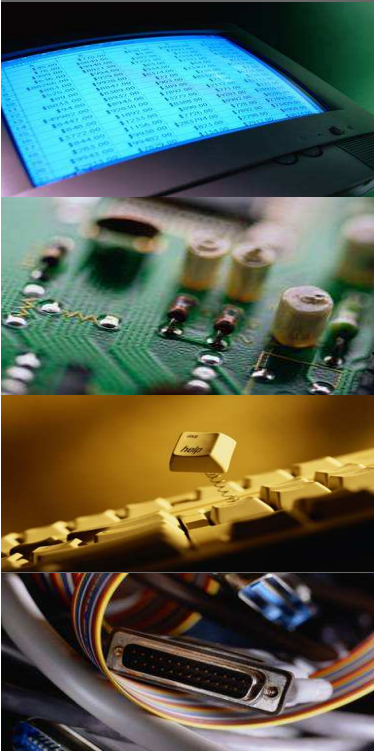


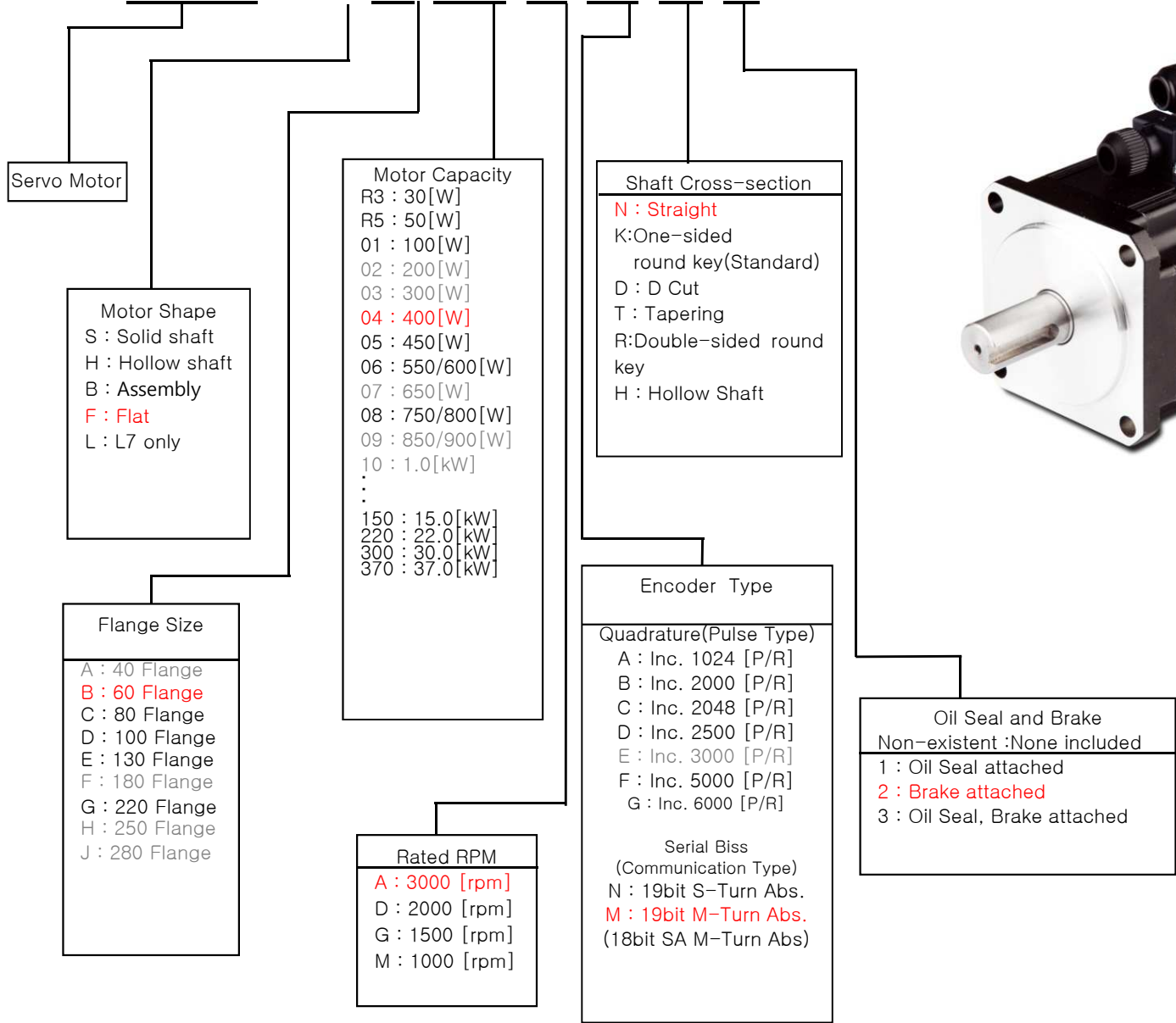
Guide Book for L7S Series Position Mode

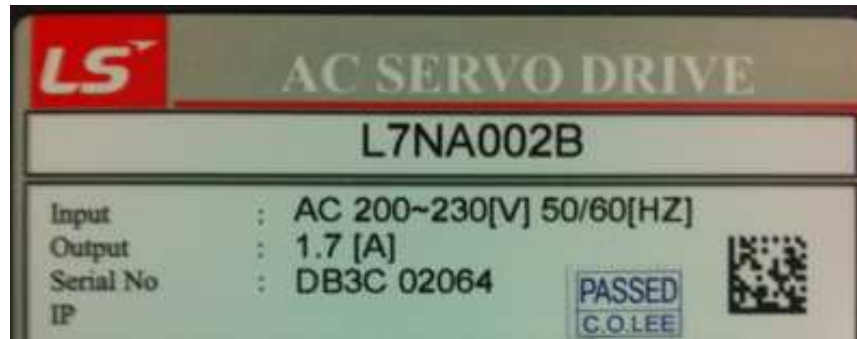


14.Feb,2014
SI team/Wonkee Son
LS Mecapion

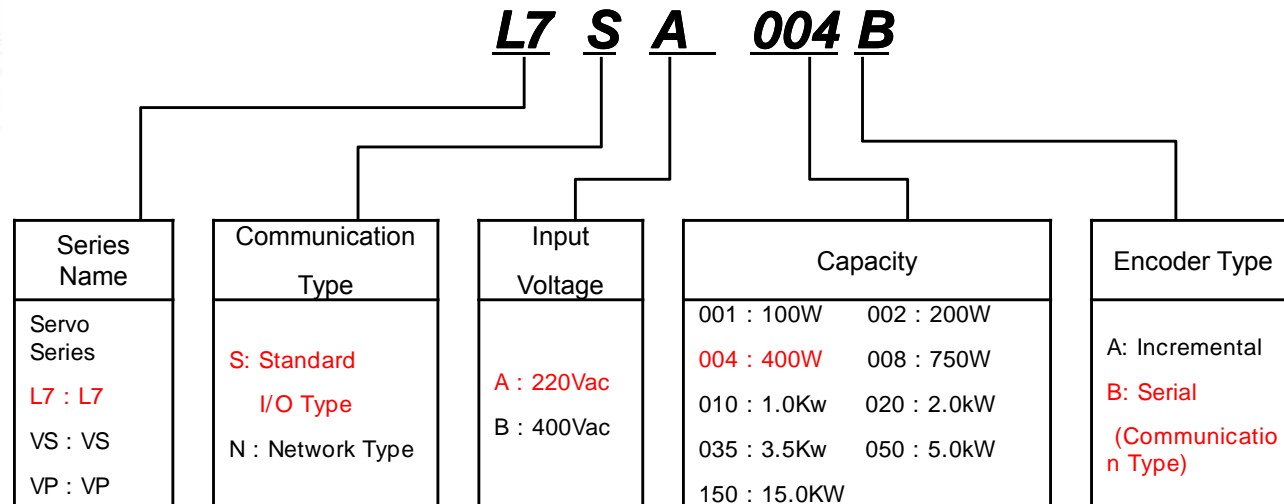
- 1. Model name**
- 2. Part name**
- 3. Wiring diagram**
- 4. Parameter editing**
- 5. Gain Tuning**
- 6. Action for abnormal situation**

