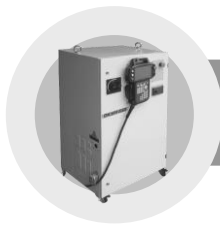# HYUNDAI
HEAVY INDUSTRIES CO.,LTD.

WARNING

THE INSTALLATION SHALL BE MADE BY QUALIFIED INSTALLATION PERSONNEL AND SHOULD CONFORM TO ALL NATIONAL AND LOCAL CODES

Hyundai Robot

Hi5 Controller Function Manual

Multitasking

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Overview

1.1. About Multitasking Function

The Hi5 controller may execute four (4) programs (JOB) independently, and a multitasking control by this mechanism is called "Multitasking Function".

The following figure shows the existing single-tasking structure (Hi5 Controller 30.00-00 version system). It has one (1) task and may not execute over two (2) programs simultaneously and independently.
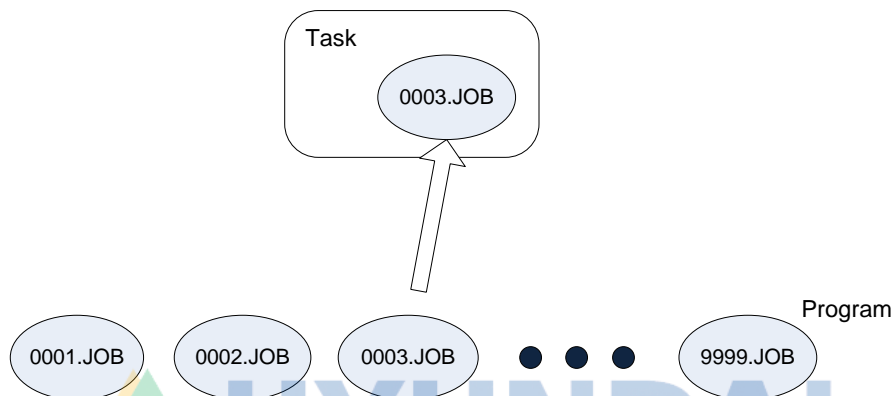
The below figure shows the multitasking structure which supported by the new Hi5 software version (Main 31.03-00 version and over). It may execute at most four (4) programs because a maximum of four (4) tasks may run simultaneously.
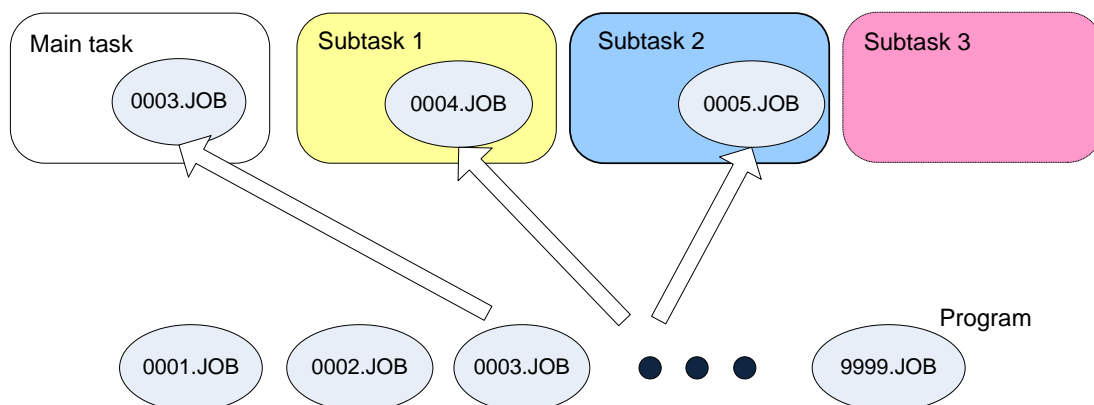
The names of four (4) tasks which execute programs are as follows.
- Main task
- Subtask 1
- Subtask 2
- Subtask 3

