
Read Analog Input (Object Configuration)	1	-	1	0-6	1	Byte	ACK		
Read Analog Input (Object status & Value)	1	-	1	0-6	2	Byte Float	ACK		
Read Analog Input (Value)	1	-	1	0-6	3	Float	ACK		
Read Analog Input	1	-	1	0-6	4-7	-	NAK	11	
Read Analog Input (Low Alarm Limit)	1	-	1	0-6	8	Float	ACK		
Read Analog Input (Low Warning Limit)	1	-	1	0-6	9	Float	ACK		
Read Analog Input (High Warning Limit)	1	-	1	0-6	10	Float	ACK		
Read Analog Input (High Alarm Limit)	1	-	1	0-6	11	Float	ACK		
Read Analog Input (Differential)	1	-	1	0-6	12	Float	ACK		
Read Analog Input	1	-	1	0-6	13-14	Float	NAK	11	
Read Binary Input (Object Configuration)	1	-	2	0-17	1	Byte	ACK		
Read Binary Input (Object status)	1	-	2	0-17	2	Byte	ACK		
Read Binary Input	1	-	2	0-17	3-4	-	NAK	11	

*1 Device manufacturing model number = M23 + M24 + M2 + "0000", Days in service = M20, Device status = "0000".

Support Command List 2

Message	Command	Sub command	Region	NPA	Attribute number	Attribute type	Response	Error code	Note
Read Analog Output (Object Configuration)	1	-	3	0-8	1	Byte	ACK		
Read Analog Output (Object status)	1	-	3	0-8	2	Byte	ACK		
Read Analog Output (Current Value)	1	-	3	0-8	3	Float	ACK		
Read Analog Output	1	-	3	0-8	4-5	Float	NAK	11	
Read Binary Output (Object Configuration)	1	-	4	0-18	1	Byte	ACK		
Read Binary Output (Object status)	1	-	4	0-18	2	Byte	ACK		
Read Binary Output (Minimum On-time)	1	-	4	0-18	3	Integer	ACK		Return attribute value is "00."
Read Binary Output (Minimum Off-time)	1	-	4	0-18	4	Integer	ACK		Return attribute value is "00."
Read Binary Output (Maximum Cycles/Hour)	1	-	4	0-18	5	Integer	ACK		Return attribute value is "00."
Read Binary Output	1	-	4	0-18	6-7	Integer	NAK	11	
Read Internal Parameter	1	-	5-8	-	1-2	-	NAK	01	
Write Analog Input (Object Configuration)	2	-	1	0-6	1	Byte	ACK		
Write Analog Input	2	-	1	0-6	2-7	-	NAK	11	
Write Analog Input (Low Alarm Limit)	2	-	1	0-6	8	Float	ACK		
Write Analog Input (Low Warning Limit)	2	-	1	0-6	9	Float	ACK		
Write Analog Input (High Warning Limit)	2	-	1	0-6	10	Float	ACK		
Write Analog Input (High Alarm Limit)	2	-	1	0-6	11	Float	ACK		
Write Analog Input (Differential)	2	-	1	0-6	12	Float	ACK		
Write Analog Input	2	-	1	0-6	13-14	Float	NAK	11	
Write Binary Input (Object Configuration)	2	-	2	0-17	1	Byte	ACK		
Write Binary Input	2	-	2	0-17	2-4	-	NAK	11	

Support Command List 3

Message	Command	Sub command	Region	NPA	Attribute number	Attribute type	Response	Error code	Note
Write Analog Output (Object Configuration)	2	-	3	0-8	1	Byte	ACK		
Write Analog Output	2	-	3	0-8	2-5	-	NAK	11	
Write Binary Output (Object Configuration)	2	-	4	0-18	1	Byte	ACK		
Write Binary Output (Object status)	2	-	4	0-18	2	Byte	NAK	11	
Write Binary Output (Minimum On-time)	2	-	4	0-18	3	Integer	ACK		No action
Write Binary Output (Minimum Off-time)	2	-	4	0-18	4	Integer	ACK		No action
Write Binary Output (Maximum Cycles/Hour)	2	-	4	0-18	5	Integer	ACK		No action
Write Binary Output	2	-	4	0-18	6-7	Integer	NAK	11	
Write Internal Parameter	2	-	5-8	-	-	-	NAK	11	
Override Analog Input	7	2	1	0-6	-	Float	ACK		No action
Override Binary Input	7	2	2	0-17	-	Byte	ACK		No action
Override Analog Output	7	2	3	0-8	-	Float	ACK		
Override Binary Output	7	2	4	0-18	-	Byte	ACK		
Override Internal Parameter	7	2	5-8	-	-	-	NAK	01	
Override Release Request	7	3	1-8	-	-	-	ACK		
Write Analog Input Attributes Request	7	7	1	0-6	-	-	NAK	01	
Write Binary Input Attributes Request	7	7	2	0-17	-	-	NAK	01	
Write Analog Output Attributes Request	7	7	3	0-8	-	-	NAK	01	
Write Binary Output Attributes Request	7	7	4	0-18	-	-	NAK	01	
Read Analog Input Attributes Request	7	8	1	0-6	-	-	NAK	01	
Read Binary Input Attributes Request	7	8	2	0-17	-	-	NAK	01	
Read Analog Output Attributes Request	7	8	3	0-8	-	-	NAK	01	
Read Binary Output Attributes Request	7	8	4	0-18	-	-	NAK	01	

Support Command List 4

Message	Command	Sub command	Region	NPA	Attribute number	Attribute type	Response	Error code	Note
Identify Device Type	F	-	-	-	-	-	ACK		Device code = "10"
Upload Request	8	0-1	-	-	-	-	NAK	01	
Upload Record	8	3	-	-	-	-	NAK	01	
Upload Complete	8	4	-	-	-	-	NAK	01	
Download Request	9	0-1	-	-	-	-	NAK	01	
Download Record	9	3	-	-	-	-	NAK	01	
Download Complete	9	4	-	-	-	-	NAK	01	

CHAPTER 6

BACnet MS/TP

BACnet MS/TP is a serial communications protocol defined by ANSI/ASHRAE Standard 135-1995 or 135-2020. It is used in building automation.

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6.1 Messages

6.1.1 Communications specifications

Item	Specifications
Physical level	EIA RS-485
Wiring distance	500 m (1640 ft) max.
Number of nodes	Total of 128
Transmission speed	9600, 19200, 38400, 76800 bits/s
Transmission mode	Half duplex
Bus topology	Master-Slave/Token Passing (MS/TP)
Character code	ASCII 7 bits (fixed)
Character length	8 bits (fixed)
Stop bit	1 bit (fixed)
Frame length	Variable length
Parity	None (fixed)
Error checking	CRC

6.2 Compatible Model Setup

Node address

Set the node address within the range of 0 to 127 using function code y01 or y11. Setting 128 or more is treated as 127.

Baud rate

Select the baud rate using function code y04 or y14. The typical baud rate of BACnet is 9600 bits/s. In addition to 9600 bits/s, 19200 , 38400 and 76800 bits/s can be selected on supported models.

Selecting 2400 or 4800 bits/s is treated as 9600 bits/s.

Protocol

Select BACnet (y10 or y20 = 5).

Character length, parity, and stop bit

These are fixed in BACnet. No setting is required.

Terminating resistors

The end nodes on a BACnet network must be terminated to avoid reflections on the bus line. Compatible models are equipped with a termination switch to set a terminating resistor easily. If it serves as a terminating device in a network, the termination switch should be in the ON position. Otherwise the switch should be in the OFF position.



If an external termination connector is used, the switch should be in the OFF position.

6.3 Property Identifiers

Supported models support the following property identifiers.

Property Identifier	Enum Value	Device	Analog Input	Analog Output	Analog Value	Binary Input	Binary Output	Binary Value	Remarks	Property Identifier
Object Identifier	75	Y	Y	Y	Y	Y	Y	Y	Y	
Object Name	77	Y	Y	Y	Y	Y	Y	Y	Y	
Object Type	79	Y	Y	Y	Y	Y	Y	Y	Y	
System Status	112	Y								OPERATIONAL (fixed)
Vendor Name	121	Y								Fuji Electric Co., Ltd.
Vendor Identifier	120	Y								Example) 700 *2
Model Name	70	Y								FRENIC-□□□□ *3
Firmware Revision	44	Y								Example) 1.00 *2
Application Software Version	12	Y								Example) 0500 *2
Protocol Version	98	Y								1
Protocol Revision	139	Y								
Protocol Services Supported	97	Y								
Protocol Object Supported	96	Y								
Object List	76	Y								
Max APDU Length Accepted	62	Y								
Segmentation Supported	107	Y								NO_SEGMENTATION(3)
APDU Timeout	11	Y								Example) 0 *2
Number of APDU Retries	73	Y								Example) 0 *2
Device Address Binding	30	Y								NULL
Database Revision	155	Y								1
Present Value	85		Y	Y	Y	Y	Y	Y		
Status Flags	111		Y	Y	Y	Y	Y	Y	Y	
Event State	36		Y	Y	Y	Y	Y	Y		
Out of Service	81		Y	Y	Y	Y	Y	Y	Y	
Units	117		Y	Y	Y					
Polarity	84					Y	Y			
Priority Array *2	87			Y	Y *1		Y	Y *1		
Relinquish Default	104			Y	Y *1		Y	Y *1		
Current command Priority	431			Y	Y *1		Y	Y *1		
Max Master	64	Y							Y	ex) 127 *2
Max Info Frames	63	Y							Y	ex) 1 *2
Reliability	103								Y	NO_FAULT_DETECTED(0)
Network_Type	427								Y	MSTP(2)
Protocol_Level	482								Y	BACNET_APPLICATION(2)
Changes_Pending	416								Y	
MAC_Address	423								Y	
Link_Speed	420								Y	
Link Speeds	421								Y	
Network_Number	425								Y	
Network_Number_Quality	426								Y	
APDU_Length	399								Y	
Property_List *2	371	Y	Y	Y	Y	Y	Y	Y	Y	

*1 Not supported in Object of Read only type.

*2 These are typical examples. The support status and response differ depending on the model.

Refer to "8.7 Differences Between Functions" for details.

*3 □□□□ is replaced with the respective model name (e.g., MEGA).

6.4 Binary Point Table

The binary point table contains items for which access is possible with 2-value data from among commands to the inverter, and the inverter status monitor. There is a binary value (BV), binary input (BI), and binary output (BO) object type, and support for each is shown in the following table. However, a response is not possible for objects that do not exist as X-terminals or Y-terminals for each model.

Object Type	Object Instance	Object Name	Function code	R/W
BV	0	Forward_Command	S06 : bit00	R/W
BV	1	Reverse_Command	S06 : bit01	R/W
BV	2	Alarm_Reset	S06 : bit15	R/W
BV	3	Forward_Rotation	M14 : bit00	R
BV	4	Reverse_Rotation	M14 : bit01	R
BV	5	DC_Braking/Pre_exiting	M14 : bit02	R
BV	6	Inverter_Shut_Down	M14 : bit03	R
BV	7	Braking	M14 : bit04	R
BV	8	DC_Voltage_Est	M14 : bit05	R
BV	9	Torque_Limiting	M14 : bit06	R
BV	10	Voltage_Limiting	M14 : bit07	R
BV	11	Current_Limiting	M14 : bit08	R
BV	12	Acceleration	M14 : bit09	R
BV	13	Deceleration	M14 : bit10	R
BV	14	Alarm_Relay	M14 : bit11	R
BV	15	Communications_Act	M14 : bit12	R
BV	16	Busy	M14 : bit15	R
BV	17	X1_Communications	S06 : bit02	R/W
BV	18	X2_Communications	S06 : bit03	R/W
BV	19	X3_Communications	S06 : bit04	R/W
BV	20	X4_Communications	S06 : bit05	R/W
BV	21	X5_Communications	S06 : bit06	R/W
BV	22	X6_Communications	S06 : bit07	R/W
BV	23	X7_Communications	S06 : bit08	R/W
BV	24	XF_Communications	S06 : bit13	R/W
BV	25	XR_Communications	S06 : bit14	R/W
BV	26	X8_Communications	S06 : bit09	R/W
BV	27	X9_Communications	S06 : bit10	R/W
BI	0	X1_Final	M13 : bit02	R
BI	1	X2_Final	M13 : bit03	R
BI	2	X3_Final	M13 : bit04	R
BI	3	X4_Final	M13 : bit05	R
BI	4	X5_Final	M13 : bit06	R
BI	5	X6_Final	M13 : bit07	R
BI	6	X7_Final	M13 : bit08	R
BI	7	EN_Final	M13 : bit11	R
BI	8	XF_Final	M13 : bit13	R
BI	9	XR_Final	M13 : bit14	R
BI	10	X8_Final	M13 : bit09	R
BI	11	X9_Final	M13 : bit10	R
BO	0	Y1_Communications	S07 : bit00	R/W
BO	1	Y2_Communications	S07 : bit01	R/W

Object Type	Object Instance	Object Name	Function code	R/W
BO	2	Y3_Communications	S07 : bit02	R/W
BO	3	Y4_Communications	S07 : bit03	R/W
BO	4	Y5_Communications	S07 : bit04	R/W
BO	5	30_Communications	S07 : bit08	R/W

About binary points

BV0 to BV2 and BV17 to BV27 enable access to each bit of communications command S06.

BI1 to BI11 indicate the final values of run commands being recognized by the inverter, including S06.

To change communications commands from the host, use BV0 to BV2 and BV17 to BV27.

6.5 Analog Point Table

The analog point table contains items for which access is possible with 2-value data from among commands to the inverter, and the inverter status monitor. There is an analog value (AV) and an analog output (AO) object type, and support for each is shown in the following table. The support status differs depending on the model. Refer to "8.7 Differences Between Functions" for details.

For details about the unit and setting range of each data, refer to each function code of data formats in Chapter 7.

Object type	Object instance	Object name	Units	Function Code	R/W
AV	0	Frequency_Command_Sp_Hz	Hz	S05	R/W
AV	1	PID_cmd_ %	%	S13	R/W
AV	2	Frequency_Command_Hz	Hz	M05	R
AV	3	Output_Torque_ %	%	M07	R
AV	4	Input_Power_ %	%	M10	R
AV	5	Output_Current_ %	%	M11	R
AV	6	Output_Voltage_V	V	M12	R
AV	7	Latest_Alarm	-	M16	R
AV	8	Operation_Time_h	h	M20	R
AV	9	DC_Link_Voltage_V	V	M21	R
AV	10	Inverter_Air_Te_C	°C	M61	R
AV	11	Inverter_Heat_Sink_Te_C	°C	M62	R
AV	12	PID_Feedback	-	M72	R
AV	13	PID_Output	-	M73	R
AV	14	Parameter_Select_0	*1	-	-
AV	15	Parameter_Value_0	-	-	R/W
AV	16	Parameter_Select_1	-	-	R/W
AV	17	Parameter_Value_1	-	-	R/W
AV	18	Parameter_Select_2	-	-	R/W
AV	19	Parameter_Value_2	-	-	R/W
AV	20	Parameter_Select_3	-	-	R/W
AV	21	Parameter_Value_3	-	-	R/W
AV	22	Parameter_Select_4	-	-	R/W
AV	23	Parameter_Value_4	-	-	R/W
AV	24	Frequency_Command_Sp_ %	%	W31	R
AV	25	Frequency_Command_ %	%	W30	R
AV	26	Input_Power_kW	kW	W21	R
AV	27	Output_Current_A	A	W05	R
AV	28	Parameter_Select_5	-	-	R/W
AV	29	Parameter_Value_5	-	-	R/W
AV	30	Parameter_Select_6	-	-	R/W
AV	31	Parameter_Value_6	-	-	R/W
AV	32	Parameter_Select_7	-	-	R/W
AV	33	Parameter_Value_7	-	-	R/W
AV	34	Parameter_Select_8	-	-	R/W
AV	35	Parameter_Value_8	-	-	R/W
AV	36	Parameter_Select_9	-	-	R/W
AV	37	Parameter_Value_9	-	-	R/W
AV	38	Parameter_Select_10	-	-	R/W

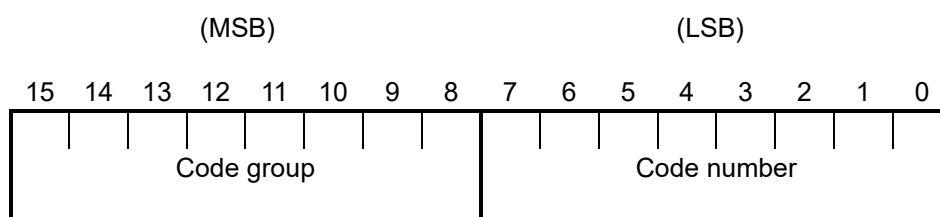
Object type	Object instance	Object name	Units	Function Code	R/W
AV	39	Parameter_Value_10	-	-	R/W
AV	40	Parameter_Select_11	-	-	R/W
AV	41	Parameter_Value_11	-	-	R/W
AV	42	Parameter_Select_12	-	-	R/W
AV	43	Parameter_Value_12	-	-	R/W
AV	44	Parameter_Select_13	-	-	R/W
AV	45	Parameter_Value_13	-	-	R/W
AV	46	Parameter_Select_14	-	-	R/W
AV	47	Parameter_Value_14	-	-	R/W
AO	0	Universal_AO	-	S12	R/W

*1 Enter a function code address to Parameter_Select (AV14). For function code addresses, refer to Section 6.6. set HEX-code to AV14. If the function code is S05, for example, set "0x705" to AV14.

6.6 Reading and Writing from/to Function Codes

Function code Nos. for reading and writing

Group	Code	Name	Group	Code	Name
F	0	00 _H Fundamental functions	U	11	0B _H Application functions 3
E	1	01 _H Extension terminal functions	U1	39	27 _H Application functions 3
C	2	02 _H Control functions	y	14	0E _H Link functions
P	3	03 _H Motor 1 parameters	o	6	06 _H Optional functions
H	4	04 _H High performance functions	o1	37	25 _H Optional functions
H1	31	1F _H High performance functions	o2	38	26 _H Optional functions
A	5	05 _H Motor 2 parameters	T	29	1D _H Timer functions
b	18	12 _H Motor 3 parameters	K	28	1C _H Keypad functions
r	10	0A _H Motor 4 parameters	S	7	07 _H Command/Function data
J	13	0D _H Application functions 1	M	8	08 _H Monitor data 1
J1	48	30 _H Application functions 1	M1	35	23 _H Monitor data 1
J2	49	31 _H Application functions 1	W	15	0F _H Monitor data 2
J4	51	33 _H Application functions 1	W1	22	16 _H Monitor data 2
J5	52	34 _H Application functions 1	W2	23	17 _H Monitor data 2
J6	53	35 _H Application functions 1	W3	24	18 _H Monitor data 2
d	19	13 _H Application functions 2	X	16	10 _H Alarm data 1
d1	54	36 _H Application functions 2	X1	25	19 _H Alarm data 1
d2	55	37 _H Application functions 2	Z	17	11 _H Alarm data 2



CHAPTER 7

FUNCTION CODES AND DATA FORMATS

This chapter describes communications dedicated function codes and the data formats of communications frames. FRENIC-Mini, FRENIC-Eco and FRENIC-Multi support different function codes. For details, see the description of each function code.

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7.1 Communications Dedicated Function Codes

7.1.1 About communications dedicated function codes

Communications dedicated function codes are available to monitor the operation and status of the inverter via communications. They are classified into the groups shown in Table 7.1 below:

Table 7.1 Types of communications dedicated function codes

Communications dedicated function code group	Function
S	Command data
M	Monitor data 1 (for reading only)
M1	Monitor data 1 (for reading only)
W	Monitor data 2 (for reading only)
W1	Monitor data 2 (for reading only)
W2	Monitor data 2 (for reading only)
W3	Monitor data 2 (for reading only)
X	Alarm information (for reading only)
X1	
Z	

The sections that follow describe communications dedicated function codes of each group.

7.1.2 Command data

[1] List of command data

The table below shows the function codes (S code) for the command data. The "Support" column indicates whether the function code is supported or not. The symbol "O" means that the code is supported and the symbol "X" means that the code is not supported.

Table 7.2 List of command data

Code	Name	Function	Permissible setting range	Unit	R/W *1
S01	Frequency reference (p.u.) *2	Frequency command issued through communications (the reference value for maximum frequency)	-32768 to 32767 (Max frequency: at +/- 20000)	–	R/W
S02	Torque command	Torque command from communication function	-327.68 to 327.67	%	R/W
S03	Torque current command	Torque current command from communication function	-327.68 to 327.67	%	R/W
S05	Frequency reference *2	Frequency command issued through communications (in units of 0.01 Hz)	0.00 to 655.35	Hz	R/W
S06	Operation command	Operation command issued through communications [general input terminal functions (X1 to X9, XF (FWD), R (REV)) and FWD, REV, RST only through communications]	0000 _H to FFFF _H	–	R/W
S07	Universal DO	Command issued to DO terminal through communications	0000 _H to FFFF _H	–	R/W
S08	Acceleration time F07	Each data is set with the code or communications format common to all the inverter types.	0.0 to 6000.0	s	R/W
S09	Deceleration time F08		0.0 to 6000.0	s	R/W
S10	Torque limit level 1 F40		20 to 200, 999	%	R/W
	Torque limit value		-300.00 to 300.00, 999		
S11	Torque limit level 2 F41		20 to 200, 999	%	R/W
	Torque limit value		-300.00 to 300.00, 999		
S12	Universal AO	Command issued to AO terminal through communications	-32768 to 32767 (Full scale: at +/- 20,000)	–	R/W
S13	PID command	PID command issued through communications	-32768 to 32767 (+/- 20000 corresponds to +/- 100%)	–	R/W
S14	Alarm reset command	Alarm reset command issued through communications	0 or 1	–	R/W
S15	Torque bias command	Torque bias command from communication	-327.68 to 327.67	%	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

*2 ROM version which is older than 0800 is not applicable to FRENIC-Multi.

Table 7.2 List of command data (Continued)

Code	Name	Function	Permissible setting range	Unit	R/W *1
S19	Speed command *2	Speed command issued via communications	-32768 to 32767	r/min	R/W
S20	Positioning data (High order)		-9999 to 9999	-	R/W
S21	Positioning data (Low order)		0 to 9999	-	R/W
S31	External PID1 command	PID command from communication	-32768 to 32767 ($\pm 100\%$ when ± 20000)	-	R/W
S32	External PID2 command			-	R/W
S33	External PID3 command			-	R/W
S90	Current year and month	Clock data settings from communication	2012 to 2099 January to December	-	R/W
S91	Current day and time		1st to 31st 00:00 to 23:59	-	R/W
S92	Current minute and second		0 to 59 min 0 to 59 sec	-	R/W
S93	Clock data settings		0 or 1	-	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

Read/*2 If a value is set for S01, S05, and S19, operation is performed in order of priority S01 → S05 → S19.

[2] Frequency and PID command data

Table 7.3 Function codes for frequency and PID command data

Code	Name	Function	Permissible setting range	Unit	R/W *1
S01	Frequency reference (p.u.)	Frequency command via communications (value based on the maximum frequency)	-32768 to 32767 ($\pm 20,000$ = maximum frequency)	—	R/W
S05	Frequency reference	Frequency command from communications (by 0.01Hz)	0.00 to 655.35	Hz	R/W
S13	PID command	PID command from communications	-32768 to 32767 ($\pm 100\%$ at $\pm 20,000$)	—	R/W
S19	Speed command	Speed command issued via communications	-32768 to 32767	r/min	R/W
S31	External PID remote command 1	PID command from communication	-32768 to 32767 ($\pm 100\%$ when ± 20000)	-	R/W
S32	External PID remote command 2	PID command from communication	-32768 to 32767 ($\pm 100\%$ when ± 20000)	-	R/W
S33	External PID remote command 3	PID command from communication	-32768 to 32767 ($\pm 100\%$ when ± 20000)	-	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

- 1) When both S01 and S05 are set and S01 is not 0, the command of S01 has precedence over that of S05. (All inverter models) When both S05 and S19 are specified and S05 is not 0, the S05 command takes precedence over the other command.
- 2) The actual operation specified by each command is limited by internal processing of the inverter. For example, a value over 20,000 can be written to S01, but the actual frequency is limited to the maximum frequency or to the upper limit frequency set with another function code. (The FRENIC-Mini/Eco treats negative data of S13 as 0.)
- 3) When an attempt is made to read the command data shown here, the data previously directed by communications, not the command value for actual operation, will be read. (Obtain the latest command value by reading the M code.)
- 4) At S01, set a value based on $\pm 20,000$ as the maximum frequency. For example, when the maximum frequency is 60Hz, set 20,000 at S01 with a set frequency of 60Hz, or 10,000 with a set frequency of 30Hz.

[3] Operation command data

Table 7.4 Function codes for operation command data

Code	Name	Function	Permissible setting range	Unit	R/W *1
S06	Operation command	Operation command via communications (general-purpose input terminal functions (X1 – X9, XF (FWD), XR (REV)) and communications dedicated command (FWD, REV, RST)	0000 _H to FFFF _H	–	R/W
S14	Alarm reset command	Alarm reset command via communications	0 or 1	–	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

- 1) To make alarm resetting with S06, bit 15 must be set to 1 and then set back to 0. Alarm resetting is impossible unless the communications side is made valid by the settings of function codes H30, y98, and y99 and the "LE" assigned terminal.
- 2) S14 does not require the operation described in 1) above, and writing 1 permits alarm resetting (because writing the value once turns ON the reset command that will be turned OFF after a specific period of time). This command is 0 whenever it is read, and is always valid, irrespective of function codes H30, y98, and y99 and the status of the "LE" assigned terminal.
- 3) X1 – X9, XF (FWD), and XR (REV) operate according to the functions set with function codes E01 – E09, E98, and E99. Refer to the User's Manual for each model for the number of general-purpose input terminals.
- 4) When giving operation command S06 via communications, the relation between S06 and the inverter terminal (external signal input) command is shown in Table 7.6 on the next page. The "Support" column of the table indicates whether each function is supported by the respective models or not. ○ indicates the function is supported, and × indicates the function is not supported.

 WARNING

If alarm resetting is performed with the operation command (S06) uncleared, the inverter will start to operate just upon alarm resetting. Before alarm resetting, confirm that the operation command is cleared.

Otherwise, an accident may result.

Table 7.5 Relation between operation command (S06) and inverter terminal command (external signal input)

Function				When not assigned (positive logic)	Function active direction* 1	Command	
Type	Assign- ment number	Internal operation command symbol	Name			Com- Munic- Ations *1	Terminal block
Fixed function	-	FWD	Forward operation/stop command	-	ON	Valid	Invalid
		REV	Reverse operation/stop command	-	ON		
		RST	Alarm reset	-	ON		
General- purpose input	0	SS1	Multistep frequency selection (0 to 1steps)	OFF	ON	Valid	Invalid
	1	SS2	Multistep frequency selection (0 to 3steps)	OFF	ON		
	2	SS4	Multistep frequency selection (0 to 7steps)	OFF	ON		
	3	SS8	Multistep frequency selection (0 to 15steps)	OFF	ON		
	4	RT1	Acceleration/deceleration time selection (2steps)	OFF	ON		
	5	RT2	Acceleration/deceleration time selection (4steps)	OFF	ON		
X1	6	HLD	3-wire operation stop command	OFF	ON	Invalid	
X2	7	BX	Coast-to-stop command	OFF	ON	Valid	
X3	8	RST	Alarm reset	OFF	ON		
X4	9	THR	Trip command (External fault)	ON	OFF	Invalid	Valid
X5	10	JOG	Jogging operation	OFF	ON	Invalid	
X6	11	Hz2/Hz1	Frequency setting 2/1 switching command	OFF	ON	Valid	Invalid
X7	12	M2/M1	Motor 2 /motor 1	OFF	ON	Valid	Invalid
		M2	Motor selection 2	OFF	ON	Valid	Invalid
X8	13	DCBRK	DC braking command	OFF	ON	Valid	Invalid
X9	14	TL2/TL1	Torque limit 2/torque limit 1	OFF	ON		
XF (FWD)	15	SW50	Switching to commercial power supply (50Hz)	OFF	ON		
XR (REV)	16	SW60	Switching to commercial power supply (60Hz)	OFF	ON		
(Note)	17	UP	UP command	OFF	ON	Invalid	Valid
	18	DOWN	DOWN command	OFF	ON		
	19	WE-KP	Write enable for keypad	ON	ON	Valid	
	20	Hz/PID	PID control cancel	OFF	ON	Valid	Invalid
	21	IVS	Normal/Inverse mode changeover	OFF	ON		
	22	IL	Interlock	OFF	ON	Invalid	Valid
	24	LE	Link operation enable	ON	ON		
	25	U-DI	Universal DI	OFF	ON		
	26	STM	Start characteristic selection	ON	ON	Valid	
				OFF	ON	Valid	
30	STOP	Forced stop	ON	OFF *2	Valid		

(Note) X4 and X5 are not provided for FRENIC-Mini.

X6, X7, X8, and X9 are provided only for FRENIC-MEGA.

*1 When the command is given through the communications, negative logic setting is invalid.

Table 7.5 Relation between operation command (S06) and inverter terminal command (external signal input)
(Continued)

Type	Assign- ment number	Internal operation command symbol	Function Name	When not assigned (positive logic)	Function active direction* 1	Command	
						Com- Munica- tions *1	Terminal block
General- purpose input X1 X2 X3 X4 X5 X6 X7 X8 X9 XF (FWD) XR (REV) (Note)	32	EXITE	Preparatory excitation	OFF	ON	Valid	Invalid
	33	PID-RST	PID integration/differential reset	OFF	ON	Valid	Invalid
	34	PID-HLD	PID integration hold	OFF	ON	Valid	Invalid
	35	LOC	Local (keypad) command selection	OFF	ON	Invalid	Valid
	36	M3	Motor selection 3	OFF	ON	Valid	Invalid
	37	M4	Motor selection 4	OFF	ON		
	38	RE	Run enable	ON	ON	Valid	Invalid
	39	DWP	Condensation protection	OFF	ON		
	40	ISW50	Switching to commercial power supply incorporated sequence (50Hz)	OFF	OFF		
	41	ISW60	Switching to commercial power supply incorporated sequence (60Hz)	OFF	OFF	Valid	Invalid
	42	LS	Zero limit switch	OFF	ON		
	43	S/R	Start/reset	OFF	ON		
	44	SPRM	Serial pulse receive mode	OFF	ON	Invalid	Valid
	45	RTN	Return mode	OFF	ON		
	46	OLS	Overload stop valid command	OFF	ON	Valid	Invalid
	47	LOCK	Servo lock command	ON	ON	Valid	Invalid
	48	PIN	Pulse train input	OFF	ON	Invalid	Valid
	49	SIGN	Pulse train sign	OFF	ON	Invalid	Valid
	50	"MCLR"	Running motor regular switching time clear	OFF	ON	Enable	Disable
	58	"STZ"	UP/DOWN frequency clear	OFF	ON	Enable	Enable
	59	"BATRY"	Effective battery operation life	OFF	ON	Enable	Enable
	60	"TB1"	Torque bias command 1	OFF	ON	Enable	Disable
	61	"TB2"	Torque bias command 2	OFF	ON	Enable	Disable
	62	"H-TB"	Hold torque bias	OFF	ON	Enable	Disable
	65	"BRKE"	Brake check	OFF	ON	Disable	Enable
	69	"PPT"	Magnetic pole position tuning command	OFF	ON	Enable	Disable
	70	"Hz/LSC"	Cancel line speed control	OFF	ON	Enable	Disable
	71	"LSC-HLD"	Hold line speed control frequency in the memory	OFF	ON	Enable	Disable
	72	CRUN-M1	Input during operation by commercial power (Motor 1)	OFF	ON	Valid	Valid
	73	CRUN-M2	Input during operation by commercial power (Motor 2)	OFF	ON		
	74	CRUN-M3	Input during operation by commercial power (Motor 3)	OFF	ON		

(Note) X4 and X5 are not provided for FRENIC-Mini.
X6, X7, X8, and X9 are provided only for FRENIC-MEGA.

*1 When the command is given through the communications, negative logic setting is invalid.

Table 7.5 Relation between operation command (S06) and inverter terminal command (external signal input)
(Continued)

Type	Assign- ment number	Function		When not assigned (positive logic)	Function active direction* 1	Command	
		Internal operation command symbol	Name			Com- Munica- tions *1	Terminal block
General- purpose input	75	CRUN- M4	Input during operation by commercial power (Motor 4)	OFF	ON	Valid	Valid
	76	DROOP	Droop selection	OFF	ON	Valid	Invalid
	77	PG-CCL	PG alarm cancel	OFF	ON		
	78	"MPRM1"	Speed control parameter selection 1	OFF	ON	Enable	Disable
	79	"MPRM2"	Speed control parameter selection 2	OFF	ON	Enable	Disable
	80	"CLC"	Cancel customizable logic	OFF	ON	Enable	Disable
	81	"CLTC"	Clear all customizable logic timers	OFF	ON	Enable	Disable
	82	"AR-CCL"	Cancel anti-regenerative control	OFF	ON	Enable	Disable
	83	"PG-SEL"	PG input switching	OFF	ON	Enable	Enable
	84	"BPS"	Acceleration/deceleration time cancel (bypass)	OFF	ON	Enable	Disable
	X1	FR2/FR1	Run command 2/run command 1	OFF	ON	Valid	Invalid
	X2	FWD2	Forward run/stop command 2	OFF	ON		
	X3						
	X4	REV2	Reverse run/stop command 2	OFF	ON		
	X5	"FJOG"	Forward rotation JOG	OFF	ON		
	X6	"RJOG"	Reverse rotation JOG	OFF	ON		
	X7	"DIR"	Command direction switching	OFF	ON	Valid	Valid
	X8	FWD *2	Forward operation/stop command	OFF	ON	Valid	Invalid
	X9	REV *2	Reverse operation/stop command	OFF	ON		
	XF (FWD)	100	"NONE"	-	-	-	-
	XR (REV)	105	"LAC-ENB"	OFF	ON	Enable	Disable
		110	"SLG2"	OFF	ON	Enable	Disable
	(Note)	111	"STOP-T"	ON	OFF	Disable	Enable
		116	"AVR-CCL"	OFF	ON	Enable	Disable
		119	"P-SEL"	OFF	ON	Enable	Enable
		121	"CLI1"	OFF	ON	Enable	Enable
		122	"CLI2"	OFF	ON		
		123	"CLI3"	OFF	ON		
		124	"CLI4"	OFF	ON		
		125	"CLI5"	OFF	ON		
		126	"CLI6"	OFF	ON		
		127	"CLI7"	OFF	ON		
		128	"CLI8"	OFF	ON		
		129	"CLI9"	OFF	ON		

(Note) X4 and X5 are not provided for FRENIC-Mini.

X6, X7, X8, and X9 are provided only for FRENIC-MEGA.

*1 When the command is given through the communications, negative logic setting is invalid.

*2 Terminals FWD/REV only

Table 7.5 Relation between operation command (S06) and inverter terminal command (external signal input)
(Continued)

Type	Assign- ment number	Function		When not assigned (positive logic)	Function active direction* 1	Command	
		Internal operation command symbol	Name			Com- Munica- tions *1	Terminal block
General- purpose input	130	"BST"	Boost command	OFF	ON	Enable	Disable
	131	"FS"	Flow switch	OFF	ON	Enable	Disable
	132	"FRC"	Filter clogging reverse command	OFF	ON	Enable	Disable
	133	"PID2/1"	PID channel switching	OFF	ON	Enable	Disable
	134	"FMS"	Forced operation command	OFF	ON	Enable	Enable
	135	"INC/ABS"	Travel relative/absolute position switching	OFF	ON	Enable	Disable
	136	"ORT"	Orientation command	OFF	ON	Enable	Disable
	137	"POS/HZ"	Position control/speed control switching	OFF	ON	Enable	Disable
	138	"ORG"	Homing command	OFF	ON	Enable	Disable
	139	" +OT"	+direction overtravel	ON	OFF	Disable	Enable
	140	" -OT"	-direction overtravel	ON	OFF	Disable	Enable
	141	"P-CLR"	Position clear command	OFF	ON	Enable	Enable
	142	"P-PRESET"	Position preset command	OFF	ON	Enable	Enable
	143	"TEACH"	Teaching command	OFF	ON	Enable	Enable
	144	"POS-SET"	Positioning data change command	OFF	ON	Enable	Disable
	145	"POS-SEL1"	Positioning data selection 1	OFF	ON	Enable	Disable
	146	"POS-SEL2"	Positioning data selection 2	OFF	ON	Enable	Disable
	147	"POS-SEL4"	Positioning data selection 4	OFF	ON	Enable	Disable
	149	"PCHG"	Pump control switching command	OFF	ON	Enable	Disable
	150	"MEN0"	Rotary control master motor	OFF	ON	Disable	Enable
	151	"MEN1"	Pump control motor 1	OFF	ON	Disable	Enable
	152	"MEN2"	Pump control motor 2	OFF	ON	Disable	Enable
	153	"MEN3"	Pump control motor 3	OFF	ON	Disable	Enable
	154	"MEN4"	Pump control motor 4	OFF	ON	Disable	Enable
	155	"MEN5"	Pump control motor 5	OFF	ON	Disable	Enable
	156	"MEN6"	Pump control motor 6	OFF	ON	Disable	Enable
	157	"MEN7"	Pump control motor 7	OFF	ON	Disable	Enable
	158	"MEN8"	Pump control motor 8	OFF	ON	Disable	Enable
	159	"ICSW"	For manufacturer	-	-	-	-
	160	"ICFB"	For manufacturer	-	-	-	-
	161	"LCFB"	For manufacturer	-	-	-	-
	169	"D-SET"	Initial diameter set command	OFF	ON	Enable	Disable
	170	"D-HLD"	Winding diameter calculation hold command	OFF	ON	Enable	Disable
	171	"PID-SS1"	PID control multistep command 1	OFF	ON	Enable	Disable
	172	"PID-SS2"	PID control multistep command 2	OFF	ON	Enable	Disable

(Note) X4 and X5 are not provided for FRENIC-Mini.