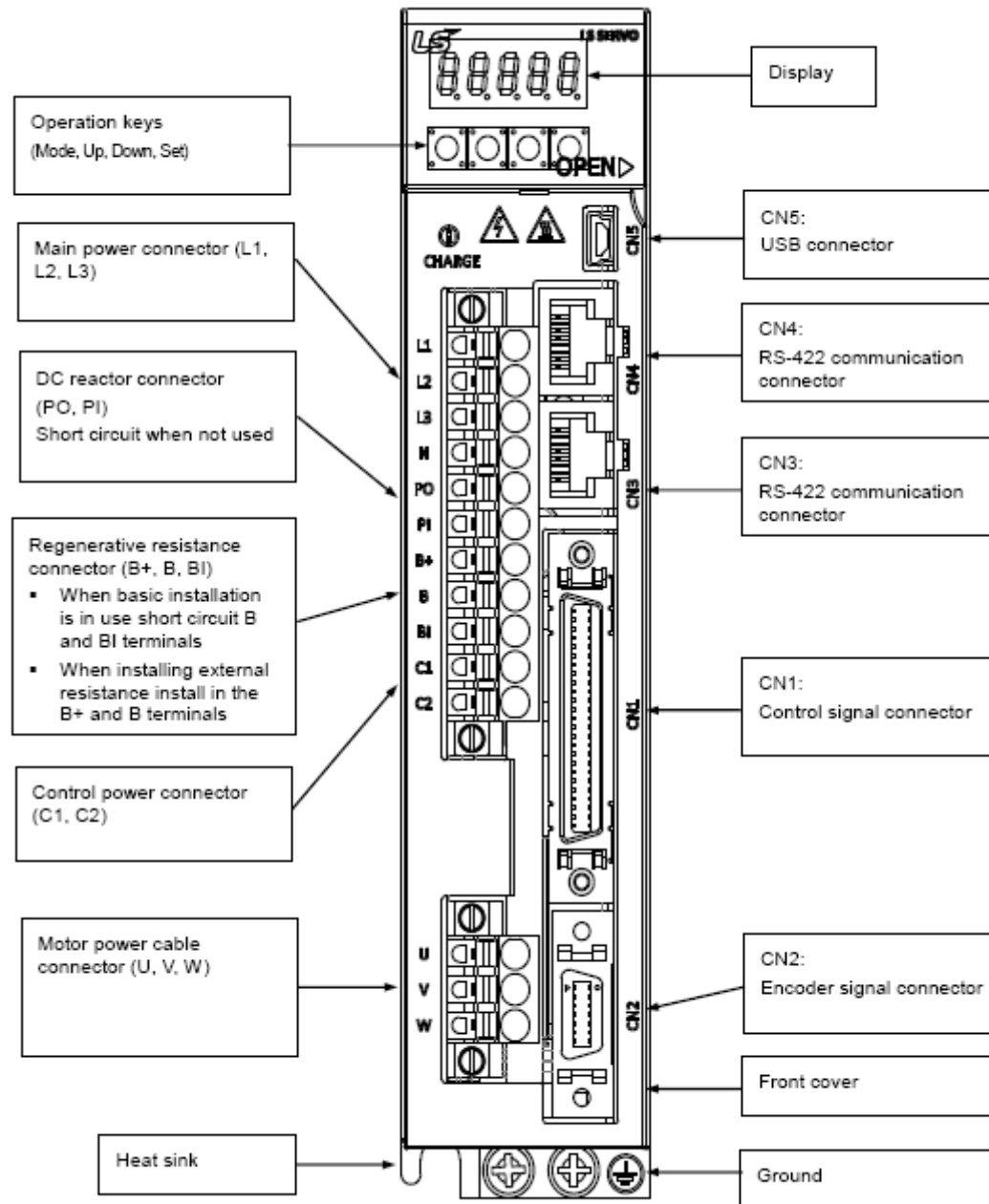
APM - FB 04 A M N 2

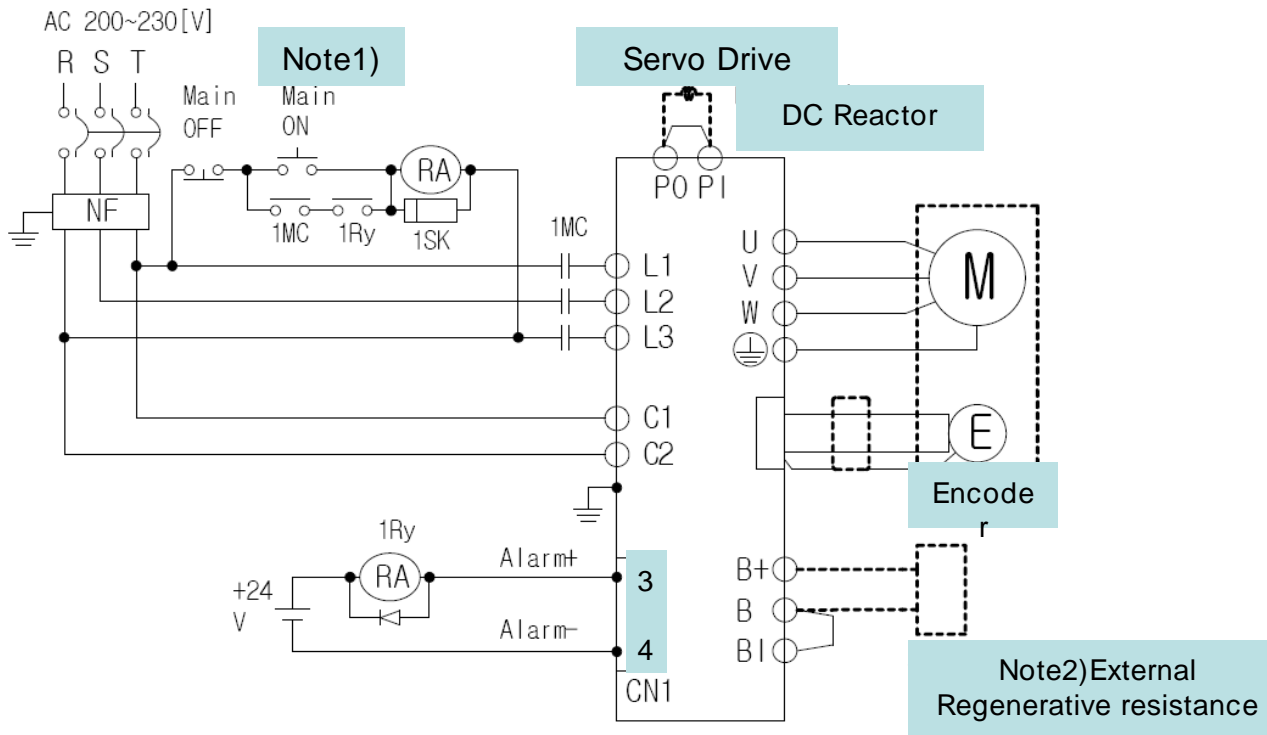




L7 S A 004 B





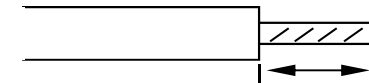


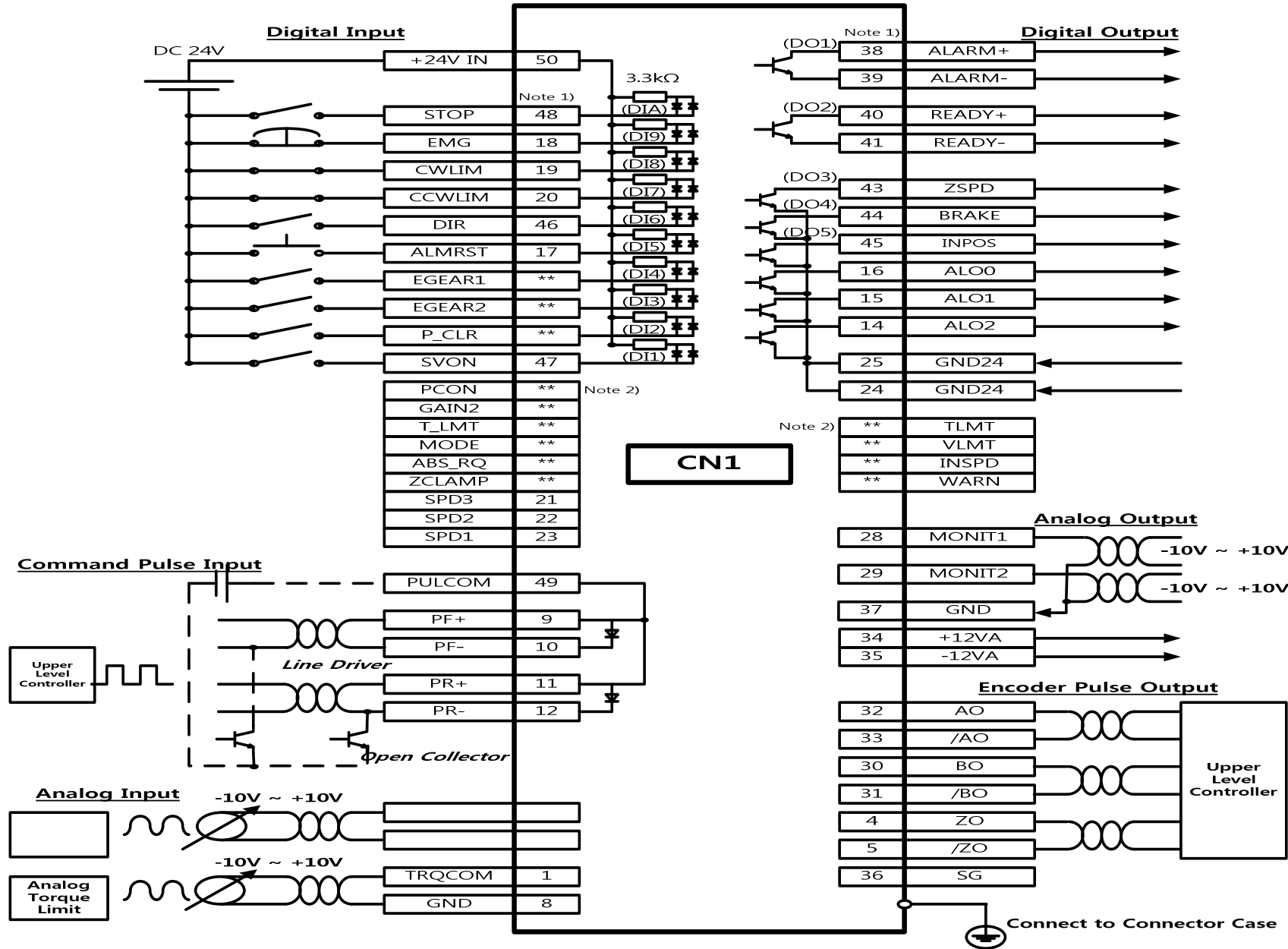
Note1) It takes approximately one to two seconds to output an alarm signal after turning on the main power(3Phase AC220V). Accordingly, press and hold the main power ON switch for at least two seconds.

