

HD-4217E-3

FOUP OPENER INTERFACE SPECIFICATIONS



KWF-12F2/3 H-TYPE

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**KWF-12F2/3 H-TYPE
FOUP OPENER INTERFACE SPECIFICATIONS
(HD-4217E-3)**

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Kumamoto Head Quarters
111 Uekimachi hitotsugi Kumamoto Kita Kumamoto
861-0198 JAPAN




Phone (096)-272-0555
Facsimile(096)272-7901

Equipment Business Div. Semiconductor Equipment Dept.
1016-6 Kusuno, Kita,Kumamoto 861-5511 JAPAN
Phone (096) 245-1333
Facsimile (096) 245-0816

NOTATION

Notes, Cautions, and Warnings

There are four levels of special notations are used in this manual.

Notation	Description
 WARNING	If the actions indicated in a WARNING are not complied with, injury or major equipment damage could result.
 CAUTION	If the action specified in the CAUTION is not complied with, damage to your equipment could result.
 NOTE	A NOTE provides supplementary information, emphasize a point or procedure, or gives a tip for easier operation.

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CHAPTER 1 Outline

This manual describes the interface of a load port and a host controller.



CAUTION

Hirata load port has five types of the communication protocol depending on the user specification. It is a factory setting by Hirata. Refer to this manual after confirming the type of the communication protocol used.ⁱ

See the manual of the separate volume for details of the load port.

1.1 Outline

Hirata load port is equipped with parallel I/O and serial I/O as an interface with a host controller.

Use parallel I/O for interlock and the device status function, and use serial I/O to control operation of the device with RS-232C.

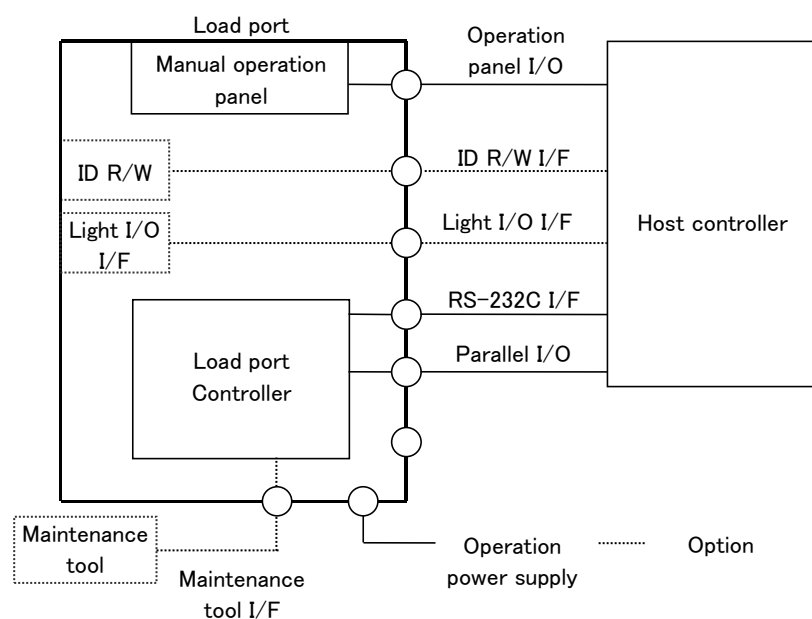


Fig.1.1 Interface connection image

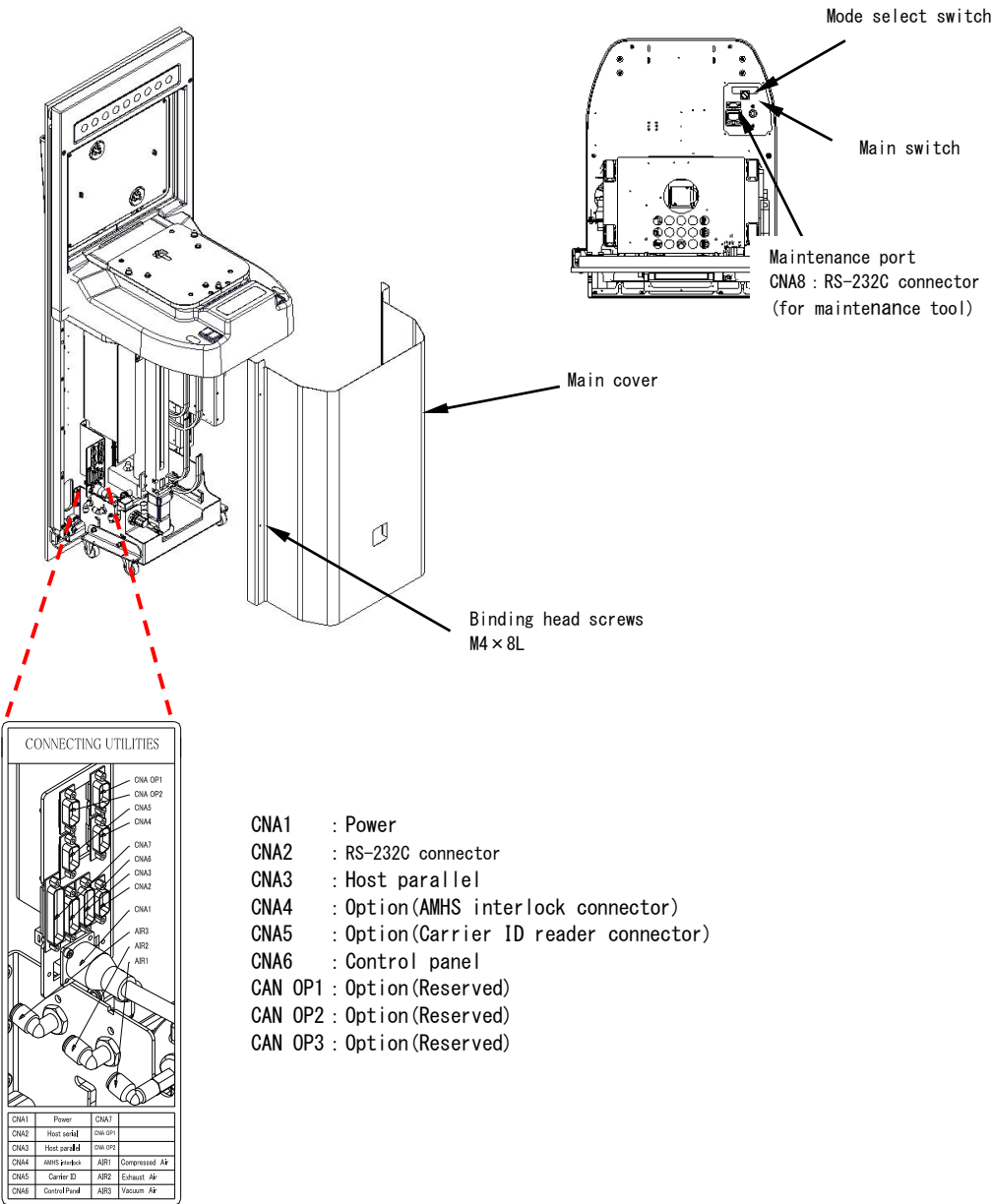
ⁱ Refer to Chapter 3 “Confirming Communication Protocol”.

CHAPTER 2 Specification

This chapter describes the interface specification of the load port.

2.1 Interface connection

Location of interface connection is shown at "Utility connection explanation seal" of the main body of the load port. (Refer to the Fig. 2.1 below) The function and the connector specification of each interface are described in detail from next page.



Label of Connecting Utilities

Fig. 2.1 FOUOP opener interface connection part

2.1.1 CNA1 Power supply connector

Supply the DC24V power source to the load port.

- Connector type CPC 4pin male
- Load port side connector 206061-1 (NIPPON AMP)
- Device side compatible connector 206060-1 (NIPPON AMP)
- Contact 66601-9 (NIPPON AMP)

Pin No.	Signal	Use
1	DC24V	DC24V5A
2	FG	Earth
3	(NC)	Not used
4	DC24GND	DC0V (DC24V Return)

2.1.2 CNA2 RS-232C communication connector (host)

It is a serial interface to a host device.

- Connector type D-sub 9pin male
 - Load port side connector DE-9PF (JAE)
 - Device side compatible connector DE-9SF (JAE)
- ※Fixing screw..... #4-40UNC

Pin No.	Signal	Use
1	(NC)	Not used
2	RxD	Receiving data (load port <- host)
3	TxD	Sending data (load port -> host)
4	(NC)	Not used
5	GND	Load port <-> host
6	(NC)	Not used
7	(NC)	Not used
8	(NC)	Not used
9	(NC)	Not used

2.1.3 CNA3 Parallel I/O connector

It is a parallel interface to a host device.

- Connector type D-sub 15pin male
 - Load port side connector DA-15PF (JAE)
 - Device side compatible connector DA-15SF (JAE)
- ※Fixing screw..... #4-40UNC

Pin No.	Signal	Direction	Use
1	Ok To Operate	Host → load port	Online signal from host. Ignores command from host when OFF.
2	Door Open	Load port → host	Turns ON when finishing loading.
3	Load Port Ready	Load port → host	Turns ON when mounting properly and clamping.
4	Presence	Load port → host	Turns ON when loading and detecting.
5	Operation Status	Load port → host	Turns OFF when Maintenance mode. Ignores command from host when OFF.
6	Available	Host → load port	Turns ON when operation is permitted. Stops operation when OFF.
7	Placement	Load port → host	Turns ON when detecting mount.
8	(NC)	Not used	
9	Placement (Return)		
10	Available (Return)		
11	Ok To Operate (Return)		
12	Door Open (Return)		
13	Load Port Ready (Return)		
14	Presence (Return)		
15	Operation Status (Return)		

2.1.3.1 Parallel I/O connection circuit diagram

Connect the contact of the output relay or the output of the photo coupler for between each input signal and external power supply (DC 0V) as shown in the figure below.

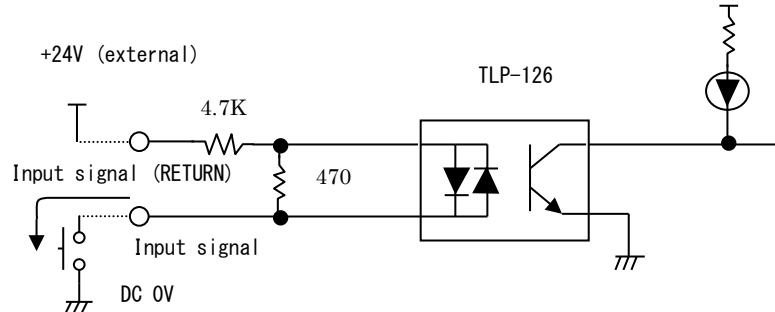


Fig. 2.2 Input circuit (host → load port)

Connect the coil of the relay or the input of the photo coupler for between each output signal and external power supply (DC +24V) as shown in the figure below. (100mA or less can be used.)

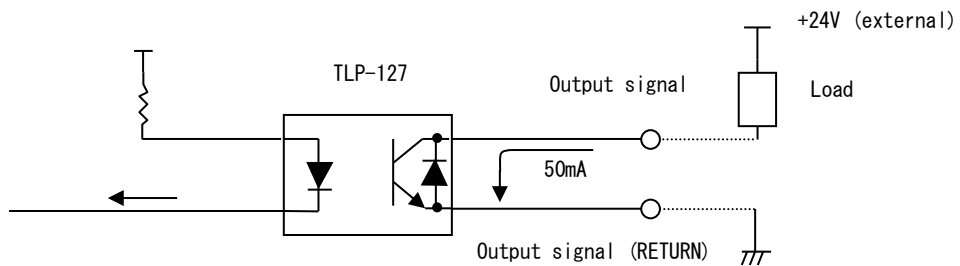


Fig. 2.3 Output circuit (load port → host)



CAUTION

The output circuit is assumed to be used for the interface with DC+24V. When other power supplies are used, it is necessary to put the relay to convert the level during the output. In this case, contact us beforehand.

2.1.4 CNA6 operation panel I/F connector

Operate the operating switch and the indicator lamp.

- Connector type D-sub 15pin female
 - Load port side connector DA-15SF (JAE)
 - Device side compatible connector DA-15PF (JAE)
- ※ Fixing screw..... #4-40UNC

Pin No.	Signal	Direction	Use
1	DC0V		Common (for button)
2	OPERATION ACCESS button	Load port -> host	Output signal of manual operation button
3	(NC)		Not used
4	(NC)		Not used
5	(NC)		Not used
6	(NC)		Not used
7	(NC)		Not used
8	(NC)		Not used
9	DC24V		Common (for lamp)
10	LOAD indicator	Host -> load port	Input signal for loading ready lamp
11	UNLOAD indicator	Host -> load port	Input signal for lunoading ready lamp
12	OPERATION ACCESS lamp	Host -> load port	Input signal for manual operation lamp
13	PRESENCE indicator	Host -> load port	Input signal for loading lamp
14	PLACEMENT indicator	Host -> load port	Input signal for proper mounting lamp
15	(NC)		Not used

Refer to "2.1.3.1 Parallel I/O connection circuit diagram" for connection circuit.

2.1.5 CNA8 RS-232C communication connector (terminal)

It is used for serial communications of the maintenance port.

Refer to "2.1.2 CNA2 RS-232C communication connector (host)" for detail of the specification such as the connector type and the assignment, etc.

2.1.6 Others

Other interfaces is not used in standard specification.

CHAPTER 3 Confirm method of communication protocol

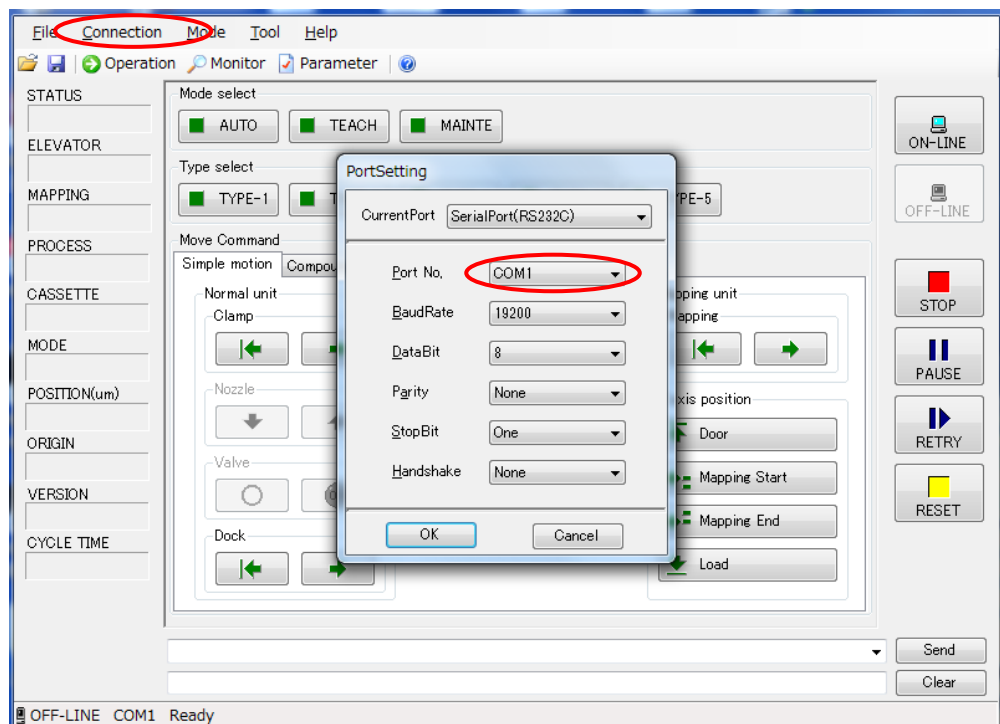
Use special maintenance tool software “KWF12F2 Maintenance Tool” for the confirmation of the communication protocol. Refer to the following procedure.

- (1) Connect the PC in which the maintenance tool is installed with the CNA 8 connector, and turn on the power supply of the load port. (Refer to "2.1 Interface connection".)
- (2) Boot KWF12F2 Maintenance Tool
- (3) Set the port number of the PC. Click “Connection” button in tool, then “Port Setting” dialog will pop up. Set the “Port No” in “Port Setting”.

“Port No” will be automatically detected on your PC and displayed.

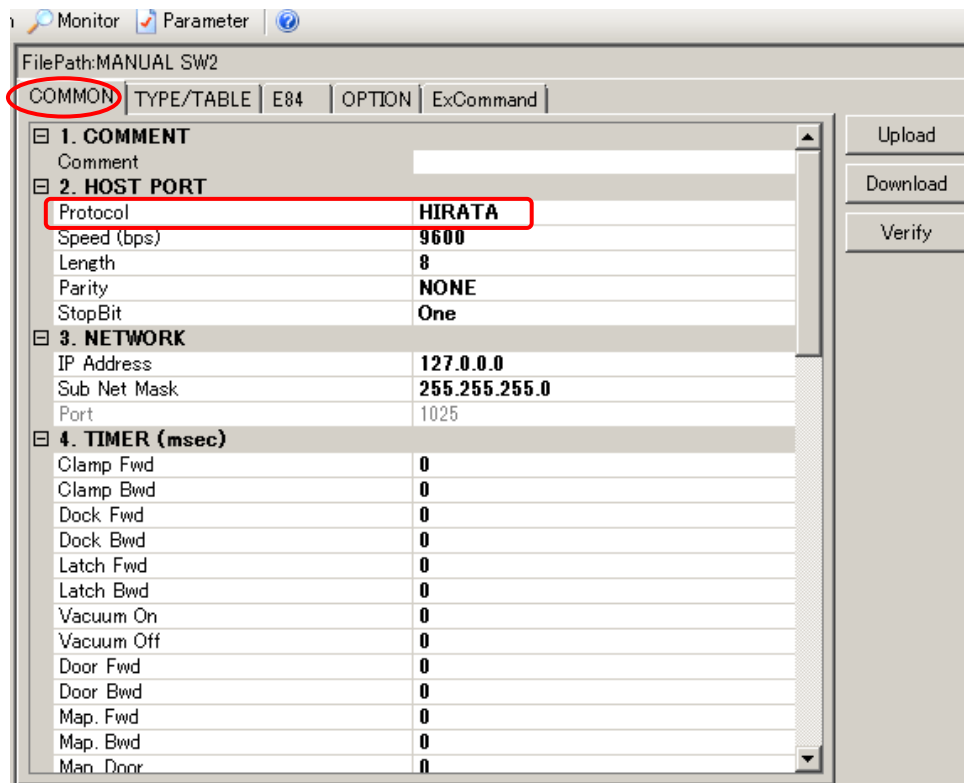
Moreover, other communication setup should set up the following.

Item	Setting value
Baud Rate	19200
Data Bits	8
Parity	None
Stop Bits	One
Hand shake	None



- (4) Upload the parameter set to KWF-12F2 to the PC.
 - ※ Regarding parameter upload, refer to “KWF-12F2 Maintenance Tool USER’S GUIDE”.

- (5) Click the tab of "Parameter" after finishing uploading, and confirm the display to "Protocol" of "HOST PORT" in the "Common" tab.



- (6) The communication format and the signal, etc. are different according to the type of displayed in "Protocol".

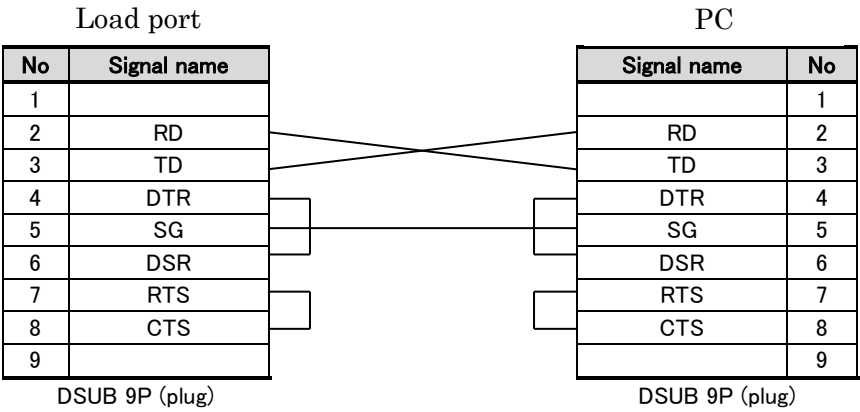
- Hirata ... Hirata Protocol
- B-Type ... B-Type Protocol
- T-Type ... T-Type Protocol (3 Types)
 - └ T-Type(ETX)
 - └ T-Type(CR/LF)
 - └ T-Type(CR)
- A-Type ... A-Type Protocol (4 Types)
 - └ A-Type(SECS)
 - └ A-Type(ASCII)
 - └ A-Type(ASCII ECHO)
 - └ A-Type(ASCII SUM)
- ST-Type ... ST-Type Protocol (3 Types)
 - └ ST-Type(ETX)
 - └ ST-Type(CR/LF)
 - └ ST-Type(CR)

CHAPTER 4 Communication Format

4.1 Communication Control Method

Communication port	RS-232C
Communication method	Asynchronous full duplex system
Baud rate	4,800bps~115,200bps
Data bit	8bit
Stop bit	1bit
Parity	None
Flow control	None

The RS-232C cable of the figure below is necessary for connecting the load port with the RS-232C port of the personal computer.



4.2 Communication Format

4.2.1 Contents of communication format

Communication such as sending and receiving the message is performed according to a regulated format like below.

①	②	③	④	⑤	⑥	⑦
SOH	CODE	ADR	CMD	CSh	CS I	CR

No.	Signal	The number of characters	Contents
①	SOH	1	Start code (ASCII code 01H)
②	CODE	2	send/ Response code Sending: "00" is input at all time. Receiving: "00"~"08" Response code
③	ADR	2	"00" is input at all time.
④	CMD	8 or more	command、 parameter
⑤	CSh	1	Check sum upper level
⑥	CSI	1	Check sum lower level
⑦	CR	1	Completion code (ASCII code CR: 0DH)

In response to a sending message, the CODE part of the sending message is changed, and it is sent back as a reply.

Normal case-1

<Upper level sending> [SOH]0000MOV:ORGN;5D[CR]

<Upper level receiving> [SOH]0000MOV:ORGN;5D[CR]

Normal case-2

<Upper level sending> [SOH]0000GET:STAS;**[CR]

<Upper level receiving> [SOH]0000GET:STAS/000000000000000000000000; **[CR]

Unusual case (At the time of a mode error)

<Upper level sending> [SOH]0000MOV:ORGN;5D[CR]

<Upper level receiving> [SOH]0700MOV:ORGN;5D[CR]

4.2.2 Response code

For the response code, a response corresponding to a sending message is made.

Table 4-1 Response code list

Code	Contents
00	Normal end
01	Check sum error
02	Command error
04	Interlock
05	Alarm occurring
06	Command processing
07	Mode error
08	Mapping error

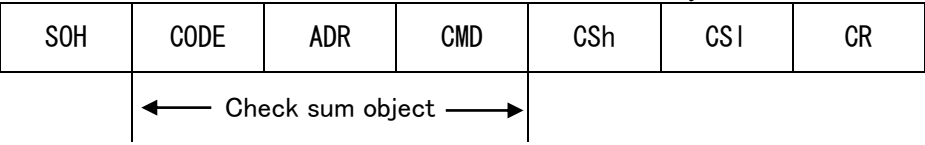


NOTE

For “04” Interlock, an interlock code is returned as a parameter.
As for the details of the see “4.4.2 Interlock”.

4.3 Calculation Range of Check Sum

Characters at between “Code” and “CMD” are the objects for check sum.



For a check sum, the lower 1 byte of the total value of the characters between CODE and CMD is used.

The lower 1 byte is converted to 2 characters of the hex digit string, and CSh is designated for the first character and CSl for the second character.

