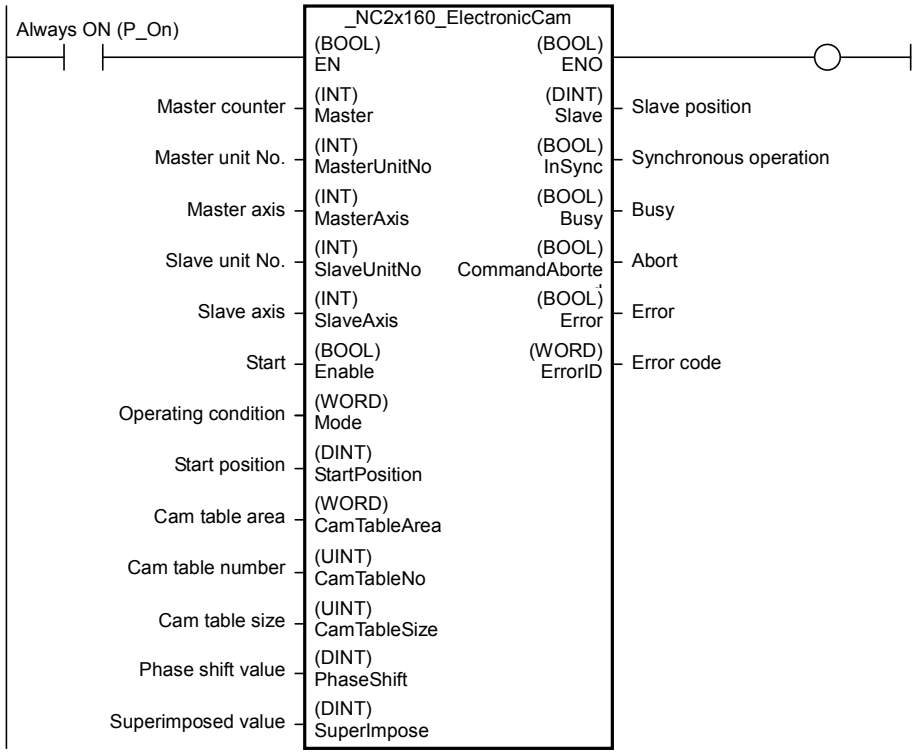
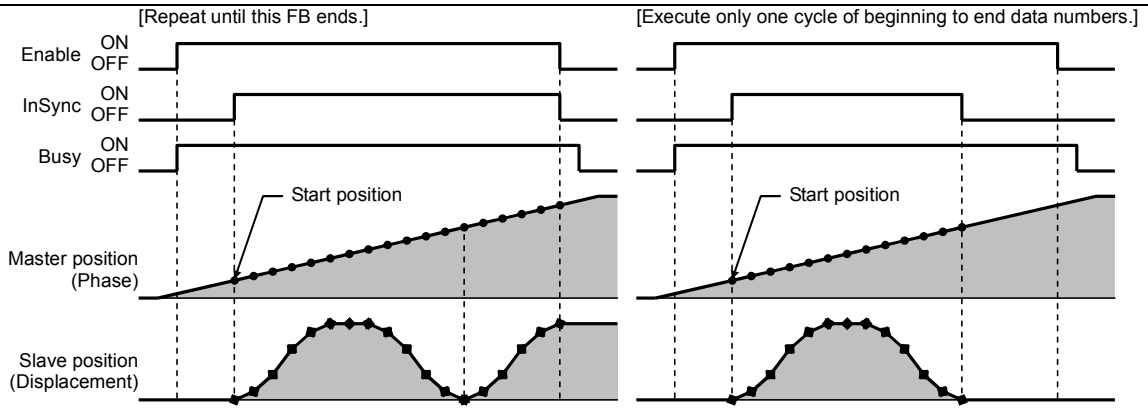
NC2x 160	Electronic Cam _NC2x160_ElectronicCam

