Fuji Electric
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Alpha 5 Smart Training

Comissioning

5. September, 2012

Fuji Electric Europe GmbH

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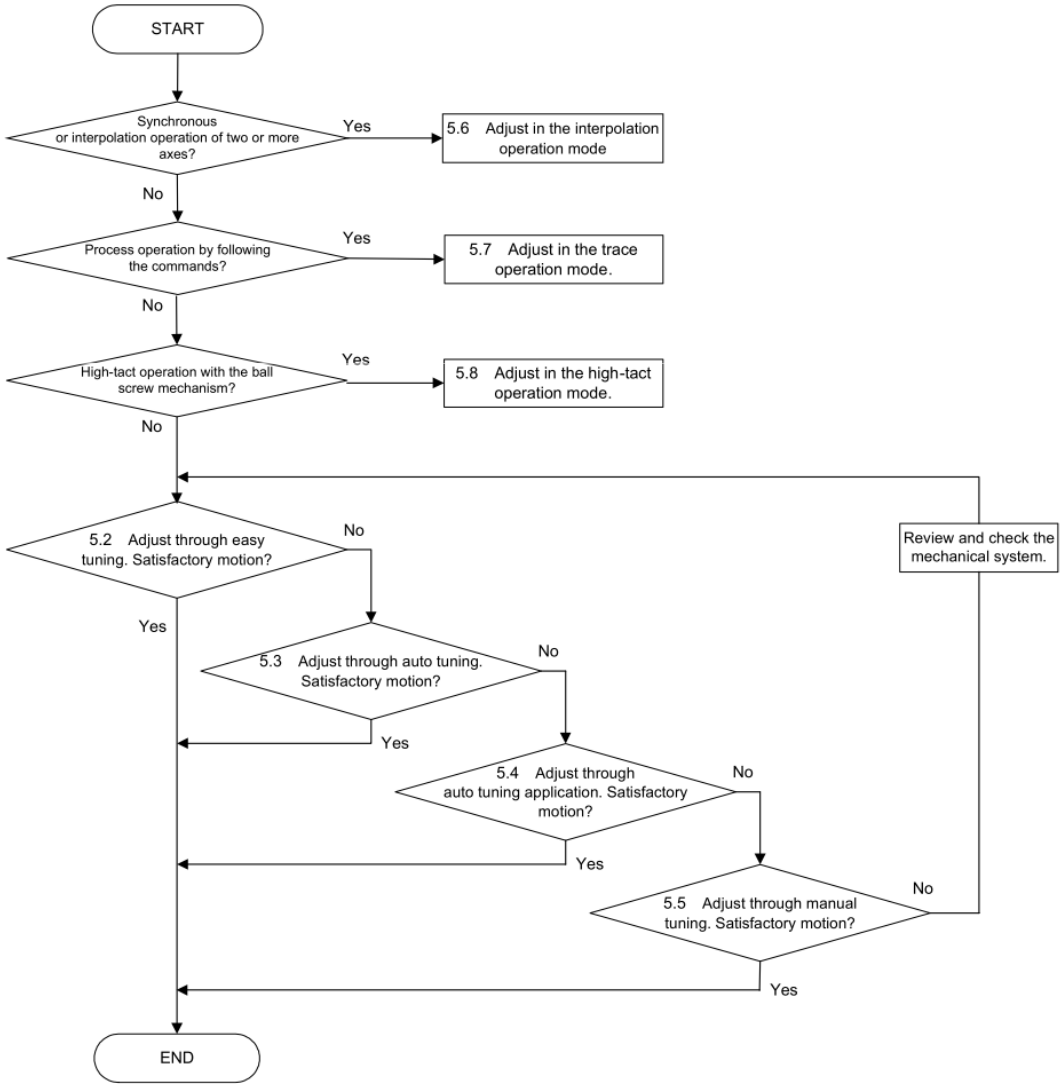
Adjustment Procedure



