



台達電子



SPECIAL FUNCTIONS ON ASDA-A2

To Audience

Advance level

This slide will teach some special functions on ASDA-A2. For better understanding the content, the new PR of ASDA-A2 should be known.

Revision

Feb. 21, 2011.

The Contents

Full-closed Loop Control

The background knowledge and parameter settings.

Gantry Control

The background knowledge and parameter settings.

Password Protection

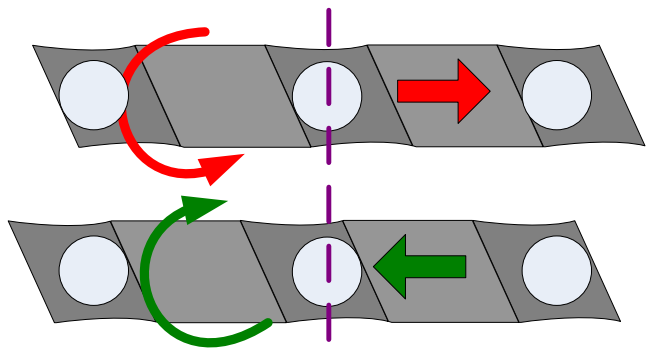
The parameter settings.

Full-closed Loop Control (1)

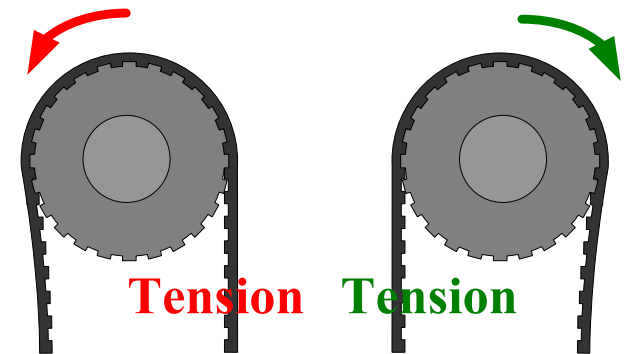
Why Full-closed Loop Control ?

Flexibility and backlash problems of machine can be fixed. The accuracy of positioning will be guaranteed.

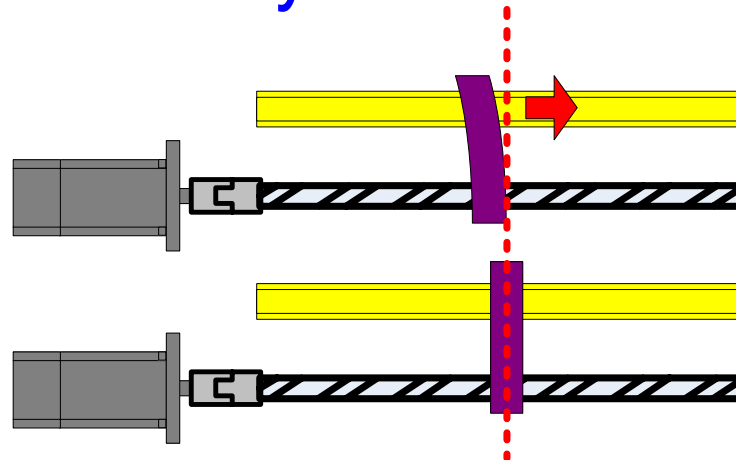
Ball Screw



Pulley and Belt System



Flexibility of Mechanism

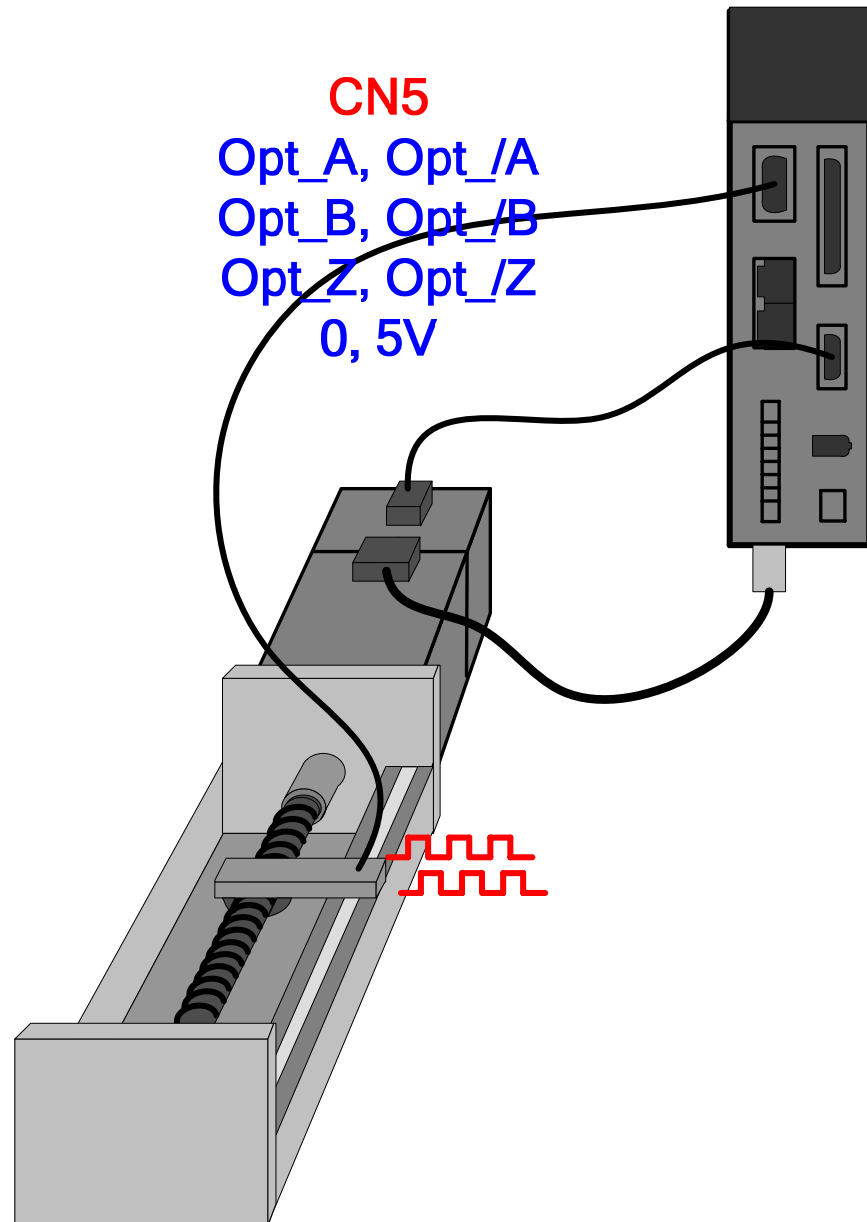




Full-closed Loop Control (2)

The Wiring

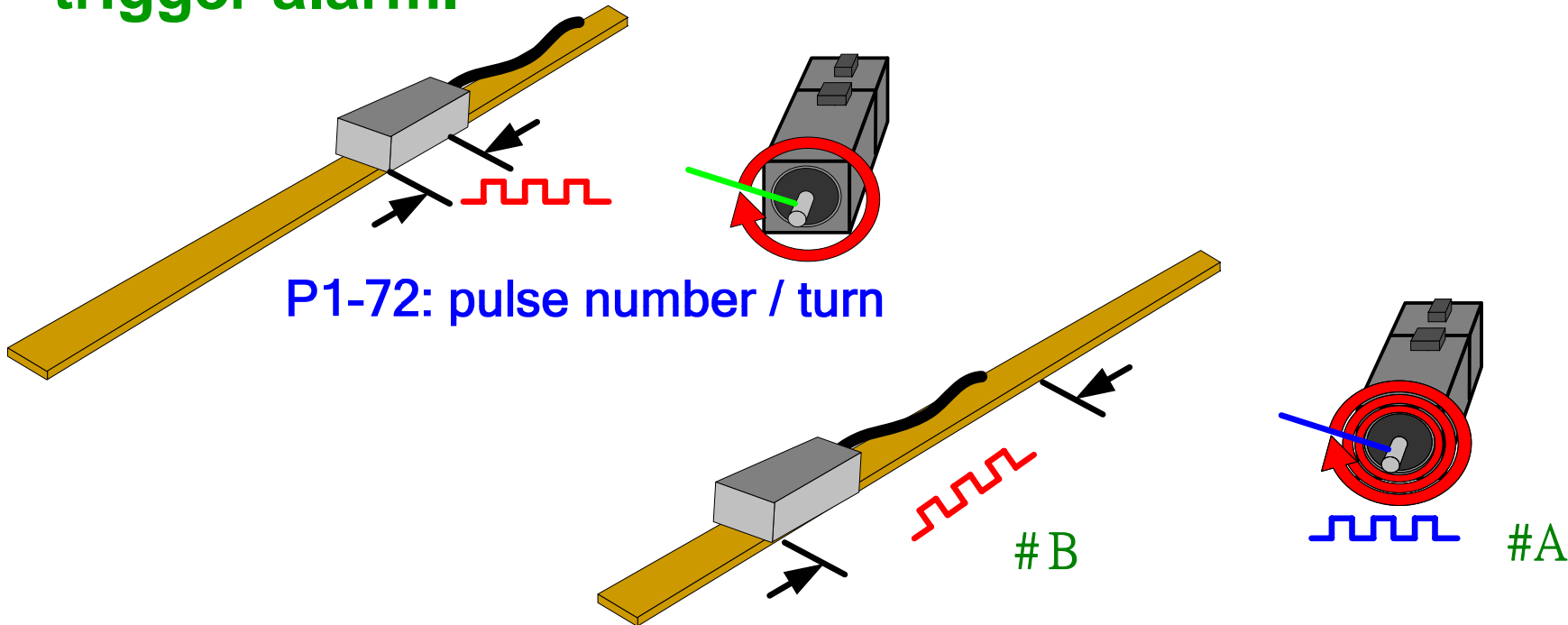
The signals will go into servo drive via CN5.
Reference ASDA-A2 manual for details. The full-closed loop control function is operated under **PT** mode only.



The Parameter Set (1)

P1-72: How many pulses will be sent from linear encoder referring one turn of the servo motor.

P1-73: The feedback pulse difference between main encoder and linear encoder for the same distance to trigger alarm.

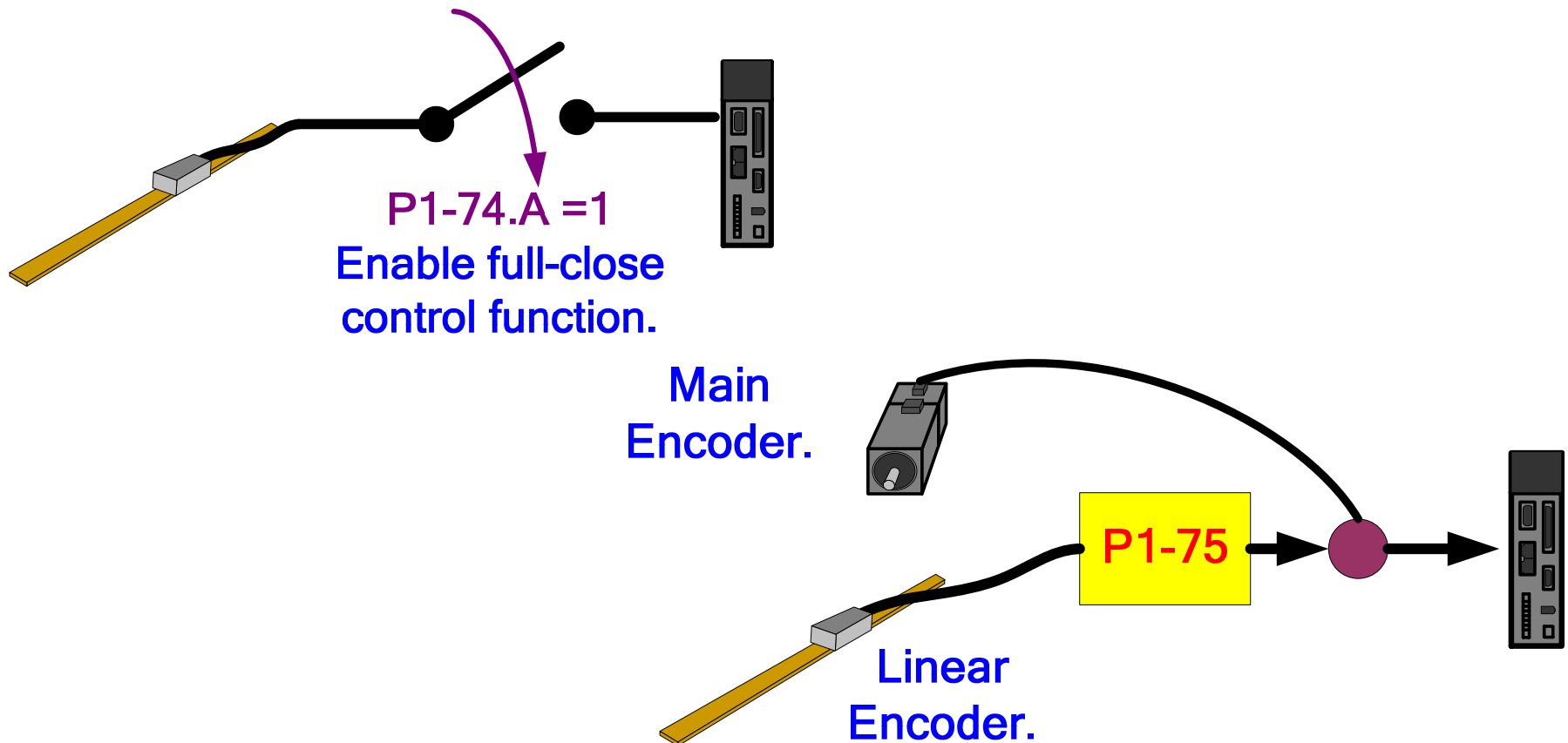


P1-73: $ABS(\#A - \#B \text{ (to the same base)})$

The Parameter Set (2)

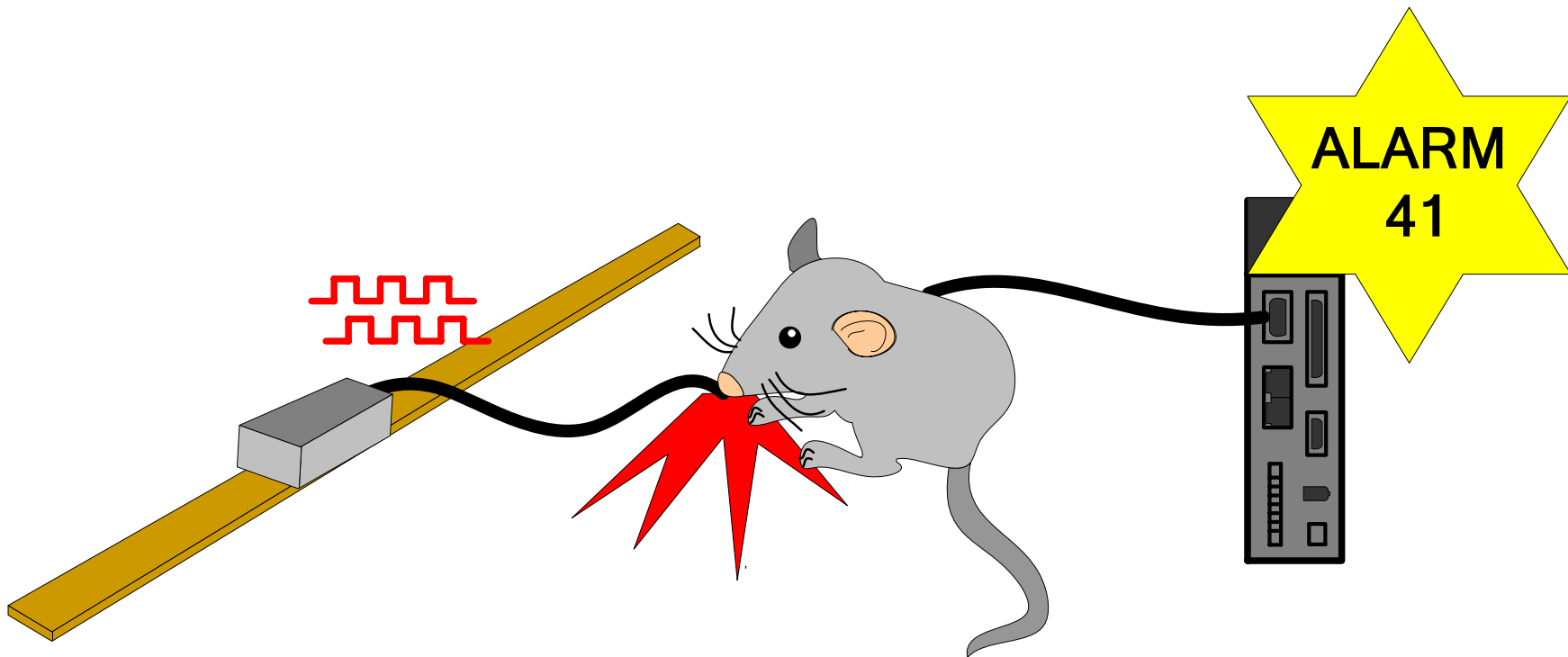
P1-74.A: Enable full-closed loop control function.

