MITSUBISHI

CO$_2$ LASER PROCESSING SYSTEM

CONTROL UNIT
LC30B

AUTO SHEET POSITIONING FUNCTION
INSTRUCTION MANUAL

Preface

This instruction manual is a guide related to the handling of the auto sheet positioning function of the Mitsubishi Laser Processing Machine LC30B control unit. Please read through this manual before starting use.

Precautions

(1) Although this manual contains as much information as possible even on special procedures, it is necessary to construe that any item not mentioned in this manual cannot be used.
When operations other than those listed are carried out, the unit may break down or not function properly.

(2) The details of this manual are subject to change without notice.

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Contents

1. OUTLINE

This function is to detect end faces of a sheet with a static sensor installed to the processing head and compensate inclination of a sheet. There are two patterns to detect end faces as follows:

<Two-point compensation pattern>
    The static sensor detects two points (on the path of M1 and M2 shown in Fig. 1) on an end face of the +X-axis direction, and compensate inclination of a sheet.

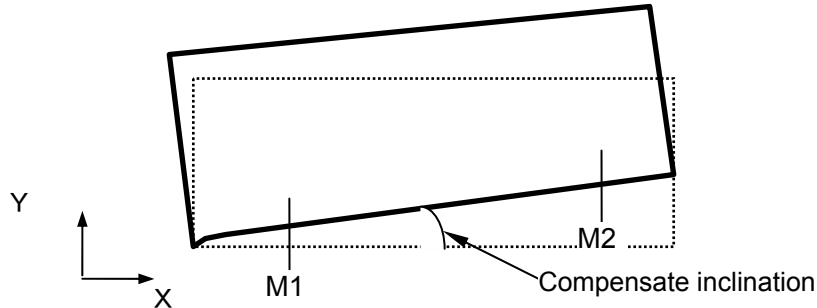Fig. 1

<Three-point compensation pattern>
    The static sensor detects two points (on the path of M1 and M2 shown in Fig. 2) on an end face of the +X-axis direction and one point (on the path of M3 shown in Fig. 2) on an end face of the +Y-axis direction, and compensate displacement and inclination of a sheet.
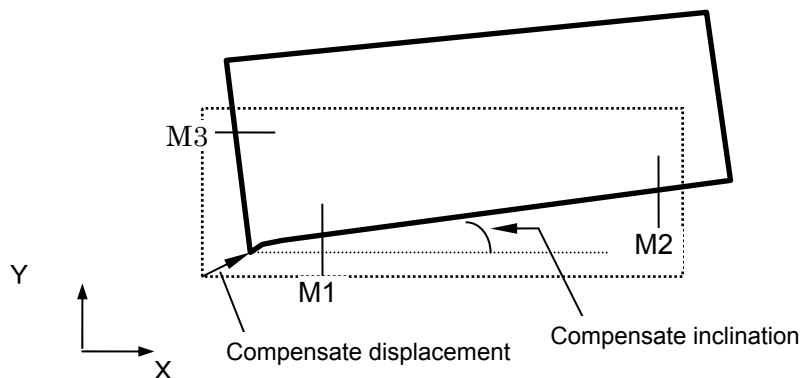   However, this pattern can be applied only when the angle between X and Y end faces of a sheet is 90 degrees.

Fig. 2

2. HOW TO USE

(1) Parameters used

Use the following compensation numbers:

OFFSET No.	Name	Details	Setting range
D202 (#10202)	X-coordinate coefficient at the measuring point 1	Sheet size of the X direction *The position of this coefficient becomes the first measuring point. (M1 shown in Fig. 3)	0.1~0.9 Can be set 0.1 by 0.1.
D203 (#10203)	X-coordinate coefficient at the measuring point 2	Sheet size of the X direction *The position of this coefficient becomes the second measuring point. (M2 shown in Fig. 3) Please set a larger value than the X-coordinate coefficient at the measuring point 1 D202 (#10202).	0.1~0.9 Can be set 0.1 by 0.1.
D204 (#10204)	Y-coordinate coefficient at the measuring point 3	Sheet size of the Y direction *The position of this coefficient becomes the third measuring point. (M3 shown in Fig. 3) This is applicable when performing the three-point compen-sation. This is ignored even if it is set when performing the two-point compensation.	0.1~0.9 Can be set 0.1 by 0.1.
D205 (#10205)	Distance to the starting point of measurement	It sets the distance from an end face of a sheet to the starting point of measurement. (K1 shown in Fig. 3)	20.0~ 15000.0(mm)

