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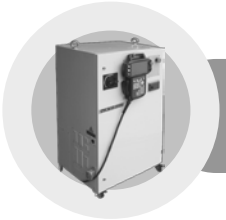
HEAVY INDUSTRIES CO.,LTD.

WARNING

INSTALLATION SHOULD ONLY BE PERFORMED BY QUALIFIED INSTALLATION PERSONNEL AND MUST CONFORM TO ALL NATIONAL AND LOCAL CODES



Hi5 Controller Function Manual

HRLadder

HYUNDAI
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1 Introduction

Thank you for using the Hyundai Robot.
This manual is based on HRLadder v2.61b2.

1.1. Preliminary Knowledge

To understand this manual well, you must have preliminary knowledge of the following.

- How to use Hi5 Controller
- Understanding of PLC utilization
- How to utilize embedded PLC of Hi5 Controller
  Refer to Hi5 embedded PLC functional manual (instruction set, operating, etc.)

1.2. About HRLadder

HRLadder is the software to edit and monitor the ladder task for embedded PLC function within Hi5 Controller. HRLadder runs on PC Windows environment and provides convenient and easy to understand user interface.

[Table 1-1] shows the key functions provided by HRLadder.

Table 1-1 Key Functions of HRLadder

Edit ladder	You can edit the ladder diagram for Hi5 Controller and save the file as PC file.
Syntax check	You can check the syntax of the ladder diagram after drafting and editing to make corrections.
Download	The ladder task of HRLadder can be transmitted to the robot controller using the communication function.
Upload	The ladder task of the robot controller can be imported to HRLadder using the communication function.
PLC monitoring	When the embedded PLC of the robot controller is operating, you can check the current condition of all relays in real time.

1.3. Execution Environment of HRLadder

Table 1-2 Execution Environment of HRLadder

Hardware	PC with Pentium 4 or above recommended	
Operating system	MS Window 2000 /XP/Vista	
Video	1024x768, 16bit color or above recommended	
Robot controller	All version of Hi5	
Others	When using RS-232C (Refer to 1.4)	1 spare COM serial port on PC side RS-232C cable
	When using Ethernet (Refer to 1.5)	PC – Ethernet function UTP cable for Ethernet

1.4. Wiring Method of RS-232C Cable

You can upload/download and monitor the ladder file through RS-232C.

Use the RS-232C cable wired as shown in [Figure 1.1]. Left picture shows the configuration when connected to the cabinet of the controller and the right picture shows the configuration when directly connected to the main board.

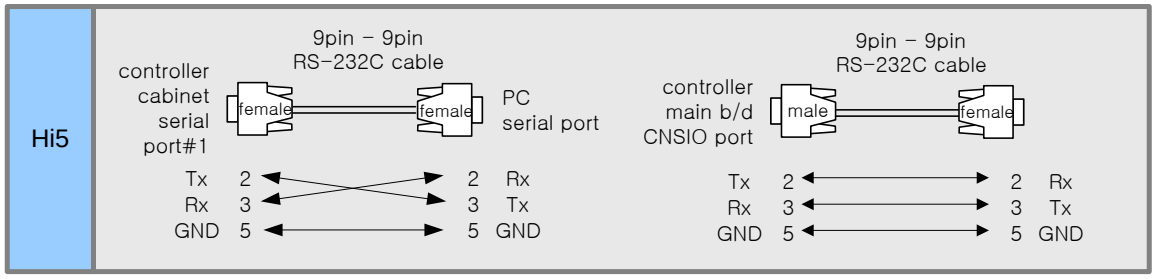

Figure 1.1 RS-232C Cable Wiring for HRLadder

1.5. Configuration Method of Ethernet Environment

You can upload/download and monitor the ladder file through the Ethernet.

(1) When the Hi5 Controller is not connected to the hub, use the Ethernet UTP cable of 1:1 cross type as shown in [Figure 1.2] to connect the PC to Hi5 Controller.

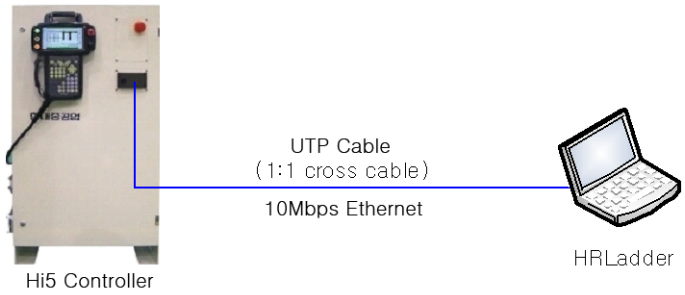

Figure 1.2 Ethernet Connection (Use 1:1 Cross Cable)

(2) When the Hi5 Controller is connected to the hub, use the Ethernet UTP cable of straight type as shown in [Figure 1.3] to connect the PC to the same hub.

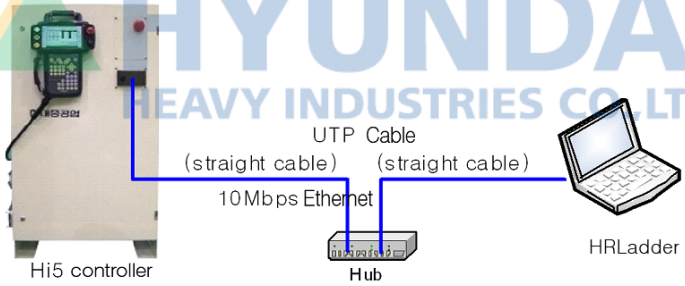

Figure 1.3 Ethernet Connection (Use Direct Cable and Hub)

(3) For the Ethernet UTP cable, you can easily purchase the straight cable on the market and the 1: 1 cross cable is wired as shown in [Figure 1.4].

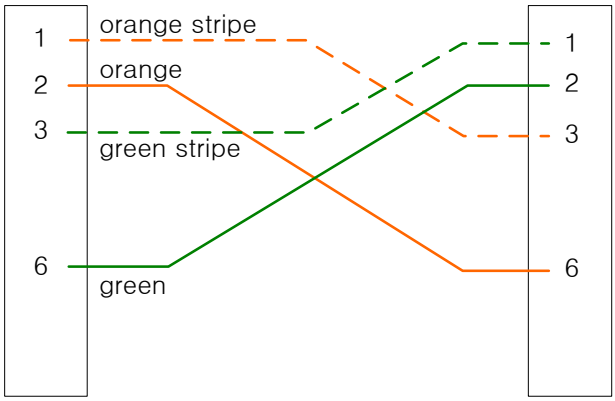

Figure 1.4 Wiring Method for 1:1 Cross Cable

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Install and Start HRLadder

2.1. Install HRLadder

(1) Insert the HRLadder CD to the CD drive.

(2) Open the HRLadder installation directory from Windows Explorer and execute “HRLadder.msi”.

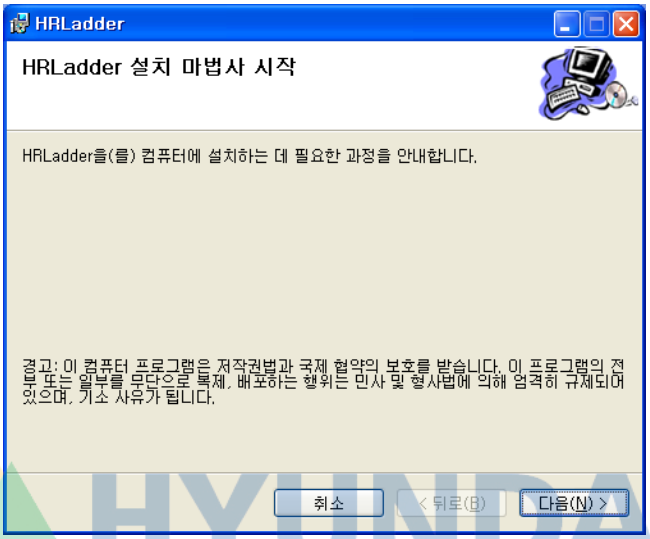


Figure 2.1 HRLadder Installation Screen

(3) Read the license agreement carefully and then click on the “Next (N) >” button.

(4) Select the folder to install and scope of use (Every one or only yourself) and click on the “Next (N) >” button.

(5) Select the language to use (Korean or English) and then click on the “Next (N) >” button.

(6) From the message screen confirming installation preparation, click on the “Next (N) >” button.

(7) When you see the dialog box that says that the installation has been completed as shown in [Figure 2.2], click on the “Close (C)” button.

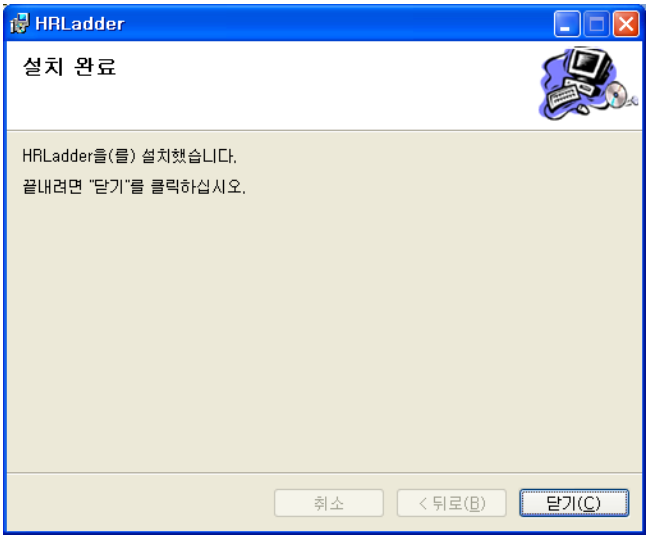


Figure 2.2 Installation Completed Dialog Box

2.2. Start HRLadder

To execute HRLadder, click on Start and then click on the HRLadder in the 『Program - HRLadder』 folder or double click on the HRLadder icon on the desktop as shown in [Figure 2.3].

Figure 2.3 HRLadder Icon

2.3. License Input

Since v2.60 build 1 version, HRLadder has become freeware. Hyundai Robot user's can use this software freely without inputting license code. In case that you have to use HRLadder older version(below v2.60), please input license code as following procedure.

To use the official version of HRLadder, you must enter the License Key number that fits the unique number of the PC on which the application is installed. When the HRLadder is installed and the License Key is not entered, the application will run in Trial Mode. If you see the message box shown in [Figure 2.4] every time you run HRLadder, it means that you are running a trial version.

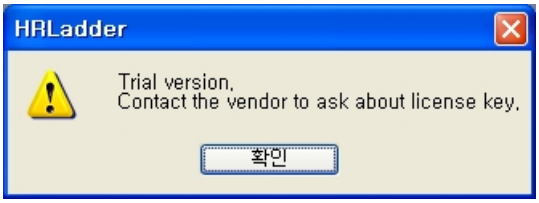


Figure 2.4 Trial Version Message Box

In this condition, the size of the width direction is limited to 1,000 pixels when editing the ladder diagram (You cannot edit to be longer even when you reduce the screen size). Therefore, this can only be used as a copy to evaluate the functions of the software. The method of registering as official copy is described as follows.

(1) Select 『Tool - License』 Input Menu. Dialog box shown in [Figure 2.5] will be displayed.

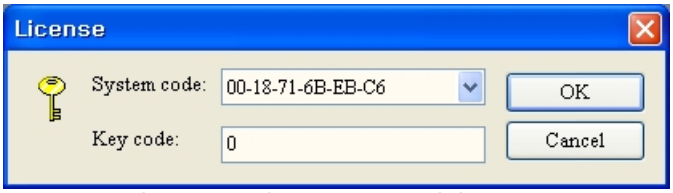


Figure 2.5 License Input Dialog Box

(2) 6 byte number shown the System Code part is data unique to the PC that HRLadder is installed on. When you purchase the license for HRLadder from the supplier, provide this number.
(This System Code is the MAC address of the Ethernet Card on your PC. For the PC without the Ethernet Card, the official version of HRLadder cannot be used.)

(3) The supplier will provide you with the Key Code that fits the System Code that you provided. Enter this number in the Key Code block as shown in [Figure 2.6] and click on OK button. Keep this number safely for future reference.

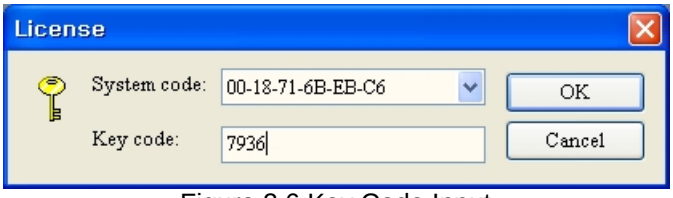


Figure 2.6 Key Code Input

(4) After closing HRLadder, rerun the application again. If you do not see the dialog box showing that it is the trial version, it means that it is running in the official version with the accurate Key Code.
In the official version, you can edit the ladder diagram without any restriction.

(5) Once you enter the Key Code, you do not need to enter it again even when you run HRLadder again, upgrade the version or reinstall HRLadder. But, if you uninstall HRLadder from the PC and reinstall the operating system or format the hard drive, the Key Code information will be deleted. Therefore you will be required to re-enter the Key Code when you install again. Therefore, you must keep the Key Code securely in a safe location.

※ For the PC with 2 or more Ethernet Cards or PC with devices such as Bluetooth or modem, several System Codes can be displayed as shown in [Figure 2.7]. If the Key Code matches any of the System Code, it will be authenticated as the official version.

※ Note that the System Code of the modem changes every time you reboot your PC.

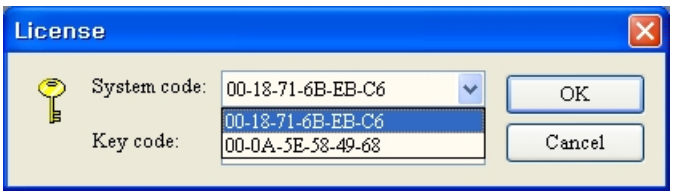


Figure 2.7 Multiple System Codes

2.4. Project Management

Let's try configuring a project in HRLadder.

(1) Execute HRLadder program.

(2) Select 『File (F) – New File (N)』 from the Menu. As shown in Figure 2.8, a window to select between the "HRLadder project" (Extension of .HLPRJ) and "Ladder" (Extension of .LAD). The project file manages several ladder files including hierarchical list and relay description etc.

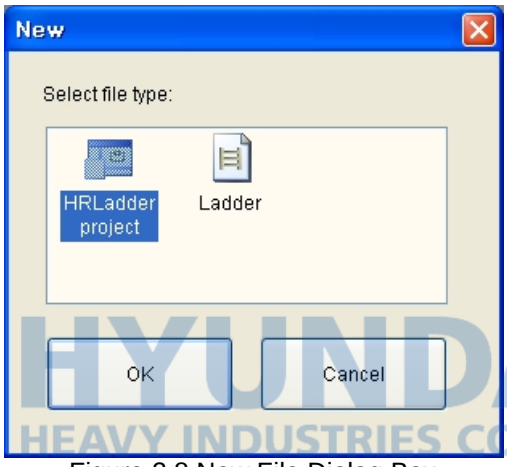


Figure 2.8 New File Dialog Box

(3) Select "HR Ladder Project" and click on the OK button. Workspace window will appear as shown in Figure 2.9.

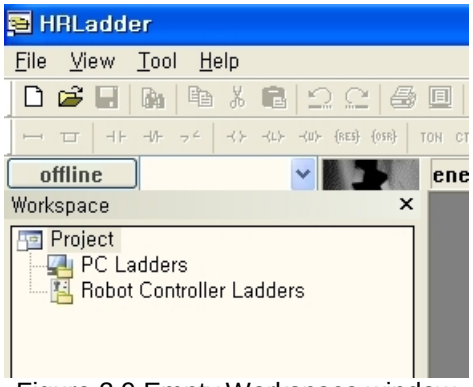


Figure 2.9 Empty Workspace window

(4) Select 『File (F) – Project Save (v)』 and save the project in an appropriate name. (In this example, the project is saved in the name of "R720.hlprj".)

(5) Now select 『File (F) – New File (N)』 from the menu again and select the "Ladder" item this time and click on the OK button. When the ladder edit window appears, select 『File (F) – Save (S)』 to save the ladder file in an appropriate name.
In the same method, let's try to create and save some more ladder files.
(In this example, the names of "S00_Main.lad" and "S03_Init.lad" are used.)

(6) Right click on “PC Ladders” in the Workspace and the following popup menu will appear as shown in Figure 2.10.

