Vision Sensor

FH Series

Vision System

Robot Connection Guide

OMRON TM Series Edition

Z447-E1-02

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CONTENTS

Introduction

Thank you for purchasing the FH Series.

This manual contains information that is necessary to use the FH Series.

Please read this manual and make sure you understand the functionality and performance of the FH Series before you attempt to use it in a control system.

Keep this manual in a safe place where it will be available for reference during operation.

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Warning

For details on Warning, refer to Warning in the *Vision System FH Series 3D Robot Vision Application Construction Guide (Cat. No. Z446)*.

Precautions for Safe Use

For details on Precautions for Safe Use, refer to Precautions for Safe Use in the *Vision System FH Series 3D Robot Vision Application Construction Guide (Cat. No. Z446)*.

Precautions for Correct Use

For details on Precautions for Correct Use, refer to Precautions for Correct Use in the *Vision System FH Series 3D Robot Vision Application Construction Guide (Cat. No. Z446)*.

Regulations and Standards

For details on Regulations and Standards, refer to Regulations and Standards in the *Vision System FH Series 3D Robot Vision Application Construction Guide (Cat. No. Z446)*.

Related Manuals

<Application Construction Guide>

Name of Manual	Cat. No.	Model	Purpose	Contents
Vision Sensor FH Series 3D Robot Vision Application Construction Guide	Z446	FH-505□ FH-SMDA-GS050B	When User want to know about the FH series 3D robot vision system.	Describes the soft functions, setup, and operations to use FH series 3D robot vision system.

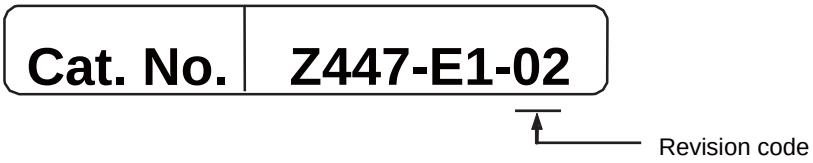
<Robot Manual>

Name of Manual	Cat. No.	Model	Purpose	Contents
Regular Payload Series Hardware Installation Manual	I623	RT6-0□□□□□□	When User want to know the setup and hardware specifications of the TM Robot	Describes the specifications, external dimensions, names of parts, I/O, installation, and wiring of the cooperative robot TM5.
Medium & Heavy Payload Series Hardware Installation Manual	I624	RT6-1□□□□□□ RT6-2□□□□□□	When User want to know the setup and hardware specifications of the TM Robot	Describes the specifications, external dimensions, names of parts, I/O, installation, and wiring of the cooperative robot TM12, TM14.
TMflow Software Manual	I626	-	When User want to know how to configure TMflow	Describes the software functions, settings, and operations for using the collaborative robot TM.
TECHMAN ROBOT Safety System 3.3 Safety Manual	I648	-	When User Want to Know the Safety Features of the TM Robot	Describes the safety functions in Collaborative robot TM.
TM5S TM7S TM Collaborative Robot Hardware Installation Manual	I686	RT6-0□□□□□□ RT6-6□□□□□□	When User want to know the setup and hardware specifications of the TM S Robot	Describes the specifications, external dimensions, names of parts, I/O, installation, and wiring of the cooperative robot TM5S, TM7S.
TM12S TM14S TM Collaborative Robot Hardware Installation Manual	I687	RT6-1□□□□□□ RT6-2□□□□□□	When User want to know the setup and hardware specifications of the TM S Robot	Describes the specifications, external dimensions, names of parts, I/O, installation, and wiring of the cooperative robot TM12S, TM14S.

TM Collaborative Robot Software Manual TM Flow Version2	I689	-	When User want to know how to configure Tmflow	Describes the software functions, settings, and operations for using the collaborative robot TM S.
TM S Series TM Collaborative Robot Safety Manual	I688	-	When User Want to Know the Safety Features of the TM S Robot	Describes the safety functions in Collaborative robot TM S.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.



Rev. Code	Rev. Date	Revision Contents
01	Feb. 2021	Original product
02	Jun. 2024	Add a connected robot. - OMRON TM S series Additional support for FH-5051 and FH-5052. Revisions for update camera cables model. Added FZ-MEM16G.

1. Overview

1.1. Overview

This manual describes procedures for connections and settings required for constructing robot vision applications by connecting your robot controller to the Vision Sensor FH (hereafter referred to as Vision Sensor).

Utilizing this manual and Robot Vision Application Construction Guide can reduce man-hours to connect the Vision Sensor to your robot controller, set the Vision Sensor, and create robot programs.

1.2. Instructions for Building a 3D Robot Vision Application

Please follow the flow below for constructing 3D robot vision applications

Procedure	Reference
Creating Data Set for Robot Vision	[3D Robot Vision Application Construction Guide] Chapter 6
↓	
System Settings for the Vision Sensors	[3D Robot Vision Application Construction Guide] Chapter 7
↓	
Setting Communications for Robot controller	Refer to Chapter 3.1
↓	
Connecting Vision Sensor to Robot Controller	Refer to Chapter 3.2 Refer to Chapter 3.3
↓	
Robot Vision Settings for Vision Sensors	[3D Robot Vision Application Construction Guide] Chapter 8
↓	
Description of the sample programs	Refer to Chapter 6

1.3. Robot Programs Covered in this Manual

The two types of robot programs covered in this manual are output from the Robot Vision Dataset Output Tool. Each program is used for a different purpose.

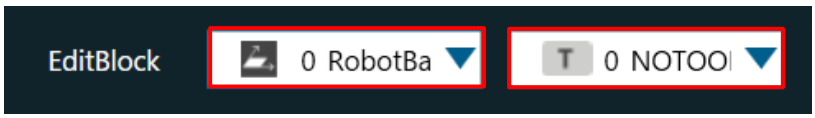
Program	Project Name	Detail
Setup Program	FHSETUPMAIN	This program allows the Vision Sensor to give operating instructions to the robot to configure the Vision Sensor for robot vision. This program consists of the following functions - Send the current robot position to the Vision Sensor. - Move to the indicated position on the Vision Sensor.
Sample Program	FHSAMPLEMAIN	This program is a sample of the basic program flow for a pick application. In this program, the robot gives control instructions to the Vision Sensor. The program consists of the following functions - Connecting to the Vision Sensor - Scene switching of the Vision Sensor - Moving to the measurement position - Registering the current robot position to the Vision Sensor - Execute measurement instructions to the Vision Sensor - Receives the position of the workpiece to be recognized - Move to approach position - Move to the target work location (grasping position) Based on this program, a pick-and-place application is built by adding the robot movement to operate the end-effector (hand) and to place the workpiece.

2. System Configuration

This chapter describes the system configuration and target devices to construct robot vision applications.

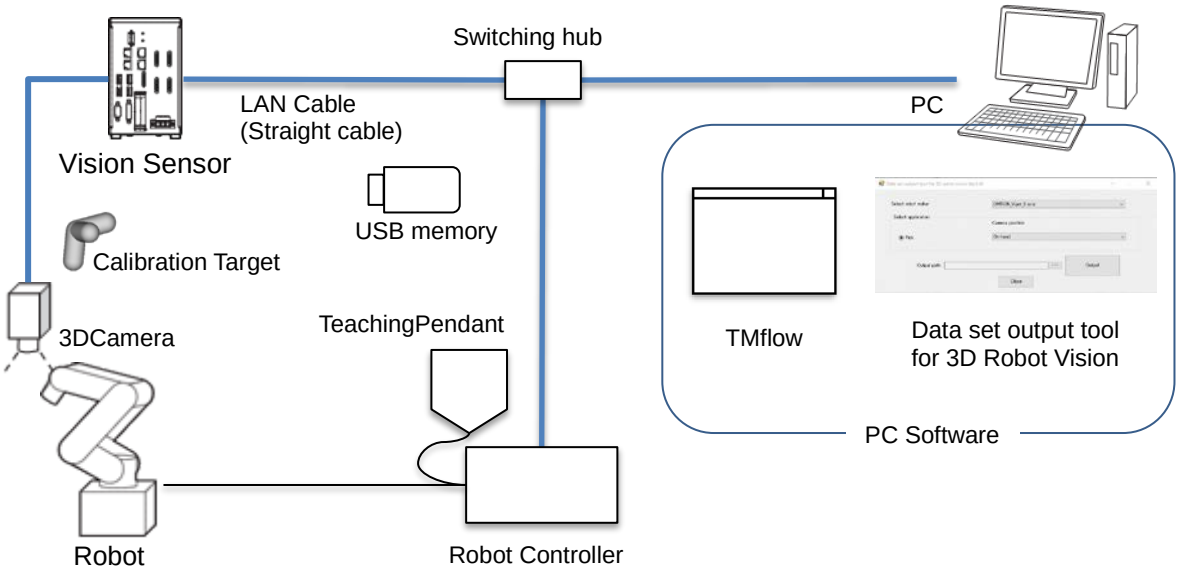
2.1. Cautions for Robot Equipment

[RobotBase] and [NOTOOL] have been selected for the robot controller's coordinate system.



2.2. When Using Vision Sensor FH Series 3D Vision Sensor

2.2.1. System Configuration



2.2.2. Target Devices

Device name	Manufacture	Name	Model	Remarks
Vision Sensor	OMRON	Vision Sensor FH Series	FH-505□	FH-5052: Ver.6.60 or higher FH-5051: Ver.6.51 FH-5050: Ver.6.40 to Ver.6.51 Controllers other than the FH-505□ are not supported.

3D Camera	OMRON	3D Vision Sensor	FH-SMDA-GS050B	
Camera Cable	OMRON	Ethernet cable super bending resistance	FHV-VNBX2□M FHV-VNLBX2□M	-
Camera I/O cable	OMRON	I/O cable super bending resistance	FH-VSDX-BX□M FH-VSDX-LBX□M	-
Calibration target	OMRON	Handeye Calibration Target	FH-XCAL-R	-
	OMRON	Camera Calibration Target	FH-XCAL-S	-
3D Software	OMRON	3D Robot Vision Software Installer	FH-UM3D1	-
Robot	OMRON	Collaborative Robot TM5-700	RT6-0□□70□□	
		TM5-900	RT6-0□□90□□	
Robot	OMRON	Collaborative Robot TM5S	RT6-0□□90□□	
		TM7S	RT6-6□□70□□	
		TM12S	RT6-1□□13□□	
		TM14S	RT6-2□□11□□	
PC software	OMRON	Data set output tool for 3D robot vision	–	Ver.1.00 Please contact us for how to obtain it.
	OMRON	Robot Programing Environment TMflow	–	Ver.1.80.5300 or later
	OMRON	Robot Programing environment (TM S) TMflow Version2	–	Ver.2.16.3500 or later
Switching hub	OMRON	Industrial switching hub	W4S1-□□□	Recommended product
USB memory	OMRON	USB memory	FZ-MEM16G	Recommended product

Precautions for Correct Use

Do not use any device except mentioned above for each device of the system configuration.

