HIWIN®

Conveyor Tracking System

User Manual

Original Instruction

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HIWIN® INDUSTRIE 4.0 Best Partner

Multi-Axis Robot

Pick-and-place / Assembly /
Array and packaging / Semiconductor /
Electro-Optical industry /
Automotive industry / Food industry

- Articulated Robot
- Delta Robot
- SCARA Robot
- Wafer Robot
- Electric Gripper
- Integrated Electric Gripper
- Rotary Joint

Single-Axis Robot

Precision / Semiconductor /
Medical / FPD

- KK, SK
- KS, KA
- KU, KE, KC

Direct Drive Rotary Table

Aerospace / Medical / Automotive industry /
Machine tools / Machinery industry

- RAB Series
- RAS Series
- RCV Series
- RCH Series

Ballscrew

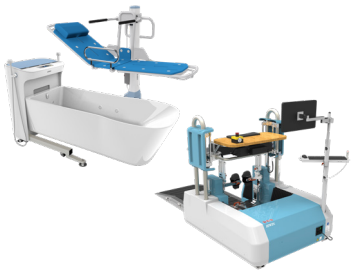
Precision Ground / Rolled

- Super S series
- Super T series
- Mini Roller
- Ecological & Economical lubrication Module E2
- Rotating Nut (R1)
- Energy-Saving & Thermal-Controlling (C1)
- Heavy Load Series (RD)
- Ball Spline

Linear Guideway

Automation / Semiconductor / Medical

- Ball Type--HG, EG, WE, MG, CG
- Quiet Type--QH, QE, QW, QR
- Other--RG, E2, PG, SE, RC



Medical Equipment

Hospital / Rehabilitation centers /
Nursing homes

- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Bearing

Machine tools / Robot

- Crossed Roller Bearings
- Ball Screw Bearings
- Linear Bearing
- Support Unit

AC Servo Motor & Drive

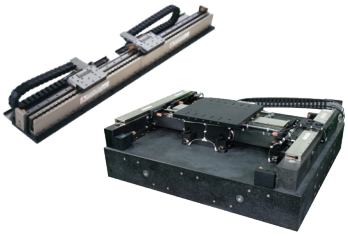
Semiconductor / Packaging machine
/SMT / Food industry / LCD

- Drives-D1, D1-N, D2T
- Motors-50W~2000W

Driven Tool Holders

All kinds of turret

- VDI Systems
  Radial Series, Axial Series, MT
- BMT Systems
  DS, NM, GW, FO, MT, OM, MS



Linear Motor

Automated transport / AOI application
/ Precision / Semiconductor

- Iron-core Linear Motor
- Coreless Linear Motor
- Linear Turbo Motor LMT
- Planar Servo Motor
- Air Bearing Platform
- X-Y Stage
- Gantry Systems

Torque Motor (Direct Drive Motor)

Inspection / Testing equipment /
Machine tools / Robot

- Rotary Tables-TMS,TMY,TMN
- TMRW Series
- TMRI Series

Warranty Terms and Conditions

The period of warranty shall commence at the received date of HIWIN product (hereafter called “product”) and shall cover a period of 12 months. The warranty does not cover any of the damage and failure resulting from:

- The damage caused by using with the production line or the peripheral equipment not constructed by HIWIN.
- Operating method, environment and storage specifications not specifically recommended in the product manual.
- The damage caused by changing installation place, changing working environment, or improper transfer after being installed by the professional installer.
- Product or peripheral equipment damaged due to collision or accident caused by improper operation or installation by the unauthorized staff.
- Installing non-genuine HIWIN products.

The following conditions are not covered by the warranty:

- Product serial number or date of manufacture (month and year) cannot be verified.
- Using non-genuine HIWIN products.
- Adding or removing any components into/out the product without authorized.
- Any modification of the wiring and the cable of the product.
- Any modification of the appearance of the product; removal of the components inside the product. e.g., remove the outer cover, product drilling or cutting.
- Damage caused by any natural disaster. i.e., fire, earthquake, tsunami, lightning, windstorms and floods, tornado, typhoon, hurricane etc.

HIWIN does not provide any warranty or compensation to all the damage caused by above-mentioned circumstances unless the user can prove that the product is defective.

For more information towards warranty terms and conditions, please contact the technical stuff or the dealer who you purchased with.