4.3.1 Example of Check Sum

In the event of the operating command “MOV : ORGN ;”

SOH	CODE		ADR		CMD									CSh	CSl	CR
	0	0	0	0	M	O	V	:	O	R	G	N	;	5	D	
01h	30h	30h	30h	30h	4Dh	4Fh	56h	3Ah	4Fh	52h	47h	4Eh	3Bh	35h	44h	0Dh

$$30h+30h+30h+30h+4Dh+4Fh+56h+3Ah+4Fh+52h+47h+4Eh+3Bh = 35Dh$$

$$\text{Total value} = 35Dh$$

$$\text{Lower 1 byte} = 5Dh$$

$$\text{Hex digit string (2 characters)} = \text{“5D”}$$

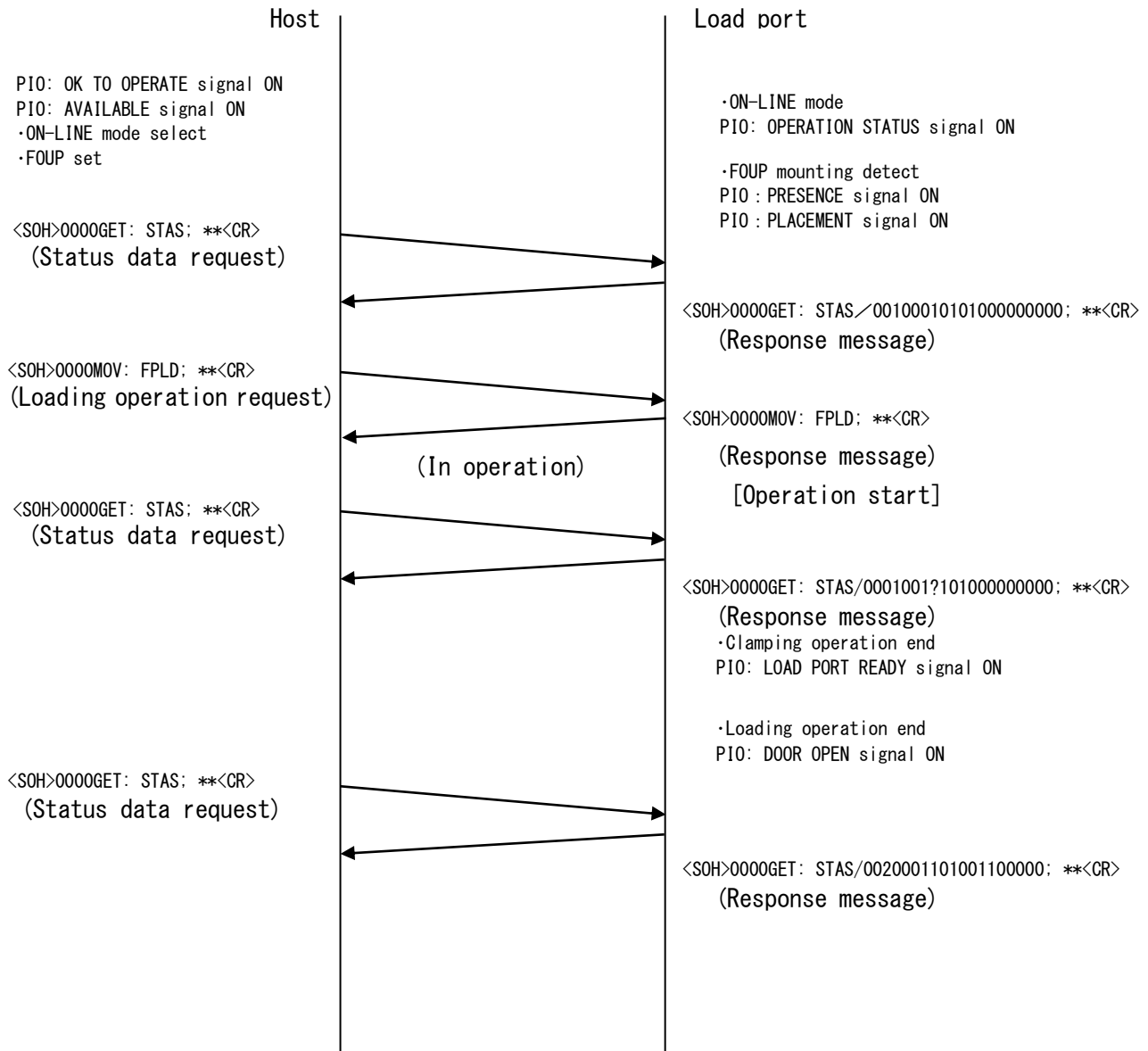
$$\text{Check sum upper level CSh} = \text{“5” (35h)}$$

$$\text{Check sum lower level CSl} = \text{“D” (44h)}$$

4.4 Communication Timing

4.4.1 Moving to LOAD position

In the event of the operation to move the load port to LOAD position, the timing chart is like following.

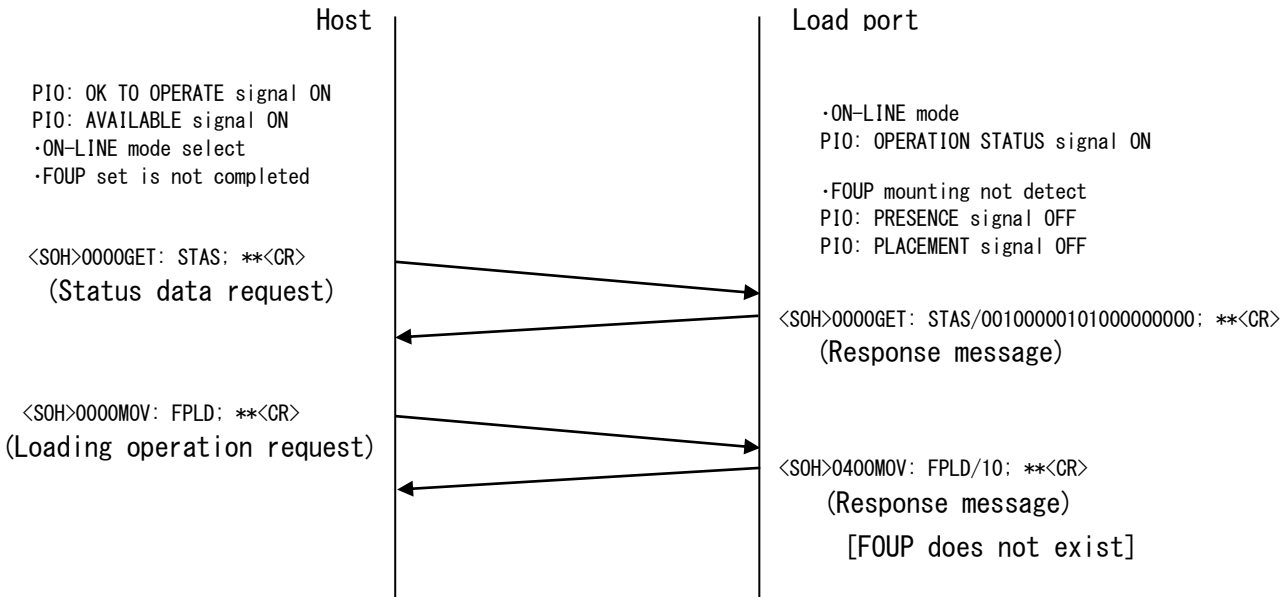


① Conditions to start moving to LOAD operation

- Load port is at home position
- FOUP is loaded properly
- PIO operation status signal is ON

4.4.2 Inter lock

In the event of the interlock condition such as FOUP does not exist, the timing chart is like following.



	CODE		ADR		CMD												
SOH	0	4	0	0	M	O	V	:	F	P	L	D	/	1	0	:	**CR

- Response message in the event of interlock consists of command type in 3 characters, command name in 4 characters and parameter in 3 characters (“/”). Also “04” is set at the code and 2 characters behind “/” is set as the interlock code.
- Interlock function is provided to operate the system safely, not to be abnormal condition.

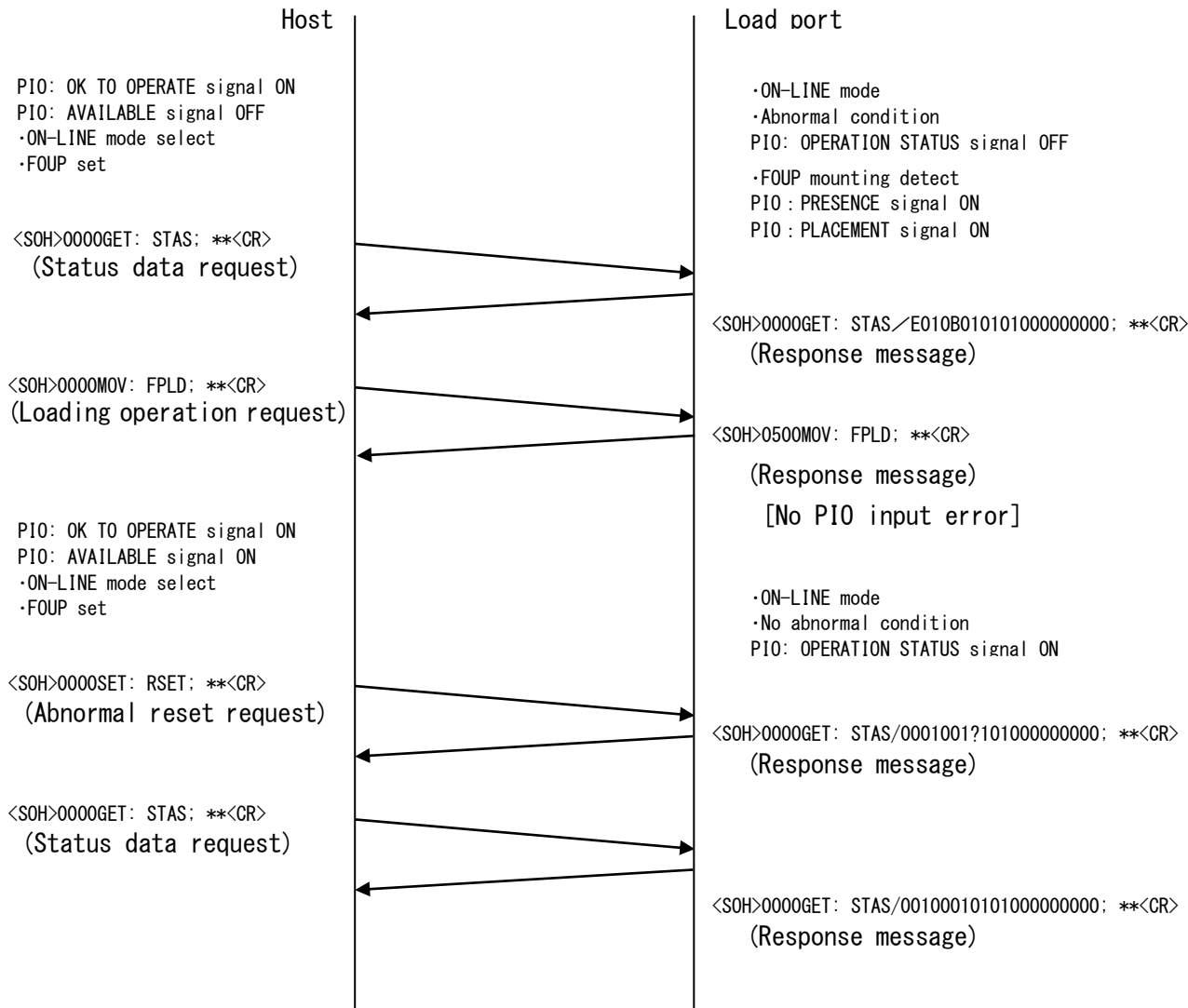
4.4.2.1 Interlock code list

Table 4.1 Interlock code list

Code	Interlock condition	Description
01	Host AVAILABLE not input	AVAILABLE signal from host computer is OFF.
10	No FOUP mounting	No FOUP mounting or mounting abnormally
12	Not home position	The device is not in the home position.
13	Loading not completed	Loading operation is not completed.
14	Clamping not completed	Clamping/unclamping operation is not completed.
15	Docking not completed	Docking operation is not completed.
16	Door vacuum not completed	Door vacuum is not completed.
17	Unlatching not completed	Unlatching operation is not completed.
18	Door opening not completed	Door opening/closing operation is not completed.
19	Mapping not started	Mapping operation is not started.
1A	Mapping forward not completed	Mapping forward/backward operation is not completed.
1C	Z axis is not door position	Z axis is not at door open/close position.
1D	Not in mapping range position	The mapping elevator axis is not in between the mapping start and end positions.
1E	Undocking not completed	Undocking operation is not completed.

4.4.3 Abnormal Condition

In the event of the abnormal condition with AVAILABLE signal OFF during load port operation, the timing chart is like following.



	CODE		ADR		CMD												
SOH	0	5	0	0	M	0	V	:	F	P	L	D	;	*	*	CR	

- Response message in the event of abnormal condition consists of command type in 3 characters and command name in 4 characters. Also “05” that stands for “alarm occurring” is set at the code.

4.4.4 Timeout between command and response message

Time limit from issuing the command to receiving the response message is 10 seconds. However there is no time limit between bytes.

CHAPTER 5 Command Format

5.1 Control Command (Host to load port)

- The command consists of “command type” and “command name”, and they are separated by “:” (colon).
- The command name may need “parameter.” The parameter is put behind the command name.
- It needs to put “;” (semicolon) behind the command name. If the parameter is used, put it behind the parameter.
- The command consists of the command type in 3 characters and the command name in 4 characters (not included the parameter.)

	CODE		ADR		CMD											
SOH	0	0	0	0	M	0	V	:	0	R	G	N	;	5	D	CR
					Command type			:	Command name							

- Control command has following 5 types and they have several diverse command names.

Command type	Description
SET	Setting command
MOD	Operation mode setting command
GET	Getting status command
MOV	Operation command
TCH	Command for teaching mode



NOTE

For the sending format, receiving format, and sending/receiving examples to be described from the next section, check-sum parts are indicated with ** for the sake of convenience.

5.1.1 SET (Initializing) command

This command is used for setting operation type, resetting the error and setting parameters of the load port.

Command name	Description	Event report
RSET	Reset error	Present
RTRY	Retry operation * When the operation is stopped (successive operation), this command can be executed.	None
STPP	Stop operation (successive operation)	Present
PASE	Stop operation (with successive operation)	None
ABOT	Command abot * When the operation is stopped, this command can be executed. (successive operation, operation retry impossible)	None
RESM	resume operation * When the operation is stopped (with successive operation), this command can be executed.	None
TYP1	Type 1 setting	Present
TYP2	Type 2 setting	Present
TYP3	Type 3 setting	Present
TYP4	setting	Present
TYP5	Type 5 setting	Present
MAPP	Mapping parameter setting (with parameter)	Present
MAP1	Mapping parameter setting (with parameter)	Present
MAP2	Mapping parameter setting (with parameter)	Present
POS0	setting of Reference position offset data (with parameter)	Present
LPON	PRESENCE LED light	Present
BLON	PRESENCE LED blink	Present
LOON	PRESENCE LED light out	Present
LPST	PLACEMENT LED light	Present
BLST	PLACEMENT LED blink	Present
LOST	PLACEMENT LED light out	Present
LPLD	LOAD LED light	Present
BLLD	LOAD LED blink	Present
LOLD	LOAD LED light out	Present
LPUD	UNLOAD LED light	Present
BLUD	UNLOAD LED blink	Present
LOUD	UNLOAD LED light out	Present
LPAL	ALARM LED light	Present
BLAL	ALARM LED blink	Present
LOAL	ALARM LED light out	Present
LPSW	OPERATION ACCESS LED light	Present
BLSW	OPERATION ACCESS LED blink	Present
LOSW	OPERATION ACCESS LED light out	Present
LPSL	OPERATION ACCESS LED 2 light	Present
BLSL	OPERATION ACCESS LED 2 blink	Present
LOSL	OPERATION ACCESS LED 2 light out	Present
LPS1	STATUS1 LED light	Present
BLS1	STATUS1 LED blink	Present
LOS1	STATUS1 LED light out	Present
LPS2	STATUS2 LED light	Present
BLS2	STATUS2 LED light out	Present
LOS2	STATUS2 LED light out	Present

LPS3	STATUS3 LED light	Present
BLS3	STATUS3 LED light out	Present
LOS3	STATUS3 LED light out	Present
LPS4	STATUS4 LED light	Present
BLS4	STATUS4 LED light out	Present
LOS4	STATUS4 LED light out	Present

The command with an event report reports the operation completion event only when the event report function is valid.

(Only when the event report function is valid)

5.1.1.1 SET:TYP1~5 command

- Description

Switches the type

- Sending format

SOH	00	00	SET:TYP1	;	**	CR
SOH	00	00	SET:TYP2	;	**	CR
SOH	00	00	SET:TYP3	;	**	CR
SOH	00	00	SET:TYP4	;	**	CR
SOH	00	00	SET:TYP5	;	**	CR

- Sending/receiving example (Type 1)

Upper level sending: [SOH]0000SET:TYP1;**[CR]

Upper level receiving: [SOH]0000SET:TYP1;**[CR]

Upper level receiving: [SOH]0000INF:TYP1;**[CR]



NOTE

When the load port is at the home position, execute a type changeover.
If the load port is not at the home position, a command error is returned.

In the standard specifications, the settings are as follows.

TYPE-1	FOUP
TYPE-2	Adapter
TYPE-3	FOSB
TYPE-4	FOUP
TYPE-5	FOUP

5.1.1.2 SET:MAPP command

- Description

Set the mapping parameters

- Sending format

SOH	00	00	SET:MAPP	abcdefgh	:	**	CR
-----	----	----	----------	----------	---	----	----

Sign	Length	Description	Range
a	2	FOUP TYPE	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5
b	4	Wafer thickness (μm)	0001-FFFF (HEX)
c	4	Cassette pitch (μm)	0001-FFFF (HEX)
d	4	Number of cassette slots	0001-001E (HEX) slot number30
e	4	Offset distance (μm)	0000-FFFF (HEX)
f	4	Wafer pitch thickness tolerance (μm)	0000-FFFF (HEX)
g	4	Wafer position tolerance (μm)	0000-FFFF (HEX)
h	2	Sensor type	00: For 12 inches 01: For 8 inches

- Sending/receiving example

FOUP TYPE:	TYPE-1	00h
Wafer thickness:	750um (0.75mm)	02EEh
Cassette pitch:	10000um (10mm)	2710h
Cassette distance:	slot number 25	0019h
Offset distance:	0mm	0000h
Wafer pitch thickness tolerance:	500um	01F4h
Wafer position tolerance:	500um	01F4h
Sensor type:	For 12 inches	00h

Upper level sending: [SOH]0000SET: MAPP0002EE27100019000001F401F400;**[CR]
 Upper level receiving: [SOH]0000SET:MAPP;**[CR]

5.1.1.3 SET: MAP1 command

- Description

Set the mapping parameters

- Sending format

[SOH]	[00]	[00]	[SET:MAP1]	[abcd]	[;]	[**]	[CR]
-------	------	------	------------	--------	-----	------	------

Sign	Length	Range	Range
a	2	FOUP TYPE	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5
b	4	Wafer thickness (μm)	0001-FFFF (HEX)
c	4	Cassette pitch (μm)	0001-FFFF (HEX)
d	4	Number of cassette slots	0000-001E (HEX) slot number 30

- Sending/receiving example

FOUP TYPE:	TYPE-1	00h
Wafer thickness:	750um (0.75mm)	02EEh
Cassette pitch:	10000um (10mm)	2710h
Number of cassette slots:	slot number 25	0019h

Upper level sending: [SOH]0000SET: MAP10002EE27100019;**[CR]

Upper level receiving: [SOH]0000SET:MAP1;**[CR]

5.1.1.4 SET: MAP2 command

- Description

Set the mapping parameters

- Sending format

SOH	00	00	SET:MAP2	abcde	;	**	CR
-----	----	----	----------	-------	---	----	----

Sign	Length	Description	Range
a	2	FOUP TYPE	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5
b	4	Offset distance (μm)	0001-FFFF (HEX)
c	4	Wafer pitch thickness tolerance (μm)	0000-FFFF (HEX)
d	4	Wafer_Position tolerance (μm)	0000-FFFF (HEX)
e	2	Sensor type	00: For 12 inches 01: For 8 inches

- Sending/receiving example

FOUP TYPE:	TYPE-1	00h
Offset distance:	0mm	0000h
Wafer pitch thickness tolerance:	500um	01F4h
Wafer position tolerance:	500um	01F4h
Sensor type:	For 12 inches	00h

Upper level sending: [SOH]0000SET:MAP200000001F401F400;**[CR]
 Upper level receiving: [SOH]0000SET:MAP2;**[CR]

5.1.1.5 SET:POS0 command

- Description

The mapping elevator axis position is set.

- Sending format

SOH	00	00	SET:POS0	abc	:	**	CR
-----	----	----	----------	-----	---	----	----

Sign	Length	Description	Range
a	2	FOUP TYPE	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5
b	2	Setting position	02: Mapping start position 03: Mapping end position
c	8	Position data (μ m)	00000000–FFFFFFF (HEX)

- Sending/receiving example

FOUP TYPE: TYPE-1 00h
 Setting position: Mapping start position 02h
 Position data: 387000um 0005E7B8h

Upper level sending: [SOH]0000SET:POS000020005E7B8;**[CR]
 Upper level receiving: [SOH]0000SET:POS0;**[CR]

5.1.1.6 SET:LPxx command

5.1.1.7 SET:BLxx command

5.1.1.8 SET:LOxx command

● Description

Lighting of an indicator, blink, and putting out lights are performed.

● Sending format

SOH	00	00	SET:LPON	:	**	CR
-----	----	----	----------	---	----	----

● Sending/receiving example (LOAD Light)

Upper level sending: [SOH]0000SET:LPLD;**[CR]

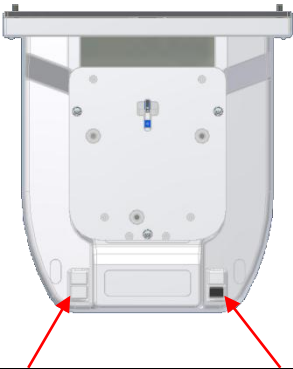
Upper level receiving: [SOH]0000SET:LPLD;**[CR]

Upper level receiving: [SOH]0000INF:LPLD;**[CR]

The character of an indicator, a color, and arrangement change with specifications.



	PRESENCE	PLACEMENT	STATUS1	STATUS2	LOAD	UNLOAD	ALARM
Light	LPON	LPST	LPS1	LPS2	LPLD	LPUD	LPAL
Blink	BLON	BLST	BLS1	BLS2	BLLD	BLUD	BLAL
Out Light	LOON	LOST	LOS1	LOS2	LOLD	LOUD	LOAL



	OPERATION ACCESS SW 2	OPERATION ACCESS SW 1
Light	LPSL	LPSW
Blink	BLSL	BLSW
Out Light	LOSL	LOSW

(Option)



NOTE

The control method of the indicator can be changed by the switch/parameter settings on the control panel.
The turning-ON position for each command varies depending on the switch settings on the control panel.

5.1.2 GET (Getting status) command

This command is used for getting current status of load port.

Command	Description
STAS	Check status
STA1	Check status 1
STA2	Check status 2
MDAT	Wafer search data (from top to bottom)
MAPR	Wafer search data (from bottom to top)
VERN	Get version number of load port
MAPP	Get mapping parameter (with parameter)
MAP1	Get mapping parameter (with parameter)
MAP2	Get mapping parameter (with parameter)
POSO	Get offset data of base position (with parameter)
POSD	Get position data (with parameter)
MDAH	Get mapping thickness data (with parameter)
MDAP	Get mapping position data (with parameter)
MDTC	Wafer search data (range) (with parameter)
MDHS	Get mapping thickness data separately (with parameter)
MDPS	Get mapping position data separately (with parameter)
LEST	Get LED status
LPIOI	IO information report

To set the command with the parameter, refer to the following procedure.

