

# Omron TM Collaborative Robot: Conveyor Tracking

**User's Manual** 



**Original Instruction** 

I853-E-03

This Manual contains information of the Techman Robot product series (hereinafter referred to as the TM AI Cobot). The information contained herein is the property of Techman Robot Inc. (hereinafter referred to as the Corporation). No part of this publication may be reproduced or copied in any way, shape or form without prior authorization from the Corporation. No information contained herein shall be considered an offer or commitment. It may be subject to change without notice. This Manual will be reviewed periodically. The Corporation will not be liable for any error or omission.

Mark are the registered trademarks of Techman Robot Inc., The Company reserves the ownership and copyright of this Instruction and its copies.

# **Terms and Conditions Agreement**

#### Warranty Limitations of Liability

#### Warranties

• Exclusive Warranty

Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

#### Limitations

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right.

#### Buyer Remedy

Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

See http://www.omron.com/global/ or contact your Omron representative for published information.

#### Limitation of Liability; Etc

OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

#### **Application Considerations**

#### Suitability of Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

#### Programmable Products

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

#### Disclaimers

#### Performance Data

Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

#### • Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron representative at any time to confirm actual specifications of purchased Product.

#### Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

# Contents

Revision History Table	8
2. Introduction	9
2.1 Scope of Use	9
2.2 Limitations of Use	9
2.3 Warning and Caution Symbols	10
2.4 Safety Precautions	10
2.5 Validation and Liability	11
2.6 Statement of Responsibilities for Cyersecurity Threats	11
2.7 Limitation of Liability	12
2.8 Functional Note Symbols	12
3. Hardware Requirements	13
3.1 TM Dongle	13
3.2 Applicable EtherCAT Coupler and Encoder Modules	13
3.3 Code Wheel	14
3.4 Camera	14
3.4.1 Lens	15
3.5 Reference Guide for Light Source Setup	15
3.6 Sensor	15
3.7 Light Box Design Reference	16
3.8 Hardware Connection Diagram	16
4. Operating Guide	17
4.1 Sensor Mode	17
4.2 ETH Mode	18
5. Software Functions	19
5.1 Conveyor Tracking Setting	19
5.1.1 Encoder Setting	19
5.1.2 Boundary Setting	20
5.1.3 Advanced Setting	21
5.2 CVSensor1	22
5.3 Main Thread Nodes	24
5.3.1 CVNewObj Node	24
5.3.2 CVPoint Node	24
5.3.3 CVCircle Node	28
6. Quick Walk-Through	
6.1 Sensor Mode	30
6.2 ETH Mode	36

# Tables

Table 1: Applicable EtherCAT coupler models	13
Table 2: Applicable Encoder Modules	13
Table 3: Camera	15

# Figures

Figure 1: Code wheel	14
Figure 2: Hardware connection diagram	16
Figure 3: Create new project	17
Figure 4: Sensor Mode diagram	18
Figure 5: ETH Mode diagram	18
Figure 6: Conveyor Tracking Setting	19
Figure 7: Encoder setting	20
Figure 8: Boundary setting	21
Figure 9: Advanced Setting	22
Figure 10: CVSensor	23
Figure 11: Sensor calibration	23
Figure 12: CVNewObj	24
Figure 13: CVPoint	26
Figure 14: Teach	27
Figure 15: Get Point	28
Figure 16: Get Point	29
Figure 17: Create new project	30
Figure 18: Start the project	31
Figure 19: Conveyor Tracking Setting	31
Figure 20: CVSensor	32
Figure 21: Sensor calibration	33
Figure 22: Point Node	33
Figure 23: Select conveyor number	33
Figure 24: Set CVNewObj	34
Figure 25: Select conveyor number and path	34
Figure 26: CVPoint	34
Figure 27: Teach	35
Figure 28: Get Point	35
Figure 29: Form a loop	36
Figure 34: Open new project	40
Figure 35: Sub-thread	41

Figure 36: Vision Job	41
Figure 37: Input vision job name	42
Figure 38: Load workspace	42
Figure 39: Pattern matching	43
Figure 40: Confirm "FIND" pattern	44
Figure 41: Save vision task	44
Figure 42: Check vison job on list	44
Figure 43: Point Node	45
Figure 44: Select conveyor	45
Figure 45: Set CVNewObj	45
Figure 46: Set conveyor for CVPoint	46
Figure 47: Set path	46
Figure 48: Get Point	47
Figure 49: Form a loop	47

# **Revision History Table**

Revision	Date	Revised Content
01	April, 2020	Original release
02	August, 2020	Added 1.80 features
03	June, 2023	Added 2.0 features

### 1. Introduction

TM Conveyor Tracking can obtain the position and motion of the object on a conveyor using vision and/or a sensor. The conveyor tracking software runs on TMflow and comes with the Sensor Mode and ETH mode. The Sensor Mode is the default function mode and does not require a license dongle to activate it.

To activate the Sensor Mode on TM Conveyor Tracking, users shall open a TM Conveyor Tracking project and use the features of the mode. To activate the ETH mode, however, users shall insert the TM Dongle they have purchased into any USB port on the control box. Be careful that during editing, trial runs or operation, the signal cable must remain connected to the control box. Otherwise, the project cannot be edited or the robot may stop. Under the ETH mode, the license dongle must remain inserted in the control box.

#### 1.1 How Can I Get Help?

You can access information sources on the corporate website: <a href="http://www.ia.omron.com/">http://www.ia.omron.com/</a>

#### 1.2 Scope of Use

- 1. A single robot can support two conveyors.
- Conveyor speed < 300 mm/s, average precision±1 mm (when the workpiece angle variation within±15°).</li>

#### 1.3 Limitations of Use

Note

- Functional mode combination per robot: Sensor Mode + Sensor Mode or ETH Mode + Sensor Mode for maximum two conveyors (ETH +ETH is not supported, and ETH mode requires use of license dongle)
- 2. Does not support two robots using one single Encoder + EtherCAT IO
- 3. Only supports linear conveyor (Does not support circular conveyor).
- 4. Does not support multiple types of objects.

#### NOTE:

The precision specifications in this manual only serves as reference. Upon the actual completion of automation setting, the precision specifications and calibration accuracy are influenced by environmental factors, workpiece variation, visual patterns, editing, and conveyor stability. Users still need to take actual tests.

This manual applies to TMflow Version 2.14 or later. There may be differences between the functions and interfaces of different software versions. Confirm the software version before using and reading this manual. To confirm the software version, click at the top right of the screen for the information.

#### 1.4 Warning and Caution Symbols

The Table below shows the definitions of the warning and caution levels used in our manuals. Pay close attention to them when reading each paragraph, and observe them to avoid personal injuries or equipment damage.



#### DANGER:

Identifies an imminently hazardous situation which, if not avoided, is likely to result in serious injury, and might result in death or severe property damage.



#### WARNING:

Identifies a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, and might result in serious injury, death, or significant property damage.



#### CAUTION:

Identifies a potentially hazardous situation which, if not avoided, might result in minor injury, moderate injury, or property damage.