The main task always exists, and the subtask1, 2, and 3 (hereinafter "subtask 1/2/3) may be created and removed. In general, the subtask is automatically created by means of the execution of the TaskStart command of the main task or subtask program, and the subtask may be automatically removed by means of the execution of the END command of each subtask program.
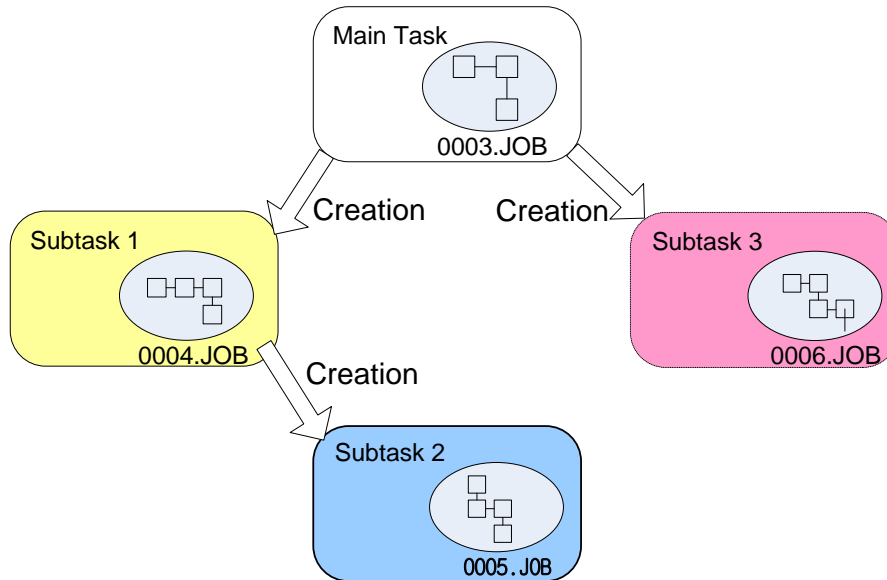
1.2. Terminology

The description of the technical terms used in this manual are follows.

Terms	Description
Program	Job programs (0001.JOB, 1001.JOB)
Main Task Subtask 1/2/3	Job program launcher
Main Task Program Subtask 1/2/3 Program	Job programs registered in the task(0001.JOB, 1001.JOB)

2
Relevant Functions

2.1. Commands

2.1.1. TaskStart

The TaskStart command creates subtasks, executing a function of starting up subtask programs. If a subtask has been already created, it ignores the program number and has only the role in starting up the created task. If the subtask is in a startup mode, the command of executing TaskStart is ignored. The format of the TaskStart command is as follows.

TaskStart SUB=<subtask number>, JOB=<program number>

Item	Description
Subtask Number	Set a created subtask number. (1~3)
Program Number	Designate a program run by the created subtask. (1~9999)

