FANUC Robot series

R-30*i*B/R-30*i*B Plus CONTROLLER

Spot Welding Function

OPERATOR'S MANUAL

Thank you very much for purchasing FANUC Robot.

Before using the Robot, be sure to read the "FANUC Robot SAFETY HANDBOOK (B-80687EN)" and understand the content.

The products in this manual are controlled based on Japan's "Foreign Exchange and Foreign Trade Law". The export from Japan may be subject to an export license by the government of Japan. Further, re-export to another country may be subject to the license of the government of the country from where the product is re-exported. Furthermore, the product may also be controlled by re-export regulations of the United States government. Should you wish to export or re-export these products, please contact FANUC for advice.

In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible".

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to ensure the safe use of the robot.
Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.
For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.
In addition, refer to the "FANUC Robot SAFETY HANDBOOK (**B-80687EN**)".

1　　　　DEFINITION OF USER

The user can be defined as follows.

Operator:
- Turns ON/OFF power to the robot
- Starts the robot program from the operator's panel

Programmer:
- Operates the robot
- Teaches the robot inside the safety fence

Maintenance engineer:
- Operates the robot
- Teaches the robot inside the safety fence
- Performs maintenance (repair, adjustment, replacement)

- Operator is not allowed to work in the safety fence.
- Programmers and maintenance engineers are allowed to work in the safety fence.　The work inside the safety fence includes lifting, setting, teaching, adjustment, maintenance, etc.
- To work inside the safety fence, the person must receive a professional training for the robot.

During the operation, programming, and maintenance of your robotic system, the programmer, operator, and maintenance engineer should take additional care of their safety by wearing the following safety items.

- Adequate clothes for the operation
- Safety shoes
- A helmet

2   DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "**WARNING**" or "**CAUTION**" according to its severity. Supplementary information is indicated by "**NOTE**".   Read the contents of each "**WARNING**", "**CAUTION**" and "**NOTE**" before using the robot.

Symbol	Definitions
⚠**WARNING**	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠**CAUTION**	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

- Check this manual thoroughly, and keep it handy for the future reference.

3   SAFETY OF THE USER

User safety is the primary safety consideration.   Because it is very dangerous to enter the operating space of the robot during automatic operation, adequate safety precautions must be observed.
The following lists the general safety precautions.   Careful consideration must be made to ensure user safety.

(1)   Have the robot system users attend the training courses held by FANUC.

> FANUC provides various training courses.   Contact our sales office for details.

(2)   Even when the robot is stationary, it is possible that the robot is still in a ready to move state, and is waiting for a signal.   In this state, the robot is regarded as still in motion.   To ensure user safety, provide the system with an alarm to indicate visually or aurally that the robot is in motion.
(3)   Install a safety fence with a gate so that no user can enter the work area without passing through the gate.   Install an interlocking device, a safety plug, and so forth in the safety gate so that the robot is stopped as the safety gate is opened.

> The controller is designed to receive this interlocking signal of the door switch. When the gate is opened and this signal received, the controller stops the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type).   For connection, see Fig. 3 (b).

(4)   Provide the peripheral equipment with appropriate earth (Class A, Class B, Class C, and Class D).
(5)   Try to install the peripheral equipment outside the robot operating space.
(6)   Draw an outline on the floor, clearly indicating the range of the robot operating space, including the tools such as a hand.
(7)   Install a mat switch or photoelectric switch on the floor with an interlock to a visual or aural alarm that stops the robot when a user enters the work area.
(8)   If necessary, install a safety lock so that no one except the user in charge can turn on the power of the robot.

> The circuit breaker installed in the controller is designed to disable anyone from turning it on when it is locked with a padlock.

(9)   When adjusting each peripheral equipment independently, be sure to turn off the power of the robot.

(10) Operators should be ungloved while manipulating the operator panel or teach pendant. Operation with gloved fingers could cause an operation error.

(11) Programs, system variables, and other information can be saved on memory card or USB memories. Be sure to save the data periodically in case the data is lost in an accident. (refer to Controller OPERATOR'S MANUAL.)

(12) The robot should be transported and installed by accurately following the procedures recommended by FANUC. Wrong transportation or installation may cause the robot to fall, resulting in severe injury to workers.

(13) In the first operation of the robot after installation, the operation should be restricted to low speeds. Then, the speed should be gradually increased to check the operation of the robot.

(14) Before the robot is started, it should be checked that no one is inside the safety fence. At the same time, a check must be made to ensure that there is no risk of hazardous situations. If detected, such a situation should be eliminated before the operation.

(15) When the robot is used, the following precautions should be taken. Otherwise, the robot and peripheral equipment can be adversely affected, or workers can be severely injured.
   - Avoid using the robot in a flammable environment.
   - Avoid using the robot in an explosive environment.
   - Avoid using the robot in an environment full of radiation.
   - Avoid using the robot under water or at high humidity.
   - Avoid using the robot to carry a person or animal.
   - Avoid using the robot as a stepladder. (Never climb up on or hang from the robot.)
   - Outdoor

(16) When connecting the peripheral equipment related to stop (safety fence etc.) and each signal (external emergency, fence etc.) of robot, be sure to confirm the stop movement and do not take the wrong connection.

(17) When preparing footstep, please consider security for installation and maintenance work in high place according to Fig. 3 (c). Please consider footstep and safety belt mounting position.
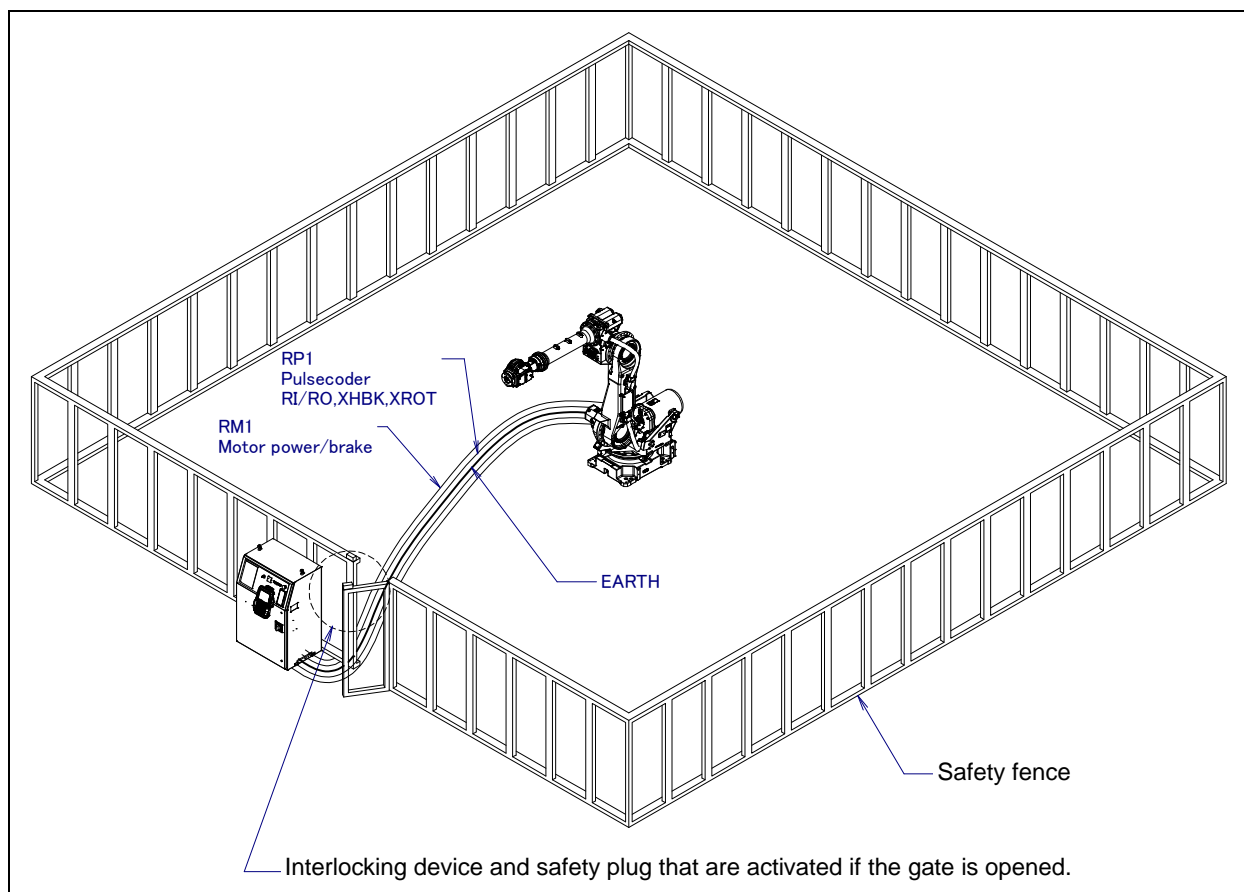
Fig. 3 (a)   Safety fence and safety gate

⚠**WARNING**

When you close a fence, please confirm that there is not a person from all directions of the robot.
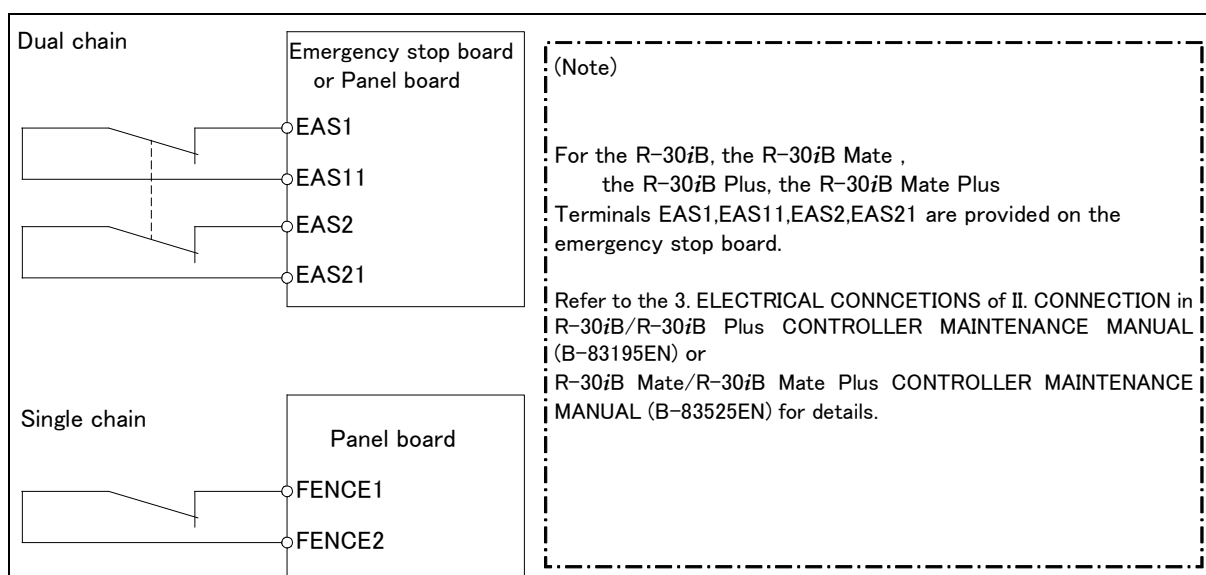

Fig. 3 (b)   Connection diagram for the signal of safety fence
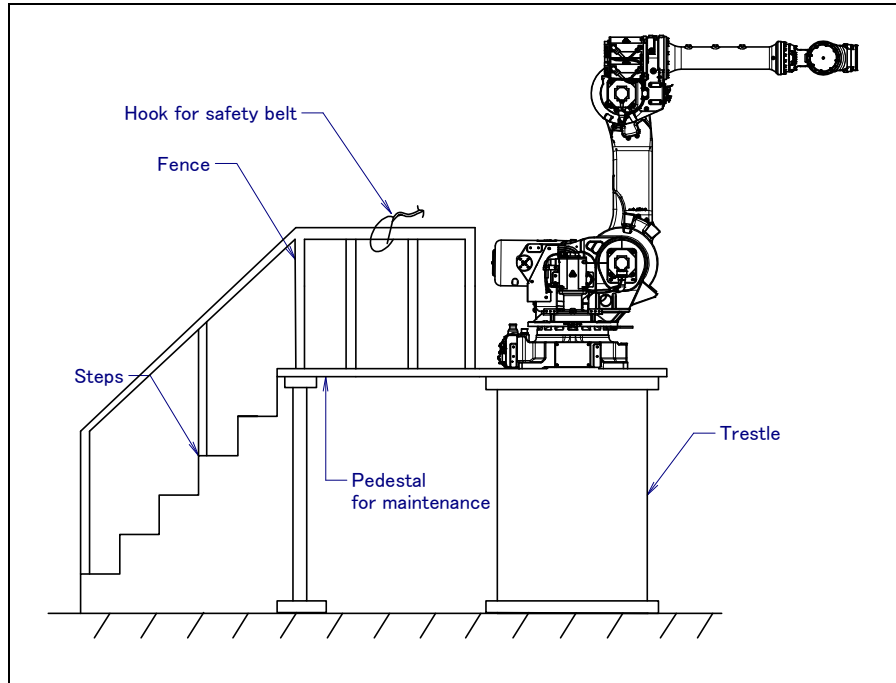
Fig. 3 (c) Pedestal for maintenance

3.1   SAFETY OF THE OPERATOR

An operator refers to a person who turns on and off the robot system and starts a robot program from, for example, the operator panel during daily operation.
Operators cannot work inside of the safety fence.

(1)   If the robot does not need to be operated, turn off the robot controller power or press the EMERGENCY STOP button during working.
(2)   Operate the robot system outside the operating space of the robot.
(3)   Install a safety fence or safety door to avoid the accidental entry of a person other than an operator in charge or keep operator out from the hazardous place.
(4)   Install one or more necessary quantity of EMERGENCY STOP button(s) within the operator's reach in appropriate location(s) based on the system layout.

The robot controller is designed to be connected to an external EMERGENCY STOP button. With this connection, the controller stops the robot operation   (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type) when the external EMERGENCY STOP button is pressed.   See the diagram below for connection.

Fig. 3.1   Connection diagram for external emergency stop button

3.2   SAFETY OF THE PROGRAMMER

While teaching the robot, the operator may need to enter the robot operation area.   The programmer must ensure the safety especially.
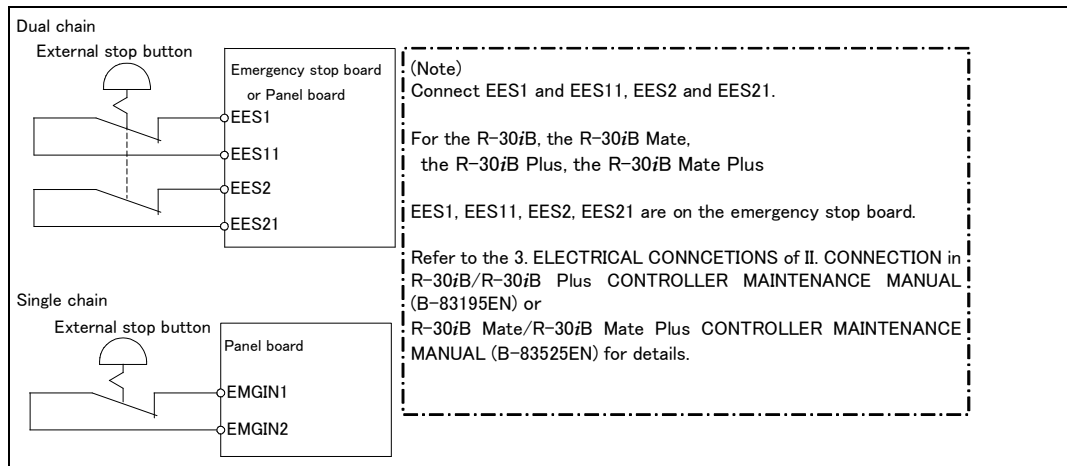
(1)   Unless it is specifically necessary to enter the robot operating space, carry out all tasks outside the operating space.
(2)   Before teaching the robot, check that the robot and its peripheral equipment are all in the normal operating condition.
(3)   If it is inevitable to enter the robot operating space to teach the robot, check the locations, settings, and other conditions of the safety devices (such as the EMERGENCY STOP button, the DEADMAN switch on the teach pendant) before entering the area.
(4)   The programmer must be extremely careful not to let anyone else enter the robot operating space.
(5)   Programming should be done outside the area of the safety fence as far as possible. If programming needs to be done inside the safety fence, the programmer should take the following precautions:
- Before entering the area of the safety fence, ensure that there is no risk of dangerous situations in the area.
- Be prepared to press the emergency stop button whenever necessary.
- Robot motions should be made at low speeds.
- Before starting programming, check the whole robot system status to ensure that no remote instruction to the peripheral equipment or motion would be dangerous to the user.

Our operator panel is provided with an emergency stop button and a key switch (mode switch) for selecting the automatic operation (AUTO) and the teach modes (T1 and T2).   Before entering the inside of the safety fence for the purpose of teaching, set the switch to a teach mode, remove the key from the mode switch to prevent other people from changing the operation mode carelessly, then open the safety gate.   If the safety gate is opened with the automatic operation set, the robot stops (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type).   After the switch is set to a teach mode, the safety gate is disabled.   The programmer should understand that the safety gate is disabled and is responsible for keeping other people from entering the inside of the safety fence.

Our teach pendant is provided with a DEADMAN switch as well as an emergency stop button.   These button and switch function as follows:

(1) Emergency stop button: Causes the stop of the robot (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type) when pressed.

(2) DEADMAN switch: Functions differently depending on the teach pendant enable/disable switch setting status.
    (a)   Enable: Servo power is turned off when the operator releases the DEADMAN switch or when the operator presses the switch strongly.
    (b)   Disable: The DEADMAN switch is disabled.
    (Note) The DEADMAN switch is provided to stop the robot when the operator releases the teach pendant or presses the pendant strongly in case of emergency.   The R-30*i*B/R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus employs a 3-position DEADMAN switch, which allows the robot to operate when the 3-position DEADMAN switch is pressed to its intermediate point.   When the operator releases the DEADMAN switch or presses the switch strongly, the robot stops immediately.

The operator's intention of starting teaching is determined by the controller through the dual operation of setting the teach pendant enable/disable switch to the enable position and pressing the DEADMAN switch.   The operator should make sure that the robot could operate in such conditions and be responsible in carrying out tasks safely.

Based on the risk assessment by FANUC, number of operation of DEADMAN SW should not exceed about 10000 times per year.

The teach pendant, operator panel, and peripheral equipment interface send each robot start signal.   However the validity of each signal changes as follows depending on the mode switch and the DEADMAN switch of the operator panel, the teach pendant enable switch and the remote condition on the software.

Mode	Teach pendant enable switch	Software remote condition	Teach pendant	Operator panel	Peripheral equipment
AUTO mode	On	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed
	Off	Local	Not allowed	Allowed to start	Not allowed
		Remote	Not allowed	Not allowed	Allowed to start
T1, T2 mode	On	Local	Allowed to start	Not allowed	Not allowed
		Remote	Allowed to start	Not allowed	Not allowed
	Off	Local	Not allowed	Not allowed	Not allowed
		Remote	Not allowed	Not allowed	Not allowed

T1,T2 mode: DEADMAN switch is effective.

(6) To start the system using the operator box or operator panel, make certain that nobody is the robot operating space area and that there are no abnormalities in the robot operating space.

(7) When a program is completed, be sure to carry out a test operation according to the following procedure.
    (a)   Run the program for at least one operation cycle in the single step mode at low speed.
    (b)   Run the program for at least one operation cycle in continuous operation at low speed.
    (c)   Run the program for one operation cycle in continuous operation at the intermediate speed and check that no abnormalities occur due to a delay in timing.
    (d)   Run the program for one operation cycle in continuous operation at the normal operating speed and check that the system operates automatically without trouble.
    (e)   After checking the completeness of the program through the test operation above, execute it in the automatic operation.

(8) While operating the system in the automatic operation, the programmer should leave the safety fence.

3.3   SAFETY OF THE MAINTENANCE ENGINEER

For the safety of maintenance engineer personnel, pay utmost attention to the following.

(1)   During operation, never enter the robot operating space.

(2)   A hazardous situation may arise when the robot or the system, are kept with their power-on during maintenance operations. Therefore, for any maintenance operation, the robot and the system should be put into the power-off state. If necessary, a lock should be in place in order to prevent any other person from turning on the robot and/or the system. In case maintenance needs to be executed in the power-on state, the emergency stop button must be pressed as far as possible.

(3)   If it becomes necessary to enter the robot operating space while the power is on, press the emergency stop button on the operator box or operator panel, or the teach pendant before entering the range. The maintenance worker must indicate that maintenance work is in progress and be careful not to allow other people to operate the robot carelessly.

(4)   When entering the area enclosed by the safety fence, the worker must check the whole robot system in order to make sure no dangerous situations exist. In case the worker needs to enter the safety area whilst a dangerous situation exists, extreme care must be taken, and whole robot system status must be carefully monitored.

(5)   Before the maintenance of the pneumatic system is started, the supply pressure should be shut off and the pressure in the piping should be reduced to zero.

(6)   Before the start of maintenance work, check that the robot and its peripheral equipment are all in the normal operating condition.

(7)   Do not operate the robot in the automatic operation while anybody is in the robot operating space.

(8)   When you maintain the robot alongside a wall or instrument, or when multiple users are working nearby, make certain that their escape path is not obstructed.

(9)   When a tool is mounted on the robot, or when any movable device other than the robot is installed, such as belt conveyor, pay careful attention to its motion.

(10) If necessary, have a user who is familiar with the robot system stand beside the operator panel and observe the work being performed.   If any danger arises, the user should be ready to press the EMERGENCY STOP button at any time.

(11) When replacing a part, please contact your local FANUC representative. If a wrong procedure is followed, an accident may occur, causing damage to the robot and injury to the user.

(12) When replacing or reinstalling components, take care to prevent foreign material from entering the system.

(13) When handling each unit or printed circuit board in the controller during inspection, turn off the circuit breaker to protect against electric shock.
        If there are two cabinets, turn off the both circuit breaker.

(14) A part should be replaced with a part recommended by FANUC. If other parts are used, malfunction or damage would occur. Especially, a fuse that is not recommended by FANUC should not be used. Such a fuse may cause a fire.

(15) When restarting the robot system after completing maintenance work, make sure in advance that there is no person in the operating space and that the robot and the peripheral equipment are not abnormal.

(16) When a motor or brake is removed, the robot arm should be supported with a crane or other equipment beforehand so that the arm would not fall during the removal.

(17) Whenever grease is spilled on the floor, it should be removed as quickly as possible to prevent dangerous falls.

(18) The following parts are heated. If a maintenance user needs to touch such a part in the heated state, the user should wear heat-resistant gloves or use other protective tools.
        −   Servo motor
        −   Inside the controller
        −   Reducer
        −   Gearbox

－ Wrist unit
(19) Maintenance should be done under suitable light. Care must be taken that the light would not cause any danger.
(20) When a motor, reducer, or other heavy load is handled, a crane or other equipment should be used to protect maintenance workers from excessive load. Otherwise, the maintenance workers would be severely injured.
(21) The robot should not be stepped on or climbed up during maintenance. If it is attempted, the robot would be adversely affected. In addition, a misstep can cause injury to the worker.
(22) When performing maintenance work in high place, secure a footstep and wear safety belt.
(23) After the maintenance is completed, spilled oil or water and metal chips should be removed from the floor around the robot and within the safety fence.
(24) When a part is replaced, all bolts and other related components should put back into their original places. A careful check must be given to ensure that no components are missing or left not mounted.
(25) In case robot motion is required during maintenance, the following precautions should be taken :
- Foresee an escape route. And during the maintenance motion itself, monitor continuously the whole robot system so that your escape route will not become blocked by the robot, or by peripheral equipment.
- Always pay attention to potentially dangerous situations, and be prepared to press the emergency stop button whenever necessary.
(26) The robot should be periodically inspected. (Refer to the robot mechanical manual and controller maintenance manual.) A failure to do the periodical inspection can adversely affect the performance or service life of the robot and may cause an accident
(27) After a part is replaced, a test execution should be given for the robot according to a predetermined method. (See TESTING section of "Controller operator's manual".) During the test execution, the maintenance worker should work outside the safety fence.

4   SAFETY OF THE TOOLS AND PERIPHERAL EQUIPMENT

4.1   PRECAUTIONS IN PROGRAMMING

(1) Use a limit switch or other sensor to detect a dangerous condition and, if necessary, design the program to stop the robot when the sensor signal is received.
(2) Design the program to stop the robot when an abnormality occurs in any other robots or peripheral equipment, even though the robot itself is normal.
(3) For a system in which the robot and its peripheral equipment are in synchronous motion, particular care must be taken in programming so that they do not interfere with each other.
(4) Provide a suitable interface between the robot and its peripheral equipment so that the robot can detect the states of all devices in the system and can be stopped according to the states.

4.2   PRECAUTIONS FOR MECHANISM

(1) Keep the component cells of the robot system clean, operate the robot where insulated from the influence of oil, water, and dust.
(2) Don't use unconfirmed liquid for cutting fluid and cleaning fluid.
(3) Adopt limit switches or mechanical stoppers to limit the robot motion, and avoid the robot from collisions against peripheral equipment or tools.
(4) Observe the following precautions about the mechanical unit cables. Failure to follow precautions may cause problems.
   • Use mechanical unit cable that have required user interface.

- Do not add user cable or hose to inside of the mechanical unit.
- Please do not obstruct the movement of the mechanical unit when cables are added to outside of mechanical unit.
- In the case of the model that a cable is exposed, please do not perform remodeling (Adding a protective cover and fix an outside cable more) obstructing the behavior of the outcrop of the cable.
- When installing user peripheral equipment on the robot mechanical unit, please pay attention that the device does not interfere with the robot itself.

(5) The frequent power-off stop for the robot during operation causes the trouble of the robot. Please avoid the system construction that power-off stop would be operated routinely. (Refer to bad case example.)   Please perform power-off stop after reducing the speed of the robot and stopping it by hold stop or cycle stop when it is not urgent. (Please refer to "STOP TYPE OF ROBOT" in "SAFETY PRECAUTIONS" for detail of stop type.)
(Bad case example)

- Whenever poor product is generated, a line stops by emergency stop and power-off of the robot is incurred.
- When alteration is necessary, safety switch is operated by opening safety fence and power-off stop is incurred for the robot during operation.
- An operator pushes the emergency stop button frequently, and a line stops.
- An area sensor or a mat switch connected to safety signal operates routinely and power-off stop is incurred for the robot.
- Power-off stop is regularly incurred due to an inappropriate setting for Dual Check Safety (DCS).

(6) Power-off stop of Robot is executed when collision detection alarm (SRVO-050) etc. occurs. Please try to avoid unnecessary power-off stops. It may cause the trouble of the robot, too. So remove the causes of the alarm.

5   SAFETY OF THE ROBOT MECHANICAL UNIT

5.1   PRECAUTIONS IN OPERATION

(1) When operating the robot in the jog mode, set it at an appropriate speed so that the operator can manage the robot in any eventuality.
(2) Before pressing the jog key, be sure you know in advance what motion the robot will perform in the jog mode.

5.2   PRECAUTIONS IN PROGRAMMING

(1) When the operating spaces of robots overlap, make certain that the motions of the robots do not interfere with each other.
(2) Be sure to specify the predetermined work origin in a motion program for the robot and program the motion so that it starts from the origin and terminates at the origin. Make it possible for the operator to easily distinguish at a glance that the robot motion has terminated.

5.3   PRECAUTIONS FOR MECHANISMS

(1) Keep the robot operation area clean, and operate the robot in an environment free of grease, water, and dust.

5.4 PROCEDURE TO MOVE ARM WITHOUT DRIVE POWER IN EMERGENCY OR ABNORMAL SITUATIONS

For emergency or abnormal situations (e.g. persons trapped in or pinched by the robot), brake release unit can be used to move the robot axes without drive power.
Please refer to controller maintenance manual and mechanical unit operator's manual for using method of brake release unit and method of supporting robot.

6 SAFETY OF THE END EFFECTOR

6.1 PRECAUTIONS IN PROGRAMMING

(1) To control the pneumatic, hydraulic and electric actuators, carefully consider the necessary time delay after issuing each control command up to actual motion and ensure safe control.
(2) Provide the end effector with a limit switch, and control the robot system by monitoring the state of the end effector.

7 STOP TYPE OF ROBOT

The following three robot stop types exist:

Power-Off stop (Category 0 following IEC 60204-1)

Servo power is turned off and the robot stops immediately. Servo power is turned off when the robot is moving, and the path of the deceleration is uncontrolled.
The following processing is performed at Power-Off stop.
- An alarm is generated and servo power is turned off. The robot operation is stopped immediately.
- Execution of the program is paused.

Frequent Power-Off stop of the robot during operation can cause failures of the robot.
Avoid system designs that require routine or frequent Power-Off stop conditions.

Controlled stop (Category 1 following IEC 60204-1)

The robot is decelerated until it stops, and servo power is turned off.
The following processing is performed at Controlled stop.
- The alarm "SRVO-199 Controlled stop" occurs along with a decelerated stop. Execution of the program is paused.
- After the decelerated stop, an alarm is generated and servo power is turned off.

Hold (Category 2 following IEC 60204-1)

The robot is decelerated until it stops, and servo power remains on.
The following processing is performed at Hold.
- The robot operation is decelerated until it stops. Execution of the program is paused.

> ⚠ **WARNING**
> The stopping distance and stopping time of Controlled stop are longer than the stopping distance and stopping time of Power-Off stop. A risk assessment for the whole robot system, which takes into consideration the increased stopping distance and stopping time, is necessary when Controlled stop is used.

When the emergency stop button is pressed or the FENCE is open, the stop type of robot is Power-Off stop or Controlled stop. The configuration of stop type for each situation is called "stop pattern". The stop patterns differ according to the controller type or option configuration.

There are the following 3 stop patterns.

Stop pattern	Mode	Emergency stop button	External Emergency stop	FENCE open	SVOFF input	Servo disconnect
A	AUTO	P-Stop	P-Stop	C-Stop	C-Stop	P-Stop
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop
B	AUTO	P-Stop	P-Stop	P-Stop	P-Stop	P-Stop
	T1	P-Stop	P-Stop	-	P-Stop	P-Stop
	T2	P-Stop	P-Stop	-	P-Stop	P-Stop
C	AUTO	C-Stop	C-Stop	C-Stop	C-Stop	C-Stop
	T1	P-Stop	P-Stop	-	C-Stop	P-Stop
	T2	P-Stop	P-Stop	-	C-Stop	P-Stop

P-Stop: Power-Off stop
C-Stop: Controlled stop
-:   Disable

The following table indicates the stop pattern according to the controller type or option configuration.

Option	R-30*i*B/R-30*i*B Mate R-30*i*B Plus/R-30*i*B Mate Plus
Standard	A (*)
Controlled stop by E-Stop (A05B-2600-J570)	C (*)

(*) R-30*i*B / R-30*i*B Mate/R-30*i*B Plus/R-30*i*B Mate Plus do not have servo disconnect. R-30*i*B Mate/R-30*i*B Mate Plus do not have SVOFF input.

The stop pattern of the controller is displayed in "Stop pattern" line in software version screen. Please refer to "Software version" in operator's manual of controller for the detail of software version screen.

"Controlled stop by E-Stop" option

When "Controlled stop by E-Stop" (A05B-2600-J570) option is specified, the stop type of the following alarms is Controlled stop in AUTO mode. In T1 or T2 mode, the stop type is Power-Off stop.

Alarm	Condition
SRVO-001 Operator panel E-stop	Operator's panel E-stop is pressed.
SRVO-002 Teach pendant E-stop	Teach pendant emergency stop is pressed.
SRVO-007 External emergency stops	External emergency stop input (EES1-EES11, EES2-EES21) is open.
SRVO-408 DCS SSO Ext Emergency Stop	In DCS Safe I/O connect function, SSO[3] is OFF.
SRVO-409 DCS SSO Servo Disconnect	In DCS Safe I/O connect function, SSO[4] is OFF.

Controlled stop is different from Power-Off stop as follows:

- In Controlled stop, the robot is stopped on the program path. This function is effective for a system where the robot can interfere with peripheral equipment or other devices if it deviates from the program path.
- Controlled stop has less physical impact than Power-Off stop. This function is effective for systems where the physical impact on tools is required to be reduced.
- The stopping distance and stopping time of Controlled stop is longer than the stopping distance and stopping time of Power-Off stop. Refer to the operator's manual of a particular robot model for the data of stopping distance and stopping time.

When this option is loaded, this function cannot be disabled.

The stop type of DCS Position and Speed Check functions is not affected by the loading of this option. The stop type set on the DCS screen is used.

> ⚠ **WARNING**
> The stopping distance and stopping time of Controlled stop is longer than the stopping distance and stopping time of Power-Off stop. A risk assessment for the whole robot system, which takes into consideration the stopping distance and stopping time increased in AUTO mode on the above alarms, is necessary when this option is loaded.

170123

TABLE OF CONTENTS

1   PREFACE

This chapter explains the manual plan.

Contents of this chapter
1.1   MANUAL PLAN

1.1   MANUAL PLAN

About this manual

FANUC Robot series (R-30*i*B, R-30*i*B Mate, R-30*i*B Plus R-30*i*B Mate Plus CONTROLLER)
OPERATOR'S MANUAL describes how to operate the FANUC Robot for spot welding function which is
controlled by the FANUC R-30*i*B, R-30*i*BMate, R-30*i*B Plus R-30*i*BMate Plus controller (called the robot
controller hereinafter) containing SpotTool+ software.

Using this manual

Each chapter of the manual describes a single operation of the robot. The user can select and read chapters
describing required operations.

Chapter 1 Preface	Describes how to use this manual.
Chapter 2 Overview	Describes feature of SpotTool+.
Chapter 3 SpotTool+ Setup	Describes setup for spot welding.
Chapter 4 SpotTool+ I/O	Describes I/O for spot welding.
Chapter 5 SpotTool+ Program Detail	Describes program detail information for spot welding.
Chapter 6 SpotTool+ Instructions	Describes instructions for spot welding.
Chapter 7 SpotTool+ Manual Operation	Describes manual operation for spot welding.
Chapter 8 SpotTool+ Test Cycle	Describes test cycle for spot welding.
Chapter 9 SpotTool+ Status	Describes status screen for spot welding.
Chapter 10 Nadex Device Weld Controller Interface	Describes operation for Nadex Device Weld Controller Interface.
Chapter 11 Process Logger	Describes operation for Process Logger.
Chapter 12 Spot Configuration transplant function	Describes operation for Spot Configuration transplant function.
Appendix	Describes SPOT MACRO, MULTI APPLICATION, APPLICATION STATUS, ALARM RECOVERY, DISABLE FAULT CHECKING, and ENABLE UI SIGNALS.

Related manuals

The following manuals are available:

Robot controller	OPERATOR'S MANUAL (This manual) B-83284EN-4	Intended readers: Operators responsible for designing, introducing, operating, and adjusting the robot system at the work site. Topics: Description of the setting and operation for spot welding application software. Use: Guide to teaching, introducing, and adjusting the robot at the work site, and application designing.
	OPERATOR'S MANUAL (Basic Operation) B-83284EN	Intended readers: Operators responsible for designing, introducing, operating, and adjusting the robot system at the work site. Topics: Functions, operations and the procedure for operating the robot. Programming procedure, interface and alarm. Use: Guide to teaching, introducing, and adjusting the robot at the work site, and application designing.
	OPERATOR'S MANUAL (Alarm code list) B-83284EN-1	Topics: Error code listings, causes, and remedies. Use: Installing and activating the system, connecting the mechanical unit to the peripheral device and maintenance the robot.
	Optional Function OPERATOR'S MANUAL B-83284EN-2	Intended readers: Operators responsible for designing, introducing, operating, and adjusting the robot system at the work site. Topics: Description of the software optional functions. Use: Guide to teaching, introducing, and adjusting the robot at the work site, and application designing.
	Arc welding Function OPERATOR'S MANUAL B-83284EN-3	Intended readers: Operators responsible for designing, introducing, operating, and adjusting the robot system at the work site. Topics: Description of the setting and operation for arc welding application software. Use: Guide to teaching, introducing, and adjusting the robot at the work site, and application designing.
	Dispense Function OPERATOR'S MANUAL B-83284EN-5	Intended readers: Operators responsible for designing, introducing, operating, and adjusting the robot system at the work site. Topics: Description of the setting and operation for dispense application software. Use: Guide to teaching, introducing, and adjusting the robot at the work site, and application designing.
	MAINTENANCE MANUAL B-83195EN	Topics: Installing and activating the system, connecting the mechanical unit to the peripheral device and maintenance the robot.

Mechanical unit	OPERATOR'S MANUAL	Topics: Installing and activating the robot, connecting the mechanical unit to the controller, maintaining the robot. Use: Guide to installation, activation, connection, and maintenance.

2   OVERVIEW

SpotTool+ is software package for application tool installed in robot controller. In addition to a basic operation described in the OPERATOR'S MANUAL (Basic Operation) (B-83284EN), SpotTool+ can do various kinds of work concerning the spot welding. Refer to the OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for basic setting and basic operation except concerning spot welding.

This chapter explains about the following items that become a peculiar setting and operation for SpotTool+ if SpotTool+ is installed.
- 2.1 Keys on the teach pendant
- 2.2 Status window
- 2.3 Screen menu and function menu
- 2.4 ICON menu

Refer to Chapter 3 of this manual for the System Setting, I/O, Program, or Test Operation concerning spot welding.

2.1   KEYS ON THE TEACH PENDANT

Fig. 2.1 shows the *i*Pendant key switch layout for SpotTool+.
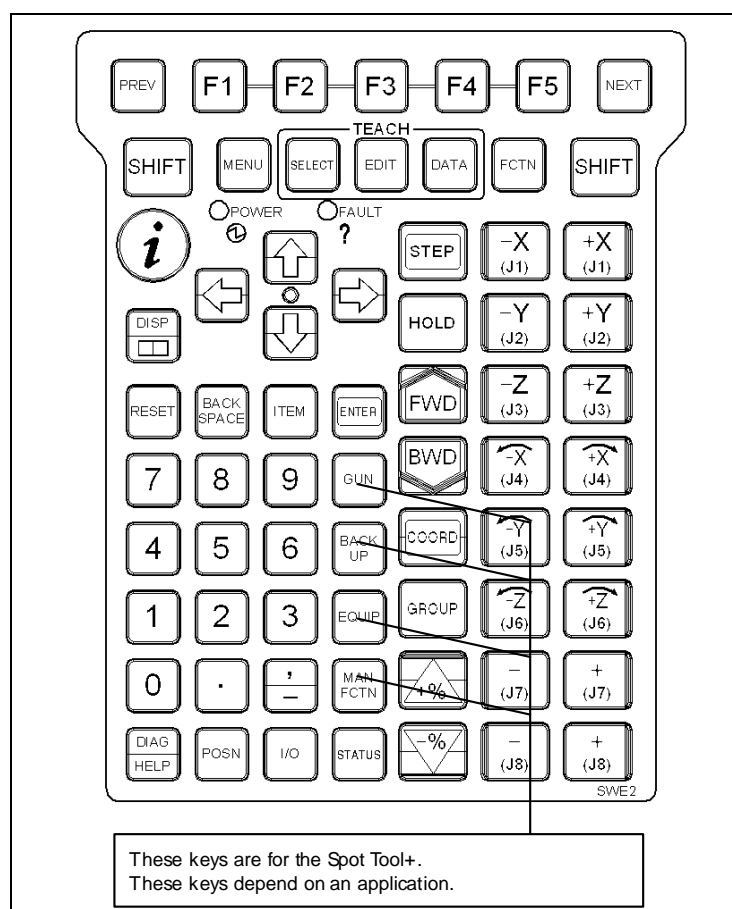
Fig. 2.1 Teach pendant key switches for SpotTool+

Table 2.1 shows keys for SpotTool+.

Table 2.1 Keys for SpotTool+

Key	Function
GUN	This key makes manual pressurization. Refer to chapter 7 for this detail.
BACK UP	This key makes manual stroke switching. Refer to chapter 7 for this detail.
EQUIP	This key displays TP Hardkeys screen. Refer to chapter 7 for this detail.
MAN FCTN	This key displays macro command screen. Refer to section 9.1 in OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for this detail.

2.2   STATUS WINDOW

The window at the top of the iPendant screen is called the status window. In this window, eight software LEDs, alarm indication, and override value are displayed.
Fig. 2.2 shows the status window when SpotTool+ is installed.
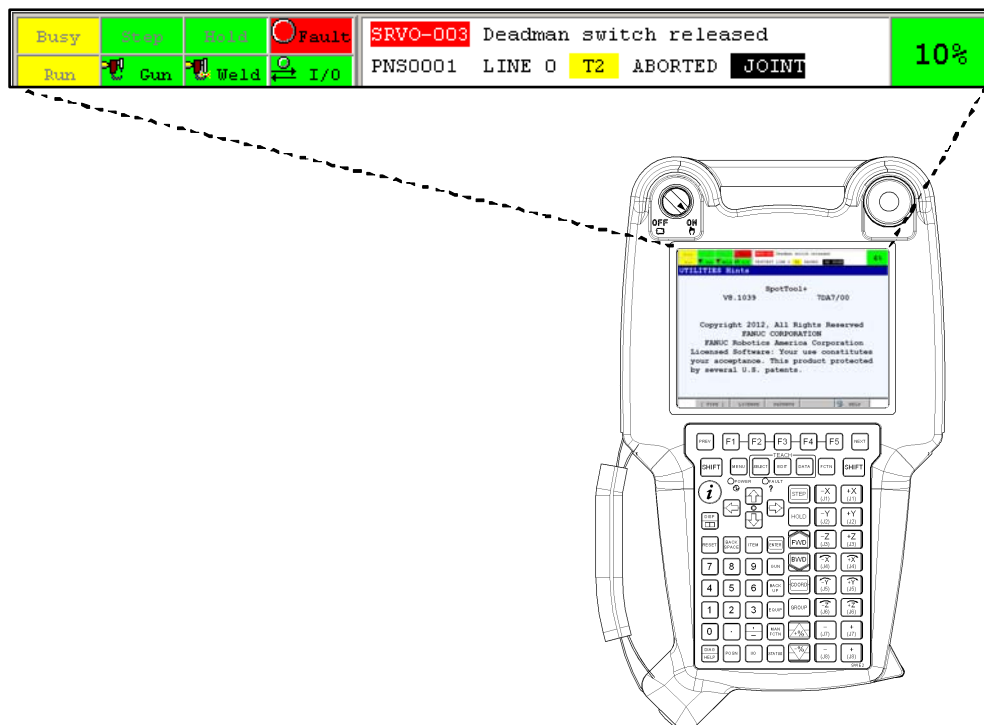
Fig.2.2 Status window for SpotTool+

When SpotTool+ is installed, LED related to SpotTool+ in Table 2.2 is displayed in the status window. Refer to the OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for LED such as other alarm indication and override value.
Each software LED is "on" when displayed together with an icon or "off" when displayed with no icon.

- 5 -

Table 2.2 Description of software LEDs for SpotTool+

LEDs (Upper: On, Lower: Off)		Description
I/O	I/O	Indicates this is a communication situation of Digital/Analog I/O and peripheral device. Refer to section 6.3 in FANUC Robot Series R-30*i*B/ R-30*i*B Mate CONTROLLER (Basic Operation) OPERATOR'S MANUAL (B-83284EN) for Digital/Analog I/O detail.
Weld	Weld	Indicates that robot is WELD or NOWELD. Refer to chapter 8 for this detail.
Gun	Gun	Indicates that robot is STROKE or NOSTROKE. Refer to chapter 8 for this detail.

2.3   SCREEN MENU AND FUNCTION MENU

Menus are used to operate the teach pendant. The screen menu is selected by the MENU key and the function menu is selected by the FCTN key. Fig. 2.3(a), Fig. 2.3(b), and Fig. 2.3(c) show the screen menu, auxiliary menu, and quick menu respectively when SpotTool+ is installed.

Screen menu

The screen menu is used to select a screen. The screen menu lists the following options.
To display the screen menu, press the [MENU] key on the teach pendant.

```
            MENU 1                      MENU 2
1 UTILITIES                  1 SELECT
2 TEST CYCLE                 2 EDIT
3 MANUAL FCTNS               3 DATA
4 ALARM                      4 STATUS
5 I/O                        5 4D GRAPHICS
6 SETUP                      6 SYSTEM
7 FILE                       7 USER2
8                            8 BROWSER
9 USER                       9 DEP
0 -- NEXT --                 0 -- NEXT --
            Page1                       Page2
```

Fig. 2.3(a) Screen menu

The screen related to the following SpotTool+ can be displayed from screen menu. Refer to OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for screen menu detail.

Table 2.3(a) Screen menu

Item	Function
TEST CYCLE	Spot weld test cycle screen can be displayed. Refer to chapter 8 for this detail.
MANUAL FCTNS	Manual spot welding screen can be displayed. Refer to chapter 7 for this detail.
ALARM	ALARM recovery screen can be displayed. Refer to chapter A.4 for this detail.
I/O	Cell interface I/O screen, spot equipment I/O screen and weld interface I/O screen can be displayed. Refer to chapter 4 for this detail.
SETUP	Spot configuration screen, cell interface setup screen, spot equipment screen and spot advance functions screen can be displayed. Refer to chapter 3 for this detail.
DATA	The screen for Nadex DeviceNet weld controller interface function can be displayed when Nadex DeviceNet weld controller interface function is installed. Refer to chapter 10 for this detail.
STATUS	Spot production monitor can be displayed. Refer to chapter 9 for this detail.
DEP	The screen for integral weld timer can be displayed when integral weld timer is installed.

