DX200/DX100/NX100 OPTIONS INSTRUCTIONS

FOR BASIC OPERATION OF STARTING POINT DETECTING FUNCTION

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

MOTOMAN INSTRUCTIONS

MOTOMAN-☐☐☐ INSTRUCTIONS
DX200/DX100/NX100 INSTRUCTIONS
DX200/DX100/NX100 OPERATOR'S MANUAL
DX200/DX100/NX100 MAINTENANCE MANUAL

The DX200/DX100/NX100 operator's manual above corresponds to specific usage.
Be sure to use the appropriate manual.

Part Number: 157327-1CD
Revision: 2

YASKAWA
MOTOMAN ROBOTICS

MANUAL NO.
HW1480804①

MANDATORY

- **This manual explains the starting point detecting function of the DX200/DX100/NX100 system. Read this manual carefully and be sure to understand its contents before handling the DX200/DX100/NX100.**
- **General items related to safety are listed in Section 1 of the DX200/DX100/NX100 instructions. To ensure correct and safe operation, carefully read the section before reading this manual.**

CAUTION

- **Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.**
- **The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.**
- **YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.**
- **If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.**
- **YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.**

Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200/DX100/NX100.
In this manual, the Notes for Safe Operation are classified as “WARNING,” “CAUTION,” “MANDATORY,” or ”PROHIBITED.”

 DANGER	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.
 MANDATORY	Always be sure to follow explicitly the items listed under this heading.
 PROHIBITED	Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations. At any rate, be sure to follow these important items.

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.

WARNING

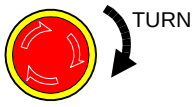
- **Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the DX200/DX100/NX100 and programming pendant are pressed.**
  When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

  Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

  Emergency Stop Button 

- **Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn ON the servo power.**

  Injury may result from unintentional or unexpected manipulator motion.

  Release of Emergency Stop 

- **Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:**
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

  Improper or unintended manipulator operation may result in injury.

- **Confirm that no persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:**
  - Turning ON the DX200/DX100/NX100 power.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

  Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem. The emergency stop buttons are located on the right of the front door of the DX200/DX100/NX100 and the programming pendant.

WARNING

- **Since detected voltage (200V), welding current, and welding voltage are applied to the starting point detecting unit, install the unit securely so that it does not fall.**

- **Failure to observe this warning may result in an electric shock or damage to the unit.**

- **Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the DX200/DX100/NX100 and the welder.**

  Failure to observe this warning may result in an electric shock.

- **Special attention should be paid during starting point detection, since 200 V_{DC} is applied across the wire and the workpiece (welding jig).**

  Failure to observe this warning may result in an electric shock.

- **Do not place any object directly on the cable of the starting point detecting unit.**

  Failure to observe this warning may result in an injury or damage caused by the disconnection of the cable.

- **Attach the cable of the starting point detecting unit for the wire feeder with the wire stand, to protect it from robot movement. If interference between the cable and the peripheral devices is unavoidable, cover the cable with a rubber plate or spiral tube, etc.**

  Failure to observe this warning may result in an electric shock, an injury, or damage to the cable.

- **Do not lay the cable of the starting point detecting unit directly on the floor, but install them in a pit or duct or shield the cable with a protective cover.**

  Failure to observe this warning may result in an injury or damage to the cable.

- **Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables cannot be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.**

CAUTION

- **Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.**

  -Check for problems in manipulator movement.
  -Check for damage to insulation and sheathing of external wires.

- **Always return the programming pendant to the hook on the DX200/DX100/NX100 cabinet after use.**

  The programming pendant can be damaged if it is left in the P-point maximum envelope of the manipulator's work area, on the floor, or near fixtures.

- **Read and understand the Explanation of the Warning Labels before operating the manipulator.**

Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product. The manipulator usually consists of the controller, the programming pendant, and manipulator cable.
In this manual, the equipment is designated as follows.

Equipment	Manual Definition
DX200/DX100/NX100 controller	Controller
DX200/DX100/NX100 programming pendant	Programming pendant
Cable between the manipulator and the controller	Manipulator cable

Descriptions of the programming pendant, buttons, and displays are shown as follows:

Equipment		Manual Designation
Programming Pendant	Character Keys	The keys which have characters printed on them are denoted with [ ]. ex. [ENTER]
	Symbol Keys	The keys which have a symbol printed on them are not denoted with [ ] but depicted with a small picture. ex. page key  The cursor key is an exception, and a picture is not shown.
	Axis Keys Number Keys	“Axis Keys” and “Number Keys” are generic names for the keys for axis operation and number input.
	Keys pressed simultaneously	When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]
	Displays	The menu displayed in the programming pendant is denoted with { }. ex. {JOB}

Description of the Operation Procedure

In the explanation of the operation procedure, the expression "Select • • • " means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or bland names for each company or corporation. The indications of (R) and TM are omitted.

Table of Contents

1 Functional Overview

The starting point detecting function searches for the groove to be welded.

This function helps find the groove regardless of workpiece size dispersion or setting position.

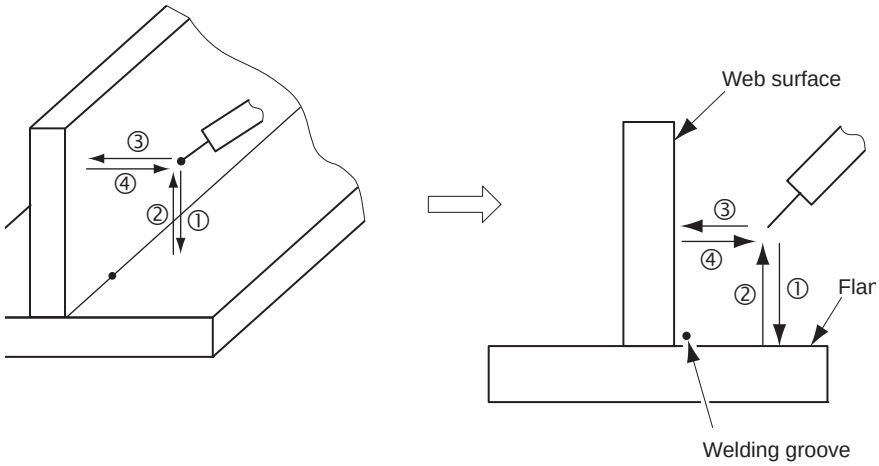


Fig. 1-1: Starting Point Detection

The manipulator moves to positions ① through ✍ as shown in *Fig. 1-1* to find the points where the wire touches the base metal. It then calculates the difference between the taught and actual positions of the flange and the web, and finds the welding groove.

The next figure *Fig.1-2 "Locating Welding Groove"* shows how the flange and the web surface position errors "h" and "l" are used to change the taught position of the groove to the actual position S'.