Additional Information

This manual does not provide operations, installation, and wiring methods for each device.
For details, refer to manuals noted in Related Manuals.

3. Connecting Vision Sensor to Robot Controller

This chapter describes procedures to connect the Vision Sensor to the robot controller. Please follow the flow below for the settings.
The IP address of each device is described below.
Vision Sensor : 10.5.5.100
Robot controller: 10.5.5.101

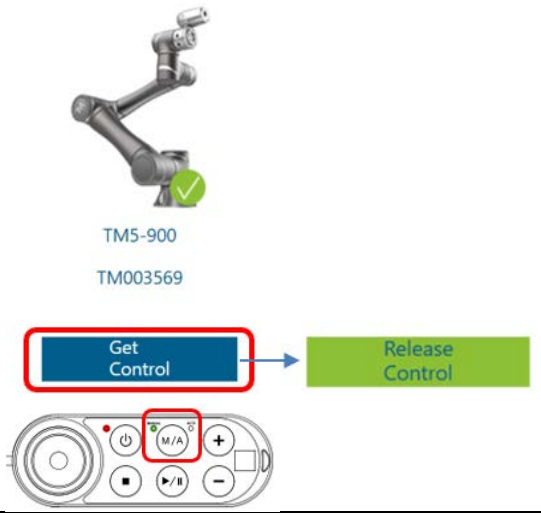
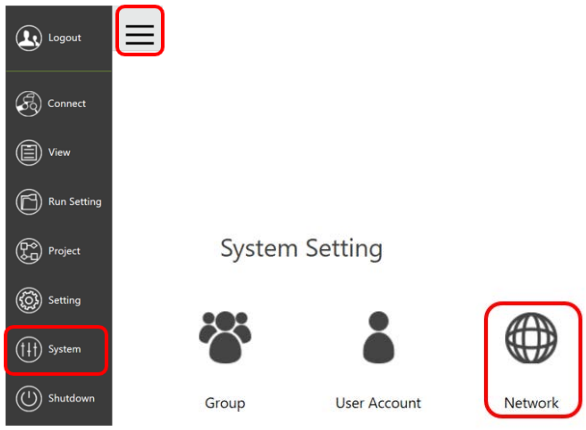
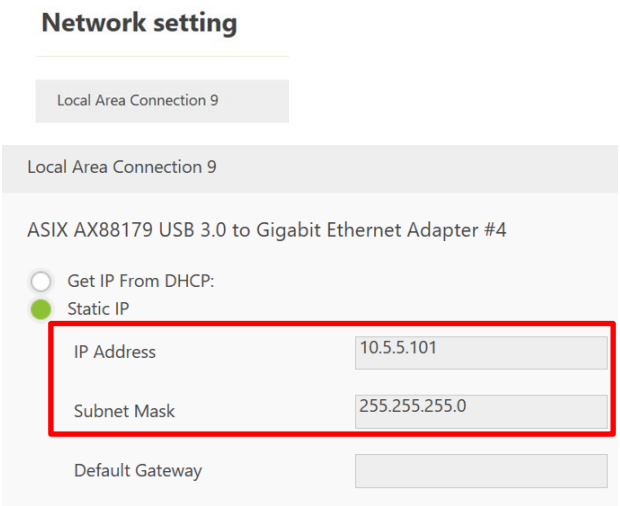
3.1	Setting communications for the robot controller	To change the robot's communication settings, connect the monitor, keyboard, and mouse to the robot control box and activate the robot. Use TMflow to change the robot's default IP address to match the communication settings set for the Vision sensor.
▼		
3.2	Verifying Ethernet Communication	Check the connection status of Ethernet using PING command.
▼		
3.3	Verify Commands Sent/Received	Run a robot program for startup to establish the TCP/IP connection between the Vision Sensor and the robot controller. Check the communication status by sending and receiving commands.

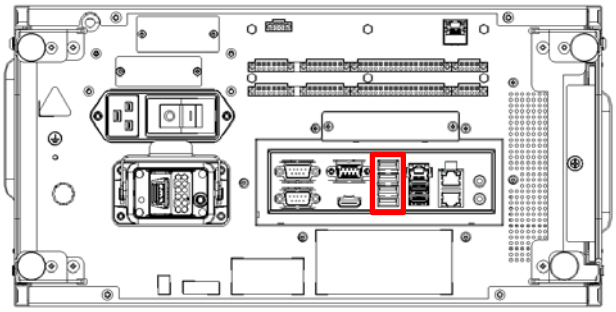
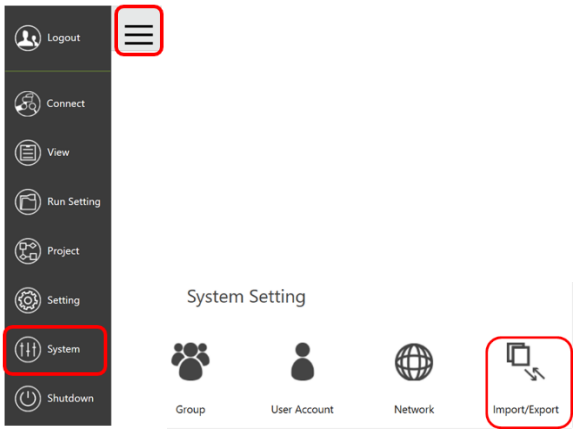
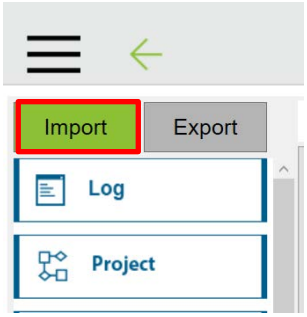
The explanation of sending and receiving commands is explained using the node name (component) / device name (network) of TM Robot. For the TM S robots, see the table below.

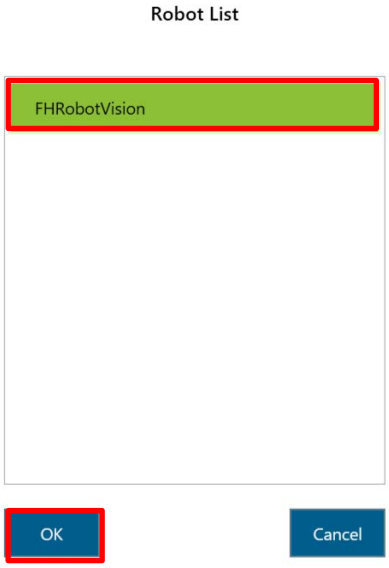
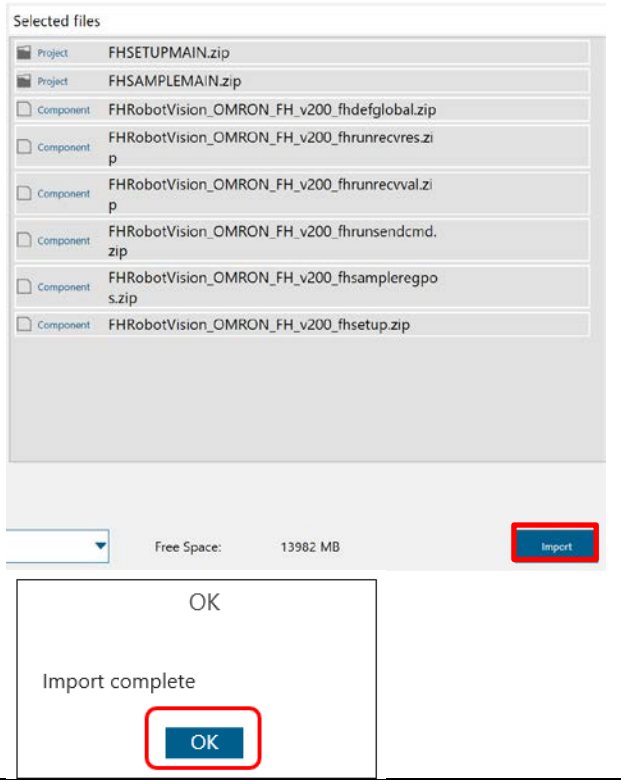
	TM	TM S
Node name (Component)	fhsetup	FH_v200_fhsetup1
Device name (Network)	FH	ntd_FH

3.1. Setting Communications for Robot controller

Please follow the procedures below to set the communications for the robot controller. Connect a monitor, keyboard, and mouse to the robot's control box, and turn on the robot's power.

1	Click [Get Control] on the robot startup screen to make the settings available. If the robot is in auto mode, switch to manual mode.	
2	Click the icon in the top left menu to display a list of the function menu. Click [System] – [Network].	
3	Click [Local Area Connection X] in Network setting. Set the IP Address and Subnet Mask. Set the IP address that does not overlap with the Vision Sensor and the PC where TMflow is running.	

	Click [OK] and Click an icon enclosed in red square on the right figure to close to Network setting.	
4	Copy the "TM_Export" folder in the "RobotProgram" folder of the data output from the Data Set Output Tool for Robot Vision to the USB memory.	
5	Change the device name of the USB memory to "TMROBOT".	
6	Connect the USB memory to the USB port of the robot controller.	
7	Click the icon in the top left menu to display a list of the function menu. Click [System] – [Import/Export]	
8	Click [import] in the top left corner. The right dialog will be displayed, select “Configure Controller” and click [Finish].	

	In Robot List , select FHRobotVision and click [OK].	
9	Select all files that appear in Project, Component. Click [Import] at the bottom right. When the import is complete and "Import complete" is displayed, click [OK].	

