

Manual No.

9007135-02

ІНСТРУКЦІЯ З ЕКСПЛУАТАЦІЇ

Модель: AW8010, AW8006

(Версія No. 2. 0)

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Ця інструкція з експлуатації спеціально підготовлена для [PANA ROBO MODEL AW8010, AW8006] і описує методи роботи, необхідні для зварювальних робіт після правильного встановлення робота.

Інструкція з експлуатації складається з наступних розділів.

CHAPTER 1 : Before Starting Operation

CHAPTER 2 : Basic Operation (Elementary Section)

CHAPTER 3 : Applied Operation (Intermediate Section)

CHAPTER 4 : Functions and System Applied Operation (Advanced Section)

CHAPTER 5 : Teaching Coordinage System

CHAPTER 6 : Description of Command

CHAPTER 7 : Error code and Error Alarm

.....

* For setting and installation of the robot, refer to the [Installation Manual].

* When referring to this operation manual, spread out the [KEY LAYOUT OF OPERATING SECTION] and [TEACHING PENDANT OUTLINE DRAWING] for confirmation.

* Should you find any incorrect descriptions or any part which is difficult to understand concerning this operation manual, please let us know.

* Contents of this operation manual are subject to change without prior notice due to continual improvements.
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Глава 1 Перед початком роботи

Керування роботом(програмування)	1 - 2
Клавіші керування	1 - 4
Назви осей маніпулятора	1 - 10

Глава 2 Основні операції (елементарний розділ)

Базові процедури експлуатації PANA ROBO	2 - 2
Операція 1: Ввімкнення живлення	2 - 3
Операція 2: Навчання(Лінійна інтерполяція).....	2 - 4
Операція 3: Запуск виконання(Трасування).....	2 - 18
Операція 4: Операції з панелью	2 - 28
Операція 5: Реєстрація виконання робочої програми (Job).....	2 - 33
Операція 6: Зовнішні операції(External)	2 - 36
Операція 7: Інструкції утримання(Hold).....	2 - 37
Операція 8: Аварійна зупинка.....	2 - 40
Операція 9: Стан та скидання блоку керування при відключенні живлення	2 - 42
Операція 10: Ручне управління.....	2 - 43
Операція 11: Режими зварювання	2 - 44

Глава 3 Прикладна операція (проміжний розділ)

Операція 12: Навчання(кругова інтерполяція).....	3 - 2
Операція 13: Коригування та видалення круга	3 - 7
Операція 14: Навчання (Коливання)	3 - 11
Операція 15: Коригування та видалення коливання.....	3 - 15
Операція 16: Навчання (Кругове коливання, РТР).....	3 - 18
Операція 17: Корекція навчальної точки під час навчання	3 - 20
Операція 18: Перевірка виконання на заданій швидкості.....	3 - 22

Operation 19: Correction of Teaching Point During PLAY	3 - 23
Operation 20: Stand-by Operation During Hold Mode and Output Reproducing Function	3 - 24
Operation 21: EDIT	3 - 26
• Overall Edit Operation Flow	3 - 27
(Examples of Program Editing)	
• Meaning of Function Keys for Edit	3 - 28
• Making and Correction of PROGRAM	3 - 30
• Making and correction of WELD START	3 - 36
sequence, WELD END sequence and LIBRARY sequence	
• PROTECT resetting	3 - 42
• COPY, DIVIDE, MERGE and DELETE	3 - 44
Operation 22: Cassette tape recorder	3 - 45
• Connecting method of cassette tape recorder ...	3 - 47
• Saving programs into cassette tape	3 - 48
• Reading (LOAD) from cassette tape	3 - 51
• Confirming (VERIFY) contents of cassette	3 - 54
tape and robot memory	
Operation 23: Printer (Optional function)	3 - 58
• Printing on the printer	3 - 61
• Measures to be taken for errors occurring	3 - 69
during printing	
Operation 24 : Shift Function	3 - 70

Chapter 4 : Functions and System Applied Operation (Advanced Section)

Operation 25 : System Setting	4 - 5
(1) Welding Conditions (WELD COND)	4 - 6
(2) Expanding Function (ADV. FUNC)	4 - 14
(3) Optional Connection	4 - 29
(4) Robot Parameters (ROBOT OFFSET)	4 - 30
(5) MEMORY CLEAR	4 - 35
Operation 26 : Control Data (PRODUCT DATA)	4 - 37
(1) Accumulate Time Display	4 - 38

(2) Number of Job Execution and Contents	4 - 38
of Register	
(3) Origin Margin Display (For DC motor type ... 4 - 39	
Aux axes)	
(4) Time	4 - 40
(5) Abnormality history	4 - 40
Operation 27 : Teaching for Home Position	4 - 41
Operation 28 : External Origin search (When an external axis... 4 - 42	
is used)	
Operation 29 : Starting of Play (PLAY START)	4 - 44
(External operation)	
Operation 30 : End of External Operation	4 - 47
Operation 31 : ADDRESS SEARCH and Lock Operation	4 - 48
Operation 32 : Display in Operation	4 - 49
Operation 33 : Program Writing by MDI	4 - 52
Operation 34 : Input/Output Terminal Specification	4 - 55

Chapter 5 : Teaching Coordinate System

Operation 35 : Selection of Coordinate System	5 - 2
Operation 36 : Movement of Linked (ARTI) Coordinate System ... 5 - 3	
Operation 37 : Movement of Cylindrical Coordinate System	5 - 5
Operation 38 : Movement of Cartesian Coordinate System	5 - 7
Operation 39 : Movement of User Coordinate System	5 - 9
Operation 40 : Movement of Tool Coordinate System	5 - 11
Operation 41 : Definition of Tool and User Coordinate System... 5 - 13	
Operation 42 : Setting of Tool Coordinate System	5 - 15
Operation 43 : Setting of User Coordinate System	5 - 16
Operation 44 : Selective Operation of User Coordinate System... 5 - 21	

Chapter 6 : Description of Commands

Structure and Name of Pana Robo Data	6 - 2
Commands Used by Pana Robo	6 - 8

Move Command	6 - 9
Output Command	6 - 11
Wait Command	6 - 12
Jump Command	6 - 14
Call Command	6 - 15
Register Command	6 - 16
Command Dedicated to Welding	6 - 17
Other Commands	6 - 19

Chapter 7 : Error Alarm Code

What is the Error Alarm Code ?	7 - 2
Error Alarm Code List	7 - 3
Cancelling Overrun	7 - 19
When CRT Screen Does Not Display	7 - 20

Supplement 1 : Functions of Keys on Teach Pendant

Supplement 2 : Teach Pendant Key Diagram

Supplement 3 : Console Panel Diagram

Supplement 4 : Operation flows

РОЗДІЛ 1

ПЕРЕД ВИКОРИСТАННЯМ ВАШОГО РОБОТА

Цей матеріал підготовлений для того, щоб ви могли прочитати та зрозуміти ключові операції робота та назву кожної осі тіла робота.

Операції робота

Ваш PANA ROBO може зберігати різноманітні роботи, а роботи робота класифікуються в розділі «ПРОГРАМА».

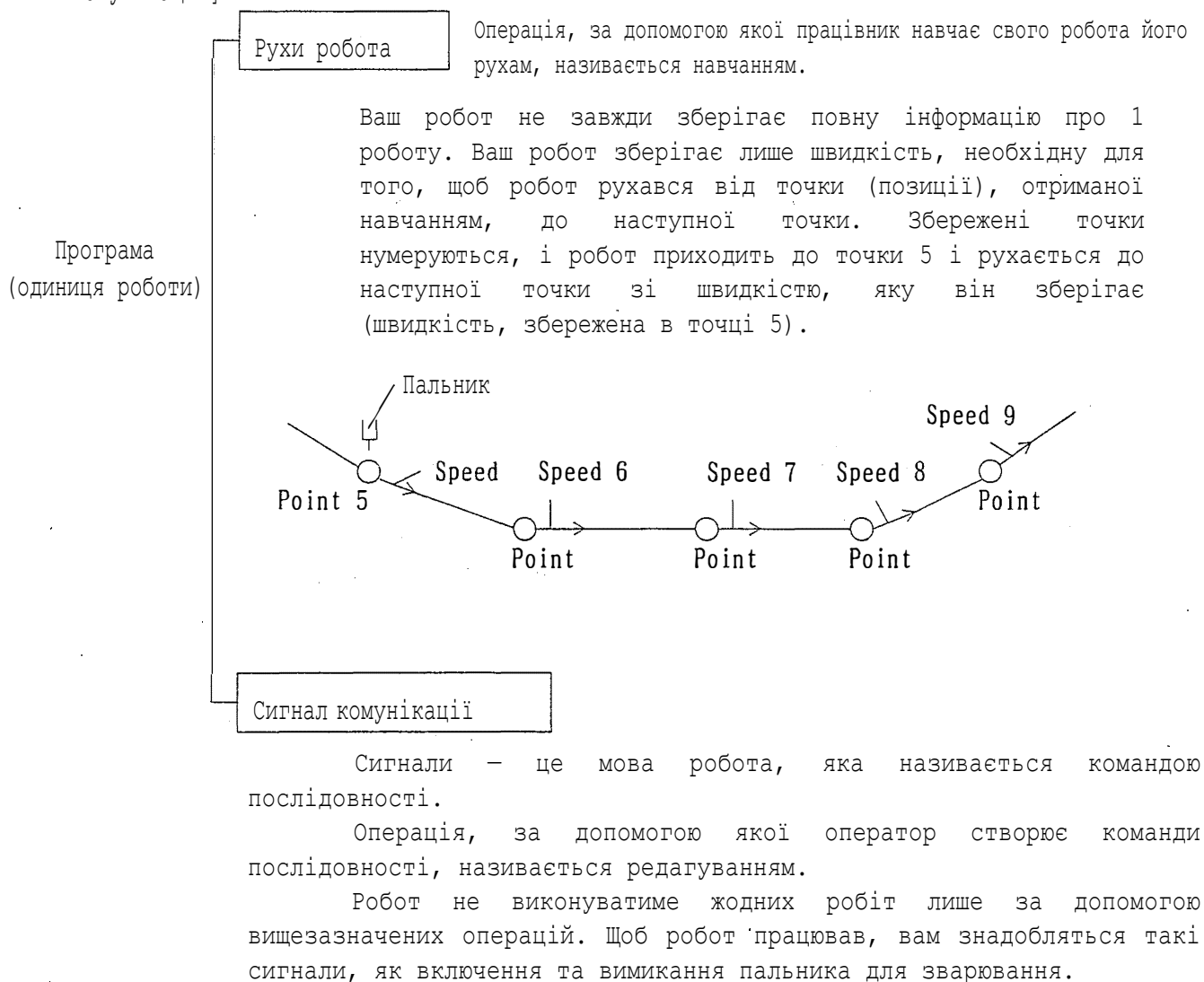
Іншими словами, робота класифікується як програма №1, заготовка під назвою А і як програма №2, заготовка під назвою В.

Щоб виразити «програму» простим терміном, можна сказати, що це [посібник], що змушує робота працювати.

Робота робота полягає в підготовці [посібника] до різних робіт.

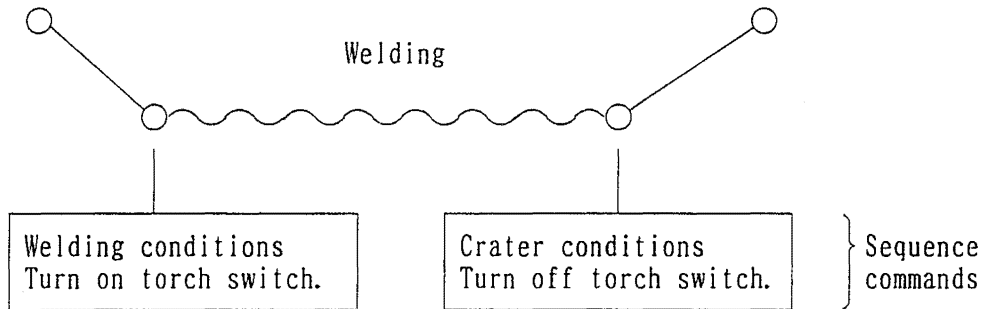
0 Структура програми

Програма складається з двох частин, [рухи робота] і [сигнал комунікації]

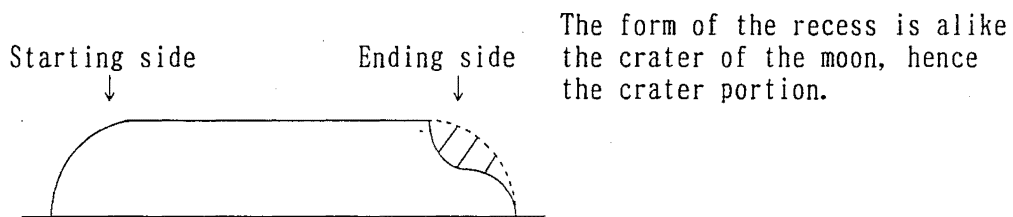


- Команди послідовності використовуються як конкретний зміст робіт.

- The diagram below shows the relation between the “sequence command” and the “point of motion” in the program, in which group of the sequence commands are stored at the point.



- * Crater conditions are the conditions of welding to fill the recess at the welding ending point.



- * Welding conditions, turning on and off of the torch switch are also the sequence commands. These commands are entered smoothly while teaching.
- Operations of the robot are used mainly to generate the programs such as above. Note that such programs are not really convenient in use and involves many other operations that makes the use of the robot conveniently.

Operation keys of Robot

1. Teaching pendant

The teaching pendant is used to create movements of the robot or to correct the movements of the robot.

Push buttons (called "keys") are used according to the language displayed.

The methods of using keys is contained in the operations stated in subsequent pages of this manual. Functions of the keys are stated in the appendix. The teaching pendant key sheet diagram is provided at the end of the manual.

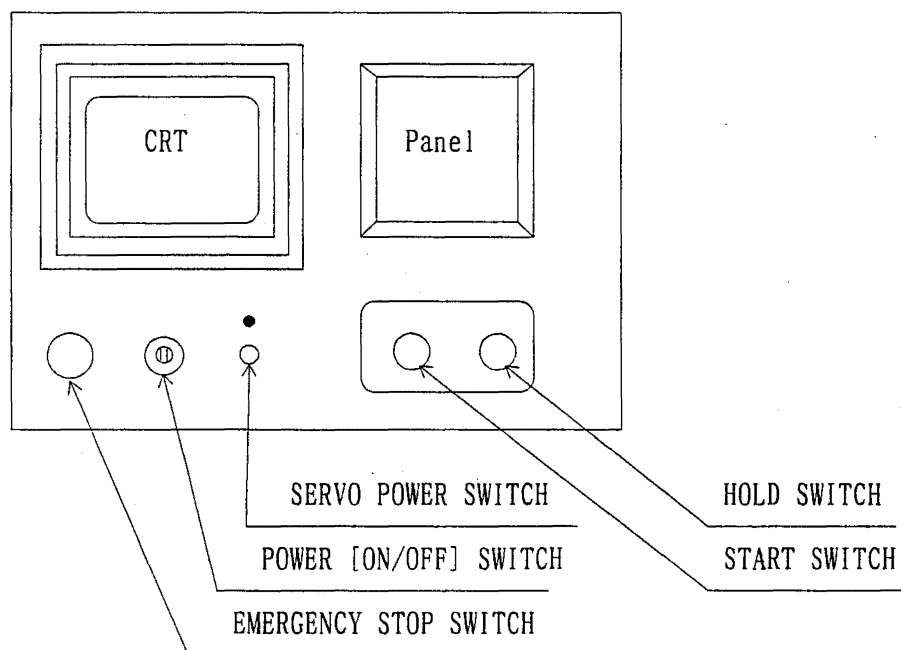
2. Panel

The panel is used to give instructions to operate the robot. It is also used to instruct the robot with various contents of work without using the teaching pendant.

(1) Construction and name of components of the panel

Console

(Operation box)



For the panel key switch arrangements, refer to the "Console Panel Diagram" at the end of this manual.

2. CRT message (CRT is a cathode ray tube.)

To cause the robot to perform certain welding works, you should teach your robot the moving paths, position to start welding and to end welding.

With PANA ROBO, the CRT screen asks you, for example, as follows.

Select the operation.				
F1	F2	F3	F4	F5
PLAY	TEACHING	EDIT	TAPE PRINT	NEXT KEY

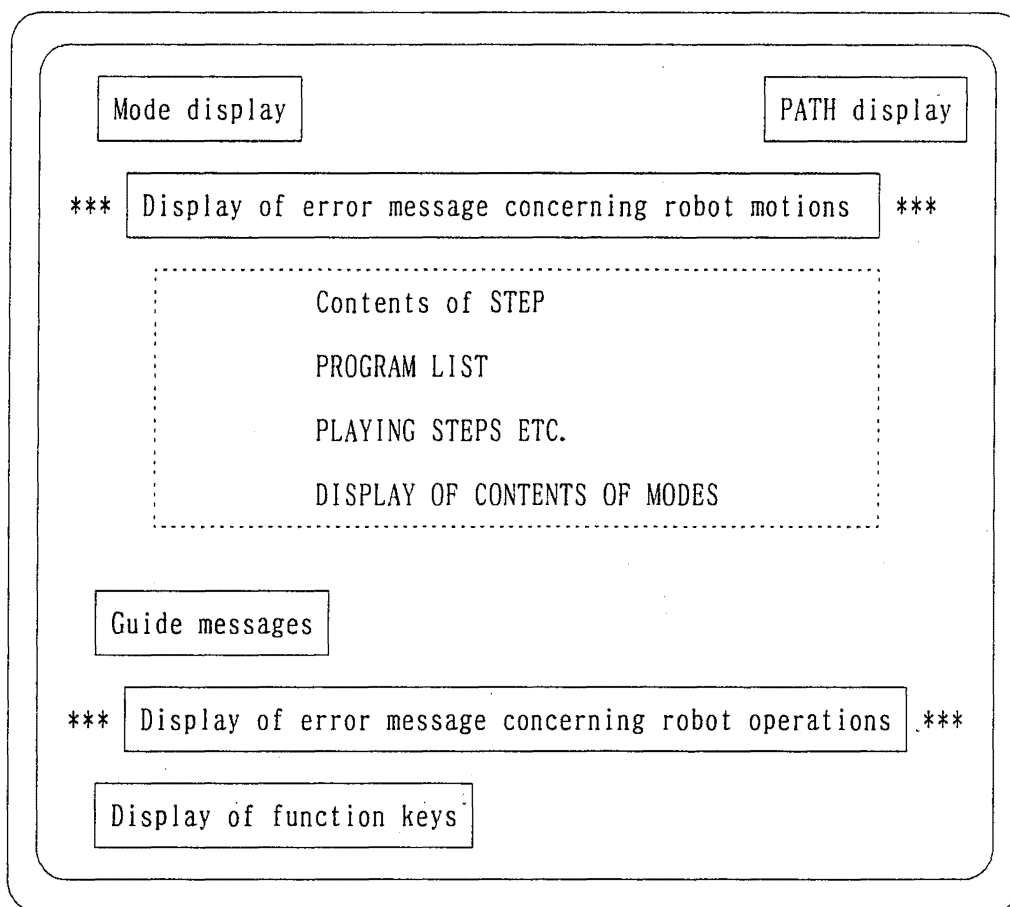
Simply operate your robot by answering the messages, and you can teach necessary matters to your robot.

At the end of this manual is provided a flowchart which described the order of the message the CRT screen asks you.

(As you become familiarized with your robot operation, you will be able to perform all necessary operations by storing the flowchart.)

3. Display on CRT screen

The following diagram shows the contents of the display on the CRT screen.



NOTE:

To prevent the burning of the CRT screen, this robot is designed to reduce the CRT illumination automatically.

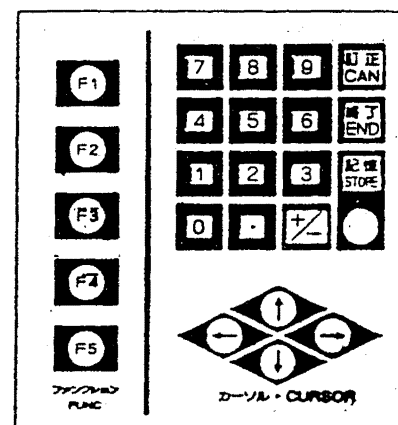
The CRT screen illumination is reduced 30 minutes after the last key operation and goes out one hour later.

The screen can be forcibly turned off during the robot operation using the "CRT OFF" key. (Refer to the display in operation stated in the operation No. 32.)

4. Function keys

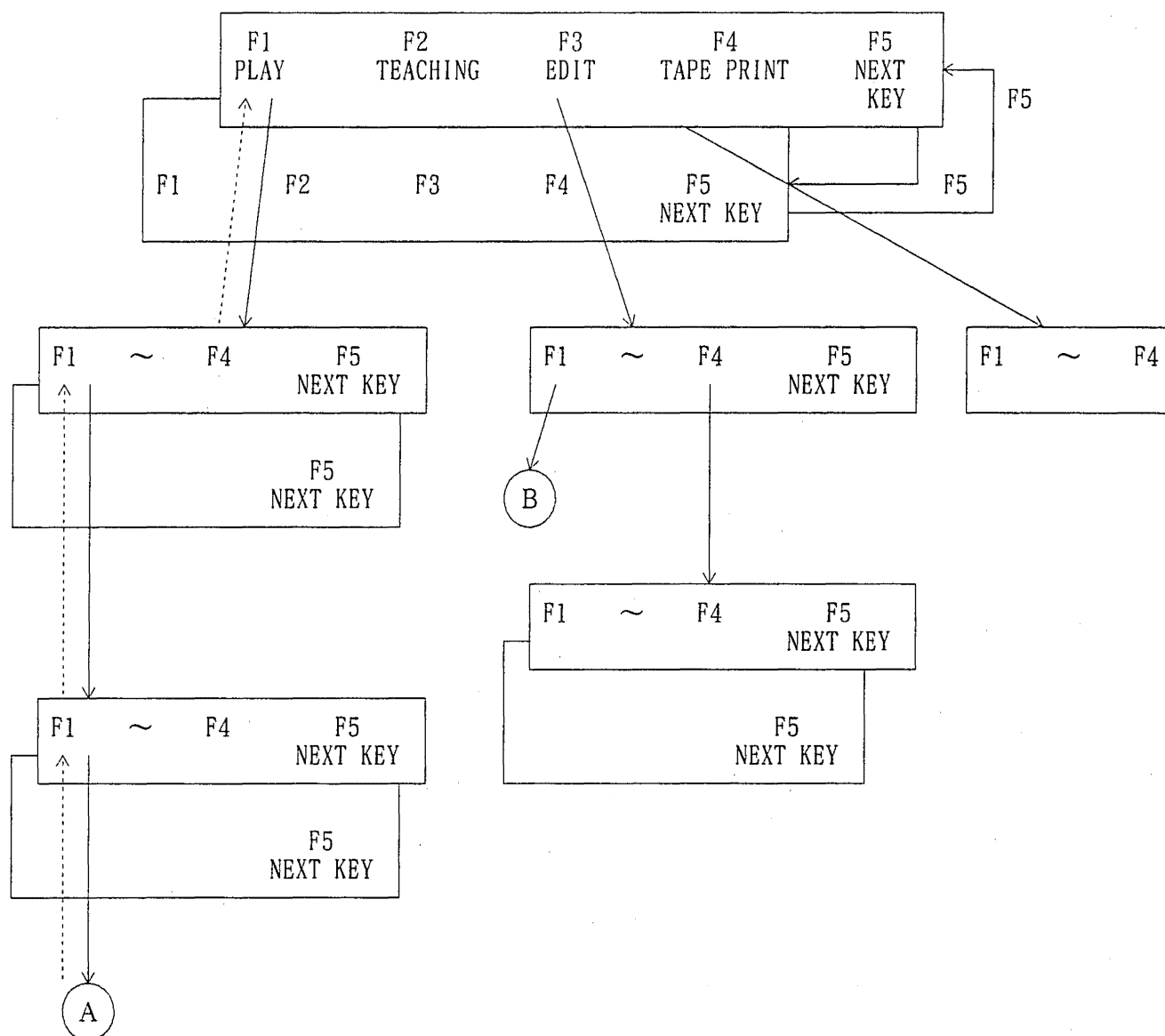
- Functions keys are provided on the panel.

F1 ~ F5 keys as shown in the diagram at right.



Function keys are used to display a number of robot operations on the CRT screen.

INITIAL DISPLAY



When the function key is pressed, the display is changed in the direction of an arrow mark. Note that these are all available routes. Therefore, it is not possible to display the operation B on the display immediately after displaying the operation A of the above diagram.

Pressing the [END] key of the panel moves back one display into the direction shown above. Press the [END] key repeatedly to return the display to the initial display, and press the function key again to show the display B.

The screen can be forcibly turned off during robot operation using the screen shut-off key.

* F5 function key (NEXT KEY)

The number of the route to be branched with the function key is more than five, not only five routes. However, since we have only five function keys, the routes are divided into two to show them on two pages. Thus the displays are changed using the F5 (NEXT KEY) key.

Pressing the F5 key repeatedly returns the display to the original display.

Regard the function key as one used for turning pages.

A diagram to show overall function keys is provided at the end of this manual.

- * In case the [F4] key of the function indicates the completion of setting and if this F4 key is pressed, one display is moved back.

5. PATH display on the screen

The step number of [TRACE +] and [TRACE -] and the PATH of the robot are displayed at upper right section of the CRT screen during tracing of robot.

For example:

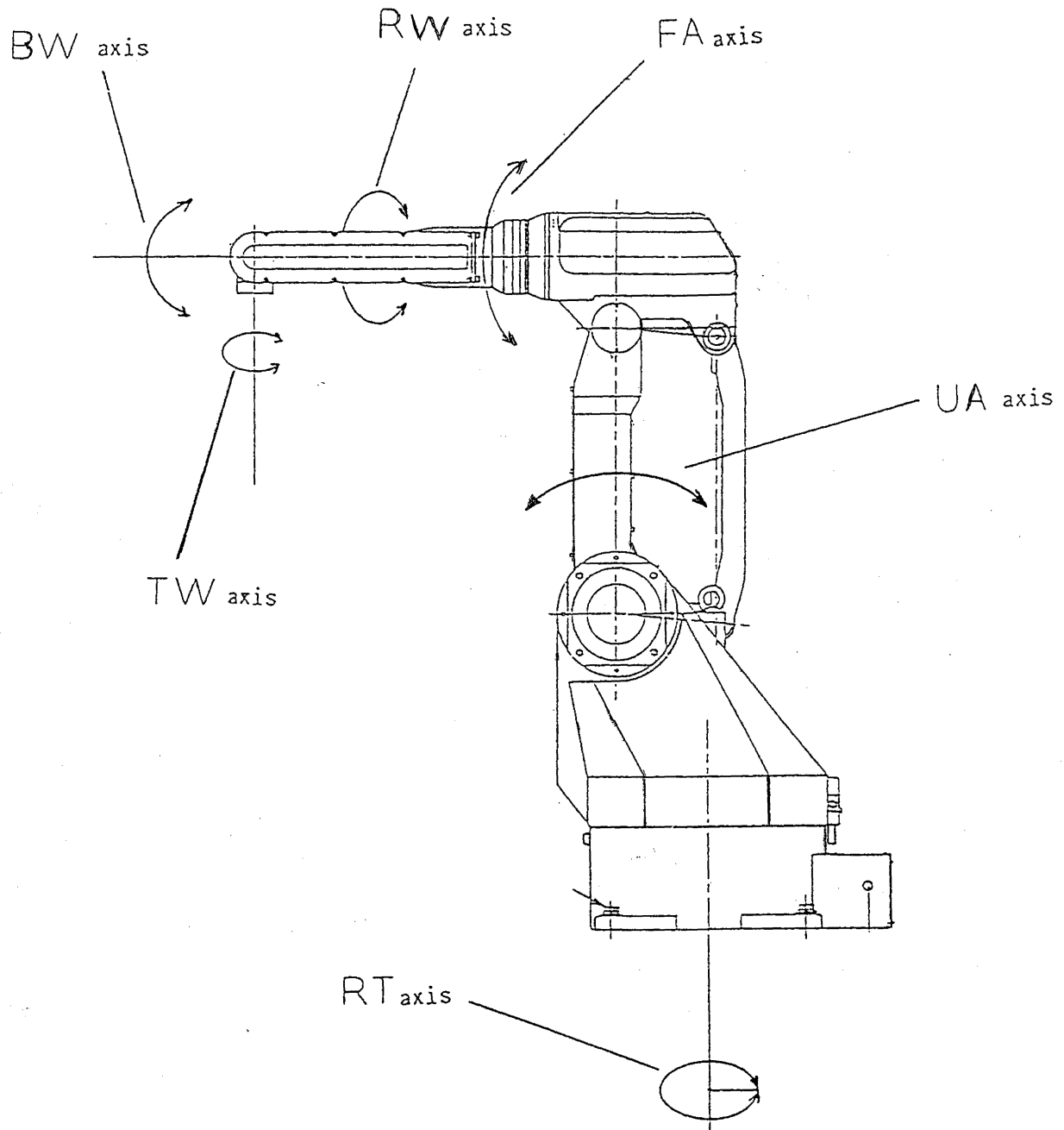
In case the display gives you [26 P : A 28],

the robot moves to the step 28 by A (linear interpolation) in the TRACE + mode, while the robot moves to the step 26 by P (PTP) in the TRACE - mode.

{	A: Linear interpolation, B: Weaving, C= Circular interpolation	}
	D: Circular weaving, P: PTP.	

If [26 P :] is displayed, it means that you cannot trace the robot.

Name of each manipulator arm



(AW8010)

CHAPTER 2

Basic Operation (Elementary Section)

The Elementary Section of this Operation Manual deals with the operations which are the basis for PANA ROBO to perform its welding requirements. PANA ROBO is different in the following two points of conventional machines.

- Conventional machines: Movements and uses of the machine are almost determined according to the job required, before the machine is delivered. This means that less contents for selection are available for the user.
- Robot: Movements and uses of the robot are designed according to the job required after the robot is delivered. This means that contents of the job are selected by the user.

The robot has a number of push buttons and displays to do the required welding jobs, but their operation procedures are predetermined. Only the limited number of such push buttons and displays are used for each of the welding operation. It does not mean that all of the push buttons and displays are used all the time.

Like learning how to drive a car at a driving school, one would be first very slow in maneuvering the car but can drive it as desired when as the driver becomes practiced. The same applies to the operation of the robot. In driving a car, the driver have to use both its hands and feet at the same time, but the robot operation can be performed by using your fingers while referring to the given data.

The basic operation (Elementary Section) describes the operations for the robot up to welding a workpiece set on the work table, and includes the operation procedures and cautions necessary for the operator who uses the robot for the first time. Whenever you are not sure on any robot operation, refer to this manual for confirmation.

It is recommended that even an operator experienced with the robot start from the Elementary Section.

This section comprises operations from [Power Supply] to [Starting Robot by Panel Operation] and [Changing of Welding Conditions].

Basic Operation Procedure of PANA ROBO

Chapter 2 describes the operation procedures which are the basic requirements of the robot.

(Operation 1)

POWER SUPPLY

(Operation 2)

TEACHING
(Used for making programs for linear motion.) Teaching is an operation to teach movements and welding to the robot.

(Operation 3)

CONFIRMATIVE OPERATION (TRACE)
Confirmative operation is used to check the program made by teaching. (Checking and correction of targets are especially performed with this operation.)

(Operation 4)

PANEL OPERATION (PLAY COND)(D)
Robot is started with the key on the panel.

(Operation 5)

REGISTRY AND CORRECTION OF JOBS
(Preparations to perform external operation.

(Operation 6)

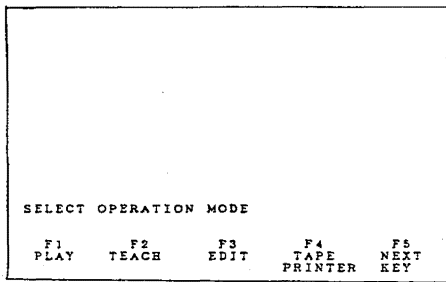
EXTERNAL OPERATION
(Starting of actual works and production)

Operation 1 : POWER SUPPLY

The operation 1 is performed to supply power to the robot.

Before supplying the power, verify that the working environments are in safe conditions.

Verify that no one is within the robot operating range, that is, within the safety fence. *1

No.	Method of operation	Response of display
1	Turn on the switch of the power unit. (User power unit: 3 Phase. 200V)	CRT screen is immediately [ON] after turning the [POWER] key switch of the operation panel to [ON].
2	Turn on the no fuse breaker of the robot control unit. • To turn on the no fuse breaker, turn counterclockwise the handle provided at upper left of the front door of the control unit.	
3	Turn the key switch [POWER] on the operation panel to [ON]. *2	
4	Turn on the power for the attached equipment, if any.	

*1 : Check daily that the emergency stop switch [EMG. STOP] actuates effectively.

*2 : CRT display is given about two seconds after the [POWER] key switch is set to [ON].

Операція 2: НАВЧАННЯ (лінійна інтерполяція)

Навчання – це операція, під час якої оператор переміщує робота до збереження позиції та генерує програми.

No.	Method of operation	Response of display
0	<Щоб перейти з іншого режиму на режим навчання> Повторіть натискання клавіші [END] на панелі, і з'явиться початковий екран (див. операцію 5.), і можна вибрати [TEACH]. Щоб завершити режим [PLAY], натисніть клавіші [END] і [CANCEL] на пульту навчання одночасно, а потім натисніть клавішу [END] на панелі.	
1	Натисніть клавішу F2[TEACH].	
2	За допомогою цифрових клавіш введіть номер програми Використовуйте незареєстрований номер програми від 1 до 999. Зверніть увагу, що номер програми, що можна зареєструвати становить до.255 Щоб перевірити номер незареєстрованої програми, натисніть клавішу [END], щоб повернутися до початкового екрана, і виберіть F3 (EDIT) і F2 (PROGRAM). Повторне натискання клавіші [END] повертає до початкового екрана.	

No.	Method of operation	Response of display
3	Натисніть клавішу STORE Якщо програма вже існує, на екрані з'являється повідомлення [ЧИ ПОТРІБНА ОПЕРАЦІЯ ТРАССИРОВКИ?]. Натисніть F2 [NO] і знову зареєструйте інший номер програми. Коли використовуються зварювальні дані додаткової функції, з'являється повідомлення [Ви використовуєте дані зварювання?]. Натисніть F2 [NO], і стане можливою наступна операція пульта навчання.	[STEP NO.]display (See note.) [Speed 7.5 (m/min.)]display (Дисплей пульта навчання)
4	Натисніть клавішу [TEACH OK] на пульта для навчання. Зауважте, що пультом навчання не можна керувати, якщо не світиться світлодіод клавіші [TEACH OK].	

ЗАПУСК РОБОТА

Для оператора, який керує роботом вперше

Робот має певну кількість навчальних систем координат.

- Щоб отримати докладнішу інформацію, зверніться до навчання системи координат в РОЗДІЛІ 5. Навіть якщо натиснуто одну й ту саму клавішу пульта навчання, пам'ятайте, що рух робота змінюється в кожній системі координат.
- Перш ніж перемістити робота, перевірте ще раз, що всередині робочої зони робота нікого немає
- Переміщайте робота на низькій швидкості, поки його рухи не будуть повністю зрозумілі. Натисніть клавішу вибору швидкості [SPEED H-M-L] на пульта навчання, щоб змінити діапазон швидкості з Високої на Середньовисоку швидкість на Середню швидкість на Середню низьку швидкість і на Низьку швидкість.
- Перевірте, чи горить лампочка [ARTI] навчальної системи координат.
 - Для некваліфікованого оператора, який керує роботом вперше, рекомендується спочатку перемістити робота за допомогою координати [ARTI] для простого переміщення кожної осі робота. Потім натисніть клавішу [COORD SYSTEM] на пульта навчання, щоб зрозуміти рухи робота в кожній системі координат.
- Як рухати роботом за допомогою клавіш керування.
 - Щоб перемістити робота, натисніть операційну клавішу [RT-TW], одночасно натиснувши клавішу [ROBOT AXIS] на пульта навчання. Поки утримується клавіша [RT-TW], робот рухається. Якщо ви хочете перемістити робота лише за допомогою клавіші [RT-TW], зверніться до Системних налаштувань, функції розширення та клавіші керування роботом у ГЛАВІ 5.
- Коли робота підвішуєть на стіні або на стелі, напрямки руху робота відрізняються

No.	Method of operation	Response of display
	i) КРОК №. 0 не існує, тому що це навчальна точка, встановлена всередині машини, щоб встановити швидкість для переходу до КРОКУ NO. = 1. ii) Швидкість до КРОКУ NO. 1, тобто (швидкість переміщення до першої точки навчання) відображається на рівні 7,5 м/хв.	
5	Виберіть швидкість, з якою зручно рухати робота. (1) Якщо швидкість 7. 5 м/хв. використовуйте без змін: Натисніть клавішу [STORE] на пульту для навчання (2) Якщо швидкість потрібно змінити: а) Використовуйте клавішу [SPEED H-M-L] і [SPEED+,-] на пульту для навчання, щоб встановити нову швидкість. б) Натисніть клавішу [STORE]	STEP NO. 0 Every time the [SPEED H-M-L] key is pressed the speed range moves in order of [HIGH->MEDIUM HIGH->MEDIM->MEDIUM LOW->LOW].
6	Зареєструйте навчальні точки вздовж траєкторії руху Перед реєстрацією необхідно зрозуміти (1) як зареєструвати навчальні точки та (2) як користуватися клавішами [STORE] та [WELD STORE] Під час навчання на екрані шафи відображається поточна позиція, команда відтворення та швидкість. Щоб керувати роботом, натисніть клавішу [RT-TW], одночасно натискаючи клавішу [ROBOT AXIS] на навчальному пульту.	Світлодіод [INS] біля кнопки [MODIFY] ○ ПРИМІТКА: Лампа INS має горіти завжди <pre> TEACH O A:----- PROGRAM= 4 CMNT= ----- STEP COMM SPEED (M/MIN) SEQ. COMMAND 1 A-0 7.50 X = 859.16MM Y = 29.88MM Z = 1268.11MM U = 178.02" V = 129.91" W = 175.51" ----- PLEASE TEACH STEP 1 ADDED </pre>

No.	Method of operation	Response of dispJay
6	• • Щоб керувати зовнішньою віссю, натисніть клавішу осі для зовнішньої осі з 1 по 6, одночасно натискаючи кнопку [AUX. AXIS] ключ пульта для навчання.	
7	Коли навчання всіх точок завершено, натисніть клавішу [TEACH OK] пульта для навчання.	
8	натисніть клавішу [END] пульта для навчання	
9	Перейдіть до [Операції 3 : Трасування].	

○ Що таке [ЛІНІЙНА ІНТЕРПОЛЯЦІЯ]

Лінійна інтерполяція використовується для лінійного переміщення робота між двома точками, зареєстрованими операцією навчання.



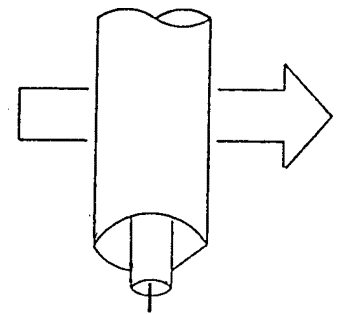
Лінійний рух

○ Як зареєструвати точки навчання

(Позиція та швидкість).

Натисканням клавіші [WELD STORE] або клавіші [STORE] пульта навчання під час навчання реєструється положення та швидкість переміщення робота.

Швидкість, яку потрібно зареєструвати



∠ Точки для реєстрації при навчанні

Швидкість, яку потрібно зареєструвати, — це швидкість, необхідна для переміщення від навчальної точки, яка має бути зареєстрована, до наступної точки навчання.

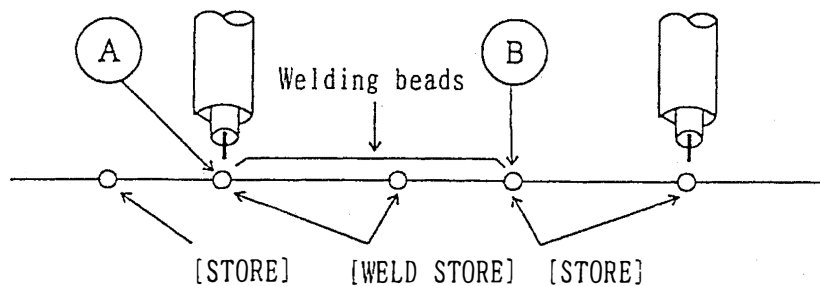
- Встановлена швидкість може регулюватися в межах від 0.01 m/min. до 120 m/min. за допомогою клавіші [SPEED H-M-L1] і [SPEED +,-] на пульта для навчання.

* Регулювання діапазону швидкостей

Low speed	:	0.01 m/min.	to	0.99 m/min.
Medium low speed	:	1.0 m/min.	to	9.9 m/min.
Medium speed	:	10 m/min.	to	29 m/min.
Medium high speed	:	30 m/min.	to	59 m/min.
High speed	:	60 m/min.	to	120 m/min.

○ Як використовувати клавіші [STORE] і [WELD STORE] яка з клавіш [STORE] або [WELD STORE] використовуватиметься, залежить від того, чи є відстань від навчальної точки, яка зараз реєструється, до наступної точки навчання траєкторії зварювання.

• [Початок зварювання]	• Натисніть [WELD STORE]
• [Середина шва (шлях)]	• Натисніть [WELD STORE]
• [Кінець зварювання (початок переміщення або середина переміщення без зварювання]	• Натисніть [STORE]



○ Режими зварювання

Меню змінюється з №1 на №5 коли ви натискаєте клавішу [SPEED +,-] і одночасно натискаєте клавішу [MENU SELECT] на пульті.

Оскільки в пам'яті робота меню зварювання зберігається, заздалегідь у відповідних режимах №1-5 виберіть номер режима для відповідних умов зварювання.

○ Навчання зварювальних точок

У точці початку зварювання (A) натисніть клавішу [MENU SELECT] а потім клавішу [WELD STORE]. В результаті автоматично генеруються умови зварювання та послідовність початку зварювання (включення перемикача пальника тощо), що відповідають номеру меню.

У кінцевій точці зварювання (B) натисніть клавішу [MENU SELECT] а потім клавішу [STORE]. В результаті автоматично генеруються умови зварювання кратерів і послідовність закінчення зварювання, що відповідають номеру режиму зварювання.

У розділі зварювання світиться світлодіод клавіші [WELD] підвісного світильника під час навчання та підтвердження.

Умови зварювання можна змінити, змінивши номер режиму та натиснувши клавішу [WELD STORE] в середній точці між (A) і (B).

○ Штовхаюча подача (JOG)

Щоб рухати робота під час навчання за допомогою пульта навчання, натисніть клавішу [JOG], перевірте, чи світиться світлодіод, і натисніть клавішу переміщення. Кожного разу, коли натискається клавіша переміщення, робот рухається на один крок. Величина подачі кроку може бути встановлена наступним чином за допомогою величини подачі, встановленої заздалегідь за допомогою параметрів робота, за допомогою клавіші [SPEED H→M→L]

[HIGH SPEED]	: 1.00 mm приблизно
[MEDIUM HIGH SPEED]	: 0.75 mm приблизно
[MEDIUM SPEED]	: 0.50 mm приблизно
[MEDIUM LOW SPEED]	: 0.35 mm приблизно
[LOW SPEED]	: 0.20 mm приблизно

Щоб скасувати JOG подачу, знову натисніть клавішу [JOG], і світлодіод погасне. Величина подачі кроку, яку можна встановити для кожної швидкості, становить від 0,01 до 10,000 мм, що має задовольняти умовам швидкості (Висока швидкість > Середня висока швидкість > Низька швидкість > Середня низька швидкість > Низька швидкість).

○ Протягування дроту (працює при ввімкненому спеціальному зварювальному апараті)

Дріт можна протягнути, натиснувши клавішу подачі дроту (WIRE +) або клавішу подачі дроту (WIRE -). Коли натиснута клавіша [+], провід спочатку подається повільно, а потім подається з високою швидкістю, утримуючи натиснутою близько трьох секунд.

При натисканні клавіші [-] дріт рухається в зворотному порядку. Як тільки ви відпустите палець від ключа, подача дроту знову почнеться з низької швидкості. Швидкість просування дроту можна вільно встановлювати.

Див. розділ "Налаштування системи, умови зварювання та швидкість протягування" у розділі 4.

○ Multiple registration (Same point registration)

When the STORE key is pressed again without moving the robot (in an attempt to register the same point twice), the alarm sounds and the message Err 9 is displayed on the Teaching pendant. To perform multiple registry of the same point, press the STORE key again. In case of malfunction, press the CANCEL key.

○ Sequence input

- (1) Verify that the lamp of the [TEACH OK] key of the Teaching pendant is turned on. If not, press the [TEACH OK] key to turn on the light.
- (2) Press the [SEQ] key and verify that the lamp of the [SEQ] key turns on.
- (3) [H-3] will be shown on the speed display section of the Teaching pendant, which can be changed as follows by pressing the [SPEED +,-] key.

[H-3]

[-] key ↑ ↓ [+] key

[0-0]

[-] key ↑ ↓ [+] key

[0-1]

[-] key ↑ ↓ [+] key

[H-0]

[-] key ↑ ↓ [+] key

[H-1]

- (4) To register, push the [STORE] key.

- When [0-0] is displayed : Pressing the [STORE] key registers [0-0 1].
- When [0-1] is displayed : Pressing the [STORE] key registers [0-0 1].
- When [H-0] is displayed : Pressing the [STORE] key registers [H-0 1].
- When [H-1] is displayed : Pressing the [STORE] key registers [H-1 1].
- When [H-3] is displayed : Pressing the [STORE] key registers [H-3].

Note: Pressing the [WELD STORE] key does not register.
Once registered, the speed cannot be cancelled from the Teaching pendant. To cancel or change the registered speed, perform editing by the panel.

(5) When the operation (4) is performed, the speed is registered in the last sequence command of the teaching point number displayed on the teaching pendant.

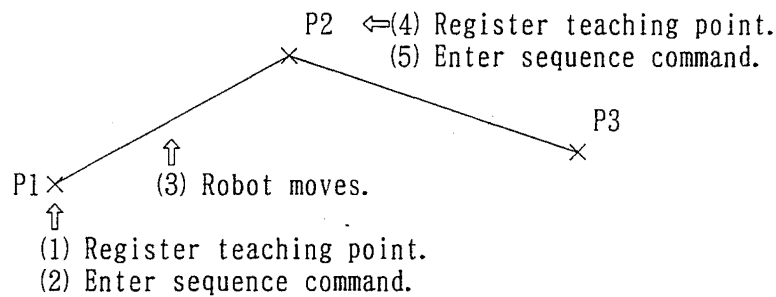
(6) To end the input of the sequence command, press the [SEQ] key again.

While the [SEQ] lamp is turned on, the robot cannot be moved.

○ Cautions in entering the sequence command from the Teaching pendant.

Before entering the sequence command from the Teaching pendant, register the teaching point first.

[Example]



(1), (4): Press the [STORE] key to store positions.

(2), (5): Press the [SEQ] key and the LED at upper left corner of the key goes on.

Press the [+,-] key to select the sequence command. The sequence is displayed on the digit of the [m/min. or %] key.

Press the [STORE] key and the sequence command is entered.

NOTE: The sequence command is entered into the STEP of the step number.

Therefore, when a sequence command is entered before performing (4) at the position P2 after operating the robot at (3), the sequence command is added to the step P1., which is regarded as the continuation of (2).

NOTE: Commands AJO, ASS, CJO and AES are inserted simultaneously with teaching point registration.

0 Коливання

(1) Звичайне коливання

Увімкніть індикатор  клавіші [PATH].

Коли ви натискаєте клавішу [SPEED +, -] під час натискання клавіші [WEAVE TYPE], на дисплеї швидкості альта навчання відображається [b 1] ~ [b 6].

Під час реєстрації коливань виберіть шаблон коливань, який потрібно зареєструвати, і натисніть клавішу [STORE] або [WELD STORE].

ПРИМІТКА: Після відпускання клавіші [WEAVE TYPE] індикація швидкості повертається до початкової індикації швидкості.

(2) Кругове коливання

Увімкніть індикатори  і  клавіші [PATH].

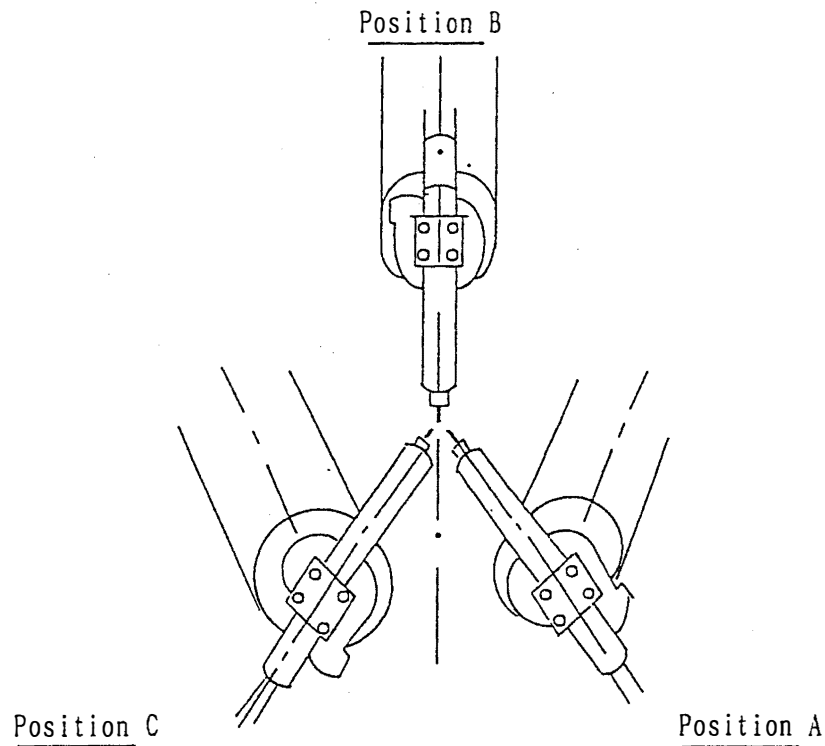
Коли ви натискаєте клавішу [WEAVE TYPE], на дисплеї швидкості навчальної підвіски відображається [d 2].

ПРИМІТКА: кругове плетіння має тільки візерунок [d 2]. Після відпускання пальця від клавіші [WEAVE TYPE] індикація швидкості повертається до початкової індикації швидкості.

0 Застереження при навчанні осей RW і TW

Під час навчання осі зап'ястя (осі RW, TW) розгойдуватися на 180° , повинна існувати навчальна точка посередині. Якщо на середині шляху немає навчальної точки, осі намагаються повернутись у зворотному напрямку, викликаючи помилки. (Виникає помилка 2.)

[Приклад) Щоб навчити вісь TW переміщатися з положення А в положення С, зареєструйте положення В перед реєстрацією положення С.



ПРИМІТКА. Ті самі проблеми, що й вище, виникають під час запуску операції, просування або відведення, залежно від положення осі зап'ястя. Будьте обережні перед початком роботи, просуванням і відведенням трасування.

Selection of Locus Calculation System of AW8010 (AW8006)

The model AW8010 (AW8006) has two types of calculation systems indicated by the CL1 and CL2 in addition to the usual calculation system, which is displayed as CL. Since each system has different application, select the calculation system according to your applications.

Both the CL1 and CL2 are the calculation system related to the circular interpolation, and used to teach a circular or a circular weaving.

For example, when the robot position changes largely while teaching a circular such as a saddle-like workpiece, teaching may become difficult. In such a case, apply the CL1 and CL2.

(1) CL1

The CL1 is a suitable calculation system when the torch vector is at within 10° to an axis that is set perpendicularly on the plane of the circular in the circular interpolation.

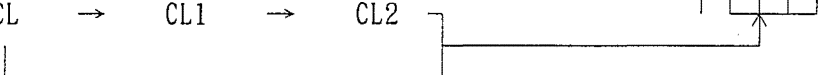
(2) CL 2

The CL 2 is suitable calculation system when the torch vector is at over 10° to an axis that is set perpendicularly on the plane of the circular in the circular interpolation.

Points taught by the CL1 and CL2 are displayed on the CRT display as the following commands.

CL 1 $\longrightarrow$ C-S1 or C $\cdot$ S1

CL 2 $\longrightarrow$ C-S2 or C $\cdot$ S2

No.	Method of operation	Response of display
1	Press the [PATH] key of the Teaching pendant to select the circular.	○ [Q] turns on.
2	When you press the [MENU SELECT] key while keeping to push the [WEAVE TYPE] key on the Teaching pendant, the number of the calculation system is displayed on the LED for displaying the step number. This number changes every time the [MENU SELECT] key is pressed. CL → CL1 → CL2 	Step No. display of Teaching pendant 
	Release your finger when the CL 1 is displayed.	CRT display (C-S1 or C • S1)
3	Register the point where the CL 1 is displayed.	
4	Move the point to the teaching point and register the point. (The second point of the circular interpolation)	
5	Move the point to the next teaching point. (The third point of the circular interpolation)	
6	Press the [CIRCLE WEAVE END] key and push the [STORE] or [WELD STORE] key.	
7	Return the calculation system to the original system in the same manner as (2). (CL 1 → CL)	

Operation 3: Confirmation Run (Tracing)

Confirmation run or tracing is an operation to check the motion, target position made by teaching and to correct points, if any.

○ Before operation

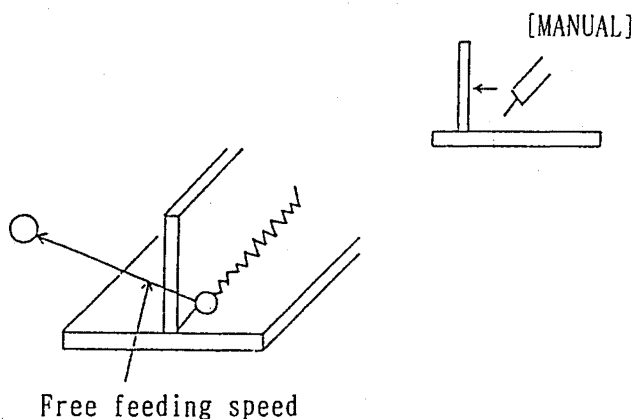
1. The robot motion is determined according to the taught position.

That is, when you want to change the motion of the robot, you should change the position of the taught points.

2. Turning on the [JOG] key

When the robot is in the confirmation run, always try to turn on the [JOG] key.

When correcting the target position (especially at the welding end point)



The speed from the welding end point is the air cut speed.

In many cases, the air cut speed is fast and the robot moves at such a fast speed.

As a result, the robot hits its torch against the workpiece.

When the [JOG] key is turned on, no possibility to be hit.

No.	Method of operation	Response of display
0	○ When teaching is ended. (Continued to No.1) ○ For the program stored in the robot: Perform the teaching No.0 to No.2 of the operation 2. If the number is registered already, the conditions become the same when the teaching is ended. (Continued to No.1)	

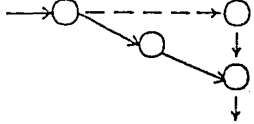
No.	Method of operation	Response of display
	<u>NOTE:</u> In these two cases, unlike the play mode, the general purpose input and output will not be active even if you start the robot. ○ For the play mode: Press the [TEACH OK] key of the Teaching pendant. (Continued to No.2) <u>NOTE:</u> If the robot is advanced or retracted in the trace mode, the general purpose input and output signal will not be active. But the outputs of the program with 0-6 are active. 1 Press the F1 [YES] key. 2 Press the [TEACH OK] key of the Teaching pendant and confirm that the lamp is turned on. ● To stop the robot at and advance from each teaching point, press the TRACE + key until the robot stops while pressing the [ROBOT AXIS] of the Teaching pendant. (Press for each step.) ● To retract the robot from the current position by one step (effective from STEP No.2), press the TRACE R - key until the robot stops while pressing the [ROBOT AXIS] key of the Teaching pendant. (Press for each step.)	Speed and step No. are displayed on the Teaching pendant. <pre> TEACH :HOLDING 4 A:----- PROGRAM= 4 STEP = 5 SPD 7.50 STEP COMM SPEED(M/MIN) SEQ.COMMAND 1 A-0 7.50 2 A-0 7.50 3 A-0 7.50 4 A-0 7.50 5 A-0 7.50 1AJO 230 22.0 2ASS 1 1CJO 100 18.0 2AES 1 FINISH TEACHING & PRESS START SW STEP F1 F2 F3 F4 F5 STEP PROGRAM INST DISP POSIT ROBOT LOCK </pre>

No.	Method of operation	Response of display
2	<u>NOTE:</u> Upon releasing your finger from the key being pressed during operation, the robot stops at a position where the key is released. If you keep pressing the key again, the robot moves to the teaching point and stops there. <u>NOTE:</u> The moving speed will be below the restricted speed set by the robot parameters. <u>NOTE:</u> The robot advances and retracts for tracing even while the [JOG] key lamp is turned on. The [JOG] key is effective only for the [RT~TW] key.	The F1 [STEP] F2 [PROGRAM] will be explained under CHAPTER 2: Applied Operation.
3	<u>Correct the teaching point as required.</u> <u>NOTE:</u> <u>The protected program cannot be corrected.</u> Refer to the paragraph "Protect." To end the confirmation run (Trace): (a) While operating Teaching pendant: (1) Press the [TEACH OK] key of the Teaching pendant and confirm that the [TEACH OK] key lamp turns off. (2) Press the [END] key and [CANCEL] key of the Teaching pendant simultaneously. (3) Press the [END] key of the panel.	

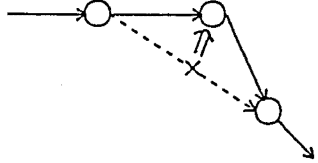
No.	Method of operation	Response of display
4	(b) When the [HOLD] key is pressed: (1) Press the [END] key and [CANCEL] key of the Teaching pendant simultaneously. (2) Press the [END] key of the panel. (c) For waiting for [START]: Press the [END] key of the panel. ○ For the teaching mode: The status of No.2 of the operation 3 is resumed. To end the teaching mode, press the [END] key of the panel. ○ For operation mode: Press the [END] key of the panel.	

= Correction of Teaching Points =

a) To change teaching points

No.	Method of operation	Response of lamp
1	Stop the robot at the teaching point to be changed by the confirmation run.	[MODIFY] lamp : CHG ○ [TEACH OK] lamp : ●→○
2	Press the [TEACH OK] key of the teaching pendant.	
3	Move the robot to the new teaching point by operating the key of the Teaching pendant.	
4	Press the [WELD STORE] key or [STORE] key.	

b) Addition of teaching points

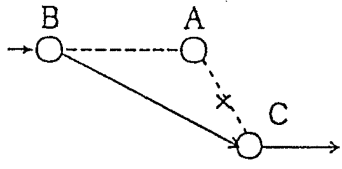
1	Stop the robot before the teaching point to be added or at a position along the path, by the confirmation run mode.	
2	Press the [TEACH OK] key of the Teaching pendant.	
3	Press once the [MODIFY] key of the teaching pendant to change the display to [INS].	
4	Press the [WELD STORE] key or [STORE] key.	

[TEACH OK] lamp : 0

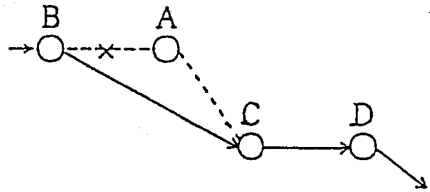
[TEACH OK] lamp : ○

[MODIFY] lamp : CHG ● → INS ○

c) Deletion of teaching points

No.	Method of operation	Response of lamp
1	Use the confirmation run mode and stop the robot at the teaching point (A) to be deleted or at a point along the path toward the next teaching point (C) of the teaching point to be deleted.	[MODIFY] lamp : CHG ● → DEL ○ [TEACH OK] lamp : ● → ○
2	Press the [TEACH OK] key of the Teaching pendant.	
3	Press twice the [MODIFY] key to turn on the [DEL] lamp.	
4	Press the [WELD STORE] key or [STORE] key.	

d) Deletion of the next teaching points

No.	Method of operation	Response of lamp
1	Stop the robot before the teaching point (A) to be deleted, in the confirmation run mode.	
2	Press the [TEACH OK] key of the teaching pendant.	
3	Press the [MODIFY] key to turn on the [INS] lamp.	
4	Press the [WELD STORE] key if the point (A) is the welding point. Press the [STORE] key if the point (A) is not the welding point.	
5	Press the [MODIFY] key to turn on the [DEL] lamp.	[TEACH OK] lamp : ● → ○ [MODIFY] lamp CHG ● → INS ○ INS ● → DEL ○ CHG ● → DEL ○
6	Press the [STORE] key or [WELD STORE] key.	
7	Press the [MODIFY] key and turn on the [DEL] lamp.	
8	Press the [STORE] key or [WELD STORE] key.	

No.	Method of operation	Response of lamp
9	The above steps complete the deletion of the point (A). Hereafter, the robot moves to the point (C) of the diagram by pressing the [TRACE +] key and to the point (B) by pressing the [TRACE -] key.	

d') Deletion of the next teaching point by locking the robot with the panel (1)

1	Stop the robot at a suitable position in confirmation run mode position.	
2	Press the [TEACH OK] key of the Teaching pendant.	[TEACH OK] lamp : ●→○
3	Press the [FUNCTION] key  [ROBOT LOCK] key to lock the robot.	
4	Use the [TRACE +, -] key in confirmation run mode to display the teaching point (A) on the display of the Teaching pendant.	
5	Set to [DEL] by the [MODIFY] key and press the [WELD STORE] key or the [STORE] key.	[MODIFY] lamp : DEL ○

d") Deletion of the next teaching point by locking the robot with the teaching pendant (2)

No.	Method of operation	Response of lamp
1	Stop the robot at a suitable position in confirmation run mode.	[TEACH OK] lamp : ●→○
2	Press the [TEACH OK] key of the teaching pendant.	
3	Simultaneously press the ROBOT LOCK key and [TRACE + (-)] key of the Teaching pendant to display the teaching point (A) on the display of the Teaching pendant.	
4	Set to [DEL] by the [MODIFY] key and press the [WELD STORE] key or the [STORE] key.	[MODIFY] lamp : DEL ○

Differences of two type of robot lock

In case of (d'), it takes about the same time during running for the robot to move to the next teaching point.

In case of (d"), the robot moves quickly to the next teaching point.

Deletion of welding start point and welding ending point:

In case (A) is the welding start point, welding starts from the point (C).

In case (A) is the welding ending point, welding ends at the point (B).

e) Changing of speed

No.	Method of operation	Response of lamp
1	Stop the robot, in confirmation run mode, at a teaching point to change the speed or at a midway position along the path.	
2	Press the [TEACH OK] key of the Teaching pendant.	[TEACH OK] lamp : ●→○
3	Press three times the [MODIFY] key to turn on the [SPEED] lamp.	[MODIFY] lamp
4	Use the [SPEED H→M→L] key and the [SPEED +, -] key to set a new speed.	CHG ●→SPD ○
5	Press the [WELD STORE] key or [STORE] key.	

Movements of robot when the robot is stopped between the teaching points with nothing being done, and movements of robot when addition and speed change are made and the robot restarted.

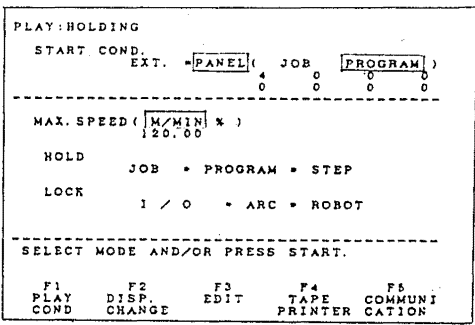
	State of holding mode	Press the [+] key.	Press the [-] key.
a) When nothing is carried out :			
b) When addition is made : (INS)			
c) When speed is changed: (SPD)	Speed $V_2 \rightarrow V^*$ 		
d) When change is made: (CHG)			

Operation 4 : Panel Operation

- So far the robot is taught its motions, and motions are checked and corrected (confirmation run). Now, we perform actual welding.
- The robot will not move if you press the PLAY [F1] only because the robot does not know of what contents it should move. Therefore, it is necessary for you to press the PLAY COND [F1] on the display and determine the contents of the robot motion. Various manners to move the robot are available and the robot motion varies with the location specified.

In this operation, we simply try to move the robot.

