9. REAL & VIRTUAL MODE SWITCHING AND STOP/RESTART

This section discusses the procedure for switching between the REAL and VIRTUAL modes, and the data items which are checked when such switching occurs.

(1) Switching between the REAL & VIRTUAL modes

Switching between the REAL & VIRTUAL modes is executed by switching the M2043 signal (REAL/VIRTUAL mode switch request flag) ON and OFF.

- For REAL mode ...... A REAL mode switching request occurs when M2043 is switched from ON to OFF.

- For VIRTUAL mode ... A VIRTUAL mode switching request occurs when M2043 is switched from OFF to ON.

(2) REAL & VIRTUAL mode confirmation

The present control mode status (REAL or VIRTUAL) is confirmed by the ON/OFF status of the M2044 signal (REAL/VIRTUAL mode status).

- M2044 OFF .... REAL mode status.

- M2044 ON .... VIRTUAL mode status.

9.1 Switching from the REAL to VIRTUAL Mode

When a REAL to VIRTUAL mode switching request (M2043 OFF → ON) occurs, the following processing occurs:

- Check to determine if switching to the VIRTUAL mode is possible
  .... See Table 9.1

- Output module check .... See Table 9.2

- Synchronous encoder axis check ...... See Table 9.3

Switching from the REAL to VIRTUAL mode is possible if the check items shown in Tables 9.1 to 9.3 are all normal.

(1) Check to determine if switching to the VIRTUAL mode is possible

(a) The items shown in Table 9.1 are checked to determine if switching to the VIRTUAL mode is possible.

All the check items must be normal in order for switching to occur.

(b) If an error exists at any of the Table 9.1 check items, M2045*1 will switch ON, and the error code will be stored at the D9195/D9195/D9193-D9195*1 register.

Refer to section 10.6 for details regarding the error codes which are stored at D9195.

| REMARK |

*1: The proper names of M2045 and D9195/D9195/D9193 - D9195 are given below.

- M2045 .... REAL/VIRTUAL mode switching error detection flag

- D9195/D9195/D9193 - D9195 .. REAL/VIRTUAL mode switching error information register.

9. REAL & VIRTUAL MODE SWITCHING AND STOP/RESTART

Table 9.1 Checklist for REAL to VIRTUAL Mode Switching

Check Sequence	Check Item	Output Module Checked				Normal Condition	Abnormal Condition
		Roller	Ball Screw	Rotary Table	Cam		
1	Are PC READY (M2000) and PCPU READY (M9074) flags ON?	O	O	O	O	ON	OFF
2	Are all axes stopped? (M2001 - M2004/M2001 - M2008/ M2001 - M2032 are OFF)	O	O	O	O	YES	NO
3	Has cam data been changed by the sequence program?	O	O	O	O	NO	YES
4	Has the mechanical system program been registered?	O	O	O	O	YES	NO
	Does the axis No. designated in the system settings match the output shaft designated in the mechanical system program?	O	O	O	O	YES	NO
5	Is the all-axes servo ON command (M2042) ON?	O	O	O	O	ON	OFF
6	Is servo START processing in progress due to a servo error reset at the amplifier module axis?	O	O	O	O	Servo START completed	Servo START processing in progress
7	Is external encoder normal?	O	O	O	O	YES	NO
8	Is an external emergency stop (EMG) input in effect?	O	O	O	O	NO	YES
9	Is the servo error detection (M1608+20n/Xn8/M2408+ 20n) signal OFF at all the axes?	O	O	O	O	YES	NO
10	Is the home position return request (M1609+20n/Xn9/ M2409+20n) signal OFF for all the axes? (excluding roller axis)	–	O	O	O	YES	NO
11	Does the system-of-units designated in the fixed parameters match that designated at the output module?	–	O	O	O	YES	NO
12	Has the cam data been registered?	–	–	–	O	YES	NO
13	Has the cam No. been designated at the "cam No. setting device" (cam parameters)?	–	–	–	O	YES	NO
14	Has the stroke (1 to $2^{31}-1$) been designated at the "stroke setting device" (cam parameters)?	–	–	–	O	YES	NO
15	Is the cam's "stroke setting device" No. an even number?	–	–	–	O	YES	NO

(2) Output module check

(a) The items shown in Table 9.2 below are checked to determine the output module status. If an error is found, switching to the VIRTUAL mode will not occur, and the corresponding system cannot be started. When an error exists, switch back to the REAL mode and correct the error cause, then switch to the VIRTUAL mode again.

(b) When an error is found, the corresponding output module's error detection signal (M1607+20n/Xn7/M2407+20n) will switch ON, and the error code will be stored in the minor/major error code register.

Table 9.2 Output Module Checklist

Check Sequence	Check Item	Output Module Checked				Normal Condition	Abnormal Condition
		Roller	Ball Screw	Rotary Table	Cam		
1	Is the feed present value within the stroke range?	–	O	O	–	YES	NO
	Is the feed present value within the range "[lower stroke limit value] to [stroke]"?	–	–	–	O		
2	When in the two-way cam mode, does "[lower stroke limit value] + [stroke]" exceed $2^{31}-1$?	–	–	–	O	NO	YES
3	[Drive module] When the clutch connected to the synchronous encoder is in an "external input mode", are the clutch's ON/OFF bit devices the same device?	O	O	O	O	YES	NO
	[Drive module] When the clutch connected to the synchronous encoder is in an "external input mode", is the encoder interface input a manual pulse generator input?	O	O	O	O	YES	NO (serial encoder (ABS) input)
4	Does a servo ON status (M1615+20n/XnF/M2415+20n is ON) exist at an output module where either a "no clutch" or "clutch ON command" is in effect for the virtual main shaft or the virtual auxiliary input shaft?	O	O	O	O	YES	NO
	Is the external input "STOP" signal OFF at an output module where either a "no clutch" status or "clutch ON command" is in effect for the virtual main shaft or the virtual auxiliary input axis?	O	O	O	O	YES	NO
5	When in the two-way cam mode, can the present value be calculated within 1 cam revolution?	–	–	–	O	YES	NO
6	Is the No. of the clutch ON/OFF address setting device (for address mode clutch) an even number?	O	O	O	O	YES	NO

(3) Synchronous encoder axis check

(a) The items shown in Table 9.3 below are checked to determine the synchronous encoder status. If an error is found, switching to the VIRTUAL mode will not occur. Error causes can only be corrected by switching back to the REAL mode.

(b) When an error is found, the corresponding output module's error detection signal (M1607+20n/Xn7/M2407+20n) will switch ON, and the error code will be stored in the minor/major error code register.

Table 9.3 Synchronous Encoder Axis Checklist

Check Sequence	Check Item	Output Module Checked		Normal Condition	Abnormal Condition
		External Synchronous Encoder	Output Module		
1	Is the synchronous encoder connected to an A171SENC/A273EX unit?	○	—	Connected	Not connected
					Cable break

9. REAL & VIRTUAL MODE SWITCHING AND STOP/RESTART

9.2 Switching from the VIRTUAL to REAL Mode

VIRTUAL to REAL mode switching can be conducted by the user or by the OS.

- By user .... Switch M2043 OFF

- By OS .... Switching occurs automatically when a servo error is detected.

9.2.1 VIRTUAL to REAL mode switching by user

(1) When a VIRTUAL to REAL mode switching request (M2043 OFF → ON) occurs, the item shown in Table 9.4 is checked. If normal, switching to the REAL mode will occur. Before switching M2043 OFF, make sure that this item's status is normal.

(2) If an error is detected, M2045 will switch ON, and the error code will be stored at the D9195/D9195/D9193 - D9195 register. (See section 10.6)

Table 9.4 Checklist for VIRTUAL to REAL Mode Switching

Check Sequence	Check Item	Normal Condition	Abnormal Condition
1	Are all axes stopped? (M2001 - M2004/M2001 - M2008/M2001 - M2032 are OFF)	YES	NO

9.2.2 VIRTUAL to REAL mode switching by OS

(1) If any of the following conditions are detected during VIRTUAL mode operation, the OS will automatically switch back to the REAL mode.

- When an external emergency stop (EMG) input occurs.

- When the servo error detection signal (M1608+20n/Xn8/M2408+20n) switches ON at any axis.

- When the PC READY (M2000) signal switches OFF.

- When an error occurs in the 24 DC power supply to the A171SENC/A278LX while servos are ON at all axes (major error: 15010).
  (This condition applies when an A171SENC brake is designated at the A171SCPU, or when an A278LX brake is designated at the A273UHCPU (8/32-axis specification).

(2) If any of the above conditions occur, the OS will switch back to the REAL mode, and the resulting error code will be stored in the D9195/D9195/D9193 - D9195 register. M2045 will not switch ON at this time.

> **REMARK**
>
> *1: The proper names of M2045 and D9195/D9195/D9193 - D9195 are given below.
>
> - M2045 .... REAL/VIRTUAL mode switching error detection flag
>
> - D9195/D9195/D9193 - D9195 .. REAL/VIRTUAL mode switching error information register.

9.3 Precautions When Switching between REAL and VIRTUAL Modes

The precautions when switching between the REAL and VIRTUAL modes are described below.

(1) The DSFRP/SVST, DSFLP/CHGA/CHGV instructions are inoperative during REAL/VIRTUAL mode switching processing (indicated by asterisks * in the timing chart below). If one of these instructions is attempted at such a time, an error will occur at the START point.

In order to execute the DSFRP/SVST and DSFLP/CHGA/CHGV instructions, M2043 and M2044 should be used as an interlock function.

[Timing Chart]
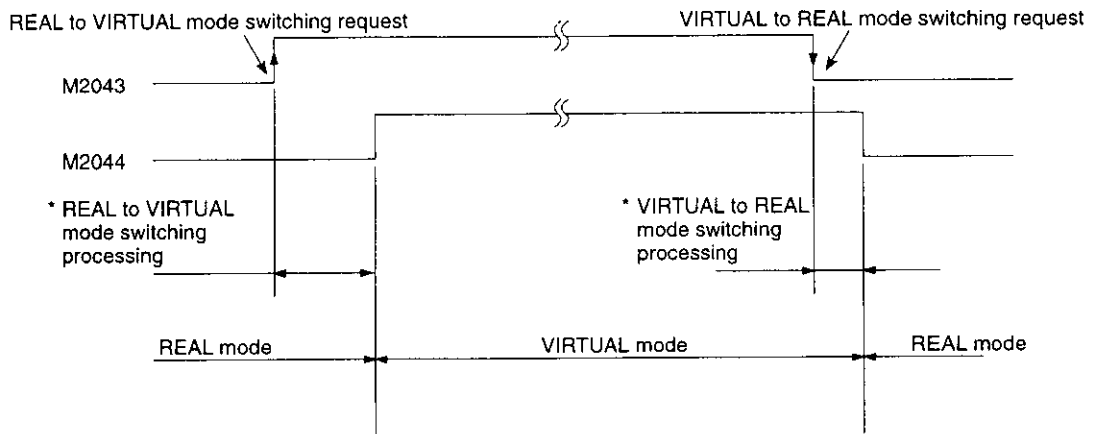
[Program Example]

(a) Servo program START request at REAL mode
(for A273UHCPU 8-axis specification)
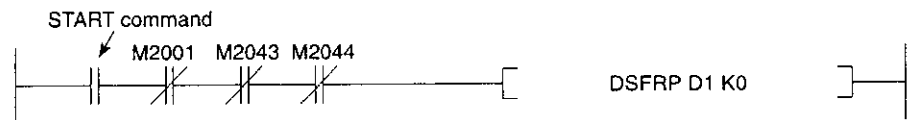
(b) Servo program START request at VIRTUAL mode
(for A273UHCPU 8-axis specification)

REMARKS

1) For details regarding the DSFRP/SVST and DSFLP/CHGA/CHGV instructions, refer to the Motion Controller (SV13/22) Programming Manual (REAL Mode) IB-67265.

2) The M2043 and M2044 names are as follows:

   • M2043 . . . . REAL/VIRTUAL mode switching request flag
   • M2044 . . . . REAL/VIRTUAL mode status flag

   (See Section 4.2)

(2) During TEST mode operation, M2043 ON/OFF (REAL/VIRTUAL mode switching request) switching from a peripheral device is ignored.

During TEST mode operation, REAL/VIRTUAL mode switching can be executed from a peripheral device.

M2044 will switch ON/OFF in accordance with the REAL/VIRTUAL mode status.

| REMARK |

When REAL/VIRTUAL mode switching is executed from a peripheral device, the data which is checked is identical to that checked at M2043 OFF → ON and ON → OFF. (See Sections 9.1 and 9.2)

9.4 STOP & RESTART

The basic method for stopping the system (output module) during VIRTUAL mode operation is to stop the main shaft. If an auxiliary input shaft is being used, that shaft should also be stopped.

(1) Virtual Axis STOP

The procedures for stopping and restarting the virtual shaft, and the stop processing details are discussed below. A virtual servo motor axis can be stopped by the 3 types of stop processing shown below. This processing is also valid for interpolation axes during interpolation operations.

1. Deceleration to stop . . . . . A deceleration to stop occurs in accordance with the parameter block's "stop deceleration time" setting.

2. Rapid stop . . . . A deceleration to stop occurs in accordance with the parameter block's "rapid stop deceleration time" setting.

3. Immediate stop . . . . An immediate stop occurs without deceleration.

Because an immediate input stop occurs for synchronous encoder axes, operation should be executed only after the synchronous encoder axis has been stopped by an external input, except for abnormal stops such as an emergency stop or a servo error occurrence, etc.

([Ex]: Switch M2000 OFF, or execute an all-axes servo OFF command, etc.)

(An immediate stop at output modules connected to the synchronous encoder will result in a servo error, and possibly, a synchronization discrepancy.)

When the stop cause is such that a synchronization discrepancy occurs, a synchronization discrepancy warning (M2046) will switch ON. In this case, re-align the axes in the REAL mode, switch M2046 OFF, then continue with the VIRTUAL mode operation.

The stop procedure/stop causes, and restarting procedure are shown in the following Table.

9. REAL & VIRTUAL MODE SWITCHING AND STOP/RESTART

No.	Stop Procedure or Stop Causes during Operation	Affected Virtual Axis			Stop Processing		Return to REAL Mode by OS after All Virtual Axes Stop Completed	Synchroniza-tion Discrepancy Warning (M2046) Set
		Virtual Servo Motor Axis	Synchro-nous Encoder Axis	All Axes Batch	Virtual Servo Motor Axis	Synchro-nous Encoder Axis		
1	Stop command ON	○ (Relevant axis)	–	–	Deceleration to stop	–	–	–
2	Rapid stop command ON	○ (Relevant axis)	–	–	Rapid stop	–	–	–
3	All-axes servo OFF command (M2042 OFF Com-mand from peripheral device when in TEST mode)	–	–	○	Deceleration to stop	Immediate input stop	–	–
4	PC READY (M2000) OFF	–	–	○	Deceleration to stop	Immediate input stop	○	–
5	Servo system CPU stop	–	–	○	Deceleration to stop	Immediate input stop	○	–
6	All-axes rapid stop by key input from periph-eral device	–	–	○	Rapid stop	Immediate input stop	–	–
7	Stop by key input from peripheral de-vice during TEST mode	○ (All axes)	–	–	Deceleration to stop	–	–	–
8	External emergency stop (EMG) input (emergency stop from teaching mod-ule)	–	–	○	Rapid stop	Immediate input stop	○	○
9	Servo error at any output module	–	–	○	Rapid stop	Immediate input stop	○	○
10	SCPU WDT error	–	–	○	Deceleration to stop	Immediate input stop	–	–
11	PCPU WDT error	–	–	○	Immediate stop	Immediate input stop	–	–
12	Servo system CPU reset	–	–	○	Immediate stop	Immediate input stop	–	–
13	Servo system CPU power OFF	–	–	○	Immediate stop	Immediate input stop	–	–
14	Other errors during virtual axis operation	○	–	–	Deceleration to stop	–	–	–
15	Error at absolute syn-chronous encoder axis	–	○	–	–	Immediate input stop	–	–

Error Set	Output Module Operation	Operation Continuation ENABLED (○)/ DISABLED (×)	Restarting after a Stop
–	• Deceleration to stop based on smoothing time constant.	○	• Resume operation by switching the stop command OFF (not necessary when ON) and executing a START.
–	• Deceleration to stop based on smoothing time constant.	○	• Resume operation by switching the stop command OFF (not necessary when ON) and executing a START.
–	• After a deceleration to stop based on the smoothing time constant, the servo OFF status is established.	○	• Resume operation by turning all clutches OFF → all axes servo ON → clutch ON. (However, there must be no motor movement during the servo OFF status. Moreover, clutch OFF/ON switching occurs only as required by the user.) • For synchronous encoder axes, switch to the REAL mode, then back to the VIRTUAL mode to resume inputs.
Minor error (200) set (virtual axis)	• Deceleration to stop based on smoothing time constant.	○	• After PC READY (M2000) switches ON, execute a REAL to VIRTUAL mode switching request (M2047 ON) to enable operation.
Minor error (200) set (virtual axis)	• Deceleration to stop based on smoothing time constant.	○	• After a servo system CPU "RUN" status is established, execute a REAL to VIRTUAL mode switching request (M2047 ON) to enable operation.
–	• Deceleration to stop based on smoothing time constant.	○	• After a stop occurs, execute a START to resume operation. • For synchronous encoder axes, switch to the REAL mode, then back to the VIRTUAL mode to resume inputs.
–	• Deceleration to stop based on smoothing time constant.	○	• After a stop occurs, execute a START to resume operation.
–	• Servo switches OFF after immediate stop.	×	• Operation cannot be resumed due to a synchronization discrepancy between the virtual axis and output module which occurs at the stop. • After canceling the emergency stop, re-align the output module in the REAL mode, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the VIRTUAL mode to resume operation.
Relevant output module (Servo error, servo error code set)	• <u>Servo error at ADU axis</u>: An immediate stop occurs at all ADU axes or MR-[ ]-B axes, and a servo OFF status is established. • <u>Servo error at MR-[ ]-B axis</u>: An immediate stop occurs only at the axis where the error occurred, and a servo OFF status is established. All other axes are synchronized with the virtual axis and are then stopped.	×	• After executing a servo error reset in the REAL mode, re-align the axes, switch the synchronization discrepancy warning (M2046) OFF, then switch back to the VIRTUAL mode to resume operation.
–	• Deceleration to stop based on smoothing time constant.	×	• After the stop, reset the servo system CPU in the REAL mode to resume operation.
M9073 (PCPU WDT error) ON	• Servo switches OFF after immediate stop.	×	• Operation cannot be resumed due to a synchronization discrepancy between the virtual axis and output module which occurs at the stop. • After resetting the servo system CPU, re-align the output module, then switch to the VIRTUAL mode to resume operation.
–	• Servo switches OFF after immediate stop.	×	• Operation cannot be resumed due to a synchronization discrepancy between the virtual axis and output module which occurs at the stop. • After resetting the servo system CPU, re-align the output module, then switch to the VIRTUAL mode to resume operation.
–	• Servo switches OFF after immediate stop.	×	• Operation cannot be resumed due to a synchronization discrepancy between the virtual axis and output module which occurs at the stop. • After resetting the servo system CPU, re-align the output module, then switch to the VIRTUAL mode to resume operation.
Relevant error set	• Deceleration to stop based on smoothing time constant.	○	• Eliminate the error cause to enable a START.
Relevant error set	• Deceleration to stop based on smoothing time constant.	×	• Return to the REAL mode, re-align the axes, then switch to the VIRTUAL mode to resume operation.

10. ERROR CODES STORED AT THE PCPU

Errors detected at the PCPU include servo program setting errors, positioning errors, and control mode switching errors.

(1) Servo program setting errors

Servo program setting errors consist of errors in the positioning data designated at the servo program. A check occurs for these errors each time a servo program is started. When positioning data is designated indirectly, an error will occur if the designated data violates the prescribed range.

When an error is activated, the following occur:

- The servo program setting error flag (M9079) switches ON.

- The program No. where the error occurred is recorded in the error program No. register (D9189).

- The error code is recorded in the error information storage register (D9190).

(2) Positioning errors

(a) Positioning errors occur at positioning START, or during the positioning operation. There are three types of positioning error: minor errors, major errors, and servo errors.

1) Minor errors .... These errors are caused by the sequence program or servo program. The error code range for these errors is 1 - 999 for drive modules, and 4000 - 9990 for output modules. The cause of these errors can be eliminated by correcting the sequence program or servo program in accordance with the error code.

2) Major errors .... These errors are caused by external input signals or by control commands from the SCPU. The error code range for these errors is 1000 - 1999 for drive modules, and 10000 - 11990 for output modules. Eliminate the cause of these errors in accordance with the error code.

3) Servo errors .... These are errors detected by the servo amplifier or servo power supply module. The error code range for these errors is 2000 - 2999. Eliminate the cause of these errors in accordance with the error code.

Error Class	Error Occurrence Point	Applicable Modules	
		Drive Module	Output Module
Minor error	Setting data	1 - 99	4000 - 4990
	At START	100 - 199	5000 - 5990
	During operation	200 - 299	6000 - 6990
	At control change	300 - 399	–
Major error	At START	1000 - 1099	10000 - 10990
	During operation	1100 - 1199	11000 - 11990
	System	–	–
		–	15000 - 15990
Servo error	Servo amplifier	–	2000 - 2799 (2100 - 2499 are warnings)
	Servo power supply module		2800 - 2999 (2900 - are warnings)

(b) When an error occurs, the error detection signal for the axis in question will switch ON, and the corresponding error code will be recorded in the minor error code, major error code, or servo error code register.

1) When A171SCPU is used

		Error Code Registers				Error Detection Signal	Error Reset Flag
		Axis 1	Axis 2	Axis 3	Axis 4		
Virtual servo motor	Minor error code	D702	D708	D714	D720	M1207+20n	M1407+20n
	Major error code	D703	D709	D715	D721		
Synchronous encoder	Minor error code	D750				M1360	M1560
	Major error code	D751					
Output module	Minor error code	D806	D826	D846	D866	M1607+20n	M1807+20n
	Major error code	D807	D827	D847	D867		
	Servo error code	D808	D828	D848	D868	M1608+20n	M1808+20n (Reset is also valid for REAL mode errors)

2) When A273UHCPU (8-axis specification) is used

		Error Code Registers								Error Detection Signal	Error Reset Flag
		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8		
Virtual servo motor	Minor error code	D702	D708	D714	D720	D726	D732	D738	D744	X1n7	Y1n7
	Major error code	D703	D709	D715	D721	D727	D733	D739	D745		
Synchronous encoder	Minor error code	D750	D754	D758						X0E0 - X0E2	Y0E0 - Y0E2
	Major error code	D751	D755	D759							
Output module	Minor error code	D806	D826	D846	D866	D886	D906	D926	D946	X0n7	Y0n7
	Major error code	D807	D827	D847	D867	D887	D907	D927	D947		
	Servo error code	D808	D828	D848	D868	D888	D908	D928	D948	X0n8	Y0n8 (Reset is also valid for REAL mode errors)

10. ERROR CODES STORED AT THE PCPU

3) When A273UHCPU (32-axis specification) is used

		Error Code Registers											
		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12
Virtual servo motor	Minor error code	D802	D812	D822	D832	D842	D852	D862	D872	D882	D892	D902	D912
	Major error code	D803	D813	D823	D833	D843	D853	D863	D873	D883	D893	D903	D913
Synchronous encoder	Minor error code	D1122	D1132	D1142	D1152	D1162	D1172	D1182	D1192	D1202	D1212	D1222	D1232
	Major error code	D1123	D1133	D1143	D1153	D1163	D1173	D1183	D1193	D1203	D1213	D1223	D1233
Output module	Minor error code	D6	D16	D26	D36	D46	D56	D66	D76	D86	D96	D106	D116
	Major error code	D7	D17	D27	D37	D47	D57	D67	D77	D87	D97	D107	D117
	Servo error code	D8	D18	D28	D38	D48	D58	D68	D78	D88	D98	D108	D118

		Error Code Registers											
		Axis 13	Axis 14	Axis 15	Axis 16	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
Virtual servo motor	Minor error code	D922	D932	D942	D952	D962	D972	D982	D992	D1002	D1012	D1022	D1032
	Major error code	D923	D933	D943	D953	D963	D973	D983	D993	D1003	D1013	D1023	D1033
Synchronous encoder	Minor error code												
	Major error code												
Output module	Minor error code	D126	D136	D146	D156	D166	D176	D186	D196	D206	D216	D226	D236
	Major error code	D127	D137	D147	D157	D167	D177	D187	D197	D207	D217	D227	D237
	Servo error code	D128	D138	D148	D158	D168	D178	D188	D198	D208	D218	D228	D238

		Error Code Registers								Error Detection Signal	Error Reset Flag
		Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32		
Virtual servo motor	Minor error code	D1042	D1052	D1062	D1072	D1082	D1092	D1102	D1112	M4007+20n	M4807+20n
	Major error code	D1043	D1053	D1063	D1073	D1083	D1093	D1103	D1113		
Synchronous encoder	Minor error code									M4640+4n	M5440+4n
	Major error code										
Output module	Minor error code	D246	D256	D266	D276	D286	D296	D306	D316	M2407+20n	M3207+20n
	Major error code	D247	D257	D267	D277	D287	D297	D307	D317		
	Servo error code	D248	D258	D268	D278	D288	D298	D308	D318	M2408+20n	M3208+20n (Reset is also valid for REAL mode errors)

(c) Each time an error occurs, the previously stored error code will be replaced (deleted) by the new error code. However, a log of errors can be recorded for reference purposes at a peripheral device (IBM PC running the SW2SRX-GSV22PE software).

(d) The error detection flag and error code are saved until the error reset signal or the servo error reset signal is switched ON.

POINTS

(1) When a servo error occurs, there are cases where the same servo error code will be stored again even after a servo error reset (M1808+20n/Yn8/M3208+20n: ON) is executed.

(2) When a servo error occurs, eliminate the error cause, then execute a servo error reset.

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(3) REAL/VIRTUAL mode switching errors

A check for REAL/VIRTUAL mode switching errors occurs when the REAL/VIRTU-
AL mode switching request flag (M2043) switches from OFF to ON, and from ON
to OFF. (See Sections 9.1 and 9.2 for the check content.) If an error is found, the
following occur:

• REAL/VIRTUAL mode switching will not occur, and the present mode will be
maintained.

• The REAL/VIRTUAL mode switching request flag (M2045) switches ON.

• The corresponding error code will be stored in the REAL/VIRTUAL mode switch-
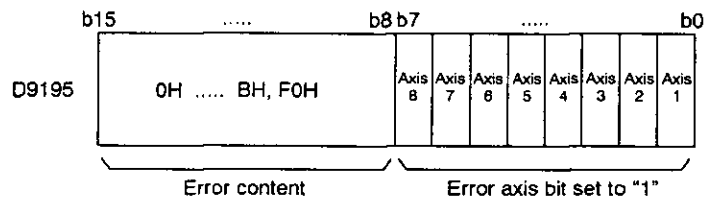ing error information register (D9195/D9195/D9193 - D9195).

POINT

(1) The error codes stored in the D9195/D9195/D9193 - D9195 storage reg-
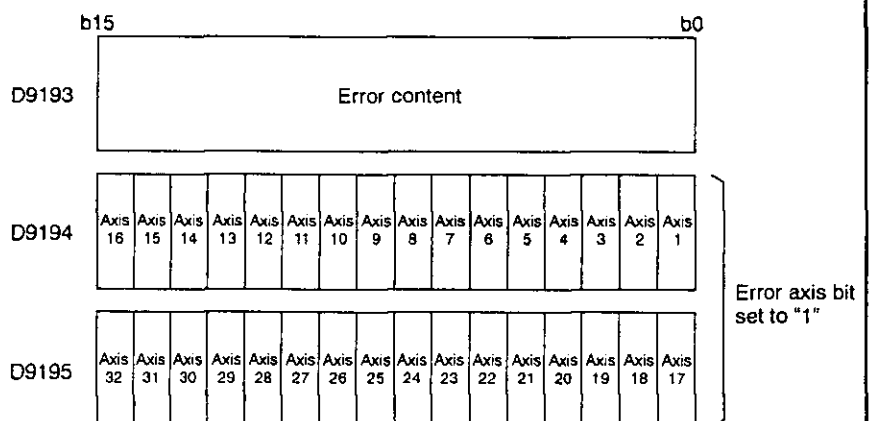isters which apply to axis errors are shown below.