Basic function	Performs electronic cam operation in sync with the specified master axis.
Symbol	
File name	Lib\FBL\omronlib\PositionController\NC2x_NC2x160_ElectronicCam10.cxf
Applicable models	Position Control Units: CJ1W-NC214/234/414/434 CPU Unit: CJ2H-CPU**(-EIP) Version 1.1 or later CX-Programmer: Version 8.1 or later
Languages in function block definitions	Ladder programming
Conditions for usage	・When using this FB, enable “Synchronous Unit Operation” of the CJ2-CPU unit, and place the instance of this FB to the synchronous interrupt task. ・For the master axis counter value and the slave axis position command value, use the synchronous data refresh area. ・Refer to “Related Manuals” for details.
Function description	・The master axis will be specified in "Master unit No. (MasterUnitNo)" and "Master axis (MasterAxis)". ・The word of the synchronous data, for which the present value of the master axis is output, will be input in "Master counter (Master)". ・The slave axis will be specified in "Slave unit No. (SlaveUnitNo)" and "Slave axis (SlaveAxis)". ・The synchronous data word that outputs the slave axis synchronous feeding command position data will be set in "Slave position (Slave)". ・The cam table will be specified in "Cam table area (CamTableArea)", "Cam table No. (CamTableNo)" and "Cam table size (CamTableSize)". ・For the specified slave axis, electronic cam operation will start under the specified operating conditions and with the cam table when "Start (Enable)" turns ON. ・If "Start (Enable)" is turned OFF during cam operation, cam operation will end. ・If “Execute only one cycle of beginning to end data numbers” is specified in “Repeat” of "Operating condition (Mode)", cam operation will end when reaching the cam table end. ・“Synchronous operation (InSync)” will turn ON when synchronous operation is begun by this FB. Synchronous operation beginning conditions will be specified in “Begin” of "Operating condition (Mode)". ・"Busy (Busy)" will be set when the "Start (Enable)" is turned ON. "Busy (Busy)" will be reset when any of the cam operation end, "Abort (CommandAborted)", or "Error (Error)" is turned ON. Even if an error occurs when the input variable is out of the range, etc., "Busy (Busy)" will be set for at least one cycle. ・"Error (Error)" will be turned ON and "Error code (ErrorID)" will be output if an error occurs for the FB. This will not occur for error in other FBs or other instances of the FB. ・These statuses (CommandAborted/Error/ErrorID) will be reset when "Start (Enable)" turns OFF. If "Start (Enable)" turns OFF before the positioning operation has been completed, the status will be set for at least one cycle when corresponding conditions have occurred.



・ Set the cam table using the table below.

Cam data No.	Channel	Setting data	Data type	Range
1	+0	Phase 1 (Master)	DINT	-2147483648 to +2147483647
	+1			
	+2	Displacement 1 (Slave)	DINT	-2147483648 to +2147483647
	+3			
2	+4	Phase 2 (Master)	DINT	-2147483648 to +2147483647 (Must be larger than cam table 1.)
	+5			
	+6	Displacement 2 (Slave)	DINT	-2147483648 to +2147483647
	+7			
⋮	⋮	⋮	⋮	⋮
C-1	+(C-1)*4	Phase (C-1) (Master)	DINT	-2147483648 to +2147483647 (Must be larger than cam table C-2.)
	+(C-1)*4+1			
	+(C-1)*4+2	Displacement (C-1) (Slave)	DINT	-2147483648 to +2147483647
	+(C-1)*4+3			
C	+C*4	Phase C (Master)	DINT	-2147483648 to +2147483647 (Must be larger than cam table C-1.)
	+C*4+1			
	+C*4+2	Displacement C (Slave)	DINT	-2147483648 to +2147483647
	+C*4+3			

C: Cam table size

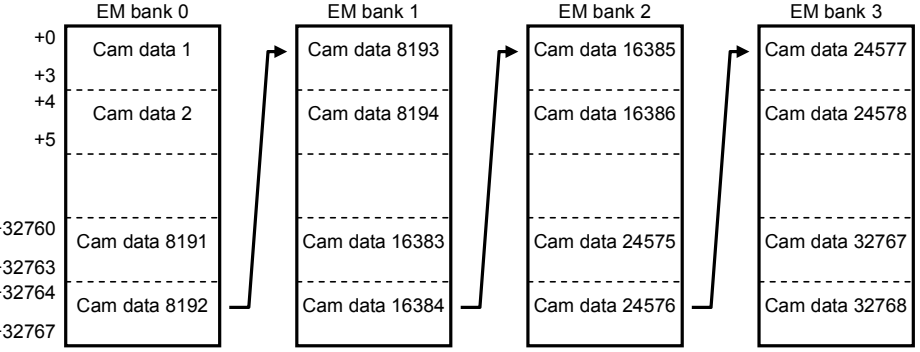
・ For the cam table, values will be regarded as relative values based on phase/displacement of cam data 1.
Example) The following cam tables are all for the same operation.