Auxiliary menu

The auxiliary menu lists the following options.
To display the auxiliary menu, press the FCTN key on the teach pendant.

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ┌─────────────────────┐  ┌─────────────────────┐  ┌─────────────────────┐│
│  │       FUNCTION 1    │  │       FUNCTION 2    │  │       FUNCTION 3    ││
│  │ 1 ABORT (ALL)       │  │ 1 QUICK/FULL MENUS  │  │ 1 REFRESH PANE      ││
│  │ 2 Disable FWD/BWD   │  │ 2 SAVE              │  │ 2                   ││
│  │ 3 CHANGE GROUP      │  │ 3 PRINT SCREEN      │  │ 3                   ││
│  │ 4                   │  │ 4 PRINT             │  │ 4                   ││
│  │ 5                   │  │ 5 CHANGE APPL-TOOL  │  │ 5                   ││
│  │ 6 CHANGE EQUIPMENT  │  │ 6 UNSIM ALL I/O     │  │ 6                   ││
│  │ 7 RELEASE WAIT      │  │ 7                   │  │ 7 Diagnostic log    ││
│  │ 8                   │  │ 8 CYCLE POWER       │  │ 8 Del Diag Log      ││
│  │ 9                   │  │ 9 ENABLE HMI MENUS  │  │ 9                   ││
│  │ 0 -- NEXT --        │  │ 0 -- NEXT --        │  │ 0 -- NEXT --        ││
│  └─────────────────────┘  └─────────────────────┘  └─────────────────────┘│
│         Page1                    Page2                    Page3           │
└─────────────────────────────────────────────────────────────────────────┘
```

Fig. 2.3(b) Auxiliary menu

Table 2.3(b) is items of auxiliary menu when SpotTool+ is installed. Refer to OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for auxiliary menu detail.

Table 2.3(b) Auxiliary menu

Item	Function
CHANGE EQUIPMENT	The equipment number can be switched when there are multiple equipments. This menu can be used on the screen related to the servo gun option.
CHANGE APPL-TOOL	The application can be switched when there are multiple applications. Refer to section A.2 for this detail.

Quick menu

When a quick menu is selected in QUICK/FULL MENUS of FUNCTIONS, the screen that can be displayed by using the screen menu is limited to the following:

```
┌─────────────────────────────────────────────────────────────────────────┐
│  ┌─────────────────────┐       ┌─────────────────────┐                   │
│  │        QUICK 1      │       │        QUICK 2      │                   │
│  │ 1 ALARM             │       │ 1                   │                   │
│  │ 2 UTILITIES         │       │ 2                   │                   │
│  │ 3 TEST CYCLE        │       │ 3 SETUP             │                   │
│  │ 4 DATA              │       │ 4                   │                   │
│  │ 5 MANUAL FCTNS      │       │ 5 4D GRAPHICS       │                   │
│  │ 6 I/O               │       │ 6                   │                   │
│  │ 7 STATUS            │       │ 7 USER2             │                   │
│  │ 8                   │       │ 8 BROWSER           │                   │
│  │ 9 USER              │       │ 9                   │                   │
│  │ 0 -- NEXT --        │       │ 0 -- NEXT --        │                   │
│  └─────────────────────┘       └─────────────────────┘                   │
│         Page1                          Page2                             │
└─────────────────────────────────────────────────────────────────────────┘
```

Fig. 2.3(c) Quick menu

In the standard, the screen related to the following SpotTool+ can be displayed from quick menu. Refer to OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for quick menu detail.

Table 2.3(c) Quick menu

Item	Function
ALARM	ALARM recovery screen can be displayed. Refer to chapter A.4 for this detail.
TEST CYCLE	Spot weld test cycle screen can be displayed. Refer to chapter 8 for this detail.
MANUAL FCTNS	Manual spot welding screen can be displayed. Refer to chapter 7 for this detail.
I/O	Cell interface I/O screen, spot equipment I/O screen and weld interface I/O screen can be displayed. Refer to chapter 4 for this detail.
STATUS	Spot production monitor can be displayed. Refer to chapter 9 for this detail.

2.4   ICON MENU

During the pop-up menu invoked by pressing MENU, DISP or FCTN key is displayed on a screen, ICON menu is also displayed at the bottom of a screen for operation short cut. Favorite screen selection and user desired window configuration operation can be done quickly to select an ICON in the menu. Refer to subsection 11.2.2 in OPERATOR'S MANUAL (Basic Operation) (B-83284EN) for ICON menu detail.

ICON menu for favorite screen

When the [MENU] key is pressed, ICON menu for favorite screens will be displayed. By select an ICON of the menu, a favorite screen associated with the ICON will be displayed.

In SpotTool+, some screens, that are used very often, have been registered into an ICON menu at FANUC shipping as the default setting.

Default setting of ICON menu in SpotTool+

Fig. 2.4(a) Default setting of ICON menu corresponding SpotTool+

Table 2.4(a) is items of ICON menu for favorite screen.

Table 2.4(a) ICON menu for favorite screen

ICON	Description
Alarm Log	Alarm history screen can be displayed.
Production	Spot production monitor can be displayed. Refer to chapter 9 for this detail.
Cell Intf	Cell interface I/O screen can be displayed. Refer to chapter 4 for this detail.
Spot Conf	Spot configuration screen can be displayed. Refer to chapter 3 for this detail.
Spot Equip	Spot equipment I/O screen can be displayed. Refer to chapter 4 for this detail.
Browser	Browser screen can be displayed.
Spot Weld	Spot weld test cycle screen can be displayed. Refer to chapter 8 for this detail.

ICON menu for sub-function

When a FCTN key is pressed, the ICON menu or sub-function will be displayed. In SpotTool+, short cut icons are registered for some functions, that are used very often for SPOT application.

Fig. 2.4(b) Sub-functions ICON menu on SpotTool+

Table 2.4(b) is items of ICON menu for sub-function.

Table 2.4(b) Sub-functions ICON menu on SpotTool+

ICON	Description
GUN	This ICON allows you to select the type of gun mode that will be used when running the program. Refer to chapter 8 for gun mode detail. When teach pendant is enabled, this icon can switch the gun mode.
WELD	This ICON allows you to select the type of weld mode that will be used when running the program. Refer to chapter 4 for weld mode detail. When following conditions consist, this ICON can switch the weld mode. • Teach pendant is ENABLED • Gun mode is STROKE
TRYOUT	This ICON enables and disables the ability of the robot to tryout mode. Refer to chapter 8 for tryout mode detail. When following conditions consist, this ICON can switch the tryout mode. • Teach pendant is ENABLED • Tryout input in cell interface I/O is assigned.
WELD SIM	This ICON enables the weld simulation. Refer to chapter 8 for tryout mode detail. When following conditions consist, this ICON can switch the weld simulation. • Teach pendant is ENABLED • Weld mode is NOWELD

> **NOTE**
>   All short cut items in ICON menu for sub-function are decided statically and can
>   not be customized.

3   SPOT TOOL+ SETUP

> **NOTE**
> In order to install SpotTool+, DRAM with minimum of 64MB is required.

This chapter describes the concept, terminology and setting items for setting up SpotTool+ appropriately.

3.1   SPOTTOOL+ TERMINOLOGY

In order to set up and use SpotTool+ properly, you must be familiar with the following concepts: gun, weld controller, and equipment.

Following shows examples of spot welding workcells and lists the number of equipment, guns, and weld controllers used in each system.
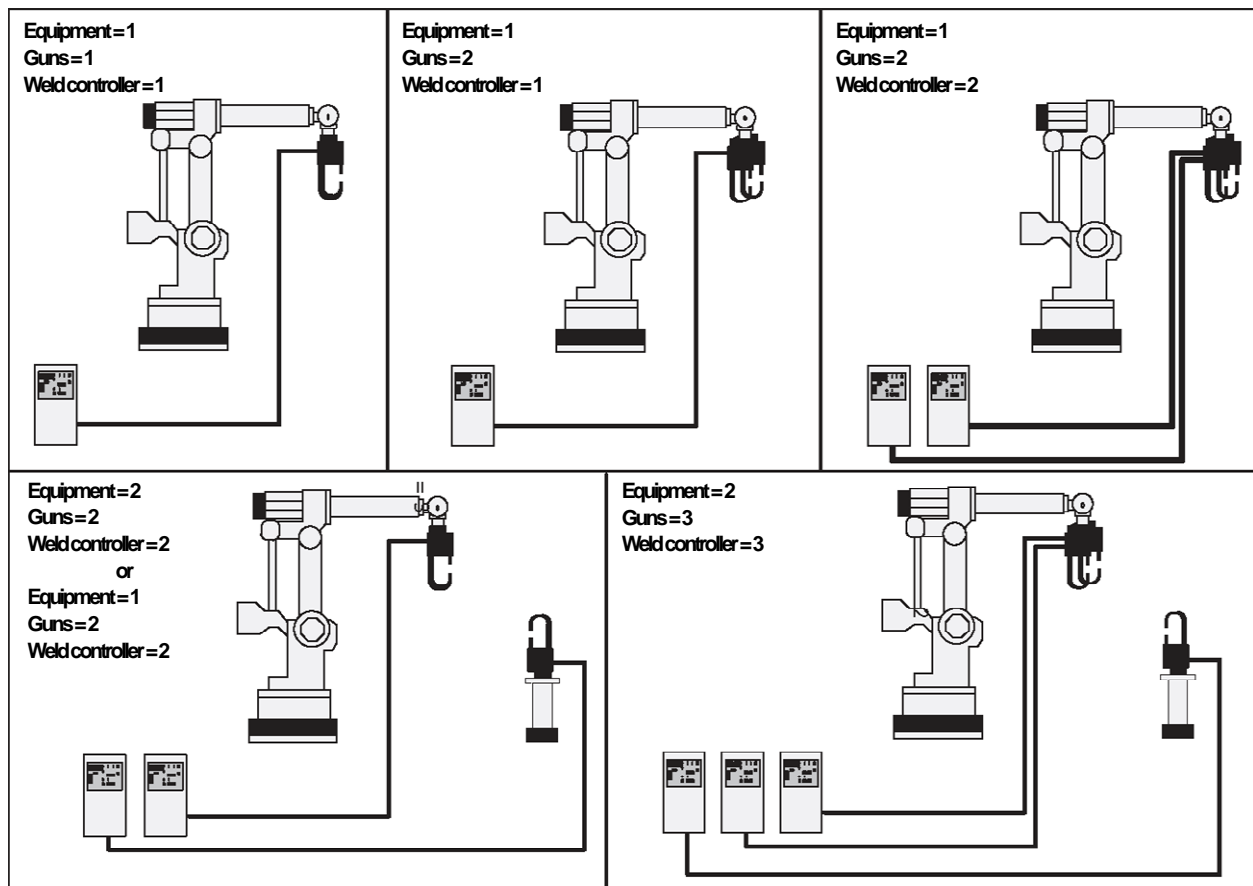
Fig. 3.1 Spot welding workcells

Gun, Weld Controller

A gun performs the welding, as directed by the weld controller. One weld controller can control one or more guns. One or more guns can be used in a workcell. Each gun can be controlled by a weld controller, or multiple guns can be controlled by the same weld controller.

- 11 -

Equipment

A gun is connected to weld equipment. Equipment is any device on which a gun is mounted, such as a robot or pedestal. Up to two guns can be mounted on a piece of weld equipment. Up to five pieces of equipment can be used in SpotTool+. Only equipment can weld at a time. If you have two guns, each connected to different equipments, you can weld only with one gun at a time. If you have two guns, each connected to the same equipment, those two guns can weld simultaneously.

Equipment Definition

At SpotTool+ configuration, you define each equipment, including information about the features of the connected gun(s). These features include items such as multiple gun pressure and backup stroke. If you have two guns with different configurations connected to the same equipment, enable everything that applies to all of the guns, even if only one gun uses certain items. When SpotTool+ executes welding programs, it will ignore items that do not apply to the specified gun, because there will be no I/O configuration to support these items.

Questions and Answers

Use the questions and answers in following Table to understand what you have in your system.

Table 3.1 Questions and Answers

Question	I have three guns and three weld controllers. How many equipments do I tell SpotTool+ I have?
Answer	You can tell SpotTool+ you have either 2 or 3 equipments: • Option 1: 2 equipments, where: • Equipment 1 has 2 guns, 2 weld controllers • Equipment 2 has 1 gun, 1 weld controller • Option 2: 3 Equipments, where: • Equipment 1 has 1 gun, 1 weld controller • Equipment 2 has 1 gun, 1 weld controller • Equipment 3 has 1 gun, 1 weld controller The advantage of Option 1 is that you can perform simultaneous welding with two guns on Equipment 1. The advantage of Option 2 is that the SpotTool+ screens and the teach pendant GUN and BACKUP keys are more easily understood.
Question	What is the best way to optimize the number of equipments I have?
Answer	Add up the number of guns you have. Add up the number of weld controllers you are using. Take the larger total, and divide it by 2. If there is a remainder, add it. The result is the optimal number of equipments. For example, in Option 1 of the previous question, • 3 weld controllers divided by 2 = 1, plus a remainder of 1 • 1 + 1 = 2; use 2 equipments. Another option is to look at the hardware. If you have three guns, then you have one of the following: • 3 standalone pieces of equipment, one gun on each • 2 guns on one equipment, and one gun by itself
Question	I have two different guns; one has a backup stroke, and one does not. One has multi pressure valving, and the other does not. Because of this, do I have to define 2 equipments?
Answer	No. SpotTool+ allows guns to be of different configurations per equipment. However, the spot configuration screen allows you to specify only one configuration per equipment. For details of spot configuration screen, refer next section. In spot configuration screen during software installation, ENABLE all options that apply to any gun. In your example, enable backup stroke and multi pressure. The SPOT[] instruction in the teach pendant program will show all of the fields you enabled, but when SpotTool+ executes a spot instruction, it will ignore anything that has unassigned I/O. Make sure that the I/O points for the gun that has no backup stroke are set to zero in the I/O spot equipment screen.

3.2 SPOT CONFIGURATION SETUP

These items are needed to set in system-up according to the specification of the weld controller and gun which you use. As for the spot screen etc., the displayed item is different according to the content set here. When the servo gun option is specified, the setting on the servo gun setup screen is added. Refer to the servo gun function manual (B-83264EN) for details.

On Table 3.2, these items perform SpotTool+ setup and initialization. Procedure 3-1 is step to display spot configuration screen.

Table 3.2 Spot configuration menu

Item	Description
F Number	This item indicates the robot's F number, and allows you to set it.
Load SpotTool Macros	Enabling this item will load the default SpotTool+ macros on the next cold start. This should only be enabled during initial setup if you don't have your own macros. Enabling this item can overwrite any pre-existing macros.
Number of Equipments	This item indicates the total number of equipments in your system. The default is 1 and the range is from 1 to 5.
Number of weld controllers	This item is the number of weld controllers used, and can be set from 1 to 10.
Current equipment, gun	This item defines the current equipment for configuration setup items, and can be set from 1 to 5, and the gun number can be set from 1 to the number of guns defined below. All items indented under this item are related to this current equipment.
Weld interface	This item displays the kind of weld interface used on the current equipment. The values can be: DIGITAL, which could be a discretely wired weld controller, DeviceNet, ControlNet, or Ethernet interface. The other value for this item is INTEGRAL which would be a WTC Integral weld controller, or a Dengensha Integral weld Controller. INTEGRAL will require the WTC Integral Weld controller option to be loaded or the Dengensha Integral weld controller option to be loaded. Since only 2 IWC cards can exist on the controller, IWC must be configured on equipment 1 or 2 only.
Number of guns	This item defines the number of guns used on the current equipment. This can be set SINGLE or DUAL.
Studwelder	This item defines whether the weld controller you are interfacing to is a studwelder that will weld studs onto a part. By default, this item is DISABLED. If studwelder is enabled, you cannot enable the following items: • Tool changer gun, • Soft touch gun, • Soft touch pulse time, • Multipressure valving, • Number of pressures, • Equalization pressure, • Number of pressures, • Extra gun contactor, • backup stroke, • Quick close backup, • Backup open detect, • BU close/gun open detect, and • Gun close detect.
Enable Backup gun	This item defines whether a backup gun is available for your studwelder. By default, this item is DISABLED. Set this to ENABLED if a second spare stud welding gun is available, operational, and should be used.
Tool changer gun	This item defines whether this equipment is a tool in a tool changer system. Enabling this feature will prevent shell polling from monitoring equipment hooked up to a disconnected gun, and will also ignore detect errors for a disconnected gun.

Item	Description
Soft touch gun	This item defines whether a soft touch gun is used on the current equipment. This allows an assignment of an additional output to close the gun at a lower line pressure setting.
Soft touch pulse time	This item defines the pulse length for the soft touch gun.
Multipressure valving	This item defines whether the current gun uses multiple pressures valving controlled by the robot.
number of pressures	This item defines the number of multiple pressures used, where 2 = high, low; 3 = high, medium, low; 4-15 = binary multiple pressures.
Equalization Pressure	This item defines whether the current gun uses equalization pressure. This allows an assignment of an additional output that is fired during a weld to allow the gun to equalize.
number of pressures	This item defines the number of multiple pressures used, where 2 = high, low; 3 = high, medium, low; 4-31 = binary equalization pressures.
Extra gun contactor	This item defines whether the current gun has an extra gun contactor.
Backupstroke	This item defines whether the current gun has a backup stroke.
Backup type	This item defines the type of the backup gun - NORMAL or SET/RESET.NORMAL type is where the backup stroke is built into the gun's cylinder. SET/RESET is a mechanical type backup where the backup stroke is held in position by a shot pin that prevents the gun from fully opening.
set/rst shot pin dly	This item defines the delay time between the set and the reset of a set/reset gun. The default is 0 ms and the range is 0 ms to 32766 ms.
set/rst set delay	This item defines the length of delay time for the gun to clear the shot pin when closing from full open.
set/rst reset delay	This item defines the delay time for the gun to close when the backup is already closed. The default is 0 ms and the range is 0 ms to 32766 ms.
Quick close backup	This item defines whether a quick close backup gun is used. This allows an assignment of an output for a special low pressure valve.
Backup valve config	This item defines if your backup valve output needs to be held high to close the backup, or if the output is a PULSE type.
Backup pulse width	This item defines the pulse width when your Backup valve config is set to PULSE.
Rst water saver time-out	This item defines the timeout value used when resetting the water saver.
pulse length	This item defines the pulse length for the reset water saver output.
dly before checking DI	This item defines the delay time between when the pulsing of the reset water saver output is completed and when the reset water saver input is checked. The default is 1000 ms and the range is 0 ms to 32766 ms. reset water saver input is checked. The default is 1000 ms and the range is 0 ms to 32766 ms.
Backup open detect	This item defines whether a backup open detect is used. This is a limit or proximity sensor mounted on the gun to determine if the gun is in the backup open position. The default is Disabled.
BU close/gun open detect	This item defines whether a backup close/ gun open detect is used. This is a limit or proximity sensor mounted on the gun to determine if the gun is in the backup closed/gun open position. The default is Disabled.
Close gun immediately	This item allows you to skip checking of the backup closed input if both a backup closed input and gun closed input are configured, and you are closing from full open to full close. This will help save cycle time, so the default is ENABLED. In a few guns, the bottom shank pivots for the backup stroke. For this type of gun, you should set this item to DISABLED.
Gun close detect	This item defines whether a gun close detect is used. This allows an assignment of an input for the use of a limit or proximity switch. The default is Disabled.
Weld cntler num for gun	This item defines the number of the weld controller used for the current gun. The default is 1 and the range is 1 to 10.
Current weld controller	This item defines the current weld controller for the remaining menu items. The default is 1 and the range is 1 to 10.
Isolation contactors	This item defines whether the robot is responsible for opening or closing the weld controller isolation contactor. The default is Disabled.

Item	Description
Contactor time-out	This item defines the time-out value for the isolation contactor input to be made after the output is fired.
End of weld type	This item defines how SpotTool+ determines when a weld is complete. The values can be: CMP_ONLY which is used when only weld complete is mapped from the weld controller; INP_ONLY, which is used for weld in process only (in this case, weld complete will be triggered when weld in process transitions from High to low), and INP & COMP (default), which is used for both in process and comp.
Weld in process time-out	This item defines the timeout value for the weld in process input to be received after initiating the weld controller. The default is 2000 ms and the range is 0 ms to 32766 ms.
Weld complete time-out	This item defines the timeout value for the weld complete input to be received after initiating the weld controller. The default is 2000 ms and the range is 0 ms to 32766 ms.
Major alarm polarity	This item defines whether a major alarm signal is ACT_HIGH (high = alarm, low = OK), or ACT_LOW (default; low=alarm, high = OK).
Minor alarm polarity	This item defines whether a minor alarm signal is ACT_HIGH (high = alarm, low = OK), or ACT_LOW (default; low=alarm, high = OK).
Rst weld cntrler time-out	This item defines the time-out value for the RESET WELD CONTROLLER instruction. The default is 2000 ms and the range is 0 ms to 32766 ms.
Rst weld cntler pulse	This item defines the pulse length for the reset weld controller output. The default is 250 ms and the range is 0 ms to 32766 ms.
Reset stepper pulse	This item defines the pulse length for the RESET STEPPER instruction. The default is 500 ms and the range is 0 ms to 32766 ms.
Weld Comp Level Detect	This item defines if the robot will require a rising edge transition to detect weld complete, or if just the DIN[weld complete] being on is enough to signal weld complete. The default is FALSE which means the rising edge transition is required.
Send schedule early	This item defines if the weld schedule and schedule strobe are sent to the weld controller on the robot anticipation time. The default is FALSE, but some weld controllers may not like receiving the weld schedule and weld init at the same time, so enabling this item can provide some buffer between when the weld schedule and weld initiate are sent to the weld controller.
Reset WC with Robot	This item defines whether a reset is sent to the weld controller whenever the robot is issued a reset.
Controls weld pressure	This item defines whether the current weld controller will control the weld pressure. For this to work, your weld controller's software must support this item. The robot will then read a binary pressure for each weld schedule from the weld controller and store it in the robot. The robot will then set the stored weld pressure for the correct schedule when that schedule is executed. The weld pressure for each schedule will get updated and stored on the robot after a weld schedule is executed, before a manual weld, or by initiating an "Update Pressure" from the Test cycle menu.
Weld pres time-out	This item defines how long the robot will wait for the pressure from the weld controller before timing out and posting an error.
Weld pres time-fac	This item defines how long the robot will wait between sending the update pressure request for each schedule.
set parity type	This item allows you to select even parity or odd parity. The selected parity is established.
Device net timer type	Specify Nadex to here if you will use Nadex DeviceNet weld controller. Refer to Chapter 10 for detail.
Timer number	Specify timer number to here if you will use Nadex DeviceNet weld controller. Refer to Chapter 10 for detail.

Item	Description
Contactor control type	This item defines how the Weld controller's Isolation contactor can be controlled if the robot can control your weld controller's contactor. The choices are: • STANDARD : The contactor is controlled by using the ISO CONTACTOR instruction in the user's TP program to OPEN and CLOSE the contactor. • SYC_WELD : Contactor is controlled via WELD/NOWELD input signal in cell interface. Contactor will be pulled in when the robot is in WELD. • SYC_W&SR : Contactor is controlled via WELD/NOWELD input signal and System Ready UOP output. Contactor will be pulled in when the robot is in WELD, and System Ready UOP output is on.
Weld ID	Specify ENABLED to here if you will use Weld ID.

NOTE
> Perform a cold start if you can change any item. To perform a cold start,
> re-power controller with pressing SHIFT and RESET key on the teach pendant.

Procedure 3-1 Setting up Spot Configuration screen

Step

1 Perform a Controlled Start.
2 Press the [MENU] key.
3 Select Spot Config.

Or you can confirm/change after Cold/Hot start.

1 Press the [MENU] key.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select Spot Config.

Move the cursor to the items you want to set and set them as desired.

Perform a cold start if you can change any item.

You can do cold start forcely in hot start mode by following.

(1) Press SHIFT and RESET key on teach pendant.
(2) Cycle power.

Procedure 3-2 Setting up Multiple weld controllers

Step

Dual-gun and Multi-gun are prepared for using multiple weld controllers. These systems can weld using more than two guns with one controller. Therefore it is needed to assign weld controller to each gun. This section describes configuration of gun, weld controller and equipment and setup procedures of weld controller to control more than two guns with one controller. The following setup procedure is set on the spot configuration screen.

NOTE
> • The total number of gun is two in following example.
> • This procedure is unnecessary in gun change function.

Setup procedure of Dual-gun

Dual-gun system controls two guns to weld by executing instruction in a program. Refer to the following figure for example of dual-gun system. Following step describes setup procedure of weld controller with this example.
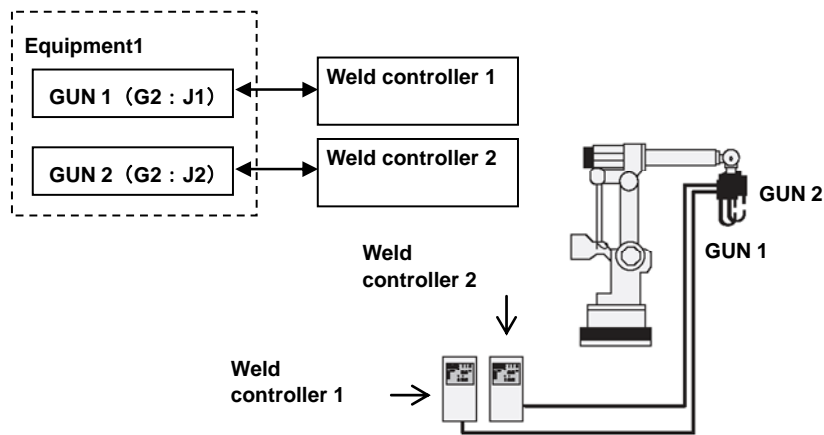
Fig. 3.2(a) Dual-gun system

Step

1   In the case of servo gun, add two axes for dual gun to same motion group on ahead.
2   Display spot configuration screen (procedure 3-1).
3   Set 1 to "Number of equipments".
4   Set 2 to "Number of weld controllers".

```
SPOT CONFIG

                                      1/34
     1 F Number:                  F00000
     2 Load Spottool Macros:      DISABLED
     3 Number of equipments:      1
     4 Number of weld controllers: 2



 [ TYPE ]                  ENABLED  DISABLED  >
```

5   In the case of servo gun, confirm "Number of guns" has been changed to DUAL. (If two axes for dual gun have already been added to the same motion group, "Number of guns" is set to DUAL automatically.)
    In the case of air gun, move cursor to "Number of guns" and select DUAL.
6   If 'Current equipment, gun' = (1, 1), confirm "Weld cntler num for gun" is set to 1. This condition means that weld controller 1 is assigned to (equipment 1, gun 1).
7   Move the cursor to the item you want to change for equipment 1, gun 1 and weld controller 1.

Next step is for assigning weld controller 2 to (equipment 1, gun 2).
8   Change the right side in "Current equipment, gun" to 2. The setup items which are displayed and setup on spot configuration screen switch to the setup items for (equipment 1, gun 2).
9   Change "Weld cntler num for gun" to 2. This condition means that weld controller 2 is assigned to (equipment 1, gun 2).
10 Move the cursor to the item you want to change for equipment1, gun2 and weld controller2.

Spot Configuration screen (servo gun)

```
SPOT CONFIG
                                    3/34
     1 F Number:                F00000
     2 Load Spottool Macros:    DISABLED
     3 Number of equipments:    1
     4 Number of weld controllers: 2
     5 Current equipment, gun:  1, 2
     6   Weld interface:        DIGITAL
     7   Number of guns:        DUAL
     8   Equalization Pressure: DISABLED
     9     number of pressures: 0
    10   Rst water saver time-out: 500   ms
    11     pulse length:        500   ms
    12     dly before checking DI: 1000  ms
    13   Weld cntler num for gun: 2
       Current weld controller: 2
    14   Isolation contactors:  DISABLED
    15     contactor time-out:  2000  ms
    16   End of weld type:      CMP_ONLY
    17   Weld in process time-out: 2000  ms
    18   Weld complete time-out: 2000  ms
    19   Major alarm polarity:  ACT_LOW
    20   Minor alarm polarity:  ACT_LOW
    21   Rst weld cntler time-out 2000  ms
    22   Rst weld cntler pulse:  250   ms
    23   Reset stepper pulse:    500   ms
    24   Weld Comp Level Detect: DISABLED
    25   Send schedule early:    DISABLED
    26   Reset WC with Robot:    ENABLED
    27   Controls weld pressure: DISABLED
    28     Weld pres time-out:   750   ms
    29     Weld pres time-fac:   25    ms
    30   set parity type:        odd
    31   Device net timer type:  DISABLED
    32     Timer number:         0
    33 Contactor control type:   STANDARD
    34 Weld ID:                  DISABLED


 | [ TYPE ] |   |    | ENABLED | DISABLED | > |
```

Spot Configuration screen (air gun)

```
SPOT CONFIG

                                        1/54
         1 F Number:                 F00000
         2 Load Spottool Macros:     DISABLED
         3 Number of equipments:     1
         4 Number of weld controllers: 2
         5 Current equipment, gun:   1, 2
         6  Weld interface:          DIGITAL
         7  Number of guns:          DUAL
         8  Studwelder:              DISABLED
         9    Enable Backup gun:     DISABLED
        10  Tool changer gun:        DISABLED
        11  Soft touch gun:          DISABLED
        12    soft touch pulse time: 200   ms
        13  Multipressure valving:   DISABLED
        14    number of pressures:   0
        15  Equalization Pressure:   DISABLED
        16    number of pressures:   0
        17  Extra gun contactor:     DISABLED
        18  Backup stroke:           DISABLED
        19  Backup type:             NORMAL
        20    set/rst shot pin dly:  0     ms
        21    set/rst set delay:     200   ms
        22    set/rst reset delay:   200   ms
        23  Quick close backup:      DISABLED
        24  Backup valve config:     HOLD
        25  Backup pulse width:      200 ms
        26  Rst water saver time-out: 500  ms
        27    pulse length:          500   ms
        28    dly before checking DI: 1000 ms
        29  Backup open detect:      DISABLED
        30  BU close/gun open detect: DISABLED
        31    Close gun immediately: ENABLED
        32  Gun close detect:        DISABLED
        33  Weld cntler num for gun: 2
           Current weld controller: 2
        34  Isolation contactors:    DISABLED
        35    contactor time-out:    2000 ms
        36  End of weld type:        CMP_ONLY
        37  Weld in process time-out: 2000 ms
        38  Weld complete time-out:  2000 ms
        39  Major alarm polarity:    ACT_LOW
        40  Minor alarm polarity:    ACT_LOW
        41  Rst weld cntler time-out: 2000 ms
        42  Rst weld cntler pulse:   250   ms
        43  Reset stepper pulse:     500   ms
        44  Weld Comp Level Detect:  DISABLED
        45  Send schedule early:     DISABLED
        46  Reset WC with Robot:     ENABLED
        47  Controls weld pressure:  DISABLED
        48   Weld pres time-out:     750   ms
        49   Weld pres time-fac:     25    ms
        50  set parity type:         odd
        51  Device net timer type:   DISABLED
        52    Timer number:          0
        53 Contactor control type:   STANDARD
        54 Weld ID:                  DISABLED


      [ TYPE ]                  ENABLED  DISABLED   >
```

NOTE
Spot configuration screen allows you to specify only one configuration per equipment. If you want to use two guns with different configurations per equipment, observe the following.
- Enable everything that applies to all of the guns, even if only one gun uses certain items.
- Assign proper I/O signals if the gun uses the certain items.
- When SpotTool+ executes welding program, it will ignore items that do not apply to the specified gun, because there will be no I/O configuration to support these items.

Setup procedure of Multi-gun

Multi-gun system controls multiple guns to weld by executing instruction with multi task in several programs. Refer to the following figure for example of multi-gun. Following step describes setup procedure of weld controller with this example.
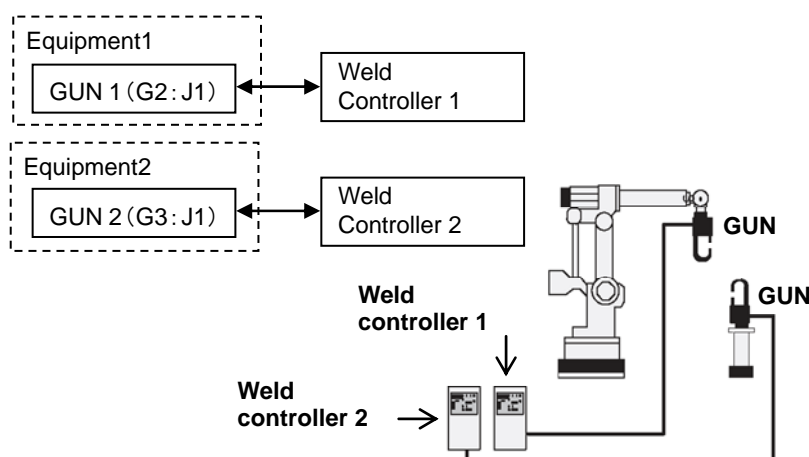
Fig. 3.2(b) Multi-gun system

Step

1   In the case of servo gun, add one axis for multiple guns to each independent motion group one by one on ahead.
2   Display spot configuration screen (procedure 3-1).
3   In the case of servo gun, make sure that "Number of equipments" is 2. (Two axes for multiple guns is added to each independent motion group, "Number of equipments" is set to 2 automatically.)
     In the case of air gun, setting the value of 'Number of equipments' = 2.
4   Set 2 to "Number of weld controllers".

```
SPOT CONFIG
                                     1/34
    1 F Number:                  F00000
    2 Load Spottool Macros:      DISABLED
    3 Number of equipments:      2
    4 Number of weld controllers: 2


  [ TYPE ]              ENABLED  DISABLED  >
```

5   Set SINGLE to "Number of guns".
6   If 'Current equipment, gun' = (1, 1), confirm "Weld cntler num for gun" is set to 1. This condition means that weld controller 1 is assigned to (equipment 1, gun 1).
7   Move the cursor to the item you want to change for equipment 1, gun 1 and weld controller 1.

Next step is for setting weld controller 2 to (equipment 2, gun 1).

8   Change the left side in "Current equipment, gun" to 2. The setup items which are displayed and setup on spot configuration screen switch to the setup items for (equipment 2, gun 1).

NOTE
GUN 2 of above example of multi-gun is defined as gun1 of equipment2 on spot configuration screen.

---

9   Change "Weld cntler num for gun" to 2. This condition means that weld controller 2 is assigned to (equipment 2, gun1).

10   Move the cursor to the item you want to change for equipment2, gun1 and weld controller2.

Spot configuration screen (servo gun)

```
SPOT CONFIG

                                        5/34
     5 Current equipment, gun:     2, 1
     6   Weld interface:           DIGITAL
     7   Number of guns:           SINGLE
     8   Equalization Pressure:    DISABLED
     9     number of pressures:    0
    10   Rst water saver time-out: 500   ms
    11     pulse length:           500   ms
    12     dly before checking DI: 1000  ms
    13   Weld cntler num for gun:  2
       Current weld controller:    2


 [ TYPE ]              ENABLED   DISABLED  >
```

Spot configuration screen (air gun)

```
SPOT CONFIG

                                        5/54
     5 Current equipment, gun:     2, 1
     6   Weld interface:           DIGITAL
     7   Number of guns:           SINGLE
     8   Studwelder:               DISABLED
     9     Enable Backup gun:      DISABLED
    10   Tool changer gun:         DISABLED
    11   Soft touch gun:           DISABLED
    12     soft touch pulse time:  200   ms
    13   Multipressure valving:    DISABLED
     :            :               :
     :            :               :
     :            :               :
    33   Weld cntler num for gun:  2
       Current weld controller:    2


 [ TYPE ]              ENABLED   DISABLED  >
```

NOTE
Spot configuration screen allows you to specify only one configuration per equipment. If you want to use two guns with different configurations per equipment, observe the following.
- Enable everything that applies to all of the guns, even if only one gun uses certain items.
- Assign proper I/O signals if the gun uses the certain items.
- When SpotTool+ executes welding program, it will ignore items that do not apply to the specified gun, because there will be no I/O configuration to support these items.

3.3   CELL INTERFACE SETUP

The cell is the area in which spot welding is performed. The robot, controller, equipment, and cell controller are some of the kinds of equipment included in a cell. You must establish the interface between the robot and cell controller before you can run production operation. Cell interface setup provides a method to define cell information to suit your installation and requirements. Cell interface setup screen provides items you can set as they apply to your installation.

Table 3.3 lists and describes each cell interface setup item.
Use Procedure 3-3 to set up the cell interface.

Table 3.3 Cell Interface Setup items

Item	Description		
Home I/O macro name **default: None**	This item specifies name of TP program SpotTool+ executes whenever the robot returns to home.		
Shell polling **default: ENABLED**	This item enables and disables shell polling. Shell polling is the periodic scan of critical process inputs that SpotTool+ monitors constantly whenever a program is not running. If your I/O is not fully configured, you might choose to disable shell polling temporarily to avoid error messages. Shell polling monitors the following items.		
	For IWC • Iso Contactor • Major Alarm • Minor Alarm • Weld Enable Mismatch • Water Flow • Water Saver • Transformer OK	For Stud Welding • Air Pressure Low • Stud Pressure Low • Maintenance Input • Weld Enable Mismatch • Minor Alarm	For Spot Welding • Iso Contactor • Water Flow OK • Water Saver OK • X-former OK • Major Alarm • Minor Alarm • Weld Enable Mismatch (Enabled Weld Output does not mach Weld Enabled Input)
Production Prompt Boxes - The following two items allow you to set whether to display specific prompt boxes when a production start signal has been received.			
NOWELD **default: DISABLED**	This item specifies whether to display a prompt box indicating that a NOWELD condition exists when a production start signal has been received. ENABLED indicates that the prompt box will be displayed if the condition is true.		
NOSTROKE **default: DISABLED**	This item specifies whether to display a prompt box indicating that a NOSTROKE condition exists when a production start signal has been received. ENABLED indicates that the prompt box will be displayed if the condition is true.		
Production run speed **default: 0** **min: 0** **max: 100**	This item allows you to specify the general override value (displayed in the upper right hand corner of the teach pendant screen) SpotTool+ should use automatically when a production start signal is received. SpotTool+ will display a prompt box (if speed override < 100 is ENABLED) and then run the style at the specified override value. A value of zero indicates that the current general override value will be used.		
Production resume speed **default: 0** **min: 0** **max: 100**	This item allows you to specify the general override value (displayed in the upper right hand corner of the teach pendant screen) SpotTool+ should use automatically when a production start signal is received to resume a paused style. SpotTool+ will display a prompt box (if speed override < 100 is ENABLED) and then resume the style at the specified override value. A value of zero indicates that the current general override value will be used.		

Procedure 3-3 Setting up Cell Interface Setup screen

Step
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select Cell. The following screen will be displayed.

```
CELL SETUP
                                          1/6
       1  Home I/O macro name:
       2  Shell polling:              ENABLED
       Production prompt boxes:
       3    NOWELD:                   ENABLED
       4    NOSTROKE:                 ENABLED
       5  Production run speed:          0  %
       6  Production resume speed:       0  %


  [ TYPE ]                    [CHOICE]          >
```

5   Move the cursor to the items you want to set and set them as desired.

3.4   SPOT EQUIPMENT SETUP

Spot equipment setup allows you to define the configuration and timing sequence of equipment between all the weld inputs and outputs during the weld sequence. A setup menu exists for each equipment defined during configuration setup (Spot configuration). Default values are supplied.

Table 3.4 lists and describes the equipment selections. Use Procedure 3-4 to change the default equipment settings.

> **NOTE**
> The following items and an actual displayed item may different by equipment/gun specifications.

Table 3.4 Spot equipment setup items

Item	Description
Anticipation type (msec or mm) **default: TIME** **min: TIME** **max: DISTANCE**	This item defines whether the close backup and close gun time values are in time or distance, where • time - is set in milliseconds • distance - is set in millimeters. Distance is only valid for linear motions. Distance is not typically used in spot welding applications. Cycle time benefits often can be realized using these anticipation settings.
Close gun (msec or mm) **default: 150** **min: 0** **max: 10000**	This item defines the amount of time in milliseconds, or distance in millimeters from, the weld position at which the gun starts to close. Distance is only valid for linear motions. NOTE: If speed changes are made in the program, the distance is still valid.
Close backup (msec or mm) **default: 300** **min: 0** **max: 10000**	This item defines time in milliseconds before, or distance in millimeters from, the weld position at which the backup starts to close. Distance is only valid for linear motions. NOTE: If speed changes are made in the program, the distance is still valid.

Item	Description
Open gun time (msec) default: 0 min: 0 max: 10000 ms	This item defines the delay time in milliseconds, to allow the gun to open after completion of the weld, prior to moving to the next position.
Open backup (msec) default: 0 min: 0 max: 10000 ms	This item defines the delay time in milliseconds, to allow the backup to go from half open to full open (backup open) prior to moving to the next position.
Weld start delay (msec) default: 0 min: 0 max: 10000	This is the amount of time the robot will delay once it reaches the point before it initiates the weld controller.
Spot count R[n] **if you have dual guns** **Gun x spot count R[n]** min: 1 max: 200	This item is used as a counter for all spot welds executed by gun 1, where [n] equals the register number. This includes all welds performed during test run, as well as all manual welds.
Tip dress R[n] min: 1 max: 32	This item can be compared to the spot count register to decide if a tip dress is required.
Target Welds/Dress	This item is the user-specified number of welds that should be done before a tip dress. This value is set in $spoteqsetup[equip_number].$td_limit[gun_number]. This value is used in the bar chart on the Spot Status menu to show you the percentage of welds until trip dress is required.
Following is used for Valve Pressure for Backup and Soft Touch Pressures	
Gun Open default: 0	This item allows you to set the Gun open pressure according to the equipment you are using. Refer to the Fig. 6.3(c) for the valve pressure settings timing diagram.
Backup Pressure default: 0	This item allows you to set the backup pressure according to the equipment you are using. Refer to the Fig. 6.3(c) for the valve pressure settings timing diagram.
Soft Touch Pressure default: 0	This item allows you to set the soft touch pressure according to the equipment you are using. Refer to the Fig. 6.3(c) for the valve pressure settings timing diagram.
Following is used for stud welding only, and only if stud backup is enabled at controlled start	
Dropoff Gun1 Macro	This item allows you to specify the name of the predefined program to be used for the dropoff during stud welding, for gun 1.
Pickup Gun1 Macro	This item allows you to specify the name of the predefined program to be used for the pickup during stud welding, for gun 1.
Dropoff Gun2 Macro	This item allows you to specify the name of the predefined program to be used for the dropoff during stud welding, for gun 2.
Pickup Gun2 Macro	This item allows you to specify the name of the predefined program to be used for the pickup during stud welding, for gun 2.

Procedure 3-4 Setting up Spot Equipment screen

Step
1 Press the [MENU] key.
2 Select SETUP.
3 Press F1, [TYPE].
4 Select Spot Equip. The following screen will be displayed. The following display screens and an actual display screen may different by equipment/gun specifications.

```
SETUP Spot Equipment
                                        1/9
        1  Anticipation type:      TIME
        2    close backup:         300  ms
        3    close gun:            150  ms
        4  Weld start delay:       0    ms
        5  Open gun time:          0    ms
        6  Open backup time:       0    ms
        7  Spot count R[]:         0
        8  Tip dress R[]:          0
        9  Target Welds/Dress:     100


    [ TYPE  ]                   [CHOICE]            >
```

5   Move the cursor to the item you want to change and type the new value.

To change the equipment number
       Press F >, NEXT key, then F8, EQ_NUM, and select a new screen based on equipment number.

3.5   SPOT ADVANCED FUNCTIONS

You can enable and use any of the following SpotTool+ Advanced Functions:
•   Automatic retry weld
•   Motion lockout with gun closed (For air gun)
This section describes how to enable and use the optional SpotTool+ Advanced Functions.
You enable and disable the SpotTool+ Advanced Functions options using the spot advanced functions
screen. Table 3.5 lists and descripts Spot advanced functions items. Use procedure 3-5 to display spot
advanced functions screen.

Table 3.5 Spot advance functions items

Items	Description
Auto retry weld	This item allows you to enable and disable the auto retry weld feature.
Number of retries	This item allows you to define information specific to the automatic retry weld feature.
Total retries R[]	This item allows you to define information specific to the auto retry weld feature.
Motion locked w/gun closed	This item allows you to enable and disable the lock out motion while the gun is closed feature.

> ⚠**CAUTION**
> • Auto weld retry is enabled only during Auto mode.
> • If large number is set on number of retries, this may cause OVC alarm.

> **NOTE**
> • Motion lockout will occur only if the gun close was successful. If a detect times
>   out, then the gun is not considered to be closed, and motion will be allowed.
> • For all kinds of guns, if the gun is not opened successfully and you want to
>   release the motion lock, you must disable the Motion locked w/gun closed item
>   on the spot advanced functions screen.
> • For controllers that are configured with multiple guns or multiple equipments, the
>   motion locked with gun closed feature, if enabled, is active whenever any gun is
>   closed. However, all guns must be open for the motion lock to be lifted.
> • If a gun is opened manually during maintenance, it is possible for SpotTool+ to
>   still consider the gun closed. You can either cold start the controller to clear the
>   condition, or temporarily disable the motion locked with gun closed option on the
>   spot advanced functions screen.
> • This function can not be used with servo gun.

Procedure 3-5 Setting up Spot Advance Functions screen

Step

1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select Spot adv Fct. The following screen will be displayed.