(a) When A171SCPU is used
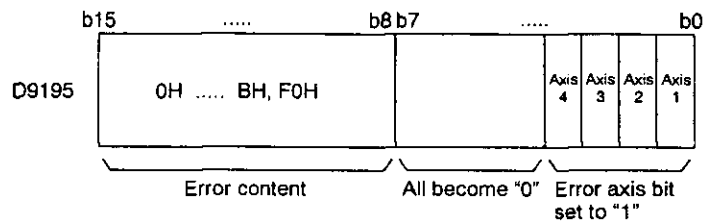
(b) When A273UHCPU (8-axis specification) is used

(c) When A273UHCPU (32-axis specification) is used

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10. ERROR CODES STORED AT THE PCPU

10.1 Related Systems & Error Processing

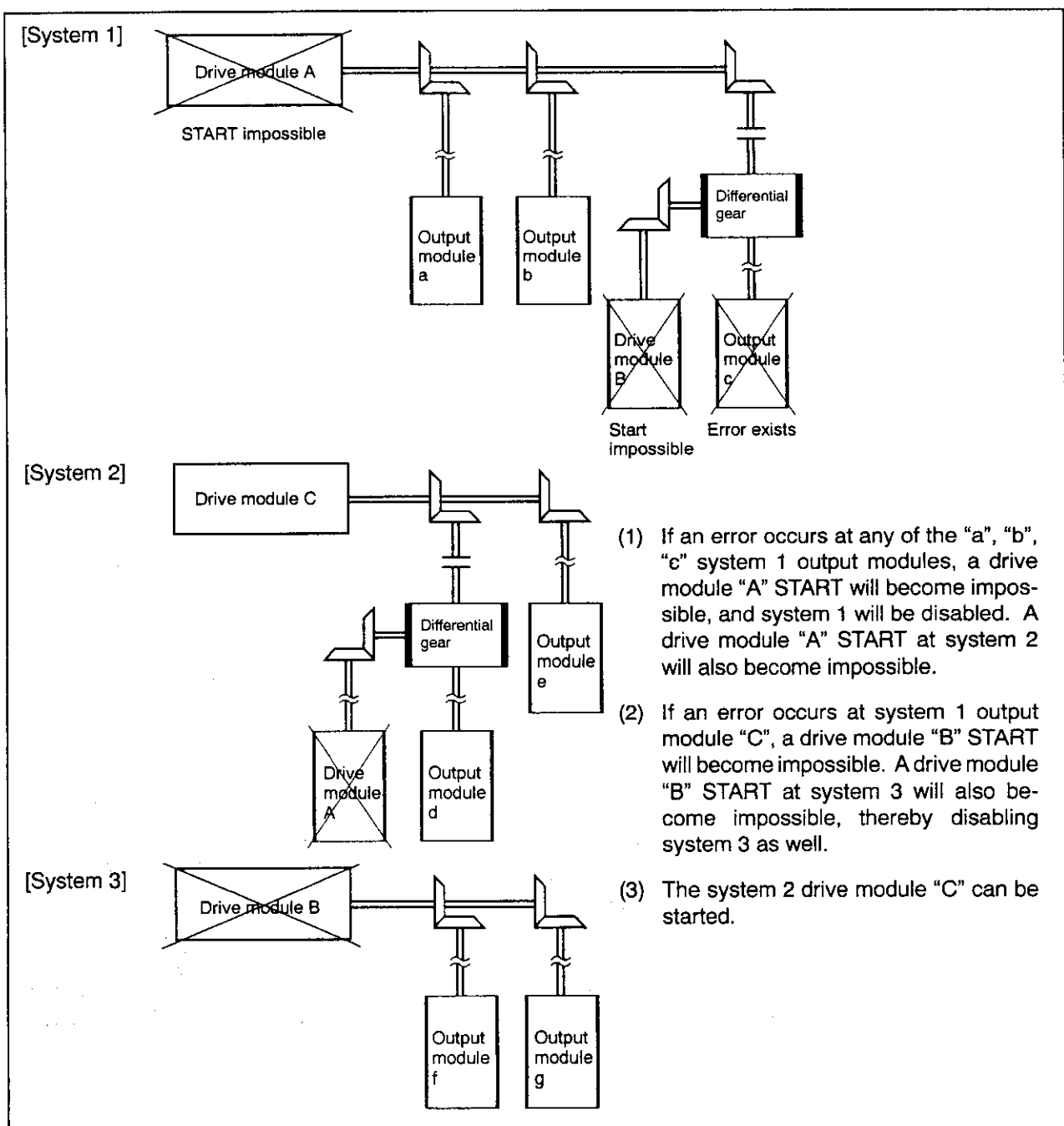The following 2 types of related systems exist in the VIRTUAL mode.

(1) System consisting of a drive module and output module.

(2) Multiple systems using the same drive module.

The following occurs when an error is detected at an output module.

(1) If an error is detected at any output module, a drive module

START will be impossible, and that system will be disabled.

The auxiliary input shaft operation for that output module will also be disabled.

(2) Other systems which use the drive module which was disabled by the output module error will also be disabled.

[System 1]

Drive module A

START impossible

Output module a

Output module b

Differential gear

Drive module B
Start impossible

Output module c
Error exists

[System 2]

Drive module C

Differential gear

Output module e

Drive module A

Output module d

(1) If an error occurs at any of the "a", "b", "c" system 1 output modules, a drive module "A" START will become impossible, and system 1 will be disabled. A drive module "A" START at system 2 will also become impossible.

(2) If an error occurs at system 1 output module "C", a drive module "B" START will become impossible. A drive module "B" START at system 3 will also become impossible, thereby disabling system 3 as well.

[System 3]

Drive module B

Output module f

Output module g

(3) The system 2 drive module "C" can be started.

10. ERROR CODES STORED AT THE PCPU

10.2 Servo Program Setting Errors

The error codes, error descriptions, and corrective actions for servo program setting errors are shown in Table 10.1 below. The "n" in the asterisked error codes in Table 10.1 indicates the axis number (1 - 4/1 - 8/1 - 32).

Table 10.1 Servo Program Setting Error List

Error Codes Stored at D9190	Error Name	Description	Error Processing	Corrective Action
1	Parameter block No. setting error	The parameter block No. setting is outside the 1 - 16 (1 - 64 range for A273UHCPU (32-axis specification)) range.	The default parameter block No. of "1" will be adopted for servo program operation.	Designate a parameter block No. within the 1 - 16 (1 - 64) range.
n03*	Address/travel value setting error (excluding speed control)	(1) Address outside the setting range was designated at absolute method positioning control. System-of-units / Address setting range degree / 0 - 35999999 / × 10⁻⁵ degree (2) At incremental method positioning control, the travel value setting is as follows: −2147483648 (H80000000)	(1) START is disabled. (at all interpolation axes during interpolation control.) (2) If an error is detected during speed switching control or constant speed control, a deceleration to stop will occur. (3) When a simultaneous START is in effect, an error at any servo program will disable all servo programs.	(1) When "degrees" is designated as the system-of-units, the address setting should be within a 0 - 35999999 range. (2) The travel value setting should be designated with a 0 - ±2147483647 range.
4	Commanded speed error	(1) The commanded speed violated the "1 to speed limit" range. (2) The commanded speed violated the setting range. System-of-units / Address setting range mm / 1 - 600000000 / × 10⁻² mm/min inch / 1 - 600000000 / × 10⁻³ inch/min degree / 1 - 600000000 / × 10⁻³ degree/min pulse / 1 - 1000000 / PLS/sec	(1) START will be disabled if a setting of 0 or less is designated. (2) When the setting exceeds the speed limit, the speed limit value will be adopted.	(1) Designate the commanded speed with the "1 to speed limit" range.
5	Dwell time setting error	The dwell time setting violated the 0 to 5000 range.	The default value of "0" will be adopted.	Designate the dwell time setting within the 0 to 5000 range.
6	M code setting error	The M code setting violated the 0 to 255 range.	The default value of "0" will be adopted.	Designate the M code setting within the 0 to 255 range.
7	Torque limit setting error	The torque limit value violated the 1 to 500 range.	The torque limit for the designated parameter block will be adopted.	Designate a torque limit value within the 1 to 500 range.
n08*	Auxiliary point setting error (at auxiliary point designation at circular interpolation)	(1) Address outside the setting range was designated at absolute method positioning control. System-of-units / Address setting range degree / 0 - 35999999 / × 10⁻⁵ degree (2) In incremental method positioning control, the travel value setting is as follows: −2147483648 (H80000000) (3) [START point] = [auxiliary point], or [auxiliary point] = [END point].	START is disabled.	(1) When "degrees" is designated as the system-of-units, the address setting should be within a 0-35999999 range. (2) The travel value setting should be designated within the range 0 to ±2147483647. (3) Set as follows: [START point] ≠ [auxiliary point] ≠ [END point].

Table 10.1 Servo Program Setting Error List (Continued)

Error Codes Stored at D9190	Error Name	Description	Error Processing	Corrective Action
n08*	Auxiliary point setting error (at auxiliary point designation at circular interpolation)	(4) The auxiliary point is located on the straight line which connects the START and END points.	START is disabled.	(4) Designate an auxiliary point value which is not located on the straight line connecting the START and END points.
n09*	Radius setting error (radius setting for circular interpolation)	(1) Address outside the setting range was designated in absolute method positioning control. System-of-units: degree / Address setting range: 0 - 35999999 / $\times 10^{-5}$ degree	START is disabled.	(1) When "degrees" is designated as the system-of-units, the address setting should be within the range 0 to 35999999.
		(2) In incremental method positioning control, the travel value setting is as follows: -2147483648 (H80000000)		(2) The travel value setting should be designated within the range 0 to ± 2147483647.
		(3) [START point] = [END point]		(3) Set as follows: [START point] $\neq$ [END point].
		(4) The distance between the START and END points is larger than the diameter.		(4) Set so that the relationship between the START point to END point distance (L) and the radius (R) is as follows: $\frac{L}{2R} \leq 1$
n10*	Center point setting error (center point setting for circular interpolation)	(1) Address outside the setting range was designated in absolute method positioning control. System-of-units: degree / Address setting range: 0 - 35999999 / $\times 10^{-5}$ degree	START is disabled.	(1) When "degrees" is designated as the system-of-units, the address setting should be within the range 0 to 35999999.
		(2) At incremental method positioning control, the travel value setting is as follows: -2147483648 (H80000000)		(2) The travel value setting should be designated within the range 0 to ± 2147483647.
11	Interpolation control system-of-units error	The interpolation system-of-units was other than 0 - 3.	The default value of "3" is adopted.	Designate a 0 - 3 interpolation system-of-units setting.
12	Speed limit setting error	The speed limit setting violates the setting range.	The default value of "200000 pulse/s" is adopted.	Designate a speed limit value within the setting range.
13	Acceleration time setting error	The acceleration time is "0".	The default value of "1000" is adopted.	Designate an acceleration time within the range 1 to 65535.
14	Deceleration time setting error	The deceleration time is "0".		Designate a deceleration time within the range 1 to 65535.
15	Rapid stop deceleration time setting error	The rapid stop deceleration time is "0".		Designate a rapid stop deceleration time setting within the range 1 to 65535.
16	Torque limit setting error	The torque limit value violates the range 1 to 500.	The default value of "300%" is adopted.	Designate a torque limit setting within the range 1 to 500.

Table 10.1 Servo Program Setting Error List (Continued)

Error Codes Stored at D9190	Error Name	Description	Error Processing	Corrective Action
17	"Allowable error range for circular interpolation" setting error	The "allowable error range for circular interpolation" setting violates the prescribed setting range. System-of-units / Address setting range: mm — $\times\,10^{-1}\,\mu m$ inch — $\times\,10^{-5}$ inch (0 - 100000) degree — $\times\,10^{-5}$ degree pulse — PLS	The default value of "100PLS" is adopted.	Designate the "allowable error range for circular interpolation" setting within the prescribed setting range.
18	"Number of repeats" setting error	The "number of repeats" setting violates the prescribed setting range 1 to 32767.	A "number of repeats" setting of "1" is adopted.	Designate the "number of repeats" setting within the range 1 to 32767.
19	START instruction setting error	(1) The servo program designated by the START instruction does not exist.	START is disabled.	(1) Create the servo program No. designated by the START command.
		(2) A START instruction exists in the designated servo program.		(2) Delete the servo program which contains a START command.
		(3) Duplicate START axes exist in the designated servo program.		(3) Designate the START axes without duplications.
20	Point setting error	During constant speed control, there is no point designation in the instruction.	START is disabled.	Designate a point between the CPSTART and CPEND instructions.
21	Reference axis speed setting error	During a reference axis speed designation in linear interpolation, a non-interpolation axis was designated as thereference axis.	START is disabled.	Designate one of the interpolation axes as the reference axis.
22	S-curve ratio setting error	When designating the S-curve acceleration/deceleration speed, the S-curve ratio violated the 0 - 100% range.	An S-curve ratio of "100%" is adopted.	Designate an S-curve ratio within the 0 - 100% range.
23	VSTART setting error	No speed switching points were designated between the VSTART and VEND instructions, or between the FOR and NEXT instructions. (Applies only at A273UHCPU 8/32-axis specification)	START is disabled.	Designate a speed switching point between the VSTART and VEND instructions, or between the FOR and NEXT instructions.
24	Cancel function start program number error	Cancel function start program number is not in the range 0 to 4095.	START is disabled.	Set the cancel function start program number in the range 0 to 4095, and start again.
900	START instruction setting error	The servo program designated by the SVST/DSFRP instruction does not exist.	START is disabled.	Designate the correct servo program.
901	START instruction setting error	The axis No. designated by the SVST/DSFRP instruction is different from that designated by servo program.	START is disabled.	Designate the correct axis No.
902	Servo program instruction code error	The instruction code at the designated servo program cannot be decoded due to an instruction code error.	START is disabled.	Read out the servo program, check it, and make the necessary corrections.
903	START error	A VIRTUAL mode program was started when in the REAL mode.	START is disabled.	Check the program's mode allocation.
904	START error	A REAL mode program was started when in the VIRTUAL mode.	START is disabled.	Check the program's mode allocation.
905	START error	An instruction that cannot be executed in the VIRTUAL mode (VPF, VPR, VPSTART, ZERO) was designated.	START is disabled.	Correct the servo program.
906	START error	An axis listed as "not used" was designated while in the VIRTUAL mode.	START is disabled.	Designate the correct axis No. at the system settings.

10. ERROR CODES STORED AT THE PCPU

Table 10.1 Servo Program Setting Error List (Continued)

Error Codes Stored at D9190	Error Name	Description	Error Processing	Corrective Action
907	START error	A START occurred while switching from the REAL to VIRTUAL mode.	START is disabled.	Use the M2034 (REAL/ VIRTUAL mode switching re- quest) and M2044 (REAL/ VIRTUAL mode status) sig- nals to create a START inter- lock condition.
908	START error	A START occurred while switching from the VIRTUAL to REAL mode.		

10. ERROR CODES STORED AT THE PCPU

10.3 Drive Module Errors

Table 10.2 Drive Module Error List (100 - 1199)

Error Class	Error Code	Positioning	Fixed-Pitch Feed	Speed	Speed Switching	Constant Speed	JOG	Manual Pulse Generator	Synchronous Encoder	Position Follow-Up	Error Cause	Processing	Corrective Action
Minor Errors	100	O	O	O	O	O	O	O		O	• The PC READY (M2000) or PCPU READY (M9074) signal is OFF.		• Set the servo system CPU to RUN. • Switch the PC READY (M2000) signal ON.
	101	O	O	O	O	O	O	O		O	• The relevant axis' "START accept" signal (M2001 - M2004/ M2001 - M2008/ M2001 - M2032) is ON.		• Set an interlock condition at the program to prevent a START from being designated at an axis which is in motion. (Designate the relevant axis and a "START accept OFF" in the START conditions.)
	103	O	O	O	O	O	O	O		O	• The relevant axis' stop command (M1400+20n/Y1n0/ M4800+20n) is ON.		• Switch the stop command (M1400+20n/Y1n0/ M4800+20n) OFF, then execute a START.
	104	O	O	O	O	O	O	O		O	• The relevant axis' rapid stop command (M1401+20n/Y1n1/ M4801+20n) is ON.		• Switch the stop command (M1401+20n/Y1n1/ M4801+20n) OFF, then execute a START.
	105	O				O				O	• On starting, the feed present value is outside the stroke limit range.		• Return to within the stroke limit range using jog operation. • Move inside the stroke limit range by performing a present value change.
	106*	O	O			O				O	• Positioning violates the stroke limit range	START is disabled.	• Execute positioning back to within the stroke limit range.
	107	O				O					• At the auxiliary point designation for circular interpolation, an address was designated which will not produce a circle. (Problem with START point, auxiliary point, and END point addresses.)		• Correct the address at the servo program.
	108*	O				O					• At the radius designation for circular interpolation, an address was designated which will not produce a circle. (Problem with START point, radius, and END point addresses.)		
	109	O				O					• At the center point designation for circular interpolation, an address was designated which will not produce a circle. (Problem with START point, center point, and END point addresses.)		
	110*	O				O					• During circular interpolation, the difference between the END point address and the ideal END point exceeds the "allowable error range for circular interpolation".		
	116						O				• The designated JOG speed is "0".		• Designate a speed setting within the prescribed setting range.
											• The designated JOG speed exceeds the JOG speed limit.	The JOG speed limit value is adopted.	
	117						O				• At a JOG simultaneous START, a forward and reverse setting are designated for the same axis.	A forward START will occur at the relevant axis only.	• Designate the setting correctly.
	140	O									• At the reference axis designation for linear interpolation, the reference axis travel value is "0".	START is disabled.	• Do not select an axis where the travel value is "0" as the reference axis.
	141									O	• The position command device No. at position follow-up control is an odd No.		• Designate an even number as the position command device No.

During interpolation operations, this error code is stored at all relevant interpolation axis storage areas

Table 10.2 Drive Module Error List (100 - 1199) (Continued)

Error Class	Error Code	Virtual Servo Axis Control Item										Error Cause	Processing	Corrective Action
		Posi-tioning	Fixed-Pitch Feed	Speed	Speed Switch-ing	Con-stant Speed	JOG	Manu-al Pulse Gener-ator	Syn-chro-nous Encod-er	Posi-tion Fol-low-Up		Error Cause	Processing	Corrective Action
Minor Errors	151	O	O	O	O	O	O	O				• In the VIRTUAL mode, a START was designated at an inoperative axis. (Error occurred at REAL to VIRTUAL mode switch-ing, and system START was disabled.)	START is disabled.	• After correcting the error cause in the REAL mode, switch back to the VIRTUAL mode and start operation.
	152	O	O	O	O	O	O	O				• A START was designated during a deceleration to stop which was occurring in response to an all-axes servo OFF (M2042 OFF).		• After correcting the error cause in the REAL mode, switch back to the VIRTUAL mode and start operation.
	153	O	O	O	O	O	O	O				• A START was designated during a deceleration to stop which was occurring in response to a servo er-ror at the output module.		
	200	O	O	O	O	O	O	O	O	O		• The PC READY (M2000) signal was switched OFF during a START which was occurring in re-sponse to a START re-quest from the sequence program.	Decelera-tion to stop	• After all axes have stopped, switch the pro-grammable controller READY (M2000) signal ON.
	204	O	O	O	O	O	O	O	O	O		• The PC READY (M2000) signal was switched ON again during a decelera-tion to stop which was oc-curring in response to the PC READY (M2000) sig-nal being switched OFF.	Ignored	• After all axes have stopped, switch the PC READY (M2000) signal ON. (PC READY (M2000) OFF → ON switching during a decel-eration to stop is ig-nored.)
	207	O				O				O		• The feed present value violated the stroke limit range during operation. In circular interpolation operations, the error code will be stored only at the axis where the stroke lim-it range was violated. In linear interpolation opera-tions, the error code will be stored at all interpola-tion axes.	Decelera-tion to stop	• Correct the stroke limit range or the travel value setting to ensure that positioning control re-mains within the stroke limit range.
	208	O				O		O				• During circular interpola-tion or manual pulse gen-erator simultaneous op-eration, the feed present value of another axis vio-lated the stroke limit range. (For other axis er-ror detection.)		
	211					O						• When the final positioning address was identified during a positioning op-eration, an overrun oc-curred due to a decelera-tion distance which was insufficient for the output speed.		(1) Designate a speed which will not cause an overrun. (2) Designate a travel value which will not cause an overrun.
	214							O				• The manual pulse gener-ator status was switched to "enabled" during axis motion, and manual pulse generator operation was attempted.	Manual pulse gen-erator in-puts are ig-nored until a stop oc-curs.	• Execute manual pulse generator operation after the axis motion has stopped.
	215				O							• The address of the speed switching point exceeds the END point address.	Rapid stop occurs.	• Designate the speed switching point some-where between the pre-vious speed switching point address and the END point address.
												• An address was desig-nated which causes op-posite direction position-ing during speed switch-ing control.		
												• The same servo program operation was designated again.		• Correct the sequence program.
	220								O	O		• During position follow-up control with "degrees" set as the system-of-units, the commanded address violated the 0 to 35999999 range.	Decelera-tion to stop. (M2000 OFF)	• When the control system-of-units is "degrees", des-ignate an address within the 0-35999999 range.
												• The address designated for position follow-up con-trol is outside the stroke limit range.		• Set the address in the stroke limit range.

10. ERROR CODES STORED AT THE PCPU

Table 10.2 Drive Module Error List (100 - 1199) (Continued)

Error Class	Error Code	Virtual Servo Axis Control Item										Error Cause	Processing	Corrective Action
		Posi-tioning	Fixed-Pitch Feed	Speed	Speed Switch-ing	Con-stant Speed	JOG	Manu-al Pulse Gener-ator	Syn-chro-nous Encod-er	Posi-tion Fol-low-Up				
Minor Errors	225					○						• During constant speed control, the speed at an intermediate point vio-lated the speed limit val-ue.	Operation occurs at the speed limit speed.	• Designate a speed within the "1 to speed limit val-ue" range.
	300	○	○	○	○	○	○	○		○		• A present value change was designated while mo-tion was in progress at the relevant axis. / • A present value change was designated at an axis which hasn't been started. / • A present value change was designated at an axis where the servo is OFF.	The present value will not be changed.	• Establish an interlock condition for the devices shown below, and avoid present value changes during axis motion. (1) Relevant axis' START accept signal (M2001 - M2004/M2001 - M2008/ M2001 - M2032) OFF. (2) Servo START signal (M1615+20n/XnF/ M2415+20n) ON.
	302	○										• A speed change was des-ignated at an axis where circular interpolation is in progress.	The speed will not be changed.	• Do not make speed changes during circular interpolation.
	303	○	○		○	○				○		• A speed change was des-ignated following the start of automatic deceleration during positioning.		• Do not make speed changes following the start of positioning decel-eration.
	304						○		○			• A speed change was at-tempted during decelera-tion which was occurring in response to the JOG START signal (M1402+20n/Y1n2/ M4802+20n, M1403+20n/ Yn3/M4803+20n) being switched OFF.		• Do not make speed changes during decelera-tion which is occurring in response to the JOG START signal (M1402+20n/Y1n2/ M4802+20n, M1403+20n/ Yn3/M4803+20n) being switched OFF.
	305	○	○	○	○	○	○			○		• The speed following a speed change violated the "0 to speed limit val-ue" range.	Operation will occur at the speed limit speed.	• Designate the post-change speed within the "0 to speed limit value" range.
	309											• A present value change which violated the range 0 to 35999999 ($\times 10^{-5}$ degrees) was designated at a "degrees" axis.	The present value will not be changed.	• Designate a value within the 0 to 35999999 ($\times 10^{-5}$ degrees) range.
Major Errors	1151								○			• A171SENC/A273EX or encoder hardware fault / • Discontinuity in encoder cable	Immediate input stop	• Check the A171SENC/ A273EX, or the encoder (H/W replacement). / • Check the encoder cable.
	1152								○			• Low voltage at A171SENC/A273EX bat-tery.	Operation is continued.	• Replace the battery.
	1153								○			• No battery or discon-nected battery at A171SENC/A273EX.		• Replace battery, or check the hardware at the A171SENC/A273EX.

10. ERROR CODES STORED AT THE PCPU

10.4 Servo Errors

The servo errors consist of servo amplifier errors and servo power supply module errors (A273UHCPU (8-/32-specification) only).

[For A273UHCPU (32-specification)]

When the A273UHCPU (32-specification) is used, the error processing when a servo error is detected can be set independently for each system. (Settings are valid only for a servo error detected by the ADU.)

The error processing and the system are set in the peripheral device system settings.

	Setting	Control
1	Each system axes off (default)	• If a servo error occurs in any ADU axis, the servos are turned OFF for all axes in the system. (Identical to all servo axes OFF control.)

2	Only error axis off	• The servo is turned OFF for only the ADU axis where the servo error occurred. Other axes are unaffected.
		• However:
		(1) If units control 2 axes, servos for both axes turn OFF when a servo error occurs for one axis.
		(2) All axes in the system turn OFF if any of the following servo errors occurs:
		   ⎧ Overcurrent (2032)
		   ⎪ Low voltage (2810)
		   ⎨ Over-regeneration (2830)
		   ⎪ Overvoltage (2833)
		   ⎩ Overheated amplifier power supply (2847)

(1) Servo amplifier errors (2000 - 2799)

Servo amplifier errors (error codes 2000 - 2799) are detected by the servo amplifier.

Servo amplifier errors include ADU errors (for A273UHCPU 8/32-axis specification only), and MR-[ ]-B errors. ADU type servo amplifiers are abbreviated as Ⓐ, and MR-[ ]-B type servo amplifiers are abbreviated as Ⓜ. When a servo amplifier error occurs, the servo error detection signal (M1608+20n/Xn8/M2408+20n) switches ON. After eliminating the error cause, switch the servo error reset signal (M1808+20n/Yn8/M3208+20n) ON to execute a servo error reset, then re-start the operation. (However, as error codes 2100 - 2499 are only warnings, the servo error detection signal will not switch ON.)

Note: (1) Even after the protective circuit operation is completed, the regenerative error protection (error code 2030) and overload protection 1 & 2 (error codes 2050 & 2051) functions save the status of the interrupted operation at the servo amplifier. The memory content will be cleared by an external power OFF, but not by the RESET signal.

(2) Error codes 2030, 2050, and 2051 are reset by an external power OFF. As repeated external power OFFs can cause failure of devices due to overheating, be sure to eliminate the error cause before restarting operation.

Servo errors are described in Table 10.3 below.

⚠ CAUTION
⚠ When motion controller or servo amplifier self-diagnosis errors occur, check the error content and re-store operation in accordance with the instructions in this manual.

