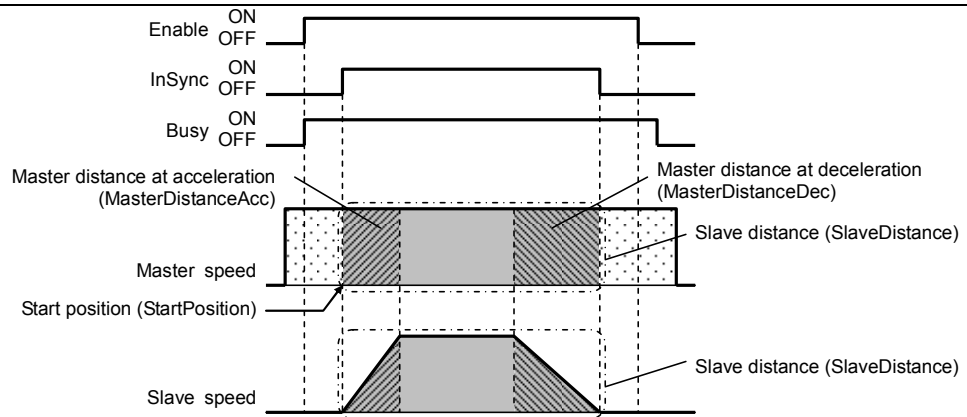


<b>NC2x164</b>	<b>Link Operation _NC2x164_LinkOperation</b>
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<b>Basic function</b>	Positioning is performed synchronizing the slave axis to the specified master axis.																																																	
<b>Symbol</b>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 5px;">Always ON (P_On)</td> <td style="width: 30%; padding: 5px;">_NC2x164_ElectronicCam</td> <td style="width: 30%; padding: 5px;"></td> </tr> <tr> <td style="padding: 5px;"></td> <td style="padding: 5px;">(BOOL) EN</td> <td style="padding: 5px;">(BOOL) ENO</td> </tr> <tr> <td style="padding: 5px;">Master counter</td> <td style="padding: 5px;">(INT) Master</td> <td style="padding: 5px;">(DINT) Slave</td> </tr> <tr> <td style="padding: 5px;">Master unit No.</td> <td style="padding: 5px;">(INT) MasterUnitNo</td> <td style="padding: 5px;">(BOOL) InSync</td> </tr> <tr> <td style="padding: 5px;">Master axis</td> <td style="padding: 5px;">(INT) MasterAxis</td> <td style="padding: 5px;">(BOOL) Busy</td> </tr> <tr> <td style="padding: 5px;">Slave unit No.</td> <td style="padding: 5px;">(INT) SlaveUnitNo</td> <td style="padding: 5px;">(BOOL) CommandAborted</td> </tr> <tr> <td style="padding: 5px;">Slave axis</td> <td style="padding: 5px;">(INT) SlaveAxis</td> <td style="padding: 5px;">(BOOL) Error</td> </tr> <tr> <td style="padding: 5px;">Start</td> <td style="padding: 5px;">(BOOL) Enable</td> <td style="padding: 5px;">(WORD) ErrorID</td> </tr> <tr> <td style="padding: 5px;">Operating condition</td> <td colspan="2" style="padding: 5px;">(WORD) Mode</td> </tr> <tr> <td style="padding: 5px;">Start position</td> <td colspan="2" style="padding: 5px;">(DINT) StartPosition</td> </tr> <tr> <td style="padding: 5px;">Slave distance</td> <td colspan="2" style="padding: 5px;">(DINT) SlaveDistance</td> </tr> <tr> <td style="padding: 5px;">Master distance</td> <td colspan="2" style="padding: 5px;">(DINT) MasterDistance</td> </tr> <tr> <td style="padding: 5px;">Master distance in acceleration</td> <td colspan="2" style="padding: 5px;">(DINT) MasterDistanceAcc</td> </tr> <tr> <td style="padding: 5px;">Master distance in deceleration</td> <td colspan="2" style="padding: 5px;">(DINT) MasterDistanceDec</td> </tr> <tr> <td style="padding: 5px;">Phase shift value</td> <td colspan="2" style="padding: 5px;">(DINT) PhaseShift</td> </tr> <tr> <td style="padding: 5px;">Superimposed value</td> <td colspan="2" style="padding: 5px;">(DINT) SuperImpose</td> </tr> </table>		Always ON (P_On)	_NC2x164_ElectronicCam			(BOOL) EN	(BOOL) ENO	Master counter	(INT) Master	(DINT) Slave	Master unit No.	(INT) MasterUnitNo	(BOOL) InSync	Master axis	(INT) MasterAxis	(BOOL) Busy	Slave unit No.	(INT) SlaveUnitNo	(BOOL) CommandAborted	Slave axis	(INT) SlaveAxis	(BOOL) Error	Start	(BOOL) Enable	(WORD) ErrorID	Operating condition	(WORD) Mode		Start position	(DINT) StartPosition		Slave distance	(DINT) SlaveDistance		Master distance	(DINT) MasterDistance		Master distance in acceleration	(DINT) MasterDistanceAcc		Master distance in deceleration	(DINT) MasterDistanceDec		Phase shift value	(DINT) PhaseShift		Superimposed value	(DINT) SuperImpose	
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<b>File name</b>	Lib\FBL\omronlib\PositionController\_NC2x164_LinkOperation10.cxf																																																	
<b>Applicable models</b>	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																																																
<b>Language in function block definitions</b>	Ladder programming																																																	
<b>Conditions for usage</b>	<ul style="list-style-type: none"> <li>• When using this FB, enable “Synchronous Unit Operation” of the CJ2-CPU unit, and place the instance of this FB to the synchronous cycle task.</li> <li>• For the master axis counter value and the slave axis position command value, use the synchronous data refresh area.</li> <li>• Refer to “Related Manuals” for details.</li> </ul>																																																	
<b>Function description</b>	<ul style="list-style-type: none"> <li>• The master axis will be specified in "Master unit No. (MasterUnitNo)" and "Master axis (MasterAxis)".</li> <li>• The word of the synchronous data, for which the present value of the master axis is output, will be input in "Master counter (Master)".</li> <li>• The slave axis will be specified in "Slave unit No. (SlaveUnitNo)" and "Slave axis (SlaveAxis)".</li> <li>• The synchronous data word that outputs the slave axis synchronous feeding command position data will be set in "Slave position (Slave)".</li> <li>• The acceleration operation when the synchronous begin is specified by “Master distance in acceleration (MasterDistanceAcc)”. The deceleration operation when the synchronous end is specified by “Master distance in deceleration (MasterDistanceDec)”. The synchronic distance is specified by “Master distance (MasterDistance)”.</li> <li>• For the specified slave axis, link operation will start when "Start (Enable)" turns ON.</li> <li>• If "Start (Enable)" is turned OFF during link operation, link operation will end.</li> <li>• “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)".</li> <li>• "Busy (Busy)" will be set when the "Start (Enable)" is turned ON. “Busy (Busy)” will be reset when link 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.</li> <li>• "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.</li> <li>• 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.</li> </ul>																																																	