```
SPOT ADV FCTS
                                       1/4
      1  Auto retry weld:         DISABLED
      2    number of retries:            0
      3    total retries R[]:            3
      4  Motion locked w/gun close: DISABLED


    [ TYPE ]                 ENABLED  DISABLED   >
```

5   If you want to set the function item to ENABLE, move cursor to the item, then press F4, ENABLE. Otherwise, press F5, DISABLE.

NOTE
You can use motion locked with gun closed only if SpotTool+ controls the gun. If the weld controller controls the gun, then you cannot use motion locked with gun closed.

⚠ **WARNING**
The motion locked with gun closed option disables robot motion when the gun is closed only for jogging and SHIFT FWD/BWD execution. When motion lock with gun closed is enabled and the gun is closed, the following commands can still cause motion:
- Execution of any macro manual function
- MOVE_TO in the DATA Position Reg screen
- MOVE_TO in the SETUP Frames screens
- KCL> RUN command

3.6   WELD COUNT CHECK FUNCTION

This section describes set-up and usage of Weld Count Check Function.

NOTE
- This function is included with Zero down time software (R854 or R882), when servo gun option (J643) is installed.
- Both servo gun and air gun equipment (types) are supported.
- STYLE, PNS, RSR (standard) job types are supported.
- "OTHER" (custom) job types are not supported.

NOTE

This function is disabled by default which means:
- $WLDCTCFG.$WLDCTCHKENB = FALSE
- "WeldCtCheck" (screen) does not appear in dropdown menu list
- Weld Count is not checked at job completion

```
CELL SETUP
                                                    1/6
                               ┌──────────────────┐
                               │    TYPE  3        │
                          ┌─────┴────────┐ffset    │
               ┌──────────┤   TYPE  2    │ol.      │
      ┌────────┤   TYPE  1 │ess          │imit     │
      │1 Cell  │           │             │O        │
      │2 Prog Select       │sition       │m        │
      │3 Spot Equip        │nit          │         │
      │4 Spot Adv Fctns    │elect        │         │
      │5 Spot Config       │larm         │         │
      │6 TP Hardkeys       │Table    ────┘         │
  ───→│7 WeldCtCheck       │nt Setup              │
      │8 Servo Gun         │T --                  │
      │9 General  └─────────┴──────────────────────┘
      │0 -- NEXT --│
      └────────────┘
       ┌────────┬──────────┬──────────────┬────────┐
       │  TYPE  │          │  [CHOICE]    │ CLEAR  │
       └────────┴──────────┴──────────────┴────────┘
```
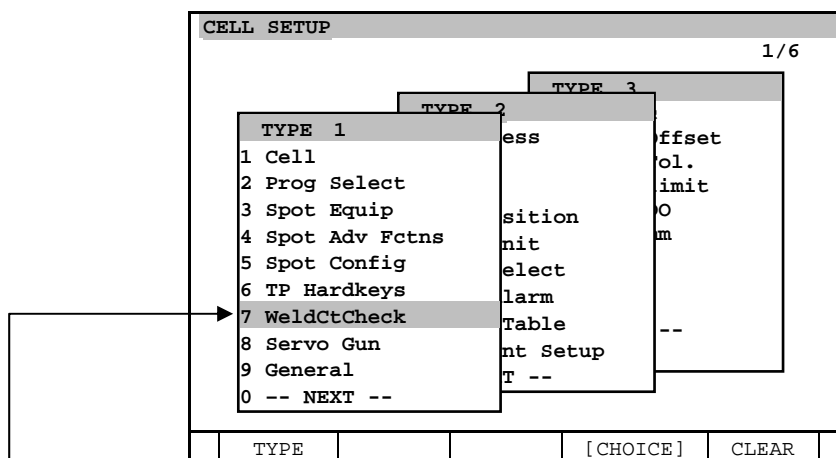
Set $WLDCTCFG.$WLDCTCHKENB = TRUE to enable function and expose weld count check screen

Functional overview:

During job execution, spot welds are counted.

At end of job (task complete), an action is taken, based on weld count benchmark:
- if weld count benchmark < 1(was not recorded previously), then observed weld count is recorded in benchmark table
- otherwise, weld count benchmark is compared to observed weld count
  - if observed weld count is less than weld count benchmark, an alarm is posted:
    SPOT-531 WeldCount:* < Expected
  - otherwise, no alarm is posted

Alarm	Description
SPOT-531 WeldCount:* < Expected:*	Observed spot weld count for job that just ended is less than the weld count benchmark. Observed weld count and the Expected weld count (benchmark) are displayed.
SPOT-530 Eq*,*,Dur(*,Exp:*)	This alarm provides "cause" info for SPOT-531. Equip number, job type, observed job duration and expected job duration are displayed.

NOTE

Default severity of SPOT-531 alarm is WARN (WLDCTCFG.$ALARM_SEV=1). Job does not stop after SPOT-531 if alarm severity is warn. To stop the job when SPOT-531 alarm occurs, increase alarm severity to pause (WLDCTCFG.$ALARM_SEV=2).

> **NOTE**
> Job start mode is specified on Prog Select screen. Please refer to "SETTING AUTOMATIC OPERATION" section in   OPERATOR'S MANUAL (Basic Operation) (B-83284EN).
> Setup procedure is basically same for both STYLE mode and PNS mode (run job one time). However, UIF varies slightly based on job start mode.
> - Use Procedure 3-6, 3-7 for Style start mode
> - Use Procedure 3-8, 3-9 for PNS start mode

Benchmark table differences:

Style mode

When STYLE start mode is used, **job name is configurable**, Index of benchmark count equals style number. Style number is the number that the plc sends to the robot, to start the job.

```
Prog Select
 Style Table Setup                    1/255
  Style  ProgName  Valid   Comment
    1     FENDER    YES
    2     JOB1      YES
    3     TEST123   YES
    4     MAIN      YES
    5     WRUPD01   YES
    6     A2        YES
    7     *******>  YES
    8     *******>  YES
    9     *******>  YES
   10     *******>  YES


 [ TYPE ]   CLEAR    CONFIG   [CHOICE]      >
```

```
   WELD COUNT CHECK
  WELD COUNT BENCHMARKS                  1/255
    #   STYLE Name Wldct  Dur(sec)      Date
    1    FENDER     21      55.0     ********
    2     JOB1      42     110.0     ********
    3    TEST123    10      21.0     ********
    4     MAIN      20      42.0     ********
    5               0       0.0     ********
    6     A2         7      16.6     ********
    7               0       0.0     ********
    8               0       0.0     ********
    9               0       0.0     ********
   10               0       0.0     ********


 [ TYPE ]  ClrAllCt   ClrCurCt                >
```

Index of benchmark count always equals style number

PNS mode

When PNS start mode is used, **job name is not configurable:**
job name is defined as "PNS#"
 where # = 4 digit pns number that the plc sends to the robot.

In PNS case, there may be large gaps between pns numbers in programs that user creates (see below). Therefore, weld count function creates the table from pns programs that actually run. End result is that benchmark table may not be a contiguous list of PNS numbers (1-N).

Therefore, benchmark table is scanned at job end (to find PNS#):
- if pns# is not found, observed weld count AND pns# are recorded at first empty slot (null name) in benchmark table
- otherwise, observed weld count is compared to benchmark value

```
WELD COUNT  CHECK
 WELD COUNT BENCHMARKS                  1/255
   #   PNS Name Wldct  Dur(sec)        Date
   1    PNS0123    21      55.0    ********
   2    PNS0001    42     110.0    ********
   3    PNS0043    10      21.0    ********
   4    PNS1234    20      42.0    ********
   5               0       0.0    ********
   6               0       0.0    ********
   7               0       0.0    ********
   8               0       0.0    ********
   9               0       0.0    ********
  10               0       0.0    ********


  [ TYPE ]  ClrAllCt   ClrCurCt  ClrName  SetName   >
```

Index of benchmark count index is not constrained to pns number

There is no screen to map pns number to program name for pns start mode: Pns number is part of job name.

Procedure 3-6 Weld count benchmark recording for Style mode

Step
1   Register the program name on Prog Select screen.
2   Run the registered program via STYLE function.

> **NOTE**
>   Refer to the "STYLE" section in OPERATOR'S MANUAL (Basic Operation)
>   (B-83284EN) for detail about STYLE program registration and execution.

> **NOTE**
> Weld count benchmark can be confirmed via Weld Count Check screen.
> Use following procedure to change weld count benchmark.
> 1   Reset benchmark:
>   • Clear benchmark data via Weld Count Check screen. (Procedure 3-7)
>   OR
>   • Change program name assigned to this style number on prog select screen
> 2   Run the style number for this program via STYLE function

Procedure 3-7 Weld Count Check screen for Style mode

Step
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select WeldCtCheck to display a screen similar to the following.

```
WELD COUNT  CHECK
 WELD COUNT BENCHMARKS                       1/255
   #  STYLE Name Wldct  Dur(sec)        Date
   1    FENDER      21      55.0   ********
   2      JOB1      42     110.0   ********
   3   TEST123      10      21.0   ********
   4      MAIN      20      42.0   ********
   5                 0       0.0   ********
   6        A2       7      16.6   ********
   7                 0       0.0   ********
   8                 0       0.0   ********
   9                 0       0.0   ********
  10                 0       0.0   ********
 Clear & run STYLE# to update benchmark.


   [ TYPE ]  ClrAllCt  ClrCurCt                 >
```

5   Use fkeys below to modify table, if needed

Fkey	Description
F2: ClrAllCt	Clear benchmark data (weld count, cycle time, date) for **all** style numbers.
F3: ClrCurCt	Clear benchmark data (weld count, cycle time, date) for **one** (highlighted) style number.

Procedure 3-8 Weld count benchmark recording for PNS mode

Step
1   Run the registered program by PNS function.

NOTE
> Refer to the "PNS" subsection in OPERATOR'S MANUAL (Basic Operation)
> (B-83284EN) for registration and execution of PNS program.

NOTE
> Weld count benchmark can be confirmed at Weld Count Check screen.
> Use Procedure 3-9 to change weld count benchmark.
>   1. Clear benchmark data via Weld Count Check screen, then
>   2. Run the style number for this program by STYLE function

Procedure 3-9 Weld Count Check screen for PNS mode

Step
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select WeldCtCheck to display the following screen.

```
WELD COUNT  CHECK
 WELD  COUNT  BENCHMARKS               1/255
   #   PNS Name  Wldct  Dur(sec)        Date
   1    PNS0123   21      55.0    ********
   2    PNS0001   42     110.0    ********
   3    PNS0043   10      21.0    ********
   4    PNS1234   20      42.0    ********
   5              0       0.0     ********
   6              0       0.0     ********
   7              0       0.0     ********
   8              0       0.0     ********
   9              0       0.0     ********
  10              0       0.0     ********


 [ TYPE ]  ClrAllCt   ClrCurCt   ClrName   SetName   >
```

5   Use fkeys below to modify table, if needed.

Fkey	Description
F2: ClrAllCt	Clear benchmark data (weld count, cycle time, date) for **all** PNS numbers. Note: name is not cleared.
F3: ClrCurCt	Clear benchmark data (weld count, cycle time, date) for **one** (highlighted) PNS number. Note: name is not cleared.
F4: ClrName	Clear benchmark data (name, weld count, cycle time, date) for **one** (highlighted) PNS number.
F5: SetName	Set job name (PNS1234) for **one** (highlighted) PNS number. Note: name is automatically added to table when job runs (if pns# is not found). Therefore, manually setting name is optional.
F6: ClrAllNm	Clear benchmark data (name, weld count, cycle time, date) for **ALL** PNS numbers
F7: Sort	Sort pns names in ascending order. Sort is optional, because benchmark table is scanned to find name. Weld count function works whether pns numbers are in ascending order or not. Sort is used to make table more readable.

4 SPOT TOOL+ I/O

This chapter describes the SpotTool+ related I/O signals.
About signal for servo gun, integral weld timer, and dispense plug-in, refer to each manual.

4.1 CELL INTERFACE I/O SIGNALS

Cell interface I/O signals are used to communicate between the robot and the cell controller. The software provides I/O assignments that can be modified for special applications.

> **NOTE**
> Some macro commands are used to communicate between the robot and the cell controller. The macro command signals must be set up using the same signal assignments as defined in the cell interface screen. The tables in each of the following sections list the cell interface I/O signals and their corresponding macro instructions. Refer to set up macro commands. The macro command must be programmed at the point in the program where it is required for the macro and cell to communicate properly.

4.1.1 Cell Interface Input Signals

You can use the cell interface input screen to
- View the status of the input signals
- Simulate input signals
- Assign input signals

Table 4.1.1 lists and describes each cell interface input signal.
Use Procedure 4-1 to set up cell interface I/O.

Table 4.1.1 Cell interface input signals

Input signal	MACRO	Description
Weld/NO WELD		This input provides a way to put the robot into WELD or NOWELD mode remotely from an external device (for example, a PLC). When this input is turned ON, the weld controller mode is changed to WELD. The gun operation is left unchanged. When this input is turned OFF, the weld controller mode is changed to NOWELD. The gun operation is left unchanged. If there is a conflict between the weld controller mode and the gun operation, then the error, "APSH-034 Gun operation is NOSTROKE," is displayed. The gun operation must be STROKE when the weld controller mode is WELD. You must make sure that the gun operation is set to STROKE when the weld controller mode is WELD. Effective of this signal is only the following. 1: ・ Program select mode is RSR/PNS/OTHER ・ Teach pendant is DISABLE 2: ・ Program select mode is STYLE ・ Remote/Local status is Remote (SI[REMOTE]＝ON) ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO Refer to section 4.4 WELD MODE for this signal.

Input signal	MACRO	Description
Stroke/NO STROKE		This input provides a way to put the robot into STROKE or NOSTROKE mode remotely. When this input is turned ON, the robot mode is changed to STROKE. When this input is turned OFF, the robot mode is changed to NOSTROKE. The cell output signal, Stroke enabled, shows whether the robot is in STROKE or NOSTROKE mode. Effective of this signal is only the following. 1: ・ Program select mode is RSR/PNS/OTHER ・ Teach pendant is DISABLE 2: ・ Program select mode is STYLE ・ Remote/Local status is Remote (SI[REMOTE]＝ON) ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO
Rmt wtr svr reset		This input provides a way to reset a water saver remotely. When this input is turned ON, the RESET WATER SAVER instruction is executed for all guns on all equipment.
Return hom frm poun	MOVE TO HOME	This input provides a way for the robot to move backwards using the taught points from the POUNCE position to the home position (beginning position of production program). While waiting for DIN [Continue from POUNCE] in AT POUNCE macro, if there turn home from pounce signal is received instead, the robot will abort the currently running production program and return to home and wait for the next program start. Note that the robot only moves to positions in the production program. There can only be one AT POUNCE macro in your production program, and the AT POUNCE macro must be in the main production program, and not in a sub program.
Prg tch mode EQ *n* (Option)		This input provides the control of program touchup mode remotely from an external device (for example, a PLC).
Tryout Mode		This input provides the control of Tryout Mode remotely from an external device (for example, a PLC). If Tryout Mode is enabled, Part thickness is automatically set to 0 to prevent a pressure shortage error with Servo Gun. Effective of this signal is only the following. 1: ・ Program select mode is RSR/PNS/OTHER ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO 2: ・ Program select mode is STYLE ・ Remote/Local status is Remote (SI[REMOTE]＝ON) ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO Tryout Mode can be changed from spot weld test cycle screen when the condition doesn't apply to the above-mentioned with this signal assigned. When this signal is not assigned, Tryout Mode becomes disabled.

4.1.2 Cell Interface Output Signals

You can use the cell interface output screen to
- View the status of the output signals
- Simulate output signals
- Force output signals
- Assign output signals

Table 4.1.2 lists and describes each cell interface output signal.
Use Procedure 4-1 to set up cell interface I/O.

Table 4.1.2 Cell interface output signals

Output signals	Description
Input Simulated	This output indicates to the cell controller (PLC) that simulated input signal exists on the controller.
Output Simulated	This output indicates to the cell controller (PLC) that simulated output signal exists on the controller.
OVERRIDE = 100	This output indicates to the cell controller (PLC) that override of Teach Pendant is 100%.
In cycle	This item indicates a production program is being executed. In Cycle is turned ON when a production program is executed. In Cycle is turned OFF when a production program is finished being executed or has been aborted. If a program is paused, In Cycle stays ON.
Program Aborted	This item indicates program aborted turns ON (high) if a program is completed, then turns ON. Condition to work this signal is that running program with AUTO mode are aborted or paused program are aborted by selecting "ABORT(ALL)" on function menu of teach pendant This returned to OFF (low) at the next program initiation sequence.
Robot ready (Option)	This item indicates whether CMDENBL items, SYSRDY items, General items (GRPn Motion enabled, Spot weld enabled, etc), and User items DI/O[] and RI/O[] are OK for production start. This signal is available when Production Display Improvement (J887) is installed.
Robot interlock (Only for Style)	This item indicates to the cell controller that the robot is in Interlock mode and that the cell controller can control the robot.
Robot in isolate (Only for Style)	This item indicates to the cell controller that Isolate mode is selected and that the manual cycle output must be acknowledged by the cell controller for program execution to begin, if initiated by the cell controller
Process fault	During weld execution this item is turned on in the following cases: ・ Contactor error ・ During production resume if "Motion Locked with Gun Closed" is enabled and the gun is closed. ・ Weld in process timeout ・ Weld complete timeout ・ Major fault ・ IWC comm. not OK ・ Weld enable mismatch ・ Water flow ・ Water Saver ・ Transformer overtemp ・ Bad schedule ・ Stroke disabled during auto retry weld During idle time (shell polling) the following DOs are turned on: ・ Weld enable mismatch ・ Iso contactor ・ Major alarm ・ Water Saver ・ Transformer overtemp ・ IWC comm. not OK ・ Water Flow OK
Process alert	This item is turned on in the following cases: ・ Running prod in noweld ・ Running prod in nostroke ・ When weld is auto retried ・ When minor alarm happens during weld and shell polling.
Process complete	The robot software will set Process complete to OFF at the start of a cycle. The AT POUNCE macro will turn Process complete to ON. You must use the AT POUNCE macro, or turn on Process complete in your own program. If a weld is skipped, or if it is done in NOWELD mode, Process complete will be set low by the robot system software. The robot can then check the teach pendant program to see whether any welds were skipped, before the program is ended.

Output signals	Description
Weld enabled	This item indicates to the cell controller whether the robot is in a WELD or NOWELD. ON = WELD OFF = NOWELD
Stroke enabled	This item indicates the STROKE or NOSTROKE status of the robot. ON = STROKE OFF = NOSTROKE
Proc _n_ tip rep re _n_ **= 1 to 2**	The Cap change request weld input is read from the weld controller before the robot turns off the initiate bit at the end of a weld. If this input is ON, the robot passes this signal through to the cell controller as Proc ntip rep req. It is the cell controller's responsibility to determine whether to allow additional cycles to be run if this output is ON. Turn off this output in a caps changed macro or program.
Apprch tip repla	The Approaching cap change request weld input is read from the weld controller. If the Cap change request input is ON, the robot passes this signal through to the cell controller as Apprch tip replac. Turn off this output in the caps changed macro or program.
Proc _n_ tip mnt re _n_ **= 1 to 2**	The Tip dress request weld output is read from the weld controller. If the Tip dress request output is ON, the robot passes this signal through to the cell controller as Procntip mnt req. When this is ON, the cell controller can decide when to tell the robot to run a tip dress style. Turn off this output in the tip dress macro.
One Spot Welded	This output will turn on to the cell controller after the first spot is completed in each program. This can let the cell controller know whether it can unclamp a part or not in an error situation. You are responsible for turning it off in your own program.
Prg tch stat EQ _n_ **(Option)**	This item indicates the program touchup mode status of robot.
Tryout Status	This item indicates the tryout status of the robot, as set using the Tryout cell input signal. ON = robot is in tryout mode. OFF = robot is not in tryout mode.
Heartbeat	This signal alternates between the ON and OFF state every Heartbeat timing. The signal is intended to verify the link between the robot and cell controller.
IWC COMM stat	This signal is for Integrated Weld Controller option. This signal is ON if and only if the system is in communication with timer board is active. If you install two timer boards, this signal is ON if and only if the system is in communication with both boards.
Robot motion G#	This item indicates the robot motion status of the motion group# (#=1-5). ON = Group# motion is enabled. OFF = Group# motion is disabled(=Machine locked).
Process fault (case of Stud Welding)	During stud welding this item is turned on in the following cases: ・ Weld enable mismatch ・ Air pressure low ・ Bad schedule ・ Weld head not retracted ・ Weld complete timeout ・ In process timeout
Process alert (case of Stud Welding)	This item is turned on in the following cases: ・ Air pressure low check in shell polling for Studwelder ・ Feeder low for studwelder shell polling ・ Minor alarm shell polling ・ Maintenance input in shell polling During Studwelding Execution: ・ Low stud ・ Minor alarm ・ Maintenance input on ・ In tolerance input after a stud
Process Out of Tolerance (Only for Stud)	This output will turn on to the cell controller if the studwelder input In/Out Tolerance is on.

Procedure 4-1 Setting Cell Interface I/O

Step

1   Press the [MENU] key and Select I/O.
2   Press F1, [TYPE].
3   Select Cell Interface. You will see either the cell interface input or output screen.

> **NOTE**
> The following display screens and an actual display screen may different by program select mode.

```
I/O Cell Inputs
                                          1/5
     INPUT SIGNAL          TYPE #    SIM  STATUS
  1 Weld/NO WELD:          DI[  0]    U   ***
  2 Stroke/NO STROKE:      DI[  0]    U   ***
  3 Rmt wtr svr rese:      DI[  0]    U   ***
  4 Ret hom frm poun:      DI[  0]    U   ***
  5 Tryout Mode:           DI[  0]    U   ***


 [ TYPE ]   CONFIG   IN/OUT    SIM    UNSIM   >
```

To change between the display of the input and output screens, press F3, IN/OUT.

> **NOTE**
> The following display screens and an actual display screen may different by program select mode.

```
I/O Cell Outputs
                                          1/22
     OUTPUT SIGNAL         TYPE #    SIM  STATUS
  1 Input Simulated:       DO[  0]    U   ***
  2 Output Simulated:      DO[  0]    U   ***
  3 OVERRIDE = 100:        DO[  0]    U   ***
  4 In cycle:              DO[  0]    U   ***
  5 Prog Aborted:          DO[  0]    U   ***
  6 Robot interlock:       DO[  0]    U   ***
  7 Robot in isolate:      DO[  0]    U   ***
  8 Process fault:         DO[  0]    U   ***
  9 Process alert:         DO[  0]    U   ***
 10 Process complete:      DO[  0]    U   ***
 11 Weld enabled:          DO[  0]    U   ***
 12 Stroke enabled:        DO[  0]    U   ***
 13 Proc1 tip rep re:      DO[  0]    U   ***
 14 Proc2 tip rep re:      DO[  0]    U   ***
 15 Apprch tip repla:      DO[  0]    U   ***
 16 Proc1 tip mnt re:      DO[  0]    U   ***
 17 Proc2 tip mnt re:      DO[  0]    U   ***
 18 One Spot Welded:       DO[  0]    U   ***
 19 Tryout Status:         DO[  0]    U   ***
 20 Heartbeat:             DO[  0]    U   ***
 21 Robot motion G1:       DO[  0]    U   ***
 22 Robot motion G2:       DO[  0]    U   ***


 [ TYPE ]   CONFIG   IN/OUT    SIM    UNSIM   >
```

To move quickly through the information, press and hold the SHIFT key and press the down or up arrow keys.

4   To specify detail information about a signal, press F2, CONFIG. The following screen will be displayed.

```
I/O Cell Outputs
  Output Signal Details


     Signal name:          Input Simulated
  1 Output type/no:        DO [   0]

 [ TYPE ]   PREV_IO  NEXT_IO          VERIFY   >
```

- To change the port type, move the cursor to Input (or Output) type/no., press F4, [CHOICE], select the type of I/O you want, and press the [ENTER] key.
- To change the port number for any type of I/O except UOP, move the cursor to Input (or Output) type/no., type the port index number, and press the [ENTER] key.
- To check whether the assignment is valid, press F5, VERIFY.
  - ᛫ If the assignment is valid, the message, "Port assignment is valid," is displayed.
  - ᛫ If the assignment is not valid, the message, "Port assignment is invalid," is displayed.

NOTE
In the collation, the double allocation check is not performed.

- To display detail information for the previous I/O signal, press F2, PREV_IO.
- To display detail information for the next I/O signal, press F3, NEXT_IO.

5   Press the [PREV] key after assignment of signal is completed. And, get out from a detail screen.

```
I/O Cell Outputs
                                    1/22
     OUTPUT SIGNAL       TYPE #    SIM  STATUS
  1 Input Simulated:     DO[  0]    U   ***
  2 Output Simulated:    DO[  0]    U   ***
  3 OVERRIDE = 100:      DO[  0]    U   ***
  4 In cycle:            DO[  0]    U   ***
  5 Prog Aborted:        DO[  0]    U   ***
  6 Robot interlock:     DO[  0]    U   ***
  7 Robot in isolate:    DO[  0]    U   ***
  8 Process fault:       DO[  0]    U   ***
  9 Process alert:       DO[  0]    U   ***
 10 Process complete:    DO[  0]    U   ***
 11 Weld enabled:        DO[  0]    U   ***
 12 Stroke enabled:      DO[  0]    U   ***
 13 Proc1 tip rep re:    DO[  0]    U   ***
 14 Proc2 tip rep re:    DO[  0]    U   ***
 15 Apprch tip repla:    DO[  0]    U   ***
 16 Proc1 tip mnt re:    DO[  0]    U   ***
 17 Proc2 tip mnt re:    DO[  0]    U   ***
 18 One Spot Welded:     DO[  0]    U   ***
 19 Tryout Status:       DO[  0]    U   ***
 20 Heartbeat:           DO[  0]    U   ***
 21 Robot motion G1:     DO[  0]    U   ***
 22 Robot motion G2:     DO[  0]    U   ***
Power OFF then ON to enable changes.

   [ TYPE ]  CONFIG   IN/OUT    SIM    UNSIM   >
```

6   Restore power supply.

NOTE
When power supply is restored on a detail screen, assignment of signal is not applied. Restore power supply after it gets out from a detail screen by the [PREV] key.

NOTE
In the case of $SHELL_CFG.$SET_IOCMNT=TRUE, when you enter a signal number for a signal in these I/O screens, the comment for the corresponding signal in the I/O Digital or I/O Group screen will be updated with the name of the signal displayed here.

Display / Change Simulate
To simulate or unsimulate I/O, place the cursor in the SIM column next to the I/O that you want to change.
- To simulate the signal, press F4, SIM. The signal will be simulated.
- To unsimulate the signal, press F5, UNSIM. The signal will be unsimulated.

Display / Change Signal Status
To force an output on or off, place the cursor in the STATUS column next to the I/O that you want to change.
- To force the I/O signal on, press F4, ON.
- To force the I/O signal off, press F5, OFF.

NOTE
In order to forcibly change the state of the input signal, it is necessary to change the input signal in state of simulation.

⚠ WARNING
If you forcibly change the state of the output signal, you must check that there are no unnecessary equipment in the workcell, all operators are evacuated outside the workcell and that all protective measures are installed. Failure to do so may result in injury to workers or damage to equipment.

NOTE
Cell interface input or output screen supports DI[1-999] and DO[1-999]. This screen doesn't support DI and DO of four digits or more.

4.2 SPOT EQUIPMENT I/O SIGNALS

Spot equipment I/O signals are used to communicate between robot and gun. Spot equipment I/O signals you use can vary depending on the kind of spot configuration setup, gun, weld interface you have.
Refer to section 6.3 about I/O sequence for spot equipment I/O signals. Use Procedure 4-2 to set up Spot equipment I/O signals.

4.2.1 Spot Equipment Input Signals

You can use the spot equipment input screen to
- View the status of the input signals
- Simulate input signals
- Assign input signals
Table 4.2.1 lists and describes each spot equipment input signal.

NOTE
In Table 4.2.1, after BU open detect, it is exclusive for air gun. Also, for each signal dedicated to the air gun, only the signal validated on the spot initial setting screen is displayed.

Table 4.2.1 Spot equipment input signals

Input signals	Description
Water saver OK	This item indicates that water saver is not abnormal. ON = OK OFF = Alarm " SPOT-003 PAUSE Water saver OK fault %s" is posted.

Input signals	Description
Water flow OK	This item indicates that water flow is not abnormal. ON = OK OFF = Alarm " SPOT-004 PAUSE Water flow OK fault %s" is posted
X-former OK	This item indicates that transformer is overheating. ON = OK OFF = Alarm " SPOT-005 X-former OK input is low" is posted
BU open detect	This item indicates that the backup is open (full open). This is displayed only if defined during configuration setup. Refer to the spot configuration setup for more information.
BU close detect	This item indicates that the backup is closed (half open). This is displayed only if defined during configuration setup. Refer to the spot configuration setup for more information.
Device set LS	This item indicates that the shot pin for the SET/RESET type backup is in the SET position.
Device reset LS	This item indicates that the shot pin for the SET/RESET type backup is in the RESET position.
Gun close detect	This item indicates that the gun is closed. This is displayed only if defined during configuration setup. Refer to the spot configuration setup for more information.
Gun open detect	This item indicates that the gun is opened. This is displayed only if defined during configuration setup. Refer to the spot configuration setup for more information.
Gun contactor	This item indicates that the gun contactor is in the closed position.
Weld Head Ret. Gun1 **for stud welding only**	This item indicates that the stud welding gun 1 is retracted.
Weld Head Ret. Gun2 **for stud welding only**	This item indicates that the stud welding gun 2 is retracted.
Air Pressure Low **for stud welding only**	This item indicates that the air pressure is below 80 psi for stud welding guns and feeders.
Gun 1 in Nest **for stud welding only**	This item indicates that gun 1 is in the tool changer. This is the first of four input signals that determine which gun is on the robot.
Gun 1 Present **for stud welding only**	This item indicates that gun 1 is present, but is not in the tool changer. This is the second of four input signals that determine which gun is on the robot.
Gun 2 in Nest **for stud welding only**	This item indicates that gun 2 is in the tool changer. This is the third of four input signals that determine which gun is on the robot.
Gun 2 Present **for stud welding only**	This item indicates that gun 2 is present, but is not in the tool changer. This is the fourth of four input signals that determine which gun is on the robot.

Stud Welding Gun Selection

Gun selection for production operation and the gun teach pendant key is determined by the status of the following input signals from a sensor on the tool changer stand, which is completely independent of the stud welding hardware:

- Gun 1 in Nest
- Gun 1 Present
- Gun 2 in Nest
- Gun 2 Present

Gun 1 and gun 2 are selected when these signals are in the states shown in following.

Gun Selection	Gun 1 in Nest Status	Gun 1 Present Status	Gun 2 in Nest Status	Gun 2 Present Status
Gun 1	OFF	ON	ON	OFF
Gun 2	ON	OFF	OFF	ON

Supplementation

- Gun selection will default to "1" if spot welding equipment input signals are not configured.
- The stud welding gun will not fire if a backup is defined and gun selection for guns 1 and 2 is incorrect.

4.2.2   **Spot Equipment Output Signals**

You use the spot equipment output screen to
- View the status of the output signals
- Force output signals
- Simulate output signals
- Assign output signals

Table 4.2.2 lists and describes each spot equipment output signal.

> **NOTE**
> The output signals listed in Table 4.2.2, except for Close gun, Reset water saver, are displayed only if they were defined during configuration setup in air gun. If your system is servo gun, only Reset water saver and Gun pressure signals are displayed.

Table 4.2.2 Spot equipment output signal

Output signals	Description
Reset water saver	This item is used to reset the water saver device if in a faulted condition.
Gun pressure	In servo gun system, this item is used to inform gun is in pressurizing. Refer servo gun function manual (B-83264EN) for more details.
Close gun	This item controls closing and opening the weld stroke on the gun. For stud welding, close gun advances the stud welding gun from the retracted position.
*Soft touch gun	This item controls the low pressure soft touch valve.
*Close backup	This item closes the backup of a dual stroke gun.
*Quick close backup	This item controls the pressure relief valve used with a quick close valve set.
*Open backup	This item opens the backup of a dual stroke gun.
Device set	This item advances the shot pin for the SET/RESET type backup to the SET position.
Device reset	This item advances the shot pin for the SET/RESET type backup to the RESET position.
*High valve prs	This item selects high valve pressure when the gun is closed.
*Med valve prs	This item selects medium valve pressure when the gun is closed.
*Low valve prs	This item selects low valve pressure when the gun is closed.
*Valve pressure if the weld controller has been set up on the spot configuration screen to control pressure, or multi-pressure	This item selects a numeric valve pressure when the gun is closed.
*High equal prs	This item selects high equalization pressure.
*Med equal prs	This item selects medium equalization pressure.
*Low equal prs	This item selects low equalization pressure.
*Equalization pressure	This item selects a numeric equalization pressure.
*Latch Head for stud welding only	This item turns on the air pressure, which latches the stud welding gun to the robot. This is independent of the stud welding equipment and is displayed only when stud welding has been enabled at controlled start. Some applications have found it useful to make Latch Head and Unlatch Head complementary I/O signals.
*Unlatch Head for stud welding only	This item turns off the air pressure, which unlatches the stud welding gun from the robot. This is independent of the stud welding equipment and is displayed only when stud welding has been enabled at controlled start. Some applications have found it useful to make Latch Head and Unlatch Head complementary I/O signals.
Gun contactor	This item closes the gun contactor if one if configured in your system.

* indicates that this item appears only if it was set up in the spot configuration screen.

Procedure 4-2 Setting Spot Equipment I/O Signals

Step
1   Press the [MENU] key and Select I/O.
2   Press F1, [TYPE].
3   Select Spot Equip. You will see either the spot equipment input or output screen.

> **NOTE**
> The following display screens and an actual display screen may different by equipment/gun specifications.

```
I/O Equip In
                                      1/9
     INPUT SIGNAL         TYPE #    SIM  STATUS
  1 Water Saver OK:       DI[  0]    U   ***
  2 Water flow OK:        DI[  0]    U   ***
  3 X-former OK:          DI[  0]    U   ***
  4 BU open detect:       DI[  0]    U   ***
  5 BU close detect:      DI[  0]    U   ***
  6 Gun close detect:     DI[  0]    U   ***
  7 Gun contactor:        DI[  0]    U   ***
  8 Tool attached:        DI[  0]    U   ***
  9 Tool in nest:         DI[  0]    U   ***


   [ TYPE ]          IN/OUT    ON      OFF    >
```

```
I/O Equip Out
                                      1/13
     OUTPUT SIGNAL        TYPE #    SIM  STATUS
  1 Close gun:            DO[  0]    U   ***
  2 Soft touch gun:       DO[  0]    U   ***
  3 Close backup:         DO[  0]    U   ***
  4 Quick close backup:   DO[  0]    U   ***
  5 Open backup:          GO[  0]    U   ***
  6 Reset water saver:    GO[  0]    U   ***
  7 High valve prs:       DO[  0]    U   ***
  8 Med valve prs:        DO[  0]    U   ***
  9 Low valve prs:        GO[  0]    U   ***
 10 High equal prs:       GO[  0]    U   ***
 11 Med equal prs:        DO[  0]    U   ***
 12 Low equal prs:        GO[  0]    U   ***
 13 Gun contactor:        GO[  0]    U   ***
Press NEXT to choose Equipment.

   [ TYPE ]          IN/OUT    ON      OFF    >
```

4   To change the equipment number, press NEXT, >, press F3, EQ_NUM, type the equipment number you want to display, and press the [ENTER] key.

5   To change between the display of the input and output screens, press F3, IN/OUT.

Port type / number change
6   If you need to change the port type, move the cursor to the signal type (DO, RO) and select with F4 (DO) or F5 (RO).
7   To change the port number, move the cursor to "#", enter the number, and press the enter key.

> **NOTE**
> If the signal does not exist, a warning is displayed. Leave 0 unused signals.

> **NOTE**
> In the case of $SHELL_CFG.$SET_IOCMNT=TRUE, when you enter a signal
> number for a signal in these I/O screens, the comment for the corresponding
> signal in the I/O Digital or I/O Group screen will be updated with the name of the
> signal displayed here.

Display / Change Simulate
To simulate or unsimulate I/O, place the cursor in the SIM column next to the I/O that you want to change.
- To simulate the signal, press F4, SIM. The signal will be simulated.
- To unsimulate the signal, press F5, UNSIM. The signal will be unsimulated.

Display / Change Signal Status
To force an output on or off, place the cursor in the STATUS column next to the I/O that you want to change.
- To force the I/O signal on, press F4, ON.
- To force the I/O signal off, press F5, OFF.

> **NOTE**
> In order to forcibly change the state of the input signal, it is necessary to change
> the input signal in state of simulation.

> ⚠ **WARNING**
> If you forcibly change the state of the output signal, you must check that there
> are no unnecessary equipment in the workcell, all operators are evacuated
> outside the workcell and that all protective measures are installed. Failure to do
> so may result in injury to workers or damage to equipment.

> **NOTE**
> Spot equipment input or output screen supports DI[1-999] and DO[1-999]. This
> screen doesn't support DI and DO of four digits or more.

4.3   WELD INTERFACE I/O SIGNALS

Weld interface I/O signals allow you to communicate with the weld controller using digital inputs and outputs.
Weld interface I/O signals you use can vary depending on the kind of weld interface you have: digital or integral.
Use Procedure 4-3 to set up weld interface I/O signals.

4.3.1   Weld Interface Input Signals

You can use the weld interface input screen to
- View the status of the input signals
- Simulate input signals
- Assign weld interface input signals

Table 4.3.1 lists and describes each weld interface input signal.

Table 4.3.1 Weld interface input signals

Input signals	Description
Weld in process	This signal indicates that the weld sequence is in process.
Weld complete	This signal indicates that the weld sequence is finished.
WELD/NOWELD status	This signal indicates the weld controller status (WELD or NOWELD). If the input is ON (high) the weld controller is in the WELD mode. If the input is OFF (low) the weld controller is in the NOWELD mode. For stud welding, change the polarity from NORMAL to INVERSE if the stud welding controller is a TRW model.
Major alarm	This signal indicates that a major alarm/fault has been detected. When this signal is received, a fault alarm message is displayed. This signal is defined as active high or low during configuration setup. Refer to the spot configuration setup for more information.
Minor alarm	This signal indicates that a minor alarm/fault has been detected. When this signal is received, a warning message is displayed. This signal is defined as active high or low during configuration setup. Refer to the spot configuration setup for more information.
Iso contactor on	This signal indicates that the isolation contactor is closed. Refer to the spot configuration setup for more information.
Cap change request	This signal is read from the weld controller before the robot turns off the initiate bit at the end of a weld. If this input is on, the robot passes this signal through to the PLC as Proc1 tip rep req on the cell Interface I/O screen. It is the PLC's responsibility to determine whether to allow additional cycles to be run if this output is on. This output should be turned off in a caps changed macro or program.
Appr Cap change	This input is read from the weld controller and passed to the PLC as Apprch tip replace on the cell Interface I/O screen. This output should be turned off in a caps changed macro or program.
Tip dress request	This input is read from the weld controller and passed to the PLC as Proc1 tip mnt req on the cell Interface I/O screen. When this is on, the PLC can decide when to tell the robot to run a tip dress style. This output should be turned off in the tip dress macro.
Tip stick detect	In servo gun system, this signal is used for tip stick detection by weld controller. Robot reads this input at gun open after welding, and if this signal is on at tip stick detect distance, robot stops and post the tip stick detection alarm.
Weld pressure displayed only if the weld controller controls the weld pressure **Read pressure displayed only if the weld controller controls the weld pressure**	The Weld pressure and Read pressure outputs are available only if Controls weld pressure has been set to ENABLED at Controlled start. This means that the weld controller controls weld pressure. Weld pressure and Read pressure are described in the following timing diagram. Robot Output **GOUT** [Weld Schedule] **Request pressure** Robot Input **GIN** [Weld pressure] **Read pressure**
Fault Head #1 for stud welding only	This signal indicates that a fault has occurred on gun 1. An error will be displayed when Fault Head #1 = OFF. It must be reset to continue.
Fault Head #2 for stud welding only	This signal indicates that a fault has occurred on gun 2. An error will be displayed when Fault Head #2 = OFF. It must be reset to continue.
Weld complete 1 for stud welding only	This signal is an output from the stud welding controller to the robot controller that the weld has completed for gun 1.
Weld complete 2 for stud welding only	This signal is an output from the stud welding controller to the robot controller that the weld has completed for gun 2.

Input signals	Description
Armed for stud welding only	This signal indicates that the stud controller is in the armed state.
All heads back for stud welding only	This signal indicates that all stud weld heads have been retracted.
Stud low for stud welding only	This signal indicates that the studweld feeder is starting to run low.
Maintenance for stud welding only	This signal indicates that the stud welder is requesting maintenance.
In/Out tolerance for stud welding only	This signal indicates that the last weld may have had a problem. If the In Tolerance signal from the studwelder is off at the completion of the weld, the Out of Tolerance output to the PLC turns on.
Auto for stud welding only	This signal indicates that the stud welder is in auto mode.
No Alert for stud welding only	This signal indicates the status at the end of a weld. If this signal is off when the Weld in Progress input turns off at the completion of the weld, the process alert output to the PLC turns on.
Weld in Progress 1 **Weld in Progress 2** for stud welding only	These signals indicate the end of the weld. When either signal turns off at the completion of a weld, the following are checked: • Weld Complete • In/Out tolerance • No Fault • No Alert Refer to section 6.3 for timing chart of stud welding sequence.

4.3.2 Weld Interface Output Signals

You can use the weld interface output screen to
- View the status of the output signals
- Simulate output signals
- Force output signals.
- Assign weld interface output signals

Table 4.3.2 lists and describes each weld interface output signal.

Table 4.3.2 Weld interface output signals

Output	Description
Weld schedule (Group output)	This item assigns the group output that sends the specified weld schedule to the weld controller.
Extended schedule	This item is used when number of weld schedule that weld controller has is larger than 16bit. Ask FANUC when you want to use this item.
Weld ID	This item assigns the group output that sends the specified weld schedule to the weld controller (or peripheral equipment). Use this item as an index to manage weld point information etc.
Weld parity	This item goes on whenever the number of weld schedule output lines being set for the current schedule is an even number to establish odd parity. If this signal is not needed, it can be set to 0.
Schedule Strobe	The schedule strobe is sent to the weld controller immediately following the weld schedule. This signals to the weld controller that it is ok to read the weld schedule.
Weld Initiate	This signal indicates welding start to Weld controller.

Output	Description
Enable weld	This signal is used to set the weld controller into WELD or NOWELD mode. If enable weld is OFF (low), the weld controller will be placed in a NOWELD mode. If enable weld is ON (high) the weld controller will be placed in the WELD mode. For stud welding, change the polarity of Enable weld from NORMAL to INVERSE if the stud welding controller is a TRW model.
Reset stepper	Informs the weld controller to set the stepper count back to zero. This can be used after replacing or dressing the weld tip.
Reset welder	Resets weld faults from the robot. When invoked, it pulses for 0.5 seconds. If the weld controller is faulted prior to the weld, the Reset Welder output is pulsed automatically in an attempt to clear the fault. If the fault cannot be cleared, a "Reset Welder timeout" fault is posted. On a Retry or Skip, the Reset Welder output is pulsed prior to performing the weld. Not all weld controllers support this function. Refer to your weld controller manual to verify that this function is supported. For stud welding, this signal resets all faults and suspect welds that occur.
ISO contactor	An output signal to close isolation contactor so that current can be sent to the gun. This signal is set on when the close contactor is executed. This signal is automatically set to OFF whenever a HOLD or ESTOP is encountered during production, or set OFF when the open contactor is executed.
Cap change comp.	This signal is sent to the weld controller from a cap change program or macro after the caps have been changed.
Enable cont. saver	This signal is turned ON to the weld controller when the robot is on so that the weld controller can use the contactor saver feature.
Tip stick timing	In servo gun system, this signal can be used to inform the PLC when the tip stick check was performed. Each time the gun opens from the weld spot, the tip stick timing output is turned on when the gun reaches the opening specified by the Tip Stick Detect Distance. This output turns on regardless of whether the tips are stuck or not.
Request pressure displayed only if the weld controller controls the weld pressure	This signal is available only when Controls weld pressure has been set to ENABLED at controlled start. This means that the weld controller controls weld pressure. Request pressure is described in the following timing diagram. Robot Output **GOUT** [Weld Schedule] **Request pressure** Robot Input **GIN** [Weld pressure] **Read pressure**
Cycle Head #1 for stud welding only	When this signal is asserted and the stud welder is in Armed and Auto, the studwelder will perform a weld with gun 1.
Cycle Head #2 for stud welding only	When this signal is asserted and the stud welder is in Armed and Auto, the studwelder will perform a weld with gun 2.
Refeed Head #1 for stud welding only	When this output is asserted, the studwelder will refeed a stud to gun 1. Pressing shift+backup will perform this function.
Refeed Head #2 for stud welding only	When this output is asserted, the studwelder will refeed a stud to gun 2. Pressing shift+backup will perform this function.
Restart for stud welding only	Restart will allow the weld controller to retry a weld fault. This output will be set automatically when the user chooses Retry Weld.
Forc Weld complete for stud welding only	This will allow the weld controller to skip a faulted weld. This will be set automatically when the user chooses Skip Weld on Fault Recovery.

Output	Description
Mode Select #1 for stud welding only	When both Mode Select #1 and #2 = HIGH the studwelder is in Weld mode. When both Mode Select #1 and #2 = LOW, the studwelder is in Noweld mode.
Mode Select #2 for stud welding only	When both Mode Select #1 and #2 = HIGH the studwelder is in Weld mode. When both Mode Select #1 and #2 = LOW, the studwelder is in Noweld mode.
All Head Weld for stud welding only	This output when asserted will cause the studwelder to weld with all heads.
Operation Start for stud welding only	This output will be ON when the robot is not faulted.

NOTE
> When Weld interface in spot configuration screen is specified for INTEGRAL, Weld ID cannot be output to outside.

Procedure 4-3 Setting Weld Interface I/O Signals

Step
1   Press the [MENU] key and Select I/O..
2   Press F1, [TYPE].
3   Select Weld Interface. Either the weld input or weld output screen will be displayed.

NOTE
> The following display screens and an actual display screen may different by weld controller type.