Table 10.3 Servo Amplifier Error List (2000 - 2799)

Error Code	Amplifier Type	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2010	Ⓐ	P-N not wired	• The servo power supply module P-N is not wired to the ADU P-N.	Constant check	Immediate stop	• Check the wiring.
	Ⓜ	Insufficient voltage	• Power supply voltage is 160VAC or less.			• Use a voltmeter to measure the input voltage (R,S,T).
			• Momentary power interruption lasting 15 msec or longer occurred.			• Use an oscilloscope to determine if a momentary power interruption occurred.
			• Voltage drop at START, etc., due to insufficient power supply capacity.			• Provide an adequate power supply capacity.
2012	Ⓐ	Internal memory error	• Error at ADU SRAM.	• Checked at power ON		• Replace the ADU.
	Ⓜ	Memory error 1	• Error at servo amplifier SRAM. • Check sum error at servo amplifier EPROM.	• Checked at power ON • Check at leading edge of PC READY (M2000) signal. • Checked at servo error reset • Checked at servo system CPU power ON		• Replace the servo amplifier.
2013	Ⓜ	Clock error	• Error at servo amplifier clock.			• Replace the servo amplifier.
2014	Ⓐ	Watchdog	• Servo control system error.	Constant check		• Reset the servo system CPU, then re-check.
			• ADU failure.			• Replace the ADU.
	Ⓜ		• Servo amplifier hardware fault • Servo system CPU hardware fault			• Replace the servo amplifier. • Replace the servo system CPU.
2015	Ⓐ	2-port memory error	• Error at ADU's 2-port memory.	• Checked at servo amplifier power ON. • Checked at servo error reset.		• Reset the servo system CPU, then re-check. • Replace the ADU.
	Ⓜ	Memory error 2	• Error at servo amplifier EEPROM.	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.		• Replace the servo amplifier.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2016	(A)	Position sensor error 1	• Abnormal communication with encoder when initializing is executed. • Connected encoder type (ABS/INC) is different from that designated at the system settings.	• Checked at servo amplifier power ON. • Checked at servo error reset.		• Reset the servo system CPU, then re-check. • Replace the servo motor (encoder). • Check/correct the system settings.
	(M)		• Abnormal communication with encoder.	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.		• Check for disconnected position sensor cable. • Replace the servo motor. • Replace the position sensor cable.
2017	(A)	PCB error	• Error at ADU's A/D converter.	• Checked at servo amplifier power ON. • Checked at servo error reset.	Immediate stop	• Reset the servo system CPU, then re-check. • Replace the ADU.
	(M)		• Error at servo amplifier PCB element.	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.		• Replace the servo amplifier.
2019	(M)	Memory error 3	• Check sum error at servo amplifier's flash ROM.	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.		• Replace the servo amplifier.
2020	(A)	Position sensor error 2	• Abnormal communication with encoder occurred during operation.			• Check the encoder and ADU connection. • Replace the servo motor (encoder).
	(M)		• Abnormal communication with encoder.	Constant check		• Check for disconnected position sensor cable. • Replace the servo motor. • Replace the position sensor cable.
2024	(M)	Output side is grounded	• Servo amplifier's U,V,W are grounded.			• Check with a multimeter between terminal U,V,W phases and grounds. • Check with a multimeter and megger between terminal U,V,W phases and cores.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2025	Ⓐ	Absolute position lost	• A voltage level of 2.5 ± 0.2V or less occurred at the absolute type encoder's internal super capacitor.	• Check occurs at servo amplifier ON. • Check occurs at servo error reset.		• Replace the battery (MR-JBAT-□). • Check the encoder and ADU connection.
			• Rotation of 500 rpm or higher occurred at the absolute type encoder during a power interruption.			
	Ⓜ	Battery error	• A low voltage condition occurred at the absolute position sensor's internal super capacitor.	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.		• Switch the power ON for 2 - 3 minutes to charge the super capacitor, then switch the power OFF and back ON again, and execute a home position return.
			• Low battery voltage.			• After switching the servo amplifier power OFF, measure the battery voltage.
			• Battery cable or battery failure. (Another home position return is required after canceling the error.)			• Replace the servo amplifier battery.
2026	Ⓐ	Unit mismatch	• A mismatch exists between the servo parameter (system settings) setting and the servo amplifier being used.	• Checked at servo amplifier power ON. • Checked at servo error reset.	Immediate stop	• Check/correct the system settings.
2030	Ⓜ	Excessive regeneration	• ON/OFF switching of the regenerating power transistor is occurring too frequently. (Regenerative resistor could overheat.)	Constant check		• Check the servo motor's regenerating level (%), and decrease the number of accelerations/decelerations, or reduce the feed speed accordingly. • Reduce the load. • Increase the motor capacity.
			• Incorrect servo parameter (system settings) setting.			• Check the servo parameter settings ("regenerative resistor", and "motor type" items in the system settings).
			• Regenerative resistor wiring error.			• Connect the regenerative resistor correctly.
			• Regenerative resistor failure.			• Replace the regenerative resistor.
			• Regenerating power transistor was shorted and damaged.			• Replace the servo amplifier.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2031	(A)	Excessive speed	• Commanded speed is too fast.	Constant check	Immediate stop	• Check/correct the commanded speed.
			• Overshooting occurred during acceleration.			• Check/correct the servo parameter setting.
			• Encoder failure.			• Replace the encoder.
			• Encoder cable failure, or incorrect wiring.			• Check the encoder and ADU connection.
	(M)		• Motor rpm exceeded the rated speed by 115% or more.			• Check the "motor rpm" servo parameter setting. • Check the "number of pulses per revolution" and "travel value per revolution" fixed parameter settings to see if they conform to the machine specifications.
			• Overshooting occurred at acceleration/deceleration because the time constant value was too low.			• If overshooting occurs at acceleration/deceleration, check the "acceleration time" and "deceleration time" fixed parameter settings.
			• Overshooting occurred due to servo system instability.			• If overshooting occurs, adjust the "position loop gain/position control gain 1 & 2" and the "speed loop gain/speed control gain 1 & 2" servo parameter settings, and increase the speed integral compensation.
			• Position sensor error.			• Check for a disconnected position sensor cable. • Replace the servo motor.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2032	Ⓐ	Overcurrent	• A servo motor different from that specified by the setting has been connected.	• Checked at servo amplifier power ON. • Checked at servo error reset.	Immediate stop	• Check/correct the system settings.
			• The ADU output's U,V,W phases have mutually shorted or grounded.			• Check the servomotor cable.
			• Incorrect ADU output U,V,W phase wiring.			• Correct the servomotor wiring.
			• Damaged ADU transistor module. • ADU failure.			• Replace the ADU.
			• Servomotor and encoder coupling failure.			• Replace the servomotor.
			• Servomotor oscillation occurred.			• Check/correct the servo parameter settings.
	Ⓜ		• The servo amplifier output's U,V,W phases have mutually shorted.	Constant check		• Check the servo amplifier output's U,V,W terminals for mutual shorting.
			• The servo amplifier output's U, V, W phases have been grounded.			• Check for grounding at the servo amplifier U,V,W terminals, and at the ground. Check for grounding at the servo-motor U,V,W terminals. If grounded, replace the servo amplifier and ser-vomotor.
			• Incorrect servo amplifier output U,V,W phase wiring.			• Correct the wiring.
			• Damaged servo amplifier transistor.			• Replace the servo ampli-fier.
			• Servo motor and encoder coupling failure.			• Replace the servomotor.
			• Damaged encoder cable.			• Replace the encoder cable.
			• A servo motor different from that specified by the setting has been connected.			• Check the "connected motor" item in the system settings.
			• Servo motor oscillation occurred.			• Check the "gain" servo parameter setting, and adjust it.
			• Noise entered the overcurrent detection circuit.			• Check for relays, valves, etc., which may be oper-ating nearby.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2033	Ⓜ	Overvoltage	• Voltage at the converter bus exceeded 400V. • Regenerating capacity was exceeded because of too many accelerations/decelerations. • Incorrect regenerative resistor connection.	Constant check	Immediate stop	• Increase the acceleration time and deceleration time in the fixed parameters. • Check the C-P connection at the regeneration terminal board.
			• Servo amplifier's internal regenerative resistor is OFF.			• Measure between C & P (at regeneration terminal board) with a multimeter. If abnormal, replace the servo amplifier. (Conduct measurement approx. 3 minutes after the charge lamp goes OFF.)
			• The regenerative resistor's power transistor has been damaged.			• Replace the servo amplifier.
			• Excessive power supply voltage.			• Measure the input voltage (R,S,T) using a voltmeter.
2034	Ⓜ	Communication error	• Error in data received from servo system CPU.			• Check the motion bus cable connection. • Check for disconnected motion bus cable. • Verify that the motion bus cable is properly clamped.
2035	Ⓐ	Data error	• Commanded speed is too fast.			• Check/correct the commanded speed.
			• Servo system CPU failure.			• Replace the servo system CPU.
	Ⓜ		• Excessive change amount in position command from servo system CPU, or commanded speed is too fast.			• Check the commanded speed, and the "number of pulses per revolution" and "travel value per revolution" fixed parameter settings.
			• Noise entered the command from the servo system CPU.			• Check the motion bus cable connector connection. • Check for disconnected motion bus cable. • Verify that the motion bus cable is properly clamped. • Check for relays, valves, etc., which may be operating nearby.
2036	Ⓐ	Transfer error	• Servo system CPU failure.			• Replace the servo system CPU.
	Ⓜ		• Error in communication with servo system CPU.			• Check the motion bus cable connector connection. • Check for disconnected motion bus cable. • Verify that the motion bus cable is properly clamped.
2042	Ⓜ	Feedback error	• Encoder signal error.			• Replace the servomotor.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2045	Ⓐ	Amplifier fin overheat	• ADU fan has stopped.	Constant check	Immediate stop	• Replace the ADU fan.
			• Operation which exceeds the ADU continuous output current has occurred.			• Reduce the load.
			• ADU thermal sensor failure.			• Replace the ADU.
	Ⓜ	Fin overheat	• The servo amplifier's heat sink has overheated. • Amplifier error (rated output exceeded). • Repeated ON/OFF switching occurred under overload conditions. • Cooling error.			• If the servomotor's effective torque is large, reduce the load. • Reduce the number of accelerations/decelerations. • Check the amplifier fan to see if it has stopped. (MR-H150B or higher) • Check for ventilation obstructions. • Check for excessive temperatures (0 - +55°C) in the enclosure. • Check to see if the electromagnetic brake has been actuated by an external signal during operation. • Replace the servo amplifier.
2046	Ⓐ	Servomotor overheat	• Malfunction of servomotor's internal thermal protector.			• Replace the servomotor.
			• Operation which exceeds the servo motor's continuous output has occurred.			• Reduce the load.
			• A servomotor overload has occurred.			• If the servomotor's effective torque is large, reduce the load.
	Ⓜ		• Servomotor and regenerating option overheating has occurred.			• Check the servomotor's ambient temperature (0 to +40°C).
			• Malfunction at encoder's internal thermal protector.			• Replace the servomotor.
2050	Ⓐ	Overload	• Servomotor's rated current was exceeded. • Excessive load inertia or friction.			• Reduce the load.
			• Hunting caused by incorrect parameter setting.			• Check/correct the servo parameter settings.
	Ⓜ	Overload 1	• A continuous overload current of approx. 200% reached the servo amplifier and servomotor.			• Check for machine collisions. • If the load inertia is excessively high, either increase the acceleration/deceleration time constant, or reduce the load. • If hunting occurs, adjust the "position loop gain" in the servo parameters. • Check the U,V,W connections at the servo amplifier and servomotor. • Check for a disconnected position sensor cable. • Replace the servomotor.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2051	Ⓜ	Overload 2	• A servo amplifier and servo-motor overload occurred near the maximum torque (95% or more of the current limit value).	Constant check	Immediate stop	• Check for machine collisions. • If the load inertia is excessively high, either increase the acceleration/deceleration time constant, or reduce the load. • If hunting occurs, adjust the following at the servo parameters: position loop gain/position control gain/position control gain 1 & 2, speed loop gain/speed control gain 1 & 2. • Check the U,V,W connections at the servo amplifier and servomotor. • Check for a disconnected position sensor cable. • Replace the servomotor. • If a low voltage condition exists at the servomotor's bus (charge lamp is OFF), replace the servo amplifier.
2052	Ⓐ	Excessive error	• Deviation counter value exceeds the stipulated value. • Acceleration impossible due to excessive inertia.			• Check/correct the servo parameters.
			• Encoder or cable failure.			• Replace the encoder or cable.
	Ⓜ		• The difference between the servo amplifier pulse and the feedback pulse exceeded 80000 pulses.			• Check for machine collisions. • Increase the acceleration/deceleration time constant. • Increase the position loop gain/position control gain 1 & 2 servo parameter settings. • Check for a disconnected position sensor cable. • Replace the servomotor. • If a low voltage condition exists at the servomotor's bus (charge lamp is OFF), replace the servo amplifier.
2057	Ⓐ	Hardware fault	• ADU hardware fault.			• Replace the ADU.
2086	Ⓜ	RS232 communication error	• Parameter module communication error.		Operation continues	• Check for disconnected parameter module cable. • Replace the parameter module.
2102	Ⓐ	Battery warning	• Absolute encoder battery voltage is low.			• Replace the battery (MR-JBAT-□).
	Ⓜ		• Servo amplifier battery voltage is low.			• Replace the battery.
2103	Ⓜ	Battery disconnection warning	• Low power supply voltage at absolute position sensor.			• Replace the battery. • Check for disconnected position sensor cable. • Replace the servo motor. • Replace the servo amplifier.

10. ERROR CODES STORED AT THE PCPU

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2140	(M)	Over-regeneration warning	• An over-regeneration error (2030) may have occurred. (85% of regenerative resistor's maximum load capacity was detected.)	Constant check	Operation continues	• Refer to the over-regeneration error (2030) description.
2141	(A)	Overload warning	• 80% of the overload error (2050) level was detected.			• Refer to the overload error (2050) description.
	(M)		• An overload error (2050, 2051) may have occurred. (85% of overload level detected.)			• Refer to the overload error (2050, 2051) description.
2143	(A)	Absolute value counter warning	• Encoder failure.			• Replace the encoder.
2146	(M)	Servo emergency stop	• Open circuit between 1A and 1B at the servo amplifier CN6 connector.			• Establish a short circuit between 1A and 1B of the servo amplifier CN6 connector.
2147	(A)	Emergency stop	• An emergency stop occurred.		Immediate stop	• Execute an emergency stop reset.
	(M)		• An emergency stop signal (EMG) input occurred from the servo system CPU.		Operation continues	• Execute an emergency stop reset.
2149	(M)	Main circuit OFF warning	• The servo ON signal (SON) was switched ON when the connector was OFF. • The main circuit bus voltage fell below 215 V at 50 rpm or lower.			• Switch the main circuit connector or main circuit power ON.
2196	(M)	Incorrect home position setting warning	• The droop pulse was not within the in-position range following a home position set command.			• Execute another home position return.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2201 - 2224	Ⓐ	Parameter warning	• An incorrect parameter setting was designated. 2201 Amplifier setting 2202 Motor type 2203 Motor capacity 2204 Number of feedback pulses 2205 In-position range 2206 Position control gain 2 (actual position gain) 2207 Speed control gain 2 (actual speed gain) 2208 Speed integral compensation 2209 Forward torque limit value 2210 Reverse torque limit value 2211 Emergency stop time delay 2212 Position control gain 1 (model position gain) 2213 Speed control gain 1 (model speed gain) 2214 Load inertia ratio 2215 Excessive error alarm level 2216 Special compensation processing 2217 Special servo processing 2218 Td dead-band compensation 2219 Feed forward gain 2220 Unbalanced torque compensation 2221 Dither command 2222 Gain operating time 2223 Servo responsibility 2224 –	Constant check	Operation continues	• Check/correct the system settings and servo parameters.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2301 - 2336	Ⓜ	Parameter error	• Servo parameter value is outside the applicable range. (Incorrect parameters are ignored, and the previously set value is maintained.) 2301 Amplifier setting 2302 Regenerative resistor setting 2303 Motor type 2304 Motor capacity 2305 Motor rpm 2306 Number of feedback pulses 2307 Rotation direction setting 2308 Automatic tuning setting 2309 Servo responsibility 2310 Forward torque limit value 2311 Reverse torque limit value 2312 Load inertia ratio 2313 Position control gain 1 2314 Speed control gain 1 2315 Position control gain 2 2316 Speed control gain 2 2317 Speed integral compensation 2318 Notch filter selection 2319 Feed forward gain 2320 In-position range 2321 Electromagnetic brake sequence output 2322 Monitor output mode selection 2323 Optional function 1 2324 Optional function 2 2325 Optional function 3 2326 Optional function 4 2327 Monitor output 1 offset 2328 Monitor output 2 offset 2329 Pre-alarm data selection 2330 Zero speed 2331 Excessive error alarm level 2332 Optional function 5 2333 Optional function 6 2334 PI-PID switching position droop 2335 Torque limit compensation coefficient 2336 Speed differential compensation (actual speed differential compensation)	Constant check	Operation continues	• Verify the servo parameter setting range.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2301 - 2324	(A)	Parameter error	• Servo parameter value is outside the applicable range. (Incorrect parameters are ignored, and the previously set parameters are maintained.) 2301 Amplifier setting 2302 Motor type 2303 Motor capacity 2304 Number of feedback pulses 2305 In-position range 2306 Position control gain 2 (actual position gain) 2307 Speed control gain 2 (actual speed gain) 2308 Speed integral compensation 2309 Forward torque limit value 2310 Reverse torque limit value 2311 Emergency stop time delay 2312 Position control gain 1 (model position gain) 2313 Speed control gain 1 (model speed gain) 2314 Load inertia ratio 2315 Excessive error alarm level 2316 Special compensation processing 2317 Special servo processing 2318 Td dead-band compensation 2319 Feed forward gain 2320 Unbalanced torque compensation 2321 Dither command 2322 Gain operating time 2323 Servo responsibility 2324 —	Constant check	Operation continues	• Verify the servo parameter setting range.
2500	(A)	Parameter error	• The following servo parameter items are incorrect: • Amplifier and external regenerative resistor setting • Motor type • Motor capacity	• Checked at servo amplifier power ON. • Checked at servo error reset.		• Check/correct the system settings and servo parameters.

10. ERROR CODES STORED AT THE PCPU

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Amplifier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2501 - 2524	Ⓐ	Parameter error	• Incorrect parameter setting value. 2501 Amplifier setting 2502 Motor type 2503 Motor capacity 2504 Number of feedback pulses 2505 In-position range 2506 Position control gain 2 (actual position gain) 2507 Speed control gain 2 (actual speed gain) 2508 Speed integral compensation 2509 Forward torque limit value 2510 Reverse torque limit value 2511 Emergency stop time delay 2512 Position control gain 1 (model position gain) 2513 Speed control gain 1 (model speed gain) 2514 Load inertia ratio 2515 Excessive error alarm level 2516 Special compensation processing 2517 Special servo processing 2518 Td dead-band compensation 2519 Feed forward gain 2520 Unbalanced torque compensation 2521 Dither command 2522 Gain operating time 2523 Servo responsibility 2524 —	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset.	Operation continues	• Check/correct the system settings and servo parameters.

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2601 - 2636	(M)	Initial param-eter error	• An incorrect parameter setting was designated. • Parameter data has been lost. 2601 Amplifier setting 2602 Regenerative resistor setting 2603 Motor type 2604 Motor capacity 2605 Motor rpm 2606 Number of feedback pulses 2607 Rotation direction setting 2608 Automatic tuning setting 2609 Servo responsibility 2610 Forward torque limit value 2611 Reverse torque limit value 2612 Load inertia ratio 2613 Position control gain 1 2614 Speed control gain 1 2615 Position control gain 2 2616 Speed control gain 2 2617 Speed integral compensation 2618 Notch filter selection 2619 Feed forward gain 2620 In-position range 2621 Electromagnetic brake sequence output 2622 Monitor output mode selection 2623 Optional function 1 2624 Optional function 2 2625 Optional function 3 2626 Optional function 4 2627 Monitor output 1 offset 2628 Monitor output 2 offset 2629 Pre-alarm data selection 2630 Zero speed 2631 Excessive error alarm level 2632 Optional function 5 2633 Optional function 6 2634 PI-PID switching position droop 2635 Torque limit compensation co-efficient 2636 Speed differential compensation (actual speed differential compensation)	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.	Immediate stop	• After checking/correcting the parameter setting value, execute one of the following: • Switch the servo system CPU OFF and back ON again. • Press the reset key, and switch the programmable controller READY signal (M2000) OFF and back ON again.

10. ERROR CODES STORED AT THE PCPU

Table 10.3 Servo Amplifier Error List (2000 - 2799) (Continued)

Error Code	Ampli-fier Type	Error Cause		Error Check Timing	Processing	Corrective Action
		Name	Description			
2601 - 2624	Ⓐ	Initial param-eter error	• An incorrect parameter setting was designated. 2601 Amplifier setting 2602 Motor type 2603 Motor capacity 2604 Number of feedback pulses 2605 In-position range 2606 Position control gain 2 (actual position gain) 2607 Speed control gain 2 (actual speed gain) 2608 Speed integral compensation 2609 Forward torque limit value 2610 Reverse torque limit value 2611 Emergency stop time delay 2612 Position control gain 1 (model position gain) 2613 Speed control gain 1 (model speed gain) 2614 Load inertia ratio 2615 Excessive error alarm level 2616 Special compensation processing 2617 Special servo processing 2618 Td dead-band compensation 2619 Feed forward gain 2620 Unbalanced torque compensation 2621 Dither command 2622 Gain operating time 2623 Servo responsibility 2624 —	• Checked at servo amplifier power ON. • Checked at leading edge of PC READY (M2000) signal. • Checked at servo error reset. • Checked at servo system CPU power ON.	Immediate stop	• After checking/correcting the parameter setting value, execute one of the following: • Switch the servo system CPU OFF and back ON again. • Press the reset key, and switch the programmable controller READY signal (M2000) OFF and back ON again.

(2) Servo power supply module errors
(2800 - 2999: For A273UHCPU 8/32-axis specification only)

Servo power supply module errors (2800 - 2999) are detected by the servo amplifier.

When a servo error occurs, the servo error detection signal (M1608+20n/Xn8/M2408+20n) switches ON. After eliminating the error cause, switch the servo error reset signal (M1808+20n/Yn8/M3208+20n) ON to execute a servo error reset, then re-start the operation. (However, as error codes 2900 - 2999 are only warnings, the servo error detection signal will not switch ON.)

Note: (1) Even after the protective circuit operation is completed, the regenerative error protection (error code 2830) function saves the status of the interrupted operation at the servo amplifier.
The memory content will be cleared by an external power OFF, but not by the RESET signal.

(2) Error code 2830 is reset by an external power OFF. As repeated external power OFFs can cause failure of devices due to overheating, be sure to eliminate the error cause before restarting operation.

Servo power supply module errors are described in Table 10.4 below.

⚠ CAUTION

⚠ When motion controller or servo amplifier self-diagnosis errors occur, check the error content and restore operation in accordance with the instructions in this manual.

Table 10.4 Servo Power Supply Module Error List (2800 - 2999)

Error Code	Error Cause		Error Check Timing	Processing	Corrective Action
	Name	Description			
2810	Undervoltage	• Voltage at servo power supply module fell below 170VAC. • A momentary power interruption occurred.	Constant check	Immediate stop	• Check/correct the power supply equipment.
		• Excessive load.			• Check/correct the power capacity.
2830	Excessive regeneration	• Regenerative resistor's maximum load capacity was exceeded due to frequent operation or continuous regeneration operation.			• Check/correct the operation pattern by reducing the number of accelerations/decelerations, or by reducing the speed, etc.
		• Regeneration power transistor has been damaged.			• Replace the servo power supply module.
		• Incorrect regenerative resistor setting in system settings.			• Check/correct the system settings.
		• Incorrect regenerative resistor wiring.			• Correct the wiring.
2833	Overvoltage	• Incorrect regenerative resistor connection.			• Correct the wiring.
		• Regeneration power transistor has been damaged.			• Replace the servo power supply module.
		• Regenerative resistor is OFF.			• Replace the regenerative resistor.
		• Power supply voltage too high.			• Check/correct the power supply equipment.

10. ERROR CODES STORED AT THE PCPU

Table 10.4 Servo Power Supply Module Error List (2800 - 2999) (Continued)

Error Code	Error Cause Name	Error Cause Description	Error Check Timing	Processing	Corrective Action
2847	Amplifier power supply overheat	• Servo power supply module amplifier has stopped.	Constant check	Immediate stop	• Replace the fan.
		• The servo power supply module's continuous output current rating was exceeded during operation.			• Reduce the load.
		• Thermal sensor failure.			• Replace the servo power supply module.
2940	Excessive regeneration warning	• A regeneration level of 80% of the excessive regeneration error (2830) level was detected.		Operation continues	• Refer to the "excessive regeneration error (2830) description.

10.5 Output Module Errors

(1) Output module errors at REAL → VIRTUAL mode switching (4000 - 5990)

Table 10.5 Output Module Error List (4000 - 5990)

Error Class	Error Code Output Module	Error Code Drive Module	Roller	Ball Screw	Rotary Table	Cam	Error Cause	Processing	Corrective Action
Minor Errors	4050	405☐				○	• The [stroke lower limit setting device value] + [stroke setting device value] exceeded $2^{31}-1$ (set system-of-units). (In 2-way cam mode.)	START disabled at related systems.	• Because the present value cannot be calculated within 1 cam shaft revolution, return to the REAL mode and designate a correct No. at the device.
	4060	406☐	○	○	○	○	• When the drive module is the synchronous encoder connected to the manual pulse generator inputs, and the connected clutch is in the "external input mode", multiple settings existed at the ON/OFF command bit device. Or, the external input mode clutch setting is incorrect.		• A one-to-one setting should be designated for the external input mode clutch and the synchronous encoder. • Return to the REAL mode, switch the programmable controller READY signal OFF, then correct and register the clutch setting.
	4070	407☐	○	○	○	○	• The connected clutch is in the external input mode for a A273EX/A171SENC set for high-speed reading.		• Do not used the clutch in the external input mode for a A273EX/A171SENC set for high-speed reading.
	5000	500☐		○	○	○	• The "feed present value" is outside the applicable range. • For cams, the feed present value is outside the "stroke lower limit to stroke" range. (When in the 2-way cam mode.) (Present value cannot be calculated within 1 cam revolution.)		• Return to the REAL mode and position within the stroke range.
	5060	506☐				○	• The "feed present value" is within the stroke range, but the present value cannot be calculated within 1 cam shaft revolution. (cam table error)		• Correct the cam table. • Make sure that stroke ratios of both "0" and "7FFFH" are included in the cam data table. Designate 0 to 7FFFH points in the cam table.
	5080	508☐	○	○	○	○	• Torque limit setting range violation.	The default setting of 300% will be adopted.	• Designate the torque limit value within the stipulated setting range.

Table 10.5 Output Module Error List (4000 - 5990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Minor Errors	5100	510□				O	• Although the limit switch output is set to the "present value within 1 cam axis revolution" mode, there is no limit switch output data registered at the file register area.	Operation continues with limit switch output OFF.	• Check the limit switch output data. • Verify that the installed memory cassette is a model A3NMCA-24 or newer.
	5200	520□				O	• Stroke lower limit storage devices start with an odd-numbered device.	Operation is enabled, but monitoring is impossible.	• Designate an even number as the first device number.
	5210	521□	O	O	O	O	• The clutch ON address setting devices start with an odd-numbered device.	START disabled at related systems.	
	5220	522□	O	O	O	O	• The clutch OFF address setting devices start with an odd-numbered device.		
	5230	523□			O	O	• The "present value within 1 virtual axis revolution" storage devices (at main shaft side) start with an odd-numbered device.	Operation is enabled, but monitoring is impossible.	
	5240	524□			O	O	• The "present value within 1 virtual axis revolution" storage devices (at auxiliary input shaft side) start with an odd-numbered device.		
	5250	525□	O	O	O	O	• When "amount of slip designation" is set as the clutch smoothing method, the "amount of slip setting device" value is outside the applicable range (0 - 2147483647).	A smoothing amount of "0" (direct clutch) is adopted.	• Designate a value within the range 0 - 2147483647.
	5260	526□				O	• Stroke setting device is out of range.	Related systems inoperative	• Set in the range $1 - (2^{31}-1)$
	5270	527□				O	• Cam number setting device is out of range.		• Correct the cam number setting.
	5280	528□	O	O	O	O	• Clutch mode setting device is out of range.		• Correct the clutch mode setting.
	5290	529□	O	O	O	O	• Clutch ON address setting device is out of range.		• Correct the clutch ON address setting.
	5300	530□	O	O	O	O	• Clutch OFF address setting device is out of range.		• Correct the clutch OFF address setting.
	5310	531□	O	O	O	O	• Clutch ON/OFF command device is out of range.		• Correct the clutch ON/OFF command.
	5320	532□	O	O	O	O	• Speed change gear ratio setting device is out of range.		• Correct the speed change gear ratio setting.
	5330	533□	O	O	O	O	• Amount of slip setting device is out of range.	Amount of slip = 0 (controlled as direct clutch)	• Correct the amount of slip setting.
	5340	534□	O	O	O	O	• Torque control limit setting device is out of range.	Controlled with 300% offset	• Correct the torque control limit setting.
	5350	535□			O	O	• Present value in one virtual axis revolution storage device (main shaft side) is out of range.	Monitoring of present value in one virtual axis revolution (main shaft side) not possible	• Correct the present value in one virtual axis revolution (main shaft side) setting.
	5360	536□			O	O	• Present value in one virtual axis revolution storage device (auxiliary input shaft side) storage device is out of range.	Monitoring of present value in one virtual axis revolution (auxiliary input shaft side) not possible	• Correct the present value in one virtual axis revolution (auxiliary input shaft side) setting.