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Easy Tuning I

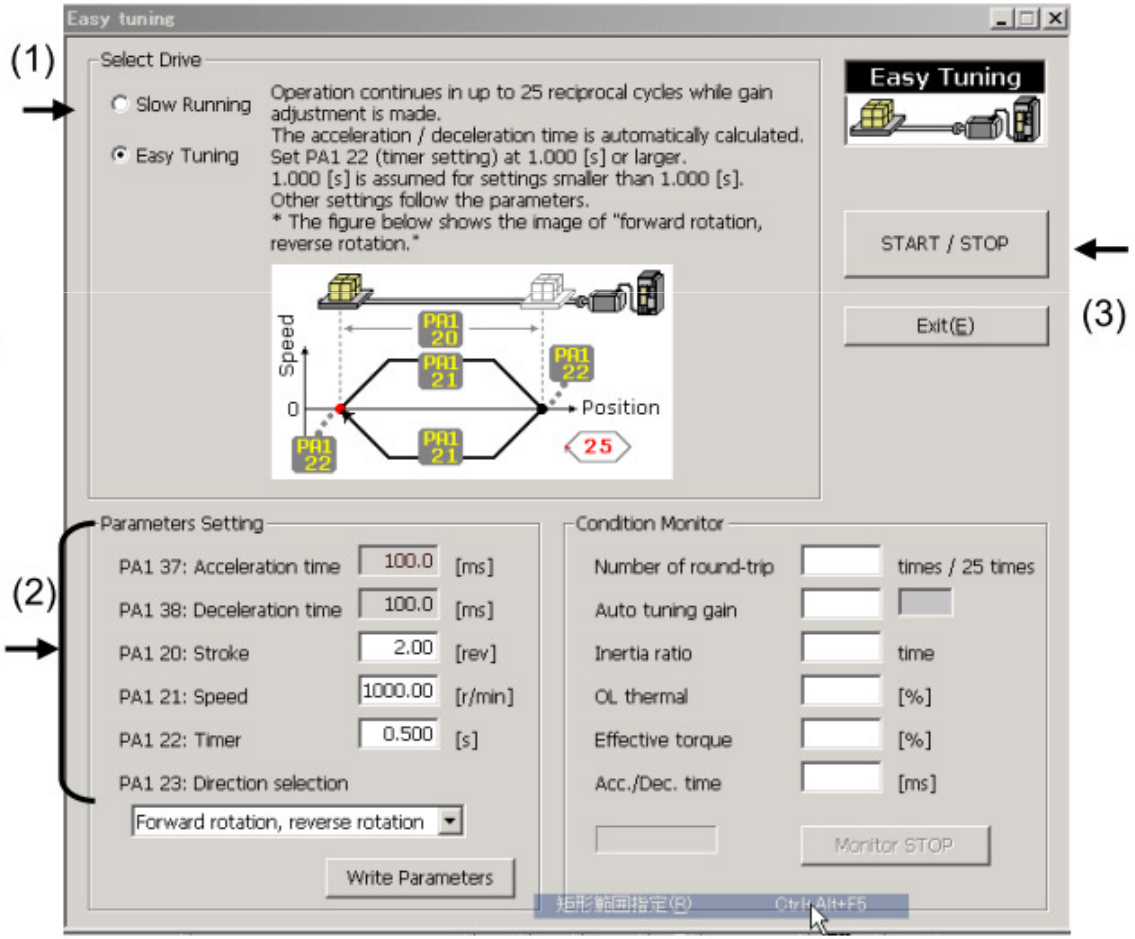
■ To operate with PC Loader

[1] Slow running

For machines with a linear driving system, follow the procedure below to perform slow running before performing easy tuning.

Turn the motor at 10 r/min (fixed) while checking the rotation direction and stroke.

Select "slow running" (1) on the PC Loader screen shown on the right and enter the "stroke setting" and "direction selection" parameters (2), and then press the "START/STOP" button (3).