⚠ WARNING	❖ Improper modification or disassemble the robot might reduce the robot function, stability or lifespan. ❖ The end-effector or the cable for devices should be installed and designed by a professional staff to avoid damaging the robot and robot malfunction. ❖ Please contact the technical stuff for special modification coming from production line set up. ❖ For the safety reason, any modification for HIWIN product is strictly prohibited.

Safety Precautions

1. Safety Information

- Safety Responsibility and Effect
  - ⊙ This chapter explains how to use the robot safely. Be sure to read this chapter carefully before using the robot.
  - ⊙ The user of the HIWIN industrial robot has responsibility to design and install the safety device meeting the industrial safety regulations in order to ensure personal safety.
  - ⊙ In compliance with the safety information on industrial robot described in this manual can't guarantee that *HIWIN* robot will not occur any safety problems.
  - ⊙ This machine is defined as a partly completed machinery, the associated hazards must be handled by system integrator in accordance with ISO 102018-1/-2.
  - ⊙ A safety-related part of control system (SRP/CS) should conform to the requirement of performance level d and category 3 according to ISO 13849-1.
  - ⊙ The installation for emergency functions shall be defined by the system integrator in accordance with ISO 10218-1/2.

- Safety Operation Principle
  - ⊙ Before connecting the power supply for HIWIN industrial robot startup assembly procedure, check whether the specification of factory output voltage matches the specification of input voltage of the product. If it does not match, ensure to use the corresponding transformer (HIWIN optional transformer is recommended).
  - ⊙ Emergency Stop button (on Teach Pendant or from external emergency stop switch) must be pressed before turning off the power, and then switch off the power switch.
  - ⊙ While connecting to the external I/O or the signal, please operate in the condition that the power switch is turned off to prevent from a shortcut caused by mistaken touch in the process, and resulting in damage.

2. Description Related to Safety

I. Safety Symbols

⊙ Carefully read the instructions in the user manual prior to robot use. The following shows the safety symbols used in this user manual.

Symbol	Description
DANGER	Failure to follow instructions with this symbol may result in serious hazard or personal injury. Please be sure to comply with these instructions.
WARNING	Failure to follow instructions with this symbol may result in personal injury or product damage. Please be sure to comply with these instructions.
CAUTION	Failure to follow instructions with this symbol may result in poor product performance. Please be sure to comply with these instructions.

II. Working Person

⊙ The personnel can be classified as follows

- ■ Operator:
  - Turns robot controller ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
- ■ Programmer or teaching operator:
  - Turns robot controller ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
  - Teaches robot
- ■ Maintenance engineer:
  - Turns robot controller ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
  - Teaches robot
  - Does maintenance, adjustment, replacement

⊙ Programmer and the maintenance engineer must be trained for proper robot operation.

3. Precautions

3.1 Common Safety Issues

⚠ DANGER	❖ All operating procedures should be assessed by professional and in compliance with related industrial safety regulations. ❖ When operating robot, operator needs to wear safety equipment, such as workwear for working environment, safety shoes and helmets. ❖ When encountering danger or other emergency or abnormal situation, please press the emergency stop button immediately. After danger is eliminated, move the robot away with low speed in manual mode. ❖ When considering safety of the robot, the robot and the system must be considered at the same time. Be sure to install safety fence or other safety equipment and the operator must stand outside the safety fence while operating the robot. ❖ A safety zone should be established around the robot with an appropriate safety device to stop the unauthorized personnel from access. ❖ While installing or removing mechanical components, be aware of a falling piece which may cause injury to operator. ❖ Ensure the weight of workpiece does not exceed the rated load or allowable load moment at wrist. Exceeding these values could lead to the driver alarm or malfunction of the robot. ❖ Do not climb on manipulator. ❖ Do not store the machine in the environment with corrosion and flammable gas or close to the flammable object. ❖ Do not operate the machine in the environment with moisture, water or grease. ❖ Do not operate the machine at the place where vibration or the strong impact occurs. ❖ Do not immerse the electric wires into grease or water.

