ADDITIONAL INFORMATION

Tuning way for FSSB High Speed Rigid Tap

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Addition of tuning way for FSSB high speed rigid tap	Add	2011.04

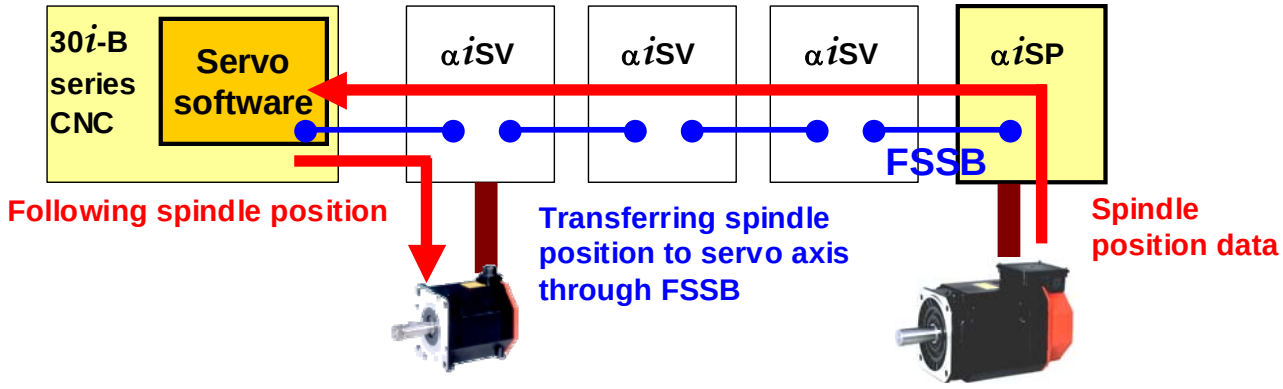
Tuning way for FSSB High Speed Rigid Tap

1. Outline

The connection between CNC and spindle amplifier is changed to FSSB in 30i-B series CNC. It becomes possible to transfer the spindle position data to servo software directly by using FSSB communication. In FSSB high speed rigid tap function, servo axis follows spindle axis in rigid tap by this high speed communication.

As the servo axis always follows the spindle axis, the synchronous error will not become large even if the torque command of spindle motor becomes a little bit saturated. Therefore it's possible to use the large torque near the limitation and to reduce cycle time with keeping the accuracy.

This document shows the tuning way for FSSB high speed rigid tap function.



2. Tuning procedure of FSSB high speed rigid tap

2.1. Initial parameter settings

First of all, please set some parameters for rigid tap as before even in case of using FSSB high speed rigid tap. And after that, please set some parameters for FSSB high speed rigid tap additionally. (* mark in the following table)

Parameter number (FS30i-B)	Contents
2005#1	Feed-forward function bit (Servo) Initial setting : 1 Note) The feed-forward coefficient for servo axis always becomes 100% regardless of parameter setting of feed-forward coefficient, when FSSB high speed rigid tap is used.
5203#2	Feed-forward function bit (Spindle) Initial setting : 0 Note) If you use feed-forward function in spindle axis, please use "Rigid tapping bell-shaped acc./dec." function together. In case of FSSB high speed rigid tap, you don't have to set same feed-forward coefficient for spindle as the one for servo.
5241~5244	Maximum speed of spindle in rigid tap
5261~5264	Time constant for acc./dec. in rigid tap Initial setting : 500
4065~4068	Position gain for spindle in servo mode Initial setting : 3000
4044~4045	Proportional gain of velocity loop for spindle in servo mode Initial setting : see following formula Proportional gain of velocity loop = 30159/Tmax*(Jm+Jl) Assume that Tmax : Short time rated torque at constant torque range * 1.2 [Nm] Jm : Motor rotor inertia [kgm^2] Jl : Load inertia converted to motor side [kgm^2]
4052~4053	Integral gain of velocity loop for spindle in servo mode Initial setting : see following formula

	Integral gain of velocity loop = 280735/Tmax*(Jm+Jl) Assume that Tmax : Short time rated torque at constant torque range * 1.2 [Nm] Jm : Motor rotor inertia [kgm^2] Jl : Load inertia converted to motor side [kgm^2]
4085	Motor voltage in rigid tap (for high speed characteristics) Initial setting : 100 When the maximum motor speed in rigid tap is higher than the base speed of the spindle motor (No. 4100 for high speed characteristics), set the value calculated from the following formula. $\text{Motor voltage (\%)} = 100 * \frac{\text{Spindle motor base speed(No.4100)}}{\text{Maximum motor speed in rigid tap}}$
4137	Motor voltage in rigid tap (for low speed characteristics) Initial setting : 100 When the maximum motor speed in rigid tap is higher than the base speed of the spindle motor (No. 4138 for low speed characteristics), set the value calculated from the following formula. $\text{Motor voltage (\%)} = 100 * \frac{\text{Spindle motor base speed(No.4138)}}{\text{Maximum motor speed in rigid tap}}$
4016#4	Motor voltage control characteristic setting in rigid tap Initial setting : 0 If you set less value than 100 in No.4085 or No.4137, please set 1.
4099	Delay time for motor excitation Initial setting : 300 However when you use Magnetic flux boost function, please change it. (Refer to chapter 4)
24203#0 (*NEW)	FSSB high speed rigid tap function bit (CNC) Initial setting : 1
2429#1 (*NEW)	FSSB high speed rigid tap function bit (Servo) Initial setting : 1
4549#1 (*NEW)	FSSB high speed rigid tap function bit (Spindle) Initial setting : 1
24204 (*NEW)	Spindle axis number which synchronizes with servo axis
2610 (*NEW)	Position gain for servo axis during FSSB high speed rigid tap Initial setting : 3000

2.2. Tuning parameters

The parameters to tune are basically same as before. But the tuning way is different in the following points when you use FSSB high speed rigid tap.

- It's possible to set less value in time constant for acc./dec. generally.
- It's not necessary to set the same value in position gain both for servo axis and spindle axis. The new position gain parameter, which is effective only in FSSB high speed rigid tap, is prepared.

Parameter number (FS30i-B)	Contents
5261~5264	Time constant for acc./dec. in rigid tap
5280~5284	Position gain of servo axis for rigid tap (These parameters are used when No.2610=0.)
2610 (*NEW)	Position gain for servo axis during FSSB high speed rigid tap
4065~4068	Position gain for spindle in servo mode
4044~4045	Proportional gain of velocity loop for spindle in servo mode
4052~4053	Integral gain of velocity loop for spindle in servo mode

2.3. Tuning with using SERVO GUIDE

Please use SERVO GUIDE for parameter tuning with observing following data (Synchronous error, Spindle speed, Torque command, and etc.)

Axis	Data kind	Data unit at observing
Servo axis	SYNC (Synchronous error)	[pulse]
	TCMD (Torque command)	[%]
Spindle axis	SPSPD (Spindle speed)	[min^{-1}]
	TCMD (Torque command)	[%]
	ERRC (Position error)	[pulse]

Note) Synchronous error is calculated by the following formula.

$$SYNC[pulse] = PERsp[pulse] - PERsv[pulse]$$

$SYNC[pulse]$: Synchronous error (4096 pulse per spindle 1 revolution)

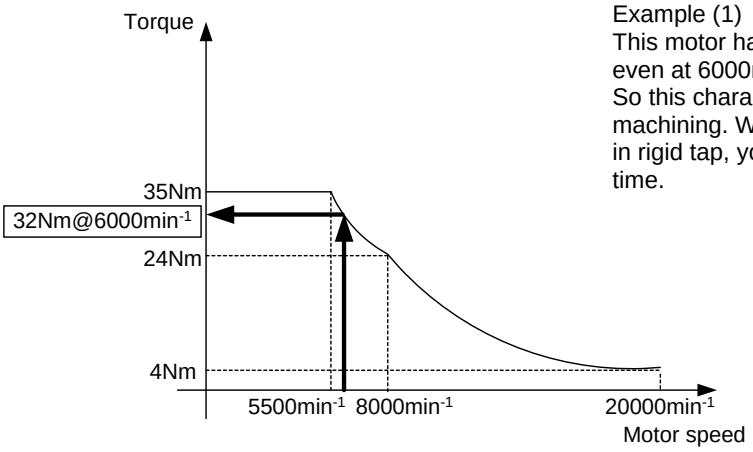
$PERsp[pulse]$: Position error of spindle

$PERsv[pulse]$: Position error of servo converted to the weight of spindle

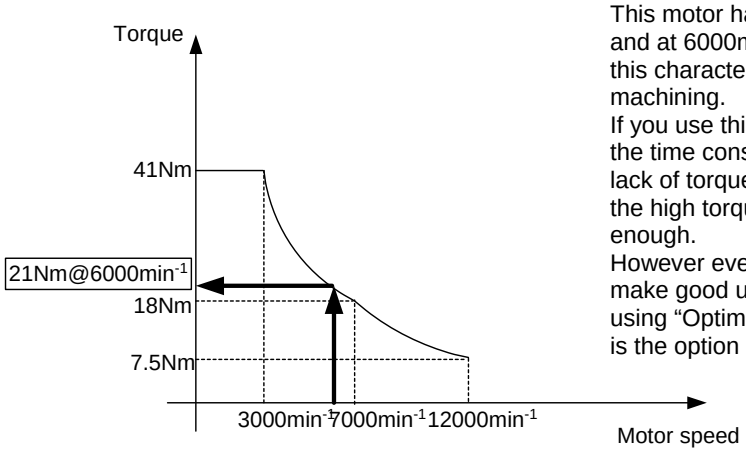
2.3.1. Setting of maximum spindle speed in rigid tap

Please set maximum spindle speed in rigid tap according to the specification of the machine. When you use higher speed domain where the spindle motor output enough torque, you might be able to reduce the cycle time of the machining.

[Example of the character of Spindle motor speed-Torque]



Example (1)
This motor has wide torque constant range and even at 6000min^{-1} enough torque can be used. So this character is suited to high speed machining. When you use high speed domain in rigid tap, you will be able to reduce cycle time.



Example (2)
This motor has narrow torque constant range and at 6000min^{-1} the torque is very small. So this character is not suited to high speed machining.
If you use this motor for high speed rigid tap, the time constant is limited by the reason of lack of torque at high speed. It also means that the high torque at low speed will not be used enough.
However even in such motor, it's possible to make good use of torque in all speed range by using "Optimum acc./dec. for rigid tap", which is the option function. (Refer to chapter 3)

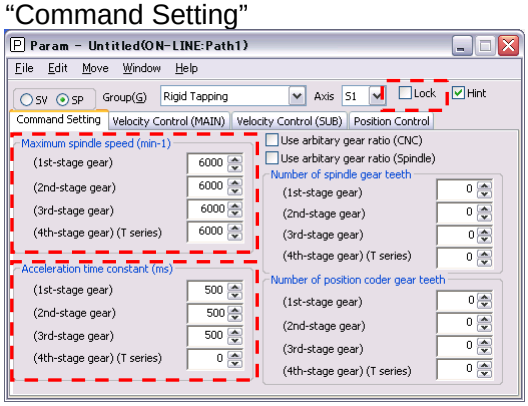
2.3.2. Preparation before start tuning

(1) Initial parameter setting

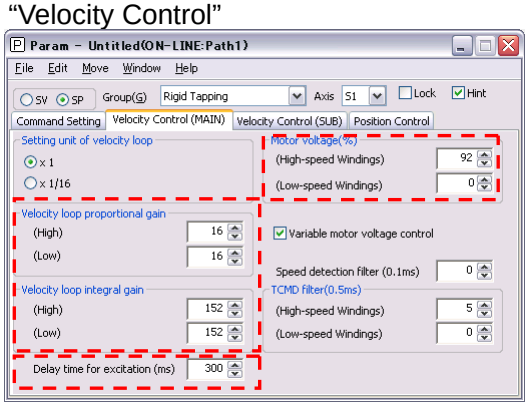
Please set some parameters for rigid tap from Parameter Window in SERVO GUIDE. Please open Parameter Window in "Online" and select "SP" in radio button and select "Rigid tapping" in Group.

"Rigid tapping" group has 4 types of tabs "Command Setting", "Velocity Control", and "Position Control". Please input the initial parameters in each tab. When you change parameters, please make sure to release the "Lock" check-box.
Please try to input 500-600ms in time constant for acc./dec. in rigid tap as initial value. (It depends on the maximum spindle speed, though.)
Regarding position gain of servo axis for FSSB high speed rigid tap, please set them in No.2610 after selecting "Parameter Table" in Group.

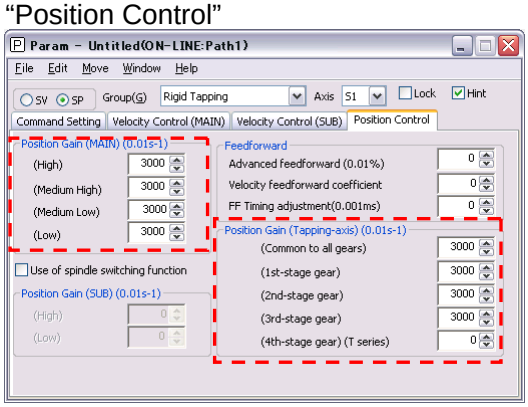
"Command Setting"



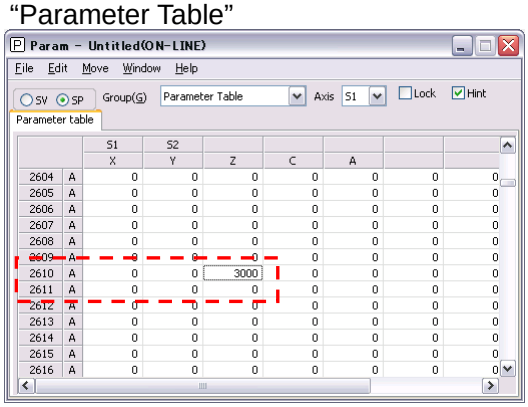
"Velocity Control"



“Position Control”

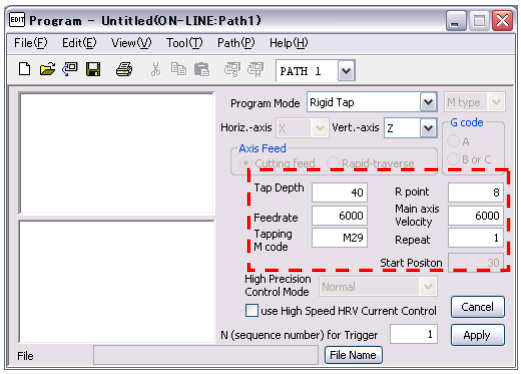


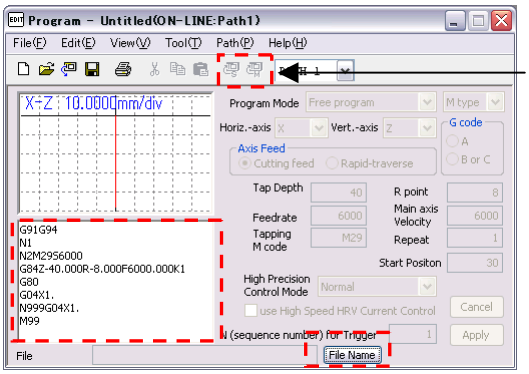
“Parameter Table”



(2) Making test program

You can make the test program by Program Window in SERVO GUIDE. Please select “Rigid tap” in program mode combo-box and set some conditions. After finishing the settings and click “Apply” button, SERVO GUIDE will make the test program.



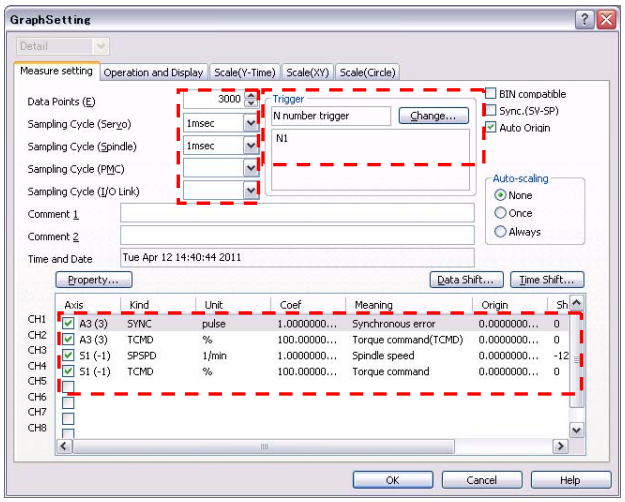


“Send” button

After confirming the program, please input the file name by click “File name” button. And send it to CNC by click “Send sub” and “Send main” button in order.

(3) Channel settings for Graph Window

Please open Graph Window and make the channel settings to measure data. The trigger condition should be the “N number” which was specified in Program Window.



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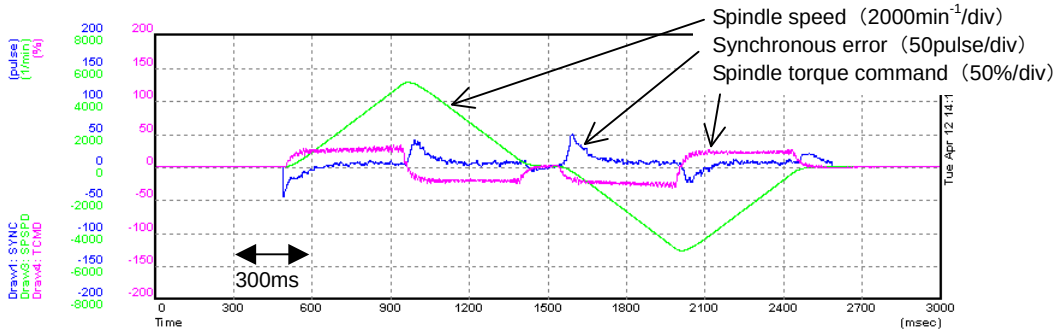
(4) Confirmation of movement in test program

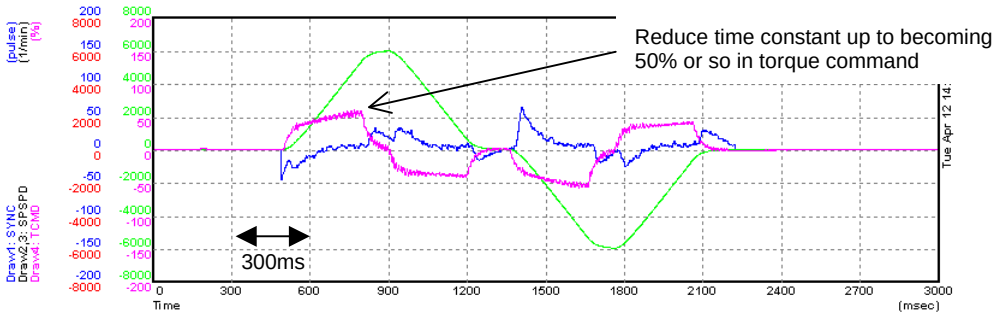
Before starting data measurement, please click “Origin” button in Graph Window. After click “Measure” button, Graph Window will be the trigger waiting state. Please press cycle start button in the operation panel on the machine. The test program, which was sent before, will be executed and the data will be measured.

Example of measurement result in rigid tap with initial parameter settings (Time constant = 500ms)



As nest step, please reduce the time constant for acc./dec. up to becoming 50% or so in spindle torque command. Based on this setting, please continue the velocity gain tuning and position gain tuning.

Example of measurement result in rigid tap after first tuning of time constant for acc./dec. (Time constant = 300ms)



In this stage, please make sure that the spindle speed reaches the maximum speed for rigid tap. If it doesn’t, please change the movement distance of Z axis in test program.

After that, to confirm whether spindle movement is proper or not, please check the position error at maximum rigid tap speed. The ideal position error can be calculated by following formula.

$$Perr[pulse] = \frac{Nr[\min^{-1}]}{60} \times 4096[pulse/rev] \times \frac{1}{PG[\sec^{-1}]} \times (1 - \frac{RFF[\%]}{100})$$

$Perr[pulse]$: Position error at speed Nr

$Nr[\min^{-1}]$: Maximum speed for rigid tap

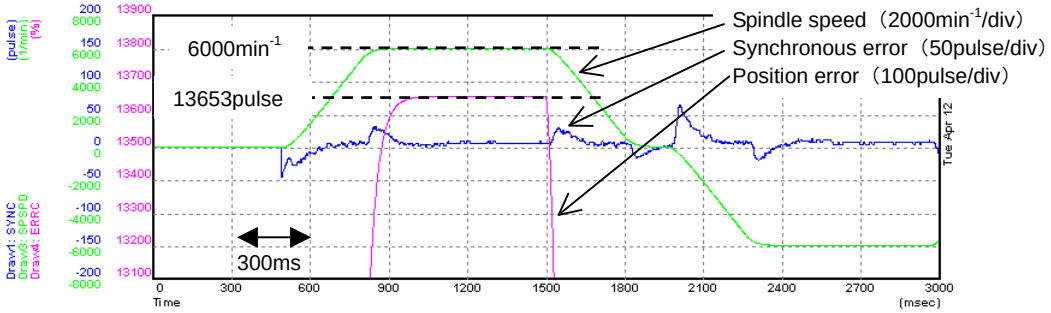
$PG[\sec^{-1}]$: Position gain for rigid tap

$RFF[\%]$: Feed-forward coefficient (in case of No.5203#2=1)

Ex.) The position error with initial setting in this document becomes

$$Perr[pulse] = \frac{6000}{60} \times 4096 \times \frac{1}{30} \times (1 - \frac{0}{100}) = 13653[pulse]$$

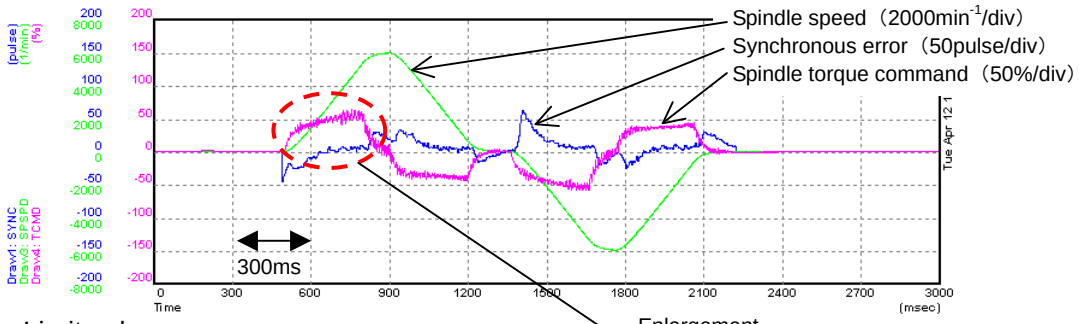
Example of measurement result in rigid tap to confirm the position error
(Ideal position error = 13653[pulse])



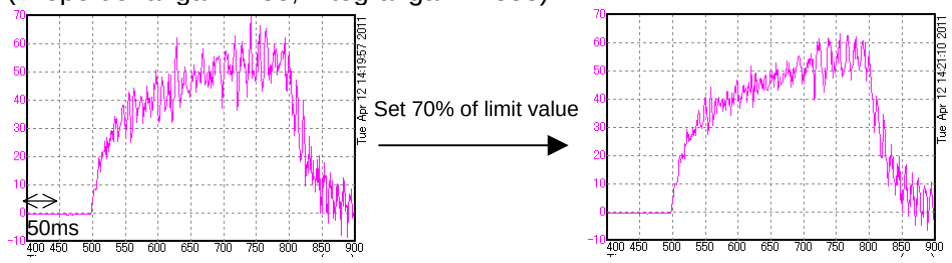
2.3.3. Velocity gain tuning

Please tune velocity loop gain. Please try to raise the proportional gain and integral gain in “Velocity Control” tab in Parameter Window with the same proportion. The limit value can be known from the torque command waveform, vibration, or motor sound. The final setting value should be the 70% of the limit value.

Example of measurement result after tuning of velocity gain
(Proportional gain = 25, Integral gain = 238)



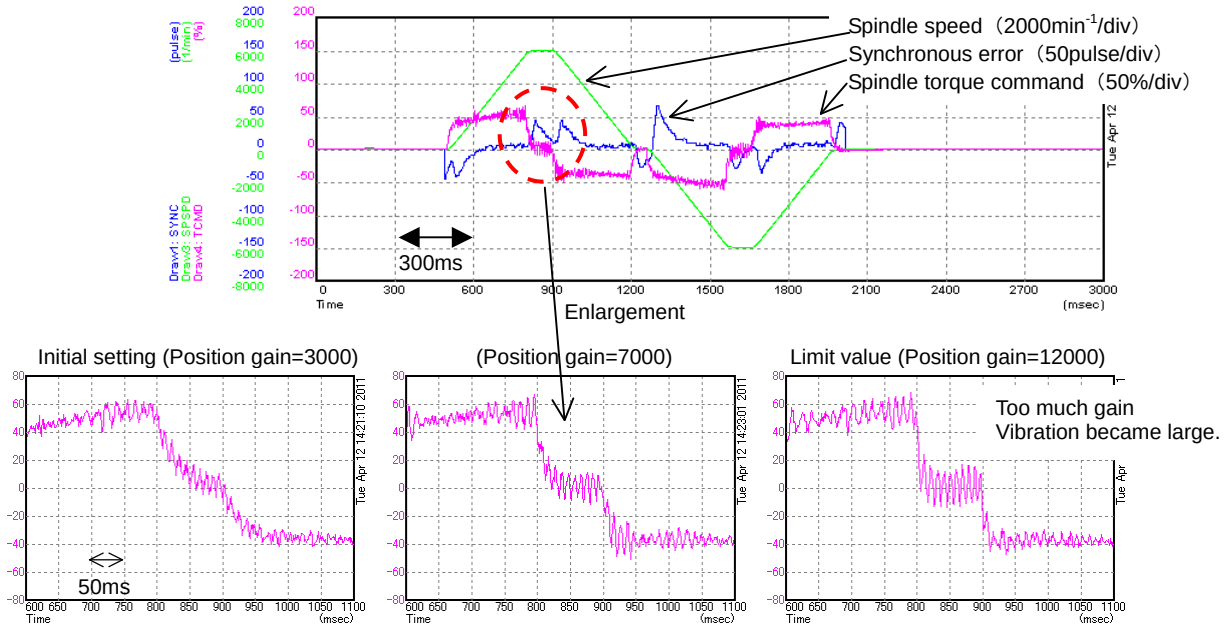
Limit value
(Proportional gain = 35, Integral gain = 333)



2.3.4. Position gain tuning

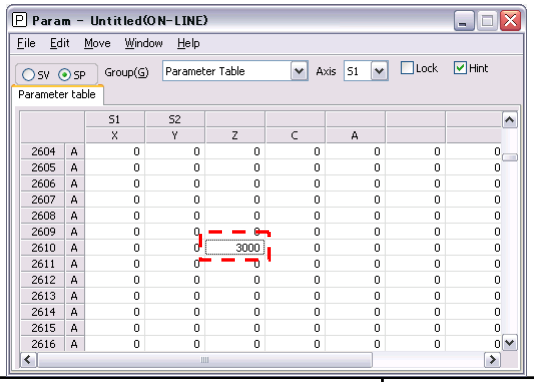
Please tune position loop gain. Please try to raise the position loop gain 2000 by 2000 in “Position Control” tab in Parameter Window. The limit value can be known from the torque command waveform, vibration, or motor sound. Please determine the final setting value from those factors.

Example of measurement result after tuning of spindle position gain (Spindle position gain = 7000)

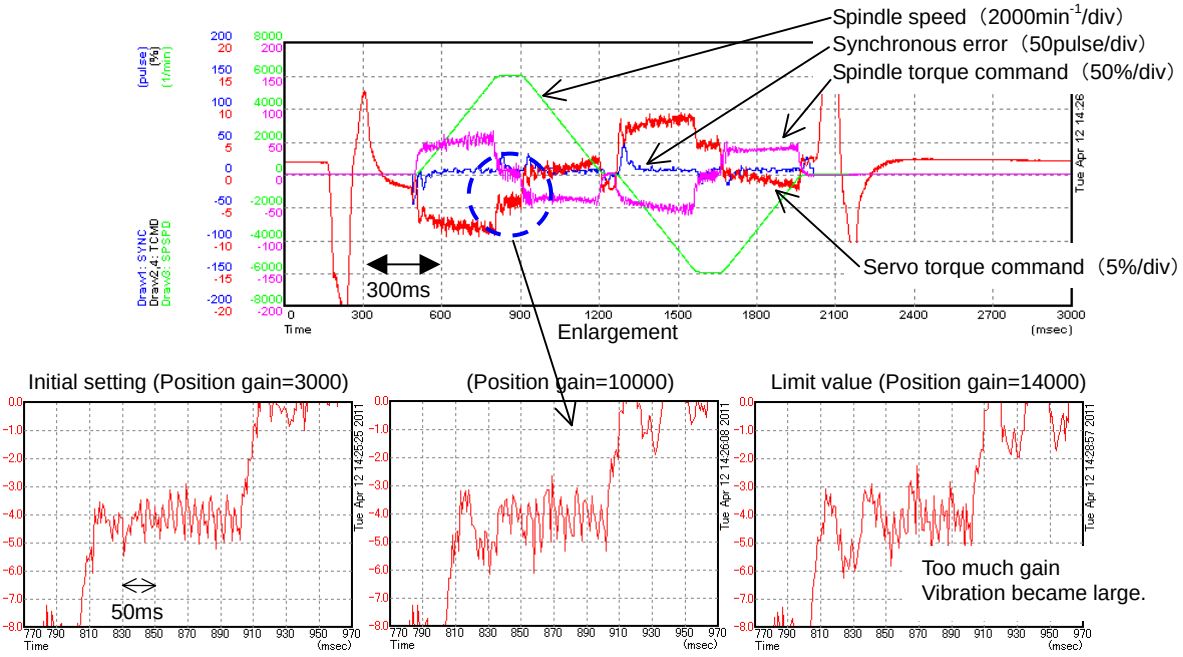


As next step, we’ll proceed to position gain of servo axis for FSSB high speed rigid tap. But before it, please tune the velocity loop gain of servo axis well in the ordinary servo tuning.

In former rigid tap, the synchronization between servo axis and spindle axis is realized by giving same position command to both axes. Therefore position gains for both servo axis and spindle axis should be same value. But in FSSB high speed rigid tap, the synchronization is realized by the way that servo axis follows spindle axis movement. So the position gains for both axes can be set independently.
The position gains for servo axis for former rigid tap are prepared in No.5280-5284. These parameters can be used also for FSSB high speed rigid tap. But new parameter No.2610, which is effective only for FSSB high speed rigid tap, is prepared.
As this parameter has not been included yet in “Rigid Tapping” group in Parameter Window of SERVO GUIDE, please change it in “Parameter Table”. The tuning way is same as the one for spindle axis.



Example of measurement result after tuning of servo position gain (Position gain = 10000)



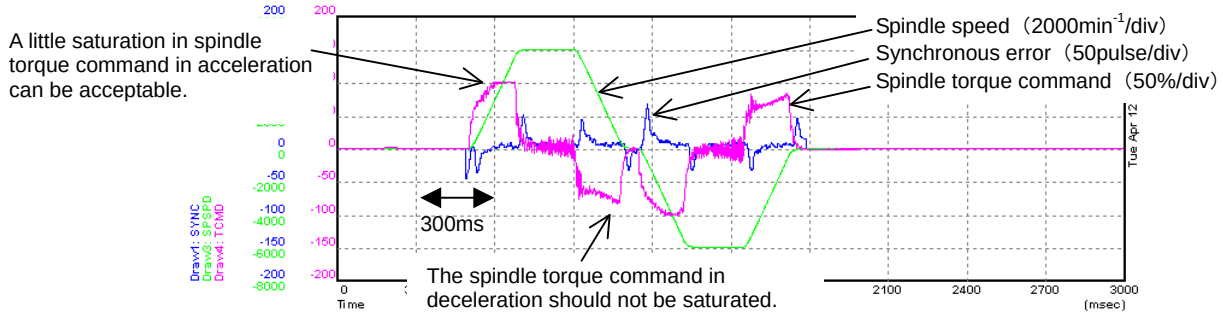
2.3.5. Tuning of time constant for acc./dec.

In former rigid tap, we've tuned the time constant for acc./dec. so that the peak torque command of spindle axis becomes 80% or so of maximum value. As the servo axis follows the spindle axis In FSSB high speed rigid tap, it's possible to use the spindle torque up to the maximum level. And there is a possibility to be able to reduce time constant for acc./dec. at using FSSB high speed rigid tap. Please tune the time constant for acc./dec. so that the peak torque command of spindle axis becomes nearly 100%. However if you reduce it up to the situation that the torque command in deceleration becomes too much saturated, the spindle motor might make a overshoot in the bottom of the hole. Please tune it so that the overshoot doesn't occur in the bottom of the hole.

Note) Assuming high speed and light load cutting, as the load torque of cutting is not so large, the time constant, which is determined in air-cut, can be used without any change. Considering low speed and heavy load cutting, the necessary torque for acc./dec. becomes small, because the speed is low. So the torque will be sufficient generally even in the heavy load cutting. Therefore the time constant, which is determined in air-cut at high speed, is usable in low speed and heavy load cutting also.

Please confirm the actual torque command in actual cutting as the final test.

Example of measurement result in rigid tap after second tuning of time constant for acc./dec. (Time constant = 175ms)



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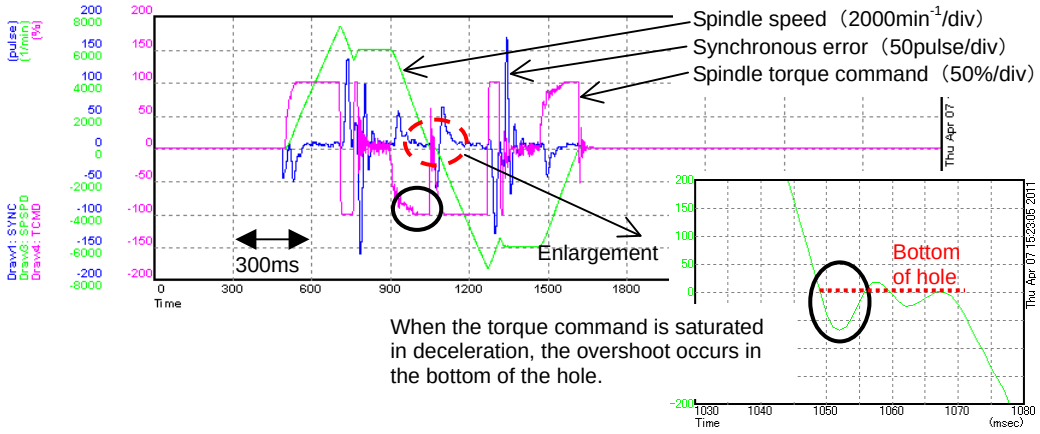
Example of measurement result in rigid tap with using too short constant for acc./dec.
(Time constant = 135ms)



2.3.6. Confirmation of synchronous error

Basically that's all for the tuning for FSSB high speed rigid tap. After finishing the tuning of time constant for acc./dec., please check the synchronous error between servo axis and spindle axis. Please make sure that the synchronous error is less than 100 or so.

2.4. Tuning of former type rigid tap (for reference)

The tuning way of former type rigid tap is shown as follows for your reference.