X6, X7, X8, and X9 are provided only for FRENIC-MEGA.

*1 When the command is given through the communications, negative logic setting is invalid.

Table 7.5 Relation between operation command (S06) and inverter terminal command (external signal input)
(Continued)

Type	Assign- ment number	Function		When not assigned (positive logic)	Function active direction* 1	Command	
		Internal operation command symbol	Name			Com- Munica- tions *1	Terminal block
General- purpose input	181	"EPID- SS1"	External PID control multistep command 1	OFF	ON	Enable	Disable
	182	"EPID- SS2"	External PID control multistep command 2	OFF	ON	Enable	Disable
	190	"TMC"	Schedule cancel	OFF	ON	Enable	Enable
	191	"TM1"	Schedule 1 enable	ON	ON	Enable	Disable
	192	"TM2"	Schedule 2 enable	ON	ON	Enable	Disable
	193	"TM3"	Schedule 3 enable	ON	ON	Enable	Disable
	194	"TM4"	Schedule 4 enable	ON	ON	Enable	Disable
	201	"EPID1- ON"	External PID control 1 ON command	OFF	ON	Enable	Disable
	202	"%/EPID1"	External PID control 1 cancel command	OFF	ON	Enable	Disable
	X1						
	203	"EPID1- INV"	External PID control 1 normal/inverse operation switching	OFF	ON	Enable	Disable
	204	"EPID1- RST"	External PID control 1 integral/differential term reset	OFF	ON	Enable	Disable
	205	"EPID1- HLD"	External PID control 1 integral hold	OFF	ON	Enable	Disable
	X2						
	211	"EPID2- ON"	External PID control 2 ON command	OFF	ON	Enable	Disable
	212	"%/EPID2"	External PID control 2 cancel command	OFF	ON	Enable	Disable
	X3						
	213	"EPID2- INV"	External PID control 2 normal/inverse operation switching	OFF	ON	Enable	Disable
	214	"EPID2- RST"	External PID control 2 integral/differential term reset	OFF	ON	Enable	Disable
	215	"EPID2- HLD"	External PID control 2 integral hold	OFF	ON	Enable	Disable
	X4						
	221	"EPID3- ON"	External PID control 3 ON command	OFF	ON	Enable	Disable
	222	"%/EPID3"	External PID control 3 cancel command	OFF	ON	Enable	Disable
	223	"EPID3- INV"	External PID control 3 normal/inverse operation switching	OFF	ON	Enable	Disable
	224	"EPID3- RST"	External PID control 3 integral/differential term reset	OFF	ON	Enable	Disable
	225	"EPID3- HLD"	External PID control 3 integral hold	OFF	ON	Enable	Disable

(Note) X4 and X5 are not provided for FRENIC-Mini.

X6, X7, X8, and X9 are provided only for FRENIC-MEGA.

*1 When the command is given through the communications, negative logic setting is invalid.

[4] Function data

Table 7.6 Function code and data (S08, S09, S10, S11)

Code	Name	Function	missible setting range	Unit	R/W *1
S08	Acceleration time F07	Set data with common code numbers and in common communications formats to models.	0.0 to 6000.0	s	R/W
S09	Deceleration time F08		0.0 to 6000.0	s	R/W
S10	torque limit value 1- 1 F40		-300.00 to 300.00, 999	%	R/W
S11	torque limit value 1- 2 F41		-300.00 to 300.00, 999	%	R/W
S90	Current year and month		2012 to 2099 January to December	-	R/W
S91	Current day and time		1st to 31st 00:00 to 23:59	-	R/W
S92	Current minute and second		0 to 59 min 0 to 59 sec	-	R/W
S93	Clock data settings		0 or 1	-	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

- 1) When an attempt is made to enter a value out of the appropriate permissible setting range, an out-of-range error will result.
- 2) The acceleration/deceleration times specified with S08, S09 are set to F07 (Acceleration time 1) and F08 (Deceleration time 1). The torque limit levels specified with S10 and S11 are set to F40 (Torque limit level 1 for driving, Torque limit 1-1 for MEGA) and F41 (Torque limit level 1 for controlling, Torque limit 1-2 for MEGA). If the function codes are changed through the keypad, etc., the changes are also reflected to S08 to S11.
- 3) The figures below the fourth place figure of the S08 acceleration time and the S09 deceleration time are omitted within the inverter. (If, for example, 123.4s is written, 123.0s is entered.)
- 4) The setting range for S10 and S11 is dependent on F40 and F41. Check the setting range for F40 and F41 in the manual for each model.
- 5) By specifying clock data with S90 to S92, and then setting "1" for S93, clock data is written to the clock IC in the inverter. The read value is always 0. Refer to Data format [85] to Data format [87] for details on the data content for S90 to S92.

[5] Universal DO and universal AO

Table 7.7 Function code and data (S07, S12)

Code	Name	Function	Permissible setting range	Unit	R/W *1
S07	Universal DO	Command from communications function to terminal DO	0000 _H to FFFF _H	–	R/W
S12	Universal AO	Command from communications function to terminal AO	-32768 to 32767 (Full scale by ± 20000)	–	R/W

*1 Legends in R/W column...R: Readable, W: Write-enable, R/W: Read/write possible

- 1) A host can control the output terminal of the inverter through the communications function to issue commands to peripheral devices.
- 2) When universal DO and universal AO are assigned to the following signals, the signals operate as simple output regardless of inverter's operation.
Universal DO: Transistor output (Y1, Y2, Y3, Y4), relay output (Y5A/C, 30A/B/C)
Universal AO: Analog output (FMA), pulse output (FMP)

7.1.3 Monitor data 1

Function codes for monitor data 1 (M codes) are described in the four tables (1 to 4) below. These function codes are for reading only.

These function codes are for reading only. The "Support" column of the table indicates whether each function is supported by the respective models or not. ○ indicates the function is supported, and × indicates the function is not supported.

Table 7.8 Monitor data 1 function codes

Code	Name	Description	Monitor range	Min. step	Unit
M01	Frequency reference (p.u.) (Final command)	Frequency command based on the maximum frequency	-32768 to 32767 (±20,000 = maximum frequency)	1	—
M02	Torque command (Final command)	Torque command based on the motor rated torque (100%)	-327.68 to 327.67	0.01	%
M03	Torque current command (Final command)	Torque current command based on the motor rated torque current (100%)	-327.68 to 327.67	0.01	%
M04	Flux command	Flux command based on the rated motor flux (100%)	-327.68 to 327.67	0.01	%
M05	Frequency reference (Final command)	Frequency command with min. step 0.01Hz	0.00 to 655.35	0.01	Hz
M06	Output frequency 1 (p.u.)	Output frequency based on the maximum frequency (before slip compensation)	-32768 to 32767 (±20,000 = maximum frequency)	1	—
M07	Torque real value	Motor output torque based on the motor's rated torque (100%)	-327.68 to 327.67	0.01	%
M08	Torque current	Torque current based on the rated torque current of the motor (100%)	-327.68 to 327.67	0.01	%
M09	Output frequency	Output frequency with min. step 0.01Hz	FGI: -655.35 to 655.35 RTU: 0.00 to 655.35	0.01	Hz
M10	Input power	Power consumption value based on the "nominal applicable motor output" (100%)	0.00 to 399.99	0.01	%
M11	Output current effective value	Output current effective value based on the inverter rated current	0.00 to 399.99 (100% = inverter rated current)	0.01	%
M12	Output voltage effective value	Output voltage effective value (min. step: 1.0V)	0.0 to 1000.0	0.1 *1	V
M13	Operation command (Final command)	Displays the final command created by information from the keypad, terminal block, and communications, and transmitted to the inverter inside.	0000H to FFFFH	1	—
M14	Operation status	Displays the operation status in bit signal.	0000H to FFFFH	1	—

*1 Since M12 does not have any data after the decimal point, the minimum step is 1.0.

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M15	General-purpose output terminal information	General-purpose output terminal information is monitored.	0000H to FFFFH	1	–
M16	Latest alarm contents	Display alarm contents in the form of code.	0 to 127	1	–
M17	Last alarm contents				
M18	Second last alarm contents				
M19	Third last alarm contents				
M20	Cumulative operation time	–	0 to 65535	1	h
M21	DC link circuit voltage	Displays the DC link circuit voltage of the inverter.	0 to 1000	1	V
M22	Motor temperature	Motor temperature is displayed.	-30 to 200	1	°C
M23	Model code	Displays the series, generation, model, and voltage series in four-digit HEX data.	0000H to FFFFH	1	–
M24	Capacity code	Displays the capacity of the inverter.	0 to 65535	1	–
M25	ROM version	Displays the ROM version used in the inverter.	0 to 9999	1	–
M26	Transmission error transaction code	Communications error code of RS-485	0 to 127	1	–
M27	Frequency reference on alarm (p.u.) (Final command)	Data equivalent to M01 on alarm	-32768 to 32767 ($\pm 20,000$ = maximum frequency)	1	–
M28	Torque command on alarm (Final command)	Data equivalent to M02 on alarm	-327.68 to 327.67	0.01	%
M29	Torque current command on alarm (Final command)	Data equivalent to M03 on alarm	-327.68 to 327.67	0.01	%
M30	Flux command on alarm (Final command)	Data equivalent to M04 on alarm	-327.68 to 327.67	0.01	%
M31	Frequency reference on alarm (Final command)	Data equivalent to M05 on alarm	0.00 to 655.35	0.01	Hz
M32	Output frequency 1 on alarm (p.u.)	Data equivalent to M06 on alarm	-32768 to 32767 ($\pm 20,000$ = maximum frequency)	1	–

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M33	Torque real value on alarm	Data equivalent to M07 on alarm	-327.68 to 327.67	0.01	%
M34	Torque current on alarm	Data equivalent to M08 on alarm	-327.68 to 327.67	0.01	%
M35	Output frequency on alarm	Data equivalent to M09 on alarm	FGI: -655.35 to 655.35 RTU: 0.00 to 655.35	0.01	Hz
M36	Input power on alarm	Data equivalent to M10 on alarm	0.00 to 399.99	0.01	%
M37	Output current effective value on alarm	Data equivalent to M11 on alarm	0.00 to 399.99 (100% = inverter rated current)	0.01	%
M38	Output voltage effective value on alarm	Data equivalent to M12 on alarm	0.0 to 1000.0	1.0	V
M39	Operation command on alarm	Data equivalent to M13 on alarm	0000H to FFFFH	—	—
M40	Operation status on alarm	Data equivalent to M14 on alarm	0000H to FFFFH	—	—
M41	Output terminal information on alarm	Data equivalent to M15 on alarm	0000H to FFFFH	—	—
M42	Cumulative operation time on alarm	Data equivalent to M20 on alarm	0 to 65535	1	h
M43	DC link circuit voltage on alarm	Data equivalent to M21 on alarm	0 to 1000	1	V
M44	Inverter internal air temperature on alarm	Air temperature inside the inverter on alarm	0 to 255	1	°C
M45	Heat sink temperature on alarm	Data equivalent to M62 on alarm	0 to 255	1	°C
M46	Life of main circuit capacitor	The capacity of the main circuit capacitor is 100% when delivered from the factory	0.0 to 100.0	0.1	%
M47	Life of PC board electrolytic capacitor	Cumulative operation time of the capacitor packaged on the PC board	0 to 65535 *1	1	h
M48	Life of heat sink	Cumulative operation time of the heat sink	0 to 65535 *1	1	h
M49	Input terminal voltage [12] (p.u.)	Input voltage of terminal [12] (-20,000/-10V, 20,000/10V)	-32768 to 32767	1	—

*1 There are certain precautions to be aware of on some models. Refer to "8.7 Differences Between Functions" for details.

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M50	Input terminal current [C1] (p.u.)	Input current of terminal [C1] (0/0mA, 20,000/20mA)	0 to 32767	1	—
M52	Input terminal voltage [32]	Input voltage of terminal [32] (-20,000/-10V, 20,000/10V)	-32768 to 32767	1	—
M53	Input terminal current [C2]	Input current of terminal [C2] (0/0mA, 20,000/20mA)	0 to 32767	1	—
M54	Input terminal voltage [V2] (p.u.)	Input voltage of terminal [V2] (-20000/10V to 20000/10V)	-32768 to 32767	1	—
M61	Inverter internal air temperature	Current temperature inside the inverter	0 to 255	1	°C
M62	Heat sink temperature	Current temperature of the heat sink within the inverter	0 to 255	1	°C
M63	Load factor	Load rate based on the motor rating	-327.68 to 327.67	0.01	%
M64	Motor output	Motor output based on the motor's rated output (kW)	-327.68 to 327.67	0.01	%
M65	Motor output on alarm	Data equivalent to M64 on alarm	-327.68 to 327.67	0.01	%
M66	Speed detection	Detected speed	-327.68 to 327.67	1	—
M67	Transmission error processing code	Error processing code for data transfer	0 to 127	—	—
M68	PID final command	±20000/±100%	-32768 to 32767	1	—
M69	Inverter rated current	FGI	0.00 to 9999	Variable	A
		RTU (inverter capacity 22kW (30HP) or less)	0.00 to 655.35	0.01	A
		RTU (inverter capacity 30kW (40HP) or more)	0.0 to 6553.5	0.1	A
M70	Operation status 2	Displays the operation status in the form of a bit signal.	0000H to FFFFH	1	—
M71	Input terminal information	Operation command information from the terminal block and communications	0000H to FFFFH	1	—
M72	PID feedback value	PID feedback based on 100% of analog input (±20000/100%)	-32768 to 32767	1	—

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M73	PID output	PID output based on the maximum frequency (F03) ($\pm 20000/100\%$)	-32768 to 32767	1	—
M74	Operating status 2	Displays the operation status in the form of a bit signal.	0000H to FFFFH	1	—
M76	Main circuit capacitor life (elapsed time)	Main circuit capacitor use time	0 to 65535 (in units of 10 hours)	1	10h
M77	Main circuit capacitor life (remaining time)	Main circuit capacitor remaining life	0 to 65535 (in units of 10 hours)	1	10h
M81	Remaining time before maintenance (M1)	Time before the next maintenance	0 to 65535 (in units of 10 hours)	1	10h
M85	No. of starting times before maintenance (M1)	Allowable starting times before the next maintenance	0 to 65535	1	Times
M86	Light alarm (latest)	Latest light alarm indicated with a code	0 to 254	1	—
M87	Light alarm (last)	Last light alarm indicated with a code	0 to 254	1	—
M88	Light alarm (second last)	Second last light alarm indicated with a code	0 to 254	1	—
M89	Light alarm (third last)	Third last light alarm indicated with a code	0 to 254	1	—
M98	Light alarm status monitor	Displays the occurrence status of light alarms.	0 to 1 (light alarm occurring when "1")		—
M101	Frequency/speed command (with sign)	Frequency command in 0.01 Hz units	-327.68 to 327.67 *1		Hz
M102	Frequency command (Absolute value) *2	Final frequency command in 0.01 Hz units	0.00 to 655.35		Hz
M103	Frequency command (with sign) *2	Final frequency command in 0.01 Hz units	-327.68 to 327.67 *1		Hz
M105	Output frequency before slip compensation (with sign)	Output frequency before slip compensation in 0.01 Hz units	-327.68 to 327.67 *1		Hz
M107	Output frequency after slip compensation (with sign)	Output frequency after slip compensation in 0.01 Hz units	-327.68 to 327.67 *1		Hz
M108	Detected speed (Absolute value) *3	Detected speed in 0.01 Hz units	0.00 to 655.35		Hz

*1 If the current value exceeds the setting range, the values limited with the maximum and minimum setting range are displayed.

*2 The final reference frequency after limiting with the upper limit frequency, etc. is displayed.

*3 This is the estimated speed when sensorless control is selected.

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M109	Detected speed (with sign) *3	Detected speed in 0.01 Hz units	-327.68 to 327.67 *1		Hz
M110	Output frequency	Output frequency before slip compensation with max. frequency at 100%	-100.00 to 100.00		%
M113	Torque limiting current	Output torque current corresponding to rated current	-327.68 to 327.67		%
M117	Output torque (4 quadrant)	Value with sign for output torque based on conditions below + sign: Forward rotation drive, reverse rotation braking - sign: Forward rotation braking, reverse rotation drive	-327.68 to 327.67		%
M123	Extended model code	Displays the model and generation with 4-digit hexadecimal number.	0000H to FFFFH		-
M125	IP address monitor 1	IP v4 address	0 to 255		-
M126	IP address monitor 2	IP v4 address	0 to 255		-
M127	IP address monitor 3	IP v4 address	0 to 255		-
M128	IP address monitor 4	IP v4 address	0 to 255		-
M129	Subnet mask monitor 1	Subnet mask	0 to 255		-
M130	Subnet mask monitor 2	Subnet mask	0 to 255		-
M131	Subnet mask monitor 3	Subnet mask	0 to 255		-
M132	Subnet mask monitor 4	Subnet mask	0 to 255		-
M133	Gateway address monitor 1	Default gateway	0 to 255		-
M134	Gateway address monitor 2	Default gateway	0 to 255		-

*1 If the current value exceeds the setting range, the values limited with the maximum and minimum setting range are displayed.

*2 The final reference frequency after limiting with the upper limit frequency, etc. is displayed.

*3 This is the estimated speed when sensorless control is selected.

Table 7.8 Monitor data 1 function codes (Continued)

Code	Name	Description	Monitor range	Min. step	Unit
M135	Gateway address monitor 3	Default gateway	0 to 255		-
M136	Gateway address monitor 4	Default gateway	0 to 255		-
M137	MAC address monitor 1	MAC address	0000H to FFFFH		-
M138	MAC address monitor 2	MAC address	0000H to FFFFH		-
M139	MAC address monitor 3	MAC address	0000H to FFFFH		-
M141	d-axis current	d-axis current with motor rated current as reference (100%)	-327.68 to 327.67		%
M142	q-axis current	q-axis current with motor rated current as reference (100%)	-327.68 to 327.67		%

7.1.4 Monitor data 2

A list of monitor data 2 function codes (W codes) is shown below.

Monitor data 2 is linked to the keypad display. These are all read only.

Refer to the parameter list for each model for details on function code support.

RTU and FGI in the Remarks field represent the Modbus RTU protocol and the Fuji general-purpose inverter protocol, respectively.

Table 7.9 Keypad-related function code (W codes)

Code	Name	Monitor range	Unit	Remarks
W01	Operation status	0000H to FFFFH	–	
W02	Frequency reference	0.00 to 655.35	Hz	
W03	Output frequency (before slip compensation)	0.00 to 655.35	Hz	
W04	Output frequency (after slip compensation)	0.00 to 655.35	Hz	
W05	Output current	0.00 to 9999	A	FGI
		0.00 to 655.35	A	RTU (inverter capacity 22kW (30HP) or less)
		0.0 to 6553.5	A	RTU (inverter capacity 30kW (40HP) or more)
W06	Output voltage	0.0 to 1000.0	V	
W07	Torque	-999 to 999	%	
W08	Rotation speed	0.00 to 99990	r/min	
W09	Load rotation speed	0.00 to 99990	r/min	
W10	Line speed	0.00 to 99990	m/min	
W11	PID process command	-999 to 9990	–	PID command value or PID feedback value converted to the physical quantity of the control target by E40 and E41
W12	PID feedback value	-999 to 9990	–	
W13	Level of torque value A	0 to 1000	%	
W14	Level of torque value B	0 to 1000	%	
W15	Ratio value	0.00 to 655.35	%	
W16	Rotation speed set value	0.00 to 99990	r/min	
W17	Load speed set value	0.00 to 99990	r/min	
W18	Line speed set value	0.00 to 99990	r/min	
W19	Constant feed time set value	0.00 to 999.9	min	
W20	Constant feed time	0.00 to 999.9	min	
W21	Input power	0.00 to 9999	kW	
W22	Motor output	0.00 to 9999	kW	
W23	Load rate	-999 to 999	%	
W24	Torque current	-999 to 999	%	
W25	Output current (0.1 A units)	0.0 to 3276.7	A	Increment does not change with capacity.
W26	Flux command value	-999 to 999	%	
W27	Timer operation remaining time	0 to 9999	s	
W28	Operation command source	0 to 23	–	*1
W29	Frequency and PID command source	0 to 36	–	*2
W30	Speed set value at percentage	0.00 to 100.00	%	
W31	Speed set value at percentage	0.00 to 100.00	%	
W32	PID output	0 to 150.0	%	PID output expressed by a percentage with setting the maximum frequency (F03) to 100%
W33	Analog input monitor	-999 to 9990	–	Inverter's analog input converted by E40 and E41

*1 Operation command source code

Indicates the current source of operation commands.

Code	Description
0	Run by the keypad (rotation direction: depends on the terminal input)
1	Run by the terminals
2	Run by the keypad (forward rotation)
3	Run by the keypad (reverse rotation)
4	Run command 2 (when FR2/FR1 is ON)
5	Forced operation
20	Port 1 (RS-485 channel 1) (Note)
21	Port 2 (RS-485 channel 2) (Note)
22	Bus option
23	Loader

For FRENIC-Mini, this code is 20 when operation commands from the loader are effective.

*2 Frequency command source/PID command source code

Code	Description
0	Keypad key operations
1	Voltage input (terminal 12)
2	Current input (terminal C1)
3	Voltage input (terminal 12) + current input (terminal C1)
4	Inverter volume
5	Voltage input (terminal V2)
6	Voltage input (terminal [V3])
7	UP/DOWN
8	Keypad key operation (balanceless bumpless)
10	Pattern operation
11	Digital input option
12	Pulse train input (input from terminal block)
13	Pulse train input (input from option)
20	Port 1 (RS-485 channel 1) (Note)
21	Port 2 (RS-485 channel 2) (Note)
22	Bus option
23	Loader (20 for FRENIC-Mini)
24	Multi-step frequency
25	JOG operation
30	PID keypad command
31	PID analog command 1
32	PID analog command 2
33	PID UP/DOWN command
34	PID communications process command
36	PID multi-step command
39	Forced operation command

Table 7.9 Keypad-related function code (W codes) (Continued)

Code	Name	Monitor range	Unit	Remarks
W35	Terminal [32] input voltage	-12.0 to 12.0	V	
W36	Terminal [C2] input current	0.0 to 30.0	mA	
W37	Terminal [A0] output voltage	-12.0 to 12.0	V	
W38	Terminal [CS] output current	0.0 to 30.0	mA	
W39	[X] pulse input monitor	-327.68 to 327.67	–	Unit: kp/s
W40	Control circuit terminal (input)	0000H to FFFFH	–	
W42	Communications control signal (input)	0000H to FFFFH	–	
W43	Communications control signal (output)	0000H to FFFFH	–	
W44	Terminal [12] input voltage	0.0 to 12.0	V	
W45	Terminal [C1] input current	0.0 to 30.0	mA	
W46	[FMA/FM1]* output voltage	0.0 to 12.0	V	
W47	[FMP/FM2]* output voltage	0.0 to 12.0	V	
W48*	FMP output frequency	0 to 6000	p/s	The output pulse rate of terminal FMP expressed by (p/s)
W49	V2 terminal input voltage	0.0 to 12.0	V	
W50	[FMA/FM1]* output current	0.0 to 30.0	mA	
W51	Situation of input terminals on DIO option	0000H to FFFFH	–	
W52	Situation of output terminals on DIO option	0000H to FFFFH	–	
W53	Pulse input (Master - side A/B phase)	-327.68 to 327.67	–	Unit: kp/s
W54	Pulse input (Master - side Z phase)	0 to 6000	p/s	
W55	Pulse input (Slave - side A/B phase)	-327.68 to 327.67	–	Unit: kp/s
W56	Pulse input (Slave - side Z phase)	0 to 6000	p/s	
W57	Current Position Pulse (Upper column)	-999 to 999	–	
W58	Current Position Pulse (Lower column)	0 to 9999	–	
W59	Stop Position Pulse (Upper column)	-999 to 999	–	
W60	Stop Position Pulse (Lower column)	0 to 9999	–	
W61	Difference Pulse of Position(Upper column)	-999 to 999	–	
W62	Difference Pulse of Position(Lower column)	0 to 9999	–	
W63	Positioning Status	0 to 10	–	
W65	Terminal [FM1/FM2] * output current	0.0 to 30.0	mA	
W67	Cumulative operation time of electrolytic	0 to 9999	10h	
W68	Cumulative operation time of cooling fan	0 to 9999	10h	
W69	Peripheral speed monitor	0.00 to 99990	m/min	
W70	Cumulative operation time	0 to 65535	h	
W71	DC link circuit voltage	0 to 1000	V	
W72	Internal air highest temperature	0 to 255	°C	
W73	Heat sink maximum temperature	0 to 255	°C	

* Some models may not be equipped with these codes, or the names may differ depending on the model.

Table 7.9 Keypad-related function code (W codes) (Continued)

Code	Name	Monitor range	Unit	Remarks
W74	Maximum effective current value	0.00 to 9999	A	FGI
		0.00 to 655.35	A	URT (inverter capacity 22 kW (30 HP) or less
		0.0 to 6553.5	A	URT (inverter capacity 30 kW (40 HP) or less
W75	Main circuit capacitor's capacitor	0.0 to 100.0	%	
W76	Cumulative ope. time of capacitor on PC board	0 to 65535	h	
W77	Cumulative ope. time of cooling fan	0 to 65535	h	
W78	Number of startups	0 to 65535	Times	
W79	Cumulative ope. time of motor	0 to 65535	h	
W80	Standard fan life	0 to 65535	h	
W81	Integrating electric power	0.000 to 9999	—	Value calculated by assuming an integral power consumption of 100kWh as one (100kWh when W81=1)
W82	Data used integrating electric power	0.000 to 9999	—	Value calculated as integral power consumption (kWh) multiplied by function code E51
W83	Number of RS485 ch1 errors	0 to 9999	Times	Mini: optional
W84	Contents of RS485 ch1 error	0 to 127	—	
W85	Number of RS485 ch2 errors	0 to 9999	Times	
W86	Number of option communications errors	0 to 9999	Times	
W87	Inverter's ROM version	0 to 9999	—	
W89	Remote keypad's ROM version	0 to 9999	—	
W90	Option1 ROM version	0 to 9999	—	
W91	Option2 ROM version	0 to 9999	—	
W92	Option3 ROM version	0 to 9999	—	
W94	Contents of RS485 ch2 error	0 to 127	—	
W95	Number of option communications errors	0 to 9999	Times	
	Option 1 (A-port) No. of communications errors			
W96	Content of option communications error	0 to 9999	—	*1
	Option 1 (A-port) communications error content			
W97	Option communicate error contents	0 to 9999	—	*1
W98	Number of option communications errors	0 to 9999	Times	
W99	Option communicate error contents	0 to 9999	—	*1

*1 Indicates the content of a communications error between the inverter and an option card. For details, see the manual of each option.

Table 7.10 Keypad related function codes (W1 codes)

Code	Name	Monitor scope	Unit	Remarks
W101	Current year and month	0000 _H to FFFF _H	-	Last 2 digits of calendar year (high order byte), year (Low order byte)
W102	Current day and time	0000 _H to FFFF _H	-	Day (High order byte), time (Low order byte)
W103	Current minute and second	0000 _H to FFFF _H	-	Minute (High order byte), second (Low order byte)
W108	Winding diameter (Physical amount)	0 to 65535	mm	
W113	Constant rate of feeding time (After filter)	0.00 to 999.9	min	
W116	PG feedback amount	0.00 to 655.35	Hz	
W117	Estimated theoretical acceleration/deceleration time value	0.000 to 9999	s	
W118	Torque bias monitor (unit: %)	0 to 100	%	
W119	Torque bias monitor (unit: 0.01%)	0.00 to 100.00	%	
W120	Speed deviation monitor	-327.68 to 327.67	%	
W124	Nameplate current type *2	0 to 65535	A	
W127	Line axis speed setting value	0.00 to 99990	m/min	
W128	Line axis speed (After filter)	0.00 to 99990	m/min	
W130	Customizable logic output monitor	0.00 to 9990	-	
W131	PID deviation	0.00 to 100.00	%	
W132	PID deviation (p.u. value)	-32768 to 32767	-	
W133	PID deviation (No filter)	0.00 to 100.00	%	
W140	Terminal [V3] input voltage	0.0 to 12.0	V	
W142	Position control - current position (High order)	-9999 to 9999	-	
W143	Position control - current position (Low order)	0 to 9999	-	
W144	Position control - stop target position (High order)	-9999 to 9999	-	
W145	Position control - stop target position (Low order)	0 to 9999	-	
W146	Position control - position deviation (High order)	-9999 to 9999	-	
W147	Position control - position deviation (Low order)	0 to 9999	-	
W148	Position control - position control start position (High order)	-9999 to 9999	-	
W149	Position control - position control start position (Low order)	0 to 9999	-	
W152	Position control - control mode	0000 _H to FFFF _H	-	
W153	PG detected pulse count (control side A/B-phase) *3	-327.68 to 327.67	-	Unit: kp/s
W154	PG detected pulse count (control side Z-phase) *3	0 to 6000	p/s	
W155	PG detected pulse count (feedback side A/B-phase) *3	-327.68 to 327.67	-	Unit: kp/s
W156	PG detected pulse count (feedback side Z-phase) *3	0 to 6000	p/s	
W159	Max. regenerative load factor (%ED)	0.0 to 100.0	%	
W160	Regenerative load factor (%ED)	0.0 to 100.0	%	
W161	Braking resistor thermal overload relay	0.0 to 100.0	%	100.0%: dBH trip level

*1 0A for products for Japanese market.

*2 If changing the command input source with the PG-SEL function, the value at the command side/feedback side after the change is displayed.

Table 7.10 Keypad related function codes (W1 codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
W162	Inverter thermal 1	0.0 to 100.0	%	100.0%: OLU trip level
W163	Inverter thermal 2	0.0 to 100.0	%	100.0%: OLU trip level
W164	Inverter thermal 3	0.0 to 100.0	%	100.0%: OLU trip level
W165	Maximum regenerative load factor value	0.0 to 100.0	%	
W166	Regenerative load factor	0.0 to 100.0	%	
W167	Anticipated Pt plate electrolytic capacitor cumulative operating life time	0 to 9999	10h	
W168	Anticipated cooling fan life time	0 to 9999	10h	
W169	IGBT life expectancy	0 to 100	%	
W170	Cumulative run time (Long time)	0 to 9999	10h	
W171	Multi-function keypad thermistor temperature value	-30 to 200	°C	
W172	Multi-function keypad battery voltage value	0.00 to 5.00	V	
W180	Auto tuning progress	0 to 100	%	
W181	Integral power	0.00 to 99990	MWh	
W182	Bus option command	0000H to FFFFH	-	
W183	Control power status	0000H to FFFFH	-	
W184	Detected load after compensation	-327.68 to 327.67	%	
W188	Max. relay ON count (Y1Ry, Y2Ry)	0.000 to 9999	Times	1.000 = 1000 times
W189	Max. relay ON count (Y3Ry, Y4Ry)	0.000 to 9999	Times	1.000 = 1000 times
W190	Max. relay ON count (Y5AC, 30ABC)	0.000 to 9999	Times	1.000 = 1000 times
W191	Max. relay ON count (Y6AC to Y12AC)	0.000 to 9999	Times	1.000 = 1000 times

Table 7.11 Monitor data 2 (W codes)

Code	Name	Monitor scope	Unit	Remarks
W202	PID1 command value	-999.00 to 9999.00	-	
W203	PID1 feedback value	-999.00 to 9999.00	-	
W205	PID2 command value	-999.00 to 9999.00	-	
W206	PID2 feedback value	-999.00 to 9999.00	-	
W212	External PID1 command value (Final)	-999.00 to 9999.00	-	
W213	External PID1 feedback value (Final)	-999.00 to 9999.00	-	
W214	External PID1 command value	-999.00 to 9999.00	-	
W215	External PID1 feedback value	-999.00 to 9999.00	-	
W217	External PID1 manual command value	0.00 to 100.00	%	
W218	External PID1 output	-10.0 to 110.0	%	
W224	External PID2 command value	-999.00 to 9999.00	-	
W225	External PID2 feedback value	-999.00 to 9999.00	-	
W227	External PID2 manual command value	0.00 to 100.00	%	
W228	External PID2 output	-10.0 to 110.0	%	
W234	External PID3 command value	-999.00 to 9999.00	-	
W235	External PID3 feedback value	-999.00 to 9999.00	-	
W237	External PID3 manual command value	0.00 to 100.00	%	
W238	External PID3 output	-10.0 to 110.0	%	
W250	Rotary operation Slave 1 output frequency	0.00 to 655.35	Hz	
W251	Rotary operation Slave 1 output current	0.00 to 9999	A	
W252	Rotary operation Slave 1 power consumption	0.00 to 9999	kW	
W253	Rotary operation Slave 1 alarm details	Same as M16	-	
W255	Rotary operation Slave 2 output frequency	0.00 to 655.35	Hz	
W256	Rotary operation Slave 2 output current	0.00 to 9999	A	
W257	Rotary operation Slave 2 power consumption	0.00 to 9999	kW	
W258	Rotary operation Slave 2 alarm details	Same as M16	-	
W260	Rotary operation Slave 3 output frequency	0.00 to 655.35	Hz	
W261	Rotary operation Slave 3 output current	0.00 to 9999	A	
W262	Rotary operation Slave 3 power consumption	0.00 to 9999	kW	
W263	Rotary operation Slave 3 alarm details	Same as M16	-	
W265	Rotary operation Slave 4 output frequency	0.00 to 655.35	Hz	
W266	Rotary operation Slave 4 output current	0.00 to 9999	A	
W267	Rotary operation Slave 4 power consumption	0.00 to 9999	kW	
W268	Rotary operation Slave 4 alarm details	Same as M16	-	
W270	Rotary operation Slave 5 output frequency	0.00 to 655.35	Hz	
W271	Rotary operation Slave 5 output current	0.00 to 9999	A	
W272	Rotary operation Slave 5 power consumption	0.00 to 9999	kW	
W273	Rotary operation Slave 5 alarm details	Same as M16	-	
W275	Rotary operation Slave 6 output frequency	0.00 to 655.35	Hz	
W276	Rotary operation Slave 6 output current	0.00 to 9999	A	
W277	Rotary operation Slave 6 power consumption	0.00 to 9999	kW	
W278	Rotary operation Slave 6 alarm details	Same as M16	-	
W280	Rotary operation Slave 7 output frequency	0.00 to 655.35	Hz	
W281	Rotary operation Slave 7 output current	0.00 to 9999	A	
W282	Rotary operation Slave 7 power consumption	0.00 to 9999	kW	
W283	Rotary operation Slave 7 alarm details	Same as M16	-	

Table 7.11 Monitor data 2 (W codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
W301	Integral power monitor interval	0 to 4 0: Disable 1: Hour units 2: Day units 3: Week units 4: Month units	-	
W302	Integral power start year/month	0000H to FFFFH	-	
W303	Integral power start minute/second	0000H to FFFFH	-	
W304	Integral power monitor 1	0.000 to 9999	100 kWh	
W305	Integral power monitor 2	0.000 to 9999	100 kWh	
W306	Integral power monitor 3	0.000 to 9999	100 kWh	
W307	Integral power monitor 4	0.000 to 9999	100 kWh	
W308	Integral power monitor 5	0.000 to 9999	100 kWh	
W309	Integral power monitor 6	0.000 to 9999	100 kWh	
W310	Integral power monitor 7	0.000 to 9999	100 kWh	
W311	Integral power monitor 8	0.000 to 9999	100 kWh	
W312	Integral power monitor 9	0.000 to 9999	100 kWh	
W313	Integral power monitor 10	0.000 to 9999	100 kWh	
W314	Integral power monitor 11	0.000 to 9999	100 kWh	
W315	Integral power monitor 12	0.000 to 9999	100 kWh	
W316	Integral power monitor 13	0.000 to 9999	100 kWh	
W317	Integral power monitor 14	0.000 to 9999	100 kWh	
W318	Integral power monitor 15	0.000 to 9999	100 kWh	
W319	Integral power monitor 16	0.000 to 9999	100 kWh	
W320	Integral power monitor 17	0.000 to 9999	100 kWh	
W321	Integral power monitor 18	0.000 to 9999	100 kWh	
W322	Integral power monitor 19	0.000 to 9999	100 kWh	
W323	Integral power monitor 20	0.000 to 9999	100 kWh	
W324	Integral power monitor 21	0.000 to 9999	100 kWh	
W325	Integral power monitor 22	0.000 to 9999	100 kWh	
W326	Integral power monitor 23	0.000 to 9999	100 kWh	
W327	Integral power monitor 24	0.000 to 9999	100 kWh	
W328	Integral power monitor 25	0.000 to 9999	100 kWh	
W329	Integral power monitor 26	0.000 to 9999	100 kWh	
W330	Integral power monitor 27	0.000 to 9999	100 kWh	
W331	Integral power monitor 28	0.000 to 9999	100 kWh	
W332	Integral power monitor 29	0.000 to 9999	100 kWh	
W333	Integral power monitor 30	0.000 to 9999	100 kWh	
W334	Integral power monitor 31	0.000 to 9999	100 kWh	
W335	Integral power monitor 32	0.000 to 9999	100 kWh	
W336	Integral power monitor 33	0.000 to 9999	100 kWh	
W337	Integral power monitor 34	0.000 to 9999	100 kWh	
W338	Integral power monitor 35	0.000 to 9999	100 kWh	
W339	Integral power monitor 36	0.000 to 9999	100 kWh	
W340	Integral power monitor 37	0.000 to 9999	100 kWh	
W341	Integral power monitor 38	0.000 to 9999	100 kWh	
W342	Integral power monitor 39	0.000 to 9999	100 kWh	
W343	Integral power monitor 40	0.000 to 9999	100 kWh	
W344	Integral power monitor 41	0.000 to 9999	100 kWh	
W345	Integral power monitor 42	0.000 to 9999	100 kWh	
W346	Integral power monitor 43	0.000 to 9999	100 kWh	
W347	Integral power monitor 44	0.000 to 9999	100 kWh	

Table 7.11 Monitor data 2 (W codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
W348	Integral power monitor 45	0.000 to 9999	100 kWh	
W349	Integral power monitor 46	0.000 to 9999	100 kWh	
W350	Integral power monitor 47	0.000 to 9999	100 kWh	
W351	Integral power monitor 48	0.000 to 9999	100 kWh	
W352	Run time monitor 1	0.000 to 9999	h	
W353	Run time monitor 2	0.000 to 9999	h	
W354	Run time monitor 3	0.000 to 9999	h	
W355	Run time monitor 4	0.000 to 9999	h	
W356	Run time monitor 5	0.000 to 9999	h	
W357	Run time monitor 6	0.000 to 9999	h	
W358	Run time monitor 7	0.000 to 9999	h	
W359	Run time monitor 8	0.000 to 9999	h	
W360	Run time monitor 9	0.000 to 9999	h	
W361	Run time monitor 10	0.000 to 9999	h	
W362	Run time monitor 11	0.000 to 9999	h	
W363	Run time monitor 12	0.000 to 9999	h	
W364	Run time monitor 13	0.000 to 9999	h	
W365	Run time monitor 14	0.000 to 9999	h	
W366	Run time monitor 15	0.000 to 9999	h	
W367	Run time monitor 16	0.000 to 9999	h	
W368	Run time monitor 17	0.000 to 9999	h	
W369	Run time monitor 18	0.000 to 9999	h	
W370	Run time monitor 19	0.000 to 9999	h	
W371	Run time monitor 20	0.000 to 9999	h	
W372	Run time monitor 21	0.000 to 9999	h	
W373	Run time monitor 2	0.000 to 9999	h	
W374	Run time monitor 23	0.000 to 9999	h	
W375	Run time monitor 24	0.000 to 9999	h	
W376	Run time monitor 25	0.000 to 9999	h	
W377	Run time monitor 26	0.000 to 9999	h	
W378	Run time monitor 27	0.000 to 9999	h	
W379	Run time monitor 28	0.000 to 9999	h	
W380	Run time monitor 29	0.000 to 9999	h	
W381	Run time monitor 30	0.000 to 9999	h	
W382	Run time monitor 31	0.000 to 9999	h	
W383	Run time monitor 32	0.000 to 9999	h	
W384	Run time monitor 33	0.000 to 9999	h	
W385	Run time monitor 34	0.000 to 9999	h	
W386	Run time monitor 35	0.000 to 9999	h	
W387	Run time monitor 36	0.000 to 9999	h	
W388	Run time monitor 37	0.000 to 9999	h	
W389	Run time monitor 38	0.000 to 9999	h	
W390	Run time monitor 39	0.000 to 9999	h	
W391	Run time monitor 40	0.000 to 9999	h	
W392	Run time monitor 41	0.000 to 9999	h	
W393	Run time monitor 42	0.000 to 9999	h	
W394	Run time monitor 43	0.000 to 9999	h	
W395	Run time monitor 44	0.000 to 9999	h	
W396	Run time monitor 45	0.000 to 9999	h	
W397	Run time monitor 46	0.000 to 9999	h	
W398	Run time monitor 47	0.000 to 9999	h	
W399	Run time monitor 48	0.000 to 9999	h	

7.1.5 Alarm information

A list of alarm information function codes (X, Z codes) is shown below.

