

# TM Conveyor Tracking

# **User's Manual**

**Original Instruction** 

Software version: TMflow 1.88 or later Document version: 1.00 Release Date: 2023-07-05 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.

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# TECHMAN ROBOT INC.

### Contents

Revision History	5
1. Introduction	6
1.1 Scope of Use	6
1.2 Limitations of Use	6
1.3 Warning and Caution Symbols	6
1.4 Safety Precautions	7
1.5 Validation and Liability	8
1.6 Limitation of Liability	8
1.7 Functional Note Symbols	8
2. Hardware Requirements	10
2.1 TM Dongle	10
2.2 Applicable EtherCAT Coupler and Encoder Modules	10
2.3 Code Wheel	11
2.4 Camera	11
2.4.1 Lens	12
2.5 Reference Guide for Light Source Setup	12
2.6 Sensor	12
2.7 Light Box Design Reference	13
2.8 Hardware Connection Diagram	13
3. Operating Guide	14
3.1 Sensor Mode	14
3.2 ETH Mode	15
4. Software Functions	16
4.1 Conveyor Tracking Setting	16
4.1.1 Encoder Setting	16
4.1.2 Boundary Setting	17
4.1.3 Advanced Setting	18
4.2 CVSensor1	19
4.3 Main Thread Nodes	21
4.3.1 CVNewObj Node	21
4.3.2 CVPoint Node	22
4.3.3 CVCircle Node	25
5. Quick Walk-Through	28
5.1 Sensor Mode	28
5.2 ETH Mode	34

### Tables

Table 1: Applicable EtherCAT coupler models	10
Table 2: Applicable Encoder Modules	10
Table 3: Camera	11

# Figures

Figure 1: Code wheel	11
Figure 2: Hardware connection diagram	13
Figure 3: Create new project	14
Figure 4: Sensor Mode diagram	15
Figure 5: ETH Mode diagram	15
Figure 6: Conveyor Tracking Setting	16
Figure 7: Encoder setting	17
Figure 8: Boundary setting	18
Figure 9: Advanced Setting	19
Figure 10: CVSensor	20
Figure 11: Sensor calibration	21
Figure 12: CVNewObj	22
Figure 13: CVPoint	23
Figure 14: Teach	24
Figure 15: Get Point	25
Figure 16: Get Point	27
Figure 17: Create new project	28
Figure 18: Start the project	29
Figure 19: Conveyor Tracking Setting	29
Figure 20: CVSensor	30
Figure 21: Sensor calibration	31
Figure 22: Point Node	31
Figure 23: Select conveyor number	32
Figure 24: Set CVNewObj	32
Figure 25: Select conveyor number and path	32
Figure 26: CVPoint	33
Figure 27: Teach	33
Figure 28: Get Point	34
Figure 29: Form a loop	34
Figure 34: Open new project	39

Figure 35: Sub-thread	39
Figure 36: Vision Job	40
Figure 37: Input vision job name	40
Figure 38: Load workspace	41
Figure 39: Pattern matching	42
Figure 40: Confirm "FIND" pattern	42
Figure 41: Save vision task	43
Figure 42: Check vison job on list	43
Figure 43: Point Node	44
Figure 44: Select conveyor	44
Figure 45: Set CVNewObj	44
Figure 46: Set conveyor for CVPoint	44
Figure 47: Set path	45
Figure 48: Get Point	45
Figure 49: Form a loop	46

# **Revision History**

Revision	Date	Revised Content
1.00	2023-07-05	Original release

### 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 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>

### 1.2 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.

#### 1.3 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.

#### **1.4 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.

1.5 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.

#### 1.6 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.

#### 1.7 Functional Note Symbols

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.



