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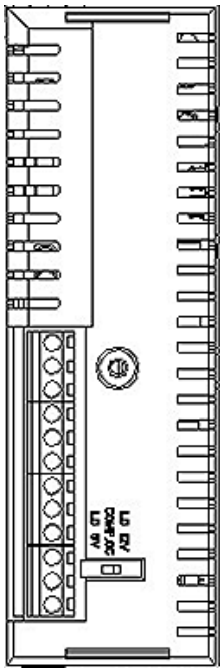
Z-Pulse Encoder Option Module

SV-iS7 Series

User Manual



Safety Instructions

- Use this board after read Safety Instruction of this manual carefully before using and follow the instructions exactly.
- Please hand this user manual to end user and trouble shooting manager
- After read this manual, keep it at handy for future reference.

- 사용 전에 '안전상의 주의사항'을 반드시 읽고 정확하게 사용하여 주십시오.
- 본 설명서는 제품을 사용하는 사람이 항상 볼 수 있는 곳에 잘 보관하십시오.

LS Industrial Systems

Safety Precaution

First thank you for using our iS7 Z-Pulse (Position Control) Option Board!

Please follow the following safety attentions since they are intended to prevent any possible accident and danger so that you can use this product safely and correctly.

Safety attentions may classify into ‘Warning’ and ‘Caution’ and their meaning is as following:

Symbol	Meaning
WARNING	This symbol indicates the possibility of death or serious injury.
CAUTION	This symbol indicates the possibility of injury or damage to property.

The meaning of each symbol in this manual and on your equipment is as follows.

Symbol	Meaning
	This is the safety alert symbol. Read and follow instructions carefully to avoid dangerous situation.
	This symbol alerts the user to the presence of “dangerous voltage” inside the product that might cause harm or electric shock.

After reading this manual, keep it in the place that the user always can contact. This manual should be given to the person who actually uses the products and is responsible for their maintenance.

WARNING

- **Do not remove the cover while power is applied or the unit is in operation.**
  Otherwise, electric shock could occur.

⚠ WARNING

- **Do not run the inverter with the front cover removed.**
  Otherwise, you may get an electric shock due to high voltage terminals or charged capacitor exposure.
- **Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.**
  Otherwise, you may access the charged circuits and get an electric shock.
- **Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power and after checking the DC link voltage is discharged with a meter (below DC 30V).**
  Otherwise, you may get an electric shock.
- **Operate the switches with dry hands.**
  Otherwise, you may get an electric shock.
- **Do not use the cable when its insulating tube is damaged.**
  Otherwise, you may get an electric shock.
- **Do not subject the cables to scratches, excessive stress, heavy loads or pinching.**
  Otherwise, you may get an electric shock.

⚠ CAUTION

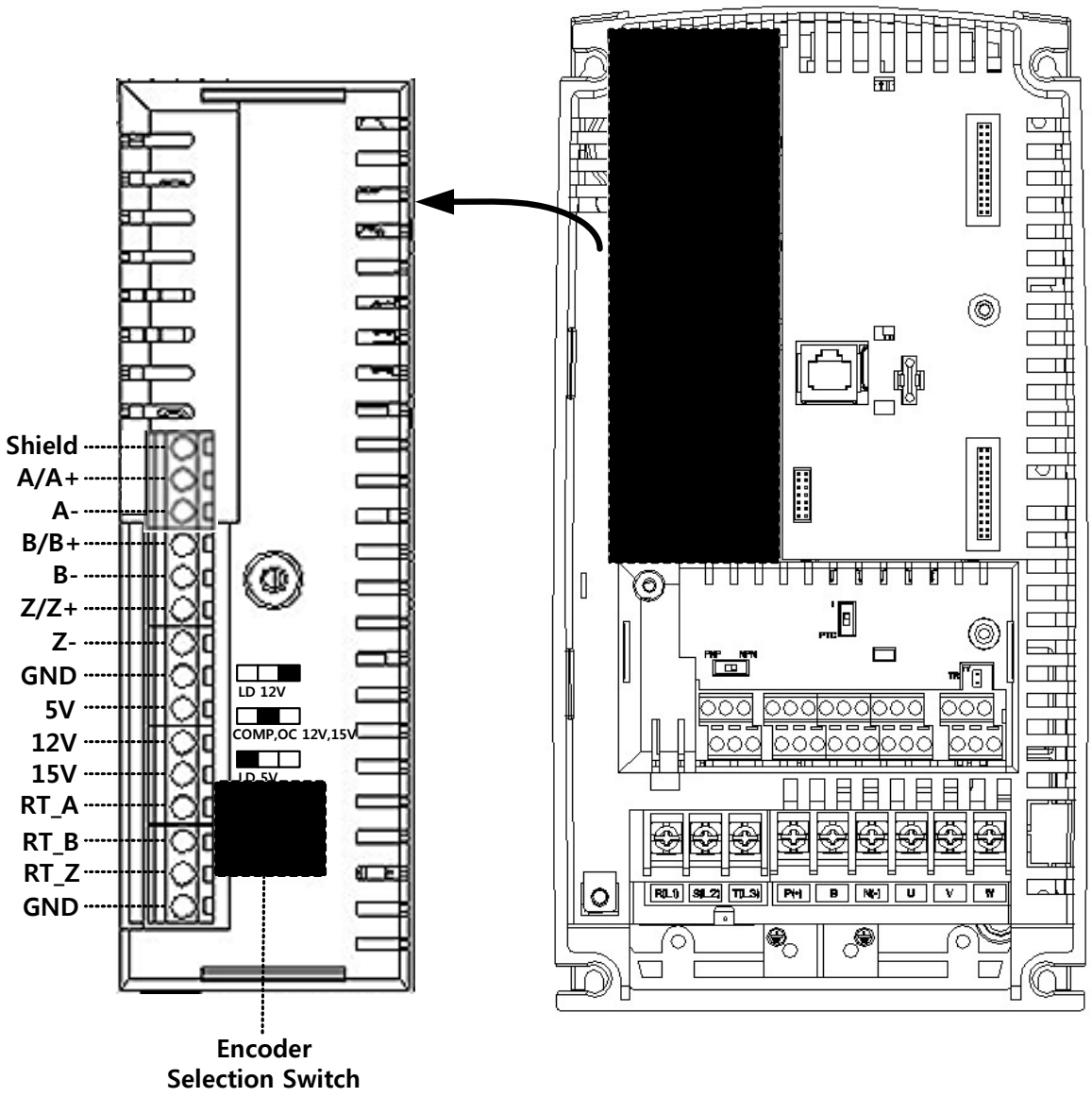
- **Be cautious when handling CMOS elements on the option board.**
  It may cause a failure due to static electricity.
- **When changing and connecting communication signal lines, proceed the work while the inverter is turned off.**
  It may cause a communication error or failure.
- **Make sure to connect the inverter body to the option board connector accurately coincided each other.**
  It may cause a communication error or failure.
- **Make sure to check the parameter unit when setting parameters.**
  It may cause a communication error.

Table of Contents

1. Installation Condition

Item	Standard
Service Temperature	-10℃ ~ 50℃
Storage Temperature	-20℃ ~ 65℃
Ambient Humidity	Relative humidity 90% RH or below (Condensational phenomenon is not allowed)
Vibration	1,000mor below, 5.9m/sec^2 (0.6G) or below
Surrounding Environment	Any corrosive gas, flammable gas, oil mist or dust is not allowed inside.

2. Product Standard



Item	Standard
Name	Encoder option card dedicated to iS7 position control
Main Function	Sensored vector control and Position control
Power Standard	▪ 5V Output : Maximum rated 1Watt ▪ 12V Output : Maximum rated 0.84Watt ▪ 15V Output : Maximum rated 1.05Watt
Encoder Input Signal	▪ Maximum 200kHz Input ▪ Open Collector type encoder (A, B, Z)

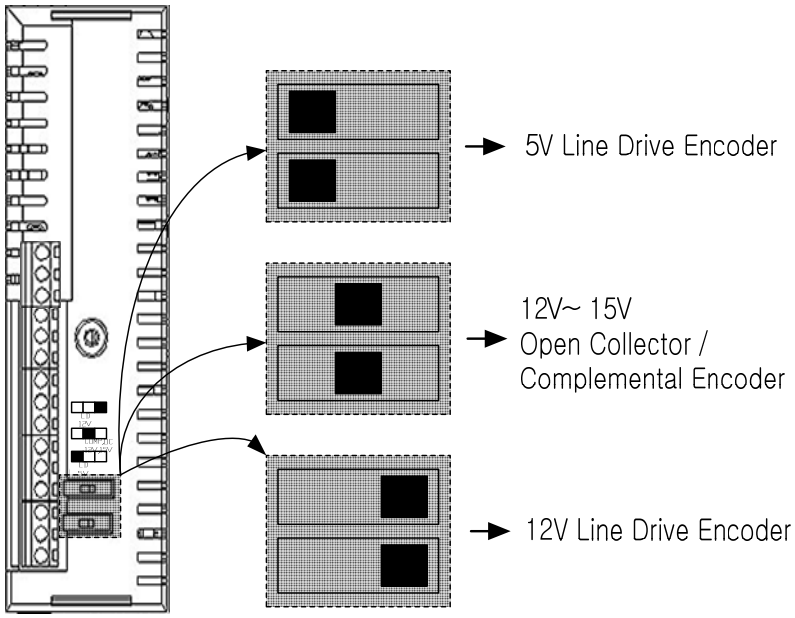
Item	Standard
	▪ Line Drive type encoder (A/A+, A-, B/B+, B-, Z/Z+, Z-)
Return Pulse Output	▪ Maximum 200kHz output ▪ Open Collector output (RT_A, RT_B, RT_Z)
How to select encoder and set switch	

Table 1 Hardware standard

Item	Name	Description
Encoder Phase A Input	A/A+	Encoder A pulse input
	A-	Encoder A- pulse input (Applicable only to Line Drive type encoder)
Encoder Phase B input	B/B+	Encoder B pulse input
	B-	Encoder B- pulse input (Applicable only to Line Drive-type encoder)
Encoder Phase Z Input	Z/Z+	Encoder Z pulse Input
	Z-	Encoder Z- pulse Input (Applicable only to Line Drive type encoder)
Return Pulse Output	RT_A	Encoder A pulse return pulse output (Open Collector)
	RT_B	Encoder B pulse return pulse output (Open Collector)
	RT_Z	Encoder Z pulse return pulse output (Open Collector)

Item	Name	Description
Power Output	5V	5V voltage output
	12V	12V voltage output
	15V	15V voltage output
	GND	Power Ground
Shielded Line	SHIELD	Common shielded line

Table 2 iS7 encoder option terminal block composition

Item	Performance Standard
Position Control	Difference from the target position shall be within ±5 degree (Note1)

Table 3 Performance Standard

1) Basic position control operating mode (PC1-12 Pos Mode : 0 Single Pos) is applicable. In addition, only virtual master is applicable in the proportional synchronization position control operating mode (PC1-12 Pos Mode : 1 Multi Sync Pos) and Speed sync position control operating mode (PC1-12 Pos Mode : 2 Multi Sync Spd).

3. Installation and Wiring

■ Step 1. Mounting encoder option

Remove the cover and mount an encoder option card (slot 3) dedicated to iS7 position control. Sensored vector operating (DRV-09 Control Mode: Vector) and Position control (APP-01 App Mode : Position) can be performed at the same time with the mounted encoder option.

