MITSUBISHI

TRANSISTORIZED INVERTER

INSTRUCTION MANUAL

POSITION CONTROL COMMUNICATION UNIT

FR-VPB

- POSITION CONTROL
- POWER SUPPLY FOR LONG DISTANCE CABLE
- EXPANSION ANALOG INPUT
- RS422/RS485 COMMUNICATIONS INTERFACE
- PLG PULSE OUTPUT (LINE DRIVER)

Thank you for choosing this Mitsubishi Vector Inverter Option unit FR-VPB.
This manual gives handling, safety and operating instructions.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect the inverter until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use the inverter until you have a full knowledge of the equipment, safety information and instructions.
In this instruction manual, the safety instruction levels are classified into "WARNING" and "CAUTION".

⚠WARNING	Assumes that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠CAUTION	This symbol indicates a general warning. Serious injury may occur if precautions are not followed.

Where these Warnings are written, pay special attention to the precautions detailed.

Operator Safety

1. Electric shock prevention

⚠ WARNING

- ⚠ Do not open the front cover while power is supplied or while the unit is running. There is a risk of electric shocks.
- ⚠ Do not run the inverter with the front cover removed. There are high voltage terminals and charged parts that are exposed, and thus there is a risk of electric shocks.
- ⚠ Do not remove the front cover even when the power is off unless carrying out wiring work or period inspections. The inside of the inverter is charged, and there is a risk of electric shocks.
- ⚠ Before starting wiring work or inspection, wait at least 10 minutes after turning the power off, and confirm the voltage with a tester, etc.
- ⚠ Wiring work and inspections must be done by a qualified worker.
- ⚠ Install the inverter before starting wiring. There is a risk of electric shocks and injuries.
- ⚠ Do not operate the switches with wet hands. There is a risk of electric shocks.
- ⚠ Do not damage, apply excessive stress, place heavy items on, or catch the cables. There is a risk of electric shocks.

2. Fire Prevention

⚠ CAUTION

- ⚠ Use a circuit breaker on the supply side of the inverter to prevent high current flow in the case of a fault.

3. Injury Prevention

⚠ CAUTION
⚠ Only supply the inverter with the voltage on the nameplate and in the Manual Specification section. Other voltage may cause the inverter to fail. ⚠ Care should be taken when wiring to ensure correct terminals are used. Check polarity, etc. ⚠ Do not touch the inverter while it is powered as certain parts become hot.

4. Other points

To prevent injury, damage, or product failure please note the following points.

(1) Transportation and mounting

⚠ CAUTION
⚠ Install according to the information in the Instruction Manual. ⚠ Do not stand or rest heavy objects on the product. ⚠ Prevent any dust, wire fragments or other foreign bodies from dropping into the inverter during wiring up and commissioning.

(2) Wiring

⚠ CAUTION
⚠ The connection orientation of the output cables U, V, W to the motor will affect the direction of rotation of the motor.

(3) Trial run

⚠ CAUTION
⚠ Check all parameters, and ensure that the machine will not be damaged by sudden start-up.

(4) Operation

⚠ CAUTION
⚠ The stop key can be used only when functions have been set. Therefore, prepare a separate emergency stop switch. ⚠ If an alarm is reset while the run signal is input, the inverter could start suddenly. Always confirm that the run signal has been turned off before resetting. ⚠ Do not modify the unit. ⚠ There may be cases when the electronic thermal relay cannot protect the motor against overheating. ⚠ Do not start and stop the inverter frequently with the magnetic contactor on the power supply side. ⚠ Reset the parameters required for operation after carrying out parameter clear or all clear. Each parameter will be returned to the default values.

(5) Emergency stop

⚠ CAUTION
⚠ Use a circuit and mechanical brake, etc., which will protect the operator of the machine should the inverter fail.

(6) Maintenance and inspection

⚠ CAUTION
⚠ Do not carry out a megger (insulation resistance) test on the control circuit of the inverter.

(7) Disposing of the option unit.

⚠ CAUTION
⚠ Treat as industrial waste.

(8) General

Many of the diagrams and drawings in the instruction manual show the option unit fitted to the inverter without a cover, or partially open. Never run the inverter like this. Always replace the cover and ensure adequate cooling etc., before using the inverter.

Position Control Function Communication Option Unit 〈〈FR-VPB〉〉
This multi-function option unit has an interface function with the Mitsubishi sequencer MELSECNET-A Series Positioning unit (AD75, etc.) and has been manufactured to meet the the needs of Factory Automation systems. This unit has the following functions.

- Position control
- Expansion analog input
- PLG pulse output (Line driver)
- Power supply for long distance cable
- RS422/RS-485 communications interface (Computer link function)

Contents

Introduction As this is a multi-function option unit, the initial functions are set as shown below. To activate the function, refer to each corresponding page, and set the parameters.

Function	Initial setting	Remarks
Position control	Does not function	Pr. 14 is set to "0" as the default value. (Refer to page 3-2.)
Expansion analog input	Does not function	Pr. 33 is set to "3" as the default value. (Refer page 4-1.)
PLG pulse output (line driver)	The PLG pulse division rate is set to 1/1.	Pr. 107 is set to "0" as the default value. (Refer to page 5-2.)
RS-485 interface	Does not function Note that each monitor value and parameter setting value can be read out.	Pr. 122 is set to "0" as the default value. (Refer to page 7-4.)

1. Before using

This product is an exclusive built-in option for the Mitsubishi FREQROL-V200 Series Inverter. Please perform the following steps before using the product.

1.1 Unpacking and confirmation of product

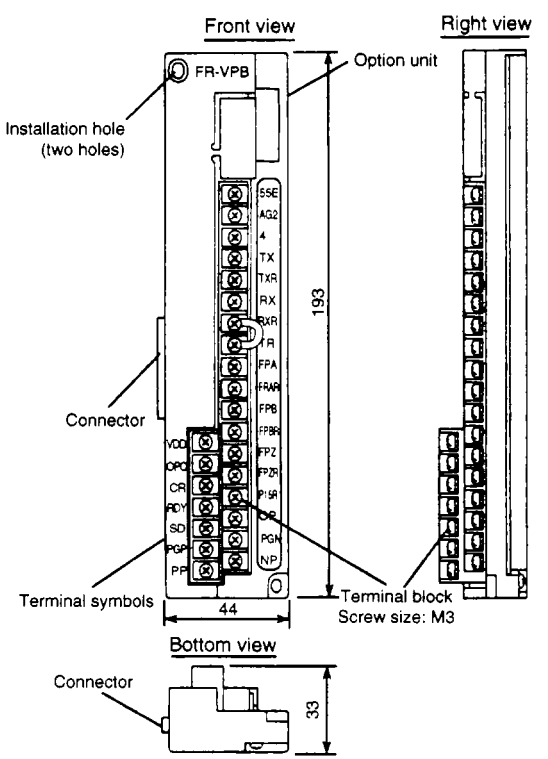
Remove the option unit from the package. Check the name on the front and confirm that it is the ordered product. Also, check for any damage caused during transportation.

1.2 Confirmation of packaging

Confirm that the following accessories are enclosed in the package.

- ○Instruction Manual ..... 1 copy
- ○Installation screw M3 × 14 ..... 2 screws
- ○Short bar (installed on terminal block) ..... 1 bar

1.3 Appearance and names of each part



2. Installation

Check the inverter model before installation.
This unit is an exclusive option for the FREQROL-V200 Series. It cannot be used with other series (FR-A, Z, F series, etc.).

2.1 Before installation

Confirm that the inverter is isolated and input power is turned OFF.
If the option unit is installed while the input power is ON, a fault may occur in the inverter. (The inverter and option unit may be damaged, and the inverter error display "E.CPU" may appear.)

Warning! Hazardous voltage present.
Always isolate the power from the inverter, and wait 10 minutes after the charge lamp has gone out before inserting or removing this option unit, or touching the terminals.

2.2 Installation method

(1) Align the option unit connector with the connector on the inverter, and insert the option unit securely.
(2) Fix the top and bottom of the option unit to the inverter using the two enclosed. If the screw hole is not aligned with the inverter, the connector may not be inserted correctly so check it.

⚠ CAUTION

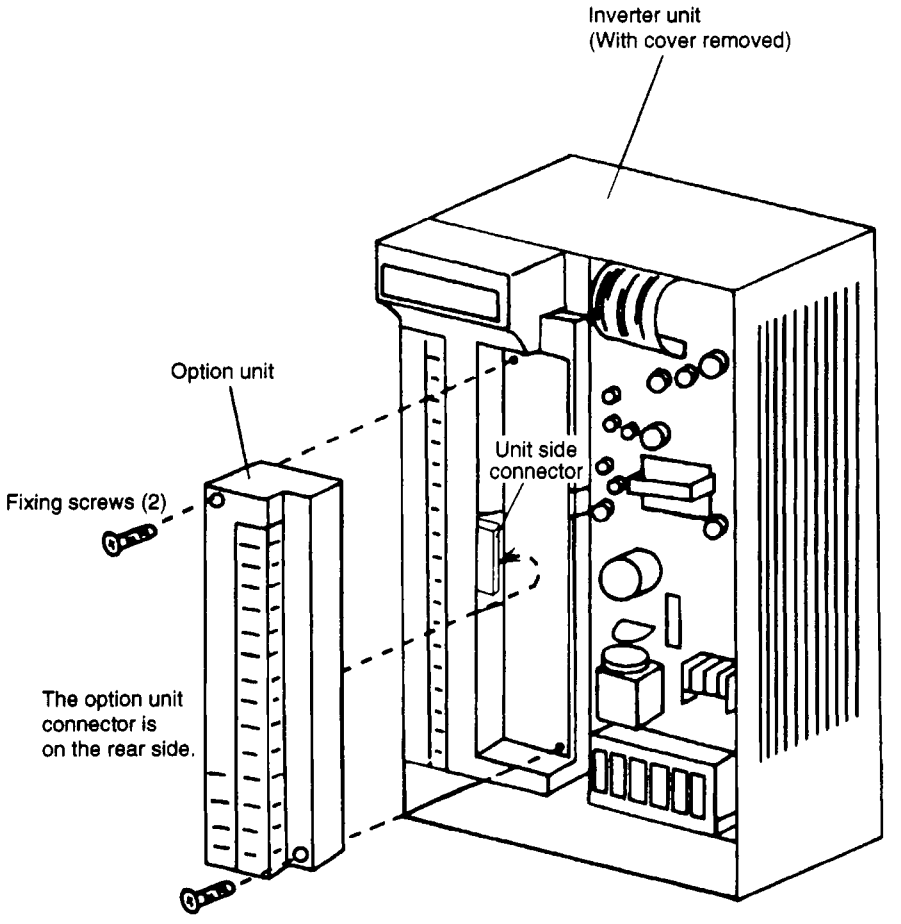
⚠ Never use open terminals as relay terminals.
These terminals are used internally by the option. If used as relay terminals, the option unit could be damaged.

⚠ Carefully route the connection wires to the inverter's control circuit terminals and option terminals within the wiring space so that they are not caught between the unit and the cover when the front cover is installed.

⚠ This option is an exclusive part for the FREQROL-V Series. Mounting of this unit on the FREQROL-A Series could lead to inverter damage, malfunctioning of functions, and the displaying of the "Option Error (E.OPT)."

2.3 Wiring

Wire the units so that the wires are not jumbled in the control circuit terminal block space.


Inverter unit
(With cover removed)
Option unit
Unit side
connector
Fixing screws (2)
The option unit
connector is
on the rear side.

2.4 Terminal list

Terminal symbol		Terminal name	Rated current, etc.	Applications	
Position control	PGP (PP)	Forward run pulse train	(Open collector method) DC24V	A pulse train is input to the forward run pulse train input terminal from a pulse train generation unit.	When using the open collector method, the VDD 24V power supply and OPC open collector power supply are connected, and each pulse is input between PP-SD and NP-SD. When using the differential receiver method, the OPC open collector power supply is opened, and each pulse is input between PP-PGP and NP-NPG.
	PGN (NP)	Reverse run pulse train		A pulse train is input to the reverse run pulse train input terminal from a pulse train generation unit.	
	P15R	DC power supply	+15VDC power supply	+15VDC power supply	
	CR	Clear terminal	—	When terminals CR-SD are short circuited, the counter is cleared (at the falling edge of the signal).	
	OPC	Open collector power supply	DC24V	This terminal is connected to the 24V power supply when the pulse train is to be input with the open collector method.	
	SD	Contact input common terminal	—	Contact input common terminal.	
Expansion analog input	4	Torque setting	Max. tolerable voltage DC20V	The AG2 terminal is used as the common. When DC0 to 10V is input, the max. torque is reached at 10V, and the input/output are proportional.	
Long distance cable	55E	PLG power supply terminal.	DC5.5V	This is the 5.5V power supply terminal for the PLG, connect 55E to the + side and AG2 to the ground side. Connect the cable screen to AG2. AG2 is not isolated from the common terminals. Do not ground this to the earth.	
	AG2	Power supply grounding terminal			

Terminal symbol		Terminal name	Rated current, etc.	Applications
PLG pulse output	FPA	Differential A phase output terminal	Tolerable differential output load 0.1A	The A phase, B phase and Z phase (zero point and mark pulse) signals are output from the PLG.
	FPAR	Differential A phase reverse signal output terminal		
	FPB	Differential B phase output terminal		
	FPBR	Differential B phase reverse signal output terminal		
	FPZ	Differential Z phase output terminal		
	FPZR	Differential Z phase reverse signal output terminal		
RS-485 interface	TX	Serial signal transmission terminal	—	——
	TXR	Serial signal transmission terminal		
	RX	Serial signal reception terminal		
	RXR	Serial signal reception terminal		
	TR	Terminator terminal	Terminator 100Ω	This is the terminal used to connect the terminator built in the FR-VPB unit. (The terminals RXR-TR are connected as the default connection.) ○ Connect between terminals RXR-TR on the inverter at the end of the chain. ○ Remove the jumper for all other inverters.
Output terminal	VDD	Driver power supply	DC24V	The interface driver power supply (approx. 24V) is output
	RDY	Ready	—	The READY signal is output when operation can be started in the servo ON state.
	OP	Encoder Z phase output terminal	—	One pulse per motor revolution is output.