Sheet size of the Y direction *#10204
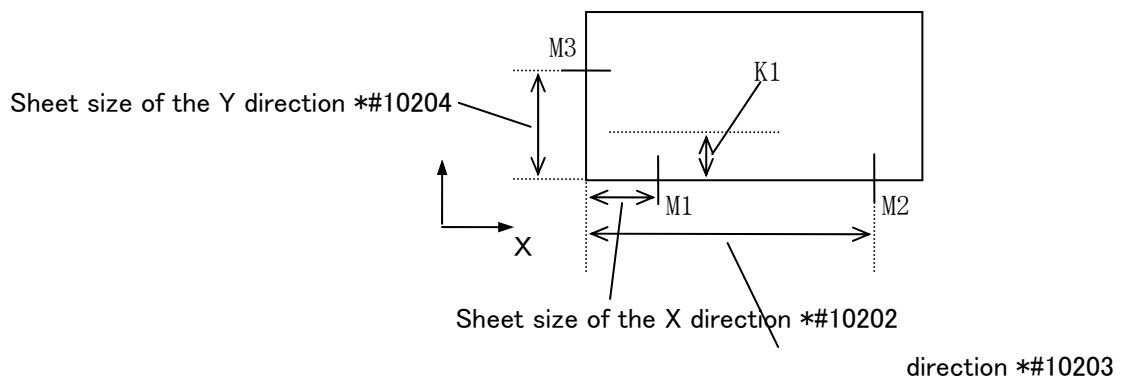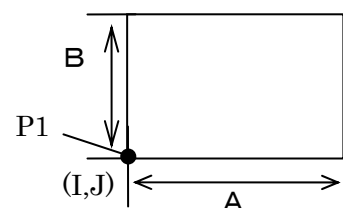
Sheet size of the X direction *#10202

direction *#10203

Fig. 3

(2) G code used

Input the following G code before the processing program:

G253A ① B ② I ③ J ④ T ⑤

①: Sheet length of the X direction
②: Sheet length of the Y direction

This is applicable when performing the three-point compensation.

This is ignored even if it is set when performing the two-point compensation.

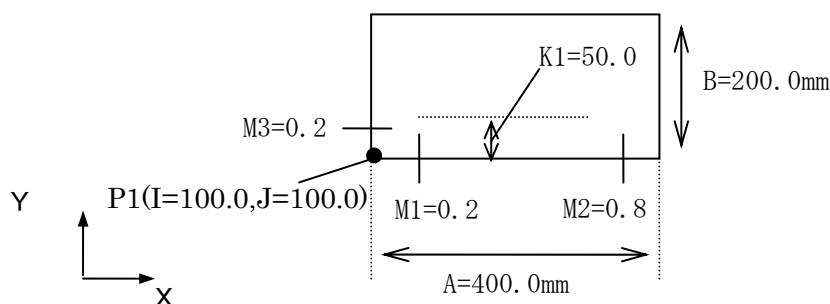③：Corner point (P1) of a sheet, X machine coordinate value (I)

④：Corner point (P1) of a sheet, Y machine coordinate value (J)

⑤：Compensation pattern No. (0: Two-point, 1: Three-point)