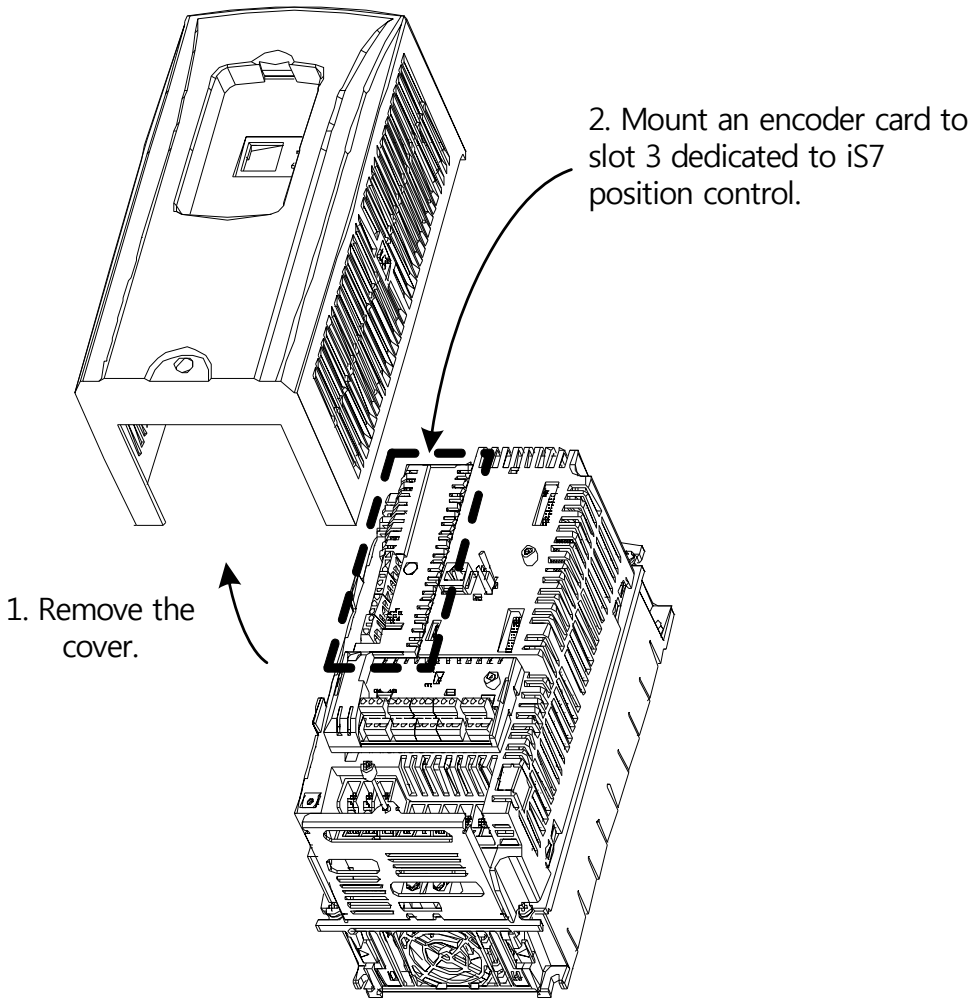
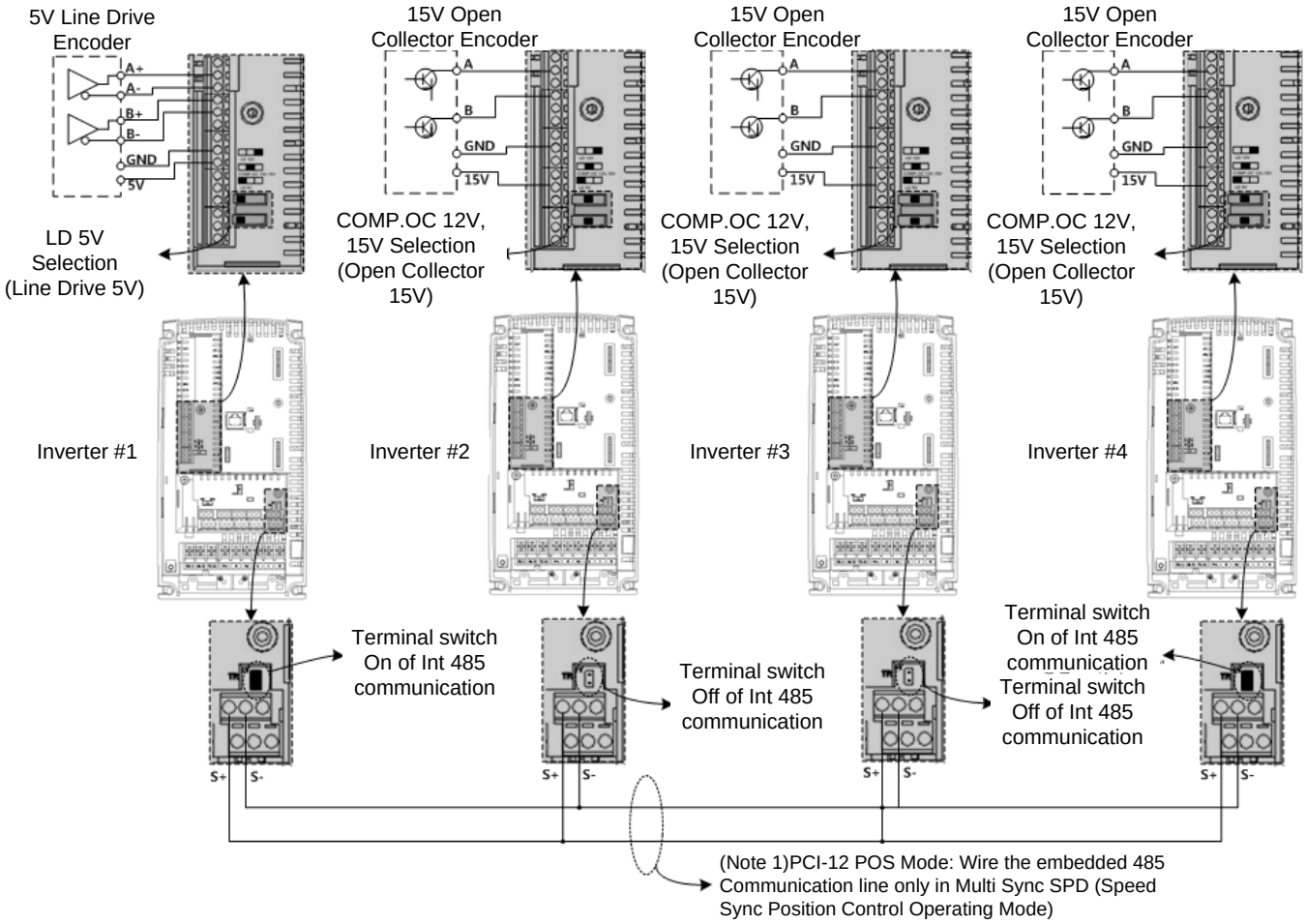


Figure 3-1 Mounting encoder option didecated to iS7 position control

■ Step 2. Encoder wiring and embedded 485 communication line wiring

Wire the motor's encoder signal lines to the encoder option card mounted to slot 3 respectively as seen in the figure below. In the figure below, arbitrarily four inverters are assumed to be wired. Inverter #1 is connected to 5V Line Drive encoder and Inverter #2 through #4 are connected to Open Collector 15 V encoders respectively.



Remark

- Basic I/O's embedded 485 signal S+/S- in the lower part of the figure is used as protocol Sending/Receiving data line dedicated to PC1-12 POS Mode: Multi Sync SPD (Speed sync position control operating mode) (See Appendix B. Speed Sync Position Control Operating)

4. Preparing Position Control Operating

The following describes how to set the inverter and tune the motor before Position control operating.

■ Step 1. Check the motor rotation direction

1. Set DRV-01 Cmd Frequency in low speed(10Hz or below) and set DRV-06 Cmd Source to keypad.

2. Set DRV-09 Control Mode to V/F and lower forward command with keypad. Then, check whether (+) value (about 9.xx [Hz]) is read when APO-08 Enc Monitor is monitored.

3. If – value is monitored, change the setting of APO-05 Enc Pulse Sel to –(A + B).

■ Step 2. Set encoder options

1. Set APO-01 Enc Opt Mode to feedback.

2. Input the pulse reference (E.g. 1024, etc) of the encoder mounted to the motor to APO-06 Enc Pulse Num.

3. Set DRV-09 Control Mode to Vector (Sensored vector operating mode).

■ Step 3. Estimate motor parameter (= Motor Auto tuning)

1. Read the motor's name plate and input BAS-11 Pole Number (Motor Pole), BAS-12 Rated Slip (Motor rated slip RPM), BAS-13 Rated Curr (Motor rated current), BAS-15 Rated Volt (Motor rated voltage), BAS-16 Efficiency (Motor efficiency: No need to input if there is not any name plate) and BAS-19 AC Input Volt (Inverter input voltage).

2. It is possible to select All (rotating tuning) or All StdStl (static tuning) from BAS-20 Auto Tuning.

⚠ CAUTION

- **If All (rotating tuning) is selected from BAS-20 Auto Tuning, auto tuning will be carried out while the motor is rotating.**

⚠ CAUTION

- **If All StdStl (static tuning) is selected from BAS-20 Auto Tuning, auto tuning will be carried out while the motor is rotating while the motor is stopped. It is used when the motor cannot rotate because its brake is closed or due to any safety matter. The accuracy of its tuning is less satisfied than that of rotating tuning.**

■ Step 4. Set the external brake control function

1. Applicable contact output can be used for controlling the external brake if BR Control is set from OUT-31through 32(Relay1, 2). Functions related to control the external brake are set from ADV-41(BR Rls Curr) through ADV-47(BR Eng Fr).

■ Step 5. Check encoder pulse direction

1. Make sure to check the encoder pulse direction before carrying out the Position control operating. That is, for the Position control operating, the encoder pulse shall increase when commanding forward operating. On the contrary, the encoder pulse shall decrease when commanding reverse operating.

2. To check it, perform forward(FWD) low-speed operating(10Hz or below) with keypad. At this time, check whether APO-16 Cur Pulse-L increases. If APO-16 Cur Pulse-L decreases, set PC1-13(POS Enc Dir) to “1 : Reverse” .

■ Step 6. Change application mode

1. Set APP-01 App Mode as Position. Also appropriately set relevant parameters described in Chapter 3, Appendix A and B.

■ Step 7. Set position control operating command method

1. Set “53: POS Run”(position operating command) from IN-65~72(Px define) or COM-70~85(Virtual DI x)(Double setting is not available).

2. Set PC1-1(POS Drv Src) to “0: Terminal” when commanding position operating command by using the multi function input IN-65~72(Px define).

3. Set PC1-1(POS Drv Src) to“1: Fieldbus” when commanding position operating command by using the virtual multi function input COM-70~85(Virtual DI x).

5. Single Position Control Operating

Depending on the current position [mm] and target position command [mm], the inverter outputs proper frequency so that its load reaches the target position.

Group	No.	Function Display	Setting Value	Setting Range	Unit
APP	01	App Mode	6 : Position	0~6	-
APO	15	Cur Pulse-H	Read only	-	pulse
APO	16	Cur Pulse-L	Read only	-	pulse
PC1	01	POS Drv Src	0 : Terminal	0 : Terminal 1 : Fieldbus	-
PC1	02	Tar Position	Read only	-	mm
PC1	03	Cur Position	Read only	-	mm
PC1	05	Pre Position	0	0~65535	mm
PC1	10	Track Err	Read only	-	pulse
PC1	12	POS Mode	0 : Single POS	0~2	-
PC1	13	POS Enc Dir	0 : Forward	0 : Forward 1 : Reverse	-
PC1	14	POS Acc Time	0.0	0.0~10.0	sec
PC1	15	POS Dec Time	0.0	0.0~10.0	sec
PC1	18	POS P Gain	50.0	0.00~1000.0	%
PC1	19	POS I Gain	0.0	0.0~100.0	sec
PC1	20	POS I Limit	5.0	0.0~300.0	%
PC1	22	POS FF Gain	100.0	0.0~3000.0	%
PC1	23	POS PI Out SCL	50.0	0.0~1000.0	%
PC1	24	POS PI Type	0	0 : Fixed 1 : Proportional	-
PC1	25	POS PropPI Min	10.0	0.0~1000.0	%
PC1	27	Fast Stop Time	5.0	0.1~100.0	sec

Group	No.	Function Display	Setting Value	Setting Range	Unit
PC1	28	SW Lmt H En	0 : No	0 : No 1 : Yes	-
PC1	29	SW Lmt H Lev	60000	PC1-31~65535	-
PC1	30	SW Lmt L En	0 : No	0 : No 1 : Yes	-
PC1	31	SW Lmt L Lev	5000	0~PC1-29	-
PC1	32	POS Err Ctrl	0 : None	0 : None 1 : Freerun 2 : Dec	-
PC1	33	POS Err Disp	Read only	0 : No Errorr 1 : HW Lmt H 2 : HW Lmt L 3 : SW Lmt H 4 : SW Lmt L 5 : Max Track Err	-
PC1	35	Max Track Err	30000	0~65535	pulse
PC1	41	Target Bound	100	0~65535	mm
PC1	42	UU Num	1	1~65535	-
PC1	43	UU Denom	1	1~65535	-
PC1	45	Preset Type	0 : Rev+Index	0 : Rev+Index 1 : Rev+No Index 2 : Fwd+Index 3 : Fwd+NoIndex	-
PC1	46	Preset RPM	100	-1800~1800	RPM
PC1	47	Preset Ramp T	1.0	0.0~100.0	sec
PC1	99	POS S/W Ver	-	x.xx	-
IN	65 ~72	Px Define	53 : POS Run	-	-
			54 : POS Preset		
COM	70~ 85	Virtual DI x	55 : POS Fast Stop	-	-
			56 : POS HW Lmt H		

Group	No.	Function Display	Setting Value	Setting Range	Unit
			57 : POS HW Lmt L		
			58 : POS Pattern-L		
			59 : POS Pattern-M		
			60 : POS Pattern-H		
			61 : POS Pattern-X		
			62 : POS Preset Run		
			63 : POS Disable		

5.1 Block Diagram

Single position control operating mode consists of four function blocks (Speed profile block, Position PI Controller, Encoder Feedback Pulse Processing Block, Accelerating & Decelerating/ Fast Stop/Trip Processing Block).