2.5 Parameter list

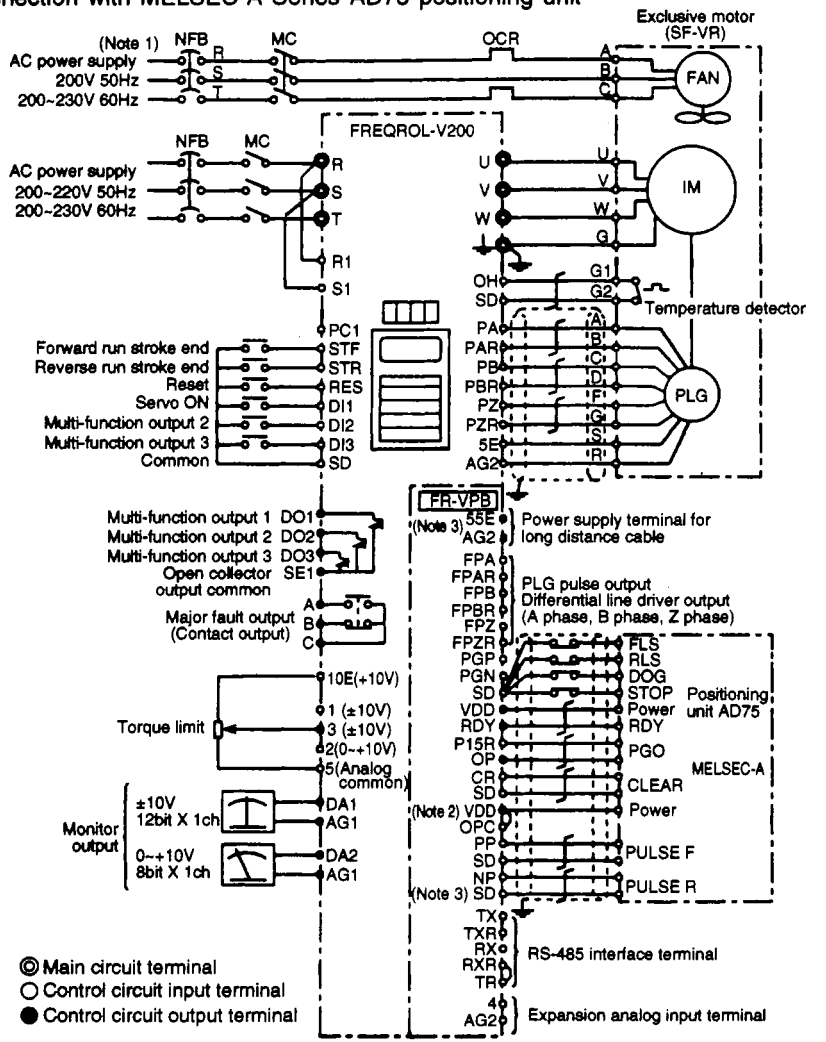
Parameter No.	Name	Setting range	Default value
107	PLG division	0 ~ 4	0
120	Baud rate	3 ~ 192	96
121	Stop bit length	0, 1, 10, 11	1
122	Parity check	0, 1, 2	2
123	CR, LF validity	0, 1, 2	1
124	Station No. setting	0 ~ 31	0
125	Maximum communication time interval value	0, 9999, 1 ~ 999.8	0
126	Maximum No. of communication retries value	0 ~ 10	1
127	Link starting mode selection	0, 1, 2	0
128	Operation command operation site selection	0, 1	0
129	Speed command operation site selection	0, 1	0
130	Serial link E^2ROM write selection	0, 1	0
131	Command pulse scale numerator	0 ~ 32767	1
132	Command pulse scale denominator	0 ~ 32767	1
133	Position loop gain	0 ~ 150SEC^{-1}	25 SEC^{-1}
134	Feed forward gain	0 ~ 100%	0
135	Position command acceleration/deceleration time constant	0 to 50 sec.	0
136	Feed forward command filter	0 to 5 sec.	0
137	Positioning complete width	0 ~ 32767	100
138	Excessive error level	0 ~ 400K	40K
139	Command pulse selection	0 ~ 5	0
140	Clear signal selection	0, 1	1
141	Pulse monitor selection	0 ~ 5, 9999	9999

3. Position control function

Positioning control can be executed by connecting the MELSEC-A Series sequencer positioning unit (AD75, etc.) and the inverter. Furthermore, the functions of each terminal can be changed as shown below.

3.1 Connection example

Connection with MELSEC-A Series AD75 positioning unit



(Note 1) The motor fan power supply is a single phase for the 5.5K and 7.5K capacities.

(Note 2) The pulse train signal from the positioning unit can be input either from the open collector or line driver.
Note that the connection will differ slightly. (The above example shows the case for the open collector.)

(Note 3) When using a long distance cable that is 50m or longer, use it as the PLG power supply.

(Note 4) There is only one SD terminal on the option FR-VPB, so bundling multiple wires with one crimp terminal and then connecting is recommended.

3.2 Explanation of terminals

3.2.1 The functions of the following terminals will change as shown below when the option FR-VPB is mounted on the FR-V200 and Pr. 14 "Control mode" is set.

Class	Terminal name	Details						
		Position control	Speed control	Torque control	Speed/torque change-over mode	Speed/vl change-over mode	Speed/position change-over mode	Position/torque change-over mode
	Pr. 14	4	0 (Default value)	1	2	3	5	6
Main card contact input	STF	Forward run stroke end	Forward operation command	(Same as) ←	(Same as) ←	(Same as) ←	Forward operation command/ forward run stroke end	Forward run stroke end/ forward operation command
	STR	Reverse run stroke end	Reverse operation command	(Same as) ←	(Same as) ←	(Same as) ←	Reverse operation command/ reverse run stroke end	Reverse run stroke end/ reverse operation command
	RES	Reset	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
	DI1	Servo ON	Multi-function input 1	(Same as) ←	(Same as) ←	(Same as) ←	Pre-excitation/ servo ON	Servo ON/ pre-excitation
	DI2	Multi-function input 2	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
	DI3	Multi-function input 3	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
Contact	A, B, C	Error output	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
Open collector output signal (Note)	DO1	Multi-function output 1	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
	DO2	Multi-function output 2	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
	DO3	Multi-function output 3	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←	(Same as) ←
Analog input	2	—	Speed command	Speed limit	Speed command/ speed limit	Speed command	Speed command/ n/a	n/a Speed limit
	1	(Same as) ↑	(Same as) ↑	(Same as) ↑	(Same as) ↑	(Same as) ↑	(Same as) ↑	(Same as) ↑
	3	Torque limit	(Same as) ←	Torque command	Torque limit	(Same as) ←	(Same as) ←	Torque limit/torque command

※ Refer to the FR-V200 inverter instruction manual for terminals not listed above.

(Note) The SU signal selected with the multi-function output will be the positioning complete signal when using position control. (Refer to page 3-14.)

3.2.2 Terminals exclusive for positioning control

Type	Terminal symbol		Terminal name	Rated current, etc.	Applications	
Option terminals	Input terminals	PGP (PP)	Forward run pulse train	(Open collector method) DC24V	A pulse train is input to the forward run pulse train input terminal from a pulse train generation unit.	When using the open collector method, the VDD 24V power supply and OPC open collector power supply are connected, and each pulse is input between PP-SD and NP-SD. When using the differential receiver method, the OPC open collector power supply is opened, and each pulse is input between PP-PGP and NP-NPG. (Refer to page 3-11.)
		PGN (NP)	Reverse run pulse train		A pulse train is input to the reverse run pulse train input terminal from a pulse train generation unit.	
		P15R	DC power supply	+15VDC power supply	+15VDC power supply	
		CR	Clear terminal	—	When terminals CR-SD are short circuited, the counter is cleared (at the falling edge of the signal).	
		OPC	Open collector power supply	DC24V	This terminal is connected to the 24V power supply when the pulse train is to be input with the open collector method.	
		SD	Common terminal	—	Common terminal.	
	Output terminals	VDD	Driver power supply	DC24V	The interface driver power supply (approx. 24V) is output.	
		RDY	READY	—	The READY signal is output when operation can be started in the servo ON state.	
		OP	PLG Z phase output terminal	—	One pulse per motor rotation is output.	
Inverter terminals	Input terminals	STF	Forward run stroke end	—	This is the forward run stroke end terminal during the position control mode. When terminals STF-SD are opened, the motor will suddenly stop and then servo lock will be applied. Operation is possible in the reverse run direction.	
		STR	Reverse run stroke end	—	This is the reverse run stroke end terminal during the position control mode. When terminals STR-SD are opened, the motor will suddenly stop and then servo lock will be applied. Operation is possible in the forward run direction.	
		DI1	Servo ON	—	Position control is possible by short circuiting the start signal terminals DI1-SD during the position control mode.	

3.3 Explanation of operation

The speed command is calculated so that the difference of the No. of command pulse train pulses and the No.of pulses in the feedback from the motor end PLG is 0, and the motor is rotated.

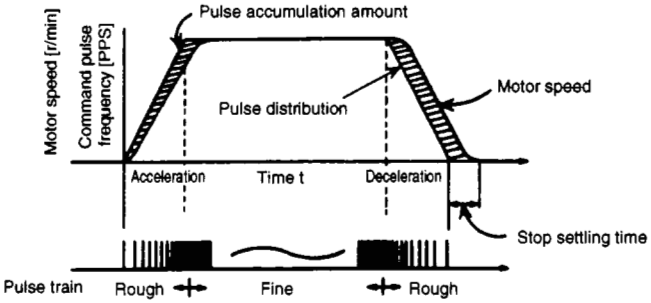


Fig. 3.1

① When a pulse train (MELSEC-A Series positioning unit AD75, etc.) is input, the pulse is sent to the electronic gears. That pulse accumulation becomes a position control pulse and in turn becomes the speed command.

② When the rotation starts by the speed command from the inverter (when using the FR-VPB), feedback pulses proportional to speed are generated from the encoder, and the accumulation of the deflection counter is subtracted.
The deflection counter maintains a set accumulation amount, and the motor continues rotating.

③ When the command pulse input stops and the pulses accumulated in the deflection counter drop, the speed decreases. The motor stops when there are no accumulated pulses left.
Thus, if the feed rate per pulse is specified, feeding to a position proportional to the No.of pulses in the pulse train is possible. The pulse frequency will be the motor speed (feedrate).

④ As shown in Fig. 3.1, the pulse train is rough during motor acceleration, and becomes fine at full speed. During deceleration, the pulse train becomes rough, and the motor will stop with a slight delay compared to the final command pulse is 0.
This time error is necessary for the stopping precision, and is called the stop settling time.

Electronic gears ····· These adjust the ratio of the machine side gears and motor side gears. (Refer to page 3-8.)

3.4 Example of operation

When the servo ON signal turns ON (when terminals DI1-SD are short circuited) the base signal shield is canceled, the READY signal will be output 0.1 sec. later. If the forward run stroke end signal (terminal STF) or the reverse run stroke end signal (terminal STR) and the SD terminal are short circuited, the motor will rotate according to the command pulse. If the forward run (reverse run) stroke end signal is open, the motor will not rotate.

