

## Appendix C: Differences with FX2N-1PG

This appendix describes the differences between the FX3U-1PG and the FX2N-1PG. The following are differences between the FX3U-1PG and the FX2N-1PG. Be careful when replacing the FX2N-1PG with the FX3U-1PG. Change the system or sequence program as needed.

### Appendix C-1 Differences of Specification

Differences in specification between FX3U-1PG and FX2N-1PG are shown in the following table.

Item	FX3U-1PG	FX2N-1PG
Applicable PLC	FX3U/FX3UC PLC	FX2N/FX2NC/FX3U/FX3UC PLC
Number of connectable units to the main unit	FX3U PLC: Up to 8 blocks can be extended. FX3UC PLC: Up to 6 blocks can be extended.	FX2N PLC: Up to 8 blocks can be extended. FX2NC PLC: Up to 4 blocks can be extended. FX3U PLC: Up to 8 blocks can be extended. FX3UC (D, DS, DSS) PLC: Up to 8 blocks can be extended. FX3UC-32MT-LT(-2) PLC: Up to 7 blocks can be extended.
Positioning	Range	-2,147,483,648 to 2,147,483,647 (user unit)
	Output frequency	1 Hz to 200 kHz The output pulse frequency (f) of FX3U-1PG is stepwise as follows. $f = 24 \times 10^6 / n$ (Hz) Where, n: Integer in range of 120 to 24,000,000
	Acceleration /deceleration time	Trapezoidal acceleration/deceleration: 1 to 32,767 ms Approximate S-shaped acceleration/deceleration: 1 to 5,000 ms
	Starting time	Motor system: 1 ms or less Machine system: 2 ms or less
Drive power supply	Inner control 5 V DC Current consumption 150 mA (Power is supplied through the extension cable from the PLC.)	5 V DC Current consumption 55 mA (Power is supplied through the extension cable from the PLC.)

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## Appendix C-2 Differences of Buffer Memory

BFM No.		Item	Setting range	
High order 16bit	Low order 16bit		FX3U-1PG	FX2N-1PG
-	#0	Pulse rate	1 to 32,767 PLS/REV	
#2	#1	Feed rate	1 to 2,147,483,647 (user unit)	1 to 999,999 (user unit)
-	#3	Operation parameter	b1, b0: System of units	
			b3, b2: Interrupt input setting	b3, b2: Not used
			b5, b4: Position data multiplier	
			b6: Acceleration/deceleration mode	b6: Not used
			b7: Variable speed operation acceleration/deceleration setting	b7: Not used
			b8: Pulse output format	
			b9: Rotation direction	
			b10: Zero return direction	
			b11: Limit deceleration mode	b11: Not used
			b12: DOG input polarity	
			b13: Count start point	
			b14: STOP input polarity	
			b15: STOP input mode	
			#5	#4
-	#6	Bias speed	0 to 32,767 (user unit) Set the value within 0 to 200,000 Hz when converted to pulse data.	0 to 15,300 (user unit) Set the value within 0 to 10,000 Hz when converted to pulse data.
#8	#7	JOG speed	1 to 2,147,483,647 (user unit) Set the value within 1 to 200,000 Hz when converted to pulse data.	1 to 153,000 (user unit) Set the value within 10 to 100,000 Hz when converted to pulse data.
#10	#9	Zero return speed (high speed)	1 to 2,147,483,647 (user unit) Set the value within 1 to 200,000 Hz when converted to pulse data.	1 to 153,000 (user unit) Set the value within 10 to 100,000 Hz when converted to pulse data.
-	#11	Zero return speed (creep)	1 to 32,767 (user unit) Set the value within 1 to 200,000 Hz when converted to pulse data.	1 to 15,300 (user unit) Set the value within 0 to 10,000 Hz when converted to pulse data.
-	#12	Number of zero-point signal for zero return	0 to 32,767	
#14	#13	Zero-point address	-2,147,483,648 to 2,147,483,647 (user unit) Set the value within -2,147,483,648 to 2,147,483,647 PLS when converted to pulse data.	-999,999 to 999,999 (user unit) Set the value within -999,999 to 999,999 PLS when converted to pulse data.
-	#15	Acceleration/deceleration time	Trapezoidal acceleration/deceleration: 1 to 32,767 ms Approximate S-shaped acceleration/deceleration: 1 to 5,000 ms	Trapezoidal acceleration/deceleration: 50 to 5,000 ms
-	#16	Starting delay time	0 to 1,000 ms	Not used
#18	#17	Target address I	-2,147,483,648 to 2,147,483,647 (user unit) Set the value within -2,147,483,648 to 2,147,483,647 PLS when converted to pulse data.	-999,999 to 999,999 (user unit) Set the value within -999,999 to 999,999 PLS when converted to pulse data.
#20	#19	Operation speed I	1 to 2,147,483,647 (user unit) Set the value within 1 to 200,000 Hz when converted to pulse data.	1 to 153,000 (user unit) Set the value within 10 to 100,000 Hz when converted to pulse data.
#22	#21	Target address II	-2,147,483,648 to 2,147,483,647 (user unit) Set the value within -2,147,483,648 to 2,147,483,647 PLS when converted to pulse data.	-999,999 to 999,999 (user unit) Set the value within -999,999 to 999,999 PLS when converted to pulse data.