No.	Method of operation	Response of display
	<To change from other mode to the PLAY mode>	
0	Repeatedly press the END key to show the initial display (refer to the Operation 3), and the [PLAY] can be selected. To end the [PLAY] mode or the [TEACH] mode, press the [END] and [CANCEL] keys on the teaching pendant at the same time.	INITIAL DISPLAY SELECT OPERATION MODE F1 PLAY F2 TEACH F3 EDIT F4 TAPE PRINTER F5 NEXT KEY
1	Press the END key of the panel.	
2	Press the F1 [PLAY] key.	
3	Press the F1 [PLAY COND] key.	
4	Press the cursor key → to confirm that the [PANEL] is inversed (flashes).	PLAY:HOLDING START COND. EXT. *PANEL(JOB PROGRAM) 0000 0000 SELECT MODE AND/OR PRESS START. F1 PLAY COND F2 DISP. CHANGE F3 EDIT F4 TAPE PRINTER F5 COMMUNI CATION
5	Press the STORE key on the display.	
6	Press the cursor key → to confirm that the [PROGRAM] flashes on the CRT display.	

No.	Method of operation	Response of display
7	Then, press the STORE key on the display.	
8	Use the number key of the panel and enter the program number. If failed, press the CANCEL key of the panel and start entering again. <u>NOTE:</u> Since the display is the 3 digit display, adjust the digits of the program number. For example, enter the program number 55 as 0 5 5 .	 The screenshot shows a control panel with the following text: PLAY: HOLDING START COND. EXT. = PANEL (JOB PROGRAM) ----- MAX. SPEED (M/MIN *) 120.00 HOLD JOB = PROGRAM = STEP LOCK 1 / 0 = ARC = ROBOT ----- SELECT MODE AND/OR PRESS START. F1 F2 F3 F4 F5 PLAY DISP. EDIT TAPE COMMUNI COND CHANGE CATION
9	Press the STORE key on the display. <u>NOTE:</u> When moving the robot continuously, it is possible to enter up to a maximum of 8 program numbers.	
10	Press the END key of the panel. This END means the end of various inputs of the playing conditions of the robot.	
11	Press the [START] switch of the operation panel. ↓ START ↓ On completing the selected program, the robot stops. <u>NOTE:</u> For air cut (no welding), press the [WELD OFF] key of the teaching pendant before pressing the START switch of the operation panel.	Display at upper left of CRT [PLAY IN RUNNING] [PLAY END]

No.	Method of operation	Response of display
	When executing the same program again	
1'	Press the F1 [PLAY COND] key.	
2'	Press the END key of the panel.	
3'	Press the START switch of the operation panel.	

When setting the playing conditions, it is not necessary to enter the [stopping conditions] and [locking conditions].

When setting the playing conditions, pressing the F4 [SETTING END] forcibly ends the playing conditions.

In this case, the playing conditions return to the previously set playing conditions.

Точне налаштування режимів зварювання (замінити)

- Перевизначення (override) – це функція для точного регулювання зварювального струму, зварювальної напруги та швидкості зварювання, що виконується під час роботи з роботом.
- Якщо режими зварювання змінюються шляхом точного регулювання будь-якої точки зварювання між навчальними точками, такі точки зварювання будуть зварюватися за змінених умов під час наступного виконання програми. Ви також можете змінити режими зварювання, виконуючи програму без зварювання після натискання клавіші [WELD OFF].

No.	Метод виконання	Реакція лампи								
1	Коли робот в режимі Play, натисніть клавішу [MODIFY] на підвісці для навчання, щоб увімкнути лампу [O.RIDE].	0. RIDE лампа :○								
2	Натисніть [+], [-] кнопок LAMP],[VOLT],[SPEED] на пульті навчання. ▼ Струм: Натискання клавіш[+] і [-] змінює струм за точно налаштованими даними, які відповідають діапазону швидкості, заданому системним налаштуванням та налаштуванням умов зварювання. Мінімальне значення, яке можна встановити – це 1A. ▼ Напруга: Натискання клавіш [+] і [-] змінює напругу за точно налаштованими даними, які відповідають діапазону швидкостей, заданому системним налаштуванням та налаштуванням умов зварювання. Мінімальне значення, яке можна встановити, дорівнює 0,1 В	Коли умови зварювання перезаписані, швидкість на пульті навчання буде виглядати наступним чином: <table><tr><td>Override</td><td>Speed display</td></tr><tr><td>Current</td><td>Current value</td></tr><tr><td>Voltage</td><td>Voltage value</td></tr><tr><td>Speed</td><td>Speed value</td></tr></table> Наведені вище індикації застосовуються до тих, які відображаються від точки, перевизначеної до наступної точки навчання. Дисплеї повертаються до нормального відображення швидкості з наступної точки навчання.	Override	Speed display	Current	Current value	Voltage	Voltage value	Speed	Speed value
Override	Speed display									
Current	Current value									
Voltage	Voltage value									
Speed	Speed value									

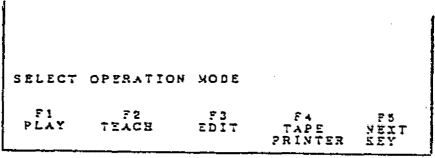
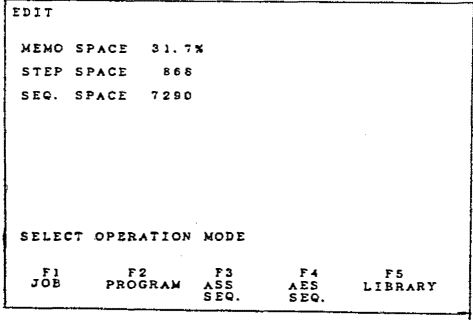
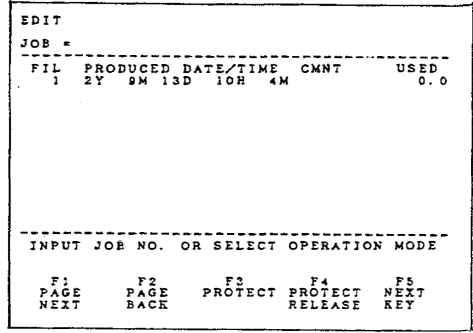
No.	Method of operation	Response of lamp																								
2	При точному налаштуванні струму та напруги робота, якщо кожна клавіша утримується натиснутою, струм і напруга змінюються повільно. Якщо ви хочете швидко змінити їх, натискайте клавіші швидко й кілька разів. ▼ Швидкість: Натискання клавіш [+] і [-] змінює швидкість за точно налаштованими даними, які відповідають діапазону швидкостей, заданому системним налаштуванням та налаштуванням умов зварювання. Мінімальне значення, яке можна встановити, становить 1%. Вихідне регулювання швидкості може бути прийняте для будь-якої кількості разів для кожного з одного виконання програми в діапазоні п'яти разів у напрямку + і п'яти разів у напрямку - між навчальними точками.	<table><tr><th>Speed range</th><th>Current (A)</th><th>Voltage (V)</th><th>Speed (X)</th></tr><tr><td>HIGH</td><td>10</td><td>1.0</td><td>10</td></tr><tr><td>MID HIGH</td><td>7</td><td>0.7</td><td>7</td></tr><tr><td>MID</td><td>5</td><td>0.5</td><td>5</td></tr><tr><td>MID LOW</td><td>2</td><td>0.2</td><td>2</td></tr><tr><td>LOW</td><td>1</td><td>0.1</td><td>1</td></tr></table> Стандартні перевизначення встановлених значень	Speed range	Current (A)	Voltage (V)	Speed (X)	HIGH	10	1.0	10	MID HIGH	7	0.7	7	MID	5	0.5	5	MID LOW	2	0.2	2	LOW	1	0.1	1
Speed range	Current (A)	Voltage (V)	Speed (X)																							
HIGH	10	1.0	10																							
MID HIGH	7	0.7	7																							
MID	5	0.5	5																							
MID LOW	2	0.2	2																							
LOW	1	0.1	1																							

ПРИМІТКА: • Перевизначення [SPEED] не діє для точок переплетення. Навіть якщо натиснути клавішу [SPEED], вона буде проігнорована. Перевизначення діє для клавіш [AMP] і [VOLT].

Захищені програми не можуть бути перевизначені. Якщо перевизначено, воно буде проігноровано.

Операція 5: Реєстрація та коригування виконання робочої програми (Job).

Виконання робочої програми(Job) — це одиниця, яку потрібно зареєструвати, щоб керувати роботом ззовні. Job складається шляхом зв'язування більш ніж однієї програми або кількох послідовностей. При переміщенні робота за допомогою пускового перемикача, передбаченого ззовні, Job вибирається і запускається цим перемикачем. Коли Job вибрано та запущено, програма та команда послідовності в завданні виконуються в порядку, в якому вони розташовані в Job. Під час зовнішнього запуску інших програм інші програми також можуть виконуватися тим самим Job.

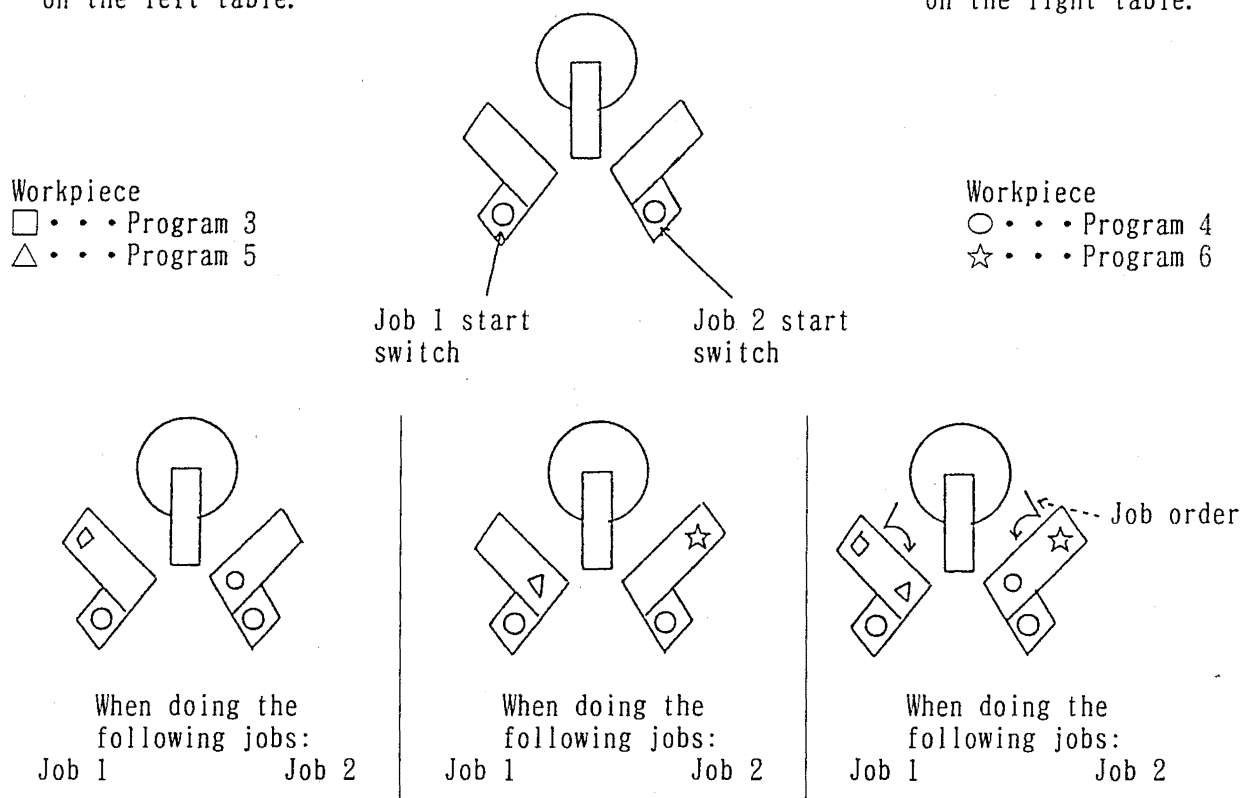
№.	Метод виконання	Покази дисплея
1	Натисніть клавішу END на панелі для відображення початкового дисплея.	
2	Натисніть клавішу F3 [EDIT]	
3	Натисніть клавішу F1 [JOB]	
4	Використовуйте цифрові клавіші на панелі та введіть номер робочої програми Job з трьох цифр.	
5	Натисніть клавішу STORE	
Щоб скоригувати існуючу Job:		
6	Використовуйте   курсові клавіші щоб перемістити блимаючий курсор до потрібного кроку.	
7	Натисніть F1 [CHG] та F2 [INS] . Переходьте до наступної операції №8 Нотатка: Для F3 ~ F5 , дивись операції №7 1~7	

№.	Метод виконання	Покази дісплея
	Для реєстрації нових програм	
8	Використовуйте функціональні та цифрові клавіші та введіть команди послідовності. Наприклад, щоб зареєструвати програму 5 в Job 5, натисніть клавішу F1 [P-C]. P-C означає програмний виклик. Натисніть клавіші 0 0 5	<pre> EDIT JOB = 001 CMNT= NO. CMD 1 P-C 110 ----- SELECT OPERATION MODE F1 F2 F3 F4 F5 CHANGE ADD DELETE INDEX NEXT KEY </pre>
9	Натисніть клавішу STORE	
10	Зв'яжіть програми за тими ж процедурами, що й операції з № 6 по № 9. ПРИМІТКА: Максимальна адреса Job це 999.	
11	Натисніть клавішу END Коли Job 1 виконується відповідно до вищенаведеного, виконується програма 5	

Example 1 : When working on tables at right and left using one robot:

Teaching completed
on the left table.

Teaching completed
on the right table.



P-C 3
↑

1. P-C 4

1. P-C 5

1. P-C 6

1. P-C 3
2. P-C 5

1. P-C 6
1. P-C 4

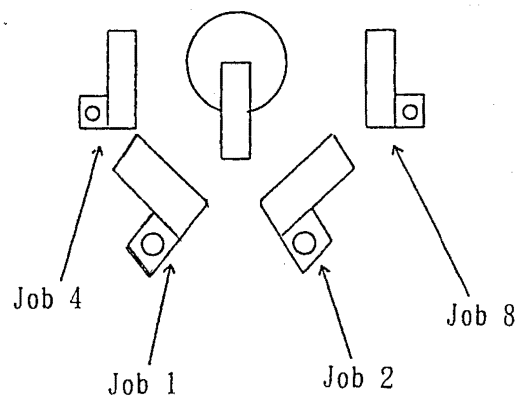
* When calling the program.

P-C is an abbreviation of Program Call.

Example 2 : Jobs as many as the table are necessary.

Job numbers to be used individually are seven

in total: 1, 2, 4, 8, 16, 32 and 64.



Example 3 : The original program will not be deleted even when the program linked to the job is changed.

Operation 6 : External Operation

- To start external operation

Initial display → Play [F1] → External run start button (Job start) →
Start of work

- To end the external operation

- State of completed play → [END] of panel → Initial display
- Midway of play → [HOLD] → [CANCEL] • [END] of Teaching pendant → [END]
of panel → Initial display.

- How to use the external start switch

This start switch is a reserve type switch. When the job 2 start switch is pressed while executing the job 1, the job 2 will be executed automatically after completing the job 1.

Start [JOB 1] → Robot starts job 1 work. → Start Job 2 → Job 2 work starts automatically when Job 1 ends. → Remove the workpiece of Job 1 and set a new workpiece. → Start [Job 1] → Job 1 starts automatically when Job 2 ends → Above steps are repeated.

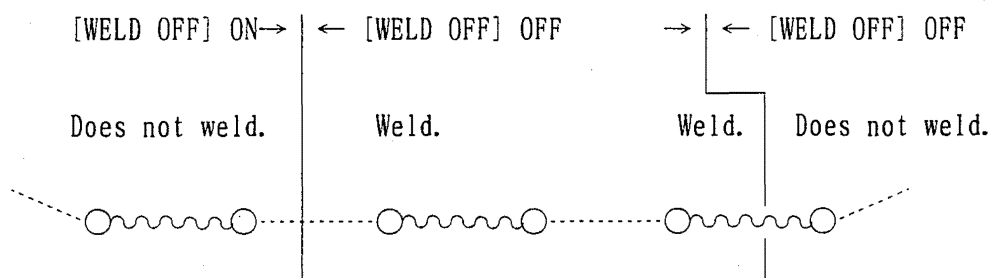
- Cautions in using jobs

- Pressing the start switch of the Job No. being executed will not be accepted.
- Unless the Job 2 start switch is pressed during the Job 1 execution, the robot stops at a position where the Job 1 ends.

Example: If the Job 2 start switch is pressed twice during the Job 1 execution, the Job 2 is executed only once.

- Fine adjustments of welding conditions can be made even during the external operation.

- [WELD OFF] of the Teaching pendant is valid even during the external operation.



Operation 7 : HOLD instruction

When you press the [HOLD] switch of the panel and the [HOLD] key of the Teaching pendant, and if an input exists at the external input terminals [STOP], [NO ARC], [STICK], [TORCH CONTACT], [NO GAS] and [NO WIRE], the robot will be in HOLD state.

When the hold is effected while welding, the robot executes the AES SEQ (AES n:n = 1 ~ 5) corresponding to the number n of the ASS SEQ (ASS n:n 1 ~ 5) and stops welding. In this case, the output signal will be OFF except for the command 0-6.

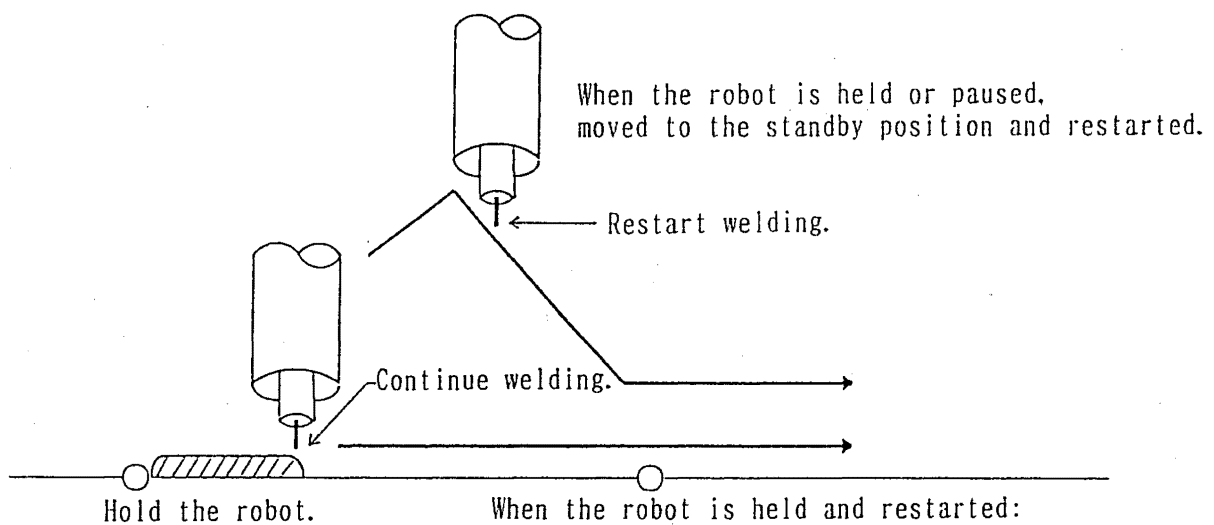
No.	Method of operation	Response of display
	▼ HOLD HOLD become valid when you press the [HOLD] switch of the panel or the [HOLD] key of the Teaching pendant. When you press the [TEACH OK] key of the Teaching pendant, the MOVE key becomes valid and the STAND-BY operation becomes possible. ▼ Restarting from HOLD state Remove the cause of the HOLD state and press the [START] switch (restart the external input terminal for the external operation). If the robot is moved by the keys of the Teaching pendant, press the [TEACH OK] key of the Teaching pendant, confirm the turning off of the lamp, and press the [START] button. For restarting after welding defects such as [NO ARC], [STICK], [TORCH CONTACT], [NO GAS] and [NO WIRE] occurred, remove the cause of the defects and press the [START] switch.	<pre> PLAY:HOLDING : A 5 JOB = 0 PROGRAM = 230 (A) 22.0 (V) STEP = 7.50 WELD COND 230 (A) 22.0 (V) SPD 7.50 ----- STEP COMM SPEED (M/MIN) SEQ. COMMAND 0 A-0 7.50 1 A-0 7.50 2 A-0 7.50 3 A-0 7.50 4 A-0 7.50 1AJ0 230 22.0 2ASS 1 ----- SELECT MODE AND/OR PRESS START. F1 F2 F3 F4 F5 PLAY DISP EDIT TAPE COMMUN COND CHANGE PRINTER CATION </pre>

No.	Method of operation	Response of display
	● To play the robot • Pressing the [START] switch restarts the PLAY mode. NOTE: For external play, press the [RESTART] and enter the input signal. * Reproduce the welding conditions before stopping the robot by the [Reproducing function for output before stopping, and restart the robot. ● Confirmation run • To restart playing the robot which is held during forward motion, simultaneously press the [ROBOT AXIS] and [+] keys of the teaching pendant. • To restart playing the robot which is held during backward motion, simultaneously press the [ROBOT AXIS] and [-] keys of the Teaching pendant.	

* Reproducing Function for Output Before Stopping

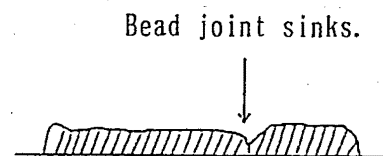
When the robot is restarted or moved after the HOLD mode:

The state of the input and output before pressing the [HOLD] key (the state of individual input and output terminals, welding current and welding voltage) is stored and the robot restarts (welds) from the position of HOLD. (For details, refer to the [Stand-by operation and the Output Reproducing Function during the hold mode.]



How to continue beads after a hold during welding:

If the robot is restarted after a hold:



Bead joint does not sink.



When the robot is reversed a little and restarted after a hold:

- When moving the robot without welding, press the [WELD OFF] key of the teaching pendant, turn on the lamp, and restart the robot.

Operation 8 : Emergency Stop

In case an emergency state occurs, press the [EMG STOP] button or open the normally closed [EXTERNAL EMG STOP] terminals. When the emergency stop is effected, the servo power source is shut off and the output signal is turned OFF.

No.	Method of operation	Response of display
1	<Input of emergency stop> Press the [EMG STOP] button of the panel or the Teaching pendant. Or, open the connection across the [EMG STOP] input terminals of the external input terminal. NOTE: Connect the emergency stop signal to a normally closed contact (B contact). The contact opens in case of an emergency stop.	
	<Releasing of emergency stop> ● To release the emergency stop using the panel, turn clockwise the [EMG STOP] button of the panel. ● To release the emergency stop caused externally, remove the signal that is in the external [EMG STOP] button.	
	1 Press the SERVO switch or turn ON and OFF across the external servo terminals. 2 Press the START switch. The robot starts moving from the state before the emergency stop was effected.	NOTE When the emergency stop is effected, contacts of the magnet switch of the control unit wear excessively, and periodic replacement is necessary. Therefore, use the HOLD function unless an emergency state occurs.

NOTE 1 : The emergency stop switch of the Teaching pendant is a locking type switch and remains mechanically locked if pressed once. To reset the emergency stop switch, turn it clockwise.

NOTE 2 : When an emergency stop is effected in the teaching play mode, only the [SERVO] switch becomes valid. All keys on the Teaching pendant and the panel become invalid.

NOTE 3 : If the [EMG STOP] button is pressed while the initial display is shown or while editing, the servo power will not be supplied even by pressing the [SERVO] switch. To supply the servo power, press the F1 PLAY and F2 TEACHING buttons on the initial display.

Operation 9 : Status and Resetting of Control Unit During Power Failure

- In case of a momentary service interruption within about 0.01 second, the system is free from abnormality and the continued operation is possible.

- In case of power failure other than the above, data being processed are protected. If the power is supplied again, the servo power is held shut off. In this case, THE CRT display shows [SERVICE INTERRUPTION]. To restart, turn off the power of the control unit and operate from pressing the [POWER ON] switch.

Operation 10 : Manual Operation

The manual operation is used to simply move the robot using the Teaching pendant and is not related to the storing of the robot.

(Example of use)

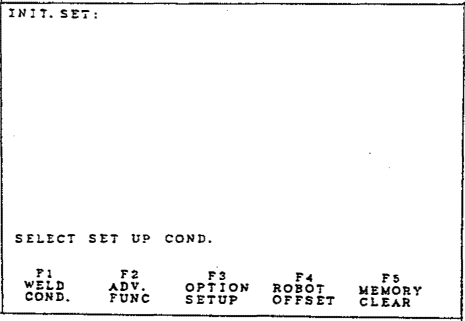
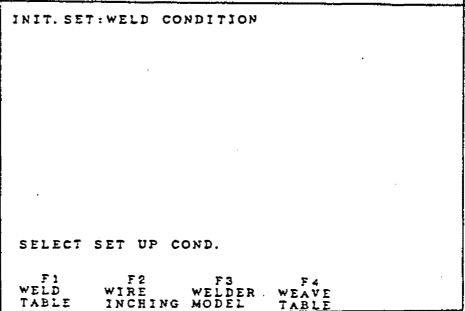
- When moving the robot to a position where the torch will not hit the robot in the ADDRESS SEARCH mode.
- When checking for proper take-over point of the robot and the workpiece setting jig.
- When you want to inch (forward) the wire after changing it.

No.	Method of operation	Response of display
0	Perform this operation from the initial display.	
1	Press the F1 [PLAY] key.	
2	Press the [TEACH OK] key of the Teaching pendant.	[TEACH OK] lamp ON : ●→○
3	Use the MOVE key of the Teaching pendant to move the robot.	
	○ To end the robot moving: Press the TEACH OK key.	[TEACH OK] lamp OFF : ○→●
5	Press the END key of the panel.	

Operation 11 : Режими зварювання

Як пояснюється в параграфі «Програмування», режим зварювання вводиться під час навчання робота шляхом вибору з п'яти типів режимів зварювання. Тобто ви вибираєте один підходящий режим з п'яти та надаєте йому точки зварювання. Ви можете вибрати режим зварювання скільки завгодно разів. Ця операція використовується для попереднього створення п'яти режимів зварювання, які відповідають заготовці, або для перевірки поточного стану зварювання.

○ Якщо ви змінюєте режим зварювання з 1 по 5 за допомогою цієї операції, режим зварювання програми, створений шляхом навчання перед введенням режимів зварювання від 1 до 5, не зміняться. Режими зварювання, введені в програму, стають режимами цієї програми. Номер не відображатиметься в програмі.

No.	Method of operation	Response of display
0	Почніть цю операцію з вибору режиму PLAY на початковому дисплеї.	
1	Натисніть F5 [NEXT KEY] клавішу.	
2	Натисніть F4 [INITIAL SETUP] клавішу.	
3	Натисніть F1 [WELD COND] клавішу.	
4	Натисніть [RESERVE TABLE] клавішу.	
5	Використовуйте клавіші курсору, щоб змінити положення, що мигає, і введіть числові значення. ↑ ↓ ← →	

No.	Method of operation	Response of display
6	Натисніть STORE клавішу	
7	Коли налаштування буде завершено, натисніть клавішу F4 [SETUP FINISHED]	Display returns to the display No. of this page.
8	Натисніть END клавішу	Display returns to the first display of the system setting.
9	Натисніть END клавішу	Display returns to the initial display (mode selection).

Режим зварювання

	AJO	
1	1 2 0	1 9. 0
2	1 6 0	2 1. 5
3	2 0 0	2 4. 0
4	2 6 0	2 7. 0
5	3 2 0	3 3. 0

Режим кратера для переміщення до кінцевої точки зварювання.

	CJO	
1	■ 8 0	1 7. 0
2	1 0 0	1 8. 0
3	1 2 0	1 9. 0
4	1 6 0	2 1. 0
5	2 0 0	2 4. 0

Щоб перемістити курсор на CJO:

(Зазвичай використовується близько 2/3 умов зварювання.)

Коли ви змінюєте умови зварювання, змінюйте також умови кратера, за умови щонайменше більше 80 А.

Це вводиться на заводі.

Якщо режими кратера особливо не потрібні, використовуйте ті самі умови, що й умови зварювання.

1. Позиція, де блимає ■, є позиція, де можна змінити числові значення.
2. ■ називається курсором. Коли вводиться числове значення, курсор автоматично переміщається до наступної позиції.

Якщо ви хочете перемістити курсор без введення числа, скористайтесь клавішами курсору. (← → ↑ ↓).

Якщо введено неправильне число, натисніть ← щоб повернути назад ■, і введіть число знову.

3. Після введення номерів від 1 до 5 для всіх необхідних позицій натисніть клавішу [STORE].
4. Якщо клавішу [STORE] не натиснути після зміни режимів курсором і натиснути клавішу [END], налаштування не зміняться.
5. Збережені режими можна видалити, натиснувши клавішу MEMORY CLEAR, але якщо касета використовується, вміст на касеті залишається.

No.	Method of operation	Response of display
	* Загальний опис умов зварювання для оператора, який не знає зварювання: ○ Струм Товщина (mm) × $\frac{2}{5} \times 100A = \text{Струм}$ ○ Напруга • Для CO₂ : 20V (для 100A), 21 V (для 120A), 22V (для 140A) 23V (для 160A), 24V (для 180A) (Напруга для змішаного газу (мікс) нижче на 3 В) Швидкість 0,5 м\хв. Зазор між наконечником і основним металом:	20мм для Ф проволочки 1,2 мм. понад 200A 15мм для Ф проволочки 1,2 мм. менше 200A 10мм для Ф проволочки 0,9 мм.

CHAPTER 3

APPLIED OPERATION (INTERMEDIATE SECTION)

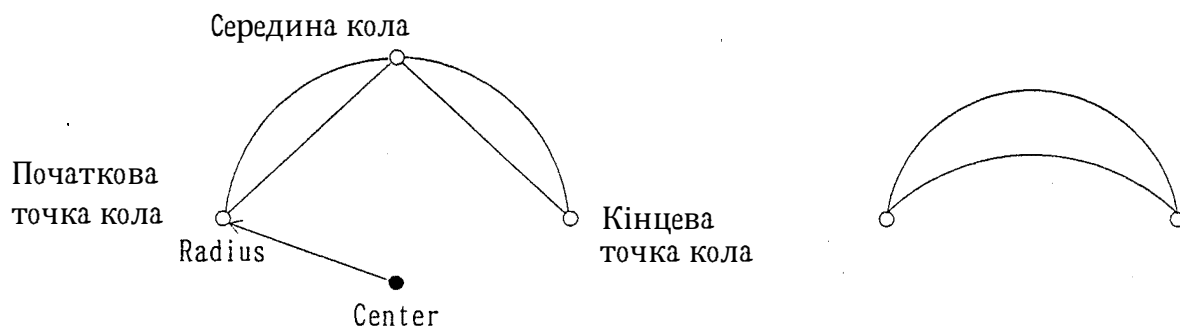
- ☐ Teaching and correction of circular interpolation
- ☐ Teaching and correction of weaving
- ☐ Correction of teaching points during teachig
- ☐ Confirmation run during operation (Correction of teaching by tracing)
- ☐ Making high level programs using sequence commands
- ☐ Editing data such as registered jobs or programs (Copying and deleting)
- ☐ Operation to save generated data into an external tape
- ☐ Outputting the registered data on the printer (option)

—— Let us master the robot and use it as you like ——

Операція 12: Навчання (Кругова інтерполяція)

У цьому параграфі лише частина операції, яка відрізняється від операції, описаної в РОЗДІЛІ 2, Операція 2 [Навчання (лінійна інтерполяція)]. Кругова інтерполяція використовується для того, щоб робот малював кругове за допомогою навчання з 3-х точок.

1. Круг можна скласти з трьох точок.



2. Якщо ви навчите свого робота тривимірному руху, і він здійснює тривимірний рух. Ваш робот робить більше, ніж рух на площині.

No.	Method of operation	Response of lamp
1	Перемістіть робота до точки навчання, щоб почати кругову інтерполяцію.	
2	Натисніть один раз клавішу [PATH] на пульту навчання та перейдіть у режим [↻]	[PATH] lamp Linear: ●→○
3	Натисніть клавішу [WELD STORE].	The teaching point is registered at [C. S]. (Pressing the [STORE] key registers the teaching point at [C-S].)
4	Перемістіть робота до наступної точки навчання. (Друга точка кругової інтерполяції)	
5	Натисніть [WELD STORE].	The teaching point is registered at [C. 0] ([STORE] key : [C-0])

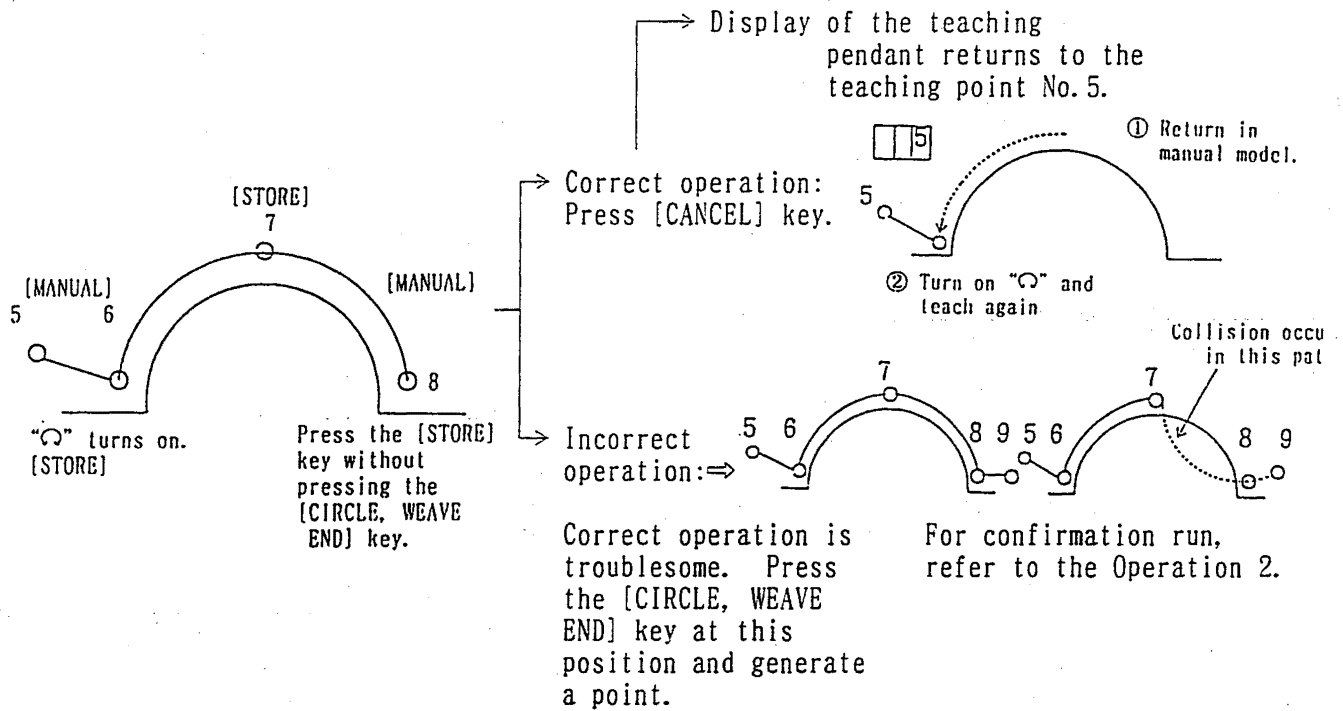
No.	Method of operation	Response of lamp
6	Перемістіть робота до наступної точки навчання. (третій пункт кругової інтерполяції)	
7	▼ Щоб навчити декілька неперервних точок на кривій за допомогою кругової: Натисніть клавішу [WELD STORE] (або клавішу [STORE]) і навчайте руховий шлях один за одним. ▼ To teach the point to end the circular interpolation: (1) Press the [CIRCLE, WEAVE END] key. (2) When you want the robot to end welding at the teaching point, press the [STORE] key. When you want the robot to continue welding after the teaching point, press the [WELD STORE] key. NOTE: Due to the operation time of the computer, the display may disappear for over about one second after registration.	The teaching point is registered at [C-0]. ([STORE]key : [C-0]) After registration: [PATH] lamp Circle ● → Linear ○ The teaching point is registered at [C-E]. The teaching point is registered at [C-E].

○ Cautions during teaching circular

1. When you miss to press the [CIRCLE, WEAVE END] key at the teaching end point of the circular and press the [STORE] key:

Press the [CANCEL] key and teach the robot again from the starting point of the circular.

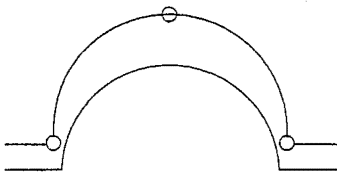
(If Err○○ is displayed, press the [CANCEL] key twice.)



* Since you did not press the [CIRCLE, WEAVE END] key, the robot does not calculate its movement. Therefore, you can teach the robot again by pressing the [CANCEL] key. In case of the linear movement, pressing the [CANCEL] key does not delete.

2. When the [CIRCLE, WEAVE END] key is pressed to register the end of the circular arc or weaving motion, the operation 1 above cannot be made even if you press the [CANCEL] key because the calculation of the circular is completed.
3. If you press the [CANCEL] key while you are making the movement of the circular the point of the circular disappears. If the "Q" is turned on by mistake, press the [CANCEL] key and you can teach the robot with linear motion.

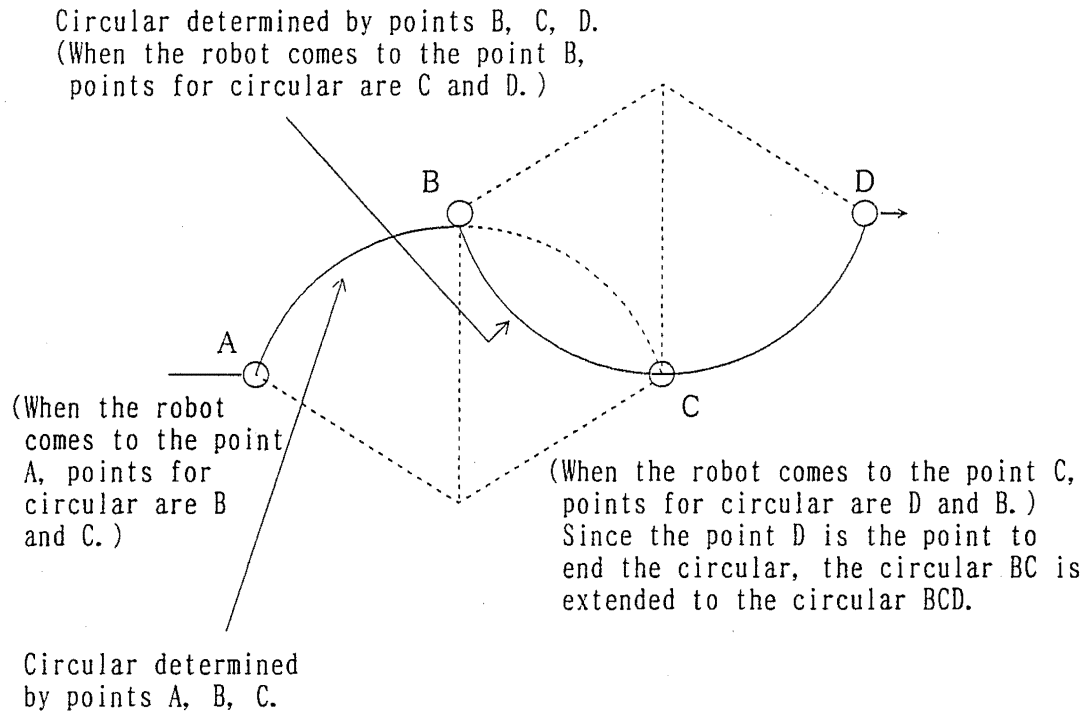
4. After you started the teaching of the circular arc portion, do not change the lamp to turn on from the "↻" lamp to the "↔" lamp. Press the [CIRCLE, WEAVE END] key to register the end of the circular or weaving motion, the operation is automatically changed to the "↔" mode. If you change the operation mode to the "↔" mode and register it, an error results.
⇒ Turn on the "↻" lamp before operating the robot.
5. The [INS] lamp must be turned on as in the case of teaching the linear motion. Refer to the cautions 2 and 3 for the linear motion.
6. While the robot is making a circular, you cannot perform the forward/backward motion for tracing because the movement is not calculated.
Press the [TRACE +(-)] key. If an error occurs, press the [CANCEL] key and continue teaching.
7. If an incorrect content is registered while the circular portion is being taught, the content registered cannot be corrected once the [CIRCLE, WEAVE END] key is pressed for registration, that is, until the circular portion is completed.
8. After the [CIRCLE, WEAVE END] key is pressed, determine whether to press the [WELD STORE] key or the [STORE] key depending on the point from which the welding starts.



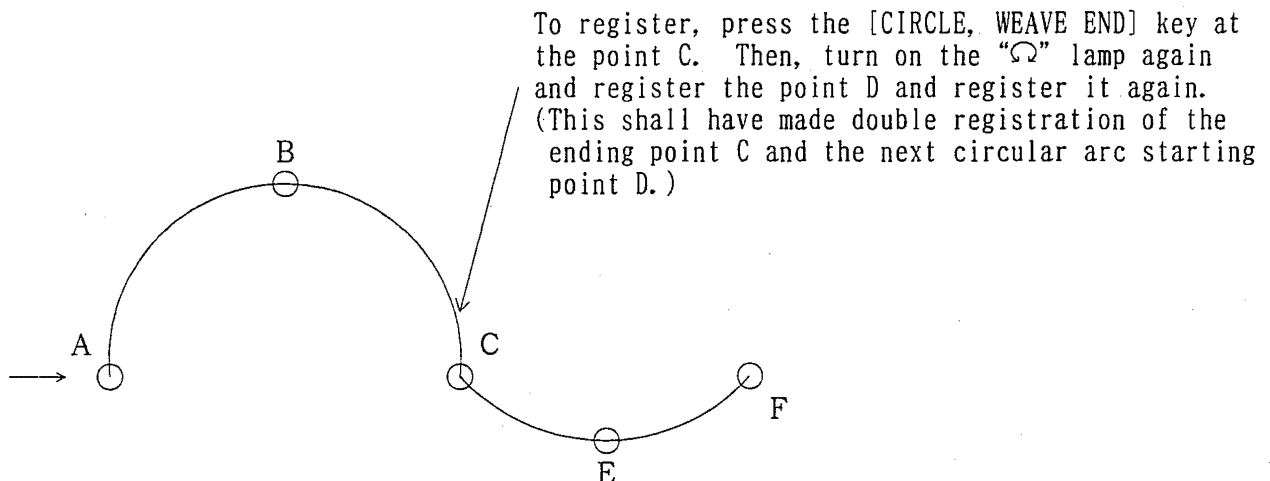
To continue welding, press the [WELD STORE] key.

To perform air cut, press the [STORE] key.

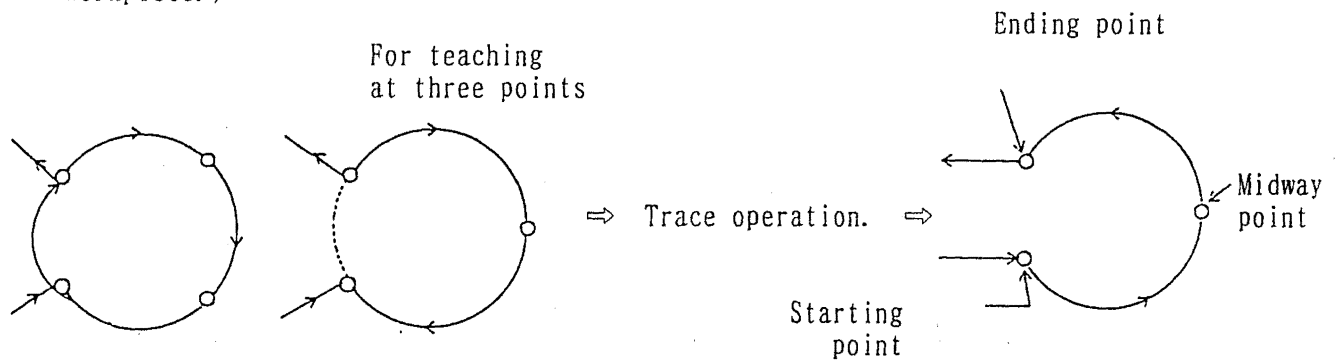
- To determine a continuous circular arc of more than four points



- Continuous circular of multiple registration



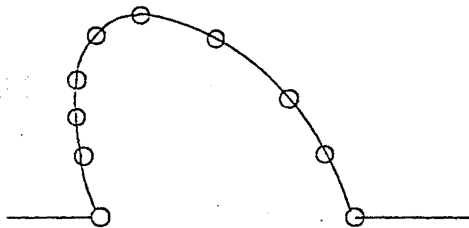
- To weld the circumference, teach over four points. (In actual welding, it is desirable to teach over 6 points in view of deformation and accuracy of the workpiece.)



Robot stores the positions of the points, and the motion performed by the [MANUAL] key is not stored.

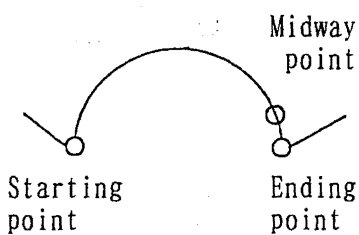
- In case the bending workpiece

More points may be provided where the bend is sharp and less points where the bend is large.

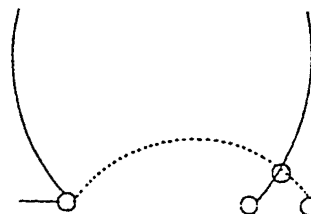


- Beginners should provide more than 1 cm distance between circular point.

When the operation is verified, the robot moves along this path.



Moving the points close each other extremely causes the robot movement to change largely.



The welding ending point was moved by pressing the [CHG] key.

Operation 13 : Correction and Deletion of Circular

Use the confirmation run (tracing) to correct or delete the circular registered by the circular interpolation.

1) Addition and changing circular

- Process is the same as the addition and changing of [Linear interpolation].
It is necessary to make additions or changes only after confirming that the [PATH] lamp of the teaching pendant shows "Q".
- If a circular point is added at the circular ending point ([C.E][C-E]), it is necessary to register more than three teaching points newly because the circular interpolation has already been completed.
(You may change the circular ending point and add the circular midway points.)

2) Deletion of circular

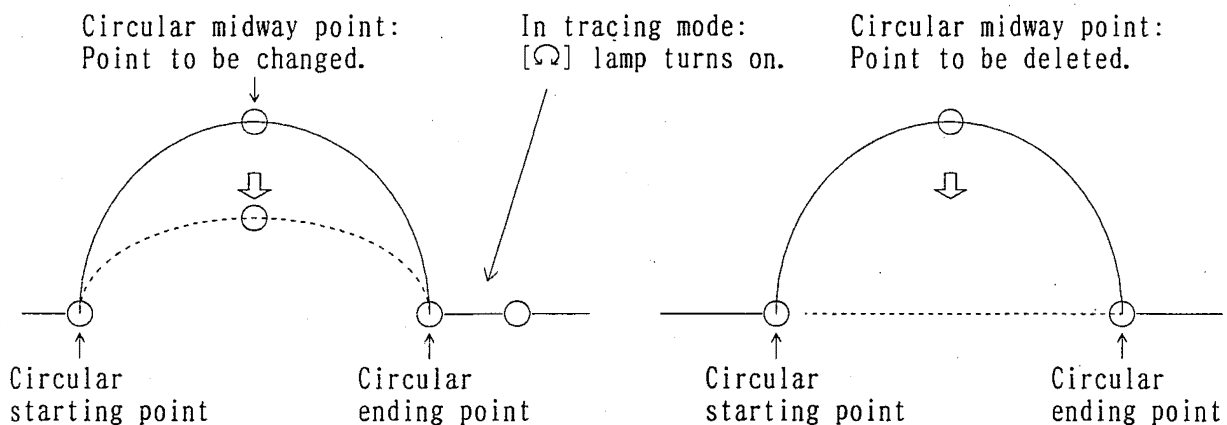
- The [deletion of circular] means to delete all of the midway points of the circular.
- Note that the circular starting point ([C.S][C-S]) and the circular ending point ([C.E][C-E]) can be deleted only after deleting the midway point.
Refer to No.4 of the following list.
- If you delete one point of the circular mid point of a circular curve having more than four points, the circular is changed into one which is formed by the remaining points.

No.	Method of operation	Response of lamp
1	Move the robot up to the circular midway point in the tracing mode.	[PATH] lamp : Q ○
2	Press twice the [MODIFY] key of the Teaching pendant to change to mode to [CANCEL] mode.	[MODIFY] lamp CHG ●→DEL ○
3	Press the [WELD STORE] key or [STORE] key.	[MODIFY] lamp DEL ●→CHG ○

No.	Method of operation	Response of lamp
4	For the circular having more than four points, move the robot to the next midway point of the circular in the tracing mode, repeat No.2 and No.3, and <u>delete all of the midway points of the circular.</u>	When all the circular midway points are deleted, teaching point commands are automatically changed as follows. $[C \cdot S] \rightarrow [A \cdot 0]$ or $[C \cdot E] \rightarrow [A \cdot 0]$ $[C-E] \rightarrow [A-0]$ The starting and ending points of the circular will be points on a linear point.

○ To change the circular midway points:

○ To delete the circular midway points:

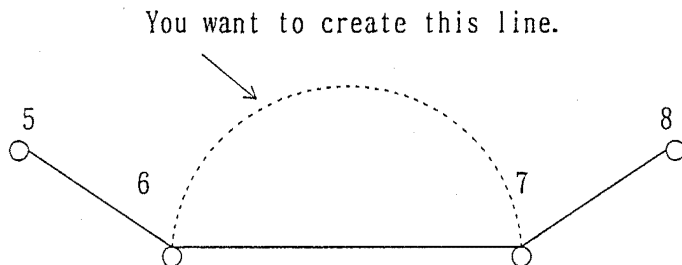


NOTE: To add teaching points between the circular ending point and the next point on the straight line, press the [PATH] key, confirm that the [↔] lamp is turned on, and press the [ADD] key to add teaching points.

NOTE: When deleting steps of the circular using the Teaching pendant, errors may occur and the steps may not be deleted. This occurs because the wrist position changes largely by deleting the teaching points. If errors occur, use the EDIT mode to delete the steps.

○ Cautions during circular tracing

1. Linear point can not be changed to circular points. When all the midway points are deleted and the starting point and ending point are changed to linear point, such points cannot be the points on the circle.

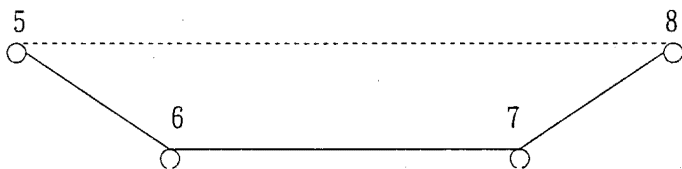


INCORRECT:

Turn on the "Q" lamp. $\Rightarrow$ [CHG] lamp is turned on. $\Rightarrow$ [STORE] key is pressed.

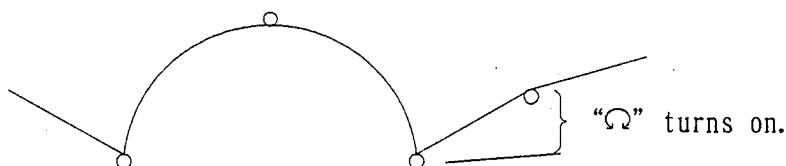
$\Rightarrow$ An error occurred.

- * The reason the starting point and ending point become linear points is that the midway points are removed, and the character of the points can not be changed by the Teaching pendant.



CORRECT:

- (1) Delete points of 6 and 7. (Make the points into the motion of dotted line.)
 - (2) Move the robot backward to the point 5 in the tracing mode. Turn on "INS" lamp and teach a new circular point.
2. If you trace the robot forward from the circular ending point to the point on the next straight line, "Q" lamp turns on.

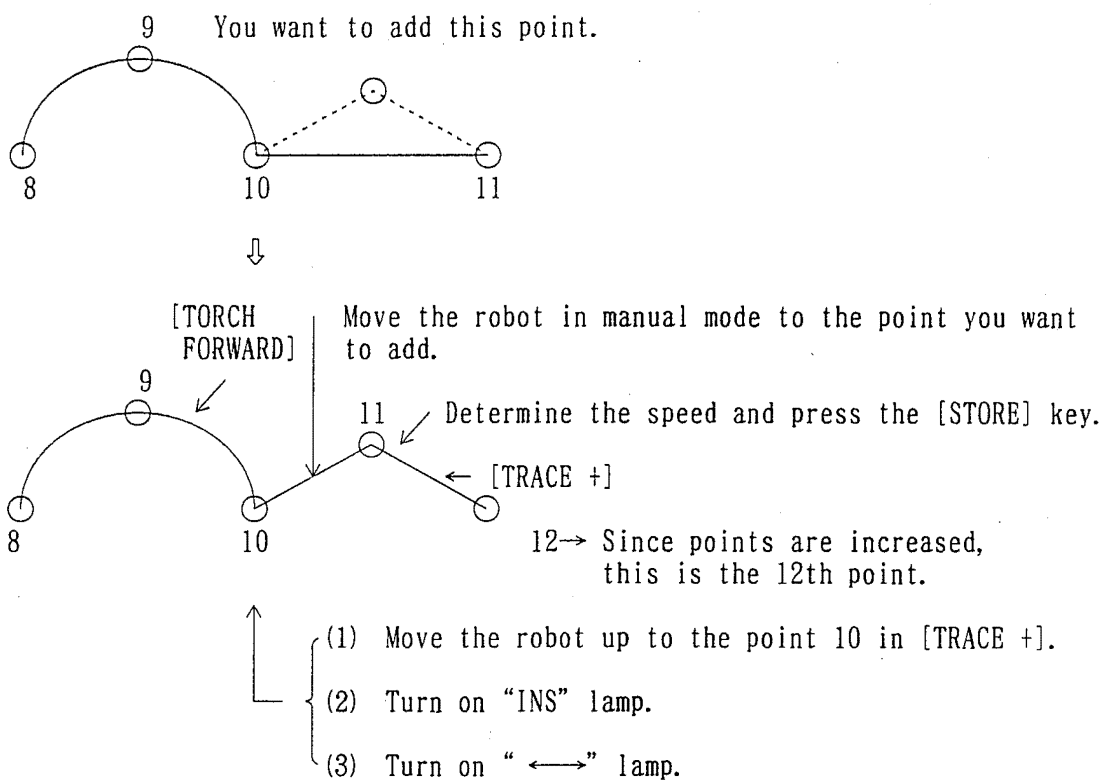


- * The lamp does not indicate the play of the robot but indicates the character of the point. Therefore, the motion from the circular ending point to the next motion is determined as a straight line.

3. To add a point after the circular ending point:

(Not possible if the "↻" lamp remains turned on.)

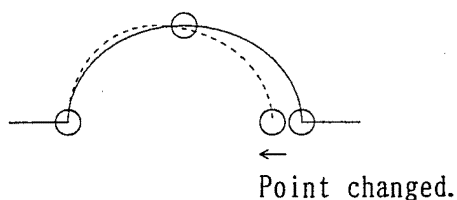
Example:



4. Diviation after changing:

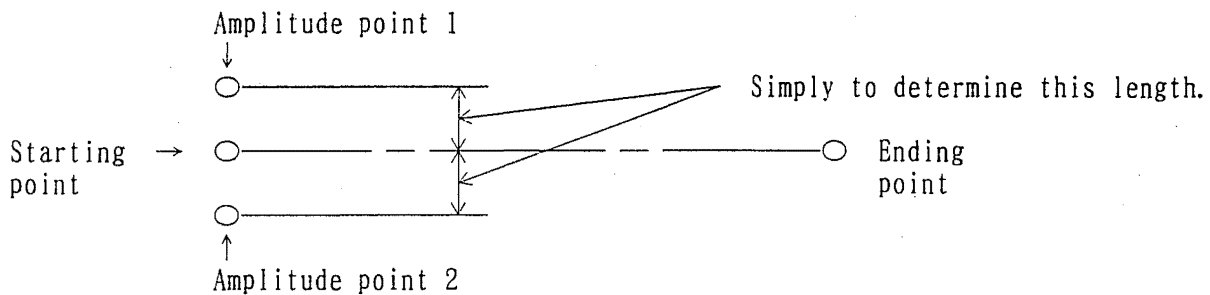
When points of the circular are changed, motions of other portions are affected.

This motion is also shifted because the motion is re-calculated.



Operation 14 : Teaching (Weaving)

- Weaving is used to select the weaving patterns (1~6) and to teach the starting point, amplitude points (normally two points pattern. Four points at 4, 5).
- It is not possible to select the fineness of weaving (called the frequency) during teaching. Amplitude points are used to determine the amplitude of the weaving with respect to the line connected from the starting point to the ending point.



No.	Method of operation	Response of lamp
1	Move the robot to the weaving start point.	
2	Press twice the [PATH] key of the Teaching pendant to change the mode to [↔].	[PATH] lamp [↔] ● → [↔] ○
3	Press the [+] [-] keys while pressing the [WEAVE TYPE] key, [b 1] to [b 6] will be shown on the speed display. Stop at the weaving pattern you want to set. Weaving patterns will be described later.	
4	Press the [WELD STORE] key. Note: While teaching, the frequency and the timer of the weaving table are registered according to the weaving patterns.	The teaching point is registered at [B.S]. (When the [STORE] key is pressed, the teaching point is registered at [B-S].)
5	Move the robot to the amplitude position 1 for weaving.	

No.	Method of operation	Response of lamp
6	Press the [WELD STORE] key.	The teaching point is registered at [B.1]. ([STORE] key → [B-1])
7	Move the robot to the amplitude position 2 for weaving.	
8	Press the [WELD STORE] key.	▼ For weaving patterns 1, 2, 3, 6, the teaching points are registered at [B.2].
9	When the weaving patterns 1, 2, 3, 6 are selected with the operation No.=3, proceed to the operation No.14.	▼ For weaving pattern 4, 5 the teaching points are registered at [B.1].
10	Move the robot to the amplitude position 3 for weaving. (For weaving pattern 4, 5)	
11	Press the [WELD STORE] key.	Teaching point is registered at [B.1]. ([STORE] key → [B-1])
12	Move the robot to the amplitude position 4 for weaving.	
13	Press the [WELD STORE] key.	Teaching point is registered at [B.2]. ([STORE] key → [B-2])
14	Move the robot to the position where the weaving ends.	
15	▼ To continue the weaving of the same pattern, press the [WELD STORE] key, return to the operation No.=5, and teach the amplitude position for weaving. ▼ To change the weaving pattern or to end it; (1) Press the [CIRCLE, WEAVE END] key.	After registration: [PATH] lamp

No.	Method of operation	Response of lamp
	(2) If the welding ends at the teaching point, press the [STORE] key. If the welding continues after the teaching point, press the [WELD STORE] key. NOTE: Due to the calculation of the computer, the display may disappear for over about one second after registration.	[] ● → [↔] ○ Teaching point is registered at [B-E]. Teaching point is registered at [B•E.]

NOTE 1. If you miss to press the [CIRCLE, WEAVE END] key at the weaving ending point and pressed the STORE key, then, press the [CANCEL] key and the point is registered as the weaving ending point.

NOTE 2. To change the frequency of the weaving and the time of the timer, change the numeric value at the teaching point using the program edit mode.

NOTE 3. There are the following restrictions on the amplitude and frequency of weaving.

(1) Frequency

Max. 5 Hz for patterns 1~5.

Max. 10 Hz for patterns 6.

(2) Amplitude × frequency

Max. ~~15~~⁶⁰ mm · Hz for patterns 1~5.

(3) Swing angle (max. axis) × frequency

Max. 125° · Hz for pattern 6.

NOTE 4. If you press the [CANCEL] key of the Teaching pendant while teaching the robot with weaving patterns, the points in the weaving teaching section being taught will be deleted.

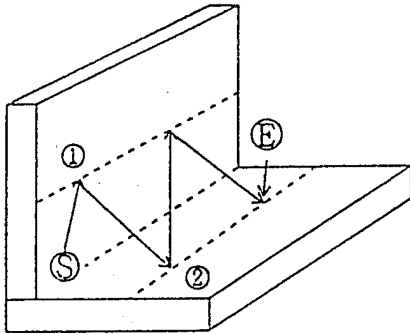
NOTE 5. The pattern 6 is the weaving carried out only by the wrist axis. Therefore, teach the robot to swing its wrist axis. If the robot is taught without swinging wrist, the robot will not weave. If you teach the amplitude point of the pattern 6 using a Cartesian or Tool coordinate system, the motion will not be that of the wrist 3 axis, and the high speed vibration does not occur.

Weaving pattern

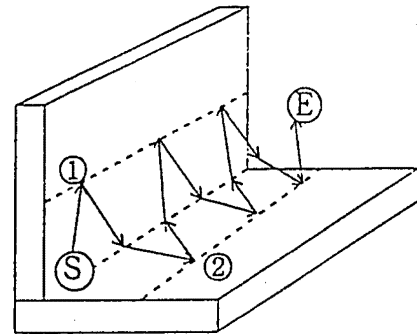
(S) Weaving starting point (E) Weaving ending point

(1)~(4) Weaving amplitude point

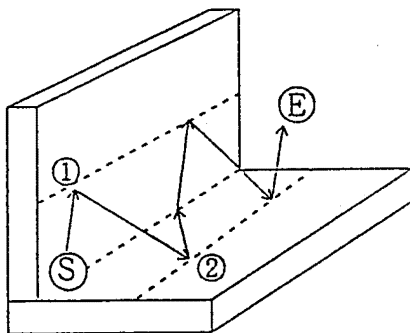
Pattern 1
(Simple harmonic vibration at low speed)



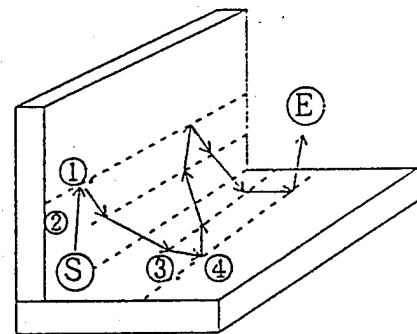
Pattern 2 (L type)



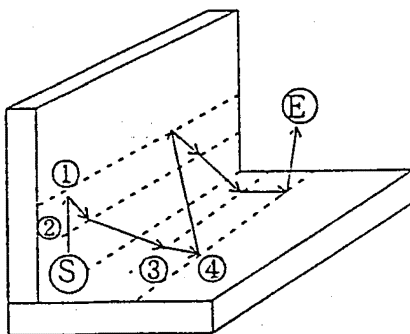
Pattern 3 (Triangle)



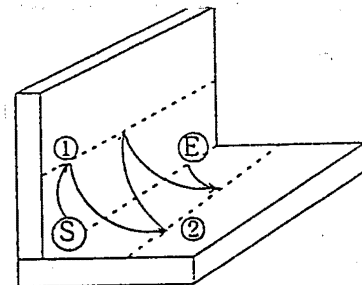
Pattern 4 (U type)



Pattern 5 (Trapezoidal)



Pattern 6
(Simple harmonic vibration at high speed)
* After teaching the starting point, turn on the "Articulation" lamp up to the [Teaching coordinate system] and teach the amplitude (1), (2). After teaching (2), turn on the "CARTES" lamp and teach the ending point.



Operation 15 : Correction and Deletion of Weaving

Use the tracing mode to add, correct or delete the weaving.

1) Addition and correction of weaving

- This is the same process as that of the [Linear interpolation].
- To call the weaving amplitude point, move the robot backward in the tracing mode from the [Weaving ending point].

Move the robot backward in order of $[B \cdot E] \rightarrow [B \cdot 2] \rightarrow [B \cdot 1] \rightarrow [B \cdot S]$.

Move the robot backward in order of $[B \cdot E] \rightarrow [B \cdot 2] \rightarrow [B \cdot 1] \rightarrow [B \cdot 1] \rightarrow [B \cdot 1]$

(patterns 4,5).

