WARNING

THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi4aSP071001FMEN3

Hi4a Controller Function Manual

Servo Parameter

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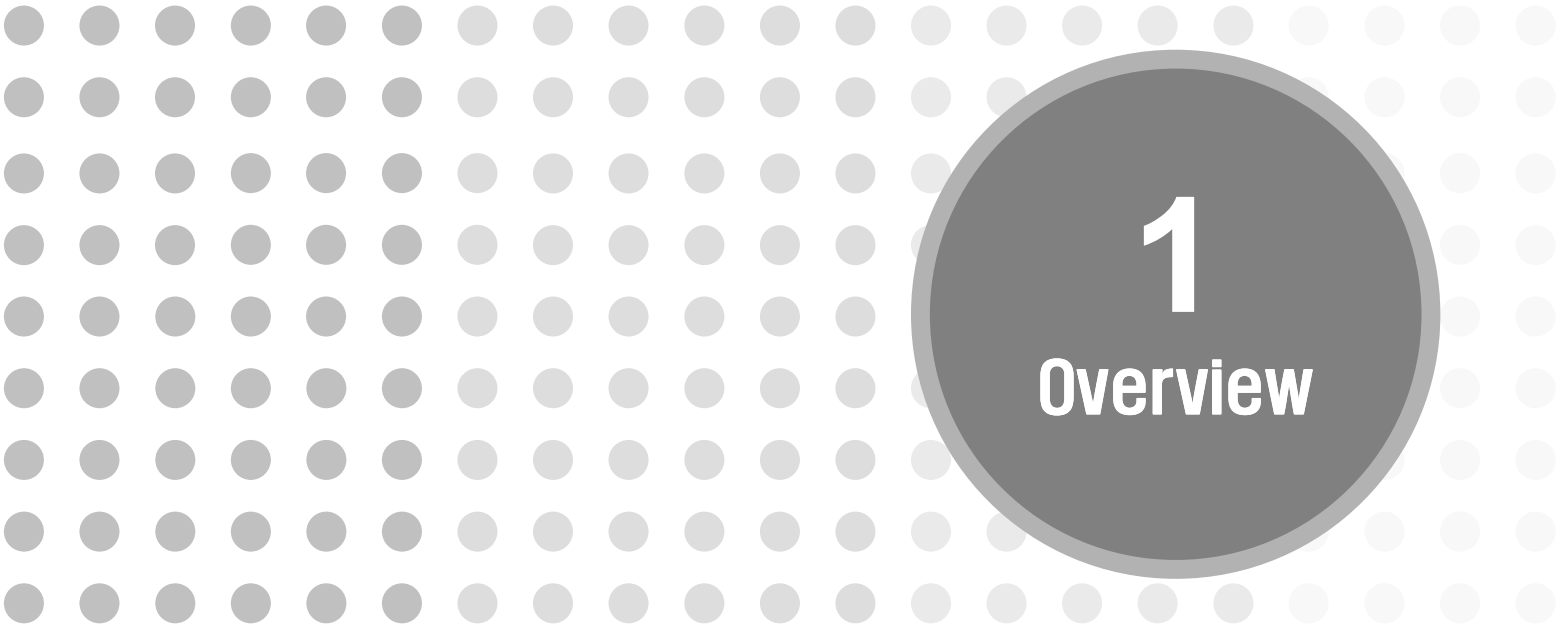
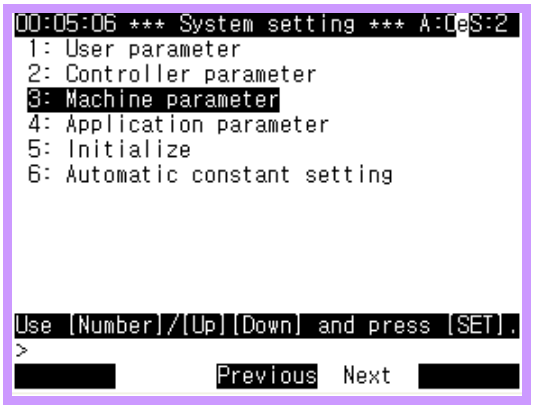
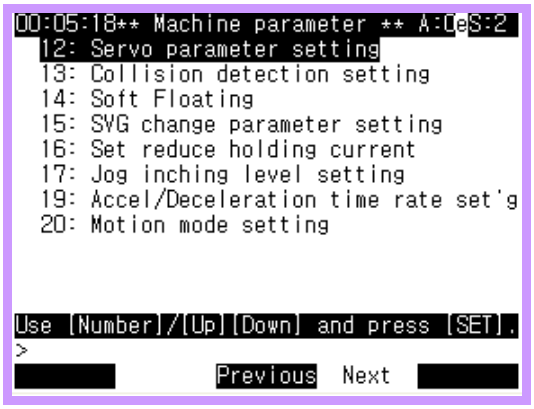

