Robostar Robot

N1 Series Option

PROFINET

☑ Option Module

- PROFINET

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Robostar Co., Ltd

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(3) Failure due to the use of unauthorized products, including parts and grease.
(4) Failure due to incidents involving fire, disasters, earthquakes, damage from storm and flood, and other force majeure events.
(5) Failure caused by the use of products outside the environment specified in our product specifications, such as in excretion and flooding.
(6) Wear-out failures for consumables.
(7) Failure due to the negligence of conducting maintenance and inspection work as specified in the operation manual and the instruction manual.
(8) Damages other than robot repair costs.

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Composition of User Manual

The User Manual of this product is composed of the following. If this is the first time to use this product, fully understand each and every detail in the manual before use.

- **PROFINET**

  Explains how to connect a connector to N1 series using PROFINET communication modules as well as how to use it.

Content

ch.1. Overview

1.1 What is a PROFINET Option Card?

PROFINIT, Ethernet-based communication protocols developed by SIMENS, is public standards adopted by many companies including Phoenix Contact and Bosch as a next automobile industry Ethernet solution. PROFINET is protocols designed for communication, configuration and diagnosis in networks and utilizes Ethernet standards along with TCP, UDP and IP.

1.2 System Configuration

PROFINET NRT (Non Real Time) is defined in a non-real-time application. This uses standard protocols as a UDP/IP. In the cycle time of 100 ms or above, PROFINET NRT takes the application in process automation as a subject. For applications with higher requirements in the cycle time like factory automation, PROFINET RT (RealTime) makes an appropriate selection. I/O data is directly exchanged with the use of Ethernet protocols, and a diagnosis and configuration utilize general UDP/IP. PROFINET RT is capable of activate the application with a cycle time of 10 ms or above.

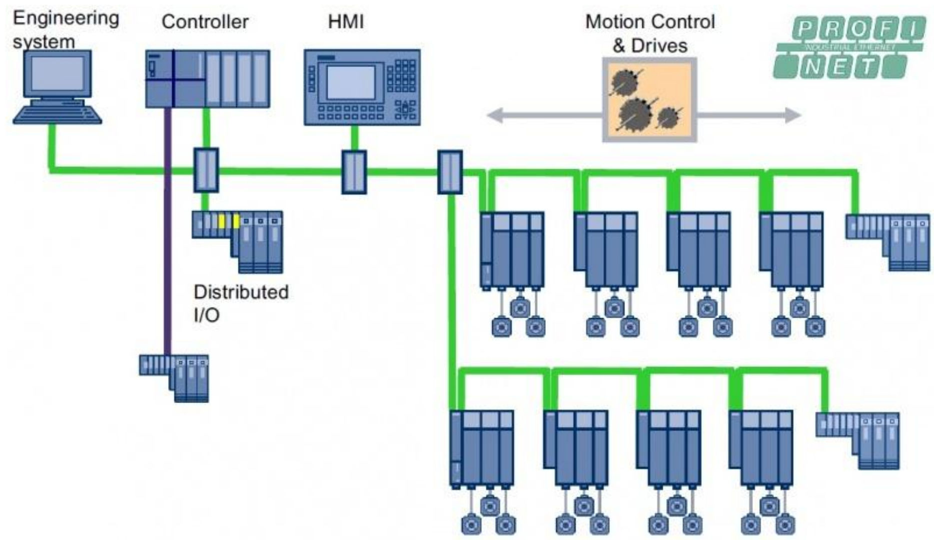


Fig. 1.2 PROFINET System Configuration

ch.2. Function

2.1 Basic Specifications of PROFINET Option Slave

Item	**Specifications**
Protocol	PROFINET I/O RT
Station Type	PROFINET IO Device
Topology	Line or Star topology
I/O Data Size	128 Bytes Input/128 Bytes Output
Indicators	Refer to "4. LED Indicator"
Baud Rate	100Mbps Full-
Default Name	N1-PNIO-XXX
Dpram Update Period	1ms

ch.3. Specifications

3.1 PROFINET Option Card Specifications

Fig. 3.1 shows the PROFINET Option Board outside view from front.

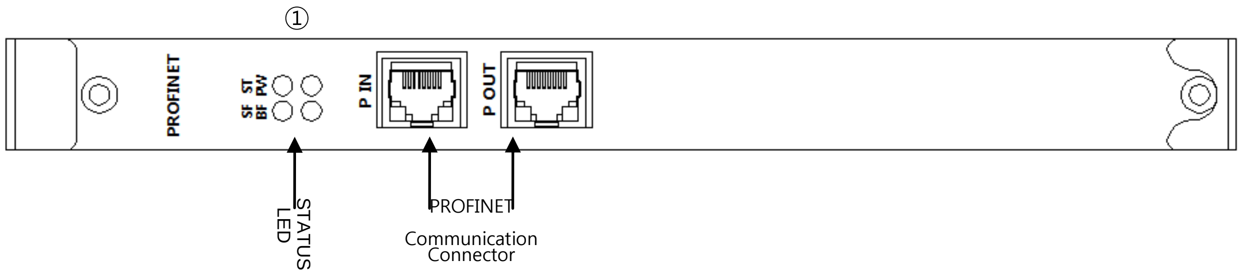


Fig. 3.1 Outside View from Front of CC- PROFINET Option Card

PROFINET Option Board has specifications in Table 3.1.

Function	Description
Status Display	- Status LED
Comm Port	- RJ45 Port x 2 (IN, OUT)
Operating Voltage	- Internal +5V ± 5% : 0.5 A nominal Maximum - External +24V ± 5% : 0.15 A nominal Maximum
Operating Temperature	- Temperature : operating 0 ~ 40 ℃ storage -15 ~ 60 ℃
Operating Humidity	- Humidity : 20 ~ 80% RH (non-condensing)

Table 3.1 PROFINET Option Board Specifications

3.2 Definition of lED Function

PROFINET Option Board comes with a total of 4 LEDs, making it possible to check briefly out PROFINET Adapter status from the outside. The external look is shown in Fig. 3.1 ①, with functions listed below.

Item	Color	Description	Remark
LED1	Green	ST: Outputs Profinet Card status	
LED2	Green	PWR: Outputs Profinet Card power	
LED3	Red	SF: Outputs System Fault	
LED4	Red	BF: Outputs Bus Fault	

LED Output	Operation	Description
ST PW SF BF	ST:ON PW:ON SF:OFF BF:OFF	Communication with PLC in normal condition
ST PW SF BF	ST:ON PW:ON SF:ON BF:OFF	Normal communication with the upper PLC is made but a diagnostic error has occurred.
ST PW SF BF	ST:ON PW:ON SF:Flashing BF:OFF	IO board in receipt of a command Node Flashing Test
ST PW SF BF	ST:ON PW:ON SF:OFF BF:ON	Communication cables not connected in normal manner. Full duplex transmission remains inactivated.
ST PW SF BF	ST:ON PW:ON SF:OFF BF: Flashing	The set IP and a Device Name are not consistent. A delay takes place in response monitoring. Parameter set values are not consistent.
ST PW SF BF	ST:OFF PW:ON SF:OFF BF: OFF	CPU on IO board in abnormal condition
ST PW SF BF	ST: Flashing PW:ON SF: ON BF: ON	Communication module(NETX) on IO board in abnormal condition

Table 3.2 Definition of LED Function

ch.4. Installation and Operation Setting

4.1 How to Install Hardware

Take the following procedure to be able to use PROFINET Option Board on a N1 controller.

1) Turn power OFF.
2) Attach the PROFINET Board to N1 Controller's Option slot..

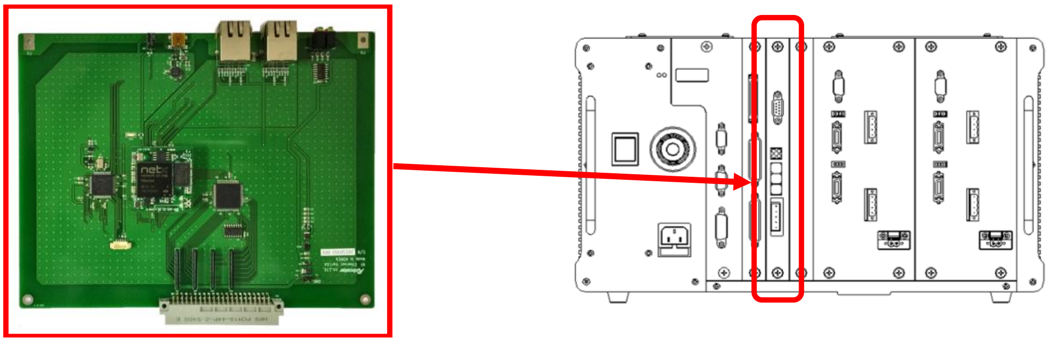


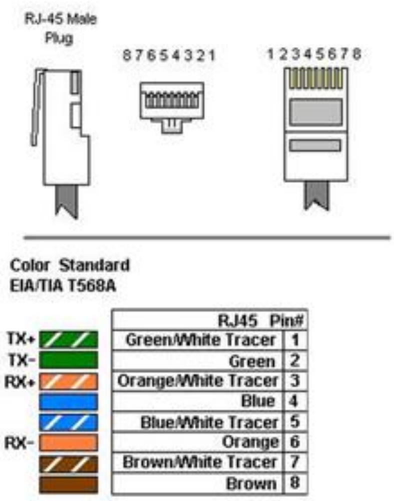
Fig. 4.1 How to Install an Option Board

3) Turn power ON.

4.2 How to Make Cable-Connector Connection and Pinmap

The connector connected to N1 PROFINET Option Module is a RJ-45 Type.

For how to connect cables, follow standard PROFINET cable connections.

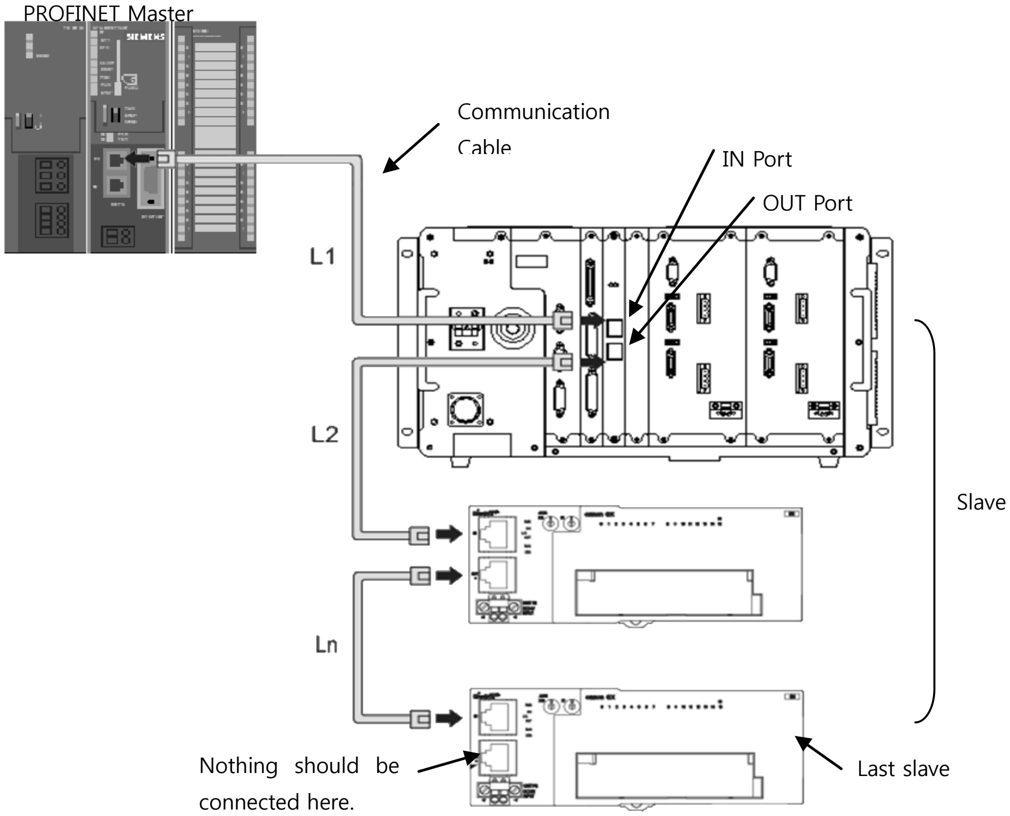


Cable Type	Application Type A	Application Type B	Application Type C
Design	Data Cable	Data Cable	Data Cable
Cable Installation Type	Stationary, no movement after installation	Flexible, occasional movement or vibration	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
System Concept:			
Cable Marking (at least)	PROFINET Type A	PROFINET Type B	PROFINET Type C
Core Cross Section	AWG 22/1	AWG 22/7	AWG 22/..
Outer Cable Diameter	5,5 - 8,0 mm		Application
Core Diameter	1,5 +/- 0,1 mm		Application
Colour (Outer Sheath)	Green RAL6018		Application
Core Identification (colours) star quad 2 pair	white, yellow, blue, orange Pair 1: white (RXD+), blue (RXD-) Pair 2: yellow(TXD+), orange(TXT-)		
Number of Cores	4		
Cable Design	2 pairs or 1 star quad		

4.3 Communication Cable Connection

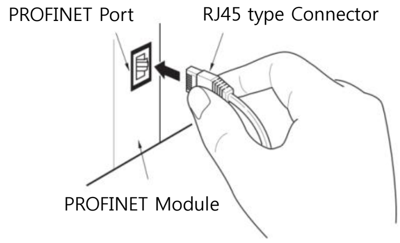
PROFINET network is enabled to be freely connected regardless of a connection type. Connect the communication cable from the PROFINET master to an IN port and the communication cable for next slave to an OUT port, respectively.

Besides, nothing should be connected to the OUT port in the last network slave.



Keep the cables between slaves within 100m long (Fig. L1,L2...Ln), respectively. Make a firm connection until the connector on the communication cable snaps into place.

Turn OFF power to the controller before connecting to or removing from PROFINET communication cables. Arrange a space with room to secure the bend radius of PROFINET communication cable. Space needed varies depending on communication cables or a connector in use, therefore, make enquiries to each maker or place of purchase.



4.4 Controller Setting

To use a PROFINET in a N1 series controller, set the Controller FIELD BUS to PROFINET Mode.

4.4.1 FIELD BUS(PROFINET) Setting

1. Setting Step

Step1. **Shift to PUBLIC Parameter screen**

```
<MAIN   MENU>
1. JOB          2. RUN
3. HOST         4. PARA
5. ORIGIN       6. I/O
7. SYSTEM       8. GPNT
9. INT/FLT      A. ALARM

                  SELECT #
```

4 L

Open the initial MAIN screen.

Select 4: PARA.

```
<PARAMETER>
 NO             TYPE
*CH1            XYZW
 CH2            XY_TEST



SEL    INFO     PUB     EXIT
```

F3

Open PUBLIC PARAMETER group screen.

Press F3 button to move to PUB.

```
<PUBLIC PARAMETER>
1: HW CONF      2: PALLET
3: PLC          4: ETC



                   group #
```

1 Q

Select 1:HW CONF.

