HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

WARNING

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

Hyundai Robot

Hi5CI130701FMEN1

Hi5 Controller Function Manual

Command independent execution

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

Printed in Korea – Jul. 2013. 3rd Edition

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

Contents

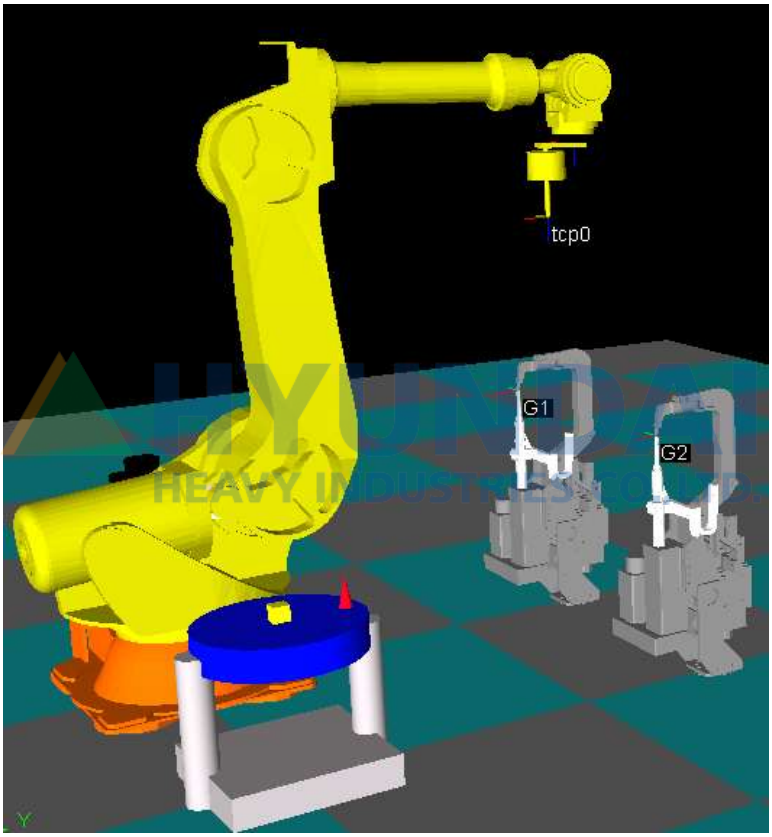
HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

1
Overview

The command independent execution function runs in a way that the user defines an input signal and a command relevant to it, and, when the state of the input signal changes from the off state to the on state, the command will be executed independently of the operation program of the robot.

This Hi5 Command independent execution Function Manual will be explained based on the following system. Considering that individual systems that are provided at actual sites may not be identical to this system, the operators at individual sites should use their own system by referring to this manual.

System specification in this manual



Robot(HS165-02), stationary servo gun (G1), stationary servo gun (G2), 1–axis positioner (P1)

G1 and G2 will carry out the tip dressing and gun search operations regardless of the operation of the robot. P1 is designed for building a system that makes it possible to move to a designated position.

Necessary manuals

- Hi5 Controller Operation Manual
- Hi5 Additional Axis Function Manual
- Hi5 Multitasking Manual

