DENSO ROBOT

INTERFACE CIRCUIT DIAGRAMS (T03)

Preface

Thank you for purchasing this high-speed, high-accuracy assembly robot.

Before operating your robot, read this manual carefully to safely get the maximum benefit from your robot in your assembling operations.

This manual covers the following products

■ Robot system configured with the RC7M controller

- Vertical articulated robot V∗-G-T series
- Horizontal articulated robot H∗-G-T series

Important

To ensure operator safety, be sure to read the precautions and instructions in "SAFETY PRECAUTIONS."

How this book is organized

This book is just one part of the robot documentation set. This book consists of SAFETY PRECAUTIONS and chapters one and two.

Chapter 1 Circuit Diagrams

Provides address maps for connecting external equipment with the robot system.

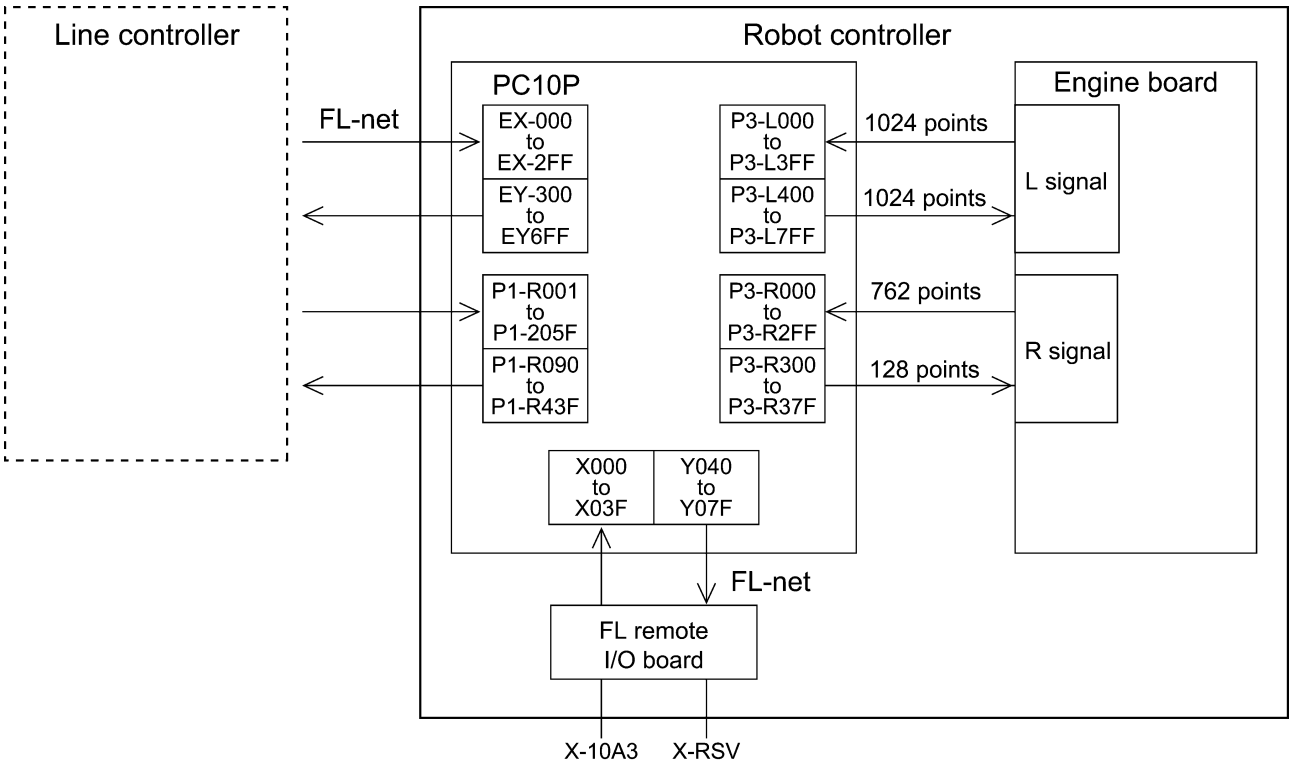
Chapter 2 Electric Circuit Diagrams

Provides electric circuit diagrams for connecting external equipment with the robot system.

Contents

Chapter 1 Circuit Diagrams

1.1 PLC Circuit Connection Diagrams



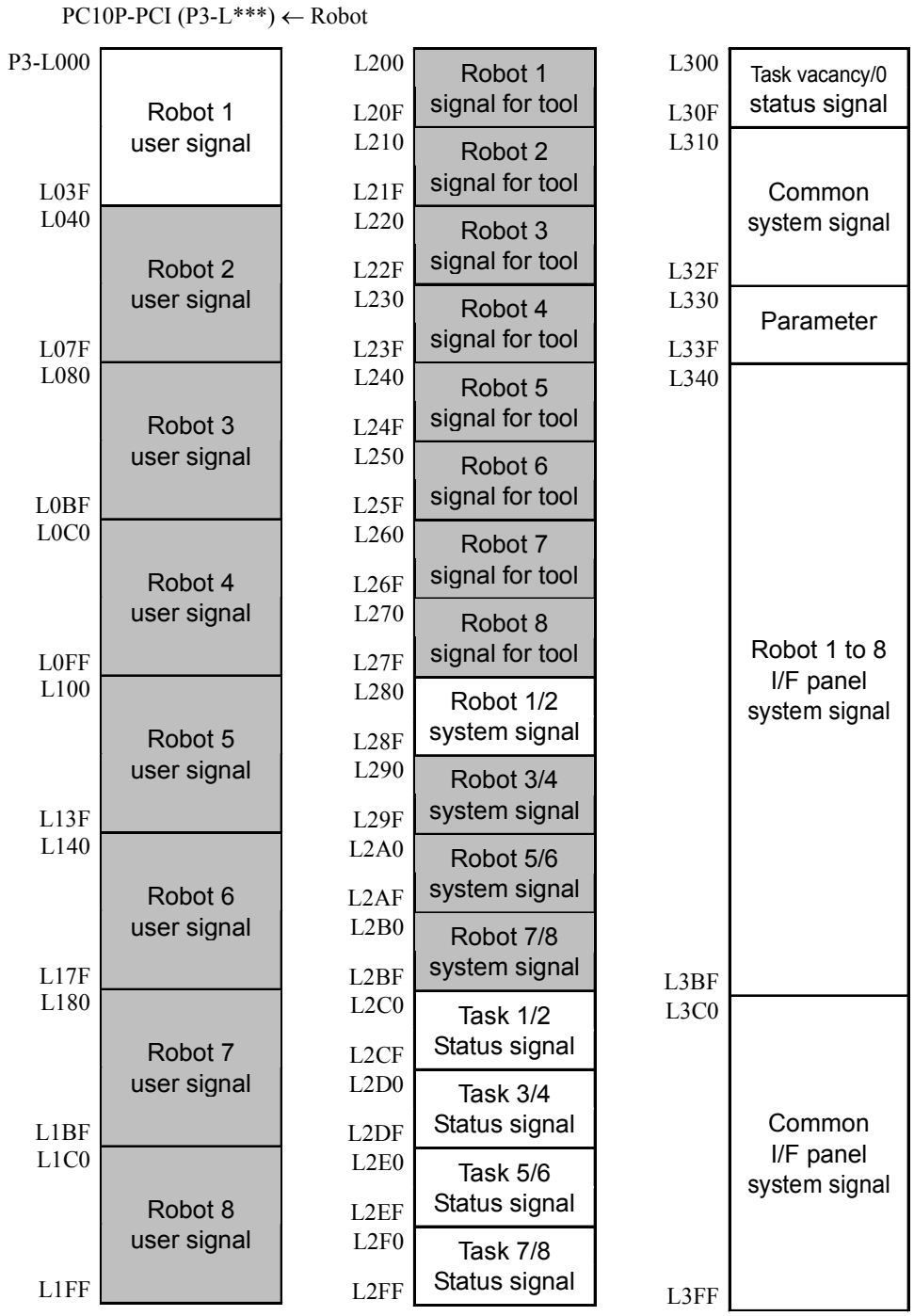
1.2 FL Remote I/O Assignment

Input		Output	
X00	Operation panel Safety unit	Y40	Operation panel
X01		Y41	
X02		Y42	
X03		Y43	
X04		Y44	
X05		Y45	
X06		Y46	
X07		Y47	
X08		Y48	
X09		Y49	
X0A		Y4A	
X0B		Y4B	
X0C		Y4C	
X0D		Y4D	
X0E		Y4E	
X0F		Y4F	
X10	Robot unit (CN22:X-10A3)	Y50	Robot unit (CN22:X-10A3)
X11		Y51	
X12		Y52	
X13		Y53	
X14		Y54	
X15		Y55	
X16		Y56	
X17		Y57	
X18		Y58	
X19		Y59	
X1A		Y5A	
X1B		Y5B	
X1C		Y5C	
X1D		Y5D	
X1E		Y5E	
X1F		Y5F	
X20	Not used. Reserved. (CN23:X-RSV)	Y60	Not used. Reserved. (CN23:X-RSV)
X21		Y61	
X22		Y62	
X23		Y63	
X24		Y64	
X25		Y65	
X26		Y66	
X27		Y67	

1.3 PC10P ← Robot

1.3.1 Address map

The hatched areas are reserved (not used).
For details of assignments, refer to the tables on the following pages.



1.3.2 Assignment tables

	P3-L00 ( ) R1 User	P3-L01 ( ) R1 User	P3-L02 ( ) R1 User	P3-L03 ( ) R1 User	P3-L28 ( ) R1	P3-L2C ( ) Task 1,2 System	P3-L2D ( ) Task 3,4 System
0	O1	O17	O33	O49	Servo ON		
1	O2	O18	O34	O50	Robot home position (Home position 1)	RPS mode	RPS mode
2	O3	O19	O35	O51	Return to home position valid area (Home position 2)		
3	O4	O20	O36	O52	(Home position 3)		
4	O5	O21	O37	O53	(Home position 4)		
5	O6	O22	O38	O54			
6	O7	O23	O39	O55			
7	O8	O24	O40	O56			
8	O9	O25	O41	O57			
9	O10	O26	O42	O58		RPS mode	RPS mode
A	O11	O27	O43	O59			
B	O12	O28	O44	O60			
C	O13	O29	O45	O61			
D	O14	O30	O46	O62			
E	O15	O31	O47	O63			
F	O16	O32	O48	O64 Operation completion			

	P3-L2E ( ) Task 5,6 System	P3-L2F ( ) Task 7,8 System	P3-L30 ( ) Task 0 System	P3-L31 ( ) Common	P3-L32 ( ) Common	P3-L33 ( ) parameter	P3-L34 ( ) I/F panel R1 (*) Material handling
0			Running at normal speed	Teach mode	Auto (SS)		R1 Tool 1 select
1	RPS mode	RPS mode	RPS mode	Play mode	Individual (SS)	Servo off at hold (signal off)	R1 Tool 2 select
2			JUMP-ST		Teach (SS)		R1 Tool 3 select
3			RPS-ST	Stationary state	Start (PB)		R1 Tool 4 select
4			Waiting for I	Cycle start on	Stop (PB)		
5			Program existing	Master on	Master on (PB)		
6			Holding	Holding	Teach preparation (PB)		
7				Error	Error reset		
8				Remote (SS)	P.P Emergency stopping		Clamp 1 select
9	RPS mode	RPS mode			Input of robot external emergency stop		Clamp 2 select
A				Teach (SS)	Robot safety stop		Clamp 3 select
B					Teaching plug on		Clamp 4 select
C					Teach OK		Adsorption 1 select
D							Adsorption 2 select
E				Battery alarm			Operation completion set
F			Always on	Watchdog			Operation completion reset

(*) An assignment example.

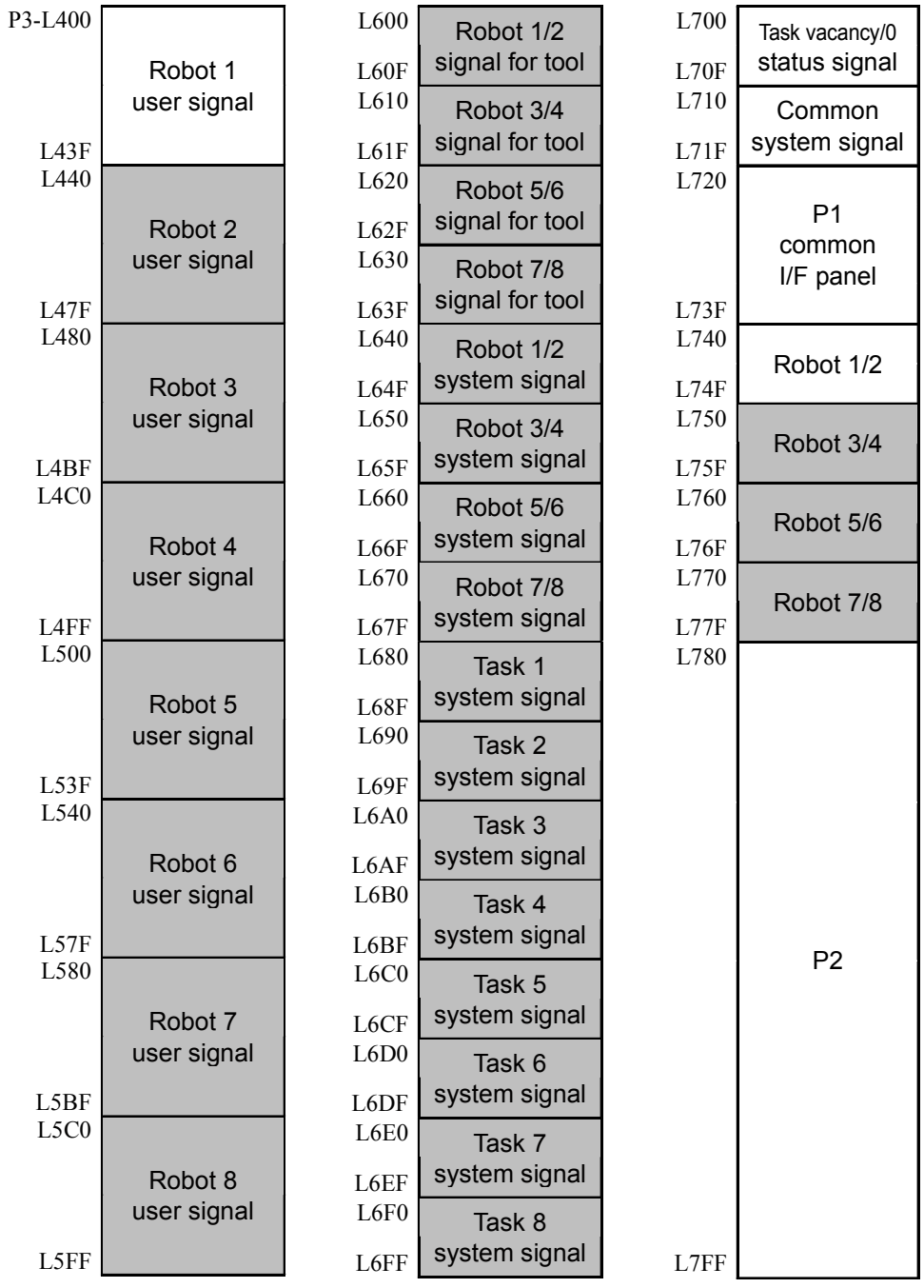
	P3-L3C ( ) I/F panel common	P3-L3D ( ) I/F panel common	P3-L3E ( ) I/F panel common	P3-L3F ( ) I/F panel common
0				
1				
2				
3				
4				
5				
6				
7				
8	Hold release (PB)			
9	Error reset (PB)			
A	Buzzer stop (PB)			
B				
C	All robot operation completion set			
D	All robot operation completion reset			
E	Advance (PB)			
F	Return (PB)			

1.4 PC10P → Robot

1.4.1 Address Map

The hatched areas are reserved (not used).
For details of assignments, refer to the tables on the following pages.

