OMRON

Robotics packaging line solution

Vision Sensor FH series
Conveyor Tracking Application
Programming Guide

FH-1□□□
FH-3□□□

SYSMAC-SE20□□

SYSMAC-RA401L

NJ501-4□□□

R88D-KN□-ECT

Startup Guide

SYSMAC always in control

Z368-E1-01

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1. Revision History

Revision Symbol	Revision Date	Reason for Revision and Revised Page
01	December 1, 2015	First edition

2. Introduction

2.1. Introduction

Thank you for purchasing FH/FZ5 Series product.

This manual provides information regarding functions, performance and operating methods that are required for using FH/FZ5 Series product. When using FH/FZ5 Series product, be sure to observe the following:

- FH/FZ5 Series product must be operated by personnel knowledgeable in electrical engineering.
- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.

This Manual does not contain safety information and other details that are required for actual use of a FH/FZ5 Series Controller. Thoroughly read and understand the manuals for all of the devices that are used in this Manual to ensure that the system is used safely. Review the entire contents of these materials, including all safety precautions, precautions for safe use, and precautions for correct use.

The contents of this manual, including product specifications, are subject to change based on improvements of the product without prior notice. Your understanding is appreciated

We are committed to providing precise information. Should you have any questions or concerns regarding the contents of this document, please do not hesitate to contact us. When you contact us, please be sure to provide us with the Catalog number printed on the back cover.

2.2. Provided Materials

The following materials are provided from OMRON:

- Sample Scenes
- Sample macros
- User's guide (this document)

2.3. Conventions Used in This Manual

Symbols in this manual are used as follows:

Safety Information

Things that should be done or avoided to safely use the product.

Precautions for Use

Things that should be done or avoided to prevent malfunction, false operation, or other negative effects to the product.

Useful Information

Things that may apply to certain situations. Information and tips that help you use the product seamlessly. This information is provided to increase understanding or make operation easier.

Reference

Location of detailed or related information.

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2.6. Meanings of Signal Words

For details on Meanings of Signal Words, refer to Meanings of Signal Words in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

2.7. Precausions for Safe Use

For details on Precautions for Safe Use, refer to Precautions for Safe Use in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

2.8. Precausions for Correct Use

For details on Precautions for Correct Use, refer to Precautions for Correct Use in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

2.9. Regulations and Standards

For details on Regulations and Standards, refer to Regulations and Standarrds in *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340-E1-08 or later).

2.10. Related Manuals

The following manuals are also helpful when using Conveyor Tracking Calibration Wizard. Use these manuals for reference.

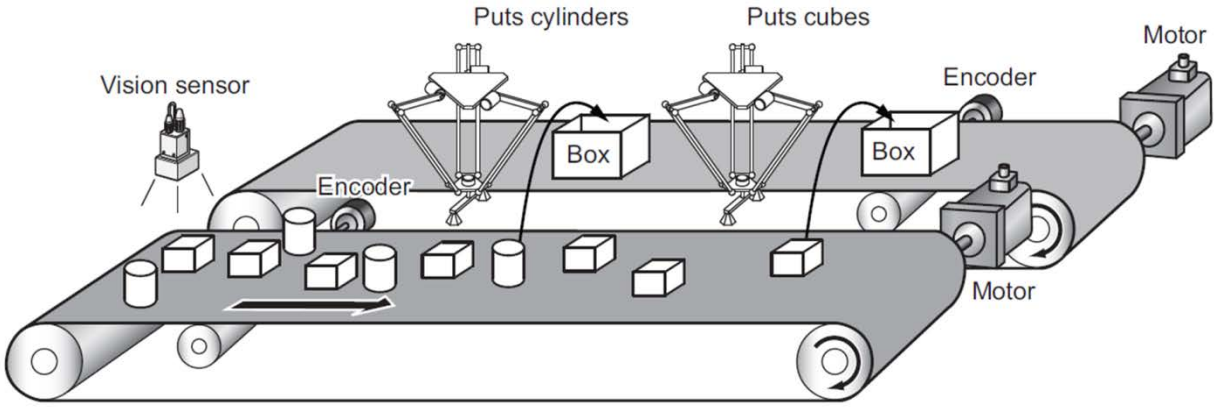
Cat. No.	Manual name	Summary	Application
Z340-E1	Vision System FH/FZ5 Series User's Manual	Describes how to configure settings on the sensor controller of FH/FZ5 Series Vision Sensors.	To learn how to configure FH/FZ5 Series Vision Sensors.
Z341-E1	Vision System FH/FZ5 Series Processing Item Function Reference Manual	Describes how to configure settings for processing items for FH/FZ5 Series Vision Sensors.	To learn how to configure settings for processing items for FH/FZ5 Series Vision Sensors.
Z342-E1	Vision System FH/FZ5 Series User's Manual (Communications Settings)	Describes how to configure communication settings on the sensor controller of FH/FZ5 Series Vision Sensors.	To learn how to configure communication settings for FH/FZ5 Series Vision Sensors.
Z343-E1	Vision System FH Series Operation Manual Sysmac Studio	Describes how to configure FH Series Sensor Controllers on Sysmac Studio.	To learn how to configure FH Series Sensor Controllers.
W504-E1	Sysmac Studio Version 1 Operation Manual	Describes the operation of Sysmac Studio.	To learn the operation and functions of Sysmac Studio.
Z369-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Calibration Plate Print Tool	Describes how to configure and operate Calibration Plate Print Tool on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure for printing the Pattern on a Calibration Plate used for calibration for cameras and robots on Sysmac Studio.
Z370-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool	Describes how to configure and operate the Conveyor Tracking Calibration Wizard tool on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure of the wizard style calibration for cameras, robots, or conveyors.
Z371-E1	Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Panorama Display Tool	Describes how to configure and operate the Conveyor Panorama Display tool on Sysmac Studio on FH Sensor Controllers.	To learn the setup procedure of panorama display for image capture of targets on conveyors.

Z368-E1	Vision Sensor FH Series Conveyor Tracking Application Programming Guide (this document)	Describes the setting procedure of sample scenes or sample macros used for applications of conveyor tracking on FH Sensor Controllers.	To learn the setting procedure of sample macros for conveyor tracking.

3. About Sample Scene and Sample Macro

3.1. Overview

The conveyor tracking application consists of the combination of Machine Automation Controllers (NJ/NX Series), a vision sensor of FH Sensor Controller, robots, conveyors, and other devices.



FH Sensor Controller has the Pick and Place capability to accommodate to conveyor tracking application.

The Pick and Place capability consists of the following three functions.

1. Function to perform conveyor tracking calibration to reciprocally convert coordinate systems of FH Sensor Controller, conveyor, and robots.
2. Function to detect target objects on a conveyor and exclude ones captured by camera more than one time from detection.
3. Function to have a robot create and output data to pick target objects.

These three functions are achieved by combining a variety of processing and the macro customization function of FH Sensor Controller.

These combinations of processing items and the macro customization function are provided as Sample Scenes and sample macros.

The Sample Scenes, sample macros, and programs for Machine Automation Controllers (NJ/NX Series) can be customized to suit your system.

This document describes how to use the Sample Scenes and macros to perform each one of the three functions.

For more information about processing items used for Pick and Place, refer to the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

For more information about Scenes and macros, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

3.2. Target Readers and Expected Skill Level

Target readers of this manual include developers of visual conveyor tracking systems, and engineers and programmers who support end users of visual conveyor tracking systems, especially those who are responsible for the following tasks.

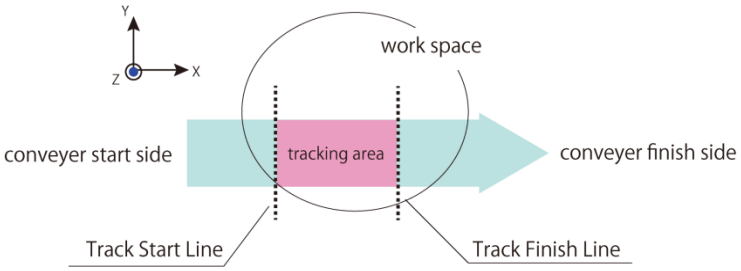
- Configuration of conveyor tracking system using the Sample Scenes and sample macros.
- Measurement flow adjustment

Additionally, the following skills are required since sample Scenes are adjusted using processing items of FH Sensor Controller and the macro customization function.

- Skill to adjust processing items of FH sensor controller
- Skill to edit macro related processing items.

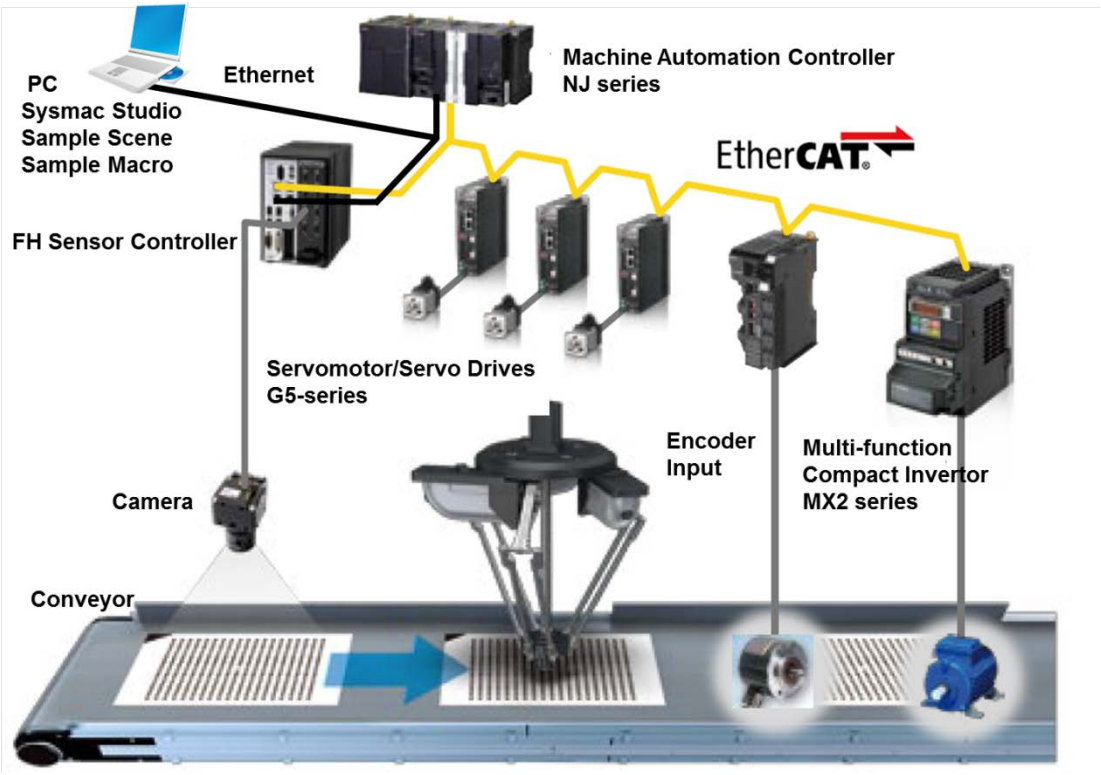
3.3. Terminology

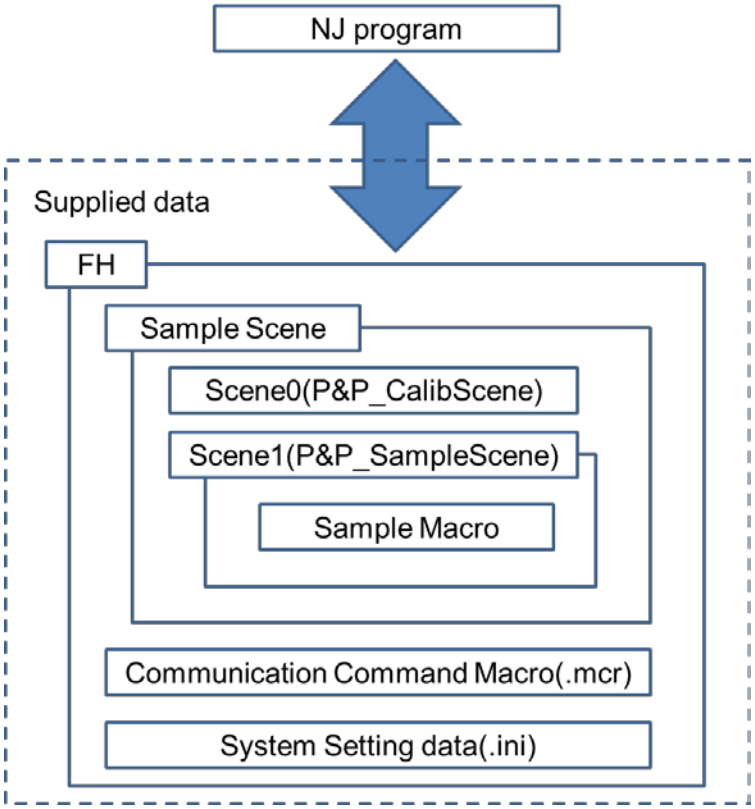
Term	Explanation
Conveyor tracking	A function that enables a robot to track targets moving on a conveyor. Transfer of targets from/to moving conveyors is enabled by combining the Conveyor Tracking function and the Pick & Place function.
Visual Conveyor Tracking	A conveyor tracking system for production lines that use vision sensors.
Calibration	A process that generates parameters to reciprocally convert coordinates that differ from the camera coordinate system.
Conveyor Calibration	Collective term for calibrations for conveyor tracking operation. Conveyor tracking calibration includes camera calibration such as lens distortion correction, camera-robot calibration, and robot-conveyor calibration.
Calibration Plate	A plate-shaped reference jig with a calibration pattern printed that is used with Conveyor Tracking Calibration Wizard.
Pick-side Conveyor	Conveyor on which target objects of Pick and Place move.
Camera Coordinate System	A 2D coordinate system used by vision sensors. Its origin point is the upper left corner of the captured image. From there, the horizontal line is determined to be the x axis, and the vertical line is determined to be the y axis. The unit of measure: pixel.

Conveyor Coordinate System	A coordinate system for conveyors. The user-defined conveyor coordinate system is set per tracking area, and is used to adjust the angle of the conveyor with respect to the robot's Machine Coordinate System (MCS). It is set as User Coordinate System (UCS).
Machine Coordinate System (MCS)	A coordinate system used by robots controlled by FH Sensor Controller. It is set as Machine Coordinate System (MCS). The unit of measure: mm.
Robot	Robot which picks and places target objects for conveyor tracking.
Set Point	Operations to have a robot touch the target object to make the robot learn and input its position information. During conveyor tracking calibration between the camera and robot, the Calibration Plate is moved into the tracking area, and a robot performs Set Point to specified Marks.
Tracking area	An area where robots can pick and place target objects. It is the overlapped area of the conveyor and the workspace of the robot. The entry border of the area is called Track Start Line, and the exit border is called Track Finish Line, and the tracking area is the space in between two lines. 
Track Start Line	It is a virtual entry border to the tracking area, over which objects will be targets of the robot's Pick and Place operation.
Track Finish Line	It is a virtual exit border from the tracking area, over which objects will no longer be targets of the robot's Pick and Place operation.
Vision and Robot Integration Simulation Vision and Robot Integration Simulator	When you consider installing new equipment for conveyor tracking application, the test verification based on the real environment is required. This verification can be performed by the simulation of Sysmac Studio. This simulation is referred to as "Vision and Robot Integration Simulation" and its tool as "Vision and Robot Integration Simulator".

3.4. Hardware Configuration

The following figure is an example of the system configuration and a conceptual diagram of the supplied Sample scene and sample macro.





Sends the Scene 0 and Scene 1 as Sample Scene.

These two Sample Scenes are included to the NJ-sample program.

Scene 0: **P&P_CalibScene**

Scene 1: **P&P_SampleScene**

Sample macro sends seven sample macros.

These seven macros are included to the P&P_SampleScene of Scene 1.

Macro processing for Debug mode settings: **DEBUG_SetGlobalData**.

Macro processing for Acquisition of Encoder value: **GetEncValue**.

Macro processing for Remove Duplication: **RemoveDuplication**.

Macro processing for Classification: **Classification**.

Macro processing for Grip Interference Check: **GripInterferenceCheck**.

Macro processing for Data Output: **DataOutput**.

Macro processing for Error processing: **DEBUG_GetMacroError**.

The communication command sample macro is included in FH_ConveyorTrackingApplication_SAMPLE_IO_MACRO_Rev*.mcr, where * represents the revision number. This macro provides the following three functions:

3DSimCalib (No.128) as a calibration command for the vision and robot integration simulator;

OutputConvDist (No.254) as a command for the calibration wizard; and

GetUnitNo (No.255) as a command for the non-wizard calibration.

Useful Information

The Sample Scene, sample macro, communication command macro, and system setting data are provided together with a single BKD file, and included in FH_ConveyorTrackingApplication_SAMPLEScene_Rev*.bkd, where * represents the revision number.

3.5. Supported Devices

Devices	Supported product
NJ-R CPU unit	NJ501-4300/4310/4400/4500 （Unit: Ver.1.09, Robot Ver.1.02 or later）
Servomotors/Servo Drive G5 series	・R88D-KN04H-ECT ・R88D-KN02H-ECT ・R88D-KN01H-ECT （Ver.2.1）
Delta robot	Yamaha Motor Delta Robot: YD06-A4A
Vision sensor	FH-3050□□ / 1050 □□ (Ver.5.50 or later)
Sysmac Studio	Ver,1,14,1 or later

3.6. Restrictions

Keep the following points in mind when using this sample Scene and related sample macros.

Item	Restriction
Sample Scene	Created on the assumption that the number of cameras is 1. For the use of multiple lines random-trigger mode of the FH Sensor Controller, create the Scene assuming that the number of cameras is 1 for each line.
Sample Scene (Scene 1: **P&P_SampleScene**) Regarding Camera image input function	Only **Camera Image Input FH** function supported
Sample Scene (Scene 1: **P&P_SampleScene**) Regarding Encoder value	To obtain correct encoder values, the multi-input function is unavailable. Restrictions for encoder value: ・The value shall be from 0 to 2147483647 ・On reaching the maximum value, 214783647, the value shall return to 0 and then perform counting up, which is the ring counting method.
Sample Scene (Scene 1: **P&P_CalibScene**) Regarding the use of User areas	To use the conveyor tracking calibration wizard, use the User area for the current encoder value and the robot position data (X, Y) in touch-up operation.
Sample Scene (Scene 1: **P&P_SampleScene**) Regarding the use of User areas	For the data of an encoder value when the trigger is activated, use the User area.
Sample Macro	Do not edit the macro except the part in between "'Start/////..." and ".../// End".
Sample Scene (Scene 1: **P&P_SampleScene**) Parallel Processing function	Do not use Sample Scene (Scene 1: P&P_SampleScene) for Parallel Processing. For details, refer to **Parallel Processing** section in the *Vision System FH/FZ5 Series User's Manual*.
Communication command macro	When performing calibration or using the vision and robot integration simulator, use the provided communication command macro.
Re-measurement using the logging images	Use the logging images in IFZ format (Omron-specific image format). The BMP format cannot be used. For the BMP format, use the BitmapToIfz tool to convert it to IFZ format before use. For how to access the tool, consult your local representative.

4. About Conveyor Tracking Calibration

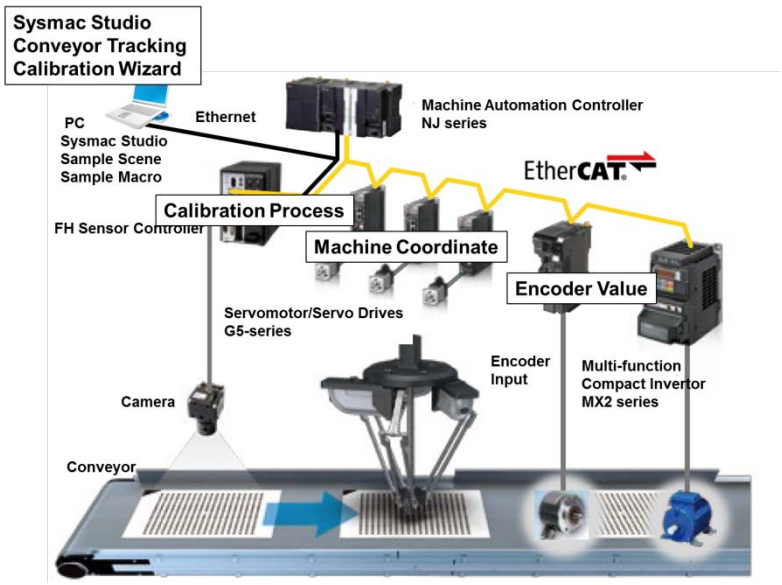
4.1. Function Overview

Conveyor Tracking Calibration can perform the calibration to reciprocally convert different coordinate systems between vision sensors, conveyors, and robots by combining processing items of FH Sensor Controller.

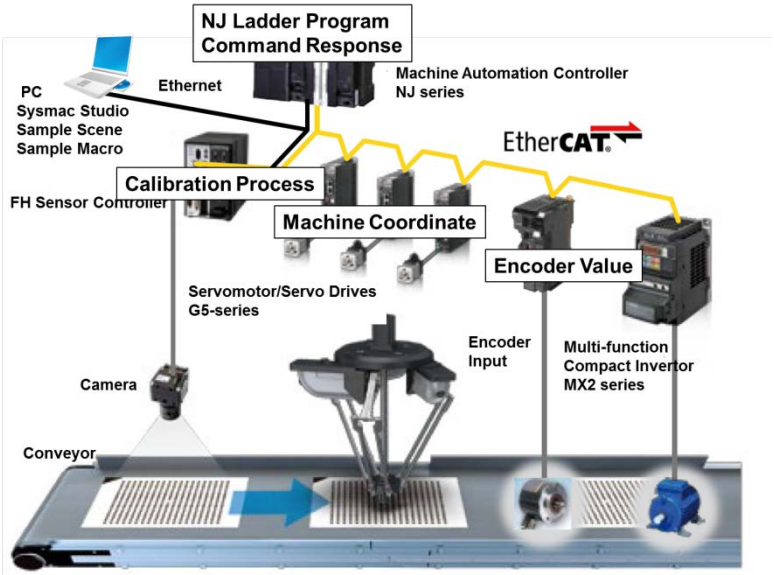
The chapter 4 describes a sample Scene provided for Conveyor Tracking Calibration function.

There are two ways to perform conveyor tracking calibration using this sample Scene.

Method1: Use the Conveyor Tracking Calibration Wizard tool. For more information, refer to the *Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool*.



Method 2: Use a command/response scheme in the NJ program. For more information, refer to the section of *Calibration Without Using the Wizard* in this manual.



4.2. About the Sample Scene

This chapter describes a Sample Scene: **0.P&P_CalibScene** provided for Conveyor Tracking Calibration function,

This sample Scene can be applied to both the Method 1 and Method 2 introduced earlier.