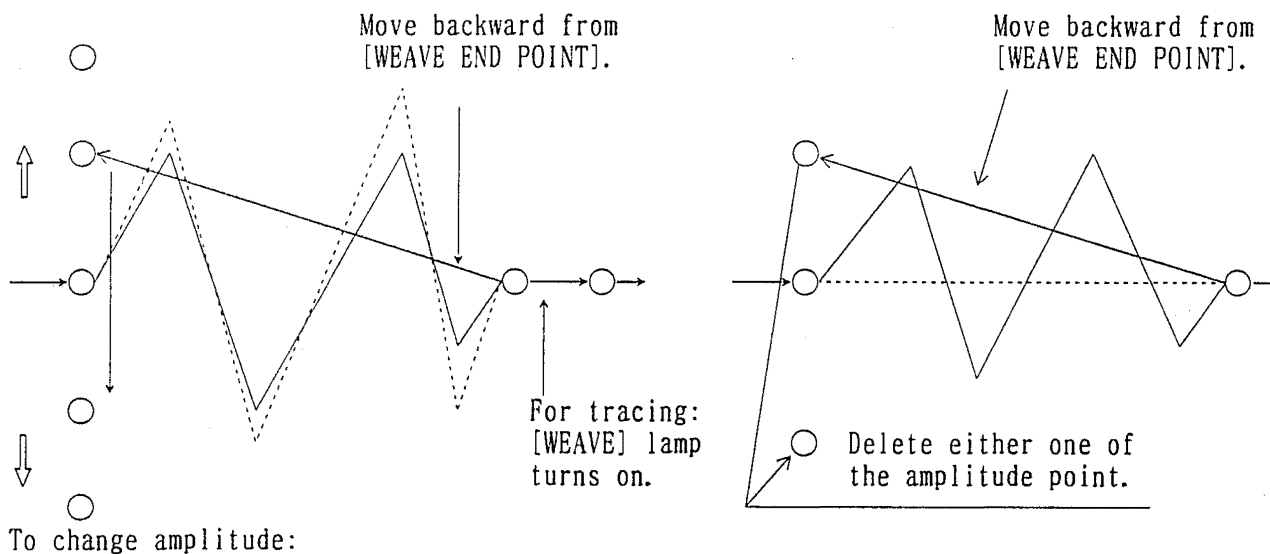
- If a weaving pattern is added at the weaving ending point ($[B \cdot E]$, $[B-E]$), it means to make a new weaving pattern, and it is necessary to register new four teaching points. For changing the weaving start point, press the STORE (WELD STORE)] key while pressing the [CANCEL] key, the amplitude and starting point will be changed.

2) Deletion of weaving

- If any of the weaving amplitude point is deleted, the weaving is deleted and changed into a straight line automatically.
- If either one of the amplitude point or the midway point of the circular is deleted, the circular weaving is deleted and changed into a straight line automatically.
- The starting point ($[B \cdot S]$ $[B-S]$) and ending point ($[B \cdot E]$ $[B-E]$) of the weaving cannot be [deleted] unless either one of the weaving amplitude point is deleted. Refer to No.3 of the following.

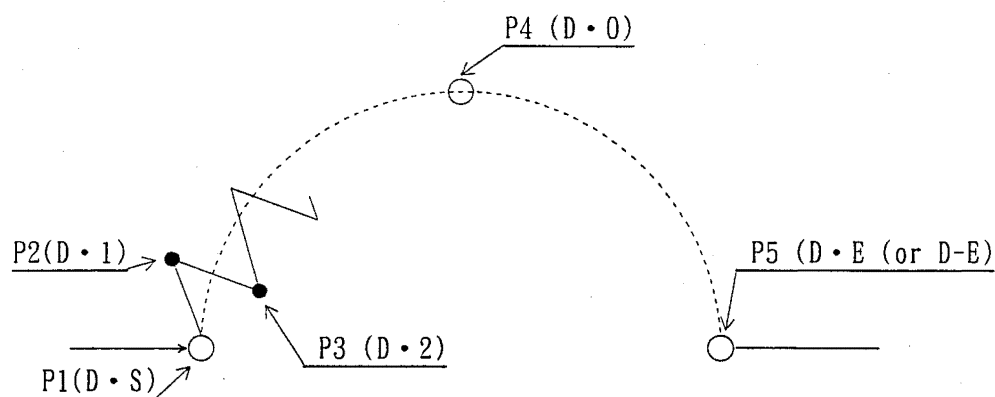
No.	Method of operation	Response of lamp
1	Move the robot in backward tracing mode from the weaving end point to the amplitude point.	[PATH] lamp : [~] ○
2	Operate the [MODIFY] key of the Teaching pendant. To change the amplitude, do not press the →key. To delete the weaving pattern, press the →key twice. ○ To change the amplitude, move the robot to the new amplitude point.	[MODIFY] lamp CHG ○ keep to remain CHG ● → DEL ○
3	Press the [WELD STORE] key of [STORE] key. ○ When the weaving is deleted, points are automatically changed as follows. [B • S] and [D • S] changed to [A • 0] [B • E] and [D • E] changed to [A • 0] [B—E] and [D—E] changed to [A—0] The starting and ending points of the weaving become the points on the straight line.	For deleting, [MODIFY] lamp DEL ● → CHG ○

● For weaving of straight line:



NOTE: To add a teaching point between the weaving ending point and the next point on the straight line, press the [PATH] key, confirm that the [$\longleftrightarrow$] lamp turns on, and press the [INS] key to add a teaching point.

● For circular weaving:



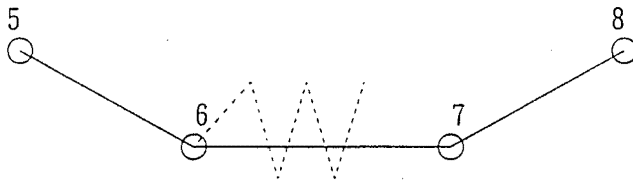
If any one of the D • 1 point or D • 2 point or D • 0 is deleted, the circular weaving is deleted and changed into a straight line automatically.



○ Cautions in tracing of weaving:

1. The linear point cannot be changed to weaving point. Even if the amplitude point is deleted and the starting and ending points are changed to the linear point, they cannot be changed to the weaving points.

You want to weave the robot as shown

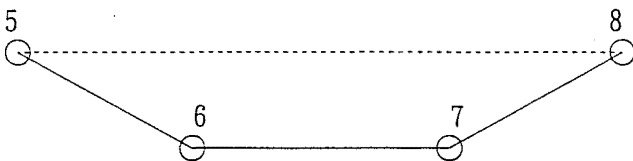


INCORRECT:

Turn on "~~~~" lamp. $\Rightarrow$ "CHG" lamp is turned on $\Rightarrow$ [STORE] key is pressed.

$\Rightarrow$ An error occurred.

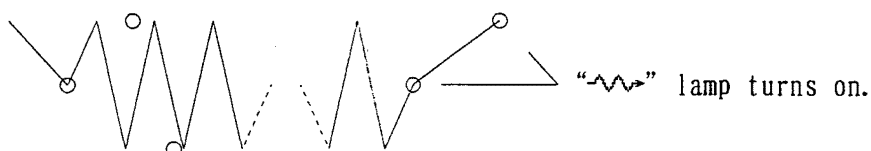
- * The reason that the starting and ending points are changed to the linear point is that the amplitude point is deleted, and the character of the points can not be changed by Teaching pendant.



CORRECT:

- (1) Delete points of 6 and 7. (Make the points into the motion of dotted line.)
- (2) Move the robot backward to the point 5 in the tracing mode. Turn on "INS" lamp and teach a new circular point.

2. If you move the robot from the weaving ending point to the point on the next straight line, "~~~~" lamp turns on.

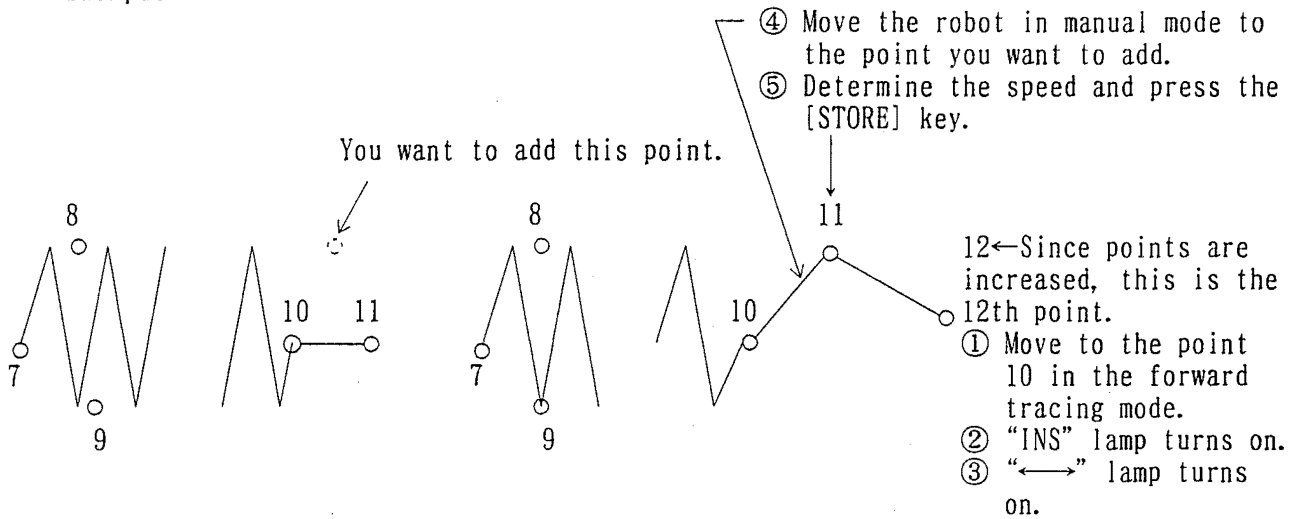


- * The lamp does not indicate the play of the robot but indicates the character of the point. Therefore, the motion from the circular ending point to the next motion is determined as a straight line.

3. To add a point on the next straight line of the weaving ending point:

(Not possible if the "~~~~" lamp remains turned on.)

Example:

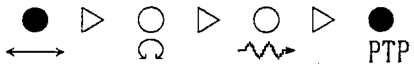


* If the "ADD" key and [STORE] key are pressed by mistake while the "~~~~" lamp being turned on, it means that you started the weaving again. Press the [CANCEL] key (refer to the cautions 2 during teaching the weaving) and perform the above operation again.

Operation 16 : Teaching (Circular Weaving, PTP)

○ Circular weaving:

The circular weaving is used to teach the robot of five points for weaving and circular ; starting point, amplitude point (2), circular midway point, and circular ending point. In this paragraph, only the operation that is different from the straight line weaving will be described.

No.	Method of operation	Response of lamp
1	Press three times the [PATH] key of the Teaching pendant and select the "↻" and "~~~~" lamps. NOTE: With the circular weaving, only the weaving pattern 2 is possible.	[PATH] lamp 
2	When the robot comes to the starting point of the circular weaving, press the [WELD STORE] key. (The D·S point of the following is registered.) NOTE: The numeric values set by the weaving table in the system setting are automatically stored as the weaving conditions.	The starting points of the circular and the weaving are registered at the D·S point (D-S for [STORE] mode).
3	Like the straight line weaving, two weaving amplitude points are registered. The point D·1 and the point D·2 of the following are registered.	The first amplitude point is registered at the point D·1. (D-1 for [STORE] mode) The second amplitude point is registered at the point D·2. (D-2 for [STORE] mode)
4	Move the robot to the mid point of the circular.	
5	Press the [WELD STORE] key. The point D·0 of the following is registered.	Weaving is registered at the point D·0. (D-0 for [STORE] mode)

No.	Method of operation	Response of lamp
6	Move the robot to the ending point of the circular.	
7	Press the [WELD STORE] key. Circular weaving is automatically completed and the linear interpolation is selected. The point D.E of the following is registered.	Weaving is registered at the point D.E. (D-E for [STORE] mode) [PATH] lamp       

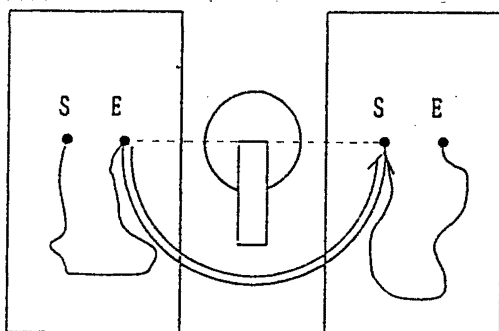
NOTE: If the [CANCEL] key of the Teaching pendant is pressed during teaching the circular weaving, the points in the section the circular weaving are deleted.

○ P.T.P. (Point To Point)

P.T.P. is short for the point to point movement of the robot, in which each axis of the robot moves to the next point designated without regard to other axis.

With the six axes, THE P.T.P. movement is convenient when the robot cannot move to the next point along a straight line because the robot has three wrist axes.

For example, if you use the P.T.P. movement in the following case and try to move the program of the left table to the program of the right table, teaching the movement with a straight line results in a line as dotted line, causing errors.



Movement of programs

If P.T.P. is used to teach the program, it moves as ☺.

S: Program starting point

E: Program ending point

* To move the program as ☺ as shown in the diagram:

Before pressing the [STORE] key (refer to the caution 1 during teaching the straight line) to store only the first welding speed after starting teaching, turn on the "P.T.P" lamp. Be sure to return the mode to "LINEAR" mode before pressing the next [STORE] key (the first teaching point). The P.T.P. may be used in the program.

Operation 17 : Correction of Teaching Point During Teaching

If a movement is taught by mistake during teaching, you can move the robot to a previously taught point and correct the movement taught by mistake. Press the [TRACE] key to move back the robot to the point taught and make correction. Use the "addition" mode for subsequent teaching.

No.	Method of operation	Response of display
0	Teaching using the operation 2:	
1	Use the [ROBOT AXIS] key and the TRACE - key to return the robot to the point taught.	[MODIFY] lamp "INS" ● → CHG ○
2	Move the robot to the correct teaching position and press the STORE key or the WELD STORE key.	
	NOTE: The [MODIFY] key may be used to delete the teaching point or to change the welding speed.	The corresponding lamp turns on.
3	Press the [ROBOT AXIS] key and the TRACE + key to move the robot to the last teaching point before the TRACE (-) key was pressed.	
4	Press the [MODIFY] key to turn on the "INS" lamp.	[MODIFY] lamp "CHG" ● → INS ○
5	Move the robot to the next teaching position and press the STORE key or the WELD STORE key. Carry on to teach the robot in the above manner.	
	Confirm that the "INS" lamp of the [MODIFY] lamp is turned on while teaching the robot. Unless no other lamp but the "INS" lamp is turned on, the new teaching point will not be stored even if you press the [STORE] key.	
6	Use the operation 3 for the subsequent teaching.	

Cautions for teaching mode:

- When the STORE key is pressed again without moving the robot, sound of alarm is given. To store the same point for more than twice, press the

STORE key again.

If other key is pressed, press the [CANCEL] key of the Teaching pendant.

- In case an emergency or power failure occurs while teaching the robot, carry out the operation 3 in confirmation mode and start adding points from the last teaching point.

Operation 18 : Confirmation (Trace) Teaching Speed

In case the robot movement is confirmed by the operation 3, the moving speed of the robot becomes the "limited speed" set by the initial setup. To confirm the robot moving speed at the actual teaching speed, perform the following operations.

NOTE THAT the following operations are not possible while teaching nor correction of teaching.

No.	Method of operation	Response of display
0	Carry out up to No.1 of the operation 3.	
1	To stop the robot at every step: Press the F1 [STEP] key. To move the robot generally in unit of programs: Press the F2 [PROGRAM] key.	
2	Then, press the START switch of the operation panel.	
3	Confirm robot movements by repeatedly pressing the HOLD switch and START switch of the operation panel as required.	

NOTE 1: ○ If you press the [TEACH OK] key of the teaching pendant in the HOLD mode, the robot can move in the TRACE mode and TRACE mode by pressing the TRACE (+) key and TRACE (-) key. In this case, the limited speed becomes valid.

○ In the above case, teaching point can be corrected in the "confirmation mode" of the operation 3.

NOTE 2: About the limited speed:

The actual moving speed is limited to the limited speed if the teaching speed is faster than the limited speed when moving the robot with the TRACE key and the MOVE key.

NOTE 3: If the robot is operated in the TRACE (+) mode or in the TRACE (-) mode while pressing the [QUICK TRACE] key, the robot moves at the limited speed except weaving section.

Operation 19 : Correction of Teaching Point During Play

With this operation mode, the robot can be held at a point and the teaching points from that point can be corrected.

No.	Method of operation	Response of display
1	Press the STOP key of the operation panel while playing the robot by the operation 4. Or press the HOLD key of the Teaching pendant.	
1'	Press the [TEACH OK] key of the Teaching pendant.	[TEACH OK] lamp: ●→○
2	On completing the above, the "confirmation" of the operation 3 becomes possible from the point where HOLD key were pressed. Correct teaching points as required. The robot can be moved in steps by the [ROBOT AXIS] key, TRACE + key and TRACE - key of the Teaching pendant.	NOTE: [MODIFY] lamp The corresponding lamp must be turned on.
2'	Press the [TEACH OK] key of the Teaching pendant.	[TEACH OK] lamp: ○→●
3	Pressing the START switch of the operation panel continues robot operation. (In case of an external starting, use "restart" input signal.)	

Операція 20 Робота в режимі очікування в режимі утримання та функція відтворення виходу

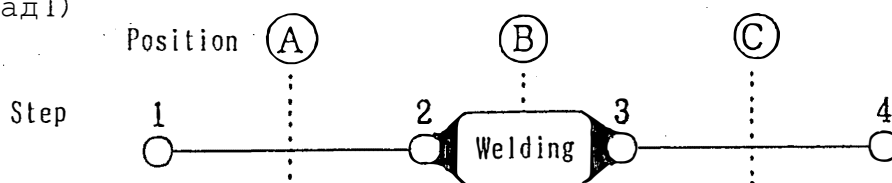
Коли робота переведено в статус "HOLD" і перезапущено, "функція відтворення вихідних даних "HOLD" використовується для відтворення умов зварювання після виходу статусу "HOLD". У випадку, якщо робота переведено в положення очікування (переміщення робота за допомогою клавіші MOVE на пульту навчання діють наступні обмеження.

(I) У цьому випадку робот переводиться в положення «HOLD» і переводиться в положення очікування, після виконання всіх команд послідовності навчальної точки: Статус виходу після перезапуску такий:

На кожному кроці навчання, який слід відстежувати вперед/назад, команда послідовності цих навчальних точок виконується одна за одною.

Однак, що стосується зварювальних виходів, ці виходи увімкнені, якщо рухома секція є зварювальною, або ВИМКНЕНА, якщо не відбувається зварювання (відрізання повітря).

(Приклад 1)



Sequence	External output terminal 2...ON	Torch switch ...ON	Torch switch...OFF
		Gas.....ON	GasOFF
		External output terminal 1ON	External output terminal 1.....OFF
			External output terminal 3.....ON

			State of reproduced output				
Stopping position	Tracing	Restarting position	Torch	Gas	Output 1	Output 2	Output 3
A	Forward	B	ON*	ON	ON	ON	—
A	Forward	C	OFF	OFF	OFF	ON	ON
B	Backward	A	OFF	OFF	ON	ON	—
B	Forward	C	OFF	OFF	OFF	ON	ON
C	Backward	A	OFF	OFF	ON	ON	ON
C	Backward	B	ON**	ON	OFF	ON	ON

* Use the condition AJO for conditions to start welding.

* Use the condition CJO for conditions to start welding.

(II) In case of that the robot is made to "HOLD" status and moved to a stand-by position while executing the sequence command of the teaching point:

Output status after restarting is as follows:

The rest of sequence command of the teaching point, where "HOLD" is happened, dose not execute. But, at every teaching step to be traced forward/backward, sequence command of those teaching point is executed one by one.

However, concerning welding output, these output are ON if the moving section is welding, or OFF if non-welding (air-cut).

The diagram illustrates a welding sequence with four steps and three positions (A, B, and C). The sequence is as follows:

- Step 1:** External output terminal 2...ON. Position A.
- Step 2:** Torch switch...ON. Position B. This step is labeled "Welding".
- Step 3:** Torch switch...OFF. Position C.
- Step 4:** Torch switch...OFF. Position C.

Additional details from the diagram:

- Position A is marked by a vertical dashed line.
- Position B is marked by a vertical dashed line.
- Position C is marked by a vertical dashed line.
- Step 2 is highlighted with an oval and labeled "Welding".
- Step 3 is followed by a waiting time of 5 seconds.
- Step 4 is followed by the external output terminal 3...ON.
- The robot is held during the waiting time.

			State of reproduced output				
Stopping	Tracing	Restarting position	Torch	Gas	Output 1	Output 2	Output 3
During waiting for the second step	Backward	A	OFF	OFF	OFF	ON	—
	Forward	B	ON	ON	OFF	ON	—
	Forward	C	OFF	OFF	OFF	ON	ON

In the example 2, the sequence commands are executed from the remaining time of the waiting time (5 second).

— 3 — 30 —

Operation 21 : Editing

○ What is editing

You have now understood so far that the robot motion will be dependent on the program. In other words, the editing serves as the "work manual" for the robot to perform its work. If the "work manual" of your company is changed of its contents, then the contents of the work will also be changed, and similarly, the contents of the work of the robot will be changed when its "work manual" is changed of its contents. As stated above, [to rewrite (change) the contents] or [to check the contents] is the editing work. Therefore, with the editing, the robot is not moved as in the case of confirmation mode. There are five types of instructions altogether including programs.

○ Types of instructions

1. Job

(No.1~No.999: 127 standard jobs. 999 jobs by Optional memories)

Instruction used to perform external works (Elementary Section)

2. Program

(No.1~No.999: 255 standard programs. 999 programs by Optional memories)

..... Instruction used to perform works.

3. Welding starting sequence

(No.1~No.5: 5 sequences).....

Instruction to turn ON the torch and etc. at the welding starting point

4. Welding ending sequence

(No.1~No.5: 5 sequences).....

Instruction used to turn OFF the torch and etc. at the welding ending point

5. Reserve sequence

(No.1~No.99: 99 sequences).....

Instruction used for like a bag made from some signals often used in works.

- * In teaching the robot, one program is used to move the robot thereby generating a movement. That is to say, one program is used to generate the work procedures.
- * The welding starting sequence and the welding ending sequence are stored with the standard contents at the factory.
- * Instructions are operated in quite the same manner except for the programs. Four types of instructions other than the program are generated by the sequence commands. They differ only depending on the applications used for the robot.

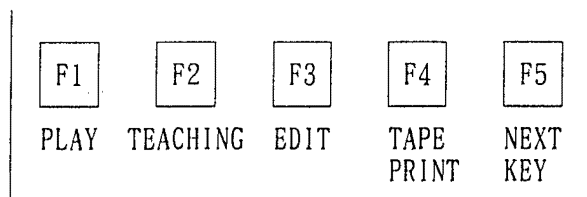
○ ■ (cursor)

The position where this blinking cursor is located can be rewritten.

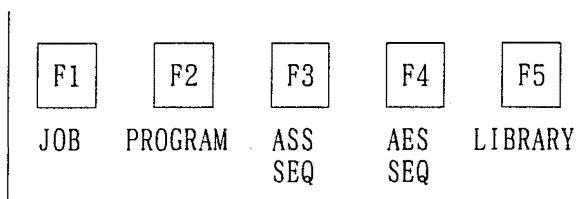
The contents of the function key vary with the position of the cursor key.

Editing : Overall Operation Flow (Examples of program editing)]

Initial display

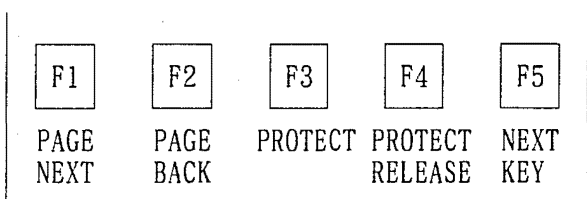


F3 Press the [EDIT] key.

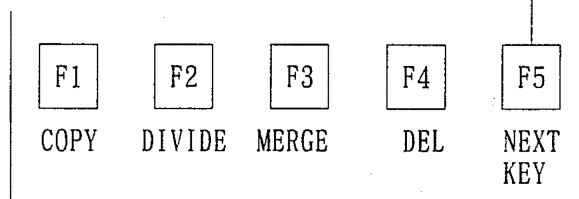


F2 Press the [PROGRAM] key.

Screen (A)

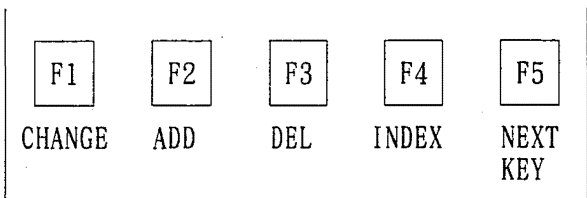


Screen (B)

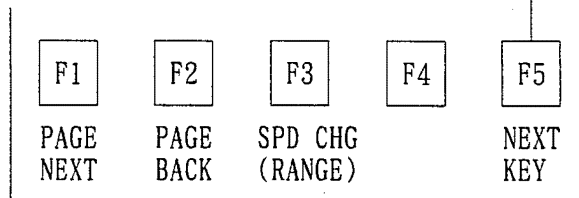


Designate the program number.

Screen (C)



Screen (D)

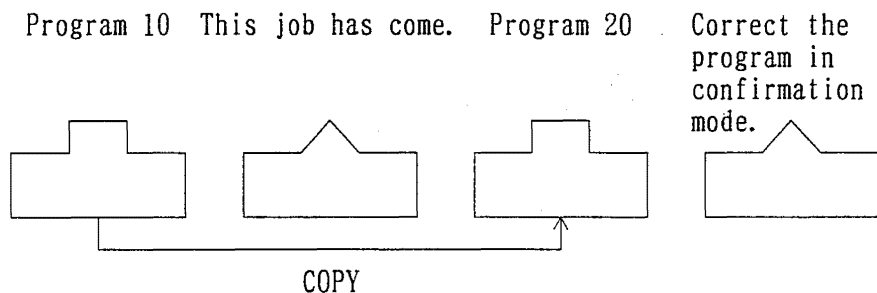


Meaning of Function Keys for Editing Operation

Function keys on the screens (A) and (B)

- PAGE NEXT Since only 20 lines (items) are displayed at one time, press the PAGE NEXT key to check the contents of further items. If the [UNABLE TO ENTER] message appears, it means the end of the program or Job.
- PAGE BACK This is the opposite of the PAGE NEXT key and is used to return to the previous page.
- PROTECT This function is used to make it impossible to correct the contents. Namely, you cannot edit nor correct even in the confirmation mode. If you try to correct any contents, errors occur in all cases.
- PROTECT This is the opposite of the PROTECT key and is used to
RELEASE remove the mark* and make the correction of contents possible.
- COPY..... The COPY function key is used to generate the contents of the instruction to other free number.

* If a part of the content of certain work is different, you must return to the original content even if you have corrected the program in the confirmation mode. If you copy the program and correct one of these two programs, you can keep another as it is.



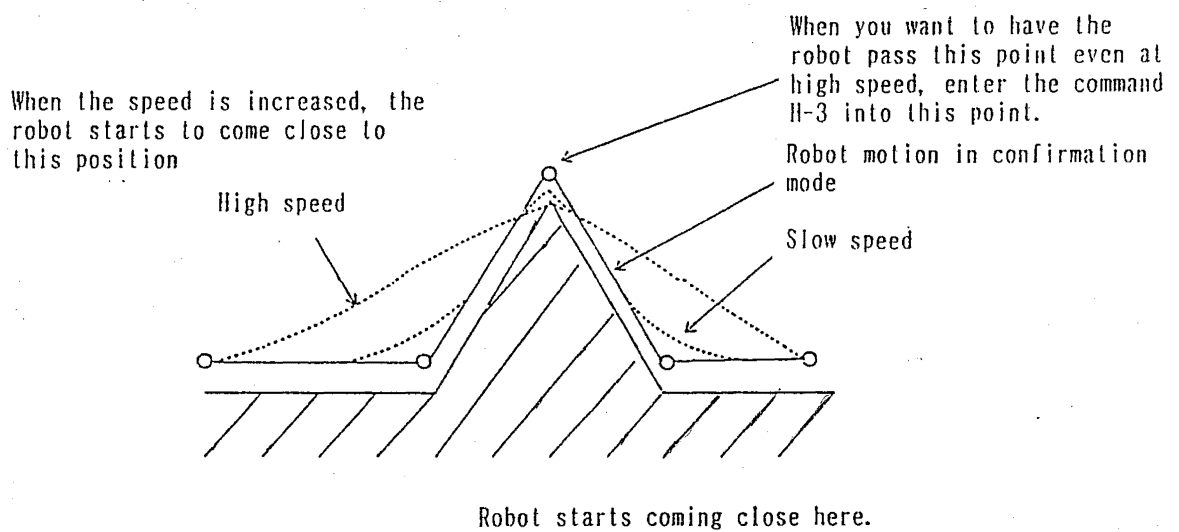
- DIVIDE..... An operation used to generate only a part of the content of an instruction into other number.
- MERGE An operation used to put an instruction of certain number and an instruction of another number together to generate an instruction of a new number.
- DEL An operation used to delete completely the contents of an instruction.

Function keys on screens (C) and (D)

- CHG Used to make some modification to the point.
- INS An operation to generate one point (A point can be generated by an NC unit in the same manner as a machining center, but this INS key must not be used because the target angle of the welding robot is not known even if the position is the same.)
- DEL An operation to delete points. With this operation, it is possible to delete the starting point of a circle and weaving, which is not possible in the confirmation mode. Note, however, that the robot will not move unless you delete all the circular weaving points because the instruction of the robot becomes disordered.
- INDEX An operation used to directly call the contents you want to check.
- PAGE NEXT Since the CRT screen displays only ten lines, this operation is used to check the page after the 11th line.
- PAGE BACK An operation contrary to the PAGE NEXT key.

- SPD CHG An operation used to change all the speeds of air cut
(RANGE) moving and of welding section.

- Even if there are some welding points and different speeds are involved, this operation makes all speeds to be the same.
- To increase the speed for air cut moving, increase by about five meters at a time. If you increase the speed by 20 to 30 meters at one time, torch may hit against the workpiece or jigs.



- SPD CHG An operation to change the contents of AJO and CJO of the
(RANGE) welding section.

Making and Correction Programs

This operation is used to enter the contents of welding work (such as interlocked operation with peripheral jigs) into the robot in the form of the sequence commands.

No.	Method of operation	Response of display																																																																						
1	Press the END key of the panel. Press the END key of the panel again, as required, to show the initial display shown at right. To end the [PLAY] mode or the [TEACH] mode, press the [END] key and the [CANCEL] key of the teaching pendant together, and press the [END] key of the panel.	SELECT OPERATION MODE F1 F2 F3 F4 F5 PLAY TEACH EDIT TAPE PRINTER NEXT KEY																																																																						
2	Press the F3 [EDIT] key.																																																																							
3	Press the F2 [PROGRAM] key.																																																																							
4	Use the number keys on the panel and enter the program numbers.	EDIT PROGRAM= 004 <table><tr><th>FIL</th><th>PRODUCED</th><th>DATE/TIME</th><th>CMNT</th><th>USED</th></tr><tr><td>1</td><td>OY OM OD</td><td>OH OM</td><td></td><td>2.7</td></tr><tr><td>2</td><td>OY OM OD</td><td>OH OM</td><td></td><td>2.7</td></tr><tr><td>3</td><td>OY OM OD</td><td>OH OM</td><td></td><td>2.7</td></tr><tr><td>4</td><td>2Y 9M 17D</td><td>10H 40M</td><td></td><td>0.2</td></tr><tr><td>5</td><td>2Y 9M 10D</td><td>18H 19M</td><td>AKYM</td><td>0.3</td></tr><tr><td>6</td><td>2Y 9M 5D</td><td>10H 51M</td><td></td><td>0.0</td></tr><tr><td>7</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.1</td></tr><tr><td>8</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.4</td></tr><tr><td>9</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.6</td></tr><tr><td>10</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.0</td></tr><tr><td>11</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.0</td></tr><tr><td>12</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.3</td></tr><tr><td>13</td><td>OY OM OD</td><td>OH OM</td><td></td><td>0.3</td></tr></table> INPUT PROG NO. OR SELECT OPERATION MODE F1 F2 F3 F4 F5 PAGE PAGE PROTECT PROTECT NEXT NEXT BACK RELEASE KEY	FIL	PRODUCED	DATE/TIME	CMNT	USED	1	OY OM OD	OH OM		2.7	2	OY OM OD	OH OM		2.7	3	OY OM OD	OH OM		2.7	4	2Y 9M 17D	10H 40M		0.2	5	2Y 9M 10D	18H 19M	AKYM	0.3	6	2Y 9M 5D	10H 51M		0.0	7	OY OM OD	OH OM		0.1	8	OY OM OD	OH OM		0.4	9	OY OM OD	OH OM		0.6	10	OY OM OD	OH OM		0.0	11	OY OM OD	OH OM		0.0	12	OY OM OD	OH OM		0.3	13	OY OM OD	OH OM		0.3
FIL	PRODUCED	DATE/TIME	CMNT	USED																																																																				
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2	OY OM OD	OH OM		2.7																																																																				
3	OY OM OD	OH OM		2.7																																																																				
4	2Y 9M 17D	10H 40M		0.2																																																																				
5	2Y 9M 10D	18H 19M	AKYM	0.3																																																																				
6	2Y 9M 5D	10H 51M		0.0																																																																				
7	OY OM OD	OH OM		0.1																																																																				
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13	OY OM OD	OH OM		0.3																																																																				
5	Press the STORE key.																																																																							
6	Use the cursor keys ↓ ↑ and set the blinking cursor to the desired step. The blinking cursor is a square frame blinking on the screen.	EDIT PROGRAM= 005 CMNT=AKYM <table><tr><th>STEP</th><th>COMM</th><th>SPEED (M/MIN)</th><th>SEQ.</th><th>COMMAND</th></tr><tr><td>0</td><td>A-O</td><td>7.50</td><td></td><td></td></tr><tr><td>1</td><td>A-O</td><td>7.50</td><td></td><td></td></tr><tr><td>2</td><td>A-O</td><td>0.50</td><td>1AJO</td><td>230 22.0</td></tr><tr><td>3</td><td>A-O</td><td>9.00</td><td>1CJO</td><td>100 18.0</td></tr><tr><td>4</td><td>A-O</td><td>7.50</td><td></td><td></td></tr><tr><td>5</td><td>A-O</td><td>7.50</td><td></td><td></td></tr><tr><td>6</td><td>C-S</td><td>7.50</td><td></td><td></td></tr><tr><td>7</td><td>C-O</td><td>7.50</td><td></td><td></td></tr><tr><td>8</td><td>C-E</td><td>7.50</td><td></td><td></td></tr></table> SELECT OPERATION MODE F1 F2 F3 F4 F5 CHANGE ADD DELETE INDEX NEXT KEY	STEP	COMM	SPEED (M/MIN)	SEQ.	COMMAND	0	A-O	7.50			1	A-O	7.50			2	A-O	0.50	1AJO	230 22.0	3	A-O	9.00	1CJO	100 18.0	4	A-O	7.50			5	A-O	7.50			6	C-S	7.50			7	C-O	7.50			8	C-E	7.50																						
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7	C-O	7.50																																																																						
8	C-E	7.50																																																																						

No.	Method of operation	Response of display
	(To change steps)	
7	Press the F1 [CHG] key.	
	NOTE For F2 ~ F5 , refer to No.7-1~7-6.	
8	The MOVE COMMAND blinks. The move command can be corrected. Displays of various commands used to select the command code from the function key are changed in order shown at right by pressing the function keys of the same system for certain number of times.	F1 F2 F3 F4 F5 T-OA-OC-SB-SD-S T-OA-OA·OC-OC-ECSB-EB·SB·1B·2B·EB·1B·2D·0D·ED·E
9	Press the STORE key.	
10	The speed display blinks. The speed can be changed. Use the number keys to enter the new speed and press the [STORE]key. Use the cursor keys ⬆ ⬇ and set the blinking cursor to the position coordinate and the position can be corrected (direct entry of the new speed with the number keys, MDI). Enter the new position with the number keys and press the [STORE] key.	* For the MOVE command, refer to CHAPTER 6.
11	Press the STORE key.	
12	Enter the sequence command using the function key and number keys. Every time the NEXT KEY is pressed, other sequence commands are displayed. (An operation used to enter or correct the sequence commands)	EDIT PROGRAM= 005 CMNT=AKYM STEP COMM SPEED(M/MIN) SEQ. COMMAND 1 A=0 7.50 1H-1 5 2 X = 680.77MM Y = 85.16MM Z = 1224.18MM U = 162.51" V = 58.52" W = 173.81" ----- INPUT SEQ. COMMAND. H-1 5 F1 F2 F3 F4 F5 O- H- J- L- NEXT (OUT) (WAIT) (JUMP) (CAL-L) KEY

No.	Method of operation	Response of display
	For example, to enter a 0.5 second waiting time: Press the F2 key. ----> (H-) Press the 1 key. ----> (H-1) Press the 5 key. ----> (H-1, 5) The figure 1 denotes 0.1 second. (Example) 0.5 seconds Since 5 is press in this case, the speed is 0.5 seconds.	
13	Press the STORE key. To enter the other sequence command into the same step, return to No. 12.	F1 F2 F3 F4 F5 0- H- J- L- ASS AES AJO CJO R- U-0 J-H ESC F- E- NEXT KEY NEXT KEY NEXT KEY NEXT KEY NEXT KEY ← ← ← ← ←
14	Press the END key of the panel. The whole page returns to the display at the lower step.	
15	Sequences with other command are made in the same procedures of the operations No.6 and on.	
	For the sequence command, refer to the "Description of Commands."	(WLD) The message WLD is displayed only when the optional work data bank is used.

When the F2 ~ F5 keys are pressed in the operation No.7:

No.	Method of operation	Response of display								
7 - 1	(To add steps) Press the F2 [ADD] key. NOTE: If the [ADD] key is pressed while the step [2] is blinking, it means to make a new step [3], and the existing step [3] becomes the step [4].	NOTE: If the [ADD] key is pressed while the addition [A] of the sequence command is blinking, it means to make a new [B], and the existing [A] becomes the next step.								
8 - 1	Enter the move command, speed command, position, and sequence command.	<Example>								
9 - 1	Press the STORE key. Then, press the END key of the panel.	<table><tr><th>Operation procedure</th><th>Display</th></tr><tr><td>① Step [1] blinks</td><td>0-01</td></tr><tr><td>② Add [0-02]</td><td>1 0-02 2 3 0-01</td></tr><tr><td>③ Press the [END] key of the panel</td><td>1 0-02 2 0-01</td></tr></table>	Operation procedure	Display	① Step [1] blinks	0-01	② Add [0-02]	1 0-02 2 3 0-01	③ Press the [END] key of the panel	1 0-02 2 0-01
Operation procedure	Display									
① Step [1] blinks	0-01									
② Add [0-02]	1 0-02 2 3 0-01									
③ Press the [END] key of the panel	1 0-02 2 0-01									
7 - 2	(To delete steps) Press the F3 [DEL] key.									
8 - 2	Be sure the step can be deleted, and press the STORE key. (The DEL will be displayed inversely.) If a step is deleted incorrectly, press the F3 [DEL] key again. (The [DEL] will be displayed normally.)	EDIT PROGRAM= 005 CMNT=AKYM STEP 1 COMM SPEED (M/MIN) SEQ. COMMAND 1 A-0 7.50 2 1H-1 3 X = 680.77MM Y = 35.16MM Z = 1224.18MM U = 162.51" V = 56.62" W = 173.81" PRESS STORE KEY IF DELETION REQUIRED F1 CHANGE F2 ADD F3 DELETE F4 INDEX F5 NEXT KEY								
9 - 2	Press the END key of the panel.									

No.	Method of operation	Response of display
7 - 3	(To search steps) Press the F4 [INDEX] key.	
8 - 3	Enter the step number, move command, and sequence command or press the [NEXT KEY] key, and press the F1 [AIR CUT POINT] key and F2 [WELD POINT] key. Then, the step where the command exists becomes the home position (the first line of the displayed lines of the command) and displayed as such after the search.	
9 - 3	Press the END key of the panel.	
7 - 4	Press the F5 [NEXT KEY] key and press the F1 [PAGE NEXT] key.	
8 - 4	The next 10 steps will be displayed.	
9 - 4	Press the [CHG], [ADD], and [DEL] keys as required.	
7 - 5	Press the NEXT KEY key and the F2 [PAGE BACK] key.	
8 - 5	The display returns by 10 steps.	
9 - 5	Press the [CHG], [ADD], and [DEL] keys as required.	

No.	Method of operation	Response of display
7 - 6	Press the F5 [NEXT KEY] key and press the F3 [SPD CHG (RANGE)] key.	
8 - 6	To change all the speeds between the steps at one time, enter the step numbers and speeds according to the guided display. Press the F1 [WELD SECTION] and F2 [AIR CUT SECTION] keys, and all the speeds of the welding section and the air cut section can be changed at one time.	
9 - 6	Press the END key of the panel.	
7 - 7	Press the F5 [NEXT KEY] key and press the F4 [WELD CHG (RANGE)] key.	
8 - 7	Press the F1 [AJ0] key, F2 [CJ0] key and F3 [WLD] key, and the welding conditions and crater conditions can be changed altogether. NOTE: When the welding data of the optional function are not used, F3 [WLD] will not be displayed. Enter the step number, conditions of AJ0, CJ0 and WLD functions according to the guided display.	
9 - 7	Press the END key of the panel.	

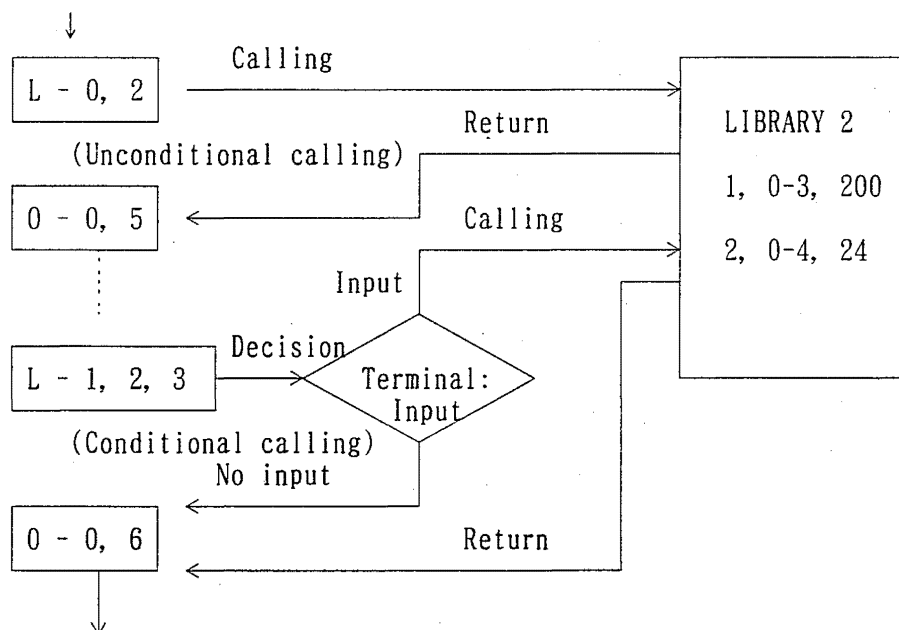
If the teaching position or the speed is changed, it may end up in a position of a speed with which the robot cannot be played.

Making and correction of ARC START sequence, ARC END sequence and LIBRARY sequence

[What is the library sequence]

As you make programs, same combination pattern may often appear.

If it is possible to combine such a command group together and to fetch and execute such group of command when it becomes necessary, the program writing should become simple and the program structure can be reduced for easy understanding. With the operations of PANA ROBO, the location where the group of command to be repeated is called the [Library Sequence]. The library sequence can be used by simply designating its number.



© Note the following in using the LIBRARY function.

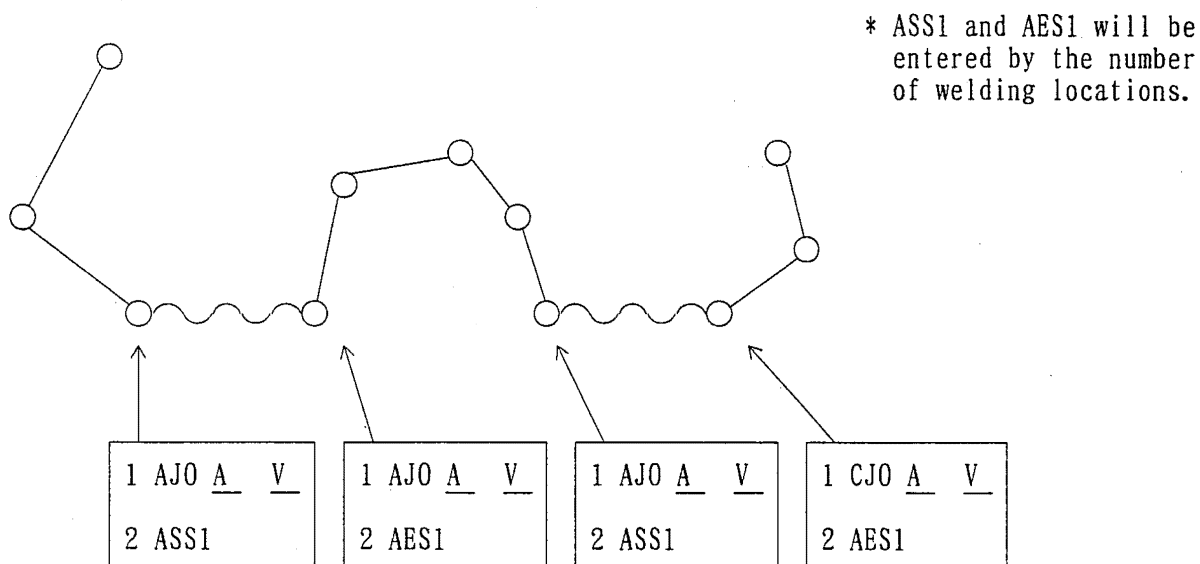
- (1) Library sequence numbers 1 through 99 can be registered.
- (2) The library sequence must be structured by the operation command within 999 sequences.
- (3) Write the library sequence first, and enter the calling command into the program.

[What are the ARC START sequence and ARC END sequence ?]

The ARC START sequence and ARC END sequence are the LIBRARY sequence that are dedicated to register the command group for starting and ending the welding and the command group for stopping the welding.

Consider it as turning ON and OFF the torch switch, provided that in actual operation the signals other than the ON • OFF that are necessary for starting and ending the welding are also included.

Therefore, when you write a program by teaching your robot, the welding start point is entered automatically with 1 of the welding conditions (AJO, current, voltage) and the arc start sequence (ASS) which correspond to the menu number, while the welding end point is entered automatically with 1 of the crater conditions (CJO, current, voltage) and the welding end sequence (AES) which correspond to the menu number.



Write the reserve command in the same manner as you write programs.

No.	Method of operation	Response of display
1	Press the END key of the panel to show the initial display.	<pre> EDIT ARC START SEQ. ASS= 1 CMNT= ----- NO. CMD 1 O-0 210 2 H-1 2 3 O-0 209 4 H-0 217 5 </pre>
2	Press the F3 [EDIT] key.	
3	Press either of the following keys F3 [ASS SEQ] key F4 [AES SEQ] key F5 [LIBRARY] key	<pre> ----- SELECT OPERATION MODE F1 F2 F3 F4 F5 CHANGE ADD DELETE INDEX NEXT KEY </pre>
4	Use the number keys of the panel to enter respective numbers of the sequence.	<pre> EDIT ARC END SEQ. AES= 1 CMNT= ----- NO. CMD 1 H-1 10 2 O-1 209 3 O-1 210 4 H-1 5 5 O-0 211 6 H-1 2 7 O-1 211 8 </pre>
5	Press the STORE key.	
	The following operations are the same as those after No.6 [Writing and Correction of Programs].	<pre> EDIT LIBRARY = 01 CMNT= ----- NO. CMD 1 AJO 50 15.0 2 H-0 1 3 AJO 100 16.0 4 H-0 2 5 AJO 150 20.0 6 H-0 3 7 AJO 200 24.0 8 H-0 4 9 AJO 250 28.0 10 H-0 5 </pre>

NOTE: The following welding start and welding end sequences are stored at the factory.

1. ASS SEQ.

Order	ASS 1	ASS 2	ASS 3	ASS 4	ASS 5
1	O-0 210	O-0 210	O-0 210	H-1 1	H-1 1
2	O-0 209	H-1 1	H-1 2	O-0 210	O-0 210
3	H-0 217	O-0 209	O-0 209	H-1 2	H-1 2
4		H-0 217	H-0 217	O-0 209	O-0 209
5				H-0 217	H-1 2
6					H-0 217

2. Meanings of sequence commands

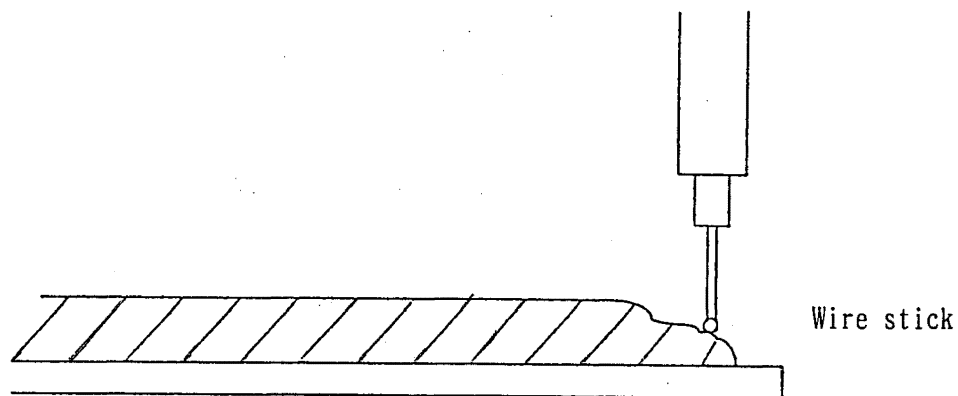
Robot language	Meaning of language			Connection of robot and welder	English
O-0 210	O- Output	0 Enter.	210 Terminal 210	Gas valve wire is connected to terminal 210.	Turn on the gas valve.
O-0 209	O-	0 Enter.	209 Terminal 209	Torch switch wire is connected to terminal 209.	Turn on the torch.
H-0 217	H-	0 Enter.	217 Terminal 217	Wire for current detection is connected to terminal 217.	Wait until current of the welder is detected.
H-1 Numbers	H-	1 Enter.	$\times 1 / 10$		Wait for $\times 1/10$ seconds.

Time is displayed in ten times the value. 10 $\Rightarrow$ One second
5 $\Rightarrow$ 0.5 second

Robot will not move until this signal is entered the robot.

2. AES SEQ

Order	AES 1	AES 2	AES 3	AES 4	AES 5
1	O-1 209	O-1 209	H-1 3	H-1 3	O-1 209
2	O-1 210	H-1 5	O-1 209	O-1 209	O-1 210
3	H-1 5	O-1 210	O-1 210	H-1 5	H-1 2
4	O-0 211	O-1 211	H-1 5	O-1 210	O-3 150
5	H-1 2	H-1 2	O-0 211	O-0 211	O-0 213
6	O-1 211	O-1 211	H-1 2	H-1 2	H-1 1
7			O-1 211	O-1 211	O-0 212
8					H-1 1
9					O-1 212
10					H-1 1
11					O-1 213
12					O-0 211
13					H-1 2
14					O-1 211



O-0 211
H-1 2
O-1 211

→ These commands issue signals to the welder to check sticking only, and it is the welder that actually performs the stick check whether the beads stick with the wire. The stick check is used to check whether the weld beads stick with the wire at the welding ending point.

If the beads and wire are stuck, the welder issues the [HOLD] signal to the robot.

Robot language		Meaning of language			Connection of robot and welder	English
O-1	209	O- Output	1 Turn OFF	209 Terminal 209	Torch switch wire is connected to terminal 209.	Turn OFF the torch switch
O-1	210	O- Output	1 Turn OFF	210 Terminal 210	Gas valve wire is connected to terminal 210.	Turn OFF the gas valve.
H-1	5	H- Wait.	1 Time	5 × 1/10	The numerals are displayed in ten times the value.	Wait for 0.5 seconds.
O-3	150	O- Output	3 Current	150 150 ampere	Connected to the current potentiometer of the remote controller.	Output 150A.
O-0	212	O- Output	0 Turn ON.	212 Terminal 212	Connected to the wire inching start wire of the terminal 212.	Extend the wire.
O-0	213	O- Output	0 Turn ON.	213 Terminal 213	Wire for reverse motor revolution is connected to the terminal 213.	Reverse motor revolution
O-1	212	O- Output	1 Turn OFF	212 Terminal 212	Connected to the wire inching start wire of the terminal 212.	Stop the wire
O-1	213	O- Output	1 Turn OFF	213 Terminal 213	Wire for reverse motor revolution is connected to the terminal 213.	Stop reverse motor revolution.
O-0	211	O- Output	0 Turn ON.	211 Terminal 211	Stick check wire is connected to the terminal 211.	Turn ON the stick check.
O-1	211	O- Output	1 Turn OFF	211 Terminal 211	Stick check wire is connected to the terminal 211.	Turn OFF the stick check.

The last half of AES 5 (from the fourth):

A command to draw in the wire coming from the chip, at the welding ending point.

O-3 150 → Determines the wire inching speed. (Greater the numeral, faster the speed.) (Used for the welding current, but is also used for the wire inching speed.)

O-0 213	}	Reverse wire inching starts.	O-0 212 means that motor rotate to the direction of wire extended. O-0 213 changes the motor rotate direction.
H-1 1			
O-0 212			

H-1 1 → Reverse inching time

O-1 212	}	→ End of reverse wire inching
H-1 1		
O-1 213		

The length of wire to be drawn in is determined by: $O-3 \ 150 \times H-1 \ 1$.
(speed) (time).

* Use this operation when the arc start becomes improper due to the wire contacting the base metal at the welding starting point.

← Starting the arc under this condition causes the wire to click and stick with the chip.

PROTECT SET, RELEASE

The operation to prevent inadvertent rewriting of the already written jobs, programs, ASS SEQ, AES SEQ, and LIBRARY is called the PROTECT, and the operation to arrange rewriting is called the PROTECT RELEASE.

No.	Method of operation	Response of display																																																																																																															
1	Press the END key to show the initial display.																																																																																																																
2	Press the F3 [EDIT] key.																																																																																																																
3	Press the F1 ~ F5 keys. For example, for protecting programs, press the F2 [PROGRAM] key.																																																																																																																
4	Press the F3 [PROTECT] key or the F4 [PROTECT RELEASE] key.	EDIT PROGRAM* <table><thead><tr><th>FIL</th><th>PRODUCED</th><th>DATE/TIME</th><th>CMNT</th><th>USED</th></tr></thead><tbody><tr><td>1</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>2</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>3</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>4</td><td>2Y</td><td>9M</td><td>17D</td><td>10H</td><td>40M</td><td>0.2</td></tr><tr><td>5</td><td>2Y</td><td>9M</td><td>17D</td><td>11H</td><td>9M</td><td>0.3</td></tr><tr><td>6</td><td>2Y</td><td>9M</td><td>5D</td><td>10H</td><td>51M</td><td>0.0</td></tr><tr><td>7</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.1</td></tr><tr><td>8</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.4</td></tr><tr><td>9</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.8</td></tr><tr><td>10</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>3.0</td></tr><tr><td>11</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.0</td></tr><tr><td>12</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.3</td></tr><tr><td>13</td><td>0T</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.3</td></tr></tbody></table> INPUT FILE NO. <table><tbody><tr><td>F1</td><td>F2</td><td>F3</td><td>F4</td><td>F5</td></tr><tr><td>PAGE</td><td>PAGE</td><td>PROTECT</td><td>PROTECT</td><td>NEXT</td></tr><tr><td>NEXT</td><td>BACK</td><td></td><td>RELEASE</td><td>KEY</td></tr></tbody></table>	FIL	PRODUCED	DATE/TIME	CMNT	USED	1	0T	0M	0D	0H	0M	2.7	2	0T	0M	0D	0H	0M	2.7	3	0T	0M	0D	0H	0M	2.7	4	2Y	9M	17D	10H	40M	0.2	5	2Y	9M	17D	11H	9M	0.3	6	2Y	9M	5D	10H	51M	0.0	7	0T	0M	0D	0H	0M	0.1	8	0Y	0M	0D	0H	0M	0.4	9	0T	0M	0D	0H	0M	0.8	10	0T	0M	0D	0H	0M	3.0	11	0T	0M	0D	0H	0M	0.0	12	0T	0M	0D	0H	0M	0.3	13	0T	0M	0D	0H	0M	0.3	F1	F2	F3	F4	F5	PAGE	PAGE	PROTECT	PROTECT	NEXT	NEXT	BACK		RELEASE	KEY
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No.	Method of operation	Response of display																																																																																																															
	(1) Only when F2 [PROGRAM] is pressed in the operation No.4 and F3 [PROTECT] keys in the operation No.3, the following message appears on the screen. "Do you want to change steps ?" YES NO If [YES] is selected: The position being taught only can be changed. It is not possible to add, delete teaching points, change path, add or correct sequence commands. Use the ← → keys, display [YES] inversely, and press the [STORE] key. The mark [+] appears after the number to be protected. If [NO] is selected: The position of the teaching point cannot be changed. Also, it is not possible to add, delete teaching points, change path, add or correct sequence commands. Use the ← , → keys, display [NO] inversely, and press the [STORE] key. The mark [*] appears after the number to be protected. (2) When the function keys other than the F2 [PROGRAM] key is pressed in the operation No.3 and the F3 [PROTECT] key in the operation No.4, the mark [*] appears after the number to be protected.	EDIT PROGRAM* <table><tr><th>FIL</th><th>PRODUCED</th><th>DATE/TIME</th><th>CMNT</th><th>USED</th></tr><tr><td>1</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>2</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>3</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>2.7</td></tr><tr><td>4</td><td>2Y</td><td>9M</td><td>17D</td><td>10H</td><td>40M</td><td>0.2</td></tr><tr><td>5</td><td>2Y</td><td>9M</td><td>17D</td><td>11H</td><td>9M</td><td>0.3</td></tr><tr><td>6</td><td>2Y</td><td>9M</td><td>17D</td><td>10H</td><td>51M</td><td>0.0</td></tr><tr><td>7</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.1</td></tr><tr><td>8</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.4</td></tr><tr><td>9</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.8</td></tr><tr><td>10</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>3.0</td></tr><tr><td>11</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.0</td></tr><tr><td>12</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.0</td></tr><tr><td>13</td><td>0Y</td><td>0M</td><td>0D</td><td>0H</td><td>0M</td><td>0.3</td></tr></table> ----- INPUT PROG NO. OR SELECT OPERATION MODE <table><tr><td>F1</td><td>F2</td><td>F3</td><td>F4</td><td>F5</td></tr><tr><td>PAGE</td><td>PAGE</td><td>PROTECT</td><td>PROTECT</td><td>NEXT</td></tr><tr><td>NEXT</td><td>BACK</td><td></td><td>RELEASE</td><td>KEY</td></tr></table>	FIL	PRODUCED	DATE/TIME	CMNT	USED	1	0Y	0M	0D	0H	0M	2.7	2	0Y	0M	0D	0H	0M	2.7	3	0Y	0M	0D	0H	0M	2.7	4	2Y	9M	17D	10H	40M	0.2	5	2Y	9M	17D	11H	9M	0.3	6	2Y	9M	17D	10H	51M	0.0	7	0Y	0M	0D	0H	0M	0.1	8	0Y	0M	0D	0H	0M	0.4	9	0Y	0M	0D	0H	0M	0.8	10	0Y	0M	0D	0H	0M	3.0	11	0Y	0M	0D	0H	0M	0.0	12	0Y	0M	0D	0H	0M	0.0	13	0Y	0M	0D	0H	0M	0.3	F1	F2	F3	F4	F5	PAGE	PAGE	PROTECT	PROTECT	NEXT	NEXT	BACK		RELEASE	KEY
FIL	PRODUCED	DATE/TIME	CMNT	USED																																																																																																													
1	0Y	0M	0D	0H	0M	2.7																																																																																																											
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5	2Y	9M	17D	11H	9M	0.3																																																																																																											
6	2Y	9M	17D	10H	51M	0.0																																																																																																											
7	0Y	0M	0D	0H	0M	0.1																																																																																																											
8	0Y	0M	0D	0H	0M	0.4																																																																																																											
9	0Y	0M	0D	0H	0M	0.8																																																																																																											
10	0Y	0M	0D	0H	0M	3.0																																																																																																											
11	0Y	0M	0D	0H	0M	0.0																																																																																																											
12	0Y	0M	0D	0H	0M	0.0																																																																																																											
13	0Y	0M	0D	0H	0M	0.3																																																																																																											
F1	F2	F3	F4	F5																																																																																																													
PAGE	PAGE	PROTECT	PROTECT	NEXT																																																																																																													
NEXT	BACK		RELEASE	KEY																																																																																																													

COPY, DIVIDE, MERGE, DELETE

These operations are used to copy, divide, merge, and delete the generated jobs, programs, ASS SEQ, AES SEQ, and LIBRARY.

No.	Method of operation	Response of display																																																																																			
1	Press the END [Key] of the panel to show the initial display.																																																																																				
2	Press the F3 [EDIT] key.																																																																																				
3	Press the F1 ~ F5 keys. For example, if you want to copy programs, press the F2 [PROGRAM] key.	EDIT PROGRAM= <table><thead><tr><th>FIL</th><th>PRODUCED</th><th>DATE/TIME</th><th>CMNT</th><th>USED</th></tr></thead><tbody><tr><td>1</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>2.7</td></tr><tr><td>2</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>2.7</td></tr><tr><td>3</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>2.7</td></tr><tr><td>4</td><td>2Y</td><td>9M 17D</td><td>10H 40M</td><td>ARYM</td><td>0.2</td></tr><tr><td>5</td><td>2Y</td><td>9M 17D</td><td>11H 9M</td><td>ARYM</td><td>0.3</td></tr><tr><td>6</td><td>2Y</td><td>9M 5D</td><td>10H 51M</td><td></td><td>0.0</td></tr><tr><td>7</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.1</td></tr><tr><td>8</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.4</td></tr><tr><td>9</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.8</td></tr><tr><td>10</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>3.0</td></tr><tr><td>11</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.0</td></tr><tr><td>12</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.3</td></tr><tr><td>13</td><td>0Y</td><td>0M</td><td>0D</td><td>0H 0M</td><td>0.3</td></tr></tbody></table> ----- INPUT PROG NO. OR SELECT OPERATION MODE PROG. STO O COPIED F1 F2 F3 F4 F5 COPY DIVIDE MERGE DELETE NEXT KEY	FIL	PRODUCED	DATE/TIME	CMNT	USED	1	0Y	0M	0D	0H 0M	2.7	2	0Y	0M	0D	0H 0M	2.7	3	0Y	0M	0D	0H 0M	2.7	4	2Y	9M 17D	10H 40M	ARYM	0.2	5	2Y	9M 17D	11H 9M	ARYM	0.3	6	2Y	9M 5D	10H 51M		0.0	7	0Y	0M	0D	0H 0M	0.1	8	0Y	0M	0D	0H 0M	0.4	9	0Y	0M	0D	0H 0M	0.8	10	0Y	0M	0D	0H 0M	3.0	11	0Y	0M	0D	0H 0M	0.0	12	0Y	0M	0D	0H 0M	0.3	13	0Y	0M	0D	0H 0M	0.3
FIL	PRODUCED	DATE/TIME	CMNT	USED																																																																																	
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4	Press the F5 [NEXT KEY] key.																																																																																				
5	Press the F1 ~ F4 keys. For example, press the F1 [COPY] key for copying.																																																																																				
6	Use the numeral keys to enter the number according to the guidance display and press the STORE key. When the CANCEL key is pressed during storing, the stored numerals are cleared (blank).																																																																																				
7	Press the END key.																																																																																				

Operation 22 : Cassette Taper Recorder

This operation is used to save the contents stored in the robot into a tape and to store the contents of the tape into the robot when necessary.

○ Before the operation:

1. Install an adaptor to the power source of the tape recorder to operate it with 100VAC.

Dry cells can be used, but you are not really sure as to whether they have sufficient capacities to play the tape recorder after it is not used for certain time.

The motor may not rotate smoothly and properly so that tape cannot record the sound properly.

2. Use the connector cable provided with the robot. This cable looks alike the commercially available cable, but the inside is different.

Code No. of cable: RP-020B IM

3. Tape recorder

Use SONY tape recorder, TCM-858.

* If other tape recorder is used, characteristics of the robot and the tape recorder may not agree.

4. Tape

The RT-60LN tape is recommended. This is a normal 60 minutes tape of low noise. Metal tapes dedicated to recording music and chrome tape cannot be used.

5. If you record the contents of the memory of the robot into the tape, the contents of the memory of the robot remain.
6. If a cassette tape recorder for computer is used, set the potentiometer scale to about 70 to 80% of the maximum level. If set to the maximum, the sound will be distorted.

7. Three operations are available for communications with the cassette tape recorder.

○ Record the contents of the robot into a tape.