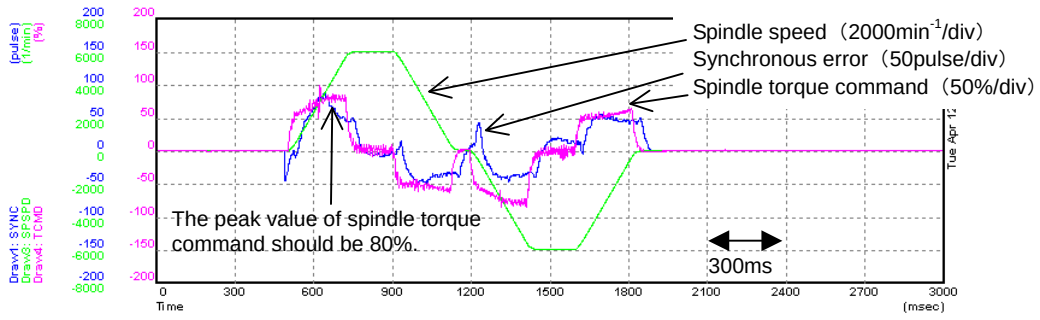
2.4.1. Initial settings and gain tuning of velocity loop and position loop

The initial settings for former rigid tap are same as the ones for FSSB high speed rigid tap.
And the tuning ways of velocity loop gain and position loop gain are almost same. There is only one difference in position gain setting. The position gains both for servo and spindle should be just same.

2.4.2. Tuning of time constant for acc./dec.

In the former type rigid tap, if the torque command is saturated, the synchronous error will be larger. So in this case, please tune the time constant for acc./dec. so that the peak value of spindle torque command becomes 80% of maximum torque, which includes a margin.

Example 1 of measurement result in former type rigid tap (Time constant = 220ms)



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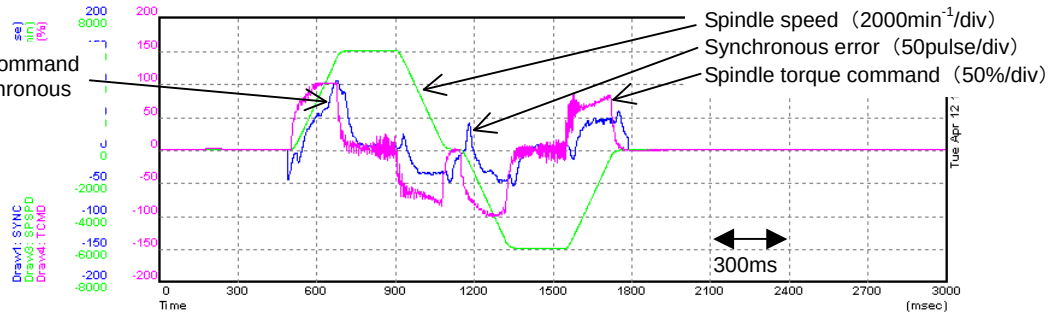
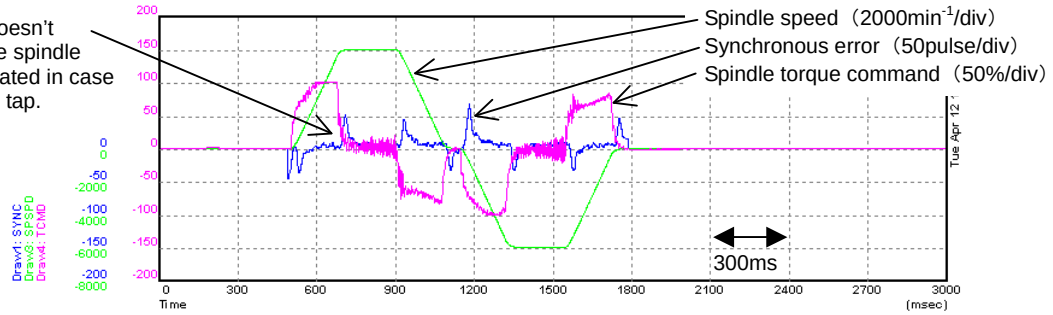
Example 2 of measurement result in former type rigid tap (Time constant = 175ms)

If the spindle torque command is saturated, the synchronous error will be worse.



Ref.) Example of measurement result in FSSB high speed rigid tap (Time constant = 175ms)

The synchronous error doesn't become worse even if the spindle torque command is saturated in case of FSSB high speed rigid tap.



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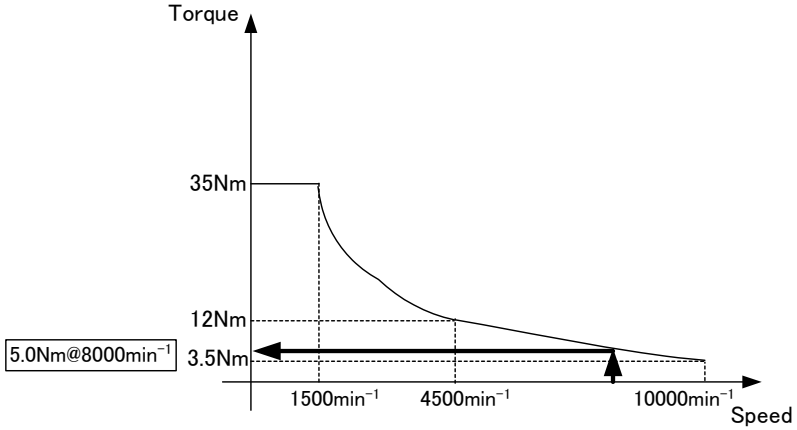
3. Using “Optimum Acc./Dec. for Rigid Tap” together

“Optimum acc./dec. for rigid tap” is the function that enables to change the acceleration in rigid tap according to the character of the spindle motor. By using this function together, the motor torque is derived at maximum in all speed range and it becomes possible to reduce the time for acc./dec.

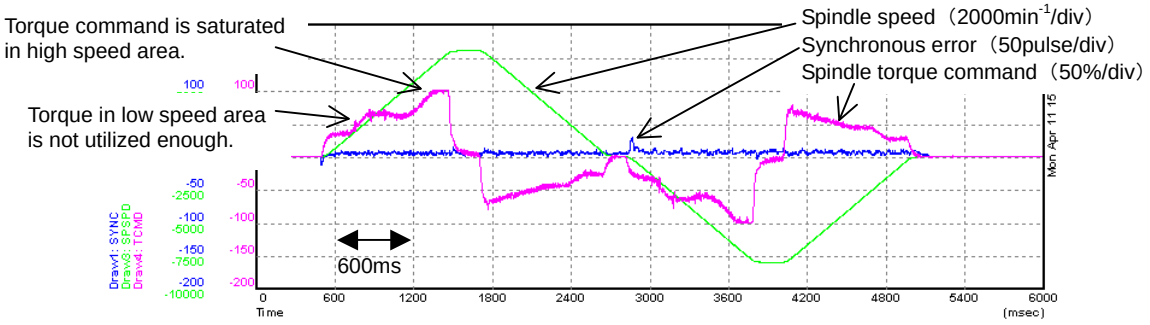
Note) “Optimum acc./dec. for rigid tap” is an option function.

(Example) Assuming that we use the spindle motor, which has following character, at 8000min^{-1} for rigid tap,



This motor has small torque at 8000min^{-1}. When the acceleration is constant value in all speed, the torque in low speed area is not utilized enough, because the tolerable acceleration is limited by the torque in high speed area.

Example of measurement result without Optimum acc./dec. for rigid tap



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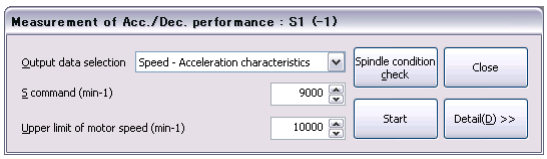
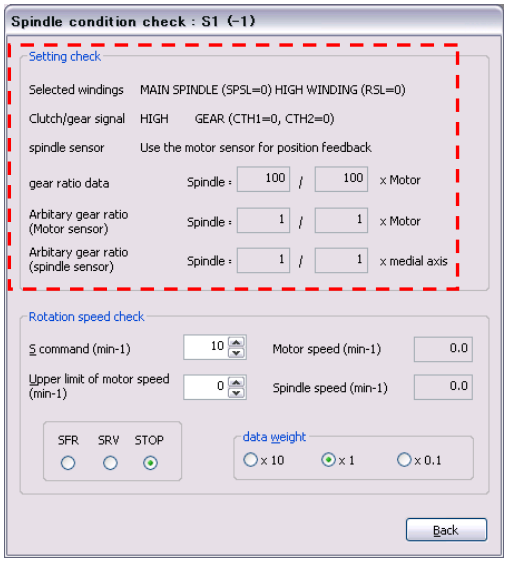
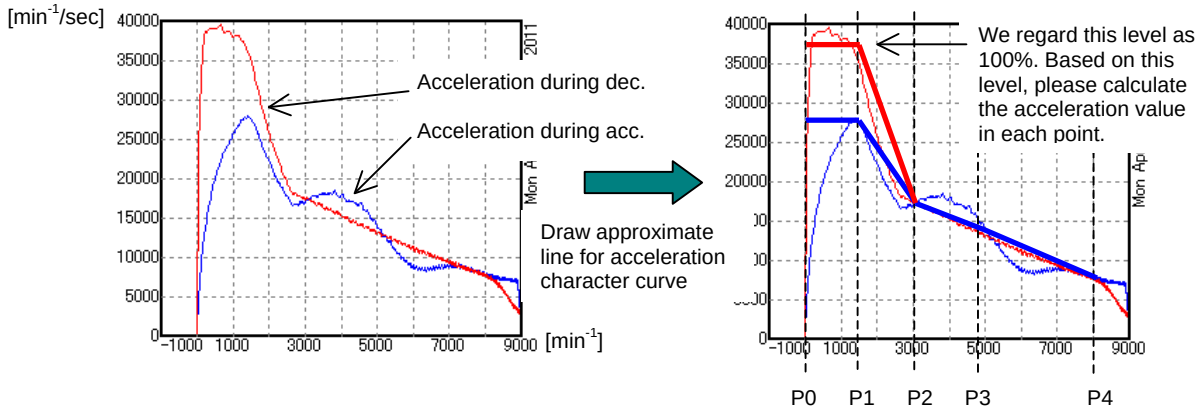
Please use “Acc./Dec performance measurement” for spindle tuning in SERVO GUIDE to determine the initial settings for Optimum acc./dec. for rigid tap.
Please open Graph Window and select [Tool] -> [Spindle Tuning] -> [Acc./Dec performance measurement]. The following window will be shown after getting spindle information.



Click [Spindle condition check] and confirm whether spindle conditions are proper or not.



Go back to the measurement window and after setting S command and upper limit of motor speed, click “Start”. Please set higher value than the maximum rigid tap speed in S command box, if you can.



Please estimate the initial setting values from the measurement result. Please draw approximate line through each setting point (P0-P4) to determine the acceleration character during acc./dec.. The above data shows the character in acc./dec. with maximum torque. So available torque in rigid tap will be less than this character. Please set the initial value for Optimum acc./dec. for rigid tap as 70% or so of approximate line.

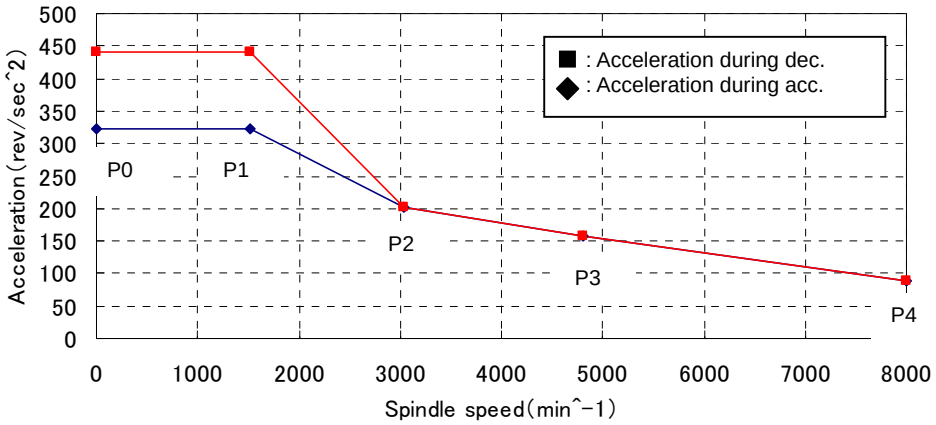
				TITLE	Tuning way for FSSB High Speed Rigid Tap
01	11.04.22	Tajima	Newly designed	DRAW. No. B-65280EN/08-01	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 14/17

(Setting example from the figure in former page)

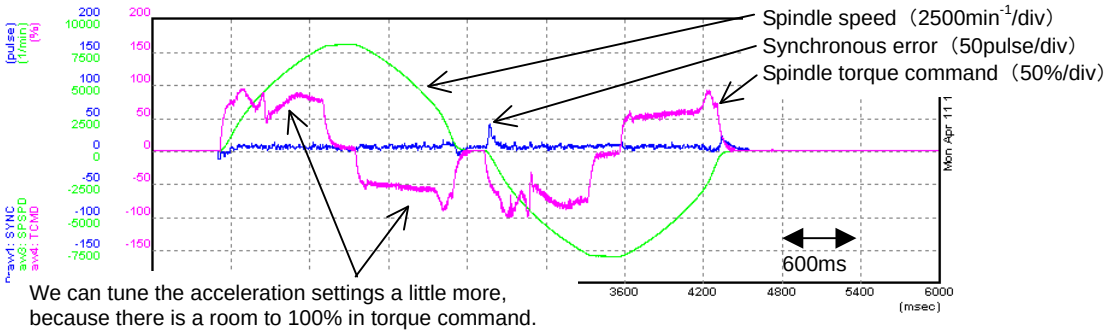
The maximum acceleration can be seen at 0-1500min^{-1} in deceleration. It's value is
$37800(0 \sim 1500\,\mathrm{min}^{-1})[\mathrm{min}^{-1}/\mathrm{sec}] \div 60[\mathrm{sec}] \times 0.7 = 441[rev/\mathrm{sec}^2]$
The rest of acceleration settings should be set as the proportion of this value.

Initial settings for Optimum acc./dec. for rigid tap

Gear	Maximum acceleration [rev/sec^2]	Maximum spindle speed [min^{-1}]	Acc. setting point	Spindle speed (Ratio to max. speed [%])	Acc. setting (Ration to max. acc. [%]) Forward / Reverse	
					During acc.	During dec.
Gear 1	No.11421=441	No.5241=8000	P0	None（0%）	No.11441=73	No.11461=100
			P1	No.11429=19	No.11442=73	No.11462=100
			P2	No.11430=38	No.11443=46	No.11463=46
			P3	No.11431=60	No.11444=36	No.11464=36
			P4	None（100%）	No.11445=20	No.11465=40



Example of **measurement result after initial setting** of Optimum acc./dec. for rigid tap



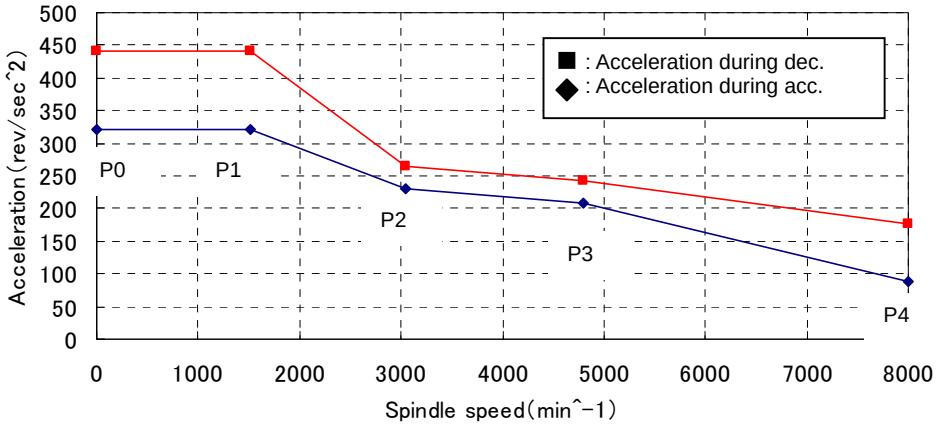
We can tune the acceleration settings a little more,
because there is a room to 100% in torque command.

After confirming the measurement result with initial setting, please tune the acceleration parameters so that the spindle torque command reaches near 100% in all speed area.
When you tune them, please use the test program, which has the maximum rigid tap speed, and start tuning from the high speed point (P4) first, and continue to the low speed points in order.

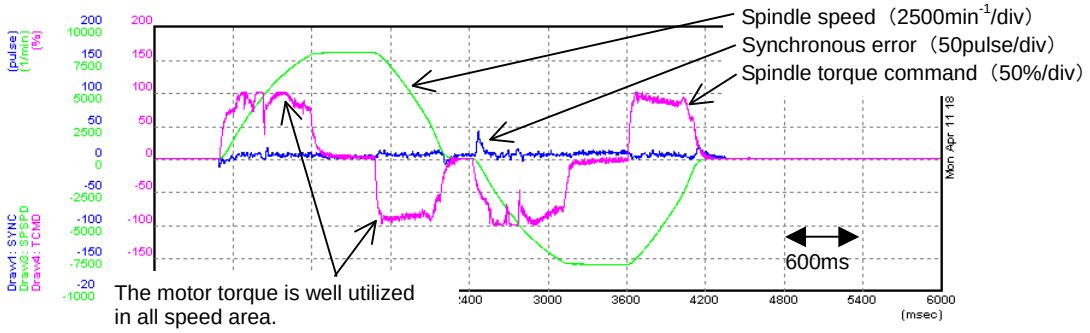
				TITLE	Tuning way for FSSB High Speed Rigid Tap
01	11.04.22	Tajima	Newly designed	DRAW. No. B-65280EN/08-01	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 15/17

After tuning settings for Optimum acc./dec. for rigid tap

Gear	Maximum acceleration [rev/sec^2]	Maximum spindle speed [min^{-1}]	Acc. setting point	Spindle speed (Ratio to max. speed [%])	Acc. setting (Ration to max. acc. [%]) Forward / Reverse	
					No.11441=73	No.11461=100
Gear 1	No.11421=441	No.5241=8000	P0	None（0%）	No.11442=73	No.11462=100
			P1	No.11429=19	No.11443=52	No.11463=60
			P2	No.11430=38	No.11444=47	No.11464=55
			P3	No.11431=60	No.11445=20	No.11465=40
			P4	None（100%）	No.11441=73	No.11461=100



Example of **measurement result after tuning** of Optimum acc./dec. for rigid tap



In the above example, the acceleration time and deceleration time are reduced as follows by applying Optimum acc./dec. for rigid tap.

	Function OFF		Function ON
Acceleration time :	976ms	->	720ms
Deceleration time :	976ms	->	588ms

				TITLE	Tuning way for FSSB High Speed Rigid Tap
01	11.04.22	Tajima	Newly designed	DRAW. No. B-65280EN/08-01	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 16/17

4. Using “Magnetic Flux Boost Function” together

Asynchronous spindle motors need some time to raise the magnetic flux at the excitation increasing. Therefore we recommend generally to set some waiting time at the changing from velocity control mode to servo mode including rigid tap. (No.4099: Delay time for stable motor excitation)
To reduce the waiting time, we are providing the function that gives large excitation current in an instance at the changing from velocity control mode to servo mode. It helps to quicken the increasing of magnetic flux. And as this function judges the status of preparation of magnetic flux, the rigid tap will start faster without waiting time set in No.4099.
There is a possibility to reduce the cycle time by using this function together.

Parameter settings for Flux boost function

Parameter number（FS30i-B）	Contents
4353#6	Magnetic flux boost function bit　Setting value : 1
4124(for high speed winding, or without speed range switching) 4155(for low speed winding)	Magnetic flux boost setting level / Magnetic flux boost coefficient Setting value : See below
4099	Delay time for stable motor excitation (ms)　Setting value : 300 Note) Even when you use magnetic flux boost function, please set something value (300 or so) in this parameter.

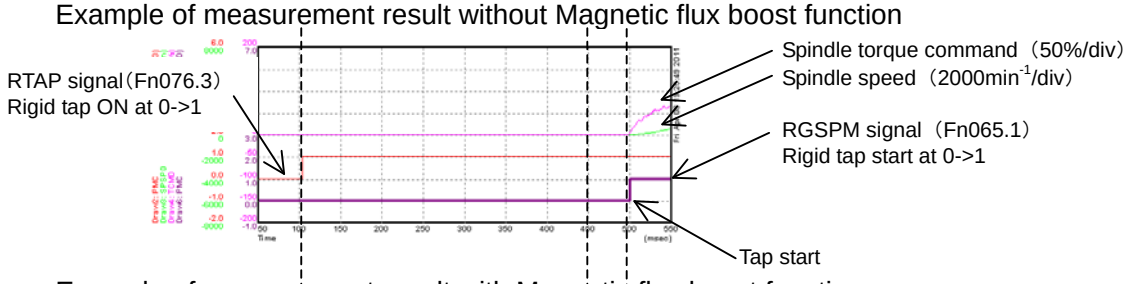
Spindle parameter manual (B-65280/08 edition or subsequent editions) shows the setting value for No.4124 and 4155. Please set them according to the description. If you can’t find the description for your motors, please calculate it according to the following formulas.

$$No.4124 = 24320 + \left\{ Minimum\_value\_between(\sqrt{(No.4111/100)^2 + 1} \times 0.9 \times 100)\_and\_255 \right\}$$

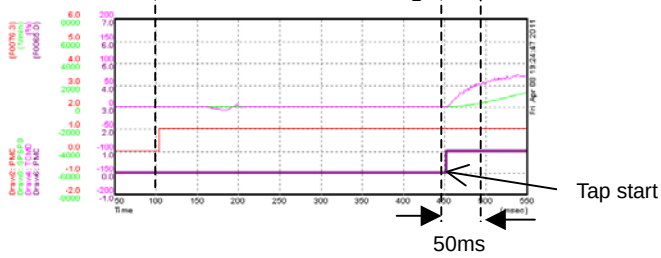
$$No.4155 = 24320 + \left\{ Minimum\_value\_between(\sqrt{(No.4147/100)^2 + 1} \times 0.9 \times 100)\_and\_255 \right\}$$

Note) If you don’t use Speed range switching function, it’s not necessary to set No.4155.

Example of measurement result without Magnetic flux boost function



Example of measurement result with Magnetic flux boost function



In the above example, the start timing of rigid tap became 50ms faster, and the total cycle time also reduced 50ms.

				TITLE	Tuning way for FSSB High Speed Rigid Tap
01	11.04.22	Tajima	Newly designed	DRAW. No. B-65280EN/08-01	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 17/17

Revision of αi series Spindle Software
(9D90/H(08), 9DA0/K(11))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/H(08), 9DA0/K(11)	Add	2011.06

				TITLE	Revision of αi series Spindle software (9D90/H(08),9DA0/K(11)
01	11.06.17	K.Tomiyama	Newly designed	DRAW. No. B-65280EN/08-02	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D90/H(08),9DA0/K(11))

1. General

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition H(08)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i* -B/C, 0*i* -D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition K(11)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30 *i*//31 *i*//32 *i*/-B, 35 *i*/-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/H	9DA0/K
(1)	It has become possible to connect spindle amplifier for FS30*i*-B to FS0*i*-D controller. Note) It's necessary to update system software to use this feature. It will be delivered from August.	-	◎
(2)	The number of the measurable spindle channel per one spindle axis has been expanded from "2" to "4". Note) It's necessary to update system software and SERVO GUIDE to use this feature. It will be delivered from September.	-	◎
(3)	It has become possible to drive αiI150/5000HV with FS0*i*-D.	◎	◎

◎ : Revised item - : Not supported

				TITLE	Revision of αi series Spindle software (9D90/H(08),9DA0/K(11)
01	11.06.17	K.Tomiyama	Newly designed	DRAW. No. B-65280EN/08-02	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Revision of αi series Spindle Software
(9D5A/L, 9D53/Y, 9D7A/A, 9D80/X)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D5A/L Revision of spindle software 9D53/Y Revision of spindle software 9D7A/A Revision of spindle software 9D80/X	Add	2011.06

				TITLE	Revision of αi series Spindle software (9D5A/L, 9D53/Y, 9D7A/A, 9D80/X)
01	11.06.22	Tsutsumi	Newly designed	DRAW. No. B-65280EN/08-03	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D5A/L, 9D53/Y, 9D7A/A, 9D80/X)

1. General

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition L(12)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0*i*-B/C Induction spindle motor
9D53 edition Y(25)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Synchronous spindle motor
9D7A *) edition A(01)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30*i*/31*i*/32*i*-A, Induction/ synchronous spindle motor
9D80 edition X(24)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-D, 0*i*-B/C, 15*i*-MB , PM*i*-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0*i*-D Induction spindle motor

*) 9D7A series is a successor of 9D70 series. 9D70/Y was revised to 9D7A/A.

- Only the name of the spindle software is changed.
- The specification No. of the amplifier is not changed.
- 9D7A series is revised from 9D70 series, and has an upper compatibility with 9D70 series.

3. Contents of modification

Contents of modification	9D5A/L	9D53/Y	9D7A/A	9D80/X
1) It has become possible to drive αiI150/5000HV with FS0*i*-D.	-	-	-	○
2) The protect operation was added to the torque command calculation not to output over the tolerable current limit of the amplifier for improvement of reliability.	○	○	○	○

○ : Revised item - : Not supported

				TITLE	Revision of αi series Spindle software (9D5A/L, 9D53/Y, 9D7A/A, 9D80/X)
01	11.06.22	Tsutsumi	Newly designed	DRAW. No. B-65280EN/08-03	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Notes for using Optimum Orientation and
Corrections of Spindle Parameter Manual

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice	Notes for using Optimum Orientation	Add	2011.07
Correction	Corrections of spindle parameter manual	Add	2011.07
Another			

Notes for using Optimum Orientation and Corrections of Spindle Parameter Manual

1. General

This document describes the notes for using the Optimum Orientation and corrections of FANUC AC SPINDLE MOTOR αi series Parameter Manual B-65280EN/08.

2. Notes for using Optimum Orientation

In case of using the optimum orientation (30*i*: No.4018#6,#3=0,1) and the following function (1) or (2) together, please set the parameter for the reference position return speed without fail.

(1) Reference position return at the start of rigid tapping (30*i*: No.5202#0=1)

(2) Reference position return for the spindle positioning

The reference position return speed for (1)and (2) is specified by the parameter below.

Please set a value other than 0 in the parameter below in case of using the optimum orientation function. It's impossible to do the reference position return if the parameter below is set to 0.

15*i*	16*i*	30*i*	
3074	4074	4074	**Speed of reference position return for Cs contouring control mode/servo mode**

Unit of data : $1min^{-1}$

Valid data range : 0 to 32767

Standard setting : 0

- When 0 is set
  The orientation speed is equal to the reference position return speed in servo mode (rigid tapping/spindle positioning) in case of using conventional type orientation function.

- When a value other than 0 is set
  The value set in this parameter is used as a reference position return speed for servo mode (rigid tapping/spindle positioning).
  Set a value other than 0 in case of using the optimum orientation function.

  Please set this parameter No.4074 according to the following guideline.
  Generally this parameter is set to between 100 and 300. In case of tuning this parameter, please follow the procedure below.
  1) Set 100 as an initial value for No.4074.
  2) If an overshoot does not occur at positioning of the reference position return, please increase the value in No.4074 as far as the overshoot does not occur. The higher speed of the reference position return, the shorter the time to complete becomes.
  3) If an overshoot occurs even when No.4074 is 100, please decrease the value in No.4074 so as to eliminate the overshoot.

3. Corrections of Spindle Parameter Manual B-65280EN/08

<table>
<tr><th>Page</th><th>Error</th><th>Correction</th></tr>
<tr><td>305</td><td>(1) Input signals (PMC→CNC)
<table>
<tr><th></th><th></th><th>#7</th><th>#6</th><th>#5</th><th>#4</th></tr>
<tr><td></td><td>G066</td><td></td><td></td><td></td><td>RTRCT</td></tr>
</table>

(2) Output signals (CNC→PMC)
<table>
<tr><th></th><th>30i</th><th>#7</th><th>#6</th><th>#5</th><th>#4</th></tr>
<tr><td></td><td>F065</td><td></td><td>SYNMOD</td><td></td><td>RTRCT</td></tr>
</table></td><td>(1) Input signals (PMC→CNC)
<table>
<tr><th>16i</th><th>30i</th><th>#7</th><th>#6</th><th>#5</th><th>#4</th></tr>
<tr><td>G066</td><td>G066</td><td></td><td></td><td></td><td>RTRCT</td></tr>
</table>

(2) Output signals (CNC→PMC)
<table>
<tr><th>16i</th><th>30i</th><th>#7</th><th>#6</th><th>#5</th><th>#4</th></tr>
<tr><td>F065</td><td>F065</td><td></td><td>SYNMOD</td><td></td><td>RTRCT</td></tr>
</table></td></tr>
<tr><td>408</td><td>
<table>
<tr><th>15i</th><th>16i</th><th>30i</th><th></th></tr>
<tr><td>3124</td><td>4124</td><td>4124</td><td>Magnetic flux boost completion level / magnetic flux boost coefficient</td></tr>
</table>
Set the parameters for using the magnetic flux boost function.
For information about the values to be set, see Subsection 5.15.7. “Adjustment Procedure.”</td><td>
<table>
<tr><th>15i</th><th>16i</th><th>30i</th><th></th></tr>
<tr><td>3124</td><td>4124</td><td>4124</td><td>Magnetic flux boost completion level / magnetic flux boost coefficient</td></tr>
</table>
Set the parameters for using the magnetic flux boost function.
For information about the values to be set, see Subsection 5.17.5 “Adjustment Procedure”.</td></tr>
</table>

				TITLE	Notice of using Optimum Orientation and Correction of Spindle Parameter Manual
01	11.07.29	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-04	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 3/3

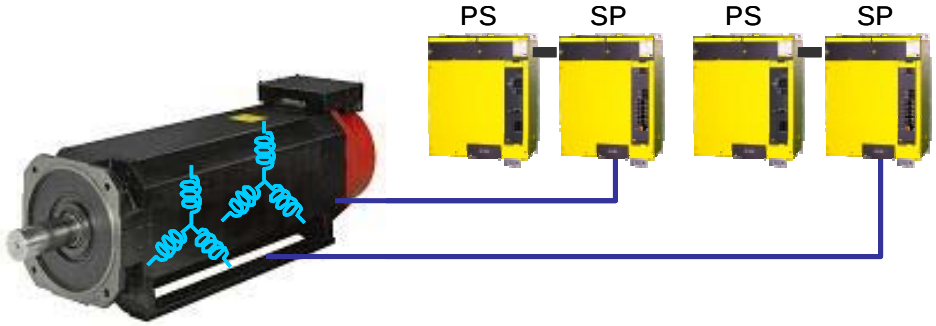
Twin Drive for Spindle Motor
Specifications

				TITLE	Twin Drive for Spindle Motor Specifications
01	11.07.29	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-05	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 1/16

1. Outline

This document describes the Twin Drive to drive a spindle motor with two windings.

Regarding the specifications of motors driven by the Twin Drive, refer to manuals for each spindle motor.



2. Application

2.1. Combination of spindle amplifier and CNC

Spindle amplifier		CNC				
Amplifier spec. No. A06B-xxxx-･･･	Software series	15*i*-MB	16*i*-B 18*i*-B	30*i*-A 31*i*-A	0*i*-D	30*i*-B 31*i*-B 32*i*-B
6112 6122	9D50 9D5A	○ *1	○*1	—	—	—
	9D70 9D7A	—	—	○*2	—	—
6142 6152	9D80	○ *3	○*3	○*3	◎*4	—
6144 6154	9D90	○ *5	○*5	○*5	◎*6	—
6220 6270	9DA0	—	—	—	◎*7	◎*7

◎: Available without option

○: CNC software option of Spindle tandem control is necessary.

* The Twin Drive uses the Spindle tandem control inside CNC system to control a motor. So the option of Spindle tandem control has been necessary for the Twin Drive. From 30*i*-B series CNC and 0*i*-D series CNC, the Twin Drive is available without option of Spindle tandem control.

Applicable spindle software

*1: 9D50/O(15) or later, 9D5A/A(01) or later
*2: 9D70/F(06) or later, 9D7A/A(01) or later
*3: 9D80/A(01) or later
*4: 9D80/X(24) or later
*5: 9D90/A(01) or later
*6: 9D90/H(08) or later
*7: 9DA0/K(11) or later

2.2. Note

- The Twin Drive needs two αiSP amplifiers (TYPE B) (as for master SP, slave SP) per one motor. αiSP of 6220 or 6270 has no distinction between TYPE A and TYPE B. All of the amplifiers support Twin Drive.

- The same spindle software series and edition should be used both for the master SP and the slave SP.

- The specification of an applied spindle amplifier depends on the specification of the spindle motor. The specification and the number of power supply (PS) also depend on the specification of the spindle motor.

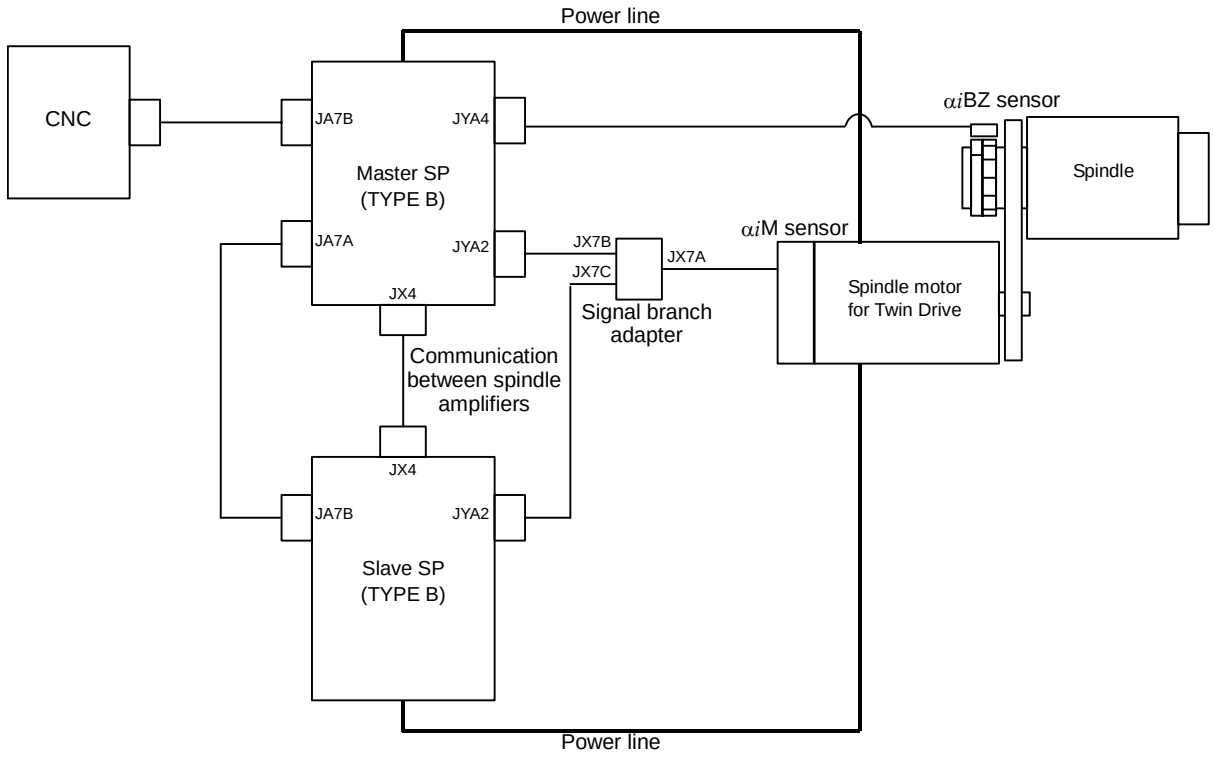
- For designation of spindle axes, 2 spindles are necessary per one twin drive spindle motor (master SP, slave SP). For designation of control axes, 1 axis is necessary per one twin drive spindle motor (master SP) in case of Cs contouring control.