Step2. Shift to FIELD BUS

```
<PUBLIC-HW CONF(0)>
1: TMR              2: COMM
3: I/O              4: D-MAN
5: SVON             6: A I/O

                  item #
```

Select 2: COMM.

2
R

```
<HW CONF - COM>
   COMMUNICATION SET
1: RS232C
2: FIELD BUS

                 group #
```

Select 2: FIELD BUS.

2
R

```
<COM-FDBUS >
1: CARD
2: USER I/O
3: PROFIBUS ENDIAN
4: MAP EXTENTION
5: PROFINET MAP
6: IP CONFIG
                  Input:
```

Select 1: CARD.

1
Q

Step3. OPTION CARD setting screen

```
<FDBUS-CARD>
        OPT COM CARD
1: NONE             2: CC-LINK
3: PROFIBUS         4: D-NET
5: EtherCAT
6: PROFINET

    Selected : PROFINET
```

Select 6: PROFINET.

6
N

```
<FDBUS-CARD>
        OPT COM CARD
1: NONE             2: CC-LINK
3: PROFIBUS         4: D-NET
5: EtherCAT
6: PROFINET

   Update OK?(ENT/ESC)
```

Press ESC and enter ENTER to save.

ESC ENTER

CAUTION

- **When there is no PROFINET B/D, a message “Not Card!” appears at the bottom of T/P screen and saving is not implemented.**

4.4.2 N1: Checking and Saving N1: PROFINET MAP Size

Step1. **Shift to FIELD BUS screen**

```
<COM-FDBUS >
 1: CARD
 2: USER I/O
 3: PROFIBUS ENDIAN
 4: MAP EXTENTION
 5: PROFINET MAP
 6: IP CONFIG
                    Input:
```

5 M

Select 5: PROFINET MAP.

```
<P-NET  MAP >
   SEL   PROFINET   MAP
 MAP:NORMAL  (46X46)


 VIEW                 SAVE
```

F1

Selects F1: VIEW.

```
<P-NET  MAP >
   SEL   PROFINET   MAP
 MAP:NORMAL  (46X46)

 FROM  CARD
 MAP:NORMAL  (46X46)
 VIEW                 SAVE
```

Check out MAP size saved to Option board.

Step2. **Save PROFINET MAP SIZE**

```
<P-NET  MAP >
   SEL   PROFINET   MAP
 MAP:NORMAL  (46X46)

 FROM  CARD
 MAP:NORMAL  (46X46)
 VIEW                 SAVE
```

F4

Select F4: SAVE.

```
<P-NET  MAP >
   SEL   PROFINET   MAP
 MAP:NORMAL  (46X46)

 FROM  CARD
 MAP:NORMAL  (46X46)
    Update OK?(ENT/ESC)
```

ESC ENTER

Press ESC and push ENTER to save.

(If there is any change)

CAUTION

- **Save MAP size and turn ON/OFF power to the controller.**

4.4.1 Checking and Saving N1: PROFINET IP, Gateway

Step1. **Shift to IP CONFIG screen**

<COM-FDBUS >
1: CARD
2: USER I/O
3: PROFIBUS ENDIAN
4: MAP EXTENTION
5: PROFINET MAP
6: IP CONFIG
Input:

6
N

Select 6: IP CONFIG.

Step2. **IP CONFIG setting screen**

<FDBUS-IPCONFIG>
IP : 192.168. 1.100
GT: 192.168. 1. 4

VIEW SAVE

Enter the IP and GATEWAY set in PLC.

Step3. **Check PROFINET IP**

<FDBUS-IPCONFIG>
IP : 192.168. 1.100
GT: 192.168. 1. 4

VIEW SAVE

F1

Select F1 : VIEW.

<FDBUS-IPCONFIG>
IP : 192.168. 1.100
GT: 192.168. 1. 4

FROM CARD
IP : 192.168. 1.100
GT: 192.168. 1. 4
VIEW SAVE

Check IP and GATWWAY set to Option card.

Step5.

```
<FDBUS-IPCONFIG>
IP : 192.168.    1.100
GT: 192.168.    1.   4

FROM   CARD
IP : 192.168.    1.100
GT: 192.168.    1.   4
VIEW                     SAVE
```

Select F4: SAVE.

```
<FDBUS-IPCONFIG>
IP : 192.168.    1.100
GT: 192.168.    1.   4

FROM   CARD
IP : 192.168.    1.100
GT: 192.168.    1.   4
    Update OK?(ENT/ESC)
```

Press ESC and press ENTER to save.

(If there is any change)

ESC ENTER

CAUTION

- **Change an address value and turn ON/OFF power to the controller.**
- **When the OPTION board is not fastened in normal condition, alarm E1237 "Not find Fieldbus" sounds.**
- **When IP and Gateway addresses saved to the Option board are not consistent with the control board, alarm E1241 "Net Addr IP mismatch" sounds.**
- **When the value for MAP size saved to the Option board is not consistent with the control board, alarm E1242 "Net MAP mismatch" sounds.**

ch.5. Examples of PROFINET Setting

Step1.

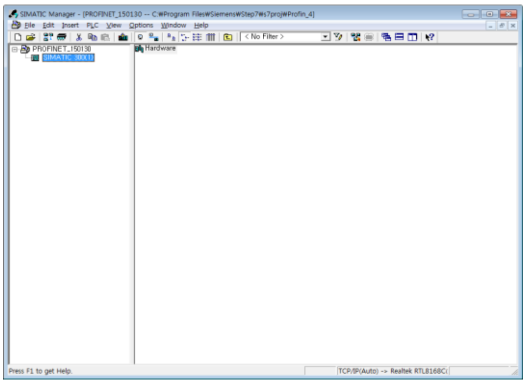


Fig. 5.1 SIMENS PLC

Run SIMATIC Manager to click Hardware (Station configuration) as shown in the figure below.

Step2.

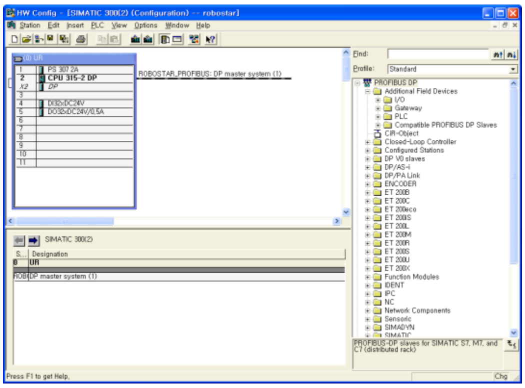


Fig. 5.2 SIMENS PLC

Run HW Config program to add PROFINET Slave.

.

Step3.

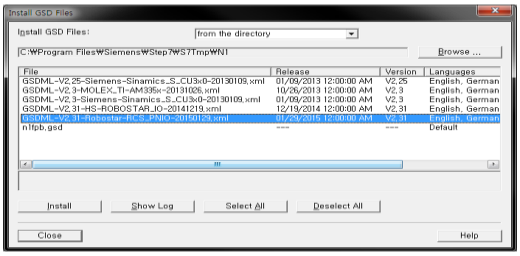


그림 5.3 SIMENS PLC

Select Options/Install New GSD menu to select the file provided as shown below.

Step4.

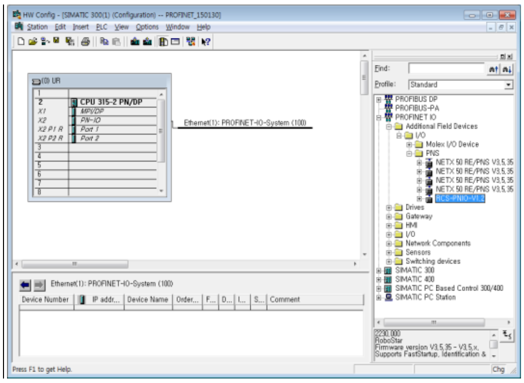


Fig. 5.4 SIMENS PLC

Fig. 5.4 shows ROBOSTAR N1 Device is registered to PROFINET.

Step5.

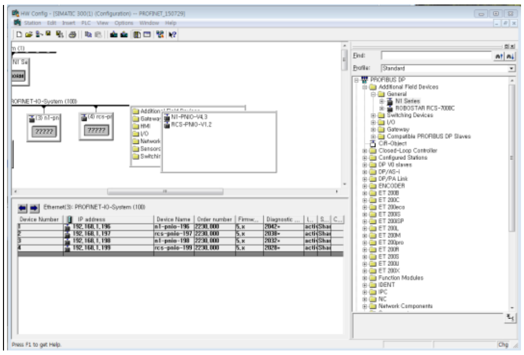


Fig. 5.5 SIMENS PLC

Press the right mouse button on PN-IO connecting line to select Insert Object, then select N1-PNIO-Vx.x.

Step6.

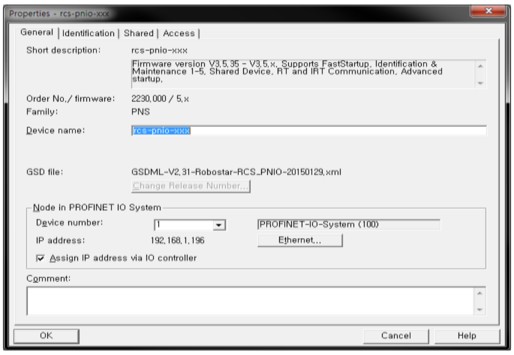


Fig. 5.6 SIMENS PLC

Once registered, the property window is displayed. Change Device name and Ethernet IP. At this time, the Device name should be set to N1-PNIO-(IP number).

Step7.

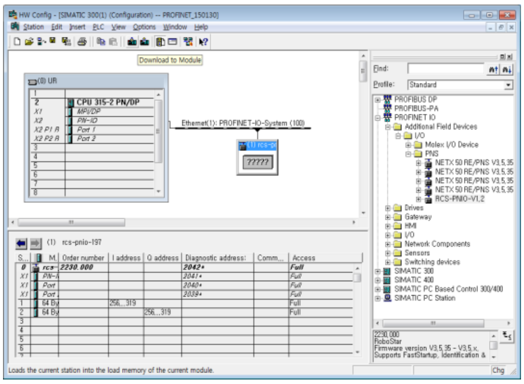


Fig. 5.7 SIMENS PLC

Select ROBOSTAR RCS object and register Input/Output Address as shown in Fig. 5.9, Fig. 5.10.

Select Insert Object from Drop menu on right mouse.

* Basic IO Size is 32Byte.

Step8.

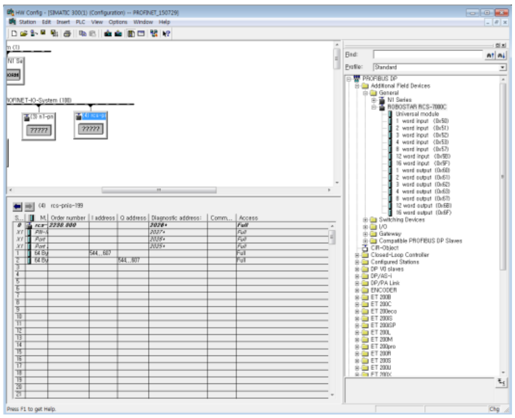


Fig. 5.8 SIMENS PLC

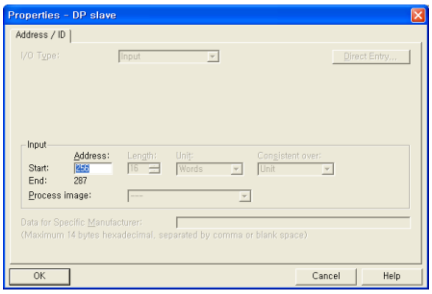


Fig. 5.9 SIMENS PLC

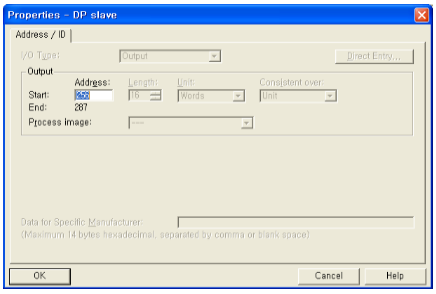


Fig. 5.10 SIMENS PLC

ch.6. Memory Mapping

6.1 N1 Controller Data Mapping

<table>
<tr><th colspan="4">Controller Data Mapping</th></tr>
<tr><th>CC-Link Data</th><th>Description</th><th>CC-Link Data</th><th>Description</th></tr>
<tr><td>RY00-0F</td><td>System Input #1</td><td>RX00-0F</td><td>System Output #1</td></tr>
<tr><td>RY10-1F</td><td>User Input</td><td>RX10-1F</td><td>User Output</td></tr>
<tr><td>RY20-2F</td><td>Option Input 0</td><td>RX20-2F</td><td>Option Output 0</td></tr>
<tr><td>RY30-37</td><td>System Input #2</td><td rowspan="2">RX30-3F</td><td rowspan="2">Error Code Read</td></tr>
<tr><td>RY38-3F</td><td>FieldBus Input #1</td></tr>
<tr><td>RY40-4F</td><td>Option Input 1</td><td>RX40-4F</td><td>Option Output 1</td></tr>
<tr><td>RY50-5F</td><td>Option Input 2</td><td>RX50-5F</td><td>Option Output 2</td></tr>
<tr><td>RY60-6F</td><td>Option Input 3</td><td>RX60-6F</td><td>Option Output 3</td></tr>
<tr><td>RY70-7F</td><td>FieldBus Input #2</td><td>RX70-7F</td><td>FieldBus Output #2</td></tr>
<tr><td>RWw0</td><td rowspan="2">1-axis Position Value Input</td><td>RWr0</td><td rowspan="2">Current 1-axis Position Value Output</td></tr>
<tr><td>RWw1</td><td>RWr1</td></tr>
<tr><td>RWw2</td><td rowspan="2">2-axis Position Value Input</td><td>RWr2</td><td rowspan="2">Current 2-axis Position Value Output</td></tr>
<tr><td>RWw3</td><td>RWr3</td></tr>
<tr><td>RWw4</td><td rowspan="2">3-axis Position Value Input</td><td>RWr4</td><td rowspan="2">Current 3-axis Position Value Output</td></tr>
<tr><td>RWw5</td><td>RWr5</td></tr>
<tr><td>RWw6</td><td rowspan="2">4-axis Position Value Input</td><td>RWr6</td><td rowspan="2">Current 4-axis Position Value Output</td></tr>
<tr><td>RWw7</td><td>RWr7</td></tr>
<tr><td>RWw8</td><td>Global Integer Input</td><td>RWr8</td><td>Global Integer Output</td></tr>
<tr><td>RWw9</td><td>Global Integer Index</td><td>RWr9</td><td rowspan="2">Global Float Output</td></tr>
<tr><td>RWw10</td><td>JOG VEL Rate Input</td><td>RWr10</td></tr>
<tr><td>RWw11</td><td>Global Point Index</td><td>RWr11</td><td>Info Data 1 Output</td></tr>
<tr><td>RWw12</td><td>Pull Up Value Input</td><td>RWr12</td><td>Info Data 2 Output</td></tr>
<tr><td>RWw13</td><td rowspan="2">Global Float Input</td><td>RWr13</td><td>Info Data 3 Output</td></tr>
<tr><td>RWw14</td><td>RWr14</td><td>Info Data 4 Output</td></tr>
<tr><td>RWw15</td><td>Global Float Index</td><td>RWr15</td><td>Program Num Output</td></tr>
</table>

Note) When using Option I/O, change Parameter I/0 EXT B/D value to 2. (Operation Manual" 1.3.1.3 Extension I/O Board Setting".)