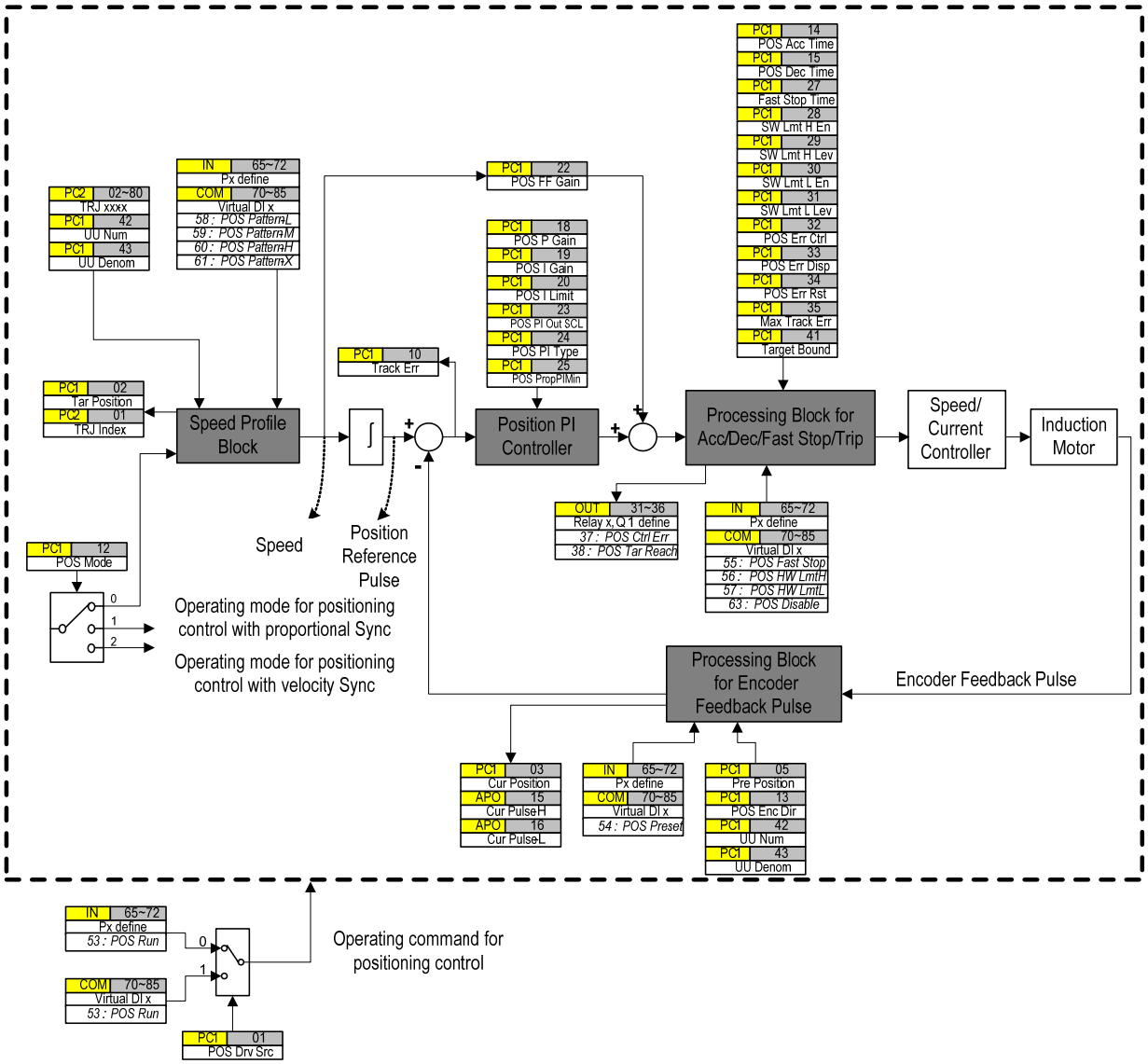


Figure 5-1 Block Diagram of Single position control operating

For Speed profile block, use information on the current position, target position, Accelerating & Decelerating time and maximum frequency and create a trapezoid-type Speed profile.

For Position PI controller block, PI control the position reference pulse and Position feedback pulse to create the inverter's proper frequency command.

For Accelerating & Decelerating/Fast Stop/Trip Processing Block, it is in charge of exemption processing among Position control operating.

For Encoder feedback pulse processing block, it appropriately processes or monitors the feedback pulse.

IN-65~72 Px Define, COM-70~85 Virtual DI x: 53 POS Run
PC1-01 POS Drv Src
Determine position control operating command-53 POS Run's command source.

If PC1-01 POS Drv Src is 0 Terminal, Position control is operated by 53 POS Run multi function input that has been set in IN-65~72 Px Define.

If PC1-01 POS Drv Src is 0 Fieldbus, Position Control is operated by 53 POS Run Virtual multi function input that has been set in COM-70~85 Virtual DI x.

PC1-12 POS Mode
Set Position control operating mode. In case of Single position control operating mode, Select 0 Single POS.

5.2 Speed Profile Block

Using the Current position[mm], Target position[mm], Accelerating time, Decelerating time, Maximum Speed, create a Speed Profile (trapezoid speed pattern of “Accelerating → steady-state operating → Decelerating”) needed to reach the target position from the current position.

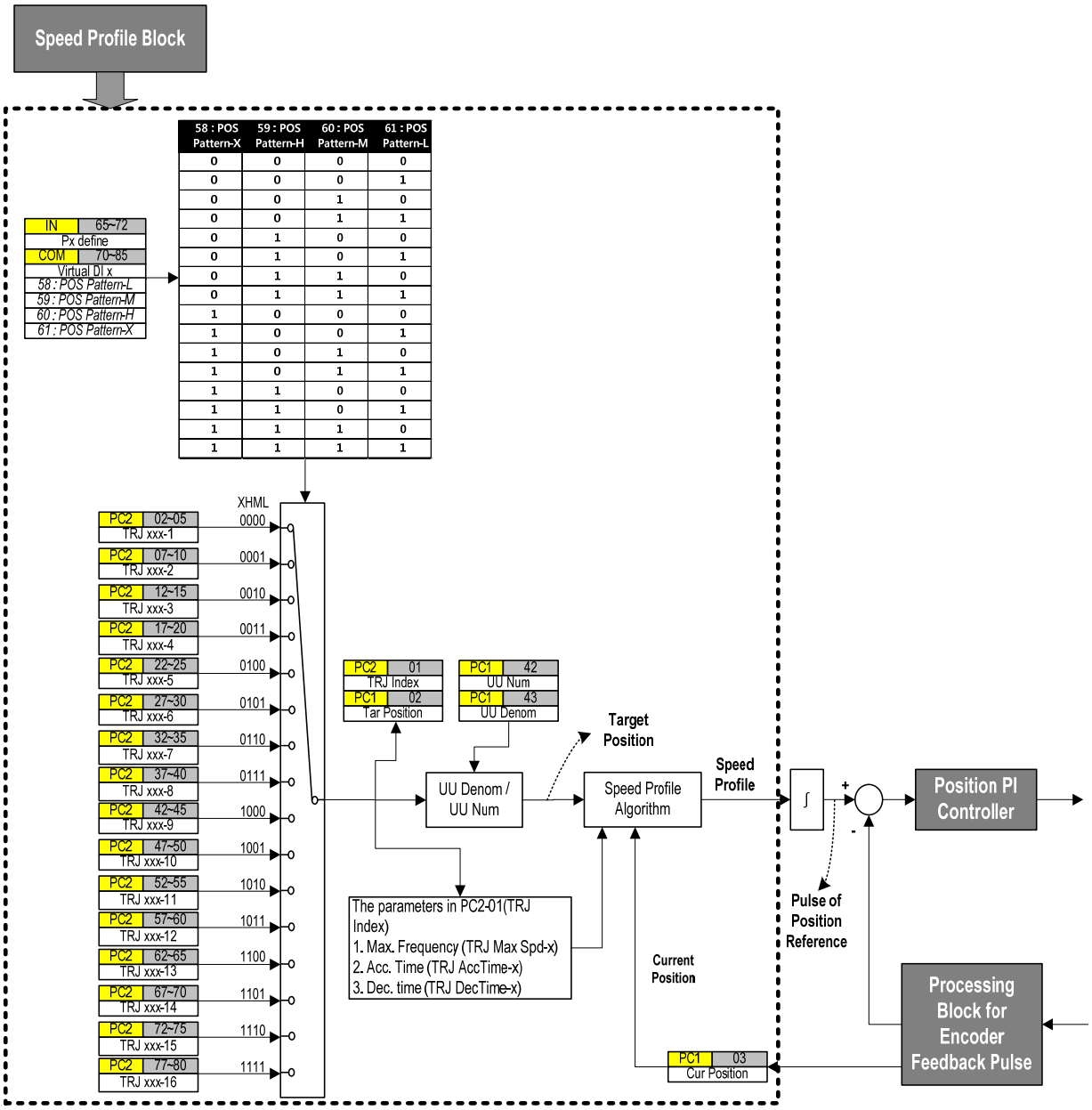


Figure 5-2 Speed profile block

PC1-01 TRJ Index
PC2-02~80 TRJ Tar Pos-x, TRJ Max Spd-x, TRJ Acc Time-x, TRJ Dec Time-x

IN65~72 Px Define, COM70~85 Virtual DI x: POS Pattern-L/M/H/X

To activate Speed profile algorithm, information on the current position(PC1-03 Cur Position), target position(PC1-02 Tar Position), accelerating time(PC2 TRJ Acc Time-x), decelerating time(PC2 TRJ Dec Time-x) and maximum Speed(PC2 TRJ Max Spd-x) are needed.

PC2 Group has information about total 16 multi-stage positions (4 sets of target position, accelerating time, decelerating time and maximum speed).

Using 4 sets of multi function input POS Pattern-L, POS Pattern-M, POS Pattern-H and POS Pattern-X, select one among total 16 multi-stage positions in PC2 Group to carry out the position control operating. At this time, the number of the multi-stage position information that has been currently selected is displayed on the multi-stage position index (Read only, PC2-01 TRJ Index).

IN65~72 Px Define or COM70~85 Virtual DI x				PC2-01 TRJ Index	Result
58 : POS Pattern-X	59 : POS Pattern-H	60 : POS Pattern-M	61 : POS Pattern-L		
0	0	0	0	1	PC1-02~05 TRJ xxxxx-1
0	0	0	1	2	PC1-07~10 TRJ xxxxx-2
0	0	1	0	3	PC1-12~15 TRJ xxxxx-3
0	0	1	1	4	PC1-17~20 TRJ xxxxx-4
0	1	0	0	5	PC1-22~25 TRJ xxxxx-5
0	1	0	1	6	PC1-27~30 TRJ xxxxx-6
0	1	1	0	7	PC1-32~35 TRJ xxxxx-7

IN65~72 Px Define or COM70~85 Virtual DI x					
0	1	1	1	8	PC1-37~40 TRJ xxxxx-8
1	0	0	0	9	PC1-42~45 TRJ xxxxx-9
1	0	0	1	10	PC1-47~50 TRJ xxxxx-10
1	0	1	0	11	PC1-52~55 TRJ xxxxx-11
1	0	1	1	12	PC1-57~60 TRJ xxxxx-12
1	1	0	0	13	PC1-62~65 TRJ xxxxx-13
1	1	0	1	14	PC1-67~70 TRJ xxxxx-14
1	1	1	0	15	PC1-72~75 TRJ xxxxx-15
1	1	1	1	16	PC1-77~80 TRJ xxxxx-16

Table 4 How to select multi-stage position by multi-function input

PC1-02 Tar Position

This unit is [mm] and Read only. The currently selected target position information (PC2 TRJ Tar Pos-x) from PC2 Group is displayed by four multi function input POS Pattern-L, POS Pattern-M, POS Pattern-H and POS Pattern-X.

PC1-03 Cur Position

Unit is [mm] and Read only. The current position is displayed.

PC1-42 UU Num
PC1-43 UU Denom

It is a factor for Unit Conversion that converts position unit from [pulse] to [mm].

For example, if 20[m](=20000[mm]) is equal to 538,000[pulse], input 2000 to PC1-42 UU Num and 53800 to PC1-43 UU Denom([mm] and [pulse] have been divided by 10 respectively)

If [mm] and [pulse] are divided by 10 respectively, input 20 to PC1-42 UU Num and 538 to PC1-43 UU Denom.

⚠ CAUTION

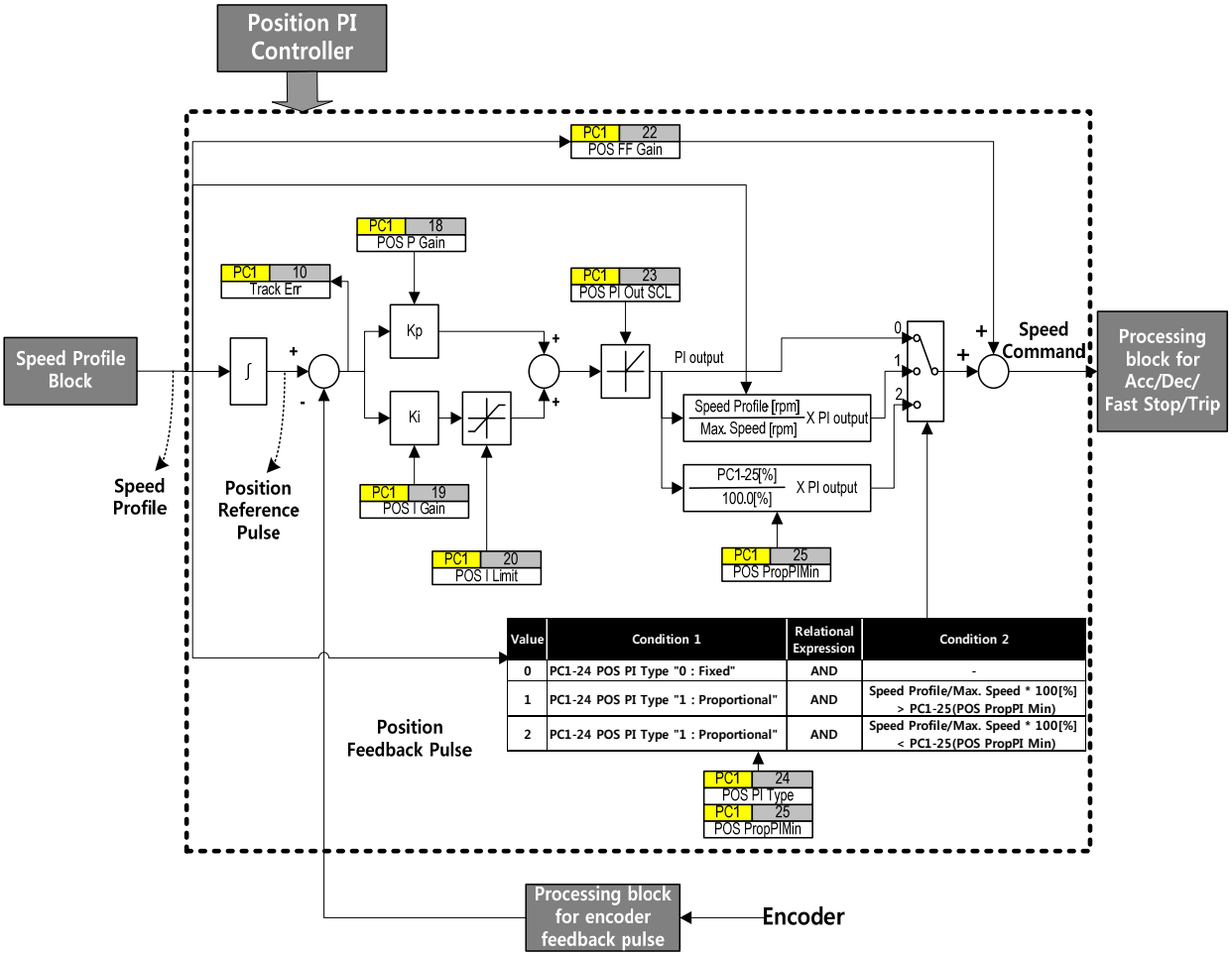
- PC1-42 and 43's input ranges from 0 to 65535 respectively. Therefore, if denominator is significantly bigger than numerator, fix the numerator to 1 and input appropriately by reducing a fraction not making denominator exceed 65535.
- For example, input as following if 37.21[m](=37210[mm]) is equal to 910,782,101[pulse]. That is, input 1 to PC1-42 UU Num and 24476 to PC1-43 UU Denom.

$$\frac{PC1-42\ UU\ Num}{PC1-43\ UU\ Denom} = \frac{37210}{910782101} = \frac{1}{24476}$$

5.3 Position PI Controller Block

Position profile is created by integrating the created speed profile created on the Speed profile block and this position profile becomes position reference pulse on the Position PI controller.