#### 1.5 Safety Precautions



#### DANGER:

This product can cause serious injury or death, or damage to itself and other equipment, if the following safety precautions are not observed:

• All personnel who install, operate, teach, program, or maintain the system must read the *Hardware installation Manual*, *Software Manual*, and *Safety Manual* according to the software and hardware version of this product, and complete a training course for their responsibilities in regard to the robot.



Read Manual Label; Impact Warning

- All personnel who design the robot system must read the *Hardware installation Manual*, *Software Manual*, and *Safety Manual* according to the software and hardware version of this product, and must comply with all local and national safety regulations for the location in which the robot is installed.
- The TM AI Cobot must be used for its intended use.
- Results of the risk assessment may require the use of additional risk reduction measures.
- Power to the robot and its power supply must be locked out and tagged out or have means to control hazardous energy or implement energy isolation before any maintenance is performed.

Dispose of the product in accordance with the relevant rules and regulations of the country or area where the product is used.

#### 1.6 Validation and Liability

The information contained herein neither includes how to design, install, and operate a complete robotic arm system, nor involves the peripherals which may affect the safety of the complete system. The integrators of the robot should understand the safety laws and regulations in their countries and prevent hazards from occurring in the complete system.

This includes but is not limited to:

- Risk assessment of the whole system
- Adding other machines and additional risk reduction measures based on the results of the risk assessment
- Using appropriate software safety features
- Ensuring the user will not modify any safety measures
- Ensuring all systems are correctly designed and installed
- Clearly labeling user instructions
- Clearly marked symbols for installation of the robot arm and the integrator contact details
- Making accessible relevant documents, including the risk assessment and this Manual



#### CAUTION:

This product is a partly complete machine. The design and installation of the complete system must comply with the safety standards and regulations in the country of use. The user and integrators of the robot should understand the safety laws and regulations in their countries and prevent major hazards from occurring in the complete system.

#### 1.7 Statement of Responsibilities for Cyersecurity Threats

To maintain the security and reliability of the system, a robust cybersecurity defense program should be implemented, which may include some or all of the following:

#### Anti-virus protection

- Install the latest commercial-quality anti-virus software on the computer connected to the control system and keep the software and virus definitions up-to-date.
- Scan USB drives or other external storage devices before connecting them to control systems and equipment.

#### Security measures to prevent unauthorized network access

- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.

- Install firewalls to block unused communications ports and limit communication between systems. Limit access between control systems and systems from the IT network.
- Control remote access and adopt multifactor authentication to devices with remote access to control systems and equipment.
- Set strong password policies and monitor for compliance frequently.

#### Data input and output protection

- Backup data and keep the data up-to-date periodically to prepare for data loss.
- Validate backups and retention policies to cope with unintentional modification of input/output data to control systems and equipment.
- Validate the scope of data protection regularly to accommodate changes.
- Check validity of backups by scheduling test restores to ensure successful recovery from incidents.
- Safety design, such as emergency shutdown and fail-soft operations in case of data tampering and incidents.

#### Additional recommendations

- When using an external network environment to connect to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering.
- You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.
- When constructing network infrastructure, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment.
- Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.
- When using devices equipped with an SD Memory Card, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing or unmounting the media.

#### 1.8 Limitation of Liability

No safety-related information shall be considered a guarantee by the Corporation that a TM AI Cobot will not cause personnel injury or property damage.

#### 1.9 Functional Note Symbols

**IMPORTAN** 

The following table defines the functional note symbols used in this manual. Read the paragraphs carefully.

#### IMPORTANT:

This symbol indicates the relevant functional details to assist programming and use.



This symbol indicates the relevant functional use tips to assist programming efficiency.

# 2. Hardware Requirements

2.1 TM Dongle

Use the purchased TM Dongle to activate ETH Conveyor Tracking function.

#### 2.2 Applicable EtherCAT Coupler and Encoder Modules

Refer to tables below regarding compatible EtherCAT couplers and encoder modules.

EtherCAT	VIPA:	Beckoff:	OMRON:	OMRON:	OMRON:
Coupler Model	053 -1EC00	EK1100	NX-ECC201	NX-ECC202	NX-ECC203
Rated voltage	DC24 V	DC24 V	DC24 V	DC24 V	DC24 V
Rated current	950mA	570mA	417mA	417mA	417mA
Support		Beckoff:		OMRON:	
Encoder Module	VIPA:		NX-EC0112/NX-E	C0122/NX-EC013	32/NX-EC0142/ NX-
Model	050-1BA00	EL5151/EL5152	E	EC0212/NX-EC02	22

Table 1: Applicable EtherCAT coupler models

Encoder	VIPA: 050-	Beckoff:	OMRON:	OMRON:	OMRON:	OMRON:	OMRON:	OMRON:
Module	1BA00	EL5151/	NX-EC0112	NX-EC0122	NX-EC0132	NX-EC0142	NX-EC0212	NX-EC0222
Model		EL5152						
Rated voltage	DC24 V	DC24 V	DC24 V	DC24 V	DC24 V	DC24 V	DC24 V	DC24 V
Rated current	75mA	130mA	35 mA	39 mA	39 mA	44 mA	35 mA	39 mA
Number of encoder	1	1or2	1	1	1	1	2	2
ON voltage	15-28.8V	15-30V	19.6-28.8V	19.6-28.8V	19.6-28.8V	19.6-28.8V	19.6-28.8V	19.6-28.8V
OFF voltage	0-5V	0-5V	0-4V	0-4V	0-4V	0-4V	0-4V	0-4V

Table 2: Applicable Encoder Modules



#### 2.3 Code Wheel

Reference specifications: wheel resolution 300  $\,$  mm  $\,$  ( or 95.49 mm in diameter )  $^{\circ}$ 

\*If a different sized wheel is used, go to **4.1.1 Encoder Setting** to adjust the parameters for perimeters.

Make sure that the code wheel is flat against the conveyor to ensure its accuracy.



Figure 1: Code wheel

#### 2.4 Camera

For detailed information about the cameras, please visit the official website of the cameras.

Specifications	Camera				
Model	Basler acA2440-20gc Basler acA2500-20gc		Basler acA2500-14gc		
Shutter		Rolling			
Sensor	Color 2/3 inch Color 1 inch		Color 1/2.5 inch		
Connection interface	GigE interface				
Remark	When conveyor speed < 300When conveyor speed < 300mm/s, the average tolerancemm/s, the average tolerance is $\pm 1$ is $\pm 1$ mm.mm.		Rolling shutter camera is recommended to be used at low speed (conveyor speed < 100 mm/s) and when precision requirement is lower.		

#### Table 3: Camera



#### **IMPORTANT**:

Techman Robot Inc. is not liable for any incompatibility issue due to use of equipment not listed above.

#### 2.4.1 Lens

It is strongly recommended to use an industrial-grade C/CS Mount lens. The lens focal distance should be set based on the real-world applications.

Lens selection example (object is 500 mm away from the camera)

Reference for calculation:

- When using a 12 mm lens, the field is 232 x 174 mm<sup>2</sup>; pixel resolution is 232/2590 ~ 0.09 mm /pixel.
- When using an 8 mm lens, the field is 351 x 263 mm<sup>2</sup>; pixel resolution is 351/2590 ~ 0.14 mm /pixel.

