FANUC Robot series

R-30*i*B Plus CONTROLLER

*i*RPickTool (Auto Visual Track Frame Setup)

QUICK SETTING GUIDE

B-83924EN-1/01

- **Original Instructions**

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.

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PREFACE

Notations used in this manual

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.

⚠ **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.

Other notations

Items that require special attention in the operations and supplementary information are indicated by the following notations.

Note	Information that requires special attention in the operations and descriptions.
Memo	Useful functions and supplementary information.

Notation/indication rules

This manual uses the notation/indication rules below.

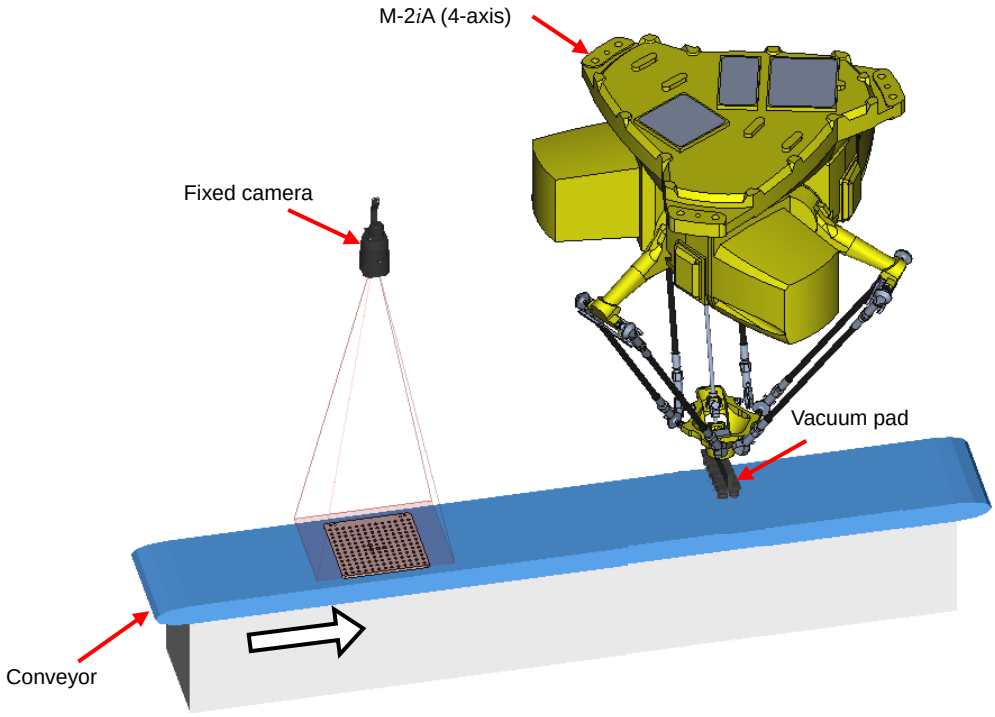
- The names of menu items, buttons and screen items on the teach pendant screen are indicated by [ ].
- Names of keys and switches that are operated on the teach pendant are indicated by [ ].
- Function menu items are indicated as keys by Fx [ ] (e.g.: F1 [Screen]).
- The names that actually match the indications are given in the [ ].
- Menu items that you select on screen are indicated separated by '-', in the order of the menu layers.
- Titles and manual names for reference are indicated by " ".

Auto visual track frame setup function

This manual describes the procedures to easily set tracking parameters and calibrate cameras using the 'auto visual track frame setup function'.
It requires skill to manually set camera calibration, tracking areas, etc., but even an inexperienced operator will be able to perform setup if he or she uses the 'auto visual track frame setup function'.

Assumed system

This manual describes the procedure to construct a system like the one shown below.



Operation flow

Preliminary preparation	1. PRELIMINARY PREPARATION (→ Page 4)
Install and set up Pulsecoder	2. INSTALLING AND SETTING UP PULSECODER (→ Page 6)
Mount and connect a camera	3. MOUNTING AND CONNECTING A CAMERA (→ Page 11)
Set up a tool frame	4. SETTING A TOOL FRAME (→ Page 12)
Set up the payload	5. SETTING UP THE PAYLOAD (→ Page 16)
Set up tracking parameters	6. SETTING UP TRACKING PARAMETERS (→ Page 19)
Teach a vision process	7. TEACHING A VISION PROCESS (→ Page 51)
Teach a program	8. TEACHING A PROGRAM (→ Page 61)
Set up the reference position	9. SETTING UP THE REFERENCE POSITION (→ Page 66)

1 PRELIMINARY PREPARATION

Prepare equipment required to use the auto visual track frame setup function.

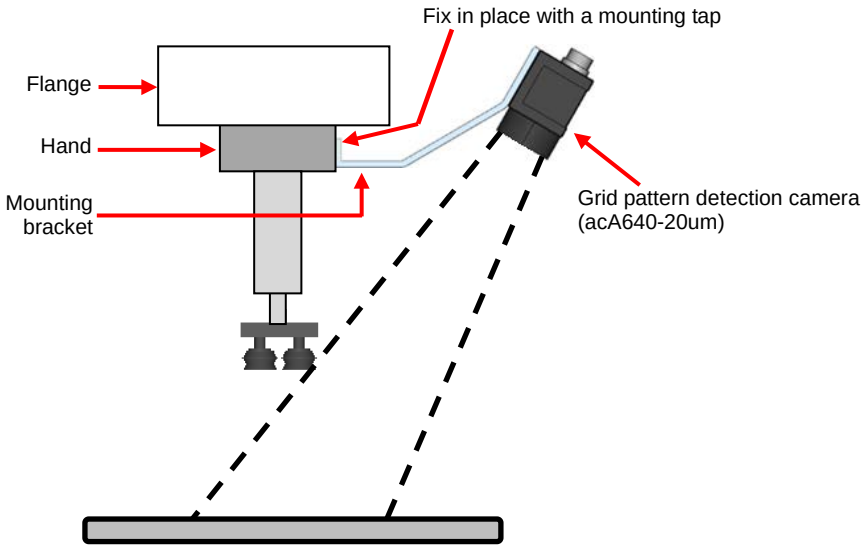
1.1 EQUIPMENT REQUIRED FOR THE AUTO VISUAL TRACK FRAME SETUP FUNCTION

The equipment required to use the auto visual track frame setup function is shown below.

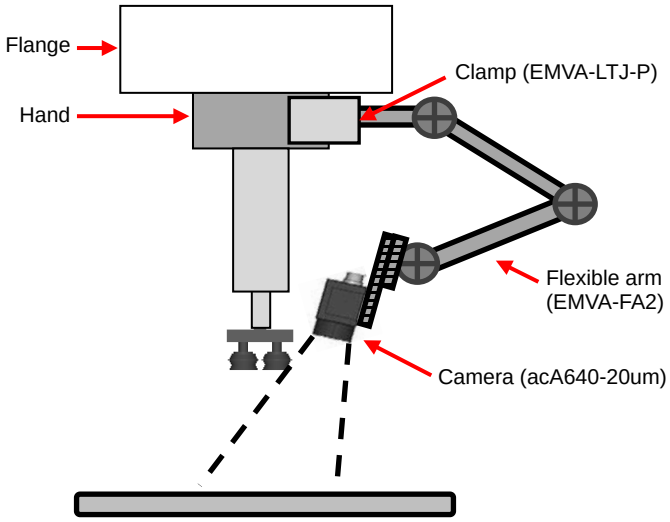
Equipment name	Description
Calibration grid (or sheet)	A grid (or a sheet) on which a specific pattern of dots has been drawn, which is used for camera calibration. It is the same as the one that is normally used for *i*RVision.
Grid pattern detection camera	A camera for detecting the grid pattern. Use a USB camera manufactured by Basler (acA640-20um), by connecting it to the teach pendant.
Camera mounting bracket	A bracket for mounting the grid pattern detection camera on the hand. You will need to prepare it yourself. For an example of a bracket, refer to "1.1.1 Mounting a Grid Pattern Detection Camera."
Cable	A cable for connecting the grid pattern detection camera. A USB 2.0 cable can be used to connect the teach pendant and the camera directly using this cable. The maximum length of the cable that is guaranteed with the USB 2.0 specification is 5 m. Operation is not guaranteed if a cable that is longer than 5 m or a USB 3.0 cable is used.
Lens	If you are using a Genkotsu robot, because its workspace is narrow in the height direction, we recommend using a wide-angle lens (e.g.: Kowa LM3NC1M, focal length = 3.5 mm).

1.1.1 Mounting a Grid Pattern Detection Camera

Below are examples of brackets for mounting the camera on the hand.
Example 1: Design a bracket



Example 2: Mount the camera using a commercial clamp and flexible arm



Memo Please prepare the camera mounting bracket yourself.

1.2 LIMITATIONS AND PRECAUTIONS REGARDING USE

1.2.1 Auto Visual Track Frame Setup Function

- Available for 4-axis robots only.
- Up to one robot group can be set up.
- Available for line conveyors only. Not available for circular conveyors and servo conveyors.

- M-1*i*A cannot be used by default.
- Up to eight conveyors can be set up. However, if you are setting up four or more conveyors, you must first expand the conveyor object on the [iRPickTool Setup] screen.
- The values for the tracking area that are set may not suit your system. Please make adjustments as required.
- The grid pattern detection camera referred to in "1.1 EQUIPMENT REQUIRED FOR THE AUTO VISUAL TRACK FRAME SETUP FUNCTION" weighs about 80 g. If the total weight including the lens and the mounting bracket exceeds the robot's load limit, consider measuring with the hand removed when detecting the grid pattern.
- If you are using a system with multiple robots, be sure to run the guide from the first robot. You cannot perform setup from the second robot onward.

1.2.2 Function to Set the Found Position to a Position Register Using the Reference Position Guide

- This function is available only when the values for [Trigger Condition] and [Trigger Action] match the combination shown below. Refer to "9 SETTING UP THE REFERENCE POSITION" for the reference position guide.

Trigger Condition	DI/RI or Distance
Trigger Action	Find part by vision

2 INSTALLING AND SETTING UP PULSECODER

Install and set up Pulsecoder. A Pulsecoder is a device that detects the travel distance of the conveyor.

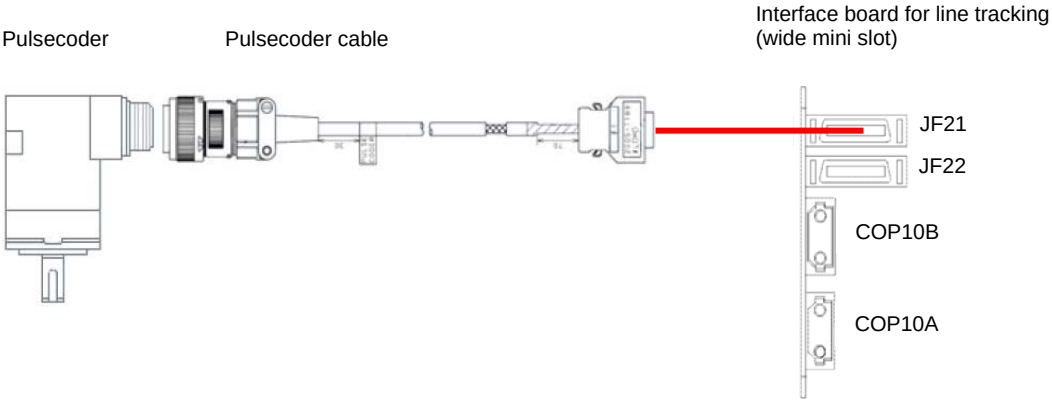
2.1 INSTALLING PULSECODER

Install Pulsecoder on the conveyor.

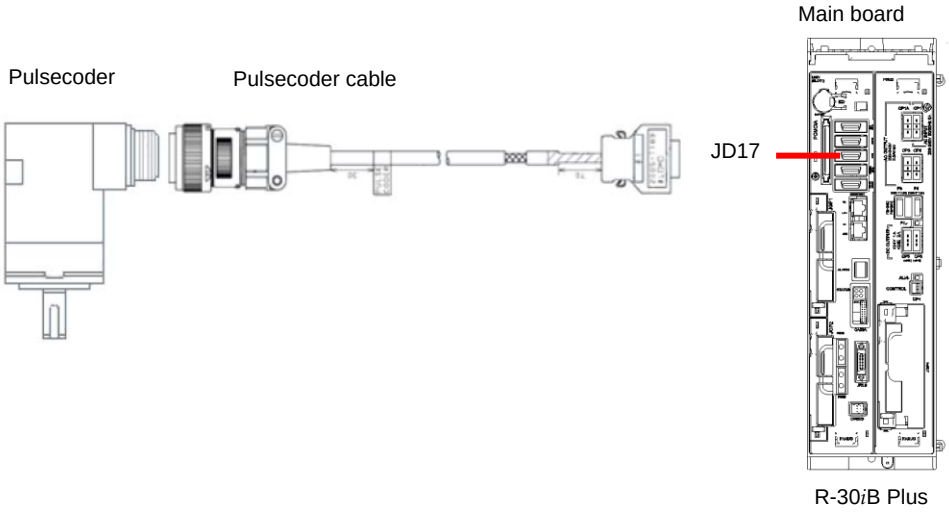
Note Install Pulsecoder outside the operating range of the robot, in order to avoid interference by the robot during operation.

Connect the installed Pulsecoder to the robot controller. They are connected in a different way depending on the slot you connect them to.

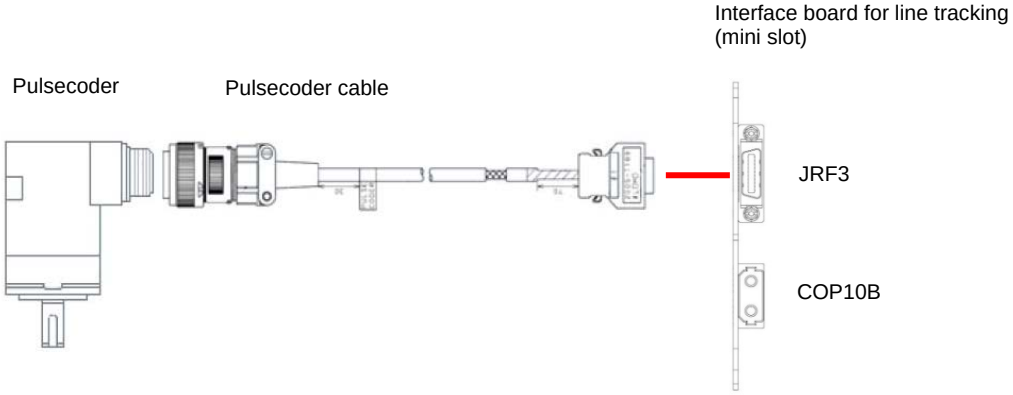
When connecting to the interface board for tracking (wide mini)



When connecting to the main board



When connecting to the interface board for tracking (mini)

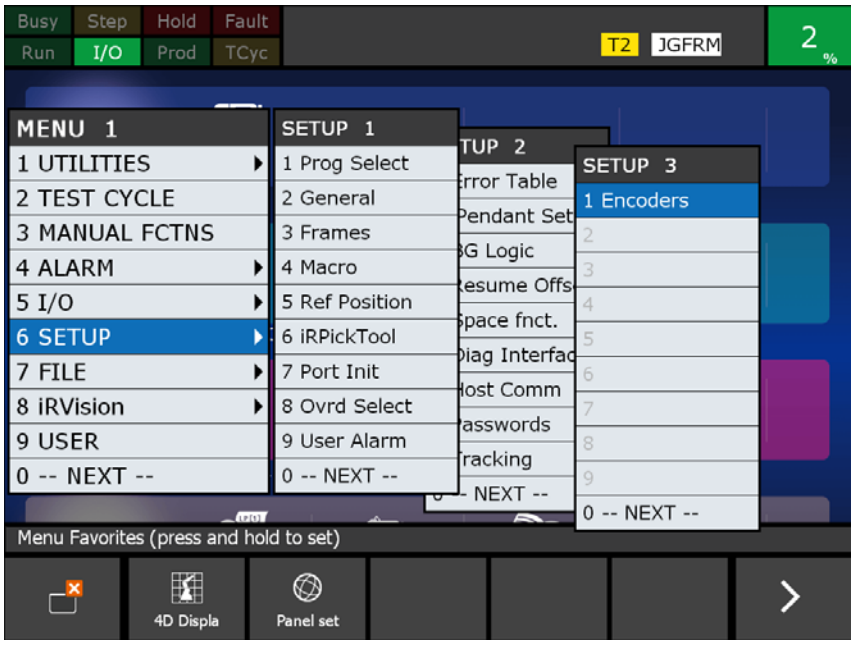


After you have finished connecting, perform setup so that you can control the Pulsecoder from the robot controller.

2.2 SETTING UP PULSECODER

Set up the Pulsecoder parameters on the teach pendant screen.

1. On the teach pendant of the robot controller, press the [MENU] key and select [SETUP] - [Encoders].



➢ The [SETUP Encoders] screen will appear.

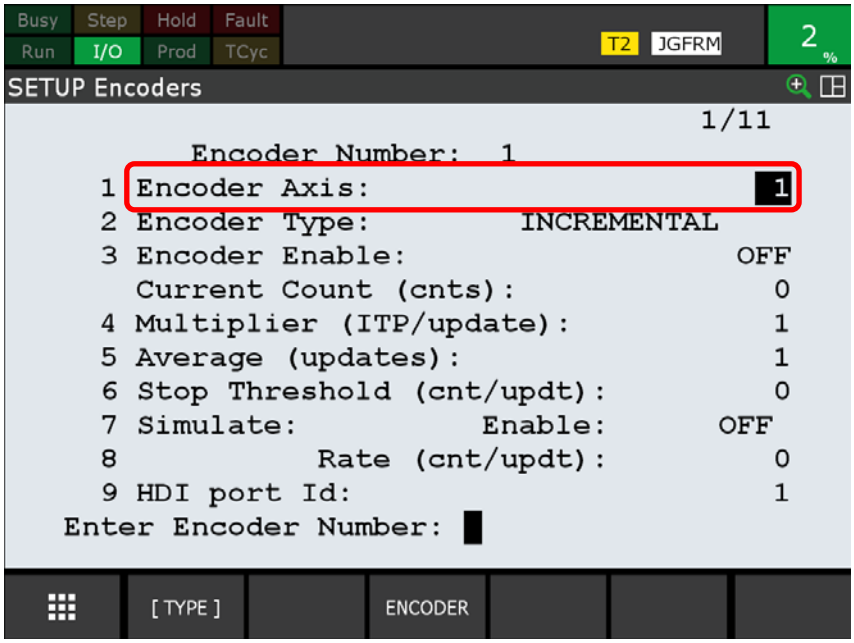
Memo

- [HDI port Id], [Ethernet Master RIPE Id] and [Ethernet Master Encoder] are items that are displayed by means of options.
- If you have connected Pulsecoder to the JF21 connector using the interface board (wide mini), select Encoder Number 1, and if you have connected it to JF22, select Encoder Number 2.
- If you are using one Pulsecoder via the interface board (mini), select Encoder Number 1. If you are using two Pulsecoders, select Encoder Number 1 for the Pulsecoder with the cable tag PULSE CODER1, and select Encoder Number 2 for the Pulsecoder with the cable tag PULSE CODER2.

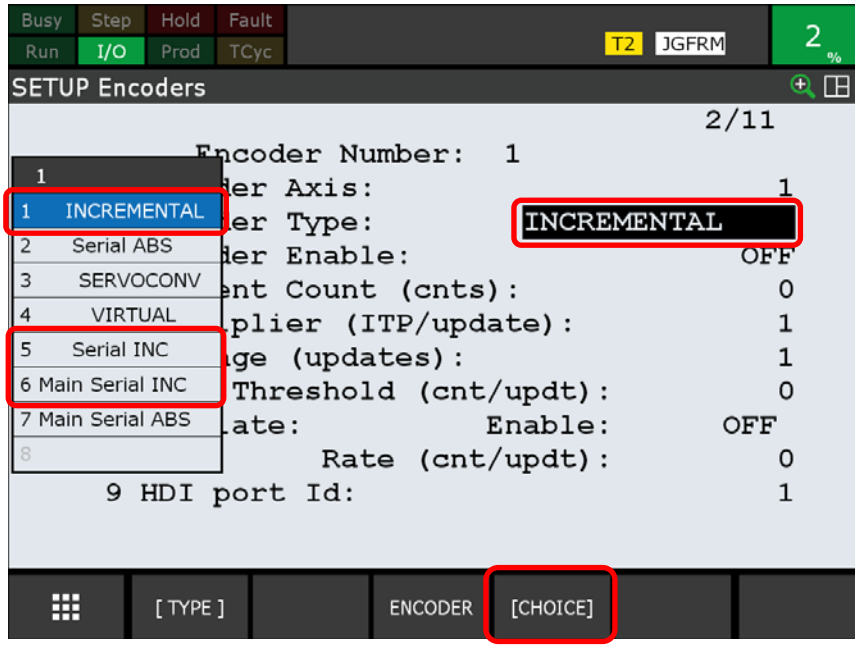
2. Move the cursor to [Encoder Axis] and enter the encoder axis number.

Memo

Normally, enter the same number as the encoder number.



3. Move the cursor to [Encoder Type] and press F4 [CHOICE]. From the displayed list, select the encoder type that corresponds to the Pulsecoder that you are connecting.



Memo

The encoder types are as follows:

- Incremental Pulsecoder (black Pulsecoder): [INCREMENTAL]

Incremental Pulsecoder
Encoder type: **INCREMENTAL**
* Cannot be connected to the main board

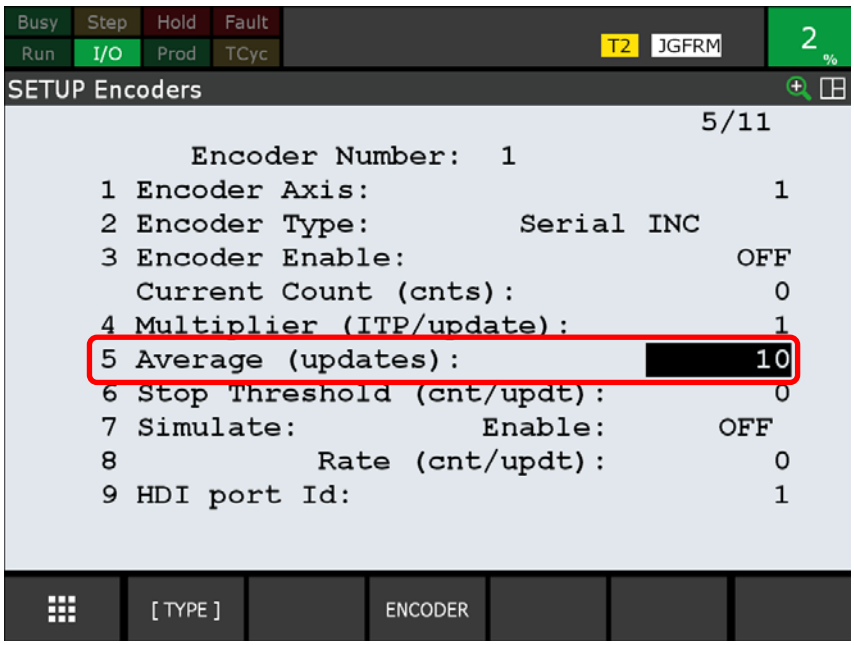
- αA1000S Pulsecoder (red Pulsecoder): [Serial INC] or [Main Serial INC]

αA1000S
Encoder type: **Serial INC**
* When connecting to the main board, **Main Serial INC**

4. Repower the robot controller.

➢ Then, perform step 1 to display the [SETUP Encoders] screen again.

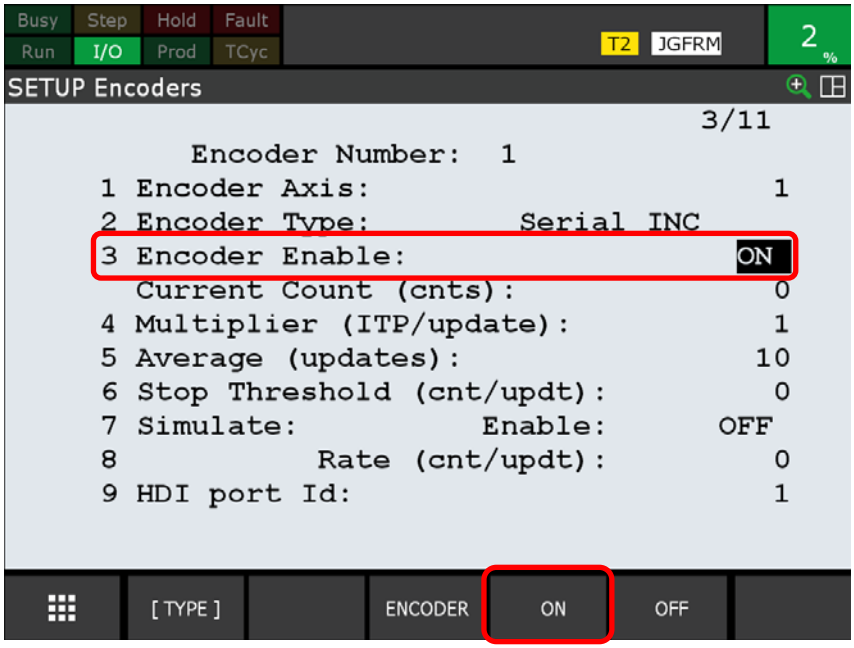
5. Move the cursor to [Average (updates)] and enter the total number of instantaneous speeds (width of moving average).



Memo

- Usually, enter "10."
- This value means the robot will stop smoothly even if the conveyor stops suddenly while the robot is tracking.

6. Move the cursor to [Encoder Enable] and press F4 [ON].



7. Move the conveyor and check that the pulse count is updated in [Current Count (cnts)].

Setup of Pulsecoder is now complete. Next, you will mount and connect a camera to use for visual tracking.

3 MOUNTING AND CONNECTING A CAMERA

Mount a camera and connect it to a robot controller.

Note If there are multiple robots, mount a camera on the most upstream robot in order to make setup simple.

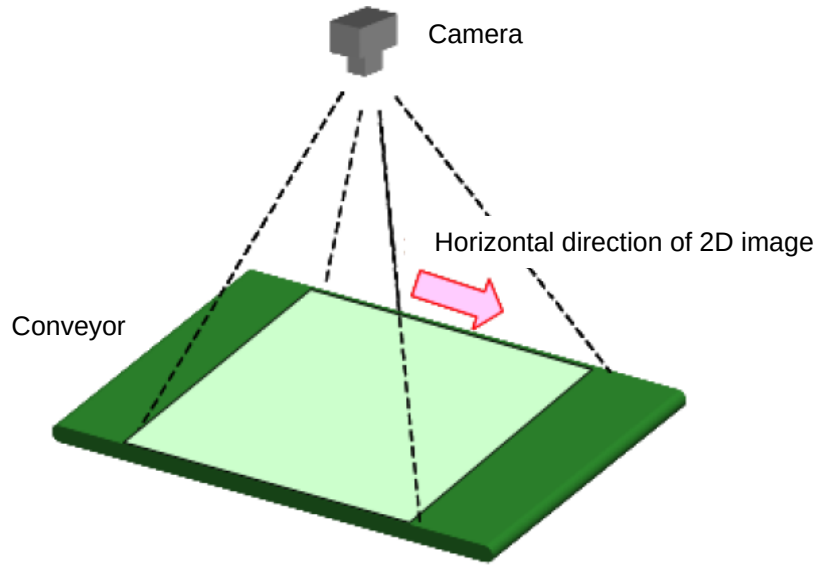
Memo The camera mounted in "1.1.1 Mounting a Grid Pattern Detection Camera" is for the auto visual track frame setup function. This section is about the fixed camera that is used for visual tracking.

3.1 MOUNTING A CAMERA

Memo For the procedure to connect a camera to a robot controller, refer to "R-30*i*B Plus / R-30*i*B Mate CONTROLLER Sensor Mechanical Unit / Control Unit OPERATOR'S MANUAL."

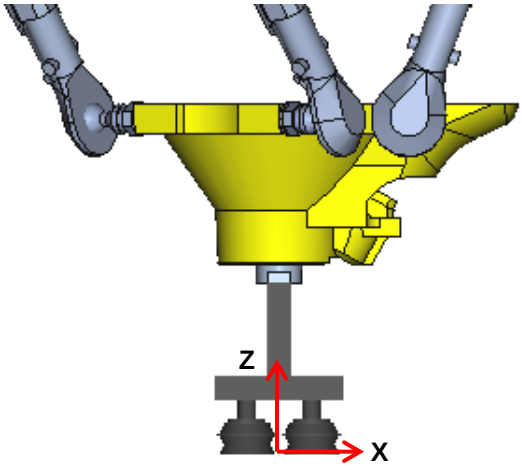
Attach a lens to a camera and mount it at the upstream part of the conveyor. Make it so that the optical axis of the camera is perpendicular to the conveyor surface.

Mount the camera so that the direction in which the conveyor moves will be the direction in which the size of the 2D image will be larger. Usually, this will be the horizontal direction. This will ensure that there is a wide field of view in the direction in which the conveyor moves.



4 SETTING A TOOL FRAME

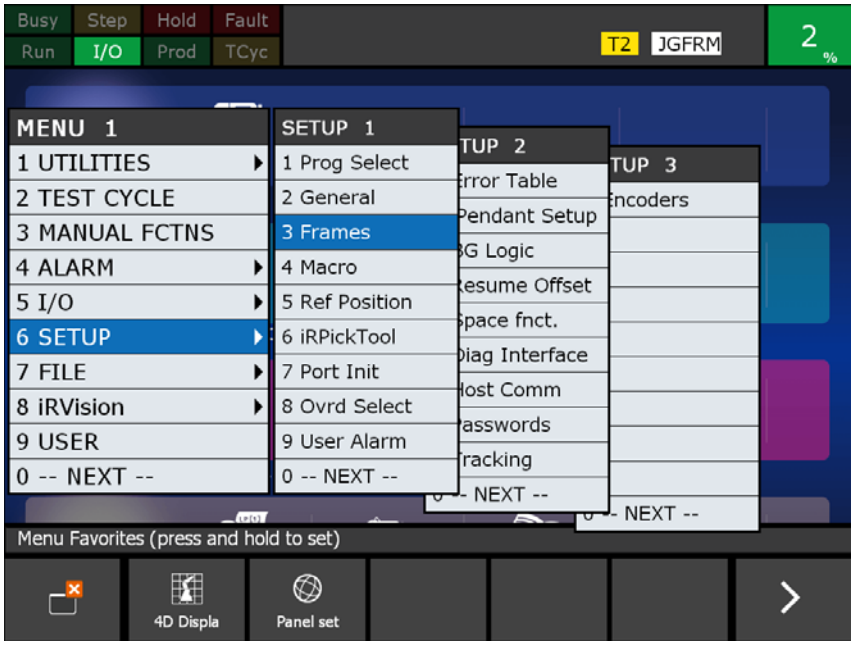
Set up a tool frame at the tip of a vacuum pad.



4.1 SETTING UP BY DIRECT LIST METHOD

Set up a tool frame on the basis of the hand design values, using direct list method.