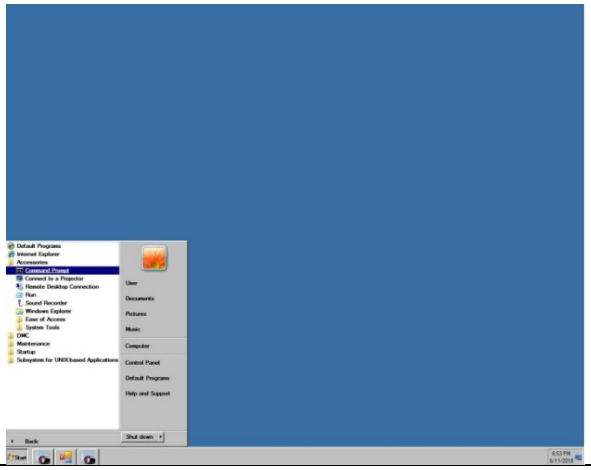
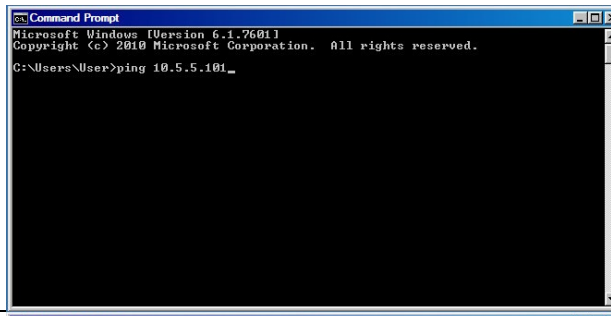
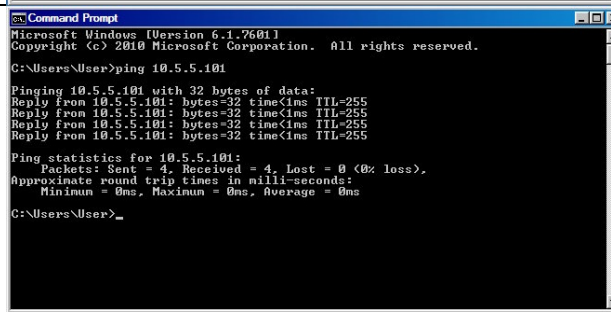
Additional Information

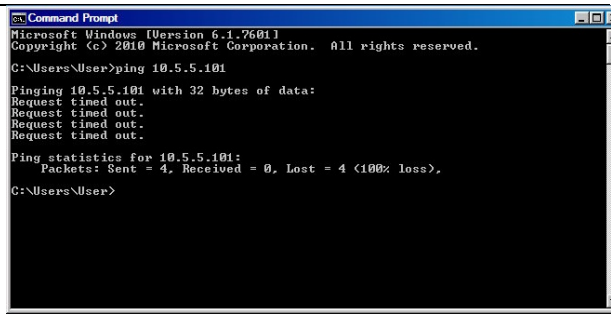
The device name of the USB flash drive is “TMROBOT”.
The program cannot be read with any other device name.
This manual does not provide operation, installation, and wiring methods for each device.
For details, refer to manuals noted in Related Manuals.

3.2. Connecting and Checking Vision Sensor and Robot Controller

Follow the procedures below to connect the Vision Sensor and the robot controller and to check the connection status.

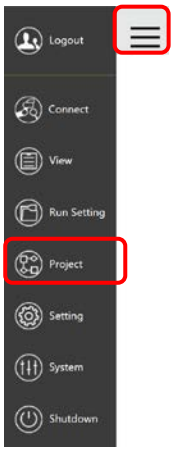
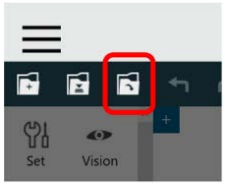
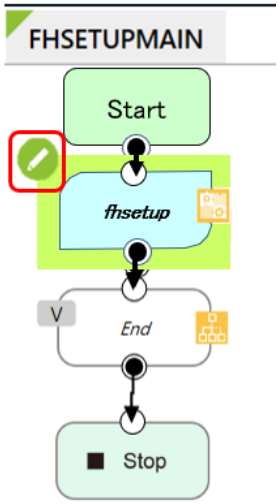
3.2.1. Verifying Ethernet Communication (FH Series Vision Sensor)

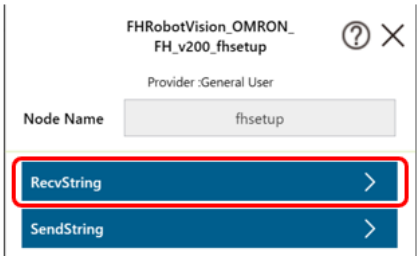
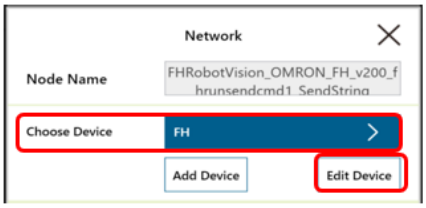
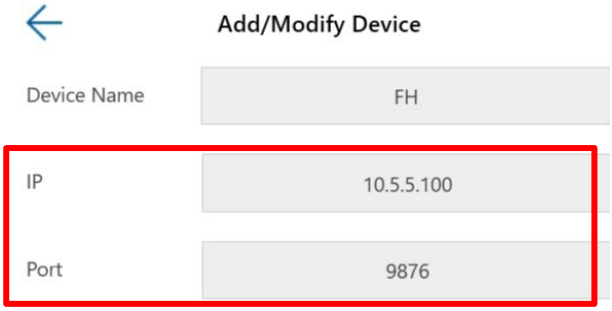
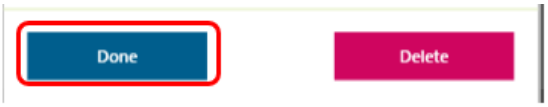
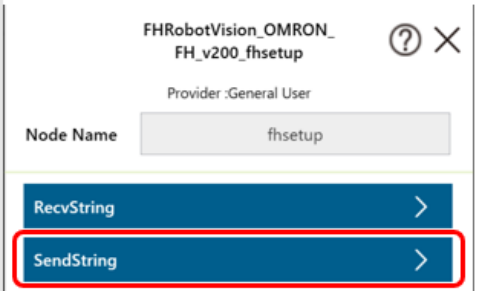
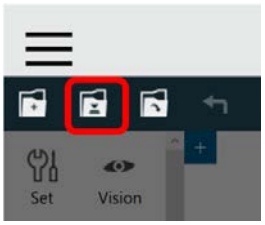
1	Connect the Vision Sensor and the robot controller with LAN cables.	
2	(Operation of the Vision Sensor) Move the mouse cursor to lower left of the window to display [Start]. Select [Start] - [All Programs] - [Accessories] - [Command Prompt] to launch [Command Prompt].	
3	(Operation of the Vision Sensor) Execute PING command to the IP address of the robot controller.	
4	(Operation of the Vision Sensor) When 32-byte data could be successfully sent/received four times as shown in the figure on the right, that means that the communications have been established and the wiring and settings of Ethernet is correctly done.	

	When 32-byte data cannot be sent/received four times and PING command timed out, check whether or not the robot controller is turned on, the wiring was correctly done, or communication settings are correct.	

3.3. Verify Commands Sent/Received

Execute the setup program on the robot controller and follow the steps below to confirm that commands can be sent and received from the Vision Sensor.

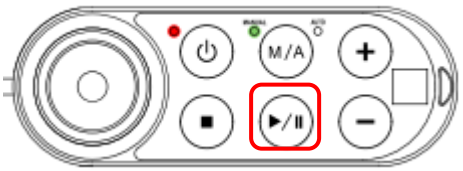
1	(Operation of TMflow) On the robot controller side, select [Project].	
2	(Operation of TMflow) Like shown on the right figure, On the project editing screen, click the icon. Select [FHSETUPMAIN] from the list of projects and click [OK] to load the setup program.	 
3	(Operation of TMflow) Like shown on the right figure, Click the icon to open the configuration dialog for [fhsetup] node.	

4	(Operation of TMflow) Select [RecvString] to open the Network Settings dialog. Make sure that [Choose Device] is set to FH. Click [Edit Device] to open the Device Settings screen. Set the IP address and port number of the Vision Sensor. Click [Done] to save the settings.	   
5	(Operation of TMflow) Select [SendString] to open the Network Settings dialog. Make sure that [Choose Device] is set to FH. After confirming, close the [fhsetup] node configuration dialog.	 
6	(Operation of TMflow) Like shown on the right figure, Click the icon to save the [FHSETUPMAIN] project to save your network settings.	

7

(Operation of Robot Stick)
Press the [Play/Pause] button on the robot stick to run the project.

When the project is in the running state, the robot's ring will flash green.

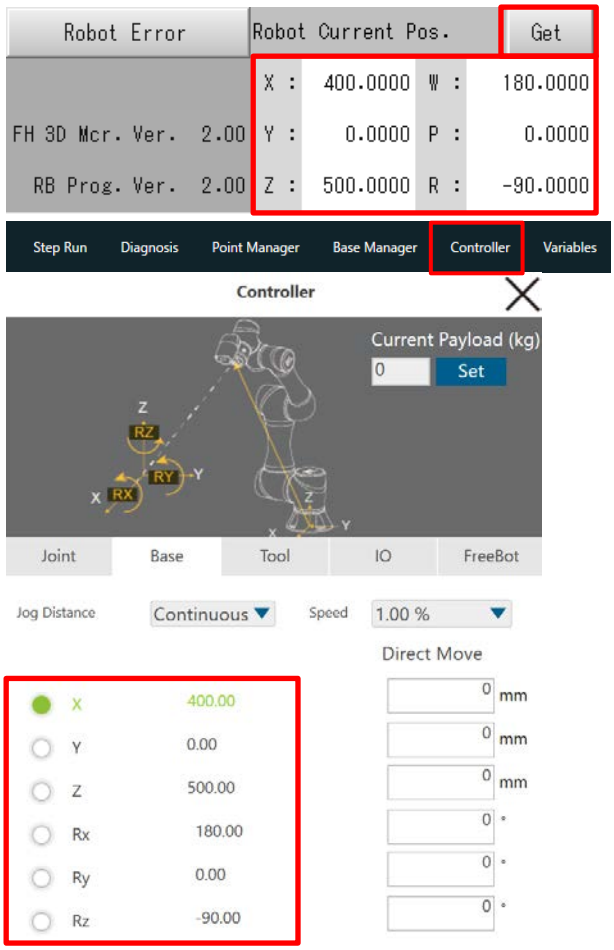


8

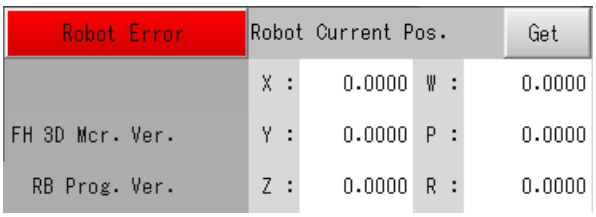
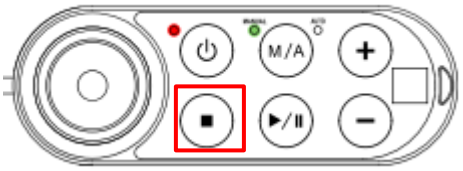
(Operation of the Vision Sensor and TMflow)
Like shown on the right figure, when [Get] is clicked on the Main Window of the Vision Sensor and the current robot position on TMflow is displayed at the same position on the Main Window of the Vision Sensor, sending/receiving commands between them have been succeeded.