Note2) Check the B and BI short-circuit terminals and the L7NA001B-L7NA004B (50 W, 100 Ω), L7NA008B ~ L7NA010B (100 W, 40 Ω), and L7NA020B ~ L7NA035B (150 W, 13 Ω) regenerative resistors before use. If the regenerative capacity is high because of frequent acceleration and deceleration, open the short-circuit pins (B , BI) and connect an external regenerative resistor to B and B+

주3) Remove approximately 7-10 mm of the sheathing from the cables for the main circuit power and attach crimp terminals. (Maker : SEOIL)

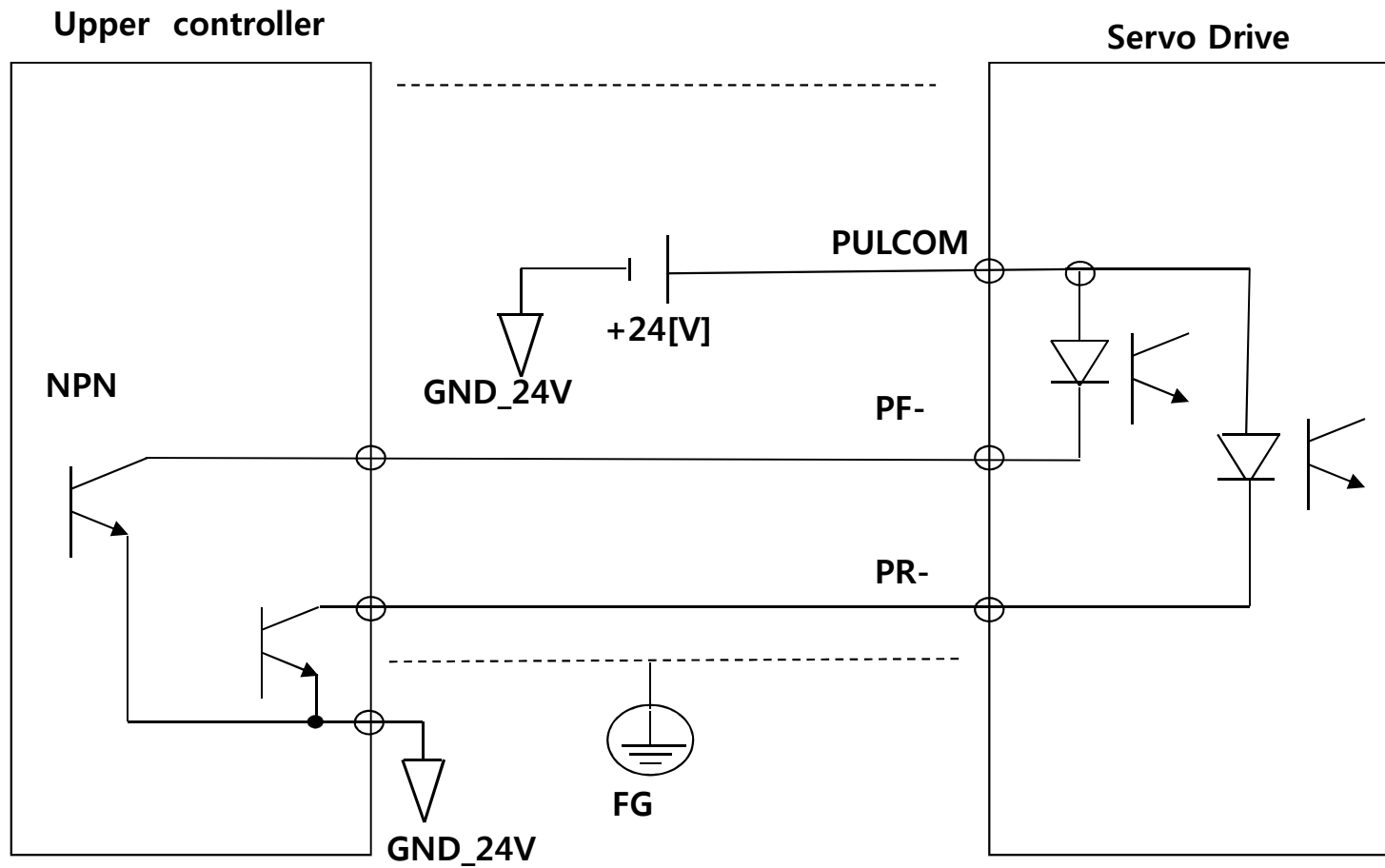
100[W]~400[W] : UA-F1510, 800[W] ~400[W]: UA-F2010, 2[kW] ~3.5[kW]: UA-F4010



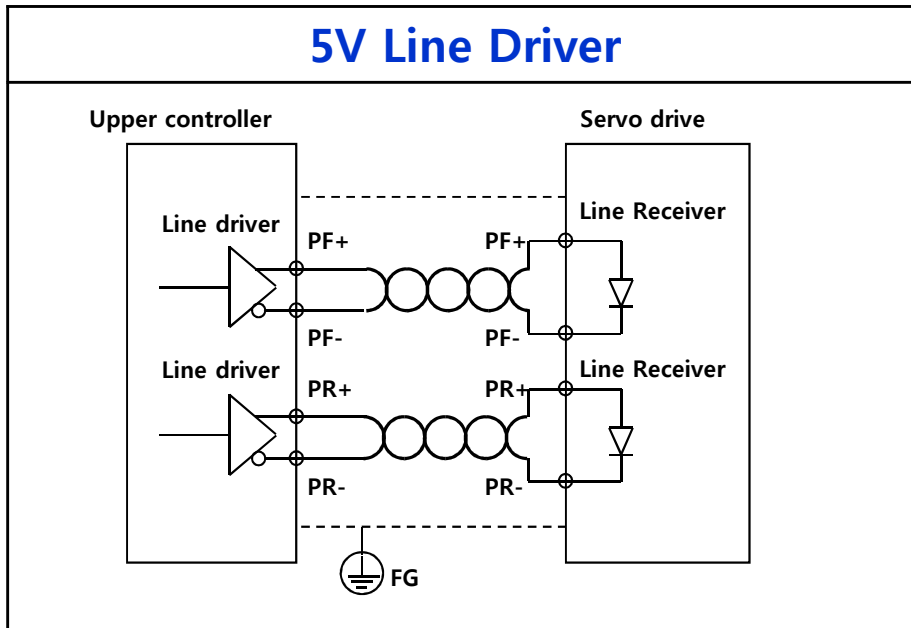


Note 1) Input signals DI1 to DIA and output signals DO1 to DO5 are default signals allocated by the factory.
 Note 2) ** These are non-allocated signals. You can change their allocation by setting parameters. For more information, refer to "4.1.6 External Input Signal and Logic Definition" and "4.1.8 External Output Signal and Logic Definition."