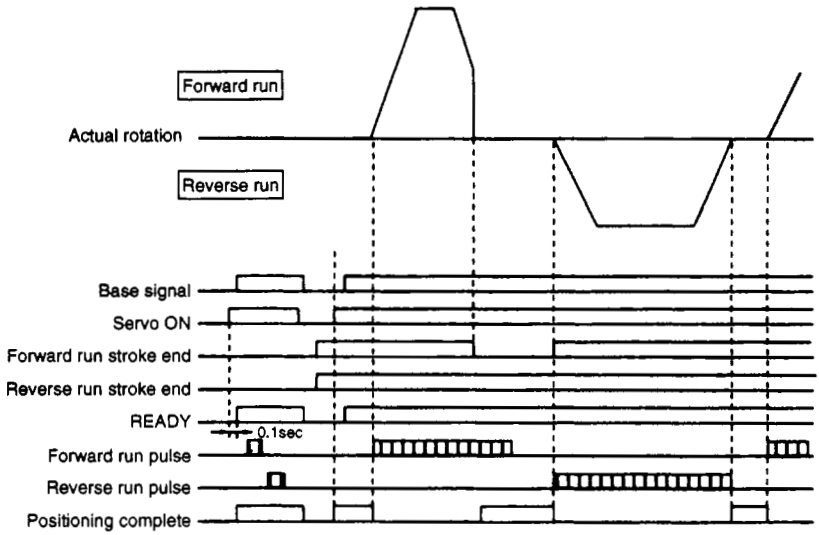


Fig. 3.2

3.4.1 Initialization

① When terminals DI1-SD (servo ON) are short circuited, the base signal shield is canceled, and the servo lock state is entered.

② When terminals DI1-SD are opened, the base will be shielded.

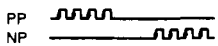
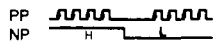
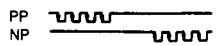
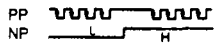
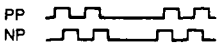
③ The forward run stroke end (terminal STF) or forward run stroke end (terminal STR) and SD are short circuited.
If each stroke end and terminal SD are opened, the motor will not rotate in that direction.

④ When the command pulse is input, the motor will rotate according to the pulse command.

3.5 Types of pulse inputs

Generally the forward run/reverse run pulse train is input in the open collector method for the command pulse. The MELSEC-A Series sequencer positioning uses this method. The FREQROL-V Series inverter allows the following pulse trains to be used. These can be changed with the parameter settings.

(1) Types of pulse train formats

Command pulse train format		During forward run / During reverse run	Pr. 139 setting	Remarks
Positive logic	Forward run pulse train Reverse run pulse train		0	
	Pulse train + coding		1	
	A phase pulse train B phase pulse train		2	The pulse frequency after multiplication is 200kpps or less.
Negative logic	Forward run pulse train Reverse run pulse train		3	AD75 (A type) Note) If A and B types are mistaken, the motor will not move in one direction.
	Pulse train + coding		4	AD75 (B type)
	A phase pulse train B phase pulse train		5	The pulse frequency after multiplication is 200kpps or less.

(Note) ⌐ and ⌙ indicate the timing when the command pulse is led in.

3.6 Parameter settings

3.6.1 Parameter list

Parameter No.	Name	Setting range	Min. setting value	Default value	Remarks
131	Command pulse scale numerator	0 ~ 32767	Integer	1	Pr. 131/Pr. 132 are valid between 1/50 or more and 20 or less.
132	Command pulse scale denominator	0 ~ 32767	Integer	1	
133	Position loop gain	0 ~ 150SEC^{-1}	Integer	25SEC^{-1}	The unit is not displayed on the PU screen.
134	Feed forward gain	0 ~ 100%	1%	0	
135	Position command acceleration/deceleration time constant	0 to 50 sec.	0.001 sec.	0	
136	Feed forward command filter	0 to 5 sec.	0.001 sec.	0	
137	Positioning complete width	0 ~ 32767	Integer	100	No. of accumulated pulses for outputting the positioning complete signal.
138	Excessive error level	0 ~ 400K	1K	40K	
139	Command pulse selection	0 ~ 5	Integer	0	
140	Clear signal selection	0, 1	Integer	1	
141	Pulse monitor selection	0 ~ 5, 9999	Integer	9999	

3.6.2 Block diagram

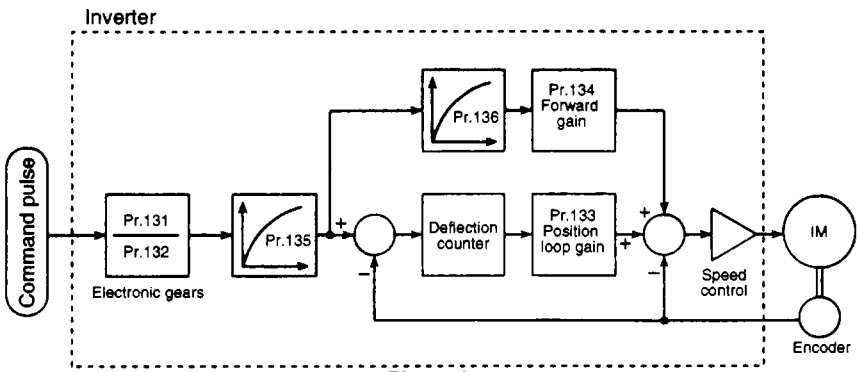


Fig. 3.3

3.6.3 Parameter settings and details

Set the No. of electronic gears ⇒ Pr. 131 "Command pulse scale numerator"
Pr. 132 "Command pulse scale denominator"

● Pr. 131 "Command pulse scale numerator" is the multiplier regarding the command pulse input, and Pr. 132 "Command pulse scale denominator" is the divisor regarding the command pulse input.

Parameter No.	Name	Setting range	Default value
131	Command pulse scale numerator	0 ~ 32767	1
132	Command pulse scale denominator	0 ~ 32767	1

(Note) The Pr. 131 and Pr. 132 setting ranges are 0 to 32767, but if "0" is set, it will be interpreted as "1".

(1) Position resolution and parameter setting.

The position resolution (movement rate $\triangle \ell$ per pulse) is determined by the movement rate $\triangle s$ per motor rotation and the detector feedback pulse Pf. The resolution is expressed with the following expression.

$$\triangle \ell = \frac{\triangle s}{Pf} \quad \cdots\cdots (a)$$

Where,

$\triangle \ell$: Movement rate per pulse [mm]
$\triangle s$: Movement rate per motor rotation [mm]
Pf : No. of feedback pulses [pulse/rev]

$\triangle \ell$ has the relation shown in expression (a), so the value is fixed in the control system when the drive system and detector are determined. However, depending on the parameter, the movement rate per command pulse can be set separately with the parameter.
The command pulse is doubled by Pr. 131 and Pr. 132 to become the position control pulse. Thus, the movement rate $\triangle \ell$ per command pulse is expressed with the following expression.

$$\triangle \ell = \frac{\triangle s}{Pf} \times \left(\frac{Pr.131}{Pr.132} \right) \quad \cdots\cdots (b$$

The movement rate per command pulse can be set as a value not having a fraction.

[Setting example]
Obtain the parameter value to achieve $\triangle\ell$ = 0.01 [mm] in a drive system with a ball screw pitch PB of 10 [mm] and deceleration rate of 1/n=1.
The PLG pulse is Pf=4000 [pulse/rev].
As $\triangle$s is 10 [mm], the following is obtained from expression (b).

$$\left(\frac{\text{Pr.131}}{\text{Pr.132}}\right) = \triangle\ell \times \frac{\text{Pf}}{\triangle\text{s}}$$
$$= 0.01 \times \frac{4000}{10} = \frac{4}{1}$$

Thus, Pr. 131 is set to 4 and Pr. 132 is set to 1.

〈Relation of position resolution $\triangle\ell$ and general precision〉
The general precision (machine's positioning precision) is obtained from the total of the electrical error and mechanical error. Generally, the electrical system error does not affect the general error. Use the following relation as a guideline.

$$\triangle\ell < \left(\frac{1}{5} \sim \frac{1}{10}\right) \times \triangle\varepsilon$$

Where,
$\triangle\varepsilon$: Positioning precision [mm]

(2) Motor speed and command pulse frequency
Normally the motor is operated at a speed where the command pulses and feedback pulses are balanced. In other words, the command pulse frequency and feedback frequency are equal, so the relation including the command pulse scale (Pr. 131, Pr. 132) setting value is as follows.

$$\text{fo} \times \frac{\text{Pr.131}}{\text{Pr.132}} = 4000 \times \frac{\text{No}}{60} \quad \cdots\cdots\cdots\cdots\cdots\cdots \text{(c)}$$

Where, fo : Command pulse frequency [pps]
Pr. 131 : Command pulse scale numerator
Pr. 132 : Command pulse scale denominator
No : Motor speed [r/min]

The command pulse scale and command pulse frequency for rotating the motor at No is obtained with the above expression.

[Setting example 1]

Example of setting the command pulse scale (Pr. 131, Pr. 132) when using AD75. Obtain the command pulse scale for operating the motor at 1500 [r/min] at the input pulse train frequency 100 [kpps].

Using expression (c):

$$\left(\frac{Pr.131}{Pr.132}\right) = 4000 \times \frac{No}{60} \times \frac{1}{fo}$$

$$= 4000 \times \frac{1500}{60} \times \frac{1}{100 \times 10^3}$$

$$= \frac{1}{1}$$

Thus, Pr. 131 is set to 1 and Pr. 132 is set to 1.

[Setting example 2]

Obtain the command pulse frequency to operate the motor at speed No 3000 [r/min].

Note that the command pulse scale Pr. 131/Pr. 132 are set to 1.

Using expression (c):

$$fo = 4000 \times \frac{No}{60} \times \frac{Pr.132}{Pr.131}$$

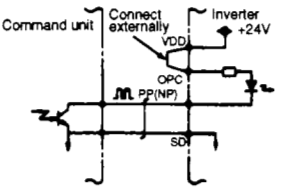
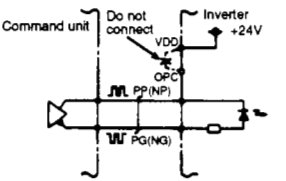
$$= 4000 \times \frac{3000}{60} \times 1$$

$$= 200 \times 10^3$$

Thus, the command pulse frequency is 200[kpps].

⟨Interface with positioning unit and inverter⟩

When operating the inverter with positioning units, the position command pulse train interface must be matched. The pulse trains for the inverter and positioning units are shown below.

Output format	Hardware type	Input pulse frequency
Open collector		Max200kpps (Note)
Differential line driver		Max200kpps (Note)

(Note) The command pulse scale parameters Pr. 108 and Pr. 109 are the settings used to set the motor speed to 3000r/min at the max. input pulse frequency of each interface format. Refer to section (1) for the relation of the mechanical system and positioning resolution.

(3) Motor stopping characteristics

① Accumulated pulses (ε)

When operating the motor with a pulse train, the command pulse frequency and motor speed have the relation shown in Fig. 3.4. During acceleration, the pulses indicating the motor speed delay are added to the deflection counter. These pulses are called the accumulated pulses. The following expression is established between the command pulse frequency (f) and position loop gain (Kp).

$$\varepsilon = \frac{fo}{Kp} \text{ [pulse]} \cdots\cdots\cdots\cdots (d)$$

Kp can be set between 5 and 100 [sec^{-1}] in the FREQROL-V200, but the default value is Kp = 25 [sec^{-1}]. In this case, if the command pulse frequency is 200 [kpps], the accumulated pulses during operation is as follows according to expression (d).

$$\varepsilon = \frac{200 \times 10^3}{85} = 800 \text{ [pulse]}$$

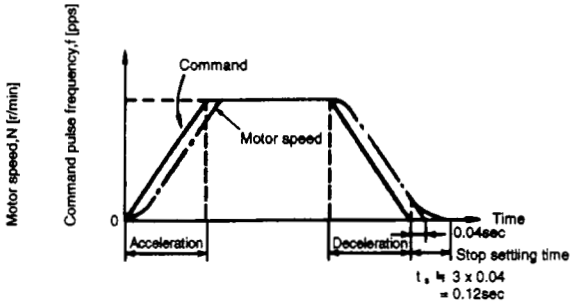


Fig. 3.4

② Stop setting time (t_s) during linear acceleration and linear deceleration
During operation, pulses are accumulated in the inverter, so the stop setting time (t_s) is required for the motor to stop after the command is set to 0. The command positioning time and machine positioning time will differ. Set the operation pattern while taking the stop setting time into consideration.
t_s is approximately the value obtained with the following expression.

$$t = 3 \times Tp$$
$$= 3 \times \frac{1}{Kp} \text{ [sec]} \cdots\cdots\cdots\cdots\cdots\cdots \text{(e)}$$

※ When the default value Kp = 25 [sec^{-1}] is used, t_s = 0.12 [sec].

(Note) The stop setting time indicates the time required for the motor to stop in the required positioning precision range. This value does not necessarily match the time required for the motor to completely stop. When using the motor at a high frequency, etc., if the positioning precision does not have an allowance regarding the movement rate per pulse ($\triangle \ell$), a time longer than the value obtained with expression (e) must be considered.
Note that t_s will also differ according to the conditions applied for the moving sections. In particular, if the load friction torque is large, the operation may be unstable in areas close to the stopping area.