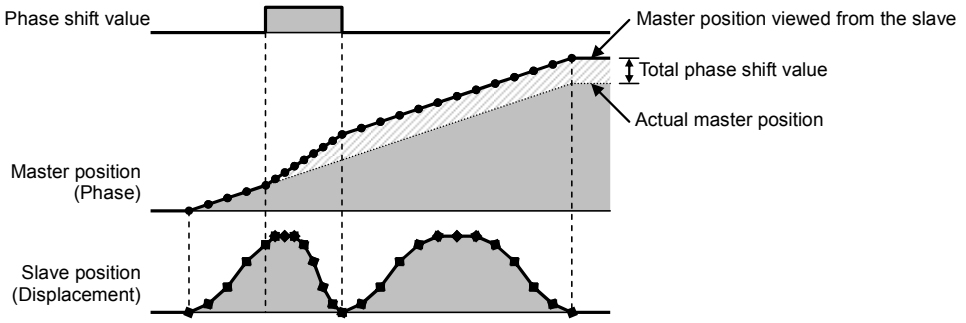
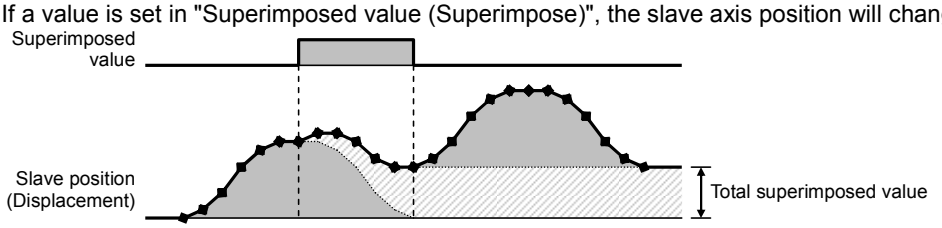
Cam data No.	Cam table 1		Cam table 2		Cam table 3	
	Phase	Displacement	Phase	Displacement	Phase	Displacement
1	+0	+0	+5000	+10000	-5000	-10000
2	+1000	+5000	+6000	+15000	-4000	-5000
3	+3000	+10000	+8000	+20000	-2000	+0
4	+6000	+5000	+11000	+15000	+1000	-5000
5	+10000	+0	+15000	+10000	+5000	-10000

・ The phase data of the cam table must be lined in the ascending order. (The larger the data No., the larger the phase.)

・ Because this FB operates while processing the cam table real time, the data which does not meet operating conditions, if any, will not be detected in advance. An error, therefore, will not be detected until the data is actually used.

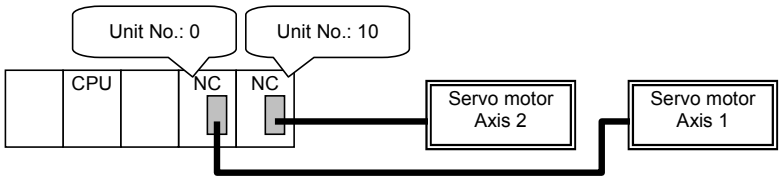
・ If the cam table size exceeds 8192, create the cam table in the EM area. Consecutive banks in the EM area can be used as consecutive areas.
Example) 32768 pieces of cam data are created, with the 0 word of EM bank 0 as the beginning address.