1. On the teach pendant of the robot controller, press the [MENU] key and select [SETUP] - [Frames].



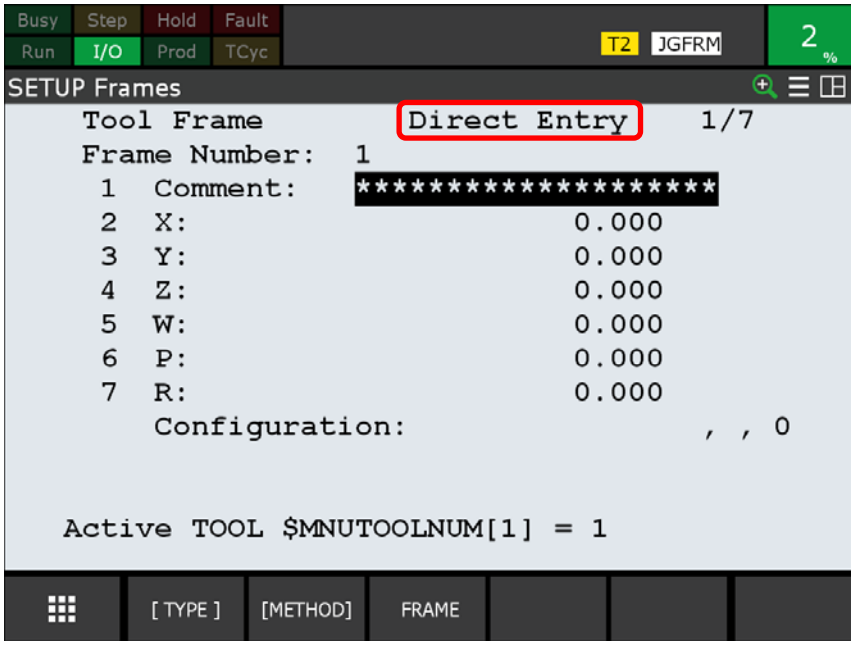
2. Press F3 [OTHER] and select [Tool Frame] from the displayed menu.

3. Move the cursor to the tool frame number to set, and press F2 [DETAIL].

- Here, Tool Frame Number 1 is selected.

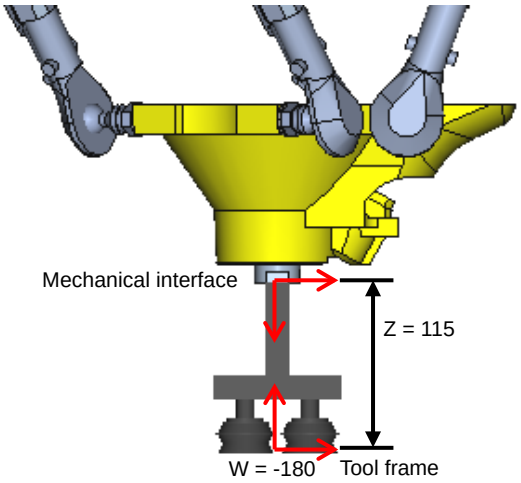
4. Check that the teaching method is [Direct Entry].

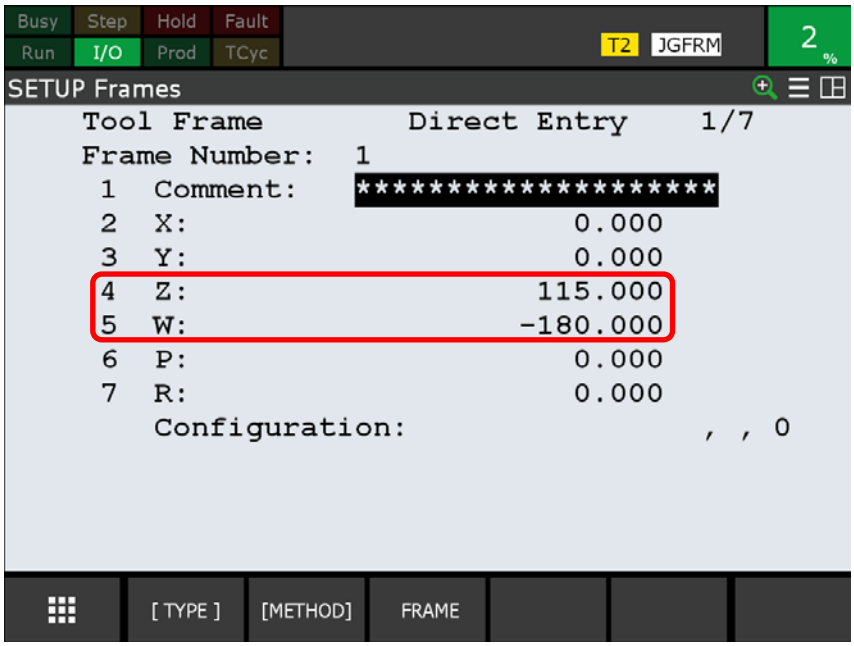
- If another teaching method is selected, press F2 [METHOD] and select [Direct Entry] from the displayed menu.



5. Enter the tool frame value directly.

➢ Here, a hand like the one shown below is used. Enter the values 'X = 0,' 'Y = 0,' 'Z = 115,' 'W = -180,' 'P = 0' and 'R = 0.'



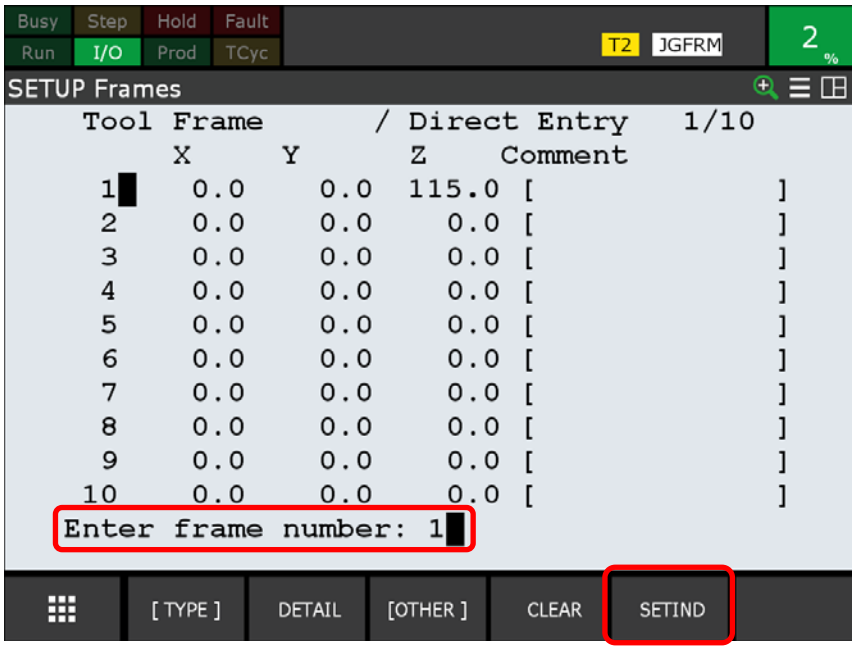


Memo

- For the [Z] value, enter the height of the tool from the mechanical interface.
- If you are using a Genkotsu robot, we recommend using "-180." for the [W] value.
  If you are using an articulated type, the Z-axis of the tool frame faces in the direction of movement away from the flange. On the other hand, if you are using a Genkotsu robot, the Z-axis of the tool frame faces in the opposite direction. Here, "-180" is entered for the [W] value, so that the Z-axis faces in the same direction as for an articulated type.

6. Press the [PREV] key and return to the screen with the list of tool frames.

7. Press F5 [SETIND] and enter the number of the tool frame you have set.



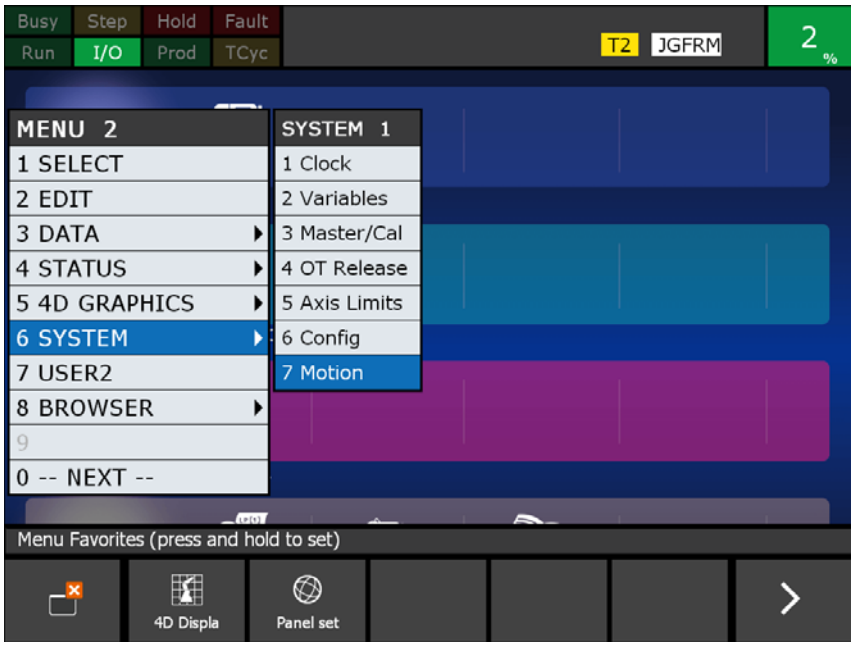
➢ Here, it is set to Tool Frame Number 1, which was set in step 4.

Setup of a tool frame is now complete. Next, you will set up the payload that is applied to the robot.

5 SETTING UP THE PAYLOAD

Set up the payload for the robot on the [MOTION PERFORMANCE] screen.
Here, 'Hand only' is set for Payload Setting No.1, and 'Hand + workpiece' is set for Payload Setting No. 2.

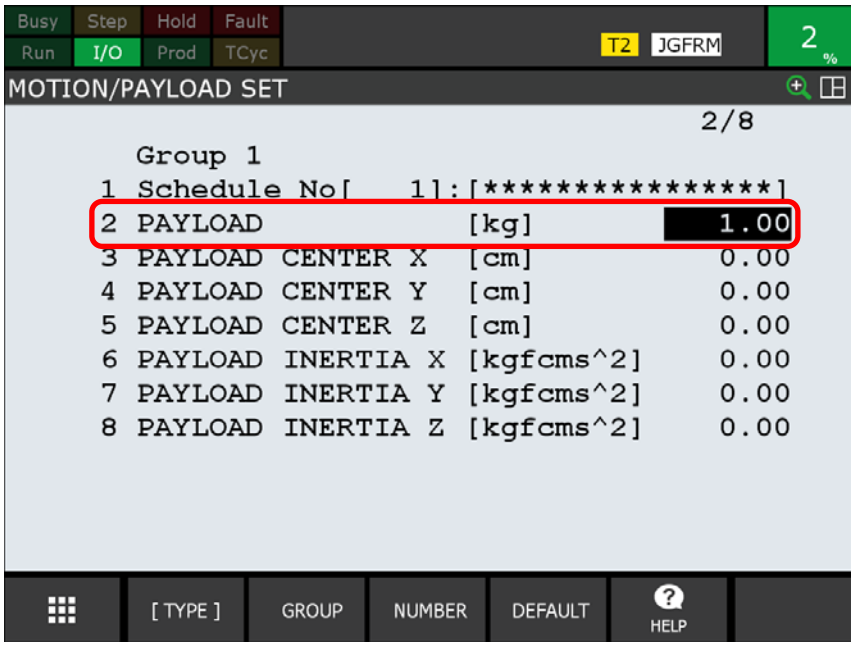
1. On the teach pendant of the robot controller, press the [MENU] key and select [NEXT] - [SYSTEM] - [Motion].



2. Move the cursor to Payload Setting No. 1 and press F3 [DETAIL].

3. Set each item as required.

Note Be sure to set [PAYLOAD].



➢ Here, the payload weight is assumed to be 1.0 kg.

Memo For [PAYLOAD], set the weight for 'Hand only,' without including the weight of the workpiece.

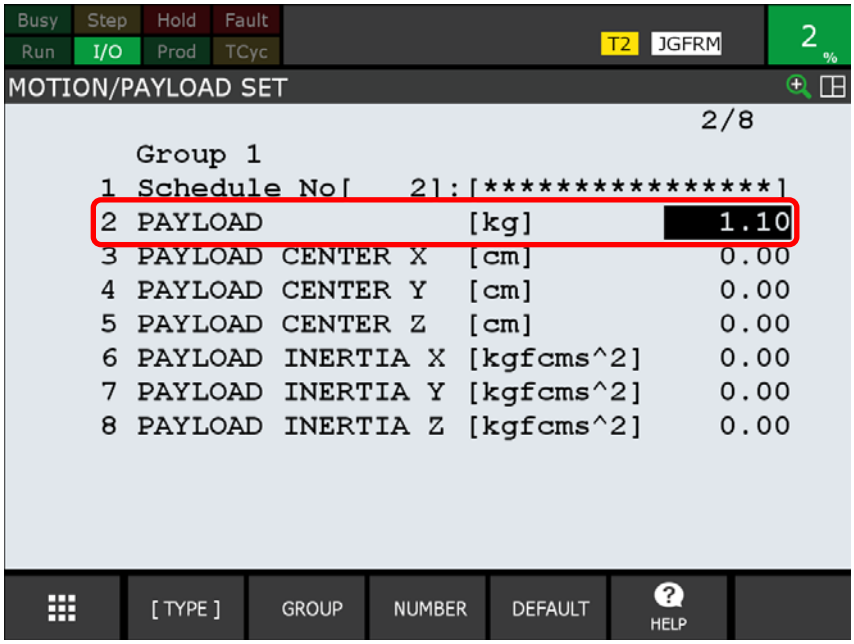
➢ If you change the setting, the message 'Path / cycle time will be changed. Continue?' will be displayed. Select F4 [YES].

4. Press the [PREV] key and return to the [MOTION PERFORMANCE] screen.

5. Move the cursor to Payload Setting No. 2 and press F3 [DETAIL].

6. Set each item as required.

Note Be sure to set [PAYLOAD].



➢ Here, the payload weight is assumed to be 1.1 kg (weight of workpiece: 0.1 kg).

Memo For [PAYLOAD], set the weight for 'Hand + workpiece' (weight when holding a workpiece).

➢ If you change the setting, the message 'Path / cycle time will be changed. Continue?' will be displayed. Select F4 [YES].

7. Press the [PREV] key and return to the [MOTION PERFORMANCE] screen.

Setup of the payload is now complete. The auto visual track frame setup function is now ready to be used.

6 SETTING UP TRACKING PARAMETERS

Using the auto visual track frame setup function, set up tracking parameters with the following procedure.

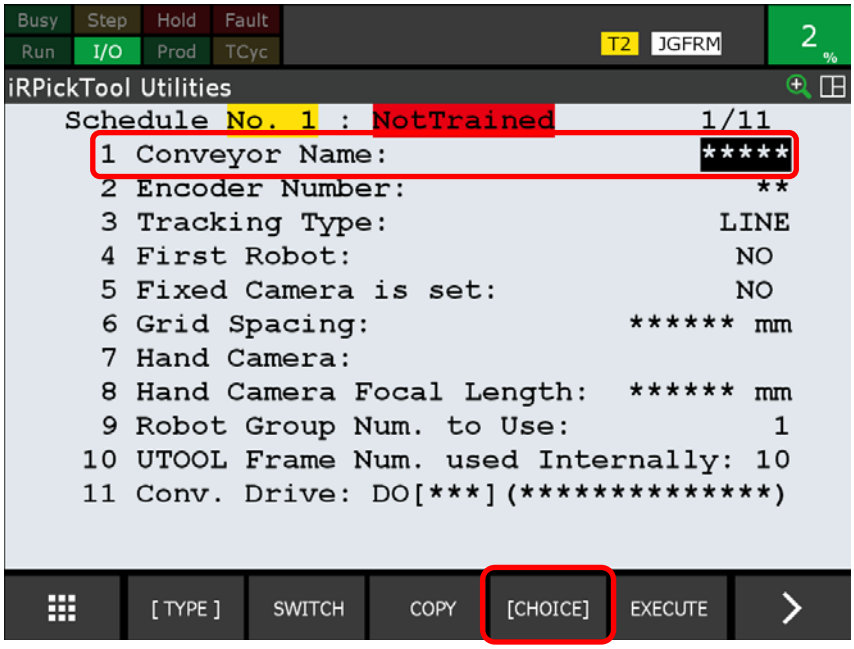
- Setting up a schedule
- Calibrating the camera
- Setting up a tracking frame

6.1 SETTING UP A SCHEDULE

Enter the items required for the auto visual track frame setup function.

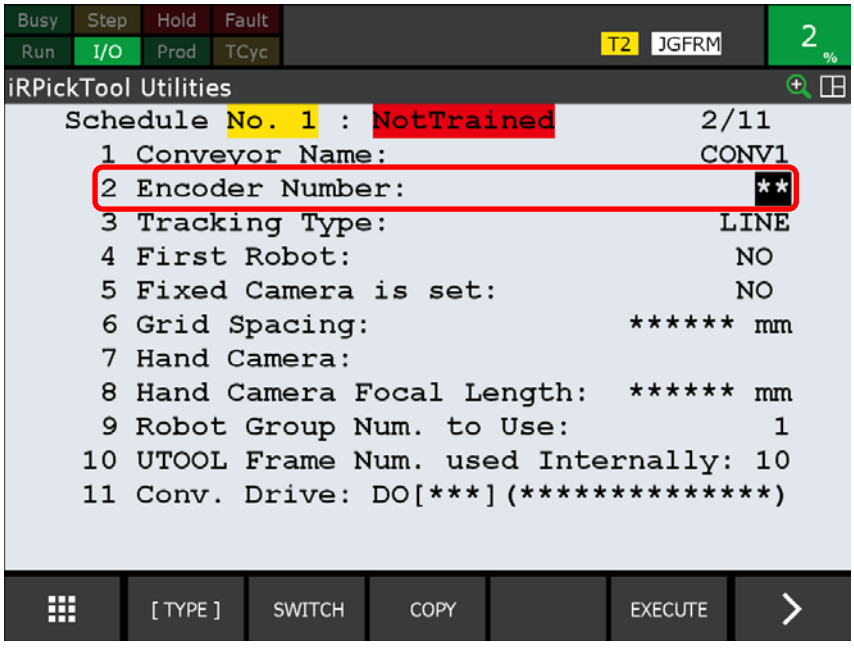
1. On the teach pendant of the robot controller, press the [MENU] key and select [UTILITIES] - [iRPickTool].

2. Move the cursor to [Conveyor Name] and press F4 [CHOICE]. From the list, select the name of the corresponding conveyor.



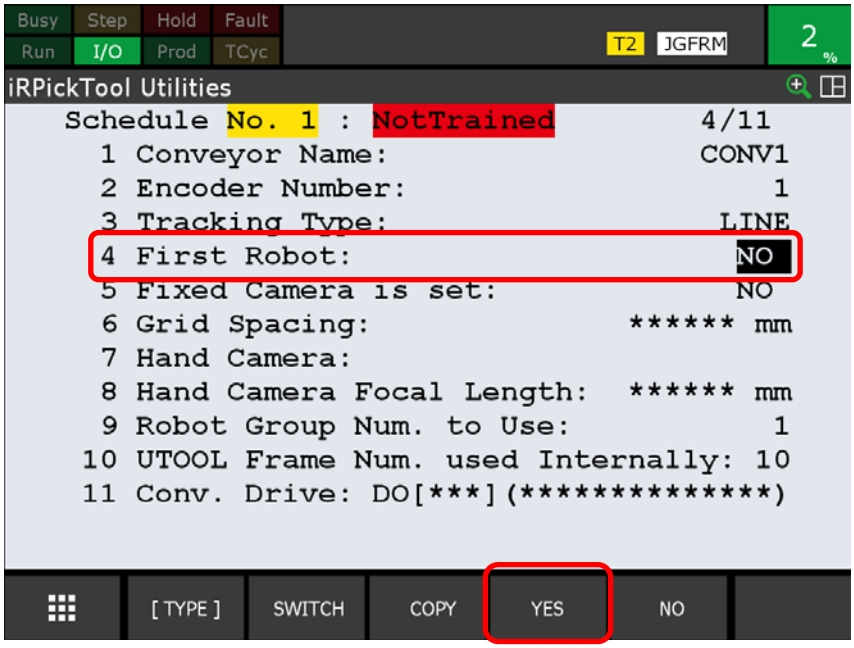
➢ Here, [CONV1] is selected.

3. Move the cursor to [Encoder Number] and enter the encoder number that you have set.

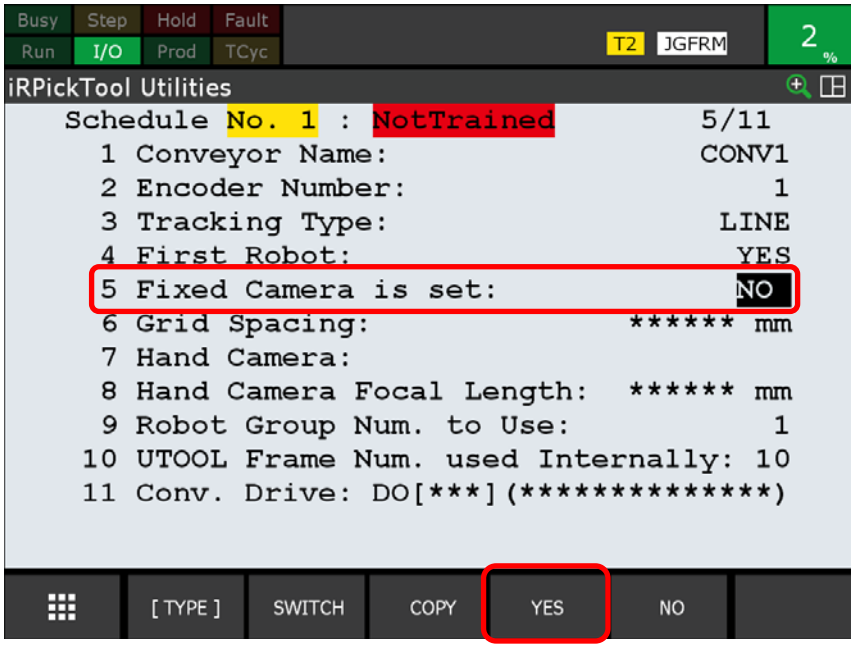


➢ Here, Encoder Number 1, which was set in "2.2 SETTING UP PULSECODER" is entered.

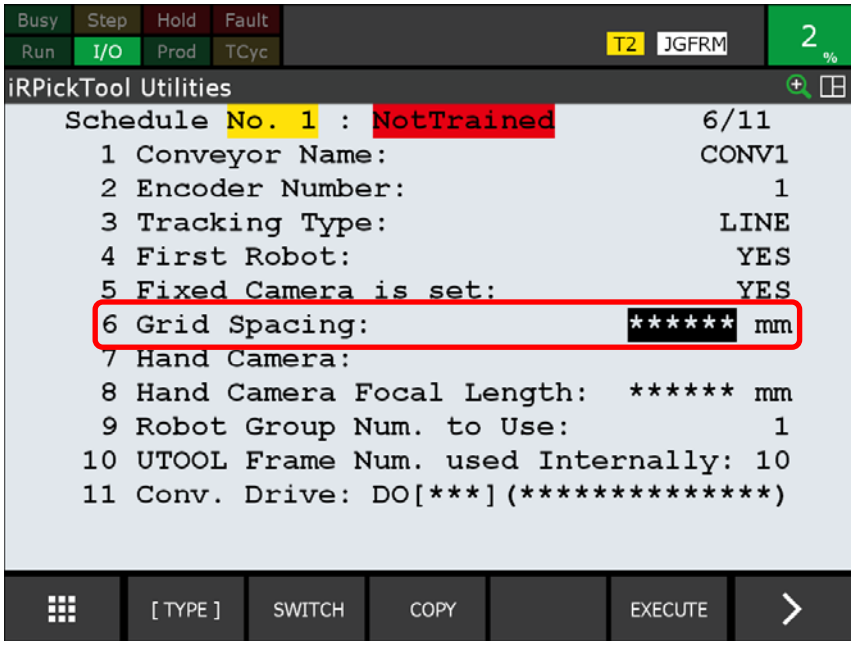
4. Move the cursor to [First Robot] and press F4 [YES].



5. Move the cursor to [Fixed Camera is set] and press F4 [YES].

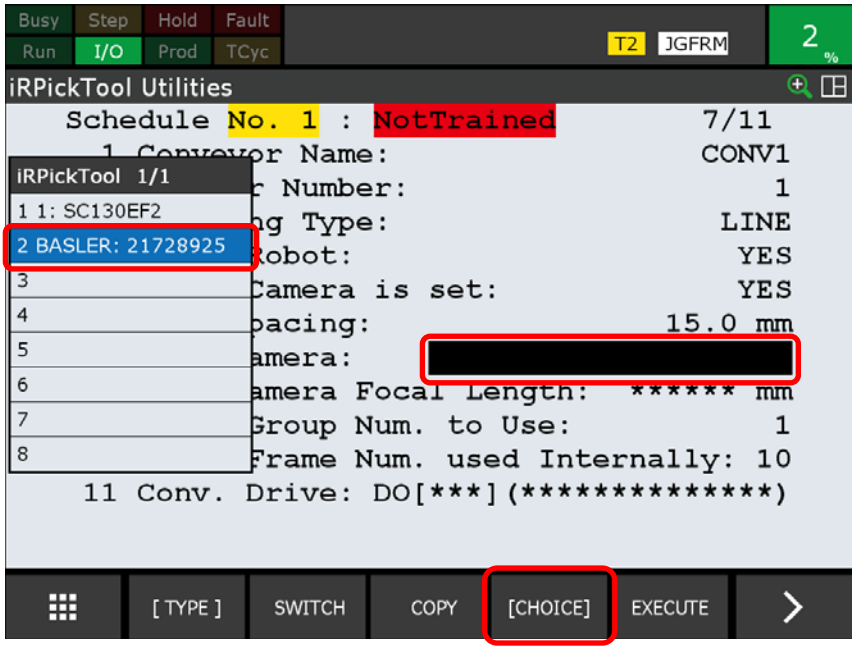


6. Move the cursor to [Grid Spacing] and enter the grid spacing.



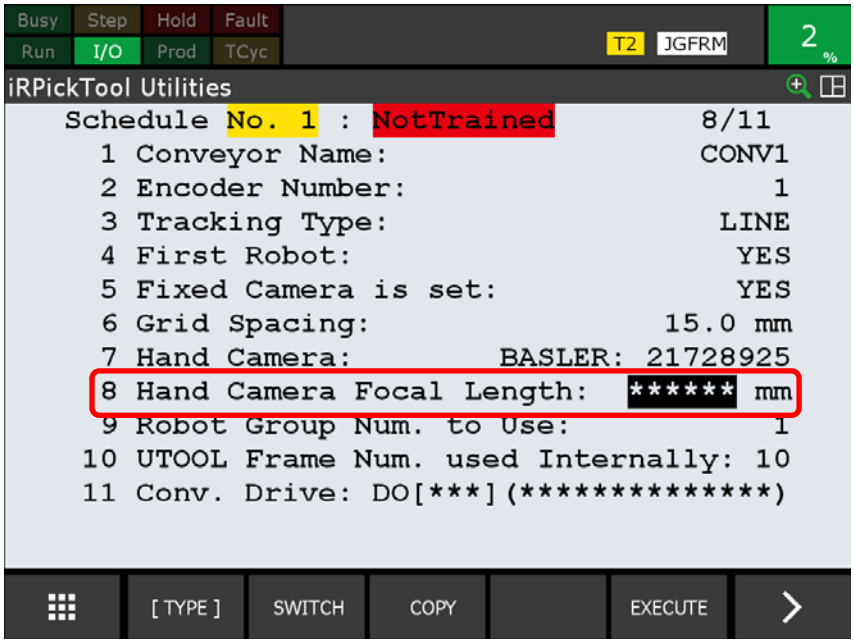
➢ Here, "15.0" is entered.

7. Move the cursor to [Hand Camera], press F4 [CHOICE] and select the corresponding camera name from the displayed list.

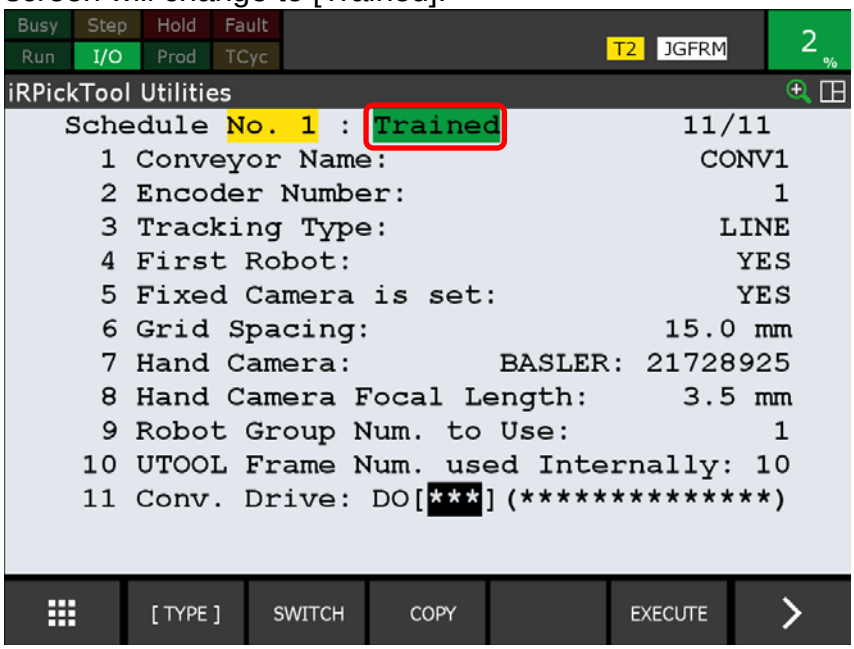


➢ Here, the grid pattern detection camera 'BASLER (USB camera manufactured by Basler (acA640-20um)),' which was mounted on the hand in "1.1.1 Mounting a Grid Pattern Detection Camera," is selected.

8. Move the cursor to [Hand Camera Focal Length], and enter the nominal focal length of the lens that you are going to use.



- Here, "3.5" is entered.
- If you enter the focal length, the [Not Trained] displayed at the top of the screen will change to [Trained].



Memo If you are controlling the drive for the conveyor using DO, enter the DO number in [Conv. Drive].

Setup of a schedule is now complete. Next, you will calibrate the camera.