Note) JOG Velocity Rate Input of RWw10 applies when in JOG Mode, with a setting range from 1 to 100%. The value set is converted by percent per axis based on the Jv values of JOINT

MOTION parameters.

6.1.1 N1 Series System Input #1

N1 series has System Bits commonly used between Robot Channel 1 and 2, and these bits operate differently between channels depending on CH_SEL Bit setting. If CH_SEL Bit set value is Low, it corresponds to Robot Channel 1, High to Robot Channel 2.

System Input #1			
0	CH SEL	8	MODE 1 / AXIS 1
1	PROG 0	9	MODE SEL
2	PROG 1	A	JOG VEL
3	PROG 2	B	VEL+ / MOV+
4	PROG 3	C	VEL- / MOV-
5	PROG 4	D	REBOOT
6	PROG SEL	E	ORG #1
7	MODE 0 / AXIS 0	F	START #1

Commonly-used bits are PROG_0 ~ PROG_4, PROG_SEL, MODE0/AXIS0, MODE1/AXIS1, MODE SEL, JOG VEL, VEL+/MOV+, VEL-/MOV- . Check the CH SEL Bit set value when using the commonly-used bits. When the CH SEL Bit set value is not correct, an unwanted robot channel may operation. The FieldBus timing diagram marked in this Manual is examples for Channel 1, and for handling and operating Channel 2 change CH_SEL Bit set value in Channel 1 timing diagram to High. Reading and writing Global Integer and Global Float Data CH_SEL Bit can be used regardless of setting.

CAUTION

> ➢ **For description of functions of each Bit, refer to Operation Manual "3.3.4 System Input/Output Functions".**

6.1.2 N1 Series System Input #2 & FIELDBUS INPUT#1

System Input #2		FieldBus Input #1	
0	STOP #1	8	DATA TYPE: XY Coordinates
1	Reserved	9	DATA TYPE: Angle Coordinates
2	SERVO ON #1	A	Data Type: Pulse (Read Only)
3	ORG #2	B	Mode Select (/Current OR GPNT)
4	START #2	C	Write Enable Flag(Position,GINT)
5	STOP #2	D	READ Enable Flag(Position, GINT)
6	Reserved	E	Reserved
7	SERVO ON #2	F	Reserved

6.1.3 N1 Series FIELDBUS INPUT #2

FieldBus Input #2			
0	JOG A(X)+	8	AUTO RUN MODE
1	JOG A(X)-	9	STEP RUN MODE
2	JOG B(Y)+	A	JOG MODE
3	JOG B(Y)-	B	JOG Forward SEL
4	JOG Z+	C	Reserved
5	JOG Z-	D	Reserved
6	JOG W+	E	Info Data Mode SEL #0
7	JOG W-	F	Info Data Mode SEL #1

6.1.4 N1 Series System Output #1

System Output #1			
0	CH SEL	8	ORG OK #2
1	ALL ALARM	9	RUNNING #2
2	READY #1	A	INPOS/INRNG #2
3	ORG OK #1	B	SERVO ON #2
4	RUNNING #1	C	Reserved
5	INPOS/INRNG #1	D	Reserved
6	SERVO ON #1	E	Reserved
7	READY #2	F	Reserved

6.1.5 N1 Series FIELDBUS Output #2

FieldBus Output #2			
0	Write Complete Flag	8	Auto Run Mode DIS
1	Read Complete Flag	9	Step Run Mode DIS
2	Reserved	A	JOG Mode DIS
3	Forward Moving State DIS	B	Reserved
4	Reserved	C	TRQ Info Data Mode
5	Brake State DIS	D	RPM Info Data Mode
6	Reserved	E	Reserved
7	Reserved	F	Reserved

6.2 Precautions for Use in N1 Series System Mode

1. < Precaution for Use in Auto Mode >

① As GINT, GFLOAT and GPNT commonly use Read / Write Enable Flag, the index values of unused variables are allocated at a time when no change is desired.

② Of Data types, XYZW and ABZW are only Coordinate Write functions available for use.

③ PROGRAM NUM output generates only the PROGRAM NUM entered in SYSTEM MODE.

④ VEL output is capable of generating robot's moving speed in JOG MODE and AUTO MODE.

2. < Precautions for use in JOG Mode >

① **JOG_VEL input is available for use only in JOG MODE and when the value is 0 it runs at 1% speed.**

② **VEL output is capable of generating robot's moving speed in JOG MODE and AUTO MODE.**

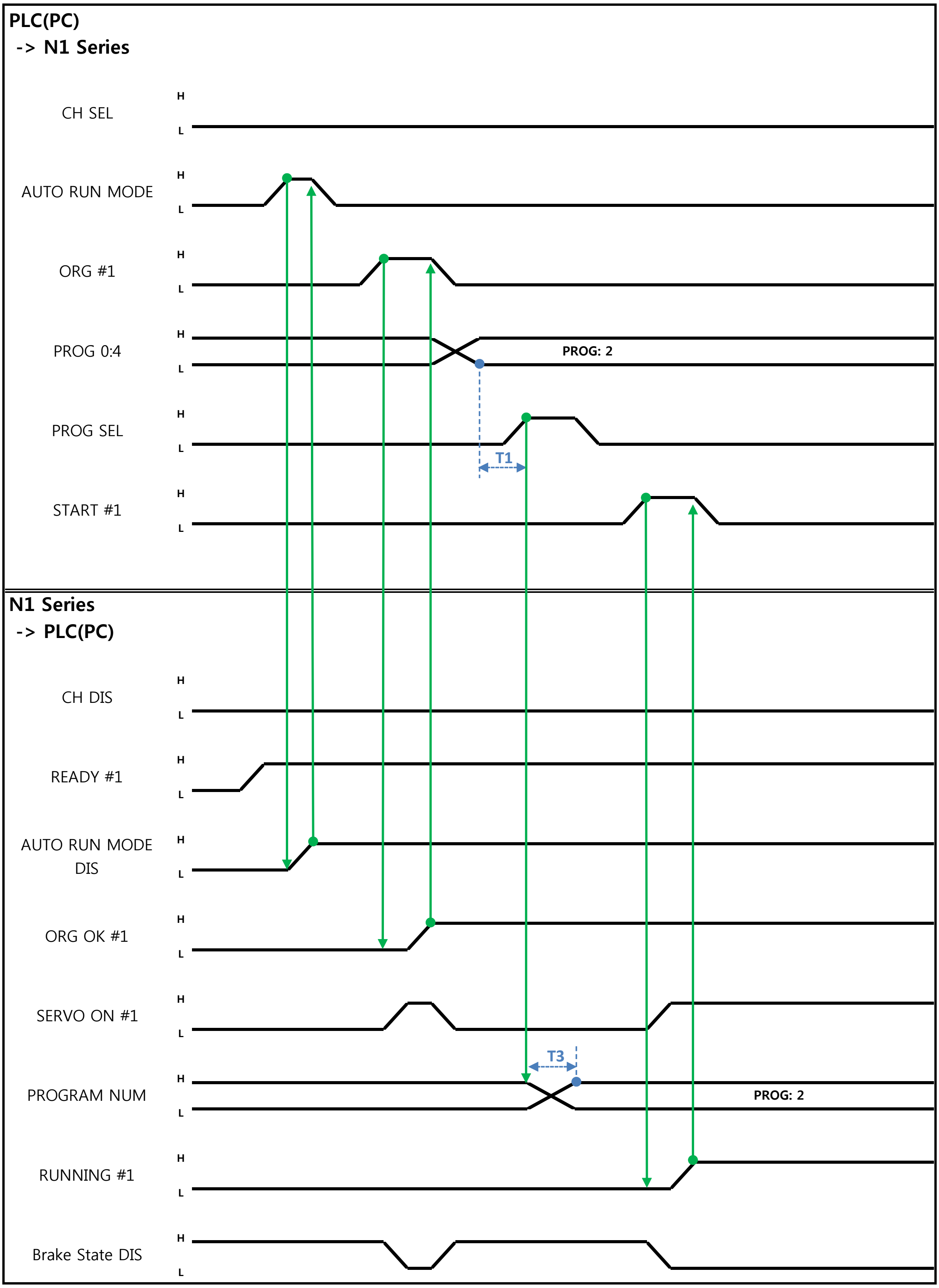
③ **Pulse inputs should be made to enter AUTO RUN MODE, STEP RUN MODE and JOG MODE in Field Bus Input #2. (When each mode is set to High, the selected bit on Jog axis in FieldBus Input #2 is operated under abnormal conditions.)**

CAUTION

- **Times displayed in Field Bus timing diagram are as follow.**
  T1: 20ms, T2: 30ms, T3: 40ms.
- **The pulse width entered when applying Field Bus should be kept over a minimum of 20ms.**
- **The time interval between signals entered when applying Field Bus should be over at least 20ms.**

6.3 N1 Series FieldBus(CC_Link) Timing Diagram

6.3.1 Operation in AUTO RUN MODE



When in Auto Servo ON

Description :

- Set CH SEL Bit. (Low: Channel 1, High: Channel 2)
- Enter AUTO RUN MODE Bit into pulse format. (High status should be kept over 20ms.)
- When ORG OK#1 Signal is Low in N1 Series, set ORG #1 Bit to High.
- When ORG OK #1 is changed to High, combine PROG 0~4 Bits to set the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller and set START #1 Bit to High.

When not in Auto Servo ON

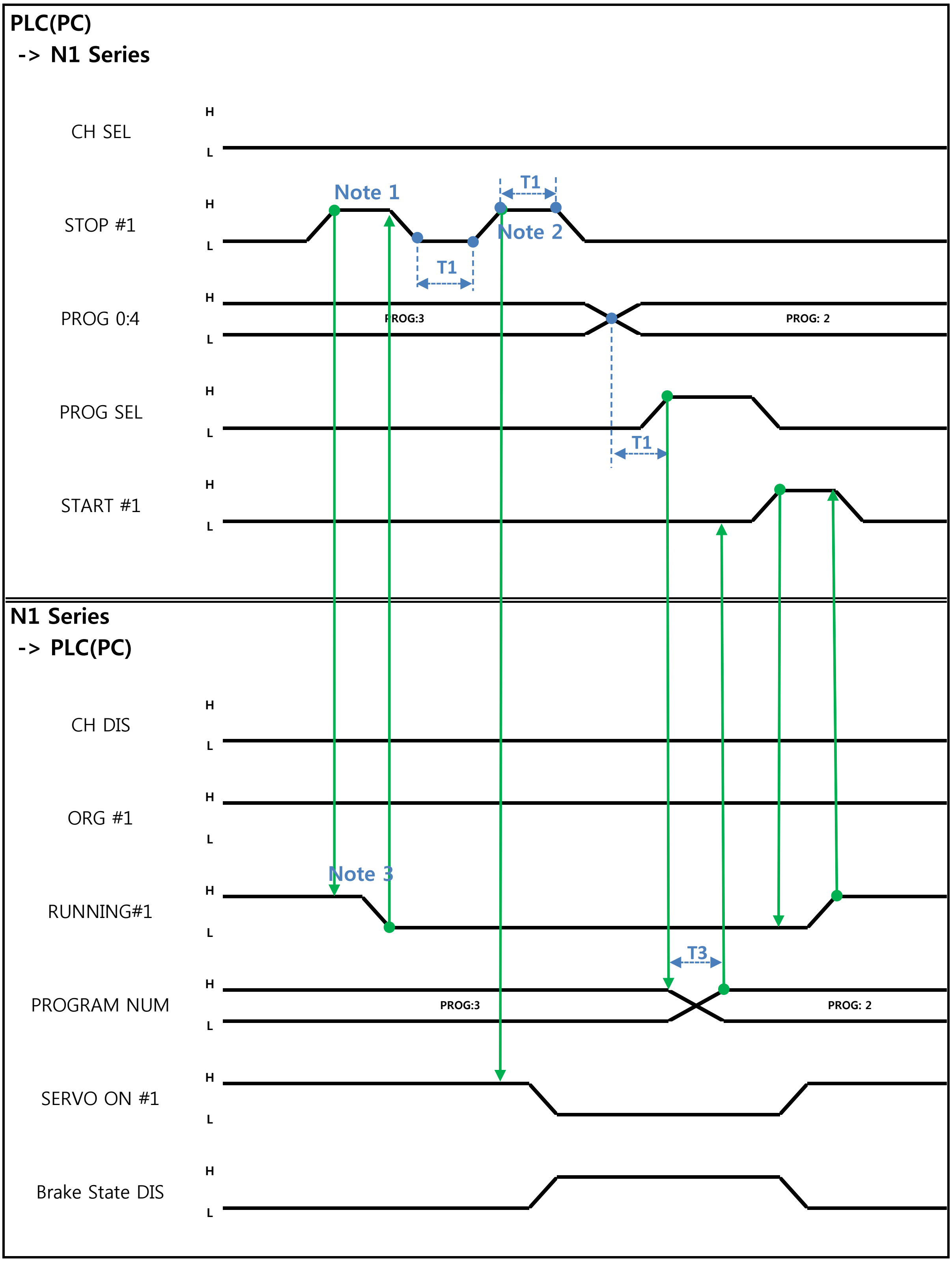
Description :

- Set CH SEL Bit. (Low: Channel 1, High: Channel 2)
- Set AUTO RUN MODE Bit into pulse format. (High status should be kept over 20ms.)
- When ORG OK#1 Signal is not set to High in N1 Series, set ORG #1 Bit to High.
- When ORG OK #1 is changed to High, combine PROG 0~4 Bits to set the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Enter SERVO ON#1 Bit in Pulse format. Check SERVO ON#1 of System Output #1 in N1 Series to see if SERVO is ON. (High status should be kept over 20ms.)
- Check PROGRAM NUM sent from N1 Controller and set START #1 Bit to High.

CAUTION

- **Check AUTO SERVO ON for setting in Parameter of N1 Series. (Refer to Operation Manual "1.3.1.5 Auto Servo On".)**
- **When Auto Servo ON is not set, output SERVO ON #1 Bit as High prior to sending out START #1 Signal.**

6.3.2 JOB Program Change during JOB Operation



When in Auto Servo ON

Description :

- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Combine PROG 0~4 Bits to enter the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller and set START #1 to High.

Note 1) Signal for stopping JOB Program from operating while running JOB Program.

Note 2) Signal for changing SERVO OFF status and initializing JOB Program.

Note 3) Robot Moving speed may lead to a difference in time taken for change to Low.

(Maximum delay time lasts as At time as set in Joint/Linear Motion Parameter.)