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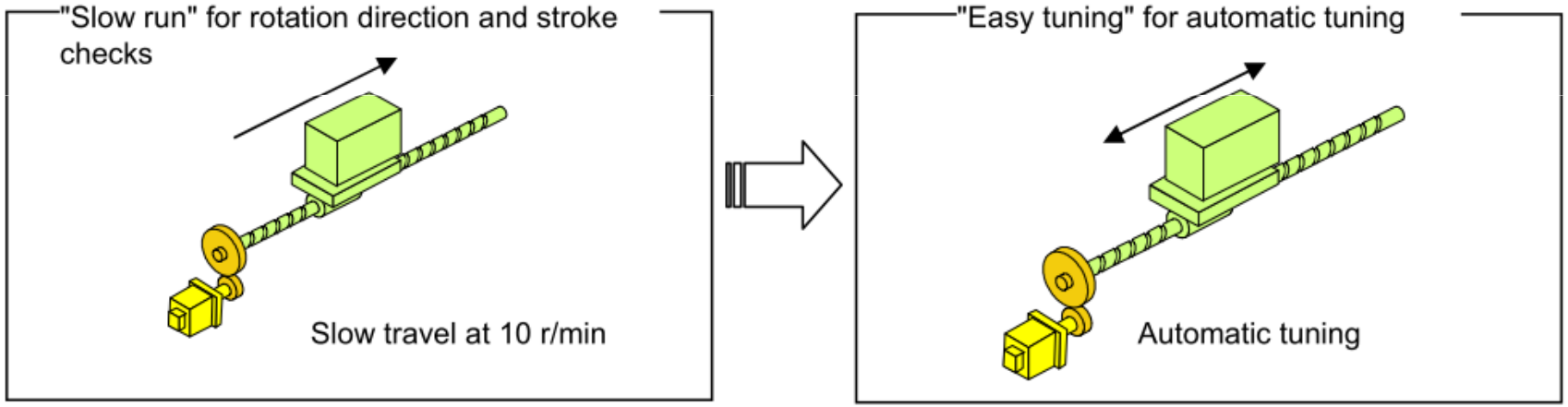
Easy Tuning II

[2] Easy tuning

Select "easy tuning" on the aforementioned screen . Enter the "stroke," "speed" and other particulars and press the "START/STOP" button. Up to 25 reciprocal motions occur while parameters are automatically tuned.



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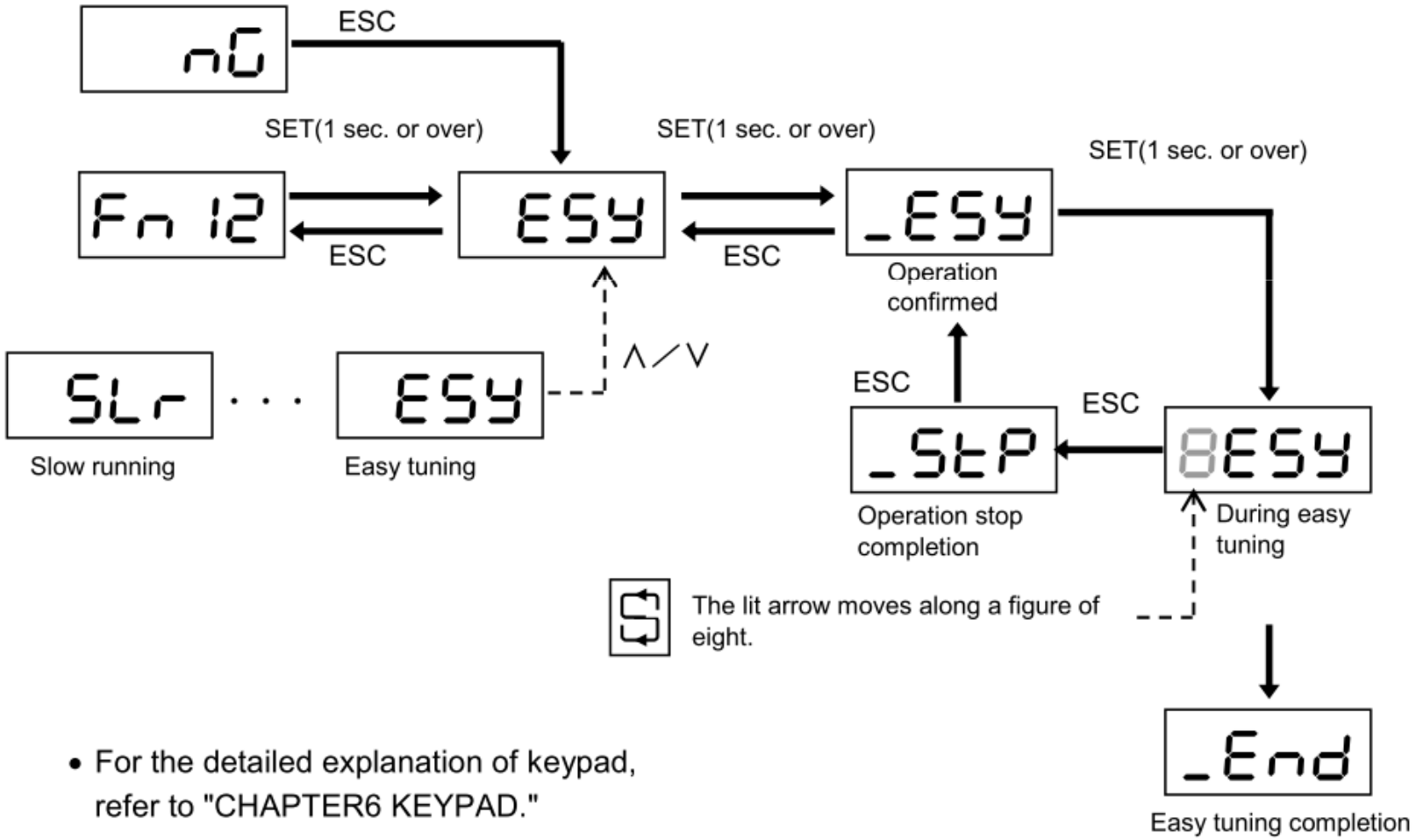
Easy Tuning II