24V Open Collector



5V Line Driver



☞ Only using PF+,PF-,PR+,PR-

Nowadays, Mostly, using for Line Driver mode due to strong point for Noise

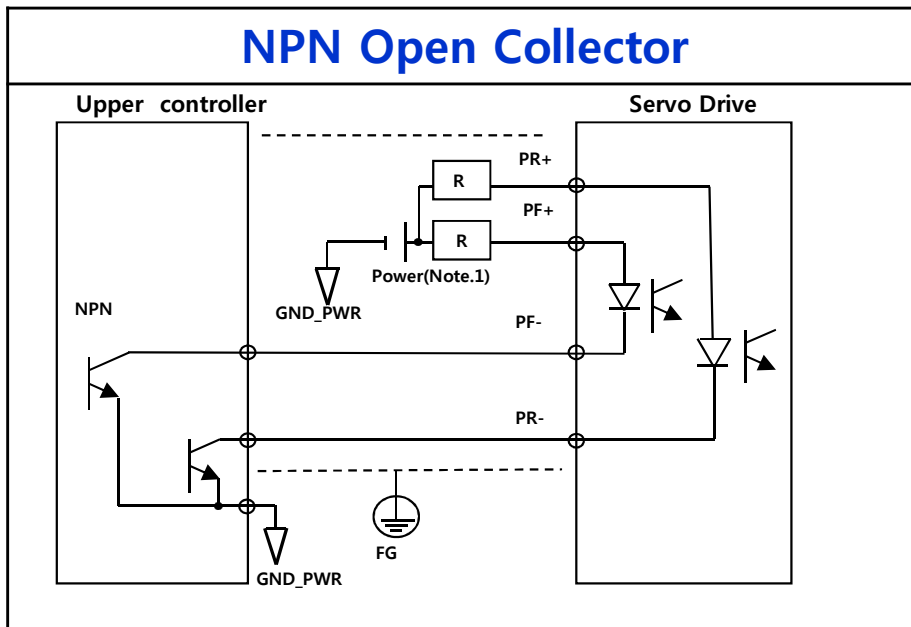
(Note.1, Note.2)

Power 24[V] : Resistor R = 1500 [Ω]

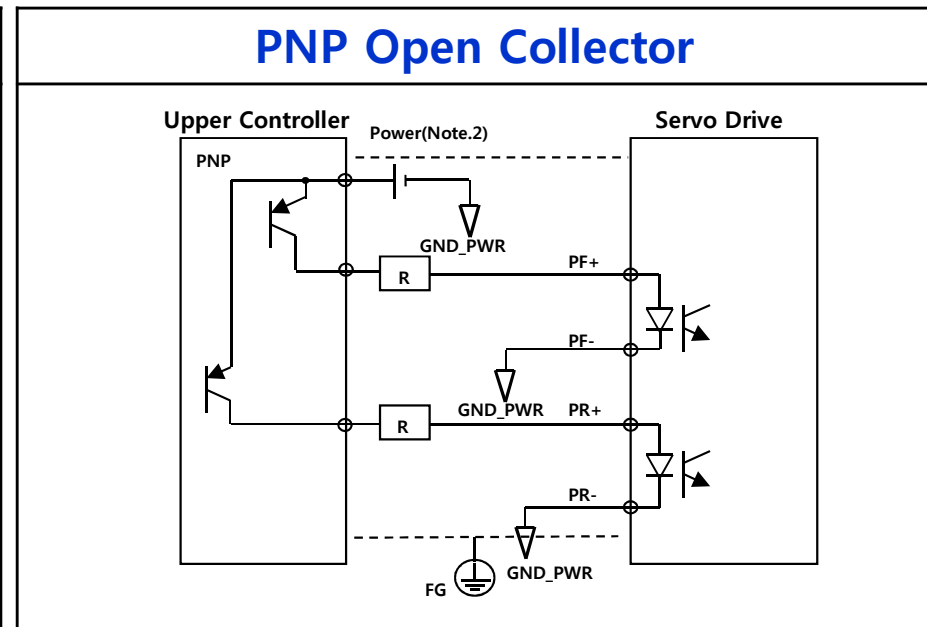
Power 12[V] : Resistor R = 560 ~ 680 [Ω]

Power 5[V] : Resistor R = 100 ~ 150 [Ω]

NPN Open Collector



PNP Open Collector



(Notice)

▶ In the case of wrong parameter set, Motor will rotate in high speed or vibrate. And, it causes burning of Motor

Motor ID [P0-00]

1. then motor constant can be automatically set
2. ID is displayed on Motor Label

Encoder Type [P0-01]

No.	Types	Signal Mode	Signal types	Remark
0	Incremental Parallel	A Phase Lead 15Lines	A,B,Z,U,V,W	
1	SingleTurn Absolute Serial	Biss Serial	Serial Type	
3	MultiTurn Absolute Serial	Biss Serial	Serial Type	

Encoder Pulse [P0-02]

1. Set Encoder Pulse Number
2. Encoder Pulse Number is displayed on Motor Label

(Notice) Serial type : Set the number of bits per turn from Encoder
 Incremental type : Set the number of Encoder pulse

(Note) Set Pulse Logic Parameter in Servo-off

Operation Mode [P0-03]

"2" (Position Mode) Set

Operation mode	Operation mode
0	Torque control operation
1	Speed control operation
2	Position control operation
3	MODE contacts ON : Speed control operation MODE contacts OFF : Position control operation
4	MODE contacts ON : Speed control operation MODE contacts OFF : Torque control operation
5	MODE contacts ON : Position control operation MODE contacts OFF : Torque control operation













(Note) Set Pulse Logic Parameter in Servo-off





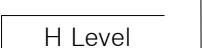
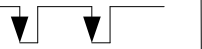
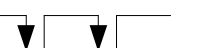





Input Pulse Logic Set [P4-00]

Logic Set as below

The Pulse output mode of Upper controller must match with Pulse input mode of Servo Drive

► Pulse Logics

PF + PR		Forward rotation	Reverse rotation
Phase A + B Positive Logic	0	PULS (CN1-9)  SIGN (CN1-11) 	PULS (CN1-9)  SIGN (CN1-11) 
CW+CCW Positive Logic	1	PULS (CN1-9)  L Level SIGN (CN1-11) 	PULS (CN1-9)  L Level SIGN (CN1-11) 
Pulse + direction positive logic	2	PULS (CN1-9)  SIGN (CN1-11) 	PULS (CN1-9)  SIGN (CN1-11) 

PF + PR		Forward rotation	Reverse rotation
Phase A + B Negative Logic	3	PULS (CN1-9)  SIGN (CN1-11) 	PULS (CN1-9)  SIGN (CN1-11) 
CW+CCW Negative Logic	4	PULS (CN1-9)  H Level SIGN (CN1-11) 	PULS (CN1-9)  H Level SIGN (CN1-11) 
Pulse + direction negative logic	5	PULS (CN1-9)  SIGN (CN1-11) 	PULS (CN1-9)  SIGN (CN1-11) 

(Note) Set Pulse Logic Parameter in Servo-off

► Pulse Logic & Positioning Module Set

■ Positioning Module: XBF-PD02A (Line-Driver, 2-Axis)

Item	X Axis	Y Axis
Pulse Output Level	0: Low Active	0: Low Active
Pulse Output Mode	0: CW/CCW	0: CW/CCW
MCode Output Mode	0: None	0: None
Bias Speed	1 pls/s	1 pls/s
Speed Limit	2000000 pls/s	2000000 pls/s
ACC No.1	500 ms	500 ms
DEC No.1	500 ms	500 ms
ACC No.2	1000 ms	1000 ms
DEC No.2	1000 ms	1000 ms
ACC No.3	1500 ms	1500 ms
DEC No.3	1500 ms	1500 ms
ACC No.4	2000 ms	2000 ms
DEC No.4	2000 ms	2000 ms
SW Upper Limit	2147483647 pls	2147483647 pls
SW Lower Limit	-2147483648 pls	-2147483648 pls
Backlash Compensation	0 pls	0 pls
SW Limit Detect	0: No Detect	0: No Detect
Pos. Comp. Condition	0: Dwell	0: Dwell
Upper/Lower Limit	1: Use	1: Use
Home Method	0: DOG/HOME(OFF)	0: DOG/HOME(OFF)
Home Direction	1: CCW	1: CCW
Home Address	0 pls	0 pls
Home High Speed	5000 pls/s	5000 pls/s
Home Low Speed	500 pls/s	500 pls/s
Home compensation	0 pls/s	0 pls/s
Homing ACC Time	1000 ms	1000 ms

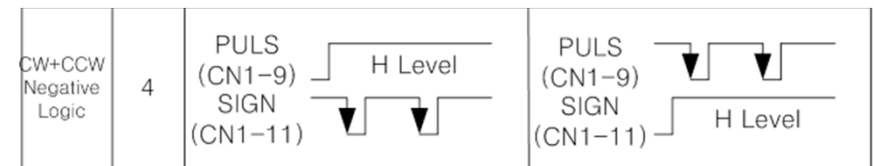
Position Parameter | X-Axis Data | Y-Axis Data