When not in Auto Servo ON

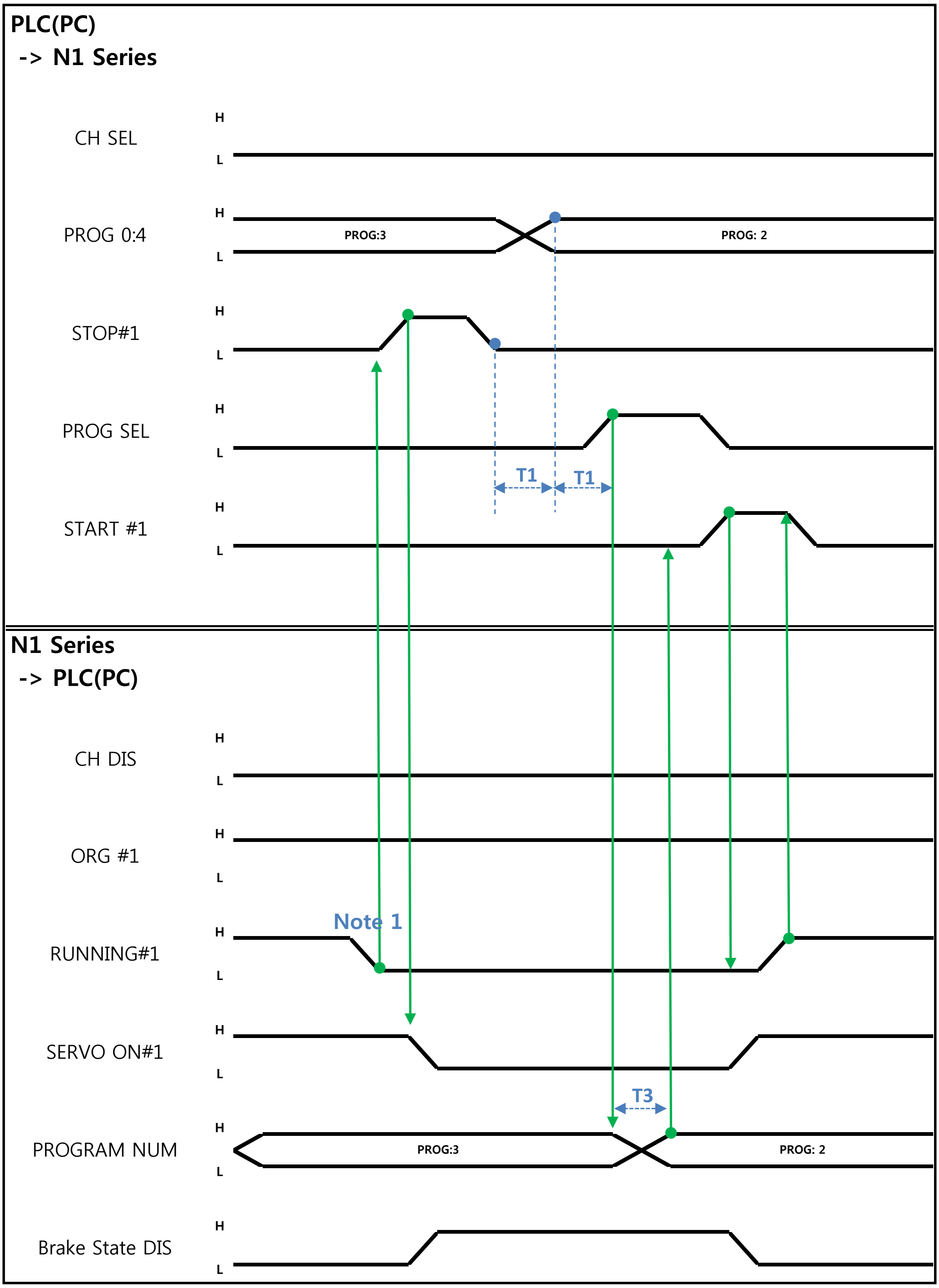
Description :

- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Instead of entering the 2nd STOP #1 Signal, enter SERVO ON #1 Signal in Pulse. (High status should be kept over 20ms.)
- Combine PROG 0~4 Bits to enter the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller and enter SERVO ON #1 Signal in Pulse. (High status should be kept over 20ms.)
- Set START #1 to High.

CAUTION

> - **Changing JOB Program can only be made with Servo OFF. Prior to changing JOB Program, check the Servo OFF status.**

6.3.3 JOB Program Change after Completing JOB Program



When in Auto Servo ON

Description :

- Check if RUNNING#1 Bit is Low.
- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Combine PROG 0~4 Bits to enter the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller and set START #1 to High.

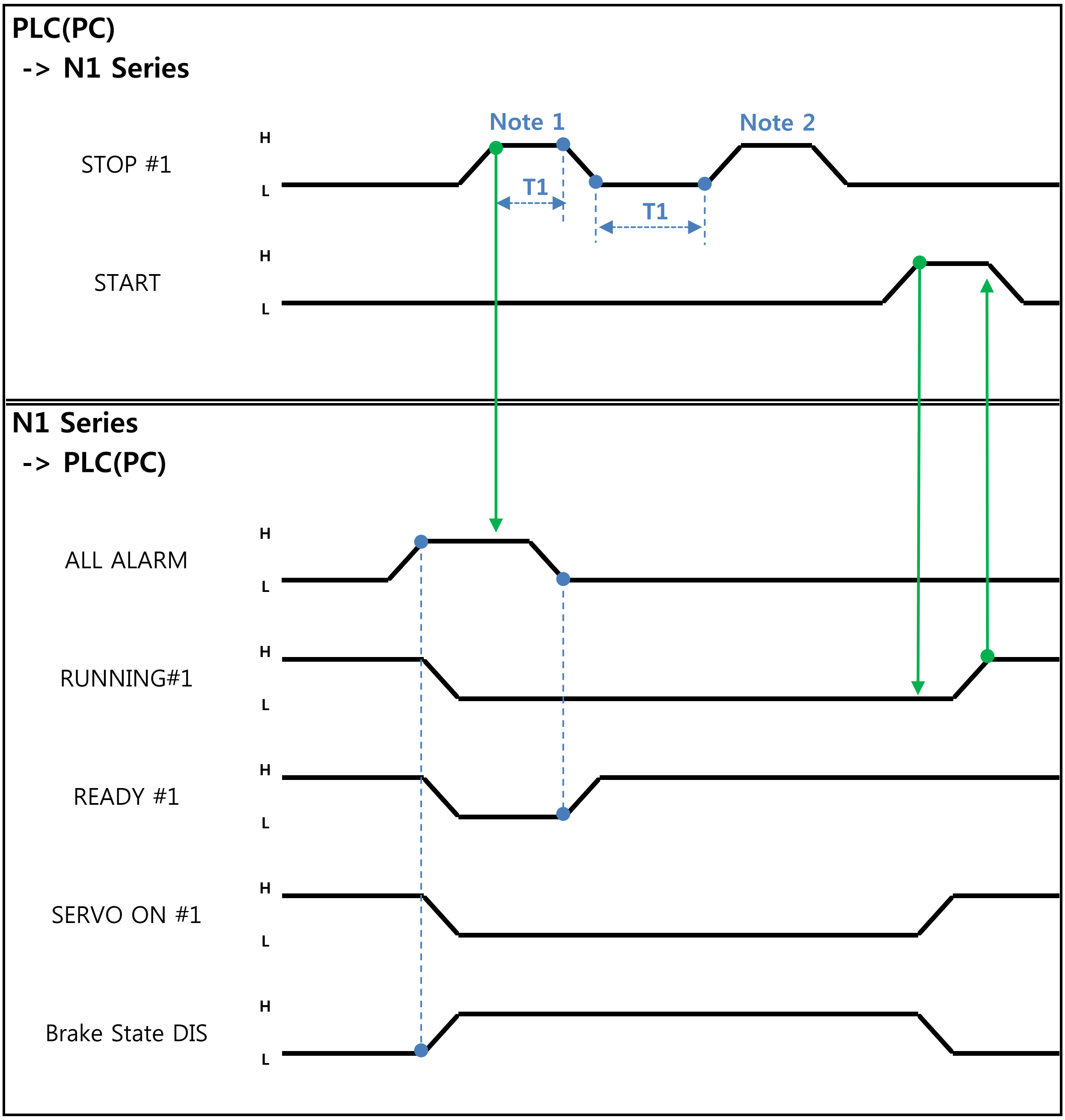
Note 1) When JOB ends in JOB Program by EOP, RUNNING#1 Bit is changed into Low.

When not in Auto Servo ON

Description :

- Instead of STOP #1 Signal, enter SERVO ON#1 Signal into pulse. (High status should be kept over 20ms.)
- Combine PROG 0~4 Bits to enter the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- With completion of setting JOB Program num, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller and enter SERVO ON #1 Signal into pulse. (High status should be kept over 20ms.)
- Set START #1 to High.

6.3.4 JOB Program START after Disabling Alarm



When in Auto Servo ON

Description :

- Enter STOP #1 Signal into pulse twice. (High status should be kept over 20ms.)
- Set START #1 to High.

Note 1) Signal for disabling an alarm.

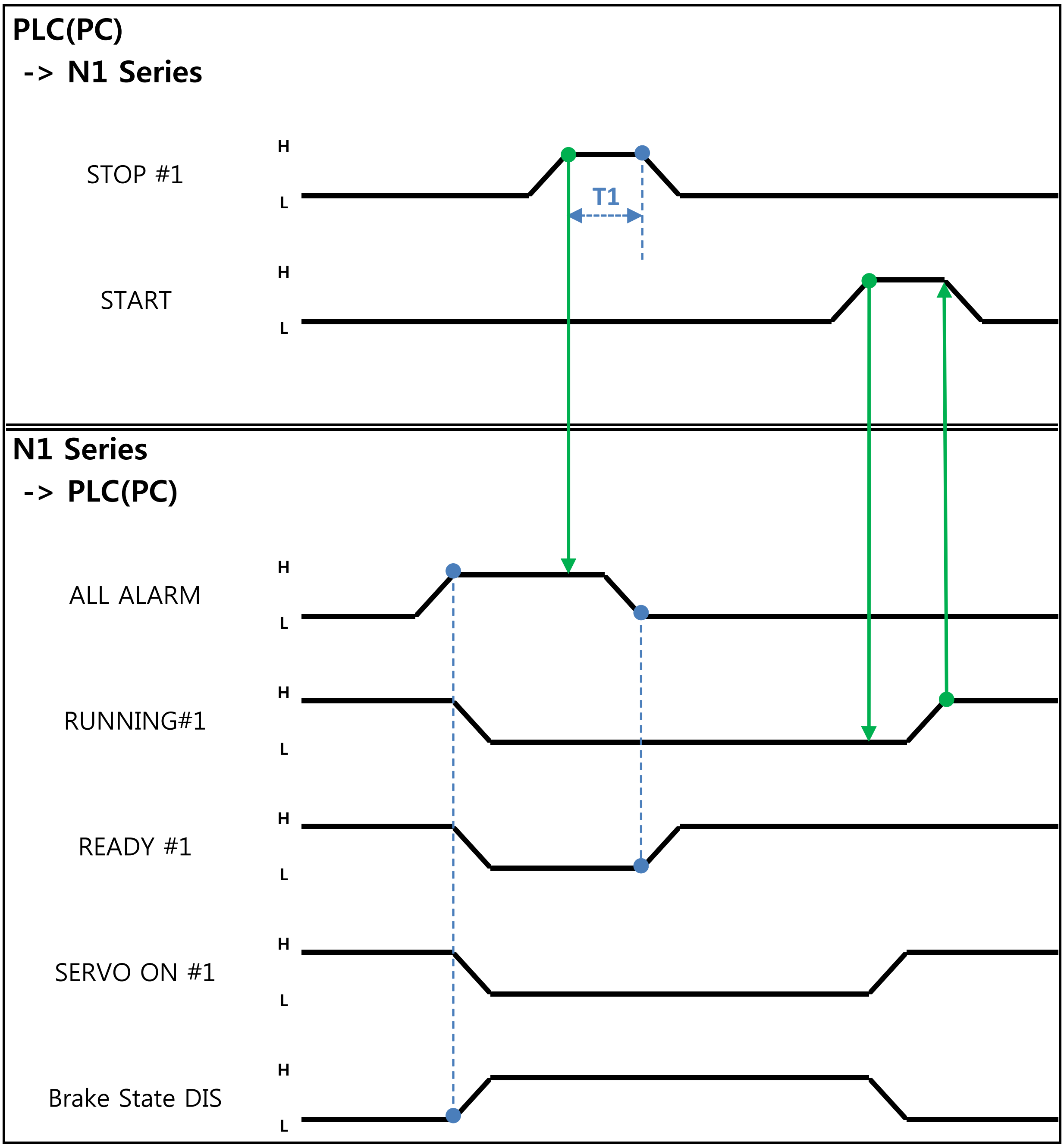
Note 2) Set JOB Program STEP Line for the first time.

When not in Auto Servo ON

Description :

- Enter STOP #1 Signal into pulse twice. (High status should be kept over 20ms.)
- Set START #1 to High.

6.3.5 **JOB Program Restart after Disabling Alarm**



When in Auto Servo ON

Description :

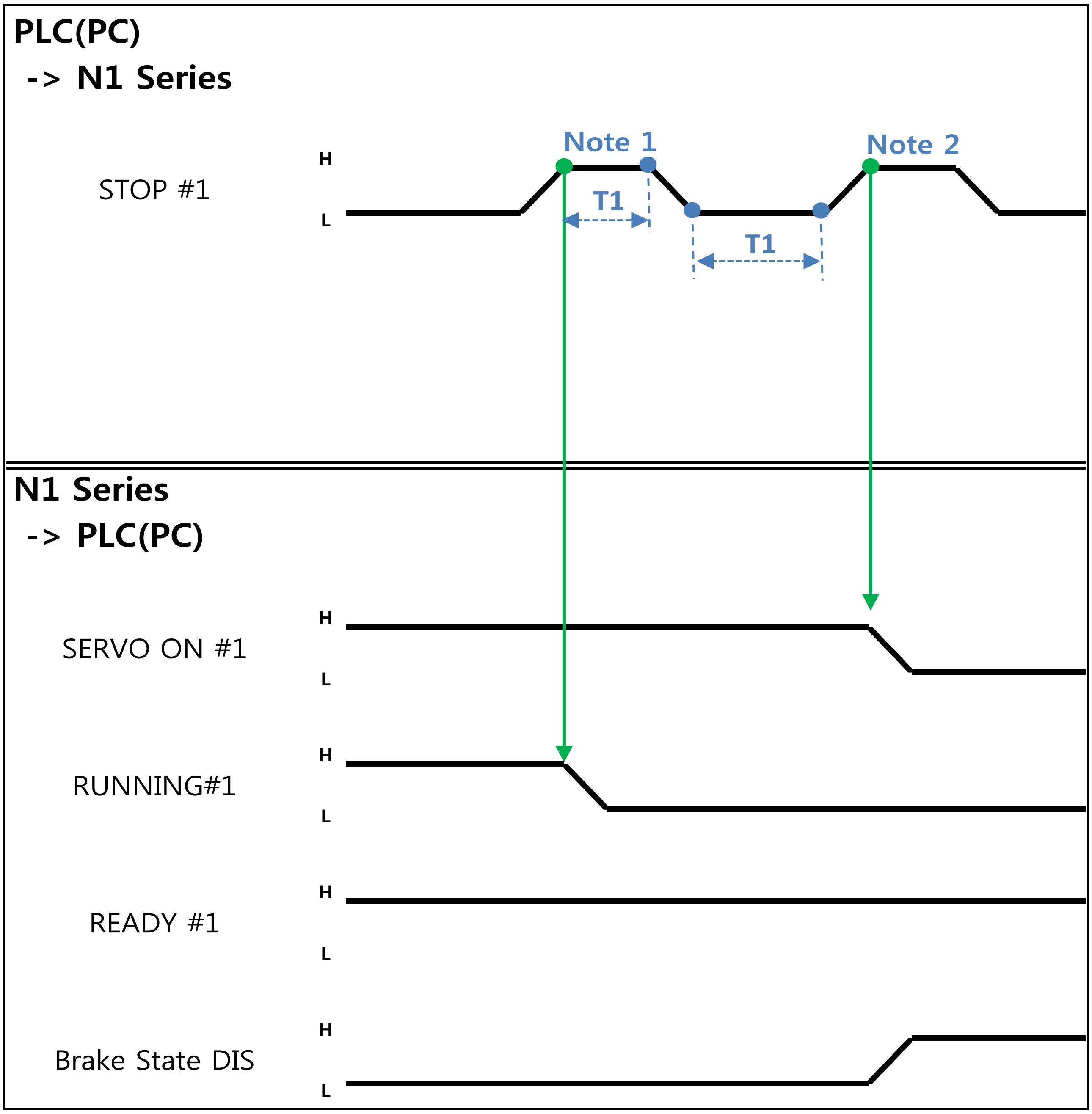
- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Set START #1 to High.