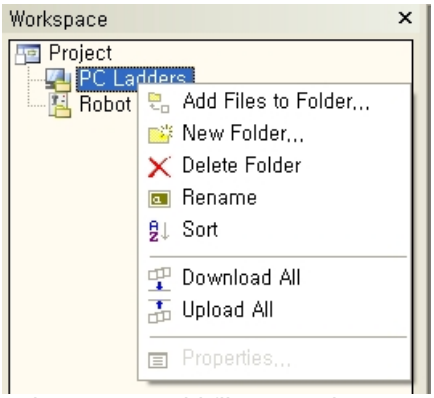


Figure 2.10 Add file to Workspace

(7) When you select “Add Files to Folder…”, the following window will appear. Select the file to add as shown in Figure 2.11 and click on the 『Open(O)』 button. By clicking with the Ctrl or Shift key pressed, you can select multiple files.

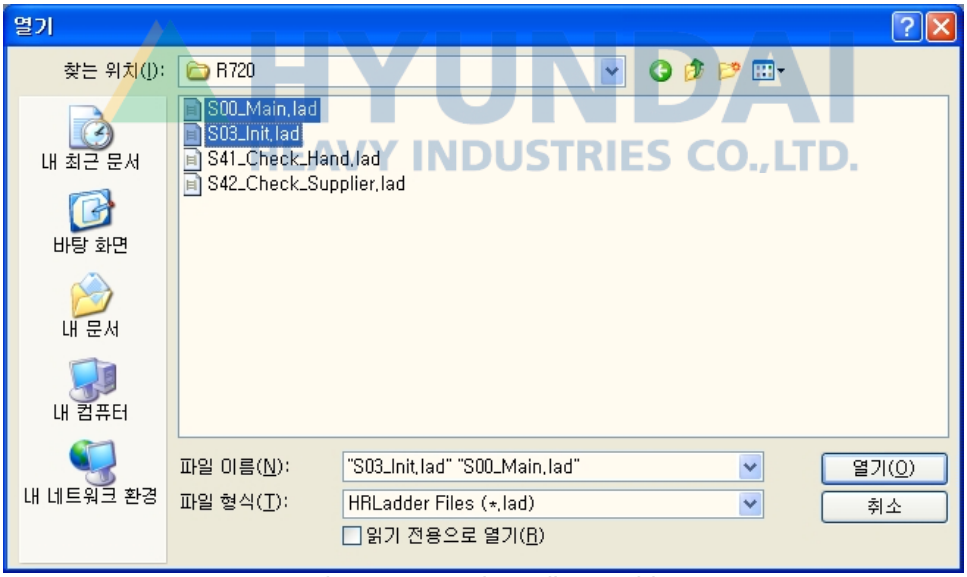


Figure 2.11 Select File to Add

(8) The file names will appear under the “PC Ladders”. After right clicking as shown in Figure 2.12, select the “New Folder…”.

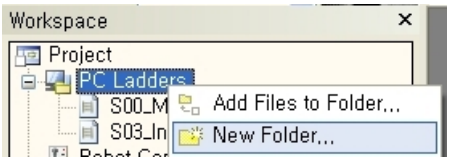


Figure 2.12 Create New Folder

(9) When the New Folder dialog box is displayed as shown in [Figure 2.13], enter an appropriate folder name. (In this example, the name of “Check_IO” is used.

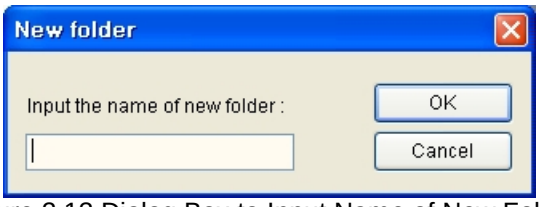


Figure 2.13 Dialog Box to Input Name of New Folder

(10) Let’s try to create two more ladder files in the method described above.
(In this example, the name of “S41_Check_Hand.lad” and “S41_Check_Supplier.lad” are used.)

(11) Let’s try to create a new ladder file based on the method described before the new folder name. Final result would look like [Figure 2.15].

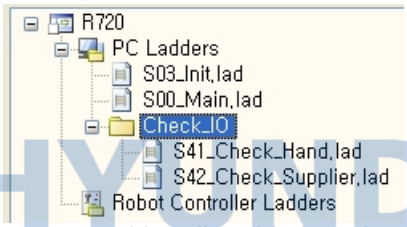


Figure 2.14 Ladder File Added to Hierarchy

(12) You can select “Rename” from the popup menu or press the [F2] key to rename the folder.

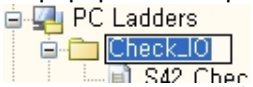


Figure 2.15 Rename folder

(13) The folder and ladder file will continuously have sub nodes while maintaining the hierarchy. One thing to note is that creating a folder in the task window does not necessarily create a folder in actual Windows OS. This folder is just a data structure that the project file of HRLadder manages within the file.

2.5. Window arrangement

As shown in Figure 2.16, you can hide or show the screen components by using the View menu or buttons on the toolbar. Each component is described in the relevant chapter.

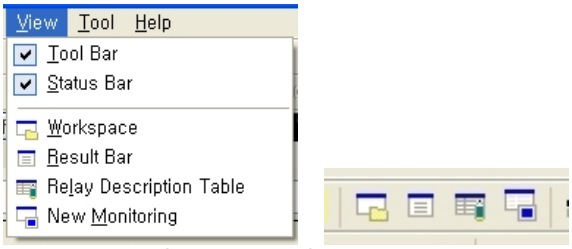


Figure 2.16 View menu

The component can be freely arranged or overlaid as shown in Figure 2.17. When you drag the title bar or bottom tab of each window, the sticker to display the location to arrange appears. Drop the window on the sticker to arrange the windows. The arrangement will be saved on the project.

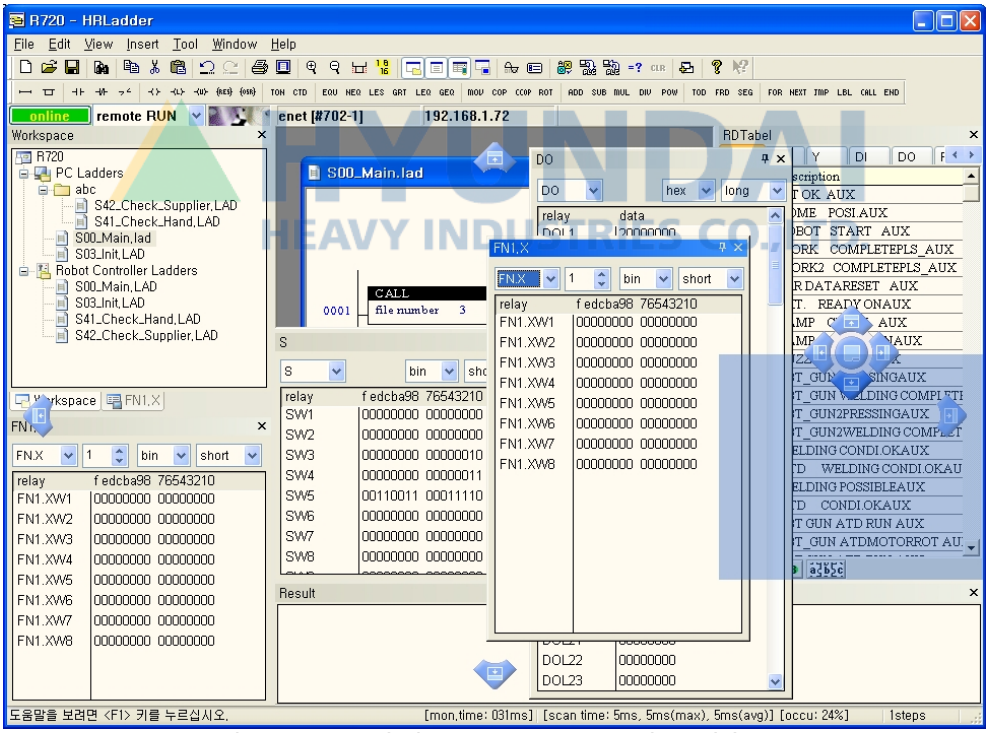


Figure 2.17 Window arrangement using sticker

3

Edit Ladder Diagram

3.1. Basic Edit

This describes the method of editing the ladder task. Try following as described below.

(1) As described in the previous chapter, create the project and ladder file.

(2) As shown in [Figure 3.1], start with ladder document with only one Rung.

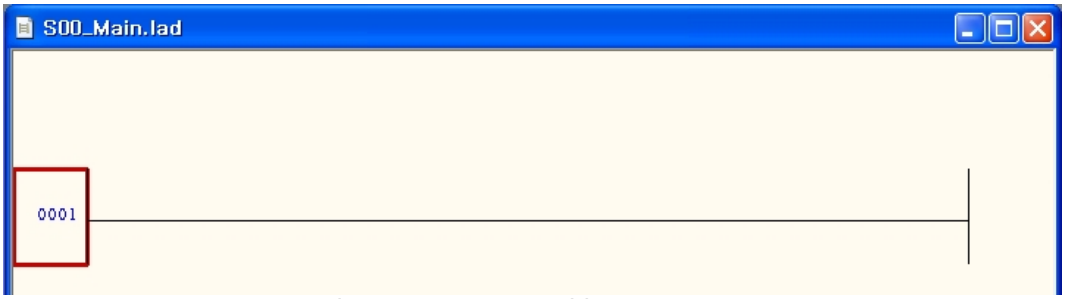


Figure 3.1 Empty Ladder Document

The red rectangle on the left side of the Rung shows that it is selected. You can click and select the Rung or instruction. The number, “0001”, is the number of the Rung, which increases every time a Rung is added.

(3) Select 『XIC(eXamine If Closed)』 from the Instruction Tool Bar as shown in [Figure 3.2].

Figure 3.2 XIC of Instruction Tool Bar

As the first instruction of the selected Rung, “XIC” symbol is added as shown in [Figure 3.3]. (When the color of the entire Rung changes to gray, it means that it is currently being edited. When the file is saved, this will disappear.)

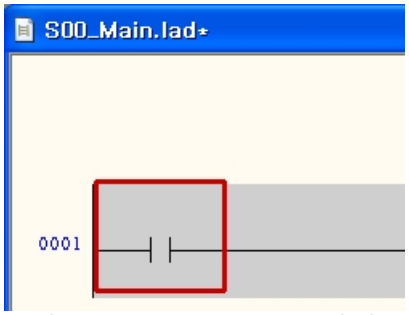


Figure 3.3 Insert XIC Symbol

(4) Double click the symbol or press the Enter key when it is selected. The edit box to enter the tag (operand) will be displayed. Enter the relay name of “X1” as shown in [Figure 3.4]. (All letters will automatically be converted to capital letters.)

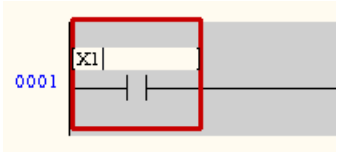


Figure 3.4 Input Relay Name

Press the Enter key to complete the entry of the operand of the instruction. (Incorrect relay name will be displayed in red.)

(5) Now as shown in [Figure 3.5], select the instruction 『OTE(OuTput Energize)』 from the Instruction Tool Bar.

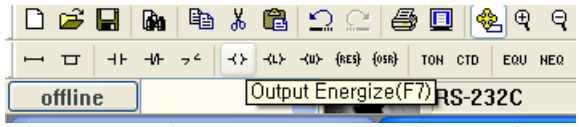


Figure 3.5 Select OTE Instruction from Tool Bar

As the next instruction of the selected instruction, “OTE” will be inserted. As with “XIC”, double click on the symbol or press the Enter to open the edit box and enter “Y1” and press the Enter key. Now it will be as shown in [Figure 3.6]. (The output instruction is arranged at the right end of the Rung.)

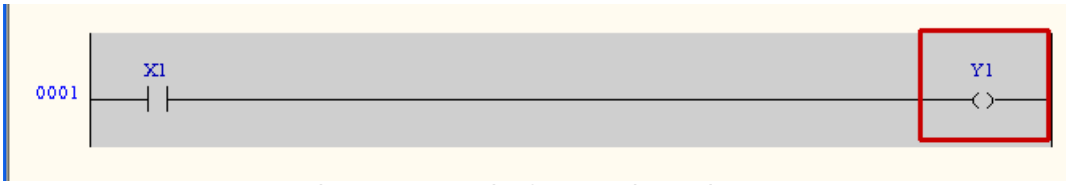


Figure 3.6 Result of XIC and OTE input

(6) Now 1 Rung is completed. When this ladder task is executed, “Y1” signal will be controlled by the “X1” signal.
As shown in [Figure 3.7], click on the Rung button on the Instruction Tool Bar. As shown in [Figure 3.8], a new Rung will be added below the current Rung.

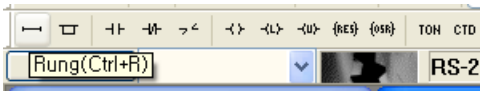


Figure 3.7 Click on Rung Button from Tool Bar

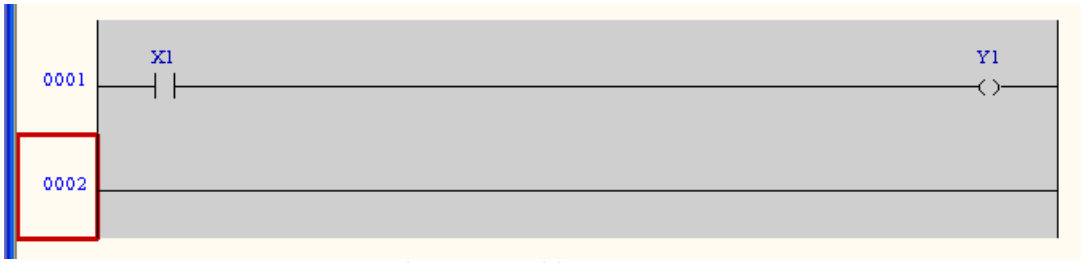


Figure 3.8 Add New Rung

3.2. Edit Branch

This describes how to insert and edit the Branch on the Rung. Try following as described below.

(1) Let's start from the condition shown in [Figure 3.9].

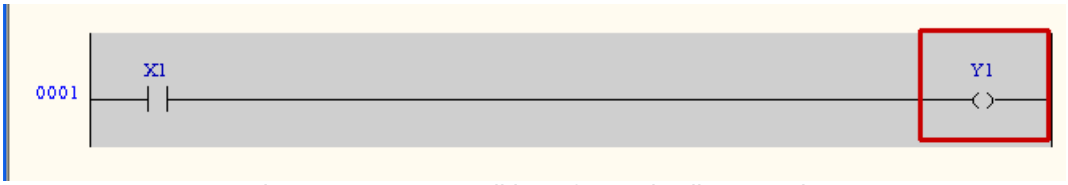


Figure 3.9 Start Condition of Brand Edit Example

In order to edit the Branch easily, turn on the Branch interval option as shown in [Figure 3.10]. As shown in [Figure 3.10], select the Branch from the Instruction Tool Bar. The Branch will be added to the Rung as shown in [Figure 3.11].

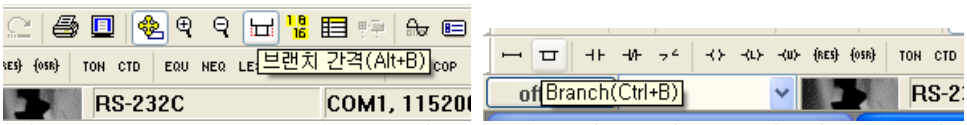


Figure 3.10 Turn on Branch Interval Option from the Tool Bar and Select Branch

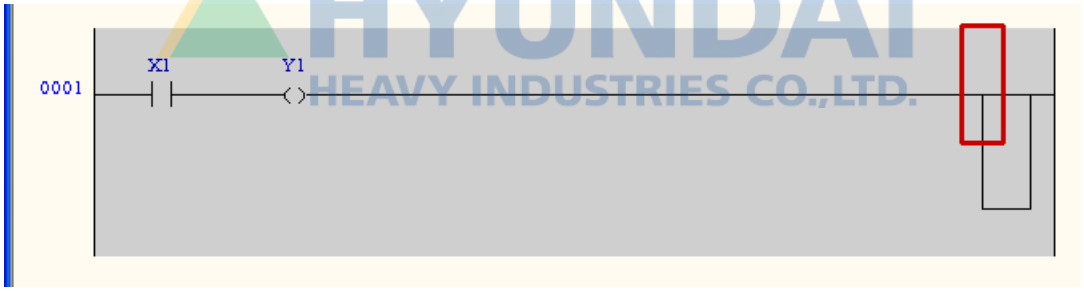


Figure 3.11 Branch Inserted

(2) Try moving "Y1(OTE)" to the inner side of the Branch. There are two ways to do so. You can drag and drop "Y1" or you can drag one end of the Branch between "X1" and "Y1". Let's try the first method. When you drag "Y1" by left clicking, yellow rectangles will be displayed on the locations where "Y1" can be dropped. When you put the cursor on the location you want to drop, the rectangle will turn red as shown in [Figure 3.12]. In this condition, release the left button of your mouse.