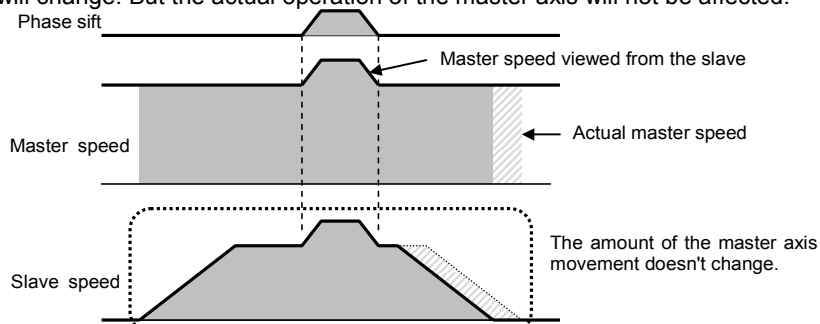


- The displacement in each section of the Master axis and the Slave axis is decided by "Slave distance (SlaveDistance)", "Master distance (MasterDistance)", "Master distance at acceleration (MasterDistanceAcc)", and "Master distance at deceleration (MasterDistanceDec)" as shown in the table below.

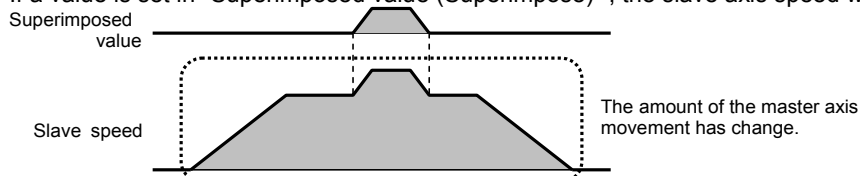
Interval	Master axis	Slave axis
Acceleration	$\left[ \begin{array}{l} \text{Master distance} \\ \text{in acceleration} \end{array} \right]$	$\left[ \begin{array}{l} \text{Master distance} \\ \text{in acceleration} \end{array} \right] \times \left[ \text{Slave distance} \right] \times \frac{\left[ \begin{array}{l} \text{Master distance} \\ \text{in acceleration} \end{array} \right] + \left[ \begin{array}{l} \text{Master distance} \\ \text{in constant speed} \end{array} \right] + \left[ \begin{array}{l} \text{Master distance} \\ \text{in deceleration} \end{array} \right]}{2}$
Constant Speed	$\left[ \begin{array}{l} \text{Master distance} \\ \text{in acceleration} \\ \text{in deceleration} \end{array} \right]$	$\left[ \text{Slave distance} \right] - \left[ \begin{array}{l} \text{Slave distance} \\ \text{in acceleration} \end{array} \right] - \left[ \begin{array}{l} \text{Slave distance} \\ \text{in deceleration} \end{array} \right]$
Deceleration	$\left[ \begin{array}{l} \text{Master distance} \\ \text{in deceleration} \end{array} \right]$	$\left[ \begin{array}{l} \text{Master distance} \\ \text{in deceleration} \end{array} \right] \times \left[ \text{Slave distance} \right] \times \frac{\left[ \begin{array}{l} \text{Master distance} \\ \text{in acceleration} \end{array} \right] + \left[ \begin{array}{l} \text{Master distance} \\ \text{in constant speed} \end{array} \right] + \left[ \begin{array}{l} \text{Master distance} \\ \text{in deceleration} \end{array} \right]}{2}$