<Example>
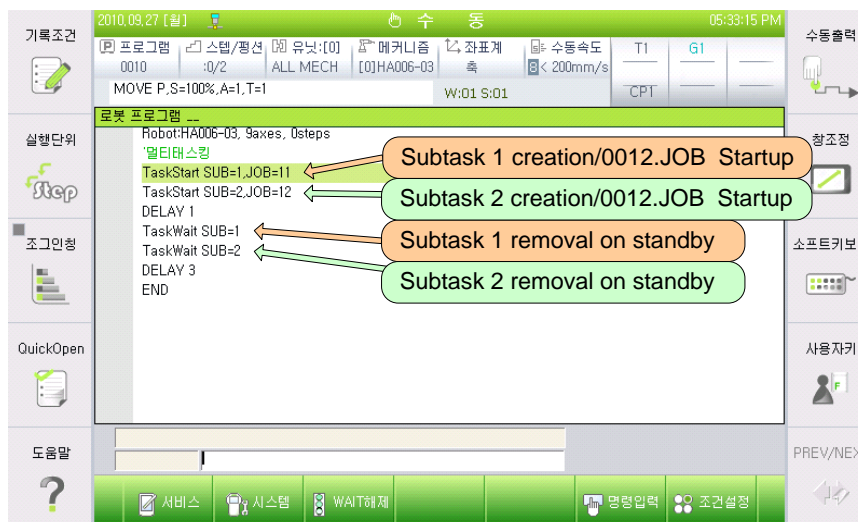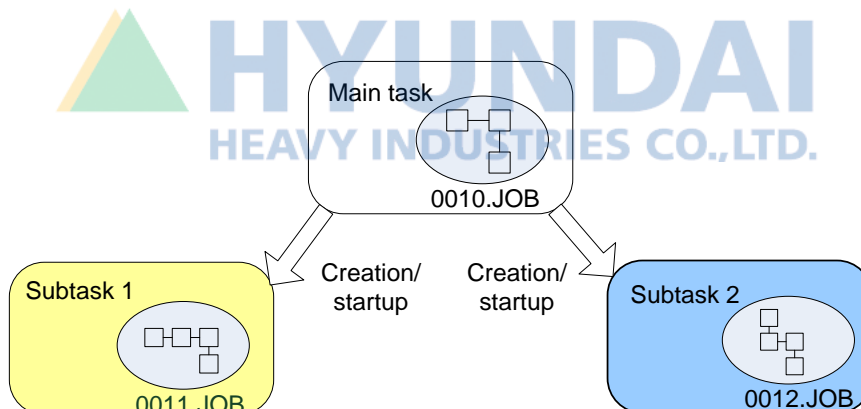
2.1.2. TaskWait

The TaskWait command is a function of having the subtask removal on standby. Generally, the subtask may be automatically removed by means of executing the END command of the involved subtask program. The format of the Task Wait is as follows.

TaskWait SUB=<subtask number>

Item	Description
Subtask number	Set a removed subtask number(1~3)

2.1.3. TaskSync

The TaskSync command is a function of synchronizing tasks. Generally, the synchronization is essential to the coordinate operation of over two (2) robots. It is used conveniently for matching the positions to start synchronizing tasks.
The format of the TaskSync command is as follows.

TaskSync ID=<identifier>, NO=<number of running the same ID>

Item	Description
Identifier	Set an identifier. (1~32)
Number of running the same ID	Set the number of running the same ID (2~4)

2.2. Monitoring
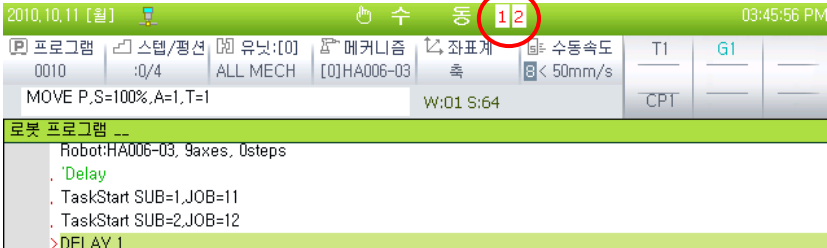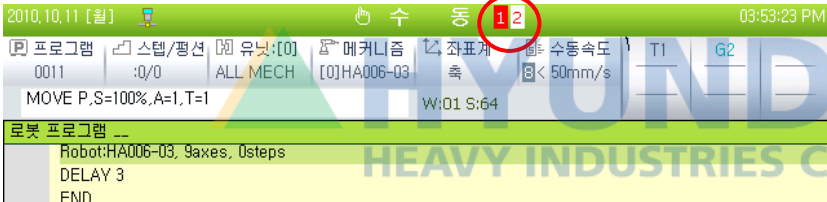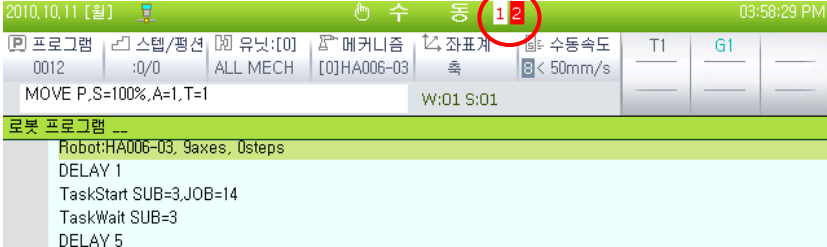
2.2.1. Subtask Creation