SAVE

○ Verify the contents of the robot with the contents of the tape

VERIFY

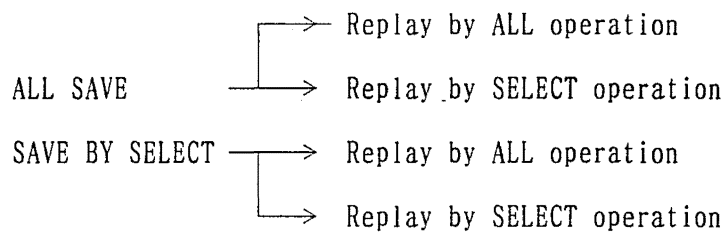
○ Load the contents of the tape into the robot.

LOAD

○ "ALL" and "SELECT" functions can be used for these operations.

ALL : Used to load or save the contents of the robot or the tape.

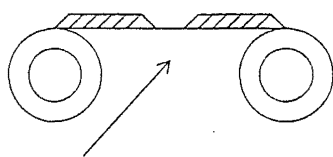
SELECT : Used to load or save only the necessary part of the contents from or to the robot or the tape. (Any number of contents)



The ALL operation means the whole part recorded by the SELECT operation.

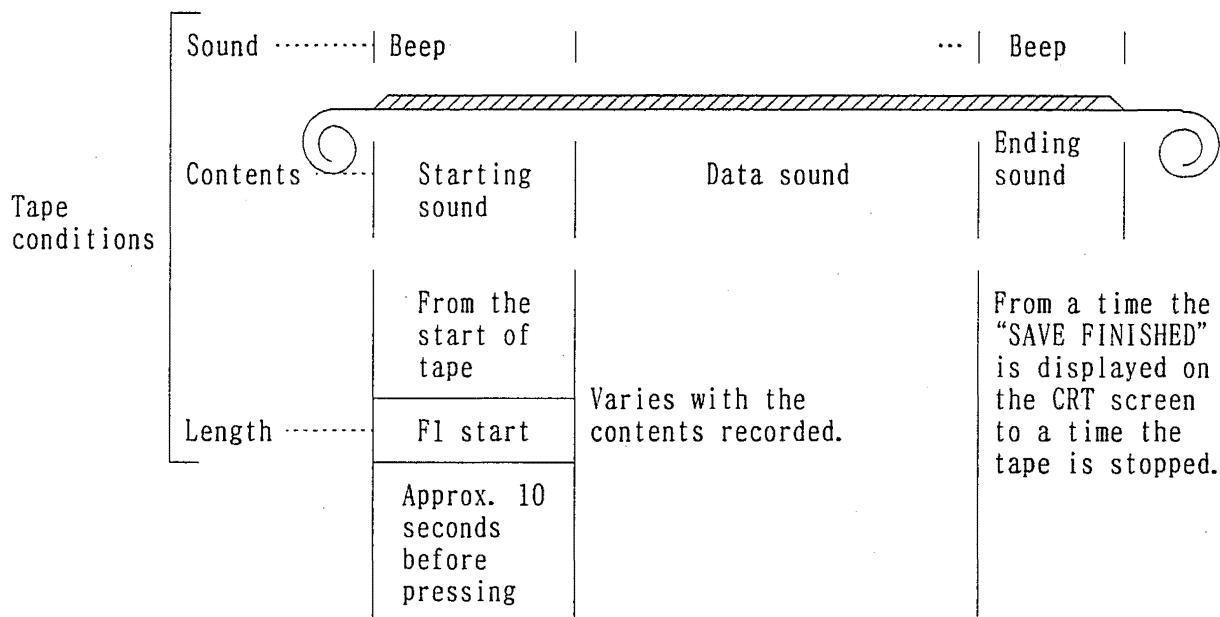
Either operation can be used.

8. Notes on tape



Keep tapes apart by 10 scales of the counter.

Tape can be used in parts, but the scale of the counter when the tape is started should be memorized.



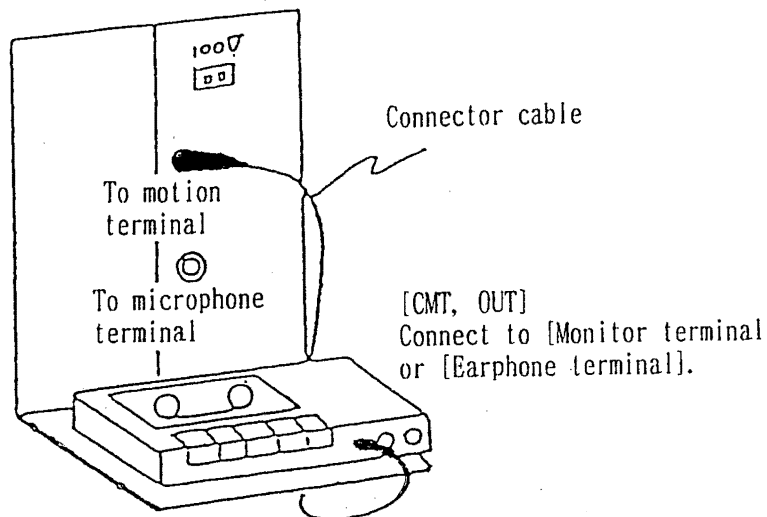
9. Control

- The place where the tape recorder is used must be free from dust, debris, and magnetism.
- For easy control, record programs by SELECT.
- When saving data, keep the record of the data also.
- For easy control, record the "program number and part number" in your voice before saving the tape.

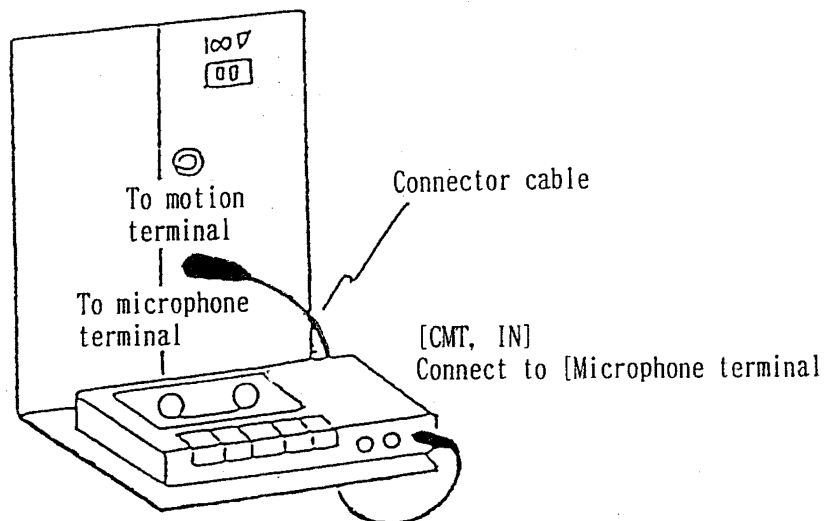
10. When the contents of the tape are loaded into the robot, the welding conditions of the initial conditions are changed to the contents recorded in the tape.

Connection of Cassette Tape Recorder

- To read programs from the cassette tape and to check memory and tape:



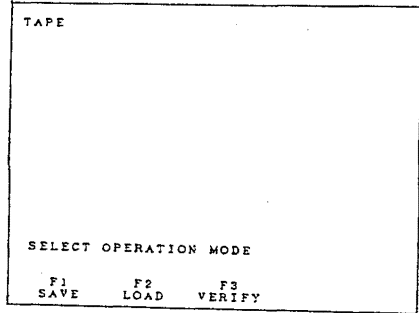
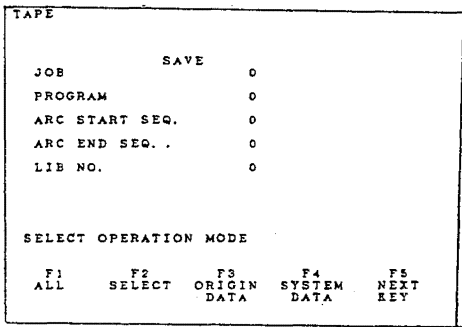
- To save programs into the cassette tape:



Saving Programs into Cassette Tapes

Write into a cassette tape and save all the contents stored in the control unit or the contents of selected jobs, programs, ASS SEQ, AES SEQ, LIBRARY, and system setting.

* When recording on a used tape, delete the recorded data by five to six scales of the counter from the starting position.

No.	Method of operation	Response of display
1	Completely rewind the tape of the tape recorder, set the sound volume potentiometer to [MAX] position, and the tone quality to [HIGH] position.	
2	Use a special cable provided and connect the "microphone terminal or CMTIN terminal" of the tape recorder to the "microphone terminal" of the interface panel.	
3	Press the END key of the panel to show the initial display.	
4	Press the F4 [TAPE PRINT] key.	
5	Press the F1 [SAVE] key.	
6	To save all the data, press the F1 [ALL] key. To save the necessary data only (for example, to save only 2 and 4 of a program) press the [SELECT] key.	

No.	Method of operation	Response of display																					
	To save the origin data (ORIGIN OFFSET, ORIGIN CORRECTION), press the F3 key. To save [ORIGIN DATA], SYSTEM DATA (LIBRARY TABLE, WIRE INCHING, WELDER CHARACTERISTIC, WEAVING TABLE, CONTENTS OF ADV. FUNC., CONTENTS OF OPTIONAL CONNECTION, TOOL OFFSET, and SOFT LIMIT (speed limit), press the F4 [SYSTEM DATA] key. To save the coordinate data (registered data of the user coordinate system), press the F5 [NEXT KEY] key and F1 [COORDINATE DATA]. To save the welding data, press the F5 [NEXT KEY] key and F2 [WELDING DATA] key. Note that the F2 [WELDING DATA] is displayed only when the work data bank of the optional function is being used. If the keys other than the F2 key is selected in the above case, proceed to the operation No. 10.																						
7	In the case of [SELECT], enter the data number to be saved. <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">JOB</td><td style="width: 20%;"></td><td style="width: 40%;">STORE</td></tr> <tr> <td>PROGRAM</td><td></td><td>STORE</td></tr> <tr> <td>ASS SEQ.</td><td></td><td>STORE</td></tr> <tr> <td>AES SEQ.</td><td></td><td>STORE</td></tr> <tr> <td>LIBRARY</td><td></td><td>STORE</td></tr> <tr> <td style="text-align: center;">↑</td><td></td><td style="text-align: center;">↑</td></tr> <tr> <td>(Press the function key.)</td><td></td><td>(Enter with the numeral keys.)</td></tr> </table> Up to 20 data can be entered with the data number at one operation.	JOB		STORE	PROGRAM		STORE	ASS SEQ.		STORE	AES SEQ.		STORE	LIBRARY		STORE	↑		↑	(Press the function key.)		(Enter with the numeral keys.)	
JOB		STORE																					
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AES SEQ.		STORE																					
LIBRARY		STORE																					
↑		↑																					
(Press the function key.)		(Enter with the numeral keys.)																					

No.	Method of operation	Response on lamp															
8	After the setting is over, press the F4 [SET-UP END] key.																
9	Press the [RECORD] button of the tape recorder and allow the tape to run by 5 to 6 scale of the tape counter. This is done to avoid writing into the leader tape.	TAPE <table> <tr> <td>JOB</td> <td>SAVE</td> <td>0</td> </tr> <tr> <td>PROGRAM</td> <td></td> <td>0</td> </tr> <tr> <td>ARC START SEQ.</td> <td></td> <td>0</td> </tr> <tr> <td>ARC END SEQ.</td> <td></td> <td>0</td> </tr> <tr> <td>LIB NO.</td> <td></td> <td>0</td> </tr> </table> START TAPE RECORDER AND PRESS F1 F1 START	JOB	SAVE	0	PROGRAM		0	ARC START SEQ.		0	ARC END SEQ.		0	LIB NO.		0
JOB	SAVE	0															
PROGRAM		0															
ARC START SEQ.		0															
ARC END SEQ.		0															
LIB NO.		0															
10	Press the F1 [START] key.																
	Start saving into the cassette tape ↓ ▲ Saving finished. ↓	Number of files are displayed during transfer. NOTE: To end saving during saving operation, press the F5 [CANCEL] key of the panel.															
11	"Please check". is displayed on the CRT screen. Turn OFF the [RECORD] button of the tape recorder.																
12	Proceed to the verification of the memory tape.																

Data that are saved in the cassette by the [ALL] operation are all the contents of jobs, programs, ASS SEQ., AES SEQ., and LIBRARY.

Welding conditions, tool offset, soft limit and speed limit in the system setting.

Note that the origin offset and origin correction of the system setting are not saved.

Reading (loading) from Cassette Tapes

With this operation, the contents written and saved in a cassette tape are stored in the control unit.

No.	Method of operation	Response of display																																			
1	Rewind the tape of the tape recorder completely, set the sound volume potentiometer to [MAX] and the sound quality potentiometer to [HIGH].																																				
2	Use the special cable provided to connect the [Monitor terminal or the CMT-OUT terminal] of the tape recorder to the [Monitor terminal] of the interface panel.																																				
3	Press the END key of the panel to show the initial display.																																				
4	Press the F4 [TAPE PRINT] key.																																				
5	Press the F1 [LOAD] key.																																				
6	To load all data, press the F1 [ALL] key. To load only the necessary data (for example, to load only 2 and 4 of a program), press the F2 [SELECT] key. To load the origin data (ORIGIN OFFSET, ORIGIN CORRECTION), press the F3 [ORIGIN DATA] key. To load the system data (LIBRARY TABLE, WIRE INCHING, WELDER CHARACTERISTICS, WEAVING TABLE, CONTENTS OF ADVANCED FUNCTION, CONTENTS OF OPTIONAL CONNECTION, TOOL OFFSET AND SPEED LIMIT), Press the F4 [SYSTEM DATA] key.	TAPE <table><tr><td>JOB</td><td>LOAD</td><td>0</td><td>PASS</td><td>0</td></tr><tr><td>PROGRAM</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>ARC START SEQ.</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>ARC END SEQ.</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>LIB NO.</td><td></td><td>0</td><td></td><td>0</td></tr></table> SELECT OPERATION MODE <table><tr><td>F1</td><td>F2</td><td>F3</td><td>F4</td><td>F5</td></tr><tr><td>ALL</td><td>SELECT</td><td>ORIGIN DATA</td><td>SYSTEM DATA</td><td>NEXT KEY</td></tr></table>	JOB	LOAD	0	PASS	0	PROGRAM		0		0	ARC START SEQ.		0		0	ARC END SEQ.		0		0	LIB NO.		0		0	F1	F2	F3	F4	F5	ALL	SELECT	ORIGIN DATA	SYSTEM DATA	NEXT KEY
JOB	LOAD	0	PASS	0																																	
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F1	F2	F3	F4	F5																																	
ALL	SELECT	ORIGIN DATA	SYSTEM DATA	NEXT KEY																																	

No.	Method of operation	Response of display																									
6	To load the data of the user coordinate system, press the F5 [NEXT KEY] key and F1 [COORDINATE DATA] key. To load the welding data of the work data bank of the optional function, press the F5 [NEXT KEY] key and F2 [WELDING DATA] key. Note that the F2 [WELDING DATA] are displayed only when the work data bank function is being used. If the F2 key is selected in the above operation, proceed to the operation No.10.																										
7	In the case of [SELECT], enter the data number to be loaded. <table><tr><td>JOB</td><td>STORE</td></tr><tr><td>PROGRAM</td><td>STORE</td></tr><tr><td>ASS SEQ.</td><td>STORE</td></tr><tr><td>AES SEQ.</td><td>STORE</td></tr><tr><td>LIBRARY</td><td>STORE</td></tr></table> ↑ (Press the function key.) ↑ (Enter with the numeral keys.) Up to 20 data can be entered with the data number at one operation.	JOB	STORE	PROGRAM	STORE	ASS SEQ.	STORE	AES SEQ.	STORE	LIBRARY	STORE																
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8	After the setting is over, press the F4 [SETUP END] key.																										
9	Press the [PLAY] or the [LOAD] button of the tape recorder and allow the tape to run by 3 to 4 scales of the tape counter. This is done to avoid writing from the leader tape.	TAPE <table><tr><td>JOB</td><td>LOAD</td><td>0</td><td>PASS</td><td>0</td></tr><tr><td>PROGRAM</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>ARC START SEQ.</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>ARC END SEQ.</td><td></td><td>0</td><td></td><td>0</td></tr><tr><td>LIB NO.</td><td></td><td>0</td><td></td><td>0</td></tr></table> START TAPE RECORDER AND PRESS F1 F1 START	JOB	LOAD	0	PASS	0	PROGRAM		0		0	ARC START SEQ.		0		0	ARC END SEQ.		0		0	LIB NO.		0		0
JOB	LOAD	0	PASS	0																							
PROGRAM		0		0																							
ARC START SEQ.		0		0																							
ARC END SEQ.		0		0																							
LIB NO.		0		0																							

No.	Method of operation	Response of display
10	Press the F1 [START] key. Start reading (loading) from the cassette tape. ↓ ▲ Reading finished. ↓	Number of files read (loaded) and the number of passed file No. are displayed during transfer. NOTE: To end saving during saving operation, press the F5 [CANCEL] key of the panel.
11	"Please check." is displayed on the CRT screen. Turn OFF the [PLAY] button of the tape recorder. Proceed to the verification of the memory tape.	

When reading (loading) from the cassette, if the number in the robot and the number of the cassette coincide, the number in the robot is given the precedence and the reading (loading) from the cassette is passed. With the reading (loading) from the cassette in the operation mode, the origin data and system data cannot be loaded.

Verification of Memory Tapes

The verification is used to make sure that the contents written and saved in the cassette tape and the contents of the storage area of the control unit coincide. If the tape is scratched or the tape rolls up debris, the contents of the tape are not normal and the robot will not accept the tape when loading. Be sure the tape is verified for normal conditions.

No.	Method of operation	Response of display
1	Completely rewind the tape of the tape recorder, set the sound volume potentiometer to [MAX] and sound quality potentiometer to [HIGH].	
2	Use the special cable provided to connect the [Monitor terminal or the CMT-OUT terminal] of the tape recorder to the [Monitor terminal] of the interface panel.	
3	Press the END key to show the initial display.	
4	Press the F4 [TAPE PRINT] key.	
5	Press the F1 [VERIFY] key.	
6	To verify all data, press the F1 [ALL] key. To verify the necessary data only (for example, to verify only 2 and 4 of a program), press the F2 [SELECT] key. To verify the origin data (ORIGIN OFFSET, ORIGIN CORRECTION), press the F3 [ORIGIN DATA] key.	TAPE JOB PROGRAM ARC START SEQ. ARC END SEQ. LIB NO. CHECK 0 0 0 0 0 SELECT OPERATION MODE F1 F2 F3 F4 F5 ALL SELECT ORIGIN DATA SYSTEM DATA NEXT KEY

No.	Method of operation	Response of display										
6	To verify system data (LIBRARY TABLE, WIRE INCHING, WELDER CHARACTERISTICS, WEAVING TABLE, CONTENTS OF ADV. FUNC., CONTENTS OF OPTIONAL CONNECTION, TOOL OFFSET, and SPEED LIMIT), press the F4 [SYSTEM DATA] key. To verify the data of the user coordinate system, press the F5 [NEXT KEY] key and F1 [COORDINATE DATA] key. To verify the welding conditions of the work data bank, press the F5 [NEXT KEY] key and F2 [WELDING DATA] key. Note that the F2 [WELDING DATA] is displayed only when the work data bank function is being used. If the keys other than the F2 key is selected in the above case, proceed to the operation No. 10.											
7	In the case of [SELECT], enter the data number to be verified. <table><tr><td>JOB</td><td>STORE</td></tr><tr><td>PROGRAM</td><td>STORE</td></tr><tr><td>ASS SEQ.</td><td>STORE</td></tr><tr><td>AES SEQ.</td><td>STORE</td></tr><tr><td>LIBRARY</td><td>STORE</td></tr></table> ↑ (Press the function key.) ↑ (Enter with the numeral keys.) Up to 20 data can be entered with the data number at one operation.	JOB	STORE	PROGRAM	STORE	ASS SEQ.	STORE	AES SEQ.	STORE	LIBRARY	STORE	
JOB	STORE											
PROGRAM	STORE											
ASS SEQ.	STORE											
AES SEQ.	STORE											
LIBRARY	STORE											

No.	Method of operation	Response of display
8	After the setting is over, press the F4 [SETUP END] key.	
9	Press the [PLAY] or the [LOAD] button of the tape recorder and allow the tape to run by 3 to 4 scales of the tape counter. This is done to avoid writing from the leader tape.	
10	Press the F1 [START] key. Verification starts. ▼ Reading finished. When the ORIGIN DATA and SYSTEM DATA are verified properly, the program returns to the operation No.5. ▼ In case an abnormality occurs such as: [***SAVE VERIFY error***] or [***LOAD VERIFY***], Press the CANCEL key. The program is saved or read (loaded) again. SAVE : Refer to 3-56. LOAD : Refer to 3-59.	The number of files is displayed during verification, and the number of files passed is displayed during loading. NOTE: To end verification during verification operation, press the F5 [CANCEL] key of the panel.

No.	Method of operation	Response of display
11	To retrieve the contents of the file passed, perform the following operations. Press the F1 [YES] key. Then, select the F1 ~ F4 keys. If retrieval is not necessary, press the F2 [NO] key.	
12	The CRT screen gives you the message [Press the END key.].	
13	Press the END key of the panel.	

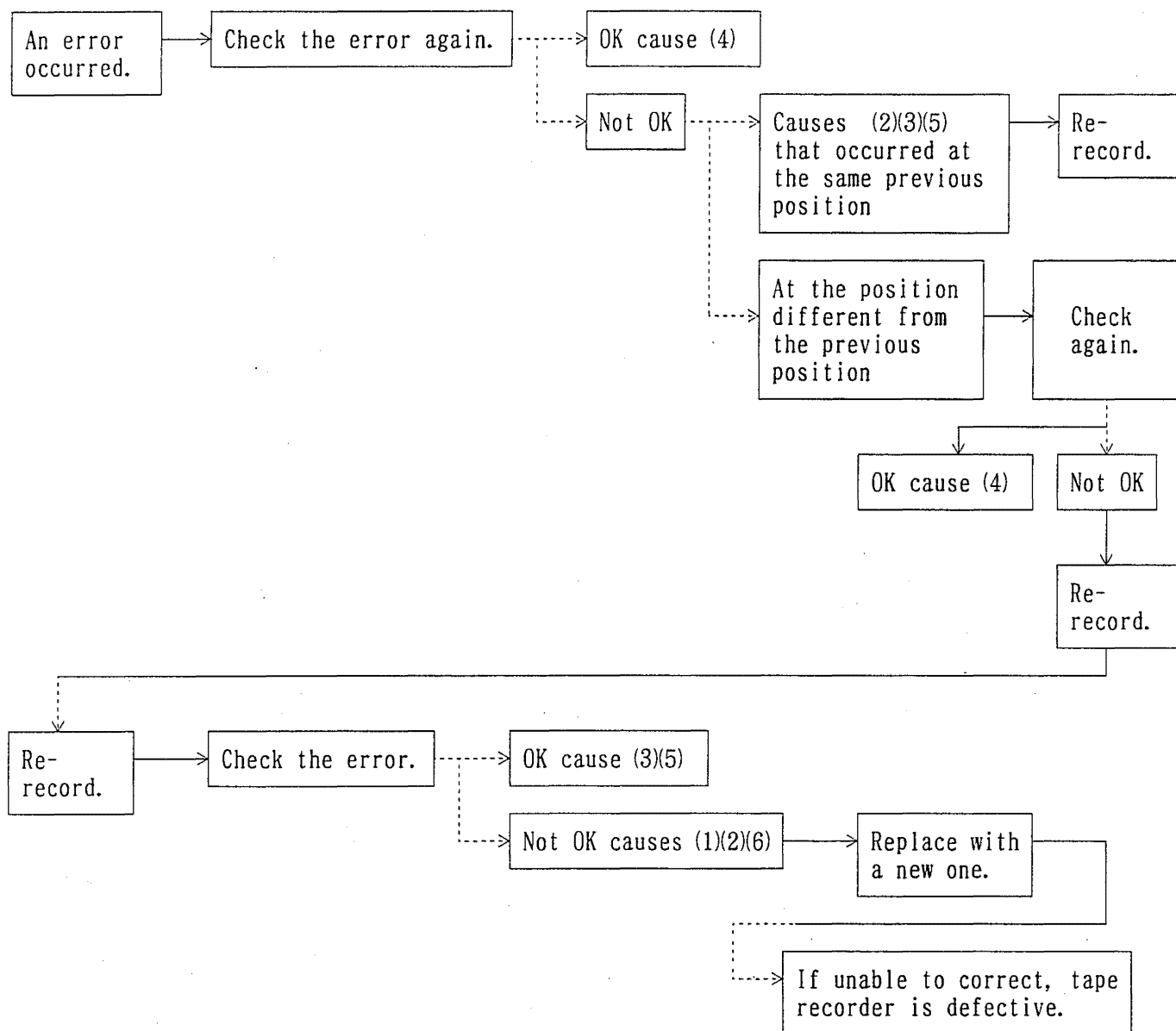
1. In case of some trouble, possible causes and countermeasures are as following.

- (1) Commercially available connector cable was used.
- (2) Tape with scratches was used.
- (3) Dust attached to the tape while recording.
- (4) Dust attached to the tape while verifying.
- (5) Starting position was not correct.
- (6) Old dry cells were used.

2. In case verification will not start for a long time, possible causes include the following.

- (1) Poor connections between the robot and the tape recorder.
- (2) Potentiometer is set to LOW.
- (3) The sound is not recorded by incorrect tape operation.

Trouble shooting of errors



Operation 23 : Printer (Optional function)

An operation used to print on the printer the contents stored in the robot.

○ Before the operation

1. Printer

Use the printer model VP-550 made by Epson. Before printing the contents stored in the robot, verify that the printer operates properly using the self-testing function incorporated in the printer. For the self-testing function, refer to the instruction manual of the printer.

2. Printer voltage

Take the printer voltage from the AC outlet of the plant. The 100VAC receptacle of the robot is intended specifically for the power source of the cassette recorder. Do not use it for taking printer voltage.

If used, blown fuse can result.

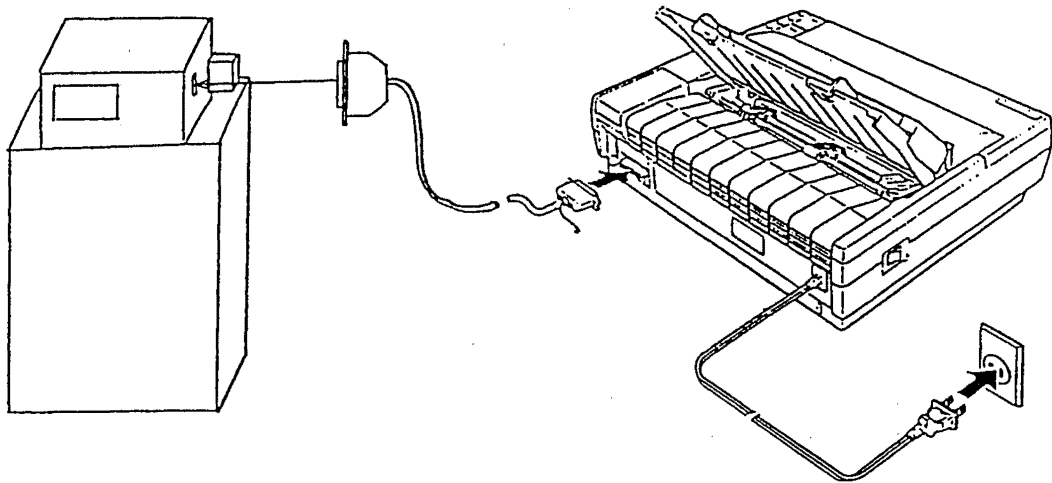
3. General specification of printer

Items		Specification
Printer interface unit		YA8003UP
Applicable printer		VP-550 (Epson) * recommendable, used in Japan
Printer dip switch setting		Same setting made at the factory before shipment
SW1 - 1	OFF	Selection of grade of alphanumeric character and Kana (High grade)
	2 OFF	Reduced printing (invalid)
	3 OFF	Selection of the list of alphanumeric character and Kana
	4 OFF	Selection of font (Standard font and Ming type)
	5 OFF	Fixed (Normally OFF) * NEVER CHANGE IT.
	6 OFF	
	7 OFF	Post card mode (invalid)
	8 OFF	ESC/P super function
1	OFF	Setting of feed paper position (8.5 mm)
	2 OFF	Selection of page length (11 inches)
	3 OFF	Fixed (Normally OFF)
	4 OFF	One inch perforation skip (invalid)
	5 OFF	Automatic line feed (invalid)
	6 OFF	Designation of printing direction of graphic and extended cascade printing (invalid)
	7 OFF	Tear off function (invalid)
	8 OFF	Cut sheet feeder mode (invalid)
Format		10 inch fan fold format
Cartridge ribbon		Cartridge ribbon for Epson printer (black). Type #7753
Overall dimension of printer		445 × 347 × 140 (W × D × H)
Weight of printer		Approx. 6 kg
Current voltage		AC100V±10%
Rated current		1.8A
Power consumption		32W
Operating environment		Temperature : 5°C to 35°C. Humidity : 10% to 80% (no dew condensation)

4. Preparation of printer for printing

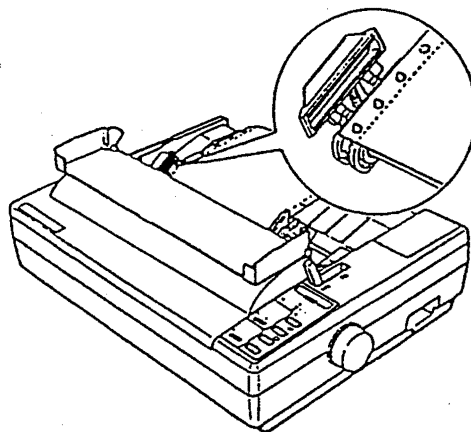
(1) Connecting the power and printer cable

Connect the printer cable to the connector provided in the cassette box of the control unit as show below. Connect the power cable to a AC outlet in the plant. Do not connect the power cable to the 100VAC receptacle provided in the cassette box because flown fuse will result.



(2) Setting the paper

Set the paper parallel with the printer to allow positive paper feeding. For the type of the paper, refer to the instruction manual of the printer.



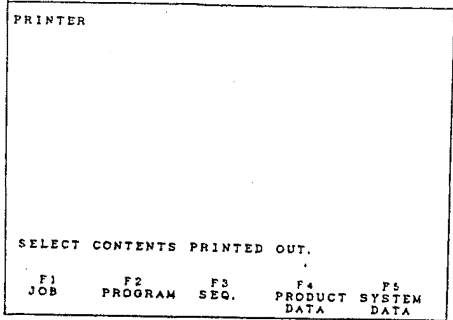
(3) Supplying the power

After the power is supplied to the printer, supply the power of the robot control unit.

Printing on the Printer

This operation is used to print the contents of the data registered in the control unit. Such data are jobs, programs, sequences (ASS SEQ., AES SEQ., LIBRARY, PRODUCT DATA (JOB REG., ACCUMUL. TIME, ORIGIN MARGIN), and system data (WELD COND., ADV. COND., OPTIONAL CONNECTION, ROBOT OFFSET).

No.	Method of operation	Response of display																																																																																																							
0	Verify that the printer connection, paper setting, and turning on the power are properly accomplished. Verify the optional settings. Verify that the printer is set in [YES] mode by confirming the proper system setting and optional connection of the printer. Unless the printer is set in [YES] mode, the printer cannot print data.	INIT. SET: OPTION SETUP <table><tr><td>1</td><td>PRINTER</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>2</td><td>AUXILIARY I/O</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>3</td><td>AUXILIARY MEMORY</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>4</td><td>SENSING UNIT</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>5</td><td>COMMUNICATION PORT</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>6</td><td>AUX. AXIS</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G1</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G2</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G3</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G4</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G5</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td></td><td>G6</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>7</td><td>WELD DATA BANK</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr><tr><td>8</td><td>FLOPPY DISK</td><td>(</td><td>N</td><td>O</td><td>YES</td><td>)</td></tr></table> SELECT OPERATION MODE <table><tr><td>F1 PLAY</td><td>F2 TEACH</td><td>F3 EDIT</td><td>F4 TAPE PRINTER</td><td>F5 NEXT KEY</td></tr></table>	1	PRINTER	(	N	O	YES	)	2	AUXILIARY I/O	(	N	O	YES	)	3	AUXILIARY MEMORY	(	N	O	YES	)	4	SENSING UNIT	(	N	O	YES	)	5	COMMUNICATION PORT	(	N	O	YES	)	6	AUX. AXIS	(	N	O	YES	)		G1	(	N	O	YES	)		G2	(	N	O	YES	)		G3	(	N	O	YES	)		G4	(	N	O	YES	)		G5	(	N	O	YES	)		G6	(	N	O	YES	)	7	WELD DATA BANK	(	N	O	YES	)	8	FLOPPY DISK	(	N	O	YES	)	F1 PLAY	F2 TEACH	F3 EDIT	F4 TAPE PRINTER	F5 NEXT KEY
1	PRINTER	(	N	O	YES	)																																																																																																			
2	AUXILIARY I/O	(	N	O	YES	)																																																																																																			
3	AUXILIARY MEMORY	(	N	O	YES	)																																																																																																			
4	SENSING UNIT	(	N	O	YES	)																																																																																																			
5	COMMUNICATION PORT	(	N	O	YES	)																																																																																																			
6	AUX. AXIS	(	N	O	YES	)																																																																																																			
	G1	(	N	O	YES	)																																																																																																			
	G2	(	N	O	YES	)																																																																																																			
	G3	(	N	O	YES	)																																																																																																			
	G4	(	N	O	YES	)																																																																																																			
	G5	(	N	O	YES	)																																																																																																			
	G6	(	N	O	YES	)																																																																																																			
7	WELD DATA BANK	(	N	O	YES	)																																																																																																			
8	FLOPPY DISK	(	N	O	YES	)																																																																																																			
F1 PLAY	F2 TEACH	F3 EDIT	F4 TAPE PRINTER	F5 NEXT KEY																																																																																																					
1	Press the END key of the panel to show the initial display.																																																																																																								
2	Press the F5 [NEXT KEY] key.																																																																																																								
3	Press the F4 [INITIAL SETUP] key.																																																																																																								
4	Press the F3 [OPTIONAL FUNC.] key. Verify that the printer is set in [YES] mode.																																																																																																								
5	Press the END key of the panel to show the initial display.	SELECT OPERATION MODE <table><tr><td>F1 TAPE</td><td>F2 PRINT</td><td>F3 FLOPPY</td></tr></table>	F1 TAPE	F2 PRINT	F3 FLOPPY																																																																																																				
F1 TAPE	F2 PRINT	F3 FLOPPY																																																																																																							

No.	Method of operation	Response of display
	Printing procedures	
6	Press the F4 [TAPE PRINT] key.	
7	Press the F2 [PRINTER] key. Unless the printer is not set in [YES] mode by means of the optional connection, the screen for selecting the F1 [CASSETTE] key and the F2 [PRINTER] key will not be displayed.	
8	Press the F1 ~ F5 keys and select the contents to be printed.	
	Press the F1 [JOB] key.	> Contents of the selected job can be printed.
	Press the F2 [PROGRAM] key.	> Contents of the selected program can be printed.
	Press the F3 [SEQ.] key.	> Contents of the LIBRARY, ASS SEQ. and AES SEQ. can be printed.
	Press the F4 [PRODUCT DATA] key.	> Job register, accumulated time and origin margin can be printed.
	Press the F5 [SYSTEM DATA] key.	> Contents of the welding conditions, advanced function, optional connection and robot parameters can be printed.

No.	Method of operation	Response of display
	Printing of jobs	
9 - 1	Press the F1 [JOB] key.	PRINTER INPUT JOB NO. PRINTED OUT F1 ALL JOB
10 - 1	☐ To print all the jobs: Press the F1 [ALL JOB] key. ☐ To print selected jobs: Enter the job number and press the STORE key of the panel.	
11 - 1	☐ Determine whether you select the exploded list. Press the F1 [YES] key. ☐ Not to select the exploded list: Press the F2 [NO] key. * The exploded list is used to print all calling commands used in the job or program.	PRINTER DO YOU REQUIRE EXPANDED FORM? F1 YES F2 NO
12 - 1	Press the F1 [START] key. Printing starts.	PRINTER PLEASE START F1 START

No.	Method of operation	Response of display
	Procedures for stopping printing Press the F5 [CANCEL] key. ○ To continue printing: Press the [YES] key. Printing starts again. ○ Not to continue printing: Press the [NO] key. The screen returns to one for selecting the F1 [ALL JOB] of 10-1 or the one for entering the job number.	PRINTER PRT JOB 1 PRT JOB 1 HOLD DO YOU CONTINUE PRINTING OUT OR CANCEL? CANNOT PRINT OUT F1 F2 YES NO
	Printing of programs	
9 - 2	Press the F2 [PROGRAM] key.	
10 - 2	○ To print all programs: Press the F1 [ALL PROGRAM] key. ○ To select a program for printing: Enter the program number and press the STORE key of the panel.	PRINTER INPUT PROGRAM NO. PRINTED OUT F1 ALL PROG
11 - 2	Determine whether you select the exploded list. Press the F1 [YES] key or the F2 [NO] key.	
12 - 2	Press the F1 [START] key. <u>Printing starts.</u>	

No.	Method of operation	Response of display			
	Printing of sequences				
9 - 3	Press the F3 [SEQ.] key.				
10 - 3	Select the sequence you want to print. Press either of the F1 [LIBRARY] key, F2 [ASS SEQ.] key or F3 [AES SEQ.] key.	PRINTER SELECT CONTENTS PRINTED OUT. <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 33%;">F1 LIBRARY</td> <td style="text-align: center; width: 33%;">F2 ASS SEQ.</td> <td style="text-align: center; width: 33%;">F3 AES SEQ.</td> </tr> </table>	F1 LIBRARY	F2 ASS SEQ.	F3 AES SEQ.
F1 LIBRARY	F2 ASS SEQ.	F3 AES SEQ.			
11 - 3	If you press the F1 [LIBRARY] key: ☐ To print all LIBRARY data: Press the F1 [ALL LIBRARY] key. When the [ASS SEQ.] key is selected, the [ALL ASS] mode becomes valid, and when the [AES SEQ.] key is selected, the [ALL AES] mode becomes valid. ☐ To select the LIBRARY for printing: Enter the LIBRARY number and press the STORE key. When the [ASS SEQ.] key is selected, enter the ASS SEQ. number. When the [ASS SEQ.] key is selected, enter the ASS SEQ. number. When the [AES SEQ.] key is selected, enter the AES SEQ. number.				
12 - 3	Press the F1 [START] key. <u>Printing starts.</u>				

No.	Method of operation	Response of display
9 - 4 10 - 4 11 - 4	Printing of product data Press the F4 [PRODUCT DATA] key. Select contents you want to print. Press either the F1 [JOB REG.] key or the F2 [ACCUMUL TIME] key. In case an DC servo type aux • axis is connected, the F3 [ORIGIN MARGIN] is displayed. Press the F1 [START] key. <u>Printing starts.</u>	PRINTER SELECT CONTENTS PRINTED OUT. F1 JOB REG. F2 ACCUMUL TIME

No.	Method of operation	Response of display
	Printing of system data	
9 - 5	Press the F5 [SYSTEM DATA] key.	
10 - 5	Select contents you want to print. Press either the F1 [WELD COND.] key, F2 [ADV. FUNC.] key, F3 [OPTIONAL CONNECTION], F4 [ROBOT OFFSET] key.	PRINTER SELECT CONTENTS PRINTED OUT. F1 WELD COND. F2 ADV. FUNC F3 OPTION SETUP F4 ROBOT OFFSET
11 - 5	Press the F1 [START] key. Printing starts.	

Measures to be taken for errors occurring during printing

- (1) When the paper runs out during printing, the following error message is displayed.

⇒ ***Cannot print.***

- (2) In this case, the following messages appear on the CRT.

○ Message ⇒ Do you continue printing ?

○ Function ⇒ F1 [YES]

F2 [NO]

- (3) After causes of the error have been removed:

Press the F1 [YES] key, and the printing starts again.

Press the F2 [NO] key, and the printing is discontinued.

Operation 24 : Shift Function

In case the teaching program does not match the workpiece due to reasons such as changing the torch, this operation is used to perform the parallel shift of all programs.

No.	Method of operation	Response of display
0	Perform this operation in the teaching mode.	----- INPUT PROG NO. OR SELECT OPERATION ----- F1 F2 F4 F5 TRANS. HOME COORDI NEXT CORRECT TEACH NATE KEY
2	Press the F1 (CONVERT CORRECTION) key.	SELECT OPERATION MODE F2 PARALLEL SHIFT
3	Press the F2 (PARELLEL SHIFT) key.	INPUT PROGRAM NO. PROG NO.
4	Enter the program number and press the [STORE] key.	
5	(1) To save the program entered by the operation No. 4: Press the F1 [YES] key, enter the number of the program to be generated, and press the STORE key. (2) To shift the program entered by the operation No. 4: Press the F2 [NO] key.	TEACH : PARALLEL: PROGRAM NO 5 DO YOU SAVE PROGRAM ? F1 F2 YES NO
6	The robot asks you the number of programs and the distance of programs to be shifted by the Cartesian coordinate. The coordinate used in this case is the same as that for the MDI of the operation No. 36.	TEACH : PARALLEL: PROGRAM NO 5 X= 0.00 (MM) Y= 0.00 (MM) Z= 0.00 (MM) STEP 1-> 999 SHIFT INPUT NUMBER
7	Enter the numerical values and press the STORE key. Verify correctness. If not correct, press the [CANCEL] key and start operations from the operation No. 6.	PLEASE PUSH STORE KEY F1 CANCEL
8	Press the [STORE] key.	

<Cautions>

This robot is a teaching playback robot. Therefore, there may be some differences between the shift data (numerical values) and the amount shifted by the actual robot motion. Consider that the amount of shift caused by the MDI is a tentative target.

To perform more accurate shifting:

- Actually move the robot from the original position to the position to be shifted in manual operation mode, read the shifted amount from the coordinate list, and use the reading as an input of the shifted amount.
- Shift the robot once, observe the difference from the actual position of the workpiece, and make fine shifting adjustment again.

After the robot has been shifted properly, verify the teaching position and robot operations, and if necessary, correct the position, before operating the robot.

<NOTE>

In case errors occur in the parallel shift operation, the following takes place.

- (i) If the teaching point is shifted and the robot moved out of its operating range, discontinue shifting in the step where the error occurred, and return the teaching point of the step where the error occurred to the previous value.

In case of an operational error, the number of the step immediately before the step where the error occurred is displayed.

The following is an example where the step 4 of the program 10 is outside the robot operating range, resulting in an error.

Teaching: Parallel shift : Program 10

Error	Step
7	3

A step that cannot be operated exists. Operation is discontinued.

- (ii) In case the robot moved out of its operating range of between the teaching points after shifting or a grammatical error occurs:

In this case, the teaching point will not return to the value before shifting the robot.

The following is an example where the an operation error occurred in the step 7 of the program 10 and a grammatical error in the step 4.

Error	Step No.
7	6
40	4

Errors occurred.

CHAPTER 4

Functions and System Applied Operation (Advanced Section)

In this Advanced Section, system settings and control display necessary for teaching and playing of the robot are described. Operations to start PANA ROBO externally are also given, in which PANA ROBO is combined with peripheral jigs.

System Setting

System setting is used to set various parameters of the robot and its systems. Standard robot parameters are set at the factory. Once the parameters are set after the robot is installed, it is not necessary to make additional settings except for changing the welding conditions and for making other necessary changes.

Items and general contents that can be set in the system are as follows.

1. Welding conditions (Setting of various conditions related to welding):
 - a. LIBRARY table ——— Condition menu (AJO, CJO conditions)
 - b. WIRE INCHING ——— Wire inching (High, low)
 - c. Welder ——— Method of input welding current and voltage characteristics
(Direct/code)

Direct: Welder used, wire diameter,
characteristic table correction

Code: Max. output code, output correction
 - d. WEAVING TABLE ——— Menu of weaving frequency and end point timer
 - e. WELDING DATA (Optional function)
2. Expansion function [ADV. FUNC] (Presence of robot expansion function and setting of detailed conditions of robot)
 - a. ROBOT AXIS ——— Valid/invalid of teaching box [ROBOT AXIS] key
 - b. TEACH INTERLOCK ——— Valid/invalid of input of teaching interlocking
 - c. HOME POSITION RETURN—Designation of home position output terminal
and origin return operation in home position
return operation
 - d. DESIGNATED JOB ——— Designation of job for starting from the home
position

- e. RT OPERATION RANGE MONITOR — Designation of direction and angle of RT axis and operation range monitoring and input/output terminal for monitoring
- f. INTERVAL TIMER OUTPUT — Setting of terminal used as an interval timer output and setting of ON time and OFF time.
- g. INTERLOCK OUTPUT — Setting of output terminal to indicate that the interlock is effected when commands H-0, H-1, H-2, H-4, are executed.
- h. WELD OFF OUTPUT — Setting of output terminal to indicate that the robot is in WELD OFF state.
- j. PANEL OPERATION OUTPUT — Setting of output terminal to indicate that the designation of operation is on the [panel] side.
- k. PALY INTERRUPT — Setting of output terminal that must be turned off and setting of input terminal for forced ending, used for stopping the robot temporarily and to end its play forcibly.
- l. QUICK TRACE — Setting of the key for moving the robot quickly in tracing mode between the welding sections.
- m. CTRL --- - Налаштування кнопки для керування вихідними сигналами в режимах TEACH та PLAY за допомогою навчального пульта.
на пульту навчання

3. Optional connection (Setting an optional unit for connection/non-connection)

- a. Printer
- b. Expansion input/output
- c. External memory
- d. Arc sensor
- e. Communication port

f. External axis (6 axes of G1 through G6)

Setting an optional unit for connection/non-connection, and external axis of above are used for setting the constant and parameters related to the robot operations.

g. Welding data bank

NOTE: Optional setting are either provided by the factory before shipment or by our serviceperson at site. Users are requested NOT to make any of such setting.

4. ROBOT OFFSET (Setting of the constant of the robot manipulator and its parameters related to the robot operation)

- a. ORIGIN OFFSET ——— Definition of origin offset
- b. TOOL OFFSET ——— Setting of tool (torch) offset data.
- c. ORG. CORRECTION ——— Setting of origin correction data.
- d. SOFT LIMIT ——— Setting of soft limit data (limit of operating range of each axis)
- e. LIMIT SPEED ——— Setting of speed limit in teaching and confirmation modes.
- f. JOG ——— Setting of robot movement in JOG FEED mode.

5. MEMORY CLEAR (Used to delete all data taught)

- a. ALL CLEAR ——— Used to delete JOB, PROGRAM, ASS SEQ., AES SEQ., LIBRARY, and returns the system setting data to the standard value.
- b. FILE CLEAR ——— Used to delete all JOB, PROGRAM, ASS SEQ. and LIBRARY which are cleared of teaching. System setting data do not change.

Operation 28 : System Setting

With this operation, parameters of the robot and system can be changed in the system setting mode.

No.	Method of operation	Response of display
0	This operation is used to perform operations from the initial mode (Initial display).	
1	Press the F5 [NEXT KEY] key.	INIT. SET: SELECT SET UP COND. F1 WELD COND. F2 ADV. FUNC F3 OPTION SETUP F4 ROBOT OFFSET F5 MEMORY CLEAR
2	Press the F4 [INITIAL SETUP] key.	
3	Select the content you want to set. { Press either of the function key F1 ~ F5	
	F1 [WELD COND] > (1) Welding condtions F2 [ADV. FUNC] > (2) Expansion function F3 [OPTIONAL CONNECTION] > (3) Optional connection F4 [ROBOT OFFSET] > (4) Robot parameters F5 [MERORY CLEAR] > (5) Memory clear	Display are changed according to the contents selected. These changes will be explained on the subsequent pages.
4	Set the data of the selected items.	
5	Press the END key.	The display returns to the initial display (mode selection). SELECT OPERATION MODE F1 PRODUCT DATA F3 COMMUNI CATION F4 INITIAL SETUP F5 NEXT KEY

1. Welding conditions (F1 [WELD COND] is selected)

No.	Method of operation	Response of display
0		INIT. SET: WELD CONDITION SELECT SET UP COND. F1WELD TABLE F2WIRE INCHING F3WELDER MODEL F4WEAVE TABLE
1	Select the item you want to set. Press either of the function keys F1 ~ F4 F1 [LIBRARY TABLE] F2 [WIRE INCHING] F3 [WELDER CHARACTERISTIC] F4 [WEAVE TABLE] F5 [WELDING DATA]	a b c d e Refer to examples of display shown on subsequent pages. Contents of each item are displayed.
2	Use the corsor keys ↑ ↓ ← → to change the blinking positions and enter numeric values. For the item of the welder characteristic, it is necessary to select the function keys.	
3	Press the STORE key.	
4	When the setting is over, press the F4 [SETUP FINISHED] key.	The display returns to the display numbered on this page.
5	Press the END key.	The display returns to the first display of system setting.

1-a. LIBRARY TABLE

The LIBRARY TABLE is used to store in the robot in advance the welding conditions (AJO) and crater welding conditions (CJO) corresponding to the menu No.1 through No.5. These conditions are the LIBRARY TABLE.

By preparing the LIBRARY TABLE, it is possible to select appropriate welding conditions and teach them together with the welding points by pressing the [MENU SELECT] key in the teaching mode.

INIT. SET: WELD CONDITION					
WELD TABLE					
A J O			C J O		
NO.	AMP	VOLT	NO.	AMP	VOLT
	(A)	(V)		(A)	(V)
1	230	22.0	1	100	18.0
2	180	22.0	2	120	18.0
3	200	24.0	3	160	21.5
4	250	28.0	4	200	24.0
5	350	35.0	5	280	27.0
INPUT NUMBER					
			F3 OVER RIDE		
			F4 SETTING END		

(Data shows those set before shipment.)

By selecting the F3 [OVERRIDE] key of the Library Table display, you can change the fine adjustment data of the welding conditions.

When the override display is shown, the display of the F3 [OVERRIDE] is changed into the inversed display.

When the F1 (STANDARD) key is pressed on this display, the values of the table below will be set.

Standard override setting

Classification	Current (A)	Voltage (V)	Speed (%)
HIGH	10	1.0	10
MID HIGH	7	0.7	7
MID	5	0.5	5
MID LOW	2	0.2	2
LOW	1	0.1	1

To set the value other than the standard value, use the keys on the panel to enter numeric values, and press the STORE key. Use positive numbers and comply with the relations HIGH>MID HIGH>MID>MID LOW>LOW.

The maximum current and voltage that can be entered are the same as those of AJO and CJO, and the speed of up to 25% can be entered.

After all the setting are finished, press the F3 key to return the display to the LIBRARY TABLE display.

1-b. WIRE INCHING

This function is used to designate the speed for feeding the wire using the teaching pendant.

(Low speed) : The speed to slowly feed the wire for the first three seconds by pressing the wire feeding key.

(High speed) : The speed to quickly feed the wire by pressing the wire feeding key for over three seconds.

Setting range : 0 ~ 255

INIT. SET: WELD CONDITION

INCHING SPEED

(HIGH) 170

(LOW) 10

INPUT NUMBER

F4
SETTING
END

(Date shows those set before shipment.)

1-C. WELDER CHARACTERISTIC

This function is used to enter data for designating the welding current and welding voltage, changing the [CODE DEIG. (INPUT)] and [DIRECT DESIG. (ABSOLUTE INPUT)] modes using the function keys **F1** and **F2**.

Code designation : Used to set the maximum value of the code which outputs the maximum value to the welder.

Direct designation : Used to set the type of welder and the wire diameter used. (Outputting the conditions to the welder conforms to the characteristic curve corresponding to the type of welder and wire diameter.)

```

INIT. SET: WELD CONDITION

WELDER MODEL
CODE
MAX. = 255

DIRECT

WELDER          WIRE/MODE
1  YD350RF      ( 0.9  1.2 )
2  YD500RF      ( 1.2  1.8 )
3  YD180HF      ( 0.8  1.0 )
4  YD350HF      ( 0.9  1.2 )
5  YD500HF      ( 1.2  1.8 )

INPUT WELDER CHARACTERISTICS

F1 CODE    F2 DIRECT  F3 GAS   F4 SETTING  F5
CODE      SPEC.     WIRE    END        CHARAC.

```

```

INIT. SET: WELD CONDITION

WELDER MODEL
CODE
MAX. = 255

DIRECT

WELDER          WIRE/MODE
1  YD350RF      ( 0.9  1.2 )
2  YD500RF      ( 1.2  1.8 )
3  YD180HF      ( 0.8  1.0 )
4  YD350HF      ( 0.9  1.2 )
5  YD500HF      ( 1.2  1.8 )

INPUT WELDER CHARACTERISTICS

F1 CODE    F2 DIRECT  F3 GAS   F4 SETTING  F5
CODE      SPEC.     WIRE    END        CHARAC.

```

(Example of display shows that is set before shipment.)

If you press the **F5** (Characteristic change) key, you can correct characteristics for outputting commands to the welder. (In the characteristic change mode, the display of the **F5** function key is inverted.)

```

INIT. SET: WELD CONDITION

WELDER MODEL: EDIT ( YD350HF )
AMP          VOLT
CORRECT 0 (A)  CORRECT 0.0 (V)

ADDRS DATA    ADDRS DATA
1      248      1      226
2      245      2      224
3      242      3      222
4      239      4      220
5      236      5      218
6      233      6      216
7      230      7      214
8      227      8      212
9      224      9      210
10     222     10     208

F1 PAGE    F2 PAGE    F3 CURRENT  F4 VOLTAGE  F5
PAGE      PAGE      STNDRD   STNDRD    CHARAC.
NEXT      BACK

```

When a code is designated, data of the characteristic curve is not displayed.

Overall output characteristic can be shifted according to the corrected current and voltage.

Example: With the current set to 300A and corrected current being 10A, the command to the welder is equivalent to 310A.

In the direct designation mode, you can rewrite the contents of the characteristic curve.

If you press the F5 key, the operation to change the characteristic is finished. (The display of the F5 characteristic change turns into the normal display from inversed display.)

The following are the applicable welder (characteristic) that is registered.

- | | | | |
|-----|----------|------|------|
| 1. | YD350RF | (0.9 | 1.2) |
| 2. | YD500RF | (1.2 | 1.6) |
| 3. | YD160HF | (0.8 | 1.0) |
| 4. | YD350HF | (0.9 | 1.2) |
| 5. | YD500HF | (1.2 | 1.6) |
| 6. | YD350HR | (0.9 | 1.2) |
| 7. | YD500HR | (1.2 | 1.6) |
| 8. | YD350ZC | (0.9 | 1.2) |
| 9. | YD500ZC | (1.2 | 1.6) |
| 10. | YD350HM | (1.0 | 1.2) |
| 11. | YD500HM | (1.2 | 1.6) |
| 12. | YD350HP | (0.9 | 1.2) |
| 13. | YD200HG | (DC | AC) |
| 14. | YD300TWX | (DC | AC) |
| 15. | YD300TR | (DC | DC) |
| 16. | YD200RF | (0.8 | 1.0) |

NOTE: For the models YD200HG, YD300TWX, and YD300TR, the changing item is not wire diameter but for the modes (DC, AC).

1-d. WEAVE TABLE

You can set in advance the weaving frequency and the end point timer with respect to the six weaving patterns. If you select the weaving patterns and register them in the teaching mode, the frequency and the values of the end point timer that are set on the weaving table are automatically registered in the program according to the weaving patterns.

INIT. SET: WELD CONDITION						
WEAVE TABLE						
NO.	FREQ. (HZ)	T0	T1	T2 (S E C)	T3	T4
1	4.5	---	0.0	0.0	---	---
2	4.5	0.0	0.0	0.0	---	---
3	0.5	0.0	0.0	0.0	---	---
4	0.5	---	0.0	0.0	0.0	0.0
5	0.5	---	0.0	0.0	0.0	0.0
6	2.5	---	0.0	0.0	---	---
INPUT NUMBER						
T4 SETTING END						

(Data shows those set at the factory before shipment.)

Range of set data

Frequency 0.1 to 5.0 (Hz) : Pattern No.1 to 5

0.1 to 10.0 (Hz): Pattern No.6

T₀~T₄ 0.0 to 9.9 (Sec)

(Timer values can not be set to "---" mark.)

1-e. WELDING DATA (Optional function)

When the joint form, thickness, bead width of the welding workpiece are set, the optimum welding conditions are automatically selected.

The welding conditions can be automatically adjusted finely during operation. This allows easy accumulation and use of optimum conditions of various welding workpieces.

```

INIT.SET:WELD CONDITION
WIRE : 1.2

1.PROTECT STATE:WLD-STAND(NO   YES)
2.PROTECT STATE:WLD-FINE (NO   YES)

SELECT OPERATION MODE

F1      F2      F4
WELD    WELD    SETTING
(STNDRD) (FINE)  END
  
```

(1) Work data

Four kinds of thickness and four kinds of bead width are used as the welding data regarding fillet welded joint, lap joint and butt joint.

```

INIT.SET:WELD CONDITION
WIRE : 1.2
WLD-STAND  FILLET
THICK  1.  1.5 (MM)
        2.  2.3 (MM)
        3.  3.2 (MM)
        4.  4.5 (MM)
-----
THICK  1.5 (MM)
NO. BEAD WIDTH AMP VOLT SPEED
(MM) (A) (V) (M/MIN)
1. 4.2 120 18.8 0.40
2. 4.5 123 18.9 0.43
3. 4.7 127 18.1 0.47
4. 5.0 130 19.2 0.50
-----
SELECT OPERATION MODE

F1      F2      F3      F4
CHANGE  ADD    DELETE SETTING
END
  
```

```

INIT.SET:WELD CONDITION
WIRE : 1.2
WLD-STAND  LAP
THICK  1.  2.3 (MM)
        2.  3.2 (MM)
        3.  4.5 (MM)
        4.
-----
THICK  2.3 (MM)
NO. BEAD WIDTH AMP VOLT SPEED
(MM) (A) (V) (M/MIN)
1. 3.2 120 18.8 0.45
2. 3.7 130 19.2 0.47
3. 4.1 140 19.6 0.48
4. 4.6 150 20.0 0.50
-----
SELECT OPERATION MODE

F1      F2      F3      F4
CHANGE  ADD    DELETE SETTING
END
  
```

INIT. SET: WELD CONDITION					
WIRE : 1.2					
WLD-STAND BUTT					
THICK	1.	1.6	(MM)		
	2.	2.5	(MM)		
	3.	3.2	(MM)		
	4.	4.5	(MM)		

THICK	1.6		(MM)		
NO.	BEAD	WIDTH	AMP	VOLT	SPEED
	(MM)		(A)	(V)	(M/MIN)
1.	2.2		100	18.0	0.40
2.	2.6		107	18.3	0.43
3.	2.9		113	18.5	0.47
4.	3.2		120	18.8	0.50

SELECT OPERATION MODE					
F1	F2	F3	F4		
CHANGE	ADD	DELETE	SETTING		
			END		

(2) Fine adjustment data

To change conditions to some extent based on the work data, it is possible to have 100 kinds of data for making fine adjustments.

As the welding conditions to be outputted during operation, the sum of the set work data and fine adjustment data are outputted.

(Output of welding conditions = Welding data + Fine adjustment data)

INIT. SET: WELD CONDITION				
WLD-FINE				

NO.	AMP	VOLT	SPEED	
	(A)	(V)	(M/MIN)	
1	0	0.0	0.00	
2	0	0.0	0.00	
3	0	0.0	0.00	
4	0	0.0	0.00	
5	0	0.0	0.00	
6	0	0.0	0.00	
7	0	0.0	0.00	
8	0	0.0	0.00	
9	0	0.0	0.00	
10	0	0.0	0.00	

SELECT OPERATION MODE				
F1	F2	F4		
PAGE	PAGE	SETTING		
NEXT	BACK	END		

2. ADV. FUNC. (When F2 (expansion function) is selected.

No.	Method of operation	Response of display
0		INIT. SET:ADVANCED FUNCTION 1 ROBOT AXIS KEY (N O) YES 2 TEACH INTERLOCK (N O) YES 3 HOME RETURN (N O) YES 4 DESIGNATED JOB (N O) YES 5 RT MOTION MONITOR (N O) YES 6 INTERVAL TIMER (N O) YES 7 INTERLOCK OUTPUT (N O) YES SELECT , YES OR NO
1	Move the blinking cursor key     to [YES] or [NO].	(The above display shows data set in the factory before shipment.)
2	Press the STORE key.	The inversely displayed data are selected.
	<To set detailed conditions>	The inversely displayed data are selected.
3	For each item appearing on the guide display, select conditions or enter numeric values. (Use the cursor keys to move the cursor and use the numeral key to enter numeric values.)	In the functions 3 and on, if the [YES] is selected, detailed conditions are set.
4	Press the STORE key.	
5	Upon completing the setting of detailed conditions, press the F4 [SETUP FINISHED] key.	[YES] and [NO] mode of the operation No.1 can be selected.
6	Press the END key.	The expansion function has been set and the display for the first system setting appears.

2-a. ROBOT AXIS key

YES

: In the teaching mode or the confirmation mode, the robot will not move unless the axis moving keys and the [TRACE + (-)] key are pressed while holding the [ROBOT AXIS] key pressed.

NO

: The robot can be moved by simply pressing the axis moving keys
or the [TRACE + (-)] key.

2-b. TEACH INTERLOCK

YES

: According to the external [STATUS INTERLOCK INPUT], the robot
play mode is restricted.

For INPUT ON (=1): i) Teaching mode can be effected.

- ii) PLAY mode cannot be effected.

For INPUT OFF (=0): i) Teaching mode cannot be effected.

ii) PLAY mode can be effected.

(In either case, determine during mode selection according to the [INTERLOCK INPUT] state.)

NO

: The [INTERLOCK INPUT] state is ignored.

2-c. HOME POSITION RETURN

This function is used to set the Home position (the second origin point) for starting the next operation after the robot has completed the work for one workpiece.

INIT. SET: ADVANCED FUNCTION			
1	ROBOT AXIS KEY	(NO YES)	
2	TEACH INTERLOCK	(NO YES)	
3	HOME RETURN	(NO YES)	
4	DESIGNATED JOB	(NO YES)	
5	RT MOTION MONITOR	(NO YES)	
6	INTERVAL TIMER	(NO YES)	
7	INTERLOCK OUTPUT	(NO YES)	

HOME POS. CHECK OUT. =		0	
AUTO HOME AFTER ORG. (NO YES)			
HOME RETURN SPEED M/MIN %		15.00	

SELECT SET-UP COND. OR INPUT NUMBER			
F4 SETTING END			

Home position output
terminal No.

: Used to allocate one of the general purpose output with an output which turns ON (contact closed) when the robot returns to the home position, and turns OFF (contact opened) when the robot moves from the home position after starting.

Operation after
completing origin
point return

: Used to select whether or not to move the robot automatically to the home position following the completion of the origin point return.

Home position
return speed

: Used to designate the speed for moving the robot to the home position.

2-d. Designated job

The job designated by this item can reduce the start response time (from pressing start sw to actual robot starting) with respect to the starting of robot from the home position.

INIT. SET: ADVANCED FUNCTION			
1	ROBOT AXIS KEY	(NO YES)	
2	TEACH INTERLOCK	(NO YES)	
3	HOME RETURN	(NO YES)	
4	DESIGNATED JOB	(NO YES)	
5	RT MOTION MONITOR	(NO YES)	
6	INTERVAL TIMER	(NO YES)	
7	INTERLOCK OUTPUT	(NO YES)	

JOB NO. =	1	2	3
	5	6	16
			32
			64

SELECT SET-UP COND. OR INPUT NUMBER			
F4 SETTING END			

(Job No. shown is set at the factory before shipment.)

2-e. RT OPERATION RANGE MONITORING

This function is used to make settings related to the operation range monitoring of the RT axis provided to avoid mutual interference when the two robots are installed oppositely, or side by side.

INIT. SET: ADVANCED FUNCTION			
1	ROBOT AXIS KEY	(N O)	YES)
2	TEACH INTERLOCK	(N O)	YES)
3	HOME RETURN	(N O)	YES)
4	DESIGNATED JOB	(N O)	YES)
5	RT MOTION MONITOR	(N O)	YES)
6	INTERVAL TIMER	(N O)	YES)
7	INTERLOCK OUTPUT	(N O)	YES)

CHECK DIRECTION (SIDE INTERVIEW)			
	RIGHT	=	20.00
	LEFT	=	10.00
	ASSIGNED IN #	=	0
	ASSIGNED OUT #	=	0

SELECT SET-UP COND. OR INPUT NUMBER			
F4 SETTING END			

Monitoring direction: Select either the [SIDE] or [OPPOSED].

Right angle : Right boundary angle (range of -150° to +150°)

Left angle : Left boundary angle (range of -150° to +150°)

Input terminal No. : Input terminal to determine whether the other robot is within the monitoring range (one of the general purpose input is allocated.)