When the pattern No. is a numeral other than 1 or is not set at all, the pattern No. will be considered as 0, Two-point compensation.
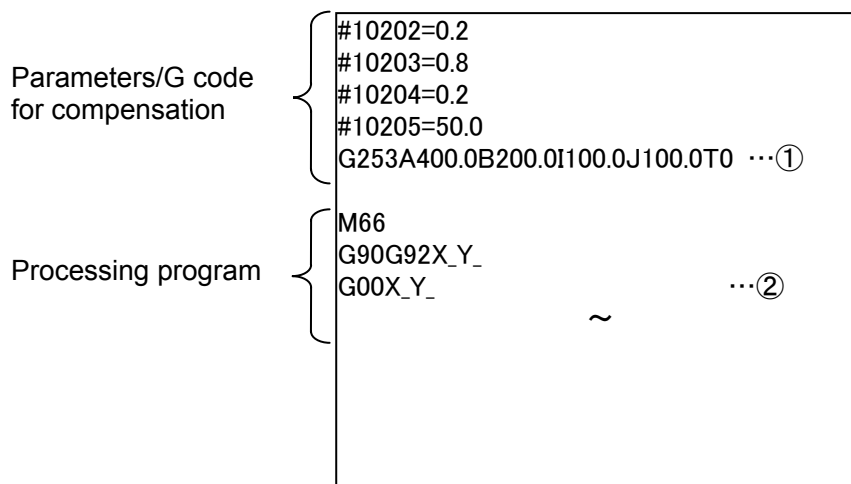
3. EXAMPLES OF USAGE

For explanations of examples, a sheet below is used.

(1) Two-point compensation

(1)-1 Create a processing program as follows:

Parameters/G code for compensation:
```
#10202=0.2
#10203=0.8
#10204=0.2
#10205=50.0
G253A400.0B200.0I100.0J100.0T0  ···①
```

Processing program:
```
M66
G90G92X_Y_
G00X_Y_                          ···②
              ~
```

(1)-2 Search and start the operation.
The processing head moves according to the position defined by the parameters and code, and starts to detect and compensate the sheet.
Movement of the processing head with the static sensor is as follows:

①To measure the position of a sheet:

    a. It moves to the measuring point M1 for the X-coordinate, and then it moves by the amount of K1 shown in the example figure above for the Y-coordinate (the distance specified as the value of D205 = #10205).
After moving, the height control is turned ON and will perform support avoidance procedures. (※)

    b. With the height control turned on, it moves in the -Y direction until it detects an end face of a sheet.

    c. After detecting an end face, the Z-axis returns to the zero point and the processing head moves to the measuring point M2 for the X-coordinate and by the amount of K1 for the Y-coordinate.
After moving, the height control is turned ON and will perform support avoidance procedures. (※)

    d. With the height control turned on, it moves in the -Y direction until it detects an end face of a sheet.

e. After detecting an end face, it moves to the machine position P1. Coordinate rotation starts at this position.
※Please refer to "3. EXAMPLES OF USAGE (3) Support Avoidance Procedures" for instructions.
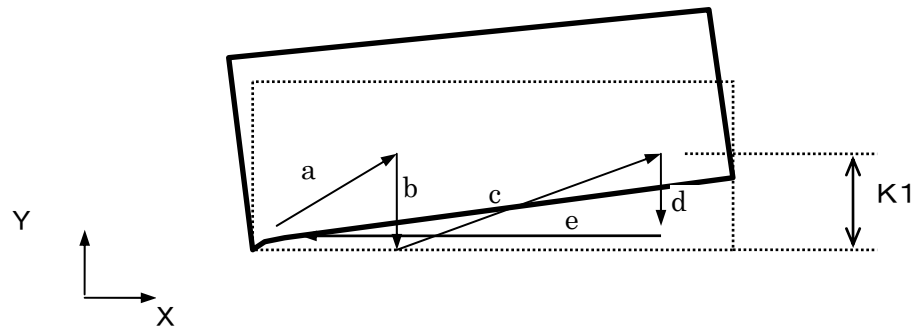
②Processing starts with a sheet inclined as measured in ①above.