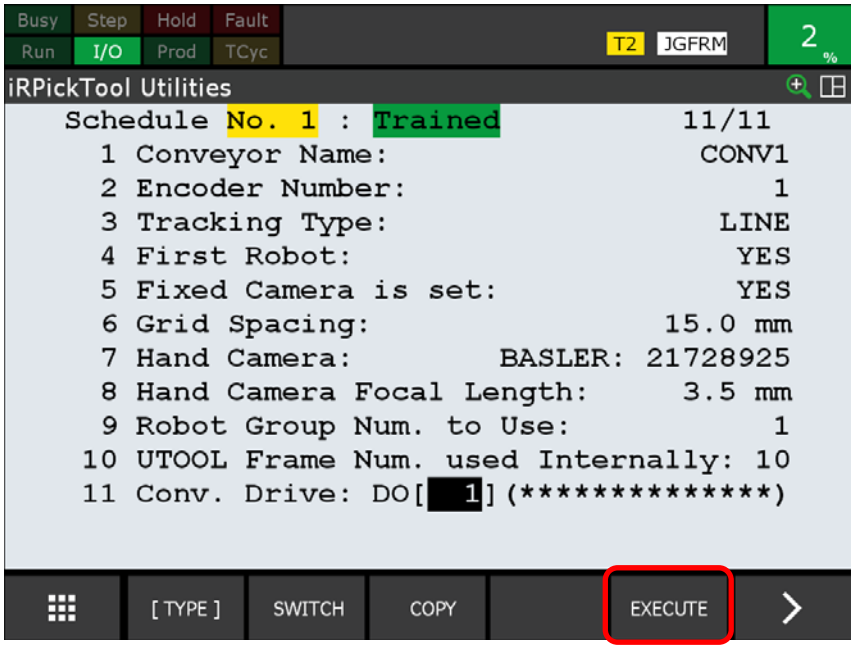
6.2 CALIBRATING THE CAMERA

Perform camera calibration by executing the schedule that you have set.
Camera calibration is carried out in the following order: creating camera data, detection test, adjusting the exposure time, specifying the focal length.

Note

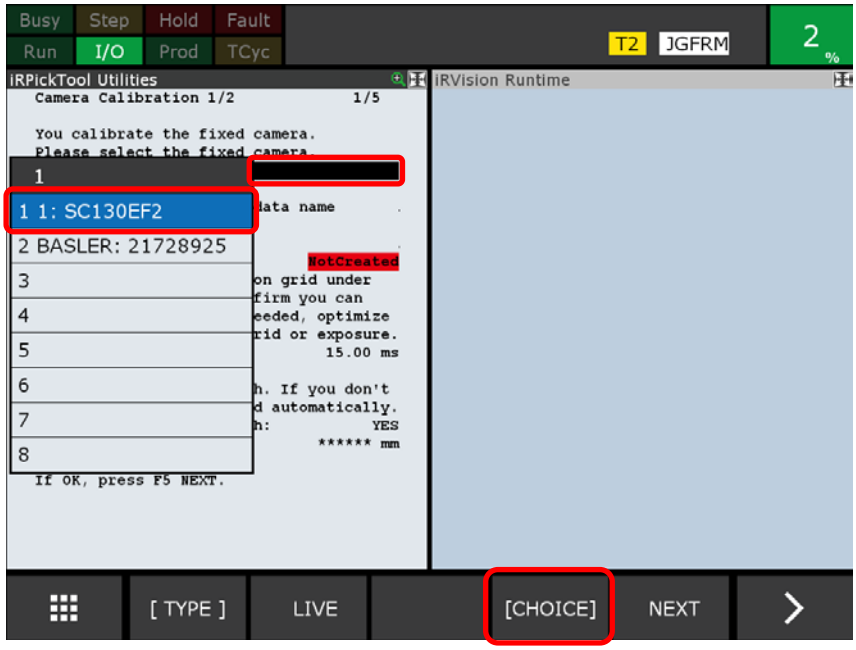
- If you are logged in on the [iRPickTool Setup] screen, log out before performing camera calibration. For the procedure to log out, refer to step 4 in "6.3.4 Calculating and Checking Parameters."
- If you are going to run auto setup, enable the teach pendant or change the mode switch to T1 or T2 mode.

1. On the [iRPickTool Utilities] screen for the corresponding schedule number, press F5 [EXECUTE].



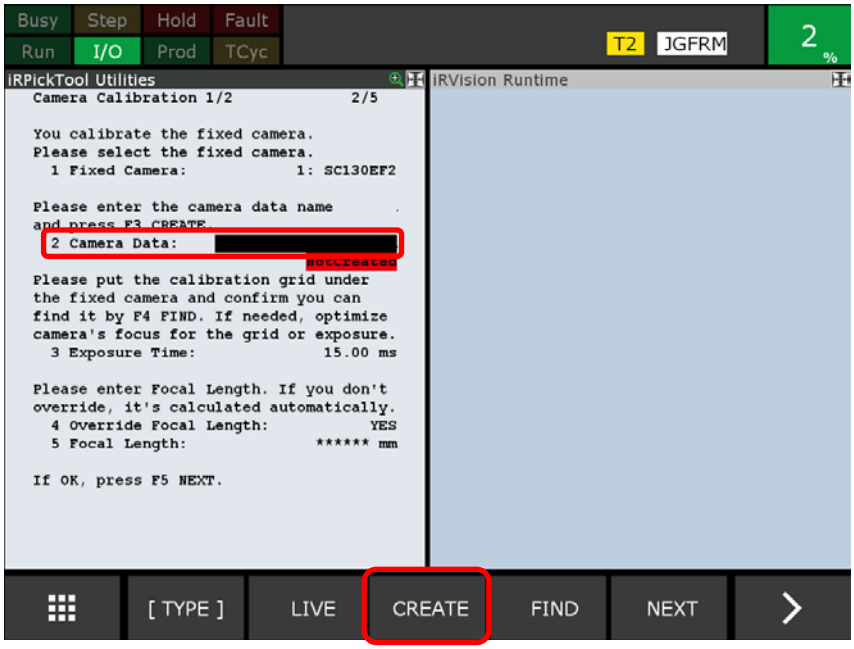
➢ The setup screen for camera calibration will appear.

2. Move the cursor to [Fixed Camera], press F4 [CHOICE] and select the corresponding fixed camera name from the displayed list.



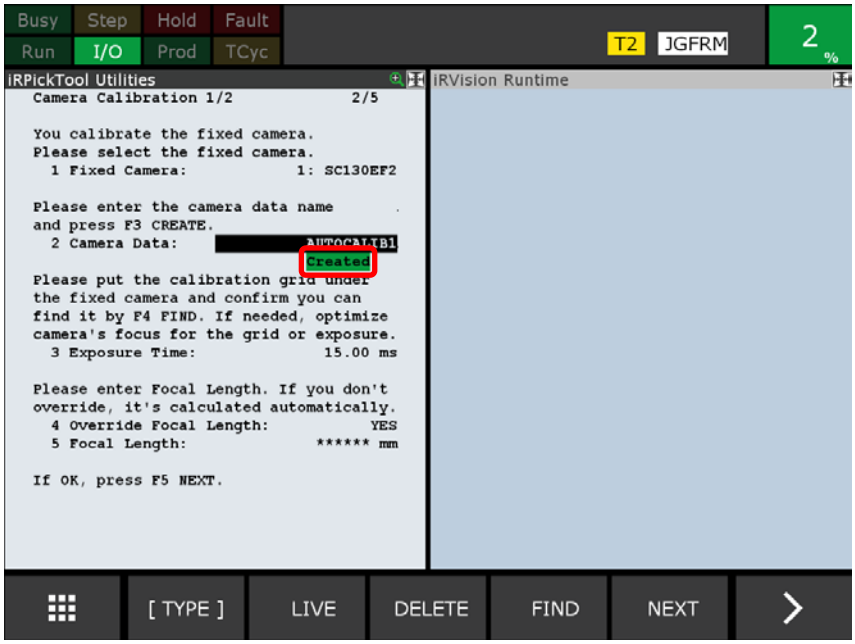
➢ Here, the digital camera [SC130EF2] is selected.

3. Move the cursor to [Camera Data] and enter the camera data name. Then, press F3 [CREATE] and enter the camera data name.



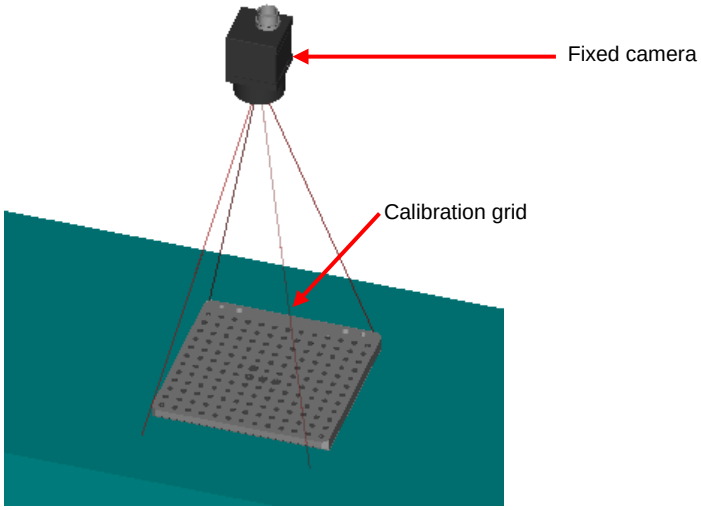
➢ Here, 'AUTOCALIB1' is entered.

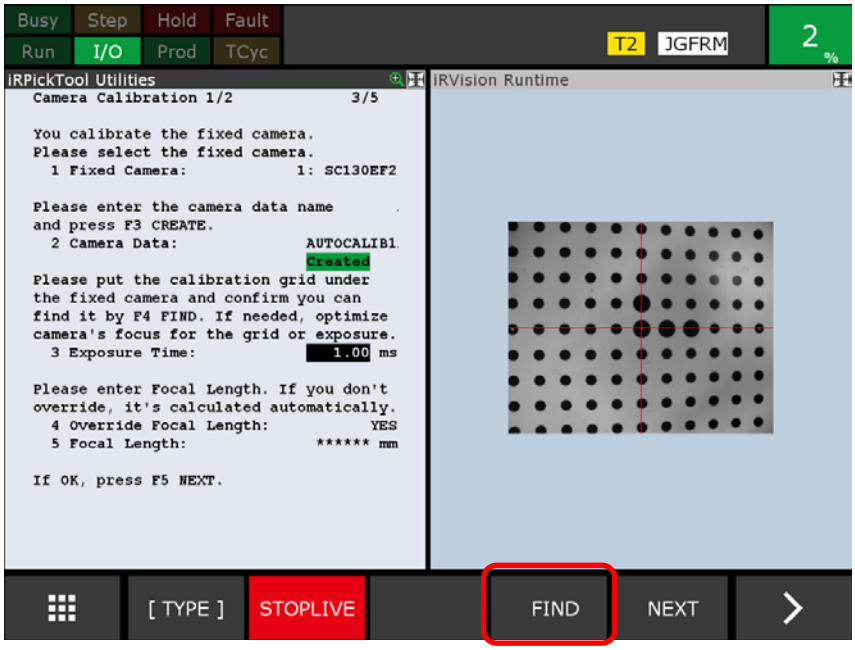
➢ When the camera data is created, [Not Created] displayed under the camera data name will change to [Created].



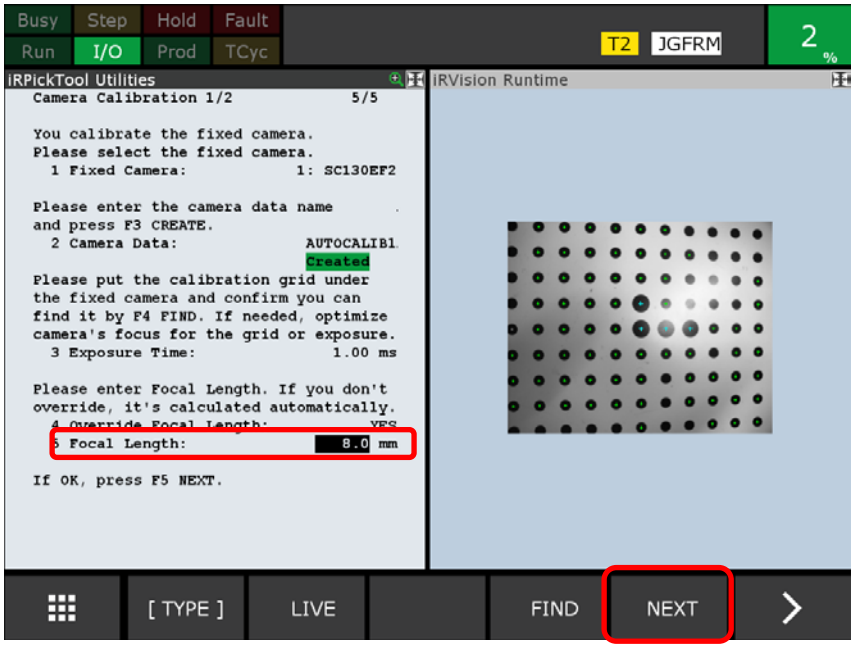
4. Check that the grid pattern is detected on the live screen.

- Place a calibration grid under the fixed camera and press F2 [LIVE].
- While checking the live screen, adjust the focus, diaphragm and exposure time of the lens so that the grid pattern can be seen clearly. Adjust the focus and diaphragm directly on the lens rather than on the screen, and adjust the exposure time on the screen.
- After making the adjustments, press F4 [FIND] and check that the grid pattern is detected.





5. Move the cursor to [Focal Length], enter the nominal focal length of the lens that you are going to use, and press F5 [NEXT].

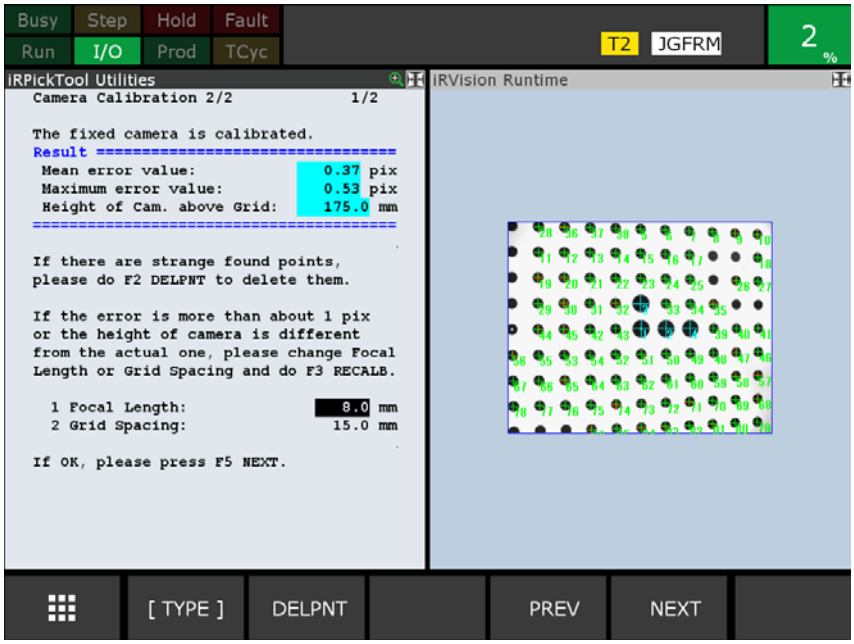


Memo

- If you select [No] for [Override Focal Length], the focal length will be detected automatically. By default, [Yes] is set, so the focal length needs to be specified manually.
- For the procedure to calculate the focal length automatically, refer to "6.2.2 Accurately Setting the Focal Length."

➢ The grid pattern will be detected.

6. Check the detection result.



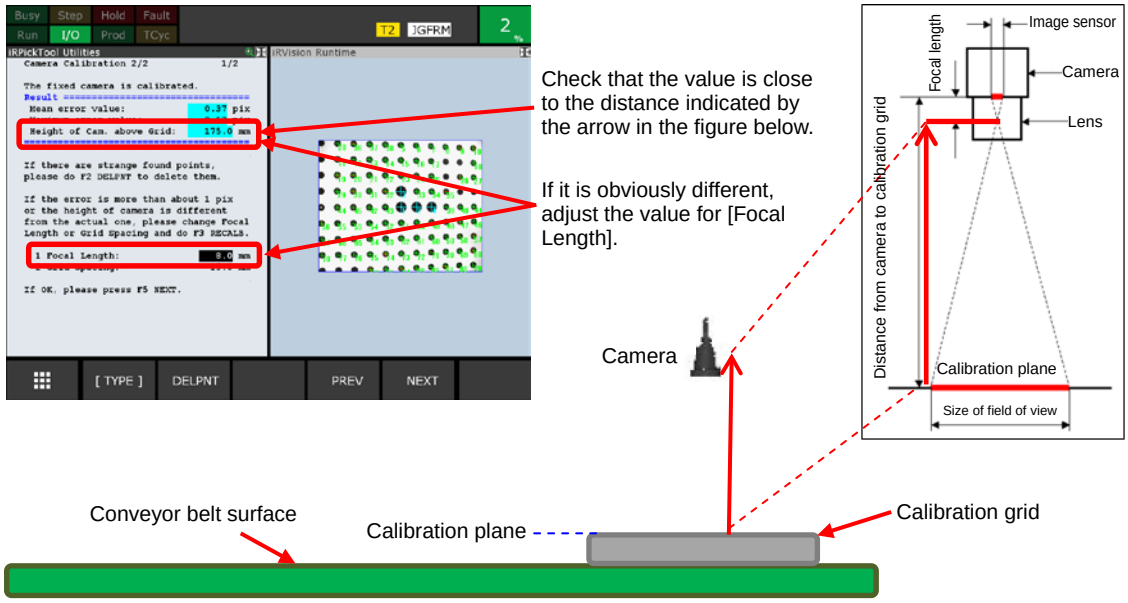
Memo

- If there are any dots that have been falsely detected, press F2 [DELPNT]. Follow the displayed message, enter the number for the falsely detected point displayed in Runtime Image, and delete it.
- If there is an error of more than 1 pixel or the height of camera is different from the actual height, make a fine adjustment to the value for [Focal Length] or review the value for [Grid Spacing].
  For details on the focal length, refer to "6.2.1 Checking the Focal Length."

If there are no problems up to here, camera calibration is complete. Press F5 [NEXT] and proceed to the setup of a tracking frame.

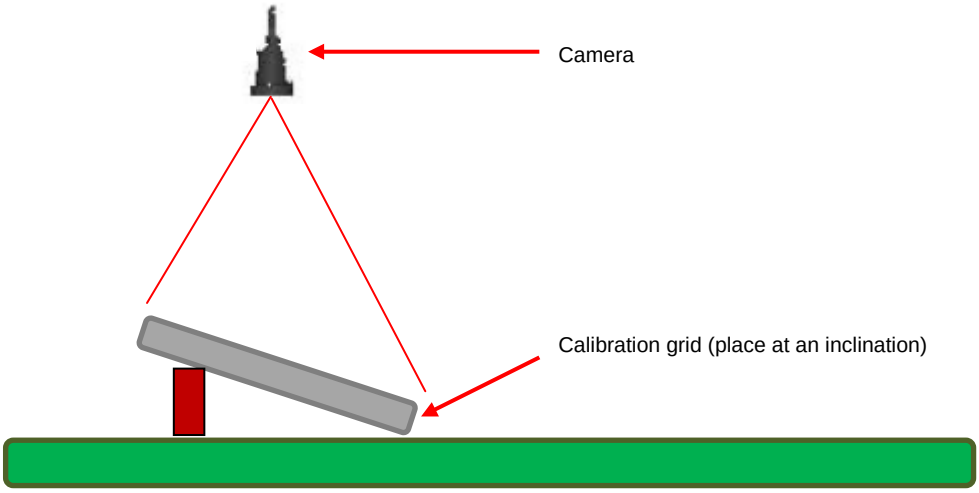
6.2.1 Checking the Focal Length

You can check the focal length by comparing the actual height from the calibration plane to the camera lens with the value for [Height of Cam. above Grid] that is displayed for the detection result. An error of a few tens of mm is permissible.



6.2.2 Accurately Setting the Focal Length

If you place the calibration grid at an inclination in step 4 under "6.2 CALIBRATING THE CAMERA," select [No] for [Override Focal Length], and then proceed to step 6, the focal length will be calculated with greater accuracy.



However, for the setup of a tracking frame described later, you must place the calibration grid so it is flat and feed it along. Therefore, press F4 [PREV] on the screen where the detection results are displayed and return to the screen before detection, select [Yes] for [Override Focal Length], place the calibration grid so it is flat, and then proceed to the next step. If you go back to the previous step, the focal length that is retained will be one that has been calculated automatically.

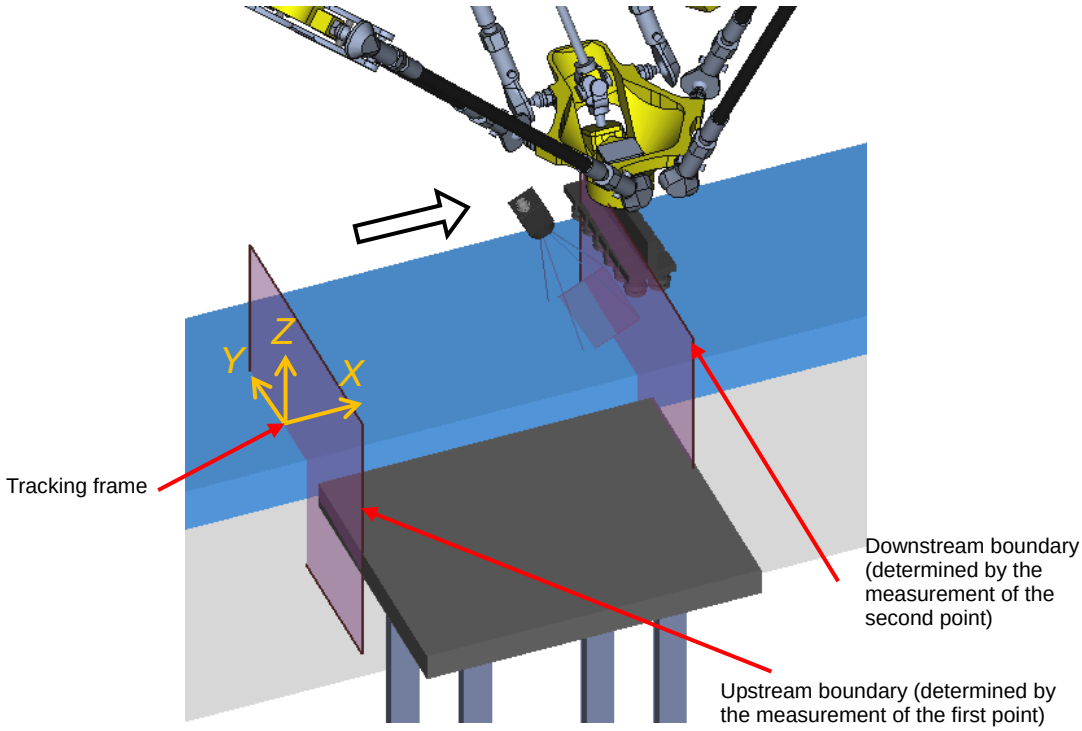
Memo As every lens will be different, re-perform automatic calculation of the focal length if you use a different lens, even if the nominal focal length is the same.

6.3 SETTING UP A TRACKING FRAME

After you have completed camera calibration, set up the tracking frame, the encoder scale, and the tracking area on the conveyor.

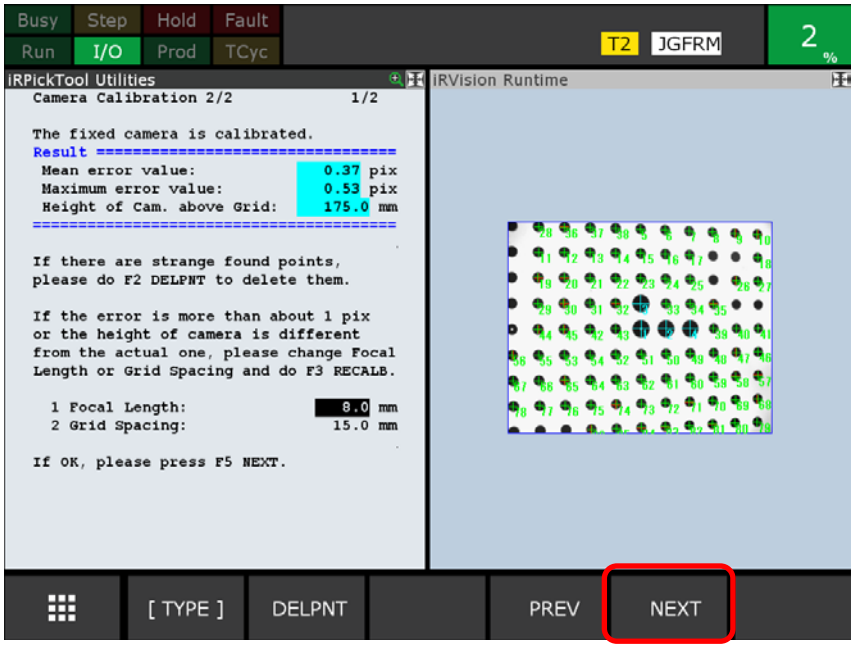
Do the setup in the following order: measurement of the first point, measurement of the second point, recording the Z height, automatic calculation of the parameters, checking the results.

The figure below is an image of the tracking frame and tracking area that will be set.



6.3.1 Measuring and Checking the First Point

1. On the screen where you have completed camera calibration, press F5 [NEXT].

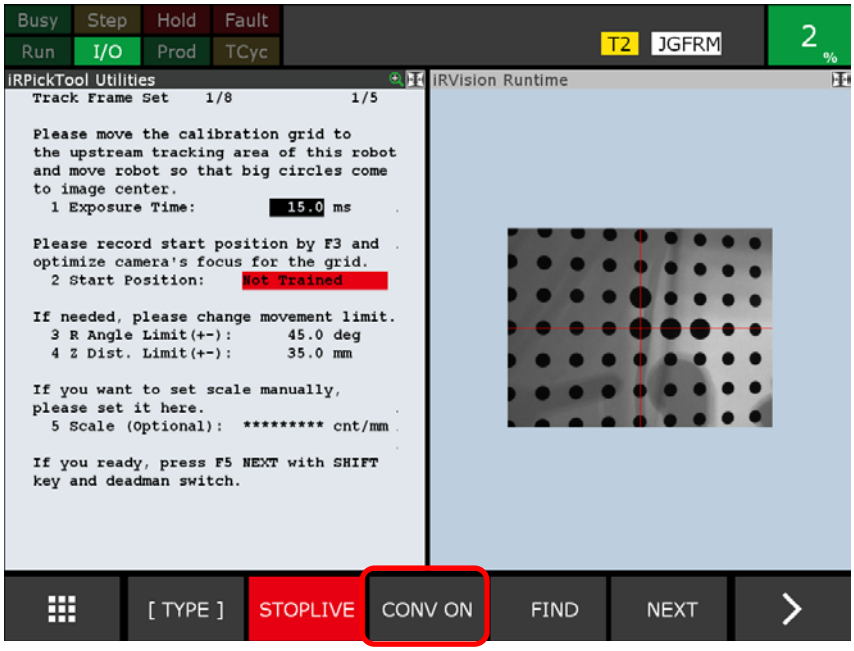


➢ The setup screen to perform measurement of the first point appears. The grid pattern detection camera snaps images automatically, and the images are displayed in real-time in Runtime Image.

2. On the hand, mount the grid pattern detection camera that was described in "1.1 EQUIPMENT REQUIRED FOR THE AUTO VISUAL TRACK FRAME SETUP FUNCTION."

3. Operate the conveyor so that the calibration grid is on the upstream side of the robot's workspace, and stop.

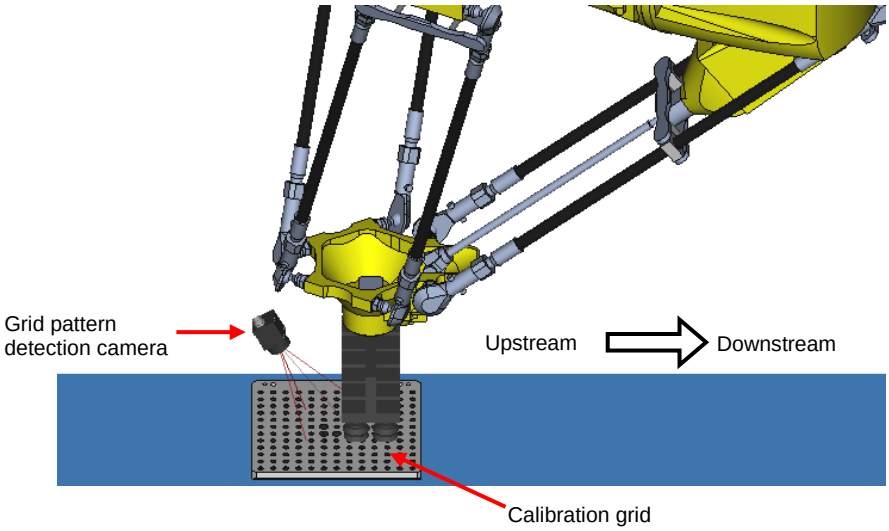
➢ If you have selected drive DO, press F3 [CONV ON] to operate the conveyor. To stop the conveyor, press F3 [CONV OFF].



4. Move the robot by jog operation so that the large dots are roughly at the center of the image, and adjust the exposure time and focus of the camera.

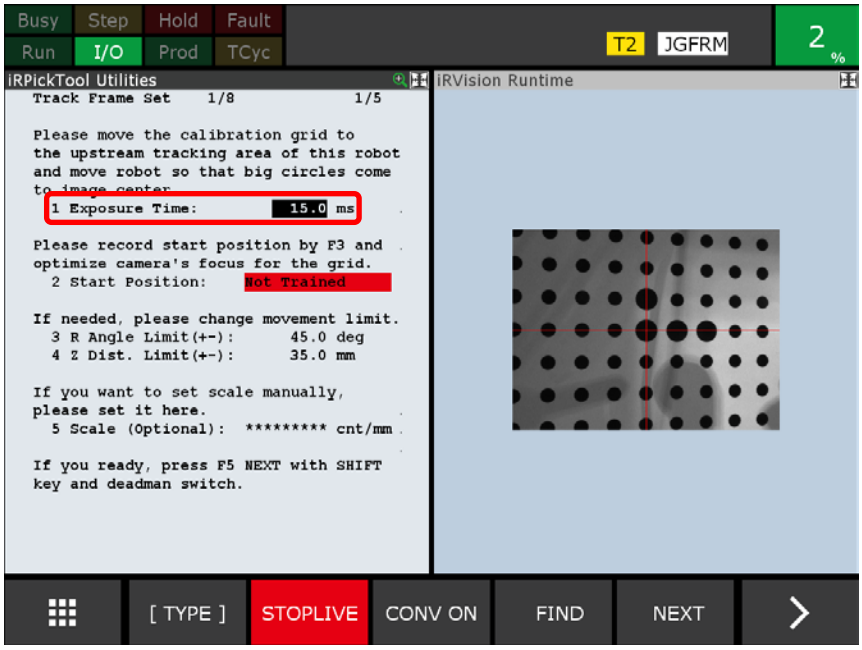
Memo

If the large dots are not at the center, the limit check described later might not be performed properly. In a limit check, the camera position is calculated roughly by means of simple measurement, and the target position is checked without actually moving the robot. The camera position will be more accurate if you perform a limit check close to the center of a large dot.