- For the detailed explanation of keypad, refer to "CHAPTER6 KEYPAD."

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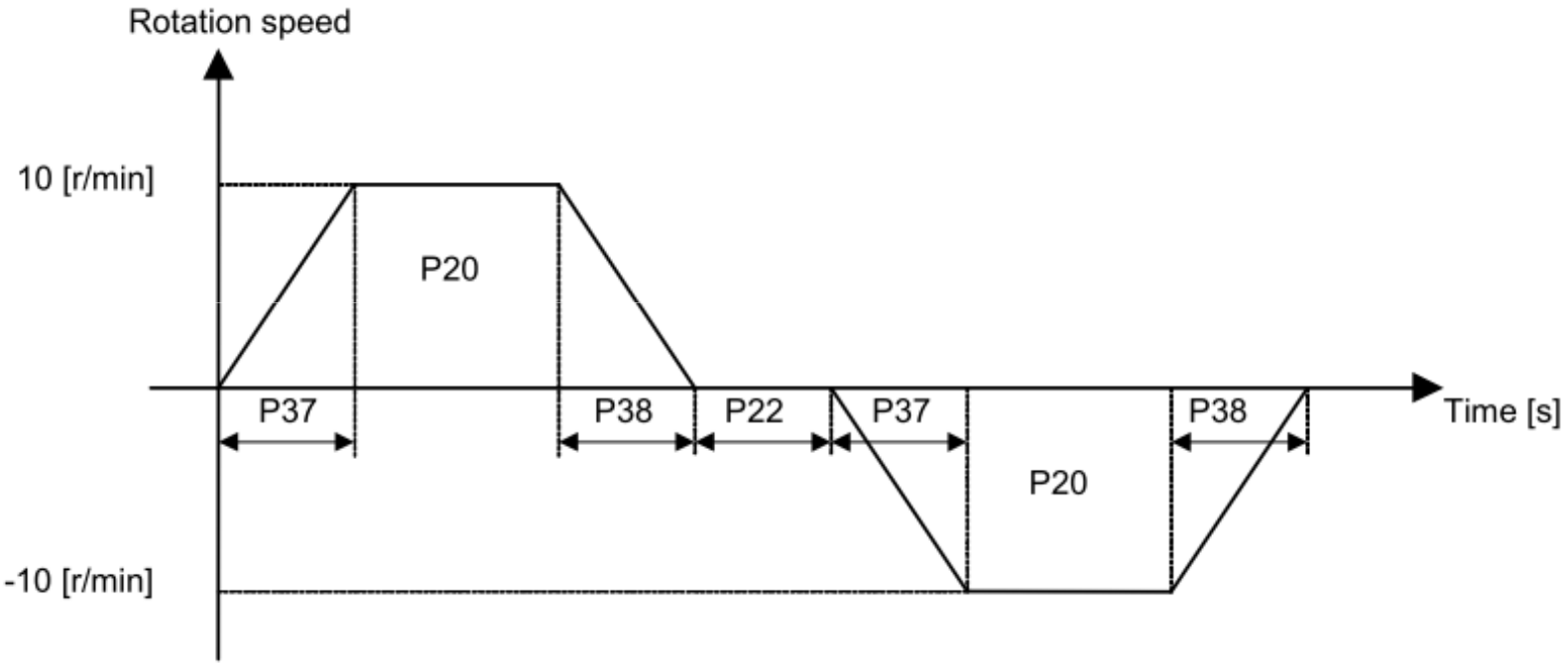
Easy Tuning – Slow Motion