When not in Auto Servo ON

Description :

- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Enter SERVO ON #1 Signal into pulse. (High status should be kept over 20ms.)
- After checking SERVO ON, set START #1 to High.

6.3.6 SERVO OFF



When in Auto Servo ON

Description :

- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)

Note 1) Signal for stopping JOB Program from operating.

Note 2) Signal for turning SERVO OFF.

When not in Auto Servo ON

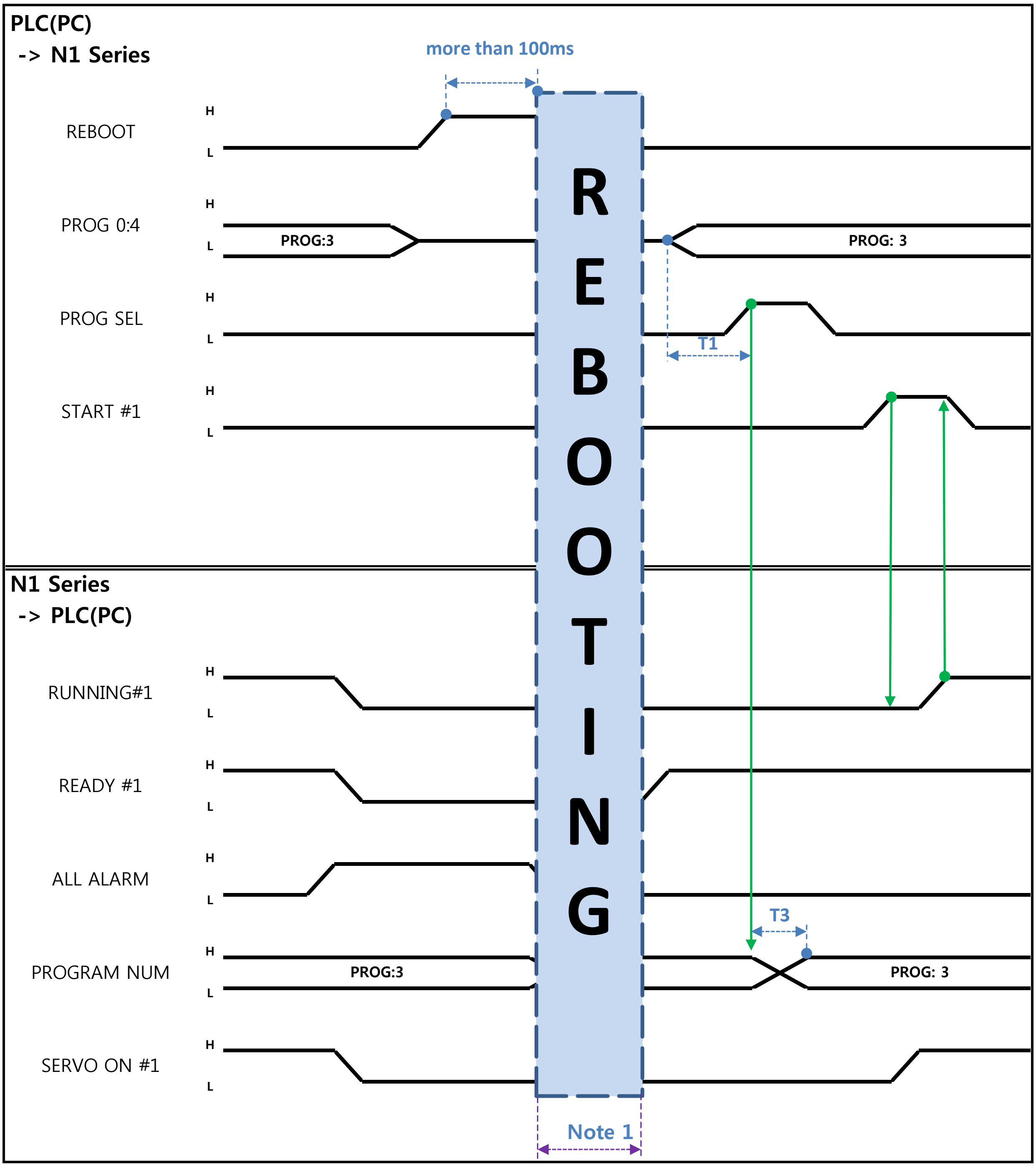
Description :

- Enter STOP #1 Signal into pulse. (High status should be kept over 20ms.)
- Instead of the 2nd STOP #1 Signal ₩, enter SERVO ON #1 Signal into pulse. (High status should be kept over 20ms.)

CAUTION

- When not in Auto Servo ON, Servo OFF does not apply though the 2nd STOP #1 Signal is sent out.
- To keep Servo OFF, send SERVO ON #1 Signal via Pulse.

6.3.7 Rebooting



Description :

- Set REBOOT Bit to High. Rebooting becomes available only when High status is kept over 100ms. When kept below 100ms, Rebooting may not be performed.
- When Rebooting is complete yet alarm conditions are not disabled, ALARM Bit maintains

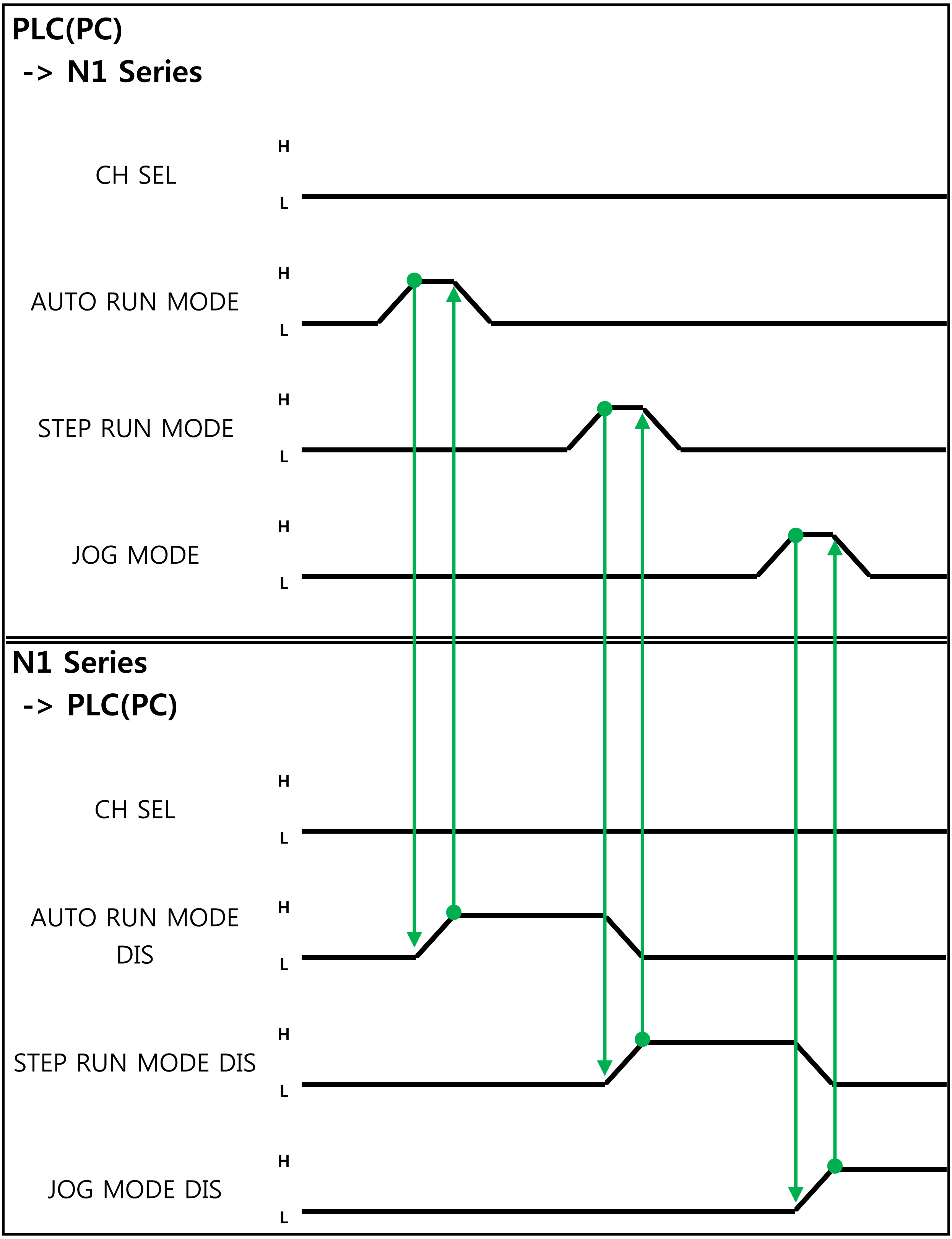
High status. In this case, disable all alarm conditions and retry Rebooting.

- When Rebooting is complete, READY #1 Signal turns into High, when JOB Program num is set.
- Check PROGRAM NUM sent from N1 Controller and set START #1 Bit to High.

CAUTION

- Note 1) When Rebooting, Signals may malfunction so use caution.
- A timing diagram upon completion of Rebooting is identical to "6.3.2 AUTO RUN.

6.3.8 MODE(AUTO, STEP, JOG) Change



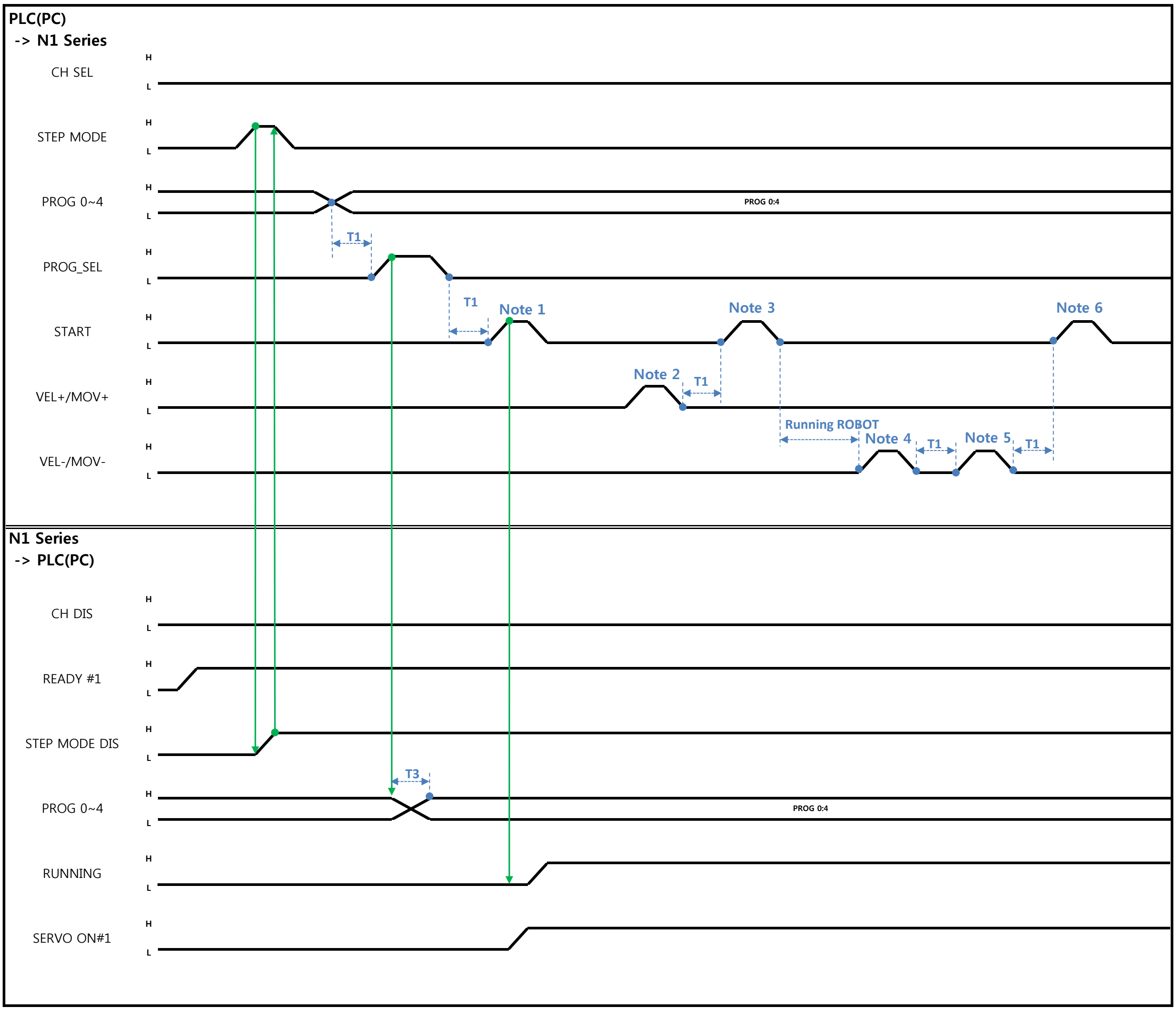
Description :

- Use CH SEL Bit to select the desired Channel. (Low: Channel 1, High: Channel 2)
- Select the desired operation MODE(AUTO RUN, STEP RUN, JOG).
  Enter MODE Signal in Pulse format when High status should be kept over 20ms.

CAUTION

- MODE can be converted only with SERVO OFF.
- Check CH SEL Bit before changing MODE.
- When CH SEL Bit is wrongly set, another Channel MODE changes.