10. ERROR CODES STORED AT THE PCPU

Table 10.5 Output Module Error List (4000 - 5990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Minor Errors	5370	537□				○	• Stroke lower-limit value storage device is out of range.	Monitoring of stroke lower-limit value not possible	• Correct the stroke lower-limit value setting.
	5380	538□	○	○	○	○	• Number of gear teeth at input shaft setting device is out of range.	Related systems inoperative	• Correct the number of gear teeth at input shaft setting.
	5390	539□	○	○	○	○	• Number of gear teeth at output shaft setting device is out of range.		• Correct the number of gear teeth at output shaft setting.
	5400	540□	○	○	○	○	• Number of gear teeth at input shaft setting device is set to zero.		• Correct the number of gear teeth at input shaft setting.
	5410	541□	○	○	○	○	• Number of gear teeth at output shaft setting device is set to zero.		• Correct the number of gear teeth at output shaft setting.

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(2) "No-clutch/clutch ON/clutch status ON" output module errors (6000 - 6990)

Table 10.5 Output Module Error List (6000 - 6990)

Error Class	Error Code Output Module	Error Code Drive Module	Roller	Ball Screw	Rotary Table	Cam	Error Cause	Processing	Corrective Action
Minor Errors	6000	600□	○	○	○	○	• The servo OFF command (M1815+20n/YnF/M3215+20n) switched ON during operation.	Operation continues. The servo ON status is maintained.	• The servo ON status is maintained. • Switch the clutch OFF, then establish the servo OFF status.
	6010	601□	○	○	○		• The output speed exceeded the speed limit value during operation. (Speed clamp processing in accordance with the speed limit value is not executed.)		• Correct the drive module's speed, gear ratio, and speed change ratio so that the speed remains within the speed limit.
	6020	602□	○	○	○	○	• The deviation counter value exceeded the "permissible number of droop pulses" value during operation.		• Stop the drive module, then correct the drive module's speed, gear ratio, and speed change gear ratio so that the speed remains within the speed limit.
	6030	603□		○	○		• The feed present value violated the stroke limit range during operation.		• Stop the drive module, then correct the drive module's speed, gear ratio, and speed change gear ratio so that the speed remains within the speed limit.
	6040	604□				○	• The cam No. setting device value violates the "used cam Nos" range. (Operation continues with the current cam No.)		• Correct the cam No. setting.
	6050	605□				○	• The stroke setting device value violates the "1 to $2^{31}-1$" range. • The designated value doesn't conform to the following requirement: [stroke lower limit] + [stroke] $\leqq$ [$2^{31}-1$]. (Operation continues with the current stroke)	Operation continues with the current cam No. and stroke.	• Correct the stroke setting.
	6060	606□				○	• A control mode (feed/2-way) discrepancy occurred at cam No. switching.	Operation continues	• Stop the drive module and correct the control mode setting.
	6080	608□	○	○	○	○	• The torque limit setting device value violates the stipulated range.	The default value of 300% is adopted.	• Designate a torque limit value within the setting range.
	6090	609□	○	○	○	○	• After servo amplifier (MR-[ ]-B) power ON, and when a servo OFF command (M1815+20n/YnF/M3215+20n OFF) is executed, the designated axis is a no-clutch axis, or a clutch ON status exists.	Servo ON will be disabled.	• After designating a clutch OFF command, designate a servo OFF command.
	6120	612□				○	• The present value in one cam axis revolution was changed to an out-of-range value.	The present value is unchanged.	• Designate a value within the range 1 to (pulses in one cam axis revolution – 1).
	6130	613□	○	○	○	○	• The number of gear teeth at input shaft is set by indirect device setting, and the device value became zero when the drive module present value wa schanged.	The gear ratio is unchanged.	• Designate a value within the range 1 - 65535.

Table 10.5 Output Module Error List (6000 - 6990)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Minor Errors	6140	614□	O	O	O	O	• The number of gear teeth at output shaft is set by indirect device setting, and the device value became zero when the drive module present value was changed.	The gear ratio is unchanged.	• Designate a value within the range 1 - 65535.

(3) Output module errors when clutch OFF and clutch OFF command issued (6500 - 6990)

Table 10.5 Output Module Error List (6500 - 6990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Minor Errors	6500	650□	O	O	O	O	• A servo OFF status existed when a clutch ON command occurred.	Clutch remains OFF.	• Return to the clutch OFF command, and repeat the clutch ON command after executing a servo ON command.
	6510	651□				O	• The feed present value violated the stroke range when a cam axis servo OFF command (M1815+20n/YnF/M3215+20n OFF) was executed. (In the 2-way cam mode) • The stroke range was violated during a follow-up operation.	Servo remains ON.	• After returning to within the stroke range, execute the servo OFF command again.
	6520	652□				O	• The [stroke lower limit] + [stroke] $\leq$ [$2^{31}-1$] condition was not satisfied when a cam axis servo OFF command (M1815+20n/YnF/M3215+20n OFF) was executed. (In the 2-way cam mode)		• Designate a value which satisfies the [stroke lower limit] + [stroke] $\leq$ [$2^{31}-1$] condition.
	6530	653□		O	O	O	• The home position return request signal (M1609+20n/Xn9/M2409+20n) was ON when a clutch ON command occurred. (Incremental axis MR-H-B/MR-J-B power switched from OFF to ON.)	Clutch remains OFF.	• Return to the REAL mode, execute a home position return, then switch back to the VIRTUAL mode.
	6540	654□				O	• When a servo ON command was executed, the feed present value was within the stroke limit range, but the present value couldn't be calculated within 1 cam axis revolution. (Cam table error)	Servo remains ON.	• Return to the REAL mode, then correct the cam data settings. • Designate the setting for the stroke from the stroke lower limit as a ratio in the range 0 to 7FFFH. Designate 0 to 7FFFH points at the cam table.

(4) System error (9000 - 9990)

Table 10.5 Output Module Error List (9000 - 9990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Minor Errors	9000	900□	○	○	○	○	• When the servo amplifier power was turned on, the motor type actually installed was different from the motor type set in the system settings. (Checked only when MR-J2-B is used)	Further operation is impossible.	• Correct the motor type setting in the system settings.
	9010	901□	○	○	○	○	• When the servo amplifier power is turned on, the amount of motor travel while the power was OFF is found to have exceeded the "POWER OF ALLOWED TRAVELING POINTS" in the system settings.	The "VIRTUAL mode continuation disabled warning device" comes ON. Further operation is impossible.	• Check the position. Check encoder battery.

(5) Output module errors at VIRTUAL servo mode axis START (10000 - 10990)

Table 10.5 Output Module Error List (10000 - 10990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Major Errors	10000	1000□		○	○	○	• The home position return request (M1609+20n/Xn9/M2409+20n) is ON.	START disabled at related systems.	• Return to the REAL mode and execute a home position return. • If position is not established after executing a home position return at all axes, VIRTUAL mode operation will be disabled.
	10010	1001□	○	○	○	○	• The servo error detection signal (M1608+20n/Xn8/M2408+20n) is ON.		• Execute a servo error reset in the REAL mode.
	10020	1002□	○	○	○	○	• A servo OFF (M1615+20n/XnF/M2415+20n ON) status exists at an output module where a "clutch ON" or "no clutch" setting is designated at either the main shaft or auxiliary input shaft.		• Switch the clutch OFF, then establish the servo ON status.
	10030	1003□	○	○	○	○	• An external input signal (STOP) is ON at an output module where a "clutch ON" or "no clutch" setting is designated at either the main shaft or auxiliary input shaft.		• Switch the stop signal (STOP) OFF.

10. ERROR CODES STORED AT THE PCPU

(6) "No-clutch/clutch ON/clutch status ON" output module errors (11000 - 11990)

Table 10.5 Output Module Error List (11000 - 11990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Major Errors	11000	1100□	○	○	○	○	• The servo error detection signal (M1608+20n/Xn8/M2408+20n) switched ON during operation.	After an immediate stop at the relevant output module, the servo will be switched OFF.	• Eliminate the servo error cause (see section 10.4).
	11010	1101□	○	○	○	○	• A servo OFF status (M1615+20n/XnF/M2415+20n ON) occurred during operation. • MR-[ ]-B power supply was interrupted. • A servo error occurred at another ADU axis.	• Operation continues at "no-clutch" axes. • At axes with clutches, control is executed in accordance with the operation mode at the time of the error. • Operation continues. • All clutches switch OFF at the relevant systems.	• When an "operation continuation" setting is designated, execute stop processing at the user's sequence program.
	11020	1102□	○	○	○	○	• The stop signal (STOP) switched ON.		
	11300	1130□	○	○	○	○	• The upper limit LS signal (FLS) switched OFF during forward (address increase direction) travel.		
	11400	1140□	○	○	○	○	• The lower limit LS signal (RLS) switched OFF during reverse (address decrease direction) travel.		

(7) Errors when using an absolute position system (12000 - 12990)

Table 10.5 Output Module Error List (12000 - 12990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Major Errors	12010	1201□	○	○	○	○	• When the separate amplifier power supply was turned ON in the VIRTUAL mode, a sum-check error occurred in the back-up data (reference values). • Home position return not conducted.	Home position return requires turns ON.	• Return to the REAL mode and execute home position return.
	12020*	1202□	○	○	○	○	• When the servo amplifier power is turned ON, a communication error in communication between the servo amplifier and encoder occurs.	Home position return requires turns ON.	• Check the motor and encoder cables and perform home position return again.
	12030*	1203□	○	○	○	○	• During operation, the amount of change in the encoder present value complies with the following expression: "Amount of change in encoder present value/3.5 ms > 180° of motor revolution" After the servo amplifier power has been turned ON, a continual check is performed (in both servo ON and OFF states).	No processing	• Check the motor and encoder cables.
	12040*	1204□	○	○	○	○	• During operation, the following expression holds: "Encoder present value (PLS) ≠ feedback present value (PLS) (number of bits in encoder's feedback present value counting range)". After the servo amplifier power has been turned ON, a continual check is performed (in both servo ON and OFF states).		

These errors occur only when using MR-H-B and MR-J2-B servo amplifiers.

(8) System errors at all-axes servo ON (15000 - 15990)

Table 10.5 Output Module Error List (15000 - 15990) (Continued)

Error Class	Error Code		Output Module				Error Cause	Processing	Corrective Action
	Output Module	Drive Module	Roller	Ball Screw	Rotary Table	Cam			
Major Errors	15000	1500□	○	○	○	○	• 3-phase 200V is not being supplied to A230P at an all-axes servo ON command, or, A230P is damaged.	All-axes servo ON will not occur.	• Error occurs only at the ADU axis in systems using ADU.
	15010	1501□	○	○	○	○	• 24 VDC is not being supplied when an A171SENC/A278LX brake setting is designated.	All-axes ON will not occur in response to an all-axes servo ON command. If the error occurs while an all-axes servo ON status is in effect, an emergency stop will occur, and the system will return to the REAL mode OS.	• Check at the all-axes servo ON command, and while an all-axes servo ON status is in effect. "SYS ERR 150□⁺ (**)" will be displayed at the A273UHCPU's LED display. ⁺: □ = "0" or "1"

10. ERROR CODES STORED AT THE PCPU

10.6 Errors At REAL ↔ VIRTUAL Mode Switching

Table 10.6 REAL ↔ VIRTUAL Mode Switching Error Code List

Error Codes Stored at D9195 (A171SCPU/A273UHCPU 8-axis Specification)		Error Codes Stored in D9193 (A273UHCPU 32-axis Specification)		Error Description	Corrective Action
Decimal Display	Hexadecimal Display	Decimal Display	Hexadecimal Display		
1 - 255	0001 - 00FF	1	0001	• M2043 OFF → ON switching occurred when all axes were not stopped.	• Execute M2043 OFF → ON switching when M2001-M2008 are all OFF.
257 - 511	0101 - 01FF	256	0100	• M2043 ON → OFF switching occurred when all axes were not stopped.	• Execute M2043 ON → OFF switching when M2001-M2008/M2001-M2008/M2001-M2032 are all OFF.
512	0200	512	0200	• M2043 OFF → ON switching occurred when no mechanical system program was registered.	• Write a mechanical system program to the servo system CPU.
				• M2043 OFF → ON switching occurred when a discrepancy existed between the axis No. designated at the system settings, and that designated at the mechanical system program (output shaft No.).	• Designate the same axis No. at both the system settings and the mechanical system program, then write the data to the servo system CPU.
513	0201	513*	0201	• M2043 OFF → ON switching occurred when the programmable controller READY signal (M2000) or the PCPU READY signal (M9074) was OFF.	• After switching the PC READY and PCPU READY signals ON, execute M2043 OFF → ON switching.
514	0202	514*	0202	• M2043 OFF → ON switching occurred when the all-axes servo START command flag (M2042) was OFF.	• Switch M2042 ON, switch the all-axes servo START accept flag ON, then execute M2043 OFF → ON switching.
515	0203	515*	0203	• M2043 OFF → ON switching occurred when the external emergency stop (EMG) signal was ON.	• Switch the external emergency stop signal OFF, then execute M2043 OFF → ON switching.
516	0204	516*	0204	• M2043 OFF → ON switching occurred during servo START processing which was occurring in response to an ADU axis servo error reset command (M1808+20n/Yn8/M3208+20n).	• When a servo error reset occurred by switching the M1808+20n/Yn8/M3208+20n signal ON, switch the servo error detection signal (M1608+20n/Xn8/M2408+20n) OFF, then execute M2043 OFF → ON switching.
519	0207	519*	0207	• M2043 OFF → ON switching occurred during batch change processing (M2016/M2056: ON) of cam data by the sequence program.	• When cam data was changed by switching M2016/M2056 ON, execute M2043 OFF → ON switching after the cam data batch change completed flag (M2017/M2057) switches ON.
769 - 1023	0301 - 03FF	768	0300	• M2043 OFF → ON switching occurred when the home position return request signal was ON at an axis whose output module is not a roller.	• After executing a home position return (servo program "zero execute"), and switching M1609+20n/Xn9/M2409+20n OFF, execute M2043 OFF → ON switching.
1025 - 1279	0401 - 04FF	1024	0400	• M2043 OFF → ON switching occurred when an all-axes normal status (M1608+20n/Xn8/M2408+20n: ON) did not exist at the ADU and MR-[ ]-B.	• Check the ADU, MR-H-B/MR-J-B, servo motor, and the wiring.

Error axis No. information will not be stored at D9194/D9195 for error codes indicated by an asterisk.

10. ERROR CODES STORED AT THE PCPU

Table 10.6 REAL ↔ VIRTUAL Mode Switching Error Code List (Continued)

Error Codes Stored at D9195 (A171SCPU/A273UHCPU 8-axis Specification)		Error Codes Stored in D9193 (A273UHCPU 32-axis Specification)		Error Description	Corrective Action
Decimal Display	Hexadecimal Display	Decimal Display	Hexadecimal Display		
1281 - 1535	0501 - 05FF	1280	0500	• M2043 OFF → ON switching occurred when a system-of-units setting discrepancy existed between the fixed parameter and output module settings for an axis whose output module is not a roller.	• Correct the fixed parameter or output module system-of-units setting, then write the data to the servo system CPU.
1537 - 1791	0601 - 06FF	1536	0600	• M2043 OFF → ON switching occurred when a cam is set as the output module, but no cam data has been registered.	• Write the cam data to the servo system CPU.
2049 - 2303	0801 - 08FF	2048	0800	• M2043 OFF → ON switching occurred when no cam No. has been designated at the cam No. setting device. (When setting in cam No. setting device is "0".)	• After writing the cam No. (No. used at cam parameters) to the cam No. setting device, execute M2043 OFF → ON switching.
2305 - 2559	0901 - 09FF	2304	0900	• The setting value at the cam stroke setting device violates the "1 to $(2^{31}-1)$" range.	• After designating a cam stroke setting device value within the "1 to $(2^{31}-1)$" range, execute M2043 OFF → ON switching.
2817 - 3071	0B01 - 0BFF	2716	0B00	• An odd number has been designated at the cam stroke setting device.	• Designate an even number at the cam stroke setting device.
-4094	F002	-4094*	F002	• During VIRTUAL mode operation, the programmable controller READY signal (M2000) switched OFF, and the system returned to the REAL mode. • The servo system CPU stopped during VIRTUAL mode operation.	• Switch M2000 ON. • Designate the servo system CPU "RUN" status.
-4095	F001	-4095*	F001	• During VIRTUAL mode operation, the servo error signal (M1608+20n/Xn8/M2408+20n) switched ON, and the system returned to the REAL mode.	• Check the servo error code register to determine the error cause at the axis in question, then eliminate the error cause (see section 10.4).
-4096	F000	-4096*	F000	• During VIRTUAL mode operation, the external emergency stop (EMG) signal switched ON, and the system returned to the REAL mode.	• Switch the external emergency stop signal OFF.

Error axis No. information will not be stored at D9194/D9195 for error codes indicated by an asterisk.

APPENDICES

APPENDIX 1 CAM CURVES

The cam acceleration curve formulas used in the VIRTUAL mode are shown below.

(1) Acceleration curve formula

<Symbols used>

- A : Dimensionless acceleration
- Am : Dimensionless maximum acceleration
- T : Dimensionless time
- Ta, Tb, Tc : T borderlines when section divisions are used

(a) Discontinuous curve

   1) Constant speed curve

$$A = C0$$

   2) Uniform acceleration curve

Section I $(0 \leqq T \leqq 0.5)$
$$A = 4 + C0$$
Section II $(0.5 < T \leqq 1)$
$$A = -4 + C0$$

(b) Both-side stationary symmetrical curve

   1) 5th curve

$$A = 120T^3 - 180T^2 + 60T + C0$$

   2) Cycloid curve

$$Am = 2\pi$$
$$A = 2\pi \sin 2t\pi T + C0$$

   3) Distorted trapezoid curve

$$Ta = \frac{1}{8}$$
$$Am = \frac{1}{\frac{1}{4} - Ta + \frac{2}{\pi}Ta}$$
Section I $(0 \leqq T \leqq Ta)$
$$A = Am \sin \frac{\pi}{2Ta} T + C0$$
Section II $(Ta < T \leqq 0.5 - Ta)$
$$A = Am + C0$$
Section III $(0.5 - Ta < T \leqq 0.5 + Ta)$
$$A = Am\overline{\cos} \frac{\pi(T - 0.5 + Ta)}{2Ta} + C0$$
Section IV $(0.5 - Ta < T \leqq 1 - Ta)$
$$A = -Am + C0$$
Section V $(1 - Ta < T \leqq 1)$
$$A = -Am\overline{\cos} \frac{\pi(T - 1 + Ta)}{2Ta} + C0$$

APPENDICES

4) Distorted sine curve

$$Ta = \frac{1}{8}$$

$$Am = \frac{1}{\frac{2Ta}{\pi} + \frac{2-8Ta}{\pi 2}}$$

Section I ($0 \leqq T \leqq Ta$)

$$A = Am\sin\frac{\pi T}{2Ta} + C0$$

Section II ($Ta < T \leqq 1 - Ta$)

$$A = Am\overline{\cos}\frac{\pi(T-Ta)}{1-2Ta} + C0$$

Section III ($1 - Ta < T \leqq 1$)

$$A = -Am\overline{\cos}\frac{\pi(T-1 + Ta)}{2Ta} + C0$$

5) Distorted constant speed curve

$$Ta = \frac{1}{16}$$

$$Tb = \frac{1}{4}$$

$$Am = \frac{1}{\frac{2}{\pi}\{ (2-\frac{8}{\pi})TaTb + (\frac{4}{\pi}-2)Tb^2 + Tb\}}$$

Section I ($0 \leqq T \leqq Ta$)

$$A = Am\sin\frac{\pi T}{2Ta} + C0$$

Section II ($Ta < T \leqq Tb$)

$$A = Am\overline{\cos}\frac{\pi(T-Ta)}{2(Tb-Ta)} + C0$$

Section III ($Tb < T \leqq Tb$)

$$A = 0 + A0$$

Section IV ($1 - Tb < T \leqq 1 - Ta$)

$$A = -Am\sin\frac{\pi(T-1 + Tb)}{2(Tb - Ta)} + C0$$

Section V ($1 - Ta < T \leqq 1$)

$$A = -Am\overline{\cos}\frac{\pi(T-1 + Ta)}{2Ta} + C0$$

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(c) Both-side stationary asymmetrical curve

1) Trapecloid curve

$$Ta = \frac{1}{8}$$

$$Tb = \frac{2 - 6Ta + \pi Ta}{2 + \pi}$$

$$Tc = \frac{2-2Ta + 3\pi Ta}{2 + \pi}$$

$$Am = \frac{1}{(-\frac{3}{2} + \frac{4}{\pi} + \frac{4}{\pi^2})T^2a + (1 + \frac{2}{\pi})TaTb + \frac{1}{2}T^2b + (\frac{2}{\pi}-\frac{4}{\pi^2})(1-Tc)^2}$$

Section I (0 $\leqq$ T $\leqq$ Ta)

$$A = Am\sin\frac{\pi T}{2Ta} + C0$$

Section II (Ta < T $\leqq$ Tb)

$$A = Am + C0$$

Section III (Tb < T $\leqq$ Tc)

$$A = Am\bar{\cos}\frac{\pi(T - T6)}{2Ta} + C0$$

Section IV (Tc < T $\leqq$ 1)

$$A = -Am\bar{\cos}\frac{\pi(T- Tc)}{2(1 - Tc)} + C0$$

2) Reverse trapecloid curve

$$Ta = \frac{1}{8}$$

$$Tb = \frac{2 - 6Ta + \pi Ta}{2 + \pi}$$

$$Tc = \frac{2-2Ta + 3\pi Ta}{2 + \pi}$$

$$Am = \frac{1}{(-\frac{3}{2} + \frac{4}{\pi} + \frac{4}{\pi^2})T^2a + (1 + \frac{2}{\pi})TaTb + \frac{1}{2}T^2b + (\frac{2}{\pi}-\frac{4}{\pi^2})(1-Tc)^2}$$

$$Va = \frac{2TaAm}{\pi}$$

$$Vb = Am(Tb - Ta) + Va$$

$$Sa = \frac{2T^2aAm}{\pi} - \frac{4T^2aAm}{\pi^2}$$

$$Sb = \frac{Am}{2}(Tb - Ta)^2 + Va(Tb - Ta) + Sa$$

$$Sc = \frac{8T^2aAm}{\pi^2} + 2VbTa + Sb$$

Section I (0 $\leqq$ T $\leqq$ 1 - Tc)

$$A = -Am\bar{\cos}\frac{\pi(1 -Tc - T)}{2(1 - Tc)} + C0$$

Section II (1 - Tc < T $\leqq$ 1 - Tb)

$$A = Am\sin\frac{\pi T}{2Ta} + C0$$

Section III (1 - Tb < T $\leqq$ 1 - Ta)

$$A = Am + C0$$

Section IV (1 - Ta < T $\leqq$ 1)

$$A = Am\sin\frac{\pi(1 - T)}{2Ta} + C0$$

(d) One-side stationary curve

1) Multiple hypotenuse curve

$$A = \frac{\pi^2}{2}(\cos\pi T - \cos 2\pi T) + C0$$

(e) Non-stationary curve

1) Single hypotenuse curve

$$A = \frac{\pi^2}{2}\cos\pi T + C0$$

(2) Cam curve coefficient

Distorted trapezoid
    Section I
        $0 < $ Section I < 0.25 (1/4)   Default value: 0.125 (1/8)
Distorted sine
    Section I
        $0 < $ Section I < 0.5 (1/2)   Default value: 0.125 (1/8)
Distorted constant speed
    Section I
        $0 < $ Section I < 0.125 (1/4)   Default value: 0.0625 (1/16)
    Section II
        $0 < $ Section II < 0.5 (1/2)   Default value: 0.25 (1/4)
Trapecloid
    Section I
        $0 < $ Section I < 0.25 (1/4)   Default value: 0.125 (1/8)
Reverse trapecloid
    Section I
        $0 < $ Section I < 0.25 (1/4)   Default value: 0.125 (1/8)

APPENDICES

APPENDIX 2 PRESENT VALUE CHANGE & SPEED CHANGE

The procedures for changing the virtual servomotor's present value and speed, and for changing the synchronous encoder's present value are discussed in this section. The CHGA instruction is used for present value changes, and the CHGV instruction is used for speed changes. Moreover, when the A171SCPU/A273UHCPU (8-axis specification) is used, present value and speed changes can also be executed using the DSFLP instruction. For details regarding the CHGA, CHGV, and DSFLP instructions, refer to the Motion Controller (SV13/22) Programming Manual (REAL Mode).

2.1   Present Value Change by CHGA Instruction and Speed Change by CHGV Instruction

Program examples are shown below.

(1) Virtual servomotor present value change program
(axis 1, A273UHCPU 8-axis specification):

```
                                                        ┌──────── Axis No.
                                                        │ ┌─ Present value designation
  Command    M2044    M2001                             │ │
 ──┤├─────────┤├─────────┤/├─────────────────┤CHGA│ J1 │ K0├──
```

(2) Virtual servomotor speed change program
(axis 1, A273UHCPU 8-axis specification):

```
                                                        ┌──────── Axis No.
                                                        │ ┌─ Speed designation
  Command    M2044    M2021                             │ │
 ──┤├─────────┤├─────────┤/├─────────────────┤CHGV│ J1 │ K1├──
```

┌─────────────┐
│ **REMARKS** │
└─────────────┘
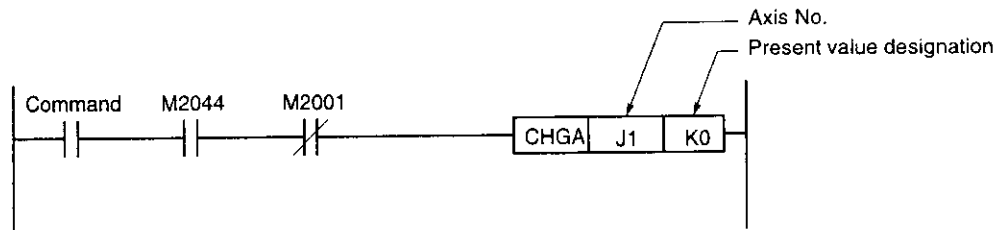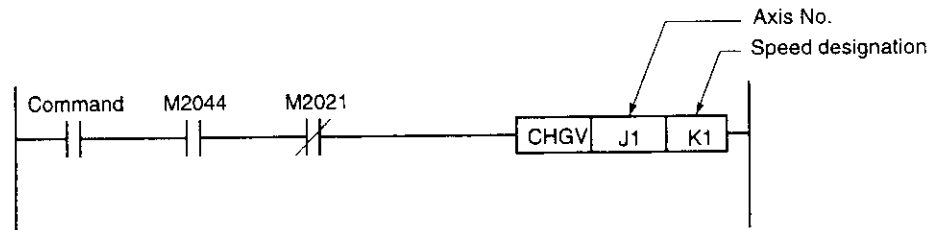
1. M2001: Start accept flag (see Section 4.2.2).

2. M2044: REAL/VIRTUAL mode status flag (see Section 4.2.20).

3. M2021: Speed change in progress flag (see Section 4.2.13).

(3) Synchronous encoder present value change program
    (encoder No. 1, A273UHCPU 8-axis specification):
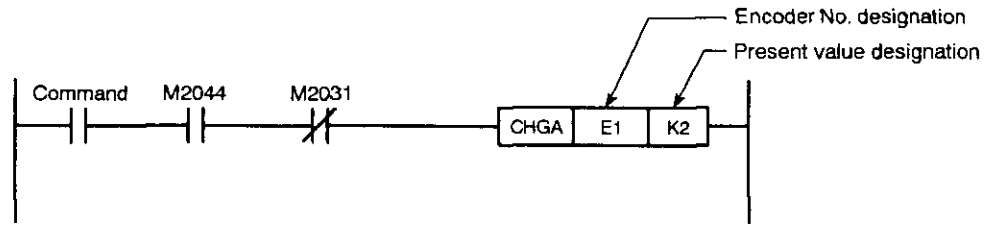
(a) The present value and speed to be change are set in the following devices.