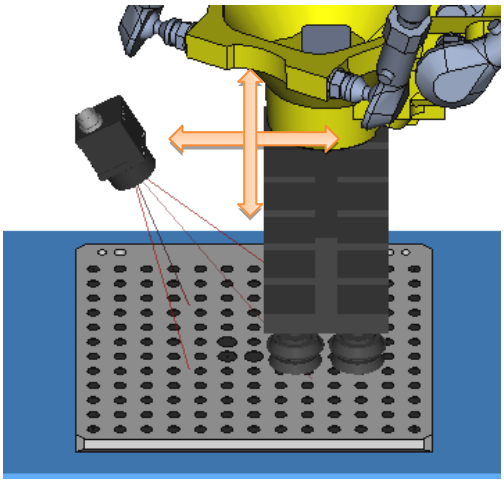
Memo

If you adjust the position so that the direction in which the three large dots are in a line is the horizontal direction in the image like in Runtime Image in the figure below, it will be easier for the measurement to become stable.

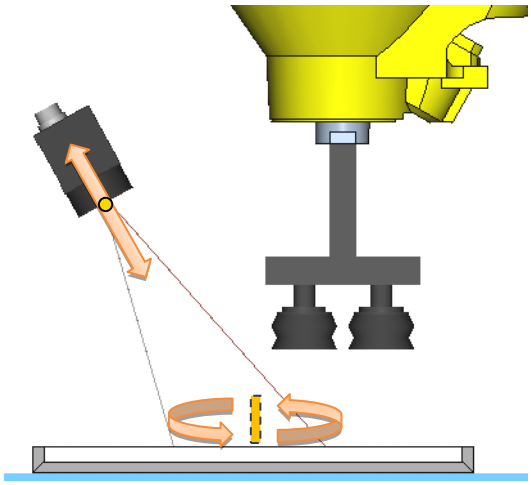


Note At least two small dots have to be in a line in the up, down, left and right directions of the large dots.

- This position will be the start position for the first point.
- The robot moves from the start position and measures the first point. During measurement, it moves as shown in the figure below.



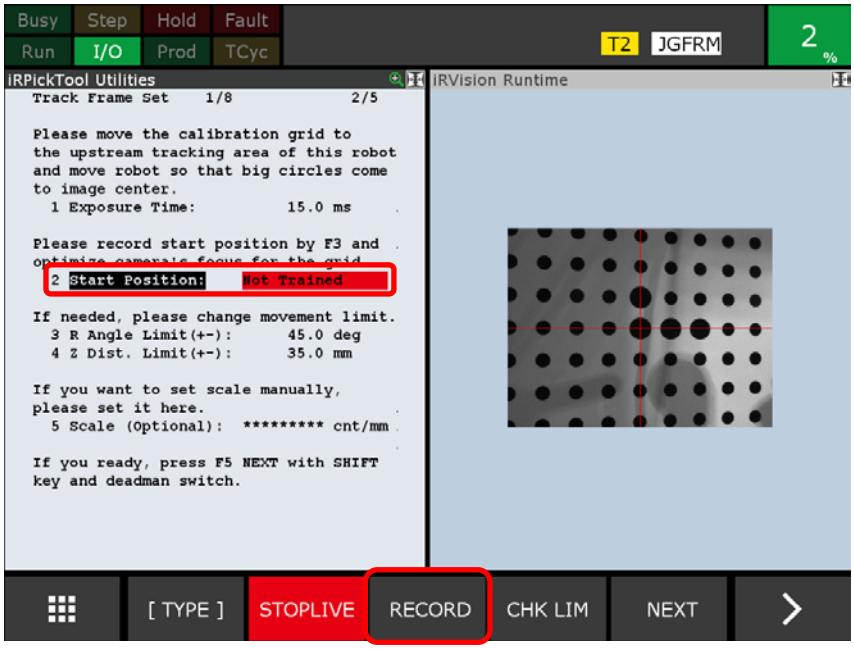
The robot moves all the way in X and Y directions within the range in which the large dots appear in the image.



In the direction of the USB camera's field of view, the robot moves up and down by the distance specified in [Z Dist. Limit]. While keeping the dots at the center, the robot rotates by the angle specified in [R Angle Limit].

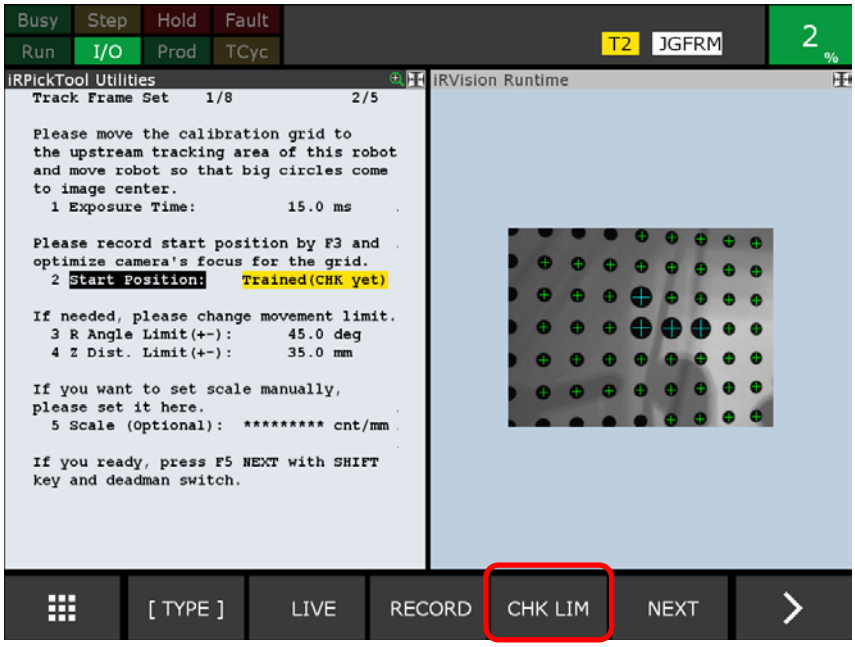
Note Adjust the start position by taking into consideration the robot's movement amount.

5. Move the cursor to [Start Position] and press F3 [RECORD].



➢ When the position is recorded, the display for [Start Position] changes to [Trained (CHK yet)].

6. While holding down the [SHIFT] key, press F4 [CHK LIM].



➢ The robot moves by the minimum amount necessary and starts to check whether it can move to the measurement point. When it does this, the robot checks while leaving a margin of about 5 mm in each of the X, Y and Z directions relative to the target position, for safety.

Memo

Measurement is possible even without performing limit error detection (limit check). Go to step 7 with things just as they are.

If you do not perform a limit check, it can sometimes be the case that the robot is sometimes unable move to the target position during measurement and you have to redo the measurement from the start.

By checking the validity of the start position in advance by means of a limit check, you can save the time and effort involved in redoing the measurement.

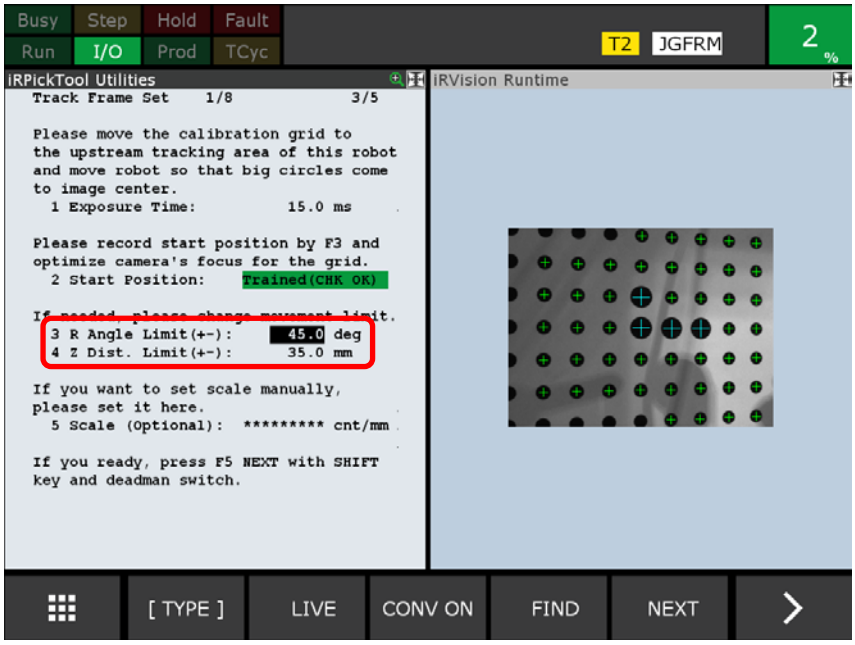
➢ If there are no problems with the check results, the display for [Start Position] changes to [Trained (CHK OK)].

Note

- If a limit error is detected as a result of the check, the display for [Start Position] changes to [Trained (CHK NG)]. If an error is detected, change the start position and repeat the procedure from step 4.
- Limit checks are performed for measurement target positions. You do not perform limit checks for all motion paths. Therefore, even if you have performed a limit check in advance, a limit error may occur near the workspace boundary.
- Measurement will also stop if the large dots go off screen during measurement. A limit check will not go so far as to check whether the large dots are contained in the snap window during measurement.

CAUTION	Robot movement brings with it the risk that the robot will collide with the conveyor or peripheral equipment. When setting the [Start Position], or the [R Angle Limit] and [Z Dist. Limit] described next, take due care.

7. Move the cursor to [R Angle Limit (+-)] or [Z Dist. Limit (+-)], and enter an appropriate value.



CAUTION	Enter appropriate limit values, so that the robot will not come into contact with the conveyor or peripheral equipment.

➢ Next, perform calibration grid frame measurement.

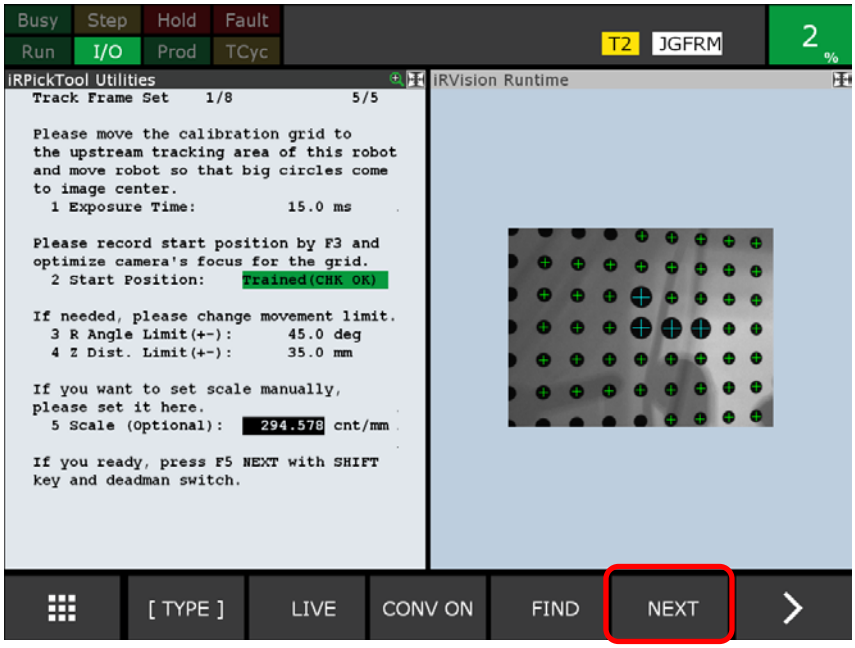
Memo

If you want to obtain a more precise result, move the cursor to [Scale (Optional)] and enter an appropriate value.

The scale can be calculated from the value obtained by dividing the amount of increase in the encoder count when an appropriate mark is fed from upstream, by the movement distance in the flow direction measured with a tape measure, etc.

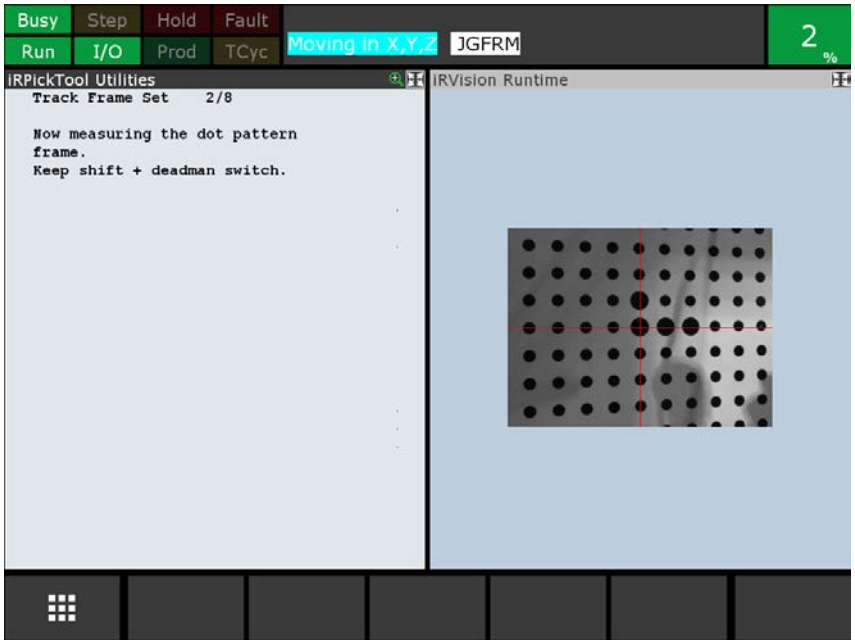
Scale = Difference in the encoder count value (cnts) / Movement distance (mm)

8. While holding down the deadman switch and the [SHIFT] key, press F5 [NEXT].



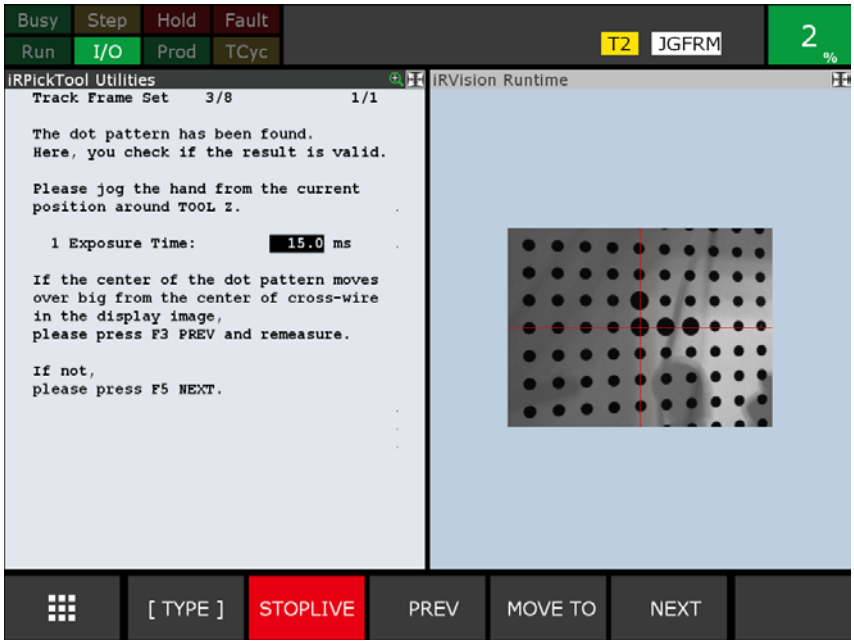
➢ Calibration grid frame measurement will start.

9. Keep holding down the [SHIFT] key while gripping the deadman switch, until the measurement is complete.

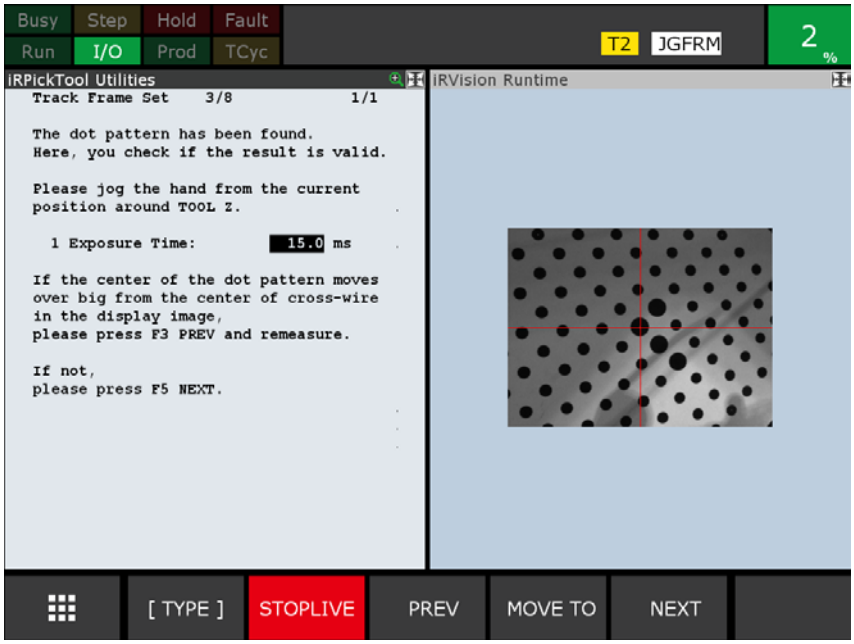


⚠ **WARNING**	● Keep the override at 10% or below. ● While checking how the measurement is going, be ready to release the deadman switch immediately if there is any risk of collision.

➢ When the measurement is complete, a screen for checking the measurement results will appear.



10. Rotate the robot around the tool's Z-axis using tool jog operation, and check that the center of the grid pattern is not off the centerline.

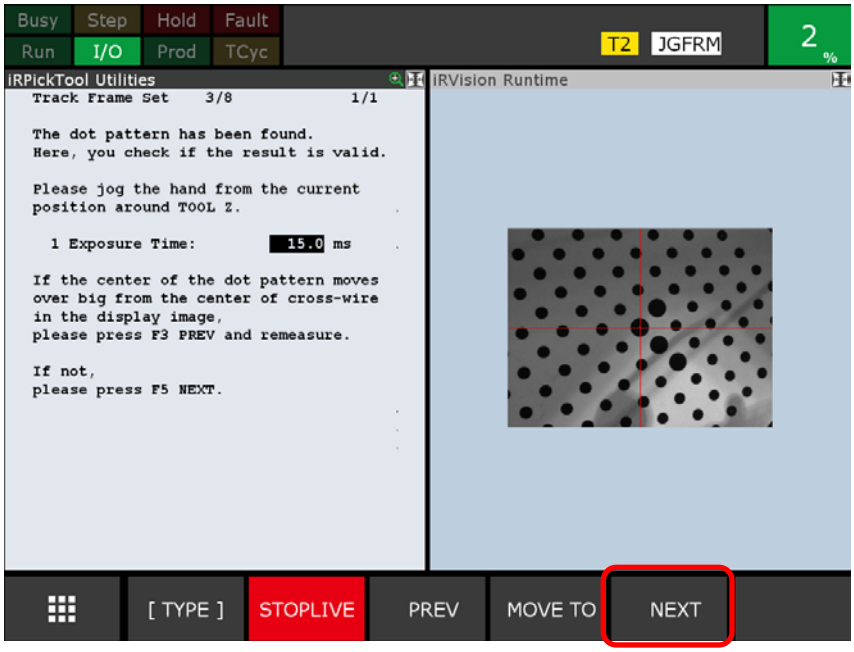


Note If it is significantly off, the camera may have gone off position during measurement. Check the mounting of the camera, press F3 [PREV], and measure again.

If there are no problems with the measurement results for the first point, proceed to measurement of the second point.

6.3.2 Measuring and Checking the Second Point

1. On the screen to check the measurement of the first point, press F5 [NEXT].



➢ The setup screen to perform measurement of the second point appears.

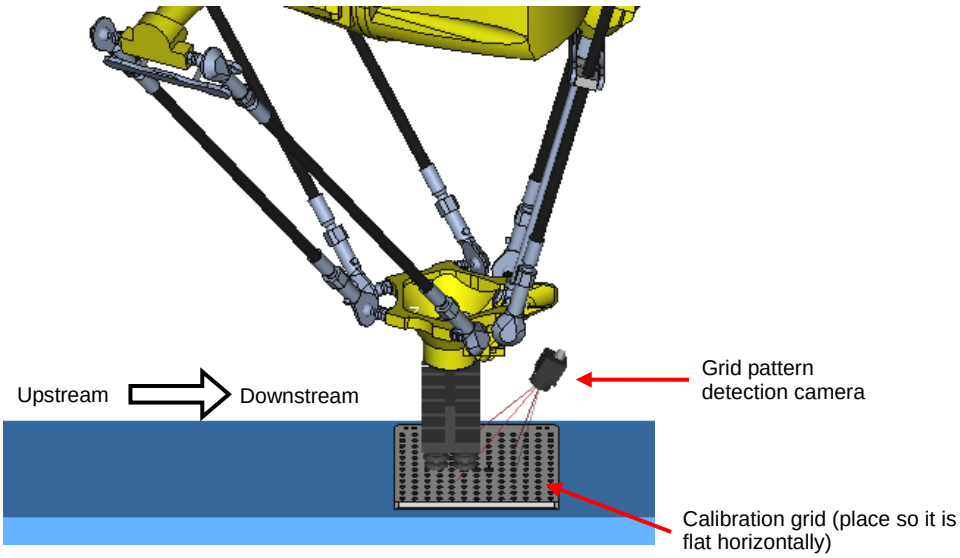
2. Operate the conveyor so that the calibration grid is on the downstream side of the robot workspace, and stop.

➢ If you have selected drive DO, press F3 [CONV ON] to operate the conveyor. To stop the conveyor, press F3 [CONV OFF].

3. Move the robot by jog operation so that the large dots are roughly at the center of the image, and adjust the exposure time and focus of the camera.

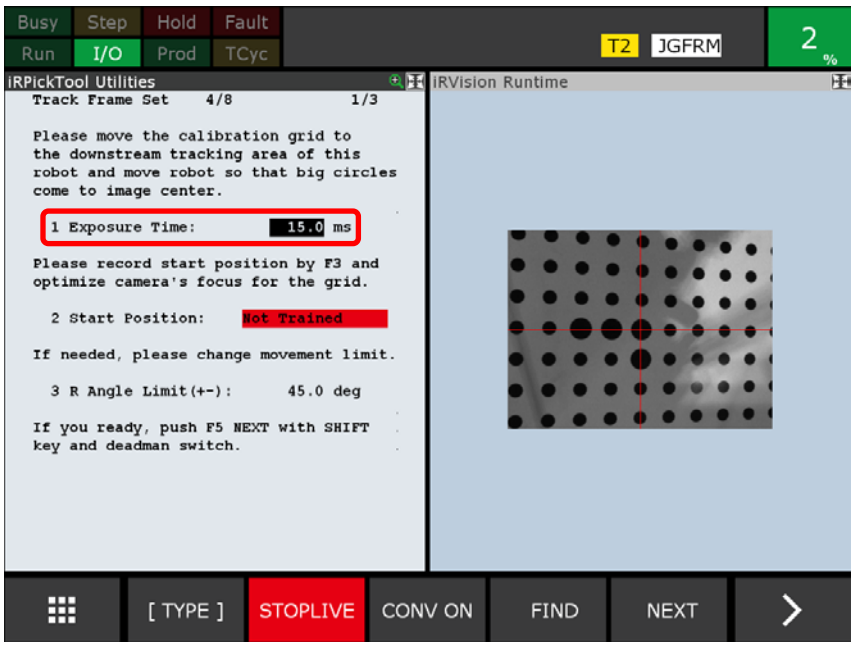
Memo

If the large dots are not at the center, the limit check described later might not be performed properly. In a limit check, the camera position is calculated roughly by means of simple measurement, and the target position is checked without actually moving the robot. The camera position will be more accurate if you perform a limit check close to the center of the large dots.



Memo

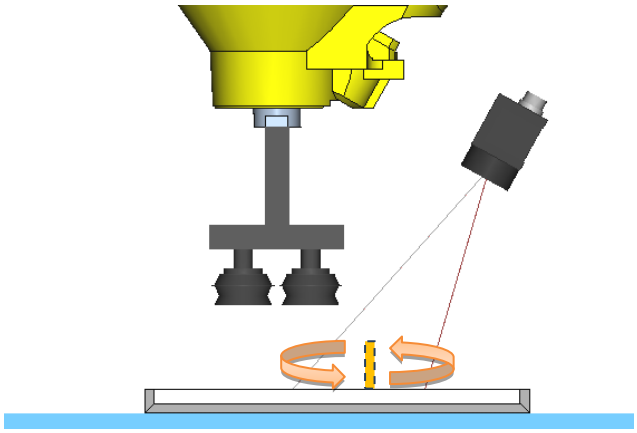
If you adjust the position so that the direction in which the three large dots are in a line is the horizontal direction in the image like in Runtime Image in the figure below, it will be easier for the measurement to become stable.



Note

At least two small dots have to be in a line in the up, down, left and right directions of the large dots.

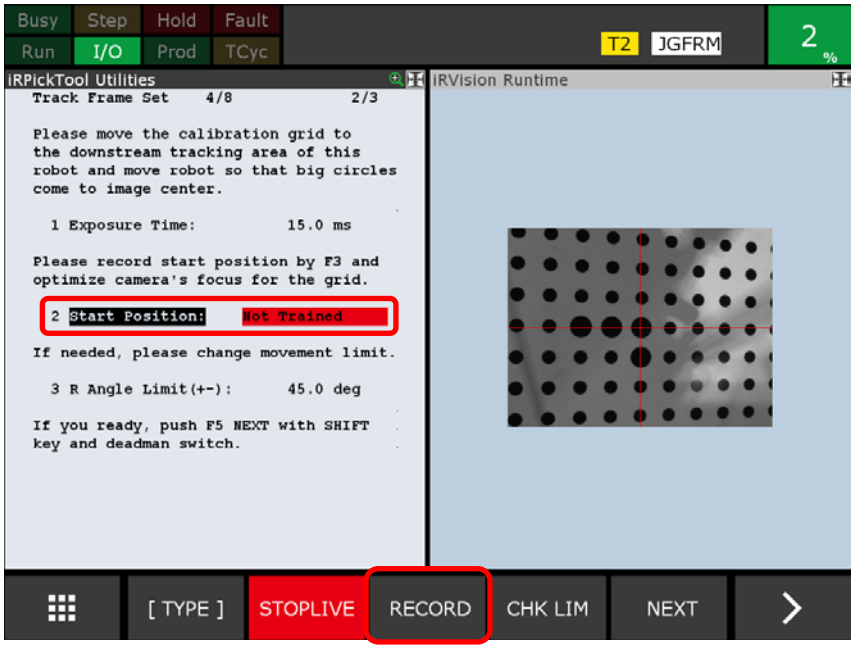
- This position will be the start position for the second point.
- The robot moves from the start position and measures the second point. During measurement, it moves as shown in the figure below.



While keeping the dots at the center, the robot rotates by the angle specified in [R Angle Limit].

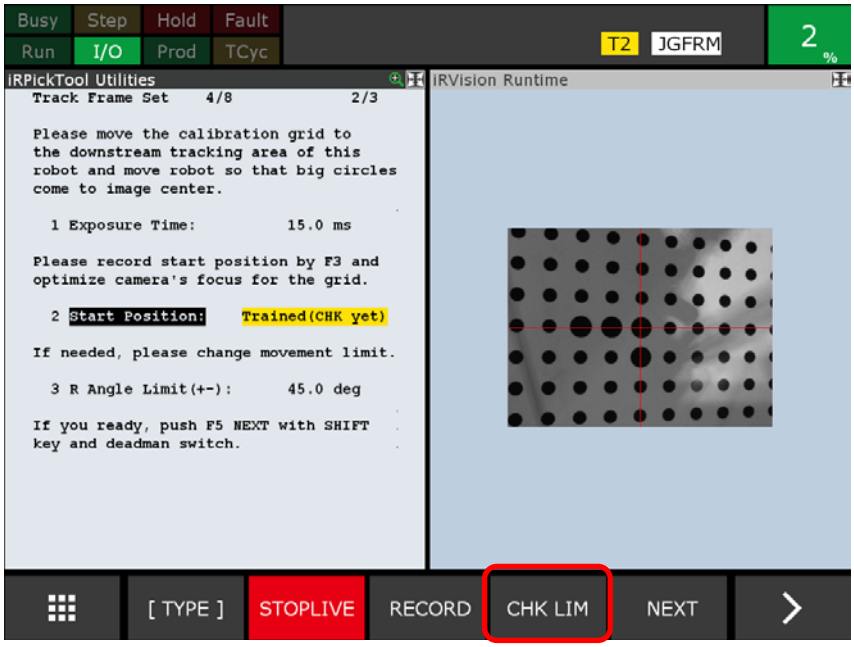
Note Adjust the start position by taking into consideration the robot's movement amount.

4. Move the cursor to [Start Position] and press F3 [RECORD].



➢ When the position is recorded, the display for [Start Position] changes to [Trained (CHK yet)].

5. While holding down the [SHIFT] key, press F4 [CHK LIM].



➢ The robot moves by the minimum amount necessary and starts to check whether it can move to the measurement point. When it does this, the robot checks while leaving a margin of about 5 mm in each of the X, Y and Z directions relative to the target position, for safety.

Memo

Measurement is possible even without performing limit error detection (limit check). Go to step 6 with things just as they are.

If you do not perform a limit check, it can sometimes be the case that the robot is sometimes unable move to the target position during measurement and you have to redo the measurement from the start.

By checking the validity of the start position in advance by means of a limit check, you can save the time and effort involved in redoing the measurement.

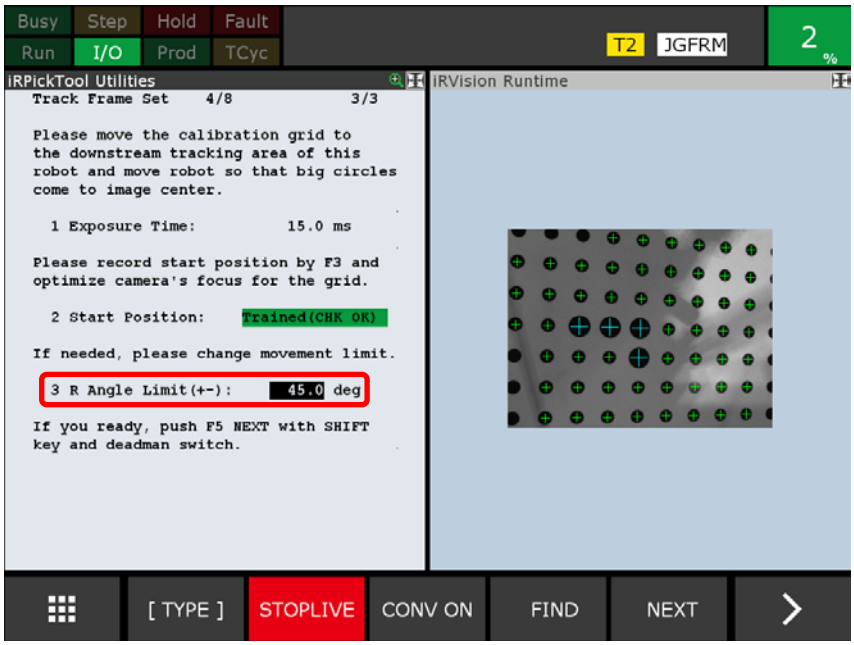
➢ If there are no problems with the check results, the display for [Start Position] changes to [Trained (CHK OK)].