The Condition of the subtask creation may be checked on the Title Frame.
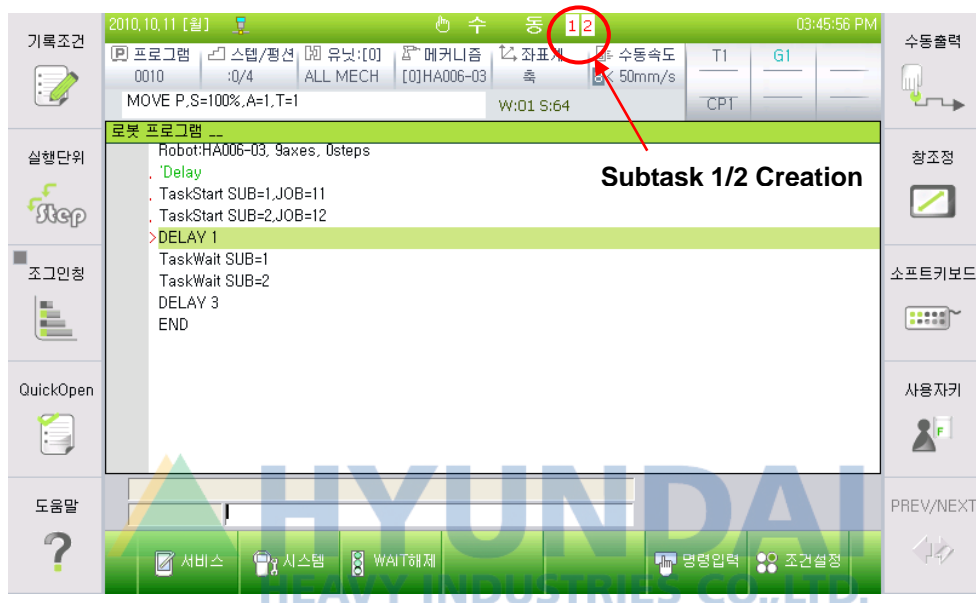
2.2.2. Current Task Selection

The condition of the current task selection may be identified on the Title Frame and by the window color of the robot program. With respect to the task transfer method, refer to the "Task Transfer" described in the manual.

Condition	Description
Main Task Selection 	– The background color indicating the condition of the subtask 1/2/3 is fixed in white. – The background color of the robot program window is fixed in white.
Subtask 1 Selection 	– The background color indicating the condition of the subtask 1 turns into white/red. – The background color of the robot program window is yellow.
Subtask 2 Selection 	– The background color indicating the condition of the subtask 2 turns into white/red. – The background color of the robot program window is light blue.

2.2.3. Multitasking Condition

The program, step and function numbers, motion and job condition of all the tasks may be checked on
『[F1]: Service』 → 『1: Monitoring』 → 『18: Multitasking Condition』 .

2.3. Subtask Creation

2.3.1. Automatic Creation

The execution of the TaskStart command creates a subtask automatically.