    • Indirect designation .... Data register (D) ⎤
                                  Link register (W) ⎬ Double-word
                                  File register (R) ⎦

    • Direct designation .... Decimal constant (K)

(b) The encoder No. setting ranges are as shown below.

    • For A171SCPU E1
    • For A273UHCPU (8-axis specification) .... E1 to E3
    • For A273UHCPU (32-axis specification) .... E1 to E12

(c) Cautions

    • If a synchronous encoder present value change is attempted while in the
      REAL mode, an error will occur, and the change will not be executed.

    • Synchronous encoder present value changes can also be executed during
      VIRTUAL mode operation (during pulse input from synchronous encoder).
      When a present value change occurs, the synchronous encoder's present
      value will be continued from the new value.

    • Present value changes at the synchronous encoder do not affect the output
      module's present value.

| REMARKS |

1. M2044: REAL/VIRTUAL mode status flag (see Section 4.2.20).

2. M2031: Synchronous encoder (P1) axis present value change in progress
          flag (see Section 4.2.13).

APPENDICES

(4) Present value in one cam axis revolution change program (for cam 1)

```
                                              ┌──────── Output axis No. designation
                                              │ ┌────── Present value designation
    Command                                   │ │
    ──┤ ├─────────────────────────┤CHGA│ C1 │ K0 ├──
```
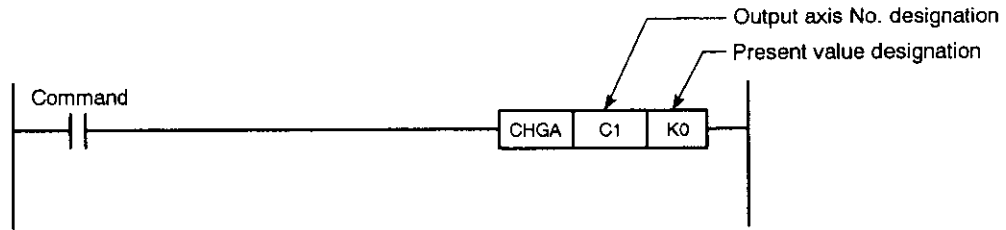
(a) The present value and speed to be changed are set in the following devices.

- Indirect designation .... Data register (D) ⎫

                                     Link register (W)   ⎬ Double-word

                                       File register (R)   ⎭

- Direct designation .... Decimal constant (K)

(b) The cam No. setting ranges are as shown below.

- For A171SCPU .... C1 to C4
- For A273UHCPU (8-axis specification) .... C1 to C8
- For A273UHCPU (32-axis specification) .... C1 to C32

(c) Cautions

- If the present value in one cam axis revolution is designated outside the range 0 to (pulses in one cam axis revolution – 1), an error (error code: 6120) occurs and the present value remains unchanged.

APPENDICES

2.2 Present Value & Speed Changes by DSFLP Instruction

Program examples are shown below.

(1) Virtual servomotor present value change program
(axis 1, A273UHCPU 8-axis specification):

- Axis No. designation
- Present value change register
- Present value change designation
- Axis No.

(2) Virtual servomotor speed change program
(axis 1, A273UHCPU 8-axis specification):

- Axis No. designation
- Present value change register
- Speed designation
- Speed change register
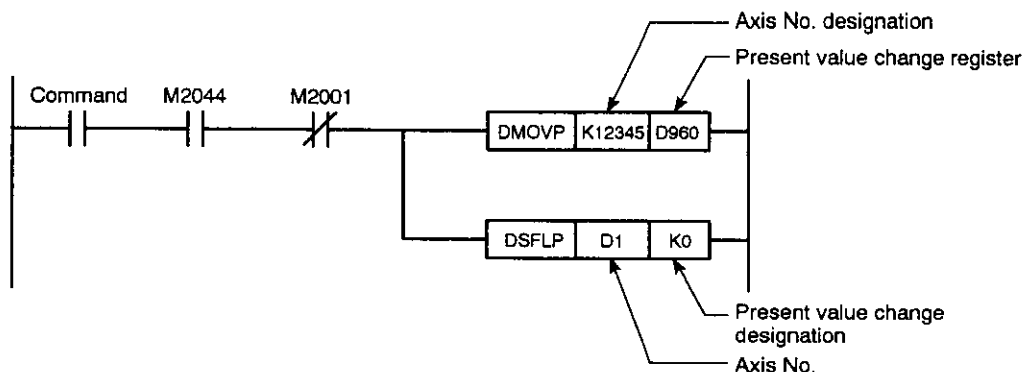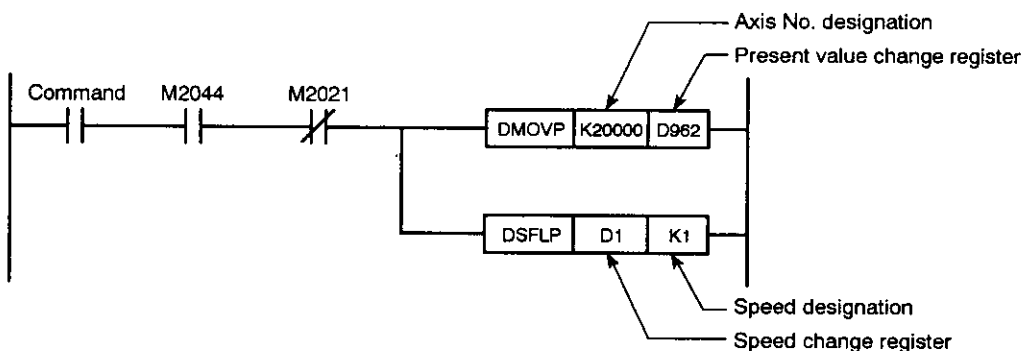
REMARKS

1. M2001: Start accept flag (see Section 4.2.2).

2. M2044: REAL/VIRTUAL mode status flag (see Section 4.2.20).

3. M2021: Speed change in progress flag (see Section 4.2.13).

(3) Synchronous encoder present value change program
(encoder No. 1, A273UHCPU 8-axis specification):
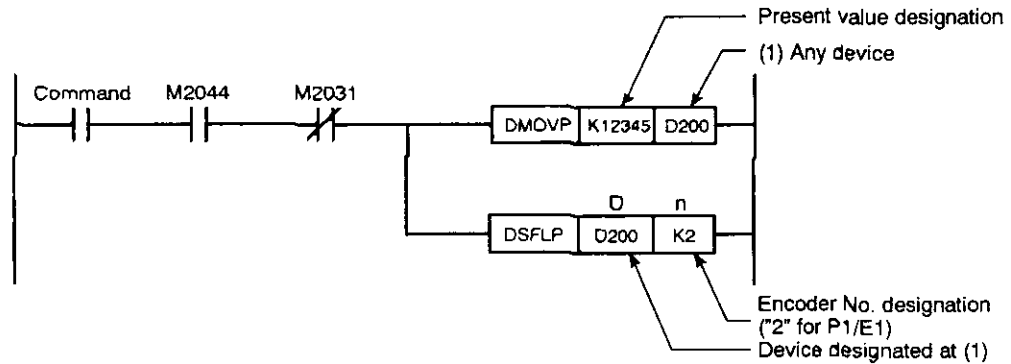
(a) The devices which can be used at "D" and "n" in the above program are as follows:

- D .. Data register (D)

  Link register (W)

  File register (R)

  Timer (T)

  Counter (C)

- n .. Decimal constant (K)

  Hexadecimal constant (H)

(b) The encoder No. is designated as follows:

- Encoder No. 1...K2/H2

- Encoder No. 2...K3/H3

- Encoder No. 3...K4/H4

(c) Cautions

- If the synchronous encoder present value change is attempted while in the REAL mode, an error will occur, and the change will not be executed.

- Synchronous encoder present value changes can also be executed during VIRTUAL mode operation (during pulse input from synchronous encoder). When a present value change occurs, the synchronous encoder's present value will be continued from the new value.

- Present value changes at the synchronous encoder do not affect the output module's present value.

| REMARKS |

1. M2044: REAL/VIRTUAL mode status flag (see Section 4.2.20).

2. M2031: Synchronous encoder (P1) axis present value change in progress flag (see Section 4.2.13).

APPENDICES

APPENDIX 3 NUMBER OF CONNECTABLE MECHANICAL MODULES

The number of mechanical modules which can be connected is not restricted by the processing time.

APPENDICES

APPENDIX 4 POSITIONING SIGNAL LIST

4.1 Common Devices

Table APP.1 Axis Input/Output Signal List

Signal Name	Device No.			Signal Direction
	A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)	
Drive module status signals	M1200 - M1279	X100 - X17F	M4000 - M4639	PCPU → SCPU
Synchronous encoder status signals	M1360 - M1365	X0E0 - X0EA	M4640 - M4687	
Drive module command signals	M1400 - M1479	Y100 - Y17F	M4800 - M5439	SCPU → PCPU
Synchronous encoder error reset signals	M1560	Y0E0 - Y0E2	M5440 - M5487	
Output module status signals	M1600 - M1679	X000 - X07F	M2400 - M3039	PCPU → SCPU
Output module command signals	M1800 - M1879	X000 - X07F	M3200 - M3839	SCPU → PCPU

APPENDICES

Table APP.2 Internal Relay List

Signal Name	Device No. A171SCPU	Device No. A273UHCPU (8-axis Specification)	Device No. A273UHCPU (32-axis Specification)	Signal Direction
Clutch ON/OFF status	M1984 - M1991	M1984 - M1999	M2160 - M2223	PCPU → SCPU
PC READY	M2000			SCPU → PCPU
Virtual servomotor start accept flags	M2001 - M2004	M2001 - M2008	M2001 - M2032	PCPU → SCPU
All-axes servo start accept flag	M2009	M2009	M2049	
Manual pulse generator enable flags	M2012	M2012 - M2014	M2051 - M2053	SCPU → PCPU
JOG simultaneous start command	M2015	M2015	M2048	
Cam data & limit switch output data batch change request flag	–	M2016	M2056	
Cam data & limit switch output data batch change completed flag	–	M2017	M2057	
Cam data & limit switch output data batch change error flag	–	M2018	M2058	
Start buffer full	M2020	M2020	M2050	PCPU → SCPU
Speed change in progress flags	M2021 - M2024	M2021 - M2028	M2061 - M2092	
Synchronous encoder axis present value change in progress flag	M2031	M2031 - M2033	M2101 - M2112	PCPU → SCPU
Speed switching point designation flag	M2040			SCPU → PCPU
System setting error flag	M2041			PCPU → SCPU
All-axes servo start command flag	M2042			SCPU → PCPU
REAL/VIRTUAL mode switching request flag	M2043			
REAL/VIRTUAL mode status flag	M2044			PCPU → SCPU
REAL/VIRTUAL mode switching error detection flag	M2045			
Synchronization discrepancy warning flag	M2046			
Motion slot module error detection flag	M2047			
Automatic deceleration in progress flag	–	–	M2128 - M2159	
Speed change "0" accept flag	–	–	M2240 - M2271	

APPENDICES

Table APP.3 Data Register List

Signal Name	Device No.			Signal Direction
	A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)	
Virtual servomotor monitoring area	D700 - D723	D700 - D747	D800 - D1119	PCPU → SCPU
Storage area for present value after main shaft's differential gear	D670 - D677	D670 - D685		
Synchronous encoder monitoring area	D748 - D755	D748 - D759	D1120 - D1239	
Storage area for present value after main shaft's differential gear	D686 - D689	D686 - D691		
Cam monitoring area	D760 - D779	D760 - D799	D1240 - D1559	
Output module monitoring area	D800 - D879	D800 - D959	D0 - D639	PCPU → SCPU (*1)
Virtual servomotor control change area	D960 - D983	D960 - D1007	D640 - D703	SCPU → PCPU
Limit switch output enabled/disabled setting	D1008, D1009	D1008 - D1011	D760 - D775	
Manual pulse generator axis setting	D1012	D1012 - D1014	D714 - D719	
JOG simultaneous axis setting	D1015	D1015	D710 - D713	
Manual pulse generator 1-pulse input magnification setting	D1016 - D1019	D1016 - D1023	D720 - D751	

*1: Signal direction is "SCPU → PCPU" for the travel value setting register only.

APPENDICES

Table APP.4 Special Register List

Signal Name	Device No.			Signal Direction
	A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)	
Limit switch output status storage area	D9180, D9181	D9180 - D9183	D776 - D791	PCPU → SCPU
PCPU error cause storage area	D9184			
Servo amplifier type storage area	D9185, D9186	D9185, D9186	D792 - D799	
Manual pulse generator axis setting error cause storage area	D9187	D9187	D9185 - D9187	
TEST mode request error cause storage area	D9188	D9188	D9182, D9183	
Error program No. storage area	D9189			
Error information storage area	D9190			
Servo amplifier motion slot loading information storage area	D9191	D9191	D9191, D9192	
Manual pulse generator smoothing magnification storage area	D9192	D9192 - D9194	D752 - D754	SCPU → PCPU
REAL/VIRTUAL mode switching error information storage area	D9195	D9195	D9193 - D9195	PCPU → SCPU

APPENDICES

4.2 Internal Relays (M)

(1) Drive module

(a) When A171SCPU is used

Table APP.5 Internal Relay List (for A171SCPU)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M1984	Virtual axis No. 1 drive clutch ON/OFF status	PCPU → SCPU	M2013	Unusable	–
			M2014		
M1985	Virtual axis No. 1 auxiliary input shaft clutch ON/OFF status		M2015	JOG simultaneous START command	SCPU → PCPU
M1986	Virtual axis No. 2 drive clutch ON/OFF status		M2016 - M2019	Unusable	–
M1987	Virtual axis No. 2 auxiliary input shaft clutch ON/OFF status		M2020	START buffer full	PCPU → SCPU
M1988	Virtual axis No. 3 drive clutch ON/OFF status		M2021	Virtual axis No. 1 speed change in progress flag	
M1989	Virtual axis No. 3 auxiliary input shaft clutch ON/OFF status		M2022	Virtual axis No. 2 speed change in progress flag	
M1990	Virtual axis No. 4 drive clutch ON/OFF status		M2023	Virtual axis No. 3 speed change in progress flag	
M1991	Virtual axis No. 4 auxiliary input shaft clutch ON/OFF status		M2024	Virtual axis No. 4 speed change in progress flag	
M1992 - M1999	Unusable	–	M2025 - M2030	Unusable	–
M2000	PC READY	SCPU → PCPU	M2031	Synchronous encoder (P1) axis present value change in progress	PCPU → SCPU
M2001	Virtual axis No. 1 start accept flag	PCPU → SCPU	M2032 - M2039	Unusable	–
M2002	Virtual axis No. 2 start accept flag		M2040	Speed switching point designation flag	SCPU → PCPU
M2003	Virtual axis No. 3 start accept flag		M2041	System setting error flag	PCPU → SCPU
M2004	Virtual axis No. 4 start accept flag		M2042	All-axes servo START command flag	SCPU → PCPU
M2005 - M2008	Unusable	–	M2043	REAL/VIRTUAL mode switching request	
M2009	All-axes servo start accept flag	PCPU → SCPU	M2044	REAL/VIRTUAL mode status	PCPU → SCPU
M2010	Unusable	–	M2045	REAL/VIRTUAL mode switching error detection	
M2011			M2046	Synchronization discrepancy warning flag	
M2012	Manual pulse generator enabled flag	SCPU → PCPU	M2047	Motion slot error detection flag	

APPENDICES

Table APP.6 Internal Relay (I/O) List (for A171SCPU)

Device					Signal Name	Virtual Servomotor	Synchronous Encoder
Synchronous Encoder	Virtual Servomotor						
P1/E1	Axis 1	Axis 2	Axis 3	Axis 4			
Input							
M1360	–	–	–	–	Error detection	–	O
M1361	–	–	–	–	External signal TREN		
M1362	–	–	–	–	Virtual mode continuation disabled warning signal		
–	M1200	M1220	M1240	M1260	Positioning start completed	O	–
	M1201	M1221	M1241	M1261	Positioning completed		
	M1202	M1222	M1242	M1262	Unusable		
	M1203	M1223	M1243	M1263	Command in-position		
	M1204	M1224	M1244	M1264	Speed control in progress		
	M1205	M1225	M1245	M1265	Unusable		
	M1206	M1226	M1246	M1266			
	M1207	M1227	M1247	M1267	Error detection		
	M1208 - M1219	M1228 - M1239	M1248 - M1259	M1268 - M1279	Unusable		
Output							
M1560	–	–	–	–	Error reset	–	O
–	M1400	M1420	M1440	M1460	Stop command	O	–
	M1401	M1421	M1441	M1461	Rapid stop command		
	M1402	M1422	M1442	M1462	Forward JOG start		
	M1403	M1423	M1443	M1463	Reverse JOG start		
	M1404	M1424	M1444	M1464	Complete signal OFF command		
	M1405	M1425	M1445	M1465	Unusable		
	M1406	M1426	M1446	M1466			
	M1407	M1427	M1447	M1467	Error reset		
	M1408	M1428	M1448	M1468	Unusable		
	M1409	M1429	M1449	M1469	Stop input enable/disable		
	M1410 - M1419	M1430 - M1439	M1450 - M1459	M1470 - M1479	Unusable		

APPENDICES

(b) When A273UHCPU (8-axis specification) is used

Table APP.7 Internal Relay List (for A273UHCPU 8-axis Specification)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M1984	Virtual axis No. 1 drive clutch ON/OFF status		M2007	Virtual axis No. 7 start accept flag	
M1985	Virtual axis No. 1 auxiliary input shaft clutch ON/OFF status		M2008	Virtual axis No. 8 start accept flag	PCPU → SCPU
M1986	Virtual axis No. 2 drive clutch ON/OFF status		M2009	All-axes servo start accept flag	
M1987	Virtual axis No. 2 auxiliary input shaft clutch ON/OFF status		M2012	Manual pulse generator No. 1 enabled flag	
M1988	Virtual axis No. 3 drive clutch ON/OFF status		M2013	Manual pulse generator No. 2 enabled flag	
M1989	Virtual axis No. 3 auxiliary input shaft clutch ON/OFF status		M2014	Manual pulse generator No. 3 enabled flag	SCPU → PCPU
M1990	Virtual axis No. 4 drive clutch ON/OFF status		M2015	JOG simultaneous start command	
M1991	Virtual axis No. 4 auxiliary input shaft clutch ON/OFF status	PCPU → SCPU	M2016	Cam & limit switch output data batch change request flag	
M1992	Virtual axis No. 5 drive clutch ON/OFF status		M2017	Cam & limit switch output data batch change completed flag	
M1993	Virtual axis No. 5 auxiliary input shaft clutch ON/OFF status		M2018	Cam & limit switch output data batch change error flag	
M1994	Virtual axis No. 6 drive clutch ON/OFF status		M2020	START buffer full	
M1995	Virtual axis No. 6 auxiliary input shaft clutch ON/OFF status		M2021	Virtual axis No. 1 speed change in progress flag	
M1996	Virtual axis No. 7 drive clutch ON/OFF status		M2022	Virtual axis No. 2 speed change in progress flag	
M1997	Virtual axis No. 7 auxiliary input shaft clutch ON/OFF status		M2023	Virtual axis No. 3 speed change in progress flag	PCPU → SCPU
M1998	Virtual axis No. 8 drive clutch ON/OFF status		M2024	Virtual axis No. 4 speed change in progress flag	
M1999	Virtual axis No. 8 auxiliary input shaft clutch ON/OFF status		M2025	Virtual axis No. 5 speed change in progress flag	
M2000	PC READY	SCPU → PCPU	M2026	Virtual axis No. 6 speed change in progress flag	
M2001	Virtual axis No. 1 start accept flag		M2027	Virtual axis No. 7 speed change in progress flag	
M2002	Virtual axis No. 2 start accept flag		M2028	Virtual axis No. 8 speed change in progress flag	
M2003	Virtual axis No. 3 start accept flag	PCPU → SCPU	M2029	Unusable	–
M2004	Virtual axis No. 4 start accept flag		M2030		
M2005	Virtual axis No. 5 start accept flag		M2031	Synchronous encoder (P1) axis present value change in progress	PCPU → SCPU
M2006	Virtual axis No. 6 start accept flag		M2032	Synchronous encoder (P2) axis present value change in progress	

APPENDICES

Table APP.7 Internal Relay List (for A273UHCPU 8-axis Specification) (Continued)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M2033	Synchronous encoder (P3) axis present value change in progress	PCPU → SCPU	M2043	REAL/VIRTUAL mode switching request	SCPU → PCPU
M2034 - M2039	Unusable	–	M2044	REAL/VIRTUAL mode status	PCPU → SCPU
M2040	Speed switching point designation flag	SCPU → PCPU	M2045	REAL/VIRTUAL mode switching error detection	
M2041	System setting error flag	PCPU → SCPU	M2046	Synchronization discrepancy warning flag	
M2042	All-axes servo start command flag	SCPU → PCPU	M2047	Motion slot error detection flag	

Table APP.8 I/O Relay List (for A273UHCPU 8-axis Specification)

	Device										Signal Name	Virtual Servo-motor	Syn-chro-nous Encoder
	Synchronous Encoder			Virtual Servomotor									
	P1/E1	P2/E1	P3/E1	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8		
Input	XE0	XE1	XE2	–	–	–	–	–	–	–	–	Error detection	–	○
	XE3	XE4	XE5	–	–	–	–	–	–	–	–	External signal TREN		
	XF8	XF9	XFA	–	–	–	–	–	–	–	–	Virtual mode con-tinuation disabled warning signal	–	
	–	–	–	X100	X110	X120	X130	X140	X150	X160	X170	Positioning start completed	○	–
				X101	X111	X121	X131	X141	X151	X161	X171	Positioning com-pleted		
				X102	X112	X122	X132	X142	X152	X162	X172	Unusable		
				X103	X113	X123	X133	X143	X153	X163	X173	Command in-position		
				X104	X114	X124	X134	X144	X154	X164	X174	Speed control in progress		
				X105	X115	X125	X135	X145	X155	X165	X175	Unusable		
				X106	X116	X126	X136	X146	X156	X166	X176			
				X107	X117	X127	X137	X147	X157	X167	X177	Error detection		
				X108 - X10F	X118 - X11F	X128 - X12F	X138 - X13F	X148 - X14F	X158 - X15F	X168 - X16F	X178 - X17F	Unusable		
Out-put	YE0	YE1	YE2	–	–	–	–	–	–	–	–	Error reset		○
				Y100	Y110	Y120	Y130	Y140	Y150	Y160	Y170	Stop command	○	–
				Y101	Y111	Y121	Y131	Y141	Y151	Y161	Y171	Rapid stop com-mand		
				Y102	Y112	Y122	Y132	Y142	Y152	Y162	Y172	Forward JOG start		
				Y103	Y113	Y123	Y133	Y143	Y153	Y163	Y173	Reverse JOG start		
				Y104	Y114	Y124	Y134	Y144	Y154	Y164	Y174	Complete signal OFF command		
	–	–	–	Y105	Y115	Y125	Y135	Y145	Y155	Y165	Y175	Unusable		
				Y106	Y116	Y126	Y136	Y146	Y156	Y166	Y176			
				Y107	Y117	Y127	Y137	Y147	Y157	Y167	Y177	Error reset		
				Y108	Y118	Y128	Y138	Y148	Y158	Y168	Y178	Unusable		
				Y109	Y119	Y129	Y139	Y149	Y159	Y169	Y179	Stop input en-able/disable		
				Y10A - Y19F	Y11A - Y11F	Y12A - Y12F	Y13A - Y13F	Y14A - Y14F	Y15A - Y15F	Y16A - Y16F	Y17A - Y17F	Unusable		

APPENDICES

(c) When A273UHCPU (32-axis specification) is used

Table APP.9 Internal Relay List (for A273UHCPU 32-axis Specification)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M2000	PC READY	SCPU → PCPU	M2024	Virtual axis No. 24 start accept flag	PCPU → SCPU
M2001	Virtual axis No. 1 start accept flag	PCPU → SCPU	M2025	Virtual axis No. 25 start accept flag	
M2002	Virtual axis No. 2 start accept flag		M2026	Virtual axis No. 26 start accept flag	
M2003	Virtual axis No. 3 start accept flag		M2027	Virtual axis No. 27 start accept flag	
M2004	Virtual axis No. 4 start accept flag		M2028	Virtual axis No. 28 start accept flag	
M2005	Virtual axis No. 5 start accept flag		M2029	Virtual axis No. 29 start accept flag	
M2006	Virtual axis No. 6 start accept flag		M2030	Virtual axis No. 30 start accept flag	
M2007	Virtual axis No. 7 start accept flag		M2031	Virtual axis No. 31 start accept flag	
M2008	Virtual axis No. 8 start accept flag		M2032	Virtual axis No. 32 start accept flag	
M2009	Virtual axis No. 9 start accept flag		M2033 - M2039	Unusable	–
M2010	Virtual axis No. 10 start accept flag		M2040	Speed switching point designation flag	PCPU → SCPU
M2011	Virtual axis No. 11 start accept flag		M2041	System setting error flag	SCPU → PCPU
M2012	Virtual axis No. 12 start accept flag		M2042	All-axes servo start command flag	PCPU → SCPU
M2013	Virtual axis No. 13 start accept flag		M2043	REAL/VIRTUAL mode switching request	SCPU → PCPU
M2014	Virtual axis No. 14 start accept flag		M2044	REAL/VIRTUAL mode status	PCPU → SCPU
M2015	Virtual axis No. 15 start accept flag		M2045	REAL/VIRTUAL mode switching error detection	
M2016	Virtual axis No. 16 start accept flag		M2046	Synchronization discrepancy warning flag	
M2017	Virtual axis No. 17 start accept flag		M2047	Motion slot error detection flag	
M2018	Virtual axis No. 18 start accept flag		M2048	JOG simultaneous start command	SCPU → PCPU
M2019	Virtual axis No. 19 start accept flag		M2049	All-axes servo start accept flag	PCPU → SCPU
M2020	Virtual axis No. 20 start accept flag		M2050	START buffer full	
M2021	Virtual axis No. 21 start accept flag		M2051	Manual pulse generator No. 1 enabled flag	SCPU → PCPU
M2022	Virtual axis No. 22 start accept flag		M2052	Manual pulse generator No. 2 enabled flag	
M2023	Virtual axis No. 23 start accept flag		M2053	Manual pulse generator No. 3 enabled flag	