#### 2.5 Reference Guide for Light Source Setup

To obtain decent image quality and rapid imaging time, it is strongly recommended that the light source intensity of the image range can reach to 2500 Lux, with uniformity higher than 90% to avoid light reflection.

At light levels below 2500 LUX, it may be necessary to increase the camera exposure time and decrease the conveyor belt speed.

For example (when the camera is 500 mm from the focus object):

When the light intensity is 2500 Lux, exposure time setting should be set as 0.5 ms, and the conveyor speed shall be set to 300 mm/sec;

# Note

#### Calculation of Uniformity :

Divide the camera field into a  $3 \times 3$  grid as in the following figure. Measure the brightness in the center of each cell and obtain the maximum and minimum value,



Substitution :

Jniformity = 
$$\left|1 - \frac{(Max - Min)}{(Max + Min)}\right| \times 100\%$$

#### 2.6 Sensor

Choose the most appropriate sensor based on the object material that needs to be detected.

When using Sensor Mode, it is strongly recommended using the official TM AI Cobot Calibration Set for positioning. When setting CVPoint is required, switch back to the specific tool for your application.



NOTE:

To purchase TM Calibration Set, contact your local distributor or dealership.

#### 2.7 Light Box Design Reference

For relevant details about reference design of light box, contact your local distributor or dealership.

#### 2.8 Hardware Connection Diagram

The diagram below shows the recommended hardware connection.

For details about the supply voltage of the power socket, refer to the robot in use.





# 3. Operating Guide

Under the Sensor Mode, click **New > New Flow** on the top-left corner of TMflow, click **Conveyor Tracking** and select **Conveyor\_0** (using only one conveyor) or **Conveyor\_1** (using two conveyors), then choose **Sensor Mode** to create a conveyor tracking project. To use the ETH mode, insert the TM dongle into the control box before activating TMflow, and after TMflow is activated, click **New > New Flow > Conveyor Tracking > Conveyor\_0** or **Conveyor\_1 > ETH Mode** to create a conveyor tracking project.

#### Select "Conveyor\_0" or "Conveyor\_1"

- Conveyor\_0: application requires only one conveyor
- Conveyor\_1: application requires two conveyors



#### **IMPORTANT**:

To start any new Conveyor Tracking project with one connected conveyor, choose **Conveyor\_0** or **Conveyor\_1**.

TM Conveyor Tracking supports two operating modes:

- **Sensor Mode**: detect the objects passing through the sensor beam (default mode)
- ETH Mode: obtain object position through camera imaging (requires a license dongle)

New File	
File Name	
Create As	
Project Cor	nponent Editor
Conveyor Tracking	
Conveyor_0	
ETHMode (	SensorMode
Conveyor_1	
	SensorMode
Cancel	Open

#### Figure 3: Create new project

#### 3.1 Sensor Mode

Sensor Mode consists of a robot and external sensors. The sensor will detect objects passing through the sensor beam. Application diagram of Sensor Mode is presented in Figure 4.



Figure 4: Sensor Mode diagram

#### 3.2 ETH Mode

ETH Mode is composed of a robot, an external camera, and light sourcing devices. Application diagram of ETH Mode is shown in Figure 5.



Figure 5: ETH Mode diagram

\* Currently, TM Conveyor Tracking only supports Sensor Mode by default. For purchase of ETH Mode license, consult with your local representatives.

# 4. Software Functions

#### 4.1 Conveyor Tracking Setting

After opening the Conveyor Tracking project, click the pencil icon of the Start Node to set the encoder parameters, working boundary, camera and advanced conveyor parameters such as vectors. Further description will be discussed in the following.

File 🗸 🛛 Manager 🗸 🛛 Pro	ject function 🗸   🦱 🦳 🖙 🔍 🖼 🖲	🕄 🖳 D Robotliase 🗸 🛃 e recition. 🗸
Node List	Conveyor Tracking Setting	× × ×
Motion 🗸	Conveyor Pracking Setting	CV Tool
Logic 🗸 🗸		Conveyor NO.
	Encoder Setting	• <b>v</b>
	Start Boundary Setting	Encoder Value
	Advanced Setting	0
	CVSenac	Encoder Speed
		0 Item Available
		0
Process		
Information 🗸		
E log		
Display		
<b>10</b>	ок	(-) 100% (+)
0		2002

Figure 6: Conveyor Tracking Setting

#### 4.1.1 Encoder Setting

Encoder setting allows users to set resolution and encoder wheel perimeters.

#### Encoder Resolution: Encoder resolution by Pulse/Rev

Wheel Resolution: encoder wheel circumference (mm).

**Reverse** (Reverse rotation): when the conveyor is operating, the speed indicator should be in positive values. If shown in negative values, select "Reverse".

The officially designated encoder model is the Omron E6C3- CWZ5GH 2000P/R 2M. However, settings shall be based on the actual encoder hardware used by users.

Conveyor Tracking Setting	$\times$	Encoder Setting		$\times$		
Conveyor_0		Reverse				
Encoder Setting		Encoder Resolution :	2000	Pulse/Rev		
Boundary Setting		Wheel Resolution :	300	mm		
Advanced Setting						
					CV Too	
					Conveyor	NO.
					0	$\sim$
					Encoder	/alue
					19722	
					Encoder :	speed
					0	
				_	Item Avai	lable
ок			ОК			



#### 4.1.2 Boundary Setting

Set the working area boundary for the robot.

B Start: Work start point

B End: Work end point

Range: Robot working range

Recommended maximum ranges:

- 650 mm (TM5-700 model)
- 850 mm (TM5-900 model)
- 1250 mm (TM12)
- 1050 mm (TM14)
- 850 mm (TM16)
- 1250 mm (TM20)

\*Regarding the actual movement range, please refer to the 6DOF Workspace for the respective user manual of each robot model.

**New object range:** the range robot selects new object (this range is executed in CVNewObj node)

**Working Area:** Actual work range, based on the intersecting boundaries of **B Start** and **B End**. If there is no intersecting point (in which case, for example, **B Start** is set to be small while **B End** is set to be very large, the system will use **Range** to determine the working area.

Robot Base: Robot placement position.



Figure 8: Boundary setting

In ETH mode, user can use "Set Search Range" on ETH camera vision job "Find" to limit the width of working area on the conveyor belt, which constitutes an rectangular robot working area.



#### 4.1.3 Advanced Setting

Note

Advanced Setting is used for setting conveyor object compensation. Description is as follows:

#### **Conveyor Vector Compensate**

#### (Calibration Point 2)

**X offset (mm)**: when adjusting calibration, compensate the calibration plate x direction offset **Y offset (mm)**: when adjusting calibration, compensate the calibration plate y direction offset

**Z offset (mm)**: when adjusting calibration, compensate the calibration plate Z direction offset (Based on Robot Base coordinates, correct the X/Y/Z offset of Calibration Point 2 coordinates)

**Maximum object moving distance in a frame (ETH Mode only):** this function prevents a single object from being detected as multiple objects.

- If a single object is detected as multiple objects, increase the value.
- If multiple objects are detected as a single object, decrease the value.