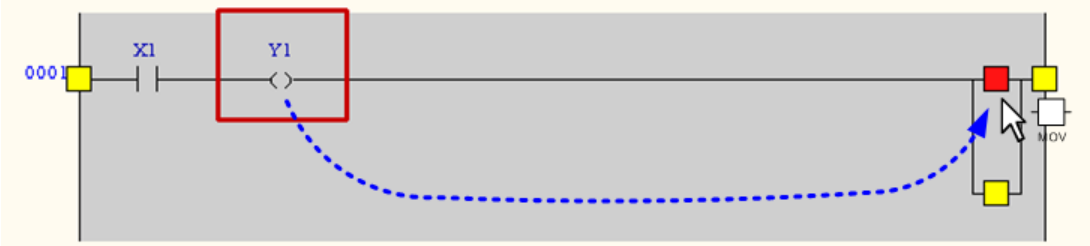


Figure 3.12 Drag and Drop the Instruction with Mouse

(3) As shown in [Figure 3.13], “Y1” has been moved to the inner side of the Branch.

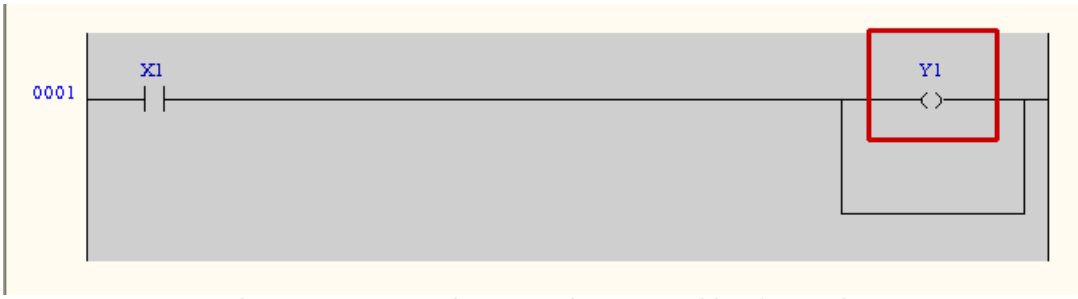


Figure 3.13 Instruction Moved to Inner Side of Branch

2nd method is similar to the 1st method. You need to drag and drop the left end of the Branch to the location you want.

(4) Method of inserting the instruction on the Branch is the same method as inserting to the Rung. As shown in [Figure 3.14], set the selection box on the location you want and click on the instruction you want to insert at the right of the selection box.

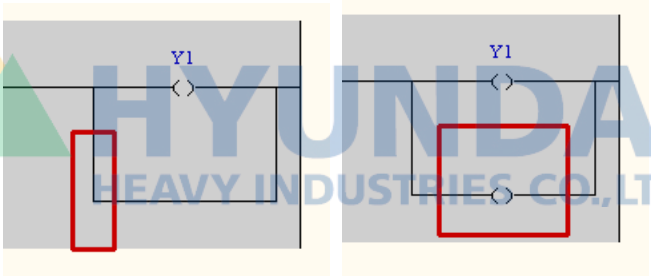


Figure 3.14 Insert Instruction on Branch

(5) You can connect a Branch on top of a Branch continuously.

(6) As shown in [Figure 3.15], place the selection box on the Branch and click on the Branch button on the Instruction Tool Bar.

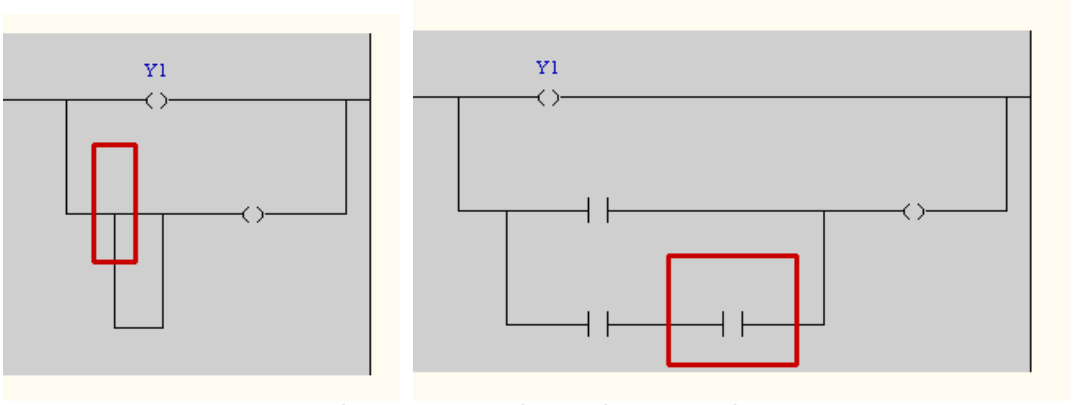


Figure 3.15 Load Branch on Branch

(7) There is no restriction in the number of Branches that can be added on the Branch in hierarchy.

3.3. Delete, Cut, Copy, Paste and Cancel

(1) When you left click on the instruction or Rung you want, it will be selected.

(2) When you left click with the [Ctrl] key pressed, you can select multiple instructions or Rungs as shown in [Figure 3.16]. But the instructions must exist on the same Branch level of the same Rung. Also you cannot select the Rungs with the instructions or Branches. When you select multiple objects, Delete/Cut/Copy will be applied to all of the objects.

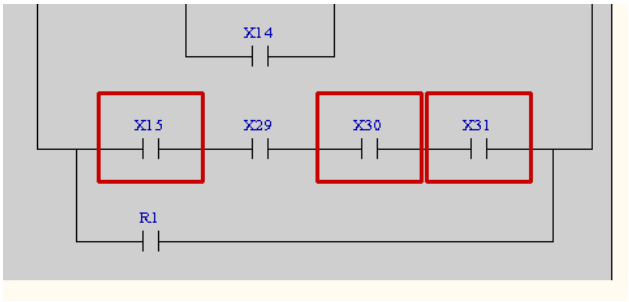


Figure 3.16 Select Several Instructions or Rungs Simultaneously

(3) As shown in [Figure 3.17], when you select the corner of the Branch, the Branch and sub Branch and the included instructions will all be applied.

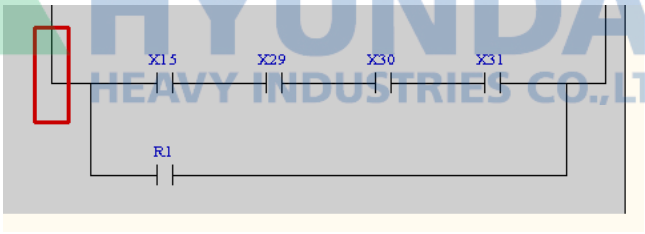


Figure 3.17 Select All Branches

(4) When you press the [Del] key, the selected instructions or selected Rungs or Branches will be deleted.

(5) When you press the [Ctrl+X] key or click on the button, the selected instructions or selected Rungs or Branches will be deleted and copied to the clipboard.

(6) When you press the [Ctrl+C] key or click on the button, the selected instructions or selected Rungs or Branches will be copied to the clipboard.

(7) When you press the [Ctrl+V] key or click on the button, the selected instructions or selected Rungs or Branches will be copied on the right of the selected location.

(8) When you press the [Ctrl+Z] key or click on the button, the previous edit operation will be canceled.

(9) When you press the [Ctrl+Y] key or click on the button, the previously canceled edit operation will be executed again.

3.4. Tag Format

1 bit data from relay index can be entered and displayed as one of the 3 formats of 1 bit, 8 bit or 32 bit.

Refer to the I/O configuration table. In most cases, 8 bit format will have a suffix of 'B' (Byte), 16 bit format will have a suffix of 'W' (Word) and 32 bit will have a suffix of 'L' (Long) on the name of relay type, and the 1 bit format will not have any suffix.

For example for the X relay of [Table 3-1], XB is used as the name for 8 bit, XW for 16 bit and X for 1 bit with an index.

Data configured as"X1~X8"is XB1, and data configured as "X1~X16" or "XB1~XB2" is XW1.

Table 3-1 Relationship of X, XB and XW

	← Higher															Lower →
1 bit	X16	X15	X14	X13	X12	X11	X10	X9	X8	X7	X6	X5	X4	X3	X2	X1
8 bit	XB2								XB1							
16 bit	XW1															

X12 for example can be entered in 4 different formats as shown in [Table 3-2]. These 4 formats mean the same data bit.

Table 3-2 4 Formats of X12

1 bit format	X12	12th X bit
8 bit format	XB2/4	4th bit of 2nd XB byte
16 bit format	XW1/12	12th bit of 1st XW word
32 bit format	XL1/12	12th bit of 1st XL double word

As one more example, X31 is the same as XB4/7, XW2/15 and XL1/31.

HRLadder has the function to select one of the 4 formats and display it on the ladder diagram. Select 『View - "In x bit tag format"』 menu or every time you press the 

button on the Tool Bar, the display format will circulate in the order of 1 bit → 8 bit → 16 bit → 32 bit as shown in [Figure 3.18].

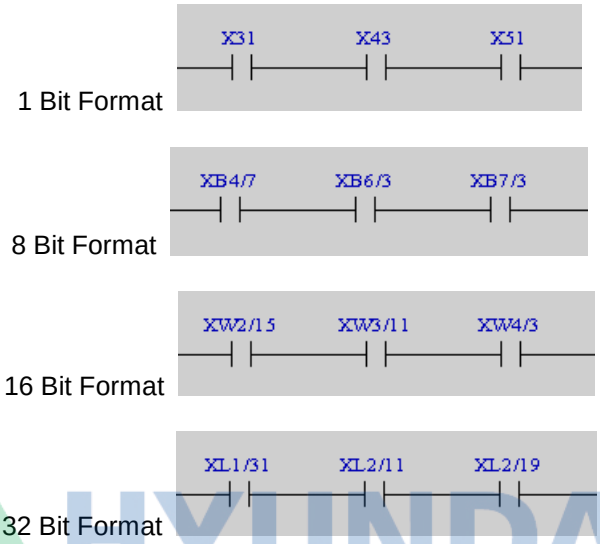


Figure 3.18 1, 8, 16 and 32 Bit Tag Format

When the user enters the tag, it will always be converted to the current display format. For example, if you enter the instruction tag of "X51" when the current display format is in 16 bit display format, it will immediately be entered as "XW4/3".

3.5. Comment and Relay Description Table

You can add a comment to each relay and open the relay description table to edit the entered relay comment in table format.

(1) When you double click on the top part of the relay you want to edit, the edit box to enter the comment will be displayed as shown in [Figure 3.19].

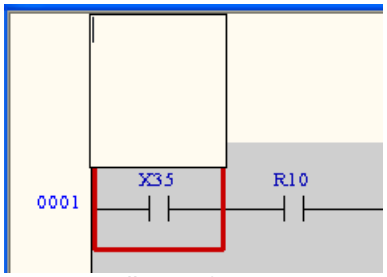


Figure 3.19 Edit Box for Comment Input

(2) When you enter the comment and press the Enter key, the comment will be displayed as shown in [Figure 3.20].

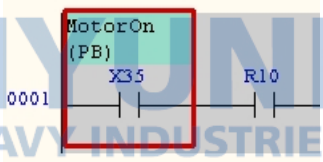


Figure 3.20 Instruction with a comment

(3) For the box type instruction, you can enter the comment by double clicking the top of the box as shown in [Figure 3.21].

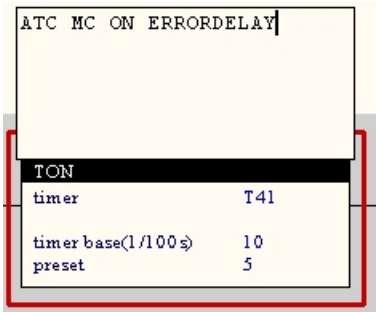


Figure 3.21 Comment Input of Box Type Instruction

(4) You can add a comment to the Rung as well. After double clicking the Rung number as shown in [Figure 3.22] enter the comment in the edit box and hit Enter when done.

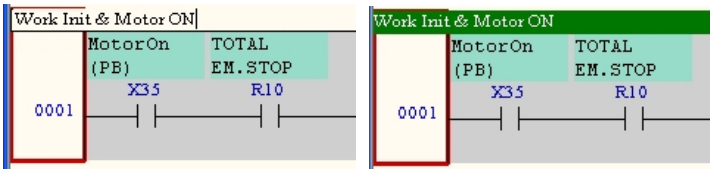


Figure 3.22 Adding Comment to Rung

(5) Comment information is saved and managed within the project file and not in the ladder file. That is, the relay comment entered applies to all the ladder files opened on the screen. If you would like to save the comment to the ladder file and not the project file, open the option dialog box by with 『Tool (T) – Option (O)』 and check the "Load/Store inst. comments in LAD file" item as shown in [Figure 3.23]. When the comment is saved in the ladder file, it will also be downloaded from/uploaded to Controller when the ladder file is downloaded/uploaded.

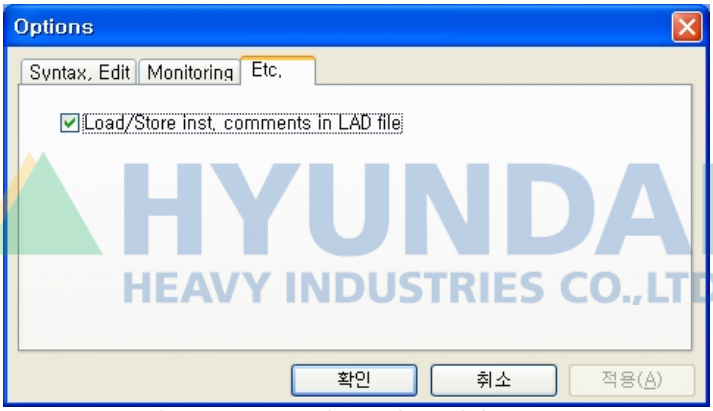


Figure 3.23 Tool –Option Dialog Box

(6) Select 『View (V) – Relay Description Table (L)』 from the main menu or click on the button to display the relay description table. The relay description table will be displayed as shown in [Figure 3.24]. On the top, name of relay type will exist as a tab to include "X, Y, DI, DO" etc. When you click on each tab, the relay comment of the selected type will be displayed and when you click on the ALL tab, all relay comments will be displayed.

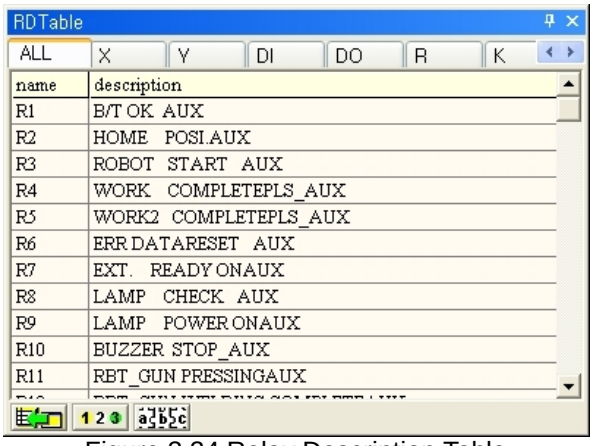


Figure 3.24 Relay Description Table

(7) When you click on the specific row, you can edit the relay name or comment of the row as shown in [Figure 3.25].

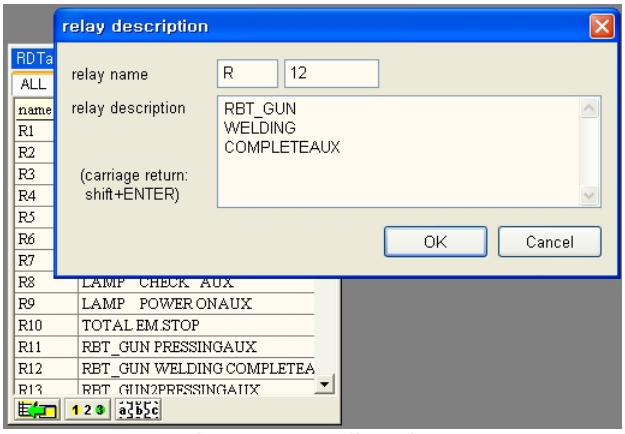
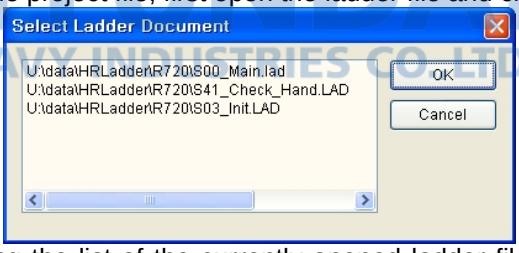
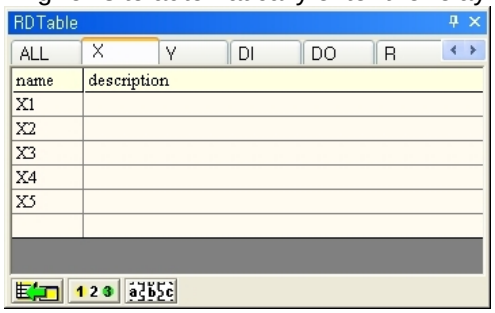


Figure 3.25 Edit Relay

(8) There are 3 buttons at the bottom of the relay description table. The role of each button is described in [Table 3-3].