1
Overview

To set servo parameters of Hi4a controller, enter engineer code 『R314』, and go to 『[PF2]: System』 → 『3: Machine parameter 』 → 『12: Servo Parameter Setting』.

To see if engineer code is entered, check “e” blinking on the top.



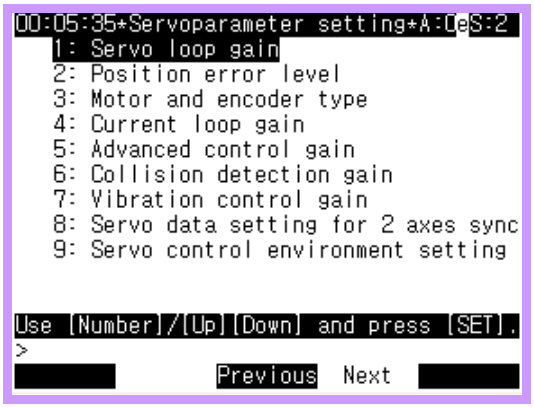


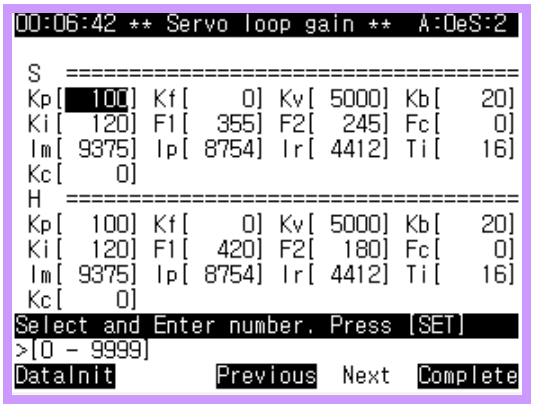
The following is details about each item of servo parameter setting menu.

Especially, among others, changed parameters are applied to 『3: Motor and encoder type』 and 『4: Current loop gain 』 after the controller power is turned off and then on again. Changes to 『5: Advanced control gain』 are available when made in the monitor off status. Although parameters of 『1: Servo loop gain』 can be changed when motor is on, it is safer to change when motor is off, if possible.

2
Servo Loop Gain

2. Servo Loop Gain



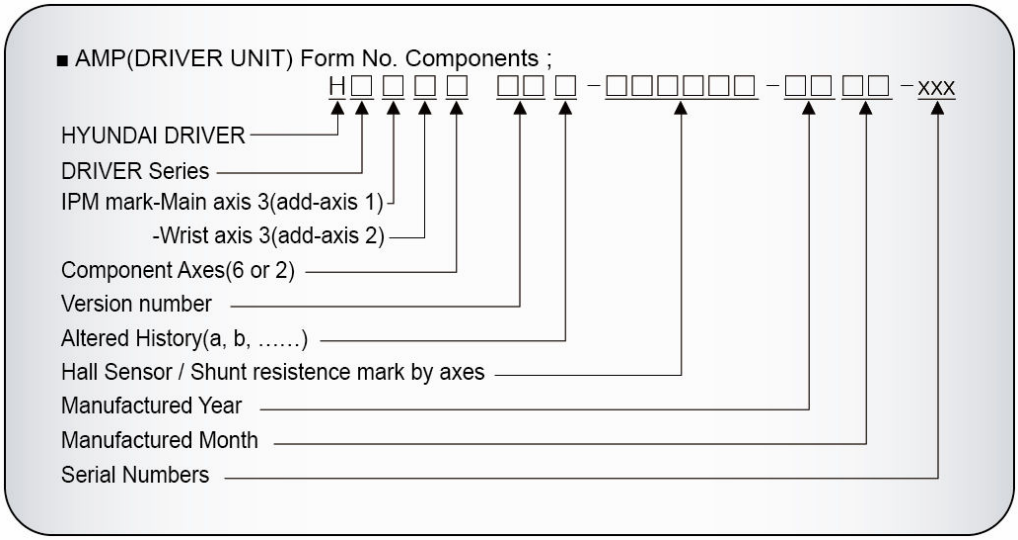


Set each gain of the servo controller. If servo loop gain is changed, this immediately affects the servo controller. Therefore, it is safe to change the gain when motor is off.