* The current robot position can be checked by clicking [Controller] on the project editing toolbar.

* Correspondence relation of notation



Vision Sensor	TMflow
W	Rx
P	Ry
R	Rz

9	(Operation of the Vision Sensor) Like shown on the right figure, If the [Robot Error] button turns red, the connection has failed. Check the wiring and others.	
10	(Operation of Robot Stick) When the Vision Sensor and the robot controller have exchanged commands, press the [Stop] button on the robot stick to stop the project.	

Additional Information

This manual does not provide operation, installation, and wiring methods for each device.
For details, refer to manuals noted in Related Manuals.

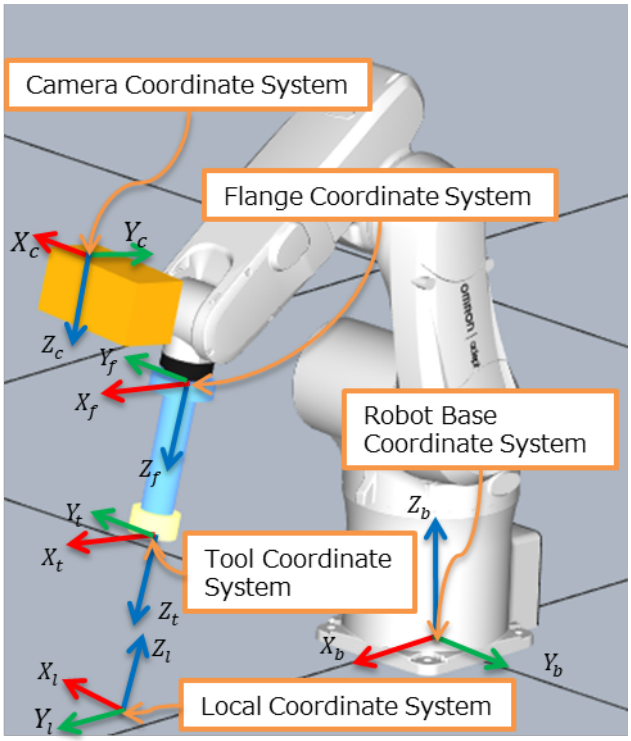
4. Coordinate System

This chapter describes the coordinate system handled by the robot vision application.

4.1. Name of Coordinate System

The robot coordinate system of the Vision Sensor uses the name shown in the table below.

Coordinate System	Meaning
Robot Base Coordinate System	Coordinate system with the robot base as the origin
Local Coordinate System	User-defined coordinate system
Flange Coordinate system	Coordinate system defined on the flange surface of the robot
Tool Coordinate System	The coordinate system is defined in the tool center point by offsetting the origin of the flange coordinates system.
Camera Coordinate System	With the optical center of the camera as the starting point, the X and Y axes are the horizontal and vertical directions of the image, and the Z axis is the optical axis of the camera.



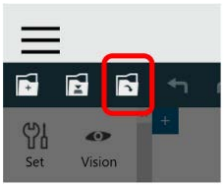
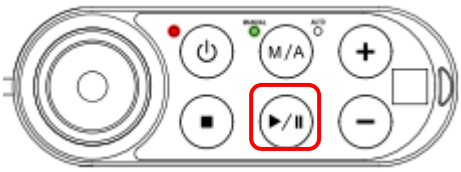
The orientation of the coordinate axes of each coordinate system depends on the robot. Please refer to the instruction manual for each robot.

There are the following differences between the names of the coordinate system in the Vision Sensor and the coordinate system in the OMRON TM series.

Vision Sensor	OMRON TM Series
Local Coordinate System	Base Coordinate System
Tool Coordinate System	Tool Coordinate System

5. How to Start the Setup Program

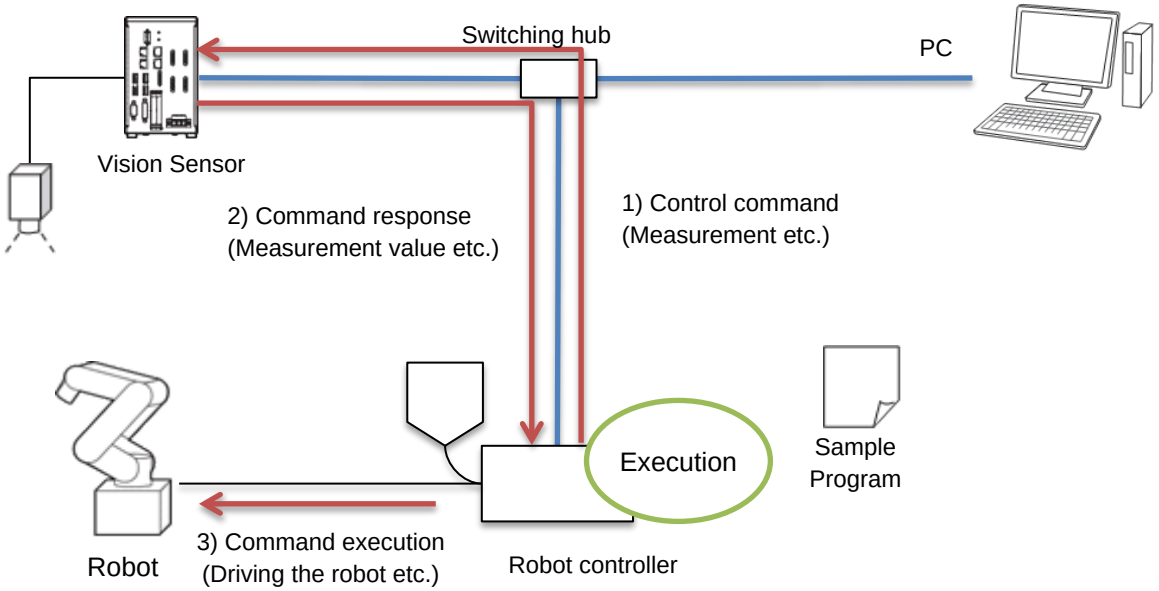
This chapter describes how to start the setup program. To set the robot vision of the Vision Sensor, the setup program must be running on the robot side. Establish the connection between the Vision Sensor and the robot controller by [3. Connecting Vision Sensor to Robot Controller]

1	(Operation of TMflow) Like shown on the right figure, On the project editing screen, click the icon. Select [FHSETUPMAIN] from the list of projects and click [OK] to load the setup program.	 
2	(Operation of Robot Stick) Press the [Play/Pause] button on the robot stick to run the project. When the project is in the running state, the robot's ring will flash green.	

6. Description of the Sample Programs

This chapter describes design examples of robot programs to construct applications using the sample program.

You can understand how to implement a robot program to control the Vision Sensor as shown in the following figure.



The sample program is implemented with the following procedures. When building an actual application, design, implement and test the robot program, utilizing the functions described in Chapter 7.

6.1	Connecting the Vision Sensor to the robot controller
▼	
6.2	Switching scenes on the Vision Sensor
▼	
6.3	Moving the robot to the image position
▼	
6.4	Register the current robot position in the Vision Sensor
▼	
6.5	Executing measurements on the Vision Sensor
▼	
6.6	Getting the measurement results
▼	
6.7	Moving the robot to the robot command position at measurement

The explanation of the sample program is explained using the node name (component) / device name (network) of the TM robot. For the TM S robots, see the table below.

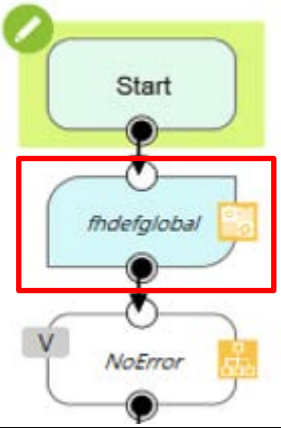
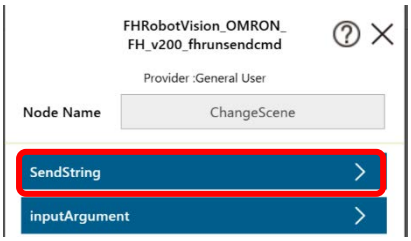
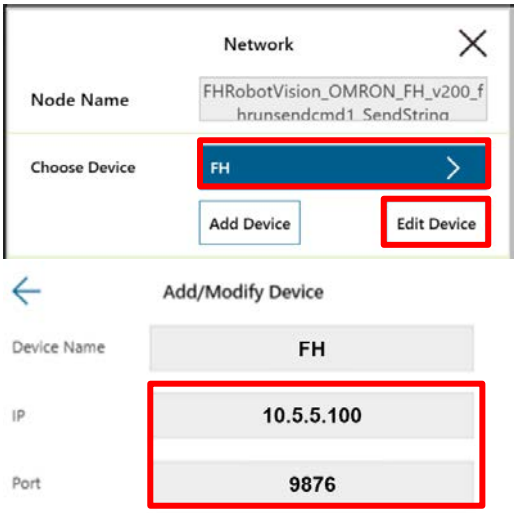
	TM	TM S
Node name (Component)	fhdefglobal	FH_v200_fhdefglobal1
	ChangeScene	FH_v200_fhrunsendcmd1
	RecvResponse	FH_v200_fhrunrecvres1-fhrunrecvres2
	RegistCurPos	FH_v200_fhsampleregpos1
	MEASURE	FH_v200_fhrunsendcmd2
	RecvVal	FH_v200_fhrunrecvval1
Device name (Network)	FH	ntd_FH

Precautions for Correct Use

The implementation procedures for robot programs noted in this chapter are a reference. You should design, implement, and test actually operating robot programs based on your specific environment and applications.
In the Main Window or “Layout setup” of the Vision Sensor, check that the “Output” of the current layout is ON. If the setting were OFF, the Vision Sensor will not output measurement values.

