MITSUBISHI ELECTRIC

VECTOR INVERTER

-INSTRUCTION MANUAL-

POSITION CONTROL

FR-V5AP

Thank you for choosing the Mitsubishi vector inverter option unit.
This instruction manual gives handling information and precautions for use of this equipment. Incorrect handling might cause an unexpected fault. Before using the equipment, please read this manual carefully to use the equipment to its optimum.
Please forward this manual to the end user.

This section is specifically about safety matters

Do not attempt to install, operate, maintain or inspect this product until you have read through this instruction manual and appended documents carefully and can use the equipment correctly. Do not use this product 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**	**Assumes that incorrect handling may cause hazardous conditions, resulting in medium or slight injury, or may cause physical damage only.**

Note that the CAUTION level may lead to a serious consequence according to conditions. Please follow the instructions of both levels because they are important to personnel safety.

SAFETY INSTRUCTIONS

1. Electric Shock Prevention

⚠ WARNING

- **While power is on or when the inverter is running, do not open the front cover. You may get an electric shock.**
- **Do not run the inverter with the front cover removed. Otherwise, you may access the exposed high-voltage terminals and charging part and get an electric shock.**
- **If power is off, do not remove the front cover except for wiring or periodic inspection. You may access the charged inverter circuits and get an electric shock.**
- **Before starting wiring or inspection, switch power off, wait for more than 10 minutes, and check for no residual voltage with a tester or the like.**

⚠ WARNING

- Any person who is involved in the wiring or inspection of this equipment should be fully competent to do the work.
- Always install the option unit before wiring. Otherwise, you may get an electric shock or be injured.
- Handle this option unit with dry hands to prevent an electric shock.
- Do not subject the cables to scratches, excessive stress, heavy loads or pinching. Otherwise, you may get an electric shock.

2. Injury Prevention

⚠ CAUTION

- Apply only the voltage specified in the instruction manual to each terminal to prevent burst, damage, etc.
- Ensure that the cables are connected to the correct terminals. Otherwise, burst, damage, etc. may occur.
- Always make sure that polarity is correct to prevent burst, damage, etc.
- While power is on or for some time after power-off, do not touch the inverter as it is hot and you may get burnt.

3. Additional instructions

Also note the following points to prevent an accidental failure, injury, electric shock, etc.:

(1) Transportation and mounting

⚠ CAUTION

- Do not install or operate the option unit if it is damaged or has parts missing.
- Do not stand or rest heavy objects on the product.
- Check that the mounting orientation is correct.
- Prevent screws, metal fragments or other conductive bodies or oil or other flammable substance from entering the inverter.

(2) Test operation and adjustment

⚠ CAUTION

- Before starting operation, confirm and adjust the parameters. A failure to do so may cause some machines to make unexpected motions.

(3) Usage

⚠ WARNING
● Do not modify the equipment.

⚠ CAUTION
● When parameter clear or all parameter clear is performed, each parameter returns to the factory setting. Re-set the required parameters before starting operation. ● For prevention of damage due to static electricity, touch nearby metal before touching this product to eliminate static electricity from your body.

(4) Maintenance, inspection and parts replacement

⚠ CAUTION
● Do not test the equipment with a megger (measure insulation resistance).

(5) Disposal

⚠ CAUTION
● Treat as industrial waste.

(6) General instruction

All illustrations given in this manual may have been drawn with covers or safety guards removed to provide in-depth description. Before starting operation of the product, always return the covers and guards into original positions as specified and operate the equipment in accordance with the manual.

CONTENTS

1.PRE-OPERATION INSTRUCTIONS

1.1 Unpacking and Product Confirmation

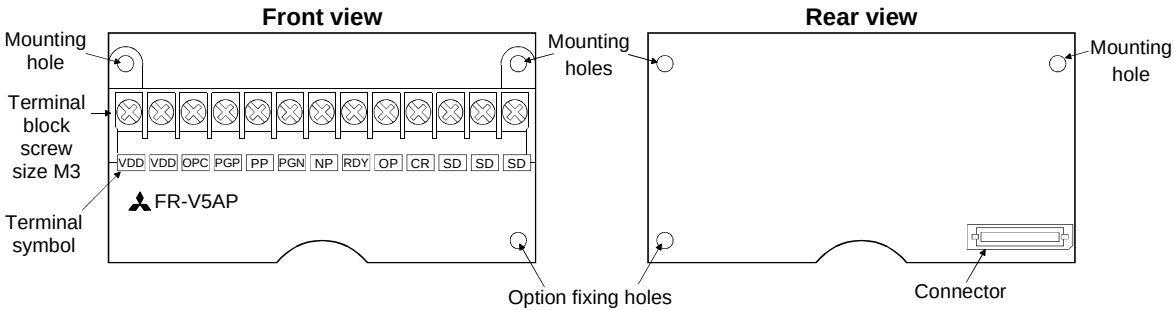
Take the option unit out of the package, check the unit name, and confirm that the product is as you ordered and intact.
This product is an option unit designed for exclusive use in the Mitsubishi FR-V500 series vector inverter.

