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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

Teach Pendant Sharing

HYUNDAI
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1 Overview

1.1. Requirements

The following knowledge is necessary to understand this manual

- Basic operation method of Hyundai Hi5 robot controller
- How to use the functions of cooperation control.

The Hi5 controller software version should be V32.11-00 or a later one.

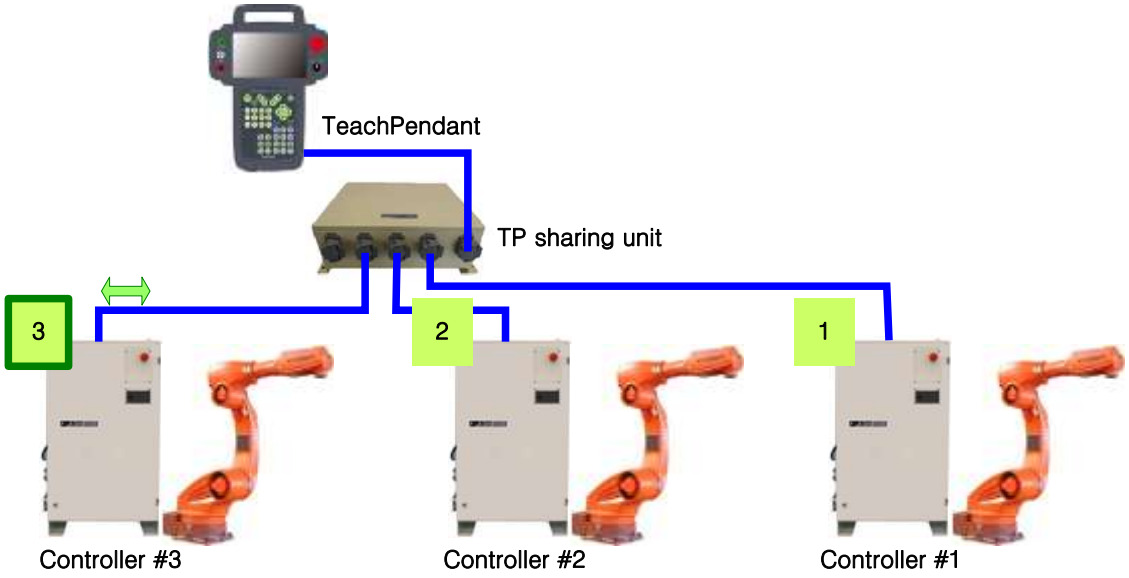
1.2. About the teach pendant sharing function

The teach pendant sharing function is for the common use of one teach pendant (TP510) by connecting it to the main bodies of multiple Hi5 robot controllers. The robot controllers could be a real Hi5 controller or a virtual Hi5 controller brought up on the HRspace3 software on a PC. The main purposes of the sharing function are as follows:

- Batch operation of the robot cooperation control system
- Use of a real teach pendant instead of a virtual teach pendant on HRSpace3

This manual explains about the first purpose.
For the second purpose, it is required to refer to "7.4 Real Teach Pendant" of the HRSpace3 function manual.

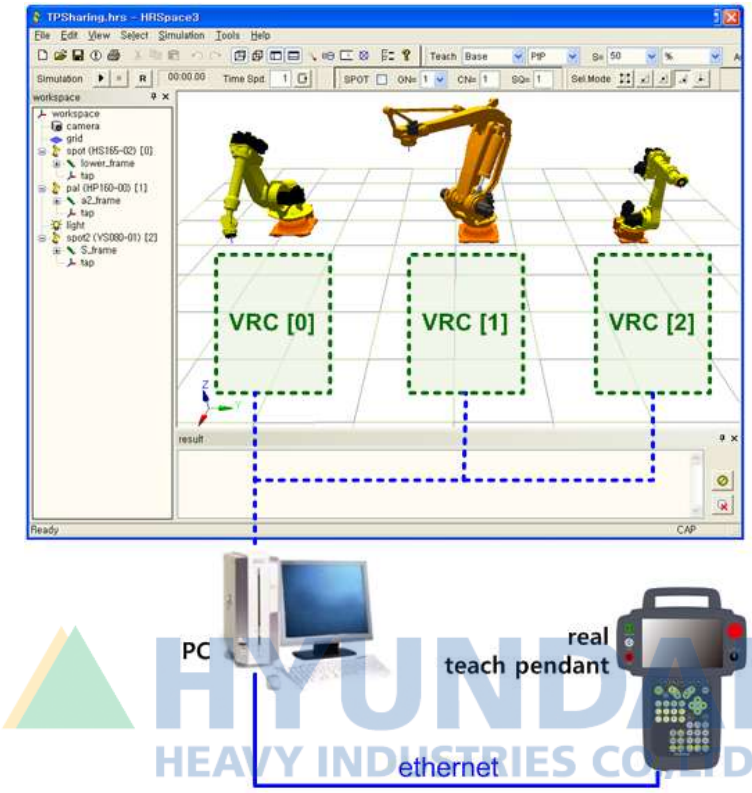
1) Batch operation of the robot cooperation control system



When operating a cooperation control system, it is required to operate multiple cooperation controlled robots, which are connected in a synchronized manner, alternately or overall. It would be more convenient to control the whole system through one teach pendant rather than using individual teach pendants that are connected to individual controllers.

In order to use this function, it is needed to have a TP sharing unit that includes an Ethernet hub and wirings for emergency and enable buttons. There should also be a preparatory process of assigning IDs for individual robot controller.

2) Use of a real teach pendant instead of a virtual teach pendant of HRSpace3



HRSpace3, a Hyundai robot simulation software contains a Hi5 VRC (Virtual Robot Controller) and a virtual teach pendant. The virtual teach pendant is almost similar to a real one. However, it is inconvenient to operate the virtual teach pendant because users need to click the keypad using a mouse. It also lacks the sense of reality. In addition, it occupies a large section of the screen of a PC, it would somewhat cause interference with using HRSpace3.