(2) Three-point compensation

(2)-1 Create a processing program as follows:

Parameters/G code for compensation
```
#10202=0.2
#10203=0.8
#10204=0.2
#10205=50.0
G253A400.0B200.0I100.0J100.0T1  ···①
```

Processing program
```
M66
G90G92X_Y_
G00X_Y_                           ···②
          ~
```

(2)-2   Search and start the operation.
Movement of the processing head with the static sensor is as follows:
① To measure the position of a sheet:
a. It moves to the measuring point M1 for the X-coordinate, and then it moves by the amount of K1 shown in the example figure above for the Y-coordinate (the distance specified as the value of D205 = #10205).
After moving, the height control is turned ON and will perform support avoidance procedures. (※)
b. With the height control turned on, it moves in the -Y direction until it detects an end face of a sheet.
c. After detecting an end face, the Z-axis returns to the zero point and the processing head moves to the measuring point M2 for the X-coordinate and by the amount of K1 for the Y-coordinate.
After moving, the height control is turned ON and will perform support avoidance procedures. (※)
d. With the height control turned on, it moves in the -Y direction until it detects an end face of a sheet.
e. After detecting an end face, the Z-axis returns to the zero point, and the processing head moves by the amount of K1 for the X-coordinate and to the measuring point M3 for the Y-coordinate. .
After moving, the height control is turned ON.

f. With the height control turned on, it moves in the -X direction until it detects an end face of a sheet.

g. After detecting an end face, it moves to the lower left corner of a sheet. Coordinate rotation starts at this position.

※Please refer to "3. EXAMPLES OF USAGE (3) Support Avoidance Procedures" for instructions.
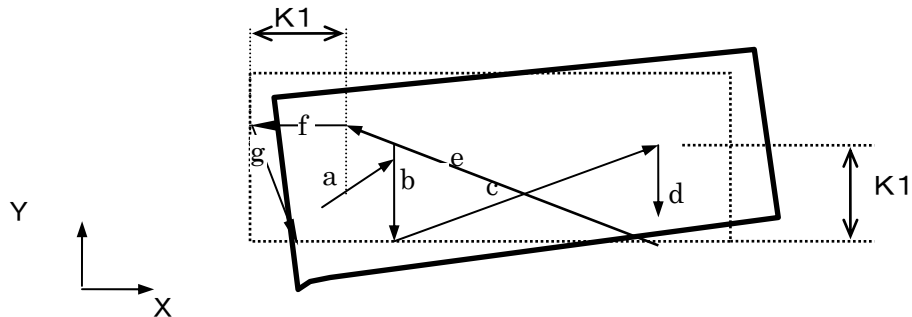
② Processing starts with a sheet inclined as measured in ①above.

(3) Support Avoidance Procedures

When the work is below t10mm, a detection error may occur at the end face due to the influence from the support. In order to avoid this error, a support avoidance procedure is taken at measuring points M1 and M2. Support avoidance procedures are as follows.