5.1.2.1 GET:STAS command

- Description

This command get the load port status.

- Sending format

SOH	00	00	GET:STAS	:	**	CR
-----	----	----	----------	---	----	----

- Receiving format

SOH	00	00	GET:STAS	/	abcdefghijklmnopqrst	:	**	CR
-----	----	----	----------	---	----------------------	---	----	----

Sign	Length	Description	Range
a	1	Error status	0: Normal A: Recoverable error E: Unrecoverable error
b	1	Mode	0: Online 1: Teaching 2: Maintenance
c	1	Device status	0: In operation 1: Home position 2: LOAD
d	1	Operating state	0: Stopping 1: Operating
e	1	Error code (Upper level)	00-FF: Error code
f	1	Error code (Lower level)	
g	1	Container status	0: None 1: Normal mounting 2: Abnormal mounting
h	1	Clamp position	0: Unclamp 1: clamp ? : Indefinite
i	1	Door latch position	0: open 1: close ? : Indefinite
j	1	Adsorption state	0: OFF 1: ON
k	1	Door positon	0: open 1: close ? : Indefinite
l	1	Wafer protrusion sensor	0: Shading 1: Lighting
m	1	Elevator axis positon	0: Rising position 1: Lowering position 2: Napping start position 3: Mapping end position ?: Indefinite
n	1	Dock position	0: undock position 1: dock position ? : Indefinite
o	1	Reserve	0: Fixation
p	1	Mapping waiting position	0: Waiting position 1: Measuring positon ? : Indefinite
q	1	Reserve	0: Fixation
r	1	Mapping status	0: Inexecution 1: Normal end 2: Abnormal end
s	1	Type	0: TYPE-1 1: TYPE-2 2: TYPE-3 3: TYPE-4 4: TYPE-5
t	1	Reserve	0: Fixation

- Sending/receiving example

Upper level sending: [SOH]0000GET:STAS;**[CR]

Upper level receiving: [SOH]0000GET:STAS/00100020101000000000;**[CR]

5.1.2.2 GET:STA1 command

- Description

get the load port status.

- Sending format

SOH	00	00	GET:STA1	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

SOH	00	00	GET:STA1	/	abcdefghijkl	;	**	CR
-----	----	----	----------	---	--------------	---	----	----

Sign	Length	Description	Range
a	1	Error status	0: Normal A: Recoverable error E: Unrecoverable error
b	1	Mode	0: On line 1: Teaching 2: Maintenance
c	1	Device status	0: In operation 1: Home position 2: LOAD
d	1	Operating state	0: operation stop 1: Operating
e	1	Error code (Upper level)	00-FF: Error code
f	1	Error code (Lower level)	
g	1	Container status	0: None 1: Normal mounting 2: Abnormal mounting
h	1	Clamp position	0: Unclamp 1: clamp ? : Indefinite
i	1	Door latch position	0: open 1: close ? : Indefinite
j	1	Vacuum status	0: OFF 1: ON

- Sending/receiving example

Upper level sending: [SOH]0000GET:STA1;**[CR]

Upper level receiving: [SOH]0000GET:STA1/0010002010;**[CR]

5.1.2.3 GET:STA2 command

- Description

get the load port status.

- Sending format

SOH	00	00	GET:STA2	:	**	CR
-----	----	----	----------	---	----	----

- Receiving format

SOH	00	00	GET:STA2	/	klmnopqrst	:	**	CR
-----	----	----	----------	---	------------	---	----	----

Sign	Length	Description	Range
k	1	Door position	0: open 1: close ?: Indefinite
l	1	WaferProtrusion sensor	0: Shading 1: Lighting
m	1	Elevator axis position	0: Rising position 1: Lowering position 2: Mapping start position 3: Mapping end position ?: Indefinite
n	1	Dick position	0: undock position 1: dock position ?: Indefinite
o	1	Reserve	0: Fixation
p	1	Mapping position	0: Waiting position 1: Measuring position ?: Indefinite
q	1	Reserve	0: Fixation
r	1	Mapping status	0: Inexecution 1: Normal end 2: Abnormal end
s	1	Type	0: TYPE-1 1: TYPE-2 2: TYPE-3 3: TYPE-4 4: TYPE-5
t	1	Reserve	0: Fixation

- Sending/receiving example

Upper level sending: [SOH]0000GET:STA2:**[CR]

Upper level receiving: [SOH]0000GET:STA2/1000000000:**[CR]

5. 1. 2. 5 GET:MAPR command

● Description

This parameter returns the result of wafer mapping from the bottom for the number of slots that set by the mapping parameter.

* Report layout may vary depending on option setting.
(It may be reported from bottom)

● Sending format

SOH	00	00	GET:MAPR	;	**	CR
-----	----	----	----------	---	----	----

● Receiving format

SOH	00	00	GET:MAPR	/	a-x	;	**	CR
-----	----	----	----------	---	-----	---	----	----

Sign	Length	Description	Range
a-x	—	Mapping result	0: no wafer exists 1: wafer exists 2: Cross 3: Thickness error (Thick) 4: Thickness error (Thin) 5: position error

If thickness detection of mapping result is larger than the data added tolerance value of mapping parameter, it is judged “Thick”.

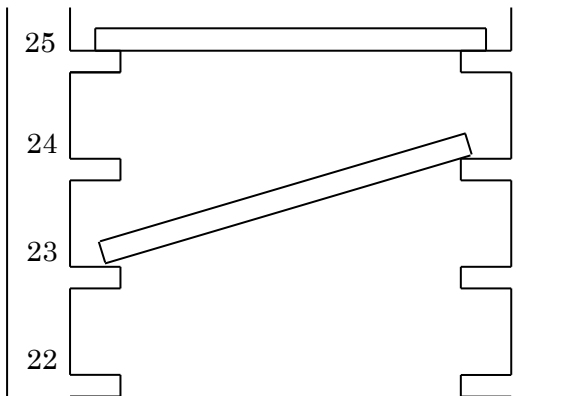
If thickness detection of mapping result is smaller than the data subtracted tolerance value of mapping parameter, it is judged “Thin”.

If positioning detection of mapping result is out of the range between the data added tolerance value and the data subtracted tolerance value of mapping parameter, it is judged “Position error”.

● Sending/receiving example

Slot No: 25

Mapping result :



Upper level sending: [SOH]0000GET:MAPR:**[CR]

Upper level receiving: [SOH]0000GET:MAPR/000000000000000000000000221;**[CR]

5.1.2.6 GET:VERN command

- Description

This command returns the software version of load port.

- Sending format

SOH	00	00	GET:VERN	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

SOH	00	00	GET:VERN	/	VER_	abcd	;	**	CR
-----	----	----	----------	---	------	------	---	----	----

_ = Space (0x20)

Sign	Length	Description	Range
a	2	Model code	00-FF (HEX)
d	2	Special code	00: Serial communication specification 01: Ethernet communication specification (XPORT version)
c	2	Major version	10 (Fixation)
d	2	Minor version	00-FF (HEX)

- Sending/receiving example

Upper level sending: [SOH]0000GET:VERN;**[CR]

Upper level receiving: [SOH]0000GET:VERN/VER 11001016;**[CR]

5.1.2.7 GET:MAPP command

- Description

This command returns the mapping parameter data.

- Sending format

SOH	00	00	GET:MAPP	a	:	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	FOUP Type	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5

- Receiving format

SOH	00	00	GET:MAPP	/	abcdefg	:	**	CR
-----	----	----	----------	---	---------	---	----	----

Sign	Length	Description	Range
a	4	Wafer Thickness (μm)	0001-FFFF (HEX)
b	4	Cassette pitch (μm)	
c	4	Number of cassette slots	
d	4	Offset distance (μm)	
e	4	Wafer pitch thickness tolerance (μm)	
f	4	Wafer position tolerance (μm)	00: For 12 inches 01: For 8 inches
g	2	Seneor type	

- Sending/receiving example

FOUP Type:	TYPE-1	00h
Wafer Thickness:	750um (0.75mm)	02EEh
Cassette pitch:	10000um (10mm)	2710h
Number of cassette slots:	Slot number 25	0019h
Offset distance:	0mm	0000h
Wafer pitch thickness tolerance:	500um	01F4h
Wafer position tolerance:	500um	01F4h
Sensor type:	For 12 inches	00h

Upper level sending: [SOH]0000GET:MAPP00:**[CR]

Upper level receiving: [SOH]0000GET:MAPP/02EE27100019000001F401F400:**[CR]

5.1.2.8 GET:MAP1 command

- Description

This command returns the mapping parameter data.

- Sending format

SOH	00	00	GET:MAP1	a	;	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	FOUP type	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5

- Receiving format

SOH	00	00	GET:MAPP	/	abc	;	**	CR
-----	----	----	----------	---	-----	---	----	----

Sign	Length	Description	Range
a	4	Wafer Thickness (μ m)	0001-FFFF (HEX)
b	4	Cassette pitch (μ m)	
c	4	Number of cassette slots	

- Sending/receiving example

FOUP Type: TYPE-1 00h

Wafer Thickness: 750um (0.75mm) 02EEh

Cassette pitch: 10000um (10mm) 2710h

Number of cassette slots: Slot number 25 0019h

Upper level sending: [SOH]0000GET:MAP100;**[CR]

Upper level receiving: [SOH]0000GET:MAP1/02EE27100019;**[CR]

5.1.2.9 GET:MAP2 command

- Description

This command returns the mapping parameter data.

- Sending format

SOH	00	00	GET:MAP2	a	:	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	FOUP Type	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5

- Receiving format

SOH	00	00	GET:MAP2	/	abcd	:	**	CR
-----	----	----	----------	---	------	---	----	----

Sign	Length	Description	Range
d	4	Offset distance (μm)	0000-FFFF (HEX)
e	4	Wafer pitch thickness tolerance (μm)	
f	4	Wafer position tolerance (μm)	
g	2	Sensor type	00: For 12 inches 01: For 8 inches

- Sending/receiving example

FOUP Type:	TYPE-1	00h
Offset distance:	0mm	0000h
Wafer pitch thickness tolerance:	500um	01F4h
Wafer position tolerance:	500um	01F4h
Sensor type:	For 12 inches	00h

Upper level sending: [SOH]0000GET:MAP200:**[CR]

Upper level receiving: [SOH]0000GET:MAP2/000001F401F400:**[CR]

5.1.2.10 GET:POS0 command

- Description

This command returns the mapping elevating axis position.

- Sending format

SOH	00	00	GET:POS0	ab	:	**	CR
-----	----	----	----------	----	---	----	----

Sign	Length	Description	Range
a	2	FOUP Type	00: TYPE-1 01: TYPE-2 02: TYPE-3 03: TYPE-4 04: TYPE-5
b	2	Get position	02: Mapping start position 03: Mapping end position

- Receiving format

SOH	00	00	GET:POS0	/	a	:	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	8	Position data (μ m)	00000000-FFFFFFFF (HEX)

- Sending/receiving example

FOUP Type: TYPE-1 00h
 Get position: Mapping start position 02h
 Position data: 387000um 0005E7B8h

Upper level sending: [SOH]0000GET:POS00002;**[CR]
 Upper level receiving: [SOH]0000GET:POS0/0005E7B8;**[CR]

5.1.2.11 GET:POSD command

- Description

This command returns the position data of the mapping elevating axis.

- Sending format

SOH	00	00	GET:POSD	a	:	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
b	2	Get position (μm)	00: ---- 01: Current position 02: ---- 03: Mapping start position 04: Mapping end position 05: ----

For the mapping start position, mapping end position, the setting value of the TYPE set at present is returned.

- Receiving format

SOH	00	00	GET:POSD	/	a	:	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	8	Position data (μm)	00000000–FFFFFFFF (HEX)

- Sending/receiving example

Get position: Mapping start position 0000h

Position data: 387000um (TYPE-1) 0005E7B8h

Upper level sending: [SOH]0000GET:POSD02;**[CR]

Upper level receiving: [SOH]0000GET:POSD/0005E7B8;**[CR]

5.1.2.12 GET:MDAH command

- Description

This parameter returns the thickness data of wafer mapping result in every 5 slots.

Number of slot can be set by the parameter of the command when data request.

Thickness data is the difference between the positions of the wafer sensor turning ON and OFF.

- Sending format

SOH	00	00	GET:MDAH	a	:	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	Specified slot	01: Slot 1~5 02: Slot 6~10 03: Slot 11~15 04: Slot 16~20 05: Slot 21~25 06: Slot 26~31

- Receiving format

SOH	00	00	GET:MDAH	/	abcde	:	**	CR
-----	----	----	----------	---	-------	---	----	----

Sign	Length	Description	Range
a	4	Slot n Thickness (μm)	0000~FFFF (HEX)
b	4	Slot n+1 Thickness (μm)	
c	4	Slot n+2 Thickness (μm)	
d	4	Slot n+3 Thickness (μm)	
e	4	Slot n+4 Thickness (μm)	

- Sending/receiving example

Specified slot: Slot 6~10 02h

Slot 6: 720um 02D0h

Slot 7: 700um 02BCh

Slot 8: 0um 0000h

Slot 9: 680um 02A8h

Slot 10: 540um 021Ch

Upper level sending: [SOH]0000GET:MDAH02:**[CR]

Upper level receiving: [SOH]0000GET:MDAH/02D002BC000002A8021C:**[CR]

5.1.2.13 GET:MDAP command

- Description

This parameter returns the position data of the wafer mapping result in every 5 slots.

Number of slot data can be set by the parameter of the command when data request.

Position data generates at the bottom surface of the wafer where the wafer sensor turns OFF.

- Sending format

SOH	00	00	GET:MDAP	a	:	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	Specified slot	01: Slot 1~5 02: Slot 6~10 03: Slot 11~15 04: Slot 16~20 05: Slot 21~25 06: Slot 26~31

- Receiving format

SOH	00	00	GET:MDAP	/	abcde	:	**	CR
-----	----	----	----------	---	-------	---	----	----

Sign	Length	Description	Range
a	6	Slot n position (μm)	0000000~FFFFFF (HEX)
b	6	Slot n+1 position (μm)	
c	6	Slot n+2 position (μm)	
d	6	Slot n+3 position (μm)	
e	6	Slot n+4 position (μm)	

- Sending/receiving example

```
Specified slot: Slot 1~5    01h
Slot 1:         10123um    00278Bh
Slot 2:         0um        000000h
Slot 3:         30456um    0076F8h
Slot 4:         41078um    00A076h
Slot 5:         50100um    00C3B4h
```

Upper level sending: [SOH]0000GET:MDAP01;**[CR]

Upper level receiving: [SOH]0000GET:MDAP/00278B0000000076F800A07600C3B4;**[CR]

5.1.2.14 GET:MDTC command

● Description

The wafer mapping result from the start slot to the end slot is reported.

● Sending format

SOH	00	00	GET:MDTC	ab	:	**	CR
-----	----	----	----------	----	---	----	----

Sign	Length	Description	Range
a	2	Start slot is specified.	01-1E (HEX)
b	2	End slot is specified.	01-1E (HEX)

● Receiving format

SOH	00	00	GET:MDTC	/	a-x	:	**	CR
-----	----	----	----------	---	-----	---	----	----

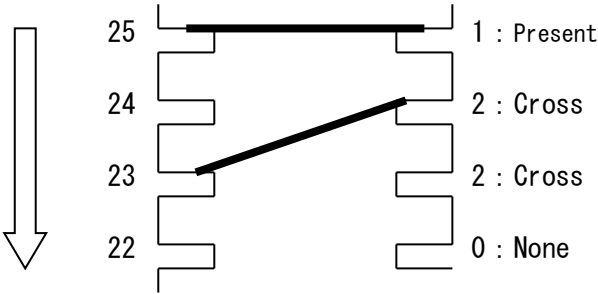
Sign	Length	Description	Range
a-x	-	Wafer search result	0: no wafer exists 1: wafer exists 2: Cross 3: Thick 4: Thin 5: Position error

● Sending/receiving example

Start slot is specified: Slot 1 01h
End slot is specified: Slot 4 04h
Slot 1: wafer exists 1h
Slot 2: Cross 2h
Slot 3: Cross 2h
Slot 4: no wafer exists0h

Upper level sending: [SOH]0000GET:MDTC0104:**[CR]
Upper level receiving: [SOH]0000GET:MDTC/1220:**[CR]

Order of wafer search



5.1.2.15 GET:MDHS command

- Description

This parameter returns the thickness data of wafer mapping result in every specified number of slots.

Number of slot can be set by the parameter of the command when data request.

Thickness data is the difference between the positions of the wafer sensor turning ON and OFF.

- Sending format

SOH	00	00	GET:MDHS	a	;	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	Specified slot	01-1E (HEX) Slot 1~31

- Receiving format

SOH	00	00	GET:MDHS/	/	a	;	**	CR
-----	----	----	-----------	---	---	---	----	----

Sign	Length	Description	Range
a	4	Wafer Thickness (μm)	00000-FFFF (HEX)

- Sending/receiving example

Specified slot: Slot 4 04h

Slot 4: 720um 02D0h

Upper level sending: [SOH]0000GET:MDHS04;**[CR]

Upper level receiving: [SOH]0000GET:MDHS/02D0;**[CR]

5.1.2.16 GET:MDPS command

- Description

This parameter returns the position data of the wafer mapping result in every specified number of slots.

Number of slot data can be set by the parameter of the command when data request.

Position data generates at the bottom surface of the wafer where the wafer sensor turns OFF

- Sending format

SOH	00	00	GET:MDPS	a	;	**	CR
-----	----	----	----------	---	---	----	----

Sign	Length	Description	Range
a	2	Specified slot	01-1E (HEX) Slot 1~31

- Receiving format

SOH	00	00	GET:MDPS	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	4	Wafer Thickness (μm)	0000000-FFFFFF (HEX)

- Sending/receiving example

Specified slot: Slot 6 06h

Slot 6 positon: 11234um 002BE2h

Upper level sending: [SOH]0000GET:MDPS06;**[CR]

Upper level receiving: [SOH]0000GET:MDPS/002BE2;**[CR]

5.1.2.17 GET:LEST command

- Description

This parameter returns the LED status.

- Sending format

[SOH]	00	00	GET:LEST	;	**	CR
-------	----	----	----------	---	----	----

- Receiving format

[SOH]	00	00	GET:LEST	/	abcdefgh	;	**	CR
-------	----	----	----------	---	----------	---	----	----

Sign	Length	Description	Range
a	1	PRESENCE LED status	0: Out Light 1: Light 2: Blink
d	1	PLACEMENT LED status	
c	1	LOAD LED status	
d	1	UNLOAD LED status	
e	1	OperatorAccess1 status	
f	1	STATUS1 LED status	
g	1	STATUS2 LED status	
h	1	OperatorAccess2 status ⁱ	

- Sending/receiving example

```

PRESENCE:      Light      1
PLACEMENT:     Light      1
LOAD:          Light      1
UNLOAD:        Out Light  0
OperatorAccess 1: Blink    2
STATUS1:       Out Light  0
STATUS2:       Out Light  0
OperatorAccess 2: Out Light 0

```

Upper level sending: [SOH]0000GET:LEST;**[CR]

Upper level receiving: [SOH]0000GET:LEST/11102000;**[CR]

ⁱ Output when the option setting is valid

5.1.2.18 GET:LI0I command

- Description

This parameter acquires the load port IO status.

- Sending format

SOH	00	00	GET:LI0I	:	**	CR
-----	----	----	----------	---	----	----

- Receiving format

SOH	00	00	GET:LI0I	/	abcdefgh	:	**	CR
-----	----	----	----------	---	----------	---	----	----

Symbol (hex)	bit	Length	Content	Status in "0"	Status in "1"
a	0	1	Load detected	With container detected	No container detected
	1		Normal loading detected 1	No container detected	With container detected
	2		Normal loading detected 2	No container detected	With container detected
	3		Normal loading detected 3	No container detected	With container detected
b	0	1	Cassette judgment sensor input 1 detected	TBD	TBD
	1		Cassette judgment sensor input 2 detected	TBD	TBD
	2		Cassette judgment sensor input 3 detected	TBD	TBD
	3		Cassette judgment sensor input 4 detected	TBD	TBD
c	0	1	Hand pinch detected	Hand pinch detected	Not detected (normal)
	1		Wafer protrusion detected	Wafer protrusion detected	Not detected (normal)
	2		Manual switch 1 detected	–	PUSH detected
	3		Manual switch 2 detected	–	PUSH detected
d	0	1	Elevation cylinder normal pressure detected	Pressure drop detected	Not detected (normal)
	1		Fan alarm detected	Fan alarm detected	Not detected (normal)
	2		Auto mode selection detected	Maintenance mode detected	Host mode detected
	3		Reserved	Fixed to 0	
e	0	1	Unclamp detected	–	Unclamp position status
	1		Clamp detected	–	Clamp position status
	2		Undock position detected	–	Undock position status
	3		Dock position detected	–	Dock position status
f	0	1	Reserved	Fixed to 0	
	1		Door normal vacuum pressure detected	Vacuum canceled status	Vacuumed status
	2		Unlatch position detected → Latch close (Home position)	–	Unlatch position status
	3		Latch position detected → Latch open (Retension position)	–	Latch positioned status
g	0	1	Door close position detected	–	Door close status
	1		Door open position detected	–	Door open status
	2		Elevation UP position detected	–	Elevation UP position status
	3		Elevation DOWN position detected	–	Elevation DOWN position status
h	0	1	Mapping arm OUT detected	–	Mapping OUT position status
	1		Mapping arm IN detected	–	Mapping IN position status
	2		Mapping sensor input 1	Shading status	Lighting status
	3		Mapping sensor input 2	Shading status	Lighting status

* Regarding the symbol a, “a = 1” if the container exists and “a = E” if not.

5.1.3 MOD (Operation mode setting) command

Operation mode is set by this command.

command	Description
TECH	Set to Teaching mode
ONLN	Set to On-line mode
MNTE	Set to Maintenance mode



CAUTION

The interlock function is NOT effective in Teaching mode to prevent hazardous conditions.

Use Maintenance mode to adjust the load port with a PC. Note that the interlock function is NOT effective in Maintenance mode to prevent hazardous conditions.

Turn the key switch to Host port mode to select ONLN (On-line) mode, and then ONLN mode and TECH mode(Teaching mode) can be selected by command in this mode.

When changing into the maintenance mode, switch the mode changeover switch of the load port main unit to "Maintenance mode"

5.1.4 MOV (Operation) command

This command executes to open/close each port and other operations. To use this command, the sensor status needs to meet the operating condition when receiving the command.



NOTE

For the interlock codes of each command explanation, refer to “Chapter 4, 4.4.2.1 Interlock code list”, and for the error codes, “5.1.6 Error code”.

- Complex Operartion command

Command	Description
ORGN	Move to home position
ABGN	Move to home position forcedly
FPLD	Move to loading status from unloading status.
FPML	Move to loading status from unloading status after mapping operation.
FDOC	Move to docking status from unloading status.
FDLD	Move to loading status from docking status.
FDML	Move to loading status from docking status after mapping operation.
FCLD	Move to loading status from clamping status.
FCML	Move to loading status from clamping status after mapping operation.
FPUL	Move to unloading status from loading status.
FPMU	Move to unloading status from load status after mapping operation.
FVOF	Move to docking status from loading status.
FVUL	Move to loading status from docking status.
FUDC	Move to clamping status from loading status.
FUMD	Move to claping status from loading status after mapping operation.
MAPP	Execute mapping operation. (from top to bottom)
RMAP	Restart mapping operation during interruption. (from top to bottom)
Z_MP	Execute mapping operation. (from top to bottom)



NOTE

For the operation description and the operation order of the complex operation, refer to “Appendex B Correspondence Table of Complex Operartion and Individual Operation”.