1.2 Packing Confirmation

Make sure that the package includes the following

- Instruction manual.....1
- Mounting screws M3 × 10 2

1.3 Structure



2.INSTALLATION

2.1 Pre-Installation Instructions

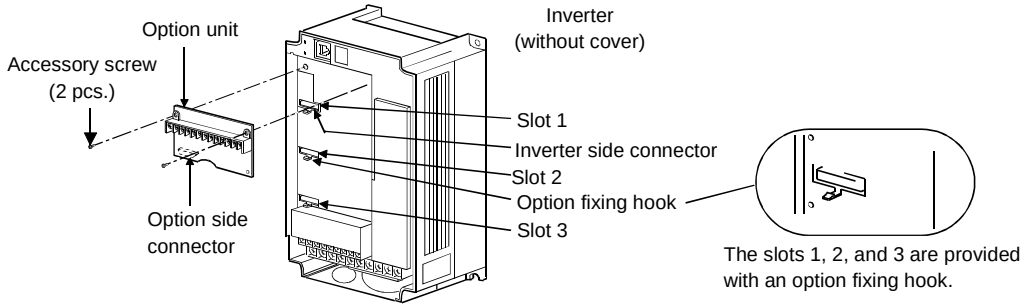
Make sure that the input power of the inverter is off.

⚠ CAUTION
⚠ **With input power on, do not install or remove the option unit. Otherwise, the inverter and option unit may be damaged.**

2.2 Installation Procedure

(1) Securely insert the connector of the option unit far into the connector of the inverter. At this time, fit the option fixing holes snugly. Also be sure to fit the unit into the option fixing hook.

(2) Securely fix the two right and left places of the option unit to the inverter with the accessory mounting screws. If the screw holes do not line up, the connector may not have been plugged snugly. Check for looseness.



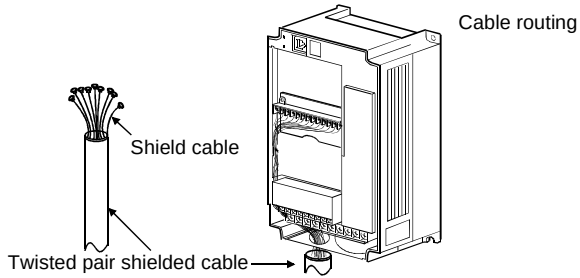
CAUTION

1. **Only one type of option per inverter may be used. When two or more options are mounted, priority is in order of slots 1, 2 and 3, the options having lower priority are inoperative.**
2. **When the inverter cannot recognize that the option is mounted, it displays the option error. The errors shown differ according to the mounting slots 1, 2, 3.**

Mounting Position	Error Display
Slot 1	E.OP1
Slot 2	E.OP2
Slot 3	E.OP3

2.3 Wiring

Route the wires so that they do not take up a lot of space in the control circuit terminal block of the option unit. During wiring, do not leave wire off-cuts in the inverter. They may cause a fault, failure or malfunction. Use the space on the left side of the control circuit terminal unit to route the wires.



REMARKS

The wires with large gaze may not be connected to the terminal block. When connected in parallel, all wires may not fit in the wiring space due to the increased number of wires. In such cases, perform wiring by using a junction terminal block.

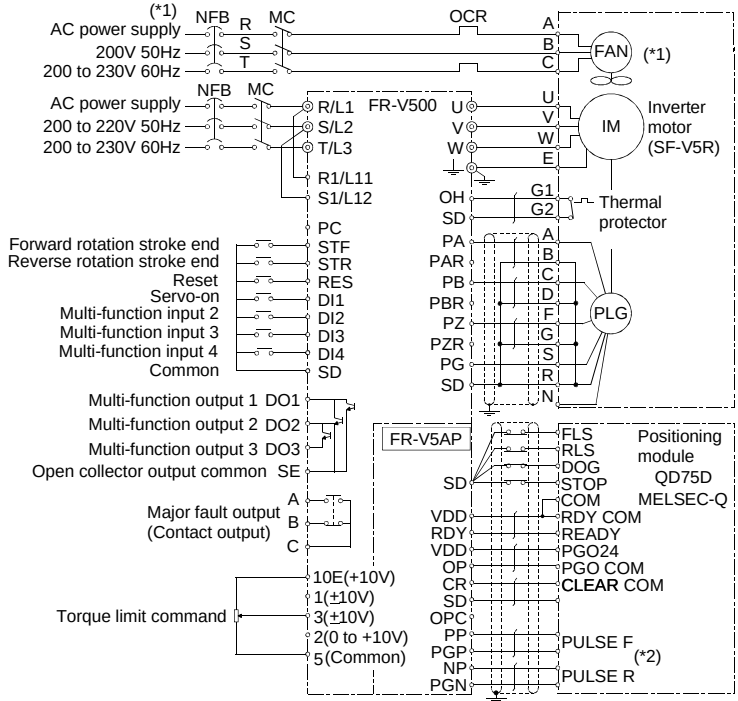
⚠ CAUTION

⚠ **When installing the inverter front cover, the cables to the inverter's control circuit terminals and option terminals should be routed properly in the wiring space to prevent them from being caught between the inverter and its cover.**

3. POSITION CONTROL FUNCTION

3.1 Connection Example

Example: Connection with the MELSEC-Q series QD75D positioning module



(*1) The inverter motor fan power supply is single-phase for 7.5kW or less.