Adjust the movement to the completion of positioning

⇒ Pr. 133 "Position loop gain"
Pr. 134 "Feed forward gain"
Pr. 135 "Position command acceleration/deceleration time constant"
Pr. 136 "Feed forward command filter"

Parameter No.	Name	Setting range	Default value
133	Position loop gain	0 ~ 150	25
134	Feed forward gain	0 ~ 100%	0
135	Position command acceleration/deceleration time constant	0 to 50 sec.	0
136	Feed forward command filter	0 to 5 sec.	0

- Pr. 133 "Position loop gain"
  The position loop gain is set.
  If the value is increased, the tracking to the position command will increase, but the servo rigidity when stopping will also increase. This can lead to overshooting or vibration.
  Normally set this parameter between approx. 5 and 50.
- Pr. 134 "Feed forward gain"
  This function cancels the delay caused by the deflection counter's accumulated pulses.
  If the tracking delay to the command pulse is a problem, gradually increase this setting value, and set in the range where overshooting and vibration do not occur.
  This function does not affect the servo rigidity during stopping.
  Normally set this parameter to 0.
- Pr. 135 "Position command acceleration/deceleration time constant"
  (1) If the electronic gear ratio (refer to Pr. 131 and 132) is large (approx. ten times or more), and the speed is low, the rotation will not be smooth, and the motor will pulsate. The rotation will become smoother if this parameter is set in this case.

(2) If an acceleration/deceleration time is not set for the command pulses, overshooting and the excessive error alarm may occur when the command pulse frequency changes suddenly. Provide an acceleration/deceleration time by setting this parameter in this case.
Normally set this parameter to 0.

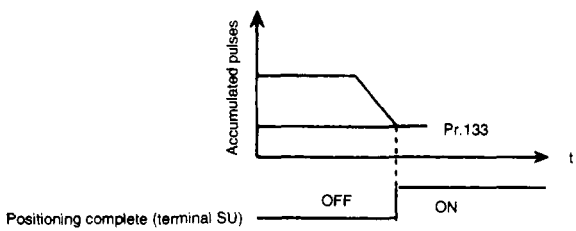
- Pr. 136 "Feed forward command filter"
  A smoothing filter is input to the feed forward command.
  If overshooting or vibration occurs while operating with a value set for the feed forward gain, setting this parameter can be effective. (Note that the trackability will drop if this value is set too high.)
  Normally set this parameter to 0.

Adjust the positioning complete width

⇒ Pr. 137 "Positioning complete width"

- The terminal SU signal becomes the positioning complete signal when using positioning control.
  If the accumulated pulses drop below the value set in Pr. 137, the positioning complete signal will turn ON.

Parameter No.	Name	Setting range	Default value
137	Positioning complete width	0 ~ 32767	100



Set the excessive error level

⇒ Pr. 138 "Excessive error level"

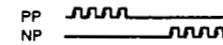
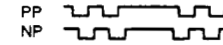
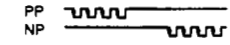
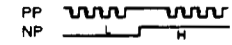
- The excessive error will occur if the accumulated pulses exceed the value set in Pr. 138.
- Adjustment
  If the Pr. 133 "Position loop gain" setting value is decreased, increase the Pr. 138 "Excessive error level" setting value.
  If a large load is to be detected early, increase the value set in Pr. 138.

Parameter No.	Name	Setting range	Default value
138	Excessive error level	0 ~ 400K	40K

Select the type of pulse train format

⇒ Pr. 139 "Command pulse selection"

- The type of command pulse train can be selected.

Pr. 139	Logic	Command pulse train format	During forward rotation / During reverse rotation
0 (Default value)	Positive	Forward/reverse pulse	
1		Pulse train + coding	
2		A, B phase pulse train	
3	Negative	Forward/reverse pulse	
4		Pulse train + coding	
5		A, B phase pulse train	

Select the clear signal

⇒ Pr. 140 "Clear signal selection"

● This is used to clear the No. of accumulated pulses to 0 during zero point return, etc.
When the clear signal is turned ON, the deflection counter will be cleared at the edge of the signal. The deflection counter can also be cleared by turning ON the clear signal in synchronization with the PLG zero pulse signal during zero point return, etc.

Pr. 140	Details
0	Clear deflection counter at falling edge*
1 (Default value)	Clear deflection counter at L level

Select the pulse monitor

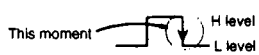
⇒ Pr. 141 "Pulse monitor selection"

● The states of various pulses during operation are indicated as pulse Nos. instead of the parameter unit's frequency monitor output.
The details displayed when the power is turned ON can be selected with Pr. 141.

Pr. 141	Details	Display range
0	The command pulse cumulative value is displayed.	Low-order 5 digits
1		High-order 5 digits
2	The feedback pulse cumulative value is displayed.	Low-order 5 digits
3		High-order 5 digits
4	The accumulated pulses are displayed on the monitor.	Low-order 5 digits
5		High-order 5 digits
9999	The default value frequency monitor is displayed.	

(Note) 1. The No. of pulses is counted even during servo ON.
2. The No. of cumulated pulse value is cleared when the base signal is shielded or when the clear signal is turned ON.

* Falling edge ····· The moment that the pulse frequency changes from the H level to the L level.



3.7 Specifications

(1)	Repeated positioning precision	±1.5° (motor shaft end) (Note) This will differ according to the load torque, load GD^2 or load backlash conditions.
(2)	Tolerable speed	3,000r/min or less (Motor shaft end)
(3)	Holding force after positioning	Servo lock function provided
(4)	Power supply	A 5V power supply (inverter control circuit) or 5.5V (option FR-VPB) for the PLG is provided.
(5)	Max. input pulse frequency	200kpps (Differential receiver or open collector)
(6)	Positioning feedback pulses	4000 pulses per motor rotation
(7)	Electronic gear setting	1/20 to 50
(8)	Positioning complete width setting	0 to 32767 pulses
(9)	Excessive error	0 to 400K pulses

4. Expansion analog input function

This is an analog input valid only during speed control, and is used when the torque limit value for driving and regeneration is to be changed.

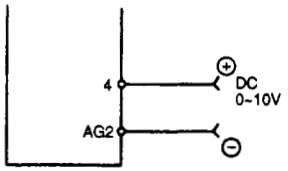
4.1 Explanation of terminals

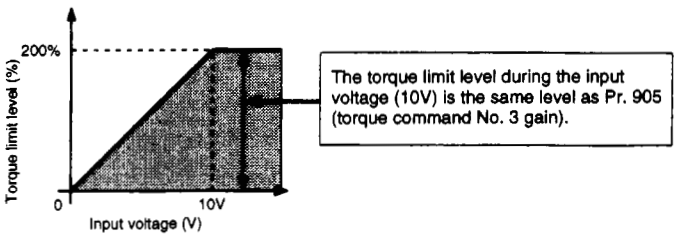
The following terminals are used for this expansion analog input function.
Refer to the connection example in section 3.1 for the connections.

Terminal symbol		Terminal name	Rated current, etc.	Application
Input terminals	4	Torque setting	Tolerable max. voltage DC20V	When DC0 to 10V is input, the max. torque is achieved at 10V, and the input/output are proportional.
	AG2	Power grounding terminal	——	This is the common terminal for the PLG power supply. This terminal is not isolated from the control circuit common terminals. Do not ground this to the earth.

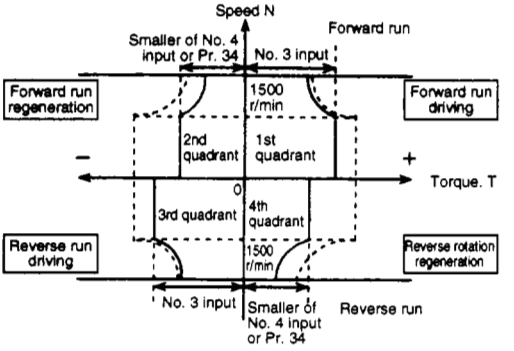
4.2 Torque limit level signal.

Input 0 to 10V in terminal 4.
The torque limit value will change according to the input voltage.





The external input terminal 5 is valid when Pr. 33 (torque control mode) is set to 2.
The torque limit level from terminal 4 is set during forward run (or reverse run) regeneration. (Note 1)



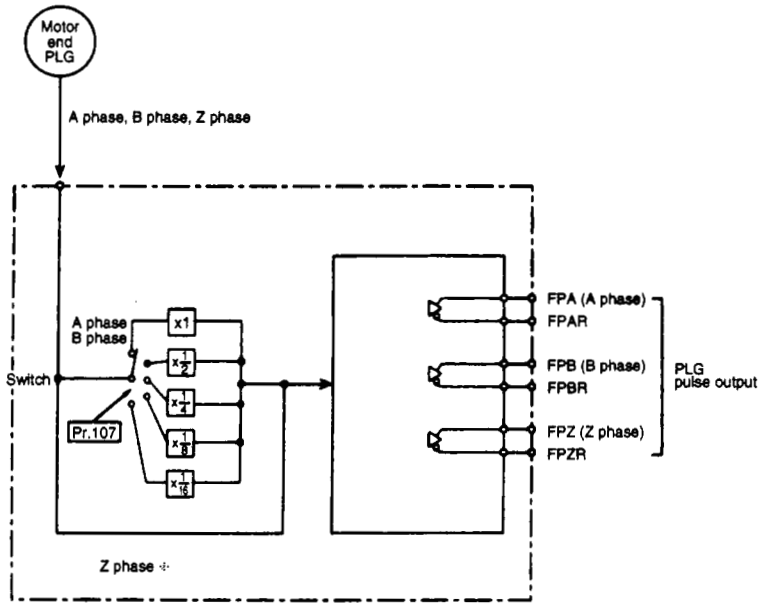
(Note 1) The torque limit level during forward run (reverse run) regeneration is the smaller of the Pr. 34 (torque limit level) setting value and terminal 4 setting value.

(Note 2) The torque limit from an external source will not be the torque when the control wire is broken or when the option is not mounted. Thus, take special care when using this for elevators or transfer machines. If an accident during overrunning could occur in the elevator, etc., use the internal torque limit.

5. PLG pulse output function

The PLG pulse input connected to the inverter or option can be output from the option terminal.
The pulse output can also be divided.

5.1 Connection example



※ The Z phase is not divided.

5.2 Explanation of terminals

The following terminals are used for this PLG pulse output function (differential line driver output).

Terminal symbol		Terminal name	Rated current, etc.	Application
Option terminals	FPA	Differential A phase output terminal	Differential output	The A phase, B phase and Z phase (zero point and mark pulse) signals from the PLG are output.
	FPAR	Differential A phase reverse signal output terminal		
	FPB	Differential B phase output terminal		
	FPBR	Differential B phase reverse signal output terminal		
	FPZ	Differential Z phase output terminal		
	FPZR	Differential Z phase reverse signal output terminal		

5.3 Setting

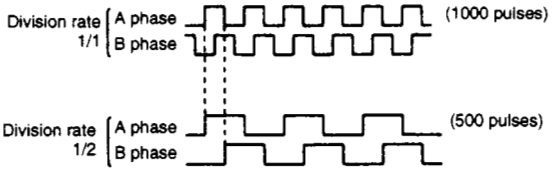
(1) Pr. 107 "PLG division rate"

- The motor end PLG pulse signals can be divided by the division rate and output. This is used to delay the response of the machine to which the signal is being input.

Pr.107	Switch 2 (division rate)
0 (Default value)	×1
1	$\times\frac{1}{2}$
2	$\times\frac{1}{4}$
3	$\times\frac{1}{8}$
4	$\times\frac{1}{16}$

(Note) If the No. of PLG pulses is 1000P/r, the max. division rate will be 1/8.

- Division waveform (Operation example) (EX. 1000 pulses)
  The ON/OFF widths both become doubles of the divider. (50% duty)

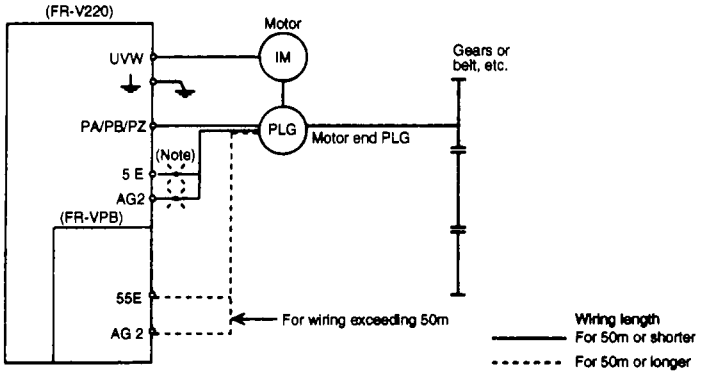


6. Power supply for long distance cable

This power supply can also be used for a motor end PLG that uses a long distance cable (50m to 100m).