BFM No.		Item	Setting range	
High order 16bit	Low order 16bit		FX3U-1PG	FX2N-1PG
#24	#23	Operation speed II	1 to 2,147,483,647 (user unit) Set the value within 1 to 200,000 Hz when converted to pulse data.	1 to 153,000 (user unit) Set the value within 10 to 100,000 Hz when converted to pulse data.
-	#25	Operation command	b0: Error reset b1: STOP b2: Reverse limit b3: Reverse limit b4: Forward JOG operation b5: Reverse JOG operation b6: DOG type mechanical zero return operation start b7: Relative/absolute address b8: 1-speed positioning operation start b9: Interrupt 1-speed positioning operation start b10: 2-speed positioning operation start b11: External command positioning operation start b12: Variable speed operation b13: Interrupt stop operation start      b13: Not used b14: Interrupt 2-speed positioning operation start      b14: Not used b15: Data-set type mechanical zero return operation start      b15: Not used	
#27	#26	Current address	-2,147,483,648 to 2,147,483,647 (user unit)	
-	#28	Status information	b0: READY b1: Forward/Reverse b2: Zero return completion b3: STOP input ON b4: DOG input ON b5: PG0 input ON b6: Current value overflow b7: Error flag b8: Positioning completion flag b9: 1-speed completion flag      b9: Not used b10: Interrupt input 0 ON      b10: Not used b11: Interrupt input 1 ON      b11: Not used b12: Remaining distance operation waiting      b12: Not used b13 to b15: Not used	
-	#29	Error code	An error code is stored at the time of the error occurrence.	
-	#30	Model code	K5,130	K5,110
-	#31	Not used	Not used	
Buffer memories BFM#32 and later are new in the FX3U-1PG. Refer to Section 7.2 for the contents of buffer memories BFM#32 and later.			Not used	



## Appendix C-3 Differences in Operation

### Appendix C-3-1 Differences in properties common to all operation modes

Differences in properties common to all operation modes of FX3U-1PG and FX2N-1PG are shown in the following table.