- Individual operation command

Command	Description
FCOP	Unclamp
FCCL	Clamp
VCON	Vacuum ON
VCOF	Vacuum OFF
DROP	Door clamp open (FOUP door unlock status)
DRCL	Door clamp close (FOUP door lock status)
MAFW	Move to mapping measurement position.
MABW	Move to mapping waiting position
Z_UP	Move elevator axis to door open/close position.
Z_DN	Move elevator axis to load position.
Z_ST	Move elevator axis to mapping start position.
Z_ED	Move elevator axis to mapping end position.
Y_BW	Move dock slide to undock position.
Y_FW	Move dock slide to dock position.
DRFW	Door open
DRBW	Door close

5.1.4.1 MOV:ORGN command

- Description (Complex Operartion)

Move to home position

- Sending format

SOH	00	00	MOV:ORGN	;	**	CR
-----	----	----	----------	---	----	----

- format

Receiving Normal response

SOH	00	00	MOV:ORGN	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:ORGN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:ORGN	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:ORGN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

When the door is retained,

The cassette shall be in the normal mounted status.

5.1.4.2 MOV:ABGN command

- Description (Complex Operartion)

Move to home position forcedly

- Sending format

SOH	00	00	MOV:ABGN	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:ABGN	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:ABGN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:ABGN	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:ABGN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.3 MOV:FPLD command

- Description (Complex Operation)

Move to loading (receiving/delivering transfer device) status from unloading status.

- Sending format

SOH	00	00	MOV:FPLD	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FPLD	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FPLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FPLD	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FPLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door position shall not be indefinite.

The mapper shall be returned.

When the door is in the close status,

- in the vacuum status, the latch shall not be open.

- in the vacuum release status, the latch shall not be closed.

5.1.4.4 MOV:FPML command

- Description (Complex Operation)

Move to loading status from unloading status after mapping operation.

- Sending format

SOH	00	00	MOV:FPML	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FPML	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FPML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FPML	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FPML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door position shall not be indefinite.

The mapper shall be returned.

When the door is in the close status,

- in the vacuum status, the latch shall not be open.

- in the vacuum release status, the latch shall not be closed.

5.1.4.5 MOV:FDOC command

- Description (Complex Operartion)

Move to docking status from unloading status.

- Sending format

SOH	00	00	MOV:FDOC	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FDOC	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FDOC	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FDOC	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FDOC	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door position shall not be indefinite.

The mapper shall be returned.

When the door is in the close status,

- in the vacuum status, the latch shall not be open.

- in the vacuum release status, the latch shall not be closed.

5.1.4.6 MOV:FDLD command

- Description (Complex Operation)
Move to loading status from docking status.

- Sending format

SOH	00	00	MOV:FDLD	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FDLD	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FDLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FDLD	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FDLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.
 Z-axis initialization shall be completed.
 The door position shall not be indefinite.
 The mapper shall be returned.
 The home position status to the dock operation shall be completed.

5.1.4.7 MOV:FDML command

- Description (Complex Operation)
Move to loading status from docking status after mapping operation.

- Sending format

SOH	00	00	MOV:FDML	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FDML	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FDML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FDML	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FDML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.
 Z-axis initialization shall be completed.
 The door position shall not be indefinite.
 The mapper shall be returned.
 The home position status to the dock operation shall be completed.

5.1.4.8 MOV:FCLD command

- Description (Complex Operation)
Move to loading status from clamping status.

- Sending format

SOH	00	00	MOV:FCLDL	;	**	CR
-----	----	----	-----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FCLD	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FCLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FCLD	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FCLD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.
 Z-axis initialization shall be completed.
 The door position shall not be indefinite.
 The mapper shall be returned.
 The home position status to the dock operation shall be completed.

5.1.4.9 MOV:FCML command

- Description (Complex Operation)
Move to loading status from clamping status after mapping operation.

- Sending format

SOH	00	00	MOV:FCMLL	;	**	CR
-----	----	----	-----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FCML	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FCML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FCML	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FCML	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.
 Z-axis initialization shall be completed.
 The door position shall not be indefinite.
 The mapper shall be returned.
 The home position status to the dock operation shall be completed.

5.1.4.10 MOV:FPUL command

- Description (Complex Operation)

Move to unloading status from loading status.

- Sending format

SOH	00	00	MOV:FPUL	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FPUL	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FPUL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FPUL	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FPUL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The mapper shall be returned.

When the elevator axis is not at the door open/close position,

- the elevator axis shall be at the load position.
- shall be in the dock status.
- the door shall be open.

5.1.4.11 MOV:FPMU command

Description (Complex Operation)

Move to unloading status from loading status after mapping operation.

Sending format

SOH	00	00	MOV:FPMU	;	**	CR
-----	----	----	----------	---	----	----

Receiving format

Normal response

SOH	00	00	MOV:FPMU	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FPMU	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

Operation finish event

Normal finish

SOH	00	00	INF:FPMU	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FPMU	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

Operating condition

The cassette shall be in the normal mounted status.
 Z-axis initialization shall be completed.
 The mapper shall be returned.

When the elevator axis is not at the door open/close position,
 - the elevator axis shall be at the load position.
 - shall be in the dock status.
 - the door shall be open.

5.1.4.12 MOV:FVOF command

- Description (Complex Operartion)

Move to docking status from loading status.

- Sending format

SOH	00	00	MOV:FVOF	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FVOF	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FVOF	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FVOF	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FVOF	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The mapper shall be returned.

When the elevator axis is not at the door open/close position,

- the elevator axis shall be at the load position.
- shall be in the dock status.
- the door shall be open.

5.1.4.13 MOV:FVUL command

- Description (Complex Operation)

Move to unload status from dock status.

- Sending format

SOH	00	00	MOV:FVUL	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FVUL	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FVUL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FVUL	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FVUL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The mapper shall be returned.

The home position status to the vacuum release shall be completed.

When the elevator axis is not at the door open/close position,

- the elevator axis shall be at the load position.
- shall be in the dock status.
- the door shall be open.

5.1.4.14 MOV:FUDC command

- Description (Complex Operartion)

Move to clamping status from loading status.

- Sending format

SOH	00	00	MOV:FUDC	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FUDC	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FUDC	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FUDC	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FUDC	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The mapper shall be returned.

The home position status to the clamp operation shall be completed.

When the elevator axis is not at the door open/close position,

- the elevator axis shall be at the load position.
- shall be in the dock status.
- the door shall be open.

5.1.4.15 MOV:FUMD command

- Description (Complex Operartion)

Move to clamp status after mapping operation from loading status.

- Sending format

SOH	00	00	MOV:FUMD	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FUMD	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FUMD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FUMD	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FUMD	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The mapper shall be returned.

The home position status to the clamp operation shall be completed.

When the elevator axis is not at the door open/close position,

- the elevator axis shall be at the load position.
- shall be in the dock status.
- the door shall be open.

5.1.4.16 MOV:MAPP command

- Description (Complex Operation)

Move to loading status again after mapping operation from loading status (from upper level to lower level).

- Sending format

SOH	00	00	MOV:MAPP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:MAPP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:MAPP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:MAPP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:MAPP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door shall be open.

The mapper position shall not be indefinite.

5.1.4.17 MOV:RMAPcommand

- Description (Complex Operartion)

Move to loading status again after mapping operation from loading status (from upper level to lower level).

- Sending format

SOH	00	00	MOV:RMAP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:RMAP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:RMAP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:RMAP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:RMAP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door shall be open.

The mapper position shall not be indefinite.

5. 1. 4. 18 MOV:Z_MPcommand

- Description (Complex Operartion)

Move to loading status again after mapping operation from loading status
(from upper level to lower level)

- Sending format

SOH	00	00	MOV:Z_MP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_MP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_MP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_MP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_MP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.
Z-axis initialization shall be completed.
The door shall be open.
The mapper position shall not be indefinite.

5.1.4.19 MOV:FCOP command

- Description (Individual operation)
Clamp open (un clamp status)

- Sending format

SOH	00	00	MOV:FCOP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FCOP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FCOP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FCOP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FCOP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.20 MOV:FCCL command

- Description (Individual operation)

Clamp close (clamp status)

- Sending format

SOH	00	00	MOV:FCCL	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:FCCL	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:FCCL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:FCCL	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:FCCL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

5.1.4.21 MOV:VCON command

- Description (Individual operation)

Vacuum on

- Sending format

SOH	00	00	MOV:VCON	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:VCON	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:VCON	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:VCON	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:VCON	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

Other than when no container exists

The cassette shall be in the normal mounted status.

The clamp shall be closed.

Shall be in the dock status.

5.1.4.22 MOV:VCOF command

- Description (Individual operation)

Vacuum off

- Sending format

SOH	00	00	MOV:VCOF	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:VCOF	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:VCOF	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:VCOF	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:VCOF	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.23 MOV:DROP command

- Description (Individual operation)

Door clamp open (FOUP door lock status)

- Sending format

SOH	00	00	MOV:DROP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:DROP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:DROP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:DROP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:DROP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.24 MOV:DRCL command

- Description (Individual operation)

Door clamp close (FOUP door unlock status)

- Sending format

SOH	00	00	MOV:DRCL	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:DRCL	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:DRCL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:DRCL	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:DRCL	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.25 MOV:MAFW command

- Description (Individual operation)

Move to mapping measuring position

- Sending format

SOH	00	00	MOV:MAFW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:MAFW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:MAFW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:MAFW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:MAFW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

Shall be in the mapping start position/end position.

The door shall be open.

5. 1. 4. 26 MOV:MABW command

- Description (Individual operation)
Move to mapping waiting position

- Sending format

SOH	00	00	MOV:MABW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:MABW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:MABW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

Operation finish event

Normal finish

SOH	00	00	INF:MABW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:MABW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

None

5.1.4.27 MOV:Z_UP command

- Description (Individual operation)

Move elevator axis to door open/close position.

- Sending format

SOH	00	00	MOV:Z_UP	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_UP	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_UP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_UP	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_UP	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

The door shall be open.

Mapping mechanism being at waiting position

In the vacuum release status, the latch shall not be open.

When the latch is not open, the vacuum shall not be ON.

5.1.4.28 MOV:Z_DN command

- Description (Individual operation)

Move elevator axis to load position.

- Sending format

SOH	00	00	MOV:Z_DN	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_DN	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_DN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_DN	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_DN	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

The door shall be open.

The mapper shall be returned.

In the vacuum release status, the latch shall not be open.

When the latch is not open, the vacuum shall not be ON.

5.1.4.29 MOV:Z_ST command

- Description (Individual operation)

Move elevator axis to mapping start position.

- Sending format

SOH	00	00	MOV:Z_ST	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_ST	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_ST	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_ST	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_ST	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door shall be open.

The mapper position shall not be indefinite, and

shall be in the mapping zone when the mapper is in the forward status.

In the vacuum release status, the latch shall not be open.

When the latch is not open, the vacuum shall not be ON.

5. 1. 4. 30 MOV:Z_ED command

- Description (Individual operation)

Move elevator axis to mapping end position.

- Sending format

SOH	00	00	MOV:Z_ED	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_ED	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_ED	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_ED	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_ED	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Z-axis initialization shall be completed.

The door shall be open.

The mapper position shall not be indefinite, and

shall be in the mapping zone when the mapper is in the forward status.

In the vacuum release status, the latch shall not be open.

When the latch is not open, the vacuum shall not be ON.

5. 1. 4. 31 MOV:Y_BW command

- Description (Individual operation)

Move dock slide to undock position.

- Sending format

SOH	00	00	MOV:Y_BW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Y_BW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Y_BW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Inter lock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Y_BW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Y_BW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

Other than when no container exists

The cassette shall be in the normal mounted status.

The clamp shall be closed.

5.1.4.32 MOV:Y_FW command

- Description (Individual operation)

Move dock slide to dock position.

- Sending format

SOH	00	00	MOV:Z_FW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:Z_FW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:Z_FW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:Z_FW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:Z_FW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

Other than when no container exists

The cassette shall be in the normal mounted status.

The clamp shall be closed.

When the door is in the close status,

- in the vacuum status, the latch shall not be open.

- in the vacuum release status, the latch shall not be closed.

5. 1. 4. 33 **MOV:DRFW** command

- Description (Individual operation)

Move door to open position

- Sending format

SOH	00	00	MOV:DRFW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:DRFW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:DRFW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:DRFW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:DRFW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

Shall not be in the vacuum status and latch open status.

At the door open/close position, shall not be in the dock status and indefinite latch position.

5. 1. 4. 34 **MOV:DRBW** command

- Description (Individual operation)

Move door to close position.

- Sending format

SOH	00	00	MOV:DRBW	;	**	CR
-----	----	----	----------	---	----	----

- Receiving format

Normal response

SOH	00	00	MOV:DRBW	;	**	CR
-----	----	----	----------	---	----	----

Interlock

SOH	00	00	MOV:DRBW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Interlock code	00-FF (HEX)

- Operation finish event

Normal finish

SOH	00	00	INF:DRBW	;	**	CR
-----	----	----	----------	---	----	----

Abnormal finish

SOH	00	00	ABS:DRBW	/	a	;	**	CR
-----	----	----	----------	---	---	---	----	----

Sign	Length	Description	Range
a	2	Error code	00-FF (HEX)

- Operating condition

The cassette shall be in the normal mounted status.

The door elevator axis shall be at the door open/close position.

Shall not be in the vacuum status and latch open status.

Shall not be latch close in the dock status and vacuum release.

5.1.5 TECH (Teaching mode) command

This command can be used in “TECH” mode only. To send “ONLN” command to return normal operation.



At the teaching mode, only the interlock to prevent danger is effective. The incorrect usage might break the machine. Do not use this command usually.

5.1.5.1 FOUP operation command

command	Description
FCOP	Clamp open (clamp status)
FCCL	Clamp close (clamp status)
VCON	Vacuum on
VCOF	Vacuum off
DROP	Door clamp open (FOUP door lock status)
DRCL	Door clamp close (FOUPdoor unlock status)
MAFW	Move mapping to measuring position.
MABW	Move mapping to waiting position.
Z_UP	Move door elevator axis to door open/close position, and move mapping elevator axis to door open/close position.
Z_DN	Move door elevator axis to load position, and move mapping elevator axis to load position.
Z_ST	Move door elevator axis to load position, and move mapping elevator axis to mapping start position.
Z_ED	Move door elevator axis to load position, and move mapping elevator axis to mapping end position.
Y_BW	Move dock slide to undock position.
Y_FW	Move dock slide to dock position.
DRFW	Door open
DRBW	Door close

For the descriptions of operation commands, refer to the MOV (operation) command.

5.1.6 Error code

H-TYPE		Error content
Code		
0	0	Normal
1	0	Clamp time over
	1	Unclamp time over
	2	Dock time over
	3	Undock time over
	4	Latch time over
	5	Unlatch time over
	6	Vacuum time over
	7	Vacuum release time over
	8	Door open time over
	9	Door close time over
	A	Mapping forward time over
	B	Mapping return time over
	F	communication error(3 times of resending) (T-Type)
	2	0
1		Loading time over
2		Unloading time over
3		Positioning time over
8		Door open/close position movement time over (mapping elevating operation)
9		Mapping start position movement time over (elevating operation)
A		Mapping end position movement time over (elevating operation)
B		Load position movement time over (elevating operation)
4	0	Mapping data error
	1	Mode select error
7	0	Clamp sensor error
	1	Dock sensor error
	2	Latch sensor error
	3	Door sensor error
	4	Mapping sensor error
	7	Elevator axis sensor error
A	0	Wafer drop
	1	Wafer protrusion
	2	FOUP mount error (Mount sensor)
	3	FOUP mount error (Load sensor)
	5	Air pressure drop
B	0	Host error (with no PIO input)
C	0	Parameter error
E	0	FAN stop alarm
	3	Voltage drop
F	E	Dock hand pinch error



NOTE

For the details, refer to “Appendix Assumed Error Cause and Recovery Method”.

5.2 Condition of Send Command (Host to load port)

5.2.1 Command Depending on Status

status	command	Description
After power ON	GET:STAS	Get status of load port
	MOV:ORGN	Move to home position
After error reset	MOV:ORGN	Move to home position
During error	SET:RSET	Reset recoverable error

5.2.2 Sending Procedure by Individual Operation Command

Operation procedures (standard flow) in automatic operation are shown below.

5.2.2.1 When loading FOUN

No.	command	Description
1	FCCL	Clamp close
2	Y_FW	Move dock slide to dock position.
3	VCON	Vacuum on
4	DROP	Unlatch (FOUP door lock release)
5	DRFW	Door open
6	Z_DN	Move elevator axis to load position.

5.2.2.2 When mapping wafer in FOUN

No.	command	Description
1	FCCL	Description
2	Y_FW	Move dock slide to dock position.
3	VCON	Vacuum on
4	DROP	Unlatch (FOUP door lock release)
5	DRFW	Door open
6	Z_ST	Move elevator axis to mapping start position.
7	MAFW	Move mapping to measuring position.
8	Z_ED	Move elevator axis to mapping end position.
9	MABW	Move to mapping waiting position
10	Z_DN	Move elevator axis to load position.



NOTE

At individual operation, the mapping result is not updated.

5.2.2.3 When unloading FOUN

No.	command	Description
1	Z_UP	Move elevator axis to door open/close position.
2	DRBW	Door close
3	DRCL	latch (FOUP door lock)
4	VCOF	Vacuum off
5	Y_BW	Move dock slide to undock position.
6	FCOP	Clamp open

5.2.2.4 When moving FOUN to home position

No.	command	Description
1	MABW	Move mapping to waiting position.
2	DRFW	Door open
3	Z_UP	Move mapping elevator axis to door open/close position.
4	DRBW	Door close
5	DRCL	latch (FOUP door lock)
6	VCOF	Vacuum off
7	Y_BW	Move dock slide to undock position.
8	FCOP	Clamp open

5.3 Event Report (Load port to host)

- Load port outputs “operation end event” and “FOUP status change report event”.
- The event consists of “event type”, “event name” or “receive command name” and “parameter (in the event of error only)”.
- “Event type” and “receive command name (event name)” are separated by “:”(colon), when “parameter” is used, “receive command name (event name)” and “parameter” are separated by “/” (slash). It needs to put “;” (semicolon) behind the “parameter”.
- The event consists of the event type in 3 characters and the receive command name (event name) in 4 characters.
- The parameter varies depending on the “error content”.

Processing completion event

	CODE		ADR		Event classification					Command name						
SOH	0	0	0	0	I	N	F	:	0	R	G	N	;	*	*	CR

Change of state event

	CODE		ADR		Event classification					Command name						
SOH	0	0	0	0	I	N	F	:	P	W	O	N	;	*	*	CR

Error report event

	CODE		ADR		Event classification					Command name						
SOH	0	0	0	0	A	B	S	:	F	P	L	D	;	*	*	CR

- Event report has following 2 types. When changing the mode (with MOD: command) or requesting the data (with GET: command), the event of operation end does not output.

Event type	Description
INF	1. Operation end report
	2. FOUP status change report
	3. Manual switch input
	4. Power ON report
	5. Air pressure drop
ABS	1. Operation error report
	2. Error report when operation stop

5.3.1 INF Event

INF event has 2 types: processing completion event and status change event.

5.3.1.1 Processing completion event

This event is output when receiving the operation command and stopping the operation properly. The received command name is set to the command name as it is.

5.3.1.2 Status change report event

Depending on the timing of loading or unloading the FOUP, following events are output.

The event name and the input conditions to raise the event are described below.

- In the event of the FOUP

Event name	Description
PDOF	Load sensors and mount sensors are all OFF
PLAC	Load sensors OFF, mount sensors ON
PRES	Load sensors ON, mount sensors OFF
PDON	Normal mount status (Load sensors/mount sensors ON)

- In the event of the 8 inch adaptor

Event name	Description
PDOF	Load sensors and mount sensors are all OFF
PRES	Mount error status
PDON	Normal mount status

- In the event of the input of operation panel switch which outputs only when the switch turns ON.

Event name	Description
MNSW	Operation access switch1 turned on
MESW	Operation access switch2 turned on

This event is reported only the activation of switch input.

* To be reported only to the system with button specifications.

- In the event of turning on the power or changing the mode from maintenance mode.

Event name	Description
PWON	1. The power turned on 2. The key switch is switched from the MAINT mode to the HOST mode.

- In the case of reporting the compressed air drop event

Event name	Description
AIRD	Compressed air pressure has dropped.

5.3.2 ABS Event

5.3.2.1 During operation

This event is output when receiving the operation command and stopping the operation improperly by the error. The received command name is set to the command name as it is. The error code is set to the parameter.

e.g. Dock time over occurs during the dock operation.

[SOH]0000ABS:Y_FW/12;F2[CR]

5.3.2.2 During operation stop

This event is output when the error occurs during operation stop. “ERRS” is set to the command name. The error code is set to the parameter.

e.g. FAN stop alarm occurs during operation stop.

[SOH]0000ABS:ERRS/E0;EB[CR]



NOTE

For the error codes, refer to “5.1.6 Error code”.

5.3.3 Event setting description

The maintenance tool is used to change the “valid/invalid” of each event.

COMMON	TYPE/TABLE	E84	OPTION	ExCommand
Expand6				Not Used
Expand7				Not Used
Expand8				Not Used
6. CONTROL				
Address			0	
Led			PIO	
7. SPECIAL				
Event Enabled				Not Used
/PWON				Not Used
/ERRS				Not Used
/MNSW				Not Used
/PDON				Not Used
/PDOF				Not Used
/PRES				Not Used
/PLAC				Not Used
/AIRD				Not Used
/MESW				Not Used
Event11				Not Used
Event12				Not Used
Event13				Not Used
Event14				Not Used
Event15				Not Used
Event16				Not Used
8. SECS				
T1 CharTimeOut			0	
T2 ProtocolTimeout			0	

* Used: Valid, Not Used: Invalid



NOTE

When the Event Enabled is Not Used, all the events are not sent.

CHAPTER 6 Precautions for Operation

Precautions for operation are described in this section.

6.1 Initial Operation

Be sure to perform initial operation in the following cases.

- When turning ON the power.
- When recovering from an error

6.2 Elevating Operation

The elevating operation conforms to semi s2. In the case of the status without container (loading not detected), by the interlock circuit of the hardware, output to the solenoid valve which drives the elevator axis is cut off.

APPENDIX

APPENDIX A

Assumed Error Cause and Recovery Method

H-TYPE Code	Error description	Assumed cause	Recovery method
10	Clamp time over * The clamp operation is not completed within the set time	<ol style="list-style-type: none"> 1. The container is deformed. 2. A foreign matter or interfering object is caught. 3. Clamp sensor adjustment fault 4. Clamp sensor failure (X24) 5. Clamp motor failure 6. Relay board failure (HPC-986-C) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Replace the container to another one. 2. Remove the foreign matter or the interfering object. 3. Adjust the sensor position. 4. Check the sensor is turned ON/OFF. Or replace it. 5. Check that the motor operates properly. Or replace it. 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.
11	Unclamp time over * The unclamp operation is not completed within the set time.	<ol style="list-style-type: none"> 1. The container is deformed. 2. A foreign matter or interfering object is caught. 3. Unclamp sensor adjustment fault 4. Unclamp sensor failure (X25) 5. Clamp motor failure 6. Relay board failure (HPC-786-C) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Replace the container to another one. 2. Remove the foreign matter or the interfering object. 3. Adjust the sensor position. 4. Check the sensor is turned ON/OFF. Or replace it. 5. Check that the motor operates properly. Or replace it. 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.
12	Dock time over * The dock operation is not completed within the set time.	<ol style="list-style-type: none"> 1. A foreign matter or interfering object is caught. 2. Door elevator axis position fault 3. Dock sensor adjustment fault 4. Dock sensor failure (X26) 5. Dock motor failure 6. Relay board failure (HPC-786-D) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Remove the foreign matter or the interfering object. 2. Adjust the door open/close position of the door elevator axis. 3. Adjust the sensor dog position. 4. Check that the sensor is turned ON/OFF. Or replace it. 5. Check if the motor operates. Or replace it. 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.