- If the cable length is less than 50m, only the inverter is required. However, if the length is 50m or longer, the following precautions will be required.

6.1 Connection example



(Note) If the wire is 50m or longer, reconnect from 5E/AG2 to 55E/AG2.

6.2 Explanation of terminals

Terminal symbol	Terminal name	Details
55E	Encoder power supply terminal	Terminal for DC5.5V output, tolerable load current 500mA
AG2	Power supply grounding terminal	Common terminal for DC5.5V output. This terminal is isolated from the control circuit common terminal. Do not ground this terminal.

6.3 Wiring with motor end PLG

● Specifications for selection and PLG cable manufacture

※ Motor (built-in) PLG

Wiring distance	PLG cable (option)	Manufactured cable		Connection of PLG power supply
		To wire with 0.2mm²	To increase the size	
0 ~ 5m	FR-VCBL5 FR-JCBL5	Two parallel or more	0.4mm² or more	Terminal 5E ↔ AG2 (inverter) (Approx. 5V)
5 ~ 10m	FR-VCBL15 FR-JCBL15	Two parallel or more	0.4mm² or more	
10 ~ 15m		Four parallel or more	0.75mm² or more	
15 ~ 20m	FR-VCBL30 FR-JCBL30	Four parallel or more	0.75mm² or more	
20 ~ 30m		Six parallel or more	1.25mm² or more	
30 ~ 50m	None	Six parallel or more	1.25mm² or more	
50 ~ 100m		Six parallel or more	1.25mm² or more	Terminal 55E ↔ AG2 (Option FR-VPB) (Approx. 5.5V)

☆ Use these as reference for manufacturing the PLG cable.

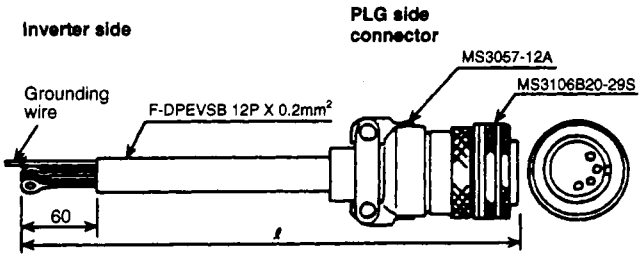
(1) Wiring of option unit and motor end PLG
- Use the option FR-VCBL, FR-JCBL(cable).
- If a cable is not available, manufacture one according to the PLG cable manufacturing specifications.

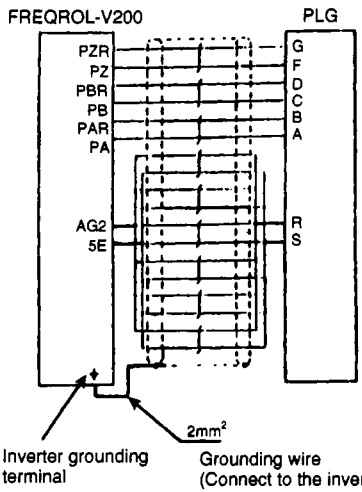
(2) Parallel connect the wiring between the terminals "55E" and "AG2" and motor end PLG, or use a larger wire size.
The details for selection and manufacturing are given below.

(3) Even if the FR-VPA 5.5V power supply is used, the long distance cable may not be usable depending on the wiring conditions.
In that case, prepare a separate 5V power supply externally (near the PLG).

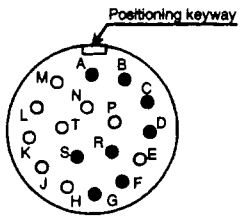
(4) PLG cable

■ Outline drawing of FR-VCBL



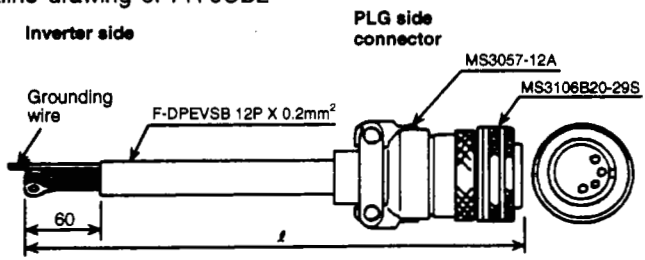


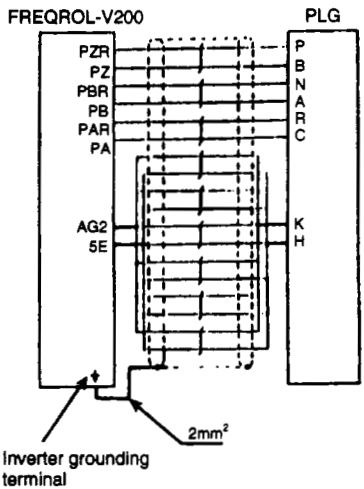
Type	Length ℓ (m)
FR-VCBL 5	5
FR-VCBL15	15
FR-VCBL30	30



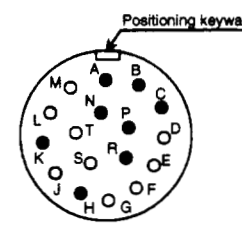
MS3106B20-29S
(Looking for wiring side)

■ Outline drawing of FR-JCBL





Type	Length ℓ (m)
FR-JCBL 5	5
FR-JCBL15	15
FR-JCBL30	30



MS3106B20-29S
(Looking for wiring side)

(Note) If the wiring length is 100m or longer, the feedback signal from the PLG will not be output correctly.

⚠ CAUTION

If the wiring length is long, the voltage supplied to the PLG may drop due to the voltage drop. Always wire as shown to prevent dropping of the voltage and so that the voltage stays within the tolerable range.

⚠ CAUTION

Route the PLG wiring away from noise sources (main circuit, high voltage circuit, etc.) so that it is not affected by noise.

⚠ CAUTION

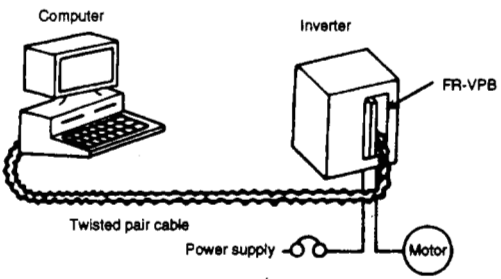
Never short circuit between 55E and AG2. The option unit could be damaged.

7. RS422/RS-485 Communications Interface (Computer link function)

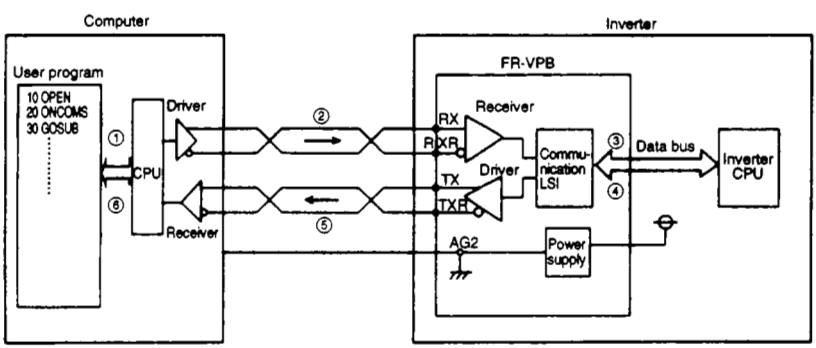
The computer link in these specifications allows the inverter to be operated and monitored and the parameters to be read and written using a user program. The link is established by mounting the option FR-VPB on the FR-V200, and connecting to a computer such as a personal computer or PLC using a communication cable.

7.1 Configuration

(1) Basic configuration



(2) Function block diagram



(3) Outline of operations

① The user program created by the user is analyzed and executed with the computer CPU.

② The data communicated according to the user program is converted into serial signals in the personal computer. It is then transmitted to the inverter at an interface level following RS-422 and RS-485 Standards by the drive

③ The data is communicated with the receiver in the FR-VPB unit, converte into parallel signals by the communication LSI and then fed into the inverter's CPU.

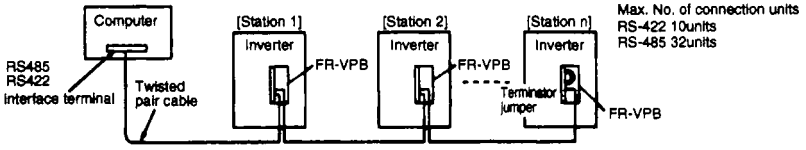
④ The data is checked for errors in the inverter's CPU. The data is processed according to the check results, and reply data is created.

⑤ The reply data is converted by the communication LSI in the FR-VPB unit. It is then converted into an interface level following RS-422 and RS-485 Standards by the driver and returned to the computer.

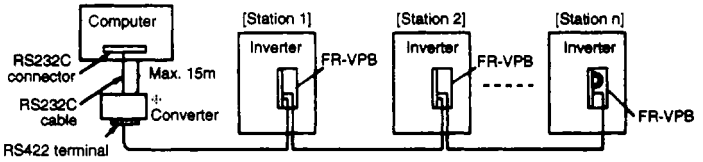
⑥ The returned data is received by the receiver in the computer, and fed into the CPU. The data is read and checked according to the user program, and then the user sequence is executed.

(4) Examples of system configuration

① To use with computer having an RS-485 or RS-422 interface



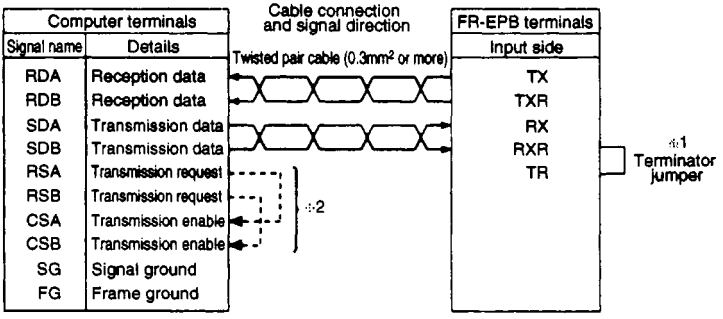
② To use with computer having an RS-232-C interface



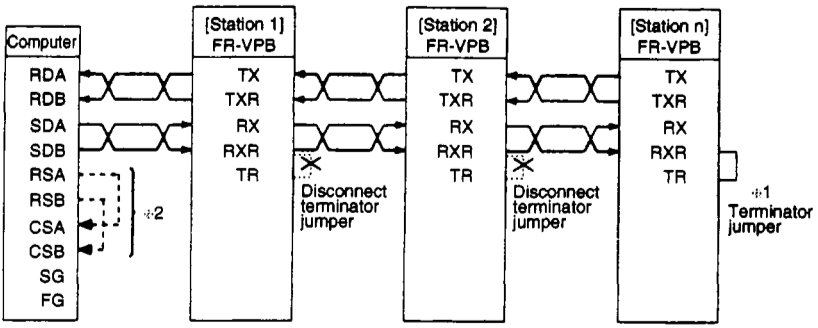
※ A commercial converter is required.

7.2 Wiring method

(1) For one computer and one inverter



(2) For one computer and n inverters



※1. Connect the terminator only on the FR-VPB unit that is at the end of the link chain. (Terminator: 10Ω)

※2. Connect the units according to the instruction manual provided with the computer being used. The computer terminal Nos. will differ according to the model, so always check them.

7.3 Explanation of terminals

Terminal symbol	Terminal name	Rating, etc.	Application
TX	Serial signal transmission terminal	—	——
TXR	Serial signal transmission terminal	—	
RX	Serial signal reception terminal	—	
RXR	Serial signal reception terminal	—	
TR	Terminator terminal	Terminator 100Ω	This is the terminal used to connect the terminator built in the FR-VPB unit. (The terminals RXR-TR are connected as the default connection.) ○ Connect between terminals RXR-TR on the inverter at the end of the chain. ○ Remove the connecting bar for all other inverters.

7.4 Parameters

Parameter No.	Name	Setting range	Default value	Setting value details
120	Baud rate	3 ~ 192	96	3: 300 baud, 6: 600 baud, 12: 1200 baud, 24: 2400 baud, 48: 4800 baud, 96: 9600 baud, 192: 19200 baud
121	Stop bit length	0, 1, 10, 11	1	0, 10 : Stop bit length 1 bit 1, 11 : Stop bit length 2 bits 0, 1 : Data length 8 bits 10, 11 : Data length 7 bits
122	Parity check	0, 1, 2	2	0: No parity check 1: Odd parity 2: Even parity
123	CR, LF validity	0, 1, 2	1	0: CR, LF invalid 1: Only CR valid 2: Both CR, LF valid
124	Station No. setting	0 ~ 31	0	
125	Maximum communication time interval value	0, 9999* 0.1 ~ 999.8	0	0.1 ~ 999.8: maximum communication time interval value 0: Computer link operation invalid 9999: Communication check stop
126	Maximum No. of communication retries value	0 ~ 10	1	Maximum No. of retries when error occurs.
127	Link starting mode selection	0, 1, 2	0	0: Normal (Follows Pr. 79) 1: Computer link operation mode 2: Computer link mode during restart after instantaneous power failure
128	Operation command operation site selection	0, 1	0	0: Computer command 1: External terminal command
129	Speed command operation site selection	0, 1	0	0: Computer command 1: External terminal command
130	Serial link E^2ROM write selection	0, 1	0	0: E^2ROM write enabled 1: E^2ROM write disabled

7.5 Initialization

To communication between the computer and inverter, the communication specifications must be set in the inverter. After each parameter is set, it will be validated when the inverter is reset. Correct operation will not be possible if the inverter is not reset.