Change point		FX3U-1PG	FX2N-1PG	Replacement point
Output frequency		<p>The output pulse frequency (f) of FX3U-1PG is stepwise as follows.  <math>f = 24 \times 10^6 / n</math> (Hz)                      Where, n: Integer in range of 120 to 24,000,000  <b>Example:</b>                      When the operation speed I is set to "99,000 Hz"  <math>99,000 = 24 \times 10^6 / n</math>  <math>n = 24 \times 10^6 / 99,000</math>  <math>= 242.4</math> (Rounded off)  <math>\approx 242</math>                      When the "n = 242"                      Output pulse frequency  <math>f = 24 \times 10^6 / 242</math>  <math>= 99,174</math> Hz</p>	<p>The output pulse frequency (f) of FX2N-1PG is stepwise as follows.  <math>f = 1 \times 10^6 / 0.25n</math> (Hz)                      Where, n: Integer in range of 40 to 400,000  <b>Example:</b>                      When the operation speed I is set to "99,000 Hz"  <math>99,000 = 1 \times 10^6 / 0.25n</math>  <math>n = 1 \times 10^6 / 0.25 / 99,000</math>  <math>= 40.4</math> (Rounded off)  <math>\approx 40</math>                      When the "n = 40"                      Output pulse frequency  <math>f = 1 \times 10^6 / 0.25 / 40</math>  <math>= 100,000</math> Hz</p>	<p>The actual output frequency may be different even if the same operation speed I is set as shown in the example on the left because the stepwise property of the output frequency is different.                      Confirm that no problem is expected in the system.                      Change the sequence program as needed.                      The frequency which can be output from the FX2N-1PG can be output also from the FX3U-1PG.                      Accordingly, by setting the actual output frequency of the FX2N-1PG in the FX3U-1PG, the motor can operate at the same speed using the FX3U-1PG.</p>
Starting time		<p>Motor system: 1 ms or less                      Machine system: 2 ms or less</p>	<p>1st time: 500 ms or less                      2nd time and later: Approximately 10 ms</p>	<p>Confirm that that the difference in the starting time causes no problem in the system.                      Change the sequence program, such as setting up starting delay time (BFM#16) if needed.</p>
Operation when the PLC mode changes from RUN to STOP		<p>Continues the positioning operation.</p>	<p>The motor decelerates and stops. However, the motor continues the operation if the FROM/TO instruction, etc. is being executed by the BFM monitoring function, etc.</p>	<p>When the positioning operation is stopped by the PLC mode change from RUN to STOP, change the sequence program so that the positioning operation is stopped by the STOP signal (BFM#25 b1 or STOP terminal).</p>
Operation command (BFM#25)	STOP detection (BFM#25 b1)	<p>Level detection.                      It is necessary to keep the STOP signal ON for 1 ms or more.</p>	<p>Edge detection.</p>	<p>When the STOP is set to "OFF → ON → OFF" in less than 1 ms, change the sequence program so that the STOP remains ON for 1 ms or more.</p>
Forward limit/ Reverse limit (forward pulse stop or reverse pulse stop)	Operation when the forward limit or reverse limit (forward pulse stop or reverse pulse stop) is detected in the operation direction	<p>The operation varies as follows depending on the setting of the limit deceleration mode (BFM#3 b11 or BFM#37 b11):</p> <ul style="list-style-type: none"> <li>When the limit deceleration mode (b11) is OFF                      The motor stops immediately, and the FX3U-1PG outputs the CLR signal.</li> <li>When the limit deceleration mode (b11) is ON                      The motor decelerates and stops, and the FX3U-1PG does not output the CLR signal.</li> </ul> <p>In either mode, the forward limit/ reverse limit error (Error code: K6) occurs after the motor stops.</p>	<p>The motor stops immediately, and the FX2N-1PG outputs the CLR signal.                      No error occurs.</p>	<p>In a sequence program that detects errors and then performs a specified action, confirm that no problem is expected when the forward limit/ reverse limit error occurs.                      Change the sequence program as needed.</p>

### Appendix C-3-2 Differences in individual operation modes

Differences in individual operation modes of FX3U-1PG and FX2N-1PG are shown in the following table.