PC10P-PCI (P3-L***) → Robot



1.4.2 Assignment tables

	P3-L40 ( ) R1 user	P3-L41 ( ) R1 user	P3-L42 ( ) R1 user	P3-L43 ( ) R1 user	P3-L70 ( ) Task 0 system	P3-L71 ( ) common	P3-L72 ( ) I/F panel
0	I1	I17	I33	I49	Second start	Error reset	Robot home position
1	I2	I18	I34	I50		External cycle start	Buzzer
2	I3	I19	I35	I51		External hold release	Auto select
3	I4	I20	I36	I32	First start		Individual select
4	I5	I21	I37	I53	Home position return (JUMP-OFF)	Robot normal	Teach select
5	I6	I22	I38	I54	Second start (JUMP-ON)	Speed regulation command	
6	I7	I23	I39	I55	Program reset	Servo temporally stop (slow down stop)	TOYOPUC RUN (Lamp)
7	I8	I24	I40	I56	RPS-ON	Watchdog	
8	I9	I25	I41	I57 Home position	RPS 1		PCI bus communicating (Lamp)
9	I10	I26	I42	I58 Return to home position valid area	RPS 2		Robot– TOYOPUC communicating (Lamp)
A	I11	I27	I43	I59 Process individual mode	RPS 4		FL-net communicating (Lamp)
B	I12	I28	I44	I60 Durable mode on	RPS 8		Line controller communicating (Lamp)
C	I13	I29	I45	I61 Verification run	RPS 16		
D	I14	I30	I46	I62 Robot synchronous command	RPS 32		
E	I15	I31	I47	I63 Second start	RPS 64		
F	I16	I32	I48	I64 First start	RPS 128		

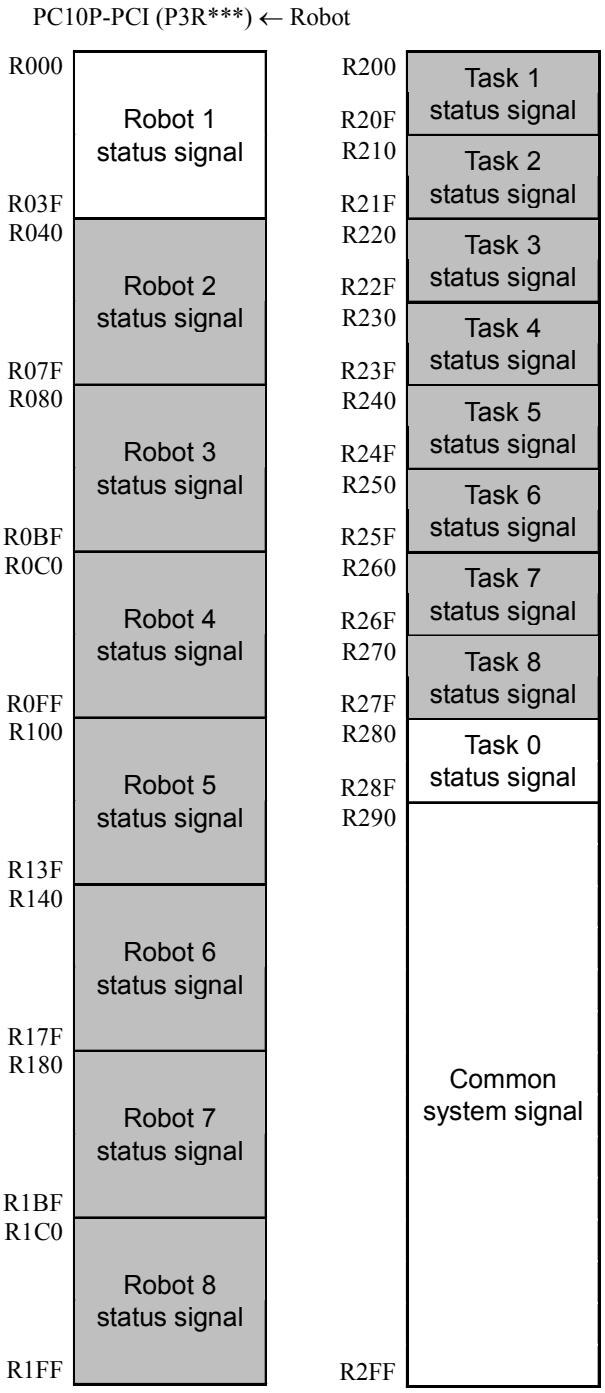
	P3-L73 ( ) I/F panel	P3-L74 ( ) R1/2	P3-L78 ( ) I/F panel R1 (*)
0	Master on (Lamp)	R1 Servo ON (Lamp)	Clamp end 1 (Lamp)
1	Auto (Lamp)	R1 Connection cutting off (Lamp)	Unclamp end 1 (Lamp)
2	Auto running (Lamp)	R1 Return to home position valid (Lamp)	Clamp end 2 (Lamp)
3	All robot home position (Lamp)	R1 Home position (Lamp)	Unclamp end 2 (Lamp)
4	All robot operation completion (Lamp)	R1 Completed (Lamp)	Clamp end 3 (Lamp)
5	Teaching (Lamp)		Unclamp end 3 (Lamp)
6	All robot servo ON (Lamp)	R1 Error (Lamp)	Clamp end 4 (Lamp)
7	Emergency stopping (Lamp)		Unclamp end 4 (Lamp)
8	Hold (Lamp)		Work check 1 (Lamp)
9	Warning (Lamp)		Work check 2 (Lamp)
A	Error (Lamp)		Work check 3 (Lamp)
B	Wire break, earth fault (Lamp)		Work check 4 (Lamp)
C	TP emergency stop (Lamp)		Adsorption 1 check
D	Line controller emergency stop (Lamp)		Adsorption 2 check
E	Line controller safety stop (Lamp)		
F	Line controller teach OK (Lamp)		

(*) An assignment example.

1.5 PC10P-PCI ← Robot

1.5.1 Address Map

The hatched areas are reserved (not used).
For details of assignments, refer to the tables on the following pages.



1.5.2 Assignment tables

Robot Status Signal

R1	R00 ( )	R01 ( )
0	1st-axis present value (Long) [pulse]	9th-axis present value (Long) (Unsupported)
1	1st-axis present value (Long)	9th-axis present value (Long) (Unsupported)
2	2nd-axis present value (Long) [pulse]	(Reserved by the system)
3	2nd-axis present value (Long)	(Reserved by the system)
4	3rd-axis present value (Long) [pulse]	(Reserved by the system)
5	3rd-axis present value (Long)	(Reserved by the system)
6	4th-axis present value (Long) [pulse]	(Reserved by the system)
7	4th-axis present value (Long)	(Reserved by the system)
8	5th-axis present value (Long) [pulse]	X-axis in Cartesian coordinates (Long) [× 100 mm]
9	5th-axis present value (Long)	X-axis in Cartesian coordinates (Long)
A	6th-axis present value (Long) [pulse]	Y-axis in Cartesian coordinates (Long) [× 100 mm]
B	6th-axis present value (Long)	Y-axis in Cartesian coordinates (Long)
C	7th-axis present value (Long) (Unsupported)	Z-axis in Cartesian coordinates (Long) [× 100 mm]
D	7th-axis present value (Long) (Unsupported)	Z-axis in Cartesian coordinates (Long)
E	8th-axis present value (Long) (Unsupported)	(Reserved by the system)
F	8th-axis present value (Long) (Unsupported)	(Reserved by the system)

Task Status Signal

R28( )	T0		
Address	Upper	Lower	Remarks
0	Select robot (BIT)	Unit number (BCD)	Only 8th-bit is ON
1	Synchronous robot (BIT)	Synchronous task (BIT)	All OFF
2	Select program number (BCD)		Program number called by RPS
3	Select step number (BCD)		Step number of selected program
4	Executive program number (BCD)		Program number of selected program
5	Executive step number (BCD)		Step number of executed program
6	SEMPH priority	SEMPH number	(Not used.)
7	(Vacancy)	(Vacancy)	
8	Comment 2	Comment 1	(Not used.)
9	Comment 4	Comment 3	(Not used.)
A	Comment 6	Comment 5	(Not used.)
B	Comment 8	Comment 7	(Not used.)
C	Comment 10	Comment 9	(Not used.)
D	Comment 12	Comment 11	(Not used.)
E	Comment 14	Comment 13	(Not used.)
F	Comment 16	Comment 15	(Not used.)

Common

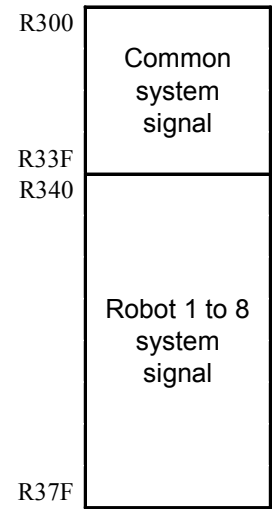
	R29 ( )	R2A ( )		R2B ( )		R2C ( )		R2D ( )	R2E ( )	R2F ( )
0	Alarm code*1	Alarm comment 2	1	Error comment 2	1	Message comment 2	1			
1	Sub data 1	Comment 4	3	Comment 4	3	Comment 4	3	Robot use R1-4		
2	Sub data 2	Comment 6	5	Comment 6	5	Comment 6	5			
3	Sub data type	Comment 8	7	Comment 8	7	Comment 8	7			
4	Error code*2	Comment 10	9	Comment 10	9	Comment 10	9			
5	Sub data 1	Comment 12	11	Comment 12	11	Comment 12	11			
6	Sub data 2	Comment 14	13	Comment 14	13	Comment 14	13			
7	Sub data type	Comment 16	15	Comment 16	15	Comment 16	15			
8	Message code	Comment 18	17	Comment 18	17	Comment 18	17			
9	Error*3	Comment 20	19	Comment 20	19	Comment 20	19			
A	Warning*4	Comment 22	21	Comment 22	21	Comment 22	21			
B		Comment 24	23	Comment 24	23	Comment 24	23			
C		Comment 26	25	Comment 26	25	Comment 26	25			
D		Comment 28	27	Comment 28	27	Comment 28	27			
E		Comment 30	29	Comment 30	29	Comment 30	29			
F		Comment 32	31	Comment 32	31	Comment 32	31			

*1 R290 Error Level 2 or higher. 4-digit hex. code
*2 R294 Error Level 1 or lower. 4-digit hex. code
*3 R299 2nd bit only available. PLC WD error (Play mode)
*4 R29A 2nd bit only available. PLC WD error (Teach mode)

1.6 PC10P-PCI → Robot

1.6.1 Address Map

PC10P-PCI (P3R***) → Robot



1.6.2 Assignment tables

	R30 ( )	R31 ( )	R32 ( )	R33 ( )
0	Standard watch, year/month	Alarm code (BIN)		
1	Standard watch, day/hour	Alarm sub code (BIT)		
2	Standard watch, minute/second	System message code (BIN)		
3	Standard watch, vacancy/day	System message sub code (BIT)		
4	Standard watch write flag (0 bit)	User message code (BIN)		
5		User message sub code (BIT)		
6		Task status (BIT)		
7	T0 interlock	Alarm, message request (BIT)		
8		I/F version (BIN)		
9				
A				
B				
C				
D				
E				
F				

Exclusive robot

	R34 ( ) R1/R2
0	Data 1
1	Data 2
2	Data 3
3	Data 4
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

1.7 Application Signal Table

1.7.1 P1 → P2

EM	Name	EM	Name	EM	Name	EM	Name
0000	R1 hold release	0010		0020		0030	
0001	R1 home position	0011		0021		0031	
0002	R1 servo on	0012		0022		0032	
0003	R1 effective	0013		0023		0033	
0004	R1 connection cutting off	0014		0024		0034	
0005		0015		0025		0035	
0006		0016		0026		0036	
0007		0017		0027		0037	
0008		0018		0028		0038	
0009		0019		0029		0039	
000A		001A		002A		003A	
000B		001B		002B		003B	
000C		001C		002C		003C	
000D		001D		002D		003D	
000E		001E		002E		003E	
000F		001F		002F		003F	

EM	Name	EM	Name
0080	Master on	0090	Hold release from line controller
0081	Play mode	0091	T0_hold release
0082	Teaching mode	0092	
0083	Cycle starting on (Driving.)	0093	
0084	Event monitor running	0094	
0085		0095	
0086	All robot_completion of tip exchange	0096	
0087	All robot_error reset	0097	
0088	All robot_servo on	0098	T0_welding operation process_program is carried out
0089	All robot_home position	0099	T0_home position return process_program is carried out
008A		009A	T0_tip exchange process_program is carried out
008B		009B	T0_robot positioner jig cleaning process_ program is carried out
008C		009C	
008D	All robot_robot operations	009D	
008E	All robot_auto-running mode	009E	
008F	All robot_individual mode of operations	009F	

1.7.2 P1 ← P2

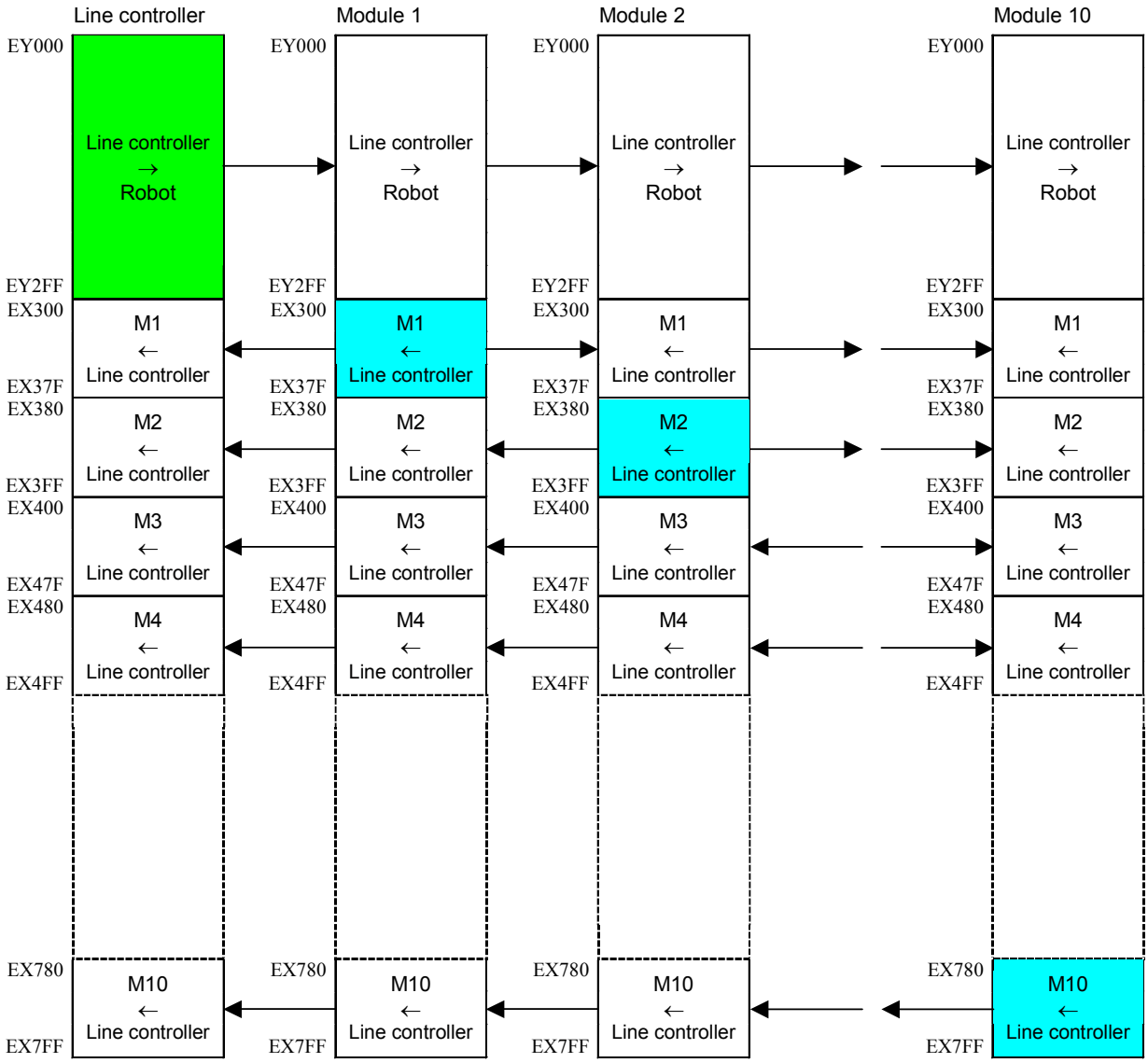
EM	Name	EM	Name	EM	Name	EM	Name
0100		0110		0120		0130	
0101		0111		0121		0131	
0102		0112		0122		0132	
0103		0113		0123		0133	
0104		0114		0124		0134	
0105		0115		0125		0135	
0106		0116		0126		0136	
0107		0117		0127		0137	
0108		0118		0128		0138	
0109		0119		0129		0139	
010A		011A		012A		013A	
010B		011B		012B		013B	
010C		011C		012C		013C	
010D		011D		012D		013D	
010E		011E		012E		013E	
010F		011F		012F		013F	

EM	Name
0180	Equipment normal
0181	Air pressure declline
0182	
0183	
0184	
0185	
0186	
0187	
0188	
0189	
018A	
018B	
018C	
018D	
018E	
018F	

1.8 FL-net Relay Link

1.8.1 Address Map

One module occupies 128 areas. Up to ten modules can be configured.