- It is not possible to use Twin Drive and the following functions together:
  - Spindle switching control
  - Position coder signal output (Connector JX4)
  - Spindle EGB
  - Spindle learning control
  - Spindle tandem control (Velocity tandem, Torque tandem)
  - Integrator copy function
  - Synchronous spindle motor driving

- There is no restriction to assign spindle axes for a master spindle and a slave spindle. In this document, the following assignment is applied for explanation.
  Master SP: 1st spindle
  Slave SP: 2nd spindle

3. System configuration

3.1. In case of a separate sensor



Note

*1 The motor sensor feedback should be connected to both the master SP and the slave SP by using a signal branch adapter.

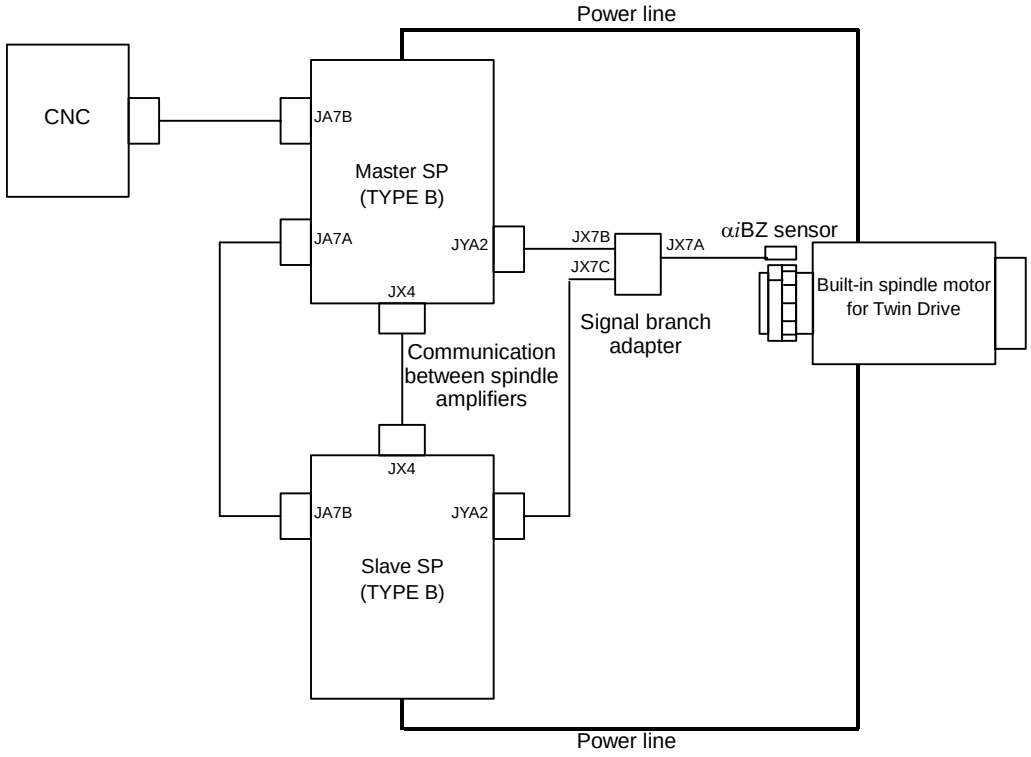
*2 The separate sensor should be connected to the master SP.

*3 Regarding detailed specifications of each cable, refer to FANUC SERVO AMPLIFIER αi series DESCRIPTIONS (B-65282EN).

*4 The number of power supply (PS) depends on the specification of the spindle motor.

*5 The emergency stop signal for power supply (PS) (connector CX4) should be connected to each PS.

3.2. In case of a built-in motor



Note

*1 The motor sensor feedback should be connected to both the master SP and the slave by using a signal branch adapter.

*2 αiCZ sensor (serial) is not applicable for the motor sensor.

*3 Regarding detailed specification of each cable, refer to FANUC SERVO AMPLIFIER αi series DESCRIPTIONS (B-65282EN).

*4 The number of power supply (PS) depends on the specification of the spindle motor.

*5 The emergency stop signal (connector CX4) for power supply (PS) should be connected to each PS.

4. Input/output Signals (CNC↔PMC)

> Note
> *1 The command to the spindle should be given to the master during Twin driving.
> The specification of the input signals is the same as that of a normal spindle (without Twin Drive).
> For details of signals for each control mode, refer to FANUC AC SPINDLE MOTOR αi series parameter manual (B-65280JA).
> *2 When Twin Drive is active, it is not necessary to input signals from PMC to slave SP. Input signals for slave SP are transmitted from master SP through communication between spindle amplifiers.
> *3 When Twin Drive is active, output signals for master SP should be used for judgments of sequence (speed arrival, alarm, etc.).

4.1. Input signals (PMC→CNC)

	15*i*	16*i*	30*i*, 0*i*-D	#7	#6	#5	#4	#3	#2	#1	#0
1st	G228	G073	G073							**SLVA**	
2nd	G236	G077	G077							**SLVB**	

SLVA : Tandem mode command (1st spindle)
SLVB : Tandem mode command (2nd spindle)
0 : Tandem mode OFF
1 : Tandem mode ON.
This signal specifies whether Tandem control is active or not.
In case Twin Drive is used, set this signal to 1 for both master SP and slave SP.

> Note
> *1 This signal should be changed during spindle stop status. The change of this signal is not accepted during rotation.
> *2 This signal should be changed in the velocity mode. The change of this signal is not accepted except in the velocity mode.

4.2. Output signals (CNC→PMC)

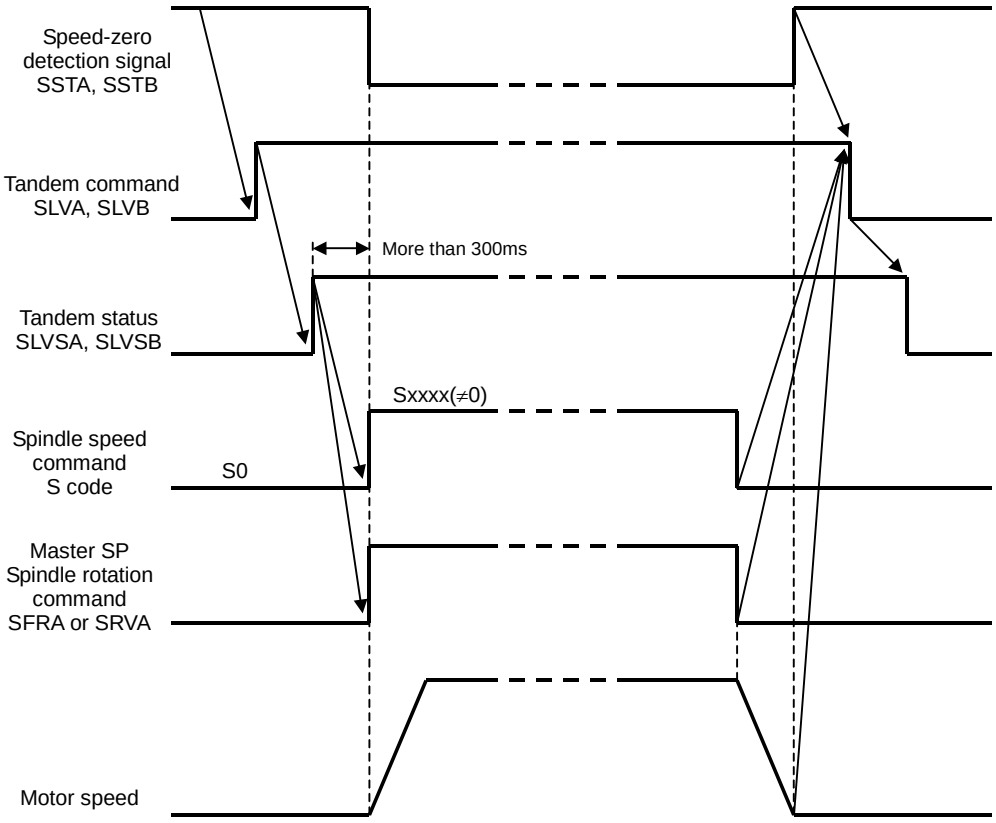
	15*i*	16*i*	30*i*, 0*i*-D	#7	#6	#5	#4	#3	#2	#1	#0
1st	F228	F046	F046				**SLVSA**				
2nd	F244	F050	F050				**SLVSB**				

SLVSA : Tandem mode status signal (1st spindle)
SLVSB : Tandem mode status signal (2nd spindle)
0 : Tandem mode OFF
1 : Tandem mode ON
After both the signals for the master spindle and the slave spindle become 1, the command should be given to the master spindle.

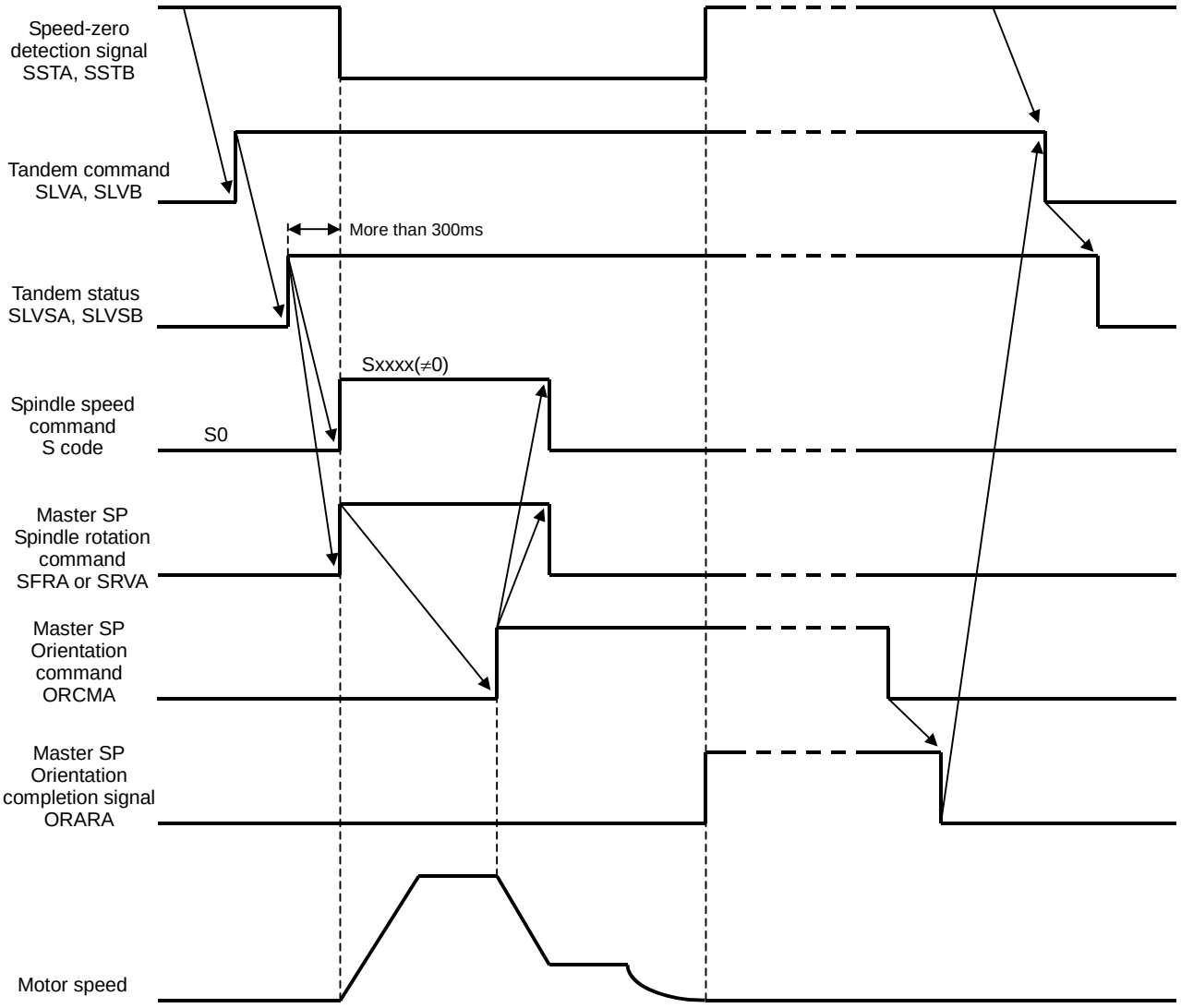
5. Sequence examples

Sequence examples for the following assignment are described as follows.
1st spindle: Master SP
2nd spindle: Slave SP

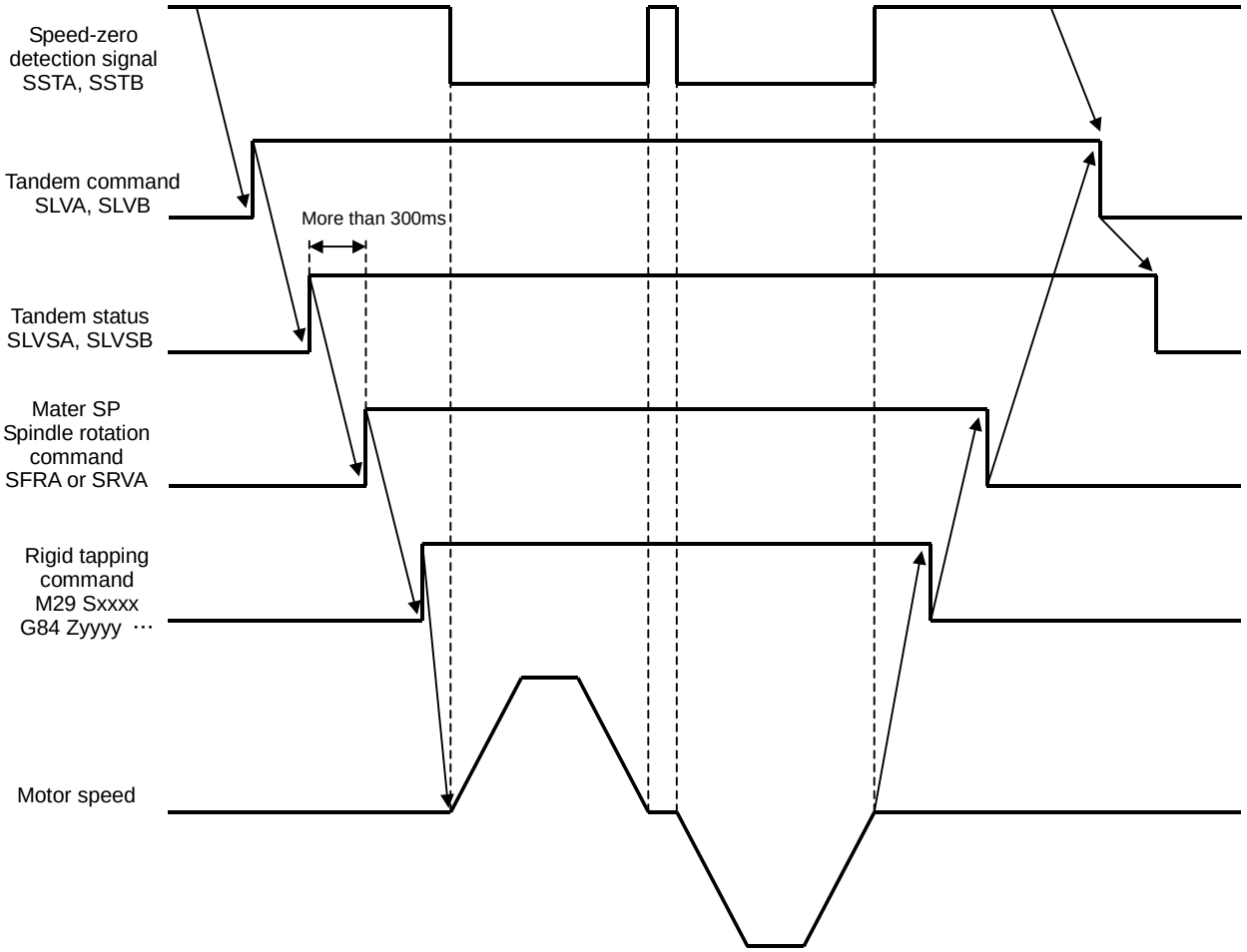
5.1.1. Velocity mode



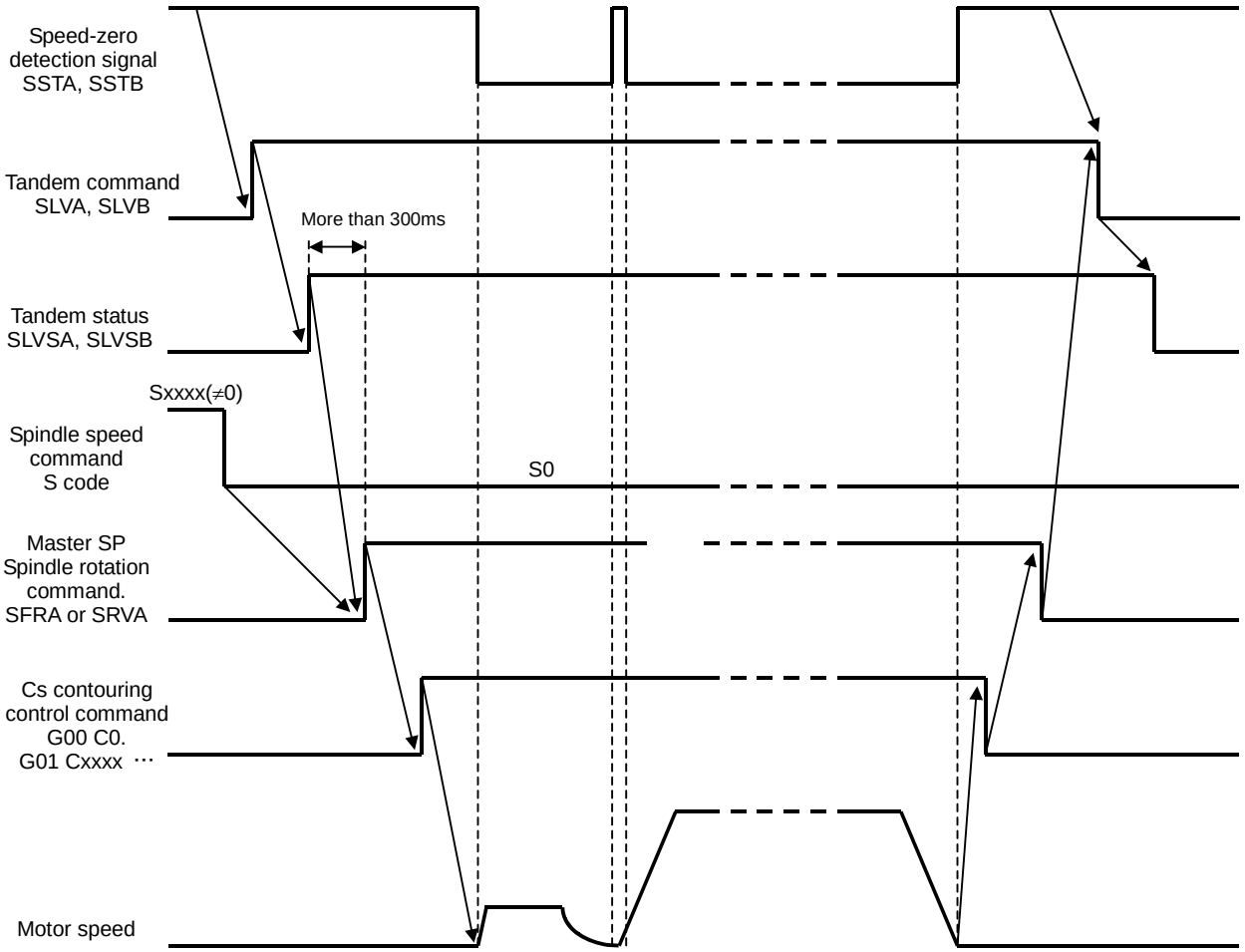
5.1.2. Spindle orientation



5.1.3. Rigid tapping



5.1.4. Cs contouring control



6. List of related parameters

Parameter No.			Contents
15*i*	16*i*	30*i*, 0*i*-D	
3015#3	4015#3	4015#3	Spindle tandem control function
3352#6	4352#6	4352#6	Slave axis for communication between spindle amplifiers
3352#7	4352#7	4352#7	Master axis for communication between spindle amplifiers
3398#3	4398#3	4398#3	Using Twin Drive

Note

*1 The spindle parameters for the master spindle and the slave spindle should be the same setting except the below parameters.

Parameter No.			Master SP	Slave SP	Contents
15*i*	16*i*	30*i*, 0*i*-D			
3352 #7,6	4352 #7,6	4352 #7,6	1, 0	0, 1	Communication between spindle amplifiers
3002 #3,2,1,0	4002 #3,2,1,0	4002 #3,2,1,0	Depending on sensor	0,0,0,0	Kind of spindle sensor
3134	4134	4134	Depending on motor	0	Motor overheat level

7. Details of related parameters

15*i*	16*i*	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
3009	4009	4009						**ALSP**		

ALSP Motor power turn-off method when spindle alarm 24 (serial data transfer error) is issued
0 : Turns off the power after the motor is decelerated to stop.
1 : Turns off the power immediately (Set 1)

15*i*	16*i*	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
3015	4015	4015					**SPDTDM**			

SPDTDM Spindle tandem control function (CNC software option is necessary)
0 : Spindle tandem function is not available
1 : Spindle tandem function is available

Note

1 When the Twin drive is used with 30*i*-B or 0*i*-D, CNC software option is not necessary. Regardless of setting status of this, Twin Drive is available.

2 When the Twin Drive is used with 15*i*-MB, 16*i*-B or 30*i*-A, CNC software option of Spindle tandem control is necessary. Please confirm this bit is 1.

15*i*	16*i*	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
3352	4352	4352	**MASTER**	**SLAVE**						

SLAVE Slave axis for communication between spindle amplifies
0 : Not slave axis
1 : Slave axis (Set 1 in case of slave SP)

MASTER Master axis for communication between spindle amplifies
0 : Not master axis
1 : Master axis (Set 1 in case of master SP)

15*i*	16*i*	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
3398	4398	4398					**WNDTDM**			

WNDTDM Using Twin Drive
0 : Twin Drive is not available
1 : Twin Drive is available (Set 1)
This parameter specifies whether Twin Drive to drive one motor by two amplifiers is available or not.

Note
If this bit is 0, Twin Drive does not work. Please confirm this bit is set to1.

8. Alarm and status error

8.1. Spindle alarm

Alarm No.				Contents	Measure
15*i*-MB	16*i*	30*i* 0*i*-D	SP		
SP0066	9066	SP9066	66	Error in communication between spindle amplifiers	Check the connection of cable (connector JX4).
SP0080	9080	SP9080	80	Alarm occurring on destination amplifier of communication between spindle amplifiers	Remove alarm factor of the amplifier.

8.2. Spindle status error

Error No.	Contents	Measure
38	・Wrong settings in parameters for communication between spindle amplifiers ・Wrong settings for function which can not used together with Twin Drive at the same time	Check parameter settings

9. Parameters for each motor model

Parameter No.			αiI 150/5000HV
			αiSP75HV x2 (*1)
FS15*i*	FS16*i*	FS30*i* FS0*i*-D	αiPS100HV x2
			150/ 180 kW 1500 / 5000 min^{-1}
3007	4007	4007	00000000
3008	4008	4008	00000000
3009	4009	4009	00000000
3010	4010	4010	00010001
3011	4011	4011	00001010
3012	4012	4012	10000000
3013	4013	4013	00001100
3019	4019	4019	00000100
3020	4020	4020	5000
3039	4039	4039	0
3080	4080	4080	10591
3083	4083	4083	30
3100	4100	4100	1520
3101	4101	4101	100
3102	4102	4102	1551
3103	4103	4103	0
3104	4104	4104	2500
3105	4105	4105	0
3106	4106	4106	4000
3107	4107	4107	0
3108	4108	4108	0
3109	4109	4109	25
3110	4110	4110	973
3111	4111	4111	324
3112	4112	4112	200
3113	4113	4113	172
3114	4114	4114	0
3115	4115	4115	100
3116	4116	4116	4691
3117	4117	4117	90
3118	4118	4118	100
3119	4119	4119	55
3120	4120	4120	0
3124	4124	4124	0
3127	4127	4127	144
3128	4128	4128	120
3129	4129	4129	0
3130	4130	4130	25700
3134	4134	4134	130
3169	4169	4169	0
Maximum power at acceleration: 216 kW			

[Procedure for setting spindle parameters]

(1) For both master spindle and slave spindle, load parameters automatically with model code 300.

(2) For both master spindle and slave spindle, set parameters manually according to the parameter table, except No.4134 for slave spindle. Set 0 in No.4134 for slave spindle.

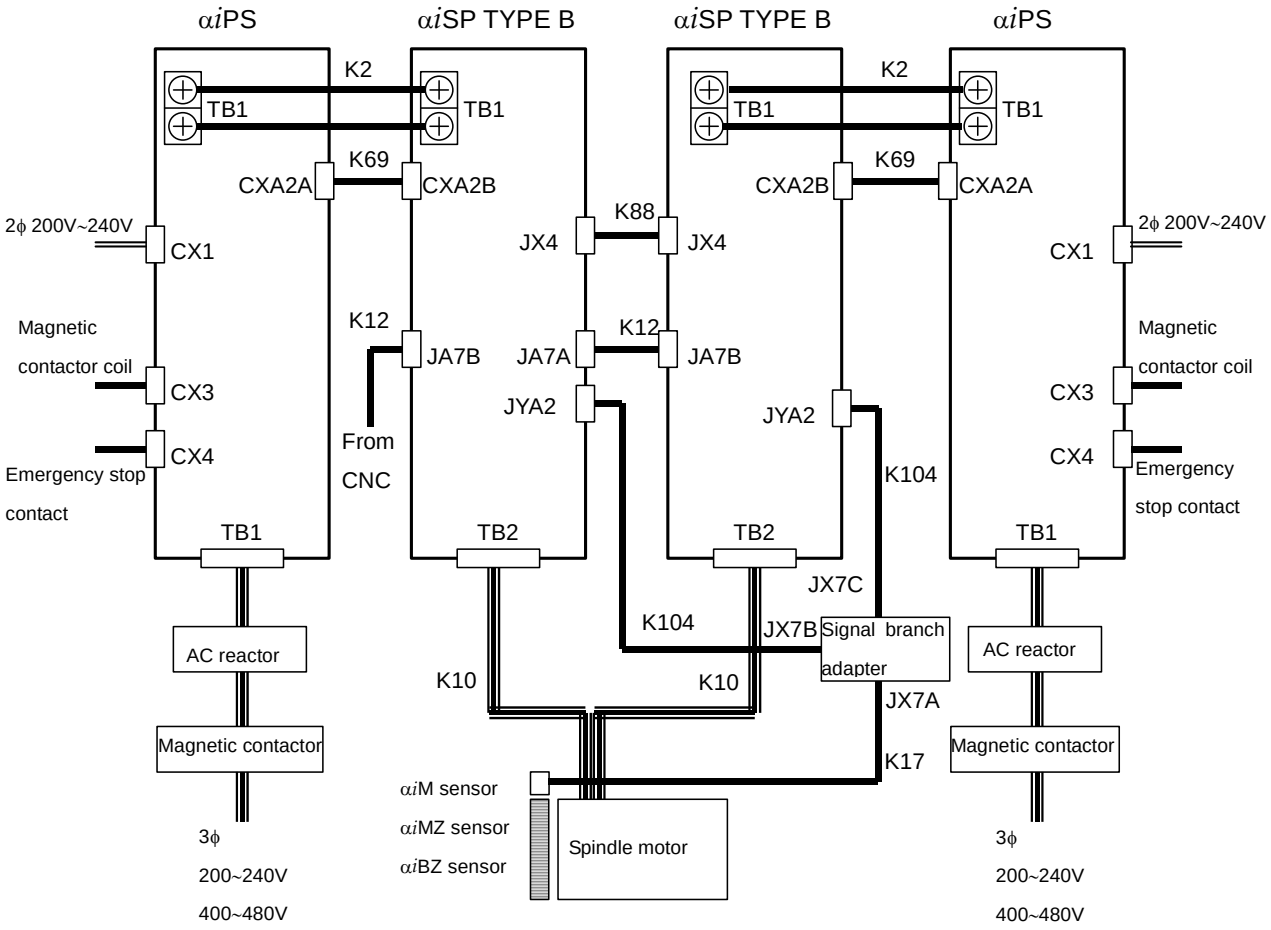
(3) Set parameter for Twin drive. (Refer to item 5.)

(4) Turn off and on again to activate spindle parameters surely.

(*1) Please note that the following αiSP75HV amplifier is not applicable for this motor.
A06B-6122-H075#Hxxx

10. Connection example

10.1. In case of configuration with two αiPSs and two αiSPs

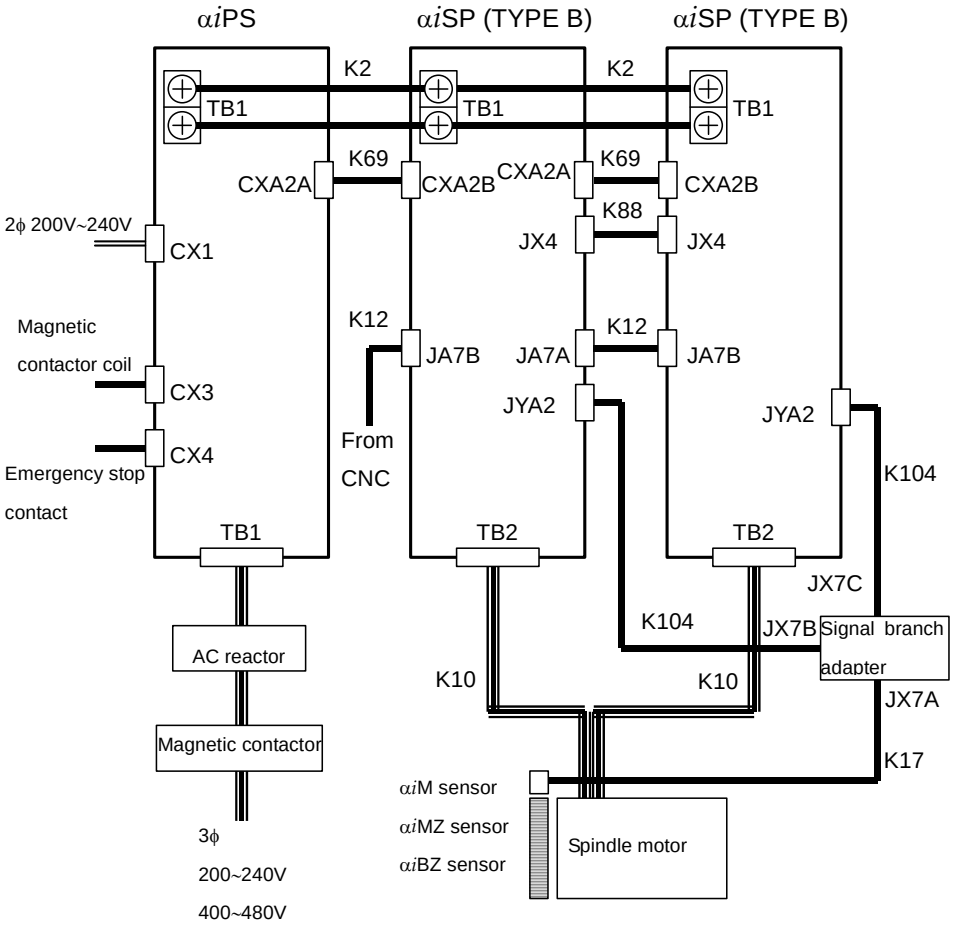


Note

*1 For detailed specification of each cable, refer to FANUC SERVO AMPLIFIER αi series DESCRIPTIONS (B-65282EN).

*2 The emergency stop signal (connector CX4) for power supply (PS) should be input to each PS.

10.2. In case of configuration with one αiPS and two αiSPs



Note

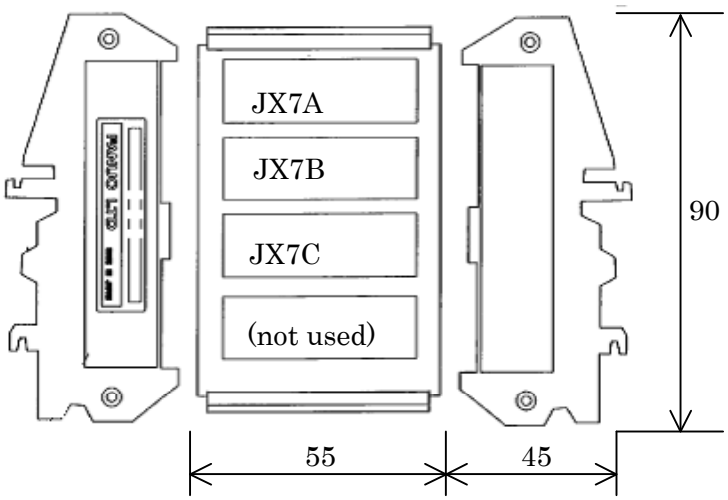
For detailed specification of each cable, refer to FANUC SERVO AMPLIFIER αi series DESCRIPTIONS (B-65282EN).

11. Signal Branch Adapter

11.1. Order information

Name	Specification No.	Note
Signal Branch Adapter	A06B-6111-H405	Cable is not attached. Please make it in the user side.

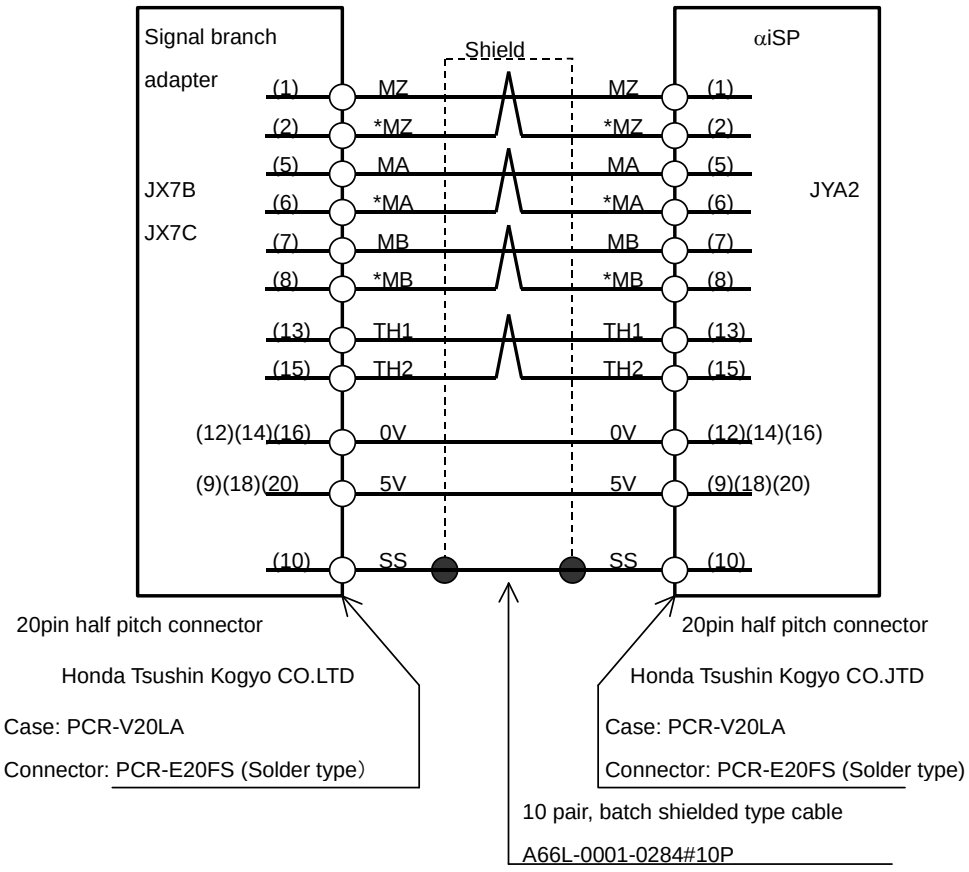
11.2. External dimension



Unit (mm)

Note
Attach this adapter to DIN rail.