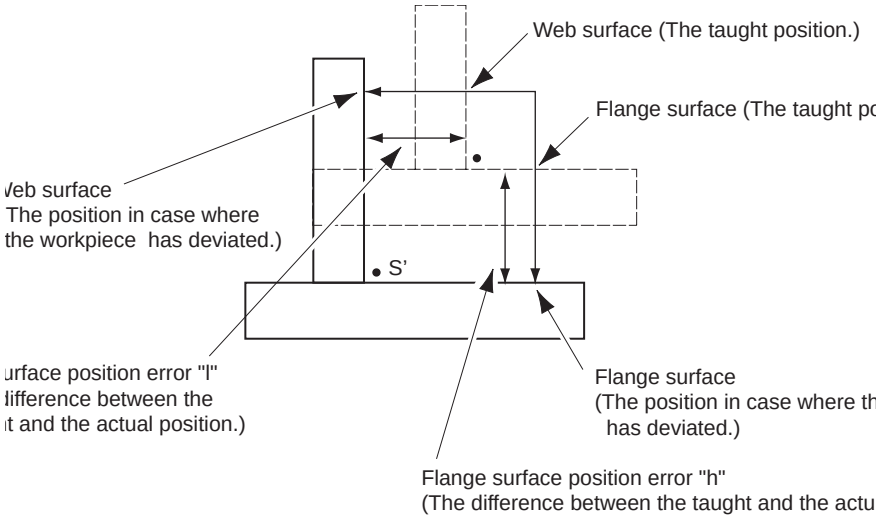


Fig. 1-2: Locating Welding Groove

2 Installation

WARNING

- **Since detected voltage (200V), welding current, and welding voltage are applied to the starting point detecting unit; for safety, install the unit securely so that it will not fall.**

  Failure to observe this warning may result in an electric shock or damage to the unit.

- **Before connecting the inter-unit cables and the welding cables, be sure to turn OFF the power supply to the DX200/DX100/NX100 and the Power Source.**

  Failure to observe this warning may result in an electric shock.

- **Special attention should be paid during starting point detection, since 200 VDC is applied across the wire and the workpiece (including fixture).**

  Failure to observe this warning may result in an electric shock.

Two types of starting point detecting unit are available: standard built-in type and floor-mounted type.

The starting point detecting unit should be installed outside of the manipulator interference area.

For installation method, refer to the instructions for each type on the following page.

2.1 Standard Built-In Type

CAUTION

- **The board for the starting point detecting unit will be shipped in a separate package. Install the board inside the Power Source in setting up the system.**

2.2 Floor-Mounted Type

Basically the floor-mounted type should be installed on the side of the Power Source.

When installing a floor-mounted standand type on top of a welder or other devices, fix the unit securely using four tapped holes M6 prepared on the side of the unit for fall prevention.

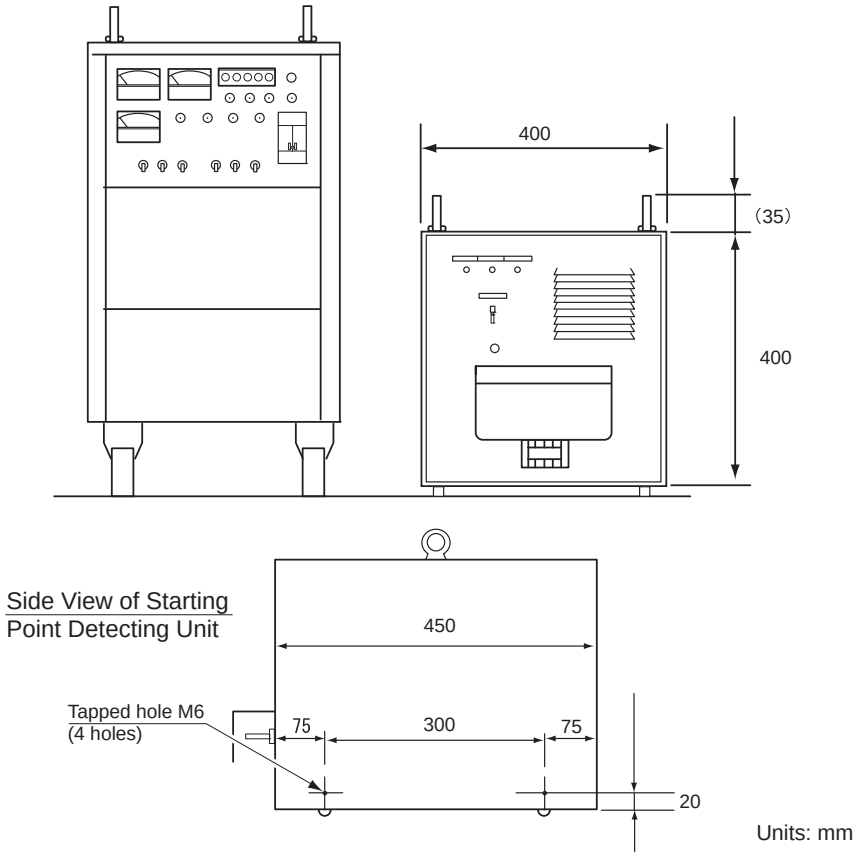


Fig.2-1 Installation of Floor-Mounted Type Unit

3 Wiring

WARNING

- **Do not place any object directly on the cable of the starting point detecting unit.**

  Failure to observe this warning may result in an injury or damage caused by the disconnection of the cable.

- **Attach the cable of the starting point detecting unit for the wire feeder to the wire stand, to protect it from robot movement. If interference between the cable and the peripheral devices is unavoidable, cover the cable with a rubber plate or spiral tube, etc.**

  Failure to observe this warning may result in an electric shock, an injury, or damage to the cable.

- **Do not lay the cable of the starting point detecting unit directly on the floor, but install them in a pit or duct or shield the cable with a protective cover.**

  Failure to observe this warning may result in an injury or damage to the cable.

- **Since a high current flows through the welding cable, separate it from the cables of the control circuit system. If the cables cannot be separated, take preventative measures such as using metallic ducts or tubes on the cables of the control circuit system.**

Perform the wiring in the following manner, referring to the figure below.

1. Connect the 1CN on the starting point detecting unit to the terminal block.
2. Connect the positive (+) terminal of the starting point detecting unit to the positive (+) terminal of the Power Source.
3. Connect the negative (-) terminal of the starting point detecting unit to the torch power supply section on the wire feeder side.
4. For the floor-mounted type, connect the front terminal block of the starting point detecting unit to the welding voltage detecting terminal on the wire feeder side.