＜Support Avoidance Procedures＞

Measure the end face away from the predetermined support range. If the head is positioned inside the support range, perform support avoidance procedures as shown in fig. 4 below. The maximum movable range by the support avoidance procedure is 25mm. Measure the end face after the avoidance.
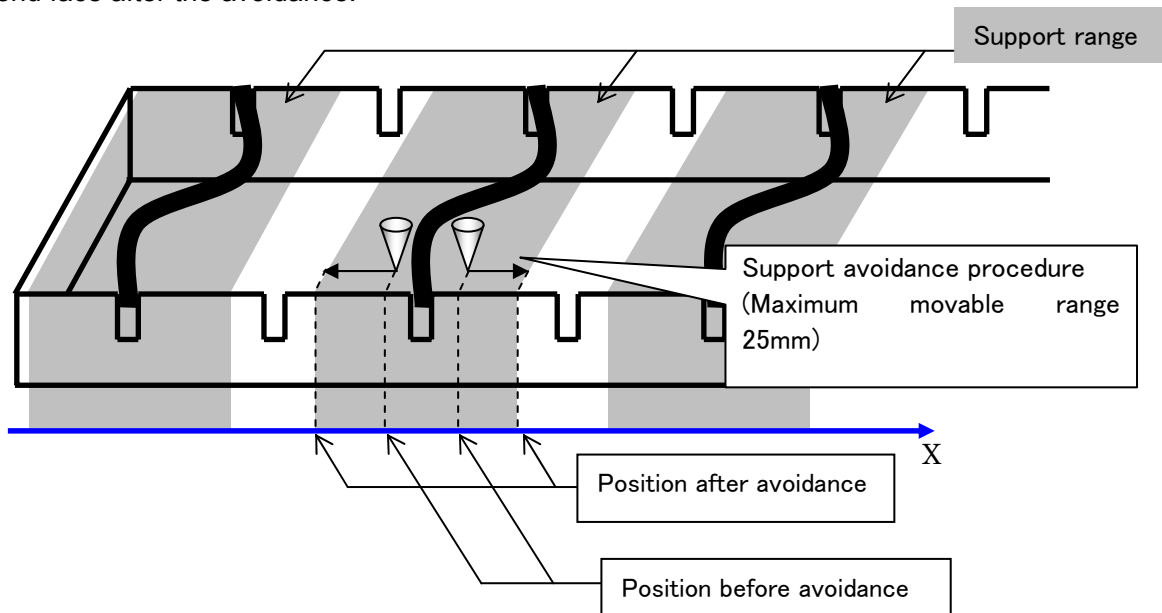

Fig. 4

Each support range is predetermined at constant intervals as shown in Fig. 5.
※ The initial support range cannot be changed.

Work support range width

Work support range width

Work support range width

Support range

. . .

X

. . .

Work support installment interval

Work support installment interval

Work support standard position
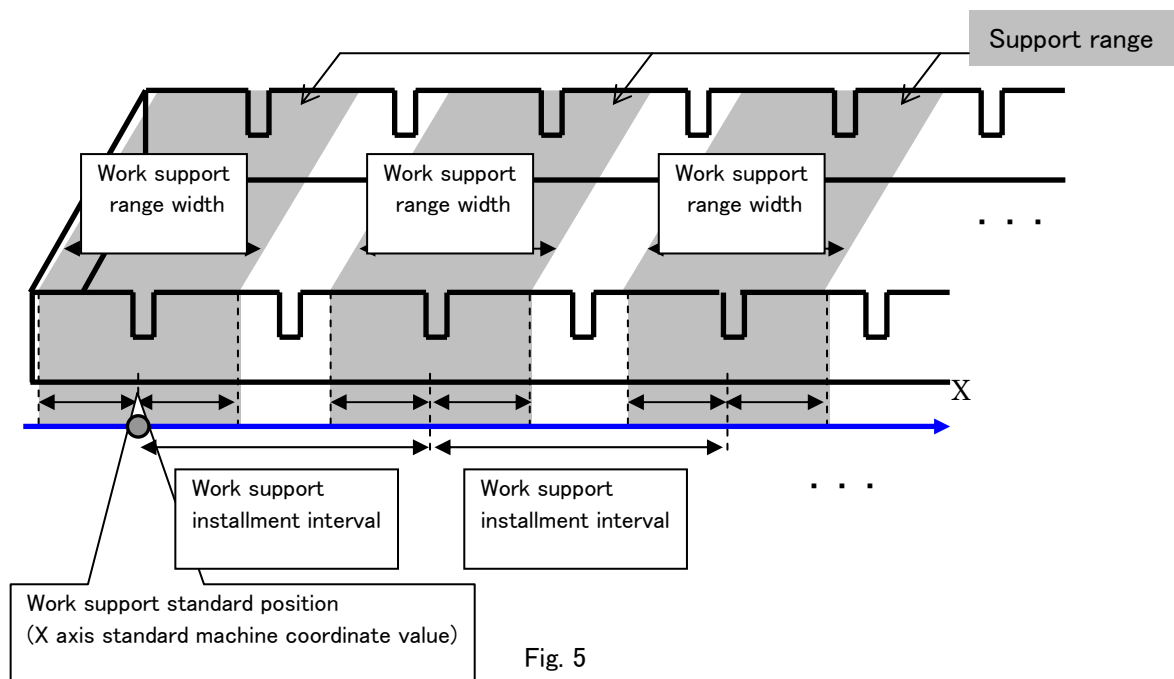（X axis standard machine coordinate value）