① **Communication parameters (PR. 120 to Pr. 123)**

② **Setting of inverter station No. (Pr. 124)**
Set the inverter's station No.

(1) Even if the computer interface is RS-422, it can be set within the range of 0 to 31. However, the max. No. of units that can be connected is ten units.

(2) The station Nos. cannot be set in duplicate. (If the No. is duplicated, correct communication will not be possible.)

(3) The station Nos. can be set regardless of the connection order. There will be no problem even if there is a blank station No.

③ **Maximum communication time interval value (Pr. 125)**
Set the tolerable value for the communication time interval with the computer. (If the non-communication state with the computer exceeds this value time, the inverter will stop with the time over error.)

(1) The inverter will not detect an error even if communication is lost due to breakage of the signal wire or a fault in the computer.

(2) The communication time interval is checked from the first communication after the power is turned ON (or reset).

(3) If the parameters are changed, the check will start from after the changes are made.

* If the data is being input from the parameter unit, input 9999. If being input from the computer, set 65535 (FFFFH).

④ **Maximum No. of communication retries value (Pr. 126)**
Set the maximum No. of retries when a data reception error occurs. If the continuous No. of error occurrences exceeds this value, the inverter will stop with an alarm.

⑤ **Link starting mode selection (Pr. 127)**
Set which operation mode to start up in when the power is turned ON (or reset). This parameter can be changed by changing the setting with PU even in computer link mode is entered.

⑥ **External terminal input selection (Pr. 128 and Pr. 129)**
Select whether the external terminal input or the command from the computer link is valid.

⑦ **Serial link E2ROM write selection (Pr. 130)**

7.6 Functions

7.6.1 Operation mode

(1) Types of operation modes

(a) PU operation ..... The inverter is operated by using the keys on the parameter unit (after this called PU) mounted on the inverter.

(b) External operation ..... The inverter is operated by turning the external signals connected to the inverter control circuit terminal ON/OFF.

(c) Computer link operation ..... The inverter is operated by the computer program via the option unit FR-VPB.

[Note that depending on the settings of Pr. 128 and Pr. 129, the signals and operation speed can be input from the control circuit terminal.]

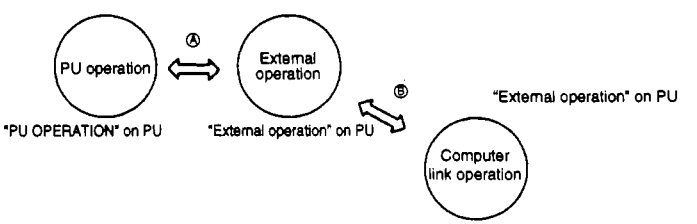
(2) Changeover of operation modes

(a) Changeover conditions

① The inverter is stopped. (Output speed 0r/min)

② Both the forward run and reverse operation commands are OFF.

(b) Changeover method



Symbol	Operation mode		Changeover method
Ⓐ	External operation ↔	PU operation	Use the keys on the PU
Ⓑ	External operation ↔	computer link operation	Operate with the computer's user program

(3) Functions per operation mode

Operation mode site	Item	Operation mode: Computer link operation	Operation mode: External operation	Operation mode: PU operation
User program from computer	Operation command	Valid*1	Invalid	Invalid
	Operation speed setting	Valid*1	Invalid	Invalid
	Monitor	Valid*	Valid	Valid
	Parameter write	Valid (when stopped)*3	Invalid*3	Invalid*3
	Parameter read	Valid	Valid	Valid
	Inverter reset	Valid*2	Invalid	Invalid
Control circuit terminal	Operation command	Valid*1	Valid	Invalid
	Operation speed setting	Valid*1	Valid	Invalid
	Inverter reset	Valid	Valid	Valid

*1. Determined by the value set in Pr. 128 and Pr. 129.
*2. Resetting is not possible during an FR-VPB communication error.
*3. Follows the details set in Pr. 77. (Note that if differing data from the PU and computer is written simultaneously into the same parameter, the RAM and E^2ROM details may not match.)

1. Operation commands

①	Forward run	(STF)
②	Reverse run	(STR)
③	Low speed	(RL)
④	Medium speed	(RM)
⑤	High speed	(RH)
⑥	No. 2 acceleration/deceleration selection	(RT)
⑦	Inverter output stop	(MRS)
⑧	Pre-excitation	(LX)
⑨	Control mode changeover	(MC)
⑩	Torque limit selection	(TL)

2. Operation speed setting

The inverter's output speed can be set.
The output range is 0 to 3000r/min in units of 1r/min (hexadecimal code). To change the speed continuously, always set the data in the inverter's RAM.

3. Status

(a) The inverter's operation status can be monitored.

① Running(RUN)
② In forward run
③ In reverse run
④ Speed reached(SU)
⑤ Overload(OL)
⑥ Instantaneous power failure(IPF)
⑦ Speed detection(FU)
⑧ Error
⑨ Minor fault output(ER)
⑩ Low speed output(LS)
⑪ Torque detection(TU)
⑫ Ready(RY)

(b) Operation speed Hexadecimal code Unit 1r/min.

(c) Output current Hexadecimal code Unit 0.01A

(d) Output voltage Hexadecimal code Unit 0.1V

(e) Error details Hexadecimal code The past four errors that have occurred can be monitored.

The inverter can be operated with signals from an external source even when in the computer link operation mode depending on the conditions set in Pr. 128 "Operation command operation site selection" and Pr. 129 "Speed command operation site selection".

Operation site selection		Equivalent functions in external terminals														
Pr. 128 (Operation command)	Pr. 129 (Speed command)	STF	STR	STOP	JOG•	RT•	2	3	1	RH, RM, RL•	RES	MRS•	LX•	MC•	TL•	OH
0: Computer	0: Computer	PCB	PCB	—	—	PCB	PCB	Ex.	Sup.	PCB	Com.	Com.	PCB	PCB	PCB	Ex.
0: Computer	1: External terminal	PCB	PCB	—	—	PCB	Ex.	Ex.	Ex.	Ex.	Com.	Com.	PCB	PCB	PCB	Ex.
1: External terminal	0: Computer	Ex.	Ex.	Ex.	Ex.	Ex.	PCB	Ex.	Sup.	PCB	Com.	Ex.	Ex.	Ex.	Ex.	Ex.
1: External terminal	1: External terminal	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.	Ex.	Com.	Ex.	Ex.	Ex.	Ex.	Ex.

Ex. : Only operation with the external terminal signals is valid.
PCB : Only operation with the computer's user program is valid.
Com. : Operation with either the external terminals or computer is valid.
– : Operation with either the external terminals or computer is valid.
Sup. : Operation with the external terminal signals is valid only when Pr. 128 "Multi-speed input compensation" is set to 1.
3 : OH does not rely on the operation mode.
* Assign this terminal with Pr. 17 (Input terminal assignment).

4. Parameter write

The inverter parameters can be written from the computer.

Refer to the command codes and data list on page 7-17 and following for the parameters that can be written.

5. Parameter read

The inverter's parameter setting values can be read to the computer.
Refer to the command codes and data list on page 7-17 and following for the parameters that can be read.

6. Inverter reset

The inverter can be reset from the computer, refer to section (4) ② on page 7-9.

(4) Errors

① Occurrence of error

The effect of an error occuring while operating in one of the operation modes is shown below.

Error occurrence site	Computer link operation	External operation	PU operation
Inverter error	Inverter stops Data communication is enabled	Inverter stops Data communication is enabled	Inverter stops Data communication is enabled
Computer error	Inverter stops※ Data communication is disabled	Inverter operation continues Data communication is disabled	Inverter operation continues Data communication is disabled

※ The inverter will stop after a set time (tolerable communication time interval value) has passed.

② Error reset

Resetting method	Computer operation	External operation	PU operation
Turn inverter power OFF	Valid	Valid	Valid
Turn terminals RES-SD ON	Valid	Valid	Valid
Computer's user program	Valid※1	Invalid	Invalid

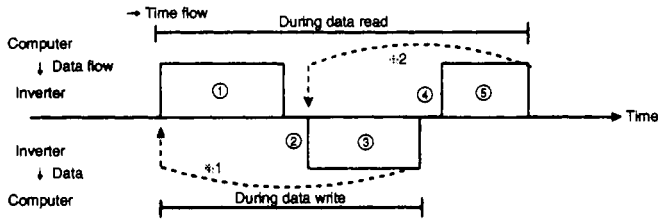
※1 If there is a fault in the computer and communication cable, the inverter cannot be reset from the computer.

If the inverter is reset during computer link operation, the external operation will be entered. To resume computer link operation, the operation mode must be changed back to the computer link operation mode.

7.7 Operation specifications

(1) Communication procedure

Data is communicated between the computer and inverter with the following procedure.



Validity of communication operations and data format types

Symbol	Operation details		Operation details					
			Operation command	Operation speed	Parameter write	Inverter reset	Monitor	Parameter read
①	The communication request is transmitted from the computer to inverter according to the computer's user program.		Ⓐ'	Ⓐ	Ⓐ	Ⓐ	Ⓑ	Ⓑ
②	Inverter data processing time (min. 20 msec.)		Valid	Valid	Valid	Invalid	Valid	Valid
③	Data returned from inverter [The data in step ① is checked for errors by the inverter (check sum, etc.)]	If there is no error, the inverter accepts the request.	Ⓒ	Ⓒ	Ⓒ	Invalid	Request acceptance: Ⓔ' / No error: Ⓔ	Ⓔ
		If there is an error, the inverter ignores the request.	Ⓓ	Ⓓ	Ⓓ	Invalid	Ⓕ	Ⓕ
④	Computer processing delay time		Invalid	Invalid	Invalid	Invalid	Valid	Valid
⑤	Response from computer regarding data returned from inverter in step ③ [The data in step ③ is checked for errors by the user program.]	If there is no error, the inverter does not process	Invalid	Invalid	Invalid	Invalid	Ⓖ	Ⓖ
		If there is an error, the inverter re-outputs the data in step ③.	Invalid	Invalid	Invalid	Invalid	Ⓗ	Ⓗ

(Ⓐ to Ⓗ in the table indicate the data format type ····· Refer to the next page.)

※1. If there is an error in the data and retrying is required, execute retrying with the user program. If the No. of continuous retries exceeds the value set in Pr. 126, the inverter will stop with an alarm (E.OPT).

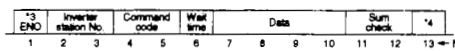
※2. If the inverter receives a signal indicating that an error has occurred in the data, it will return the data in step ③ to the computer again. If the No. of continuous data errors exceeds the value set in the parameters, the inverter will stop with an alarm (E.OPT).

☆ ACK and NAK do not need to be returned to the inverter in step ⑤. (The inverter does not check these.) If ACK is returned, it will not be processed, and if NAK is returned, the data will be sent to the computer again.

(2) Types of data formats (Refer to previous page)

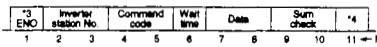
1) Communication request data from computer to inverter

[Data write]
Format A



※3. Control code

Format A'



[Data read]
Format B

(Note) The inverter station No. is set between H00 and H1F (No. 0 to 31) with a hexadecimal code.

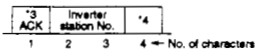
※4. CR, LF code

When transmitting data from the computer to the inverter, the CR (carriage return) or LF (line feed) code will automatically be set by the computer at the end of the data group. In this case, the data from the inverter must be s according to the computer.

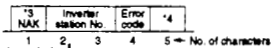
The validity of the CR and LF codes can be selected with Pr. 123.

2) Data returned from inverter to computer during data write

[No data error]
Format C

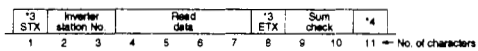


[With data error]
Format D

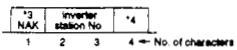


3) Data returned from inverter to computer during data read

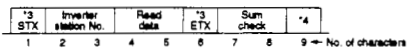
[No data error]
Format E



[With data error]
Format F

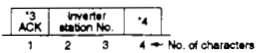


Format E'

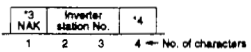


4) Data transmitted from computer to inverter during data read

[No data error]
Format G



[With data error]
Format H



(3) Explanation of data

1) Control codes

Signal name	ASCII code	Details	
NUL	H00	Null	(No process)
STX	H02	Start of Text	(Data process)
ETX	H03	End of Text	(End of data)
ENQ	H05	Enquiry	(Communication request)

Signal name	ASCII code	Details	
ACK	H06	Acknowledge	(No data error)
LF	H0A	Line Feed	(Line feed)
CR	H0D	Carriage Return	(Carriage return)
NAK	H15	Negative Acknowledge	(With data error)

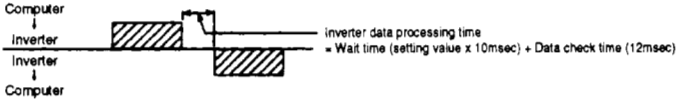
Select the validity of *CR and *LF with Pr. 123.