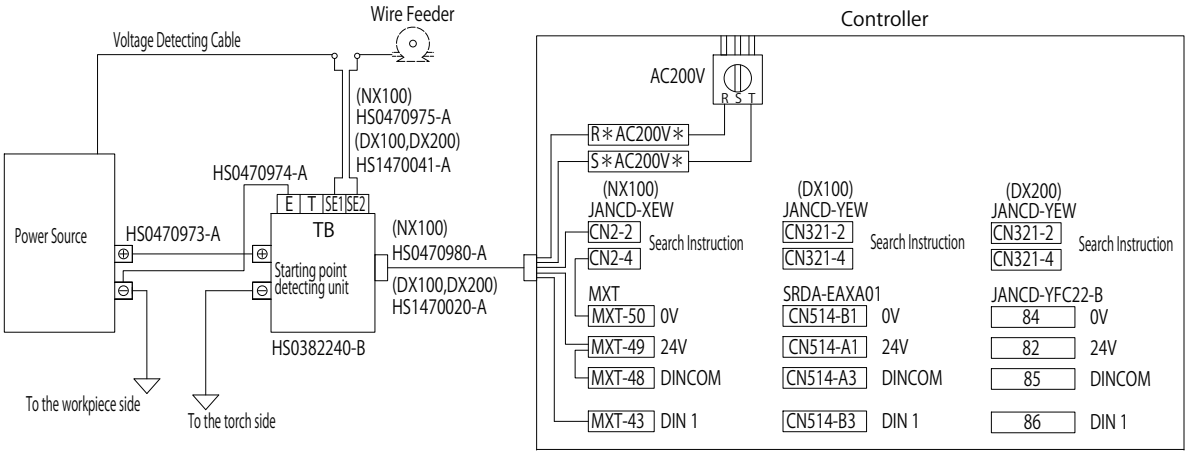


Fig. 3-3(a): Configuration of Starting Point Detecting Unit

3.1 Hardware Setup

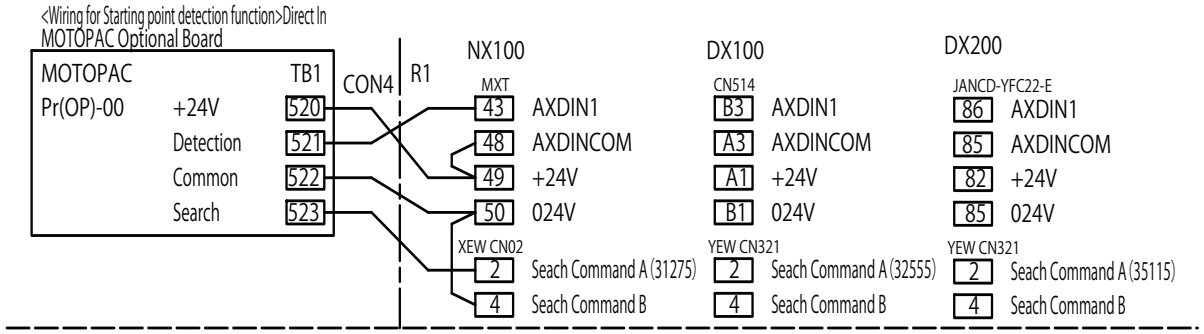


Fig. 3-3(b):

<Wiring for starting point detection function> Direct in The external axies are 4 or more

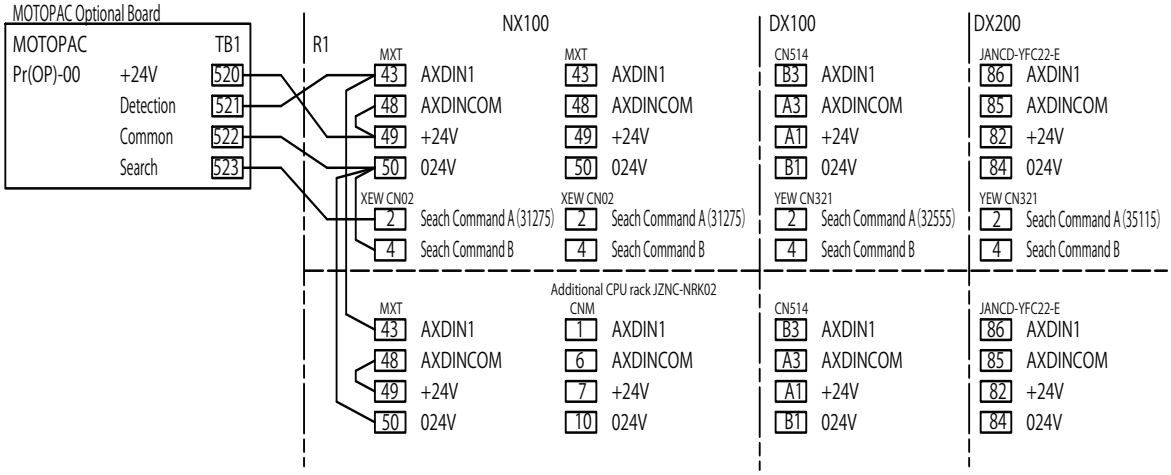


Fig. 3-3(c):

3.2 Software Setup

3.2.1 Loading application JOB.

- Pliease select JOB that suits control group type from the tables below, and load JOB.

Control Group type	Contents
JOB Name	Function(Control Group type)

R1	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)

R1+B1	Contents
HR1B1T1.JBI	Starting point detection for tee fillet(R1+B1)
HR1B1T2.JBI	Corner point detection for tee fillet(R1+B1)
HR1B1T3.JBI	End point detection for tee fillet(R1+B1)

R1+B1+S1	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1+B1)
HR1T2.JBI	Corner point detection for tee fillet(R1+B1)
HR1T3.JBI	End point detection for tee fillet(R1+B1)
HRB1S1T1.JBI	Starting point detection for tee fillet(R1+B1+S1)
HRB1S1T2.JBI	Corner point detection for tee fillet(R1+B1+S1)
HRB1S1T3.JBI	End point detection for tee fillet(R1+B1+S1)

R1+B1+S1+S2	R1+B1+S1+S2
HR1T1.JBI	Starting point detection for tee fillet(R1+B1)
HR1T2.JBI	Corner point detection for tee fillet(R1+B1)
HR1T3.JBI	End point detection for tee fillet(R1+B1)
HRB1S1T1.JBI	Starting point detection for tee fillet(R1+B1+S1)
HRB1S1T2.JBI	Corner point detection for tee fillet(R1+B1+S1)
HRB1S1T3.JBI	End point detection for tee fillet(R1+B1+S1)

R1+B1+S1+S2	R1+B1+S1+S2
HRB1S2T1.JBI	Starting point detection for tee fillet(R1+B1+S2)
HRB1S2T2.JBI	Corner point detection for tee fillet(R1+B1+S2)
HRB1S2T3.JBI	End point detection for tee fillet(R1+B1+S2)

R1+B1+S1+S2+S3	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1+B1)
HR1T2.JBI	Corner point detection for tee fillet(R1+B1)
HR1T3.JBI	End point detection for tee fillet(R1+B1)
HRB1S1T1.JBI	Starting point detection for tee fillet(R1+B1+S1)
HRB1S1T2.JBI	Corner point detection for tee fillet(R1+B1+S1)
HRB1S1T3.JBI	End point detection for tee fillet(R1+B1+S1)
HRB1S2T1.JBI	Starting point detection for tee fillet(R1+B1+S2)
HRB1S2T2.JBI	Corner point detection for tee fillet(R1+B1+S2)
HRB1S2T3.JBI	End point detection for tee fillet(R1+B1+S2)
HRB1S3T1.JBI	Starting point detection for tee fillet(R1+B1+S3)
HRB1S3T2.JBI	Corner point detection for tee fillet(R1+B1+S3)
HRB1S3T3.JBI	End point detection for tee fillet(R1+B1+S3)

R1+R2(JIGLESS)	Contents
HR2T1.JBI	Starting point detection for tee fillet(R2)
HR2T2.JBI	Corner point detection for tee fillet(R2)
HR2T3.JBI	End point detection for tee fillet(R2)
HR2R1T1.JBI	Starting point detection for tee fillet(R1+R2)
HR2R1T2.JBII	Corner point detection for tee fillet(R1+R2)
HR2R1T3.JBI	End point detection for tee fillet(R1+R2)

R1+R2(TWIN)	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)
HR2T1.JBI	Starting point detection for tee fillet(R2)

R1+R2(TWIN)	Contents
HR2T2.JBI	Corner point detection for tee fillet(R2)
HR2T3.JBI	End point detection for tee fillet(R2)