#### NOTE:

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		Deekoff		OMRON:	
Encoder Module			NX-EC0112/NX-E	C0122/NX-EC013	32/NX-EC0142/ NX-
Model	000-1BA00	EL0101/EL0152	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	D024 V	DC24 V	DC24 V	DC24 V	D024 V	DC24 V	DC24 V	D024 V
Rated	75m \	130m A	35 m A	20 m A	20 m A	44 m A	25 m A	20 m 4
current	75IIIA	ISUIIA	55 IIIA	39 MA	39 MA	44 MA	55 MA	39 MA
Number								
of	1	1or2	1	1	1	1	2	2
encoder								
ON		45.001/	40.0.00.00/	40.0.00.01/	40.0.00.01/	40.0.00.00/	40.0.00.01/	40.0.00.01/
voltage	15-28.8V	15-30V	19.6-28.8V	19.6-28.8V	19.6-28.87	19.6-28.8V	19.6-28.8V	19.6-28.87
OFF		0.5\/	0.41/	0.41/	0.417	0.41/	0.41/	0.414
voltage	U-5V	0-5V	0-4V	0-4V	0-4V	0-4 V	0-4V	0-4V

Table 2: Applicable Encoder Modules

Note

#### NOTE:

- Equipment needs to be connected to external power supply for proper use. For detailed product information, visit the product's official website.
- Suggested Encoder Model: E6C3-CWZ5GH



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

#### 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 < 300 mm/s, the average tolerance is ±1 mm.	When conveyor speed < 300 mm/s, the average tolerance is ±1 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;



#### 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 :

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

#### 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.



Figure 2: Hardware connection diagram

# 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 Co	emponent Editor
Conveyor Tracking	
Conveyor_0	
ETHMode	SensorMode
Conveyor_1	
ETHMode	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 🗸	Project function 🗸 🛛 🦷	🛯 🕞 🔍 🗄 😳 🗟 🕼 📕 🛃 🖉	2 0 NOTOOL
Node List		Conveyor Tracking Setting	< > Y, ~
Motion	× *		CV Tool
	$\overline{\mathbf{v}}$	Conveyor_0	Conveyor NO.
		Encoder Setting	• 🗸
	Start	Boundary Setting	Encoder Value
		Advanced Setting	0
			Encoder Speed
	Cvsensc		0
			Item Available
die M-Decision			0
Process	×		
	~		
📧 Log			
Display			
Co Voice		ок	

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 Tool
					Conveyor NO.
					0 🗸
					Encoder Value
					19722
					Encoder Speed
					0
					Item Available

Figure 7: Encoder setting

#### 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.



#### NOTE:

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

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 $\qquad \qquad \qquad$	Advanced Setting	9	$\times$	
Conveyor_0	Vector compensate(Cali	bration Point2)		
Encoder Setting	x offset :	0	mm	
Boundary Setting	y offset :	0	mm	
Advanced Setting	z offset :	0	mm	
		onveyor Vector Comp	ensate	CV Tool
		vevor Point1 Conve	avor Point?	Conveyor NO.
			Syot Point2	0 🗸
		•	•	Encoder Value
		Robot bas	e xyz onset	19722
	Sensor			Encoder Speed
				0
				Item Available
ок		ОК		0

Figure 9: Advanced Setting



#### 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

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	CVSensor	1	
Set Sensor Para	meters		
Conveyor NO.	0		
I/O Number	0	$\sim$	
Enable Time	0	ms	
Rising Edg	je Detect		
	Г		

Figure 10: CVSensor

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

CVSensor		$\times$	CVSensor X
Node Name	CVSensor1		
Set Sensor Parar	neters		
Conveyor NO.	0		
I/O Number	7 🗸		
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 sensor.
		ОК	Cancel





#### 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 sec 0 = No Time Out		
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.



#### NOTE:

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 To		
Conveyor NO.	0		^
Follow Time	0 sec		
Get Poi	nt Teach		
Stop Criteria			
Analog Ir	nput	Select	
Digital In	put		
	✓ ✓ L	$\sim$	
Motion Setting			~
		ОК	

Figure 13: CVPoint

#### NOTE:

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	$\times$
Node Name CVPoint1 Recorded on Conveyor_0 10 Conveyor NO. 0 Follow Time 0 sec Get Point Teach	^		
Stop Criteria Analog Input Digital Input L V L V		Please put object before sensor on conveyor. Then activate the conveyor. Deactivate the conveyor after object within Robot range.	
Motion Setting	~		
ОК		Finished	

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.