PI control the position feedback pulse that has been feedbacked from position reference pulse and iS7 encoder option and make a reference speed command. In addition, for fast controller response, feed forward (PC1-22 POS FF Gain) Speed profile.



Value	Condition 1	Relational Expression	Condition 2
0	PC1-24 POS PI Type "0 : Fixed"	AND	-
1	PC1-24 POS PI Type "1 : Proportional"	AND	Speed Profile/Max. Speed * 100[%] > PC1-25(POS PropPI Min)
2	PC1-24 POS PI Type "1 : Proportional"	AND	Speed Profile/Max. Speed * 100[%] < PC1-25(POS PropPI Min)

Figure 5-3 Block diagram of position PI Controller

PC1-18 POS P Gain

It inputs P Gain[%]. For example, when P Gain is equal to 10[%], 10[%] of the maximum speed (PC2 TRJ Max Spd-x) is generated as P controller's output if position error 2π [rad] takes place against the motor's mechanical degree. For example, 6.00[Hz] is P controller's output when PC2 TRJ Mas Spd-x is 60.00[Hz].

PC1-19 POS I Gain

It inputs I Gain[sec]. For example, when I Gain is equal to 10.0[sec], it takes 10[sec] until I controller's output is saturated to its maximum speed(PC2 TRJ Max Spd-x) if position error 2π [rad] takes place against motor's mechanical degree.

PC1-20 POS I Limit

It prevents the integrator output (Anti-windup) from being saturated by limiting it. If 10.0[%] is inputted, it limits the integrator output to 10.0[%] of the maximum Speed (PC2 TRJ Max Spd-x). That is, if the maximum speed(PC2 TRJ Max Spd-x) is 60[Hz], it limits the integrator output to ±6[Hz], 10% of 60[Hz].

PC1-23 POS PI Out SCL

It sets PI controller's output scale[%]. If the setting value is 50.0[%], finally, 50.0[%] of PI controller output is outputted.

PC1-24 POS PI Type
PC1-25 POS Prop PI Min

- PC1-24 POS PI Type "0 Fixed": Regardless of the current Speed, the final output value of PI controller from PC1-23 POS PI Out SCL is fixed.
- PC1-24 POS PI Type "1 Proportional": It lowers PI controller output proportionally as it is slower. Because PI controller output is excessively low in low speed, it limits PI controller's minimum value to PC1-25 POS Prop PI Min.

PC1-22 POS FF Gain

It sets Feed forward(FF) Gain[%]. By feed forwarding Speed Profile(predictable information), it can improve the response faster and more stable.

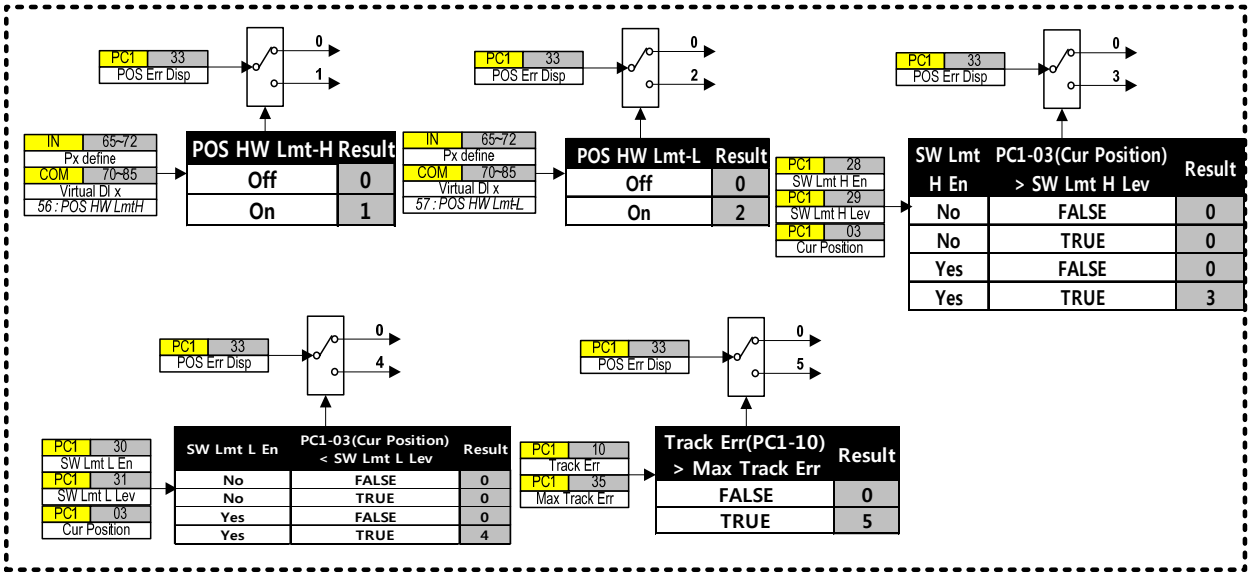
PC1-10 Track Err

It shows the difference between position reference pulse and position Feedback pulse during the position control operating in real time. In stop state, it always clears to 0.

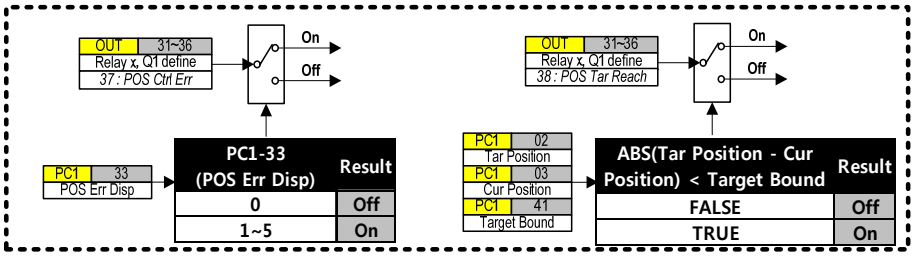
5.4 Processing Block of Accelerating & Decelerating/Fast Stop/Trip (Exemption Processing)

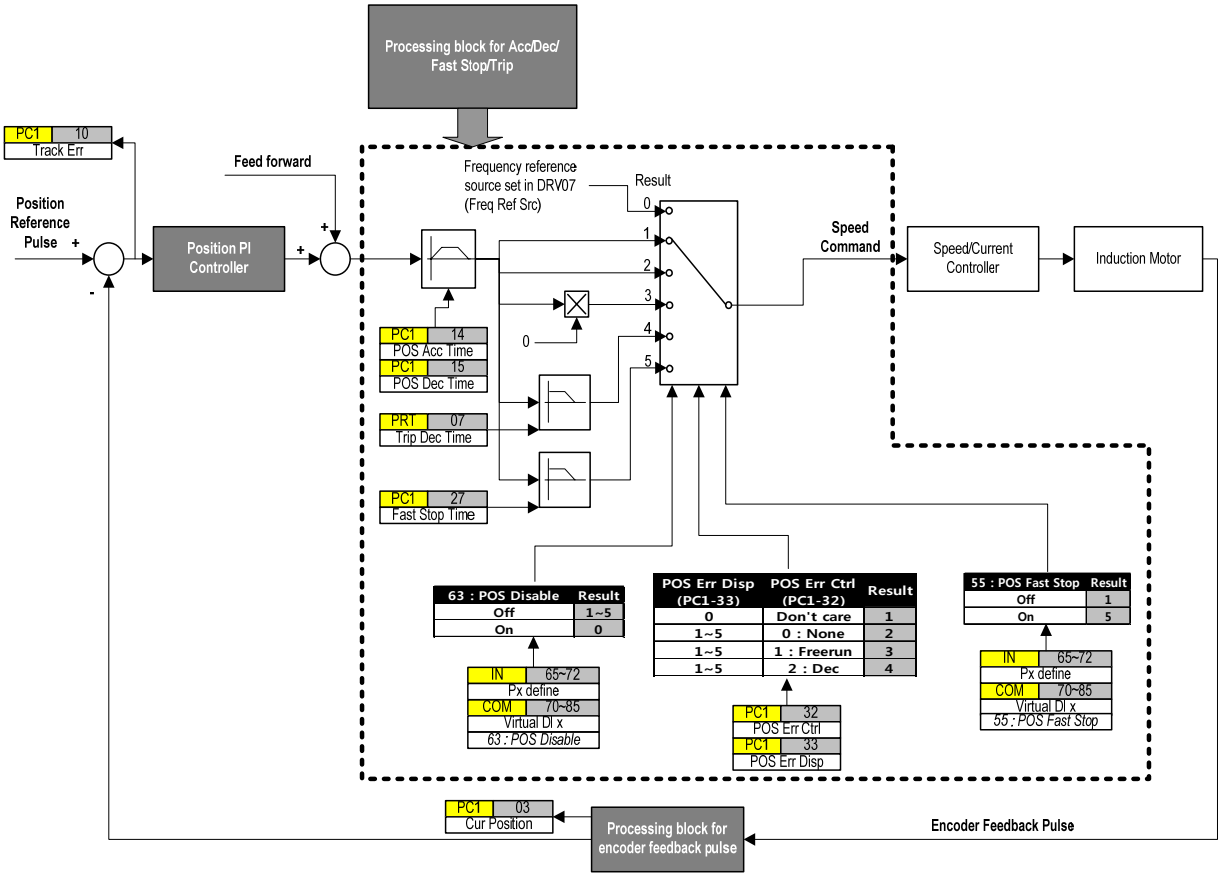
During the position control operating, operating is continued or stopped in the method that is set when trip related to Position control operating takes place.

Trip Processing related to Position Control Operating



Multi-Function Output related to Position Control Operating





PC1-14 POS Acc Time
PC1-15 POS Dec Time

It is Accelerating & Decelerating time dedication to the Position control operating. To make the position PI Controller follow position reference pulse fast, set the minimum value 0.0[sec] (factory setting value).

IN65~72 Px Define : POS HW Lmt-H/L
PC1-32 POS Err Ctrl
PC1-33 POS Err Disp

It is possible to monitor the upper limit hardware switch(POS HW Lmt-H) or the lower limit hardware switch(POS HW Lmt-L) Input.

If applicable input is generated, “1 : POS HW Lmt-H” or “2 : POS HW Lmt-L” is displayed on PC1-33 POS Err Disp .

Also, if applicable input is generated, it is operated in the methods(0 None / 1 Freerun / 2 Dec) that has been set on PC1-32 POS Err Ctrl.

- 0 None : Its operating state continuously remains.
- 1 Freerun : The inverter output is blocked. At this time, if external brake control function(OUT-31~32 BR Control) is used, the inverter output will be blocked and the brake will be also closed at the same time.
- 2 Dec : It stops at the decelerating time set on PRT-07 Trip Dec Time . At this time, if external brake control function (OUT-31~32 BR Control) is used, the brake will be closed at brake close frequency(ADV-47 BR Eng Fr).

PC1-28 SW Lmt H En
PC1-29 SW Lmt H Lev
PC1-30 SW Lmt L En
PC1-31 SW Lmt L Lev
PC1-32 POS Err Ctrl
PC1-33 POS Err Disp

It is possible to monitor whether the current position goes beyond the position set by the user. Because the user can set a limit to position, it is called the software limit switch(SW Lmt H/L).

- PC1-28 SW Lmt H En : It sets whether Upper Limit Software Switch is used. If 0 : No, the Upper Limit Software Switch does not run.
- PC1-29 SW Lmt H Lev : If PC1-28 SW Lmt H En is 1 : Yes , the upper limit level[mm] can be set.
- PC1-30 SW Lmt L En : It sets whether Lower Limit Software Switch is used. If 0 : No, the Lower Limit Software Switch does not run.
- PC1-31 SW Lmt L Lev : If PC1-30 SW Lmt L En is 1 : Yes, the lower limit level[mm] can be set.

If any applicable trip takes place, “3 : POS SW Lmt-H” or “4 : POS SW Lmt-L” is displayed on PC1-33 POS Err Disp .

Also, If any applicable trip takes place, it is operated in the methods(0 None / 1 Freerun / 2 Dec) set o PC1-32 POS Err Ctrl.

- 0 None : Its operating state continuously remains.
- 1 Freerun : The inverter output is blocked. At this time, if external brake control function(OUT-31~32 BR Control) is used, the inverter output will be blocked and the brake will be also closed at the same time
- 2 Dec : It stops at the decelerating time set on PRT-07 Trip Dec Time . At this time, if external brake control function (OUT-31~32 BR Control) is used, the brake will be closed at brake close frequency(ADV-47 BR Eng Fr).