2.3.2. Manual Creation

Select the subtask 1/2/3 program items on the multitasking condition monitoring window, then input a program number by clicking on 『[F5]: Selection』.
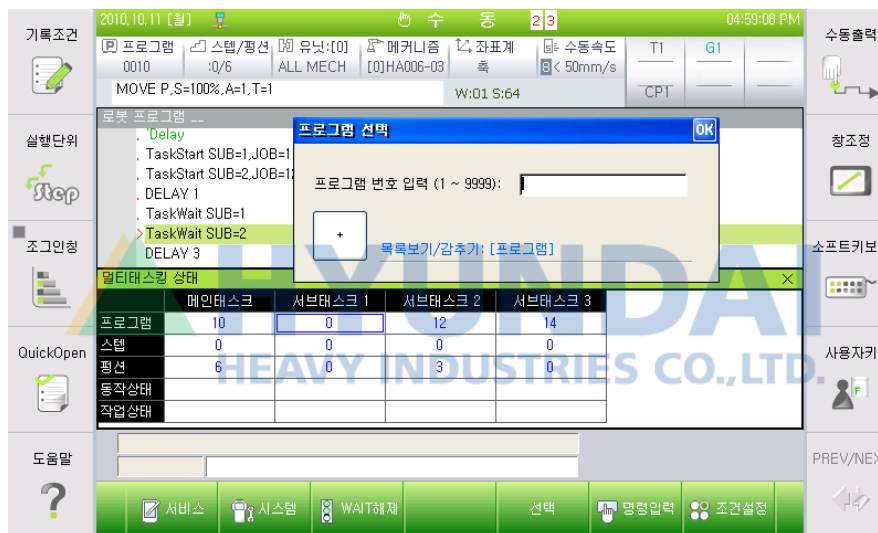
2.4. Subtask Removal

2.4.1. Automatic Removal

The execution of subtask's END command removes a subtask automatically.

2.4.2. Manual Removal

Select the subtask 1/2/3 program items on the multitasking condition monitoring window, then input the program number of zero (0) by clicking on 『[F5]: Selection』.
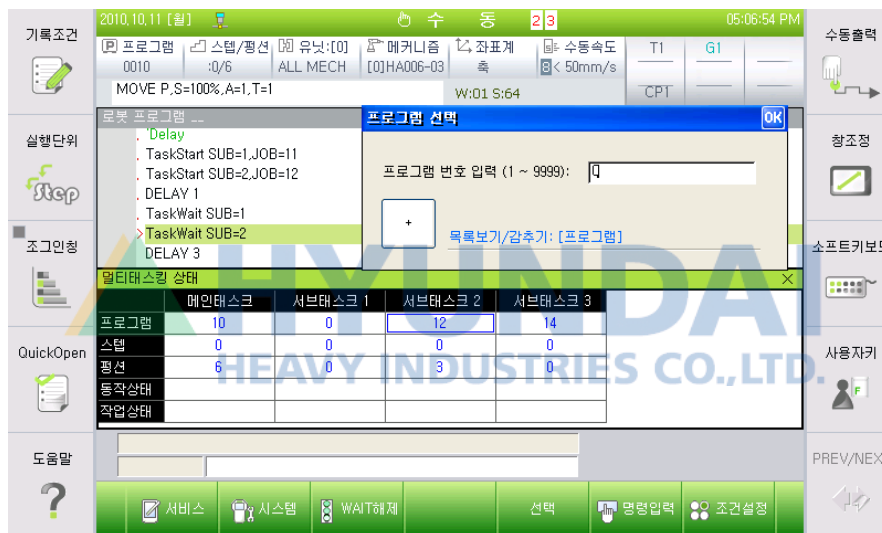
2.5. Task Transfer

2.5.1. Robot Program

The specifications of the task transfer are as follows, provided that the only created numbers may be transferred.

Motion	Description
[CTRL]+[▶]key	Transfer to the next task.
[CTRL]+[◀]key	Transfer to the previous task.
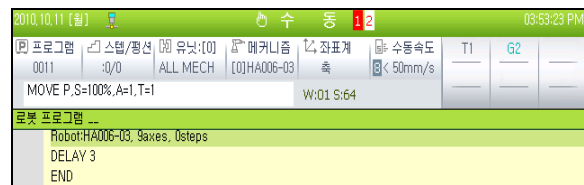
[Main Task]   [Subtask 1]

2.5.2. Dialogue Box for Setting

The specifications of the task transfer are shown in the table below and all the tasks are transferred successively.