Alarm information is linked to the keypad display. These are all read only.

The function codes shown in Table 7.12 and Table 7.13 are the same as the menu numbers displayed on the keypad LED indicated in the "Corresponding LED indicator" field. Refer to the parameter list for each model for details on function code support.

Refer to the User's Manual for each model for details on the keypad display.

RTU and FGI in the "Remarks" field represent the Modbus RTU protocol and FUJI general-purpose inverter protocol, respectively.

Table 7.12 Keypad-related function codes (X codes)

Code	Name	Monitor scope	Unit	Remarks
X00	Alarm history (latest)	0000H to FFFFH	—	Contents of 1 in alarm list (example: ! 0l1)
X01	Multiple alarm 1 (latest)	0000H to FFFFH	—	
X02	Multiple alarm 2 (latest)	0000H to FFFFH	—	
X03	Sub code	0 to 9999	—	
X04	Multiple alarm 1 subcode (Latest)	0 to 9999	—	
X05	Alarm history (last)	0000H to FFFFH	—	Contents of 2 in alarm list (example: Z.0c1A)
X06	Multiple alarm 1 (last)	0000H to FFFFH	—	
X07	Multiple alarm 2 (last)	0000H to FFFFH	—	
X08	Sub code	0 to 9999	—	
X09	Multiple alarm 1 subcode (Last)	0 to 9999	—	
X10	Alarm history (second last)	0000H to FFFFH	—	Contents of 3 in alarm list (example: # 0c1)
X11	Multiple alarm 1 (second last)	0000H to FFFFH	—	
X12	Multiple alarm 2 (second last)	0000H to FFFFH	—	
X13	Sub code	0 to 9999	—	
X14	Multiple alarm 1 subcode (Second last)	0 to 9999	—	
X15	Alarm history (third last)	0000H to FFFFH	—	Contents of 4 in alarm list (example: \$ lu)
X16	Multiple alarm 1 (third last)	0000H to FFFFH	—	
X17	Multiple alarm 2 (third last)	0000H to FFFFH	—	
X18	Sub code	0 to 9999	—	
X19	Multiple alarm 1 subcode (Third last)	0 to 9999	—	
X20	Latest info. on alarm (output frequency)	0.00 to 655.35	Hz	
X21	(output current)	0.00 to 9999	A	FGI
		0.00 to 655.35	A	RTU (inverter capacity 22kW (30HP) or less)
		0.0 to 5000.0	A	RTU (inverter capacity 30kW (40HP) or more)
X22	(output voltage)	0 to 1000	V	
X23	(Torque)	-999 to 999	%	
X24	(set frequency)	0.00 to 655.35	Hz	
X25	(operation status)	0000H to FFFFH	—	
X26	(cumulative ope. time)	0 to 65535	h	
X27	(number of startups)	0 to 65535	Times	
X28	(DC link circuit voltage)	0 to 1000	V	
X29	(internal air temperature)	0 to 255	°C	
X30	(heat sink temperature)	0 to 255	°C	

Table 7.12 Keypad-related function codes (X codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
X31	Latest info. on alarm (input terminal)	0000H to FFFFH	–	
X32	(output terminal)	0000H to FFFFH	–	
X33	(input terminal(com.))	0000H to FFFFH	–	
X34	(output terminal(com.))	0000H to FFFFH	–	
X35	(Input power)	0.00 to 9999	kW	
X36	(operation status)	0000H to FFFFH	–	
X37	(speed detection)	-32768 to 32767	–	
X38	(Running status 3)	0000H to FFFFH	-	
X49	Error count monitor	0 to 65535	Times	
X54	Light alarm factor (Fourth last)	Fourth light alarm factor	1	
X55	Light alarm factor (Fifth last)	Fifth light alarm factor	1	
X60	Last info. on alarm (output frequency)	0.00 to 655.35	Hz	
	(output current)	0.00 to 9999	A	FGI
X61		0.00 to 655.35	A	RTU (inverter capacity 22kW (30HP) or less)
		0.0 to 5000.0	A	RTU (inverter capacity 30kW (40HP) or more)
X62	(output voltage)	0 to 1000	V	
X63	(Torque)	-999 to 999	%	
X64	(set frequency)	0.00 to 655.35	Hz	
X65	(operation status)	0000H to FFFFH	–	
X66	(cumulative ope. time)	0 to 65535	h	
X67	(number of startups)	0 to 65535	Times	
X68	(DC link circuit voltage)	0 to 1000	V	
X69	(internal air temperature)	0 to 255	°C	
X70	(heat sink temperature)	0 to 255	°C	
X71	(input terminal)	0000H to FFFFH	–	
X72	(output terminal)	0000H to FFFFH	–	
X73	(input terminal(com.))	0000H to FFFFH	–	
X74	(output terminal(com.))	0000H to FFFFH	–	
X76	(operation status)	0000H to FFFFH	–	
X77	(speed detection)	-32768 to 32767	–	
X78	(Running status 3)	0000H to FFFFH	–	
X89	Customizable logic (Digital I/O)	0000H to FFFFH	–	
X90	(Timer monitor)	0.00 to 600.00	–	
X91	(Analog input 1)	-9990 to 9990	–	
X92	(Analog input 2)	-9990 to 9990	–	
X93	(Analog output)	-9990 to 9990	–	
X94	Relay output terminal information	0000H to FFFFH	-	
X95	Flow sensor monitor	-999 to 9990	-	
X96	Terminal (CS2) output current	0.0 to 30.0	mA	
X97	Terminal (PTC/NTC) input voltage	-12.0 to 12.0	V	
X98	PT option detection temperature (ch.1)	-100.0 to 200.0	°C	
X99	PT option detection temperature (ch.2)	-100.0 to 200.0	°C	
X105	Year and month of alarm occurrence (Latest)	0000H to FFFFH	-	
X106	Day and hour of alarm occurrence (Latest)	0000H to FFFFH	-	
X107	Minute and second of alarm occurrence (Latest)	0000H to FFFFH	-	
X115	Year and month of alarm occurrence (Last)	0000H to FFFFH	-	

Table 7.12 Keypad-related function codes (X codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
X116	Day and hour of alarm occurrence (Last)	0000H to FFFFH	-	
X117	Minute and second of alarm occurrence (Last)	0000H to FFFFH	-	
X125	Year and month of alarm occurrence (Second last)	0000H to FFFFH	-	
X126	Day and hour of alarm occurrence (Second last)	0000H to FFFFH	-	
X127	Minute and second of alarm occurrence (Second last)	0000H to FFFFH	-	
X135	Year and month of alarm occurrence (Third last)	0000H to FFFFH	-	
X136	Day and hour of alarm occurrence (Third last)	0000H to FFFFH	-	
X137	Minute and second of alarm occurrence (Third last)	0000H to FFFFH	-	
X140	Alarm history (Fourth last)	0000H to FFFFH	-	
X145	Year and month of alarm occurrence (Fourth last)	0000H to FFFFH	-	
X146	Day and hour of alarm occurrence (Fourth last)	0000H to FFFFH	-	
X147	Minute and second of alarm occurrence (Fourth last)	0000H to FFFFH	-	
X150	Alarm history (Fifth last)	0000H to FFFFH	-	
X155	Year and month of alarm occurrence (Fifth last)	0000H to FFFFH	-	
X156	Day and hour of alarm occurrence (Fifth last)	0000H to FFFFH	-	
X157	Minute and second of alarm occurrence (Fifth last)	0000H to FFFFH	-	
X160	Alarm history (Sixth last)	0000H to FFFFH	-	
X165	Year and month of alarm occurrence (Sixth last)	0000H to FFFFH	-	
X166	Day and hour of alarm occurrence (Sixth last)	0000H to FFFFH	-	
X167	Minute and second of alarm occurrence (Sixth last)	0000H to FFFFH	-	
X170	Alarm history (Seventh last)	0000H to FFFFH	-	
X175	Year and month of alarm occurrence (Seventh last)	0000H to FFFFH	-	
X176	Day and hour of alarm occurrence (Seventh last)	0000H to FFFFH	-	
X177	Minute and second of alarm occurrence (Seventh last)	0000H to FFFFH	-	
X180	Alarm history (Eighth last)	0000H to FFFFH	-	
X185	Year and month of alarm occurrence (Eighth last)	0000H to FFFFH	-	
X186	Day and hour of alarm occurrence (Eighth last)	0000H to FFFFH	-	
X187	Minute and second of alarm occurrence (Eighth last)	0000H to FFFFH	-	
X190	Alarm history (Ninth last)	0000H to FFFFH	-	
X195	Year and month of alarm occurrence (Ninth last)	0000H to FFFFH	-	
X196	Day and hour of alarm occurrence (Ninth last)	0000H to FFFFH	-	
X197	Minute and second of alarm occurrence (Ninth last)	0000H to FFFFH	-	

Table 7.13 Keypad-related function codes (Z codes)

Code	Name	Monitor scope	Unit	Remarks
Z00	Second last info. on alarm (output frequency)	0.00 to 655.35	Hz	
Z01	(output current)	0.00 to 9999	A	FGI
		0.00 to 655.35	A	RTU (inverter capacity 22kW (30HP) or less)
		0.0 to 5000.0	A	RTU (inverter capacity 30kW (40HP) or more)
Z02	(output voltage)	0 to 1000	V	
Z03	(Torque)	-999 to 999	%	
Z04	(set frequency)	0.00 to 655.35	Hz	
Z05	(operation status)	0000H to FFFFH	–	
Z06	(cumulative ope. time)	0 to 65535	h	
Z07	(number of startups)	0 to 65535	Times	
Z08	(DC link circuit voltage)	0 to 1000	V	
Z09	(internal air temperature)	0 to 255	°C	
Z10	(heat sink temperature)	0 to 255	°C	
Z11	(input terminal)	0000H to FFFFH	–	
Z12	(output terminal)	0000H to FFFFH	–	
Z13	(input terminal(com.))	0000H to FFFFH	–	
Z14	(output terminal(com.))	0000H to FFFFH	–	
Z16	(operation status)	0000H to FFFFH	–	
Z17	(speed detection)	-32768 to 32767	–	
Z18	(Running status 3)	0000H to FFFFH	–	
Z40	cumulative operation time of motor (M1)	0 to 65535 (in units of 10 hours)	10h	
Z41	cumulative operation time of motor (M2)	0 to 65535 (in units of 10 hours)	10h	
Z42	cumulative operation time of motor (M3)	0 to 65535 (in units of 10 hours)	10h	
Z43	cumulative operation time of motor (M4)	0 to 65535 (in units of 10 hours)	10h	
Z44	number of startups (M2)	0 to 65535	Times	
Z45	number of startups (M3)	0 to 65535	Times	
Z46	number of startups (M4)	0 to 65535	Times	
Z50	Third last info. on alarm (output frequency)	0.00 to 655.35	Hz	
Z51	(output current)	0.00 to 9999	A	FGI
		0.00 to 655.35	A	RTU (inverter capacity 22kW (30HP) or less)
		0.0 to 5000.0	A	RTU (inverter capacity 30kW (40HP) or more)
Z52	(output voltage)	0 to 1000	V	
Z53	(Torque)	-999 to 999	%	
Z54	(set frequency)	0.00 to 655.35	Hz	
Z55	(operation status)	0000H to FFFFH	–	
Z56	(cumulative ope. time)	0 to 65535	h	
Z57	(number of startups)	0 to 65535	Times	
Z58	(DC link circuit voltage)	0 to 1000	V	
Z59	(internal air temperature)	0 to 255	°C	
Z60	(heat sink temperature)	0 to 255	°C	
Z61	(input terminal)	0000H to FFFFH	–	

Table 7.13 Keypad-related function codes (Z codes) (Continued)

Code	Name	Monitor scope	Unit	Remarks
Z62	Third last info. on alarm (output terminal)	0000H to FFFFH	—	
Z63	(input terminal(com.))	0000H to FFFFH	—	
Z64	(output terminal(com.))	0000H to FFFFH	—	
Z66	(operation status)	0000H to FFFFH	—	
Z67	(speed detection)	-32768 to 32767	—	
Z68	(Running status 3)	0000H to FFFFH	—	
Z90	Current Position Pulse (Upper column)	-999 to 999	—	
Z91	Current Position Pulse (Lower column)	0 to 9999	—	
Z92	Stop Position Pulse (Upper column)	-999 to 999	—	
Z93	Stop Position Pulse (Lower column)	0 to 9999	—	
Z94	Difference Pulse of Position (Upper column)	-999 to 999	—	
Z95	Difference Pulse of Position (Lower column)	0 to 9999	—	

7.2 Data Formats

7.2.1 List of data format numbers

Shows the communication data format No. for function code data. Create data in accordance with the data format specifications described later. Refer to the User's Manual and parameter list for each model for details on the data range and units, as well as which data formats are supported.

RTU, FGI, and BUS in the "Format number" field represent the Modbus RTU protocol, FUJI general-purpose inverter protocol, and fieldbus, respectively.

Table 7.14 List of data format numbers (F codes)

Code	Name	Format number
F00	Data Protection	[1]
F01	Frequency command 1	[1]
F02	Operation method	[1]
F03	Maximum frequency 1	[3]
F04	Base frequency 1	[3]
F05	Rated voltage at base frequency 1	[1]
F06	Maximum output voltage 1	[1]
F07	Acceleration time 1	[12]
F08	Deceleration time 1	[12]
F09	Torque boost 1	[3]
F10	Electronic thermal overload protection for motor 1 (Select motor characteristics)	[1]
F11	(Overload detection level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
F12	(Thermal time constant)	[3]
F14	Restart mode after momentary power failure (Mode selection)	[1]
F15	Frequency Limiter (High)	[3]
F16	(Low)	[3]
F18	Bias (Frequency command 1)	[6]
F20	DC Braking 1 (Braking starting frequency)	[3]
F21	(Braking level)	[1]
F22	(Braking time)	[5]
F23	Starting frequency 1	[3]
F24	(Holding time)	[5]
F25	Stopping frequency	[3]
F26	Motor sound (Carrier frequency)	[1] *2
F27	(Tone)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The frequency of 0.75kHz will be treated as 0.

*3 The data format when using RTU changes based on function code y93 and y96.

*4 The terminal name differs depending on the model.

Table 7.14 List of data format numbers (F codes) (Continued)

Code	Name	Format number
F29	Terminal [FMA*1] (Function selection)	[1]
	Terminal [FM] (Function selection)	[1]
F30	Terminal [FMA*1] (Gain to output voltage)	[1]
	Terminal [FM] (Gain to output voltage)	[1]
F31	Terminal [FMA*1] (Function Selection)	[1]
	Terminal [FM] (Function Selection)	[1]
F32	Terminal [FM2] (Mode selection)	[1]
F33	Terminal [FMP] (Pulse Rate)	[1]
	Terminal [FM] (Pulse Rate)	[1]
F34	Terminal [FMP*6] (Voltage adjust)	[1]
	Terminal [FMI] (output current adjust)	[1]
F35	Terminal [FMP*6] (Function)	[1]
	Terminal [FMI] Function)	[1]
F37	Load Selection/Auto Torque Boost/Auto Energy Saving Operation	[1]
F38	Stop Frequency (Detection System)	[1]
F39	(Holding Time)	[5]
F40	Torque Limiter 1 (Limiting Level for driving)	[1]
F41	(Limiting Level for braking)	[1]
F42	Control Mode Selection 1	[1]
F43	Current Limiter (Mode selection)	[1]
F44	(Level)	[1]
F50	Electronic Thermal Overload Protection for Braking Resistor (Discharging capability)	[1] *7
F51	(Allowable average loss)	[7] *7
F52	(for braking resistor)	[12]
F58	Terminal [FMA/FM/FM1] *3 (Filter)	[5]
F59	Terminal [FMA/FM/FM1] *3 (Bias)	[4]
F60	Terminal [FM2] (Output gain)	[1]
F61	Terminal [FM2] (Function selection)	[1]
F62	Terminal [FM2] (Filter)	[5]
F63	Terminal [FM2] (Bias)	[4]
F64	Terminal [FMP] (Filter)	[5]
F80	HD/LD switching	[1]

*1 The terminal name differs depending on the model.

*7 The value of 999 will be treated as 7FFFH.

Table 7.15 List of data format numbers (E codes)

Code	Name	Format number
E01	Terminal [X1] Function	[1]
E02	Terminal [X2] Function	[1]
E03	Terminal [X3] Function	[1]
E04	Terminal [X4] Function	[1]
E05	Terminal [X5] Function	[1]
E06	Terminal [X6] Function	[1]
E07	Terminal [X7] Function	[1]
E08	Terminal [X8] Function	[1]
E09	Terminal [X9] Function	[1]
E10	Acceleration time 2	[12]
E11	Deceleration time 2	[12]
E12	Acceleration time 3	[12]
E13	Deceleration time 3	[12]
E14	Acceleration time 4	[12]
E15	Deceleration time 4	[12]
E16 *2	Torque Limiter 2 (Limiting Level for driving)	[1]
	Torque Limiter 2 -1	[2]
E17 *2	Torque Limiter 2 (Limiting Level for braking)	[1]
	Torque Limiter 2 -2	[2]
E20	Terminal [Y1] Function	[1]
E21	Terminal [Y2] Function	[1]
E22	Terminal [Y3] Function	[1]
E23	Terminal [Y4] Function	[1]
E24	Terminal [Y5] Function	[1]
E27	Terminal [30A/B/C] Function	[1]
E29	Frequency level detection delay timer	[5]
E30	Frequency Arrival (Hysteresis width)	[3]
E31	Frequency Detection (FDT) (Detection level)	[3]
E32	(hysteresis width)	[3]
E34	Overload early warning/Current detection 1 (level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
E35	(timer)	[5]
E36	Frequency Detection 2 (FDT 2) (Detection Level)	[3]
E37	Current detection 2/Low current detection (Detection Level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
E38	(timer)	[5]
E39	Coefficient for Constant Feeding Rate Time	[7]
E40	PID Display Coefficient A	[12]
E41	PID Display Coefficient B	[12]
E42	LED Display filter	[5]
E43	LED Monitor (Item selection)	[1]
E45	LCD monitor (Item selection)	[1]

*2 The format No. differs depending on the model.

Table 7.15 List of data format numbers (E codes) (Continued)

Code	Name	Format number
E46	LCD monitor (Language selection)	[1]
E47	(Contrast control)	[1]
E48	LED Monitor details (Speed monitor item)	[1]
E49	Torque Command Monitor (Polarity selection)	[1]
E50	Coefficient for Speed Indication	[5]
E51	Display Coefficient for Input Watt-hour Data	[45]
E52	Keypad (Menu display mode)	[1]
E54	Frequency detection 3 (Level)	[3]
E55	Current detection 3 (Level)	[24](FGI)
		[19](RTU) *3
		[24](BUS) *1
E56	(Timer time)	[5]
E57	Integral power pulse output unit	[1]
E59	Switch function of C1 terminal	[1]
E60	Built-in Potentiometer (Function selection)	[1]
E61	Terminal [12] Extended Function	[1]
E62	Terminal [C1] (Extended function selection)	[1]
	Terminal [C2] (C1 function) (Extended function selection)	[1]
E63 *4	Terminal [V2] (Extended function selection)	[1]
	Terminal [C1] (V2 function) (Extended function selection)	[1]
E64	Saving Digital Reference Frequency	[1]
E65	Reference Loss Detection	[1] *2
E70	M/Shift key (Function selection)	[1]
E71	M-LED indicator (Function selection)	[1]
E76	DC link bus low-voltage detection level	[1]
E78	Torque detection 1 (Level)	[1]
E79	(Timer time)	[5]
E80	Detect Torque 2/Detect Low Torque 2 (Detection level)	[1]
E81	(Timer)	[5]
E82	Acceleration/deceleration switching frequency	[3]
E83	Low-speed acceleration time	[12]
E84	Low-speed deceleration time	[12]
E85	Slow deceleration time switching frequency	[3]
E86	Slow deceleration time (Check valve protection)	[12]
E98	Terminal [FWD] Function	[1]
E99	Terminal [REV] Function	[1]

*1 BUS: This the fieldbus option format. Refer to the instruction manual for each fieldbus option for details on the respective fieldbus options.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

*4 The terminal name differs depending on the model.

Table 7.16 List of data format numbers (C codes)

Code	Name	Format number
C01	Jump Frequency 1	[3]
C02	Jump Frequency 2	[3]
C03	Jump Frequency 3	[3]
C04	Jump Frequency (Hysteresis)	[3]
C05	Multi-Frequency 1	[5]
		[22]
C06	Multi-Frequency 2	[5]
		[22]
C07	Multi-Frequency 3	[5]
		[22]
C08	Multi-Frequency 4	[5]
		[22]
C09	Multi-Frequency 5	[5]
		[22]
C10	Multi-Frequency 6	[5]
		[22]
C11	Multi-Frequency 7	[5]
		[22]
C12	Multi-Frequency 8	[5]
		[22]
C13	Multi-Frequency 9	[5]
		[22]
C14	Multi-Frequency 10	[5]
		[22]
C15	Multi-Frequency 11	[5]
		[22]
C16	Multi-Frequency 12	[5]
		[22]
C17	Multi-Frequency 13	[5]
		[22]
C18	Multi-Frequency 14	[5]
		[22]
C19	Multi-Frequency 15	[5]
		[22]
C20	Jogging Frequency	[5]
C21	Timer Operation	[1]
C22 *1	Pattern operation	(Stage 1) [84]
		[12]
C23 *1		(Stage 2) [84]
		[12]
C24 *1		(Stage 3) [84]
		[12]
C25 *1		(Stage 4) [84]
		[12]

*1 The terminal name differs depending on the model.

*2 Functions differ depending on the model.

*3 Rewriting is possible on certain models.

Table 7.16 List of data format numbers (C codes) (Continued)

Code	Name	Format number
C26 *1	Pattern operation (Stage 5)	[84]
		[12]
C27 *1	(Stage 6)	[84]
		[12]
C28 *1	(Stage 7)	[84]
		[12]
C30	Frequency command 2	[1]
C31	Analog Input Adjustment for [12] (offset)	[4]
C32	(Gain)	[5]
C33	(Filter time constant)	[5]
C34	(Gain base point)	[5]
C35	(Polarity)	[1]
C36	Analog Input Adjustment for [C1] (Offset)	[4]
	Analog Input Adjustment for [C1] (C1 function) (Offset)	[4]
C37	Analog Input Adjustment for [C1] (Gain)	[5]
	Analog Input Adjustment for [C1] (C1 function) (Gain)	[5]
C38	Analog Input Adjustment for [C1] (Filter time constant)	[5]
	Analog Input Adjustment for [C1] (C1 function) (Filter time constant)	[5]
C39	Analog Input Adjustment for [C1] (Gain base point)	[5]
	Analog Input Adjustment for [C1] (C1 function) (Gain base point)	[5]
C41	Analog Input Adjustment for [V2] (Offset)	[4]
	Analog Input Adjustment for [C1] (V2 function) (Offset)	[4]
C42	Analog Input Adjustment for [V2] (Gain)	[5]
	Analog Input Adjustment for [C1] (V2 function) (Gain)	[5]
C43	Analog Input Adjustment for [V2] (Filter time constant)	[5]
	Analog Input Adjustment for [C1] (V2 function) (Filter time constant)	[5]
C44	Analog Input Adjustment for [V2] (Gain base point)	[5]
	Analog Input Adjustment for [C1] (V2 function) (Gain base point)	[5]
C45	Analog input Adjustment for [V2] (Polarity)	[1]
C50	Bias (Frequency command 1) (Bias base point)	[5]
C51	Bias [PID command 1] (Bias value)	[6]
C52	(Bias base point)	[5]
C53	Selection of Normal/Inverse Operation (Frequency command 1)	[1]
C54	Selection of normal/inverse operation (Frequency setting 2)	[1]
C55	Analog input adjustment (Terminal [12]) (Bias)	[6]
C56	(Bias base point)	[5]
C58	(Display unit)	[1]
C59	(Maximum scale)	[12]
C60	(Minimum scale)	[12]
C61	Analog input adjustment (Terminal [C1](C1 function)) (Bias)	[6]
C62	(Bias base point)	[5]
C64	(Display unit)	[1]
C65	(Maximum scale)	[12]
C66	(Minimum scale)	[12]

*1 The terminal name differs depending on the model.

*2 Functions differ depending on the model.

*3 Rewriting is possible on certain models.

Table 7.16 List of data format numbers (C codes) (Continued)

Code	Name	Format number
C67 *1	Analog input adjustment (Terminal [V2/C1] (V2 function)) (Bias)	[6]
C68	(Bias base point)	[5]
C70	(Display unit)	[1]
C71	(Maximum scale)	[12]
C72	(Minimum scale)	[12]
C74	Analog input adjustment (Terminal [V3] (Offset))	[4]
C75	(Gain)	[5]
C76	(Filter)	[5]
C77	(Gain base point)	[5]
C78	(Polarity selection)	[1]
C82 *2	Rotation direction, acceleration/deceleration time (Stage 1)	[1]
	Analog input adjustment (Terminal [V3] (Bias))	[6]
C83 *2	Rotation direction, acceleration/deceleration time (Stage 2)	[1]
	Analog input adjustment (Terminal [V3])(Bias base point)	[5]
C84 *2	Rotation direction, acceleration/deceleration time (Stage 3)	[1]
	Analog input adjustment (Terminal [V3] (Display unit))	[1]
C85 *2	Rotation direction, acceleration/deceleration time (Stage 4)	[1]
	Analog input adjustment (Terminal [V3] (Maximum scale))	[12]
C86 *2	Rotation direction, acceleration/deceleration time (Stage 5)	[1]
	Analog input adjustment (Terminal [V3] (Minimum scale))	[12]
C87	Rotation direction, acceleration/deceleration time (Stage 6)	[1]
C88	Rotation direction, acceleration/deceleration time Stage 7)	[1]
C89	Frequency correction with communication function 1 (Numerator)	[2]
C90	Frequency correction with communication function 2 (Denominator)	[2]
C94	Jump frequency 4	[3]
C95	Jump frequency 5	[3]
C96	Jump frequency 6	[3]
C99	Digital setting frequency * Writing is possible only with the communication function. * TP means monitor only. *3	[22]

*1 The terminal name differs depending on the model.

*2 Functions differ depending on the model.

*3 Rewriting is possible on certain models.

Table 7.17 List of data format numbers (P codes)

Code	Name	Format number
P01	Motor 1 (No. of poles)	[1]
P02	(Rated Capacity)	[11]
	When P99 = 1 only	[25]
P03	(Rated current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
P04	(Auto-tuning)	[21]
P05	(Online Tuning)	[1]
P06	(No-load current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
P07	(%R1)	[5]
P08	(%X)	[5]
P09	(Slip compensation gain for driving)	[3]
P10	(Slip compensation response time)	[5]
P11	(Slip compensation gain (Braking))	[3]
P12	(Rated slip frequency)	[5]
P13	(Iron loss coefficient 1)	[5]
P14	(Iron loss coefficient 2)	[5]
P15	(Iron loss coefficient 3)	[5]
P16	(Magnetic saturation coefficient 1)	[3]
P17	(Magnetic saturation coefficient 2)	[3]
P18	(Magnetic saturation coefficient 3)	[3]
P19	(Magnetic saturation coefficient 4)	[3]
P20	(Magnetic saturation coefficient 5)	[3]
P21	(Magnetic saturation expansion coefficient a)	[3]
P22	(Magnetic saturation expansion coefficient b)	[3]
P23	(Magnetic saturation expansion coefficient c)	[3]
P24	(Load inertia 1)	[45]
P53	(%X compensation coefficient 1)	[1]
P54	(%X compensation coefficient 2)	[1]
P55	(Vector control torque current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
P56	(Vector control t inductive voltage coefficient)	[1]
P57	Reserved.	[7]
P60	Motor 1 (PMSM armature resistance)	[45]
P61	(PMSM d-axis inductance)	[24]
P62	(PMSM q-axis inductance)	[24]
P63	(PMSM induced voltage)	[1]
P64	(PMSM iron loss)	[3]
P65	(PMSM d-axis inductance magnetic saturation correction)	[3]
P74	(PMSM reference current at starting)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

Table 7.17 List of data format numbers (P codes) (Continued)

Code	Name	Format number
P82	Motor 1 (PMSM, for manufacturer)	[1]
P83	(PMSM, for manufacturer)	[3]
P84	(PMSM, for manufacturer)	[3]
P85	(PMSM flux limitation value)	[3]
P86	(PMSM, for manufacturer)	[3]
P87	(PMSM reference current for polarity discrimination)	[1]
P88	(PMSM, for manufacturer)	[1]
P89	(PMSM, for manufacturer)	[1]
P90 *1	(PMSM overcurrent protection level)	[19]
		[24]
P91	(Damping control d-axis compensation gain)	[5]
P92	(Damping control q-axis compensation gain)	[5]
P93	(Step-out detection current detection level)	[1]
P95	(Magnetic pole position sensor offset)	[3]
P99	Motor 1 Selection	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

Table 7.18 List of data format numbers (H codes)

Code	Name	Format number
H00	Simulated operation mode	[1]
H02	Data initialization (Method)	[1]
H03	Data Initialization	[1]
H04	Auto-reset (times)	[1]
H05	(Reset interval)	[3]
H06	Cooling Fan ON/OFF Control	[1]
H07	Acceleration/Deceleration Pattern	[1]
H08	Rotation Direction Limitation	[1]
H09	Start Mode (Auto search)	[1]
H11	Deceleration Mode	[1]
H12	Instantaneous Overcurrent Limiting (Mode selection)	[1]
H13	Restart Mode after Momentary Power Failure (Restart time)	[3]
H14	(Frequency fall rate)	[5] *1
H15	(Holding DC voltage)	[1]
H16	(Allowable momentary power failure time)	[3] *1
H17	Start Mode (Pick up frequency)	[3] *1
H18	Torque control (Operation selection)	[1]
H26	Thermistor (Mode selection)	[1]
H27	(Level)	[5]
H28	Droop control	[4]
H30	Communications Link Function (Mode selection)	[1]
H31	Link function (Terminal operation selection)	[1]
H42	Capacitance of DC Link Bus Capacitor	[1]
H43	Cumulative Run Time of Cooling Fan	[1]
H44	Startup Times 1 of Motor	[1]
H45	Mock Alarm	[1]
H46	Restart Mode after Momentary Power Failure (Restart time)	[3]
H47	Initial Capacitance of DC Link Bus Capacitor	[1]
H48	Cumulative Run Time of Capacitors on the PCB	[1]
H49	Starting Mode (Delay time)	[3]
H50	Non-linear V/f Pattern 1 (Frequency)	[3]
H51	(Voltage)	[1]
H52	Non-linear V/f 2 (Frequency)	[3]
H53	(Voltage)	[1]
H54	Acceleration time (Jogging operation)	[12]
H55	Deceleration time (Jogging operation)	[12]
H56	Deceleration Time for Forced Stop	[12]
H57	1st S-curve range at acceleration (start)	[1]
H58	2nd S-curve range at deceleration (end)	[1]
H59	1st S-curve range at acceleration (start)	[1]
H60	2nd S-curve range at deceleration (end)	[1]
H61	UP/DOWN Control Initial frequency setting	[1]
H62	UP/DOWN extended function selection	[1]
H63	Low Limiter (Mode selection)	[1]
H64	(Lower limiting frequency)	[3]
H65	Non-linear V/f 3 (Frequency)	[3]
H66	(Voltage)	[1]

*1 The value of 999 will be treated as 7FFFH.