```
I/O Weld In
                                    1/10
   INPUT SIGNAL        TYPE #    SIM STATUS
 1 Weld in process:    DI[  0]    U  ***
 2 Weld complete:      DI[  0]    U  ***
 3 WELD/NOWELD status: DI[  0]    U  ***
 4 Major alarm:        DI[  0]    U  ***
 5 Minor Alarm:        DI[  0]    U  ***
 6 Iso contactor on:   DI[  0]    U  ***
 7 Cap change request: DI[  0]    U  ***
 8 Appr Cap change:    DI[  0]    U  ***
 9 Tip dress request:  DI[  0]    U  ***
10 Tip stick detect:   DI[  0]    U  ***


   [ TYPE ]          IN/OUT    ON     OFF   >
```

```
I/O Weld Out
                                    1/12
   OUTPUT SIGNAL       TYPE #    SIM STATUS
 1 Weld schedule:      GO[  0]    U  **********
   Extended schedule:               0
 2 Weld ID:            GO[  0]    U  **********
 3 Weld parity:        DO[  0]    U  ***
 4 Schedule strobe:    DO[  0]    U  ***
 5 Weld Initiate:      DO[  0]    U  ***
 6 Enable weld:        DO[  0]    U  ***
 7 Reset stepper:      DO[  0]    U  ***
 8 Reset welder:       DO[  0]    U  ***
 9 Iso contactor:      DO[  0]    U  ***
10 Cap change comp:    DO[  0]    U  ***
11 Enbl cont. savr:    DO[  0]    U  ***
12 Tip stck timing:    DO[  0]    U  ***


   [ TYPE ]          IN/OUT    ON     OFF   >
```

4   To change the weld controller number, press NEXT, >, press F3, WC_NUM, type the weld
     controller number you want to display, and press the [ENTER] key.

5   To change between the display of the input and output screens, press F3, IN/OUT.

Port type / number change

6   To change the port number, move the cursor to [number], enter the number, and press the enter key.

> **NOTE**
> If the signal does not exist, a warning is displayed. Leave 0 unused signals.

> **NOTE**
> In the case of $SHELL_CFG.$SET_IOCMNT=TRUE, when you enter a signal
> number for a signal in these I/O screens, the comment for the corresponding
> signal in the I/O Digital or I/O Group screen will be updated with the name of the
> signal displayed here.

Display / Change Simulate
To simulate or unsimulate I/O, place the cursor in the SIM column next to the I/O that you want to
change.
   •   To simulate the signal, press F4, SIM. The signal will be simulated.
   •   To unsimulate the signal, press F5, UNSIM. The signal will be unsimulated.

Display / Change Signal Status
To force an output on or off, place the cursor in the STATUS column next to the I/O that you want to
change.
   •   To force the I/O signal on, press F4, ON.
   •   To force the I/O signal off, press F5, OFF.

> **NOTE**
> In order to forcibly change the state of the input signal, it is necessary to change
> the input signal in state of simulation.

> ⚠ **WARNING**
> If you forcibly change the state of the output signal, you must check that there
> are no unnecessary equipment in the workcell, all operators are evacuated
> outside the workcell and that all protective measures are installed. Failure to do
> so may result in injury to workers or damage to equipment.

> **NOTE**
> Weld input or weld output screen supports DI[1-999] and DO[1-999]. This screen
> doesn't support DI and DO of four digits or more.

4.4   WELD MODE

Robot's weld mode can change by WELD/NOWELD signal ((1) in Fig.4.4) in cell interface input signals. Effective of input signal is only the following.

1:
・   Program select mode is RSR/PNS/OTHER
・   Teach pendant is DISABLE

2:
・   Program select mode is STYLE
・   Remote/Local status is Remote (SI[REMOTE]＝ON)
・   Teach pendant is DISABLE
・   3 mode swich is AUTO

Moreover, Robot's weld mode can be changed from spot weld test cycle screen ((2) in Fig.4.4)). However, when following conditions consist, Robot's weld mode cannot be changed on spot weld test cycle screen. Refer to chapter 8 TEST CYCLE for spot weld test cycle screen.

1:
・   Program select mode is RSR/PNS/OTHER
・   Teach pendant is DISABLE

2:
・   Program select mode is STYLE
・   Teach pendant is DISABLE
・   3 mode swich is AUTO

When the enable weld signal ((3) in Fig.4.4) is assigned, a robot changes the weld mode of the weld controller by this signal. <Note 1>
Robot outputs weld signals, such as weld schedule at the time of spot command execution and waits for the weld complete signal regardless of robot's weld mode status.<Note 1>
However, when the weld mode is disabled and the weld I/O sim is enabled, weld signals, such as weld schedules are not outputted and robot does not wait for the weld complete signal.   <Note 2>
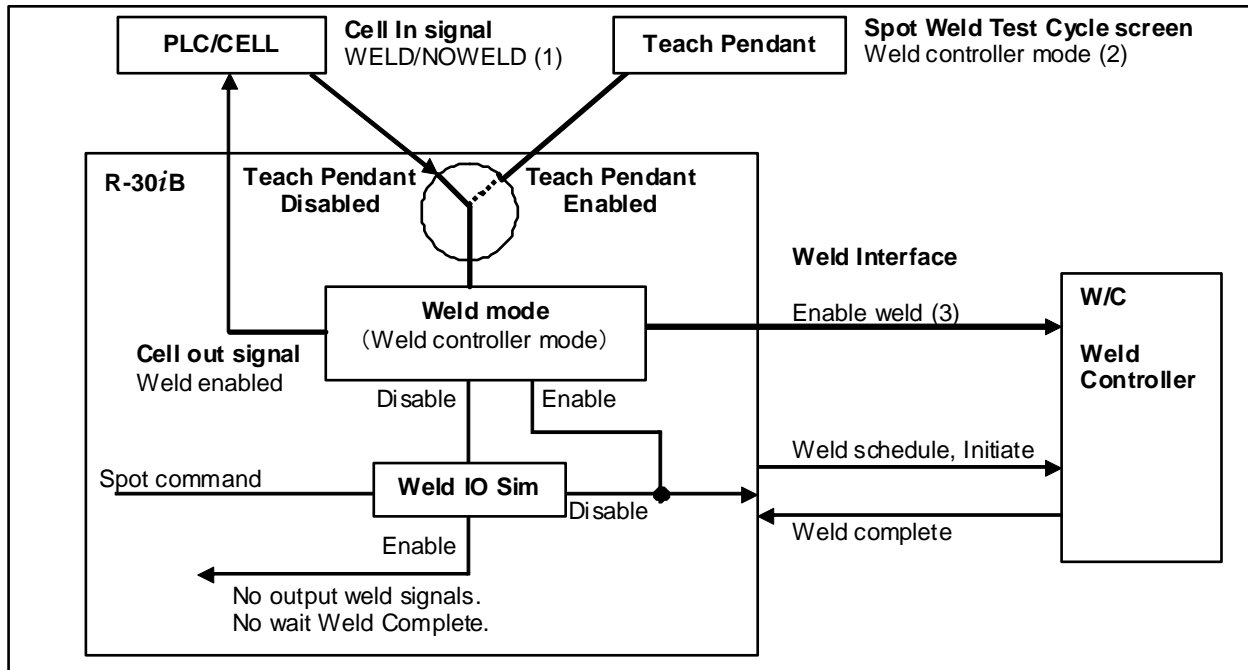
Fig.4.4 Weld mode

Weld processing with Weld mode and Weld IO sim

Weld mode	Weld IO sim	Enable weld signal	Weld mode of W/C	Weld processing at Spot command
Enable	-	ON	WELD	Output the weld schedule signals and
Disable	Disable	OFF	NOWELD	wait the weld complete signal
	Enable	OFF	(unrelated)	No output weld signals No wait Weld Complete

---

NOTE
1 When not using enable weld signal (3), it is necessary to change weld mode of W/C from PLC/CELL directly. When not performing this, welding may be performed even if a robot's weld mode is disabled.
2 About weld I/O Sim: This can be changed from spot weld test cycle screen. The change by a signal cannot be performed. It can be used only when weld mode is disabled. It does not depend on the mode of a weld controller and welding is not performed. Waiting time is decided by setup (Weld-I/O-sim/Weld duration) of a robot, and differs from the actual weld timer schedule.

5   SPOTTOOL+ PROGRAM DETAIL

This section describes detail information of each spot welding program.

5.1   CHANGE APPLICATION TOOL

When multiple applications are used, it is necessary to select application used for program. When multiple applications are not used, the application change need not be considered. Refer to A.2 MULTI APPLICATION for multiple applications.

Procedure 5-1 Change application tool

Step

1 Press the [MENU] key. The program selection screen will be displayed.
2 Move cursor to the program.
3 Press the [NEXT] key and press F2, DETAIL in the next page. The program detail screen is displayed.
4 Press F3, NEXT. The application tool change screen will be displayed.

> **NOTE**
> The displayed screen is different by the usage condition of multiple applications.

```
Appl process
                                      1/3

    1 Spot Weld                    TRUE
    2 Handling                     FALSE
    3 Dispense                     FALSE



           PREV    NEXT    TRUE    FALSE   >
```

5 Specify TRUE to the application used to this program if multiple applications.

> **NOTE**
> As default, Spot Weld is TRUE.
> About the detail of Handling, refer to OPERATOR'S MANUAL (Basic Operation) (B-83284EN).
> About the detail of Dispense, refer to Dispense Function OPERATOR'S MANUAL (B-83284EN-5).

5.2   CHANGE EQUIPMENT NUMBER

When multiple equipments are used, it is necessary to specify equipment number used for program. When multiple equipments are not used, equipment number change need not be considered.

Procedure 5-2 Change equipment number

Step
1   Press the [MENU] key. The program selection screen is displayed.
2   Move cursor to the program.
3   Press the [NEXT] key, > and press F2, DETAIL in the next page. The program detail screen is displayed.
4   Press F3, NEXT. The equipment number screen is displayed.

```
Appl process
      Spot Welding Application Data      1/1

        Equipment Number:             1


   |   END   |  PREV  |  NEXT  |       |       |  >
```

5   Change this item into equipment number used for this program if multiple equipments.

> **NOTE**
> As default, equipment number is 1.

6   SPOTTOOL+ INSTRUCTIONS

This chapter describes each spot welding instruction.
For servo gun and/or integrated weld controller, refer to the each option manual for more details.

6.1   SPOT WELDING INSTRUCTIONS

Spot welding instructions tell the robot when and how to weld. The instruction can be configured for single or dual guns. There are seven kinds of spot welding instructions:
- Spot instructions
  (Stud welding instructions)
- Backup instructions
- ISO Contactor
- GUN Contactor
- Reset Stepper
- Reset Welder
- Reset Water Saver

6.2   SPOT INSTRUCTION

Spot instructions tell the robot to spot weld. This section describes air gun for spot instruction.

SPOT[WID=*:BU=*,EP=*,P=*,S=x,EP=*,BU=*]

SPOT[WID=*:BU=*,EP=*,P=*,S=x,EP=*,BU=*] instruction initiates the spot weld routine for a single gun using the specified backup state (BU), equalization pressure (EP), valve pressure (P) and weld schedule (S). Refer to Table 6.2. Use weld ID(WID) to manage welding point information etc.

> **NOTE**
> The format of this instruction varies with spot weld settings. If weld ID is disabled, WID is not displayed. If multiple valve pressure is disabled, P is not displayed. If backups are disabled, BU is not displayed. If equalization pressure is disabled, EP is not displayed. Weld ID, backup, equalization pressure, valve pressure, and gun detection are enabled only if defined using the spot configuration at CTRL or COLD Start.

Table 6.2 Spot instruction

WID=*	Weld ID
BU=C	Backup closed before weld
BU=*	Backup unchanged before weld
EP = H	Equalization pressure high before weld
EP = M	Equalization pressure medium before weld
EP = L	Equalization pressure low before weld
EP = x	Equalization pressure 0-31 (binary encoded) before weld
P = H	Valve pressure high
P = M	Valve pressure medium
P = L	Valve pressure low
P = x	Valve pressure 0-15 (binary encoded)
S = x	Weld schedule number
EP = H	Equalization pressure high after weld

EP = M	Equalization pressure medium after weld
EP = L	Equalization pressure low after weld
EP = x	Equalization pressure 0-31
	(binary encoded) after weld
BU=O	Backup open after weld
BU=*	Backup unchanged after weld

Select SPOT WELDING from sub-menu after pressing the F1, [INST] to teach this instruction.

```
    Instruction 1         Instruction 2         Instruction 3
1 SPOT WELDING        1 Skip                1 Tool_Offset
2 Registers          2 Payload             2 LOCK PREG
3 I/O                3 Offset/Frames       3 String
4 IF/SELECT          4 Miscellaneous       4 DIAGNOSE
5 WAIT               5 Program control     5
6 JMP/LBL            6 MACRO               6
7 CALL               7 FOR/ENDFOR          7
8 --next page--      8 --next page--       8 --next page--
```

SPOT[WID=(*,*):BU=(*,*),EP=(*,*),P=(*,*),S=(x,y),EP=(*,*),BU=(*,*)]

SPOT[BU=(*,*),EP=(*,*),P=(*,*),S=(x,y),EP=(*,*),BU=(*,*)] instruction initiates the spot welding routine for a dual gun using the backup states (BU), equalization pressure (EP), valve pressures (P), and weld schedules (S) specified. In the (*,*), the item to the left of the comma represents the value for gun 1 and the value to the right of the comma represents the value for gun 2. Use Weld ID(WID) to manage welding point information etc.

NOTE

The format of this instruction varies with spot weld settings. If weld ID is disabled, WID is not displayed. If multiple valve pressure is disabled, P is not displayed. If backups are disabled, BU is not displayed. If equalization pressure is disabled, EP is not displayed. Weld ID, backup, equalization pressure, valve pressure, and gun detection are enabled only if defined using the spot configuration screen at CTRL or COLD Start.

Select SPOT WELDING from sub-menu after pressing the F1, [INST] to teach this instruction.

```
    Instruction 1         Instruction 2         Instruction 3
1 SPOT WELDING        1 Skip                1 Tool_Offset
2 Registers          2 Payload             2 LOCK PREG
3 I/O                3 Offset/Frames       3 String
4 IF/SELECT          4 Miscellaneous       4 DIAGNOSE
5 WAIT               5 Program control     5
6 JMP/LBL            6 MACRO               6
7 CALL               7 FOR/ENDFOR          7
8 --next page--      8 --next page--       8 --next page--
```

J P[x] 100% FINE
SPOT[WID=*:BU=*,EP=*,P=*,S=x,EP=*,BU=*,ANTIC(B=m,G=n)]

This instruction is spot instruction for motion option.

The gun close anticipation override (ANTIC) allows you to override global anticipation override settings on a point-by-point basis. This means that if you have defined an Anticipation Type and Gun Close or Backup Close value on the spot equipment setup screen, you can override those values by specifying anticipation values within a particular spot welding motion instruction in your teach pendant program.

You can specify anticipation override values only in spot motion instructions and BACKUP motion instructions. See Fig. 6.2(a) and 6.2(b) for the format of spot motion instructions that use anticipation override.

```
J P[x] 100% FINE SPOT[*,S=*,*,ANTIC(B=m,G=n)]

Anticipation value for Backup 1 (and backup 2) ———
                    0 - 1000 ms or 0 - 1000 mm
     Anticipation value for Gun 1( and Gun2 ) ———
                    0 - 1000 ms or 0 - 1000 mm
```

Fig. 6.2(a) Anticipation override for spot instruction, single and dual gun with backup

```
J P[x] 100% FINE SPOT[S=*,ANTIC=m]

Anticipation value for Gun 1 ( and Gun2) ──┐
                    0 - 1000 ms or 0 - 1000 mm
```

Fig. 6.2(b) Anticipation override for spot instruction, single and dual gun without backup

---

NOTE
   You cannot use ANTIC in a SPOT instruction in a program line that does not
   include a motion instruction.

Select from SPOT default menu after pressing the F2, SPOT to teach this instruction.

```
SAMPLE1
                                        1/1
    [End]

              SPOT default menu  1
1 L P[] 2000mm/sec FINE SPOT[S=1]
2 L P[] 2000mm/sec FINE SPOT[S=1]
3 L P[] 2000mm/sec FINE SPOT[S=1]
4 L P[] 2000mm/sec FINE SPOT[S=1]


     POINT   ED_DEF                    TOUCHUP  >
```

The content of SPOT default menu can be changed by pressing F2, ED_DEF.
Even if SPOT[ ]in Motion Modify menu is selected, this instruction can be taught. Press F4, [CHOICE] to
display Motion Modify menu after moving the cursor to end of motion instruction.

```
SAMPLE1
                                        4/5

    4: L P[3] 2000mm/sec CNT100
    [End]



                          [CHOICE]
```

```
SAMPLE1
                                              4/5

     Motion Modify  1
    1 No option
    2 SPOT[...,S=,...
    3 BACKUP[*,...]
    4 ISO CONTACTOR
    5 GUN CONTACTOR
    6 RESET STEPPER
    7 RESET WELDER
    8 --next page--


         4: L P[3] 2000mm/sec CNT100


                              [CHOICE]
```

6.3   TIMING CHART FOR SPOT INSTRUCTION

This section describes the timing chart of I/O which SpotTool+ performs. Please make it the reference in the case of an I/O setup of SpotTool+ and an equipment setup.

Fig. 6.3(a) and 6.3(b) are the sequence of typical spot welding by an air gun.
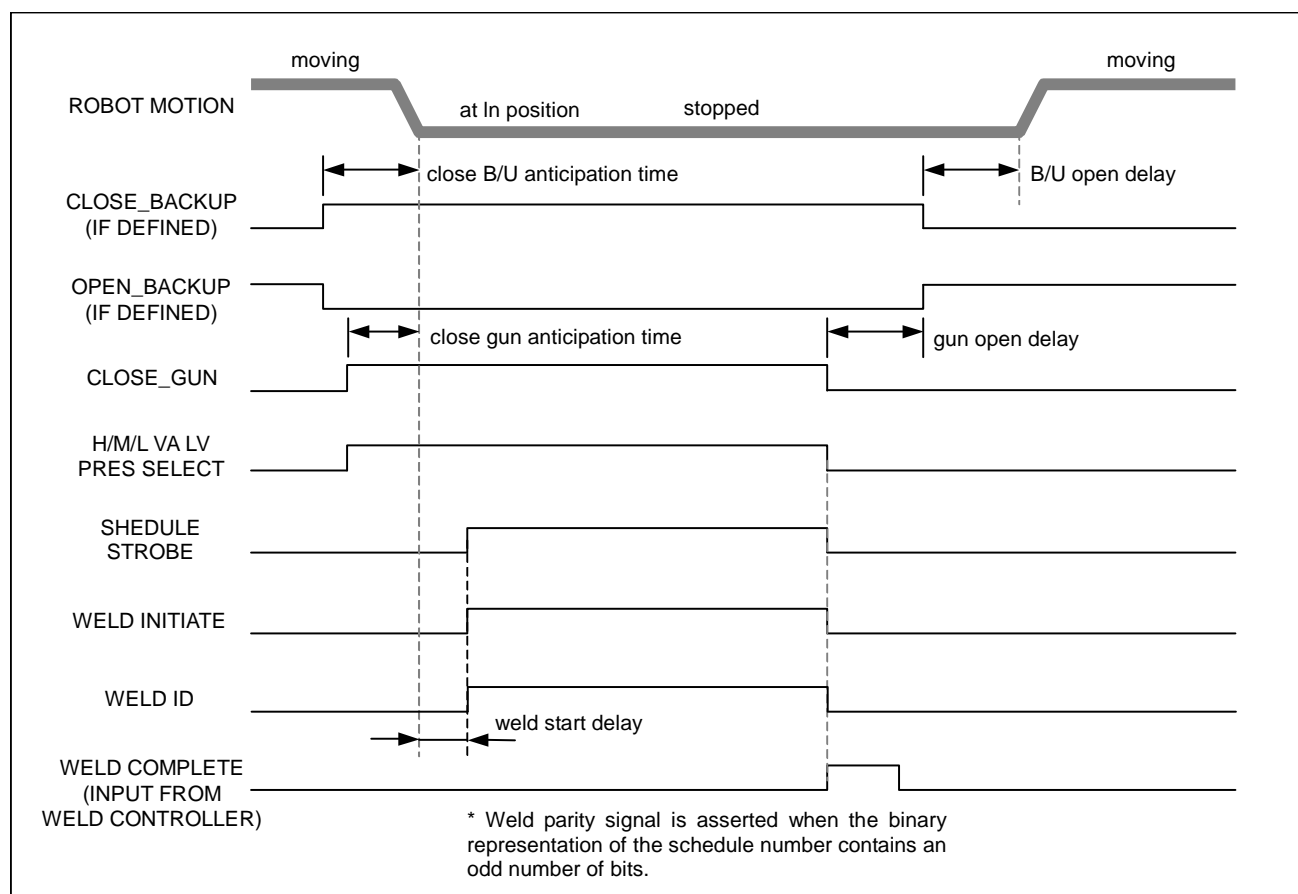
Fig. 6.3(a) Weld timing sequence when a spot instruction is executed
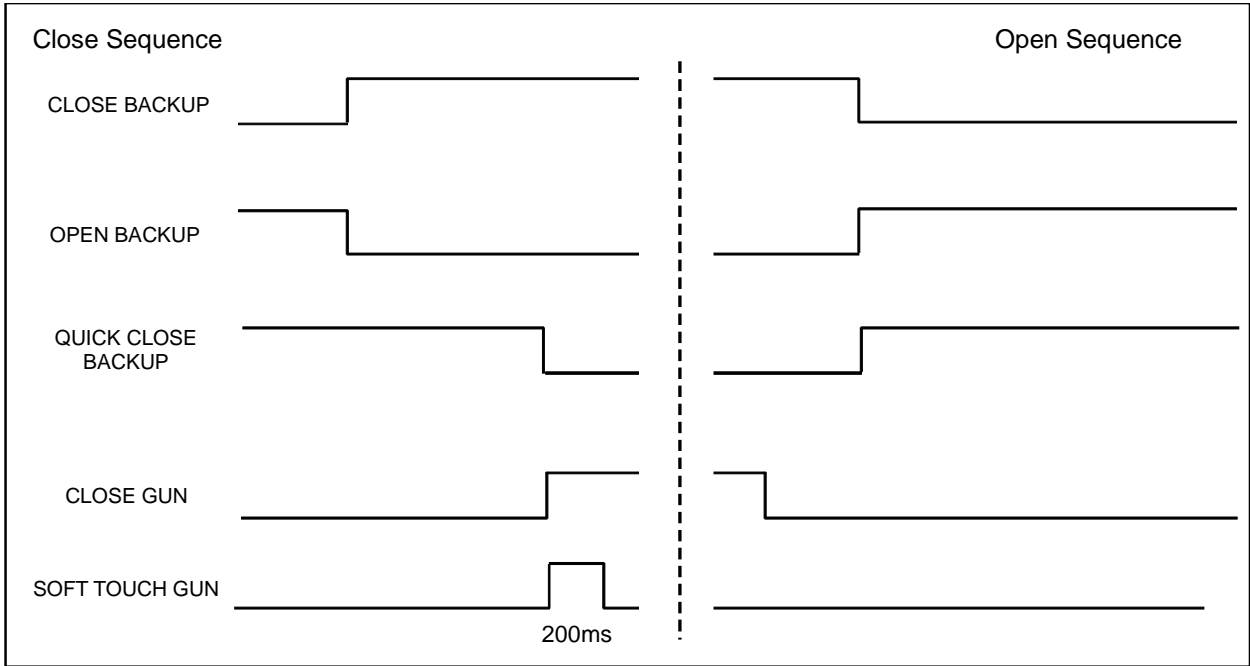
Fig. 6.3(b) Timing sequence when quick close backup or soft touch gun is used

STP : Soft Touch Pressure(If used, assert for Soft Touch Time)
VP: Valve Pressure
OG: Open Gun Pressure
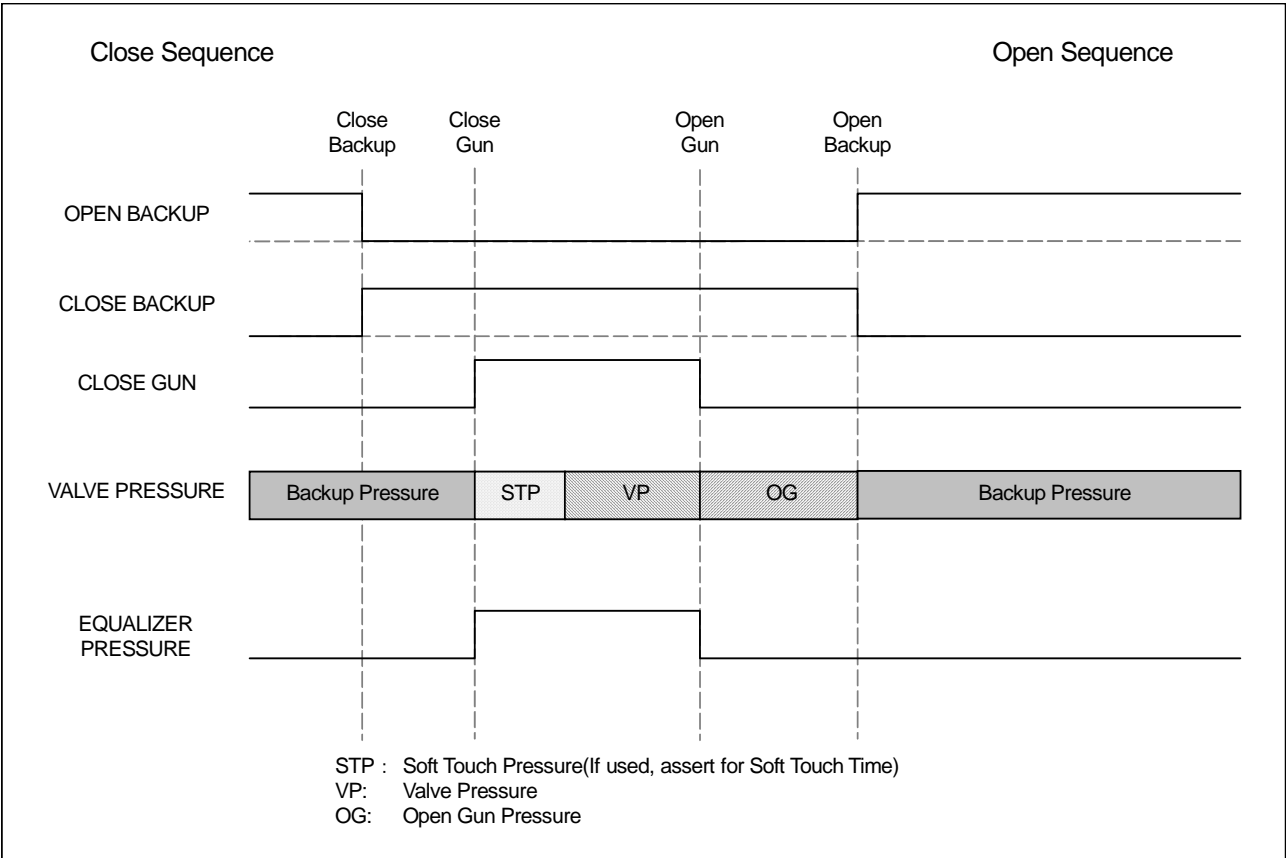
Fig. 6.3(c) Valve pressure settings

Fig. 6.3(d) and 6.3(e) are the sequence of set/reset type spot welding by an air gun.
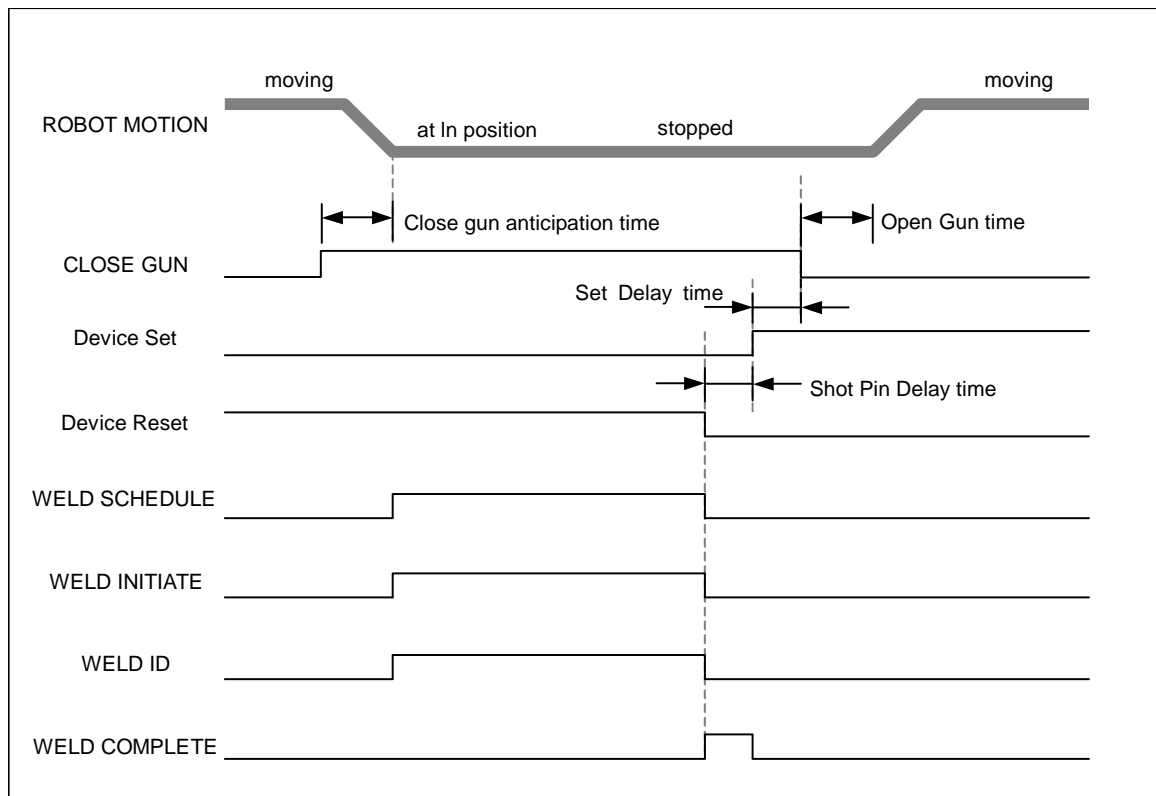
Fig. 6.3(d) Spot sequence with spot(BU=C, S=x, BU=*)
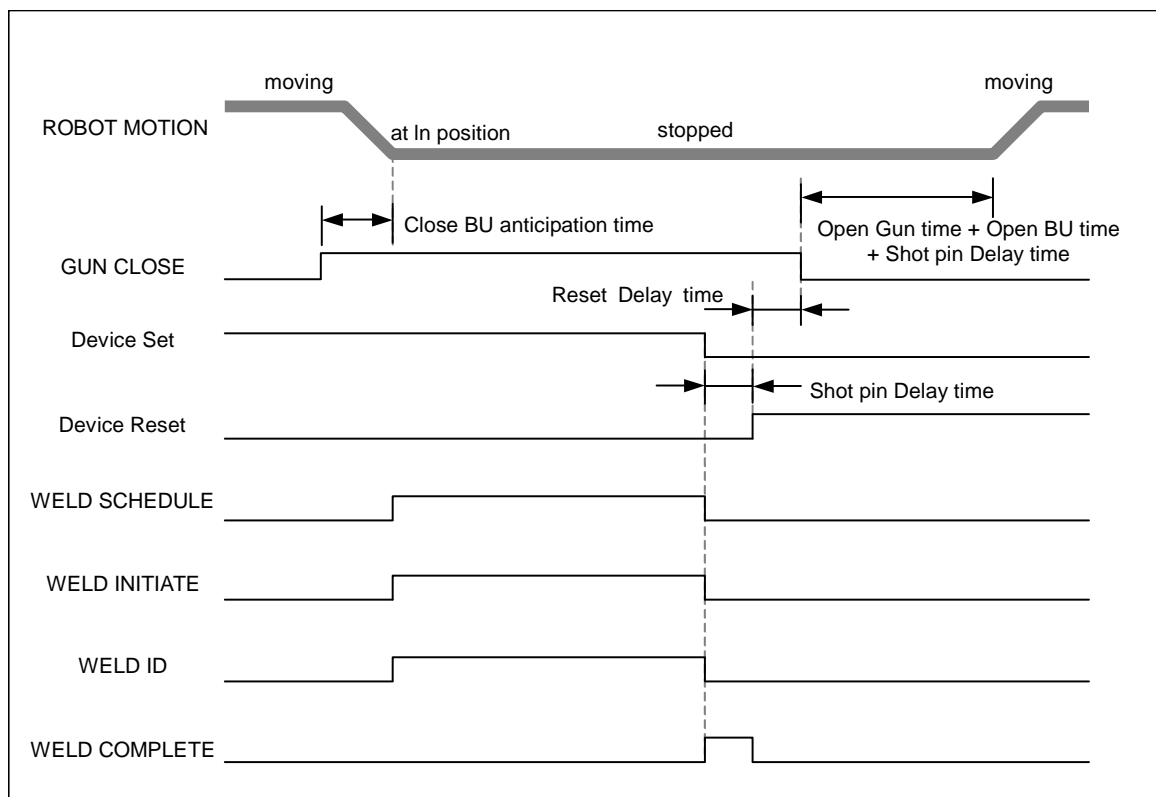
Fig. 6.3(e) Spot sequence with spot(BU=*, S=x, BU=O)

Fig. 6.3(f) and 6.3(g) are the sequence for STUD welding.
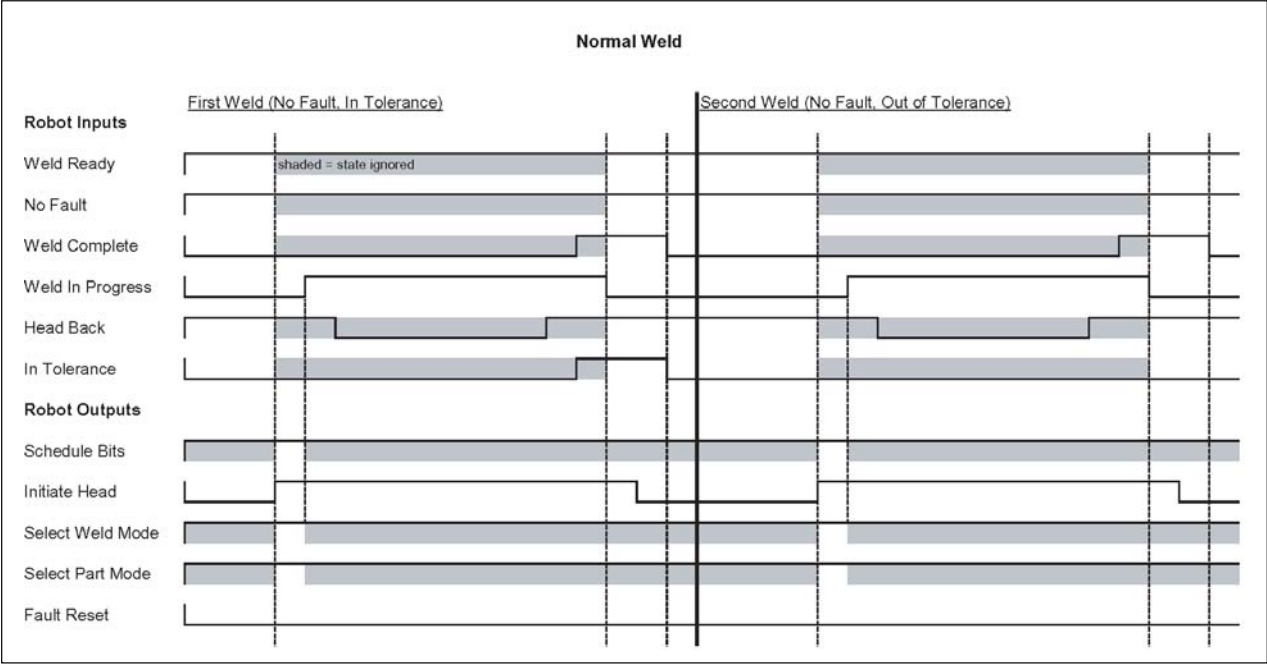
Fig. 6.3(f) Normal stud weld sequence
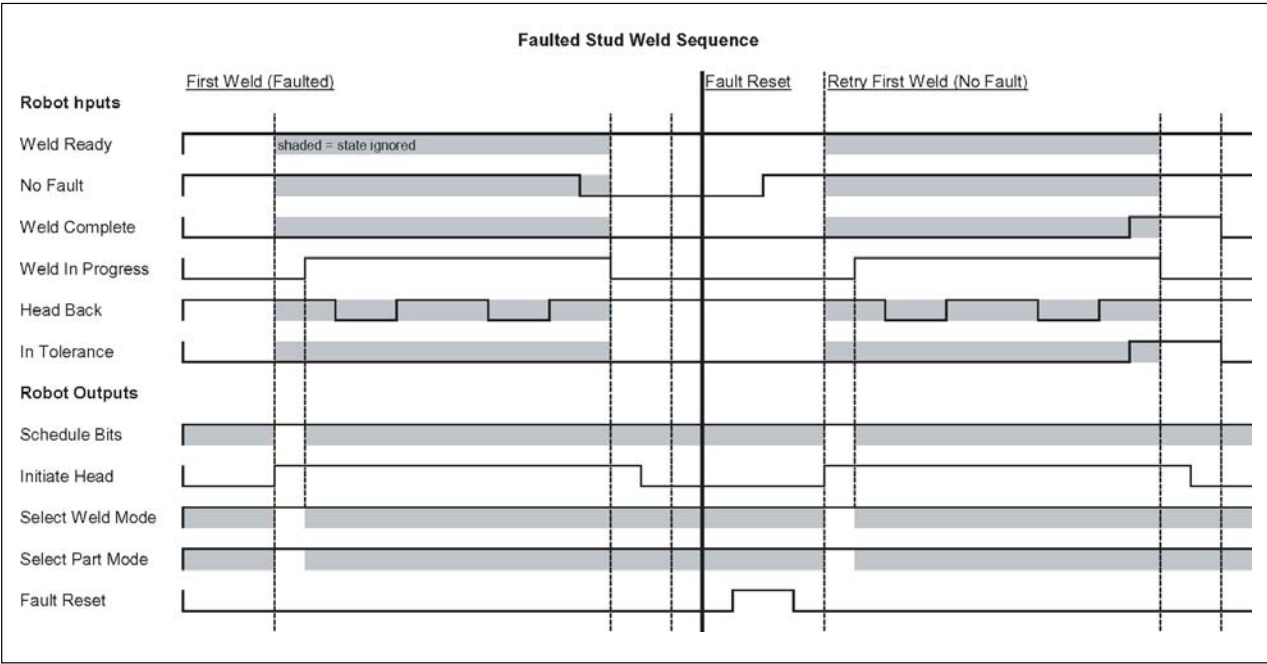
Fig. 6.3(g) Faulted stud weld sequence

6.4   BACKUP INSTRUCTION

Backup instructions control the backup stroke of the gun(s). If Backup stroke in spot configuration screen is disabled, this instruction cannot be used.

BACKUP = [*]

BACKUP=[*] instruction opens, closes, or keeps constant the state of a single gun for the equipment specified in the program header. See Fig. 6.4(a).

```
                    BACKUP = [*]
                          ├── OPEN  - Opens the gun, full open
                          ├── CLOSE - Closes the gun , half open
                          └── *      - Gun state is unchanged
```
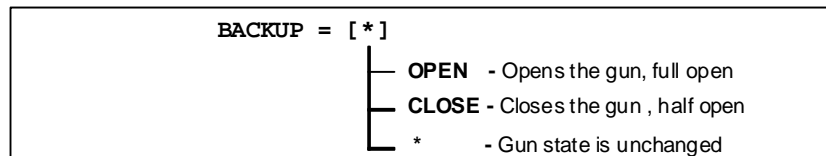
Fig. 6.4(a) Backup=[*]

Select SPOT WELDING from sub-menu after pressing the F1, [INST] to teach this instruction.

Instruction 1	Instruction 2	Instruction 3
1 SPOT WELDING	1 Skip	1 Tool_Offset
2 Registers	2 Payload	2 LOCK PREG
3 I/O	3 Offset/Frames	3 String
4 IF/SELECT	4 Miscellaneous	4 DIAGNOSE
5 WAIT	5 Program control	5
6 JMP/LBL	6 MACRO	6
7 CALL	7 FOR/ENDFOR	7
8 --next page--	8 --next page--	8 --next page--

BACKUP = [*,*]

BACKUP=[*,*] instruction opens, closes, or keeps constant the states of each gun in a dual gun configuration. In the [*,*], the item to the left of the comma represents the value for gun 1 and the value to the right of the comma represents the value for gun 2. See Fig. 6.4(b).

```
              Gun 1     Gun 2
                 ┌───┐  ┌───┐
       BACKUP = [ * , * ]
                    └───┘
                          ├── OPEN  -  Opens the gun, full open
                          ├── CLOSE -  Closes the gun, half open
                          └── *      -  Gun state is unchanged
```
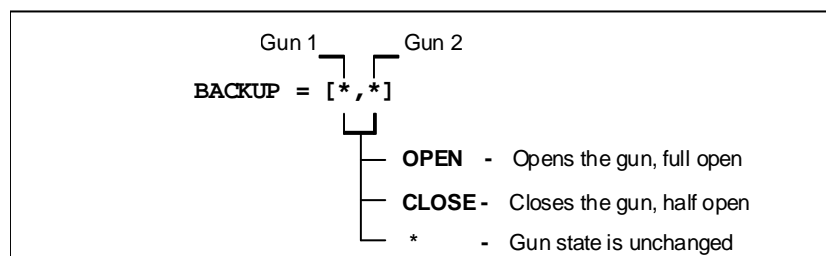
Fig. 6.4(b) Backup=[action1, action2]

Select SPOT WELDING from sub-menu after pressing the F1, [INST] to teach this instruction.

Instruction 1	Instruction 2	Instruction 3
1 SPOT WELDING	1 Skip	1 Tool_Offset
2 Registers	2 Payload	2 LOCK PREG
3 I/O	3 Offset/Frames	3 String
4 IF/SELECT	4 Miscellaneous	4 DIAGNOSE
5 WAIT	5 Program control	5
6 JMP/LBL	6 MACRO	6
7 CALL	7 FOR/ENDFOR	7
8 --next page--	8 --next page--	8 --next page--

J P[x] 100% FINE BACKUP [B=*, ANTIC=m]

See Fig. 6.4(c) for the format of BACKUP motion instructions that use anticipation override.

```
J P[x] 100% FINE BACKUP[B=*,ANTIC=m]

Anticipation value for Backup 1 (and Basckup2) ⌐

         0 - 1000 ms or 0 - 1000 mm
```

Fig. 6.4(c) Backup anticipation override for backup instruction, single and dual backups

To teach this instruciton, press F4, [CHOICE] to display Motion Modify menu after moving the cursor to end of motion instruction. And, Select BACKUP[*] from Motion Modify menu.

```
SAMPLE1
                                    4/5

     4: L P[3] 2000mm/sec CNT100
  [End]




                              [CHOICE]
```

```
SAMPLE1
                                    4/5
   ┌─────────────────────┐
   │ Motion Modify  1    │
   │1 No option          │
   │2 SPOT[...,S=,...     │
   │3 BACKUP[*,...]       │
   │4 ISO CONTACTOR       │
   │5 GUN CONTACTOR       │
   │6 RESET STEPPER       │
   │7 RESET WELDER        │
   │8 --next page--       │
   └─────────────────────┘

     4: L P[3] 2000mm/sec CNT100

                              [CHOICE]
```

6.5   OTHER SPOT WELDING INSTRUCTIONS

Use other spot welding instructions to control spot welding functions.

ISO CONTACTOR [WC=1, OPEN]
The Isolation (ISO) Contactor is an instruction to turn ON or OFF an electro-mechanical switching device used to isolate the primary circuit from the welding transformer when the welding ISO would be OFF not ON. It is often activated by the weld controller depending on the hardware setup. WC indicates the Weld Controller number.

GUN CONTACTOR [OPEN]
The GUN Contactor is a program instruction to open or close a contactor that will isolate the secondary circuit from the welding transformer when welding is not-in-process.

RESET STEPPER [WC=1, SN=1, SV=0]
The RESET Stepper resets the counter to the initial stepper value as defined on the weld controller. WC indicates the Weld Controller number, SN indicates the Stepper Number to reset, and SV indicates the Stepper Valve, but is currently not used.

RESET WELDER [WC=1]

The RESET Welder is a program instruction that sends out a signal from the controller to the weld controller to reset welding faults. This instruction would typically be at the beginning of every cycle. WC indicates the Weld Controller number.

RESET WATER SAVER

The RESET Water Saver is an instruction that signals the weld controller to reset the water saver device of the welding equipment. This instruction would typically be sent after a repair cycle or water saver fault. This is so you can reset all equipment water savers in one program such as a cap change program.

Select SPOT WELDING from sub-menu after pressing the F1, [INST] to teach these instructions.