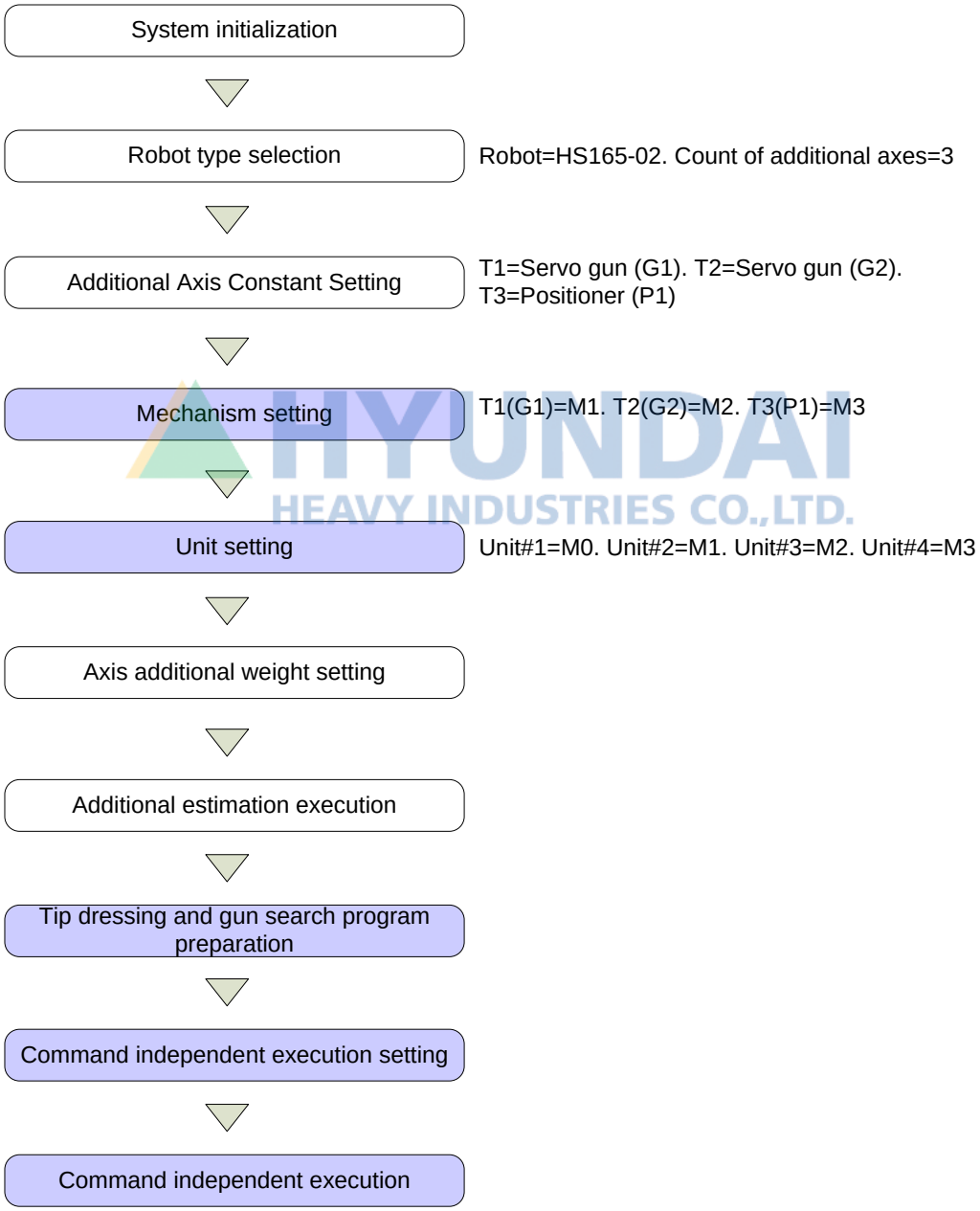
1.1. Key specification

Item	Specification
Command independent execution setting file	ROBOT.CON
Maximum count for the setting	24
Maximum count for simultaneous execution	3
Independent execution condition	Auto mode Motor on Input signal off → on
Commands that cannot be supported	SMOV ENDLESS SELSTN ServoFree OnLTrack ForceCtrl TOOLCHNG EGUNSEA GUNCHNG

1.2. Operation sequence

The following sequence is a general case. Users need refer to it only for information considering that some other steps may be added or some steps of it may be ignored depending on the system configuration at individual sites.

Of the steps in the sequence, the operations in the colored boxes are essential when applying this function. They will be explained in Chapter 2 with more details.



2 Related functions

2.1. Mechanism setting

A mechanism refers to a system like a robot, a servo gun or a positioner, and refers to Hi5 Controller User Manual for more details.

In general, there are two reasons for setting a mechanism. The first one is for designating an axis that will respond when pushing the [Axis Jog] key according to the entered state of the [Mechanism] key in manual mode. The second one is that setting a mechanism will help identify a unit for setting it.

In order to use this function, unit setting is essential. For this, mechanism setting is an essential process that must be performed.

It may look simple when we think that we identify robots, positioners and servo guns in their configuration as a mechanism.

(1) Set through the screen of [System/Initialize/Mechanism Setting] as shown below.