	❖ Do not connect or operate the machine with wet hands. ❖ Do not operate the machine in potentially explosive environment. ❖ Please ensure the controller is grounded. ❖ Keep hands away from the inner part of the controller while it is connecting to the power or during operating. ❖ Do not touch the heat sink, regenerative resistance, the power supply or the computer inside the controller while it is operating due to its high temperature. ❖ Be sure power is disconnected prior to repair and maintenance, and ensure to operate under the condition of no electrical shock risk. ❖ Do not disassembly the controller without permission. If there's any issues, please contact our engineers.
⚠ WARNING	❖ The personnel installing robot should be trained and licensed. ❖ To ensure personal safety, robot installation must comply with this manual and related industrial safety regulations. ❖ The control cabinet should not be placed near high voltage or machines that generate electromagnetic fields to prevent interference that could cause the robot to deviation or malfunction. ❖ Using non-HIWIN spare parts to repair may cause robot damage or malfunction. ❖ Beware of the heat generated by the controller and servo motor. ❖ Do not overbend the cable to avoid poor circuit contact or unexpected damage. ❖ Do not stand on the controller or put heavy objects on it. ❖ Do not block the vent or put foreign objects into the controller. ❖ Please ensure the controller is fixed on the base.

	❖ Do not pull the connector violently or twist the electric wires excessively. ❖ Do not frequently switch ON/OFF the power switch and the control button. ❖ Please ensure that the robot, the emergency stop switch and the controller are functioning properly before performing any work. ❖ Do not shutdown the power switch during the operation. ❖ Do not open, modify, disassemble and maintain the machine without permission. ❖ The power must be disconnected when the machine does not operate in a long time. ❖ Do not turn off the power of the controller when modifying the program or parameter. Otherwise, the data stored in the controller will be damaged. ❖ After the brake of a servo motor is released, the robot will be moved due to gravity and it may injured the operator. ❖ The industrial robots can be applied for the different industrial environments. ❖ When the operating procedures are interrupted, the special attention should be paid during the troubleshooting.

3.2 Operation

⚠ DANGER	❖ Teaching, jogging or programming should be done outside of the safety fence. If it is inevitable to enter the safety fence, press the emergency stop button before entrance. Operation should be restricted at low speed and beware of surrounding safety. ❖ All operations shall be executed by trained staff.

3.3 Maintenance

⚠ DANGER	❖ Please contact us if the procedure not specified by HIWIN is needed. ❖ Please contact us if the replacement of the component not specified by HIWIN is needed. ❖ Be sure to carry out regular maintenance, otherwise it will affect the service life of the robot or other unexpected danger. ❖ Prior to repair and maintenance, please switch off power supply. ❖ Maintenance and repair should be performed by a qualified operator with a complete understanding of the entire system to avoid risk of robot damage and personal injury. ❖ When replacing the components, avoid foreign object going into the robot.

3.4 End Effector

The end effector can be classified as two types:

A. Gripper: Used to load and unload, such as pneumatic gripper, electric gripper and vacuum sucker.
B. Tool: Used to process, such as welding, cutting and surface treatment.

DANGER	❖ More attention must be paid to the design of the end effector to prevent power loss or any other errors that could lead to workpiece falling or damage. ❖ The tool-type end effector is usually equipped with high voltage, high temperature and active rotary shaft. Special attention should be paid to the operating safety. ❖ The end effector should be mounted firmly on the robot to avoid workpiece fall during operation which may cause personal injury or hazard.
WARNING	❖ The end effector may be equipped with its own control unit. During installation, pay attention to installed location. Ensure that the control unit does not interfere with robot operation. ❖ The gripper-type end effector should prevent the workpiece from dropping or damaging when the robot experiences a power error or other errors. If potential dangers or abnormal situations exist when using end effector, the associated hazards must be handled by the system integrator in accordance with the related standards.0

3.5 Pneumatic, Hydraulic System

DANGER	❖ When using the pneumatic or hydraulic system, the gripped workpiece may fall due to insufficient pressure or gravity. ❖ The pneumatic or hydraulic system must be equipped with the relief valve, so that it can be applied in an emergency.
WARNING	❖ More attention should be paid to the pressure remained in the pneumatic systems after the power is disconnected.

	❖ The internal pressure must be released before the pneumatic systems are maintained. ❖ More attention should be paid to the pressure in the pneumatic system as it is several times more than the atmosphere pressure.