The address space for line controller is EY000-EY2FF.
The address space for module 1 is EX300-EX37F.

1.8.2 Line Controller → Robot

(1) Assignment map

The hatched areas are not used in this robot system.

EX	Application	EX	Application	EX	Application
000 to 007	Robot 1 to 8 Home position	080 to 087	All welding robots common Hold release, Completion reset, etc.	100 to 107	Welding robots common Jig interlock I17 to I24
008 to 00F	Robot 9 to 16 Home position	088 to 08F	Exclusive robot 1,2 Hold release, Completion reset, etc.	108 to 10F	Welding robots common Jig interlock I25 to I32
010 to 017	Robot 17 to 24 Home position	090 to 097	Exclusive robot 3,4 Hold release, Completion reset, etc.	110 to 117	Welding robots common (Extended jig interlock: Disabled)
018 to 01F	Robot 25 to 32 Home position	098 to 09F	Exclusive robot 5,6 Hold release, Completion reset, etc.	118 to 11F	Welding robots common (Extended jig interlock: Disabled)
020 to 027	All welding robots Common vehicle type	0A0 to 0A7	Exclusive robot 7,8 Hold release, Completion reset, etc.	120 to 127	(Disabled)
028 to 02F	(Disabled)	0A8 to 0AF	Exclusive robot 9,10 Hold release, Completion reset, etc.	128 to 12F	(Disabled)
030 to 037	Exclusive robot 1 Vehicle type (material handling)	0B0 to 0B7	Spot welding use Drainage and water stop command for spot welding	130 to 137	(Disabled)
038 to 03F	Exclusive robot 2 Vehicle type (material handling)	0B8 to 0BF	Individual mode Durable mode on	138 to 13F	(Disabled)
040 to 047	Exclusive robot 3 Vehicle type (material handling)	0C0 to 0C7	Special purpose signal, Tip grinding directions, Welding robot 1 to 8	140 to 147	Exclusive robot 1 Jig interlock I17 to I24
048 to 04F	Exclusive robot 4 Vehicle type (material handling)	0C8 to 0CF	Special purpose signal Tip grinding directions, Welding robot 9 to 16	148 to 14F	Exclusive robot 1 Jig interlock I25 to I32
050 to 057	Exclusive robot 5 Vehicle type (material handling)	0D0 to 0D7	Special purpose signal, Tip grinding directions, Welding robot 17 to 24	150 to 157	Exclusive robot 1 Jig interlock I1 to I8
058 to 05F	Exclusive robot 6 Vehicle type (material handling)	0D8 to 0DF	Special purpose signal, Tip grinding directions, Welding robot 25 to 32	158 to 15F	Exclusive robot 1 Jig interlock I9 to I16
060 to 067	Exclusive robot 7 Vehicle type (material handling)	0E0 to 0E7	Special purpose signal, Step up reset, Welding robot 1 to 8	160 to 167	Exclusive robot 1 Jig interlock I17 to I24
068 to 06F	Exclusive robot 8 Vehicle type (material handling)	0E8 to 0EF	Special purpose signal, Step up reset, Welding robot 9 to 16	168 to 16F	Exclusive robot 1 Jig interlock I25 to I32
070 to 077	Exclusive robot 9 Vehicle type (material handling)	0F0 to 0F7	Special purpose signal, Step up reset, Welding robot 17 to 24	170 to 177	Exclusive robot 1 Jig interlock I1 to I8
078 to 07F	Exclusive robot 10 Vehicle type (S robot location)	0F8 to 0FF	Special purpose signal, Step up reset, Welding robot 25 to 32	178 to 17F	Exclusive robot 1 Jig interlock I9 to I16

EY	Application	EY	Application	EY	Application
180 to 187	Exclusive robot 3 Jig interlock I17 to I24	200 to 207	Exclusive robot 7 Jig interlock I17 to I24	280 to 287	(S location) Clamp command 1 to 8
188 to 18F	Exclusive robot 3 Jig interlock I25 to I32	208 to 20F	Exclusive robot 7 Jig interlock I25 to I32	288 to 28F	(S location) Clamp command 9 to 16
190 to 197	Exclusive robot 3 Jig interlock I1 to I8	210 to 217	Exclusive robot 7 Jig interlock I1 to I8	290 to 297	(S location) Clamp command 17 to 24
198 to 19F	Exclusive robot 3 Jig interlock I9 to I16	218 to 21F	Exclusive robot 7 Jig interlock I9 to I16	298 to 29F	(S location) Clamp command 25 to 32
1A0 to 1A7	Exclusive robot 4 Jig interlock I17 to I24	220 to 227	Exclusive robot 8 Jig interlock I17 to I24	2A0 to 2A7	(S location) Unclamp command 1 to 8
1A8 to 1AF	Exclusive robot 4 Jig interlock I25 to I32	228 to 22F	Exclusive robot 8 Jig interlock I25 to I32	2A8 to 2AF	(S location) Unclamp command 9 to 16
1B0 to 1B7	Exclusive robot 4 Jig interlock I17 to I24	230 to 237	Exclusive robot 8 (Disabled)	2B0 to 2B7	(S location) Unclamp command 17 to 24
1B8 to 1BF	Exclusive robot 4 Jig interlock I25 to I32	238 to 23F	Exclusive robot 8 (Disabled)	2B8 to 2BF	(S location) Unclamp command 25 to 32
1C0 to 1C7	Exclusive robot 5 Jig interlock I17 to I24	240 to 247	Exclusive robot 9 Jig interlock I17 to I24	2C0 to 2C7	Exclusive robot 1 data 3
1C8 to 1CF	Exclusive robot 5 Jig interlock I25 to I32	248 to 24F	Exclusive robot 9 Jig interlock I25 to I32	2C8 to 2CF	Exclusive robot 1 data 4
1D0 to 1D7	Exclusive robot 5 Jig interlock I1 to I8	250 to 257	Exclusive robot 9 Jig interlock I1 to I8	2D0 to 2D7	Exclusive robot 2 data 3
1D8 to 1DF	Exclusive robot 5 Jig interlock I9 to I16	258 to 25F	Exclusive robot 9 Jig interlock I9 to I16	2D8 to 2DF	Exclusive robot 2 data 4
1E0 to 1E7	Exclusive robot 6 Jig interlock I17 to I24	260 to 267	Exclusive robot 10 Jig interlock I17 to I24	2E0 to 2E7	Exclusive robot 3 data 3
1E8 to 1EF	Exclusive robot 6 Jig interlock I25 to I32	268 to 26F	Exclusive robot 10 Jig interlock I25 to I32	2E8 to 2EF	Exclusive robot 3 data 4
1F0 to 1F7	Exclusive robot 6 Jig interlock I1 to I8	270 to 277	Exclusive robot 10 Jig interlock I1 to I8	2F0 to 2F7	Exclusive robot 4 data 3
1F8 to 1FF	Exclusive robot 6 Jig interlock I9 to I16	278 to 27F	Exclusive robot 10 Jig interlock I9 to I16	2F8 to 2FF	Exclusive robot 4 data 4

(2) Address tables

EX	Name	EX	Name	EX	Name	EX	Name
000	Robot 1 home position	020	Vehicle type BCD1	040	Exclusive robot 3 vehicle type 1	060	Exclusive robot 7 vehicle type 1
001	Robot 2 home position	021	Vehicle type BCD2	041	Exclusive robot 3 vehicle type 2	061	Exclusive robot 7 vehicle type 2
002	Robot 3 home position	022	Vehicle type BCD4	042	Exclusive robot 3 vehicle type 4	062	Exclusive robot 7 vehicle type 4
003	Robot 4 home position	023	Vehicle type BCD8	043	Exclusive robot 3 vehicle type 8	063	Exclusive robot 7 vehicle type 8
004	Robot 5 home position	024	Vehicle type BCD10	044	Exclusive robot 3 vehicle type 10	064	Exclusive robot 7 vehicle type 10
005	Robot 6 home position	025	Vehicle type BCD20	045	Exclusive robot 3 vehicle type 20	065	Exclusive robot 7 vehicle type 20
006	Robot 7 home position	026	Vehicle type BCD40	046	Exclusive robot 3 vehicle type 40	066	Exclusive robot 7 vehicle type 40
007	Robot 8 home position	027	Vehicle type BCD80	047	Exclusive robot 3 vehicle type 80	067	Exclusive robot 7 vehicle type 80
008	Robot 9 home position	028	(Disabled)	048	Exclusive robot 4 vehicle type 1	068	Exclusive robot 8 vehicle type 1
009	Robot 10 home position	029	(Disabled)	049	Exclusive robot 4 vehicle type 2	069	Exclusive robot 8 vehicle type 2
00A	Robot 11 home position	02A	(Disabled)	04A	Exclusive robot 4 vehicle type 4	06A	Exclusive robot 8 vehicle type 4
00B	Robot 12 home position	02B	(Disabled)	04B	Exclusive robot 4 vehicle type 8	06B	Exclusive robot 8 vehicle type 8
00C	Robot 13 home position	02C	(Disabled)	04C	Exclusive robot 4 vehicle type 10	06C	Exclusive robot 8 vehicle type 10
00D	Robot 14 home position	02D	(Disabled)	04D	Exclusive robot 4 vehicle type 20	06D	Exclusive robot 8 vehicle type 20
00E	Robot 15 home position	02E	(Disabled)	04E	Exclusive robot 4 vehicle type 40	06E	Exclusive robot 8 vehicle type 40
00F	Robot 16 home position	02F	(Disabled)	04F	Exclusive robot 4 vehicle type 80	06F	Exclusive robot 8 vehicle type 80
010	Robot 17 home position	030	Exclusive robot 1 vehicle type 1	050	Exclusive robot 5 vehicle type 1	070	Exclusive robot 9 vehicle type 1
011	Robot 18 home position	031	Exclusive robot 1 vehicle type 2	051	Exclusive robot 5 vehicle type 2	071	Exclusive robot 9 vehicle type 2
012	Robot 19 home position	032	Exclusive robot 1 vehicle type 4	052	Exclusive robot 5 vehicle type 4	072	Exclusive robot 9 vehicle type 4
013	Robot 20 home position	033	Exclusive robot 1 vehicle type 8	053	Exclusive robot 5 vehicle type 8	073	Exclusive robot 9 vehicle type 8
014	Robot 21 home position	034	Exclusive robot 1 vehicle type 10	054	Exclusive robot 5 vehicle type 10	074	Exclusive robot 9 vehicle type 10
015	Robot 22 home position	035	Exclusive robot 1 vehicle type 20	055	Exclusive robot 5 vehicle type 20	075	Exclusive robot 9 vehicle type 20
016	Robot 23 home position	036	Exclusive robot 1 vehicle type 40	056	Exclusive robot 5 vehicle type 40	076	Exclusive robot 9 vehicle type 40
017	Robot 24 home position	037	Exclusive robot 1 vehicle type 80	057	Exclusive robot 5 vehicle type 80	077	Exclusive robot 9 vehicle type 80
018	Robot 25 home position	038	Exclusive robot 2 vehicle type 1	058	Exclusive robot 6 vehicle type 1	078	Exclusive robot 10 vehicle type 1
019	Robot 26 home position	039	Exclusive robot 2 vehicle type 2	059	Exclusive robot 6 vehicle type 2	079	Exclusive robot 10 vehicle type 2
01A	Robot 27 home position	03A	Exclusive robot 2 vehicle type 4	05A	Exclusive robot 6 vehicle type 4	07A	Exclusive robot 10 vehicle type 4
01B	Robot 28 home position	03B	Exclusive robot 2 vehicle type 8	05B	Exclusive robot 6 vehicle type 8	07B	Exclusive robot 10 vehicle type 8
01C	Robot 29 home position	03C	Exclusive robot 2 vehicle type 10	05C	Exclusive robot 6 vehicle type 10	07C	Exclusive robot 10 vehicle type 10
01D	Robot 30 home position	03D	Exclusive robot 2 vehicle type 20	05D	Exclusive robot 6 vehicle type 20	07D	Exclusive robot 10 vehicle type 20
01E	Robot 31 home position	03E	Exclusive robot 2 vehicle type 40	05E	Exclusive robot 6 vehicle type 40	07E	Exclusive robot 10 vehicle type 40
01F	Robot 32 home position	03F	Exclusive robot 2 vehicle type 80	05F	Exclusive robot 6 vehicle type 80	07F	Exclusive robot 10 vehicle type 80

EX	Name	EX	Name	EX	Name	EX	Name
080	Hold release	0A0	Exclusive robot 7 hold release	0E0	Step up reset 1	100	Jig interlock I17
081	Operation completion reset	0A1	Exclusive robot 7 completion reset	0E1	Step up reset 2	101	Jig interlock I18
082	First start	0A2	Exclusive robot 7 first start	0E2	Step up reset 3	102	Jig interlock I19
083	Second start	0A3	Exclusive robot 7 second start	0E3	Step up reset 4	103	Jig interlock I20
084	(Disabled)	0A4	Exclusive robot 8 hold release	0E4	Step up reset 5	104	Jig interlock I21
085	(Disabled)	0A5	Exclusive robot 8 completion reset	0E5	Step up reset 6	105	Jig interlock I22
086	(Disabled)	0A6	Exclusive robot 8 first start	0E6	Step up reset 7	106	Jig interlock I23
087	(Disabled)	0A7	Exclusive robot 8 second start	0E7	Step up reset 8	107	Jig interlock I24
088	Exclusive robot 1 hold release	0A8	Exclusive robot 9 hold release	0E8	Step up reset 9	108	Jig interlock I25
089	Exclusive robot 1 completion reset	0A9	Exclusive robot 9 completion reset	0E9	Step up reset 10	109	Jig interlock I26
08A	Exclusive robot 1 first start	0AA	Exclusive robot 9 first start	0EA	Step up reset 11	10A	Jig interlock I27
08B	Exclusive robot 1 second start	0AB	Exclusive robot 9 second start	0EB	Step up reset 12	10B	Jig interlock I28
08C	Exclusive robot 2 hold release	0AC	Exclusive robot 10 hold release	0EC	Step up reset 13	10C	Jig interlock I29
08D	Exclusive robot 2 completion reset	0AD	Exclusive robot 10 completion reset	0ED	Step up reset 14	10D	Jig interlock I30
08E	Exclusive robot 2 first start	0AE	Exclusive robot 10 first start	0EE	Step up reset 15	10E	Jig interlock I31
08F	Exclusive robot 2 second start	0AF	Exclusive robot 10 second start	0EF	Step up reset 16	10F	Jig interlock I32
090	Exclusive robot 3 hold release	0B0	(Drainage command)	0F0	Step up reset 17	110	(Expansion interlock)
091	Exclusive robot 3 completion reset	0B1	(Water stop command)	0F1	Step up reset 18	111	(Expansion interlock)
092	Exclusive robot 3 first start	0B2		0F2	Step up reset 19	112	(Expansion interlock)
093	Exclusive robot 3 second start	0B3		0F3	Step up reset 20	113	(Expansion interlock)
094	Exclusive robot 4 hold release	0B4		0F4	Step up reset 21	114	(Expansion interlock)
095	Exclusive robot 4 completion reset	0B5		0F5	Step up reset 22	115	(Expansion interlock)
096	Exclusive robot 4 first start	0B6		0F6	Step up reset 23	116	(Expansion interlock)
097	Exclusive robot 4 second start	0B7	Jig cleaning impossible	0F7	Step up reset 24	117	(Expansion interlock)
098	Exclusive robot 5 hold release	0B8	With the general tip exchange	0F8	Step up reset 25	118	(Expansion interlock)
099	Exclusive robot 5 completion reset	0B9	General completion of tip exchange	0F9	Step up reset 26	119	(Expansion interlock)
09A	Exclusive robot 5 first start	0BA	Tip exchange impossible	0FA	Step up reset 27	11A	(Expansion interlock)
09B	Exclusive robot 5 second start	0BB	Directions for a home position return	0FB	Step up reset 28	11B	(Expansion interlock)
09C	Exclusive robot 6 hold release	0BC	Robot synchronous	0FC	Step up reset 29	11C	(Expansion interlock)
09D	Exclusive robot 6 completion reset	0BD	Error reset	0FD	Step up reset 30	11D	(Expansion interlock)
09E	Exclusive robot 6 first start	0BE	Line individual mode	0FE	Step up reset 31	11E	(Expansion interlock)
09F	Exclusive robot 6 second start	0BF	Durable mode on	0FF	Step up reset 32	11F	(Expansion interlock)

* Signals EX0B0 to 0BF are shared with exclusive robots.