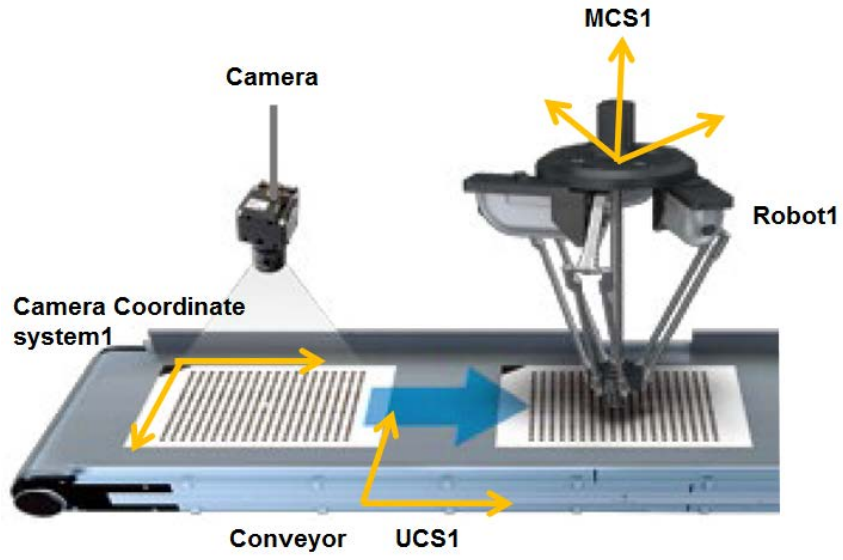
For more information about each processing item, refer to the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

This table describes the sample Scene following the arrangement of the Scene contents.

Scene content	Available processing items	Description
Camera Image Input type processing	Camera Image Input FH Camera Image Input HDR	Select the camera number of the camera to calibrate with.
↓		
Calibration type processing	Precise Calibration	Load the Calibration Plate in the camera FOV, and then perform the calibration.
↓		
Conveyor Tracking Calibration processing	Conveyor Tracking Calibration	Performs the calibration using plate position, machine coordinate, and Encoder values with loaded in the Precise Calibration function.

4.3. Function Details

Conveyor Tracking Calibration is a process to reciprocally convert coordinate systems of the conveyor, robot MCS and camera.



1. Calibration the Robot 1 and UCS1.
   Robot 1: Machine coordinate system
   UCS 1: Conveyor coordinate system
2. Calibration Robot 2 and USC 2.
   Robot 2: Machine coordinate system
   UCS 2: Conveyor coordinate system
3. Calibration Robot 1 and MCS 1.
   Describes about this calibration.

For more information about 1 and 2, refer to the NJ program.
Perform 3 after completing 1 and 2.

To calibrate MCS1 and the camera coordinate system, the coordinates of the four corners of the Calibration Plate on MCS1 and on the camera coordinate system are matched in the camera FOV.

For more information about the procedure of calibration, refer to the *Conveyor Tracking Calibration Wizard Tool* section in this manual.

4.4. Hints for Adjustment

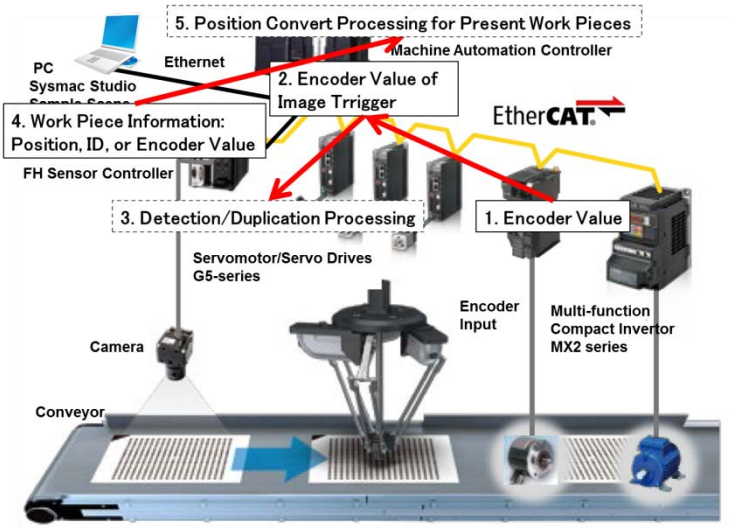
Situation	Where to adjust	Adjustment
Cannot load the Calibration Plate	Camera Image Input FH function Camera Image Input HDR function	Adjust the brightness as needed to have uniform brightness across the calibration plate. Adjust the focus to Marks on the Calibration Plate. Do not include objects other than the Pattern in camera the FOV. Increase the contrast of the black area and white area on the Calibration Plate by using the Camera Image Input HDR function. For the Camera Image Input HDR function, refer to *FH/FZ5 Processing Item Function Reference Manual.*
	Position of the Calibration Plate	Adjust the Plate position, or calibration region to not include objects other than the calibration pattern.
	Calibration Plate	Make sure the Marks do not overlap and that the diameter of the Marks is 20 pixels or larger. Adjust the Calibration Plate size to the camera FOV.

	Sample Scenes (Scene: **0.P&P_CalibScene**)	If the contrast of the black area and white area of the Calibration Plate is uneven, correct the image. To do so, you can set image correction type processing items after the image capture type processing items and before the calibration type processing items.

5. About Detection and Duplicate Duplication Capability

5.1. Function Overview

By combining multiple processing items and the macro customization function of the FH Sensor Controller, you can exclude objects that have already been in the camera FOV and captured by the camera from the next detection.



5.2. Sample Scene Overview

This chapter explains the Sample Scene (Scene: **1. P&P_SampleScene**) when the detection and duplicate exclusion function are used.

Although this Sample Scene includes processing items described in *6. Generating and Outputting Data for the Pick Operation* in this manual.

For more information about each processing item, refer to the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

For more information about Scenes and macros, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

This table describes the Sample Scene following the arrangement of the Scene contents.

Scene content	Available processing items	Explanation
Image capture processing	Camera Image Input FH function	Select the camera used for Conveyor Tracking. Select the camera number for measurement.
↓		

Macro processing for Debug mode	Unit Macro (Sample macro: **DEBUG_SetGlobalData**)	Is used to change the startup mode or debug mode. For details of this function, refer to *Sample Macro for Debug* in this manual.
↓		
Reference calibration data processing	Reference Calib Data	References the calibration data created through conveyor calibration.
↓		
Sample Macro for Acquisition Encoder Value	Unit Macro (Sample macro: **GetEncValue**)	Obtains the encoder value saved in the NJ For more detail of this function, refer to GetEncValue macro section in this manual.
↓		
Processing unit data acquisition	Get Unit Data	Obtains the value of the conveyor movement per encoder value set through conveyor calibration.
↓		
Detection processing	Search Shape Search II Shape Search III EC Circle Search Labeling	Detects target objects for Pick and Place. Select processing items which can detect multiple work pieces. When you use the Labeling function, Label Data function is used simultaneously.
↓		
Camera switching processing	Camera Switching function	This processing item returns an image of filter processing items used detection processing to an image of Image capture processing. If you do not use the filter processing items, turn to OFF the processing units at the same time of calibration reference processing.
↓		
Calibration reference processing	Calibration data reference	Retry to reference the reset calibration data when the Camera Switching function is performed.
↓		
Macro(RemoveDuplication) processing	Unit Macro: **RemoveDuplication**	For details of this function, refer to *Sample Macro for Duplicate Exclusion* in this manual.

5.3. Function Detail

5.3.1. Data Flow Diagram

Describes the data flow dialog in the Sample Scene.

For more details, refer to *Data Flow Dialog within Processing Time* in this manual.

5.3.2. Unit Labels Used in This Sample Scene

In Sample Scenes, the unit labels are used to reference the result of each processing.

For more information about unit labels, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

Unit type	Unit label
Calibration data reference	REF_CALIB_DATA
Processing unit data acquisition	GET_CONVEYOR_DIST
Macro (GetEncValue)	GET_ENC_VALUE
Detection	DETECT_UNIT
Label Data (only using Labelling function)	LABEL_DATA
Macro (RemoveDuplication)	REMOVE_DUPLICATION

5.4. Restrictions

Keep the following points in mind when using this Sample Scene and related sample macros.

Subject	Explanation
Regarding Camera Image Input	For image capture, only the Camera Image Input FH processing item is available since you are capturing moving objects. Only **Camera Image Input FH** function supported.
Regarding the Encoder value	Multiple Input not supported.
	Restrictions for encoder value: ・The value shall be from 0 to 2147483647 ・On reaching the maximum value (2147483647), the value shall return to 0 and then perform counting up, which is the ring counting method.
Sample Macro	Programs except User change area “'Start////////// ・・・ ///////////////End” are applied.
Parallelize function	Do not use the Parallelize processing items: Parallelize and Parallelize Task.
System setting (Communication)	Only EtherCAT communication is supported Sample Scene and Sample Macro.
	For the restrictions of EtherCAT communication, as below. ・Output control: None ・Line N (N is the number used Line). Data output counts: **Result Data Format** 7 (LREAL 32 counts) User area: Enable
	When you use **Multi-line random-trigger mode**, set the communication of each Lines to EtherCAT.

6. Generating and Outputting Data for the Pick Operation

6.1. Function Overview

After the FH Sensor Controller detects a workpiece on the conveyor, it does the following:

1. Sorts the work pieces by type.
2. Extracts the work pieces that the robot can grip.
3. Outputs the information data for 1 and 2 above.

6.2. Sample Scene Overview

Describes about Sample Scene: P&P_SampleScene when generates the information for Set Point, and performs the output function.

The Sample Scene: P&P_SampleScene includes functions described in *About Detection and Duplicate Exclusion Capability* in this manual.

For more information about each processing item, refer to the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).
For more information about Scenes and macros, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

This table describes the sample Scene following the arrangement of the Scene contents.

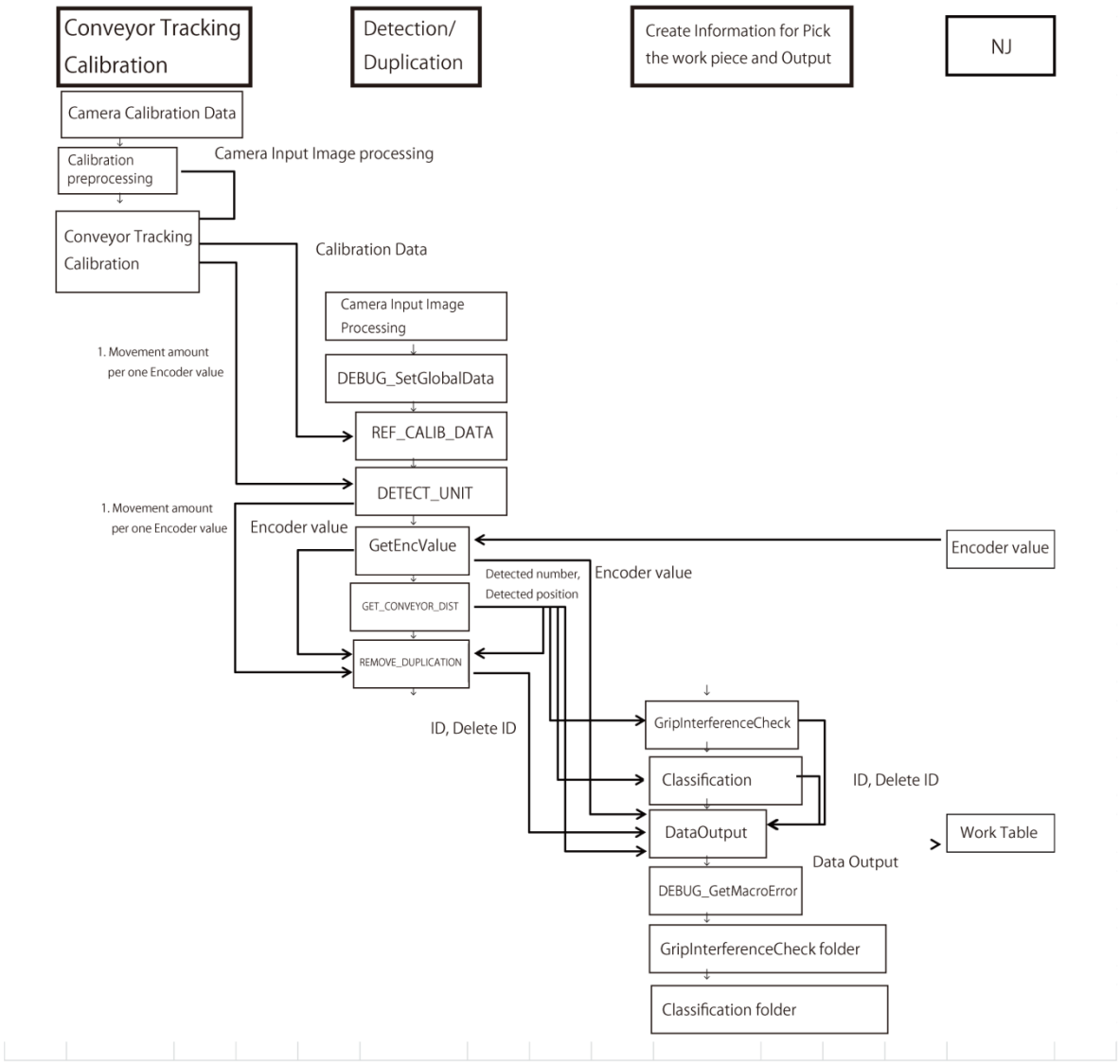
Scene content	Available processing items	Explanation
Classification macro processing	Unit Macro (Sample macro: **Classification**)	This macro sorts the detected work pieces according to the user-defined conditional expression. For details of this function, refer to *Classification Sample Macro* in this manual.
↓		
GripInterfer-enceCheck macro processing	Unit macro (Sample macro: **GripInterferenceCheck**)	This macro determines the capability of the robot tool to grip the detected work piece. For details of this function, refer to *Sample Macro for Grip Interference Check* in this manual.
↓		

DataOutput macro processing	Unit macro (Sample macro: **DataOutput**)	This macro outputs the detected work pieces information (measured data). It integrates data from each processing items and Sample Macros, and then generates the data array for outputting. For details of this function, refer to *Data Output Sample Macro* in this manual.
↓		
Macro (DBUG_ GetMacroError)	Unit Macro (Sample Macro: **DEBUG_GetMacroError**)	For details of this macro, refer to DEBUG Get Macro Error in this manual. This macro references and displays errors for sample macros. For more details, refer to *Error processes* in this manual.
↓		
Measurement completion		
↓		
Folder (Processing items for Classification)	Gravity and Area Search Shape Search II Shape Search III Labeling Barcode 2D Code OCR Character Inspection	Processing items using for classification are stored in this folder. For details of this function refer to *11.Error: Cannot find reference location* in this manual.
↓		
Folder (Processing items for the grip interference check)	Gravity and Area	Holds processing items used for the grip interference check processing. For details of this function, refer to *Sample Macro for Grip Interference Check* in this manual. Processing items using for **Grip Interference Check** are stored in this folder.

6.3. Function Detail

6.3.1. Data Flow Diagram

The data flow diagram is presented below.



6.3.2. Unit Labels Used in Sample Scenes

In Sample Scenes, unit labels are used to reference the result of each processing.

For more information about unit labels, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

Processing unit	Unit label
Classification macro	CLASSIFICATION
GripInterferenceCheck macro	GLIP_INTERFERENCE_CHECK
DataOutput macro	DATA_OUTPUT
Folder (Processing items for the grip interference check)	
Reset Scroll (Classification):	SCROLL_RESET_UNIT_00
Scroll (GripInterferenceCheck)	SCROLL_UNIT_01
Inspection Unit 0	INSPECTION_UNIT_00
Inspection Unit 1	INSPECTION_UNIT_01
Inspection Unit 2	INSPECTION_UNIT_02
Inspection Unit 3	INSPECTION_UNIT_03
Folder (for Classification processing item)	
Reset Scroll (GripInterferenceCheck)	SCROLL_RESET_UNIT_01
Scroll (GripInterferenceCheck)	SCROLL_UNIT_01
Grip interference check processing unit	COLOR_AREA

6.3.3. Output Data Format

Data is output in following formats.

Data that are defined as external reference table on existing models and versions of FH Sensor Controller can be output. Although up to 100 pieces of target position information can be sent to the NJ-Robotic CPU, if the number of information exceeds the number of the **Result Data** objects, output cannot be complete at once. Send the information separately in that case.

If data output is split up, a zero data package will be output so that the data for each work piece (position, angle, ID) is not split up. The header for each data output package must include the encoder value and the number of work pieces.

Data	Data type	Explanation
Encoder value when outputs Trigger	DINT (At data output time the data is converted to LREAL type and outputted.)	Return output of the encoder value at NJ trigger generation time is sent. The setting range of encoder value is 0 to 2147483647, and the value goes back to 0 after reaching 2147483647.

Work position and rotation information for each Line Number of work pieces sent per data output.	DINT (At data output time the data is converted to LREAL type and outputted.)	The maximum number of work pieces per 1 time data output will vary between 3 to 7 depending on data type/number.
Sysmac Error Status Position and angle of output work pieces	LREAL	* Available on ver.5.20 FH Sensor Controller Outputs the output data: Mark position X, Y, and angle TH. If the Mark does not have angle information, always outputs zero as angle information.
User-defined processing result	LREAL	* Available on ver.5.20 FH Sensor Controller Outputs the User-defined processing result, When you use this data, you can combine the processing results of multiple Sample Macros and output these as one processing result (ID).

Data output (PDO assignment image) is as follows.

Port	Data Type	Description
LineN LREAL Result Data 0	LREAL	Encorder values when sends the Trigger signal. (Returned value)
LineN LREAL Result Data 1	LREAL	Number of work piece which send at once output.
LineN LREAL Result Data 2	LREAL	X coordinate of work piece 1
LineN LREAL Result Data 3	LREAL	Y coordinate of work piece 1
LineN LREAL Result Data 4	LREAL	Angle of work piece 1
LineN LREAL Result Data 5	LREAL	ID of work piece 1
LineN LREAL Result Data 6	LREAL	X coordinate of work piece 2
⋮	⋮	⋮
LineN LREAL Result Data 29	LREAL	ID of work piece 7
LineN LREAL Result Data 30	LREAL	0: This information is a zero padding.
LineN LREAL Result Data 31	LREAL	0: This information is a zero padding.

FH → NJ-R			
Result Data [0]	LREAL	Encoder values when sends the Trigger signal. (Returned value)	FH Sample Macro returns.
Result Data [1]	LREAL	Detected number of work piece	FH Sample Macro calculates.
Result Data [2]	LREAL	X coordinate of work piece 1	FH Sample Macro calculates.
Result Data [3]	LREAL	Y coordinate of work piece 1	FH Sample Macro calculates.
Result Data [4]	LREAL	Angle of work piece 1	FH Sample Macro calculates.
Result Data [5]	LREAL	Classification ID of work piece 1	FH Sample Macro calculates.
Result Data [6]	LREAL	X coordinate of work piece 2	FH Sample Macro calculates.
⋮			
Result Data [31]	LREAL		

The detection result is divided into several outputs when it exceeds Result Data[32].

6.4. Restrictions

Keep the following points in mind when using this sample Scene and related sample macros.

Setting	Description
Sample Scene: Scene: **1 P&P_SampleScene** Regarding Encoder value	To obtain correct encoder values, the multi-input function is unavailable. Restrictions for encoder value: ・Encoder value must be set 0-2147483647 ・Once reaching its maximum value (2147483647), the encoder value must return to 0.
Sample Macro	Do not edit the macro except the part in between "'Start/////..." and "...///End".
Data Output	In this Sample Macro, you cannot carry out the following processes: ・Using the Sample Macro having data for data output process. ・Data output processes when the measurement is NG (judgment is failed). In this case, re-adjustment is required until the judgment of related Sample Macro is OK.

7. Hints for Adjustment

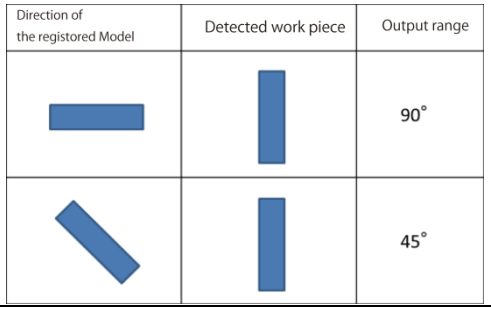
7.1. Workflow for Startup and Setting Adjustment

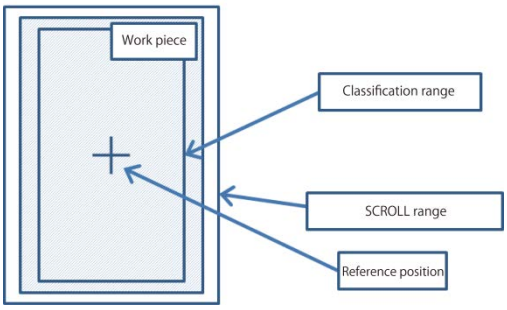
Follow the steps described in the table on this page to launch or adjust the FH Sensor Controller. You can skip steps for functions that are unnecessary, or are already adjusted.

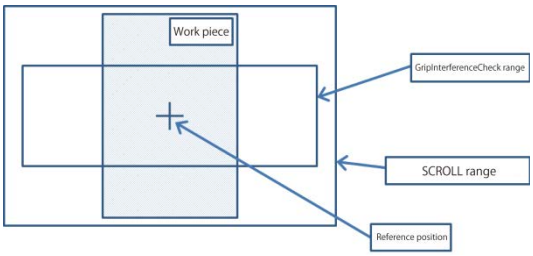
For more information about each processing item, refer to the *Vision System Processing Item Function Reference Manual* (Cat. No. Z341-E1).

For more information about Scenes and macros, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

No	Overview	Where to adjust	Adjustment
1.	Camera	Image capture	Adjusts the Camera Image Input function.
2.	Unit label setting	All Sample Macros	Sets the Unit label for all of the applicable processing items. For the target object, refer to 5.3.2 and 6.3.2 *Unit Labels Used in This Sample Scene* in this manual.
3.	Calibration data processing item	Calibration data processing item	Disable measurement on unit macros since measuring without setting up unit macros may cause errors. Using the **Edit flow** button in the Toolbox Pane, measurement processing is disabled. Macro (GetEncValue) Macro (RemoveDuplication) Macro (GripInterferenceCheck) Macro (Classification) Macro (DataOutput)
4.	Setting of where to reference the calibration data	Calibration data reference	Set the Scenes and units to reference for calibration data. Target Scene: **0.P&P_CalibScene** Target Unit: Conveyor Calibration
5.	Setting of where to obtain the value of movement per Encoder value from.	Processing items for processing unit data acquisition	Set the Scene, unit, and data number from which to obtain the conveyor movement value per encoder value. Target Scene: **0.P&P_CalibScene** Target unit: Conveyor Calibration Target data number: **127** (movement amount X per one encoder value.) Target data number: **128** (movement amout Y per one Encoder value.)