	$\sim$	C at Dailat	$\sim$
CVPOINT	×	Get Point	X
Node Name CVPoint1		X 192.529 mm	
Recorded on Conveyor_ 0 T0	_		
Conveyor NO.		Y 85.729 mm	
Follow Time 0 sec		Z 230.197 mm	
Get Point Teach		Rx 24.367 -	
Stop Criteria		Pv 0F 739	
Analog Input Select		ry -55.720 -	
Digital Input		Rz -31.294 -	
✓ ✓ L ✓			
Motion Setting	~		
ОК		Get 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.



#### 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_0 Conveyor_1	CVCircle	
	Conveyor_0	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				$\times$
Node Name	CVCircle1			
Recorded on	Conveyor_ 0	ТО		
Conveyor NO.	0	1		^
Follow Time	0	sec		
Degree	0			
Get Poir	nt 1	Get Point 2	Get Point 3	
Teach	h			
Stop Criteria				
Analog II	nput		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		
File Name		
Conveyor_Tracking		
Create As		
Project Component 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.

File 🗸 Manager 🗸	Proje	set function 🗸 📔 🗂 🦳 🕞 🔾 🚼 😳 😇 📔 🗾 O Robolibase		
Node List		Conveyor_Tracking_Sensor Conveyor_0		$\langle \rangle = \langle \rangle$
Motion	$\sim$		CV Tool	<u>^</u>
Logic	$\sim$		Conveyor NO.	
Process	$\sim$		o 🗸	
	•	Start	Encoder Value	
Information	$\sim$		4294967251	
Communication	$\sim$	(Vsensort	Encoder Speed	
Force-Related	$\sim$		0	
Conveyor Tracking	$\sim$		Item Available	
CVNewObj			0	
CVPoint				
CVCircle				
Components	$\sim$			
				- 100%
		<		>

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 🗸	🦳 🕞 Q, 🗄 💬 🗟 🗐 📙 Robotiasse	
Node List		Conveyor Tracking Setting	$\langle \rangle = \langle \rangle$
Motion	× ^		CV Tool
Logic	~	Conveyor_0	Conveyor NO.
(있 Set		Encoder Setting	0 🗸
	Star	Boundary Setting	Encoder Value
¢⊷ lt		Advanced Setting	0
G WaitFor	CVSens		Encoder Speed
Gateway			0
di M. Decision			Item Available
			0
Process	×		
Information	~		
🖹 Log			
Display			
Voice		ок	100%

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	ameters	
Conveyor NO.	0	
I/O Number	7 🗸	
Enable Time	0 ms	
Rising Edg	ge Detect	
	Start Calibration OK	

Figure 20: CVSensor

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

CVSensor	$\times$	CVSensor X
Node Name CVSensor1		
Set Sensor Parameters		
Conveyor NO. 0		
I/O Number 0		
Enable Time 0 ms		
Rising Edge 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 sensor.
ок		Cancel

Figure 21: Sensor calibration

- 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.

File 🗸 🛛 Manager 🗸	Project function 🗸 🛛 🛌 🕞 📿 🖓 😳 📾 🗎 🖾 0 RobotBase 🗸 📇 0	NOTOOL
Node List	+ Conveyor_Tracking_Sensor Conveyor_0	$\langle \rangle = \langle \rangle$
Motion	$\checkmark$	CV Tool
Logic	~	Conveyor NO.
Process	×	• •
	Start	Encoder Value
Information		19722
Communication	✓ Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø Ø	Encoder Speed
Force-Related	V TO P1	0
Conveyor Tracking		Item Available
🚰 CVNewObj		0
CVPoint		
CVCircle		
Components	$\checkmark$	
	x	- 100% + · · ·

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 Ou	sec	
			ОК

Figure 24: Set CVNewObj

11. 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**.