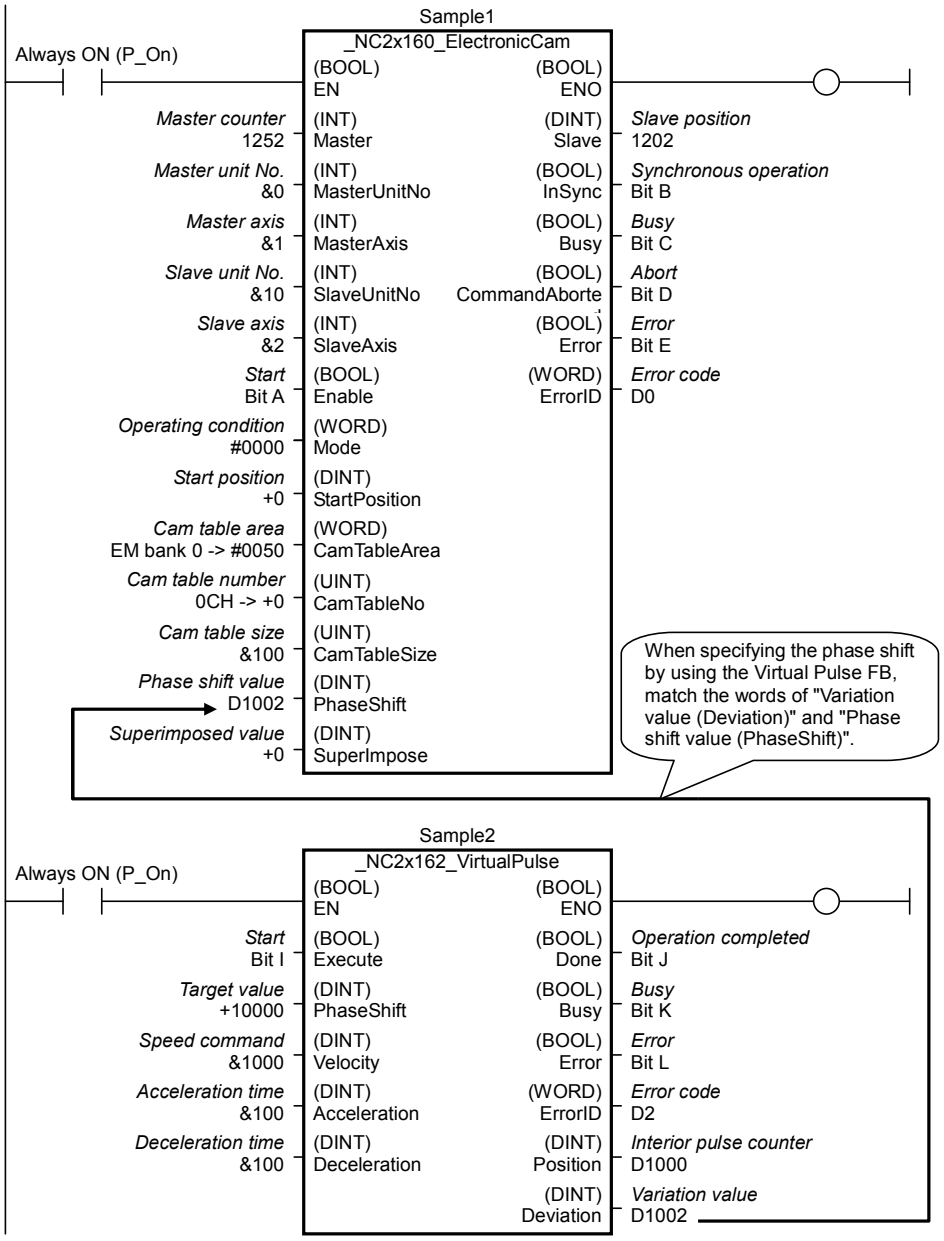


	・If a value is set in "Phase shift value (PhaseShift)", the phase of the master axis viewed from the slave axis will change. But the actual operation of the master axis will not be affected.  ・If a value is set in "Superimposed value (Superimpose)", the slave axis position will change.  ・Specify "Phase shift value (PhaseShift)" and "Superimposed value (Superimpose)" using the variation value per cycle. Be careful of the amount of variation value. If it is too large, abrupt braking of the axis will occur. ・For the input of "Phase shift value (PhaseShift)" and "Superimposed value (Superimpose)", use the Virtual Pulse FB "_NC2x162_VirtualPulse". (Refer to “Application example”.) ・"Phase shift value (PhaseShift)" and "Superimposed value (Superimpose)" will be enabled after synchronous operation has started. (“Synchronous operation (InSync)” has turned ON.)
Kind of FB definition	Always execution type. Connect the EN input to the Always ON Flag (P_On). The same instance cannot be used in two or more places.
FB precautions	・If the master axis variation value per cycle is larger than half of the maximum value of the master axis ring counter, the master axis movement amount cannot be detected correctly. (The operation will be regarded as in the opposite direction from the actual operation.) ・Set the constant value of 0 when "Phase shift value (PhaseShift)" and "Superimposed value (Superimpose)" are not used. If the value other than 0 is set, the set value will be added every cycle. ・If the slave axis variation value per cycle is larger than half of the maximum value of the master axis ring counter, an error code "Slave axis excessive movement" occurs.
EN input condition	・Connect the EN input to the Always ON Flag (P_On). If another bit is connected to EN, the FB outputs will be held when the connected bit turns OFF.
Restrictions Other	・This FB does not recognize the existence of the axis specified in "Master unit No. (MasterUnitNo)", "Master axis (MasterAxis)", and "Slave unit No. (SlaveUnitNo)", "Slave axis (SlaveAxis)". If these input variables have not been set correctly, the FB may not work normally. ・This FB uses bits of the Position Control Unit. Therefore, do not turn these bits ON or OFF. For the same reason, do not use these bits for coil outputs (OUT commands). Refer to the "■Used bits list" for the bits used by this FB. ・The phase swingings per one cycle of the master axis input on the cam table are up to 100 back and forth. If it is exceeded, an error code "Cam table setting error" occurs. ・When EN is set first, the following axis parameters which master axis and slave axis have are read from PCU. Therefore, even if Enable (effective) and EN are set again, these axis parameters are not reflected even if changed. Axis Parameters : Axis Feeding Mode / Rotation Axis Upper Limit