PC1-10 Track Err
PC1-35 Max Track Err
PC1-32 POS Err Ctrl
PC1-33 POS Err Disp

Monitor whether the diference between the position reference pulse and the position feedback pulse of position PI controller block described in 5.3 exceeds the Setting Value PC1-35 Max Track Err or over druing inverter operting.

If any applicable trip takes place, “5 : Max Track Err” is displayed on PC1-33 POS Err Disp.

Also, if applicable trip takes place, operate it in the method set in PC1-32 POS Err Ctrl (0 None / 1 Freerun / 2 Dec).

- 0 None : Its operating state continuously remains.
- 1 Freerun : The inverter output is blocked. At this time, if external brake control function(OUT-31~32 BR Control) is used, the inverter output will be blocked and the brake will be also closed at the same time
- 2 Dec : It stops at the decelerating time set on PRT-07 Trip Dec Time . At this time, if external brake control function (OUT-31~32 BR Control) is used, the brake will be closed at brake close frequency(ADV-47 BR Eng Fr).

IN-65~72 Px Define : POS Fast Stop
PC1-27 Fast Stop Time

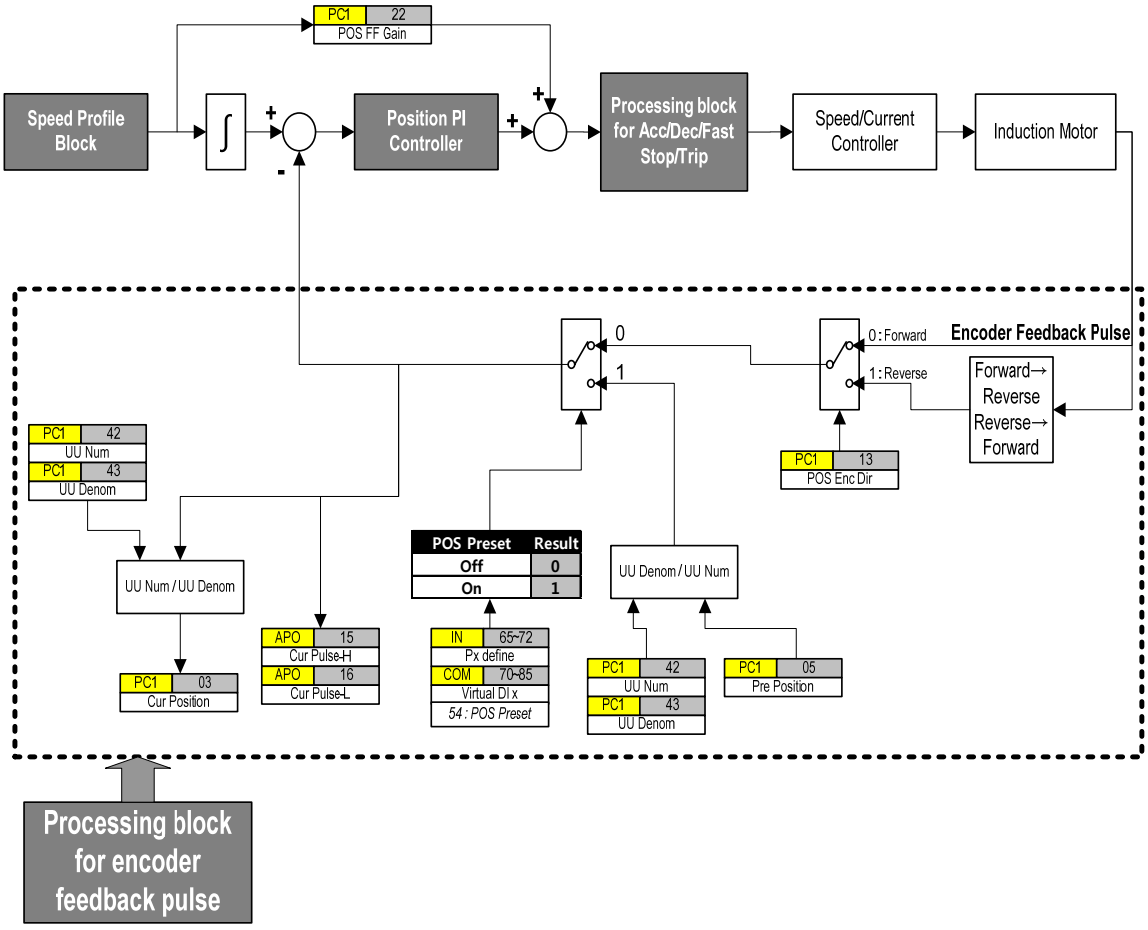
It can suddely stop the motor that is performing the position control operating.

If multi function input POS Fast Stop is inputted, it will stop at the decelerating time set on PC1-27 Fast Stop Time regardless of the inverter’s current output frequency. Since it is of latch type, it will remain Fast Stop Decelerating even though POS Fast Stop is turned off during the Fast Stop Decelerating .

Fast Stop is a function that makes it stop at the Decelerating time set at only PC1-27 Fast Stop Time regardless of the target position and the current position.

5.5 Processing Block of Encoder Feedback Pulse

It carries out monitoring, presetting, shifting directions or other functions for the pulse feedbacked from the encoder.



5.5.1 Block diagram of encoder feedback pulse processing

IN-65~72 Px Define, COM-70~85 Virtual DI x: 54 POS Preset
PC1-05 Pre Position
It presets with the position[mm] PC1-05 Pre Position set by the user by using multi function/Virtual multi function input 54 POS Preset. It shall be performed when the inverter is in stop state and multi function input shall be turned Off after presetting.

APO-15 Cur Pulse-H
APO-16 Cur Pulse-L
PC1-13 POS Enc Dir
After the initial installation of the inverter, set the diretion to PC1-13

POS Enc Dir while monitoring pulse (APO-15 Cur Pulse-H, APO-16 Cur Pulse-L).

For iS7 Position control operating, pulse shall increase during the forward operating. Therefore, after installing the inverter, set PC1-13 POS Enc Dir to 0 Forward if pulse increases on APO-15,16 Cur Pulse-H/L when forward operating command(Normal operating rather than Position control operating) is made with keypad/ terminal block/communication and set PC1-13 POS Enc Dir to 1 Reverse if pulse decreases.

5.6 Position Initialization Operating

It moves in a specific Speed(PC1-46 Preset RPM: reverse operating when (-) Value is inputted) at a specific accelerating & decelerating time(PC1-47 Preset Ramp T) by multi function input(62: POS Preset Run) and a position reference point is decided in various ways(PC1-45 Preset Type) when it reaches a certain position reference point.

IN65~72 Px Define, COM70~85 Virtual DI x: 54 POS Preset
IN65~72 Px Define, COM70~85 Virtual DI x: 62 POS Preset Run
PC1-05 Pre Position
PC1-45 Preset Type
PC1-46 Preset RPM (Note1)
PC1-47 Preset Ramp T (Note2)

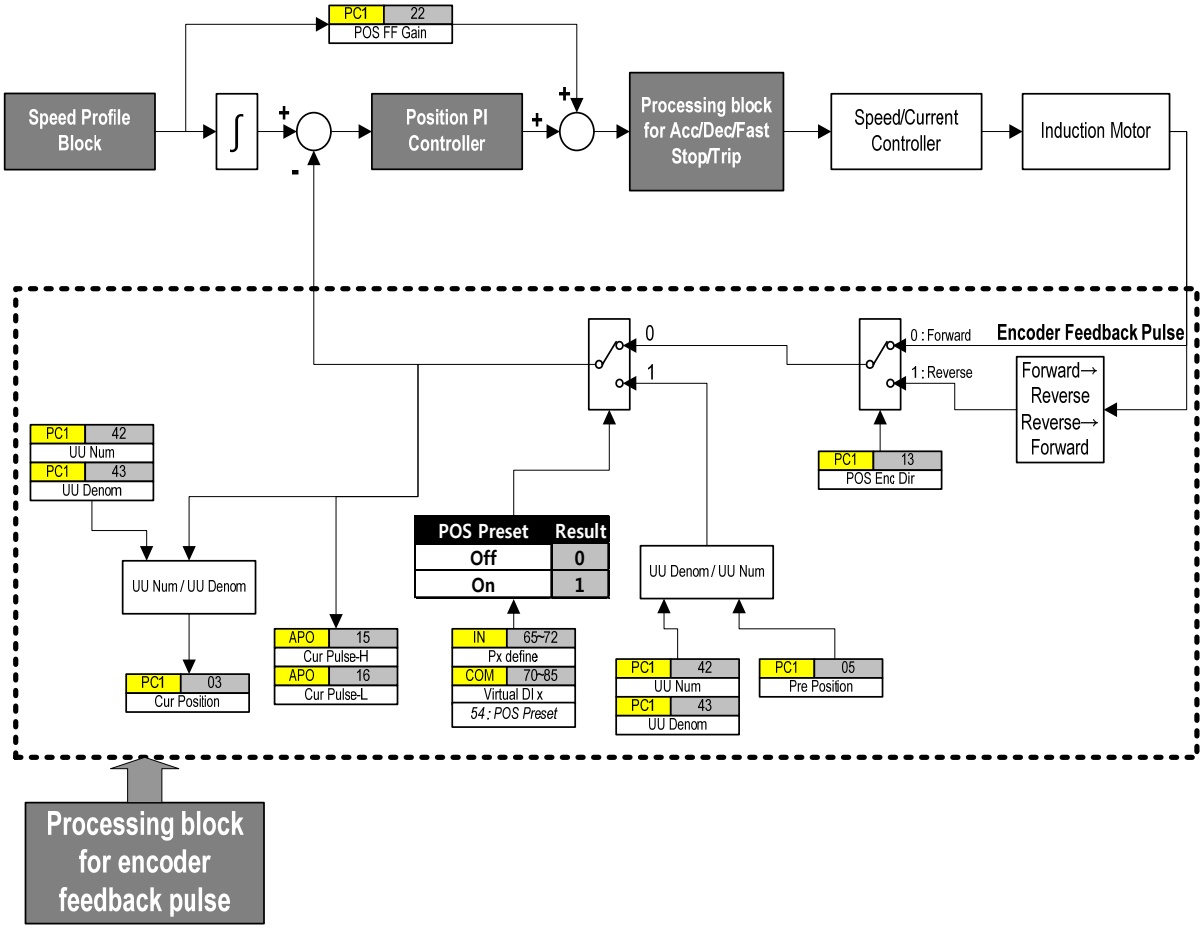
PC1-45 Preset Type	How to Run
0 : Rev+Index	**1.** If multi function input 62 POS Preset Run is On, it will be operated in a specific Speed(PC1-46 Preset RPM) at a specific accelerating & decelerating time(PC1-47 Preset Ramp T). **2.** At the moment when multi function input 54 POS Preset is On, its rotation direction is changed and it is operated in about 20% of the specific Speed (PC1-46 Preset RPM). **3.** If it leaves multi function input 54 POS Preset-that means if POS Preset is Off, the current pulse is initiated to PC1-05 Pre Position and the motor stops at the first index pulse (Encoder Zpulse).
1 : Rev+No Index	**1.** If multi function input 62 POS Preset Run is On, it will be operated in a specific Speed(PC1-46 Preset RPM) at a specific accelerating & decelerating time(PC1-47 Preset Ramp T). **2.** At the moment when multi function input 54 POS Preset is On, its rotation direction is changed and it is operated in about 20% of the specific Speed (PC1-46 Preset RPM). **3.** If it leaves multi function input 54 POS Preset-that means if POS Preset is Off, the current pulse is initiated to PC1-05 Pre Position and the motor stops at the first index pulse (Encoder Zpulse).

PC1-45 Preset Type	How to Run
2 : Fwd+Index	**1.** If multi function input 62 POS Preset Run is On, it will be operated in a specific Speed(PC1-46 Preset RPM) at a specific accelerating & decelerating time(PC1-47 Preset Ramp T). **2.** At the moment when multi function input 54 POS Preset is On, its rotation direction is changed and it is operated in about 20% of the specific Speed (PC1-46 Preset RPM). **3.** If it leaves multi function input 54 POS Preset-that means if POS Preset is Off, the current pulse is initiated to PC1-05 Pre Position and the motor stops at the first index pulse(Encoder Zpulse).
3 : Fwd+No Index	**1.** If multi function input 62 POS Preset Run is On, it will be operated in a specific speed(PC1-46 Preset RPM) at a specific accelerating & decelerating time(PC1-47 Preset Ramp T). **2.** At the moment when multi function input 54 POS Preset is On, its rotation direction is changed and it is operated in about 20% of the specific Speed (PC1-46 Preset RPM). **3.** If it leaves multi function input 54 POS Preset-that means if POS Preset is Off, the current pulse is initiated to PC1-05 Pre Position and the motor stops at the first index pulse(Encoder Zpulse).

1) If (-) value is inputted to PC1-46 Preset RPM, it is operated in the reverse direction.
2) PC1-47 Preset Ramp T is accelerating & decelerating time based on DRV20 Max Freq.

PC1-99 POS S/W Ver

It indicates the version of Position Control S/W.


PC1 22
POS FF Gain
Speed Profile Block
Position PI Controller
Processing block for Acc/Dec/Fast Stop/Trip
Speed/Current Controller
Induction Motor
0
1
0 : Forward
1 : Reverse
Encoder Feedback Pulse
Forward→ Reverse Reverse→ Forward
PC1 13
POS Enc Dir
PC1 42
UU Num
PC1 43
UU Denom
UU Num / UU Denom
PC1 03
Cur Position
APO 15
Cur Pulse-H
APO 16
Cur Pulse-L
POS Preset Result
Off 0
On 1
IN 65~72
Px define
COM 70~85
Virtual DI x
54 : POS Preset
UU Denom / UU Num
PC1 42
UU Num
PC1 43
UU Denom
PC1 05
Pre Position
Processing block for encoder feedback pulse

APPENDIX A. Proportional Synchronization Position Control Operating

It is an operating mode in which multiple inverters reach their target position[mm] within the same time. Since information exchange(the current position[mm] etc.) between inverters in their stop state is essential, it shall be connected with its Top controller in Fieldbus communication.