Output terminal No. : Inform to the other robot that the position is within the monitoring range.

(One of the general purpose output is allocated.)

○ RT operation range monitoring function

(1) Area of RT axis operation range monitoring

The area of the operation range monitoring is shown below (Fig. 1).

Either of the following can be selected.

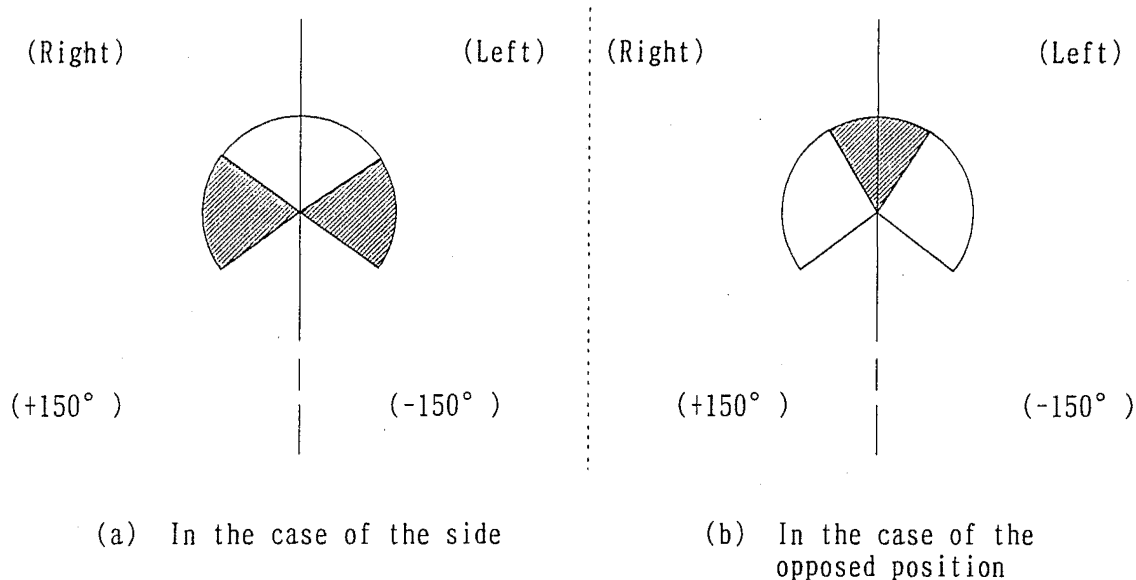


FIG. 1 : Area of RT axis operation range monitoring (Shaded portion)

(2) Setting of operation range monitoring area

For setting, use the screen for advanced function setting of the "INITIAL SETUP" mode.

<Details of setting>

- (a) Presence of operation [YES]
range monitoring
- (b) Selection of monitoring Either the side or opposite position
direction
- (c) Right angle Right boundary angle
(range of -150° to +150°)
Left angle Left boundary angle
(range of -150° to +150°)
- (d) Input terminal No. Designate one of the general purpose
input terminal No.

(Input of information as to whether the other robot is within the monitoring area: Interference monitoring input)

(e) Output terminal No. Designate one of the general purpose output terminal No.

(Output to inform that the position is within the monitoring area)

(3) Signal (output) within operation range monitoring area

At the output terminal whose number is set by the previous item are outputted the signals such as those shown in the diagram below (Fig. 2) corresponding to the position of the RT axis.

(Contact output that closes within the operation range monitoring area)

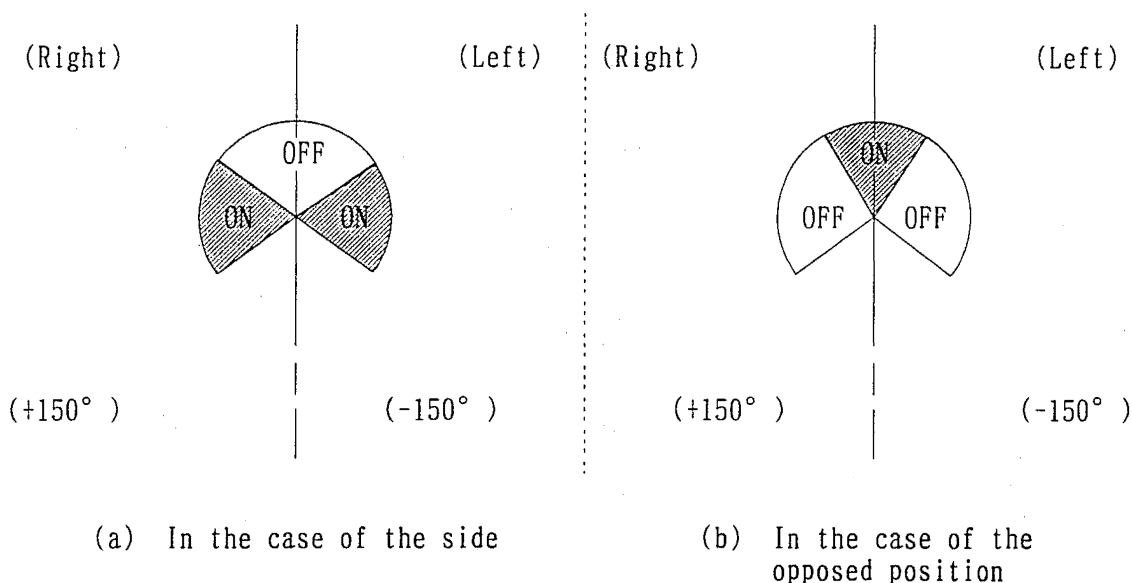


FIG. 2 : Signal (output) within operation range monitoring area

(4) Holding operation by operation range monitoring

○ Valid mode : PLAY mode

The operation is invalid (robot does not stop) even in the PLAY mode if the teaching pendant is used for verification.

○ Conditions of hold mode :

(a) Input signal exists at the terminal set by (2) of (d).

(The other robot is withing monitoring area.)

(b) Terminal set by (2) of (e) closes (position is within the monitoring area.).

When both of (a) and (b) above are valid, the robot is automatically held temporarily.

○ Releasing hold mode:

Move one robot outside the monitoring area using the teaching pendant and restart the remaining robots.

NOTE: The robot will not move if it is restarted in the hold mode.

(5) Signal connection method

The output signal is connected to the interference monitoring input to notify that both robots are in the monitoring area.

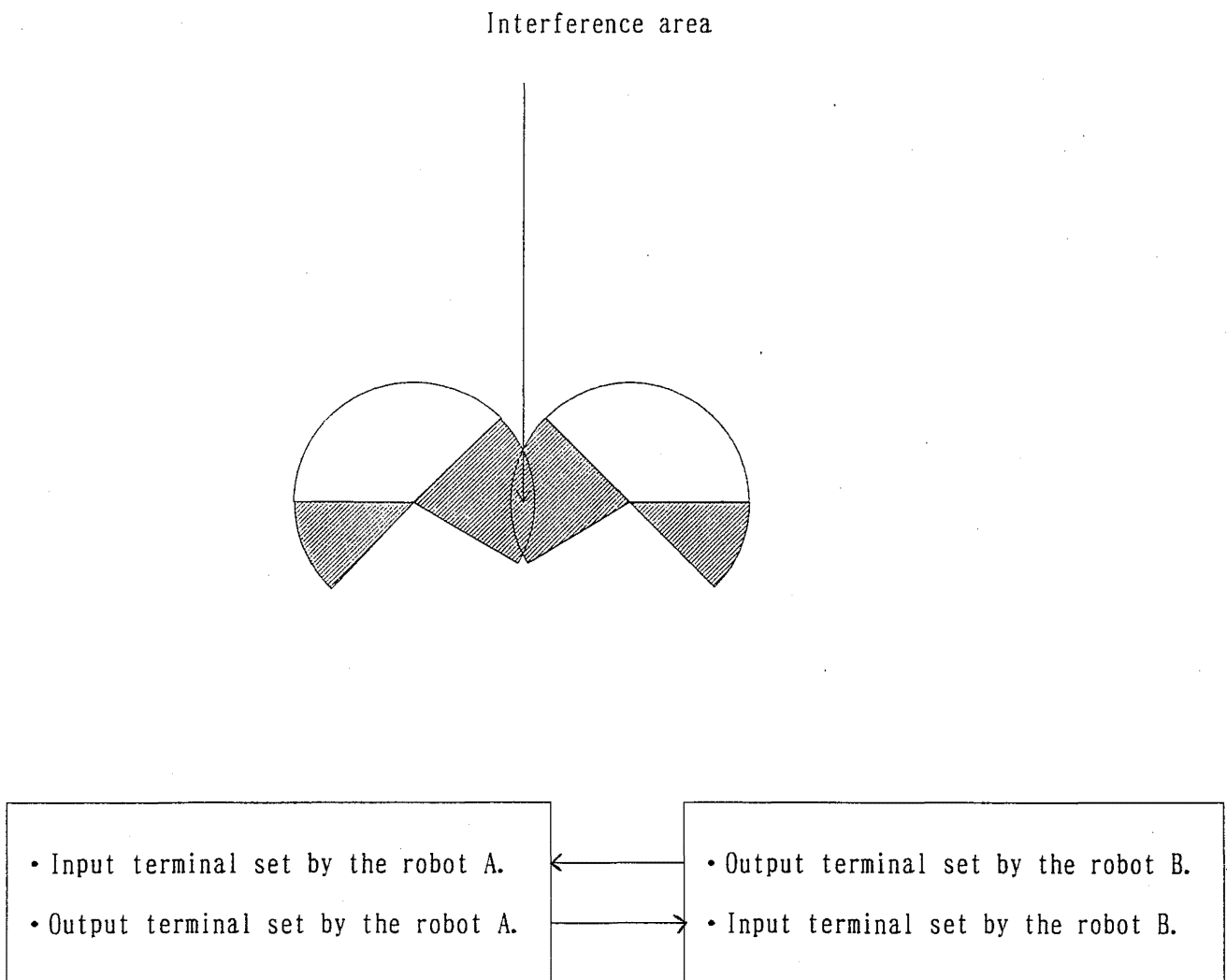


Fig. 3 : Connection diagram

2-f. Interval timer output

This function is used to provide settings related to the interval timer output which repeats turns ON and OFF by the robot motion in the PLAY mode.

INIT. SET: ADVANCED FUNCTION			
1	ROBOT AXIS KEY	(N O)	YES)
2	TEACH INTERLOCK	(N O)	YES)
3	HOME RETURN	(N O)	YES)
4	DESIGNATED JOB	(N O)	YES)
5	RT MOTION MONITOR	(N O)	YES)
6	INTERVAL TIMER	(N O)	YES)
7	INTERLOCK OUTPUT	(N O)	YES)

ASSIGNED OUT #	= 15
ON TIME	= 1.0 (SEC)
OFF TIME	= 1.0 (SEC)

SELECT SET-UP COND. OR INPUT NUMBER

F4
SETTING
END

Output terminal No.: Used to allocate the terminal (One of the general purpose output) used as the interval timer output.

ON time : The time the output is turned ON (contact closes).

OFF time : The time the output is turned OFF (contact opens).

(The time ranges from 0.1 to 99.9 sec.)

NOTE: The interval timer output is executed by the normal output command (0-0, 0-1).

0-0 K : Interval timer output starts.

0-1 k : Interval timer output stops.

The output of the general purpose output terminal k starts turning ON and OFF by the sequence command 0-0 k and ends turning ON and OFF by the command 0-1 k.

2-g. Interlock output

In the PLAY mode operation, the interlock output is used to provide settings related to the output to indicate that an interlock (waiting) state exist externally while the robot executes the qesunce commands H-0, H-1, H-2, and H-4.

INIT. SET: ADVANCED FUNCTION			
1	ROBOT AXIS KEY	(N O)	(YES)
2	TEACH INTERLOCK	(N O)	(YES)
3	HOME RETURN	(N O)	(YES)
4	DESIGNATED JOB	(N O)	(YES)
5	RT MOTION MONITOR	(N O)	(YES)
6	INTERVAL TIMER	(N O)	(YES)
7	INTERLOCK OUTPUT	(N O)	(YES)

H-0, H-2 : ASSIGNED OUT # = 11
H-1, H-4 : ASSIGNED OUT # = 12

SELECT SET-UP COND. OR INPUT NUMBER

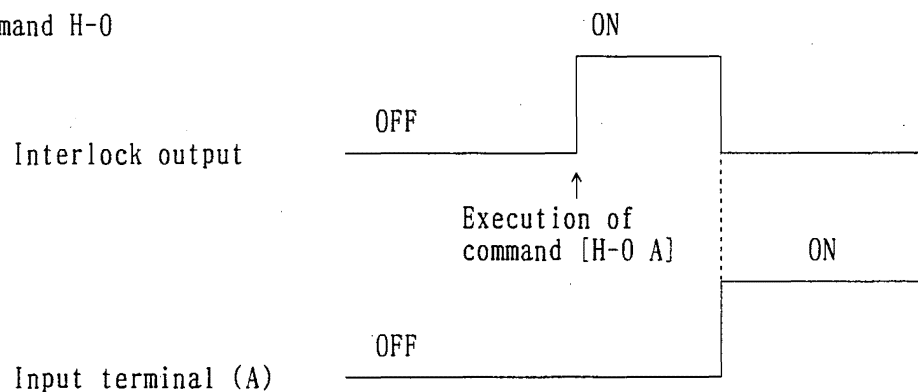
F4
SETTING
END

H-0, H-2: Output terminal NO.: Used to allocate the terminal (one of the general purpose outputs) which turns ON (contact closes) while executing the commands H-0 or H-2.

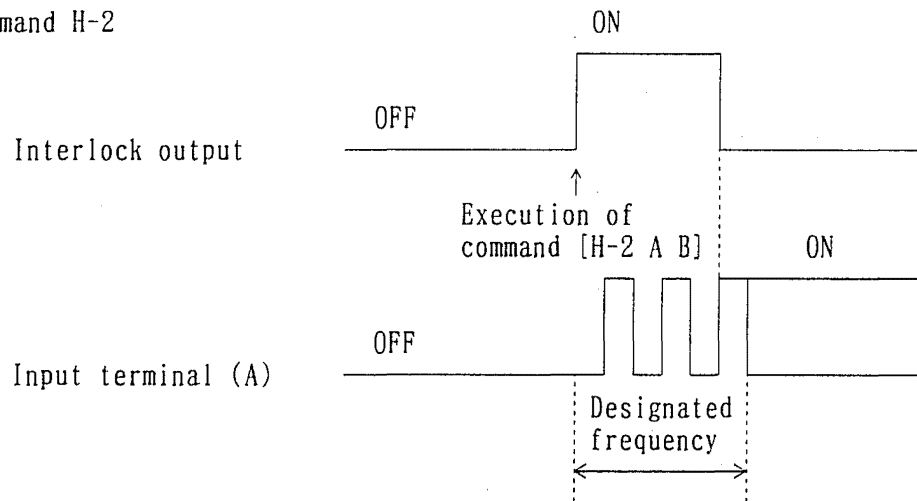
H-1, H-4: Output terminal No.: Used to allocate the terminal (one of the general purpose outputs) which turns ON (contact closes) while executing the commands H-1 or H-4.

○ Operation (timing of interlock output)

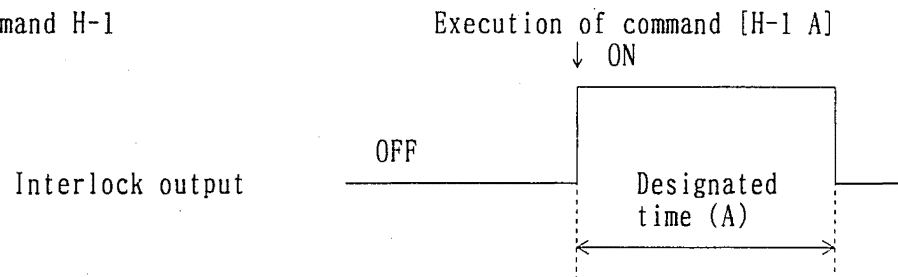
(1) Command H-0



(2) Command H-2

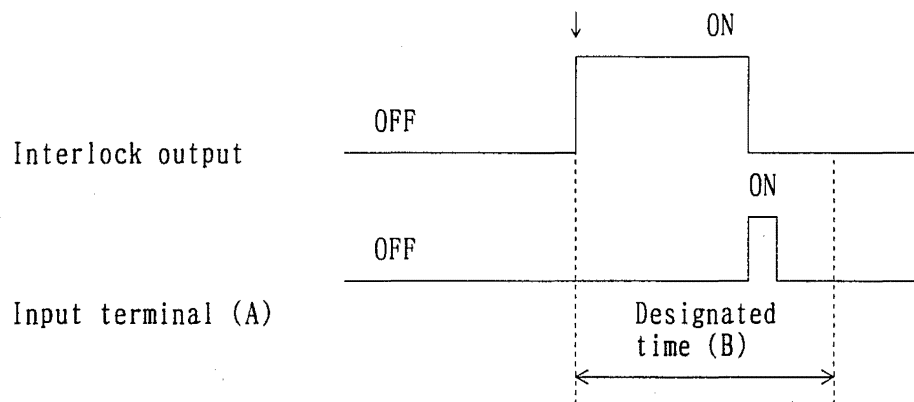


(3) Command H-1

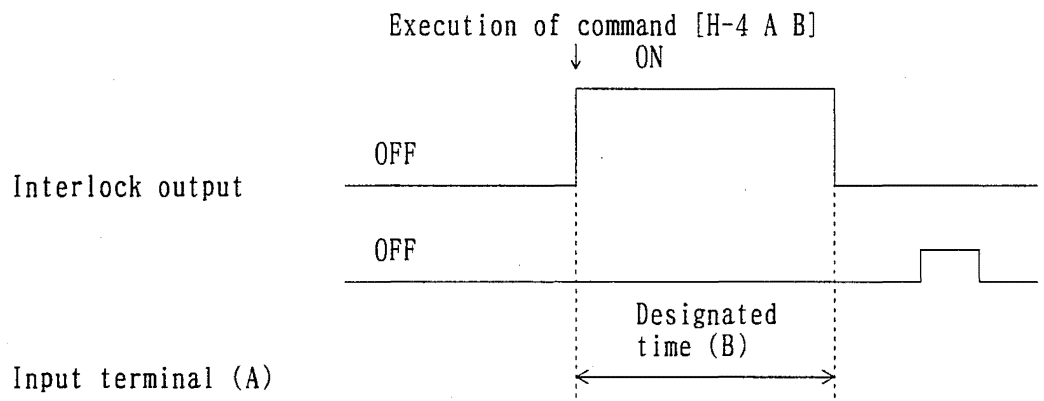


(4) Command H-4

(1) When the designated terminal input is within the designated time:



(2) When the designated terminal input is not within the designated time:



2-h. WELD OFF output

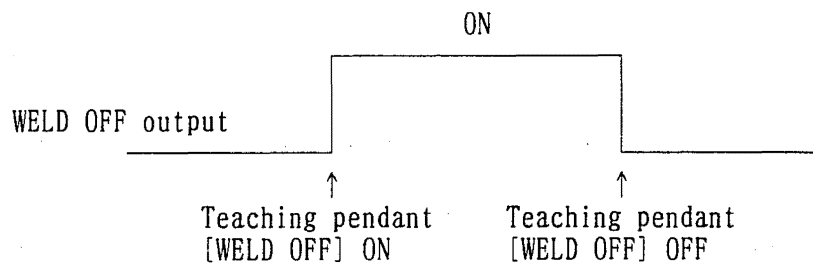
In the PLAY mode operation, the WELD OFF output is used to provide settings related to the output to indicate that the operation is in the [WELD OFF] mode.

INIT. SET: ADVANCED FUNCTION			
7	INTERLOCK OUTPUT	(NO)	YES
8	WELD OFF OUTPUT	(NO)	YES
9	PANEL PLAY OUTPUT	(NO)	YES
10	ESCAPING PLAY MODE	(NO)	YES
11	QUICK TRACE KEY	(NO)	YES
12	CTRL KEY IN T.P.	(NO)	YES
13	SEQ EDIT BY T.P.	(NO)	YES

ASSIGNED OUT # = 14			

SELECT SET-UP COND. OR INPUT NUMBER			
F4 SETTING END			

Output terminal No.: Used to allocate the terminal (one of the general purpose outputs) which turns on the output (contact closed) in the [WELD OFF] mode.



2-й. Панель операцій з виходами

In the PLAY mode operation, the panel operation output is used to provide settings related to the output to indicate that the [PANEL/EXT.]

У режимі PLAY панель управління виходами використовується для надання налаштувань, пов'язаних із виходами, щоб вказати, що [PANEL/EXT.] умови відтворення встановлено в положення [PANEL].

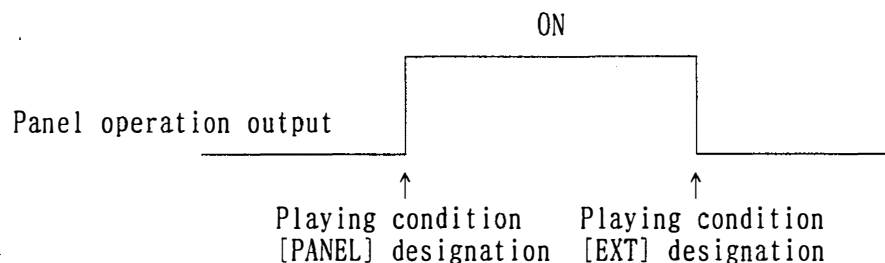
INIT. SET: ADVANCED FUNCTION			
7	INTERLOCK OUTPUT	(NO)	YES)
8	WELD OFF OUTPUT	(NO)	YES)
9	PANEL PLAY OUTPUT	(NO)	YES)
10	ESCAPING PLAY MODE	(NO)	YES)
11	QUICK TRACE KEY	(NO)	YES)
12	CTRL KEY IN T.P.	(NO)	YES)
13	SEQ EDIT BY T.P.	(NO)	YES)

ASSIGNED OUT # = 13

SELECT SET-UP COND. OR INPUT NUMBER

F4
SETTING
END

Номер вихідної клеми: Використовується для визначення терміналу (один із виходів загального призначення), який вмикається (контакт закритий) у режимі [WELD OFF].



2-k. Hold of play

When holding the playing mode operation and ending execution forcibly, this setting function is used to assign the output terminal which should become OFF. And the input terminal for external hold is also set at this section.

INIT. SET: ADVANCED FUNCTION			
7	INTERLOCK OUTPUT	(N O)	YES)
8	WELD OFF OUTPUT	(N O)	YES)
9	PANEL PLAY OUTPUT	(N O)	YES)
10	ESCAPING PLAY MODE	(N O)	YES)
11	QUIT TRACE KEY	(N O)	YES)
12	CTRL KEY IN T.P.	(N O)	YES)
13	SEQ EDIT BY T.P.	(N O)	YES)

Turns outputs of at
Escaping Play Mode. NO. = 1
to escape play mode is
executed by a input NO. = 1

SELECT SET-UP COND. OR INPUT NUMBER

F4
SETTING
END

Output terminal No.: Used to allocate the output terminal (four of the general purpose outputs) which must be turned OFF when the execution of the robot playing is forcibly ended (even if the output terminal is turned ON by the command 0-6.)

Input terminal No.: Used to allocate the external input terminal (one of the general purpose inputs) used to forcibly end the execution of the robot playing.

2-1. Quick trace

When tracing the slow speed section, such as the welding section, the function of the Quick trace key is used to make the robot move quickly. Effectively set the function of this key and hold the Quick trace key pressed. Then, press the TRACE [+] [-] key and the robot moves at the limited speed.

While the robot is played with this key, the setting of the [ROBOT AXIS] key is ignored. Weaving and circular weaving are operated at the teaching speed.

INIT. SET: ADVANCED FUNCTION			
7	INTERLOCK OUTPUT	(NO)	YES)
8	WELD OFF OUTPUT	(NO)	YES)
9	PANEL PLAY OUTPUT	(NO)	YES)
10	ESCAPING PLAY MODE	(NO)	YES)
11	QUICK TRACE KEY	(NO)	YES)
12	CTRL KEY IN T.P.	(NO)	YES)
13	SEQ EDIT BY T.P.	(NO)	YES)

SELECT . YES OR NO

2-м. Клавiша CTRL навчального пульта (зараз не можна використовувати)

Ця клавiша використовується для надання налаштувань, якi керують вихiдним сигналом у режимi навчання та режимi вiдтворення PLAY за допомогою пульта навчання.

INIT. SET: ADVANCED FUNCTION			
7	INTERLOCK OUTPUT	(NO)	YES)
8	WELD OFF OUTPUT	(NO)	YES)
9	PANEL PLAY OUTPUT	(NO)	YES)
10	ESCAPING PLAY MODE	(NO)	YES)
11	QUICK TRACE KEY	(NO)	YES)
12	CTRL KEY IN T.P.	(NO)	YES)
13	SEQ EDIT BY T.P.	(NO)	YES)

CTRL 1:	OUT NO= 11	:INIT.	(ON OFF)
CTRL 2:	OUT NO= 12	:INIT.	(ON OFF)
CTRL 3:	OUT NO= 13	:INIT.	(ON OFF)
CTRL 4:	OUT NO= 14	:INIT.	(ON OFF)

SELECT SET-UP COND. OR INPUT NUMBER			
F4 SETTING END			

Вихiдна клемa NO: Використовується для видiлення термiналу з-помiж загальних виходiв (№1...16).

Початковий стан: Використовується для виконання обробки вiдповiдно до налаштувань, коли увiмкнено лампу [TEACH OK] навчального пульта.

(Приклад) : Коли вихiдний термiнал №1 i початковий стан увiмкнено, клавiша [TEACH OK] вмикає окремий вихiд 1, а лампа CTRL1 вмикається.

3. Optional connection (F3 (optional connection) is selected)

No.	Method of operation	Response of display
0		<pre> INIT. SET: OPTION SETUP 1 PRINTER (N O YES) 2 AUXILIARY I/O (N O YES) 3 AUXILIARY MEMORY (N O YES) 4 SENSING UNIT (N O YES) 5 COMMUNICATION PORT (N O YES) 6 AUX. AXIS G1 (N O YES) G2 (N O YES) G3 (N O YES) G4 (N O YES) G5 (N O YES) G6 (N O YES) 7 WELD DATA BANK (N O YES) 8 FLOPPY DISK (N O YES) </pre>
1	Move the cursor key ↑ ↓ ← → on the option key [YES] or [NO] to blink it.	
2	Press the STORE key. <In the case of the external axis G1~ G6 is [VALID] >	The selected item is displayed inversely. If the [YES] key of the [EXTERNAL AXIS G1~G6] is selected, detailed parameters are set.
3	Select conditions or enter numeric values of each item. (Use cursor keys and the numeral keys.)	
4	Press the STORE key.	
5	When the detailed parameter setting is finished, press the F4 [SETUP FINISHED] key.	[YES] Return to No. 1.
6	Press the END key.	Setting of the expansion function has been finished and the initial display of the system setting appears.

NOTE: Optional connection are provided at our plant before shipment or by our serviceperson at site. Users are not allowed to make any optional connections. It is possible to see the contents of [YES] or [NO] of the connection.

4. Robot parameter (F4 (robot parameter) is selected)

No.	Method of operation	Response of display
0		INIT. SET:ROBOT OFFSET 1. ORG OFFSET 2. TOOL OFFSET 3. STANDARD OFFSET VALUES 4. SOFT LIMIT 5. SPEED LMT 6. JOG SELECT SET UP COND.
1	Move the cursor key ↑ ↓ ← → on the [ROBOT OFFSET] position you want to set.	
	1. ORIGIN OFFSET> a 2. TOOL OFFSET> b 3. ORIGIN CORRECTION VALUE> c 4. SOFT LIMIT> d 5. SPEED LIMIT> e 6. JOG> f	Refer to examples of display shown on subsequent pages. (Contents of each item are displayed.)
2	Press the STORE key.	
3	When the setting is finished, press the F4 [SETUP FINISHED] key.	The display returns to the display No.0 on this page.
4	Press the END key.	The display returns to the first display of system setting.

NOTE: Origin offset and the origin correction are set at our plant before shipment or set by our serviceperson at site. Users are requested NOT to make any such settings (changes). Users can check the contents of setting.

4-a. Заводське зміщення (виставлення нулів) .

Ця функція використовується для визначення початкового положення кожної осі робота.

INIT. SET:ROBOT OFFSET			
ORG OFFSET			
	(ANGLE)		(PULSE)
RT:	0.00 °	(	0)
UA:	0.00 °	(	0)
FA:	0.00 °	(	0)
RW:	0.00 °	(	0)
BW:	- 90.00 °	(	40960)
TW:	0.00 °	(-	512)
F4 SETTING END			

ПРИМІТКА. Користувачам заборонено змінювати налаштування.

4-b. ЗМІЩЕННЯ ІНСТРУМЕНТУ

Ця функція використовується для визначення розмірів, пов'язаних з інструментом (факелом), який встановлюється на зап'ясті.

INIT. SET:ROBOT OFFSET	
OFFSET	
L1 =	420.00 (MM)
L2 =	0.00 (MM)
L3 =	385.00 (MM)
TW =	- 20.00 (°)
INPUT NUMBER	
F1 STNDRD	F4 SETTING END

(Data are the standard values.)

In the case of the standard torch, when the F1 [STANDARD] key is pressed, the standard values are entered.

* The value of L2 has the following restriction.

$$L2 < \frac{L3}{130} \cdot L1$$

(Unit of L1, L2 and L3 is [mm].)

Since the robot does not check the above restriction, please pay much attention to the setting.

If the value of L2 does not meet the above restriction the error message [Cannot operate] is displayed during playing, and the robot can not move.

If the torch offset value is changed, it causes that the movement of the circular weaving and circular weaving become different between play mode and the trace mode.

Should the torch offset value be changed, perform either of the following operations.

- (1) Set the torch offset value to the original value.
- (2) Move the robot by trace mode to the teaching point of the circular, weaving and circular weaving, and restore those teaching point without changing the teaching position.
- (3) Use the program editing to move the cursor to the teaching points of the circular, weaving and circular weaving, and restore those teaching point without changing the teaching position.

4-с. ЗНАЧЕННЯ ЗАВОДСЬКОЇ КОРЕКЦІЇ

Це дані корекції, які використовуються для визначення початкового положення робота.

INIT. SET: ROBOT OFFSET			
ENCODER CORRECT PULSE			
RT:	87	*	0
UA:	- 285	*	2
FA:	1173	*	0
RW:	57	*	0
BW:	285	*	0
TW:	1721	*	3
F4 SETTING END			

ПРИМІТКА. Ці дані встановлюються на нашому заводі або нашим сервісним працівником, і користувачі не можуть встановлювати або змінювати ці дані.

4-d. SOFT LIMIT Програмне обмеження.

Це дані для обмеження робочого діапазону кожної осі за допомогою програмного забезпечення.

INIT. SET: ROBOT OFFSET				
SOFT LIMIT				
	(-)		(+)	
RT:	-180.00	*	180.00	*
UA:	- 90.00	*	150.00	*
FA:	-140.00	*	150.00	*
RW:	-200.00	*	200.00	*
BW:	-135.00	*	135.00	*
TW:	-200.00	*	200.00	*
INPUT NUMBER				
F1	STNDRD			
		F4	SETTING	
			END	

(AW8010)

Щоб встановити ліміт програмного забезпечення, використовуйте параметри, описані в [Посібник зі специфікацій].

Щоб отримати стандартне значення, натисніть клавішу F1 [STANDARD]

4-e. SPEED LIMIT

In the tracing mode or the confirmation mode, the speed limit in manual mode and trace mode can be set.

[m/min.] or [%] can be selected.

```

INIT. SET: ROBOT OFFSET

SPEED LMT( M/MIN % )

      15.00

INPUT NUMBER

F1  STNDRD          F4  SETTING
                        END
  
```

For the standard value, press the F1 [STANDARD] key.

The standard value is 15.00 m/min.

4-f. JOG

The JOG mode is used to set the value of robot movement for jogging.

```

INIT. SET: ROBOT OFFSET

JOG

H      = 1.00 (MM)
M. H   = 0.75 (MM)
M      = 0.50 (MM)
M. L   = 0.35 (MM)
L      = 0.20 (MM)

INPUT NUMBER

F1  STNDRD          F4  SETTING
                        END
  
```

	Standard value	Input range
HIGH	1.00	0.01~10.00
MID HIGH	0.75	0.01~10.00
MID	0.50	0.01~10.00
MID LOW	0.35	0.01~10.00
LOW	0.20	0.01~10.00

[mm]

For the standard value, press the F1 [STANDARD] key. The input must satisfy the conditions (HIGH>MID HIGH>MID>MID LOW>LOW).

5. MEMORY CLEAR (F5 [MEMORY CLEAR] is selected)

This function is used to delete all the contents that are taught to the robot. Two functions are available;

(1) ALL CLEAR and (2) FILE CLEAR.

(1) ALL CLEAR

When pressed, the ALL CLEAR function deletes JOB, PROGRAM, ASS SEQ., AES SEQ., LIBRARY and INITIAL SETUP data. After the INITIAL SETUP data are deleted, the standard specification values are automatically written again.

No.	Method of operation	Response of display
1	Press the F1 [ALL CLEAR] key.	INIT. SET: MEMORY CLEAR SELECT OPERATION MODE F1 F2 ALL FILE CLEAR CLEAR The [ALL CLEAR] is displayed inversely.
2	Press the 3 , 9 , [STORE] keys.	
3	Press the END key.	

(2) FILE CLEAR

This function is used to delete JOB, PROGRAM, LIBRARY, ASS SEQ./AEW SEQ.

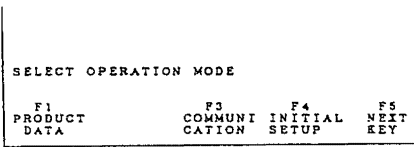
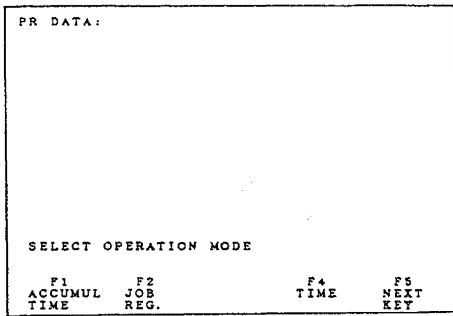
Note that the INITIAL SETUP data does not change.

No.	Method of operation	Response of display
1	Press the F2 [FILE CLEAR] key.	The [FILE CLEAR] key.
2	Press the 3 , 9 , [STORE] keys.	
3	Press the END key.	CLEAR JOB. PRG. LIB. ASS. AES. F1 ALL CLEAR F2 FILE CLEAR

Operation 26 :PRODUCT DATA

This function is used to display and reset the contents of production data and the control data of the robot.

- Contents : (1) Accumulted time display
 (2) Number of job execution and contents of register
 (3) Origin margin display (when DC motor type external axis is used)
 (4) Time
 (5) Abnormality history

No.	Method of operation	Response of display
0	Perform this operation in the mode selection state.	
1	F5 Press the [NEXT KEY] key.	
2	F1 Press the [PRODUCT DATA] key.	
3	Press either the following keys according to the selected item.	
	F1 [ACCUMUL TIME] key -----> a	
	F2 [JOB] key -----> b	
	F3 [ORIGIN MARGIN] key -----> c	
	NOTE: Origin Margin key is used when DC motor type external axis is used.	
	F4 [TIME] key -----> d	
	F5 [NEXT KEY] key and F1 [ERROR HISTORY] key -----> e	
4	After check or reset the content, press the END key.	

Contents of respective selected items are displayed. These displays are explained on subsequent pages.

- a. ACCUMUL TIME (F1 [ACCUMUL TIME] key is selected)

This function is used to display and reset various accumulated time related to the robot operations.

PR DATA: ACCUMULATED TIME		
	TIME	
CONTROLLER ON	348.2	(HOUR)
PLAY TIME (TOTAL)	201.1	(HOUR)
ARC ON (TOTAL)	3.2	(HOUR)
PLAY TIME IN JOB	0.0	(SEC)
ARC ON IN JOB	0.0	(SEC)
ARC ON % IN JOB	0.0	%
SELECT OPERATION MODE		
F1	ACC TIM	
RESET		

Resetting of accumulated time : Press the F1 3 9 STORE keys in that order.

- b. JOB, REGISTER (F2 [JOB, REGISTER] key is selected)

This function is used to display and reset the number of job execution and the contents of the register.

PR DATA: JOB . REGISTER				
JOB	COUNT	REGISTER	REGISTER	
1	88	1= 255	11= 0	
2	4	2= 252	12= 0	
3	3	3= 0	13= 0	
4	1	4= 0	14= 0	
5	80	5= 0	15= 0	
6	0	6= 0	16= 0	
7	0	7= 0	17= 0	
8	1	8= 0	18= 0	
9	0	9= 0	19= 0	
10	3	10= 0	20= 0	
SELECT OPERATION MODE				
F1	F2	F3	F4	F5
JOB	JOB	REGSTR	REGSTR	NEXT
NEXT	BACK	NEXT	BACK	KEY

Press the F1 [JOB NEXT] key and F2 [JOB BACK] key to show the next or previous page for JOB.

To show the next or previous page for Register, press the F3 [REGISTER NEXT] key and F4 [REGISTER BACK] key.

To display further function keys, press the F5 [NEXT KEY] key.

PR DATA:JOB . REGISTER					
JOB	COUNT	REGISTER		REGISTER	
1	88	1=	255	11=	0
2	4	2=	252	12=	0
3	3	3=	0	13=	0
4	1	4=	0	14=	0
5	80	5=	0	15=	0
6	0	6=	0	16=	0
7	0	7=	0	17=	0
8	1	8=	0	18=	0
9	0	9=	0	19=	0
10	3	10=	0	20=	0
SELECT OPERATION MODE					
F1	F2			F3	
ALL JOB	ALL REG			NEXT	
RESET	RESET			KEY	

To reset the number of all jobs executed, press the F1 [JOB ALL RESET] key ("0" CLEAR).

To reset all contents of the register, press the F2 [REGISTER ALL RESET] key. ("0" CLEAR)

c. ORIGIN MARGIN (F3 [ORIGIN MARGIN] key is selected)

This function is used to display the origin margin data when DC motor type external axis is used optionally.

- d. DATE AND TIME (F4 [TIME] key is selected)

This function is used to display the current time and date. To set the time, press the [CANCEL] 3 , 9 , STORE keys on the panel in that order.

```

PR DATA:TIME

CURRENT DATE/TIME:
  90Y  9M 17D 13H 42M

SELECT OPERATION MODE

F1      F2      F4      F5
ACCUMUL JOB    TIME  NEXT
TIME    REG.
  
```

```

PR DATA:TIME

CURRENT DATE/TIME:
  90Y  9M 17D 13H 44M

INPUT YEAR MONTH DATA HOUR MIN
  02Y  9M 17D 13H 43M

F4
SETTING
END
  
```

- e. ERROR HISTORY (F5 [NEXT KEY] key and F1 [ERROR HISTORY] key are selected)

This function is used to display the history of abnormality.

```

PR DATA:

SELECT OPERATION MODE

F1      F5
ERR.    NEXT
HISTORY KEY
  
```

```

PR DATA:ERROR HISTORY

ALARM 15: 2Y  9M 13D 10H 12M
ALARM 15: 2Y  9M 13D 11H 30M
ALARM 14: 2Y  9M 13D 13H 18M
ALARM 15: 2Y  9M 13D 13H 19M
ALARM 15: 2Y  9M 13D 13H 21M
ALARM 15: 2Y  9M 13D 13H 22M
ALARM 15: 2Y  9M 13D 13H 23M
ALARM 15: 2Y  9M 14D 14H 42M
ALARM 15: 2Y  9M 14D 14H 43M
ALARM 15: 2Y  9M 14D 14H 46M

SELECT OPERATION MODE

F1      F2      F4
PAGE    PAGE    SETTING
NEXT    BACK    END
  
```

Operation 27 : Teaching at Home Position

The home position is a position where the robot waits for starting the next operation after the work for one workpiece is finished.

No.	Method of operation	Response of display
0	Refer to No.0 of the operation 3.	
1	Press the F2 [TEACH] key.	
2	Press the F2 [HOME POS TEACH] key.	
3	(1) If the home position is not registered, proceed to the operation No.5. (2) If the home position is registered, process to the operation No.4.	TEACH HOME POSITION REGISTRATION X = 808.96MMRT = 5.82° Y = 132.38MMUA = 24.09° Z = 1255.19MMFA = 15.19° U = 177.26°RW = 1.00° V = 30.63°BW = 85.62° W = 175.24°TW = 11.19° DO YOU CHANGE THE HOME POSITION ? F1 YES F2 NO
4	(1) To change the home position, press the F1 [YES] key and go to the operation No.5. (2) If you do not change the home position, press the F2 [NO] key and return to operation No.2.	
5	Press the [TEACH OK] key of the teaching pendant.	[TEACH OK] lamp : ●→○
6	Press the STORE key.	The message [WAIT PORISION IS REGISTERED] appears.
7	Press the [TEACH OK] key.	[TEACH OK] lamp: ●→○
8	Press the END key of the panel.	

NOTE: Use the following functions to set the home position.

Move command : Command T-0 (PTP)

Speed : [HOME POSITION RETURN] (advanced function) of the initial setup.

Operation 28 : External Origin Search

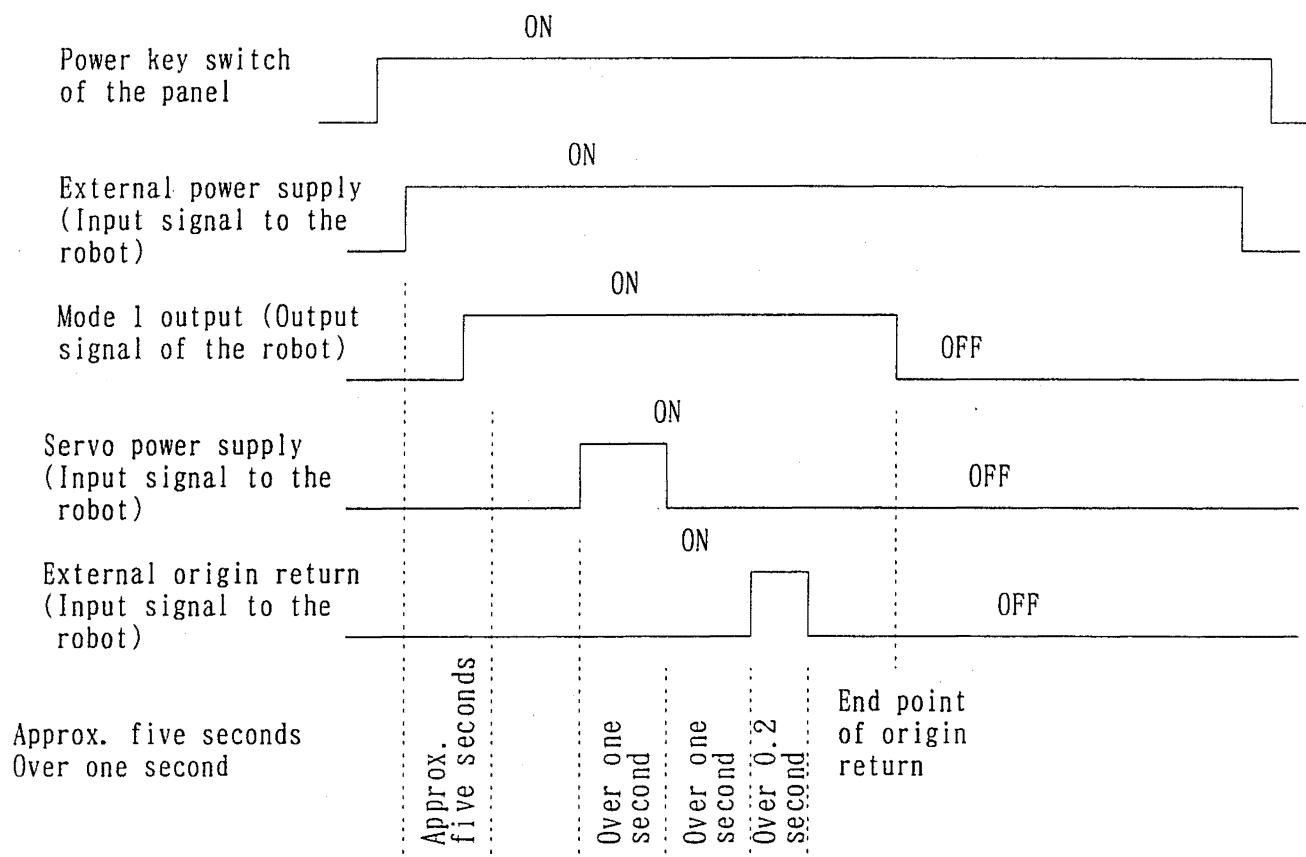
This function is used to return the robot to its origin by external signal.

No.	Method of operation	Response of display
1	Turn ON the power key switch of the panel and make the external power supply terminal to short.	 About one second later.
2	Verify the output of the robot external control output [Mode 1]*.	* An contact output closes when the robot is ready to return to the origin (Servo ON).
3	Make the external servo power supply terminals to short.	
4	Make the robot external control input [ORIGIN RETURN] and the COM to short. **	** Move the robot to a position where the robot does not interfere with the workpiece before short-circuiting.
5	Then, open the external servo power supply terminals.	

NOTE: Before performing the external origin search, verify that the robot position does not interfere with the jig, workpiece and other components. Refer to the item (1) "Origin returnable position" of the operation 2, as required.

NOTE: Always keep the power supply terminal to short during operation.

NOTE: The pulse width should be more than 0.2(sec) for the [ORIGIN SEARCH] mode input.



NOTE: When the HOLD signal is received during the external origin search mode, the robot stops.

Then,

- (1) Send a pulse of over 0.2 seconds width to the restarting terminal.
Refer to the item (1) "Origin returnable position" of the operation 2 as required.
- (2) To stop the external origin search mode, press the END key of the panel.

Operation 29 : Starting of Play (PLAY START) (External operation)

This function is used to start the play from an external signal and can be started by entering the external job select starting signal.

a) External starting operation

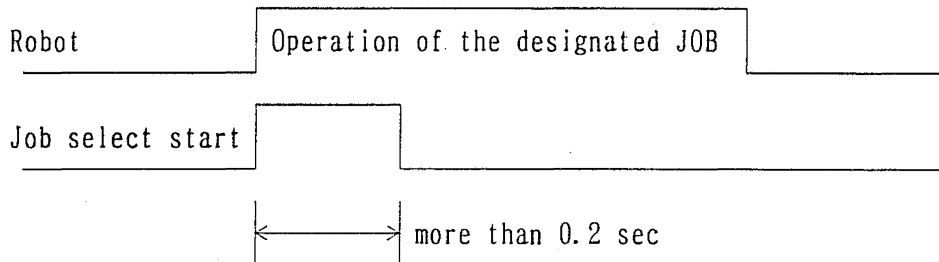
No.	Method of operation	Response of display
0	In the case of the external origin search: On completing the origin search, the contact of the robot external control output [MODE 1] is turned OFF, the external operation mode is selected, and the robot is caused to wait for starting.	
1	In the case of manual origin search: After performing No.6 of the operation 2, press the F1 [PLAY] key.	
2	Enter signal into the [JOB SELECT START] terminal. ↓ OPERATION STARTS ↓ The robot stops after finishing the work and waits for the signal to start next work.	

To enter the job select start signal:

1. External job starting (1):

In case the [STROBE] terminal is connected to the [COM] terminal and the power is supplied:

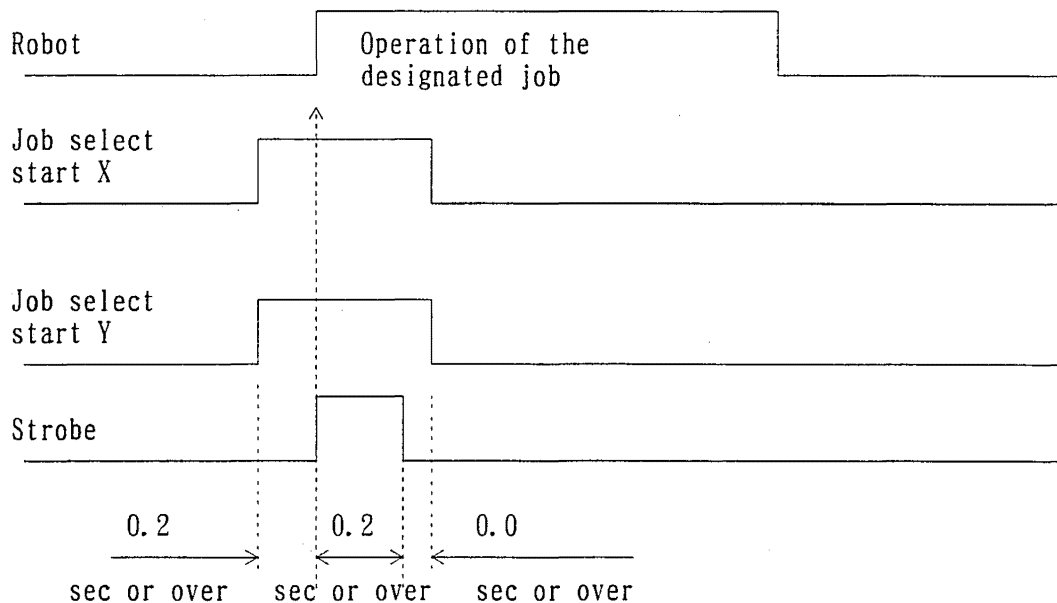
Only the seven kinds of the job 1, 2, 4, 8, 16, 32, and 64 can be started by making the [JOB SELECT START] terminal and the [COM] terminal to short.



2. External job starting (2):

In case the [STROBE] terminal is not connected (open) to the [COM] terminal and the power is supplied:

After making the necessary [JOB SELECT START] terminal and the [COM] terminal to short, and make the [STROBE] terminal and the [COM] terminal to short.



(Designated job No.) = (Total of the numeric values of the [No.] of the [COM] terminal and the short-circuited [JOB SELECT START No.])

Job select start No.	64	32	16	8	4	2	1	Designated Job No.
Example 1	○	○	○	○	○	○	○	Job 127
Example 2	○			○	○			Job 76
Example 3			○				○	Job 17
Example 4							○	Job 1

“○” mark indicates short-circuiting to [COM] terminal.

3. Job reserve starting (1):

In case the [STROBE] terminal and the [COM] terminal are short-circuited and the power supplied, 7 jobs (max.) can be reserved by short-circuiting the [JOB SELECT START] terminal to the [COM] terminal at over 0.2 seconds intervals. Note that the job of the same No. and the job being executed cannot be reserved.

4. Job reserve starting (2):

In case the [STROBE] terminal is not connected (open) to the [COM] terminal and the power is supplied:

Make the necessary [JOB SELECT START] terminal and the [COM] terminal to short, and make the [STROBE] terminal and the [COM] terminal to short at over 0.2 seconds intervals. Thus 16 jobs (max.) can be reserved.

Note that the job of the same No. and the job being executed cannot be reserved.

5. Specification of reserving function.

- (1) This function becomes valid, when play condition is set as “External”.
- (2) The JOB of the same number cannot be re-reserved or continuously reserved.
- (3) When the work execution is finished, the functions are cancelled sequentially.

- (4) When the reserve cancel signal is entered, all reservations are cancelled except the works currently being executed.
- (5) The reserve functions are accepted in the [HOLD] mode.
- (6) When the [CANCEL] key and [END] key of the teaching pendant are pressed in the [HOLD] mode, all the reserved functions are cancelled.

6. Other signals related to starting and stopping

The following input and output are available.

- (1) [RESTART] input used for starting operation after effecting the [HOLD] mode and hold operations.
- (2) Contact output used to close during [OPERATION] mode.
- (3) Contact output used to close during [HOLD] mode.

Operation 30 : End of External Operation

This function is used to end the external operations by changing the starting conditions under the play conditions from the [EXTERNAL] to the [PANEL] or by ending the operation mode.

No.	Method of operation	Response of display
1	Press the HOLD key. * To restart the operation from the Hold mode, send the external signal to the [RESTART] input terminal.	
2	Press the END key and the CANCEL key of the teaching pendant simultaneously.	
3	(a) To change the starting conditions to the [PANEL], refer to No.3 and thereafter of the operation 5. (b) To end the operation mode, press the END key of the panel. The above procedures complete the ending of the external operation.	

Operation 31 : ADDRESS SEARCH and Lock Operation

Address search: Used to move the robot to certain point of a program.

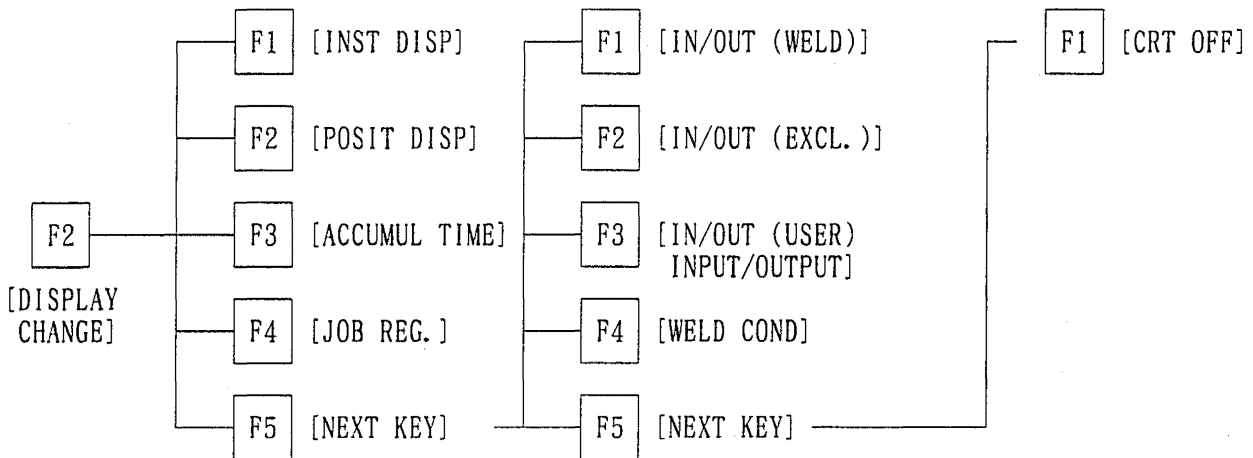
Lock operation: Used to lock the part of robot functions and operate the robot.

○ Address search

No.	Method of operation	Response of display
1	Press the F1 [PLAY COND] key.	
2	Press the F1 [ADDRESS SEARCH] key.	
3	Press the STORE key.	
4	Use the numeral keys and enter the job number, program number and step number.	
5	Press the STORE key. (1) If the step number designated by No.3 exists: The message [Address is found] appears. (2) If the step number designated by No.3 does not exist: The message [Address is not found] appears.	<pre> PLAY:HOLDING COND. SET START COND. : ADDRESS SEARCH JOB NO. 1 PROGRAM NO. 333 STEP NO. 100 ----- MAX. SPEED (M/MIN) 120.00 HOLD JOB = PROGRAM = STEP LOCK I / O = ARC = ROBOT ----- INPUT COND. AND PRESS END. ADDRESS NOT FOUND F4 ALL CANCEL </pre>
6	Press the [END] key of the panel.	
7	Press the START switch. The robot moves to the designated step at the speed of 8.4 m/min. Be sure the robot moving path is free from any obstacles.	
8	After the robot is moved to the designated step, the message [ADDRESS SEARCH FINISHED] is displayed.	
9	(1) Verification: Press the [ROBOT AXIS] key and the [+/-] key of the teaching pendant. (2) Operation: Press the START switch of the panel.	

Operation 32 : Display in Operation

Pressing the F2 [DISPLAY CHANGE] key displays the following function keys.



Displays can be changed during operation by pressing the function key to show the desired display.

1. INST DISP

Displays the contents of the current work the robot is performing.

2. POSIT DISP

Displays the position of the tip of the robot.

3. ACCUMUL TIME

Displays the accumulated time.

4. JOB REG

Displays the accumulated number of JOB, and Register.

Next or previous page is displayed by NEXT or BACK key.

5. IN/OUT (WELD)

Displays the conditions of connection with the welding machine.

6. IN/OUT (EXCL)

Displays conditions of basic connections of the robot to external equipment.

7. IN/OUT (USER)

Displays the status of the signal that can be used by users.

8. WELD COND.

Displays the conditions of the welding.

9. CRT OFF

Displays on the screen are turned off. Displays on the screen are shown again by key operation other than the CRT OFF key.

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50
STEP	COMM	SPEED (M/MIN)	SEQ. COMMAND	
0	A=0	7.50		
1	A=0	7.50		
2	A=0	7.50		
3	A=0	7.50		
4	A=0	7.50		
				1AJO 230 22.0
				ZASS 1

SELECT MODE AND/OR PRESS START.				
F1 INST DISP	F2 POSIT DISP	F3 ACCUMUL TIME	F4 JOB REG.	F5 NEXT KEY

(INST DISP)

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50

X = 1005.73MM	RT=	7.31"		
Y = 87.35MM	UA=	2.29"		
Z = 1373.54MM	FA=	23.38"		
U = 178.01"	RW=	5.88"		
V = 29.91"	BW=	90.78"		
W = 175.51"	TW=	27.56"		

SELECT MODE AND/OR PRESS START.				
F1 INST DISP	F2 POSIT DISP	F3 ACCUMUL TIME	F4 JOB REG.	F5 NEXT KEY

(POSIT DISP)

PLAY:HOLDING DSP CHANGE		:A 5
JOB =	0	PROGRAM= 4
WELD COND	230 (A)	22.0 (V) SPD 7.50

	TIME	
CONTROLLER ON	348.5 (HOUR)	
PLAY TIME (TOTAL)	201.1 (HOUR)	
ARC ON (TOTAL)	3.2 (HOUR)	
PLAY TIME IN JOB	0.0 (SEC)	
ARC ON IN JOB	0.0 (SEC)	
ARC ON % IN JOB	0.0 %	

SELECT MODE AND/OR PRESS START.		
F1 INST DISP	F2 POSIT DISP	F3 ACCUMUL TIME
F4 JOB REG.	F5 NEXT KEY	

(ACCUMUL TIME)

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50

JOB	COUNT	REGISTER	REGISTER	
1	88	1= 255	11= 0	
2	4	2= 252	12= 0	
3	3	3= 0	13= 0	
4	1	4= 0	14= 0	
5	80	5= 0	15= 0	
6	0	6= 0	16= 0	
7	0	7= 0	17= 0	
8	1	8= 0	18= 0	
9	0	9= 0	19= 0	
10	3	10= 0	20= 0	

SELECT MODE AND/OR PRESS START.				
F1 JOB NEXT	F2 JOB BACK	F3 REGSTR NEXT	F4 REGSTR BACK	

(JOB REG.)

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50

INPUT		OUTPUT		
WELD CURR DETECT		TORCH SW		
NO ARC		GAS VALVE		
STICK		STICK CHECK		
TORCH CONTACT		WIRE JOG (+)		
NO WIRE		WIRE JOG (-)		
ERROR CANCEL				

SELECT MODE AND/OR PRESS START.				
F1	F2	F3	F5	
IN/OUT	IN/OUT	IN/OUT	NEXT	
(WELD)	(EXCL.)	(USER)	KEY	

IN/OUT (WELD)

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50

INPUT NO.		OUTPUT NO.		
EMG STOP 1		INPUT POWER		
EMG STOP 2		RUNNING		
RESERVE CANCEL		HOLDING		
START		MODE 1		
HOLD		MODE 2		

SELECT MODE AND/OR PRESS START.				
F1	F2	F3	F5	
IN/OUT	IN/OUT	IN/OUT	NEXT	
(WELD)	(EXCL.)	(USER)	KEY	

IN/OUT (EXCL.)

PLAY:HOLDING DSP CHANGE				:A 5
JOB =	0	PROGRAM=	4	STEP = 4
WELD COND	230 (A)	22.0 (V)	SPD	7.50

INPUT NO.		OUTPUT NO.		
1	11	1	11	
2	12	2	12	
3	13	3	13	
4	14	4	14	
5	15	5	15	
6	16	6	16	
7	17	7	17	
8	18	8	18	
9	19	9	19	
10	20	10	20	

SELECT MODE AND/OR PRESS START.				
F1	F2			
PAGE	PAGE			
NEXT	BACK			

IN/OUT (USER)

Operation 33 : Program Making by MDI

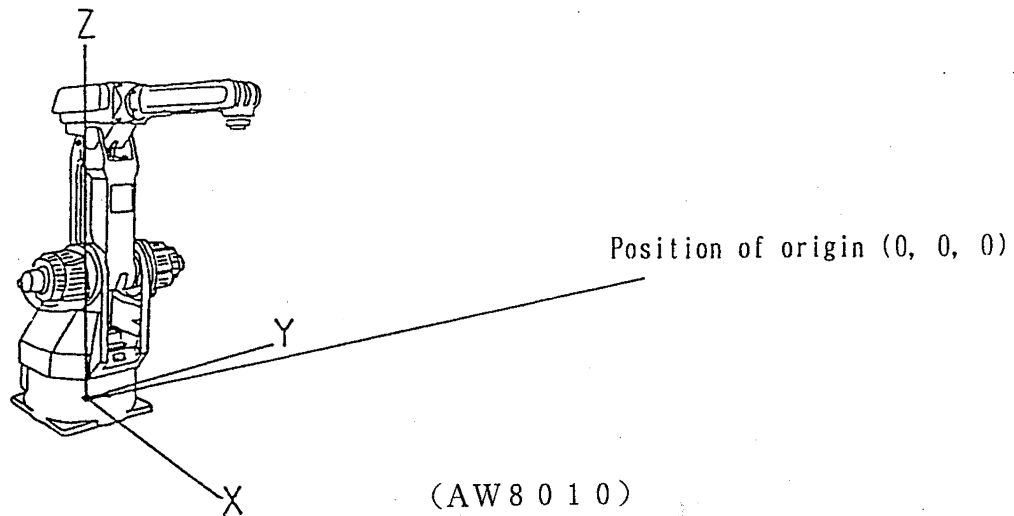
(1) Selection of MDI teaching

Use the following operations to make and correct programs by the MDI teaching.

No.	Method of operation	Response of display
1	Use No.7 of the operation 19 to directly enter the MOVE COMMAND, SPEED COMMAND, POSITION and SEQ. COMMAND. Use No.10 of the operation 19 to directly enter and correct the robot positions.	

(2) Origin position and origin angle of the coordinate system:

The origin position is as shown in the diagram. The origin angle is as stated in CHAPTER 1.



● Cautions on MDI function

This robot is not designed on the MDI standard but is designed to use the teaching as the standard.

Take note of the following:

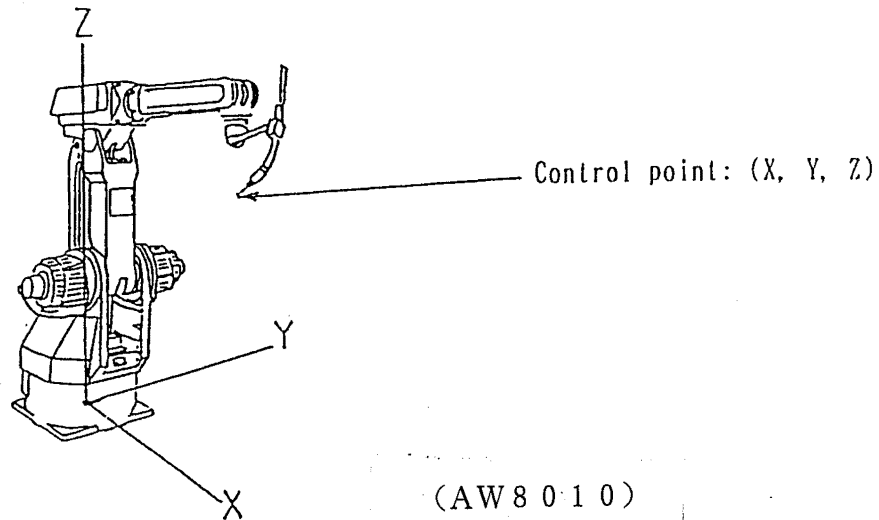
- 1) When the input value of the coordinate and angle are stored, there occurs some differences between the entered value and the stored value.
(Particularly, the second place of decimals)

- 2) If the coordinate Y is stored at the same point, the already registered coordinate X is also changed to some extent as above.

○ Position display (X, Y, Z, U, V, W)

Coordinate values (X, Y, Z) indicate the absolute position of the robot.

(See the diagram below.)



Coordinate values (U, V, W) form a coordinate system to indicate the position of the tool. See the diagram below.