```
     Instruction 1            Instruction 2            Instruction 3
1 SPOT WELDING          1 Skip                  1 Tool_Offset
2 Registers             2 Payload               2 LOCK PREG
3 I/O                   3 Offset/Frames         3 String
4 IF/SELECT             4 Miscellaneous         4 DIAGNOSE
5 WAIT                  5 Program control       5
6 JMP/LBL               6 MACRO                 6
7 CALL                  7 FOR/ENDFOR            7
8 --next page--         8 --next page--         8 --next page--
```

7   SPOT TOOL+ MANUAL OPERATION

This chapter describes manual operations for spot welding.

7.1   MANUAL CONTROL OF GUN AND BACKUP

Manual control of the spot weld gun and backup is opening and closing the gun and backup without executing a program. Controlling the gun and backup manually is used to check the recorded spot weld positions, clearance for the gun, and alignment of gun tips.

Use Procedure 7-1 to control a gun manually. Use Procedure 7-2 to control a backup.

Procedure 7-1 Manually Controlling a Gun

Conditions
- All personnel and unnecessary equipment are out of the workcell.
- The gun is functioning properly.

Step
1 Continuously press the DEADMAN switch and turn the teach pendant ON/OFF switch to ON.
2 Jog the robot to the position where you want to test the gun.

> ⚠ **WARNING**
> In the next step the gun will open or close. Make sure all personnel and unnecessary equipment are out of the workcell; otherwise, personnel could be injured or equipment damaged.

> ⚠ **CAUTION**
> The next step will open or close the gun. If the gun is OPEN, it will close. If the gun is CLOSED, it will open.

3 If dual guns have been defined, press EQUIP (on the teach pendant or on the SETUP TP Hardkeys screen), to select the gun number that is operating. To select GUN, GUN1, or BOTH, press F4, [CHOICE].
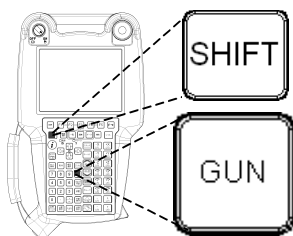
4 To open or close the gun, press and hold in SHIFT and press the GUN key.

Procedure 7-2 Manually Controlling a Backup

Conditions
- All personnel and unnecessary equipment are out of the workcell.
- The gun is functioning properly.
- The gun is configured with a backup.

Step
1   Continuously press the DEADMAN switch and turn the teach pendant ON/OFF switch to ON.
2   Jog the robot to the position where you want to test the backup.

⚠ **WARNING**
   In the next step the backup will open or close. Make sure all personnel and
   unnecessary equipment are out of the workcell; otherwise, personnel could be
   injured or equipment damaged.

⚠ **CAUTION**
   The next step will open or close the backup. If the backup is OPEN, it will close.
   If the backup is CLOSED, it will open.

---

3   To change the backup, press EQUIP (on the teach pendant or on the SETUP screen) to specify
     which backup the BACKUP key will operate.
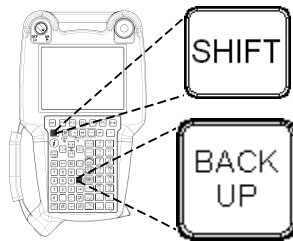
4   To open or close the backup, press and hold in SHIFT and press BACKUP.

7.2   MANUAL SPOT WELDING

Manual spot welding is performing a single spot weld without running a program. You can manually spot
weld with a single or a dual gun. Use manual spot welding to check the operation of the gun, weld
schedule, backup, and other welding information. Use Procedure 7-3 to perform a manual spot weld.
Refer to the servo gun manual for servo gun manual spot welding.

Procedure 7-3 Manual Spot Welding

Conditions
   • All personnel and unnecessary equipment are out of the workcell.
   • All safeguards and safety barriers are in place and working.
   • The gun and all other equipment are ready to weld.

Step
1   Press the [MENU] key and select MANUAL FCTNS.
2   Press F1, [TYPE].
3   Select Manual Weld. The following screen will be displayed.

NOTE
   The following screen is air gun sample. Refer to servo gun function manual
   (B-83264EN) for servo gun manual spot welding.

```
MANUAL FCTNS
 Manual Weld                              3/3
        1 Equipment number                 1
        2 Valve pressure:                 LOW
        3 Schedule number:                 1
          Weld duration(ms):               0

Press SHIFT F3 to perform weld.

    [TYPE]              EXEC
```

Equip number will be displayed only if you have multiple equipment.
Valve pressure will be displayed only if you have enabled valve pressure.

4   If you defined multiple equipment, change the equipment number.
                    1 Equipment number: 1
5   If you enabled Multipressure Valving at Controlled Start, select Valve pressure, press F4, [CHOICE],
     select the valve pressure you want (low, medium, high), and press the [ENTER] key.
6   Select Schedule number and enter the schedule number to use.
7   Turn the teach pendant ON/OFF switch to ON.

⚠ **WARNING**
   The next step causes the robot to spot weld. Make sure all personnel and
   unnecessary equipment are out of the workcell, all safeguards are in place, and
   weld equipment is working properly before continuing; otherwise, you could
   injure personnel or damage equipment.

---

8   Press and hold in SHIFT and press F3, EXEC.

The robot will weld with the weld information you set up in above.
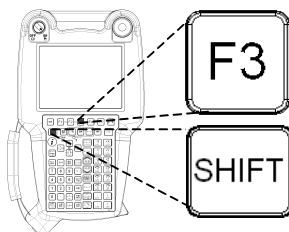
NOTE
   Even when servo is turned off, manual spot welding by an air gun can be
   operated. To operate manual spot welding when servo is turned off, Robot
   motion should be temporarily disabled on test cycle screen.

7.3   TP HARDKEYS SCREEN

In dual gun and/or multi equipments system, you can specify the target GUN/EQUIPMENT of GUN key and BACKUP key within Hardkeys menu. In 1 gun and 1 equipment system, you do not need to use this menu.

GUN (UK1)	Use this key to switch between gun open and gun closed.
BACKUP (UK2)	Use this key to switch between backup open and closed.
EQUIP (UK3)	Use this key to select which gun to use. (Display TP Hardkeys screen if your system has 2 or more guns, equipments.) 1 gun and 1 equipment system, this key do not any action.
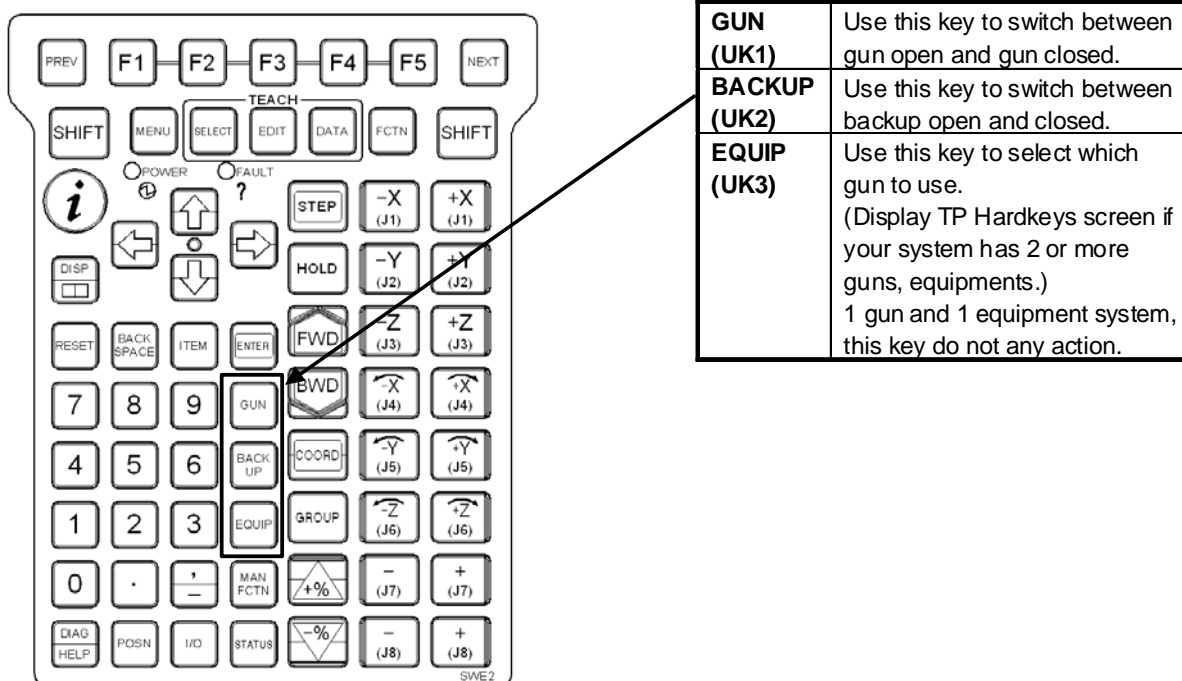
Fig. 7.3 Teach pendant

The following table lists and describes the items that are displayed on the TP Hardkeys screen. Please refer to following procedure to display the TP Hardkeys screen and operation.

Table 7.3 TP hardkeys screen items

Item	Description

GUN/BU hardkeys	Display and to choice the operation target for GUN(UK1) and BACKUP(UK2).
	•Gun 1/Eq N:
	  Gun 1 of equip number N is the target. Gun 1 is the present (attached) gun. In dual gun system, gun axis assigned to gun 1 is the target.
	•Gun 2/Eq N:
	  When dual gun is attached to equip number N, gun axis assigned to gun 2 is the target.
	•Both guns/Eq N:
	  When dual gun is attached to equip number N, both gun axes are the target.

Procedure 7-4 TP Hardkeys

Step

1   Press EQUIP key.
     OR
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select TP Hardlkeys.

> **NOTE**
> If your system has only 1 gun and 1 equipment, the following menu will not be displayed.

```
SETUP TP Hardkeys
                                            1/1
       1 GUN/BU hardkeys:        Gun 1/Eq 1


      [TYPE]                    [CHOICE]
```

5   Press F4,[CHOICE]
6   Select Gun/Eq compination

Or

1   Press the EQUIP key on the teach pendant. The above screen will be displayed.
    Note: If it is not a dual gun or multiple equipments, this screen will not be displayed.
2   Press F4,[CHOICE] and select the gun to be operated.

Example:
    In 2 equipments and 2 guns, you can choice one from followings.
    • Gun 1/Eq 1
    • Gun 2/Eq 1
    • Both guns/Eq 1
    • Gun 1/Eq 2
    • Gun 2/Eq 2
    • Both guns/Eq 2

> **NOTE**
> Both guns is for simultaneous operation (GUN, BACKUP).

8   SPOT TOOL+ TEST CYCLE

This chapter describes the settings for the test cycle to confirm the correct operation of robot or gun before automatic operation executed in the conditions of production. This chapter describes spot weld test cycle screen and they're items.

8.1   SPOT WELD TEST CYCLE

You must set the following items to appropriate values.

Table 8.1 Spot weld test cycle items

Items	Description
Gun operation **Cannot be changed if a** **program is running**	This item allows you to select the type of gun mode that will be used when running the program. • STROKE - opens and closes the gun at each weld point. Passing current depends on the setting of weld controller mode. • NOSTROKE - does not close and open the gun, and does NOT pass current through the gun. Backup stroke will still function. The weld controller mode must be set to NOWELD. When following conditions consist, this item cannot be changed on this screen. Use Stroke/NO STROKE cell input signal to control this. 1: ・ Program select mode is RSR/PNS/OTHER ・ Teach pendant is DISABLE 2: ・ Program select mode is STYLE ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO
Weld controller mode **Cannot be changed if a** **program is running**	This item allows you to select the type of weld mode that will be used when running the program • WELD - when the gun closes, the weld controller executes the appropriate schedule and passes current through the gun. • NOWELD - no current passes through the gun when the weld controller executes the weld sequence. NOTE: If you do not use "Enable weld" signal in weld interface I/O, you have to set the weld controller into NOWELD by your plc. When following conditions consist, this item cannot be changed on this screen. Use Weld/NO WELD cell input signal to control this. 1: ・ Program select mode is RSR/PNS/OTHER ・ Teach pendant is DISABLE 2: ・ Program select mode is STYLE ・ Teach pendant is DISABLE ・ 3 mode switch is AUTO Refer to section 4.4 WELD MODE for the detail. Note: In case of integrated weld controller, the weld controller is started with no current. In case of digital interface weld controller, PLC should command NOWELD to the weld controller. So "WELD/NO WELD" input signal of Cell Interface I/O should be set to OFF. Refer to section 8.2 for the way not to output weld schedule.

Items	Description
Tryout mode	This item enables and disables the ability of the robot to tryout mode. • ENABLED - In case of servo gun, thickness on SPOT instruction need not be changed, and pressure shortage error is not generated even if there is no panel. • DISABLED - In case of servo gun, pressure motion is normally executed with thickness for pressure on SPOT instruction. When following conditions consist, this item cannot be changed on this screen. Use Tryout Mode cell input signal to control this. ・　Teach pendant is DISABLE ・　3 mode switch is AUTO Note: You have to assign the tryout input in cell interface to use this mode. If the tryout input is not defined, you can not change the status of this item. The Tryout cell output signal reports the status of tryout mode. Note: Even if tryout mode is enabled, open distance and trajectory of tips and timing of deceleration is same as case that there is panel (tryout mode is disabled). Even if there is no panel, gun motion is decelerated before panel position. So cycle time of tryout mode is difference from cycle time of case that there is panel (tryout mode is disabled). Note: Even If welding is enabled during tryout mode , welding is executed
Weld IO Sim	This item enables the weld simulation. Refer to the next section for more details. When following conditions consist, this item cannot be changed. ・　Teach pendant is DISABLE ・　3 mode switch is AUTO
Force process complete	This item allows you to force the process complete signal. • ENABLED - Process Complete is turned on immediately. Process Complete will be cleared at the start of the next style. The Process Alert signal is turned on whenever Force Process Complete is enabled, and a warning error is displayed on the ALARMS screen to indicate that this abnormal operation was performed. • DISABLED - Process Complete is turned off. When following conditions consist, this item cannot be changed. ・　Teach pendant is DISABLE ・　3 mode switch is AUTO
Update weld pressures	If the weld controller controls weld pressure (the Controls weld pressure item is enabled at spot config), Update weld pressures is displayed. • ENABLED - This will force an update of the weld pressure table from the weld controller. • DISABLED - Update Weld Pressures is turned off When following conditions consist, this item cannot be changed. ・　Teach pendant is DISABLE ・　3 mode switch is AUTO

Procedure 8-1　Spot Weld Test Cycle Menu

Step
1　Press the [MENU] key, then select TEST CYCLE.
2　Press F1[TYPE], then select Spot Weld.

```
SPOT WELD
                                   1/7
     1 Gun operation:           STROKE
     2 Weld controller mode:      WELD
     3 Tryout mode:          DISABLED
     4 Weld IO sim:          DISABLED
     5   Weld Duration (ms):    500   ms
     6   Inform output to plc    DO[ 0]
     7 Force process complete:  DISABLED


     [TYPE]                    STROKE   NOSTROKE
```

3   Set the conditions as desired.

8.2   WELD SIMULATION

Weld Simulate allows you to test the cycle time of a job without having to set up any external hardware I/O signals.
When you use weld simulate to test the cycle time of a job, the robot will close the gun, and wait for a period of time that is equal to the weld duration you specify on the spot weld test cycle screen. After the robot has simulated the weld, it will move to the next point in the welding sequence, and simulate another weld, until the weld sequence has been completed.

Using weld Simulate
Table 8.2 shows the Weld Simulate setup items.

```
SPOT WELD
                                          1/7
         1 Gun operation:             STROKE
         2 Weld controller mode:        WELD
         3 Tryout mode:              DISABLED
         4 Weld IO sim:              DISABLED
         5   Weld Duration (ms):      500   ms
         6   Inform output to plc     DO[ 0]
         7 Force process complete:   DISABLED


     [TYPE]                    STROKE   NOSTROKE
```

Table 8.2 Weld simulate setup items

Item	Description
Weld IO Sim **Default : DISABLE**	This item enables the weld simulation items on the Spot Weld Test Cycle screen.
Weld Duration **Default: 500** **Min.: 0** **Max.: 32767**	This item specifies the duration of the weld you want to simulate. NOTE: Sometimes sim weld time is not specified value.
Inform output PLC	This item allows the user to have the specified output turned on at the PLC when Weld Simulate is used.

In order for a weld to be simulated, the following conditions must be true:
- You have to set Weld controller mode to DISABLE.
- You have to set Weld IO sim to ENABLE.
- You have to enter a value for the WeldDuration.

> ⚠ **CAUTION**
> - When you run a job that uses the weld simulate feature in the place of a weld controller, the weld schedule and other I/O associated with the weld schedule will not be sent to the weld controller.
> - When Weld controller mode is enable, Weld IO sim becomes disable forcibly. You can not enable Weld IO sim when Weld controller mode is enable.
> - When power cycle, Weld IO sim becomes disable forcibly.

A report that shows the cycle time of the simulated weld sequence will be displayed on both the User screen and the Status screen.

When you run a job that uses weld simulation in place of a weld controller, you need to run the job from either the Use Operator Panel (UOP) or the Standard Operator Panel (SOP) for the cycle time report to be displayed on the User and Status screens.
When using weld simulate, the cycle time will not be displayed on the User and Status screens, when the job is run using the shift and forward keys on the teach pendant.

When using weld simulate, the robot must be in NOWELD.

9   SPOT TOOL+ STATUS

This chapter descript Status menu for SpotTool+.

9.1   SPOT PRODUCTION MONITOR

This screen allows you to monitor items related to running production with your robot.

Table 9.1 Spot production monitor items

Item	Description
Production Status	This item shows the current state of the robot as RUNNING, PRODUCTION IDLE, or PAUSED.
Program Name	This item shows the name of the main program that the PLC initiated for production.
Routine Name	This item shows the name of the macro or subroutine that is currently executing.
Cycle Counts	This item shows the current number of completed cycles. This value will be updated every time a cycle that was started by a production start, or an SOP cycle start is completed. This value is stored in $SPOTCONFIG.$CYCLECOUNT. If you want to reset the cycle counter you must manually set this sysvar = 0, or set $SPOTCONFIG.$CYCLECOUNT = 0 in the TP program or in a Macro attached to a DIN[...] so that the PLC can reset it when it wants to.
Last Cycle Time	This item shows the execution time of the last production cycle. It is updated at the end of the production run when the robot transitions from Running to Idle.
Weld count	The bottom of the screen shows a progress chart that indicates the number of welds since the last tip maintenance, and graphically represents this weld count as a percentage of the "Target Welds/Dress." You can set the "Target Welds/Dress" on the spot equipment screen. You can also set the Spot Count Register on the spot equipment screen. For each weld that is done with weld enabled, SpotTool+ will automatically increment this data register. This information will then be reflected in the chart at the bottom of the Production Monitor screen.

Procedure 9-1   Spot Production Monitor

Step

1   Press the [MENU] key, then select STATUS.
2   Press F1 [TYPE], then select Production.
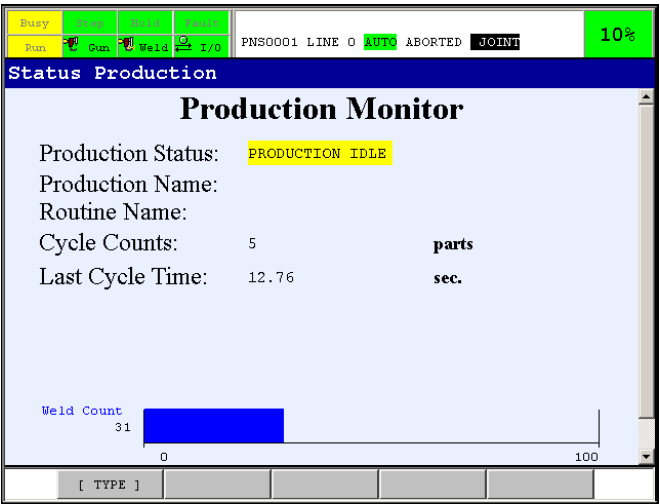
10 NADEX DEVICENET WELD CONTROLLER INTERFACE

10.1 OVERVIEW

This function is option software in SpotTool+ software to enable the connection of Nadex DeviceNet weld controller (hereinafter called weld controller) and robot.
This weld controller uses DeviceNet explicit message communication.

In the communication with the DeviceNet in this function, there are two kinds of the following.
1   I/O CONNECTION
   Robot⇒Weld controller: Start schedule (Weld schedule), Fault reset etc.
   Weld controller⇒Robot: Weld complete, Alarm, Warning etc.

2   EXPLICIT MESSAGE COMMUNICATION
   The following information is communicated by explicit message.
   ・   Setting parameter in weld controller
   ・   Setting value and item name in weld controller
   ・   Message of weld alarm etc.

To use this function, it is necessary to refer to the DeviceNet manual (B-82694EN).
This function enables the display and the setting by acquiring all information(item name, setting value, input range etc) from weld controller based on information(Data sheet file: DSF) offered from weld controller.

10.2 CONFIGURATION

The I/O connection between robot controller and weld controller has two types (DeviceNet and Discrete I/O) as the diagram below indicates.
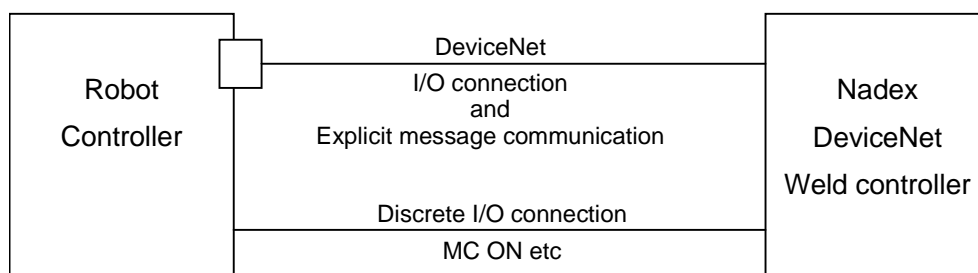
Fig. 10.2 I/O configuration

To use this function, the following options are needed.
・   Nadex DeviceNet weld controller interface function : A05B-2600-J925
・   DeviceNet Interface (Master & Slave) : A05B-2600-J753

10.3 SETTING OF WELD CONTROLLER CONNECTION

Do the following operation when you connect robot controller with weld controller for the first time.
1   Setting to use Nadex DeviceNet weld controller
2   Setting to connect weld controller with DeviceNet

3   Setting to assign DeviceNet I/O
4   Reading of weld controller information

The settings such as baud rate and node number of DeviceNet of weld controller side are needed in initial setting. It is necessary to do this operation in the Teaching Box for weld controller.

10.3.1   Setting to Use Nadex DeviceNet Weld Controller

SpotTool+ software can use multiple weld controllers according to the system configuration of robot. And, what kind of weld controller interface you use for each weld controller can be set. Do the following settings in the spot configuration screen if you use the Nadex DeviceNet weld controller.

Procedure 10-1   Setting up to use Nadex DeviceNet Weld Controller

Step
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select Spot Config. Spot configuration screen will be displayed.

```
SPOT CONFIG
                                    1/34
   1 F Number:                 1037555>
   2 Load Spottool Macros:      DISABLED
   3 Number of equipments:             1
   4 Number of weld controllers:       1
   5 Current equipment, gun:        1, 1
   6  Weld interface:            DIGITAL
   7  Number of guns:             SINGLE
   8  Equalization Pressure:     DISABLED
   9    number of pressures:           0
  10  Rst water saver time-out:  500   ms
  11    pulse length:            500   ms
  12    dly before checking DI:  1000  ms
  13  Weld cntler num for gun:          1
    Current weld controller:           1
  14  Isolation contactors:      DISABLED
  15    contactor time-out:      2000  ms
  16  End of weld type:          CMP_ONLY
  17  Weld in process time-out:  2000  ms
  18  Weld complete time-out:    2000  ms
  19  Major alarm polarity:       ACT_LOW
  20  Minor alarm polarity:       ACT_LOW
  21  Rst weld cntler time-out:  2000  ms
  22  Rst weld cntler pulse:     250   ms
  23  Reset stepper pulse:       500   ms
  24  Weld Comp Level Detect:    DISABLED
  25  Send schedule early:       DISABLED
  26  Reset WC with Robot:        ENABLED
  27  Controls weld pressure:    DISABLED
  28    Weld pres time-out:      750   ms
  29    Weld pres time-fac:       25   ms
  30  set parity type:              odd
  31  Device net timer type:       Nadex
  32    Timer number:                 1
  33 Contactor control type:     STANDARD
  34 Weld ID:                    DISABLED



 |     |     |     |     |     |     | > |
```

A left chart indicates that Nadex DeviceNet weld controller is specified to the weld controller of weld controller number 1, and 1 is specified for a timer number.

10.3.2   Setting to Connect Weld Controller with DeviceNet

To recognize weld controller as an equipment connected with DeviceNet, it is necessary to set I/O connection for DeviceNet. The procedure of this setting is the same as the procedure of the setting to connect usual DeviceNet. Refer to the DeviceNet manual (B-82694EN) for this procedure.

- Setting of DeviceNet board: Chapter 5. DEVICENET BOARD SETUP AND CONFIGURATION
- Setting of I/O communication with weld controller: Chapter 5.2. CREATING A DEVICE LIST FOR EACH DEVICENET DAUGHTERBOARD TO BE CONFIGURED AS MASTER
- Setting change of board number of DeviceNet board: Appendix A.2, Appendix A.3

This setting decides where in DI/DO of robot controller to assign weld controller signal. Refer to manual Chapter 6 "DEVICENET I/O AND ASSIGNMENTS" of DeviceNet for procedure for confirmation of the starting number of DI of weld controller signal.
In the following, starting number is explained as DI[I] and DO[J].

10.3.3   Setting to Assign DeviceNet I/O

Weld controller and robot controller send and receive a start schedule signal, a welding complete signal, and a fault signal, etc. by using DeviceNet I/O communication. Assignation of these signals is set on a spot weld interface I/O screen. The mapping or the kind of these signals might be different depending on the kind of DeviceNet weld controller made by Nadex. The kind of DeviceNet I/O that can be assigned on the spot weld interface I/O screen is the following.

DeviceNet Input [Robot⇒Weld controller]
- Start schedule   1 - 255 (8bit)
- Weld / Test
- Fault reset
- Stepper reset
- Stepper reset   1 - 4 (4bit)
- MC ON

DeviceNet Output [Weld controller⇒Robot]
- Weld complete
- Alarm
- Warning
- Weld ready
- Stepper complete
- Stepper complete   1 - 4 (4bit)
- Fault code   BCD output (4bit * two-digit)

NOTE

In WC5 or PH5 of DeviceNet weld controller made by Nadex, the above-mentioned DeviceNet I/O can be assigned on the spot weld interface I/O screen. Assign DeviceNet I/O if necessary on I/O configuration screen after confirming the specification of the signal when you want to assign DeviceNet I/O other than the above-mentioned.

As an example, here explains the assignation of DeviceNet I/O when IWC5-11015/PH5-2012 of DeviceNet weld controller made by Nadex is connected. The following is a mapping on DeviceNet I/O for IWC5-11015/PH5-2012.

-Input specification-
DeviceNet Input [Robot >> Weld controller]

Start schedule   1-255(8bit)
Weld/Test
Fault reset
Stepper reset   1-4(4bit)

Bitmap

	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1byte	Start Sch 128	Start Sch 64	Start Sch 32	Start Sch 16	Start Sch 8	Start Sch 4	Start Sch 2	Start Sch 1
2byte			Stepper Reset4	Stepper Reset3	Stepper Reset2	Stepper Reset1	Fault reset	Weld/ Test

-Output specification-
DeviceNet Output [Weld controller >> Robot]

Weld complete
Alarm
Warning
Weld ready
Stepper complete   1-4(4bit)
Fault code   BCD output(4bit*2digit)

Bitmap

	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1byte	Stepper Complete4	Stepper Complete3	Stepper Complete2	Stepper Complete1	Weld ready	Warning	Alarm	Weld complete
2byte	Fault code 10th-8	Fault code 10th-4	Fault code 10th-2	Fault code 10th-1	Fault code 1st-8	Fault code 1st-4	Fault code 1st-2	Fault code 1st-1

Specifically, the signals of above-mentioned weld controller are assigned as follows.

Robot⇒Weld controller	
Start schedule 1	DO[J]
Start schedule 2	DO[J+1]
Start schedule 4	DO[J+2]
Start schedule 8	DO[J+3]
Start schedule 16	DO[J+4]
Start schedule 32	DO[J+5]
Start schedule 64	DO[J+6]
Start schedule 128	DO[J+7]
Weld / Test	DO[J+8]
Fault reset	DO[J+9]
Stepper reset 1	DO[J+10]
Stepper reset 2	DO[J+11]
Stepper reset 3	DO[J+12]
Stepper reset 4	DO[J+13]
	DO[J+14]
	DO[J+15]

Weld controller⇒Robot	
Weld complete	DI[I]
Alarm	DI[I+1]
Warning	DI[I+2]
Weld ready	DI[I+3]
Stepper complete 1	DI[I+4]
Stepper complete 2	DI[I+5]
Stepper complete 3	DI[I+6]
Stepper complete 4	DI[I+7]
Fault code 1st - 1	DI[I+8]
Fault code 1st - 2	DI[I+9]
Fault code 1st - 4	DI[I+10]
Fault code 1st - 8	DI[I+11]
Fault code 10th - 1	DI[I+12]
Fault code 10th - 2	DI[I+13]
Fault code 10th - 4	DI[I+14]
Fault code 10th - 8	DI[I+15]

To recognize these signals to SpotTool+ software, it is necessary to set these signals on the spot weld interface I/O screen.

Procedure 10-2　　　　Assigning DeviceNet I/O

In the following, DI[I] and DO[J] are explained as DI[1] and DO[1]. Moreover, Start schedule 1 - 128 is assigned in GO[1], and Fault code 1st 1 - 10th 8 is assigned in GI[1].

Robot⇒Weld controller	
Start schedule 1	DO[1]　(GO1)
Start schedule 2	DO[2]　(GO1)
Start schedule 4	DO[3]　(GO1)
Start schedule 8	DO[4]　(GO1)
Start schedule 16	DO[5]　(GO1)
Start schedule 32	DO[6]　(GO1)
Start schedule 64	DO[7]　(GO1)
Start schedule 128	DO[8]　(GO1)
Weld / Test	DO[9]
Fault reset	DO[10]
Stepper reset 1	DO[11]
Stepper reset 2	DO[12]
Stepper reset 3	DO[13]
Stepper reset 4	DO[14]
	DO[15]
	DO[16]

Weld controller⇒Robot	
Weld complete	DI[1]
Alarm	DI[2]
Warning	DI[3]
Weld ready	DI[4]
Stepper complete 1	DI[5]
Stepper complete 2	DI[6]
Stepper complete 3	DI[7]
Stepper complete 4	DI[8]
Fault code 1st - 1	DI[9]　(GI1)
Fault code 1st - 2	DI[10]　(GI1)
Fault code 1st - 4	DI[11]　(GI1)
Fault code 1st - 8	DI[12]　(GI1)
Fault code 10th - 1	DI[13]　(GI1)
Fault code 10th - 2	DI[14]　(GI1)
Fault code 10th - 4	DI[15]　(GI1)
Fault code 10th - 8	DI[16]　(GI1)

Step

1　Press the [MENU] key.
2　Select I/O.
3　Press F1, [TYPE].
4　Select Weld Interface. Spot weld interface I/O screen will be displayed.

```
Weld interface output signals
 [Robot⇒Weld controller]
I/O Weld Out
                                      1/16
     NAME            OUT PT  SIM   STATUS
  1 Weld schedule:   GO[ 1] U      0
    Extended schedule:              0
  2 Weld ID:         GO[ 0] U      **********
  3 Weld parity:     DO[ 0] U      ***
  4 Schedule strobe: DO[ 0] U      ***
  5 Weld Initiate:   DO[ 0] U      ***
  6 Enable weld:     DO[ 9] U      OFF
  7 Reset stepper:   DO[ 0] U      ***
  8 Reset welder:    DO[10] U      OFF
  9 Iso contactor:   DO[ 0] U      ***
 10 Cap change comp: DO[ 0] U      ***
 11 Enbl cont. savr: DO[ 0] U      ***
 12 Tip stck timing: DO[ 0] U      ***
 13 Reset stepper 1: DO[11] U      OFF
 14 Reset stepper 2: DO[12] U      OFF
 15 Reset stepper 3: DO[13] U      OFF
 16 Reset stepper 4: DO[14] U      OFF

    [TYPE]
```

Table 10.3.3(a) Weld interface output signals

Output signals	Description
Weld schedule	This corresponds to Start schedule in above-mentioned table. In this example, DO[1]-DO[8] is assigned to GO[1].

Output signals	Description
Enable weld	This corresponds to Weld/Test in the above-mentioned table.
	This signal is used to set the weld controller into WELD or NOWELD mode. If enable weld is OFF (low), the weld controller will be placed in a NOWELD mode. If enable weld is ON (high) the weld controller will be placed in the WELD mode.
	Refer to section 4.4 for more information about the above-mentioned weld mode.
Reset welder	This corresponds to Fault reset in the above-mentioned table.
	Resets weld faults from the robot. When invoked, it pulses for 0.5 seconds. This pulse width can be changed.
	Refer to section 4.3.2 for more information about this signal.
Reset stepper 1-4	Informs the weld controller to set the stepper count back to zero.
	The pulse of 0.5 seconds is output by executing the RESET STEPPER [WC=i, SN=j, SV=0] (j is stepper number) instruction. This pulse width can be changed. Also, DOUT instruction can be used for the output of this signal.

```
Weld interface input signals
 [Weld controller⇒Robot]
┌────────────────────────────────────────────────┐
│I/O Weld In                                      │
│                                         1/16    │
│          NAME          OUT PT   SIM  STATUS     │
│    1 Weld in process:  DI[ 0]    U   ***        │
│    2 Weld complete:    DI[ 1]    U   OFF        │
│    3 WELD/NOWELD status: DI[ 4]  U   OFF        │
│    4 Major alarm:      DI[ 2]    U   OFF        │
│    5 Minor Alarm:      DI[ 3]    U   OFF        │
│    6 Iso contactor on: DI[ 0]    U   ***        │
│    7 Cap change request: DI[ 0]  U   ***        │
│    8 Appr Cap change:  DI[ 0]    U   ***        │
│    9 Tip dress request: DI[ 0]   U   ***        │
│   10 Tip stick detect: DI[ 0]    U   ***        │
│   11 Weld alarm code:  GI[ 1]    U   0          │
│   12 Stepper complete 1: DI[ 5]  U   OFF        │
│   13 Stepper complete 2: DI[ 6]  U   OFF        │
│   14 Stepper complete 3: DI[ 7]  U   OFF        │
│   15 Stepper complete 4: DI[ 8]  U   OFF        │
│   16 ELCB:             DI[ 0]    U   ***        │
│                                                 │
│  ┌──────┬────┬────┬────┬────┬────┬────┐         │
│  │[TYPE]│    │    │    │    │    │    │         │
│  └──────┴────┴────┴────┴────┴────┴────┘         │
└────────────────────────────────────────────────┘
```

Table 10.3.3(b) Weld interface input signals

Input signals	Description
Weld complete	This signal indicates that the weld sequence is finished.
WELD/NOWELD status	This corresponds to Weld ready in the above-mentioned table.
	This signal indicates the weld controller status (WELD or NOWELD). If the input is ON (high) the weld controller is in the WELD mode. If the input is OFF (low) the weld controller is in the NOWELD mode.
Major alarm	This corresponds to Alarm in the above-mentioned table.
	When Major Alarm Polarity of the spot config menu is ACT_HIGH, this signal is that ON is an alarm, and OFF is OK. When Major Alarm Polarity of the spot config menu is ACT_LOW, this signal is that ON is an OK, and OFF is alarm.
	Note: Default of Major Alarm Polarity is ACT_LOW.
Minor Alarm	This corresponds to Warning in the above-mentioned table.
	When Minor Alarm Polarity of the spot config menu is ACT_HIGH, this signal is that ON is an alarm, and OFF is OK. When Minor Alarm Polarity of the spot config menu is ACT_LOW, this signal is that ON is an OK, and OFF is alarm.
	Note: Default of Minor Alarm Polarity is ACT_LOW.
Weld alarm code	This corresponds to Fault code in the above-mentioned table. In this example, DI[9]-DI[16] is assigned to GI[1]. Bit0 ~ bit3 of fault code GI indicates the ones place of the weld alarm, until bit4 ~ 7bit indicates the tens place of the weld alarm.
Stepper complete 1-4	This corresponds to Stepper complete 1-4 in the above-mentioned table. When this is ON, Proc 1 tip replace request on the Cell Interface I/O screen is turned ON.

NOTE
Cycle power supply after changing the setting of spot weld interface I/O screen.

10.3.4 Setting to Assign Discrete I/O

Weld controller and robot controller send and receive a MC ON signal, an ELCB signal, etc. by using Discrete I/O communication according to the kind of weld controller. The assignation of these signals is set on a spot weld interface I/O screen. The kind of these signals might be different depending on the kind of the DeviceNet weld controller made by Nadex. The kind of the Discrete I/O that can be assigned on the spot weld interface I/O screen is the following.

DeviceNet Input [Robot⇒Weld controller]
• MC ON

DeviceNet Output [Weld controller⇒Robot]
• MC auxiliary contact (a contact)
• ELCB auxiliary contact (a contact)

NOTE
In WC5 or PH5 of DeviceNet weld controller made by Nadex, the above-mentioned Discrete I/O can be assigned on the spot weld interface I/O screen. Assign Discrete I/O if necessary on I/O configuration screen after confirming the specification of the signal when you want to assign Discrete I/O other than the above-mentioned.

Procedure 10-3   Assigning Discrete I/O

The following table is an example for the allocation of Discrete I/O.

Robot⇒Weld controller	
MC ON	DO[20]

Weld controller⇒Robot	
MC auxiliary contact	DI[30]
ELCB auxiliary contact	DI[40]

Step
1   Press the [MENU] key.
2   Select I/O.
3   Press F1, [TYPE].
4   Select Weld Interface. Spot weld interface I/O screen will be displayed.

```
Weld interface output signals
 [Robot⇒Weld controller]
┌──────────────────────────────────────────────────┐
│ I/O Weld Out                                       │
│                                            1/16    │
│         NAME              OUT PT   SIM  STATUS     │
│    1 Weld schedule:       GO[  0]   U   0          │
│      Extended schedule:             U   0          │
│    2 Weld ID:             GO[  0]   U   *********   │
│    3 Weld parity:         DO[  0]   U   ***        │
│    4 Schedule strobe:     DO[  0]   U   ***        │
│    5 Weld Initiate:       DO[  0]   U   ***        │
│    6 Enable weld:         DO[  0]   U   ***        │
│    7 Reset stepper:       DO[  0]   U   ***        │
│    8 Reset welder:        DO[  0]   U   ***        │
│    9 Iso contactor:       DO[ 20]   U   OFF        │
│   10 Cap change comp:     DO[  0]   U   ***        │
│   11 Enbl cont. savr:     DO[  0]   U   ***        │
│   12 Tip stck timing:     DO[  0]   U   ***        │
│   13 Reset stepper 1:     DO[  0]   U   ***        │
│   14 Reset stepper 2:     DO[  0]   U   ***        │
│   15 Reset stepper 3:     DO[  0]   U   ***        │
│   16 Reset stepper 4:     DO[  0]   U   ***        │
│                                                    │
│    [TYPE]                                          │
└──────────────────────────────────────────────────┘
```

Table 10.3.4(a) Weld interface output signals

Output signals	Description
Iso contactor	This corresponds to MC ON in above-mentioned table. Assign the signal here when it is necessary to control MC. Output condition is influenced by contactor control type. Refer to section 3.2 for more information about contactor control type. Note: Wire so that contactor may shut when this signal is ON.

> **NOTE**
> When this signal is on, wire so that the contactor closes.

```
Weld interface input signals
 [Weld controller⇒Robot]
┌──────────────────────────────────────────────────┐
│ I/O Weld In                                        │
│                                            1/16    │
│         NAME              OUT PT   SIM  STATUS     │
│    1 Weld in process:     DI[  0]   U   ***        │
│    2 Weld complete:       DI[  0]   U   ***        │
│    3 WELD/NOWELD status:  DI[  0]   U   ***        │
│    4 Major alarm:         DI[  0]   U   ***        │
│    5 Minor Alarm:         DI[  0]   U   ***        │
│    6 Iso contactor on:    DI[ 30]   U   OFF        │
│    7 Cap change request:  DI[  0]   U   ***        │
│    8 Appr Cap change:     DI[  0]   U   ***        │
│    9 Tip dress request:   DI[  0]   U   ***        │
│   10 Tip stick detect:    DI[  0]   U   ***        │
│   11 Weld alarm code:     GI[  0]   U   0          │
│   12 Stepper complete 1:  DI[  0]   U   ***        │
│   13 Stepper complete 2:  DI[  0]   U   ***        │
│   14 Stepper complete 3:  DI[  0]   U   ***        │
│   15 Stepper complete 4:  DI[  0]   U   ***        │
│   16 ELCB:                DI[ 40]   U   OFF        │
│                                                    │
│    [TYPE]                                          │
└──────────────────────────────────────────────────┘
```

Table 10.3.4(b) Weld interface input signals

Input signals	Description
Iso contactor on	This corresponds to MC auxiliary contact in the above-mentioned table. This is a signal to detect the opening and closing situation of contactor. Set this signal so that it is ON when the contactor is closed or OFF when the contactor is open.

Input signals	Description
ELCB	This corresponds to ELCB auxiliary contact in the above-mentioned table. When this signal is OFF, the robot controller automatically outputs the alarm "ELCB signal detection".

> **NOTE**
> Please cycle power supply after changing the setting of spot weld interface I/O screen.

10.4   READING OF WELD CONTROLLER INFORMATION

It is necessary to read information on weld controller (Data Sheet File: DSF) to an internal memory of robot controller when you connect robot controller with weld controller for the first time. Reading DSF can be operated on the initial setting screen.

Procedure 10-4   Displaying Initial Setting Screen

When Nadex DeviceNet weld controller interface function is installed, a top screen for this function can be displayed.

Step
1   Press the [DATA] key.
2   Press F1, [TYPE].
3   Select NadexDevWTC. The following top screen will be displayed.

```
Top screen
(Communication NG OR Initialization incomplete)
 Nadex DeviceNet WC
 WC: 1


        Nadex DeviceNet Weld timer

        Weld timer is not ready



    [TYPE]   RELEASE  TimerNumm  INITIAL  MANAGE
```

```
Top screen
(Communication OK AND Initialization complete)
 Nadex DeviceNet WC
 WC: 1                              1/6

      1 COMMON PROGRAM       <*DETAIL*>
      2 STEPPER MONITOR      <*DETAIL*>
      3 COMMON MONITOR       <*DETAIL*>
      4 SCHEDULE PROGRAM     <*DETAIL*>
      5 STEPPER PROGRAM      <*DETAIL*>
      6 SCHEDULE MONITOR     <*DETAIL*>

    [TYPE]   RELEASE  TimerNumm  INITIAL  MANAGE
```

4   Press F4, INITIAL. The following initial setting screen will be displayed.

If you use multiple Nadex DeviceNet weld controller, this screen changes into the initial setting screen of each weld controller by pushing F3, TimerNum of this screen.

```
 Nadex DeviceNet Weld timer
 Initial setting / WC:1                    1/2

      1 Device net board number:        1
      2 Device net node number:       255
        DSF reading:                INCOMP



    [TYPE]           TimerNum  DSF read
```

Procedure 10-5   Reading DSF

Read DSF according to the following procedures.

Step

1   First, set board number and node number (MAC-Id) for the DeviceNet with which weld controller is connected.

     About board number
Input board number of DeviceNet board specified in subsection 10.3.2. Board number of DeviceNet board is set with the DIP switch. Refer to DeviceNet manual (Appendix A.2, Appendix A.3 in B-82694EN) for more information about this change.
     About node number
Input node number (MAC-Id) of weld controller specified in subsection 10.3.2. The useful range is 0 - 63, and 255 means the unsetting.

2   Next, press F4, DSF read. Prompt for the confirmation is displayed, and select F4, Yes. Reading DSF (Data sheet file) from weld controller is begun. When reading ends, COMP is displayed to DSF reading.
Note: DSF is memorized to FROM device.

NOTE
     Do not turn off power supply while reading.

10.5   OPERATION OF WELD CONTROLLER DATA

This function can do the display and the setting of data of weld controller connected with robot controller from Teach Pendant. The display and the setting can be operated according to the following procedures.

Procedure 10-6   Operating the Weld Controller Data

Step

1   Press the [DATA] key.
2   Press F1, [TYPE].
3   Select NadexDevWTC. The following top screen is displayed, and access to other screens becomes possible.
If you use multiple Nadex DeviceNet weld controller, this screen changes into the screen of welding controller of desire by pushing F3, TimerNum of this screen.

```
Nadex DeviceNet WC
WC: 1                                            1/6

        1 COMMON PROGRAM          <*DETAIL*>
        2 STEPPER MONITOR         <*DETAIL*>
        3 COMMON MONITOR          <*DETAIL*>
        4 SCHEDULE PROGRAM        <*DETAIL*>
        5 STEPPER PROGRAM         <*DETAIL*>
        6 SCHEDULE MONITOR        <*DETAIL*>


    [TYPE]   RELEASE   TimerNum   INITIAL   MANAGE
```

4   Move the cursor to a purposeful item, and press the [ENTER] key. After information is acquired from weld controller, a purposeful screen is displayed. The figure below is an example for common program screen.

NOTE
     The content of the display is different by on the kind of the weld controller (DSF).