6.	Setting of encoder value source and the maximum Encoder value	GetEncValue macro	Set the user input area number of the encoder value data source. Default value: 1. Also set the maximum encoder value.
7.	Setting of detection processing items	Processing items for detection	Set processing items for detection. Adjust model settings, color specification, and measurement parameters. Set the calibration to **ON**. Set the Overall judgment to Enable. Note: If an angle information is include the measurement result of your using processing items, output angle data may be changed according to the reference coordinate angle when Model is registered even the detected position of Mark is same. 
8.	Initialize image after executing filter processing.	Camera switching processing item	If you use the processing items of, this macro replace an image proceeded by Camera Input Image function with an image after Filter processing items.
9.	Setting of where to reference the calibration data	Calibration data reference	This macro re-references the calibration data from Camera Switching. The settings from No.4 above will be used as the reference settings.
10	Setting of Remove Duplication	Processing of RemoveDuplication	For this macro to work correctly, the work piece position coordinates along with the following settings are required: ・From Num. 5 above: Setting for where to obtain the value of movement per encoder value from. ・From Num. 6 above: The encoder value source setting and the maximum encoder value setting. Set variables included in the user specified area.

			To use Sample Macro of Remove Duplication, set to ON. The following settings described in preceding sections of this table must be complete: "5. Setting of where to obtain the value of movement per encoder value from", and "6. Setting of encoder value source and the maximum encoder value". Set variables included in the user specified area. For details of each parameters settings, refer to *Sample Macro for Duplicate Exclusion* in this manual.
11.	Settings for Macro (GripInterferenceCheck)	SCROLL (Classification)	This macro sets the Classification macro to ON for adjustment. Sets the target area of SCROLL. The target area is used for SCROLL which is set the Reference position of Detected units to X and Y. E.g. 
12	Settings for Classification	Processing of Classification 0 to 3	Sets parameters for Measurement region and/or Model registration. Image capture and adjustment will be performed one by one for each work piece object for classification. Work pieces judged as NG by the Classification Processing item will be separated from the target work piece output data. At the same time, set the Judgment conditions in the Measurement parameters.

13	Settings for SCROLL of GripInterfer-enceCheck	Processing of SCROLL of GripInterfer-enceCheck	This macro set the GripInterfer-enceCheck macro to ON for adjustment (Using the **Edit flow** button in the Toolbox Pane). Set the target region of SCROLL of GripInterferenceCheck. The target area is used for SCROLL which is set the Standard position of Detected units to X and Y.
14	Settings for Mac-Mac-ro(GripInterferenceCheck) (Gravity and Ar-ea)	Processing items for the grip inter-ference check	Set a region for the grip interference check. 
15	Settings for Center of gravity of GripInterfer-enceCheck Gravity and Area	Processing of GripInterfer-enceCheck	This macro sets the GripInterfer-enceCheck settings and its background color. Removes the work piece what is judged as NG (failed) in the GripInterfer-enceCheck Make sure to set the judgment condition of measurement parameters simulta-neously.
16	Settings for Standard area value of GripIn-terferenceCheck	GripInterfer-enceCheck	References the Center of gravity area values set in Step 15 above and uses them to set the Standard area value: Gravity and Area **IN_STANDARD_AREA#**
17	Settings for Mac-Mac-ro(Classification) (user-defined area)	Classification macro	Set variables included in the user speci-fied area. For detail of each parameter, refer to Classification Sample Macro section in this manual.
18	Settings of Data Output macro	DataOutput macro	This macro set the **GripInterfer-enceCheck** macro to ON for adjustment (Using the **Edit flow** button in the Toolbox Pane). Sets a variable including the Us-er-defined area.

			For detail of each parameter settings, refer to *Output Data Sample Macro* section in this manual.
19	Data output confirmation	Confirm on Sysmac Studio	Confirm that the measurement result of the FH Sensor Controller is output to NJ series. There should be data for more than one target as described in *6.3.3. Output Data Forma*t.

7.2. Sample Macro Errors

There are errors uniquely defined in the sample macros other than Error Message described in the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1), and Sysmac Error Status (described in the *FH/FZ5 Series Vision System User's Manual for Communications Settings* (Z342-E1).

When sample errors occur, stop measurement until the issue is solved to prevent false measurements.

"Error codes and error sub-codes are defined for each Sample Macro. The Error code shows the type of error. The Error sub-code shows the location of the error in the Sample Macro. Use the Error codes and Error sub-codes to resolve errors.

In the image below, ERR CODE and SUB CODE are displayed on the upper-left of the image.

7.2.1. List of Error Codes

Errors defined for the sample macros are described in the following table.

Error code	Code name	Summary	Possible cause
-10	Setting Data is Out Of Range	Data is set outside the available range	A value outside the available setting range is specified.
-11	Setting Data is Out Of Range	Obtained data is out of the available range.	Data obtained from other units has value set outside the measurable range. Wrong data is obtained.
-12	Set wrong label name	Unit label issue	Wrong unit label is set.
-13	Sorting Error	Sorting error	There is an issue during sorting.
-14	Set wrong string	Character string setting error	Character string is changed to unsupported form.
-15	Set wrong System Data	System data setting error	Required system data is not setup.
-16	Exceptional error	Other type of Error	・Confirm the displayed number as **ERR_SUB_CODE**, see the Error List in the *Vision System FH/FZ5 Series User's Manua*l.
-17	Relating Sample-Macro Unit Judgement is 'JUDGE_NG'	Related Sample Macro Unit Judgment is NG (FAIL) Judgement.	・The judgment of Sample Macro related to the measurement processing is Judgement is NG (FAIL).

7.2.2. Error code details

Detailed information for error codes is described in the following table.

Error name	Setting Data is Out Of Range	Error code	-10
Summary	Data is set outside the available range		
Problem area	Sample Macro	Solution	Macro code revision
Cause and remedy	Possible cause	Corrective action	Prevention
	A value outside the available setting range is specified.	Adjust the value within the available setting range.	Confirm that the value does not exceed the setting range when changing a setting.
Note/ comment	None		

Error name	Setting Data is Out Of Range	Error code	-11
Summary	Obtained data is out of the available range.		
Problem area	Sample Macro	Solution	Macro code revision
Cause and remedy	Possible cause	Corrective action	Prevention
	Data obtained from other units has value set outside the measurable range.	Check the target data.	When changing data, consider how it affect to other macros.
	Wrong data is obtained.	Confirm the name of variables and units to obtain the data from.	Pay close attention to the name of variables, etc.
Note/ comment	None		

Error name	Set wrong label name	Error code	-12
Summary	Unit label issue		
Problem area	Sample Macro	Solution	Macro code revision
Cause and remedy	Possible cause	Corrective action	Prevention
	Incorrect unit label is set.	Correct the unit label.	Pay close attention when labeling units.
Note/ comment	None		

Error name	Sorting Error	Error code	-13
Summary	Sorting error		
Problem area	Sample Macro	Solution	Macro code revision
Cause and remedy	Possible cause	Corrective action	Prevention
	There is an issue during sorting.	Confirm and correct user-specified variables such as data type count as needed.	When changing data, consider how it affect to other macros.
Note/ comment	If the error cannot be solved even you try to the corrective action, confirm **Errno** (error number) in the Data Output Sample Macro, and then retry the corrective action. The error list in the Macro Reference section on page 320-323 in the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).		

Error name	Set wrong string	Error code	-14
Summary	Character string setting error		
Problem area	Sample Macro	Solution	Macro code revision
Cause and remedy	Possible cause	Corrective action	Prevention
	Character string is changed to unsupported form.	Confirm and correct the character string.	Make sure character string is correct.
Note/ comment	None		

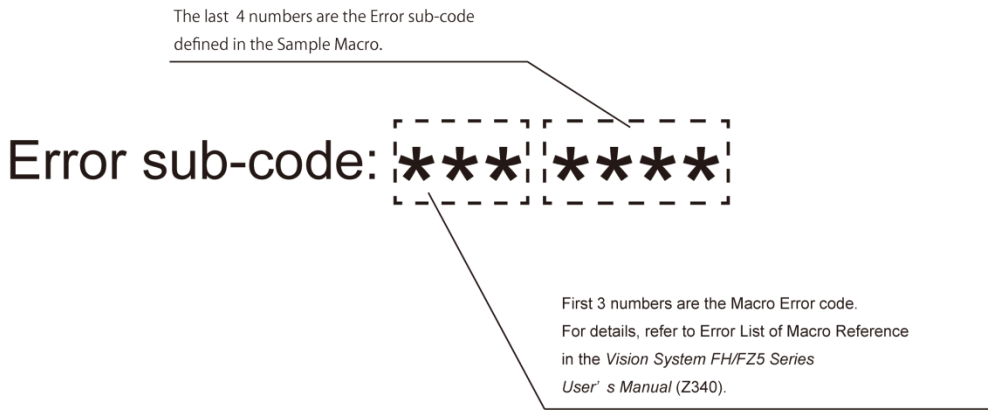
Error name	Set wrong System Data	Error code	-15
Summary	System data setting error		
Problem area	Sample Macro	Solution	System setting change
Cause and remedy	Possible cause	Corrective action	Prevention
	Required system data is not setup.	Set the communication module fieldbus to EtherCAT, and enable the user input area.	Pay extra attention when changing the system setting.
Note/ comment	None		

Error name	Exceptional error	Error code	-16
Summary	Other Error		
Problem area	Sample Macro	Solution	Corrects Macro code
Cause and remedy	Possible cause	Corrective action	Prevention
	Confirm the displayed number as **ERR_SUB_CODE**, see the Error List in the *Vision System FH/FZ5 Series User's Manual*.	Same as the left description.	Same as the left description.
Note/ comment	None		

Error name	Relating SampleMacroUnit Judgement is 'JUDGE_NG'	Error code	-17
Summary	Related Sample Macro Unit Judgment is NG (FAIL) judgement.		
Problem area	Sample Macro where the data is referenced	Solution	Change the System settings
Cause and remedy	Possible cause	Corrective action	Prevention
	The judgment of Sample Macro referenced data is Judgement is NG (FAIL).	Readjust the judgement of Sample Macro to be from NG (FAIL) to OK.	When you restart measurement, the judgement status for all the sample macro units must be OK.
Note/ comment	None		

7.2.3. Error Sub Code

Error sub-codes are defined for the Sample Macro. The Error codes and Error sub-codes can be used to help solve errors. How to use the Error sub-codes differs depending on the Error code.

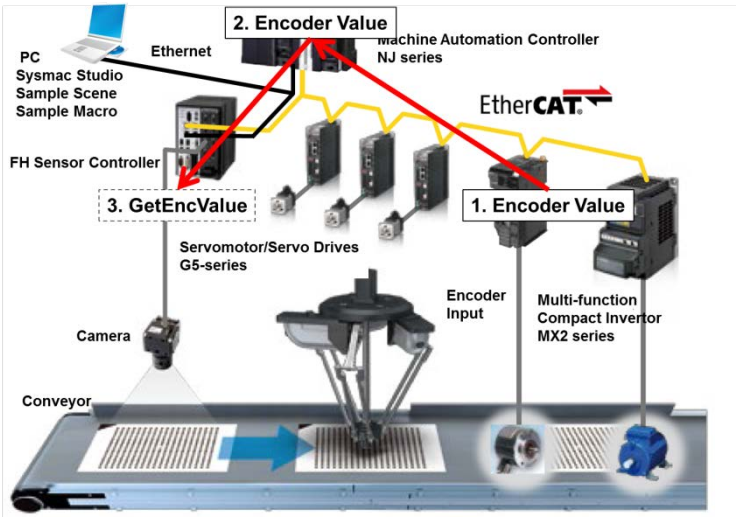
ERR CODE	Corrective action for the displayed Error sub-code (SUB CODE)
-10 -12 -14	Error sub-codes are defined for the Sample Macro. The Error codes and Error sub-codes can be used to help solve errors. How to use the Error sub-codes differs depending on the Error code.
-11 -17	Error sub-codes are defined for the Sample Macro. The Error codes and Error sub-codes can be used to help solve errors. How to use the Error sub-codes differs depending on the Error code.
-13 -16	The displayed Error sub-code is a 7 digit number comprised of the Macro Error number and the Error sub-code defined in the Sample macro. The contents are as below:  Error sub-codes are defined for the Sample Macro. The Error codes and Error sub-codes can be used to help solve errors. How to use the Error sub-codes differs depending on the Error code.
-15	Confirm the settings of *5.4 Restriction System settings* in this manual.

8. Sample Macro for Obtaining Encoder Value

This Sample Macro (GetEncValue) aquires the encoder values used for the measurement of FH Sensor Controller.

8.1. When to Use This Sample Macro

This sample macro is used when obtaining the conveyor encoder value via NJ series.



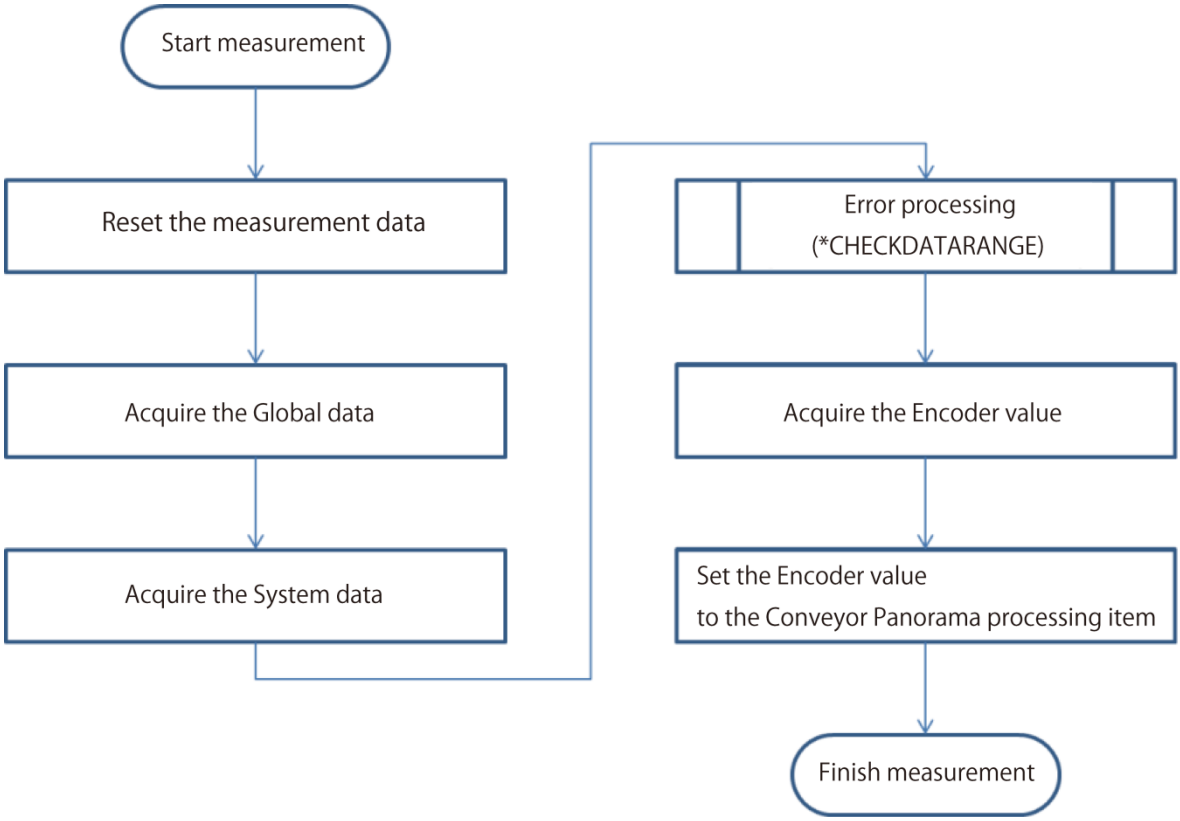
Precautions for Use

Only encoder values in an integer (DINT) can be obtained using this sample macro.

To be able to obtain the encoder value in LREAL, changing the NJ program and sample macro itself is necessary.

8.2 Flow Chart of Sample Macro

The flow chart of the GetEncValue Sample Macro is as below.



8.3. Required Settings List

The following settings need to be adjusted when using the sample macro for encoder value acquisition.

Setting	Overview
Input argument	Set the Input argument. You can adjust the encoder value acquisition process by changing the Input argument.

8.4. Setting Input Arguments

Specify the User Input Area number of the Encoder value source area and set the maximum Encoder value.

Precautions for Use

If the encoder value acquisition is not performed correctly, the following cases may occur:

- The Remove Duplication process will not be performed correctly.
- The NJ-Robotics may malfunction due to Mark position shift.

Confirm the encoder value acquisition is performed correctly at start time, or when adjusted.

The format and parameters of arguments are listed below.

Name	Type	Description
IN_AREA_NO&	Integer type	Sets the user input area number to write the encoder value during image capture. For more about how to use the user input area, refer to *User's Manual for Communications Settings.*
IN_MAX_ENC_VALUE&	Integer type	Sets the maximum encoder value that FH Sensor Controller obtains.

8.5. Returned value

Name	Type	Descriptions
OUT_ENC_VALUE&	Integer type	Stores the encoder value acquired by this Sample Macro. When the **IN_AREA_NO&** is set to 4 or 5, convert the type **LREAL** to **DINT**, and then stores its encoder value.
OUT_MAX_ENC_VALUE&	Integer type	Saves the maximum encoder value used for the measurement.

Useful Information

The returned value of sample macro is obtained using the macro function "GetUnitData".
The formats will be as follows: GetUnitData **<unitNo>**, **<dataIdent>**, **<data>**. The argument applies as follows:

・**<unitNo>**:
The unit number assigned to the Sample Macro unit used to obtain the encoder value.

・**<dataIdent>**:
The name of the variable of the returned value to be referenced (**OUT_ENC_VALUE&**, etc.). It should be enclosed in double quotes since it will be treated as a character string.

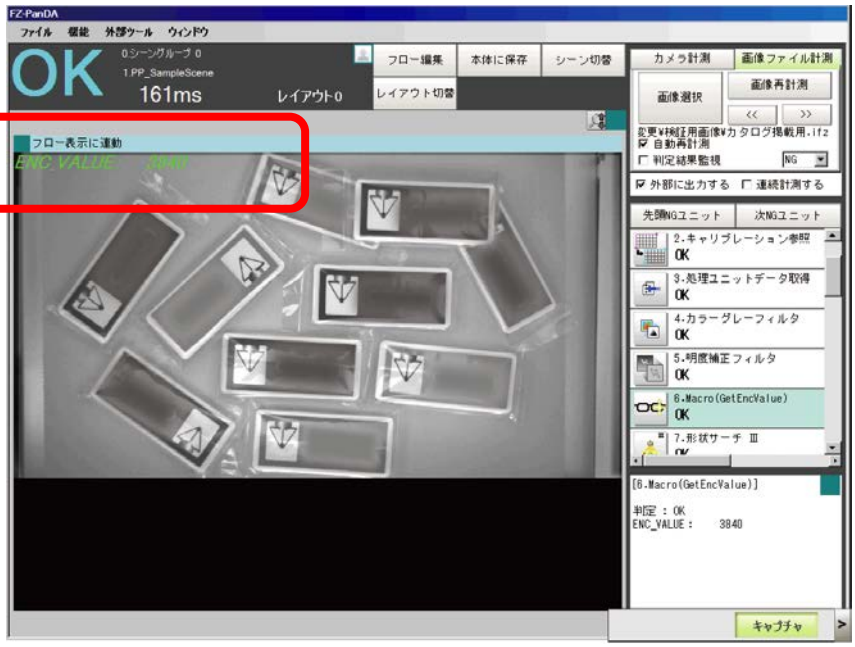
・**<data>**:
Prepare variable in the same data type as the reference data.

For more information about macro functions, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

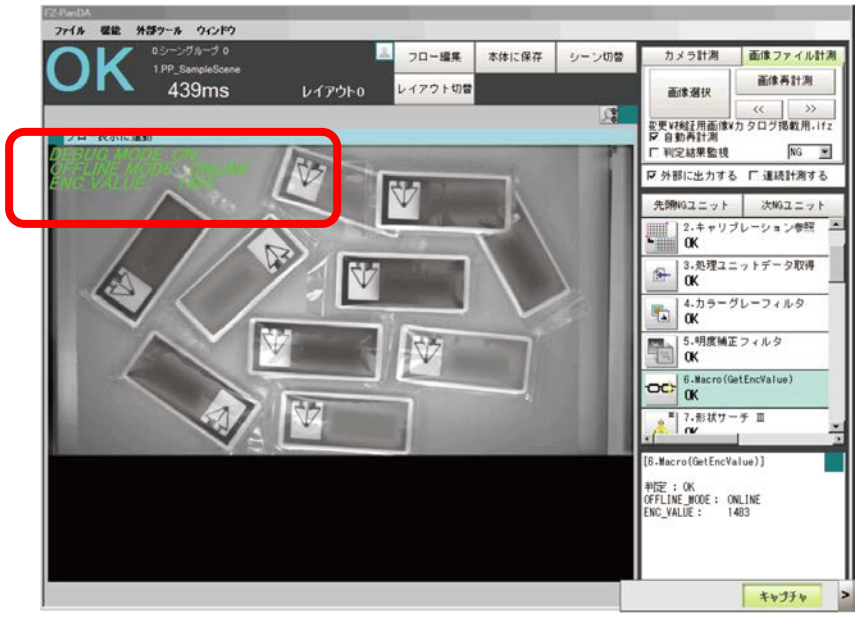
8.6. Processing of Display and Drawing

Displaying and Drawing Processing can be used in the Sample Macro.
With the **GetEncValue** function for acquiring encoder values, the following information can be displayed in the Graphic display window and the Detailed result display window,
When Sysmac Studio is on-line status, is not applied to display on the Detailed result window.

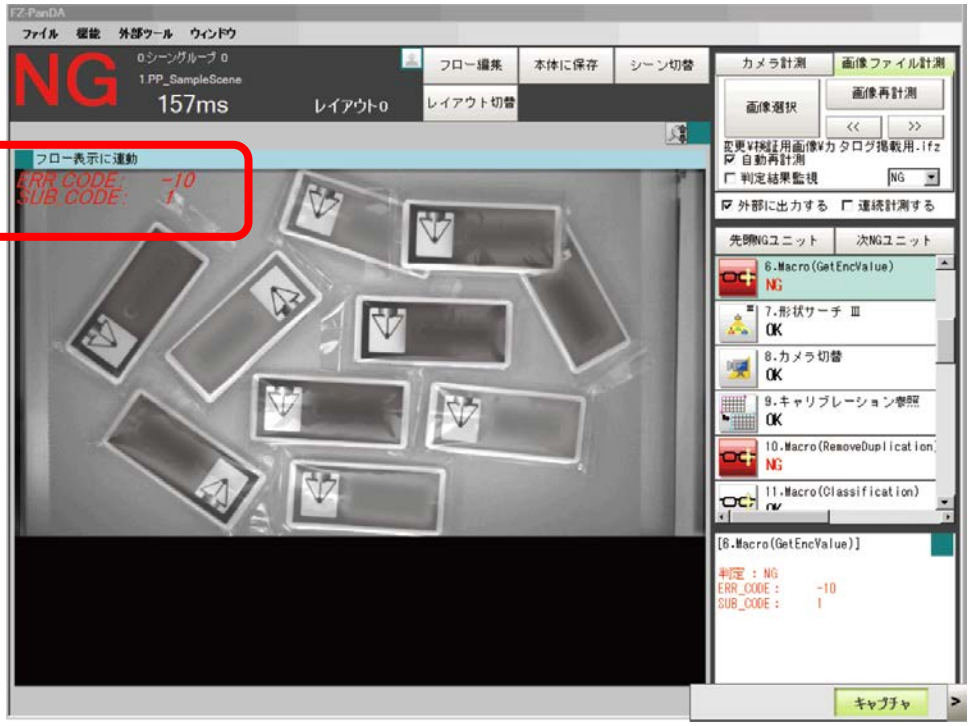
・**Acquired Encoder Values.**



・**Debugging mode and Off-line mode (Does not display in the release mode).**



・**Error Code and Error Sub Code (Only when the Error occurs.)**



8.7. Troubleshooting

When	What to adjust	Confirm:
Cannot acquire the Encoder value.	EtherCAT	・Is the EtherCAT available for communication? ・Isn't EtherCAT enabled? ・Is the PDO mapping different from NJ? ・Is the User Input Area enabled?
Encoder value is not updated.	Sysmac Studio	・NJ series is not Error status? ・Is the Encoder value written in a different User input area?