R1+R2+S1(TWIN)	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)
HR1S1T1.JBI	Starting point detection for tee fillet(R1+S1)
HR1S1T2.JBI	Corner point detection for tee fillet(R1+S1)
HR1S1T3.JBI	End point detection for tee fillet(R1+S1)
HR2T1.JBI	Starting point detection for tee fillet(R2)
HR2T2.JBI	Corner point detection for tee fillet(R2)
HR2T3.JBI	End point detection for tee fillet(R2)
HR2S1T1.JBI	Starting point detection for tee fillet(R2+S1)
HR2S1T2.JBI	Corner point detection for tee fillet(R2+S1)
HR2S1T3.JBI	End point detection for tee fillet(R2+S1)

R1+S1	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)
HR1S1T1.JBI	Starting point detection for tee fillet(R1+S1)
HR1S1T2.JBI	Corner point detection for tee fillet(R1+S1)
HR1S1T3.JBI	End point detection for tee fillet(R1+S1)

R1+S1+S2	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)
HR1S1T1.JBI	Starting point detection for tee fillet(R1+S1)
HR1S1T2.JBI	Corner point detection for tee fillet(R1+S1)

R1+S1+S2	Contents
HR1S1T3.JBI	End point detection for tee fillet(R1+S1)
HR1S2T1.JBI	Starting point detection for tee fillet(R1+S2)
HR1S2T2.JBI	Corner point detection for tee fillet(R1+S2)
HR1S2T3.JBI	End point detection for tee fillet(R1+S2)

R1+S1+S2+S3	Contents
HR1T1.JBI	Starting point detection for tee fillet(R1)
HR1T2.JBI	Corner point detection for tee fillet(R1)
HR1T3.JBI	End point detection for tee fillet(R1)
HR1S1T1.JBI	Starting point detection for tee fillet(R1+S1)
HR1S1T2.JBI	Corner point detection for tee fillet(R1+S1)
HR1S1T3.JBI	End point detection for tee fillet(R1+S1)
HR1S2T1.JBI	Starting point detection for tee fillet(R1+S2)
HR1S2T2.JBI	Corner point detection for tee fillet(R1+S2)
HR1S2T3.JBI	End point detection for tee fillet(R1+S2)
HR1S3T1.JBI	Starting point detection for tee fillet(R1+S3)
HR1S3T2.JBI	Corner point detection for tee fillet(R1+S3)
HR1S3T3.JBI	End point detection for tee fillet(R1+S3)

- Please load from the supplied CD.

4 Teaching

This chapter describes the teaching methods of the single starting point detecting function and the coordinated starting point detecting function.

4.1 Single System

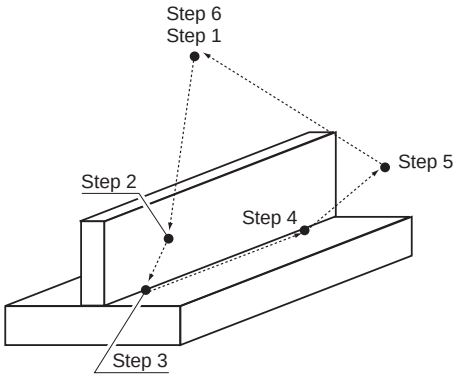
The single manipulator starting point detecting function detects the starting point with a single manipulator including the base axis. Perform the single manipulator starting point detection in the following manner.

4.1.1 Creating a Starting Point

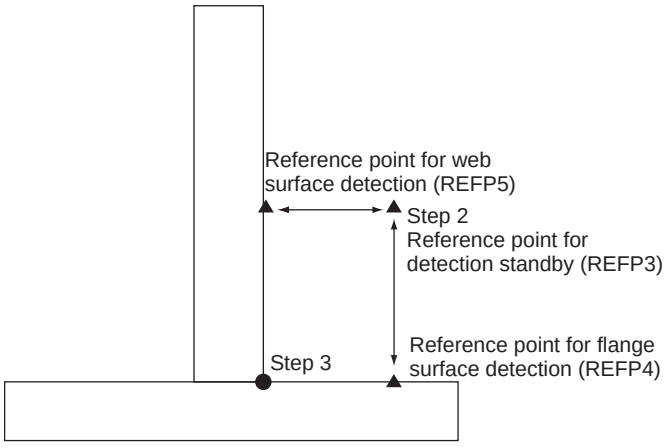
First, create a program for welding and a program for searching the starting point.

1. Create a work job for welding.

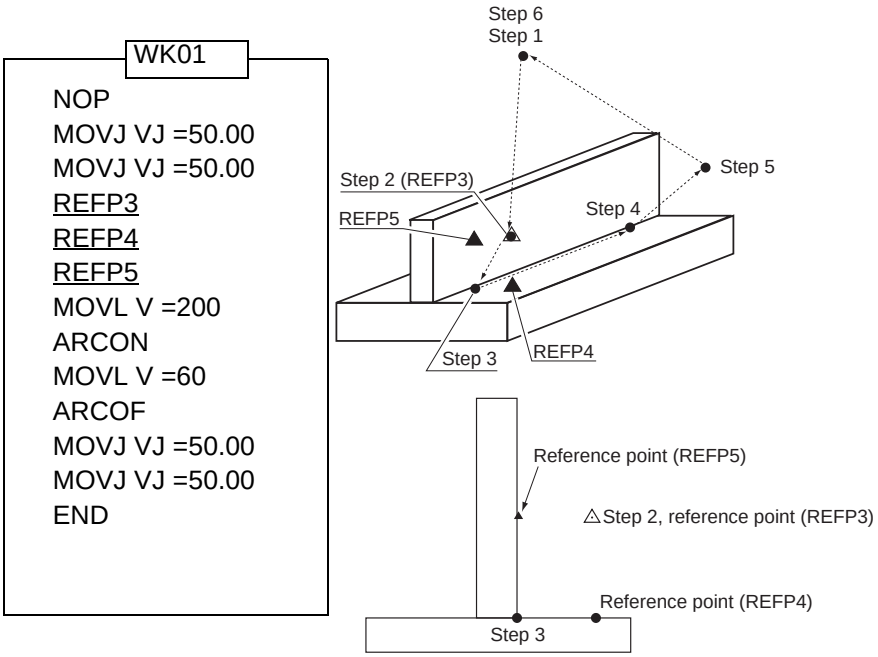
```
WK01
NOP
MOVJ JV =50.00
MOVJ VJ =50.00
MOVL V =200
ARCON
MOVL V =60
ARCOF
MOVJ VJ =50.00
MOVJ VJ =50.00
END
```



2. Teach the following three reference points for defining the detection path near the groove. Add the reference points between the teaching steps 2 and 3.
   - Reference point for detection standby (REFP3)
   - Reference point for flange surface detection (REFP4)
   - Reference point for web surface detection (REFP5)



Locations of Reference Points

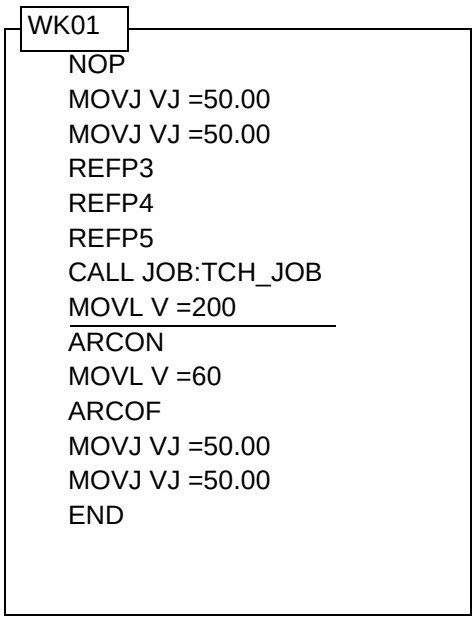


Point Teaching for Defining Detection Path

4.1.1.1 Add the CALL Instruction

Add the CALL instruction for the single starting point detecting job, TCH_JOB, in the work job WK01.