3.6 Emergency Stop Switch

⚠ DANGER	❖ The robot or other control component should have at least one device for immediate halt, such as an emergency stop switch. ❖ The emergency stop button must be installed in an easily accessible location for quick stop. ❖ While executing an emergency stop, power to the servo motor will be cut, and all movements will be stopped. And the control system will be shut down. Emergency stop should be reset if the restoration of operating procedure is wanted. ❖ Avoid using emergency stop to replace a normal stop procedure. This could reduce the lifespan of the robot.
⚠ WARNING	❖ The drive power and the control system will be disconnected to stop all actions during the emergency stop. ❖ If you want to restart the procedures, you should reset the emergency stop switch. ❖ Emergency stop established an immediate stop: Immediately stop the robot system, and disconnect the driver power. ❖ The emergency stop switch is used for emergency stop only. ❖ The *HIWIN* robot is equipped with two emergency stop switches, where one is installed on the teach pendant and the other is directly connected to the controller via a cable. If additional emergency stop switches are required, other connecting method can be applied for the same purpose. ❖ Based on the relevant industrial safety regulations, the emergency stop switch is directly connected to the controller of the robot via the physical wires.

	❖ If the version of the braking is not applied to the whole axis, once the emergency stop is executed and the heavy objects are loaded on the robot end, the axis without brake will move due to gravity. This attention must be paid for safety issue.

4. Intended use

HIWIN robots are industrial robots and intended for pick-and-place, handling, assembling, deburring, grinding and polishing. Use is only permitted under the specified environment, for more detailed information please see section 2.5 environmental conditions.

Use is not permitted under the following conditions:

- Use in potentially explosive environments
- Use without performing risk assessments
- Transportation of people and animals
- Operation outside the allowed operating parameters

5. Disposal

The disposal of HIWIN robot shall be in accordance with the local environmental regulations.