Table 3-3 Button Function of Relay Description Table

Importing from Ladder Document 	If the comment information is saved in the ladder file, and you would like to import this information to the project file, first open the ladder file and click on this button.  Dialog box displaying the list of the currently opened ladder files will be displayed as shown above. Select the file you want and click on the OK button. The comment information of the selected ladder file will be copied to the project file as a batch process and displayed on the relay description table.
Auto Increase 	For example, if you select the “X1” item from the relay description table and click on this button, every time you click on this button, the relay index will increase as “X2, X3, X4…” in the following rows to automatically enter the relay items. 
Sort 	This sorts the relay in order and sorts in reverse order when you click once more.

(9) The relay description table can also be saved as the text file. Select 『File (F) – Export Relay Description... (E)』 with the project window selected. Enter the file name and click on the Save button. The file is saves the relay name and description in a simple tab delimited format as shown in [Figure 3.26].

Figure 3.26 Relay Description Table Saved as Text File

(10) You can open this type of text file from Microsoft Excel as shown in [Figure 3.27].

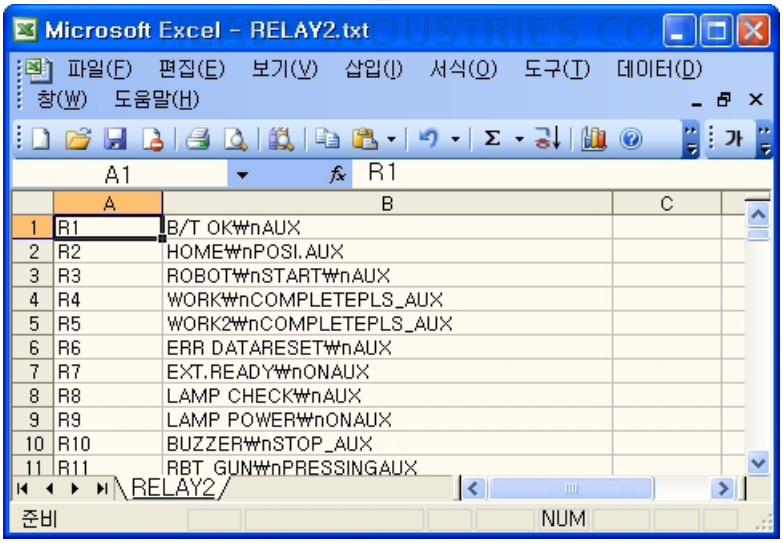


Figure 3.27 Relay Description Table Imported from Excel

(11) On the other hand, you can save relay description table prepared in Excel as the tab delimited text file and import the file to the project through 『File (F) – Import Relay Description... (I)』.

3.6. Find and Replace

This is the function to search the entire ladder diagram to find the designated text or replace the designated text with other text. Select 『Edit (E) – Find & Replace (F)』 menu or click on the  button on the Tool Bar or press the Ctrl+F key, and the following Find and Replace dialog box will be displayed as shown in [Figure 3.28].

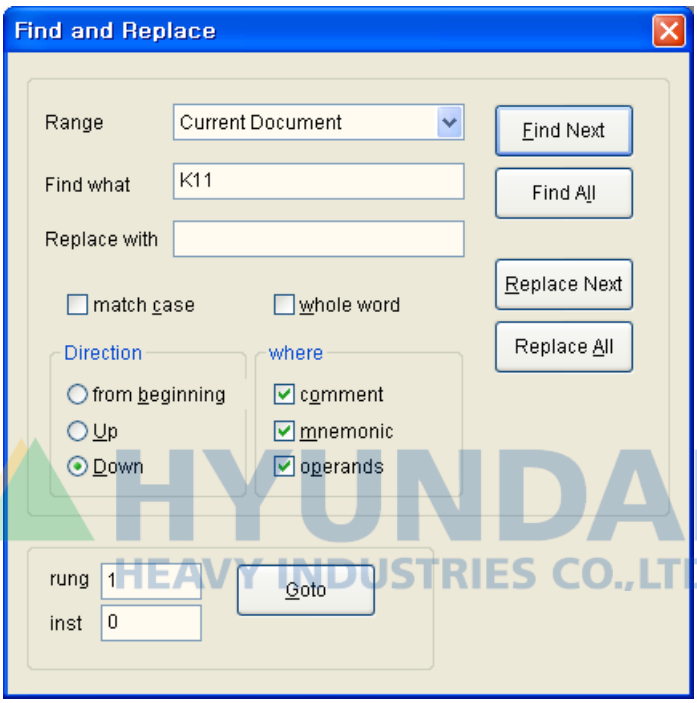
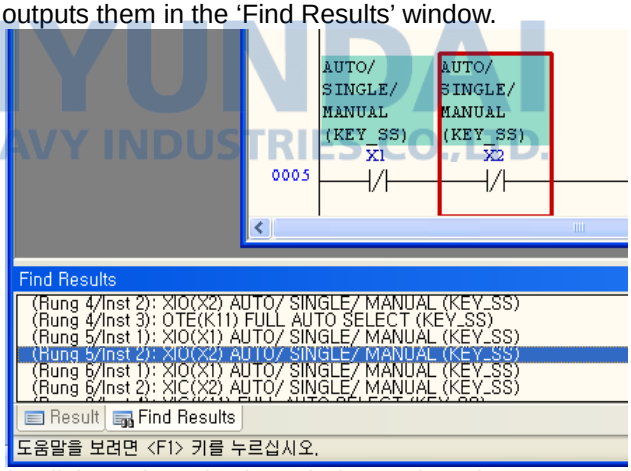


Figure 3.28 Find and Replace Dialog Box

Each part of the dialog box is described in [Table 3-4].

Table 3-4 Each Part of Find and Replace Dialog Box

Range	Current Project	Find/Replace is done over all .LAD in current project.
	Current Document	Find/Replace is done over the current focused .LAD window.
Find what	Enter the text you want to find.	
Replace with	Enter the new text you want to replace with the text you find. Enter this only when you are using the Replace function. You can keep this blank when you are using just the Find function.	
Find Next	This finds and moves the cursor to the location that matched with the 'Find what' in the specified range.	
Find All	This finds all locations that matched with the 'Find what' in the specified range, and outputs them in the 'Find Results' window.  If you double-click an item in the 'Find Results', the cursor moves to the location.	
Replace Next	This replaces the text at the current cursor location and moves the cursor to the next location.	
Replace All	This searches the specified range and replaces all 'Find what' into 'Replace with' as a batch process.	
Match case	Select whether to distinguish lower and upper case when finding or replacing the text.	

Direction	When you select the direction as down, the system will search downward after completing the search to the right direction. When you select the direction as up, the system will search the upward Rung after completing the search to the left direction.
Where	Select the search target. You can specify the target to comment, mnemonic and operand to limit the search. But for the mnemonic, you cannot execute the Replace function.
Rung/inst/Goto	When you enter the rung and instruction number, and press the Goto button, the cursor will move to the location. For example, if you want to search for the 5th instruction of the 30th rung, enter “30” in the Rung and “5” in the instruction, and press the Goto button. If you want to go to a rung, enter 0 for the instruction number.
Close	Close the Find and Replace dialog box.

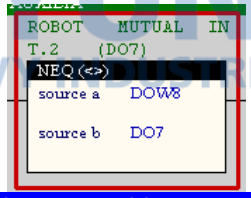
3.7. Syntax Check

This is the function to check for any incorrect syntax in the prepared ladder diagram.
Select the window of the ladder diagram to check.

(1) Select the 『Tool (T) – Syntax Check (S)』 menu or click on the  button on the Tool Bar. As shown in [Figure 3.29], the output of the syntax check is displayed in the result window a shown below the screen. The error item is shown as error location of Rung/Inst format and error detail.

Figure 3.29 Syntax Check Result of Result Window

(2) When you double click on the error item, the cursor of the ladder diagram will move to the error location. In most cases, the error occurs from incorrect relay name or operand of the instruction, combination of inappropriate relay or relay index out of range etc. For example, a syntax error occurred in [Figure 3.30] because D07 entered as source b operand is the bit relay.



error [rung 20 / inst 3]: 1'th operand is not pertinent for the instruction.

Figure 3.30 Example of Syntax Error

(3) Using one relay more than once for output is also considered a syntax error. But you can also allow the duplicated output in the syntax check. When you select 『Tool (T) – Option (O)』, the dialog box shown in [Figure 3.31] will be displayed. Here you can check the “Permit duplicated output” item.

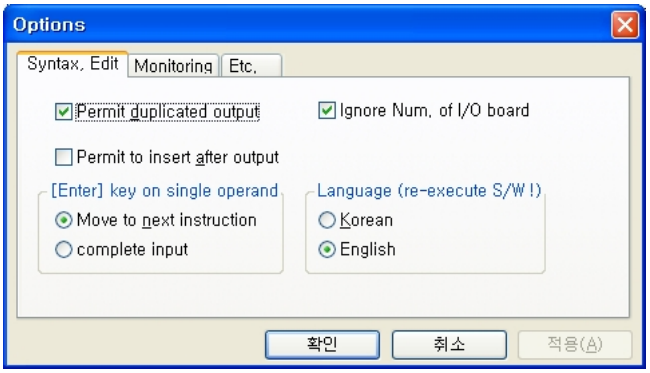


Figure 3.31 Option Dialog Box

4

Communication Setting

4.1. RS-232C Communication Setting

4.1.1. **Hi5 Controller Side Setting**

As shown in [Figure 4.1], enter the screen by selecting 『[F2]: System』 → 『2: Control Parameter』 → 『3: Serial Port』→『1: Serial Port #1』 (Or 『2: Serial Port #2』) from the Teach Pedant of the Hi5 Controller. Select the Baudrate, Character length, Stop bit, Parity bit, Echo, Port usage and Communication method as shown below.

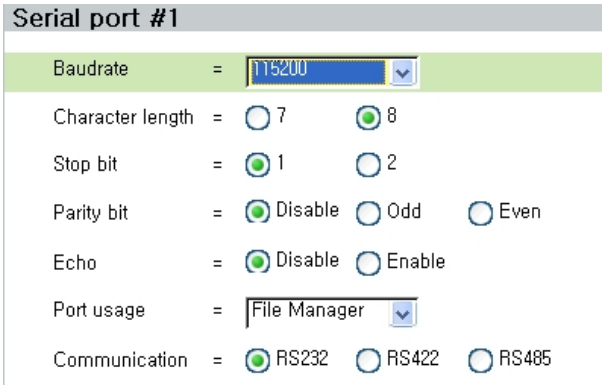


Figure 4.1 Display of Communication Port and Transmission Speed Setting

4.1.2. **PC Side Setting**

First, you must select the communication method to RS-232C. Click on the button from the Tool Bar or select 『Tool (T) – Option (O)』 from the menu to open the option dialog box as shown in [Figure 4.2].

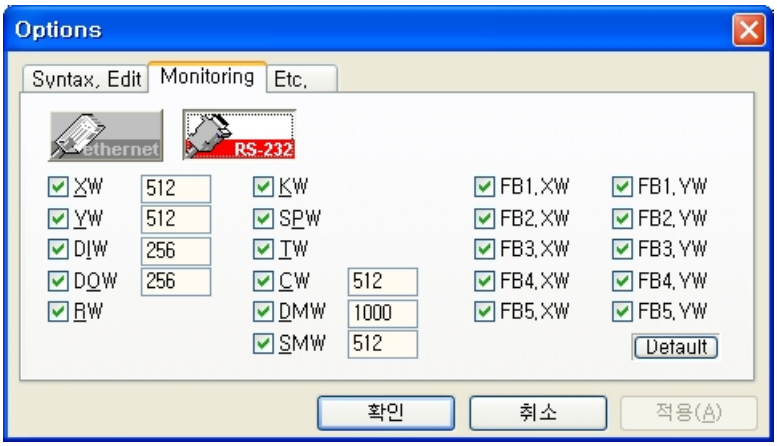


Figure 4.2 Option Dialog Box

(1) After selecting the monitoring tab from the option dialog box as shown in [Figure 4.2], press the RS-232 button and click on OK. The communication method will be set to RS-232C and the dialog box will be closed.

(2) Next, you must set the parameter of RS-232C.

(3) Click on the button from the Tool Bar or select 『Tool (T) – Comm Setup... (C)』 from the menu to open RS-232C communication setting dialog box as shown in [Figure 4.3].

Figure 4.3 RS-232C Communication Setting Dialog Box

(4) 

Button in the RS-232 communication setting dialog box must be unchecked (That is, not connected) to make changes to the parameter. Therefore if this is checked, uncheck the box.

(5) Select the communication port that RS-232C cable is connected on the PC and set the same baudrate as that of Hi5 Controller. Set the data bit, stop bit and parity as they are set up in Hi5 Controller as shown in [Figure 4.3].

(6) Click on OK to apply the setting and close the dialog box.

(7) The communication port and baudrate that has been set will be displayed on the PLC Control Bar as shown in [Figure 4.4].

Figure 4.4 Display of Communication Port and Transmission Speed on PLC Control Bar

4.2. RS-232C Communication Troubleshooting

If you have problems with RS-232C communication, follow the Troubleshooting Flowchart of [Figure 4.5].

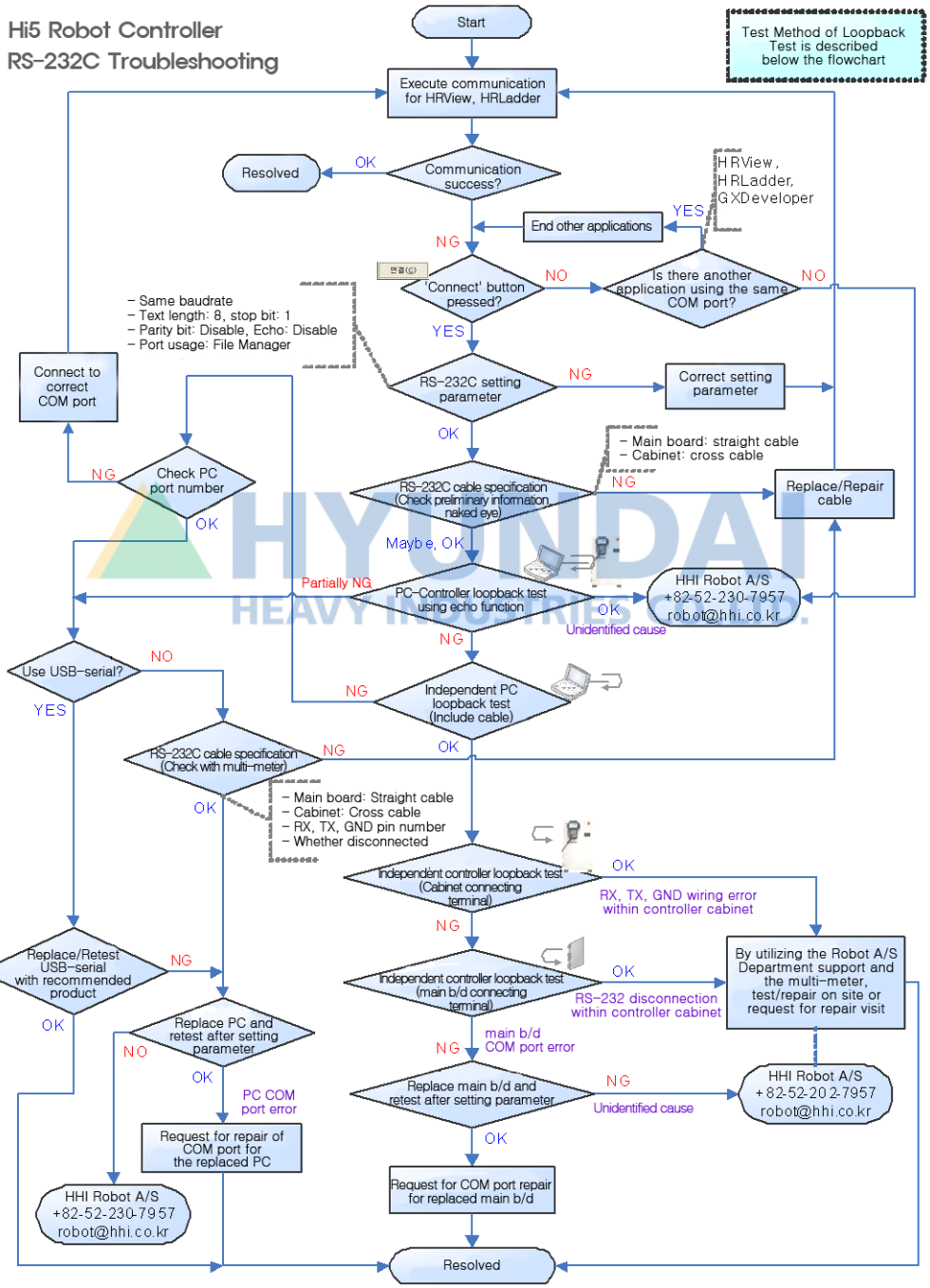


Figure 4.5 RS-232C Troubleshooting Flowchart

4.2.1. **PC Side Loopback Test Method**

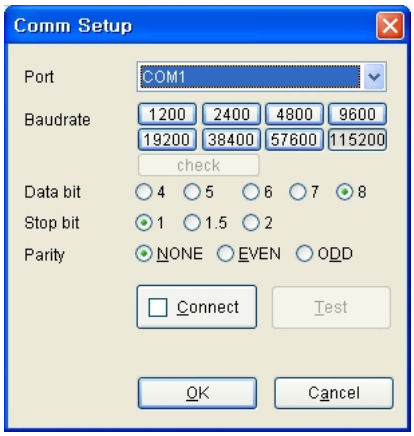


Figure 4.6 RS-232C Communication Setting Dialog Box

(1) To test whether the RS-232C connection is normal, first open the communication setting dialog box and press the Connect button to connect the communication. When you press the Test button, the following RS-232C communication test dialog box will be displayed.