The following is details and setting method of each parameter.

Parameter	Detail	Setting Method
Kp	Proportional gain of position loop	0 ~ 9999
Kf	Feed forward gain	0 ~ 9999
Kv	Proportional gain of velocity loop	0 ~ 9999
Kb	Velocity feedback constant	0 ~ 9999
Ki	Velocity loop integral gain	0 ~ 9999
F1	1st filter time constant	1 ~ 1500, unit 0.5msec
F2	2nd filter time constant	1 ~ 500, unit 0.5msec
Fc	Filter coefficient	F1, F2 filter coefficients for 0 ~ 100[%] arc weaving
Im	Full Scale current	AMP peak current [Apeak]×100
Ip	Current limit	Motor instant peak current [Apeak]×100
Ir	Overload detection level	Motor rated current [Apeak]×100
Ti	Motor overload detection time constant	0 ~ 31, usually set at 16

To set AMP peak current, refer to AMP type number.



The following is medium-size AMP peak current according to shunt resistance value.
Shunt resistance value (medium-size drive unit only)

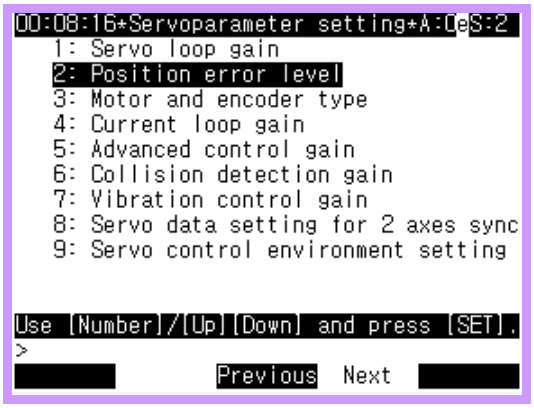
Shunt resistance symbol	**1**	2 mΩ : 93.75 Apeak
	2	4 mΩ : 46.87 Apeak
	3	8 mΩ : 23.44 Apeak
	4	12 mΩ : 15.58 Apeak
	5	16 mΩ : 11.72 Apeak

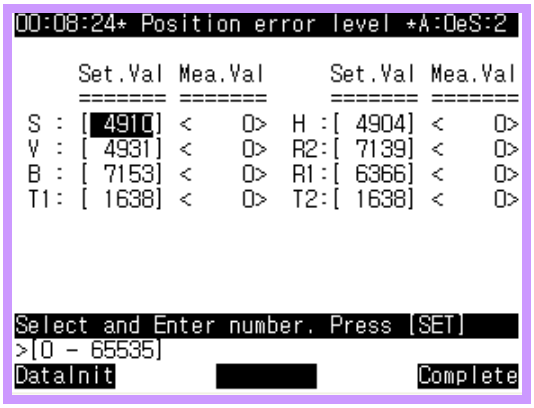
The following is small-size AMP peak current according to hall sensor.

Small-size AMP IPM capacity	**A**	(IPM rated current) 30A, (hall sensor rated current) 4V/15A : 28.12 Apeak
	B	(IPM rated current) 20A, (hall sensor rated current) 4V/10A : 18.75 Apeak
	C	(IPM rated current) 15A, (hall sensor rated current) 4V/10A : 14.06 Apeak
	D	(IPM rated current) 10A, (hall sensor rated current) 4V/5A : 9.37 Apeak

3

Position Error Level





Set a deviation value to detect axis deviation error 『E0117 ○Ax) Too large position drift』 when unusual moves are found in robot performance.