(*2) The pulse signals from the positioning module may either be open collector or differential line driver signals. In that case, connection differs between them. (The example shown is for the differential line driver.

Refer to the terminal specifications on page 6 for the connection method.)

◎ Main circuit terminals
○ Control circuit terminals

3.2 Terminal Specifications

3.2.1 Terminal specifications

Terminal Symbol	Terminal Name	Rated Current, etc.	Application	
PGP PP	Forward rotation pulse train	Open collector system/differential line driver system	Forward rotation pulse train input terminal. Input a pulse train from a pulse generation module.	For the open collector system, connect a VDD24V power and OPC open collector power supply and input pulses to PP-SD and NP-SD. For the differential line driver system, disconnect the OPC open collector power supply and input pulses to PP-PGP and NP-PGN. (Refer to page 15.)
PGN NP	Reverse rotation pulse train		Reverse rotation pulse train input terminal. Input a pulse train from a pulse generation module.	
CR	Clear terminal	——	Shorting the terminals CR-SD clears the counter on the trailing edge of the signal.	
OPC	Open collector power supply input	24VDC	Connect this terminal to the VDD terminal (24V power supply) when inputting pulses in the open collector system. (Refer to page 15.)	
SD	Contact input common	——	Contact input common terminal. Do not connect it to the earth.	
VDD	Driver power supply	24VDC	Driver power supply terminal for interface.	
RDY	Ready signal	——	Outputs a signal in an operation ready status after servo-on.	
OP	PLG Z-phase output terminal	Open collector output Permissible load 24VDC, max. 50mA	Outputs one pulse per motor revolution.	

3.3 Operation

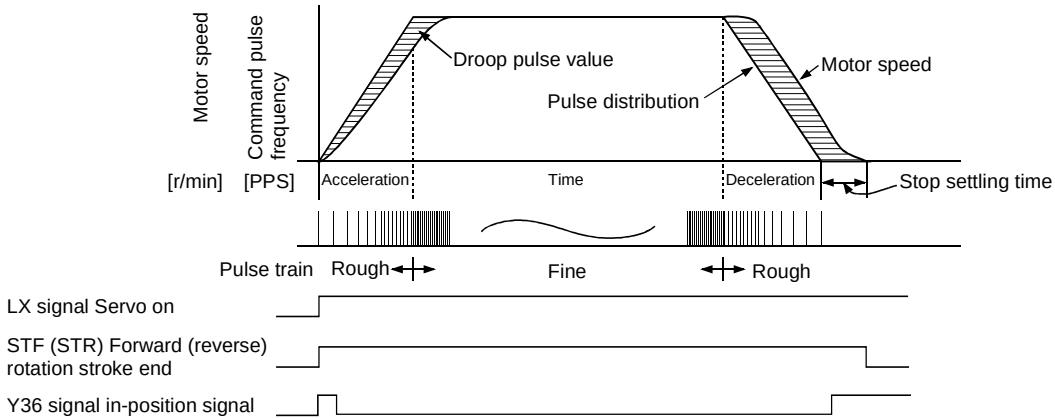
The command pulse train given to rotate the motor is calculated to zero the difference between the number of command pulse train pulses and the number of pulses feed back from the motor end PLG.

(1) When a pulse train (MELSEC-Q series QD75D positioning module or the like) is input, pulses are accumulated in the deviation counter and these droop pulses act as position control pulses to give the speed command.

(2) As soon as the motor starts running under the speed command of the inverter, the encoder generates feed back pulses and the droop of the deviation counter is counted down. The deviation counter maintains a given droop pulse value to keep the motor running.

(3) When the command pulse input stops, the droop pulses of the deviation counter decrease, reducing the speed. The motor stops when there are no droop pulses.

(4) When the number of droop pulses has fell below the value set in Pr.426 (in-position width), it is regarded as completion of positioning and the in-position signal (Y36) turns on.