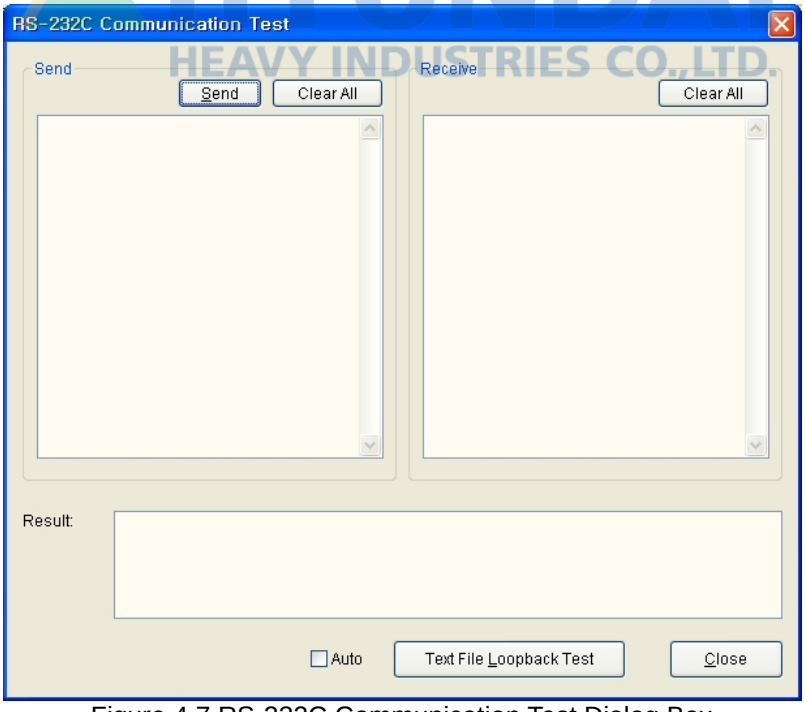


Figure 4.7 RS-232C Communication Test Dialog Box

Table 4-1 RS-232C Communication Test Dialog Box

Send group box	**Send button**	This sends the text entered in the send edit box to RS-232C. (Only the first 500byte is sent.)
	Clear all button	This deletes all the text in the send edit box.
	Edit box	This is where you enter the text to send. For text file loopback test, this shows the text that will be transmitted.
Receive group box	**Clear all button**	This delete all the text in the receive edit box.
	Edit box	This displays the text received in RS-232C.
Test result edit box		This shows the result of the text file loopback result. Byte sent, byte received, comparison, location and content of discrepancy etc. will be displayed.
Auto checkbox		Select whether to automatically repeat the text file loop back test.
Text file loopback test button		This runs the text file loopback test. The test reads the long text data from the internal text file, sends the text to RS-232 and compares the received data through loopback. Data sent and received are displayed respectively in the send and receive edit box.
Close button		This closes the RS-232C communication test dialog box.

(2) You can check whether the selected COM port from the serial port of the PC is operating normally as follows. First short circuit the #2 and #3 pin of the connector of the cable installed in the COM port of the PC as shown in [Figure4.8].

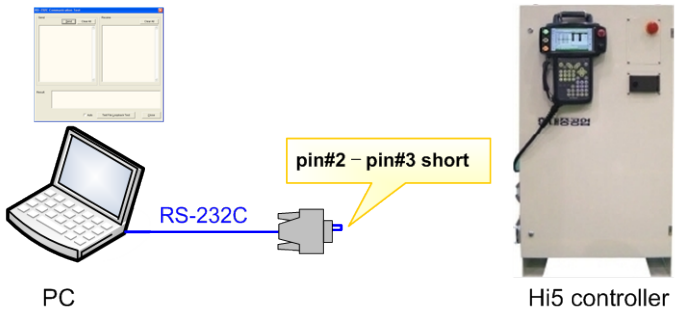


Figure 4.8 PC Side Transmission Short Circuit

(3) When you press the Text File Loopback Test button, the internal text will be transmitted, and the content will be shown in the edit box. The result is normal if it is shown as [Figure 4.9].

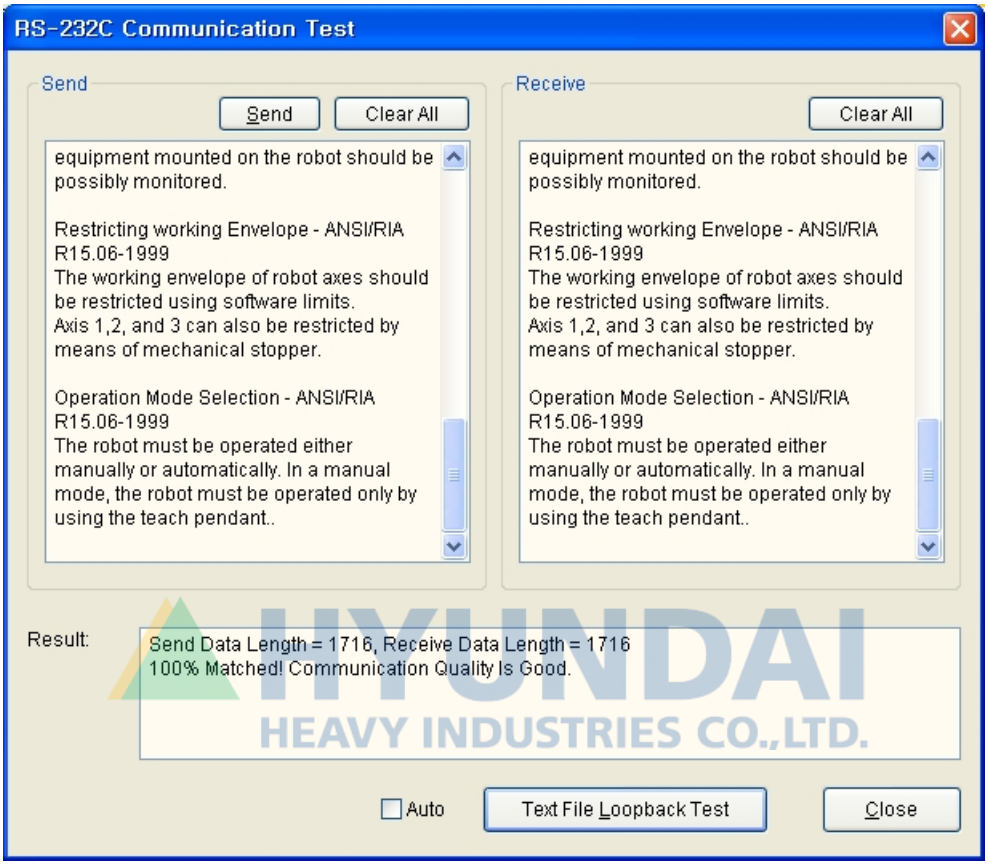


Figure 4.9 Text File Loopback Check

(4) The conclusions according to the test results are shown in [Table 4-2] as shown below.

Table 4-2 PC Side Text File Loopback Test Result

Result	Conclusion (Estimated cause)
Data shown in the receive edit box is the same as the data sent and the test result shows 100% Matched!	Operation of COM port of PC is normal
When there is no data in the receive edit box.	- Cable disconnected. - Cable incorrectly connected to a different COM port on PC. - COM port error on PC - Pin #2 and #3 not short circuited. - USB-Serial product (If used) setting error or defect
The data in the receive edit box is different from the data sent and data is partially damaged.	- Partial defect in send/receive function of COM port of PC. Check for H/W error. - USB-Serial product (If used) error or poor performance

(5) You can check whether the serial communication connection to the robot controller is normal as follows. First connect the robot controller to the COM port of the PC through the serial communication cable as shown in [Figure 4.10].

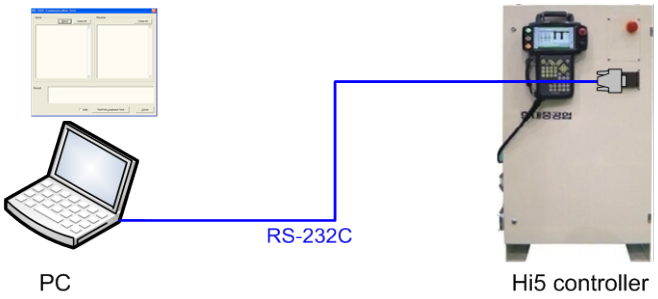


Figure 4.10 RS-232C Connection Between PC and Controller

(6) From the Teach Pendant of the robot controller, select 『[F2]: System』 → 『2: Control Parameter』 → 『3: Serial Port』 → 『1: Serial Port #1』(Or, 『2: Serial Port #2』) screen and set up so that the communication parameter aligns with the PC side, and set the "Echo" to <Enable> as shown in [Figure 4.11].

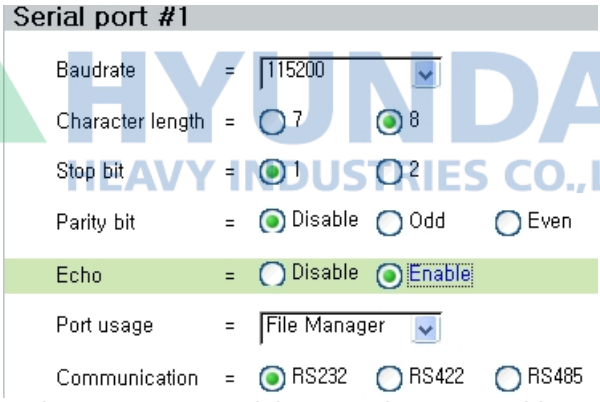


Figure 4.11 Set Serial Port "Echo" to <Enable>

(7) When you press the Text File Loopback Test Button and internal text file will be transmitted and the details will be shown in the edit box. The conclusion based on the test result is shown in [Table 4-3] below.

Table 4-3 PC –Controller Text File Loopback Check Result

Result	Conclusion (Estimated cause)
Data received in receive edit box is printed as is but the test result is shown as 100% Matched!.	Serial connection between the robot controller and the PC is normal.
No data is shown in receive edit box.	(When the loopback test on PC side is normal,) - RX and TX of cable is incorrectly connected. - Cable is incorrectly connected to a different COM port of the robot controller. - COM port error of robot controller. - Serial cable within robot controller cabinet is disconnected.
The data in the receive edit box is different from the data sent and data is partially damaged.	(When the loopback test on PC side is normal,) The transmission function of COM port of the robot controller has partial error. Need to check for H/W error.

(8) After the test, set the “Echo” of the Teach Pendant serial port screen back to <Disable>.

4.2.2. **Controller Side Loopback Test Method**

(1) From the Teach Pendant of the robot controller, select 『[F2]: System』 → 『2: Control Parameter』 → 『3: Serial Port』 → 『1: Serial Port #1』(Or, 『2: Serial Port #2』) screen and press the 『[F1]: Communication Test』 button.

(2) In accordance with the direction on the screen, short circuit the 2-3 pin of the RS-232C terminal of the controller cabinet as shown in [Figure 4.12] A.)

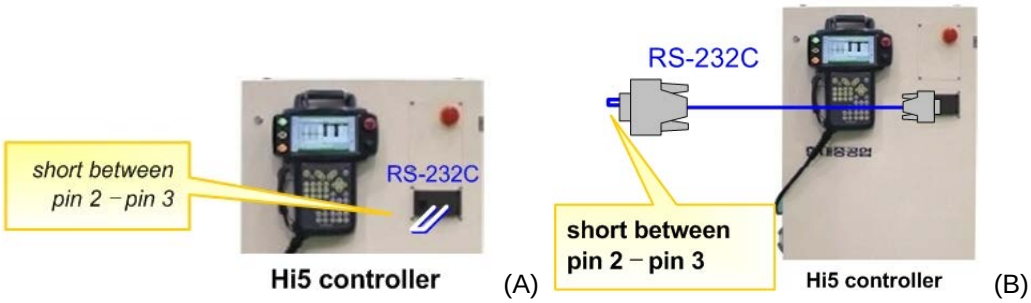


Figure 4.12 Controller Cabinet Side RS-232C Transmission Short Circuit

(3) If you see the message shown in [Figure 4.13] when you press the [ENTER] key, it is normal.

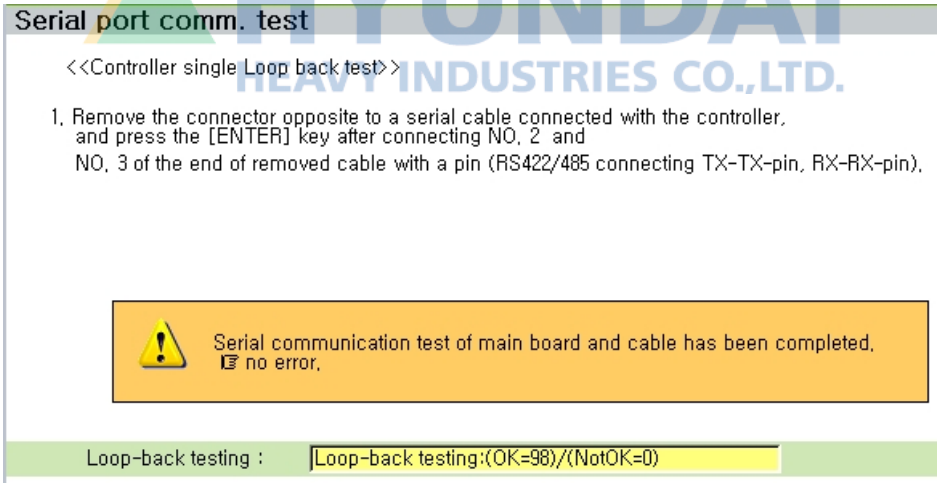


Figure 4.13 Normal Loopback Test Result

(4) In case of an error, a message saying that it is moving to the 2nd stage will be displayed as shown in [Figure 4.14]. In accordance with the direction on the screen, short circuit the 2-3 pin of the main board RS-232C terminal.