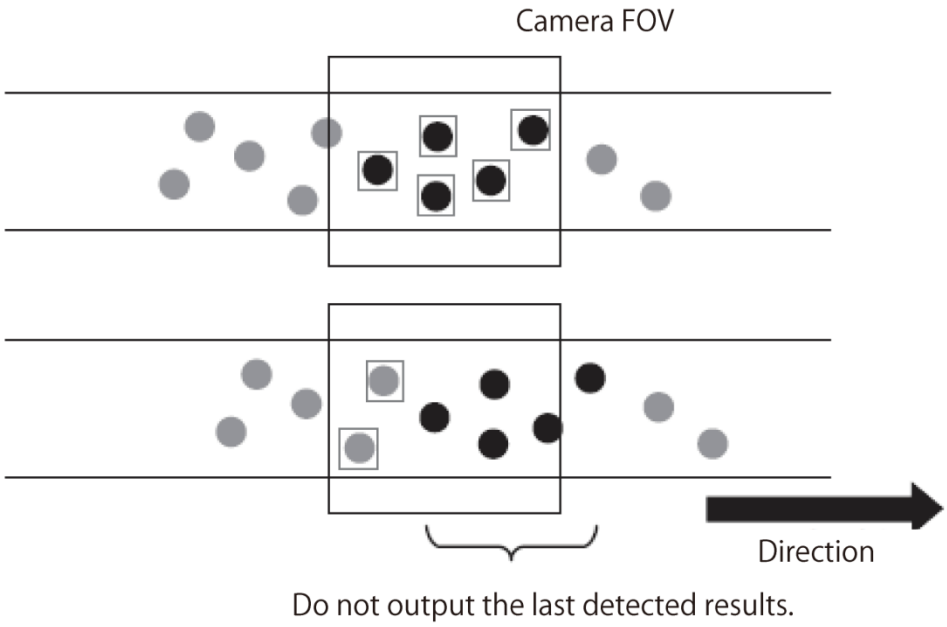
9. Sample Macro for Duplicate Duplication

This macro performs **RemoveDuplication** function.

When detecting objects moving on the conveyor, you can exclude objects that already have been measured from detection using the encoder value.

9.1. When to Use This Sample Macro

Use this sample macro when you want to exclude objects that are previously detected from the current detection.



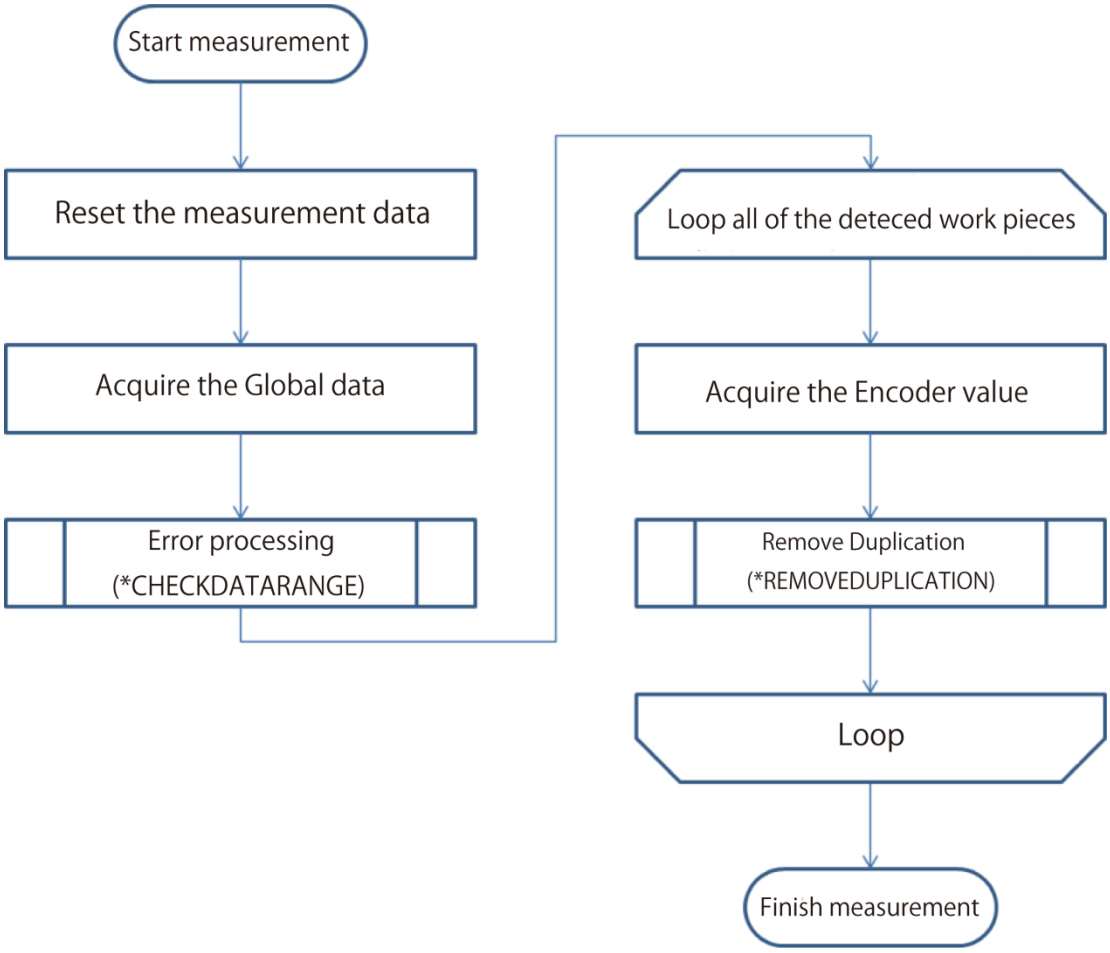
Precautions for Use

・To use this Sample Macro, the Encoder value and the conveyor movement value per Encoder value are required.

・To enable duplicate exclusion, the trigger needs to be set in a pace where images overlap by the width of one target object.

9.2. Flow Chart of Sample Macro

The flow chart of the RemoveDuplication Sample Macro is as below.



9.3. Required Settings List

Setting	Overview
Unit label setting	Set the unit label to save data to be used for Remove Duplication.
Input argument setting	Set the Input argument. You can adjust the Remove Duplication process by changing the Input argument.

9.4. Unit Label Setting

Sets the Unit label having data used in the GripInterferenceCheck.
Target of Unit label settings are the following:

- GET_CONVEYOR_DIST
- GetEncValue
- DETECT_UNIT

For more information, refer to *5.3.2. Unit Labels Used in Sample Scenes*.

Precautions for Use

・Unit labels can be set and changed only by using the Scene control macro.

・Setting a unit label is required when using the duplicate exclusion sample macro.

・To change or add name of unit labels listed in *5.3.2. Unit Labels Used in Sample Scenes*, editing of sample macro is required.

Useful Information

・By assigning unit labels, processing units can be specified by the unit label instead of the processing unit number.

・By doing this, you can avoid editing macro program when the processing unit number changes due to a change of the measurement flow.

Reference

5. Optimizing Scenes (Measurement Flows) (Macro Customize Functions) in the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

9.5. Setting Input Arguments

This chapter describes the Input argument used for the duplicate exclusion processing.

You can adjust settings for duplicate exclusion or data destination by changing the Input argument.

Precautions for Use

To use this sample macro, the values of movement per encoder value and measurement data are required.

The format and parameters of arguments are listed below.

Name	Type	Description
IN_ENC_UNIT$	Character string type	Sets a Unit Label for the **GetEncValue** macro.
IN_CONVEYOR_DIST_UNIT$	Character string type	Sets a unit label for **IN_CONVEYOR_DIST_UNIT** which is used to obtain the conveyor movement value per encoder value.
IN_DETECT_UNIT$	Character string type	Sets a unit label for Detection processing items.
IN_CNT_DATA$	Character string type	Sets an identifier for detection count data on Detection processing items.
IN_DATA_IDENT_X$	Character string type	Sets an identifier for the X coordinate on Detection processing items.

IN_DATA_IDENT_Y$	Character string type	Sets an identifier for the Y coordinate on Detection processing items.
IN_DATA_IDENT_Y$	Character string type	Sets an identifier for the angle data on Detection processing items.
IN_LABELING_FLG&	Integer type	Sets to **True**: Enable when the Detection processing items is Labeling.
IN_LABEL_DATA_UNIT$	Character string type	This macro sets the Unit Label of Label data. If the Detection processing item is not Labeling, set the non-whitespace character: **(“”).**
IN_THRESHOLD_NUM#	Double precision type	Sets the threshold value of duplication determination in mm.
IN_DELETE_ID&	Integer type	An ID assigned to duplicates. By setting a value between -90 to -99, it is excluded from data output.

Precautions for Use

Data will not be obtained if the unit label that is set preliminary is not used.

9.6. Returned Value

Name	Type	Description
OUT_DATA_NUM&	Integer type	Saves the count of data used for duplicate exclusion.
OUT_DATA#(,)	Double-precision type	Saves the assigned ID and the data used for duplicate exclusion.
OUT_ENC_VALUE&	Integer type	Saves the encoder value used for duplicate exclusion.

Useful Information

The returned value of sample macro is obtained using the macro function "GetUnitData". The formats will be as follows: GetUnitData **<unitNo>**, **<dataIdent>**, **<data>**. The argument applies as follows:

・**<unitNo>**:

The unit number assigned to the Sample Macro unit used to obtain the encoder value.

・**<dataIdent>**:

The name of the variable of the returned value to be referenced (OUT_ENC_VALUE&, etc.). It should be enclosed in double quotes since it will be treated as a character string.

・**<data>**:

Prepare variable in the same data type as the reference data.

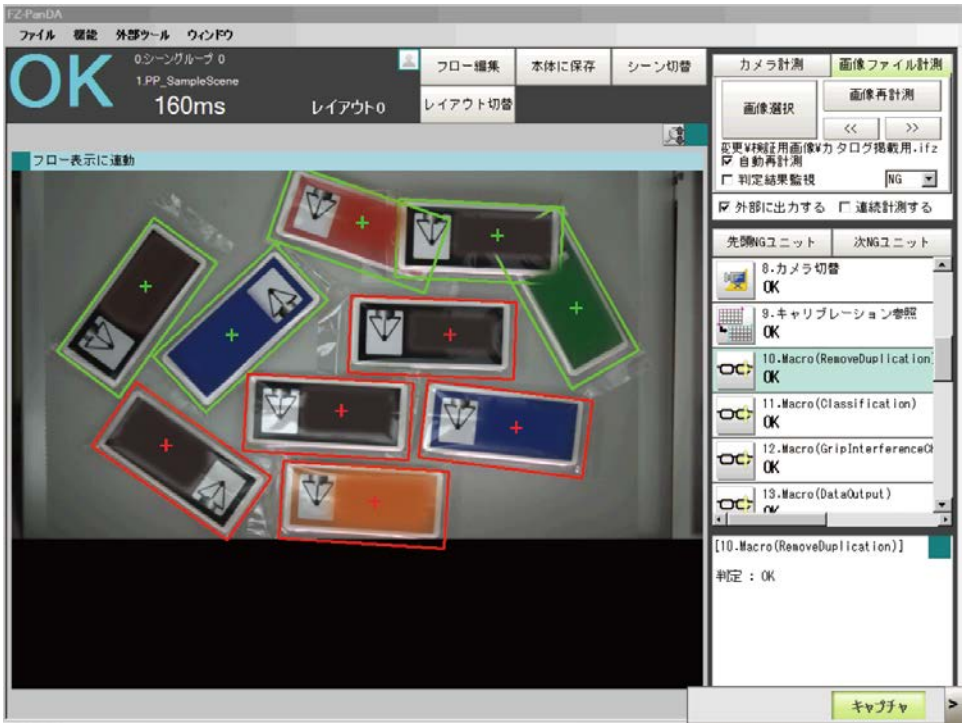
For more information about macro functions, refer to the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

9.7. Processing of Display and Drawing

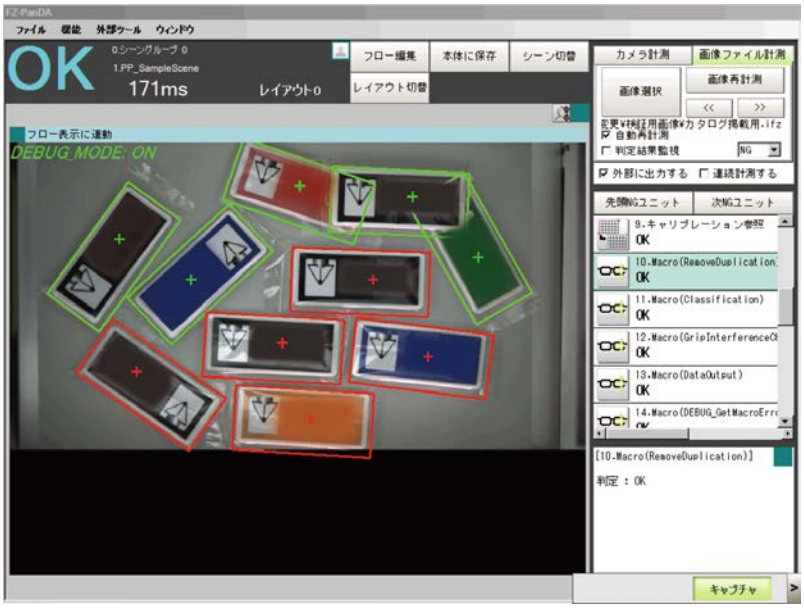
Displaying and Drawing Processing can be used in the Sample Macro. With the **GetEncValue** function for acquiring encoder values, the following information can be displayed in the Graphic display window and the Detailed result display window,

- A graphic display of the processing unit model used for detecting the work piece objects, with cross-hair display (when there is no angle information available from the Processing item used to detect the target work pieces, only the cross-hairs pointer will be displayed.

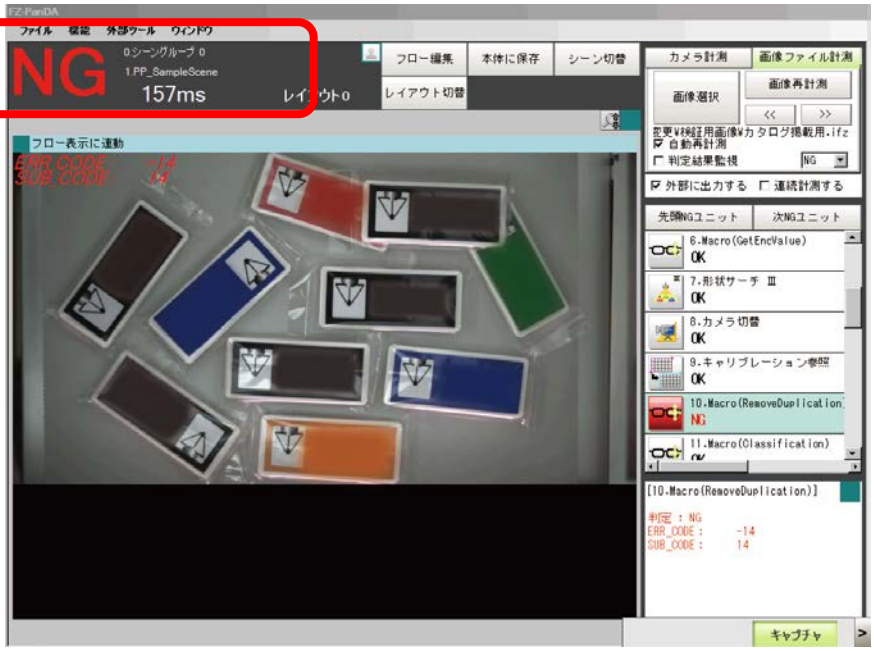
  - **No-duplication work pieces: Green**
  - **Duplicated work pieces: Red**



・**Debug mode: Does not display in Release mode.**



・**Error Code and Error Sub Code (Only when the Error occurs.)**



9.8. Troubleshooting

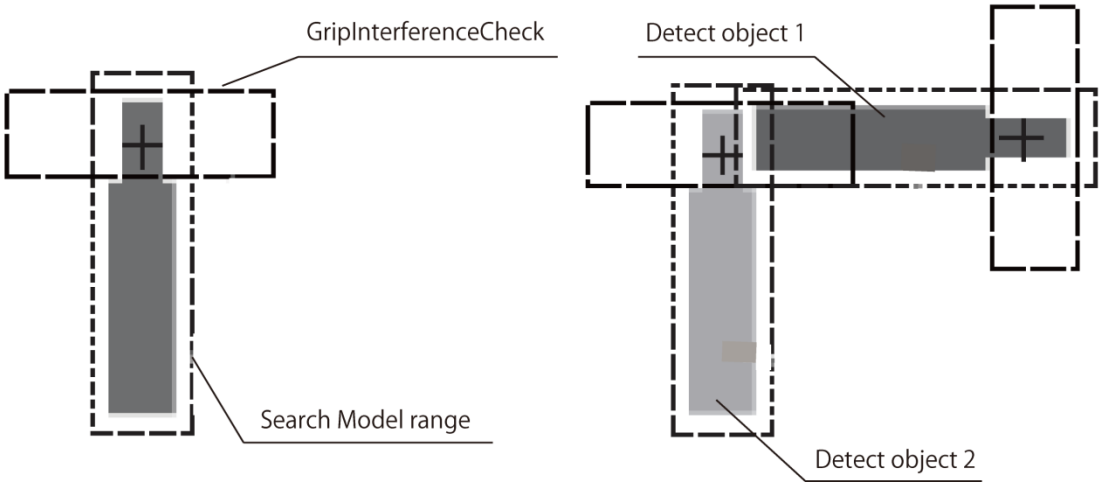
When	What to adjust	Confirm:
Duplicates are not recognized	Macro (RemoveDuplication)	Is the value of **IN_THRESHOLD_NUM#** too small?
All detections are recognized as duplicates	Macro (RemoveDuplication)	Is the value of **IN_THRESHOLD_NUM#** too large?
Duplicate exclusion is not performed when the encoder value strides the maximum value and 0.	Macro (GetEncValue)	Is the maximum encoder value set in the Macro (GetEncValue) unit different from the actual maximum encoder value?
Does not remove the duplicated work piece.	・Calibration data reference ・Processing unit data acquisition ・Detection processing ・RemoveDuplication	・Calibration data reference macro refers the accurate data? ・Processing unit data acquisition macro acquires the accurate data? ・Did you set the calibration of the Detection processing macro to ON? ・Can you acquire the **CONVEYOR_DIST#()**?

10. Sample Macro for Grip Interference Check

Sample macro "Macro (**GripInterferenceCheck**)" is used to evaluate whether or not there is enough space for a robot to grip the target object moving on the conveyor. The space evaluation is performed by measuring the surface area of the back ground. If there is not enough space, the target object is excluded from the detection.

10.1. When to Use This Sample Macro

Use this sample macro to evaluate if there is enough space for the robot to grip the target object within a specified region.



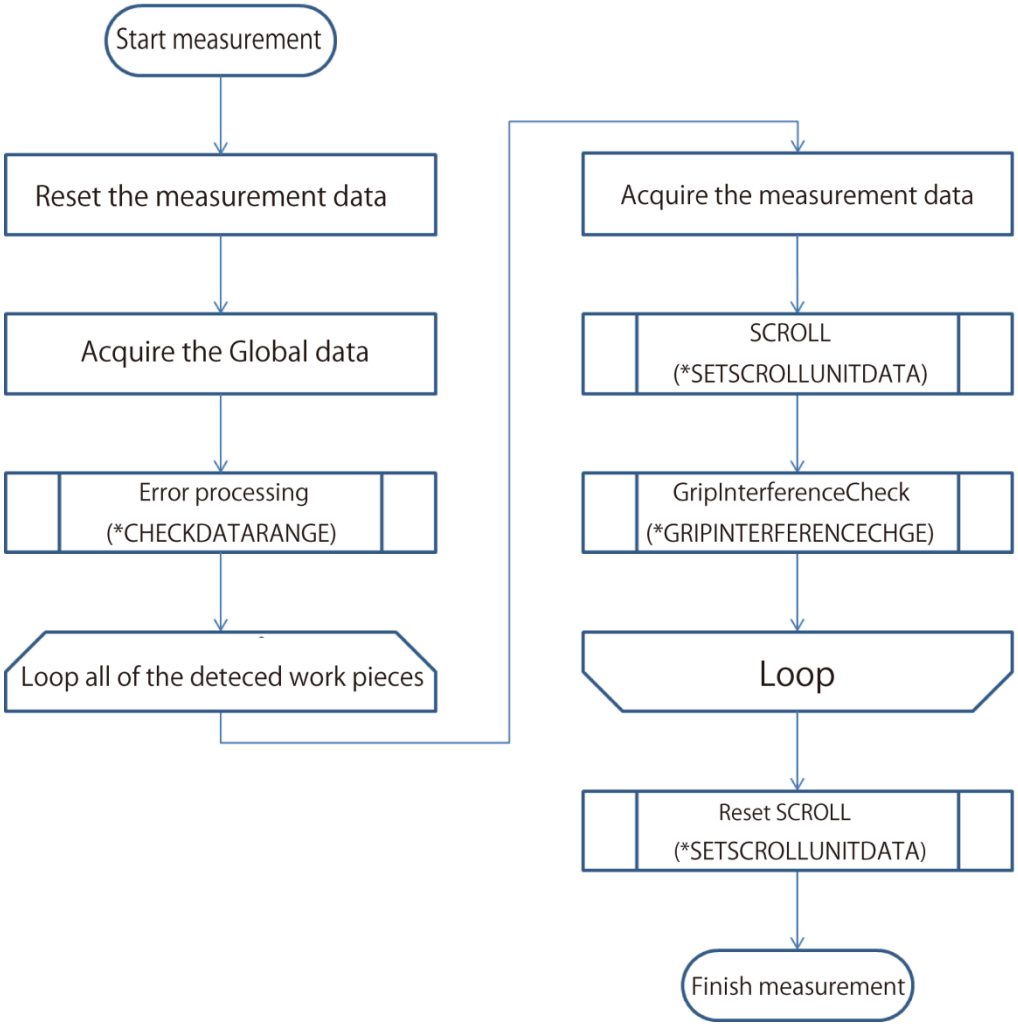
Precautions for Use

The grip capability is determined by the area ratio (%) of the detected surface area against the reference surface area of the background surface area.