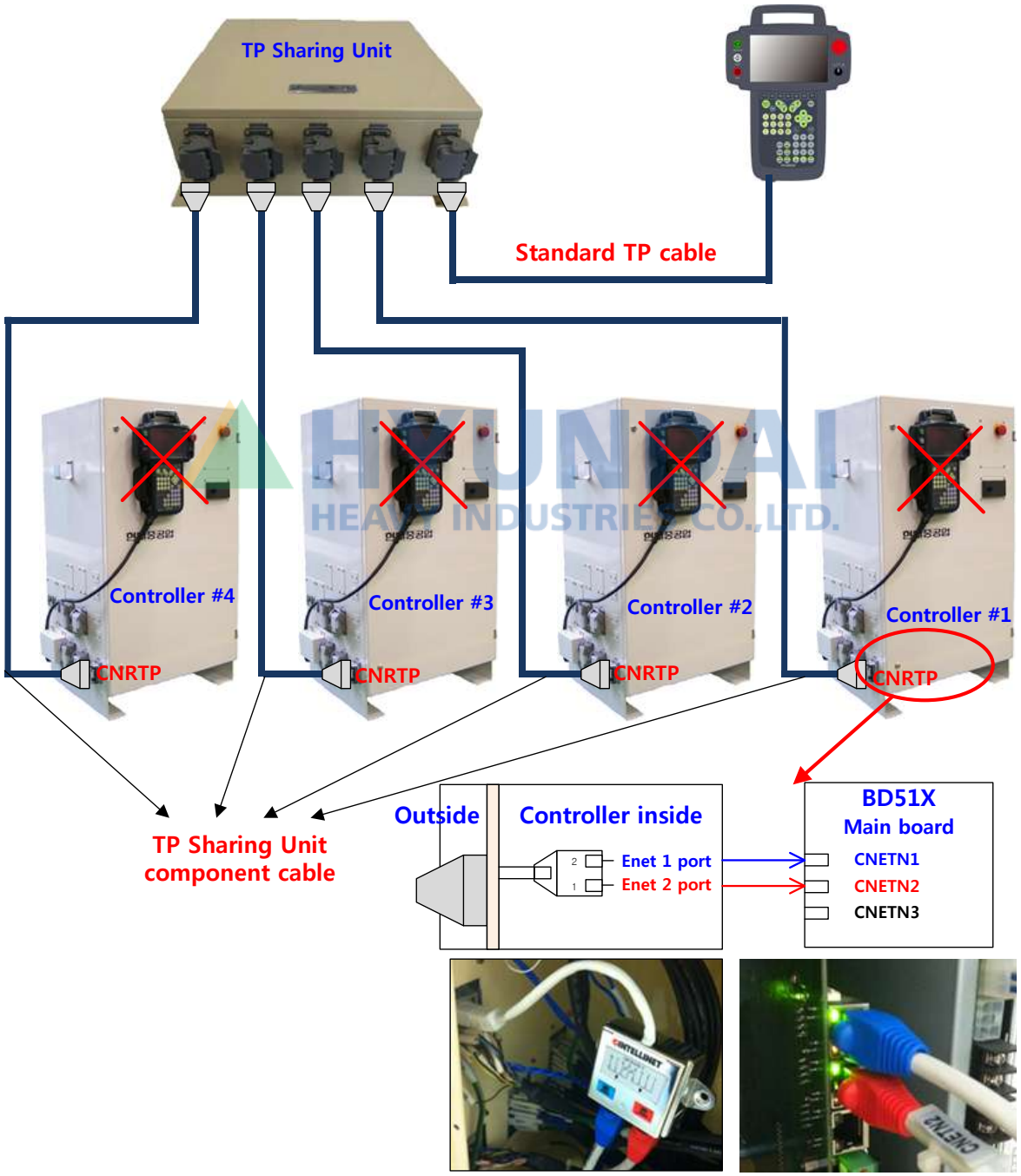
Using the teach pendant sharing function makes it possible to use a real teach pendant by connecting it to a PC through the Ethernet. Using it is advantageous because it does not occupy a section of the screen of a PC. A professional user of a real teach pendant would learn fast about how to operate HRSpace3. As using the sharing function provides users with the real-like sense of operating a robot at a site, the function is also useful for the training of users by Hyundai. Even when there are multiple robot models in HRSpace3, it is still possible to operate a desired robot by connecting to the desired robot.

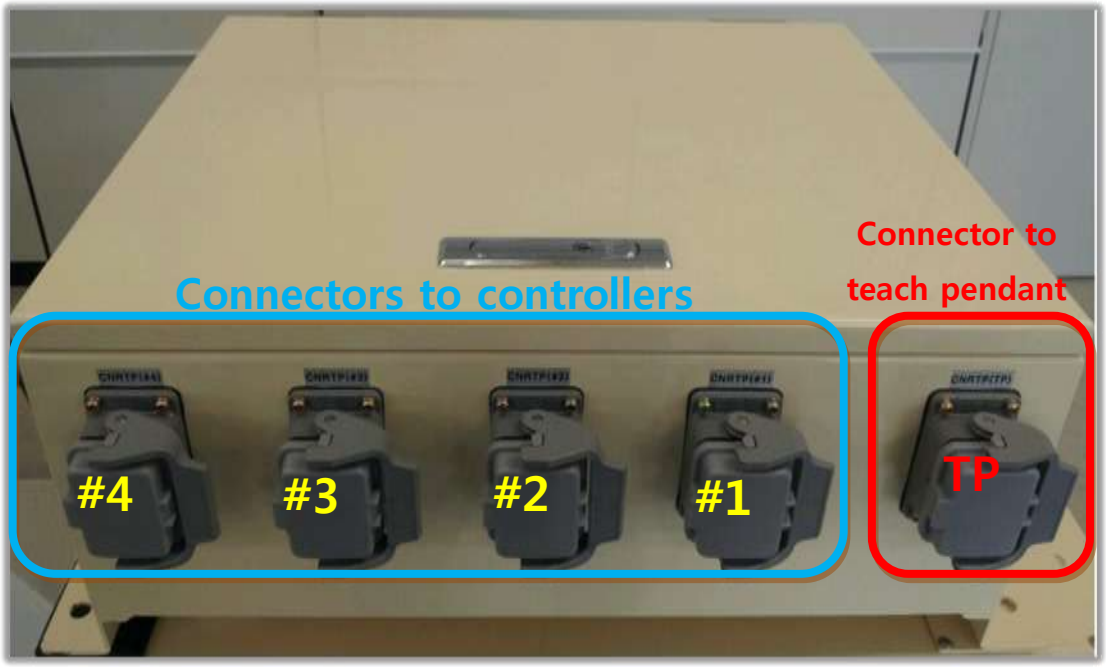
2
Preparations for use

2.1. Hardware installation

Individual teach pendants need to be connected to corresponding controllers through the teach pendant sharing unit.

The following shows the overall configuration that uses the sharing unit.





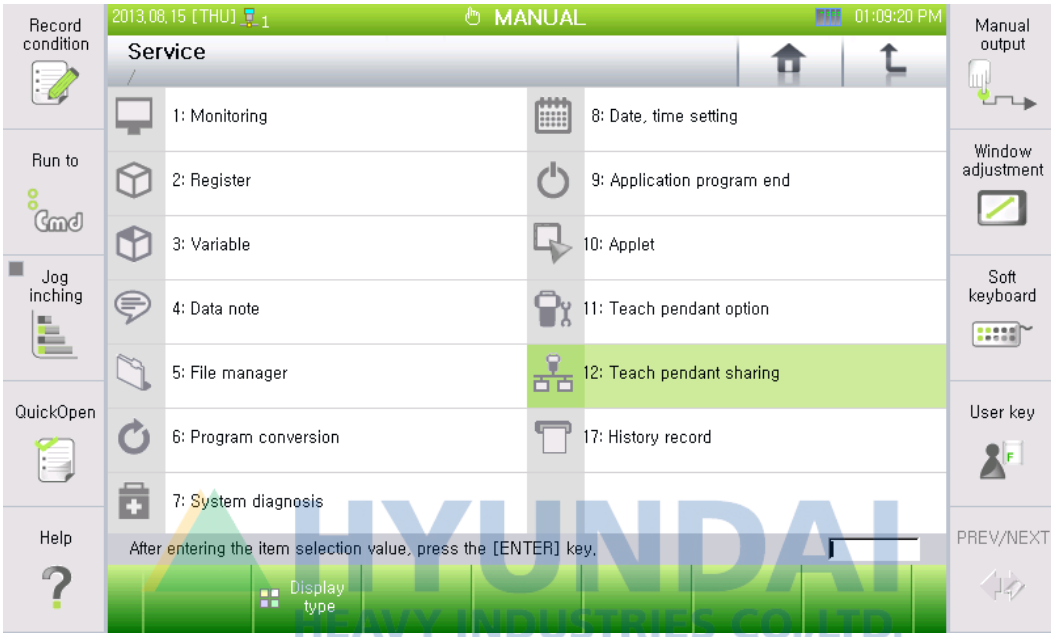
The following shows the detailed sequence for connecting hardware.