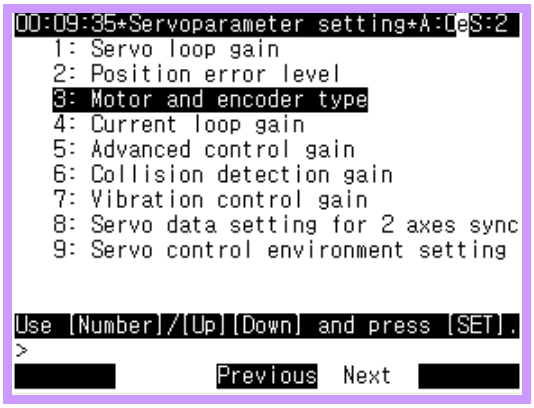
- Set .Val: Deviation value to detect deviation error
- Mea.Val: Maximum deviation value since the controller power is ON until the current time.

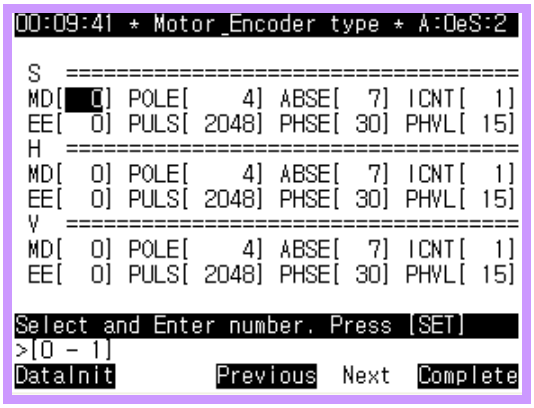
Although basic values are set according to the robot type, if set values are adjusted to the job site, errors can be detected more quickly. Revise axis position error levels to 1.2 ~ 1.5 times of measured values after robot installation is completed and the program is operated several times. Then, damage can be reduced by quick error detection when unusual moves are found in robot performance. If errors occur during normal operation, increase set value referring to the measured value.

If deviation error set value is 0, deviation error is not detected.

4

Motor, Encoder Type



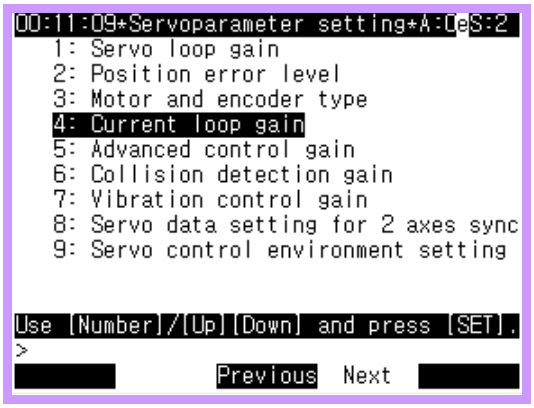


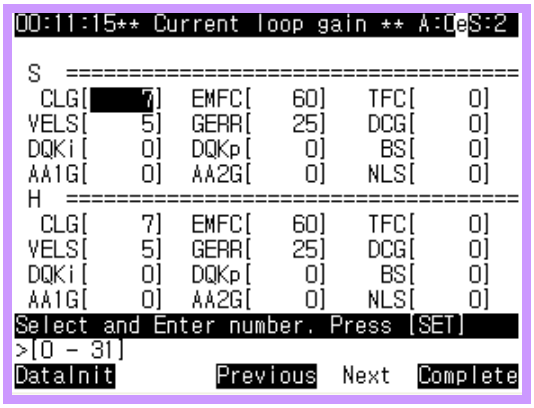
Set parameters according to the type of motor and encoder.
The changed setting of motor and encoder type is applied after the controller power is turned off and then on again.

Parameter	Detail	Setting method
MD	Motor rotation direction	Provided the direction in which encoder value increases is the forward direction, if the forward direction is CCW according to the shaft rotation direction seen from the flange of the motor, MD is 0. If the forward direction is CW, MD is 1.
POLE	Number of motor poles	Number of motor poles / 2
ABSE	Absolute value of encoder type	1- Yaskawa 2-Tamakawa 3-Panasonic 4-Seial Encoder Type 7-Compact Encoder type
ICNT	Incremental count direction	In motor forward direction rotation, 0 if the A phase comes first and 1 if B phase comes first.
EE	Encoder extension	0-Standard 1-Tamakawa Even 2-Tamakawa 21bitEven 3-Tamakawa 21bitOdd
PULS	Number of encoder pulses per motor rotation	1024, 2048, 4096, 8192 All figures are converted to 8192 in the controller.
PHSE	Current phase angle at zero	0°~ 359°, Generally Panasonic type is 30°
PHVL	Current delay compensating angle according to speed	0°~ 359°, usually 11°~ 30°. Current delay compensating angle when motor rotation speed is 2000rpm.