P1-75: The time constant is to reduce the sensitive of liner encoder signal while settling period.



The Parameter Set (3)

P2-65, bit5: Enable detection of wire disconnected when P1-74.A=1 (full-closed function activated).

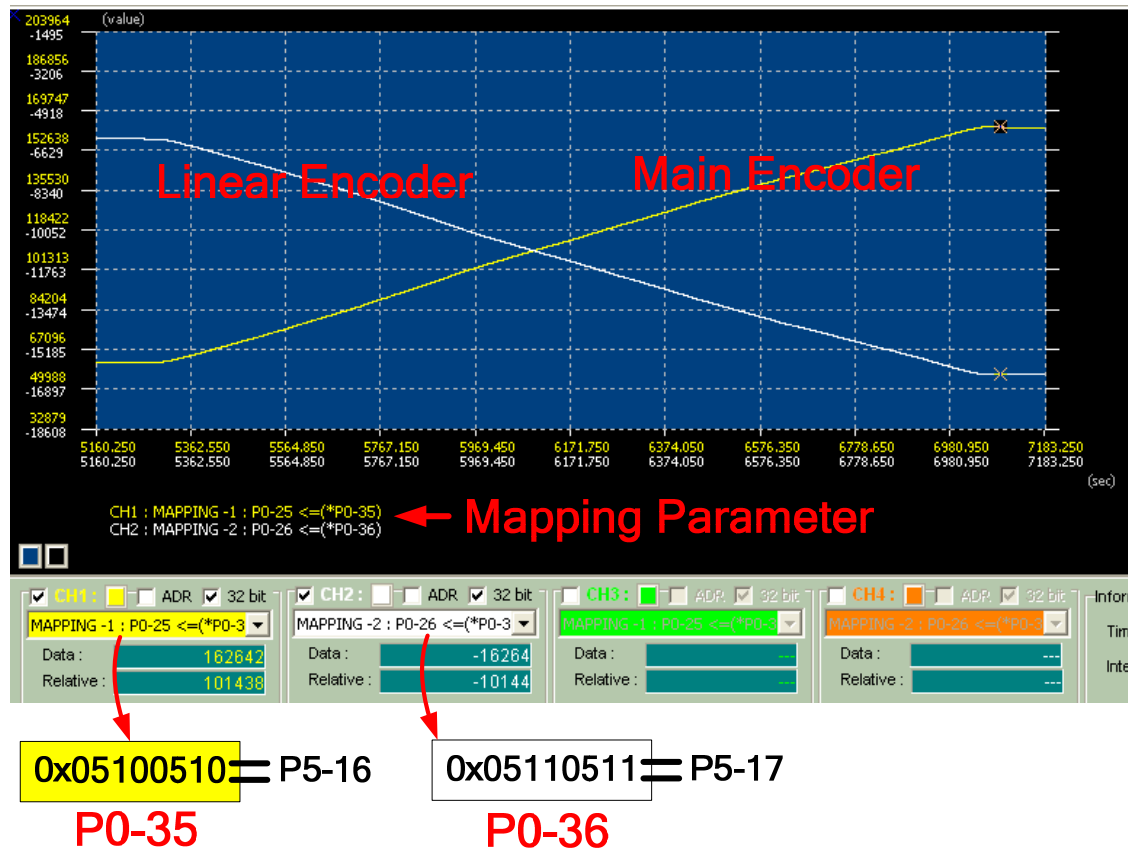




Full-closed Loop Control (6)

Check the Pulse Direction (1)

Both of the pulse trains should have the same trend, positive or negative trend. If not, set P1-74.C=1 for reversing the direction of pulse from linear encoder.

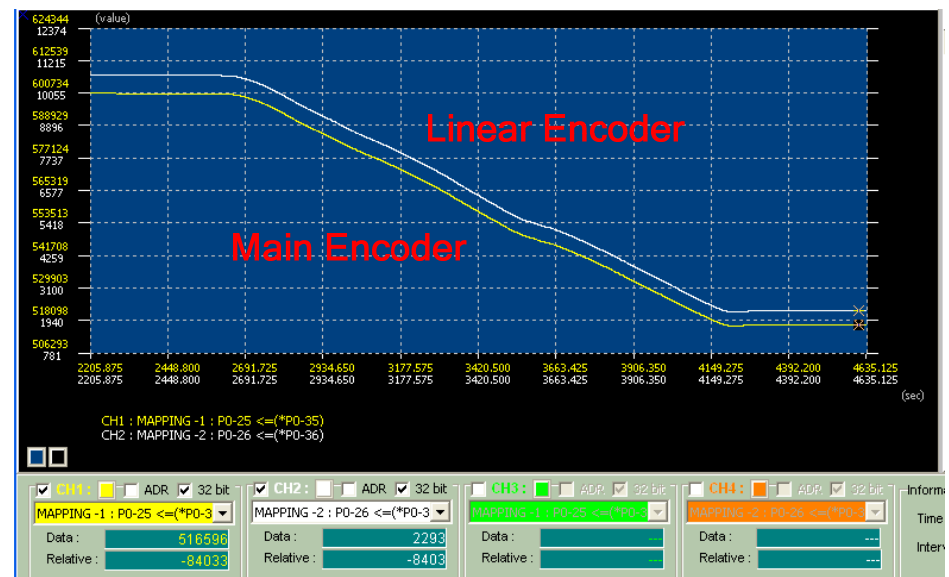
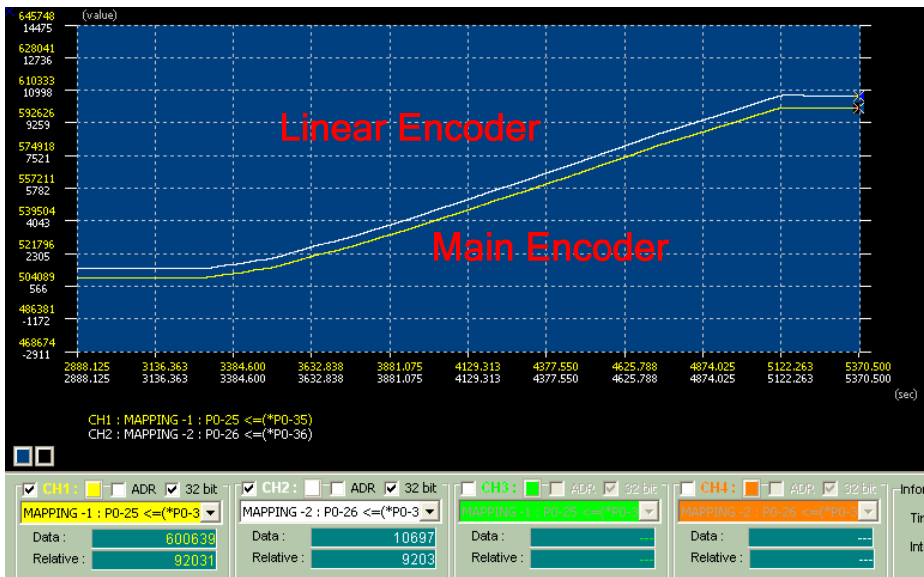




Full-closed Loop Control (7)

Check the Pulse Direction (2)

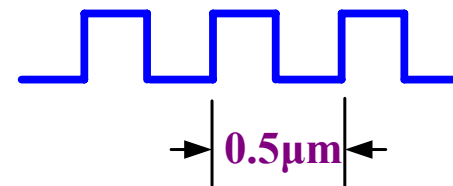
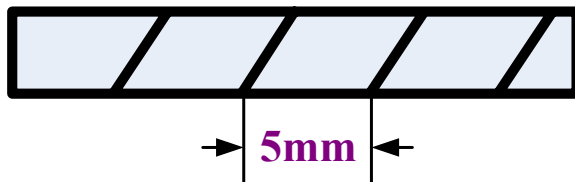
The pulse trends are correct on this slide after P1-74=0x100 set for reversing the pulse direction of linear encoder.



Example of P1-72

If the specification of your mechanism already known, the P1-72 can be calculated directly.

The pitch of ball screw is 5 mm, and the resolution of linear encoder is $0.5 \mu\text{m/pulse}$.



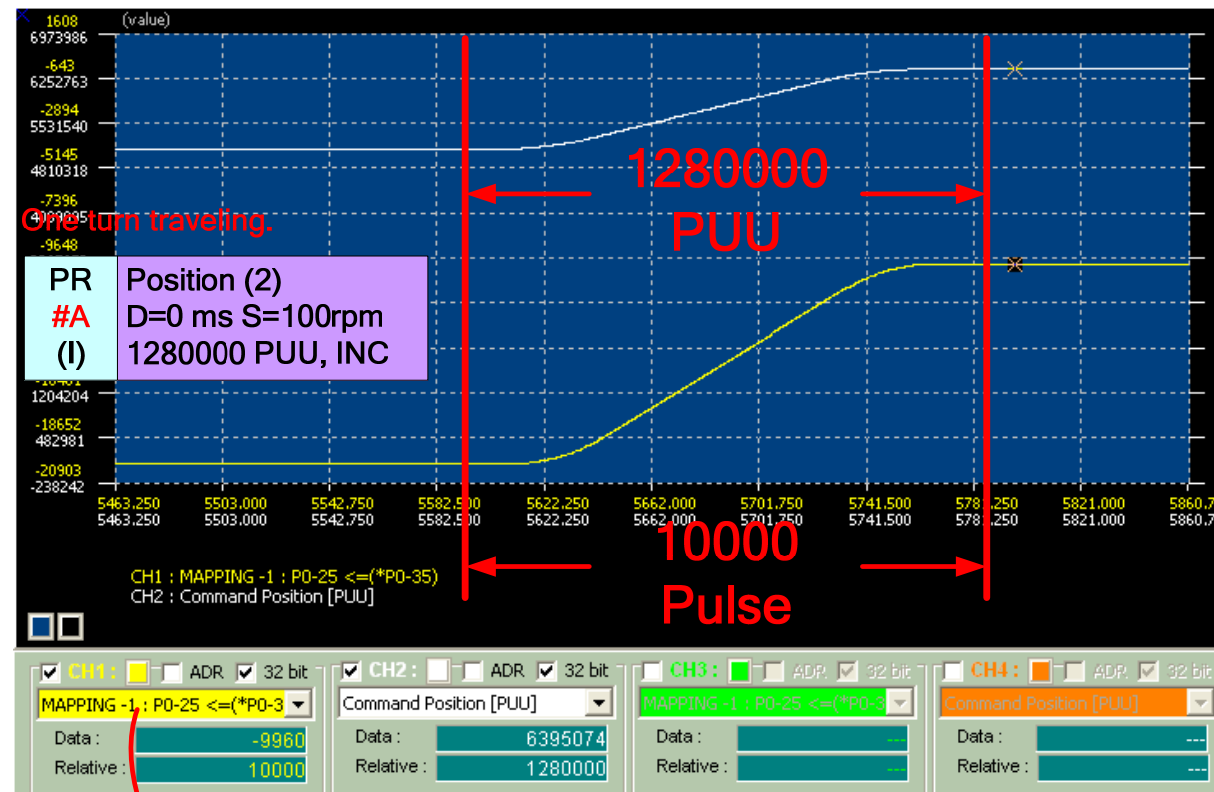
$$\frac{5 \text{ mm/rev}}{0.5 \mu\text{m/pulse}} = 10000 \text{ pulse/rev}$$



Full-closed Loop Control (9)

Use the PC Scope to Measure P1-72 (1)

Set P1-44=1 and P1-45=1, there will be 1280000 PUU for one turn. Use this value as base to count linear encoder. It is easy to measure from PR mode by a simple PR.