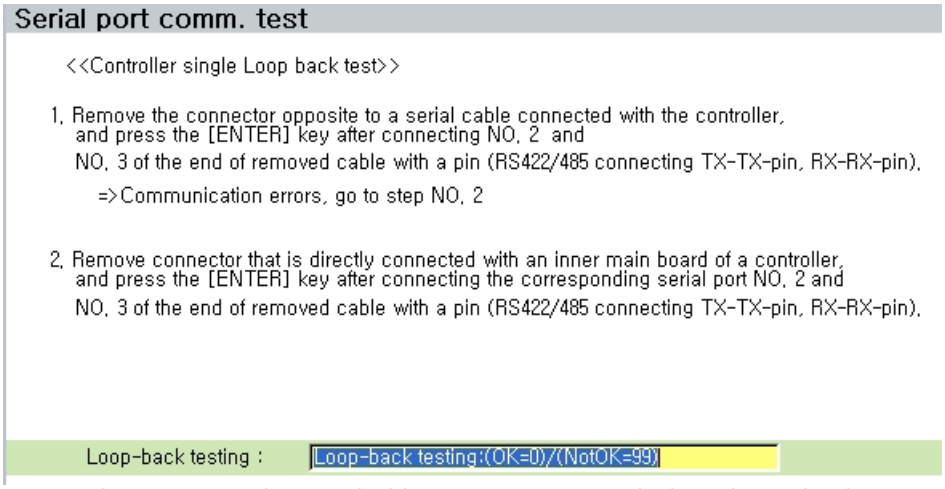


Figure 4.14 Main Board Side RS-232C Transmission Short Circuit

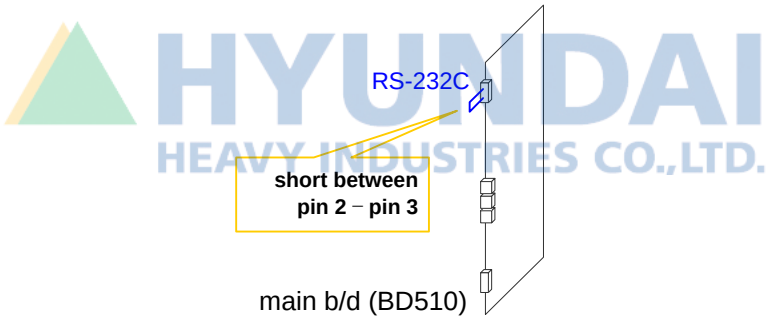


Figure 4.15 Main Board Side RS-232C Transmission Short Circuit

(5) If you see the following message when you press the [ENTER] key, it means that there is no problem with the main board. Check the cable connection with the control box connected from the inner RS-232C terminal to the main board.

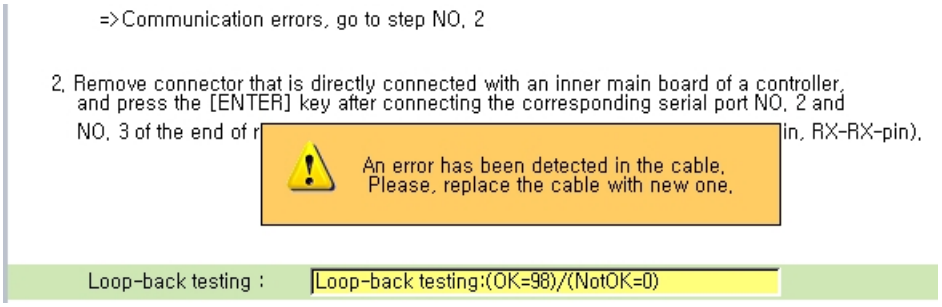


Figure 4.16 RS-232C Cable Check Message within Control Box

(6) If you see the following message when you press the [ENTER] key, it means that there is an problem with the main board. Try replacing the main board.

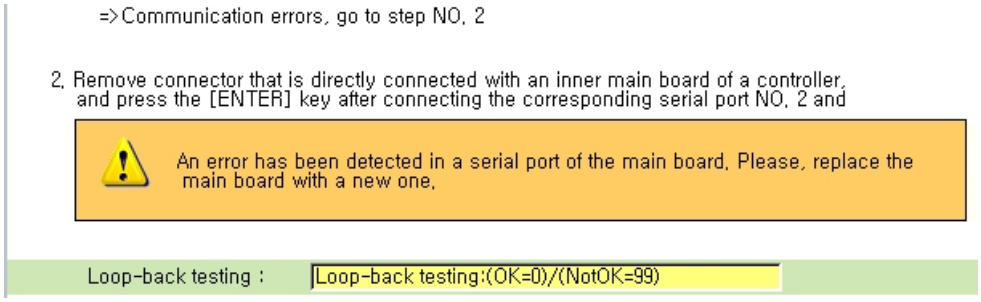


Figure 4.17 Main Board RS-232C Error Message

4.3. Ethernet Communication Setting

4.3.1. **Hi5 Controller Side Setting**

From the Teach Pedant of Hi5 Controller, select 『[F2]: System』 → 『2: Control Parameter』 → 『9: Network』 → 『1: Environment Setting』 screen. As shown in [Figure 4.18], check whether the setting including IP address is set up properly by selecting the EN2 (Common) tab.

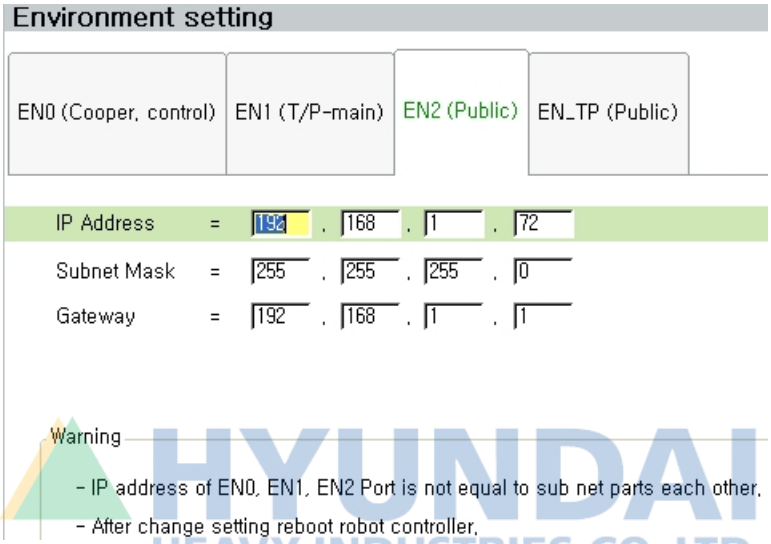


Figure 4.18 Display of Communication Port and Transmission Speed Setting

4.3.2. **PC Side Setting**

First, you must select Ethernet as the communication method. When you click on the button from the Tool Bar or select 『Tool (T) – Option (O)』 from the menu, the option dialog box will be displayed.

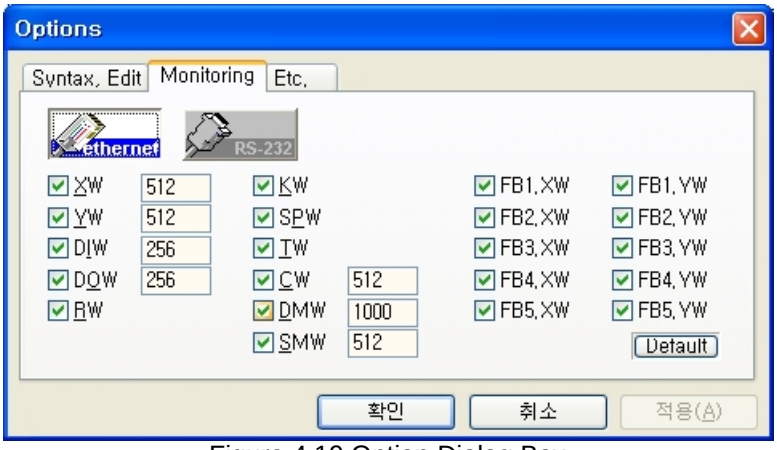


Figure 4.19 Option Dialog Box

(1) After selecting the monitoring tab from the option dialog box as shown in [Figure 4.19], press the Ethernet button and then the OK button to close the dialog box. The communication method will be selected to Ethernet.

(2) Next you must set up the parameter including IP address of Ethernet and port number etc. When you click on the button from the Tool Bar or select『Tool (T) – Comm Setup... (C)』 from the menu, the Ethernet setting dialog box will be displayed as shown in [Figure 4.20].

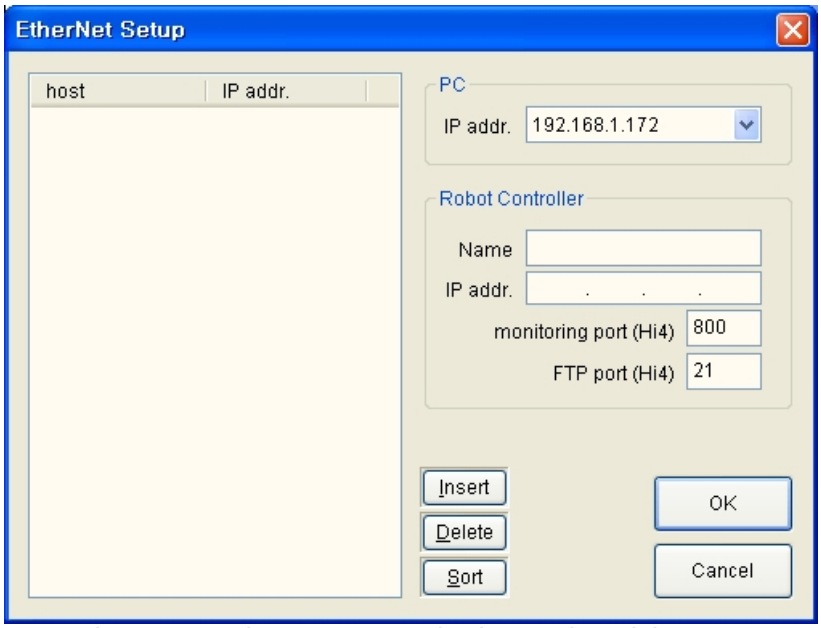


Figure 4.20 Ethernet Communication Setting Dialog Box

(3) First, open the list box of the IP address in the PC group box as shown in [Figure 4.21] and select the IP address of the PC itself. If there are 2 or more Ethernet devices installed on the PC, this is the process to designate which device to communication with.

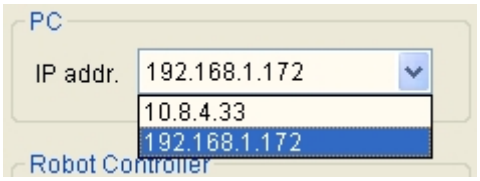


Figure 4.21 Select PC IP Address

(4) Now register the frequently accessed controller in this dialog box. The controller can be registered as follows.

① Enter the Host Name (Controller name or number) and the IP address in the right block. After entering the information, click on the [Add (I)] button to add to the left list. Repeat this process to enter all the controllers as shown in [Figure 4.22].

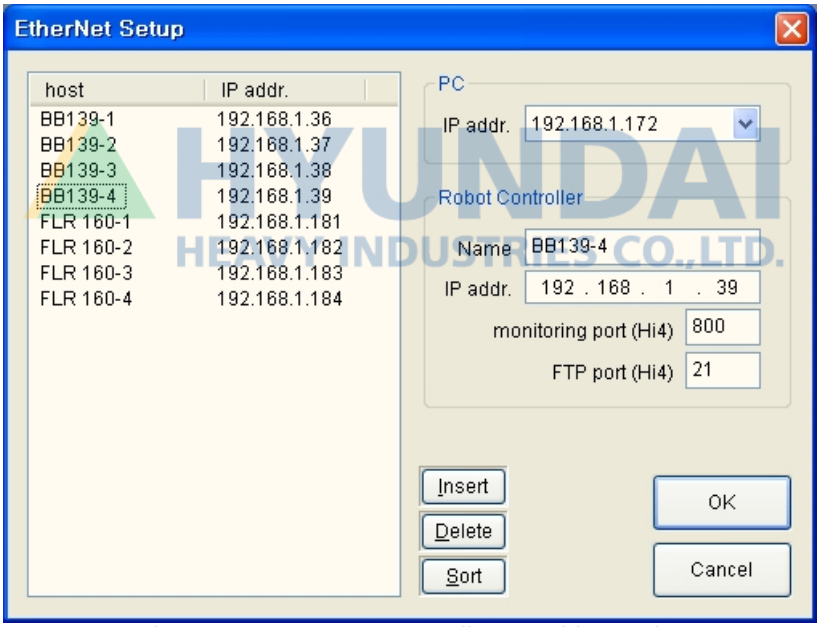


Figure 4.22 Prepare Controller IP Address List

② To delete one item from the list, select the item and then click on the [Delete (D)] button.

③ To sort the items on the list in the order of 123 and ABC, click on the [Sort (S)] button.

④ To edit the item on the list already entered, select the item and change the value on the right side. And then click on a different item to reflect the changes.

⑤ After selecting the item you want from the list, click on the [OK] button. The selected item will be shown as the host to connect and the dialog box will be closed. At this time, the prepared list will be saved as the text file named “ENetSetup.dat” in the directory where the HRView execution file is located.

(5) [Figure 4.23] shows an example of the “ENetSetup.dat” file opened in Notepad.

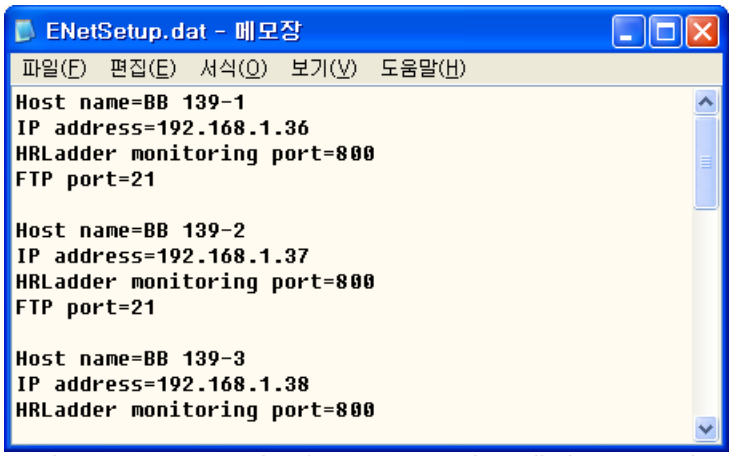


Figure 4.23 Example of “ENetSetup.dat” File in Notepad

(6) The name and IP address of the item selected from the Ethernet setting dialog box will be display on the PLC Control Bar as shown in [Figure 4.24]. This is the host to connect.

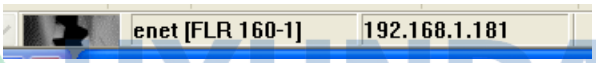


Figure 4.24 Display of Host Name and IP Address on PLC Control Bar

4.4. Ethernet Communication Troubleshooting

When the system does not operate normally related to the RS-232C communication, open the Command Prompt window as shown in [Figure 4.25] and [Figure 4.26], and execute the ping command for the IP address of the robot controller.

The conclusion based on the test result is shown in [Table 4-4].

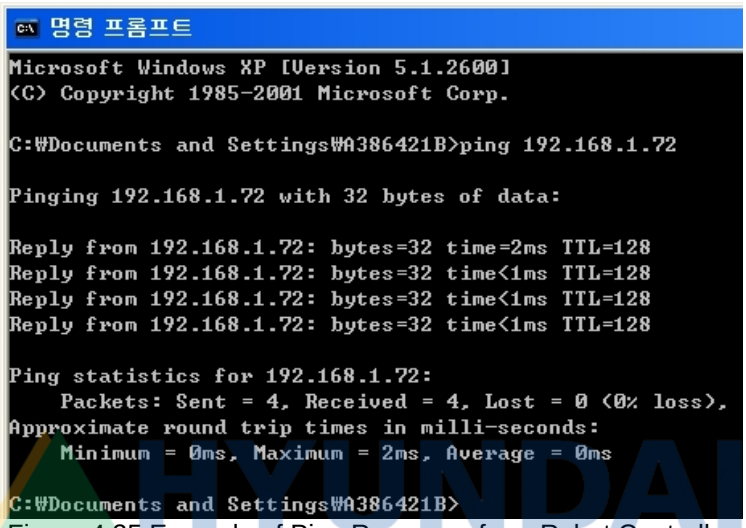


Figure 4.25 Example of Ping Response from Robot Controller

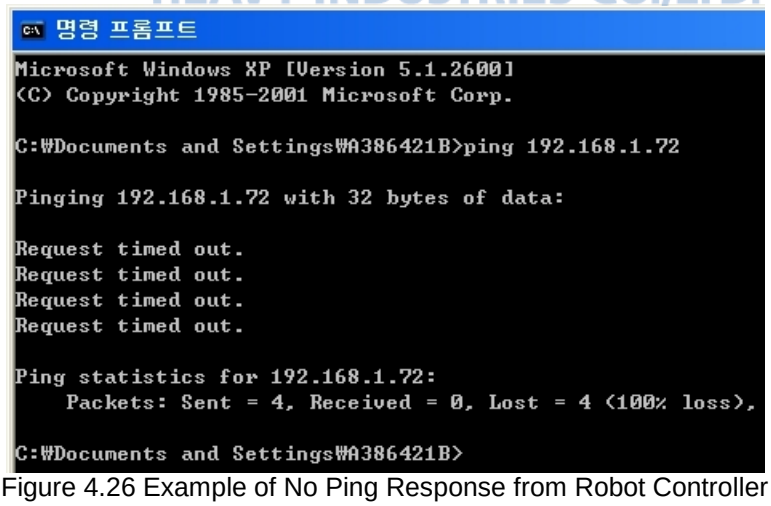


Figure 4.26 Example of No Ping Response from Robot Controller

Table 4-4 Ping Test Result from Robot Controller

Result	Conclusion (Estimated cause)
Reply from {IP address} is shown. That is, there is a ping response from the robot controller.	Even though the Ethernet connection between the robot controller and the PC is normal, the communication is failing due to a different cause. - Incorrect communication setting in HRLadder - Robot controller monitoring service error → Try rebooting both the HRLadder and the robot controller. - Service for HRLadder prohibited due to Windows Firewall → Include HRLadder to the exceptional program list of the Windows Firewall. (Control Panel – Security Center – Windows Firewall – Exception Tab)
Request timed out is shown. That is, there is no ping response from the robot controller.	▶ When the applicable PC has problem connecting to Internet or LAN: → Ethernet function error on PC. Request to have PC checked
	▶ When the applicable PC does not have problems connecting to Internet or LAN: - Incorrect IP address setting or incorrect subnet. - Incorrect Ethernet connection between robot controller and PC. (Disconnected cable, defective cable etc.) - (When using hub) Hub error, poor power supply → Check/Replace cable after testing with LAN tester. - Disconnected Ethernet cable inside the robot controller cabinet Or Ethernet function error on controller main board → Consult the A/S Center

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5

File Upload/ Download

5.1. Ladder file

5.1.1. **Hi5 controller**

Hi5 controller enables modular ladder programming and total of 100 ladder files can be saved. By using the CALL {Ladder number} instruction, the ladder file can be called as the subroutine of another ladder file.