Note

- If a limit error is detected as a result of the check, the display for [Start Position] changes to [Trained (CHK NG)]. If an error is detected, change the start position and repeat the procedure from step 4.
- Limit checks are performed for measurement target positions. You do not perform limit checks for all motion paths. Therefore, even if you have performed a limit check in advance, a limit error may occur near the workspace boundary.
- Measurement will also stop if the large dots go off screen during measurement. A limit check will not go so far as to check whether the large dots are contained in the snap window during measurement.

CAUTION	Robot movement brings with it the risk that the robot will collide with the conveyor or peripheral equipment. When setting the [Start Position], or the [R Angle Limit] described next, take due care.

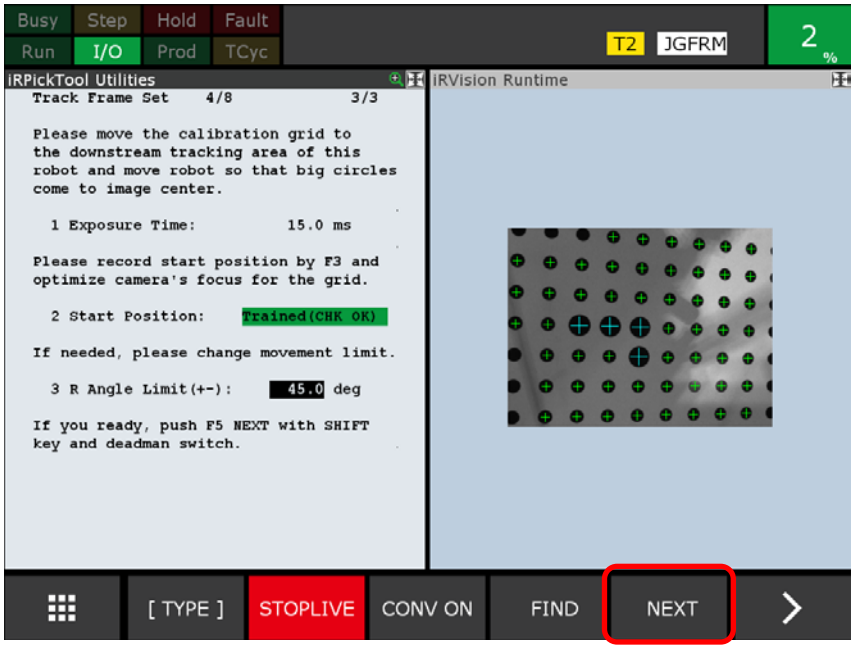
6. Move the cursor to [R Angle Limit (+-)] and enter an appropriate value.



CAUTION	Enter an appropriate limit value for the movement angle, so that the robot will not come into contact with the conveyor or peripheral equipment.

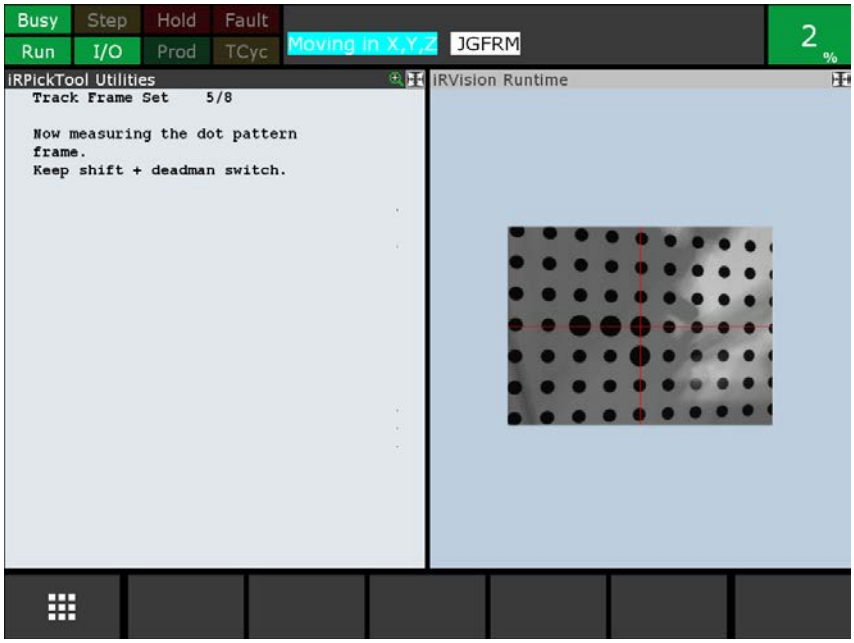
- Here, it is left as "45.0."
- Next, perform calibration grid frame measurement.

7. While holding down the deadman switch and the [SHIFT] key, press F5 [NEXT].



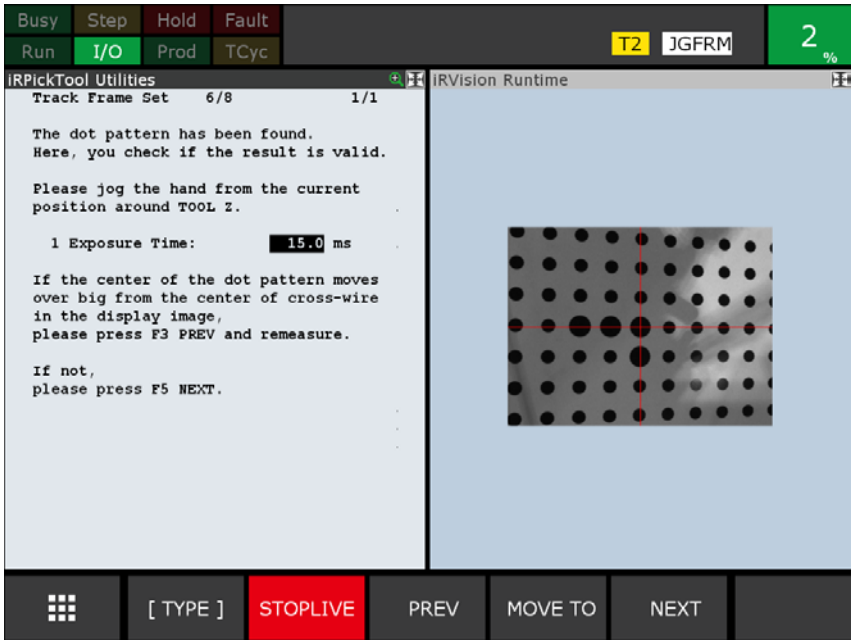
➢ Calibration grid frame measurement will start.

8. Keep holding down the [SHIFT] key while gripping the deadman switch, until the measurement is complete.

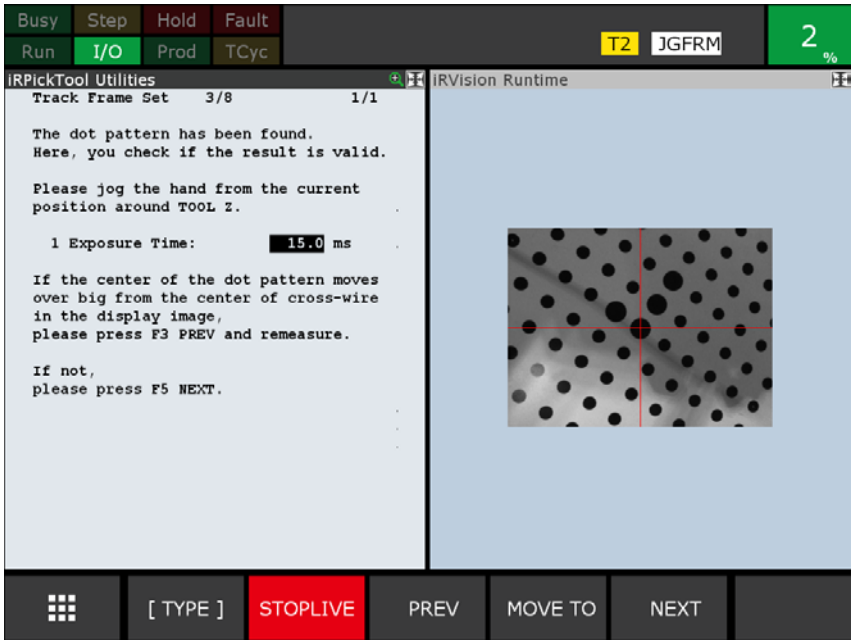


⚠ **WARNING**	● Keep the override at 10% or below. ● While checking how the measurement is going, be ready to release the deadman switch immediately if there is any risk of collision.

➢ When the measurement is complete, a screen for checking the measurement results will appear.



9. Rotate the robot around the tool's Z-axis using tool jog operation, and check that the center of the grid pattern is not off the centerline.

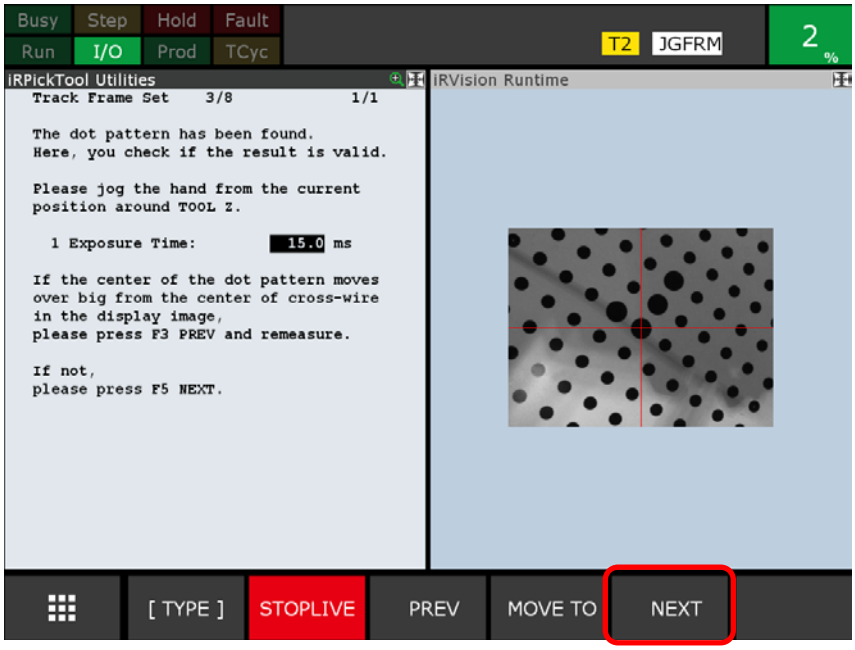


Note If it is significantly off, the camera may have gone off position during measurement. Check the mounting of the camera, press F3 [PREV], and measure again.

If there are no problems with the measurement results for the second point, proceed to setup of the tracking frame height (recording the Z height).

6.3.3 Recording the Z Height

1. On the screen to check the measurement results for the second point, press F5 [NEXT].

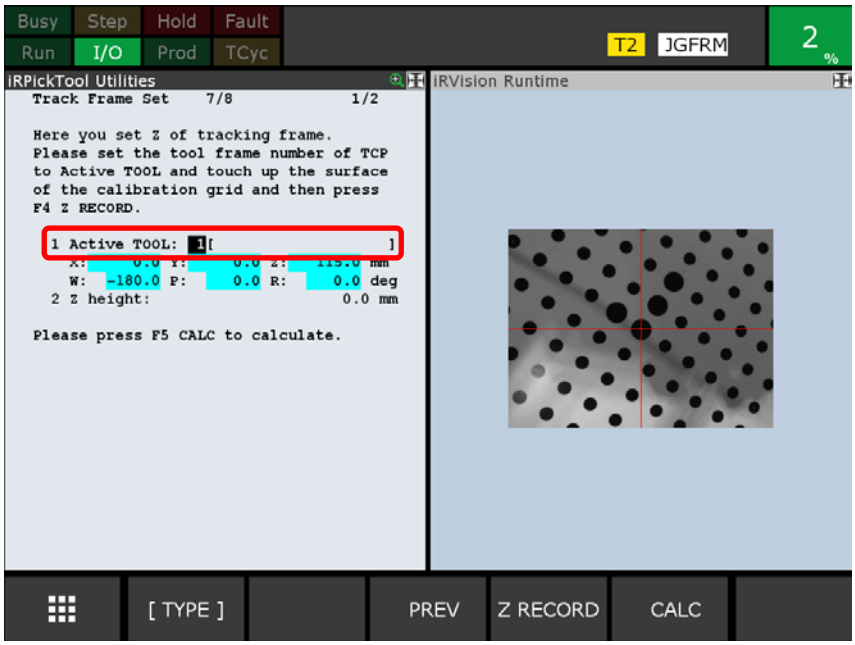


➢ The screen to set up the tracking frame height (Z value) will appear.

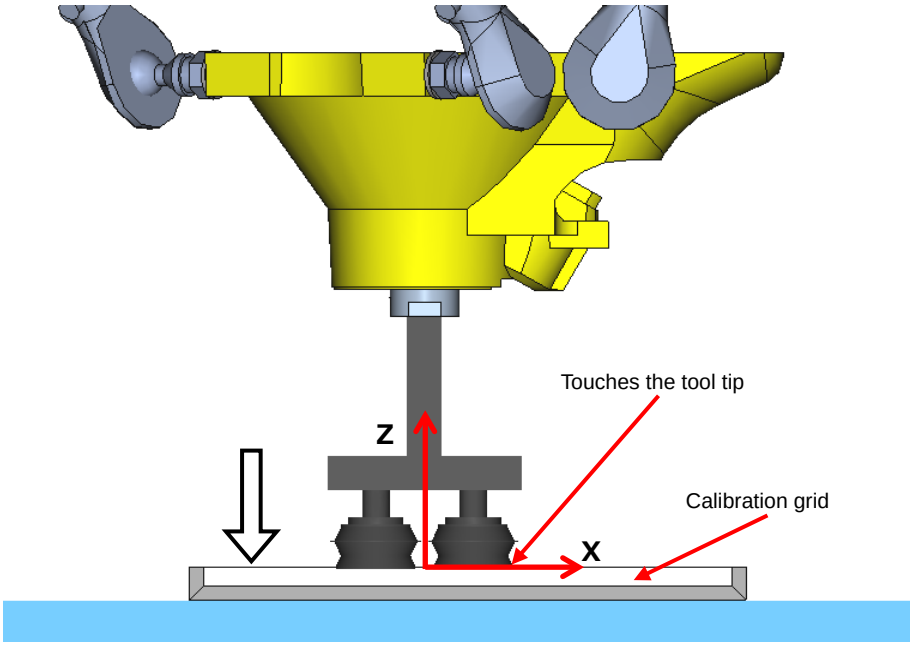
2. Move the cursor to [Active TOOL] and enter the tool frame number that you set in "4. SETTING A TOOL FRAME."

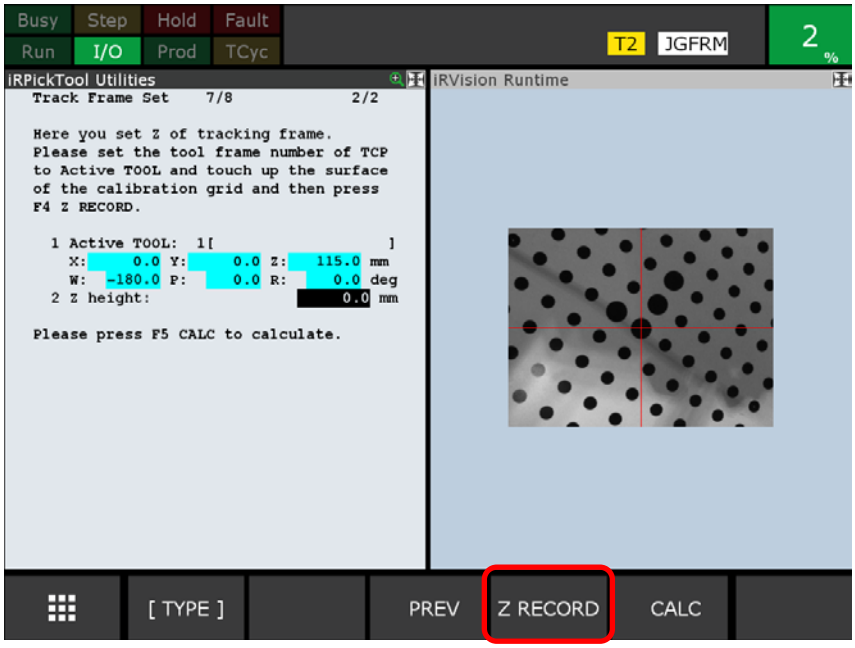
➢ Here, it is left as Tool Frame Number 1. (It does not need to be changed.)

➢ The values for the frame that has been set for the tool frame number will be displayed under [Active TOOL].

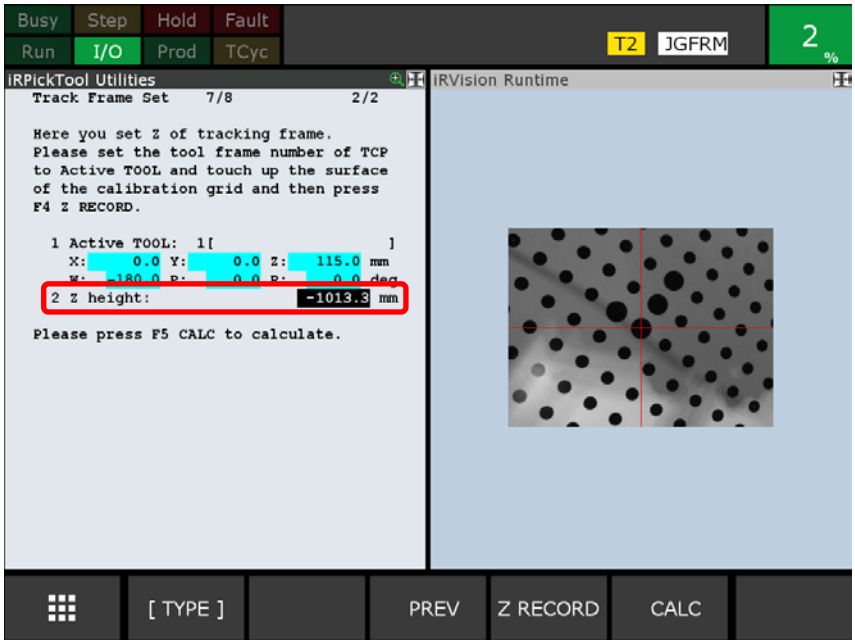


3. Move the robot by jog operation, and after it has touched up the surface of the calibration grid, press F4 [Z RECORD].





➢ The tracking frame height (Z value) will be recorded.

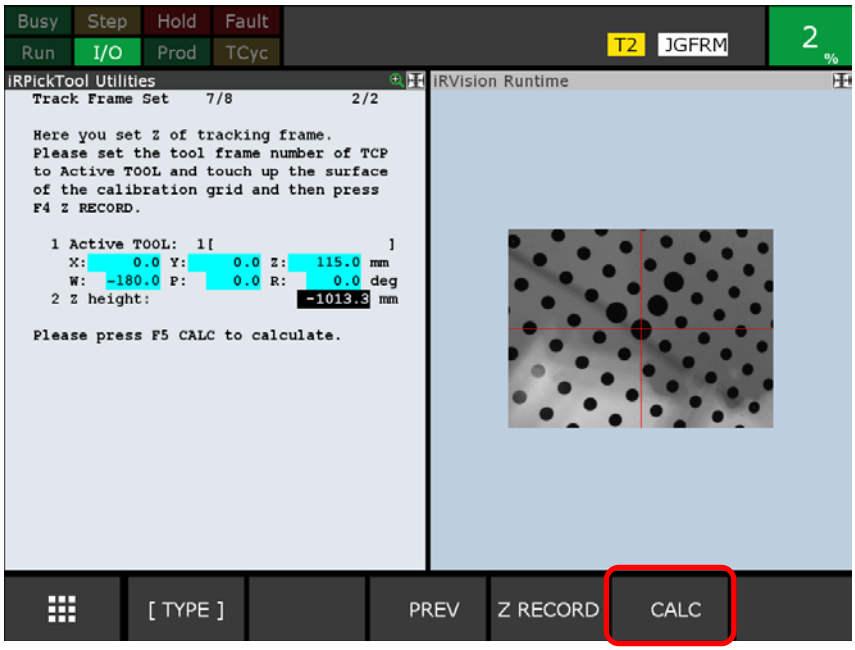


Memo You can also enter a value directly in [Z height]. Enter the tracking frame height as viewed from the robot's world frame.

Check that [Z height] has been entered, then proceed to parameter calculation.

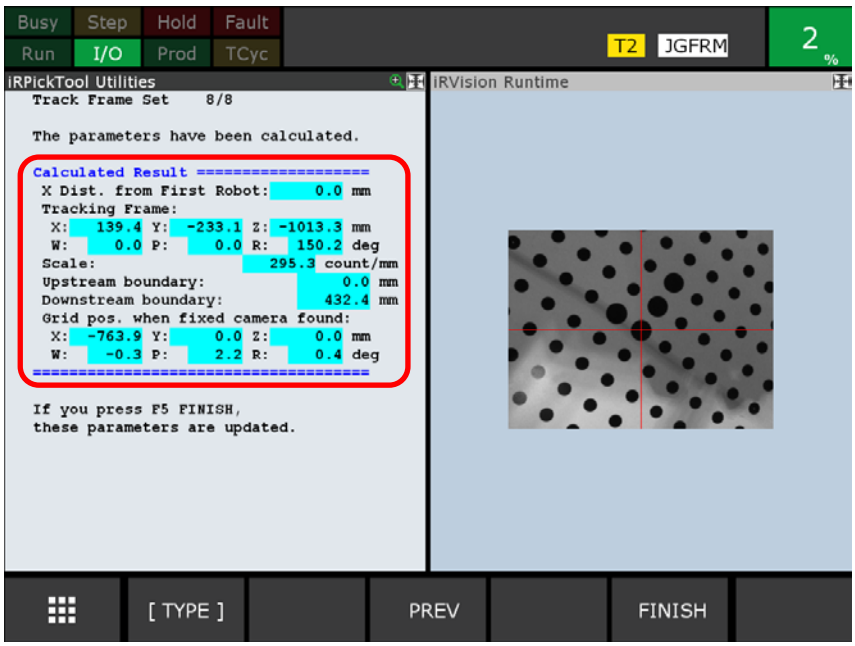
6.3.4 Calculating and Checking the Parameters

1. After [Z height] has been entered, press F5 [CALC].



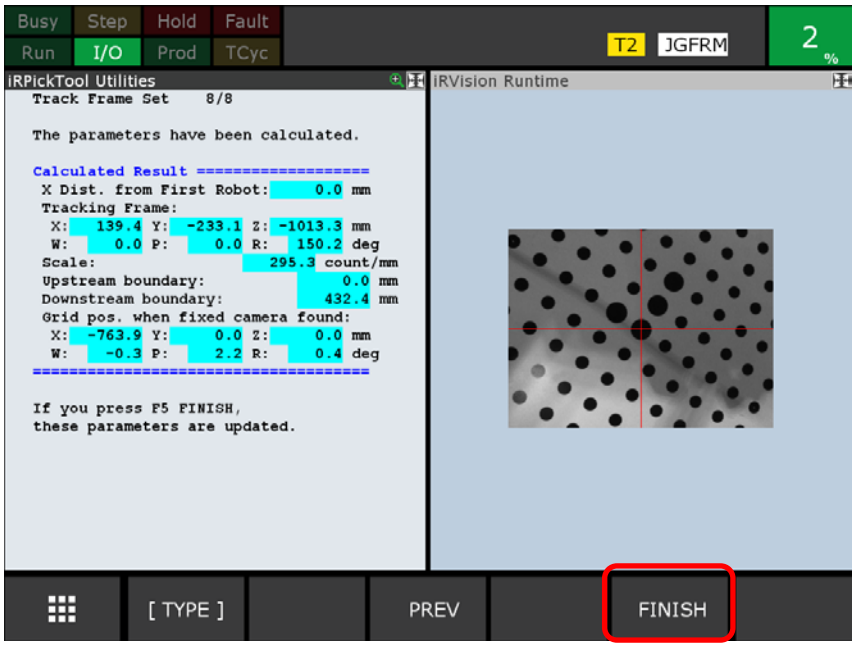
➢ The parameters will be calculated from the measurement results for the first and the second points and [Z height], and the screen will change to a screen for checking the parameter calculation results.

2. Check the parameter calculation results. Check whether the Z value for [Tracking Frame] is an appropriate value as seen from the robot's base position, whether the X value for [Grid pos. when fixed camera found] is an appropriate position as seen from the tracking frame, etc.



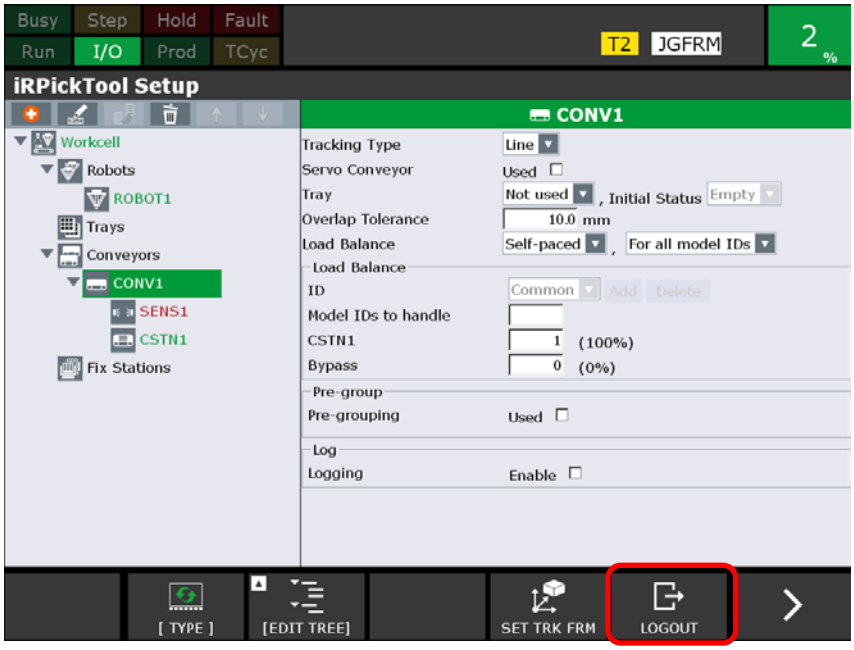
Memo If the Z value for [Tracking Frame] is inappropriate, press F3 [PREV], enter an appropriate [Z height] and calculate again.

3. Press F5 [FINISH].

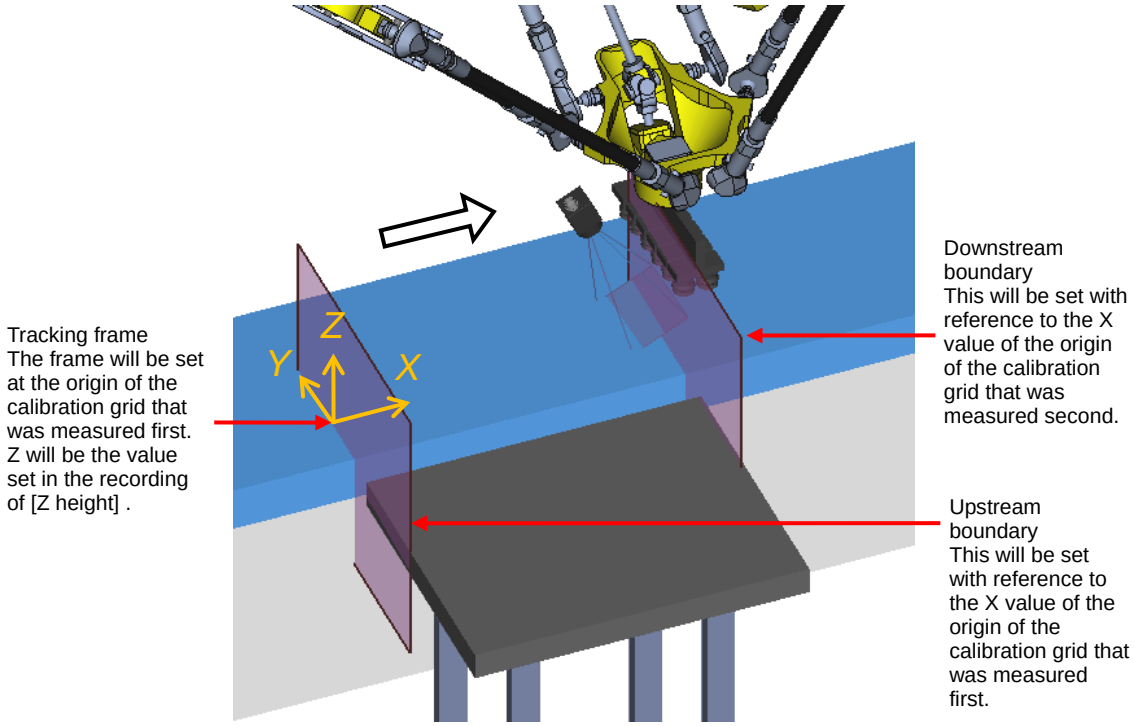


➢ On the basis of the calculation results, robot and conveyor objects will be created automatically, and the [iRPickTool Setup] screen will appear.

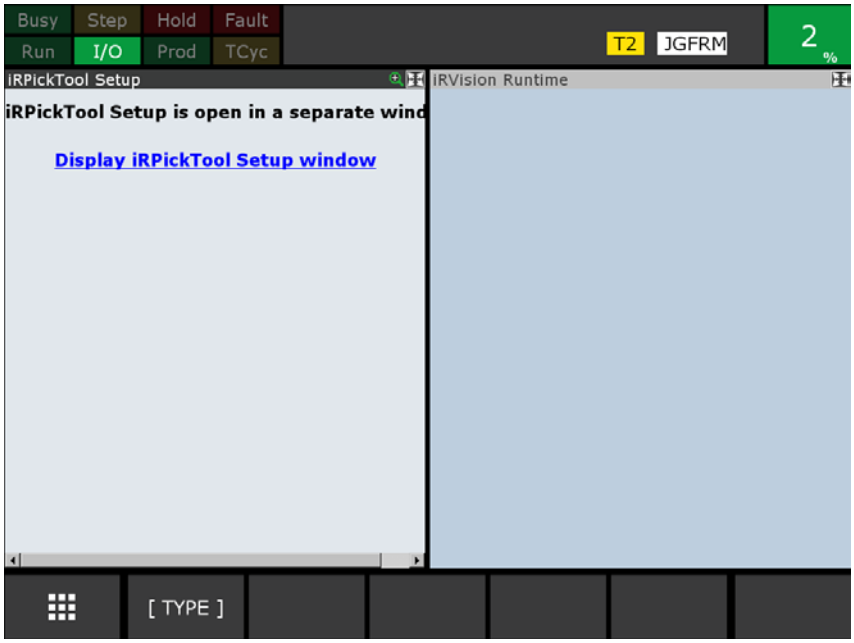
4. On the displayed [iRPickTool Setup] screen, check the parameters that have been set and press F5 [LOGOUT].