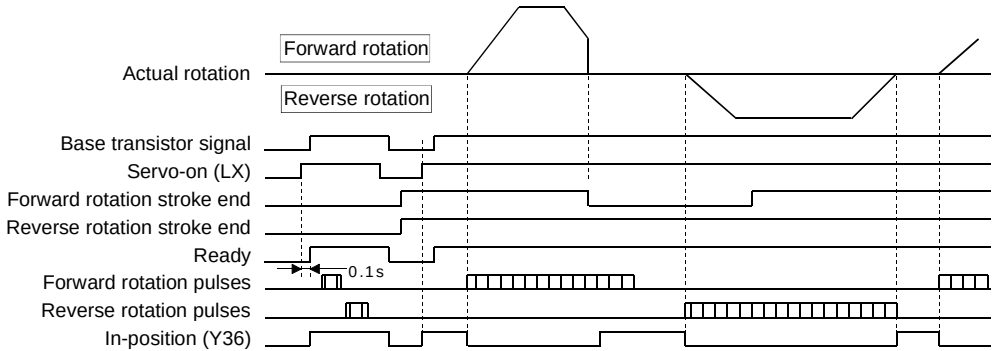
- The pulse train is rough during acceleration and coarse at the maximum speed.
  During deceleration the pulse train is rough and at last there are no pulses.
  The motor stops shortly after the command pulse stops. This time lag is necessary for maintaining the stop accuracy and called stop setting time.

REMARKS

- Servo on (LX) signal : Set "23" in any of Pr. 180 to Pr. 183 and Pr. 187 (input terminal function selection).
- In-position signal (Y36) : Set "36" in any of Pr.190 to Pr.192 and Pr.195 (output terminal function selection).

3.3.1 Pulse train-based position command ON/OFF

When the servo-on signal is turned on (terminals LX-SD are shorted), base transistor shut-off is canceled, and 0.1s later, the ready signal is output. Assign the servo ON (LX) signal in input terminal function selection "Pr.180 to Pr.183 and Pr.187". When the terminal STF (forward rotation stroke end signal) or terminal STR (reverse rotation stroke end signal) and terminal SD are shorted at this time, the motor starts rotating in accordance with the command pulses. When the forward (reverse) rotation stroke end signal is opened, the motor does not run in the corresponding direction.



3.3.2 Initial setting

(1) Short terminals LX-SD (servo-on) to switch the servo on, cancel base shut-off, and servo-lock the motor.
(2) Open terminals LX-SD to shut off the base circuit.
(3) Short the terminal STF (forward rotation stroke end) or terminal STR (reverse rotation stroke end) and the SD terminal.
(4) Input the command pulses to rotate the motor under the pulse command.

3.3.3 Electronic gear setting

Adjust the ratio of the machine side and motor side gears.
The position resolution (travel per pulse $\Delta\ell$ [mm]) is determined by the travel per motor revolution Δs [mm] and detector feedback pulses Pf [pulses/revolution] and is expressed by the following formula:

$$\Delta\ell = \frac{\Delta s}{Pf}$$

$\Delta\ell$:Travel per pulse [mm]
Δs :Travel per motor revolution [mm]
Pf :Number of feedback pulses [pulse/rev] (The number of pulses after multiplying the number of PLG pulses by 4.)

REMARKS

- When SF-V5R is used : Number of PLG pulses = 2048 pulse
  Pf = 2048 pulse/rev × 4 multiplied = 8192 pulse/rev
- When SF-VR is used : Number of PLG pulses = 1000 pulse
  Pf = 1000 pulse/rev × 4 multiplied = 4000 pulse/rev

Since command pulses are converted to position control pulses multiplied by Pr.420/Pr.421 using parameters, the travel $\Delta\ell$ per pulse is expressed by the following fomula:

$$\Delta\ell = \frac{\Delta s}{Pf} \times \frac{Pr.420}{Pr.421}$$

Hence, the travel per command pulse can be set to a fraction-free value.
The relationship between the motor speed and command pulse frequency is as follows:

$$fo \times \frac{Pr.420}{Pr.421} = Pf \times \frac{No}{60}$$

fo: Command pulse frequency [pps]
No: Motor speed [r/min]

[Setting example 1]

Example of setting the command pulse scale factor (Pr. 420, Pr. 421) when the QD75D is used

Find the command pulse scale factor for running the motor at 1500 (r/min) at the input pulse train frequency of 100 (kpps).

- When SF-V5R is used

On the assumption that the number of Feedback pulses Pf is 8192 (pulses/revolution)

$$\frac{Pr.420}{Pr.421} = 8192 \times \frac{No}{60} \times \frac{1}{fo}$$

$$= 8192 \times \frac{1500}{60} \times \frac{1}{100 \times 10^3} = \frac{2048}{1000}$$

Hence, set "2048" in Pr. 420 and "1000" in Pr. 421.

- When SF-VR is used

On the assumption that the number of Feedback pulses Pf is 4000 (pulses/revolution)

$$\frac{Pr.420}{Pr.421} = 4000 \times \frac{No}{60} \times \frac{1}{fo}$$

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

Hence, set "1" in Pr. 420 and "1" in Pr. 421.

[Setting example 2]

Find the command pulse frequency to run the motor at speed No of 3000 (r/min).
Note that the command pulse scale factor Pr. 420/Pr. 421 = 1.

- When SF-V5R is used

On the assumption that the number of Feedback pulses Pf is 8192 (pulses/revolution)

$$fo = 8192 \times \frac{No}{60} \times \frac{Pr.421}{Pr.420}$$

$$= 8192 \times \frac{3000}{60} \times \frac{1}{1} = 409.6 \times 10^3$$

Hence, the command pulse frequency is 409.6 [kpps].