Link data error (error code #0102) in case of "Master distance" < "Master distance in acceleration" + "Master distance in deceleration".

- 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 speed 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. ("During Synchronization (InSync)" has turned ON.)

<b>Kids of FB definition</b>	Always execute type Connect the EN input to the Always ON Flag (P_ON). The same instance cannot be used in two or more places.
<b>FB precautions</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul>
<b>EN input condition</b>	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
<b>Restrictions Other</b>	<ul style="list-style-type: none"> <li>• "Slave position (Slave)" had rounding errors, if "Slave distance(SlaveDistance)" was set to the value that is greater than 24bit. In this case, Use "_NC2x164A_LinkOperation" FB.</li> <li>• 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.</li> <li>• 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.</li> <li>• 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</li> </ul>

**Application example**

Turning OFF bit A and then ON will perform rlink 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".

**Sample1**

Always ON (P\_On)

Parameter	Data type	Value
Master counter	(INT)	1250
Master unit No.	(INT)	&1
Master axis	(INT)	&1
Slave unit No.	(INT)	&10
Slave axis	(INT)	&2
Start Bit A	(BOOL)	Enable
Operating condition	(WORD)	#0000
Start position	(DINT)	+0
Slave distance	(DINT)	&25000
Master distance	(DINT)	&30000
Master distance in acceleration	(DINT)	&5000
Master distance in deceleration	(DINT)	&5000
Phase shift value	(DINT)	D1002
Superimposed value	(DINT)	+0

Parameter	Data type	Value
Slave position	(DINT)	1202
Synchronous operation	(BOOL)	InSync
Busy	(BOOL)	Busy
Abort	(BOOL)	CommandAborted
Error	(BOOL)	Error
Error Code	(WORD)	ErrorID
D0	(DINT)	

**Sample2**

Always ON (P\_On)



Parameter	Data type	Value
Start Bit I	(BOOL)	Execute
Phase shift value	(DINT)	+10000
Speed command	(DINT)	&1000
Acceleration time	(DINT)	&100
Deceleration time	(DINT)	&100

When specifying the phase shift by using the Virtual Pulse FB, match the words of "Variation value (Deviation)" and "Phase shift value (PhaseShift)".

**Related manuals** C-J-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 link operation  : Stops link operation				
Operating condition	Mode	WORD	#0000	#0000, #0001, #0002	Set link operation. Bit 15      12 11      08 07      04 03      00 <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 25px;">Not used</td> <td style="width: 25px;">Not used</td> <td style="width: 25px;">Not used</td> <td style="width: 25px;">Begin</td> </tr> </table> <ul style="list-style-type: none"> <li>• Begin (Bit 00 to 03) Select beginning conditions for link operation.</li> <li>#0: Immediately after FB execution, the slave axis performs link operation when the master axis is rotating in the forward direction.</li> <li>#1: After the master axis passes "Start position (StartPosition)".</li> <li>#2: Immediately after FB execution, the slave axis performs link operation when the master axis is rotating in the reverse direction.</li> </ul>	Not used	Not used	Not used	Begin
Not used	Not used	Not used	Begin						
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.				
Slave distance	SlaveDistance	DINT	+0	-2147483648 to +2147483647	Specifies the slave axis distance amount, which is required when performing link operation in sync with the master axis.				
Master distance	Master Distance	DINT	+1	+1 to +2147483647	Specifies the master axis distance amount, while the slave axis is performing link operation.				
Master distance in acceleration	Master DistanceAcc	DINT	+0	+0 to +2147483647	Specifies the master axis distance amount, while the slave axis is performing acceleration.				
Master distance in deceleration	Master DistanceDec	DINT	+0	+0~ +2147483647	Specifies the master axis distance amount, while the slave axis is performing deceleration.				
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.
Link data error	#0102	A faulty set value of link data has been detected.	Check the master distance, master distance in acceleration, master distance in deceleration.
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 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	2011.04.	The problem that occurs 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.