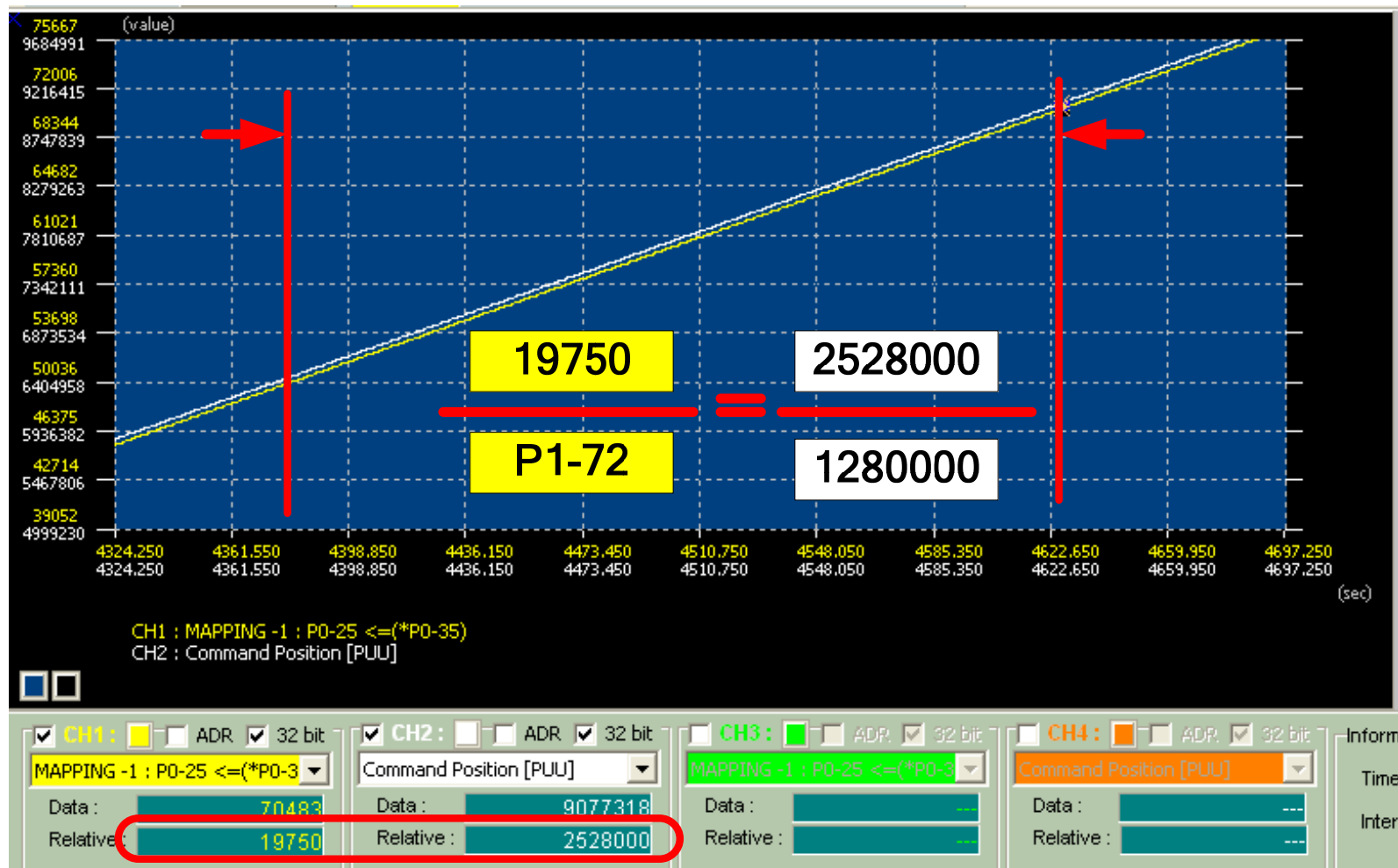
0x05110511 = P5-17

P0-35

DELTA Full-closed Loop Control (10)

Use the PC Scope to Measure P1-72 (2)

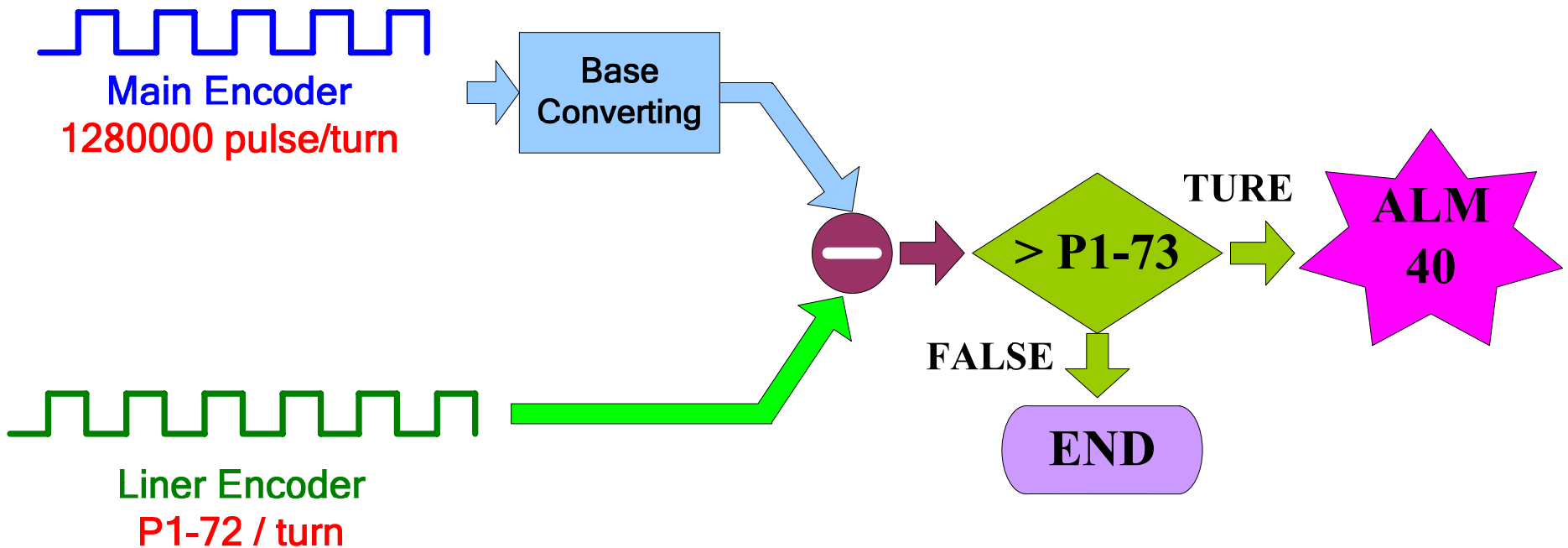
A long distance with a proportional operation, the P1-72 can be found out from.



DELTA Full-closed Loop Control (11)

Alarm 40

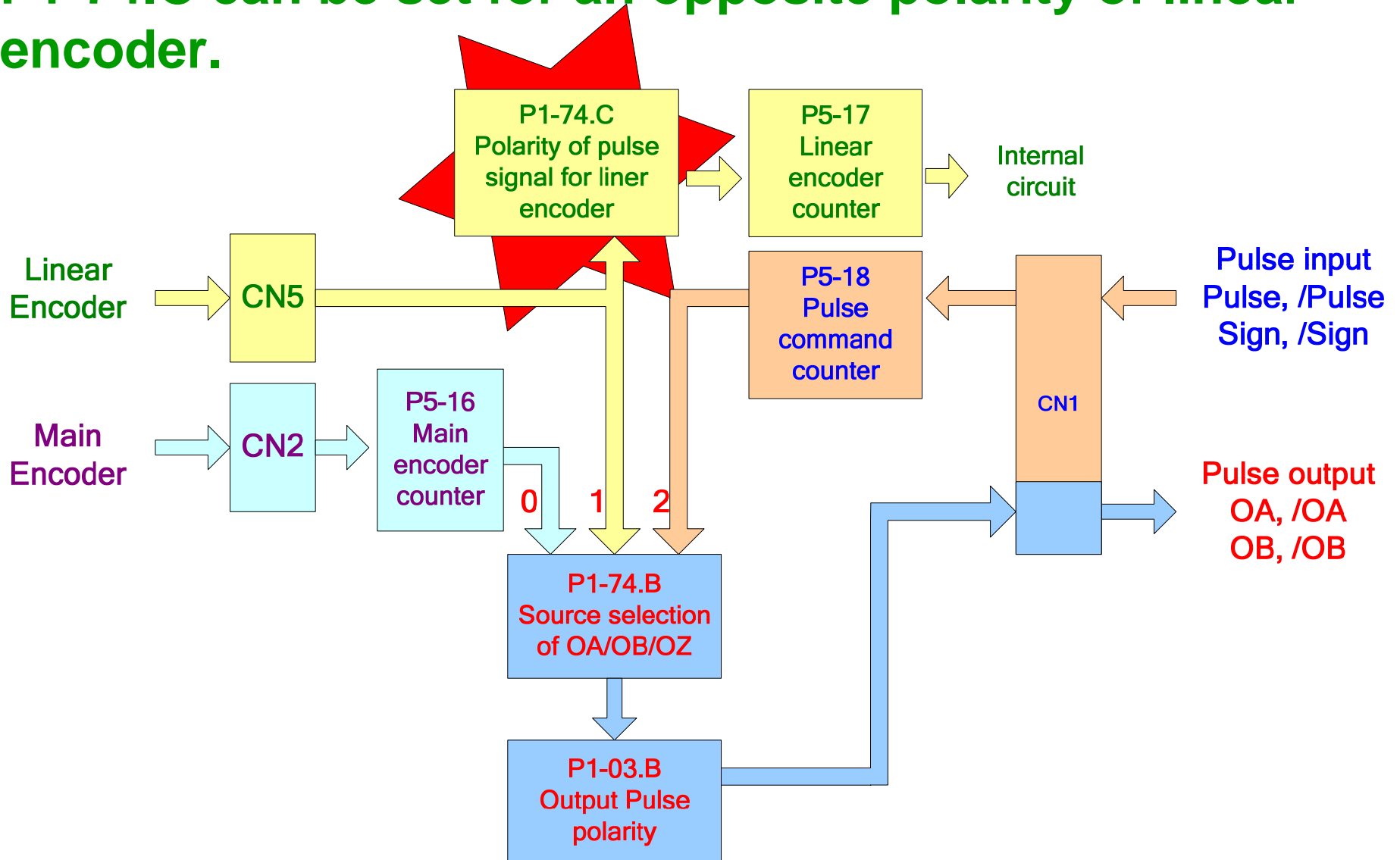
The alarm 40 will be raised when the difference of feedback pulse numbers from main encoder and linear encoder exceeding the value set in P1-73 .



DELTA Full-closed Loop Control (12)

Change Polarity

P1-74.C can be set for an opposite polarity of linear encoder.



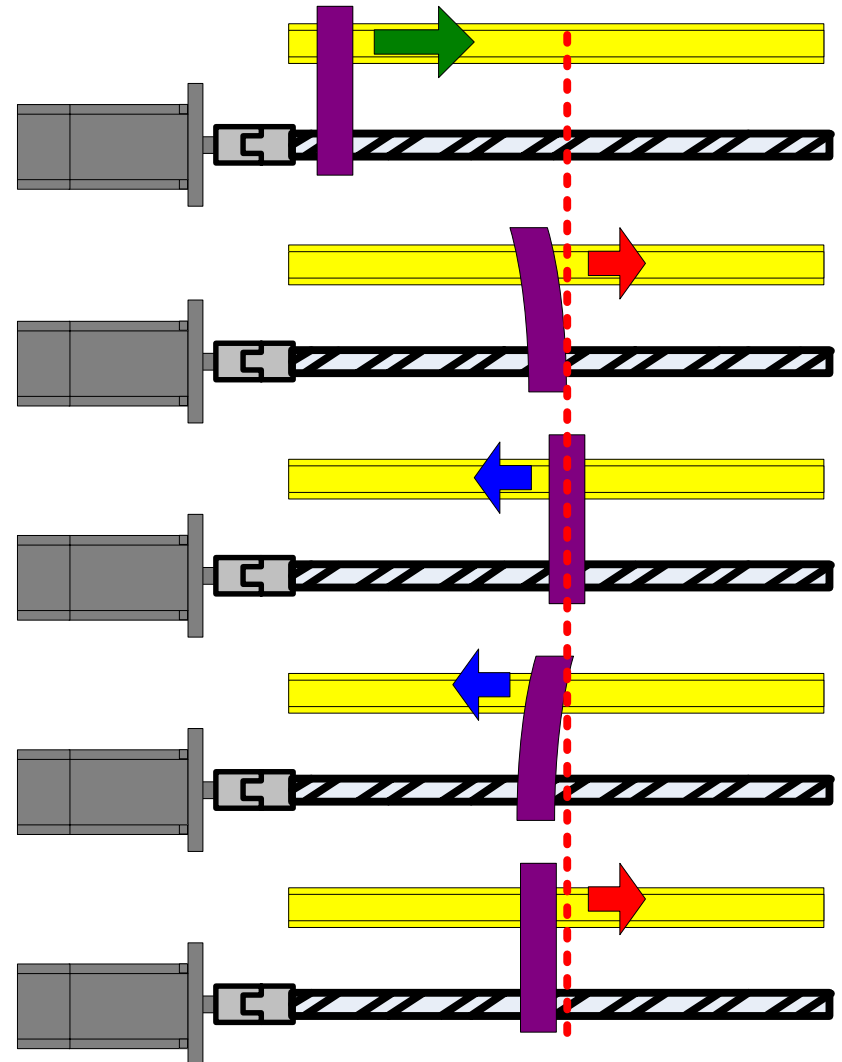
DELTA Full-closed Loop Control (13)

P1-75 Full-closed Loop Low-pass Filter Time Constant

This parameter will help a mechanism will less rigidity to settle down faster.

P1-75 is high for mechanism with less rigidity.

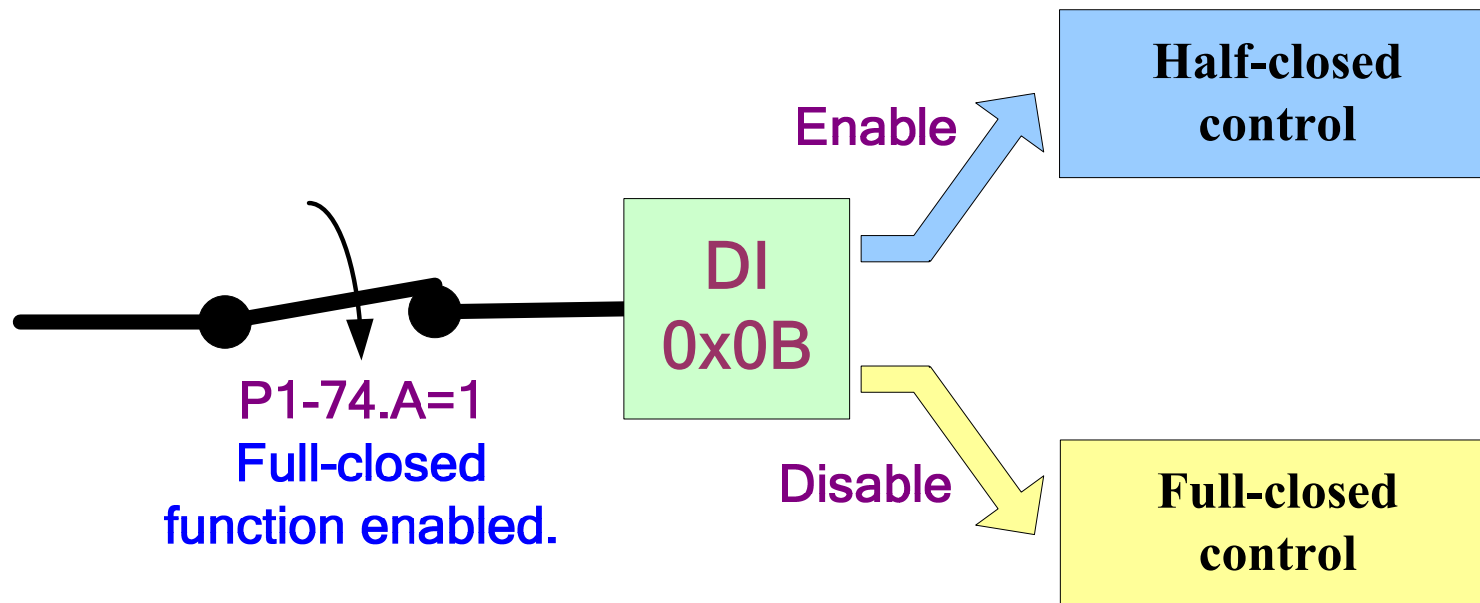
P1-75 is low for mechanism with higher rigidity.