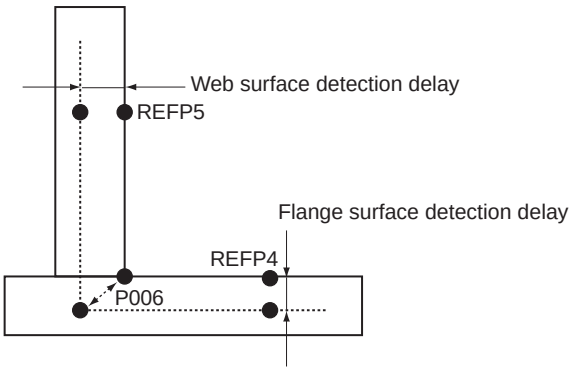
In this example, the single starting point detecting job is named "TCH_JOB".



1. Add an instruction to shift the welding path by the deviation amount to the program. The shift amount for the starting point is set at the position variable “P006” after carrying out the job, “TCH_JOB”.

```
WK01
    NOP
    MOVJ VJ =50.00
    MOVJ VJ =50.00
    REFP3
    REFP4
    REFP5
    CALL JOB:TCH_JOB
    SFTON P006
    MOVL V =200
    ARCON
    MOVL V =60
    ARCOF
    SFTOF
    MOVJ VJ =50.00
    MOVJ VJ =50.00
    END
```

2. Measure the shift amount compensating for detection delay included in the shift amount "P006" at the starting point in advance. Also, when an offset from the groove position is required for welding, measure the offset separately.



Web and Flange Surface Detection Delays

4.1.2 Measuring the Shift Amount Compensating for Detection Delay

1. Execute the starting point detection under the condition when the positions are taught and the workpiece is not offset.
2. Calculate the differences between the detected web surface position and the taught web surface position, and between the detected flange surface position and the taught flange surface position. Register the differences in the position variable P006.
3. Copy the set value at the position variable P006 to P010. This offset amount of P010 is the amount of the detection delay offset.

To subtract the detection delay offset amount P010 from the offset amount P006 obtained by starting point detection, add a subtraction instruction as follows.

```
WK01
NOP
MOVJ VJ =50.00
MOVJ VJ =50.00
REFP3
REFP4
REFP5
CALL JOB:TCH_JOB
SUB P006 P010
SFTON P006
MOVL V =200
ARCON
MOVL V =60
ARCOF
SFTOF
MOVJ VJ =50.00
MOVJ VJ =50.00
END
```

The work job added with the starting point detecting function has been completed.

4.2 Coordinated System

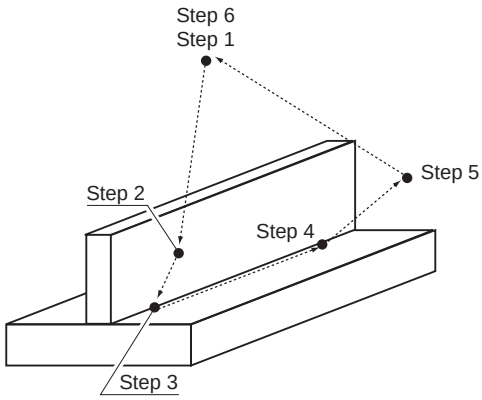
The coordinated starting point detecting function detects the starting point in a coordinated operation using two manipulators or a manipulator and station.

When a welding job carries out a coordinated operation, the coordinated starting point detection must be carried out instead of the single starting point detection.

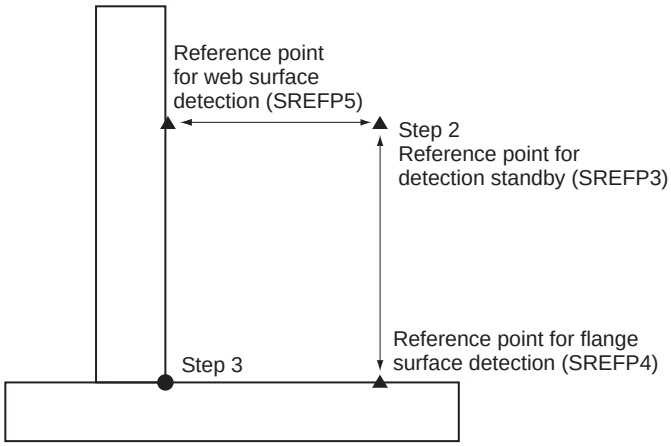
Perform the coordinated starting point detection in the following manner.

1. Create a work job for welding.

```
WK01
NOP
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
SMOVL V =200
+MOVL
ARCON
SMOVL V =60
+MOVL
ARCOF
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
END
```

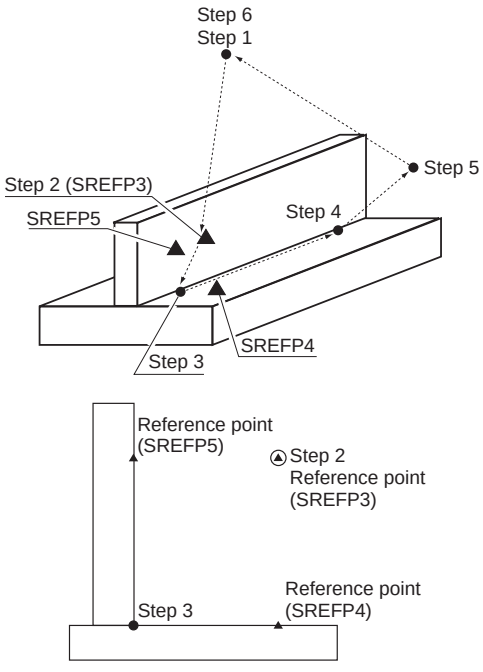


2. Teach the following three reference points for defining the detection path near the groove. Add the reference points between the teaching steps 2 and 3.
   - Reference point for detection standby (SREFP3)
   - Reference point for flange surface detection (SREFP4)
   - Reference point for web surface detection (SFEFP5)



Locations of Reference Points

```
WK01
NOP
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
SREFP3
SREFP4
SREFP5
SMOVL V =200
+MOVL
ARCON
SMOVL V =60
+MOVL
ARCOF
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
END
```



Point Teaching for Defining Detection Path

3. Add the CALL instruction for the coordinated starting point detecting job, TCH_JOB, in the work job WK01.

In this example, the coordinated starting point detecting job is named "TCH_JOB".