EX	Name	EX	Name	EX	Name	EX	Name
120	(Disabled)	140	Exclusive robot 1 interlock I17	160	Exclusive robot 2 interlock I17	180	Exclusive robot 3 interlock I17
121	(Disabled)	141	Exclusive robot 1 interlock I18	161	Exclusive robot 2 interlock I18	181	Exclusive robot 3 interlock I18
122	(Disabled)	142	Exclusive robot 1 interlock I19	162	Exclusive robot 2 interlock I19	182	Exclusive robot 3 interlock I19
123	(Disabled)	143	Exclusive robot 1 interlock I20	163	Exclusive robot 2 interlock I20	183	Exclusive robot 3 interlock I20
124	(Disabled)	144	Exclusive robot 1 interlock I21	164	Exclusive robot 2 interlock I21	184	Exclusive robot 3 interlock I21
125	(Disabled)	145	Exclusive robot 1 interlock I22	165	Exclusive robot 2 interlock I22	185	Exclusive robot 3 interlock I22
126	(Disabled)	146	Exclusive robot 1 interlock I23	166	Exclusive robot 2 interlock I23	186	Exclusive robot 3 interlock I23
127	(Disabled)	147	Exclusive robot 1 interlock I24	167	Exclusive robot 2 interlock I24	187	Exclusive robot 3 interlock I24
128	(Disabled)	148	Exclusive robot 1 interlock I25	168	Exclusive robot 2 interlock I25	188	Exclusive robot 3 interlock I25
129	(Disabled)	149	Exclusive robot 1 interlock I26	169	Exclusive robot 2 interlock I26	189	Exclusive robot 3 interlock I26
12A	(Disabled)	14A	Exclusive robot 1 interlock I27	16A	Exclusive robot 2 interlock I27	18A	Exclusive robot 3 interlock I27
12B	(Disabled)	14B	Exclusive robot 1 interlock I28	16B	Exclusive robot 2 interlock I28	18B	Exclusive robot 3 interlock I28
12C	(Disabled)	14C	Exclusive robot 1 interlock I29	16C	Exclusive robot 2 interlock I29	18C	Exclusive robot 3 interlock I29
12D	(Disabled)	14D	Exclusive robot 1 interlock I30	16D	Exclusive robot 2 interlock I30	18D	Exclusive robot 3 interlock I30
12E	(Disabled)	14E	Exclusive robot 1 interlock I31	16E	Exclusive robot 2 interlock I31	18E	Exclusive robot 3 interlock I31
12F	(Disabled)	14F	Exclusive robot 1 interlock I32	16F	Exclusive robot 2 interlock I32	18F	Exclusive robot 3 interlock I32
130	(Disabled)	150	Exclusive robot 1 interlock I1	170	Exclusive robot 2 interlock I1	190	Exclusive robot 3 interlock I1
131	(Disabled)	151	Exclusive robot 1 interlock I2	171	Exclusive robot 2 interlock I2	191	Exclusive robot 3 interlock I2
132	(Disabled)	152	Exclusive robot 1 interlock I3	172	Exclusive robot 2 interlock I3	192	Exclusive robot 3 interlock I3
133	(Disabled)	153	Exclusive robot 1 interlock I4	173	Exclusive robot 2 interlock I4	193	Exclusive robot 3 interlock I4
134	(Disabled)	154	Exclusive robot 1 interlock I5	174	Exclusive robot 2 interlock I5	194	Exclusive robot 3 interlock I5
135	(Disabled)	155	Exclusive robot 1 interlock I6	175	Exclusive robot 2 interlock I6	195	Exclusive robot 3 interlock I6
136	(Disabled)	156	Exclusive robot 1 interlock I7	176	Exclusive robot 2 interlock I7	196	Exclusive robot 3 interlock I7
137	(Disabled)	157	Exclusive robot 1 interlock I8	177	Exclusive robot 2 interlock I8	197	Exclusive robot 3 interlock I8
138	(Disabled)	158	Exclusive robot 1 interlock I9	178	Exclusive robot 2 interlock I9	198	Exclusive robot 3 interlock I9
139	(Disabled)	159	Exclusive robot 1 interlock I10	179	Exclusive robot 2 interlock I10	199	Exclusive robot 3 interlock I10
13A	(Disabled)	15A	Exclusive robot 1 interlock I11	17A	Exclusive robot 2 interlock I11	19A	Exclusive robot 3 interlock I11
13B	(Disabled)	15B	Exclusive robot 1 interlock I12	17B	Exclusive robot 2 interlock I12	19B	Exclusive robot 3 interlock I12
13C	(Disabled)	15C	Exclusive robot 1 interlock I13	17C	Exclusive robot 2 interlock I13	19C	Exclusive robot 3 interlock I13
13D	(Disabled)	15D	Exclusive robot 1 interlock I14	17D	Exclusive robot 2 interlock I14	19D	Exclusive robot 3 interlock I14
13E	(Disabled)	15E	Exclusive robot 1 interlock I15	17E	Exclusive robot 2 interlock I15	19E	Exclusive robot 3 interlock I15
13F	(Disabled)	15F	Exclusive robot 1 interlock I16	17F	Exclusive robot 2 interlock I16	19F	Exclusive robot 3 interlock I16

EX	Name	EX	Name	EX	Name	EX	Name
1A0	Exclusive robot 4 interlock I17	1C0	Exclusive robot 5 interlock I17	1E0	Exclusive robot 6 interlock I17	200	Exclusive robot 7 interlock I17
1A1	Exclusive robot 4 interlock I18	1C1	Exclusive robot 5 interlock I18	1E1	Exclusive robot 6 interlock I18	201	Exclusive robot 7 interlock I18
1A2	Exclusive robot 4 interlock I19	1C2	Exclusive robot 5 interlock I19	1E2	Exclusive robot 6 interlock I19	202	Exclusive robot 7 interlock I19
1A3	Exclusive robot 4 interlock I20	1C3	Exclusive robot 5 interlock I20	1E3	Exclusive robot 6 interlock I20	203	Exclusive robot 7 interlock I20
1A4	Exclusive robot 4 interlock I21	1C4	Exclusive robot 5 interlock I21	1E4	Exclusive robot 6 interlock I21	204	Exclusive robot 7 interlock I21
1A5	Exclusive robot 4 interlock I22	1C5	Exclusive robot 5 interlock 22	1E5	Exclusive robot 6 interlock I22	205	Exclusive robot 7 interlock I22
1A6	Exclusive robot 4 interlock I23	1C6	Exclusive robot 5 interlock I23	1E6	Exclusive robot 6 interlock I23	206	Exclusive robot 7 interlock I23
1A7	Exclusive robot 4 interlock I24	1C7	Exclusive robot 5 interlock I24	1E7	Exclusive robot 6 interlock I24	207	Exclusive robot 7 interlock I24
1A8	Exclusive robot 4 interlock I25	1C8	Exclusive robot 5 interlock I25	1E8	Exclusive robot 6 interlock I25	208	Exclusive robot 7 interlock I25
1A9	Exclusive robot 4 interlock I26	1C9	Exclusive robot 5 interlock I26	1E9	Exclusive robot 6 interlock I26	209	Exclusive robot 7 interlock I26
1AA	Exclusive robot 4 interlock I27	1CA	Exclusive robot 5 interlock I27	1EA	Exclusive robot 6 interlock I27	20A	Exclusive robot 7 interlock I27
1AB	Exclusive robot 4 interlock I28	1CB	Exclusive robot 5 interlock I28	1EB	Exclusive robot 6 interlock I28	20B	Exclusive robot 7 interlock I28
1AC	Exclusive robot 4 interlock I29	1CC	Exclusive robot 5 interlock I29	1EC	Exclusive robot 6 interlock I29	20C	Exclusive robot 7 interlock I29
1AD	Exclusive robot 4 interlock I30	1CD	Exclusive robot 5 interlock I30	1ED	Exclusive robot 6 interlock I30	20D	Exclusive robot 7 interlock I30
1AE	Exclusive robot 4 interlock I31	1CE	Exclusive robot 5 interlock I31	1EE	Exclusive robot 6 interlock I31	20E	Exclusive robot 7 interlock I31
1AF	Exclusive robot 4 interlock I32	1CF	Exclusive robot 5 interlock I32	1EF	Exclusive robot 6 interlock I32	20F	Exclusive robot 7 interlock I32
1B0	Exclusive robot 4 interlock I1	1D0	Exclusive robot 5 interlock I1	1F0	Exclusive robot 6 interlock I1	210	Exclusive robot 7 interlock I1
1B1	Exclusive robot 4 interlock I2	1D1	Exclusive robot 5 interlock I2	1F1	Exclusive robot 6 interlock I2	211	Exclusive robot 7 interlock I2
1B2	Exclusive robot 4 interlock I3	1D2	Exclusive robot 5 interlock I3	1F2	Exclusive robot 6 interlock I3	212	Exclusive robot 7 interlock I3
1B3	Exclusive robot 4 interlock I4	1D3	Exclusive robot 5 interlock I4	1F3	Exclusive robot 6 interlock I4	213	Exclusive robot 7 interlock I4
1B4	Exclusive robot 4 interlock I5	1D4	Exclusive robot 5 interlock I5	1F4	Exclusive robot 6 interlock I5	214	Exclusive robot 7 interlock I5
1B5	Exclusive robot 4 interlock I6	1D5	Exclusive robot 5 interlock I6	1F5	Exclusive robot 6 interlock I6	215	Exclusive robot 7 interlock I6
1B6	Exclusive robot 4 interlock I7	1D6	Exclusive robot 5 interlock I7	1F6	Exclusive robot 6 interlock I7	216	Exclusive robot 7 interlock I7
1B7	Exclusive robot 4 interlock I8	1D7	Exclusive robot 5 interlock I8	1F7	Exclusive robot 6 interlock I8	217	Exclusive robot 7 interlock I8
1B8	Exclusive robot 4 interlock I9	1D8	Exclusive robot 5 interlock I9	1F8	Exclusive robot 6 interlock I9	218	Exclusive robot 7 interlock I9
1B9	Exclusive robot 4 interlock I10	1D9	Exclusive robot 5 interlock I10	1F9	Exclusive robot 6 interlock I10	219	Exclusive robot 7 interlock I10
1BA	Exclusive robot 4 interlock I11	1DA	Exclusive robot 5 interlock I11	1FA	Exclusive robot 6 interlock I11	21A	Exclusive robot 7 interlock I11
1BB	Exclusive robot 4 interlock I12	1DB	Exclusive robot 5 interlock I12	1FB	Exclusive robot 6 interlock I12	21B	Exclusive robot 7 interlock I12
1BC	Exclusive robot 4 interlock I13	1DC	Exclusive robot 5 interlock I13	1FC	Exclusive robot 6 interlock I13	21C	Exclusive robot 7 interlock I13
1BD	Exclusive robot 4 interlock I14	1DD	Exclusive robot 5 interlock I14	1FD	Exclusive robot 6 interlock I14	21D	Exclusive robot 7 interlock I14
1BE	Exclusive robot 4 interlock I15	1DE	Exclusive robot 5 interlock I15	1FE	Exclusive robot 6 interlock I15	21E	Exclusive robot 7 interlock I15
1BF	Exclusive robot 4 interlock I16	1DF	Exclusive robot 5 interlock I16	1FF	Exclusive robot 6 interlock I16	21F	Exclusive robot 7 interlock I16

EX	Name	EX	Name	EX	Name	EX	Name
220	Exclusive robot 8 interlock I17	240	Exclusive robot 9 interlock I17	260	Exclusive robot 10 interlock I17	280	(S location) Clamp command 1
221	Exclusive robot 8 interlock I18	241	Exclusive robot 9 interlock I18	261	Exclusive robot 10 interlock I18	281	(S location) Clamp command 2
222	Exclusive robot 8 interlock I19	242	Exclusive robot 9 interlock I19	262	Exclusive robot 10 interlock I19	282	(S location) Clamp command 3
223	Exclusive robot 8 interlock I20	243	Exclusive robot 9 interlock I20	263	Exclusive robot 10 interlock I20	283	(S location) Clamp command 4
224	Exclusive robot 8 interlock I21	244	Exclusive robot 9 interlock I21	264	Exclusive robot 10 interlock I21	284	(S location) Clamp command 5
225	Exclusive robot 8 interlock I22	245	Exclusive robot 9 interlock I22	265	Exclusive robot 10 interlock I22	285	(S location) Clamp command 6
226	Exclusive robot 8 interlock I23	246	Exclusive robot 9 interlock I23	266	Exclusive robot 10 interlock I23	286	(S location) Clamp command 7
227	Exclusive robot 8 interlock I24	247	Exclusive robot 9 interlock I24	267	Exclusive robot 10 interlock I24	287	(S location) Clamp command 8
228	Exclusive robot 8 interlock I25	248	Exclusive robot 9 interlock I25	268	Exclusive robot 10 interlock I25	288	(S location) Clamp command 9
229	Exclusive robot 8 interlock I26	249	Exclusive robot 9 interlock I26	269	Exclusive robot 10 interlock I26	289	(S location) Clamp command 10
22A	Exclusive robot 8 interlock I27	24A	Exclusive robot 9 interlock I27	26A	Exclusive robot 10 interlock I27	28A	(S location) Clamp command 11
22B	Exclusive robot 8 interlock I28	24B	Exclusive robot 9 interlock I28	26B	Exclusive robot 10 interlock I28	28B	(S location) Clamp command 12
22C	Exclusive robot 8 interlock I29	24C	Exclusive robot 9 interlock I29	26C	Exclusive robot 10 interlock I29	28C	(S location) Clamp command 13
22D	Exclusive robot 8 interlock I30	24D	Exclusive robot 9 interlock I30	26D	Exclusive robot 10 interlock I30	28D	(S location) Clamp command 14
22E	Exclusive robot 8 interlock I31	24E	Exclusive robot 9 interlock I31	26E	Exclusive robot 10 interlock I31	28E	(S location) Clamp command 15
22F	Exclusive robot 8 interlock I32	24F	Exclusive robot 9 interlock I32	26F	Exclusive robot 10 interlock I32	28F	(S location) Clamp command 16
230	Exclusive robot 8 interlock I1	250	Exclusive robot 9 interlock I1	270	Exclusive robot 10 interlock I1	290	(S location) Clamp command 17
231	Exclusive robot 8 interlock I2	251	Exclusive robot 9 interlock I2	271	Exclusive robot 10 interlock I2	291	(S location) Clamp command 18
232	Exclusive robot 8 interlock I3	252	Exclusive robot 9 interlock I3	272	Exclusive robot 10 interlock I3	292	(S location) Clamp command 19
233	Exclusive robot 8 interlock I4	253	Exclusive robot 9 interlock I4	273	Exclusive robot 10 interlock I4	293	(S location) Clamp command 20
234	Exclusive robot 8 interlock I5	254	Exclusive robot 9 interlock I5	274	Exclusive robot 10 interlock I5	294	(S location) Clamp command 21
235	Exclusive robot 8 interlock I6	255	Exclusive robot 9 interlock I6	275	Exclusive robot 10 interlock I6	295	(S location) Clamp command 22
236	Exclusive robot 8 interlock I7	256	Exclusive robot 9 interlock I7	276	Exclusive robot 10 interlock I7	296	(S location) Clamp command 23
237	Exclusive robot 8 interlock I8	257	Exclusive robot 9 interlock I8	277	Exclusive robot 10 interlock I8	297	(S location) Clamp command 24
238	Exclusive robot 8 interlock I9	258	Exclusive robot 9 interlock I9	278	Exclusive robot 10 interlock I9	298	(S location) Clamp command 25
239	Exclusive robot 8 interlock I10	259	Exclusive robot 9 interlock I10	279	Exclusive robot 10 interlock I10	299	(S location) Clamp command 26
23A	Exclusive robot 8 interlock I11	25A	Exclusive robot 9 interlock I11	27A	Exclusive robot 10 interlock I11	29A	(S location) Clamp command 27
23B	Exclusive robot 8 interlock I12	25B	Exclusive robot 9 interlock I12	27B	Exclusive robot 10 interlock I12	29B	(S location) Clamp command 28
23C	Exclusive robot 8 interlock I13	25C	Exclusive robot 9 interlock I13	27C	Exclusive robot 10 interlock I13	29C	(S location) Clamp command 29
23D	Exclusive robot 8 interlock I14	25D	Exclusive robot 9 interlock I14	27D	Exclusive robot 10 interlock I14	29D	(S location) Clamp command 30
23E	Exclusive robot 8 interlock I15	25E	Exclusive robot 9 interlock I15	27E	Exclusive robot 10 interlock I15	29E	(S location) Clamp command 31
23F	Exclusive robot 8 interlock I16	25F	Exclusive robot 9 interlock I16	27F	Exclusive robot 10 interlock I16	29F	(S location) Clamp command 32