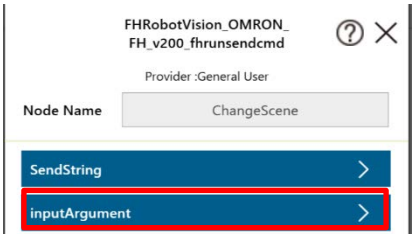
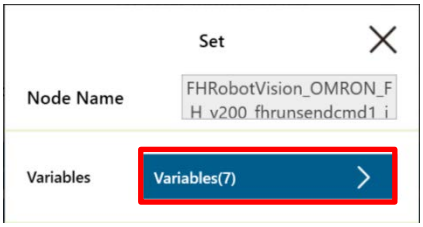
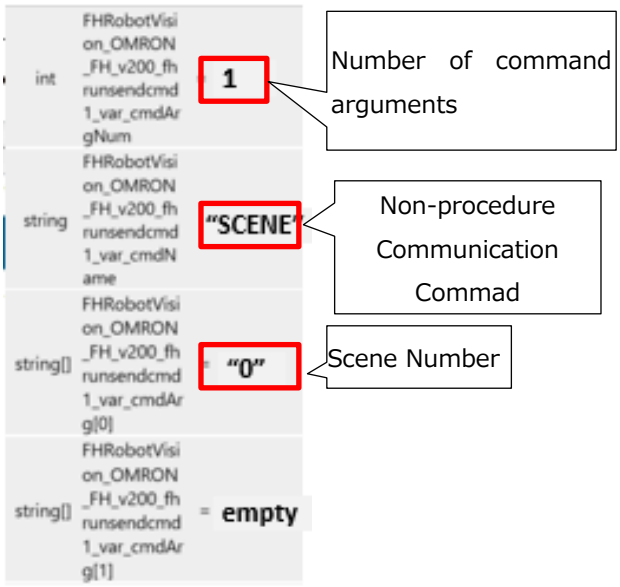
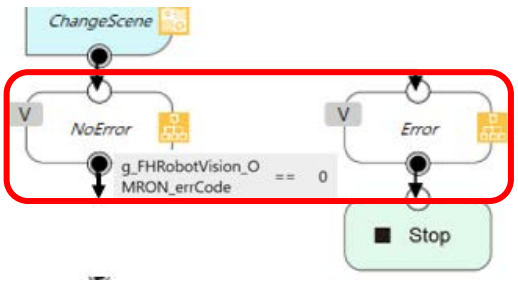
6.1. Initialization of the Sample Program

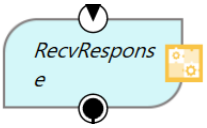
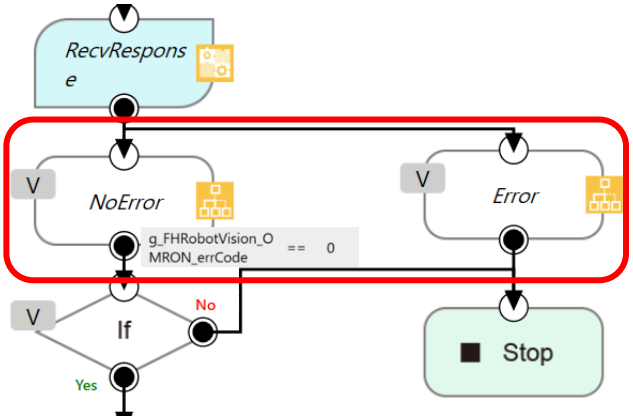
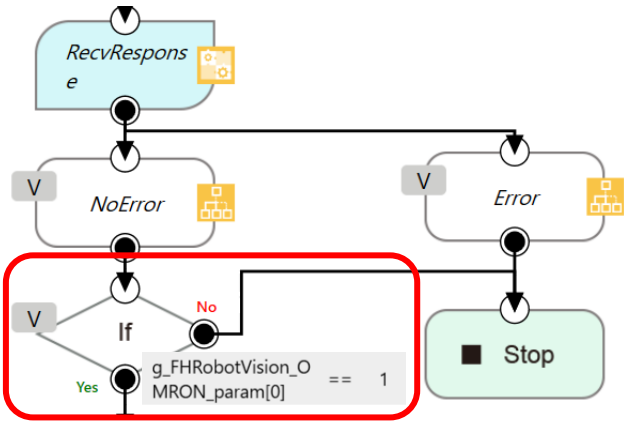
This section describes how to initialize global variables, set the IP address and port number of the Vision Sensor.

1	Open [FHSAMPLEMAIN] sub-flow in the Project Edit page.	
2	The [fhdefglobal] component is placed at the beginning of the flow. This component initializes the global variables needed to communicate with the Vision Sensor.	 fhdefglobal Component
3	Select the ChangeScene node on the flow and click the pencil icon to open the settings dialog box. Click [SendString] and make sure that [Choose Device] is "FH". Click Edit Device and set the IP address and port number of the Vision Sensor. Click [Done] to close the dialog box. The communication device “FH” is commonly used in the sample program. It is not necessary to configure the communication setting for each node.	 fhrunsendcmd Component  

6.2. Switching Scenes on the Vision Sensor

Sends a scene switching command to the Vision Sensor and receives the response to that command.

1	Select the [ChangeScene] node on the flow and click the pencil icon to open the settings screen.	 fhrunsendcmd Component
2	Click [input Argument] to open the configuration dialog box. Click [Variables(7)] to open the Variables configuration dialog box. Make sure that [cmdName] is [SCENE]. Sets the scene number to be used for [cmdArg[0]] argument.	  
3	Check for the error in the [ChangeScene] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode].	

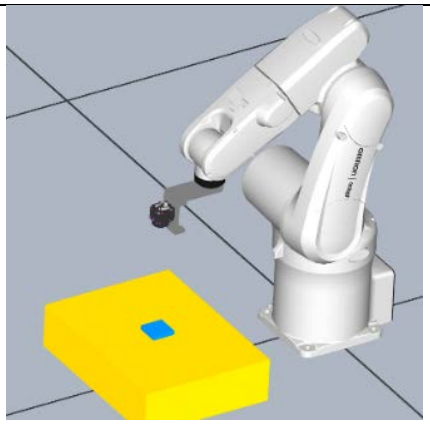
	If the error code is 0 (zero), proceed to the next node.	
4	The [RecvResponse] node receives the response to the scene switching command.	 fhrunrecvres Component
5	Check for the error in the [RecvResponse] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode]. If the error code is 0 (zero), proceed to the next node.	
6	Check the execution result (command response) of the [RecvResponse] node. The result of the execution is stored in the global variable [g_FHRobotVision_OMRON_param[0]]. If the result of the execution is 1 (OK), then proceed to the next node.	

6.3. Moving Robot to Robot Image Position

Move the robot to the imaging position and register the imaging position in the variable.

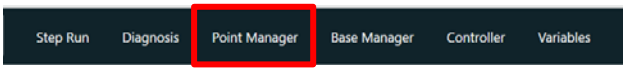
1

Move the robot to the imaging position.

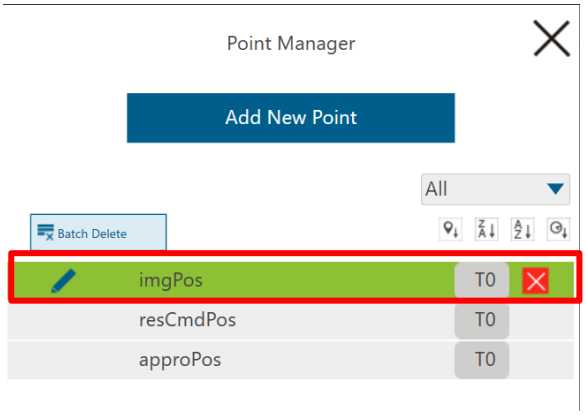


2

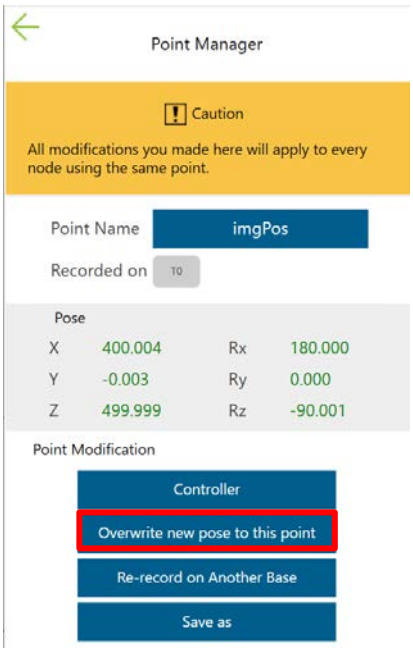
Click [Point Manager] to open the dialog box.



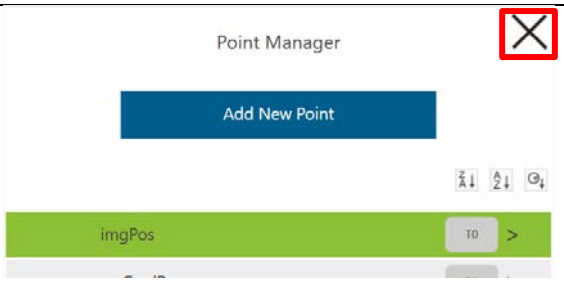
Select [imgPos] and click the pencil icon.



Click [Overwrite new pose to this point] to record the current robot position in [imgPos]



Click [X] to close the Point Manager dialog.



3

At the [imgPos] point node, the robot moves to the imaging position.

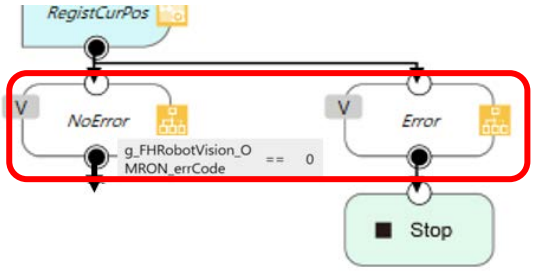
Point Node

⚠WARNING

- These operations drive the robot.
- Operate the robot in the state whereby pressing the [Emergency stop] button can stop its motion anytime.
- In the base list, select [RobotBase] as the current base.
- In the tool list, select [NOTOOL] as the current tool.