6.3.9 STEP MODE



When in Auto Servo ON

Description:

- Enter STEP MODE Bit in System Input #2 into pulse. (High status should be kept over 20ms.)
- Once STEP MODE has been set, STEP MODE DIS is set to High.
- Combine PROG 0~4 Bits to set the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- Once JOB Program num setting is complete, set PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller.
- Use START Bit in System Input #1 to run JOB.
- Use VEL+/ VEL- Bit in System Input #1 to select the desired JOB step.

- Select the desired STEP to operate, enter START#1 Bit into pulse.
- Use START Bit and run it with one STEP increase at a time.
- To view the only desired motion, use VEL+/VEL- Bit, set to the desired motion STEP Line, use START #1 Bit for operation.

Note 1) Means JOB Program START. (Currently Step Line: 1)

Note 2) Add +1 to JOB program Step. (Currently Step Line: 2)

Note 3) Run the current Step Line. Add +1 to Step. (Step Line: 3)

Note 4) Subtract -1 from the current Step. (Step Line: 2)

Note 5) Subtract -1 from the current Step. (Step Line: 1)

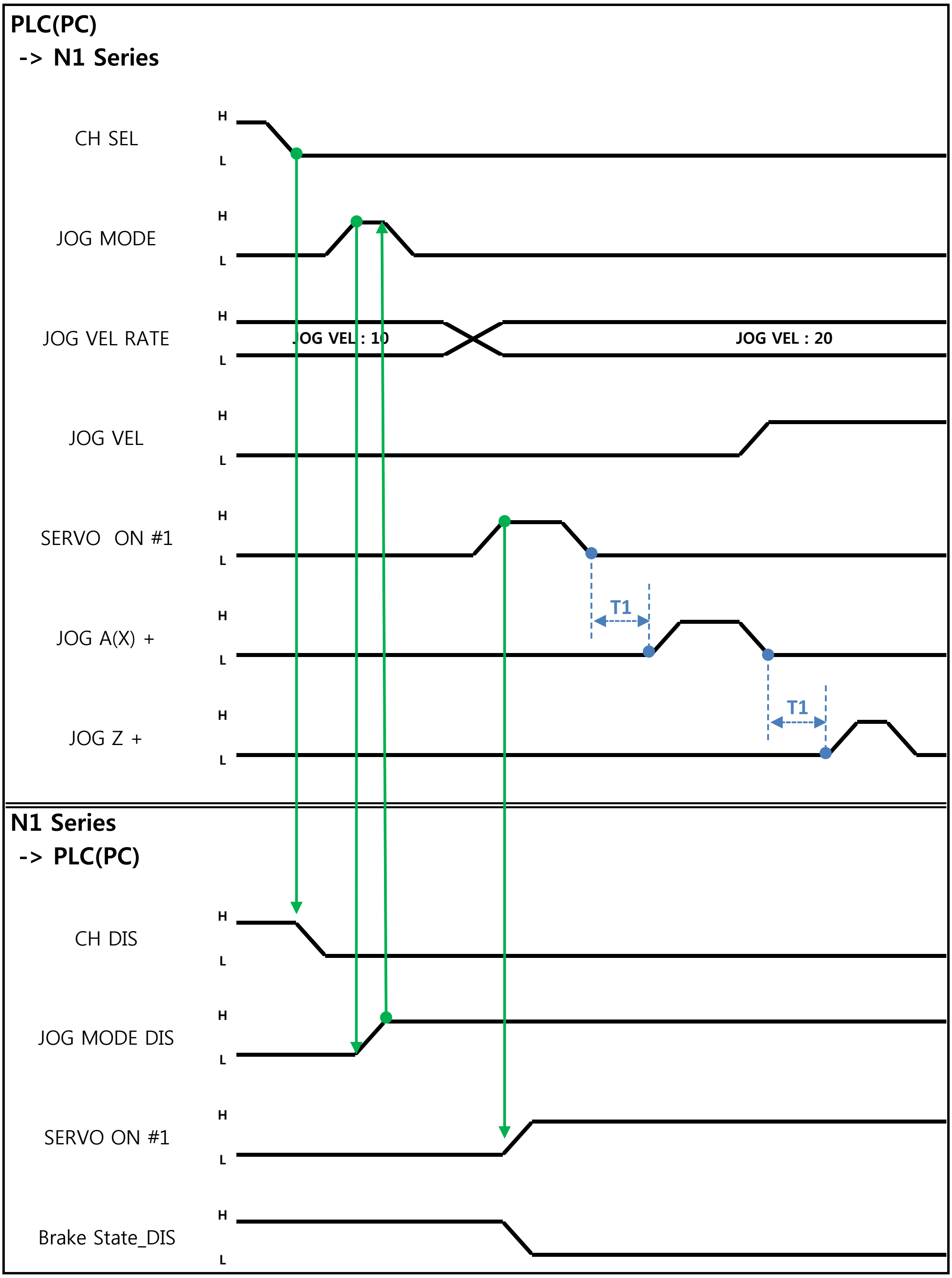
Note 6) Run the current Step Line. Add +1 to Step. (Step Line: 2)

When not in Auto Servo ON

Description :

- Enter STEP MODE Bit in System Input #2 into pulse. (High status should be kept over 20ms.)
- Once STEP MODE has been set, STEP MODE DIS is changed to High.
- Combine PROG 0~4 Bits to set the desired JOB Program num. (PROG0 Bit is the lowest (LSB) Bit and PROG4 Bit is the highest (MSB) Bit.)
- Once JOB Program num is complete, change PROG SEL Bit to High.
- Check PROGRAM NUM sent from N1 Controller.
- Enter SERVO ON#1 Bit into pulse. Check SERVO ON#1 in System output # on N1 Series to see if it is in SERVO ON.
- Use START Bit in System Input #1 to operate JOB.
- Use VEL+/ VEL- Bit in System Input #1 to select the desired JOB step.
- Select the desired STEP to operate and enter START#1 Bit into Pulse.
- Use START Bit and run it with one STEP increase at a time.

6.3.10 Operation in JOG MODE



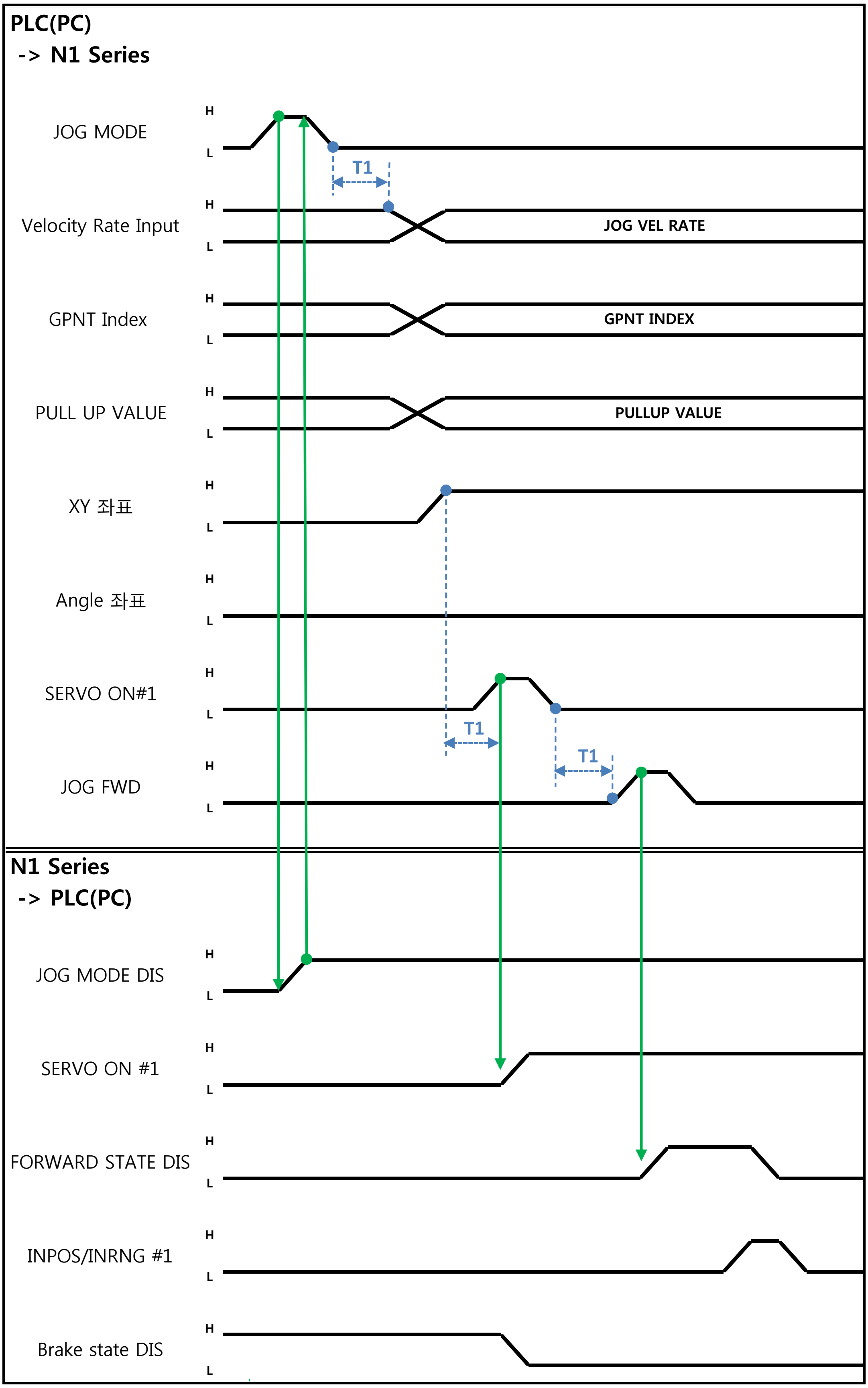
Description:

- Enter JOG MODE Bit in FIELDBUS INPUT #2 into Pulse.
- Once JOG MODE has been set, JOG MODE DIS is set to High.
- Use JOG MODE DIS for details about the currently selected MODE, maintaining its state until AUTO MODE or STEP MODE is selected.
- Set the moving speed during JOG operation, with an input range of 0 to 100%.
- Setting is done selectively among JOG X(A)+ ~ JOG W- in FIELDBUS INPUT #2.
- When setting JOG VEL Bit to Low, operation is performed at $\frac{1}{2}$ speed of the set value for JOG VEL RATE.

CAUTION

- **When Velocity Rate Input is 0, operation is performed at 1% speed.**
- **In JOG MODE SET BIT, enter PULSE.**
- **When operating JOG, Auto Servo ON does not apply regardless of setting Auto Servo ON.**
- **When operating JOG, be sure to send out SERVO ON #1 Signal to turn into Servo ON.**
- **When not selecting a coordinate, it operates by Angle coordinate.**

6.3.11 Forward Operation in JOG MODE



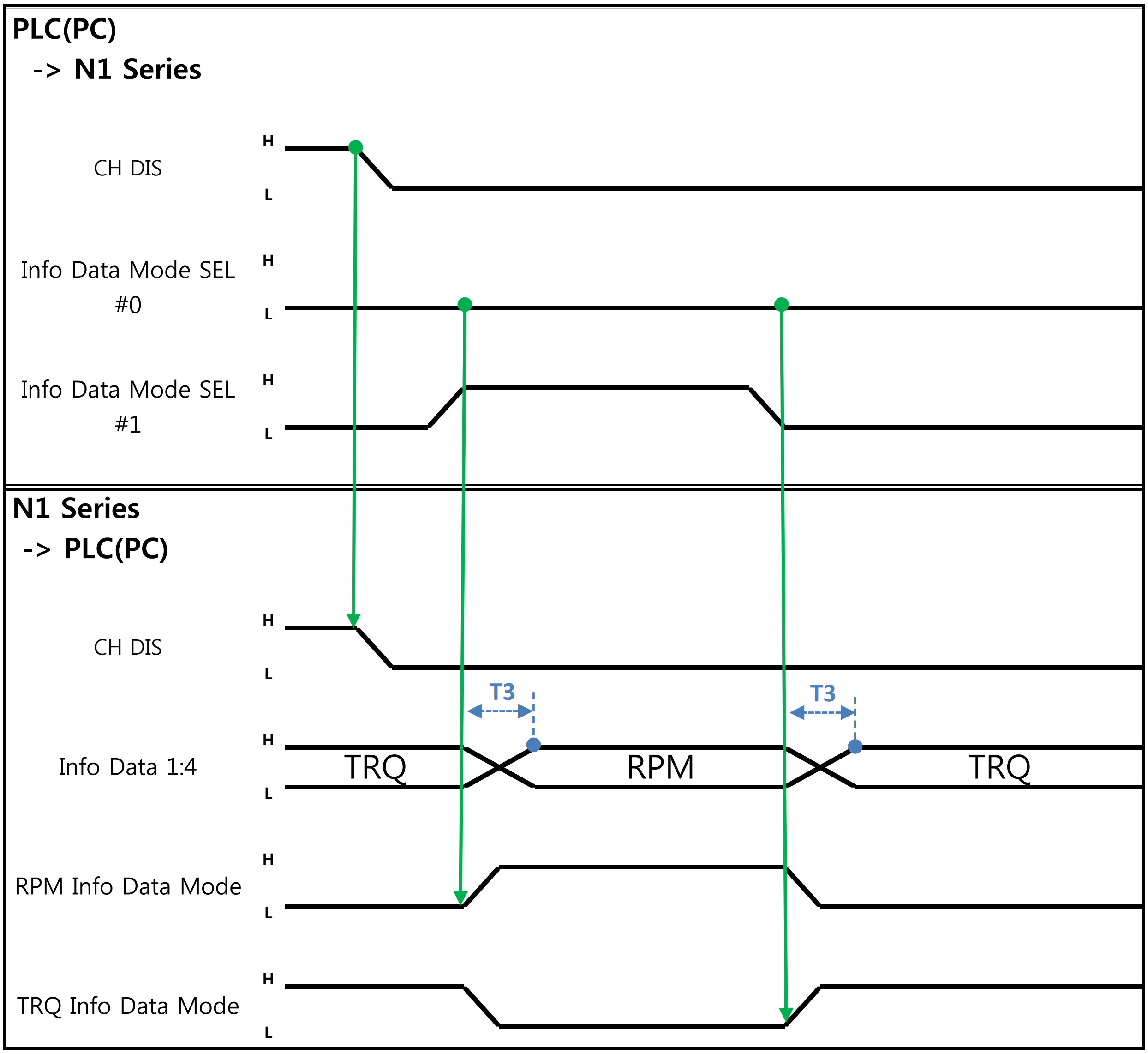
Description:

- Use JOG MODE DIS state Bit for details about the currently selected MODE, maintaining its state until selecting AUTO MODE or STEP MODE.
- Set the speed to apply when performing JOG FWD operation, with input range of 0 to 100% and initial value of 1%)
- Set the GP Point Index to move.
- Set the PULL UP value to apply during FWD operation.
- Enter JOG FWD Bit in FIELDBUS INPUT #2 into Pulse.
- When running Forward operation, Forward State DIS bit is set to High and turns into Low with completion of operation.