➢ The parameters for the tracking frame will be set as in the figure below.

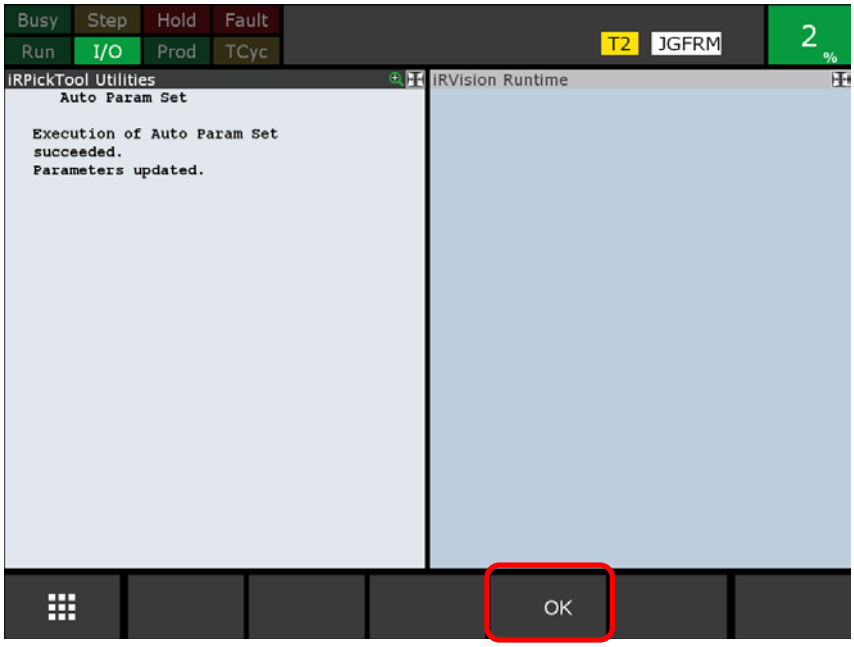


➢ If you log out, *i*RPickTool closes and the logout screen appears.



5. On the teach pendant of the robot controller, press the [MENU] key and select [UTILITIES] - [iRPickTool].

6. On the finish screen for tracking frame setup, press F4 [OK].



Set up of a tracking frame is now complete. Next, you will teach a vision process for visual tracking.

7 TEACHING A VISION PROCESS

In this chapter you teach 'Single-View Visual Tracking'. Vision processes are taught using the following flow:

- Editing a Vision Process
- Editing a Snap Tool

- Editing a GPM Locator Tool

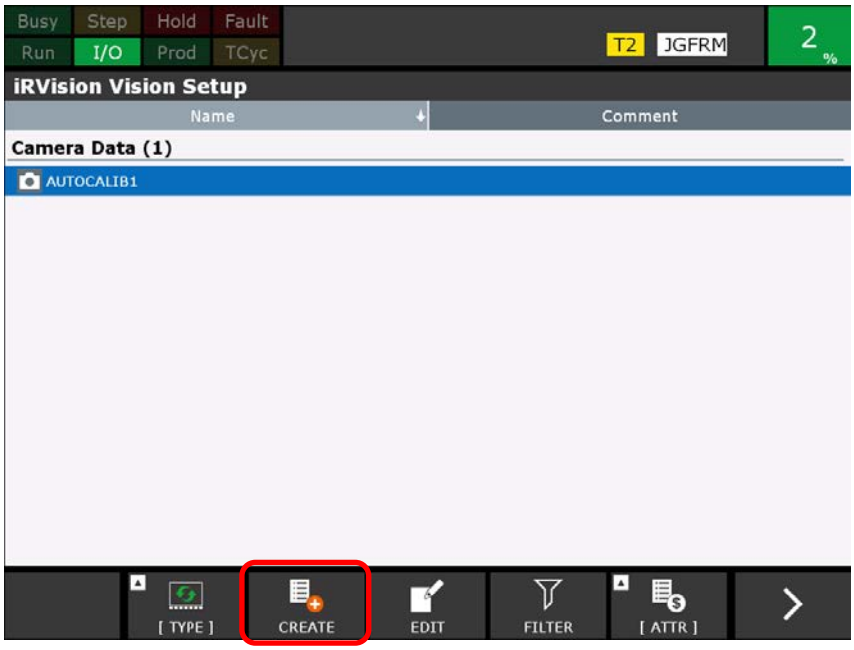
7.1 EDITING A VISION PROCESS

Create a new vision process and edit the vision process.

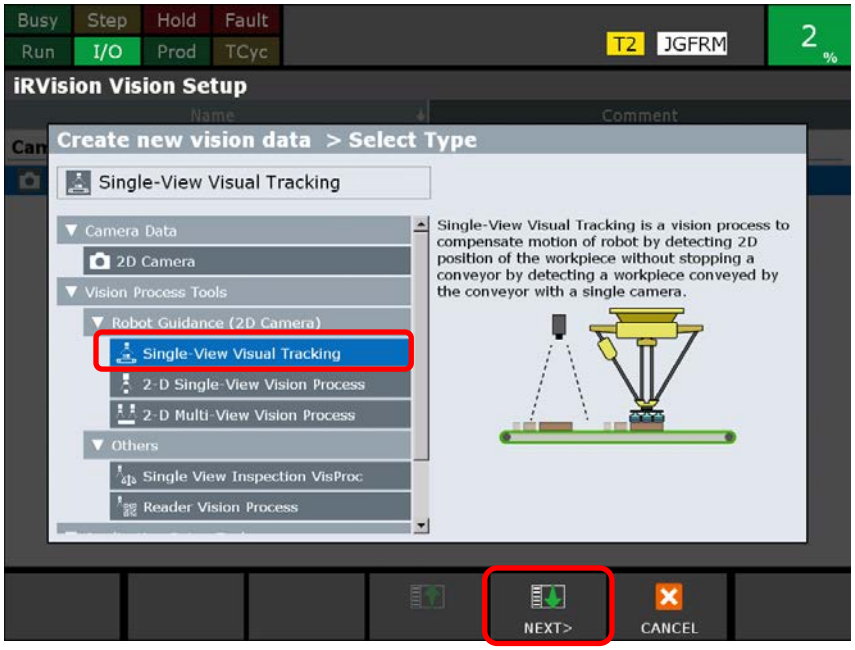
1. On the teach pendant of the robot controller, press the [MENU] key and select [iRVision] - [Vision Setup].

➢ The [iRVision Vision Setup] screen will appear.

2. Press F2 [CREATE].



3. For the selection of the type, select [Vision Process Tools] - [Single-View Visual Tracking], and press F4 [NEXT].

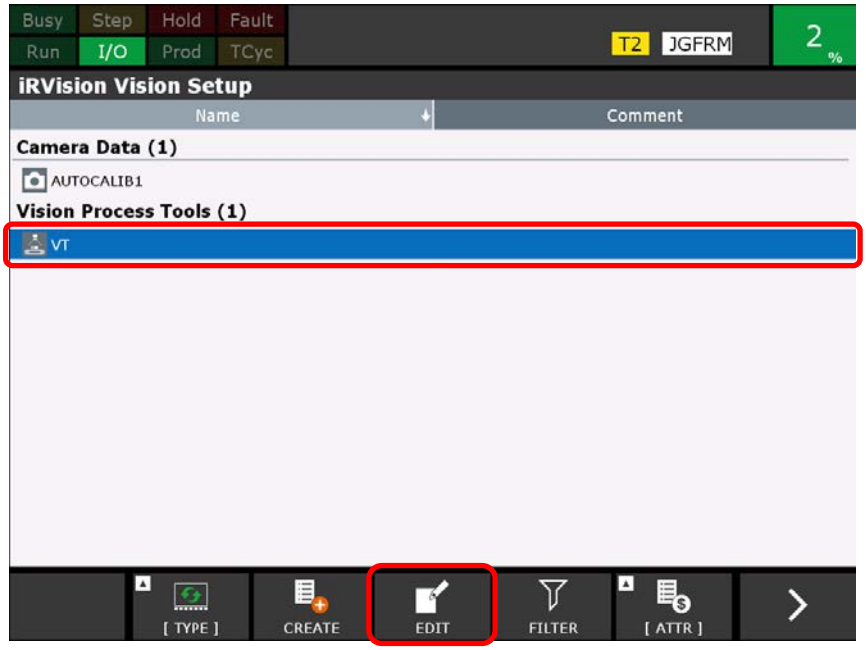


➢ The create screen for vision data will appear.

4. Enter an arbitrary name in [Name], and press F4 [OK].

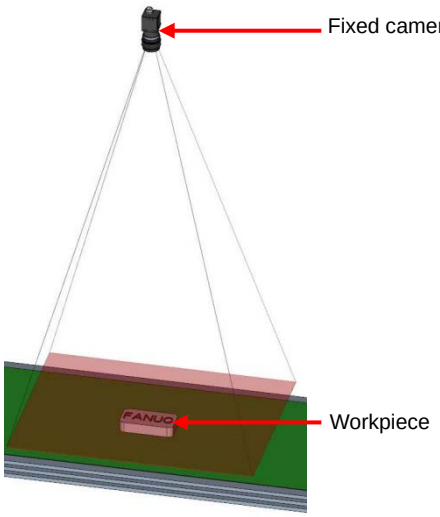
➢ The vision process that you created on the [iRVision Vision Setup] screen will appear.

5. Select the vision process that you created, and press F3 [EDIT].



➢ The edit screen for vision processes will appear.

6. Place a workpiece in the field of view of the fixed camera.

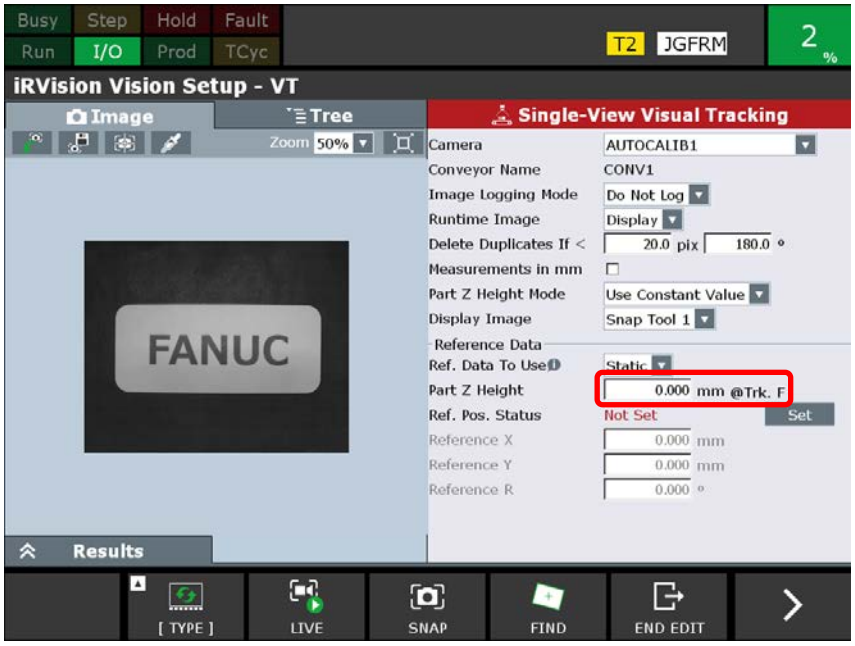


7. On the vision process edit screen, select the camera data name that you created in "6.2 CALIBRATING CAMERA."

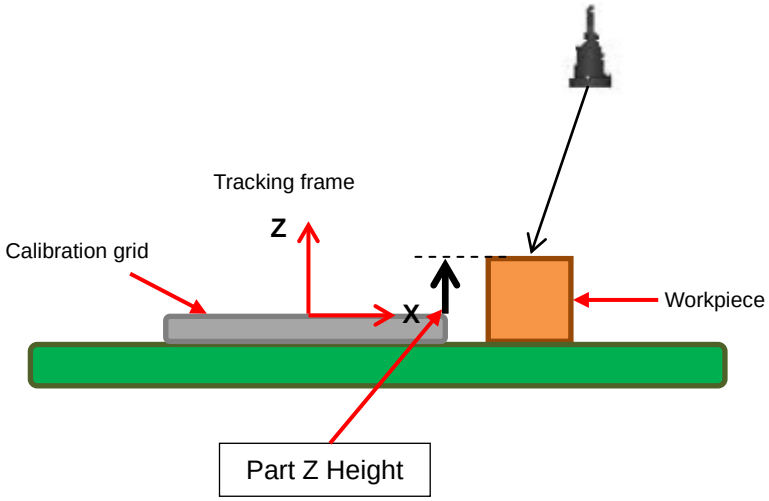
➢ The workpiece will be displayed in the image view.

Memo If the workpiece is not displayed or you have moved the workpiece, press F2 [LIVE] to display the workpiece in real-time. After you have checked the workpiece position, press F2 [STOPLIVE] to enable vision process editing.

8. Enter an appropriate value for [Part Z Height].



Memo [Part Z Height] is the height of the workpiece's detection plane, as viewed from the tracking frame. Measure it with a ruler, etc.

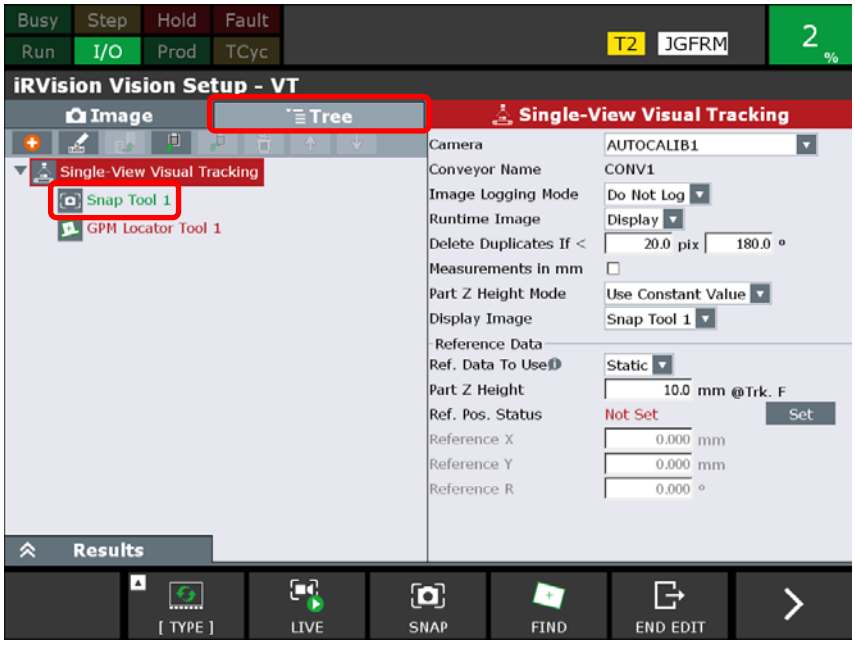


Snap the workpiece with the snap tool.

7.2 EDITING A SNAP TOOL

Edit the snap tool settings and snap a workpiece.

1. On the vision process edit screen, select the [Tree] tab and select [Snap Tool 1].



➢ The setting items for [Snap Tool 1] will be displayed.

2. Click the [Image] tab, and while checking the displayed image view, enter an appropriate value for [Exposure Time], then press F3 [SNAP].

➢ A workpiece image will be snapped.

Note If it is not snapped properly, recheck the camera connection.

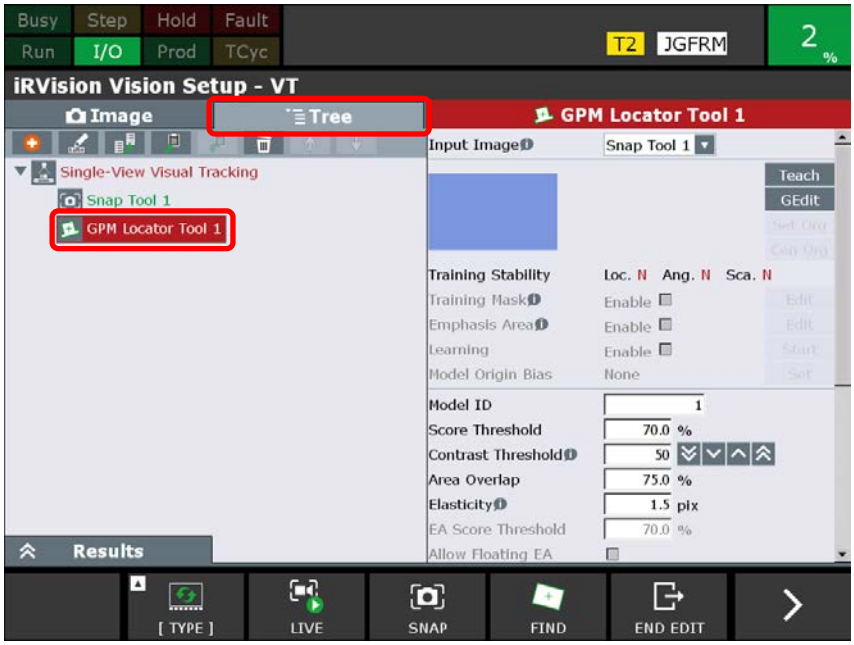
Memo Set items other than [Exposure Time] to arbitrary values, in accordance with the environment and the shape of the workpiece.

Snapping of a workpiece image is now complete. Next, you will teach the GPM locator tool.

7.3 EDITING A GPM LOCATOR TOOL

Teach the command tools' GPM locator tool. Carry out setup in the following order: teaching the model pattern, specifying the area to exclude, and specifying the DOF. Here, the minimum required settings are described.

1. On the vision process edit screen, select the [Tree] tab and select [GPM Locator Tool 1].



➢ The setting items for [GPM Locator Tool 1] will be displayed.

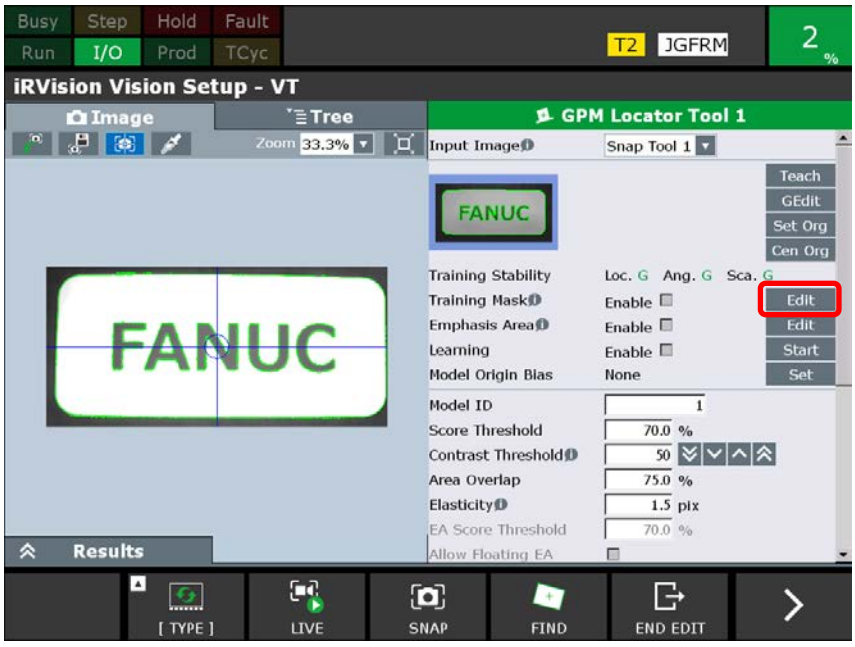
2. Select [Teach].

➢ The screen to teach the model of a workpiece to detect will appear

3. Enclose the workpiece in the reddish-purple window, and press F4 [OK].

➢ Return to the vision process edit screen.

4. Select [Edit] under [Training Mask].

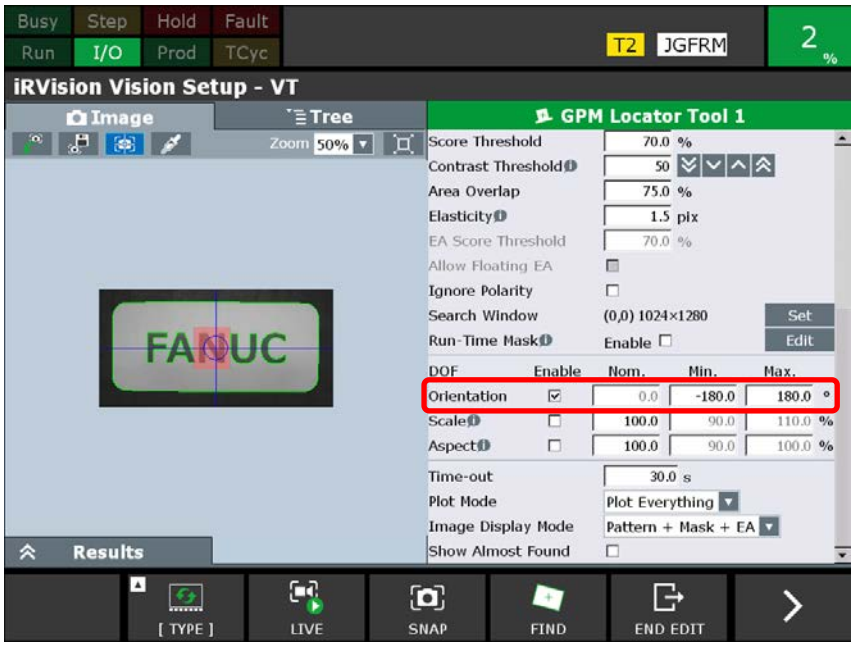


➢ The screen to edit the training mask area of the model taught in step 3 (the area to be excluded from the model) will appear.

5. Select the area you do not want make a feature of the model pattern, and press F4 [OK].

➢ Return to the vision process edit screen.

6. Specify the range of the angle for searching for the model pattern.



Memo If you do not want to search, remove the check for [Enable].

7. Press [Next page]. On the displayed function menu, press F4 [Save], and press F5 [END EDIT].

➢ The edit screen will close and the screen with the list of vision data will appear.

Teaching of a vision process is now complete. Next, you will teach a program.

8 TEACHING A PROGRAM

Perform teaching of a program. A 'tracking program' is a robot program that operates the robot so that it follows the motion of the conveyor. This section describes how to use a sample program that is included in the auto visual track frame setup function. It will be efficient if you create a program by changing the details to suit the actual system, on the basis of installed sample programs.

Memo The sample programs assume that a workpiece is placed at a fixed station, but in this manual, a fixed station is not assumed. If you are going to use a fixed station, refer to "6.7 SETUP OF A FIXED STATION" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

8.1 PROGRAM ADVANCED SETTINGS

Unlike normal robot programs, a tracking program requires a line tracking schedule, etc. to be set up in advance on the program details screen.

1. On the teach pendant of the robot controller, press the [SELECT] key.

➢ A list of programs will appear.

2. Select a tracking program from the list.

Memo If you are using sample programs, AA_PICKCS is the tracking program.

3. Press F2 [DETAIL] on the function menu that is displayed by pressing [Next page].

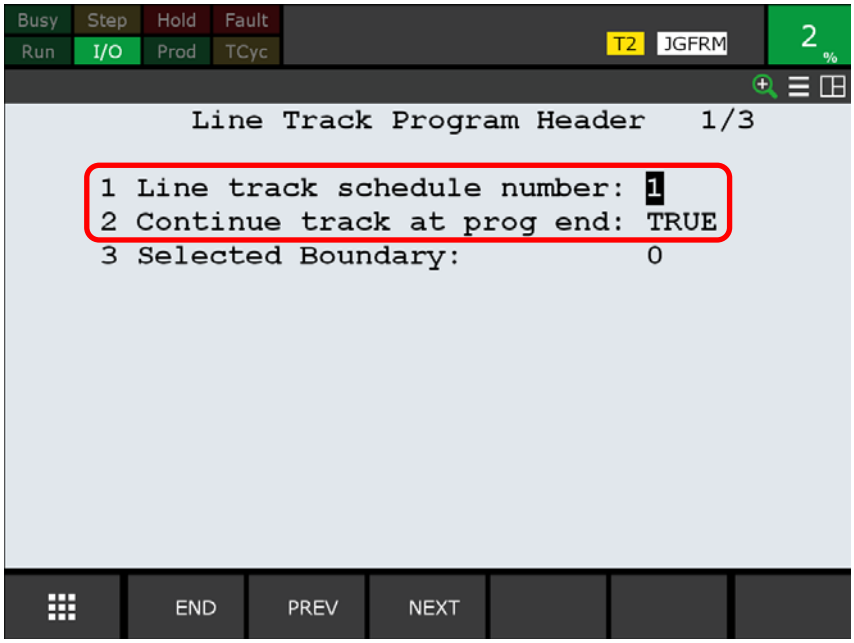
➢ An advanced settings screen for the selected program will appear.

4. Press F3 [NEXT].

➢ An advanced settings screen for tracking programs will appear.

5. Check the following content.

- [Line track schedule number] must be Schedule Number 1, which was set in "6 SETTING UP TRACKING PARAMETERS."
- [Continue track at prog end] must be [TRUE].



Note

If [Continue track at prog end] is [FALSE], the robot will stop the tracking operation once the tracking program ends. In this case, even if you immediately start the next tracking program and start the tracking operation, the motion of the robot will not continue smoothly. For a visual tracking system, as there are many reasons for needing to move the robot at a high speed, set [TRUE] in [Continue track at prog end] so that the operation of the robot will continue smoothly.

Memo

Leave [Selected Boundary] set to [0]. If [0] is set, the tracking area set up in "6 SETTING UP TRACKING PARAMETERS" will be used.

8.2 SAMPLE PROGRAM

There are three types of sample programs for the tracking program that is to be installed.

- AA_MAIN: The main program.
- AA_PICKCS: A tracking program that performs a picking operation on a feed conveyor.
- AA_DROPFS: A program that performs a placing operation at a fixed station.

Use a sample program by selecting it from the program list that is displayed when the [LIST] key is pressed on the teach pendant of the robot controller. You will have to change the details to suit the actual system. Below are explanations of the sample programs.

8.2.1 AA_MAIN

```
 1: -- Initialize parameters ;
 2: --
 3: --
 4: R[1:CYCLE STOP]=0     ;
 5: CALL PKCSGETID('CONV1',CStn ID Reg=6) ;
 6: CALL PKCSGETID('FSTN1',CStn ID Reg=7) ;
 7: PAYLOAD [1] ;
 8: ;
 9: -- Prepare tray in fixed station ;
10: --
11: --
12: CALL PKFSPUTQUE(FStn ID=R[7:FSTN1_ID]) ;
13: ;
14: -- Perch Position ;
15: --
16: --
17: UTOOL_NUM=1 ;
18: UFRAME_NUM=0 ;
19: J P[...] 50% FINE     ;
20: ;
21: -- StartProduction ;
22: --
23: --
24: CALL PKWCSTART     ;
25: ;
26: -- Main loop ;
27: --
28: --
29: LBL[100] ;
30: CALL AA_PICKCS     ;
31: IF R[1:CYCLE STOP]=1, JMP LBL[900] ;
32: ;
33: CALL AA_DROPFS     ;
34: IF R[1:CYCLE STOP]=1, JMP LBL[900] ;
35: JMP LBL[100] ;
36: ;
37: -- EndProduction ;
38: --
39: --
40: LBL[900: End] ;
41: CALL PKWCEND     ;
```

R[1] is a cycle stop flag.

R[6] is a conveyor station ID.

R[7] is a fixed station ID.

You have to teach a wait position.

This line calls a program that performs a workpiece picking operation.

This line calls a program that performs a workpiece placing operation.

Call a program that performs a picking operation in line 30, and call a program that performs a placing operation in line 33. These two operations are repeated alternately, and the operations stop when the cycle stop flag becomes active.

Lines 1 to 7: Each of the registers and payload settings are initialized.
Lines 9 to 12: A trays is prepared at a fixed station.

Lines 14 to 19: A wait position for the robot is defined. The wait position must be taught in accordance with the environment.
Lines 21 to 41: The operation of the robot from the start to the end of production is defined. It consists of content that keeps processing workpieces on the conveyor, by repeating lines 29 to 35.

8.2.2 AA_PICKCS

```
   1: UTOOL_NUM=1 ;
   2: UFRAME_NUM=0 ;
   3: STOP_TRACKING ;
   4: ;
   5: -- Get part data from CStn ;
   6: --
   7: --
   8: LBL[100] ;
   9: CALL PKCSGETQUE(CStn1 ID=R[6:CSTN1_ID],Consec Flag=1,
Timeout (ms)=100,Offset VR=1,Stat Reg=2) ;
  10: IF R[1:CYCLE STOP]=1, JMP LBL[900] ;
  11: IF R[2:CSGETQ Status]>0, JMP LBL[100] ;
  12: ;
  13: -- Pick part ;
  14: --;
  15: --
  16: LPR [7:PickPosCS1] max_speed CNT100 VOFFSET,VR[1]
Offset,PR[11:ApproachPosCS1]    ;
  17: LPR [7:PickPosCS1] max_speed CNT0 VOFFSET,VR[1]
AP_LD10    ;
  18: ;
  19: -- Set payload (hand + part) ;
  20: --
  21: --
  22: PAYLOAD [2] ;
  23: ;
  24: LPR [7:PickPosCS1] max_speed CNT100 VOFFSET,VR[1]
Offset,PR[11:ApproachPosCS1] RT_LD10    ;
  25: ;
  26: -- Notify of picking result ;
  27: --
  28: --
  29: CALL PPKCSACKQUE(CStn ID=R[6:CSTN1_ID],Success=1) ;
  30: ;
  31: LBL[900] ;
```

Specify the tool frame number that was in "4 SETTING A TOOL COORDINATE SYSTEM."

Be sure to specify [0].

R[6] is a conveyor station ID.

R[1] is a cycle stop flag.

R[2] is the GETQ status. [0] indicates success.

Position register [7] is a picking position.

Position register [11] is an approach offset.

8.2.3 AA_DROPFS

```
   1: UTOOL_NUM=1 ;
   2: UFRAME_NUM=0 ;
   3: ;
   4: -- Wait for preparation of tray ;
   5: --
   6: --
   7: LBL[100] ;
   8: WAIT DI[...]=...       ;
   9: ;
  10: -- Get cell from tray ;
  11: --
  12: --
  13: CALL PKFSGETQUE(FStn ID=R[7:FSTN1_ID],Offset VR=2,Stat
Reg=5) ;
  14: IF R[1:CYCLE STOP]=1, JMP LBL[900] ;
  15: ;
  16: -- Drop part to cell ;
  17: --
  18: --
  19: LPR [8:DropPosFS1] max_speed CNT100 VOFFSET,VR[2]
Offset,PR[12:ApproachPosFS1]     ;
  20: LPR [8:DropPosFS1] max_speed CNT0 VOFFSET,VR[2]
AP_LD10     ;
  21: ;
  22: -- Set payload (hand) ;
  23: --
  24: --
  25: PAYLOAD [1] ;
  26: ;
  27: LPR [8:DropPosFS1] max_speed CNT100 VOFFSET,VR[2]
Offset,PR[12:ApproachPosFS1]     ;
  28: ;
  29: -- Notify of droping result ;
  30: --
  31: --
  32: CALL PKFSACKQUE(FStn ID=R[7:FSTN1_ID],Success=1) ;
  33: ;
  34: -- Check remaining cells ;
  35: --
  36: --
  37: CALL PKFSGETQUE(FStn ID=R[7:FSTN1_ID],Offset VR=2,Stat
Reg=5) ;
  38: IF R[5:FSGETQ Status]>0, JMP LBL[300] ;
  39: ;
```

Specify the tool frame number that was in "4 SETTING A TOOL COORDINATE SYSTEM."