The reference area needs to be adjusted again when the grip region or the specified color is changed.

10.2. Flow Chart of Sample Macro

The flow chart of the **GripInterferenceCheck** Sample Macro is as below.



10.3. Required Settings List

Setting	Overview
Unit label setting	Set a unit label to a processing item that has data for sorting.
Input Argument Setting	Set the Input argument. You can adjust the classification process by changing the Input argument.

10.4. Unit Label Setting

Set the Unit Labels for processing items that has data for grip interference check.

Precautions for Use

・Unit Labels can be set and changed only by using the Scene control macro.

・The Unit Label setting is required when using the GripInterferenceCheck macro unit.

・To change or add the Unit Labels listed in *6.3.2. Unit Labels Used in Sample Scenes*, editing of sample macro is required.

Useful Information

・By assigning Unit Labels, you will be able to specify processing units by the Unit Label instead of the processing unit number.

・By doing this, you can avoid editing macro program when the processing unit number changes due to a change of the measurement flow.

Reference

5. Optimizing Scenes (Measurement Flows) (Macro Customize Functions) in the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

10.5. Setting Input Arguments

This chapter describes the Input argument used for the grip interference check processing.

You can adjust settings for duplicate exclusion or data destination by changing the Input argument.

Name	Type	Description
IN_DETECT_UNIT$	Character string type	Set unit labels for detection type processing units.
IN_CNT_DATA$	Character string type	Sets a detection count identifier data for detect units of target work piece.
IN_DATA_IDENT_X$	Character string type	Set an identifier for the X coordinate in the detection processing items.
IN_DATA_IDENT_Y$	Character string type	Set an identifier for the Y coordinate in the detection processing items.
IN_DATA_IDENT_TH$	Character string type	Sets an angle identifier of detect units. If the detection unit processing items does not have any angle information, set the disable strings: **""**.
IN_LABELING_FLG&	Integer type	Sets to **True**: Enable when the Detection processing items is Labeling.
IN_LABEL_DATA_UNIT$	Character string type	This macro sets the Unit Label of Label data. If the Detection processing item is not Labeling, set the non-whitespace character: **(" ").**
IN_SCROLL_NAME_X$	Character string type	Sets an identifier for the X coordinate on target object of SCROLL.
IN_SCROLL_NAME_Y$	Character string type	Sets an identifier for the Y coordinate on target object of SCROLL.
IN_SCROLL_NAME_TH$	Character string type	Sets an angle identifier for target object of SCROLL. If the detection unit processing items does not

		have any angle information, set the disable strings: ””.
IN_SCROLL_UNIT $	Character string type	Sets the Unit Label of SCROLL.
IN_INSPECTION_UNIT$	Character string type	Sets the Unit Label of GripInterferenceCheck.
IN_INSPECTION_DATA$	Character string type	Sets a data identifier using for GripInterfer-enceCheck.
IN_SCROLL_RESET_UNIT$	Character string type	Sets the Unit Label name of Camera Switching.
IN_DELETE_ID&	Integer type	Sets the delete ID which is assigned when the GripInterferenceCheck is judged impossible.
IN_THRESHOLD_NUM#	Double pre-cision type	Sets the threshold (%) of the area ratio where is detected to the reference area of background area.
IN_STANDARD_AREA#	Double pre-cision type	Sets the reference area value of background of GripInterferenceCheck.

Precautions for Use

Data will not be obtained if the unit label that is set preliminary is not used.

10.6. Returned Value

Name	Type	Description
OUT_DATA_NUM&	Integer type	Sets the reference area value of background of GripInterferenceCheck.
OUT_DATA#(,)	Real type	Stores the assigned ID and the data used in GripInterferenceCheck.

Useful Information

The returned value of sample macro is obtained using the macro function "GetUnitData".
The formats will be as follows: GetUnitData **<unitNo>**, **<dataIdent>**, **<data>**. The argument applies as follows:

・**<unitNo>**:

The unit number assigned to the Sample Macro unit used to obtain the encoder value.

・**<dataIdent>**:

The name of the variable of the returned value to be referenced (OUT_ENC_VALUE&, etc.). It should be enclosed in double quotes since it will be treated as a character string.

・**<data>**:

Prepare variable in the same data type as the reference data.

For more information about macro functions, refer to *the FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

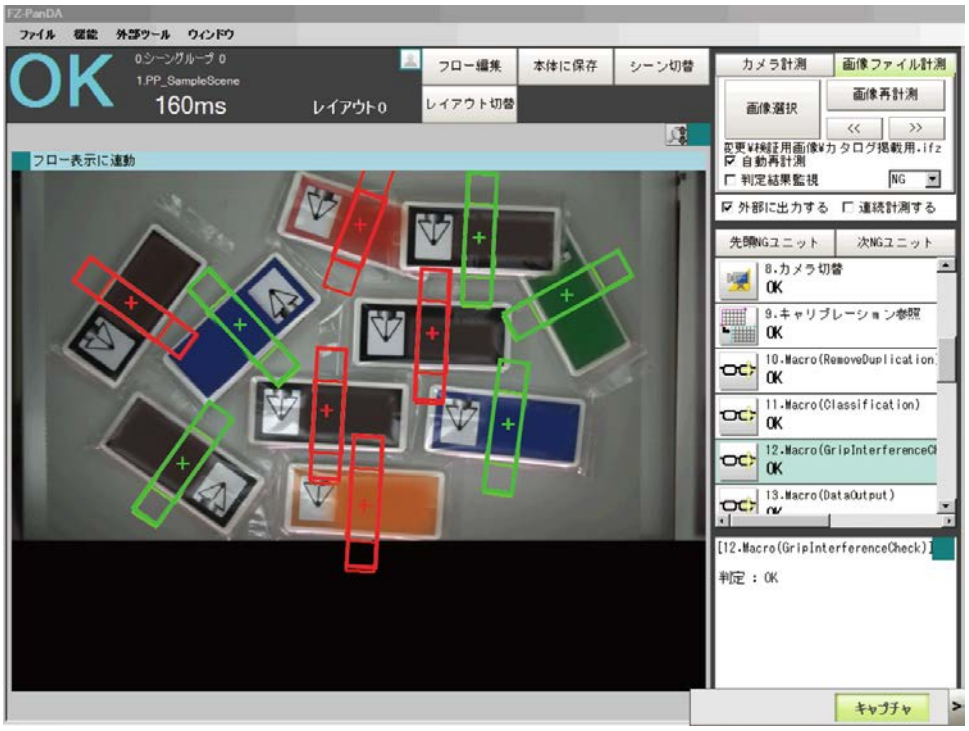
10.7. Processing of Display and Drawing

Displaying and Drawing Processing can be used in the Sample Macro. With the **GetEncValue** function for acquiring encoder values, the following information can be displayed in the Graphic display window and the Detailed result display window,

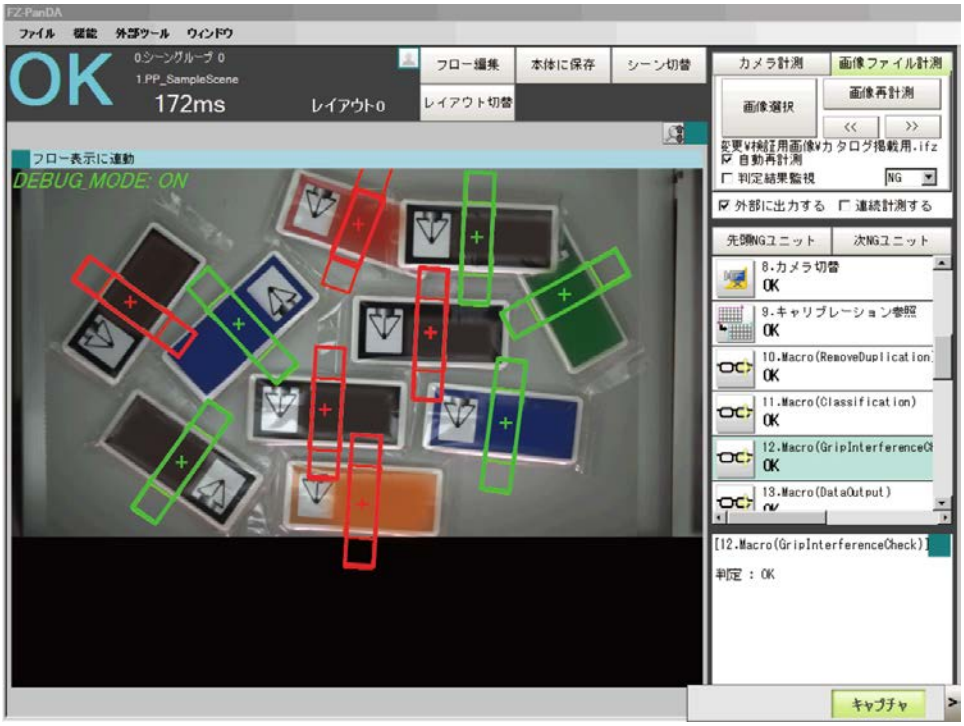
The Detailed result window is not displayed when Sysmac Studio is in the On-line status.

・A graphic display of the processing unit model used for detecting the work piece objects, with cross-hair display (when there is no angle information available from the Processing item used to detect the target work pieces, only the cross-hairs pointer will be displayed.

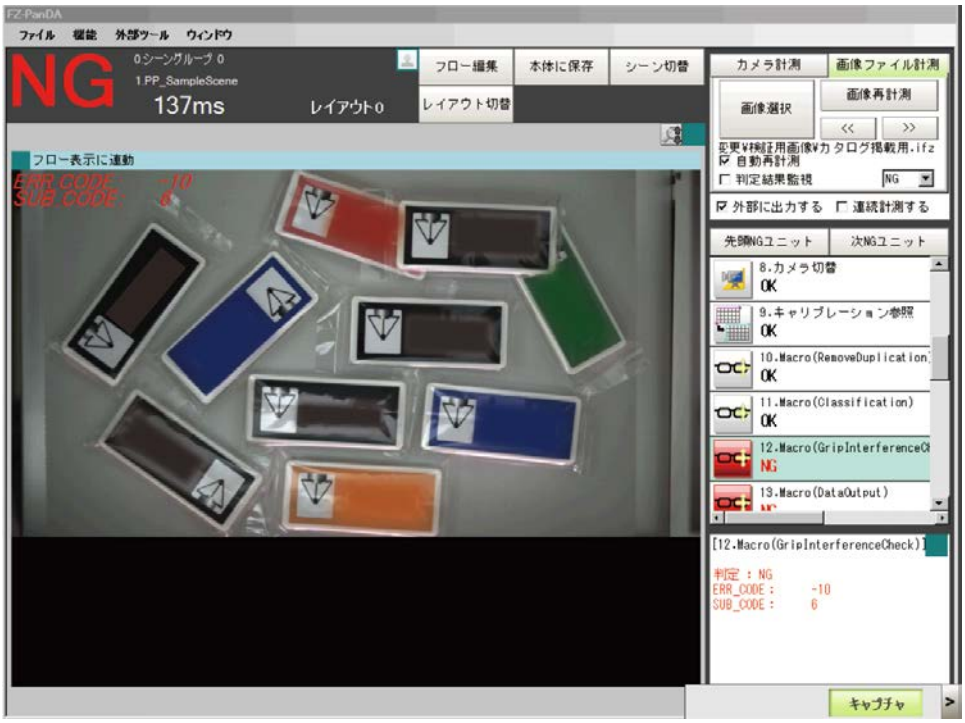
- **No- GripInterferenceCheck work pieces: Green**
- **GripInterferenceChecked work pieces: Red**



Debug mode: Does not display in Release mode.



Error Code and Error Sub Code (Only when the Error occurs.)



10.8. Folders of GrapInterferenceCheck Processing Item

Processing item	Usable function	Description
Reset SCROLL	SCROLL	Resets the SCROLL which is executed measurement.
SCROLL	SCROLL	Moves the detected work piece in Detection processing unit to Standard position.
Processing units of GripInterferenceCheck	Gravity and Area	Measure the necessary region for GripInterferenceCheck to the detected work pieces one-by-one.

10.9. Troubleshooting

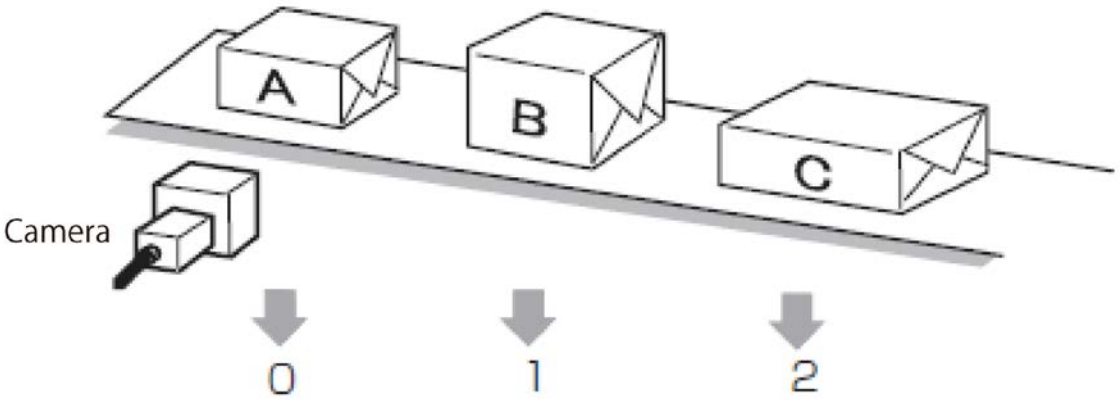
When	What to adjust	Confirm:
Duplicates are not recognized	GripInterferenceCheck Sample Macro	・Is the value of **IN_THRESHOLD_NUM#** too small? ・Is the value of **IN_STANDARD_AREA#**?
All detections are recognized as duplicates	GripInterferenceCheck Sample Macro	・Is the value of **IN_THRESHOLD_NUM#** too large? ・Is the value of **IN_STANDARD_AREA#** too small? ・Is the judgment of GripInterferenceCheck as NG (failed)?

11. Classification Sample Macro

When there are various types of work pieces moving on the conveyor, this macro can classify them according to User-defined conditions and assign IDs.

11.1. When to Use This Sample Macro

- This macro classifies or discriminates the various work pieces on the conveyor.

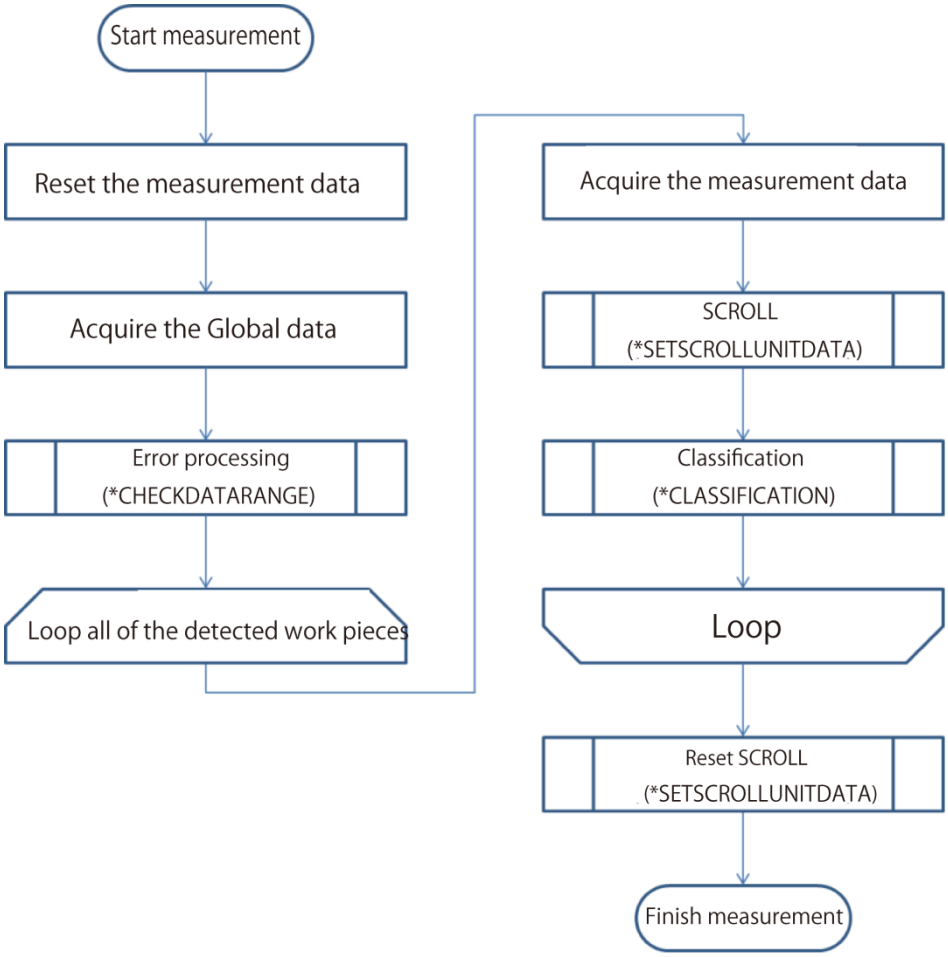


Precautions for Use

Changing the configuration or setting of Classification processing items, this macro can carry out the Classification of the various patterns.
The work pieces can be sorted into a maximum of eight types (by default, four types).

11.2. Flow Chart of Sample Macro

Classification Sample Macro performs the processes as the following flow chart.



11.3. Required Settings List

Setting	Overview
Unit label setting	Set a unit label to a processing item that has data for sorting. Set a unit label having processing item data used for classification.
Input argument setting	Set the Input argument. You can adjust the classification process by changing the Input argument. Changing the **Input** argument, Classification processing can be changed also.

11.4. Unit Label Setting

Set a unit label having processing item data used for classification.

Precautions for Use

・Unit labels can be set and changed only by using the Scene control macro.

・Setting a unit label is required when using the duplicate exclusion sample macro.
・When you change or add new Unit labels described in *5.3.2 Unit Labels Used in Sample Scenes*, the written data is required to change.

Useful Information

・By assigning unit labels, you will be able to specify processing units by the unit label instead of the processing unit number.
・By doing this, you can avoid editing macro program when the processing unit number changes due to a change of the measurement flow.

Reference

5. Optimizing Scenes (Measurement Flows) (Macro Customize Functions) in the *FH/FZ5 Series Vision System User's Manual* (Cat. No. Z340-E1).

11.5. Setting Input Arguments

This describes the Input argument used for measurement.
You can adjust the classification process by changing the Input argument.

Name	Type	Description
IN_DATA_KIND_NUM&	Integer type	Sets the number of Classification, which can be up to 8 types. The default value is 4 types. When you change the settings, changing of **IN_DATA_INFO$(,)** is also required.
IN_DATA_INFO$(,)	Character string type	Sets the Unit Label and data identifier of Classification processings. Need to change only the number of Classification kinds which set in **IN_DATA_KIND_NUM&.**
IN_DETECT_UNIT$	Character string type	Sets a unit label for Detection processing item.
IN_CNT_DATA$	Character string type	Sets an identifier for detection count data on Detection processing item.
IN_DATA_IDENT_X$	Character string type	Sets an identifier for the X coordinate on Detection processing item,
IN_DATA_IDENT_Y$	Character string type	Sets an identifier for the Y coordinate on Detection processing item,

IN_DATA_IDENT_TH$	Character string type	Sets an angle identifier of detect units. If the detection unit processing items does not have any angle information, set the disable strings:**””**.
IN_LABELING_FLG&	Integer type	Sets to **True**: Enable when the Detection processing items is Labeling.
IN_LABEL_DATA_UNIT$	Character string type	This macro sets the Unit Label of Label data. If the Detection processing item is not Labeling, set the non-whitespace character: **(“”)**.
IN_SCROLL_NAME_X$	Character string type	Sets the X coordinate identifier for
IN_SCROLL_NAME_Y$	Character string type	Sets the Y coordinate identifier for SCROLL.
IN_SCROLL_NAME_TH$	Character string type	Sets the angle identifier of SCROLL. If the detection unit processing items does not have any angle information, set the disable strings:**””**.
IN_SCROLL_UNIT $	Character string type	Sets the Unit Label of SCROLL.
IN_SCROLL_RESET_UNIT$	Character string type	Sets the Unit Label of Camera Switching.
IN_THRESHOLD_NUM#()	Double precision type	Sets the threshold for judgment of Classification condition. This parameter can set the threshold of each unit judged each kind. When the threshold is larger than Classification condition data, assigns the Classification ID.
IN_DELETE_ID&	Integer type	This ID is possible to assign when the Classification is impossible. Values of -99 to 99 are excluded from output data
IN_ID&(0)	Integer type	Sets the assigned ID when the judgment parameters of Classification reach the threshold.

Precautions for Use

Data will not be obtained if the Unit Label that is set preliminary is not used.

11.6. Returned Value

Name	Type	Description
OUT_DATA_NUM&	Integer type	Saves the count of data used for duplicate exclusion.
OUT_DATA#(,)	Real number type	Saves the assigned ID and the data used for duplicate exclusion.

Useful Information

Return value of Sample Macro perform to acquire using macro function **GetUnitData**.
Arguments for the GetUnitData function

・**<unitNo>**:
The unit number assigned to the Sample Macro unit used to obtain the encoder value.

・**<dataIdent>**:
The name of the variable of the returned value to be referenced (OUT_ENC_VALUE&, etc.). It should be enclosed in double quotes since it will be treated as a character string.

・**<data>**:
Prepare variable in the same data type as the reference data.