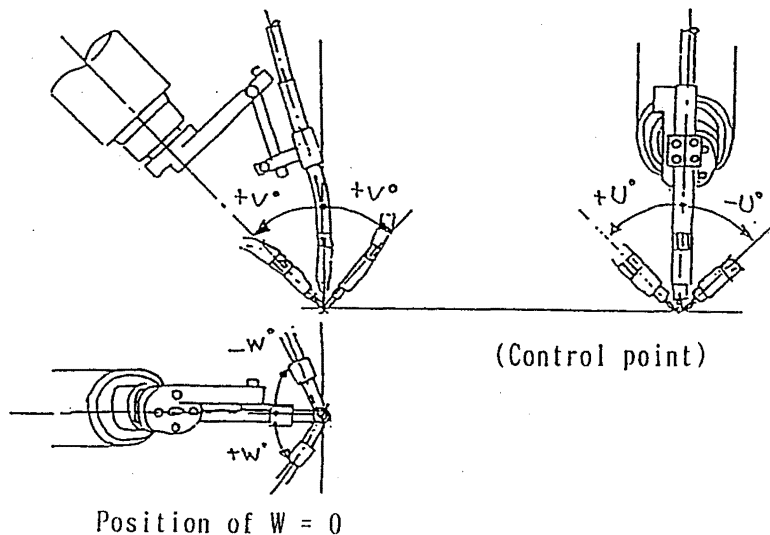
U: A rotating angle to Z axis which includes control point, without changing V angle.

V: An angle of the tool inclined from a vertical place.

W: A twisting angle of the wrist which is fixed of the tool direction.

Position of V = 0

Position of U = 0



<CAUTIONS>

This robot is designed as a teaching playback robot, and therefore, there may occur some differences between the shift (numeric values) data entered by the MDI and the amount of shift resulting from the actual robot movement.

For this reason, consider the amount of shift obtained by the MDI as a tentative value.

To accomplish more accurate robot shifting, perform the following.

- Move the robot manually from the original position to the position to be shifted, read the amount of shift from the coordinate table, and use such amount as the robot shifting amount.
- After the robot is shifted, observe the difference from the actual workpiece position, and make fine adjustment of shifting again.

After finishing shifting operation, verify the positions and operations in the teaching mode. And, if necessary, correct the positions before operating the robot.

Operation 34 : Input/Output Terminal Specification

(1) Kinds of inputs

Name of terminal		Functions
Individual input (General purpose input)	1 2 3 : 14 15 16	An input the user can use freely and handle individually by generating sequences. (16 inputs)
Welding input (Private input)	217 218 219 220 221	Current detect No Arc Stick Torch contact No wire No Gas
Job select start	1 2 4 8 16 32 64 Strobe	JOB SELECT/START input used in [EXTERNAL] mode.
Cancel input		Used to cancell job reservation.
Restarting input		Used to restart operations after hold state.
Stop input		Used to stop robot operations temporarily.
Emergency stop input		Used to effect emergency stop externally. **
Origin return input		Used to effect origin return externally.
Operation inside shelf		When short-circuited, the maximum speed is restricted. *
Status input	Origin return	Not used
	Teaching	Input used to select the teaching mode when the selectable terminal of the status output is closed.
	Operation	Input used to select the operation mode when the selectable terminal of the status output is closed.

* The speed becomes limited speed from the next teaching point of the short-circuited point.

** Connect the normally closed point (B type contact).

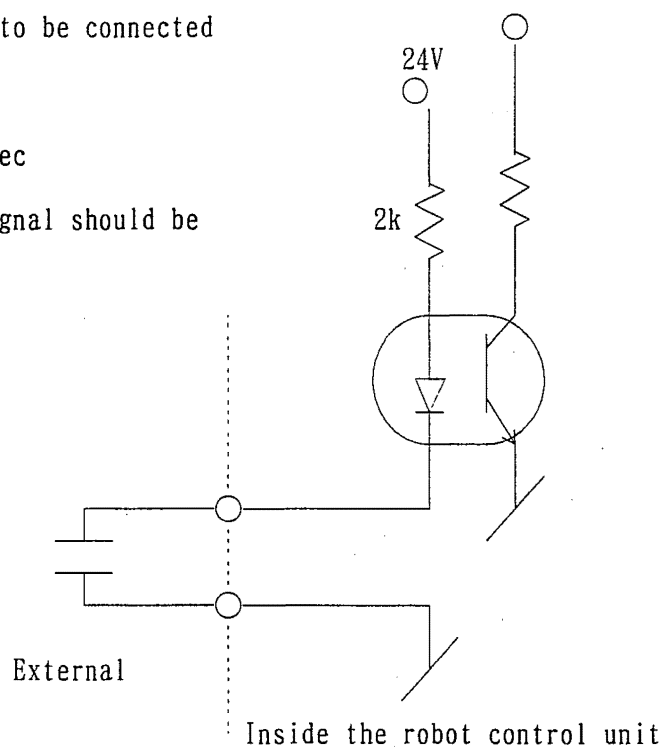
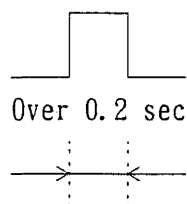
Name of terminal	Functions
Interlock	If an input signal exists, the teaching mode can be effected. If an input signal exist, the operation mode cannot be effected. If an input signal does not exist, the teaching mode cannot be effected. If an input signal does not exist, the operation mode cannot be effected.
Error cancel	Used to perform [ERROR CANCEL] externally.

NOTE: ○ [YES/NO] of the interlock input can be designated by the "INITIAL SETUP" mode. (Designated as INVALID before shipment from factory)

○ Errors can be cancelled only when the play condition is set to [EXTERNAL].

(2) Input terminal equivalent circuit

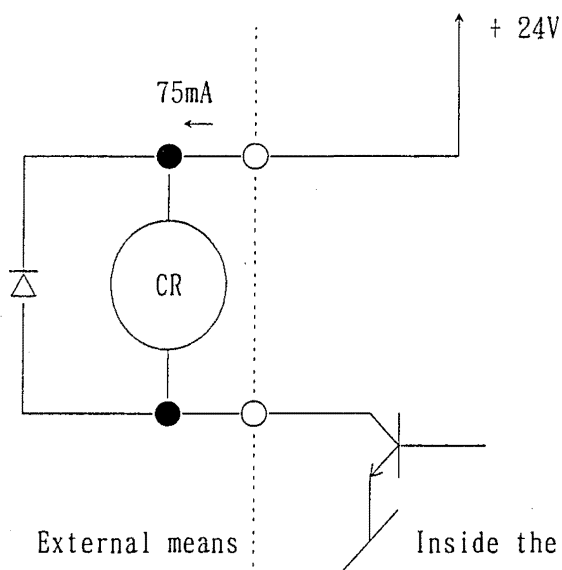
- The circuit receives the ON • OFF contact signal of no-voltage externally.
- External relay contact to be connected
resistance $\leq 1 \Omega$
chattering $\leq 10 \text{ msec}$
- Pulse width of input signal should be more than 0.2 sec.



(3) Kinds of outputs

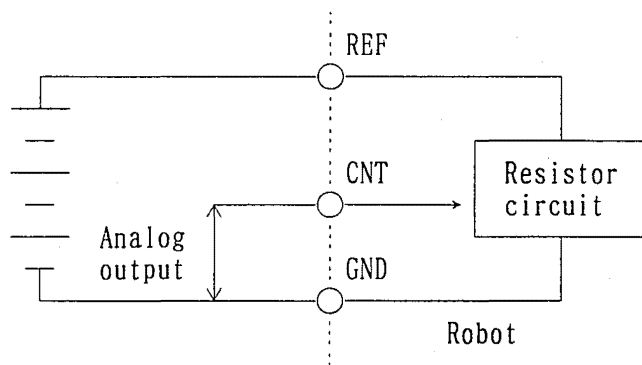
Name of terminal		Functions
Individual output (general purpose output)	1	Individual output that can be used freely by the user for using the sequence commands.
	2	
	3	
	⋮	
	14	
	15	
	16	
Welding output	209	Torch switch
	210	Gas valve
	211	Stick check
	212	Wire inching
	213	Wire retract
Welding condition output	0-3	Welding current
	0-4	Welding voltage
Output during operation		Contact output that closes in [PLAY] mode.
Hold output		Contact output that closes in Hold mode and Emergency stop mode.
Mode 1 output		Contact output that closes in origin returnable mode and during origin returning.
Emergency stop output		Contact output that opens in emergency stop mode.
Mode 2 output		Contact output that closes in case an error occurs during operation.
Speed signal		Speed output for HA power source
Status output	Selectable	Contact output that closes to be able to select origin return mode, teaching mode, and operation mode.
	Origin search	Contact output that closes when the origin search is finished.
	Teaching	Contact output that closes when the teaching mode is selected.
	Operation	Contact output that closes when the operation mode is selected.
Job select response	1	Output of response to the external jig when a job is reserved externally.
	2	
	4	
	8	
	16	
	32	
	64	
Strobe		

(4) Equivalent circuit of output terminal



- * + 24V must be stabilized by a capacitor.
- * Use the relay (CR) of 24VDC and connect the noise absorption diode (100V, 1A)

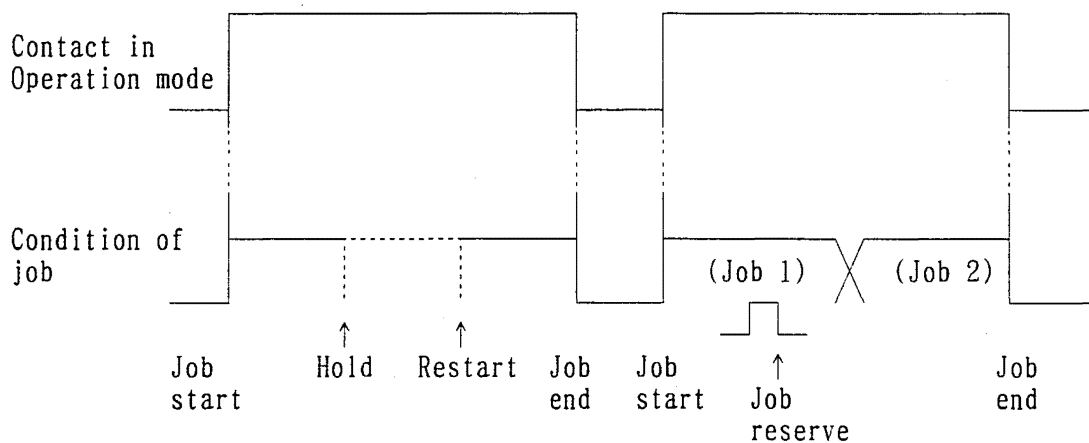
(5) Analog terminal equivalent circuit



Applied voltage must be below 24VDC.
Output impedance: 2.2 k ohm

(6) Specification of contact output "OPERATION"

Closes during job execution (closes also during Hold mode. The contact output keeps ON during Job reserve).



(7) Output state in Hold mode and Restart mode

- The output 0-0, 0-3, 0-4 and 0-5 can be reset by the HOLD SW of the panel or by [HOLD INPUT] externally and can be set by the [START] key of the panel or by an external [RESTART] key. The output 0-6 cannot be reset during the Hold mode.
- The output is reset when the [E.STOP] button is pressed or when an alarm is given.
- The output is reset by cancelling the emergency stop mode (operation 8.)
- The output is reset when the operation mode is finished.

(8) [SELECTABLE] output of the status output

- Closes after the robot returns to the origin.

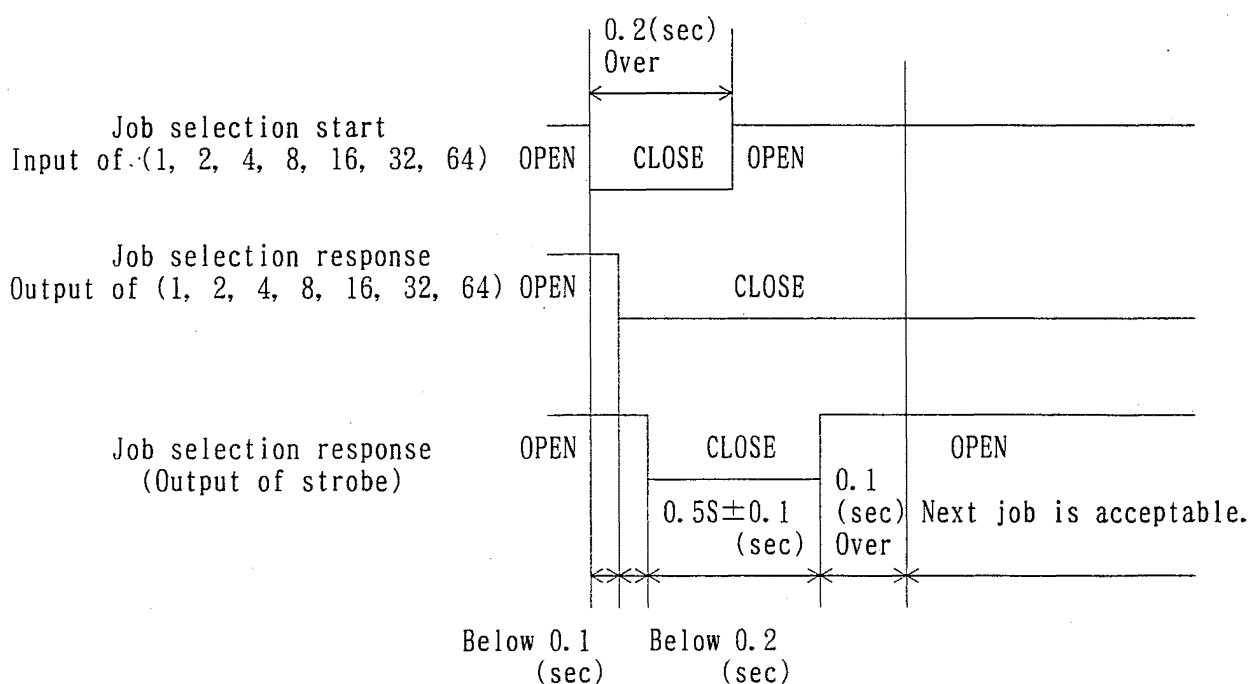
In this case, [TEACHING] mode of the input or the [PLAY] input can be accepted.

(9) There is no difference in priority between the mode selection by the

status input and the mode selection by the panel operation. The robot can be operated by either mode or operation.

(10) Interlock is valid for both the mode selection by the status input and the mode selection by the panel operation.

(11) Timing of output for job selection response.



○ Lock operation

[INPUT/OUTPUT] : General purpose external input/output do not operate, but the welding input/output operates.

[ARC] : Input/output dedicated for welding does not operate.

[ROBOT] : General purpose input/output can be verified without moving the robot. Assuming that the robot is operating, the output is given of the input accepted after the robot moving time is over.

No.	Method of operation	Response of display
1	Press the F1 [PLAN COND.] key.	
2	Use the cursor key ↓ and move the cursor to the input/output.	
3	Use the cursor keys → ← and move the cursor to the content to the lock to be set.	
4	Press the STORE key.	
5	Press the END key of the panel.	

NOTE: When the [WELD STORE] lamp of the teaching pendant is turned on, [ARC] is automatically set.

CHAPTER 5

Teaching Coordinate System

In this chapter, operations of the teaching coordinate system in the teaching mode will be described.

Read through this part so that you have full understanding of your PANA ROBO and effectively use the coordinate systems ([articulation coordinate system], [cylindrical coordinate system], [Cartesian coordinate system], [user coordinate system] and [tool coordinate system]).

Teaching coordinate

• Articulation (link) coordinate system	Rotation of each axis of the robot
• Cylindrical coordinate system	Cylindrical coordinate system fixed on the robot
• Cartesian coordinate system	Cylindrical coordinate system intersecting with the robot at right angle
• User coordinate system	Coordinate system given to a workpiece for robot welding
• Tool coordinate system	Cartesian coordinate system given to a tool to be mounted in order of robot welding procedures

Operation 35 : Selection of Coordinate System

In this operation, the **TEACH COORDINATE SYSTEM** key of the teaching pendant is used to select the coordinate system.

Operation 36 : Movement of ARTI (Linked) Coordinate System

In this operation, the COORDINATE SYSTEM

teaching pendant is used to turn on the

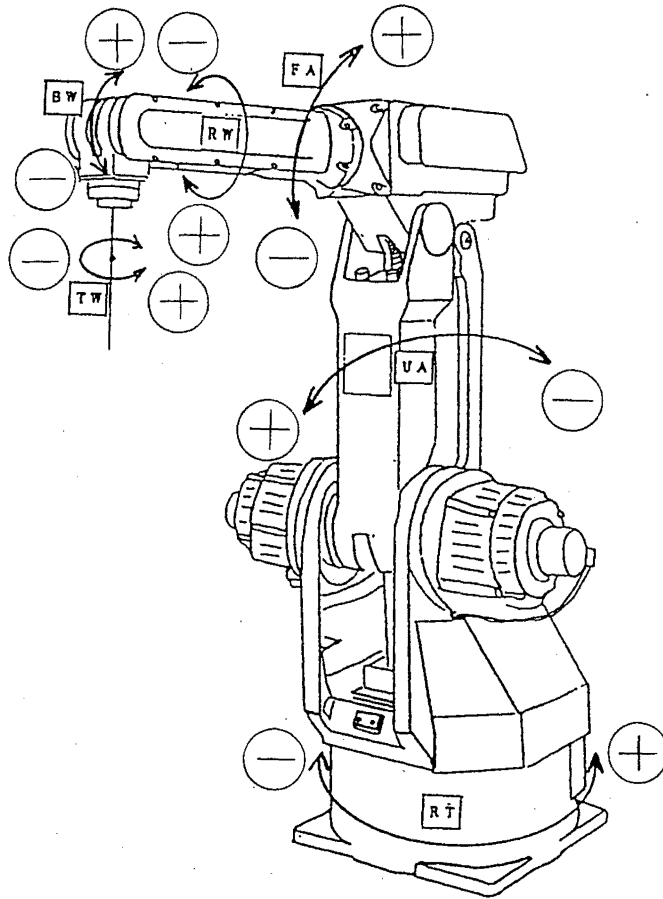
[ARTI] lamp.



key of the

	Operation keys	Name of axis	Movement
Basic 3 axes	— RT + Y AUX1	RT (Rotating axis)	RT axis moves to right or left direction.
	— UA + X AUX2	UA (Upper arm)	UA axis moves forward or backward.
	— FA + Z AUX3	FA (Fore arm)	FA axis moves upward or downward.
3 wrist axes	— RW + U AUX4	RW	RW axis rotates clockwise or counterclockwise.
	— BW + V AUX5	BW	BW axis rotates clockwise or counterclockwise.
	— TW + W AUX6	TW	TW axis rotates clockwise or counterclockwise.

Press each key while pressing the ROBOT AXIS key, and the axis of which the applicable key is pressed rotates clockwise or counterclockwise respectively.

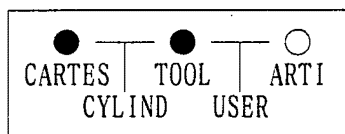


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Actuation of ARTI (Linked) Coordinate System

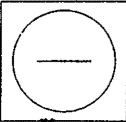
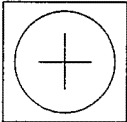
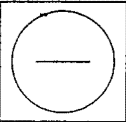
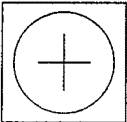
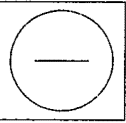
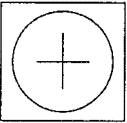
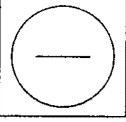
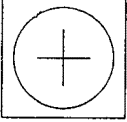
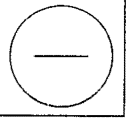
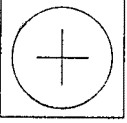
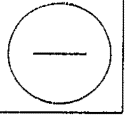
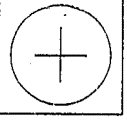
Operation 37 : Movement of Cylindrical Coordinate System

In this operation, the COORDINATE SYSTEM key of the teaching pendant is used to turn on the



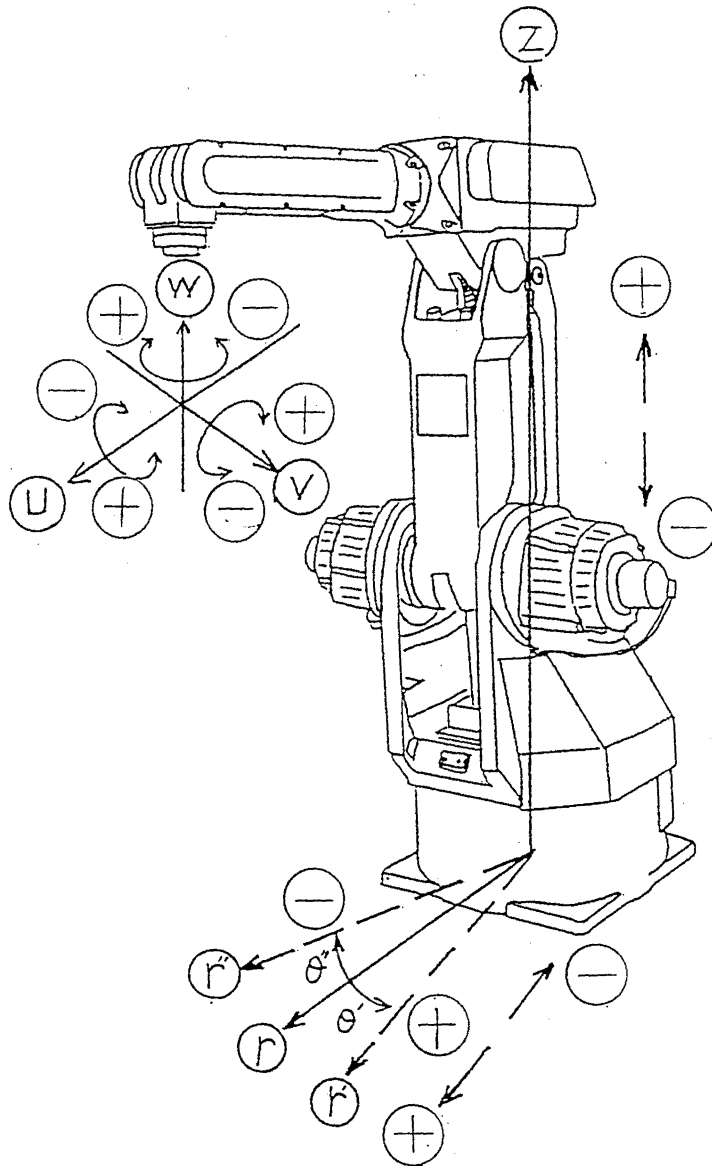
key of

[CYLIND] lamp. The diagram at right shows the [CARTES] lamp and [TOOL] lamp being turned on.

	Operation keys	Name of axis	Movement
3 Basic axes	 RT Y AUX1 	θ axis	RT axis (rotating) rotates clockwise or counterclockwise.
	 UA X AUX2 	γ axis	Moves forward and backward at right angle to the Z axis.
	 FA Z AUX3 	z axis	Moves upward or downward in parallel with the Z axis.
3 wrist axes	 RW U AUX4 	U axis	Rotates in (+) or (-) direction to the U axis.
	 BW V AUX5 	V axis	Rotates in (+) or (-) direction to the V axis.
	 TW W AUX6 	W axis	Rotates in (+) or (-) direction to the W axis.

- 3 basic axes: Cylindrical coordinate system for the robot.
- 3 wrist axes: Uses the r and z axes of the cylindrical coordinate system and the axis perpendicular to the r and z axes as a coordinate and rotates around such axes. (Operation with the fixed control point)

The θ axis operates around the RT axis, the r axis moves parallel to the UA axis, and the z axis moves parallel with the Z axis of the robot coordinate system.

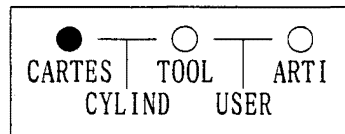


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Operations of Cylindrical Coordinate System

Operation 38 : Movement of Cartesian Coordinate System

In this operation, the COORDINATE SYSTEM key is used to turn on the [CARTES] lamp.



key is

	Operation keys	Name of axis	Movement
Basic 3 axes	— RT Y AUX1 +	Y axis	Moves to right or left in parallel with Y axis of the robot coordinate system.
	— UA X AUX2 +	X axis	Moves forward or backward in parallel with X axis of the robot coordinate system.
	— FA Z AUX3 +	Z axis	Moves upward or downward in parallel with the Z axis of the robot coordinate system.
3 wrist rotates	— RW U AUX4 +		Torch rotates in (+) or (-) directions on a cone plane. Torch angle to horizontal and control point is fixed.
	— BW V AUX5 +		Up or down with the control point fixed in a plane which includes a perpendicular axis and torch.
	— TW W AUX6 +		Rotates in (+) or (-) direction with the control point. Torch direction is fixed.

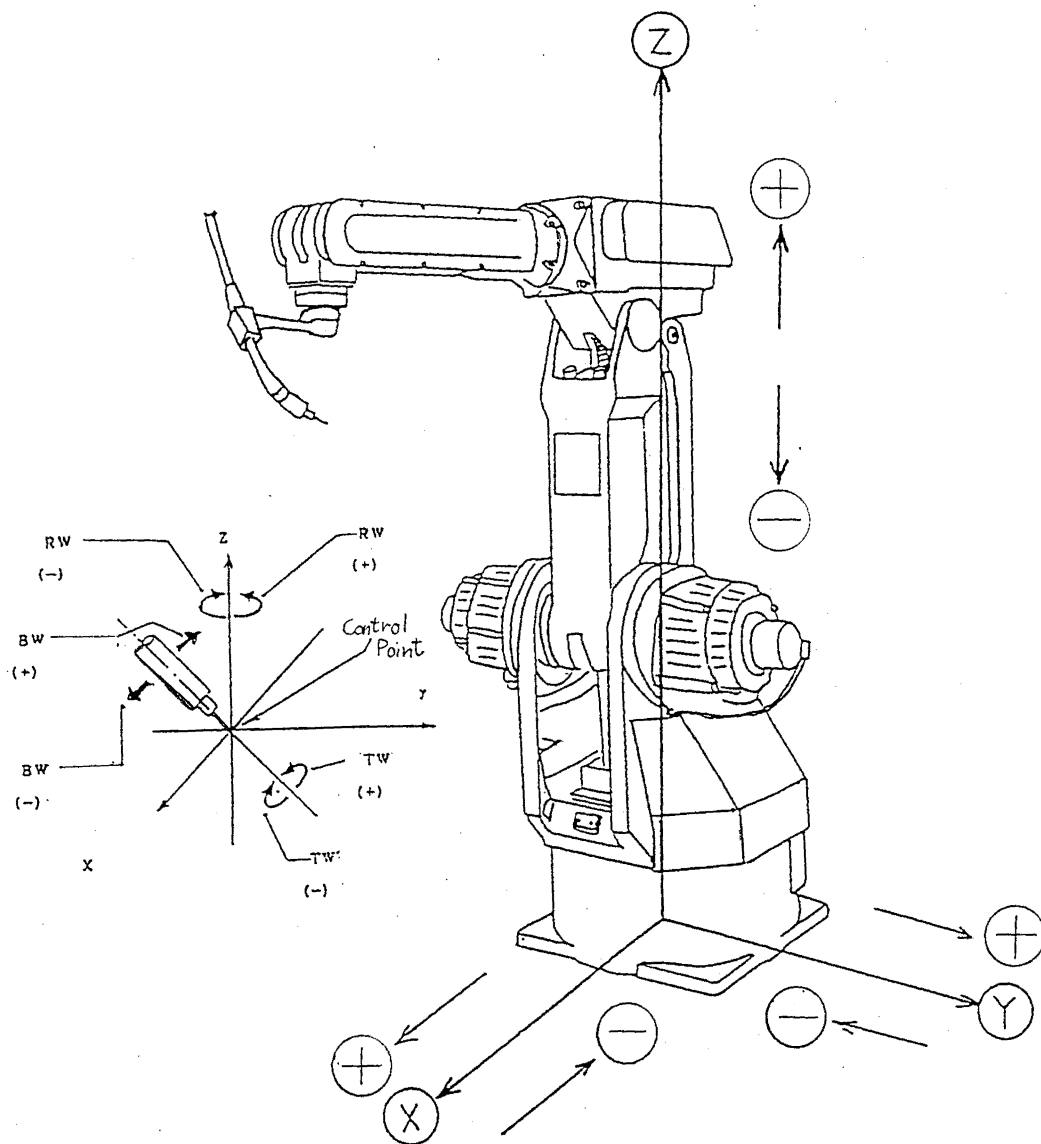
○ 3 basic axes: Movement with the cartesian coordinate system of robot

(Robot coordinate system)

○ 3 wrist axes: Uses a wrist (cartesian) coordinate system corresponding to the robot coordinate system turns round the coordinate axis of that system.

(Operation with the fixed control point)

The cartesian coordinate system moves parallel with the X axis, Y axis and Z axis of the robot coordinate system.

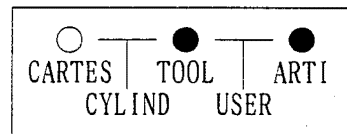


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Operation of Cartesian Coordinate

Operation 39 : Movement of User Coordinate System

In this operation, the COORDINATE SYSTEM key of the teaching pendant is used to turn on the



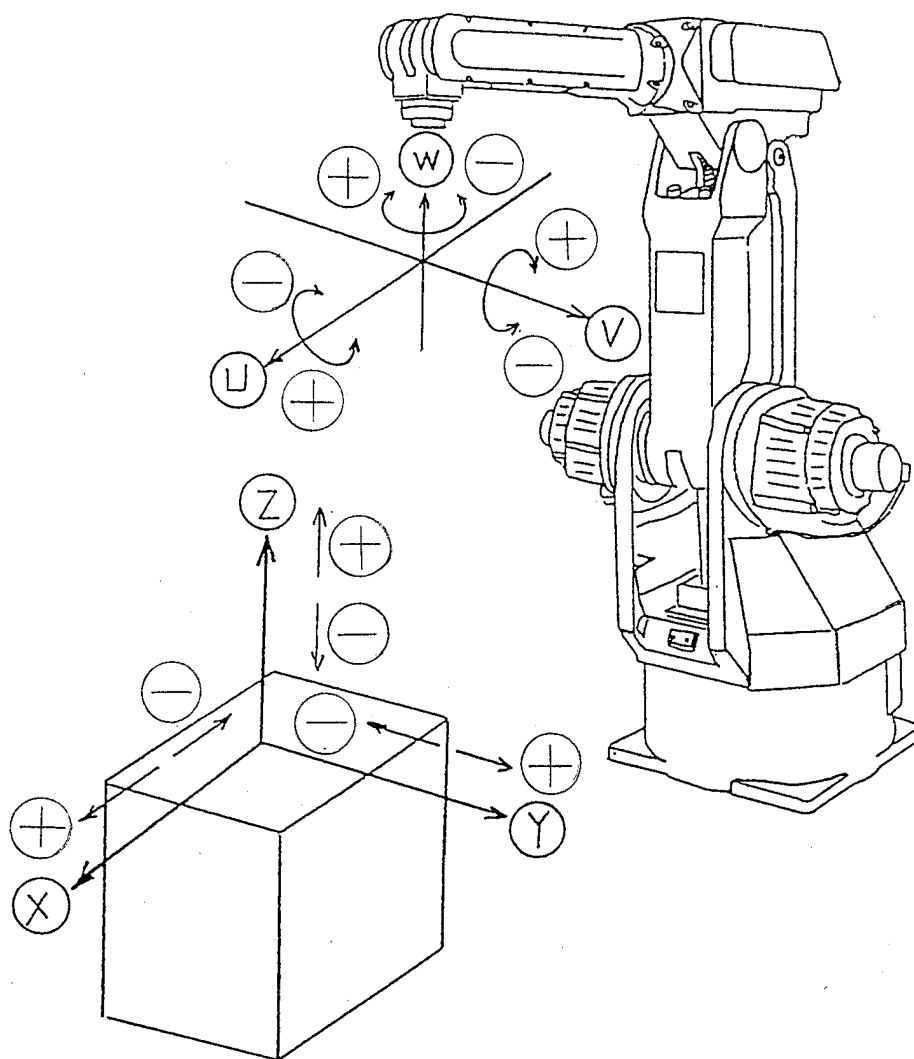
[USER] lamp. (The diagram at right shows the [TOOL] lamp and [ARTI] lamp being turned on.)

	Operation keys	Name of axis	Movement
Basic 3 axes	RT Y AUX1	Y axis	Moves to right or left in direction parallel with the Y axis of the user coordinate system.
	UA X AUX2	X axis	Moves forward or backward in parallel with the X axis of the user coordinate system.
	FA Z AUX3	Z axis	Moves upward or downward in parallel with the Z axis of the user coordinate system.
3 wrist axes	RW U AUX4	U axis	Rotates in (+) or (-) direction with the U axis.
	BW V AUX5	V axis	Rotates in (+) or (-) direction with the V axis.
	TW W AUX6	W axis	Rotates in (+) or (-) direction with the W axis.

- 3 basic axes: Movement with the designated user coordinate system.
- 3 wrist axes: Rotation round the designated user coordinate axis.

(Operation with the fixed control point)

With the user coordinate system actuation, the robot moves in parallel to each axis of the designated user coordinate system.



(AW8010)

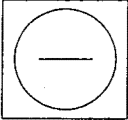
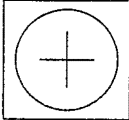
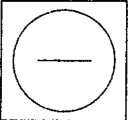
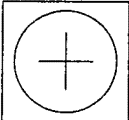
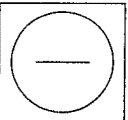
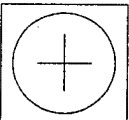
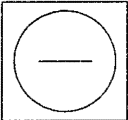
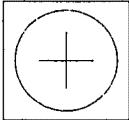
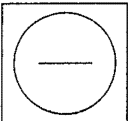
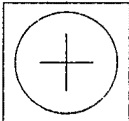
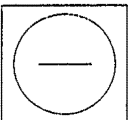
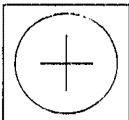
User Coordinate System

Operation 40 : Movement of Tool Coordinate System

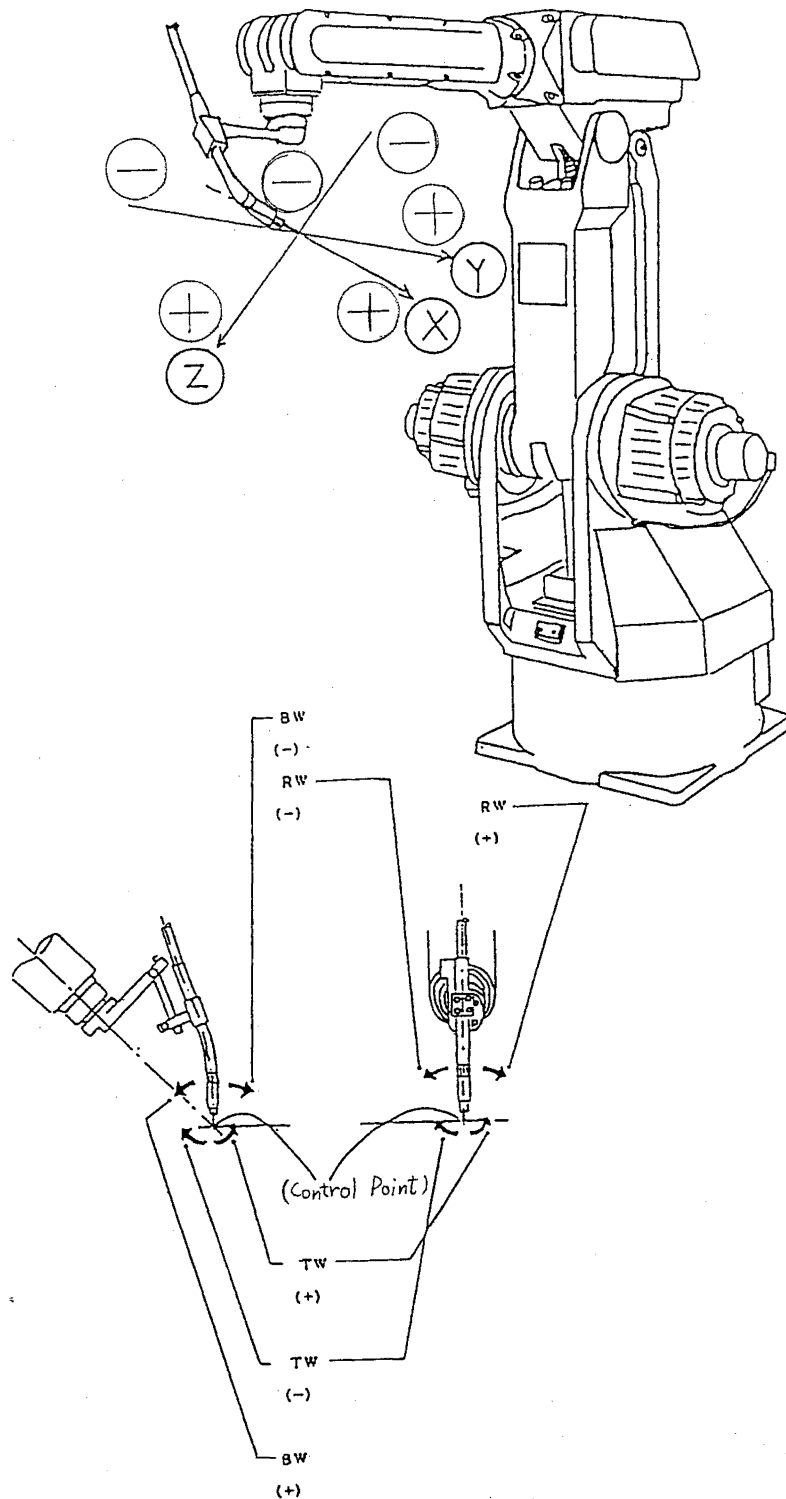
In this operation, the COORDINATE SYSTEM key of the teaching pendant is used to turn on the [TOOL] lamp.



key of

	Operation keys	Name of axis	Movement
3 basic axes	 RT Y AUX1 	Y axis	Moves parallel to the Y axis of the tool coordinate system.
	 UA X AUX2 	X axis	Moves parallel to the X axis of the tool coordinate system.
	 FA Z AUX3 	Z axis	Moves parallel to the Z axis of the tool coordinate system.
3 wrist axes	 RW U AUX4 		Rotates (+) or (-) direction with the control point which is in the vertical plane to torch direction.
	 BW V AUX5 		Up or down with the control point which is in the vertical plane to torch direction.
	 TW W AUX6 		Rotates (+) or (-) round the torch direction, with the fixed control point.

○ Tool coordinate System



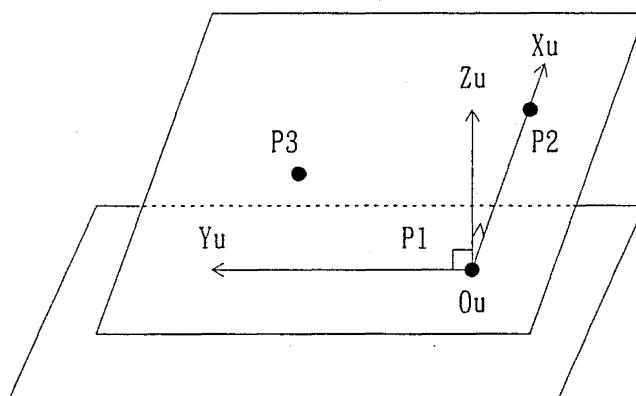
(AW8010)

Tool Coordinate System Operation

Operation 41 : Definition and Setting of Tool and User Coordinate System

(1) Definition of user coordinate system

In addition to the standard coordinate system (Cartesian, Cylindrical, Articulated), the user coordinate system is a coordinate system which can give a workpiece as a reference. This is freely defined by user. The user coordinate system can be set up to a maximum of eight kinds.



Use these P_1 , P_2 , P_3 with the MDI and enter the data directly or enter the data while teaching the robot through the teaching pendant.

(1) P_1 : Position of origin of user coordinate system (O_u)

P_2 : Point on the X axis of user coordinate system

P_3 : Point indicating the Y axis direction of user coordinate system

(On the X_u - Y_u plane)

Y_u axis: On X_u - Y_u plane vertical to X_u axis.

Z_u axis: Vertical to X_u - Y_u plane (Right hand system)

(2) Definition of tool coordinate system

The tool coordinate is a coordinate system given to the tool mounted on the wrist flange of the robot body and is defined by the position (shape) of the applicable tool. Since the position of the robot is not sensed in the tool coordinate system but the robot is moved based on the tool, the tool coordinate system is suitable in cases where the robot is moved parallel while maintaining the tool position.

This robot is designed to control so that the torch tip is interpolated. (In other words, the robot moves in a manner so that the torch tip interpolates the straight line or circular to achieve a constant line speed.)

Therefore, if the torch is installed, measure the correct dimensions shown in the diagram below and enter the measurements into the control unit as the system setting data. Values shown in the table below are entered into the controller as the standard values before shipment from our plant.

	Shipping condition	Maximum value restricted by accuracy
L1	420	600
L2	0	100
L3	385	—
TW	-20	—

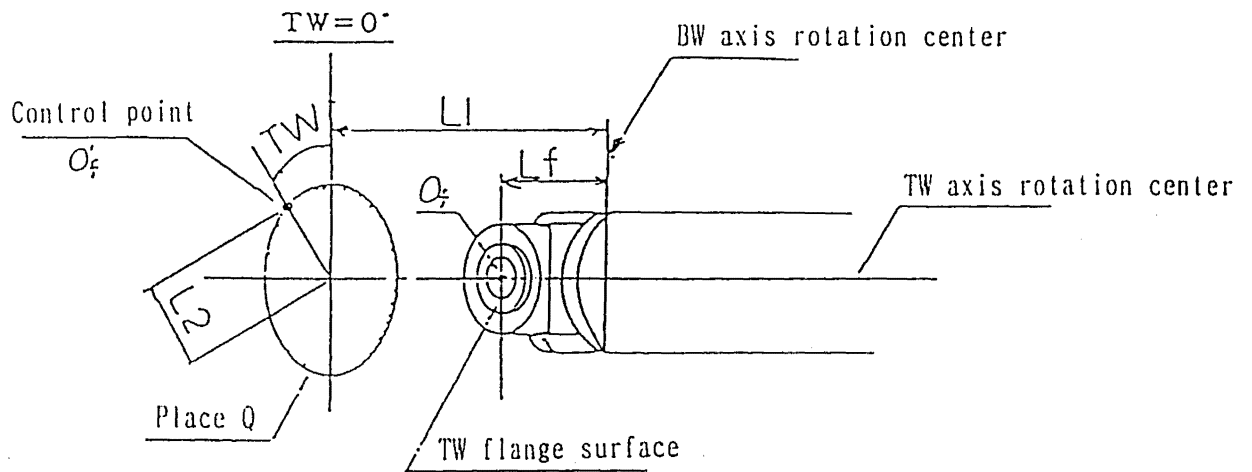
① Definition of control point

The control point is used to move the origin O_F of the tool coordinate system at the center of the TW axis to O_F' .

The control point is defined by L 1mm, L 2mm and angle TW.

The origin O_F' becomes the origin (control point) of the new tool coordinate system.

Definition of origin (control point O_F') of tool coordinate system.



Model	Lf [mm]
AW8010	130
AW8006	

Place Q : The plane that includes the control point and is parallel to the TW axis flange surface. (Setting parameters)

- L_1 : Distance from BW axis rotation center to the plane Q.
- L_2 : Distance from control point to TW axis rotation center.
- TW: Angle of rotation based on 0° of TW axis.
- L_3 : Distance from O'_F to the point intersecting TW flange surface and tool extension line.

Use the [MDI] key for entering data for setting.

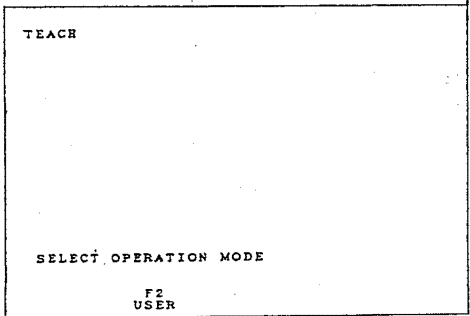
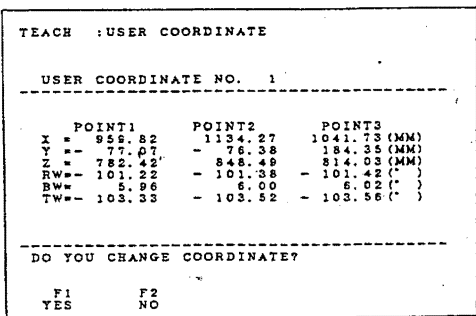
Operation 42 : Setting of Tool Coordinate System

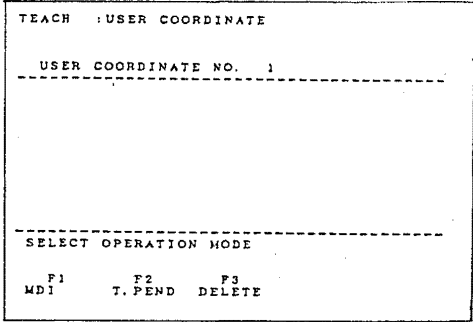
This operation mode is used to define the dimensions related to the tool (torch) to be mounted on the wrist of the robot.

No.	Method of operation	Response of display
0	This operation is used to select the operation mode (initial display).	
1	Press the F5 [NEXT KEY] key.	
2	Press the F4 [INITIAL SETUP] key.	
3	Press the F4 [ROBOT OFFSET] key.	
4	Use cursor keys ↑ ↓ ← → to move the blinking key to "2. TOOL OFFSET".	
5	Press the STORE key.	
6	Enter the values L1, L2, L3 and TW. For the standard torch, press the F1 [STANDARD] key to enter the standard value.	
7	Press the STORE key.	
8	When the setting is over, press the F4 [SETUP FINISHED] key.	
9	Press the END key.	The display returns to the initial display of the system setting.

Operation 43 : Setting of User Coordinate System

With this operation, a maximum of eight kinds of user coordinate system can be set.

No.	Method of operation	Response of display
0	This operation is used to start the teaching mode.	
1	Press the F4 [COORDINAE SYSTEM] key. F2 [USER] key is used to set the user coordinate system (2).	
2	Press the F2 [USER] key.	
3	Enter the number of the coordinate system to be set. If the coordinate system is already registered and if a change is to be made by inquiring the robot, press the F1 key and verify the robot operation before making the change. F1 [YES] F2 [NO] (* When making a new registration, the verification work is omitted.)	

No.	Method of operation	Response of display
4	Select the setting method. Use the F1 [MDI] key of the operation panel to enter data directly. Use the F2 [TEACH PENDANT] key of teaching pendant. Use the F3 [DEL] key for deleting the set data. Press either of the F1 ~ F3 keys and select the method used for setting data. Setting methods are stated in the Setting of tool coordinate system and the Operation of user coordinate system.	
5	After the setting is finished, press the END key.	

NOTE: To enter the standard values, in case 255 programs are registered, the user coordinate system cannot be registered. In such a case, delete one unnecessary program.

In the case of option, if 999 programs are resistered, the user coordinate system cannot be registered as in the case of the standard values. In such as case, delete one unnecessary program.

Enter the setting of P_1 , P_2 , and P_3 explained in the definition of "(1) User coordinate system" under the Operation 41.

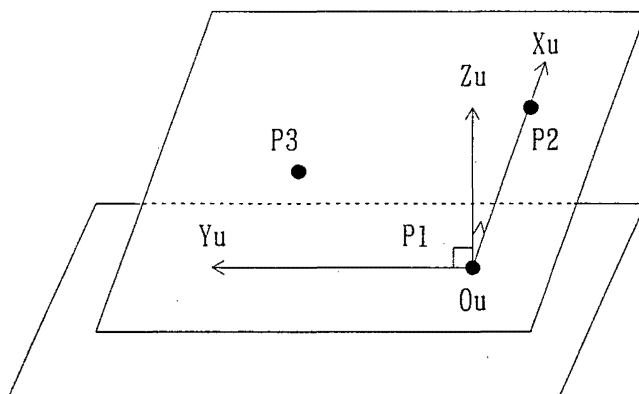
- (a) If the [MDI] key (coordinate data entry from operation panel) is selected for setting.

TEACH USER COORDINATE			
USER COORDINATE NO. 1			

POINT1	POINT2	POINT3	
X = 959.82	1134.27	1041.73 (MM)	
Y = - 77.07	- 76.38	184.35 (MM)	
Z = 782.42	848.49	814.03 (MM)	
RW = - 101.22	- 101.38	- 101.42 (")	
BW = 5.80	8.00	6.02 (")	
TW = 103.33	- 103.52	- 103.56 (")	

INPUT NUMBER			
F4 SETTING END			

Enter data directly into the points 1, 2 and 3.



Point 1: Origin (O_u)

Point 2: Point on X axis

Point 3: Point indicated by
the Y axis direction

Enter the value and press the F4 [SETUP FINISHED] key.

(b) If the [T. PENDANT] key is selected for setting.

Use the teaching pendant to enter the points 1, 2, 3. (Points can be resigered by using the [STORE] key of the teaching pendant.) When the setting is finished, press the [END] key.

(c) If the F3 [DEL] key is selected:

TEACH : USER COORDINATE			
USER COORDINATE NO. 1			

	POINT1	POINT2	POINT3
X =	959.82	1134.27	1041.73 (MM)
Y =	77.07	- 76.38	184.38 (MM)
Z =	782.42	- 848.48	814.03 (MM)
RW=	101.22	- 101.38	- 101.42 (°)
BW=	5.98	8.00	8.02 (°)
TW=	103.33	- 103.82	- 103.86 (°)

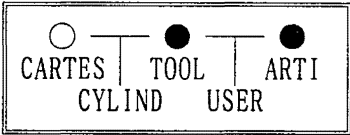
PRESS STORE KEY IF DELETION REQUIRED			
F1			
CANCEL			

To delete the data, press the [STORE] key.

To cancel the data, press the F1 [DEL] key.

Operation 44 : Selective Operation of User Coordinate System

In this operation, the coordinate system is changed to the user coordinate system during play or teaching. Coordinate systems can be selected from eight kind systems.

No.	Method of operation	Response of display
0	Select an operation which can be achieved by the teaching pendant or select the teaching mode.	
1	Press the [TEACH OK] key of the teaching pendant.	
2	Press the [COORDINATE SYSTEM] key and select the user coordinate system.	[TEACH OK] lamp : ● → ○ OFF ON
3	Press the [ROBOT AXIS] key while pressing the [MENU SELECT] key, and the teaching pendant shows [U 0].	
4	Then, press the [ROBOT AXIS] key to select the number of the user coordinate system. When the [ROBOT AXIS] key is pressed, the displays change as follows. <pre> [U 0] ↓ [U 1]: User coordinate system No.1 ↓ [U 2]: User coordinate system No.2 ↓ [U 8]: User coordinate system No.8 </pre>	
5	When operations are performed in the manual mode, the operation of the selected user coordinate system becomes operable.	

NOTE: When an undefined user coordinate system is selected and operated in the manual mode, the operation of the cartesian coordinate becomes operable.

ЧАСТИНА 6

Опис команд

Команди, які використовує PANA ROBO, пояснюються в цьому розділі. Зберігаючи команди в порядку виконання робіт, ви можете змусити свого робота виконувати певні роботи.

Необхідно, щоб ви повністю розуміли зв'язок команд і рухів робота.

Data Structure and Name of Pana Robo

In order to make your robot perform welding works, you must store various data into the robot. At first data structure will be explained.

- Job : A unit used to execute the robot work.

Jobs are controlled by the job number (maximum of 127 kind jobs).

Job constructions are as shown below.

[JOB NO. 1]	=	1	(Program call) or (Sequence command)
[JOB NO. 2]	=	2	(Program call) or (Sequence command)
[JOB NO. 3]	=		
		9 9 9	(Program call) or (Sequence command)

↑

Address No.
(Max. 999)

↑

Commands

NOTE: Job number entries are permitted from 1 through 999, but the maximum
number of job that can be registered is 127.

When additional memories are connected, up to a maximum of 999 jobs can be registered.

- Program : Programs are generated by each teaching.

Programs are controlled by the program number (maximum of 255 programs). Constructions of programs are as shown below.

[JOB NO. 1]	=	0	Move command			}	Max. 99 commands		
				1	Move command			1	Sequence command
								2	Sequence command
									
								9 9	Sequence command
[JOB NO. 2]	=	2	Move command	1	Sequence command	}	Max. 99 commands		
				2	Sequence command				
									
				9 9	Sequence command				
									
[JOB NO. 999]	=	9 9 9	Move command	1	Sequence command	}	Max. 99 commands		
				2	Sequence command				
									
				9 9	Sequence command				
									

↑
Step No.
(Max. 99)=
Teaching
point No.

↑
Command

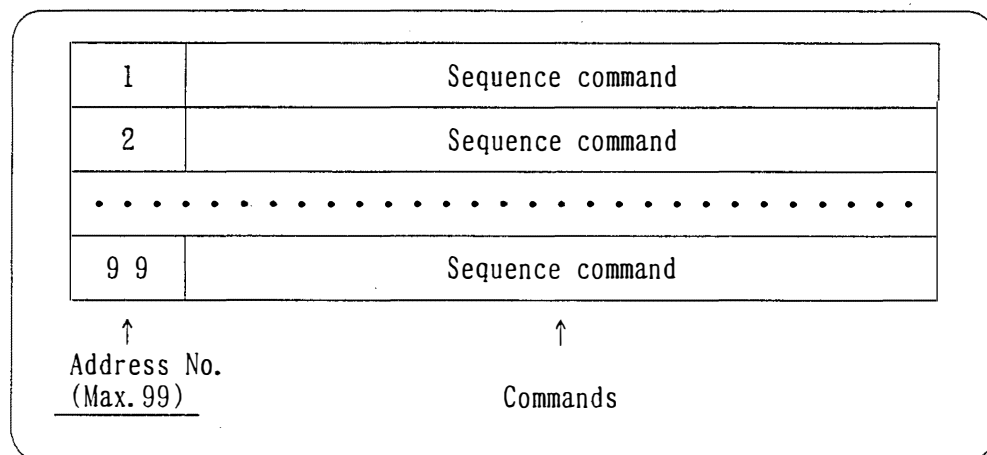
↑
Address
(Max. 99 programs
of each step)

↑
Command

NOTE: Program number entries are permitted from 1 through 999 but the maximum number of program that can be registered is 255.

When additional memories are connected, up to a maximum of 999 programs can be registered.

- ```
[LIBRARY]served
(Reserved sequence 1) =
[LIBRARY]served
(Reserved sequence 2) =
 .
 .
 .
 .
 .
[LIBRARY]served
(Reserved sequence 99)=
```



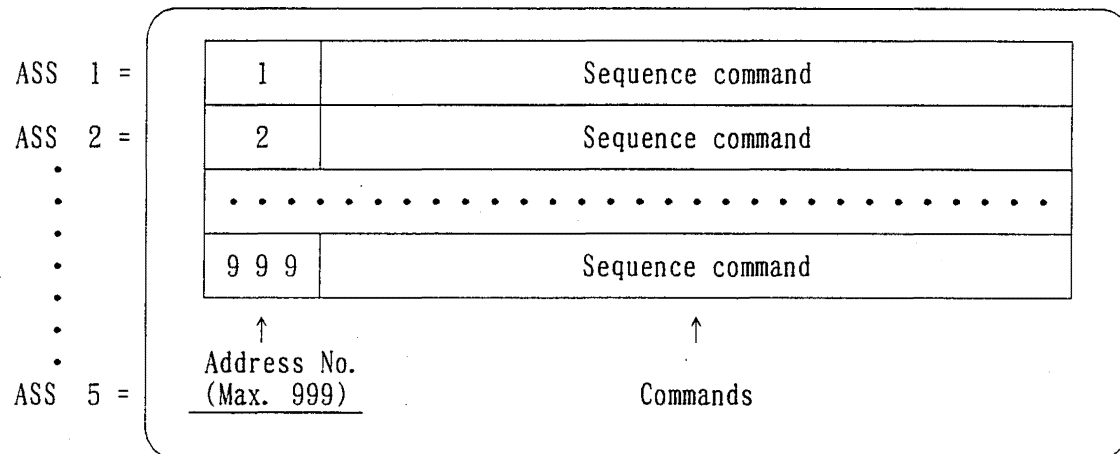
○ Режими зварювання: зварювальний струм і напруга для початкової точки зварювання і точки проходу:  
Режими зварювання контролюються кількістю (п'ять видів) AJO зарезервованої таблиці в системних налаштуваннях.

○ Умови зварювання  
кратерів:

Струм і напруга кінцевої точки зварювання:

Умови зварювання кратерів контролюються кількістю (п'ять видів) CJO зарезервованої таблиці в системних налаштуваннях.

- The ASS SEQ. or the welding starting sequence is controlled by the welding starting sequence number (ASS1 to ASS5: maximum of five kinds). Constructions of the ASS SEQ. are as shown below.



- |       |                  |
|-------|------------------|
| 1     | Sequence command |
| 2     | Sequence command |
| ..... |                  |
| 9 9 9 | Sequence command |
- ↑

Address No.

(Max. 999)

↑

Commands

● Name of data to be generated:

- JOB NO. .... Displayed by 1 to 999. (Maximum of 127)

The job number is used as the data of the unit of the work to be performed by the robot and is configured by more than one program or sequence command. One job can call a maximum of 999 programs or register a maximum of 999 sequence commands.

- ADDRESS NO. .... Displayed by 1 to 999.

The address number is used as the registration sequence of the commands that comprise the work unit, and can be registered from the address number 1 through 999 for one job and from the address number from one through 99 for one teaching point in a program.

- PROGRAM NO. .... Designated by 1 to 999. (Maximum of 255)

The program number is given as a batch of a command group consisted of teaching points and sequence commands and used as the unit for generation and correction of data. One program has a maximum of 999 teaching points (steps).

- TEACHING POINT NO. .... Displayed by 1 to 999.

The teaching point number is used as the execution sequence of the registered point. One teaching point (step) can register a maximum of 99 sequence commands.

- SEQ. COM. NO. (Sequence No.) .... Displayed by 1 to 99.

The sequence number is used as the sequence to execute the operation command (sequence command) and is given by a teaching point and a reserved sequence number.

○ SEQUENCE COMMAND.

The sequence command is a coded command for execution to or from the robot.

○ LIBRARY NO. .... Designated by 1 to 99.

Groups of commands frequently used are registered as the reserved sequence (LIBRARY) to simplify repeated use. The group of the reserved sequence registered is called the reserved sequence number (LIBRARY NO.). One reserved sequence can register a maximum of 99 sequence commands.

○ WELD COND. NO./CRATER WELD COND. NO. .... Designated by 1 to 5 for each conditions.

These conditions are used to register only the welding current and the welding voltage for simplified operations. These conditions are used as the dedicated reserve command.

○ ASS SEQ. NO./AES SEQ. NO. .... Designated by 1 to 5 for each number.

These numbers represent the welding starting and welding ending sequences in particular among the reserve sequences and are used as dedicated sequences. One welding starting sequence (ASS SEQ.)/welding ending sequence (AES SEQ.) can register a maximum of 999 sequence commands.

## Commands Used by Pana Robo

In order to make your robot perform certain welding works, you must teach your robot where to start the welding, how to set the welding conditions, and where the welding is to be ended.

The contents of the robot works are expressed in the form of [command] of certain code and stored in the robot. The robot executes the command in the stored sequences.

### 1. Configuration of commands

Commands of your Pana Robo are configured with four parts: [COMMAND CODE PART (OPERATION CODE)], [DESIGNATED PART 1 (OPERAND 1)], [DESIGNATED PART 2 (OPERAND 2)], and [DESIGNATED PART 3 (OPERAND 3)].

| Commands of Pana Robo                 |                                  |                                  |                                  |
|---------------------------------------|----------------------------------|----------------------------------|----------------------------------|
| COMMAND CODE PART<br>(OPERATION CODE) | DESIGNATED PART 1<br>(OPERAND 1) | DESIGNATED PART 2<br>(OPERAND 2) | DESIGNATED PART 3<br>(OPERAND 3) |

The command configurations are as above, but it is not necessary to memorize them for entering commands for actual operations.

The following are examples of the sequence of key operations.

- (1) 

|                       |
|-----------------------|
| COMMAND CODE PART KEY |
|-----------------------|

|                       |
|-----------------------|
| DESIGNATED PART 1 KEY |
|-----------------------|

|                       |
|-----------------------|
| DESIGNATED PART 2 KEY |
|-----------------------|

|       |
|-------|
| STORE |
|-------|

  
(Input sequences such as command H-2, command H-4, command J-4 and command J-7 )
- (2) 

|                       |
|-----------------------|
| COMMAND CODE PART KEY |
|-----------------------|

|                       |
|-----------------------|
| DESIGNATED PART 1 KEY |
|-----------------------|

|       |
|-------|
| STORE |
|-------|

  
(Input sequences such as command O-0, command H-0, command J-0 and command L-0 and command R-1)
- (3) 

|                       |
|-----------------------|
| COMMAND CODE PART KEY |
|-----------------------|

|       |
|-------|
| STORE |
|-------|

  
(Input sequences of command J-H, command U-0 and command F-1)

## Move Command

The move command is used to move the robot at the designated speed.

Move commands are automatically registered by pressing the [STORE] key or the [WELD STORE] key of the teaching pendant in the [TEACH] mode.

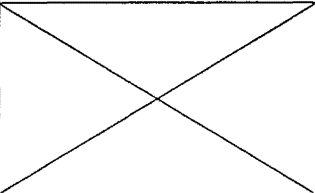
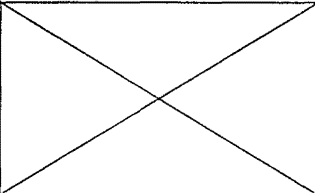
NOTE: Codes that are registered change as show in the list below according the combinations of the [PATH] key and the [STORE] and [WELD STORE] keys of the teaching box.

| Move commands | Meanings                                                                                           |
|---------------|----------------------------------------------------------------------------------------------------|
| T - 0         | PTP , Non-welding point<br>PTP , Welding ending point                                              |
| T • 0         | PTP , Welding starting point<br>PTP , Welding progress point                                       |
| A - 0         | Straight line, Non-welding point<br>Straight line, Welding ending point                            |
| A • 0         | Straight line, Welding starting point<br>Straight line, Welding progress point                     |
| C - 0         | Circular mid point, Non-welding point<br>Circular mid point, Welding ending point                  |
| C - S         | Circular starting, Non-welding point<br>Circular starting, Welding starting point                  |
| C - E         | Circular ending, Non-welding point<br>Circular ending, Welding ending point                        |
| C • 0         | Circular mid point, Welding progress point<br>Circular mid point, Welding starting point           |
| C • S         | Circular starting point, Welding progress point<br>Circular starting point, Welding starting point |
| C • E         | Circular ending point, Welding progress point<br>Circular ending point, Welding starting point     |

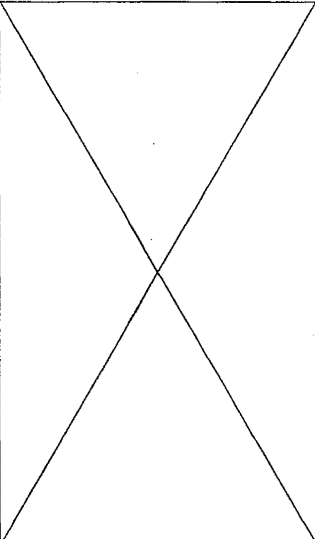
| Move commands                | Meanings                                                                                 |
|------------------------------|------------------------------------------------------------------------------------------|
| B - S<br>(Note 1)            | Weaving starting, Non-welding point<br>Weaving starting, Welding ending point            |
| B - E                        | Weaving ending, Non-welding point<br>Weaving ending, Welding ending point                |
| B • S<br>(Note 1)            | Weaving starting, Welding progress point<br>Weaving starting, Welding starting point     |
| B • E                        | Weaving ending, Welding progress point<br>Weaving ending, Welding starting point         |
| B - 1<br>(B • 1)<br>(Note 2) | Weaving amplitude                                                                        |
| B - 2<br>(B • 2)<br>(Note 3) | Weaving amplitude                                                                        |
| D • S                        | Circular weaving starting, Welding progress point<br>Welding starting point              |
| D • 1<br>(D-1)<br>(Note 5)   | Circular weaving amplitude                                                               |
| D • 2<br>(D-2)<br>(Note 5)   | Circular weaving amplitude                                                               |
| D • 0                        | Circular mid point of circular arc weaving                                               |
| D • E                        | Circular weaving ending, Welding progress point<br>Welding starting point                |
| D - S                        | Circular weaving starting, Non-welding point<br>Welding ending point                     |
| D - 0                        | Circular mid point of circular arc weaving,<br>Non-welding point<br>Welding ending point |
| D - E                        | Circular weaving ending, Non-welding point<br>Welding ending point                       |



(Note 1) Description type of weaving

| Pattern No<br>Move command | 1 , 6                                                                             | 2 , 3                                                                              | 4 , 5                                    |
|----------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------|
| Weaving starting           | B • S [Pattern No.]<br>(B-S) [Frequency]                                          | B • S [Pattern No.]<br>(B-S) [Frequency]<br>[Timer:T0]                             | B • S [Pattern No.]<br>(B-S) [Frequency] |
| Weaving amplitude          | B • 1 [Timer:T1]<br>(B-1)                                                         | B • 1 [Timer:T1]<br>(B-1)                                                          | B • 1 [Timer:T1]<br>(B-1)                |
|                            | B • 2 [Timer:T2]<br>(B-2)                                                         | B • 2 [Timer:T2]<br>(B-2)                                                          | B • 1 [Timer:T2]<br>(B-1)                |
|                            |  |  | B • 1 [Timer:T3]<br>(B-1)                |
|                            |                                                                                   |                                                                                    | B • 2 [Timer:T4]<br>(B-2)                |
| Weaving ending             | B • E<br>(B-E)                                                                    | B • E<br>(B-E)                                                                     | B • E<br>(B-E)                           |

(Note 2) Description type of circular weaving

| Pattern No<br>Move command             | 2                                | 1, 3, 4, 5, 6                                                                        |
|----------------------------------------|----------------------------------|--------------------------------------------------------------------------------------|
| Circular weaving starting              | D • S [2 : pattern No.]<br>(D-S) |  |
| Circular weaving amplitude             | D • 1<br>(D • 1)                 |                                                                                      |
|                                        | D • 2<br>(D • 2)                 |                                                                                      |
| Circular mid point of circular weaving | D • 0<br>(D • 0)                 |                                                                                      |
| Circular weaving ending                | D • E<br>(D-E)                   |                                                                                      |

(Note 3) Only the pattern No.2 applies for the circular weaving

(Note 4) Non-welding point is valid when the mark [•] is replaced with the mark [-].