It is an useful function available for applications(e.g. stage equipments, etc) that require multiple inverters to reach their target position[mm] within the same time.

Group	No.	Function Display	Setting Value	Setting Range	Unit
APP	01	App Mode	6 : Position	0~6	-
APO	15	Cur Pulse-H	Read only	-	pulse
APO	16	Cur Pulse-L	Read only	-	pulse
PC1	01	POS Drv Src	0 : Terminal	0 : Terminal 1 : Fieldbus	-
PC1	02	Tar Position	Read only	-	mm
PC1	03	Cur Position	Read only	-	mm
PC1	05	Pre Position	0	0~65535	mm
PC1	10	Track Err	Read only	-	pulse
PC1	11	V Master Set	0 or 1	0 : No 1 : Yes	-
PC1	12	POS Mode	1 : Multi Sync POS	0~2	-
PC1	13	POS Enc Dir	0 : Forward	0 : Forward 1 : Reverse	-
PC1	14	POS Acc Time	0.0	0.0~10.0	sec
PC1	15	POS Dec Time	0.0	0.0~10.0	sec
PC1	18	POS P Gain	50.0	0.00~1000.0	%
PC1	19	POS I Gain	0.0	0.0~100.0	sec
PC1	20	POS I Limit	5.0	0.0~300.0	%

Group	No.	Function Display	Setting Value	Setting Range	Unit
PC1	22	POS FF Gain	100.0	0.0~3000.0	%
PC1	23	POS PI Out SCL	50.0	0.0~1000.0	%
PC1	24	POS PI Type	0	0 : Fixed 1 : Proportional	-
PC1	25	POS PropPI Min	10.0	0.0~1000.0	%
PC1	27	Fast Stop Time	5.0	0.1~100.0	sec
PC1	28	SW Lmt H En	0 : No	0 : No 1 : Yes	-
PC1	29	SW Lmt H Lev	60000	PC1-31~65535	-
PC1	30	SW Lmt L En	0 : No	0 : No 1 : Yes	-
PC1	31	SW Lmt L Lev	5000	0~PC1-29	-
PC1	32	POS Err Ctrl	0 : None	0 : None 1 : Freerun 2 : Dec	-
PC1	33	POS Err Disp	Read only	0 : No Errorr 1 : HW Lmt H 2 : HW Lmt L 3 : SW Lmt H 4 : SW Lmt L 5 : Max Track Err	-
PC1	35	Max Track Err	30000	0~65535	pulse
PC1	41	Target Bound	100	0~65535	mm
PC1	42	UU Num	1	1~65535	-
PC1	43	UU Denom	1	1~65535	-
PC1	45	Preset Type	0 : Rev+Index	0 : Rev+Index 1 : Rev+No Index 2 : Fwd+Index 3 : Fwd+NoIndex	-

Group	No.	Function Display	Setting Value	Setting Range	Unit
PC1	46	Preset RPM	100	-1800~1800	RPM
PC1	47	Preset Ramp T	1.0	0.0~100.0	sec
PC1	99	POS S/W Ver	-	x.xx	-
IN	65 ~72	Px Define	53 : POS Run	-	-
			54 : POS Preset		
COM	70~ 85	Virtual DI x	55 : POS Fast Stop		
			56 : POS HW Lmt H		
			57 : POS HW Lmt L		
			58 : POS Pattern-L		
			59 : POS Pattern-M		
			60 : POS Pattern-H		
			61 : POS Pattern-X		
			62 : POS Preset Run		
			63 : POS Disable		

(1) How to realize proportional synchronization position control system

In the proportional synchronization position control operating mode, multiple inverter reach different target positions[mm] simultaneously.

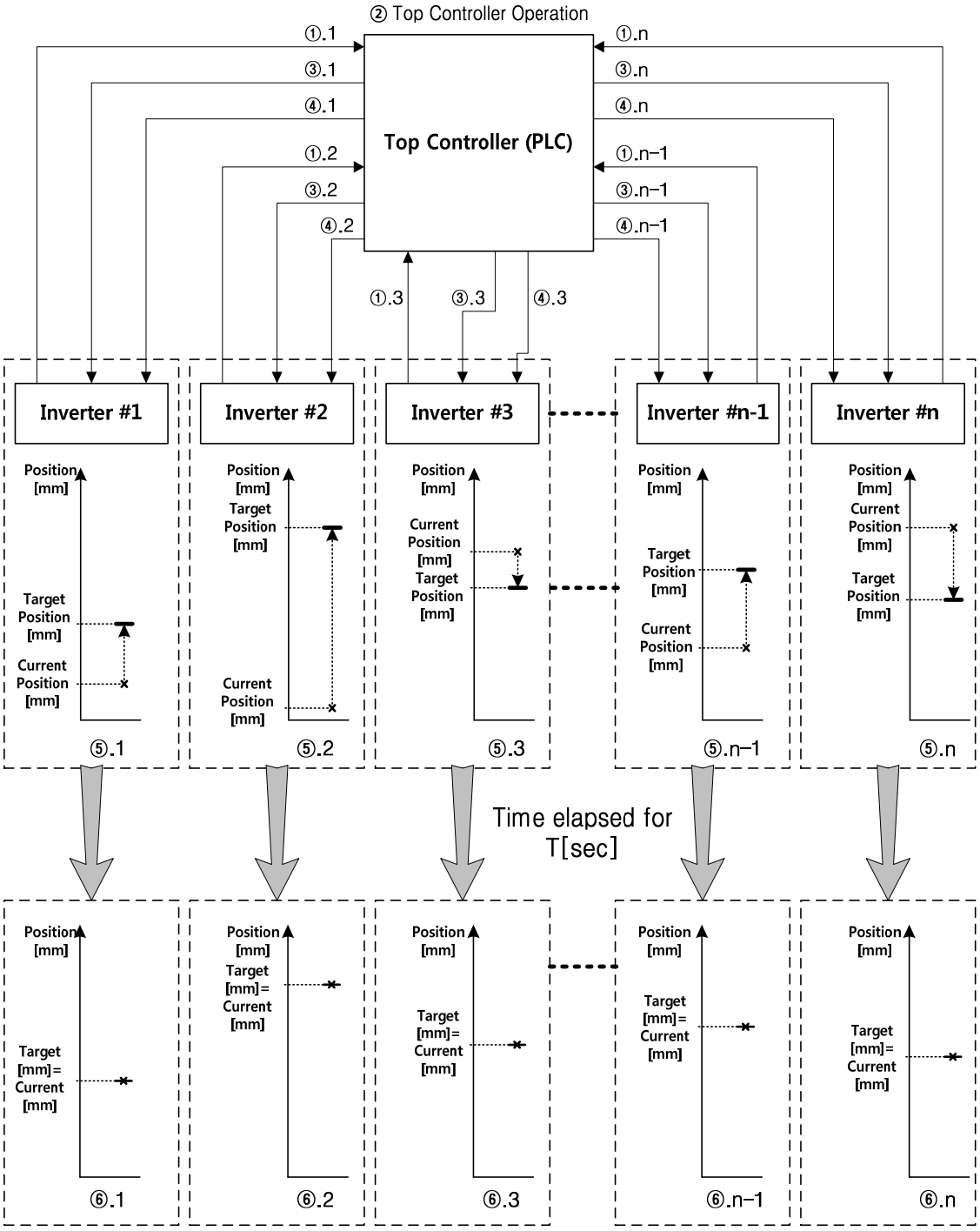


Figure A-1 Network composition of proportional synchronization position control operation mode and How to run

Comm. Address	Parameter	Scale	Unit	R/W	Assignment for each bit		Setting Method
0h0385	Virtual Multi-Function Input	-	-	R/W	POS Run		Position Control Run
0h0600	Position/Sync Control Bit	-	-	R/W	B15	0 : Slave 1 : Virtual master	0 : virtual slave(Multiple) 1 : virtual master(One)
0h0601	Target Position	0	mm	R/W	Target Position[mm]		Position command within 0 through 65535 of each inverter
0h0603	Current position of the virtual master	0	mm	R/W	Current position[mm] of one virtual master		Inform the current position of the virtual master to virtual slave inverters.
0h0604	Target position of the virtual master	0	mm	R/W	Target position[mm] of one virtual master		Inform the target position of the virtual master to virtual slave inverters.
0h0610	Current position	0	mm	R	Current position[mm] of the applicable inverter		Monitor the current position of each inverter

The following steps show how to realize the proportional synchronization position control operating mode according to Figure A-1.

Step 1. Set the proportional synchronization position control operating mode

To set the proportional synchronization position control operating mode, select 1 Multi Sync POS for each inverter(inverter1 through inverter n) in PC1-12 Pos Mode .

Step 2. Inform the current position[mm]

①.1 ~ ①.n : N inverters(inverter1~inverter n) send/receive their current positions[mm](Communication Address: 0h0610) to/from PLC.

Comm. Address	Parameter	Scale	Unit	R/ W	Assignment for each bit	Setting Method
0h0610	Current position	0	mm	R	Current position[mm] of the applicable inverter	Monitor the current position of each inverter

Step 3. Calculate Top controller(PLC)

② : Decide one virtual master(One) and several virtual slaves(Multiple) on PLC.

Get the absolute difference between each inverter's target position[mm] and its current position[mm] received on Step 2.

One inverter(That is, the inverter that has to move farthest) with the biggest value among those absolute values becomes the virtual master.

Therefore, Inverter 2 that has the longest distance to reach its target position[mm] from its current position becomes the virtual master as seen in ⑤.2 of Figure A-1. Remaining inverters other than Inverter 2 become the virtual slaves.

Comm. Address	Parameter	Scale	Unit	R/ W	Assignment for each bit	Setting Method
0h0601	Target position	0	mm	R/ W	Target position[mm]	Position command within 0 through 65535 of each inverter
0h0610	The current position	0	mm	R	Current position[mm] of the applicable inverter	Monitor the current position of each inverter

Step 4. Assign the virtual master and virtual slaves by PLC

1. ③.1 ~ ③.n : PLC assigns via communication the virtual master(Inverter 2) and virtual slaves(Inverters other than inverter 2) decided on Step 3. If the top bit(MSB) of the following communication address 0h0600 is turned On, the virtual master is assigned, if it is Off, the virtual slave is assigned. Therefore, after setting the top bit(MSB) of communication address 0h0600 to 1, send and receive Inverter 2 to assign it as the virtual master. In addition, after resetting the top bit(MSB) of communication address 0h0600 to 0, send and receive inverters other than Inverter 2 to assign it as the virtual slaves.

Comm. Address	Parameter	Scale	Unit	R/ W	Assignment for each bit	Setting Method
0h0600	Position/ Sync Control Bit	-	-	R/ W	B15	0 : Slave 1 : Virtual master

2. ③.1 ~ ③.n : As decided on Step 3, send/receive the current position and target position of Inverter 2 assigned as the current virtual master to/from each slave inverter through communication address(0h0603 : Current position of the virtual master, 0h0604 : Target position of the virtual master).

Comm. Address	Parameter	Scale	Unit	R/W	Assignment for each bit	Setting Method
0h0603	Current position of the virtual master	0	mm	R/W	Current position[mm] of one virtual master	Inform the current position of the virtual master to virtual slave inverters.
0h0604	Target position of the virtual master	0	mm	R/W	Target position[mm] of one virtual master	Inform the target position of the virtual master to virtual slave inverters.

Step 5. Operate Inverters

1. ④.1 ~ ④.n : Turn 53 POS Run of Virtual multi function input(0h0385 communication address) On in the top controller to start the position control operating.

2. ⑤.1 ~ ⑤.n : Each inverter's motor load axis begins to move from the current position[mm] to the target position[mm].

Comm. Address	Parameter	Scale	Unit	R/W	Assignment for each bit	Setting Method
0h0385	Virtual Multi-Function Input	-	-	R/W	POS Run	Position Control Run

Step 6. End operating

⑥.1 ~ ⑥.n : Once all of inverters(virtual master/virtual slave) reach their target positions simultaneously after a certain time T[sec] elapses, the proportional synchronization position control operating ends.

⚠ CAUTION

- For the proportional synchronization position control operating, the accelerating & decelerating time and maximum Speed(TRJ Acc Time-x, TRJ Dec Time-x, TRJ Max Spd-x) of the virtual master and those of the virtual slaves shall be the same.

(2) Block Diagram

For the proportional synchronization position control operating mode, one virtual master inverter and multiple virtual slave inverters shall be arranged.

In the proportional synchronization position control operating mode, all of the inverters (virtual master/virtual slave) shall reach different target positions simultaneously.