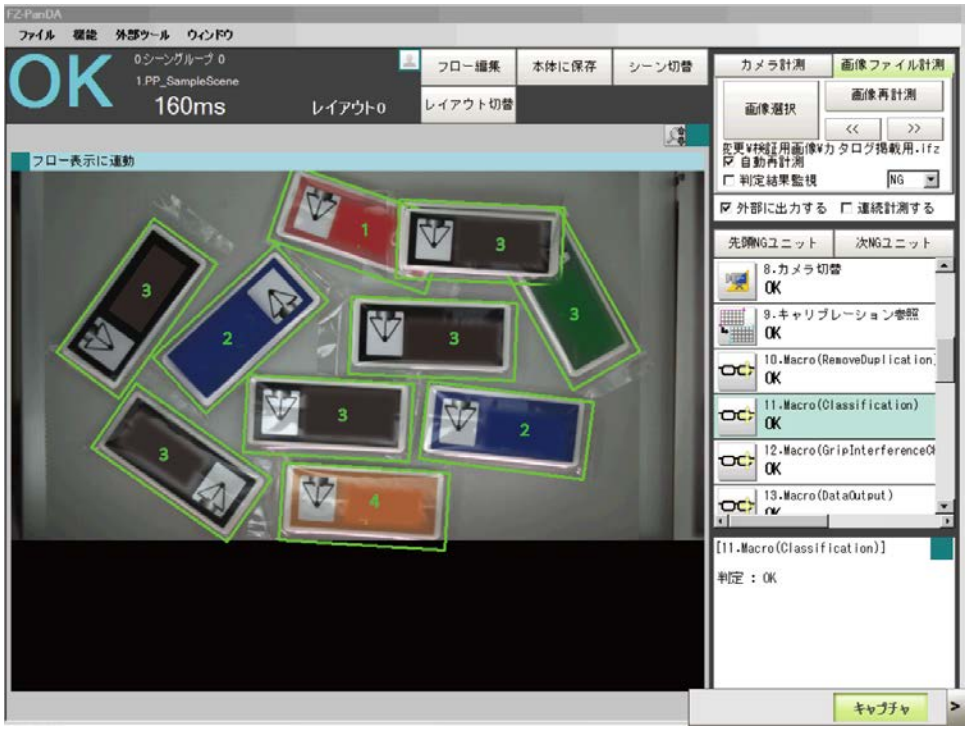
For detail of macro function, refer to *Vision System FH/FZ5 Series User's Manua*l.

11.7. Processing of Display and Drawing

Displaying and Drawing Processing can be used in the Sample Macro.
With the **GetEncValue** function for acquiring encoder values, the following information can be displayed in the Graphic display window and the Detailed result display window,
The Detailed result window is not displayed when Sysmac Studio is in the On-line status.

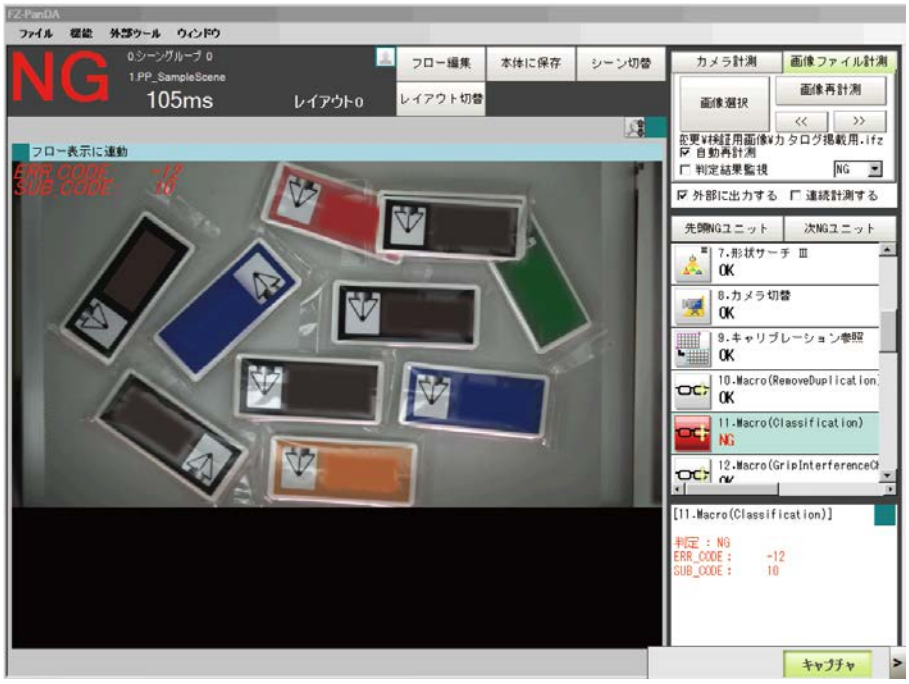
・A graphic display of the processing unit model used for detecting the work piece objects, with cross-hair display (when there is no angle information available from the Processing item used to detect the target work pieces, only the cross-hairs pointer will be displayed.

- **No- Classification work pieces: Green**
- **Classified work pieces: Red**



Debug mode: Does not display in Release mode.

Error Code and Error Sub Code (Only when the Error occurs.)



11.8. Folders for Classification

Processing item	Usable function	Description
Reset SCROLL	SCROLL	SCROLL executed at measurement time.”
SCROLL	SCROLL	Moves the detected work piece of Detection processing unit to Standard position.
Classification processing unit	Search type processing items Edge type processing items Barcord and 2D Barcord OCR, etc.	Executes the detail measurement to work pieces detected in Detection processing unit one-by-one. Using the multiple Classification processing items, confirms the followings: ・Which measurement result of processing unit exceeds the threshold ・Which judgment is OK, Then executes the Classification.

11.9. Troubleshooting

When	What to adjust	Confirm:
Incorrect ID is assigned.	・Classification Sample Macro ・Processing items for Sorting	・Is the value of **IN_THRESHOLD_NUM#()** too small? ・The judgment condition of Sorting processing items is set correctly?
Delete ID is assigned.	Classification Sample Macro	・Is the value of **IN_THRESHOLD_NUM#()** too large? ・Is the judgment of Sorting processing item NG (failed) ?

12. Sample Macro for Data Output

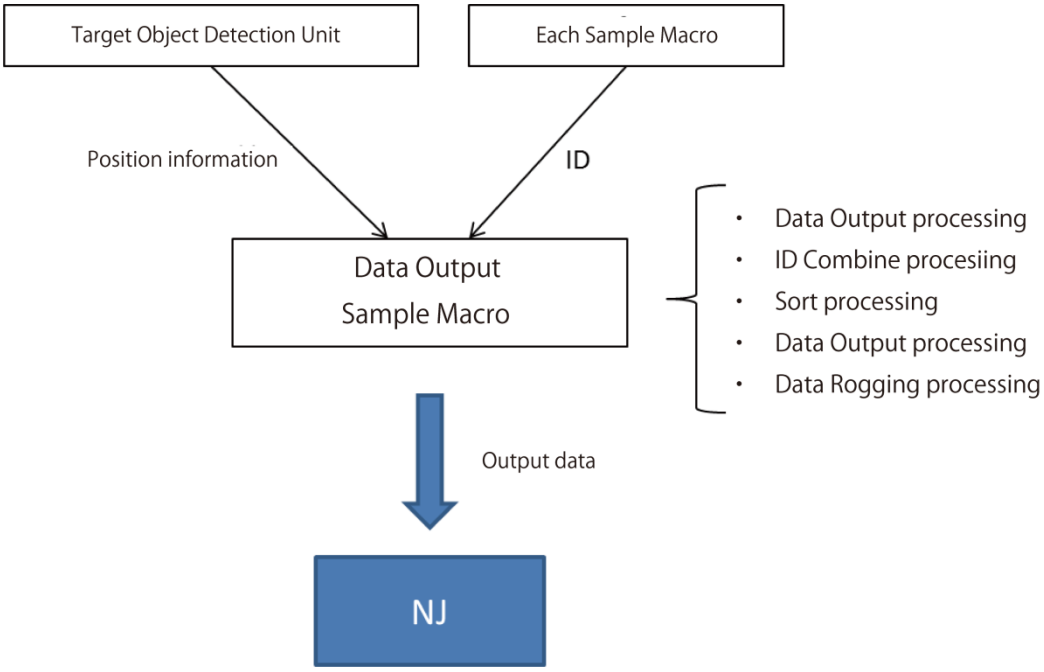
DataOutput Sample Macro executes the data output.

This macro gets the data from the target processing unit and outputs the detected work piece information (measured data) to NJ-Robotics.

This macro can combine the ID which each Sample Macro has and rearrange the acquired data.

12.1. When to Use This Sample Macro

Use this sample macro to evaluate if there is enough space for the robot to grip the target object within a specified region.



Precautions for Use

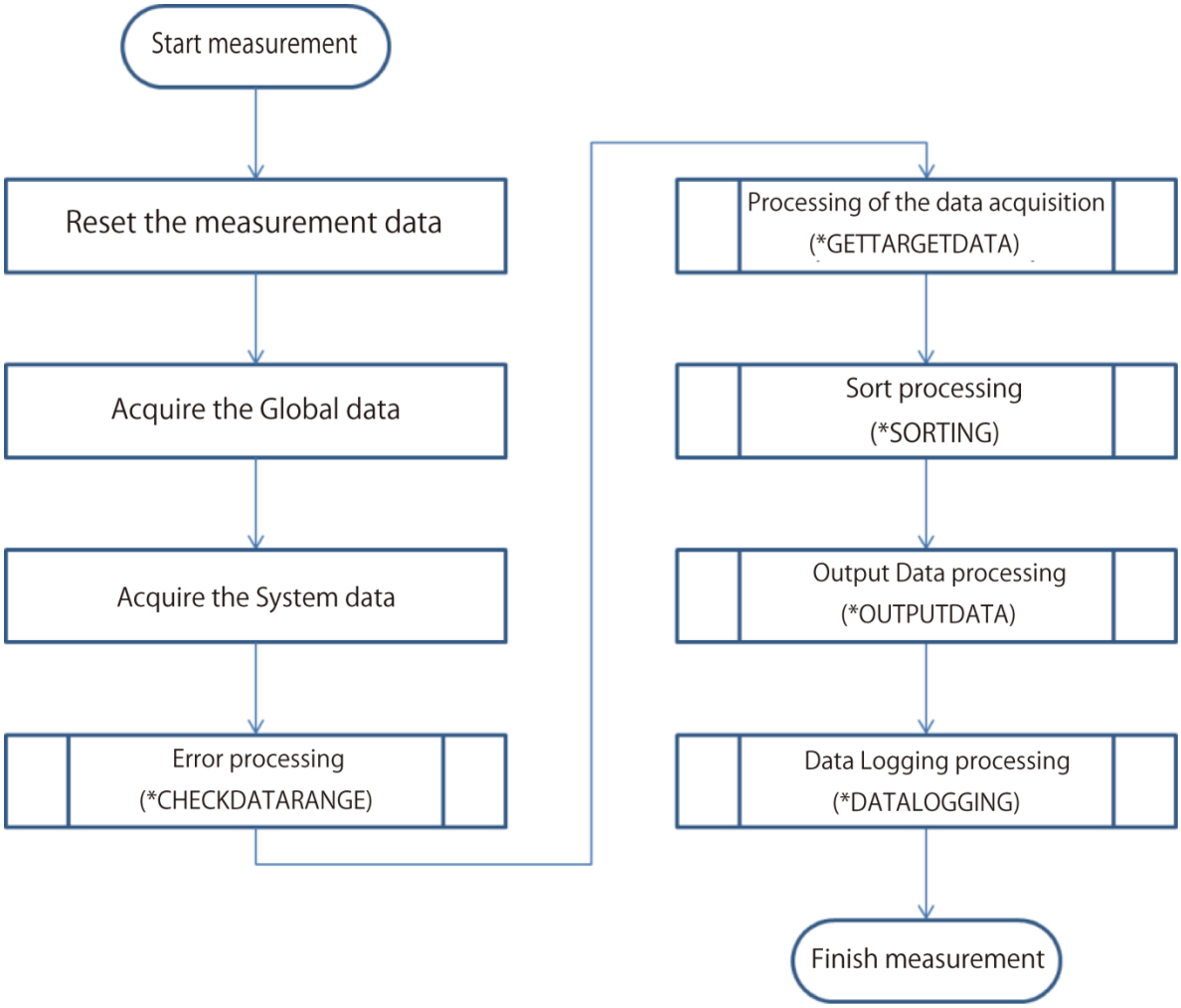
The grip capability is determined by the area ratio (%) of the detected surface area against the reference surface area of the background surface area.

The reference area needs to be adjusted again when the grip region or the specified color is changed.

Changing the DataOutput Sample Macro, the format, contains, or data order can be changed.

12.2. Flow Chart of Sample Macro

The flow chart of the DataOutput Sample Macro is as below.



12.3. Required Settings List

Setting	Overview
Unit label setting	Set a unit label to a processing item that has data for sorting.
Input argument setting	Set the Input argument. You can adjust the classification process by changing the Input argument.

12.4. Unit Label Setting

Sets the Unit label having processing item data for classification.

Precautions for Use

- Unit labels can be set and changed only by using the Scene control macro.
- Setting a unit label is required when using the duplicate exclusion sample macro.
- When you change or add newly the Unit labels described in *5.3.2 Unit Labels Used in Sample Scenes*, the written data is required to change.

Useful Information

・By assigning unit labels, you will be able to specify processing units by the unit label instead of the processing unit number.

・By doing this, you can avoid editing macro program when the processing unit number changes due to a change of the measurement flow.

Reference

Optimizing Scenes (Measurement Flows) in the *Vision System FH/FZ5 Series User's Manual*.

12.5. Setting Input Arguments

The format and parameters of arguments are listed below.

Name	Type	Description
IN_KEY_DATA_NO&	Integer type	Sets the data of Sorting processing. Need to set the parameters relate to **IN_DATA_KIND_NUM&.**
IN_SORT_TYPE&	Integer type	Sets the sort processing order: descending and ascending order.
IN_ENC_UNIT$	Character string type	Sets the Unit Label of GetEncValue Sample Macro.
IN_DETECT_UNIT$	Character string type	Sets the Unit Label of Detection processing items.
IN_CNT_DATA$	Character string type	Sets the data identifier of detected count in Detection processing items.
IN_DATA_KIND_NUM&	Integer type	Sets the data counts for Data Output. Need to change the setting of **IN_TARGET_INFO$(,)**.

IN_TARGET_INFO$(,)	Character string type	For the first argument, set the unit label of the processing unit that holds the data for data output, the data identifier, and the count data identifier. For the second argument, the settings must be made for each data count set in **IN_DATA_KIND_NUM&.** The second argument is fixed in the order below. If you add data, therefore, use 4 or later. 0: X coordinate 1: Y coordinate 2: θ 3: ID
IN_LABELING_FLG&	Integer type	Sets to **True**: Enable when the Detection processing items is Labeling.
IN_LABEL_DATA_UNIT$	Character string type	This macro sets the Unit Label of Label data. If the Detection processing item is not Labeling, set the non-whitespace character: **(“”)**.
IN_ID_MACRO_KIND_NUM&	Integer type	Sets the count of Sample Macro executed to acquire ID. If you change the settings, need to change I**N_ID_MACRO_INFO$(,).**
IN_ID_MACRO_INFO$(,)	Character string type	Sets the following: ・Unit Label having the data of Data Output. ・Data identifier ・Count data identifier Need to change only the count set in **I N_ID_MACRO_KIND_NUM&.**
IN_PRIMARY_TASK_PERIOD#	Double precision type	Sets the executed cycle of primary task which set in NJ series.
IN_DATA_LOGGING_FLG&	Integer type	Selects the existence or nonexistence of Data Logging execution.
IN_DATA_LOGGING_FILE_NAME$	Character string type	Sets the file name written the Data Logging.

Precautions for Use

・If the preset Unit label is not used, data acquirement cannot be allowed.

・If the same data is include in the data of target object of sorting, the sorted order may be

indefinite.

12.6. Returned Value

Name	Type	Description
OUT_DATA_NUM&	Integer type	Saves the count of data used for duplicate exclusion.
OUT_DATA_KIND_NUM&	Integer type	Stores the counts of data type used Data Output.
OUT_DATA#(,)	Double-precision type	Saves the assigned ID and the data used for duplicate exclusion.

Useful Information

Arguments for the **GetUnitData** macro.

・**<unitNo>**:

The unit number assigned to the Sample Macro unit used to obtain the encoder value.

・**<dataIdent>**:

The name of the variable of the returned value to be referenced (**OUT_ENC_VALUE&,** etc.). It should be enclosed in double quotes since it will be treated as a character string.

・**<data>**:

Prepare variable in the same data type as the reference data.

For detail of macro function, refer to *Vision System FH/FZ5 Series User's Manua*l.

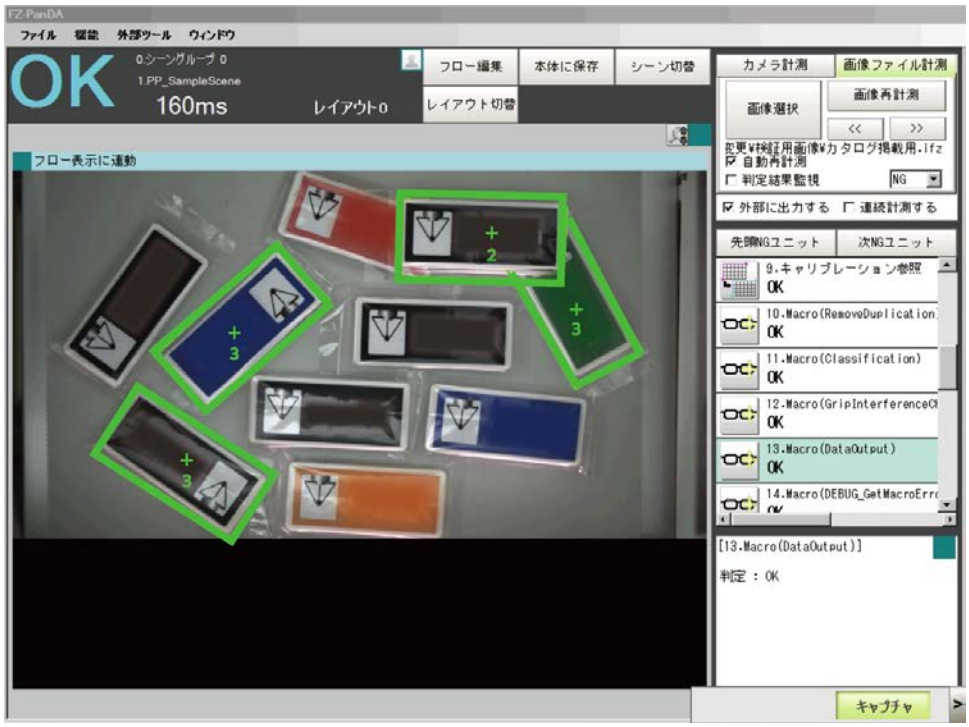
12.7. Processing of Display and Drawing

Displaying and Drawing Processing can be used in the Sample Macro. With the **GetEncValue** function for acquiring encoder values, the following information can be displayed in the Graphic display window and the Detailed result display window,

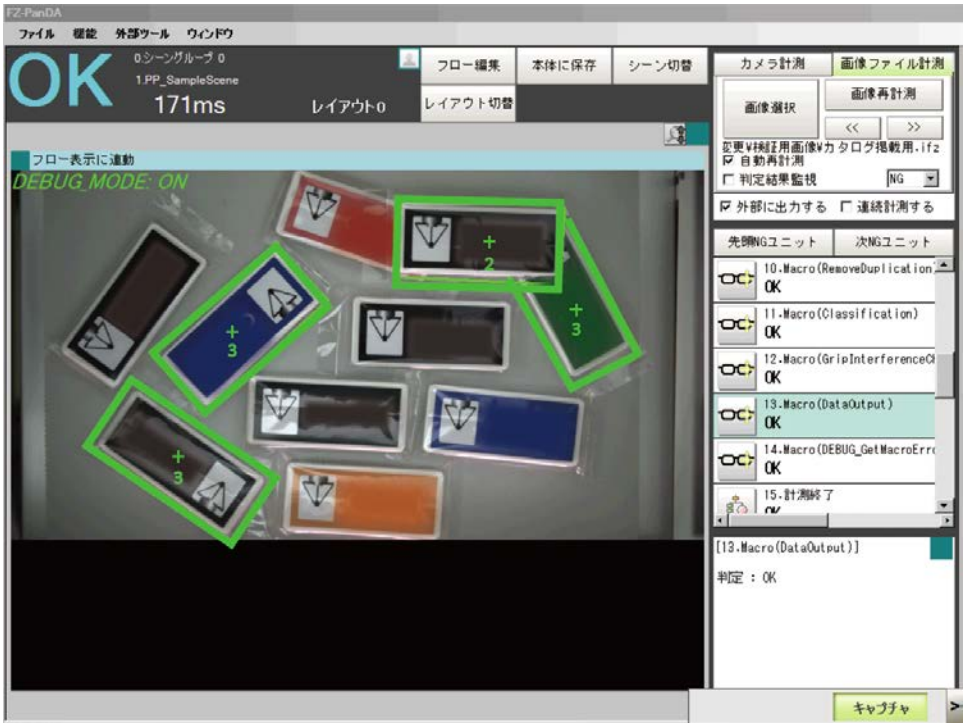
The Detailed result window is not displayed when Sysmac Studio is in the On-line status.

・A graphic display of the processing unit model used for detecting the work piece objects, with cross-hair display (when there is no angle information available from the Processing item used to detect the target work pieces, only the cross-hairs pointer will be displayed.

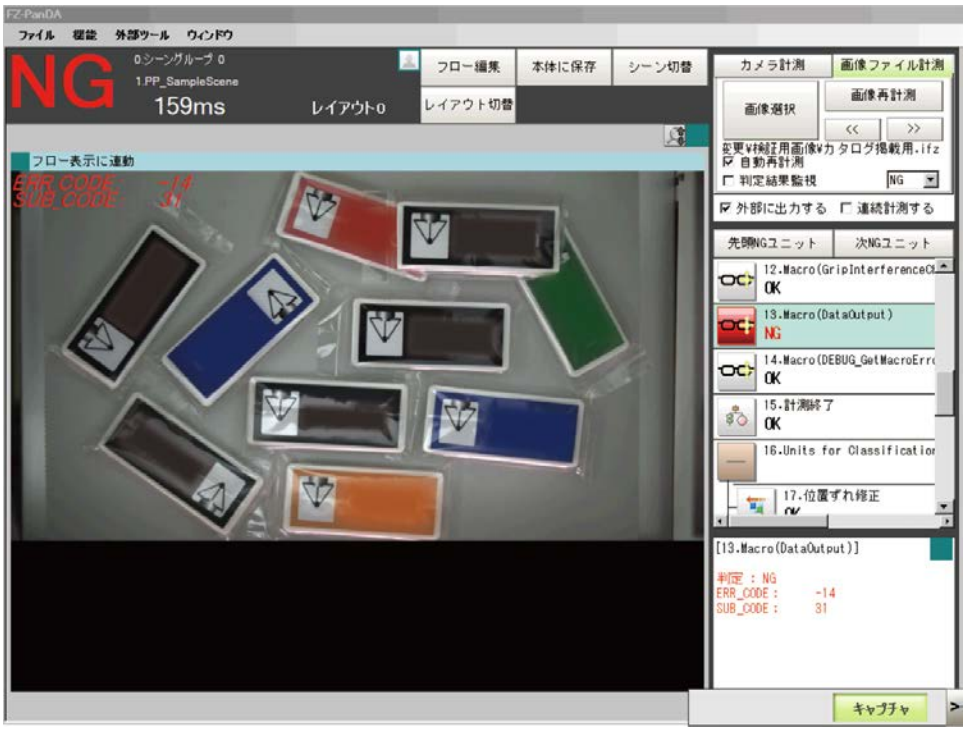
- **No- Outputed work pieces: Green**
- **Outputed work pieces: Red**



Debug mode: Does not display in Release mode.



Error Code and Error Sub Code (Only when the Error occurs.)