OK Cancel

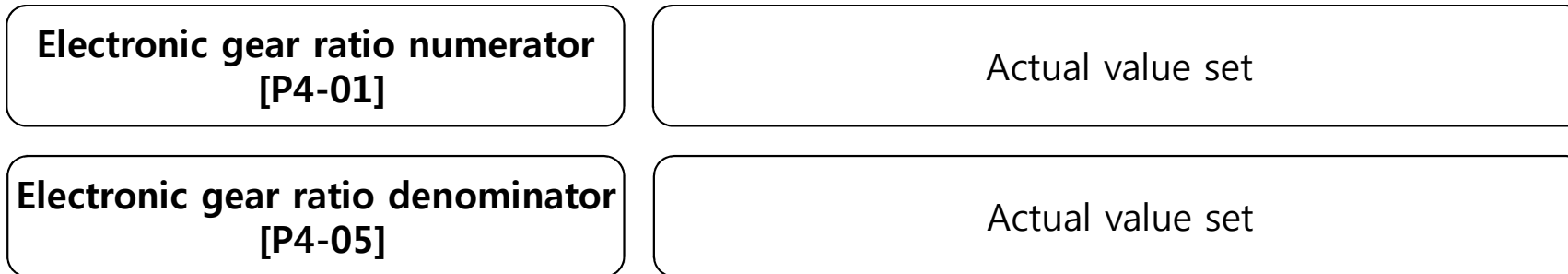
1. Pulse Output Level : Low Active
2. Pulse Output Mode : CW/CCW

=>

The positioning Module of the left picture is Pulse Logic No.4 on Servo Drive



- Actual Pulse of Operating Motor = Command Pulse of Upper controller x (Electronic gear ratio numerator/Electronic gear ratio denominator)**
- When upper controller commands 1 pulse, The necessary Scale Factor to travel basic position
For example, The scale factor to travel 1[um] Per 1 Pulse of command**



You need to know in order to set the Electronic Gear

No	List	Contents	Remark
1	Machine Spec	Ball screw type, Turn Table, Roller	Ball screw type : Pitch, Roller : Roller Diameter
2	Deceleration ratio	In the case of using of reducer	Pulley ratio in the case of Pulley
3	Encoder Pulse Number	Applied Encoder Pulse Number	19 bit Serial : 524288 (=2 ¹⁹), Inc 3000 : 12,000 (= 3000 x 4)
4	Command unit	Travel per 1 Pulse	degree or mm

(Note) Set Pulse Logic Parameter in Servo-off

Example for Electronic gear set

No	List	Machine Configuration		
		Ball Screw	Turn Table	Belt+Pulley
1	Machine Spec	Ball Screw Pitch : 5 [mm]	Degree per rotation : 360°	Pulley Diameter : 100 [mm] (Pulley Circumference : 314 [mm])
2	deceleration ratio	1/1	1/100	1/50
3	Encoder Pulse	19bit (= 524,288)	19bit (= 524,288)	19bit (= 524,288)
4	Command Unit	0.001 [mm] (= 1 [um])	0.01°	0.005 [mm] (= 5 [um])
5	Travel per rotation of load axis (= Machine spec / Command Unit)	5000 (= 5 / 0.001)	36000 (= 360 / 0.01)	62800 (= 314 / 0.005)
6	Electronic gear (= (Encoder Pulse number/Travel per rotation of load axis) * (1/deceleration ratio))	Electronic gear = (524288/5000)*(1/1)	Electronic gear = (524288/36000)*(100/1)	Electronic gear = (524288/62800)*(50/1)
7	Parameter Set	Electronic gear ratio numerator = 524,288 Electronic gear ratio denominator = 5,000	Electronic gear ratio numerator = 52,428,800 Electronic gear ratio denominator = 36,000	Electronic gear ratio numerator = 2,621,4400 Electronic gear ratio denominator = 62,800

(Tip) If Electronic gear ratio is 2, "2" = 100(numerator)/50(denominator) = 2(numerator)/1(denominator)

1. Position command frequency = (*Encoder pulse number x Motor speed[r/min])/(60*Electric gear ratio)
 - *Incremental Encoder = Encoder pulse number X 4
 - *Serial Encoder = Actual Encoder pulse number (19bit = 524288)

- Input frequency of L7S Drive : 1Mpps.
- LSIS XGF-PO*H(Open collector) : Maximum output pulse 500kpps,
XGF-PD*H(Line Driver) : Maximum output pulse 4Mpps

- * In the use of Positioning module XGF-PD*H, Set as output pulse 1Mpps
When output pulse exceeds 1Mpps, Motor is operated abnormally. (The speed is too slow)

Ex) Encoder pulse :19bit Rated speed : 3000rpm. Not use electric gear ratio in the drive

=> Motor speed is operated below approximately 115rpm

*Motor speed = (position command frequency/Actual encoder pulse number)*60*Electric gear ratio

To operate rated speed 3000rpm, use electric gear ratio in the drive

Electric gear ratio numerator : 524288, Electric gear ratio denominator : 20,000

Position command frequency = (524288 x 3000)/(60*(524288/20000)) = 1Mpps

1. In the case of Cascade type Controller, Inner Loop(Speed Control) -> Outer Loop(Position Control)

2. Proportional Gain -> Integral Gain -> Feedforward Gain

- **Proportional Gain (Controller BW)** : The Slope to reach command value

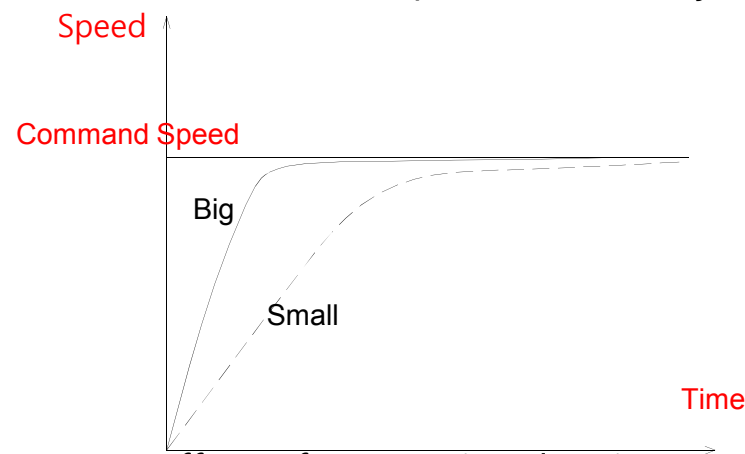
If Proportional gain is big, the slope is steep.

That's to say, response is fast.

- **Integral gain(Steady-state error, Overshoot occurrence)**

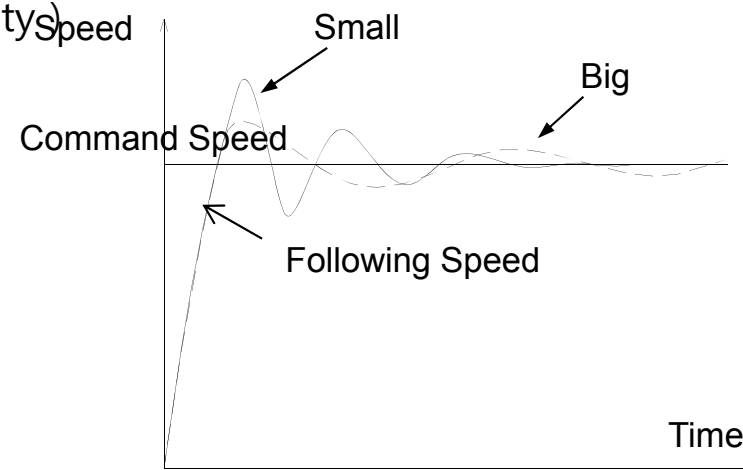
Notice 1) For L7 series. Using Integral time constant instead of Integral gain. To increase Integral gain, decrease Integral time constant

- **Feedforward Gain(Improvement of System Lag Quality)**



< Effect of Proportional Gain >

If the proportional gain is low, the slope corresponding to the command is slow



< Effect of Integral time constant >

If we reduced I_{tc} , speed following characteristic can be improved as excessive response characteristic is improved. But if it is too small, overshoot would be occurred.

Set the gain as below ordering

1. Inertia : [P1-00]

- Using Auto tuning : [Cn-05]
- Manual Set : [P1-00]

2. Speed Proportional Gain : [P1-06]

- Increase step by step (Increase 50 per step)
- If noise or vibration occurs, decrease 50 per step from current value

3. Speed Integral Time Constant : [P1-08]

- Increase step by step (Increase 1 per step)
- After monitoring OverShoot and Steady-state error, if Overshoot occurs, increase 10per step.