DELTA Full-closed Loop Control (14)

DI=0x0B Full-closed/ Half-closed Switch

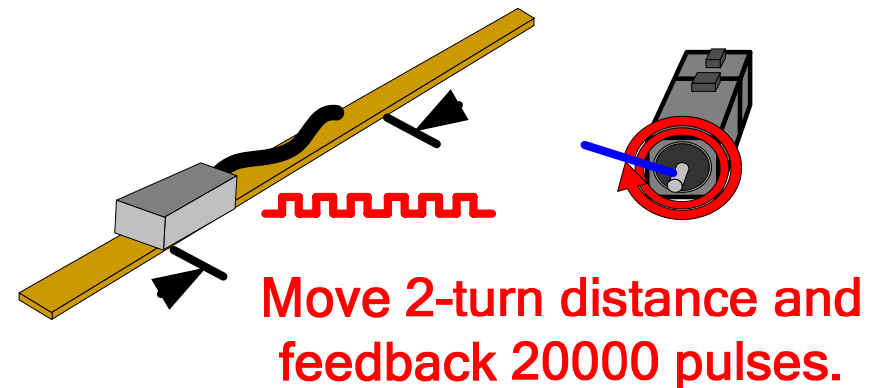
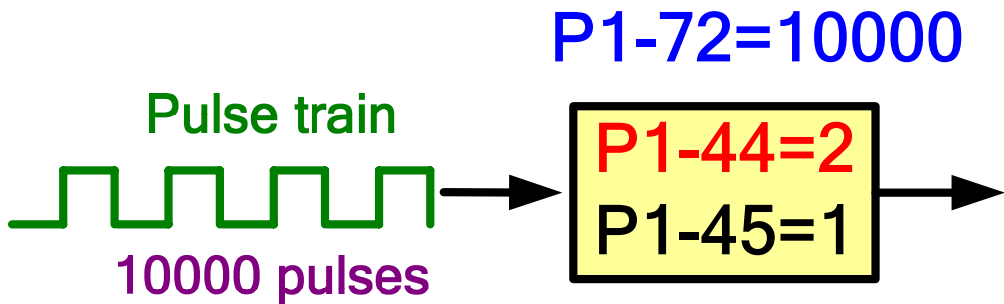
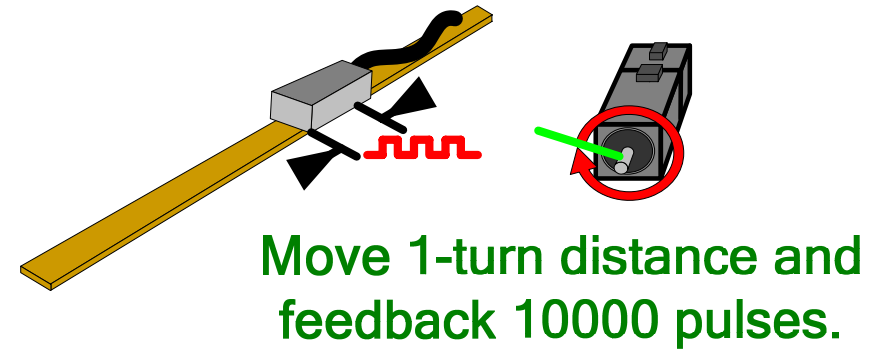
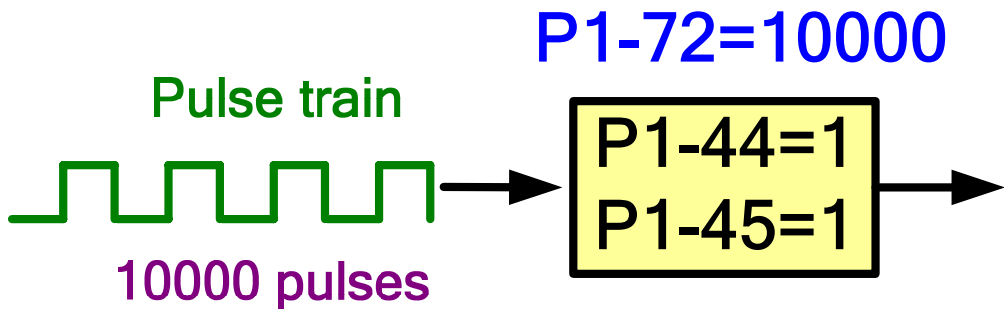
This DI works as a switch to change the system between full-closed and half-closed when P1-74.A=1.



Full-closed Loop Control (15)

The E-Gear Under Full-closed Loop Control

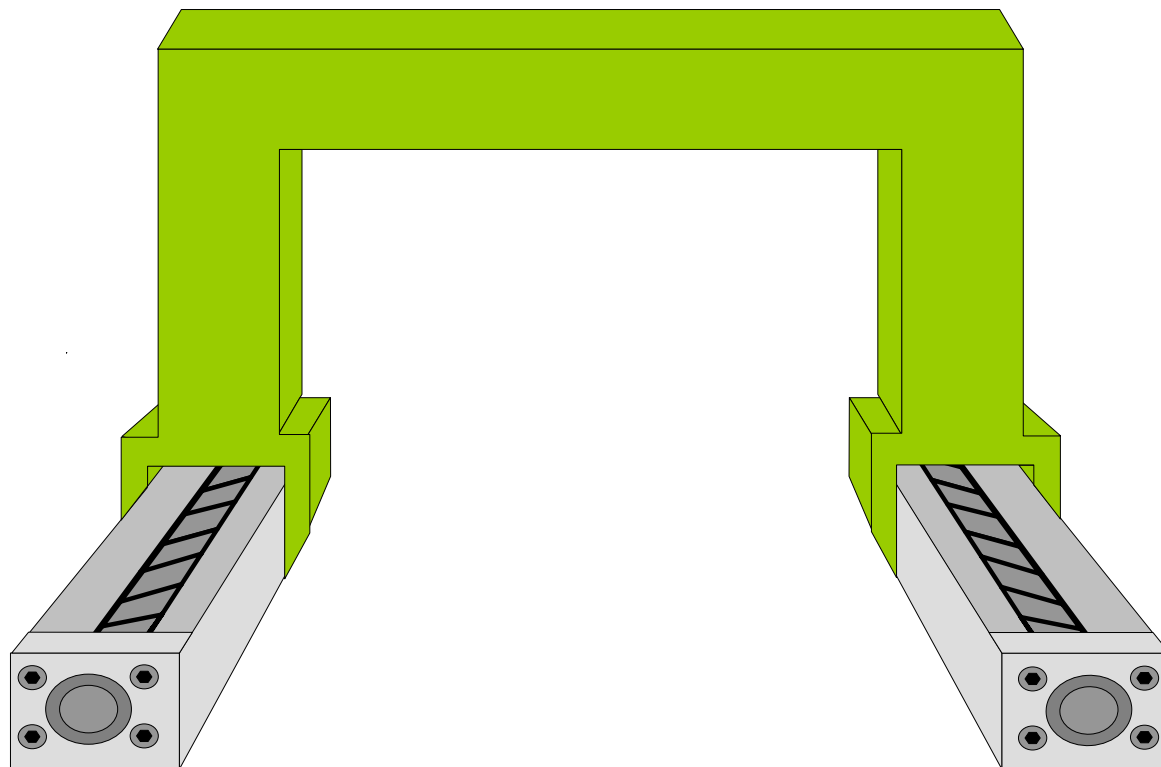
The E-Gear will be referred to the command resolution of linear encoder instead of main encoder under full-closed control function.



Gantry Control (1)

The Synchronous Movement

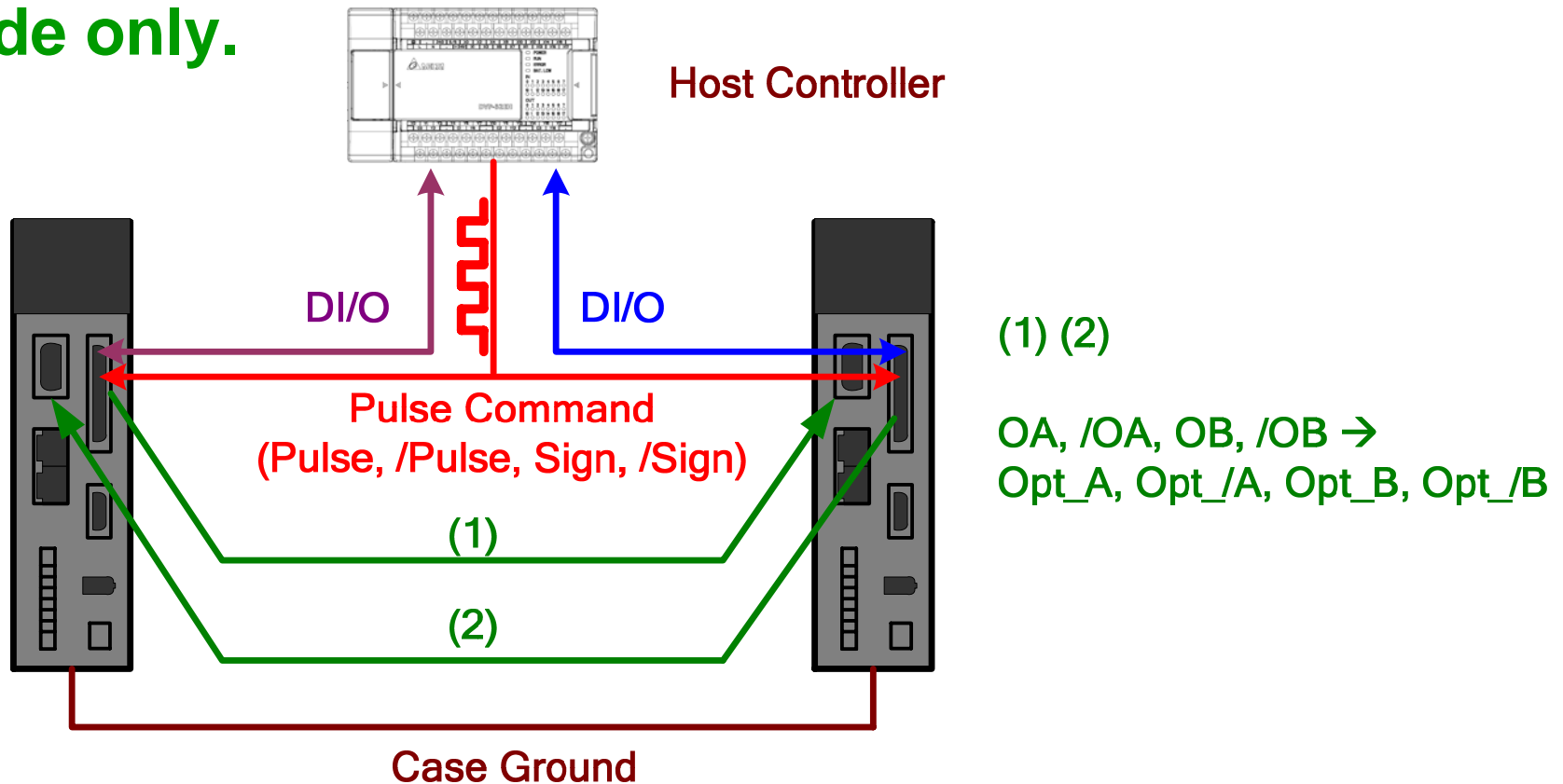
For the application requesting two axes moving synchronously, the gantry is a good solution.



Gantry Control (2)

Delta Solution

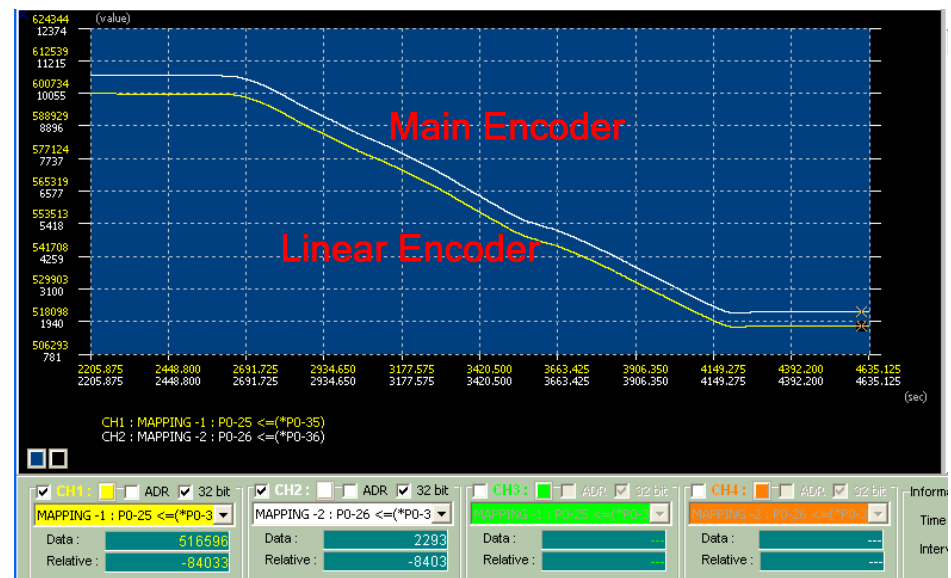
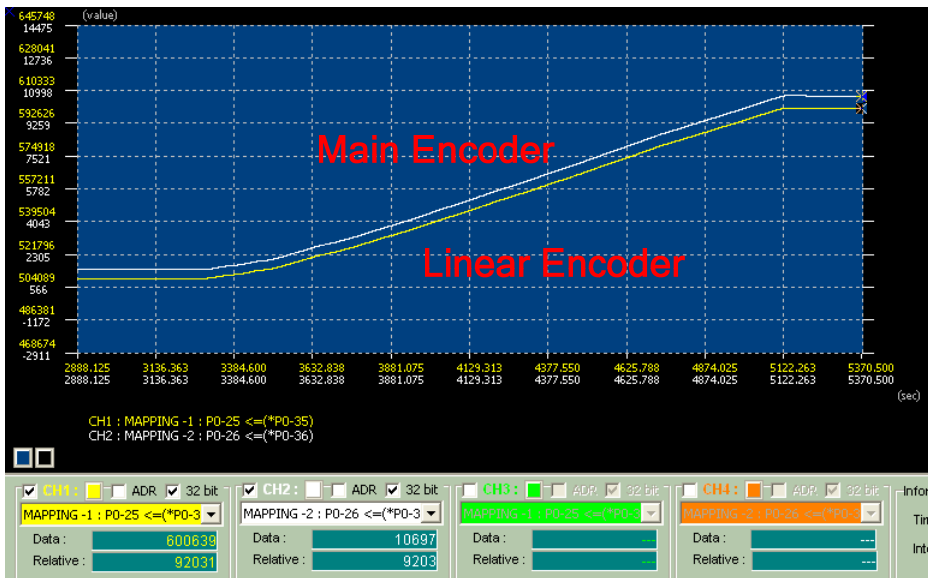
This is an awesome solution. The wiring is very simple. The pulse command of host control is shared by both of the two axes. Separate DI/O signals. The monitoring signals are also separate. This function supports PT mode only.