Motion	Description
[CTRL]+[▶]key	Transfer to the next task. [Main Task] →[Subtask1] → [Subtask 2] → [Subtask 3]
[CTRL]+[◀]key	Transfer to the previous task. [Main Task] → [Subtask 3] → [Subtask 2] → [Subtask 1]
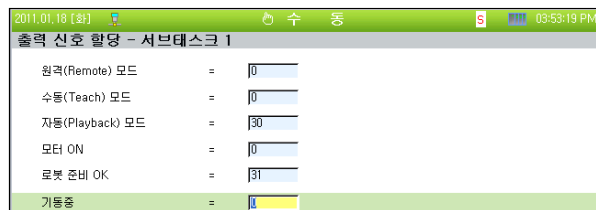
[Main Task]   [Subtask 1]

2.6. Program Selection

When the program is selected by means of running [SHIFT] + [Program] key, the motions are as follows.

2.6.1. Selection on Main Task

If the program is selected on the main task, all the created subtasks shall be removed.

Main Task	Change programs.
	Clear Step and Function numbers.
Subtask	Clear program numbers.
	Clear step and Function numbers.

2.6.2. Selection on Subtask

If the program is selected on the subtask, subtask programs shall be changed.

Subtask	Change programs.
	Clear step and function numbers.

2.7. Step Forward/Backward

The specifications of the Step Forward/Backward are as follows.

Motions	Description
[FWD]/[BWD]key	Run all the created tasks simultaneously.
[CTRL]+[FWD]/[BWD]key	Run the currently selected task alone.

2.8. Startup Process

Start up all the tasks created during the input of the T/P startup button and external startup.

2.9. Shutdown Process

Shut down all the tasks created during the input of T/P startup button and external startup.

2.10. Startup/Shutdown Lamp

The specifications of the teaching pendant's Startup/Shutdown On/Off are as follows.

Motions	Description
Startup Lamp ON, Shutdown lamp OFF	When at least one task is in a startup mode.
Startup Lamp OFF, Shutdown lamp ON	When all the tasks shut down.

2.11. AuxiliaryAxis Multitasking Program

2.11.1. Overview of multitasking Motion

It may comprise an independent program by allocating an auxiliary axis as a subtask with the use of the multitasking. Starting up each subtask independently is possible by separately designating units as shown in the following figure.