(1) The file name starts with capital S and must be entered in the following format.

S {Ladder number} {Additional description} . LAD	
Ladder number	Two digit (00 ~ 99)
Additional description	Alphabetical character or underscore up to maximum of 15 characters

(2) Because the ladder file that starts with S00, among the ladder files, is recognized as the main ladder file and executed first in the PLC cycle, it must exist in order to operate the embedded PLC.

(3) If you download the ladder file that does not comply with the above rule, it will be saved as S00.LAD unconditionally.

※ The files with the same numbers of the Ladder despite different file names may not exist together in the Hi5 controller. For instance, if you download S32_Proc.LAD onto the controller with S32_Sub.LAD, the existing S32_Sub.LAD is automatically cleared.

5.1.2. **Hi4a controller**

Only 1 ladder file named ROBOT.LDO exists in Hi4a controller. That means that modular programming is not possible.

When you download any arbitrary file with extension of LAD from HRLadder, it will be saved as ROBOT.LD0 unconditionally.

5.2. Download

When downloading the ladder diagram, first HRLadder and the embedded PLC must be connected in "online" condition. Check the online button on the PLC Control Bar. If not "online", press the button to switch to "online" condition.

5.2.1. **Download selected ladder window**

This is the function to download the ladder diagram after editing while the window is currently open. If not for modular ladder programming, use this function.

(1) After selecting the ladder edit window and checking any syntax errors, press the download button from the toolbar or select [Tool – Download] menu or press [Ctrl+F5] to download the file as shown in Figure 5.1.
(When downloading the file, the syntax error for the ladder diagram is automatically checked. If there is any syntax error, the download will stop and the error detail will be displayed on the result window.)

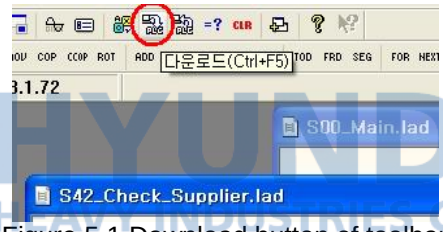


Figure 5.1 Download button of toolbar

(2) If the embedded PLC is in stopped condition, in other words "STOP" or "remote STOP" as shown in [Figure 5.2], the file will be downloaded immediately.

Figure 5.2 PLC Stopped Condition

(3) If it is not in stopped condition and is in operating condition, in other words "RUN" or "remote RUN" condition, the dialog box of [Figure 5.3] will be displayed as follows.

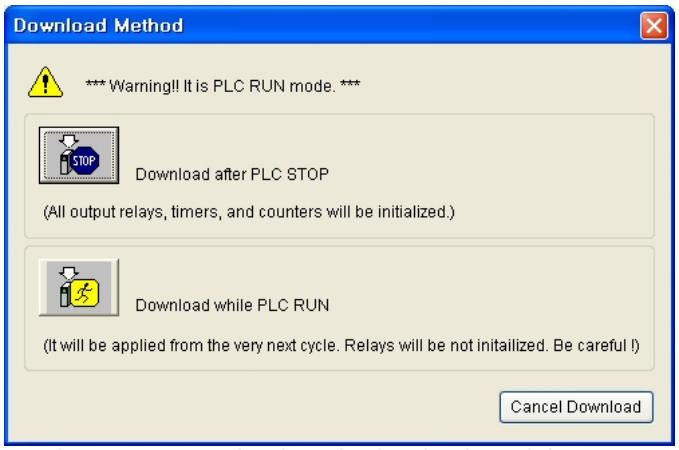


Figure 5.3 Download Method Selection Dialog Box

(4) If you select 『Download after PLC stop』, it will automatically switch the condition of the embedded PLC from “remote RUN” to “remote STOP” and then start the download. (If the embedded PLC is in “RUN” condition, an error message will be displayed because it cannot be switched to remote mode.) Because the embedded PLC is stopped, the downloaded ladder task will start the operation with all the setting initialized including the output contact point, timer and counter etc.

If the signal is disconnected, be careful of any potential object falling.

(5) When you select 『Download while PLC is running』, the file will be downloaded while the PLC is operating. But, the newly downloaded PLC ladder file will be applied from the next cycle of the PLC.

Settings, including output contact point, timer and counter, are not initialized. Therefore, you must be careful to check whether the residual ladder values have any problem with the modified ladder logic structure.

(6) If you see the success message as shown in [Figure5.4], the download process is completed. The downloaded ladder diagram will be saved as the file within the robot controller, and will operate when in “RUN” mode.

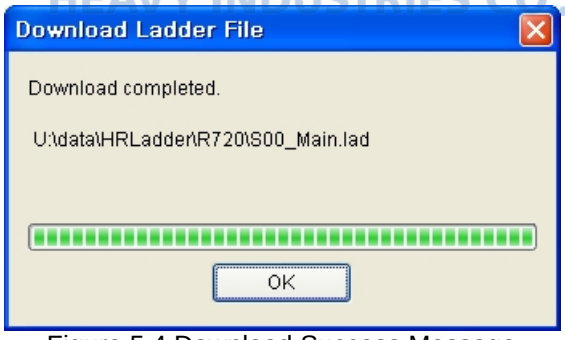


Figure 5.4 Download Success Message

5.2.2. **Download in Workspace**

This function is for modular ladder programming in Hi5 controller. (Do not use this for Hi4a.)

(1) Open the popup menu for the PC Ladders item or folder, and select “Download All” to download all the ladder files (Including sub folder) registered below the item.

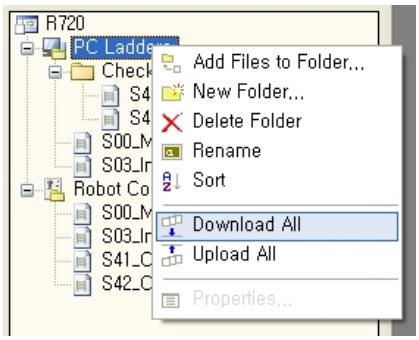


Figure 5.5 Download all

(2) Or you can select and download specific ladder files as shown in Figure 5.6.

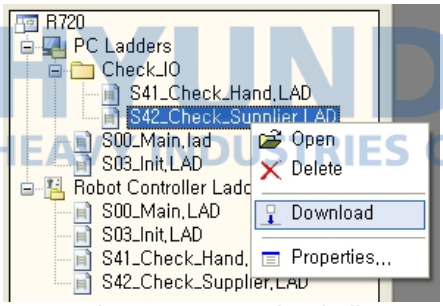


Figure 5.6 Download all

(3) In the online condition, the downloaded ladder files below the Robot Controller Ladders item of the Workspace are displayed.

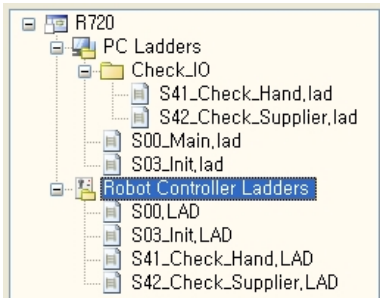


Figure 5.7 Downloaded ladder files

5.3. Upload

This is the function to receive and open the embedded PLC ladder file (ROBOT_00.LAD) of the robot controller in HRLadder.

When uploading the ladder diagram, first the HRLadder and embedded PLC must be in online condition as shown in [Figure5.5]. If not, switch to “online”.

Figure 5.8 Confirmation of Online Condition

5.3.1. **Upload main program in ladder window**

This function uploads the main ladder program of robot controller (S00.LAD for Hi5 and ROBOT.LD0 for Hi4a) to the PC and opens the ladder edit window.

(1) Click on the Upload button on the Tool Bar as shown in Figure 5.6 or use the 『Tool (T) – Upload(U)』 menu or use the function key [Ctrl+F6] to upload the file.

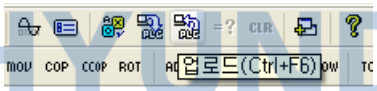


Figure 5.9 Upload Button on Tool Bar

(2) When you see the success message, it means that the upload has been successfully completed. The uploaded ladder diagram will be opened as “Noname.lad” within HRLadder.

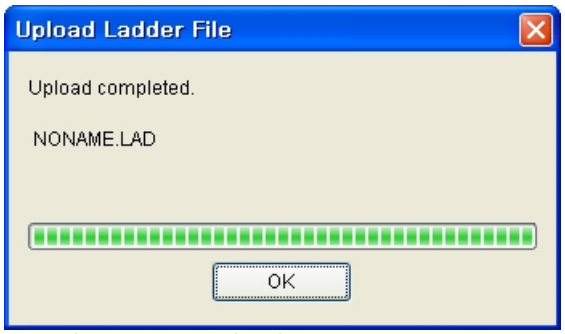


Figure 5.10 Upload Success Message

5.3.2. **Upload from Workspace**

This function is for modular ladder programming of Hi5 controller. (Do not use this for Hi4a.)

(1) Open the popup menu for the PC Ladders item or Robot Controller Ladders item and select “Upload All” to upload all ladder files of Hi5 controller. The location where the ladder files are saved is the same folder as the project folder and items of tree structure are saved below the PC Ladders.

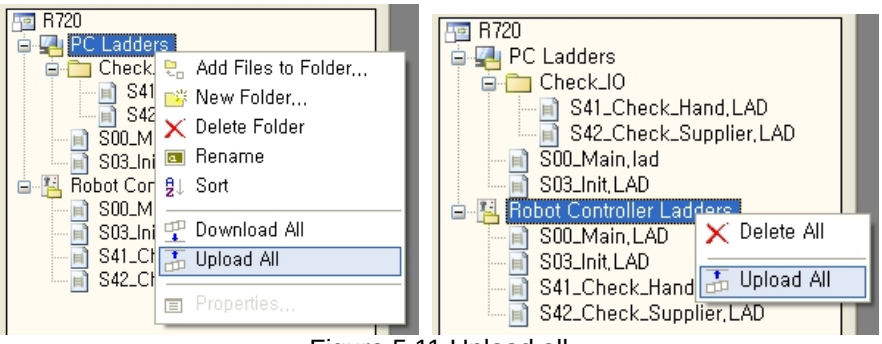


Figure 5.11 Upload all

(2) When the item already exists below the PC Ladders item, the following message box appears as shown in Figure 5.12. When you select “Yes”, the existing items will be deleted and then the uploaded items will be created. (This does not refer to deleting the actual file but the tree item.) When you select “No”, the existing item will be kept and the uploaded items will be added.

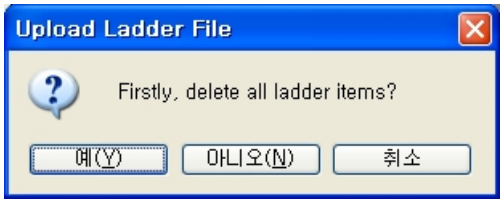


Figure 5.12 Ladder item delete confirmation message box

(3) You can “Upload All” files to a specific folder as shown in Figure 5.13.

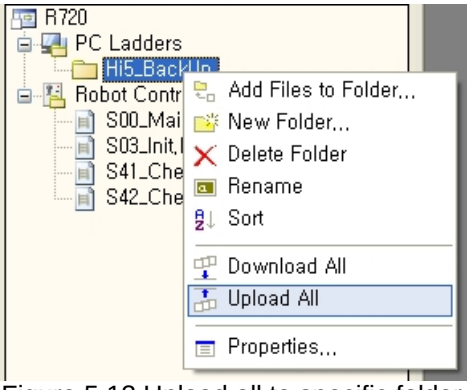


Figure 5.13 Upload all to specific folder

(4) You can upload only the selected ladder files as shown in Figure 5.14.

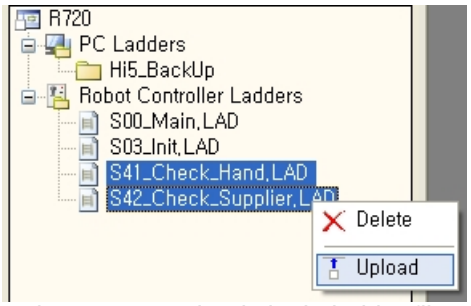


Figure 5.14 Upload single ladder file

6 Monitoring

6.1. PLC Monitoring

This is the function to use HRLadder to monitor the current relay value condition of the embedded PLC of the robot controller.

(1) As shown in [Figure6.1], the project file (*.HlPrj) must be opened. Use the 『File – New File』 instruction to create a new project file or use the 『File - Open』 instruction to open an existing project file.

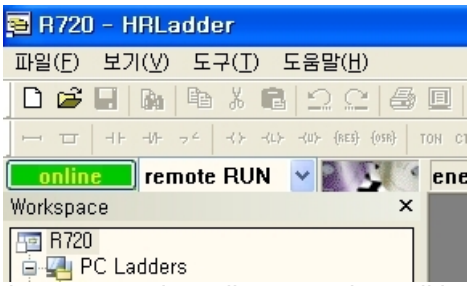
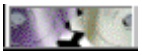


Figure 6.1 Project File Opened Condition

(2) When you press the “Online” button to switch the status to online condition, the saw-toothed wheel icon on the PLC Control Bar will start to move. When this moves, it means that the monitoring operation is working normally. [Table 6-1] describes the meaning of icons of the monitoring operation.

Table 6-1 Monitoring Image for Operating Status

Icon status	Meaning
 Separated saw-toothed wheel	Communication offline condition
 Stopped red saw-toothed wheel	Communication online condition. Communication error condition.
 Rotating saw-toothed wheel	Communication online condition. Normal communication condition.

(3) If you want to switch to “Offline” condition, press the “online” button once more time to turn it off.

(4) PLC mode list box located at the right side of the “Online” button displays the current PLC mode and can be used for remote control. In the PLC mode, there are 6 statuses as shown in [Table 6-2].

Table 6-2 Status of All PLC List Box

PLC Mode	Meaning
STOP	Ladder operation stopped. Can switch mode only with controller T/P.
RUN	Ladder operation running. Can switch mode only with controller T/P.
Remote STOP	Ladder operation stopped. Can switch mode remotely with Remote-RUN from HRLadder
Remote RUN	Ladder operation running. Can switch mode remotely with Remote –STOP from HRLadder
PLC OFF	Embedded PLC turned off. (H4a Controller dip s/w #5 OFF or Hi5 Controller application condition PLC OFF)
NO LAD	No ladder diagram in embedded PLC

(5) For example, when the embedded PLC is in “remote RUN” or “remote STOP” status, you can remotely switch the mode through the drop down list box as shown in [Figure 6.2].

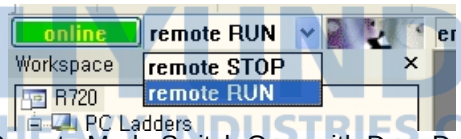


Figure 6.2 Remote Mode Switch Over with Drop Down List Box

(6) In other cases, it cannot be switched remotely. PLC status list box only shows the current status and does not allow any user operation as shown in [Figure 6.3].

Figure 6.3 Remote Mode Switch Over Disabled Drop Down List Box

(7) Click on the tab located at the bottom of the screen as shown in Figure 6.4 to display the monitoring window. Open the relay type dropdown list box at the top of the monitoring window and select the type to display the relay value.