CAUTION

- **When Velocity Rate Input is 0, operation is performed at 1% speed.**
- **In JOG MODE SET BIT, enter PULSE.**
- **When operating JOG, Auto Servo ON does not apply regardless of setting Auto Servo ON.**
- **When operating JOG, be sure to send out SERVO ON #1 Signal to turn into Servo ON.**
- **When selecting Angle coordinate from Scara Robot Type, JMOV operates and when selecting XY coordinates operation is performed by LMOV.**

6.3.12 **Read RPM, TRQ**

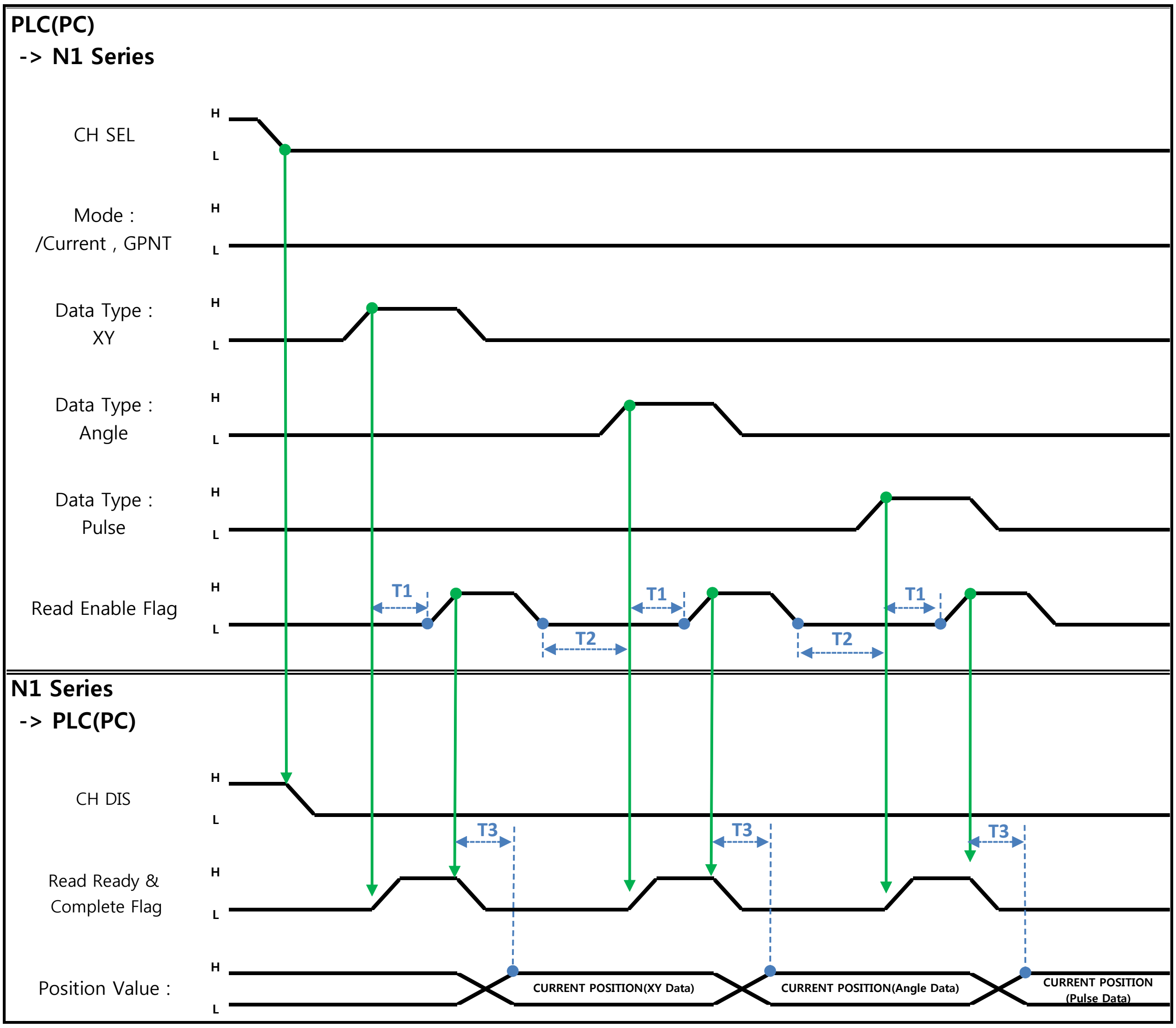


Description:

- Sends out TRQ or RPM value according to Info Data Mode 0:1 setting.
- Information about current output values can be confirmed via TRQ Info Data Mode Bit and RPM Info Data Mode Bit.

	TRQ	RPM
Info Data Mode SEL #0	LOW	LOW
Info Data Mode SEL #1	LOW	HIGH

6.3.13 Read Current Position



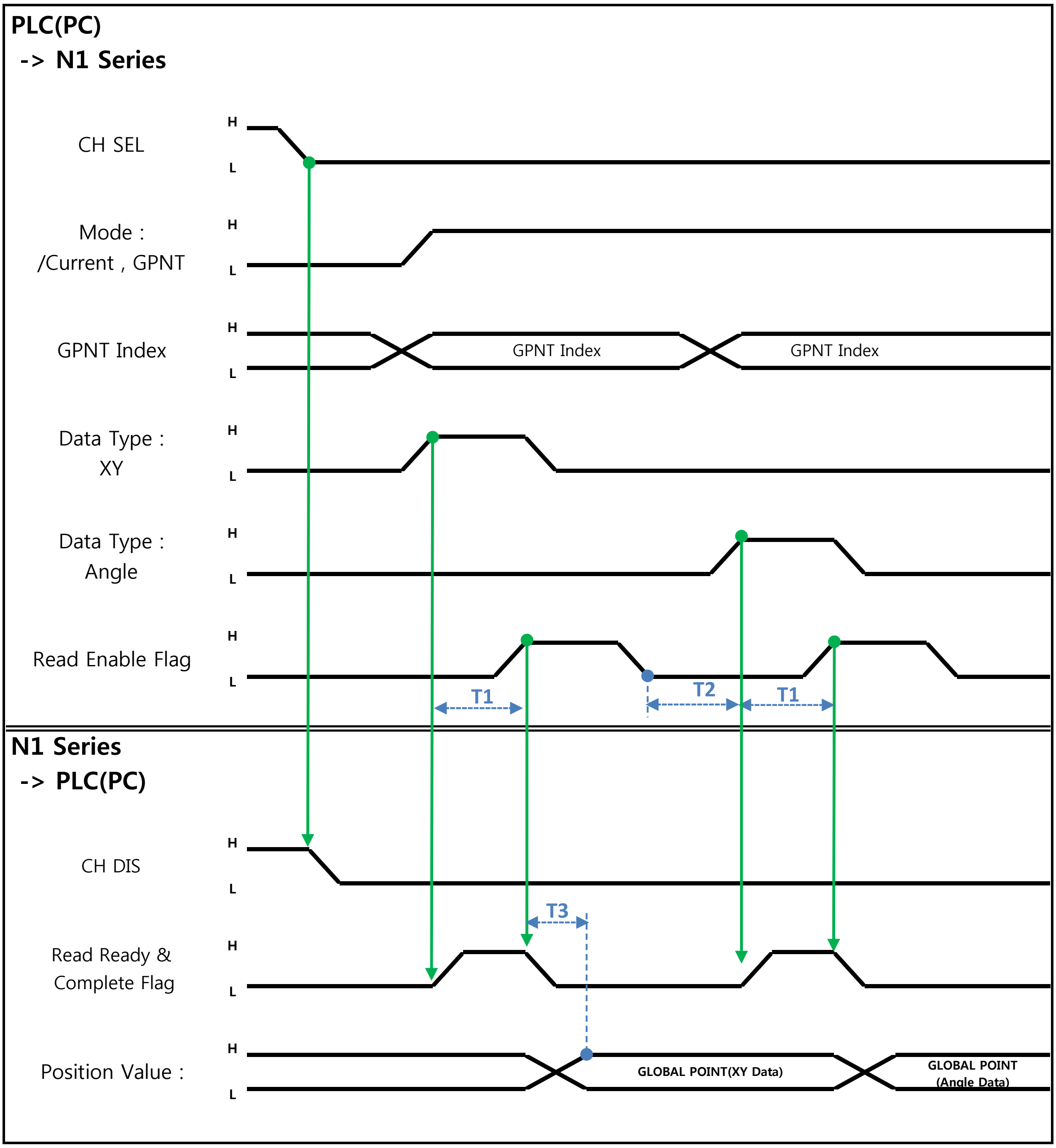
Description:

- Sets CH SEL Bit. (Low: Channel 1, High: Channel 2)
- Set Data Type(XYZW, ABZW) for reading the Current Position.
- To read the current position, set Mode Select bit to Low. (Low: Reads robot's current coordinate, High: Reads Global Point)
- Enable determining if readable using Read Ready & Complete Flag Bit in System OUT2.
- Use Read Enable Flag to be able to read the current position value.
- The minimum standby time (T2:30ms) is needed when reading the current position in accordance with change to Data Type.

CAUTION

> - **If Data Type is not changed to Low in Read Enable Flag High, Read Ready & Complete Flag instantly turns back into High.**
> - **The minimum standby time is required in Current Position Read following change to Data Type.**

6.3.14 Read GLOBAL Point



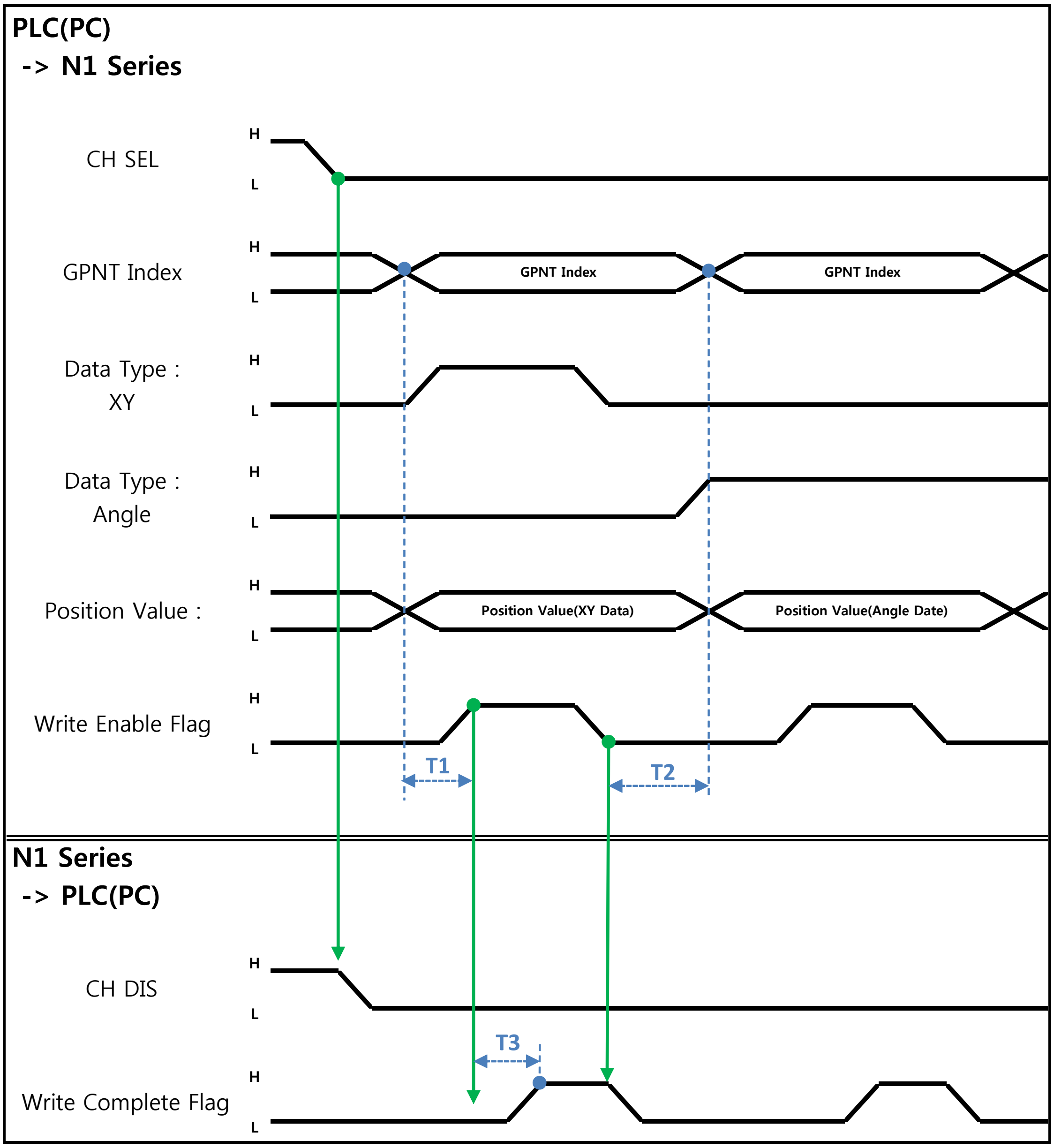
Description :

- Set CH SEL Bit. (Low: Channel 1, High: Channel 2)
- Set Mode Select bit to High. (Low: (Low: Reads robot's current coordinate, High: Reads Global Point)
- Set GPNT Index.
- After delaying as much time as T1(20ms), set Read Enable Flag Bit to High, when Read Ready&Complete Flag state should be High.
- Depending on a Data Type choice, the values saved in Global Point can be read by XY coordinate value or Angle value.
- When Read Enable Flag Bit in Field Bus Input #1 is set to High, GLOBAL Point of N1 Series is set.
- When Global Point Read occurs continually, a delay time of T2(30ms) is needed.