CAUTION

The command pulse frequency max. is 200 kpps if the pulse train is input when open collector system is selected for the PLG.
Hence, the command pulse frequency needs to be 200 kpps with the command pulse ratio setting Pr.420/Pr.421.

- When SF-VR is used

On the assumption that the number of Feedback pulses Pf is 4000 (pulses/revolution)

$$fo = 4000 \times \frac{No}{60} \times \frac{Pr.421}{Pr.420}$$

$$= 4000 \times \frac{3000}{60} \times \frac{1}{1} = 200 \times 10^3$$

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

<Relationship between $\Delta\ell$ and overall accuracy>

Since overall accuracy (positioning accuracy of machine) is the sum of electrical error and mechanical error, normally take measures to prevent the electrical system error from affecting the overall error. As a guideline, refer to the following relationship.

$$\Delta\ell < \left(\frac{1}{5} \text{ to } \frac{1}{10}\right) \times \Delta\varepsilon$$

$\Delta\varepsilon$: Positioning accuracy

<Motor stopping characteristics>

When running the motor using the parameters, pulses indicating the delays of the motor speed from the command pulse frequency are accumulated in the deviation counter of the inverter. These pulses are called droop pulses (ε), and the command pulse frequency (fo) and position loop gain (Kp: Pr. 422) have the relationship as indicated by the following formula:

When command pulse frequency is 200 kpps.

$$\varepsilon = \frac{fo}{Kp} \text{ [pulse]} \qquad \varepsilon = \frac{200000}{25} \text{ [pulse] (At rated motor speed)}$$

When Kp is as factory - set = $25s^{-1}$, the droop pulses (ε) are 8000 pulses.

Since the inverter has droop pulses during operation, the settling time (ts) is required from when a 0 command is given until when the motor stops. The settling time should be taken into consideration when setting the operation pattern.

$$ts \fallingdotseq 3 \times \frac{1}{Kp} \text{ [s]}$$

When Kp is as factory - set = $25s^{-1}$, the settling time (ts) is about 0.12s.

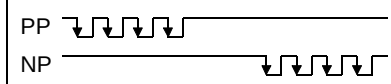
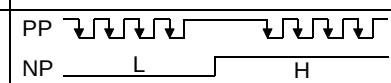
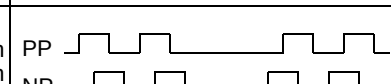
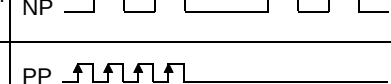
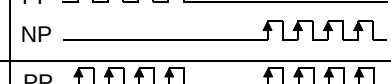
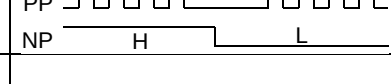
CAUTION

The settling time (ts) indicates the time required by the motor to settle in the necessary positioning accuracy range. It does not indicate the time required for the motor to stop completely. When the positioning accuracy does not have an allowance for the travel per pulse ($\Delta\ell$) in high duty applications, for example, a longer setting time than the value derived from the above formula must be considered. Note that ts also differs with the conditions of the moving sections. Particularly at a large load friction torque, the motor may run unstably when it is coming to a stop.

3.4 Pulse Input Types

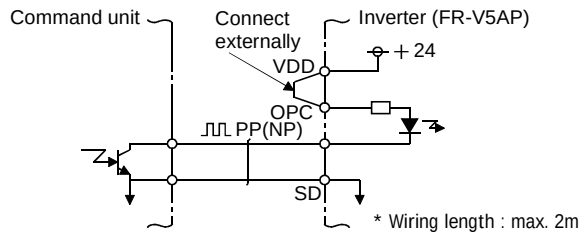
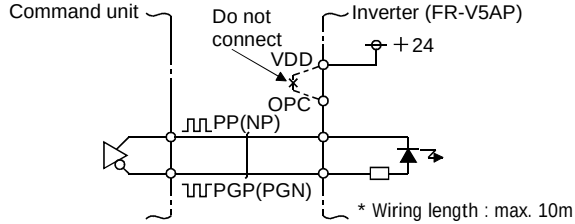
For command pulses, a forward/reverse rotation pulse train is generally entered in the open collector system, which is also used by the MELSEC-Q series programmable controller positioning module. The FR-V500 series is designed to allow any of the following pulse trains to be selected by changing the parameter value so that it may be used with various command units in addition to the above positioning module.

(1) Pulse train format types

Command Pulse Train Format		Forward Rotation / Reverse Rotation	Pr. 428 Setting	Remarks
Negative logic	Forward rotation pulse train		0 (factory setting)	QD75D (CW/CCW mode) Note: If selection between (CW/CCW mode) and (PLS/SIGN mode) is wrong, the motor is held stationary in one direction.
Negative logic	Pulse train + sign		1	QD75D (PLS/SIGN mode)
Negative logic	A-phase pulse train B-phase pulse train		2	Pulse train frequency is counted after multiplication by 4. Pulse train frequency is 500kpps or less in the differential driver system and 200kpps or less in the open collector system.
Positive logic	Forward rotation pulse train Reverse rotation pulse train		3	
Positive logic	Pulse train + sign		4	
Positive logic	A-phase pulse train B-phase pulse train		5	Pulse train frequency is counted after multiplication by 4. Pulse train frequency is 500kpps or less in the differential driver system and 200kpps or less in the open collector system.