H-TYPE Code	Error description	Assumed cause	Recovery method
13	Undock time over * The undock operation is not completed within the set time.	<ol style="list-style-type: none"> 1. A foreign matter or interfering object is caught. 2. Door elevator axis position fault 3. Undock sensor adjustment fault 4. Undock sensor failure (X27) 5. Dock motor failure 6. Relay board failure (HPC-786-D) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Remove the foreign matter or the interfering object. 2. Adjust the door open/close position of the door elevator axis. 3. Adjust the sensor position. 4. Check that the sensor is turned ON/OFF. Or replace it. 5. Check if the motor operates. Or replace it. 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.
14	Latch time over * The latch operation is not completed within the set time	<ol style="list-style-type: none"> 1. Door elevator axis position fault 2. Latch sensor adjustment fault. 3. Latch sensor failure. (X13) 4. Latch drive motor failure. 5. Latch drive board failure. (HPC-931) 6. Relay board failure (HPC-786-B) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Adjust the door open/close position of the door elevator axis. 2. Adjust the sensor position. 3. Check that the latch sensor is turned ON/OFF. 4. Replace the latch drive motor. 5. Adjust or replace the latch drive board. Or replace it. 6. Insert and disconnect the connector of the relay board. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.
15	Unlatch time over * The unlatch operation is not completed within the set time.	<ol style="list-style-type: none"> 1. Door elevator axis position fault 2. Unlatch sensor adjustment fault. 3. Unlatch sensor failure. (X14) 4. Latch drive motor failure. 5. Latch drive board failure. (HPC-931) 6. Relay board failure (HPC-786-B) 7. Relay cable disconnection 8. I/O board failure 	<ol style="list-style-type: none"> 1. Adjust the door open/close position of the door elevator axis. 2. Adjust the sensor position. 3. Check that the unlatch sensor is turned ON/OFF. Or replace it. 4. Replace the latch drive motor. 5. Adjust or replace the latch drive board. Or replace it. 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board.

H-TYPE Code	Error description	Assumed cause	Recovery method
16	Vacuum time over *The vacuum operation is not completed within the set time.	<ol style="list-style-type: none"> 1. A vacuum source pressure has dropped. 2. The container is deformed. 3. Dust is adhered to the container door face 4. Door elevator axis position fault 5. Air hose breakage and coming-off 6. The absorbent pad is deformed. 7. Registration pin error 8. Threshold setting fault of the vacuum switch (X03) 9. Solenoid valve operation fault 10. Relay board failure (HPC-928-2A) 11. Relay cable disconnection 12. I/O board failure 	<ol style="list-style-type: none"> 1. Check the vacuum source pressure. 2. Replace the container. 3. Clean the container 4. Adjust the door open/close position of the door elevator axis. 5. Replace the air hose. 6. Replace the absorbent pad. 7. Adjust or replace the registration pin. 8. Adjust the threshold setting of the vacuum switch. 9. Replace the solenoid valve. 10. Insert and disconnect the connector of the relay cable. 11. Execute the continuity test. Or replace it. 12. Replace the I/O board.
17	Vacuum release time over * The vacuum release operation is not completed within the set time.	<ol style="list-style-type: none"> 1. Air hose breakage 2. Threshold setting fault of the vacuum switch (X03) 3. Solenoid valve operation fault 4. Relay board failure (HPC-786-E) 5. Relay cable disconnection 6. I/O board failure 	<ol style="list-style-type: none"> 1. Replace the air hose. 2. Adjust the threshold setting of the vacuum switch 3. Replace the solenoid valve 4. Insert and disconnect the connector of the relay cable. Or replace it. 5. Execute the continuity test. Or replace it. 6. Replace the I/O board.
18	Door open time over * The door open operation is not completed within the set time.	<ol style="list-style-type: none"> 1. Adjustment fault of the door open sensor 2. Door open sensor failure. (X22) 3. Door open/close motor failure 4. Relay board failure (HPC-786-B) 5. Relay cable disconnection 6. I/O board failure 	<ol style="list-style-type: none"> 1. Adjust the sensor position. 2. Check that the sensor is turned ON/OFF. 3. Check if the motor operates properly. 4. Insert and disconnect the connector of the relay board. 5. Execute the continuity test. Or replace it. 6. Replace the I/O board.

H-TYPE Code	Error description	Assumed cause	Recovery method
19	Door close time over * The door close operation is not completed within the set time.	<ol style="list-style-type: none"> 1. A wafer is not set properly. (cloth, or others) 2. Door close sensor adjustment fault. 3. Door close sensor failure. (X23) 4. Door open/close motor failure. 5. Relay board failure (HPC-786-B) 6. Relay cable disconnection 7. I/O board failure 	<ol style="list-style-type: none"> 1. Reset the wafer properly. 2. Adjust the sensor position. 3. Check that the sensor is turned ON/OFF. Or replace it. 4. Check that the motor operates properly. Or replace it. 5. Insert and disconnect the connector of the relay board. Or replace it. 6. Execute the continuity test. Or replace it. 7. Replace the I/O board.
1A	Mapping forward time over * The mapping forward operation is not completed within the set time.	<ol style="list-style-type: none"> 1. The start position and end position of mapping are incorrect. 2. Mapping output sensor adjustment fault. 3. Mapping output sensor failure. (X16) 4. Mapping in/out motor failure. 5. Relay board failure (HPC-786-A) 6. Relay cable disconnection 7. I/O board failure 	<ol style="list-style-type: none"> 1. Adjust the start position and end position of mapping. 2. Adjust the sensor position. 3. Check that the sensor is turned ON/OFF. Or replace it. 4. Check that the motor operates properly. Or replace it. 5. Insert and disconnect the connector of the relay board. Or replace it. 6. Execute the continuity test. Or replace it. 7. Replace the I/O board.
1B	Mapping return time over * The mapping return operation is not completed within the set time.	<ol style="list-style-type: none"> 1. Mapping input sensor adjustment fault. 2. Mapping input sensor failure. (X17) 3. Mapping in/out motor failure. 4. Relay board failure (HPC-786-A) 5. Relay cable disconnection 6. I/O board failure 	<ol style="list-style-type: none"> 1. Adjust the sensor position. 2. Check that the sensor is turned ON/OFF. Or replace it. 3. Check that the motor operates properly. Or replace it. 4. Insert and disconnect the connector of the relay board. Or replace it. 5. Execute the continuity test. Or replace it. 6. Replace the I/O board.
1F	Communication error * Although reply for the event has been retried 3 times, nor-mal command hand-shake is not established.	<ol style="list-style-type: none"> 1. No response for an event is made. (T-TYPE only) 	-

H-TYPE Code	Error description	Assumed cause	Recovery method
20	Home return time over * Because the home return operation has been performed with vacuumed state in the TYPE setting other than FOUP TYPE, the home return operation is unavailable, and an error is detected during the operation.	1. Detection of vacuumed state (FOUPFOUP container) during the home return operation in open cassette/FOSB TYPE	1. Change to a container corresponding the type at present. In case of the erroneous detection of the vacuum sensor, search the surroundings. (Reference: Content check on the code 16/17)Change to a container corresponding to the type at present.
21	Loading time over * The loading operation is not completed within the set time.	1. Setting fault of the parameter	1. Extend the TIMER/Load time of the parameter.
22	Unloading time over * The unloading operation is not completed within the set time.	1. Setting fault of the parameter	1. Extend the TIMER/Unload time of the parameter.
23	Positioning time over * The retry operation by the elevator axis intermediate stop operation (mapping start/end position) by is unavailable within the range	1. The source pressure has dropped. 2. Speed controller adjustment fault 3. Correction parameter adjustment fault	1. Check that the source pressure is applied properly. (Check the regulator set value.) 2. Adjust the dial of the speed controller. 3. Perform the Z-elevation calibration.
28	Elevator axis door open/close position movement time over * The elevator axis door open/close position movement is not completed within the set time. * The door open/close operation is not completed.	1. The source pressure has dropped. 2. Speed controller adjustment fault. 3. A foreign matter or interfering object is caught. 4. Adjustment fault of the door rising limit sen-sors. 5. Door rising limit sensors failure (X04) 6. Solenoid valve failure 7. Cylinder operation fault 8. Relay board failure. (HPC-786-E) 9. Relay cable disconnection 10. I/O board failure.	1. Check that the source pressure is applied properly. (Check the regulator set value.) 2. Adjust the dial of the speed controller. 3. Remove the foreign matter or the interfering object. 4. Adjust the sensor dog position. 5. Check the sensor is turned ON/OFF. Or replace it. 6. Replace the solenoid valve. 7. Replace the Cylinder 8. Insert and disconnect the connector of the relay board. Or replace it. 9. Execute the continuity test. Or replace it.

H-TYPE Code	Error description	Assumed cause	Recovery method
		11. Setting fault of the parameter	10. Replace the I/O board. 11. Extend the TIMER/Map.Door time of the parameter.
29	Elevator axis mapping start position movement time over * The elevator axis mapping stat position movement is not completed within the set time.	1. The source pressure has dropped. 2. Speed controller adjustment fault 3. A foreign matter or interfering object is caught. 4. Solenoid valve failure 5. Cylinder operation fault 6. Relay board failure. (HPC-786-E) 7. Relay cable disconnection 8. I/O board failure. 9. Setting fault of the parameter	1. Check that the source pressure is applied properly. (Check the regulator set value.) 2. Adjust the dial of the speed controller. 3. Remove the foreign matter or the interfering object. 4. Replace the solenoid valve. 5. Replace the Cylinder 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board. 9. Extend the TIMER/Map Start time of the parameter.
2A	Elevator axis mapping end position movement time over * The elevator axis mapping end position movement is not completed within the set time.	1. The source pressure has dropped. 2. Speed controller adjustment fault 3. A foreign matter or interfering object is caught. 4. Solenoid valve failure 5. Cylinder operation fault 6. Relay board failure. (HPC-786-E) 7. Relay cable disconnection 8. I/O board failure. 9. Setting fault of the parameter	1. Check that the source pressure is applied properly. (Check the regulator set value.) 2. Adjust the dial of the speed controller. 3. Remove the foreign matter or the interfering object. 4. Replace the solenoid valve. 5. Replace the Cylinder 6. Insert and disconnect the connector of the relay board. Or replace it. 7. Execute the continuity test. Or replace it. 8. Replace the I/O board. 9. Extend the TIMER/Map.End time of the parameter.
2B	Elevator axis load position movement time over * The elevator axis door load position movement is not completed within the set time.	1. The source pressure has dropped. 2. Speed controller adjustment fault 3. A foreign matter or interfering object is caught. 4. Adjustment fault of the door lowering limit sensors. 5. Door lowering limit sensors failure (X05) 6. Solenoid valve failure 7. Cylinder operation fault 8. Relay board failure. (HPC-786-E) 9. Relay cable disconnection 10. I/O board failure. 11. Setting fault of the parameter	1. Check that the source pressure is applied properly. (Check the regulator set value.) 2. Adjust the dial of the speed controller. 3. Remove the foreign matter or the interfering object. 4. Adjust the sensor dog position. 5. Check the sensor is turned ON/OFF. Or replace it. 6. Replace the solenoid valve. 7. Replace the Cylinder 8. Insert and disconnect the connector of the relay board. Or replace it. 9. Execute the continuity test. Or replace it. 10. Replace the I/O board. 11. Extend the TIMER/Map.Load time of the parameter.

H-TYPE Code	Error description	Assumed cause	Recovery method
30	Mapping Calibration error1	1. There is no wafer on the lowest level. (Maintenance mode only.)	1. Set a wafer to the lowest level.
31	Mapping Calibration error 2	1. There is no wafer on the highest level. (Maintenance mode only.)	1. Set a wafer to the highest level.
32	Mapping Calibration error 3	1. Calibration procedure error (Maintenance mode only)	1. Perform the calibration again.
36/37	Mapping Calibration error 4	1. A wafer isn't normally stored in the most lower berth/top line.. (Maintenance mode only.)	1. The wafer store state is confirmed (Ver*****2C, after).
40	Mapping data error	1. Setting fault of the mapping start position and end position 2. Adjustment fault of the mapping sensor light axis 3. Threshold setting fault of the mapping sensor amplifier	1. Adjust the start position and end position of mapping . 2. Adjust the mapping sensor light axis. 3. Adjust the threshold setting of the mapping sensor amplifier.
41	Mode select error	1. The mode SW is switched during operation. 2. Mode SW failure (X09) 3. Relay board failure (HPC-786-DA) 4. Relay cable failure. 5. I/O board failure	1. Be sure not to switch the mode SW during operation. 2. Switch the mode SW for several times. Or replace the mode SW. 3. Insert and disconnect the connector, or replace it. 4. Execute the continuity test. Or replace it. 5. Replace the I/O board
50	Z-elevator axis Calibration error 1	1. Offset calculation result error (Maintenance mode only)	1. Perform the calibration again.
51	Z-elevator axis Calibration error 1	1. The operation is not stopped within the stop range when checked after the calibration. (Down operation start position) (Maintenance mode only)	1. Adjust the dial of the speed controller. 2. Check the parameter setting. (Positioning Zone) 3. Perform the calibration again.
52	Z-elevator axis Calibration error 1	1. The operation is not stopped within the stop range when checked after the calibration. (Down operation end position) (Maintenance mode only)	1. Adjust the dial of the speed controller. 2. Check the parameter setting. (Positioning Zone) 3. Perform the calibration again.
53	Z-elevator axis Calibration error 1	1. The operation is not stopped within the stop range when checked after the calibration. (Up operation start position) (Maintenance mode only)	1. Adjust the dial of the speed controller. 2. Check the parameter setting. (Positioning Zone) 3. Perform the calibration again.

H-TYPE Code	Error description	Assumed cause	Recovery method
54	Z-elevator axis Calibration error 1	1. The operation is not stopped within the stop range when checked after the calibration. (Up operation end position) (Maintenance mode only)	1. Adjust the dial of the speed controller. 2. Check the parameter setting. (Positioning Zone) 3. Perform the calibration again.
70	Clamp sensor error * The clamp sensor and unclamp sensor are detected simultaneously.	1. Clamp and unclamp sensor failure (X14, X25) 2. Connection fault of the sensor wires 3. Relay board failure (HPC-786-C) 4. Relay cable disconnection 5. I/O board failure	1. Check that the clamp and the unclamp sensors are turned ON/OFF. Or replace it. 2. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. 3. Insert and disconnect the connector, or replace it. 4. Execute the continuity test. Or replace it. 5. Replace the I/O board
71	Dock sensor error * The dock sensor and undock sensor are detected simultaneously.	1. Dock/undock sensor failure (X26,X27) 2. Connection fault of the sensor wires 3. Relay board failure (HPC-786-D) 4. Relay cable disconnection 5. I/O board failure	1. Check that the dock and the undock sensors are turned ON/OFF. Or replace it. 2. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. 3. Insert and disconnect the connector, or replace it. 4. Execute the continuity test. Or replace it. 5. Replace the I/O board.
72	Latch sensor error * The latch sensor and unlatch sensor are detected simultaneously.	1. Latch/unlatch sensor failure. (X13,X14) 2. Connection fault of the sensor wires 3. Latch drive board failure. (HPC-931) 4. Relay board failure (HPC-786-B) 5. Relay cable disconnection 6. I/O board failure	1. Check that the latch and the unlatch sensors are turned ON/OFF. Or replace it. 2. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. 3. Adjust or replace the latch drive board. Or replace it. 4. Insert and disconnect the connector, or replace it. 5. Execute the continuity test. Or replace it. 6. Replace the I/O board
73	Door sensor error * The door open and door close sensor are detected simultaneously.	1. Door open/close sensor failure. (X22,X23) 2. Connection fault of the sensor wires 3. Relay board failure (HPC-786-B) 4. Relay cable disconnection 5. I/O board failure	1. Check that the door open and the door close sensors are turned ON/OFF. Or replace it. 2. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. 3. Insert and disconnect the connector, or replace it. 4. Execute the continuity test. Or replace it. 5. Replace the I/O board

H-TYPE Code	Error description	Assumed cause	Recovery method
74	Mapping sensor error * The mapping in sensor and mapping out sensor are detected simultaneously.	<ol style="list-style-type: none"> Mapping in/out sensor failure. (X,16,X17) Connection fault of the sensor wires Relay board failure (HPC-786-A) Relay cable disconnection I/O board failure 	<ol style="list-style-type: none"> Check that the mapping in and the mapping out sensors are turned ON/OFF. Or replace it. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. Insert and disconnect the connector, or replace it. Execute the continuity test. Or replace it. Replace the I/O board
77	Elevator axis sensor error * The door rising limit sensor and door lowering limit sensor are detected simultaneously.	<ol style="list-style-type: none"> Door rising/lowering limit sensors failure (X04, X05) Connection fault of the sensor wires. Relay board failure (HPC-786-E) Relay cable disconnection I/O board failure 	<ol style="list-style-type: none"> Check that the door rising/lowering limit sensor is turned ON/OFF. Or replace it. Check for damage on the sensor wire, and check the connection status of the connector. Or replace it. Insert and disconnect the connector, or replace it. Execute the continuity test. Or replace it. Replace the I/O board
A0	Wafer drop * The door detection state is changed during door retention.	<ol style="list-style-type: none"> The door detection sensor is come-off during door retention. (X03) The latch sensor is come-off during door retention. (X13) Latch drive board failure. (HPC-931) Relay board failure. (HPC-786-B) Relay board failure. (HPC-786-E) Relay cable disconnection I/O board failure. 	<ol style="list-style-type: none"> Check the vacuum pressure and the connection status of the "Vacuum sensor". Or replace it. Check the connection status of the latch sensor. Or replace it. Insert and disconnect the connector, or replace it. Insert and disconnect the connector, or replace it. Insert and disconnect the connector, or replace it. Execute the continuity test. Or replace it. Replace the I/O board
A1	Wafer protrusion * The wafer protrusion sensor is detected during dock output.	<ol style="list-style-type: none"> Wafer storage position fault Dust is adhered to the wafer protrusion sensor. Wafer protrusion sensor failure. (X01) An unspecified adapter is used. (when adapter is used) 	<ol style="list-style-type: none"> Adjust the wafer storage position of the wafer transfer robot. Clean the wafer protrusion sensor. Check the wafer protrusion sensor is turned ON/OFF. Or replace it. Check the specifications of the cassette adapter.
A2	FOUP mount error (Mount sensor) * The state of mount sensor is not correct	<ol style="list-style-type: none"> The cassette is deformed. Mount sensor failure (X32, X33, X34) Relay board failure. (HPC-786-C) Relay cable disconnection I/O board failure. 	<ol style="list-style-type: none"> Replace the cassette. Check the mount sensor is turned ON/OFF. Or replace it. Insert and disconnect the connector, or replace it. Execute the continuity test. Or replace it. Replace the I/O board

H-TYPE Code	Error description	Assumed cause	Recovery method
A3	FOUP mount error (Load sensor) * The state of load presence sensor is not correct.	<ol style="list-style-type: none"> 1. The transparent cassette is used. 2. The type setting is incorrect. 3. Deviation of the presence sensor light axis 4. The load presence sensor failure (X00) 5. Relay cable disconnection 6. Relay board failure. (HPC-786-E) 7. I/O board failure. 	<ol style="list-style-type: none"> 1. Adjust the load presence sensor light axis for the transparent container. Or replace the container. 2. Set a type corresponding to the container. 3. Adjust the presence sensor light axis. 4. Check that the presence sensor is turned ON/OFF. 5. Execute the continuity test. Or replace it. 6. Insert and disconnect the connector. 7. Replace the I/O board.
A5	Air pressure drop * The state of supplying air pressure is not correct.	<ol style="list-style-type: none"> 1. The source pressure has dropped. 2. Air hose breakage and coming-off. 3. Threshold setting fault of the pressure sensor. 4. Pressure sensor failure. (X06) 	<ol style="list-style-type: none"> 1. Check if the source pressure is properly provided. 2. Check for leakage from the air joint of the door elevator area and dock area cylinder. 3. Set the threshold of the pressure sensor correctly. 4. Replace the pressure sensor.
B0	Host error (with no PIO input)	Available signal from upper level device is not input.	Check the signal status of the upper level device and the connection status of CNA3, and execute the insertion/disconnection of the connector and continuity test.
C0	Parameter error	The check sum of the parameter is incorrect.	Download the backup parameter. If this error often occurs, replace the CPU board.
E0	FAN stop alarm	<ol style="list-style-type: none"> 1. A foreign matter is caught by FAN. 2. Relay board failure. (HPC-786-E) 3. Relay cable disconnection 4. Fan failure. (X08) 	<ol style="list-style-type: none"> 1. When the foreign matter is caught by FAN, remove it. 2. Insert and disconnect the connector of the relay board. Or replace it. 3. Execute the continuity test. Or replace it. 4. Replace the fan.
E3	Power supply voltage drop	The power supply voltage has dropped.	Check for the power supply voltage. (DC24V±5%, 4.0A)
FE	Dock hand pinch error	<ol style="list-style-type: none"> 1. A foreign matter is detected between the door and FOUP during dock operation. 2. Door elevator axis position fault 3. Hand pinch sensor position fault. 4. Hand pinch sensor failure. (X02) 5. Relay board failure. (HPC-786-C) 6. Relay cable disconnection 7. I/O board failure. 	<ol style="list-style-type: none"> 1. Execute the undock operation to remove the foreign matter or the interfering object. 2. Adjust the door open/close position of the door elevator axis 3. Adjust the hand pinch sensor position. 4. Check that the hand pinch sensor is turned ON/OFF. Or replace it. 5. Insert and disconnect the connector of the relay board. Or replace it. 6. Execute the continuity test. Or replace it. 7. Replace the I/O board.

APPENDIX B Complex operation and individual operation

APPENDIX B.1 In case of FOUP (H-TYPE)

* Depending on the specifications, the specific operation is performed.

	Complex operation																Individual operation description
	FPLD	FPML	FDOC	FDLD	FDML	FCLD	FCML	FPUL	FPMU	FVOF	FVUL	FUDC	FUMD	MAPP	RMAP	Z_MP	
FCCL	①	①	①														Clamp close
Y_FW	②	②	②			①	①										Dock operation
VCON	③	③		①	①	②	②										Vacuum ON
DROP	④	④		②	②	③	③										Door clamp open
DRFW	⑤	⑤		③	③	④	④										Door open operation
Z_ST		⑥			④		⑤		③				③	①	①	①	Move to mapping stat position
MAFW		⑦			⑤		⑥		②				②	②	②	②	Move to mapping measurement position
Z_ED		⑧			⑥		⑦		①				①	③	③	③	Move to mapping end position
MABW		⑨			⑦		⑧		④				④	④	④	④	Move to mapping waiting position
Z_DN	⑥	⑩		④	⑧	⑤	⑨							⑤	⑤	⑤	Move to loading position
Z_UP								①	⑤	①		①	⑤				Move to door open/close position
DRBW								②	⑥	②		②	⑥				Door close operation
DRCL								③	⑦	③		③	⑦				Door clamp close
VCOF								④	⑧	④		④	⑧				Vacuum OFF
Y_BW								⑤	⑨		①	⑤	⑨				Undock operation
FCOP								⑥	⑩		②						Clamp open
Load operation								Unload operation						Mapping operation			

APPENDIX B.2 In CASE OF oC (H-TYPE)

* Depending on the specifications, the specific operation is performed.