5 Current Loop Gain

5. Current Loop Gain



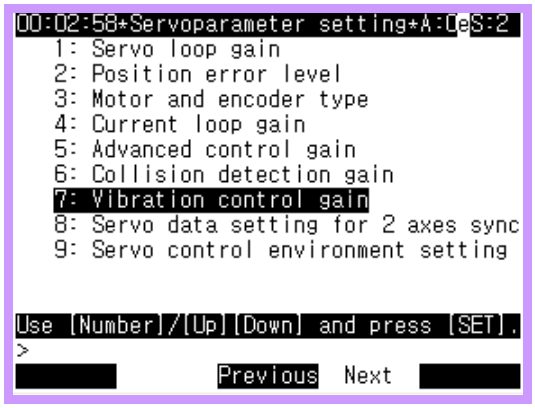


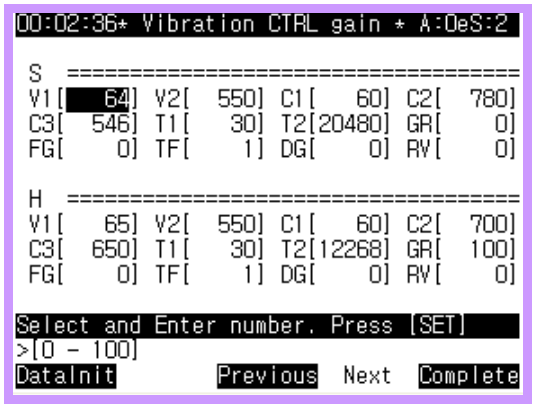
Hi4a controller is embodied with full digital servo, and motor current control is also digital type. Changed current loop gain is also run after the controller power is turned off and then on again.

Parameter	Detail	Setting method
INTL	Current interrupt lag after PWM top/bottom	[0~1] 0:0%, 1:5%, always 0
LSEL	Current loop available/unavailable	[0~1] 0:Disable, 1:Enable, always 1
CLG	Current loop gain	[0~31] Determined by motor and AMP
CTL	Current loop time constant	[0~7] always 5
FDIS	ASIC current operation part filter available/unavailable	[0~1] 0:Enable, 1:Disable, always 0
FSEL	Current feedback scale	[0~3] 0-1/8,1-1/4,2-1/2,3-1/1, always 3
PDLY	PWM on delay (dead time) setting value	[0~15] always 9
PFRQ	PWM carrier frequency	[0~15] always 13
EMFC	BackEMF compensating coefficient	[0~32767]Measured according to motor
TFC	Torque filter cutoff frequency	[0~511] always 0
VELS	Real speed calculation cycle	[0~7] always 5
GERR	Current loop error compensation	[0~127] Measured according to motor and AMP. If not known, 0.