1. Connect a teach pendant that is to be shared to the TP connector at the right side of the above figure.
2. Make a connection between the TP connector of the #1 controller and the #1 connector on the above figure by using the connection cable that is a component of the sharing unit.
   The sharing unit connection cable has the same specification of the general TP cable. Both ends are in the form of being connected to the teach pendant connectors.
3. The Ethernet divider at the teach pendant connection cable section inside the controller needs to be used to connect the Ethernet for the teach pendant and the Ethernet for the cooperation control individually to the main board (refer to the figure)
4. Power on the controller and the TP sharing unit, and execute the ‘function setting and ID assignment’ process.

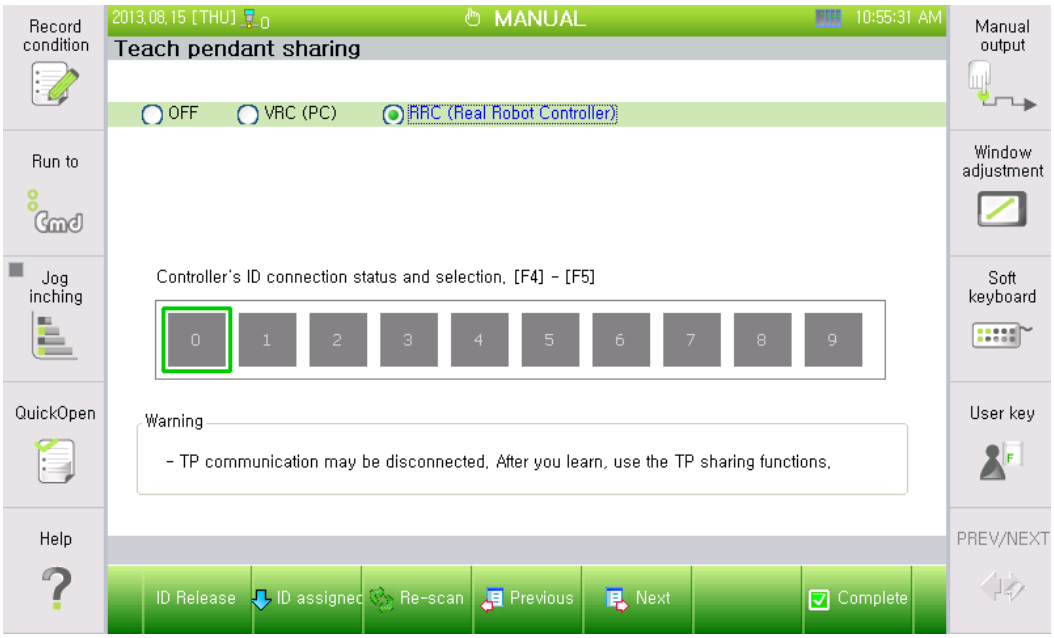
2.2. Function setting and ID assignment

As described in 2.1, only the #1 controller should have the connection with the Ethernet connector.

Select 『[F1]: Service』 - 『12: Teach pendant sharing』.

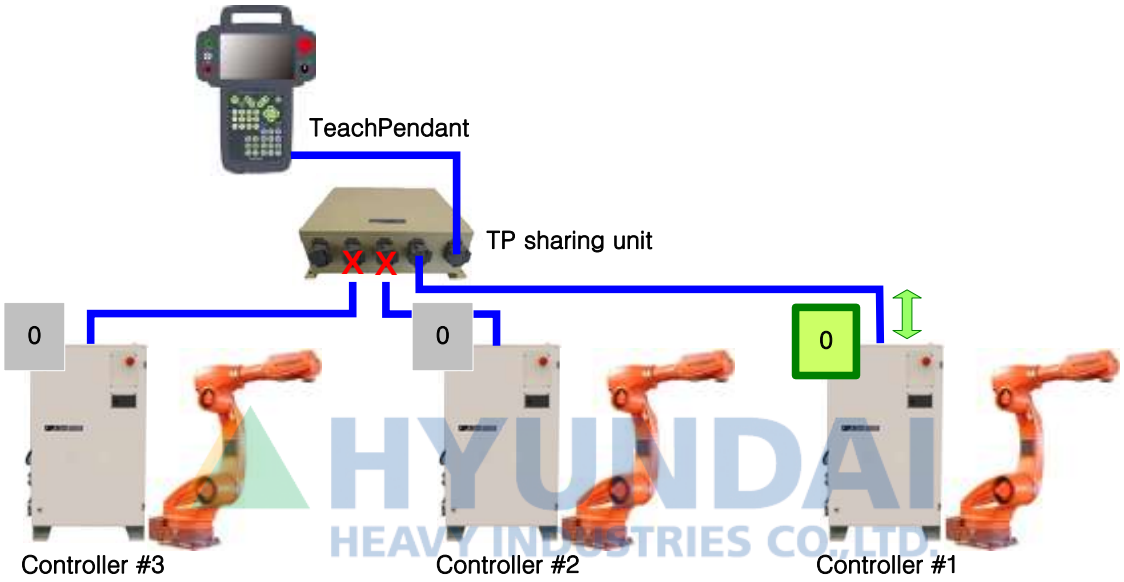


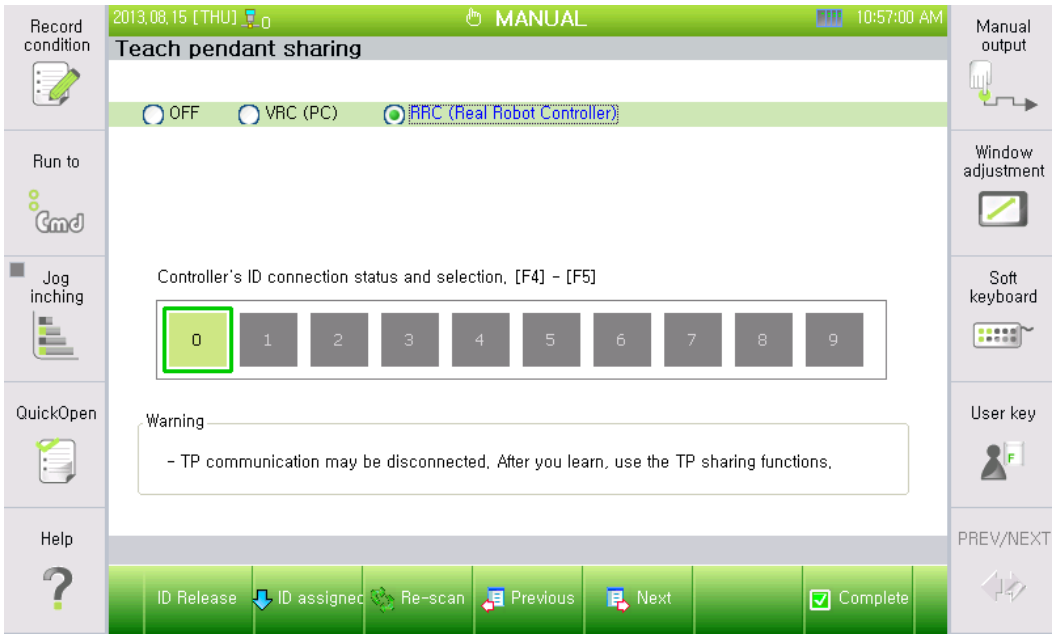
Select RRC (Real Robot Controller)



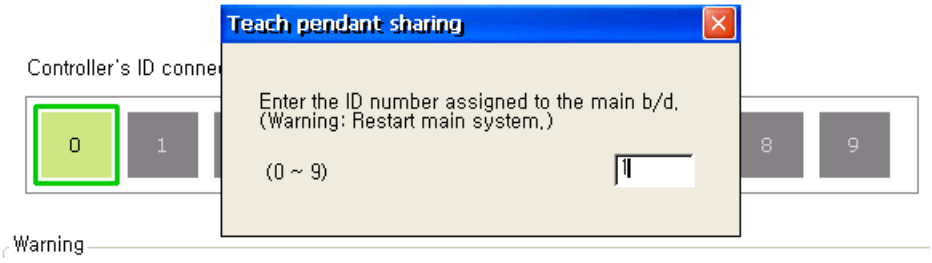
When it comes to the ID connection status of individual controllers, the turned on light green rectangle signifies that the corresponding controller is recognized, while the turned off gray rectangle means that its corresponding controller is not recognized. Individual unique IDs need to be assigned when connecting individual controllers one by one.