Fig. 5

Supports are unavoidable if they are installed outside the support range as shown in Fig. 6. If there is a support under the position after the avoidance procedure is taken for M1 and M2 points and thus results in a deviation of the detection point, please remove the support or reinstall it to a different position.
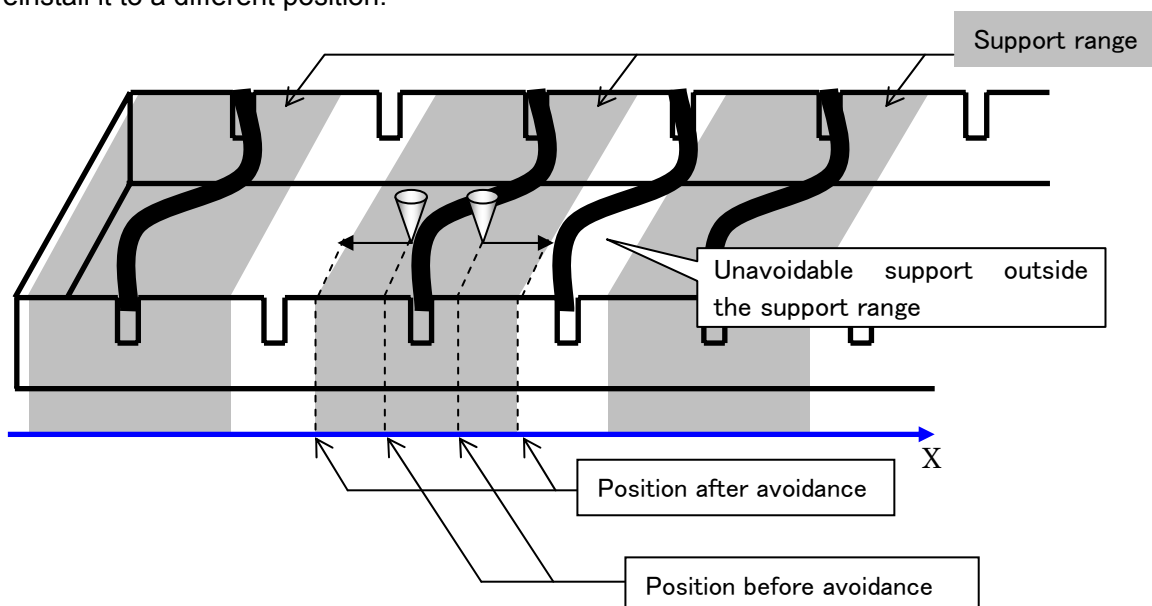

Support range

Unavoidable support outside the support range

X

Position after avoidance

Position before avoidance

Fig. 6

4. SPECIAL OPERATION

(1) Teaching of the machine position P1

When the value of the machine position P1 is not fixed, it can be set easily as follows:

\<Teaching method for P1\>

 a. Move the processing head to P1.

 b. Select the function selection key "PARAM", and then select the menu key "ROTATE ".

 —＞ Then, the rotation offset screen appears.

 c. Select the line of the workpiece 1.

 d. Press the sub menu key "P1".

 —＞ Then, the current position of the processing head is specified and stored as P1 for the workpiece number 1.

  The values for P1 are stored in the parameter #10351 for the X-coordinate value and in the parameter #10352 for the Y-coordinate value.

 e. Set the items, I and J in G253 code of the processing program as follows:

  G253A____B____I#10351J#10352T____

 f. Search and execute the processing program created in Step e above.

 —＞ Then, the processing head moves to P1 specified in Step d above, and measurement starts.