2) Inverter station No.
Designate the No. of the station to communicate with the computer.
Designate the station No. between H00 and H1F (station 0 to 31) with a hexadecimal code.

3) Command code
Designate the process request details such as operation and monitor issued from the computer to the inverter. By setting a command code, various operations and monitoring can be executed.

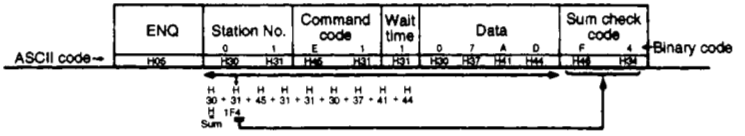
4) Data
The read and write data such as speed and parameters for the inverter is expressed.
The meaning of the data and setting range is determined according to the command code in item 3).

5) Wait time
Specify the time to wait to transmit the reply data after the inverter receives the data from the computer.
The wait time is set between 0 and 150msec in 10msec units according to the response possible time of the computer. (Example: Setting 1: 10msec, 2: 20msec.)

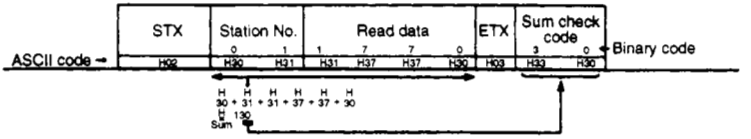


6) Sum check code
The sum check code is the low-order byte (8 bit) obtained from the results (sum) of adding the ASCII converted target data with the BIN code. The low-order byte is then converted into a two-digit (hexadecimal) code to be used as the sum check code.

(Example 1) Inverter from computer



(Example 2) Data returned from inverter to computer during data read



7) Error codes
If there is an error in the data received by the inverter, the error details will be returned in addition to the NAK code to the computer. The details of the error follow the error code list on the next page.

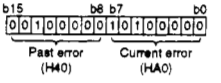
Error code list

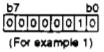
The details of the error returned when there is an error in the communication request data from the computer are shown below.

Error code	Error item	Error details	Operation on inverter side
H0	Computer NAK error	Errors exceeding the maximum No. of tolerable retries were found in the communication request data from the computer.	The inverter will stop with an alarm (E.OPT) when an error exceeding the maximum No. of retries occurs.
H1	Parity error	The details differ regarding the parity designation.	
H2	Sum check error	The sum check code in the computer and the sum check code value of the data received by the inverter differ.	
H3	Protocol error	An error was found in the syntax of the data received by the inverter. The data reception was not completed within the specified time. The CR, LF are not as designated by the parameters.	
H4	Framing error	The stop bit length differed from the default value.	
H5	Overrun error	The next data was transmitted from the computer before the inverter completed reception of the data.	
H6	—	——	——
H7	Character error	An invalid character (character other than 0 to 9, A to F, control code) was received.	The reception data will not be accepted. Note that the inverter will not stop with an alarm.
H8	—	——	——
H9	—	——	——
HA	Mode error	Writing of the parameters was attempted when not in the computer link operation mode or while the inverter was operating.	The reception data will not be accepted. Note that the inverter will not stop with an alarm.
HB	Command code error	An invalid command code was designated.	
HC	Data range error	Data not in the setting range was designated during parameter or operation speed writing.	
HD	—	——	——
HE	—	——	——
HF	—	——	——

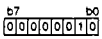
(5) Setting items and setting data

After initializing, set the command codes and data as shown below. When communication from the computer starts, operation control and monitoring will be possible.

<table>
<tr><th>No.</th><th colspan="3">Item</th><th>Command code</th><th>Data details</th><th>No. of data digits</th></tr>
<tr><td>1</td><td colspan="2">Operation mode</td><td>Read</td><td>H7B</td><td>H0000: Computer link operation
H0001: External operation
H0002: PU operation</td><td rowspan="2">4 digits</td></tr>
<tr><td></td><td></td><td>Write</td><td>HFB</td><td>H0000: Computer link operation
H0001: External operation</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">Monitor</td><td colspan="2">Operation speed</td><td>H6F</td><td>H0000 – HFFFF: Operation speed (hexadecimal) unit 1r/min.</td><td rowspan="3">4 digits</td></tr>
<tr><td colspan="2">Output current</td><td>H70</td><td>H0000 – HFFFF: Output current (hexadecimal) unit 0.01A.</td></tr>
<tr><td colspan="2">Output voltage</td><td>H71</td><td>H0000 – HFFFF: Output voltage (hexadecimal) unit 0.1V.</td></tr>
<tr><td colspan="2">Special monitor</td><td>H72</td><td>H0000 – HFFFF: Data of monitor selected with command code HF3.</td><td>4 digits</td></tr>
<tr><td colspan="2" rowspan="2">Special monitor selection No.</td><td>Read H73
Write HF3</td><td>H01 – H0E : Monitor selection data
<table>
<tr><th>Data</th><th>Details</th><th>Unit</th><th>Data</th><th>Details</th><th>Unit</th></tr>
<tr><td>H01</td><td>Output frequency</td><td>0.01Hz</td><td>H06</td><td>Operation speed</td><td>1r/min.</td></tr>
<tr><td>H02</td><td>Output current</td><td>0.01A</td><td>H07</td><td>Motor torque</td><td>0.1%</td></tr>
<tr><td>H03</td><td>Output voltage</td><td>0.1V</td><td>H08</td><td>Converter output voltage</td><td>0.1V</td></tr>
<tr><td></td><td></td><td></td><td>H19</td><td>Operation speed setting</td><td>1r/min</td></tr>
</table></td><td>2 digits</td></tr>
<tr><td colspan="2">Error details</td><td>H74
to
H75</td><td>H0000 – HFFFF: Details of past two errors
Example of error detail display
(For command code H74)
Read data [Example] For H40A0
 

(Past error OV1
Current error ..... OPT)
Error data ··· Refer to the inverter instruction manual for details on the errors.
<table>
<tr><th>Data</th><th>Details</th><th>Data</th><th>Details</th></tr>
<tr><td>H00</td><td>No error</td><td>H60</td><td>OLT</td></tr>
<tr><td>H10</td><td>OC1</td><td>H70</td><td>BE</td></tr>
<tr><td>H11</td><td>OC2</td><td>H90</td><td>OHT</td></tr>
<tr><td>H12</td><td>OC3</td><td>HA0</td><td>OPT</td></tr>
<tr><td>H20</td><td>OV1</td><td>HB0</td><td>PE</td></tr>
<tr><td>H21</td><td>OV2</td><td>HB1</td><td>PUE</td></tr>
<tr><td>H22</td><td>OV3</td><td>HB2</td><td>RET</td></tr>
<tr><td>H30</td><td>THT</td><td>HC0</td><td>CPU</td></tr>
<tr><td>H31</td><td>THM</td><td>HC1</td><td>ECA</td></tr>
<tr><td>H50</td><td>IPF</td><td>HD0</td><td>OS</td></tr>
<tr><td>H51</td><td>UVF</td><td>HD1</td><td>OSD</td></tr>
<tr><td></td><td></td><td>HD2</td><td>ECT</td></tr>
</table></td><td>4 digits</td></tr>
<tr><td>3</td><td colspan="2">Operation command</td><td>HFA</td><td>H00 – HFF : Operation command operation
 

b0: –
b1: Forward run (STF)
b2: Reverse run (STR)
b3: DI1
b4: DI2
b5: DI3
[Example 1]
H02 ··· Select the foward run.</td><td>2 digits</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Data details</th><th>No. of data digits</th></tr>
<tr><td>4</td><td colspan="2">Inverter status monitor</td><td>H7A</td><td>H00 ~ HFF : Inverter operation status
 
b7 b0
0 0 0 0 0 0 1 0
(For example 1)
b0 : Inverter running (RUN)
b1 : In forward run
b2 : In reverse run
b3 : DO1
b4 : DO2
b5 : DO3
b7 : Frequency detection
b8 : Error occurrence
[Example 1] H03 : In forward run operation
[Example 2] H80 : Inverter stopped due to error.</td><td>2 digits</td></tr>
<tr><td>5</td><td colspan="2">Operation speed write (E^2 ROM)</td><td>HEE</td><td>H0000 ~ H0BB8 : Unit 1r/min (hexadecimal) (0 ~ 3000 r/min)
To change the speed continuously, always set the data in the inverter's RAM.
(Command code : HED)</td><td>4 digits</td></tr>
<tr><td>6</td><td colspan="2">Inverter reset</td><td>HFD</td><td>H9696: The inverter is reset.
When communicating from the computer, the inverter will be reset. Thus, the reply data cannot be sent to the computer.</td><td>4 digits</td></tr>
<tr><td>7</td><td colspan="2">Parameter all clear</td><td>HFC</td><td>Each parameter is rest to the default value.
There are four types of all clear used according to the data.
<table><tr><th>Pr. / Data</th><th>Communication Pr.</th><th>Calibration</th><th>Other PR.</th><th>HEC, HED, HEE</th></tr><tr><td>9696H</td><td>○</td><td>×</td><td>○</td><td>○</td></tr><tr><td>9966H</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>5A5AH</td><td>×</td><td>×</td><td>○</td><td>○</td></tr><tr><td>55AAH</td><td>×</td><td>○</td><td>○</td><td>○</td></tr></table>If parameter all clear is executed with H9696 and H9966, the initialization items set in section (4) will also be returned to the default values. Thus, initialization must be re-executed to resume operation.</td><td>4 digits</td></tr>
<tr><td>8</td><td colspan="2">Parameter write</td><td>H80 ~ HFD</td><td rowspan="2">Refer to the command code and data list on the next pages, and read or write the data are required.
Note that there are some parameters that cannot be read or written.</td><td rowspan="2">4 digits</td></tr>
<tr><td>9</td><td colspan="2">Parameter read</td><td>H00 ~ H7B</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Link parameter expansion setting</td><td>Read</td><td>H7F</td><td rowspan="2">The parameter details of the H00 ~ H6C, H80 ~ HEC codes are changed.
H00: The details of Pr.0 to Pr. 99 can be read and written.
H01: The details of Pr.100 to Pr. 905 can be read and written.</td><td rowspan="2">2 digits</td></tr>
<tr><td>Write</td><td>HFF</td></tr>
<tr><td rowspan="2">11</td><td rowspan="2">No. 2 parameter changeover (Code FF = 1)</td><td>Read</td><td>H6C</td><td rowspan="2">Within H5E ~ H6A, HDE ~ HEA (Code FF=1):
H000: Offset/gain
H001: Analog
H002: Terminal analog value</td><td rowspan="2">4 digits</td></tr>
<tr><td>Write</td><td>HEC</td></tr>
</table>

HEC, HF3 and HFF are 0 when the power is turned ON. However, once set. they are held. They can be reset to 0 with all clear.
(HFF = 1) (HFF = 0, 1) (HFF = 0.1)

7.8 Performance specifications

Item	Specification	
Applicable standards	RS-422 (EIA*1 Standards) } common RS-485 (EIA*1 Standards) }	
Transmission format	Multi-drop link method	
Compatible inverter	FR-V200	
Compatible computer	Computer with RS-422 or RS-485 interface function.*2	
No. of connected inverters	For RS-422 computer interface	Max. 10 units
	For RS-485 computer interface	Max. 32 units
Transmission distance	Max. total length 500m	

*1 EIA: Electronic Industries Association
*2 A computer with RS-232-C interface can be used by using a converter.

7.9 Hardware specifications

Item		Specification
Shape		Inverter built-in optional PCB (Connect to the inverter with a connector)
Power supply	Control power supply	DC5V supplied from inverter
	Communication power supply	DC5V max. 60mA
Connection method		Terminal block connection

7.10 Communication specifications

Item		Specification
Baud rate		Select from 19200, 9600, 4800, 2400, 1200, 600 or 300 baud.
Inverter response time		The time for the control such as inverter starting or stopping to start after the computer starts communication differs according to the baud rate.