Currently, as shown in the below figure, all the controllers have ID 0 as the initial value. Clicking the 『[F3]: Re-scan』 key will turn on ID 0. It is that the ID 0 of the #1 controller is recognized by the teach pendant because only the #1 controller have the Ethernet connector connected.

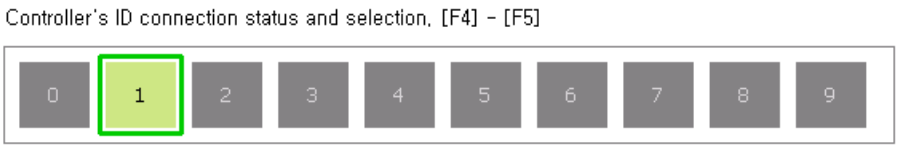




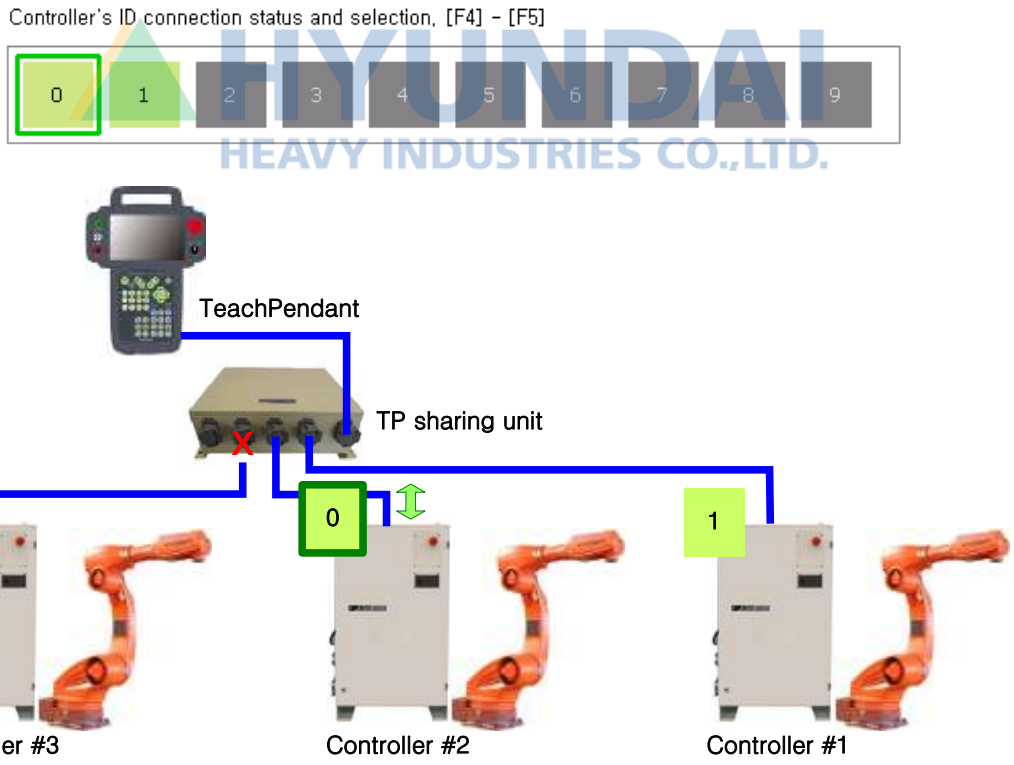
Let's try to assign ID 1 for the #1 controller. Clicking the『[F2]: ID assigned』 key will bring up a dialogue window to enter an ID number. Then, click 1 and then [Enter], ID 1 will be set for the controller #1. As the #1 controller will be rebooted automatically, users need to wait for a while.



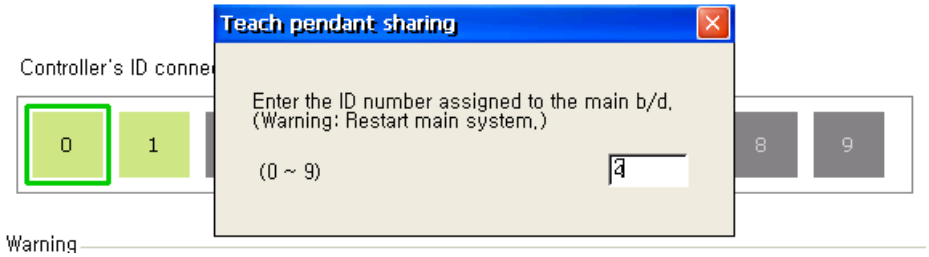
After the rebooting, clicking 『[F3]: Re-scan』 key will help check that ID 1 exists on the network.



Next, let's try to assign ID 2 for the #2 controller. It is required to have the Ethernet connection additionally for the #2 controller. Clicking 『[F3]: Re-scan』 key will help recognize ID 0 as the initial value of the #2 controller. The current status is as shown below.