11.3. Detail of cable K104



				TITLE	Twin Drive for Spindle Motor Specifications
01	11.07.29	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-05	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 16/16

Revision of αi series Spindle Software
(9D90/I(09), 9DA0/L(12))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/I(09), 9DA0/L(12)	Add	2011.08

				TITLE	Revision of αi series Spindle software (9D90/I(09),9DA0/L(12)
01	11.08.17	K.Tomiyama	Newly designed	DRAW. No. B-65280EN/08-06	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/3

Revision of αi series Spindle Software (9D90/I(09),9DA0/L(12))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition I(09)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i* -B/C, 0*i* -D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition L(12)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30 *i*//31 *i*//32 *i*/-B, 35 *i*/-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/I	9DA0/L
(1)	It has become possible to connect spindle amplifier for FS30*i*-B to FS0*i*-D controller. In the former report for 9DA0/K, we informed that it became possible, but we found that an alarm occurs when you connect the spindle amplifier next to αiPS. We improved it. Please use 9DA0/L or subsequent editions when you connect the spindle amplifier for FS30*i*-B to FS0*i*-D controller from now on.	-	◎
(2)	We added the function “Spindle DC link stabilizer during power failure”, which keeps DC link voltage and supports the controlled stop of other axes at power failure by using kinetic energy of spindle. Regarding detail of the function, please refer to the technical report (B-65280EN/08-07).	◎	◎
(3)	We corrected the problem that the position error always becomes 0 during Cs contouring control or rigid tapping when we use Dual position feedback function. Please refer to the item 4 in detail.	◎	◎
(4)	We corrected the problem that the Safety parameter error (SP9071) is mis-detected. Please refer to the item 5 in detail.	◎	-
(5)	“U-axis control” using two spindle motors has been supported in this revision. It’s necessary to update the CNC system software also to use the function. But the development of CNC system software has not been completed yet. After the completion, we’ll issue the technical report for the function.	-	◎
(6)	“Energy saving level selecting function” has been supported in this revision. The function enables the smart selection for trade-off between "shorter cycle time" and "energy saving". It’s necessary to update the CNC system software also to use the function. But the development of CNC system software has not been completed yet. After the completion, we’ll issue the technical report for the function.	-	◎

◎ : Revised item　- : Not supported

				TITLE	Revision of αi series Spindle software (9D90/I(09),9DA0/L(12)
01	11.08.17	K.Tomiyama	Newly designed	DRAW. No. B-65280EN/08-06	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3

4. The problem of Dual position feedback function

We found the problem that the position error always becomes 0 during Cs contouring control or rigid tapping when we use Dual position feedback function in the following spindle software. We corrected it.

[The software editions having the problem]
- 9D90 series / edition G(07) or H(08)
- 9DA0 series / edition H(08) to K(11)

[Countermeasure]
When you use Dual position feedback function, please use the software which is not listed above or use the revised software in this time.
If you use the software having the problem and execute Cs contouring control or rigid tapping, the position error becomes always 0. And the detection of excess error and in-position check aren't executed. As it might cause something trouble, please use the software which doesn't have the problem.

5. The problem of mis-detection of Safety parameter error (SP9071)

We found the problem that Safety parameter error (SP9071) occurs when we use the following spindle software and Dual check safety function. We corrected it.

[The software editions having the problem]
- 9D90 series / edition G(07), H(08)

[Countermeasure]
Please use the revised software (9D90/I) in this time or subsequent edition.
As temporary countermeasure, it's possible to avoid the alarm by setting No.4544=11111111, No.4545=00000000.

Additional information)
Dual check safety function doesn't support "Spindle switching control". If set Dual check safety ON in the axis which uses "Spindle switching control", Safety parameter alarm (SP9071) occurs. Please don't use these two functions together.

Spindle DC-link stabilizer during power failure Specifications

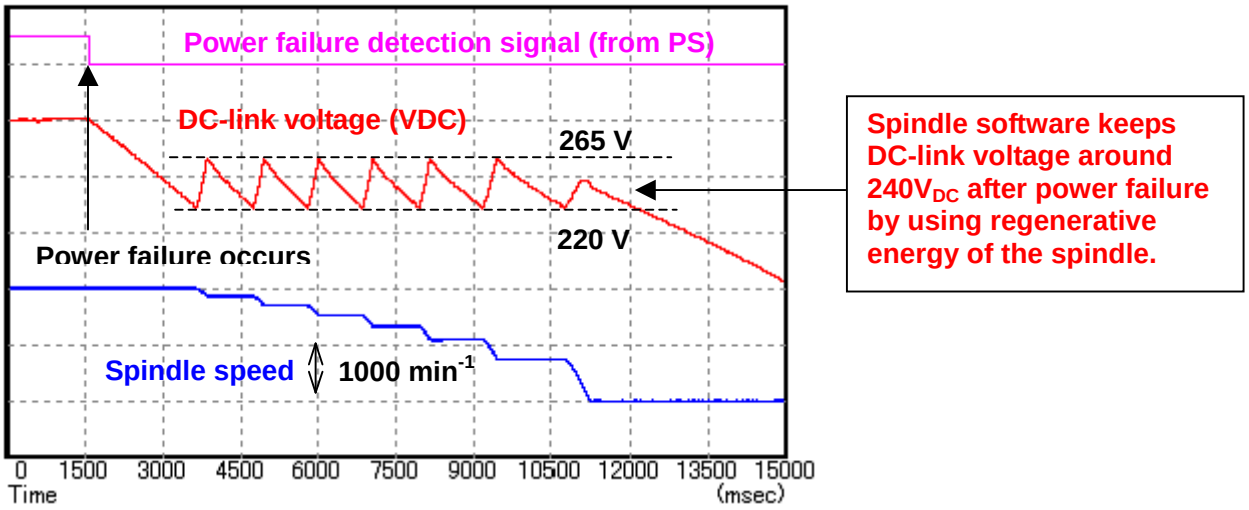
				TITLE	Spindle DC-link stabilizer during power failure Specifications
01	11.08.22	Morita	Newly designed	DRAW. No. B-65280EN/08-07	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 1/11

1. Outline

This document describes specification of Spindle DC-link stabilizer during power failure.
This function monitors power failure detection signal and DC-link voltage, and keeps DC-link voltage within specific range after power failure until spindle stops by using spindle regenerative energy.
If the following conditions are fully satisfied, you can use spindle regenerative energy for the retraction at power failure.

(1) Retraction axes are driven by servo amplifiers connected to the same power supply (PS) which spindle amplifier is also connected.
(2) Spindle always rotates with sufficient kinetic energy when the retraction at power failure is required.

Example of application



2. Application

2.1. Combination of spindle software, amplifier and CNC

Spindle software		Spindle amplifier	CNC
Series	Version		
9D90	I (09)	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	FS30*i*-A/FS31*i*-A/FS32*i*-A, FS0*i*-D
9DA0	L(12)	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600 A06B-6230-H001#H600 (SVP) A06B-6280-H001#H600 (SVP)	FS30*i*-B/FS31*i*-B/FS32*i*-B/FS35*i*-B, FS0*i*-D (SVP can't be used with FS0*i*-D.)

2.2. Notes for application

- When you apply this function, you should use UPS(Uninterruptible Power Supply) or Power Failure Backup Module(PFBM) to keep the control power source for CNC (24VDC) or for servo amplifiers (Single phase 200VAC for FS30i-A, 24VDC for FS30i-B) during power failure.

  If the backup system of control power source is broken, this function dose not work properly.

- You can use this function with Spindle HRV control (induction motor/ synchronous motor).

- When you use this function with speed range switching control, you should keep the power source of magnetic contactor (MCC) to suppress switching of MCC during power failure.
  And you have to make the ladder program to keep the state of MCC and signals for speed range switching control (RSLx/ RCFNx/ RCHPx) during power failure.

- When you use this function with spindle switching control, you should keep the power source of MCC to suppress switching of MCC during power failure.
  And you have to make the ladder program to keep the state of MCC and signals for spindle switching control (SPSLx/ MCFNx/ MFNHGx) during power failure.

- When the system drives plural spindle motors connected mechanically with synchronous control (Spindle synchronous control/ Spindle tandem control), you should apply this function to 1 spindle only, and you should set MPOFx signals to “1” for other spindles when the power failure is detected.

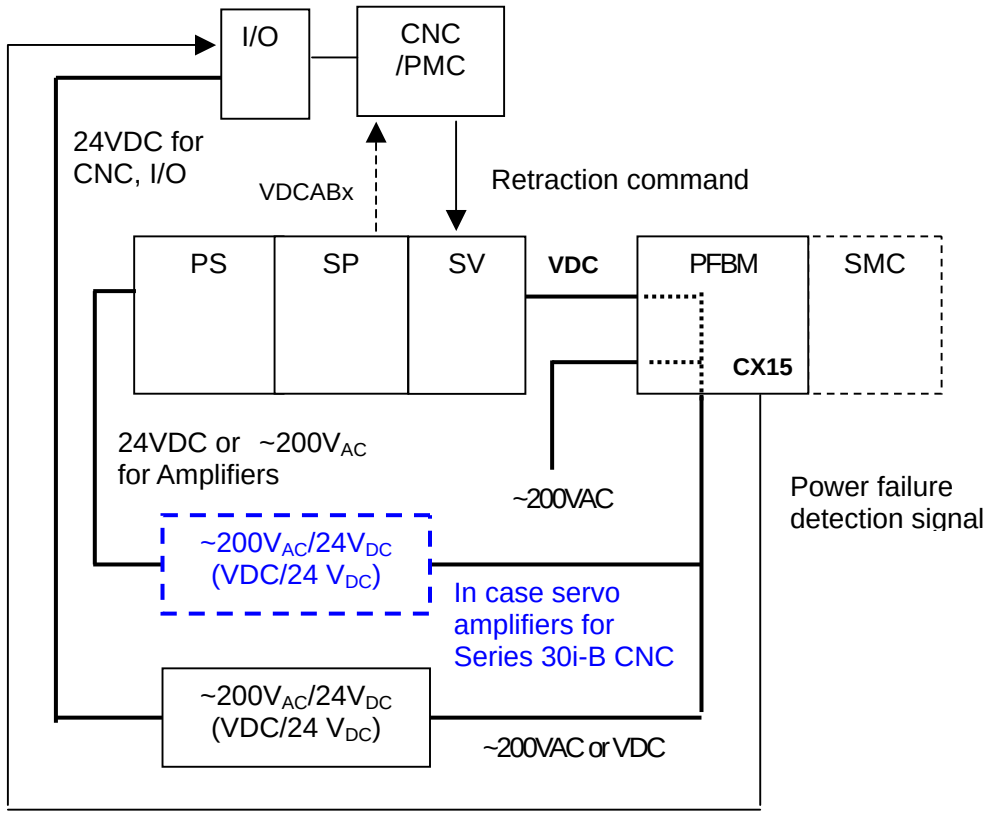
- When you use this function with spindle software 9DA0 series, you should use “Servo Amplifiers for series 30i-B CNC (A06B-62xx-Hxxx)” for all of the Servo Amplifiers (PS/SP/SV).

- When you use this function with spindle software 9D90 series, you should use “Servo Amplifiers for series 30i-A CNC (A06B-61xx-Hxxx)” for all of the Servo Amplifiers (PS/SP/SV).

- When you use this function with spindle software 9D90 series, you should complete the retraction within 1 minute, because PS alarm (SP9004/SV0607) may occur in 1 minute after power failure. Please consult FANUC if you need retraction time over 1 minute.

3. System configuration example

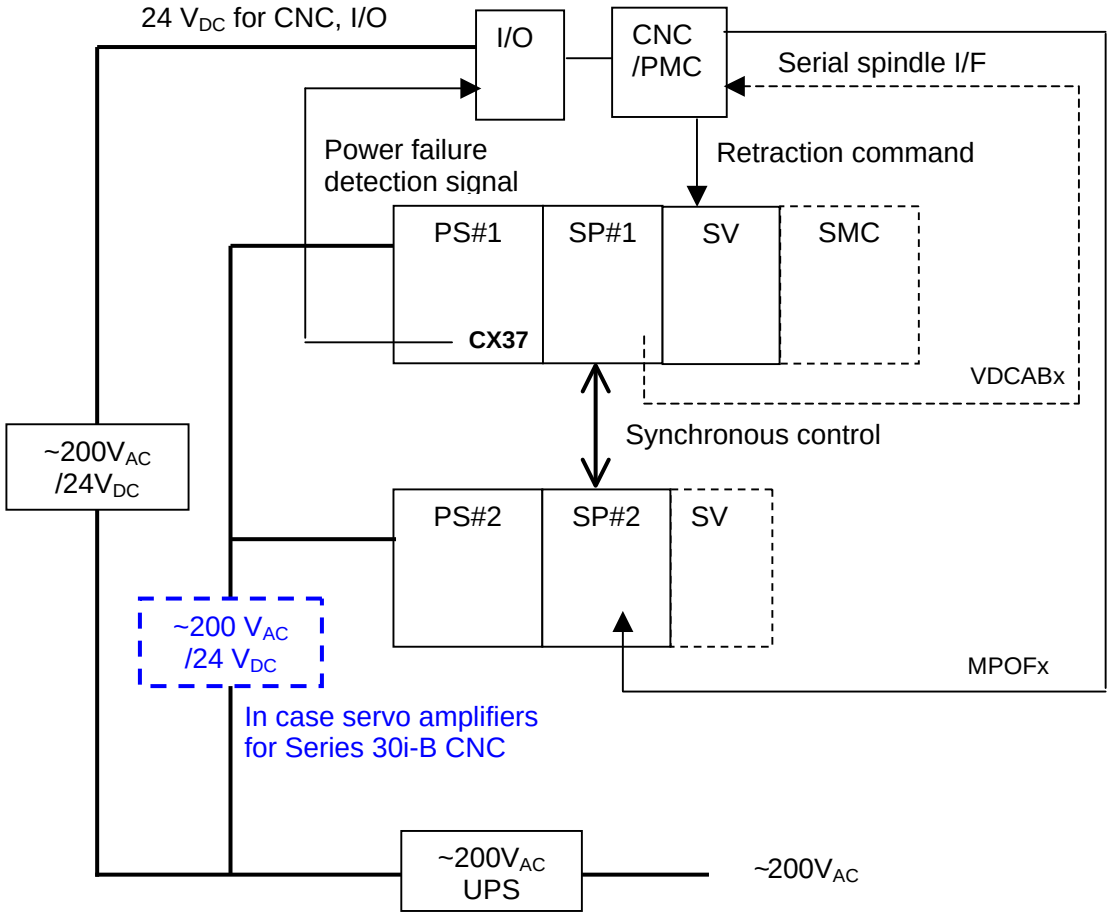
3.1. In case of using power failure backup module (PFBM)



Please refer to “FANUC SERVO AMPLIFIER α i series DESCRIPTION (B-65282EN)” for details of connection.

3.2. In case of driving 2 spindles synchronously and using UPS for control power back-up

The system drives 2 spindle motors connected mechanically
with synchronous control (Spindle synchronous control/ spindle tandem control).



Please refer to “FANUC SERVO AMPLIFIER α i series DESCRIPTION (B-65282EN)” for details of connection.

				TITLE	Spindle DC-link stabilizer during power failure Specifications
01	11.08.22	Morita	Newly designed	DRAW. No. B-65280EN/08-07	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 5/11

4. Input/output signals (CNC↔PMC)

4.1. Input signals (PMC→CNC)

	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
1st SP	G073						**MPOFA**		
2nd SP	G077						**MPOFB**		

MPOFx : Motor power turn off signal (1st spindle)
0 : Disabled
1 : Enabled (Turn off the motor power).

When the system drives plural spindle motors connected mechanically with synchronous control (Spindle synchronous control/ Spindle tandem control), you should apply this function to 1 spindle only, and you should set MPOFx signals to “1” for other spindles when the power failure is detected. For power failure detection, please use the signal of PS(CX37) or PFBM(CX15) or unexpected DC-link voltage detection signal (VDCABx).

4.2. Output signals (CNC→PMC)

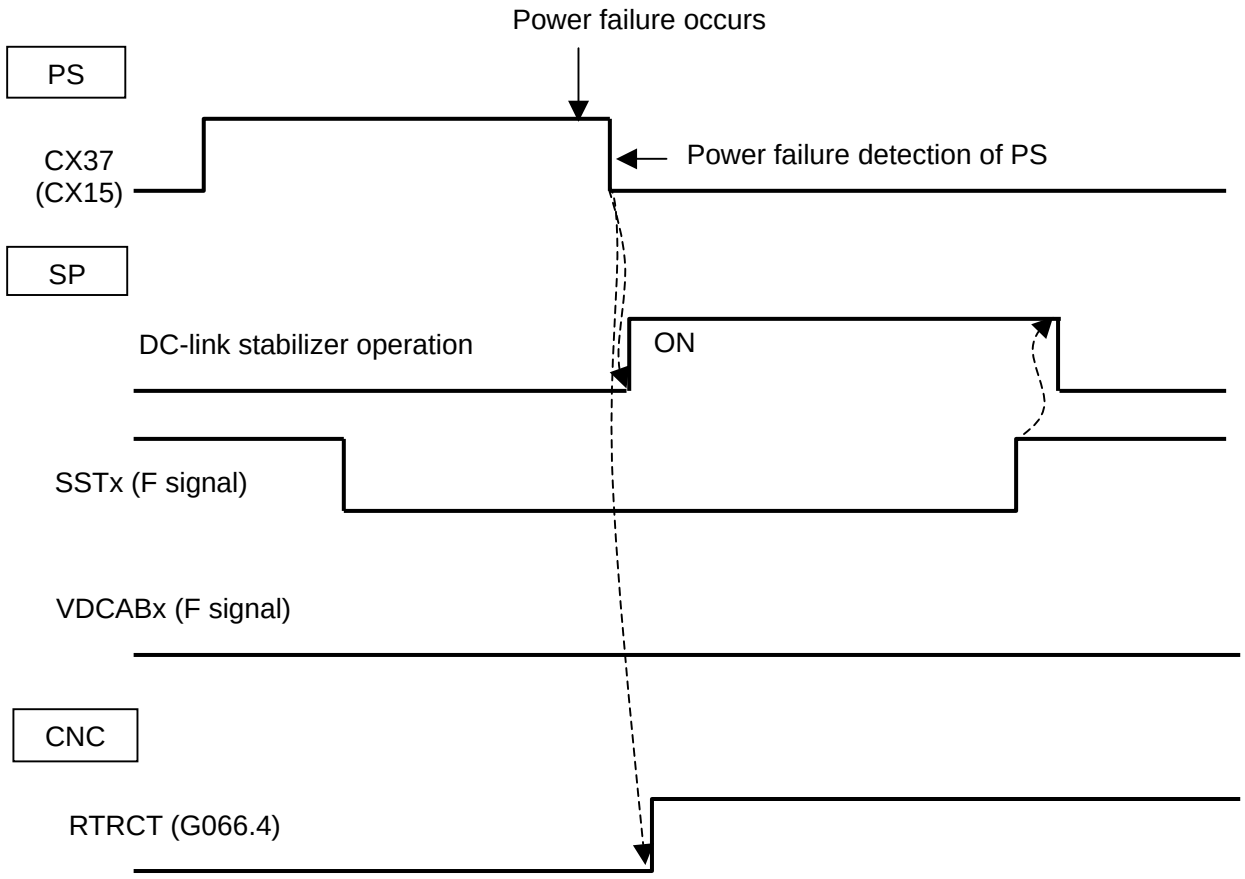
	30*i*, 0*i* –D	#7	#6	#5	#4	#3	#2	#1	#0
1st SP	F306				**VDCABA**				
2nd SP	F308				**VDCABB**				

VDCABx : Unexpected DC-link voltage detection signal
0 : Normal state.
1 : Unexpected state

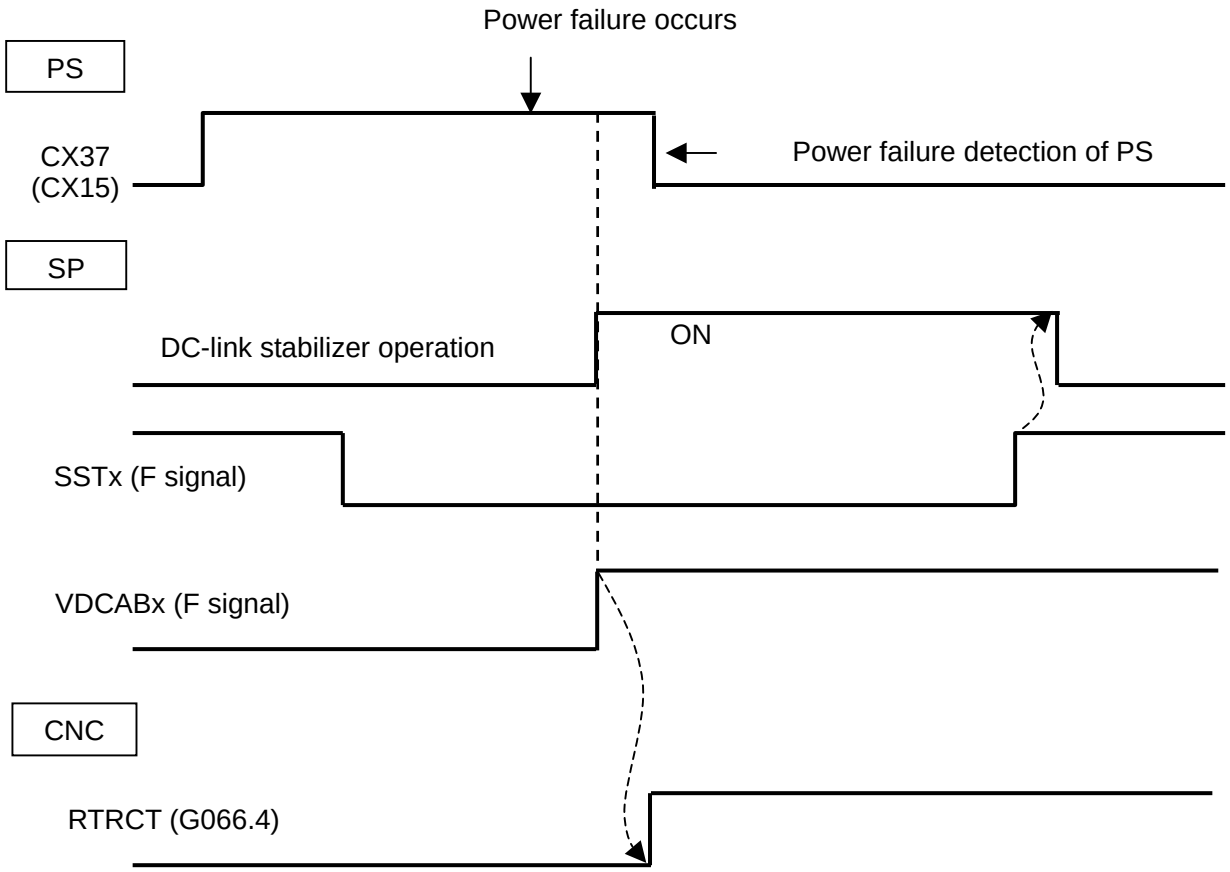
When you use Spindle DC-link stabilizer during power failure, this signal turns to “1” and the DC-link stabilizer operation starts if an unexpected state of DC-link voltage is detected.
When the parameter “VDCPFD(No.4548#5)” is set to”1”, the detection of unexpected DC-link voltage (Power failure detection with DC-link voltage) is disabled.

5. Sequence examples

5.1. In case of normal power failure



5.2. In case unexpected DC-link voltage is detected



				TITLE	Spindle DC-link stabilizer during power failure Specifications
01	11.08.22	Morita	Newly designed	DRAW. No. B-65280EN/08-07	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 8/11

6. List of related parameters

Parameter No. 30*i*, 0*i* –D	Contents
4540#7 4670#7	Setting of spindle DC-link stabilizer during power failure
4540#2	Setting of preload during power failure
4548#5 4678 #5	Setting of unexpected state of DC-link voltage detection
4352#4 4678#4	Setting of torque limit during DC-link keeping operation
4510	Spindle DC-link stabilizer/ Upper limit of DC-link voltage
4511	Spindle DC-link stabilizer/ Lower limit of DC-link voltage

7. Details of related parameters

	30*i*, 0*i* -D	#7	#6	#5	#4	#3	#2	#1	#0
Main	4540	**GOPF**					**PLDPWF**		
Sub	4670								

GOPF Spindle DC-link stabilizer during power failure is
0 : Disabled
1 : Enabled

When you set this parameter to “1”, the spindle software keeps DC-link voltage within specific range by using spindle regenerative energy in case of a power failure or an unexpected state of DC-link voltage is detected.
When you use this function with Twin drive spindle motor, please set this parameter to ”1” to master SP and “0” to slave SP.

PLDPWF Setting of preload during power failure
0 : Preload is enabled during power failure
1 : Preload is disabled during power failure

When you use Spindle DC-link stabilizer during power failure with spindle tandem control and preload, set this parameter to “1” to both spindles.

	30*i*, 0*i* –D	#7	#6	#5	#4	#3	#2	#1	#0
Main	4548			**VDCPFD**	**PFTLD**				
Sub	4678								

VDCPFD Unexpected state of DC-link voltage detection (Power failure detection for DC-link voltage) is
0 : enabled (Standard setting)
1 : disabled

If an unexpected state of DC-link voltage is detected, spindle software starts DC-link stabilizer operation and sets VDCABx to ”1”. When this parameter is set to”1”, the detection of Unexpected DC-link voltage is disabled.
In case there are some misdetections of unexpected state of DC-link voltage during acceleration/ deceleration of spindle, set this parameter to”1”.

PFTLD Torque limit during power failure is
0 : enabled (Standard setting)
1 : disabled

During the DC-link stabilizer operation is performing, maximum torque is limited the value specified by No.4025.
When this parameter is set to”1”, torque limit during DC-link stabilizer operation is disabled.

Note:
Torque limit signal (TLMH,L) is always available regardless of this parameter setting.

30*i*, 0*i* -D
4510

Spindle DC-link stabilizer/ Upper limit of DC-link voltage

Setting Unit : 1 VDC
Setting range : 0, 550~700(400V Amp.), 250~325(200V Amp.)
Standard setting: 0 = 650VDC(400V Amp.), 265VDC(200V Amp.)

30*i*, 0*i* -D
4511

Spindle DC-link stabilizer/ Lower limit of DC-link voltage

Setting Unit : 1 VDC
Setting range : 0, 450~650(400V Amp.), 200~300(200V Amp.)
Standard setting: 0 = 550VDC(400V Amp.), 220VDC(200V Amp.)

During the DC-link stabilizer operation is performing, spindle software keeps DC-link voltage between upper limit (No4510) and lower limit (No4511) by repeating deceleration mode and velocity keeping mode.
Normally please set 0 to both parameters.
When you adjust these parameters, refer to the setting range of both parameters.

8. Alarm

After the spindle is stopped by DC link stabilizer operation, DC-link voltage will go down gradually. And following alarms will occur, if the control power source is kept at that time.

In case of 9D90 series (Series 30i-A CNC)

CNC alarm message : None.
If a SV is connected, SV alarm (SV0433/ SV0607) will occur.
PS alarm display(LED) : 4 (DC-link low voltage), E (Open phase)
SP alarm display(LED) : None

In case of 9DA0 series (Series 30i-B CNC)

CNC alarm message : SP9004
If SV is connected with PS, SV alarm (SV0607) will occur.
PS alarm display(LED) : 14 (Improper input power)
SP alarm display(LED) : None

Correction of a parameter for spindle motor βiI15/7000

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction	Correction of a parameter for spindle motor βiI15/7000	Add	2011.08
Another			

				TITLE	Correction of a parameter for spindle motor βiI15/7000
01	11.08.22	G.Li	Newly designed	DRAW. No. B-65280EN/08-08	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Correction of a parameter for spindle motor βiI15/7000

1. General

This document describes correction of parameter No.4127 (Load meter indication value at maximum output) for spindle motor βiI15/7000.

Incorrect value: No.4127=148
Correct value: No.4127=136

The value of No.4127 is used for calculating the load value on the spindle monitor screen and the diagnosis screen (No.410).

So in case of setting 148 to No.4127, the load meter value is 8% larger than the value in case of setting 136 to No.4127.

But, even though 148 is set to No.4127, the spindle motor output characteristic and the alarm detection don't receive the influence.

2. Detail of correction

Motor model		βi I 15/7000
Applicable amplifier		βi SVSPx-18
Model code		–
Applicable software series and edition		–
Continuous rated characteristics		15kW 2000/7000min^{-1}
15-min,rated characteristics		18.5kW 1500/7000min^{-1}
FS0*i*-C	FS0*i*-D FS0*i* Mate-D	
4007	4007	00000000
4008	4008	00000000
4009	4009	00000000
4010	4010	00010000
4011	4011	00011010
4012	4012	10000000
4013	4013	00001100
4019	4019	00000100
4020	4020	7000
4023	4023	
4039	4039	0
4040	4040	
4041	4041	
4048	4048	
4049	4049	
4080	4080	15445
4083	4083	30
4093	4093	0
4100	4100	1550
4101	4101	81
4102	4102	1610
4103	4103	0
4104	4104	2500
4105	4105	0
4106	4106	5000
4107	4107	0
4108	4108	0
4109	4109	25
4110	4110	1426
4111	4111	389
4112	4112	200
4113	4113	298
4114	4114	0
4115	4115	100
4116	4116	4344
4117	4117	90
4118	4118	100
4119	4119	32
4120	4120	0
4124	4124	0
4127	4127	136*
4128	4128	0
4129	4129	0
4130	4130	25700
4134	4134	130
4136	4136	0
4138	4138	0
4139	4139	0
4140	4140	0
4141	4141	0
4142	4142	0
4143	4143	0
4144	4144	0
4145	4145	0
4146	4146	0
4147	4147	0
4148	4148	0
4149	4149	0
4150	4150	0
4151	4151	0
4152	4152	0
4153	4153	0
4154	4154	0
4155	4155	0
4156	4156	0
4158	4158	0
4159	4159	0
4161	4161	0
4165	4165	0
4166	4166	0
4169	4169	0

* Modified parameter

				TITLE	Correction of a parameter for spindle motor βiI15/7000
01	11.08.22	G.Li	Newly designed	DRAW. No. B-65280EN/08-08	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Revision of αi series Spindle Software
(9D5A/M, 9D5D/A, 9D7A/B, 9D80/Y)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D5A/M Revision of spindle software 9D5D/A from 9D53/Y Revision of spindle software 9D7A/B Revision of spindle software 9D80/Y	Add	2011.10

				TITLE	Revision of αi series Spindle software (9D5A/M, 9D5D/A, 9D7A/B, 9D80/Y)
01	11.10.20	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-09	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/1

Revision of αi series Spindle Software (9D5A/M, 9D5D/A, 9D7A/B, 9D80/Y)

1. General

   αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition M(13)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0*i*-B/C Induction spindle motor
9D5D *) edition A(01)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Synchronous spindle motor
9D7A edition B(02)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30*i*/31*i*/32*i*-A, Induction/ synchronous spindle motor
9D80 edition Y(25)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-D, 0*i*-B/C, 15*i*-MB , PM*i*-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0*i*-D Induction spindle motor

*) 9D5D series is the successor of 9D53 series. 9D53/Y was revised to 9D5D/A.

- Only the name of the spindle software is changed.
- The specification No. of the amplifier is not changed.
- 9D5D series is revised from 9D53 series, and has an upper compatibility with 9D53 series.

				TITLE	Revision of αi series Spindle software (9D5A/M, 9D5D/A, 9D7A/B, 9D80/Y)	
01	11.10.20	Tomiyama	Newly designed	DRAW. No.	B-65280EN/08-09	CUST.
Ed.	Date	Design.		FANUC CORPORATION		SHEET 2/2

3. Contents of modification

Contents of modification	9D5A/L	9D53/Y	9D7A/A	9D80/X
1) Spindle backlash acceleration function was revised. Spindle backlash acceleration function has made the compensation depending on the acceleration value at reversal point since first. However there are some cases that it doesn't work effectively in low speed circle. Therefore we've revised it so that the compensation can be done effectively by specified parameter value irrespective of acceleration value. Please refer to the technical report (B-65280EN/08-10)	○	○	○	○
2) A problem, which might occur in using "U-axis control", was corrected. "U-axis control" is used to control the servo axis called U-axis which is on the spindle axis. The function is realized by input of spindle feedback pulses to Separate detector I/F unit for servo axes. We found that there is a possibility that U-axis might move slightly at the turning on CNC if the following conditions are satisfied. We revised it in this software edition. - The output pulses from JX4(A/B phase TTL) on a spindle amplifier is used for input pulsed to Separate detector I/F unit for servo axes to use "U-axis control". - The DI signal for "U-axis control" (Gn067.4) is "1" at turning on CNC. - The spindle had rotated before tuning off CNC - Only the CNC was turned off/on keeping the power of spindle amplifier.	○	○	○	○

○ : Revised item - : Not supported

Spindle Backlash Acceleration Function
Specifications

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function	Improving the spindle backlash acceleration function (The CNC software option (Cs contouring control) is required.)	Correct	2011.10
Unit			
Maintenance Parts			
Notice			
Correction			
Another			

Spindle Backlash Acceleration Function
Specifications

1. Outline

The spindle backlash acceleration function improves a contour error caused by the delay in the reversal point in Cs contouring control axis.

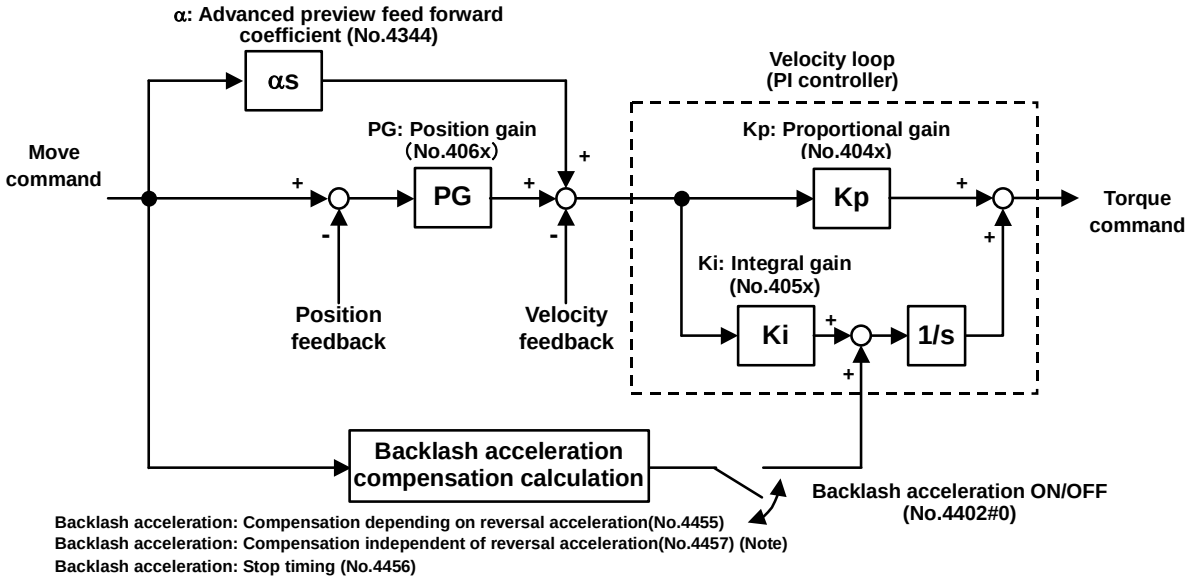
NOTE
1 To use this function, the CNC software option (Cs contouring control) is required.
2 This function is unavailable for the sub-spindle for spindle switching.
3 This function can't be used together with the spindle EGB function.