6

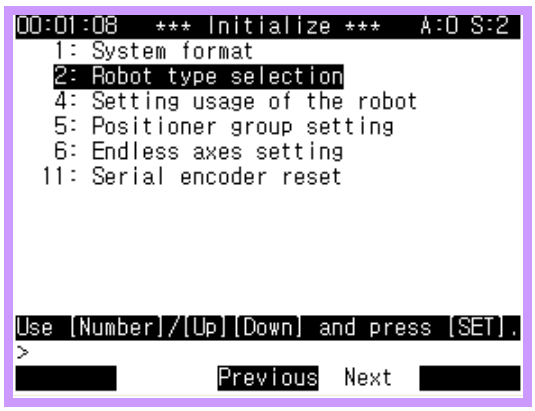
Vibration Control Gain

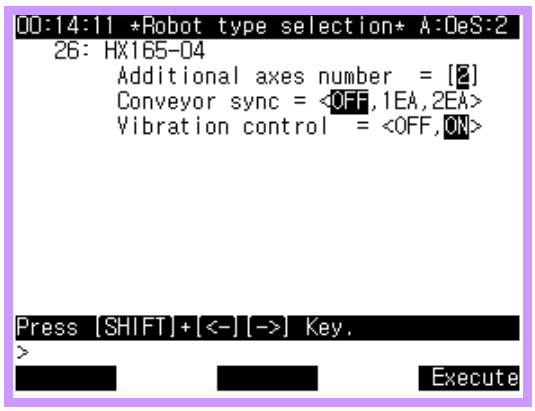




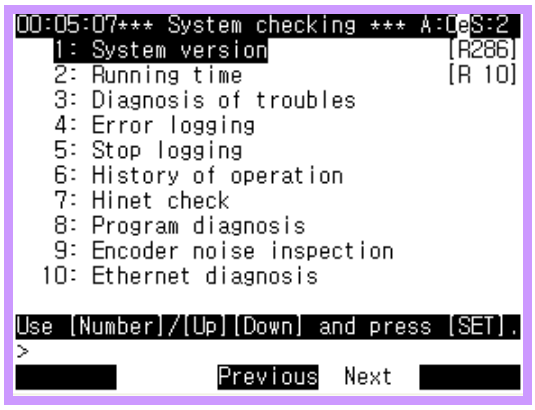
With PID controller of Hi3 controller, Hi4a controller provides also a vibration controller which has the excellent capability.

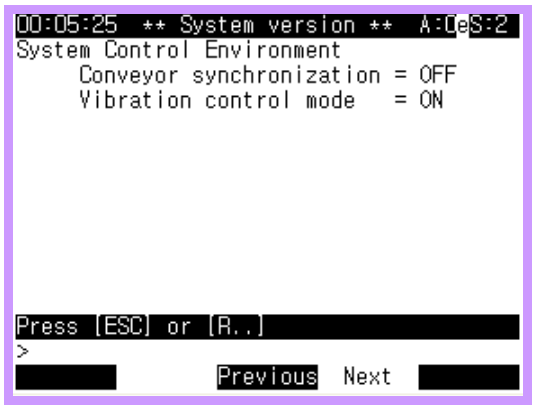
To determine whether to apply the vibration controller, go to 『[PF2]: System』 → 『5: Initialize』 → 『2: Robot Type Selection』 in the following menu.





Also, after the initialization is completed, go to 『[PF1]: Service』 → 『7: System checking』 → 『1: System Version』 → 『[PF4]: Next』 to check vibration controller availability.





Since the vibration controller controls the robot based on robot dynamics, load data of tool is necessary to improve control performance.

Go to 『[PF2]: System』 → 『3: Machine parameter』 → 『1: Tool Data』 to enter tool weight and the center of mass. Or, go to 『[PF2]: System』 → 『6: Automatic constant setting』 → 『6: Load Estimation』 to enter the automatically estimated value.

Enter the data on additional weight mounted on the robot body. Go to 『[PF2]: System』 → 『3: Machine parameter 』 → 『11: Additional weight on each axis』 to enter the center point and load weights attached to axis 1, 2 and 3.

When the vibration controller is applied, previously set servo loop gain is used. However, the initial gain value when the vibration controller is in use is differently set from when it is not in use.

Although the vibration controller has the excellent capability, linear trajectory can go amiss in linear interpolation steps, compared to other existing controllers. Therefore, select an appropriate vibration controller according to the installation site.

Parameter	Detail	Setting method
V1	Zeta of the pole determining the observer damping ratio * 10	0 ~ 100
V2	Omega of the pole determining the observer response frequency * 10	0 ~ 5000
C1	Zeta of the pole determining the controller damping ratio * 10	0 ~ 100
C2	Omega of the pole determining the controller response frequency * 10	0 ~ 5000
C3	Value determining the controller equal root * 10	0 ~ 10000
T1	2 stage gain ratio %	0 ~ 100
T2	2 stage gain application threshold	0 ~ 32767
GR	Gravity compensation ratio %	0 ~ 100
FG	Static friction compensating gain	0 ~ 500
TF	Torque filter time constant	0 ~ 500
DG	Distubance observer gain	0 ~ 32767
RV	Reserved	

Since the vibration controller is based on robot dynamics, it can be used only in the robot type equipped with a robot dynamics parameter. If a vibration controller is selected in the robot type which does not support the vibration controller, a message 『This robot is inapplicable function[ESC]』 appears.

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