CVPoint		$\times$
Node Name	CVPoint1	
Recorded on	Conveyor_ 0 TO	
Conveyor NO.	0	Â
Follow Time	0 sec	
Get Poi	nt Teach	
Stop Criteria		
Analog Ir	Select	
Digital In	put	
	✓ ✓ L ✓	
Motion Setting		~
	ок	

Figure 26: CVPoint

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	$\times$	CVPoint	$\times$
Node Name     CVPoint1       Recorded on Conveyor_0     III       Conveyor NO.     III       Follow Time     0       Get Point     Teach	^		
Stop Criteria Analog Input Digital Input L		Please put object before sensor on conveyor. Then activate the conveyor. Deactivate the conveyor after object within Robot range.	
Motion Setting OK	~	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	×	Ge	t Point		$\times$
Node Name CVPoint1		х	123.551	mm	
Recorded on Conveyor_ 0					
Conveyor NO.	^	Y	-42.89	mm	
Follow Time 0 sec		Z	-145.602	mm	
Get Point Teach		Rx	25.867	-	
Stop Criteria	Select	Ry	-82.769	-	
Digital Input		Rz	-31.768	-	
✓ ✓ ↓	~				
Motion Setting	~				
	ОК		Get		Set
	Figure 28: Get F	Point			

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

File 🗸 🛛 Manager 🗸	Proje	t function 🗸 📔 🦳 📿 🚰 🤤 🖼 🛛 📶 🚣 0 Robotilizee 🗸 🛃 0 NOLOOL 🗸	
Node List		+ Conveyor Tracking Sensor Conveyor 0	$\sim$
Motion	$\sim$	CV Tool	^
Logic	$\sim$	Conveyor NO.	
Process	$\sim$	0 🗸	
1100035	•	Start Encoder Value	
Information	$\sim$	26586	
Communication	$\sim$	Encoder Speed	
Force-Related	$\sim$	TO P1 0	
Conveyor Tracking	$\sim$	Item Available	
CVNewObj			
CVPoint		Pass	
CVCircle			
Components	$\sim$		-)
			~ ~

Figure 29: Form a loop

# Note

#### 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.

1. 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).

Conveyor Auto			C	ontroller		
1. Calibrate	1. Viace the Califoration Viate at a different position with a different position of the position of th	Joint	Base	Tool	ю	Setting
Camera	Next	Payload	0.00 kg	Set		
	Live Video	Jog Distand	ce Continuous 🗸	Speed	1.00 %	$\sim$
et Vorkspace			Joint Angl	e	Direct Move	
		<b>D</b> J1	-4.38	deg		deg
space	- <del>.</del> .	J2	8.88	deg		deg
		Ов	138.22	dea		den
ift			77.00	deg		deg
orkspace		J4	-77.20	aeg		deg
		J5	78.90	deg		deg
e Result		) J6	26.85	deg		deg
	🖂 10% 🕀 🦣 🕨 🗉	Trigger 😑 te	o opposite move. / Trigi	per 📀 to positive	move. / Trigger	🕑 to mov
	Success					
	The camera calibration procedure is	nivel(a)				
	Completed, and the error value is 0.33	pixel(s).				
	calibrate. (It is recommended that the	error				
	value is lower than 3 pixels.)					
	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.





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.