2. Series and Editions of Applicable Spindle Software

Series	Edition	Usable CNC
9D50	O(15) edition or later	FS16*i* / FS18*i* / FS21*i*-B, FS0*i*-B/C/D , FS15*i*-B
9D5A	A(01) edition or later	FS16*i* / FS18*i* / FS21*i*-B , FS0*i*-B/C/D , FS15*i*-B
9D53	G(07) edition or later	FS16*i* / FS18*i* / FS21*i*-B , FS0*i*-B/C/D , FS15*i*-B
9D5D	A(01) edition or later	FS16*i* / FS18*i* / FS21*i*-B , FS0*i*-B/C/D , FS15*i*-B
9D70	F (06) edition or later	FS30*i* / FS31*i* / FS32*i*-A
9D7A	A (01) edition or later	FS30*i* / FS31*i* / FS32*i*-A
9D80	A (01) edition or later	FS16*i* / FS18*i* / FS21*i*-B , FS0*i*-B/C/D ,FS15*i*-B , FS30*i* / FS31*i* / FS32*i*-A
9D90	A (01) edition or later	FS16*i* / FS18*i* / FS21*i*-B , FS0*i*-B/C/D ,FS15*i*-B , FS30*i* / FS31*i* / FS32*i*-A
9DA0	A (01) edition or later	FS30*i* / FS31*i* / FS32*i*-B

Note) We added the following two improvements about spindle backlash acceleration in 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).
- The improvement to give an enough effenct even in the low speed revesal movement
- The improvement for a problem that backlash acceleration doesn't work correctly in some setting cases of relationship between motor direction and spindle direction, relationship between spindle direction and sensor direction.

3. Block diagram



Note) No.4457(Compensation independent of reversal acceleration) can be used with 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).

4. Parameter

4.1. Parameter list

Parameter No.		Description
15*i*	**16*i*/30*i*/0*i***	
3402#0	4402#0	Backlash acceleration ON
3402#1	4402#1	Setting of the feed-forward coefficient when the backlash acceleration function is enabled
3353#0	4353#0	Improvement of backlash acceleration for low speed reverse (Note)
3455	4455	Backlash acceleration : Compensation depending on reversal acceleration
3457	4457	Backlash acceleration : Compensation independent of reversal acceleration (Note)
3456	4456	Backlash acceleration : Stop timing
3458	4458	Backlash acceleration : Time for judgement as axis stop (Note)

Note) These parameters can be used with 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).

4.2. Details of parameters

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3402	4402							**MDLINF**	**BKAFNC**

BKAFNC Backlash acceleration function is
0 : OFF
1 : ON

MDLINF Setting for the advanced preview feed-forward coefficient when the backlash acceleration function is enabled

0 : Feed-forward coefficient is less than 100% (No.4344≠10000).

1 : Feed-forward coefficient is 100% (No.4344=10000).

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3353	4353								**BKAITP**

BKAITP Improvement of backlash acceleration for low speed reverse is

0 : Not done

1 : Done

Please set "1" in this parameter to make backlash acceleration effective even in low speed.

But if you set this parameter in the machine which has not used this parameter, there is a possibility that the behavior might be changed. Please take care of it.

Note) This parameter can be used with 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).

15*i*	16*i*, 30*i*, 0*i*	
3455	4455	**Backlash acceleration : Compensation depending on reversal acceleration**

Unit of data : Internal unit

Valid data range : 0 to 32767

Standard setting value : 10 or so

This parameter determines the compensation, which is depending on the reversal acceleration.

It is mainly used to compensate the delay at relatively high speed.

15*i*	16*i*, 30*i*, 0*i*	
3457	4457	**Backlash acceleration : Compensation independent of reversal acceleration**

Unit of data : Internal unit

Valid data range : 0 to 32767

Standard setting value : 100 or so

This parameter determines the compensation, which is fixed value and independent of the reversal acceleration.

It is mainly used to compensate the delay at relatively low speed.

This parameter becomes effective only when No.4353#0=1.

Note) This parameter can be used with 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).

15*i*	16*i*, 30*i*, 0*i*	
3456	4456	**Backlash acceleration : Stop timing**

Unit of data : 0.001deg

Valid data range : 0 to 32767

Standard setting value : 5 or so

This parameter determines the finish timing of backlash acceleration.

Backlash acceleration will stop after the spindle moves the distance specified by this parameter from reversal point.

If the value is small and not enough, backlash acceleration will stop instantly and it works with less effect.

On the contrary, if the value is too much large, it works with over effect, because the compensation will keep during long distance.

15*i*	16*i*, 30*i*, 0*i*	
3458	4458	**Backlash acceleration : Time for judgment as axis stop**

Unit of data : 1ms

Valid data range : 0 to 32767

Standard setting value : 0 (The value "0" is treated as "200" internally.)

When the axis stops during a time specified by this parameter after start of backlash acceleration, backlash acceleration will stop.

Normally the management of acceleration stop is done by the parameter of stop timing. But if the reverse distance is very small and it is less than the parameter value of stop timing, backlash acceleration will continue. To avoid such situation, this parameter manages the time period of backlash acceleration.

If this parameter is "0", "200" ms is used as time period. This parameter becomes effective only when No.4353#0=1.

When you execute circle movement at very low speed, there is a possibility that the backlash acceleration doesn't work because of the effect of this parameter as the motor hardly move at the reversal point. In such case please set the value over 200.

Note) This parameter can be used with 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), and 9DA0/M(13).

(Note) Parameters for rotation direction of spindle or sensor

There are following parameters to specify the rotation direction of spindle or sensor. There are some cases that backlash acceleration function doesn't work correctly depending on some combination of following parameters. We improved it in the following spindle softwares.

Improved software : 9D5A/M(13), 9D5D/A(01), 9D7A/B(02), 9D80/Y(25), 9D90/J(10), 9DA0/M(13) and subsequent editions

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3000	4000							**ROTA2**	**ROTA1**

ROTA1 Indication of the relationship between the rotation directions of spindle and spindle motor

0 : The spindle and spindle motor rotate in the same direction.

1 : The spindle and spindle motor rotate in the reverse direction.

ROTA2 Indication of the spindle direction by the move command (+). (Only effective on Cs contouring control)

0 : When the value of a move command from the CNC is positive (+), the spindle rotates in the CCW direction.

1 : When the value of a move command from the CNC is positive (+), the spindle rotates in the CW direction.

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3001	4001				**SSDIRC**				

SSDIRC Indication of the mounting direction of spindle sensor

0 : The spindle and spindle sensor rotate in the same direction.

1 : The spindle and spindle sensor rotate in the reverse direction.

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3002	4002				**CSDRCT**				

CSDRCT Selection of using the rotation direction signal (SFR/SRV) on Cs contouring control

0 : Using the rotation direction signal

1 : Not using the rotation direction signal

5. Additional information

There are some cases that the delay at reversal point can't be compensated only by backlash acceleration function because of the large mechanical backlash in case of the spindle, which is connected to the motor by some gears. In such case, there is a possibility that the delay at reversal point might be well compensated by following settings.

- Use Dual position feedback function together
- Set a value, which is equal to the amount of mechanical backlash, in Backlash compensation parameter (No.1851)
- Set following parameter

15*i*	16*i*, 30*i*, 0*i*	#7	#6	#5	#4	#3	#2	#1	#0
3005	4005						**HBKLEN**		

HBKLEN Destination to add backlash compensation at using Dual position feedback

0 : Error counter for full-closed side

1 : Error counter for semi-closed side **<- Set this bit**

				TITLE	Spindle Backlash Acceleration Function Specifications
01	11.10.25	Tajima	Newly designed	DRAW. No. B-65280EN/08-10	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 8/8

Revision of αi series Spindle Software
(9D90/J(10), 9DA0/M(13))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/J(10), 9DA0/M(13)	Add	2011.12

				TITLE	Revision of αi series Spindle software (9D90/J(10),9DA0/M(13)
01	11.12.5	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-11	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/3

Revision of αi series Spindle Software (9D90/J(10),9DA0/M(13))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition J(10)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i* -B/C, 0*i* -D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition M(13)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30 *i*//31 *i*//32 *i*/-B, 35 *i*/-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/J	9DA0/M
(1)	Spindle backlash acceleration function was revised. Spindle backlash acceleration function has made the compensation depending on the acceleration value at reversal point since first. However there are some cases that it doesn't work effectively in low speed circle. Therefore we've revised it so that the compensation can be done effectively by specified parameter value irrespective of acceleration value. Please refer to the technical report (B-65280EN/08-10)	○	○
(2)	Energy saving level selecting function is supported. Please refer to the technical report A-93722 in detail.	-	○
(3)	In spindle EGB(Electric Gear Box), in order to follow the master axis of EGB precisely, the No.4036 (Feed forward coefficient) normally should be set to 100%. At that time, No.4036 is applied to both to following command for master axis and to superimposed CNC command. Now a new specification is added, that feed forward coefficient for the following command for master axis is fixed as 100% and No.4036 is applied only to superimposed CNC command. No.4548#6 0: The feed forward coefficient for following command for master axis is No.4036 1: The feed forward coefficient for following command for master axis is 100% regardless of No.4036.	○	○
(4)	Spindle inertia estimation function was improved. The applicable inertia range was expanded to ten times of former one.	○	○

○ : Revised item - : Not supported

				TITLE	Revision of αi series Spindle software (9D90/J(10),9DA0/M(13)
01	11.12.5	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-11	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3

4. Contents of modification

	Contents	9D90/J	9DA0/M
(5)	The protect operation was added to the torque command calculation not to output over the tolerable current limit of the amplifier for improvement of reliability.	○	○
(6)	A problem, which might occur in using “U-axis control”, was corrected. “U-axis control” is used to control the servo axis called U-axis which is on the spindle axis. The function is realized by input of spindle feedback pulses to Separate detector I/F unit for servo axes. We found that there is a possibility that U-axis might move slightly at the turning on CNC if the following conditions are satisfied. We revised it in this software edition. - The output pulses from JX4(A/B phase TTL) on a spindle amplifier is used for input pulsed to Separate detector I/F unit for servo axes to use “U-axis control”. - The DI signal for “U-axis control” (Gn067.4) is “1” at turning on CNC. - The spindle had rotated before tuning off CNC - Only the CNC was turned off/on keeping the power of spindle amplifier.	-	○
(7)	In the former edition, disconnection alarm occurs, when the following action is executed. - Detach the spindle - After that, the power of CNC turns off/on At this moment, the alarm occurs. In this software edition, it was fixed.	-	○

○ : Revised item - : Not supported

Divided backlash compensation output in non-cutting mode for Cs contour control Specifications

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Addition of correspondence of spindle software series	Correct	2012.10

				TITLE	Divided backlash compensation output in non-cutting mode for Cs contour control Specifications
02	12.10.12	Tajima	02 Edition added (page 3 changed)		
01	11.12.28	Tajima	Newly designed	DRAW. No. B-65280EN/08-12	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/5

Divided backlash compensation output in non-cutting mode for Cs contour control Specifications

1. Outline

There is a case that we use Dual position feedback function together with using the method to add backlash compensation to the error counter for semi-closed side to improve the delay of reverse of Cs contour control axis in cutting. It is used for the axis, which has relatively large backlash because of large reduction ratio between the motor and the spindle, like in large rotary table. In such case, it' s necessary to set relatively large backlash compensation to improve the reversal behavior in cutting. However there is a possibility that the large position command and instantaneous large backlash compensation might cause a shock in the machine in "non-cutting mode"(NOTE).

We added the new specification that we can give the divided backlash compensation in non-cutting mode. It becomes possible not to output backlash compensation instantly but to output it gently, and becomes possible to reduce the mechanical shock.

NOTE
"non-cutting mode" includes the rapid traverse, Jog feed and handle mode.
The divided compensation will be invalid at the handle interrupt during AUTO mode.

2. Series and Editions of Applicable Spindle Software

	Series	Edition	Usable CNC
	9D5A	N(14) edition or later	FS0*i*-D
	9D5D	B(02) edition or later	FS0*i*- D
	9D7A	C (03) edition or later	FS30*i* / FS31*i* / FS32*i*-A
	9D8A	A (01) edition or later	FS0*i*-D, FS30*i* / FS31*i* / FS32*i*-A
②	9D90	P (16) edition or later	FS0*i*-D, FS30*i* / FS31*i* / FS32*i*-A
②	9DA0	S (19) edition or later	FS0*i*-D, FS30*i* / FS31*i* / FS32*i* / FS35*i* -B

Note) 9D5A series, 9D5D series, 9D7A series and 9D8A series are the successor of 9D50 series, 9D53 series, 9D70 series and 9D80 series respectively.

3. Parameter

3.1. Related parameter table

Parameter number 30*i* ,0*i*-D	Content
1851	Backlash compensation amount
4600	Divided amount for backlash compensation

3.2. Explanation of parameters

30*i*, 0*i*-D

1851	**Backlash compensaiton amount**

Unig : Detection unit

Range : -9999~9999

Please set backlash compensation amout for each axis

30*i*, 0*i*-D

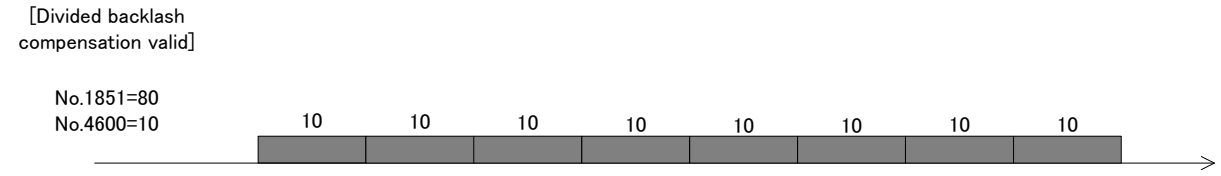
4600	**Divided amount of backlash compensation**

Unit : Detection unit

データ範囲 : -9999~9999

Please set the divided backlash compensation for non-cutting mode. It is derived from No.1851 and should be smaller than No.1851.

We show an example of No.1851=80 and No.4600=10 as following
In normal backlash compensation, the amount “80” is output in one shot.
But when we set No.4600=10, the amount “10” is output in eighth times.
(If No.1851 is not divisible by No.4600, the remainder is output in the last time compensation.)



3.3. A parameter for reference

Please set the following parameter to input backlash compensation to the error counter for semi-closed side when you use Dual position feedback function.

30*i*, 0*i*-D	#7	#6	#5	#4	#3	#2	#1	#0
4005						**HBKLEN**		

HBKLEN Destination to add backlash compensation at using Dual position feedback

0 : Error counter for full-closed side

1 : Error counter for semi-closed side **<- Set this bit**

				TITLE	Divided backlash compensation output in non-cutting mode for Cs contour control Specifications
01	11.12.28	Tajima	Newly designed	DRAW. No. B-65280EN/08-12	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 5/5

Revision of αi series Spindle Software
(9D5A/N(14), 9D5D/B(02), 9D7A/C(03), 9D8A/A(01))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./ Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	- Revision of spindle software 9D5A/N(14) - Revision of spindle software 9D5D/B(02) - Revision of spindle software 9D7A/C(03) - Revision of spindle software 9D8A/A (01) from 9D80/Y(25) - Addition of model codes for automatic initial parameter setting	Add	2011.12

Revision of αi series Spindle Software (9D5A/N(14), 9D5D/B(02), 9D7A/C(03), 9D8A/A(01))

1. Outline

   αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition N(14)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0*i*-B/C Induction spindle motor
9D5D edition B(02)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Synchronous spindle motor
9D7A edition C(03)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30*i*/31*i*/32*i*-A, Induction/ synchronous spindle motor
9D8A *) edition A(01)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-D, 0*i*-B/C, 15*i*-MB , PM*i*-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0*i*-D Induction spindle motor

*) 9D8A series is the successor of 9D80 series. 9D80/Y was revised to 9D8A/A.

- Only the name of the spindle software was changed.
- The specification No. of the amplifier is not changed.
- 9D8A series was revised from 9D80 series, and has an upper compatibility with 9D80 series.

3. Contents of modification

Contents of modification	9D5A/N	9D5D/B	9D7A/C	9D8A/A
1) When the large backlash compensation for Cs contour control is set in case of existing large backlash in the axis which has large reduction ratio between motor and spindle, there is a possibility that a shock occurs in handle movement due to the instant adding of large compensation. So we've prepared the new function that the divided backlash compensation can be output in non-cutting mode. Please refer to the technical report B-65280EN/08-12 in detail.	○	○	○	○
2) Some model codes for automatic initial parameter setting are added. They are - the combination of βiI 6/10000 and βiSVSPx-18 - the combination of βiI 8/10000 and βiSVSPx-18 - the combination of βiI 12/8000 and βiSVSPx-18 - the combination of βiI 15/7000 and βiSVSPx-18 - the combination of βiI_p 15/6000 and βiSVSPx-18 - the combination of βiI_p 18/6000 and βiSVSPx-18 - the combination of βiI_p 22/6000 and βiSVSPx-18 - the combination of βiI_p 30/6000 and βiSVSPx-18 - the combination of βiI_p 22/6000 and βiSVSPx-15 Please refer to item 4 about the concrete parameters.	○	—	—	○

○ : Revised item − : Not supported

				TITLE	Revision of αi series Spindle software (9D5A/N(14), 9D5D/B(02), 9D7A/C(03), 9D8A/A(01))	
01	11.12.28	Tomiyama	Newly designed	DRAW. No.	B-65280EN/08-13	CUST.
Ed.	Date	Design.		FANUC CORPORATION		SHEET 3/6

4. Addition of model codes for AC SPINDLE MOTOR βi series

4.1 Outline

Model codes for FANUC AC SPINDLE MOTOR βi series are added.

Spindle motor	Amplifier	Model code
βiI$_P$ 15/6000 (A06B-1442-…)	βiSVSP*-18 (A06B-6164-…)	354
βiI$_P$ 18/6000 (A06B-1443-…)	βiSVSP*-18 (A06B-6164-…)	355
βiI$_P$ 22/6000 (A06B-1459-…)	βiSVSP*-15 (A06B-6134-… A06B-6164-…)	356
βiI$_P$ 22/6000 (A06B-1459-…)	βiSVSP*-18 (A06B-6164-…)	357
βiI$_P$ 30/6000 (A06B-1499-…)	βiSVSP*-18 (A06B-6164-…)	358
βiI 6/10000 (A06B-1445-…)	βiSVSP*-18 (A06B-6164-…)	359
βiI 8/10000 (A06B-1446-…)	βiSVSP*-18 (A06B-6164-…)	360
βiI 12/8000 (A06B-1447-…)	βiSVSP*-18 (A06B-6164-…)	361
βiI 15/7000 (A06B-1498-…)	βiSVSP*-18 (A06B-6164-…)	362

4.2 Added parameter tables

Spindle motor βiI series

Motor model	βiI 6/10000	βiI 8/10000	βiI 12/8000	βiI 15/7000
Applicable amplifier	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18
Model code	359	360	361	362
Applicable software series and edition	9D8A/A	9D8A/A	9D8A/A	9D8A/A
Continuous rated characteristics	5.5kW 2000/10000min^{-1}	7.5kW 2000/10000min^{-1}	11kW 2000/8000min^{-1}	15kW 2000/7000min^{-1}
15−min. rated characteristics	7.5kW 1500/10000min^{-1}	11kW 1500/10000min^{-1}	15kW 1500/8000min^{-1}	18.5kW 1500/7000min^{-1}
FS0*i*				
4007	00000000	00000000	00000000	00000000
4008	00000000	00000000	00000000	00000000
4009	00000000	00000000	00000000	00000000
4010	00010000	00010000	00010000	00010000
4011	00011001	00011010	00011010	00011010
4012	10000000	10000000	10000000	10000000
4013	00001100	00001100	00001100	00001100
4019	00000100	00000100	00000100	00000100
4020	10000	10000	8000	7000
4023				
4039	0	0	0	0
4040				
4041				
4048				
4049				
4080	14170	75	60	15445
4083	30	30	30	30
4093	0	0	0	0
4100	1550	1500	1550	1550
4101	90	95	82	81
4102	2621	2602	1844	1610
4103	58	64	80	0
4104	2000	2000	3000	2500
4105	0	0	0	0
4106	5500	6000	8000	5000
4107	0	0	0	0
4108	0	0	0	0
4109	25	25	25	25
4110	1040	1774	1375	1426
4111	208	381	355	389
4112	200	200	200	200
4113	800	500	705	298
4114	0	0	23040	0
4115	100	100	100	100
4116	7395	8000	6300	4344
4117	90	90	90	90
4118	100	100	100	100
4119	12	19	14	32
4120	0	0	0	0
4124	0	0	0	0
4127	150	161	150	136
4128	115	78	95	0
4129	0	0	0	0
4130	25700	25700	25700	25700
4134	110	110	110	130
4136	0	0	0	0
4138	0	0	0	0
4139	0	0	0	0
4140	0	0	0	0
4141	0	0	0	0
4142	0	0	0	0
4143	0	0	0	0
4144	0	0	0	0
4145	0	0	0	0
4146	0	0	0	0
4147	0	0	0	0
4148	0	0	0	0
4149	0	0	0	0
4150	0	0	0	0
4151	0	0	0	0
4152	0	0	0	0
4153	0	0	0	0
4154	0	0	0	0
4155	0	0	0	0
4156	0	0	0	0
4158	0	0	0	0
4159	0	0	0	0
4161	0	0	0	0
4165	0	0	0	0
4166	0	0	0	0
4169	0	0	0	0

Spindle motor $\beta i I_P$ series

Motor model	βi IP 15/6000	βi IP 18/6000	βi IP 22/6000	βi IP 22/6000	βi IP 30/6000
Applicable amplifier	βi SVSPx-18	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18	βi SVSPx-18
Model code	354	355	356	357	358
Applicable software series and edition	9D8A/A	9D8A/A	9D5A/N 9D8A/A	9D8A/A	9D8A/A
Continuous rated characteristics	7.5kW 1200/6000min^{-1}	9kW 1000/6000min^{-1}	11kW 1000/6000min^{-1}	11kW 1000/6000min^{-1}	15kW 1000/6000min^{-1}
15−min. rated characteristics	9kW 750/6000min^{-1}	11kW 750/6000min^{-1}	15kW 750/6000min^{-1}	15kW 750/6000min^{-1}	18.5kW 750/6000min^{-1}
FS0i					
4007	00000000	00000000	00000000	00000000	00000000
4008	00010000	00010000	00010000	00010000	00010000
4009	00000000	00000000	00000000	00000000	00000000
4010	00010000	00010000	00010000	00010000	00010000
4011	00001010	00001010	00001010	00001010	00001010
4012	10000000	10000000	10000000	10000000	10000000
4013	00001100	00001100	00001100	00001100	00001100
4019	00000100	00000100	00000100	00000100	00000100
4020	6000	6000	6000	6000	6000
4023					
4039	0	0	0	0	0
4040					
4041					
4048					
4049					
4080	20575	21845	19275	19275	16730
4083	30	30	30	30	30
4093	0	0	0	0	0
4100	750	750	770	770	750
4101	79	79	100	100	100
4102	1566	1191	953	953	1007
4103	0	0	0	0	0
4104	2000	3000	4000	4000	3500
4105	0	0	0	0	0
4106	7000	7000	9000	9000	8000
4107	0	0	0	0	0
4108	0	0	0	0	0
4109	25	25	25	25	25
4110	1886	1586	1077	1436	1143
4111	503	410	333	333	334
4112	200	200	200	200	200
4113	228	268	300	300	300
4114	0	0	20480	20480	0
4115	100	100	100	100	100
4116	5307	4194	4408	4408	4298
4117	90	90	90	90	90
4118	100	100	100	100	100
4119	42	36	32	32	32
4120	0	0	0	0	0
4124	0	0	0	0	0
4127	132	134	150	150	136
4128	90	105	103	103	0
4129	0	0	0	0	0
4130	25700	25700	25700	25700	25700
4134	130	130	130	130	130
4136	0	0	0	0	0
4138	0	0	0	0	0
4139	0	0	0	0	0
4140	0	0	0	0	0
4141	0	0	0	0	0
4142	0	0	0	0	0
4143	0	0	0	0	0
4144	0	0	0	0	0
4145	0	0	0	0	0
4146	0	0	0	0	0
4147	0	0	0	0	0
4148	0	0	0	0	0
4149	0	0	0	0	0
4150	0	0	0	0	0
4151	0	0	0	0	0
4152	0	0	0	0	0
4153	0	0	0	0	0
4154	0	0	0	0	0
4155	0	0	0	0	0
4156	0	0	0	0	0
4158	0	0	0	0	0
4159	0	0	0	0	0
4161	0	0	0	0	0
4165	0	0	0	0	0
4166	0	0	0	0	0
4169	0	0	0	0	0

Revision of αi series Spindle Software
(9D90/K(11), 9DA0/N(14))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/K(11), 9DA0/N(14)	Add	2012.02

				TITLE	Revision of αi series Spindle software (9D90/K(11),9DA0/N(14)
01	12.02.10	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-14	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D90/K(11),9DA0/N(14))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition K(11)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-B/C, 0*i*-D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition N(14)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30*i*//31*i*//32*i*/-B, 35 *i*-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/K	9DA0/N
(1)	In Cs contour control, IS-D (0.00001 deg) command was supported. Please refer to the technical report (A-97077E-009) to know detail information.	-	○
(2)	The following data was added as measurable spindle data by SERVO GUIDE. **TCMD2 : Torque command value in consideration of torque limit.** Generally speaking, spindle motors are used by limited output torque according to velocity in order to achieve specified output characteristics. A generally used torque command data TCMD output the value, which shows the maximum torque value of spindle motor as 100%. Even if spindle motor outputs specified maximum torque, there are some cases that TCMD doesn't show 100%. In this revision, we prepared data TCMD2, which shows the specified limited torque value as 100%. We recommend you to use data TCMD2 when you want to know the margin to the limit of torque, for example, in case of the adjustment of FSSB High-speed rigid tapping. It's necessary to prepare SERVO GUIDE 8.10 edition or later in order to observe data TCMD2.	○	○

○ : Revised item - : Not supported

				TITLE	Revision of αi series Spindle software (9D90/K(11),9DA0/N(14)
01	12.02.10	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-14	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Load meter

(Normalized by cont. rated output)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

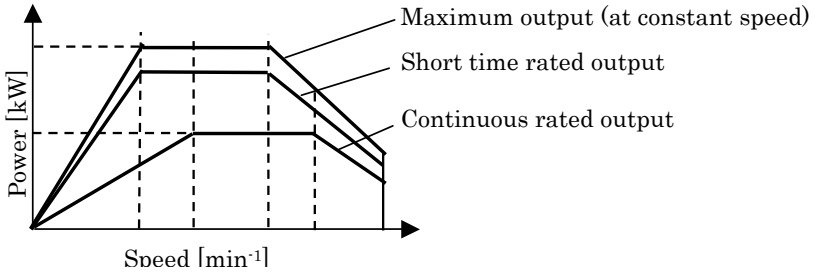
Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function	Load meter (Normalized by cont. rated output) was added.	Add	2012.05
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another			

Load meter (Normalized by cont. rated output)

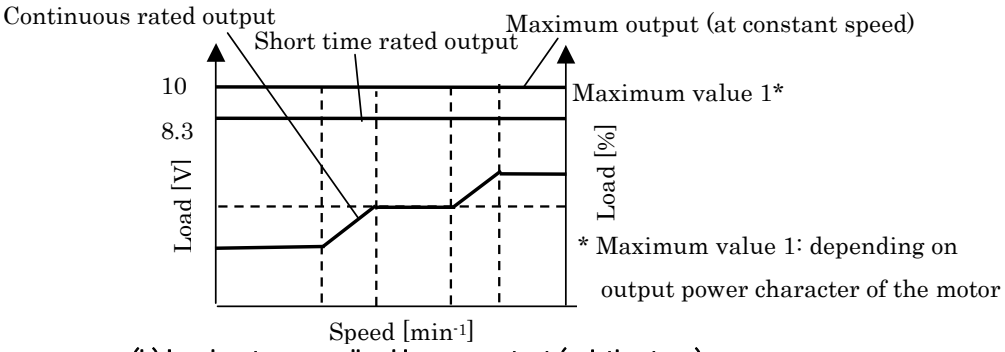
1. Outline

We added the new type of load meter which is normalized by continuous rated output and in addition to the existing load meter which is normalized by maximum output. It's possible to select appropriate type in two types.

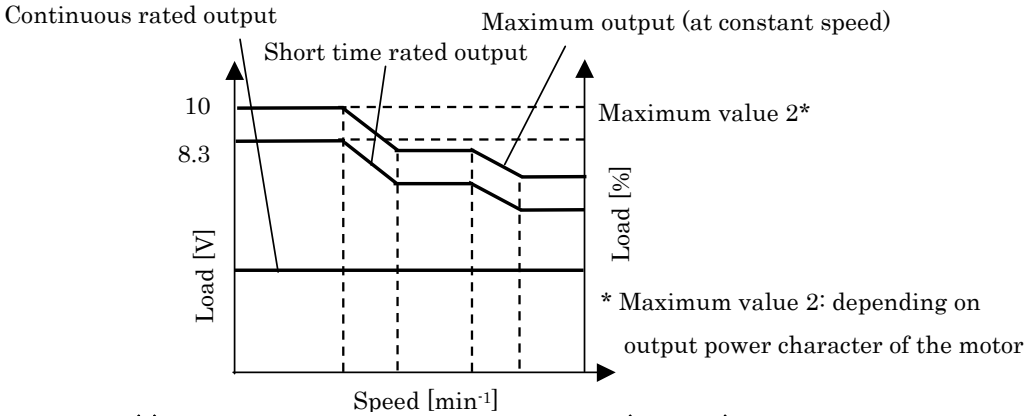
- Existing load meter normalized by max. output shows the character that load meter value becomes constant at maximum output in all speed. It is suited to watch the margin to the maximum output. (The example of this type load meter is shown as Fig.(b) when the motor output character is Fig.(a).)
- New load meter normalized by cont. rated output shows the character that load meter value becomes constant at continuous rated output in all speed. It is suited to watch the margin to the continuous rated output. (The example of this type load meter is shown as Fig.(c) when the motor output character is Fig.(a).)



(a) Output power character of spindle motor



(b) Load meter normalized by max. output (existing type)



(c) Load meter normalized by cont. rated output (new type)

Fig 1. Output power character and Load meter

				TITLE: Load meter (Normalized by cont. rated output)	
01	12.05.17	Li	Newly designed	DRAW. No. B-65280EN/08-15	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/6

Note)
*1 It's impossible to apply load meter normalized by max. output and load meter normalized by cont. rated output together.
*2 It's impossible to select different load meter type in main axis and sub axis of spindle switching control.

2. Series and editions of applicable spindle software

Series	Edition	Usable CNC
9D90	G (07) edition or later	FS0*i*- D , FS30*i* / FS31*i* / FS32*i*-A
9DA0	I (09) edition or later	FS30*i* / FS31*i* / FS32*i*-B, FS35*i*-B

3. Parameter

3.1. Parameter list

Parameter No.				Contents	Remarks
MH	ML	SH	SL		
4352#3	←	←	←	Switching bit for changing load meter type (Normalized by max. output / Normalized by cont. rated output)	New parameter
4127	4093	4274	4279	Load meter value at max. output	A parameter depending on motor model (This parameter has been used since previous. But the meaning of this parameter is changed at using load meter normalized by cont. rated output.) (Ref. 3-2)
4612	4614	4728	4730	Parameter (1) for load meter normalized by cont. rated output	New parameter depending on motor model (Ref. 3-2)
4613	4615	4729	4731	Parameter (2) for load meter normalized by cont. rated output	New parameter depending on motor model (Ref. 3-2)
4353#3	←	←	←	Selection bit of detection base for load detection level signal (LDT1A and LDT2A)	New parameter
4026	←	4201	←	Load detection level 1	This parameter has been used since previous to determine load detection level. But the meaning of this parameter is changed at using load meter normalized by cont. rated output. (Ref. 3-2)
4027	←	←	←	Load detection level 2	This parameter has been used since previous to determine load detection level. But the meaning of this parameter is changed at using load meter normalized by cont. rated output. (Ref. 3-2)

Note)
MH: Parameter number for high speed winding in main side used in spindle switching control
ML: Parameter number for low speed winding in main side used in spindle switching control
SH: Parameter number for high speed winding in sub side used in spindle switching control
SL: Parameter number for low speed winding in sub side used in spindle switching control

3.2. Details of parameters

		#7	#6	#5	#4	#3	#2	#1	#0
MAIN/SUB	4352					**LMTYPE**			

LMTYPE Selection of load meter type (Regarding load meter type, please find Fig. 1.)

0 : Load meter normalized by max. output

1 : Load meter normalized by cont. rated output

MH	4127	**Load meter value at max. output**
ML	4093	**Same as above**
SH	4274	**Same as above**
SL	4279	**Same as above**

Setting value : This is the motor-specific parameter. Please find the following table to know the value.

MH	4612	**Parameter (1) for load meter normalized by cont. rated output**
ML	4614	**Same as above**
SH	4728	**Same as above**
SL	4730	**Same as above**

Setting value : This is the motor-specific parameter. Please find the following table to know the value.

MH	4613	**Parameter (2) for load meter normalized by cont. rated output**
ML	4615	**Same as above**
SH	4729	**Same as above**
SL	4731	**Same as above**

Setting value : This is the motor-specific parameter. Please find the following table to know the value.

Parameter table for ai series power up models Load meter parameter table

Motor model				αi I 6/10000		αi I 8/8000		αi I 12/7000	
Applicable amplifier				αi SP11		αi SP15		αi SP15	
Drawing No.				A06B-1406-Bxxx#0Pxx		A06B-1407-Bxxx#0Pxx		A06B-1408-Bxxx#0Pxx	
Low-speed winding characteristics				–		–		–	
High-speed winding characteristics				5.5/7.5/11kW		7.5/11/15		11/15/18.5	
				1500/10000min^{-1}		1500/8000		1500/7000	
FS30*i*				Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)	Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)	Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)
MH	ML	SH	SL						
4127	4093	4274	4279	240(*1)	240	240(*1)	240	202(*1)	202
4352 #3	←	←	←	0(*1)	1	0(*1)	1	0(*1)	1
4612	4614	4728	4730	0(*1)	97	0(*1)	75	0(*1)	127
4613	4615	4729	4731	0(*1)	21643	0(*1)	16514	0(*1)	16774

Motor model				αi I 15/7000		αi I 18/7000		αi I 22/7000	
Applicable amplifier				αi SP22		αi SP22		αi SP26	
Drawing No.				A06B-1409-Bxxx#0Pxx		A06B-1410-Bxxx#0Pxx		A06B-1411-Bxxx#0Pxx	
Low-speed winding characteristics				–		–		–	
High-speed winding characteristics				15/18.5/25		18.5/22/30		22/26/35	
				1500/7000		1500/7000		1500/7000	
FS30*i*				Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)	Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)	Load meter (Normalized by max. output)	Load meter (Normalized by cont. rated output)
MH	ML	SH	SL						
4127	4093	4274	4279	200(*1)	202	195(*1)	195	191(*1)	191
4352 #3	←	←	←	0(*1)	1	0(*1)	1	0(*1)	1
4612	4614	4728	4730	0(*1)	128	0(*1)	132	0(*1)	134
4613	4615	4729	4731	0(*1)	16531	0(*1)	16778	0(*1)	16771

(*1) Standard setting

Note)
Please ask the parameters for other motor models to our sales engineers, if you need.