Conveyor Tracking Setting	$\times$	Advanced Set	ting	$\times$	
Conveyor_0		Vector compensate	(Calibration Point2)		
Encoder Setting		x offset :	0	mm	
Boundary Setting		y offset :	0	mm	
Advanced Setting		z offset :	0	mm	
			Conveyor Vector	Compensate Conveyor Point2	CV Tool Conveyor NO.
			Rot	oot base xyz offset	Encoder Value
		Sensor			Encoder Speed
					0 Item Available
ок			ОК		0



NOTE:

- When executing Conveyor Tracking project, click "View Page" from the drop-down menu on the top-left corner of TMflow and click "Conveyor Data" to adjust Advanced Setting.
- Advanced Setting does not support Warp Node project switching. If your project would use Warp Node, remember to set Advanced Setting first and then use Warp.

#### 4.2 CVSensor1

Note

Click the pencil icon of CVSensor1 to set the sensor calibration.

**Conveyor NO.**: current conveyor in use. It is a fixed number.

**I/O Number**: The number of Digital Input channel of the control box connected to the sensor. The number must be set in order to trigger the sensor.

**Enable Time**: sets the minimum trigger time of the sensor. If the sensor trigger time is lower than Enable Time, this signal will not be considered as an object moving pass the sensor.

**Rising Edge Detect**: the default is checked, indicating the signal is active High when an object is detected by the sensor.

- When no object passes through the sensor beam, the signal is Low.
- When an object passes through the sensor beam, the signal is High.

Then, click "Start Calibration".

CVSensor				×
Node Name	CVSensc	or1		
Set Sensor Paran	neters			
Conveyor NO.	0			
I/O Number	0	$\sim$		
Enable Time	0		ms	
Rising Edge	e Detect			
		Sta	rt Calibration	ОК

Figure 10: CVSensor

Follow the instruction on the screen to perform calibration. Users have to calibrate two Calibration Points.

CVSensor			×	CVSensor	$\times$
Node Name	CVSensor1				
Set Sensor Parar	neters				
Conveyor NO.	0				
I/O Number	7 🗸				M
Enable Time	0	ms			
Rising Edge	e Detect				
				Sensor Calibration	
				Please put the object on the conveyor sensor and activate the conveyor. De conveyor after the object passing the	eactivate the
			ок		Cancel

Figure 11: Sensor calibration



Users are not required to move the robot arm when clicking Next and Finish.

#### 4.3 Main Thread Nodes

#### 4.3.1 CVNewObj Node

#### Return to Conveyor main thread to select CVNewObj node.



This node indicates that the robot is waiting for valid objects that have been detected by the

sensor and will move to the robot's New Object Range within the Working Area (refer to **4.1.2** for details about range and area).

When dragging this node, users are required to select Conveyor\_0 or Conveyor\_1.

CVNewObj	
Conveyor_0	Conveyor_1

Conveyor NO: Selected conveyor.

Time Out: Set the waiting time for a valid object, which is detected within New Object Range.

• When Time Out = 0, it indicates no time out is set.

When a valid object enters the robot operating range, the thread will go to the next node.

CVNewObj				$\times$
Node Name	CVNewObj1			
Conveyor NO.	0			
Time Out :	0 0 = No Time C	sec		
Î			ОК	

Figure 12: CVNewObj

#### 4.3.2 CVPoint Node



CVPoint Node sets the linear motion under Conveyor main thread. This node is mainly used to track object motion through the conveyor in linear motion.



Under ETH Mode, the tool end will rotate along with the object. However, in Sensor Mode, the tool end will not rotate along with the object.

When dragging the CVPoint node, users are required to select Conveyor\_0 or Conveyor\_1, and then set Pass Path or Fail Path.



**Pass Path:** If the time for a valid object to reach New Object Range is less than Time Out, it is a Pass Path.

**Fail Path**: If the time for a valid object to reach New Object Range is greater than Time Out, it is a Fail Path. Users may drag the Fail Path to connect other nodes, such as Display, for error handling purposes.



Conveyor NO: Selected conveyor

Follow Time: Set the stopping time after the CVPoint tracks to position.

Get Point: Set the CVPoint above the object.

Teach: Set the steps for objects that pass the sensor on the conveyor.

**Analog Input**: Set stop criteria via analog I/O setting for control box, end module or other peripherals.

**Digital Input**: Set stop criteria via digital I/O setting for control box, end module or other peripherals.

Motion Settings: Set the motion speed of the CVPoint in-position process.

**Digital Output**: Set the output status of the control box or tool end.

**Output Variables**: The CVPoint outputs the current motion state via the custom variables. The output variables can go with Plug&Play software package to control the end tools.

Blending: Enable the robot to move to different points in a smooth way.

**Advanced Settings**: Switch the end tool. The CVPoint changes the in-position pose by the end tool setting.

CVPoint	$\times$
Node Name CVPoint1	
Recorded on Conveyor_ 0	
Conveyor NO.	, in the second s
Follow Time 0 sec	
Get Point Teach	
Stop Criteria	
Analog Input So	elect
Digital Input	
✓ ✓ L	$\sim$
Motion Setting	
	ок

Figure 13: CVPoint

Note

- **1.** If the object remains in its original position, users do not have to re-teach the robot in sensor-setting nodes CVPoint and CVCircle.
- 2. Methods to reset corresponding relations between the robot and the object:
  - Sensor Mode: redo 5.1 Step. 12. If the Encoder device has been replaced, resume to the thread with CVSensor1 to reset the sensor.
  - ETH Mode: redo 5.2 Step. 9 to Step. 17. If the Encoder device has been replaced, create new vision job in sub-thread.

The following provides instructions about **Teach** and **Get Point** under CVPoint Node. When entering "Teach", follow the instruction to place object on the conveyor and in front of the sensor. Activate the conveyor. When the object is within robot working area, deactivate the conveyor.

CVPoint	$\times$	CVPoint ×
Node Name CVPoint1 Recorded on Conveyor_0 II Conveyor NO. Follow Time 0 sec Get Point Teach	~	
Stop Criteria  Analog Input  Digital Input  L  Motion Setting  OK	×.	Please put object before sensor on conveyor. Then activate the conveyor. Deactivate the conveyor after object within Robot range.

Figure 14: Teach

**Get**: Automatically obtain the relative position values of the identification points on the tool and the object. Click **OK** after clicking **Get**. (Note: Please reset when the values of X, Y, and Z are unreasonable.)

**Set**: Save result and return to the previous page. (Note: If the project comes with a value obtained CVPoint node, users can directly edit the values in the newly added CVPoint node and click **OK**.)

imes: Go back to the previous page without making any changes.

The other setting of the CVPoint node is the same as the parameters of the Point Node.

CVPoint ×	< G	et Point	×
Node Name CVPoint1	×	192.529	mm
Recorded on Conveyor_ 0 TO Conveyor NO.	∩ Y	85.729	mm
Follow Time 0 sec	z	230.197	mm
Get Point Teach	R	× 24.367	-
Stop Criteria Analog Input Select	Ry	-95.728	
Digital Input	Rz	z -31.294	-
✓ ✓ L ✓	L		
Motion Setting	~		
б		Ge	t Set

#### Figure 15: Get Point



#### NOTE:

•

If the values in **Get Point** are unreasonable or the object is beyond the defined range to work, users must recalibrate the object position (calibration for Sensor Mode, and saving new source images in the vision job for ETH Mode). If the project has CVPoint Node with pre-obtained values, users may just enter values to update the pre-obtained values when adding a new CVPoint Node. Then click OK to save the results. Analog/Digital IO could be set to control the component to grip/release or other implementation before the Follow Time of CVPoint.