12.8. Troubleshooting

When	What to adjust	Confirm:
Does not output data.	Other Sample Macro	・Is the Delete ID assigned to other Sample Macro? ・Is the related Sample Macro judgment NG (failed)?

13. Sample Macro for Debug

This macro is for debugging (**DEBUG_SetGlobalData**).

When you want this Sample Macro to perform virtually in the status where you cannot use under the real environment.

This macro carries out the describes for debug efficiency when the

13.1. When to Use This Sample Macro

This macro is used when executes the changing of debug mode to display the detection condition or Error condition.

Precautions for Use

Make sure to place this DEBUG Sample Macro before other Sample Macro.

13.2. Required Settings List

Setting	Overview
Unit label setting	Sets the Unit Label having data for Sorting.
Input argument setting	Set the Input argument. You can adjust the classification process by changing the Input argument.

13.3. Setting Input Arguments

Sets the Input argument used measurement.

Changing the Input argument, GetEncValue method or Debug mode are possible to be changed.

This chapter describes the Input argument used for measurement.

Name	Type	Description
IN_DEBUG_MODE&	Integer type	Sets the Debug mode. For details of Debug mode, refer to the *Vision System FH/FZ5 Series User's Manua*l.

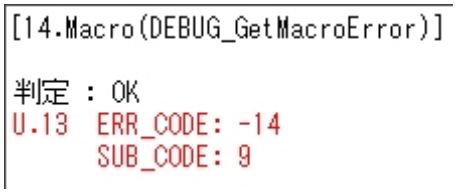
14. Sample Macro for Error Processing

This macro; **DEBUG_GetMacroError** displays the Error defined Sample Macro.

This macro can acquire the Error defined in each Sample Macro and control to display the judgment of each Macro unit or display and integer these Error information.

14.1. When to Use This Sample Macro

Since this macro can specify the Unit and parameter position which Error occurred, the Debug processing can be more efficient.

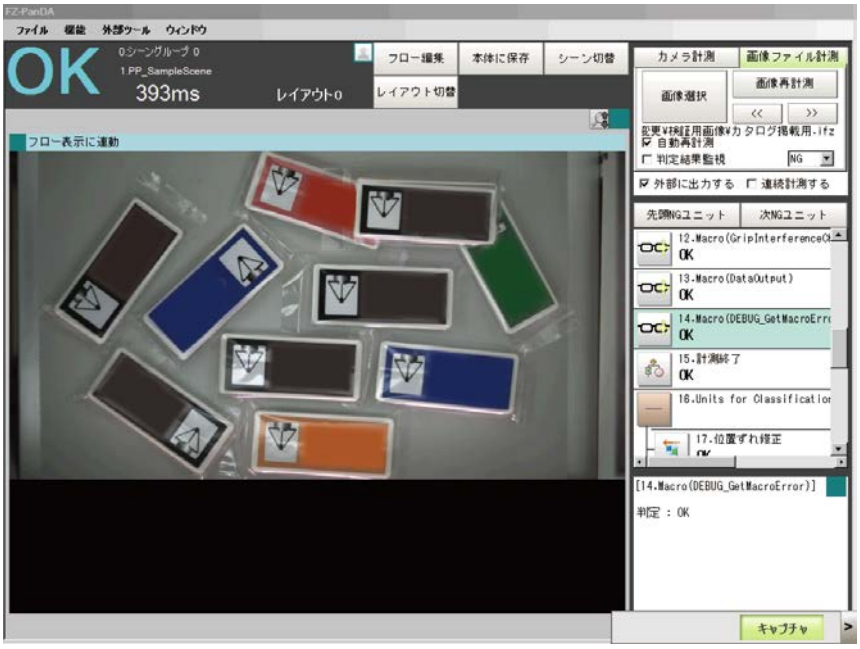


When an Error occurs, this macro displays the Error code and Error Sub code on the Image window and detail result display window.

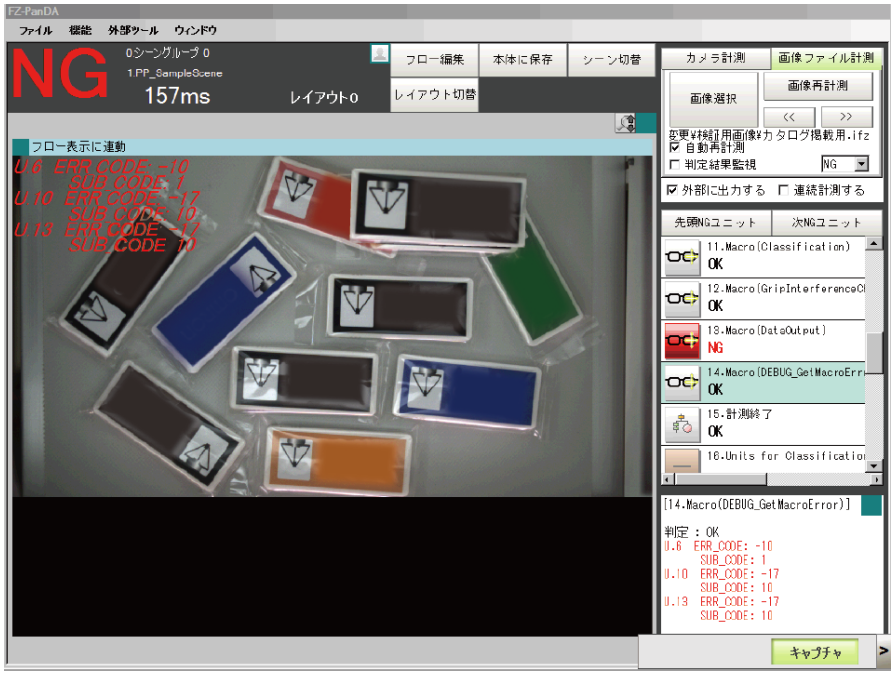
In this case, the above image describes as below.

Error code 14 is occurs on the Unit 13 processing unit when the 9 Error processing is performed,

Normal status.



When an Error occurs



15. Sample Macro for Communication Command

This sample macro is for communication commands to exchange data with the NJ program: FH_ConveyorTrackingApplication_SAMPLE_IO_MACRO_Rev*.mcr, where * represents the revision number.

Create the NJ program based on the interface specifications described in the following pages.

The communication command sample macro includes the following three functions:

3DSimCalib (No.128) as a calibration command for the vision and robot integration simulator;

OutputConvDist (No.254) as a command for the calibration wizard; and

GetUnitNo (No.255) as a command for the non-wizard calibration.

Useful Information

・For the communication commands of the FH Sensor Controller, refer to the *FH/FZ5 Series Vision System User's Manual (Communications Settings)* (Z342-E1-05).

・For the macro customization feature and reference of the FH Sensor Controller, refer to the *FH/FZ5 Series Vision System User's Manual* (Z340-E1-08).

15.1. When to Use This Sample Macro

(1) Calibration Command for the Vision and Robot Integration Simulator

This sample macro serves as a communication command for the calibration by FH using parameters relating to a camera set up in the vision and robot integration simulator (these parameters are referred to as vision and robot integration simulator camera parameters hereafter).

This macro is required only for the use of the vision and robot integration simulator.

Useful Information

For details of the vision and robot integration simulator, refer to *The Vision and Robot Integration Simulation Startup Guide* (****-****).

(2) Command for the Calibration Wizard

This sample macro serves as a communication command for reflecting "Conveyor travel distance per encoder", which is created by using the NJ program after calibration performed with the conveyor tracking calibration wizard, to NJ.

This macro is required only for the use of the conveyor tracking calibration wizard.

Useful Information

For details of the conveyor tracking calibration wizard, refer to the Conveyor tracking calibration wizard described in the *FH Series Vision System Operation Manual for Sysmac Studio*.

(3) Command for the Non-Wizard Calibration

This sample macro serves as a communication command for obtaining the number of a unit that performs high-precision calibration and conveyor calibration, both of which are set up in the Sample Scene for conveyor tracking calibration (Scene: 0.P&P_CalibScene).

This macro is required only when the conveyor tracking calibration wizard is not used.

Useful Information

For details of the conveyor tracking calibration, refer to Processing Unit Number Fetch Command (⑤) described in 18 Calibration Without Using the Wizard.

15.2. Calibration Command for the Vision and Robot Integration Simulator

15.2.1. Prerequisites and Restrictions

The use of the calibration command for vision and robot integration simulator is subject to the following prerequisites and restrictions:

Item	Overview
Vision and robot integration simulator	Use the simulator with the vision and robot integration simulator camera parameters already set.
Modification to the calibration command for vision and robot integration simulator	The calibration command for vision and robot integration simulator does not need to be changed. This command is enabled automatically when the vision and robot integration simulator is used.
Relationship among the Sample Scene, sample macro, and communication command sample macro	Use the command with the Sample Scene (P&P_CalibScene as Scene 0 and P&P_SampleScene as Scene 1) in 4.4 Hardware Configuration, sample macro, and communication command sample macro loaded.
Status after the execution of the calibration command for vision and robot integration simulator	After the calibration, the image mode of all the image windows is changed to [Image data Freeze].

15.2.2. Details of Each Function

The calibration command for vision and robot integration simulator has two functions, the details of which are as follows:

① Setting up the following vision and robot integration simulator camera parameters, created in the vision and robot integration simulator, to the FH sensor controller:

For the origin coordinate (X, Y) on the camera coordinate system of the machine coordinate

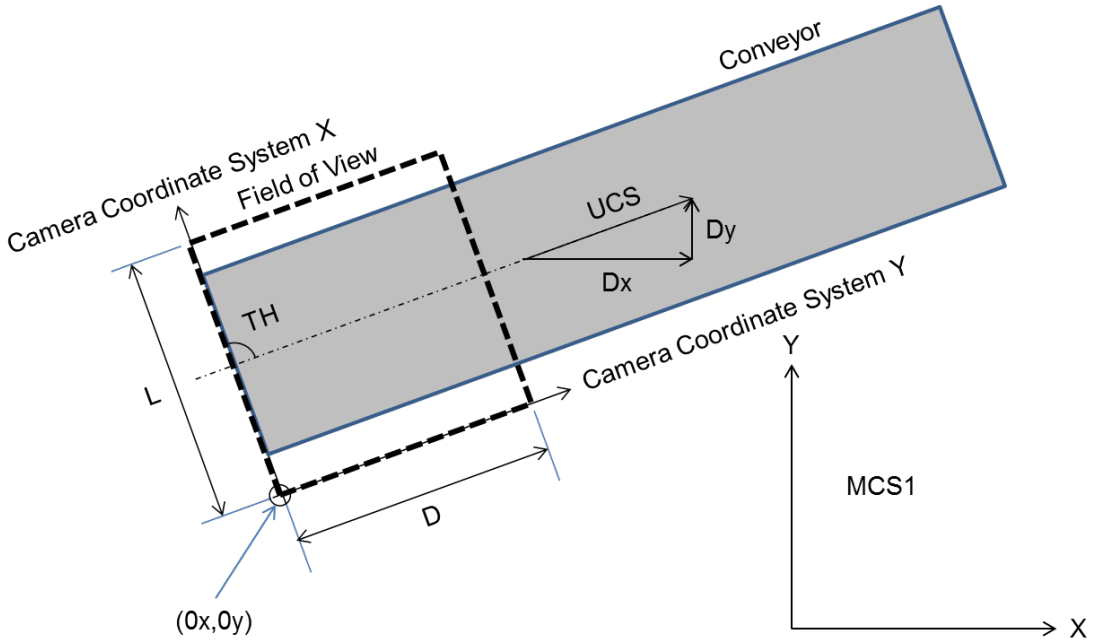
system (MCS1): (0x, 0y)

For the unit vectors (X, Y) of conveyor travel distance of the machine coordinate system (MCS1): (Dx, Dy)

For the camera's field of view (Length, Distance) in the machine coordinate system (MCS1): (L, D)

For the slope of X-axis of the camera's field of view with respect to the conveyor coordinate system (UCS): TH

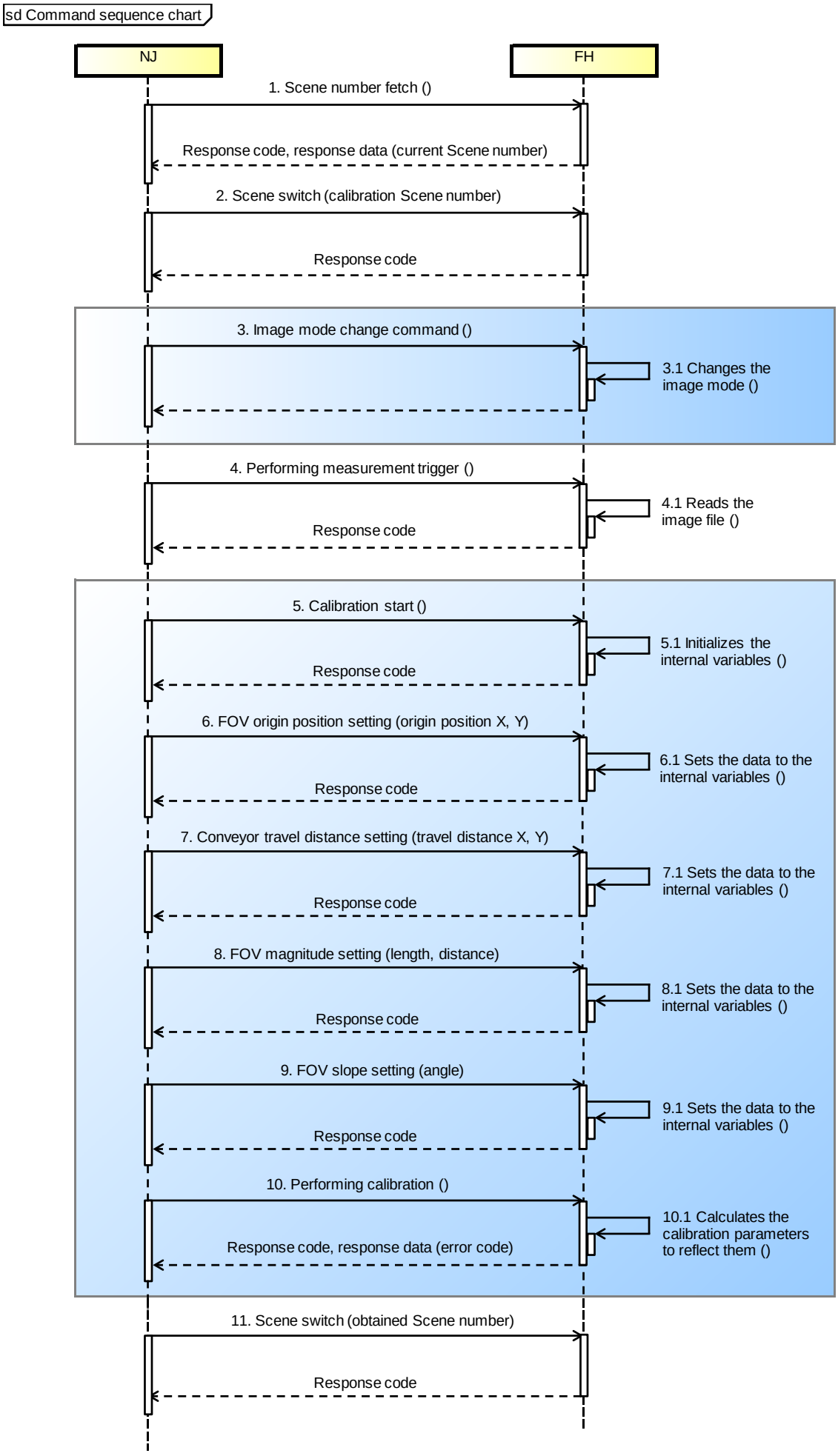
The following is the case of TH = 90° :



② Calculating the calibration parameters based on the data set up in ① and updating the calibration parameters of the Sample Scene (0.P&P_CalibScene).

(1) Command sequence

This section shows a schematic of the command sequence to perform the calibration of FH. The blue-colored areas indicate the calibration command for vision and robot integration simulator.


sd Command sequence chart
NJ
FH
1. Scene number fetch ()
Response code, response data (current Scene number)
2. Scene switch (calibration Scene number)
Response code
3. Image mode change command ()
3.1 Changes the image mode ()
4. Performing measurement trigger ()
4.1 Reads the image file ()
Response code
5. Calibration start ()
5.1 Initializes the internal variables ()
Response code
6. FOV origin position setting (origin position X, Y)
6.1 Sets the data to the internal variables ()
Response code
7. Conveyor travel distance setting (travel distance X, Y)
7.1 Sets the data to the internal variables ()
Response code
8. FOV magnitude setting (length, distance)
8.1 Sets the data to the internal variables ()
Response code
9. FOV slope setting (angle)
9.1 Sets the data to the internal variables ()
Response code
10. Performing calibration ()
10.1 Calculates the calibration parameters to reflect them ()
Response code, response data (error code)
11. Scene switch (obtained Scene number)
Response code

(2) Command specifications

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code defined in the communication command macro. The setting value is fixed to 00000080 Hex.
Command Parameter 0 (DINT)	Command type	Sets the type of this command. The setting range is 0 to 6. For each value, how the command works is shown below: 0: Image mode change command The image mode of all the image windows is changed to [Image data Freeze]. 1: Starting calibration The internal variables for a communication command macro are zeroed. These variables include the original coordinates of camera's field of view (X, Y), the conveyor traffic distance (X, Y), the range of camera's field of view (Length, Distance), and the slope of camera's field of view. 2: Setting the original coordinate of camera's field of view Assigns the original coordinate of camera's field of view, (X, Y), to the internal variables of a communication command macro. 3: Setting the conveyor traffic distance Assigns the conveyor traffic distance, (X, Y), to the internal variables of a communication command macro. 4: Setting the range of camera's field of view Assigns the range of camera's field of view, (Length, Distance), to the internal variables of a communication command macro. 5: Setting the slope of camera's field of view Assigns the slope of camera's field of view to the internal variables of a communication

		command macro. 6: Performing calibration Calculates the calibration parameters based on the internal variables of a communication command macro. The obtained results are set to the conveyor calibration processing unit registered in the specified calibration scene.
User Input Area 4 (LREAL)	User input area 4	According to the command type set in Command Parameter 0, set the following I/F parameters: For the "Image mode change command" (Command Parameter0＝0) : None For the "Starting calibration" (Command Parameter0＝1) : None For the "Setting the original coordinate of camera’s field of view" (Command Parameter0＝2) : Set the original coordinate X of camera’s field of view on the MCS1 coordinate system. Adjust the setting range to be the same as that of the vision and robot integration simulator. For the "Setting the conveyor traffic distance" (Command Parameter0＝3) : Set the conveyor traffic distance X on the MCS1 coordinate system. The setting range is -1 to 1. For the "Setting the range of camera’s field of view" (Command Parameter0＝4) : Set the extent of camera’s field of view. Adjust the setting range to be the same as that of the vision and robot integration simulator. For the "Setting the slope of camera’s field of view" (Command Parameter0＝5) : Set the slope of camera’s field of view with

		respect to the conveyor coordinate system (UCS). The following settings are allowed: 0: 0˚ 1: 90˚ 2: 180˚ 3: -90˚ For the "Performing calibration" (Command Parameter0＝6) : None
User Input Area 5 (LREAL)	User input area 5	According to the command type set in Command Parameter 0, set the following I/F parameters:。 For the "Image mode change command" (Command Parameter0＝0) : None For the "Starting calibration" (Command Parameter0＝1) : None For the "Setting the original coordinate of camera’s field of view" (Command Parameter0＝2) : Set the original coordinate Y of camera’s field of view on the MCS1 coordinate system. Adjust the setting range to be the same as that of the vision and robot integration simulator. For the "Setting the conveyor traffic distance" (Command Parameter0＝3) : Set the conveyor traffic distance Y on the MCS1 coordinate system. The setting range is -1 to 1. For the "Setting the range of camera’s field of view" (Command Parameter0＝4) : Set the extent of camera’s field of view. Adjust the setting range to be the same as that of the vision and robot integration simulator. For the "Setting the slope of camera’s field of view" (Command Parameter0＝5)

		: None For the "Performing calibration" (Command Parameter0＝6) : None

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex,　NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	Response data other than the result of command execution is stored. The response data varies depending on the command type set in Command Parameter 0. For the "Image mode change command" (Command Parameter0＝0) : None For the "Starting calibration" (Command Parameter0＝1) : None For the "Setting the original coordinate of camera’s field of view" (Command Parameter0＝2) : None For the "Setting the conveyor traffic distance" (Command Parameter0＝3) : None For the "Setting the range of camera’s field of view" (Command Parameter0＝4) : None For the "Setting the slope of camera’s field of view" (Command Parameter0＝5) : None For the "Performing calibration" (Command Parameter0＝6)

		: Error code*

* For each bit of response data, the code and definition of error is given as follows:

Corresponding bit	Error type	Description
0 bit position	Command type 2 not transmitted	With the command type 2, 3, 4, or 5 not transmitted, sending the command type 6 causes this error. The transmission status of each command, the internal parameters of which include the execution flag (0: Not executed, 1: Executed), changes from 0 to 1 when the command is executed; is zeroed when the command type 1 is executed.
1 bit position	Command type 3 not transmitted	
2 bit position	Command type 4 not transmitted	
3 bit position	Command type 5 not transmitted	
4 bit position	Calibration parameter calculation failure	If any of the following conditions applies, this error occurs: ・If the extent of FOV (Length/Distance) is set to 0 or less, the four corner points cannot be calculated, and the error occurs. ・If the slope of FOV is set out of range (other than 0 to 3), the error occurs. ・If an image file is not selected in the operation window, a failure to obtain the image size occurs, which causes the error. ・If the conveyor calibration processing unit is not registered in the current Scene, a failure to reflect the parameters occurs, which causes the error. ・If the original coordinate X/Y of FOV or the extent of FOV(Length/Distance) is set to an out-of range value that the FH Sensor Controller cannot handle, or if any of the four corner points on the MCS1 coordinate system is out of the range of - 99999.9999 to 99999.9999, the parameters cannot be calculated, which causes the error.