		#7	#6	#5	#4	#3	#2	#1	#0
MAIN/SUB	4353					**LMTDET**			

LMTDET Selection bit of detection base for load detection level signal (LDT1A and LDT2A)
0 : The detection base for load detection level signal is that max. output is 100%, regardless of load meter type.
1 : If load meter normalized by cont. rated output is used, the detection base for load detection level signal is that cont. rated output is 100%.

MAIN	4026	**Load detection level 1**
SUB	4455	**Same as above**

Unit of data : 1%
Valid data range : Refer to the following table
Standard setting value : 83

				TITLE	Load meter (Normalized by cont. rated output)
01	12.05.17	Li	Newly designed	DRAW. No. B-65280EN/08-15	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 5/6

This parameter determines the detection level for load detection signal 1 (LDT1A).

The load detection signal 1 (LDT1A) will become "1", when the output value of spindle motor becomes larger than setting value(%).

LMTYPE (N4352#3)	0		1	
LDTDET (N4353#3)	0	1	0	1
Detection base	Max. output (=100%)			Cont. rated output (=100%)
Unit of data	1% (If the setting value is negative, the unit becomes 0.1%.)			1%
Valid data range	-1000~100			0~32767
Standard setting	83			

4027 **Load detection level 2**

Unit of data : 1%

Valid data range : Refer to the following table

Standard setting value : 95

This parameter determines the detection level for load detection signal 2 (LDT2A).

The load detection signal 2 (LDT2A) will become "1", when the output value of spindle motor becomes larger than setting value(%).

LMTYPE (N4352#3)	0		1	
LDTDET (N4353#3)	0	1	0	1
Detection base	Max. output (=100%)			Cont. rated output (=100%)
Unit of data	1% (If the setting value is negative, the unit becomes 0.1%.)			1%
Valid data range	-1000~100			0~32767
Standard setting	95			

Note)
When you change this parameter, please turn CNC off/on.

Addition of parameter table for AC SPINDLE MOTOR αi series

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series FANUC AC SPINDLE MOTOR βi series FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date	
Basic Function				
Optional Function				
Unit				
Maintenance Parts				
Notice				
Correction	Parameter tables for αiI 6/10000 driven by βiSVSP were corrected.	Correct	Oct. 2012	(*2)
Another	Parameter tables for the following spindle motor models are added. (1) Parameter tables for αiI series (Power up model) αiI 6/10000, αiI 8/8000, αiI 12/7000 αiI 15/7000, αiI 18/7000, αiI 22/7000 (2) Parameter tables for αiI series driven by βiSVSP	Add	May 2012	

Addition of parameter table for AC SPINDLE MOTOR αi series

1. General

Parameter tables for some motor models of FANUC AC SPINDLE MOTOR αi series are added.

2. Addition of parameter table of spindle motor αi series (Power up model)

Added models

No.	Spindle motor	Amplifier	Model code
1	αiI6/10000 (A06B-1406-Bxxx#xPxx)	αiSP 11 βi SVSPx-11	363
2	αiI8/8000 (A06B-1407-Bxxx#xPxx)	αiSP 15 βi SVSPx-15	364
3	αiI12/7000 (A06B-1408-Bxxx#xPxx)	αiSP 15	365
		βi SVSPx-18	369
4	αiI15/7000 (A06B-1409-Bxxx#xPxx)	αiSP 22	366
5	αiI18/7000 (A06B-1410-Bxxx#xPxx)	αiSP 22	367
6	αiI22/7000 (A06B-1411-Bxxx#xPxx)	αiSP 26	368

Spindle motor αiI series (Power up model) can be driven by level-up αi series spindle amplifier (A06B-614x-…) or spindle amplifier for 30i-B series CNC (A06B-6220-…).
No.1, 2 and 3 can be driven by βi SVSP (A06B-6164-Hxxx#H580) also. Please refer item 3 for details.

Parameter setting method

(1) Load parameters automatically with model code (from 363 to 368).
(2) In case of No.1, 5 and 6, change parameter No.4400 manually according to the parameter table on the following page.

Parameter table for αiI series (Power up model)

Motor model		αi I 6/10000	αi I 8/8000	αi I 12/7000	αi I 15/7000	αi I 18/7000	αi I 22/7000
Applicable amplifier		αi SP11	αi SP15	αi SP15	αi SP22	αi SP22	αi SP26
Model code		363	364	365	366	367	368
Applicable software series and edition		9D8A/B 9DA0/P	9D8A/B 9DA0/P	9D8A/B 9DA0/P	9D8A/B 9DA0/P	9D8A/B 9DA0/P	9D8A/B 9DA0/P
Low-speed winding characteristics		–	–	–	–	–	–
High-speed winding characteristics		5.5/7.5/11kW 1500/10000min^{-1}	7.5/11/15kW 1500/8000min^{-1}	11/15/18.5kW 1500/7000min^{-1}	15/18.5/25kW 1500/7000min^{-1}	18.5/22/30kW 1500/7000min^{-1}	22/26/35kW 1500/7000min^{-1}
FS30i -A FS30i -B	FS0i -D FS0i Mate-D						
4007	4007	00000000	00000000	00000000	00000000	00000000	00000000
4008	4008	00010000	00010000	00010000	00010000	00010000	00010000
4009	4009	00000000	00000000	00000000	00000000	00000000	00000000
4010	4010	00000000	00000000	00000000	00000000	00000000	00000000
4011	4011	00001010	00001010	00001010	00001010	00001010	00001010
4012	4012	10000111	10000010	10000010	10000010	10000111	10000111
4013	4013	00001100	00001100	00001100	00001100	00001100	00001100
4019	4019	00000100	00000100	00000100	00000100	00000100	00000100
4020	4020	10000	8000	7000	7000	7000	7000
4023	4023						
4039	4039	0	0	0	0	0	0
4040	4040						
4041	4041						
4048	4048						
4049	4049						
4080	4080	16710	20565	16735	24410	18005	15460
4083	4083	30	30	30	30	30	30
4093	4093	0	0	0	0	0	0
4100	4100	1570	1600	1550	1500	1700	1550
4101	4101	100	94	100	100	100	100
4102	4102	2016	1656	1922	1710	1909	1756
4103	4103	0	0	0	0	0	0
4104	4104	3000	6000	3000	5500	1600	1500
4105	4105	0	0	0	0	0	0
4106	4106	6000	20000	10000	5500	5000	5000
4107	4107	0	0	0	0	0	0
4108	4108	0	0	0	0	0	0
4109	4109	25	25	25	25	25	25
4110	4110	603	754	905	794	943	924
4111	4111	261	265	337	305	418	353
4112	4112	200	200	200	200	200	200
4113	4113	690	790	295	304	308	290
4114	4114	0	19200	0	23040	0	23040
4115	4115	100	100	100	100	100	100
4116	4116	6500	8118	5279	5177	4500	5000
4117	4117	90	90	90	90	90	90
4118	4118	100	100	100	100	100	100
4119	4119	527	12	32	31	31	29
4120	4120	0	0	0	0	0	0
4124	4124	0	0	0	0	0	0
4127	4127	240	240	202	200	195	191
4128	4128	6505	117	0	105	0	0
4129	4129	0	0	0	0	0	0
4130	4130	25700	25700	25700	25700	25700	25700
4134	4134	130	130	130	130	130	130
4136	4136	0	0	0	0	0	0
4138	4138	0	0	0	0	0	0
4139	4139	0	0	0	0	0	0
4140	4140	0	0	0	0	0	0
4141	4141	0	0	0	0	0	0
4142	4142	0	0	0	0	0	0
4143	4143	0	0	0	0	0	0
4144	4144	0	0	0	0	0	0
4145	4145	0	0	0	0	0	0
4146	4146	0	0	0	0	0	0
4147	4147	0	0	0	0	0	0
4148	4148	0	0	0	0	0	0
4149	4149	0	0	0	0	0	0
4150	4150	0	0	0	0	0	0
4151	4151	0	0	0	0	0	0
4152	4152	0	0	0	0	0	0
4153	4153	0	0	0	0	0	0
4154	4154	0	0	0	0	0	0
4155	4155	0	0	0	0	0	0
4156	4156	0	0	0	0	0	0
4158	4158	0	0	0	0	0	0
4159	4159	0	0	0	0	0	0
4161	4161	0	0	0	0	0	0
4165	4165	0	0	0	0	0	0
4166	4166	0	0	0	0	0	0
4169	4169	0	0	0	0	0	0
4400	4400	00000001 (*6)				00000001 (*6)	00000001 (*6)
Maximum output during acceleration (for PS selection)		13.2kW	18.0kW	22.2kW	30.0kW	36.0kW	42.0kW

(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 3/12

3. Addition of parameter table of spindle motor αi series driven by βi SVSP.

Added models

Parameter tables for spindle motor αiI series, αiI$_P$ series and αiI$_T$ series which can be driven by βi SVSP (A06B-6164-Hxxx#H580) are added.
Parameter tables of αiI6/10000, αiI8/8000, αiI12/7000 are for the power up model described in item 2.

Parameter setting method

(1) Load parameters automatically with model code according to the parameter table on the following pages.
When the motor has model code with round brackets, use model code in brackets.
When the motor has no model code, use model code 300 (400 for motor with speed-range switching control).
(2) Change parameter manually according to the parameter table.

Parameter table for αiI series (1/4)

Motor model	αi I 0.5/10000	αi I 0.5/10000	αi I 0.5/10000	αi I 1/10000	αi I 1/10000	αi I 1/10000	αi I 1.5/10000	αi I 1.5/10000	αi I 1.5/10000
Applicable amplifier	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15
Model code	(301)	(301)	(301)	(302)	(302)	(302)	(304)	(304)	(304)
Applicable software series and edition	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A
Low-speed winding characteristics	–	–	–	–	–	–	–	–	–
High-speed winding characteristics	0.55/1.1kW 3000/10000min^{-1}	0.55/1.1kW 3000/10000min^{-1}	0.55/1.1kW 3000/10000min^{-1}	1.5/2.2kW 3000/10000min^{-1}	1.5/2.2kW 3000/10000min^{-1}	1.5/2.2kW 3000/10000min^{-1}	1.1/3.7kW 1500/10000min^{-1}	1.1/3.7kW 1500/10000min^{-1}	1.1/3.7kW 1500/10000min^{-1}
FS0*i*-D FS0*i* Mate-D									
4007	00000000	←	←	00000000	←	←	00000000	←	←
4008	00000000	←	←	00000000	←	←	00000000	←	←
4009	00000000	←	←	00000000	←	←	00000000	←	←
4010	00000000	←	←	00000000	←	←	00000000	←	←
4011	00011000	←	←	00011001	←	←	00011001	←	←
4012	10000010	←	←	10000010	←	←	10000010	←	←
4013	00001100	←	←	00001100	←	←	00001100	←	←
4019	00000100	←	←	00000100	←	←	00000100	←	←
4020	10000	←	←	10000	←	←	10000	←	←
4023									
4039	0	←	←	0	←	←	0	←	←
4040									
4041									
4048									
4049									
4080	90	←	←	83 80(*1)	←	←	85 65(*1)	←	←
4083	30	←	←	30	←	←	30	←	←
4093	0	←	←	0	←	←	0	←	←
4100	3400	←	←	3100	←	←	1650	←	←
4101	100	←	←	100	←	←	100	←	←
4102	6500	←	←	3557	←	←	2767	←	←
4103	46 0(*1)	←	←	87 0(*1)	←	←	60 0(*1)	←	←
4104	3000	←	←	6000	←	←	6000	←	←
4105	0	←	←	0	←	←	0	←	←
4106	7500	←	←	6000	←	←	6000	←	←
4107	0	←	←	0	←	←	0	←	←
4108	0	←	←	0	←	←	0	←	←
4109	25	←	←	25	←	←	25	←	←
4110	2513 (*6)	3142 (*6)	4713 (*6)	1104 (*6)	1380 (*6)	2070 (*6)	900 (*6)	1126 (*6)	1689 (*6)
4111	260	←	←	102	←	←	217	←	←
4112	200	←	←	200	←	←	200	←	←
4113	2077	←	←	2100	←	←	1635	←	←
4114	23040	←	←	17920	←	←	0	←	←
4115	100	←	←	100	←	←	100	←	←
4116	13760	←	←	10018	←	←	9598	←	←
4117	90	←	←	90	←	←	90	←	←
4118	100	←	←	100	←	←	100	←	←
4119	5	←	←	5	←	←	5	←	←
4120	0	←	←	0	←	←	0	←	←
4124	0	←	←	0	←	←	0	←	←
4127	240	←	←	176	←	←	404	←	←
4128	120	←	←	0	←	←	115	←	←
4129	0	←	←	0	←	←	0	←	←
4130	25700	←	←	25700	←	←	25700	←	←
4134	110	←	←	110	←	←	110	←	←
4136	0	←	←	0	←	←	0	←	←
4138	0	←	←	0	←	←	0	←	←
4139	0	←	←	0	←	←	0	←	←
4140	0	←	←	0	←	←	0	←	←
4141	0	←	←	0	←	←	0	←	←
4142	0	←	←	0	←	←	0	←	←
4143	0	←	←	0	←	←	0	←	←
4144	0	←	←	0	←	←	0	←	←
4145	0	←	←	0	←	←	0	←	←
4146	0	←	←	0	←	←	0	←	←
4147	0	←	←	0	←	←	0	←	←
4148	0	←	←	0	←	←	0	←	←
4149	0	←	←	0	←	←	0	←	←
4150	0	←	←	0	←	←	0	←	←
4151	0	←	←	0	←	←	0	←	←
4152	0	←	←	0	←	←	0	←	←
4153	0	←	←	0	←	←	0	←	←
4154	0	←	←	0	←	←	0	←	←
4155	0	←	←	0	←	←	0	←	←
4156	0	←	←	0	←	←	0	←	←
4158	0	←	←	0	←	←	0	←	←
4159	0	←	←	0	←	←	0	←	←
4161	0	←	←	0	←	←	0	←	←
4165	0	←	←	0	←	←	0	←	←
4166	0	←	←	0	←	←	0	←	←
4169	0	←	←	0	←	←	0	←	←
4400									
Maximum output during acceleration (for PS selection)	1.32kW 2.60kW(*1)	1.32kW 2.60kW(*1)	1.32kW 2.60kW(*1)	2.64kW 2.87kW(*1)	2.64kW 2.87kW(*1)	2.64kW 2.87kW(*1)	4.44kW 6.7kW(*1)	4.44kW 6.7kW(*1)	4.44kW 6.7kW(*1)

(*1) This setting makes the maximum output during acceleration greater and the acceleration time reduced.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 5/12

Parameter table for αiI series (2/4)

Motor model	αi I 2/10000	αi I 2/10000	αi I 2/10000	αi I 3/10000	αi I 3/10000	αi I 3/10000
Applicable amplifier	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15
Model code	(306)	(306)	(306)	(308)	(308)	(308)
Applicable software series and edition	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A
Low-speed winding characteristics	–	–	–	–	–	–
High-speed winding characteristics	2.2/3.7kW 1500/10000min^{-1}	2.2/3.7kW 1500/10000min^{-1}	2.2/3.7kW 1500/10000min^{-1}	3.7/5.5kW 1500/10000min^{-1}	3.7/5.5kW 1500/10000min^{-1}	3.7/5.5kW 1500/10000min^{-1}
FS0*i*-D FS0*i* Mate-D						
4007	00000000	←	←	00000000	←	←
4008	00000000	←	←	00000000	←	←
4009	00000000	←	←	00000000	←	←
4010	00000000	←	←	00000000	←	←
4011	00011001	←	←	00011001	←	←
4012	10000010	←	←	10000010	←	←
4013	00001100	←	←	00001100	←	←
4019	00000100	←	←	00000100	←	←
4020	10000	←	←	10000	←	←
4023						
4039	0	←	←	0	←	←
4040						
4041						
4048						
4049						
4080	77 70(*1)	←	←	60 65(*1)	←	←
4083	30	←	←	30	←	←
4093	0	←	←	0	←	←
4100	1550	←	←	1600	←	←
4101	100	←	←	100	←	←
4102	2567	←	←	1967	←	←
4103	68 0(*1)	←	←	75 0(*1)	←	←
4104	6000	←	←	7000	←	←
4105	0	←	←	0	←	←
4106	6000	←	←	7000	←	←
4107	0	←	←	0	←	←
4108	0	←	←	0	←	←
4109	25	←	←	25	←	←
4110	758 (*6)	948 (*6)	1422 (*6)	760 (*6)	950 (*6)	1425 (*6)
4111	175	←	←	200	←	←
4112	200	←	←	19400	←	←
4113	1192	←	←	1077	←	←
4114	0	←	←	0	←	←
4115	100	←	←	100	←	←
4116	9300	←	←	7950	←	←
4117	90	←	←	28250	←	←
4118	100	←	←	110	←	←
4119	8	←	←	5	←	←
4120	0	←	←	0	←	←
4124	0	←	←	0	←	←
4127	202	←	←	178	←	←
4128	90	←	←	0	←	←
4129	0	←	←	0	←	←
4130	25700	←	←	25700	←	←
4134	110	←	←	110	←	←
4136	0	←	←	0	←	←
4138	0	←	←	0	←	←
4139	0	←	←	0	←	←
4140	0	←	←	0	←	←
4141	0	←	←	0	←	←
4142	0	←	←	0	←	←
4143	0	←	←	0	←	←
4144	0	←	←	0	←	←
4145	0	←	←	0	←	←
4146	0	←	←	0	←	←
4147	0	←	←	0	←	←
4148	0	←	←	0	←	←
4149	0	←	←	0	←	←
4150	0	←	←	0	←	←
4151	0	←	←	0	←	←
4152	0	←	←	0	←	←
4153	0	←	←	0	←	←
4154	0	←	←	0	←	←
4155	0	←	←	0	←	←
4156	0	←	←	0	←	←
4158	0	←	←	0	←	←
4159	0	←	←	0	←	←
4161	0	←	←	0	←	←
4165	0	←	←	0	←	←
4166	0	←	←	0	←	←
4169	0	←	←	0	←	←
4400						
Maximum output during acceleration (for PS selection)	4.44kW 6.4kW(*1)	4.44kW 6.4kW(*1)	4.44kW 6.4kW(*1)	6.6kW 7.9kW(*1)	6.6kW 7.9kW(*1)	6.6kW 7.9kW(*1)

(*1) This setting makes the maximum output during acceleration greater and the acceleration time reduced.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 6/12

Parameter table for αiI series (3/4)

Motor model	αi I 6/10000	αi I 6/10000	αi I 6/10000	αi I 8/8000	αi I 8/8000	αi I 12/7000
Applicable amplifier	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18	βi SVSPx-18
Model code	363	(363)	(363)	364	(364)	369
Applicable software series and edition	9D8A/D (*2)	9D8A/D(*2)	9D8A/D(*2)	9D8A/B	9D8A/B	9D8A/B
Low-speed winding characteristics	–	–	–	–	–	–
High-speed winding characteristics	5.5/7.5/11kW 1500/10000min^{-1}	5.5/7.5/11kW 1500/10000min^{-1}	5.5/7.5/11kW 1500/10000min^{-1}	7.5/11/15kW 1500/8000min^{-1}	7.5/11/15kW 1500/8000min^{-1}	11/15/18.5kW 1500/7000min^{-1}
FS0i-D FS0i Mate-D						
4007	00000000	←	←	00000000	←	00000000
4008	00010000	←	←	00000000	←	00010000
4009	00000000	←	←	00000000	←	00000000
4010	00000000	←	←	00000000	←	00000000
4011	00001010	←	←	00011010	←	00001010
4012	10000111	←	←	10000010	←	10000010
4013	00001100	←	←	00001100	←	00001100
4019	00000100	←	←	00000100	←	00000100
4020	10000	←	←	8000	←	7000
4023						
4039	0	←	←	0	←	0
4040						
4041						
4048						
4049						
4080	16710	←	←	75	←	16735
4083	30	←	←	30	←	30
4093	0	←	←	0	←	0
4100	1570	←	←	1600	←	1550
4101	100	←	←	100	←	100
4102	2016	←	←	1656	←	1922
4103	0	←	←	0	←	0
4104	3000	←	←	8000	←	3000
4105	0	←	←	0	←	0
4106	6000	←	←	8000	←	10000
4107	0	←	←	0	←	0
4108	0	←	←	0	←	0
4109	25	←	←	25	←	25
4110	603	1131 (*6)	1508 (*6)	754	1006 (*6)	1207
4111	261	←	←	170	←	337
4112	200	←	←	200	←	200
4113	690	←	←	790	←	295
4114	0	←	←	19200	←	0
4115	100	←	←	100	←	100
4116	6500	←	←	8118	←	5279
4117	90	←	←	90	←	90
4118	100	←	←	100	←	100
4119	527	←	←	12	←	32
4120	0	←	←	0	←	0
4124	0	←	←	0	←	0
4127	240	←	←	176	←	202
4128	6505	←	←	117	←	0
4129	0	←	←	0	←	0
4130	25700	←	←	25700	←	25700
4134	130	←	←	130	←	130
4136	0	←	←	0	←	0
4138	0	←	←	0	←	0
4139	0	←	←	0	←	0
4140	0	←	←	0	←	0
4141	0	←	←	0	←	0
4142	0	←	←	0	←	0
4143	0	←	←	0	←	0
4144	0	←	←	0	←	0
4145	0	←	←	0	←	0
4146	0	←	←	0	←	0
4147	0	←	←	0	←	0
4148	0	←	←	0	←	0
4149	0	←	←	0	←	0
4150	0	←	←	0	←	0
4151	0	←	←	0	←	0
4152	0	←	←	0	←	0
4153	0	←	←	0	←	0
4154	0	←	←	0	←	0
4155	0	←	←	0	←	0
4156	0	←	←	0	←	0
4158	0	←	←	0	←	0
4159	0	←	←	0	←	0
4161	0	←	←	0	←	0
4165	0	←	←	0	←	0
4166	0	←	←	0	←	0
4169	0	←	←	0	←	0
4400	00000001(*6)	←	←			
Maximum output during acceleration (for PS selection)	13.2kW	13.2kW	13.2kW	18.0kW	18.0kW	22.2kW

(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE: Addition of parameter table for AC SPINDLE MOTOR αi series
02	12.10.02	Li	Software editions were corrected. (marked *2)	
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16 / CUST.
Ed.	Date	Design.		FANUC CORPORATION / SHEET 7/12

Parameter table for αi I series (4/4)

Motor model	αi I 1/15000	αi I 1/15000	αi I 1/15000	αi I 1.5/20000	αi I 1.5/20000	αi I 2/20000	αi I 3/12000	αi I 3/12000	αi I 3/12000
Applicable amplifier	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15	βi SVSPx-15	βi SVSPx-18	βi SVSPx-18	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18
Model code	(303)	(303)	(303)	305	(305)	(307)	309	(309)	(309)
Applicable software series and edition	9D8A/B	9D8A/B	9D8A/B	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A
Low-speed winding characteristics	–	–	–	–	–	–	–	–	–
High-speed winding characteristics	1.5/2.2kW 3000/15000min^{-1}	1.5/2.2kW 3000/15000min^{-1}	1.5/2.2kW 3000/15000min^{-1}	1.5/2.2kW 3000/20000min^{-1}	1.5/2.2kW 3000/20000min^{-1}	2.2/3.7kW 3000/20000min^{-1}	3.7/5.5kW 1500/12000min^{-1}	3.7/5.5kW 1500/12000min^{-1}	3.7/5.5kW 1500/12000min^{-1}
FS0i -D FS0i Mate-D									
4007	00000000	←	←	00000000	←	00000000	00000000	←	←
4008	00000000	←	←	00000000	←	00000000	00000000	←	←
4009	00000000	←	←	00000000	←	00000000	00000000	←	←
4010	00000001	←	←	00000001	←	00000001	00000000	←	←
4011	00011001	←	←	00011001	←	00011001	00011001	←	←
4012	10000010	←	←	10000010	←	10000010	10000010	←	←
4013	00001100	←	←	00001100	←	01010000	00001100	←	←
4019	00000100	←	←	00000100	←	00000100	00000100	←	←
4020	15000	←	←	20000	←	20000 (*6)	12000	←	←
4023									
4039	0	←	←	0	←	0	0	←	←
4040									
4041									
4048									
4049									
4080	85 80(*1)	←	←	14165	←	19290 (*)	16720	←	←
4083	30	←	←	10	←	10	30	←	←
4093	0	←	←	0	←	0	0	←	←
4100	3100	←	←	3250	←	3200	1500	←	←
4101	93	←	←	33	←	45	87	←	←
4102	8015	←	←	7145	←	6432	3015	←	←
4103	70 0(*1)	←	←	75	←	92	82	←	←
4104	2000	←	←	2300	←	3000	3200	←	←
4105	0	←	←	0	←	0	0	←	←
4106	7000	←	←	8700	←	3000	7500	←	←
4107	0	←	←	0	←	0	0	←	←
4108	0	←	←	0	←	0	0	←	←
4109	25	←	←	25	←	25	25	←	←
4110	548 (*6)	686 (*6)	1029 (*6)	629	838 (*6)	588	559	838 (*6)	1118 (*6)
4111	102	←	←	180	←	175	190	←	←
4112	200	←	←	200	←	200	200	←	←
4113	1870	←	←	2227	←	1800	900	←	←
4114	0	←	←	0	←	0	19200	←	←
4115	100	←	←	90	←	80	100	←	←
4116	9669	←	←	10289	←	16564	7376	←	←
4117	90	←	←	90	←	90	90	←	←
4118	100	←	←	100	←	100	100	←	←
4119	5	←	←	5	←	2	9	←	←
4120	0	←	←	0	←	0	0	←	←
4124	0	←	←	0	←	0	0	←	←
4127	176	←	←	176	←	202	178	←	←
4128	80	←	←	73	←	85	0	←	←
4129	0	←	←	0	←	0	0	←	←
4130	25700	←	←	25700	←	25700	25700	←	←
4134	110	←	←	110	←	110	110	←	←
4136	0	←	←	0	←	0	0	←	←
4138	0	←	←	0	←	0	0	←	←
4139	0	←	←	0	←	0	0	←	←
4140	0	←	←	0	←	0	0	←	←
4141	0	←	←	0	←	0	0	←	←
4142	0	←	←	0	←	0	0	←	←
4143	0	←	←	0	←	0	0	←	←
4144	0	←	←	0	←	0	0	←	←
4145	0	←	←	0	←	0	0	←	←
4146	0	←	←	0	←	0	0	←	←
4147	0	←	←	0	←	0	0	←	←
4148	0	←	←	0	←	0	0	←	←
4149	0	←	←	0	←	0	0	←	←
4150	0	←	←	0	←	0	0	←	←
4151	0	←	←	0	←	0	0	←	←
4152	0	←	←	0	←	0	0	←	←
4153	0	←	←	0	←	0	0	←	←
4154	0	←	←	0	←	0	0	←	←
4155	0	←	←	0	←	0	0	←	←
4156	0	←	←	0	←	0	0	←	←
4158	0	←	←	0	←	0	0	←	←
4159	0	←	←	0	←	0	0	←	←
4161	0	←	←	0	←	0	0	←	←
4165	0	←	←	0	←	0	0	←	←
4166	0	←	←	0	←	0	0	←	←
4169	0	←	←	0	←	0	0	←	←
4400									
Maximum output during acceleration (for PS selection)	5.6kW 7.0kW(*1)	5.6kW 7.0kW(*1)	5.6kW 7.0kW(*1)	13.0kW	13.0kW	20.0kW	13.0kW	13.0kW	13.0kW

(*1) This setting makes the maximum output during acceleration greater and the acceleration time reduced.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 8/12

Parameter table for αi I$_P$ series (1/2)

Motor model	αi I$_P$ 12/6000	αi I$_P$ 12/6000	αi I$_P$ 12/6000	αi I$_P$ 12/8000	αi I$_P$ 12/8000	αi I$_P$ 12/8000	αi I$_P$ 15/6000	αi I$_P$ 15/6000
Applicable amplifier	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18
Model code	407	(407)	(407)	(407)	(407)	(407)	408	(408)
Applicable software series and edition	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A
Low-speed winding characteristics	3.7/7.5kW 500/1500min^{-1}	3.7/7.5kW 500/1500min^{-1}	3.7/7.5kW 500/1500min^{-1}	3.7/7.5kW 500/1500min^{-1}	3.7/7.5kW 500/1500min^{-1}	3.7/7.5kW 500/1500min^{-1}	5/9kW 500/1500min^{-1}	5/9kW 500/1500min^{-1}
High-speed winding characteristics	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/8000min^{-1}	5.5/7.5kW 750/8000min^{-1}	5.5/7.5kW 750/8000min^{-1}	7.5/9kW 750/6000min^{-1}	7.5/9kW 750/6000min^{-1}
FS0i -D FS0i Mate-D								
4007	00000000	←	←	←	←	←	00000000	←
4008	00000000	←	←	←	←	←	00000000	←
4009	00000000	←	←	←	←	←	00000000	←
4010	00000000	←	←	←	←	←	00000000	←
4011	00011010	←	←	←	←	←	00011010	←
4012	10000010	←	←	←	←	←	10000010	←
4013	00001100	←	←	←	←	←	00001100	←
4019	00000100	←	←	←	←	←	00000100	←
4020	6000	←	←	8000 (*6)	←	←	6000	←
4023	125(*2)	←	←	94(*2)	←	←	125(*2)	←
4039	0	←	←	←	←	←	0	←
4040								
4041								
4048								
4049								
4080	11610	←	←	←	←	←	16730	←
4083	30	←	←	←	←	←	30	←
4093	243	←	←	←	←	←	216	←
4100	750	←	←	←	←	←	750	←
4101	100	←	←	←	←	←	90	←
4102	1488	←	←	←	←	←	1431	←
4103	75	←	←	←	←	←	65	←
4104	4000	←	←	←	←	←	3800	←
4105	0	←	←	←	←	←	0	←
4106	10000	←	←	←	←	←	11000	←
4107	0	←	←	←	←	←	0	←
4108	0	←	←	←	←	←	0	←
4109	25	←	←	←	←	←	25	←
4110	815	1222 (*6)	1630 (*6)	815	1222 (*6)	1630 (*6)	1043	1390 (*6)
4111	297	←	←	←	←	←	326	←
4112	200	←	←	←	←	←	200	←
4113	240	←	←	←	←	←	270	←
4114	23040	←	←	←	←	←	23040	←
4115	100	←	←	←	←	←	100	←
4116	5307	←	←	←	←	←	5171	←
4117	90	←	←	←	←	←	90	←
4118	100	←	←	←	←	←	100	←
4119	40	←	←	←	←	←	35	←
4120	0	←	←	←	←	←	0	←
4124	0	←	←	←	←	←	0	←
4127	164	←	←	←	←	←	144	←
4128	105	←	←	←	←	←	105	←
4129	0	←	←	←	←	←	0	←
4130	25700	←	←	←	←	←	25700	←
4134	130	←	←	←	←	←	130	←
4136	30	←	←	←	←	←	30	←
4138	530	←	←	←	←	←	560	←
4139	90	←	←	←	←	←	100	←
4140	887	←	←	←	←	←	1143	←
4141	0	←	←	←	←	←	80	←
4142	6500	←	←	←	←	←	5000	←
4143	15000	←	←	←	←	←	13000	←
4144	0	←	←	←	←	←	0	←
4145	25	←	←	←	←	←	25	←
4146	1494	2241 (*6)	2988 (*6)	1494	2241 (*6)	2988 (*6)	2514	3352 (*6)
4147	565	←	←	←	←	←	816	←
4148	200	←	←	←	←	←	200	←
4149	270	←	←	←	←	←	280	←
4150	23040	←	←	←	←	←	23040	←
4151	100	←	←	←	←	←	100	←
4152	5268	←	←	←	←	←	5170	←
4153	90	←	←	←	←	←	90	←
4154	100	←	←	←	←	←	100	←
4155	0	←	←	←	←	←	0	←
4156	0	←	←	←	←	←	0	←
4158	110	←	←	←	←	←	105	←
4159	0	←	←	←	←	←	0	←
4161	25700	←	←	←	←	←	25700	←
4165	15	←	←	←	←	←	34	←
4166	70	←	←	←	←	←	70	←
4169	0	←	←	←	←	←	0	←
4400								
Maximum output during acceleration (for PS selection)	12.3kW	12.3kW	12.3kW	12.3kW	12.3kW	12.3kW	13.5kW	13.5kW

(*2) When using the SDT signal, manually change the parameters that were automatically set.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 9/12

Parameter table for αi I$_P$ series (2/2)

Motor model	αi I$_P$ 15/8000	αi I$_P$ 15/8000	αi I$_P$ 18/6000	αi I$_P$ 18/6000	αi I$_P$ 18/8000	αi I$_P$ 18/8000
Applicable amplifier	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18
Model code	(408)	(408)	409	(409)	(409)	(409)
Applicable software series and edition	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A
Low-speed winding characteristics	5/9kW 500/1500min^{-1}	5/9kW 500/1500min^{-1}	6/11kW 500/1500min^{-1}	6/11kW 500/1500min^{-1}	6/11kW 500/1500min^{-1}	6/11kW 500/1500min^{-1}
High-speed winding characteristics	7.5/9kW 750/8000min^{-1}	7.5/9kW 750/8000min^{-1}	9/11kW 750/6000min^{-1}	9/11kW 750/6000min^{-1}	9/11kW 750/8000min^{-1}	9/11kW 750/8000min^{-1}
FS0i -D FS0i Mate-D						
4007	00000000	←	00000000	←	←	←
4008	00000000	←	00000000	←	←	←
4009	00000000	←	00000000	←	←	←
4010	00000000	←	00000000	←	←	←
4011	00011010	←	00011010	←	←	←
4012	10000010	←	10000010	←	←	←
4013	00001100	←	00001100	←	←	←
4019	00000100	←	00000100	←	←	←
4020	8000 (*6)	←	6000	←	8000 (*6)	←
4023	94(*2)	←	125(*2)	←	94(*2)	←
4039	0	←	0	←	0	←
4040						
4041						
4048						
4049						
4080	16730	←	75	←	←	←
4083	30	←	30	←	←	←
4093	216	←	220	←	←	←
4100	750	←	740	←	←	←
4101	90	←	100	←	←	←
4102	1431	←	1261	←	←	←
4103	65	←	70	←	←	←
4104	3800	←	5500	←	←	←
4105	0	←	0	←	←	←
4106	11000	←	17000	←	←	←
4107	0	←	0	←	←	←
4108	0	←	0	←	←	←
4109	25	←	25	←	←	←
4110	1043	1390 (*6)	754	1005 (*6)	754	1005 (*6)
4111	326	←	225	←	←	←
4112	200	←	200	←	←	←
4113	270	←	300	←	←	←
4114	23040	←	0	←	←	←
4115	100	←	100	←	←	←
4116	5171	←	5671	←	←	←
4117	90	←	90	←	←	←
4118	100	←	100	←	←	←
4119	35	←	32	←	←	←
4120	0	←	0	←	←	←
4124	0	←	0	←	←	←
4127	144	←	147	←	←	←
4128	105	←	105	←	←	←
4129	0	←	0	←	←	←
4130	25700	←	25700	←	←	←
4134	130	←	130	←	←	←
4136	30	←	30	←	←	←
4138	560	←	500	←	←	←
4139	100	←	90	←	←	←
4140	1143	←	755	←	←	←
4141	80	←	60	←	←	←
4142	5000	←	8000	←	←	←
4143	13000	←	23000	←	←	←
4144	0	←	0	←	←	←
4145	25	←	25	←	←	←
4146	2514	3352 (*6)	1489	1985 (*6)	1489	1985 (*6)
4147	816	←	476	←	←	←
4148	200	←	200	←	←	←
4149	280	←	315	←	←	←
4150	23040	←	0	←	←	←
4151	100	←	100	←	←	←
4152	5170	←	5660	←	←	←
4153	90	←	90	←	←	←
4154	100	←	115	←	←	←
4155	0	←	0	←	←	←
4156	0	←	0	←	←	←
4158	105	←	0	←	←	←
4159	0	←	0	←	←	←
4161	25700	←	25700	←	←	←
4165	34	←	10	←	←	←
4166	70	←	77	←	←	←
4169	0	←	0	←	←	←
4400						
Maximum output during acceleration (for PS selection)	13.5kW	13.5kW	15.1kW	15.1kW	15.1kW	15.1kW