	Complex operation																Individual operation description
	FPLD	FPML	FDOC	FDLD	FDML	FCLD	FCML	FPUL	FPMU	FVOF	FVUL	FUDC	FUMD	MAPP	RMAP	Z_MP	
FCCL	①	①	①														Clamp close
DRFW	②	②	②			①	①										Door open operation
Y_FW	③	③	③			②	②										Dock operation
Z_ST		④			①		③		③				③	①	①	①	Move to mapping stat position
MAFW		⑤			②		④		②				②	②	②	②	Move to mapping measurement position
Z_ED		⑥			③		⑤		①				①	③	③	③	Move to mapping end position
MABW		⑦			④		⑥		④				④	④	④	④	Move to mapping waiting position
Z_DN	④	⑧		①	⑤	③	⑦							⑤	⑤	⑤	Move to loading position
Z_UP								①	⑤	①		①	⑤				Move to door open/close position
Y_BW								②	⑥		①	②	⑥				Undock operation
DRBW								③	⑦		②	③	⑦				Door close operation
FCOP								④	⑧		③						Clamp open
Load operation								Unload operation					Mapping operation				

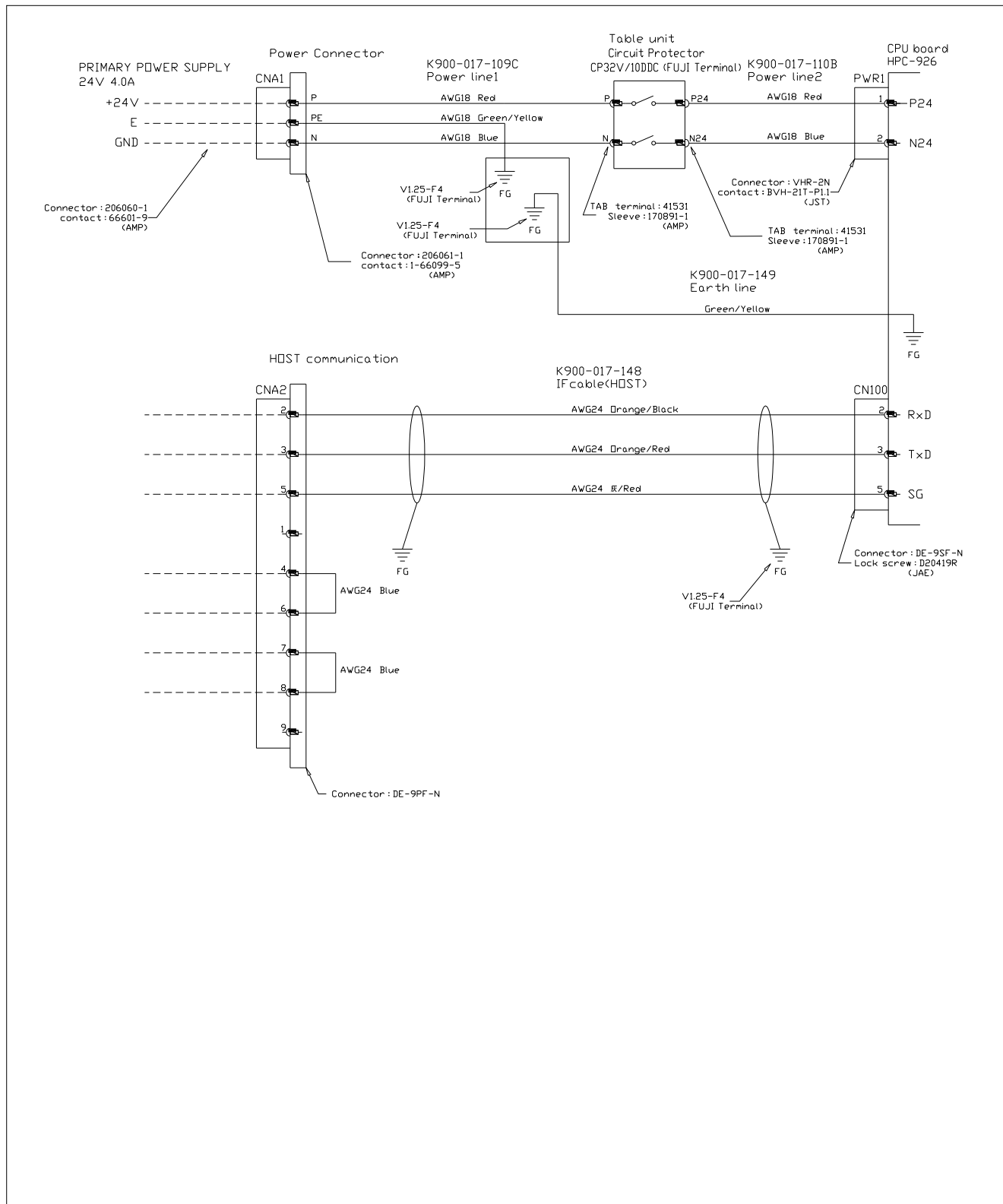
APPENDIX B.3 In case of FOSB (H-TYPE)

* Depending on the specifications, the specific operation is performed.

	Complex operation																Individual operation description
	FPLD	FPML	FDOC	FDLD	FDML	FCLD	FCML	FPUL	FPMU	FVOF	FVUL	FUDC	FUMD	MAPP	RMAP	Z_MP	
FCCL	①	①	①														Clamp close
DROP	②	②	②			①	①										Door clamp open
Y_FW	③	③	③			②	②										Dock operation
DRFW	④	④		①	①	③	③										Door open operation
Z_ST		⑤			②		④		③				③	①	①	①	Move to mapping stat position
MAFW		⑥			③		⑤		②				②	②	②	②	Move to mapping measurement position
Z_ED		⑦			④		⑥		①				①	③	③	③	Move to mapping end position
MABW		⑧			⑤		⑦		④				④	④	④	④	Move to mapping waiting position
Z_DN	⑤	⑨		②	⑥	④	⑧							⑤	⑤	⑤	Move to loading position
Z_UP								①	⑤	①		①	⑤				Move to door open/close position
DRBW								②	⑥	②		②	⑥				Door close operation
Y_BW								③	⑦		①	③	⑦				Undock operation
DRCL								④	⑧		②	④	⑧				Door clamp close
FCOP								⑤	⑨		③						Clamp open
Load operation								Unload operation					Mapping operation				