Traveling distance	Operation frequency	Acceleration time	Deceleration time	Rotation speed	Timer	Rotation direction	
						Go stroke	Return stroke
P20	Once	P37	P38	10 r/min	P22	P23	

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Easy Tuning – Easy Tuning

■ Easy tuning

Starting condition

Conditions necessary to start easy tuning are indicated "○" in the table below.
Easy tuning does not start if the following conditions are not satisfied ("NG1" is indicated).
Easy tuning is interrupted if any condition is unsatisfied during operation ("NG2" is indicated).

Power supply to main circuit	No alarm	Neither ±OT nor EMG	BX signal OFF	Auto tuning*1	Parameter write enable*2
○	○	○	○	○	○

*1) PA1_13 (tuning mode selection): other than 12 (manual tuning)
*2) PA2_74 (parameter write protection): 0 (write enable)

Hint

Easy tuning may not function correctly in mechanisms listed below.

- Machines susceptible to vibration due to small rigidity
- Machines with large backlash
- Machines with large viscous friction
- Machines with very small rotation speed (example: 100 r/min or less)
- Machines with large load inertia of load
  GYS/GYC motor (750 W or less) : 100 times or over
  GYS/GYC motor (1.0 kW or more) : 30 times or over
  GYG motor : 10 times or over
- Machines with large and fluctuating load inertia

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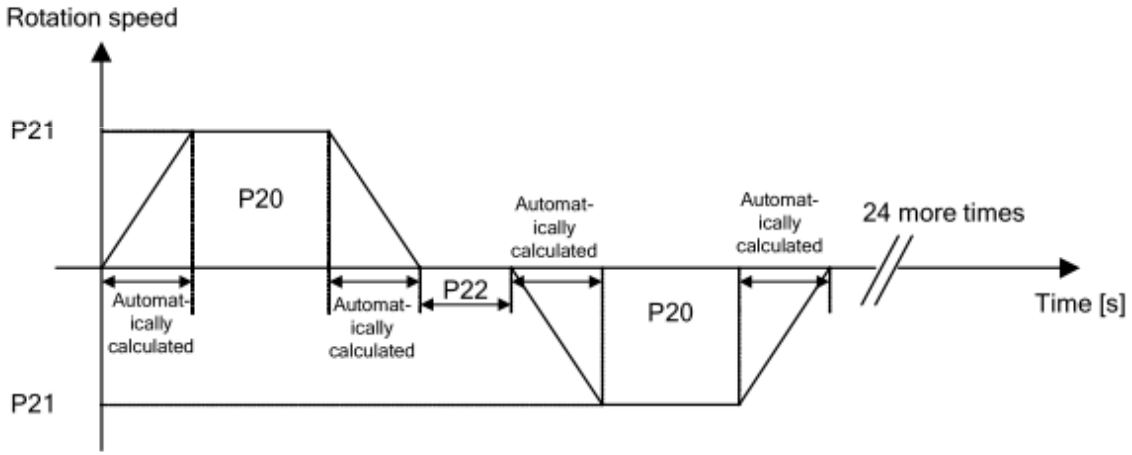
Easy Tuning – Easy Tuning

Operation profile (in case of reciprocal motion)

The operation profile is shown below. "P☐☐" in the table indicates the number of the basic setting parameter (PA1_☐☐).