DO	~	DO	~
DO_0		DO_0	B
DO_1	0	DO_1	
DO_2		DO_2	

#### 4.3.3 CVCircle Node



CVCircle Node is a circular motion setting node under Conveyor main thread, used for specific applications, such as a gluing operation where a circular part is placed on a moving linear conveyor.

When dragging the CVCircle node, users are required to select Conveyor\_0 or Conveyor 1.



**Conveyor NO.:** shows the selected conveyor. It is a fixed number.

Follow Time: Set the stopping time after the CVCircle tracks to position.

**Degree:** Set the movement path circular angle according to the established arc. Set the degrees for the movement path based on the arc established by the points.

Teach: Set the steps for objects that pass the sensor on the conveyor (Re-teach is not

necessary if the object remains in the same position under CVPoint and CVCircle)

Get Point 1/2/3: Set CVCircle point. (P1 starting point, P2 midpoint, and P3 end point). Similar

to CVPoint, the only difference is that three different points need to be set to form an arc.

The remaining setting of the CVCircle is the same as the CVPoint.

**Analog Input**: Set stop criteria via analog I/O setting for control box, end module or other peripherals.

Digital Input: Set stop criteria via digital I/O setting for control box, end module or other

peripherals.

Motion Settings: Set the motion speed of the CVCircle in-position process.

**Digital Output**: Set the output status of the control box or tool end.

**Output Variables**: The CVCircle outputs the current motion state via the custom variables. The output variables can go with Plug&Play software package to control the end tools.

Blending: Enable the robot to move to different points in a smooth way.

**Advanced Settings**: Switch the end tool. The CVCircle changes the in-position pose by the end tool setting.

CVCircle				>
Node Name	CVCircle1			
Recorded on C	Conveyor_ 0	ТО		
Conveyor NO.	0	J		
Follow Time	0	sec		
Degree	0			
Get Point	t 1	Get Point 2	Get Point 3	
Teach				
Stop Criteria				
Analog In	put		Select	
			ОК	

Figure 16: Get Point

# 5. Quick Walk-Through

- 5.1 Sensor Mode
- 1. Create new Conveyor Tracking project
  - A. Start a new project by clicking New > New Flow from the Project page in TMflow
  - B. Check the Conveyor Tracking box
  - C. Select the conveyor
    - Choose Conveyor\_0 if 1 conveyor is used
    - Choose both Conveyor\_0 and Conveyor\_1 if 2 conveyors are used
  - D. Select Sensor Mode.
  - E. Enter project name and click **Open**.

New File	
ile Name	
Conveyor_	Tracking
Create As	
Project Cor	nponent Editor
Conveyor Tracking	
Conveyor_0	
ETHMode	SensorMode
Conveyor_1	
ETHMode	SensorMode
Cancel	Open

Figure 17: Create new project

- 2. Conveyor Tracking project appears
  - A. Two threads appear
  - B. One is the main thread to edit the movement procedure of the robot (the name of this thread shall appear identical to the project name you entered in Step 1)
  - C. Another is the sub-thread, which is Conveyor\_0 in **Figure 18**. This thread is configuration-only and cannot add any node.
  - D. The sub-thread must be edited before the main thread can be edited.

Node List	+ Conveyo	r Tracking Sensor Conveyor 0		< > デ」 く
Motion	~		CV Tool	
.ogic	~		Conveyor NO.	
rocess	~ (		• ~	
		Start	Encoder Value	
nformation	~		4294967251	
Communication	~	CVSensor1	Encoder Speed	
orce-Related	~		0	
Conveyor Tracking	~		Item Available	
Gt CVNewObj			0	
O CVPoint				
O CVCircle				
Components	~			
				$\sim$ $\sim$

Figure 18: Start the project

- 3. Enter Conveyor Tracking Setting
  - A. Click the pencil icon the start node in the sub-thread to proceed with Conveyor Tracking Setting.
  - B. For details, refer to 4.1.

File 🗸 🛛 Manager 🗸	Project function 🗸   🔎	n 🦳 🕞 🔍 🗄 💬 🖼 🖾 🗍 🚄 0 Robotilisse 🗸 🚑 o Noticol. 🗸	
Node List		Conveyor Tracking Setting	< > ¥, ~
Motion	~	CV Tool	
	~	Conveyor_0 Conveyor NO.	
		Encoder Setting 0	
		Boundary Setting Encoder Value	
		Advanced Setting 0	
	a	Encoder Speed	
		0	
		Item Available	
		0	
Process	~		
	~		
Log			
Display			
S Voice		ок	100% +
			3

Figure 19: Conveyor Tracking Setting

4. Select Tool for your conveyor tracking project.

Default options are "NOTOOL" and "HandCamera".



To ensure consistent precision, it is strongly recommended to use TM Calibration Set while teaching the two CV points.

5. Click the pencil icon of the CVSensor node.

Set IO parameters based on the sensor's IO position and the sensor trigger signal.

- **Conveyor NO.**: it's a fixed number for the selected conveyor number
- I/O Number: The number of DI (Digital Input) on the control box connected to sensor. The number ranges from 0 to 15.
- If the trigger signal is high, select **Rising Edge Detect**.
- For details about I/O Number and Enable Time settings, refer to **4.2**.
- Then click Start Calibration for the sensor.

CVSensor		$\times$
Node Name	CVSensor1	
Set Sensor Para	meters	
Conveyor NO.	0	
I/O Number	7 🗸	
Enable Time	0 ms	
Rising Edg	je Detect	
	Start Calibration OK	

Figure 20: CVSensor

Upon entering calibration, follow the instructions shown in the image (Figure 21).

CVSensor				$\times$	CVSensor	$\times$
Node Name	CVSensor1					
Set Sensor Paran	neters					
Conveyor NO.	0					
I/O Number	0 🗸					
Enable Time	0	ms				
Rising Edge	e Detect					
					Sensor Calibration	
					Please put the object on the conveyor before the sensor and activate the conveyor. Deactivate the conveyor after the object passing through the sen	sor.
			ОК		Cance	el .

- 6. Calibration
  - A. When the conveyor is stopped as instructed in the last step, click **NEXT**.
  - B. Activate the conveyor again to set it in motion. Stop the conveyor when the part is in the robot's working area.
  - C. Click **Finish** to set Calibration Point 2.
- 7. Switch back to main thread to select the tool to use during the application
- 8. Drag a Point Node to the project editing page and set it as the robot's initial work point.