The calibr	ation procedure is completed, and
the calibra	ation error is 0.314673.
Please go	to the next step.
Suggestio	n: If the distance between the
camera ar	nd plate is lower than 30 cm, then
the error	should 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.

nveyor Auto			C	ontroller		
	Press save to save the result.	Joint	Base	Tool	10	Fr
alibrate		Payload	0.00 kg	Set	t	
	Live Video	lea Distan	continuous à	e coud	1.00.0	
t orkspace	8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8	Jog Distan	leint Angl	speed	Direct Mai	
		<b>I</b> I	5.31	deg	Direct Mo	deg
rkspace bration		J2	12.43	deg		deg
		Лз	121.21	deg		de
ft		J4	-43.06	deg		de
in replace		J5	89.84	deg		deg
ve Result	(2.2,4.1) (532.2, 40.9, -156.5)	J6	2.89	deg		deg
		Timer O	to appendie many / Tala	and (a) to positive	mous / Trios	
Load Workspace Workspace List	Ce Description of Select	ed Workspac : 1222 : 2448 x 20	te from Lis	st		
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (Joint) TM Calibration Board Size	ed Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.6,8.8,11 (mm): 7.6	te from Lis 48 12 / 16:30:10 15,163.3,-174 14.4,-28.1,89.	st 4.6,0.5,90. 9,6.5)	.9)	
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saver	ed Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.6,8.8,11 (mm): 7.6 : 40.41	248 22 / 16:30:10 3.5,163.3,-174 14.4,-28.1,89.	st 4.6,0.5,90 9,6.5)	.9)	
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Savec Name of this Workspace	ed Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3-89 : (7.6,8.8,11 (mm): 7.6 : 40.41 I Workspace	24 48 22 / 16:30:10 5,5163.3,-174 14.4,-28.1,89.	st 4.6,0.5,90 9,6.5)	.9)	
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saveco Name of this Workspace Image Size	red Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.6,8.8,11 (mm): 7.6 : 40.41 I Workspace Untitled : 2448 x 20	te from Lis 48 22 / 16:30:10 .5,163.3,-174 14.4,-28.1,89. 48	st 4.6,0.5,90 9,6.5)	.9)	
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saveco Name of this Workspace Image Size Date/Time	red Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.68,87) : (7.68, : 40.41 ! Workspace Untitled : 2448 x 20 : 2022-12-2	te from Lis 48 12 / 16:30:10 15,163.3,-174 14,4,-28.1,89. 14,4,-28.1,89.	st 4.6,0.5,90 9,6.5)	.9)	
Load Workspace Workspace List	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saveco Name of this Workspace Image Size Date/Time Initial Pose (mm, Degree)	red Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.68,83,-89 : (7.68,84,-80) : 7.6 : 40.41 I Workspace Untitled : 2448 x 20 : 2022-12-2 : (480,9,-12) : (480,9,-12)	te from Lis 48 12 / 16:30:10 15,163.3,-174 14,4,-28.1,89. 14,4,-28.1,90.14,4,0,00. 14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00.14,4,0,00. 14,4,0,00.14,4,0,00.14,14,0,00.14,14,14,00.14,14	st 4.6,0.5,90 9,6.5)	.9)	
Load Workspace Workspace List 1222	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saveco Name of this Workspace Image Size Date/Time Initial Pose (joint) TM Calibration Board Size	red Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.68,87) (mm): 7.6 : 40.41 Workspace Untitled : 2448 x 20 : 2022-12-2 : (480.9,-12 : (2.77,20) (mm): 20	te from Lis 48 12 / 16:30:10 15,163.3,-174 14,4,-28.1,89. 14,4,-28.1,89. 48 48 13 13 14,4,-28,1,89. 14,4,-28,1,90. 14,4,-20,1,90.14,4,-20,1,90. 14,4,-20,1,90.14,4,-20,1,90.14,4,-20,10	st 4.6,0.5,90. 9,6.5) 2,1.6,94) 9,-1)	.9)	
Load Workspace Workspace List 1222	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Savec Name of this Workspace Image Size Date/Time Initial Pose (joint) TM Calibration Board Size Error Value (mm)	red Workspace : 1222 : 2448 x 20 : 2022-12-2 : (435.3,-89 : (7.6,8,3-87 : (7.6,8,3-87 : (40.41 Workspace Untitled : 2448 x 20 : 2022-12-2 : (480.9,-12 : (2.7,32,10 (mm): 20 : (0.31	te from Lis 48 12 / 16:30:10 15,163.3,-174 14,4,-28.1,89. 14,4,-28.1,89. 48 13 13 13 14,4,-28,1,89. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,1,9,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19. 14,4,-28,19,-14,19.14,19,19,19,19,19,19,19,19,19,19,19,19,19,	st 4.6,0.5,90. 9,6.5) 2,1.6,94) 9,-1)	.9)	
Load Workspace Workspace List 1222	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Saveco Name of this Workspace Image Size Date/Time Initial Pose (joint) TM Calibration Board Size Error Value (mm) Instruction Please enter the name of	red Workspace : 1222 : 2448 × 20 : 2022-12-2 : (435.3-89 : (7.6,8.8,11 (mm): 7.6 : 40.41 Workspace Untitled : 2448 × 20 : 2022-12-2 : (480.9,-12 : (2.7,32,10 (mm): 20 : 0.31 the workspace, a	te from Lis 48 22 / 16:30:10 .5,163.3,-174 14.4,-28.1,89. 48 48 48 48 48 48 48 48 48 48 48 48 48	st 4.6,0.5,90 9,6.5) 2,1.6,94) 9,-1) ve.	.9)	
Load Workspace Workspace List 1222	Ce Description of Select Name Image Size Date/Time Initial Pose (mm, Degree) Initial Pose (joint) TM Calibration Board Size Error Value (mm) Description of Savec Name of this Workspace Image Size Date/Time Initial Pose (joint) TM Calibration Board Size Error Value (mm) Instruction Please enter the name of	ed Workspace : 1222 : 2448 × 20 : 2022-12-2 : (435.3,-89 : (7.6,8.8,11 (mm): 7.6 : 40.41 I Workspace Untitled : 2448 × 20 : 2022-12-2 : (480.9,-12 : (2.7,32,10 (mm): 20 : 0.31 the workspace, a	te from Lis 48 22 / 16:30:10 3.5,163.3,-174 14.4,-28.1,89. 48 33 38,43.9,-169.2 7.3,-38.8,87.9	st .6,0.5,90 9,6.5) 2,1.6,94) 9,-1) ve.	.9)	