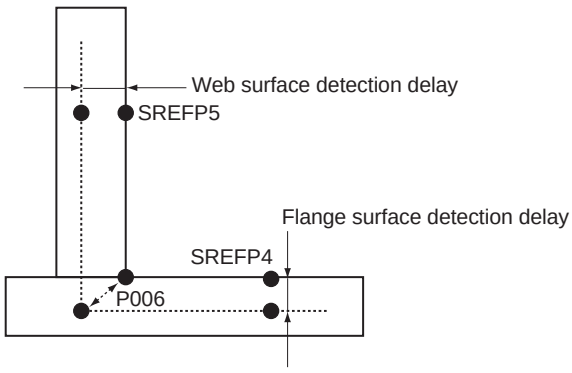
```
WK01
NOP
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
SREFP3
SREFP4
SREFP5
CALL JOB:TCH_JOB
SMOVL V =200
+MOVL
ARCON
SMOVL V =60
+MOVL
ARCOF
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
END
```

Addition of the CALL Instruction for the Starting Point Detecting Job

1. Add an instruction to shift the welding path by the deviation amount to the program. The shift amount for the starting point is set at the position variable "P006" after carrying out the job, "TCH_JOB".

```
WK01
NOP
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
SREFP3
SREFP4
SREFP5
CALL JOB:TCH_JOB
SSFTON P006
SMOVL V =200
+MOVL
ARCON
SMOVL V =60
+MOVL
ARCOF
SSFTOF
MOVJ VJ =50.00
+MOVJ
 MOVJ VJ =50.00
+MOVJ
END
```

2. Measure the shift amount compensating for detection delay included in the shift amount "P006" at the starting point in advance. Also, when an offset from the groove position is required for welding, measure the offset separately.



Web and Flange Surface Detection Delays

4.2.1 Measuring the Shift Amount Compensating for Detection Delay

1. Execute the starting point detection under the condition when the positions are taught and the workpiece is not offset.
2. Calculate the differences between the detected web surface position and the taught web surface position, and between the detected flange surface position and the taught flange surface position. Register the differences in the position variable P006.
3. Copy the set value at the position variable P006 to P010. This offset amount of P010 is the amount of the detection delay offset.

To subtract the detection delay offset amount P010 from the offset amount P006 obtained by starting point detection, add a subtraction instruction as follows.

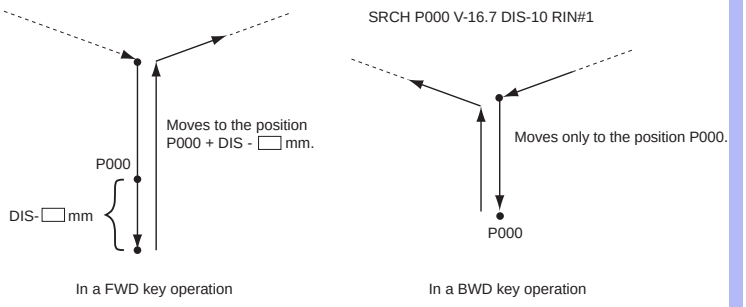
```
WK01
NOP
MOVJ VJ =50.00
+MOVJ
MOVJ VJ =50.00
+MOVJ
SREFP3
SREFP4
SREFP5
CALL JOB:TCH_JOB
SUB P006 P010
SSFTON P006
SMOVL V =200
+MOVL
ARCON
SMOVL V =60
+MOVL
ARCOF
SSFTOF
MOVJ VJ =50.00
+MOVJ
 MOVJ VJ =50.00
+MOVJ
END
```

The work job added with the starting point detecting function has been completed.

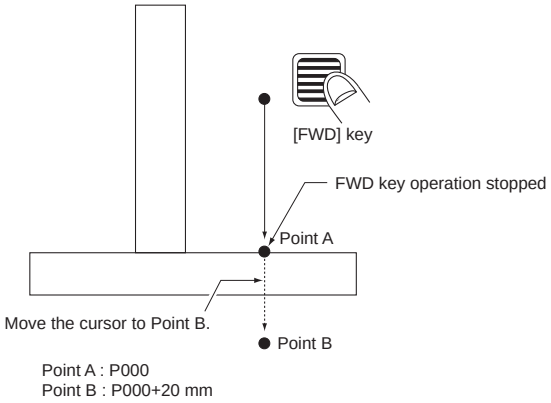
NOTE

- **The moving amount of the SRCH in a FWD key operation is different from the amount in a BWD key operation.**

MOVL P000 V = 10.0 SRCH RIN#1 = ON T = 0.1
DIS =10.0



- **During a FWD key operation, the SRCH instruction is not output to the starting point detecting unit. Therefore, the manipulator only moves to the position specified by the position variable set for the SRCH instruction and the distance (DIS), but detection will not be carried out.**
- **Holding down the [FWD] key moves the manipulator from point A to point B continuously. Release the [FWD] key, move the cursor to the next step, and then press the [FWD] key again.**



- **Since the starting point detecting function finds a workpiece position by touching with a wire, irregular wire length negatively affects the detection accuracy.**

Before detection, check to make sure that the wires are the same length.

5 Instructions

This chapter describes the instructions used in the starting point detecting function.

5.1 Format

5.1.1 SRCH (Search Instruction)

SRCH is an instruction to carry out the search function. It is an additional item to the move instruction.

Format: MOVL <Position type variable> <V = Speed> SRCH RIN# (Direct IN No.) = <Status> <T = Time> DIS = <Distance>

- **Position type variable:** Manipulator (P) position type variable
- **Speed:** Control point speed (Set a moderate speed so that the welding wire does not bend.)
- **Direct IN No:** 1 to 3
- **Status:** Status of direct IN No.

  ON/OFF or B type variable
- **Distance:** Specifies the shift amount from the target point specified by the position type variable.

  In units of 0.1 mm (0 to 6553.4 mm)
- **Time:** The delay time of starting the direct IN input check (in units of 0.01 sec.)

  While the starting point detecting unit relay is switched from 0V to 200V, a direct IN signal may be input continuously. Therefore, T must be set to 0.1 sec. or longer.
- **Result:** When a direct IN signal is input, “1” is set to $B002. When the direct IN signal is not input, “0” is set to $B002.

5.1.2 GETS (Read-in System Variable Instruction)

GETS is an instruction to save a system variable ($ variable) as a user variable.

The controller cannot use system variables directly for operating instructions. Use GETS to fetch a value as a user variable.

Format: GETS <User variable> <System variable>

For GETS, note the following points.

- The user and the system variables must be of the same type.

  <Example>
  GETS B000 $B000
- Position variables can be specified only by PX variables.
- PX variables are position type variables that are defined in a job. In a job for a single manipulator, PX000 equals P000.

For details of $PX variables, refer to *section 5.2 "System Variables"*.

5.1.3 CNVRT (Position Variable Conversion Instruction)

CNVRT is an instruction to convert a pulse-type position variable into a Cartesian data position type variable, using a specified coordinate system.

Format: CNVRT PX variable (B) PX variable (A) <Coordinate system>

- **PX variable (A):** Pulse data only
- **PX variable (B):** Cartesian data (Converted Cartesian data is stored.)
- **Coordinate system**

Base coordinate:	BF
Manipulator coordinate:	RF
Tool coordinate:	TF
User coordinate:	UF
Master tool coordinate:	MTF

When the master tool coordinate is selected, the pulse data is converted into Cartesian data on the coordinates relative to the master manipulator (only when a coordinated system is selected).