```
┌──────────────────────────────────────────────────────┐
│ COMMON PROGRAM                                         │
│ Y address (noPRG)    WC:1 X 0              1/13        │
│                                                        │
│      0 #1 LOW CURR. LIMIT              90%             │
│      1 #1 HIGH CURR. LIMIT           120%             │
│      2 #2 LOW CURR. LIMIT              90%             │
│      3 #2 HIGH CURR. LIMIT           120%             │
│      4 #3 LOW CURR. LIMIT              90%             │
│      5 #3 HIGH CURR. LIMIT           120%             │
│      6 SHORT DETECT.CURR.             15A             │
│     12 STEPPER                       STAIR            │
│     15 PULSE PILOT                   OFF              │
│     16 FAULT RES. BY PILOT           OFF              │
│                                                        │
├──────────────────────────────────────────────────────┤
│   [TYPE]   Series   TimerNum         PROG    >        │
└──────────────────────────────────────────────────────┘
```

Operating instructions
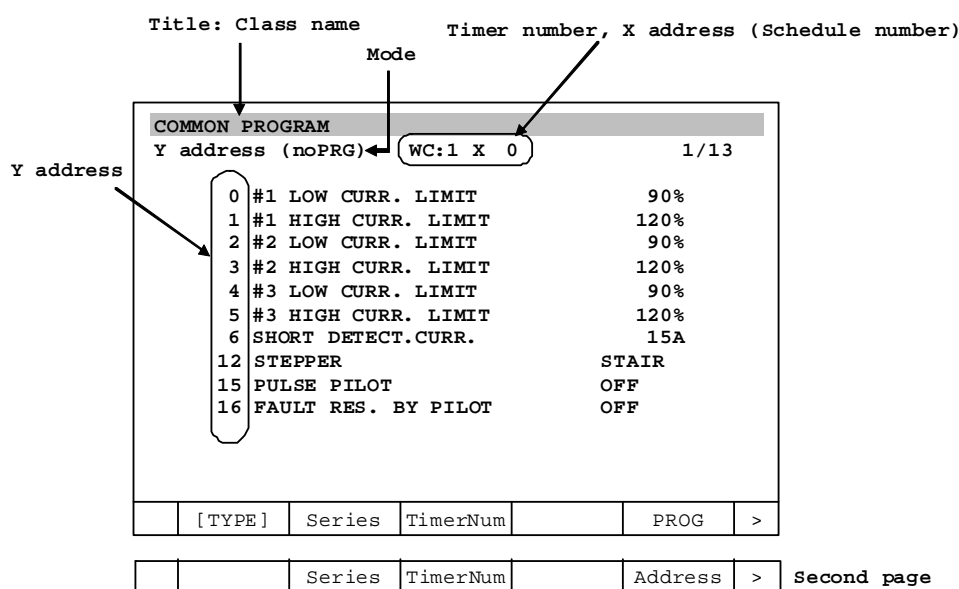
Fig. 10.5 Operating instructions

- The title is a class name. This is the same as the item name of a top screen.
- Mode is displayed to under the title. Switch with a F5, PROG/NoPRG key.
  PROG: Editable status in a setting screen.
  NoPRG: Un-editable status in a setting screen.
  Nondisplay: Monitor screen
- Timer number of Nadex DeviceNet weld controller is displayed to under the title. If you use multiple Nadex DeviceNet weld controller, timer number can be changed by pushing F3, TimerNUM of this screen.
- X address (Schedule number) is displayed to under the title. X address is synonymous with the explanation of Teaching Box made by Nadex.
- Y address is displayed to the left side of each item. Y address is synonymous with the explanation of Teaching Box made by Nadex.
- F2, Series can change schedule number (X address) of this class.
  When the values other than 0 are specified for X address in common class screen, schedule class screen of the specified schedule number is displayed.
  When the 0 are specified for X address in schedule class screen, common class screen is displayed.
- X and Y address can be specified directly when F10, Address is pushed.

10.6   MANAGEMENT OF WELD CONTROLLER DATA

Management information screen can save the external device the weld controller settings from Teach Pendant of robot. Similarly, management information screen can load the weld controller settings saved to the external device from Teach Pendant into weld controller.
The following management information screen can be displayed by pushing F5, MANAGE of top screen.

```
Nadex DeviceNet Weld timer
Management Info / WC:1                        1/6
       Weld Timer connection stat:       OK
       DSF stat:                         OK
       DSF ID(Weld Timer):               706
       DSF ID(Robot):                    706
       Directory Path:
                                         MC:¥

       Class Name                 Revision
        COMMON PROGRAM                   2
        STEPPER MONITOR                  2
        COMMON MONITOR                   2


   [TYPE]              TimerNum    SAVE     LOAD    >
```

> **NOTE**
> Do save/load of the weld controller settings after doing "SETTING OF WELD CONTROLLER CONNECTION".

> **NOTE**
> Because save/load for weld controller settings is executed while communicating with the weld controller, some processing time is required. Moreover, processing time might increase by connected composition (when multiple slaves exist, etc) and baud rate setting condition (when baud rate is not 500KB) of DeviceNet.

> **NOTE**
> Save of weld controller settings can be executed only on management information screen because of processing time necessary for the saving. It is not possible to save with the automatic backup and file screen. And, file screen cannot load weld controller settings.

10.6.1   Procedure for Save

- Management information screen can save weld controller settings.
- Press F4, SAVE. Weld controller settings is saved to directory such as "MC:" that have been displayed on this screen.
- The file name is NDDNWC0n.DT. n is a weld timer number.
- Also, DSF read from weld controller in initial setting screen is saved with weld controller settings. The file name is NDDSF0n.DT. n is a weld timer number.

```
Nadex DeviceNet Weld timer
Management Info / WC:1                         1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                              MC:¥SAVEFILE¥

        Class Name               Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2



    [TYPE]            TimerNum ( SAVE )  LOAD    >
```

```
†Nadex DeviceNet Weld timer
Management Info / WC:1                         1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                              MC:¥SAVEFILE¥

        Class Name               Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Saving file… Don't Power OFF.

    [TYPE]            TimerNum  SAVE    LOAD    >
```

```
Nadex DeviceNet Weld timer
Management Info / WC:1                         1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                              MC:¥SAVEFILE¥

        Class Name               Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Execute save?


                              ( YES )   NO     >
```

```
Nadex DeviceNet Weld timer
Management Info / WC:1                         1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                             (MC:¥SAVEFILE¥)

        Class Name               Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Save done.

    [TYPE]            TimerNum  SAVE    LOAD    >
```

NDDNWC0*n*.DT and NDDSF0*n*.DT
are saved here.

Fig. 10.6.1 Saving procedure

> **NOTE**
> When ID (attribute information) of DSF is not matching (when weld controller
> changes places into another model) to ID of currently connected weld controller,
> weld controller settings cannot be saved. Again, read DSF for currently
> connected weld controller in initial setting screen if you want to save weld
> controller settings.

10.6.2   Procedure for Load

- Management information screen can load weld controller settings.
- Open the directory in which NDDNWC0n.DT exists on the file screen after putting
  NDDNWC0n.DT on external device.
- Press F5, LOAD. Weld controller settings is loaded into weld controller.

```
Nadex DeviceNet Weld timer
Management Info / WC:1                      1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                                MC:¥SAVEFILE¥

        Class Name              Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2



    [TYPE]          TimerNum   SAVE   LOAD   >
```

```
†Nadex DeviceNet Weld timer
Management Info / WC:1                      1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                                MC:¥SAVEFILE¥

        Class Name              Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Loading file… Don't Power OFF.

    [TYPE]          TimerNum   SAVE   LOAD   >
```

```
Nadex DeviceNet Weld timer
Management Info / WC:1                      1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                                MC:¥SAVEFILE¥

        Class Name              Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Execute load?

                          YES     NO    >
```

```
Nadex DeviceNet Weld timer
Management Info / WC:1                      1/6
        Weld Timer connection stat:      OK
        DSF stat:                        OK
        DSF ID(Weld Timer):              706
        DSF ID(Robot):                   706
        Directory Path:
                                MC:¥SAVEFILE¥

        Class Name              Revision
         COMMON PROGRAM              2
         STEPPER MONITOR             2
         COMMON MONITOR              2

Load done.

    [TYPE]          TimerNum   SAVE   LOAD   >
```
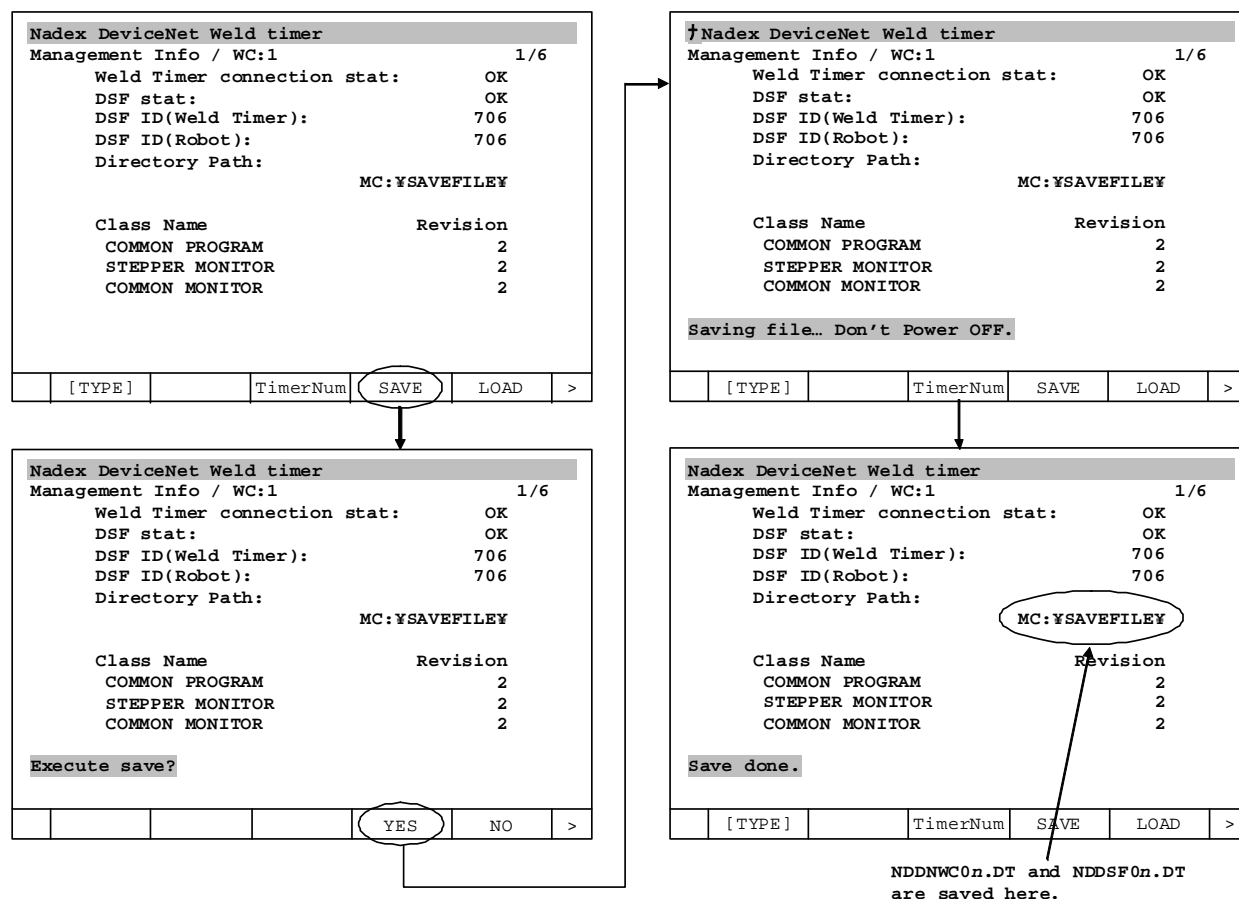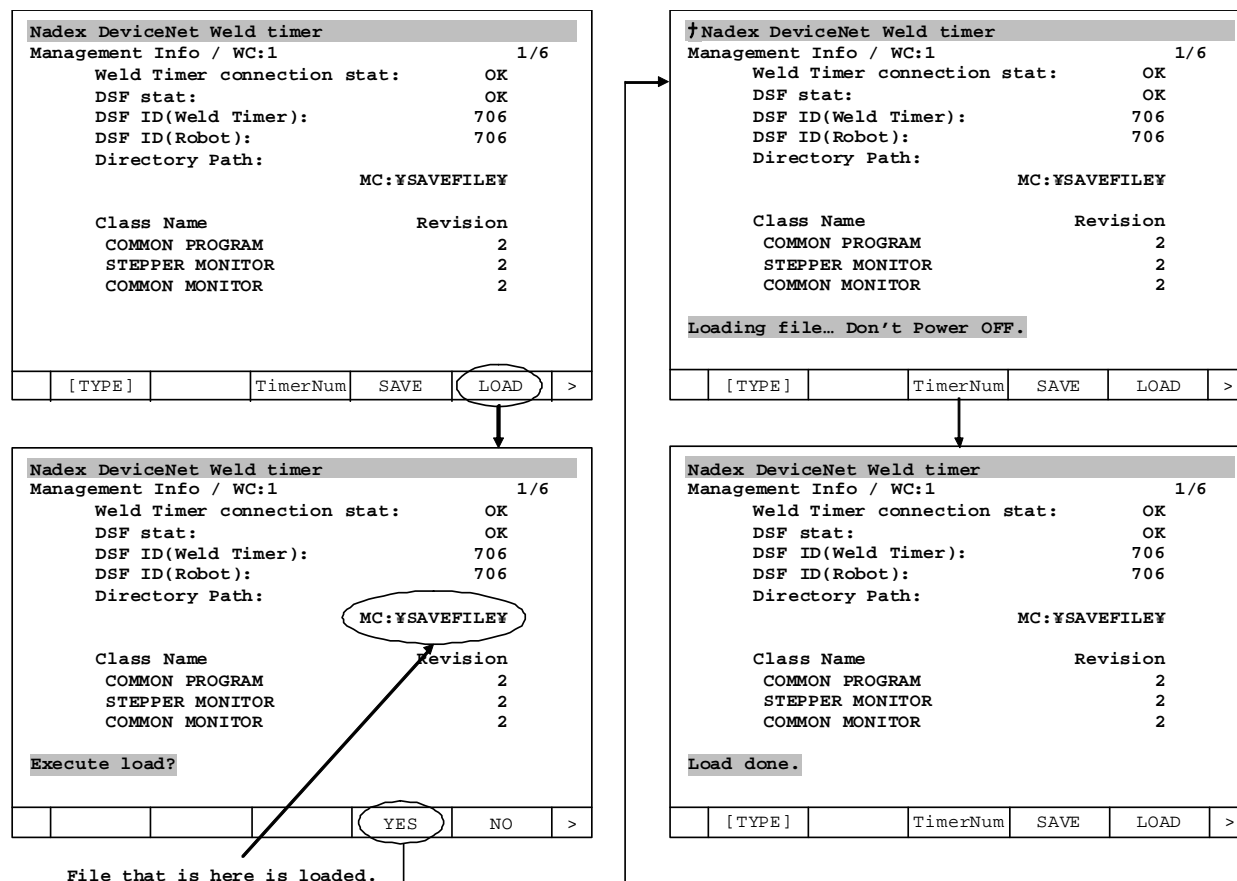
File that is here is loaded.

Fig. 10.6.2 Loading procedure

> **NOTE**
> When ID (attribute information) of DSF is not matching (when weld controller changes places into another model) to ID of currently connected weld controller, weld controller settings cannot be loaded. Again, read DSF for currently connected weld controller in initial setting screen if you want to save weld controller settings.

10.7   OTHER FUNCTION

10.7.1   Backup for Robot Settings

Information memorized on the robot side is saved to the external device by the backup operation of data on the file screen. Also, DSF read from weld controller in initial setting screen is saved. The following are files saved to the external device.
- SYSDNET.SV :   DeviceNet settings
- NDNW.SV :   Robot settings for this function
- NDNW_WC.SV :   Displayed data for screen of this function
- NDDSF01.DT :   DSF (01 is a weld timer number)

> ⚠ **WARNING**
> Aside from the files, there are SYSSPOT.SV of settings for spot configuration screen, spot weld interface I/O screen, and cell interface screen. However, unique data for servo gun is included to SYSSPOT.SV on 7DC1, too. Therefore, do not load SYSSPOT.SV into other robots on 7DC1. SYSSPOT.SV does not include unique data for servo gun on 7DC2 or later. Therefore, you can load SYSSPOT.SV into other robots on 7DC2. Note: SYSSPOT.SV includes all SPOT settings. So do not load SYSSPOT.SV if spot system configuration (number of equipment, number of welder, and so on) is different.

10.7.2   Alarm for Communication Disconnect

- When the communication with weld controller is disconnected after initial setting is completed, the following alarms are generated according to the cause of disconnect.

SPOT-496   STOP.G   NDNW Device Net Disconnect
Cause: DeviceNet communication has been disconnected. Note:Alarm of DeviceNet might be generated at the same time.
Remedy: Confirm that:
    1.   Look for the alarm of "DNET-xxx" in DeviceNet alarm screen, and refer to the cause and remedy for the alarm.
    2.   Confirm the board used for weld controller is not OFFLINE on board list screen of DeviceNet.
    3.   Confirm the device of node number of weld controller is not OFFLINE on device list screen of DeviceNet.

> **NOTE**
> Robot cannot be jogged while this alarm has been generated. Refer to section 10.10 if you want to jog the robot.

SPOT-500   STOP.G   NDNW request timeout(Board:%d,MAC:%d)
Cause: There was no response from weld controller.
Remedy: Make the DeviceNet communication between weld controller and robot a stable state. Board:%d and MAC:%d displayed here indicate the weld controller. Confirm the connection and the wiring for the connector.

SPOT-495   STOP.G   NDNW different DSF
Cause: ID (attribute information) of DSF is not matching to ID of currently connected weld controller.
Remedy: Weld controller might have changed places into another mode. Confirm currently connected weld controller. Read DSF for currently connected weld controller in initial setting screen if you want to weld with currently connected weld controller.

> **NOTE**
> Robot cannot be jogged while this alarm has been generated. Set system variable $NDNW_CFG.$CHK_ALM_SEV to 0 if you want to jog the robot. Set system variable $NDNW_CFG.$CHK_ALM_SEV to 1 after completing jogging.

- When these alarms are generated, DevNet COMM Stat in cell interface output screen is turned OFF. Whenever these alarms have not been generated, this signal is turning ON. PLC will be able to detect abnormality of the communication of DeviceNet by checking this signal to early.

10.7.3   Initialization of Weld Controller Settings

This function initializes weld controller settings. When the state of the memory of weld controller becomes abnormal, and the initialization of weld controller settings is needed, this operation is used. Do not use this operation usually. Operating procedure is the following.

Procedure 10-7   Operating of weld controller setting initialization

Step
1   Set system variable $NDNW_CFG.$INITIALIZE to 1.
2   Press the [NEXT] key on management information screen. Afterwards, F5, RESET will be displayed to the function key.
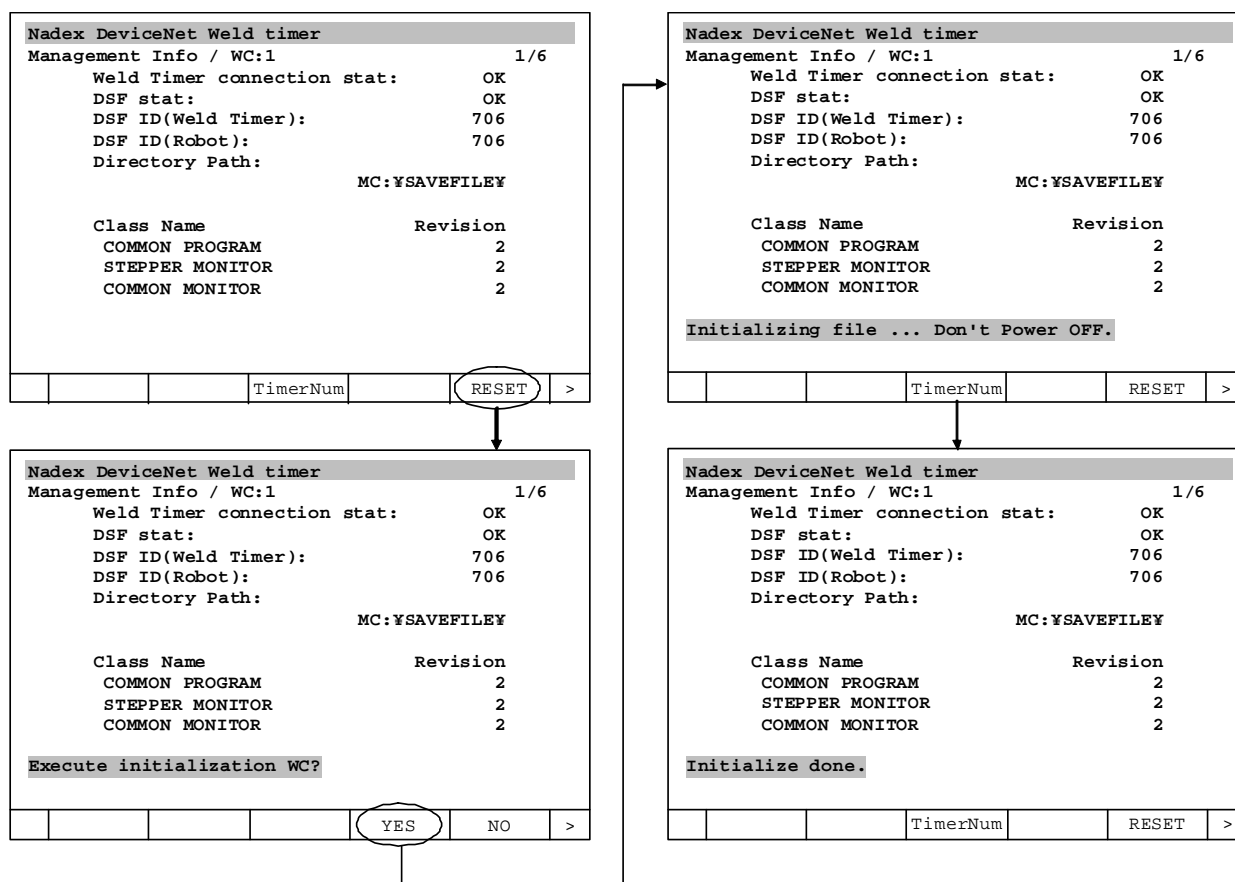
Fig. 10.7.3 Initialization procedure

3   When F5, RESET is pressed, message "Execute initialization WC?" is displayed. The initialization instruction is transmitted to the weld controller when F4, YES is selected, and weld controller settings is initialized. When F5, NO is selected, the initialization of weld controller settings is canceled.
4    $NDNW_CFG.$INITIALIZE is automatically set to 0 when moving from this screen to other screens.

10.8   ALARM

10.8.1   Alarm in Weld Controller

Information for alarm or warning is transmitted on to robot controller via Weld alarm code GI when alarm or warning is generated in weld controller, and robot controller generates the following alarm.

> **NOTE**
> Fault code is notified from the weld controller side. Refer to the instruction
> manual of the weld controller about the number and contents of the fault code.

SPOT-091   STOP.G   91**: XXXX

The number of above-mentioned "**" indicate the fault code of weld controller. And, "XXXX" indicate an alarm message. Refer to Nadex DeviceNet weld controller manual for more information about fault code and alarm message.
Moreover, either of the following alarms is generated with above-mentioned alarm.

SPOT-010   STOP.G   Major alarm detected
  Cause: A Major Alarm was received.
Remedy: Check the weld controller for the reason for the alarm.

SPOT-011   WARN   Minor alarm detected
  Cause: A Minor Alarm was received.
Remedy: Check the weld controller for reason of alarm.

These alarms mean major alarm or minor alarm in weld interface input signals was detected.

When alarm or warning occurs in weld controller while welding with teach pendant enabled, the same alarm might be generated twice continuously like the following examples. This is not because the alarm is generated in weld controller twice continuously. Robot controller is generating the alarm twice continuously. This is a limitation of the robot controller.

Ex)
SPOT-010   Major alarm detected
SPOT-091   9160: EXTREMELY LOW CURR.
SPOT-010   Major alarm detected
SPOT-091   9160: EXTREMELY LOW CURR.
SPOT-010   Major alarm detected

10.8.2   Other Alarms

Refer to the alarm code list (B-83284-1) for the alarm of this function.

> **NOTE**
> Timer number and the board number might be displayed to the alarm.
> Timer number is 1 or 2. This is a number set on spot configuration screen.
> Board number is 1-4. This corresponds to board number of DeviceNet (channel).

> **NOTE**
> Robot cannot be jogged while alarm "SPOT-092 ELCB signal detection" has been generated. Refer to subsection 10.10 if you want to jog the robot

10.9   LIMITATION

- When the power supply of robot controller is turned on earlier than weld controller, the following alarms might be generated.
    - DNET-055   Board or network error: Bd %d
    - DNET-119   Dup. MAC Ack Faul
  These alarms can be released by reset key. Turn on the power supply of robot controller after turning on the power supply of weld controller if you do not want to generate these alarms.
- Robot controller receives fault code from weld controller, and generates the alarm corresponding to the level (warning/alarm). If multiple alarm occurs at the same time in weld controller, only the alarm generated most recently is generated in robot controller. Only it is recorded in alarm history.
- There is design limitation about the number of structural parameters in DSF as follows.
    - Maximum number of common classes is 10.
    - Maximum number of schedule classes is 12.
    - Maximum number of class attribute is 50.
    - Maximum number of instance is 255.
    - Maximum number of attribute ID is 255.
    - Maximum number of fault code is 99.
- Save/Load of weld controller settings can be executed only on management information screen.
- This function supports Japanese and English. When other languages are used, this function uses English.
- Because robot controller acquires the latest data from weld controller to display the screen, some processing time (2sec-3sec) might be required. Moreover, processing time might increase by connected composition (when multiple slave exists, etc) and baud rate setting condition (when baud rate is not 500KB) of DeviceNet.
- The update speed of the screen might slow when multiple screens for this function are displayed at the same time.
- The update speed of the screen might slow if the save/load of file is executed when multiple screens for this function are displayed at the same time.
- When ID of DSF of weld controller is less than 1000, the weld result monitor cannot be displayed. This is a limitation by Nadex DeviceNet weld controller.
- The maximum number of fault items supported on this function is 99.
- The screen might become uneven as follows for the convenience of display width information obtained from weld controller.

```
COMMON PROGRAM
Y address (noPRG)    WC:1 X  0              1/13


    0 #1 LOW CURR. LIMIT               90%
    1 #1 HIGH CURR. LIMIT             120%
    2 #2 LOW CURR. LIMIT               90%
    3 #2 HIGH CURR. LIMIT             120%
    4 #3 LOW CURR. LIMIT               90%
    5 #3 HIGH CURR. LIMIT             120%
    6 SHORT DETECT.CURR.               15A
   12 STEPPER                    OFF
   15 PULSE PILOT                OFF
   16 FAULT RES. BY PILOT        OFF


     [TYPE]   Series   TimerNum         PROG   >
```

```
STEPPER MONITOR
Y address            WC:1 X  0                    1/8

     40¥STEPPER 1 STEP No.          0
                                    STEP
     41 STEPPER 1 WLD.COUNT              0
     42 STEPPER 2 STEP No.          0
                                    STEP
     43 STEPPER 2 WLD.COUNT              0
     44 STEPPER 3 STEP No.          0
                                    STEP
     45 STEPPER 3 WLD.COUNT              0
     46 STEPPER 4 STEP No.          0


     [TYPE]    Series    TimerNum
```

10.10 WHEN YOU WANT TO JOG ROBOT IN CASE OF WELD CONTROLLER POWER-OFF

When the communication with weld controller is disconnected after initial setting is completed, the following alarms are generated according to the cause of disconnect. (Note: Alarm of DeviceNet might be generated at the same time. Specify STATUS to OFFLINE on the DeviceNet board list screen to release alarm of DeviceNet. Refer to DeviceNet manual (B-82694EN) for more information.)

    SPOT-496   NDNW Device Net Disconnect
    SPOT-092   ELCB signal detection

Robot cannot be jogged until the communication with the weld controller is restarted when the above-mentioned alarms are generated. This chapter describes the procedure to jog the robot under the situation in which robot cannot communicate with weld controller. Change the setting according to the following procedures.

Procedure 10-8   **Operating procedure of robot under the situation in which robot cannot communicate with weld controller**

Step
1   Press the [DATA] key.
2   Press F1, [TYPE].
3   Select NadexDevWTC. Top screen will be displayed.
4   Press F2, RELEASE. The following alarm release screen will be displayed.

```
Nadex DeviceNet Weld timer
Alarm Release                                    1/1

     Nadex DeviceNet alarm stat:     ACTIVE
  1  Release time(min):                 60
     Elapsed time(min):                 60


     [TYPE]                    RELEASE    STOP
```

5   When F4, RELEASE is pressed, the alarm is released only the release time. Press F5, STOP if you want to cancel the alarm release on the way.

⚠ **CAUTION**
Stop the alarm release after completing jogging.

10.11   REPLACEMENT OF WELD CONTROLLER

When weld controller under the connection is replaced with weld controller of another model (product code is different), procedure of deletion/addition of device is necessary usually from I/O DeviceNet Board List screen (Refer to DeviceNet manual (B-82694EN) for more information.). This section explains method of replacement with weld controller of another model without procedure of deletion/addition of device.

> **NOTE**
> This method corresponds only to the weld controller that uses DeviceNet Explicit message communication made by NADEX.

> **NOTE**
> When product code of previous weld controller and following weld controller is same (same model), this method is not necessary.

> **NOTE**
> Vendor Id of previous weld controller and following weld controller should be same.
> Device Type of previous weld controller and following weld controller should be same.

> **NOTE**
> It is necessary to connect following weld controller to DeviceNet board of same board number as previous weld controller.
>
> ```
> Nadex DeviceNet Weld timer
> Initial setting / WC:1                        1/2
>
>         1  Device net board number:          1
>         2  Device net node number:           2
>            DSF reading:                    COMP
>
>
>
>      [TYPE]           TimerNum  DSF read
> ```

> **NOTE**
> Node number of previous weld controller and following weld controller should be same.
>
> ```
> Nadex DeviceNet Weld timer
> Initial setting / WC:1                        1/2
>
>         1  Device net board number:          1
>         2  Device net node number:           2
>            DSF reading:                    COMP
>
>
>
>      [TYPE]           TimerNum  DSF read
> ```

> **NOTE**
> This method has been supported since software version 7DC1P06.

Procedure 10-9   Replacement of weld controller

Step

1   Replace the weld controller after turning off robot controller's power supply.
2   Turn on robot controller's power supply. Disregard them though the following alarms are generated.

   DNET-063   Device error: Bd %d MAC %d
   DNET-066   Incorrect product code
   SPOT-496   NDNW Device Net Disconnect

3   Set following system variables on system variable list screen.

Table 10.11 System variables for replacement of weld controller

System variable	Description
$ndnw_wcchg[*n*].$dvprdcd_chg	Specify 1 to here for replacement of weld controller.
$ndnw_wcchg[*n*].$dv_prdctcod	Specify product code of following weld controller to here. Specify 0 to here when product code is an uncertainty. When this value is 0, the robot doesn't check product code while communicating with weld controller. If you surely know product code, product code is recommended to be specified.
$ndnw_wcchg[*n*].$num_dv_din	This item is number of digital input points for the following weld controller. Number of digital input points is not changed when this value is 0, and number of digital input point is the same as previous weld controller.
$ndnw_wcchg[*n*].$num_dv_dout	This item is number of digital output points for the following weld controller. Number of digital output points is not changed when this value is 0, and number of digital output point is the same as previous weld controller.

n is a weld timer number.

4   Perform a Controlled Start.
5   Perform a Cold Start.
6   Confirm the above-mentioned system variable has been changed to 0 on system variable list screen.
     $ndnw_wcchg[*n*].$dvprdcd_chg = 0
     $ndnw_wcchg[*n*].$dv_prdctcod = 0
     $ndnw_wcchg[*n*].$num_dv_din = 0
     $ndnw_wcchg[*n*].$num_dv_dout = 0

> **NOTE**
> When the above-mentioned system variable is not changed to 0, a set value of
> the system variables might be wrong. In this case, because be not done weld
> controller's setting change, correct a set value.

7   DSF reading of initial setting screen is changed to INCOMP. Read DSF.

```
Nadex DeviceNet Weld timer
Initial setting / WC:1                    1/2

    1  Device net board number:        1
    2  Device net node number:         2
       DSF reading:                   INCOMP



    [TYPE]            TimerNum  DSF read
```

11   PROCESS LOGGER

11.1   OVERVIEW

11.1.1   Description of Process Logger

Process Logger function records welding status information automatically. The recorded welding information is managed by unique ID consisted by program name and PROCESS ID. Users can check them not only on teach pendant but on PC connected to the robot controller through network.
The followings are the representative features of Process Logger function.

- Confirm the recorded welding information on teach pendant.
- Derive and show some statistical data of the recorded welding information.
- Search the recorded welding information which satisfies several conditions; for example, some welding errors occurred et.al.
- Display and save the above search result.
- Confirm the recorded welding information on Web browser connected to the controller through Ethernet network.
- Download the recorded welding information with FTP.

> **NOTE**
> • This function is an option(A05B-2600-R758)

11.1.2   Inherent Features for SpotTool+

In SpotTool+, WID is treated as PROCESS ID. So, you must have Weld ID enabled on the spot configuration screen. Spot configuration screen can be displayed according to the following procedures.

Procedure 11-1   Enabled Weld ID function

1   Perform a Controlled Start.
2   Press the [MENU] key.
3   Select Spot Config.
Or you can confirm/change after Cold/Hot start.
1   Press the [MENU] key.
2   Select SETUP.
3   Press F1, [TYPE].
4   Select Spot Config.

The bottom of the screen has "Weld ID" content, move cursor to the contents and press F4, ENABLED.

```
SPOT CONFIG
                                3/34
     1 F Number:               F00000
     2 Load Spottool Macros:   DISABLED
     3 Number of equipments:   1
          …………Omit…………
    32    Timer number:        0
    33 Contactor control type: STANDARD
    34 Weld ID:                ENABLED

    [ TYPE ]             ENABLED  DISABLED  >
```

By default Auto Weld ID will be on when Process Logger is loaded. Auto Weld ID for Spotwelding means that when you teach a SPOT[…] instruction by performing SHIFT-SPOT in the editor, the WeldD ID field in the SPOT instruction will automatically be set to the Position ID * 10.

```
:L P[15] 2000mm/sec CNT 100 SPOT[WID=150,SD=1,P=1,t=**,S=1,ED=1]

          └────Position ID                     └────Position ID×10
```

> **NOTE**
> For the dual gun system, the Weld ID field in the SPOT instruction will automatically be set to the following values.
> Gun A : Position ID * 10
> Gun B : Position ID * 10 + 1

If you want to manually assign Weld ID's, then set $spotconfig.$auto_wldid = FALSE.

> **NOTE**
> When the Weld ID is disabled, process logger function does not work.

In SpotTool+, the following welding status is recorded by the function.

Table 11.1.2 Welding information recorded for SpotTool+

Contents	Description
Executed time	Date of the spot welding is executed.
Fault	Occurred alarm codes
Bookmark	This is not used.
Weld time	This is time from output of weld schedule signal to receiving weld complete signal.
Time to force	After contact, this is time until specified pressure reaches.
Weld sched	This is weld schedule number.
SD index	This is start distance schedule number.
P index	This is pressure schedule number.
ED index	This is end distance schedule number.
Inst type	This is not used.
Gun num	This is gun number.
Retried	This indicates that auto retry weld was executed on this welding point. 1: Auto retry weld was executed. 0: Auto retry weld was not executed.
Weld noweld	This indicates that robot is WELD or NOWELD. 1: Weld mode is WELD 0: Weld mode is NOWELD
FFR active	This indicates that FFR (Fast Fault Recovery) sequence was executed on this welding point. 1: FFR sequence was executed. 0: FFR sequence was not executed. Auto error recovery function is necessary for FFR.
Thick before	This is part thickness before applying current.
Setdown	This is decrement of thickness after applying current.
Tip wear	This is tip wear volume.
SD val	This is specified start distance.
Thick val	This is specified part thickness.
Pressure cmd	This is specified pressure command.
ED val	This is specified end distance.
Contact pos	This is a position in which gun did contact to board.
Pressure pos	This is a position of the gun tip under the welding.

Contents	Description
Pressure trq	This is servo gun motor torque while welding.
Pressure fdb	This is a presumption value of the pressure.

11.2 RECORDING WELDING INFORMATION

Process Logger function record each welding information automatically, however, by limitation of memory size et.al., it cannot record it inexhaustibly. Confirm the following limitation and specification.

- The maximum keeping number of welding information stored in the controller is 50 for each welding point. If a welding point has been welded more than 50, Process Logger function deletes older information to make room for the new one.
- The statistical information; minimum, maximum and average value of each welding status is derived on the every welding information that Process Logger function records until now.
- The number of recordable welding point is depended on the equipped memory module size.
- Process Logger records welding information at the welding has finished.
- The first time a program is executed, the data is not saved until the program ends. So if power was cycled before the program was completed the first time, then the data would be lost. Once the program ends the first time, then the data will be saved. All subsequent executions will always be saved.

11.3 PROCESS LOGGER USER INTERFACE

Process Logger function provides the following user interface to confirm welding information on teach pendant.

- Process Data screen
- Related view for Process Logger function.
- Process Report screen

11.3.1 Process Data Screen

Process Data screen shows any welding information that Process Logger records.

Procedure 11-2 Display Process Data screen

1 Press the [MENU] key.
2 Select STATUS.
3 Press F1 [TYPE] key.
4 Select Process Data, then the following screen will be displayed.
   If you would like to confirm the below:
   - Previous weld position: Press F2, PRV_PRC.
   - Next weld position: Press F3, NXT_PRC.
   - Older information: Press F4, PRV_HST.
   - Newer information: Press F5, NXT_HST.

Process Data screen

```
Process Data
       Program:SPOTLINE1
       Process ID: 1              [              ]
       Record : 9                 Total : 210
       Touchup:                   1-APR-12 16:01
       Execute:                   3-APR-12 17:25

       Fault:                     None
        Bookmark:                  None
       Weld time:                 300
       Time to force:              100
       Weld Sched:                2
       …
     [TYPE]   PRV_PRC   NXT_PRC   PRV_HST   NXT_HST
```

Table 11.3   Contents on process data screen

Contents	Description
Program	Program name executed the currently-shown welding information.
Process ID	Process ID corresponding to currently-shown welding information. At SpotTool+, Weld ID is used.
Records	Record Index of currently-shown welding information.
Total	Total number of welding to current Process ID.
Touch up date	Touch up date of the weld.
Executed	Executed date the currently-shown welding information

11.3.2   Related View for Process Logger

Related View for Process Logger also shows any welding information same as the above Process Data screen. In addition, it is available to select welding position on TP program by Related View function and to confirm the temporal behavior of welding information by chart function.

Procedure 11-3   Display Related View for Process Logger

---

1   Press the [MENU] key.
3   Select SELECT.
4   Select TP program you would like to confirm welding information and show edit screen.
5   Press FCTN key with *i* key, then the following menu will be displayed.

```
      Related View 1
1 Node Map
2 Process Data
3 Servo gun
```

6   Select Process Data, then the following screen will be displayed.
     If you would like to confirm the below:
     •   Older information: Press F4, PRV_HST.
     •   Newer information: Press F5, NXT_HST.
     •   Other welding position: Move cursor to the SPOT instruction you want in edit screen on top-left window.
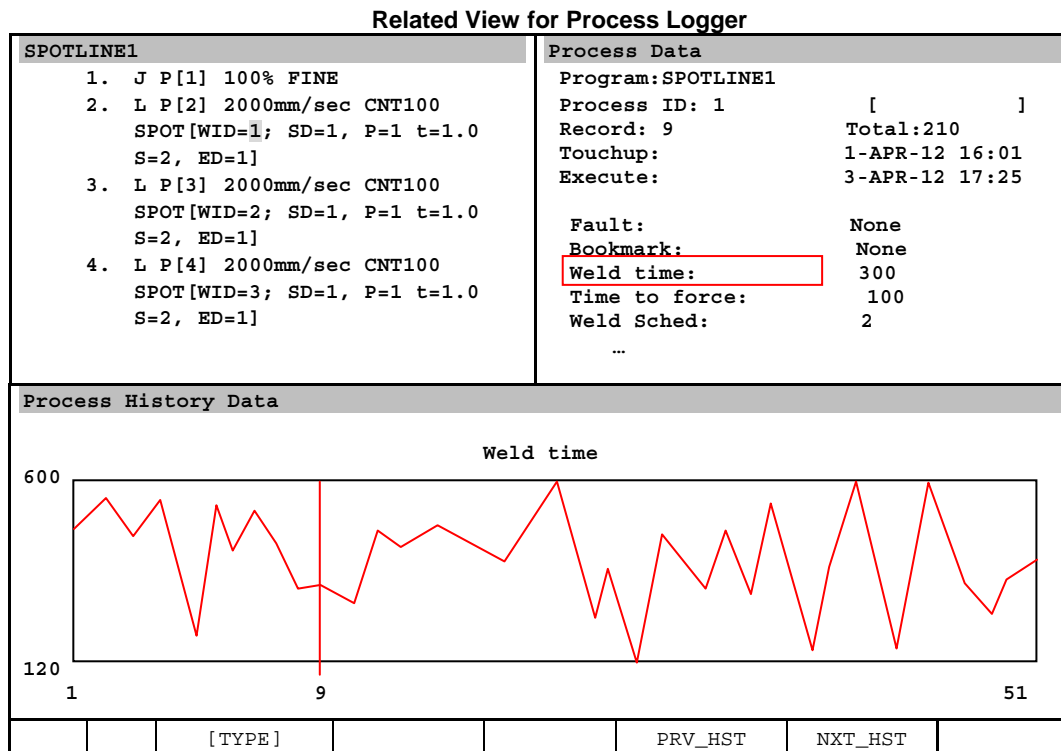
Related View for Process Logger

```
SPOTLINE1                              Process Data
    1.  J P[1] 100% FINE                Program:SPOTLINE1
    2.  L P[2] 2000mm/sec CNT100        Process ID: 1          [         ]
        SPOT[WID=1; SD=1, P=1 t=1.0     Record: 9              Total:210
        S=2, ED=1]                      Touchup:               1-APR-12 16:01
    3.  L P[3] 2000mm/sec CNT100        Execute:               3-APR-12 17:25
        SPOT[WID=2; SD=1, P=1 t=1.0
        S=2, ED=1]                       Fault:                None
    4.  L P[4] 2000mm/sec CNT100         Bookmark:             None
        SPOT[WID=3; SD=1, P=1 t=1.0      Weld time:            300
        S=2, ED=1]                       Time to force:         100
                                         Weld Sched:           2
                                           …
```

```
Process History Data

                           Weld time
    600

    120
      1           9                                           51

         [TYPE]                      PRV_HST    NXT_HST
```

Table 11.3.1   Display contents on related view for process data

Contents	Description
Program	Program name executed the currently-shown welding information
Process ID	Process ID corresponding to currently-shown welding information. At spot welding, Weld ID is used.
Records	Record Index of currently-shown welding information
Total	Total number of welding to current Process ID.
Touch up date	Touch up date of the weld
Executed	Executed date the currently-shown welding information
Process History Data	Show time series graph selected welding information in Process Data screen on top – right screen. The red polygonal line along to transverse axis is the welding information selecting at Process Data screen. The red straight line along to vertical axis is executed time of currently-shown welding information.

11.3.3   Process Report Screen

Process Report screen extracts and displays some welding information that satisfies several conditions from among   every welding information Process Logger records. For example, by using some error occurs or weld time is too short as extracting condition, you will find poor welding points quickly.
The statistical information; maximum, minimum and average value of welding information also is displayed.

Procedure 11-4   Display Process Report screen

1   Press the [MENU] key.
2   Select STATUS.
3   Press F1[TYPE] key.
4   Select Process Report, then the following screen will be displayed.

Process Report search condition screen

```
Process Report
     Application: Spot Weld
     Report Type: USER DEFINED
     Filter name:
     Filters
      1:Exec_time
        Start date: 01/APR/12 TIME:12:00:00
        End date  : 02/APR/12 TIME:12:00:00
      2:Weld time <   100.0
      3:None                  =   0.00
      4:None                  =   0.00
      5:None                  =   0.00

     Outputs
      1:MIN   Weld time
      2:AVG   Weld time
      3:MAX   Weld time
```

[TYPE]		EXEC	[CHOICE]	CLEAR	
CLR_DAT			[CHOICE]		

Table 11.3.2 Display and configuration contents on process report search condition screen

Contents	Description
Application	Application type; Spot Weld et.al.
Report Type	Set search type. At "USER DEFINED", You can set up search and output conditions circumstantially. Spot weld application provides the following presets of search conditions. "RP1:ALL SPOTS": Show every welding information "RP2:SPOTS WITH FAULTS": Show welding information some alarms occur.
Filter name	Name of search conditions This content is displayed only when report type is "USER DEFINED".
Filters	Search conditions. At search result screen, the welding information which satisfies any filter condition expect "None" The maximum number of condition is 5. This content is displayed only when report type is "USER DEFINED".
Outputs	Select some welding information shown statistical data on search result screen. Users can select 3 type statistical information; maximum, minimum and average value. The statistical data is derived by the search result. This content is displayed only when report type is "USER DEFINED".

> **NOTE**
>   Only 1st filter supports "execute time"

Procedure 11-5   Search welding information

1   Select Application and Report type
    a: "USER DEFINED" requires to configure filter conditions and outputs. At least, a filter must be
         configured.
    b: "RP1: ALL SPOT" and "RP2: SPOTS WITH FAULTS" have no configuration.
2   Press F3, EXEC then start searching and displayed search result as following.
    If you would like to the search result, press F4, SAVE, then, the search result is saved as
    "PATREPORT.HTM" to the default device with HTML format.

Process report search result screen

```
PAT Report
F Number : XXXXXX
VERSION  : SpotTool
$VERSION : 7DC1P/01
DATE     : 3-APR-12 12:00


Spot Weld filtered report.