Baud rate (baud)	19200	9600	4800	2400	1200	600	300
Response time (msec)	Approx. 10	Approx. 15	Approx. 24	Approx. 43	Approx. 80	Approx. 155	Approx. 302

Control procedure		Start-stop synchronization
Communication method		Half-duplex
Character method		Select from ASCII (7 bits/8 bits)
Stop bit length		Select from 1/2 bit
Check method	Parity check	Select from valid (even/odd) or none
	Sum check	Valid

Data code list [When link parameter expansion setting (Data code 7F) is set to 0]

Parameter No.	Name	Data code Read	Data code Write	Setting range	Min. setting unit	Default value
0	—	—	—			
1	Upper limit setting	01	81	0 ~ 3000r/min	1r/min	1500r/min
2	Lower limit setting	02	82	0 ~ 3000r/min	1r/min	0r/min
3	—	—	—			
4	3-speed setting (high speed)	04	84	0 ~ 3000r/min	1r/min	1500r/min
5	3-speed setting (middle speed)	05	85	0 ~ 3000r/min	1r/min	750r/min
6	3-speed setting (low speed)	06	86	0 ~ 3000r/min	1r/min	150r/min
7	Acceleration time	07	87	0 to 3600 sec.	0.1 sec.	5 sec./15 sec.
8	Deceleration time	08	88	0 to 3600 sec.	0.1 sec.	5 sec./15 sec.
9	—	—	—			
10	DC braking operation speed	0A	8A	0 to 1500r/min, 9999	1r/min	90r/min
11	DC braking operation time	0B	8B	0 to 10 sec., 9999	0.1 sec.	0.5 sec.
12	DC braking operation voltage	0C	8C	0 ~ 30%	0.1 %	3 %
13	Starting speed	0D	8D	0 ~ 1500r/min	1r/min	15r/min
14	Control mode	0E	8E	0 ~ 6	Integer	0
15	JOG speed setting	0F	8F	0 ~ 1500r/min	1r/min	300r/min
16	JOG acceleration/deceleration time	10	90	0 to 3600 sec.	0.1 sec.	0.5 sec.
17	Input terminal assignment	11	91	0 ~ 999	Integer	12
18	—	—	—			
19	—	—	—			
20	Acceleration/deceleration reference speed	14	94	0 ~ 3000r/min	1r/min	1500r/min
21	—	—	—			
22	—	—	—			
23	—	—	—			
24	Multi-speed setting (4th speed)	18	98	0 ~ 3000r/min, 9999	1r/min	9999
25	Multi-speed setting (5th speed)	19	99	0 ~ 3000r/min, 9999	1r/min	9999
26	Multi-speed setting (6th speed)	1A	9A	0 ~ 3000r/min, 9999	1r/min	9999
27	Multi-speed setting (7th speed)	1B	9B	0 ~ 3000r/min, 9999	1r/min	9999
28	Multi-speed compensation selection	1C	9C	0, 1	Integer	0
29	Acceleration/deceleration pattern	1D	9D	0, 1	Integer	0
30	Regenerative brake selection	1E	9E	0, 1	Integer	0
31	Speed deflection level	1F	9F	0 ~ 1500r/min, 9999	1r/min	9999
32	Overspeed detection level	20	A0	0 ~ 3000r/min	1r/min	3000r/min
33	Torque limit mode	22	A2	1, 2, 3, 4	Integer	3
34	Torque limit level	21	A1	0 ~ 200%	0.1%	150%
35	Torque limit level (regenerative)	23	A3	0 ~ 200%, 9999	0.1%	9999
36	Torque limit level (3rd quadrant)	24	A4	0 ~ 200%, 9999	0.1%	9999
37	Torque limit level (4th quadrant)	25	A5	0 ~ 200%, 9999	0.1%	9999
38	Torque limit level 2	26	A6	0 ~ 200%, 9999	0.1%	9999
39	Torque detection	27	A7	0 ~ 200%	0.1%	150%
40	Output terminal assignment	28	A8	0 ~ 999	Integer	12
41	Speed reached operation width	29	A9	0 ~ 100%	0.1%	10%
42	Speed detection	2A	AA	0 ~ 3000r/min	1r/min	300r/min
43	Low speed detection	2B	AB	0 ~ 1500r/min	1r/min	45r/min
44	No. 2 acceleration/deceleration time	2C	AC	0 to 3600 sec.	0.1 sec.	5 sec.
45	No. 2 deceleration time	2D	AD	0 to 3600 sec., 9999	0.1 sec.	9999
46	—	—	—			
47	Torque boost	2F	AF	0 ~ 30%	0.1%	3%
48	Base frequency	30	B0	50 ~ 200Hz	0.01Hz	60Hz
49	Base frequency voltage	31	B1	0 ~ 500V, 9999	0.1V	9999
50	—	—	—			

Data code list [When link parameter expansion setting (Data code 7F) is set to 0]

Parameter No.	Name	Data code Read	Data code Write	Setting range	Min. setting unit	Default value
51	Main unit LED display data	33	B3	1 ~ 8, 17	Integer	1
52	PU main display data	34	B4	0, 17, 20	Integer	0
53	PU level meter display data	35	B5	0 ~ 3, 5 ~ 8, 17	Integer	1
54	DA1 terminal function selection	36	B6	1 ~ 3, 5 ~ 8, 17, 21	Integer	1
55	DA2 terminal function selection	37	B7	1 ~ 3, 5 ~ 8, 17, 21	Integer	7
56	Speed monitor reference	38	B8	0 ~ 3000r/min	1r/min	1500r/min
57	Current monitor reference	39	B9	0 ~ 500A	1A	Rated value
58	Torque monitor reference	3A	BA	0 ~ 200%	0.1%	100%
59	Language changeover	3B	BB	0, 9999	1	9999
60	—	—	—			
61	—	—	—			
62	—	—	—			
63	—	—	—			
64	—	—	—			
65	—	—	—			
66	—	—	—			
67	—	—	—			
68	—	—	—			
69	—	—	—			
70	Regenerative brake usage rate	46	C6	0 ~ 30%	0.1%	0%
71	—	—	—			
72	Carrier frequency selection	48	C8	0 ~ 6	Integer	6
73	Speed setting signal	49	C9	0 ~ 3	Integer	0
74	—	—	—			
75	PU stop key selection	4B	CB	0, 1	Integer	1
76	Fault definition	4C	CC	0, 1	Integer	0
77	Parameter write prevention selection	—	—	0, 1, 2	Integer	0
78	Reverse run prevention selection	4E	CE	0, 1, 2	Integer	0
79	Operation mode selection	—	—	0, 1, 2	Integer	0
80	Speed control P gain 1	50	D0	0 ~ 1000%	1%	30%
81	Speed control I gain 1	51	D1	0 ~ 1000%	0.1%	3%
82	Speed setting filter 1	52	D2	0 to 5 sec.	0.001 sec.	0 sec.
83	Speed detection filter 1	53	D3	0 to 5 sec.	0.001 sec.	0 sec.
84	Torque control P gain 1	54	D4	0 ~ 1000%	1%	100%
85	Torque control I gain 1	55	D5	0 ~ 1000%	1%	100%
86	Torque setting filter 1	56	D6	0 to 5 sec.	0.001 sec.	0 sec.
87	Torque detection filter 1	57	D7	0 to 5 sec.	0.001 sec.	0 sec.
88	—	—	—			
89	—	—	—			
90	Speed control P gain 2	5A	DA	0 ~ 1000%	1%	30%
91	Speed control I gain 2	5B	DB	0 ~ 1000%	0.1%	3%
92	Speed setting filter 2	5C	DC	0 to 5 sec.	0.001 sec.	0 sec.
93	Speed detection filter 2	5D	DD	0 to 5 sec.	0.001 sec.	0 sec.
94	Torque control P gain 2	5E	DE	0 ~ 1000%	1%	100%
95	Torque control I gain 2	5F	DF	0 ~ 1000%	1%	100%
96	Torque setting filter 2	60	E0	0 to 5 sec.	0.001 sec.	0 sec.
97	Torque detection filter 2	61	E1	0 to 5 sec.	0.001 sec.	0 sec.
98	—	—	—			
99	—	—	—			
100	DI selection A1	00	80	0 ~ 999	1	0

Data code list [When link parameter expansion setting (Data code 7F) is set to 0]

Parameter No.	Name	Data code Read	Data code Write	Setting range	Min. setting unit	Default value
101	DI selection A2	01	81	0 ~ 999	1	0
102	DO selection A1	02	82	0 ~ 999	1	0
103	—	—	—			
104	—	—	—			
105	—	—	—			
106	—	—	—			
107	PLG division	07	87	0 ~ 4	1	0
108	—	—	—			
109	—	—	—			
110	—	—	—			
111	—	—	—			
112	—	—	—			
113	—	—	—			
114	—	—	—			
115	—	—	—			
116	—	—	—			
117	—	—	—			
118	—	—	—			
119	—	—	—			
120	Baud rate	14	94	3, 6, 12, 24, 48, 96, 192	1	96
121	Stop bit length	15	95	0, 1, 10, 11	1	1
122	Parity check	16	96	0 ~ 2	1	2
123	CR, LF validity	17	97	0 ~ 2	1	1
124	Station No. setting	18	98	0 ~ 31	1	0
125	Maximum communication time interval value	19	99	0, 9999, 0.1 ~ 999.8	0.1	0
126	Maximum No. of communication retries value	1A	9A	0 ~ 10	1	1
127	Link starting mode selection	1B	9B	0 ~ 2	1	0
128	Operation command operation site selection	1C	9C	0, 1	1	0
129	Speed command operation site selection	1D	9D	0, 1	1	0
130	Serial link E^2ROM write selection	1E	9E	0, 1	1	0
131	Command pulse scale numerator	1F	9F	0 ~ 32767	Integer	1
132	Command pulse scale denominator	20	A0	0 ~ 32767	Integer	1
133	Position loop gain	21	A1	0 ~ 150	Integer	25
134	Feed forward gain	22	A2	0 ~ 100%	1%	0
135	Position command acceleration/deceleration time constant	23	A3	0 to 50 sec.	0.001 sec.	0
136	Feed forward command filter	24	A4	0 to 5 sec.	0.001 sec.	0
137	Positioning complete width	25	A5	0 ~ 32767	Integer	100
138	Excessive error level	26	A6	0 ~ 400K	1K	40K
139	Command pulse selection	27	A7	0 ~ 5	Integer	0
140	Clear signal selection	28	A8	0, 1	Integer	1
141	Pulse monitor selection	29	A9	0 ~ 5, 9999	Integer	9999
142	—	—	—			
143	—	—	—			
144	—	—	—			
145	—	—	—			
146	—	—	—			
147	—	—	—			

Data code list [When link parameter expansion setting (Data code 7F) is set to 0]

Parameter No.	Name		Data code Read	Data code Write	Setting range	Min. setting unit	Default value
148	—		—	—			
149	—		—	—			
150	—		—	—			
151	—		—	—			
152	—		—	—			
153	—		—	—			
154	—		—	—			
155	—		—	—			
156	—		—	—			
157	—		—	—			
158	—		—	—			
159	—		—	—			
900	DA1 terminal calibration		5C	DC	—	—	—
901	DA2 terminal calibration		5D	DD	—	—	—
902	Speed setting No. 2 bias		5E	DE	0 ~ 10V ¦ 0 ~ 3000r/min	1r/min	(0V) ¦ 0r/min
903	Speed setting No. 2 gain		5F	DF	0 ~ 10V ¦ 0 ~ 3000r/min	1r/min	(10V) ¦ 1500r/min
904	Torque command No. 3 bias		60	E0	0 ~ 10V ¦ 0 ~ 200%	0.1%	(0V) ¦ 0%
905	Torque command No. 3 gain		61	E1	0 ~ 10V ¦ 0 ~ 200%	0.1%	(10V) ¦ 150%
—	No. 2 parameter changeover		6C	EC	00, 01, 02	1	00
—	Speed setting	Operation speed (RAM)	6D	ED	0 ~ 3000r/min	1r/min	0r/min
—		Operation speed (E^2ROM)	6E	EE	0 ~ 3000r/min	1r/min	0r/min
—	Monitor	Operation speed monitor	6F	—	0 ~ 3000r/min	1r/min	
—		Output current monitor	70	—	0 ~ 500A	0.01A	
—		Output voltage monitor	71	—	0 ~ 1000V	0.1V	
—		Special monitor	72	—	—	—	
—		Special monitor selection No.	73	F3	1 ~ 14	1	1
—	Error display	Latest No. 1, No. 2/error display clear	74	F4	9696H		
—		Latest No. 3, No. 4	75	—			
—		Latest No. 5, No. 6	76	—			
—		Latest No. 7, No. 8	77	—			
—	Inverter status/operation command		7A	FA	00 ~ FF		
—	Operation mode acquisition (write)		7B	FB	0, 1, 2 (2 cannot be set)		0
—	Parameter all clear		—	FC	9696H, 9966H, 5A5AH, 55AAH		—
—	Inverter reset		—	FD	9696H		—
—	Link parameter expansion setting		7F	FF	0: Pr. 0 ~ 99, 1: Pr. 100 ~ 915	1	0

MEMO

REVISIONS

※The manual number is given on the bottom left of the back cover.

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