CAUTION

> - **If Data Type is not changed to Low in Read Enable Flag Signal High, Read Ready & Complete Flag instantly turns back into High.**
> - **The minimum standby time is required in continual Global Point Read.**

6.3.15 Write GLOBAL Point



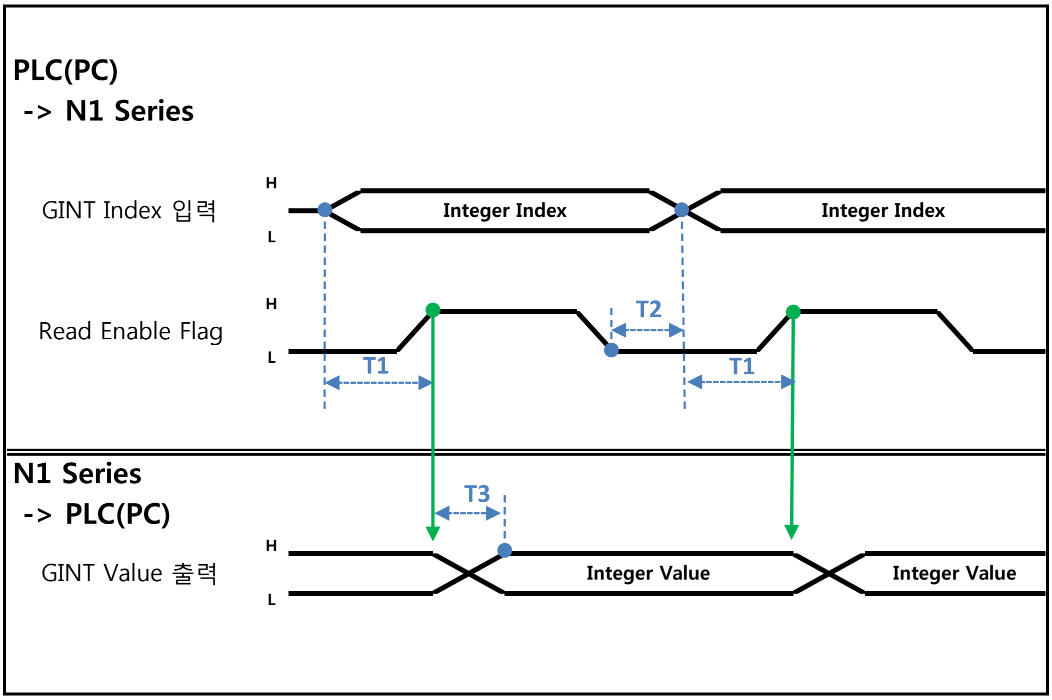
Description:

- Set CH SEL Bit. (Low: Channel 1, High: Channel 2)
- Set Global Point Index and Data Type(XYZW, ABZW).
- Set the position data of each axis to save.
- With completion of setting GPNT Index and Data Type, set Write Enable Flag Bit in Field Bus Input #1 to High.
- When the saving process is complete in N1 Series, Write Complete Flag is changed into High.
- When Write Enable Flag Bit is set to Low, Write Complete Flag is also changed to Low.
- When saving the continual Global Point, a delay time of T2(30ms) is needed.

CAUTION

- **Data Type is available only in XY coordinates and Angle coordinate.**
- **GINT, GFLOAT and GPOINT commonly use Read Enable Flag so the Index value of an unused variable is allocated at a time when no change is desired.**
- **The minimum standby time is required in continual GPOINT Write.**

6.3.16 Read GLOBAL Integer



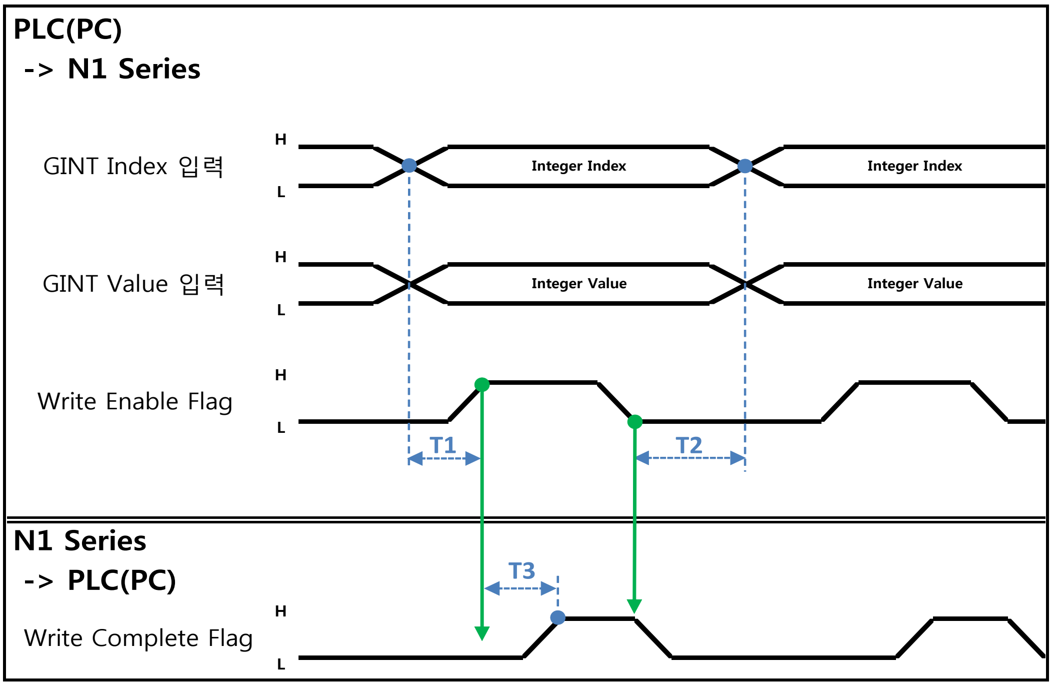
Description :

- Set the Index of a Global Integer to read.
- After setting the Index, set Read Enable Flag Bit in Field bus Input#1 to High.
- Check the Global Integer value sent from N1 Series.
- When continually reading Global Integer value, as much delay time as T2(30ms) is needed.

CAUTION

- **GLOBAL Integer, GLOBAL Float, and GLOBAL Point commonly use Read Enable Flag so caution should be taken in setting the Index value of an unused variable at a time when no change is desired.**

6.3.17 Write GLOBAL Integer



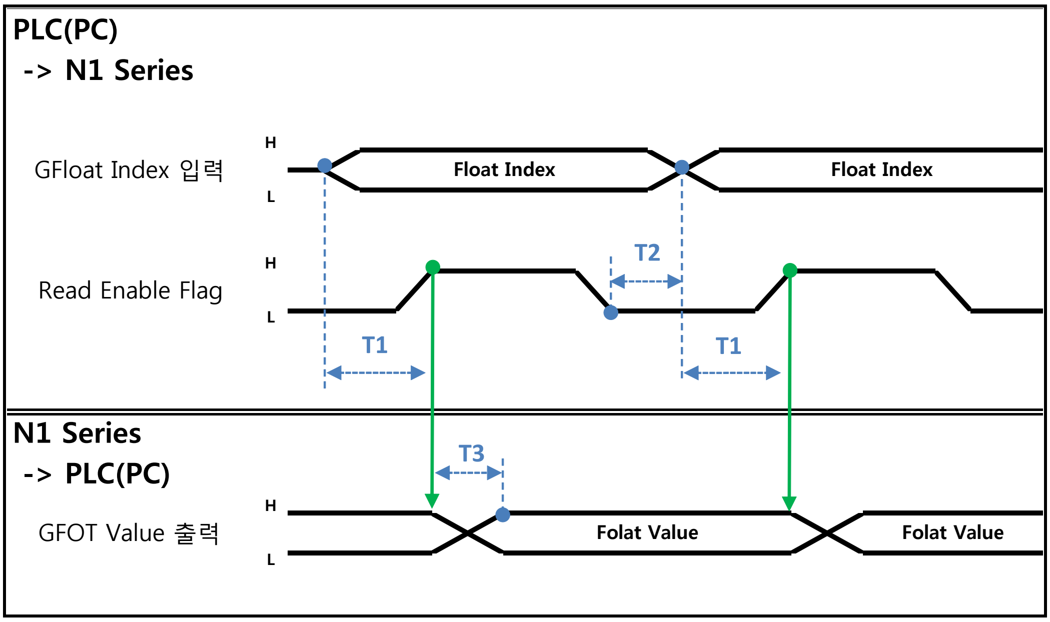
Description :

- Set the values of Global Integer Index and Global Integer to write.
- Set Write Enable Flag to High.
- When the saving process is completed in N1 Series, Write complete Flag changes from Low to High.
- When setting Write Enable Flag to Low, Write Complete Flag Bit is changed to Low.
- In case of saving Global Integer values continually, a delay time of T2(30ms) is required.

CAUTION

> - **GLOBAL Integer, GLOBAL Float, GLOBAL Point commonly use Read Enable Flag so caution should be taken in setting the Index value of an unused variable at a time when no change is desired.**

6.3.18 Read GLOBAL Float



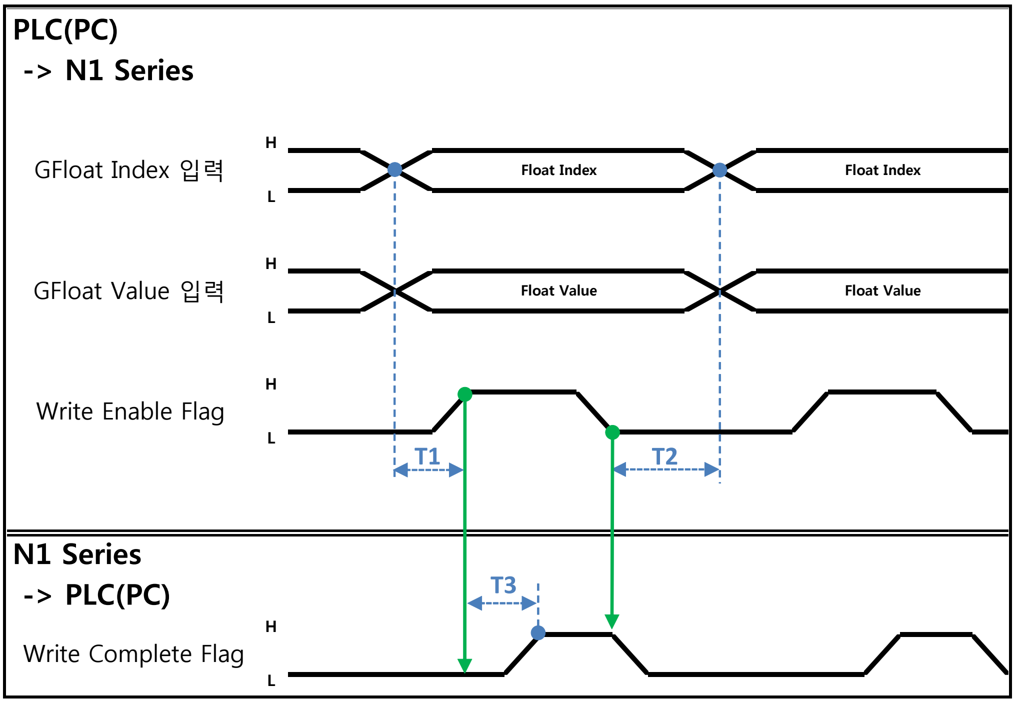
Description:

- Set the Index of Global Float to read.
- After setting Index, set Read Enable Flag Bit in Field bus Input#1 to High.
- Check the Global Float value sent from N1 Series.
- When continually reading Global Integer values, as much delay time as T2(30ms) is needed.

CAUTION

> **GLOBAL Integer, GLOBAL Float, GLOBAL Point commonly use Read Enable Flag so caution should be taken in setting the Index value of an unused variable at a time when no change is desired.**

6.3.19 Write GLOBAL Float



Description :

- Set the values of Global Float Index and Global Float to write.
- Set Write Enable Flag to High.
- When the saving process is complete in N1 Series, Write complete Flag changes from Low to High.
- When setting Write Enable Flag to Low, Write Complete Flag Bit changes into Low.
- In case of saving Global Integer values continually, a delay time of T2(30ms) is required.

CAUTION

> **GLOBAL Integer, GLOBAL Float, GLOBAL Point commonly use Write Enable Flag so caution should be taken in setting the Index value of an unused variable at a time when no change is desired.**

ch.7. Appendix – How to Use B/D Debugging Program

Step1.

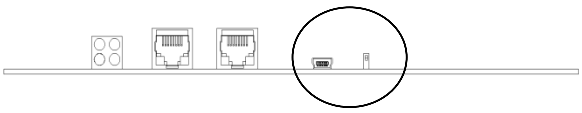


Fig. 7.1 PROFINET B/D

When the front cover of PROFINET Board is removed, a Service USB Port and Switch exist.

When the corresponding Switch is switched to ON (Board direction), it boots in Service Mode at time of feeding power.

Step2.

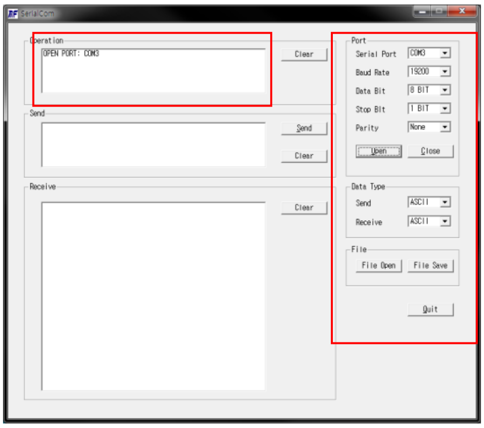


Fig. 7.2 SerialCom

Run SerialCom program to set Serial Port.(COM 1~10)

Baud Rate is 19200bps.

Set Data Type to ASCII and click Open.

When displayed as OPEN PORT : COMx on Operation, connection is made normally.

Step3.

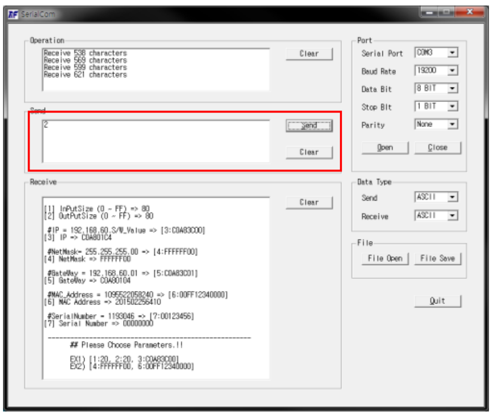


Fig. 7.3 SerialCom

Enter "1" on Send window and click Send button, then currently-set I/O Size and IP information are displayed.

Step4.

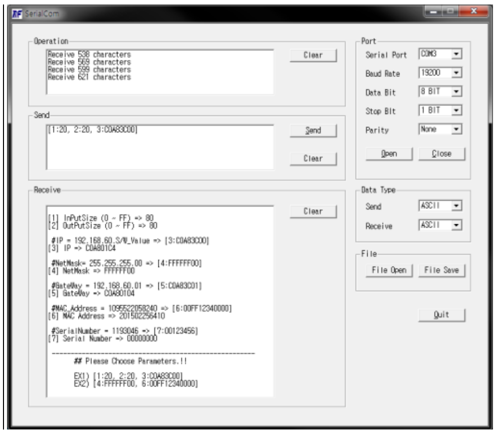


Fig. 7.4 SIMENS PLC

Enter an item to set on Send window and click Send button.

Ex1> When changing only one item,

[1:20]

Ex2> When changing several items simultaneously

[1:20, 2:20, 3:C0A83C00]

Step5.

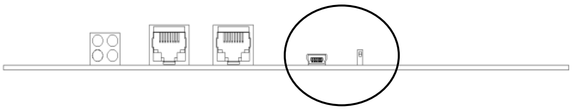


Fig. 7.5 PROFINET B/D

Turn OFF Service Switch on PROFINET Board and feed power supply again.

CAUTION

- **A voluntary change to set values in Service Mode may result in abnormal operation of PROFINET Module. The corresponding operation should be done after contacting the customer support team for information.**

Rev.	Date of Revision	Description	Revised by	S/W Version
V.1	**July 30, 2015**	**1st Edition Prints**		

N1 ROBOT CONTROLLER

CONTROLLER MANUAL

FIRST EDITION OCTOBER 2015
ROBOSTAR CO, LTD
ROBOT R&D CENTER