Application example

Turning OFF bit A and then ON will perform cam operation for the axis 2 of the Position Control Unit of unit number 10, with the axis 1 of the Position Control Unit of unit number 0 as the master axis.
Turning OFF bit I and then ON will perform phase shift for the slave axis of “Sample 1”.

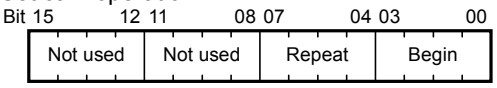




Related manuals

CJ-series Position Control Unit Operation Manual (W477)
10 Synchronous Unit Operation Function
12-6 Error Code List

■**Variable Tables**
Input Variables

Name	Variable name	Data type	Default	Range	Description
EN	EN	BOOL			1(ON): FB started 0(OFF): FB not started
Master counter	Master	DINT	+0	-2147483648 to +2147483647	Input the present value of the master counter. Set the relevant word of synchronous data.
Master unit No.	MasterUnitNo	INT	+0	+0 to +94, -1	Specify the unit number of the master axis. ※ If -1 is specified, the Position Control Unit is not used for the master axis. In this case, the master axis works as the ring counter with the range of -2147483648 to +2147483647.
Master axis	MasterAxis	INT	+1	+1 to +4, +241(#F1)	Specify the axis or external encoder. +1 to +4: Specify the axis number of the master axis. +241(#F1): Specify an external encoder for the master axis. ※ If -1 is specified in "Master unit No. (MasterUnitNo)", this input variable is not used.
Slave unit No.	SlaveUnitNo	INT	+0	+0 to +94	Specify the unit number of the slave axis.
Slave axis	SlaveAxis	INT	+1	+1 to +4	Specify the axis number of the slave axis.
Start	Enable	BOOL	0(OFF)		↑: Starts electronic cam ↓: Stops electronic cam
Operating condition	Mode	WORD	#0000	#0000, #0001, #0010, #0011	Set cam operation.  ・ Begin (Bit 00 to 03) Select beginning conditions for cam operation. #0: Immediately after FB execution (“Synchronous operation (InSync)” turns ON.) #1: After the master axis passes “Start position (StartPosition)”. ・ Repeat (Bit 04 to 07) Select repeat conditions for cam operation. #0: Repeat until this FB ends. #1: Execute only one cycle of beginning to end data numbers.
Start position	StartPosition	DINT	+0	-2147483648 to +2147483647	When #1 is selected in the operation beginning conditions of "Operating condition (Mode)", the position at which the slave axis starts synchronous operation will be specified as the absolute value.
Cam table area	CamTableArea	WORD	#0082	#00B0 to #00B2, #0082, #0050 to #0068	Specify the cam table area type. P_CIO(#00B0): CIO P_WR(#00B1): WR P_HR(#00B2): HR P_DM(#0082): DM P_EM00(#0050) to P_EM19(#0068): EM bank 00 to 18
Cam table number	CamTableNo	UINT	&0	&0 to &32767	Specify the beginning address of the cam table area.
Cam table size	CamTableSize	UINT	&2	&2 to &32768	Specify the number of cam table point data.
Phase shift value	PhaseShift	DINT	+0	-2147483648 to +2147483647	Specify the phase shift value per cycle. Input the output variable "Variation value (Deviation)" of the FB "_NC2x162_VirtualPulse".
Superimposed value	SuperImpose	DINT	+0	-2147483648 to +2147483647	Specify the superimposed value per cycle. Input the output variable "Variation value (Deviation)" of the FB "_NC2x162_VirtualPulse".