Gantry Control (3)

The Pulse Direction

Follow the same procedure in full-closed control to measure the pulse trend in both of the axes. Make sure the trend on both of the axes should be the same.



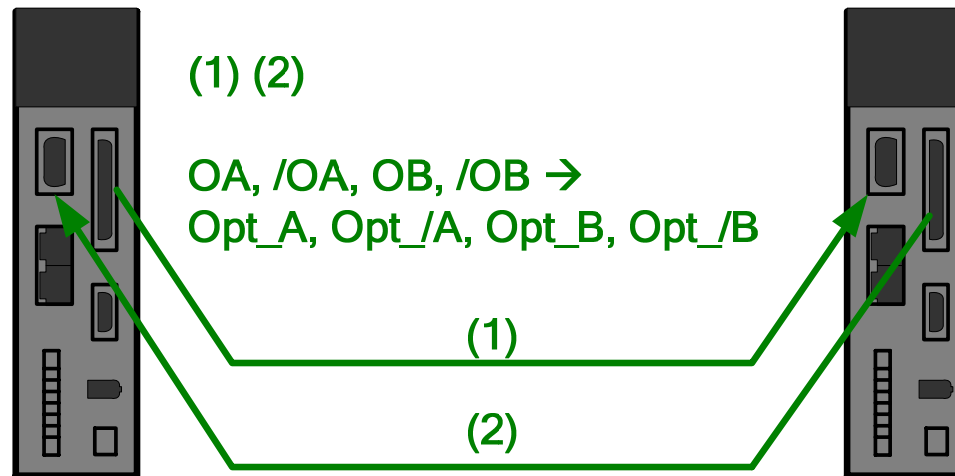
Gantry Control (4)

Monitoring Signal

The limit of port CN5 should be considered with the formula below. A safety coefficient 0.9 is used.

$$\frac{\text{Max. Motor Speed (rpm)}}{60} \times (\text{P1-46}) \times 4 < (8 \times 10^6 \times 0.9)$$

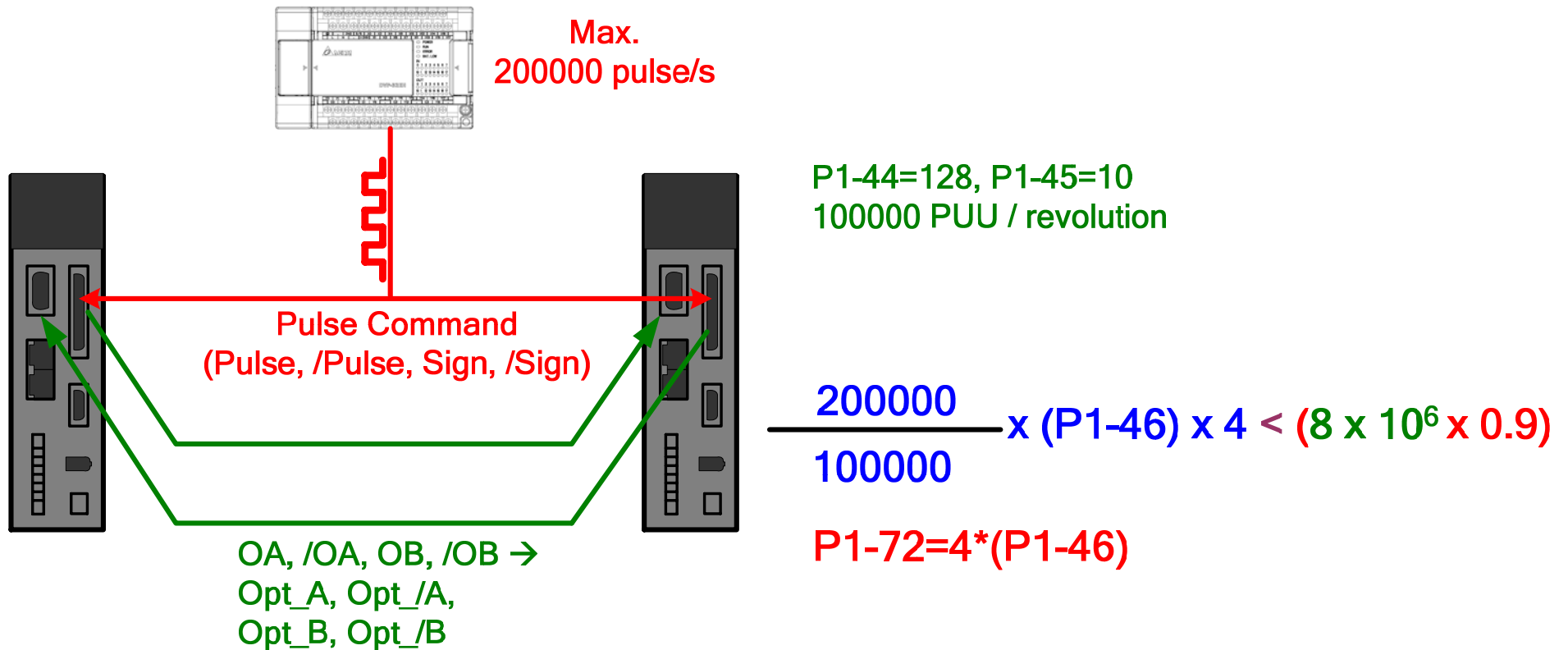
$$\text{P1-72} = 4 * (\text{P1-46})$$



Gantry Control (5)

From Command to Evaluate

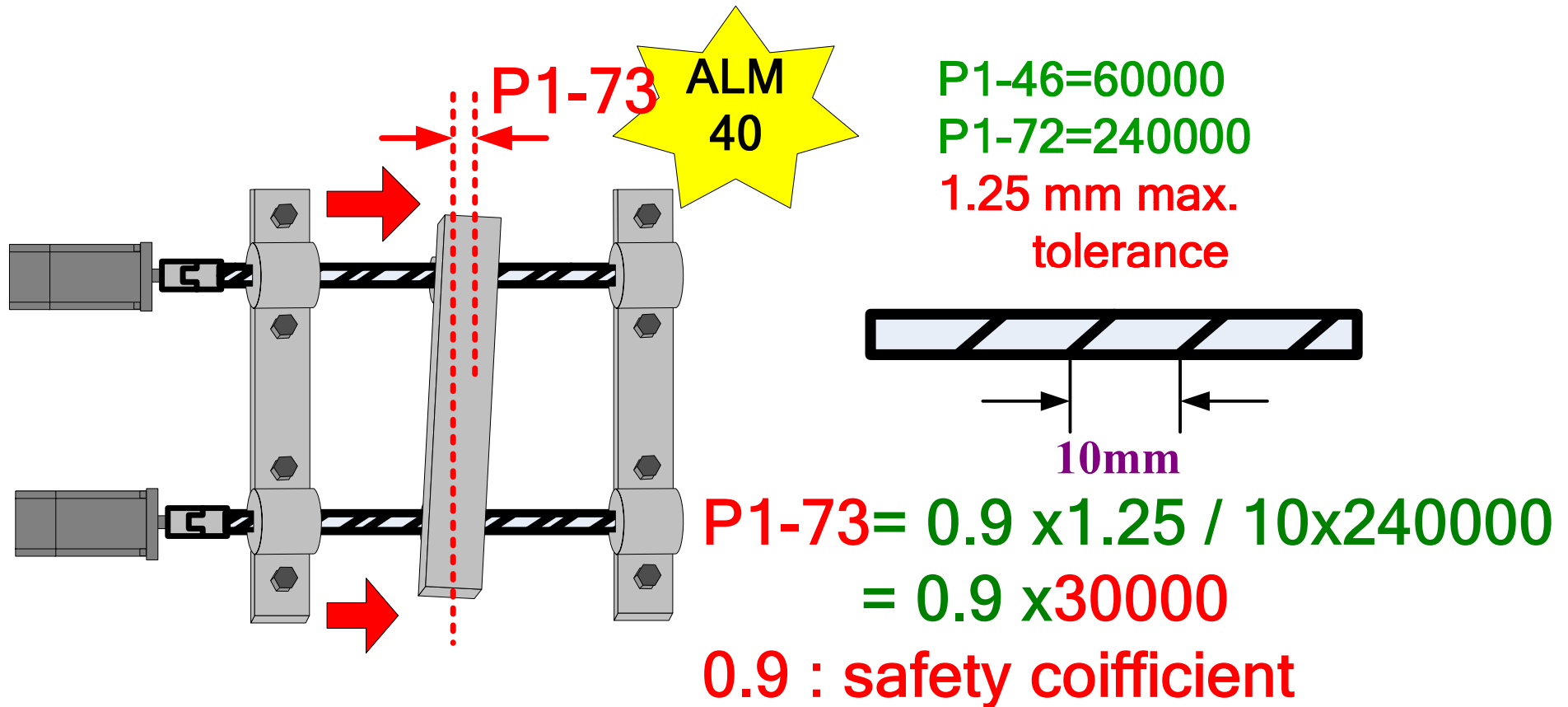
The command frequency can also be used to evaluate P1-46.



Gantry Control (6)

The Protection of Miss-Synchronization

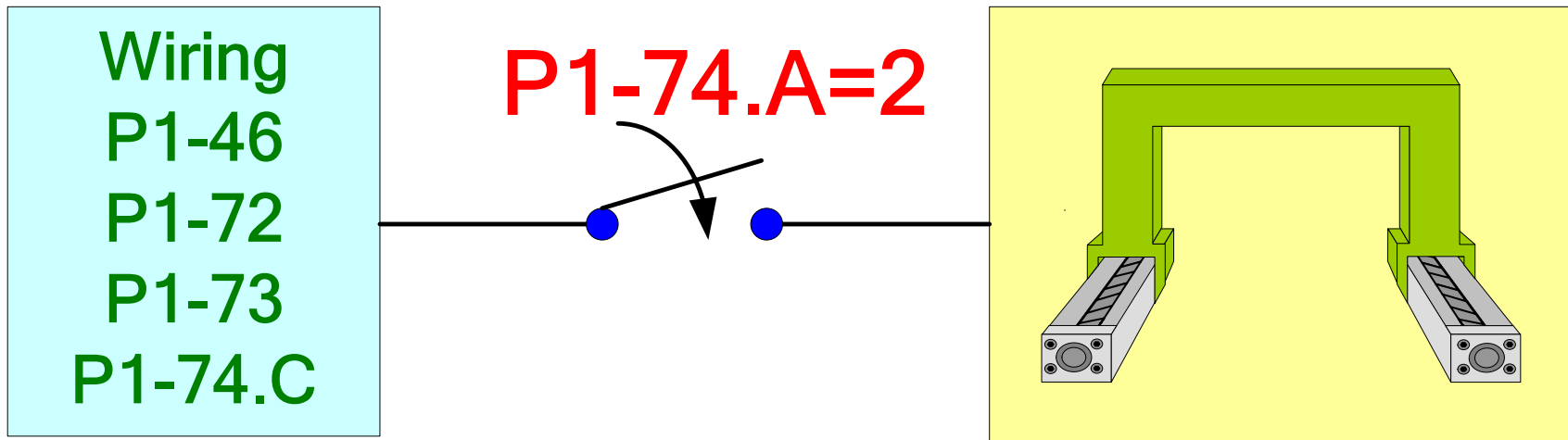
The parameter P1-73 can be set for the protection. This parameter should be set based on the real mechanism tolerance.



Gantry Control (7)

The Switch of Gantry Function

The gantry function is enabled by P1-74.A=2.

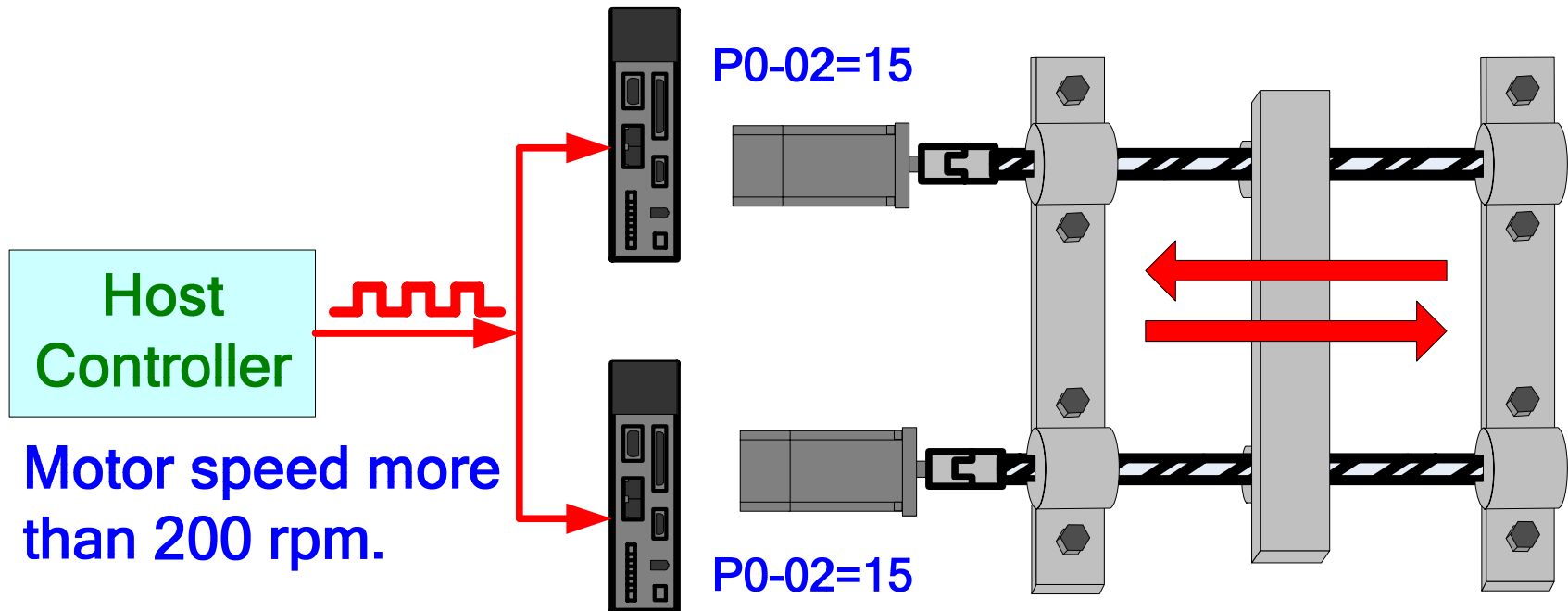


Gantry Control (8)

The Inertial Ratio

Use host controller to control the gantry mechanism moving forward and backward at a speed above 200 rpm and read from the panels for their inertial ratio respectively.