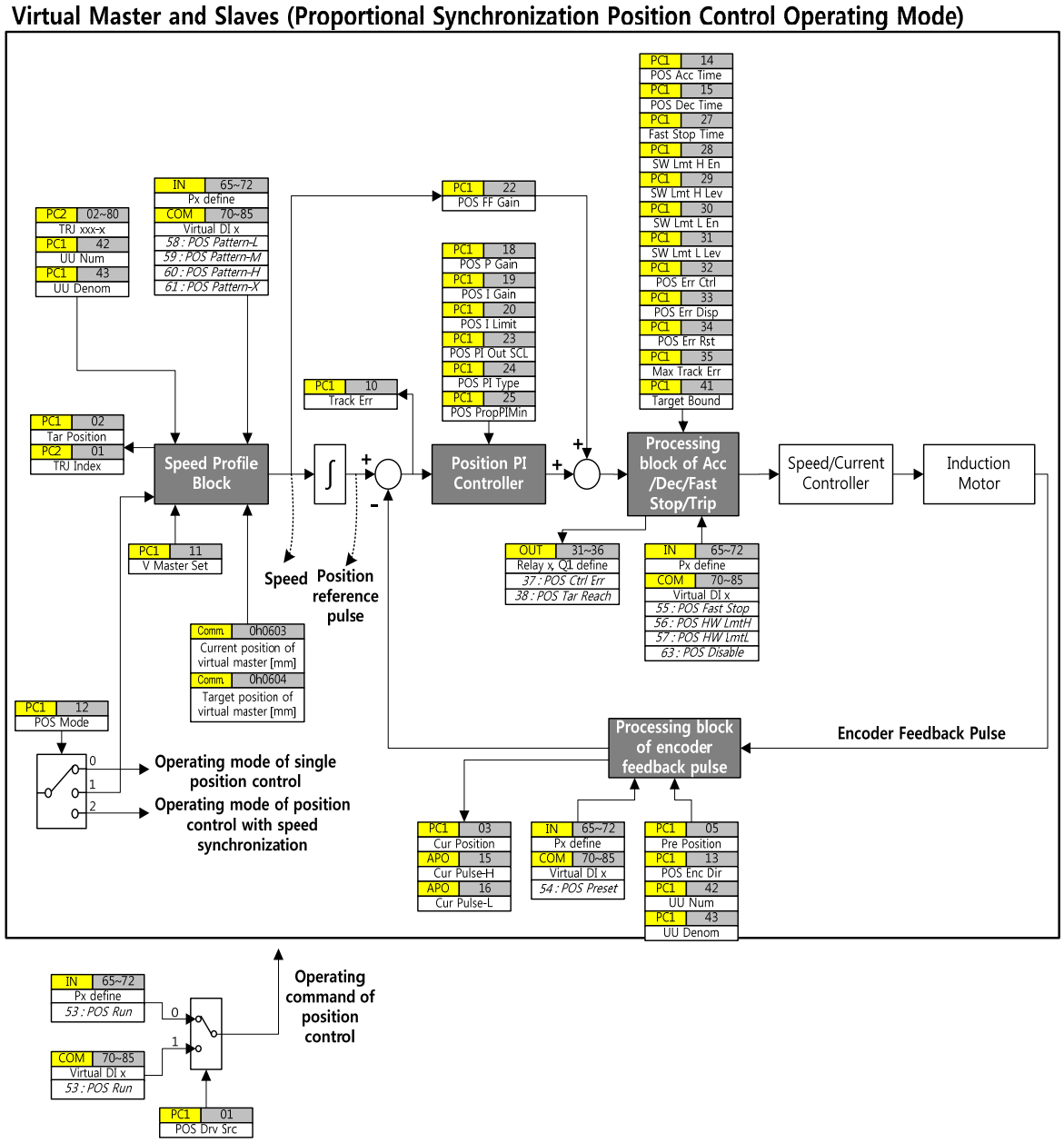


Figure A-1 Block diagram of proportional synchronization position control operating mode

Because inverters are not wired(Hard-wiring) to each other, there is no limit to the number of virtual slaves.

However, the virtual slaves need to know two kinds of information(the current position of the virtual master: common area 0h0603 address, target position: common area 0h0604 address) on the virtual master in the inverter stop state. Therefore, inverters shall be connected to the top controller (PLC, etc) with Fieldbus communication (see Speed Profile Block)

Largely, four function blocks (Speed profile block, Position PI Controller, Encoder Feedback Pulse Processing Block and Accelerating & Decelerating/Fast Stop/Trip Processing Block) are composed.

In the Speed profile block, make trapezoid-type Speed profiles with information on the current position, target position, accelerating & decelerating time and maximum frequency.

In case of the inverters assigned as virtual slaves, additional information on the current position of the virtual master(0x603 communication address) and the target position of the virtual master(0x604 communication address) except applicable slave inverters' current position, target position, accelerating & decelerating time and maximum frequency are needed to make a proper Speed Profile synchronized with the virtual master.

The Position PI controller block, Accelerating & decelerating/Fast Stop/Trip Processing Block and Encoder Feedback Pulse Processing Block are the same as in 3.1 Single Position Control Operating.

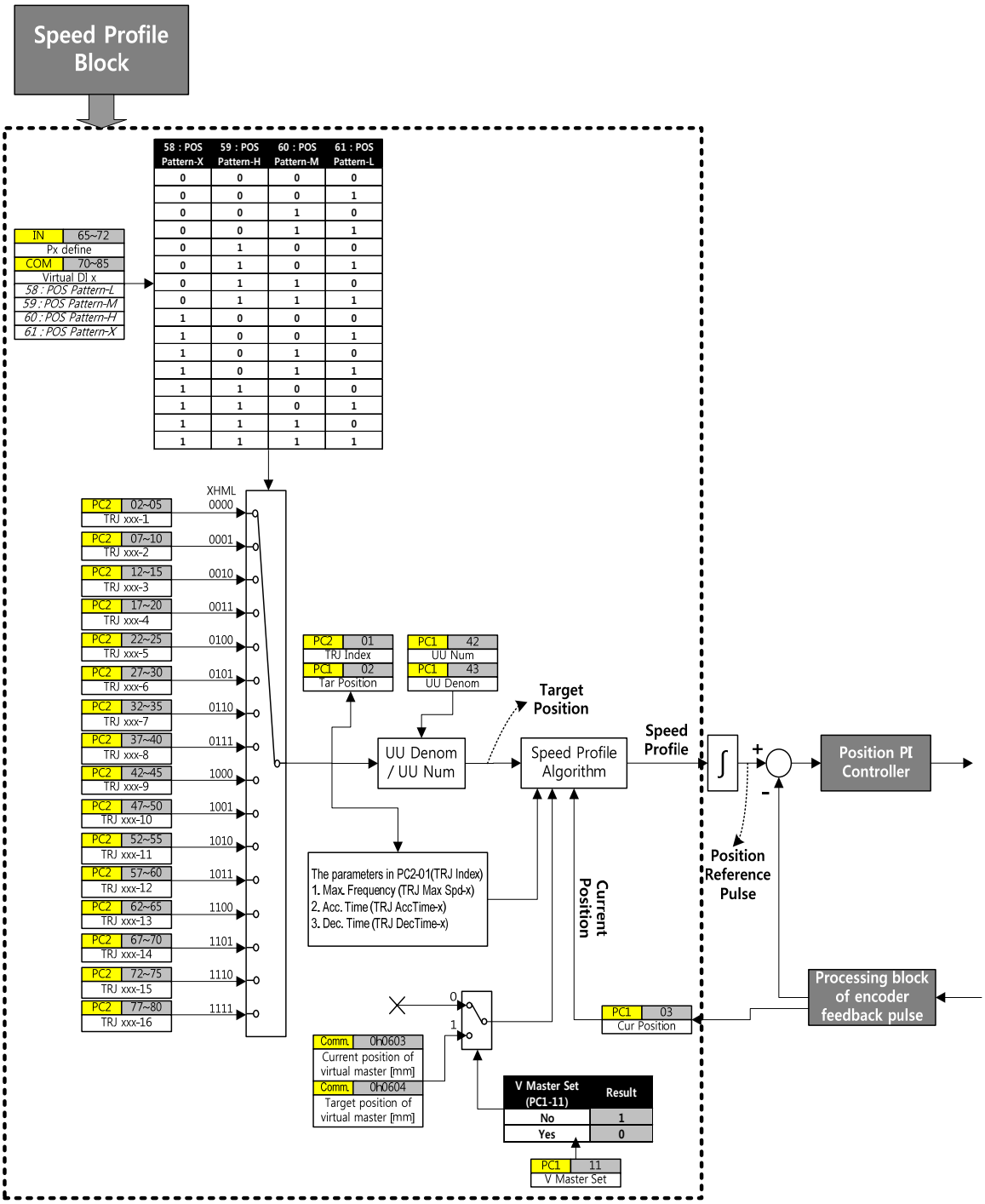
PC1-12 POS Mode

Set the Position control operating mode. In case of the Proportional synchronization position control operating mode, select 1 Multi Sync POS.

(3) Speed profile block

The virtual master is the same with the Speed profile block in 5.2 Single Position Control Operating Mode.

On the contrary, the virtual slaves shall have information on the current position of the virtual master(0h0603 communication address) and the target position of the virtual master(0h0604 communication address) to work well.



PC1-01 TRJ Index
PC2-02~80 TRJ Tar Pos-x, TRJ Max Spd-x, TRJ Acc Time-x, TRJ Dec Time-x
IN65~72 Px Define, COM70~85 Virtual DI x: POS Pattern-L/M/H/X

TRJ Max Spd-x, TRJ Acc Time-x and TRJ Dec Time-x of the virtual master and those of the virtual slaves shall be se identically. For example, the inverters shown in A.1.1 have the following values:

Inverter No.	IN Grp Px Define, COM Grp Virtual DI x				PC2-01 TRJ Index	PC2-02 TRJ Tar Pos-1	PC2-03 TRJ Max Spd-1	PC2-04 TRJ Acc T-1	PC2-05 TRJ Dec T-1
	POS Pattern -X	POS Pattern -H	POS Pattern -M	POS Pattern -L					
Inverter 1	0	0	0	0	1	10000	70.00Hz	8.0sec	5.0sec
Inverter 2	0	0	0	0	1	40000	70.00Hz	8.0sec	5.0sec
Inverter 3	0	0	0	0	1	20000	70.00Hz	8.0sec	5.0sec
Inverter n-1	0	0	0	0	1	21000	70.00Hz	8.0sec	5.0sec
Inverter n	0	0	0	0	1	17000	70.00Hz	8.0sec	5.0sec

Their max Speed, accelerating time and decelerating time are identical.

(4) Position PI controller block

It is the same with the Position PI controller block of Single Position Control described in 5.3.

(5) Accelerating & decelerating/Fast Stop/Trip Processing (Exemption Processing) Block

It is the same with the Accelerating & Decelerating/Fast Stop/Trip Processing (Exception Processing) Block of Single Position Control described in 5.4.

(6) Encoder Feedback Pulse Processing Block

It is the same with the Processing Block of Encoder Feedback Pulse of Single Position Control described in 5.5.

(7) Position Initialization Operating

It is the same with the “Position Initialization Operating” of Single Position Control described in 5.6.

APPENDIX B. Speed Sync Position Control Operating

One virtual master inverter and multiple virtual slave inverters are synchronized in speed to operate. At this time, one virtual master is subject to the Position control operating until it reaches its target position[mm] and multiple virtual slave inverters are not subject to the Position control operating and they are speed synchronized with only one virtual master inverter for being operated.

For the Speed Sync Position Control Operating, additional sync card is not needed. But, during the operating, virtual slaves need to receive the speed information on the virtual master inverter trough iS7 embedded 485 communication(19200bps, 10ms right interval). Therefore, in the Speed sync position control operating mode, iS7 embedded 485 Function cannot be used for other purposes(LS485, Modbus-RUT) but it is used only for 485 communication dedication to the Speed Sync Position Control .

Group	No.	Function Display	Setting Value	Setting Range	Unit
APP	01	App Mode	6 : Position	0~6	-
APO	15	Cur Pulse-H	Read only	-	pulse
APO	16	Cur Pulse-L	Read only	-	pulse
PC1	01	POS Drv Src	0 : Terminal	0 : Terminal 1 : Fieldbus	-
PC1	02	Tar Position	Read only	-	mm
PC1	03	Cur Position	Read only	-	mm
PC1	05	Pre Position	0	0~65535	mm
PC1	10	Track Err	Read only	-	pulse
PC1	11	V Master Set	0 or 1	0 : No 1 : Yes	-
PC1	12	POS Mode	2 : Multi Sync SPD	0~2	-
PC1	13	POS Enc Dir	0 : Forward	0 : Forward 1 : Reverse	-
PC1	14	POS Acc Time	0.0	0.0~10.0	sec

Group	No.	Function Display	Setting Value	Setting Range	Unit
PC1	15	POS Dec Time	0.0	0.0~10.0	sec
PC1	18	POS P Gain	50.0	0.00~1000.0	%
PC1	19	POS I Gain	0.0	0.0~100.0	sec
PC1	20	POS I Limit	5.0	0.0~300.0	%
PC1	22	POS FF Gain	100.0	0.0~3000.0	%
PC1	23	POS PI Out SCL	50.0	0.0~1000.0	%
PC1	24	POS PI Type	0	0 : Fixed 1 : Proportional	-
PC1	25	POS PropPI Min	10.0	0.0~1000.0	%
PC1	27	Fast Stop Time	5.0	0.1~100.0	sec
PC1	28	SW Lmt H En	0 : No	0 : No 1 : Yes	-
PC1	29	SW Lmt H Lev	60000	PC1-31~65535	-
PC1	30	SW Lmt L En	0 : No	0 : No 1 : Yes	-
PC1	31	SW Lmt L Lev	5000	0~PC1-29	-
PC1	32	POS Err Ctrl	0 : None	0 : None 1 : Freerun 2 : Dec	-
PC1	33	POS Err Disp	Read only	0 : No Errorr 1 : HW Lmt H 2 : HW Lmt L 3 : SW Lmt H 4 : SW Lmt L 5 : Max Track Err	-
PC1	35	Max Track Err	30000	0~65535	pulse
PC1	41	Target Bound	100	0~65535	mm
PC1	42	UU Num	1	1~65535	-
PC1	43	UU Denom	1	1~65535	-

Group	No.	Function Display	Setting Value	Setting Range	Unit
PC1	45	Preset Type	0 : Rev+Index	0 : Rev+Index 1 : Rev+No Index 2 : Fwd+Index 3 : Fwd+No Index	-
PC1	46	Preset RPM	100	-1800~1800	RPM
PC1	47	Preset Ramp T	1.0	0.0~100.0	sec
PC1	50	Rcv Frame Num	Read only	-	-
PC1	51	Err Frame Num	Read only	-	-
PC1	99	POS S/W Ver	-	x.xx	-
IN	65 ~72	Px Define	53 : POS Run	-	-
			54 : POS Preset		
COM	70~85	Virtual DI x	55 : POS Fast Stop	-	
			56 : POS HW Lmt H		
			57 : POS HW Lmt L		
			58 : POS Pattern-L		
			59 : POS Pattern-M		
			60 : POS Pattern-H		
			61 : POS Pattern-X		
			62 : POS Preset Run		
			63 : POS Disable		

(1) How to realize Speed Sync Position Control System

In the Speed sync position control operating mode, one virtual master inverter and multiple virtual slave inverters are composed.