You do not necessarily have to set 0 for the user frame, because it is not a tracking program.

R[7] is a fixed station ID.

R[2] is the GETQ status. [0] indicates success.

R[1] is a cycle stop flag.

Position register [8] is a placing position.

Position register [12] is an approach offset.

```
40: -- If there are still remaining cells, return the cell. ;
41: --
42: --
43: CALL PKFSACKQUE(FStn ID=R[7:FSTN1_ID],Return=2) ;
44: JMP LBL[900] ;
45: ;
46: -- If there is no longer remaining cells, prepare new tray. ;
47: --
48: --
49: LBL[300] ;
50: DO[...]=PULSE     ;
51: CALL PKFSPUTQUE(FStn ID=R[7:FSTN1_ID]) ;
52: ;
53: LBL[900] ;
```

9 SETTING UP THE REFERENCE POSITION

Set up the workpiece found position that will be the reference for picking / placing in a robot program.

Set up a reference position using the following flow.

- Setting up the trigger condition and trigger action, and select a vision process
- Setting up the reference position

Here, 'Distance' is specified for the trigger condition, and 'Find part by vision' for the action.

Memo

If a photoelectric tube sensor, etc. is installed for use with the trigger, specify [DI] for the trigger condition, and [Find part by vision] for the action. For the setup method, refer to "6.5.1.4 When [DI] and [Find part by vision] are selected" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

The function to set the found position in position register using the reference position guide is available only when the values for [Trigger Condition] and [Trigger Action] are the combinations shown below.

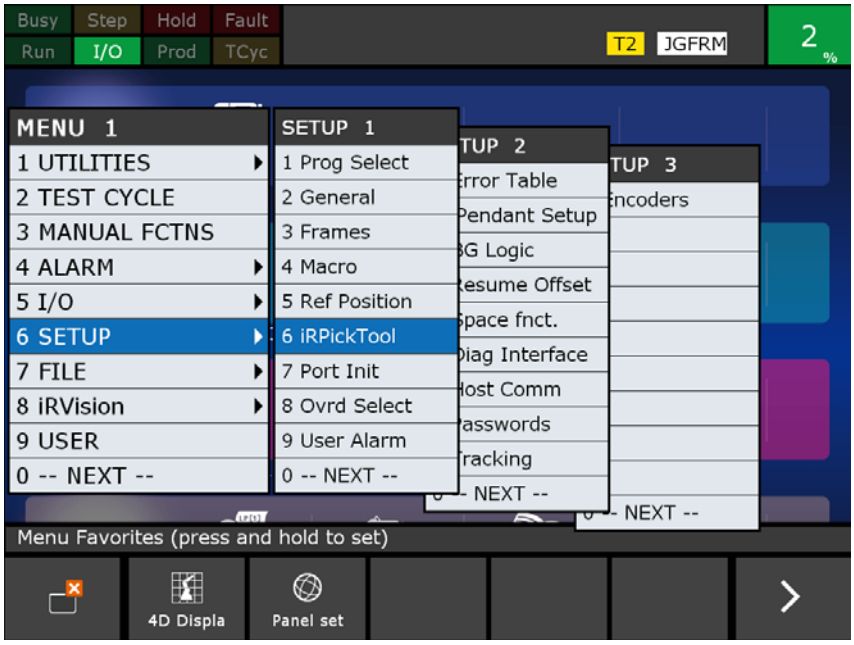
Trigger Condition	DI, RI, or Distance
Trigger Action	Find part by vision

9.1 SETTING UP THE TRIGGER CONDITION AND TRIGGER ACTION, AND SELECT A VISION PROCESS

On the [iRPickTool Setup] screen, set up the trigger condition and trigger action, and select the vision process.

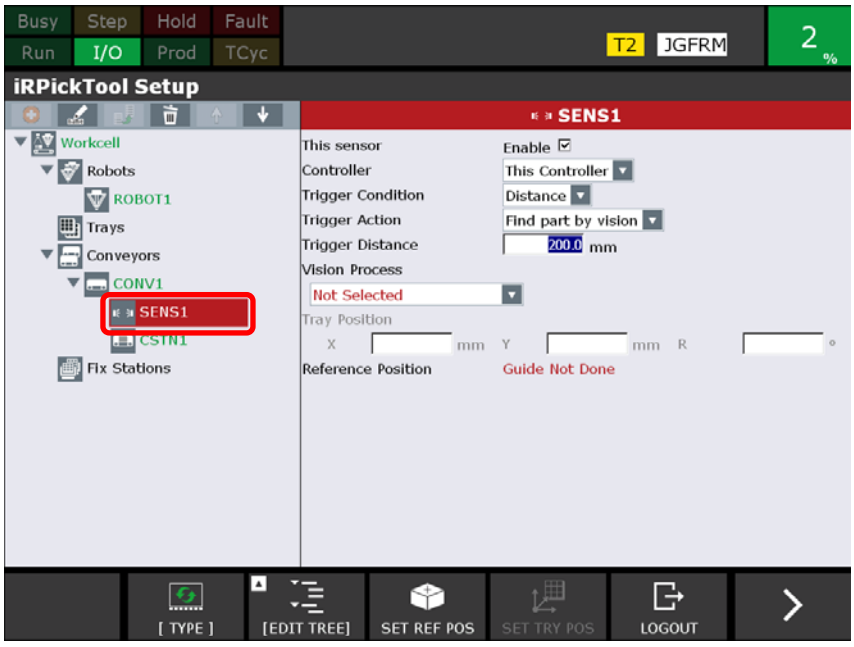
1. Place a workpiece in the field of view of the fixed camera.

2. On the teach pendant of the robot controller, press the [MENU] key and select [SETUP] - [iRPickTool].



➢ The [iRPickTool Setup] screen will appear.

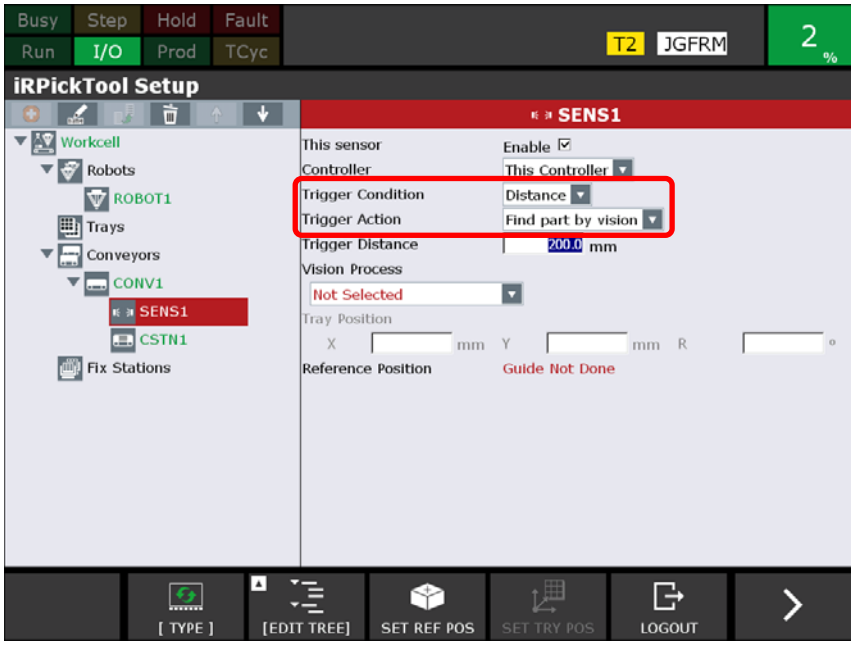
3. Select a sensor in the tree on the left side.



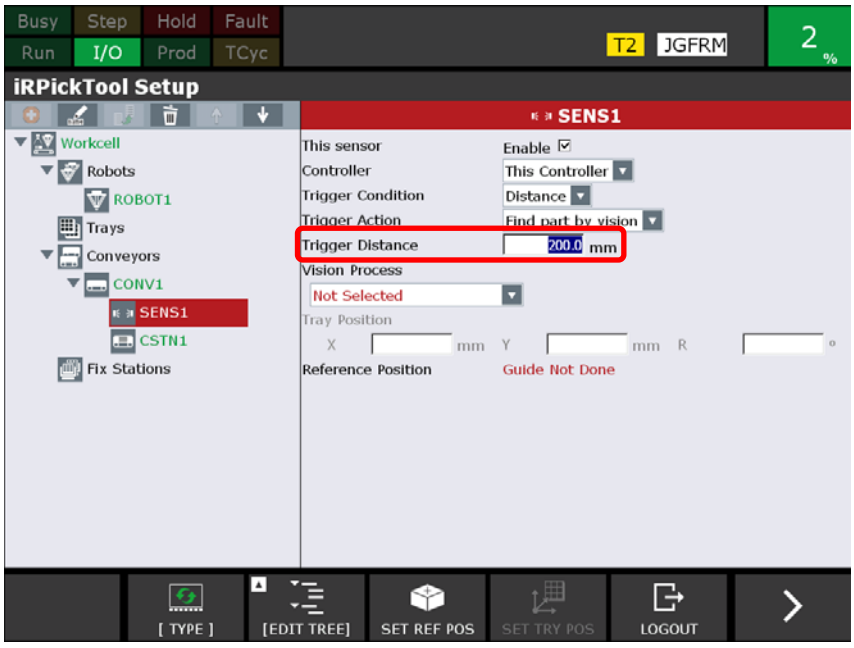
➢ The setting items for the sensor will appear on the right side of the screen.

4. Confirm that [Distance] is set for [Trigger Condition], and [Find part by vision] is set for [Trigger Action].

➢ If you have carried out "6 SETTING UP TRACKING PARAMETERS", there is no need to select, because they are set automatically.

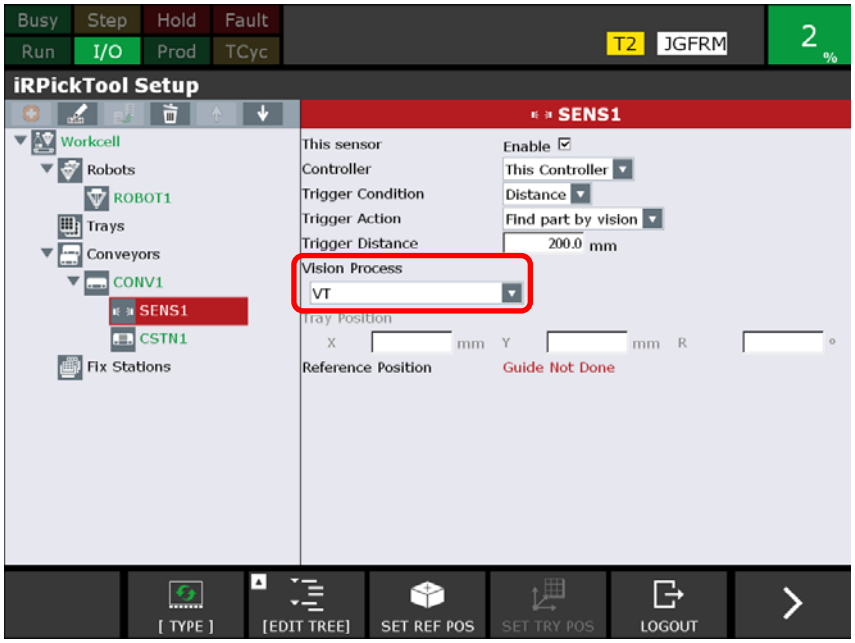


5. Enter an appropriate value in [Trigger Distance].



Memo Usually, enter a value that is half the size of the field of view.

6. Select a created vision process from [Vision Process].



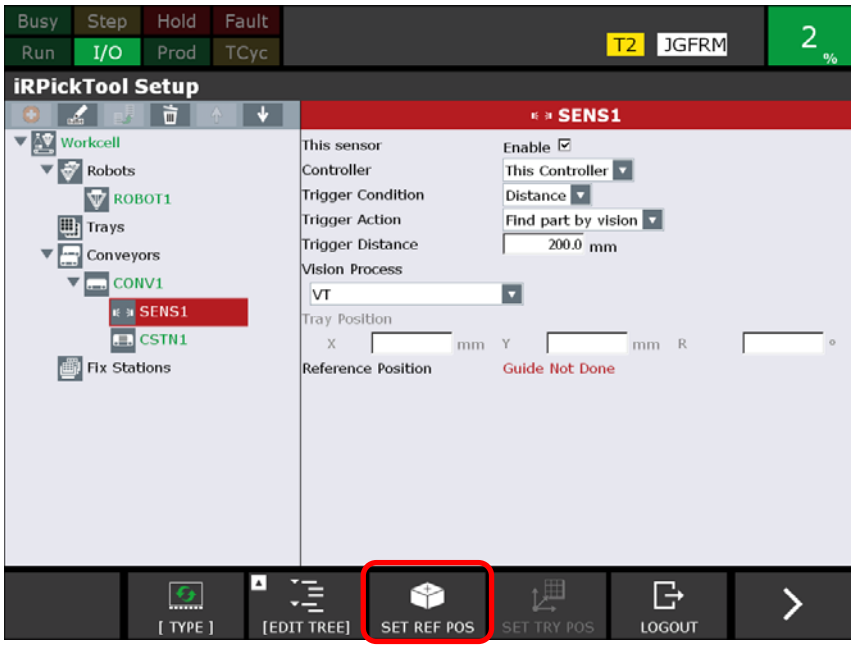
Memo For [Vision Process], select the vision process for visual tracking that was created beforehand. If you haven't created it, create it by referring to "7 TEACHING A VISION PROCESS."

After selecting a vision process, set the reference position in accordance with the guide screen.

9.2 SETTING UP THE REFERENCE POSITION

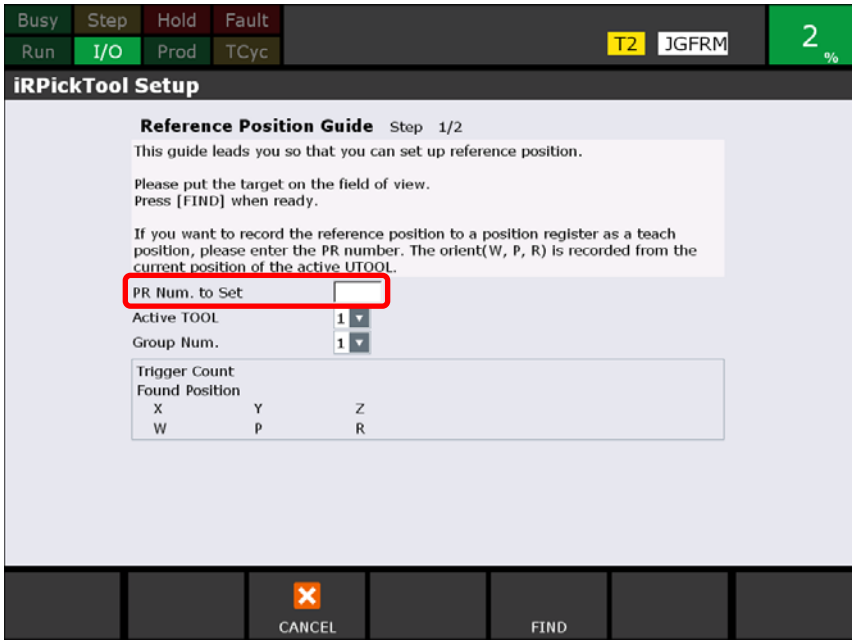
Set the reference position while moving the robot, in accordance with the guide screen.

1. Press F3 [SET REF POS].



➢ [Reference Position Guide Step: 1/2] will appear.

2. Enter a position register number in [PR Num. to Set].



Memo

Even if you do not specify a position register, the reference position can still be set.
In this case, position teaching for the robot will be necessary after setting the reference position.

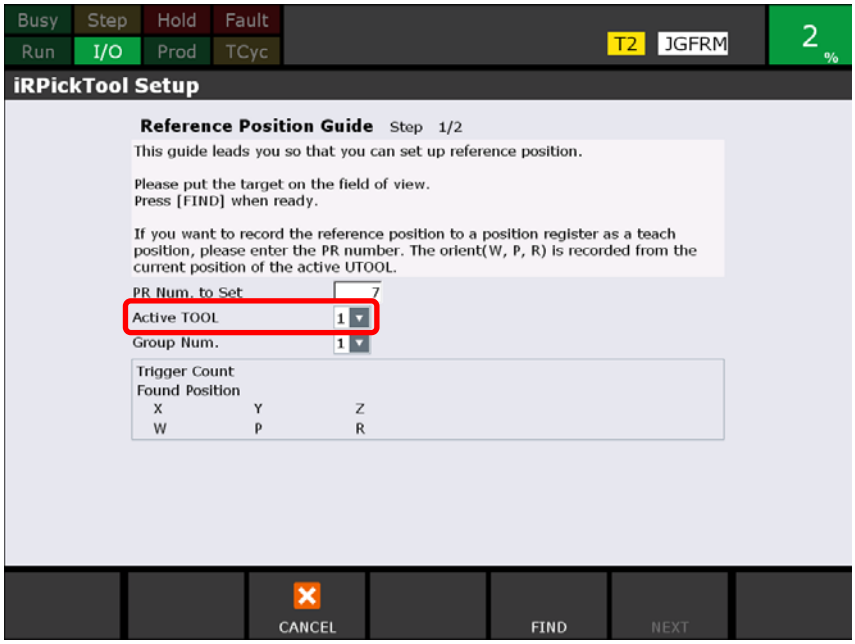
➢ Here, a sample program will be used, so "7" is entered as the position register.

Memo

You can omit the position teaching for the robot by setting the found position to the position register as the reference position. The conditions under which this function can be used are as follows.

- The vision model origin position is correct
- The part Z height is correct
- The tool frame settings for the hand are correct

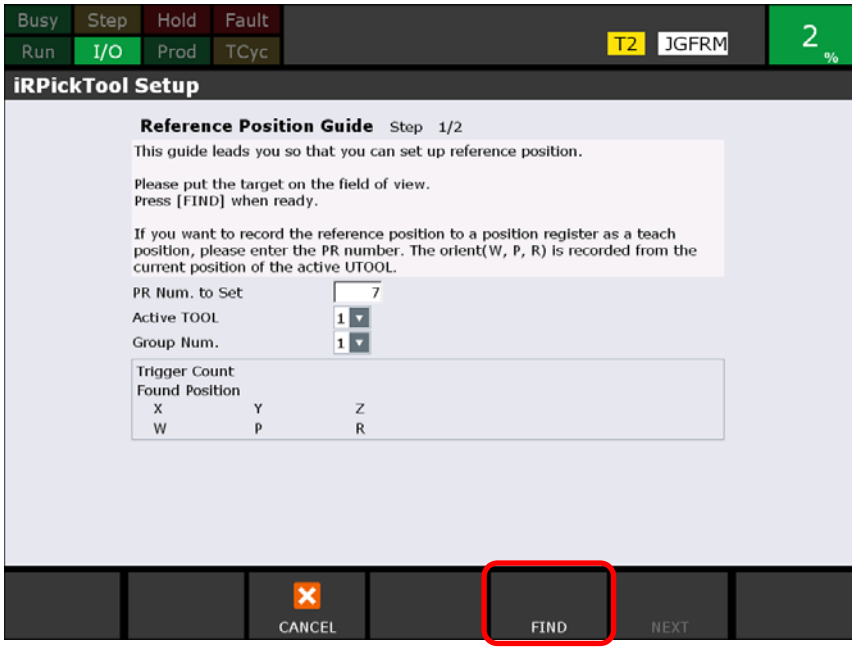
3. Set the tool frame number in [Active TOOL].



➢ Here, Tool Frame Number 1, which was set in "4 SETTING A TOOL FRAME" is selected.

⚠ **CAUTION**	The posture and configuration of the robot that will be stored in the position registers are determined from the current position of the selected tool. If a tool frame number that differs from the one that was set in "4 SETTING A TOOL FRAME" is specified in [Active TOOL], the robot may not be in the posture or configuration that was intended, which may be dangerous. Carry out the operations with regard to the setup of the reference position with the utmost caution.

4. Moving the robot by jog operation, adjust the tool position so that the robot will be in the posture for when picking up a workpiece, and press F4 [FIND].



- If the detection succeeds, a value will be displayed under [Found Position].
- Next, check that the detection has been carried out properly in Runtime Image.

5. If you press the [DISP] key a few times while holding down the [*i*] key on the teach pendant, a screen for the detection result will be displayed on the *i*RVision Runtime Image.

Memo

If Runtime Image is not displayed, press the [MENU] key on the teach pendant of the robot controller and select [iRVision] - [Vision Runtime], and Runtime Image will be displayed again.

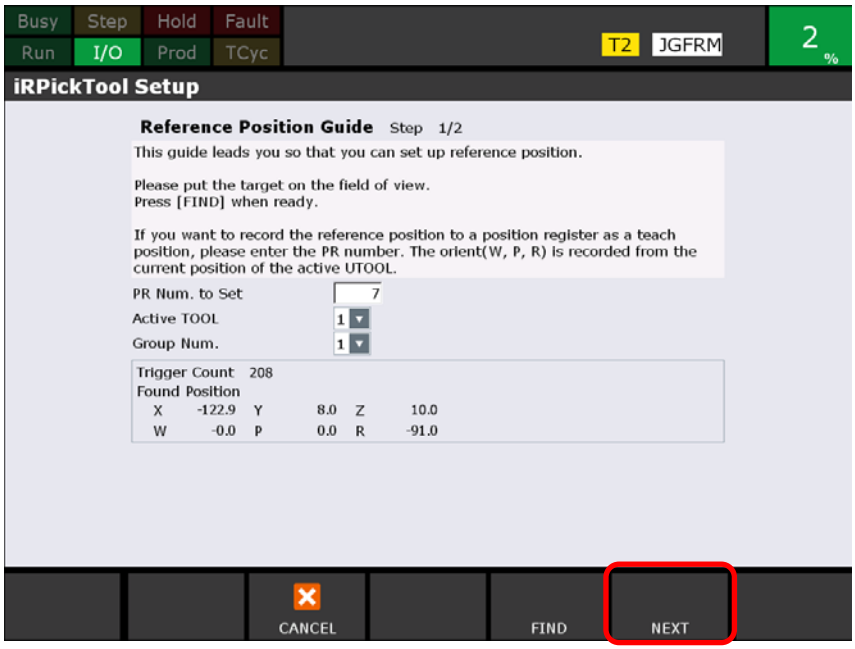
- After checking the detection result, press the [DISP] key a few times while holding down the [*i*] key again, and the screen will return to the reference position guide screen.

Note

If the detection fails, display the vision process on the [iRVision Vision Setup] screen, and change the detection parameters. If the detection result cannot be checked on Runtime Image even though the detection test has succeeded on the [iRVision Vision Setup] screen, check whether the vision process name that was set in "9.1 SETTING UP THE TRIGGER CONDITION AND TRIGGER ACTION, AND SELECT A VISION PROCESS" is correct.

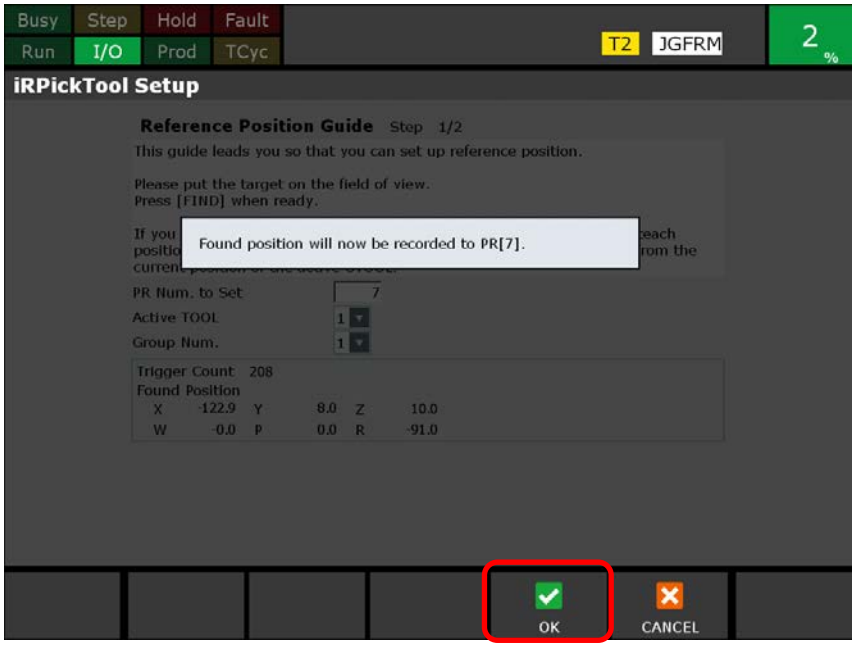
- If the detection succeeds, the [Found Position] will be displayed and F5 [NEXT] will be enabled.

6. Press F5 [NEXT].



- A message to confirm the position register number that has been set in step 2 will appear.

7. Press F4 [OK].



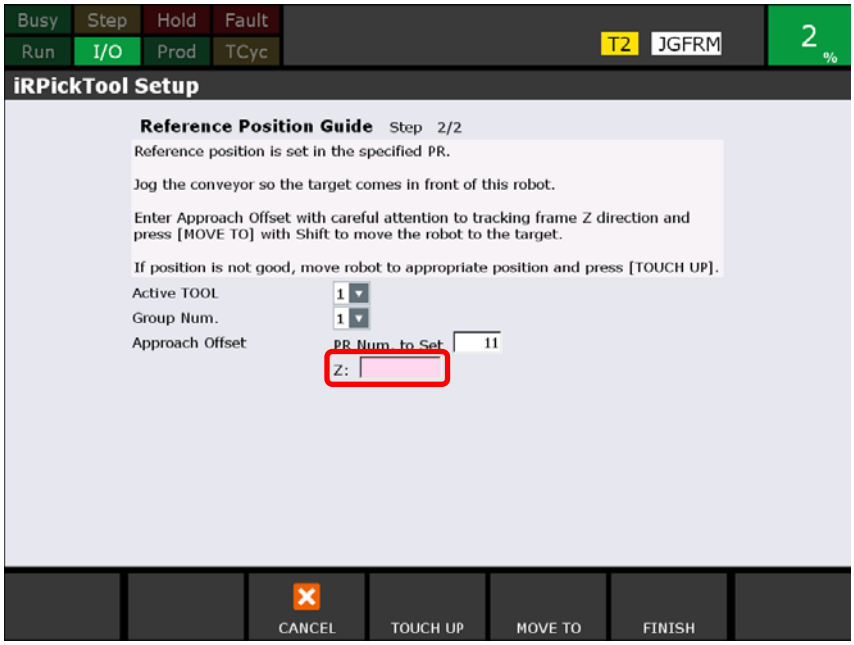
➢ The found position is recorded to the position register, and [Reference Position Guide Step: 2/2] will appear.

8. Enter a position register number in [PR Num. to Set].

➢ Here, a sample program will be used, so "11" is entered as the position register.

⚠ **CAUTION**	It is assumed that [PR Num. to Set] will be used to a direct offset instruction (Offset,PR[PR Num]) for a tracking frame, not a direct tool offset instruction (Tool_Offset, PR[PR Num]).

9. In [Z], enter an approach offset for Z as viewed from the tracking frame.



➢ Here, "10.0" is entered as the offset.

⚠ **CAUTION**	Enter an approach offset in accordance with the direction of the Z-axis of the tracking frame. Usually, the value is positive. If you set the values incorrectly, there is the danger that, for example, the robot could crash into a conveyor or workpiece. Be very careful when setting the values.

10. Move the conveyor until the workpiece is directly in front of the robot.

11. Press F4 [MOVE TO] while holding down the [SHIFT] key.

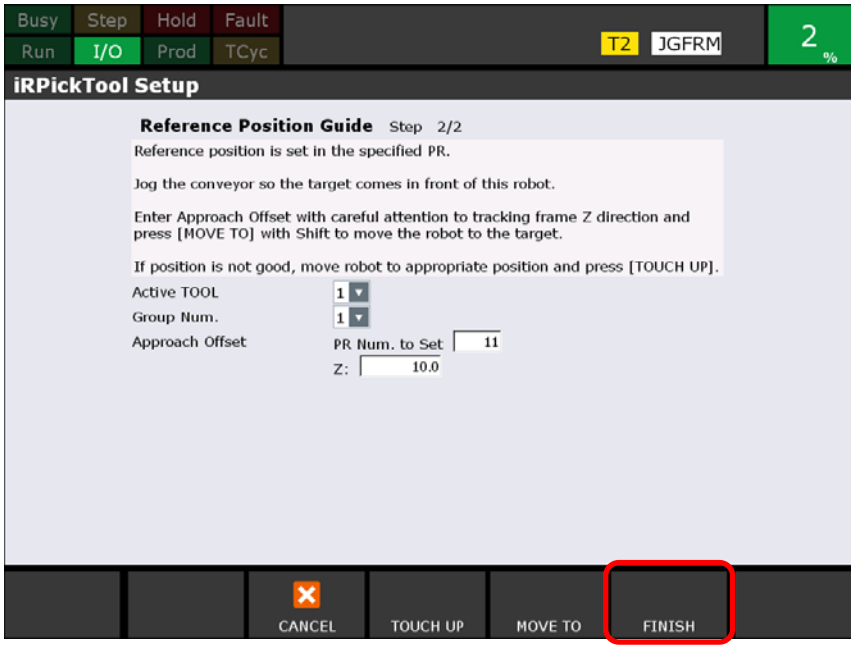
⚠ **WARNING**	Keep the speed override at 10% or below, and work carefully.

➢ The tip point of the vacuum pad will touch up the found position via the approach points.

Note

- In order for the tip point to touch up the correct position, the model origin position for the vision process and the tool frame must be set up correctly.
- If the touch-up position is not correct, move the robot to an appropriate position by jog operation and press F3 [TOUCH UP].

12. Press F5 [FINISH].



➢ Setup of a reference position will finish.

13. [Guide Done] will be displayed on the [iRPickTool Setup] screen.

Construction of a visual tracking system using the auto visual track frame setup function is now complete.