(*2) When using the SDT signal, manually change the parameters that were automatically set.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 10/12

Parameter table for αi I$_T$ series (1/2)

Motor model	αi I$_T$ 1.5/20000	αi I$_T$ 1.5/20000	αi I$_T$ 2/20000	αi I$_T$ 3/12000	αi I$_T$ 3/12000	αi I$_T$ 3/12000
Applicable amplifier	βi SVSPx-15	βi SVSPx-18	βi SVSPx-18	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18
Model code	–	–	–	–	–	–
Applicable software series and edition	–	–	–	–	–	–
Low-speed winding characteristics	–	–	–	–	–	–
High-speed winding characteristics	1.5/2.2kW 3000/20000min^{-1}	1.5/2.2kW 3000/20000min^{-1}	2.2/3.7kW 3000/20000min^{-1}	3.7/5.5kW 1500/12000min^{-1}	3.7/5.5kW 1500/12000min^{-1}	3.7/5.5kW 1500/12000min^{-1}
FS0i-D FS0i Mate-D						
4007	00000000	←	00000000	00000000	←	←
4008	00000000	←	00000000	00000000	←	←
4009	00000000	←	00000000	00000000	←	←
4010	00000001	←	00000001	00000001	←	←
4011	00011001	←	00011001	00011001	←	←
4012	10000010	←	10000010	10000010	←	←
4013	00001100	←	01010000	00001100	←	←
4019	00000100	←	00000100	00000100	←	←
4020	20000	←	20000	12000	←	←
4023						
4039	0	←	0	0	←	←
4040						
4041						
4048						
4049						
4080	14165	←	19290	16720	←	←
4083	10	←	10	30	←	←
4093	0	←	0	0	←	←
4100	3250	←	3200	1500	←	←
4101	33	←	45	87	←	←
4102	7145	←	6432	3015	←	←
4103	75	←	92	82	←	←
4104	2300	←	3000	3200	←	←
4105	0	←	0	0	←	←
4106	8700	←	3000	7500	←	←
4107	0	←	0	0	←	←
4108	0	←	0	0	←	←
4109	25	←	25	25	←	←
4110	629	838	588	559	838	1118
4111	180	←	175	190	←	←
4112	200	←	200	200	←	←
4113	2227	←	1800	900	←	←
4114	0	←	0	19200	←	←
4115	90	←	80	100	←	←
4116	10289	←	16564	7376	←	←
4117	90	←	90	90	←	←
4118	100	←	100	100	←	←
4119	5	←	2	9	←	←
4120	0	←	0	0	←	←
4124	0	←	0	0	←	←
4127	176	←	202	178	←	←
4128	73	←	85	0	←	←
4129	0	←	0	0	←	←
4130	25700	←	25700	25700	←	←
4134	110	←	110	110	←	←
4136	0	←	0	0	←	←
4138	0	←	0	0	←	←
4139	0	←	0	0	←	←
4140	0	←	0	0	←	←
4141	0	←	0	0	←	←
4142	0	←	0	0	←	←
4143	0	←	0	0	←	←
4144	0	←	0	0	←	←
4145	0	←	0	0	←	←
4146	0	←	0	0	←	←
4147	0	←	0	0	←	←
4148	0	←	0	0	←	←
4149	0	←	0	0	←	←
4150	0	←	0	0	←	←
4151	0	←	0	0	←	←
4152	0	←	0	0	←	←
4153	0	←	0	0	←	←
4154	0	←	0	0	←	←
4155	0	←	0	0	←	←
4156	0	←	0	0	←	←
4158	0	←	0	0	←	←
4159	0	←	0	0	←	←
4161	0	←	0	0	←	←
4165	0	←	0	0	←	←
4166	0	←	0	0	←	←
4169	0	←	0	0	←	←
4400						
Maximum output during acceleration (for PS selection)	13.0kW	13.0kW	20.0kW	13.0kW	13.0kW	13.0kW

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 11/12

Parameter table for αi I$_T$ series (2/2)

Motor model	αi I$_T$ 6/12000	αi I$_T$ 6/12000	αi I$_T$ 6/12000(*4)	αi I$_T$ 6/12000(*4)	αi I$_T$ 8/12000	αi I$_T$ 8/12000	αi I$_T$ 8/12000(*4)	αi I$_T$ 8/12000(*4)
Applicable amplifier	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18	βi SVSPx-15	βi SVSPx-18
Model code	–	–	–	–	–	–	–	–
Applicable software series and edition	–	–	–	–	–	–	–	–
Low-speed winding characteristics	5.5/7.5kW 1500/12000min^{-1}	5.5/7.5kW 1500/12000min^{-1}	5.5/7.5kW 1500/12000min^{-1}	5.5/7.5kW 1500/12000min^{-1}	7.5/11kW 1500/12000min^{-1}	7.5/11kW 1500/12000min^{-1}	7.5/11kW 1500/12000min^{-1}	5.5/7.5kW 1500/12000min^{-1}
High-speed winding characteristics	5.5/7.5kW 4000/12000min^{-1}	5.5/7.5kW 4000/12000min^{-1}			7.5/11kW 4000/12000min^{-1}	7.5/11kW 4000/12000min^{-1}	7.5/11kW 4000/12000min^{-1}	
FS0i-D FS0i Mate-D								
4007	00000000	←	00000000	←	00000000	←	00000000	←
4008	00000000	←	00000000	←	00000000	←	00000000	←
4009	00000000	←	00000000	←	00000000	←	00000000	←
4010	00000001	←	00000001	←	00000001	←	00000001	←
4011	00011010	←	00011010	←	00011010	←	00011010	←
4012	10000010	←	10000010	←	10000010	←	10000010	←
4013	00001100	←	00001100	←	00001100	←	00001100	←
4019	00000100	←	00000100	←	00000100	←	00000100	←
4020	12000	←	12000	←	12000	←	12000	←
4023	333(*2)	←			333(*2)	←		
4039	0	←	0	←	0	←	0	←
4040			6(*3)	←			6(*3)	←
4041	6(*3)	←			6(*3)	←		
4048			6(*3)	←			6(*3)	←
4049	6(*3)	←			6(*3)	←		
4080	81	←	58	←	70	←	49	←
4083	30	←	30	←	30	←	30	←
4093	164	←	0	←	176	←	0	←
4100	4200	←	1500	←	3580	←	1500	←
4101	50	←	71	←	100	←	89	←
4102	4561	←	2630	←	3580	←	1642	←
4103	70	←	70	←	0	←	77	←
4104	3000	←	5500	←	2300	←	5000	←
4105	0	←	0	←	0	←	0	←
4106	3000	←	5500	←	2300	←	5000	←
4107	0	←	0	←	0	←	0	←
4108	0	←	0	←	0	←	0	←
4109	25	←	25	←	25	←	25	←
4110	646	861	1131	1508	421	561	566	755
4111	185	←	353	←	100	←	162	←
4112	200	←	200	←	200	←	200	←
4113	650	←	620	←	980	←	1090	←
4114	20480	←	20480	←	0	←	19200	←
4115	100	←	100	←	100	←	100	←
4116	10783	←	8803	←	11031	←	8000	←
4117	90	←	90	←	90	←	90	←
4118	100	←	100	←	100	←	100	←
4119	15	←	527	←	522	←	521	←
4120	0	←	0	←	0	←	0	←
4124	0	←	0	←	0	←	0	←
4127	164	←	164	←	176	←	176	←
4128	95	←	105	←	0	←	0	←
4129	0	←	0	←	0	←	0	←
4130	25700	←	25700	←	25700	←	25700	←
4134	130	←	130	←	130	←	130	←
4136	30	←	0	←	30	←	0	←
4138	1500	←	0	←	1500	←	0	←
4139	71	←	0	←	89	←	0	←
4140	2630	←	0	←	1642	←	0	←
4141	70	←	0	←	77	←	0	←
4142	5500	←	0	←	5000	←	0	←
4143	5500	←	0	←	5000	←	0	←
4144	0	←	0	←	0	←	0	←
4145	25	←	0	←	25	←	0	←
4146	1131	1508	0	1508	566	754	0	←
4147	353	←	0	←	162	←	0	←
4148	200	←	0	←	200	←	0	←
4149	620	←	0	←	1090	←	0	←
4150	20480	←	0	←	19200	←	0	←
4151	100	←	0	←	100	←	0	←
4152	8803	←	0	←	8000	←	0	←
4153	90	←	0	←	90	←	0	←
4154	100	←	0	←	100	←	0	←
4155	0	←	0	←	0	←	0	←
4156	0	←	0	←	0	←	0	←
4158	105	←	0	←	0	←	0	←
4159	0	←	0	←	0	←	0	←
4161	25700	←	0	←	25700	←	0	←
4165	527	←	0	←	521	←	0	←
4166	58	←	0	←	49	←	0	←
4169	0	←	0	←	0	←	0	←
4400								
Maximum output during acceleration (for PS selection)	13.0kW	13.0kW	13.0kW	13.0kW	13.2kW	13.2kW	13.2kW	13.2kW

(*2) When using the SDT signal, manually change the parameters that were automatically set.
(*3) Set this value as the initial value of the velocity loop gain for low-speed characteristics of speed range switching.
(*4) This setting is used when only a low-speed winding is connected without the output range being switched in the output range switching motor.

				TITLE	Addition of parameter table for AC SPINDLE MOTOR αi series
01	12.5.24	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-16	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 12/12

Revision of αi series Spindle Software
(9D5A/O(15), 9D5D/C(03), 9D7A/D(04), 9D8A/B(02))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./ Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	- Revision of spindle software 9D5A/O(15) - Revision of spindle software 9D5D/C(03) - Revision of spindle software 9D7A/D(04) - Revision of spindle software 9D8A/B(02)	Add	2012.05

Revision of αi series Spindle Software (9D5A/O(15), 9D5D/C(03), 9D7A/D(04), 9D8A/B(02))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition O(15)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0*i*-B/C Induction spindle motor
9D5D edition C(03)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Synchronous spindle motor
9D7A edition D(04)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30*i*/31*i*/32*i*-A, Induction/ synchronous spindle motor
9D8A edition B(02)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-D, 0*i*-B/C, 15*i*-MB , PM*i*-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0*i*-D Induction spindle motor

3. Contents of modification

Contents of modification	9D5A/O	9D5D/C	9D7A/D	9D8A/B
The alpha i series spindle motor model codes for initial setting have been added. Please refer to the technical report (B-65280EN/08-16) to know detail information.	○	○	○	○

○ : Revised item　－ : Not supported

				TITLE	Revision of αi series Spindle software (9D5A/O(15), 9D5D/C(03), 9D7A/D(04), 9D8A/B(02))
01	12.05.18	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-17	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3

4. Addition of model codes for AC SPINDLE MOTOR αi series

Spindle motor	Amplifier	Model code
αiI 1/15000 (A06B-1422-…)	αiSP5.5	303
αiI 6/10000 (Power up model) (A06B-1406-Bxxx#xPxx)	αiSP11 (A06B-614x-H011#H580)	363
	βiSVSP*-11 (A06B-6164-…)	
αiI 8/8000 (Power up model) (A06B-1407-Bxxx#xPxx)	αiSP15 (A06B-614x-H015#H580)	364
	βiSVSP*-15 (A06B-6164-…)	
αiI 12/7000 (Power up model) (A06B-1408-Bxxx#xPxx)	αiSP15 (A06B-614x-H015#H580)	365
	βiSVSP*-18 (A06B-6164-…)	369
αiI 15/7000 (Power up model) (A06B-1409-Bxxx#xPxx)	αiSP22 (A06B-614x-H022#H580)	366
αiI 18/7000 (Power up model) (A06B-1410-Bxxx#xPxx)	αiSP22 (A06B-614x-H022#H580)	367
αiI 22/7000 (Power up model) (A06B-1411-Bxxx#xPxx)	αiSP26 (A06B-614x-H026#H580)	368

Revision of αi series Spindle Software
(9D90/M(13), 9DA0/P(16))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/M(13), 9DA0/P(16)	Add	2012.05

				TITLE	Revision of αi series Spindle software (9D90/M(13),9DA0/P(16)
01	12.05.18	Tajima	Newly designed	DRAW. No. B-65280EN/08-18	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D90/M(13),9DA0/P(16))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition M(13)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-B/C, 0*i*-D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition P(16)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30*i*//31*i*//32*i*/-B, 35 *i*-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/M	9DA0/P
(1)	The alpha i series spindle motor model codes for initial setting have been added. Please refer to the technical report (B-65280EN/08-16) to know detail information.	○	○

○ : Revised item - : Not supported

4. Addition of model codes for AC SPINDLE MOTOR αi series

No.	Spindle motor	Amplifier	Model code
1	αiI1/15000	αiSP5.5	303
2	αiI6/10000(power up model) (A06B-1406-Bxxx#xPxx)	αiSP11	363
3	αiI8/8000(power up model) (A06B-1407-Bxxx#xPxx)	αiSP15	364
4	αiI12/7000(power up model) (A06B-1408-Bxxx#xPxx)	αiSP15	365
5	αiI15/7000(power up model) (A06B-1409-Bxxx#xPxx)	αiSP22	366
6	αiI18/7000(power up model) (A06B-1410-Bxxx#xPxx)	αiSP22	367
7	αiI22/7000(power up model) (A06B-1411-Bxxx#xPxx)	αiSP26	368

				TITLE	Revision of αi series Spindle software (9D90/M(13),9DA0/P(16)
01	12.05.18	Tajima	Newly designed	DRAW. No. B-65280EN/08-18	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Revision of αi series Spindle Software
(9D5A/16(P), 9D5D/04(D), 9D7A/05(E), 9D8A/03(C))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./ Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	- Revision of spindle software 9D5A/16(P) - Revision of spindle software 9D5D/04(D) - Revision of spindle software 9D7A/05(E) - Revision of spindle software 9D8A/03(C)	Add	2012.06

Revision of αi series Spindle Software (9D5A/16(P), 9D5D/04(D), 9D7A/05(E), 9D8A/03(C))

1. Outline

   αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition 16(P)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0*i*-B/C Induction spindle motor
9D5D edition 04(D)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16*i*/18*i*/21*i*-B, 0*i*-B/C, 15*i*-MB, PM*i*-D Synchronous spindle motor
9D7A edition 05(E)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30*i*/31*i*/32*i*-A, Induction/ synchronous spindle motor
9D8A edition 03(C)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-D, 0*i*-B/C, 15*i*-MB , PM*i*-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0*i*-D Induction spindle motor

				TITLE: Revision of αi series Spindle software (9D5A/16(P), 9D5D/04(D), 9D7A/05(E), 9D8A/03(C))	
01	12.06.12	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-19	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3

3. Contents of modification

Contents of modification	9D5A/16	9D5D/04	9D7A/05	9D8A/03
The following data was added as measurable spindle data by SERVO GUIDE. **TCMD2 : Torque command value in consideration of torque limit.** Generally speaking, spindle motors are used by limited output torque according to velocity in order to achieve specified output characteristics. A generally used torque command data TCMD output the value, which shows the maximum torque value of spindle motor as 100%. Even if spindle motor outputs specified maximum torque, there are some cases that TCMD doesn't show 100%. In this revision, we prepared data TCMD2, which shows the specified limited torque value as 100%. We recommend you to use data TCMD2 when you want to know the margin to the limit of torque, for example, in case of the adjustment of FSSB High-speed rigid tapping. It's necessary to prepare SERVO GUIDE 8.10 edition or later in order to observe data TCMD2.	○	○	○	○

○ : Revised item　－ : Not supported

				TITLE	Revision of αi series Spindle software (9D5A/16(P), 9D5D/04(D), 9D7A/05(E), 9D8A/03(C))
01	12.06.12	Tomiyama	Newly designed	DRAW. No. B-65280EN/08-19	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 3/3

Revision of αi series Spindle Software
(9D90/N(14), 9DA0/Q(17))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/N(14), 9DA0/Q(17)	Add	2012.06

				TITLE	Revision of αi series Spindle software (9D90/N(14),9DA0/Q(17)
01	12.06.25	Tajima	Newly designed	DRAW. No. B-65280EN/08-20	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D90/N(14),9DA0/Q(17))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition N(14)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-B/C, 0*i*-D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition Q(17)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30*i*//31*i*//32*i*/-B, 35 *i*-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/N	9DA0/Q
(1)	When multiple twin drive motors are used, it becomes possible to use Multi-axes integrator copy and Preload.	○	○

○ : Revised item　－ : Not supported

Note). Please refer to the technical report (B-65280EN/08-21) to know detail information.

				TITLE	Revision of αi series Spindle software (9D90/N(14),9DA0/Q(17)
01	12.06.25	Tajima	Newly designed	DRAW. No. B-65280EN/08-20	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2

Spindle Tandem Control (Improvement of Preload and Multi-axes integrator copy)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function	Addition of the contents for the improvement of the preload and Multi-axes integrator copy in Spindle tandem control	Add	2012.06
Unit			
Maintenance Parts			
Notice			
Correction			
Another			

Spindle Tandem Control
(Improvement of Preload and Multi-axes integrator copy)

1. Outline

The following specification was added in Spindle tandem control.

(1) The preload can be applied between plural twin drive motors.
(2) The Preload and Multi-axes integrator copy for plural tandem groups including Twin drive motors can be switched by a signal.

This manual described about above contents. About other contents for the tandem function, please refer to the section 5.11, 5.13 in Spindle parameter manual (B-65280EN). And, please refer to TMS11/059 (Twin Drive for Spindle Motor) about Twin drive control.

NOTE

*1 The following CNC software option are required for this function.
Case of FS30*i*-A / FS31*i*-A
- Spindle tandem control
- Spindle simple synchronous control

*) FS32i-A doesn't support Spindle tandem control.
Case of FS30*i*-B / FS31*i*-B / FS32*i*-B / FS35*i*-B
- Spindle synchronous control

2. Applicable Spindle Amplifier and Spindle Software

Spindle amplifier drawing	Spindle software		Usable CNC
	Series	Edition	
A06B-6144-Hxxx#H590 (200V) A06B-6154-Hxxx#H590 (400V)	9D90	N(14) or later	FS30*i*-A / FS31*i*-A
A06B-6220-Hxxx#H600 (200V) A06B-6230-Hxxx#H600 (200V) A06B-6270-Hxxx#H600 (400V) A06B-6280-Hxxx#H600 (400V)	9DA0	Q (17) or later	FS30*i* -B / FS31*i*-B FS32*i* -B / FS35*i*-B

3. I/O Signals (CNC↔PMC)

(1) Input signals (PMC→CNC)

	30*i*	#7	#6	#5	#4	#3	#2	#1	#0
1st	G306						**TDFCANA**		
2nd	G310						**TDFCANB**		
3rd	G314						**TDFCANC**		
4th	G318						**TDFCAND**		

TDFCANx Preload and Multi-axes integrator copy for plural tandem groups including Twin drive motors

0： are valid.

1： are invalid.

NOTE

Please pay attention to the following points about this signal TDFCANx.

- As for this signal, the meaning changes by setting of parameter No.4542#3,2. Please refer to the latter explanataion of No.4542#3,2.
- When you turn off preload and an multi-axes integrator copy by this signal TDFCANx, you have to input this signal to all spindle axes related to these functions.

Ex.1) If preload and multi-axes integrator copy are applied to plural twin drive motors, you have to input this signal TDFCANx to the respective master axis of twin drive motor.

Ex.2) If preload is applied to all spindle axes of plural velocity-tandem pairs (No.4360 of all spindles <>0), you have to input this signal TDFCANx to all spindle axes.

4. Parameters

(1) Details of Parameters

	30*i*	#7	#6	#5	#4	#3	#2	#1	#0
	4541		**RVDPOL**						

RVDPOL Master/slave motor rotation direction for the multi-axes integrator copy

0： The rotation directions of the master and slave motors are the same (motor shaft side view).

1： The rotation directions of the master and slave motors are opposite (motor shaft side view).

Set this parameter to the slave axis for the multi-axes integrator copy.

	30*i*	#7	#6	#5	#4	#3	#2	#1	#0
	4542					**TDFCS1**	**TDFCS0**		

TDFCS1,TDFCS0 Setting for invalidation signal TDFCANx of preload and multi-axes integrator copy

0,0： The signal TDFCANx is not used.

0,1： If the signal TDFCANx is “1”, preload becomes invalid.

1,0： If the signal TDFCANx is “1” , both preload and multi-axes integrator copy become invalid.

0,1： Please don’t use this setting. If you use it, it works as the setting (1,0).

NOTE

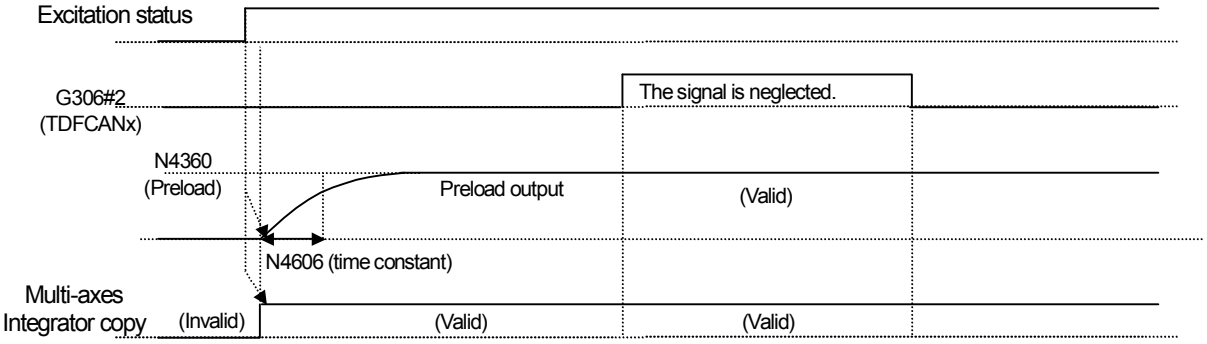
Please set No.4542#3,2 according to the following guide line.

- In case of No.4542#3,2=0,0
  Please use this setting when plural tandem groups are always connected mechanically and it's not necessary to turn OFF/ON preload and multi-axes integrator copy.
- In case of No.4542#3,2=0,1
  Please use this setting when there is a possibility that plural tandem groups are intermittently disconnected mechanically and you want to turn off preload at gear change for example.
- In case of No.4542#3,2=1,0
  Please use this setting when there are cases that the plural tandem groups are driven by connected state and driven by disconnected state. In the disconnected state, it's possible to turn off both preload and multi-axes integrator copy.

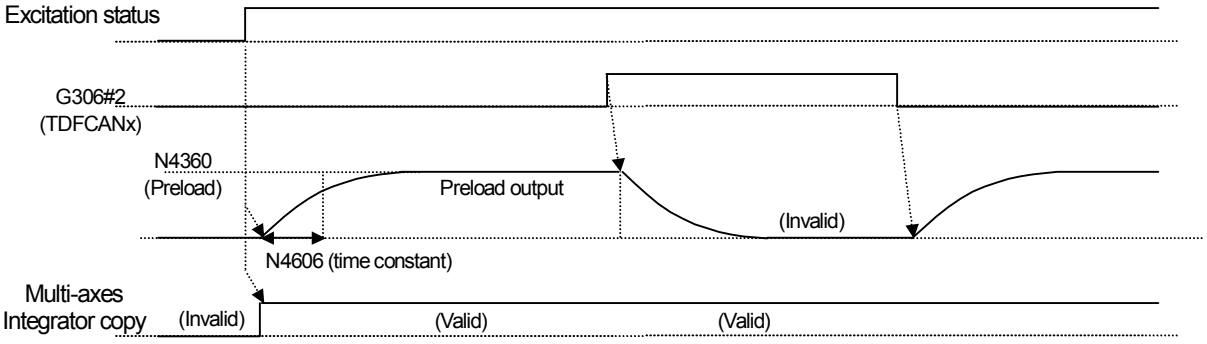
[The behavior at using TDFCANx depending on different parameter setting]

The following figures show the difference of the behavior at inputting TDFCANx signal depending on the different parameter setting (No.4542#3,2). In the following examples, we assume that each tandem group is already in tandem mode, and we show the behavior of only one spindle as example. Therefore, in actual situation, you have to input TDFCANx to other spindle axes too.

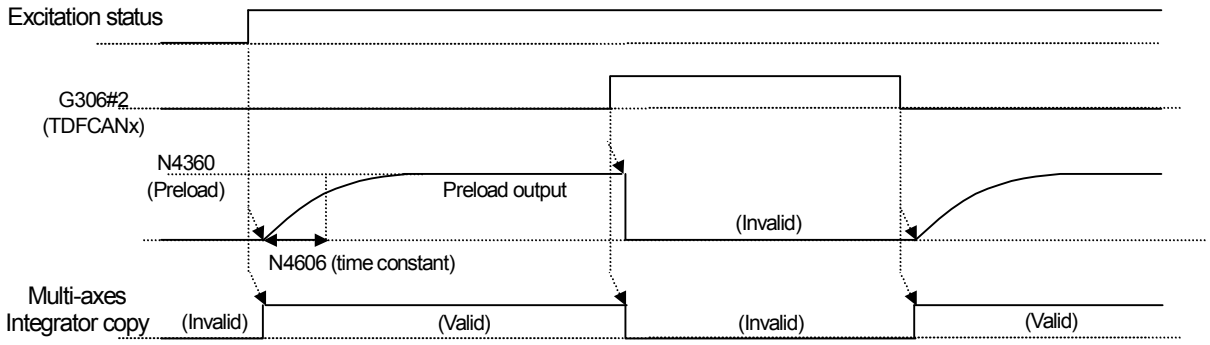
[In case of No.4542#3,2=0,0] The signal (TDFCANx) is neglected.



[In case of No.4542#3,2=0,1]



[In case of No.4542#3,2=1,0 の場合]



30*i*

4597 Setting for the multi-axes integrator copy

Standard setting value : 0

0: The function is invalid.
-1: Please set "-1" to the master axis for the multi-axes integrator copy.
Larger than 0: Please set the number of master axis, which transmits the data, to the slave axis. (Use a logical spindle number of master axis)

30*i*

4360 **Preload value**

Unit of data : ±16384 equivalent to torque command 100%
Valid data range : -8192 to 8192(-50% to +50%)
Standard setting value : 0

Please set preload value.
There is a possibility that this parameter suppresses vibration at the stop caused by backlash.

30*i*

4606 **Preload time constant**

Unit of data : 100msec
Valid data range : 0 to 50
Standard setting value : 0

Please set a time constant for preload to suppress the mechanical shock at inputting preload.
If this parameter is 0, the time constatn will be 32msec.

				TITLE Spindle Tandem Control (Improvement of Preload and Multi-axes integrator copy)	
01	2012.06.18	K.Takahashi	Newly designed	DRAW. No. B-65280EN/08-21	CUST.
Ed.	Date	Design.		FANUC LTD	SHEET 6/6

Change of technical term (Multi-axes integrator copy)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	The name of control way called “Extended integral copy” in Spindle tandem control was changed. It becomes “Multi-axes integrator copy”.	Correct	2012.06

1. Outline

The name of control way called “Extended integral copy” in Spindle tandem control was changed. It becomes “Multi-axes integrator copy”.
This document shows the changed points in parameter manual.

2. Changed points

I 5.11.6 (2) List of parameters

Parameter No. 30*i*	Description
4541#6	Master/slave motor rotation direction relationship for the **Multi-axes integrator copy**
4597	Setting for the **Multi-axes integrator copy**

I 5.11.6 (3) Detail of parameters

The following parameter needs to be set when an **integrator** copy is made between two axes that are driven by spindle simple synchronous control during tandem drive using four or more spindle motors (**Multi-axes integrator copy**). For information about this setting, see also "Additional information 2: Spindle drive using four or more spindle motors" in Subsection 5.11.9, "Additional Information".

30*i*	#7	#6	#5	#4	#3	#2	#1	#0
4541		RVDPOL						

RVDPOL Master/slave motor rotation direction relationship for the **multi-axes integrator copy**

0 : The rotation directions of the master and slave motors are the same during spindle rotation (when viewed from the motor shaft).
1 : The rotation directions of the master and slave motors are opposite during spindle rotation (when viewed from the motor shaft).

Set this parameter for the slave axis for the **multi-axes integrator copy**.

30*i*	
4597	**Setting for the multi-axes integrator copy**

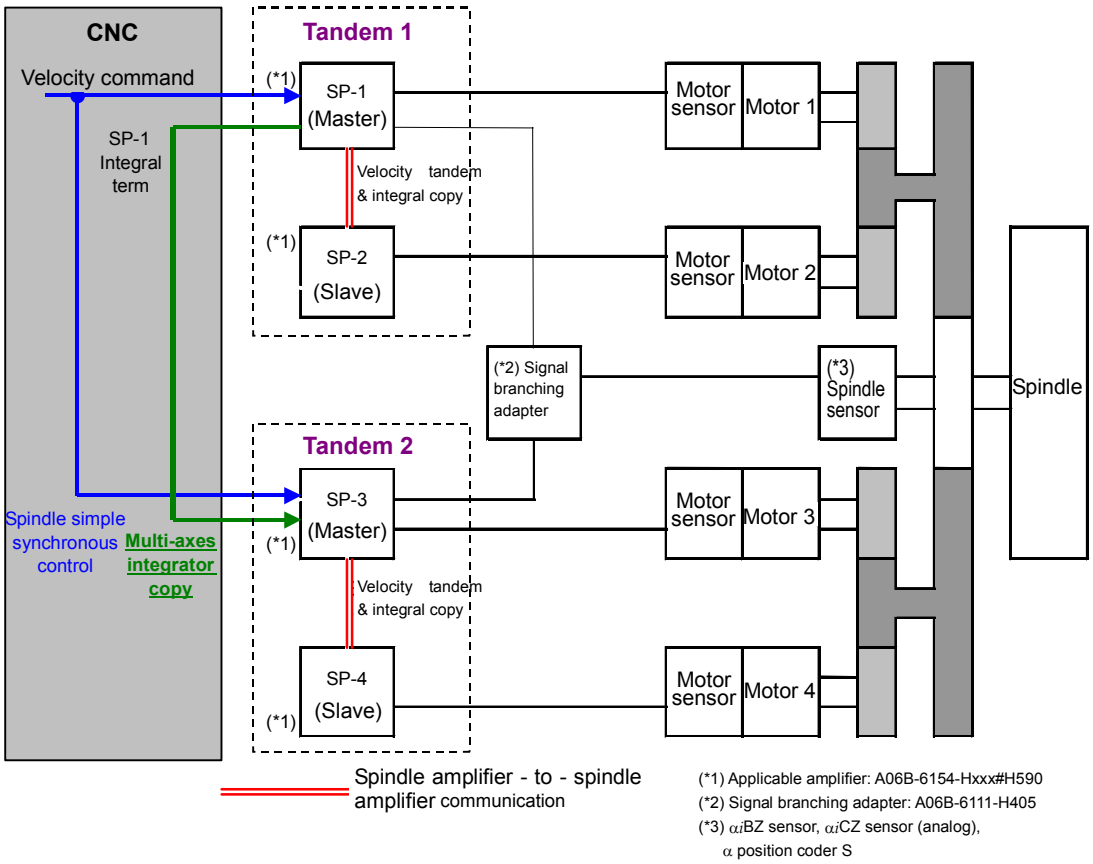
Standard setting value : 0

Sets the master and slave axes for the **multi-axes integrator copy**.

0: The function is disabled.
-1: Setting of the master axis: When "-1" is set, the master axis for the **multi-axes integrator copy** is used.
Larger than 0: Setting of the slave axis: Specify the master axis number to be received in data transfer.
(Use a logical spindle number to specify which spindle is to be used as the master axis.)

(2) System configuration

The following figure shows an example where the velocity tandem function is applied to a machine that drives the spindle with four spindle motors using spindle simple synchronous control.



<1>The spindle is driven by four spindle motors.

<2>The master axes SP-1 and SP-3 of the two tandems are controlled by spindle simple synchronous control.

<3>In this case, the speed integral term can be copied from SP-1 engaged in spindle simple synchronous control to SP-3. This is called "**Multi-axes integrator copy**".

<4>The slave axes SP-2 and SP-4 of the two tandems receive the velocity command and speed integral term from the master axes SP-1 and SP-3 of the tandems and use the received values as their own velocity command and velocity integral term (velocity tandem control).

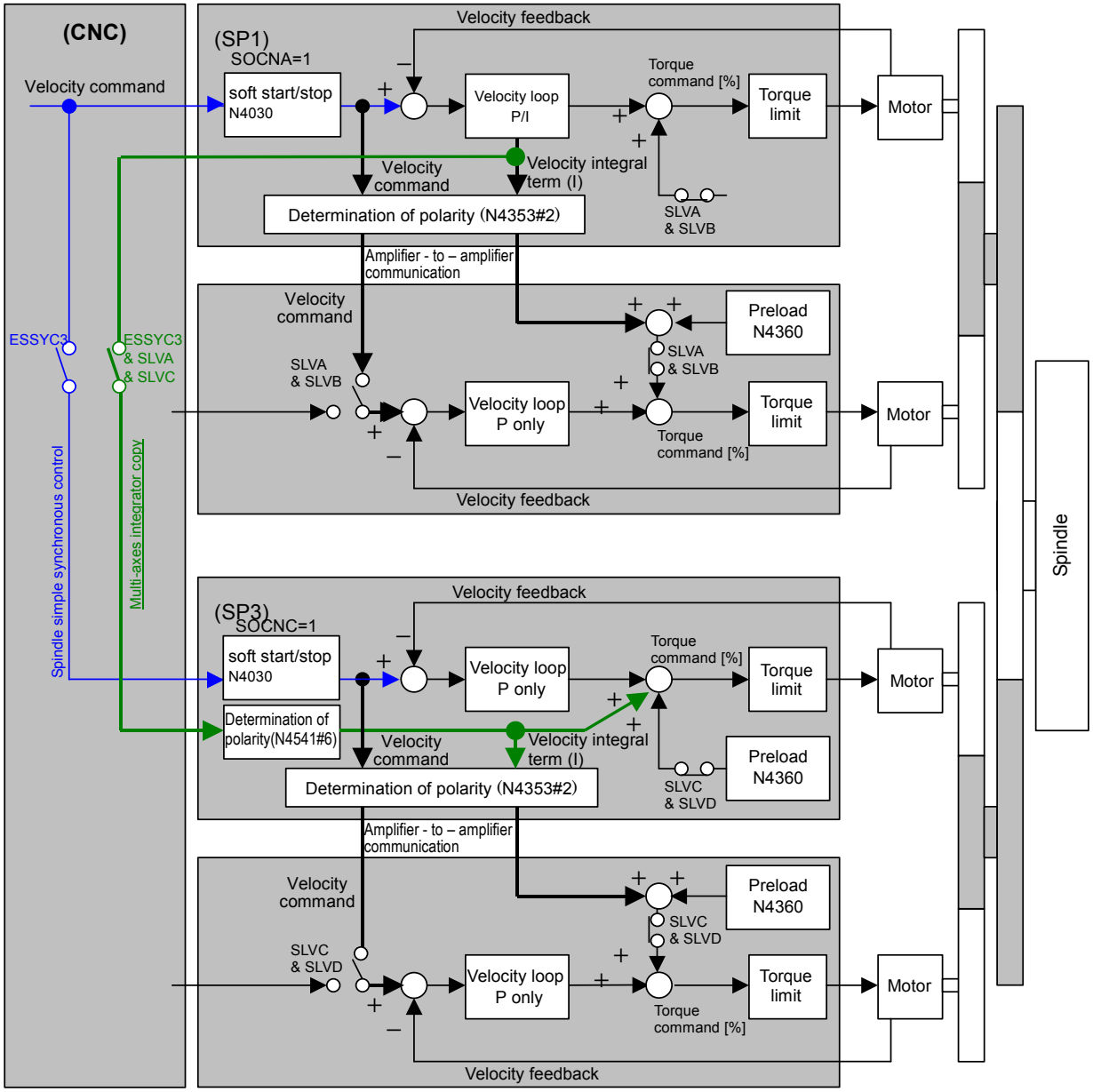
(3) Block diagram

The following figure shows a control block diagram applicable when this function operates using four spindle motors.