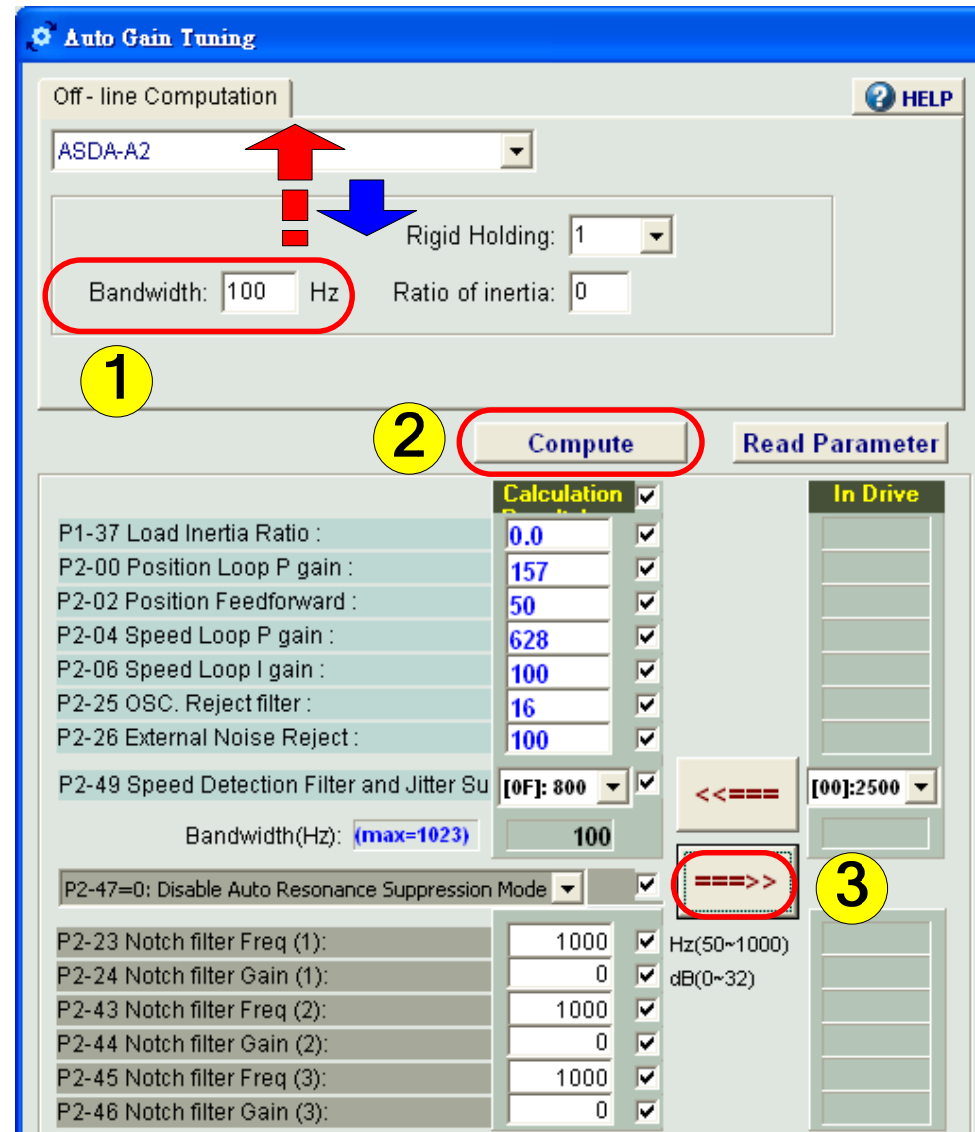
Read from the panel of both servo drives for $JL=?$



Gantry Control (9)

Test the Maximum Bandwidth

Use the PC software to test the maximum bandwidth of your system. Keep increasing the bandwidth until the sound coming out from the motor and reduce the bandwidth until the acceptable volume of noise heard.



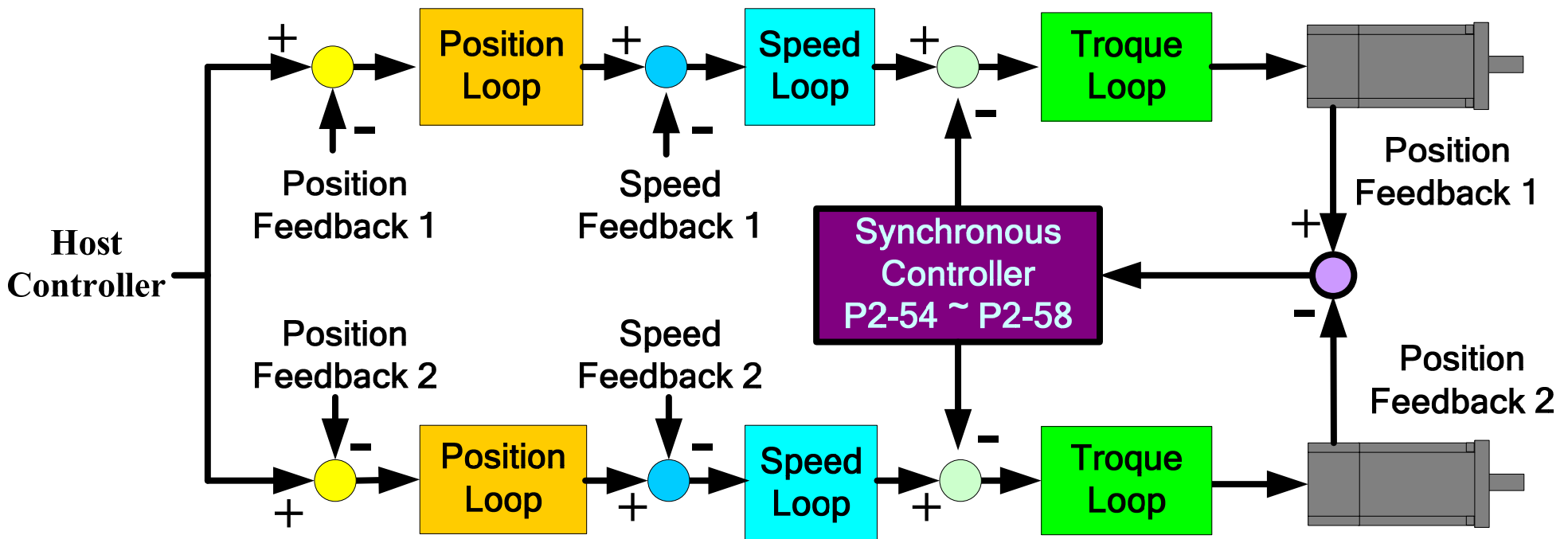
The screenshot shows the 'Auto Gain Tuning' software interface. Key elements and annotations include:

- 1**: A red circle highlights the 'Bandwidth: 100 Hz' input field.
- 2**: A red circle highlights the 'Compute' button.
- 3**: A red circle highlights the right arrow navigation button.
- A red dashed arrow points up from the 'Bandwidth' field to the 'ASDA-A2' dropdown menu.
- A blue dashed arrow points down from the 'ASDA-A2' dropdown menu to the 'Bandwidth' field.

| Parameter | Value | Unit |
|--|-----------|-------------|
| P1-37 Load Inertia Ratio | 0.0 | |
| P2-00 Position Loop P gain | 157 | |
| P2-02 Position Feedforward | 50 | |
| P2-04 Speed Loop P gain | 628 | |
| P2-06 Speed Loop I gain | 100 | |
| P2-25 OSC. Reject filter | 16 | |
| P2-26 External Noise Reject | 100 | |
| P2-49 Speed Detection Filter and Jitter Su | [OF]: 800 | |
| Bandwidth(Hz) | 100 | (max=1023) |
| P2-23 Notch filter Freq (1) | 1000 | Hz(50~1000) |
| P2-24 Notch filter Gain (1) | 0 | dB(0~32) |
| P2-43 Notch filter Freq (2) | 1000 | |
| P2-44 Notch filter Gain (2) | 0 | |
| P2-45 Notch filter Freq (3) | 1000 | |
| P2-46 Notch filter Gain (3) | 0 | |

The Control Skeleton of Gantry

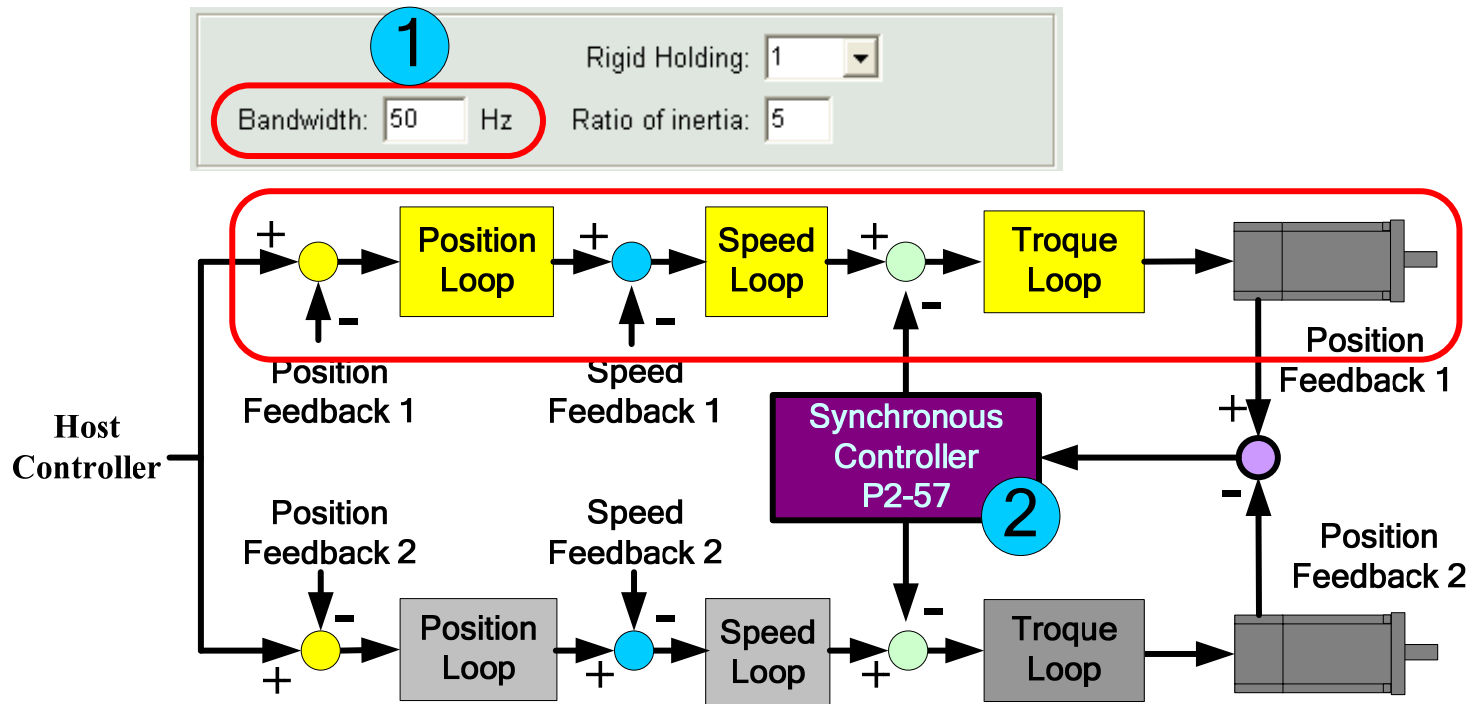
There is a new feature call **Synchronous Controller** for gantry function. The controller will share the maximum bandwidth with loop controller.



Gantry Control (11)

The Limit of Maximum Bandwidth

It is better to turn the summation of loop gain and synchronous gain not exceeding the maximum bandwidth.



$$\text{Bandwidth of Loop} + \text{Bandwidth of P2-57} \leq \text{Max. Bandwidth}$$

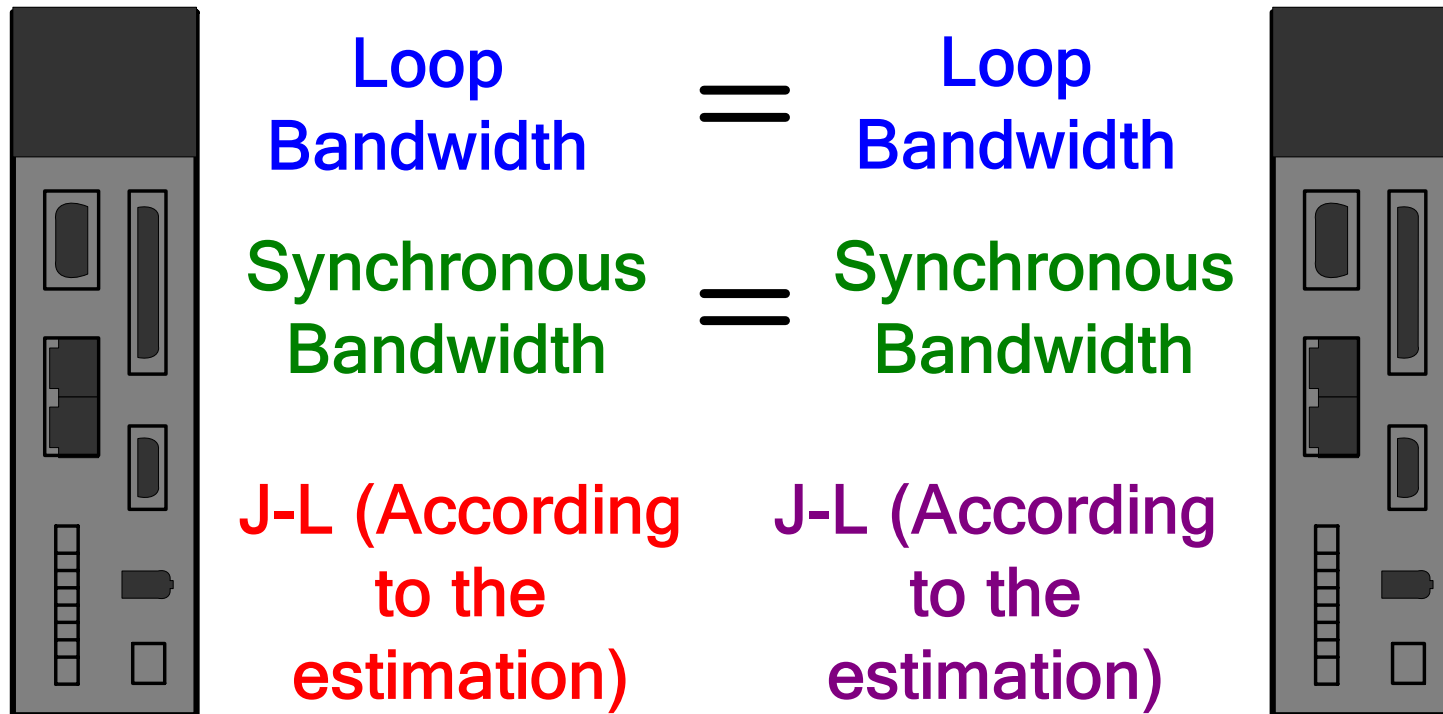
1

2

Gantry Control (12)