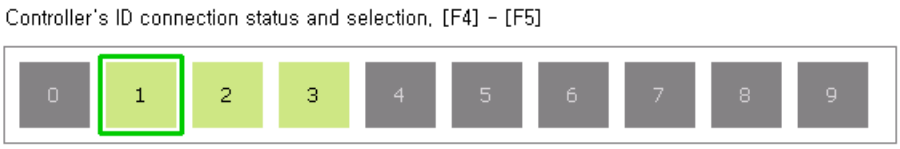


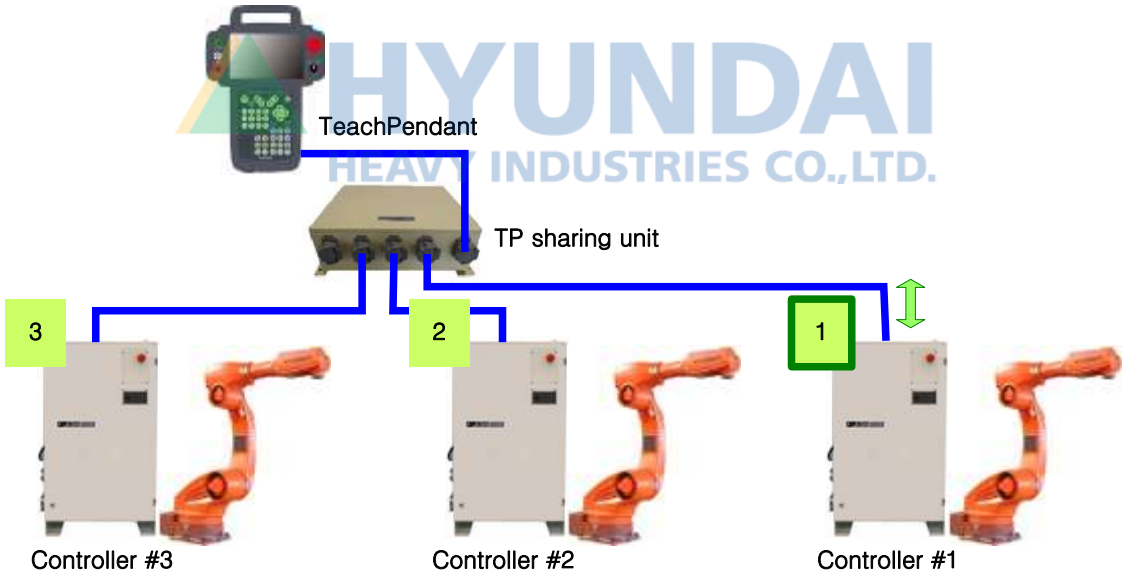
Place the cursor on '0' and click the 『[F2]: ID assigned』 key and then enter 2 into the dialogue window and click [Enter]. Then, ID 2 will be set for the #2 controller.



Wait for a while to allow the #2 controller to be rebooted automatically.

Set individual unique IDs for all the connected controllers by applying the same procedure. When the setting is completed, it is required to connect all the connectors through the Ethernet, and then click the 『[F3]: Re-scan』. All the set IDs are turned on, the preparatory work is completed.





Lastly, it is required to click the 『[F7]: Complete』 key to save that RRC is selected, the setting process will be completed.

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3
How to use

3.1. Dialogue box for teach pendant sharing

When the teach pendant sharing function is turned on, a small teach pendant icon and a number together will be indicated on the left side of the title bar on the top of the screen.

The number is the ID number of the controller that is connected to the teach pendant currently. In order to connect it to other controller, it is required to click [SHIFT]+[5] button to open up a dialogue box for sharing the teach pendant.

The content of the dialogue box is similar to that of the teach pendant sharing function setting screen. The rectangle in light green show the ID of the controller recognized on the network. The outline in dark green is the connection cursor that represents the currently connected controller. It is possible to shift the connection cursor to the desired ID by clicking one of the [0] ~ [9] keys on the keypad. It is also possible to move the cursor in the left or right direction by using the left and right arrows. Shifting can be performed also by touching the desired ID directly on the screen.

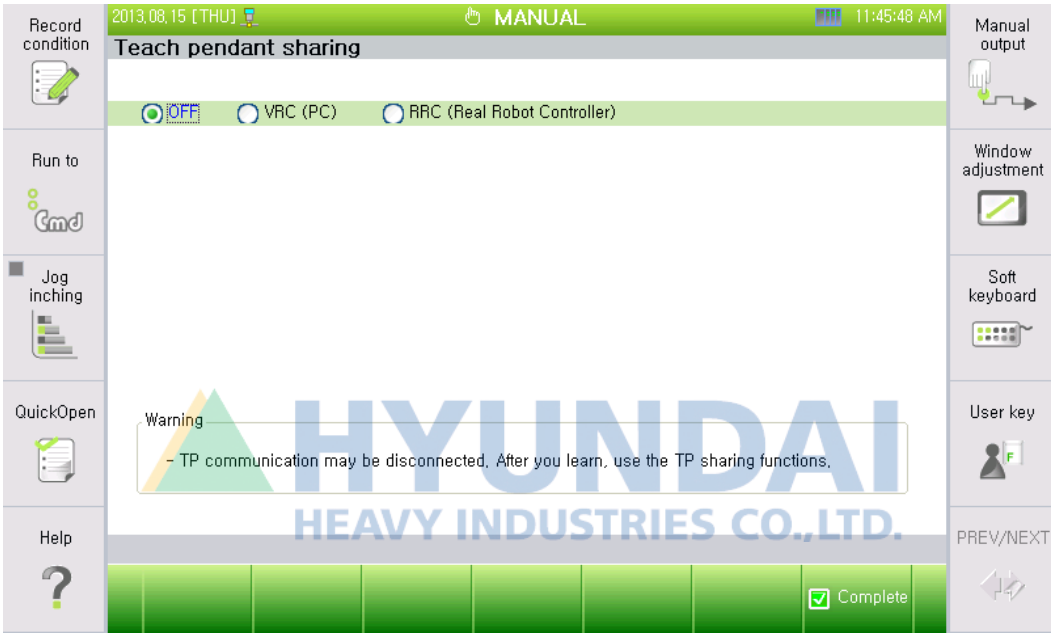
When the connection cursor moves to other ID number, the teach pendant displays the relevant ID on the title bar and shows the screen of the connected controller. Clicking the [ESC] key will close the sharing dialogue window.

The operation of the emergency key and robot enable switch can be carried out for all controllers, while the operation of other functions of the teach pendant can be performed only through the currently connected controller.

3.2. How to remove the installed function

When the teach pendant sharing function is not to be used any longer, the ID numbers assigned to individual controllers need to be set as '0' which is the initial value.

Select 『[F1]: Service』 – 『12: Teach pendant sharing』. Select all the IDs that are turned on in light green by using the connection cursor, and then click the 『[F1]: ID release』. Lastly, change the setting into the 'off' state in RRC and click the 『[F7]: Complete』 key to save the setting.



Now, it is required to power off all the controllers and remove the teach pendant sharing hardware. Then install each teach pendant to each controller cabinet.

Reference

The ID numbers of individual controllers are to be saved in the Teach Pendant Sharing section in the #003 User Parameter section of the ROBOT.CON file. When the TP sharing function is set, it has the values of 0~9 and, while the sharing function is not set, it has the value of 255. If a specific controller is not connected well to the TP, it is required to check the value of the ROBOT.CON file through HRview. If the value is wrong, it is required to correct it using the text editor and copy it to the relevant controller and power off and then on again.

#003 User parameter

{Skipped}

-Teach pendant sharing=255

#004 Control environment setting

4

Batch operation of the robot cooperation control system

4.1. Specification for the batch operation of the cooperation control system

A cooperation control system consists of 1 master system and 1~3 slave systems.
In general, cooperation control system for each system is connected to the teach pendant. But, if you use this function, one teach pendant can control the system.

The following shows the conditions for the batch operation of the cooperation control system.

1. The manual mode cooperation control status of the controller that is connected to the teach pendant is set as 'Master'
2. The manual mode cooperation control status of the controller that is disconnected from the teach pendant is set as 'Slave'
3. When the teach pendant is connected to a controller that is set as 'Slave', it is only possible to operate the relevant system alone.

The following table can be performed in a batch operation is a list of the button.

Button names	Button icons	Explanation
Motor On		Button used to supply Servo power to the motor in each axis of Robot. If becoming [MOTOR ON] status by pressing this button, the [MOTOR ON] lamp flickers in Manual mode, and the [MOTOR ON] lamp turns on in AUTO mode.
Start		Button used to automatically operate created program. If AUTO operation of Robot is started, the [START] lamp turns on and the [STOP] lamp turns off.
Stop		Used to temporarily stop Robot during AUTO operation. If Robot stop, the [STOP] lamp turns on and the [START] lamp turns off. When the robot stops, there is no risk of colliding with other devices because it stops on the originally planned path.
Select		This is the switch to change among (REMOTE), (AUTO) and (MANUAL) mode. In the REMOTE mode, the mode is decided by the MANUAL mode and AUTO mode signal of the input allocation signal.
Emergency Stop		Used in emergent status where there is risk that Robot may collide against peripheral units during operation. This is button for Motor Off breaking Servo power to Robot motor and the [MOTOR ON] lamp turns Off. **※ This button is for the batch operation regardless of settings.**
Step Forward/ Backward		This button is for bringing forward or backward the job program in the manual mode by the unit of individual commands, steps, or programs.