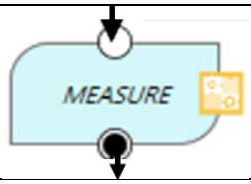
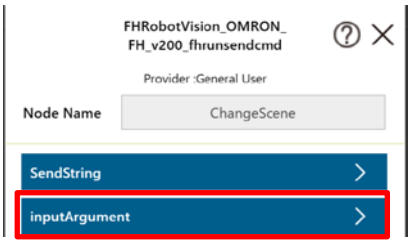
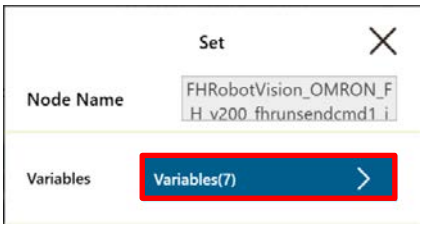
6.4. Register the Current Robot Position in the Vision Sensor

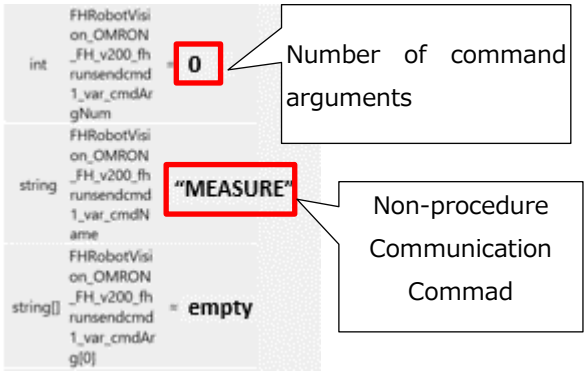
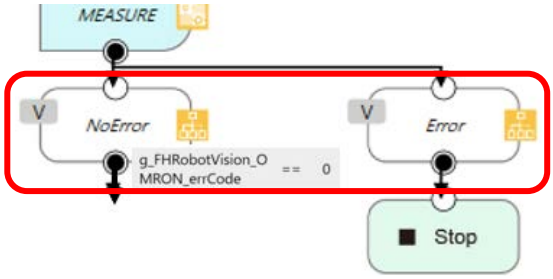
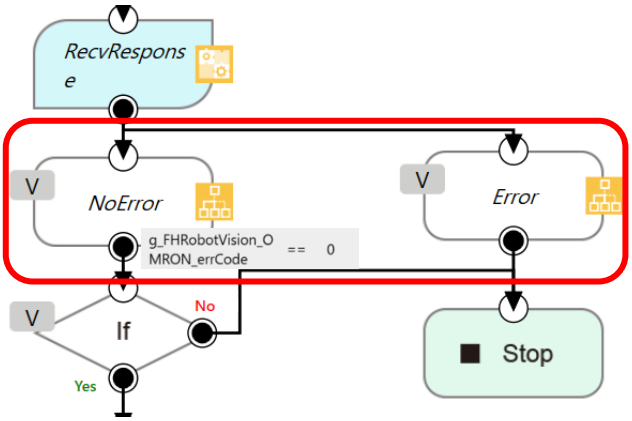
To register the current robot position to the Vision Sensor, use "fhsample_regpos".

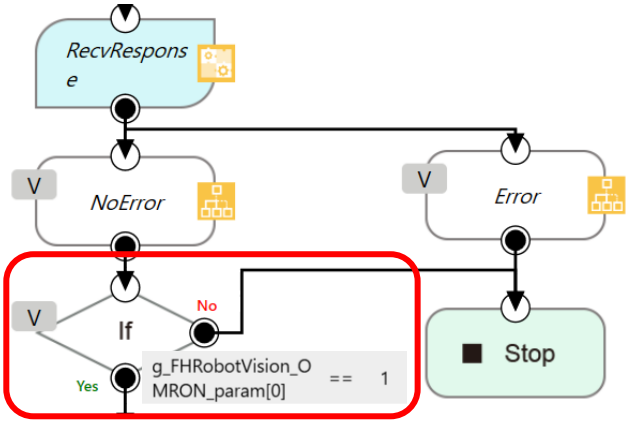
1	The [RegistCurPos] node registers the current robot position to the Vision Sensor.	 fhsample_regpos Component
2	Check for the error in the [RegistCurPos] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode]. If the error code is 0 (zero), proceed to the next node.	

6.5. Executing Measurements on Vision Sensor

Send the measurement command to the Vision Sensor and receives a response to that command.

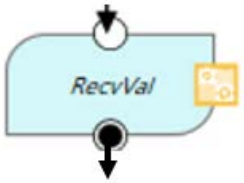
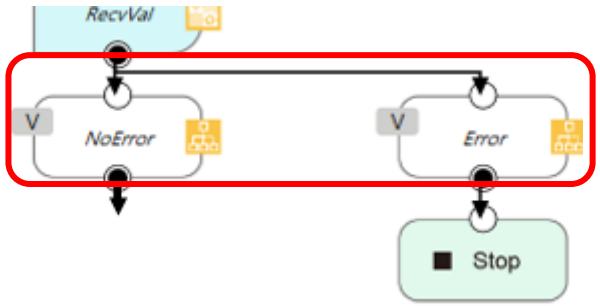
1	Click the [MEASURE] node to open the configuration dialog box.	 fhrunsendcmd Component
2	Click the [inputArgument] to open the configuration dialog box. Click [Variables(7)] to open the Variables configuration dialog box.	 

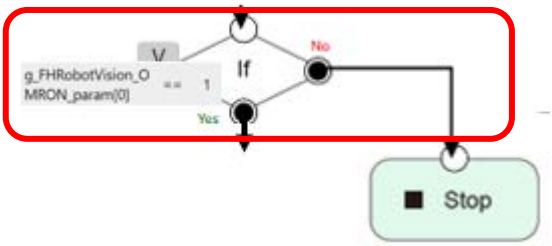
	Make sure that [cmdName] is [MEASURE]. By executing the [MEASURE] node, measurement command is sent to the Vision Sensor.	
3	Check for the error in the [MEASURE] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode]. If the error code is 0 (zero), proceed to the next node.	
4	The [RecvResponse] node receives the response to the measurement command.	 fhrunrecvres Component
5	Check for the error in the [RecvResponse] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode]. If the error code is 0 (zero), proceed to the next node.	

6	Check the execution result (command response) of the [RecvResponse] node. The result of the execution is stored in the global variable [g_FHRobotVision_OMRON_param[0]]. If the result of the execution is 1 (OK), then proceed to the next node.	

6.6. Getting the Measurement Results

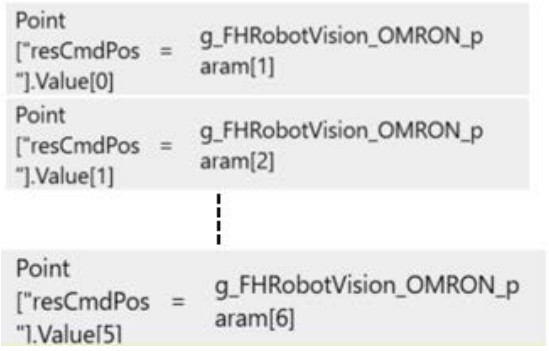
The Vision Sensor measurements are received using "fhrunrecvval". In this sample program, it is assumed that the Vision Sensor measurements are sent in the order "TJG X Y Z W P R".

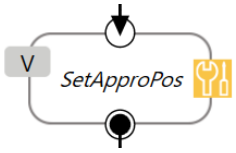
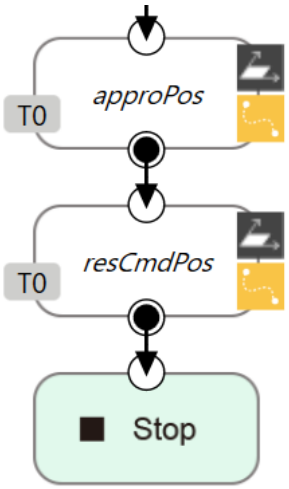
1	The [RecvVal] node receives the measurement result of the Vision Sensor and stores it in the g_FHRobotVision_OMRON_param[0-6]. Each element contains the measurement results as shown in the table on the right.	 fhrunrecvval Componrnt g_FHRobotVision_OMRON_param[0] TJG g_FHRobotVision_OMRON_param[1] X g_FHRobotVision_OMRON_param[2] Y g_FHRobotVision_OMRON_param[3] Z g_FHRobotVision_OMRON_param[4] W g_FHRobotVision_OMRON_param[5] P g_FHRobotVision_OMRON_param[6] R
2	Check for the error in the [RecvResponse] node. The error is stored in the global variable [g_FHRobotVision_OMRON_errCode]. If the error code is 0 (zero),	

	proceed to the next node.	
3	Check the TJG of the Vision Sensor measurement result. The TJG of the Vision Sensor measurement result is stored in the global variable [g_FHRobotVision_OMRON_param[0]]. If TJG is OK (1), proceed to the next node, otherwise exit the program.	

6.7. Moving Robot to Robot Command Position at Measurement

Using the measurement results of the Vision Sensor the robot is moved to Robot Command Position via the approach position.

1	The [SetCmdPos] node sets the results of the Vision Sensor measurements to the point variable [resCmdPos]. You can grip the Robot Command position of the point variable [resCmdPos].	 Set Node 
2	Select the [SetApproDist] node and click the pencil icon to open the Settings dialog box. Click [Variables(1)] and set the approach distance to var_approDist.	 Set Node 

	The approach position is the point of access to the Robot Command position. The approach distance is the offset value in the Z direction(mm) in the robot base coordinate system.	float var_approDist = 30
3	The [SetApproPos] node calculates the approach position by adding the approach distance in the Z+ direction from the robot command position.	 Set Node Point ["approPos"].Value = Point["resCmdPos"].Value Point ["approPos"].Value[2] = Point["approPos"].Value[2] +var_approDist
4	The [aproPos] node moves the robot to the approach position. Then, move to the robot command position [resCmdPos]. At this position, the workpiece can be grasped. The sample program ends after moving to the robot command position.	 Point Node Point Node

⚠WARNING

- These operations drive the robot.
- Operate the robot in the state whereby pressing the [Emergency stop] button can stop its motion anytime.
- In the base list, select [RobotBase] as the current base.
- In the tool list, select [NOTOOL] as the current tool.