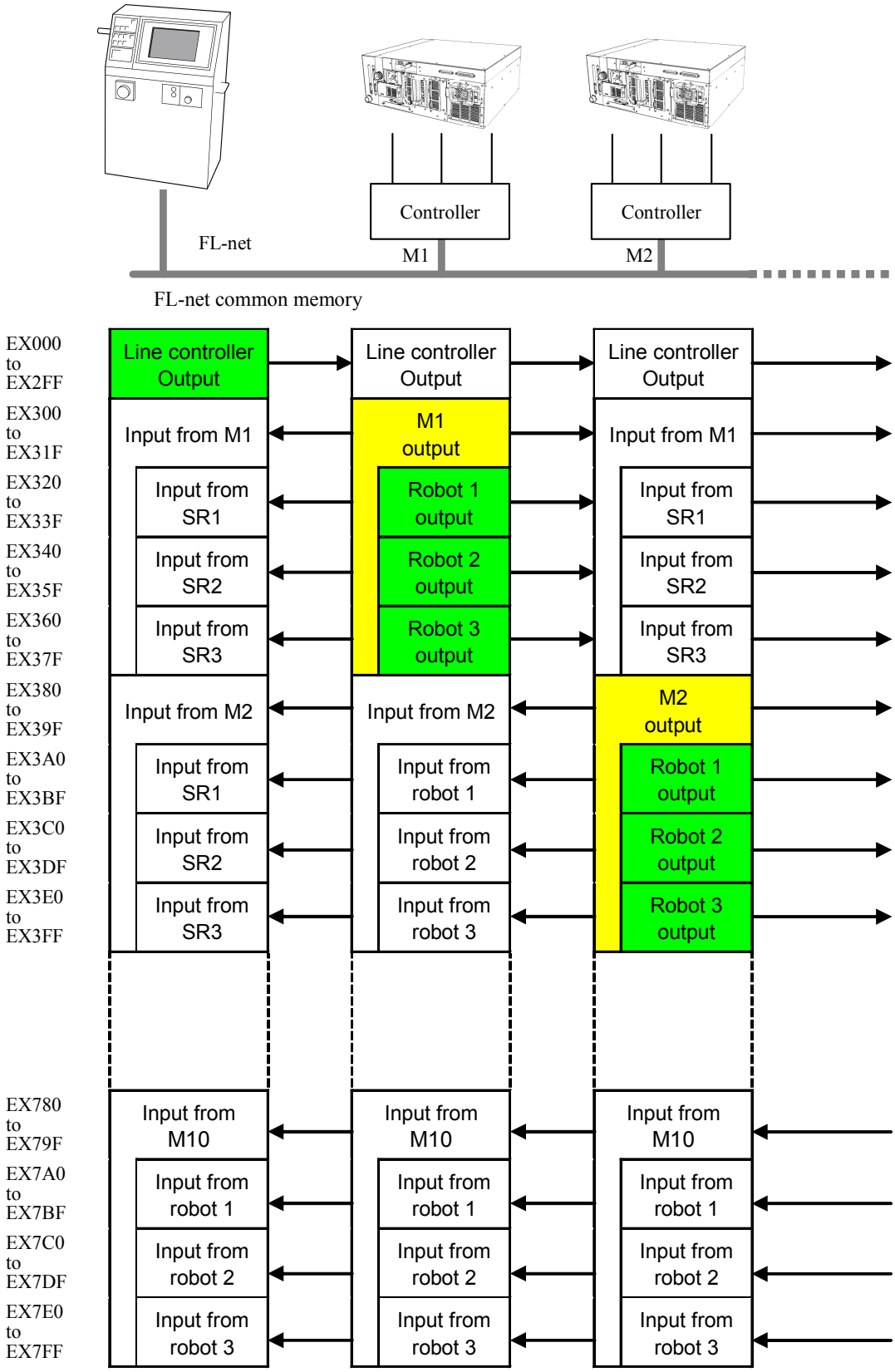
EX	Name	EX	Name	EX	Name
2A0	(S location) Unclamp command 1	2C0	Exclusive robot 1 data 3 1	2E0	Exclusive robot 3 data 3 1
2A1	(S location) Unclamp command 2	2C1	Exclusive robot 1 data 3 2	2E1	Exclusive robot 3 data 3 2
2A2	(S location) Unclamp command 3	2C2	Exclusive robot 1 data 3 4	2E2	Exclusive robot 3 data 3 4
2A3	(S location) Unclamp command 4	2C3	Exclusive robot 1 data 3 8	2E3	Exclusive robot 3 data 3 8
2A4	(S location) Unclamp command 5	2C4	Exclusive robot 1 data 3 16	2E4	Exclusive robot 3 data 3 16
2A5	(S location) Unclamp command 6	2C5	Exclusive robot 1 data 3 32	2E5	Exclusive robot 3 data 3 32
2A6	(S location) Unclamp command 7	2C6	Exclusive robot 1 data 3 64	2E6	Exclusive robot 3 data 3 64
2A7	(S location) Unclamp command 8	2C7	Exclusive robot 1 data 3 128	2E7	Exclusive robot 3 data 3 128
2A8	(S location) Unclamp command 9	2C8	Exclusive robot 1 data 4 1	2E8	Exclusive robot 3 data 4 1
2A9	(S location) Unclamp command 10	2C9	Exclusive robot 1 data 4 2	2E9	Exclusive robot 3 data 4 2
2AA	(S location) Unclamp command 11	2CA	Exclusive robot 1 data 4 4	2EA	Exclusive robot 3 data 4 4
2AB	(S location) Unclamp command 12	2CB	Exclusive robot 1 data 4 8	2EB	Exclusive robot 3 data 4 8
2AC	(S location) Unclamp command 13	2CC	Exclusive robot 1 data 4 16	2EC	Exclusive robot 3 data 4 16
2AD	(S location) Unclamp command 14	2CD	Exclusive robot 1 data 4 32	2ED	Exclusive robot 3 data 4 32
2AE	(S location) Unclamp command 15	2CE	Exclusive robot 1 data 4 64	2EE	Exclusive robot 3 data 4 64
2AF	(S location) Unclamp command 16	2CF	Exclusive robot 1 data 4 128	2EF	Exclusive robot 3 data 4 128
2B0	(S location) Unclamp command 17	2D0	Exclusive robot 2 data 3 1	2F0	Exclusive robot 4 data 3 1
2B1	(S location) Unclamp command 18	2D1	Exclusive robot 2 data 3 2	2F1	Exclusive robot 4 data 3 2
2B2	(S location) Unclamp command 19	2D2	Exclusive robot 2 data 3 4	2F2	Exclusive robot 4 data 3 4
2B3	(S location) Unclamp command 20	2D3	Exclusive robot 2 data 3 8	2F3	Exclusive robot 4 data 3 8
2B4	(S location) Unclamp command 21	2D4	Exclusive robot 2 data 3 16	2F4	Exclusive robot 4 data 3 16
2B5	(S location) Unclamp command 22	2D5	Exclusive robot 2 data 3 32	2F5	Exclusive robot 4 data 3 32
2B6	(S location) Unclamp command 23	2D6	Exclusive robot 2 data 3 64	2F6	Exclusive robot 4 data 3 64
2B7	(S location) Unclamp command 24	2D7	Exclusive robot 2 data 3 128	2F7	Exclusive robot 4 data 3 128
2B8	(S location) Unclamp command 25	2D8	Exclusive robot 2 data 4 1	2F8	Exclusive robot 4 data 4 1
2B9	(S location) Unclamp command 26	2D9	Exclusive robot 2 data 4 2	2F9	Exclusive robot 4 data 4 2
2BA	(S location) Unclamp command 27	2DA	Exclusive robot 2 data 4 4	2FA	Exclusive robot 4 data 4 4
2BB	(S location) Unclamp command 28	2DB	Exclusive robot 2 data 4 8	2FB	Exclusive robot 4 data 4 8
2BC	(S location) Unclamp command 29	2DC	Exclusive robot 2 data 4 16	2FC	Exclusive robot 4 data 4 16
2BD	(S location) Unclamp command 30	2DD	Exclusive robot 2 data 4 32	2FD	Exclusive robot 4 data 4 32
2BE	(S location) Unclamp command 31	2DE	Exclusive robot 2 data 4 64	2FE	Exclusive robot 4 data 4 64
2BF	(S location) Unclamp command 32	2DF	Exclusive robot 2 data 4 128	2FF	Exclusive robot 4 data 4 128

(3) Address and RPS initial value (BCD) for each vehicle type

T0							
Vehicle type	**Register**		**Value**	**Vehicle type**	**Register**		**Value**
00	D000	L	00	50	D019	L	50
01		H	01	51		H	51
02	D001	L	02	52	D01A	L	52
03		H	03	53		H	53
04	D002	L	04	54	D01B	L	54
05		H	05	55		H	55
06	D003	L	06	56	D01C	L	56
07		H	07	57		H	57
08	D004	L	08	58	D01D	L	58
09		H	09	59		H	59
10	D005	L	10	60	D01E	L	60
11		H	11	61		H	61
12	D006	L	12	62	D01F	L	62
13		H	13	63		H	63
14	D007	L	14	64	D020	L	64
15		H	15	65		H	65
16	D008	L	16	66	D021	L	66
17		H	17	67		H	67
18	D009	L	18	68	D022	L	68
19		H	19	69		H	69
20	D00A	L	20	70	D023	L	70
21		H	21	71		H	71
22	D00B	L	22	72	D024	L	72
23		H	23	73		H	73
24	D00C	L	24	74	D025	L	74
25		H	25	75		H	75
26	D00D	L	26	76	D026	L	76
27		H	27	77		H	77
28	D00E	L	28	78	D027	L	78
29		H	29	79		H	79
30	D00F	L	30	80	D028	L	80
31		H	31	81		H	81
32	D010	L	32	82	D029	L	82
33		H	33	83		H	83
34	D011	L	34	84	D02A	L	84
35		H	35	85		H	85
36	D012	L	36	86	D02B	L	86
37		H	37	87		H	87
38	D013	L	38	88	D02C	L	88
39		H	39	89		H	89
40	D014	L	40	90	D02D	L	90
41		H	41	91		H	91
42	D015	L	42	92	D02E	L	92
43		H	43	93		H	93
44	D016	L	44	94	D02F	L	94
45		H	45	95		H	95
46	D017	L	46	96	D030	L	96
47		H	47	97		H	97
48	D018	L	48	98	D031	L	98
49		H	49	99		H	99

1.8.3 Line Controller ← Robot

(1) Address assignment map



(2) Address tables

Module

Address	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
M	EY300	EY380	EY400	EY480	EY500	EY580	EY600	EY680	EY700	EY780

EY	Module-M	Description
+00	Master on completion	
+01	Auto	
+02	All operation completion	
+03	Synthetic error	
+04	Servo on robot exists	
+05	Teaching	
+06	Teaching mode	
+07	Play mode	
+08	All robot home position	
+09	All robot return to home position valid area	
+0A		
+0B		
+0C		
+0D		
+0E		
+0F	Watchdog	
+10		
+11		
+12		
+13		
+14		
+15		
+16		
+17		
+18		
+19		
+1A		
+1B		
+1C		
+1D		
+1E		
+1F		

Robot

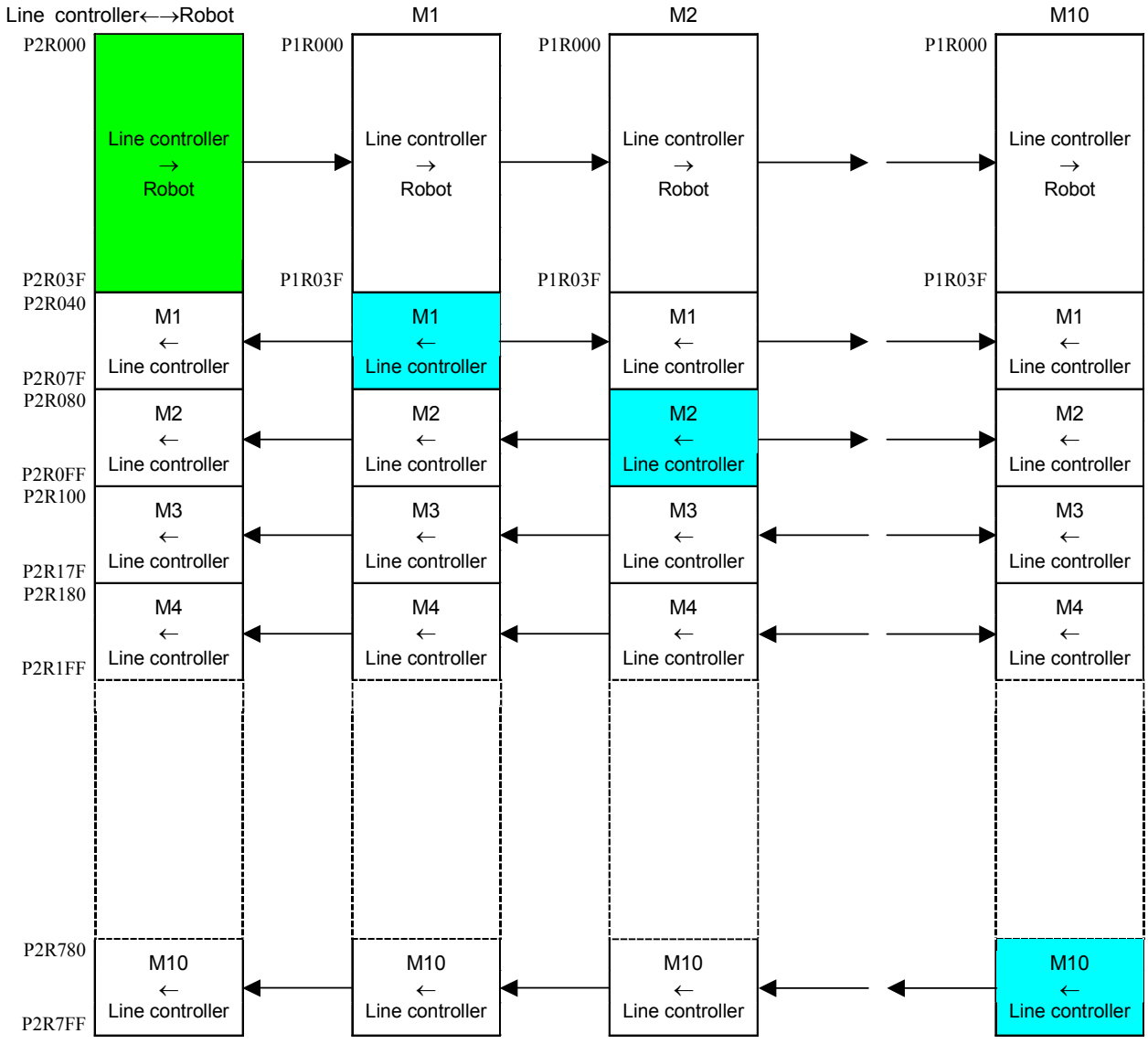
Address	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
SR1	EY320	EY3A0	EY420	EY4A0	EY520	EY5A0	EY620	EY6A0	EY720	EY7A0
SR2	EY340	EY3C0	EY440	EY4C0	EY540	EY5C0	EY640	EY6C0	EY740	EY7C0
SR3	EY360	EY3E0	EY460	EY4E0	EY560	EY5E0	EY660	EY6E0	EY760	EY7E0

EY	Module robot SR1 to SR3	Description
+00	Effective (Not during connection cutting)	
+01	Connection cutting available	
+02	Operation completion	
+03	Error	
+04	Servo on	
+05		
+06		
+07		
+08	Home position (home position 1)	
+09	Return to home position valid area (home position 2)	
+0A	(home position 3)	
+0B	(home position 4)	
+0C	Interference interlock 1	
+0D	Interference interlock 2	
+0E	Interference interlock 3	
+0F	Interference interlock 4	
+10	Jig interlock O17	
+11	Jig interlock O18	
+12	Jig interlock O19	
+13	Jig interlock O20	
+14	Jig interlock O21	
+15	Jig interlock O22	
+16	Jig interlockO23	
+17	Jig interlock O24	
+18	Jig interlock O25	
+19	Jig interlock O26	
+1A	Jig interlock O27	
+1B	Jig interlock O28	
+1C	Jig interlock O29	
+1D	Jig interlock O30	
+1E	Jig interlock O31	
+1F	Jig interlock O32	

1.9 FL-net Register Link

1.9.1 Address Map

One module occupies 128-word areas. Up to ten modules can be configured.
Note that, when checking the robot interface circuits, the addresses in robot modules are P1-R***, and ones in line controllers are P2-R***.