15.3. Command for the Calibration Wizard

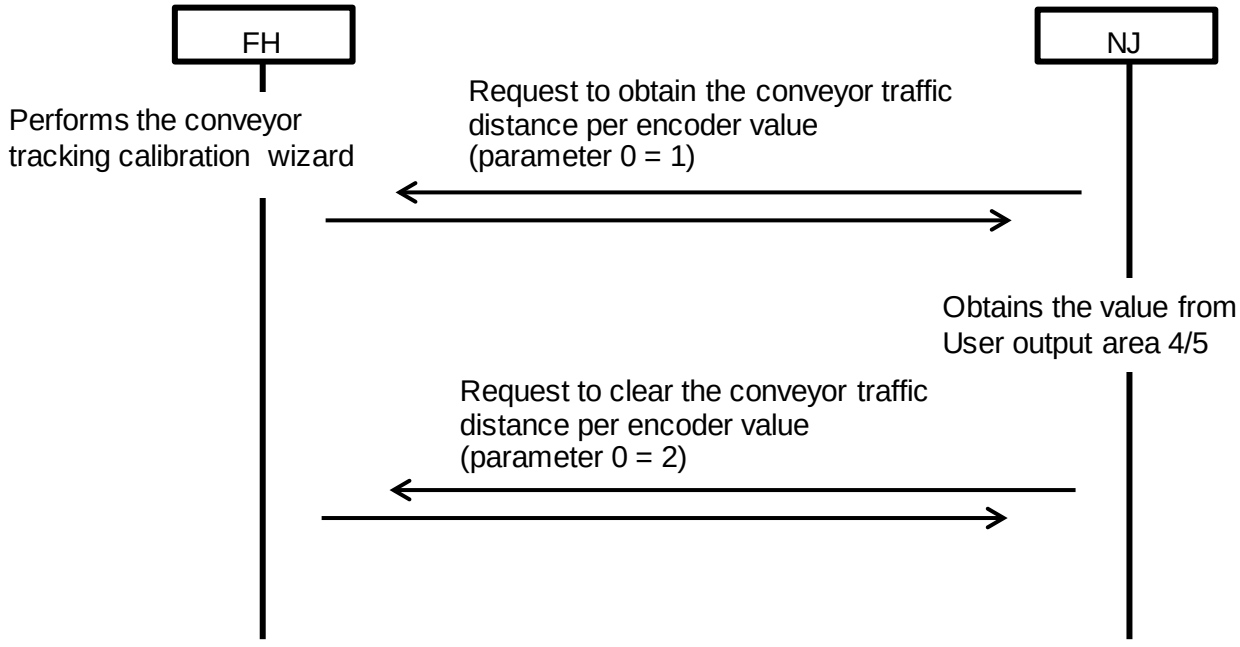
15.3.1. Prerequisites and Restrictions

The use of the command for calibration wizard is subject to the following prerequisites and restrictions:

Item	Overview
Command for calibration wizard	The execution of this command is permitted only in the Sample Scene (P&P_CalibScene as Scene 0) described in 4.4 Hardware Configuration.
Command for calibration wizard	After the completion of the calibration from the conveyor tracking calibration wizard, use the command for calibration wizard.
Modification to the Command for calibration wizard	The command for calibration wizard does not need to be changed.
Relationship between the Sample Scene, sample macro, and communication command sample macro	Use the command with the Sample Scene (P&P_CalibScene as Scene 0 and P&P_SampleScene as Scene 1) in 4.4 Hardware Configuration, sample macro, and communication command sample macro loaded.
Unit label	Do not change the unit label set in the Sample Scene. (Refer to the following.) Processing unit: Conveyor calibration Unit label name: CALIBRATION_UNIT

15.3.2. Details of Each Function

(1) Command sequence



(2) Command specifications

The user output areas 4 and 5 are used.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code defined in the communication command macro. The setting value is fixed to 000000FE Hex.
Command Parameter 0 (DINT)	Command type	Sets the type of this command. The setting range is 1 or 2. For each value, how the command works is shown below: 1: Outputting the conveyor travel distance per encoder value Requests the conveyor travel distance per encoder value (unit: mm) calculated in the FH Sensor Controller to be output to the user output areas 4 and 5. 2: Performing zero clear Requests the user output areas 4 and 5 to be zeroed.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	None

● I/O port for user output areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
User Output Area 4 (LREAL)	User output area 4	According to the command type set in Command Parameter 0, the behavior changes. For the "Outputting the conveyor travel distance per encoder value" (Command Parameter0＝1) : The conveyor travel distance per encoder value, X (unit: mm), calculated in the FH Sensor Controller is output. For the "Performing zero clear" (Command

		Parameter0＝2) : The user output area 4 is zeroed.
User Output Area 5 (LREAL)	User output area 5	According to the command type set in Command Parameter 0, the behavior changes. For the "Outputting the conveyor travel distance per encoder value" (Command Parameter0＝1) : The conveyor travel distance per encoder value, Y (unit: mm), calculated in the FH Sensor Controller is output. For the "Performing zero clear" (Command Parameter0＝2) : The user output area 5 is zeroed.

15.4. Command for the Non-Wizard Calibration

15.4.1. Prerequisites and Restrictions

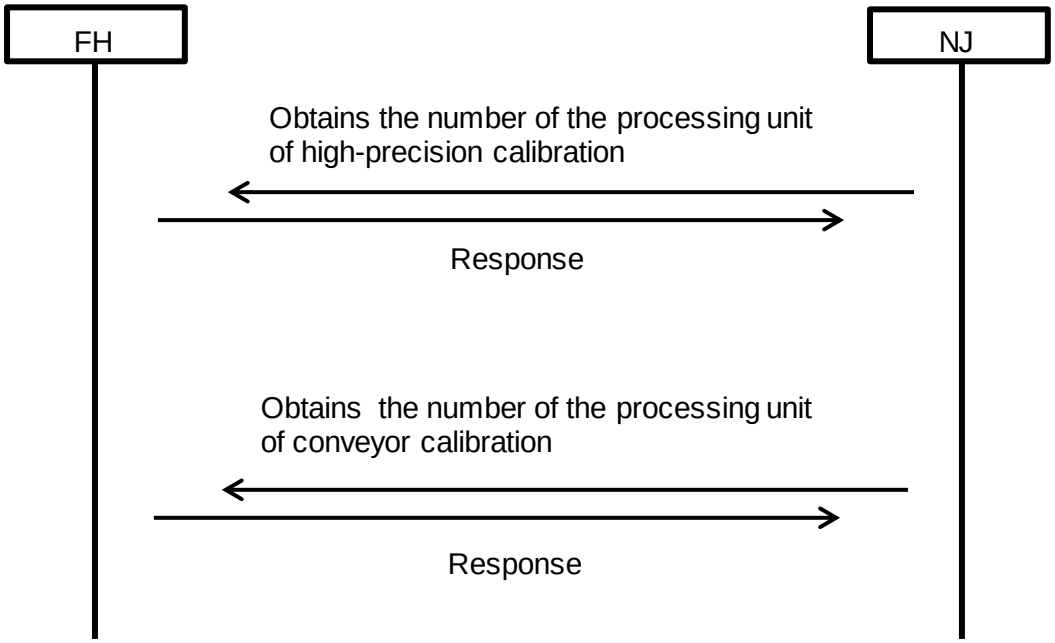
The use of the command for non-wizard calibration is subject to the following prerequisites and restrictions:

Item	Overview
Command for non-wizard calibration	The execution of this command is permitted only in the Sample Scene (P&P_CalibScene as Scene 0) described in 4.4 Hardware Configuration.
Relationship between the Sample Scene, sample macro, and communication command sample macro	Use the command with the Sample Scene (P&P_CalibScene as Scene 0 and P&P_SampleScene as Scene 1) in 4.4 Hardware Configuration, sample macro, and communication command sample macro loaded.
Unit label	Do not change the unit label set in the Sample Scene. (Refer to the following.) Processing unit: High-precision calibration Unit label name: SAMPLING_UNIT Processing unit: Conveyor calibration Unit label name: CALIBRATION_UNIT

15.4.2. Details of Each Function

(1) Command sequence

For details of the command sequence, refer to 18.2.5 Non-Wizard Calibration Command (⑤) described in18 Calibration Without Using the Wizard.



(2) Command specifications

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code defined in the communication command macro. The setting value is fixed to 000000FF Hex.
Command Parameter 0 (DINT)	Command type	Sets the type of this command. The setting range is 1 or 2. For each value, how the command works is shown below: 1: Obtaining the processing unit number of high-precision calibration Obtains the number of a processing unit that performs high-precision calibration (Unit label name: SAMPLING_UNIT) set in the FH Sensor Controller. 2: Obtaining the processing unit number of conveyor calibration Obtains the number of a processing unit that performs conveyor calibration (Unit label name: CALIBRATION_UNIT) set in the FH Sensor Controller.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	The response data varies according to the command type set in Command Parameter 0. For the "Obtaining the processing unit number of high-precision calibration" (Command Parameter 0=1) : The number of a processing unit that performs high-precision calibration (Unit label name: SAMPLING_UNIT) set in FH Sensor Controller is output. For the "Obtaining the processing unit number of conveyor calibration" (Command Parameter 0=2) : The number of a processing unit that performs conveyor calibration (Unit label name: CALIBRATION_UNIT) set in FH Sensor Controller is output. For the cases other than Command Parameter 0=1 and 2 : 0 is output.

16. Conveyor Panorama Display Tool

Conveyor Panorama Display is a tool to display the outline of the model registered region and of each image capture that constitutes a panoramic image over the panoramic image so that you can estimate how targets move on the conveyor, using Sysmac Studio as a platform.

For more information, refer to the *Vision Sensor FH Series Operation Manual Sysmac Studio Conveyor Panorama Display Tool.*

Useful Information

Regarding the Image Logging method used for Off-line measurement.

・In the Conveyor Panorama Display Tool, the file name of Logging Image used for Off-line measurement cannot be created the Image Logging function in FH Sensor Controller.

・The file names of Logging image used for Off-line measurement are the following:

・measurementID_Encoder value at image capture.btm

・measurementID_Encoder value at image capture.ifz

・The above file name of image Logging are created by using GetEncValue Sample Macro.

・Examples of code are the following:

In the subroutine of GetEncValue Sample Macro, *MEASUREPROC, saves the measurement images which named measurement ID_ Encoder value at the image shotted.bmp.

Make sure to add this code to the after *MEASUREPROC subroutine: before Return.

```
---------------------------------------------------------------------------------
*MEASUREPROC
    :
    :
  Rem Acquire the measurement ID and the Encoder value at the capture time and calculate the character strings of file name
  FILENAME$ = MeasureId$ + "_" + Str$(OUT_ENC_VALUE&(0)) + ".bmp"

  Rem Outputs the measurement image 0 to the default path of data save destination as the bmp format.
  SaveMeasureImage 0, ApplicationPath$(2) + FILENAME$, 0
Return
---------------------------------------------------------------------------------
```

For details of Macro, refer to *Vision System FH/FZ5 Series User's Manua*l.

17. Conveyor Tracking Calibration Wizard Tool

Conveyor Tracking Calibration Wizard is a wizard-style calibration tool for reciprocally converting different coordinate systems between vision sensors, conveyors, and robots using Sysmac Studio as a platform.

For more information, refer to the *Operation Manual Sysmac Studio Conveyor Tracking Calibration Wizard Tool*.

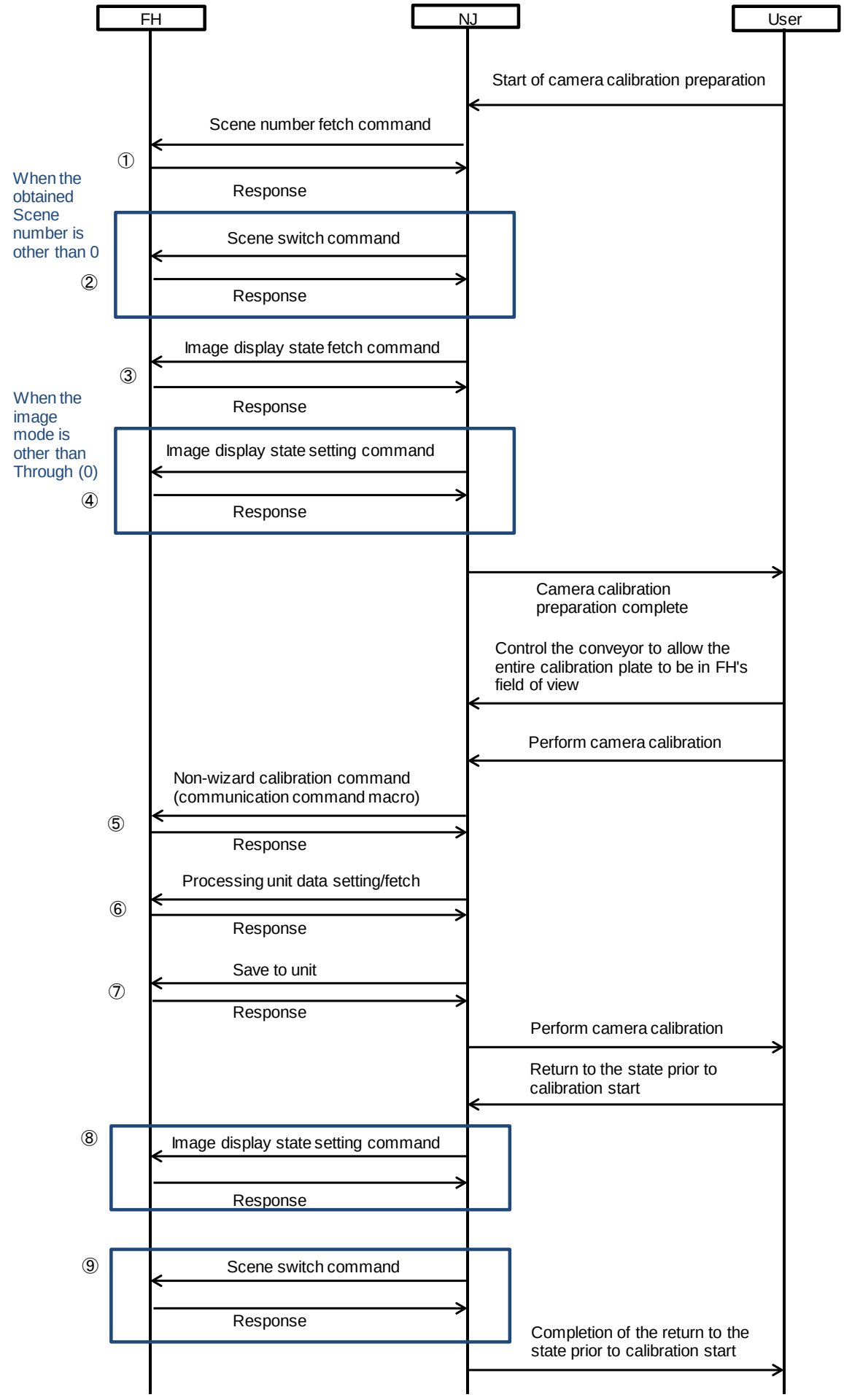
18. Calibration Without Using the Wizard

Creating the NJ program that follows the sequence below allows conveyor calibration without the conveyor tracking calibration wizard.

18.1. Command Sequence

The command sequence is processed as follows:

Conveyor calibration sequence



18.2. Command Specifications

The numbers ① to ⑨ in this section correspond to those in the command sequence.

18.2.1. Scene Number Fetch Command (①)

The current Scene number is obtained.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00201000 Hex.
Command Parameter 0 (DINT)	Command type	None

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	The current Scene number is stored.

18.2.2. Scene Switch Command (②)

The Scene to be used is switched.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00301000 Hex.
Command Parameter 0 (DINT)	Command type	Sets the Scene number to be used.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	For the response data, the result of command execution is stored. 0: OK Other than 0: NG

18.2.3. Image Display State Fetch Command (③)

The state of image mode set in the specified image display window is obtained.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00205030 Hex.
Command Parameter 0 (DINT)	Command type	Sets the number of the intended image display window.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	For the response data, the obtained status of the image mode is stored. 0: Camera image Through 1: Camera image Freeze, or the camera image and last NG image mixed 2: Last NG image

18.2.4. Image Display State Setting Command (④)

The image mode of a specified image display window is set.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Set the command code. The setting value is fixed to 00305030 Hex.
Command Parameter 0 (DINT)	Command type	Set the number of the intended image display window.
Command Parameter 1 (DINT)	Command type	Set the status of the image mode. 0: Camera image Through

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data	Response data	For the response data, the result of command

(DINT)		execution is stored. 0: OK Other than 0: NG

18.2.5. Non-Wizard Calibration Command (⑤)

The processing unit number is obtained when the wizard is not used for calibration.
This command is intended for the case where the wizard of the communication command macro is not used. (Reference: 15.4 Command for the Non-Wizard Calibration described in 15 Sample Macro for Communication Command)

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Set the command code. The setting value is fixed to 000000FF Hex.
Command Parameter 0 (DINT)	Command type	Set the type of this command. The setting range is 1 or 2. 1: Obtaining the number of the sampling processing unit 2: Obtaining the number of the calibration processing unit

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	The response data varies according to the command type set in Command Parameter 0. For the "Obtaining the number of the sampling processing unit" (Command Parameter 0=1) : The number of the sampling processing unit is stored. For the "Obtaining the number of the calibration processing unit" (Command Parameter 0=2) : The number of the calibration processing unit is stored.

18.2.6. Processing Unit Data Setting/Fetch Command (⑥)

The parameters of the processing unit are set.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Set the command code. For the setting range, refer to Command Code described in Details of the Processing Unit Data Setting/Fetch Command.
Command Parameter 0 (DINT)	Command type	Set the type of this command. For the setting range, refer to Command Parameter 0 described in Details of the Processing Unit Data Setting/Fetch Command.
Command Parameter 1 (DINT)	Command type	Set the type of this command. For the setting range, refer to Command Parameter 1 described in Details of the Processing Unit Data Setting/Fetch Command.
Command Parameter 2 (DINT)	Command type	Set the type of this command. For the setting range, refer to Command Parameter 2 described in Details of the Processing Unit Data Setting/Fetch Command.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	The response data varies according to the command type set in Command Parameter. For details, refer to Response data described in Details of the Processing Unit Data Setting/Fetch Command.

● Details of the Processing Unit Data Setting/Fetch Command

Command Code	Command Parameter 0	Command Parameter 1	Command Parameter 2	Command description	Response data
00501000 Hex	Set the number of the sampling processing unit.	180	Set the value obtained by multiplying the number of rows of sampling points (only an odd number from	Sets the number of rows of sampling points.	None

			5 to 19) by 1000.		
		181	Set the value obtained by multiplying the number of columns of sampling points (only an odd number from 5 to 19) by 1000.	Sets the number of columns of sampling points.	None
		182	Set the value obtained by multiplying the interval of sampling points (1 to 1000 and mm as the unit) by 1000.	Sets the interval of sampling points.	None
	Set the number of the calibration processing unit.	120	Set the value obtained by multiplying the number of touch-up times of the robot (fixed at 4 times) by 1000.	Sets the number of touch-up times of the robot.	None
		122	Set the value obtained by multiplying the number of the sampling processing unit by 1000.	Sets the number of the sampling processing unit.	None
		126	Set the value obtained by multiplying the input method for traffic distance per	Sets the input method for traffic distance per encoder value.	None

			encoder value (fixed at 1) by 1000.		
00401000 Hex		5003	None	Clears the buffered data of the camera coordinate system.	The result of command execution is stored. 0: OK -1000: NG
		5002	None	Performs sampling measurement on the camera coordinate system.	The result of command execution is stored. 0: OK -1000: NG
		5	None	Obtains the pattern number detected in sampling measurement.	The number of detected patterns
00501000 Hex		400	Set the value obtained by multiplying the X-axis (upper left) of the machine coordinate system by 1000.	Sets the X-axis (upper left) of the machine coordinate system where the robot is in touch-up operation.	None
		401	Set the value obtained by multiplying the X-axis (upper right) of the machine coordinate system by 1000.	Sets the X-axis (upper right) of the machine coordinate system where the robot is in touch-up operation.	None
		402	Set the value obtained by multiplying the X-axis (lower left) of the machine	Sets the X-axis (lower left) of the machine coordinate system where the	None

			coordinate system by 1000.	robot is in touch-up operation.	
		403	Set the value obtained by multiplying the X-axis (lower right) of the machine coordinate system by 1000.	Sets the X-axis (lower right) of the machine coordinate system where the robot is in touch-up operation.	None
		500	Set the value obtained by multiplying the Y-axis (upper left) of the machine coordinate system by 1000.	Sets the Y-axis (upper left) of the machine coordinate system where the robot is in touch-up operation.	None
		501	Set the value obtained by multiplying the Y-axis (upper right) of the machine coordinate system by 1000.	Sets the Y-axis (upper right) of the machine coordinate system where the robot is in touch-up operation.	None
		502	Set the value obtained by multiplying the Y-axis (lower left) of the machine coordinate system by 1000.	Sets the Y-axis (lower left) of the machine coordinate system where the robot is in touch-up operation.	None
		503	Set the value obtained by multiplying the Y-axis (lower right)	Sets the Y-axis (lower right) of the machine coordinate sys-	None

			of the machine coordinate system by 1000.	tem where the robot is in touch-up operation.	
		602	0	Sets the encoder value of the measurement position of the camera coordinate system (fixed at 0).	None
		603	0	Sets the encoder value of the obtained position (upper) of the machine coordinate system where the robot is in touch-up operation (fixed at 0).	None
		604	None	Sets the encoder value of the obtained position (lower) of the machine coordinate system where the robot is in touch-up operation (fixed at 0).	None
00401000 Hex		5000	None	Calculates the calibration parameters.	The result of command execution is stored. 0: OK -1000: NG
00501000 Hex		127	Sets the value obtained by	Sets the magnitude of	None

			multiplying the magnitude of the vector in the X-axis direction by 1000.	the vector in the X-axis direction of UCS calculated by NJ.	
		128	Sets the value obtained by multiplying the magnitude of the vector in the Y-axis direction by 1000.	Sets the magnitude of the vector in the Y-axis direction of UCS calculated by NJ.	None
00401000 Hex		171	None	Obtains the calibration parameter A.	Stores the value obtained by multiplying the calibration parameter A by 1000.
		172	None	Obtains the calibration parameter B.	Stores the value obtained by multiplying the calibration parameter B by 1000.
		173	None	Obtains the calibration parameter C.	Stores the value obtained by multiplying the calibration parameter C by 1000.
		174	None	Obtains the calibration parameter D.	Stores the value obtained by multiplying the calibration parameter D by 1000.
		175	None	Obtains the calibration parameter E.	Stores the value obtained by multiplying the calibration parameter E by 1000.

		176	None	Obtains the calibration parameter F.	Stores the value obtained by multiplying the calibration parameter F by 1000.

18.2.7. Save-to-Unit Command (⑦)

The current system data and Scene group data are saved in the FH Sensor Controller.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00103010 Hex.
Command Parameter 0 (DINT)	Command type	None

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	For the response data, the result of command execution is stored. 0: OK Other than 0: NG

18.2.8. Image Display State Setting Command (⑧)

The image mode of a specified image display window is set.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00305030 Hex.
Command Parameter 0 (DINT)	Command type	Sets the number of an intended image display window.
Command Parameter 1 (DINT)	Command type	Sets the state of the image mode. 0: Camera image Through

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	For the response data, the result of command execution is stored. 0: OK Other than 0: NG

18.2.9. Scene Switch Command (⑨)

The Scene to be used is switched.

● I/O port for instruction areas (NJ Controller → FH Sensor Controller)

PDO signal	Name	Functional description
Command Code (DWORD)	Command code	Sets the command code. The setting value is fixed to 00301000 Hex.
Command Parameter 0 (DINT)	Command type	Sets the Scene number to be used.

● I/O port for response areas (FH Sensor Controller → NJ Controller)

PDO signal	Name	Functional description
Response Code (DWORD)	Response code	The result of command execution is stored. (OK: 00000000 Hex, NG: FFFFFFFF Hex)
Response Data (DINT)	Response data	For the response data, the result of command execution is stored. 0: OK Other than 0: NG

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