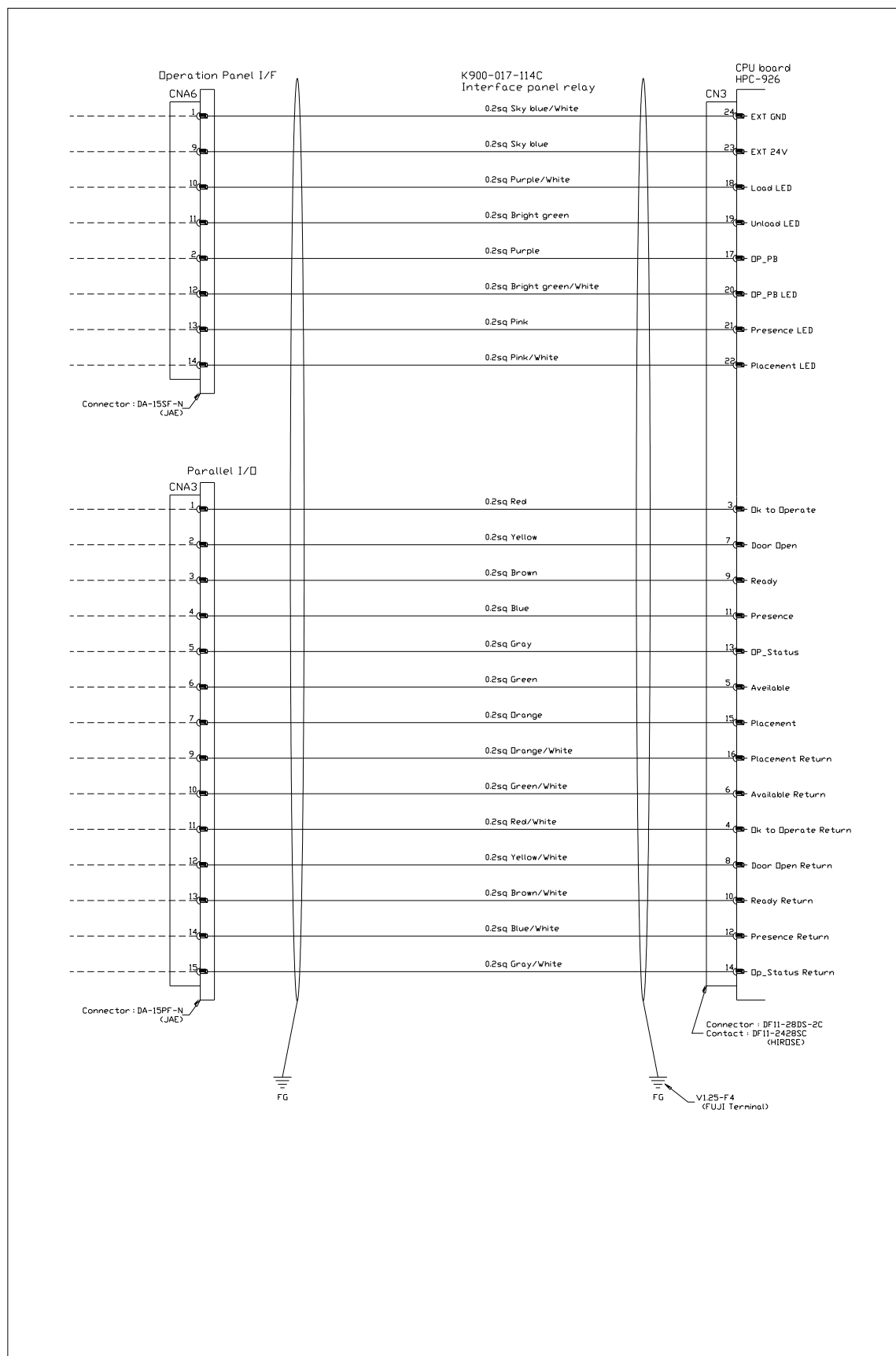
APPENDIX C Wiring Diagram

APPENDIX C.1 Interface Panel 1

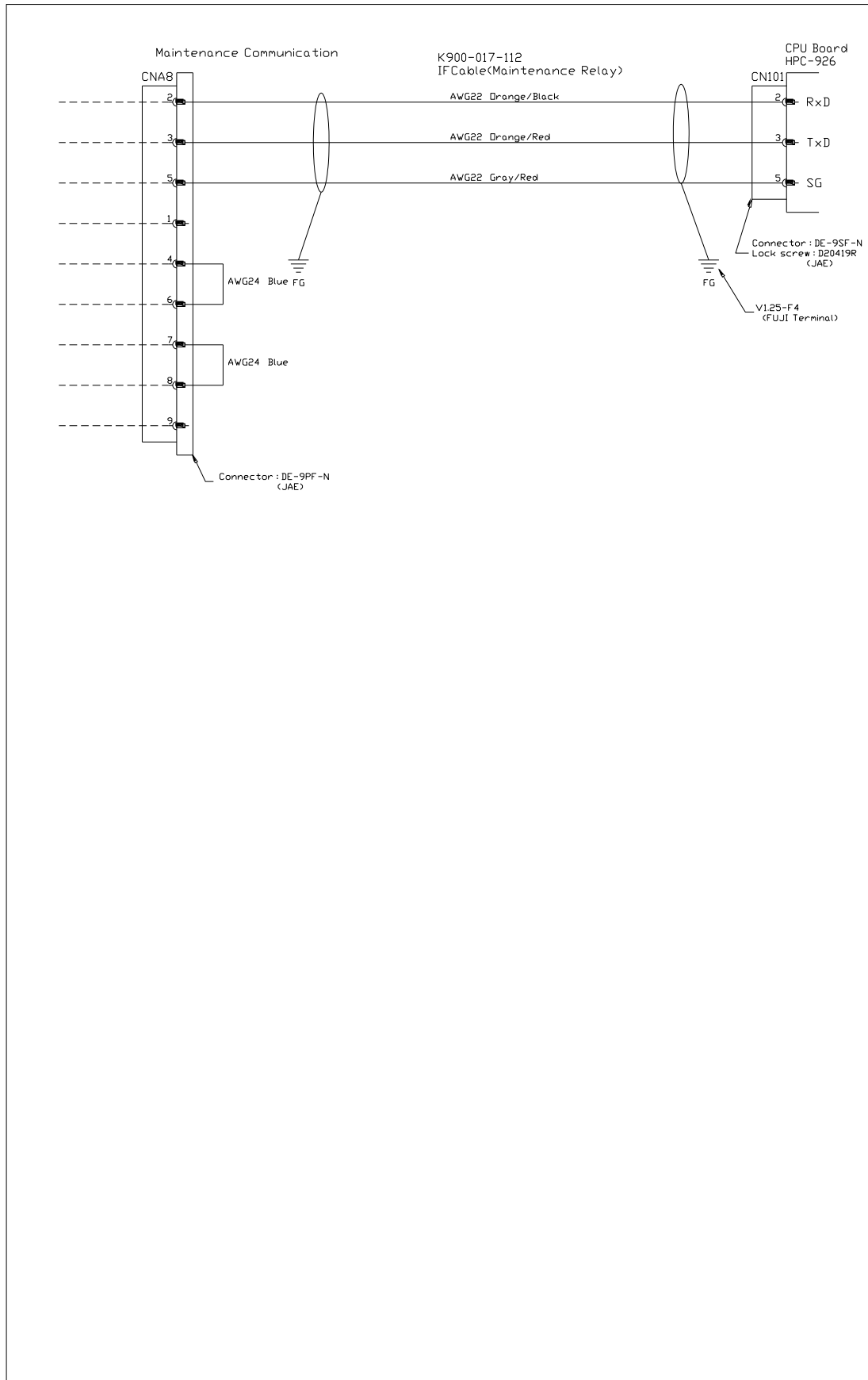


APPENDIX C.2

Interface Panel 2



APPENDIX C.3 Interface Panel 3



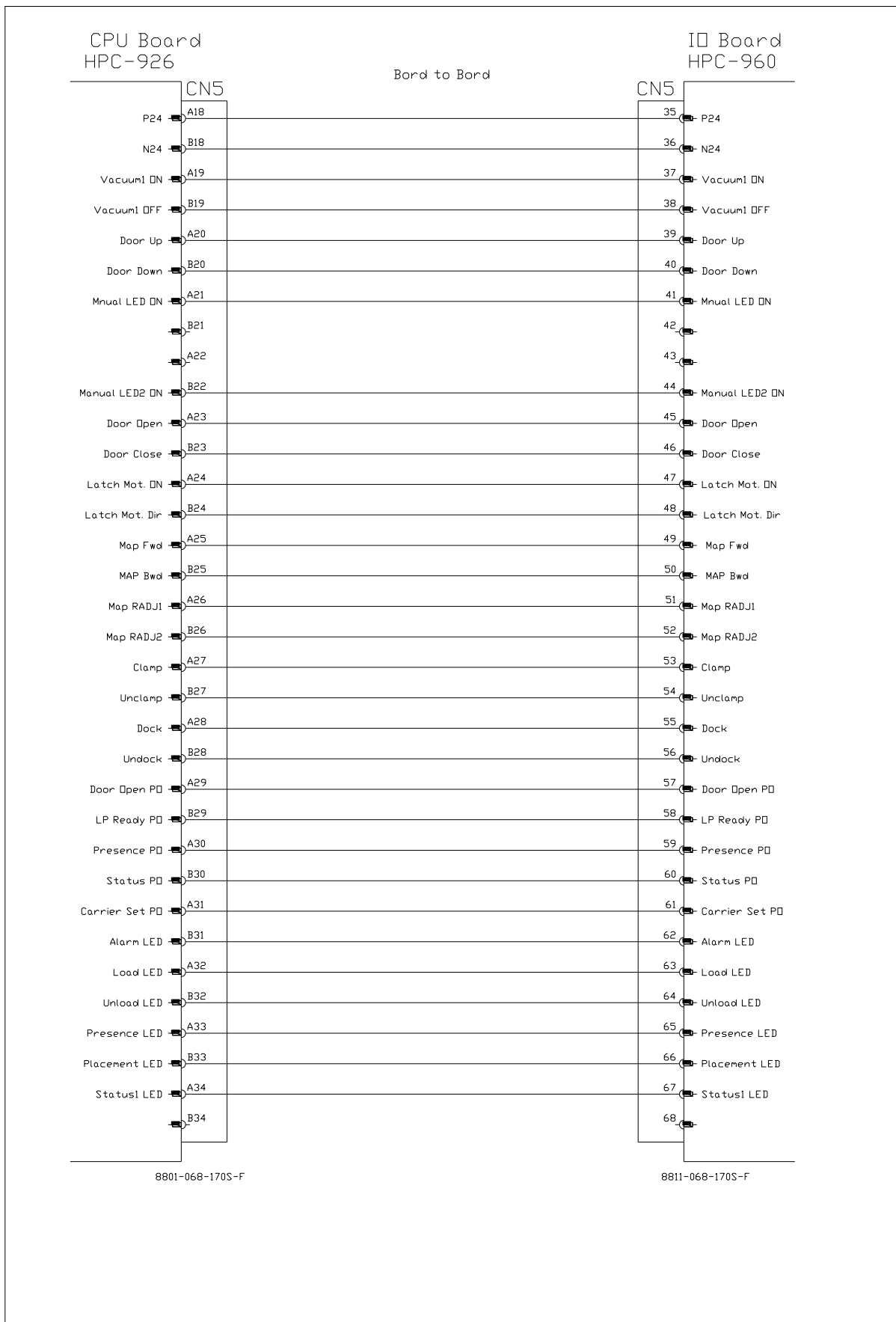
APPENDIX C.4

CPU-IO 1

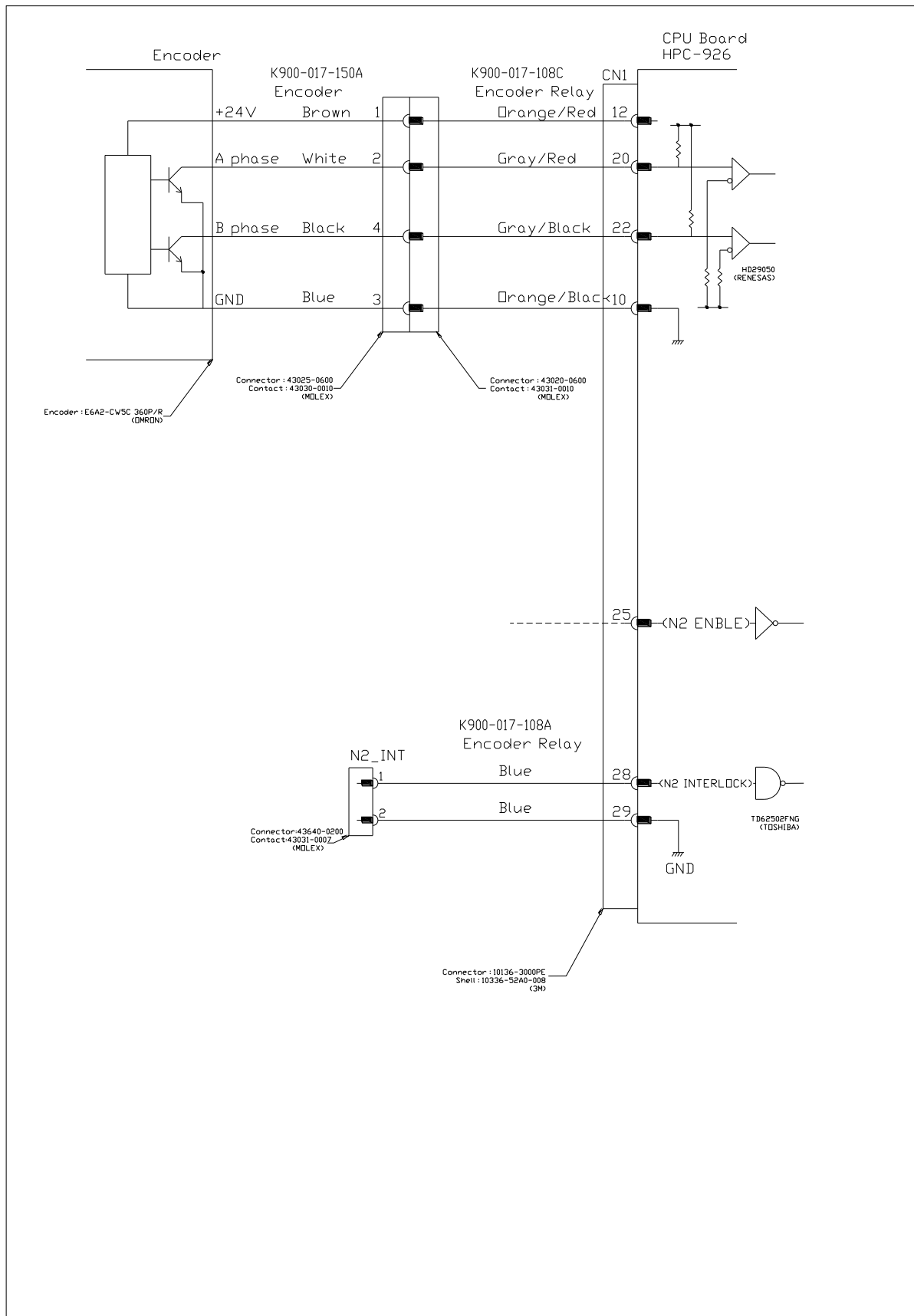


APPENDIX C.5

CPU-IO 2

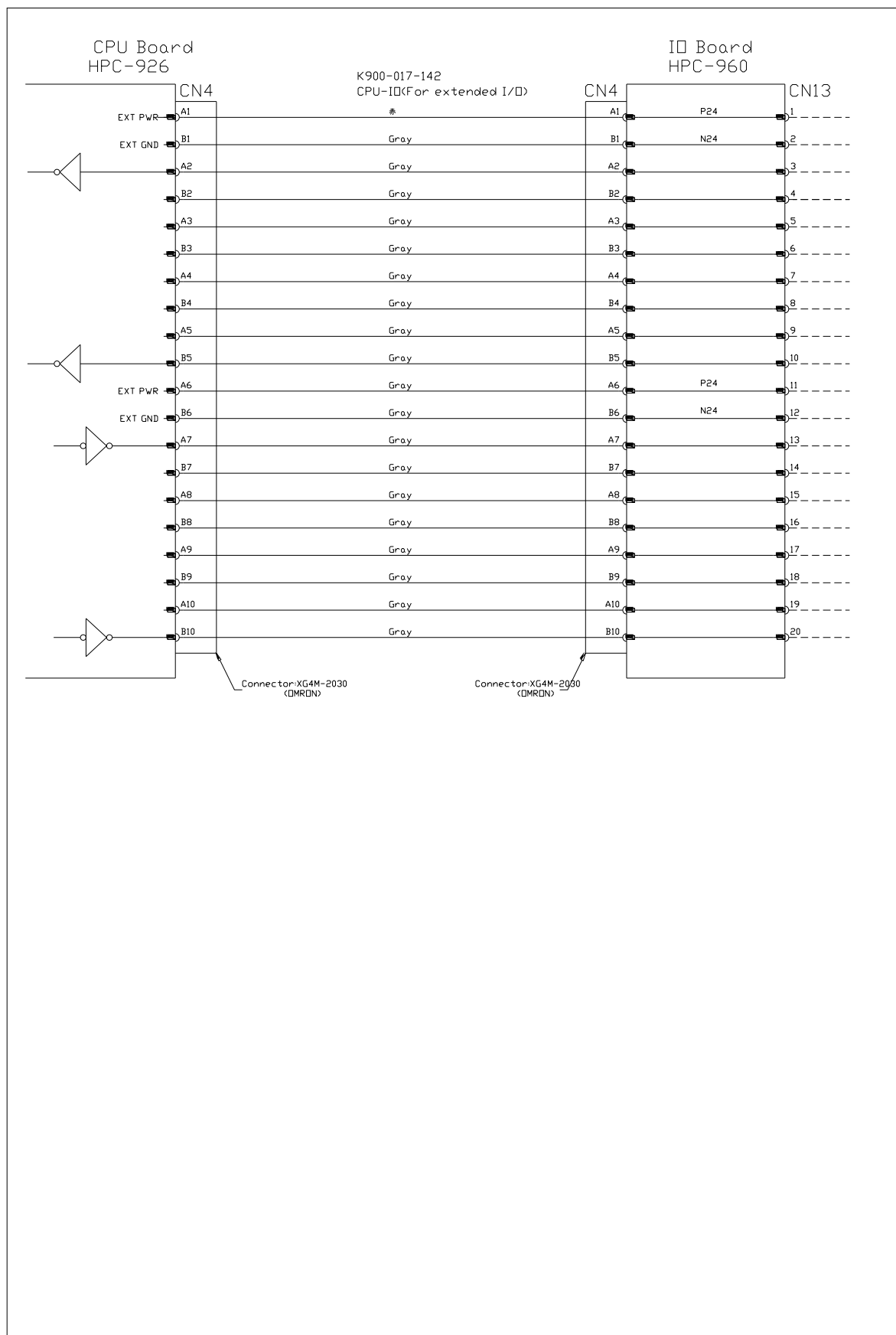


APPENDIX C. 6 CPU-Encoder



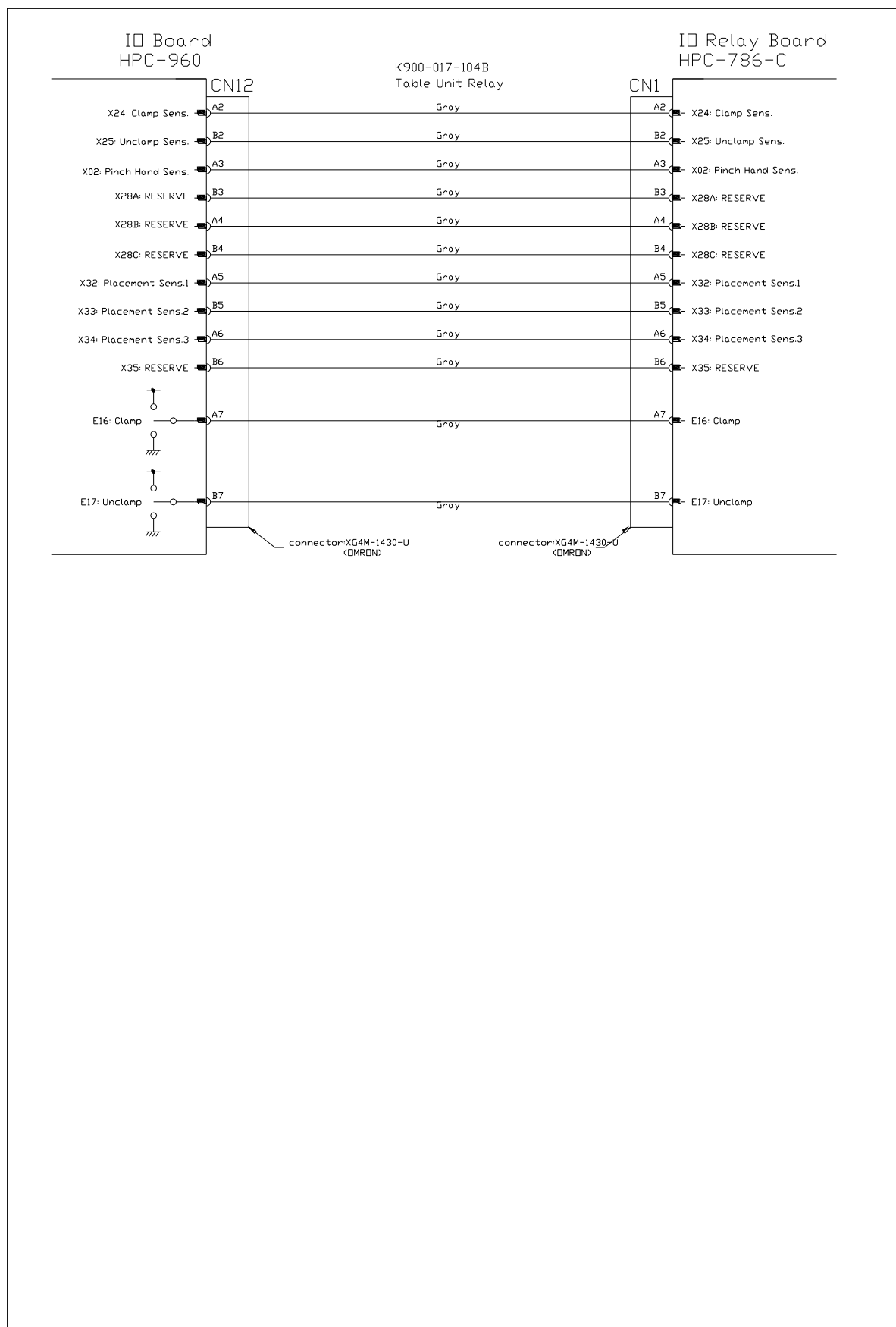
APPENDIX C.7

CPU-IO 3



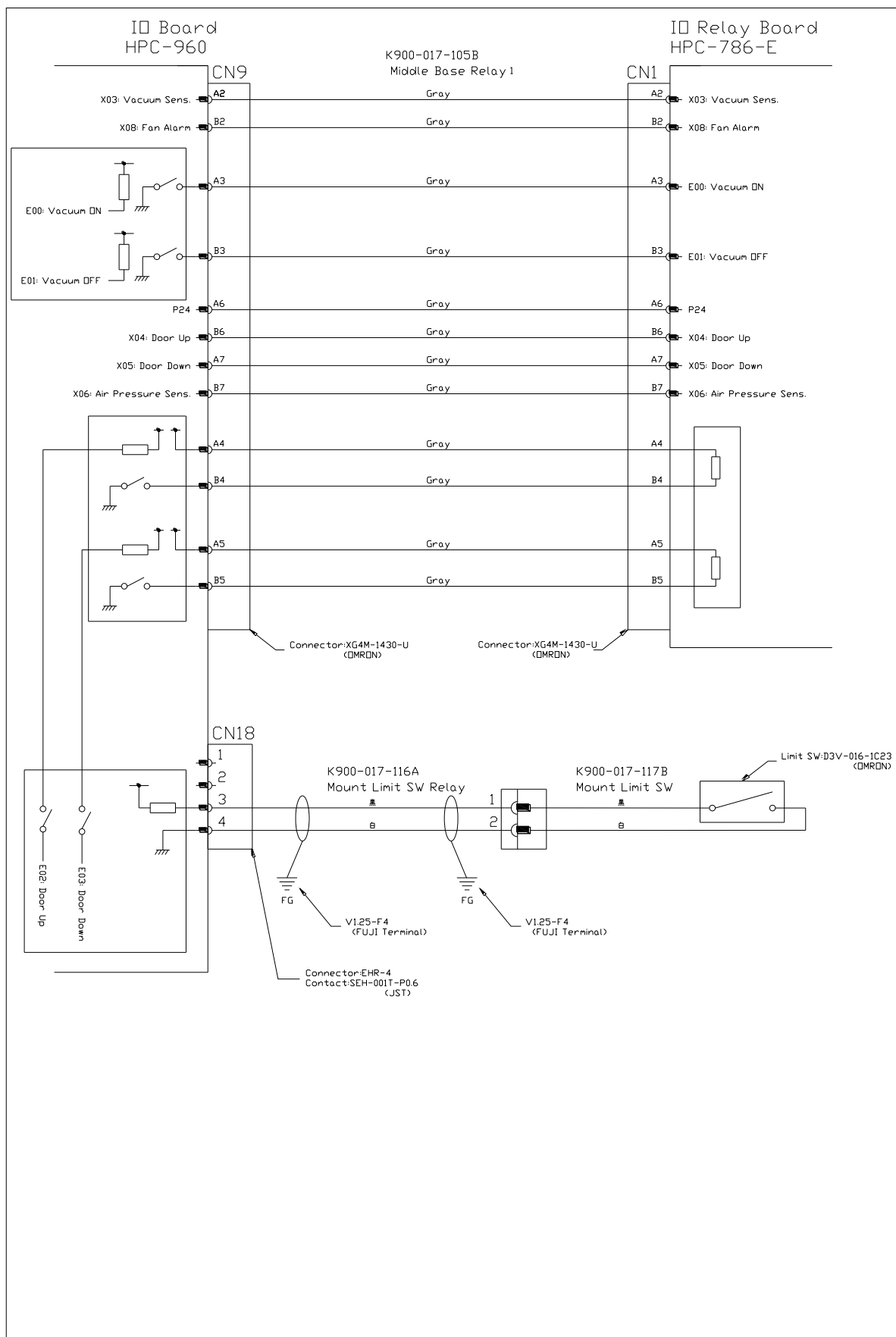
APPENDIX C. 8

IO-Table



APPENDIX C.9

IO-Middle Base

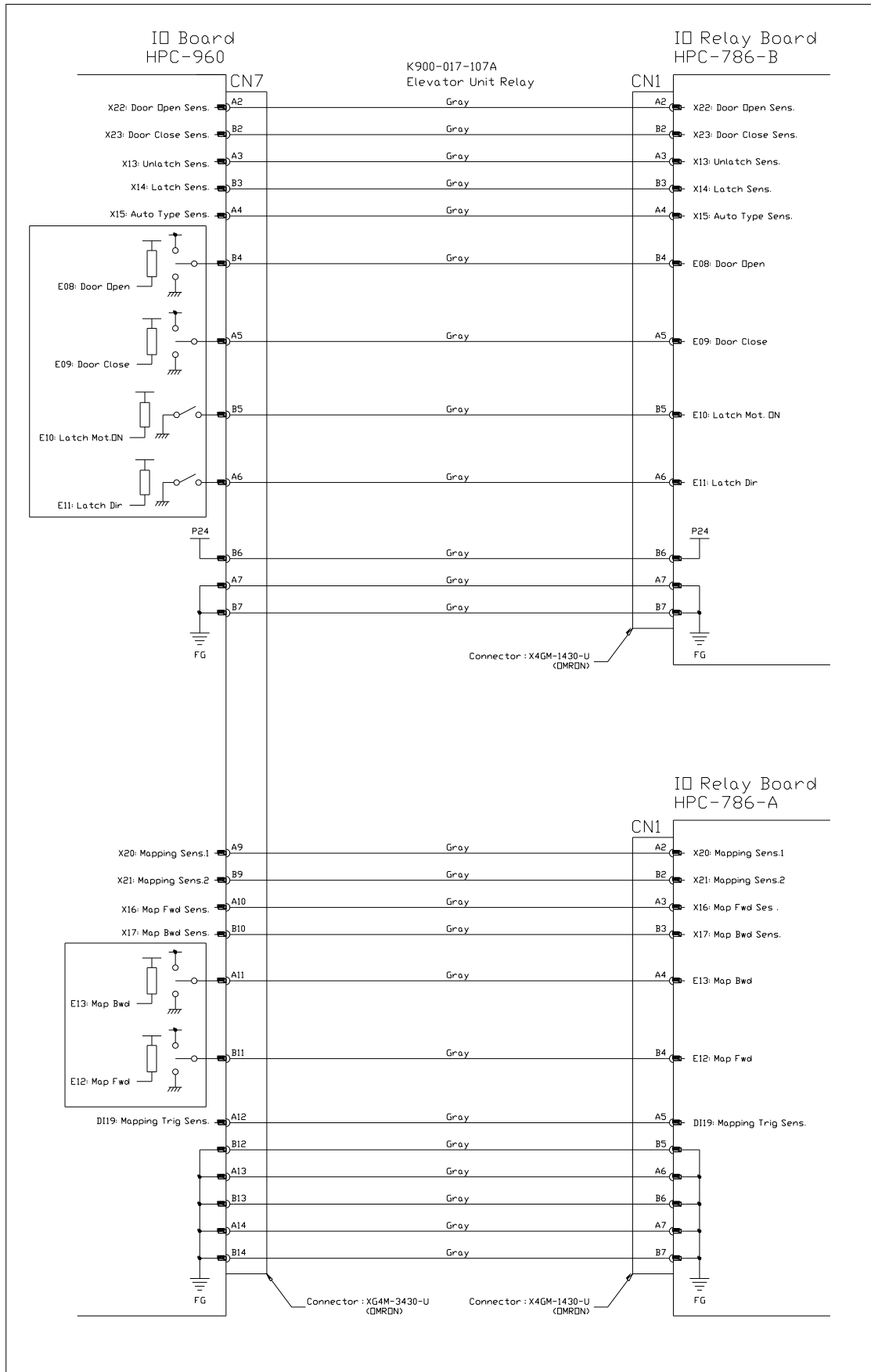


IO-Middle Base

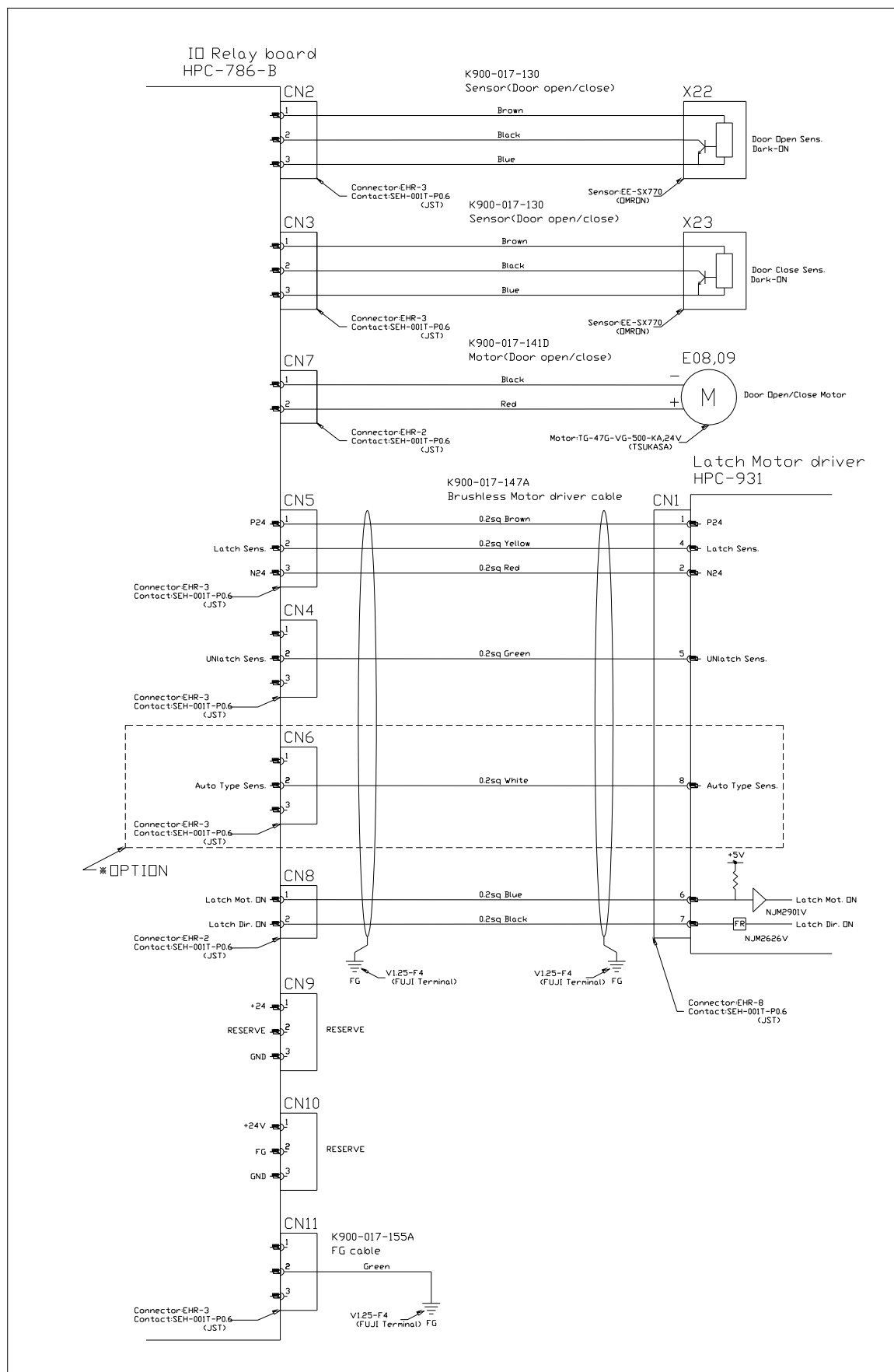