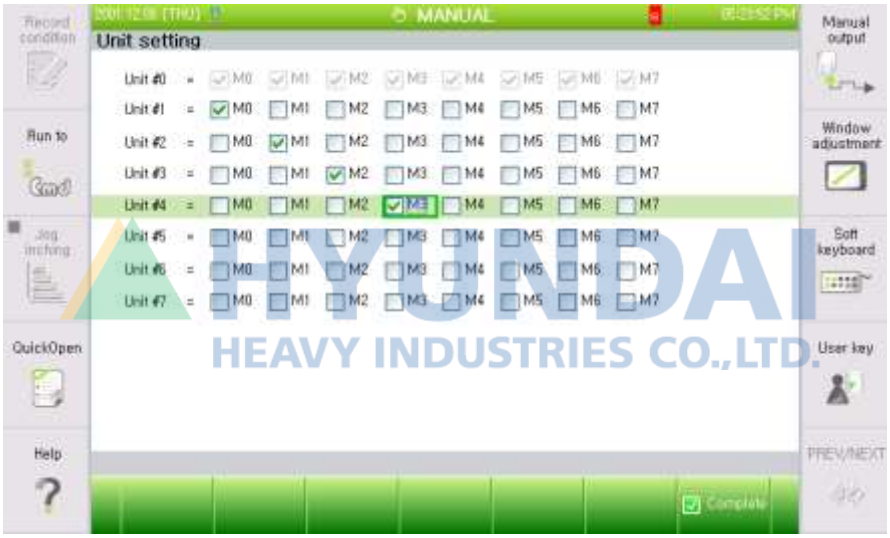
2.2. Unit setting

Unit setting is for deciding mechanisms that will be controlled when executing an operation program. Refer to Hi5 Controller User Manual for more details.

In order to use this function, an operation program that includes other mechanisms, rather than a robot, needs to be executed independently of the operation program of a robot. Considering that, unit setting must be performed.

For example, when the Move command set for Unit 0 is executed, G1, G2 and P1 will reach the target position at the same time. When the Move command set for Unit 1 is executed, only the robot will reach the target position.

Set through the screen of [System/Initialize/Unit Setting].



2.3. Tip dressing and gun search program preparation

Prepare individual tip dressing and gun search programs that are to be executed by G1 and G2. Refer to the Spot Welding Function Manual separately for more details about the tip dressing and gun search functions.

The figure shown below is an example of the tip dressing and gun search programs for G1. Here, we need to go through features that should be part of the program configuration for executing the tip dressing and gun search programs for G1, independently of the execution of the operation program.

- **AXISCTRL OFF,T1**
  For turning the G1 axis into the “additional axis control invalid’ state. In the state, if the below Move command is executed, the G1 axis can be executed independently.

- **MOVE command**
  The Move command needs to be prepared using the units that have a position only in relation to the G1 axis. Set the unit number as 2 by pushing the [SHIFT]+[Unit] keys, and then record the Move command by pushing the [REC] key.

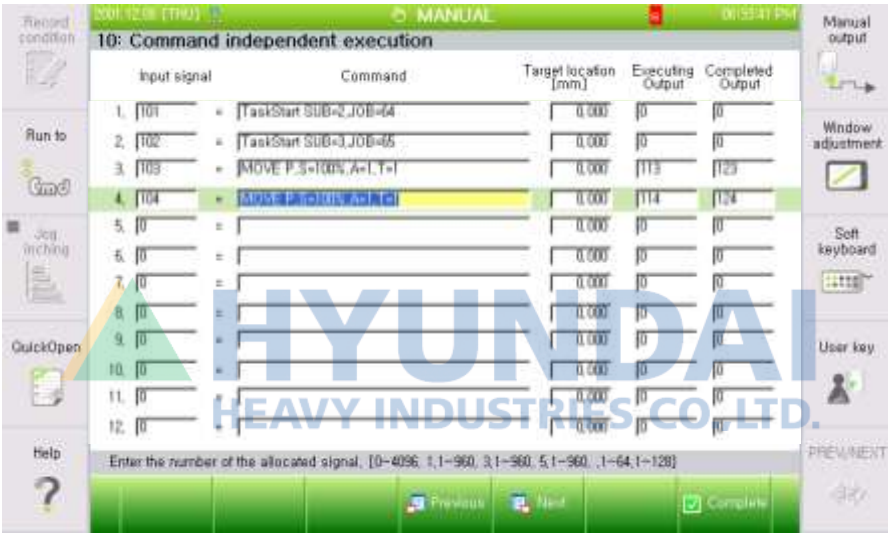
- **AXISCTRL ON,T1**
  It is required to turn the G1 axis into the “additional axis control valid’ state. In this state, the G1 axis can be executed simultaneously when executing the operation program of the robot.

2.4. Command independent execution setting

Users need to set the conditions for using the function. It is required to register the TaskStart command for the independent execution of the tip dressing and gun search programs for G1 and G2. It is required to register the Move command for moving to a designated position in relation to P1.

The TaskStart command is for executing multiple tasks. Refer to Multitasking Function Manual separately for more details. However, the command will be executed independently at subtask 1, TaskStart SUB=1 cannot be used.

Set through the screen of [System/Application Parameter/Command independent execution] as shown below



Input signal	The number of the input signal that will execute the command
Command	A command that will be executed independently
Target position	A target position for a command that will be executed after moving to the specific position.
Output signal while execution in progress	Output while the relevant command is being executed.
Output signal when execution is completed	Output when the relevant command is completely executed.