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 Component Editor
Conveyor Tracking
Conveyor_0
ETHMode SensorMode
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 🗸	ر		a,	£	$\odot$	÷.	🚑 0 Roboti	Base 🗸	P NOTOOL	
Node List		+ CV_Test_ETH	1_1223_2	Conveyor_0					 			
Motion	$\sim$										CV To	ol
Logic	$\sim$										Conve	or NO.
Process	~										0	$\sim$
	×		Start								Encode	r Value
Information	$\sim$		-0								42949	57251
Communication	$\sim$		$\square$								Encode	r Speed
Force-Related	$\sim$										0	
Conveyor Tracking	~										Item A	ailable
G⊕ CVNewObj											0	
CVPoint												
CVCircle												
Components	$\sim$											
		<										

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.

File 🗸 🛛 Manager 🗸	Project function 🗸	_ ∽ ~ ⊂	🖅 🖉 0 RobotBase 🗸 🛃		
Node List	+ CV_Test_E	ETH_122	~		$\langle \rangle = \langle \rangle$
Motion	~	VISION	~	CV Tool	
Logic	~	Node Name		Conveyor NO.	
Process	~	Vision Job	Select	• 🗸	
				Encoder Value	
Information	<b>~</b>	Change payload (X) T 0	kg	4294967251	
Communication	~			Encoder Speed	
Force-Related	$\sim$			0	
Conveyor Tracking	~			Item Available	
fle cynrwchi				0	
criterio oj					
CVPoint					
CVCircle					
Components	~				
			ок		-) 100% +

Figure 36: Vision Job

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

Vision	$\times$	Vision Job	$\times$
Node Name		Select Job	Variable
Vision Job			+
Change payload (X) T 0	kg	Create New Job.	
ок		Set	
Job Name Input	t	×	
	I		
	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**.