Table 7.18 List of data format numbers (H codes) (Continued)

Code	Name	Format number
H67	Automatic energy saving operation (Mode selection)	[1]
H68	Slip Compensation 1 (Operating conditions)	[1]
H69	Automatic deceleration (Mode selection)	[1]
H70	Overload prevention control	[5] *1
H71	Deceleration Characteristics	[1]
H72	Main Power Down Detection (Mode Selection)	[1]
H73	Torque Limiter (Operation condition selection)	[1]
H74	(Control target)	[1]
H75	(Applicable quadrant)	[1]
H76	Torque Limiter (Frequency increment limit for braking)	[3]
H77	Main circuit capacity life (remaining hour)	[74]
H78	Maintenance setting time (M1)	[74]
H79	No. of maintenance setting starting times (M1)	[1]
H80	Output Current Fluctuation Damping Gain for Motor 1	[5]
H81	Light alarm selection 1	[1]
H82	Light alarm selection 2	[1]
H83	Light alarm selection 3	[1]
H84	Pre-excitation (initial level)	[1]
H85	(time)	[5]
H86	Reserved.	[1]
H87		[3]
H88		[1]
H89		[1]
H90		[1]
H91	PID feedback disconnection detection	[1]
H92	Continue to Run (P-component: gain)	[7] *1
H93	(I-component: time)	[7] *1
H94	Cumulative Motor Run Time 1	[1]
H95	DC braking (Braking response mode)	[1]
H96	STOP key priority / Start check function	[1]
H97	Clear alarm data	[1]
H98	Protection/Maintenance Function (Mode selection)	[1]

*1 The value of 999 will be treated as 7FFFH.

Table 7.19 Data format No. list (H1 codes)

Code	Name	Format number
H101	Destination setting	[1]
H104	Retry count clear time	[3]
H105	Retry target selection 1	[1]
H106	Retry target selection 2	[1]
H110	Input phase loss protection avoidance operation	[1]
H111	UPS operation level	[1]
H112	Undervoltage avoidance operation	[1]
H114	Anti-regenerative control (Operation level)	[3]
H116	Forced operation (Operation selection)	[1]
H117	(Confirmation time)	[3]
H118	(Set frequency)	[3]
H119	(Run command)	[1]
H120	(Starting method)	[1]
H121	(Interval)	[3]
H122	Cooling fan min. run time	[1]
H130	For manufacturer	[7]
H131		[7]
H132		[7]
H133		[7]
H134		[7]
H135		[7]
H136		[5]
H137		[7]
H147	Speed control (Jogging) FF (Gain)	[5]
H154	Torque bias (Function selection)	[1]
H155	(Level 1)	[2]
H156	(Level 2)	[2]
H157	(Level 3)	[2]
H158	(Mechanical loss compensation)	[1]
H159	(Startup timer)	[5]
H161	(Shutdown timer)	[5]
H162	(Limiter)	[1]
H173	Magnetic flux level at light load	[1]
H180	Brake signal (Check-timer for brake operation)	[5]
H181	Light alarm selection 1	[1]
H182	Light alarm selection 2	[1]
H183	Light alarm selection 3	[1]
H184	Light alarm selection 4	[1]
H185	For manufacturer	[1]
H190	Motor output phase sequence selection	[1]
H193	User initial value (Save)	[1]
H194	(Protection)	[1]
H195	DC braking (Braking timer at the startup)	[5]
H196	For manufacturer	[7]
H197	User password 1 (Selection of protective operation)	[1]
H198	(Setting/comparison)	[1]
H199	User password (Protection enabled)	[1]

Table 7.20 List of data format numbers (A codes)

Code	Name	Format number
A01	Maximum frequency 2	[3]
A02	Base frequency 2	[3]
A03	Rated voltage at base frequency 2	[1]
A04	Maximum output voltage 2	[1]
A05	Torque boost 2	[3]
A06	Electronic thermal overload protection for motor 2 (Select motor characteristics)	[1]
A07	(Overload detection level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
A08	(Thermal time constant)	[3]
A09	DC Braking 2 (Braking starting frequency)	[3]
A10	(Braking level)	[1]
A11	(Braking time)	[5]
A12	Starting frequency 2	[3]
A13	Load Selection/Auto Torque Boost/Auto Energy Saving Operation 2	[1]
A14	Control Mode Selection 2	[1]
A15	Motor 2 (No. of poles)	[1]
A16	(Rated Capacity)Motor 2 (No. of poles) When A39 = 0, 2 to 4	[11]
		When A39 = 1 [25]
A17	Rated Motor 2 Capacity	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
A18	Motor 2 (Auto-tuning)	[21]
A19	(Online-tuning)	[1]
A20	(No-load current)	[24] (FGI)
		[19] (RTU)
		[24](BUS) *1
A21	(%R2)	[5]
A22	(%X)	[5]
A23	(Slip compensation gain for driving)	[3]
A24	(Slip compensation response time)	[5]
A25	(Slip compensation gain for braking)	[3]
A26	(Rated slip frequency)	[5]
A27	(Iron loss coefficient 1)	[5]
A28	(Iron loss coefficient 2)	[5]
A29	(Iron loss coefficient 3)	[5]
A30	(Magnetic saturation coefficient 1)	[3]
A31	(Magnetic saturation coefficient 2)	[3]
A32	(Magnetic saturation coefficient 3)	[3]
A33	(Magnetic saturation coefficient 4)	[3]
A34	(Magnetic saturation coefficient 5)	[3]
A35	(Magnetic saturation expansion coefficient a)	[3]
A36	(Magnetic saturation expansion coefficient b)	[3]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

*4 Functions differ depending on the model.

Table 7.20 List of data format numbers (A codes) (Continued)

Code	Name	Format number
A37	Motor 2 (Magnetic saturation expansion coefficient c)	[3]
A39	Motor 2 Selection	[1]
A40	Slip Compensation 2 (Operating conditions)	[1]
A41	Output Current Fluctuation Damping Gain 2	[5]
A42	Motor/parameter switching 2 (Mode selection)	[1]
A43	Speed control 2 (Speed command filter)	[7]
A44	(Speed detection filter)	[7]
A45	Cumulative Motor Run Time 2	[1]
	Speed control 2 P (Gain)	[3]
A46	Number of Starting Times 2	[1]
	Speed control 2 I(Integration time)	[7]
A47	(FF gain)	[5]
A48	(Output filter)	[7]
A49	(Notch filter resonance frequency)	[1]
A50	(Notch filter attenuation level)	[1]
A51	Cumulative Motor Run Time 2	[74]
A52	Startup Times of Motor 2	[1]
A53	Motor 2 (%X compensation efficient 1)	[1]
A54	(%XCompensation coefficient 2)	[1]
A55	(Vector control torque current	[24] (FGI)
		[19] (RTU)
		[24](BUS) *1
A56	(Vector control inductive voltage coefficient)	[1]
A57	Reserved.	[7]
A58	Speed control 2 (Notch filter width)	[1]
A60	Speed display coefficient 2	[5]
A61	Constant rate of feeding coefficient 2	[45]
A62	Starting frequency 2 holding time	[5]
A63	Starting frequency 2	[3]
A64	Stop frequency 2 detection method	[1]
A65	Stop frequency 2 holding time	[5]
A66	Thermistor operation selection 2	[1]
A67	Thermistor operation level 2	[5]
A98	Motor 2 (Function selection)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

*4 Functions differ depending on the model.

Table 7.21 List of data format numbers (b codes)

Code	Name	Format number
b01	Maximum frequency 3	[3]
b02	Base frequency 3	[3]
b03	Rated voltage at base frequency 3	[1]
b04	Maximum output voltage 3	[1]
b05	Torque boost 3	[3]
b06	Electronic thermal overload protection for motor 3 (Select motor characteristics)	[1]
b07	(Overload detection level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
b08	(Thermal time constant)	[3]
b09	DC Braking 3 (Braking starting frequency)	[3]
b10	(Braking level)	[1]
b11	(Braking time)	[5]
b12	Starting frequency 3	[3]
b13	Load Selection/Auto Torque Boost/Auto Energy Saving Operation 3	[1]
b14	Control Mode Selection 3	[1]
b15	Motor 3 (No. of poles)	[1]
b16	Motor 3 (Rated Capacity) b39=0, 2 to4 b=1	[11]
		[25]
b17	Motor 3 (Rated current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
b18	(Auto-tuning)	[21]
b19	(Online tuning)	[1]
b20	(No-load current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
b21	(%R3)	[5]
b22	(%X)	[5]
b23	(Slip compensation gain for driving)	[3]
b24	(Slip compensation response time)	[5]
b25	(Slip compensation gain for braking)	[3]
b26	(Rated slip frequency)	[5]
b27	(Iron loss coefficient 1)	[5]
b28	(Iron loss coefficient 2)	[5]
b29	(Iron loss coefficient 3)	[5]
b30	(Magnetic saturation coefficient 1)	[3]
b31	(Magnetic saturation coefficient 2)	[3]
b32	(Magnetic saturation coefficient 3)	[3]
b33	(Magnetic saturation coefficient 4)	[3]
b34	(Magnetic saturation coefficient 5)	[3]
b35	(Magnetic saturation expansion coefficient a)	[3]
b36	(Magnetic saturation expansion coefficient b)	[3]
b37	(Magnetic saturation expansion coefficient c)	[3]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.21 List of data format numbers (b codes) (Continued)

Code	Name	Format number
b38	Motor 3 (Load inertia 3)	[45]
b39	Motor 3 Selection	[1]
b40	Slip Compensation 3 (Operating conditions)	[1]
b41	Output Current Fluctuation Damping Gain 3	[5]
b42	Motor/parameter switching 3 (Mode selection)	[1]
b43	Speed control 3 (Speed command filter)	[7]
b44	(Speed detection filter)	[7]
b45	Speed control 3 P (Gain)	[3]
b46	(Integration time)	[7]
b47	FF (Gain)	[5]
b48	Speed control 3 (Output filter)	[1]
b49	(Notch filter resonance frequency)	[1]
b50	(Notch filter attenuation level)	[1]
b51	Cumulative Motor Run Time 3	[7]
b52	Startup Times of Motor 3	[1]
b53	Motor 3 (%X compensation efficient 1)	[1]
b54	(%XCompensation coefficient 2)	[1]
b55	(Vector control torque current)	[24] (FGI)
		[19] (RTU)
		[24](BUS) *1
b56	(Vector control inductive voltage coefficient)	[1]
b57	Reserved.	[1]
b57	(For manufacturer)	[7]
b58	Speed control 3 (Notch filter width)	[1]
b60	Speed display coefficient 3	[5]
b61	Constant rate of feeding coefficient 3	[45]
b62	Starting frequency 3 holding time	[5]
b63	Starting frequency 3	[3]
b64	Stop frequency 3 detection method	[1]
b65	Stop frequency 3 holding time	[5]
b66	Thermistor operation selection 3	[1]
b67	Thermistor operation level 3	[5]
b98	Motor 3 (Function selection)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.22 List of data format numbers (r codes)

Code	Name	Format number
r01	Maximum frequency 4	[3]
r02	Base frequency 4	[3]
r03	Rated voltage at base frequency 4	[1]
r04	Maximum output voltage 4	[1]
r05	Torque boost 4	[3]
r06	Electronic thermal overload protection for motor 4 (Select motor characteristics)	[1]
r07	(Overload detection level)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
r08	(Thermal time constant)	[3]
r09	DC Braking 4 (Braking starting frequency)	[3]
r10	(Braking level)	[1]
r11	(Braking time)	[5]
r12	Starting frequency 4	[3]
r13	Load Selection/Auto Torque Boost/Auto Energy Saving Operation 4	[1]
r14	Control Mode Selection 4	[1]
r15	Motor 4 (No. of poles)	[1]
r16	Motor 4 (Rated Capacity) r49=0, 2 to4 r=1	[11]
		[25]
r17	Motor 4 (Rated current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
r18	(Auto-tuning)	[21]
r20	(No-load current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
r21	(%R4)	[5]
r22	(%X)	[5]
r23	(Slip compensation gain for driving)	[3]
r24	(Slip compensation response time)	[5]
r25	(Slip compensation gain for braking)	[3]
r26	(Rated slip frequency)	[5]
r27	(Iron loss coefficient 1)	[5]
r28	(Iron loss coefficient 2)	[5]
r29	(Iron loss coefficient 4)	[5]
r30	(Magnetic saturation coefficient 1)	[3]
r31	(Magnetic saturation coefficient 2)	[3]
r32	(Magnetic saturation coefficient 4)	[3]
r33	(Magnetic saturation coefficient 4)	[3]
r34	(Magnetic saturation coefficient 5)	[3]
r35	(Magnetic saturation expansion coefficient a)	[3]
r36	(Magnetic saturation expansion coefficient b)	[3]
r37	(Magnetic saturation expansion coefficient c)	[3]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.22 List of data format numbers (r codes) (Continued)

Code	Name	Format number
r38	Motor 4 (Load inertia 4)	[45]
r39	Motor 4 Selection	[1]
r40	Slip Compensation 4 (Operating conditions)	[1]
r41	Output Current Fluctuation Damping Gain 4	[5]
r42	Motor/parameter switching 4 (Mode selection)	[1]
r43	Speed control 4 (Speed command filter)	[7]
r44	(Speed detection filter)	[7]
r45	Speed control 4 P (Gain)	[3]
r46	(Integration time)	[7]
r47	FF (Gain)	
r48	Speed control 4 (Output filter)	[1]
r49	(Notch filter resonance frequency)	[1]
r50	(Notch filter attenuation level)	[1]
r51	Cumulative Motor Run Time 4	[7]
r52	Startup Times of Motor 4	[1]
r53	Motor 4 (%X compensation efficient 1)	[1]
r54	(%XCompensation coefficient 2)	[1]
r55	(Vector control torque current)	[24] (FGI)
		[19] (RTU)
		[24](BUS) *1
r56	(Vector control inductive voltage coefficient)	[1]
r57	Reserved.	[1]
r58	Speed control 4 (Notch filter width)	[1]
r60	Speed display coefficient 4	[5]
r61	Constant rate of feeding coefficient 4	[45]
r62	Starting frequency 4 holding time	[5]
r63	Starting frequency 4	[3]
r64	Stop frequency 4 detection method	[1]
r65	Stop frequency 4 holding time	[5]
r66	Thermistor operation selection 4	[1]
r67	Thermistor operation level 4	[5]
r98	Motor 4 (Function selection)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 999 is handled as 7FFFH.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.23 List of data format numbers (J codes)

Code	Name	Format number
J01	PID control (Mode selection)	[1]
J02	(Remote command)	[1]
J03	P (gain)	[7]
J04	I (Integration time)	[3]
J05	D (Derivative time)	[5]
J06	(Feedback filter)	[3]
J08	(Pressurized frequency)	[3]
J09	(Pressuring time)	[1]
J10	(Anti reset windup)	[1]
J11	(Select alarm output)	[1]
J12	(Upper level alarm (AH))	[2]
J13	(Lower level alarm (AL))	[2]
J15	(Stop frequency for slow flowrate)	[1]
J16	(Slow flowrate level stop latency)	[1]
J17	(Starting frequency)	[1]
J18	(Upper limit of PID process output)	[1]
		[2]
J19	(Lower limit of PID process output)	[1]
		[2]
J21	Dew Condensation Prevention (Duty)	[1]
J22	Commercial Power Switching Sequence	[1]
J23	PID control (Startup feedback deviation following low liquid level stop)	[3]
J24	(Startup delay time following low liquid level stop)	[1]
J56	(Speed command filter)	[5]
J57	(Dancer reference position)	[2]
J58	(Detection width of Dancer position deviation)	[1]
J59	P (gain) 2	[7]
J60	I (Integral time) 2	[3]
J61	D (Derivative time) 2	[5]
J62	(PID control block selection)	[1]
J63	Overload Stop (Detected value)	[1]
J64	(Detection level)	[1]
J65	(Function selection)	[1]
J66	(Operation condition)	[1]
J67	(Timer)	[5]
J68	Braking signal (Brake release current)	[1]
J69	(Brake release frequency)	[3]
J70	(Brake release timer)	[3]
J71	(Brake apply frequency)	[3]
J72	(Brake apply timer)	[3]
J73	Position control (Start time)	[3]
J74	(Start point : Upper column)	[73]
J75	(Start point : Lower column)	[75]
J76	(Zero point : Upper column)	[73]
J77	(Zero point : Lower column)	[75]
J78	(Distance of low speed control : Upper column)	[73]

*1 The value of 999 will be treated as 7FFFH.

*2 The format No. differs depending on the model.

Table 7.23 List of data format numbers (J codes) (Continued)

Code	Name	Format number
J79	Position control (Distance of low speed control : Lower column)	[1]
J80	(Speed command on low speed control)	[1]
J81	(Objective Stop point : Upper column)	[73]
J82	(Objective Stop point : Lower column)	[1]
J83	(Permissible range of objective stop point)	[1]
J84	(End time)	[3]
J85	(Compensation of over travel)	[1]
J86	(Selection mode)	[1]
J87	(Compensation of over travel)	[1]
J88	(Selection mode)	[1]
J90	Overload Stop Function Torque Limit P (Gain)	[7]
J91	Overload Stopping Function Torque Limit I (Integral time)	[7]
J92	Overload Stopping Function (Current control level)	[3]
J95 *2	Brake Signal (Release torque)	[1]
		[5]
J96	(Speed selection)	[1]
J97 *2	Servo lock (Gain)	[5]
		[7]
J98	(Completion timer)	[7]
J99	Position control (Permissible range of objective stop point)	[1]

*1 The value of 999 will be treated as 7FFFH.

*2 The format No. differs depending on the model.

Table 7.24 Data format No. list (J1 codes)

Code	Name	Format number
J101	PID control 1 (Operation selection)	[1]
J102	(Remote process command)	[1]
J103	(Feedback selection)	[1]
J104	(Deviation selection)	[1]
J105	(Display unit)	[1]
J106	(Maximum scale)	[12]
J107	(Minimum scale)	[12]
J108	(Auto-tuning)	[1]
J109	(Operation frequency when tuning)	[1]
J110	(P (Gain))	[7]
J111	(I (Integral time))	[3]
J112	(D (Differential time))	[5]
J113	(Feedback filter)	[3]
J114	(Anti-reset windup)	[12]
J118	(Output limiter upper limit)	[3]
J119	(Output limiter lower limit)	[3]
J121	(Select Warning output)	[1]
J122	(Upper limit of warning (AH))	[12]
J124	(Lower limit of warning (AL))	[12]
J127	(PV error detection operation selection)	[1]
J128	(PV error holding time)	[1]
J129	(PV error upper limit)	[12]
J130	(PV error lower limit)	[12]
J131	(PV error detection time)	[3]
J136	(Multistep command 1)	[12]
J137	(Multistep command 2)	[12]
J138	(Multistep command 3)	[12]
J143	Boost function (Operation selection)	[1]
J144	(Operating frequency)	[3]
J145	(Acceleration time)	[12]
J146	(Run time)	[3]
J147	(Cancel PV level)	[12]
J149	Slow flowrate stop function (Operation selection)	[1]
J150	(Operation level)	[12]
J151	(Elapsed time)	[1]
J152	(Operating frequency lower limit)	[3]
J153	(Pressurization frequency)	[3]
J154	(Pressurization time)	[1]
J156	(Initiation inhibition time)	[1]
J157	(Cancel frequency)	[3]
J158	(Cancel deviation level 1)	[12]
J159	(Cancel delay timer)	[1]
J160	(Cancel deviation level 2)	[12]
J163	Flow sensor (Input selection)	[1]
J164	(ON level)	[12]
J165	(OFF level)	[12]
J166	(Input filter)	[5]

Table 7.24 Data format No. list (J1 codes) (Continued)

Code	Name	Format number
J168	Frequent operation protection (Operation selection)	[1]
J169	(Slow flowrate stop detection count)	[1]
J176	Dry pump protection (Operation selection)	[1]
J177	(Detected current)	[24]
J178	(Deviation)	[12]
J179	(Flow sensor)	[1]
J180	(Detection timer)	[1]
J182	End of protection (Operation selection)	[1]
J183	(Detected current)	[24]
J184	(Deviation)	[12]
J185	(Flow sensor)	[1]
J186	(Detection timer)	[1]
J188	Filter clogging/anti-jam operation selection	[1]
J189	Filter clogging (Reverse rotation cycle time)	[1]
J190	(Load resistor current)	[24]
J191	(Load resistor PV signal)	[12]
J192	(Load resistor detection timer)	[1]
J193	Filter clogging/anti-jam prevention (Reverse rotation operating frequency)	[3]
J194	(Reverse rotation operating time)	[1]
J195	(Permissible reverse rotation count)	[1]
J198	Wet-bulb temperature control frequency reduction rate	[5]
J199	Wet-bulb temperature estimation control PV rise detection width	[12]

Table 7.25 Data format No. list (J2 codes)

Code	Name	Format number
J201	PID control 2 (Operation selection)	[1]
J202	(Remote process command)	[1]
J203	(Feedback selection)	[1]
J205	(Display unit)	[1]
J206	(Maximum scale)	[12]
J207	(Minimum scale)	[12]
J208	(Auto-tuning)	[1]
J209	(Operation frequency when tuning)	[1]
J210	(P (Gain))	[7]
J211	(I (Integral time))	[3]
J212	(D (Differential time))	[5]
J213	(Feedback filter)	[3]
J214	(Anti-reset windup)	[12]
J218	(Output limiter upper limit)	[3]
J219	(Output limiter lower limit)	[3]
J221	(Select Warning output)	[1]
J222	(Upper limit of warning (AH))	[12]
J223	(Upper limit of warning (AH), hysteresis width)	[12]
J224	(Lower limit of warning (AL))	[12]
J225	(Upper limit of warning (AH), hysteresis width)	[12]
J227	(PV error detection operation selection)	[1]
J228	(PV error holding time)	[1]
J229	(PV error upper limit)	[12]
J230	(PV error lower limit)	[12]
J231	(PV error detection time)	[3]
J247	Boost function cancel PV level	[12]
J249	Slow flowrate stop function (Operation selection)	[1]
J250	(Operation level)	[12]
J251	(Elapsed time)	[1]
J256	(Initiation inhibition time)	[1]
J257	(Cancel frequency)	[3]
J258	(Cancel deviation level 1)	[12]
J259	(Cancel delay timer)	[1]
J260	(Cancel deviation level 2)	[12]
J276	Dry pump protection (Operation selection)	[1]
J277	(Detected current)	[24]
J278	(Deviation)	[12]
J279	(Flow sensor)	[1]
J280	(Detection timer)	[1]

Table 7.26 Data format No. list (J4 codes)

Code	Name	Format number
J401	Pump control operation selection	[1]
J402	Communication master/slave selection	[1]
J403	Number of slaves	[1]
J404	Master input transmission selection	[1]
J411	Motor 1 operation selection	[1]
J412	Motor 2 operation selection	[1]
J413	Motor 3 operation selection	[1]
J414	Motor 4 operation selection	[1]
J415	Motor 5 operation selection	[1]
J416	Motor 6 operation selection	[1]
J417	Motor 7 operation selection	[1]
J418	Motor 8 operation selection	[1]
J425	Motor switching order	[1]
J430	Motor stop method	[1]
J435	Motor regular switching operation selection	[1]
J436	Motor regular switching time	[3]
J437	Motor regular switching signal output time	[5]
J450	Motor increase judgment (Judgment frequency)	[1]
J451	(Holding time)	[12]
J452	Motor decrease judgment (Judgment frequency)	[1]
J453	(Holding time)	[12]
J454	Contactor waiting time when switching motor	[5]
J455	Motor increase switching time	[12]
J456	Motor increase switching level	[1]
J457	Motor increase PID control starting frequency	[1]
J458	Motor decrease switching time	[12]
J459	Motor decrease witching level	[1]
J460	Motor decrease PID control starting frequency	[1]
J461	Motor increase/decrease witching judgment non-responsive area width	[3]
J462	Abnormal equipment judgment time	[3]
J465	Auxiliary motor (Frequency operation level)	[3]
J466	(Hysteresis width)	[3]
J467	(PV operation level)	[12]
J468	(Connection timer)	[5]
J469	(Shut-off timer)	[5]
J480	Cumulative run time (Motor 0)	[1]
J481	(Motor 1)	[1]
J482	(Motor 2)	[1]
J483	(Motor 3)	[1]
J484	(Motor 4)	[1]
J485	(Motor 5)	[1]
J486	(Motor 6)	[1]
J487	(Motor 7)	[1]
J488	(Motor 8)	[1]
J490	Max. cumulative relay ON count (Y1, Y2)	[45]
J491	(Y3, Y4)	[45]
J492	(Y5AC, 30ABC)	[45]
J493	(Y6RY to Y12RY)	[45]

Table 7.27 Data format No. list (J5 codes)

Code	Name	Format number
J501	External PID control 1 (Operation selection)	[1]
J502	(Remote command)	[1]
J503	(Feedback selection)	[1]
J504	(Deviation selection)	[1]
J505	(Display unit)	[1]
J506	(Maximum scale)	[12]
J507	(Minimum scale)	[12]
J510	(P (Gain))	[7]
J511	(I (Integral time))	[3]
J512	(D (Differential time))	[5]
J513	(Feedback filter)	[3]
J514	(Anti-reset windup)	[12]
J515	(ON/OFF control hysteresis width)	[12]
J516	(Proportional operation output convergent value)	[1]
J517	(Proportional cycle)	[1]
J518	(Upper limit of PID process output)	[2]
J519	(Lower limit of PID process output)	[2]
J520	(Upper/lower limit selection)	[1]
J521	(Select Warning output)	[1]
J522	(Upper limit of warning (AH))	[12]
J524	(Lower limit of warning (AL))	[12]
J527	(Feedback error detection operation selection)	[1]
J529	(Feedback error upper limit)	[12]
J530	(Feedback error lower limit)	[12]
J531	(Feedback error detection time)	[3]
J540	(Manual command)	[1]
J550	External PID multistep command (Operation selection)	[1]
J551	(Multistep 1)	[12]
J552	(Multistep 2)	[12]
J553	(Multistep 3)	[12]

Table 7.28 Data format No. list (J6 codes)

Code	Name	Format number
J601	External PID control 2 (Operation selection)	[1]
J602	(Remote command)	[1]
J603	(Feedback selection)	[1]
J605	(Display unit)	[1]
J606	(Maximum scale)	[12]
J607	(Minimum scale)	[12]
J610	(P (Gain))	[7]
J611	(I (Integral time))	[3]
J612	(D (Differential time))	[5]
J613	(Feedback filter)	[3]
J614	(Anti-reset windup)	[12]
J615	(ON/OFF control hysteresis width)	[12]

Table 7.28 Data format No. list (J6 codes) (Continued)

Code	Name	Format number
J616	External PID control 2 (Proportional operation output convergent value)	[1]
J617	(Proportional cycle)	[1]
J618	(Upper limit of PID process output)	[2]
J619	(Lower limit of PID process output)	[2]
J620	(Upper/lower limit selection)	[1]
J621	(Select Warning output)	[1]
J622	(Upper limit of warning (AH))	[12]
J624	(Lower limit of warning (AL))	[12]
J627	(Feedback error detection operation selection)	[1]
J629	(Feedback error upper limit)	[12]
J630	(Feedback error lower limit)	[12]
J631	(Feedback error detection time)	[3]
J640	(Manual command)	[1]
J651	External PID control 3 (Operation selection)	[1]
J652	(Remote command)	[1]
J653	(Feedback selection)	[1]
J655	(Display unit)	[1]
J656	(Maximum scale)	[12]
J657	(Minimum scale)	[12]
J660	(P (Gain))	[7]
J661	(I (Integral time))	[3]
J662	(D (Differential time))	[5]
J663	(Feedback filter)	[3]
J664	(Anti-reset windup)	[12]
J665	(ON/OFF control hysteresis width)	[12]
J666	(Proportional operation output convergent value)	[1]
J667	(Proportional cycle)	[1]
J668	(Upper limit of PID process output)	[2]
J669	(Lower limit of PID process output)	[2]
J670	(Upper/lower limit selection)	[1]
J671	(Select Warning output)	[1]
J672	(Upper limit of warning (AH))	[12]
J674	(Lower limit of warning (AL))	[12]
J677	(Feedback error detection operation selection)	[1]
J679	(Feedback error upper limit)	[12]
J680	(Feedback error lower limit)	[12]
J681	(Feedback error detection time)	[3]
J690	(Manual command)	[1]

Table 7.29 List of data format numbers (d codes)

Code	Name	Format number
d01	Speed control 1 (Speed command filter)	[7]
d02	(Speed detection filter)	[7]
d03	P (Gain)	[3]
d04	I (Integral time)	[7] *1
d05	FF (Gain)	[5]
d06	(Output filter)	[7]
d07	(Notch filter resonance frequency)	[1]
d08	(Notch filter attenuation level)	[1]
d09	Speed control (JOG) (Speed command filter)	[7]
d10	(Speed detection filter)	[7]
d11	P (Gain)	[3]
d12	I (Integral time)	[7] *1
d13	(Output filter)	[7]
d14	Feedback (Feedback input) (Pulse input format)	[1]
d15	(Encoder pulse resolution)	[1]
d16	(Pulse scaling factor 1)	[1]
d17	(Pulse scaling factor 2)	[1]
d18	(Filter time constant)	[7]
d21	Speed consistency/PG error (Detection width)	[3]
d22	(Detection timer)	[5]
d23	PG Error Selection	[1]
d24	Zero Speed Control	[1]
d25	ASR Switching Time	[7]
d27	Servo lock (Gain switching time)	[7]
d28 *2	(Gain 2)	[5]
		[7]
d29	Speed control 1 (Notch filter width)	[1]
d30	ASR gain automatic setting	[1]
d32	Torque Control Speed Limit 1	[1]
d33	Torque Control Speed Limit 2	[1]
d35	Over speed detection level	[1]
d41	Application control selection	[1]
d51	Reserved	[1]
d52		[1]
d53		[1]
d54		[1]
d55		[1]
d56	Magnetic pole position tuning alternating voltage	[5]
d57	Control operation selection switch	[1]
d59	Command (Pulse train input) Pulse Input Method	[1]
d61	Command (Pulse train input) Filter Time Constant	[1]
d62	Command (Pulse train input) Pulse Compensation Coefficient 1	[1]
d63	Command (Pulse train input) Pulse Compensation Coefficient 2	[1]
d67	Starting Mode (Auto search)	[1]
d68	Reserved	[3]
d69		[3]

*1 999 is handled as 7FFFH.

*2 The format No. differs depending on the model.

Table 7.29 List of data format numbers (d codes) (Continued)

Code	Name	Format number
d70	Speed control limiter	[5]
d71	Master follower control (Main speed regulator gain)	[5]
d72	(APR gain)	[5]
d73	(APR output +side limiter)	[1]
d74	(APR output -side limiter)	[1]
d75	(Z phase alignment gain)	[5]
d76	(Offset angle between master and follower)	[1]
d77	(Synchronous completion detection angle)	[1]
d78	(Deviation overflow detection width)	[1]
d79	(For manufacturer)	[1]
d80	Synchronous motor magnetic pole position draw-in frequency	[3]
d81	(For manufacturer)	[1]
d82	Magnetic flux weakening control (Speed sensorless vector)	[1]
d83	Magnetic flux weakening lower limit (Speed sensorless vector)	[1]
d84	(For manufacturer)	[1]
d85		[1]
d86	Acceleration/deceleration filter time constant	[7]
d88	(For manufacturer)	[5]
d89	Synchronous motor high-efficiency control	[1]
d90	Magnetic flux level during deceleration (Under vector control)	[1]
d91	(For manufacturer)	[5]
d92		[5]
d93		[5]
d94		[5]
d95		[5]
d96		[4]
d97		[4]
d98		[1]
d99	Extension function 1	[1]

*1 999 is handled as 7FFFH.

*2 The format No. differs depending on the model.

Table 7.30 Data format No. list (d1 codes)

Code	Name	Format number
d120	Brake signal (Release current(REV))	[5]
d121	(Brake-release frequency (REV))	[3]
d122	(Brake-release timer (REV))	[7]
d123	(Brake-release torque (REV))	[5]
d124	(Brake-applied frequency (REV))	[3]
d125	(Brake-applied timer (REV))	[7]
d132	For manufacturer	[7]
d150	PID control (Dancer upper limit warning position)	[6]
d151	(Dancer lower limit warning position)	[6]
d152	(Line speed lower limit for dancer PID output)	[3]
d153	Constant surface speed control (Line speed compensation gain)	[3]
d154	(Selector switch)	[1]
d158	Winding diameter calculation (Moving average count)	[1]
d159	(Dead zone)	[7]
d160	(Calculation gain)	[5]
d161	(Compensation gain)	[7]
d162	(Low-speed line speed ratio)	[5]
d163	(Minimum winding diameter)	[1]
d164	(Maximum winding diameter)	[1]
d165	(Initial winding diameter)	[1]
d166	(FM output gain)	[3]
d167	Line speed command (Maximum value)	[3]
d168	(Acceleration time)	[12]
d169	(Deceleration time)	[12]
d170	Detected load after compensation	[6]
d171	Load conversion gain (Hoisting)	[6]
d172	Load conversion offset (Hoisting)	[4]
d173	Load conversion gain (Lowering)	[6]
d174	Load conversion offset (Lowering)	[4]
d175	Light load speed multiplying factor (Hoisting)	[3]
d176	Light load speed multiplying factor (Lowering)	[3]
d177	Medium load speed multiplying factor (Hoisting)	[3]
d178	Medium load speed multiplying factor (Lowering)	[3]
d179	Speed multiplying factor safety factor	[3]
d180	Load judgment delay time (Hoisting)	[5]
d181	Load judgment delay time (Lowering)	[5]
d182	Light load detection level (Hoisting)	[3]
d183	Light load detection level (Lowering)	[3]
d184	Heavy load detection level (Hoisting)	[3]
d185	Heavy load detection level (Lowering)	[3]
d186	Overload judgment delay time	[5]
d187	Overload detection level	[3]
d188	Overload detection monitor	[6]
d189	Hoist function auxiliary setting	[1]
d190	For manufacturer	[1]
d192	For manufacturer	[5]
d193	For manufacturer	[3]
d194	For manufacturer	[3]

Table 7.30 Data format No. list (d1 codes) (Continued)

Code	Name	Format number
d195	For manufacturer	[3]
d196	For manufacturer	[1]
d197	For manufacturer	[1]
d198	For manufacturer	[1]
d199	For manufacturer	[1]

Table 7.31 Data format No. list (d2 codes)

Code	Name	Format number
d201	Position control (Feed forward gain)	[5]
d202	(Feed forward command filter)	[7]
d203	(Proportional gain 1)	[3]
d204	(Proportional gain 2)	[3]
d205	(Gain switching frequency)	[1]
d206	Electronic gear denominator	[1]
d207	Electronic gear numerator	[1]
d208	Orientation operation selection	[1]
d209	Homing operation selection	[1]
d210	Homing stopper detection time	[7]
d211	Reference signal for homing	[1]
d212	Reference signal for shift operation	[1]
d213	Homing frequency/orientation frequency	[3]
d214	Homing creep frequency	[3]
d215	Homing deceleration time/Orientation deceleration time	[12]
d216	Positioning data teaching	[1]
d217	Homing shift teaching	[1]
d218	Software OT detection position teaching	[1]
d219	Pass point detection position teaching	[1]
d220	Feedback current position memory selection	[1]
d221	Position clear command operation selection	[1]
d222	Software OT operation selection	[1]
d223	Deviation detection overflow value (High order)	[1]
d224	Deviation detection overflow value (Low order)	[1]
d225	+ software OT detection position (High order)	[73]
d226	+ software OT detection position (Low order)	[1]
d227	- software OT detection position (High order)	[73]
d228	- software OT detection position (Low order)	[1]
d229	Pass point detection position 1 (High order)	[73]
d230	Pass point detection position 1 (Low order)	[1]
d231	Pass point detection position 2 (High order)	[73]
d232	Pass point detection position 2 (Low order)	[1]
d237	Positioning data type	[1]
d238	Positioning data selection signal agreement timer	[7]
d239	In-position range	[1]
d240	Preset position (High order)	[73]
d241	Preset position (Low order)	[1]
d242	Homing shift (High order)	[73]
d243	Homing shift (Low order)	[1]

Table 7.31 Data format No. list (d2 codes) (Continued)

Code	Name	Format number
d244	Positioning data 1 (High order)	[73]
d245	Positioning data 1 (Low order)	[1]
d246	Positioning data 2 (High order)	[73]
d247	Positioning data 2 (Low order)	[1]
d248	Positioning data 3 (High order)	[73]
d249	Positioning data 3 (Low order)	[1]
d250	Positioning data 4 (High order)	[73]
d251	Positioning data 4 (Low order)	[1]
d252	Positioning data 5 (High order)	[73]
d253	Positioning data 5 (Low order)	[1]
d254	Positioning data 6 (High order)	[73]
d255	Positioning data 6 (Low order)	[1]
d256	Positioning data 7 (High order)	[73]
d257	Positioning data 7 (Low order)	[1]
d258	Positioning data 8 (High order)	[73]
d259	Positioning data 8 (Low order)	[1]
d276	Positioning data (Infinite direction)	[1]
d277	Positioning data communication command selection	[1]
d280	Forced deceleration operation selection	[1]
d296	Command current position monitor (High order)	[73]
d297	Command current position monitor (Low order)	[1]
d298	Feedback current position monitor (High order)	[73]
d299	Feedback current position monitor (Low order)	[1]

Table 7.32 Data format No. list (U codes, FRENIC-MEGA (G1))

Code	Name	Format number
U00	Customizable logic (Operation selection)	[1]
U01	Customizable logic: Step 1 (Input 1)	[1]
U02	(Input 2)	[1]
U03	(Logic function block)	[1]
U04	(Timer selection)	[1]
U05	(Time setting)	[5]
U06	Customizable logic: Step 2 (Input 1)	[1]
U07	(Input 2)	[1]
U08	(Logic function block)	[1]
U09	(Timer selection)	[1]
U10	(Time setting)	[5]
U11	Customizable logic: Step 3 (Input 1)	[1]
U12	(Input 2)	[1]
U13	(Logic function block)	[1]
U14	(Timer selection)	[1]
U15	(Time setting)	[5]
U16	Customizable logic: Step 4 (Input 1)	[1]
U17	(Input 2)	[1]
U18	(Logic function block)	[1]
U19	(Timer selection)	[1]
U20	(Time setting)	[5]
U21	Customizable logic: Step 5 (Input 1)	[1]
U22	(Input 2)	[1]
U23	(Logic function block)	[1]
U24	(Timer selection)	[1]
U25	(Time setting)	[5]
U26	Customizable logic: Step 6 (Input 1)	[1]
U27	(Input 2)	[1]
U28	(Logic function block)	[1]
U29	(Timer selection)	[1]
U30	(Time setting)	[5]
U31	Customizable logic: Step 7 (Input 1)	[1]
U32	(Input 2)	[1]
U33	(Logic function block)	[1]
U34	(Timer selection)	[1]
U35	(Time setting)	[5]
U36	Customizable logic: Step 8 (Input 1)	[1]
U37	(Input 2)	[1]
U38	(Logic function block)	[1]
U39	(Timer selection)	[1]
U40	(Time setting)	[5]
U41	Customizable logic: Step 9 (Input 1)	[1]
U42	(Input 2)	[1]
U43	(Logic function block)	[1]
U44	(Timer selection)	[1]
U45	(Time setting)	[5]

Note) Refer to Table 7.33 for the FRENIC-Ace (E2, E3), MEGA (G2), and HVAC/AQUA.