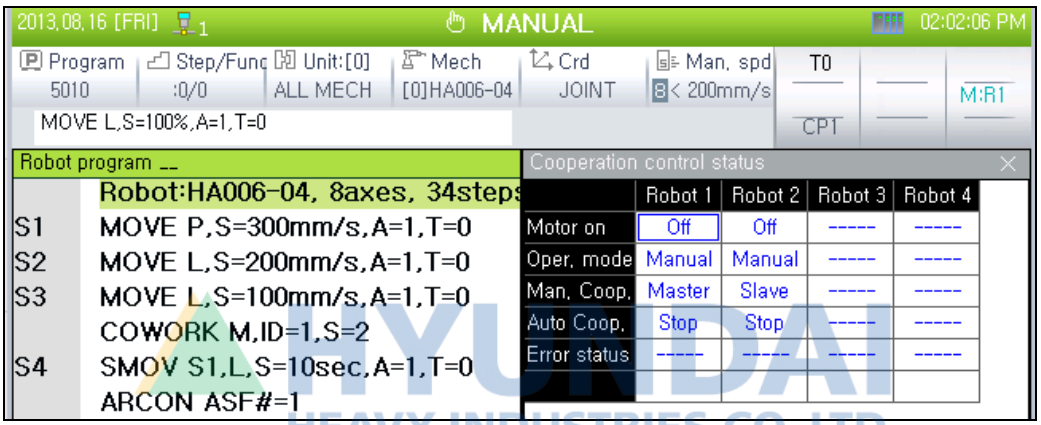
The following conditions should be in place to meet the conditions for the batch operation.

1. TP needs to be connected to a robot that is to be operated as a mater robot.

2. The manual mode cooperation control status of the master robot needs to be set as “master”

   A. The manual mode cooperation control status can be set by entering [R..]+[351] and then enter 0~3. Enter 1 for setting a controller as a master.
   (0: Individual, 1: Master, 2: Slave, 3: CMOV record mode)

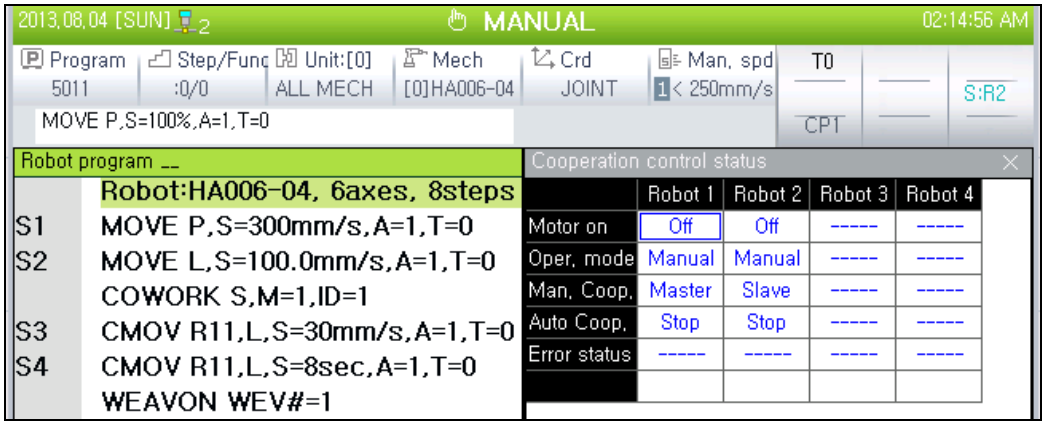
   B. If the setting is carried out normally, the current manual mode cooperation control status will be displayed on the top right section of the teach pendant.



3. The manual mode cooperation control status of the slave robot that is to be operated through the batch operation needs to be set as ‘Slave’

   A. Enter [R..]+[351], and then enter 2 to set the manual mode cooperation control status as ‘Slave’.

   B. If the setting is carried out normally, the current manual mode cooperation control status will be displayed on the top right section of the teach pendant.

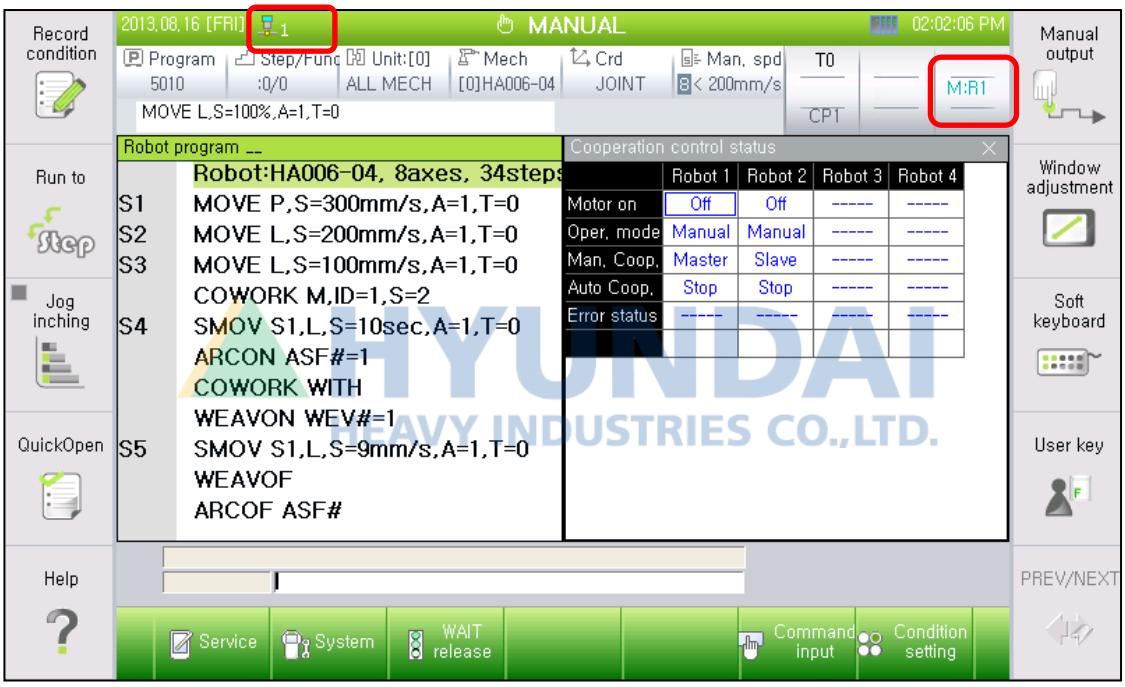


4.2. Example of the batch operation of the cooperation control system

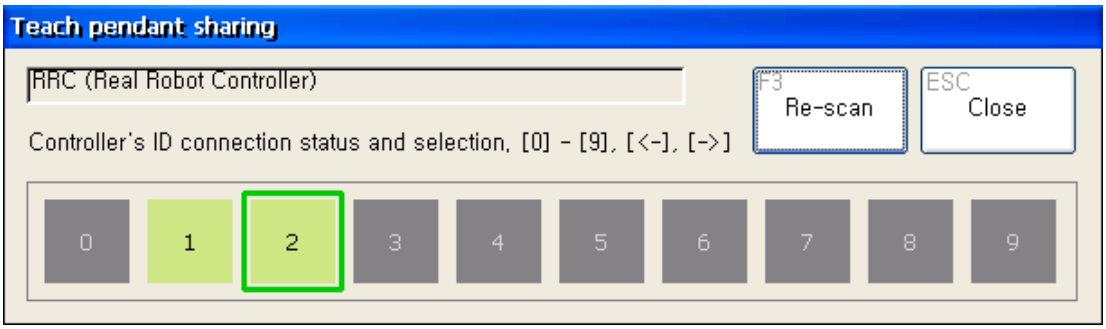
The following shows an example of the operation based on the teach pendant sharing function in a cooperation control system that uses 2 robots.