- **TaskStart SUB=2,JOB=64**
  When the relevant input signal (DI101) is fed, 0064.JOB (A program for tip dressing and gun search for G1) will be executed independently of the operation program of the robot.

- **MOVE P,S=100%,A=1,T=1**
  When the relevant input signal (DI103) is fed, P1 will move to a position, as well as in the condition, as recorded in the Move command, independently of the operation program of the robot. However, when it comes to the conditions for moving, the interpolation type will change to P and the accuracy will change to 0 automatically

2.4.1. Command editing

It is required to press the [Soft Keyboard] button to correct the entered command or to enter a command that does not exist on the F menu.

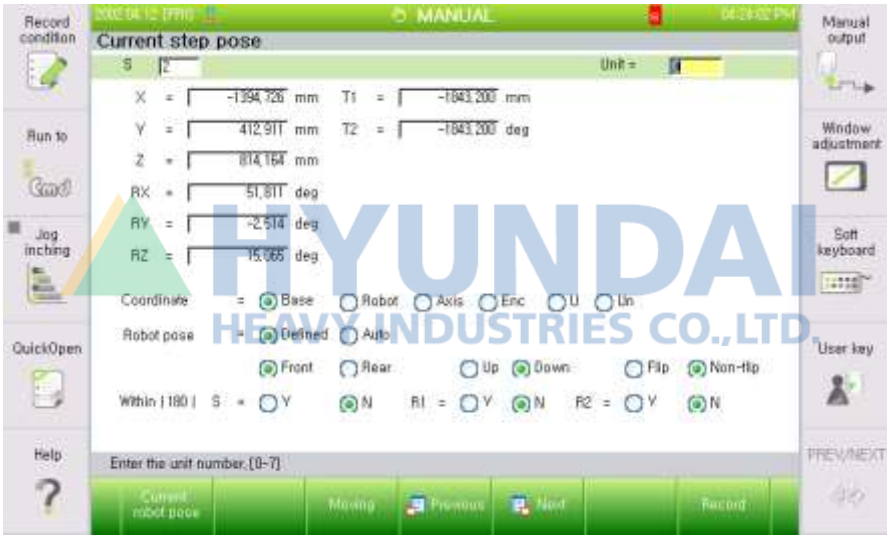
After editing a string in the below dialogue box, if the [F7: Complete] key is pressed, the edited string will be set.

2.4.2. MOVE command

Compared with other command, the Move command requires additional information for the users. The related information is as shown below.

(1) Input method
Press the [REC] key to record a MOVE command for a hidden pose Move. And press the [F6: MOVE] key to record a Move command that has a pose expression
Information about the hidden pose MOVE and Move that has a pose expression, refer to the Hi5 controller operation manual.

(2) Position editing
While the MOVE command is recorded, if the [Quick Open] button is pressed, the following screen will be displayed. The unit number needs to be set as 4 and the position of P1 needs to be set before pressing the [F7: Complete] key.



(3) Execution condition
For the independent execution of the Move command, the P1 axis needs to be changed to the “additional axis control invalid’ state first. This can be achieved by executing AXISCTRL OFF, T3 or through the “362: Axis control status manual setting” section.

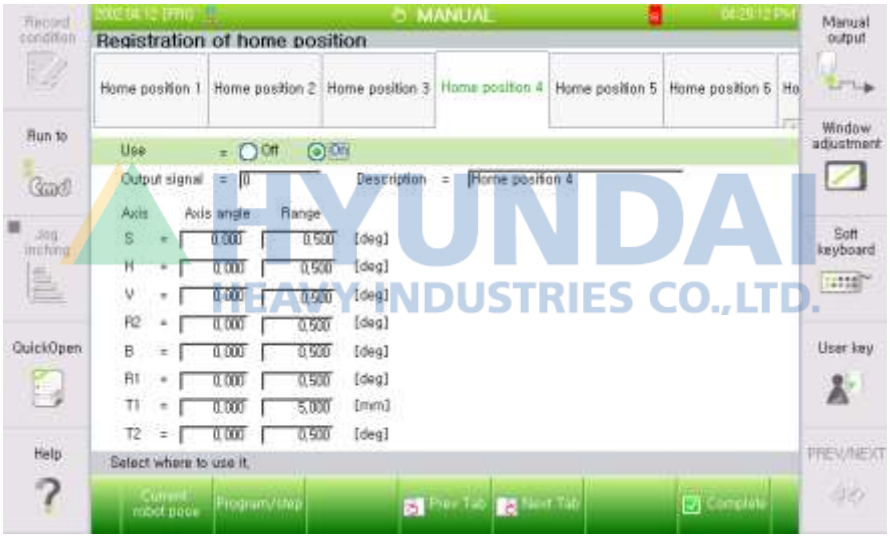
2.4.3. Home position registration

When executing a Move command independently, it may be required to check whether the relevant additional axis is at the right position.