Note) If overshoot occurs when Integral gain increase, using for P/PI Conversion Mode

4. Speed feedback filter : [P1-11]

- Using for reducing Vibration and Noise
- Increase step by step (Increase 1 per step) till no vibration

Set the gain as below ordering

1. Position Proportional Set : [P1-01]

- Increase step by step (Increase 10 per step)
- If noise or vibration occurs, decrease 10 per step from current value








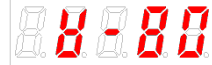
2. Position Feedforward Set : [P1-04]

- Increase step by step (Increase 10 per step)
- As monitoring Pulse Error(st-05), to set the value in order to be minimum value.

3. Position Command & Feedforward filter : [P1-03,05]

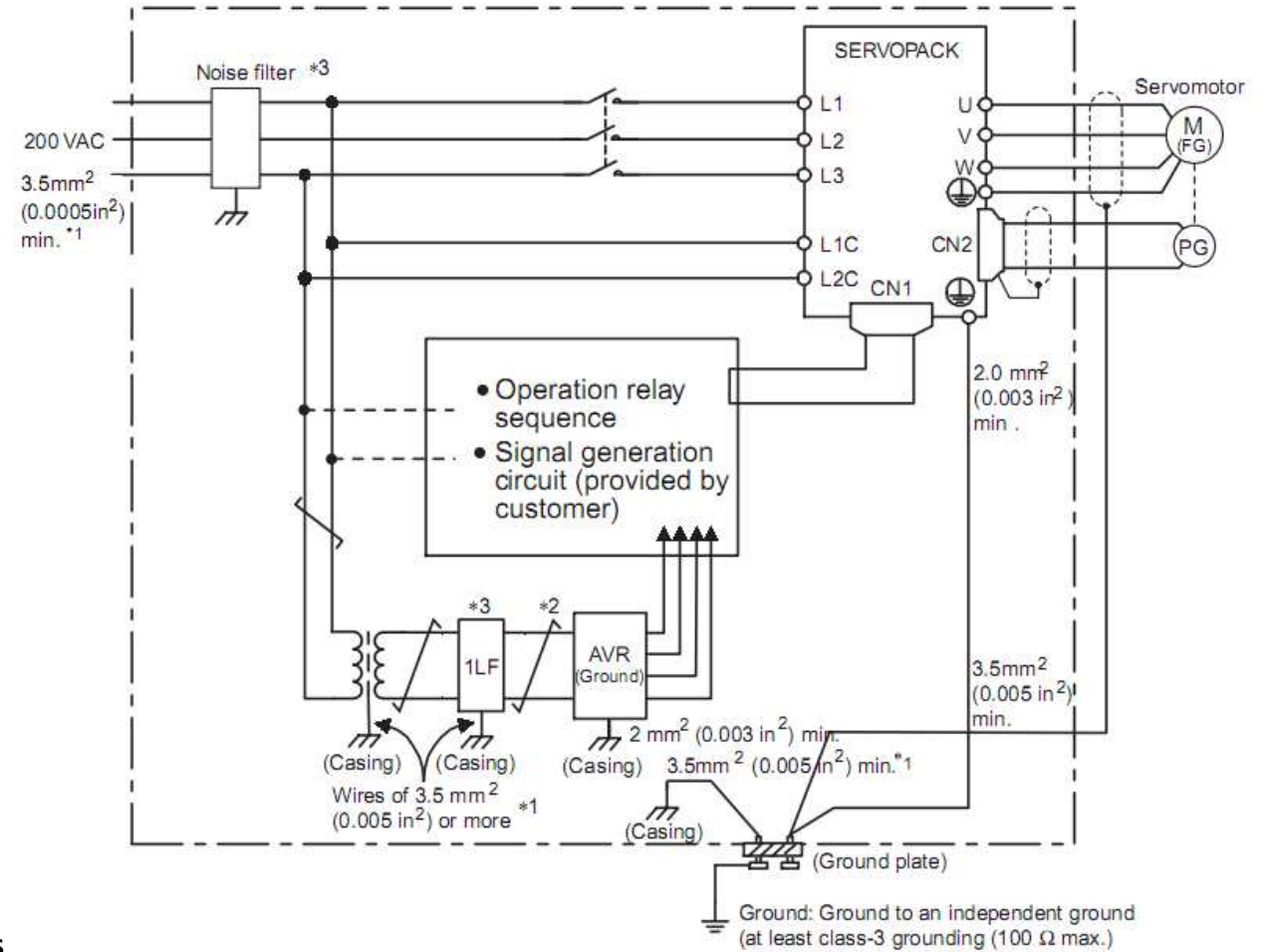
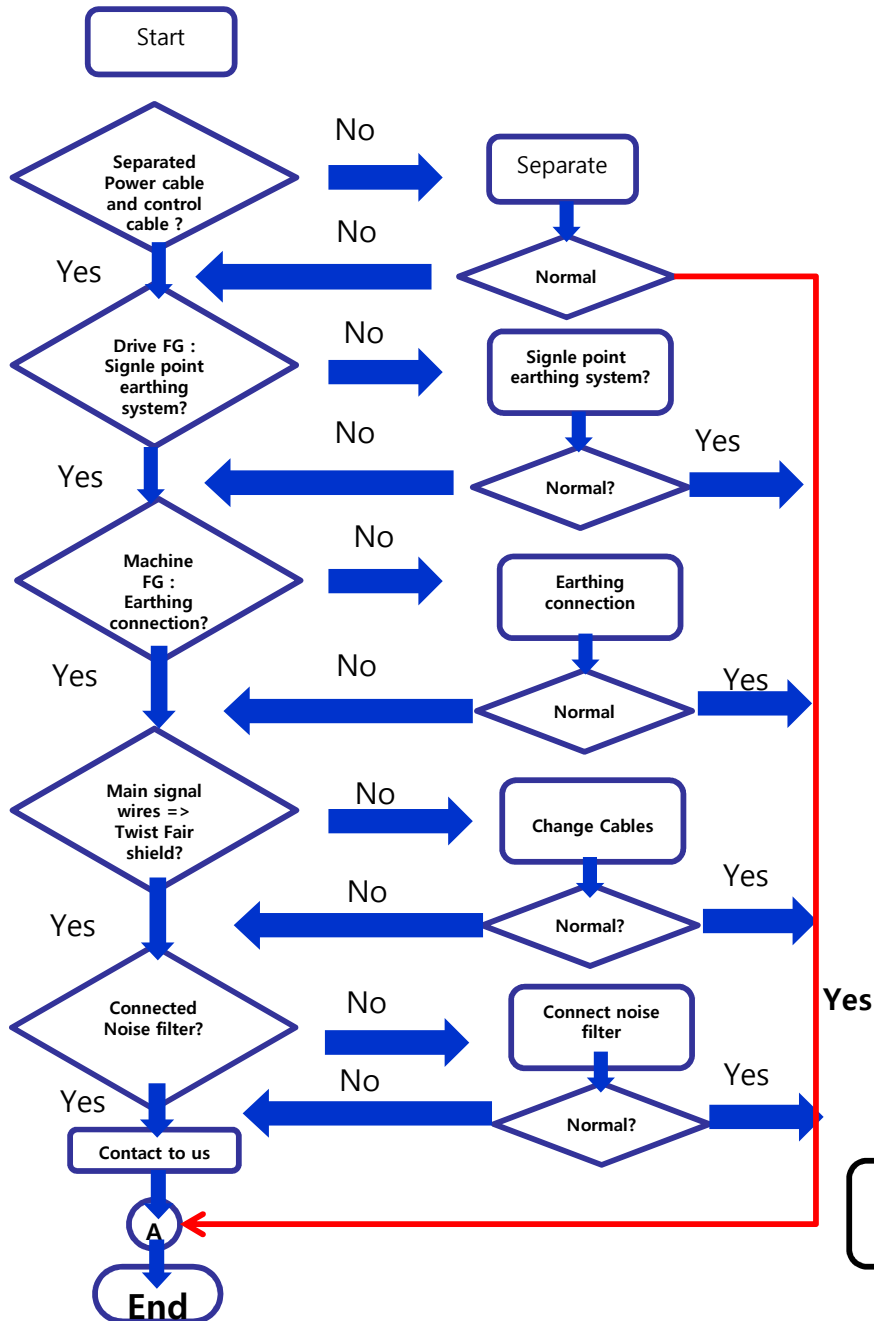
- Set the filter if noise occurs after you increase feedforward gain

8. Warning Alarm

(CODE)	Name	Reason of Alarm	Checking Point
	RST_PFAIL	Open Phase of Main Power	When [P0-06]DIGIT2 is set as 1, Power is not applied
	LOW_BATT	Shortage of Battery	
	OV_TCMD	Over Torque Command	Input over torque command
	OV_VCMD	Over Speed Command	Input over speed command
	OV_LOAD	Warning for overload	Over the range of Max. Setting overload [P0-13]
	SETUP	Selection of Motor	Motor capacity is bigger than Drive
	UD_VTG	Warning for low voltage	When [P0-06] DIGIT2 is set as 1 DC-link voltage is lower than 190V
	EMG	EMG Conatact	I/O Wiring & [P2-09] setting checking

◆ Warning is not saved on History of L7 Drive. And when 2 kinds of warning alarm is occurred added value is displayed .