Workspace List	Description of Selected	d 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 (m	m): 20
	Error Value (mm)	: 0.31
	Instruction Please select 1 workspace fr press "Load".	rom the list, and then



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.

Flow-ConveyTrack			Result			Find	
						Pattern Matching (Shape)	
INITIATE						Image Source	
Basler 81.00 ms				12.51		Papier	,
				20		Basier	
1				L.		Name	
FIND SHAPE			74			ShapePattern_1	
ShapePattern							
0.00 ms							
				2.0			
FINISH				8		Please press "Pattern Selection	
All: 94.00 ms	e	) 10% ⊕	) 🔮 💽	▶ <sub>1</sub> Ⅱ	[]	or "Smart Pattern Learner".	
	X (pixel)	Y (pixel)	R (degree)	Scale	Score		

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

Range Decision Please select the patter	n from the image:	
Standard	Original	Next

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.



Figure 40: Confirm "FIND" pattern

11. Click 🖬 to save visual task, and input a name for the visual job.

	Save Job						Circl.
Flow-ConveyTrac	roject Name:						Find
	CV_Test_ETH_1223						g (Snape)
INITIATE						M	
Baster Jo 80.00 ms	b Name:					-	
00100 1110	CV_ETH						· · · · · · · · · · · · · · · · · · ·
						83	
	I/O parameter Setting 5						
FIND_SHAPE							
ShapePattern	Basler_EnableLight	INITIATE	$\sim$	EnableLight	$\sim$	Add	
20.00 ms	Descent and Alexand	Madula		Deservation			
	Parameter Name	Module		Parameter			
							N
FINISH							
							BOT
All: 112.00 ms							Terrestown.
							and the second
					satisfiers (		
					Cancol	Calle	

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.

File 🗸 🛛 Manager 🗸	Project function 🗸 🛛 🦳 📿 Q, 🕃 😳 🖾 🛛 🖾 0 Relaxitizee 🗸 🛃 0 NOTOOL 🗸
Node List	Vision X Vision Job X
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Logic	Nooe name
Process	Vision Job Select
Information	Change payload (x) T 0 kg
Communication	
Force-Related	
Conveyor Tracking	
Components	
	ок Set — 100% (+)
	· · · · · · · · · · · · · · · · · · ·

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 $\checkmark$	5		q	£	$\odot$	÷.	🔔 0 Ro	obotBase 🗸 🖌	2 0 NOTOOL					
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Motion	$\sim$										CV T	ool				î
Logic	$\sim$										Conv	eyor NO.				
Process	$\sim$										0	$\sim$				
			Start								Enco	der Value				
Information	$\sim$		-								4294	967251				
Communication	$\sim$		 	Ø							Encor	der Speed				
Force-Related	$\sim$	то	-0	5							0					
Conveyor Tracking	$\sim$										Item	Available				
Components	$\sim$										0					
													(-)	100%	(+)	
		<													,	Ň