SPOTLINE 1
  Process ID = 1, Hist Index = 1  Weld time = 98.0
  Process ID = 1, Hist Index = 8  Weld time = 50.0
  Process ID = 1, Hist Index = 34 Weld time = 73.3
     Global STAT for Process ID:1 after 210 execution
     Weld time      :MIN:50.00, MAX:432.00, AVG:240.00

  Process ID = 2, Hist Index = 34  Weld time = 48.0
     Global STAT for Process ID:2 after 210 execution
     Weld time      :MIN:73.30, MAX:432.00, AVG:240.00

SPOTLINE 2
  Process ID = 4, Hist Index = 4  Weld time = 25.0
  Process ID = 4, Hist Index = 5  Weld time = 43.0
     Global STAT for Process ID:4 after 210 execution
     Weld time      :MIN:25.00, MAX:392.00, AVG:233.00


6 histories's with matching parameters found.
 Min  Weld time        = 25.0
 Max  Weld time        = 98.0
 Avg  Weld time        = 56.2
```

		BACK		SAVE		

11.4   CONFIRM WELD INFO ON PC VIA ETHERNET NETWORK

If a PC connects to a robot controller through Ethernet network, it's available to confirm welding information of Process Logger function on the PC. Process Logger function supports the following 2 procedures.

- Confirm the welding information on Web browser
- Access the welding information via FTP.

Procedure 11-6   Confirm the welding information on Web browser

1   With Web browser on PC connected to a robot controller, bring up the robot home page, then the following page will be displayed.
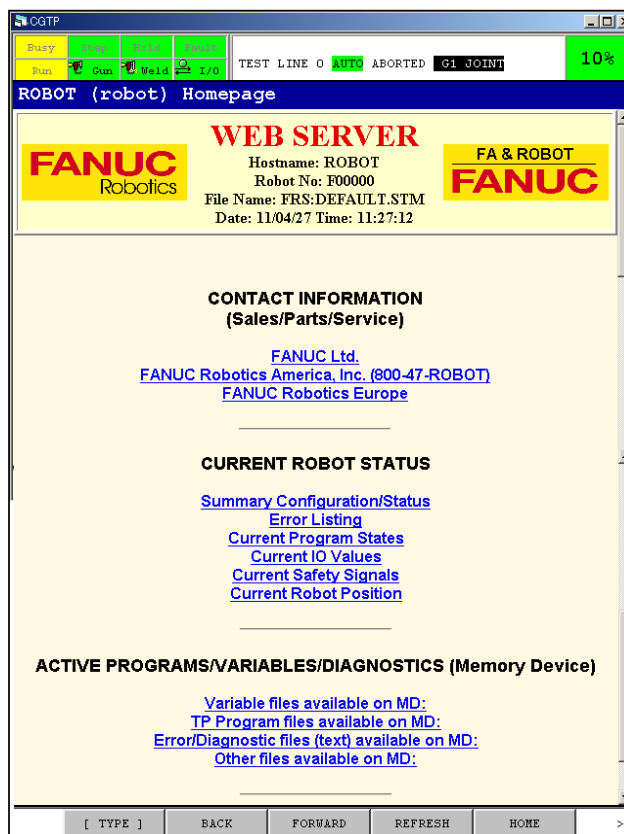
2   Select "Error/Diagnostic files (text) available on MD:"

3   The list of error and diagnostic files will be displayed. The welding information recorded by Process Logger function for spot welding is saved in "PRCSWSUM.DG". When it is selected, the welding information is displayed as the following type.

Procedure 11-7   Accessing welding information via FTP

1   Connect a PC and a robot controller via FTP.

2   After logging in, open MD: device in the robot controller.

3   Select "PRCSWSUM.CSV" in the MD: device and copy it to the PC.

NOTE
"PRCSWSUM.CSV", welding information is saved, is also obtained at performing a "backup all" from the File menu.

11.5 PROCESS MONITOR

Process Monitor function detects abnormal welding by comparing with specified thresholds at recording weld information. The values of thresholds is specified it directly or allowable ratio of statistical information of past recorded weld information.
Alarm severity can be set each recorded item.

NOTE
Process Monitor function is provided since V8.20 and later.

11.5.1 Process Monitor setup screen

Enabled/Disabled of monitoring and threshold values is specified on Process Monitor setup screen.

Procedure 11-8   Process Monitor setup screen

Step
1   Press the [MENU] key.
2   Select "SETUP".
3   Press F1[TYPE].
4   Select "Process Monitor" then the following screen will be displayed.

Process Monitor setup screen

```
PROC LOG MON
      Application:  ARC Weld
      Fault Output:   DO[0]
      Warning Output: DO[0]
      Alarm Reset Input: DI[0]

#    Item         Act    ULim    LLim    TYPE  Sev
1 Weld time        Y     100.0    65.0    DIR    W
2 Time to force    N      10.0    10.0     %     W
3 Weld sched       N      10.0    10.0     %     W
4 SD index         N      10.0    10.0     %     W
5 P index          N      10.0    10.0     %     W


     [TYPE]
```

Table 11.5.1 (a)   Process Monitor setup screen

Items	Descriptions
Application	Monitoring target application.
Fault Output	When a value of item that error severity is "WARN" exceed upper/lower limit, the DO specified the content becomes ON.
Warning Output	When a value of item that error severity is "FAULT" exceed upper/lower limit, the DO specified the content becomes ON.
Alarm Reset Input	DOs specified "Fault Output" and "Warning Output" become OFF
Item	Recorded item name.
Act	Enabled/Disabled monitoring feature for the item.
ULim	Specify upper limit. unit of the limit depends on "TYPE"
LLim	Specify lower limit. unit of the limit depends on "TYPE"

Items	Descriptions
Type Sev	Specify the unit of threshold value and error severity.
	The unit of threshold.
	"TOL"(TOLerance):
	The ULim and LLim value become percentage values around a reference value.
	"DIR"(DIRect):
	The ULim and LLim value become threshold values directly.
	Error severity.
	"W: Warning"
	Severity of alarm emergency becomes WARN, so, a robot continues processes after the emergency.
	"F: Fault"
	Severity of alarm emergency becomes PAUSE, so, a robot stops processes after the emergency.

Procedure 11-9   Enable monitoring with direct type

Step
1   Display Process Monitor setup screen.
2   Move cursor on the item you would like to monitor.
3   Move cursor on "ULim" and input upper limit value in "ULim".
4   Move cursor on "LLim" and input lower limit value.
5   Move cursor on "TYPE" and select "DIR". Set error severity to "W:Warning" or "F:Fault".
6   Move cursor on "Act" and press F4 "Y".

Procedure 11-10   Enable monitoring with tolerance type

Step
1   Display Process Monitor setup screen.
2   Move cursor on the item you would like to monitor.
3   Move cursor on "ULim" and input upper limit value in "ULim".
4   Move cursor on "LLim" and input lower limit value.
5   Move cursor on "TYPE" and select "DIR". Set error severity to "W:Warning" or "F:Fault".
6   Move cursor on "Act" and press F4 "Y" and then the following details setup screen will be displayed.

Process Monitor detailed setup screen.

```
PROC LOG MON DET


   Tol. Avg type: Running Average


     [TYPE]    APPLY           [CHOICE]
```

7   Move cursor on "Tol. Avg type" and press F4 [CHOICE] then the following menu will be displayed.
8   Select average type for tolerance, for the details of each type, please see table. 11.5.2.

```
1 Running Average
2 Learn X-->STOP Learning
3 Learn X-->Cont. Learning
```

9   When "Learn X -->STOP Learning" or "Learn X-->Cont. Learning" is selected, it requires to input the number of sample corresponding to "X" in each type. Input the number of it.

```
PROC LOG MON DET


Tol. Avg type: Learn X-->STOP Learning
Number of lern cycles:    20


     [TYPE]    APPLY        [CHOICE]
```

10   After every setup has done, press F2 "APPLY", the monitoring feature becomes to enable.

Table 11.5.1 (b) Process Monitor detailed setup screen

Items	Descriptions
Tol. Avg type	"Running Average" Use average of all recorded data as the reference value. **The average is updated by executing processes.** "Learn X --> STOP Learning" User average for the next X cycles values as the reference value. **The average isn't updated after the X cycle.** "Learn X -->Cont. Learning" User average for the recorded values of the next X cycles and after values as the reference value. **The average is updated after the X cycle.**
Number of Learn	The content appears only when "Learn X-->STOP Learning" or "Learn X-->Cont. Learning" is selected as "Tol. Avg type". Specify the minimal number of cycles to calculate the reference value(corresponding to "X" in each type).

> **NOTE**
> - Since the reference value derived at each weld point, the reference value depend on weld point.
> - Until F2 "APPLY" is pressed, the monitoring feature doesn't become to enable.
> - When "Learn X-->STOP Learning" or "Learn X-->Cont. Learning" is selected as "Tol. Avg type", the motoring feature is disabled until the X specified as "Number of Learn" cycles have executed.

Procedure 11-11   Change reference value type

Step
1   Display Process Monitor setup screen.
2   Move cursor on the item you would like to change the reference value.
3   Mover cursor on "Act" and press F4 "Y" then Process Monitor detailed setup screen will be displayed.
4   Change reference value type with step 7 to 9 in Procedure 11-10.
5   After every setup has done, press F2 "APPLY", the new reference value becomes to enable.

11.5.2   User interfaces with Process Monitor feature

On Process Data screen, the item of monitoring target displays with red character.

Process Data screen Process Monitor is enabled

```
Process Data
        Program:SPOTLINE1
        Process ID: 1              [              ]
        Record : 9                 Total : 210
        Touchup:                   1-APR-12 16:01
        Execute:                   3-APR-12 17:25

        Fault:                     None
        Bookmark:                  None
        Weld time:                 300
        Time to force:             100
        Weld Sched:                2


     [TYPE]   PRV_PRC   NXT_PRC   PRV_HST   NXT_HST
```
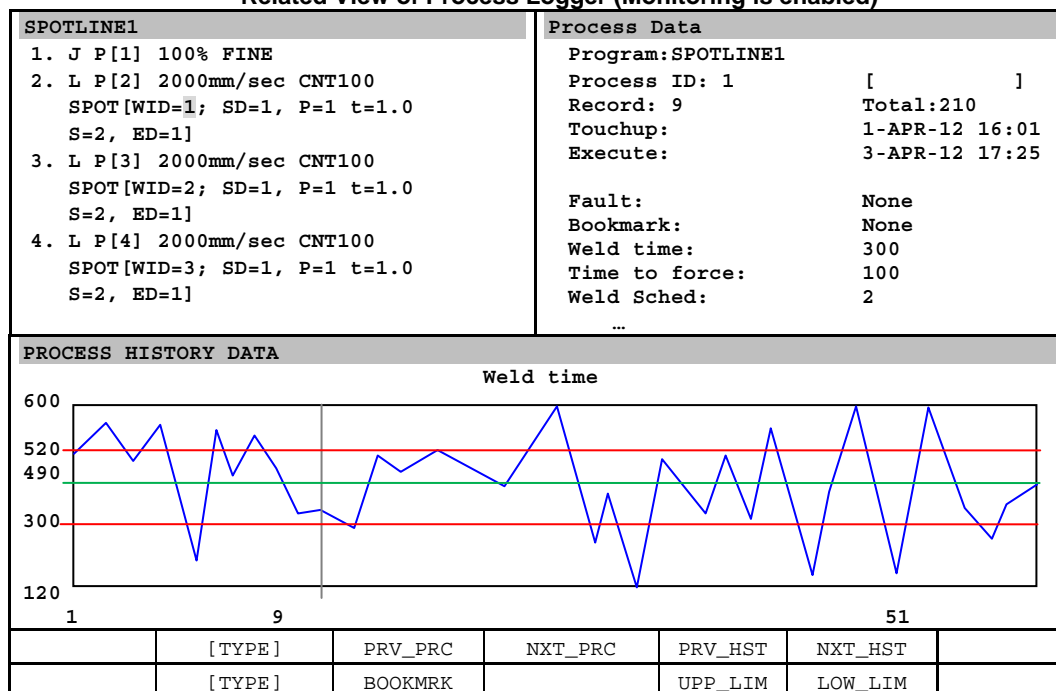
Related view of Process Logger, the item of monitoring target displays with red character on Process Data screen at right-top window same as above. The contents on PROCESS HISTORY DATA screen at bottom depend on Process Monitoring setup.

When monitoring feature is enabled, the reference value will be displayed with green charactera and line on the chart and upper and lower limit will be displayed with red characters and lines.

Related View of Process Logger (Monitoring is enabled)

```
SPOTLINE1                                Process Data
1. J P[1] 100% FINE                       Program:SPOTLINE1
2. L P[2] 2000mm/sec CNT100               Process ID: 1           [           ]
   SPOT[WID=1; SD=1, P=1 t=1.0            Record: 9               Total:210
   S=2, ED=1]                             Touchup:                1-APR-12 16:01
3. L P[3] 2000mm/sec CNT100               Execute:                3-APR-12 17:25
   SPOT[WID=2; SD=1, P=1 t=1.0
   S=2, ED=1]                             Fault:                  None
4. L P[4] 2000mm/sec CNT100               Bookmark:               None
   SPOT[WID=3; SD=1, P=1 t=1.0            Weld time:              300
   S=2, ED=1]                             Time to force:          100
                                          Weld Sched:             2
                                               …
PROCESS HISTORY DATA
                              Weld time
600
520
490
300
120
1        9                                                        51

     [TYPE]   PRV_PRC   NXT_PRC   PRV_HST   NXT_HST
     [TYPE]   BOOKMRK             UPP_LIM   LOW_LIM
```

When "Learn X-->STOP Leaning" or "Learn X-->Cont. Leaning" is selected, the monitoring features is disabled until X specified at "The number of Learn" on Process Monitor detailed setup screen cycles have executed. In this case, the number of required and current executed cycles will be displayed with item name on PROCESS HISTORY DATA screen as below.

Related View of Process Logger (Monitoring is enabled but required cycles haven't executed)

SPOTLINE1	Process Data
1. J P[1] 100% FINE	Program:SPOTLINE1
2. L P[2] 2000mm/sec CNT100	Process ID: 1 [ ]
SPOT[WID=1; SD=1, P=1 t=1.0	Record: 9 Total:210
S=2, ED=1]	Touchup: 1-APR-12 16:01
3. L P[3] 2000mm/sec CNT100	Execute: 3-APR-12 17:25
SPOT[WID=2; SD=1, P=1 t=1.0	
S=2, ED=1]	Fault: None
4. L P[4] 2000mm/sec CNT100	Bookmark: None
SPOT[WID=3; SD=1, P=1 t=1.0	Weld time: 300
S=2, ED=1]	Time to force: 100
	Weld Sched: 2
	…

PROCESS HISTORY DATA

Weld time * 1 of 20 learned

```
600




120
  1         9                                              51
```

	[TYPE]	PRV_PRC	NXT_PRC	PRV_HST	NXT_HST	
	[TYPE]	BOOKMRK		UPP_LIM	LOW_LIM	

Thresholds of monitoring feature can be changed on PROCESS HISTORY DATA in Related View of Process Logger

---

Procedure 11-12   Change thresholds on Related View of Process Logger

Step
1   Display Related View of Process Logger.
2   Press DISP key until PROCESS HISTORY DATA is selected.
3   Press the [NEXT] key.
4   The following function key will be displayed.

	[TYPE]	BOOKMRK		UPP_LIM	LOW_LIM	

5   To change the upper limit, press F4 "UPP_LIM", to change the lower limit, press F5 " LOW_LIM".
6   The background of pressed item becomes blue and the current setting appears of the bottom of PROCESS HISTORY DATA screen. The following example is corresponding to when Upper limit is selected as changed target.

PROCESS HISTORY DATA

Weld time

```
600
520
490

300

120
  1         9                                              51
              Upper Lim. Threshold =  10.00 %
```

	[TYPE]	BOOKMRK		UPP_LIM	LOW_LIM	
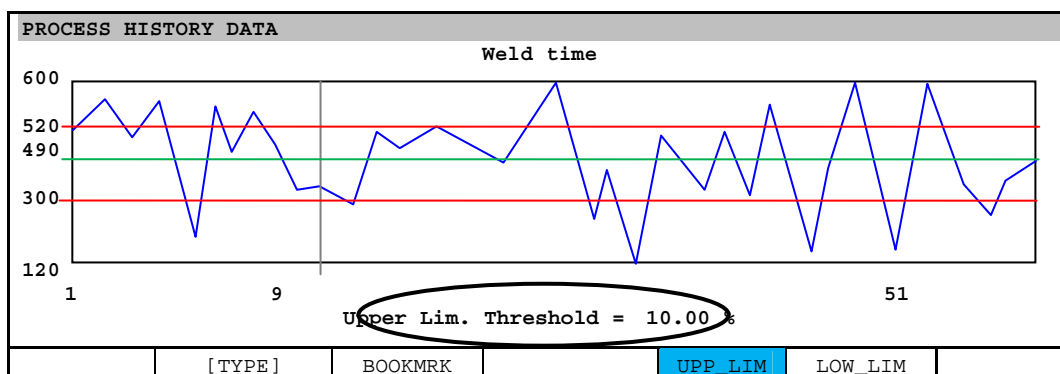
7   The threshold value increases/decreases by pressing UP/DOWN key. When the type is "TOL", it
     increases/decreases 1, otherwise, it increases/decreases the 1% value of average.
8   After the change, press same function key again, back to step 4. status.

> **NOTE**
> When "Learn X-->STOP Leaning" or "Learn X-->Cont. Leaning" is selected and
> required cycles haven't done, since the monitoring feature is still disabled, it isn't
> prohibited to change the threshold values from Related View of Process Logger.

11.5.3   Adjust Process Monitor settings from TP program

Process Monitor feature provides a macro to adjust Process Monitor settings from TP program. The
format of the macro is below.

```
                                              ┌ Weld ID
                                              │
                                              │ Enabled/Disable Monitoring
                                              │ 0:Disabled, 1:Enabled
                                              │ Item number
                                              │ (In this case, Time to force)
                                              │ Error severity
                                              │ (1:Warning, 2:Fault)
                                              │ Upper limit (DIR type, option)
                                              │ Lower limit (DIR type, option)
CALL PRLOGMON(10,1,2,2,200,0)
```
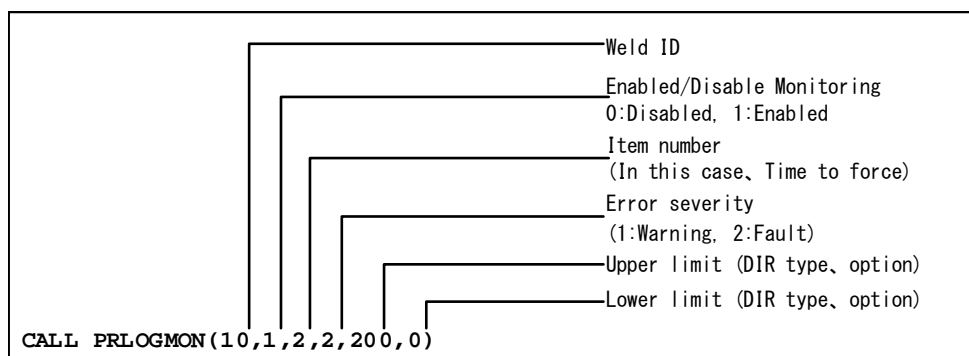
Procedure 11-13   Adjust Process Monitor settings from TP program

1   Open the TP program you would like to adjust Process Monitor settings.
2   Move cursor to a previous line from the weld point you would like to adjust.
3   Press the [NEXT] key.
4   Press F1[INST] key.
5   Select "CALL".
6   Select "CALL program".
7   Select "PROGMONOVER" in the list.
8   Press F4[CHOICE] and input new settings.

> **NOTE**
> -   It isn't prohibited to change the type of threshold; TOL or DIR from the macro.
> -   The macro must execute in the same TP program with the weld point you would
>   like to change Process Monitoring settings.
> -   The macro must execute before the weld point you would like to change
>   Process Monitoring settings.

11.6   D PROCESS LOGGER

11.6.1   Overview

4D Process Logger feature provides a new 4D screen to confirm recorded data and process executed
position of current selecting TP program on teach pendant screen graphically.

The principal features of this function are as follows.

- Show process executed points as map pins on 4D graphics screen.
- Show recorded data on pop-up text.
- Record Filtering.
- Calculate statistical information.
- Display record as time-series chart format.

NOTE
This function requires 4D Graphics function.
This function recommends to use touch panel type *i*Pendant
This function is provided since V8.20 and later.

11.6.2   Home Screen

Procedure 11-14   Show home screen of 4D Process Logger

Step
1   Press the [MENU] key.
2   Select "4D GRAPHICS".
3   Press F1[TYPE] key.
4   Select "4D Process Logger". The following screen will be displayed.
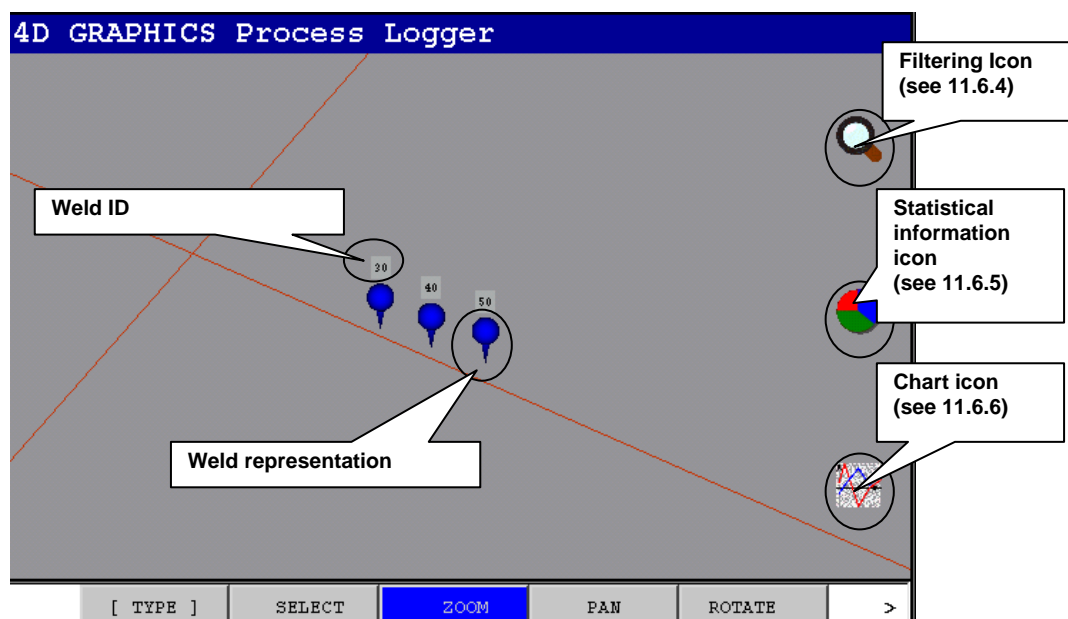
Fig 11.6.2 Descriptions items on home screen of 4D Process Logger

11.6.3   Fundamental Features

11.6.3.1   Process representation

At SpotTool, positions executing SPOT instruction are represented as a map pin format and the process ID specified in SPOT instruction is displayed above of each map pin.

```
1.L P[1] 2000mm/sec CNT100
   SPOT[…,WID=60]
2.L P[2] 2000mm/sec CNT100
   SPOT[…,WID=70]
3.L P[3] 2000mm/sec CNT100
   SPOT[…,WID=80]
4.L P[4] 2000mm/sec CNT100
   SPOT[…,WID=90]
5.L P[5] 2000mm/sec CNT100
   SPOT[…,WID=100]
6.L P[6] 2000mm/sec CNT100
   SPOT[…,WID=110]
```

Process ID

Process Representation
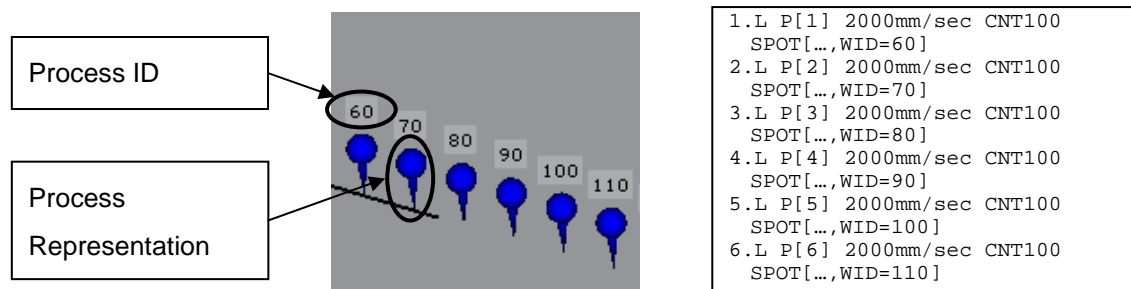
Fig 11.6.3.1(a) Weld representation

User can change the direction of map pin between two different frames; WORLD frame and USER TOOL frame.
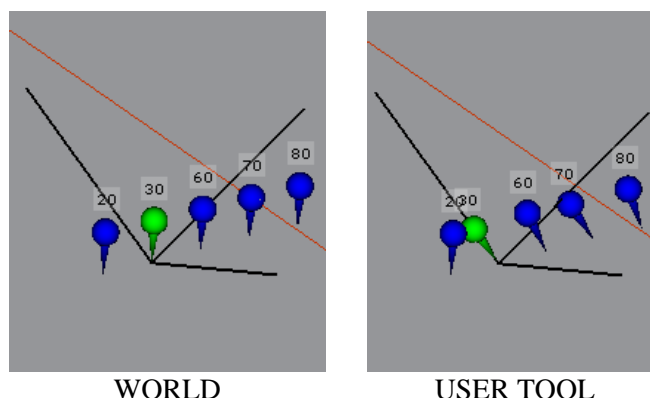
WORLD   USER TOOL
Fig 11.6.3.1(b) Two different map pin direction)

Procedure 11-15   Change map pin direction

Step
1   Display home screen of 4D Process Logger.
2   Press F2 "SELECT".
3   Press the [NEXT] key
4   Press F3 key then the frame of map pin .

11.6.3.2   Select process and popup

4D Process Logger provides to show recorded weld information on pop-up window. It requires selecting a Process you would like to confirm it. When a process is selected, the color of the process representation is changed to light green from blue and popup that shows latest history data appears near the process representation.
There are two ways to select a process; using a touch panel feature or key

Procedure 11-16   Select a process on 4D Process Logger with touch

Condition
1   *i*Pendant has touch panel
2   Home screen of 4D Process Logger has been displayed.

Step
1   Press F2 "SELECT".
2   Touch a map pin that represents the process you would like to select.
3   If something other than process representations is selected, the selected process becomes unselected.

Procedure 11-17   Select Process on 4D Process Logger with key

Condition
1   Home screen of 4D Process Logger has been displayed.

Step
1   Press F2 "SELECT".
2   Press UP key then a process that has the lowest process ID is selected when any process isn't selected.
3   Press UP key when you would like to select next process.
4   Press DOWN key when you would like to select previous process.
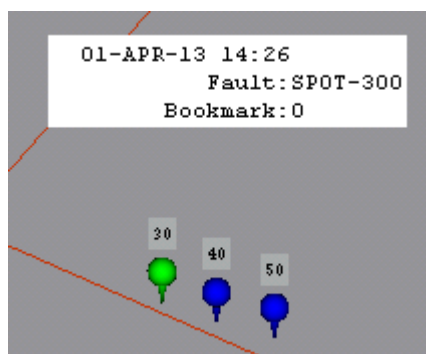
Fig. 11.6.3.2 (a) Pop-up on 4D Process Logger

Procedure 11-18   Change displayed record in the process

Condition
1   A process has been selected and popup has been displayed.

Step
1   Press F2 "SELECT".
2   Press LEFT key then older history is displayed.
3   Press RIGHT key then later history is displayed.
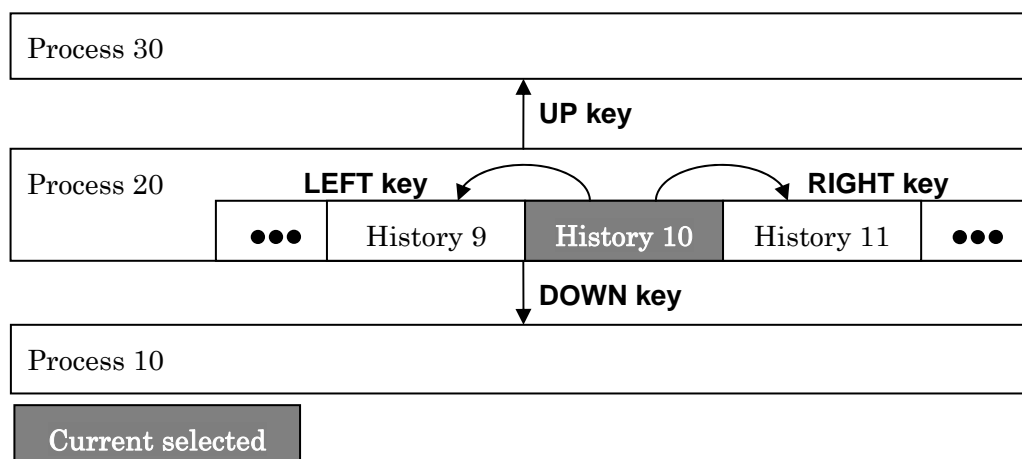
Fig. 11.6.3.2.(b) Key features to select process and history

11.6.4   Filtering

Filtering feature extracts processes that satisfy specified filtering conditions. When a process that have no records satisfy the filtering conditions, the process representation becomes invisible on 4D Process Logger screen and cannot select from touch, UP, DOWN key.

Procedure 11-19   Show and setup filtering condition setup dialog with touch

Condition

  1   *i*Pendant has touch panel

Step

  1   Press F2 "SELECT".
  2   Touch the following filtering icon.
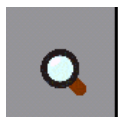
Fig 11.6.4.(a) Filtering icon
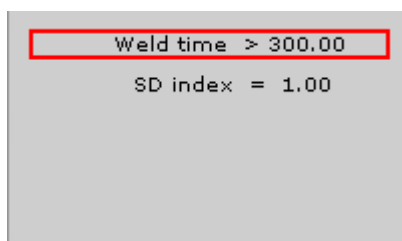
Fig 11.6.4.(b) List of filtering condition

  3   Fig 11.6.4.(c) or (d) will be displayed.
  4   To change a target…
      a Touch the target item text box.
      b Item list box will be displayed.
      c Select the item you would like to set to target from the list.
  5   To change a comparison operator…
      a Touch comparison operator text box.
      b Operator list box will be displayed.
      c Select the comparison operator from the list.
  6   To change a threshold value…
      a Touch threshold text box.
      b Input new threshold value.
  7   After every filtering condition has been setup, press OK button, the new filtering conditions are applied.
  8   If you would like to back to previous filtering conditions, press Cancel button, the new filtering conditions are ignored and back to previous filtering conditions.
  9   If you would like to reset every filtering condition, press Erase button, the every filtering condition is initialized.

Procedure 11-20   Show and setup filtering condition setup dialog with key

Condition

  1   No dialog is displayed.

Step

  1   Press F2 "SELECT".
  2   Press the [NEXT] key
  3   Press F4 key once.
  4   The following dialog will be displayed.
  5   To change a target…
      a Move cursor on the target item text box and press the [ENTER] key.
      b Item list box will be displayed.
      c Select the item you would like to set to target from the list.

6   To change a comparison operator…
     a Move cursor on the comparison operator text box and press the [ENTER] key.
     b Operator list box will be displayed.
     c Select the comparison operator from the list.
7   To change a threshold value…
     a Move cursor on the threshold text box and press the [ENTER] key.
     b Input new threshold value.
8   After every filtering condition has been setup, move cursor on OK button and press the [ENTER] key.
9   If you would like to back to previous filtering conditions, move cursor on Cancel button and press the [ENTER] key. The new filtering conditions are ignored and back to previous filtering conditions.
10   To reset every filtering condition, move cursor on Erase button and press the [ENTER] key. The every filtering condition is initialized.
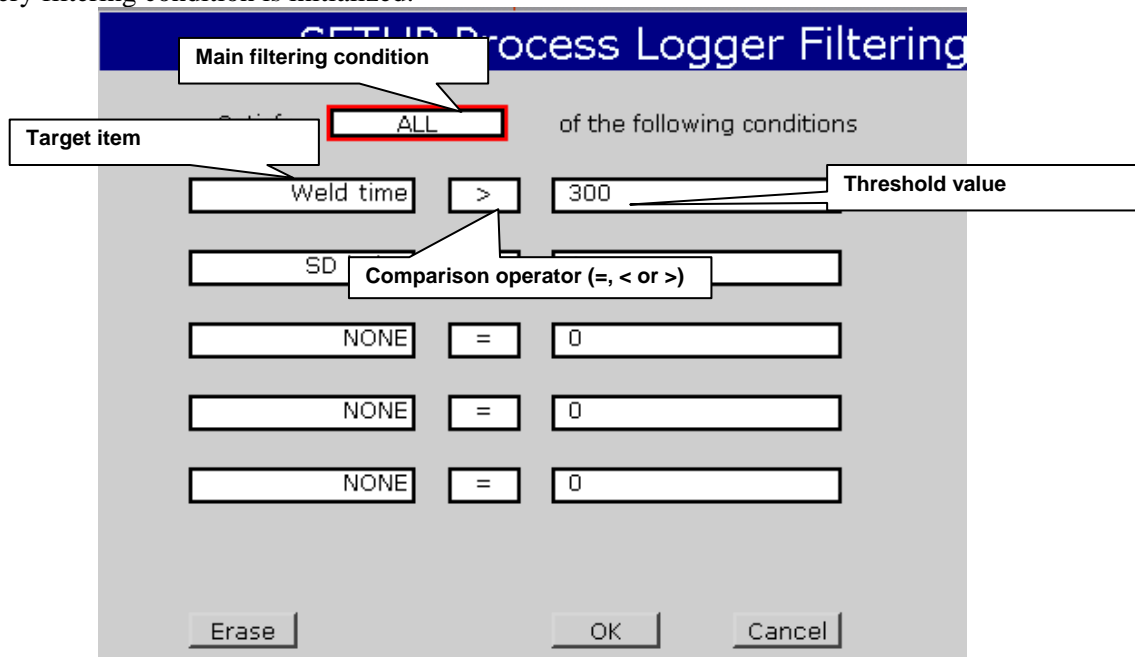
Fig 11.6.4(c) Filtering condition setup dialog(Normal)
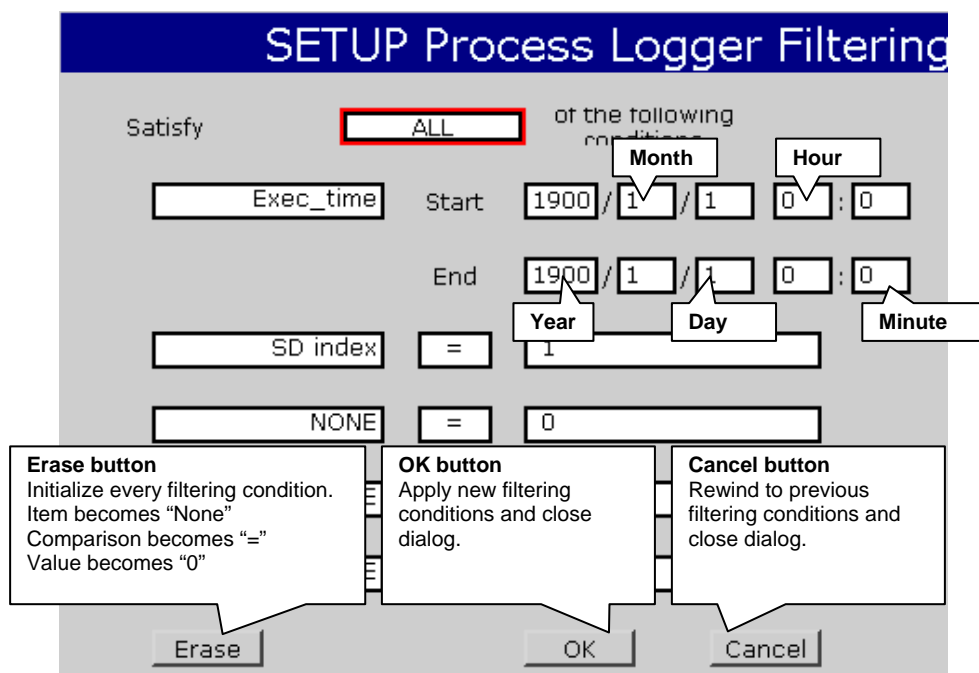
Fig 11.6.4(d) Filtering condition setup dialog(1ˢᵗ item is executed time)

There are 2 main filtering methods.
"SOME"
Processes that satisfy any of the filtering conditions will be displayed on 4D Process Logger screen.
"ALL "
Processes that satisfy all of the filtering conditions will be displayed on 4D Process Logger screen.

DATA	Conditions	Decision	
		All	**Some**
Fault is 2 Bookmark is 1 Weld time is 40	Fault > 0 Bookmark = 1 Weld time > 100	**Not satisfy** (Since, weld time doesn't satisfy the condition 3)	**Satisfy** (Since, Fault satisfies the condition 1)

Fig 11.6.4.(e) Illustration of filtering condition.

When filtering is applied, sub window that shows filtering condition is appeared on the right-top of screen and record data of the target item of the filtering is appeared on pop-up text.
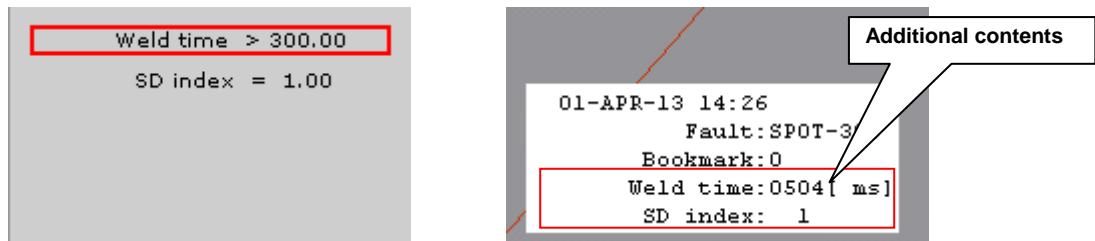
Fig 11.6.4(f) Sub window and additional information on popup

When a filtering is applied, the data that doesn't satisfy the filtering condition isn't appeared on pop-up screen. Therefore, UP/DOWN/LEFT/RIGHT key features differ slightly when filtering isn't applied.
For example, in the following situations,
-      Process 10 has some satisfying records.
-      Process 20 has some satisfying records and current selected process.
    ➤   9th record satisfies the condition.
    ➤   10th record satisfies the conditions and current selected history.
    ➤   11th record doesn't satisfy the conditions.
    ➤   12th record satisfies the conditions
-      Process 30 doesn't have any records that satisfy the conditions.
-      Process 40 has some satisfying records

Each key operation becomes as the followings.
      UP key   : Move to Process 40 by skip Process 30.
      DOWN key   : Move to Process 10.
      LEFT key: Move to 9th record in Process 20
      RIGHT key   : Move to 12th record in Process 20 by skip Process 30.

Process 40

Process 30(Any histories don't satisfy filtering conditions)

UP key

Process 20   **LEFT key** ━━ **RIGHT key**

●●● 9 10 11 12 ●●●

DOWN key

Process 10

Not satisfy   Current selected
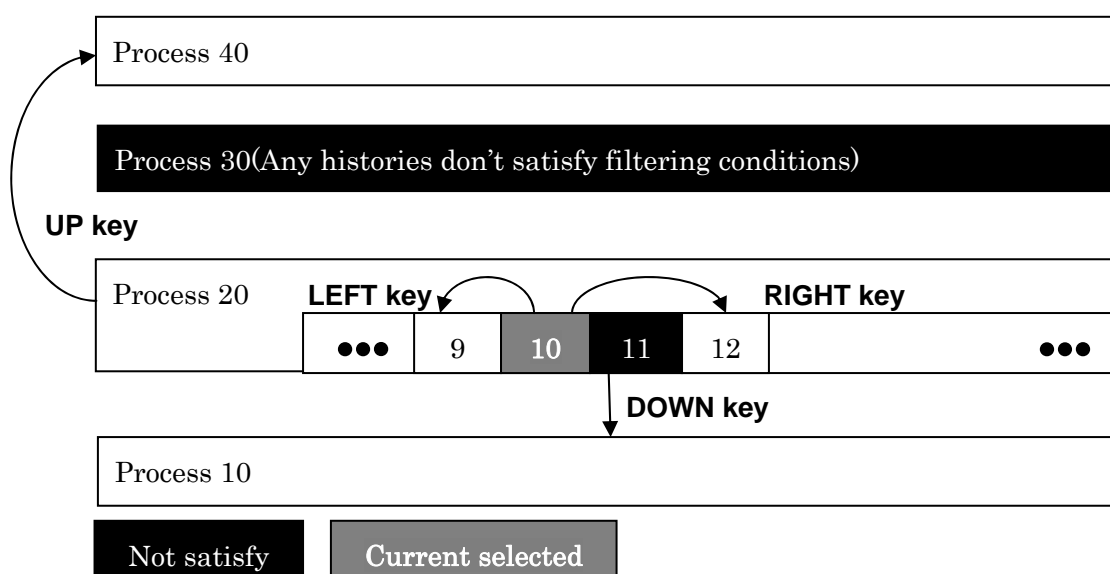
Fig 11.6.4(g) Key features to select process and history with filtering

11.6.5   Statistical Information

Statistical information feature shows fundamental statistical information; minimum, maximum and average of selected items at sub window on 4D Process Logger screen.

Procedure 11-21   Show and setup statistical information dialog with touch

Condition

1   *i*Pendant has touch panel

Step

1   Press F2 "SELECT".
2   Touch the following statistical information icon. When statistical information has been displayed, touch the list of statistical information textbox.

Fig 11.6.5(a) Statistical information icon

Weld time:504.000 504.000 504.000

Time to force:0.000 36.000 60.000

Weld sched:1.000 1.000 1.000
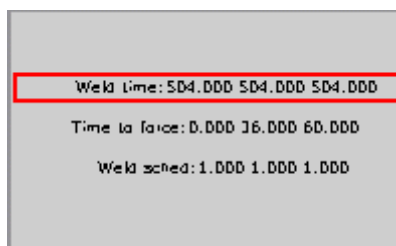
Fig 11.6.5(b) List of statistical information

3   Fig. 11.6.5.(c) will be displayed.
4   To change a target…
     a. Touch the target item text box.
     b. Item list box will be displayed.
     c. Select the item you would like to set to target from the list.

5   After every target has been setup, press OK button.
6   If you would like to back to previous filtering conditions, press Cancel button, the new filtering conditions are ignored and back to previous filtering conditions.
7   If you would like to reset every filtering condition, press Erase button, the every filtering condition is initialized.

Procedure 11-22   Show and setup statistical information dialog with key

Condition
1   No dialog is displayed.

Step
1   Press F2 "SELECT".
2   Press the [NEXT] key
3   Press F4 key twice
4   Fig. 11.6.5.(c) will appear.
5   To change a target…
    a. Move cursor on the target item text box and press the [ENTER] key.
    b. Item list box is appeared.
    c. Select the item you would like to set to target from the list.
6   After every target has been setup, move cursor on OK button and press the [ENTER] key.
7   If you would like to back to previous filtering conditions, move cursor on Cancel button and press the [ENTER] key.   The new filtering conditions are ignored and back to previous filtering conditions.
8   If you would like to reset every filtering condition, move cursor on Erase button and press the [ENTER] key. The every filtering condition is initialized.
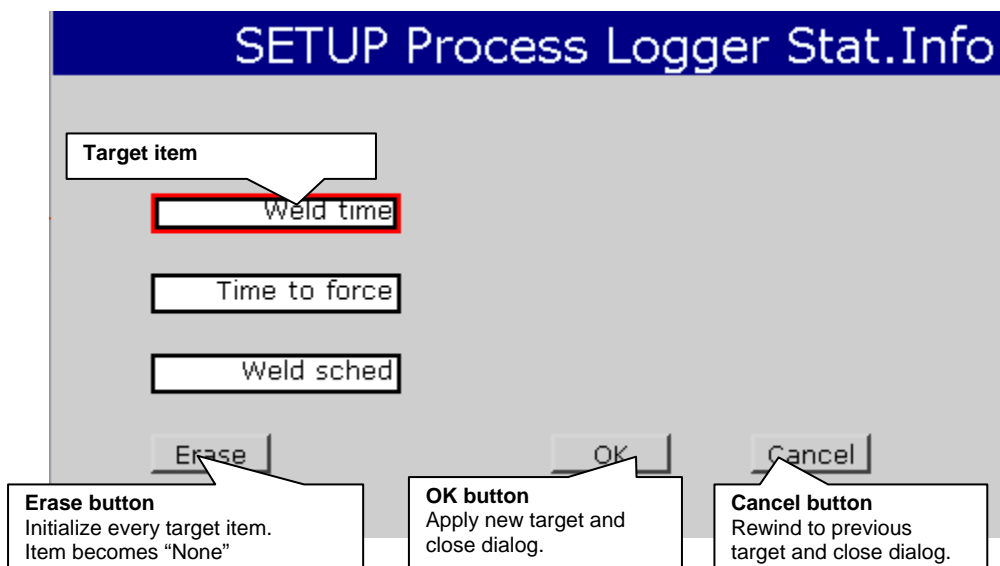
Fig 11.6.5(c) Statistical information setup dialog

When statistical information is setup, the following sub window is appeared at right-middle of 4D Process Logger screen. This sub window shows statistical information of current selecting process.
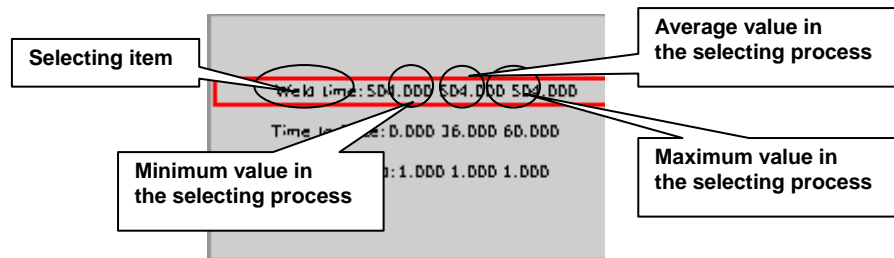
Fig 11.6.5(d) Sub window for statistical information

11.6.6   Chart

Chart feature show time-series behavior of each target item in a process.

Procedure 11-23   Show and setup chart dialog with touch

Condition
1   *i*Pendant has touch panel

Step
1   Press F2 "SELECT".
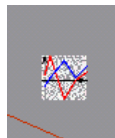2   Touch the following statistical chart icon.

Fig 11.6.6(a)Chart icon

3   Fig. 11.6.6.(b) will be displayed.
4   To change the selecting process…
     a. Press ">" button on the top of dialog to forward the process.
     b. Press "<" button on the top of dialog to backward the process.
     The selecting process ID is displayed at the text box between the buttons.
5   To change a target…
     a. Touch the target item text box.
     b. Item list box will be displayed.
     c. Select the item you would like to set to target from the list.
6   To change the executed date of record…
     a. Press ">" button on the bottom of dialog to forward executed date.
     b. Press "<" button on the bottom of dialog to backward executed date.
     The selecting executed date is displayed at the text box between the buttons.
     When executed date is changed, the record data displayed at below of each record item text box is
also changed.

Procedure 11-24   Show and setup chart dialog with touch

Condition
1   No dialog is displayed.

Step
1   Press F2 "SELECT".
2   Press the [NEXT] key
3   Press F4 key three times.
4   The following dialog will be displayed.
5   To change the selecting process…
     a. Move cursor on ">" button on the top of dialog and press the [ENTER] key to forward the

process.
b. Move cursor on "<" button on the top of dialog and press the [ENTER] key to backward the
   process.
The selecting process ID is displayed at the text box between the buttons.

6   To change a target…
a. Move cursor on the target item text box and press the [ENTER] key.
b. Item list box will be displayed.
c. Select the item you would like to set to target from the list.

7   To change the executed date of record…
a. Move cursor on ">" button on the bottom of dialog and press the [ENTER] key
to forward executed date.
b. Move cursor on "<" button on the bottom of dialog and press the [ENTER] key
to backward executed date.
The selecting executed date is displayed at the text box between the buttons.

When executed date is changed, the record data displayed at below of each record item text box is
also changed.
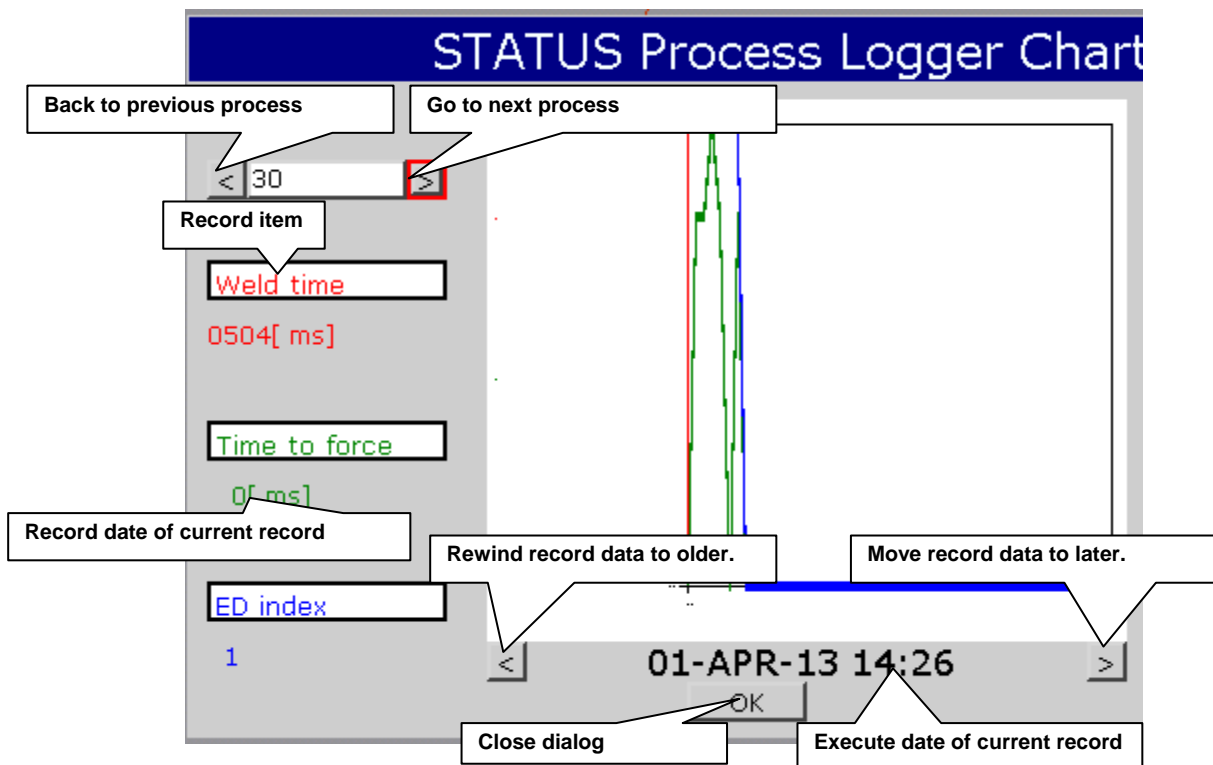
Fig 11.6.6(b) Chart dialog on 4D Process Logger screen

12 SPOT CONFIGURATION TRANSPLANT FUNCTION

12.1 OVERVIEW

Configurations for SPOT/servogun can be transplanted from other controller by this function.
- Parameter file for transplant is generated based on choice of output or not for each setup
- Parameter of other gun can be loaded because it does not include gun characteristics
- All operation can be done on teach pendant
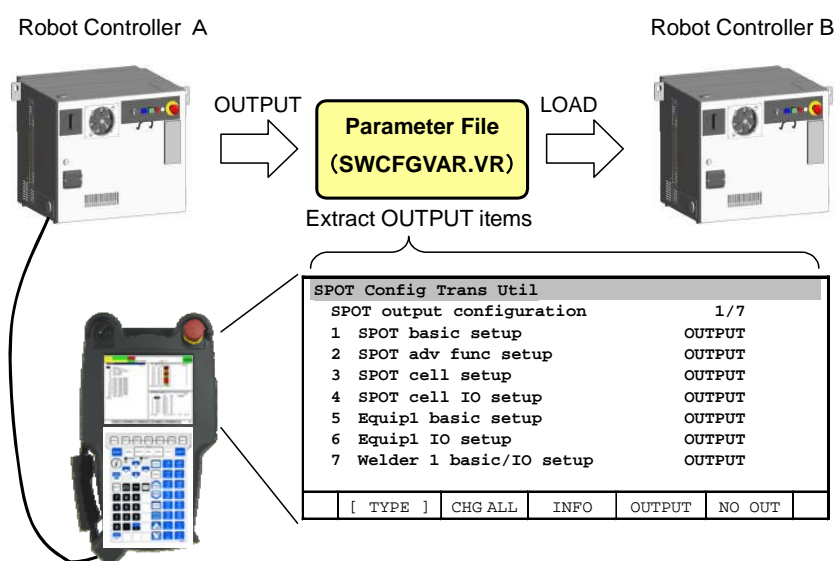
NOTE
SPOT configuration transplant function is option software. (A05B-2600-J890)

NOTE
Parameter file cannot be loaded if setup for equipment/welder/gun is different.
Please refer to 12.5 LIMITATION for more details.

All operations for this function are done on SPOT Config Trans Util screen.

Procedure 12-1   Display SPOT Config Trans Util Screen

1   Press the [MENU] key, then select UTILITIES.
2   Press F1 [TYPE] key.
3   Select "SPOT Cfg Trans". The following screen will be displayed.

12.2   OUTPUT CONFIGURATION

This section describes a procedure to specify output items.

Procedure 12-2   Display Output Configuration Screen

1   Press the [MENU] key, then select UTILITIES.
2   Press F1 [TYPE].
3   Select "SPOT Cfg Trans". SPOT Config Trans Util screen will be displayed.
4   Move cursor on "Configure output", then press the [ENTER] key. The following screen will be displayed.