7. Component Reference

This chapter describes the functions for building a robot vision application

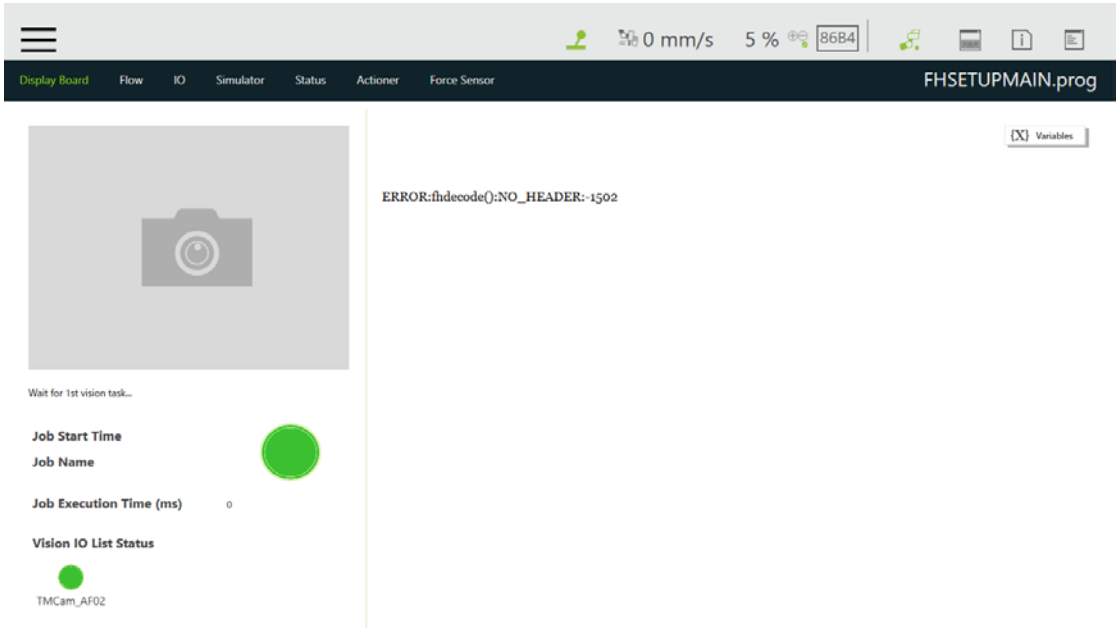
7.1. List of Components

This is a list of functions that can be used by the actual driving robot program.

Component Name	Description	Reference
fhdefglobal	Initialize a global variable.	Chapter 7.3.1
fhsampleregpos	Register the current robot coordinates to the Vision Sensor	Chapter 7.3.2
fhrunsendcmd	Send a no-procedure command to the Vision Sensor	Chapter 7.3.3
fhrunrecvres	Receive a command response from the Vision Sensor	Chapter 7.3.4
fhrunrecvval	Receive numerical data from the Vision Sensor	Chapter 7.3.5

7.2. Error Message

The error message will be displayed on the DisplayBoard of TMflow.



7.3. Component Details

7.3.1. fhdefglobal

■ Function

Initialize a global variable.

■ Input Parameters

None

■ Output Parameters

None

■ Exit Process

This component has one exit node as follows

NoError : Normal termination.

■ Remarks

Define the global variables that are necessary to use the robot application.

■ Return Value

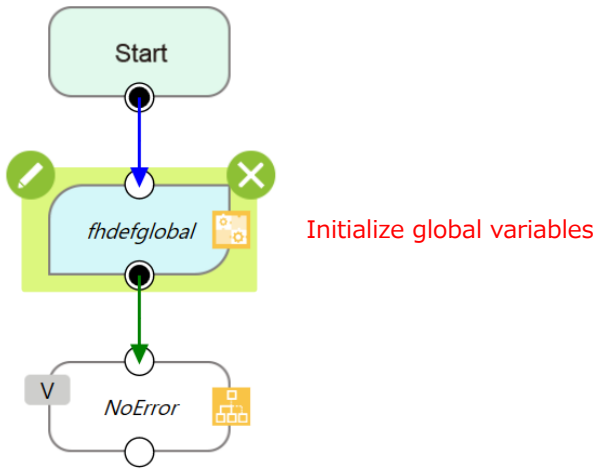
None

■ Precautions

Be sure to call this function before using any other function.

■ Example

The following example initializes a global variable.



7.3.2. fhsampleregpos

■ Function

Register the current robot position to the Vision Sensor.

■ Input Parameters

Setting Node	Setting Target	Data Type	Description
SendString	ChooseDevice	device	Communication Settings for the Vision Sensors
	WaitTime	int	Communication waiting time(ms)
RecvString	ChooseDevice	device	Communication Settings for the Vision Sensors
	WaitTime	int	Communication waiting time(ms)

■ Output Parameters

None

■ Exit Process

There are two exit nodes in this component as follows

NoError : Normal termination.

Error : Abnormal termination (Please check the message displayed in the view window.)

■ Remarks

Get the current position of the robot in accordance with the selected coordinate system number and register the current position to the Vision Sensor.

Return an error if this function is called while the Vision Sensor is not connected.

Returns an error if a response of current position registration failure is received from the Vision Sensor.

■ Return value

Err. No.	Error Message	Description
0	-	normal termination
-1800	ERROR:fhsampleregpos():Trigger NG:-1800	Response NG
-1601	ERROR:fhsendstring():NO_DATA:-1601	Send string length 0
-1601	ERROR:fhsendstring():NO_CONNECT:-1601	Unconnected state
-1602	ERROR:fhsendstring():STRING_LEN:-1602	Send string length over
-1301	ERROR:fhrecvstring():NO_CONNECT-1301	Unconnected state

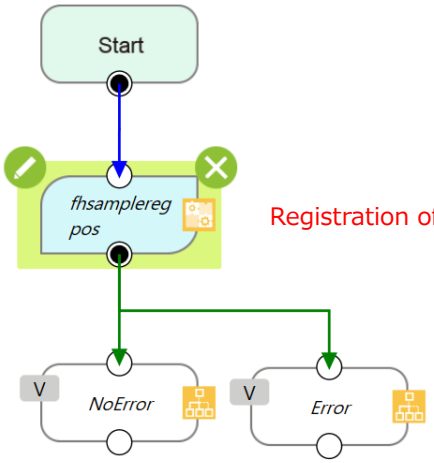
-1301	ERROR:fhrecvstring():NO_DATA:-1301	Receive data length 0
-1302	ERROR:fhrecvstring():STRING_LEN:-1302	Receive data length over

■ Precautions

None

■ Example

In the following example, the current robot position is registered to the Vision Sensor.



Registration of the current robot position in the Vision Sensor

7.3.3. fhrunsendcmd

■ Function

Send a no-procedure command to the Vision Sensor

■ Input Parameters

Setting Node	Setting Target	Data Type	Description
SendString	ChooseDevice	device	Communication Settings for the Vision Sensors
	WaitTime	int	Communication waiting time(ms)
inputArgument	cmdArgNum	int	Number of no-procedural command arguments to be sent to the Vision Sensor (0 to 5)
	cmdName	String	No-procedural commands to be sent to the Vision Sensor
	cmdArg[0]	String	Argument 1 of the no-procedure command sent to the Vision Sensor(string).
	cmdArg[1]	String	Argument 2 of the no-procedure command sent to the Vision Sensor(string).
	cmdArg[2]	String	Argument 3 of the no-procedure command sent to the Vision Sensor(string).
	cmdArg[3]	String	Argument 4 of the no-procedure command sent to the Vision Sensor(string).
	cmdArg[4]	String	Argument 5 of the no-procedure command sent to the Vision Sensor(string).

■ Output Parameters

None

■ Exit Process

There are two exit nodes in this component as follows

NoError : Normal termination.

Error : Abnormal termination (Please check the message displayed in the view window.)

■ Remarks

Sends a no-procedure command to the Vision Sensor, concatenating the parameters according to the following format.

If the number of no-protocol command arguments is out of the input range, an error is returned.

<Format>

No-protocol command	SP(*1)	Command argument 1	SP	Command argument 1	SP	…	Command argument n(*2)

*1: “SP” is space

*2: The command argument n depends on the number of non-procedural command arguments.

■ Return Value

Err. No.	Error Message	Description
0	-	normal termination
-1506	ERROR:fhrunsendcmd():Invalid Command Argument No.:-1506	The number of non-procedural command arguments is out of the input range.
-1601	ERROR:fhsendstring():NO_CONNECT:-1601	Unconnected state
-1601	ERROR:fhsendstring():NO_DATA:-1601	Send string length 0
-1602	ERROR:fhsendstring():STRING_LEN:-1602	Send string length over

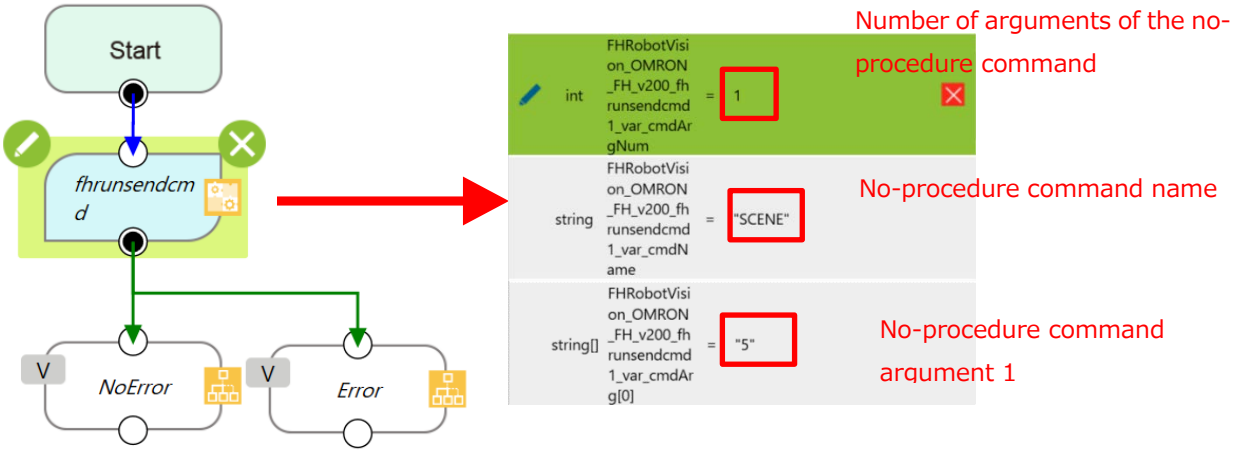
■ Precautions

The length of the string of the no-stepping command that can be sent is 127 bytes (not including the delimiter).