The address spaces in line controllers are P2-R000 to P2-R03F.
The address spaces in module 1 are P1-R040 to P1-R07F.

1.9.2 Line Controller → Robot

(1) Address tables

R	Name	Type	R	Name *2		Type
000	Standard watch, year/month	BCD	020	Exclusive robot 1 data 2 / 1		BIN
				M1 jig interlock I1 to I16		BIT
001	Standard watch, day/hour	BCD	021	Exclusive robot 2 data 2 / 1		BIN
				M2 jig interlock I1 to I16		BIT
002	Standard watch, minute/second	BCD	022	Exclusive robot 3 data 2 / 1		BIN
				M3 jig interlock I1 to I16		BIT
003	Standard watch, vacancy/day	BCD	023	Exclusive robot 4 data 2 / 1		BIN
				M4 jig interlock I1 to I16		BIT
004	Standard watch write flag (0 bit)	BIT	024	Exclusive robot 5 data 2 / 1		BIN
				M5 jig interlock I1 to I16		BIT
005	Serial number	BCD *1	025	Exclusive robot 6 data 2 / 1		BIN
				M6 jig interlock I1 to I16		BIT
006	Vehicle type	BCD	026	Exclusive robot 7 data 2 / 1		BIN
				M7 jig interlock I1 to I16		BIT
007	Sequence wait	BIT	027	Exclusive robot 8 data 2 / 1		BIN
				M8 jig interlock I1 to I16		BIT
008	Area 1 request record ID number	BCD	028	SR1_RNo.	SR1_MNo.	HEX/BCD
009	Area 2 request record ID number	BCD	029	SR2_RNo.	SR2_MNo.	HEX/BCD
00A			02A	SR3_RNo.	SR3_MNo.	HEX/BCD
00B			02B	SR4_RNo.	SR4_MNo.	HEX/BCD
00C			02C	SR5_RNo.	SR5_MNo.	HEX/BCD
00D			02D	SR6_RNo.	SR6_MNo.	HEX/BCD
00E	Master operation button	BIT	02E	SR7_RNo.	SR7_MNo.	HEX/BCD
00F		BIT	02F	SR8_RNo.	SR8_MNo.	HEX/BCD
010	SR1 operation button	BIT	030	M1 master operation button		BIT
011	SR1 operation button	BIT	031	M1 master operation button		BIT
012	SR2 operation button	BIT	032	M2 master operation button		BIT
013	SR2 operation button	BIT	033	M2 master operation button		BIT
014	SR3 operation button	BIT	034	M3 master operation button		BIT
015	SR3 operation button	BIT	035	M3 master operation button		BIT
016	SR4 operation button	BIT	036	M4 master operation button		BIT
017	SR4 operation button	BIT	037	M4 master operation button		BIT
018	SR5 operation button	BIT	038	M5 master operation button		BIT
019	SR5 operation button	BIT	039	M5 master operation button		BIT
01A	SR6 operation button	BIT	03A	M6 master operation button		BIT
01B	SR6 operation button	BIT	03B	M6 master operation button		BIT
01C	SR7 operation button	BIT	03C	M7 master operation button		BIT
01D	SR7 operation button	BIT	03D	M7 master operation button		BIT
01E	SR8 operation button	BIT	03E	M8 master operation button		BIT
01F	SR8 operation button	BIT	03F	M8 master operation button		BIT

*1 Serial numbers inputted from ALC are usually expressed in the form of 0000 to 0999; ones manually entered are expressed in F000 to F999 (with "F" at their head, and the lower 3 digits are binary coded decimal).

*2 Signals M1 to M8 jig interlock I1 to I16 are only for material handling robots.

All purposes common

Address	Name	Signal pattern	Description
R00E-0	Auto		
1	Individual		
2	Teach		
3			
4			
5	Home position return button		
6	Individual aux		
7	Error reset		
8			
9	Speed regulation command		
A	Robot start		
B	Robot stop		While this signal is being inputted, the system stops all tasks.
C	Hold release		
D	Hold-run		While this signal is being inputted, the system holds all individual sub tasks without holding master tasks.
E	Advance		
F	Return		

(2) R010-0 to R01F-F: Robot operation buttons for SR1 to SR8 robots

To use these signals, remote operation definition signals R28 to R2F are required. Without the definition signals, all of these signals are applied to M1.

Robot	SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8
Head address	R010	R012	R014	R016	R018	R01A	R01C	R01E

All purposes common

Address	Name	Signal pattern	Description
+00	Operation completion set		
+01	Operation completion reset		
+02	Home position return select		Commonly used with Advance button
+03	Connection cutting off		
+04	JOG operation shaft select code 1		Commonly used with Advance and Return buttons
+05	JOG operation shaft select code 2		Commonly used with Advance and Return buttons
+06	JOG operation shaft select code 4		Commonly used with Advance and Return buttons
+07	JOG operation shaft select code 8		Commonly used with Advance and Return buttons

These signals are used in P1 of TOYOPUC PLC, so assignment change by the equipment manufacturer is not allowed.

JOG operation selection code (BIN)

Address	Name	Description
0	(Not used.)	To prevent malfunction, do not use.
1	X-axis in Cartesian coordinates	
2	Y-axis in Cartesian coordinates	
3	Z-axis in Cartesian coordinates	
4	X-axis in tool coordinates	
5	Y-axis in tool coordinates	
6	Z-axis in tool coordinates	
7	1st-axis in link coordinates	
8	2nd-axis in link coordinates	
9	3rd-axis in link coordinates	
10	4th-axis in link coordinates	
11	5th-axis in link coordinates	
12	6th-axis in link coordinates	
13	7th-axis in link coordinates	
14		
15		

For material handling robots and exclusive robots

Address	Name	Signal pattern	Description
+10	Clamp 1		
+11	Unclamp 1		
+12	Clamp 2		
+13	Unclamp 2		
+14	Clamp 3		
+15	Unclamp 3		
+16	Clamp 4		
+17	Unclamp 4		
+18	Air blow		
+19	Tool 2 select		
+1A	Tool 3 select		
+1B	Tool 4 select		
+1C	Adsorption 1		
+1D	Destruction 1		
+1E	Adsorption 2		
+1F	Destruction 2		

If the actual tool configuration does not fit the signal assignment shown above, equipment manufacturers can change the assignment.

These signals are used in P2 of TOYOPUC PLC.

(3) R020 to 027: Exclusive robots 1 to 8, Data 1 and 2

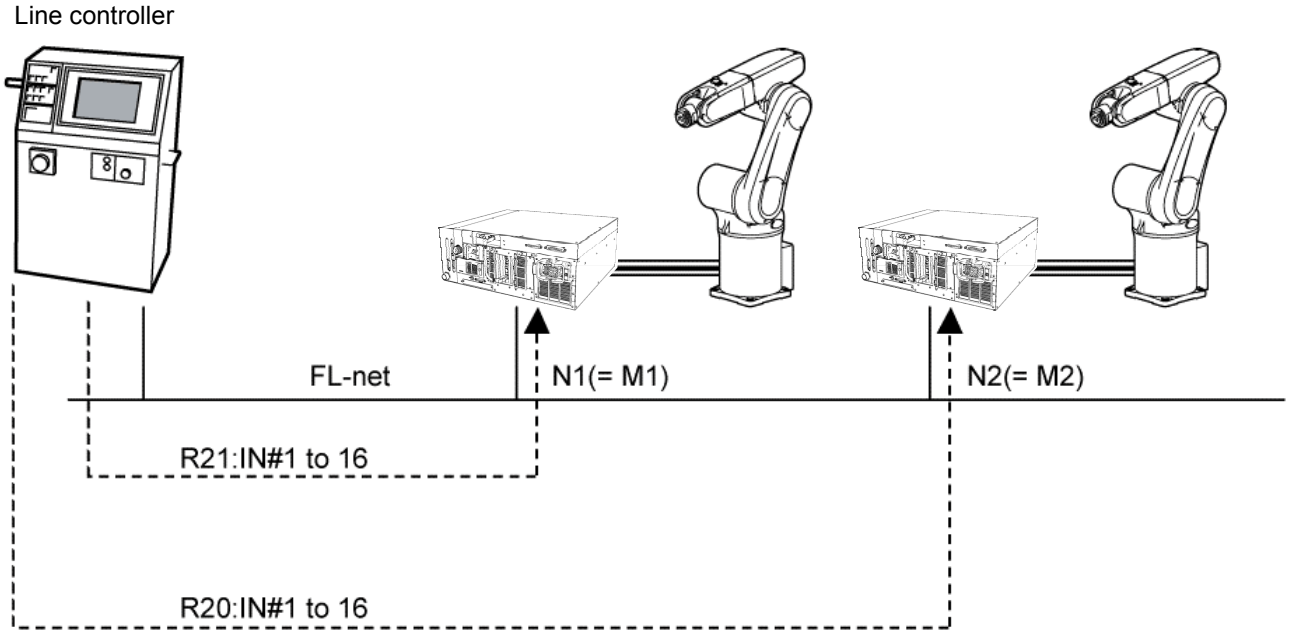
These signals are used to send values from the line controller to the robot program in palletizing or other operations.
These signals can be used only for exclusive robots. To change the purpose of robots, use the robot parameters.

Exclusive robots								Purpose
1	2	3	4	5	6	7	8	
P3-R20L	P3-R21L	P3-R22L	P3-R23L	P3-R24L	P3-R25L	P3-R26L	P3-R27L	Data 1 (BIN)
P3-R20H	P3-R21H	P3-R22H	P3-R23H	P3-R24H	P3-R25H	P3-R26H	P3-R27H	Data 2 (BIN)
EX2CL	EX2DL	EX2EL	EX2FL	-	-	-	-	Data 3 (BIN)
EX2CH	EX2DH	EX2EH	EX2FH	-	-	-	-	Data 4 (BIN)

* Data 3 and 4 can be used only for exclusive robots 1 to 4.

(4) R020 to 027: M1 to M8 jig interlock

These signals can be used only for material handling robots.
Material handling robots, which use many jig interlocks, can use the user-input signals IN#1 to 16 as jig interlocks. Because of this, these robots cannot use the user-input/output signals IN/OUT#1 to 16 as interlocks between robots.
You can assign different signal for each node number (i.e. module number) for jig interlocks.

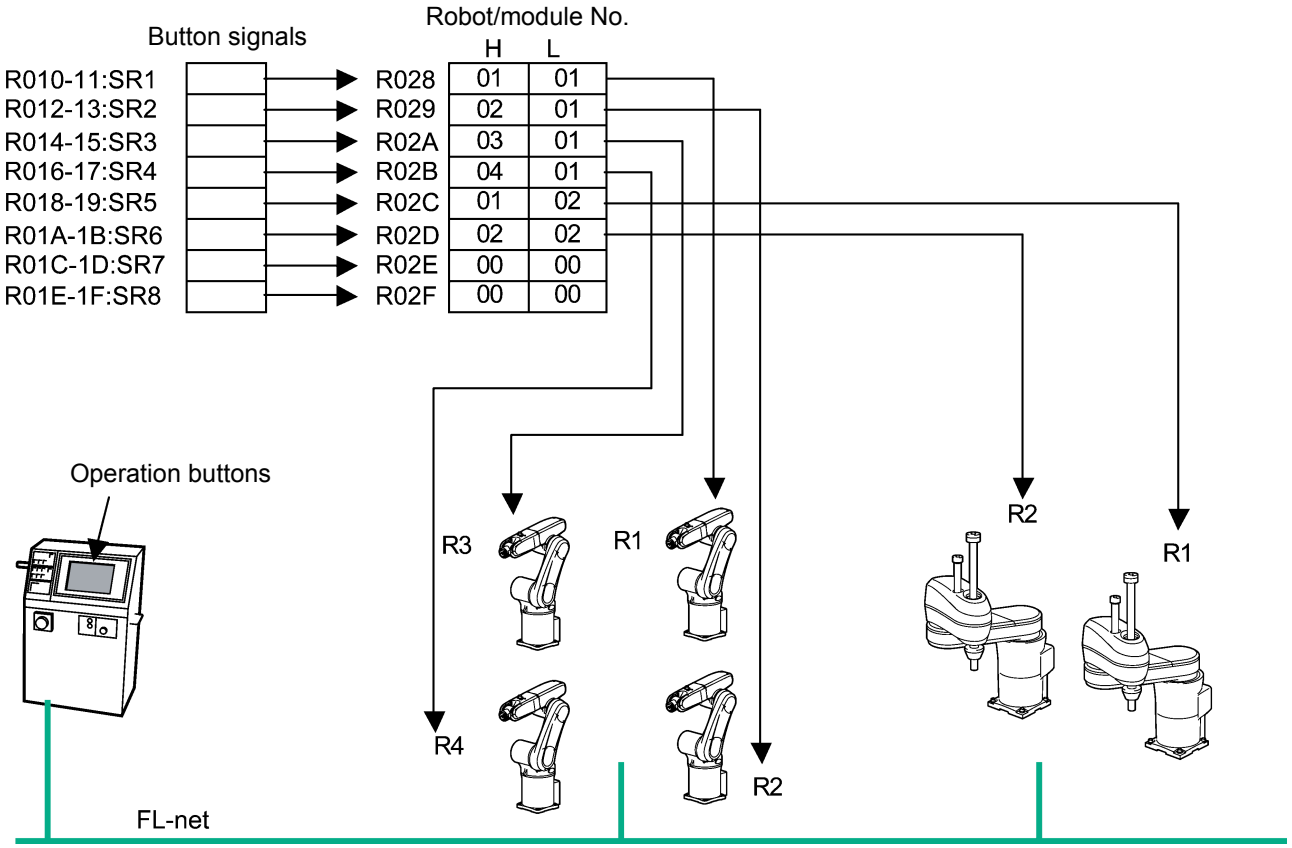


(5) R028 to R02F: Remote operation definition

These signals define connection relationship between the remote operation buttons R10 to R1F and the robots.

Address	Name		Data type	Description
	H	L		
R028	SR1 robot No.	SR1 module No.	HEX	
R029	SR2 robot No.	SR2 module No.	HEX	
R02A	SR3 robot No.	SR3 module No.	HEX	
R02B	SR4 robot No.	SR4 module No.	HEX	
R02C	SR5 robot No.	SR5 module No.	HEX	
R02D	SR6 robot No.	SR6 module No.	HEX	
R02E	SR7 robot No.	SR7 module No.	HEX	
R02F	SR8 robot No.	SR8 module No.	HEX	

A conceptual diagram for signals is given below.