Output Variables

Name	Variable name	Data type	Range	Description
ENO	ENO	BOOL		1(ON): FB operating normally 0(OFF): FB not started / FB ended with error
Slave position	Slave	DINT		Outputs the slave axis position command value. Set the corresponding word of synchronous feeding command position data.
Synchronous operation	InSync	BOOL		Turns ON when synchronous operation is being performed.
Busy	Busy	BOOL		Turns ON when FB is in the process.
Abort	CommandAborted	BOOL		Turns ON when an abort has occurred in the FB. Refer to "Error code (ErrorID)" for details.
Error	Error	BOOL		Turns ON when an error has occurred in the FB. Refer to "Error code (ErrorID)" for details.
Error code	ErrorID	WORD		Returns the error code when an error occurred in the FB. Refer to "■Error code list" for details.

■Error code list

Error name	Error code	Probable cause	Clearing method
Input variable out of range	#0001	The value of input variable of this FB is out of valid range.	Set the value of input variable within the specified range.
Operating memory area allocation out of range	#0002	The allocation of Axis Operating Memory Area of Common Parameter is out of allowable setting range.	Correct the allocation of Axis Operating Memory Area of Common Parameter so that it falls within the allowable setting range of data.
Synchronous operation setting error	#0100	Axes to be used have not met FB operation conditions.	Check the settings for the master and slave axes.
Cam table setting error	#0101	A faulty set value of cam point data has been detected.	Check the cam table.
Cam data error	#0102	Target position has not been acquired due to the large phase fluctuation.	Check the cam table, master axis operation speed and phase shift value.
Master axis excessive movement	#0103	Normal operation has not been performed due to the excessive movement of the master axis.	Check the master axis operation speed and phase shift value.
Slave axis excessive movement	#0104	Normal operation has not been performed due to the excessive movement of the slave axis.	Check the cam table, master axis operation speed and superimposed value.
Synchronous disabled	#01F0	The synchronous unit operation is disabled.	Enable the synchronous unit operation by the PLC system setting.
Unit error	#1001	An error in individual unit has occurred.	Check "Unit common error code". Identify the error cause from the Operation Manual of the Position Control Unit.
Axis error	#1002	An error in individual axis has occurred.	Check "Axis error code". Identify the error cause from the Operation Manual of the Position Control Unit.
Unit setup	#2000	The Position Control Unit is not in unit ready status.	Execute the FB after putting the Position Control Unit in unit ready status.
Deceleration stop	#2100	The deceleration stop (Deceleration stop / Synchronous group stop Selection / All Synchronous Unit stop) or the Error counter reset output was executed while the FB was active.	Due to the deceleration stop command, the active FB was interrupted. But this is normal operation. Check that the deceleration stop command has started correctly.
Servo unlock	#2102	The Servo unlock was executed while the FB was active.	Due to the servo unlock command, the active FB was interrupted. But this is normal operation. Check that the servo unlock command has started correctly.
Command disabled	#2300	FB commands have not been accepted.	Execute the FB after putting the unit in status that can accept commands.
Synchronous feeding	#3208	"Synchronous feeding" of the Direct Operation Command Memory area has been operated by the outside of the FB.	Do not operate each bit which the active FB is operating, by the external unit of the FB. Do not use it on OUT command.

■**Used bits list**

Memory area	Name	Data type	Address	Note
Direct Operation Command Memory area	Synchronous feeding	BOOL	B+00.08	
Synchronous Data Refresh Area	Output	DINT	(Note.)	Used as "Slave position (Slave)".
	Input	DINT	(Note.)	Used as "Master counter (Master)".

(Note.) Specify via the PLC system setting. Refer to “Related Manuals” for details.

■**Version History**

Version	Date	Contents
1.00	2009.06.	Original production.
1.01	2010.04	The problem of cam table search has been improved.
1.02	2011.04	The problem that the direction of slave axis movement is reverse when slave movement is over the half of slave ring count value has been improved.

■**Note**

This document explains the function of the function block.
It does not provide information of restrictions on the use of Units and Components or combination of them. For actual applications, make sure to read the operation manuals of the applicable products.