More on the Bandwidth

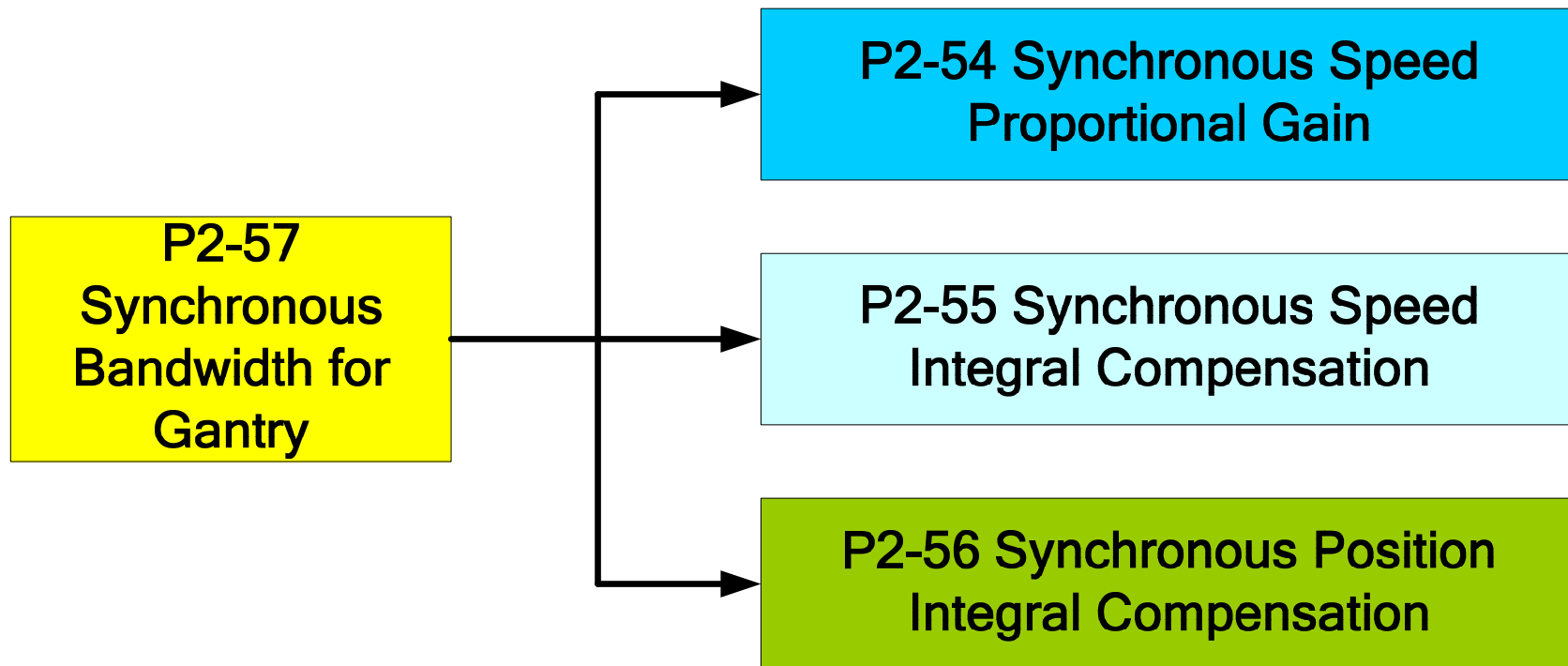
Both of the two drives should be set to the identical bandwidth of loop gain and synchronous gain. The inertial ratio could be different but the bandwidths must be the same.



Gantry Control (13)

More on Synchronous Bandwidth

At the moment P2-57 is put, the servo drive will calculate P2-54~P2-56 automatically.



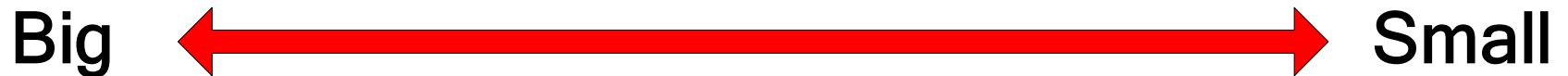


Gantry Control (14)

The Distribution of Maximum Bandwidth

The position displacement tolerance of system is a reference for distributing the bandwidth.

The tolerance set in P1-73



Maximum Bandwidth =
Loop Bandwidth + Synchronous Bandwidth

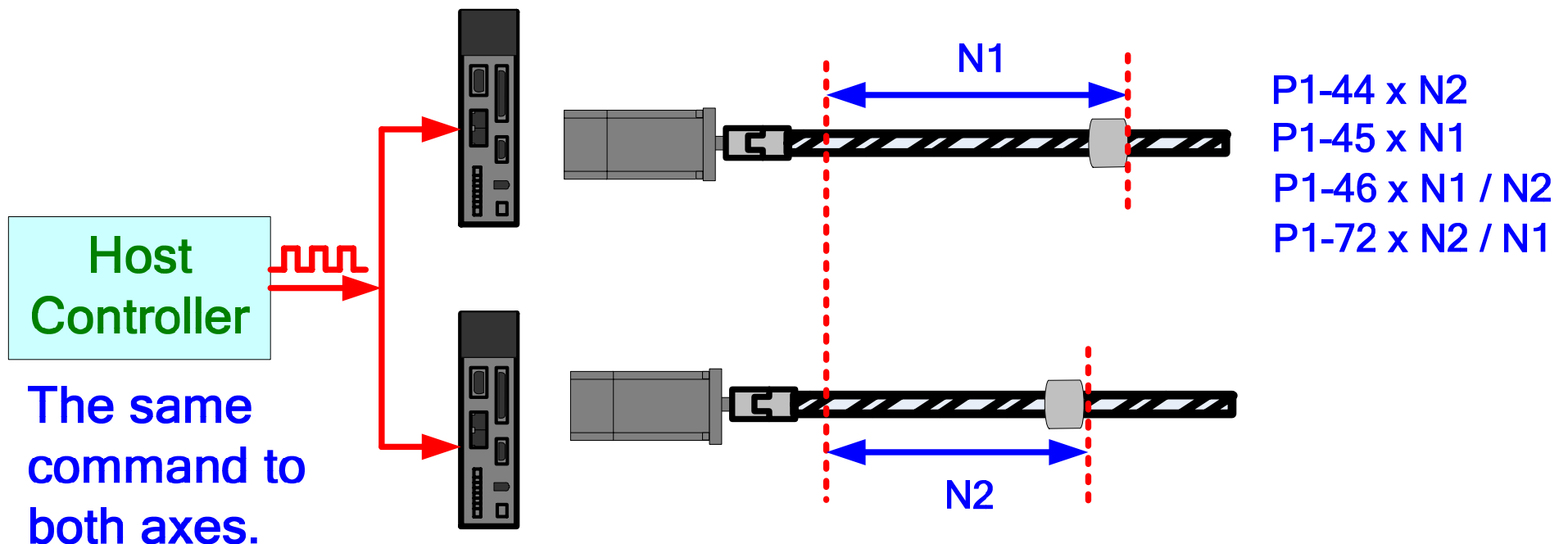
Loop
Bandwidth
Synchronous
Bandwidth

| | | | | | | | | | |
|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 100 % | 90 % | 80 % | 70 % | 60 % | 50 % | 40 % | 30 % | 20 % | 10 % |
| 0 % | 10 % | 20 % | 30 % | 40 % | 50 % | 60 % | 70 % | 80 % | 90 % |

Gantry Control (15)

The Difference of Mechanism

Once the mechanism exists difference, there are some parameters changed to fix this problem.



Password Protection (1)

The Range of Protection Parameter

The password, when enabled, will keep group 5, 6, and 7 from reading except the parameters marked with (■) whose contents will be reset for every power-on. It is write permit.

Group 5, 6, and 7 all protected. The 0 is read from these group.

| P 0 - XX | P 1 - XX | P 2 - XX | P 3 - XX | P 4 - XX | P 5 - XX | P 6 - XX | P 7 - XX |
|----------|----------|----------|----------|----------|----------|----------|----------|
| V 1.038 | | | | | | | |
| P7 - 00 | | | | | | | |
| P7 - 01 | | | | | | | |
| P7 - 02 | | | | | | | |
| P7 - 03 | | | | | | | |
| P7 - 04 | | | | | | | |
| P7 - 05 | | | | | | | |
| P7 - 06 | | | | | | | |
| P7 - 07 | | | | | | | |
| P7 - 08 | | | | | | | |
| P7 - 09 | | | | | | | |
| P7 - 10 | | | | | | | |

Delta ASDA-Soft
Password protection has been enabled!
OK

PR Mode Editor
Ver:1038

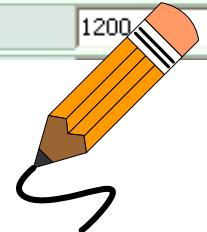
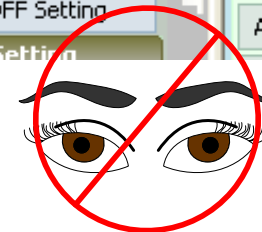
Speed, Time Setting
Accel / Decel Time
Delay Time
Internal Target S

General Param
Electronic Gear R
Software Limit
Event Decel Time
Event ON/OFF Setting

Homing Setting

P5-20~P5-35: Accel / Decel Tim
AC00 200
AC06 1000
AC07 1200

Delta ASDA-Soft
Password protection has been enabled!
It can't load parameter from Drive!
OK

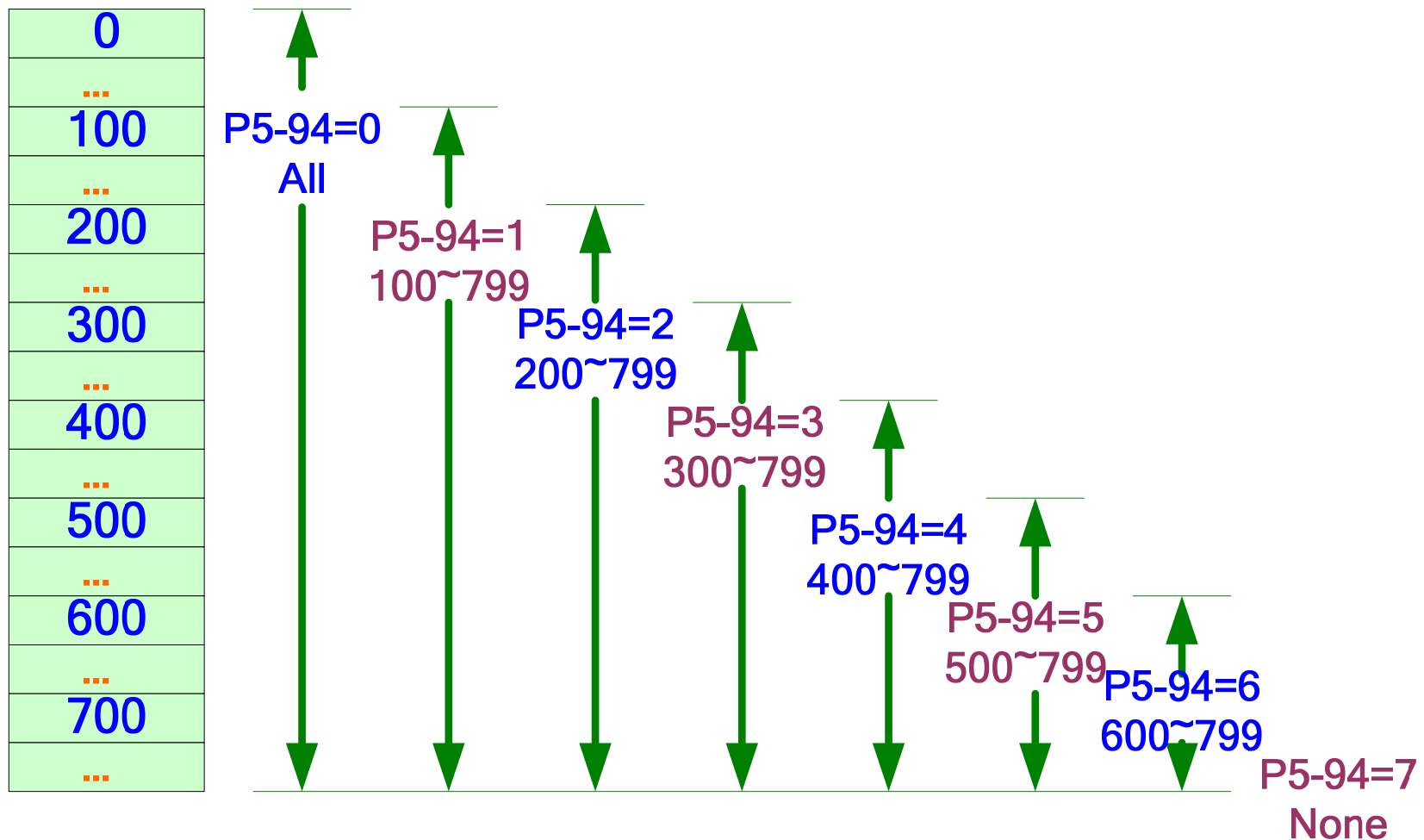




Password Protection (2)

The Range of Protection Data Array

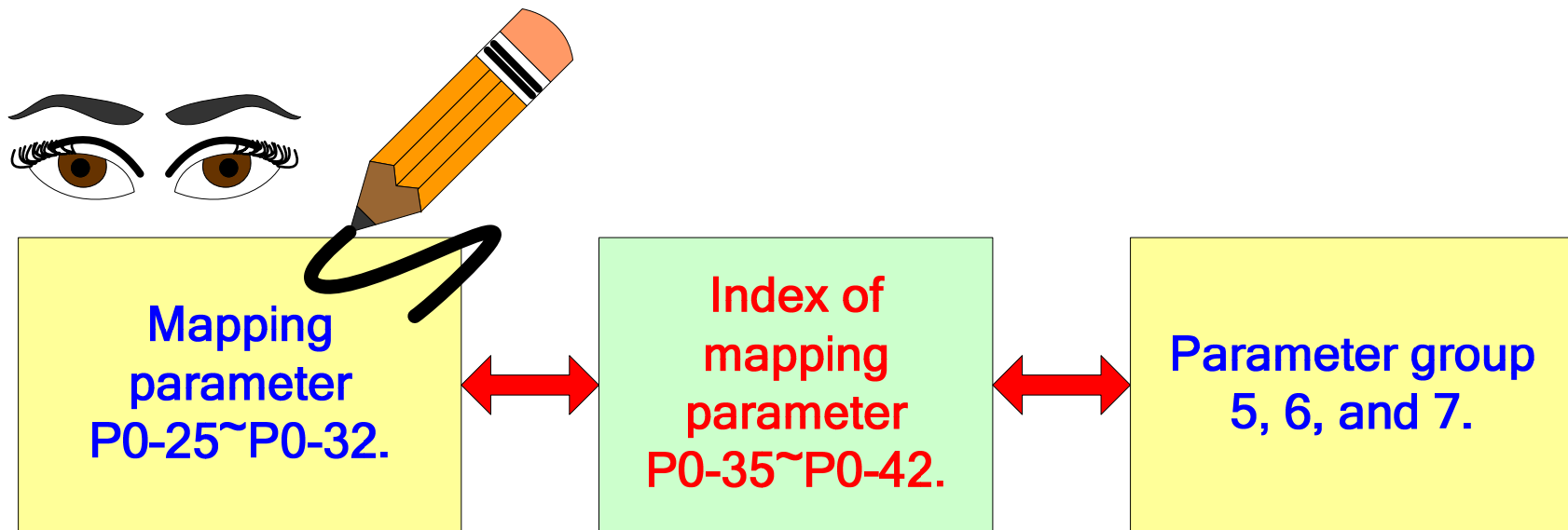
The range of password protected data array can be set.