```
SPOT Config Trans Util
  SPOT/SVGN Config Trans Utility      1/3
  1  Comment:                      SPOT01
  2  SPOT Setup:              <*DETAIL*>
  3  Servogun Setup:          <*DETAIL*>

     [ TYPE ]
```

Table 12.2 Output Configuration screen

ITEM	Description
Comment	Specify comment for the parameter file. This comment is displayed when loading the parameter file. Use this comment if multiple parameter files are used.
SPOT Setup	Display output configuration screen for SPOT function.
Servogun Setup	Display output configuration screen for servogun function. NOTE: This item is not displayed when system has no servogun.

12.2.1   SPOT Output Configuration

Output configuration about SPOT function is done in this screen.
Move the cursor on a line and press F4 "OUTPUT", F5 "NO OUT" to select output or not. F2 "CHG ALL" key change all items at one time. F3 "INFO" key displays settings that are output by the item.

```
SPOT Config Trans Util
  SPOT output configuration         1/7
  1  SPOT basic setup              OUTPUT
  2  SPOT adv func setup           OUTPUT
  3  SPOT cell setup               OUTPUT
  4  SPOT cell IO setup            OUTPUT
  5  Equip1 basic setup            OUTPUT
  6  Equip1 IO setup               OUTPUT
  7  Welder 1 basic/IO setup       OUTPUT

     [ TYPE ]  CHG ALL   INFO   OUTPUT   NO OUT
```

The following table shows save content for each item.

Table 12.2.1 SPOT output configuration

ITEM	Description (save contents)
SPOT basic setup	Number of SPOT equipment Number of SPOT welder Settings that are not depending on equipment/welder
SPOT adv func setup	Settings on SPOT adv func screen
SPOT cell setup	Settings related to SPOT on cell setup screen
SPOT cell IO setup	Settings related to SPOT on cell IO setup screen

ITEM	Description (save contents)
Equip# basic setup	Settings on SPOT equipment setup
	Settings related to equip# on SPOT config screen
Equip# IO setup	Settings on SPOT equipment IO setup screen
Welder # basic/IO setup	Settings related to welder# on SPOT config screen
	Settings on SPOT welder IO setup

NOTE

Don't output "Welder# basic/IO setup" if different welder is used. For example, if robot controller A uses welder A with integral timer and robot controller B uses welder B with digital signal, don't output "Welder# basic/IO setup".

12.2.2   Servogun Output Configuration

Output configuration about servogun function can be done in this screen.
Configuration for each gun is required.

```
SPOT Config Trans Util
 SVGN output configuration           1/2
 1  GUN 1:                     <*DETAIL*>
 2  GUN 2:                     <*DETAIL*>


    [ TYPE ]
```

Move the cursor on a line and press F4 "OUTPUT", F5 "NO OUT" to select output or not. F2 "CHG ALL" key change all items at one time. F3 "INFO" key displays settings that are output by the item.

```
SPOT Config Trans Util
 SVGN output configuration           2/9
 1  comment:                        GUN1
 2  tip wear comp setup           OUTPUT
 3  gun sag comp enable/disable   OUTPUT
 4  gun close direction (robot)   OUTPUT
 5  pressure calibration setup    OUTPUT
 6  pressure schedule             OUTPUT
 7  distance schedule             OUTPUT
 8  manual backup                 OUTPUT
 9  manual thickness table        OUTPUT

  [ TYPE ] CHG ALL   INFO   OUTPUT  NO OUT
```

The following table shows save content for each item.

Table 12.2.2 Servogun Output Configuration

ITEM	Description (save contents)
comment	Comment for this gun (this is displayed when loading parameter file)
tip wear comp setup	Tip wear comp enabled/disabled
	Max wear value (Gun)
	Inform signal (Gun)
	Increased error (Gun)
	Max wear value (Robot)
	Inform signal (Robot)
	Increased error (Robot)
gun sag comp enable/disable	Gun sag comp enabled/disabled
gun close direction (robot)	Close direction frame type
	Close direction frame number
	Close direction

ITEM	Description (save contents)
pressure calibration setup	Pressuring time Thickness of gauge Gun open value Pressure 1~15
pressure schedule	Pressure schedule
distance schedule	Distance schedule
manual backup	Manual backup
manual thickness	Manual Thickness table

12.3   OUTPUT PARAMETER FILE

This section describes a procedure to output parameter file to an external device.

Procedure 12-3   Output Parameter File

1   Press the [MENU] key, then select UTILITIES.
2   Press F1 [TYPE].
3   Select "SPOT Cfg Trans". SPOT Config Trans Util screen will be displayed.
4   Move the cursor on "Output parameters" and press the [ENTER] key. The following screen will be displayed.

```
SPOT Config Trans Util
  Output parameter file          1/15
  The output file :  MC:SWCFGVAR.VR
  The following items will be output.
  Select F4 [OUTPUT] if you OK.
  Press prev key if not want to output.
  Select output device on FILE screen.

  Items will be output.
   Date: 03-SEP-13 15:59
   Comment:
  *** SPOT ***
  SPOT basic setup

  [ TYPE ]              OUTPUT
```

5   Move the cursor up/down and confirm output items.
6   Press F4 "OUTPUT" key. Confirmation screen is displayed, then select "YES".

Parameter file (SWCFGVAR.VR) is output to root directory of selected device. (selected device is "MC:" in the above screen)

12.4   LOAD PARAMETER FILE

This section describes a procedure to load parameter file.

> **NOTE**
> Copy parameter file to root directory of a device preliminarily. This function cannot recognize a parameter file which is placed on subdirectory.

> **NOTE**
> Select device which has parameter file on FILE screen preliminarily.

Procedure 12-4   Load Parameter File

1   Press the [MENU] key, then select UTILITIES.
2   Press F1 [TYPE].
3   Select "SPOT Cfg Trans". SPOT Config Trans Util screen will be displayed.
4   Move the cursor on "Load parameters", then press the [ENTER] key. The following screen will be displayed.

```
SPOT Config Trans Util
 Load parameter file           1/15
 The load file :  MC:SWCFGVAR.VR
 The following items will be loaded.
 Select F4 [LOAD] if you OK.
 Press prev key if not want to load it.
 Select loading device on FILE screen.

 Items will be loaded.
  Date: 13- 9- 3   16:00
  Comment:
 *** SPOT ***
  SPOT basic setup


     [ TYPE ]                      LOAD
```

7   Move the cursor up/down and confirm load items.
8   Press F4 "LOAD" key. Confirmation screen is displayed, then select "YES".

Parameter file (SWCFGVAR.VR) is loaded from selected device. (selected device is "MC:" in the above screen)
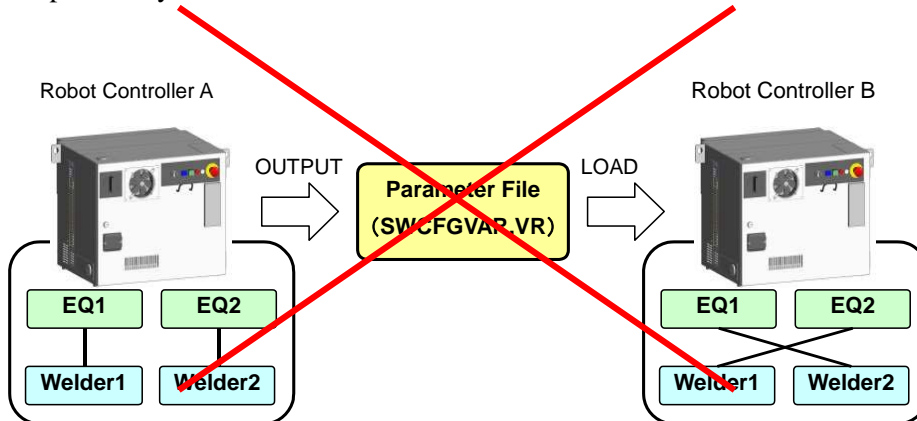
12.5   LIMITATION

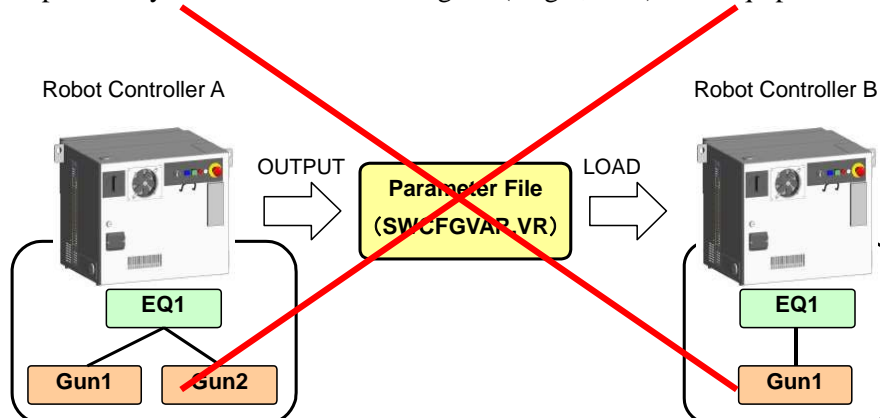- Cannot transplant to system whose number of equipments is different.
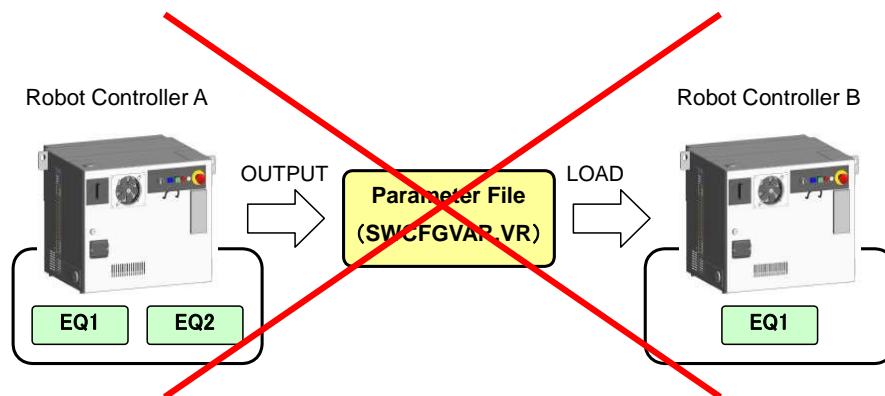
- Cannot transplant to system whose number of welders is different.
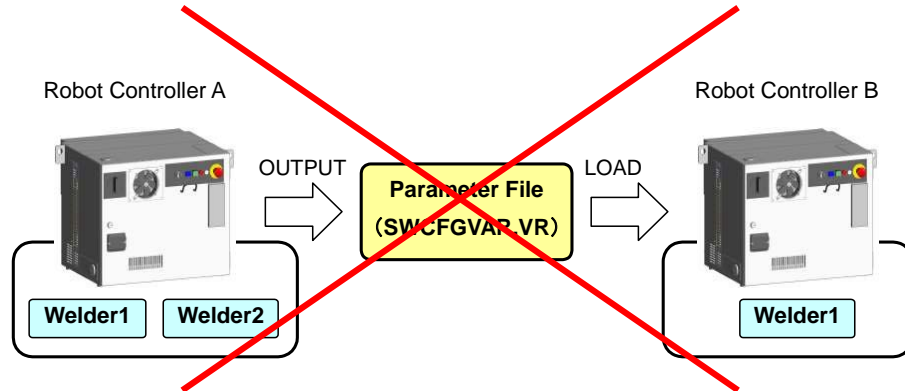
- Cannot transplant to system whose relation of connection is different.

- Cannot transplant to system whose number of guns (single, dual) for a equipment is different.

- Can transplant to gun change system even if number of servoguns is different. Note that number of servogun does not increase even if Robot Controller A has more servoguns than Robot Controller B. This function configures servoguns which has been already configured on the controller.
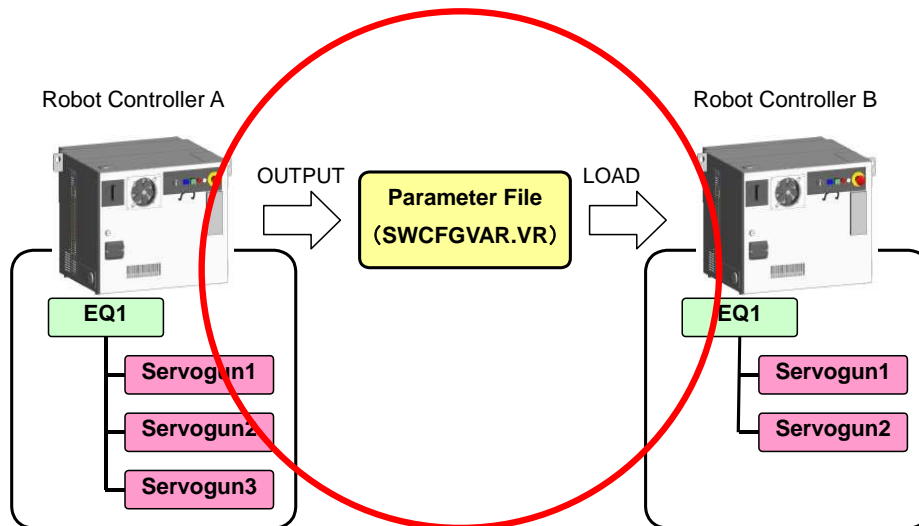
- Don't output "Welder# basic/IO setup" if different welder is used. For example, if robot controller A uses welder A with integral timer and robot controller B uses welder B with digital signal, don't output "Welder# basic/IO setup".
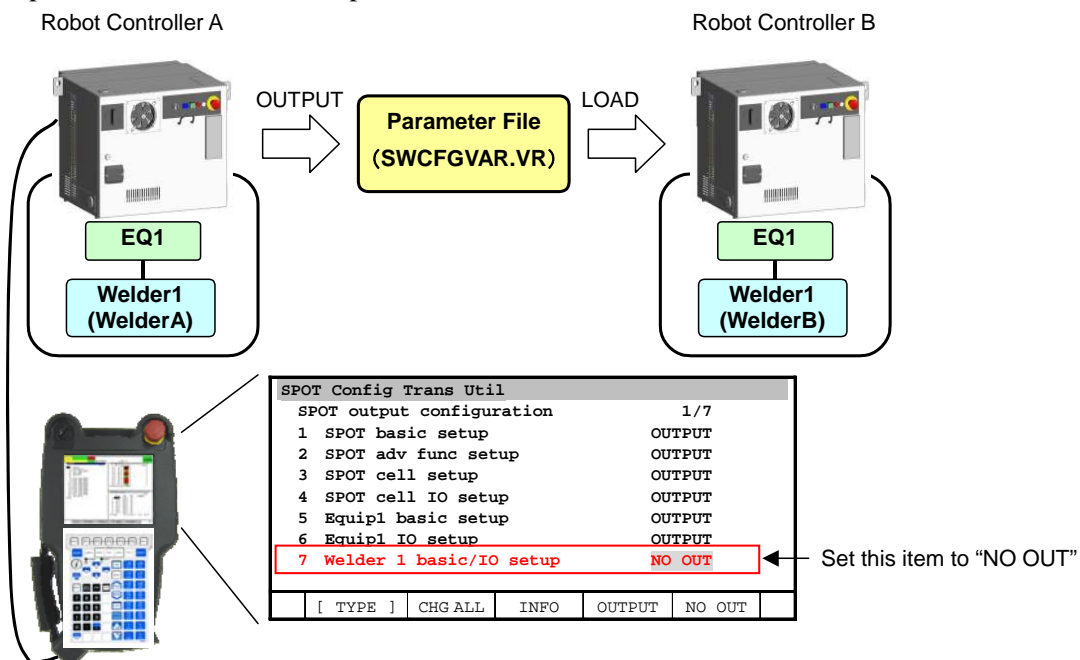
APPENDIX

A   SPOTTOOL+ SUPPLEMENTARY NOTE

Contents of this appendix

A.1   SPOT MACRO

The SpotTool+ software provides predefined macro programs to assist in the spot welding process. There are 9 predefined macro commands.

To use the predefined macro commands, you must assign the I/O signal used with each macro command to match the corresponding cell I/O signal. For some macro commands, you must also record a position. The macro command must be inserted at the point in the program where it is required for the robot and workcell to communicate properly.

Table A.1 lists and describes the SpotTool+ predefined macros. Table A.1 also identifies the signal assignments that need to be made in each macro program.

Note: The predefined macros listed in Table A.1 might differ for customized software packages.

Table A.1 Spot macros

Macro Instruction Name	Macro Program	I/O Signal Assignment	Description (bold type indicates the signal)
clr of transfer	clr_tran	DO[...]=ON	SetClear of transfer output on
enter I-zone	ENTR1ZON	DO[...]=OFF WAIT DI[...]=ON	Set Clear of Zone **n** output off. Waiting for Zone **n** is clear input to go on. **n** is the number of the zone, which is a parameter passed into the macro program.
exit I-zone	EXIT1ZON	DO[...]=ON	Set Clear of Zone **n** output on **n** is the number of the zone, which is a parameter passed into the macro program.
SAFE ZONE	SAFEZONE	EXIT I-ZONE 1 EXIT I-ZONE 2 EXIT I-ZONE 3 EXIT I-ZONE 4 EXIT I-ZONE 5 EXIT I-ZONE 6	SetClear of Zone 1output on SetClear of Zone 2output on SetClear of Zone 3output on SetClear of Zone 4output on SetClear of Zone 5output on SetClear of Zone 6output on

Macro Instruction Name	Macro Program	I/O Signal Assignment	Description (bold type indicates the signal)
Move to home	mov_home	CALL GET_HOME[int, int] J PR[1] 100% FINE	This signal moves the robot to **HOME position** as defined in reference position 1. You can use the first of two optional integer parameters to select one of three defined home positions. Valid values for the first integer value of GET_HOME[int, int] are 1 through 3. The second optional integer parameter allows you to select a motion group. If you only have one motion group defined, the second integer value of GET_HOME[int, int] defaults to 1. Valid values for the second integer value of GET_HOME[int, int] are 1 through 5. NOTE: To use the home macro command, you must record reference position 1 as the home position. When the robot is at the HOME position the UOP output ATPERCH will be ON.
move to repair	mov_repr	DO[...]=ON	Set **At repair** output ON NOTE: To use the repair macro command, you must add position instructions to move the robot to the repair position.
at pounce	atpounce	DO[...] = ON DO[...]=ON WAIT DI[...]=ON DO[...]=OFF	Set **Process complete** output ON Set **At pounce** output ON Wait for **Leave pounce** input Set **At pounce** output OFF
open clamp early	opnclmer	DO[...]=ON	Set **Open clamps early** output ON
reposition clamp	repos_cl	DO[...]=ON WAIT DI[...]=ON DO[...]=OFF	Set **Reposition clamps** output ON Waiting for **Reposition clamp** input to go ON Set **Reposition clamps** output OFF

A.2   MULTI APPLICATION

The following menu items in controlled start menu are related to multi application.
- Appl-select
- Seal Config
- Handling Config

In SpotTool+, you can select following application tools.
- DispenseTool plugin
- HandlingTool plugin

In the Appl-slect menu, you can select the using application.

All teach pendant keys and LED indicators correspond to the currently selected application. The currently selected application is displayed in the middle of the screen name line on the teach pendant screen. If more than one application has been enabled during a controlled start, you can toggle between them by pressing FCTN and selecting Change APPL-Tool. The character abbreviations are as follows: DI for dispensing, HT for material handling, and SW for spot welding.

If you have enabled more than one application (such as spot welding, dispensing, or material handling) during software installation, you must set the application mask item to the application you want to use in

your program header. After you specify the application to use in your program header, the program instructions and function key labels will change to reflect the application you specified.
Note: You can not use the different application instruction in a program.

NOTE
    The following operation is normally once performed at the time of system setup.
    About operation, the operator experts in controlled start operation.

Procedure A-1   Selection of Application

STEP
1   Perform a Controlled Start.
2   Press the [MENU] key.
3   Select NEXT then select Appl-select.

```
Appl selection
                                          1/3

      1 Spot Weld                    TRUE
      2 Handling                     FALSE
      3 Dispense:                    FALSE


     [TYPE]                    TRUE    FALSE
```

4   The item to be used set TRUE.

NOTE
    As default, Spot Weld is TRUE.
    About the detail of Handling, refer to OPERATOR'S MANUAL (Basic Operation)
    (B-83284EN).
    About the detail of Dispense, refer to Dispense Function OPERATOR'S
    MANUAL (B-83284EN-5).

A.3   APPLICATION STATUS

The Application Status screen displays the teach pendant key and LED indicators used for the currently selected application. Available applications are enabled at controlled start. The current application is selected either using the FCTN menu or from within a teach pendant program.

Table A.3 Application status screen items

Item	Description
USERKEYS	This item lists the use of teach pendant user keys U1 through U7 for the currently selected application.
LEDS on TP	This item lists the use of teach pendant LEDs L1 through L3 for the currently selected application.

Procedure A-2   Displaying Application Status

Step
1   Press STATUS.
2   Press F1, [TYPE].
3   Select Appl-status. The following screen will be displayed.

```
┌─────────────────────────────────────────────────────┐
│ Application Status                                    │
│                                                       │
│    SpotTool                                           │
│    USERKEYS                    LEDS on TP             │
│    U1 : GUN                    L1 : GUN ENBL          │
│    U2 : BACKUP                 L2 : WELD ENBL         │
│    U3 : EQUIP                  L3 : I/O ENBL          │
│    U4 : MAN FCTNS                                     │
│    U5 : STATUS                                        │
│    U6 : I/O                                           │
│    U7 : POSITION                                      │
│                                                       │
│                                                       │
│  ┌───────┬───────┬───────┬───────┬───────┬───────┐   │
│  │[TYPE] │       │       │       │       │       │   │
│  └───────┴───────┴───────┴───────┴───────┴───────┘   │
└─────────────────────────────────────────────────────┘
```

NOTE
    The screen for the currently selected application will be displayed.

A.4   ALARM RECOVERY

You can monitor faults from the ALARM RECOVERY screen.
If a fault occurs while a production style is running, you can recover from the fault using the ALARM Recovery screen. This screen contains a description of the error and the appropriate actions you must take to recover from the error.
ALARM Recovery Screen Example is below:

Procedure A-3   Displaying Alarm Recovery

Step
1   Press the [MENU] key.
2   Select ALARM.
3   Press F1, [TYPE].
4   Select Recovery. ALARM Recovery Screen is displayed. Below is example.

```
┌─────────────────────────────────────────────────────┐
│ ALARM Recovery                                        │
│                                                       │
│    ERROR:   A MAJOR ALARM input was received         │
│             from the weld controller.                │
│                                                       │
│    ACTION:  Check the weld controller for            │
│             the cause of this alarm.  Press          │
│             F4 [CHOICE] to select recovery           │
│             option.                                  │
│                                                       │
│ Perform action, then press [CHOICE].                 │
│                                                       │
│  ┌───────┬───────┬───────┬─────────┬───────┬──────┐  │
│  │[TYPE] │       │       │[CHOICE] │       │      │  │
│  └───────┴───────┴───────┴─────────┴───────┴──────┘  │
└─────────────────────────────────────────────────────┘
```

If a fault occurs for which no specific error or action text exists, you will see the following screen.
ALARM Recovery Screen Without Specific Error and Action Text is below:

```
┌─────────────────────────────────────────────────────┐
│ ALARM Recovery                                        │
│                                                       │
│    ERROR:   An undefined error has occurred          │
│             (one for which no fault recovery         │
│             sequence is provided).                   │
│                                                       │
│    ACTION:  Press FAULT RESET to clear the           │
│             error.                                   │
│                                                       │
│                                                       │
│  ┌───────┬───────┬───────┬───────┬───────┬───────┐   │
│  │[TYPE] │       │       │       │       │       │   │
│  └───────┴───────┴───────┴───────┴───────┴───────┘   │
└─────────────────────────────────────────────────────┘
```

[CHOICE] Screens

Depending on the error that has occurred, you could see one of the following recovery choices.

The screen displayed when you press F4, [CHOICE], varies depending on whether the fault is a weld fault, a non-weld fault, or a water saver fault. Refer to the following table for each [CHOICE] menu and description of each kind of [CHOICE] screen.

> ⚠ **WARNING**
> When you initiate or select Fast Fault Recovery, the program will be executed immediately. Be ready for the robot to move before you initiate or select Fast Fault Recovery; otherwise, you could injure personnel or damage equipment.

> **NOTE**
> Fast fault recovery items will be displayed only if the fast fault recovery option has been installed.

Table A.4(a) [CHOICE] Screens

Condition	[CHOICE] Menu	
Weld Fault without stud backup gun enabled	1	Retry weld and continue program
	2	Skip weld and continue program
	3	Initiate fast fault recovery
Non-weld fault	1	Cont. Weld/Wet
	2	Cont. NoWeld/Dry
	3	Cont. NoStrok/Dry
	4	Fast fault recovery
	5	Disable alarm
Water Saver Fault	1	Reset water saver; resume in WELD
	2	Bypass water sav; resume in NOSTROKE
	3	Initiate fast fault recovery
	4	Disable alarm
Stud Welding Fault	1	Skip Weld
	2	Retry Weld
	3	Chg Gun & Skip
	4	Chg Gun & Retry
	5	Man. Chg & Skip
	6	Man. Chg & Retry
	7	Fast Fault Recov.
Dispensing Fault	1	Initiate fast fault recovery
Motion Fault	1	Jog to position where TP was enabled
	2	Continue from current position
Material Handling Fault	1	Continue from current position
	2	Fast Fault recov
	3	Disable alarm

Table A.4(b) [CHOICE] screen menu items

Screen	Item	Description
Weld Fault (SpotTool+)	**Retry weld and continue program**	This item automatically resets the fault and resumes the program. The weld that caused the fault will be retried. If the weld fails again, the program will pause and the appropriate ERROR/ACTION Recovery screen will be displayed.
	Skip weld and continue program	This item automatically resets the fault and resumes the program. The weld that caused the fault will not be retried.
	Initiate fast fault recovery	This item initiates the fast fault recovery sequence. This item will only be displayed if the fast fault recovery option has been installed.

Screen	Item	Description
Non-Weld Fault (SpotTool+, DispenseTool, Material Handling, and Stud Welding)	**Continue Weld/Wet**	This item prompts the user to reset the fault (if required) and to press CYCLE START. When a CYCLE START is received, the program is resumed.
	Continue Noweld/Dry	This item prompts the user to reset the fault (if required) and to press CYCLE START. When a CYCLE START is received, the program is resumed, and NOWELD or DRY mode is set automatically.
	Continue Nostroke/Dry	This item prompts the user to reset the fault (if required) and to press CYCLE START. When a CYCLE START is received, the program is resumed, and NOSTROKE and NOWELD or DRY mode are set automatically.
	Fast fault recovery	This item initiates the fast fault recovery sequence. This item will only be displayed if the fast fault recovery option has been installed.
	Disable alarm	This item allows you to disable the fault. Refer to the next section for more information.
Stud Welding Fault	**Skip weld**	Automatically resets the fault and resumes the program. The weld that caused the fault will not be retried.
	Retry weld	Automatically resets the fault and resumes the program. The weld that caused the fault will be retried. If the weld fails again, the program will pause and the appropriate ERROR/ACTION Recovery screen will be displayed.
	Change gun and skip*	The robot drops off the currently attached gun in the tool changer, picks up the other gun, then skips the weld. Note You must reset the stud welding controller before a Change Gun and Skip Weld can occur.
	Change gun and retry*	The robot drops off the currently attached gun in the tool changer, picks up the other gun, and then retries the weld. Note You must reset the stud welding controller before a Change Gun and Retry Weld can occur.
	Fast fault recovery	The fast fault recovery sequence is initiated. This item will only be displayed if the fast fault recovery option has been installed.
Stud Welding Fault	**Manual change and skip**	The currently executing teach pendant program is completed in NOSTROKE and NOWELD modes and will return to the HOME position where manual repairs or a stud gun change can be done. When manual repairs or a stud gun change are completed, press CYCLE START; the robot will return in NOSTROKE and NOWELD modes to the position after the location where the original fault occurred, then continue welding. Note You must reset the stud welding controller before a Manual Change and Skip can occur.
	Manual change and retry	The currently executing teach pendant program is completed in NOSTROKE and NOWELD modes and will return to the HOME position where manual repairs or a stud gun change can be done. When manual repairs or a stud gun change are completed, press CYCLE START; the robot will return in NOSTROKE and NOWELD modes to the location where the fault occurred, and continue welding. Note You must reset the stud welding controller before a Manual Change and Retry can occur.

Screen	Item	Description
Water Saver Fault (SpotTool+ only)	**Reset water saver; resume in WELD**	Resets the water saver. If successful, the program is resumed with welding enabled.
	Bypass water saver; resume in NOSTROKE	Bypasses the water saver and resumes the program in NOSTROKE.
	Initiate fast fault recovery	The fast fault recovery sequence is initiated. This item will only be displayed if the fast fault recovery option has been installed.
	Disable alarm	This item allows you to disable the fault. Refer to the next section for more information.
Motion Fault (Definable Resume option)	**Jog to position where TP was enabled**	Jog the robot to a location that is within the stop tolerance. The robot will check again whether it is out of resume tolerance. If it is out of stop tolerance, the prompt box is displayed again.
	Continue from current position	The robot will move from the current position to the stop position and continue the program. The robot does not check whether it is out of stop tolerance, and the prompt box is not displayed again.
Material Handling Fault	**Continue from current position**	The robot will move from the current position to the stop position and continue the program. The robot does not check whether it is out of stop tolerance, and the prompt box is not displayed again.
	Fast Fault Recov.	The fast fault recovery sequence is initiated. This item will only be displayed if the fast fault recovery option has been installed.
	Disable alarm	This item allows you to disable the fault. Refer to the next section for more information. The Alarm Recovery screen is then redisplayed so that an additional recovery choice can be made.

A.5 DISABLE FAULT CHECKING

During program execution, certain alarms involving inputs are monitored. If one of these alarms occurs, you will be given a choice of whether to disable the fault for a certain number of program execution cycles.
You can only disable specific faults, which are shown in following.

Spot Welding	Water saver OK
	Wtr flow OK
	X-former
	Gun detect OK
	Backup detect

You can only disable a fault after it has occurred, and an error message has been displayed.

The following screen will be displayed. If you press F4, [CHOICE], and then select Disable Alarm, the fault that is being disabled is automatically added to the Disabled Faults screen.

```
┌─────────────────────────────────────────────────────┐
│ ALARM Recovery                                        │
│                                                       │
│     ERROR:   The GUN CLOSE DETECT input               │
│              was not received.                        │
│                                                       │
│                                                       │
│     ACTION:  Check the wiring and verify              │
│              that the sens┌───────────────────────┐   │
│              properly. Pre│1 Resume in weld       │   │
│              select recove│2 Resume in noweld     │   │
│                           │3 Resume in nostroke   │   │
│                           │4 Disable Alarm        │   │
│                           └───────────────────────┘   │
│                                                       │
│   ┌──────────┬──────┬───────┬──────────┬──────┬────┐  │
│   │ [TYPE]   │      │       │ [CHOICE] │      │    │  │
│   └──────────┴──────┴───────┴──────────┴──────┴────┘  │
└─────────────────────────────────────────────────────┘
```

Disabled Faults Screen

The Disabled Faults screen gives a status of the alarms that are currently disabled. You can also use the Disabled Faults screen to clear the disabled faults manually.

The fault table is cleared (no faults are disabled) when you Cold start the controller. Otherwise, faults are not cleared automatically and the fault count will continue to increase. You can change the fault count in the Status Disabled Faults screen. A fault's count is incremented at the beginning of each job cycle after the fault is added to the table.

All faults use the same maximum fault count. At the end of each job cycle, every fault count in the fault table is incremented by one. Each time, when certain faults occur, the table is checked:

- If the fault is in the table and the count is less than the current   maximum number of cycles disabled, the alarm is ignored.
- If the count is greater than the current maximum number of cycles disabled, the alarm is displayed.
- If the fault is not in the table, the Alarm Recovery screen is displayed with disable alarm as one of the choices.

The following table lists and describes the items that are displayed on the Status Disabled Faults screen. Following procedure explains how to display the Status Disabled Faults screen and to clear faults manually using this screen.

Table A.5 Disabled faults screen menu items

Item	Description
FAULT NAME	This item displays the name of the fault. You cannot change the fault name on this screen.
TYPE	This item displays the type of input signal that failed. You cannot change the type on this screen.
#	This item displays the port number of the input signal that failed. You cannot change the # on this screen.
SIM	This item displays the simulated status of the input signal that failed: • U is unsimulated • Sis simulated You cannot change the simulated status on this screen.
STATUS	This item displays the current status of the input signal that failed. You cannot change the status on this screen.
CNT	This item displays the number of cycles that have run since this fault was disabled. You can change the cycle count on this screen.
Configuration Menu	
Disabled Faults Option **Default: ENABLED**	This item allows you to specify whether you want to use the Disabled Faults option: • DISABLED means that the Disabled Faults option will not be used. • ENABLED means that the Disabled Faults option will be used.
Max Cycles Disabled **Min: 0** **Max: 9999** **Default: 20**	This item allows you to specify the number of cycles a fault will be disabled. If you set this to 0, the fault will be posted every time it occurs. If you set this to a number other than 0, the fault will be posted only when the number of cycles equals the Max Cycles Disabled you specified.

Procedure A-4   Disabling Fault Checking

Step
1   Press the [MENU] key.
2   Select STATUS.
3   Press F1, [TYPE].
4   Select DisableFault. The following screen will be displayed.

```
Status DsblFaults
                                              1/10
   FAULT NAME          TYPE   #    SIM  STAT  CNT
 1 BU close detect   DI[  10]   U    OFF   8
 2 Gun open detect   DI[  10]   U    OFF   6
 3                   DI[   0]   U    ***   0
 4                   DI[   0]   U    ***   0
 5                   DI[   0]   U    ***   0
 6                   DI[   0]   U    ***   0
 7                   DI[   0]   U    ***   0
 8                   DI[   0]   U    ***   0
 9                   DI[   0]   U    ***   0


    [TYPE]    CONFIG   CLEARFLT
```

5   Review the fault status.
6   To clear a single fault,
     a   Move the cursor to the fault you want to clear.
     b   Press F3, CLEARFLT.

7   To clear all of the faults listed,
     a   Press NEXT, >.
     b   Press F3, CLEARALL.

8   To enable or disable the Disabled Faults option,
     a   Press F2, CONFIG. The following screen will be displayed.

```
Status DsblFaults
                                              1/2

    1 Disable Faults Option:      ENABLED
    2 Max Cycles Disabled:        20



    [TYPE]                     ENABLED  DISABLED
```

     b   Move the cursor to Disable Faults Option.
     c   Press the appropriate key:
          •   To enable the Disable Faults option, press F4, ENABLE.
          •   To disabled the Disable Faults option, press F5, DISABLE.

9   To set the maximum number of cycles a fault will be disabled,
     a   Move the cursor to the fault you want.
     b   Press F2, CONFIG. The following screen will be displayed.

```
┌─────────────────────────────────────────────────┐
│ Status DsblFaults                               │
│                                         1/2     │
│                                                 │
│     1 Disable Faults Option:    ENABLED         │
│     2 Max Cycles Disabled:      20              │
│                                                 │
│                                                 │
│                                                 │
│  ┌──────┬─────┬─────┬─────┬─────┬─────┐         │
│  │[TYPE]│     │     │     │     │     │         │
│  └──────┴─────┴─────┴─────┴─────┴─────┘         │
└─────────────────────────────────────────────────┘
```

    c   Move the cursor to Max Cycles Disabled.

    d   Type the number of cycles you want and press the [ENTER] key.

A.6   ENABLE UI SIGNALS

In SpotTool+, when 3 mode switch is specified to AUTO with STYLE selected to Program select mode, Enable UI singnals in System/Config automatically becomes TRUE. Turn on the power supply again after selecting either RSR, PNS or OTHER to Program select mode when you want to specify Enable UI singals to FALSE with the 3 mode switch specified for AUTO.

INDEX

REVISION RECORD

Edition	Date	Contents
04	Mar.,2017	• Applied to R-30*i*B Plus. • Description for WELD COUNT CHECK FUNCTION is added to Section 3.6.
03	Aug.,2013	• Description for 7DC2 is added.
02	Sep.,2012	• Description for REPLACEMENT OF WELD CONTROLLER is added to Section 10.11. • Description for PROCESS LOGGER is added to Chapter 11.
01	May, 2012	