The checking can be carried out by utilizing the home position input signal that is provided by the controller as a function, or by adding a process in which the relevant additional axis can be located and checked through a PLC.

This manual only provides a simple explanation about how to utilize the home position output signal that is provided by the controller as a function.

If the user checks the position of P1 and decides to send an output signal when the position is within ±0.5 degrees (In other words 179.5 ~ 180.5 degrees) when taking 180 degrees as a reference, it is required to set 180 degrees for the T3 axis angle and 0.5 degrees for the scope while setting 0 for the scope for all other axes (The axes whose range is set as 0 will be ignored in the home position check).



2.5. Command independent execution

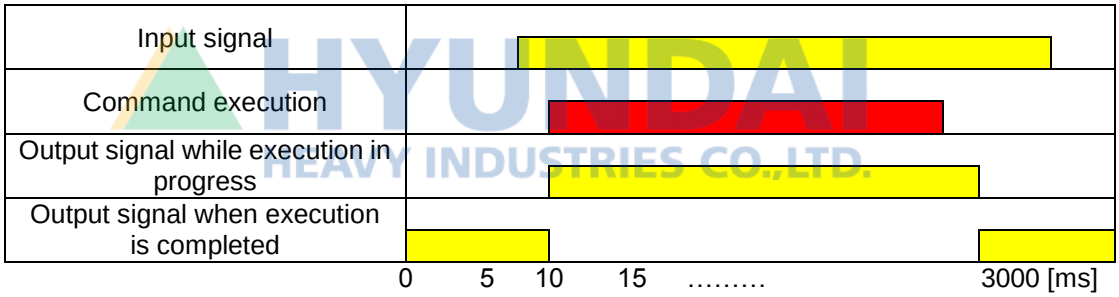
When it comes to the setting for the command independent execution, if the state of a signal, which is set as an input signal, changes the off state to the on state, the set command will be interpreted and processed.

However, if the robot is in the power saving state, the independent execution will take place only after waiting for the power saving state to be deactivated. Considering that the input signal on time needs to be maintained for longer than one second.

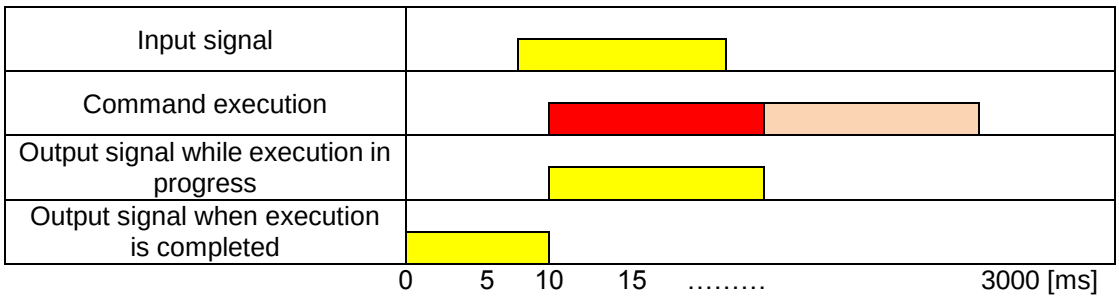
2.5.1. Timing chart

The timing charts are displayed for a case in which there is no power saving state, in other words, for a case in which the command can be executed immediately.

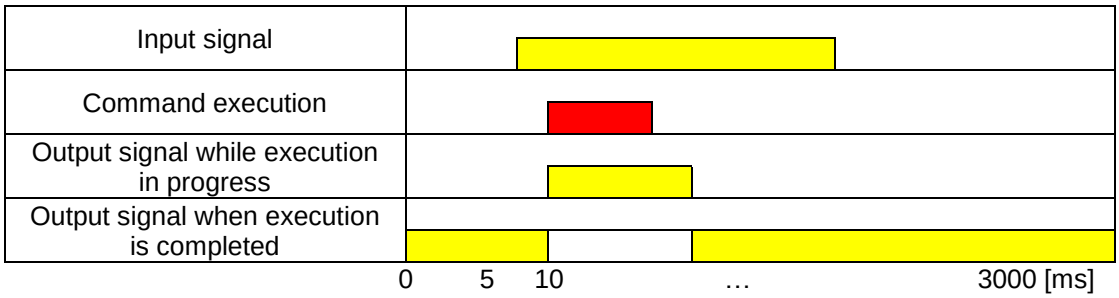
(1) MOVE command normal ending
The following table shows timing charts for a case in which the Move command independent execution ends normally. The input signal needs to be maintained in the on state continuously until reaching the recorded position.