Password Protection (3)

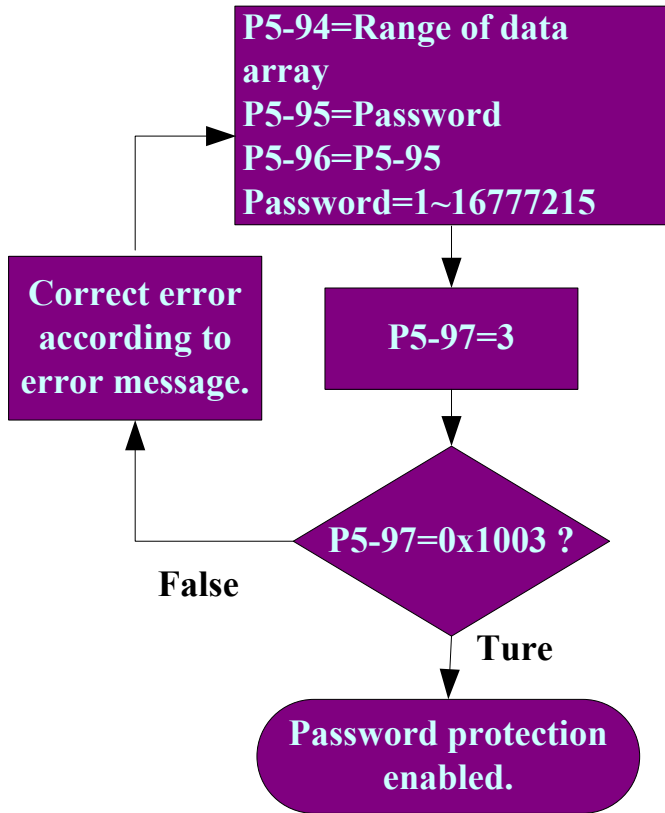
The Exception Window from Protection

The mapping parameters can be assigned to read parameters from protection area when the password protection enabled. Those parameters should be assigned well before password set.



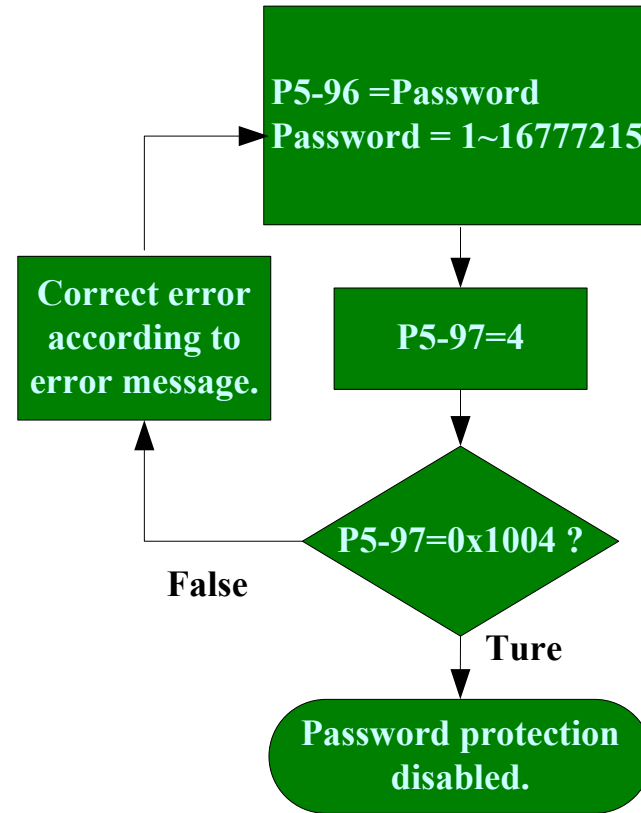
After password protection enabled, the contents of P0-35 to P0-42 cannot be modified if they index to parameters in group 5, 6, and 7.

The Macro Instructions



Error Messages

- F031h : Password protection enabled already.
- F032h : Double confirmation error, P5-95 ≠ P5-96.
- F033h : Password should be in range of 1~16777215.
- F034h : Data array selection in P5-94 should be 0~7.



Error Messages

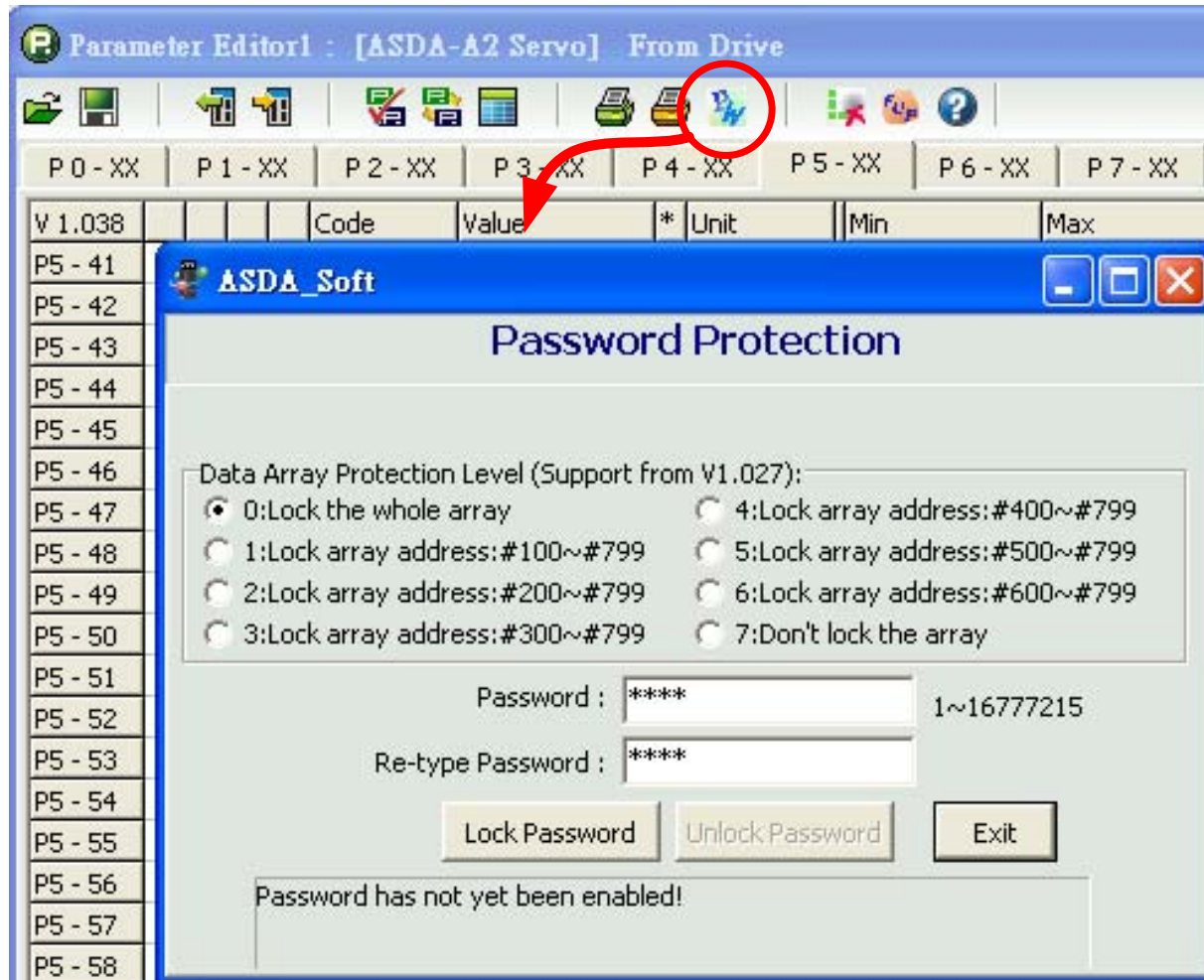
- F041h : Password protection disabled already.
- F043h : Password should be in the range of 1~16777215.
- F044h : Wrong passwords entered more than 20 times, the protection function cannot be disabled.
- Ennnh : The available number to try for unlocking the password.



Password Protection (5)

Use PC Software to Set Password

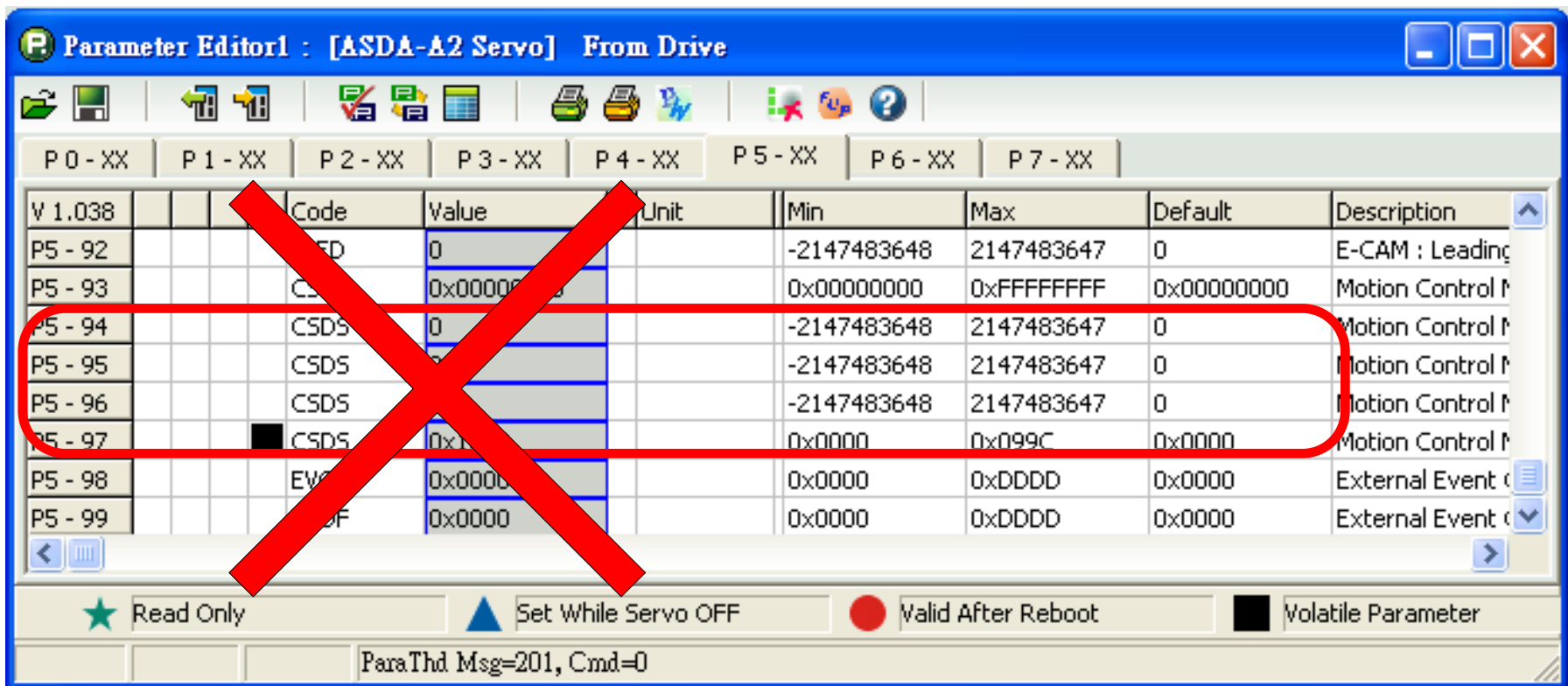
It is an easy way to set password. Highly recommend always use PC software for password function.



Password Protection (6)

Do Not Use Parameter Editor

The parameter editor will retry its writing to servo drive 3 times for every write and this will cause the wrong password test number reducing from 20 times to 7 times.



| Code | Value | Unit | Min | Max | Default | Description |
|---------|------------|------|-------------|------------|------------|------------------|
| P5 - 92 | 0 | | -2147483648 | 2147483647 | 0 | E-CAM : Leading |
| P5 - 93 | 0x00000000 | | 0x00000000 | 0xFFFFFFFF | 0x00000000 | Motion Control P |
| P5 - 94 | 0 | | -2147483648 | 2147483647 | 0 | Motion Control P |
| P5 - 95 | | | -2147483648 | 2147483647 | 0 | Motion Control P |
| P5 - 96 | | | -2147483648 | 2147483647 | 0 | Motion Control P |
| P5 - 97 | 0x0000 | | 0x0000 | 0x099C | 0x0000 | Motion Control P |
| P5 - 98 | 0x0000 | | 0x0000 | 0xDDDD | 0x0000 | External Event C |
| P5 - 99 | 0x0000 | | 0x0000 | 0xDDDD | 0x0000 | External Event C |

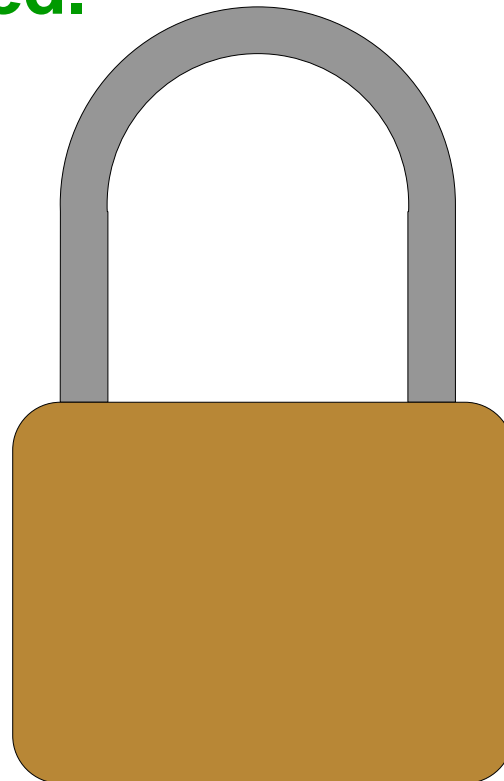
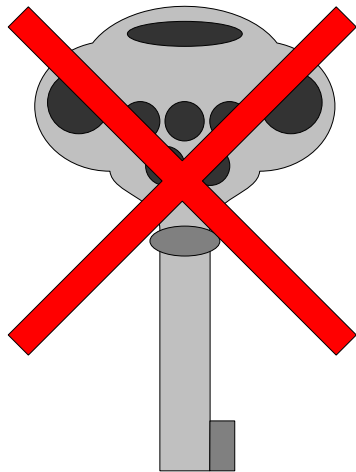
★ Read Only ▲ Set While Servo OFF ● Valid After Reboot ■ Volatile Parameter

ParaThd Msg=201, Cmd=0

Password Protection (7)

What if 20-times error try for unlocking reached?

The parameter group 5, 6, & 7, and data array will be kept from reading forever. **DELTA DO NOT HAVE A UNIVERSAL KEY TO UNLOCK IT.** The servo can keep its status for working. If P2-08=10 is put, the factory default parameters will be restored.



Thank You