The setting of the unit and mechanism and the execution of the AXISCTRL command are needed to run this function.
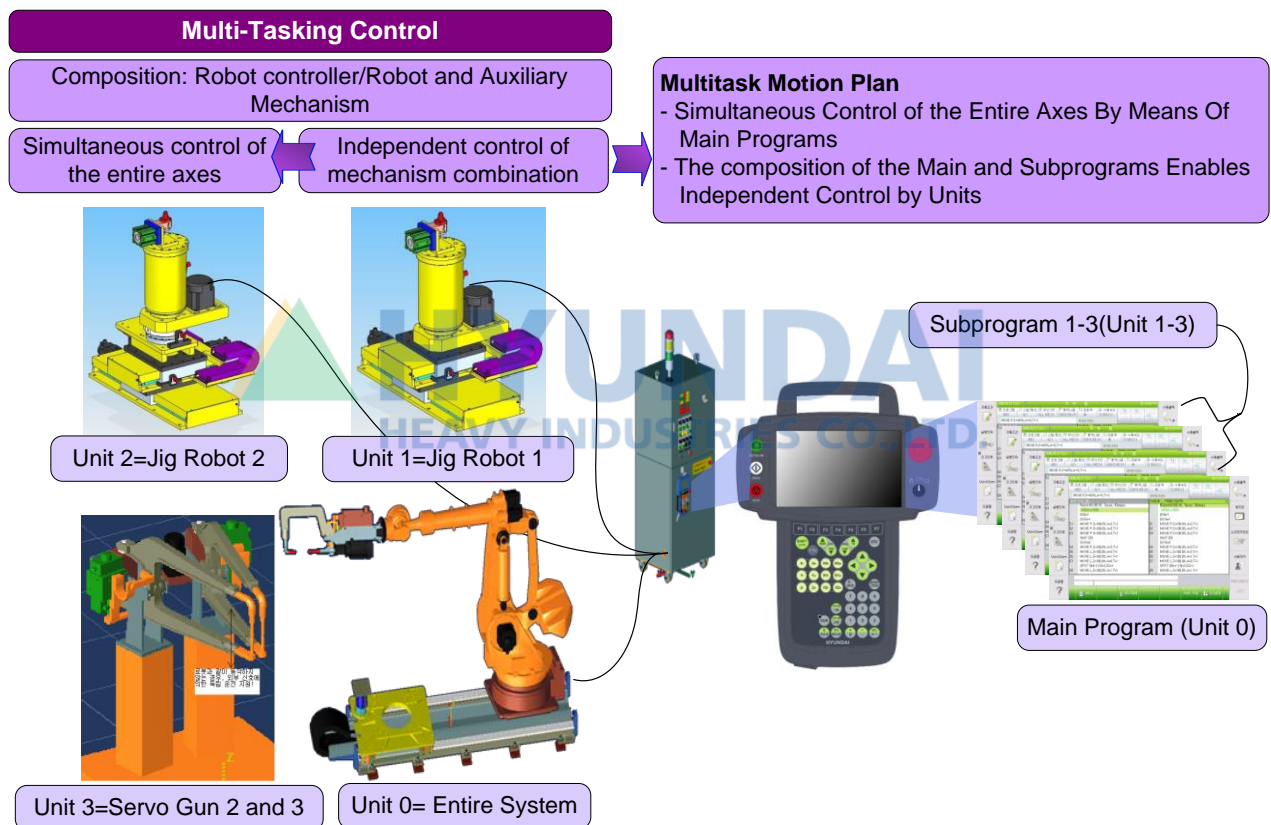
2.11.2. Example of Application of Multitasking Motion

The users may be informed of how to use the function through examples of the application of multitasking motion to the system with three (3) auxiliary axes, consisting of the jig shaft, robot and stationary guns as shown in the following Fig.

(1) The main program is the program # 100. The main program may start up all the axes by selecting the unit 0. When the main program runs, and the commands of the MOVE and STOP run in turn, executing commands to Step 10.

(2) Then, if the main program runs the commands of the AXISCTRL OFF T1, T2, and T3, the designated axial numbers are set to be controlled by the subtask. As the result, they are not moved to the positions of T1, T2, and T3 recorded in the Step 11-15 of the main program.

(3) By means of the TaskStart command, programs run by the subtask 1/2/3 shall be set. The allocated program to the subtask must be set as an independent unit, and the axis designated as a unit between the subtasks must not be overlapped. For example, the unit 1 is set as an axis of mechanism M1=T1, and the unit 2 and 3, as axes of mechanism M2=T2 and M3=T3, respectively in an exclusive way with each other.

(4) The programs of 0063, 0064, and 00165 allocated to the subtasks by means of the StartTask command are executed, and the main program runs the Step 11-15.

(5) When the TaskWait command is executed by the main program, the designated subtask has been completed and is on standby until the END command is executed. Therefore, the main program waits until the subtask 1/2/3 end.

(6) For the main program to obtain the control over the auxiliary axis again, the AXISCTRL ON command shall be executed.