(Note 5) The type of D • S [Frequency] is valid. Timer cannot be used for the circular weaving.

## Output Command

The output command is used for the robot to send signals to operate other units. The standard output terminals are numbered from 1 through 16.

These numbers represent the commands that turn ON or OFF the output terminals.

### ◎ General purpose output terminal command (ON-OFF)

| Command        |                     |                      |                 | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|---------------------|----------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1           | Operand 2            | Operand 3       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0 - 0          | Output terminal No. |                      |                 | Designated output terminal: ON<br>(Note) Terminal is turned OFF by pressing the HOLD key or the EMS. STOP key, but can be turned ON by pressing the RESTART key.                                                                                                                                                                                                                                                                                                                             |
| 0 - 1          | Output terminal No. |                      |                 | Designated output terminal: OFF                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 0 - 5          | Output terminal No. | Contents of register | Register number | When executing, if the designated register number is the designated value, the designated output terminal is turned ON. If not, the output terminal is ignored.<br>(Note) Terminal is turned OFF by pressing the HOLD key or the EMG. STOP key, but can be turned ON by pressing the RESTART key.                                                                                                                                                                                            |
| 0 - 6          | Output terminal No. |                      |                 | Contents are the same as those of the operation code "0-0". But the terminal does not turn OFF in this case, by pressing the HOLD key.<br>(Note) • Terminal turns OFF with the EMG. STOP key but turns ON upon pressing the servo power push button before pressing the RESTART key.<br>• This command is executed during the verification.<br>(The command is also executed even during the verification run after the address search.)                                                     |
| 0 - 7          | Output terminal No. | Contents of register | Register number | Contents are the same as those of the operation code "0-5". But the terminal does not turn OFF in this case, by pressing the HOLD key.<br>(Note) • Terminal turns OFF with the EMG. STOP key but turns ON upon pressing the servo power push button before pressing the RESTART key.<br>• When the register count is the designated value, the terminal turns ON even during the verification run. (The command is also executed even during the verification run after the address search.) |

## Wait Command

The wait command is used for the robot to stop its operation and waits until the designated conditions are satisfied.

| Command        |                |           |           | Contents                                                                                                                                                              |
|----------------|----------------|-----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1      | Operand 2 | Operand 3 |                                                                                                                                                                       |
| H - 0          | Input terminal |           |           | Robot stops until the designated input terminal turns ON.                                                                                                             |
| H - 1          | Time           |           |           | Robot stops for the designated time. The [TIME] can be designated from 1=0.1 second to 999=99.9 seconds.                                                              |
| H - 2          | Input terminal | Count     |           | Robot stops until the designated port number turns ON for the designated number of times.                                                                             |
| H - 3          |                |           |           | Corner out command                                                                                                                                                    |
| H - 4          | Input terminal | Time      |           | Robot waits until the designated input terminal turns ON or the designated time has elapsed. The [TIME] can be designated from 1=(0.1 second) to 999 (=99.9 seconds). |

\* Use the numbers from 1 through 16 to designate the [INPUT TERMINAL NO.].

\* Use the numbers 1(=0.1 second) through 999 (99.9 seconds) to designate the [TIME].

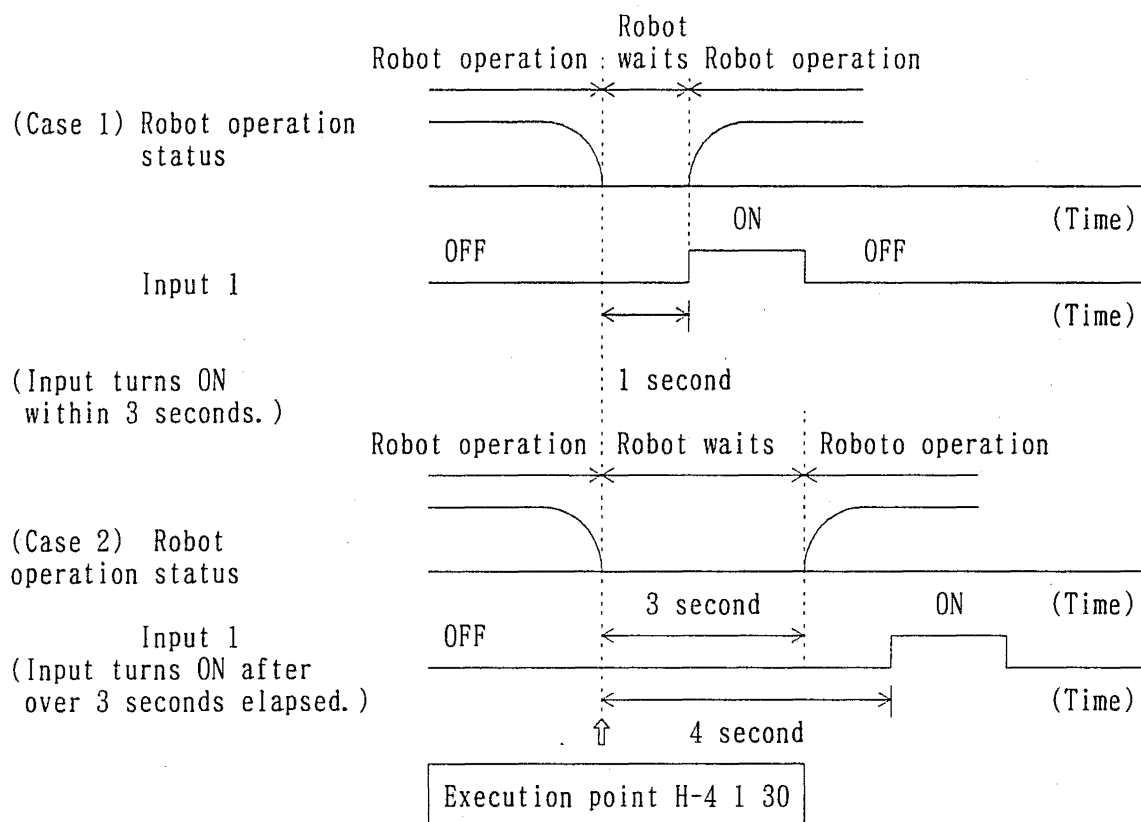
\* Use the numbers from 1 through 255 to designate [COUNT].

- ◎ [WAIT INPUT COMMAND (H-0)] is used for the robot to stop its operation and wait until the signal is entered into the designated [INDIVIDUAL INPUT TERMINAL].

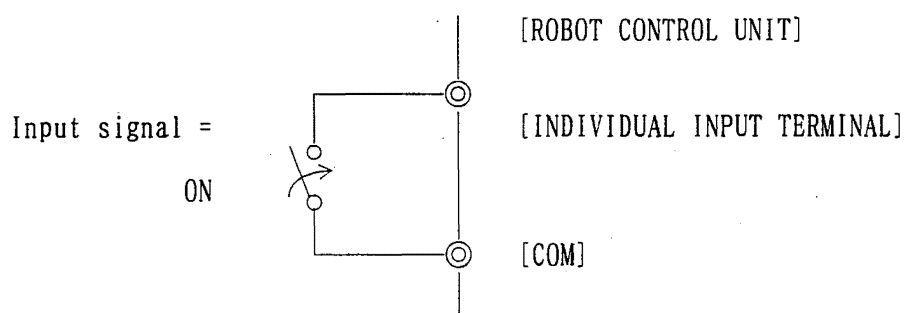
When the robot is stopped by the command H-0, the robot is not in the HOLD mode but is waiting for the signals to be entered. Therefore, go inside robot moving range only after you have pressed the EMG. STOP key.

- ◎ [WAIT TIME COMMAND (H-1)] is used to designate the robot operations, and continues the operations up to the designated time.
- ◎ [WAIT COUNT COMMAND (H-2)] is used for the robot to stop its operations and wait until the signal of the designated frequency is entered into the designated [GENERAL PURPOSE INPUT TERMINAL].
- ◎ [CORNER OUT COMMAND (H-3)] is used to prevent the robot path from rounding during high speed operation.

- © The following is an example of execution of the [WAIT INPUT COMMAND or TIMER COMMAND (H-4)].



NOTE: An input signal exists means that the shortcircuit occurred across the [INDIVIDUAL INPUT TERMINAL] and [COM] terminal.



## Jump Command

The robot operates according to the registered sequence of the operation commands. The [Jump command] is used to jump and change the execution sequences of the robot operations.

| Commands       |                                 |                      |              | Contents                                                                                                                                                                                                    |
|----------------|---------------------------------|----------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1                       | Operand 2            | Operand 3    |                                                                                                                                                                                                             |
| J - 0          | Address No. of sequence command |                      |              | The command jumps to the address number of the sequence command.                                                                                                                                            |
| J - 1          | Address No. of sequence command | Input terminal No.   |              | If the designated input terminal number is ON, the command jumps to the address number of the sequence command. In case of OFF, the command is ignored. The Jump command is valid only within the sequence. |
| J - 3          | Address No. of program          |                      |              | The command jumps from the program address in the program to the program address in the same job.                                                                                                           |
| J - 4          | Address No. of program          | Input terminal No.   |              | If the designated input terminal number is ON, the command jumps from the program address in the program to the program address in the same job.                                                            |
| J - 5          | Address No. of sequence command | Contents of register | Register No. | If the designated register number is the designated value, the command jumps to the address number of the sequence command, provided that the jump command is valid only within the sequence command.       |
| J - 6          | Step No.                        |                      |              | The command jumps to the step number of the unconditional program, provided that the jump command is valid only within the program.                                                                         |
| J - 7          | Step No.                        | Input terminal No.   |              | If the designated input terminal number is ON, the command jumps to the step number of the program. In case of OFF, the command is ignored. The jump command is valid only within the program.              |
| J - 8          | Step No.                        | Contents of register | Register No. | If the designated register number is the designated value, the command jumps to the step number of the program, provided that the jump command is valid only within the program.                            |
| J - H          |                                 |                      |              | The robot returns to the home position.                                                                                                                                                                     |

## Call Command

The call command is used to call the registered [LIBRARY] (reserved sequence), [WELD COND.] and [CRATER COND.].

### ◎ LIBRARY call command

| Command        |             |                      |              | Contents                                                                                                                                                                                                            |
|----------------|-------------|----------------------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1   | Operand 2            | Operand 3    |                                                                                                                                                                                                                     |
| L - 0          | LIBRARY No. |                      |              | The command calls the reserved sequence of the designated number.                                                                                                                                                   |
| L - 1          | LIBRARY No. | Input terminal No.   |              | If the designated input terminal is ON, the command calls the reserved sequence of the designated number, and if OFF, the command is ignored.                                                                       |
| L - 2          | LIBRARY No. | Contents of register | Register No. | If the designated register number is the designated value, the command calls the reserved sequence of the designated number. If the designated register number is not the designated value, the command is ignored. |

### ◎ Call command for welding conditions and crater conditions

|     |               |               |  |                                                                          |
|-----|---------------|---------------|--|--------------------------------------------------------------------------|
| AJO | Current value | Voltage value |  | The designated current and voltage of the regular welding are outputted. |
| CJO | Current value | Voltage value |  | The designated current and voltage of the crater outputted.              |

### ◎ Call command for Arc start sequence and arc end sequence.

Unlike the already described call command which call the single function, this command is used for the multipul function. This command is a group often used welding starting and welding ending operations.

|     |        |  |  |                                                                                      |
|-----|--------|--|--|--------------------------------------------------------------------------------------|
| ASS | Number |  |  | The command calls the welding starting sequence (ASS SEQ.) of the designated number. |
| AES | Number |  |  | The command calls the welding ending sequence (AES SEQ.) of the designated number.   |

\* During teaching the robot, "1" of the ASS enters automatically into the welding starting point being programmed and "1" of the AES into the welding ending point.

## Register Command

The register command is used to set numeric values in the register or to process addition and subtraction. (Used as a counter)

The register command is used with the output command and the jump command.

| Command        |              |               |           | Contents                                                                          |
|----------------|--------------|---------------|-----------|-----------------------------------------------------------------------------------|
| Operation code | Operand 1    | Operand 2     | Operand 3 |                                                                                   |
| R - 0          | Register No. | Numeric value |           | The designated value is set in the designated register.                           |
| R - 1          | Register No. |               |           | Content of designated register = Content of designated register + 1 (Addition)    |
| R - 2          | Register No. |               |           | Content of designated register = Content of designated register - 1 (Subtraction) |
| R - 3          | Register No. | Register No.  |           | Contents of designated register are substituted. (Data are exchanged.)            |

Values that can be designated as the register number are 1 through 99.

Values that can be designated to the designated register are 0 through 255.

If addition starts from 255, addition restarts from 0.

If subtraction starts from 0, subtraction restarts from 255.

### Command Dedicated to Welding

The robot is normally connected to the welding machine, and the method of welding commands are the same as the output command and wait command described already. Because the commands are dedicated to welding, the terminal numbers are used more than 200. Terminals are given their names instead of the numbers.

◎ Input/output terminal commands (ON-OFF) etc. dedicated to welding.

The following numbers are assigned to the special terminals such as [WELDING START], [GAS VALVE], [STICK CHECK] and [CURRENT DETECTION] terminals.

| Items           | Name              | Terminal No. |
|-----------------|-------------------|--------------|
| Dedicated input | Current detection | 217          |
| Abnormal input  | Arc OFF           | 218          |
|                 | Stick             | 219          |
|                 | Torch contact     | 220          |
|                 | Wire OFF          | 221          |
|                 | No gas            |              |
| Stick           | Torch switch      | 209          |
|                 | Gas valve         | 210          |
|                 | Stick check       | 211          |
|                 | Wire inching      | 212          |
|                 | Retract           | 213          |

} Abnormal status is informed to the robot, causing the robot to stop.



- \* 1. When the welding machine is given the instruction "Stick check" from the robot, the welding machine checks the stick of the output.  
When the welding machine is checking the stick, the "Stick check" input (terminal No. 219) is turned ON to stop the robot.
- 2. To feed the wire forward, turn ON the wire motor. To feed the wire backward, simply change the rotational direction of the wire motor. Therefore, it is necessary to turn ON both outputs when retracting the wire.
- 3. For the "Torch contact", "No wire" and "No gas" terminals, optional equipment is required.

◎ Command for setting welding current and welding voltage

| Command        |               |           |           | Contents                                |
|----------------|---------------|-----------|-----------|-----------------------------------------|
| Operation code | Operand 1     | Operand 2 | Operand 3 |                                         |
| 0 - 3          | Current value |           |           | Welding current setting (Analog output) |
| 0 - 4          | Voltage value |           |           | Welding voltage setting (Analog output) |

- \* • When a welding machine dedicated to Pana Robo is used, use the current [in unit of ampere] and the voltage [in unit of 0.1 volt] as an absolute input. When a machine other than the dedicated welding machine is used, inputs corresponding to codes (255 split codes) are used. In this case, a conversion table is necessary.

## Other Commands

### (1) Commands for calling and returning programs

| Command        |           |           |           | Contents                                                                                                                                                                                                                                                                                                                      |
|----------------|-----------|-----------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1 | Operand 2 | Operand 3 |                                                                                                                                                                                                                                                                                                                               |
| P - C          | Number    |           |           | The program of the designated number is called.<br>NOTE: Use this command only in the job.                                                                                                                                                                                                                                    |
| U - 0          |           |           |           | Return command:<br>When used in the job, the return command used finishes the job execution.<br>When this command exists in the sequence command of the program step, the sequence commands after U-0 will not be executed.<br>When this exists in the reserved sequence command, the command after U-0 will not be executed. |

## (2) ESC (Escape) command

- The ESC command is used to execute the parallel processing (simultaneous processing) of the robot operations and the sequence commands.

- How to enter the ESC command

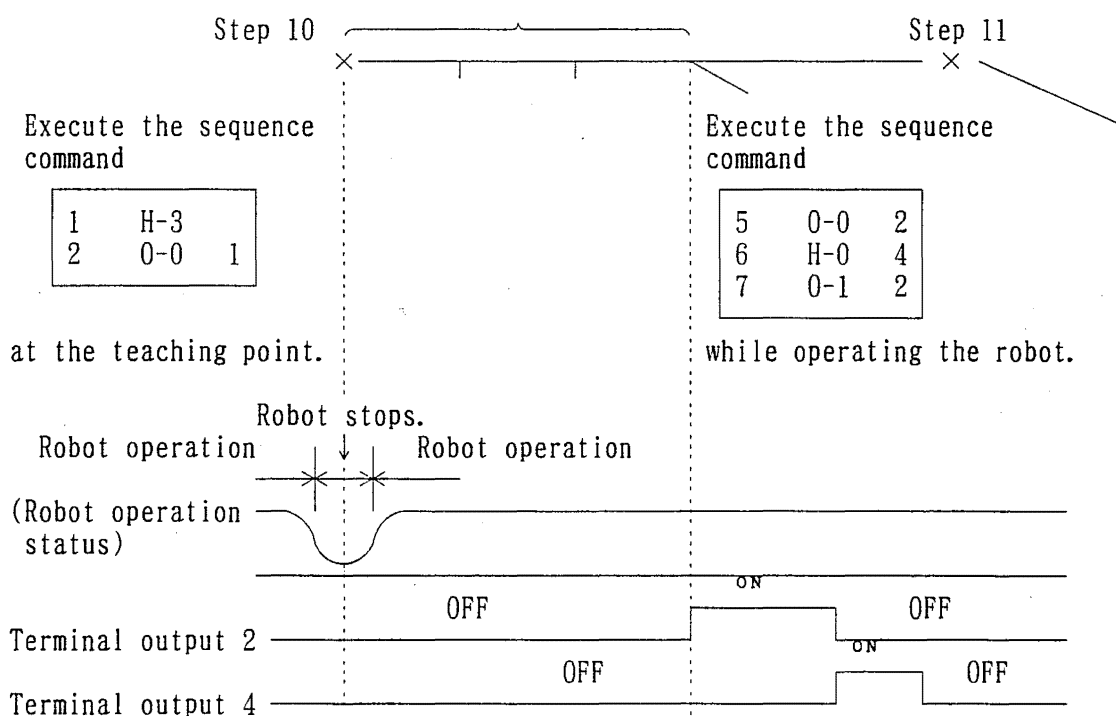
Enter the [ESC] command to a location where you want a parallel processing to take place while you enter the sequence command into the teaching point. A function key [ESC] is provided.

Therefore, the sequence command group beyond the ESC command becomes the sequence command group for parallel processing.

| (Example) | Step 1 | Command | Speed (m/min)                                                                                                                                                                        | Sequence commands                                                                                                                        |     |     |   |     |     |   |     |     |   |                                                                            |   |
|-----------|--------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|---|-----|-----|---|-----|-----|---|----------------------------------------------------------------------------|---|
|           | 10     | A-0     | 60                                                                                                                                                                                   | <table><tr><td>1</td><td>H-3</td><td></td></tr><tr><td>2</td><td>0-0</td><td>1</td></tr><tr><td>3</td><td>ESC</td><td></td></tr></table> | 1   | H-3 |   | 2   | 0-0 | 1 | 3   | ESC |   | Same as the conventional sequence command (Execute at the teaching point.) |   |
| 1         | H-3    |         |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
| 2         | 0-0    | 1       |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
| 3         | ESC    |         |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
|           |        |         | <table><tr><td>4</td><td>H-1</td><td>30</td></tr><tr><td>5</td><td>0-0</td><td>2</td></tr><tr><td>6</td><td>H-0</td><td>4</td></tr><tr><td>7</td><td>0-1</td><td>2</td></tr></table> | 4                                                                                                                                        | H-1 | 30  | 5 | 0-0 | 2   | 6 | H-0 | 4   | 7 | 0-1                                                                        | 2 |
| 4         | H-1    | 30      |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
| 5         | 0-0    | 2       |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
| 6         | H-0    | 4       |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |
| 7         | 0-1    | 2       |                                                                                                                                                                                      |                                                                                                                                          |     |     |   |     |     |   |     |     |   |                                                                            |   |

↓  
(Execution status) Execute the sequence command

4 H-1 30 while operating the robot.



○ Cautions in using ESC command

- (i) When the sequence command to be parallel processed remains even if the robot has reached the next teaching point, unexecuted sequence commands are cancelled.

(Example)

10 seconds

| Case | Command group for parallel processing    | Sequence command to be cancelled |
|------|------------------------------------------|----------------------------------|
| 1    | ...<br>ESC<br>H - 1    200<br>O - 0    1 | 0 - 0    1                       |
| 2    | ...<br>ESC<br>H - 0    5<br>O - 1    3   | 0 - 1    3                       |

- (ii) The sequence jump command cannot be used before the ESC command from the sequence command group to be parallel processed.

(Example)

```

1 H - 1 20
2 O - 0 1
3 ESC
4 H - 1 30

```

|   |       |   |   |
|---|-------|---|---|
| 5 | J - 1 | 2 | 4 |
|---|-------|---|---|

← This is not possible.

The sequence jump command to the command group for parallel processing can be used, but when the address following the ESC command is designated at this time, the command group for parallel processing will not be processed even if such command groups exists.

```

1 H - 1 20
2 O - 0 1
3 J - 0 5
4 ESC
5 H - 1 50

```

⇒ Robot stops for seven seconds.

(iii) The step jump command cannot be used in the command group for parallel processing.

(For the ESC command group, commands J-3, J-4, J-6, H-7 and J-8 cannot be used.)

(iv) Return command (U-0) is processed as follows.

- If the command U-0 exists before the ESC command, the sequence command group after the command U-0 will be cancelled.
- If the command U-0 exists following the ESC command, the sequence command group for parallel processing existing after the command U-0 will be cancelled.

(v) When the robot is hold state while the sequence command group for parallel processing is being executed, the execution of such sequence command group is halted. The halted execution is started again by restarting the robot. This processing applies to the emergency stop processing as well.

(vi) Address search, input/output locking and robot locking are processed as follows.

|                      |   |                                                                                    |
|----------------------|---|------------------------------------------------------------------------------------|
| Address search       | } | are virtually executed and actually<br>outputted after returning to the operation. |
| Input/output locking |   |                                                                                    |

Robot locking is processed in a usual manner.

(vii) The ESC command cannot be used for the job, reserved sequence, ASS SEQ., and AES SEQ.

- \* Since the [WAIT INPUT COMMAND (H-0)] after the ESC command is for waiting for the input terminal signal, the execution of the sequence command is stopped but the robot movement will not be stopped.

(3) E-0 and E-1 commands

| Command        |           |           |           | Contents                                                                                                                                                                                                                                                                                                                    |
|----------------|-----------|-----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1 | Operand 2 | Operand 3 |                                                                                                                                                                                                                                                                                                                             |
| E - 0          | 0         |           |           | When this command is executed:<br>the welding abnormality is ignored unless either of the following takes place.<br>(i) Execution of the command [E-0 1].<br>(ii) Completion of robot movement to the next step.                                                                                                            |
|                | 1         |           |           | When this command is executed:<br>the welding abnormality signal thereafter is processed as the error (HOLD) in an usual manner.                                                                                                                                                                                            |
| E - 1          | Number    |           |           | When this command is executed:<br>the robot will be in error status (HOLD).<br>When this command is executed with [900~999] for setting numbers, the following messages are displayed.<br>T.pendant:Err [Number]<br>Message:*** Error[Number]***<br>When restarted, the execution from the next sequence command continues. |

- The command E-0 ignores the welding abnormality as following range

|       |   |                   |
|-------|---|-------------------|
| E - 0 | 0 | } for this range. |
| E - 0 | 1 |                   |

The command E-0 is used in a manner that error (HOLD) does not occur even if the welding abnormality is happened in a sequence execution range.

- Command E-1

The command E-1 is used that error (HOLD) status may occur because of the status of general purpose input or execution status of the sequence command etc.

Example)

|    |       |     |   |
|----|-------|-----|---|
|    | H - 1 | 30  |   |
| 10 | J - 1 | 12  | 1 |
| 11 | E - 1 | 909 |   |

Wait for three seconds and check the input.

If the input 1 is not ON, the error 909 is displayed and the robot is halted its operation.

(4) Command related to arc sensor/touch sensor (Optional function)

\* For details of the method for use, refer to the Operation Manual (separate volume) of each function.

| Command        |                          |           |           | Contents                                                                                                      |
|----------------|--------------------------|-----------|-----------|---------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1                | Operand 2 | Operand 3 |                                                                                                               |
| F - 0          | Arc sensing menu No. (1) |           |           | Arc sensing operation starts when this sequence command is entered into the step of the move command [B • S]. |
| F - 1          |                          |           |           | Command used to stop arc sensing operation.                                                                   |

\* Suppose that arc sensing menu number is "1" in this case.

|       |           |           |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------|-----------|-----------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F - 2 | 1         |           |  | The robot calculates the amount of correction which is determined by the teaching point with this command, the next teaching point, and the actual moving point. The robot then conducts three-dimensional parallel movement on real time, from the next teaching point.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| F - 3 | 0         |           |  | The robot starts the three-dimensional parallel movement and rotating movement from the next teaching point.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|       | 1         |           |  | The three-dimensional parallel movement and the rotating movement are stopped at the teaching point where this command exists.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| F - 4 |           |           |  | This command clears the contents of the buffer of the amount of correction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| F - 5 | 1         | 1         |  | This command is used to determine three reference points to correct the shifted workpiece position (rotation) in the teaching and play modes. When the commands [F-5 1 1~3] are executed in the play mode, the position where the commands are executed is stored of the three points.<br>The command changes the position (correction) with respect to the teaching point based on these three points, from the step having the command [F-30] to the step having the command [F-31].<br>The three reference points are valid within the execution program unless a new setting is made. Execution of this command automatically clears the [BUFFER OF CORRECTION AMOUNT] (Used with the command F-2). |
|       |           | 2         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|       |           | 3         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| F - 7 | $\pm a.a$ | $\pm b.b$ |  | With the offset command of the welding line, the welding line is shifted $\pm a.a(\text{mm})$ in the weaving amplitude direction and $\pm b.b(\text{mm})$ in the torch direction.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

| Command        |                  |           |           | Contents                                                                                                                                                                                                                                                                                                      |
|----------------|------------------|-----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation code | Operand 1        | Operand 2 | Operand 3 |                                                                                                                                                                                                                                                                                                               |
| F - 8          | $\pm c c$        | $\pm d d$ |           | With the welding line tracing gain command, the tracing gain in the weaving amplitude direction is changed $\pm cc(\%)$ and the follow-up gain in the torch direction is changed $\pm dd(\%)$ .                                                                                                               |
| F - 6          | Step No.         | 0         |           | This command is used to replace the position data of the step number designated by the operand with the position reading data when this command is executed. Note that the wrist vector (torch position) is not changed.<br>Execution of this command automatically clears the [BUFFER OF CORRECTION AMOUNT]. |
|                |                  | 1         |           | The difference between designated step No. position data and the position data of the step where this command is input is added to the designated step No. position data.                                                                                                                                     |
| F - L          | Shift-buffer No. |           |           | Write the contents of the shift-buffer specified by operand into the process shift-buffer.<br>The range of shift-buffer number is upto 20.                                                                                                                                                                    |
| F - S          | Shift-buffer No. |           |           | Write the contents of the process shift-buffer currently processing into the shift-buffer specified by operand.<br>The range of shift-buffer number is upto 20.                                                                                                                                               |
| F - R          |                  |           |           | Clear all the contents of the shift-buffer.                                                                                                                                                                                                                                                                   |

- (i) Commands (F-L), (F-S) and (F-R) can not be registered after the commands (F-2), (ESC), (AJ0) or (CJ0) within one step.
- (ii) Commands (F-L), (F-S) and (F-R) are to be registered with Program Edit or input of Sequence from the teach pendant.
- (iii) Command (F-R) is used to clear a shift-buffer. Clear action is not performed by starting or ending program or by turning the power off.

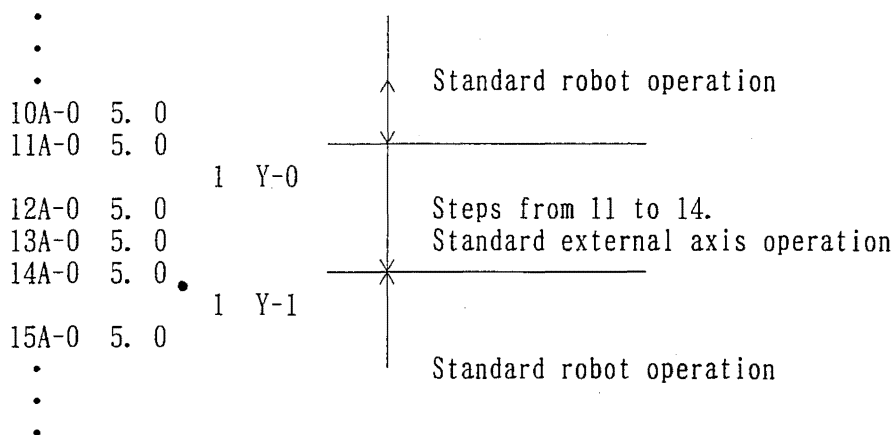


(5) Command related to external axis (Optional function)

The following sequence commands are used to set the playing speed to the standard robot operation or to the standard external axis operation for details, refer to the Operation Manual (separate volume) of the external axis.

| Operation code | Operand 1 | Operand 2 | Operand 3 | Contents                                                                                                                                                       |
|----------------|-----------|-----------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Y - 0          | —         | —         | —         | After the step in which this command exists (up to the step having the command Y-1), the robot operation will conform to the standard external axis operation. |
| Y - 1          | —         | —         | —         | After the step where this command exists, the operation conforms to the standard robot operation.                                                              |

The standards of operations are changed by the registered step of the commands [Y-0] and [T-1].



- (i) The robot operation before the step registered with the command [Y-0] by a program conforms to the standard robot operation.
- (ii) The command [Y-0] is effective up to the last program.
- (iii) Commands [Y-0] and [Y-1] cannot be entered into the end points of weaving and circular weaving. Commands cannot be registered to the steps [B-1], [B-2], [D-1], [D-2], [B • 1], [B • 2], [D • 1] and [D • 2].

- (iv) If a step jump is executed, the robot operation conforms to the operation designated by the other step.

Example)

1 A - 0 5. 0

2 A - 0 5. 0

1 Y - 0

3 A - 0 5. 0

4 A - 0 5. 0

5 A - 0 5. 0

1 Y - 1

6 A - 0 5. 0

7 A - 0 5. 0

1 J - 6 3

After executing this command, the robot operation from the step 3 conforms to the standard external axis operation.

- (v) When deleting the step registered with the commands [Y-0] and [Y-1], a error is given with T.PENDANT:[Err 50]

a message : [AN EXTERNAL AXIS CONTROL COMMAND EXISTS.].

In this case:

- (a) The deleting operation becomes invalid by pressing the [CANCEL] key of the teaching pendant.
- (b) When the [STORE] key or [WELD STORE] key is pressed again, the warning display goes out and the teaching point is deleted.

## CHAPTER 7

### Error/Alarm Code

The Pana Robo has a self-diagnosis function to detect and display abnormalities in operations and controller.

Contents of the abnormality are grouped into the [ERROR] and [ALARM] codes.

The [ERROR] code indicates minor errors caused in operations, while the [ALARM] code indicates an abnormal state in the controller.

For safety's sake, when the [ALARM] code is given, the servo power is automatically shut off.

## What is the Error/Alarm Code ?

When the self-diagnosis function detects an abnormal state, contents of the abnormal state are displayed in the numeric value code, and the control is shut off.

With your Pana Robo, such contents of the abnormal state are divided into the [ERROR] code and [ALARM] code.

### (1) Alarm code

- a) The alarm code is used in the case where it is dangerous to operate the robot.
- b) The alarm code is displayed on the teaching pendant in two digit numerical code.
- c) Contents of the alarm code is displayed on the CRT screen as  
\*\*\*  \*\*\*.
- d) When the alarm code is given, the servo power is turned off.
- e) When the alarm code is given, the [IN EMG. STOP] output is released (normally closed and released in emergency) and all other external outputs are turned OFF.
- f) Turn off the power source, remove the cause of abnormality, return the robot to its origin, and restart operations.

### (2) Error code

- a) The error code is given for a relatively minor abnormal state caused by incorrect operations or abnormal conditions of the robot.
- b) The message "Err" is displayed on the teaching pendant in two digit numerical code.
- c) Contents of the alarm code is displayed on the CRT screen as  
\*\*\*  \*\*\*.
- d) The servo power remains turned ON.

- e) The output [0-0] is turned OFF with the output [0-6] remaining intact.  
The output [IN OPERATION] is held turned ON.
- f) Pressing the [CANCEL] key of the teaching pendant automatically resets  
the robot operation.

# Error/Alarm Code List

| Display code | CRT display                                           | Cause                                                                                                                                               | Corrective action                                                                                                                   |
|--------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Err 1        | Circ-weave uncompleted                                | A circle is registered with other type of interpolation during teaching.<br>Weaving is registered with other type of interpolation during teaching. | Press the [CANCEL] key and teach with the circle interpolation.<br>Press the [CANCEL] key and teach with the weaving interpolation. |
| Err 2        | Teaching and computed postore do not match.           | Refer to page 7-21                                                                                                                                  | Refer to page 7-21                                                                                                                  |
| 3            |                                                       |                                                                                                                                                     |                                                                                                                                     |
| Err 4        | Path exceeds limit                                    | Software check error of the teaching position during teaching.                                                                                      | When interpolated, the locus goes out of the moving range. Change the teaching position.                                            |
| Err 5        | Corner speed is out of range.                         | Abnormal speed                                                                                                                                      | When interpolated, the rated speed is exceeded.<br>Lower the teaching speed.                                                        |
| Err 6        | Cannot interpolate path                               | Operation errors of circle and weaving                                                                                                              | Cannot interpolate. Change the position and speed of teaching.                                                                      |
| Err 7        | Cannot calculate                                      | Operation error                                                                                                                                     | Change the position and speed of teaching                                                                                           |
| ALr 8        | Calculation error                                     | Abnormality or mixed noise of control unit                                                                                                          | Turn off the power and turn it on again to remove the cause of trouble.                                                             |
| Err 9        | Кілька зареєстрованих кроків                          | Багаторазова реєстрація                                                                                                                             | Виконайте операцію 2.<br>Див. сторінку 2-10                                                                                         |
| Err 10       | Memory full                                           | Memory over                                                                                                                                         | Delete the memory.<br>If necessary for future use, save the memory into a cassette tape.                                            |
| Err 11       | RT, UA, FA, RW, BW, TW soft limit                     | The robot is being forced to move out of moving range.                                                                                              | Press the [CANCEL] key.                                                                                                             |
| ALr 12       | RT, UA, FA, RW, BW, TW hard limit                     | The robot has overrun the moving range.                                                                                                             | Refer to the paragraph "Overrun Releasing."                                                                                         |
| ALr 13       | Servo error, RT, UA, FA, RW, BW, TW error, count over | Deviation over                                                                                                                                      | Change the teaching so that a specific axis does not move quickly. Check motors and amplifiers.                                     |

| Display code | CRT display                                                                                   | Cause                                                                     | Corrective action                                                                                                             |
|--------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| ALr 14       | Servo communication error                                                                     | Abnormality and noise mixing of control unit                              | Shut of the power and turn it on again to remove the cause of trouble.                                                        |
| ALr 15       | RT, UA, FA, RW, BW, TW<br>Servo amp error                                                     | Servo amplifier is giving an alarm.                                       | Reduce the speed. Remove causes of trouble in the motor and amplifier.                                                        |
|              | Servo amplifier error 0                                                                       | Amp. ready error                                                          | Вимкніть живлення та увімкніть знову.<br><br>Перевірте мотор, сервопідсилювач, плату ЦП сервоприводу та батареї для енкодера. |
|              | 1                                                                                             | Overcurrent detected.                                                     |                                                                                                                               |
|              | 2                                                                                             | Overvoltage detected.                                                     |                                                                                                                               |
|              | 3                                                                                             | Insufficient voltage of amplifier power                                   |                                                                                                                               |
|              | 4                                                                                             | Overspeed detected.                                                       |                                                                                                                               |
|              | 5                                                                                             | Overload detected.                                                        |                                                                                                                               |
|              | 6                                                                                             | Locking detected.                                                         |                                                                                                                               |
|              | 7                                                                                             | A/D error detected.                                                       |                                                                                                                               |
|              | 8                                                                                             | DSP trouble detected.                                                     |                                                                                                                               |
|              | 9                                                                                             | Abnormal parameters                                                       |                                                                                                                               |
|              | 10                                                                                            | Abnormal servo driver                                                     |                                                                                                                               |
|              | 11                                                                                            | Abnormal absolute encoder                                                 |                                                                                                                               |
|              | 12                                                                                            | Abnormal counter                                                          |                                                                                                                               |
|              | 13                                                                                            |                                                                           |                                                                                                                               |
|              | 14                                                                                            |                                                                           |                                                                                                                               |
|              | 15                                                                                            |                                                                           |                                                                                                                               |
| Err 16       | Cannot move forward.                                                                          | Robot has moved to the last teaching point, and the [+] key is pressed.   | Press the [CANCEL] key and operate the robot correctly.                                                                       |
| Err 17       | Cannot move backward.                                                                         | Robot has returned to the first teaching point, and the [-] key is press. | Press the [CANCEL] key and operate the robot correctly.                                                                       |
| Err 18       | Program <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> not found. | Program is not registered.                                                | Register the program correctly.                                                                                               |

| Display code | CRT display                                                                                    | Cause                                                                        | Corrective action                                                                                                                                                                                                                                                                                        |
|--------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Err 19       | Library <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> not found.  | Reserved sequence is not registered.                                         |                                                                                                                                                                                                                                                                                                          |
| Err 20       | Weld seq <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> not found. | Welding sequence is not registered.                                          |                                                                                                                                                                                                                                                                                                          |
| Err 21       | Job <input type="checkbox"/> <input type="checkbox"/> not found.                               | Job is not registered.                                                       |                                                                                                                                                                                                                                                                                                          |
| Err 22       | Cannot jump to this step.                                                                      | Jumped point is inadapttable.                                                | No step for jumping exists.<br>End point and halfway point of weaving.<br>Unable to move the step to a halfway point of a circle.                                                                                                                                                                        |
| Err 23       | Cannot move                                                                                    | Software check error of teaching point (during operation)                    | Change the position and speed of the teaching.<br>Check for abnormal state and noise mixing of control unit. Remove causes of trouble.                                                                                                                                                                   |
| Err 24       | Edit & play use same file.                                                                     | Playing conditions occurred during editing wherein that file is used.        | CRT screen display:<br>*** Do you continue playing ? ***<br><br>If the <input type="checkbox"/> F1 [YES] key is pressed, robot is restarted and the editing discontinued.<br><br>If the <input type="checkbox"/> F2 [NO] key is pressed, both the playing and editing are discontinued.                  |
| ALr 25       | Memory contents failure.                                                                       | Fault in contents of memory                                                  | Verify the initial values and files.<br>If the memory is destroyed, conduct "all clear" and teach the robot again.                                                                                                                                                                                       |
| Err 26       | Abnormal welding<br>Stick<br>No Arc<br>No gas<br>No wire<br>Torch contact                      | Abnormal welding (Abnormal signals from the welding power and interface box) | Stick: Shut off the wire contact. Change the teaching position where stick does not occur. Check welding power. (Burn-back time limit)<br>Arc off: Review welding conditions and check for correct wire feeding path.<br>Insufficient gas pressure, wire off and torch contact: Remove cause of trouble. |



| Display code | CRT display                      | Cause                                                                                                                                                                               | Corrective action                                                                                                             |
|--------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| ALr 27       | Power fail.                      | Service interruption<br>(Instantaneous service interruption)                                                                                                                        | Review the power source facility of the plant. Check input voltage.                                                           |
| ALr 28       | Over temperature                 | Temperature of the operating section of control unit is high.                                                                                                                       | Open the door of the control unit and lower the inside temperature. Check for normal operation of the cooling fan.            |
| ALr 30       | Servo power off.                 | Servo power is turned off by an instantaneous input of the external emergency stop signal.                                                                                          | Start operation from origin return.                                                                                           |
| Err 31       | Cannot add                       | An attempt to add a teaching point is made in the circular interpolation area using other type of interpolation. Addition of a teaching point was attempted in the weaving section. | Press the [CANCEL] key of the teaching pendant and operate the robot correctly.                                               |
| Err 32       | Cannot change                    | An attempt was made to change the teaching point in the circular interpolation area using other type of interpolation.                                                              | Press the [CANCEL] key of the teaching pendant and operate the robot correctly.                                               |
| Err 33       | Cannot delet                     | An attempt was made to delete the starting point and the ending point of a circle or weaving.                                                                                       | Press the [CANCEL] key of the teaching pendant and operate the robot correctly.                                               |
| Err 34       | Check program with edit mode.    | Power is shut off during grammer and operation check. Grammatical error is in the contents taught.                                                                                  | Operate in order of [CANCEL] → [EDIT] → [PROGRAM] → [NO.] → [STORE] → [END]. Refer to the paragraph "Error Recovery" on page. |
| Err 35       | Cannot move with circular        | Operation error of circular                                                                                                                                                         | Press the [CANCEL] key and change the teaching point.                                                                         |
| Err 36       | Circular uncompleted, cannot end | The [END] key is pressed during circular arc teaching.                                                                                                                              | Press the [CANCEL] key, then the [CIRCLE WEAVE END] key. Press the [STORE] key and then the [END] key.                        |

| Display code | CRT display                                        | Cause                                                                                                                                                        | Corrective action                                                                                         |
|--------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Err 37       | Weave uncompleted, cannot end                      | The [END] key is pressed during teaching of weaving.                                                                                                         | Press the [CANCEL] key, then the [CIRCLE WEAVE END] key. Press the [STORE] key and then the [END] key.    |
| Err 38       | Circl weave uncompleted, cannot end                | The [END] key of the teaching pendant is pressed while registering the circular weaving.                                                                     | Press the [CANCEL] key of the teaching pendant and register teaching points.                              |
| ALr 39       | Hard error: Drift over<br>RT, UA, FA<br>RW, BW, TW | The dirft in the servo circuit became excessively large.                                                                                                     | Adjust the drift in the servo circuit. Contact our service department.                                    |
|              |                                                    | The fuse of the servo power is blown.<br>The fuse of the servo amplifier is blown.                                                                           | Check respective fuses.<br>Servo power: 30A and 15A fuses<br>Servo amplifier: 1A fuse                     |
| Err 40       | Check program with edit mode.                      | Grammatical error                                                                                                                                            | Remove the grammatical error.<br>Refer to the paragraph "Error Recovery" on page.                         |
| Err 41       | Same job No. reserved                              | The number of the job that is reserved and started is the same as the number of the job whose operation is finished just before job is reserved and started. | Cancel the error and move the job in the restarting mode. Or end the error forcibly and move another job. |
| Err 42       | Protected                                          | An attempt was made to correct the file which is protected.                                                                                                  | Release in advance the protect status of the file to be corrected (INS. CHG. DELETE).                     |
| ALr 43       | Encoder cable error                                | Broken wire of encoder cable                                                                                                                                 | Check cable connection between robot body and control unit.                                               |
| ALr 44       | Over drift;                                        | Refer to ALr.<br>(Detected by servo CPU.)                                                                                                                    | Refer to ALr.                                                                                             |
| ALr 45       | Servo CPU error                                    | Abnormality and noise mixing of control unit                                                                                                                 | Shut off the power and turn it on again. (Remove causes of trouble.)                                      |
| Err 46       | Release the gun.                                   |                                                                                                                                                              |                                                                                                           |
| ALr 48       | Aux-Axes communication error                       | Abnormality and noise mixing of control unit                                                                                                                 | Shut off the power and turn it on again. (Remove causes of trouble.)                                      |

| Display code | CRT display                                               | Cause                                                                                  | Corrective action                                                                                                      |
|--------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| ALr 49       | Aux axes encoder cable error.                             | Abnormality of encoder cable of control unit and external axis                         | Check the cable connector.                                                                                             |
| ALr 50       | Aux axes command not found                                | An attempt was made to delete the step registered with the command [Y-].               | To delete, press the [STORE] key again. To stop deleting, press the [CANCEL] key.                                      |
| ALr 51       | Aux axes calculation error                                | An error occurred in the operation check.                                              | Change the teaching position.                                                                                          |
| ALr 52       | Command of the Aux axis control sensor not found          | An attempt was made to delete the step registered with the commands[Y-] and [F-].      | To delete, press the [STORE] key again. To stop deleting, press the [CANCEL] key.                                      |
| Err 63       | *** G1, G2, G3, G4, G5, G6 Soft limit ***                 | Robot is being moved out of its moving range.                                          | Press the [CANCEL] key and move the robot back into the moving range.                                                  |
| ALr 64       | *** Servo error G1, G2, G3, G4, G5, G6 Deviation over *** | Deviation over                                                                         | Change the teaching so that a specific axis does not move quickly. Check the motor and amplifier.                      |
| ALr 65       | *** G1, G2, G3, G4, G5, G6 Servo amp error***             | An alarm is given from the servo amplifier.                                            | Reduce the robot speed. Remove causes of the troubles of the motor and amplifier.                                      |
| ALr 66       | *** Over drift: G1, G2, G3, G4, G5, G6 ***                | The drift of the servo circuit became excessively large.                               | Adjust the drift of the servo circuit. Contact our service department.                                                 |
|              |                                                           | The fuse of the servo power source is blown. The fuse of the servo amplifier is blown. | Check the fuse.<br>Servo power: 30A fuse<br>Servo amplifier: 1A                                                        |
| ALr 67       | *** G1, G2, G3, G4, G5, G6, Hard limit ***                | Robot has overrun the moving range.                                                    | Refer to the paragraph "Releasing Overrun" of the Robot operation manual.                                              |
| ALr 68       | Aux-Axes cannot move                                      | Soft check error of the teaching point (During operation)                              | Change the position and speed of the teaching. Abnormality and noise mixing of control unit. Remove causes of trouble. |
| ALr 69       | Aux-Axes corners speed is out of range.                   | Abnormal speed                                                                         | Reduce the teaching speed.                                                                                             |

| Display code | CRT display                             | Cause                                                                                                                          | Corrective action                                                                                                         |
|--------------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Err 70       | Cannot shifted by rotation.             | Three standards points are within the same plane, thus the rotating shift cannot be calculated.                                | Change the position of the step with the command [F-5].                                                                   |
| Err 76       | *** A sensor command exists.***         | The teaching point stored with the touch sensor operation command is being deleted.                                            | Press the [CANCEL] key. To delete the teaching point, press the [STORE] key again.                                        |
| Err 77       | *** Sensing could not be achieved. ***  | An interruption did not occur within the sensing distance.                                                                     | Press the [CANCEL] key. To restart, press the [TRACE (+)(-)] key of the teaching pendant and restart the robot operation. |
| Err 78       | *** Sensing could not be achieved. ***  | Robot was stopped in emergency mode and restarted from the teaching point where the touch sensor operation command was stored. | Press the [CANCEL] key. To restart the robot, press the [RESTART] key again.                                              |
| Err 79       | Arc sensor error                        | Abnormal welding conditions.<br>Wire diameter of the welding power is set to those of other than the arc sensor specification. | Press the [CANCEL] key. To restart the robot, press the [RESTART] key again.                                              |
| Err 80       | Arc sensor communication error          | Abnormality and noise mixing of control unit                                                                                   | Turn off the power and turn on the power again.                                                                           |
| ALr 101      | *** Added memory error ***              | Added memory status is abnormal.                                                                                               | Check for proper optional setting and mounting of added memory board. Make correct setting.                               |
| Err 108      | Ненормальна напруга батареї енкодера.   | Зниження напруги акумулятора енкодера.                                                                                         | Замініть акумулятор                                                                                                       |
| ALr 110      | Directory error attempt to clear memory | Contents of memory are abnormal.                                                                                               | Clear the memory.                                                                                                         |
| Err 111      | Overrun limit released                  | Robot did not overrun but the overrun switch is at the release position.                                                       | Throw the overrun release switch to the normal play position.                                                             |
| Err 112      | Power fail in program editing           | Service interruption occurred during editing.                                                                                  | Check the contents of the program in the first place.                                                                     |

| Display code | CRT display                                           | Cause                                                                                                                                         | Corrective action                                                                                                                                                                                                           |
|--------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ALr 113      | Parameter error<br>Reset parameters<br><br>1, 2, 3, 4 | 1: Amount of origin correction<br>2: Tool offset<br>3: Origin offset<br>4: External axis parameters<br>Abnormality exists in the above.       | Properly set each parameter again.                                                                                                                                                                                          |
| Err 114      | External holding                                      | A hold signal of the external signal is entered.                                                                                              | Remove the hold signal of the external signal.                                                                                                                                                                              |
| Err 115      | Emg stop (TB, panel, ext) ON                          | Emergency stop switch was pressed.                                                                                                            | Release the switches of the teaching pendant, panel, and external axis.                                                                                                                                                     |
| Err 116      | Attempt to turn power on again                        | Incorrect timing of supplying power                                                                                                           | Press the [SERVO POWER] switch.                                                                                                                                                                                             |
| Err 117      | RT interference                                       | RT axis is in the interference area.                                                                                                          | Move the RT axis outside of the interference area.                                                                                                                                                                          |
| Err 118      | Home position is not registered.                      | The command J-H was used although the home position was not registered.                                                                       | Register the home position.                                                                                                                                                                                                 |
| ALr 119      | ABORT                                                 | Contents of memory are abnormal.                                                                                                              | Shut off the power and clear the memory.                                                                                                                                                                                    |
| Err 130      | Calculation method No. not appropriate.               | Wrong combination of the designated interpolation type and the calculation numbers (CL, CL1, CL2, CL3) during registering the teaching point. | Correct to the correct combination.                                                                                                                                                                                         |
| Err 131      | Safety holder has actuated.                           | An input was stored into the safety holder input terminal of the sequencer P board.                                                           | Safety holder is actuating. Release it.                                                                                                                                                                                     |
| Err 133      | Cannot weave.                                         | Robot was stopped by the emergency stop mode or operated in the manual mode in the weaving section, and was restarted.                        | <ul style="list-style-type: none"> <li>• Move the robot to the weaving starting point by the TRACE (+) key, and start the robot.</li> <li>• When restarted, the robot moves along the straight line or circular.</li> </ul> |
| ALr 134      | Non-communication of main servo                       | Abnormality and noise mixing of control unit                                                                                                  | Shut off the power and turn it on again.                                                                                                                                                                                    |

| Display code | CRT display                  | Cause                                                                    | Corrective action                           |
|--------------|------------------------------|--------------------------------------------------------------------------|---------------------------------------------|
| ALr 135      | IOP T.P. COMMUNICAT<br>ERROR | Abnormality and noise<br>mixing of control unit<br>and teaching pendant. | Turn off the power and turn<br>it on again. |
| ALr 136      | IOP CPU ERROR                | Abnormality and noise<br>mixing of control unit                          | Turn off the power and turn<br>it on again. |

Communication error list

| Error No. | Message                            | Contents of error                                                    |
|-----------|------------------------------------|----------------------------------------------------------------------|
| 201       | File not registered.               | Designated file is not registered.                                   |
| 202       | File already registered.           | Designated file is not registered.                                   |
| 203       | Protected file cannot delete.      | Unable to delete because it is a<br>protected file.                  |
| 204       | File under play and cannot delete. | Unable to delete because it is a file<br>being executed of the play. |
| 211       | Memory full                        | Memory area over                                                     |
| 212       | File record length error           | Abnormal file record length                                          |
| 213       | Step flag error                    | Abnormal control flag in the step                                    |
| 214       | Verify error                       | File collate error                                                   |
| 221       | Command code error                 | Error of command code                                                |
| 222       | Command seq error                  | Improper as the sequence of the command                              |
| 223       | Command lenght error               | Abnormal lenght of command and parameter                             |
| 224       | File type/No. error                | Abnormal file type and file number                                   |
| 225       | Command parameter error            | Improper mode designation of "I" command                             |
| 227       | Robot No. error                    | Improper robot No.                                                   |
| * 270     | Transmission error                 | Error of transmission control                                        |
| * 275     | Option CPU soft error              | Abnormality occurs inside the robot.                                 |
| * 280     | Option CPU communication error     |                                                                      |
| * 285     | Option CPU hard error              |                                                                      |

\* Error releasing by the [CAN] key of the panel is necessary.

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

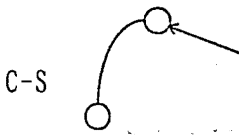
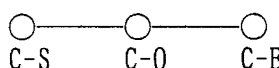
| Error location         | Cause of error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Recovery processing                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Free moving point      | In spite of the air cut point, there exist commands relating to the welding such as AJO, ASS, CJO and AES.                                                                                                                                                                                                                                                                                                                                                                                          | Delete commands relating to the welding such as AJO, ASS, AJO and AES by the program editing mode.                                                                                                                                                                                                                                                                                                            |
| Welding starting point | <p>The welding starting point requires</p> <p style="margin-left: 40px;">AJO<br/>ASS</p> <p>a pair of welding starting commands AJO and ASS.</p> <p>Do not insert any other commands between the command AJO and the command ASS.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Example</p> <ol style="list-style-type: none"> <li>1. AJO 200 24.0</li> <li>2. <span style="border: 1px dashed black; padding: 2px;">H-1 5</span></li> <li>3. ASS 1</li> </ol> </div> | <p>Delete the sequence command between the commands AJO and ASS using the program editing mode.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Example</p> <ol style="list-style-type: none"> <li>1. AJO 200 24.0</li> <li>2. ASS 1</li> </ol> </div>                                                                                                                            |
|                        | <p>In spite of the welding starting point, there are sequence commands (CJO, AES) of the welding ending.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Example</p> <ol style="list-style-type: none"> <li>1. AJO 200 24.0</li> <li>2. ASS 1</li> <li>3. H-1 20</li> <li>4. <span style="border: 1px dashed black; padding: 2px;">CJO 150 21.0</span></li> <li>5. <span style="border: 1px dashed black; padding: 2px;">AES 1</span></li> </ol> </div>                 | <p>Delete the commands CJO and AES using the program editing mode.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p>Example</p> <ol style="list-style-type: none"> <li>1. AJO 200 24.0</li> <li>2. ASS 1</li> <li>3. H-1 20</li> </ol> </div> <p>NOTE: To conduct the arc spot welding, accomplish one more multiple registration of the same point.<br/>(Refer to page 2-12.)</p> |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location         | Cause of error                                                                                                                                                                                                                                                                                                         | Recovery processing                                                                                                                                                                                  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Welding progress point | <p>In spite of the welding progress point,</p> <p>ASS<br/>AES<br/>CJO</p> <p>there are sequence commands such as ASS, AES and CJO that cannot be used at the welding progress point.</p>                                                                                                                               | Delete the sequence commands ASS, AES and CJO using the program editing mode.                                                                                                                        |
| Welding ending point   | <p>The welding ending point requires a</p> <p>CJO<br/>AES</p> <p>pair of welding ending commands CJO and AES.</p> <p>Do not insert any other commands between the command CJO and the command AES.</p> <div>Example</div> <ol style="list-style-type: none"> <li>CJO 150 21.0</li> <li>H-1 5</li> <li>ASS 1</li> </ol> | <p>Delete the sequence command between the commands CJO and AES using the program editing mode.</p> <div>Example</div> <ol style="list-style-type: none"> <li>CJO 150 21.0</li> <li>AES 1</li> </ol> |
|                        | <p>In spite of the welding ending point, there are sequence commands (AJO and ASS) of the welding starting.</p> <div>Example</div> <ol style="list-style-type: none"> <li>CJO 150 21.0</li> <li>AES 1</li> <li>AJO 200 24.0</li> <li>ASS 1</li> </ol>                                                                  | <p>Delete the commands AJO and ASS using the program editing mode.</p> <div>Example</div> <ol style="list-style-type: none"> <li>CJO 150 21.0</li> <li>AES 1</li> </ol>                              |