APPENDICES

Table APP.9 Internal Relay List (for A273UHCPU 32-axis Specification) (Continued)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M2054	Unusable	–	M2082	Virtual axis No. 22 speed change in progress flag	PCPU → SCPU
M2055			M2083	Virtual axis No. 23 speed change in progress flag	
M2056	Cam & limit switch output data batch change request flag	SCPU → PCPU	M2084	Virtual axis No. 24 speed change in progress flag	
M2057	Cam & limit switch output data batch change completed flag	PCPU → SCPU	M2085	Virtual axis No. 25 speed change in progress flag	
M2058	Cam & limit switch output data batch change error flag		M2086	Virtual axis No. 26 speed change in progress flag	
M2059	Unusable	–	M2087	Virtual axis No. 27 speed change in progress flag	
M2060			M2088	Virtual axis No. 28 speed change in progress flag	
M2061	Virtual axis No. 1 speed change in progress flag	PCPU → SCPU	M2089	Virtual axis No. 29 speed change in progress flag	
M2062	Virtual axis No. 2 speed change in progress flag		M2090	Virtual axis No. 30 speed change in progress flag	
M2063	Virtual axis No. 3 speed change in progress flag		M2091	Virtual axis No. 31 speed change in progress flag	
M2064	Virtual axis No. 4 speed change in progress flag		M2092	Virtual axis No. 32 speed change in progress flag	
M2065	Virtual axis No. 5 speed change in progress flag		M2093 - M2100	Unusable	–
M2066	Virtual axis No. 6 speed change in progress flag		M2101	Synchronous encoder (P1) axis present value change in progress	PCPU → SCPU
M2067	Virtual axis No. 7 speed change in progress flag		M2102	Synchronous encoder (P2) axis present value change in progress	
M2068	Virtual axis No. 8 speed change in progress flag		M2103	Synchronous encoder (P3) axis present value change in progress	
M2069	Virtual axis No. 9 speed change in progress flag		M2104	Synchronous encoder (P4) axis present value change in progress	
M2070	Virtual axis No. 10 speed change in progress flag		M2105	Synchronous encoder (P5) axis present value change in progress	
M2071	Virtual axis No. 11 speed change in progress flag		M2106	Synchronous encoder (P6) axis present value change in progress	
M2072	Virtual axis No. 12 speed change in progress flag		M2107	Synchronous encoder (P7) axis present value change in progress	
M2073	Virtual axis No. 13 speed change in progress flag		M2108	Synchronous encoder (P8) axis present value change in progress	
M2074	Virtual axis No. 14 speed change in progress flag		M2109	Synchronous encoder (P9) axis present value change in progress	
M2075	Virtual axis No. 15 speed change in progress flag		M2110	Synchronous encoder (P10) axis present value change in progress	
M2076	Virtual axis No. 16 speed change in progress flag		M2111	Synchronous encoder (P11) axis present value change in progress	
M2077	Virtual axis No. 17 speed change in progress flag		M2112	Synchronous encoder (P12) axis present value change in progress	
M2078	Virtual axis No. 18 speed change in progress flag		M2113 - M2127	Unusable	–
M2079	Virtual axis No. 19 speed change in progress flag		M2128	Virtual axis No. 1 automatic deceleration in progress flag	PCPU → SCPU
M2080	Virtual axis No. 20 speed change in progress flag		M2129	Virtual axis No. 2 automatic deceleration in progress flag	
M2081	Virtual axis No. 21 speed change in progress flag		M2130	Virtual axis No. 3 automatic deceleration in progress flag	

APPENDICES

Table APP.9 Internal Relay List (for A273UHCPU 32-axis Specification) (Continued)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M2131	Virtual axis No. 4 automatic deceleration in progress flag		M2159	Virtual axis No. 32 automatic deceleration in progress flag	
M2132	Virtual axis No. 5 automatic deceleration in progress flag		M2160	Virtual axis No. 1 drive clutch ON/OFF status	
M2133	Virtual axis No. 6 automatic deceleration in progress flag		M2161	Virtual axis No. 1 auxiliary input shaft clutch ON/OFF status	
M2134	Virtual axis No. 7 automatic deceleration in progress flag		M2162	Virtual axis No. 2 drive clutch ON/OFF status	
M2135	Virtual axis No. 8 automatic deceleration in progress flag		M2163	Virtual axis No. 2 auxiliary input shaft clutch ON/OFF status	
M2136	Virtual axis No. 9 automatic deceleration in progress flag		M2164	Virtual axis No. 3 drive clutch ON/OFF status	
M2137	Virtual axis No. 10 automatic deceleration in progress flag		M2165	Virtual axis No. 3 auxiliary input shaft clutch ON/OFF status	
M2138	Virtual axis No. 11 automatic deceleration in progress flag		M2166	Virtual axis No. 4 drive clutch ON/OFF status	
M2139	Virtual axis No. 12 automatic deceleration in progress flag		M2167	Virtual axis No. 4 auxiliary input shaft clutch ON/OFF status	
M2140	Virtual axis No. 13 automatic deceleration in progress flag		M2168	Virtual axis No. 5 drive clutch ON/OFF status	
M2141	Virtual axis No. 14 automatic deceleration in progress flag		M2169	Virtual axis No. 5 auxiliary input shaft clutch ON/OFF status	
M2142	Virtual axis No. 15 automatic deceleration in progress flag		M2170	Virtual axis No. 6 drive clutch ON/OFF status	
M2143	Virtual axis No. 16 automatic deceleration in progress flag		M2171	Virtual axis No. 6 auxiliary input shaft clutch ON/OFF status	
M2144	Virtual axis No. 17 automatic deceleration in progress flag	PCPU → SCPU	M2172	Virtual axis No. 7 drive clutch ON/OFF status	PCPU → SCPU
M2145	Virtual axis No. 18 automatic deceleration in progress flag		M2173	Virtual axis No. 7 auxiliary input shaft clutch ON/OFF status	
M2146	Virtual axis No. 19 automatic deceleration in progress flag		M2174	Virtual axis No. 8 drive clutch ON/OFF status	
M2147	Virtual axis No. 20 automatic deceleration in progress flag		M2175	Virtual axis No. 8 auxiliary input shaft clutch ON/OFF status	
M2148	Virtual axis No. 21 automatic deceleration in progress flag		M2176	Virtual axis No. 9 drive clutch ON/OFF status	
M2149	Virtual axis No. 22 automatic deceleration in progress flag		M2177	Virtual axis No. 9 auxiliary input shaft clutch ON/OFF status	
M2150	Virtual axis No. 23 automatic deceleration in progress flag		M2178	Virtual axis No. 10 drive clutch ON/OFF status	
M2151	Virtual axis No. 24 automatic deceleration in progress flag		M2179	Virtual axis No. 10 auxiliary input shaft clutch ON/OFF status	
M2152	Virtual axis No. 25 automatic deceleration in progress flag		M2180	Virtual axis No. 11 drive clutch ON/OFF status	
M2153	Virtual axis No. 26 automatic deceleration in progress flag		M2181	Virtual axis No. 11 auxiliary input shaft clutch ON/OFF status	
M2154	Virtual axis No. 27 automatic deceleration in progress flag		M2182	Virtual axis No. 12 drive clutch ON/OFF status	
M2155	Virtual axis No. 28 automatic deceleration in progress flag		M2183	Virtual axis No. 12 auxiliary input shaft clutch ON/OFF status	
M2156	Virtual axis No. 29 automatic deceleration in progress flag		M2184	Virtual axis No. 13 drive clutch ON/OFF status	
M2157	Virtual axis No. 30 automatic deceleration in progress flag		M2185	Virtual axis No. 13 auxiliary input shaft clutch ON/OFF status	
M2158	Virtual axis No. 31 automatic deceleration in progress flag		M2186	Virtual axis No. 14 drive clutch ON/OFF status	

Table APP.9 Internal Relay List (for A273UHCPU 32-axis Specification) (Continued)

Device No.	Singal Name	Signal Direction	Device No.	Singal Name	Signal Direction
M2187	Virtual axis No. 14 auxiliary input shaft clutch ON/OFF status		M2215	Virtual axis No. 28 auxiliary input shaft clutch ON/OFF status	
M2188	Virtual axis No. 15 drive clutch ON/OFF status		M2216	Virtual axis No. 29 drive clutch ON/OFF status	
M2189	Virtual axis No. 15 auxiliary input shaft clutch ON/OFF status		M2217	Virtual axis No. 29 auxiliary input shaft clutch ON/OFF status	
M2190	Virtual axis No. 16 drive clutch ON/OFF status		M2218	Virtual axis No. 30 drive clutch ON/OFF status	
M2191	Virtual axis No. 16 auxiliary input shaft clutch ON/OFF status		M2219	Virtual axis No. 30 auxiliary input shaft clutch ON/OFF status	PCPU → SCPU
M2192	Virtual axis No. 17 drive clutch ON/OFF status		M2220	Virtual axis No. 31 drive clutch ON/OFF status	
M2193	Virtual axis No. 17 auxiliary input shaft clutch ON/OFF status		M2221	Virtual axis No. 31 auxiliary input shaft clutch ON/OFF status	
M2194	Virtual axis No. 18 drive clutch ON/OFF status		M2222	Virtual axis No. 32 drive clutch ON/OFF status	
M2195	Virtual axis No. 18 auxiliary input shaft clutch ON/OFF status		M2223	Virtual axis No. 32 auxiliary input shaft clutch ON/OFF status	
M2196	Virtual axis No. 19 drive clutch ON/OFF status		M2224 - M2239	Unusable	–
M2197	Virtual axis No. 19 auxiliary input shaft clutch ON/OFF status		M2240	Virtual axis No. 1 speed change "0" accept flag	
M2198	Virtual axis No. 20 drive clutch ON/OFF status		M2241	Virtual axis No. 2 speed change "0" accept flag	
M2199	Virtual axis No. 20 auxiliary input shaft clutch ON/OFF status		M2242	Virtual axis No. 3 speed change "0" accept flag	
M2200	Virtual axis No. 21 drive clutch ON/OFF status		M2243	Virtual axis No. 4 speed change "0" accept flag	
M2201	Virtual axis No. 21 auxiliary input shaft clutch ON/OFF status	PCPU → SCPU	M2244	Virtual axis No. 5 speed change "0" accept flag	
M2202	Virtual axis No. 22 drive clutch ON/OFF status		M2245	Virtual axis No. 6 speed change "0" accept flag	
M2203	Virtual axis No. 22 auxiliary input shaft clutch ON/OFF status		M2246	Virtual axis No. 7 speed change "0" accept flag	
M2204	Virtual axis No. 23 drive clutch ON/OFF status		M2247	Virtual axis No. 8 speed change "0" accept flag	
M2205	Virtual axis No. 23 auxiliary input shaft clutch ON/OFF status		M2248	Virtual axis No. 9 speed change "0" accept flag	PCPU → SCPU
M2206	Virtual axis No. 24 drive clutch ON/OFF status		M2249	Virtual axis No. 10 speed change "0" accept flag	
M2207	Virtual axis No. 24 auxiliary input shaft clutch ON/OFF status		M2250	Virtual axis No. 11 speed change "0" accept flag	
M2208	Virtual axis No. 25 drive clutch ON/OFF status		M2251	Virtual axis No. 12 speed change "0" accept flag	
M2209	Virtual axis No. 25 auxiliary input shaft clutch ON/OFF status		M2252	Virtual axis No. 13 speed change "0" accept flag	
M2210	Virtual axis No. 26 drive clutch ON/OFF status		M2253	Virtual axis No. 14 speed change "0" accept flag	
M2211	Virtual axis No. 26 auxiliary input shaft clutch ON/OFF status		M2254	Virtual axis No. 15 speed change "0" accept flag	
M2212	Virtual axis No. 27 drive clutch ON/OFF status		M2255	Virtual axis No. 16 speed change "0" accept flag	
M2213	Virtual axis No. 27 auxiliary input shaft clutch ON/OFF status		M2256	Virtual axis No. 17 speed change "0" accept flag	
M2214	Virtual axis No. 28 drive clutch ON/OFF status		M2257	Virtual axis No. 18 speed change "0" accept flag	

APPENDICES

Table APP.9 Internal Relay List (for A273UHCPU 32-axis Specification) (Continued)

Device No.	Signal Name	Signal Direction	Device No.	Signal Name	Signal Direction
M2258	Virtual axis No. 19 speed change "0" accept flag	PCPU → SCPU	M2266	Virtual axis No. 27 speed change "0" accept flag	PCPU → SCPU
M2259	Virtual axis No. 20 speed change "0" accept flag		M2267	Virtual axis No. 28 speed change "0" accept flag	
M2260	Virtual axis No. 21 speed change "0" accept flag		M2268	Virtual axis No. 29 speed change "0" accept flag	
M2261	Virtual axis No. 22 speed change "0" accept flag		M2269	Virtual axis No. 30 speed change "0" accept flag	
M2262	Virtual axis No. 23 speed change "0" accept flag		M2270	Virtual axis No. 31 speed change "0" accept flag	
M2263	Virtual axis No. 24 speed change "0" accept flag		M2271	Virtual axis No. 32 speed change "0" accept flag	
M2264	Virtual axis No. 25 speed change "0" accept flag		M2272 - M2319	Unusable	–
M2265	Virtual axis No. 26 speed change "0" accept flag				

Table APP.10 Internal Relay List (Synchronous Encoder)
(for A273UHCPU (32-axis Specification))

	Device						Signal Name
	P1/E1	P2/E2	P3/E3	P4/E4	P5/E5	P6/E6	
Input	M4640	M4644	M4648	M4652	M4656	M4660	Error detection
	M4641	M4645	M4649	M4653	M4657	M4661	External signal TREN
	M4642	M4646	M4650	M4654	M4658	M4662	Virtual mode continuation disabled warning signal
	M4643	M4647	M4651	M4655	M4659	M4663	Unusable
	P7/E7	P8/E8	P9/E9	P10/E10	P11/E11	P12/E12	
	M4664	M4668	M4672	M4676	M4680	M4684	Error detection
	M4665	M4669	M4673	M4677	M4681	M4685	External signal TREN
	M4666	M4670	M4674	M4678	M4682	M4686	Virtual mode continuation disabled warning signal
	M4667	M4671	M4675	M4679	M4683	M4687	Unusable
Output	P1/E1	P2/E2	P3/E3	P4/E4	P5/E5	P6/E6	
	M5440	M5444	M5448	M5452	M5456	M5460	Error reset
	M5441	M5445	M5449	M5453	M5457	M5461	Unusable
	M5442	M5446	M5450	M5454	M5458	M5462	
	M5443	M5447	M5451	M5455	M5459	M5463	
	P7/E7	P8/E8	P9/E9	P10/E10	P11/E11	P12/E12	
	M5464	M5468	M5472	M5476	M5480	M5484	Error reset
	M5465	M5469	M5473	M5477	M5481	M5485	Unusable
	M5466	M5470	M5474	M5478	M5482	M5486	
	M5467	M5471	M5475	M5479	M5483	M5487	

Table APP.10 Internal Relay List (Virtual Servomotor)
(for A273UHCPU (32-axis Specification))

		Device								Signal Name
		Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
Input		M4000	M4020	M4040	M4060	M4080	M4100	M4120	M4140	Positioning start completed
		M4001	M4021	M4041	M4061	M4081	M4101	M4121	M4141	Positioning completed
		M4002	M4022	M4042	M4062	M4082	M4102	M4122	M4142	Unusable
		M4003	M4023	M4043	M4063	M4083	M4103	M4123	M4143	Command in-position
		M4004	M4024	M4044	M4064	M4084	M4104	M4124	M4144	Speed control in progress
		M4005	M4025	M4045	M4065	M4085	M4105	M4125	M4145	Unusable
		M4006	M4026	M4046	M4066	M4086	M4106	M4126	M4146	
		M4007	M4027	M4047	M4067	M4087	M4107	M4127	M4147	Error detection
		M4008 - M4019	M4028 - M4039	M4048 - M4059	M4068 - M4079	M4088 - M4099	M4108 - M4119	M4128 - M4139	M4148 - M4159	Unusable
Output		M4800	M4820	M4840	M4860	M4880	M4900	M4920	M4940	Stop command
		M4801	M4821	M4841	M4861	M4881	M4901	M4921	M4941	Rapid stop command
		M4802	M4822	M4842	M4862	M4882	M4902	M4922	M4942	Forward JOG start
		M4803	M4823	M4843	M4863	M4883	M4903	M4923	M4943	Reverse JOG start
		M4804	M4824	M4844	M4864	M4884	M4904	M4924	M4944	Complete signal OFF command
		M4805	M4825	M4845	M4865	M4885	M4905	M4925	M4945	Unusable
		M4806	M4826	M4846	M4866	M4886	M4906	M4926	M4946	
		M4807	M4827	M4847	M4867	M4887	M4907	M4927	M4947	Error reset
		M4808	M4828	M4848	M4868	M4888	M4908	M4928	M4948	Unusable
		M4809	M4829	M4849	M4869	M4889	M4909	M4929	M4949	Stop input enable/disable
		M4810 - M4819	M4830 - M4839	M4850 - M4859	M4870 - M4879	M4890 - M4899	M4910 - M4911	M4930 - M4939	M4950 - M4959	Unusable
		Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16	
Input		M4160	M4180	M4200	M4220	M4240	M4260	M4280	M4300	Positioning start completed
		M4161	M4181	M4201	M4221	M4241	M4261	M4281	M4301	Positioning completed
		M4162	M4182	M4202	M4222	M4242	M4262	M4282	M4302	Unusable
		M4163	M4183	M4203	M4223	M4243	M4263	M4283	M4303	Command in-position
		M4164	M4184	M4204	M4224	M4244	M4264	M4284	M4304	Speed control in progress
		M4165	M4185	M4205	M4225	M4245	M4265	M4285	M4305	Unusable
		M4166	M4186	M4206	M4226	M4246	M4266	M4286	M4306	
		M4167	M4187	M4207	M4227	M4247	M4267	M4287	M4307	Error detection
		M4168 - M4179	M4188 - M4199	M4208 - M4219	M4228 - M4239	M4248 - M4259	M4268 - M4279	M4288 - M4299	M4308 - M4319	Unusable
Output		M4960	M4980	M5000	M5020	M5040	M5060	M5080	M5100	Stop command
		M4961	M4981	M5001	M5021	M5041	M5061	M5081	M5101	Rapid stop command
		M4962	M4982	M5002	M5022	M5042	M5062	M5082	M5102	Forward JOG start
		M4963	M4983	M5003	M5023	M5043	M5063	M5083	M5103	Reverse JOG start
		M4964	M4984	M5004	M5024	M5044	M5064	M5084	M5104	Complete signal OFF command
		M4965	M4985	M5005	M5025	M5045	M5065	M5085	M5105	Unusable
		M4966	M4986	M5006	M5026	M5046	M5066	M5086	M5106	
		M4967	M4987	M5007	M5027	M5047	M5067	M5087	M5107	Error reset
		M4968	M4988	M5008	M5028	M5047	M5068	M5088	M5108	Unusable
		M4969	M4989	M5009	M5029	M5049	M5069	M5089	M5109	Stop input enable/disable
		M4970 - M4979	M4990 - M4999	M5010 - M5019	M5030 - M5039	M5050 - M5059	M5070 - M5079	M5090 - M5099	M5110 - M5119	Unusable

Table APP.10 Internal Relay List (Virtual Servomotor)
(for A273UHCPU (32-axis Specification)) (Continued)

	Device								Signal Name
	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24	
Input	M4320	M4340	M4360	M4380	M4400	M4420	M4440	M4460	Positioning start completed
	M4321	M4341	M4361	M4381	M4401	M4421	M4441	M4461	Positioning completed
	M4322	M4342	M4362	M4382	M4402	M4422	M4442	M4462	Unusable
	M4323	M4343	M4363	M4383	M4403	M4423	M4443	M4463	Command in-position
	M4324	M4344	M4364	M4384	M4404	M4424	M4444	M4464	Speed control in progress
	M4325	M4345	M4365	M4385	M4405	M4425	M4445	M4465	Unusable
	M4326	M4346	M4366	M4386	M4406	M4426	M4446	M4466	
	M4327	M4347	M4367	M4387	M4407	M4427	M4447	M4467	Error detection
	M4328 - M4339	M4348 - M4359	M4368 - M4379	M4388 - M4399	M4408 - M4419	M4428 - M4439	M4448 - M4459	M4468 - M4479	Unusable
Output	M5120	M5140	M5160	M5180	M5200	M5220	M5240	M5260	Stop command
	M5121	M5141	M5161	M5181	M5201	M5221	M5241	M5261	Rapid stop command
	M5122	M5142	M5162	M5182	M5202	M5222	M5242	M5262	Forward JOG start
	M5123	M5143	M5163	M5183	M5203	M5223	M5243	M5263	Reverse JOG start
	M5124	M5144	M5164	M5184	M5204	M5224	M5244	M5264	Complete signal OFF command
	M5125	M5145	M5165	M5185	M5205	M5225	M5245	M5265	Unusable
	M5126	M5146	M5166	M5186	M5206	M5226	M5246	M5266	
	M5127	M5147	M5167	M5187	M5207	M5227	M5247	M5267	Error reset
	M5128	M5148	M5168	M5188	M5208	M5228	M5248	M5268	Unusable
	M5129	M5149	M5169	M5189	M5209	M5229	M5249	M5269	Stop input enable/disable
	M5130 - M5139	M5150 - M5159	M5170 - M5179	M5190 - M5199	M5210 - M5219	M5230 - M5239	M5250 - M5259	M5270 - M5279	Unusable
	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32	
Input	M4480	M4500	M4520	M4540	M4560	M4580	M4600	M4620	Positioning start completed
	M4481	M4501	M4521	M4541	M4561	M4581	M4601	M4621	Positioning completed
	M4482	M4502	M4522	M4542	M4562	M4582	M4602	M4622	Unusable
	M4483	M4503	M4523	M4543	M4563	M4583	M4603	M4623	Command in-position
	M4484	M4504	M4524	M4544	M4564	M4584	M4604	M4624	Speed control in progress
	M4485	M4505	M4525	M4545	M4565	M4585	M4605	M4625	Unusable
	M4486	M4506	M4526	M4546	M4566	M4586	M4606	M4626	
	M4487	M4507	M4527	M4547	M4567	M4587	M4607	M4627	Error detection
	M4488 - M4499	M4508 - M4519	M4528 - M4539	M4548 - M4559	M4568 - M4579	M4588 - M4599	M4608 - M4619	M4628 - M4639	Unusable
Output	M5280	M5300	M5320	M5340	M5360	M5380	M5400	M5420	Stop command
	M5281	M5301	M5321	M5341	M5361	M5381	M5401	M5421	Rapid stop command
	M5282	M5302	M5322	M5342	M5362	M5382	M5402	M5422	Forward JOG start
	M5283	M5303	M5323	M5343	M5363	M5383	M5403	M5423	Reverse JOG start
	M5284	M5304	M5324	M5344	M5364	M5384	M5404	M5424	Complete signal OFF command
	M5285	M5305	M5325	M5345	M6365	M5385	M5405	M5425	Unusable
	M5286	M5306	M5326	M5346	M5366	M5386	M5406	M5426	
	M5287	M5307	M5327	M5347	M5367	M5387	M5407	M5427	Error reset
	M5288	M5308	M5328	M5348	M5368	M5388	M5408	M5428	Unusable
	M5289	M5309	M5329	M5349	M5369	M5389	M5409	M5429	Stop input enable/disable
	M5290 - M5299	M5310 - M5319	M5330 - M5339	M5350 - M5359	M5370 - M5379	M5390 - M5399	M5410 - M5419	M5430 - M5439	Unusable

(2) Output module

(a) When A171SCPU is used

Table APP.11 Internal Relay (I/O) List (for A171SCPU)

	Device				Signal Name		Roller	Ball Screw	Rotary Table	Cam
	Axis 1	Axis 2	Axis 3	Axis 4						
Inputs	M1219	M1239	M1259	M1279	M code output in progress signal		O	O	O	O
	M1600	M1620	M1640	M1660	Vacant (OFF)		–	–	–	–
	M1601	M1621	M1641	M1661						
	M1602	M1622	M1642	M1662	In-position		O	O	O	O
	M1603	M1623	M1643	M1663	Vacant (OFF)		–	–	–	–
	M1604	M1624	M1644	M1664						
	M1605	M1625	M1645	M1665						
	M1606	M1626	M1646	M1666	Zero-point pass		O	O	O	O
	M1607	M1627	M1647	M1667	Error detection		O	O	O	O
	M1608	M1628	M1648	M1668	Servo error detection		O	O	O	O
	M1609	M1629	M1649	M1669	Home position return request		O	O	O	O
	M1610	M1630	M1650	M1670	Home position return completed		O	O	O	O
	M1611	M1631	M1651	M1671	External signals	FLS	O	O	O	O
	M1612	M1632	M1652	M1672		RLS	O	O	O	O
	M1613	M1633	M1653	M1673		STOP	O	O	O	O
	M1614	M1634	M1654	M1674		DOG	O	O	O	O
	M1615	M1635	M1655	M1675	Servo ON/OFF status		O	O	O	O
	M1616	M1636	M1656	M1676	Torque limit in progress signal		O	O	O	O
	M1617	M1637	M1657	M1677	Vacant (OFF)		–	–	–	–
	M1618	M1638	M1658	M1678	VIRTUAL mode continuation disabled warning signal		O	O	O	O
	M1619	M1639	M1659	M1679	Vacant (OFF)		–	–	–	–
Out-puts	M1419	M1439	M1459	M1479	FIN signal		O	O	O	O
	M1800	M1820	M1840	M1860	Vacant		–	–	–	–
	M1801	M1821	M1841	M1861						
	M1802	M1822	M1842	M1862						
	M1803	M1823	M1843	M1863						
	M1804	M1824	M1844	M1864						
	M1805	M1825	M1845	M1865						
	M1806	M1826	M1846	M1866	Limit switch output enabled		–	O	O	O
	M1807	M1827	M1847	M1867	Error reset		O	O	O	O
	M1808	M1828	M1848	M1868	Servo error reset		O	O	O	O
	M1809	M1829	M1849	M1869	Vacant		–	–	–	–
	M1810	M1830	M1850	M1870						
	M1811	M1831	M1851	M1871						
	M1812	M1832	M1852	M1872						
	M1813	M1833	M1853	M1873	Address clutch reference setting		–	–	O	O
	M1814	M1834	M1854	M1874	Cam reference position setting		–	–	–	O
	M1815	M1835	M1855	M1875	Servo OFF		O	O	O	O
	M1816	M1836	M1856	M1876	Vacant		–	–	–	–
	M1817	M1837	M1857	M1877						
	M1818	M1838	M1858	M1878						
	M1819	M1839	M1859	M1879						

APPENDICES

(b) When A273UHCPU (8-axis specification) is used

Table APP.12 Input/Output List (for A273UHCPU 8-axis Specification)

	Device								Signal Name		Roller	Ball Screw	Rotary Table	Cam
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8						
Inputs	X0	X10	X20	X30	X40	X50	X60	X70	Vacant (OFF)		–	–	–	–
	X1	X11	X21	X31	X41	X51	X61	X71						
	X2	X12	X22	X32	X42	X52	X62	X72	In-position		O	O	O	O
	X3	X13	X23	X33	X43	X53	X63	X73	Vacant (OFF)		–	–	–	–
	X4	X14	X24	X34	X44	X54	X64	X74						
	X5	X15	X25	X35	X45	X55	X65	X75						
	X6	X16	X26	X36	X46	X56	X66	X76	Zero-point pass		O	O	O	O
	X7	X17	X27	X37	X47	X57	X67	X77	Error detection		O	O	O	O
	X8	X18	X28	X38	X48	X58	X68	X78	Servo error detection		O	O	O	O
	X9	X19	X29	X39	X49	X59	X69	X79	Home position return request		O	O	O	O
	XA	X1A	X2A	X3A	X4A	X5A	X6A	X7A	Home position return completed		O	O	O	O
	XB	X1B	X2B	X3B	X4B	X5B	X6B	X7B	FLS	FLS	O	O	O	O
	XC	X1C	X2C	X3C	X4C	X5C	X6C	X7C		RLS	O	O	O	O
	XD	X1D	X2D	X3D	X4D	X5D	X6D	X7D		STOP	O	O	O	O
	XE	X1E	X2E	X3E	X4E	X5E	X6E	X7E		DOG	O	O	O	O
	XF	X1F	X2F	X3F	X4F	X5F	X6F	X7F	Servo ON/OFF status		O	O	O	O
	XD0	XD1	XD2	XD3	XD4	XD5	XD6	XD7	Torque limit in progress signal		O	O	O	O
	XD8	XD9	XDA	XDB	XDC	XDD	XDE	XDF	External signal	CHANGE	O	O	O	O
	XF0	XF1	XF2	XF3	XF4	XF5	XF6	XF7	VIRTUAL mode continuation disabled warning signal		O	O	O	O
	X10F	X11F	X12F	X13F	X14F	X15F	X16F	X17F	M code output in progress signal		O	O	O	O
Outputs	Y0	Y10	Y20	Y30	Y40	Y50	Y60	Y70	Vacant		–	–	–	–
	Y1	Y11	Y21	Y31	Y41	Y51	Y61	Y71						
	Y2	Y12	Y22	Y32	Y42	Y52	Y62	Y72						
	Y3	Y13	Y23	Y33	Y43	Y53	Y63	Y73						
	Y4	Y14	Y24	Y34	Y44	Y54	Y64	Y74						
	Y5	Y15	Y25	Y35	Y45	Y55	Y65	Y75						
	Y6	Y16	Y26	Y36	Y46	Y56	Y66	Y76	Limit switch output enabled		–	O	O	O
	Y7	Y17	Y27	Y37	Y47	Y57	Y67	Y77	Error reset		O	O	O	O
	Y8	Y18	Y28	Y38	Y48	Y58	Y68	Y78	Servo error reset		O	O	O	O
	Y9	Y19	Y29	Y39	Y49	Y59	Y69	Y79	Vacant		–	–	–	–
	YA	Y1A	Y2A	Y3A	Y4A	Y5A	Y6A	Y7A						
	YB	Y1B	Y2B	Y3B	Y4B	Y5B	Y6B	Y7B						
	YC	Y1C	Y2C	Y3C	Y4C	Y5C	Y6C	Y7C						
	YD	Y1D	Y2D	Y3D	Y4D	Y5D	Y6D	Y7D	Address clutch reference setting		–	–	O	O
	YE	Y1E	Y2E	Y3E	Y4E	Y5E	Y6E	Y7E	Cam reference position setting		–	–	–	O
	YF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	Servo OFF		O	O	O	O
	Y10F	Y11F	Y12F	Y13F	Y14F	Y15F	Y16F	Y17F	FIN signal		O	O	O	O