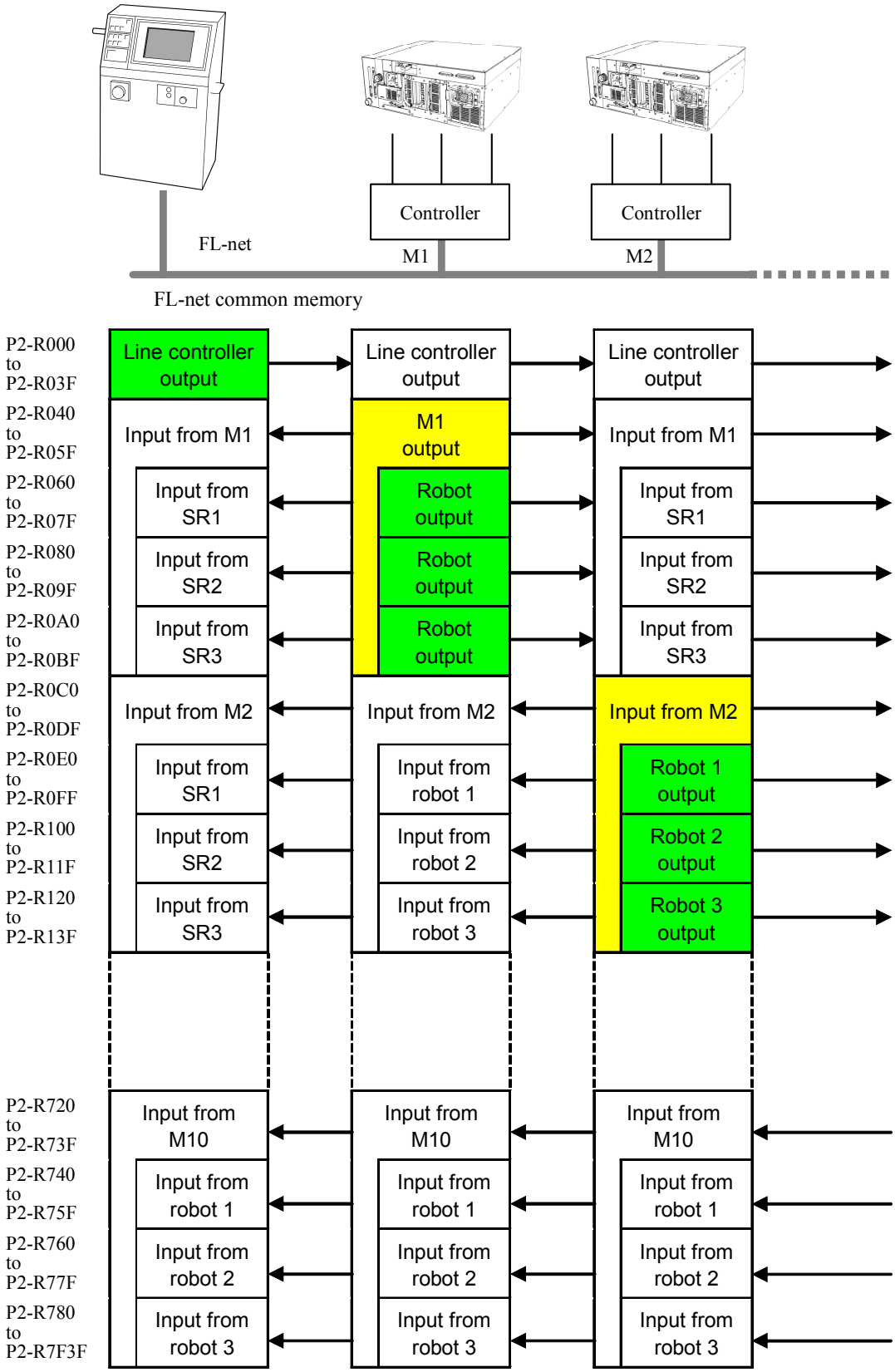


Module	M1	M2	M3	M4	M5	M6	M7	M8
Head address	R030	R032	R034	R036	R038	R03A	R03C	R03E

Address	Name	Signal pattern	Description
+00	Auto		
+01	Individual		
+02	Teach		
+03			
+04			
+05	Home position return button		
+06	Individual aux		
+07	Error reset		
+08			
+09	Speed regulation command		
+0A	Robot start		
+0B	Robot stop		While this signal is being inputted, the system stops all tasks.
+0C	Hold release		
+0D	Hold-run		While this signal is being inputted, the system holds all individual sub tasks without holding master tasks.
+0E	Advance		
+0F	Return		
+10			
+11			
+12			
+13			
+14			
+15			
+16			
+17			
+18			
+19			
+1A			
+1B			
+1C			
+1D			
+1E			
+1F			

1.9.3 Line Controller ← Robot

(1) Address assignment map



(2) Module

Address table

Node No.	N1	N2	N3	N4	N5	N6	N7	N8
Module No.	M1	M2	M3	M4	M5	M6	M7	M8
Head address	R040	R0C0	R140	R1C0	R240	R2C0	R340	R3C0

Address	**Name**		**Description**
	H	**L**	
+00	Connected robot (BIT)	Node No. (HEX)	Robot information contained in the module
+01	T1: Robot (BIT)	Unit (BCD)	Information of units operating for each task
+02	T2: Robot (BIT)	Unit (BCD)	
+03	T3: Robot (BIT)	Unit (BCD)	
+04	T4: Robot (BIT)	Unit (BCD)	
+05	T5: Robot (BIT)	Unit (BCD)	
+06	T6: Robot (BIT)	Unit (BCD)	
+07	T7: Robot (BIT)	Unit (BCD)	
+08	T8: Robot (BIT)	Unit (BCD)	
+09	T0: Robot (BIT)	Unit (BCD)	
+0A	Production control condition signal (BIT)		Operation status of the module
+0B	(Vacancy)		
+0C	Related information 1 (HEX)		Related information of the message.
+0D	Related information 2 (HEX)		
+0E	Message type (BCD)		Error or warning
+0F	Message No. (HEX)		Serial number of message
+10	Message 2	Message 1	Message
+11	Message 4	Message 3	
+12	Message 6	Message 5	
+13	Message 8	Message 7	
+14	Message 11	Message 10	
+15	Message 12	Message 11	
+16	Message 14	Message 13	
+17	Message 16	Message 15	
+18	Message 18	Message 17	
+19	Message 20	Message 19	
+1A	Message 22	Message 21	
+1B	Message 24	Message 23	
+1C	Message 26	Message 25	
+1D	Message 28	Message 27	
+1E	Message 30	Message 29	
+1F	Message 32	Message 31	

+00: Connected robot and node No.

Upper	Lower	Description
Connected robot	Node No.	
		Bits for robot number stored in the module in binary digits (BIT) 1: Exist 0: Not exist
		Stores the node number of own station in hexadecimal.

BIT	F	E	D	C	B	A	9	8
Robot	8	7	6	5	4	3	2	1

+01 to 09: Robot selected by each task (BIT) and unit number (BCD)

Upper	Lower	Description
Connected robot	Node No.	
		Bits for robot number selected by each task in binary digits (BIT) 1: Selected 0: Not selected
		Stores the unit number in binary-coded decimal (BCD).

BIT	F	E	D	C	B	A	9	8
Robot	8	7	6	5	4	3	2	1

+0A: Production control condition signal (BIT)

BIT	Module	Signal pattern	Description
0	Holding		External stop signal is being inputted to the robot or the robot is stopped due to an error.
1	Starting		The robot is running
2	T.P emergency stopping		Emergency stop signal from the teach pendant is being inputted.
3	Emergency stop		Emergency stop signal from the line controller is being inputted.
4	Safety stop		Emergency stop signal from the line controller is being inputted.
5			
6			
7			
8			
9			
A			
B			
C			
D			
E			
F	Robot preparation completion		The robot is ready to run after turning the power ON.

+0C: Related information 1(HEX), +0D: Related information 2 (HEX)

Outputs information related to warning or error message.
Information outputted is as below depending on the message type.

Error/Warning common

Type	Details of related information
System	For a PLC error, outputs related information stored in PLC special register. Otherwise, this address is vacant.
R1	Outputs executive program number or step number.

+0E: Message type (BCD)

Upper	Lower	Description
For line controller	For robot interface	
		Line controller gives information to this area when outputting to the signboard ("andon"). Robot interface does not write in this area.
		Stores the unit number in binary-coded decimal (BCD).

BCD	Meaning
0	None
1	Error
2	Warning
3	Vacancy
4	Vacancy
5	Vacancy
6	Vacancy
7	Vacancy

+0F: Message No. (HEX)

Outputs information related to warning or error message.
Information outputted is as below depending on the message type.

Error/Warning common

Type	Details of related information
System	The address where the error or warning has been detected is outputted in the form of "****" of "EM****" in hexadecimal.
R1	The address where the error or warning has been detected is outputted in the form of "****" of "EM****" in hexadecimal.

+10 to +1F: Message

Outputs information related to the warning or error message in ASCII format.

(3) Robot–material handling robots/exclusive robots

Address table

Node No.	Module robot No.	Network robot No.	Head address
M1	SR1	NR1	R0060
	SR2	NR2	R0080
	SR3	NR3	R00A0
M2	SR1	NR4	R00E0
	SR2	NR5	R0100
	SR3	NR6	R0120
M3	SR1	NR7	R0160
	SR2	NR8	R0180
	SR3	NR9	R01A0
M4	SR1	NR10	R01E0
	SR2	NR11	R0200
	SR3	NR12	R0220
M5	SR1	NR13	R0260
	SR2	NR14	R0280
	SR3	NR15	R02A0
M6	SR1	NR16	R02E0
	SR2	NR17	R0300
	SR3	NR18	R0320
M7	SR1	NR19	R0360
	SR2	NR20	R0380
	SR3	NR21	R03A0
M8	SR1	NR22	R03E0
	SR2	NR23	R0400
	SR3	NR24	R0420
M9	SR1	NR25	R0460
	SR2	NR26	R0480
	SR3	NR27	R04A0
M10	SR1	NR28	R04E0
	SR2	NR29	R0500
	SR3	NR30	R0520

Address	For material handling robots		Description
+00	Robot No.	Purpose	
+01	SEMPH interlock		
+02	Interference interlock		
+03	Executive program number		
+04	Executive step number		
+05	Production control condition signal (BIT)		
+06	Robot independent message (BIT)		
+07	Each robot alarm (BIT)		
+08	Comment 2	Comment 1	
+09	Comment 4	Comment 3	
+0A	Comment 6	Comment 5	
+0B	Comment 8	Comment 7	
+0C	Comment 10	Comment 9	
+0D	Comment 12	Comment 11	
+0E	Comment 14	Comment 13	
+0F	Comment 16	Comment 15	
+10	Material handling condition signal, standard (BIT)		
+11	Jig interlock O1 to O16		
+12	Material handling condition signal tool 1 (BIT)		
+13	Material handling condition signal tool 1 (BIT)		
+14	Material handling condition signal tool 2 (BIT)		
+15	Material handling condition signal tool 2 (BIT)		
+16	Material handling condition signal tool 3 (BIT)		
+17	Material handling condition signal tool 3 (BIT)		
+18	Material handling condition signal tool 4 (BIT)		
+19	Material handling condition signal tool 4 (BIT)		
+1A			
+1B			
+1C			
+1D			
+1E			
+1F			

+06: Robot independent message, +07: Each robot alarm

Material handling robots

+06: BIT	Robot independent message	+07: BIT	Each robot alarm
0		0	
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
A		A	
B		B	
C		C	
D		D	
E		E	
F		F	

+10: Material handling condition signal, standard

Outputs status signal of material handling robots

BIT	Name
0	Clamp end 1-1
1	Unclamp end 1-1
2	Clamp end 1-2
3	Unclamp end 1-2
4	Clamp end 2-1
5	Unclamp end 2-1
6	Clamp end 2-2
7	Unclamp end 2-2
8	Clamp end 3-1
9	Unclamp end 3-1
A	Clamp end 3-2
B	Unclamp end 3-2
C	Parts detection 1
D	Parts detection 2
E	Parts detection 3
F	Parts detection 4

+11: Jig interlock O1 to O16

Used when available jig interlocks are insufficient, only for material handling robots.

BIT	Name
0	O1
1	O2
2	O3
3	O4
4	O5
5	O6
6	O7
7	O8
8	O9
9	O10
A	O11
B	O12
C	O13
D	O14
E	O15
F	O16

+12 to 19: Material handling condition signal tool 1 to 4

Outputs status signal of material handling tool

Assignments of signals outputted and the internal extended memory addresses are as shown below.

Assignments for Tools 3 and 4 are to be determined.

BIT	Tool 1	Tool 2	Name
0	EM0000	EM0020	Clamp end 1-1
1	1	21	Unclamp end 1-1
2	2	22	Clamp end 1-2
3	3	23	Unclamp end 1-2
4	4	24	Clamp end 2-1
5	5	25	Unclamp end 2-1
6	6	26	Clamp end 2-2
7	7	27	Unclamp end 2-2
8	8	28	Clamp end 3-1
9	9	29	Unclamp end 3-1
A	000A	002A	Clamp end 3-2
B	000B	002B	Unclamp end 3-2
C	000C	002C	Clamp end 4-1
D	000D	002D	Unclamp end 4-1
E	000E	002E	Clamp end 4-2
F	000F	002F	Unclamp end 4-2
10	EM0080	EM00A0	Parts detection 1
11	81	00A1	Parts detection 2
12	82	00A2	Parts detection 3
13	83	00A3	Parts detection 4
14	84	00A4	
15	85	00A5	
16	86	00A6	
17	87	00A7	
18	88	00A8	Adsorption confirmation 1
19	89	00A9	
1A	008A	00AA	Adsorption confirmation 2
1B	008B	00AB	
1C	008C	00AC	
1D	008D	00AD	
1E	008E	00AE	
1F	008F	00AF	

1.10 I/O Signal Assignment

No.	Name	PLC assignment
I1		L 400
I2		L 401
I3		L 402
I4		L 403
I5		L 404
I6		L 405
I7		L 406
I8		L 407
I9		L 408
I10		L 409
I11		L 40A
I12		L 40B
I13		L 40C
I14		L 40D
I15		L 40E
I16		L 40F
I17		L 410
I18		L 411
I19		L 412
I20		L 413
I21		L 414
I22		L 415
I23		L 416
I24		L 417
I25		L 418
I26		L 419
I27		L 41A
I28		L 41B
I29		L 41C
I30		L 41D
I31		L 41E
I32		L 41F
I33		L 420
I34		L 421
I35		L 422
I36		L 423
I37		L 424
I38		L 425
I39		L 426
I40		L 427
I41		L 428
I42		L 429
I43		L 42A
I44		L 42B
I45		L 42C
I46		L 42D
I47		L 42E
I48		L 42F

No.	Name	PLC assignment
I49		L 430
I50		L 431
I51		L 432
I52		L 433
I53		L 434
I54		L 435
I55		L 436
I56		L 437
I57	Home position	L 438
I58	Return to home position valid area	L 439
I59	Line individual mode	L 43A
I60	Durable mode run	L 43B
I61	Verification run	L 43C
I62	Robot synchronous command	L 43D
I63	Second start	L 43E
I64	First start	L 43F
I65	RPS code 1	L 708
I66	RPS code 2	L 709
I67	RPS code 4	L 70A
I68	RPS code 8	L 70B
I69	RPS code 16	L 70C
I70	RPS code 32	L 70D
I71	RPS code 64	L 70E
I72	RPS code 128	L 70F
I73	Robot 1 connection cutting off	L 741
I74	Robot 2 t connection cutting off (Not used)	L 749
I75	Robot 3 connection cutting off (Not used)	L 751
I76	Robot 4 connection cutting off (Not used)	L 759
I77	Robot 5 connection cutting off (Not used)	L 761
I78	Robot 6 connection cutting off (Not used)	L 769
I79	Robot 7 connection cutting off (Not used)	L 771
I80	Robot 8 connection cutting off (Not used)	L 779
I81	Robot 1 home position	L 743
I82	Robot 2 home position (Not used)	L 74B
I83	Robot 3 home position (Not used)	L 753
I84	Robot 4 home position (Not used)	L 75B
I85	Robot 5 home position (Not used)	L 763
I86	Robot 6 home position (Not used)	L 76B
I87	Robot 7 home position (Not used)	L 773
I88	Robot 8 home position (Not used)	L 77B
I89	JOG operation shaft select code 1	R 307 BIT2
I90	JOG operation shaft select code 2	R 307 BIT3
I91	JOG operation shaft select code 4	R 307 BIT4
I92	JOG operation shaft select code 8	R 307 BIT5
I93	JOG operation movement + direction	R 307 BIT6
I94	JOG operation movement - direction	R 307 BIT7
I95	TO second start	L 700
I96	TO first start	L 703

No.	Name	PLC assignment
O1		L 000
O2		L 001
O3		L 002
O4		L 003
O5		L 004
O6		L 005
O7		L 006
O8		L 007
O9		L 008
O10		L 009
O11		L 00A
O12		L 00B
O13		L 00C
O14		L 00D
O15		L 00E
O16		L 00F
O17		L 010
O18		L 011
O19		L 012
O20		L 013
O21		L 014
O22		L 015
O23		L 016
O24		L 017
O25		L 018
O26		L 019
O27		L 01A
O28		L 01B
O29		L 01C
O30		L 01D
O31		L 01E
O32		L 01F
O33		L 020
O34		L 021
O35		L 022
O36		L 023
O37		L 024
O38		L 025
O39		L 026
O40		L 027
O41		L 028
O42		L 029
O43		L 02A
O44		L 02B
O45		L 02C
O46		L 02D
O47		L 02E
O48		L 02F

No.	Name	PLC assignment
O49		L 030
O50		L 031
O51		L 032
O52		L 033
O53		L 034
O54		L 035
O55		L 036
O56		L 037
O57		L 038
O58		L 039
O59		L 03A
O60		L 03B
O61		L 03C
O62		L 03D
O63		L 03E
O64	Operation completion	L 03F
O65		
O66		
O67		
O68		
O69		
O70		
O71		
O72		
O73		
O74		
O75		
O76		
O77		
O78		
O79		
O80		
O81		
O82		
O83		
O84		
O85		
O86		
O87		
O88		
O89		
O90		
O91		
O92		
O93		
O94		
O95		
O96		

Reference: Sample Programs for JOG Operations Using Input Signals I89 through I94

Using input signals I89 through I94 enables JOG operations from a line controller. In sample programs (using Program 191) given below, a program initiation is commanded from the line controller. Have the equipment manufacturer assign functions to the buttons on the line controller as necessary.