#### JOG operation

Change point	FX3U-1PG	FX2N-1PG	Replacement point
Inching travel amount	The FX3U-1PG outputs pulses corresponding to 1 user unit. However, the FX3U-1PG outputs 1 pulse even if the value "Position data multiplier x Pulse rate" is smaller than the feed rate in the machine system setting or combined system setting and the pulse number required for the travel in 1 user unit is less than 1 pulse.	The FX2N-1PG outputs 1 pulse.	Confirm that no problem is expected in the system when the travel amount generated by 1 inching operation is large if the pulse number corresponding to 1 user unit is larger than 1 pulse. Change the sequence program as needed.

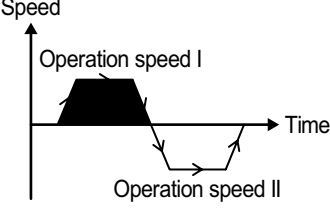
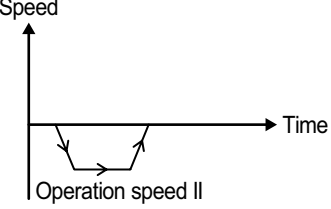
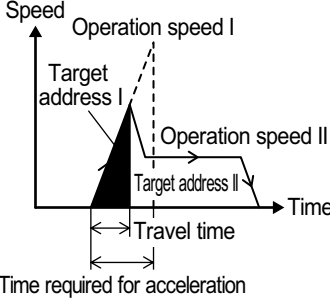
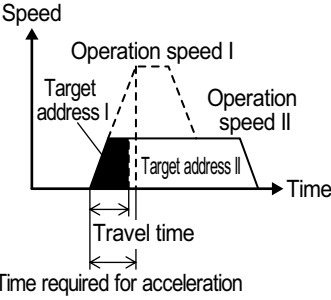
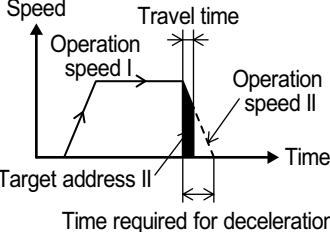
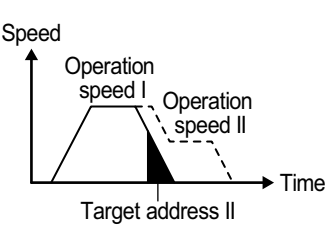
#### DOG type mechanical zero return operation

Change point	FX3U-1PG	FX2N-1PG	Replacement point
DOG search operation when the forward limit/reverse limit is ON	The motor starts the DOG search operation even when the direction of the forward limit or reverse limit in the ON status is the same as the zero return direction.	The motor does not perform the operation when the direction of the forward pulse stop (forward limit) or reverse pulse stop (reverse limit) in the ON status is the same as the zero return direction.	Confirm that no problem is expected in the system when an error occurs at the forward limit or reverse limit, the zero return operation is executed from the corresponding limit position, and the motor reverses the operation direction. Change the sequence program as needed.
Operation when the DOG cannot be detected	The motor stops at the forward limit (or reverse limit) and the forward limit/reverse limit error occurs if the DOG cannot be detected while the motor starts the zero return operation, reverses the operation direction at the reverse limit (or forward limit) and then reaches the forward limit (or reverse limit).	The motor stops at the forward limit (or reverse limit) but no error occurs if the DOG cannot be detected while the motor starts the zero return operation, reverses the operation direction at the reverse limit (or forward limit) and then reaches the forward limit (or reverse limit).	Confirm that no problem is expected in the system when an error occurs at the forward limit or reverse limit, the zero return operation is executed from the corresponding limit position, and the motor reverses the operation direction. Change the sequence program as needed.