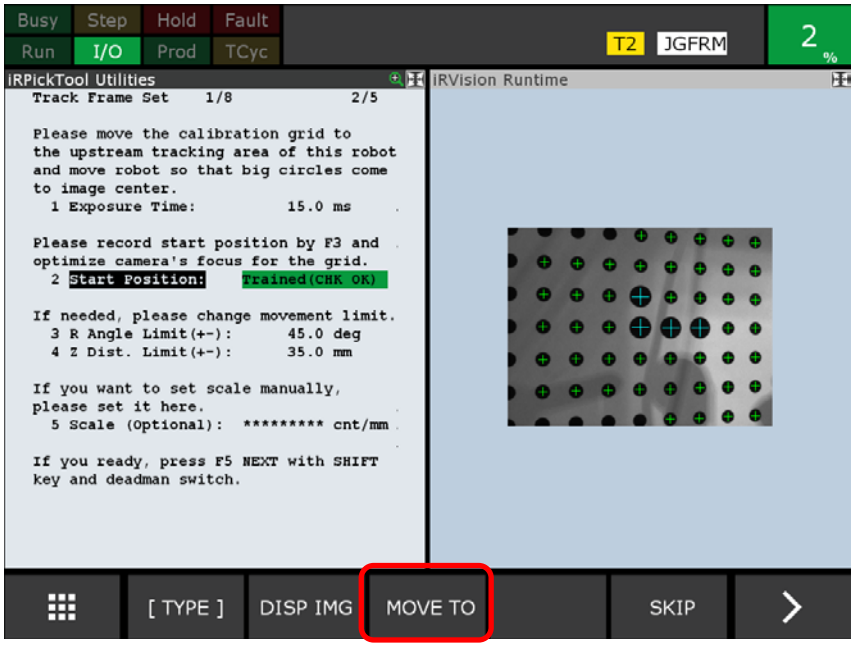
10 TROUBLESHOOTING

Refer to this chapter if any problems occurred while you were using the auto visual track frame setup function.

10.1 THE ROBOT EXCEEDED THE JOINT MOVABLE RANGE DURING MEASUREMENT

An error will be output if the robot exceeds the movable range during measurement for the tracking frame setup. If an error is output, the start position needs to be taught again manually.

1. Press [Next page] to change the function menu, and press F3 [MOVE TO] while holding down the [SHIFT] key.



➢ The robot moves to the start position.

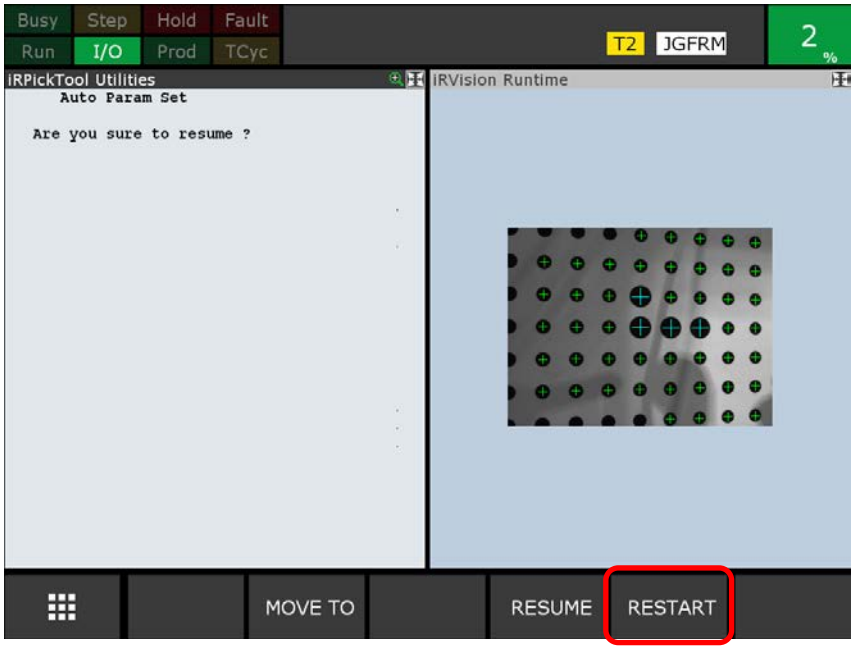
2. Teach the start position again.

➢ Refer to step 4 in "6.3.1 Measuring and Checking the First Point."

3. Press [Next page] to change the function menu, and press F5 [NEXT].

➢ A message to confirm whether to resume measurement will appear.

4. While holding down the [SHIFT] key, press F5 [RESTART].

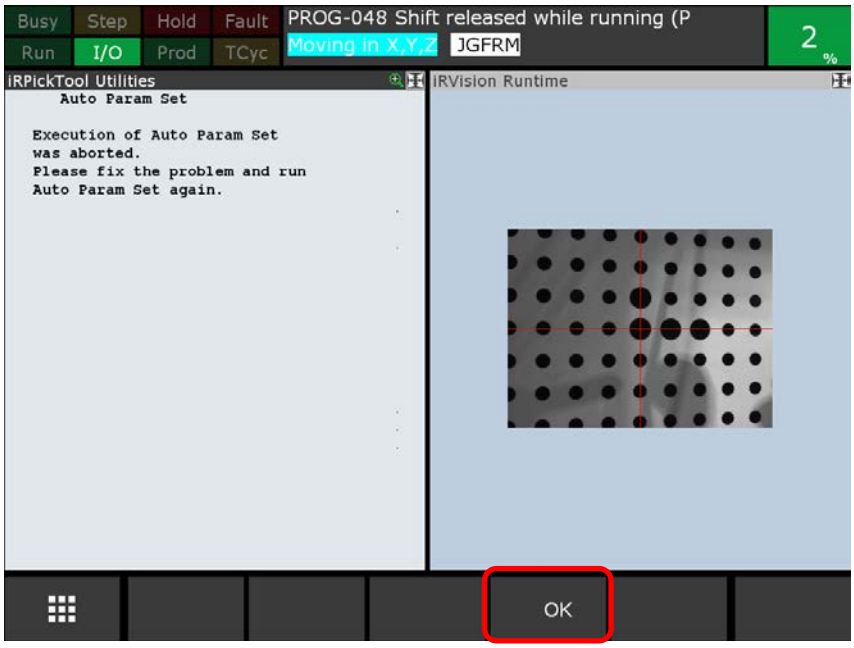


➢ The measurement will be performed again from the start position.

10.2 THE [SHIFT] KEY WAS RELEASED

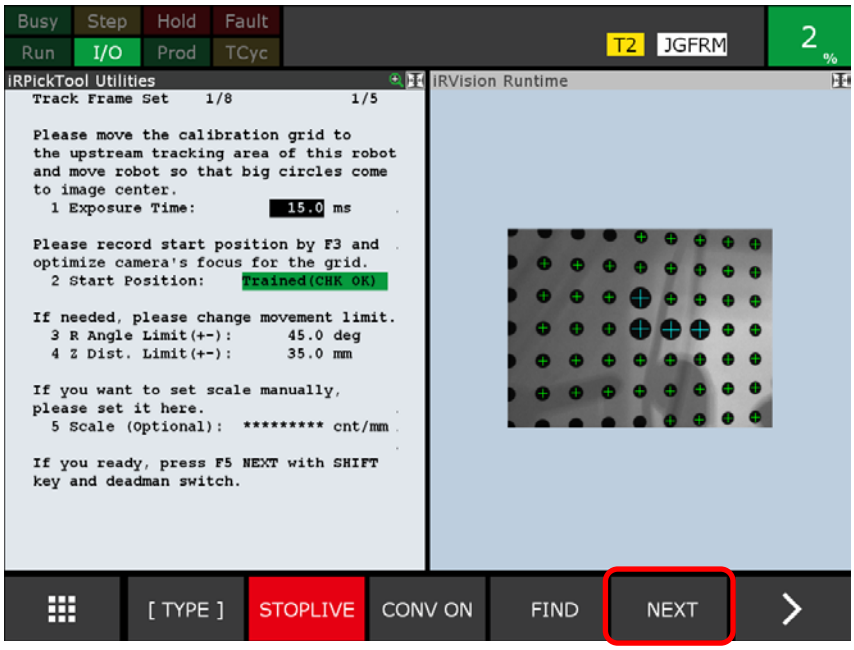
While measuring the grid pattern, you have to press and hold down the [SHIFT] key. If you release the [SHIFT] key in the middle, the measurement will be interrupted. You can resume measurement from the point at which it was interrupted.

1. Press F4 [OK].



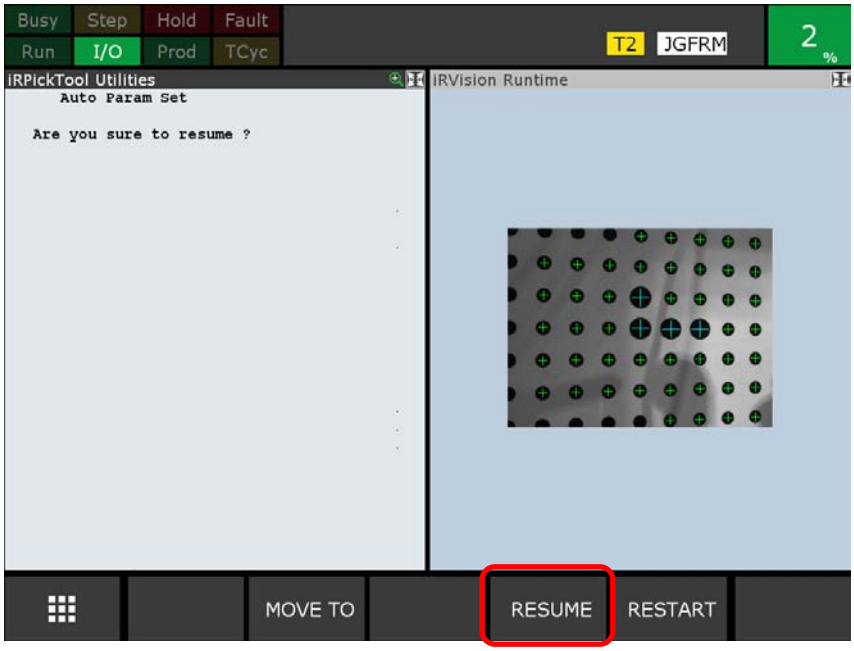
➢ The tracking frame setup screen will appear.

2. Press F5 [NEXT].



➢ A message to confirm whether to resume measurement will appear.

3. While holding down the [SHIFT] key, press F4 [RESUME].

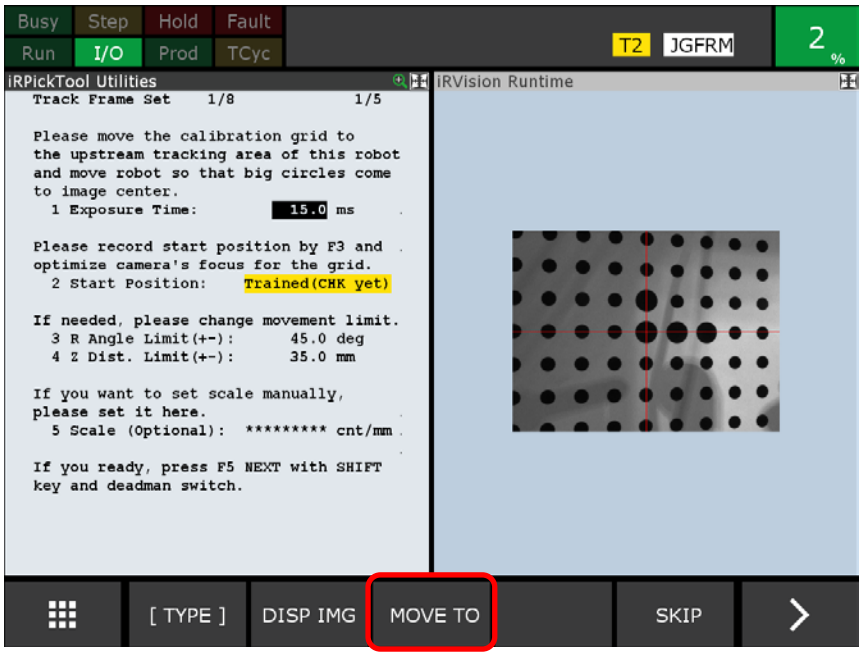


➢ The measurement will be resumed from the location at which it was interrupted.

10.3 THE ROBOT COULD NOT IDENTIFY THE LARGE DOTS DURING DETECTION

If the robot could not detect the large dots during measurement of the calibration grid, an error will be output. If an error is output, you will either have to change the exposure time, or teach the start position again manually.

1. Press [Next page] to change the function menu, and press F3 [MOVE TO] while holding down the [SHIFT] key.



➢ The robot moves to the start position.

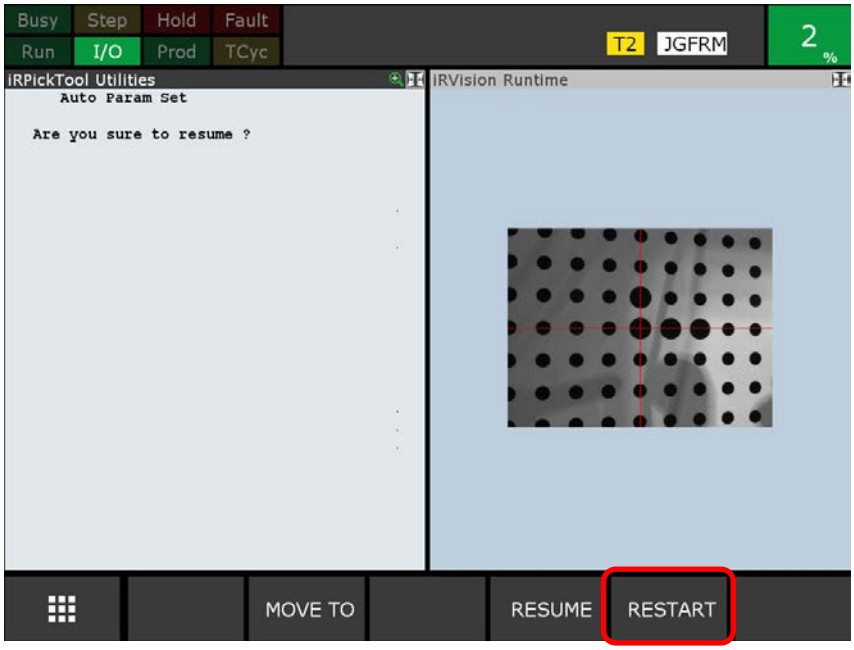
2. Change the exposure time or teach the start position again.

➢ Refer to step 4 in "6.3.1 Measuring and Checking the First Point."

3. Press [Next page] to change the function menu, and press F5 [NEXT].

➢ A message to confirm whether to resume measurement will appear.

4. While holding down the [SHIFT] key, press F5 [RESTART].



➢ The measurement will be performed again from the start position.

APPENDIX A SETUP IF USING MULTIPLE ROBOTS

By constructing a robot network, it is possible to perform setup for carrying out visual tracking using multiple robots.

APPENDIX A.1 NETWORK CREATION

Set up the robot ring in a robot network. First, set an IP address for each robot controller. Then, decide which robot to make the master and which robots to make the slaves, and perform the RIPE setup.
Refer to the following for details on the communication settings.

- For the IP address settings, see "5.1.3 Setting IP Addresses" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL"
- For robot ring setup, refer to "5.1.4 Setting up the Robot Ring" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

APPENDIX A.2 INSTALLING AND SETTING UP PULSECODER

For the connections for when using a pulse multiplexer with multiple robots, refer to "E.3.2 Connecting to Pulse Multiplexer" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."
For the setup for when using an ethernet encoder with multiple robots, refer to "5.2.4 Set Up Pulsecoders for Multiple Robots" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

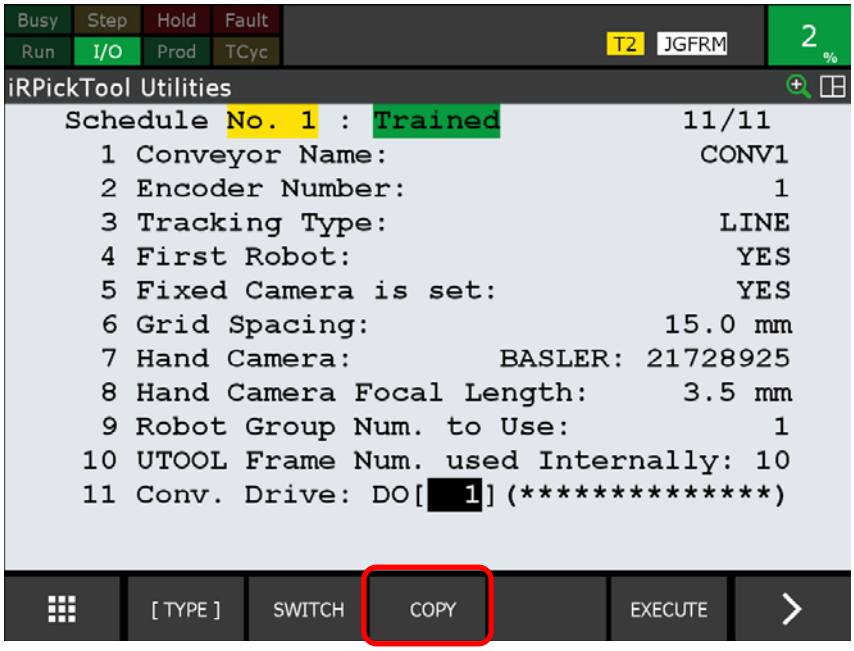
APPENDIX A.3 COPYING SETTINGS TO OTHER ROBOTS

The setting values used with the auto visual track frame setup function can be copied to other robots on the network.

Note

Confirm that the robot ring RIPE setup is complete. If it has not been set up, set it up by referring to "5.1 NETWORK CREATION" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

1. Press F3 [COPY] on the [iRPickTool Utilities] screen.



➢ A message to confirm whether to copy the setting details to other robots will appear.

2. Press F4 [Yes].

➢ The necessary settings will be copied to the same schedule number for the other robots.

Memo In the other robots, the copied schedule number will be selected automatically, and will be in a state in which the guide can be run immediately.

APPENDIX A.4 SYSTEM STARTUP METHODS

If performing visual tracking with multiple robots, set things up so that the robot controller programs for which a sensor will be run will start up last. This is because in order for a sensor task to start detection of workpieces, all the workpiece information within the conveyor station needs to be deleted in each robot controller.
If there are multiple robot controllers that will run a sensor, insert a wait statement before sensor startup, and start up the sensor after all the workpiece information within the conveyor station has been deleted.

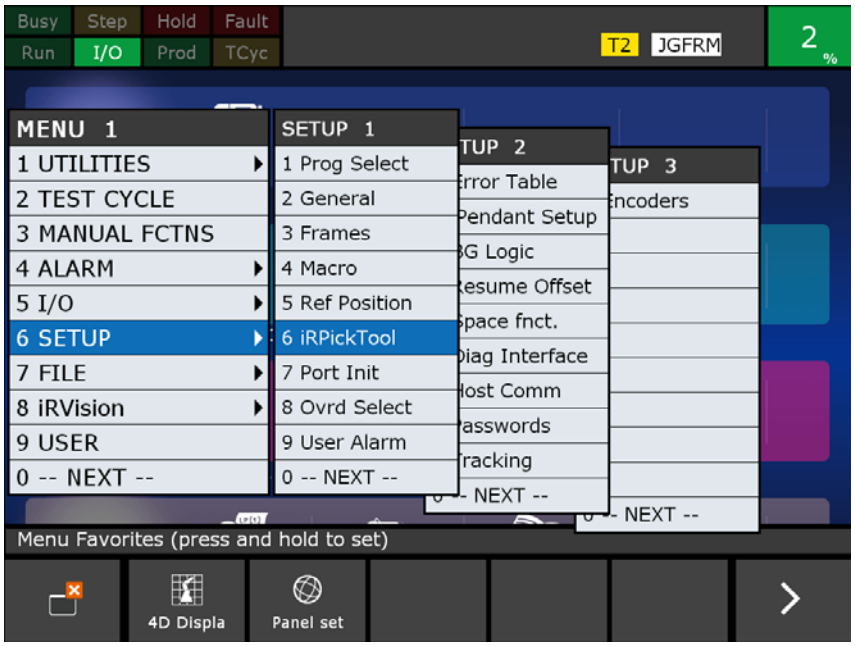
APPENDIX B TRACKING OPTIMIZATION

Refer to this chapter when adjustments are required for tracking parameters that have been set using the auto visual track frame setup function.

APPENDIX B.1 TRACKING AREA ADJUSTMENT

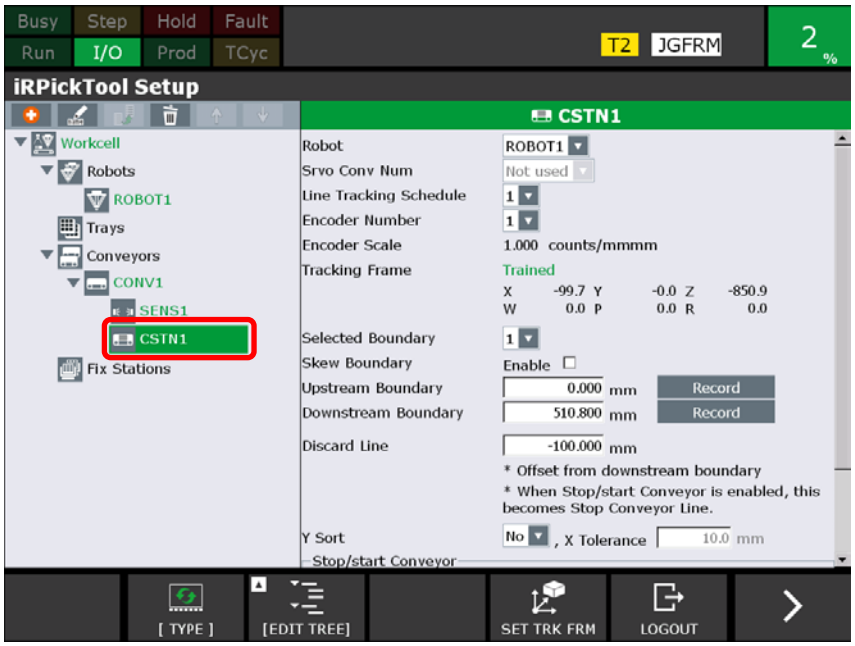
Tracking areas can be set manually. Position the robot by jog operation, and register the current position to set the tracking area again.

1. On the teach pendant of the robot controller, press the [MENU] key and select [SETUP] - [iRPickTool].



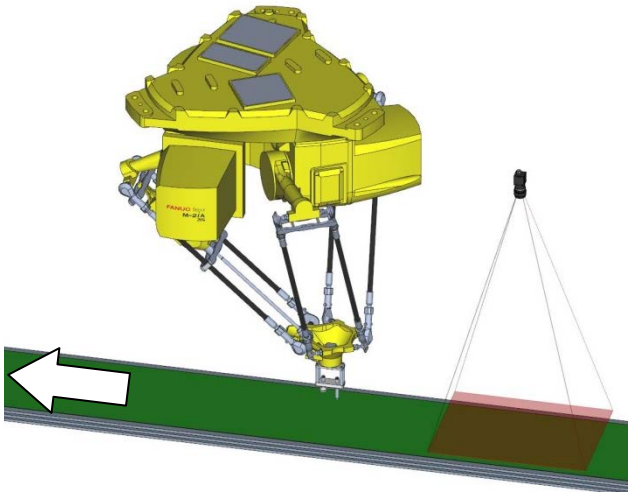
➢ The [iRPickTool Setup] screen will appear.

2. Select a conveyor station in the tree on the left side of the screen.

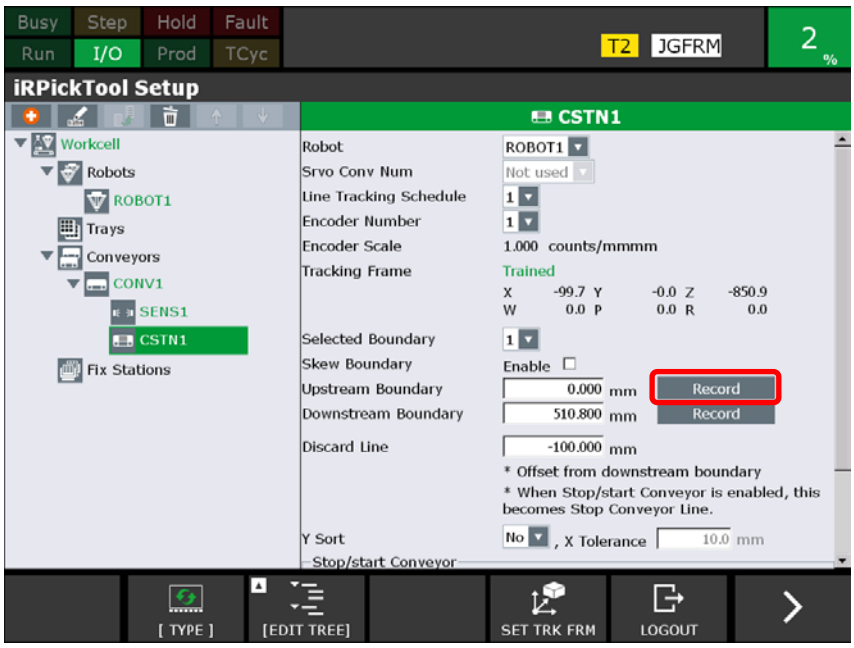


➢ The setup items for the conveyor station will appear on the right side of the screen.

3. Move the robot to upstream of the work area by jog operation.



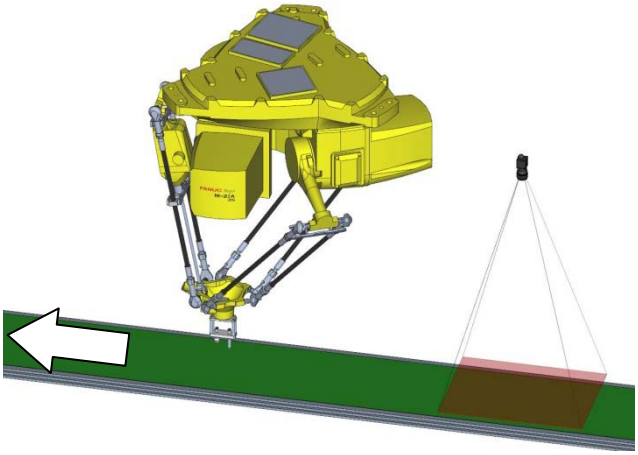
4. Place the cursor over [Record] for [Upstream Boundary], and press the [ENTER] key.



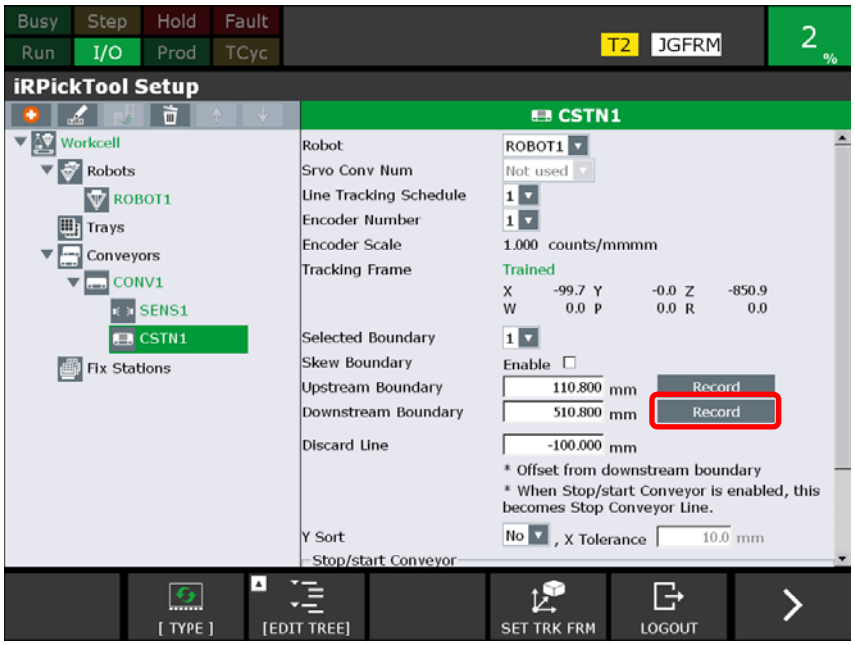
➢ The X value of the current position as viewed from the tracking frame will be registered and displayed.

Note Check that the selected tool frame matches the current tool frame.

5. Move the robot to the downstream of a work area by jog operation.



6. Place the cursor over [Record] for [Downstream Boundary], and press the [ENTER] key.



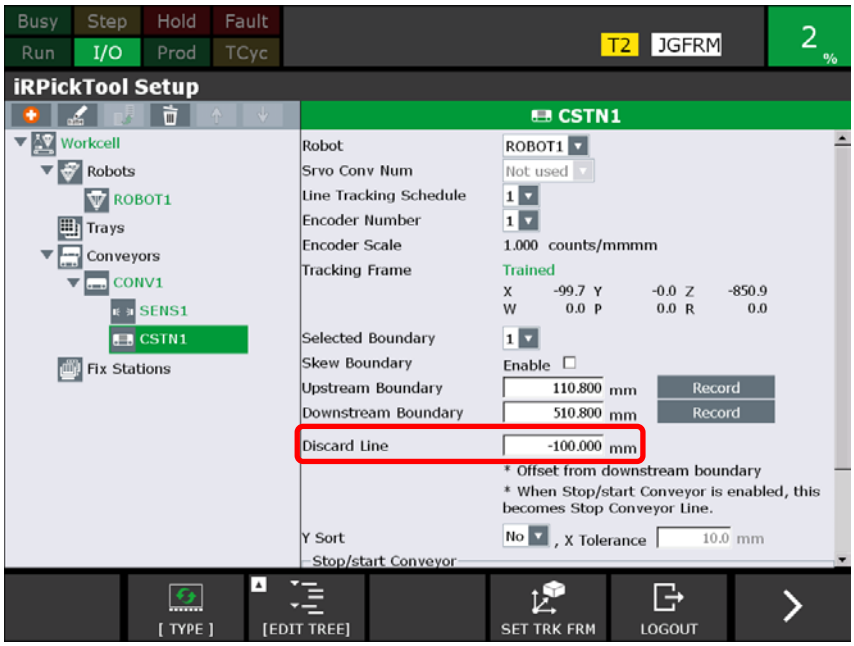
➢ The X value of the current position as viewed from the tracking frame will be registered and displayed.

Note Make sure that the selected tool frame matches the current tool frame.

APPENDIX B.2 DISCARD LINE ADJUSTMENT

The position of a discard line can be adjusted manually.

1. Place the cursor over [Discard Line] in the setting items for a conveyor station and enter an appropriate value.



Note

A discard line must be set to a value that is larger than the following calculation result.

Time required for motion (sec) x Conveyor speed (mm/sec)

For discard lines, refer to "6.6 SETUP OF A CONVEYOR STATION" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

APPENDIX B.3 FINE ADJUSTMENT OF TRACKING MOTION

Adjustment can be performed to optimize the tracking motion of a robot. For details, refer to "6.12 FINE ADJUSTMENT OF THE TRACKING MOTION" in the "R-30*i*B Plus CONTROLLER *i*RPickTool OPERATOR'S MANUAL."

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