Servo Gun's Tip Dressing (G1 and G2) & Jig Shaft's Independent Operation

G1: 로봇건

G2: 정치건

J3: 지그축
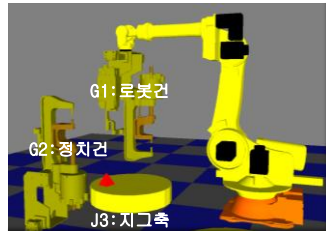
The Main Program may start up all the mechanisms.

AXISCTRL OFF
→ Transfer the control over the auxiliary axis to the subtask.
~
AXISCTRL ON
→ Return the control over the auxiliary axis to the main task.

℗ 프로그램	⮑ 스텝/평션	⊠ 유닛:[0]
0100	:3/0	ALL MECH

MOVE P,S=60%,A=1,T=1

로봇 프로그램 __
```
S3  > MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S4   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S5   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S6   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S7   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S8   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S9   MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
S10  MOVE P,S=60%,A=1,T=1
       SPOT GN=1,CN=1,SQ=1
     AXISCTRL OFF,T1,T2,T3
     TaskStart SUB=1,JOB=63
     TaskStart SUB=2,JOB=64
     TaskStart SUB=3,JOB=165
S11  . MOVE P,S=20%,A=1,T=1
S12  . MOVE P,S=20%,A=1,T=1
S13  . MOVE P,S=60%,A=1,T=1
S14  . MOVE P,S=20%,A=1,T=1
S15  . MOVE P,S=20%,A=1,T=5
     TaskWait SUB=1
     TaskWait SUB=2
     TaskWait SUB=3
     AXISCTRL ON,T1,T2,T3
```

℗ 프로그램	⮑ 스텝/평션	⊠ 유닛:[1]
0063	:1/0	M1

MOVE P,S=60%,A=1,T=1

로봇 프로그램 __
```
       Robot:HS165-02, 9axes, 7steps
S1   . MOVE L,S=60%,A=1,T=1
       SPOT GN=1,CN=64,SQ=64
S2   MOVE P,S=60%,A=1,T=1
       GUNSEA GN=1,SE=1,PR=100,SP=10
S3   MOVE P,S=60%,A=1,T=1
S4   MOVE P,S=60%,A=1,T=2
S5   MOVE P,S=60%,A=1,T=2
```

℗ 프로그램	⮑ 스텝/평션	⊠ 유닛:[2]
0064	:1/0	M2

MOVE P,S=60%,A=1,T=2

로봇 프로그램 __
```
       Robot:HS165-02, 9axes, 3steps
S1   . MOVE P,S=60%,A=1,T=2
       SPOT GN=2,CN=64,SQ=64
S2   MOVE P,S=60%,A=1,T=2
       GUNSEA GN=2,SE=1,PR=100,SP=10
```

℗ 프로그램	⮑ 스텝/평션	⊠ 유닛:[3]
0165	=1/0	M3

MOVE P,S=60%,A=1,T=1

로봇 프로그램 __
```
       Robot:HS165-02, 9axes, 6steps
S1   MOVE P,S=60%,A=1,T=1
S2   MOVE P,S=60%,A=1,T=1
S3   MOVE P,S=60%,A=1,T=1
S4   MOVE P,S=60%,A=1,T=1
S5   MOVE P,S=60%,A=1,T=1
S6   MOVE P,S=60%,A=1,T=1
     END
```

2-15

2.11.3. Notes for Application of Multitasking Motion

(1) With respect to a subprogram, **set a mechanism** limited to the axis where the AXISCTRL OFF command has been executed, designate it as a unit, then register a program.

(2) **Set the units exclusively** between subprograms so that their axes are not overlapped with each other.

(3) When the commands of the MOVE L and MOVE C are recorded in the subprogram, they result in the speediest motion of an auxiliary axis. Therefore, pay close attention and **record the MOVE P instead.**

(4) When the speed unit is recorded as mm/s in the subprogram, the auxiliary may move at the highest speed; therefore, be careful and **record the speed unit as % or sec in the subprogram.**

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