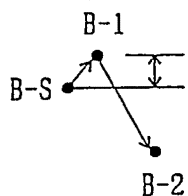
Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location | Cause of error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Recovery processing                                                                                                                                                                                                                                                                                                                                     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Circular       | <p>There is no starting point of the circular, C-S, C • S or the ending point of the circular, C-E and C • E.</p> <div>Example</div> <ol style="list-style-type: none"> <li>1. A-0 60.00</li> <li>2. C-0 1.00</li> <li>3. C-0 1.00</li> <li>4. C-E 60.00</li> </ol>                                                                                                                                                                                                                           | <p>Add the starting point and ending point of the circular using the program editing mode.</p> <div>Example</div> <p>In the case of the example shown in the left column, add the command C-S.</p> <ol style="list-style-type: none"> <li>1. A-0 60.00</li> <li>2. C-0 1.00</li> <li>3. C-0 1.00</li> <li>4. C-0 60.00</li> <li>5. C-E 60.00</li> </ol> |
| Circular       | <p>Robot cannot move because of the circular.<br/>An error occurs due to the initial calculation of the circular.</p> <div>Example 1</div> <p>C-0, C-E</p>  <p>Two of the three points are the same point or very close each other.</p> <div>Example 2</div>  <p>Three points are run along the same straight line.</p> | <p>Change the teaching point so that the robot can move along the circular using the program editing mode.</p> <div>Example</div> <p>Shift C-0 or C-E point slightly.</p> <div>Example 1</div> <p>Shift C-0 or C-E point slightly.</p>                                                                                                                  |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location | Cause of error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Recovery processing |     |       |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----|-------|-------|-------|----|-----|-----|-----|------|----|-----|-----|-----|------|----|-----|--|--|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---|-----|-------|----|-----|-----|-----|------|----|-----|-----|-----|------|----|-----|--|-----|-------|----|-----|--|--|-------|
| Weaving        | <p>There are no weaving starting points B-S, B · S or the ending points B-E, B · E or the amplitude points B-1, B-2, B · 1, B · 2.</p> <div><div>Example</div><table><tr><td>1.</td><td>A-0</td><td></td><td></td><td>60.00</td></tr><tr><td>2.</td><td>B-S</td><td>1</td><td>0.0</td><td>5.00</td></tr><tr><td>3.</td><td>B-2</td><td>1.5</td><td>0.0</td><td>5.00</td></tr><tr><td>4.</td><td>B-E</td><td></td><td></td><td>60.00</td></tr></table><div>Weaving frequency</div><div>Stopping time of amplitude point</div><div>(Weaving time)</div><div>Pattern No.</div><div>Speed</div></div>                            | 1.                  | A-0 |       |       | 60.00 | 2. | B-S | 1   | 0.0 | 5.00 | 3. | B-2 | 1.5 | 0.0 | 5.00 | 4. | B-E |  |  | 60.00 | <p>Use the program editing mode and add a command that is lacking, from the commands of the starting point, ending point, and amplitude point of weaving.</p> <div><div>Example</div><p>In the case of the example shown in the left column, add the command B-1.</p><table><tr><td>1.</td><td>A-0</td><td></td><td></td><td>60.00</td></tr><tr><td>2.</td><td>B-S</td><td>1</td><td></td><td>5.00</td></tr><tr><td>3.</td><td>B-1</td><td>1.5</td><td>0.0</td><td>5.00</td></tr><tr><td>4.</td><td>B-2</td><td></td><td>0.0</td><td>5.00</td></tr><tr><td>5.</td><td>B-E</td><td></td><td></td><td>60.00</td></tr></table></div> | 1. | A-0 |   |     | 60.00 | 2. | B-S | 1   |     | 5.00 | 3. | B-1 | 1.5 | 0.0 | 5.00 | 4. | B-2 |  | 0.0 | 5.00  | 5. | B-E |  |  | 60.00 |
|                | 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | A-0                 |     |       | 60.00 |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 2.             | B-S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                   | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 3.             | B-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.5                 | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 4.             | B-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     | 60.00 |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 1.             | A-0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     | 60.00 |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 2.             | B-S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                   |     | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 3.             | B-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.5                 | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 4.             | B-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 5.             | B-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     | 60.00 |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
|                | <p>The weaving starting point has the command B-S (air cut point), while the amplitude point has the command B.1 and B.2 (Welding progress point).</p> <p>The weaving starting point has the command B.S (welding point), while the amplitude point has the commands B-1 and B-2 (air cut point).</p> <div><div>Example</div><table><tr><td>1.</td><td>B.S</td><td>1</td><td>0.0</td><td>2.00</td></tr><tr><td>2.</td><td>B-1</td><td>1.5</td><td>0.0</td><td>5.00</td></tr><tr><td>3.</td><td>B-2</td><td></td><td>0.0</td><td>5.00</td></tr><tr><td>4.</td><td>B-E</td><td></td><td></td><td>60.00</td></tr></table></div> | 1.                  | B.S | 1     | 0.0   | 2.00  | 2. | B-1 | 1.5 | 0.0 | 5.00 | 3. | B-2 |     | 0.0 | 5.00 | 4. | B-E |  |  | 60.00 | <p>Use the program editing mode and give the commands B-1 and B-2 to the amplitude point when the weaving point has the command B-S.</p> <p>Give the commands B.1 and B.2 to the amplitude point when the weaving point has the command B.S.</p> <div><div>Example</div><table><tr><td>1.</td><td>B.S</td><td>1</td><td>0.0</td><td>2.00</td></tr><tr><td>2.</td><td>B.1</td><td>1.5</td><td>0.0</td><td>5.00</td></tr><tr><td>3.</td><td>B.2</td><td></td><td>0.0</td><td>5.00</td></tr><tr><td>4.</td><td>B-E</td><td></td><td></td><td>60.00</td></tr></table></div>                                                           | 1. | B.S | 1 | 0.0 | 2.00  | 2. | B.1 | 1.5 | 0.0 | 5.00 | 3. | B.2 |     | 0.0 | 5.00 | 4. | B-E |  |     | 60.00 |    |     |  |  |       |
| 1.             | B.S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                   | 0.0 | 2.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 2.             | B-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.5                 | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 3.             | B-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 4.             | B-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     | 60.00 |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 1.             | B.S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                   | 0.0 | 2.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 2.             | B.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1.5                 | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 3.             | B.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     | 0.0 | 5.00  |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |
| 4.             | B-E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |     | 60.00 |       |       |    |     |     |     |      |    |     |     |     |      |    |     |  |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |     |   |     |       |    |     |     |     |      |    |     |     |     |      |    |     |  |     |       |    |     |  |  |       |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location | Cause of error                                                                                                                                                                                                                                                                                                                                                                          | Recovery processing                                                                                                                                                                                                                                                      |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Weaving        | <p>The sequence command exist at the amplitude point of the weaving.</p> <div data-bbox="403 510 549 575" data-label="Section-Header"> <p>Example</p> </div> <div data-bbox="424 589 901 880" data-label="Text"> <pre> 1. B.S      1      0.0   2.00               1.5 2. B-1      0.0   5.00               1 0-0 1 3. B.2      0.0   5.00 3. B-E      60.00 </pre> </div>              | <p>Delete the sequence command at the weaving amplitude point using the program editing mode.</p> <p>In the case of the left example, delete the sequence command in the section </p> |
|                | <p>Robot cannot weave because an error occurs during the initial calculation of weaving.</p> <div data-bbox="403 1086 577 1151" data-label="Section-Header"> <p>Example 1</p> </div> <div data-bbox="434 1164 916 1359" data-label="Diagram">  <p>Check that the amplitude exceeds 20 mm.</p> </div> | <p>Reduce the amplitude to less than 20 mm using the program editing mode.</p>                                                                                                                                                                                           |
|                | <div data-bbox="403 1406 577 1471" data-label="Section-Header"> <p>Example 2</p> </div> <p>The speed at the point B-S is too fast, and the robot cannot weave.</p>                                                                                                                                                                                                                      | <p>Lower the speed using the program editing mode.</p>                                                                                                                                                                                                                   |
|                | <div data-bbox="403 1630 577 1695" data-label="Section-Header"> <p>Example 3</p> </div> <p>The weaving frequency is zero and the robot cannot weave.</p>                                                                                                                                                                                                                                | <p>Insert the frequency using the program editing mode.</p>                                                                                                                                                                                                              |
|                | <div data-bbox="403 1854 577 1919" data-label="Section-Header"> <p>Example 3</p> </div> <p>The weaving timer is too large (weaving stopping time) and the robot cannot weave.</p>                                                                                                                                                                                                       | <p>Reduce the weaving timer to a size which allows the weaving using the program editing mode.</p>                                                                                                                                                                       |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location   | Cause of error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Recovery processing                                                                                                                                                                                                                                                                                                                                                                                     |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------|--------|-----|------|--------|-----|------|--------|--|------|--------|--|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|---|------|--------|-----|------|--------|--|------|--------|--|------|--------|--|-------|
| Circular weaving | <p>Either of the following commands does not exist.</p> <p>Starting points of circular weaving:</p> <p style="text-align: right;">D-S, D-S</p> <p>Ending points                   D-E, D-E</p> <p>Amplitude points               D-1, D-1</p> <p>Halfway points                 D-2, D-2</p> <p style="text-align: right;">D-0, D-0</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>Use the program editing mode and add any command that is lacking for the starting point, ending point, amplitude point and halfway point of the circular weaving.</p>                                                                                                                                                                                                                                |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
|                  | <div style="display: flex; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">Example</div> <div> <p style="text-align: center;">Weaving frequency</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"></th><th style="width: 20%; text-align: center;">pattern No.</th><th style="width: 40%; text-align: center;">Speed</th></tr> </thead> <tbody> <tr> <td>1. D-S</td><td style="text-align: center;">2</td><td style="text-align: center;">1.00</td></tr> <tr> <td>2. D-1</td><td style="text-align: center;">1.0</td><td style="text-align: center;">5.00</td></tr> <tr> <td>3. D-2</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>4. D-E</td><td></td><td style="text-align: center;">60.00</td></tr> </tbody> </table> </div> </div> |                                                                                                                                                                                                                                                                                                                                                                                                         | pattern No. | Speed | 1. D-S | 2   | 1.00 | 2. D-1 | 1.0 | 5.00 | 3. D-2 |  | 5.00 | 4. D-E |  | 60.00 | <div style="display: flex; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">Example</div> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>1. D-S</td><td style="text-align: center;">2</td><td style="text-align: center;">1.00</td></tr> <tr> <td>2. D-1</td><td style="text-align: center;">1.0</td><td style="text-align: center;">5.00</td></tr> <tr> <td>3. D-2</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>4. D-0</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>5. D-E</td><td></td><td style="text-align: center;">60.00</td></tr> </tbody> </table> </div> | 1. D-S | 2 | 1.00 | 2. D-1 | 1.0 | 5.00 | 3. D-2 |  | 5.00 | 4. D-0 |  | 5.00 | 5. D-E |  | 60.00 |
|                  | pattern No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Speed                                                                                                                                                                                                                                                                                                                                                                                                   |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 1. D-S           | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 2. D-1           | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 3. D-2           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 4. D-E           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 60.00                                                                                                                                                                                                                                                                                                                                                                                                   |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 1. D-S           | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 2. D-1           | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 3. D-2           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 4. D-0           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 5. D-E           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 60.00                                                                                                                                                                                                                                                                                                                                                                                                   |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
|                  | <p>The starting point of the circular weaving has the command D-S (free moving point), while the amplitude point has the commands D-1 and D-2 or the halfway point has the command D-0 (welding progress point).</p> <p>The starting point of the circular weaving has the command D.S (welding point), while the amplitude point has the commands D-1 and D-2 or the halfway point has the command D-0 (free moving point).</p>                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Use the program editing mode and give the commands D-1 and D-2 to the amplitude points or the command D-0 to the halfway point when the circular weaving starting point has the command D-S.</p> <p>Use the program editing mode and give the commands D.1 and D.2 to the amplitude points or the command D.0 to the halfway point when the circular weaving starting point has the command D.S.</p> |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
|                  | <div style="display: flex; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">Example</div> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>1. D.S</td><td style="text-align: center;">2</td><td style="text-align: center;">1.00</td></tr> <tr> <td>2. D-1</td><td style="text-align: center;">1.0</td><td style="text-align: center;">5.00</td></tr> <tr> <td>3. D-2</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>4. D-0</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>5. D-E</td><td></td><td style="text-align: center;">60.00</td></tr> </tbody> </table> </div>                                                                                                                                                                  | 1. D.S                                                                                                                                                                                                                                                                                                                                                                                                  | 2           | 1.00  | 2. D-1 | 1.0 | 5.00 | 3. D-2 |     | 5.00 | 4. D-0 |  | 5.00 | 5. D-E |  | 60.00 | <div style="display: flex; align-items: flex-start;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;">Example</div> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td>1. D.S</td><td style="text-align: center;">2</td><td style="text-align: center;">1.00</td></tr> <tr> <td>2. D.1</td><td style="text-align: center;">1.0</td><td style="text-align: center;">5.00</td></tr> <tr> <td>3. D.2</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>4. D.0</td><td></td><td style="text-align: center;">5.00</td></tr> <tr> <td>5. D.E</td><td></td><td style="text-align: center;">60.00</td></tr> </tbody> </table> </div> | 1. D.S | 2 | 1.00 | 2. D.1 | 1.0 | 5.00 | 3. D.2 |  | 5.00 | 4. D.0 |  | 5.00 | 5. D.E |  | 60.00 |
| 1. D.S           | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 2. D-1           | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 3. D-2           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 4. D-0           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 5. D-E           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 60.00                                                                                                                                                                                                                                                                                                                                                                                                   |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 1. D.S           | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 2. D.1           | 1.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 3. D.2           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 4. D.0           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5.00                                                                                                                                                                                                                                                                                                                                                                                                    |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |
| 5. D.E           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 60.00                                                                                                                                                                                                                                                                                                                                                                                                   |             |       |        |     |      |        |     |      |        |  |      |        |  |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |   |      |        |     |      |        |  |      |        |  |      |        |  |       |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location | Cause of error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Recovery processing                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | <p>The sequence command exists at the amplitude point of the circular weaving.</p> <div data-bbox="395 477 544 542" data-label="Section-Header"> <p>Example</p> </div> <div data-bbox="419 555 777 591" data-label="Text"> <p>1. D-S 2 1.00</p> </div> <div data-bbox="419 618 777 654" data-label="Text"> <p>2. D-1 1.0 2.00</p> </div> <div data-bbox="710 665 863 734" data-label="Text"> <p>1 0-0 1</p> </div> <div data-bbox="419 745 777 781" data-label="Text"> <p>3. D-2 2.00</p> </div> <div data-bbox="419 808 777 844" data-label="Text"> <p>3. D-0 2.00</p> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Delete the sequence command at the amplitude point using the program editing mode.</p> <p>In the case of the left example, delete the sequence command in the  section.</p>                                                                                                                                                                                                   |
|                | <p>Robot cannot weave because an error occurs during the initial calculation of weaving.</p> <div data-bbox="395 992 571 1057" data-label="Section-Header"> <p>Example 1</p> </div> <div data-bbox="458 1057 898 1247" data-label="Diagram"> </div> <div data-bbox="395 1214 571 1279" data-label="Section-Header"> <p>Example 2</p> </div> <div data-bbox="430 1290 877 1386" data-label="Text"> <p>The speed at the point D-S is too fast, and the robot cannot weave.</p> </div> <div data-bbox="395 1404 571 1469" data-label="Section-Header"> <p>Example 3</p> </div> <div data-bbox="430 1480 865 1547" data-label="Text"> <p>The weaving frequency is zero and the robot cannot weave.</p> </div> <div data-bbox="395 1565 571 1630" data-label="Section-Header"> <p>Example 4</p> </div> <div data-bbox="430 1641 895 1738" data-label="Text"> <p>The weaving timer is too large (weaving stopping time) and the robot cannot weave.</p> </div> <div data-bbox="395 1756 571 1821" data-label="Section-Header"> <p>Example 5</p> </div> <div data-bbox="430 1832 895 1930" data-label="Text"> <p>Two of the three points of the circular arc are the same point or very close each other.</p> </div> <div data-bbox="395 1948 571 2013" data-label="Section-Header"> <p>Example 6</p> </div> <div data-bbox="430 2022 916 2089" data-label="Text"> <p>Three points of D-S, D-0 and D-E run along the same straight line.</p> </div> | <p>Reduce the amplitude to less than the limit value using the program editing mode.</p> <p>Lower the speed using the program editing mode.</p> <p>Enter the frequency using the program editing mode.</p> <p>Reduce the weaving time to a size which allows the weaving using the program editing mode.</p> <p>Shift the point D-0 or D-E slightly using the program editing mode.</p> <p>Shift the point D-0 or D-E slightly using the program editing mode.</p> |

Recovery processing of Err34 (occurring while playing) and Err40 (occurring while editing)

| Error location     | Cause of error                                                                                                                                                                                                                                                                                                                          | Recovery processing                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MDI input          | <p>The following errors occurred during checking when the program editing was finished.</p> <ol style="list-style-type: none"> <li>(1) Robot moves beyond the software limit range.</li> <li>(2) Robot moves beyond the moving range when the interpolation is calculated.</li> <li>(3) Angle speed exceeds the rated speed.</li> </ol> | <p>Use the program editing mode and change the teaching point to a point closest to the robot moving range or lower the robot moving speed.</p>                                                                                                                                                                                                                                                                                           |
| Power is shut off. |                                                                                                                                                                                                                                                                                                                                         | <p>Use the editing mode and verify the contents again.</p> <ol style="list-style-type: none"> <li>(1) Select the [EDIT] mode.</li> <li>(2) Press the [PROGRAM] (or [JOB], [ASS SEQ.], [AES SEQ.] and [LIBRARY]).</li> <li>(3) And, enter the program number.</li> <li>(4) If any points to be corrected remain, continue correcting them, and if not, press the [END] key.</li> </ol> <p>Then, check again the operation and grammer.</p> |

## Err 2

The "Err 2" takes place, as a result of the robot's calculation of its operating axis path, when the position of each axis is realized in a different condition from the taught condition whereas the torch tip position and the welding position are realized as taught. For example, a phenomenon is considered wherein in the playback mode the rotated RW axis is caused to conform the taught moving path and position when the RW axis is not moved in teaching.

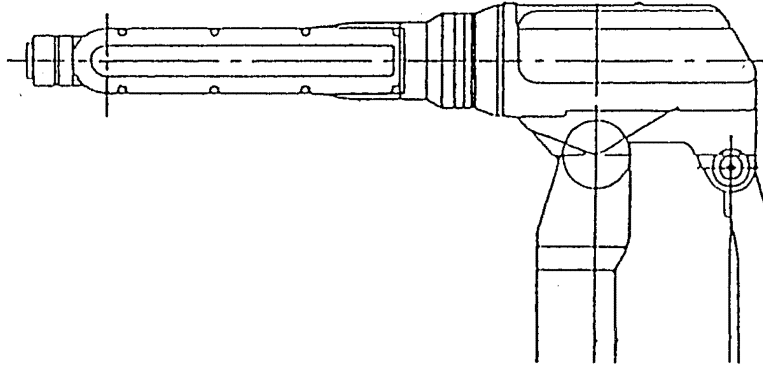
Such conditions result due to the degree of freedom at the robot in the calculation of the moving path and positions, and in such cases, the robot is designed to stop as a result of an error occurring.

The following explains the trouble shooting of the "Err 2".

- (1) The "Err 2" may result when an attempt is made to move the robot by the linear interpolation (command A-0) while rotating the wrist RW axis and TW axis to over 180° between the teaching points. The same error may result due to the positions of the RW and TW axes while the robot moves toward the first point after starting, when the wrist is moved and then the TRACE +(-) or other robot motions are conducted in the trace mode.

In such a case, add teaching points to prevent the RW and TW axes from rotating over 180° or change to the PTP motion (command T-0) or change the starting position (RW, TW positions).

- (2) The "Err 2" may occur when the FA axis and BW axis take parallel positions (see the diagram) during circular interpolation.



(AW8 0 1 0)

In this case, change to the PTP motion (command T-0) or avoid the parallel positions of the FA axis and BW axis by changing the teaching (realize the motions of the same torch direction as by moving each axis).



## Releasing of Overrun

When an overrun status is entered, release the overrun status in the following manners.

- (1) Turn off the power.
- (2) Open the cassette panel (on the right side of the CRT operation box).
- (3) Throw the snap switch to the Overrun position.
- (4) Turn on the power.
- (5) Press the [SERVO POWER] switch.
- (6) Move the robot in opposite direction of the overrun and release the overrun conditions. Refer to the message shown on the CRT screen.
- (7) Turn off the power.
- (8) Throw the snap switch [OVERRUN RELEASE] to NORMAL RUN position.
- (9) Turn on the power and operate the robot again.

NOTE: The overrun releasing mode is valid only when the overrun conditions is present.

### When CRT Screen Does Not Display

In case the CRT display disappears subsequent to an operation upon or after turning the power on, there is a possibility that the robot has detected instantaneous service interruption causing the hardware to be reset. Check the following.

- (1) Turn off and turn on the no fuse breaker (NFB) of the robot controller, and turn on the power. Then, verify that the CRT screen displays messages. The robot controller NFB is located at the upper left section, which can be seen after the front door is opened. To turn ON/OFF the NFB, rotate the handle provided at upper left of the front door.

- (2) Turn OFF the NFB and check for blown fuse of the sequence board (provided with terminal block) provided on the lower part of the front door.

If blown, identify the cause, provide necessary measures, and replace with the new fuse.

If the CRT screen remains in the same condition (does not show any messages) after above checks are made, contact us or the nearest service shop in your area.

In case the CRT screen goes out during the robot operation, press the panel key.

To prevent the burning of the screen of this robot, the screen luminance is reduced 30 seconds after the last operation and goes out one hour later.

## SUPPLEMENTS

### Table of Contents

Supplement 1 : Functions of Keys on Teaching Pendant

Supplement 2 : Console

Supplement 3 : Teaching Pendant

Supplement 4 : Operation Flows

4.1 Operation modes

4.2 Playing

4.3 Teaching

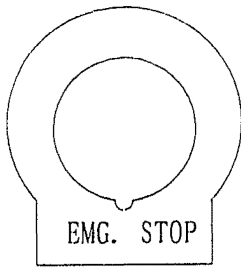
4.4 Editing

4.5 Cassette/Printer

4.6 Control data

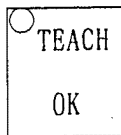
4.7 System setting

## Supplement 1 : Functions of Keys on Teaching Pendant



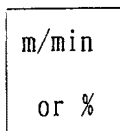
### 1. E.STOP push-button switch

This push-button switch is provided for stopping the robot in an emergency. Pressing the switch once stops operation immediately. Pressing the switch for the second time resumes operation.



### 2. [TEACH OK] key

This key enables starting, ending (interruption) of operation from the teaching pendant, and is used as an LED which indicates the current status. Press the TEACH OK key when starting operation from the teaching pendant. All operations can be carried out when the LED is ON. Press the TEACH OK key to end or interrupt operation. The LED turns OFF and operations instructed from the teaching pendant become invalid.



### 3. [M/MIN OR %] key

This key is used to indicate the unit of the speed displayed in m/min or to change to % which is the rate of the maximum speed.



### 4. [QUICK TRACE] key

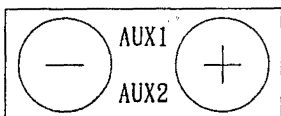
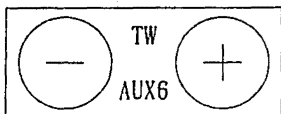
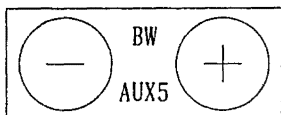
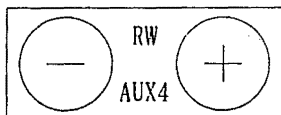
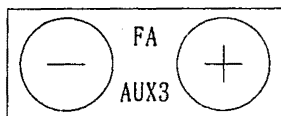
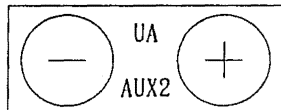
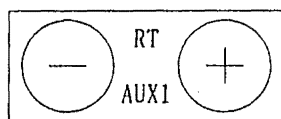
To trace the robot in the trace verify mode through a slow teaching speed section such as the welding section, press the TRACE [+] [-] key while pressing the [QUICK TRACE] key. The robot moves at the limited speed.

When the robot is operated by this key, the setting of the [ROBOT AXIS] key is ignored. Weaving and circular weaving are carried out at the taught speed.

Whether to make the function of this key "valid" or "invalid" can be selected by the "Initial Setup (advanced function) mode. The system is set as "invalid" at shipping condition.

## 5. Various keys for moving robot

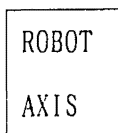
The various + and - keys are used to rotate the robot and move its arms and wrists. They are also used when moving the auxiliary axes.



It is possible in the INITIAL SETUP (ADVANCED FUNCTIONS) MODE to set the ROBOT AXIS YES or NO.

If YES is selected, you must press and hold the ROBOT AXIS key for the +/- keys to operate. If NO is selected, the robot can be moved by simply operating these +/- keys without the need to press and hold the ROBOT AXIS key.

There are fine sets of coordinate systems (CARTES, CYLINDRICAL, USER, TOOL AND ARTI) used to move the robot. Each system is selected using [SPEED H→M→L] key. When moving the auxiliary axes, press and hold the AUX AXIS key while using the +/- keys (AUX 1/AUX 2), which are used for special systems.



#### 6. [ROBOT AXIS] key

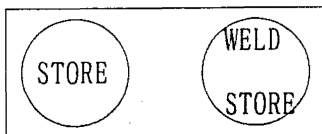
When moving the arms and wrists, and tracing forward and backward, press and hold the ROBOT AXIS key then press the +/- keys for each axis or the FORWARD/BACKWARD keys.

Whether to make the function of this key "valid" or "invalid" can be selected by the Initial Setup (advanced function) mode. The system is set as "valid" at shipping condition.



#### 7. [AUX AXIS] key

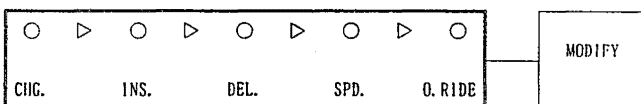
To select auxiliary axis operation, press and hold the AUX AXIS key. Then use the +/- keys for each axis.



#### 8. [STORE] [WELD STORE] keys

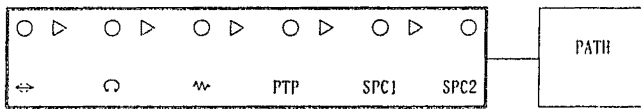
Used to store teaching points. Use the STORE key to save non-welding points and the WELD STORE key to save welding points. During teaching, use the STORE key for the [SEQUENCE INPUT] saving operation.

#### 9. [MODIFY] key



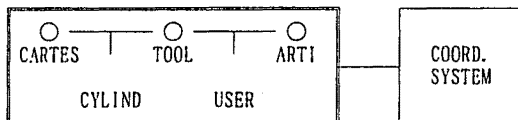
When [CHANGING], [INSERTING] or [DELETING] teaching points, when changing the [SPEED] between teaching points, and when [OVERRIDING] (changing the welding conditions during playing), use this key to select the appropriate action. Each time you press the key, the contents of corrections are changed and indicated by the lighting of the LED.

#### 10. [PATH] key



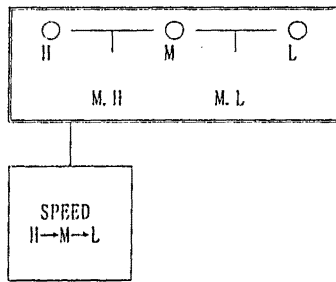
This key is used to specify the manner in which the robot moves. In teaching, press the key to select the desired manner of robot movement. Each time the key is pressed, the LEDs indicate the manner of robot movement in the sequence: [LINEAR] - [CIRCULAR ARC] - [WEAVING] - [CIRCULAR ARC WEAVING] - [PTP]. The SPEC 1 and SPEC 2 keys are used for expansion but are not used currently.

#### 11. [TEACH COORD. SYSTEM] key



This key is used in teaching to select the coordinate system in which to move the robot. The LEDs indicate the selected system. Each time you press the key, the coordinate system changes in the sequence: [CARTES (Cartesian coordinate system)] - [TOOL (Wrist coordinate system)] - [ART (operation of each axis)] - [CYLINDER (cylindrical coordinate system)] - [USER (User coordinate system)].

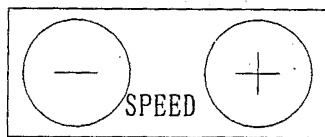
12. [SPEED H→M→L] key



The [SPEED H→M→L] key is used to select the operating speed of the robot. The LED lamps indicate the selected speed range. Press the [SPEED H→M→L] key to select the desired range in either of the sequence [HIGH], [MID. HIGH], [MID.], [MID LOW] and [LOW]. Then, use the [SPEED +/-] keys to set the speed more specifically.

|             |                      |
|-------------|----------------------|
| [HIGH]      | 60 to 120 (m/min)    |
| [MID. HIGH] | 30 to 59 (m/min)     |
| [MID.]      | 10 to 29 (m/min)     |
| [MID. LOW]  | 1.0 to 9.9 (m/min)   |
| [LOW]       | 0.01 to 0.99 (m/min) |

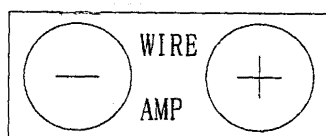
13. [SPEED +/-] key



These keys are used to set the exact operation speed. First select the appropriate speed range, then press [+] or [-] key to adjust the speed to the exact speed. The data of the speed is displayed on the LED (8 digit  $5 \times 7$  dots) for speed indication.

The SPEED +/- keys are also used to select the menu numbers and commands to carry out the [WEAVE TYPE], [MENU SELECT] and [SEQ] operations. Also used in the speed overriding operation while robot playing.

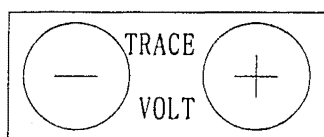
14. [WIRE +/-] [CURRENT +/-] key



These keys are used to feed the welding wires in forward or backward direction in the manual mode. Keys are also used in the overriding operation of the welding current during the robot playing.



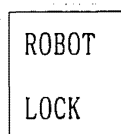
15. [TRACE +/-] key [VOLTAGE +/-] key



The TRACE +/- keys are used in the TRACE mode to move the robot forward or backward for each teaching point. If the ROBOT AXIS key has been set ON in the INITIAL SETUP mode, you must press and hold the ROBOT AXIS key then press the +/- keys for these keys to operate. If you press and hold the ROBOT LOCK key, then press the +/- keys, the robot will not move, but the teaching point can be moved forward or backward.

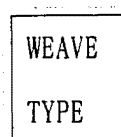
Using the override operation during the robot play, you can use these keys to increase (+) or decrease (-) the welding current.

16. [ROBOT LOCK] key



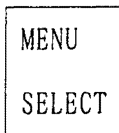
This key is used in trace mode to move only the teaching point forward or backward without the need to move the robot. Press and hold the ROBOT LOCK key then press the +/- keys.

17. [WEAVE TYPE] key



This key is used in the teaching mode to select the type of weaving. Press and hold the WEAVE TYPE key then press the +/- keys. The weaving menu number is displayed on the [SPEED DISPLAY LED] and the corresponding weaving type can be taught and registered.

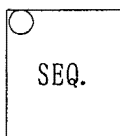
18. [MENU SELECT] key



This key is used to select a welding menu and a user coordinate system number during teaching. Each time you press this key, the speed display indicates the welding menu numbers.

When you press the speed [+] / [-] keys while the welding menu number is displayed, the welding menu number will be displayed. Press and hold the [MENU SELECT] key then press the [ROBOT AXIS] key, the user coordinate system can be selected. To select the number of the user coordinate system, press and hold the [MENU SELECT] key, and press the [ROBOT AXIS] key.

19. [SEQ.] key



The [SEQ.] key is used in teaching to put the robot in the state ready for entering the sequence commands to a teaching point, and is also equipped with an LED lamp. Pressed once, the LED turns ON and the sequence command (limited to specific commands) is indicated by the [SPEED DISPLAY LED]. Use the [+/-] keys to select and store the desired command. Press the SEQ. key again when the command entry is finished. Then, the LED turns OFF.

20. [JOG] key



The JOG key is used in teaching to manually move the robot in minute amounts (pitch feed). The LED lamp turn ON when the key input is accepted and the robot is put in the pitch feeding state. The amount by which the robot moves is determined by the SPEED RANGE (HIGH, MIDDLE HIGH, MIDDLE, MIDDLE LOW and LOW), as follows: Amount of travel by pitch feed can be set through the INITIAL SETUP : ROBOT PARAMETER screen.

Amount of travel by pitch feed

|             | Standard value |
|-------------|----------------|
| HIGH        | 1.00           |
| MIDDLE HIGH | 0.75           |
| MIDDLE      | 0.50           |
| MIDDLE LOW  | 0.35           |
| LOW         | 0.20           |

(mm)

21. [WELD OFF] key



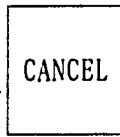
This key is used to interrupt welding during play. The LED turns ON when the key input is accepted and the robot put in the no-weld state. To restart welding, press the [WELD OFF] key again to cancel the weld-stop state (the LED turns OFF).

22. [CIRCLE WEAVE END] key



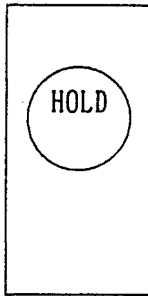
The CIRCLE WEAVE END key is used in teaching to cancel a specified CIRCLE, WEAVE or CIRCLE WEAVING state after such state has been taught.

23. [CANCEL] key



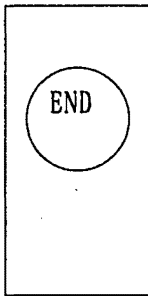
The CANCEL key is used to cancel an error state and to cancel (interrupt) midway the teaching of a CIRCLE, etc., format specification.

24. [HOLD] key



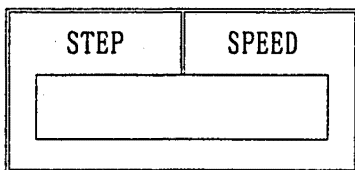
The HOLD key is used to interrupt (pause, or hold) the operation of the robot during play. The function is exactly the same as that of the [HOLD] key on the control panel.

25. [END] key



The END key is used to end or terminate the teaching of a program in the teaching mode. Also, in pausing (holding) during tracing or running, you can force the ending of execution by simultaneously pressing the END and CANCEL keys.

26. [STEP NO.] and [SPEED] LED display

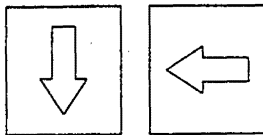
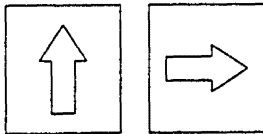
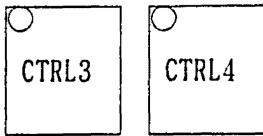
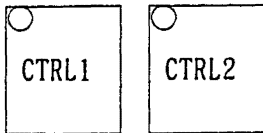


This is an 8-digit 5×7 dot LED display used to show the current teaching point number and the speed. The SPEED display LED is usually used to show the speed in m/min. It is also used to show the selected value used in overriding pre-set values and the contents of other operations such as WEAWE SELECT, MENU SELECT and SEQ. INPUT.

27. [WELD] LED



This LED lamp turns ON during tracing or play to show that the welding is taking place.

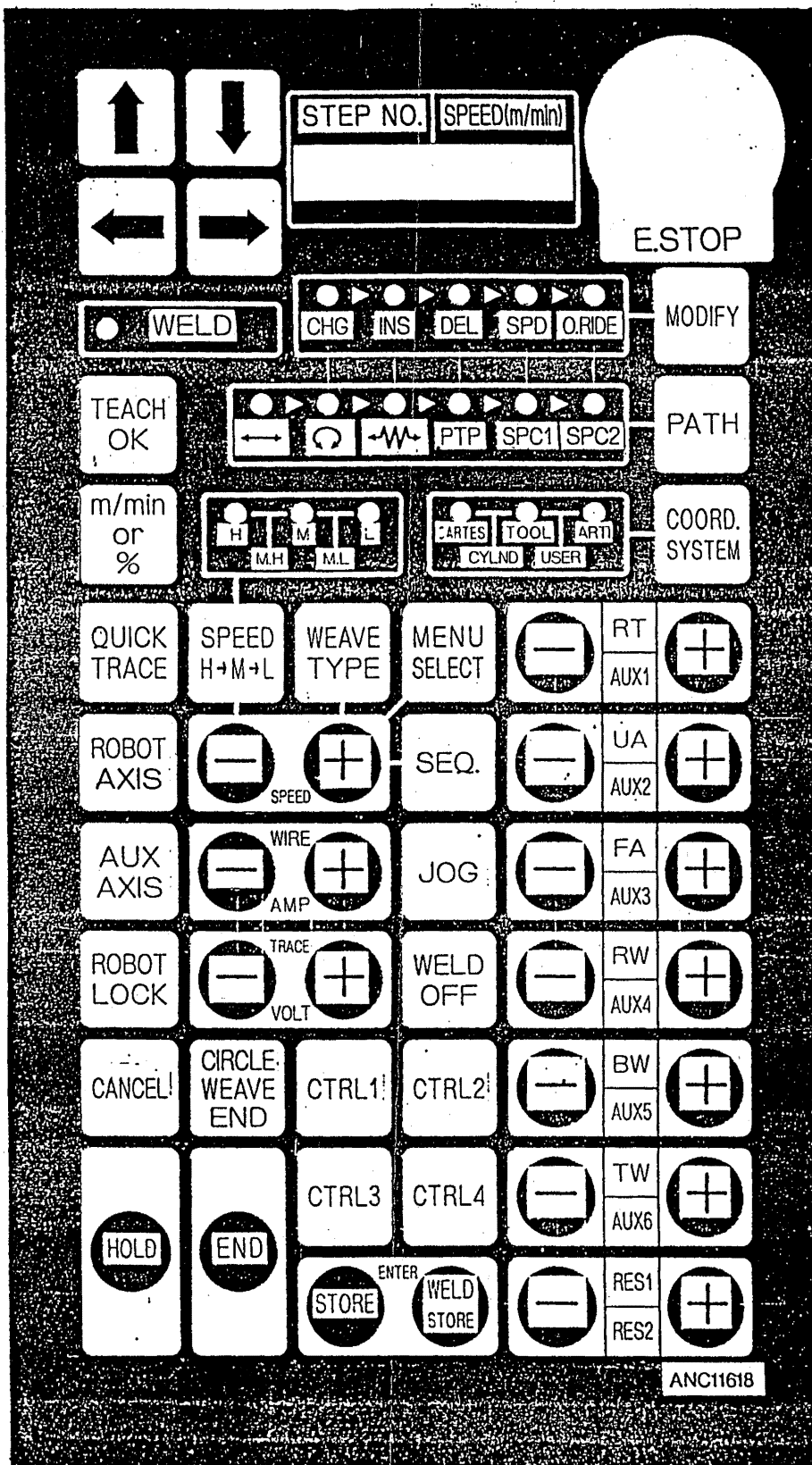


28. [CTRL1]~ [CTRL4] keys

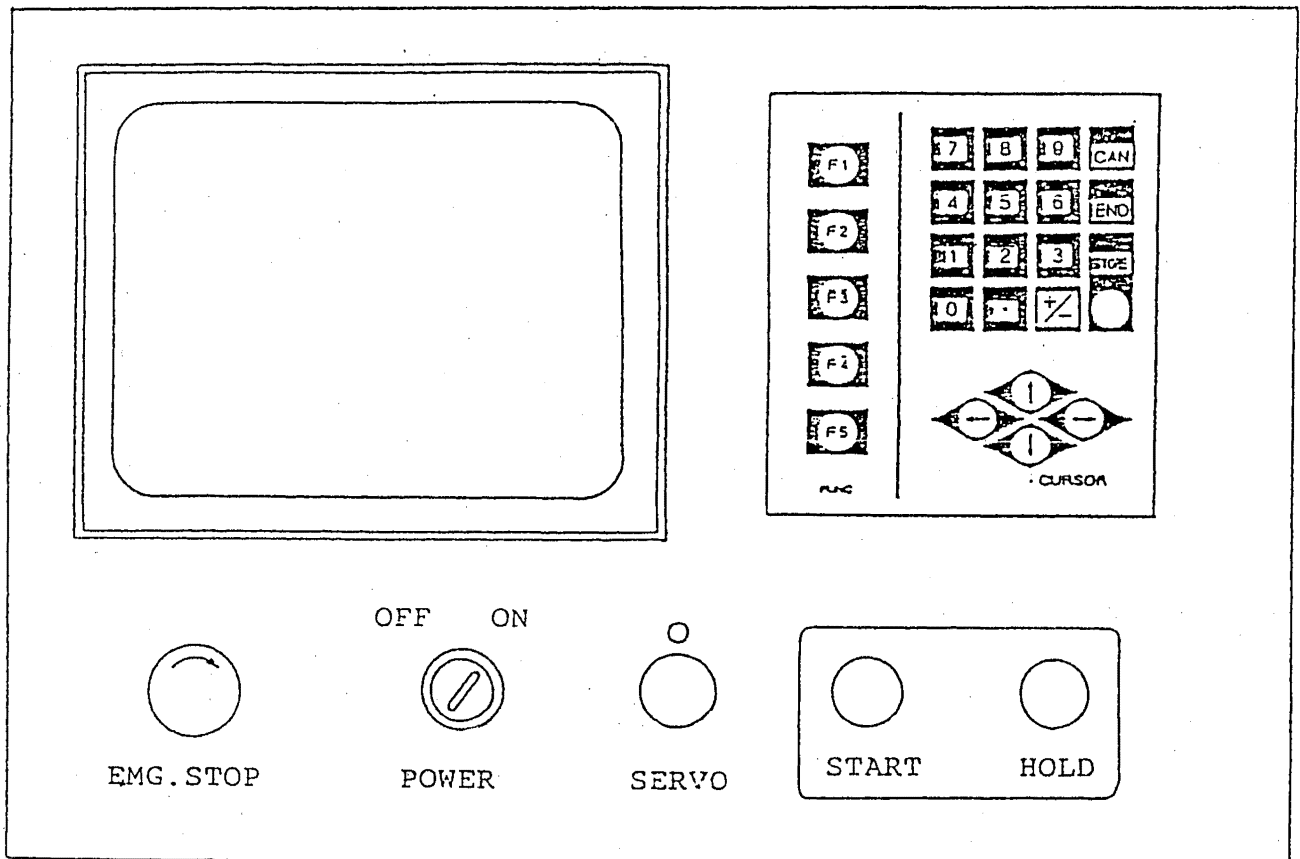
These keys are used in teaching mode or playing mode to control the output signals from the teaching pendant.

29. [↑] [↓] [←] [→] keys

These keys are used to enter the sequence commands from the teaching pendant or to monitor the state of the input/output terminals. Note that these keys cannot be used at present.



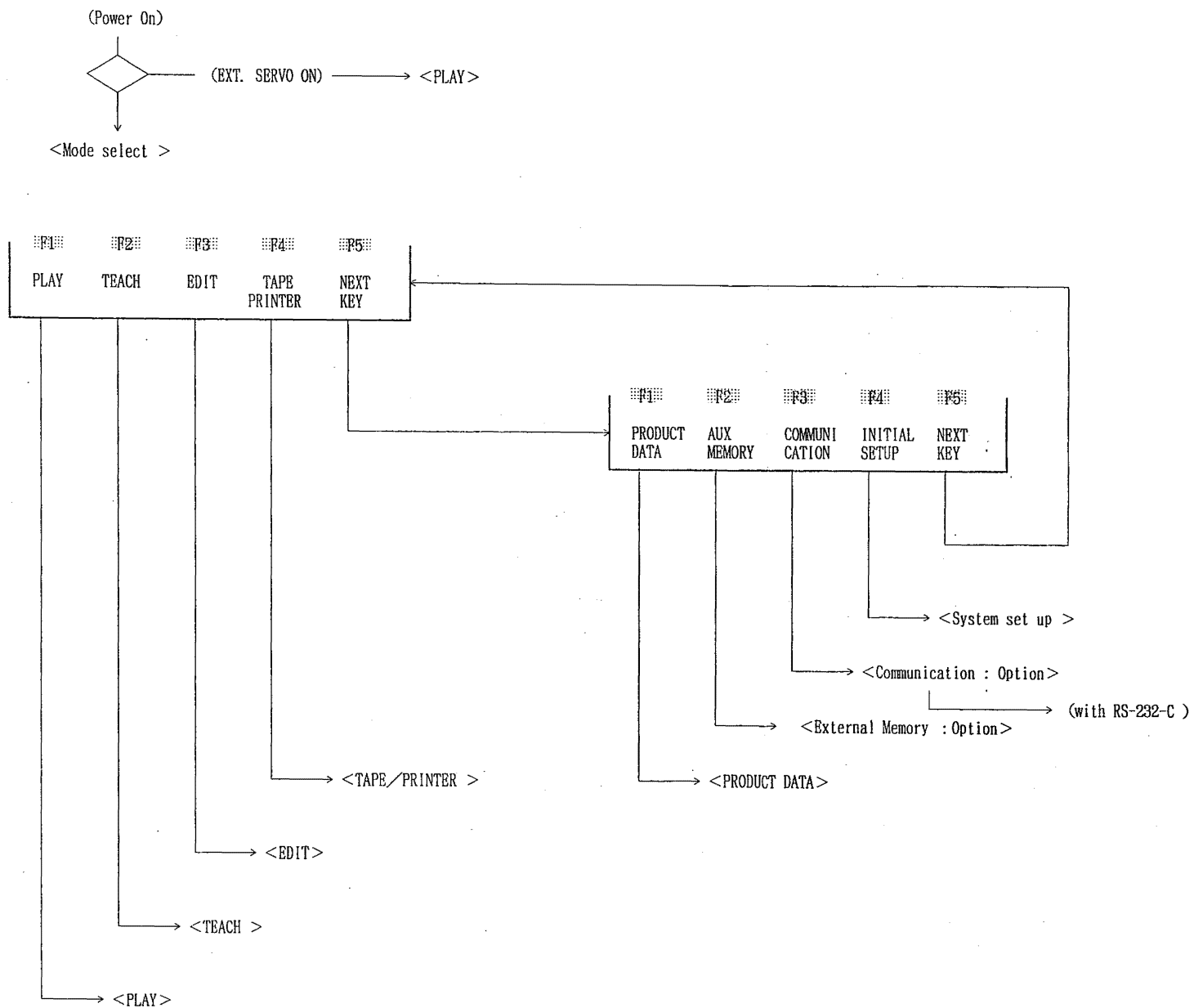
Supplement 2. Teach Pendant Key Diagram



Supplement 3. Console Panel Diagram

## Supplement 4. Operation flow chart

### 4.1 Operation mode select





```

graph TD
 subgraph Start [Start]
 StartPanel[Panel start
(at address search)]
 StartExt[Start
(Panel/External)]
 end

 subgraph F1_F5_Top [F1 F2 F3 F4 F5]
 F1_Top[PLAY COND]
 F2_Top[DISP CHANGE]
 F3_Top[EDIT]
 F4_Top[TAPE PRINTER]
 F5_Top[COMMUNICATION]
 end

 subgraph F1_F5_Bottom [F1 F2 F3 F4 F5]
 F1_Bottom[PLAY COND]
 F2_Bottom[DISP CHANGE]
 F3_Bottom[EDIT]
 F4_Bottom[TAPE PRINTER]
 F5_Bottom[COMMUNICATION]
 end

 StartPanel --> AS_Execute[Address Search Execute]
 StartExt --> PE_Execute[PLAY Execute]
 PE_Execute -- Execute complete (*) --> StartExt

 AS_Execute -- Complete --> Hold[Hold]
 Hold --> PE_Execute

 F1_Top --> PC_Setting[Play condition Setting]
 F2_Top --> DC[Display change]
 F3_Top --> EM_Execute[Edit mode execute]
 F4_Top --> TP_Execute[Tape/Printer mode execute]
 F5_Top --> CM_Execute[Communicate mode execute]

 PC_Setting --> AS_Setup[Address search Setup search designated step]
 AS_Setup -- Complete (*) --> PC_Setting

 DC --> DC_List["Instruction
Position
IN/OUT(Exclusive)
IN/OUT(Welder)
IN/OUT(User)
Accumulated Time
Job/Register
CRT OFF"]
 DC_List --> DC

 AS_Execute --> PC_Setting

 F1_Bottom --> PC_Setting
 F2_Bottom --> DC2[DISP CHANGE]
 F3_Bottom --> E2[EDIT]
 F4_Bottom --> TP2[TAPE/PRINTER]
 F5_Bottom --> C2[COMMUNICATION]

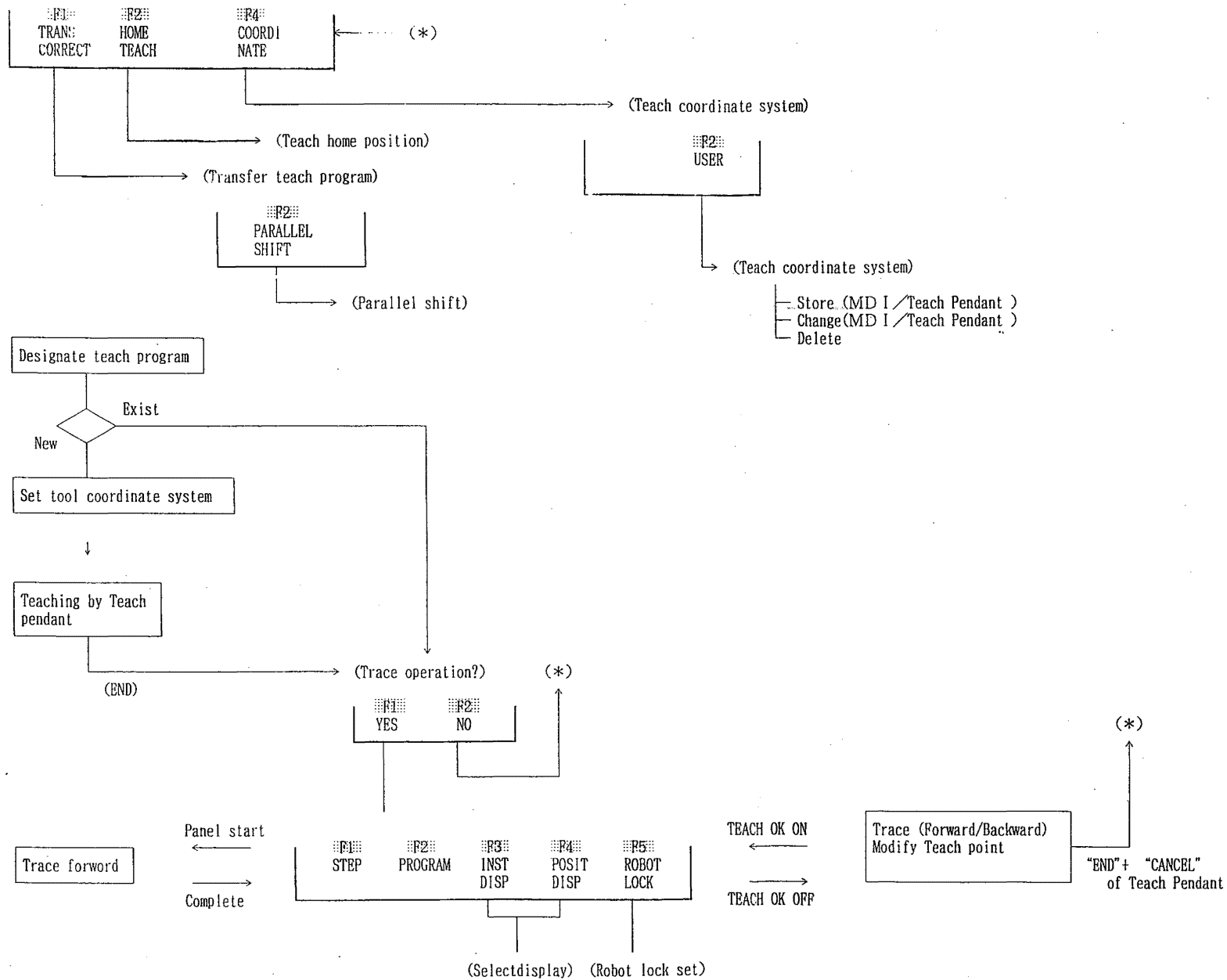
 DC2 --> DC2_Box[DISP CHANGE]
 E2 --> E2_Box[EDIT]
 TP2 --> TP2_Box[TAPE/PRINTER]
 C2 --> C2_Box[COMMUNICATION]

 DC2_Box --> DC2
 E2_Box --> E2
 TP2_Box --> TP2
 C2_Box --> C2

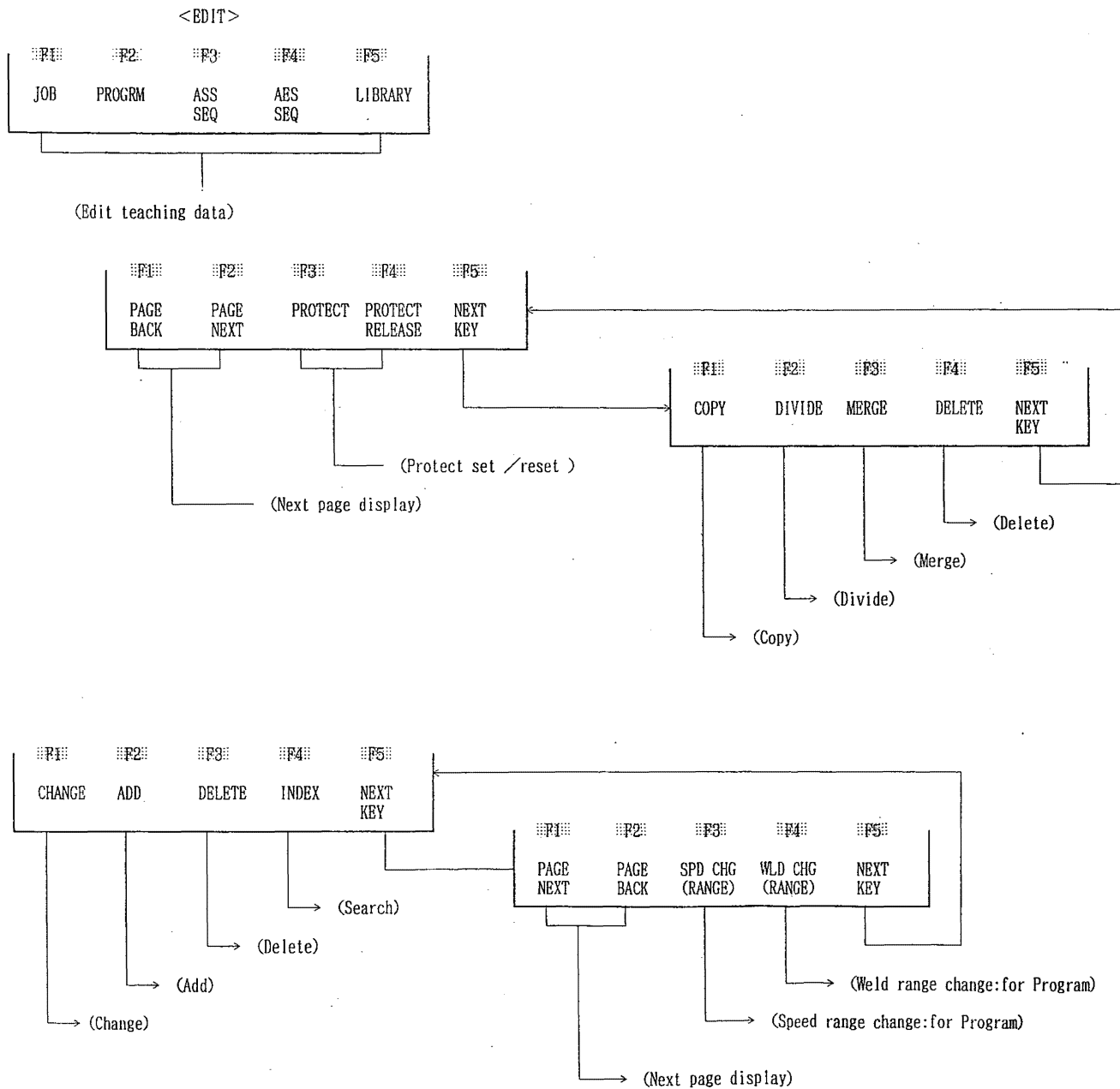
 PC_Setting --> TPC[Trace forward/backward
Modify teach point
(by Teach pendant)]
 TPC -- "END" + "CANCEL" of Teach Pendant (*) --> StartExt
 TPC -- Teach OK ON --> TPC
 TPC -- Teach OK OFF --> DC2

```

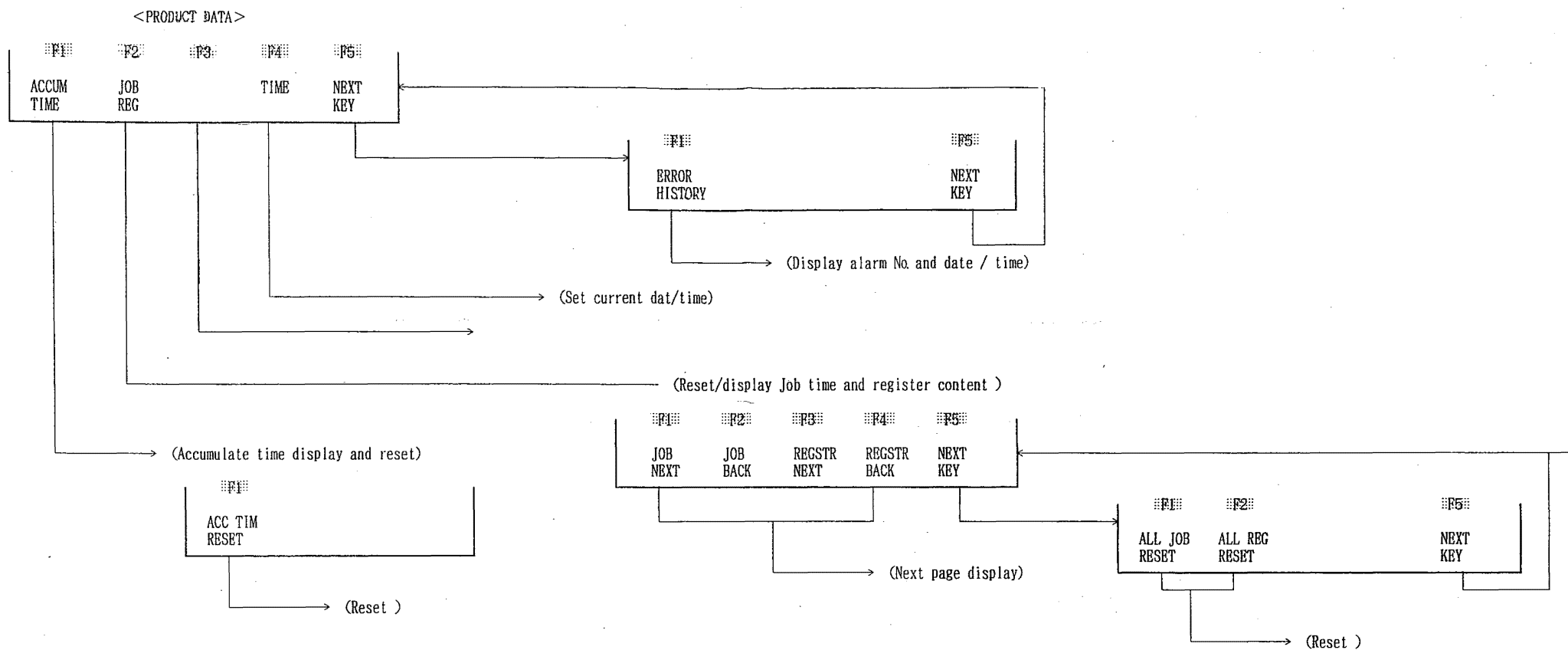
### 4.3 Teaching



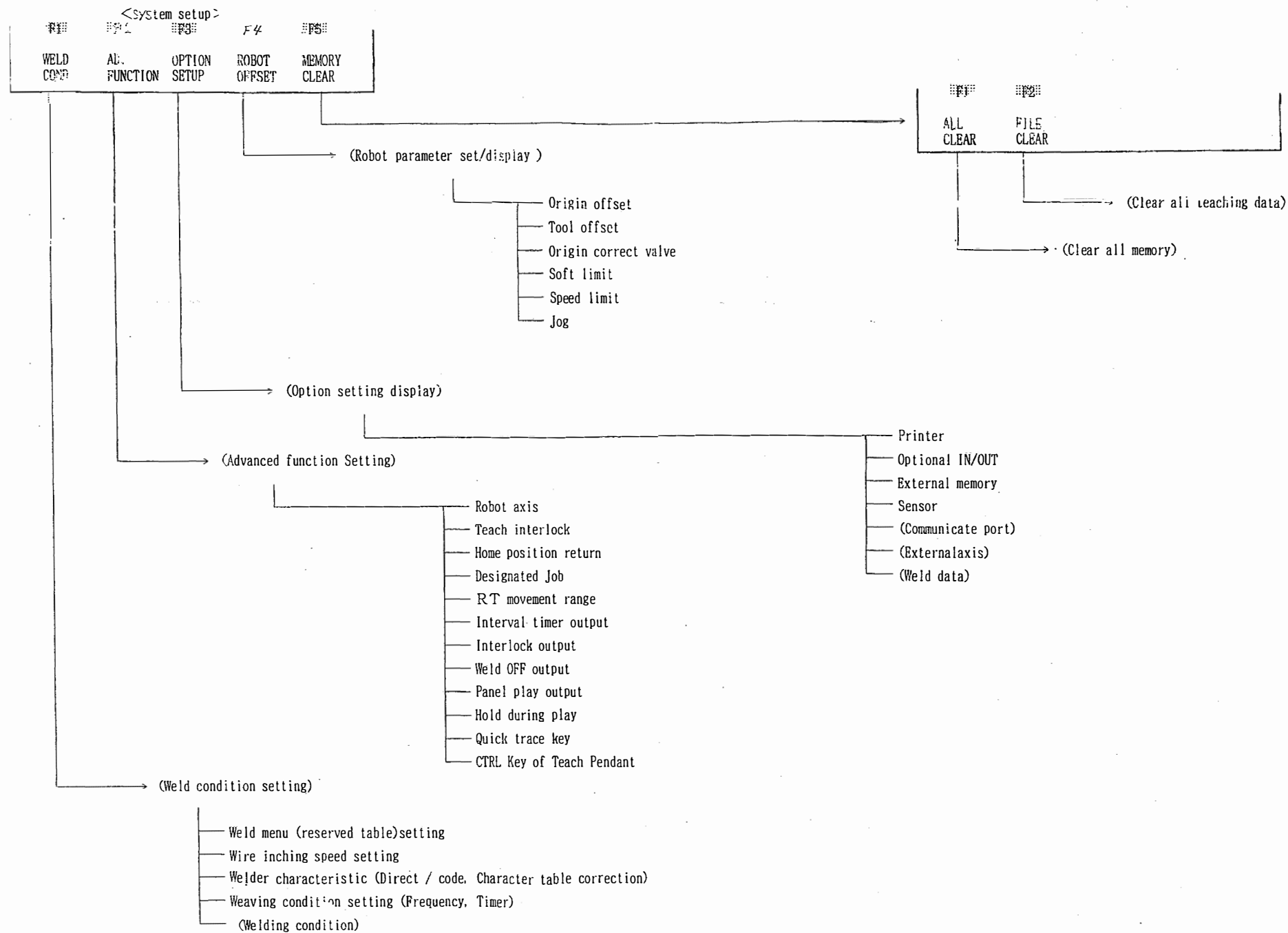
#### 4. 4 EDIT



# 4. 6 PRODUCT DATA

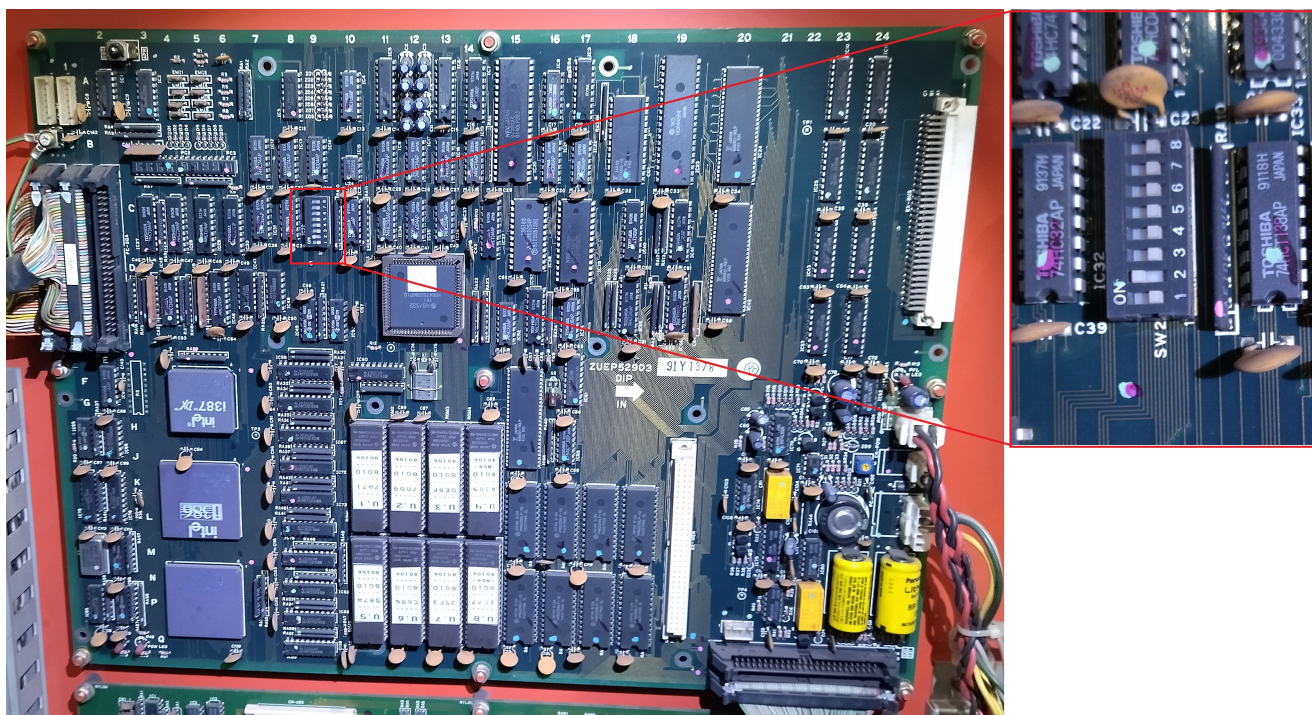


# 4. 7 SYSTEM SETUP



## Для перезапуска энкодера AW-8010

1. Включите DISP SW # 6,7 и 8 на ZUEP 52903
2. Включите питание
3. F5[NEXT KEY] --> F5[NEXT KEY] --> STANDARD POSITION SETTING (ORIGIN POSITION)
4. F1[AXIS SELECT] --> RT --> [STORE] --> [END]
5. F4[ENCODER RESET] --> F1[ORIGIN POSIT.] --> servo power ON, match the mark of RT axis  
--> [3] [9] [STORE] --> panel[END]
6. F4[ENCODER RESET] --> F1[ROTATION] --> servo power ON, match the mark of RT axis  
--> [3] [9] [STORE] --> panel[END]
7. Выключите питание
8. Выключите Disp SW # 6,7 & 8 на ZUEP 52903



### Використання системи очистки.

1. Накінечник для пальників використовувати лише М6.
2. Зняти сопло.
3. Підвести накінечник до системи очистки та виставити по вертикалі(фото 2).
4. В Декартовій системі координат (CARTES) опустити накінечник вниз щоб він зайшов в фрезу(фото 3).
5. Запам'ятати точки.
6. В режимі редагування програми (EDIT) додати команди SEQ як в таблиці на на фото 1.

|     |    |                                        |
|-----|----|----------------------------------------|
| H-1 | 10 | Затримка руху робота на 10мсек         |
| O-0 | 3  | Ввімкнути вихід №3 (станція очистки)   |
| H-1 | 25 | Затримка руху робота на 25мсек         |
| O-1 | 3  | Вимкнути вихід №3 (станція очистки)    |
| O-0 | 2  | Ввімкнути вихід №2 (продувка пальника) |
|     |    |                                        |
| O-1 | 2  | Вимкнути вихід №2 (продувка пальника)  |
| H-1 | 15 | Затримка руху робота на 15мсек         |

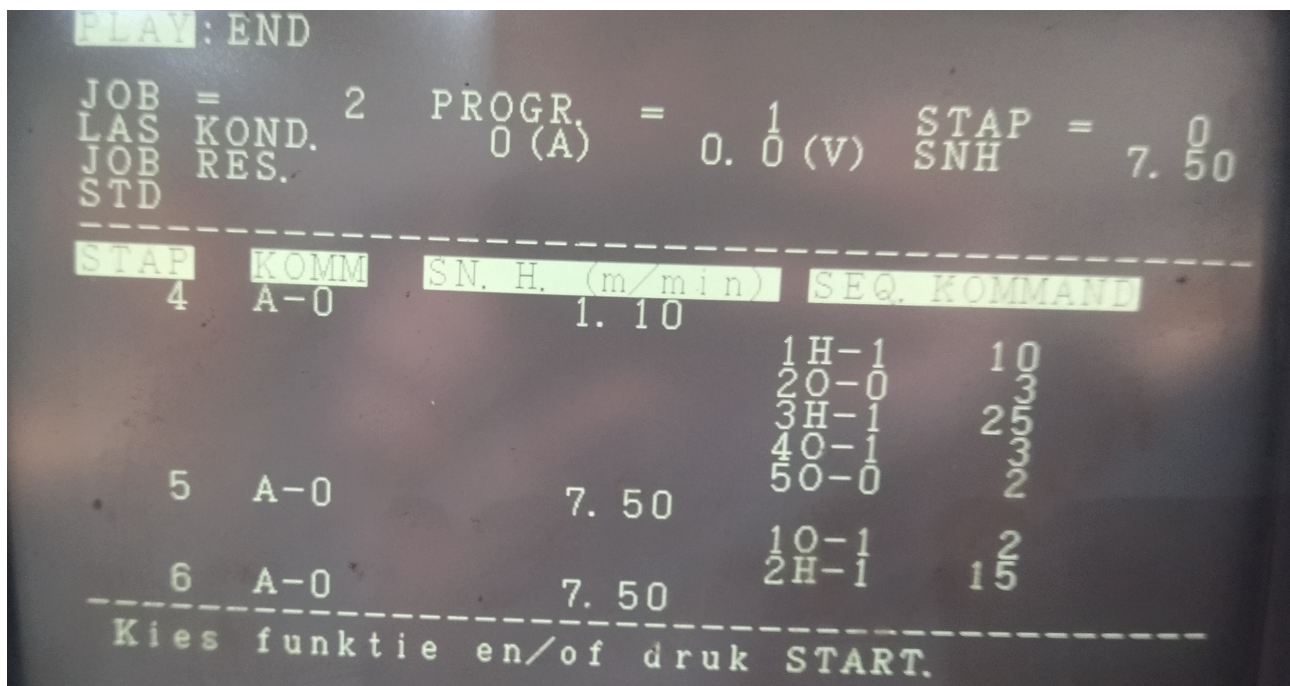


Фото 1





Фото 2





Фото 3