#### Figure 43: Point Node

Motion   Logic   Process   Information   Communication   Force-Related   Conveyor.0   Conveyor.0   Conveyor.0   Conveyor.0   Conveyor.0   Conveyor.0   Conveyor.1	Node List		CV_Test_ETH_1223 Conveyor_0	< > <del>\</del>
Logic Conveyor NO. Process Conveyor NO. Information Conveyor NO. Communication Conveyor NO. Conveyor NO. Encoder Value 4294967251 Encoder Value 4294	Motion	~		CV Tool
Process   Information   Communication   Proce-Related   Convergor_0   Convergor_0   Convergor_1	Logic	~		Conveyor NO.
Information Converger_0 Converger_1 Encoder Value 23967251 Encoder State 23967251 Encoder Speed 0 0 tem Available 0 0 Converger_0 Converger_1 0 0 Converger_0 Converger_1 0	Process	~		0 🗸
Information   Communication  Communication  Conveyor Tracking  Conveyor Tracking  Conveyor 1  Conveyor 1  Conveyor 1  Conveyor 1  Conveyor 2  Conveyor 1  Conveyor 2  Conveyor 1  Conveyor 2  Conveyor			Start	Encoder Value
Communication            Encoder Speed         0          Force-Related            Encoder Speed         0          Conveyor Tracking          Cenveyor,0         Conveyor,1           Encoder Speed         0          CVNewObj          Conveyor,0         Conveyor,1           Becoder Speed         0          CVNewObj          Conveyor,0         Conveyor,1           Becoder Speed         0          CvNoint          Components           Conveyor,2	Information	$\sim$		4294967251
Force-Related CVNewObj Streaking CVNewObj Streaking CVNewObj Streaking Conveyor_0 Conveyor_1 Streaking Str	Communication	$\sim$		Encoder Speed
Conveyor Tracking     Item Available             CVNewObj          CVNinit          Curveyor.0          Conveyor.1	Force-Related	$\sim$	CVNewObj	0
<sup>2</sup> CVRexObj <sup>2</sup> <sup>2</sup> CVRoint <sup>2</sup> <sup>2</sup> CVCircle <sup>2</sup> <sup></sup>		~	Conveyor_0 Conveyor_1	Item Available
	CVNewObj			0
Components	CVPoint			
Components V	CVCircle			
	Components	~		

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

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			×
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 🗸 🔰 🦳 🦳 🖓 🖓 🖓 🖓 🖓 🖓	NOTOOL V
Node List	+ CV_Test_ETH_1223 Conveyor_0	$<>\tau_{\rm s} \sim$
Motion		
Logic		
Process		
la fa sua tin a		
Communication	Pr CVPoint	
Force-Related		
Conveyor Tracking	Conveyor_0 Conveyor_1	
CVNewObj		
CVPoint		
CVCircle		
Components		

Figure 46: Set conveyor for CVPoint

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

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Node List		+ CV Test ETH 1223 Conveyor 0 <>	¥. 🗸
Motion	$\sim$	CV Tool	
Logic	~	Conveyor NO.	
Process	~	• • •	
		Start Encoder Value	
Information	$\sim$	4294967251	
Communication	$\sim$	Encoder Speed	
Force-Related	$\sim$	T0 0	
Conveyor Tracking	~	Pass Path Fail Path Item Available	
An canwoki			
CVNewObj		CVNewObj1 🚨	
CVPoint			
CVCircle			
Components	~		
		- 1004	

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	$\times$	Get Point 🛛 🗙
Node Name CVPoint1		X -26.776 mm
Recorded on Conveyor_ 0 10	^	Y -156.832 mm
Follow Time 0 sec		Z -192.664 mm
Get Point		Rx -1.608 -
Stop Criteria		Ry -1.544 -
Digital Input		Rz 45.783 -
✓ ✓ L ✓		
Motion Setting	~	
ОК		Get Set

Figure 48: Get Point

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

File 🗸 🛛 Manager 🗸	Proje	ct function 🗸 🛛 I	<b>^</b> ~ □	, q	3. G	) 🛤	🔔, 0 Rob	ootBase 🗸 🐣	0 NOTOOL 🗸			
Node List		+ CV_Test_ETH_1223	Conveyor_0								> ₹	-
Motion	$\sim$								CV Tool			
Logic	$\sim$		Start						Conveyor NO.			
Process	$\sim$		•						• 🗸			
									Encoder Value			
Information	$\sim$	то	P1						4294967251			
Communication	$\sim$		•						Encoder Speed			
Force-Related	$\sim$		•						0			
Conveyor Tracking	$\sim$	C1/	NewObj1 🦲						Item Available			
CVNewObj		Pas							0			
CVPoint		TO C	/Point1									
CVCircle												
Components	$\sim$											
										$\bigcirc$	100%	7
		<										

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.

# ΤΕ**CΗΜΑΝ** <sup>R</sup> O B O T



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