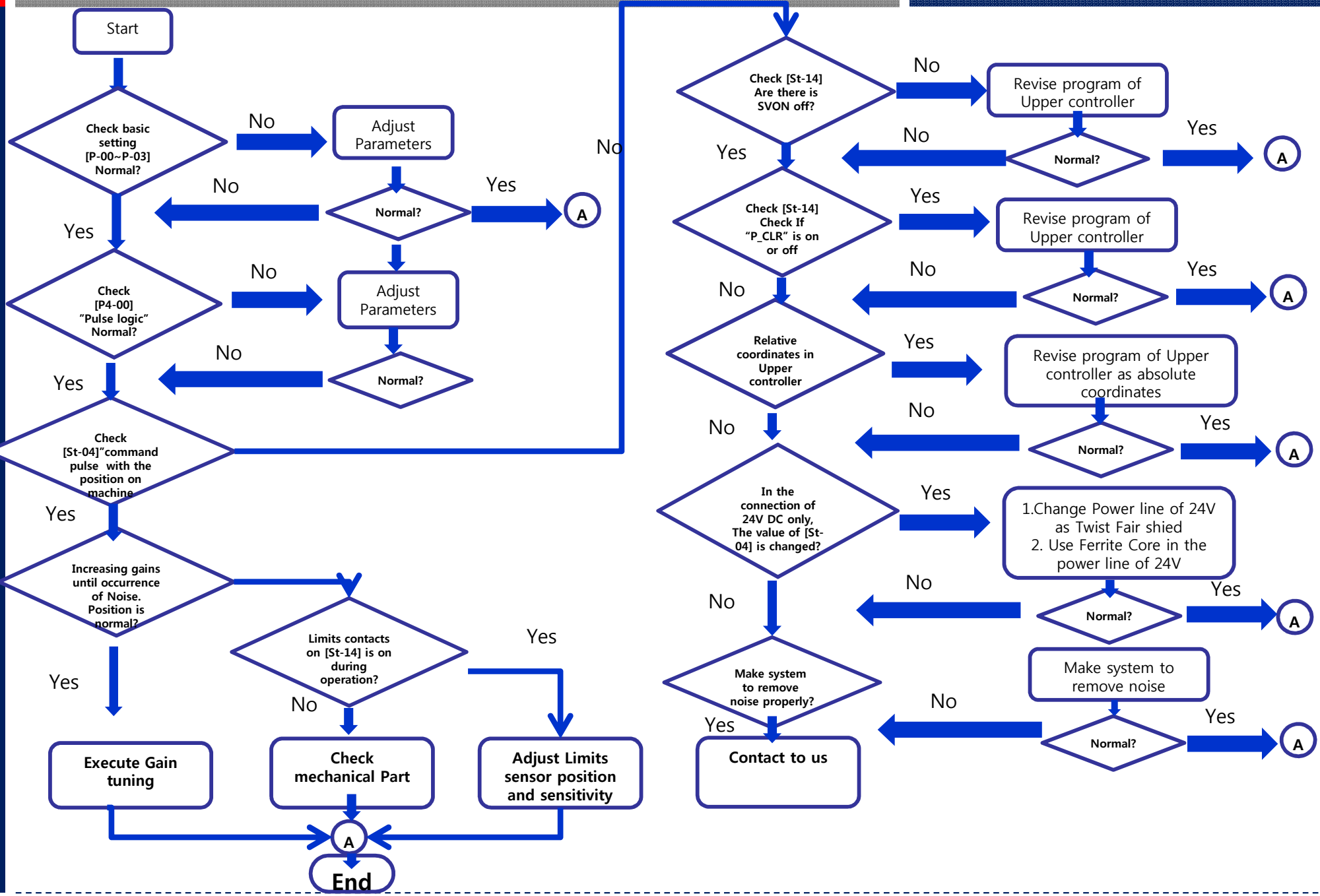
ex) [W-41] = [W-01] + [W-40] = Open phase of main power + Warning for Low voltage