The following explains only about the batch operation assuming that the settings of the network (HiNet) and common coordinates for the cooperation control are completed already.

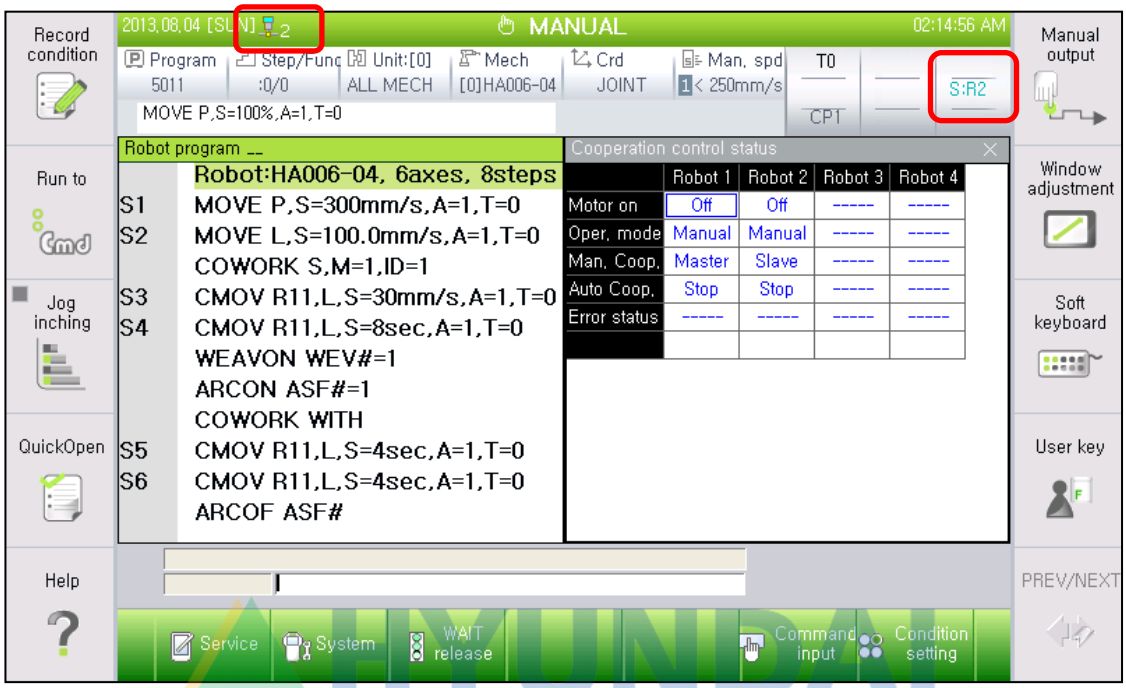
Eneter [R..]+351 for the #1 robot (Master), and then enter 1 to set the manual mode cooperation control status as ‘Master’.



Click [Shift]+5 to change the teach pendant connection to the #2 robot that is to be used as ‘Slave’.

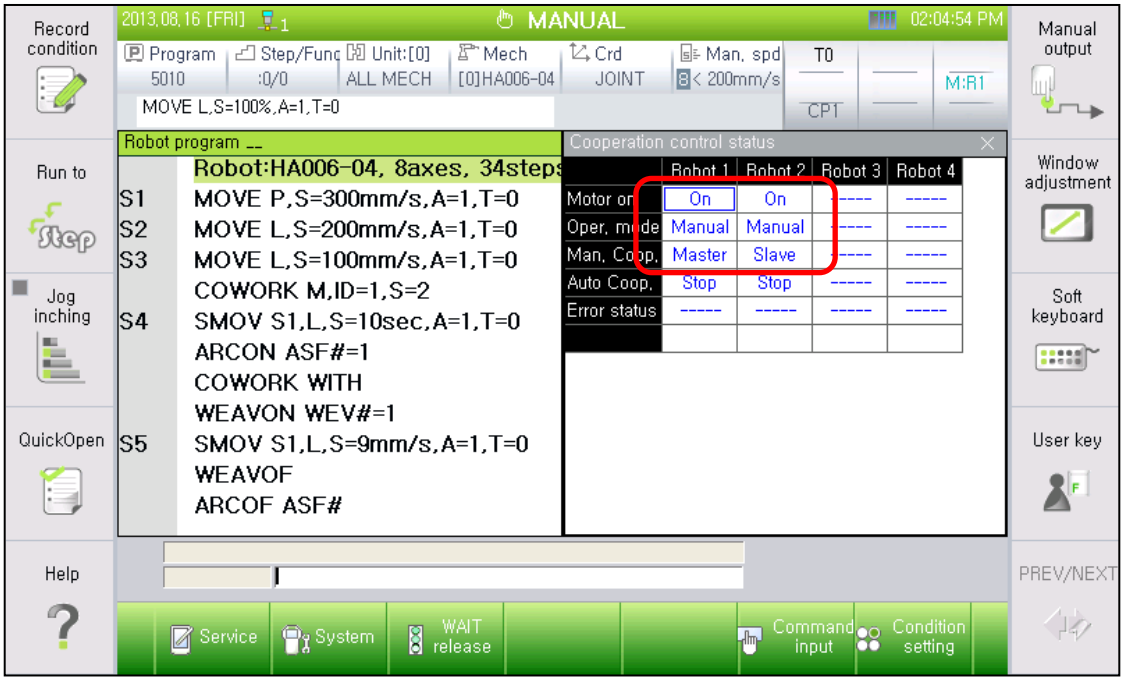


Eneter [R..]+351 for the #2 robot (Slave) then enter 2 to set the manual mode cooperation control status as ‘Slave’