3.5 Interface between Positioning Module and Inverter

When running the inverter with any positioning module, the position command pulse train interface must be matched with the corresponding format.

Output Format	Hardware Type	Input Pulse Frequency
Open collector		Max. 200 kpps
Differential line driver		Max. 500 kpps

3.6 Parameter List

Parameter No.	Name	Setting Range	Minimum Setting Increments	Factory Setting	Description
419	Position command right selection	0, 1(*1)	1	0	Set position command input.
420	Command pulse scale factor numerator	0 to 32767	1	1	Set the electronic gear.
421	Command pulse scale factor denominator	0 to 32767	1	1	
422	Position loop gain	0 to 150s^{-1}	1s^{-1}	25s^{-1}	Set the gain of the position loop.
423	Position feed forward gain	0 to 100%	1%	0%	Function to cancel a delay caused by the droop pulses of the deviation counter.
424	Position command acceleration/ deceleration time constant	0 to 50s	0.001s	0s	
425	Position feed forward command filter	0 to 5s	0.001s	0s	Enter the primary delay filter in response to the feed forward command.
426	In-position width	0 to 32767 pulses	1 pulse	100 pulses	The in-position signal turns on when the droop pulses become less than the setting.
427	Excessive error level	0 to 400K, 9999	1K	40K	An error becomes excessive when the droop pulses exceed the setting.
428(*2)	Command pulse selection	0 to 5	1	0	Selection of the command pulse train
429(*2)	Clear signal selection	0, 1	1	1	Used to zero the number of droop pulses for a home position return etc.
430	Pulse monitor selection	0 to 5, 9999	1	9999	Display the number of pulses.
800	Control system selection	0 to 5, 20	1	0	

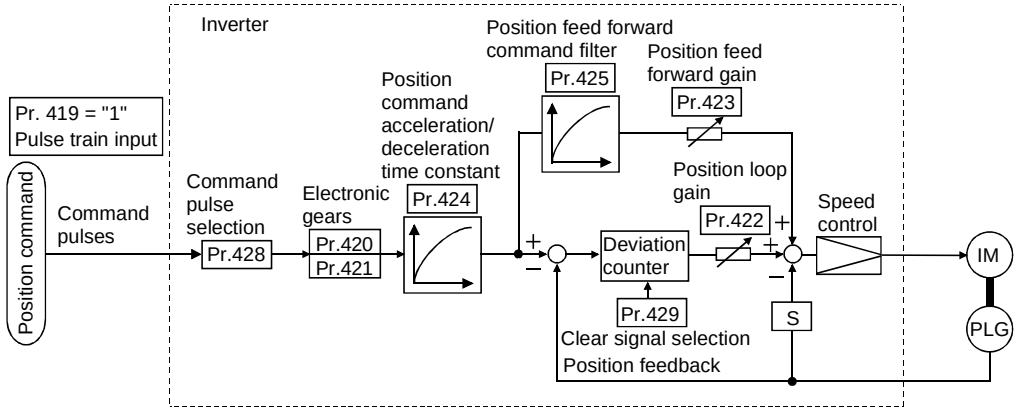
*1 Setting "1" in Pr.419 is enabled when the FR-V5AP is fitted.

*2 Setting is enabled when the FR-V5AP is fitted.

3.7 Setting and Details of the Parameters

When fitting the FR-V5AP to exercise position control, set the following parameters.

3.7.1 Block diagram



3.7.2 Control system selection

When exercising position control, set "3", "4" or "5" in Pr. 800. This parameter setting changes the functions of the control circuit terminals. (When the setting value is either "4" or "5", position control needs to be selected by switching MC signal. Refer to the instruction manual (basic) of the inverter for details.)

Parameter No.	Name	Factory Setting	Setting Range
800	Control system selection	0	0 to 5, 20

POSITION CONTROL FUNCTION

The terminal functions change as shown below with control mode switchover.