Table 7.32 Data format No. list (U codes, FRENIC-MEGA (G1)) (Continued)

Code	Name	Format number
U46	Customizable logic: Step 10 (Input 1)	[1]
U47	(Input 2)	[1]
U48	(Logic function block)	[1]
U49	(Timer selection)	[1]
U50	(Time setting)	[5]
U71	Customizable logic output signal 1 (Output selection)	[1]
U72	2	[1]
U73	3	[1]
U74	4	[1]
U75	5	[1]
U81	Customizable logic output signal 1 (Function selection)	[1]
U82	2	[1]
U83	3	[1]
U84	4	[1]
U85	5	[1]
U91	Customizable logic timer monitor (Step selection)	[1]

Note) Refer to Table 7.33 for the FRENIC-Ace (E2, E3), MEGA (G2), and HVAC/AQUA.

Table 7.33 Data format No. list (U codes, FRENIC-Ace (E2, E3)/MEGA (G2)/HVAC/AQUA)

Code	Name	Format number
U00	Customizable logic (Operation selection)	[1]
U01	Customizable logic: Step 1 (logic circuit)	[1]
U02	(Input 1)	[1]
U03	(Input 2)	[1]
U04	(Function 1)	[12]
U05	(Function 2)	[12]
U06	Customizable logic: Step 2 (logic circuit)	[1]
U07	(Input 1)	[1]
U08	(Input 2)	[1]
U09	(Function 1)	[12]
U10	(Function 2)	[12]
U11	Customizable logic: Step 3 (logic circuit)	[1]
U12	(Input 1)	[1]
U13	(Input 2)	[1]
U14	(Function 1)	[12]
U15	(Function 2)	[12]
U16	Customizable logic: Step 4 (logic circuit)	[1]
U17	(Input 1)	[1]
U18	(Input 2)	[1]
U19	(Function 1)	[12]
U20	(Function 2)	[12]
U21	Customizable logic: Step 5 (logic circuit)	[1]
U22	(Input 1)	[1]
U23	(Input 2)	[1]
U24	(Function 1)	[12]
U25	(Function 2)	[12]
U26	Customizable logic: Step 6 (logic circuit)	[1]
U27	(Input 1)	[1]
U28	(Input 2)	[1]
U29	(Function 1)	[12]
U30	(Function 2)	[12]
U31	Customizable logic: Step 7 (logic circuit)	[1]
U32	(Input 1)	[1]
U33	(Input 2)	[1]
U34	(Function 1)	[12]
U35	(Function 2)	[12]
U36	Customizable logic: Step 8 (logic circuit)	[1]
U37	(Input 1)	[1]
U38	(Input 2)	[1]
U39	(Function 1)	[12]
U40	(Function 2)	[12]
U41	Customizable logic: Step 9 (logic circuit)	[1]
U42	(Input 1)	[1]
U43	(Input 2)	[1]
U44	(Function 1)	[12]
U45	(Function 2)	[12]

Note) Refer to Table 7.32 for the FRENIC-MEGA (G1).

Table 7.33 Data format No. list (U codes, FRENIC-Ace (E2, E3)/MEGA (G2)/HVAC/AQUA) (Continued)

Code	Name	Format number
U46	Customizable logic: Step 10 (logic circuit)	[1]
U47	(Input 1)	[1]
U48	(Input 2)	[1]
U49	(Function 1)	[12]
U50	(Function 2)	[12]
U51	Customizable logic: Step 11 (logic circuit)	[1]
U52	(Input 1)	[1]
U53	(Input 2)	[1]
U54	(Function 1)	[12]
U55	(Function 2)	[12]
U56	Customizable logic: Step 12 (logic circuit)	[1]
U57	(Input 1)	[1]
U58	(Input 2)	[1]
U59	(Function 1)	[12]
U60	(Function 2)	[12]
U61	Customizable logic: Step 13 (logic circuit)	[1]
U62	(Input 1)	[1]
U63	(Input 2)	[1]
U64	(Function 1)	[12]
U65	(Function 2)	[12]
U66	Customizable logic: Step 14 (logic circuit)	[1]
U67	(Input 1)	[1]
U68	(Input 2)	[1]
U69	(Function 1)	[12]
U70	(Function 2)	[12]
U71	Customizable logic output signal 1 (Output selection)	[1]
U72	2	[1]
U73	3	[1]
U74	4	[1]
U75	5	[1]
U76	6	[1]
U77	7	[1]
U78	8	[1]
U79	9	[1]
U80	10	[1]
U81	Customizable logic output signal 1 (Function selection)	[1]
U82	2	[1]
U83	3	[1]
U84	4	[1]
U85	5	[1]
U86	6	[1]
U87	7	[1]
U88	8	[1]
U89	9	[1]
U90	10	[1]
U91	Customizable logic timer monitor (Step selection)	[1]

Note) Refer to Table 7.32 for the FRENIC-MEGA (G1).

Table 7.33 Data format No. list (U codes, FRENIC-Ace (E2, E3)/MEGA (G2)/HVAC/AQUA) (Continued)

Code	Name	Format number
U92	Customizable logic operation coefficient (Mantissa of KA1)	[8]
U93	(Exponent part of KA1)	[2]
U94	(Mantissa of KB1)	[8]
U95	(Exponent part of KB1)	[2]
U96	(Mantissa of KC1)	[8]
U97	(Exponent part of KC1)	[2]
U98	Customizable logic output monitor (LE selection)	[1]
U99	(Unit selection)	[1]
U100	Task process end setting	[1]
U101	Customizable logic Conversion operating point (X1)	[12]
U102	Conversion operating point (Y1)	[12]
U103	Conversion operating point (X2)	[12]
U104	Conversion operating point (Y2)	[12]
U105	Conversion operating point (X3)	[12]
U106	Conversion operating point (Y3)	[12]
U107	Customizable logic (Auto calculation of coefficients of approximate formula)	[1]
U121	Customizable logic (User parameter 1)	[12]
U122	(User parameter 2)	[12]
U123	(User parameter 3)	[12]
U124	(User parameter 4)	[12]
U125	(User parameter 5)	[12]
U126	(User parameter 6)	[12]
U127	(User parameter 7)	[12]
U128	(User parameter 8)	[12]
U129	(User parameter 9)	[12]
U130	(User parameter 10)	[12]
U131	(User parameter 11)	[12]
U132	(User parameter 12)	[12]
U133	(User parameter 13)	[12]
U134	(User parameter 14)	[12]
U135	(User parameter 15)	[12]
U136	(User parameter 16)	[12]
U137	(User parameter 17)	[12]
U138	(User parameter 18)	[12]
U139	(User parameter 19)	[12]
U140	(User parameter 20)	[12]
U141	(User parameter 21)	[12]
U142	(User parameter 22)	[12]
U143	(User parameter 23)	[12]
U144	(User parameter 24)	[12]
U145	(User parameter 25)	[12]
U146	(User parameter 26)	[12]
U147	(User parameter 27)	[12]
U148	(User parameter 28)	[12]
U149	(User parameter 29)	[12]
U150	(User parameter 30)	[12]
U151	(User parameter 31)	[12]

Note) Refer to Table 7.32 for the FRENIC-MEGA (G1).

Table 7.33 Data format No. list (U codes, FRENIC-Ace (E2, E3)/MEGA (G2)/HVAC/AQUA) (Continued)

Code	Name	Format number
U152	Customizable logic (User parameter 32)	[12]
U153	(User parameter 33)	[12]
U154	(User parameter 34)	[12]
U155	(User parameter 35)	[12]
U156	(User parameter 36)	[12]
U157	(User parameter 37)	[12]
U158	(User parameter 38)	[12]
U159	(User parameter 39)	[12]
U160	(User parameter 40)	[12]
U161	(User parameter 41)	[12]
U162	(User parameter 42)	[12]
U163	(User parameter 43)	[12]
U164	(User parameter 44)	[12]
U165	(User parameter 45)	[12]
U166	(User parameter 46)	[12]
U167	(User parameter 47)	[12]
U168	(User parameter 48)	[12]
U169	(User parameter 49)	[12]
U170	(User parameter 50)	[12]
U171	Customizable logic (Storage area 1)	[12]
U172	(Storage area 2)	[12]
U173	(Storage area 3)	[12]
U174	(Storage area 4)	[12]
U175	(Storage area 5)	[12]
U176	(Storage area 6)	[12]
U177	(Storage area 7)	[12]
U178	(Storage area 8)	[12]
U179	(Storage area 9)	[12]
U180	(Storage area 10)	[12]
U181	Customizable logic output signal 11 (Output selection)	[1]
U182	12	[1]
U183	13	[1]
U184	14	[1]
U185	Customizable logic output signal 11 (Function selection)	[1]
U186	12	[1]
U187	13	[1]
U188	14	[1]
U190	Customizable logic step setting (Step number)	[1]
U191	(Circuit selection)	[1]
U192	(Input 1)	[1]
U193	(Input 2)	[1]
U194	(Function 1)	[12]
U195	(Function 2)	[12]
U196	Customizable ROM version first 4 digits (Monitor)	[1]
U197	(for user)	[1]
U198	Customizable ROM version last 4 digits (Monitor)	[1]
U199	(for user)	[1]

Note) Refer to Table 7.32 for the FRENIC-MEGA (G1).

Table 7.34 List of data format numbers (y codes)

Code	Name	Format number
y01	RS-485 Communications (Standard) (Station address)	[1]
y02	(Communications error processing)	[1]
y03	(Timer)	[3]
y04	(Baud rate)	[1]
y05	(Data length)	[1]
y06	(Parity check)	[1]
y07	(Stop bits)	[1]
y08	(No response error detection time)	[1]
y09	(Response interval)	[5]
y10	(Protocol selection)	[1]
y11	RS-485 Communications (Option) (Station address)	[1]
y12	(Communications error processing)	[1]
y13	(Timer)	[3]
y14	(Baud rate)	[1]
y15	(Data length)	[1]
y16	(Parity check)	[1]
y17	(Stop bits)	[1]
y18	(No response error detection time)	[1]
y19	(Response interval)	[5]
y20	(Protocol selection)	[1]
y21	Reserved	[1]
y24		[1]
y25		[1]
y26		[1]
y27		[1]
y28		[1]
y29		[1]
y30		[1]
y31		[1]
y32		[1]
y33		[1]
y34		[1]
y35		[3]
y36		[1]
y60	BACnet MS/TP device instance (High order)	[1]
y61	BACnet MS/TP device instance (Low order)	[1]
y85	For manufacturer	[1]
y86	For manufacturer	[1]
y87	For manufacturer	[1]
y88	For manufacturer	[1]
y93	RTU current format switching	[1]
y94	Link function X-terminal operation selection	[1]
y95	Data clear processing for communication error	[1]
y96	Communication code older model compatibility mode *1	[1]
y99	Loader Link Function (Mode selection)	[1]

Table 7.35 Data format No. list (o codes)

Code	Name	Format number
o01	Terminal [O1] (Function selection)	[1]
o02	Terminal [O2] (Function selection)	[1]
o03	Terminal [O3] (Function selection)	[1]
o04	Terminal [O4] (Function selection)	[1]
o05	Terminal [O5] (Function selection)	[1]
o06	Terminal [O6] (Function selection)	[1]
o07	Terminal [O7] (Function selection)	[1]
o08	Terminal [O8] (Function selection)	[1]
o09	PT option display unit	[1]
o10	PT option channel 1 (Sensor type selection)	[1]
o11	(Extended function selection)	[1]
o12	(Filter)	[3]
o15	PT option channel 2 (Sensor type selection)	[1]
o16	(Extended function selection)	[1]
o17	(Filter)	[3]
o19	DI option (DI polarity selection)	[1]
o20	(DI operation selection)	[1]
o21	DO option (DO operation selection)	[1]
o22	RY option operation selection	[1]
o23	Y1Ry terminal function selection	[1]
o24	Y2Ry terminal function selection	[1]
o25	Y3Ry terminal function selection	[1]
o26	Y4Ry terminal function selection	[1]
o27	Transmission error (Operation selection)	[1]
o28	(Timer time)	[3]
o30	Bus setting parameter 01	[1]
o31	02	[1]
o32	03	[1]
o33	04	[1]
o34	05	[1]
o35	06	[1]
o36	07	[1]
o37	08	[1]
o38	09	[1]
o39	10	[1]
o40	Write function code assignment 1	[1]
o41	2	[1]
o42	3	[1]
o43	4	[1]
o44	5	[1]
o45	6	[1]
o46	7	[1]
o47	8	[1]
o48	Read function code assignment 1	[1]
o49	2	[1]
o50	3	[1]
o51	4	[1]
o52	5	[1]

Table 7.35 Data format No. list (o codes) (Continued)

Code	Name	Format number
o53	Read function code assignment 6	[1]
o54	7	[1]
o55	8	[1]
o56	9	[1]
o57	10	[1]
o58	11	[1]
o59	12	[1]
o60	Terminal [32] (Function selection)	[1]
o61	(Offset adjustment)	[4]
o62	(Gain adjustment)	[5]
o63	(Filter setting)	[5]
o64	(Gain base point)	[5]
o65	(Polarity selection)	[1]
o66 *1	Terminal [32] (Bias)	[1]
	Terminal [C2] (Function selection)	[1]
o67 *1	Terminal [32] (Bias reference point)	[4]
	Terminal [C2] (Offset adjustment)	[4]
o68	Terminal [C2] (Gain adjustment)	[5]
o69 *1	Terminal [32] (Display unit)	[5]
	Terminal [C2] (Filter setting)	[5]
o70 *1	Terminal [32] (Maximum scale)	[5]
	Terminal [C2] (Gain reference point)	[5]
o71 *1	Terminal [32] (Minimum scale)	[1]
	Terminal [Ao] (Function selection)	[1]
o72	Terminal [Ao] (Output gain)	[1]
o73	Terminal [Ao] (Polarity selection)	[1]
o74	Terminal [CS] (Function selection)	[1]
o75 *1	Terminal [C2] (Range selection)	[1]
	Terminal [CS] (Output gain)	[1]
o76	Terminal [C2] (Function selection)	[1]
o77	(Offset adjustment)	[4]
o78	(Gain adjustment)	[5]
o79	(Filter setting)	[5]
o81	(Gain base point)	[5]
o82	(Bias)	[6]
o83	(Bias base point)	[5]
o85	(Display unit)	[1]
o86	(Maximum scale)	[12]
o87	(Minimum scale)	[12]
o90	Terminal [Ao/CS2] (Function selection)	[1]
o91	(Output gain)	[1]
o93	(Polarity selection)	[1]
o96	Terminal [CS/CS1] (Function selection)	[1]
o97	(Output gain)	[1]
o101	Terminal [I1] (Function selection)	[1]
o102	Terminal [I2] (Function selection)	[1]
o103	Terminal [I3] (Function selection)	[1]
o104	Terminal [I4] (Function selection)	[1]

*1 Functions differ depending on the model.

Table 7.36 Data format No. list (o1 codes)

Code	Name	Format number
o105	Terminal [I5] (Function selection)	[1]
o106	Terminal [I6] (Function selection)	[1]
o107	Terminal [I7] (Function selection)	[1]
o108	Terminal [I8] (Function selection)	[1]
o109	Terminal [I9] (Function selection)	[1]
o110	Terminal [I10] (Function selection)	[1]
o111	Terminal [I11] (Function selection)	[1]
o112	Terminal [I12] (Function selection)	[1]
o113	Terminal [I13] (Function selection)	[1]
o114	Terminal [I14] (Function selection)	[1]
o115	Terminal [I15] (Function selection)	[1]
o116	Terminal [I16] (Function selection)	[1]
o121	Terminal [O1] (Function selection)	[1]
o122	Terminal [O2] (Function selection)	[1]
o123	Terminal [O3] (Function selection)	[1]
o124	Terminal [O4] (Function selection)	[1]
o125	Terminal [O5] (Function selection)	[1]
o126	Terminal [O6] (Function selection)	[1]
o127	Terminal [O7] (Function selection)	[1]
o128	Terminal [O8] (Function selection)	[1]
o201	IP address setting 1	[1]
o202	IP address setting 2	[1]
o203	IP address setting 3	[1]
o204	IP address setting 4	[1]
o205	Subnet mask setting 1	[1]
o206	Subnet mask setting 2	[1]
o207	Subnet mask setting 3	[1]
o208	Subnet mask setting 4	[1]
o209	Gateway address setting 1	[1]
o210	Gateway address setting 2	[1]
o211	Gateway address setting 3	[1]
o212	Gateway address setting 4	[1]
o213	IP address setting mode	[1]
o214	Communication function selection	[1]
o215	TCP communication KEEP-ALIVE startup time	[1]
o216	Modbus monitoring time setting	[3]
o217	BACnet communication port No.	[1]
o218	BACnet communication Instance_Number (First 3 digits)	[1]
o219	BACnet communication Instance_Number (Last 4 digits)	[1]
o221	Write function code assignment 01	[1]
o222	Write function code assignment 02	[1]
o223	Write function code assignment 03	[1]
o224	Write function code assignment 04	[1]
o225	Write function code assignment 05	[1]
o226	Write function code assignment 06	[1]
o227	Write function code assignment 07	[1]
o228	Write function code assignment 08	[1]
o229	Write function code assignment 09	[1]

Table 7.36 Data format No. list (o1 codes) (Continued)

Code	Name	Format number
o230	Write function code assignment 10	[1]
o231	Write function code assignment 11	[1]
o232	Write function code assignment 12	[1]
o233	Write function code assignment 13	[1]
o234	Write function code assignment 14	[1]
o235	Write function code assignment 15	[1]
o236	Write function code assignment 16	[1]
o237	Write function code assignment 17	[1]
o238	Write function code assignment 18	[1]
o239	Write function code assignment 19	[1]
o240	Write function code assignment 20	[1]
o241	Write function code assignment 21	[1]
o242	Write function code assignment 22	[1]
o243	Write function code assignment 23	[1]
o244	Write function code assignment 24	[1]
o245	Write function code assignment 25	[1]
o246	Write function code assignment 26	[1]
o247	Write function code assignment 27	[1]
o248	Write function code assignment 28	[1]
o249	Write function code assignment 29	[1]
o250	Write function code assignment 30	[1]
o251	Write function code assignment 31	[1]
o252	Write function code assignment 32	[1]
o253	Read function code assignment 01	[1]
o254	Read function code assignment 02	[1]
o255	Read function code assignment 03	[1]
o256	Read function code assignment 04	[1]
o257	Read function code assignment 05	[1]
o258	Read function code assignment 06	[1]
o259	Read function code assignment 07	[1]
o260	Read function code assignment 08	[1]
o261	Read function code assignment 09	[1]
o262	Read function code assignment 10	[1]
o263	Read function code assignment 11	[1]
o264	Read function code assignment 12	[1]
o265	Read function code assignment 13	[1]
o266	Read function code assignment 14	[1]
o267	Read function code assignment 15	[1]
o268	Read function code assignment 16	[1]
o269	Read function code assignment 17	[1]
o270	Read function code assignment 18	[1]
o271	Read function code assignment 19	[1]
o272	Read function code assignment 20	[1]
o273	Read function code assignment 21	[1]
o274	Read function code assignment 22	[1]
o275	Read function code assignment 23	[1]
o276	Read function code assignment 24	[1]
o277	Read function code assignment 25	[1]

Table 7.36 Data format No. list (o1 codes) (Continued)

Code	Name	Format number
o278	Read function code assignment 26	[1]
o279	Read function code assignment 27	[1]
o280	Read function code assignment 28	[1]
o281	Read function code assignment 29	[1]
o282	Read function code assignment 30	[1]
o283	Read function code assignment 31	[1]
o284	Read function code assignment 32	[1]
o299	Reflect Ethernet setting	[1]

Table 7.37 Data format No. list (T codes)

Code	Name	Format number
T01	Scheduled operation 1 (Operation selection)	[1]
T02	(Start time)	[88]
T03	(End time)	[88]
T04	(Day)	[94]
T06	Scheduled operation 2 (Operation selection)	[1]
T07	(Start time)	[88]
T08	(End time)	[88]
T09	(Day)	[94]
T11	Scheduled operation 3 (Operation selection)	[1]
T12	(Start time)	[88]
T13	(End time)	[88]
T14	(Day)	[94]
T16	Scheduled operation 4 (Operation selection)	[1]
T17	(Start time)	[88]
T18	(End time)	[88]
T19	(Day)	[94]
T51	Scheduled operation (Pause day 1)	[89]
T52	(Pause day 2)	[89]
T53	(Pause day 3)	[89]
T54	(Pause day 4)	[89]
T55	(Pause day 5)	[89]
T56	(Pause day 6)	[89]
T57	(Pause day 7)	[89]
T58	(Pause day 8)	[89]
T59	(Pause day 9)	[89]
T60	(Pause day 10)	[89]
T61	(Pause day 11)	[89]
T62	(Pause day 12)	[89]
T63	(Pause day 13)	[89]
T64	(Pause day 14)	[89]
T65	(Pause day 15)	[89]
T66	(Pause day 16)	[89]
T67	(Pause day 17)	[89]
T68	(Pause day 18)	[89]
T69	(Pause day 19)	[89]
T70	(Pause day 20)	[89]

Table 7.38 Data format No. list (K codes)

Code	Name	Format number
K01	Multi-function keypad (Language selection)	[1]
K02	(Backlight OFF time)	[1]
K03	(Backlight brightness adjustment)	[1]
K04	(Contrast adjustment)	[1]
K08	(LCD monitor status display)	[1]
K15	(Sub-monitor display selection)	[1]
K16	(Sub-monitor 1 display selection)	[1]
K17	(Sub-monitor 2 display selection)	[1]
K20	(Bar graph 1 display selection)	[1]
K21	(Bar graph 2 display selection)	[1]
K22	(Bar graph 3 display selection)	[1]
K25	(Load speed display unit)	[1]
K29	LED display filter	[3]
K30	Display coefficient for speed monitor	[5]
K31	Integral power data display unit	[1]
K32	Display coefficient for "Input watt-hour data"	[45]
K33	Long-term integral power data monitor	[1]
K40	For manufacturer	[1]
K51	Traceback (Overwrite selection)	[1]
K52	(Sampling cycle)	[1]
K53	(CH4 operation selection)	[1]
K54	(Analog Ch.1 source)	[1]
K55	(Analog Ch.2 source)	[1]
K56	(Analog Ch.3 source)	[1]
K57	(Analog Ch.4 source)	[1]
K58	(Digital Ch.1 source)	[1]
K59	(Digital Ch.2 source)	[1]
K60	(Digital Ch.3 source)	[1]
K61	(Digital Ch.4 source)	[1]
K62	(Digital Ch.5 source)	[1]
K63	(Digital Ch.6 source)	[1]
K64	(Digital Ch.7 source)	[1]
K65	(Digital Ch.8 source)	[1]
K81	YY/MM/DD format	[1]
K82	Time format	[1]
K83	Summertime (Operation selection)	[1]
K84	(Start date and time)	[90]
K85	(End date and time)	[90]
K90	Application selection	[1]
K91	Multi-function keypad (< key shortcut selection)	[1]
K92	(> key shortcut selection)	[1]
K96	TP-G1 compatibility mode	[1]

Table 7.39 List of data format numbers (S codes)

Code	Name	Format number
S01	Frequency reference (p.u.)	[29]
S02	Torque command	[6]
S03	Torque current command	[6]
S05	Frequency reference	[22]
S06	Operation command	[14]
S07	Universal DO	[15]
S08	Acceleration time F07	[3]
S09	Deceleration time F08	[3]
S10	Torque Limit Level 1	[1]
	Torque Limit Level 1-1	[6]
S11	Torque Limit Level 2	[1]
	Torque Limit Level 1-2	[6]
S12	Universal AO	[29]
S13	PID command	[29]
S14	Alarm reset command	[1]
S15	Torque bias command	[6]
S19	Speed command	[2]
S20	Positioning data (High order)	[73]
S21	Positioning data (Low order)	[1]
S31	External PID1 command	[29]
S32	External PID2 command	[29]
S33	External PID3 command	[29]
S90	Current year and month	[85]
S91	Current day and time	[86]
S92	Current minute and second	[87]
S93	Clock data settings	[1]

*1 Not applicable with the FRENIC-Multi ROM version 0799 or older.

Table 7.40 List of data format numbers (M codes)

Code	Name	Format number
M01	Frequency reference (p.u.) (Final command)	[29]
M02	Torque command (Final command)	[6]
M03	Torque current command (Final command)	[6]
M04	Magnetic flux command value	[6]
M05	Frequency reference (Final command)	[22]
M06	Output frequency 1 (p.u.)	[29]
M07	Torque real value	[6]
M08	Torque current	[6]
M09	Output frequency	[23] (FGI)
		[22] (RTU)
		[22] (BUS) *1
M10	Input power	[5]
M11	Output current effective value	[5]
M12	Output voltage effective value	[3]
M13	Operation command (Final command)	[14]
M14	Operation status	[16]
M15	General-purpose output terminal information	[15]
M16	Latest alarm contents	[10]
M17	Last alarm contents	[10]
M18	Second last alarm contents	[10]
M19	Third last alarm contents	[10]
M20	Cumulative operation time	[1]
M21	DC link circuit voltage	[1]
M22	Motor temperature	[2]
M23	Model code	[17]
M24	Capacity code	[11]
M25	ROM version	[35]
M26	Transmission error transaction code	[20]
M27	Frequency reference on alarm (p.u.) (Final command)	[29]
M28	Torque command on alarm (Final command)	[6]
M29	Torque current command on alarm (Final command)	[6]
M30	Flux command on alarm (Final command)	[6]
M31	Frequency reference on alarm (Final command)	[22]
M32	Output frequency 1 on alarm (p.u.)	[29]
M33	Torque real value on alarm	[6]
M34	Torque current on alarm	[6]
M35	Output frequency on alarm	[23] (FGI)
		[22] (RTU)
		[22] (BUS) *1
M36	Input power on alarm	[5]
M37	Output current effective value on alarm	[5]
M38	Output voltage effective value on alarm	[3]
M39	Operation command on alarm	[14]
M40	Operation status on alarm	[16]
M41	Output terminal information on alarm	[15]
M42	Cumulative operation time on alarm	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

Table 7.40 List of data format numbers (M codes) (Continued)

Code	Name	Format number
M43	DC link circuit voltage on alarm	[1]
M44	Inverter internal air temperature on alarm	[1]
M45	Heat sink temperature on alarm	[1]
M46	Life of main circuit capacitor	[3]
M47	Life of PC board electrolytic capacitor	[1]
M48	Life of heat sink	[1]
M49	Input terminal voltage [12] (p.u.)	[29]
M50	Input terminal current [C1] (p.u.)	[29]
M51	Input terminal current [22]	[29]
M52	Input terminal current [32]	[29]
M53	Input terminal current [C2]	[29]
M54	Input terminal voltage [V2] (p.u.)	[29]
M55	Input terminal voltage [V3]	[29]
M56	Input terminal voltage [PTC/NTC]	[29]
M57	Electrical angle	[3]
M58	Rotor angle	[3]
M59	Electronic thermal overload relay monitor	[1]
M61	Inverter internal air temperature	[1]
M62	Heat sink temperature	[1]
M63	Load rate	[6]
M64	Motor output	[6]
M65	Motor output on alarm	[6]
M66	Speed detection	[29]
M67	Transmission error handling code 2	[20]
M68	PID final command	[29]
M69	Inverter rated current	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
M70	Operation status 2	[44]
M71	Input terminal information	[14]
M72	PID feedback value	[29]
M73	PID output	[29]
M74	Operating status 2	[76]
M75	Frequency command (p.u.)	[29]
M76	Main circuit capacity life (Elapsed time)	[74]
M77	(Remaining time)	[74]
M81	Maintenance (Remaining time) (M1)	[74]
M85	Maintenance (Starting times) (M1)	[1]
M86	Light alarm contents (Latest)	[10]
		[41]
M87	Light alarm contents (Last)	[10]
		[41]
M88	Light alarm contents (Second last)	[10]
		[41]
M89	Light alarm contents (Third last)	[10]
		[41]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

Table 7.41 Data format No. list (M1 codes)

Code	Name	Format number
M98	Light alarm status monitor	[1]
M101	Frequency/speed command (with sign)	[6]
M102	Frequency command (Absolute value)	[22]
M103	Frequency command (with sign)	[6]
M105	Output frequency before slip compensation (with sign)	[6]
M107	Output frequency after slip compensation (with sign)	[6]
M108	Detected speed (Absolute value)	[22]
M109	Detected speed (with sign)	[6]
M110	Output frequency	[6]
M113	Torque limiting current	[6]
M117	Output torque (4 quadrant)	[6]
M123	Extended model code	[99]
M125	IP address monitor 1	[1]
M126	IP address monitor 2	[1]
M127	IP address monitor 3	[1]
M128	IP address monitor 4	[1]
M129	Subnet mask monitor 1	[1]
M130	Subnet mask monitor 2	[1]
M131	Subnet mask monitor 3	[1]
M132	Subnet mask monitor 4	[1]
M133	Gateway address monitor 1	[1]
M134	Gateway address monitor 2	[1]
M135	Gateway address monitor 3	[1]
M136	Gateway address monitor 4	[1]
M137	MAC address monitor 1	[1]
M138	MAC address monitor 2	[1]
M139	MAC address monitor 3	[1]
M141	d-axis current	[6]
M142	q-axis current	[6]

*2 The format No. differs depending on the model.

Table 7.42 List of data format numbers (W codes)

Code	Name	Format number
W01	Operation status	[16]
W02	Frequency reference	[22]
W03	Output frequency (before slip compensation)	[22]
W04	(after slip compensation)	[22]
W05	Output current	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
W06	Output voltage	[3]
W07	Torque	[2]
W08	Rotation speed	[37]
W09	Load rotation speed	[37]
W10	Line speed	[37]
W11	PID process command	[12]
W12	PID feedback value	[12]
W13	Level of torque value A	[1]
W14	Level of torque value B	[1]
W15	Ratio value	[5]
W16	Rotation speed set value	[37]
W17	Load speed set value	[37]
W18	Line speed set value	[37]
W19	Constant feed time set value	[37]
W20	Constant feed time	[37]
W21	Input power	[24]
W22	Motor output	[24]
W23	Load rate	[2]
W24	Torque current	[2]
W26	Flux reference	[2]
W27	Timer operation remaining time	[1]
W28	Operation command source	[1]
W29	Frequency and PID command source	[1]
W30	Speed at percentage	[5]
W31	Speed set value at percentage	[5]
W32	PID output	[4]
W33	Analog input monitor	[12]
W35	Terminal [32] input voltage	[4]
W36	Terminal [C2] input current	[3]
W37	Terminal [A0] output voltage	[4]
W38	Terminal [CS] output frequency	[3]
W39	Pulse input monitor [X7]	[6]
W40	Control circuit terminal (input)	[43]
W41	(output)	[15]
W42	Communications control signal (input)	[14]
W43	(output)	[15]
W44	Terminal [12] input voltage	[4]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W45	Terminal [C1] input current	[4]
W46	FMA/FM1 output voltage	[3]
W47	FMP output voltage	[3]
W48	FMP output frequency	[1]
W49	V2 terminal input voltage	[4]
W50	FMA/FM1 output current	[3]
W51	Situation of input terminals on DIO option	[77]
W52 *2	Situation of output terminals on DIO option	[1]
		[78]
W53	Pulse input (Master - side A/B phase)	[6]
W54	(Master - side Z phase)	[1]
W55	(Slave - side A/B phase)	[6]
W56	(Slave - side Z phase)	[1]
W57	Current Position Pulse (Upper column)	[73]
W58	(Lower column)	[1]
W59	Stop Position Pulse (Upper column)	[73]
W60	(Lower column)	[1]
W61	Difference Pulse of Position (Upper column)	[73]
W62	(Lower column)	[1]
W63	Positioning Status	[1]
W65	Terminal [FM1] output current	[3]
	Terminal [FM2] output current	[3]
W67	Cumulative operation time of electrolytic	[74]
W68	Cumulative operation time of cooling fan	[74]
W70	Cumulative operation time	[1]
W71	DC link circuit voltage	[1]
W72	Internal air highest temperature	[1]
W73	Heat sink maximum temperature	[1]
W74	Maximum effective current value	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *3
W75	Main circuit capacitor's capacitor	[3]
W76	Cumulative ope. time of capacitor on PC board	[1]
W77	Cumulative ope. time of cooling fan	[1]
W78	Number of startups	[1]
W79	Cumulative ope. time of motor driving	[74]
W80	Standard fan life	[1]
W81	Integrating electric power	[45]
W82	Data used integrating electric power	[45]
W83	Number of RS485 ch1 errors	[1]
W84	Contents of RS485 ch1 error	[20]
W85	Number of RS485 ch2 errors	[1]
W86	Number of option communications errors	[1]
W87	Inverter's keypad's ROM version	[35]
W89	Remote keypad's ROM version	[35]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W90	Option 1 ROM version	[35]
W91	Option 2 ROM version	[35]
W92	Option 3 ROM version	[35]
W94	Contents of RS485 ch2 error	[20]
W95	Number of option communications errors	[1]
W96	Option communicate error contents	[1]
W97	Option communicate error contents	[1]
W98	Number of option communications errors	[1]
W99	Option communicate error contents	[1]
W101	Current year and month	[85]
W102	Current day and time	[86]
W103	Current minute and second	[87]
W108	Winding diameter (Physical amount)	[1]
W113	Constant feedrate (After filter)	[37]
W116	PG feedback amount	[22]
W117	Estimated theoretical acceleration/deceleration time value	[45]
W118	Torque bias monitor (unit: %)	[2]
W119	Torque bias monitor (unit: 0.0%)	[6]
W120	Speed deviation monitor	[6]
W124	Nameplate current type	[1]
W127	Line axis speed setting value	[37]
W128	Line axis speed (After filter)	[37]
W130	Customizable logic output monitor	[12]
W131	PID deviation	[12]
W132	PID deviation (p.u. value)	[29]
W133	PID deviation (No filter)	[12]
W140	Terminal [V3] input voltage	[4]
W142	Position control - current position (High order)	[73]
W143	Position control - current position (Low order)	[1]
W144	Position control - stop target position (High order)	[73]
W145	Position control - stop target position (Low order)	[1]
W146	Position control - position deviation (High order)	[73]
W147	Position control - position deviation (Low order)	[1]
W148	Position control - position control start position (High order)	[73]
W149	Position control - position control start position (Low order)	[1]
W152	Position control - control mode	[1]
W153	PG detected pulse count (Command side A/B-phase)	[6]
W154	PG detected pulse count (Command side Z-phase)	[1]
W155	PG detected pulse count (Feedback side A/B-phase)	[6]
W156	PG detected pulse count (Feedback side Z-phase)	[1]
W159	Max. regenerative load factor (%ED)	[3]
W160	Regenerative load factor (%ED)	[3]
W161	Braking resistor thermal overload relay	[3]
W162	Inverter thermal 1	[3]
W163	Inverter thermal 2	[3]
W164	Inverter thermal 3	[3]
W165	Maximum regenerative load factor value	[3]
W166	Regenerative load factor	[3]