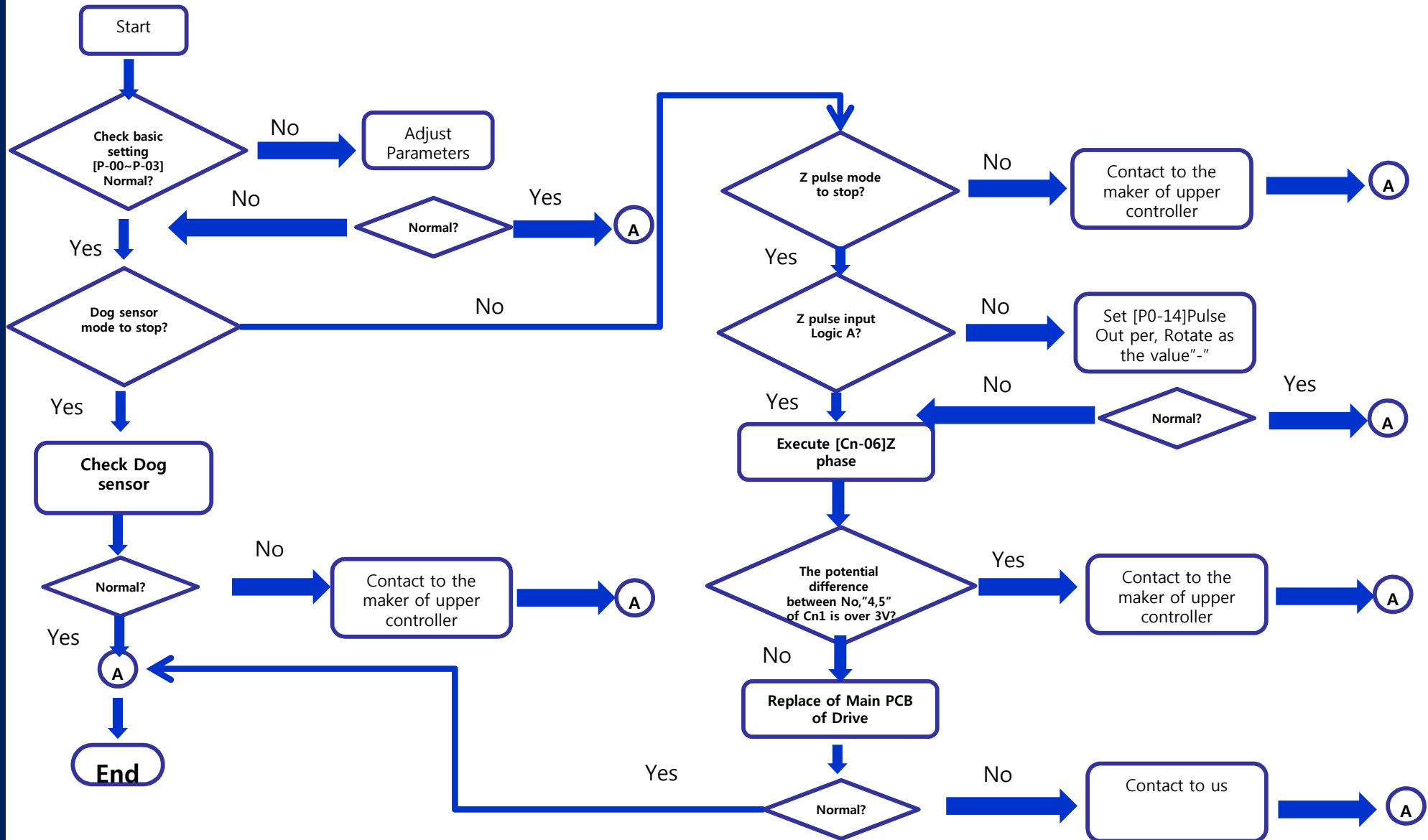


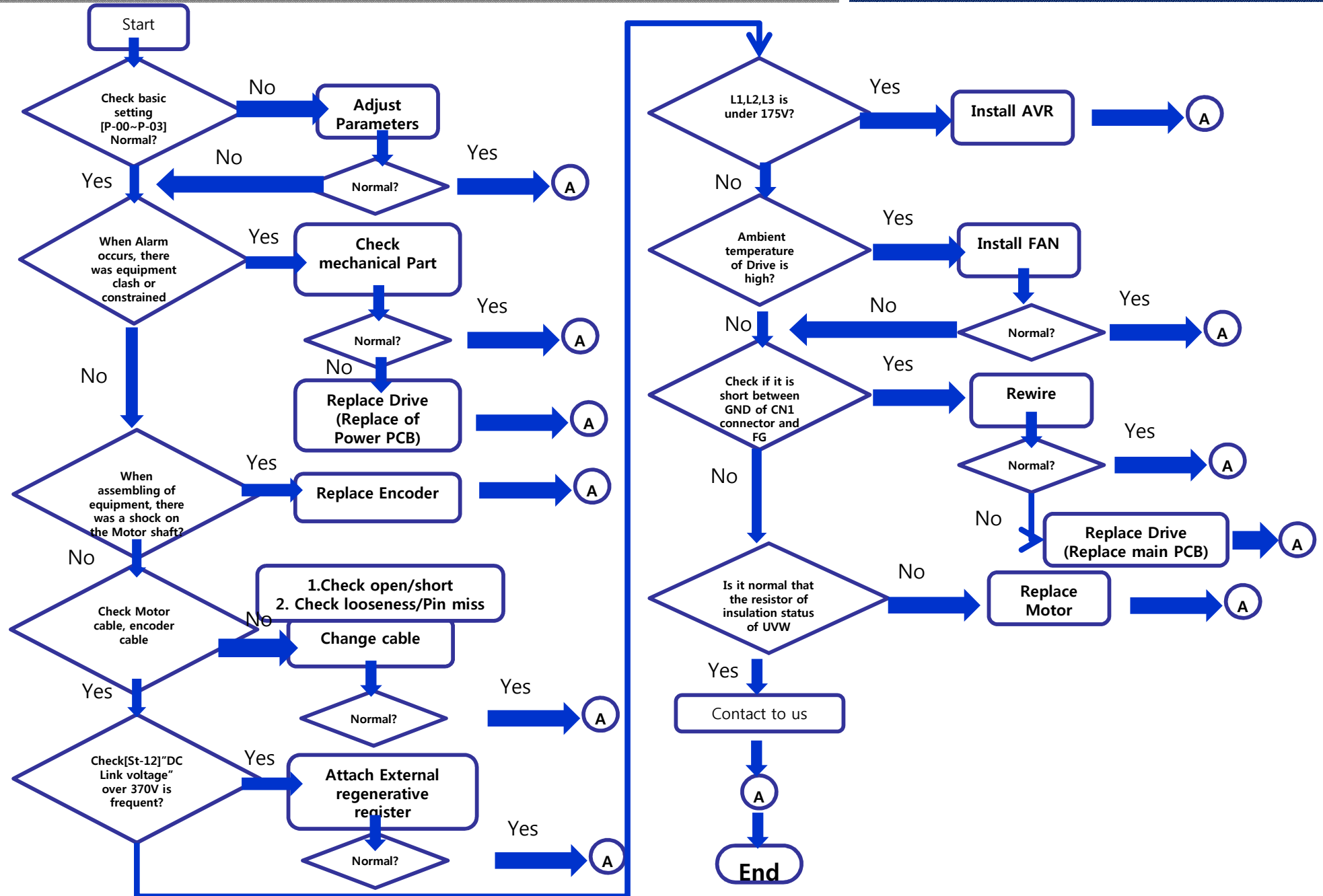
Main Signal:
Voltage line,
Pulse line

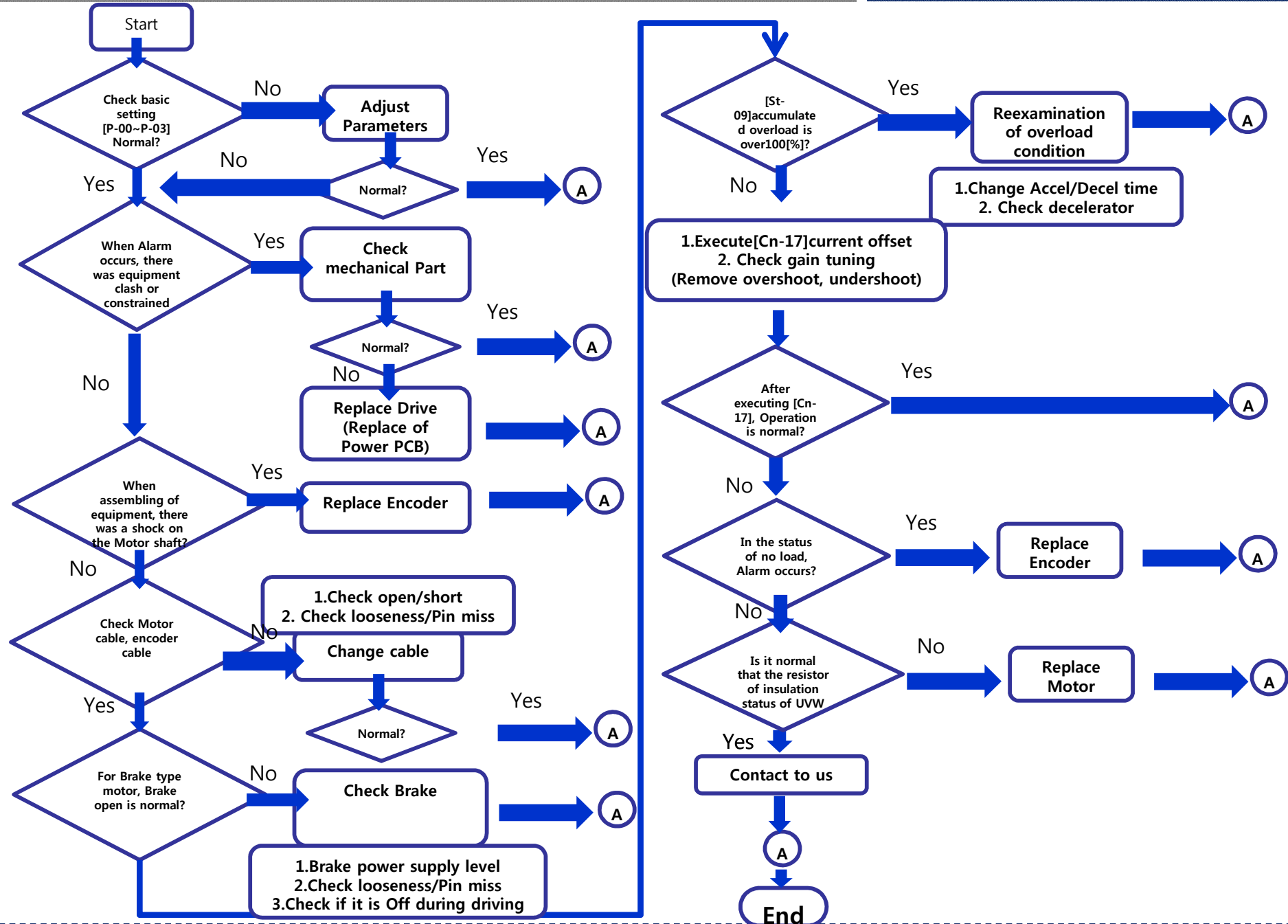
Check Process in the case of position Error

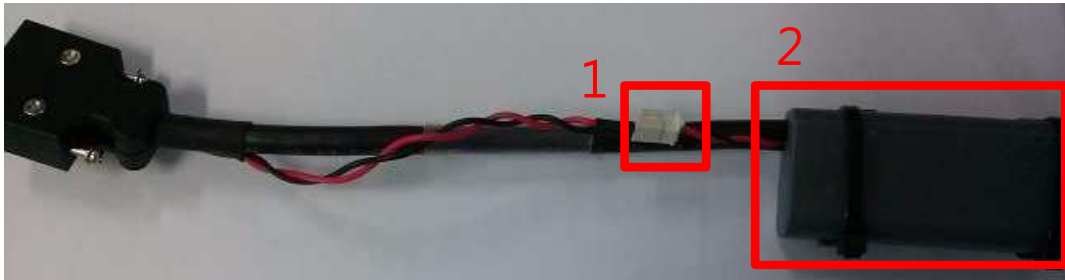
Action for abnormal situation











-The battery is connected with Encoder cable



- To replace battery,

1) Disconnect the connection line as No.1


2) After Cut cable tie, Open battery case with pressing as No.3



- There is a battery (Toshiba ER6V) in the case

- Possible the battery to purchase the battery in electronic components store or Internet mall

- Replace of Battery FAQ –

1. The voltage Level that low voltage warning  occurs
=> 3.3V
2. Changing period after warning ?
=> it is recommended to replace as fast as possible when warning occurs. After warning occurs, possible to use approximately 20 days(in the case of 24 hours a day by Battery)
But, it is estimated figure not guaranteed
3. The voltage level not possible to use battery
=> Under 3.0V
4. After disassembling battery, changing time?
=> within 20minutes. Without battery, possible to save position data because of Super capacitor on Encoder for 20 minutes