5.2 System Variables

In this section, the system variable function and the PX variables are explained.

5.2.1 System Variable Function

GETS is the only instruction which refers to system variables written by the controller system.

System Variable	Type	Explanation
$B-type	B	$B002: Specifies whether the SRCH instruction was detected/not detected. 0: Not detected, 1: Detected
$I-type	I	Not used
$D-type	D	Not used
$R-type	R	Not used
$PX-type	PX	$PX000: Current pulse $PX002: Detecting position pulse $PX011: REFP1 pulse $PX012: REFP2 pulse $PX013: REFP3 pulse $PX014: REFP4 pulse $PX015: REFP5 pulse $PX016: REFP6 pulse $PX017: REFP7 pulse $PX018: REFP8 pulse $PX021: SREFP1 pulse $PX022: SREFP2 pulse $PX023: SREFP3 pulse $PX024: SREFP4 pulse $PX025: SREFP5 pulse $PX026: SREFP6 pulse $PX027: SREFP7 pulse $PX028: SREFP8 pulse

5.2.2 PX Variables

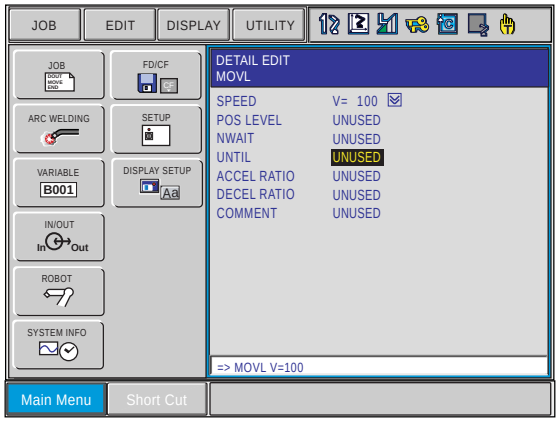
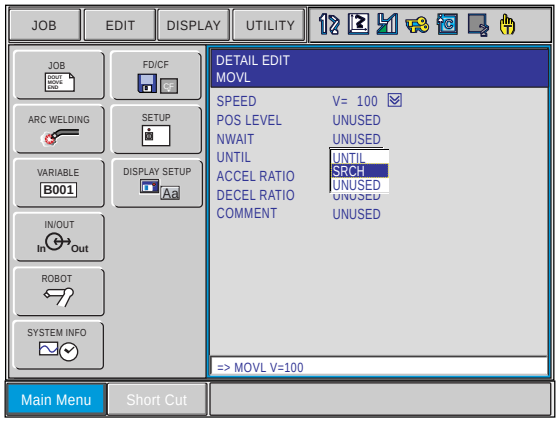
The PX variable is a group of position variables defined by the control group specified in the job header.

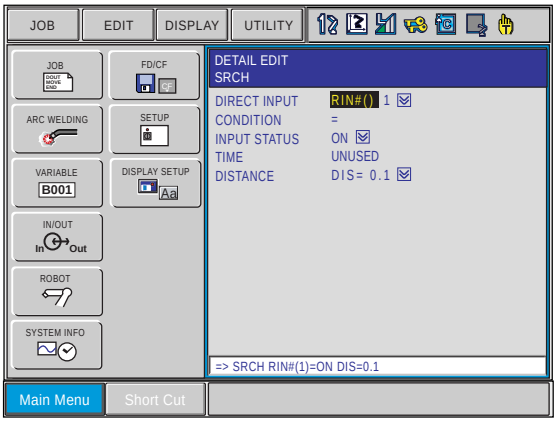
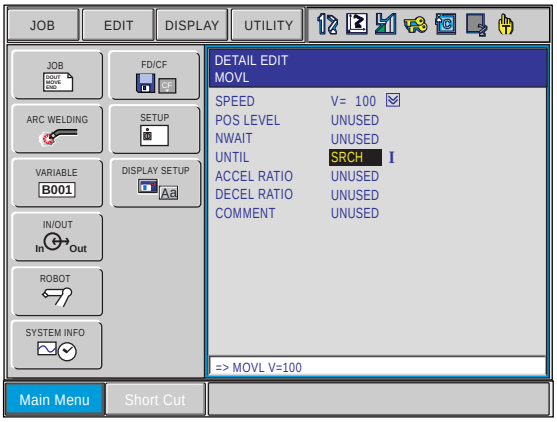
- When the control group is R1, PX000 indicates P000.
- When the control group is R1+B1, PX000 indicates P000 and BP000.
- When the control group is R1+B1+ST1, PX000 indicates P000, BP000 and EX000.
- When the control group is R1+R2+B1+B2+ST1, and the job is a cooperated job and the master coordinates are R1+B1, PX000 indicates the following coordinates.

P000	R2 (slave)
P001	R1 (master)
BP000	B2 (slave)
BP001	B1 (master)
EX000	ST1

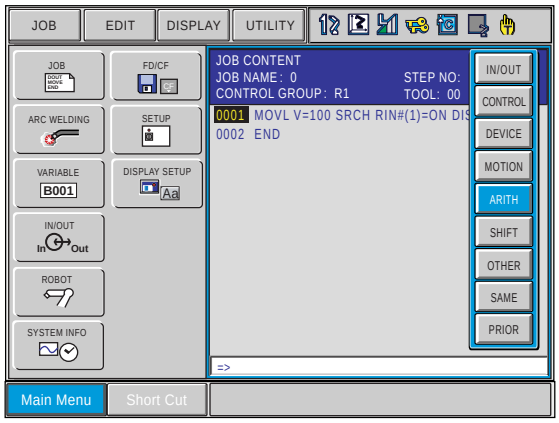
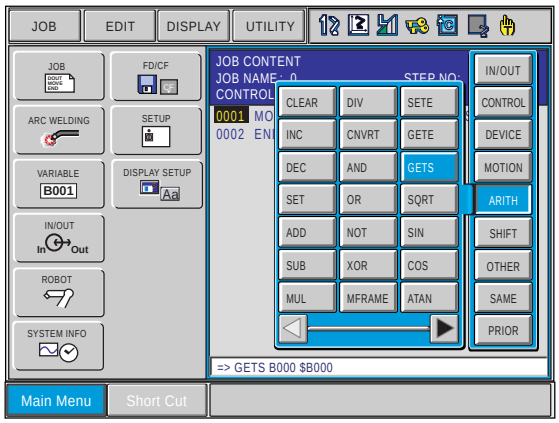
6 Registering Instruction

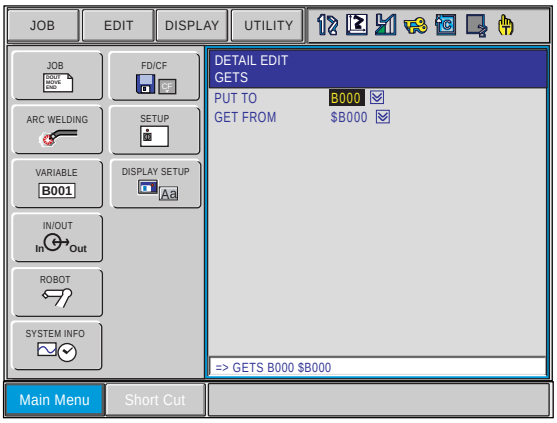
6.1 SRCH Instruction

	Operation	Explanation
1	Move the cursor to the instruction area.	
2	Move the cursor to the line where SRCH instruction is to be registered.	
3	Press [SELECT] twice.	Pressing [SELECT] once displays the contents registered in the job in the input buffer line. Pressing [SELECT] a second time displays the detail edit window of the move instruction. 
4	Click on {UNTIL}.	
5	Select {SRCH}.	Select {SRCH} from the pull-down list. 