The user can set the virtual master and slaves with loader(If PC1-11 V Master Set : 0 No, virtual slave, if 1 Yes, virtual master) or he/she may access to communication address(if setting 0x600 address's MSB, virtual master, if resetting, virtual slave) to set them.

Only the assigned virtual master is subject to the Position control operating until it reaches its target position[mm] and remaining virtual slaves are just synchronized in speed with the virtual master to operate. Therefore, target position[mm] does not mean anything to virtual slaves. Virtual slaves receive the speed information on the virtual master through iS7 embedded 485 communication during the operating in 10ms interval.

Step 1. Wiring of Speed Sync Position Control Operating Mode

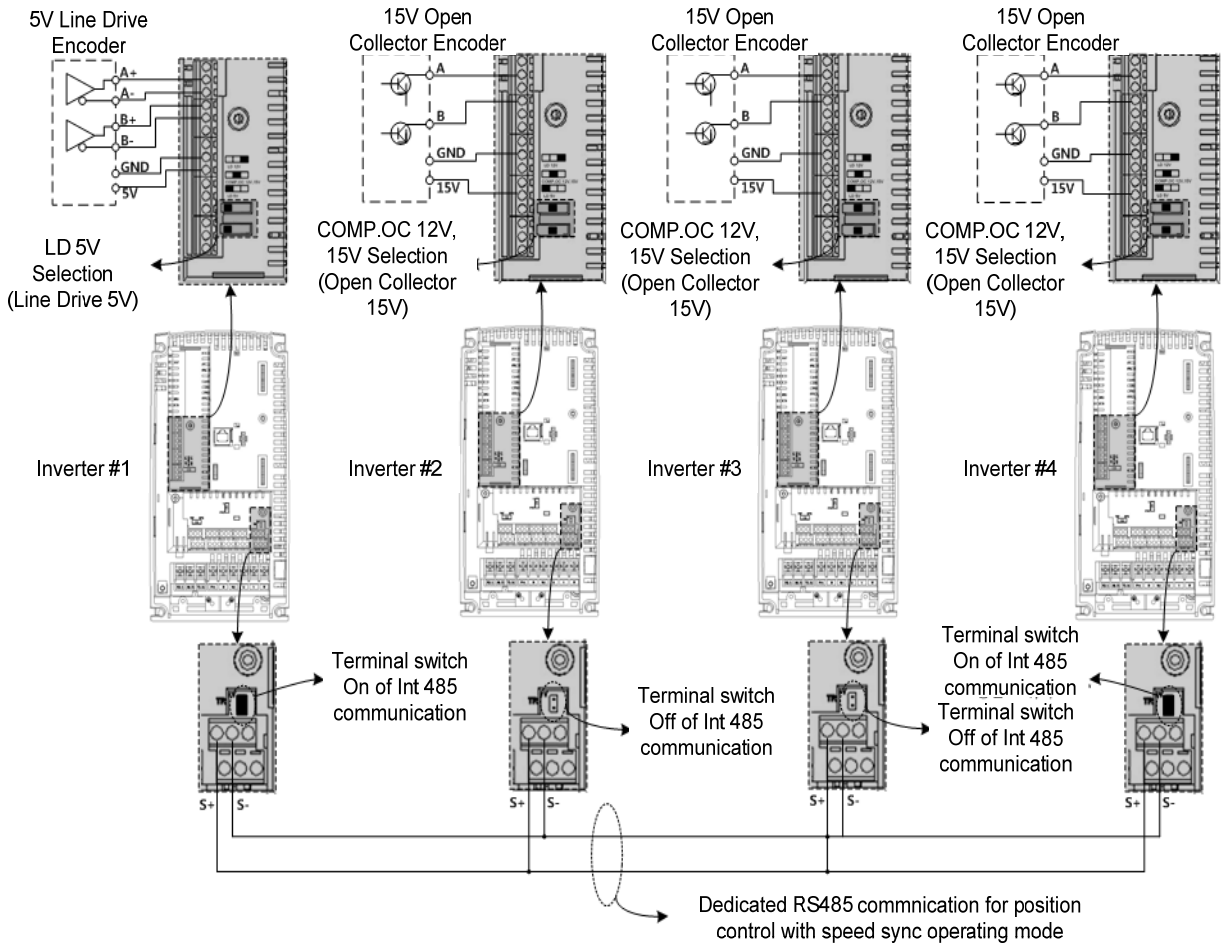


Figure A-2 Wiring of four inverters' Speed sync position control operating

Figure A-2 shows an example of wiring four inverters. Each inverter is wired with an encoder. For the Speed sync position control operating mode, iS7 basic I/O embedded 485 Terminal S+ and S- on the bottom of Figure A-2 shall be wired with each other. Also, end inverters(Inverter #1 and Inverter #4 are end inverters in Figure A-2)and basic I/O communication end switches shall be On.

⚠ CAUTION

- iS7 embedded 485 communication is allowed up to total 16 inverters without additional repeater for communication use. To use more inverters, repeater for RS485 communication shall be used.

Step 2. Set operating mode and virtual master

1. To set the Speed sync position control operating mode, select 2 Multi Sync SPD from PC1-12 Pos Mode.
2. Assign one inverter as the virtual master that will need the Position control operating until it reaches its target position[mm]. Set other inverters that will be synchronized with the virtual master in speed as virtual slaves. There are two ways to set a virtual master and slave as following:

- Method with loader

  If 1 Yes is selected for PC1-11 V Master Set, a virtual master will be set. If 0 No is selected, a virtual slave will be set.

- Method with communication

  If MSB(Bit15) of communication address 0x600 address(position/sync control bit) is set to 1, a virtual master will be set. If it is reset to 0, a virtual slave will be set.

Comm. Address	Parameter	Scale	Unit	R/ W	Assignment for each bit	Setting Method
0h0600	Position/ Sync Control Bit	-	-	R/ W	B15	0 : Slave 1 : Virtual master

⚠ CAUTION

- Only one virtual master inverter shall exist on iS7 embedded 485 communication network dedicated to the Speed sync position control operating mode. If two or over virtual masters exist on 485 network, virtual slaves cannot be synchronized and operated with the virtual master any more due to network collision.

Step 3. Input the target position of the virtual master

Input a target position[mm] to the virtual master inverter. But, virtual slave inverters do not need any target position[mm].

Input a target position[mm] to communication address 0h0601 as following:

Comm. Address	Parameter	Scale	Unit	R/W	Assignment for each bit	Setting Method
0h0601	Target Position	0	mm	R/W	Target Position[mm]	Position command within 0 through 65535 of each inverter

It is also possible to input a target position directly by loader. Input a target position[mm] to PC2-2 TRJ Tar Pos-1. At this time, all of multi function input POS Pattern L/M/H/X shall be Off.

Step 4. Operate the inverters

Start the Speed sync position control operating of the virtual master/slaves by turning On 53 POS Run Terminal of multi function input(IN-65~72 Px Define) or Virtual multi function input(COM-70~85 Virtual DI x).

Now, one virtual master inverter is operated for its load axis to reach its target position[mm] and other multiple virtual slave inverters are synchronized and operated with the virtual master.

⚠ CAUTION

- The virtual master inverter and the virtual slave inverters shall also have the same operating direction (forward/reverse).

(2) Block Diagram

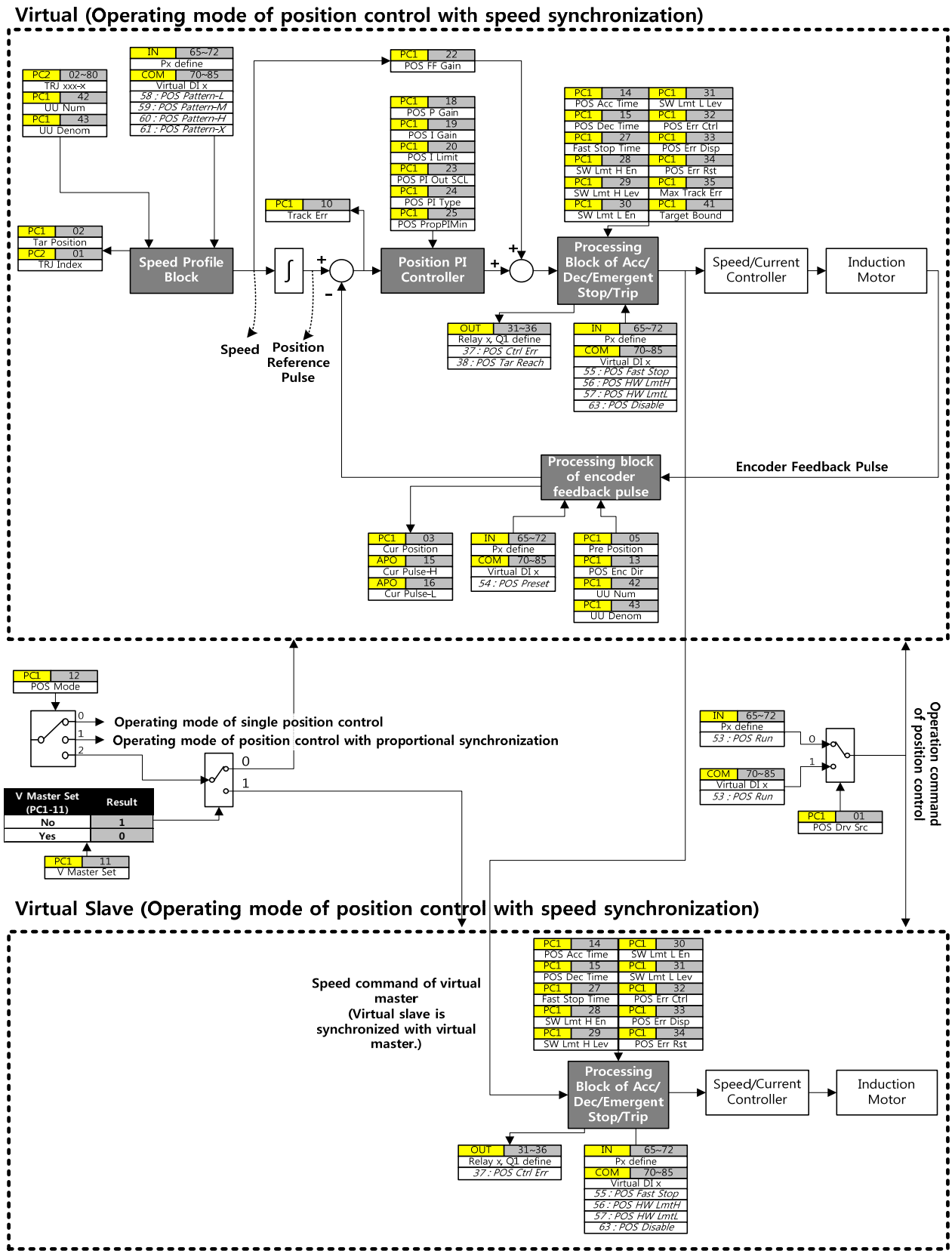


Figure A-3 Block diagram of Speed sync position control operating mode

In the Speed sync position control operating mode, the virtual master inverter(Inside of the upper dot line in Figure A-3)'s Block diagram is the same with the block diagram of Single position control operating described in 5.1.

However, in case of virtual slave inverters (Inside of the bottom dot line in Figure A-3), they are just synchronized in speed with the virtual master.

Remark

- Virtual slave inverters receive the virtual master inverter's speed command as input. Therefore, the virtual master and slaves are synchronized in speed with each other to operate.

(3) Speed profile block

In the Speed sync position control operating mode, the virtual master's speed profile block is the same with the speed profile block of Single position control operating described in 5.2.

However, since virtual slaves are synchronized in speed with the virtual master, the speed profile block of virtual slaves is not needed.

(4) Position PI controller block

In the Speed sync position control operating mode, the virtual master's position PI controller block is the same with the position PI controller block of Single position control operating described in 5.3.

However, since virtual slaves are synchronized in speed with the virtual master, the position PI controller block of virtual slaves is not needed.

(5) Accelerating & decelerating/Fast Stop/Trip Processing (Exemption Processing) Block

In the Speed sync position control operating mode, the Accelerating & decelerating/Fast Stop/Trip Processing Block of the virtual master/slaves is the same with the Accelerating & decelerating/Fast Stop/Trip Processing Block of Single Position Control Operating described in 5.4.

(6) Encoder Feedback Pulse Processing Block

In the Speed sync position control operating mode, the virtual master's encoder feedback pulse processing block is the same with the encoder feedback pulse processing block of Single position control operating described in 5.5.

However, since virtual slaves are synchronized in speed with the virtual master, the Encoder Feedback Pulse Processing Block of virtual slaves is not needed.

(7) Position Initialization Operating

Same with "Position Initialization Operating" of Single position control described in 5.6.

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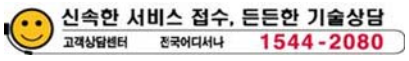

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