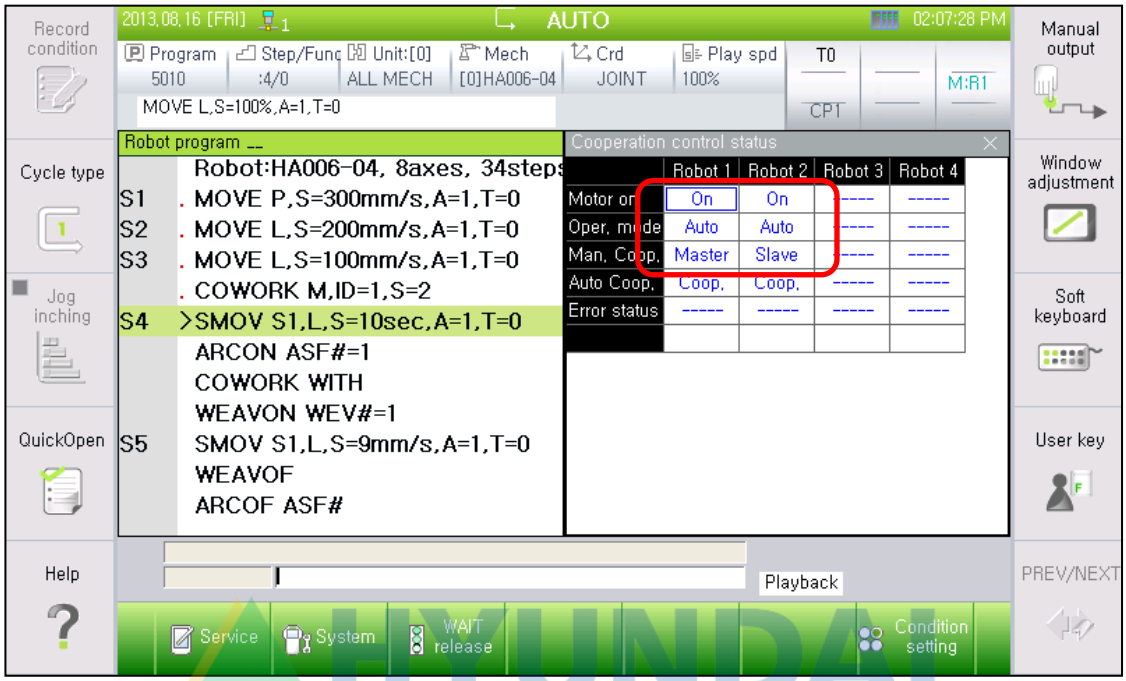


Click [Shift]+5 again to change the teach pendant connection to the #1 robot.

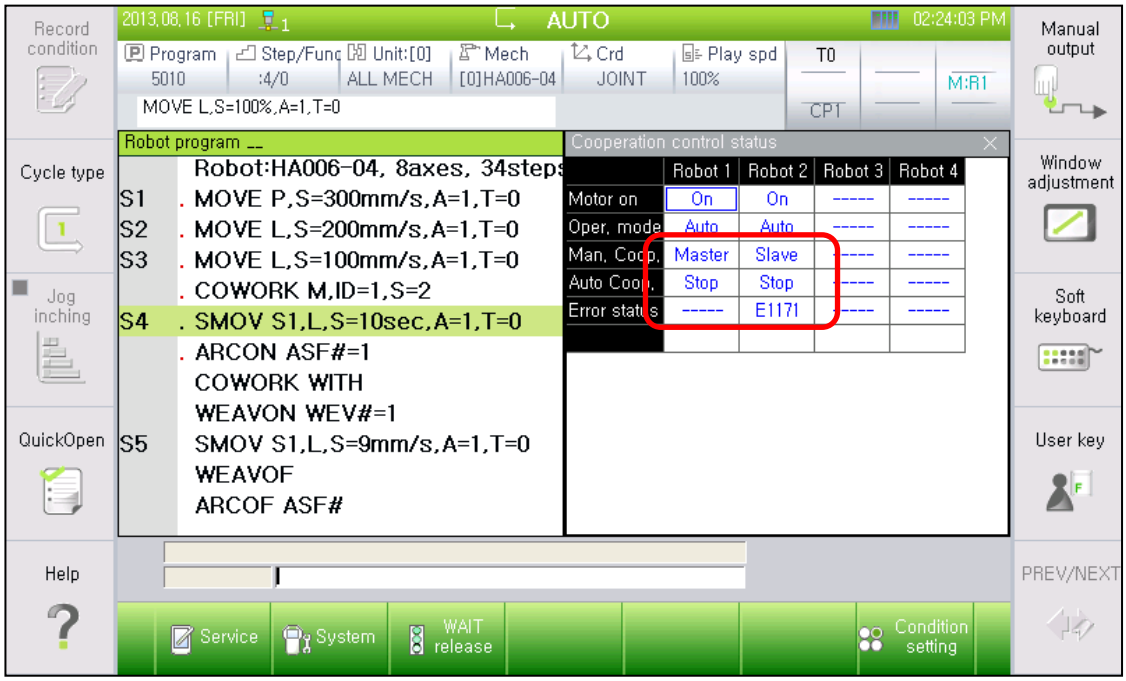
Click the [Motor On] button and push the [Enable] switch of the teach pendant to check whether the slave robot motor is turned on.



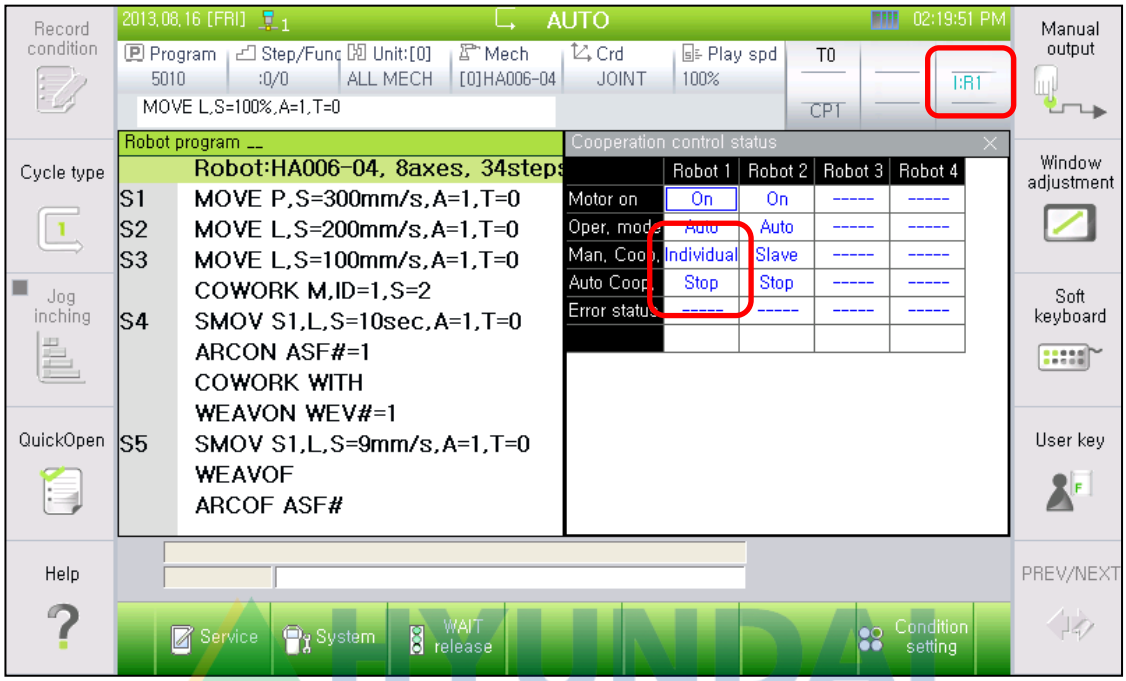
Change the [Select] switch to ‘Auto’ and the push the [Start] button to carry out the cooperation control operation.



If an error occurs to a controller to which the teach pendant is not connected currently, the ‘Cooperation control status’ monitoring window will display the ‘error state’.



In order to operate a robot alone by releasing the cooperation control system batch operation, enter [R..]+351 and then enter 0 to set the manual mode individual operation.



Reference

This function manual does not explain about details regarding the functions of the cooperation control. Refer to the 'Hi5 Controller Function Manual: Cooperation Control' for more information about them.

When a robot is operated based on the cooperation control mode, it is highly possible for a robot to suffer interference with adjacent structures. Users must check the working area of robots before playing back the robots.

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