(2) Stop input while the Move command execution in progress
The following table shows charts for a case in which stoppage occurs as the input signal is turned off while the Move command independent execution is in progress (Moving to the recorded position). The output signal will be turned off immediately while the execution is in progress, and the execution completion output signal will not be turned on.



(3) Normal ending of other commands
The following table shows timing charts for a case in which other commands, not the Move command, are ending normally.

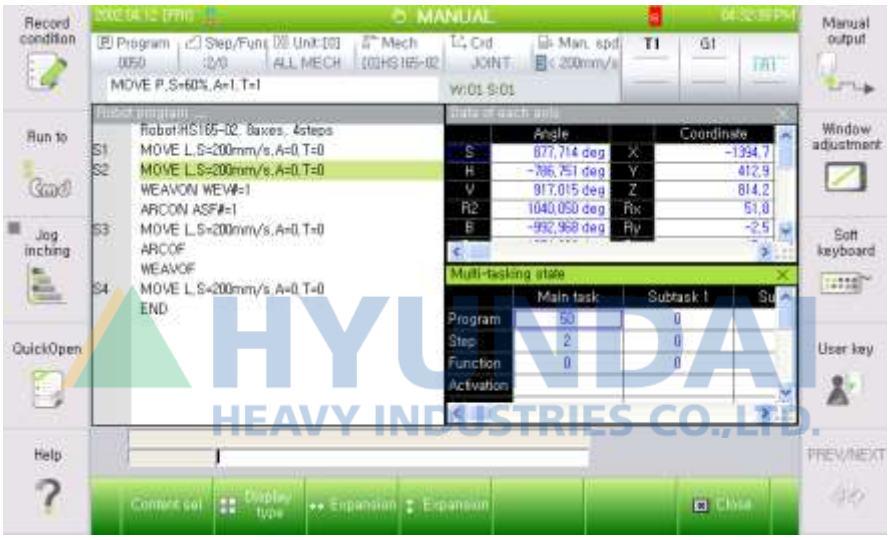


2.5.2. State display

The state display for command independent execution is exactly identical to that for multitasking. Considering that, refer to Multitasking Function Manual separately for more details

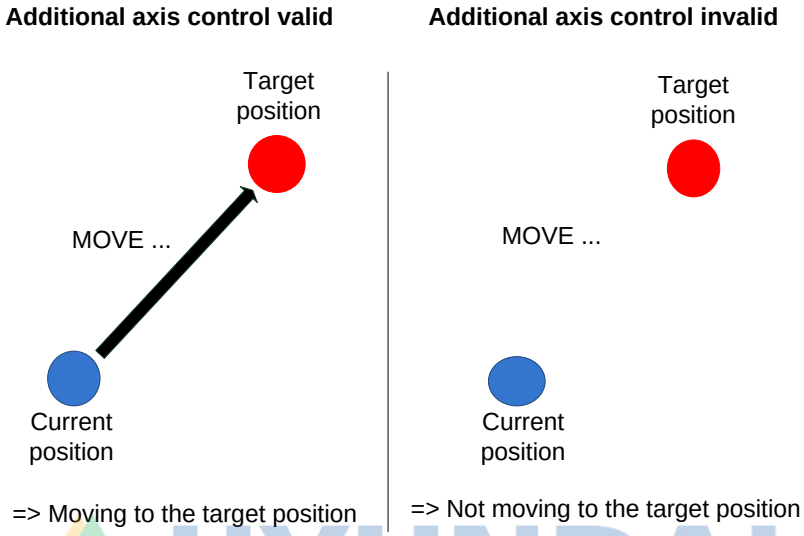
(1) Display in simple mode
As shown in the below screen, the right section of the 'auto' mode will display the number of the subtask that is being executed currently.

(2) Monitoring
The current execution state can be checked through the screen of [Service/Monitoring/ Multi-tasking state].



2.6. Additional axis control state

This function will help decide whether to move to the target position in relation to the additional axis, when executing commands (Such as Move, Stop) that would require axial movement.