  ＊）The explanation above uses P1 of the workpiece number 1. Parameter numbers corresponding to other workpiece numbers are as follows (please use them as necessary):

Parameter No.	Workpc No.	Stored value
#10351	1	X coordinate value when pressing the submenu "P1"
#10352	1	Y coordinate value when pressing the submenu "P1"
#10356	2	X coordinate value when pressing the submenu "P1"
#10357	2	Y coordinate value when pressing the submenu "P1"
#10361	3	X coordinate value when pressing the submenu "P1"
#10362	3	Y coordinate value when pressing the submenu "P1"
#10366	4	X coordinate value when pressing the submenu "P1"
#10367	4	Y coordinate value when pressing the submenu "P1"
#10371	5	X coordinate value when pressing the submenu "P1"
#10372	5	Y coordinate value when pressing the submenu "P1"
#10376	6	X coordinate value when pressing the submenu "P1"
#10377	6	Y coordinate value when pressing the submenu "P1"
#10381	7	X coordinate value when pressing the submenu "P1"
#10382	7	Y coordinate value when pressing the submenu "P1"
#10386	8	X coordinate value when pressing the submenu "P1"
#10387	8	Y coordinate value when pressing the submenu "P1"
#10391	9	X coordinate value when pressing the submenu "P1"
#10392	9	Y coordinate value when pressing the submenu "P1"

（2）Combination with the Multiple Setup

Explaining how to combine the sheet detection function and the multiple setup function.
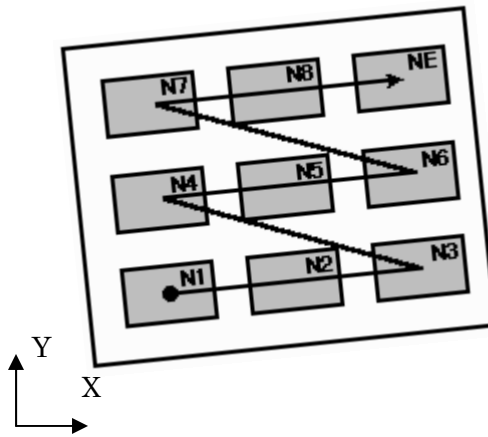
Example using the sheet below.

P1(I=100.0,J=100.0)

※Detection type: 3 point detection
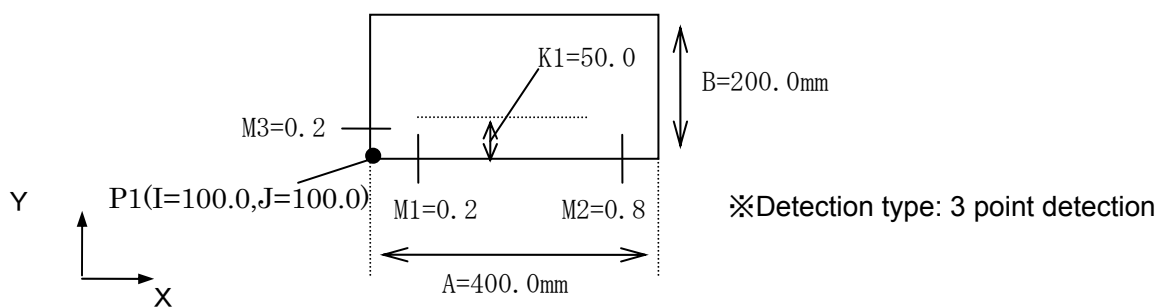
(2)-1 Create a parts program and save it in the processing machine.
    ※ Unnecessary to enter the sheet compensation code in the parts program
    ※ Can only enter up to 20 English one byte characters for the file name

(2)-2 Create a multiple setup main program using the sheet compensation codes as shown below and save it in the processing machine.
    ※ Can only enter numbers for the file name

Sheet compensation codes
(Please enter the sheet
compensation codes correctly)

```
#10202=0.2
#10203=0.8
#10204=0.2
#10205=50.0
G253A400.0B200.0I100.0J100.0T1
```

Multiple setup call codes
(Please enter as shown in the
example)

```
G00G40
G65P9991

M30
```