APPENDICES

(c) When A273UHCPU (32-axis specification) is used

Table APP.13 Internal Relay (I/O) List (for A273UHCPU 32-axis Specification)

	Signal Name		Roller	Ball Screw	Rotary Table	Cam	Device No.					
							Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Inputs	Vacant (OFF)		–	–	–	–	M2400	M2420	M2440	M2460	M2480	M2500
							M2401	M2421	M2441	M2461	M2481	M2501
	In-position		O	O	O	O	M2402	M2422	M2442	M2462	M2482	M2502
	Vacant (OFF)		–	–	–	–	M2403	M2423	M2443	M2463	M2483	M2503
							M2404	M2424	M2444	M2464	M2484	M2504
							M2405	M2425	M2445	M2465	M2485	M2505
	Zero-point pass		O	O	O	O	M2406	M2426	M2446	M2466	M2486	M2506
	Error detection		O	O	O	O	M2407	M2427	M2447	M2467	M2487	M2507
	Servo error detection		O	O	O	O	M2408	M2428	M2448	M2468	M2488	M2508
	Home position return request		O	O	O	O	M2409	M2429	M2449	M2469	M2489	M2509
	Home position return completed		O	O	O	O	M2410	M2430	M2450	M2470	M2490	M2510
	FLS	FLS	O	O	O	O	M2411	M2431	M2451	M2471	M2491	M2511
		RLS	O	O	O	O	M2412	M2432	M1652	M2472	M2492	M2512
		STOP	O	O	O	O	M2413	M2433	M2453	M2473	M2493	M2513
		DOG	O	O	O	O	M2414	M2434	M2454	M2474	M2494	M2514
	Servo ON/OFF status		O	O	O	O	M2415	M2435	M2455	M2475	M2495	M2515
	Torque limit in progress signal		O	O	O	O	M2416	M2436	M2456	M2476	M2496	M2516
	External signal CHANGE		O	O	O	O	M2417	M2437	M2457	M2477	M2497	M2517
	VIRTUAL mode continuation disabled warning signal		O	O	O	O	M2418	M2438	M2458	M2478	M2498	M2518
	Vacant		O	O	O	O	M2419	M2439	M2459	M2479	M2499	M2519
	M code output in progress signal		O	O	O	O	M4019	M4039	M4059	M4079	M4099	M4119
Out-puts	Vacant		–	–	–	–	M3200	M3220	M3240	M3260	M3280	M3300
							M3201	M3221	M3241	M3261	M3281	M3301
							M3202	M3222	M3242	M3262	M3282	M3302
							M3203	M3223	M3243	M3263	M3283	M3303
							M3204	M3224	M3244	M3264	M3284	M3304
							M3205	M3225	M3245	M3265	M3285	M3305
	Limit switch output enabled		–	O	O	O	M3206	M3226	M3246	M3266	M3286	M3306
	Error reset		O	O	O	O	M3207	M3227	M3247	M3267	M3287	M3307
	Servo error reset		O	O	O	O	M3208	M3228	M3248	M3268	M3288	M3308
	Vacant		–	–	–	–	M3209	M3229	M3249	M3269	M3289	M3309
							M3210	M3230	M3250	M3270	M3290	M3310
							M3211	M3231	M3251	M3271	M3291	M3311
							M3212	M3232	M3252	M3272	M3292	M3312
	Address clutch reference setting		–	–	O	O	M3213	M3233	M3253	M3273	M3293	M3313
	Cam reference position setting		–	–	–	O	M3214	M3234	M3254	M3274	M3294	M3314
	Servo OFF		O	O	O	O	M3215	M3235	M3255	M3275	M3295	M3315
	Vacant		O	O	O	O	M3216	M3236	M3256	M3276	M3296	M3316
			O	O	O	O	M3217	M3237	M3257	M3277	M3297	M3317
			O	O	O	O	M3218	M3238	M3258	M3278	M3298	M3318
			O	O	O	O	M3219	M3239	M3259	M3279	M3299	M3319
	FIN signal		O	O	O	O	M4819	M4839	M4859	M4879	M4899	M4919

	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16	Signal Direction
	M2520	M2540	M2560	M2580	M2600	M2620	M2640	M2660	M2680	M2700	–
	M2521	M2541	M2561	M2581	M2601	M2621	M2641	M2661	M2681	M2701	
	M2522	M2542	M2562	M2582	M2602	M2622	M2642	M2662	M2682	M2702	PCPU → SCPU
	M2523	M2543	M2563	M2583	M2603	M2623	M2643	M2663	M2683	M2703	–
	M2524	M2544	M2564	M2584	M2604	M2624	M2644	M2664	M2684	M2704	
	M2525	M2545	M2565	M2585	M2605	M2625	M2645	M2665	M2685	M2705	
	M2526	M2546	M2566	M2586	M2606	M2626	M2646	M2666	M2686	M2706	PCPU → SCPU
	M2527	M2547	M2567	M2587	M2607	M2627	M2647	M2667	M2687	M2707	
	M2528	M2548	M2568	M2588	M2608	M2628	M2648	M2668	M2688	M2708	
	M2529	M2549	M2569	M2589	M2609	M2629	M2649	M2669	M2689	M2709	
	M2530	M2550	M2570	M2590	M2610	M2630	M2650	M2670	M2690	M2710	
	M2531	M2551	M2571	M2591	M2611	M2631	M2651	M2671	M2691	M2711	
	M2532	M2552	M2572	M2592	M2612	M2632	M2652	M2672	M2692	M2712	
	M2533	M2553	M2573	M2593	M2613	M2633	M2653	M2673	M2693	M2713	
	M2534	M2554	M2574	M2594	M2614	M2634	M2654	M2674	M2694	M2714	
	M2535	M2555	M2575	M2595	M2615	M2635	M2655	M2675	M2695	M2715	
	M2536	M2556	M2576	M2596	M2616	M2636	M2656	M2676	M2696	M2716	
	M2537	M2557	M2577	M2597	M2617	M2637	M2657	M2677	M2697	M2717	
	M2538	M2558	M2578	M2598	M2618	M2638	M2658	M2678	M2698	M2718	
	M2539	M2559	M2579	M2599	M2619	M2639	M2659	M2679	M2699	M2719	–
	M4139	M4159	M4179	M4199	M4219	M4239	M4259	M4279	M4299	M4319	PCPU → SCPU
	M3320	M3340	M3360	M3380	M3400	M3420	M3440	M3460	M3480	M3500	–
	M3321	M3341	M3361	M3381	M3401	M3421	M3441	M3461	M3481	M3501	
	M3322	M3342	M3362	M3382	M3402	M3422	M3442	M3462	M3482	M3502	
	M3323	M3343	M3363	M3383	M3403	M3423	M3443	M3463	M3483	M3503	
	M3324	M3344	M3364	M3384	M3404	M3424	M3444	M3464	M3484	M3504	
	M3325	M3345	M3365	M3385	M3405	M3425	M3445	M3465	M3485	M3505	
	M3326	M3346	M3366	M3386	M3406	M3426	M3446	M3466	M3486	M3506	SCPU → PCPU
	M3327	M3347	M3367	M3387	M3407	M3427	M3447	M3467	M3487	M3507	
	M3328	M3348	M3368	M3388	M3408	M3428	M3448	M3468	M3488	M3508	
	M3329	M3349	M3369	M3389	M3409	M3429	M3449	M3469	M3489	M3509	–
	M3330	M3350	M3370	M3390	M3410	M3430	M3450	M3470	M3490	M3510	
	M3331	M3351	M3371	M3391	M3411	M3431	M3451	M3471	M3491	M3511	
	M3332	M3352	M3372	M3392	M3412	M3432	M3452	M3472	M3492	M3512	
	M3333	M3353	M3373	M3393	M3413	M3433	M3453	M3473	M3493	M3513	SCPU → PCPU
	M3334	M3354	M3374	M3394	M3414	M3434	M3454	M3474	M3494	M3514	
	M3335	M3355	M3375	M3395	M3415	M3435	M3455	M3475	M3495	M3515	
	M3336	M3356	M3376	M3396	M3416	M3436	M3456	M3476	M3496	M3516	–
	M3337	M3357	M3377	M3397	M3417	M3437	M3457	M3477	M3497	M3517	
	M3338	M3358	M3378	M3398	M3418	M3438	M3458	M3478	M3498	M3518	
	M3339	M3359	M3379	M3399	M3419	M3439	M3459	M3479	M3499	M3519	
	M4939	M4959	M4979	M4999	M5019	M5039	M5059	M5079	M5099	M5119	SCPU → PCPU

APPENDICES

Table APP.13 Internal Relay (Input/Output) List (for A273UHCPU 32-axis Specification) (Continued)

	Signal Name	Roller	Ball Screw	Rotary Table	Cam	Device No. Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	
Inputs	Vacant (OFF)	–	–	–	–	M2720	M2740	M2760	M2780	M2800	M2820	
						M2721	M2741	M2761	M2781	M2801	M2821	
	In-position	O	O	O	O	M2722	M2742	M2762	M2782	M2802	M2822	
	Vacant (OFF)	–	–	–	–	M2723	M2743	M2763	M2783	M2803	M2823	
						M2724	M2744	M2764	M2784	M2804	M2824	
						M2725	M2745	M2765	M2785	M2805	M2825	
	Zero-point pass	O	O	O	O	M2726	M2746	M2766	M2786	M2806	M2826	
	Error detection	O	O	O	O	M2727	M2747	M2767	M2787	M2807	M2827	
	Servo error detection	O	O	O	O	M2728	M2748	M2768	M2788	M2808	M2828	
	Home position return request	O	O	O	O	M2729	M2749	M2769	M2789	M2809	M2829	
	Home position return completed	O	O	O	O	M2730	M2750	M2770	M2790	M2810	M2830	
	FLS FLS	O	O	O	O	M2731	M2751	M2771	M2791	M2811	M2831	
	FLS RLS	O	O	O	O	M2732	M1652	M2772	M2792	M2812	M2832	
	FLS STOP	O	O	O	O	M2733	M2753	M2773	M2793	M2813	M2833	
	FLS DOG	O	O	O	O	M2734	M2754	M2774	M2794	M2814	M2834	
	Servo ON/OFF status	O	O	O	O	M2735	M2755	M2775	M2795	M2815	M2835	
	Torque limit in progress signal	O	O	O	O	M2736	M2756	M2776	M2796	M2816	M2836	
	External signal CHANGE	O	O	O	O	M2737	M2757	M2777	M2797	M2817	M2837	
	VIRTUAL mode continuation disabled warning signal	O	O	O	O	M2738	M2758	M2778	M2798	M2818	M2838	
	Vacant	O	O	O	O	M2739	M2759	M2779	M2799	M2819	M2839	
	M code output in progress signal	O	O	O	O	M4339	M4359	M4379	M4399	M4419	M4439	
Outputs	Vacant	–	–	–	–	M3520	M3540	M3560	M3580	M3600	M3620	
						M3521	M3541	M3561	M3581	M3601	M3621	
						M3522	M3542	M3562	M3582	M3602	M3622	
						M3523	M3543	M3563	M3583	M3603	M3623	
						M3524	M3544	M3564	M3584	M3604	M3624	
						M3525	M3545	M3565	M3585	M3605	M3625	
	Limit switch output enabled	–	O	O	O	M3526	M3546	M3566	M3586	M3606	M3626	
	Error reset	O	O	O	O	M3527	M3547	M3567	M3587	M3607	M3627	
	Servo error reset	O	O	O	O	M3528	M3548	M3568	M3588	M3608	M3628	
	Vacant	–	–	–	–	M3529	M3549	M3569	M3589	M3609	M3629	
						M3530	M3550	M3570	M3580	M3610	M3630	
						M3531	M3551	M3571	M3581	M3611	M3631	
						M3532	M3552	M3572	M3582	M3612	M3632	
	Address clutch reference setting	–	–	O	O	M3533	M3553	M3573	M3583	M3613	M3633	
	Cam reference position setting	–	–	–	O	M3534	M3554	M3574	M3584	M3614	M3634	
	Servo OFF	O	O	O	O	M3535	M3555	M3575	M3585	M3615	M3635	
	Vacant	O	O	O	O	M3536	M3556	M3576	M3586	M3616	M3636	
		O	O	O	O	M3537	M3557	M3577	M3587	M3617	M3637	
		O	O	O	O	M3538	M3558	M3578	M3588	M3618	M3638	
		O	O	O	O	M3539	M3559	M3579	M3589	M3619	M3639	
	FIN signal	O	O	O	O	M5139	M5159	M5179	M5199	M5219	M5239	

Axis 23	Axis 24	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32	Signal Direction
M2840	M2860	M2880	M2900	M2920	M2940	M2960	M2980	M3000	M3020	—
M2841	M2861	M2881	M2901	M2921	M2941	M2961	M2981	M3001	M3021	
M2842	M2862	M2882	M2902	M2922	M2942	M2962	M2982	M3002	M3022	PCPU → SCPU
M2843	M2863	M2883	M2903	M2923	M2943	M2963	M2983	M3003	M3023	—
M2844	M2864	M2884	M2904	M2924	M2944	M2964	M2984	M3004	M3024	
M2845	M2865	M2885	M2905	M2925	M2945	M2965	M2985	M3005	M3025	
M2846	M2866	M2886	M2906	M2926	M2946	M2966	M2986	M3006	M3026	PCPU → SCPU
M2847	M2867	M2887	M2907	M2927	M2947	M2967	M2987	M3007	M3027	
M2848	M2868	M2888	M2908	M2928	M2948	M2968	M2988	M3008	M3028	
M2849	M2869	M2889	M2909	M2929	M2949	M2969	M2989	M3009	M3029	
M2850	M2870	M2890	M2910	M2930	M2950	M2970	M2990	M3010	M3030	
M2851	M2871	M2891	M2911	M2931	M2951	M2971	M2991	M3011	M3031	
M2852	M2872	M2892	M2912	M2932	M2952	M2972	M2992	M3012	M3032	
M2853	M2873	M2893	M2913	M2933	M2953	M2973	M2993	M3013	M3033	
M2854	M2874	M2894	M2914	M2934	M2954	M2974	M2994	M3014	M3034	
M2855	M2875	M2895	M2915	M2935	M2955	M2975	M2995	M3015	M3035	
M2856	M2876	M2896	M2916	M2936	M2956	M2976	M2996	M3016	M3036	
M2857	M2877	M2897	M2917	M2937	M2957	M2977	M2997	M3017	M3037	
M2858	M2878	M2898	M2918	M2938	M2958	M2978	M2998	M3018	M3038	
M2859	M2879	M2899	M2919	M2939	M2959	M2979	M2999	M3019	M3039	—
M4459	M4479	M4499	M4519	M4539	M4559	M4579	M4599	M4619	M4639	PCPU → SCPU
M3640	M3660	M3680	M3700	M3720	M3740	M3760	M3780	M3800	M3820	—
M3641	M3661	M3681	M3701	M3721	M3741	M3761	M3781	M3801	M3821	
M3642	M3662	M3682	M3702	M3722	M3742	M3762	M3782	M3802	M3822	
M3643	M3663	M3683	M3703	M3723	M3743	M3763	M3783	M3803	M3823	
M3644	M3664	M3684	M3704	M3724	M3744	M3764	M3784	M3804	M3824	
M3645	M3665	M3685	M3705	M3725	M3745	M3765	M3785	M3805	M3825	
M3646	M3666	M3686	M3706	M3726	M3746	M3766	M3786	M3806	M3826	SCPU → PCPU
M3647	M3667	M3687	M3707	M3727	M3747	M3767	M3787	M3807	M3827	
M3648	M3668	M3688	M3708	M3728	M3748	M3768	M3788	M3808	M3828	
M3649	M3669	M3689	M3709	M3729	M3749	M3769	M3789	M3809	M3829	—
M3650	M3670	M3690	M3710	M3730	M3750	M3770	M3790	M3810	M3830	
M3651	M3671	M3691	M3711	M3731	M3751	M3771	M3791	M3811	M3831	
M3652	M3672	M3692	M3712	M3732	M3752	M3772	M3792	M3812	M3832	
M3653	M3673	M3693	M3713	M3733	M3753	M3773	M3793	M3813	M3833	SCPU → PCPU
M3654	M3674	M3694	M3714	M3734	M3754	M3774	M3794	M3814	M3834	
M3655	M3675	M3695	M3715	M3735	M3755	M3775	M3795	M3815	M3835	
M3656	M3676	M3696	M3716	M3736	M3756	M3776	M3796	M3816	M3836	—
M3657	M3677	M3697	M3717	M3737	M3757	M3777	M3797	M3817	M3837	
M3658	M3678	M3698	M3718	M3738	M3758	M3778	M3798	M3818	M3838	
M3659	M3679	M3699	M3719	M3739	M3759	M3779	M3799	M3819	M3839	
M5259	M5279	M5299	M5319	M5339	M5359	M5379	M5399	M5419	M5439	SCPU → PCPU

APPENDICES

4.3 Data Registers (D)

(1) Drive module

(a) When A171SCPU is used

Table APP.14 Data Register List (for A171SCPU)

Signal Name	Device				
	Synchro-nous Encoder	Virtual Servo Motor			
	P1/E1	Axis 1	Axis 2	Axis 3	Axis 4
Present value following main shaft's differential gear	D686	D670	D672	D674	D676
	D687	D671	D673	D675	D677
Feed present value		D700	D706	D712	D718
		D701	D707	D713	D719
Minor error code		D702	D708	D714	D720
Major error code	–	D703	D709	D715	D721
Execution program No.		D704	D710	D716	D722
M-code		D705	D711	D717	D723
Present value	D748	–	–	–	–
	D749	–	–	–	–
Minor error code	D750	–	–	–	–
Major error code	D751	–	–	–	–
Present value change		D960	D966	D972	D978
		D961	D967	D973	D979
Speed change	–	D962	D968	D974	D980
		D963	D969	D975	D981
JOG operation setting		D964	D970	D976	D982
		D965	D971	D977	D983
Manual pulse generator axis setting	D1012	–	–	–	–
JOG simultaneous start axis setting	–	D1015			
Manual pulse generator 1-pulse input magnification setting	–	D1016	D1017	D1018	D1019

APPENDICES

(b) When A273UHCPU (8-axis specification) is used

Table APP.15 Data Register List (for A273UHCPU 8-axis Specification)

Signal Name	Device										
	Synchronous Encoder			Virtual Servo Motor							
	P1/E1	P2/E2	P3/E3	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Present value following main shaft's differential gear	D686	D688	D690	D670	D672	D674	D676	D678	D680	D682	D684
	D687	D689	D691	D671	D673	D675	D677	D679	D681	D683	D685
Feed present value				D700	D706	D712	D718	D724	D730	D736	D742
				D701	D707	D713	D719	D725	D731	D737	D743
Minor error code	–	–	–	D702	D708	D714	D720	D726	D732	D738	D744
Major error code				D703	D709	D715	D721	D727	D733	D739	D745
Execution program No.				D704	D710	D716	D722	D728	D734	D740	D746
M-code				D705	D711	D717	D723	D729	D735	D741	D747
Present value	D748	D752	D756	–	–	–	–	–	–	–	–
	D749	D753	D757	–	–	–	–	–	–	–	–
Minor error code	D750	D754	D758	–	–	–	–	–	–	–	–
Major error code	D751	D755	D759	–	–	–	–	–	–	–	–
Present value change				D960	D966	D972	D978	D984	D990	D996	D1002
				D961	D967	D973	D979	D985	D991	D997	D1003
Speed change	–	–	–	D962	D968	D974	D980	D986	D992	D998	D1004
				D963	D969	D975	D981	D987	D993	D999	D1005
JOG operation setting				D964	D970	D976	D982	D988	D994	D1000	D1006
				D965	D971	D977	D983	D989	D995	D1001	D1007
Manual pulse generator axis setting	D1012	D1013	D1014	–	–	–	–	–	–	–	–
JOG simultaneous start axis setting	–	–	–	D1015							
Manual pulse generator 1-pulse input magnification setting	–	–	–	D1016	D1017	D1018	D1019	D1020	D1021	D1022	D1023

APPENDICES

(c) When A273UHCPU (32-axis specification) is used

Table APP.16 Data Register List (for A273UHCPU 32-axis Specification)

Signal Name	Device No.								
	Synchronous Encoder								
	P1/E1	P2/E2	P3/E3	P4/E4	P5/E5	P6/E6	Axis 1	Axis 2	Axis 3
JOG speed setting	–	–	–	–	–	–	D640	D642	D644
							D641	D643	D645
JOG simultaneous start axis setting								D710,	
Manual pulse generator axis setting	D714 - D719						–	–	–
Manual pulse generator 1-pulse input magnification setting	–	–	–	–	–	–	D720	D721	D722
Feed present value							D800	D810	D820
							D801	D811	D821
Present value	D1120	D1130	D1140	D1150	D1160	D1170	–	–	–
	D1121	D1131	D1141	D1151	D1161	D1171			
Minor error code	D1122	D1132	D1142	D1152	D1162	D1172	D802	D812	D822
Major error code	D1123	D1133	D1143	D1153	D1163	D1173	D803	D813	D823
Execution program No.	–	–	–	–	–	–	D804	D814	D824
M-code							D805	D815	D825
Unusable	D1124	D1134	D1144	D1154	D1164	D1174	–	–	–
	D1125	D1135	D1145	D1155	D1165	D1175			
Present value following main shaft's differential gear	D1126	D1136	D1146	D1156	D1166	D1176	D806	D816	D826
	D1127	D1137	D1147	D1157	D1167	D1177	D807	D817	D827
Error search output shaft No.	D1128	D1138	D1148	D1158	D1168	D1178	D808	D818	D828
Constant speed control data set pointer	–	–	–	–	–	–	D809	D819	D829
Unusable	D1129	D1139	D1149	D1159	D1169	D1179	–	–	–

Signal Name	Device No.								
	Synchronous Encoder								
	P7/E7	P8/E8	P9/E9	P10/E10	P11/E11	P12/E12	Axis 17	Axis 18	Axis 19
JOG speed setting	–	–	–	–	–	–	D672	D674	D676
							D673	D675	D677
JOG simultaneous start axis setting								D710,	
Manual pulse generator axis setting	D714 - D719						–	–	–
Manual pulse generator 1-pulse input magnification setting	–	–	–	–	–	–	D736	D737	D738
Feed present value							D960	D970	D980
							D961	D971	D981
Present value	D1180	D1190	D1200	D1210	D1220	D1230	–	–	–
	D1181	D1191	D1201	D1211	D1221	D1231			
Minor error code	D1182	D1192	D1202	D1212	D1222	D1232	D962	D972	D982
Major error code	D1183	D1193	D1203	D1213	D1223	D1233	D963	D973	D983
Execution program No.	–	–	–	–	–	–	D964	D974	D984
M-code							D965	D975	D985
Unusable	D1184	D1194	D1204	D1214	D1224	D1234	–	–	–
	D1185	D1195	D1205	D1215	D1225	D1235			
Present value following main shaft's differential gear	D1186	D1196	D1206	D1216	D1226	D1236	D966	D976	D986
	D1187	D1197	D1207	D1217	D1227	D1237	D967	D977	D987
Error search output shaft No.	D1188	D1198	D1208	D1218	D1228	D1238	D968	D978	D988
Constant speed control data set pointer	–	–	–	–	–	–	D969	D979	D989
Unusable	D1189	D1199	D1209	D1219	D1229	D1239	–	–	–

Virtual Servo Motor													Signal Direction
Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16	
D646	D648	D650	D652	D654	D656	D658	D660	D662	D664	D666	D668	D670	SCPU → PCPU
D647	D649	D651	D653	D655	D657	D659	D661	D663	D665	D667	D669	D671	
D711, 712, 713													
–	–	–	–	–	–	–	–	–	–	–	–	–	
D723	D724	D725	D726	D727	D728	D729	D730	D731	D732	D733	D734	D735	
D830	D840	D850	D860	D870	D880	D890	D900	D910	D920	D930	D940	D950	PCPU → SCPU
D831	D841	D851	D861	D871	D881	D891	D901	D911	D921	D931	D941	D951	
–	–	–	–	–	–	–	–	–	–	–	–	–	–
D832	D842	D852	D862	D872	D882	D892	D902	D912	D922	D932	D942	D952	PCPU → SCPU
D833	D843	D853	D863	D873	D883	D893	D903	D913	D923	D933	D943	D953	
D834	D844	D854	D864	D874	D884	D894	D904	D914	D924	D934	D944	D954	
D835	D845	D855	D865	D875	D885	D895	D905	D915	D925	D935	D945	D955	
–	–	–	–	–	–	–	–	–	–	–	–	–	–
D836	D846	D856	D866	D876	D886	D896	D906	D916	D926	D936	D946	D956	PCPU → SCPU
D837	D847	D857	D867	D877	D887	D897	D907	D917	D927	D937	D947	D957	
D838	D848	D858	D868	D878	D888	D898	D908	D918	D928	D938	D948	D958	
D839	D849	D859	D869	D879	D889	D899	D909	D919	D929	D939	D949	D959	
–	–	–	–	–	–	–	–	–	–	–	–	–	–

Virtual Servo Motor													Signal Direction
Axis 20	Axis 21	Axis 22	Axis 23	Axis 24	Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32	
D678	D680	D682	D684	D686	D688	D690	D692	D694	D696	D698	D700	D702	SCPU → PCPU
D679	D681	D683	D685	D687	D689	D691	D693	D695	D697	D699	D701	D703	
D711, 712, 713													
–	–	–	–	–	–	–	–	–	–	–	–	–	
D739	D740	D741	D742	D743	D744	D745	D746	D747	D748	D749	D750	D751	
D990	D1000	D1010	D1020	D1030	D1040	D1050	D1060	D1070	D1080	D1090	D1100	D1110	PCPU → SCPU
D991	D1001	D1011	D1021	D1031	D1041	D1051	D1061	D1071	D1081	D1091	D1101	D1111	
–	–	–	–	–	–	–	–	–	–	–	–	–	–
D992	D1002	D1012	D1022	D1032	D1042	D1052	D1062	D1072	D1082	D1092	D1102	D1112	PCPU → SCPU
D993	D1003	D1013	D1023	D1033	D1043	D1053	D1063	D1073	D1083	D1093	D1103	D1113	
D994	D1004	D1014	D1024	D1034	D1044	D1054	D1064	D1074	D1084	D1094	D1104	D1114	
D995	D1005	D1015	D1025	D1035	D1045	D1055	D1065	D1075	D1085	D1095	D1105	D1115	
–	–	–	–	–	–	–	–	–	–	–	–	–	–
D996	D1006	D1016	D1026	D1036	D1046	D1056	D1066	D1076	D1086	D1096	D1106	D1116	PCPU → SCPU
D997	D1007	D1017	D1027	D1037	D1047	D1057	D1067	D1077	D1087	D1097	D1107	D1117	
D998	D1008	D1018	D1028	D1038	D1048	D1058	D1068	D1078	D1088	D1098	D1108	D1118	
D999	D1009	D1019	D1029	D1039	D1049	D1059	D1069	D1079	D1089	D1099	D1109	D1119	
–	–	–	–	–	–	–	–	–	–	–	–	–	–