Classification	Terminal Name	Description		
		Pr. 800 = "3"	**Pr. 800 = "4"**	**Pr. 800 = "5"**
		Position Control	**Speed Control/Position Control Switchover (MC signal:ON/OFF)**	**Position Contorl/Torque Control Switchover (MC signal:ON/OFF)**
Contact input signal	STF	Forward rotation stroke end	Forward rotation command/ forward rotation stroke end	Foward rotaion stroke end/ forward rotation command
	STR	Reverse rotation stroke end	Reverse rotation command/ reverse rotation stroke end	Reverse rotation stroke end/ reverse rotation command
	DI1	Multi-function input 1	←	←
	DI2	Multi-function input 2	←	←
	DI3	Multi-function input 3	←	←
	DI4	Multi-function input 4	←	←
Contact output	ABC	Alarm contact	←	←
Open collector output	DO1	Multi-function output 1	←	←
	DO2	Multi-function output 2	←	←
	DO3	Multi-function output 3	←	←
Analog input	2	Invalid	Speed command/invalid	Invalid/speed restriction
	1	Invalid	Speed command/invalid	Invalid/speed restriction
	3	Torque restriction input	←	Torque restriction/torque command
Analog output	DA1	Multi-function monitor output 1	←	←
	DA2	Multi-function monitor output 2	←	←

REMARKS

MC signal terminal assignment : Set "26" in any two of terminals DI1 to DI4 or STF using Pr.180 to Pr. 183 or Pr.187 (input terminal function selection)

3.7.3 Position control

(1) Position command right selection (Pr. 419)
When using the FR-V5AP, set "1" in Pr. 419.

Parameter No.	Name	Factory Setting	Setting Range
419	Position command right selection	0	0, 1

Setting	Description
0	Contact input-based simple position feed function (using parameters)
1	Pulse train input-based position command (when FR-V5AP is fitted)

(2) Setting the electronic gear (Pr.420, Pr.421)
Refer to page 9

(3) Position command acceleration/deceleration time constant (Pr. 424)
1) When the electronic gear ratio is large (about 10 or more times) and the speed is low, rotation will not be smooth, resulting in pulse-wise rotation. At such a time, set this parameter to smooth the rotation.
2) When acceleration/deceleration time cannot be provided for the command pulses, a sudden change in command pulse frequency may cause an overshoot or error excess alarm. At such a time, set this parameter to provide acceleration/deceleration time. Normally set 0.

(4) In-position width (Pr. 426)
The Y36 terminal signal acts as an in-position signal. The in-position signal turns on when the number of droop pulses becomes less than the setting.

(5) Excessive level error (Pr. 427)
An error becomes excessive when the droop pulses exceed the setting.
When you decreased the position loop gain (Pr. 422) setting, increase the error excessive level setting.
Also decrease the setting when you want to detect an error slightly earlier under large load.
When the value "9999(*)" is set, an excessive position error (E. OD) will not occur regardless of droop pulses.

*Refer to the inverter manual (basic) for validity of the setting value "9999".

(6) Pulse monitor selection (Pr. 430)
The states of various pulses during operation are displayed in terms of the number of pulses instead of the speed monitor output.

Pr. 430	Description	Display Range (FR-DU04-1)	Display Range (FR-PU04V)
0	The cumulative command pulse value is displayed.	Lower 4 digits	Lower 5 digits
1		Upper 4 digits	Upper 5 digits
2	The cumulative feedback pulse value is displayed.	Lower 4 digits	Lower 5 digits
3		Upper 4 digits	Upper 5 digits
4	The droop pulses are monitored.	Lower 4 digits	Lower 5 digits
5		Upper 4 digits	Upper 5 digits
9999	The speed monitor is displayed. (factory setting)		

REMARKS

- Count the number of pulses when the servo is on.
- The cumulative pulse value is cleared when the base is shut off or the clear signal is turned on.

3.7.4 Concept of position control gains

Easy gain tuning is available as an easy tuning method. For easy gain tuning, refer to the Instruction Manual (basic). If it does not produce any effect, make fine adjustment by using the following parameters. Set "0" in Pr.819 "easy gain tuning" before setting the parameters below.

(1) Pr. 422 position loop gain (factory setting $25s^{-1}$)
Make adjustment when any of such phenomena as unusual vibration, noise and overcurrent of the motor/machine occurs.
Increasing the setting improves trackability for the position command and also improves servo rigidity at a stop, but oppositely makes an overshoot and vibration more liable to occur. Normally set this parameter within the range about 5 to 50.

No.	Phenomenon/ Condition	Adjustment Method	
1	Slow response	Increase the Pr. 422 value.	
		Pr.422	Increase the value $3s^{-1}$ by $3s^{-1}$ until just before an overshoot, stop-time vibration or other instable phenomenon occurs, and set about 0.8 to 0.9 of that value.
2	Overshoot, stop-time vibration or other instable phenomenon occurs.	Decrease the Pr. 422 value.	
		Pr.824	Decrease the value $3s^{-1}$ by $3s^{-1}$ until just before an overshoot, stop-time vibration or other instable phenomenon occurs, and set about 0.8 to 0.9 of that value.

(2) Pr.423 position feed forward gain (factory setting 0)
This function is designed to cancel a delay caused by the droop pulses of the deviation counter.
When a tracking delay for command pulses poses a problem, increase the setting gradually and use this parameter within the range where an overshoot or vibration will not occur.
This function has no effects on servo rigidity at a stop.
Normally set this parameter to 0.

3.7.5 Pulse train format type selection

- You can choose the command pulse train type.

Parameter No.	Name	Factory Setting	Setting Range
428	Command pulse selection	0	0 to 5

Refer to page 14 for details of the input pulses.