(2)-3 Enter multiple setup settings in the "MULTIPLE SET" screen.
    ・ Input the file name of the parts program created in (2)-1 for "#1 Part PROG. NO."
    ・ Input the start point of the multiple setup from the lower left corner (P1) for "#8 Start point"

・ Input the file name of the main program created in (2)-2 for "#9 MAIN PROG. NO."
・ Please refer to the "Screen Instruction Manual" for other multiple setup settings and specific explanations

Enter the parts program created in (2)-1

Enter various settings Refer to Screen Instruction Manual for specific explanations

Input the start point of the multiple setup from the lower left corner (P1)

Enter the main program created in (2)-2

(2)-4 Press the start button after pressing the "MULTI" button on the lower left part of the screen
・The "MULTI" button will turn yellow after it has been pressed. The program will execute when pressing the START button.

The program will execute as follows.
① First, detect and compensate the sheet
② Second, perform multiple setup after the compensation

(2)-5 Reset "#9 MAIN PROG. NO." to 9990
※ This procedure is unnecessary if continuing the combination of the sheet detection function and the multiple setup

5. SPECIAL NOTES

（1） There is a danger of head collision if the sheet detection function is incorrectly set. Please observe the points below.
  ・ Please set the measuring start point (M1 to M3 start points) within the sheet (over 20mm inside the end face).
  ・ If a processing hole already exists on the work, please set the measuring start point so that the measuring path will not go over that hole.
  ※ The measuring start point is determined by the setting in the processing program. Please refer to "2. HOW TO USE (1) Parameters used" and "2. HOW TO USE (2) G code used" for settings.

（2） The measurable inclination range of the sheet is -30 to 30 degrees. If the measurement result exceeds this range, P00139 macro alarm message "ROTATE-ANGLE-ERROR" will appear (the message will appear in the "OPERATOR MESSAGE" column of the alarm display window).

（3） If the end face cannot be detected, P00139 macro alarm message "SHEET-NASHI" will appear (the message will appear in the "OPERATOR MESSAGE" column of the alarm display window).

（4） The condition selection number will be "0" after executing the sheet detection program.

（5） Cannot be combined with the mirror image function on the AXIS PARAMETER screen and mirror image command (G51.1) in the processing program.

（6） Since this function detects end faces of a sheet, it may not be able to be accurate when the angle between end faces of a sheet is not acute.

（7） When a value outside the variable range is entered, P00139 macro alarm message "MEASURE-VALUE-ERR" will appear (the message will appear in the operator message column of the alarm display window).
  D202(#10202) values other than 0.1～0.9
  D203(#10203) values other than 0.1～0.9
  D204(#10204) values other than 0.1～0.9
  D205(#10205) values other than 20.0～15000.0

（8） When the distance from end faces of a sheet to the effective processing range is not more than approximately 10 mm, inclination may not be measurable due to the limit error, etc.

（9） Cannot be combined with single block or M code lock on the ON／OFF Parameter screen.
  Also cannot be combined with the "Invalid Hight Mcode" on the Sensor Control Parameters screen. Please turn these functions OFF when performing sheet detection.

（10） This function cannot be used in combination with the rotation offset function using the rotation offset screen.

（11） If a check sequence is operated on the program, a limit error will appear and will not be able to check the processing program using sheet compensation codes. Please enter a block skip at the beginning of the sheet compensation code G253 row to perform a check.

（12） When the work is below t10mm, a detection error may occur at the end face due to the influence from the support. In this case, please remove the support or move it to a different position. Also, if there is a deviation in the position of measuring point M3, influence from the support can also be avoided by moving the workpiece to where no support directly lies under the work's end face.

（13） The support avoidance operation cannot be performed on the special specifications pallet.

（14） Please enter sheet detection orders only once at the top of the processing program. When performing sheet detection continuously on multiple works, please execute the processing

program on each work using the processing management function (the scheduling function on the stocker system can also be combined if it is installed on the machine.)

5-2