Traveling distance	Operation frequency	Acceleration time	Deceleration time	Rotation speed	Timer	Rotation direction*1	
						Go stroke	Return stroke
P20	Max. 25 times	Automatically calculated*1	Automatically calculated*1	P21	P22*2	P23	

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Easy Tuning – Tuning Calculations

< The parameters set with easy-tuning >

No.: PA1_	Name
14	Load inertia ratio
51	Moving average S-curve time
54	Position command response time constant
55	Position loop gain 1
56	Speed loop gain 1
57	Speed loop integration time constant 1
59	Torque filter time constant for position and speed control
87	Model torque filter time constant
88	Position loop integration time constant

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Auto Tuning – Conditions

Auto tuning may not function correctly if the following conditions are not satisfied.

- The load inertia ratio of the mechanical system is within the range shown below.
  GYS/GYC motor (750 W or less) : 100 times or over
  GYS/GYC motor (1.0 kW or more) : 30 times or over
  GYG motor : 10 times or over
- Required time to reach 2000 r/min is 5 s or shorter with the acceleration/deceleration time constant.
- The motor rotation speed is 100 r/min or more.
- There is no substantial load fluctuation during operation or acceleration/deceleration.
- The friction force is not large and does not apply pressure.

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Auto Tuning – Parameters

No.	Name	Approximate reference value	
PA1_13	Tuning mode selection	10: Auto tuning	11: Semi-auto tuning
PA1_14	Load inertia ratio	No need to enter (automatically updated)	Enter a stable estimated value (or average value).
PA1_15	Auto tuning gain 1	Refer to "5.3.3 Approximate Reference Value of Auto Tuning Gain 1" for adjustment.	
PA1_16	Auto tuning gain 2	Enter when necessary.	

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Auto Tuning – Gain 1 reference

Machine configuration (Division by mechanism)	Auto tuning gain 1 (Approximate reference value)
Large transfer machine	1 to 10
Arm robot	5 to 20
Belt mechanism	10 to 25
Ball screw + Belt mechanism	15 to 30
Mechanism directly coupled with ball screw	20 to 40