Mation   Logic   Process   Information   Communication   Communication   Force-Related   Conveyor Tracking	Node List	+	Conveyor_Tracking_Sensor Conveyor_0		< > 🖷 🗸 🗸
Logic     0       Process     0       Information     0       Communication     0       Force-Related     0       Conveyor Tracking     0       @     Conveyor Tracking	Motion	$\sim$		CV Tool	, î
Process     Information     Information     Information     Information       Communication     Information     Information     Information       Force-Related     Information     Information       Conveyor Tracking     Information     Information       Information     Information     Informat	Logic	~		Conveyor NO.	
Information  Information  Communication  Force-Related  Conveyor Tracking  Conveyor Tracking  Conveyor Tracking  Convexors  Convexor	Process	-		o 🗸	
Communication     Incoder Speed       Force-Related     0       Conveyor Tracking     0       @:     CVNewObj       O     0			Start	Encoder Value	
Force-Related     0       Conveyor Tracking     0       @:     CVNewObj       0     0	Information	~		19722	
Conveyor Tracking Conveyor Tra	Communication	~		Encoder Speed	
Q2:     CV/NewObj       Q2:     CV/NewObj       Q2:     CV/NewObj	Force-Related	$\sim$	TO PI	D	
Be     CV/NewObj       Cv/NewTobj       CvCride	Conveyor Tracking	~			
<u> <u> </u> <u></u></u>	B: CVNewObj			0	
	O CVPoint				
Components 🗸	<u>C</u> cvCircle				
	Components	$\sim$			

Figure 22: Point Node

9. Drag a CVNewObj Node to the project editing page and select the conveyor number.

CVNewObj	
Conveyor_0	Conveyor_1

Figure 23: Select conveyor number

10. Click the pencil icon of the CVNewObj node for the Time Out setting. For details, refer to 4.3.1.

CVNewObj				$\times$
Node Name	CVNewObj1			
Conveyor NO.	0			
Time Out :	0 0 = No Time	sec		
	0 - 110 mile		ОК	

Drag a CVPoint Node to the project editing page, select the conveyor, and set Pass Path or Fail Path.
 For details of the path setting, refer to 4.3.2.

CVPoint	
Conveyor_0	Conveyor_1
Pass Path	Fail Path

Figure 25: Select conveyor number and path

12. Click the pencil icon of CVPoint's, and click **Teach**.

Node Name	CVPoint	1				
Recorded on C	Conveyor_	0 <b>TO</b>				
Conveyor NO.		$\sim$				
Follow Time	0		sec			
Get Poir	nt		Teach			
Stop Criteria						
Analog In	put				Select	
Digital In	out					
		$\sim$		<b>~</b> L	$\sim$	



When the teaching instruction appears, use the conveyor belt to flow the object through the sensor. After the sensor has detected the object, click the **Finish** button under the teaching instruction so that the relative relationship between the robot and the object can then be established for conveying.

CVPoint	× CVPoint	×
Node Name CVPoint1 Recorded on Conveyor_0 IEE Conveyor NO. 0 Follow Time 0. sec		
Get Point Teach Stop Criteria Analog Input Sele	Please put object before sensor on conveyor. activate the conveyor. Deactivate the conveyo object within Robot range.	Then or after
Digital Input		
~	DK Finished	

Figure 27: Teach

After passing the sensor, user the conveyor belt to move the object in the working range of the robot. Click **Finish** to go back to CVPoint, then click **Get Point** > **Get** > **Set** to complete the setting.

CVPoint	X Get Point		$\times$
Node Name CVPoint1	X 123.551	mm	
Recorded on Conveyor_ 0 TO			
Conveyor NO.	^ Y42.89	mm	
Follow Time 0 sec	Z -145.602	mm	
Get Point Teach	Rx 25.867	-	
Stop Criteria	Ry -82.769	-	
Digital Input	Rz -31.768	-	
✓ ✓ L ✓			
Motion Setting	~		
б		Get	Set

Figure 28: Get Point

13. Make the flow an infinite loop to form a simple object tracking process.
| lode List         |        | - Conveyor Tracking Sensor Conveyor 0 |                | < > Y_ ~ |
|-------------------|--------|---------------------------------------|----------------|----------|
| Motion            | ~      |                                       | CV Tool        |          |
| .ogic             | ~      |                                       | Conveyor NO.   |          |
| Process           | ~      |                                       | • 🗸            |          |
|                   |        | Start                                 | Encoder Value  |          |
| nformation        | ~      |                                       | 26586          |          |
| Communication     | $\sim$ |                                       | Encoder Speed  |          |
| Force-Related     | $\sim$ | T0 P1                                 | 0              |          |
| Conveyor Tracking | ~      |                                       | Item Available |          |
| CVNewObj          |        |                                       | 0              |          |
| CVPoint           |        |                                       |                |          |
| C CVCircle        |        |                                       |                |          |
| Components        | $\sim$ | TO CVPDint1                           |                |          |

Figure 29: Form a loop



#### NOTE:

Use either the advanced setting of gripping objects to go with the CVPoint's end tool I/O status and the point position setting or the output variables to go with Plug&Play software package to control the end tool to complete the gripping and releasing process.

## 5.2 ETH Mode

ETH requires the purchase of a TM Dongle, and the Dongle must be inserted into the control box before TMflow is activated.

- Navigate to Configuration > Vision Setting and click Calibration. Choose the Conveyor Tracking camera in the Camera List at the left. (If the camera is used for the first time, it will appear as Unknown and with the Un-Calibrated state. If not, the camera appears as Conveyor Tracking and with the Calibrated state. The example below is an un-calibrated one.)
- 2. Click **Conveyor-tracking** in **Select Application**, then click **Automatic**.
  - **Camera calibration**: By the instructions on the screen, put the calibration plate under the Conveyor Tracking camera. In addition, users have to get 15 shots in different angles and directions and ensure the shots are not distorted (this depends on whether the calibration plate is tilted).

onveyor Auto				Co	ntroller		
l. Calibrate Camera		Place the Calibration Plate at a different position with a diffe Ensure the plate is detectable.     Press Next to capture image.     Ponnet Ston 1.2 and 2 until 15 images are easy und     Next	Joint Payload	Base	Tool Set	ю	Setting
		Live Video	Jog Distant	ce Continuous 🗸	Speed	1.00 %	~
Set Workspace				Joint Angle		Direct Mov	e
1.1		and the second se	<b>I</b> 1	-4.38	deg		deg
Workspace Calibration			J2	8.88	deg		deg
-			Et 🔘	138.22	deg		deg
hift Vorkspace			<b>J4</b>	-77.20	deg		deg
		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	<b>J</b> 5	78.90	deg		deg
ive Result			O le	26.85	deg		deg
		Ə 10% 🕀 🦺 🕨 🗉	Trigger 😑 te	o opposite move. / Trigg	er 💿 to positive	move. / Trigger	r 💽 to move.
		Success					
	т	he camera calibration procedure is					
		ompleted, and the error value is 0.33	Bpixel(s).				
		ou can now go to the next step or re					
		alibrate. (It is recommended that th alue is lower than 3 pixels.)	e error				
	V	alde is lower than 5 pixels.)					
		ок					
		OK					

- Set Workspace: Confirm to align the calibration board's x-axis with the conveyor direction and the board's y-axis with the edge of the screen (same for automatic and manual). The main goals of the step are to
  - obtain a precise value for the position of any object relative to the edge of the camera FOV, and
  - ensure more precise coordinates of any object in the image to avoid taking repeated photos of the objects.