Set the input parameters so that the string length of the no-procedure command does not exceed 127 bytes.

■ Example

In the following example, we will switch to scene number 5.



7.3.4. fhrunrecvres

■ Function

fhrunrecvres

■ Input Parameters

Setting Node	Setting Target	Data Type	Description
RecvString	ChooseDevice	device	Communication Settings for the Vision Sensors
	WaitTime	int	Communication waiting time(ms)

■ Output Parameters

Variable Name	Data Type	Description
g_FHRobotVision_OMRON_param	float[]	param[0] : Command Response Results (1: Command response "OK" - 1: other than "OK")
g_FHRobotVision_OMRON_errCode	int	Execution Result(0: Normal termination Other than 0: Error)

■ Exit Process

There are two exit nodes in this component as follows

NoError : Normal termination.

Error : Abnormal termination (Please check the message displayed in the view window.)

■ Remarks

Receive the response (command response) to the no-procedure command sent to the Vision Sensor.

If the command response is OK, assign 1 to the global variable g_FHRobotVision_OMRON_param[0].

If the command response is not OK, assign "-1" to the global variable g_FHRobotVision_OMRON_param[0].

■ Return Value

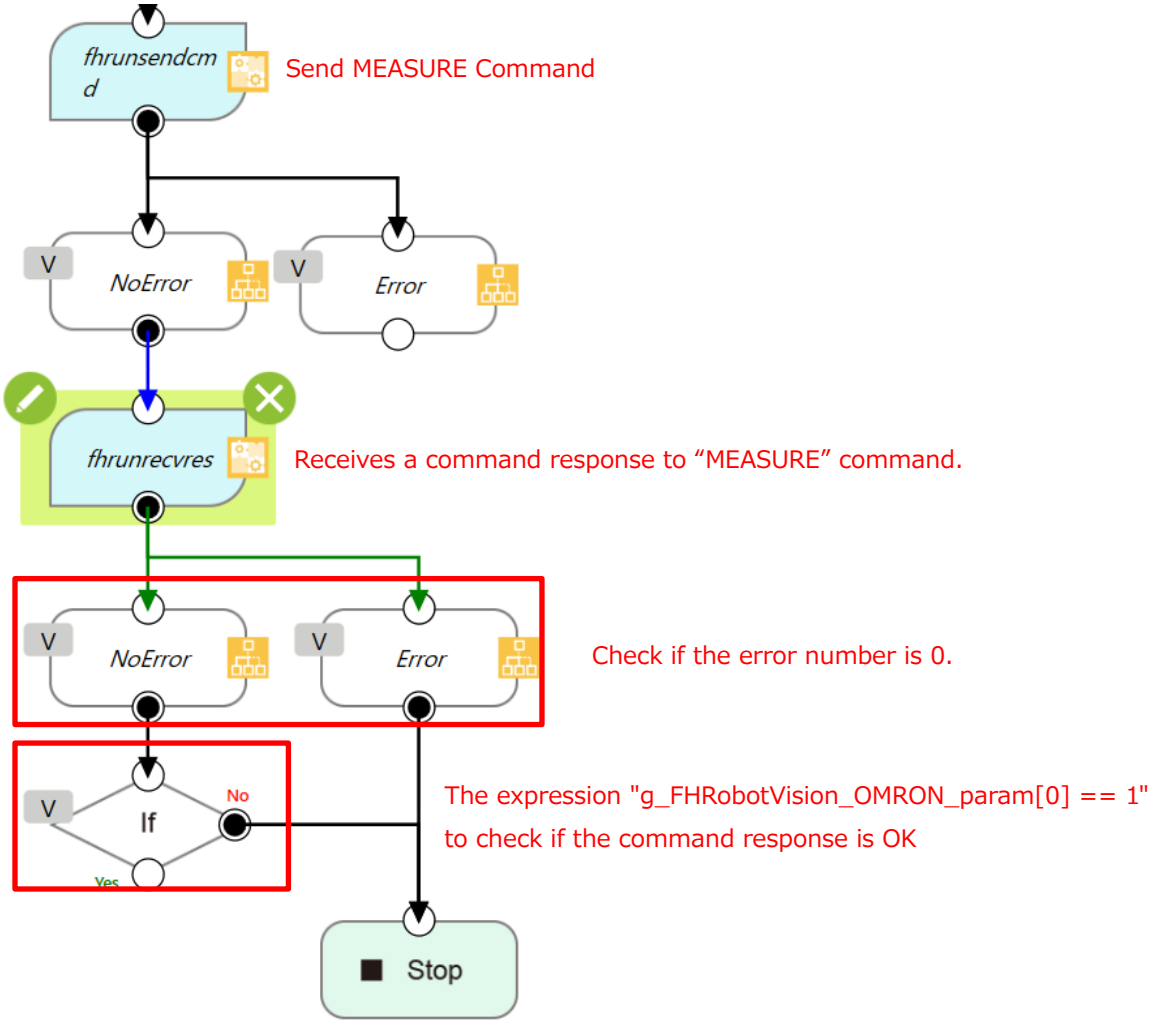
Err. No.	Error Message	Description
0	-	normal termination
-1301	ERROR:fhrecvstring():NO_CONNECT:-1301	Unconnected state
-1301	ERROR:fhrecvstring():NO_DATA:-1301	Receive data length 0
-1302	ERROR:fhrecvstring():STRING_LEN:-1302	Receive data length over

■ Precautions

None

■ Example

In the following example, the response to the measurement command is received and if the command response is not OK, the program is terminated.



7.3.5. fhrunrecvval

■ Function

Receive numerical data from the Vision Sensor

■ Input Parameters

Setting Node	Setting Target	Data Type	Description
RecvString	ChooseDevice	device	Communication Settings for the Vision Sensors
	WaitTime	int	Communication waiting time(ms)

■ Output Parameters

Variable Name	Data Type	Description
g_FHRobotVision_OMRON_param	float[]	param[0] - param[9] : Received numeric data 0 - 9)
g_FHRobotVision_OMRON_errCode	int	Execution Result(0: Normal termination Other than 0: Error)

■ Exit Process

There are two exit nodes in this component as follows

NoError : Normal termination.

Error : Abnormal termination (Please check the message displayed in the view window.)

■ Remarks

This function stores the numerical data sent from the Vision Sensor into the global variable "g_FHRobotVision_OMRON_param".

This function outputs up to 10 values.

If there are more than 11 numbers, this function outputs only the first 10.

If the length of the segmented string is longer than 12 bytes, this function returns an error of abnormal parameter length.

Returns an error if the number of numeric data is zero.

The following is an example of the output when a string is included.

<Conversion example>

The string before conversion	The result of the analysis after conversion
abc	0
123abc	123
abc123	0
1.00E+03	1000

■ Return Value

Err. No.	Error Message	Description
0	-	normal termination
-1301	ERROR:fhrecvstring():NO_CONNECT:-1301	Unconnected state
-1301	ERROR:fhrecvstring():NO_DATA:-1301	Receive data length 0
-1302	ERROR:fhrecvstring():STRING_LEN:-1302	Receive data length over

■ Precautions

The maximum length of the string to be received is 127 bytes (not including the delimiter). if more than 128 bytes are received, an error is returned.

The measurement result received from the Vision Sensor will be stored in the g_FHRobotVision_OMRON_param.

To get the measurement result with this function, Result Output (Message) must be placed in the flow, and the settings must be as follows

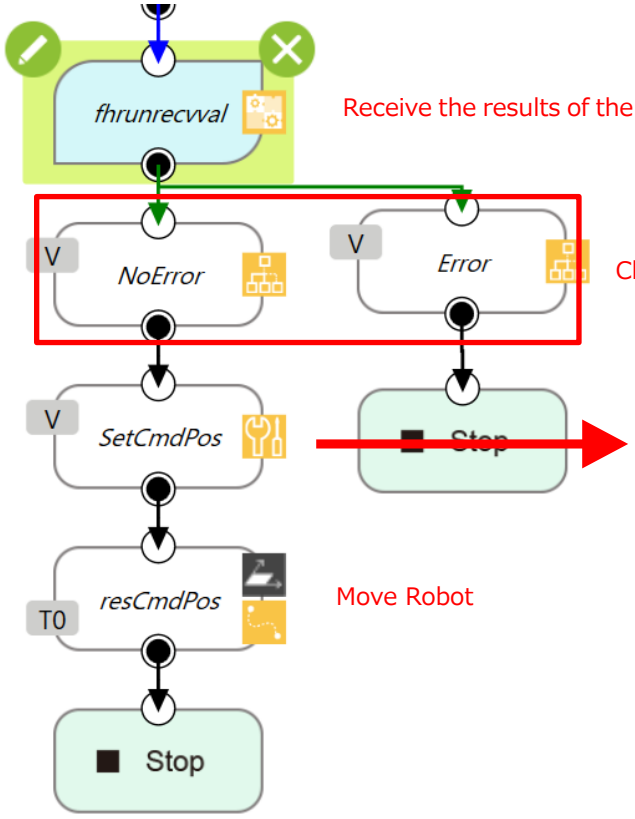
Result Output (Message) Processing Item		The destination of the received measurement results
Setting Target	Setting details	
Output device	IoModule2: Serial (Ethernet)	-
Termination string	\r (Carriage Return)	-
Delimiter string	\x20 (Space)	-
Output Data 0 - 9	numerical data(*1)	g_FHRobotVision_OMRON_param [0] - g_FHRobotVision_OMRON_param [9]

*1: The output data format should be set as follows

- Data type: Number
- Digits of integer: 6
- Digits of decimal: 4

■ Example

In the following example, the robot moves after receiving the measurement result of the Vision Sensor (grasping position X, Y, Z, W, P, R).



Receive the results of the Vision Sensor measurements

Check if the error number is 0.

Move Robot

Store the received results in a Point

Point ["resCmdPos "].Value[0]	=	g_FHRobotVision_OMRON_param[0]
Point ["resCmdPos "].Value[1]	=	g_FHRobotVision_OMRON_param[1]
Point ["resCmdPos "].Value[2]	=	g_FHRobotVision_OMRON_param[2]
Point ["resCmdPos "].Value[3]	=	g_FHRobotVision_OMRON_param[3]
Point ["resCmdPos "].Value[4]	=	g_FHRobotVision_OMRON_param[4]
Point ["resCmdPos "].Value[5]	=	g_FHRobotVision_OMRON_param[5]

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