2.6.1. State change

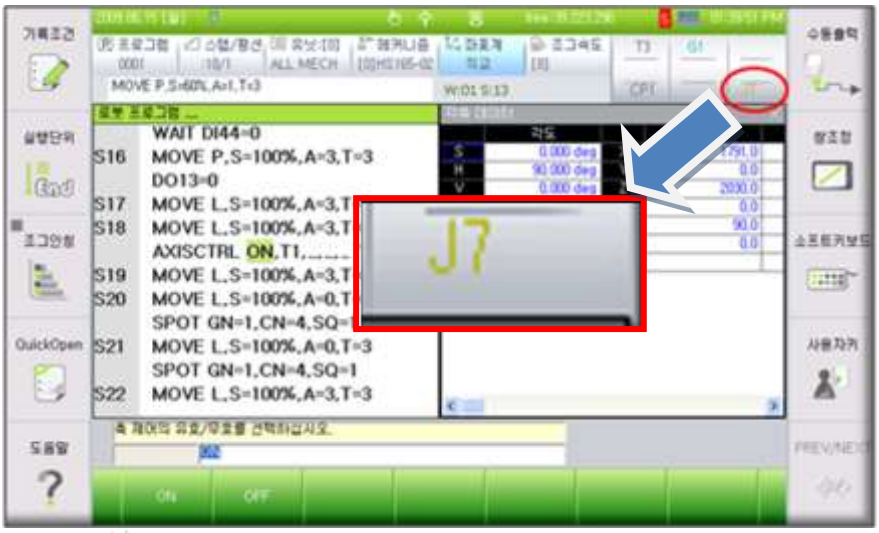
For changing the additional axis control state, two methods, manual change and auto change, are provided.

(1) Manual change
Users can change the state manually through the R362 input.

(2) Auto change
The state can be changed automatically through the execution of the AXISCTRL command.

2.6.2. State display

In manual mode or auto mode, the state flag display section on the main screen will display the axis whose additional axis control state is invalid.

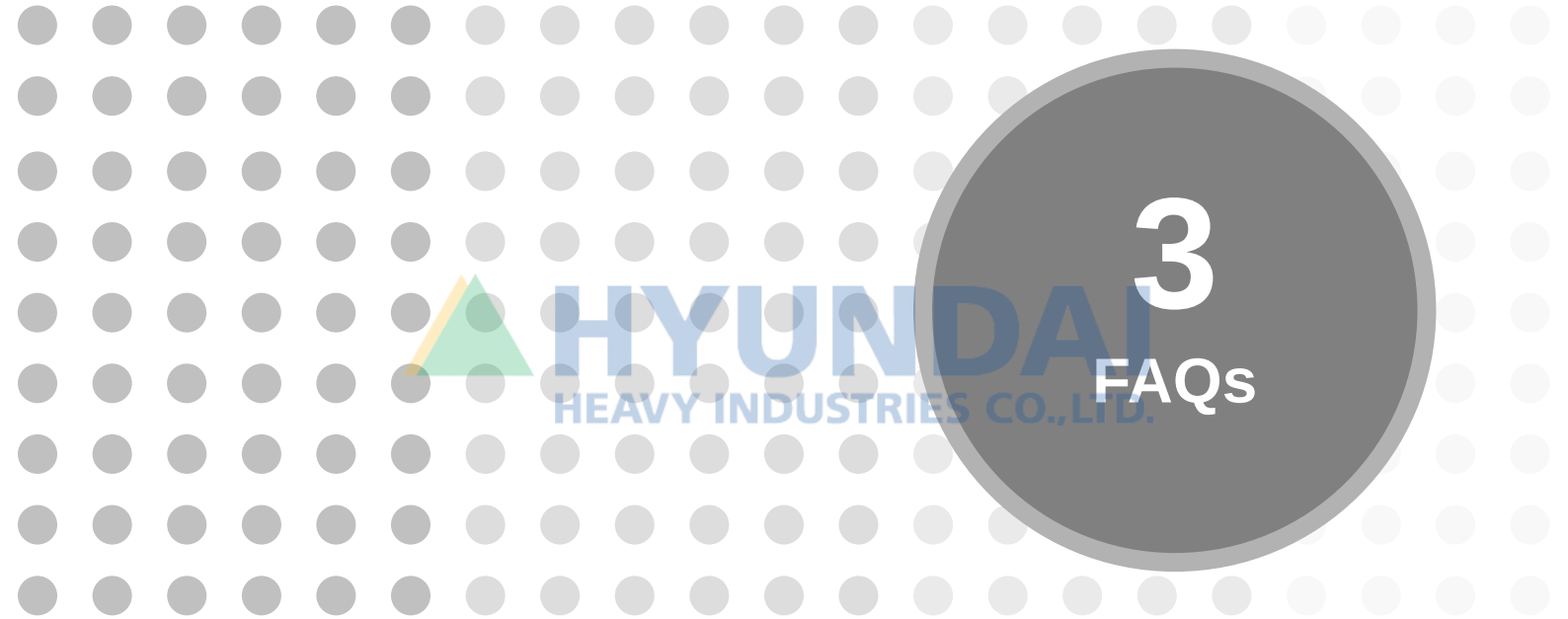


2.6.3. State output

The controller will update the additional axis control state internally and periodically for SW190 of the PLC relays in a form as shown below.