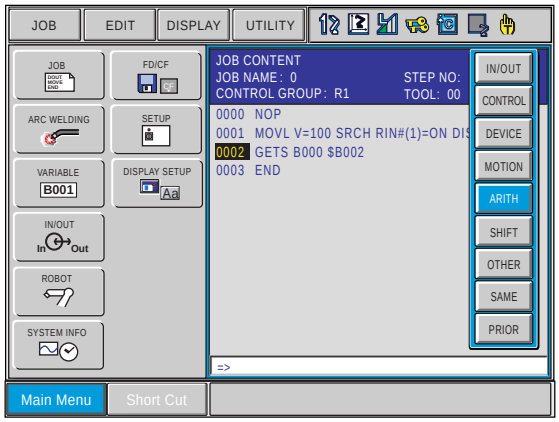
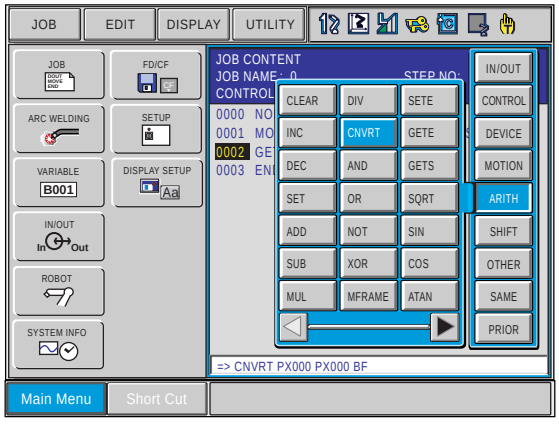
	Operation	Explanation
5	(Continued from the previous page.)	The detail edit window of the SRCH instruction appears. 
6	Enter each item in the DETAIL EDIT window of SRCH instruction.	
7	Press [ENTER].	The window returns to the detail edit window of the move instruction. 
8	Press [ENTER] twice.	Pressing [ENTER] once displays the set contents in the input buffer line. Pressing [ENTER] a second time registers the set contents in the job.

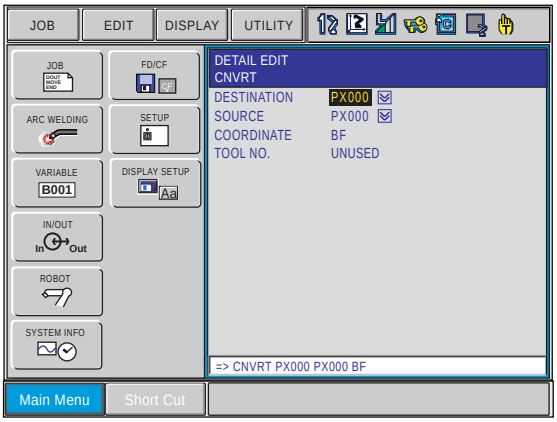
6.2 GETS Instruction

	Operation	Explanation
1	Move the cursor to the address area.	
2	Move the cursor to the line where GETS instruction is to be registered.	
3	Press [INFORM LIST].	The instruction list dialog appears. The cursor moves to the instruction list dialog, while the cursor in the address area changes to an underbar. 
4	Select {GETS}.	The instruction where the cursor is positioned is displayed in the input buffer line with the previously registered additional items. 

	Operation	Explanation
5	Press [ENTER] twice.	The detail edit window of the GETS instruction appears. 
6	Enter variables in the detail edit window of GETS instruction.	
7	Press [ENTER] twice.	Pressing [ENTER] once displays the set contents in the input buffer line. Pressing [ENTER] a second time registers the set contents in the job.

6.3 CNVRT Instruction

	Operation	Explanation
1	Move the cursor to the address area.	
2	Move the cursor to the line where CNVRT instruction is to be registered.	
3	Press [INFORM LIST].	The instruction list dialog appears. The cursor moves to the instruction list dialog, while the cursor in the address area changes to an underbar. 
4	Select {CNVRT}.	The instruction where the cursor is positioned is displayed in the input buffer line with the previously registered additional items. 

	Operation	Explanation
5	Press [ENTER] twice.	The detail edit window of the CNVRT instruction appears. 
6	Enter variables in the detail edit window of CNVRT instruction.	
7	Press [ENTER] twice.	Pressing [ENTER] once displays the set contents in the input buffer line. Pressing [ENTER] a second time registers the set contents in the job.

7 Alarm Message List

Alarm Number	Message	Cause	Remedy
4474	WRONG CONTROL GROUP AXIS	An instruction such as CALL or JUMP was used for a job other than in the currently used job control group.	Use the same control group for the call destination job, as the control group for the call source job.
4499	UNDEFINED POSITION VARIABLE	Undefined position data was used.	Define the position data.
4507	REFP POS ERROR (SEARCH MOTION)	The distance between the search starting point and the target point was too short to determine the search direction.	Reset the alarm and increase the distance between the search starting point and the target point.

8 Instruction List

The information in parentheses < > indicates numerical or alphabetical data. If more than one items are shown in one section, select one of the items.

SRCH (Search)	Function	Executes the SRCH function	
	Format	RIN# (<Direct IN No.>) = <Status>	Direct IN No: 1 to 3 Status: ON, OFF, B <Variable No.>
		T = <Time in sec.>	The delay time of starting the direct IN signal input check
		DIS = <Distance in mm>	Shift amount from the target point specified by the position variable
	Example	MOVL P000 V=138 SRCH RIN#(1)=ON T=1.00 DIS=10.0	
GETS (Get S)	Function	Sets the system variable as a user variable	
	Format	B <Variable No.>, I <Variable No.>, D <Variable No.>, R <Variable No.>, PX <Variable No.>	User variable
		$B <Variable No.>, $I <Variable No.>, $D <Variable No.>, $R <Variable No.>, $PX <Variable No.>	System variable
	Examples	GETS B000 $B000 GETS I001 $I[1] GETS PX003 $PX001	

CNVRT (Convert)	Function	Converts the position variable of Data 2 to a Cartesian data position variable using a specified coordinate system, and stores in Data 1. Format: CNVRT <Data 1> <Data 2> Coordinate system specification		
	Format	Data 1	PX <Variable No.>	
		Data 2	PX <Variable No.>	
		BF, RF, TF, UF# (<User coordinate No.>), MTF		BF: Base coordinate RF: Manipulator coordinate TF: Tool coordinate UF: User coordinate MTF: Master tool coordinate
	Examples	CNVRT PX000 PX001 BF CNVRT LPX000 LPX001 TF		

Revision History

Date	CEN / ECN	Revision No.	Reason For Revision	Initials
9/4/2014	M2094/ 14-1139M	2	Add DX200	JFC

DX200/DX100/NX100 OPTIONS INSTRUCTIONS

FOR BASIC OPERATION OF STARTING POINT DETECTING FUNCTION

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