APPENDIX C.11

IO-Door • Mapping Evacuation

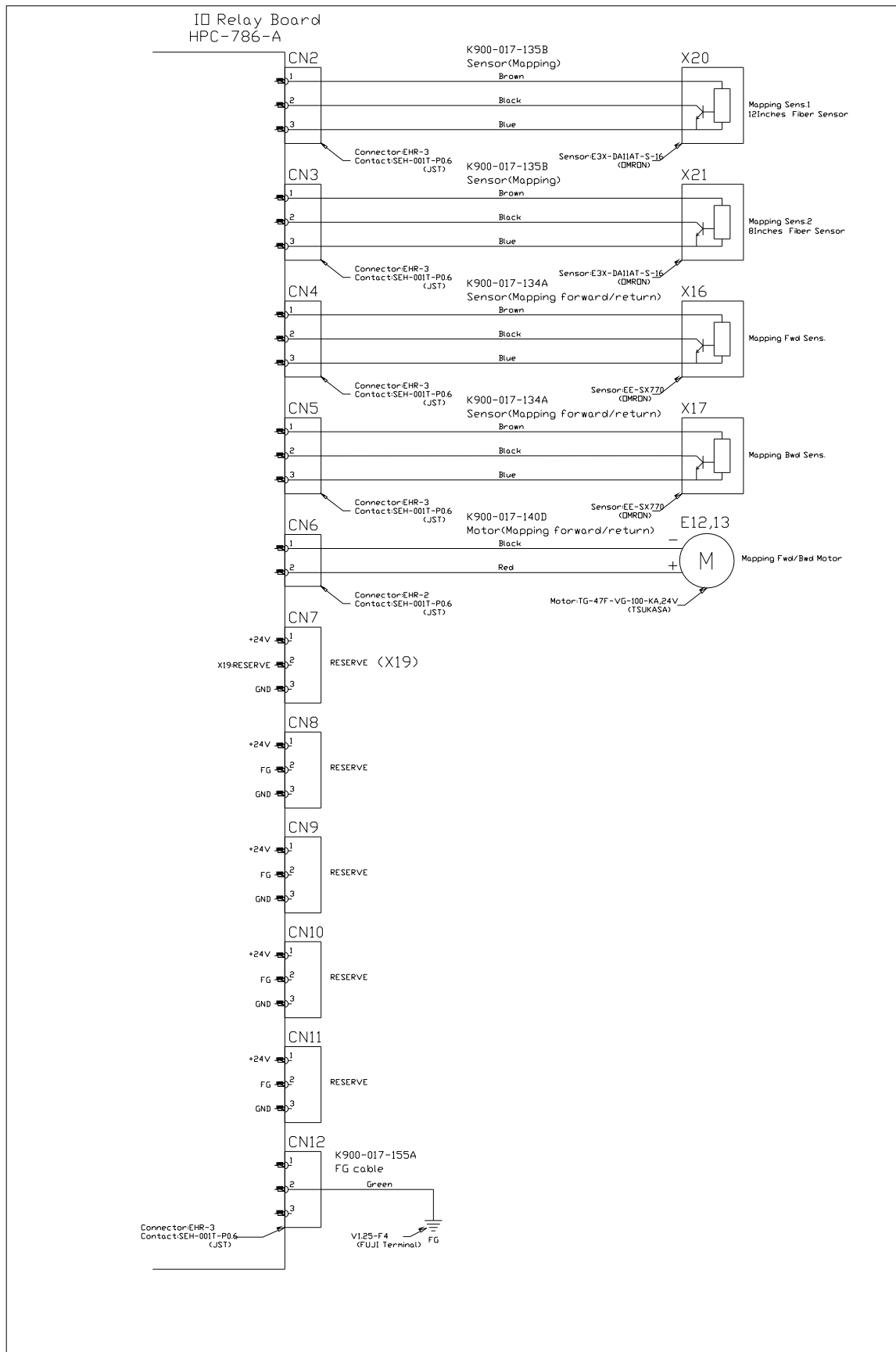


APPENDIX C.12 Door Evacuation

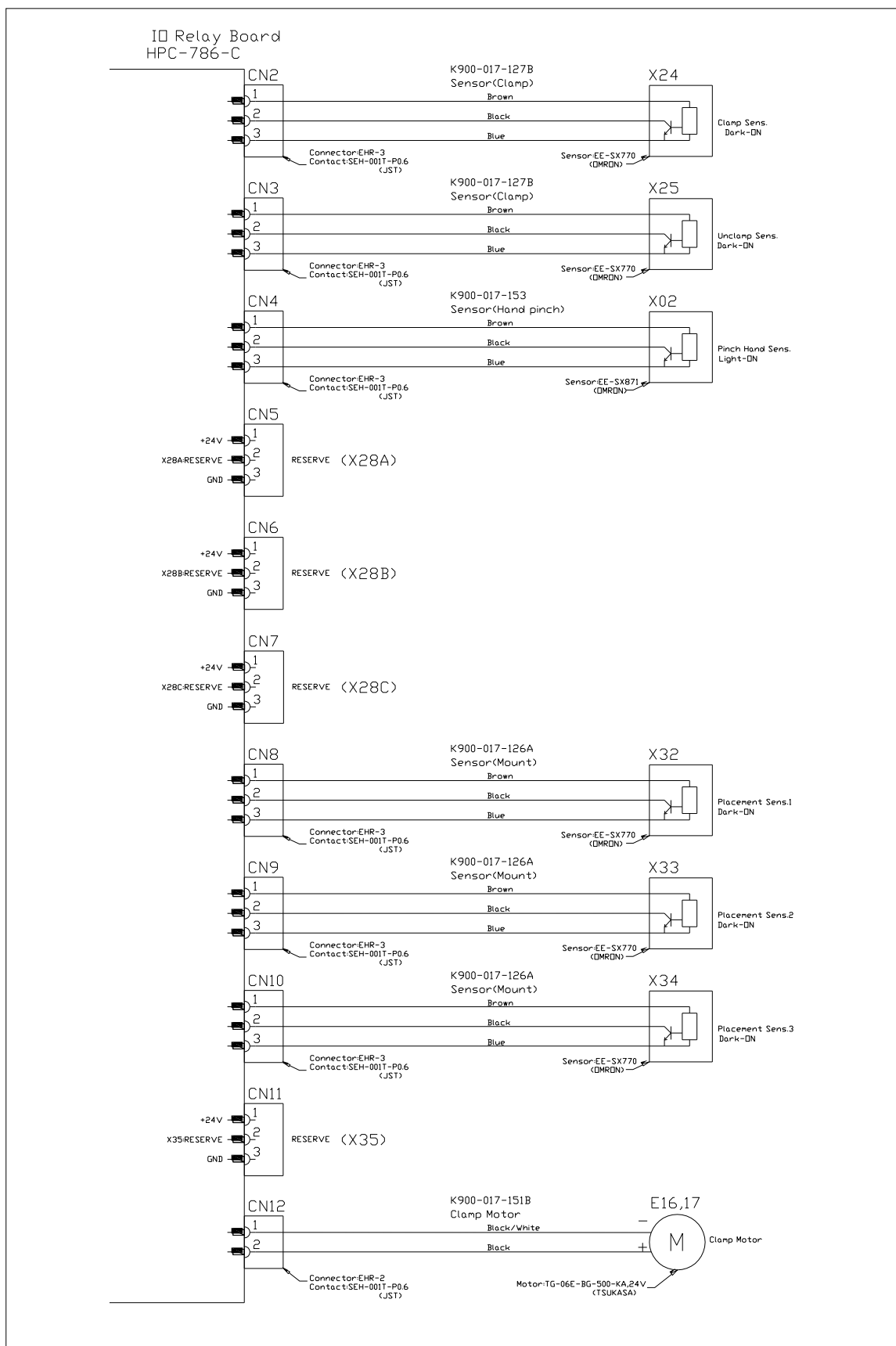


APPENDIX C.13

Mapping Evacuation



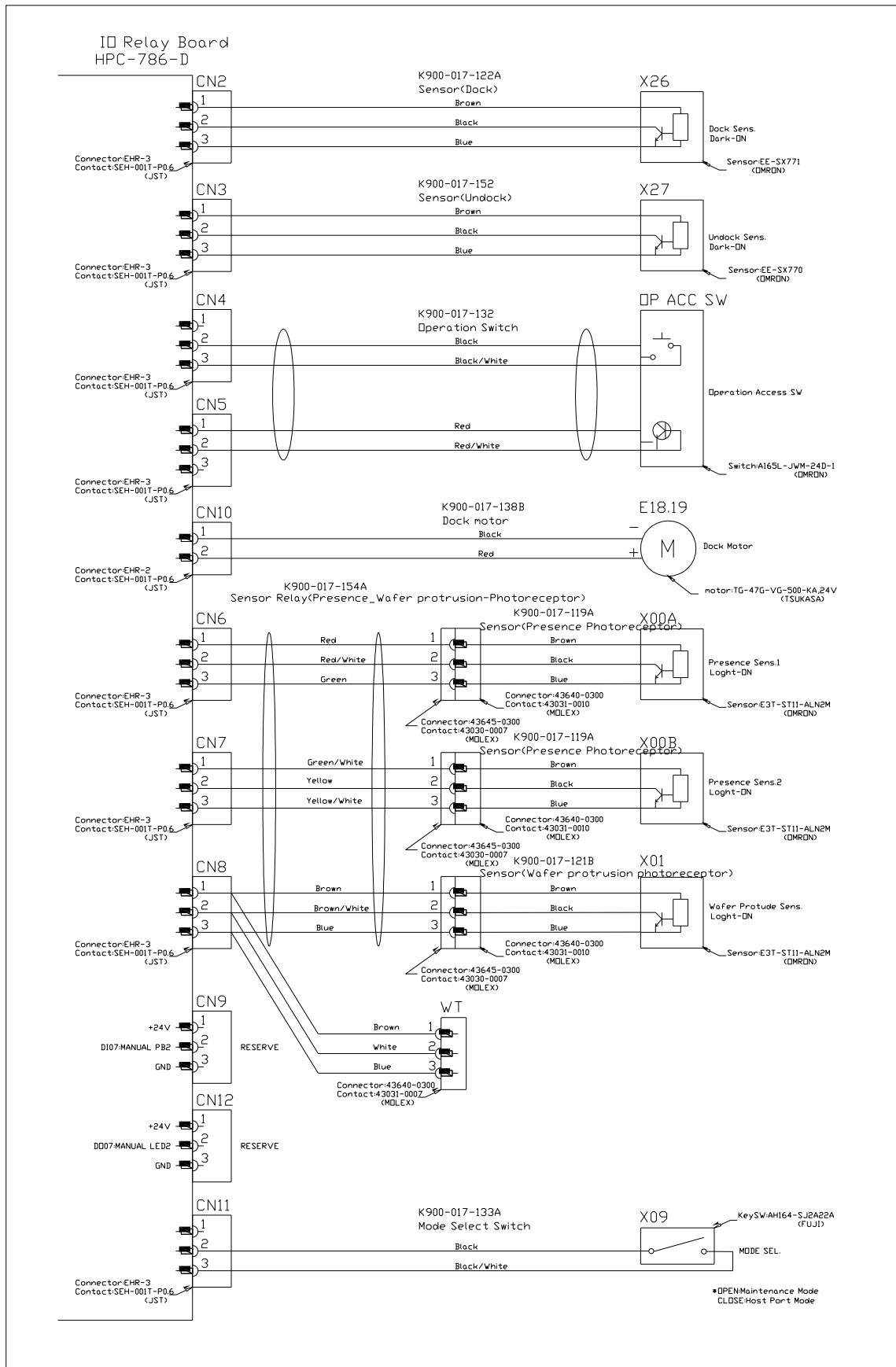
APPENDIX C.14 Table



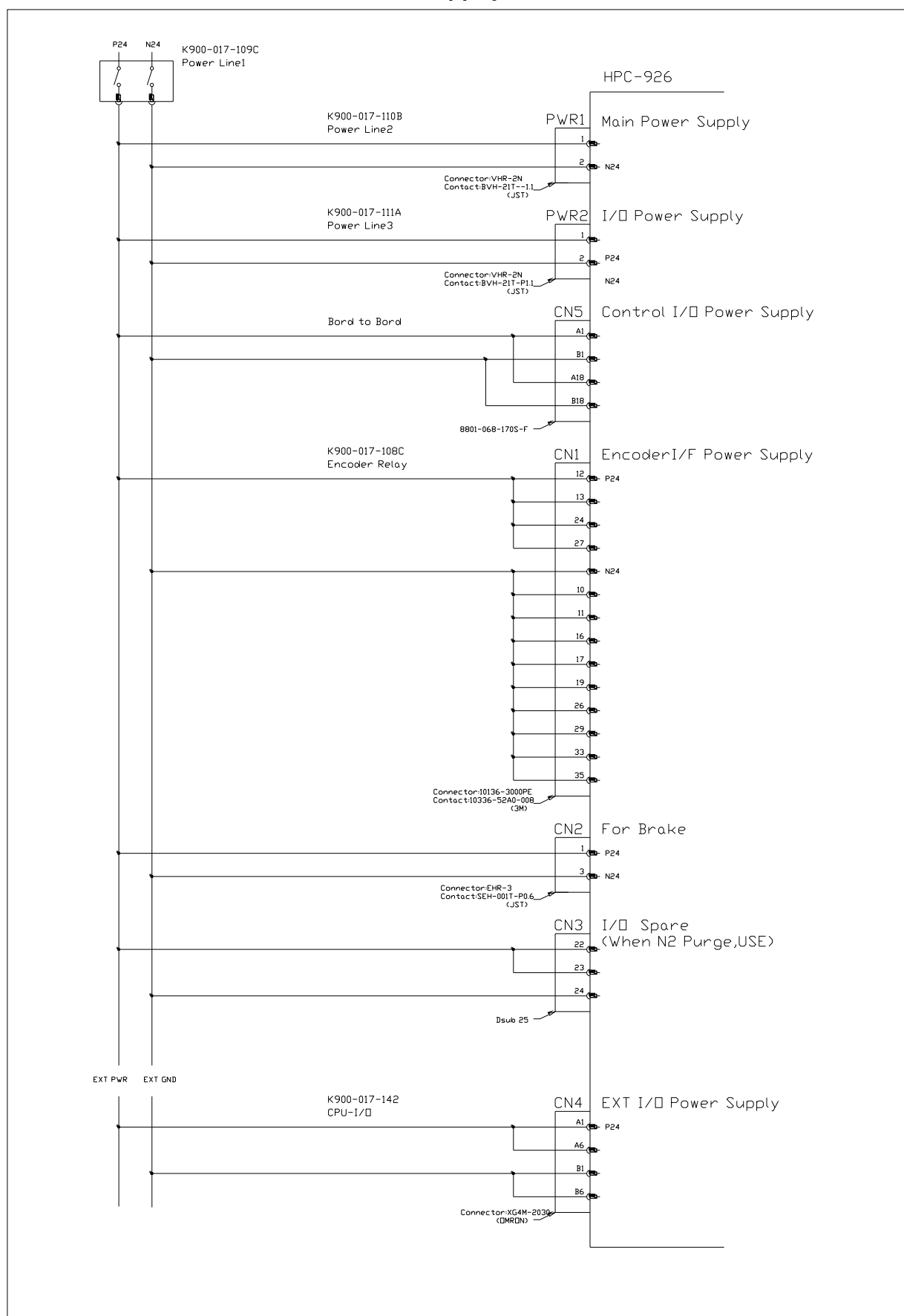
Middle Base 1

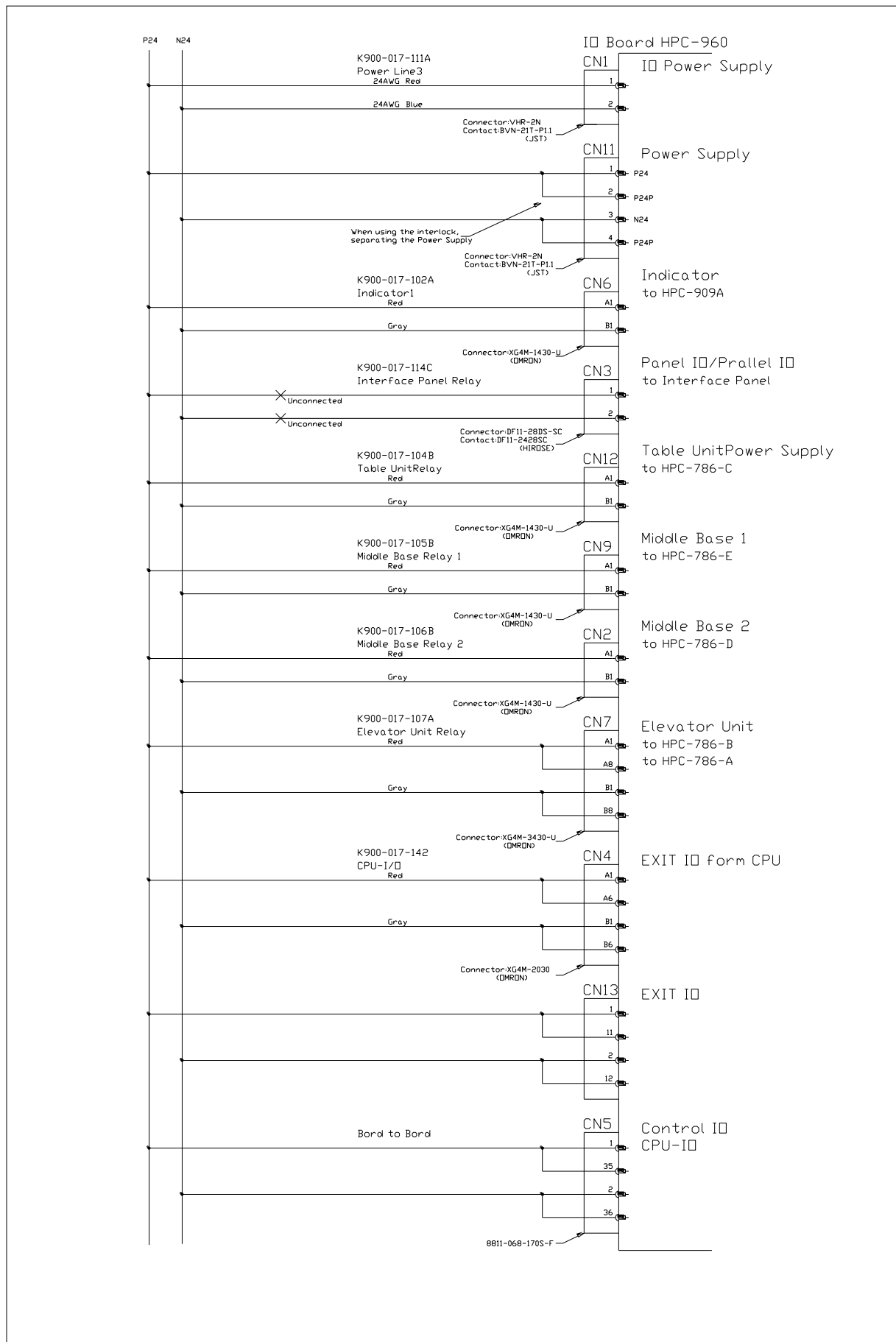
APPENDIX C.16

Middle Base 2

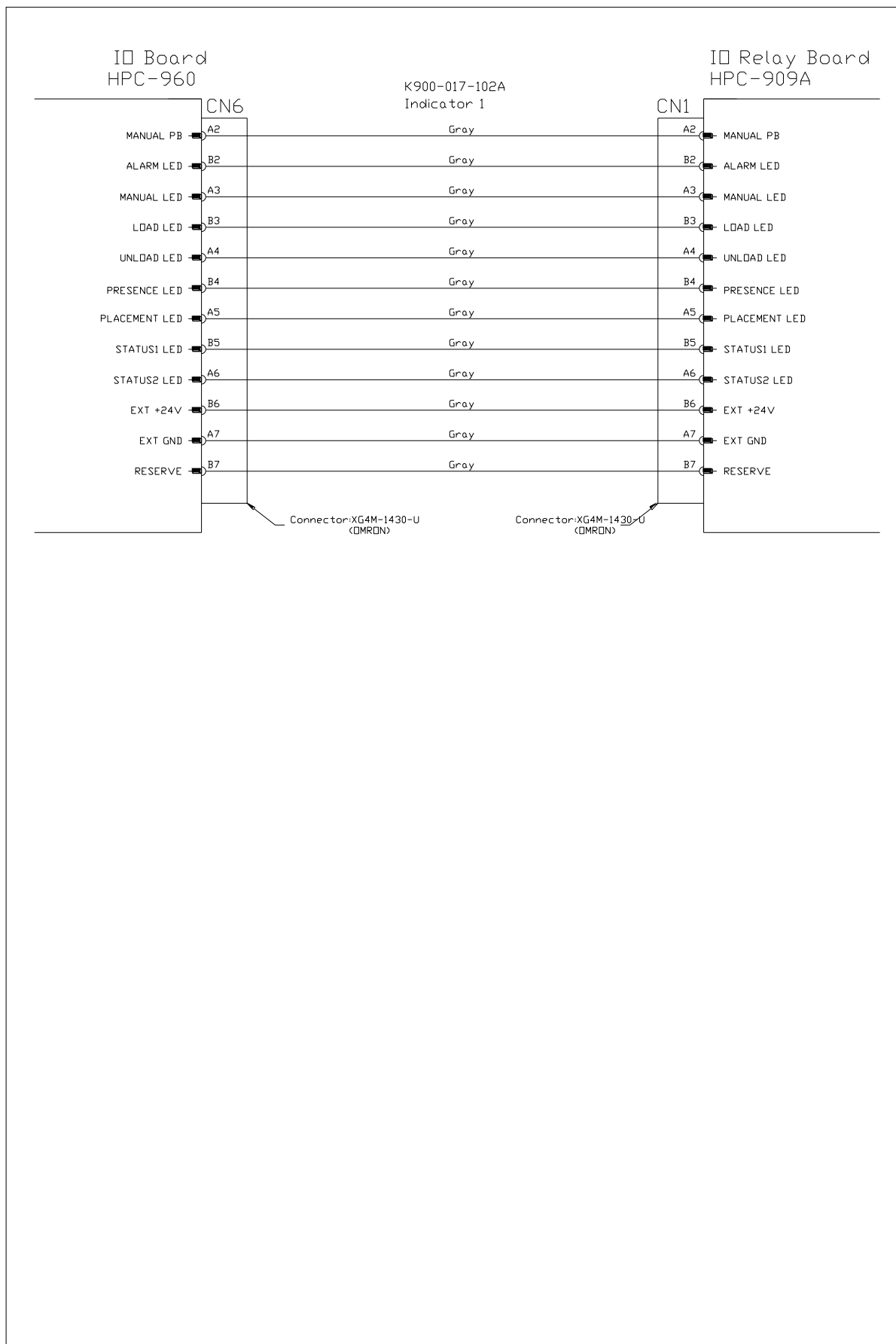


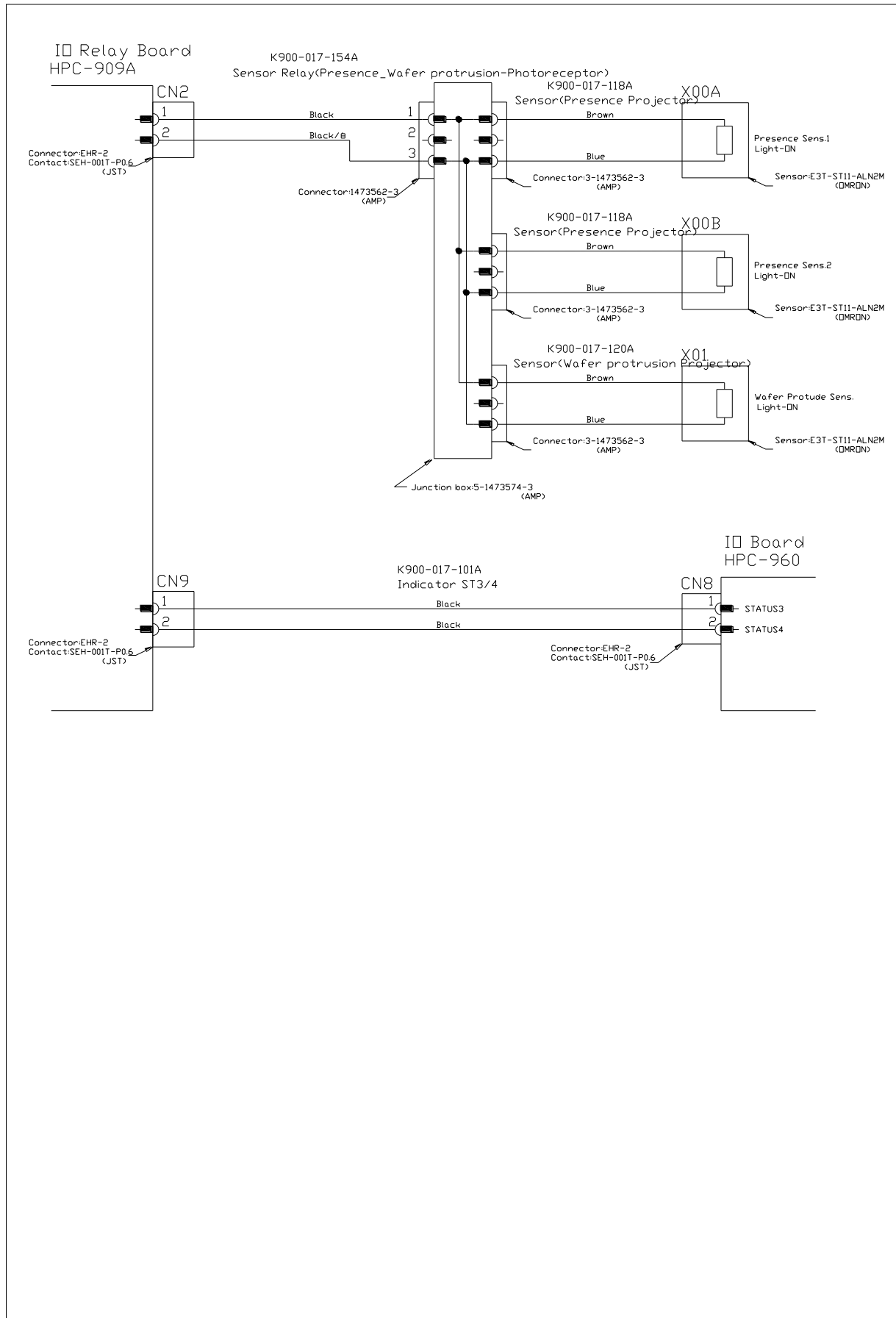
APPENDIX C.17 Power Supply





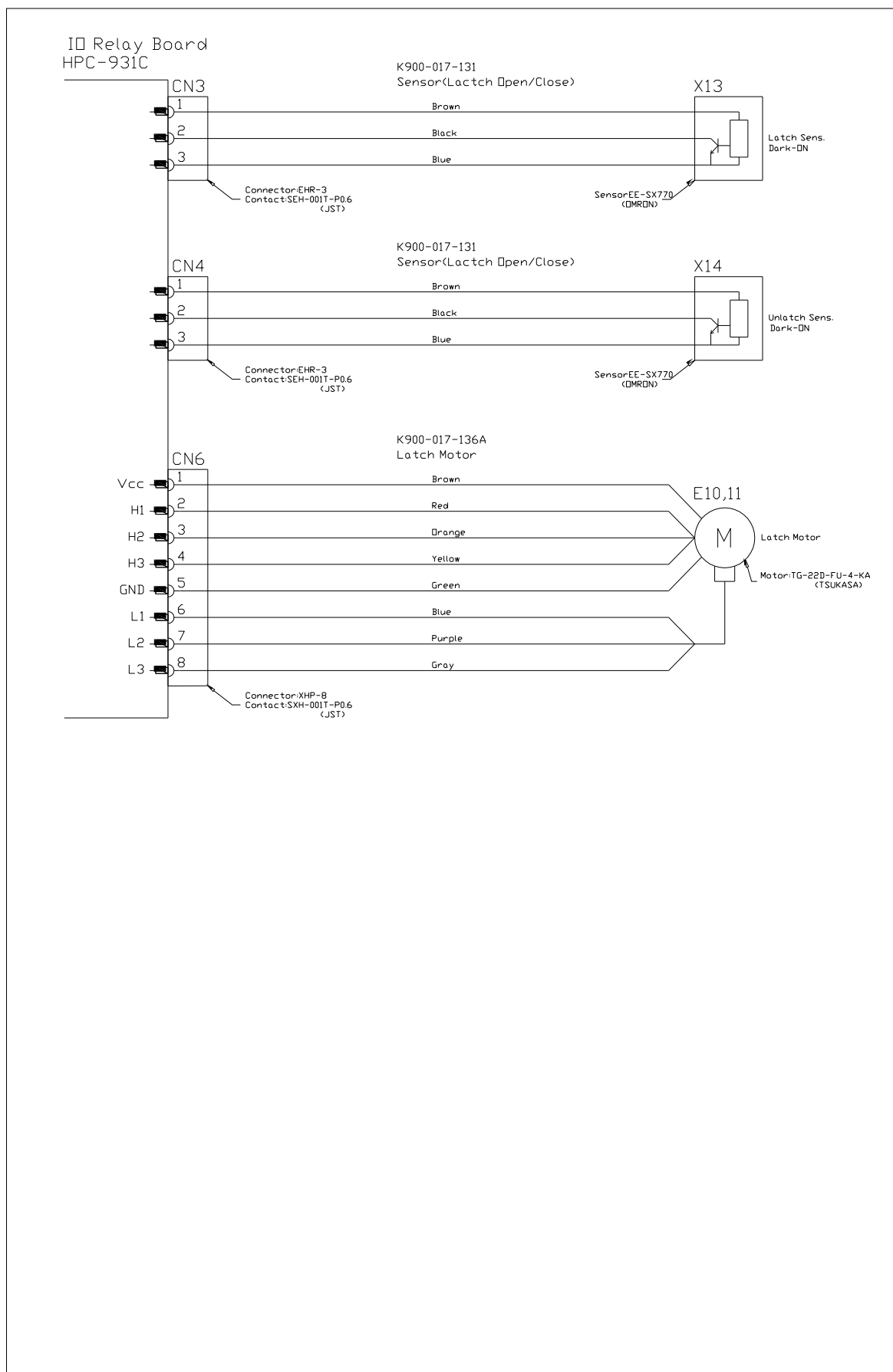
APPENDIX C.18 Indicator





APPENDIX C.19

Door Evacuation (Latch Board)



APPENDIX C. 20 Interlock (Jumper wire)