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W167	Anticipated Pt plate electrolytic capacitor cumulative operating life time	[74]
W168	Anticipated cooling fan life time	[74]
W169	IGBT life expectancy	[1]
W170	Cumulative run time (Long time)	[74]
W171	Multi-function keypad thermistor temperature value	[2]
W172	Multi-function keypad battery voltage value	[5]
W180	Auto tuning progress	[1]
W181	Integral power	[24]
W182	Bus option command	[103]
W183	Control power status	[104]
W184	Detected load after compensation	[6]
W188	Max. relay ON count (Y1Ry, Y2Ry)	[45]
W189	Max. relay ON count (Y3Ry, Y5Ry)	[45]
W190	Max. relay ON count (Y5AC, 30ABC)	[45]
W191	Max. relay ON count (Y6AC, Y12AC)	[45]
W202	PID1 command value	[12]
W203	PID1 feedback value	[12]
W205	PID2 command value	[12]
W206	PID2 feedback value	[12]
W212	External PID1 command value (Final)	[12]
W213	External PID1 feedback value (Final)	[12]
W214	External PID1 command value	[12]
W215	External PID1 feedback value	[12]
W217	External PID1 manual command value	[6]
W218	External PID1 output	[4]
W224	External PID2 command value	[12]
W225	External PID2 feedback value	[12]
W227	External PID2 manual command value	[6]
W228	External PID2 output	[4]
W234	External PID3 command value	[12]
W235	External PID3 feedback value	[12]
W237	External PID3 manual command value	[6]
W238	External PID3 output	[4]
W250	Rotary operation Slave 1 output frequency	[22]
W251	Rotary operation Slave 1 output current	[24]
W252	Rotary operation Slave 1 power consumption	[24]
W253	Rotary operation Slave 1 alarm details	[10]
W255	Rotary operation Slave 2 output frequency	[22]
W256	Rotary operation Slave 2 output current	[24]
W257	Rotary operation Slave 2 power consumption	[24]
W258	Rotary operation Slave 2 alarm details	[10]
W260	Rotary operation Slave 3 output frequency	[22]
W261	Rotary operation Slave 3 output current	[24]
W262	Rotary operation Slave 3 power consumption	[24]
W263	Rotary operation Slave 3 alarm details	[10]
W265	Rotary operation Slave 4 output frequency	[22]
W266	Rotary operation Slave 4 output current	[24]
W267	Rotary operation Slave 4 power consumption	[24]

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W268	Rotary operation Slave 4 alarm details	[10]
W270	Rotary operation Slave 5 output frequency	[22]
W271	Rotary operation Slave 5 output current	[24]
W272	Rotary operation Slave 5 power consumption	[24]
W273	Rotary operation Slave 5 alarm details	[10]
W275	Rotary operation Slave 6 output frequency	[22]
W276	Rotary operation Slave 6 output current	[24]
W277	Rotary operation Slave 6 power consumption	[24]
W278	Rotary operation Slave 6 alarm details	[10]
W280	Rotary operation Slave 7 output frequency	[22]
W281	Rotary operation Slave 7 output current	[24]
W282	Rotary operation Slave 7 power consumption	[24]
W283	Rotary operation Slave 7 alarm details	[10]
W301	Integral power monitor interval	[1]
W302	Integral power start year/month	[85]
W303	Integral power start minute/second	[86]
W304	Integral power monitor 1	[45]
W305	Integral power monitor 2	[45]
W306	Integral power monitor 3	[45]
W307	Integral power monitor 4	[45]
W308	Integral power monitor 5	[45]
W309	Integral power monitor 6	[45]
W310	Integral power monitor 7	[45]
W311	Integral power monitor 8	[45]
W312	Integral power monitor 9	[45]
W313	Integral power monitor 10	[45]
W314	Integral power monitor 11	[45]
W315	Integral power monitor 12	[45]
W316	Integral power monitor 13	[45]
W317	Integral power monitor 14	[45]
W318	Integral power monitor 15	[45]
W319	Integral power monitor 16	[45]
W320	Integral power monitor 17	[45]
W321	Integral power monitor 18	[45]
W322	Integral power monitor 19	[45]
W323	Integral power monitor 20	[45]
W324	Integral power monitor 21	[45]
W325	Integral power monitor 22	[45]
W326	Integral power monitor 23	[45]
W327	Integral power monitor 24	[45]
W328	Integral power monitor 25	[45]
W329	Integral power monitor 26	[45]
W330	Integral power monitor 27	[45]
W331	Integral power monitor 28	[45]
W332	Integral power monitor 29	[45]
W333	Integral power monitor 30	[45]
W334	Integral power monitor 31	[45]
W335	Integral power monitor 32	[45]

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W336	Integral power monitor 33	[45]
W337	Integral power monitor 34	[45]
W338	Integral power monitor 35	[45]
W339	Integral power monitor 36	[45]
W340	Integral power monitor 37	[45]
W341	Integral power monitor 38	[45]
W342	Integral power monitor 39	[45]
W343	Integral power monitor 40	[45]
W344	Integral power monitor 41	[45]
W345	Integral power monitor 42	[45]
W346	Integral power monitor 43	[45]
W347	Integral power monitor 44	[45]
W348	Integral power monitor 45	[45]
W349	Integral power monitor 46	[45]
W350	Integral power monitor 47	[45]
W351	Integral power monitor 48	[45]
W352	Run time monitor 1	[45]
W353	Run time monitor 2	[45]
W354	Run time monitor 3	[45]
W355	Run time monitor 4	[45]
W356	Run time monitor 5	[45]
W357	Run time monitor 6	[45]
W358	Run time monitor 7	[45]
W359	Run time monitor 8	[45]
W360	Run time monitor 9	[45]
W361	Run time monitor 10	[45]
W362	Run time monitor 11	[45]
W363	Run time monitor 12	[45]
W364	Run time monitor 13	[45]
W365	Run time monitor 14	[45]
W366	Run time monitor 15	[45]
W367	Run time monitor 16	[45]
W368	Run time monitor 17	[45]
W369	Run time monitor 18	[45]
W370	Run time monitor 19	[45]
W371	Run time monitor 20	[45]
W372	Run time monitor 21	[45]
W373	Run time monitor 22	[45]
W374	Run time monitor 23	[45]
W375	Run time monitor 24	[45]
W376	Run time monitor 25	[45]
W377	Run time monitor 26	[45]
W378	Run time monitor 27	[45]
W379	Run time monitor 28	[45]
W380	Run time monitor 29	[45]
W381	Run time monitor 30	[45]
W382	Run time monitor 31	[45]
W383	Run time monitor 32	[45]

Table 7.42 List of data format numbers (W codes) (Continued)

Code	Name	Format number
W384	Run time monitor 33	[45]
W385	Run time monitor 34	[45]
W386	Run time monitor 35	[45]
W387	Run time monitor 36	[45]
W388	Run time monitor 37	[45]
W389	Run time monitor 38	[45]
W390	Run time monitor 39	[45]
W391	Run time monitor 40	[45]
W392	Run time monitor 41	[45]
W393	Run time monitor 42	[45]
W394	Run time monitor 43	[45]
W395	Run time monitor 44	[45]
W396	Run time monitor 45	[45]
W397	Run time monitor 46	[45]
W398	Run time monitor 47	[45]
W399	Run time monitor 48	[45]

Table 7.43 List of data format numbers (X codes)

Code	Name	Format number
X00	Alarm history (latest)	[41]
X01	Multiple alarm 1 (latest)	[40]
X02	Multiple alarm 2 (latest)	[40]
X03	Sub code	[1]
X04	Multiple alarm subcode (Latest, second)	[1]
X05	Alarm history (last)	[41]
X06	Multiple alarm 1 (last)	[40]
X07	Multiple alarm 2 (last)	[40]
X08	Sub code	[1]
X10	Alarm history (second last)	[41]
X11	Multiple alarm 1 (second last)	[40]
X12	Multiple alarm 2 (second last)	[40]
X13	Sub code	[1]
X15	Alarm history (third last)	[41]
X16	Multiple alarm 1 (third last)	[40]
X17	Multiple alarm 2 (third last)	[40]
X18	Sub code	[1]
X20	Latest info. on alarm (output frequency)	[22]
X21	(output current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1
X22	(output voltage)	[1]
X23	(Torque)	[2]
X24	(set frequency)	[22]
X25	(operation status)	[16]
X26	(cumulative ope. time)	[1]
X27	(number of startups)	[1]
X28	(DC link circuit voltage)	[1]
X29	(internal air temperature)	[1]
X30	(heat sink temperature)	[1]
X31	(input terminal)	[43]
X32	(output terminal)	[15]
X33	(input terminal(com.))	[14]
X34	(output terminal(com.))	[15]
X35	(Input power)	[24]
X36	(Power consumption during alarm)	[76]
X37	(Operation status 2)	[29]
X38	(Running status 3)	[44]
X54	Light alarm factor (Fourth last)	[41]
X55	Light alarm factor (Fifth last)	[41]
X60	Last info. on alarm (output frequency)	[22]
X61	(output current)	[24] (FGI)
		[19] (RTU)
		[24] (BUS) *1

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.43 List of data format numbers (X codes) (Continued)

Code	Name	Format number
X62	Last info. on alarm (output voltage)	[1]
X63	(Torque)	[2]
X64	(set frequency)	[22]
X65	(operation status)	[16]
X66	(cumulative ope. time)	[1]
X67	(number of startups)	[1]
X68	(DC link circuit voltage)	[1]
X69	(internal air temperature)	[1]
X70	(heat sink temperature)	[1]
X71	(input terminal)	[43]
X72	(output terminal)	[15]
X73	(input terminal(com.))	[14]
X74	(output terminal(com.))	[15]
X76	(Operation status 2)	[76]
X77	(Speed detection)	[29]
X78	(Running status 3)	[44]
X89	Customizable logic (Digital I/O)	[95]
X90	(Timer monitor)	[5]
X91	(Analog input 1)	[12]
X92	(Analog input 2)	[12]
X93	(Analog output)	[12]
X94	Relay output terminal information	[91]
X95	Flow sensor monitor	[12]
X96	Output current on terminal [CS2]	[3]
X97	Terminal [PTC/NTC] input voltage	[4]
X98	PT option detection temperature (Ch.1)	[6]
X99	PT option detection temperature (Ch.2)	[6]
X105	Year and month of alarm occurrence (Latest)	[85]
X106	Day and hour of alarm occurrence (Latest)	[86]
X107	Minute and second of alarm occurrence (Latest)	[87]
X115	Year and month of alarm occurrence (Last)	[85]
X116	Day and hour of alarm occurrence (Last)	[86]
X117	Minute and second of alarm occurrence (Last)	[87]
X125	Year and month of alarm occurrence (Second last)	[85]
X126	Day and hour of alarm occurrence (Second last)	[86]
X127	Minute and second of alarm occurrence (Second last)	[87]
X135	Year and month of alarm occurrence (Third last)	[85]
X136	Day and hour of alarm occurrence (Third last)	[86]
X137	Minute and second of alarm occurrence (Third last)	[87]
X140	Alarm history (Fourth last)	[41]
X145	Year and month of alarm occurrence (Fourth last)	[85]
X146	Day and hour of alarm occurrence (Fourth last)	[86]
X147	Minute and second of alarm occurrence (Fourth last)	[87]
X150	Alarm history (Fifth last)	[41]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.43 List of data format numbers (X codes) (Continued)

Code	Name	Format number
X155	Year and month of alarm occurrence (Fifth last)	[85]
X156	Day and hour of alarm occurrence (Fifth last)	[86]
X157	Minute and second of alarm occurrence (Fifth last)	[87]
X160	Alarm history (Sixth last)	[41]
X165	Year and month of alarm occurrence (Sixth last)	[85]
X166	Day and hour of alarm occurrence (Sixth last)	[86]
X167	Minute and second of alarm occurrence (Sixth last)	[87]
X170	Alarm history (Seventh last)	[41]
X175	Year and month of alarm occurrence (Seventh last)	[85]
X176	Day and hour of alarm occurrence (Seventh last)	[86]
X177	Minute and second of alarm occurrence (Seventh last)	[87]
X180	Alarm history (Eighth last)	[41]
X185	Year and month of alarm occurrence (Eighth last)	[85]
X186	Day and hour of alarm occurrence (Eighth last)	[86]
X187	Minute and second of alarm occurrence (Eighth last)	[87]
X190	Alarm history (Ninth last)	[41]
X195	Year and month of alarm occurrence (Ninth last)	[85]
X196	Day and hour of alarm occurrence (Ninth last)	[86]
X197	Minute and second of alarm occurrence (Ninth last)	[87]

Table 7.44 List of data format numbers (Z codes)

Code	Name	Format number
Z00	Second last info. on alarm (output frequency)	[22]
Z01	(output current)	[24] (FGI)
		[19] (RTU) *3
		[24] (BUS) *1
Z02	(output voltage)	[1]
Z03	(Torque)	[2]
Z04	(set frequency)	[22]
Z05	(operation status)	[16]
Z06	(cumulative ope. time)	[1]
Z07	(number of startups)	[1]
Z08	(DC link circuit voltage)	[1]
Z09 *2	(internal air temperature)	[1]
		[2]
Z10 *2	(heat sink temperature)	[1]
		[2]
Z11	(input terminal)	[43]
Z12	(output terminal)	[15]
Z13	(input terminal(com.))	[14]
Z14	(output terminal(com.))	[15]
Z16	(Operation status 2)	[74]
Z17	(Speed detection)	[74]
Z18	(Running status 3)	[44]
Z40	Cumulative operation time of motor (M1)	[74]
Z41	Cumulative operation time of motor (M2)	[74]
Z42	Cumulative operation time of motor (M3)	[74]
Z43	Cumulative operation time of motor (M4)	[74]
Z44	Number of starting time (M2)	[74]
Z45	Number of starting time (M3)	[74]
Z46	Number of starting time (M4)	[74]
Z48	Retry history (Latest)	[41]
Z49	Retry history (Last)	[41]
Z50	Third last info. on alarm (output frequency)	[22]
Z51	(output current)	[24] (FGI)
		[19] (RTU) *3
		[24] (BUS) *1
Z52	(output voltage)	[1]
Z53	(Torque)	[2]
Z54	(set frequency)	[22]
Z55	(operation status)	[16]
Z56	(cumulative ope. time)	[1]
Z57	(number of startups)	[1]
Z58	(DC link circuit voltage)	[1]
Z59	(internal air temperature)	[1]
Z60	(heat sink temperature)	[1]

*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

Table 7.44 List of data format numbers (Z codes) (Continued)

Code	Name	Format number
Z61	Third last info. on alarm (input terminal)	[43]
Z62	(output terminal)	[15]
Z63	(input terminal(com.))	[14]
Z64	(output terminal(com.))	[15]
Z66	(Operation status 2)	[76]
Z67	(Speed detection)	[29]
Z68	(Running status 3)	[44]
Z78	Set speed (r/min)	[2]
Z79	Speed command (r/min)	[2]
Z80	Speed detection	[2]
Z81	Output torque	[6]
Z82	Load factor	[6]
Z83	Motor output	[6]
Z84	Output current	[24](FGI)
		[19](RTU) *3
		[24](BUS) *1
Z85	PID feedback value	[12]
Z86	Power consumption	[24]
Z87	PID output	[4]
Z88	Integral power	[93]
Z89	Control Circuit Terminal	[43]
Z90	Current Position Pulse (Upper column)	[73]
Z91	Current Position Pulse (Lower column)	[1]
Z92	Stop Position Pulse (Upper column)	[73]
Z93	Stop Position Pulse (Lower column)	[1]
Z94	Difference Pulse of Position (Upper column)	[73]
Z95	Difference Pulse of Position (Lower column)	[1]

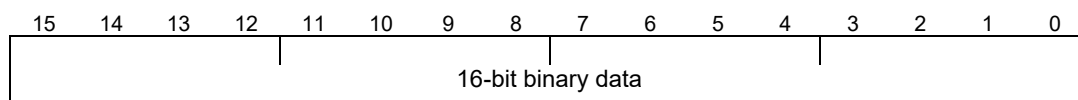
*1 BUS: The field bus option format is selected. For details about the field bus option, see the instruction manual for each field bus option.

*2 The format No. differs depending on the model.

*3 The data format when using RTU changes based on function code y93 and y96.

7.2.2 Data format specifications

The data in the data fields of a communications frame are 16 bits long, binary data, as shown below.



For the convenience of description, 16-bit data is expressed in hexadecimal with one upper-order byte (eight bits from 15 to 8) and one lower-order byte (eight bits from 7 to 0).

For example, the following data is 1234H in hexadecimal and expressed as

12 _H	34 _H
-----------------	-----------------

.

0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Data format [1] Integer data (positive): Minimum step 1

(Example) When F05 (base) frequency voltage = 200V

200 = 00C8_H Consequently

⇒

00 _H	C8 _H
-----------------	-----------------

Data format [2] Integer data (positive/negative): Minimum step 1

(Example) When the value is -20

-20 = FFEC_H Consequently,

⇒

FF _H	EC _H
-----------------	-----------------

Data format [3] Decimal data (positive): Minimum step 0.1

(Example) When F17 (gain frequency set signal) = 100.0%

100.0 x 10 = 1000 = 03E8_H Consequently,

⇒

03 _H	E8 _H
-----------------	-----------------

Data format [4] Decimal data (positive/negative): Minimum step 0.1

(Example) When C31 (analog input offset adjustment) = -5.0%

-5.0 x 10 = -50 = FFCE_H Consequently,

⇒

FF _H	CE _H
-----------------	-----------------

Data format [5] Decimal data (positive): Minimum step 0.01

(Example) C05 (multistep frequency) = 50.25Hz

50.25 x 100 = 5025 = 13A1_H Consequently,

⇒

13 _H	A1 _H
-----------------	-----------------

Data format [6] Decimal data (positive/negative): Minimum step 0.01

(Example) When M07 (actual torque value) = -85.38%

-85.38 x 100 = -8538 = DEA6_H Consequently,

⇒

DE _H	A6 _H
-----------------	-----------------

Data format [7] Decimal data (positive): Minimum step 0.001

(Example) When F51(electronic thermal (permissible loss)) = 0.105kW

$0.105 \times 1000 = 105 = 0069_H$ Consequently,

$\Rightarrow$

00 _H	69 _H
-----------------	-----------------

Data format [8] Decimal data (positive/negative): Minimum step 0.001

(Example) When the data is -1.234

$-1.234 \times 1000 = -1234 = FB2E_H$ Consequently,

$\Rightarrow$

FB _H	2E _H
-----------------	-----------------

Data format [10] Alarm codes

Table 7.45 List of alarm codes

Code	Description		Code	Description	
0	No alarm	---	51	Data save error on insufficient voltage	<i>E-rF</i>
1	Overcurrent (during acceleration)	<i>OL1</i>	52	Excessive position deviation	<i>dB</i>
2	Overcurrent (during deceleration)	<i>OL2</i>	53	RS-485 communications error (Option/Communications port 2)	<i>E-rP</i>
3	Overcurrent (during constant speed operation)	<i>OL3</i>	54	Hardware error	<i>E-rH</i>
5	Ground fault	<i>EF</i>	56	Position control error	<i>E-ro</i>
6	Overvoltage (during acceleration)	<i>OLV1</i>	57	EN circuit error	<i>ECF</i>
7	Overvoltage (during deceleration)	<i>OLV2</i>	58	PID feedback disconnection detected	<i>CoF</i>
8	Overvoltage (during constant speed operation or stopping)	<i>OLV3</i>	59	DB transistor trouble	<i>dbA</i>
10	Undervoltage	<i>LU</i>	65	Customizable logic error	<i>ECL</i>
11	Input phase loss	<i>Li n</i>	66	PID control 1 feedback error detection	<i>PU1</i>
14	Fuse blown	<i>FUS</i>	67	PID control 2 feedback error detection	<i>PU2</i>
16	Charging circuit fault	<i>PbF</i>	70	Charging resistor overheat	<i>OH6</i>
17	Heat sink overheat	<i>OH1</i>	81	Dry pump protection	<i>Pdr</i>
18	External alarm	<i>OH2</i>	82	Control of maximum starts per hour	<i>roC</i>
19	Internal air overheat	<i>OH3</i>	83	End of curve protection	<i>Pol</i>
20	Motor protection (PTC/NTC thermistor)	<i>OH4</i>	84	Anti jam	<i>rLo</i>
22	Braking resistor overheat	<i>dbH</i>	85	Filter clogging error	<i>FoL</i>
23	Motor overload	<i>OL1</i>	91	External PID control 1 feedback error detection	<i>PUA</i>
24	Motor overload: motor 2	<i>OL2</i>	92	External PID control 2 feedback error detection	<i>PUb</i>
25	Inverter overload	<i>OLU</i>	93	External PID control 3 feedback error detection	<i>PUc</i>
27	Over speed protection	<i>OS</i>	98	IGBT lifetime alarm	<i>Ob</i>
28	PG disconnection	<i>PG</i>	99	Cooling capability drop warning	<i>rPF</i>
29	NTC disconnection error	<i>nr-b</i>	100	DC fan lock detected	<i>FAL</i>
31	Memory error	<i>E-r1</i>	101	Motor overload warning	<i>OL</i>
32	Keypad communications error	<i>E-r2</i>	102	Cooling fin overheat warning	<i>OH</i>
33	CPU error	<i>E-r3</i>	103	Life warning	<i>LiF</i>
34	Option communications error	<i>E-r4</i>	104	Command loss	<i>rEF</i>
35	Option error	<i>E-r5</i>	105	PID warning output	<i>P id</i>
36	Run operation error	<i>E-r6</i>	106	Low torque detected	<i>UL</i>
37	Tuning error	<i>E-r7</i>	107	Thermistor detected (PTC)	<i>PTC</i>
38	RS-485 communications error (communications port1)	<i>E-r8</i>	108	Machine life (accumulated operation hours)	<i>rFE</i>
42	Step-out	<i>E-rd</i>	109	Machine life (No. of starting times)	<i>EnF</i>
43	Motor selection error	<i>E-rL</i>	121	User-defined alarm 1	<i>RA1</i>
44	Motor overload: motor 3	<i>OL3</i>	122	User-defined alarm 2	<i>RA2</i>
45	Motor overload: motor 4	<i>OL4</i>	123	User-defined alarm 3	<i>RA3</i>
46	Output phaseloss	<i>OPL</i>	124	User-defined alarm 4	<i>RA4</i>
47	Following error, excessive speed deviation	<i>E-rE</i>	125	User-defined alarm 5	<i>RA5</i>
50	Magnetic pole position error	<i>E-rC</i>	166	PID control 1 warning output	<i>PA1</i>

Table 7.45 List of alarm codes

Code	Description		Code	Description	
167	PID control 2 warning output	<i>PR2</i>	250	Low battery	<i>Lob</i>
190	Mutual operation slave alarm	<i>SLA</i>	251	Date information lost	<i>dLl</i>
191	External PID control 1 warning output	<i>PR1</i>	252	Fire mode	<i>Fod</i>
192	External PID control 2 warning output	<i>PRb</i>	253	Password protection	<i>LoP</i>
193	External PID control 3 warning output	<i>PRc</i>	254	Simulated error	<i>Err</i>

(Example) In the case of overvoltage (during acceleration) (*ovl*)

6 = 0006_H Consequently,

⇒

00 _H	06 _H
-----------------	-----------------

Data format [11] Capacity code (unit: kW)

As shown in the table below, the capacity (kW) is multiplied by 100.

If the capacity exceeds 600 kW, the data value will be 60000+ (kW).

Table 7.46 Capacities and data

Capacity (kW)	Data	Capacity (kW)	Data	Capacity (kW)	Data
0.06	6	22	2200	280	28000
0.1	10	30	3000	315	31500
0.2	20	37	3700	355	35500
0.4	40	45	4500	400	40000
0.75	75	55	5500	450	45000
1.5	150	75	7500	500	50000
2.2	220	90	9000	550	55000
3.7	370	110	11000	600	60000
5.5	550	132	13200	650	60650
7.5	750	160	16000	700	60700
11	1100	200	20000	750	60750
15	1,500	220	22000	800	60800
18.5	1850	250	25000	1000	61000

(Example) When the capacity is 2.2 kW

$2.20 \times 100 = 220 = 00DC_H$ Consequently,

$\Rightarrow$

00 _H	DC _H
-----------------	-----------------

Data format [12] Floating point data (accel./decal. time, PID display coefficient)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Polarity	0	0	0	Exponent											
	Unused														

Polarity: 0 → Positive (+), 1 → Negative (-) Exponent: 0 to 3 Mantissa: 1 to 999

Value expressed in this form = (polarity) Mantissa x (Exponent - 2) power of 10

Value	Mantissa	Exponent	(Exponent - 2) power of 10
0.01 to 9.99	1 to 999	0	0.01
10.0 to 99.9	100 to 999	1	0.1
100 to 999	100 to 999	2	1
1000 to 9990	100 to 999	3	10

(Example) When F07 (acceleration time 1) = 20.0 seconds

$20.0 = 200 \times 0.1 \Rightarrow 0000\ 0100\ 1100\ 1000_b = 04C8_H$

$\Rightarrow$

04 _H	C8 _H
-----------------	-----------------

Consequently,

Data format [14] Operation command

15	14	13	12	11*1	10	9	8	7	6	5	4	3	2	1	0
RST	XR (REV)	XF (FWD)	0	EN	X9	X8	X7	X6	X5	X4	X3	X2	X1	REV	FWD
↑ Alarm reset	General-purpose input		Unused	EN terminal	General-purpose input								FWD: Forward command REV: Reverse command		

*1 bit11: The EN terminal is a bit dedicated for monitor and the terminal command cannot be input through communications.

(All bits are turned ON when set to 1.)

(Example) When S06 (operation command) = FWD, X1 = ON

0000 0000 0000 0101_b = 0005_H Consequently,

⇒

00 _H	05 _H
-----------------	-----------------

Data format [15] General-purpose output terminal

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Y3A	Y2A	Y1A	0	0	0	30	0	0	0	Y5	Y4	Y3	Y2	Y1
Unused	Relay option output (Eco only)		Unused			↑	Unused	General-purpose output							

Alarm (general-purpose output)

(All bits are turned ON when set to 1.)

(Example) When M15 (general-purpose output terminal) = Y1 = ON

0000 0000 0000 0001_b = 0001_H Consequently,

⇒

00 _H	01 _H
-----------------	-----------------

Data format [16] Operation status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
BUSY	0	0	RL	ALM	DEC	ACC	IL	VL	0	NUV	BRK	INT	EXT	REV	FWD

(All bits are turned ON or become active when set to 1.)

- * Supported bits differ for each model. Refer to 8.8 Differences Between Data Formats for details.

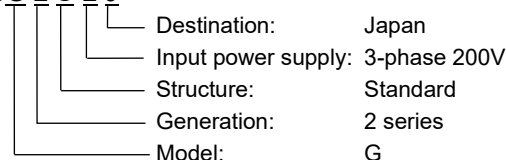
Data format [17] Model code

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Model				Generation				Destination				Input power supply			

Table 7.47 List of model codes

Code	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Model	VG	G	P	E	C	S	DPS	DGS	H (1667Hz)	H (3000Hz)	F	RHC	RHR	Lift	Expansion
Generation	11 series	7 series	1 series RHR A series RHC C series	Eco PLUS series	2 series										Expansion
Destination	Japan (standard)	Asia	China	Europe	USA	East Asia									
Input power supply	Single-phase 100V	Single-phase 200V	Three-phase 200V	Three-phase 400V											

(Example) When the inverter type is FRN1.5G 2 S-2 J



Since "model ":G is represented by code 2, "generation": 2 series by code 5, "destination": Japan (standard) by 1, and "input power supply": 3-phase 200V by 3, the model code is 2513_H.

If the "Model" code is "F" (Extended), read the M123 extended model code to determine the model. Refer to Data format [99] for details on extended model codes.

If the "Destination" code is "East Asia", this includes "South Korea" and "Taiwan".

Data format [19] Current value

Current values are decimal data (positive). The minimum step is 0.01 for an inverter capacity of 22kW (30HP) or less and 0.1 for an inverter capacity of 30kW (40HP) or more.

When inverter capacity is 22kW (30HP) or less, any data higher than 655A cannot be written. No correct value can be read out when a direction for write data higher than 655A is issued.

Current data is rounded down on and after the fifth digit inside the inverter. (Ex.: When a writing direction of 107.54A is issued to an inverter with a capacity of 22kW (30HP), 107.5A is written.)

(Ex.) When F11 (electronic thermal operation level) = 107.0A (40HP)

$$107.0 \times 10 = 1070 = 042E_H, \text{ consequently}$$

⇒

04 _H	2E _H
-----------------	-----------------

(Ex.) When F11 (electronic thermal operation level) = 3.60A (1HP)

$$3.60 \times 10 = 360 = 0168_H, \text{ consequently}$$

⇒

01 _H	68 _H
-----------------	-----------------

Data format [20] Communications error

Table 7.48 Communications error codes (common to both protocols)

Code	Description	Code	Description
71	Checksum error, CRC error ⇒ No response	73	Framing error, overrun error, buffer full ⇒ No response
72	Parity error ⇒ No response		

Table 7.49 Communications error codes (for Fuji general-purpose inverter protocol)

Code	Description	Code	Description
74	Format error	78	Function code error
75	Command error	79	Write disabled
76	Link priority error	80	Data error
77	Function code data write right error	81	Error during writing

Table 7.50 Communications error codes (for RTU protocol)

Code	Description	Code	Description
1	Improper 'FC'	3	Improper data (range error)
2	Improper address (function code error)	7	NAK (link priority, no right, write disabled)

(Example) In case of an improper address

2 = 0002_H Consequently, ⇒

00 _H	02 _H
-----------------	-----------------

Data format [21] Auto tuning

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	REV	FWD								
Not used						Data part									

When FWD is 1, this data is the forward rotation command. When REV is 1, this data is the reverse rotation command. However, if both FWD and REV are 1, the command is not effective. Both FWD and REV are 0 for reading.

(Ex.) When P04 (motor 1 automatic tuning) = 1 (forward rotation),

0000 0001 0000 0001_b = 0101_H Consequently, ⇒

01 _H	01 _H
-----------------	-----------------

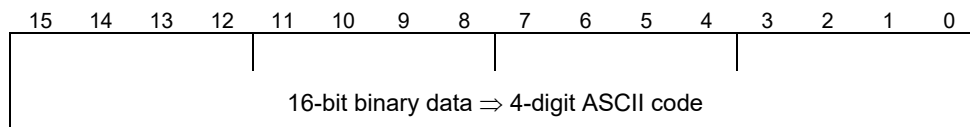
Data format [22] Frequency data

Decimal data (positive): Resolution 0.01Hz

Data format [23] Polarity + decimal data (positive)

(for Fuji general-purpose inverter protocol)

Decimal data (positive): Resolution 0.01Hz



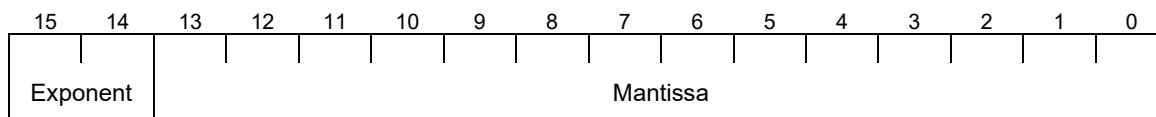
For reverse rotation, add a negative sign (-) (ASCII) to the special additional data in the standard frame, or for forward rotation, enter a space (ASCII).

(Example) When maximum frequency = 60Hz and M09 (output frequency) = 60.00Hz (forward rotation)

$$60.00 \times 100 = 6000 = 1770_H \text{ Consequently, } \Rightarrow \begin{array}{|c|c|c|c|c|} \hline & 1 & 7 & 7 & 0 \\ \hline \end{array}$$

(Positive data is in the same data format as data format [5].)

Data format [24] Floating point data



Exponent: 0-3 Mantissa: 1 to 9999

The value expressed by this format = the mantissa $\times 10^{(\text{exponent}-2)}$

Numeric value	Mantissa	Exponent	$10^{(\text{exponent}-2)}$
0.00 to 99.99	0 to 9999	0	0.01
100.0 to 999.9	1000 to 9999	1	0.1
1000 to 9999	1000 to 9999	2	1
10000 to 99990	1000 to 9999	3	10

(Example)

Numerical value	Exponent part	Mantissa		Exponent part+	Mantissa
99.99	0000 _H	$99.99 \div 0.01 = 9999_d = 270F_H$	$\Rightarrow$	27 _H	0F _H
999.9	4000 _H	$999.9 \div 0.1 = 9999_d = 670F_H$	$\Rightarrow$	67 _H	0F _H
9999	8000 _H	$9999 \div 1 = 9999_d = A70F_H$	$\Rightarrow$	A7 _H	0F _H
99990	C000 _H	$99990 \div 10 = 9999_d = E70F_H$	$\Rightarrow$	E7 _H	0F _H

Data format [25] Capacity code (for HP)

As shown in the table below, the capacity (HP) is multiplied by 100.

If the capacity exceeds 600 HP, the data value will be 60000+ (HP).

Table 7.51 Capacities and data (for HP)

Code	Capacity (HP)	Code	Capacity (HP)	Code	Capacity (HP)
7	0.07 (reserved)	3000	30	40000	400
15	0.15 (reserved)	4000	40	45000	450
25	0.25	5000	50	50000	500
50	0.5	6000	60	60000	600
100	1	7500	75	60700	700
200	2	10000	100	60750	750
300	3	12500	125	60800	800
500	5	15000	150	60850	850
750	7.5	17500	175	60900	900
1000	10	20000	200	60950	950
1,500	15	25000	250	61000	1000
2000	20	30000	300	61050	1050
2500	25	35000	350		

(Example) When the capacity is 3HP

$3 \times 100 = 300 = 012C_H$ Consequently,

⇒

01 _H	2C _H
-----------------	-----------------

Data format [29] Positive/Negative data of values converted into standard (p.u.) with 20,000

(Example) Speed (frequency) Data of $\pm 20,000/\pm$ maximum speed (frequency)

Data format [35] ROM version

Range: 0 to 9999

Data format [37] Floating point data (load rotation speed, etc.)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Exponent		Mantissa													

Exponent: 0-3 Mantissa: 1 to 9999

The value expressed by this format = the mantissa $\times 10^{(\text{exponent}-2)}$

Numeric value	Mantissa	Exponent	$10^{(\text{exponent}-2)}$
0.01 to 99.99	1 to 9999	0	0.01
100.0 to 999.9	1000 to 9999	1	0.1
1000 to 9999	1000 to 9999	2	1
10000 to 99990	1000 to 9999	3	10

(Example)

Numerical value	Exponent part	Mantissa		Exponent part+	Mantissa
99.99	0000 _H	$99.99 \div 0.01 = 9999_d = 270F_H$	$\Rightarrow$	27 _H	0F _H
999.9	4000 _H	$999.9 \div 0.1 = 9999_d = 670F_H$	$\Rightarrow$	67 _H	0F _H
9999	8000 _H	$9999 \div 1 = 9999_d = A70F_H$	$\Rightarrow$	A7 _H	0F _H
99990	C000 _H	$99990 \div 10 = 9999_d = E70F_H$	$\Rightarrow$	E7 _H	0F _H

Data format [40] Alarm factor

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Alarm caused by multiple factors (1 to 5)				Order of alarm occurrences (1 to 5)				Alarm code (See Table 7.45.)							

Data format [41] Alarm history

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Number of serial occurrences of same alarm								Alarm code (See Table 7.45.)							

Indicates the content of an alarm that has occurred and the number of serial occurrence times of the alarm.

Data format [43] Operation command (for I/O check)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	EN2	EN1	X9	X8	X7	X6	X5	X4	X3	X2	X1	REV	FWD
Unused			EN Input		General-purpose input										

(All bits are turned ON when set to 1.)

Data format [44] Operation status 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	IDL	ID	OLP	LIFE	OH	TRY	FAN	KP	OL	IPF	0	RDY	FDT	FAR

(All bits are turned ON or become active when set to 1.)

Supported bits differ for each model. Refer to 8.8 Differences Between Data Formats for details.