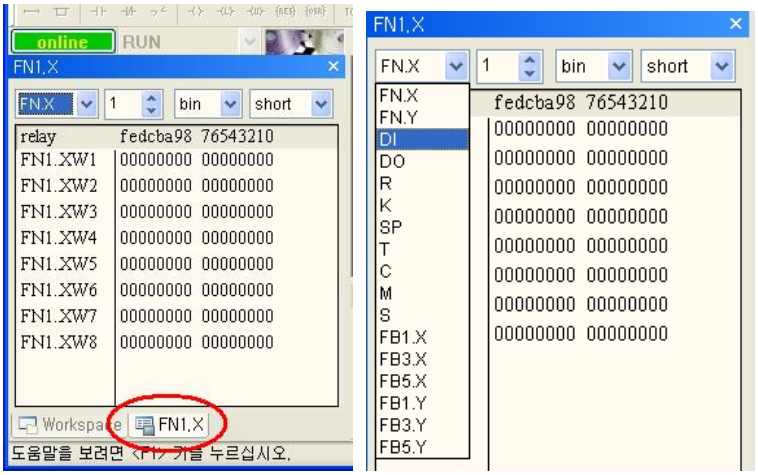


Figure 6.4 Select Relay Type to Monitor

(8) As shown in [Figure6.5], you can open the drop down list box of bit type at the top of the monitoring window to select which type to display the relay value. You can select from bin (Binary), dec (Decimal) and hex (Hexa Decimal) and you can select from 3 types of short, long and float.

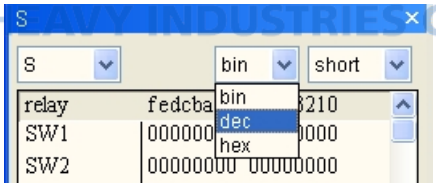


Figure 6.5 Select Antilogarithm Expression for Monitoring

(9) When you select FN.X or FN.Y, the control to select the number of FN object is displayed. Type in the number or click on the Spin button (or operate the mouse wheel) to select the FN object.

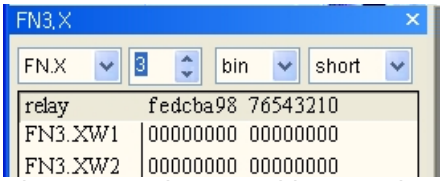


Figure 6.6 Select FN Object Number

(10) When you want to view several relay types simultaneously, open several windows open. When you select “View (V) –Monitoring” window item from the main menu or click on the tool button , another monitoring window will appear. Appropriately adjust the location and size and set the relay type dropdown list box.

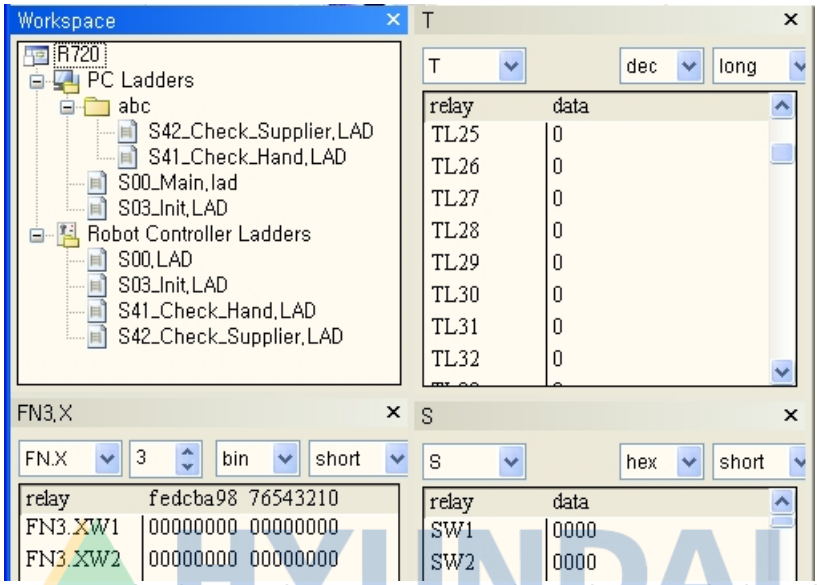


Figure 6.7 Example of Appropriate Arrangement of Opening 4 Monitoring Windows

(11) The relay status is also displayed on the ladder diagram symbol during the monitoring operation. As shown in [Figure6.8], the symbol of “DO18, DO17, DO21” is displayed as short and bold horizontal line, which means that it is activated. Symbol of “DO21” is “XIO (B contact point)”, which means that the “DO21” signal is turned off.

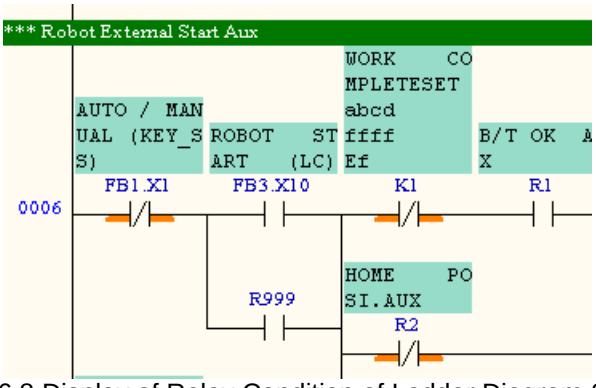


Figure 6.8 Display of Relay Condition of Ladder Diagram Symbol

(12) For the box type instruction, the current relay value is displayed in purple below the operand as shown in [Figure 6.9].

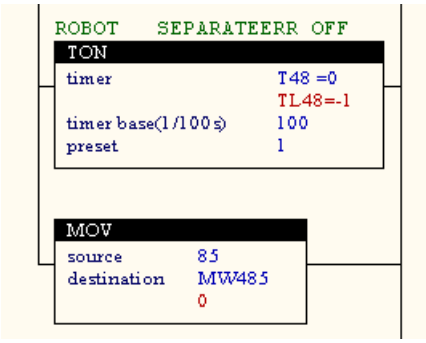


Figure 6.9 Display of Relay Condition of Box Type Instruction

(13) If the embedded PLC is in Stop condition, the monitoring value of operand is not displayed. Also if the ladder diagram is different from the file downloaded from the embedded PLC, the following display of Figure 6.10 appears on the top right corner of the ladder window and the monitoring value of operand is not displayed. That is, only when the ladder is the same as the currently executed ladder, you can analyze the operation of the ladder while viewing the monitoring value of each operand.
(If only the comments are different, it is considered to be the same ladder file.)

The display can disappear as time goes by. If you want to check again, press the F5 key.

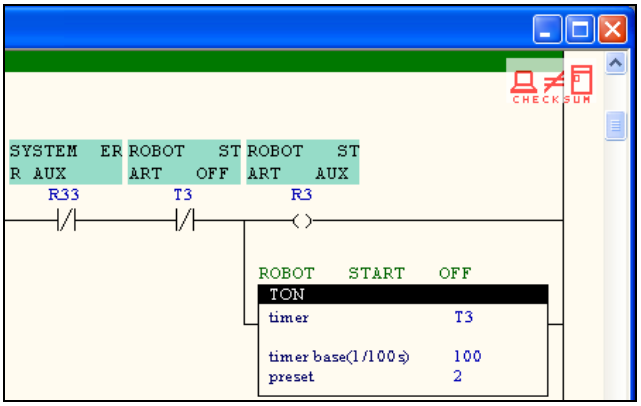


Figure 6.10 When Content of Ladder Window is Different From That of Embedded PLC

(14) If you click on the check sum not equal icon at the top right corner of the ladder window and click on 'Yes' for the message box as shown in [Figure 6.11], the monitoring value can be displayed by force.

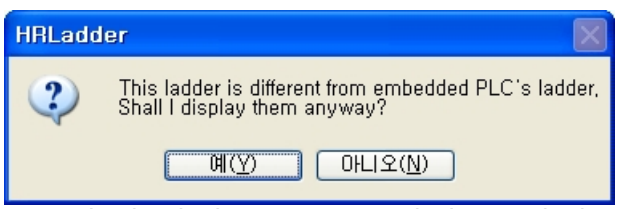


Figure 6.11 Check Whether to Force to Display Monitoring Value

(15) HRLadder continuously received large amount of monitoring information through the communication cable form the controller. Therefore the refreshing speed of the monitoring information may not feel satisfactory. In order to accelerate the refreshing speed, increase the baudrate in the RS-232C setting. (The setting of the controller must also be adjusted as well.)

Another method is to keep only the relay type that you need to monitor and to disable the monitoring for the other types. When you select 『Tool (T) – Option (O)』 menu, the following dialog box show in [Figure6.12] will be displayed. Only the relay types checked will be monitored. Uncheck any relay types that do not require monitoring. You can gain significant improvements in speed by excluding large scale relay types including “RW” or “KW, TW, CW, DMW, SMW”. For “CW, DMW, SMW”, you can limit the number of data in the edit box on the right side of the check box to improve the communication speed. For the “FB” object, select only the “FB” of the channel in use to improve the communication speed.

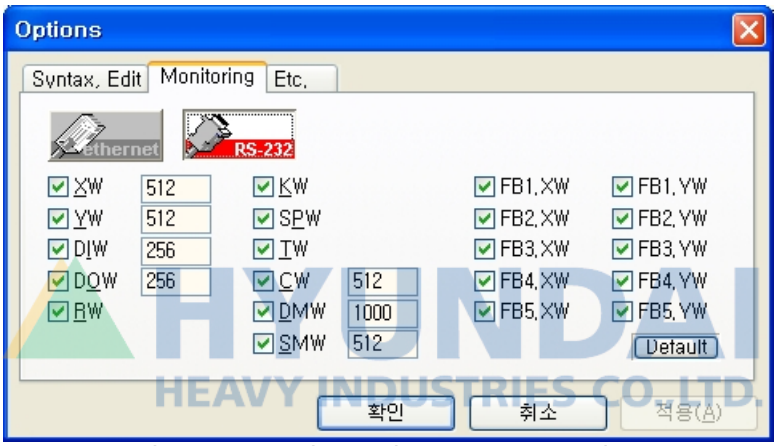


Figure 6.12 Select Relay Range to Monitor

6.2. Reset All Relays

Reset All Relays function is the function to initialize the relay values of all the embedded PLCs in HRLadder to “0”.

To use this function, the following conditions must be satisfied.

(1) Project file (*.hpp) must be opened and in “ONLINE” status.

(2) Embedded PLC must be turned on and in “STOP”, “remote STOP” or “NO LAD (No ladder file)” condition.

Click on the Reset All Relays Tool button on the Tool Bar as shown in [Figure 6.13]. Or select 『Tool – Clear All Relays』 from the menu.

Figure 6.13 Select Relay Range to Monitor

(3) When you see the following warning message, click on “Yes”.

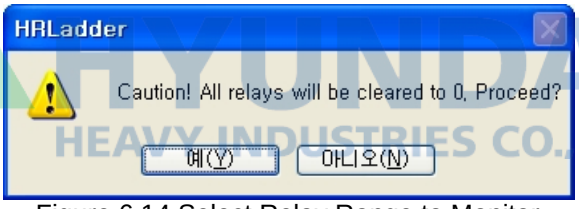


Figure 6.14 Select Relay Range to Monitor

(4) When successful, the following completion message will be displayed.

Figure 6.15 Select Relay Range to Monitor

6.3. Manual Output

With this function, you can set the relay value of Hi5 controller remotely via Ethernet. (It doesn't support Hi4a controller or RS-232C.) In order to activate this function, the project file (*.hpp) have to be open, and be ONLINE state.

Click the manual output button on toolbar, as figure 6.16.

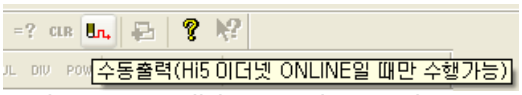


Figure 6.16 Click manual output button

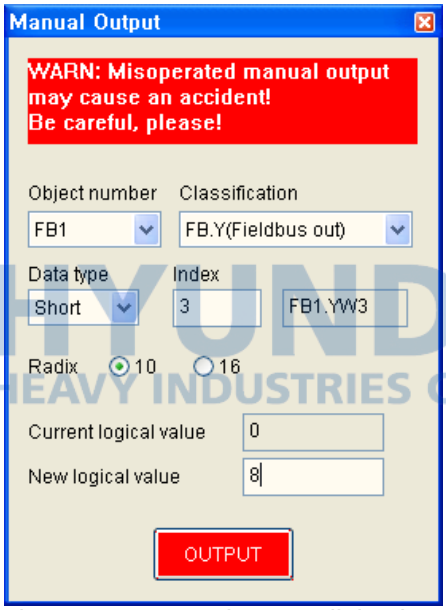


Figure 6.17 Manual output dialog box

Input object number, classification, data type, index, then the relay name is displayed on the right side of index.
If you select radix, you can check the current logical value of the relay. Input new logical value you want, and click OUTPUT button, then the relay value is set remotely.

Table 6-3 Manual output dialogue box

Item	Description
Object No.	If the relay type is Y, select the FN object number (1~64); if the relay type is FB.Y, select the FB object number (1, 3, 5). Object numbers are not used in the case of other relay types (they are inactivated).
Type	Select the relay number among Y, DO, K, T, C, M, S, etc.
Data type	Select one of the types of Bit (1bit), Char (1byte), Short (2byte), and Long (4byte).
Index	Input the index number of the relay.
Antilogarithm	Select whether to convert the current and new logic values into the decimal or hexadecimal number.
Current logic value	Display the current relay value. (It is a logic value, not a physical value. That is, in the case of the output, it is the value before the negative logic was applied.)
New logic value	Input the new applicable value when clicking the output button.

6.4. Status Bar Information

(1) A shown in [Figure6.18], the Status Bar located at the bottom of HRLadder partially provides the information of the operating condition f the embedded PLC. (This information is only displayed when the embedded PLC is in RUN or remote RUN condition.) The meaning is described in Table 6-3.

Figure 6.18 Embedded PLC Operating Condition Information on Status Bar

Table 6-4 Meaning of Embedded PLC Operating Condition Information on Status Bar

mon.time (monitoring time)	Frequency of relay value monitoring
scan time	Operating repeat frequency of entire ladder task Current value, maximum value, average value
occu (occupation)	Ratio within frequency unit
n steps	Number of steps (instructions) of entire ladder task

(2) The frequency unit of the Hi5 Controller is 5ms. If the frequency exceeds 5ms, the scan time will increase by 5ms as shown in [Table 6-5]. Roughly about 1,700 steps would exceed the 20ms. (Based on Hi5 main board S/W version 30.11-00)

Table 6-5 Relationship Between Ladder Processing Time and Processing Frequency

(Ladder processing time) < 5ms	Repeatedly execute the ladder task every 5ms.
5ms < (Ladder processing time) < 10ms	Repeatedly execute the ladder task every 10ms.
10ms < (Ladder processing time) < 15ms	Repeatedly execute the ladder task every 15ms.
....	……

(3) When the ladder task takes the long time and exceeds the set scan time, some PLCs will not execute the instruction of exceeded time and ignore that operation. This is called the Fixed Scan Time Method.

(4) Embedded PLC uses the Variable Scan Time Method. Therefore when the ladder task exceeds the preset scan time, the scan time will be increased by 5ms.

(5) [Figure6.19] shows the concept of occu. and is an example of when the required time of the ladder task exceeds the 5ms. Therefore the scan time becomes 10ms. Based on the 40% value of occu. you can see that there is still some room to reach scan time of 15ms.

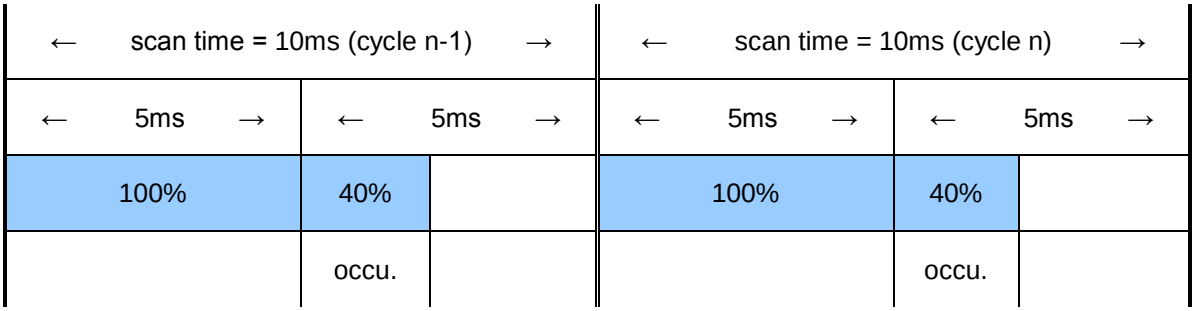


Figure 6.19 Example of occu. Concept

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