#### Warning

Please check the direction of DiceBoard.Align X - axis with conveyor moving direction and X = 0 line with the edge of the camera screen.



Figure 30: Set Workspace

• **Calibrate Workspace**: Follow the instructions on the screen, and move the robot above the calibration board. Then press the **PLAY** button on the robot stick to start visual navigation.

Conveyor Auto	1. Video shows the		12		Co	ntroller		
	2. Turn on the Conv 3. Ensure the plate	Warning	er	Joint	Base	Tool	10	Setting
1. Calibrate Camera	Can A Secure the relation of	The robot will start the visual avigation procedure. Please naintain appropriate distance from		Payload 0	x0 kg	Sei		
2.5e	Live	he robot and press  the presponding button on the control stick to activate/pause the		Jog Distance	Continuous 🗸	Speed	1.00 %	$\sim$
Workspace		obot visual navigation procedure, and press the STOP button to leave			Joint Angle		Direct Move	
		his stage.		(i) 11				deg
3. Workspace Calibration		-						deg
								deg
4. Shift Workspace								deg
		Cancel			91.70			deg
5. Save Result		Electronic						deg
	Success		-	linggør 🚍 te a	opraste mines. / Stigp	er (🔮 til prætke	mme / Trigger (	<ul> <li>to move.</li> </ul>
	The calibration	procedure is cor		d, and				
		error is 0.314673	•					
	Please go to th		un an th					
		the distance betw						
	camera and pla			CIICII				
	camera and pla the error shoul	ld be less than 0.5						

Figure 31: Calibrate Workspace

 Shift Workspace: In this step, users have to turn on the conveyor again and make the calibration board shift to another position. Then press the PLAY button on the robot stick to start visual navigation.



Figure 32: Shift Workspace

 Save Result: When the steps above are completed, click Save to save result and name the workspace.



Workspace List	Description of Selected	d Workspace from List
1222	Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (Joint) TM Calibration Board Size (m Error Value (mm)	: (7.6,8.8,114.4,-28.1,89.9,6.5)
	Description of Saved V	Vorkspace
	Name of this Workspace Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (Joint) TM Calibration Board Size (m Error Value (mm)	: (2.7,32,107.3,-38.8,87.9,-1)
	Instruction Please enter the name of the	e workspace, and press Save.

Figure 33: Save calibration result

- 3. Create a new Conveyor Tracking project
  - A. Insert the TM Dongle into the control box before activating TMflow.
  - B. Start a new project by clicking New > New Flow from the Project page in TMflow
  - C. Check the Conveyor Tracking box
  - D. Select the conveyor
    - Choose Conveyor\_0 if 1 conveyor is used
    - Choose Conveyor\_1 if 2 conveyors are used
  - E. Select ETH Mode

Enter project name and click **Open**.

## **New File**

File Name	
Create As Project Co Conveyor Tracking	mponent Editor
Conveyor_0 ETHMode Conveyor_1 ETHMode	SensorMode
Cancel	Open

Figure 34: Open new project

#### 4. Conveyor Tracking project appears

This project come with two threads. One is the main thread for editing the robot motion process (the name is the project name), and the other is the sub-thread for the conveyor tracking setting (this thread is as shown in the figure below, which is for setting purposes only and users cannot add any node with it). Users can edit the main thread after editing the sub-thread.

File 🗸 🛛 Manager 🗸	Proje	ct function 🗸 📄	$\sim$	~ a	3. (	) 🖼	0 RobotBa	ise 🗸 名 (	NOTOOL		
Node List		+ CV Test ETH 1223	2 Conveyor								$\langle \rangle = \langle \neg \rangle$
Motion	~								CV Tool		,
Logic	~								Conveyor NO.		
Process	~								• 🗸		
			Start						Encoder Value		
Information	~		$\rightarrow$						4294967251		
Communication	$\sim$		Ŭ 7						Encoder Speed		
Force-Related	$\sim$								0		
Conveyor Tracking	~								Item Available		
CVNewObj									0		
OCVPoint											
CVCircle											
Components	$\sim$										
		6								Θ	100%

Figure 35: Sub-thread

5. Enter Conveyor Tracking Setting

Click the pencil icon of the Start Node in the sub-thread to proceed with Conveyor Tracking Setting. Refer to **4.1** for details about sub-thread setting.

6. Once completed the settings, click the pencil icon of Vision Node and click **Select** next to the Vision Job to proceed vision job settings.

Node List		- CV Test ETH 12	<u>~~</u> ~ ~ ~ ~ 3*				< > 🔨 🗸
Motion	×		Vision		×	CV Tool	
Logic	~		Node Name			Conveyor NO.	
Process	,		Vision Job	Select	i	• 🗸	
					·	Encoder Value	
Information	~	0	Change payload (X)	τ ο	kg	4294967251	
Communication	~	T				Encoder Speed	
Force-Related	~					0	
Conveyor Tracking	~					Item Available	
D CVTervOls						0	
CVPant							
Contraction (			1				
Components	~						
					ок		- 100% (+)



7. In the Vision Job, click the + icon and input the vision job name, and click **OK** to start new vision job.

Vision X	Vision Job	×
Node Name	Select Job	Variable
Vision Job Select		Ð
Change payload (X) T 0 kg	Create New Job	
OK	Set	
Job Name Input	×	
ОК		

Figure 37: Input vision job name

- 8. Load Workspace
  - A. Choose Conveyor Tracking camera, and click Conveyor-tracking in Application Selection.
  - B. Choose a workspace from the **Workspace List**. Click **Load**.

Load Workspace		
Workspace List	Description of Selected	Workspace from List
1222	Name	: CV_1223
CV_1223	Image Size	: 2448 x 2048
	Date/Time	: 2022-12-23 / 09:47:12
	Initial Pose (mm, Degree)	: (480.9,-128,43.9,-169.2,1.6,94)
	Initial Pose (Joint)	: (2.7,32,107.3,-38.8,87.9,-1)
	TM Calibration Board Size (mr	n): 20
	Error Value (mm)	: 0.31
	Instruction Please select 1 workspace fro press "Load".	m the list, and then
Cancel		Load

Figure 38: Load workspace

9. Place an object in the center of the vision area. Then go to **Pattern Matching (Shape)**, and the robot will recognize the pattern and its range.



Click **Select Pattern** and select **Standard**. Hover the mouse cursor on the object in the image to decide the range of the pattern.



Figure 39: Pattern matching

10. Confirm the editing procedure

- A. Once the pattern recognition is completed, a set of positioning values is shown.
- B. The **FIND** shown in the editing procedure at the left is supposed to come with a triangle in green at top right. If the triangle is in **orange**, the pattern recognition is not completed.