<1> The velocity command from the CNC are passed to SP1 and SP3. The soft start/stop function limits the specified acceleration rate to reduce the mechanical shock, and SP1 and SP3 pass the limited command to SP2 and SP4, respectively. Then, each motor exerts velocity control.

<2> SP2 and SP3 receive the integral term from SP1, and SP4 receives the integral term from SP3. They add the received integral term to the proportional term to create a torque command.

<3> Each SP adds the set preload value to this torque command to create a final torque command.

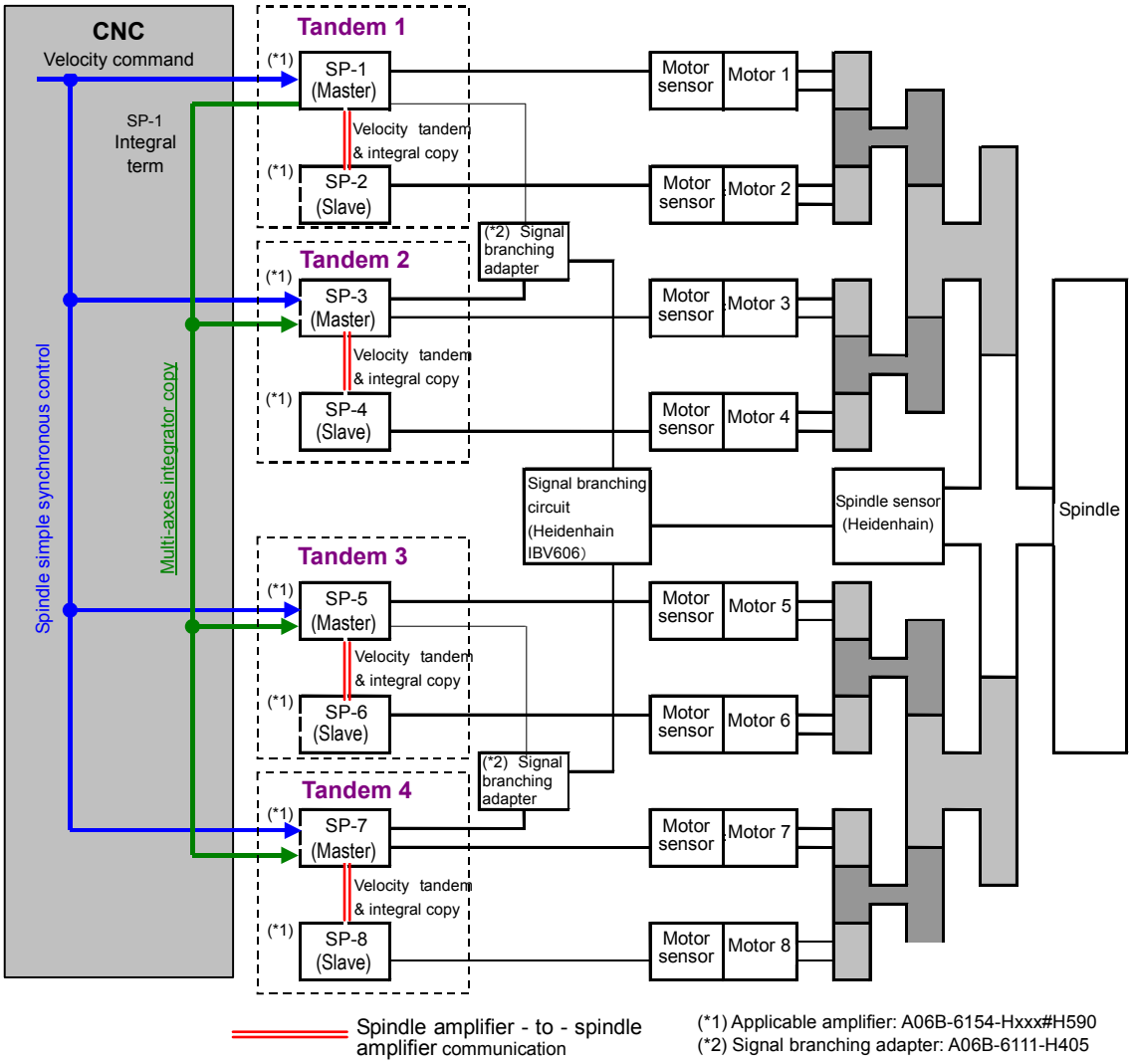


				TITLE	Change of technical term (Multi-axes integrator copy)
01	2012.06.26	Y.Morita	Newly designed	DRAW. No. B-65280EN/08-22	CUST.
Ed.	Date	Design.		FANUC LTD	SHEET 4/5

(5) Setting examples of the parameters related to the integral copy

When the spindle is driven by four velocity tandems (eight motors) as shown in the following figure, the settings related to the velocity integral copy are to be made as indicated by the examples given below.

SP	N4398#5,4,3	N4353#2	N4541#6	N4597	Remarks
SP-1	1,1,0	1	0	-1	Spindle simple synchronous control (+ **multi-axes integrator copy**) master axis Velocity tandem 1 (+ **integrator** copy) master axis
SP-2	1,1,0	-	0	0	Velocity tandem 1 (+ **integrator** copy) slave axis
SP-3	1,1,0	1	0	1	Spindle simple synchronous control (+**multi-axes integrator copy**) slave axis Velocity tandem 2 (+ **integrator** copy) master axis
SP-4	1,1,0	-	0	0	Velocity tandem 2 (+ **integrator** copy) slave axis
SP-5	1,1,0	1	0	1	Spindle simple synchronous control (+**multi-axes integrator copy**) slave axis Velocity tandem 3 (+ **integrator** copy) master axis
SP-6	1,1,0	-	0	0	Velocity tandem 3 (+ **integrator** copy) slave axis
SP-7	1,1,0	1	0	1	Spindle simple synchronous control (+**multi-axes integrator copy**) slave axis Velocity tandem 4 (+ **integrator** copy) master axis
SP-8	1,1,0	-	0	0	Velocity tandem 4 (+ **integrator** copy) slave axis



				TITLE	Change of technical term (Multi-axes integrator copy)
01	2012.06.26	Y.Morita	Newly designed	DRAW. No. B-65280EN/08-22	CUST.
Ed.	Date	Design.		FANUC LTD	SHEET 5/5

Revision of Spindle Software (for speed sensor-less motors)
(9D60/H)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D60/H	Add	2012.06

				TITLE	Revision of Spindle software (for speed sensor-less motors) (9D60/H)
01	12.06.28	Li	Newly designed	DRAW. No. B-65280EN/08-23	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of Spindle Software (for speed sensor-less motors) (9D60/H)

1. General

   Spindle software for speed sensor-less motors was revised as follows.

2. Software series, edition and applied spindle amplifier

Software specification	Series and edition	Amplifier specification	
A06B-6116-H560	9D60 edition H(08)	βiSVSPC	A06B-6167-Hxxx#H560
		βiSVSP	A06B-6165-Hxxx#H560
		βiSVSP	A06B-6134-Hxxx#C
		αCi(SPMC)	A06B-6116-Hxxx#H560

3. Contents of modification

   Power consumption monitor function was added. Please refer to「FANUC Series 0*i*-MODEL D/FANUC Series 0*i* Mate-MODEL D Power consumption monitor Specifications」(A-93067) for detail.

				TITLE	Revision of Spindle software (for speed sensor-less motors) (9D60/H)	
01	12.06.28	Li	Newly designed	DRAW. No.	B-65280EN/08-23	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2	

Revision of αi series Spindle Software
(9D5A/17(Q), 9D5D/05(E), 9D7A/06(F), 9D8A/04(D))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./ Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	- Revision of spindle software 9D5A/17(Q) - Revision of spindle software 9D5D/05(E) - Revision of spindle software 9D7A/06(F) - Revision of spindle software 9D8A/04(D)	Add	2012.10

Revision of αi series Spindle Software
(9D5A/17(Q), 9D5D/05(E), 9D7A/06(F), 9D8A/04(D))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D5A edition 17(Q)	αiSP	A06B-6111-Hxxx#H550 A06B-6112-Hxxx#H550 A06B-6121-Hxxx#H550 A06B-6122-Hxxx#H550	16i/18i/21i-B, 0i-B/C, 15i-MB, PMi-D Induction spindle motor
	βiSVSP	A06B-6134-Hxxx#A A06B-6134-Hxxx#D	0i-B/C Induction spindle motor
9D5D edition 05(E)	αiSP	A06B-6111-Hxxx#H553 A06B-6112-Hxxx#H553 A06B-6121-Hxxx#H553 A06B-6122-Hxxx#H553	16i/18i/21i-B, 0i-B/C, 15i-MB, PMi-D Synchronous spindle motor
9D7A edition 06(F)	αiSP	A06B-6111-Hxxx#H570 A06B-6112-Hxxx#H570 A06B-6121-Hxxx#H570 A06B-6122-Hxxx#H570	30i/31i/32i-A, Induction/ synchronous spindle motor
9D8A edition 04(D)	αiSP	A06B-6141-Hxxx#H580 A06B-6142-Hxxx#H580 A06B-6151-Hxxx#H580 A06B-6152-Hxxx#H580	30i/31i/32i-A, 16i/18i/21i-B, 0i-D, 0i-B/C, 15i-MB , PMi-D Induction/ synchronous spindle motor
	βiSVSP	A06B-6164-Hxxx#H580	0i-D Induction spindle motor

3. Contents of modification

(1) The model code 363 is available for amplifier βiSVSP, and description of model code 363 in technical report B-65280JA/08-16 is corrected as following table.

	Amplifier	Uncorrected	Corrected
Applicable software series and edition of model code 363	βiSVSP	9D8A edition 02(B) or later	9D8A edition 04(D) or later

Please refer to technical report B-65280EN/08-16 (edition 02) for detail information.

				TITLE: Revision of αi series Spindle software (9D5A/17(Q), 9D5D/05(E), 9D7A/06(F), 9D8A/04(D))	
01	12.10.02	Li	Newly designed	DRAW. No. B-65280EN/08-24	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3

(2) The βi series spindle motor model codes for initial setting have been added.

	Model code	Motor	Amplifier
1	347	βiP 12/6000	βiSVSP*-7.5
2	348		βiSVSP*-11
3	349		βiSVSP*-15
4	370		βiSVSP*-18
5	371	βiI 3/6000	

Please refer to technical report B-65280EN/08-25 for detail information.

(3) The parameter lists for αi series spindle motors with βiSVSP*-18 amplifier are added.

	Motor	Amplifier
1	αiI 0.5/10000	βiSVSP*-18
2	αiI 1/10000	
3	αiI 1.5/10000	
4	αiI 2/10000	
5	αiI 3/10000	
6	αiI 1.5/15000	

Please refer to technical report B-65280EN/08-25 for detail information.

				TITLE Revision of αi series Spindle software (9D5A/17(Q), 9D5D/05(E), 9D7A/06(F), 9D8A/04(D))	
01	12.10.02	Li	Newly designed	DRAW. No. B-65280EN/08-24	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 3/3

Addition of parameter tables and model codes for AC SPINDLE MOTOR αi series

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series FANUC AC SPINDLE MOTOR βi series FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	(1) Parameter tables for spindle motor αiI series driven by βiSVSPx-18 are added. (2) Model codes for spindle motor βiI series are added.	Add	Oct. 2012

				TITLE Addition of parameter tables and model codes for AC SPINDLE MOTOR αi series	
01	12.10.02	Li	Newly designed	DRAW. No. B-65280EN/08-25	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 1/3

Addition of parameter table for AC SPINDLE MOTOR αi series

1. General
   Parameter tables for spindle motor αiI series driven by βiSVSPx-18 and model codes for spindle motor βiI series are added.

2. Parameter tables for spindle motor αiI series driven by βiSVSPx-18(addition)

Motor model	αi I 0.5/10000	αi I 1/10000	αi I 1.5/10000	αi I 2/10000	αi I 3/10000	αi I 1/15000
Applicable amplifier	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18	βi SVSPx-18
Model code	(301)	(302)	(304)	(306)	(308)	(303)
Applicable software series and edition	9D80/A	9D80/A	9D80/A	9D80/A	9D80/A	9D8A/B
Low-speed winding characteristics	–	–	–	–	–	–
High-speed winding characteristics	0.55/1.1kW 3000/10000min^{-1}	1.5/2.2kW 3000/10000min^{-1}	1.1/3.7kW 1500/10000min^{-1}	2.2/3.7kW 1500/10000min^{-1}	3.7/5.5kW 1500/10000min^{-1}	1.5/2.2kW 3000/15000min^{-1}
FS0*i*-D FS0*i* Mate-D						
4007	00000000	00000000	00000000	00000000	00000000	00000000
4008	00000000	00000000	00000000	00000000	00000000	00000000
4009	00000000	00000000	00000000	00000000	00000000	00000000
4010	00000000	00000000	00000000	00000000	00000000	00000001
4011	00011000	00011001	00011001	00011001	00011001	00011001
4012	10000010	10000010	10000010	10000010	10000010	10000010
4013	00001100	00001100	00001100	00001100	00001100	00001100
4019	00000100	00000100	00000100	00000100	00000100	00000100
4020	10000	10000	10000	10000	10000	15000
4023						
4039	0	0	0	0	0	0
4040						
4041						
4048						
4049						
4080	90	83 80(*1)	85 65(*1)	77 70(*1)	60 65(*1)	85 80(*1)
4083	30	30	30	30	30	30
4093	0	0	0	0	0	0
4100	3400	3100	1650	1550	1600	3100
4101	100	100	100	100	100	93
4102	6500	3557	2767	2567	1967	8015
4103	46 0(*1)	87 0(*1)	60 0(*1)	68 0(*1)	75 0(*1)	70 0(*1)
4104	3000	6000	6000	6000	7000	2000
4105	0	0	0	0	0	0
4106	7500	6000	6000	6000	7000	7000
4107	0	0	0	0	0	0
4108	0	0	0	0	0	0
4109	25	25	25	25	25	25
4110	6283 (*6)	2760 (*6)	2250 (*6)	1895 (*6)	1900 (*6)	1370 (*6)
4111	260	102	217	175	200	102
4112	200	200	200	200	19400	200
4113	2077	2100	1635	1192	1077	1870
4114	23040	17920	0	0	0	0
4115	100	100	100	100	100	100
4116	13760	10018	9598	9300	7950	9669
4117	90	90	90	90	28250	90
4118	100	100	100	100	110	100
4119	5	5	5	8	5	5
4120	0	0	0	0	0	0
4124	0	0	0	0	0	0
4127	240	176	404	202	178	176
4128	120	0	115	90	0	80
4129	0	0	0	0	0	0
4130	25700	25700	25700	25700	25700	25700
4134	110	110	110	110	110	110
4136	0	0	0	0	0	0
4138	0	0	0	0	0	0
4139	0	0	0	0	0	0
4140	0	0	0	0	0	0
4141	0	0	0	0	0	0
4142	0	0	0	0	0	0
4143	0	0	0	0	0	0
4144	0	0	0	0	0	0
4145	0	0	0	0	0	0
4146	0	0	0	0	0	0
4147	0	0	0	0	0	0
4148	0	0	0	0	0	0
4149	0	0	0	0	0	0
4150	0	0	0	0	0	0
4151	0	0	0	0	0	0
4152	0	0	0	0	0	0
4153	0	0	0	0	0	0
4154	0	0	0	0	0	0
4155	0	0	0	0	0	0
4156	0	0	0	0	0	0
4158	0	0	0	0	0	0
4159	0	0	0	0	0	0
4161	0	0	0	0	0	0
4165	0	0	0	0	0	0
4166	0	0	0	0	0	0
4169	0	0	0	0	0	0
4400						
Maximum output during acceleration (for PS selection)	1.32kW 2.60kW(*1)	2.64kW 2.87kW(*1)	4.44kW 6.7kW(*1)	4.44kW 6.4kW(*1)	6.6kW 7.9kW(*1)	5.6kW 7.0kW(*1)

(*1) This setting makes the maximum output during acceleration greater and the acceleration time reduced.
(*6) Change parameters manually according to the table after load parameters automatically with the model code.

				TITLE: Addition of parameter tables and model codes for AC SPINDLE MOTOR αi series	
01	12.10.02	Li	Newly designed	DRAW. No. B-65280EN/08-25	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 2/3

3. Model codes for spindle motor βiI series(addition)

Motor model	βi I 3/10000	βi IP 12/6000	βi IP 12/6000	βi IP 12/6000	βi IP 12/6000
Applicable amplifier	βi SVSPx-18	βi SVSPx-7.5	βi SVSPx-11	βi SVSPx-15	βi SVSPx-18
Model code	371	347	348	349	370
Applicable software series and edition	9D8A/D	9D8A/D	9D8A/D	9D8A/D	9D8A/D
Low-speed winding characteristics	–	–	–	–	–
High-speed winding characteristics	3.7/5.5kW 1500/10000min^{-1}	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/6000min^{-1}	5.5/7.5kW 750/6000min^{-1}
FS0*i* -D FS0*i* Mate-D					
4007	00000000	00000000	00000000	00000000	00000000
4008	00000000	00010000	00010000	00010000	00010000
4009	00000000	00000000	00000000	00000000	00000000
4010	00010000	00010000	00010000	00010000	00010000
4011	00011001	00001010	00001010	00001010	00001010
4012	10000000	10000000	10000000	10000000	10000000
4013	00001100	00001100	00001100	00001100	00001100
4019	00000100	00000100	00000100	00000100	00000100
4020	10000	6000	6000	6000	6000
4023					
4039	0	0	0	0	0
4040					
4041					
4048					
4049					
4080	13412	18000	18000	18000	18000
4083	30	30	30	30	30
4093	0	0	0	0	0
4100	1700	800	800	800	800
4101	90	78	78	78	78
4102	2154	1059	1059	1059	1059
4103	72	0	0	0	0
4104	2500	5000	5000	5000	5000
4105	0	0	0	0	0
4106	6600	11000	11000	11000	11000
4107	0	0	0	0	0
4108	0	0	0	0	0
4109	25	25	25	25	25
4110	2872	927	1159	1738	2318
4111	318	403	403	403	403
4112	200	200	200	200	200
4113	850	780	780	780	780
4114	21760	20480	20480	20480	20480
4115	100	100	100	100	100
4116	7978	6000	6000	6000	6000
4117	90	90	90	90	90
4118	100	100	100	100	100
4119	11	12	12	12	12
4120	0	0	0	0	0
4124	0	0	0	0	0
4127	164	150	150	150	150
4128	120	0	0	0	0
4129	0	0	0	0	0
4130	25700	25700	25700	25700	25700
4134	110	110	110	110	110
4136	0	0	0	0	0
4138	0	0	0	0	0
4139	0	0	0	0	0
4140	0	0	0	0	0
4141	0	0	0	0	0
4142	0	0	0	0	0
4143	0	0	0	0	0
4144	0	0	0	0	0
4145	0	0	0	0	0
4146	0	0	0	0	0
4147	0	0	0	0	0
4148	0	0	0	0	0
4149	0	0	0	0	0
4150	0	0	0	0	0
4151	0	0	0	0	0
4152	0	0	0	0	0
4153	0	0	0	0	0
4154	0	0	0	0	0
4155	0	0	0	0	0
4156	0	0	0	0	0
4158	0	0	0	0	0
4159	0	0	0	0	0
4161	0	0	0	0	0
4165	0	0	0	0	0
4166	0	0	0	0	0
4169	0	0	0	0	0
4400					
Maximum output during acceleration (for PS selection)	6.1kW	8.3kW	8.3kW	8.3kW	8.3kW

The alarms about incorrect setting of spindle parameters alarm (SP9034, SP9068)

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Detail of the alarm about incorrect settings of spindle parameters (SP9034, SP9068) is added	Add	2012.10

The alarms about incorrect setting of spindle parameters (SP9034, SP9068)

1. Outline

There are plural causes in the alarms about incorrect setting of spindle alarm (SP9034, SP9068). We inform the method to identify the cause of the alarms as follows

2. The cause of Illegal parameter alarm (SP9034)

The parameter number which causes of Illegal parameter alarm (SP9034) can be known in the diagnosis screen. Please confirm the parameter setting range of it, and change it to the appropriate value.

Diagnosis No.	Description
FS30i /FS0i-D	
720	Parameter internal data No.

NOTE) Parameter internal data No. is not the number displayed on CNC. Please check appendix A : SPINDLE PARMETER TABLE.

3. The cause of Illegal spindle parameter alarm (SP9068)

Illegal spindle parameter alarm (SP9068) occurs with the spindle state errors at the same time. The cause of alarm. The diagnosis screen checked the spindle state error No..

Diagnosis No.	Description
FS30i /FS0i-D	
710	State error No.

State error No.	Description	Cause and countermeasure
52	Increment system IS-D: Function setting error	The following functions can't be used at applying Increment system IS-D (No.4005#1,0=1,0). ● Spindle orientation ● Servo mode control (for example, Rigid tapping) ● Spindle synchronous control ● Learning control ● Spindle tandem control ● Synchronous built-in spindle motor control or spindle non-HRV control (not No.4012#7,6=1,0) ● Spindle amplifier communication (not No.4352#7,6=0,0) ● Spindle backlash acceleration function (No.4402#0=1) ● Cs contouring control by customer's board SP9068 will occur when Increment system IS-D is used with above functions. Please check parameter settings and ladder program.

				TITLE	The alarms about incorrect setting of spindle parameters (SP9034, SP9068)	
01	12.10.12	Tajima	Newly designed	DRAW. No.	B-65280EN/08-27	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/3	

State error No.	Description	Cause and countermeasure
54	FSSB communication: Function setting error	Following two functions using the FSSB communication can't be used together. SP9068 will occur when the settings for two functions are done. ● FSSB high-speed rigid tapping (No.4549#1=1). ● EGB function (FSSB type) (No.4549#2=1). Please check parameter settings.
57	Reference position return in servo mode with optimum orientation: Setting error	When reference position return in servo mode is executed with using optimum orientation, it is necessary to set a value except 0 in reference position return speed (No.4074). SP9068 will occur if the setting value of No.4074 is 0. Please check the parameter setting.
58	Dual check safety: Setting error of spindle speed check	There is the safety speed monitoring function using spindle speed in the Dual check safety. With the following spindle sensor conditions, this function is not usable. ● No spindle sensor (No.4002#3,2,1,0=0,0,0,0) ● Using αi position coder (No.4002#3,2,1,0=0,0,1,0) Please use suitable spindle sensor or please check parameter settings.
59	Least setting unit 1/32768rev for the stop position of Spindle orientation Setting error	When least setting unit 1/32768rev for the stop position of Spindle orientation (No.4542#0=1) is used, SP9068 will occur in the following state. ● CNC software does not support least setting unit 1/32768rev. Please check series and edition of CNC software. ● Spindle orientation during spindle synchronization control is enable (No.4014#6=1). It cannot be used it together with this function. Please check parameter settings.

Output power limitation in spindle motor

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function	Addition of the output power limitation parameter for Low-speed winding	Add	2012.10
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another			

				TITLE Output power limitation in spindle motor	
01	12.10.12	Tajima	Newly designed	DRAW. No. B-65280EN/08-28	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 1/5

Spindle motor output power limitation

1. Outline

It is possible to limit output power in spindle motor depending on the demand of customers. But only one common setting can be used even if you use the motor with speed range switching control as the output power limitation parameter.

So we added output power limitation parameter for Low-speed winding. Therefore output power limitation can be set for High-speed winding and Low-speed winding separately.

2. Series and editions of applicable spindle software

Series	Edition	Usable CNC
9D90	P (16) edition or later	FS0*i*- D , FS30*i* / FS31*i* / FS32*i*-A
9DA0	S (19) edition or later	FS0*i*- D , FS30*i* / FS31*i* / FS32*i*-B, FS35*i*-B

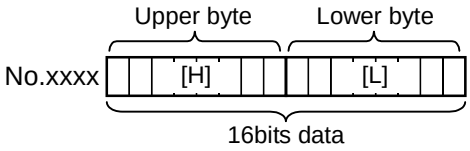
3. Parameter

3.1. Parameter list

Parameter No.	Contents
30*i*/0*i*	
4028(L)	Output power limitation pattern(MAIN/High-speed, MAIN/Low-speed)
4028(H)	Output power limitation pattern(MAIN/Low-speed) 【NEW】
4202(L)	Output power limitation pattern(SUB/High-speed, SUB/Low-speed)
4202(H)	Output power limitation pattern(SUB/Low-speed) 【NEW】
4029	Output power limitation value(MAIN/High-speed, MAIN/Low-speed)
4626	Output power limitation value(MAIN/Low-speed) 【NEW】
4203	Output power limitation value(SUB/High-speed, SUB/Low-speed)
4732	Output power limitation value(SUB/Low-speed) 【NEW】

NOTE

"[H]" and "[L]" suffix of parameter number show the upper byte and lower byte of parameter No. xxxx. (See below figure)。



Example:

Assume that

No.4028[L] : Output power limitation pattern(MAIN/High-speed) =3

No.4028[H] : Output power limitation pattern(MAIN/Low-speed) =5

The setting value of parameter No. 4028 becomes as follows:

No.4028 = 5 × 256+3 = 1283

				TITLE: Output power limitation in spindle motor	
01	12.10.12	Tajima	Newly designed	DRAW. No. B-65280EN/08-28	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 2/5

3.2. Details of parameters

There are nine patterns depending on the combination of output curve form and applicable range. For the pattern selection, the following parameters are used.

30*i*, 0*i*

4028(L)	**Output power limitation pattern (MAIN/High-speed, MAIN/Low-speed)**
4028(H)	**Output power limitation pattern (MAIN/Low-speed)** **【NEW】**

4202(L)	**Output power limitation pattern (SUB/High-speed, SUB/Low-speed)**
4202(H)	**Output power limitation pattern (SUB/Low-speed)** **【NEW】**

Unit of data : -

Valid data range : 0 to 9 (No.4028(L),No.4202(L)) ,(0~9) × 256 (No.4028(H), No.4202(H))

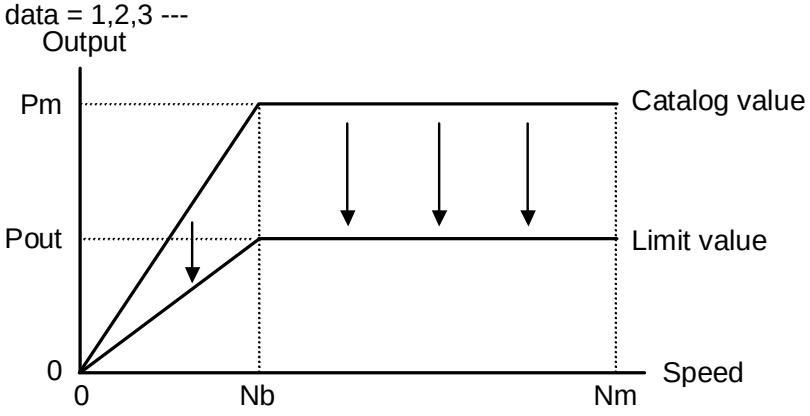
Standard setting value : 0

When Low-speed parameter is set as No.4028(H)/No.4202(H)=0, No.4028(L)/No.4202(L) are used both for High-speed winding and Low-speed winding.

Select an appropriate pattern from the following:

Output curve form / Applicable range of output power limitation	Setting data		
	Output curve form 1	**Output curve form 2**	**Output curve form 3**
No limitation	0	0	0
A.Output power is limited only at acc./dec. to achieve gradual acceleration, and the rated output power is used for stable rotation.	1	4	7
B.Output power is not limited at acc./dec., but output power is limited in stable rotation.	2	5	8
C.Output power is always limited. (This is used to achieve different output specification by using the same motor and amplifier.)	3	6	9

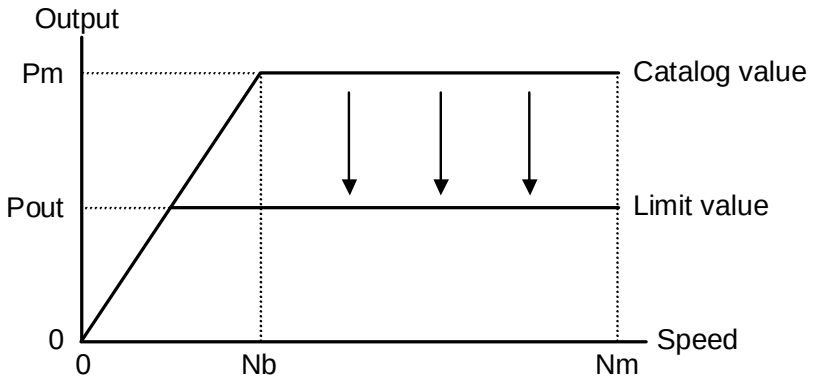
[Output curve form 1]--- Setting data = 1,2,3 ---



$$Pout = \frac{\text{Setting in Parameter No.4029}}{100} \times Pm$$

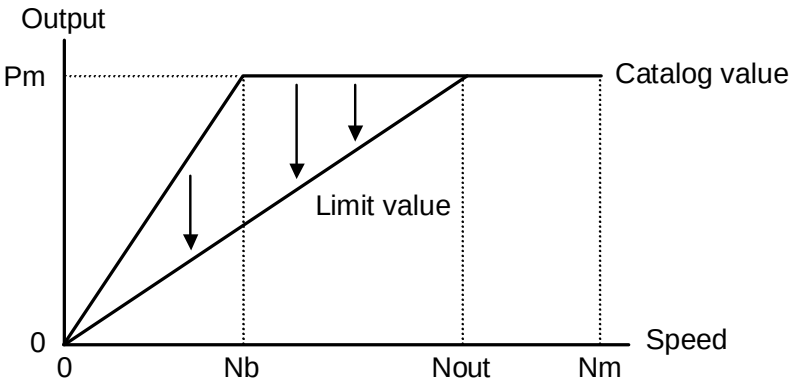
				TITLE	Output power limitation in spindle motor
01	12.10.12	Tajima	Newly designed	DRAW. No. B-65280EN/08-28	CUST.
Ed.	Date	Design.		**FANUC CORPORATION**	SHEET 3/5

[Output curve form 2]--- Setting data = 4,5,6 ---



$$Pout = \frac{\text{Setting in parameter No.4029}}{100} \times Pm$$

[Output curve form 3]--- Setting data = 7,8,9 ---



$$Nout = \frac{100}{\text{Setting in parameter No.4029}} \times Nb$$

Output power limitation value should be set in the following parameters.

30*i*, 0*i*	
4029	**Output power limitation value (MAIN/High-speed, MAIN/Low-speed)**
4626	**Output power limitation value (MAIN/Low-speed)** **【NEW】**

4203	**Output power limitation value (SUB/High-speed, SUB/Low-speed)**
4732	**Output power limitation value (SUB/Low-speed)** **【NEW】**

Unit of data : 1%

Valid data range : 0 to 100

Standard setting value : 100(No.4029, No.4203),0(No.4626, No.4732)

When Low-speed parameter is set as No.4026/No.4732=0, No.4029/No.4203 are used both for High-speed winding and Low-speed winding.

A desired limitation value should be set in this parameter, and 100% means the maximum output.

These parameters become valid when something value except 0 are set.

Note

Set following parameters if you want to apply power limitation only in High-speed winding or in Low-speed winding.

In case of applying output power limitation only in High-speed winding

Output power limitation pattern (High-speed winding)	Output power limitation pattern (Low-speed winding)	Output power limitation value (High-speed winding)	Output power limitation value (Low-speed winding)
No.4028(L)【MAIN】 No.4202(L)【SUB】	No.4028(H)【MAIN】 No.4202(H)【SUB】	No.4029【MAIN】 No.4203【SUB】	No.4626【MAIN】 No.4732【SUB】
Arbitrary pattern	0	Arbitrary value	100

In case of applying output power limitation only in Low-speed winding

Output power limitation pattern (High-speed winding)	Output power limitation pattern (Low-speed winding)	Output power limitation value (High-speed winding)	Output power limitation value (Low-speed winding)
No.4028(L)【MAIN】 No.4202(L)【SUB】	No.4028(H)【MAIN】 No.4202(H)【SUB】	No.4029【MAIN】 No.4203【SUB】	No.4626【MAIN】 No.4732【SUB】
0	Arbitrary pattern	100	Arbitrary value

Revision of αi series Spindle Software
(9D90/P(16), 9DA0/S(19))

1. Type of applied documents

Name	FANUC AC SPINDLE MOTOR αi series, FANUC AC SPINDLE MOTOR βi series, FANUC BUILT-IN SPINDLE MOTOR Bi series PARAMETER MANUAL
Spec. No./Ver.	B-65280EN/08

2. Summary of Change

Group	Name / Outline	New, Add Correct, Del	Applicable Date
Basic Function			
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Revision of spindle software 9D90/P(16), 9DA0/S(19)	Add	2012.10

				TITLE	Revision of αi series Spindle software (9D90/P(16),9DA0/S(19)
01	12.10.12	Tajima	Newly designed	DRAW. No. B-65280EN/08-29	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 1/2

Revision of αi series Spindle Software (9D90/P(16),9DA0/S(19))

1. Outline

αi series spindle software was revised as follows.

2. Software series, edition and applied spindle amplifier

Software edition	Spindle amplifier specification		Notes
9D90 edition P(16)	αiSP	A06B-6144-Hxxx#H590 A06B-6154-Hxxx#H590	30*i*/31*i*/32*i*-A, 16*i*/18*i*/21*i*-B, 0*i*-B/C, 0*i*-D,15*i*-MB,PM*i*-D Induction/ synchronous spindle motor
9DA0 edition S(19)	αiSP	A06B-6220-Hxxx#H600 A06B-6270-Hxxx#H600	30*i*//31*i*//32*i*/-B, 35 *i*-B Induction/ synchronous spindle motor
	αiSVP	A06B-6230-Hxxx#H600	

3. Contents of modification

	Contents	9D90/P	9DA0/S
(1)	The function to output divided backlash compensation in non-cutting mode for Cs contour control has been added.	○	○
(2)	The warning level parameter for Leakage Detection Function has been added.	-	○
(3)	The output power limit parameter for Low-speed winding has been added.	○	○
(4)	Distance coded sensors have been supported.	○	○

○ : Revised item - : Not supported

Note).
Please refer to the technical report (B-65280EN/08-12(02 Edition)) to know detail information of (1).
Please refer to the technical report (B-65412EN/01-01 or B-65285EN/03-02(04 Edition)) to know detail information of (2).
Please refer to the technical report (B-65280EN/08-28) to know detail information of (3).
Please refer to the technical report (B-65280EN/08-26) to know detail information of (4).

				TITLE: Revision of αi series Spindle software (9D90/P(16),9DA0/S(19)	
01	12.10.12	Tajima	Newly designed	DRAW. No. B-65280EN/08-29	CUST.
Ed.	Date	Design.		FANUC CORPORATION	SHEET 2/2