Data format [45] Floating point data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Exponent			Mantissa												

Exponent: 0-3 Mantissa: 0 to 9999

The value expressed by this format = the mantissa $\times 10^{(\text{exponent}-3)}$

Numeric value	Mantissa	Exponent	$10^{(\text{exponent}-3)}$
0.000 to 9.999	0 to 9999	0	0.001
10.0 to 99.9	1000 to 9999	1	0.01
100.0 to 999.9	1000 to 9999	2	0.1
1000 to 9999	1000 to 9999	3	1

(Example)

Numerical value	Exponent part	Mantissa		Exponent part+	Mantissa
9.999	0000 _H	$9999 \div 0.001 = 9999d = 270F_H$	⇒	27 _H	0F _H
99.99	4000 _H	$99.99 \div 0.01 = 9999d = 670F_H$	⇒	67 _H	0F _H
999.9	8000 _H	$9999 \div 0.1 = 9999d = A70F_H$	⇒	A7 _H	0F _H
9999	C000 _H	$9999 \div 1 = 9999d = E70F_H$	⇒	E7 _H	0F _H

Data format [67] Operation command source codes

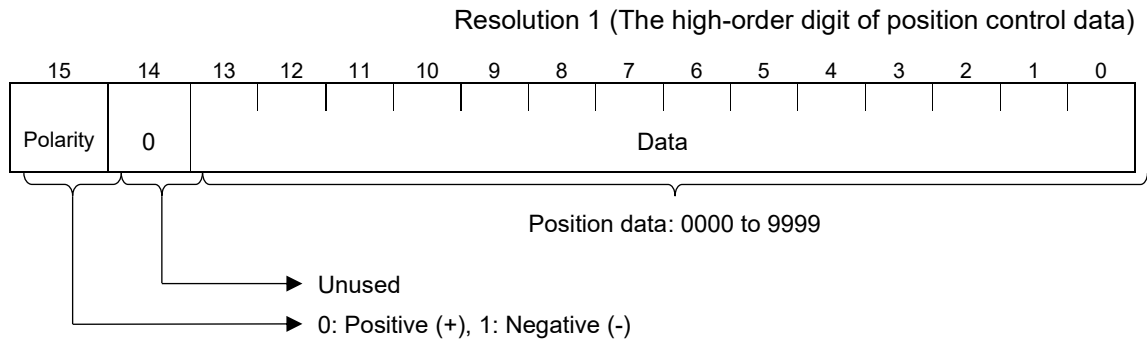
Code	Description	Remarks
0	Keypad operation (Rotating direction: Depends on the terminal input)	Same with the selections for F02
1	Terminal operation	
2	Keypad operation (CW)	
3	Keypad operation (CCW)	
4	Operation command 2	
5 to 19	Reserved	
20	RS-485 channel1	
21	RS-485 channel2	
22	Bus option	
23	FRENIC Loader	

Data format [68] Frequency command source codes

Code	Description	Remarks
0	Keypad key operation	Same with the selections for F01
1	Voltage input (Terminal [12])	
2	Current input (Terminal [C1])	
3	Voltage input (Terminal [12]) + Current input (Terminal [C1])	
4	Inverter body volume	
5	Voltage input (Terminal [V2])	
7	UP/DOWN	
8	Keypad key operation (Balanceless, bumpless functions are activated.)	
11	Digital input (option)	
12	Pulse train input	
20	RS-485 channel1	
21	RS-485 channel2	
22	Bus option	
23	FENIC Loader	
24	Multi-step	
25	JOG	
30 *1	PID TP	
31 *1	PID analog1	
33 *1	PID UP/DOWN	
34 *1	PID communications command	
36 *1	PID multi-step	

*1 Under the PID dancer control, the inverter monitors the PID command source although the frequency command becomes effective as the main setting.

Data format [73] Integer data (positive/negative sign bit)



(Example) In the case of ±9999:

9999 = 270_H

+9999 polarity: 0000_H + data part: 270F_H = 270F_H, and consequently,

-9999 polarity: 8000_H + data part: 270F_H = 270F_H, and consequently,

⇒

02_H 0F_H

-9999 polarity: 8000_H + data part: 270F_H = 270F_H, and consequently,

⇒

A7_H 0F_H

Data format [74] Integer data (positive): by 10 hours

(Example) M81 (Maintenance remaining hours-M1) = 12340 hours

12340 ÷ 10 = 04D2_H

Consequently ⇒

04_H D2_H

Data format [75] Integer data (positive) + [P] Exception for position control

Based on the positive integer data, setting of “-1” is permitted exceptionally. When “-1” is set on the touch probe or the loader, [P] is displayed.

Data format [76] Operating status 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Speed limit ON	Spare	Select motor	Control method				

(Spares are always set to “0.”)

Supported bits differ for each model. Refer , to "8.8 Differences Between Data Formats" for details.

Data format [77] Optional input terminals

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
I16	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1

Data format [78] Optional output terminals

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	08	07	06	05	04	03	02	01

----- Unused -----

Data format [84] Pattern operation

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Rotation direction	0	Time	Exponent part	Data part											

Item	Details
Rotation direction	0: Forward, 1: Reverse rotation
Time	0: No. 1 acceleration/deceleration time 1: No. 2 acceleration/deceleration time 2: No. 3 acceleration/deceleration time 3: No. 4 acceleration/deceleration time
Exponent part	0: 0.01 1: 0.1 2: 1 3: 10
Mantissa	When exponent part is 0: 000 to 999 When exponent part is other than 0: 100 to 999

(Example) If C22 (Stage 1) = 10.0 s REV 2

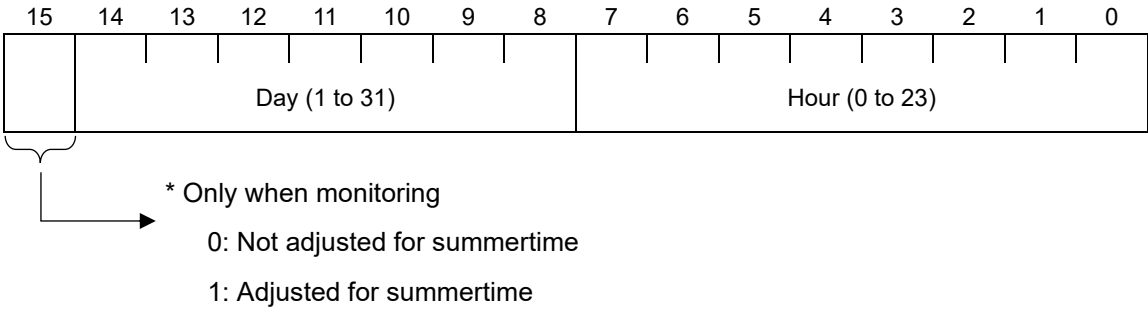
From $10.0 = 0.1 \times 100 \Rightarrow 9000_H + 0400_H + 0064_H = 9464_H$, $\Rightarrow$

94 _H	64 _H
-----------------	-----------------

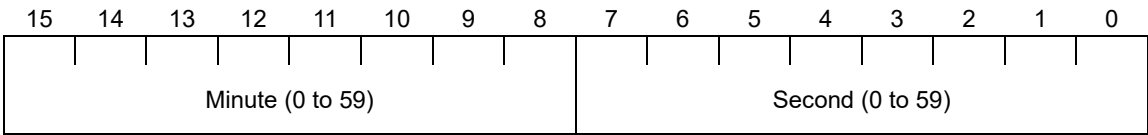
Data format [85] Clock data (YYMM)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Western calendar year (11 to 99) $\Rightarrow$ (2011 to 2099)								Month (1 to 12)							

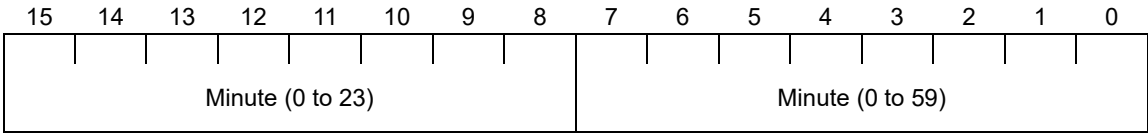
Data format [86] Clock data (DDHH)



Data format [87] Clock data (MMSS)



Data format [88] Clock data (HHMM)



Data format [89] Month/day (for scheduled operation)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Operation selection	Spare	Format specification	Month	Day								Spare	Spare	Spare	Spare
				nth week								Day of week			

Spare bit is always "0".

Format specification = 0 (in case of month, week, day of week)

Item	Details
Day of week	0 to 6: Monday to Sunday
nth week	0 to 3: 1st week to 4th week 4: Final week 5 to 31 : Illegal
Month	1 to 12: January to December 0.13 to 15 : Illegal
Operation selection	Indicates whether the pause day specified for timer operation is valid or invalid. 0: Disable 1: Enable

Format specification = 1 (in case of month and day)

Item	Details
Day	1 to 31: 1st to 31st 0: Illegal
Month	1 to 12: January to December 0.13 to 15 : Illegal
Operation selection	Indicates whether the pause day specified for timer operation is valid or invalid. 0: Disable 1: Enable

Data format [90] Month/day (for summertime adjustment setting)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Spare	Month	nth week		Day of week		Hour		Minute							
		Day													

Spare Bit is always "0".

Item	Details
Minute	0: 0 minutes, 1: 15 minutes, 2: 30 minutes, 3: 45 minutes
Hour	0 to 7: 00:00 to 07:00
Day of week	0 to 6: Monday to Sunday
nth week	0 to 3: 1st week to 4th week 4: Final week 5 to 31 : Illegal
Month	1 to 12: January to December 0.13 to 15 : Illegal

Data format [91] Relay output terminal

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	Y12 A *2	Y11 A *2	Y10 A *2	Y9A *2	Y8A *2	Y7A *2	Y6A *2	0	Y4A *1	Y3A *1	Y2A *1	Y1A *1

Indicates that the relay is ON when 1 for all bits.

*1 For OPC-RY

*2 For OPC-RY2

Data format [93] Floating point data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Exponent part		Mantissa													

Exponent part: 0 to 3, Mantissa: 0 to 9999

Numerical value expressed with this format = Mantissa x (Exponent part-1) to the power 10

Numerical value	Mantissa	Exponent part	(Exponent part-1) to the power 10
0.0 to 999.9	0 to 9999	0	0.1
1000 to 9999	1000 to 9999	1	1
10000 to 99990	1000 to 9999	2	10
100000 to 999900	1000 to 9999	3	100

(Example)

Numerical value	Exponent part	Mantissa		Exponent part+	Mantissa
999.9	0000 _H	999.9 ÷ 0.1 = 9999 _d = 270F _H	⇒	27 _H	0F _H
9999	4000 _H	9999 ÷ 1 = 9999 _d = 670F _H	⇒	67 _H	0F _H
99990	8000 _H	9999 ÷ 10 = 9999 _d = A70F _H	⇒	A7 _H	0F _H
999900	C000 _H	999900 ÷ 100 = 9999 _d = E70F _H	⇒	E7 _H	0F _H

Data format [94] Day of week data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Spare									Sunda y	Mond ay	Tuesd ay	Wedn esday	Thurs day	Friday	Saturd ay

Data format [95] Customizable logic status data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Step enable/disable	Spare	Spare	Output type	Spare	Spare	Input type 2	Spare	Spare	Input type 1				Digital output	Digital input 2	Digital input 1

Digital input 1, digital input 2, digital output 0: OFF, 1: ON

Input type 1, input type 2, output type 0: No function assigned. 1: Digital, 2: Analog

Step enable/disable 0: Disable, 1: Enable

Data format [99] Extended model code

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Model												Generation			

(Example 1) 0162H indicates that the model is 16H (22), the generation is 2H (x), and the series is "G2S".

Data format [103] Bus option command

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Spare														BX	Q_STOP

Indicates that the command for each signal from the field bus option is ON when "1" is set for all bits.

- Q_STOP: Forced stop command (Quick Stop)
- BX: Coast-to-stop command

Data format [104] Control power status

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Spare													24 V power supply	USB bus power	Main power

Indicates that the status of each power supply is ON when "1" is set for all bits.

CHAPTER 8

MODEL DEPENDENT CONTENT

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Content with differences based on model is shown below.

8.1 Material for Each Model

Refer to the following material for information such as function codes which differ for each model.

FRENIC-Mini (C1)

Name	Document No.	Description
User's Manual	MHT270	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0005	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-0791-E INR-SI47-1205-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.
RS-485 Communication Card Instruction Manual	INR-SI47-0773	Arrival inspection, product installation method

FRENIC-Mini (C2)

Name	Document No.	Description
User's Manual	24A7-E-0023	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0011	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-1674-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-Eco

Name	Document No.	Description
User's Manual	24A7-E-0022	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0036	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-0882-E INR-SI47-1059-E INR-SI47-1225-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.
RS-485 Communication Card Instruction Manual	INR-SI47-0872	Arrival inspection, product installation method

FRENIC-Multi

Name	Document No.	Description
User's Manual	24A7-E-0055	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0006	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-1094-E INR-SI47-1204-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.
RS-485 Communication Card Instruction Manual	INR-SI47-1089	Arrival inspection, product installation method

FRENIC-Ace (E2)

Name	Document No.	Description
User's Manual	24A7-E-0088	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0085	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-1733	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-Ace (E3)

Name	Document No.	Description
User's Manual	24A7-E-0161	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0174	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-2550	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-MEGA (G1)

Name	Document No.	Description
User's Manual	24A7-E-0054	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0015	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-1183-E INR-SI47-1223-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-MEGA (G2)

Name	Document No.	Description
User's Manual	24A7-E-0161	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0166	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-2392	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-HVAC

Name	Document No.	Description
User's Manual	24A7-E-0127	Overview of the product, how to operate the keypad, control block diagram, peripheral equipment selection, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0024	Product overview, features, specifications, external drawings, options, etc.
Instruction Manual	INR-SI47-1707-E	Inspection when product arrives, product installation and wiring, keypad operation method, troubleshooting, maintenance and inspection, specifications, etc.

FRENIC-AQUA

Name	Document No.	Description
User's Manual	24A7-E-0077	Overview of FRENIC-AQUA, how to operate the keypad, control block diagrams, selection of peripherals, capacity selection, specifications, function codes, etc.
Catalog	24A1-E-0013	Overview of FRENIC-AQUA, features, specifications, outline drawings, options, etc.
Instruction Manual	INR-SI47-1611-E	Inspection at the time of product arrival, installation and wiring, how to operate the keypad, troubleshooting, maintenance and inspection, specifications, etc.

8.2 Connection Configuration and Compatible Protocols

The RS-485 communication connection configuration and compatible protocols for each model are shown below.

Table 8.1 FRENIC series connection configuration and compatible protocols

Model	Compatibility method	Connection port	Connection port hardware specifications	Port type	Compatible protocols *1			
					Modbus RTU *2	FUJI general-purpose inverter protocol	Metasys N2	BACnet MS/TP
FRENIC-Mini (C1)	RS-485 communication card (option)	RJ-45 connector	2.1.1 See .	Expansion port	Y	Y	N	N
FRENIC-Mini (C2)	Inverter unit RS-485 communication connector	RJ-45 connector	2.1.1 See .	Standard port	Y	Y	N	N
FRENIC-Eco	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See .	Standard port	Y	Y	N	N
	RS-485 communication card (option)	Terminal block	2.1.2 See.	Expansion port	Y	Y	N	N
FRENIC-Multi	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	N	N
	RS-485 communication card (option)	Function expansion RJ-45 connector (2)	8.5 See.	Expansion port	Y	Y	N	N
FRENIC-Ace (E2)	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	N	N
	Inverter unit RS-485 communication connector	RJ-45 connector	8.6 See.	Standard port	Y	Y	N	N
	RS-485 communication card (option)	Function expansion RJ-45 connector (2)	8.5 See.	Expansion port	Y	Y	N	N

*1 The support scope (e.g., accessible function codes) differs depending on the protocol and model. Refer to each instruction manual for details.

*2 FRENIC-Mini (C1) Modbus RTU does not support coil commands. Refer to "8.7 Differences Between Functions" for details.

Table 8.1 FRENIC series connection configuration and compatible protocols (Continued)

Model	Compatibility method	Connection port	Connection port hardware specifications	Port type	Compatible protocols *1			
					Modbus RTU *2	FUJI general-purpose inverter protocol	Metasys N2	BACnet MS/TP
FRENIC-Ace (E3)	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	N	Y
	Inverter unit RS-485 communication connector	Terminal block	2.1.1 See.	Standard port	Y	Y	N	Y
	RS-485 communication card (option)	Function expansion RJ-45 connector (2)	8.5 See.	Expansion port	Y	Y	N	Y
FRENIC-MEGA (G1)	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	N	N
	Inverter unit control circuit terminal block	Terminal block	2.1.2 See.	Standard port	Y	Y	N	N
FRENIC-MEGA (G2)	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	Y	Y
	Inverter unit control circuit terminal block	Terminal block	2.1.2 See.	Standard port	Y	Y	Y	Y
FRENIC-HVAC/AQUA	Inverter unit keypad connection connector	RJ-45 connector	2.1.1 See.	Standard port	Y	Y	Y	Y
	Inverter unit control circuit terminal block	Terminal block	2.1.2 See.	Standard port	Y	Y	Y	Y

*1 The support scope (e.g., accessible function codes) differs depending on the protocol and model. Refer to each instruction manual for details.

*2 FRENIC-Mini (C1) Modbus RTU does not support coil commands. Refer to "8.7 Differences Between Functions" for details.

8.3 Precautions with Combinations or Replacements from E11S

• If connecting the FRENIC series to the same communication network as that of the FVR-E11S series, a power supply short circuit or signal line collision will occur, resulting in possible damage. It is therefore necessary to switch pins 3 to 5 of the connection cable, etc. Table 8.2 shows a comparison of pin assignments on the FRENIC series and FVR-E11S series.

Table 8.2 FRENIC series and FVR-E11S series pin assignment comparison

Pin No.	FRENIC series inverter unit (option required for FRENIC-Mini (C1))	FVR-E11S series	Remarks
1	VCC (+5 V)	SEL_TP (Keypad selection)	The power supply is short circuited if connected.
2	GND	GND	
3	NC	DX-	
4	DX-	DX+	
5	DX+	SEL_ANY (Option selection)	
6	NC	GND	
7	GND	VCC	The power supply is short circuited if connected.
8	VCC (+5 V)	VCC	The power supply is short circuited if connected.

The DX+ and DX- signal pin assignments on RS-485 communication card function expansion RJ-45 connector for FRENIC-Multi/Ace (E2, E3) can be configured the same as that for the FVR-E11S using signal switching switch SW10. Refer to " 8.5 Function Expansion RJ-45 Connector (Modular jack) Specifications" for details, and refer to "8.6 Specifications for Dedicated RJ-45 Connector (Modular jack) for RS-485 Communication Fig. 8.1 (1) (e)" for the signal switching switch SW10 configuration.

8.4 Terminating Resistors

The terminating resistor switch No. and arrangement differs for each model. Refer to the following table for details.

Model	Applicable PCB	Switch No.	Layout drawing
FRENIC-Mini (C1)	RS485 communication card	SW1	See Fig. 8.1 (a).
FRENIC-Mini (C2)	Unit (control PCB)	SW3	See Fig. 8.2 (b).
FRENIC-Eco	Unit (control PCB)	SW3	See Fig. 8.1 (b).
	RS485 communication card	SW103	See Fig. 8.1 (c).
FRENIC-Multi	Unit (control PCB)	SW3	See Fig. 8.1 (d).
	RS485 communication card	SW9	See Fig. 8.1 (e).
FRENIC-Ace (E2)	Unit (control PCB)	SW2, SW6	See Fig. 8.2 (c).
	RS485 communication card	SW9	See Fig. 8.2 (d).
FRENIC-Ace (E3)	Unit (control PCB)	SW2, SW6	See Fig. 8.3 (b).
	RS485 communication card	SW6	See Fig. 8.3 (c).
FRENIC-MEGA (G1)	Unit (PCB)	SW2	See Fig. 8.2 (a).
		SW3	
FRENIC-MEGA (G2)	Unit (PCB)	SW2	See Fig. 8.3 (a).
		SW3	
FRENIC-HVAC/AQUA	Unit (PCB)	SW2	See Fig. 8.4 (a).
		SW3	

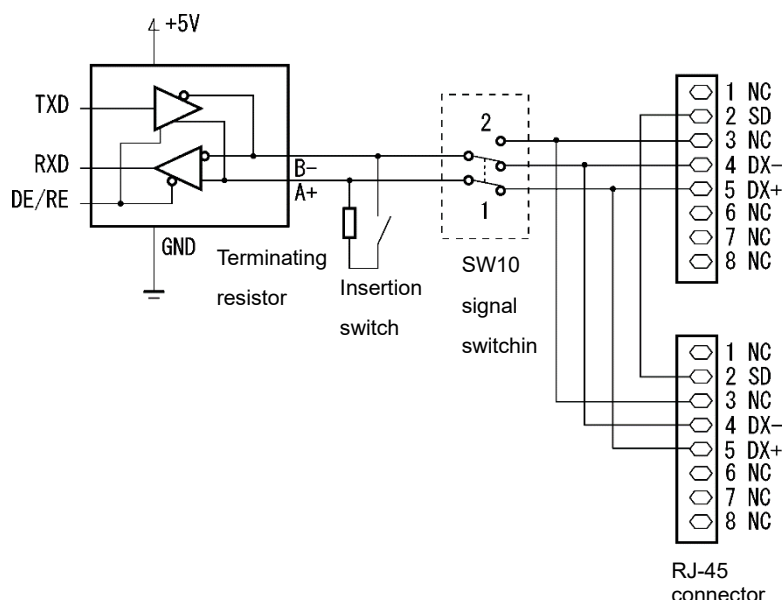
8.5 Function Expansion RJ-45 Connector (Modular jack) Specifications

- FRENIC-Ace (E2,E3)/Multi RS-485 communication card (option)

Two RJ-45 connectors for function extension have been prepared for the multi-probe. The respective terminal symbols, and terminal names and functions are shown in the table below. The specifications are the same for both the standard and relay connectors.

Pin No.	Signal name	Content	Remarks
1, 6, 7, 8	NC	Vacant terminal	-
2	SD	Communication cable shield terminal	This terminal acts as a relay for the shield wire shield. Terminal number 2 on the two RJ-45 connectors are connected to each other internally.
3	-	Vacant terminal	Terminal numbers 3 on the two RJ-45 connectors are connected to each other internally.
4	DX-	RS-485 communication data (-) terminal	This is the RS-485 communication data (-) terminal.
5	DX+	RS-485 communication data (+) terminal	This is the RS-485 communication data (+) terminal.

CAUTION Terminal details differ from that for the inverter unit keypad connection RJ-45 connector.



- * Refer to "2.2.2 Connection procedures [2] About terminating resistors " for details on the terminating resistor insertion switch (insertion SW).

CAUTION Replacing the inverter from the FVR-E11S series

The FVR-E11S series pin assignment differs for that of the FRENIC series, and therefore it is not possible to join the communication system to which the FVR-E11S series is connected without making some changes. Refer to "8.3Precautions with Combinations or Replacements from E11S" for details.

Pin No.	Signal name	Content	Remarks
1, 6, 7, 8	NC	Vacant terminal	-
2	SD	Communication cable shield terminal	This terminal acts as a relay for the shield wire shield. Terminal number 2 on the two RJ-45 connectors are connected to each other internally.
3	DX-	RS-485 communication data (-) terminal	This is the RS-485 communication data (-) terminal.
4	DX+	RS-485 communication data (+) terminal	This is the RS-485 communication data (+) terminal.
5	NC	Vacant terminal	Terminal numbers 5 on the two RJ-45 connectors are connected to each other internally.

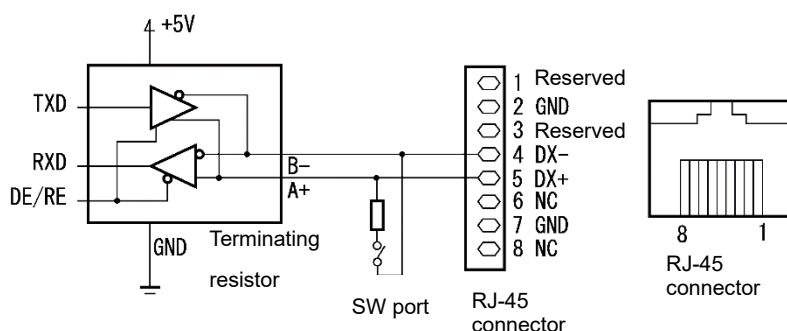
* Refer to "8.3 Precautions with Combinations or Replacements from E11S" for a comparison of the FRENIC series and FVR-E11S series pin assignments. Furthermore, refer to "8.4 Terminating Resistors" for the single switching switch SW10 configuration.

8.6 Specifications for Dedicated RJ-45 Connector (Modular jack) for RS-485 Communication

The pin assignment for the RJ-45 connector for FRENIC-Ace (E2) inverter unit RS-485 communication is shown in the following table.

Pin No.	Signal name	Description	Remarks
1	Reserved	Reserved (for manufacturer)	
2	GND	Reference potential	GND
3	Reserved	Reserved (for manufacturer)	
4	DX-	RS-485 communication data (-) terminal	
5	DX+	RS-485 communication data (+) terminal	
6	NC	Vacant terminal	
7	GND	Reference potential	GND
8	NC	Vacant terminal	

* Refer to "8.4 Terminating Resistors" for details on the terminating resistor insertion switch (insertion SW).



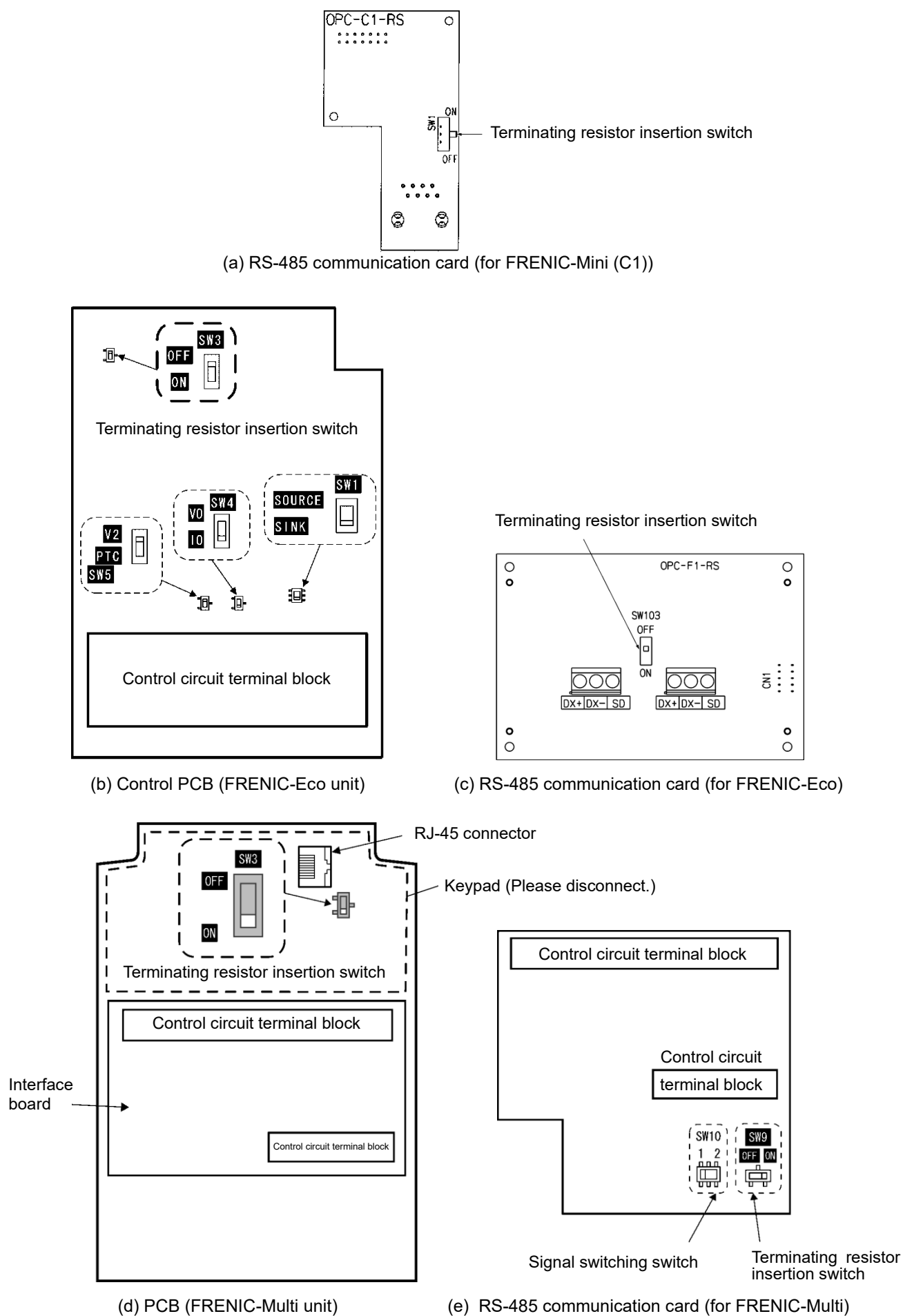


Fig. 8.1 Terminating resistor insertion switch arrangement (Mini (C1), Eco, Multi)

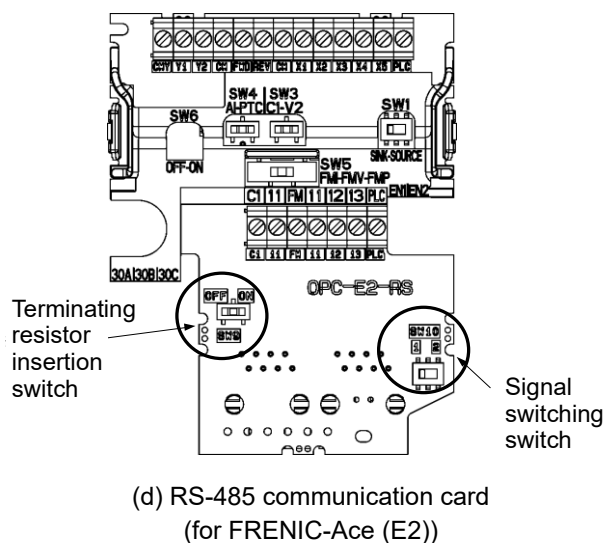
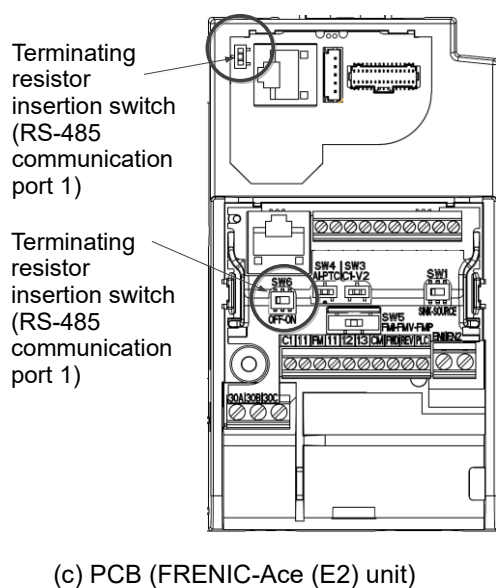
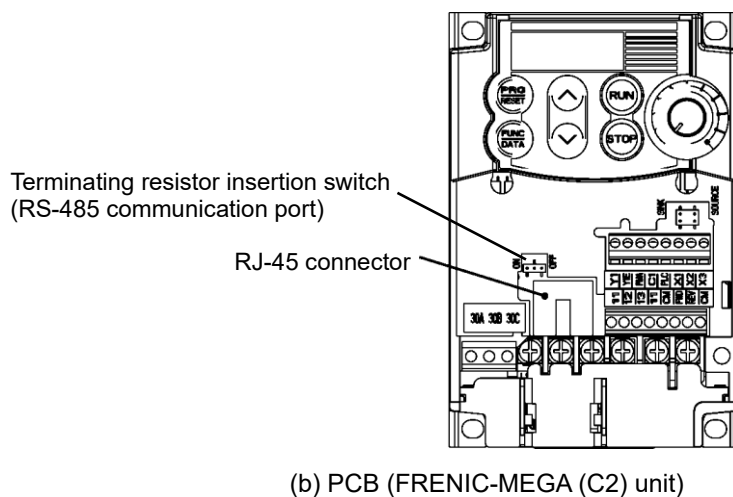
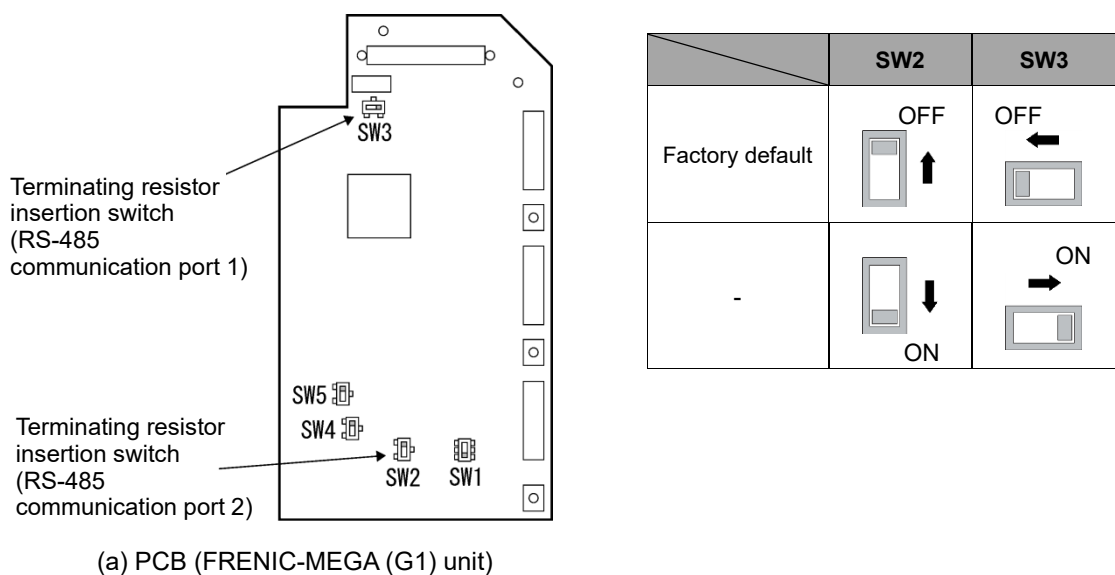
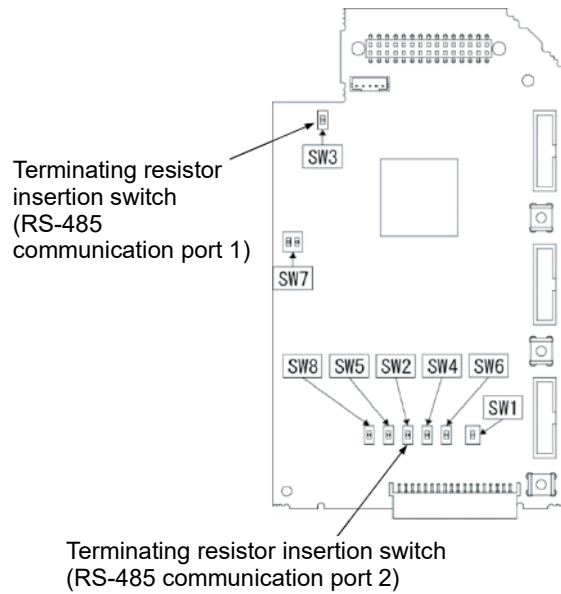
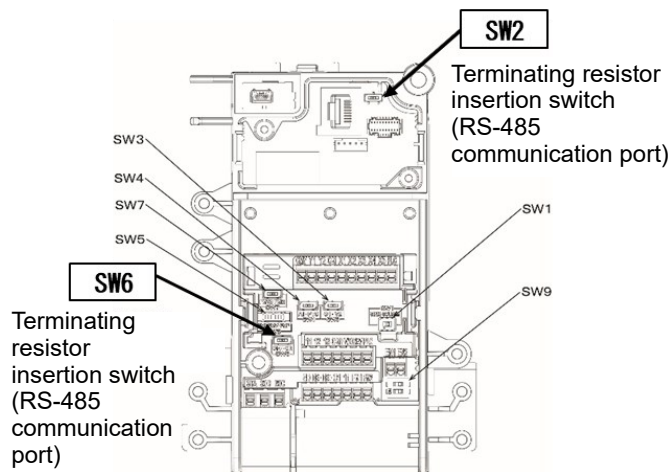


Fig. 8.2 Terminating resistor insertion switch arrangement (Mega (G1), Mini (C2), Ace (E2))



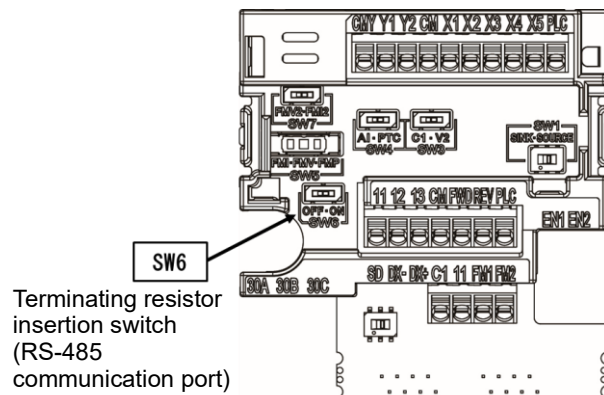
(a) Switch positions (MEGA (G2) unit)

	SW2	SW3
Variable range	OFF ↑ ↓ ON	OFF ↑ ↓ ON
Factory default	OFF ↑	OFF ↑



(b) Switch positions (Ace (E3) unit)

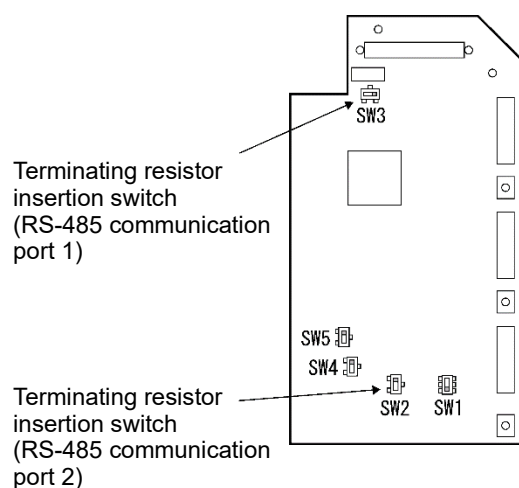
	SW2	SW6
Variable range	← → ON	← → ON
Factory default	←	←



(c) RS-485 communication card (OPC-CP-RS)

	SW6
Variable range	← → ON
Factory default	←

Fig. 8.3 Terminating resistor insertion switch arrangement (Mega (G2), Ace (E3))



(a) Switch positions (HVAC/AQUA)

	SW2	SW3
Factory default	OFF  ↑	OFF  ←
-	 ↓ ON	 → ON

Fig. 8.4 Terminating resistor insertion switch arrangement (HVAC/AQUA)



To change the switch settings shown in Fig. 8.1 to 8.4, use a tool with fine tip (tweezers, etc.), and be careful not to touch any other electronic components. The switch will be at open state when the slider is in the middle, so be sure to push it fully in to the end.