Flow-ConveyTrack			Result			Find
INITIATE Basler						Pattern Matching (Shape) Image Source
78.00 ms					and the second se	Basler Name
FIND_SHAPE ShapePattern						ShapePattern_1
20.00 ms		M				
FINISH						ROBOT
All: 110.00 ms	e	) 20% (pixel)	R (degree)	Scale	Score	- Journa and
All: 110.00 Ms	X (pixel)					

Figure 40: Confirm "FIND" pattern

11. Click  $\blacksquare$  to save visual task, and input a name for the visual job.

Flow-ConveyTrac	Save Job	Find	÷:
INITIATE Basler 80.00 ms	Project Name: CV_Test_ETH_1223 ob Name: CV_ETM	g (Shap	e) ~
FIND_SHAPE ShapePattern 20.00 ms	I/O parameter Setting         Save Image Setting           Basler_EnableLight         INITIATE         EnableLight         INITIATE           Parameter Name         Module         Parameter	Add	
FINISH All: 112.00 ms		0.80	1
	Cancel	Save	1111 A.

Figure 41: Save vision task

12. Back to TMflow and make sure the vision job edited just now is in the list of Vision Job. Click Set > OK to complete the setting.

Motion       Logic       Process       Vision Job       Communication       Force-Related       Components.			Vision Job	×	Vision	Node List
Logic Logic Vision Job Select Vision Job Communication Force-Related Conveyor Tracking					And Many	Motion
rocess change payload 00 T 0 kg	1000	Variable	Select Job			ogic
Change payload (X) T o kg communication orce-Related Conveyor Tracking				Select	Vision Job	rocess
Communication Force-Related Conveyor Tracking		۲	CV_ETH	14	Change payload up to a	Information
Conveyor Tracking	- 1			kg	to to	Communication
	- 1					orce-Related
Components	- 1					Conveyor Tracking
	- 8					omponents
	- 8					
	- 8					
	- 8					

Figure 42: Check vison job on list

13. Switch to the main thread and select a tool for the project.

14. Drag a point node in the project editing page to set as the robot's initial work point.

File 🗸 🛛 Manager 🗸	Proje	ect function 🗸			Q,	8•	$\bigcirc$	÷#	0 RobotBa	* ~ 2	0 NOTOOL 🗸			
Node List		+ CV_Test_ETH	1223 Cor	iveyor 0									< >	¥. V
Motion	$\sim$										CV Tool			-
Logic	$\sim$										Conveyor NO.			
Process	$\sim$										0 🗸			
			Start								Encoder Value			
Information	$\sim$										4294967251			
Communication	$\sim$	1 Y	 P1	0							Encoder Speed			
Force-Related	$\sim$	то	0	in .							0			
Conveyor Tracking	$\sim$										Item Available			
Components	$\vee$										0			
		c										Θ	100%	$\oplus$

Figure 43: Point Node

15. Drag a CVNewObj node in the project editing page and choose the conveyor number.

Node List		+ CV Test ETH 1223 Conveyor 0		< > Y_ Y
Motion	~		CV Tool	
Logic	~		Conveyor NO.	
Process	~		a 🗸	
		Start	Encoder Value	
Information	×		4294967251	
Communication	V		Encoder Speed	
Force-Related	×	CVNewObj	0	
	~	Conveyor_0 Conveyor_1	Item Available	
CVNewObj			0	
CVOrde				
Components	~			
				100%

Figure 44: Select conveyor

Click the pencil icon of the CVNewObj node for the Time Out setting. For details, refer to **4.3.1**.

CVNewObj	l.		$\times$
Node Name	CVNewObj1		
Conveyor NO.	0		
Time Out :	0 0 = No Time Ou	sec	
			ОК

Figure 45: Set CVNewObj

16. Drag a CVPoint node in the project editing page and choose the conveyor number.

File 🗸 🛛 Manager 🗸	Project function 🗸 🕴 🦱 👘 👘 👘	e Notool 🗸
Node List	+ CV, Inst, ETH, 1225 Conveyor, 0	< > ¥, ~
Mittan		
Logic		
Process		
Information		
Communication		
	CVPoint	
Force-Related		
Formerson President	Conveyor_0 Conveyor_1	
di conson	Connect 😫	
( <u>C</u> : 0990(0))		
(D) Hereiter		
Companyints		

Figure 46: Set conveyor for CVPoint

## Select Pass Path. Refer to 4.3.2 for details.

Node List	+ CV Test ETH 1223 Conveyor 0	< > Y, ~
Motion	~	CV Tool
Logic	~	Conveyor NO.
Process		ð 🗸
	Start	Encoder Value
Information		4294967251
Communication	~	Encoder Speed
Force-Related		•
	Pass Path	Fall Path Item Available
CVNewObj	Currences &	
O CNOrde		
Components	~	
		100%

Figure 47: Set path

#### 17. Enter CVPoint Node

- A. Click the pencil icon of the CVPoint Node. Use the conveyor to move the object to the robot's working area.
- B. Hand-guide the robot at the top of the object.
- C. Click **Get Point**, click **Get**, and click **OK** to complete CVPoint setting in ETH Mode.

CVPoint	×	Get Point	×
Node Name CVPoint1		X -26.776	mm
Recorded on Conveyor_0 TO Conveyor NO.	^	Y -156.832	mm
Follow Time 0 sec		Z -192.664	mm
Get Point		Rx -1.608	-
Stop Criteria Analog Input Select		Ry -1.544	
Digital Input		Rz 45.783	-
✓ ✓ L ✓			
Motion Setting	~	Ge	t Set

Figure 48: Get Point

18. Make the flow an infinite loop to form a simple object tracking process.

Node List	+ CV_Test_ETH_1223 Conveyor_0	< > ¥, ~
Motion	~	CV Tool
Logic	Start	Conveyor NO.
Process		• 🗸
		Encoder Value
Information	TO P1	4294967251
Communication	v	Encoder Speed
Force-Related	~	0
Conveyor Tracking		Item Available
CVNewObj		0
CVPoint	TO CVRoint1	
C CVCircle		
Components	~	
		100%

Figure 49: Form a loop



#### NOTE :

Use either the advanced setting of gripping objects to go with the CVPoint's end tool I/O status and the point position setting or the output variables to go with Plug&Play software package to control the end tool to complete the gripping and releasing process.

# **OMRON Corporation** Industrial Automation Company

#### Kyoto, JAPAN

**Regional Headquarters** 

OMRON EUROPE B.V. Wegalaan 67-69, 2132 JD Hoofddorp The Netherlands Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

OMRON ASIA PACIFIC PTE. LTD. 438B Alexandra Road, #08-01/02 Alexandra Technopark, Singapore 119968 Tel: (65) 6835-3011 Fax: (65) 6835-3011 Contact : www.ia.omron.com

OMRON ELECTRONICS LLC 2895 Greenspoint Parkway, Suite 200 Hoffman Estates, IL 60169 U.S.A. Tel: (1) 847-843-7900 Fax: (1) 847-843-7787

OMRON ROBOTICS AND SAFETY TECHNOLOGIES, INC. 4225 Hacienda Drive, Pleasanton, CA 94588 U.S.A. Tel: (1) 925-245-3400 Fax: (1) 925-960-0590

OMRON (CHINA) CO., LTD. Room 2211, Bank of China Tower, 200 Yin Cheng Zhong Road, PuDong New Area, Shanghai, 200120, China Tel: (86) 21-6023-0333 Fax: (86) 21-5037-2388 Authorized Distributor:

©OMRON Corporation 2023 All Rights Reserved. In the interest of product improvement, specifications are subject to change without notice.

Cat. No. 1853-E-03 0723 (0420)