Axis whose additional axis control state is invalid	SW190 data
Axis 7	&B00000000 01000000
Axis 7, Axis 8	&B00000000 11000000

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.


3
FAQs

- Independent execution does not take place even when turning on the input signal.
  Check whether the input signal on time is maintained for about 1 second. The power saving state will be deactivated if an input signal is turned on when the robot is in the power saving state. Considering that independent execution will take place after the power saving state is deactivated completely, the input signal on time should include the time for the robot to shift to the power saving on state to the power saving off state.

- Trying but hard to execute a Move command independently.
  For executing a Move command independently, the relevant additional axis control state should be invalid. The 'AXISCTRL OFF" command or the '362: Axis control status manual setting' should be executed to turn the additional axis control state into invalid state.

  The invalid state of an additional axis control will be displayed through the state flag of the initial screen.

- The"E1480 There is an axis being used by another task" situation occurred. How can I analyze possible causes?
  While it is a command related to the spot welding, it is required for the relevant additional axis to move when the Move command is executed independently. In case of E1480, when the input signal is turned on and the command, which needs to be executed independently, is analyzed, if it is found that the command requires the movement of the additional axis, it is needed to check whether the relevant additional axis moves due to the independent execution of the previous command. In relation to that, if the movement is still in progress, the message will be displayed.

  When the state of input signals is checked from the history of E1480, there may be more than 2 input signals turned on for independent execution. The following figure is about a case in which, as DI104 is fed, a command that requires P1 to move to the 180-degree position is received while P1 is moving to the 0 degree position.

  In order to take measures against errors, if an additional axis is being executed independently, it is required to supplement the PLC circuit to prevent an axis identical to the axis from being executed independently.

4 Errors and warnings

Code	E1477 Please operate it with Motor ON status.
Description	Tried while the motor is not on.
Measure	Try again after checking whether the motor is on.

Code	E1478 Please operate it with automatic mode.
Description	Tried while not in auto mode.
Measure	Try again after checking whether it is the auto mode.

Code	E1479 All subtasks are being used.
Description	The count of subtasks is restricted up to 3. An execution command that exceeds the limit is requested
Measure	Required to contact the company for queries.

Code	E1480 There is an axis being used by another task.
Description	The axis that needs to move to subtasks has been moving already.
Measure	Required to check the control state of an axis that needs to be moved. Required to contact the company for queries.

HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

- **Head Office**
  Tel. 82-52-202-7901 / Fax. 82-52-202-7900
  1, Jeonha-dong, Dong-gu, Ulsan, Korea

- **A/S Center**
  Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- **Seoul Office**
  Tel.82-2-746-4711 / Fax. 82-2-746-4720
  140-2, Gye-dong, Jongno-gu, Seoul, Korea

- **Ansan Office**
  Tel.82-31-409-4945 / Fax.82-31-409-4946
  1431-2, Sa-dong, Sangnok-gu, Ansan-si, Gyeonggi-do, Korea

- **Cheonan Office**
  Tel.82-41-576-4294 / Fax.82-41-576-4296
  355-15, Daga-dong, Cheonan-si, Chungcheongnam-do, Korea

- **Daegu Office**
  Tel.82-53-746-6232 / Fax.82-53-746-6231
  223-5, Beomeo 2-dong, Suseong-gu, Daegu, Korea

- **Gwangju Office**
  Tel. 82-62-363-5272 / Fax. 82-62-363-5273
  415-2, Nongseong-dong, Seo-gu, Gwangju, Korea

- 본사
  Tel. 052-202-7901 / Fax. 052-202-7900
  울산광역시 동구 전하동 1 번지

- A/S 센터
  Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- 서울 사무소
  Tel. 02-746-4711 / Fax. 02-746-4720
  서울특별시 종로구 계동 140-2 번지

- 안산 사무소
  Tel. 031-409-4945 / Fax. 031-409-4946
  경기도 안산시 상록구 사동 1431-2 번지

- 천안 사무소
  Tel. 041-576-4294 / Fax. 041-576-4296
  충남 천안시 다가동 355-15 번지

- 대구 사무소
  Tel. 053-746-6232 / Fax. 053-746-6231
  대구광역시 수성구 범어 2 동 223-5 번지

- 광주 사무소
  Tel. 062-363-5272 / Fax. 062-363-5273
  광주광역시 서구 농성동 415-2 번지