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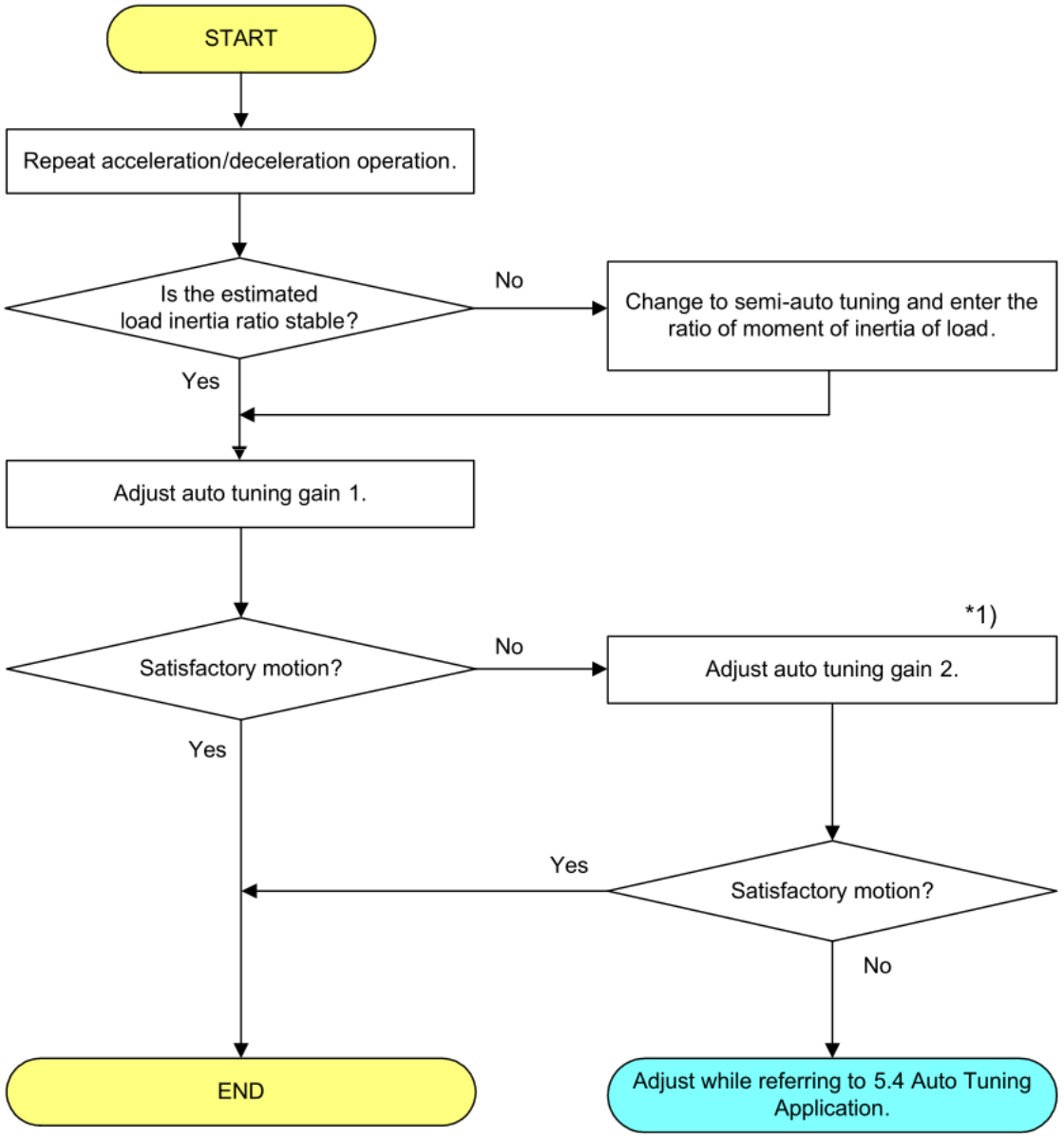
Auto Tuning Setting Procedure



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Auto Tuning – Gain influence

No.	Name	Auto tuning gain 1 and 2	
		PA1_15	PA1_16
PA1_14	Load inertia ratio	Always updated when PA1_13 is set to 10 (auto)	
PA1_51	Moving average S-curve time	○	○
PA1_54	Position command response time constant	○	○
PA1_55	Position loop gain 1	○	×
PA1_56	Speed loop gain 1	○	×
PA1_57	Speed loop integration time constant 1	○	×
PA1_59	Torque filter time constant for position and speed contorol	○	×
PA1_87	Model torque filter time constant	○	×
PA1_88	Position loop integration time constant	○	×

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Auto Tuning Application

No.	Name	Approximate reference value	
PA1_13	Tuning mode selection	10: Auto tuning	11: Semi-auto tuning
PA1_14	Load inertia ratio	No need to enter (automatically updated)	Enter a stable estimated value (or average value).
PA1_15	Auto tuning gain 1	Refer to "5.3.3 Approximate Reference Value of Auto Tuning Gain 1" for adjustment.	
PA1_16	Auto tuning gain 2	Enter when necessary.	
PA1_59	Torque filter time constant for position and speed control	Increase in increments of 0.5 ms, starting at the current setting.	
PA1_64	Position loop gain 2	70	
PA1_65	Speed loop gain 2	70	
PA1_66	Speed loop integration time constant 2	70	
PA1_70	Automatic notch filter selection	Select 0 (disable).	
PA1_71	Notch filter 1, frequency	Use the servo analyze function of the PC Loader for adjustment.	
PA1_72	Notch filter 1, attenuation		
PA1_73	Notch filter 1, width		
PA1_94	Torque filter setting mode	Select 0 (Not set automatically).	

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Auto Tuning Application