In the sample programs below, changing deltaC, deltaT, and deltaA values modifies the motion distance in mm (angle in degree).

Given below are two sample programs for JOG operation, one that starts programs every cycle and the other that runs programs in consecutive cycles.

[JOG operation, starting programs every cylce]

For PAC programs, refer to the PROGRAMMER'S MANUAL (I) (T03).

[Program 191]

```
CALL_RUN  TMC_JOG
[TMC_JOG.PAC]
'!TITLE "TMC_JOG"
PROGRAM TMC_JOG
#DEFINE DIRECTTOP  1   'Start Code of Cartesian Coordinate
#DEFINE DIRECTBTM  3   'End Code of Cartesian Corrdiante
#DEFINE TOOLTOP    4   'Start Code of Tool Coordinate
#DEFINE TOOLBTM    6   'End Code of Tool Coordinate
#DEFINE LINKTOP    7   'Start Code of Axis Coordinate
#DEFINE LINKBTM   13   'End Code of Axis Coordinate
#DEFINE JOG_IO_NUM 89 'JOG Start Number of the IO for JOG Operation DEFINT iJOG1,
                      iJOG2, iJOG3, iJOG4, iPLUS, iMINUS, iCODE, AXIS
  DEFJNT CURJ
  DEFPOS CURP
'================================================
' Main Process
'================================================
  TAKEARM                         'Get Arm Group

  SPEED 30                        'Set Speed

   iJOG1=IN_SIGNAL[JOG_IO_NUM]    'Get Code 1 of the selected JOG Operation Axis
   iJOG2=IN_SIGNAL[JOG_IO_NUM+1]  'Get Code 2 of the selected JOG Operation Axis
   iJOG3=IN_SIGNAL[JOG_IO_NUM+2]  'Get Code 4 of the selected JOG Operation Axis
   iJOG4=IN_SIGNAL[JOG_IO_NUM+3]  'Get Code 8 of the selected JOG Operation Axis
   iPLUS=IN_SIGNAL[JOG_IO_NUM+4]  'Get Plus Motion of the JOG Operation
   iMINUS=IN_SIGNAL[JOG_IO_NUM+5] 'Get Minus Motion of the JOG Operation
   iCODE = iJOG1                  'Calc. the selected JOG Operation Axis
   iCODE = iCODE + iJOG2 * 2
   iCODE = iCODE + iJOG3 * 4
   iCODE = iCODE + iJOG4 * 8
   SELECT CASE iCODE
     CASE DIRECTTOP TO DIRECTBTM  'Cartesian Coordinates, X to Z axes
       GOSUB *DIRECTMOVE
     CASE TOOLTOP TO  TOOLBTM     'Tool Coordinates, X to Z axes
```

```
      GOSUB *TOOLMOVE
    CASE LINKTOP TO LINKBTM      'Axis Coordinates, 1 to 7 axes
      GOSUB *LINKMOVE
  END SELECT
  'GIVEARM                       'Release Arm Group
END
'================================================
' Cartesian Coordinates Motion
'================================================
*DIRECTMOVE:
 AXIS = iCODE - DIRECTTOP + 1    'Calc. Axis number
 CURP = CURPOS                   'Get Current Position
 deltaC = 5
SELECT CASE AXIS
   CASE 1                        'X Axis
     IF iPLUS = ON THEN
       CURP = CURP + (deltaC, 0, 0, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURP = CURP + (-deltaC, 0, 0, 0, 0, 0)
     END IF
   CASE 2                        'Y Axis
     IF iPLUS = ON THEN
       CURP = CURP + (0, deltaC, 0, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURP = CURP + (0, -deltaC, 0, 0, 0, 0)
     END IF
   CASE 3                        'Z Axis
     IF iPLUS = ON THEN
       CURP = CURP + (0, 0, deltaC, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURP = CURP + (0, 0, -deltaC, 0, 0, 0)
     END IF
 END SELECT
 MOVE L, CURP                    'Motion Start
 RETURN
'================================================
' Tool Coordinates Motion
'================================================
*TOOLMOVE:
 AXIS = iCODE - TOOLTOP + 1      'Calc. Axis number
 CURP = CURPOS                   'Get Current Position
 deltaT = 5
SELECT CASE AXIS
   CASE 1                        'X Axis
     IF iPLUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((deltaT, 0, 0, 0, 0, 0)))
     ELSEIF iMINUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((-deltaT, 0, 0, 0, 0, 0)))
     ENDIF
```

```
    CASE 2                          'Y Axis
      IF iPLUS = ON THEN
        CURP = T2P(P2T(CURP) * P2T((0,deltaT, 0, 0, 0, 0)))
      ELSEIF iMINUS = ON THEN
        CURP = T2P(P2T(CURP) * P2T((0, -deltaT, 0, 0, 0, 0)))
      ENDIF
    CASE 3                          'Z Axis
      IF iPLUS = ON THEN
        CURP = T2P(P2T(CURP) * P2T((0, 0,deltaT, 0, 0, 0)))
      ELSEIF iMINUS = ON THEN
        CURP = T2P(P2T(CURP) * P2T((0, 0, -deltaT, 0, 0, 0)))
      ENDIF
  END SELECT
  MOVE L, CURP                      'Motion Start
  RETURN
'================================================
' Axis Coordinates Motion
'================================================
*LINKMOVE:
  AXIS = iCODE - LINKTOP + 1        'Calc. Axis number
  CURJ = CURJNT                     'Get Current Position
  deltaA = 5
SELECT CASE AXIS
    CASE 1                          '1st Axis
      IF iPLUS = ON THEN
        CURJ = CURJ + (deltaA, 0, 0, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURJ = CURJ + (-deltaA, 0, 0, 0, 0, 0)
      END IF
    CASE 2                          '2nd Axis
      IF iPLUS = ON THEN
        CURJ = CURJ + (0,deltaA, 0, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURJ = CURJ + (0, -deltaA, 0, 0, 0, 0)
      END IF
    CASE 3                          '3rd Axis
      IF iPLUS = ON THEN
        CURJ = CURJ + (0, 0,deltaA, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURJ = CURJ + (0, 0, -deltaA, 0, 0, 0)
      END IF
    CASE 4                          '4th Axis
      IF iPLUS = ON THEN
        CURJ = CURJ + (0, 0, 0,deltaA, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURJ = CURJ + (0, 0, 0, -deltaA, 0, 0)
      END IF
    CASE 5                          '5th Axis
      IF iPLUS = ON THEN
```

```
      CURJ = CURJ + (0, 0, 0, 0,deltaA, 0)
    ELSEIF iMINUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, -deltaA, 0)
    END IF
   CASE 6                        '6th Axis
    IF iPLUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, 0,deltaA)
    ELSEIF iMINUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, 0, -deltaA)
    END IF
  END SELECT
  MOVE L, CURJ                   'Motion Start
  RETURN
```

[JOG operation in consecutive cycles]

For PAC programs, refer to the PROGRAMMER'S MANUAL (I) (T03).

[Program 191]

```
CALL_RUN  TMC_JOG2
[TMC_JOG2.PAC]
'!TITLE "TMC_JOG"
PROGRAM TMC_JOG#DEFINE DIRECTTOP  1 'Start Code of Cartesian Coordinate
#DEFINE DIRECTBTM  3                'End Code of Cartesian Corrdiante
#DEFINE TOOLTOP    4                'Start Code of Tool Coordinate
#DEFINE TOOLBTM    6                'End Code of Tool Coordinate
#DEFINE LINKTOP    7                'Start Code of Axis Coordinate
#DEFINE LINKBTM   13                'End Code of Axis Coordinate
#DEFINE JOG_IO_NUM 89               'Start Number of the IO for JOG Operation  DEFINT
                                    iJOG1, iJOG2, iJOG3, iJOG4, iPLUS, iMINUS, iCODE,
                                    AXIS
  DEFJNT CURJ
  DEFPOS CURP
'================================================
' Main Process
'================================================
  TAKEARM                        'Get Arm Group

  SPEED 30                       'Set Speed

DO
   iJOG1=IN_SIGNAL[JOG_IO_NUM]    'Get Code 1 of the selected JOG Operation Axis
   iJOG2=IN_SIGNAL[JOG_IO_NUM+1]  'Get Code 2 of the selected JOG Operation Axis
   iJOG3=IN_SIGNAL[JOG_IO_NUM+2]  'Get Code 4 of the selected JOG Operation Axis
   iJOG4=IN_SIGNAL[JOG_IO_NUM+3]  'Get Code 8 of the selected JOG Operation Axis
   iPLUS=IN_SIGNAL[JOG_IO_NUM+4]  'Get Plus Motion of the JOG Operation
   iMINUS=IN_SIGNAL[JOG_IO_NUM+5] 'Get Minus Motion of the JOG Operation
```

```
   iCODE = iJOG1                  'Calc. the selected JOG Operation Axis
   iCODE = iCODE + iJOG2 * 2
   iCODE = iCODE + iJOG3 * 4
   iCODE = iCODE + iJOG4 * 8
   SELECT CASE iCODE
     CASE DIRECTTOP TO DIRECTBTM  'Cartesian Coordinates, X to Z axes
       GOSUB *DIRECTMOVE
     CASE TOOLTOP TO  TOOLBTM     'Tool Coordinates, X to Z axes
       GOSUB *TOOLMOVE
     CASE LINKTOP TO LINKBTM      'Axis Coordinates, 1 to 7 axes
       GOSUB *LINKMOVE
   END SELECT
   'GIVEARM                      'Release Arm Group
LOOP
END
'================================================
' Cartesian Coordinates Motion
'================================================
*DIRECTMOVE:
  AXIS = iCODE - DIRECTTOP + 1    'Calc. Axis number
  CURP = CURPOS                   'Get Current Position
  deltaC = 5
SELECT CASE AXIS
    CASE 1                        'X Axis
      IF iPLUS = ON THEN
        CURP = CURP + (deltaC, 0, 0, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURP = CURP + (-deltaC, 0, 0, 0, 0, 0)
      END IF
    CASE 2                        'Y Axis
      IF iPLUS = ON THEN
        CURP = CURP + (0, deltaC, 0, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURP = CURP + (0, -deltaC, 0, 0, 0, 0)
      END IF
    CASE 3                        'Z Axis
      IF iPLUS = ON THEN
        CURP = CURP + (0, 0, deltaC, 0, 0, 0)
      ELSEIF iMINUS = ON THEN
        CURP = CURP + (0, 0, -deltaC, 0, 0, 0)
      END IF
  END SELECT
  MOVE L, CURP                    'Motion Start
  RETURN
'================================================
' Tool Coordinates Motion
'================================================
*TOOLMOVE:
  AXIS = iCODE - TOOLTOP + 1      'Calc. Axis number
```

```
  CURP = CURPOS                    'Get Current Position
  deltaT = 5
SELECT CASE AXIS
   CASE 1                          'X Axis
     IF iPLUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((deltaT, 0, 0, 0, 0, 0)))
     ELSEIF iMINUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((-deltaT, 0, 0, 0, 0, 0)))
     ENDIF
   CASE 2                          'Y Axis
     IF iPLUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((0,deltaT, 0, 0, 0, 0)))
     ELSEIF iMINUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((0, -deltaT, 0, 0, 0, 0)))
     ENDIF
   CASE 3                          'Z Axis
     IF iPLUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((0, 0,deltaT, 0, 0, 0)))
     ELSEIF iMINUS = ON THEN
       CURP = T2P(P2T(CURP) * P2T((0, 0, -deltaT, 0, 0, 0)))
     ENDIF
  END SELECT
  MOVE L, CURP                     'Motion Start
  RETURN
'================================================
' Axis Coordinates Motion
'================================================
*LINKMOVE:
  AXIS = iCODE - LINKTOP + 1       'Calc. Axis number
  CURJ = CURJNT                    'Get Current Position
  deltaA = 5
SELECT CASE AXIS
   CASE 1                          '1st Axis
     IF iPLUS = ON THEN
       CURJ = CURJ + (deltaA, 0, 0, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURJ = CURJ + (-deltaA, 0, 0, 0, 0, 0)
     END IF
   CASE 2                          '2nd Axis
     IF iPLUS = ON THEN
       CURJ = CURJ + (0,deltaA, 0, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURJ = CURJ + (0, -deltaA, 0, 0, 0, 0)
     END IF
   CASE 3                          '3rd Axis
     IF iPLUS = ON THEN
       CURJ = CURJ + (0, 0,deltaA, 0, 0, 0)
     ELSEIF iMINUS = ON THEN
       CURJ = CURJ + (0, 0, -deltaA, 0, 0, 0)
```

```
    END IF
  CASE 4                        '4th Axis
    IF iPLUS = ON THEN
      CURJ = CURJ + (0, 0, 0,deltaA, 0, 0)
    ELSEIF iMINUS = ON THEN
      CURJ = CURJ + (0, 0, 0, -deltaA, 0, 0)
    END IF
  CASE 5                        '5th Axis
    IF iPLUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0,deltaA, 0)
    ELSEIF iMINUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, -deltaA, 0)
    END IF
  CASE 6                        '6th Axis
    IF iPLUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, 0,deltaA)
    ELSEIF iMINUS = ON THEN
      CURJ = CURJ + (0, 0, 0, 0, 0, -deltaA)
    END IF
END SELECT
MOVE L, CURJ                    'Motion Start
RETURN
```

Chapter 2 Electric Circuit Diagrams

For the PDF version, refer to the USER MANUALS\SUPPLEMENT\SUPPLEMENT\ Electric Circuit Diagrams in the DENSO ROBOT Manual Pack CD-ROM.
For the Unidraf version, refer to the "Unidraf" folder in the DENSO ROBOT Manual Pack CD-ROM.

Vertical articulated V*-G-T SERIES
Horizontal articulated H*-G-T SERIES

INTERFACE CIRCUIT DIAGRAMS (T03)

First Edition May 2007
Second Edition August 2008
Third Edition September 2010

DENSO WAVE INCORPORATED 9M**C

The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.