3.7.6 Clear signal selection

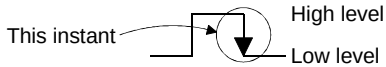
- Used to zero the number of droop pulses for a home position return, etc.
  When the clear signal is turned on, the deviation counter is cleared on its edge. Alternatively, the deviation counter is cleared by turning on the clear signal in synchronization with the zero-pulse signal of the PLG for a home position return, etc.

Parameter No.	Name	Factory Setting	Setting Range
429	Clear signal selection	1	0, 1

Pr.429	Description
0	Deviation counter cleared on trailing edge*.
1 (factory setting)	Deviation counter cleared at Low level.

REMARKS

*A trailing..... edge indicates an instant when the pulse frequency changes from a High to Low level.



3.7.7 Troubleshooting

	Phenomenon	Cause	Corrective Action
1	Motor does not rotate.	The phase sequence of the motor or PLG wiring is wrong.	Check the wiring.
		The control mode selection, Pr. 800, setting is improper.	Check the Pr. 800 setting. (Factory setting is speed control)
		The servo on signal or start signal (STF, STR) is not input.	Check that the signals are input normally.
		The command pulses are not input correctly.	1. Check that the command pulses are input normally. (Check the cumulative command pulse value in Pr. 430.) 2. Check the command pulse form and command pulse selection, Pr. 428, setting.
		The position command right selection, Pr. 419, setting is not correct.	Check the position command right selection in Pr. 419.
		Check the communication cable for wire breakage.	Check the communication cable.
2	Position shift occurs.	The command pulses are not input correctly.	1. Check the command pulse form and command pulse selection, Pr. 428, setting. 2. Check that the command pulses are input normally. (Check the cumulative command pulse value in Pr. 430.)
		The command is affected by noise or the PLG feedback is compounded with noise.	1. Decrease the PWM carrier frequency in Pr. 72. 2. Change the shielded cable earthing (grounding) place or raise the cable.
3	Motor or machine hunts.	The position loop gain is high.	Decrease Pr. 422.
		The speed loop gain is high.	1. Perform easy gain tuning. 2. Decrease Pr. 820 and increase Pr. 821.
4	Machine operation is instable.	The acceleration/deceleration time setting has adverse effect.	Decrease Pr. 7 and Pr. 8.

REMARKS

Please refer to the instruction manual (basic) when adhering to a related parameter.

4.PULSE TRAIN TORQUE COMMAND

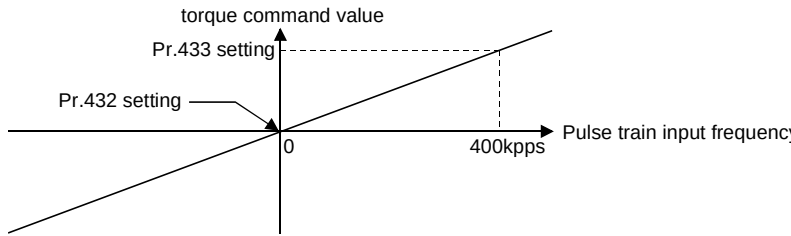
4.1 Parameters

Set the following parameters to give the torque command by the pulse train.

Parameter No.	Name	Setting Range	Minimum Setting Increments	Factory Setting
432	Pulse train torque command bias	0 to 400%	1%	0%
433	Pulse train torque command gain	0 to 400%	1%	150%
800	Control system selection	0 to 5, 20	1	0
804	Torque command right selection	0 to 4	1	0

4.2 Torque command by the pulse train

When the torque control is selected, setting "2" in Pr. 804 "torque command right selection" enables the torque command by pulse train input. Set "1, 2 or 5" in Pr. 800 to exercise torque control.
(When setting "2 or 5", torque control need to be selected by MC terminal switchover.)
The interfaces of the inverter and torque command pulses need to be matched. Refer to page 15 for wiring.
Set bias (Pr. 432) and gain (Pr. 433) for torque command. The relationship between the input pulse and torque command is as follows.



5. SPECIFICATIONS

(1)	Repetitive positioning accuracy	±1.5° (motor shaft end) (This accuracy varies with the load torque, load inertia moment J, load backlash conditions, etc.)
(2)	Holding force after positioning	Servo lock provided
(3)	Power supply	A 24V power supply is provided for the interface driver.
(4)	Maximum input pulse frequency	Differential line receiver : 500kpps, open collector : 200kpps
(5)	Positioning feedback pulses	The number of PLG pulses x 4 per motor revolution
(6)	Electronic gear setting	1/50 to 20
(7)	In-position width setting	0 to 32767 pulses
(8)	Excessive error	0 to 400000 pulses

REVISIONS

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

Print Date	*Manual Number	Revision
Oct., 2001	IB(NA)-0600087-A	First edition
Jun., 2002	IB(NA)-0600087-B	Additions Pr. 432 "pulse train torque command bias" Pr. 433 "pulse train torque command gain"