APPENDICES

(2) Output module

(a) When A171SCPU is used

Table APP.17 Data Register List (for A171SCPU)

Signal Name	Roller	Ball Screw	Rotary Table	Cam	Device			
					Axis 1	Axis 2	Axis 3	Axis 4
Effective cam No.	–	–	–	O	D760	D765	D770	D775
Effective stroke	–	–	–	O	D761	D766	D771	D776
					D762	D767	D772	D777
Present value in 1 cam shaft revolution	–	–	–	O	D763	D768	D773	D778
					D764	D769	D774	D779
Roller peripheral velocity	O	–	–	–	D800	D820	D840	D860
					D801	D821	D841	D861
Feed present value	–	O	O	O	D800	D820	D840	D860
					D801	D821	D841	D861
Present value	–	O	O	O	D802	D822	D842	D862
					D803	D823	D843	D863
Deviation counter value	O	O	O	O	D804	D824	D844	D864
					D805	D825	D845	D865
Minor error code	O	O	O	O	D806	D826	D846	D866
Major error code	O	O	O	O	D807	D827	D847	D867
Servo error code	O	O	O	O	D808	D828	D848	D868
(Travel value after DOG ON)	REAL mode data stored				D809	D829	D849	D869
					D810	D830	D850	D870
(Home position return second travel value)					D811	D831	D851	D871
(Execution program No.)	No change when "0"				D812	D832	D852	D872
(M-code)					D813	D833	D853	D873
Torque limit value	O	O	O	O	D814	D834	D854	D874
(Travel value change register)	Ignored				D815	D835	D855	D875
					D816	D836	D856	D876
(Actual present value at STOP input)	REAL mode data stored				D817	D837	D857	D877
					D818	D838	D858	D878
Vacant	–				D819	D839	D859	D879

(b) When A273UHCPU (8-axis specification) is used

Table APP.18 Data Register List (for A273UHCPU 8-axis Specification)

Signal Name	Roller	Ball Screw	Rotary Table	Cam	Device							
					Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Effective cam No.	–	–	–	○	D760	D765	D770	D775	D780	D785	D791	D795
Effective stroke	–	–	–	○	D761	D766	D771	D776	D781	D786	D792	D796
					D762	D767	D772	D777	D782	D787	D793	D797
Present value in 1 cam shaft revolution	–	–	–	○	D763	D768	D773	D778	D783	D788	D794	D798
					D764	D769	D774	D779	D784	D789	D795	D799
Roller peripheral velocity	○	–	–	–	D800	D820	D840	D860	D880	D900	D920	D940
					D801	D821	D841	D861	D881	D901	D921	D941
Feed present value	–	○	○	○	D800	D820	D840	D860	D880	D900	D920	D940
					D801	D821	D841	D861	D881	D901	D921	D941
Present value	–	○	○	○	D802	D822	D842	D862	D882	D902	D922	D942
					D803	D823	D843	D863	D883	D903	D923	D943
Deviation counter value	○	○	○	○	D804	D824	D844	D864	D884	D904	D924	D944
					D805	D825	D845	D865	D885	D905	D925	D945
Minor error code	○	○	○	○	D806	D826	D846	D866	D886	D906	D926	D946
Major error code	○	○	○	○	D807	D827	D847	D867	D887	D907	D927	D947
Servo error code	○	○	○	○	D808	D828	D848	D868	D888	D908	D928	D948
(Travel value after DOG ON)	REAL mode data stored				D809	D829	D849	D869	D889	D909	D929	D949
					D810	D830	D850	D870	D890	D910	D930	D950
(Home position return second travel value)					D811	D831	D851	D871	D891	D911	D931	D951
(Execution program No.)	No change when "0"				D812	D832	D852	D872	D892	D912	D932	D952
(M-code)					D813	D833	D853	D873	D893	D913	D933	D953
Torque limit value	○	○	○	○	D814	D834	D854	D874	D894	D914	D934	D954
(Travel value change register)	Ignored				D815	D835	D855	D875	D895	D915	D935	D955
					D816	D836	D856	D876	D896	D916	D936	D956
(Actual present value at STOP input)	REAL mode data stored				D817	D837	D857	D877	D897	D917	D937	D957
					D818	D838	D858	D878	D898	D918	D938	D958
Vacant	–				D819	D839	D859	D879	D899	D919	D939	D959

(c) When A273UHCPU (32-axis specification) is used

Table APP.19 Data Register List (for A273UHCPU 32-axis Specification)

Signal Name	Roller	Ball Screw	Rotary Table	Cam	Device No.							
					Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Vacant			–		D1240	D1250	D1260	D1270	D1280	D1290	D1300	D1310
Effective cam No.	–	–	–	O	D1241	D1251	D1261	D1271	D1281	D1291	D1301	D1311
Effective stroke	–	–	–	O	D1242	D1252	D1262	D1272	D1282	D1292	D1302	D1312
					D1243	D1253	D1263	D1273	D1283	D1293	D1303	D1313
Present value in 1 cam shaft revolution	–	–	–	O	D1244	D1254	D1264	D1274	D1284	D1294	D1304	D1314
					D1245	D1255	D1265	D1275	D1285	D1295	D1305	D1315
Roller peripheral velocity	O	–	–	–	D0	D20	D40	D60	D80	D100	D120	D140
					D1	D21	D41	D61	D81	D101	D121	D141
Feed present value	–	O	O	O	D0	D20	D40	D60	D80	D100	D120	D140
					D1	D21	D41	D61	D81	D101	D121	D141
Present value	–	O	O	O	D2	D22	D42	D62	D82	D102	D122	D142
					D3	D23	D43	D63	D83	D103	D123	D143
Deviation counter value	O	O	O	O	D4	D24	D44	D64	D84	D104	D124	D144
					D5	D25	D45	D65	D85	D105	D125	D145
Minor error code	O	O	O	O	D6	D26	D46	D66	D86	D106	D126	D146
Major error code	O	O	O	O	D7	D27	D47	D67	D87	D107	D127	D147
Servo error code	O	O	O	O	D8	D28	D48	D68	D88	D108	D128	D148
(Home position return second travel value)	REAL mode data stored				D9	D29	D49	D69	D89	D109	D129	D149
(Travel value after DOG/CHANGE ON)					D10	D30	D50	D70	D10	D110	D130	D150
					D11	D31	D51	D71	D11	D111	D131	D151
(Execution program No.)	No change when "0"				D12	D32	D52	D72	D92	D112	D132	D152
(M-code)					D13	D33	D53	D73	D93	D113	D133	D153
Torque limit value	O	O	O	O	D14	D34	D54	D74	D94	D114	D134	D154
Constant speed control data set pointer	No change when "0"				D15	D35	D55	D75	D95	D115	D135	D155
					D16	D36	D56	D76	D96	D116	D136	D156
(Travel value change register)	Ignored				D17	D37	D57	D77	D97	D117	D137	D157
					D18	D38	D58	D78	D98	D118	D138	D158
(Actual present value at STOP input)	REAL mode data stored				D19	D39	D59	D79	D99	D119	D139	D159

Signal Name	Roller	Ball Screw	Rotary Table	Cam	Device No.							
					Axis 25	Axis 26	Axis 27	Axis 28	Axis 29	Axis 30	Axis 31	Axis 32
Vacant			–		D1480	D1490	D1500	D1510	D1520	D1530	D1540	D1550
Effective cam No.	–	–	–	O	D1481	D1491	D1501	D1511	D1521	D1531	D1541	D1551
Effective stroke	–	–	–	O	D1482	D1492	D1502	D1512	D1522	D1532	D1542	D1552
					D1483	D1493	D1503	D1513	D1523	D1533	D1543	D1553
Present value in 1 cam shaft revolution	–	–	–	O	D1484	D1494	D1504	D1514	D1524	D1534	D1544	D1554
					D1485	D1495	D1505	D1515	D1525	D1535	D1545	D1555
Roller peripheral velocity	O	–	–	–	D480	D500	D520	D540	D560	D580	D600	D620
					D481	D501	D521	D541	D561	D581	D601	D621
Feed present value	–	O	O	O	D480	D500	D520	D540	D560	D580	D600	D620
					D481	D501	D521	D541	D561	D581	D601	D621
Present value	–	O	O	O	D482	D502	D522	D542	D562	D582	D602	D622
					D483	D503	D523	D543	D563	D583	D603	D623
Deviation counter value	O	O	O	O	D484	D504	D524	D544	D564	D584	D604	D624
					D485	D505	D525	D545	D565	D585	D605	D625
Minor error code	O	O	O	O	D486	D506	D526	D546	D566	D586	D606	D626
Major error code	O	O	O	O	D487	D507	D527	D547	D567	D587	D607	D627
Servo error code	O	O	O	O	D488	D508	D528	D548	D568	D588	D608	D628
(Home position return second travel value)	REAL mode data stored				D489	D509	D529	D549	D569	D589	D609	D629
(Travel value after DOG/CHANGE ON)					D490	D510	D530	D550	D570	D590	D610	D630
					D491	D511	D531	D551	D571	D591	D611	D631
(Execution program No.)	No change when "0"				D492	D512	D532	D552	D572	D592	D612	D632
(M-code)					D493	D513	D533	D553	D573	D593	D613	D633
Torque limit value	O	O	O	O	D494	D514	D534	D554	D574	D594	D614	D634
Constant speed control data set pointer	No change when "0"				D495	D415	D535	D555	D575	D595	D615	D635
					D496	D416	D536	D556	D576	D596	D616	D636
(Travel value change register)	Ignored				D497	D417	D537	D557	D577	D597	D617	D637
					D498	D418	D538	D558	D578	D598	D618	D638
(Actual present value at STOP input)	REAL mode data stored				D499	D419	D539	D559	D579	D599	D619	D639

	Axis 9	Axis 10	Axis 11	Axis 12	Axis 13	Axis 14	Axis 15	Axis 16	Axis 17	Axis 18	Axis 19	Axis 20	Axis 21	Axis 22	Axis 23	Axis 24
	D1320	D1330	D1340	D1350	D1360	D1370	D1380	D1390	D1400	D1410	D1420	D1430	D1440	D1450	D1460	D1470
	D1321	D1331	D1341	D1351	D1361	D1371	D1381	D1391	D1401	D1411	D1421	D1431	D1441	D1451	D1461	D1471
	D1322	D1332	D1342	D1352	D1362	D1372	D1382	D1392	D1402	D1412	D1422	D1432	D1442	D1452	D1462	D1472
	D1323	D1333	D1343	D1353	D1363	D1373	D1383	D1393	D1403	D1413	D1423	D1433	D1443	D1453	D1463	D1473
	D1324	D1334	D1344	D1354	D1364	D1374	D1384	D1394	D1404	D1414	D1424	D1434	D1444	D1454	D1464	D1474
	D1325	D1335	D1345	D1355	D1365	D1375	D1385	D1395	D1405	D1415	D1425	D1435	D1445	D1455	D1465	D1475
	D160	D180	D200	D220	D240	D260	D280	D300	D320	D340	D360	D380	D400	D420	D440	D460
	D161	D181	D201	D221	D241	D261	D281	D301	D321	D341	D361	D381	D401	D421	D441	D461
	D160	D180	D200	D220	D240	D260	D280	D300	D320	D340	D360	D380	D400	D420	D440	D460
	D161	D181	D201	D221	D241	D261	D281	D301	D321	D341	D361	D381	D401	D421	D441	D461
	D162	D182	D202	D222	D242	D262	D282	D302	D322	D342	D362	D382	D402	D422	D442	D462
	D163	D183	D203	D223	D243	D263	D283	D303	D323	D343	D363	D383	D403	D423	D443	D463
	D164	D184	D204	D224	D244	D264	D284	D304	D324	D344	D364	D384	D404	D424	D444	D464
	D165	D185	D205	D225	D245	D265	D285	D305	D325	D345	D365	D385	D405	D425	D445	D465
	D166	D186	D206	D226	D246	D266	D286	D306	D326	D346	D366	D386	D406	D426	D446	D466
	D167	D187	D207	D227	D247	D267	D287	D307	D327	D347	D367	D387	D407	D427	D447	D467
	D168	D188	D208	D228	D248	D268	D288	D308	D328	D348	D368	D388	D408	D428	D448	D468
	D169	D189	D209	D229	D249	D269	D289	D309	D329	D349	D369	D389	D409	D429	D449	D469
	D170	D190	D210	D230	D250	D270	D290	D310	D330	D350	D370	D390	D410	D430	D450	D470
	D171	D191	D211	D231	D251	D271	D291	D311	D331	D351	D371	D391	D411	D431	D451	D471
	D172	D192	D212	D232	D252	D272	D292	D312	D332	D352	D372	D392	D412	D432	D452	D472
	D173	D193	D213	D233	D253	D273	D293	D313	D333	D353	D373	D393	D413	D433	D453	D473
	D174	D194	D214	D234	D254	D274	D294	D314	D334	D354	D374	D394	D414	D434	D454	D474
	D175	D195	D215	D235	D255	D275	D295	D315	D335	D355	D375	D395	D415	D435	D455	D475
	D176	D196	D216	D236	D256	D276	D296	D316	D336	D356	D376	D396	D416	D436	D456	D476
	D177	D197	D217	D237	D257	D277	D297	D317	D337	D357	D377	D397	D417	D437	D457	D477
	D178	D198	D218	D238	D258	D278	D298	D318	D338	D358	D378	D398	D418	D438	D458	D478
	D179	D199	D219	D239	D259	D279	D299	D319	D339	D359	D379	D399	D419	D439	D459	D479

APPENDICES

APPENDIX 5 TABLES OF PROCESSING TIMES

This section lists the signal and instruction processing times for positioning control with a servo system CPU.

(1) Operation period of each servo system CPU

The processing time for the execution of positioning control operation by each servosystem CPU is indicated below.

		A171SCPU		A273UHCPU		
	Set Axes	1 - 2	3 - 4	1 - 8	9 - 18	19 - 32
Operation period		3.5 ms	7.1 ms	3.5 ms	7.1 ms	14.2 ms

(2) PCPU operation period

The table below shows the processing times for the PCPU after the start request signal and PC ready (M2000) signal are detected ON.

		A171S CPU	A273UHCPU (8-axis Specification)		A273UHCPU		
	Axes Used	4 Axes	4 Axes	8 Axes	8 Axes	16 Axes	32 Axes
Servoprogram processing time		7 - 14 ms[*1]	4 - 11 ms		4 - 11 ms	10 - 18 ms	14 - 21 ms
Speed change response time		7 - 14 ms	0 - 4 ms		0 - 4 ms	0 - 8 ms	0 - 14 ms
Time between PC ready flag (M2000) ON and PCPU ready flag (M9074) ON.		100 - 300 ms	80 - 100 ms		8 - 100 ms	90 - 400 ms	100 - 800 ms
Simultaneous start processing time		7 - 17 ms[*2]	7 - 17 ms		7 - 17 ms	10 - 24 ms	14 - 28 ms

*1: FEED varies greatly according to other conditions.
If other axes are stopped, operation period becomes 14 to 28 ms.

*2: Consider 7 to 17 ms as a guideline only.

(3) Common Devices

The table below shows the common device processing times for each axis during positioning control. The notification period from PCPU to SCPU is shown for signals with PCPU → SCPU signal direction. The notification period from SCPU to PCPU or the PCPU detection period is shown for signals with SCPU → PCPU signal direction.

Signal Name	Device Number			Signal Direction	A171SCPU		A273UHCPU			
							8-axis Specification	32-axis Specification		
	A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)		Set Axes		Set Axes	Set Axes		
					1 - 2	3 - 4	1 - 8	1 - 8	9 - 18	19 - 32
Clutch ON/OFF status	M1984 - M1991	M1964 - M1999	M2160 - M2223	PCPU → SCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Axis start accept flag	M2001 - M2004	M2001 - M2008	M2001 - M2032		10 ms	10 ms	10 ms	10 ms	10 ms	10 ms
All-axes start accept flag	M2009	M2009	M2049		10 ms	10 ms	10 ms	END*1	END*1	END*1
Cam & limit switch output data batch change completed flag	–	M2017	M2057	SCPU → PCPU	–	–	END*1	END*1	END*1	END*1
Cam & limit switch output data batch change error flag	–	M2018	M2058		–	–	END*1	END*1	END*1	END*1
Speed change in progress flag	M2021 - M2024	M2021 - M2028	M2061 - M2092		END*1	END*1	END*1	END*1	END*1	END*1
Synchronous encoder axis present value change in progress flag	M2031	M2031 - M2033	M2101 - M2112		END*1	END*1	END*1	END*1	END*1	END*1
System setting error flag	M2041	M2041	M2041		END*1	END*1	END*1	END*1	END*1	END*1
REAL/VIRTUAL mode switching request flag	M2044	M2044	M2044		END*1	END*1	END*1	END*1	END*1	END*1
REAL/VIRTUAL mode switching error detection flag	M2045	M2045	M2045	PCPU → SCPU	END*1	END*1	END*1	END*1	END*1	END*1
Synchronization discrepancy warning flag	M2046	M2046	M2046		END*1	END*1	END*1	END*1	END*1	END*1
Motion slot error detection flag	M2047	M2047	M2047		END*1	END*1	END*1	END*1	END*1	END*1
Automatic deceleration in progress flag	–	–	M2128 - M2159		–	–	–	3.5 ms	7.1 ms	14.2 ms
Speed change "0" accept flag	–	–	M2240 - M2271		–	–	–	3.5 ms	7.1 ms	14.2 ms
Limit switch output status storage area	D9180 - D9181	D9180 - D9183	D776 - D791		3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Manual pulse generator smoothing magnification storage area	D9192	D9192 - D9194	D752 - D754	SCPU → PCPU	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge
Limit switch output enabled/disabled setting	D1008 - D1009	D1008 - D1011	D760 - D775		3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Manual pulse generator axis setting	D1012	D1012 - D1014	D714 - D719		At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge
JOG simultaneous axis setting	D1015	D1015	D710 - D713		At start	At start	At start	At start	At start	At start

END *1: For A171SCPU   : 80 ms or sequence program scan time, whichever is longer
         For A273UHCPU : 50 ms or sequence program scan time, whichever is longer

Signal Name	Device Number			Signal Direction	A171SCPU		A273UHCPU			
							8-axis Specification	32-axis Specification		
	A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)		Set Axes		Set Axes	Set Axes		
					1 - 2	3 - 4	1 - 8	1 - 8	9 - 18	19 - 32
Manual pulse generator 1-pulse input magnification setting	D1016 - D1019	D1016 - D1023	D720 - D751		At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge	At manual pulse generator enabled signal rising edge
Present value change register	D960 - D1007	D960 - D1007	-	SCPU → PCPU	At DSFLP instruction execution	At DSFLP instruction execution	At DSFLP instruction execution	-	-	-
Speed change register			-		At DSFLP instruction execution	At DSFLP instruction execution	At DSFLP instruction execution	-	-	-
JOG speed setting register			D640 - D703		At start	At start	At start	At start	At start	At start

(4) Individual Device

The table below shows the processing times for the individual devices for each axis during positioning control. The notification period from PCPU to SCPU is shown for signals with PCPU → SCPU signal direction. The notification period from SCPU to PCPU or the PCPU detection period is shown for signals with SCPU → PCPU signal direction.

Signal Name		Device Number			Signal Direction	A171SCPU		A273UHCPU			
								8-axis Specification	32-axis Specification		
		A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)		Set Axes		Set Axes	Set Axes		
						1 - 2	3 - 4	1 - 8	1 - 8	9 - 18	19 - 32
Output module devices	in-position	M1600 - M1759	X000 - X0FF	M2400 - M3039	PCPU → SCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Zero-point pass					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Servo error detection					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Home position return completed					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Servo ON/OFF status					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Torque limit in progress signal (for output module)					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Limit switch output enabled	M1400 - M1559	Y000 - Y07F	M3200 - M3839	SCPU → PCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Address clutch reference setting					At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching
	Cam reference position setting					At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching
	Servo OFF					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Effective cam No.	D760 - D799	D760 - D799	D1240 - D1559	PCPU → SCPU	END*1	END*1	END*1	3.5 ms	7.1 ms	14.2 ms
	Effective stroke					END*1	END*1	END*1	3.5 ms	7.1 ms	14.2 ms
	Present value in 1 cam shaft revolution					END*1	END*1	END*1	3.5 ms	7.1 ms	14.2 ms
	Roller peripheral velocity	D800 - D959	D800 - D959	D0 - D639		END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Feed present value					END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Present value					END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Deviation counter value					END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Torque limit value					3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms

*1: For A171SCPU : 80 ms or sequence program scan time, whichever is longer
For A273UHCPU : 50 ms or sequence program scan time, whichever is longer

Signal Name			Device Number			Signal Direction	A171SCPU		A273UHCPU 8-axis Specification	A273UHCPU 32-axis Specification		
			A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)		Set Axes		Set Axes	Set Axes		
							1 - 2	3 - 4	1 - 8	1 - 8	9 - 16	19 - 32
Virtual servomotor axis device	Positioning start completed		M1200 . M1359	X100 . X17F	M4000 . M4639	PCPU → SCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Positioning completed						3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Command in-position						3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Speed control in progress						3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Stop command		M1400 . M1599	X100 . X17F	M4800 . M5439	SCPU → PCPU	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Rapid stop command						3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Stop input enable/disable						At start	At start	At start	At start	At start	At start
	Feed present value	Set virtual servo axes 1 - 8	D700 . D747	D700 . D747	D800 . D1119		–	–	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		9 - 16					–	–	7.1 ms	7.1 ms	7.1 ms	14.2 ms
		17 - 32					–	–	14.2 ms	14.2 ms	14.2 ms	28.4 ms
		1 - 4					END	END	–	–	–	–
	Execution program No.						At start	At start	At start	At start	At start	At start
	M-code	Set virtual servo axes 1 - 8					–	–	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		9 - 16					–	–	7.1 ms	7.1 ms	7.1 ms	14.2 ms
		17 - 32					–	–	14.2 ms	14.2 ms	14.2 ms	28.4 ms
		1 - 4					3.5 ms	7.1 ms	–	–	–	–
	Present value following main shaft's differential gear	Set virtual servo axes 1 - 8	D670 . D685	D670 . D685		PCPU → SCPU	–	–	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		9 - 16					–	–	7.1 ms	7.1 ms	7.1 ms	14.2 ms
		17 - 32					–	–	14.2 ms	14.2 ms	14.2 ms	28.4 ms
		1 - 4					END	END	–	–	–	–
Synchronous encoder axis device	Present value	Set synchronous encoder axes 1 - 6	D748 . D759	D748 . D759	D1120 . D1239		–	–	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		7 - 11					–	–	7.1 ms	7.1 ms	14.2 ms	14.2 ms
		1					END	END	–	–	–	–
	Present value following main shaft's differential gear	Set synchronous encoder axes 1 - 6	D686 . D691	D686 . D691			–	–	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		7 - 12					–	–	7.1 ms	7.1 ms	14.2 ms	14.2 ms
		1					END	END	–	–	–	–

*1: For A171SCPU : 80 ms or sequence program scan time, whichever is longer
For A273UHCPU : 50 ms or sequence program scan time, whichever is longer

APPENDICES

(5) Mechanical system module parameters

Setting Item		Default Value	Setting Range	Setting Possible		A171SCPU		A273UHCPU 8-axis Specification	A273UHCPU 32-axis Specification		
				Direct Clutch	Smoothing Clutch	Set Axes 1 - 2	Set Axes 3 - 4	Set Axes 1 - 8	Set Axes 1 - 8	Set Axes 9 - 18	Set Axes 19 - 32
Clutch	Mode setting device	–	Word device *1	O	O	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Clutch ON/OFF command device	–	Bit device	O	O	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Clutch ON address setting device	–	Word device *1	O	O	END *2	END *2	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Clutch OFF address setting device	–									
	Amount of slip setting device	–	Word device	–	O	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching	At REAL to VIRTUAL switching

*1: Enabled only when ON/OFF mode/address mode are both used.

*2: For A171SCPU : 80 ms or sequence program scan time, whichever is longer
For A273UHCPU : 50 ms or sequence program scan time, whichever is longer

Setting Item		Default Value	Device Number			A171SCPU		A273UHCPU 8-axis Specification	A273UHCPU 32-axis Specification		
			A171SCPU	A273UHCPU (8-axis Specification)	A273UHCPU (32-axis Specification)	Set Axes 1 - 2	Set Axes 3 - 4	Set Axes 1 - 8	Set Axes 1 - 8	Set Axes 9 - 18	Set Axes 19 - 32
Gearbox	Speed change gear ratio setting device	–	D0 - D799 W000 - W3FF	D0 - D799 D1824 - D3069 D3080 - D8191 W000 - W1FFF	D800 - D3069 D3080 - D8191 W000 - W1FFF	3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
Output module	Roller	Torque limit value setting device	–	–(300%)/word device			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Ball-screw	Torque limit value setting device	–	–(300%)/word device			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Rotary Table	Torque limit value setting device	–	–(300%)/word device			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Virtual axis present value in one revolution storage device (main shaft side)	–	–/word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Virtual axis present value in one revolution storage device (auxiliary input shaft side)	–	–/word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
	Cam	Cam No. setting device	–	word device			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Stroke setting device	–	word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Torque control limit setting device	–	–(300%)/word device			3.5 ms	7.1 ms	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Stroke lower limit value setting device	–	–/word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Present value in one virtual axis revolution storage device (main shaft side)	–	–/word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms
		Present value in one virtual axis revolution storage device (auxiliary input shaft side)	–	–/word device			END*1	END*1	3.5 ms	3.5 ms	7.1 ms	14.2 ms

*1: For A171SCPU : 80 ms or sequence program scan time, whichever is longer
For A273UHCPU : 50 ms or sequence program scan time, whichever is longer

APPENDICES

(6) Virtual axis/synchronous encoder processing time

	Servo Motor Axes		A171SCPU			A273UHCPU		
			1 Axis	2 Axes	3 - 4 Axes	1 - 8 Axes	9 - 18 Axes	9 - 32 Axes
Number of virtual servomotors		1 - 2	3.5 ms	3.5 ms	7.1 ms	3.5 ms	7.1 ms	14.2 ms
		3 - 4	3.5 ms	3.5 ms	7.1 ms			
		5 - 6	–	7.1 ms	7.1 ms			
		7 - 8	–	–	7.1 ms			
		9 - 16	–	–	–	7.1 ms	7.1 ms	14.2 ms
		17 - 32	–	–	–	14.2 ms	14.2 ms	28.4 ms
Number of synchronous encoders		1 - 6	–	–	–	3.5 ms	7.1 ms	14.2 ms
		7 - 12	–	–	–	7.1 ms	14.2 ms	14.2 ms

(7) DSFRP, SVST, DSFLP, END instruction processing time

The table below shows the processing times for the sequence program instructions used to start positioning control, etc.

Refer to the ACPU Programming Manual (Common Instructions) (IB-66250) for the processing times of sequence program instructions not listed below.

A171SCPU : Same as A1SCPU processing times
A273UHCPU : Same as A3UCPU processing times

			A171SCPU	A273UHCPU (8-axis Specification)		A273UHCPU (32-axis Specification)			
		Axes Used	4 Axis	4 Axis	8 Axis	4 Axis	8 Axis	16 Axis	32 Axis
DSFRP	Start 1 axis		180 μs	25 μs		–			
	Start 2, 3 axes		200 μs	25 μs		–			
	Error		850 μs	120 μs		–			
DSFLP	Change present value	Normal	120 μs	10 μs		–			
		Error	770 μs	25 μs		–			
	Speed control	Normal	80 μs	15 μs		–			
		Error	700 μs	30 μs		–			
SVST	Start 1 axis		190 μs	35 μs		35 μs			
	Start 2, 3, 4 axes		700 μs	70 μs		70 μs			
	Error		900 μs	150 μs		150 μs			
END			7600 μs	5000 μs		5000 μs			