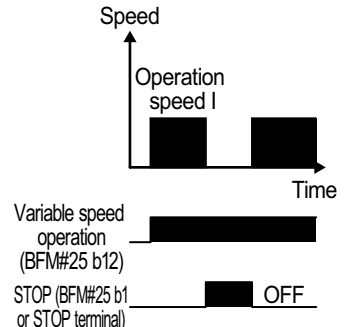
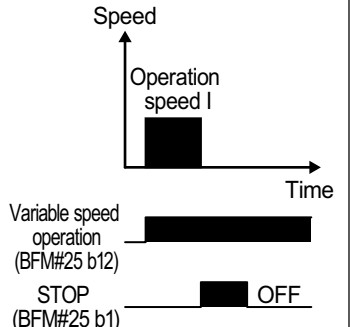
#### Interrupt 1-speed positioning operation

Change point	FX3U-1PG	FX2N-1PG	Replacement point
Operation when the travel amount is small (When the time required to perform deceleration from the operation speed I is longer than the travel time)	<p>The motor decelerates when the interrupt input is detected, and stops at the target address I.</p>	<p>The motor does not accelerate until the operation speed I is reached, and performs acceleration only until it reaches a speed so as to achieve "Travel amount during deceleration = Target address I".</p>	<p>Confirm that no problem is expected in the system when the operation speed is different or when the travel amount is small and the motor stops immediately. Change the sequence program as needed so that the motor operation using the FX3U-1PG becomes the same motor operation using the FX2N-1PG by reducing the operation speed I.</p>

**2-speed positioning operation**

Change point	FX3U-1PG	FX2N-1PG	Replacement point
<p>When the operation direction is different between the 1-speed and the 2-speed</p>	<p>The motor reaches the target address I at the operation speed I, reverses the operation direction, and then reaches the target address II at the operation speed II.</p> 	<p>The motor reaches the target address II at the operation speed II from the beginning.</p> 	<p>Confirm that no problem is expected in the system when the motor reverses the operation direction if the operation direction is different between the 1-speed and the 2-speed. 1-speed positioning operation can be substituted for operation of the FX2N-1PG. Change the sequence program as needed.</p>
<p>Operation when the travel amount at the 1-speed is small (When the time required to perform acceleration until the operation speed I is longer than the travel time until the target address I)</p>	<p>The motor performs acceleration until it reaches the target address I.</p>  <p>Time required for acceleration</p>	<p>The motor starts with operation speed II from the beginning.</p>  <p>Time required for acceleration</p>	<p>Confirm that acceleration until the operation speed I causes no problem in the system. 1-speed positioning operation can be substituted for operation of the FX2N-1PG. Change the sequence program as needed.</p>
<p>Operation when the travel amount at the 2-speed is small (When the time required to perform deceleration from the operation speed I is longer than the travel time until the target address II)</p>	<p>The motor starts deceleration at the end of the 1-speed, and stops immediately when it reaches the target address II.</p>  <p>Time required for deceleration</p>	<p>The motor starts deceleration before it reaches the target address I, and stops when it reaches the target address II.</p> 	<p>Confirm that immediate stop causes no problem in the system. 1-speed positioning operation can be substituted for operation of the FX2N-1PG. Change the sequence program as needed.</p>

**Variable speed operation**

Change point	FX3U-1PG	FX2N-1PG	Replacement point
Operation when the operation speed I starts at a speed lower than the bias speed	The FX3U-1PG does not output pulses. The READY flag (BFM#28 b0) turns OFF.	The motor operates at the bias speed. (The motor operates at 10 Hz if the bias speed is set to "0".)	Change the sequence program so that the operation speed I at the beginning is set to the bias speed.
Operation when the operation speed I is changed to a speed lower than the bias speed	The FX3U-1PG stops the pulse output. The READY flag (BFM #28 b0) remains OFF.	The motor operates at the bias speed. (The motor operates at 10 Hz if the bias speed is set to "0".)	Change the sequence program so that the operation speed I is changed to the bias speed.
Operation when the STOP is set from ON to OFF while the operation command remains ON	The motor restarts the operation when the STOP signal is set to OFF.  	The motor does not restart the operation even if the STOP signal is set to OFF.  	Confirm that no problem is expected in the system when the operation is restarted by setting the STOP signal to OFF. Change the sequence program as needed so that the motor is stopped by the STOP signal, the operation command is set to OFF, and then the STOP signal is set to OFF.

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