8.7 Differences Between Functions

The differences between functions supported by each model are shown in the table below (However, the differences with BACnet MS/TP are described after this table.)

Refer to the function code list for each model to determine which function codes are supported.

Major item	Minor item	Mini (C1)	Mini (C2)	Eco	Multi	Ace (E2)	MEGA (G1)	MEGA (G2)/ Ace (E3)	HVAC/ AQUA
Baud rate [bps]	2400, 4800, 9600, 19200	Y	Y	Y	Y	Y	Y	Y	Y
	38400	N	Y	Y	Y	Y	Y	Y	Y
	57600, 76800, 115200	N	N	N	N	N	N	Y	N
RTU	Max. transfer data (words)	50	50	50	50	100	100	100	50
	Max. frame length	105	105	105	105	205	205	205	105
	Read/write data qty	1 to 50	1 to 50	1 to 50	1 to 50	1 to 100	1 to 100	1 to 100	1 to 50
	Byte count	2 to 100	2 to 100	2 to 100	2 to 100	2 to 200	2 to 200	2 to 200	2 to 100
	Coil read/write	N	Y	Y	Y	Y	Y	Y	Y
	No parity, stop bit set to 1	N	Y	Y	Y	Y	Y	Y	Y

[S10, S11 torque limiting level setting range, data format]

The setting range for Multi only is 20 to 200,999, and the data format is [3].

[M47 PCB electrolytic capacitor life, M48 cooling fan life]

If using the FRENIC-Eco/Multi, M47 and M48 data is still retained for 65,535 hours, even if each cumulative run time exceeds 65,535 hours. In this case, use W67 or W68 that are monitored in 10 hour units.

With BACnet MS/TP, there are differences in the following items depending on the model and ROM No.

Major item	Minor item	HVAC/AQUA			MEGA (G2) ACE (E3)
		ROM No.			
		Up to 1899	Up to 2399	2400 to	
Response details	Vendor Identifier	163	700		
	Firmware Revision	1.00	2.00	2.01	1.06
	Protocol Revision	4	12		20
	APDU Timeout	3000ms	0 ms		
	Number of APDU Retries	3	0		
	Max Master	Not supported	127		
	Max Info Frames	Not supported	1		
Property identifier	Priority Array	Not supported	Supported		
	Property List	Not supported			Supported
	Current command Priority				
Object type	Network Port	Not supported			Supported
Analog point	Analog value (AV) Compatible object Instance No.	Up to 15		Up to 27	Up to 47

8.8 Differences Between Data Formats

Differences in the support status for data format functions on each models are shown in the table below.

• Data format [16] Support status

Bit	Symbol	Description	Supported *1				Bit	Symbol	Description	Supported *1			
			Mini (C1)	Mini (C2)	Eco	Multi Ace (E2, E3) MEGA (G1, G2) HVAC/ AQUA				Mini (C1)	Mini (C2)	Eco	Multi Ace (E2, E3) MEGA (G1, G2) HVAC/ AQUA
0	FWD	Performing forward rotation	Y	Y	Y	Y	8	IL	Under current limiting control	Y	Y	Y	Y
1	REV	Performing reverse rotation	Y	Y	Y	Y	9	ACC	During acceleration	Y	Y	Y	Y
2	EXT	During DC braking (or during pre-excitation)	Y	Y	Y	Y	10	DEC	During deceleration	Y	Y	Y	Y
3	INT	Inverter shut-off	Y	Y	Y	Y	11	ALM	Alarm output (for any alarm)	Y	Y	Y	Y
4	BRK	During braking (FRENIC-Mini: fixed at "0")	N	Y	Y	Y	12	RL	Communication enabled	N	Y	Y	Y
5	NUV	DC intermediate voltage establishment (undervoltage when "0")	Y	Y	Y	Y	13	0	-	N	Y	N	N
6	TL	Under torque limiting control	N	Y	N	Y	14	0	-	N	Y	N	N
7	VL	Under voltage limiting control	Y	Y	Y	Y	15	BUSY	Writing function code data	Y	Y	Y	Y

*1 The "Supported" field in the table indicates whether each bit is supported on the respective models.

○1 The "Supported" field in the table indicates whether each bit is supported on the respe For items indicated "N", the bit is fixed at "0".

• Data format [44] Support status

Bit	Symbol	Description	Supported						Bit	Symbol	Description	Supported					
			Mini (C1)	Mini (C2)	Eco, HVAC/AQUA	Multi	Ace (E2, E3) MEGA (G1)	MEGA (G2)				Mini (C1)	Mini (C2)	Eco, HVAC/AQUA	Multi	Ace (E2, E3) MEGA (G1)	MEGA (G2)
0	FAR	Frequency arrival	Y	Y	Y	Y	Y	Y	8	TRY	Attempting retry	Y	Y	Y	Y	Y	Y
1	FDT	Frequency detection	Y	Y	Y	Y	Y	Y	9	OH	Coolant overheat warning	N	Y	Y	Y	Y	Y
2	RDY	Ready for operation	N	N	Y	Y	Y	Y	10	LIFE	Lifetime warning	Y	Y	Y	Y	Y	Y
3	SWM2	Motor 2 selected	N	Y	N	Y	Y	Y	11	OLP	Under overload prevention control	Y	Y	Y	Y	Y	Y
4	IPF	Restarting after momentary power failure	Y	Y	Y	Y	Y	Y	12	ID	Current detected	Y	Y	Y	Y	Y	Y
5	OL	Motor overload early warning	Y	Y	Y	Y	Y	Y	13	IDL	Low current detection	Y	Y	N	N	Y	Y
6	KP	Keypad operation	N	N	N	N	Y	Y	14	ID2	Current detection 2	N	Y	N	Y	Y	Y
7	FAN	Fan running	N	N	Y	N	Y	Y	15	IDL2	Low current detection 2	N	N	N	N	N	Y

- * The "Supported" field in the table indicates whether each bit is supported on the respective models.
○ The "Supported" field in the table indicates whether each bit is supported on the respec For items indicated "N", the bit is fixed at "0".

• Data format [76] Support status

Signal name	Content	Mini (C1)	Mini (C2)	Eco	Multi	Ace (E2)	Ace (E3)	MEGA (G1)	MEGA (G2)	HVAC/ AQUA
Control method	Indicates the final control method including setting values and terminal status, etc. 0: V/f control: without slip compensation 1: Dynamic torque vector control 2: V/f control: with slip compensation 3: V/f control with speed sensor 4: Dynamic torque vector control with speed sensor 5: Speed sensorless vector control 6: Vector control with speed sensor 10: Torque control (speed sensorless vector control) 11: Torque control (vector control with speed sensor) Other than above: Reserved	N	Y	N	N	Y	Y	Y	Y	Y
Selected motor	Indicates the selected motor No. 00b: Motor 1 01b: Motor 2 10b: Motor 3 11b: Motor 4	N	Y	N	N	Y	Y	Y	Y	N
Under speed limiting control	"1" when under speed limiting control	N	N	N	N	Y	Y	Y	Y	N
Under rotation direction limiting control	"1" when under rotation direction limiting control 1 when under torque current command direction limiting control (vector control)	N	Y	N	N	Y	Y	N	Y	N
Retry failure	"1" when an alarm occurs due to retry failure Clear to "0" when alarm reset	N	N	N	N	N	Y	N	N	N
Roll back following retry failure	"1" when alarm information roll back occurs due to retry failure This bit is only recorded in alarm information.	N	N	N	N	N	Y	N	N	N
Performing self-diagnosis	1 for performing self-diagnosis	N	N	N	N	Y	Y	N	N	N
Drive motor type	0: Induction motors 1: Synchronous motors	N	Y	N	N	Y	Y	Y	Y	Y

===Appendix===

CHAPTER 9

FLOOR LEVEL NETWORK

(P1 PROTOCOL)

The FRN***F1S-*U (FRENIC-Eco USA version) has an optional built-in Floor Level Network (FLN) communication driver and point database allowing the FRENIC-Eco to coexist on an APOGEE® network with other FLN devices.

A Fuji Electric systems representative is responsible for proper configuration of the drive for its primary application, while a Siemens Building Technologies, Inc. representative is responsible for field panel programming, to make use of the drive's functionality in the building automation system. As such, there must be coordination between the Fuji Electric systems and Siemens Building Technologies representatives to ensure that programming of the FRENIC-Eco is consistent with requirements for field panel programming.

This chapter describes how the FRN***F1S-*U can be accessed through a field panel and how it can be used as a part of a larger control scheme.

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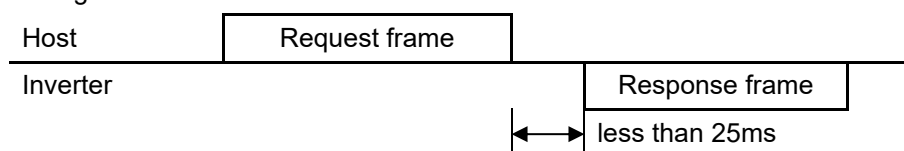
9.6.10 Reading and Writing from/to Inverter's Function Codes 9-10

9.1 Messages

9.1.1 polling/selecting

When the FRENIC-Eco receives a request frame from the host addressed to itself (local station), the FRENIC-Eco sends back a response frame.

Polling/ Selecting



9.2 Point Database

Table 9.3 presents the point database information for FLN. For complete descriptions of these points, See this manual and FRENIC-Eco Instruction Manual (*INR-SI47-0882a-E* or *INR-SI47-1225-E*).

For more information on installation, start-up, and programming, See FRENIC-Eco Drives User's Manual (*MEH456*).

9.3 Setting up Communications of the FRENIC-Eco

Set up of the FRENIC-Eco variable frequency drive for FLN communications and control must be performed by the drive representative. This document provides the correct parameters required for FLN communications and control of the drive.

Table 9.1 lists the values required for proper FLN communications and control:

Table 9.1 Set-up Parameters.

Parameter Number/Name	Value
H30 / Link functions (operation selection)	3 = Possible via RJ45 socket port 8 = Possible via Optional terminal block port
y01 / Station address of RJ45 port	Set the Node address (default=1)
y04 / Baud rate of RJ45 port	Select P1 baudrate (default =19200) 1 = 4800, 2 = 9600 Also the following extended settings are possible; 0 = 2400, 3 = 19200 and 4 = 38400
y10 / Protocol Select of RJ45 port	4 = P1 Protocol
y11 / Station address of Optional port	Set the Node address (default=1)
y14 / Baud rate of Optional port	Select P1 baudrate (default =19200) 1 = 4800, 2 = 9600 Also the following extended settings are possible; 0 = 2400, 3 = 19200 and 4 = 38400
y20 / Protocol Select of Optional port	4 = P1 Protocol

9.4 Using the FRENIC-Eco

The FRENIC-Eco controls the speed of fans, pumps, and other equipment. The following strategies achieve a required control sequence. The field panel commands other tasks and functions specific to the FRENIC-Eco.

A Siemens Building Technologies representative must communicate all control requirements to a factory trained Fuji Electric systems representative before setting up the FRENIC-Eco. The Fuji Electric systems representative must implement these strategies, tasks, and functions prior to setting up the FRENIC-Eco.

9.5 Strategies

9.5.1 Monitoring

Several drive parameters are available for monitoring purposes. These include DR.FREQUENCY (Point 3), DR.TORQUE(Point4), DR.CURRENT (Point 5), DR.VOLTAGE (Point 6), DR.POWER (Point 7), OPERAT.TIME (Point 8), and INTEGRAT.PWR (Point 9). These points can be unbundled for monitoring or used in various global control strategies.

9.5.2 Supervisory Control

This is the most typical application. The sensor for the control variable (e.g., water temperature) is hard-wired to the FRENIC-Eco and the control device (fan) is modulated using the control loop (PI loop macro must be enabled during drive set-up) that is built into the FRENIC-Eco. The set point for the control variable (water temperature set point) is unbundled and commanded by the field panel, based on some building control strategy implemented in PPCL.

When this strategy is used, the point to unbundle and command for the set point is REF.FREQ (Point 21). The control variable (e.g., water temperature) can be monitored by unbundling PID FEEDBACK (Point 55). These points are provided with units of percent, where 0% and 100% correspond to the range of the sensor being used to measure the control variable. These points have default units in Hz. If other units are required, unbundle these points with appropriate slopes and intercepts. The new intercept will be equal to the lowest value of the desired range. The following formula lets you define a new slope and intercept in order to accomplish the unit conversion.

$$\begin{aligned}\text{New Slope} &= \frac{(\text{Desired Range}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\ &= \frac{(60 - 0 \text{ HZ}) \times (0.01)}{100 - 0 \%} = 0.006\end{aligned}$$

New Intercept is equal to the lowest value of the desired range.
The following examples illustrate this conversion procedure:

9.5.2.1 Example

You are controlling water temperature from a cooling tower using the FRENIC-Eco to control a fan. The temperature sensor has a range of 30 to 250 degrees Fahrenheit.

To unbundle the set point (REF.FREQ), for commanding in degrees Fahrenheit, where 0 to 60 Hz is equal to 30 to 250 degrees Fahrenheit:

New Intercept = 30 (the temperature that corresponds to 0%)

$$\begin{aligned}\text{New Slope} &= \frac{(\text{Desired Range}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\ &= \frac{(250 - 30 \text{ degrees Fahrenheit}) \times (0.1)}{100 - 0\%} = 0.22\end{aligned}$$

To unbundle the feedback (PID FEEDBACK) for monitoring in degrees Fahrenheit:

New Intercept = 30

$$\begin{aligned}\text{New Slope} &= \frac{(\text{Desired Range}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\ &= \frac{(250 - 30 \text{ degrees Fahrenheit}) \times (0.01)}{100 - 0\%} = 0.022\end{aligned}$$

9.5.3 Slaving the Drive

In this strategy, the sensor is connected to the APOGEE network at a remote location, and the control loop is executed in PPCL. The drive speed command is passed from the field panel to the FRENIC-Eco by commanding REF.FREQ (Point 21).

 CAUTION	This strategy is not normally recommended because it means that the loop is being closed over the network. Delays due to network traffic can cause control to be degraded or lost, and depending on the setup of the drive, if there is a problem with the network, the drive may cause physical damage to the HVAC system by winding up to its maximum or dropping off to its minimum speed.
--	--

9.6 Other Functionality

Each of the following functions must be enabled during start-up of the FRENIC-Eco.

9.6.1 Start and stop the drive

CMD RUN.STOP (Point 25) can be commanded to start or stop the drive. RUN.STOP (Point 24) shows the current status of the drive.

9.6.2 Change drive directions

CMD FWD.REV (Point 23) can be commanded to change the drive direction. FWD.REV (Point 22) shows the current direction of the drive rotation.

 CAUTION	Changing drive directions while the controlled equipment is moving may damage HVAC equipment.
--	---

9.6.3 Lock the FRENIC-Eco panel

Locking the panel prevents users from modifying any parameters locally at the drive panel. LOCK PANEL (Point 33) can be commanded to lock and unlock the panel.

9.6.4 Digital Outputs

Y1 (Point 40), Y2 (Point 41), Y3 (Point 42), and Y5 (Point 44) are physical DOs on the FRENIC-Eco. Their purpose depends on how the drive has been set-up. The drive can be programmed so that these points can display various limits, warnings, and status conditions. Some examples include current limiting, undervoltage detection, and motor overload early warning.

9.6.5 Analog Inputs monitor

AI VALUE 12 (Point 56), AI VALUE C1(Point 57), and AI VALUE V2 (Point 58) are monitors of an analog value inputted into physical AIs on the FRENIC-Eco.

9.6.6 Loop gains

PID P GAIN (Point 52) and PID I TIME (Point 53) are gain parameters similar to the P and I gains in the APOGEE TECs. The Fuji Electric systems PID loop is structured differently than the Siemens loop, so there is not a one-to-one correspondence between the gains. The following formulas allow translation from Fuji Electric systems gains to Siemens gains and vice versa:

Converting from Fuji Electric systems PI gains to Siemens P and I gains

$$\begin{aligned} \text{P GAIN}_{\text{Siemens}} &= \text{PI GAIN}_{\text{FujiElectric}} \times 0.000015 \\ \text{I GAIN}_{\text{Siemens}} &= \frac{\text{PI GAIN}_{\text{FujiElectric}}}{\text{PI TIME}_{\text{FujiElectric}}} \times 0.0015 \end{aligned}$$

Converting from Siemens P and I gains to Fuji Electric systems PI gains

$$\begin{aligned} \text{P GAIN}_{\text{FujiElectric}} &= \text{PI GAIN}_{\text{Siemens}} \times 66700 \\ \text{I GAIN}_{\text{FujiElectric}} &= \frac{\text{PI GAIN}_{\text{Siemens}}}{\text{PI TIME}_{\text{Siemens}}} \times 667 \end{aligned}$$

9.6.7 Reading and resetting faults

FAULT (Point 80) shows the current status of the drive. FLT.MEM.0 (Point 83) contains the code for the most recent fault. LAST FAULT (Point 82) contains the code for the second most recent fault. See Table 9.2 for descriptions of the fault codes. The drive can be reset back to OK mode by commanding FAULT RESET (Point 81) to RESET.

9.6.8 Address limitations

The default value for CTRLR ADDRESS (Point 1) is 1.

Table 9.2 FRENIC-Eco Drive Faults.

Fault Number	Meaning
1	Overcurrent in acceleration (OC1)
2	Overcurrent in deceleration (OC2)
3	Overcurrent in constant speed (OC3)
5	Earth fault (EF)
6	Overvoltage in acceleration (OU1)
7	Overvoltage in deceleration (OU2)
8	Overvoltage in constant speed or stopping (OU3)
10	Undervoltage (LU)
11	Input phase loss (Lin)
14	Fuse blowout (FUS)
16	Charging circuit abnormal (PbF)
17	Cooling fin overheat (OH1)
18	External alarm (OH2)
19	Inverter inside overheat (OH3)
20	Motor protection by PTC thermistor (OH4)
22	Braking resistor overheat (dbH)
23	Motor overload (OL1)
25	Inverter overload (OLU)
31	Memory error (Er1)
32	Keypad communications error (Er2)
33	CPU error (Er3)
34	Option communications error (Er4)
35	Option error (Er5)
36	Run operation error (Er6)
37	Tuning error (Er7)
38	RS485 communications error in RJ45 (Er8)
46	Output phaseloss (OPL)
51	Data save error on insufficient voltage (ErF)
53	RS485 communications error in option (ErP)
54	LSI error on power PCB (ErH)

Table 9.3 Point Database for FLN.

Point Number	Point Type	Subpoint Name	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
1	LAO	CTRL ADDRESS	1	-	1	0	-	-
2	LAO	APPLICATION	2743	-	1	0	-	-
{3}	LAI	DR.FREQUENCY	0	HZ	0.01	0	-	-
{4}	LAI	DR.TORQUE	0	PCT	0.01	0	-	-
{5}	LAI	DR.CURRENT	0	PCT	0.01	0	-	-
{6}	LAI	DR.VOLTAGE	0	VOLTS (V)	0.1	0	-	-
{7}	LAI	DR.POWER	0	PCT	0.01	0	-	-
{8}	LAI	OPERAT. TIME	0	HRS	1	0	-	-
{9}	LAI	INTEGRAT.PWR	0	KWH	10	0	-	-
{10}	LDI	READY	NOTRDY	-	1	0	RDY	NOTRDY
{11}	LDI	IN ACCEL	NO ACC	-	1	0	ACC	NO ACC
{12}	LDI	IN DECEL	NO DEC	-	1	0	DEC	NO DEC
{13}	LDI	DRIVE.AT.REF	NOTREF	-	1	0	AT REF	NOTREF
{14}	LDI	FREQ.LVL.DTC	NO DTC	-	1	0	DTC	NO DTC
{15}	LDI	TORQUE.LIMIT	OFF	-	1	0	ON	OFF
{16}	LDI	VOLT.LIMIT	OFF	-	1	0	ON	OFF
{17}	LDI	CURRNT.LIMIT	OFF	-	1	0	ON	OFF
{18}	LDI	REMOTE.LOCAL	LOC	-	1	0	REM	LOC
20	LAO	OVRD TIME	0	HRS	1	0	-	-
{21}	LAO	REF.FREQ	0	HZ	0.01	0	-	-
{22}	LDI	FWD.REV	FWD	-	1	0	REV	FWD
{23}	LDO	CMD FWD.REV	FWD	-	1	0	REV	FWD
{24}	LDI	RUN.STOP	STOP	-	1	0	RUN	STOP
{25}	LDO	CMD RUN.STOP	STOP	-	1	0	RUN	STOP
26	LAO	FREQ UPLIMIT	0	-	0.1	0	-	-
27	LAO	FREQ LOLIMIT	0	-	0.1	0	-	-
{29}	LDO	DAY.NIGHT	DAY	-	1	0	NGT	DAY
33	LDO	LOCK PANEL	UNLOCK	-	1	0	LOCK	UNLOCK
{40}	LDI	Y1	OFF	-	1	0	ON	OFF

- Points not listed are not used in this application.
- A single value in a column means that the value is the same in English units and in SI units.
- Point numbers that appear in brackets { } may be unbundled at the field panel.

continued on the next page...

Table 9.3 Point Database for FLN. (Continued)

Point Number	Point Type	Subpoint Name	Factory Default (SI Units)	Engr. Units (SI Units)	Slope (SI Units)	Intercept (SI Units)	On Text	Off Text
{41}	LDI	Y2	OFF	-	1	0	ON	OFF
{42}	LDI	Y3	OFF	-	1	0	ON	OFF
{44}	LDI	Y5	OFF	-	1	0	ON	OFF
{50}	LAO	UNI.ANLG.OUT	0	PCT	0.01	-150	-	-
51	LAO	PID MODE SL	0	-	1	0	-	-
52	LAO	PID P GAIN	0	PCT	0.1	0	-	-
53	LAO	PID I TIME	0	SEC	0.1	0	-	-
{54}	LAI	PID OUTVALUE	0	PCT	0.01	-160	-	-
{55}	LAI	PID FEEDBACK	0	PCT	0.01	-160	-	-
{56}	LAI	AI VALUE 12	0	PCT	0.01	-150	-	-
{57}	LAI	AI VALUE C1	0	PCT	0.01	0	-	-
{58}	LAI	AI VALUE V2	0	PCT	0.01	-150	-	-
59	LAI	OUTPUT.AMPS	0	Amps (A)	0.1	0	-	-
{60}	LDO	X1	OFF	-	1	0	ON	OFF
{61}	LDO	X2	OFF	-	1	0	ON	OFF
{62}	LDO	X3	OFF	-	1	0	ON	OFF
{63}	LDO	X4	OFF	-	1	0	ON	OFF
{64}	LDO	X5	OFF	-	1	0	ON	OFF
{70}	LDO	UNIVRSL.DO.1	OFF	-	1	0	ON	OFF
{71}	LDO	UNIVRSL.DO.2	OFF	-	1	0	ON	OFF
{72}	LDO	UNIVRSL.DO.3	OFF	-	1	0	ON	OFF
{74}	LDO	UNIVRSL.DO.5	OFF	-	1	0	ON	OFF
{80}	LDI	FAULT	NOTFLT	-	1	0	FLT	NOTFLT
{81}	LDO	FAULT RESET	NORMAL	-	1	0	RESET	NORMAL
{82}	LAI	LAST FAULT	0	-	1	0	-	-
{83}	LAI	FLT.MEM.0	0	-	1	0	-	-
{90}	LAO	RD PARAM NUM	0	-	1	0	-	-
{91}	LAI	RD PARAM DAT	0	-	1	0	-	-
{92}	LAO	WR PARAM NUM	0	-	1	0	-	-
{93}	LAO	WR PARAM DAT	0	-	1	0	-	-
{99}	LAI	ERROR STATUS	0	-	1	0	-	-

- Points not listed are not used in this application.
- A single value in a column means that the value is the same in English units and in SI units.
- Point numbers that appear in brackets { } may be unbundled at the field panel.

Table 9.4 Point Database for FLN.

Point Number	Subpoint Name	Parameter
1	CTRL ADDRESS	y01 : RJ45 port y11 : Optional port
3	DR.FREQUENCY	M09
4	DR.TORQUE	M07
5	DR.CURRENT	M11
6	DR.VOLTAGE	M12
7	DR.POWER	M10
8	OPERAT. TIME	M20
9	INTEGRAT.PWR	W81
10	READY	M70 (Bit 2)
11	IN ACCEL	M14 (Bit 9)
12	IN DECEL	M14 (Bit 10)
13	DRIVE.AT.REF	M70 (Bit 0)
14	FREQ.LVL.DTC	M70 (Bit 1)
15	TORQUE.LIMIT	M14 (Bit 6)
16	VOLT.LIMIT	M14 (Bit 7)
17	CURRNT.LIMIT	M14 (Bit 8)
18	REMOTE.LOCAL	M14 (Bit 12)
21	REF.FREQ	S05
22	FWD.REV	M14 (Bit 0 and Bit 1)
23	CMD FWD.REV	S06 (Bit 0 and Bit 1)
24	RUN.STOP	M14 (Bit 0 and Bit 1)
25	CMD RUN.STOP	S06 (Bit 0 and Bit 1)
26	FREQ UPLIMIT	F15
27	FREQ LOLIMIT	F16
33	LOCK PANEL	F00
40	Y1	M15 (Bit 0)
41	Y2	M15 (Bit 1)
42	Y3	M15 (Bit 2)
44	Y5	M15 (Bit 4)
50	UNI.ANLG.OUT	S12
51	PID MODE SL	J01
52	PID P GAIN	J03
53	PID I TIME	J04
54	PID OUTVALUE	M73
55	PID FEEDBACK	M72
56	AI VALUE 12	M49
57	AI VALUE C1	M50
58	AI VALUE V2	M54
59	OUTPUT.AMPS	-
60	X1	S06 (Bit 2)
61	X2	S06 (Bit 3)

Table 9.4 Point Database for FLN. (Continued)

Point Number	Subpoint Name	Parameter
62	X3	S06 (Bit 4)
63	X4	S06 (Bit 5)
64	X5	S06 (Bit 6)
70	UNIVRSL.DO.1	S07 (Bit 0)
71	UNIVRSL.DO.2	S07 (Bit 1)
72	UNIVRSL.DO.3	S07 (Bit 2)
74	UNIVRSL.DO.5	S07 (Bit 4)
80	FAULT	M14 (Bit 11)
81	FAULT RESET	S14
82	LAST FAULT	M17
83	FLT.MEM.0	M16

9.6.9 Point 90,91,92,93 Read/Write Parameter Number (Parameter Data)

Parameter Number is used to access the object (function code) not allocated in Table 9.3.

When the writing processing is done by Write Point(07H) and the Memorize Point(75H) command, the writing value is not judged by Value Range according to the Point Type(PT).

9.6.9.1 Function code reading procedure

1. Write the function code to "Point Number 90 Read Parameter Number" in the format shown in 6.6.10.
2. Read "Point Number 91 Read Parameter Data".

After writing Read Parameter Number, Read Parameter Number can be read at the point of executing 2. The same function code can be read by executing 2 only.

Moreover, when the function code that doesn't exist is specified, the data read by 2 becomes "0".

9.6.9.2 Function code writing procedure

1. Write the function code to "Point Number 92 Write Parameter Number" in the format shown in 6.6.10.
2. Write a data to "Point Number 93 Write Parameter Data".

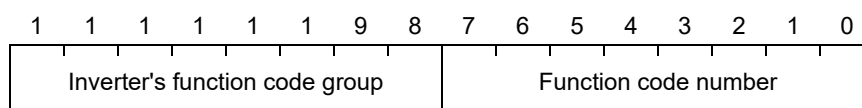
The reflection of writing value to the function code is done at the point of executing 2. After 1 is previously done without fail, it is necessary to do 2.

It is possible to write to the same function code by executing 2 only.

When writing to the function code of not being possible to write or the function code that doesn't exist is specified, it is ignored. (The reply becomes ACK reply.) Moreover, when the upper limit value of the function code data range is exceeded, the upper limit value is written to the function code.

It is similar for the lower limit value.

9.6.10 Reading and Writing from/to Inverter's Function Codes



Inverter's function code group: Group of function codes (F, E, C etc.). See Table 9.5 below.

Function code number: 2-digit number following the function code group. For example, 98 in E98.

(Example) Reading H30 from the inverter

H:	Function code group 08	}	081E (hexadecimal) = 2078 (decimal)
30:	1E (hexadecimal)		

 For details about the data format of individual function codes, refer to the Chapter 5, Section 5.2 "Data Formats."

Table 9.5 Function Code Groups

Group	Group code	Function code name	Group	Group code	Function code name
S	0x02	Run command data	o	0x0A	Option function
M	0x03	Monitor data	J	0x0E	Application functions
F	0x04	Fundamental functions	y	0x0F	Link functions
E	0x05	Extension terminal functions	W	0x10	Keypad monitor data
C	0x06	Control functions	X	0x11	Alarm data 1 for keypad
P	0x07	Motor parameters	Z	0x12	Alarm data 2 for keypad
H	0x08	High performance functions			

FRENIC-Mini (C1, C2)

FRENIC-Eco

FRENIC-Multi

FRENIC - MEGA (G1, G2)

FRENIC-Ace (E2, E3)

FRENIC-HVAC

FRENIC-AQUA

User's Manual for RS-485 Communications

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Fuji Electric Systems Co., Ltd.

- We prepared and examined the contents of this manual with extreme care. However, if you have any questions or notice errors, omissions, misprints, etc., please contact us.
- We are not responsible for any effects of the results caused by the operation of this product, irrespective of such errors, omissions, misprints, etc. as described above.



NOTES

When running general-purpose motors

- **Driving a 400V general-purpose motor**
When driving a 400V general-purpose motor with an inverter using extremely long cables, damage to the insulation of the motor may occur. Use an output circuit filter (OFL) if necessary after checking with the motor manufacturer. Fuji's motors do not require the use of output circuit filters because of their reinforced insulation.
- **Torque characteristics and temperature rise**
When the inverter is used to run a general-purpose motor, the temperature of the motor becomes higher than when it is operated using a commercial power supply. In the low-speed range, the cooling effect will be weakened, so decrease the output torque of the motor. If constant torque is required in the low-speed range, use a Fuji inverter motor or a motor equipped with an externally powered ventilating fan.
- **Vibration**
When the motor is mounted to a machine, resonance may be caused by the natural frequencies, including that of the machine. Operation of a 2-pole motor at 60Hz or more may cause abnormal vibration.
* Study use of tie coupling or dampening rubber.
* It is also recommended to use the inverter jump frequency control to avoid resonance points.
- **Noise**
When an inverter is used with a general-purpose motor, the motor noise level is higher than that with a commercial power supply. To reduce noise, raise carrier frequency of the inverter. High-speed operation at 60Hz or more can also result in more noise.

When running special motors

- **High-speed motors**
When driving a high-speed motor while setting the frequency higher than 120Hz, test the combination with another motor to confirm the safety of high-speed motors.
- **Explosion-proof motors**
When driving an explosion-proof motor with an inverter, use a combination of a motor and an inverter that has been approved in advance.
- **Submersible motors and pumps**
These motors have a larger rated current than general-purpose motors. Select an inverter whose rated output current is greater than that of the motor.
These motors differ from general-purpose motors in thermal characteristics. Set a low value in the thermal time constant of the motor when setting the electronic thermal function.
- **Brake motors**
For motors equipped with parallel-connected brakes, their braking power must be supplied from the primary circuit (commercial power supply). If the brake power is connected to the inverter power output circuit (secondary circuit) by mistake, problems may occur.
Do not use inverters for driving motors equipped with series-connected brakes.
- **Geared motors**
If the power transmission mechanism uses an

oil-lubricated gearbox or speed changer/reducer, then continuous motor operation at low speed may cause poor lubrication. Avoid such operation.

- **Synchronous motors**
It is necessary to use software suitable for this motor type. Contact Fuji for details.
- **Single-phase motors**
Single-phase motors are not suitable for inverter-driven variable speed operation. Use three-phase motors.
* Even if a single-phase power supply is available, use a three-phase motor as the inverter provides three-phase output.

Environmental conditions

- **Installation location**
Use the inverter in a location with an ambient temperature range of -10 to 50°C.
The inverter and braking resistor surfaces become hot under certain operating conditions. Install the inverter on nonflammable material such as metal. Ensure that the installation location meets the environmental conditions specified in "Environment" in inverter specifications.

Combination with peripheral devices

- **Installing a molded case circuit breaker (MCCB)**
Install a recommended molded case circuit breaker (MCCB) or an earth leakage circuit breaker (ELCB) in the primary circuit of each inverter to protect the wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.
- **Installing a magnetic contactor (MC) in the output (secondary) circuit**
If a magnetic contactor (MC) is mounted in the inverter's secondary circuit for switching the motor to commercial power or for any other purpose, ensure that both the inverter and the motor are fully stopped before you turn the MC on or off. Remove the surge killer integrated with the MC.
- **Installing a magnetic contactor (MC) in the input (primary) circuit**
Do not turn the magnetic contactor (MC) in the primary circuit on or off more than once an hour as an inverter fault may result. If frequent starts or stops are required during motor operation, use FWD/REV signals.
- **Protecting the motor**
The electronic thermal function of the inverter can protect the motor. The operation level and the motor type (general-purpose motor, inverter motor) should be set. For high-speed motors or water-cooled motors, set a small value for the thermal time constant to protect the motor.
If you connect the motor thermal relay to the motor with a long cable, a high-frequency current may flow into the wiring stray capacitance. This may cause the relay to trip at a current lower than the set value for the thermal relay. If this happens, lower the carrier frequency or use the output circuit filter (OFL).
- **Regarding power-factor correcting capacitor**
Do not mount power factor correcting capacitors in the inverter (primary) circuit. Use the DC REACTOR to improve the inverter power factor. Do

not use power factor correcting capacitors in the inverter output circuit (secondary). An overcurrent trip will occur, disabling motor operation.

- **Discontinuance of surge killer**
Do not mount surge killers in the inverter output (secondary) circuit.
- **Reducing noise**
Use of a filter and shielded wires are typical measures against noise to ensure that EMC Directives are met.
- **Measures against surge currents**
If an overvoltage trip occurs while the inverter is stopped or operated under a light load, it is assumed that the surge current is generated by open/close of the phase-advancing capacitor in the power system.
We recommend connecting a DC REACTOR to the inverter.
- **Megger test**
When checking the insulation resistance of the inverter, use a 500V megger and follow the instructions contained in the Instruction Manual.

Wiring

- **Wiring distance of control circuit**
When performing remote operation, use twisted shield wire and limit the distance between the inverter and the control box to 20m.
- **Wiring length between inverter and motor**
If long wiring is used between the inverter and the motor, the inverter will overheat or trip as a result of overcurrent (high-frequency current flowing into the stray capacitance) in the wires connected to the phases. Ensure that the wiring is shorter than 50m. If this length must be exceeded, lower the carrier frequency or mount an output circuit filter (OFL).
- **Wiring size**
Select cables with a sufficient capacity by referring to the current value or recommended wire size.
- **Wiring type**
Do not use multicore cables that are normally used for connecting several inverters and motors.

- **Grounding**
Securely ground the inverter using the grounding terminal.

Selecting inverter capacity

- **Driving general-purpose motor**
Select an inverter according to the applicable motor ratings listed in the standard specifications table for the inverter. When high starting torque is required or quick acceleration or deceleration is required, select an inverter with a capacity one size greater than the standard.
- **Driving special motors**
Select an inverter that meets the following condition:
Inverter rated current > Motor rated current.

Transportation and storage

When transporting or storing inverters, follow the procedures and select locations that meet the environmental conditions that agree with the inverter specifications.