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Attachment

Attachment 1 - Calibration plate1

Attachment 2 - Calibration plate2

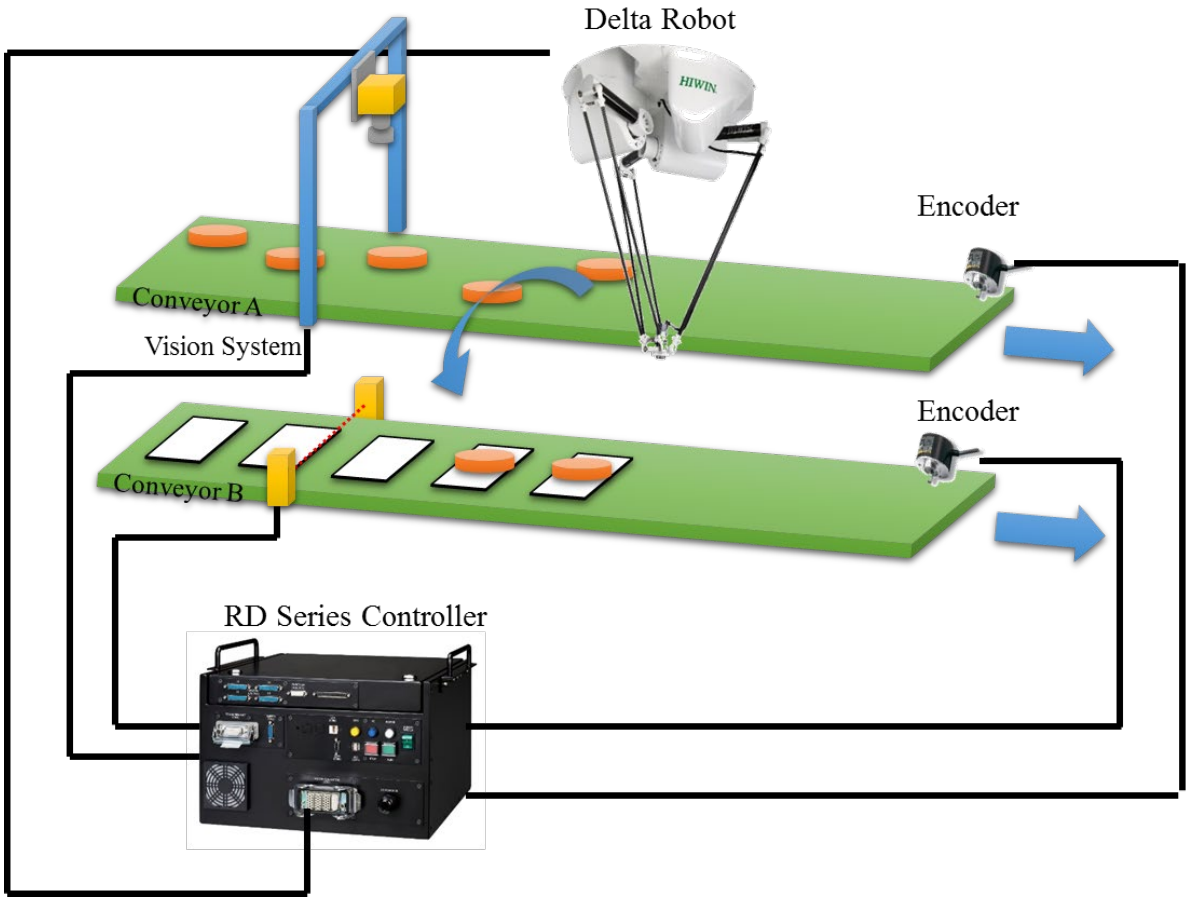
Version Update

EDITION	Date	Applicable Scope	Note
1.0.0	2016.08.16	Delta Robot Series HRSS 3.0.7	Preliminary issue
1.1.0	2016.08.31	Delta Robot Series HRSS 3.1.2	Operation interface updated Added the filter of vision object
1.2.0	2017.01.24	Delta Robot Series HRSS 3.1.6	Operation interface updated Added machine vision communication timing description Added 4.3 content Update 3.12, 3.2, 6.0 Add-Attachment
1.2.1	2017.02.17	Delta Robot Series HRSS 3.1.6	Modify 4.1 Configure Command Add Offset command of convey number
1.3.0	2017.07.17	Delta Robot Series HRSS 3.2.0	Modify Track→Setting interface Add ENC SOURCE function Optimize content 3.2 Sensor calibration Redefine content 6 Error Message
1.3.1	2018.01.03	Delta Robot Series HRSS 3.2.5	Modify Track→Setting interface
1.3.2	2018.02.22	Delta Robot Series HRSS 3.2.6	Update 3.1.1 content Update 6.0 error exclusion content
1.3.3	2018.11.01	Delta Robot Series HRSS 3.2.8	Modify Chp.2.2 Encoder Socket, pin assignment IDI1~IDI4

1. Introduction to Conveyor Tracking System

1.1 HIWIN Robot Tracking System (HRTS)

The HIWIN Robot Tracking System, referred as HRTS, is developed for robot use in cooperation with a conveyor.
The basic structure of the conveyor tracking system is shown in the figure below.
The robot calculates the motion of the conveyor through the value change of the encoder installed on the conveyor, and detects the relative position of target objects on the conveyor with a sensor. With an optical sensor or vision system, the robot can perform conveyor tracking after the encoder values and the positions of the target objects are sent back to the robot controller.

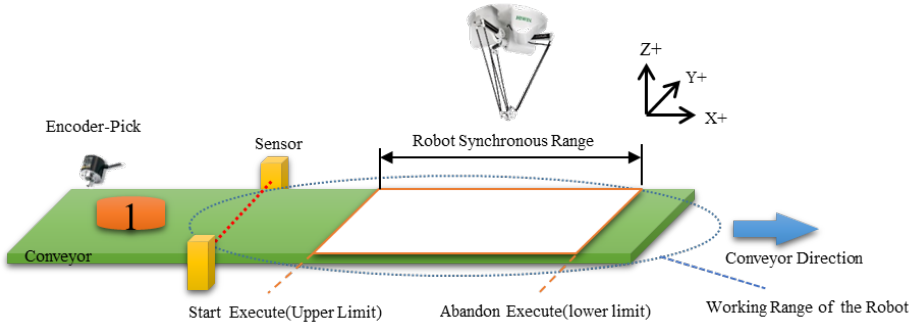


1.2 Function Overview

The robot detects the conveyor displacement via the encoder value on the conveyor, as shown in the figure below, and trigger signal via a vision system or a sensor.
When the signals are triggered by the sensor, the robot will receive a queue. When the target objects goes to the synchronous range, the robot will start conveyor tracking to pick or place. If the target objects exceeds the synchronous range, the robot will quit the queue.
The following sections will describe the states and the corresponding procedures when the robot performs conveyor tracking.

State when the sensor doesn't detected the object:

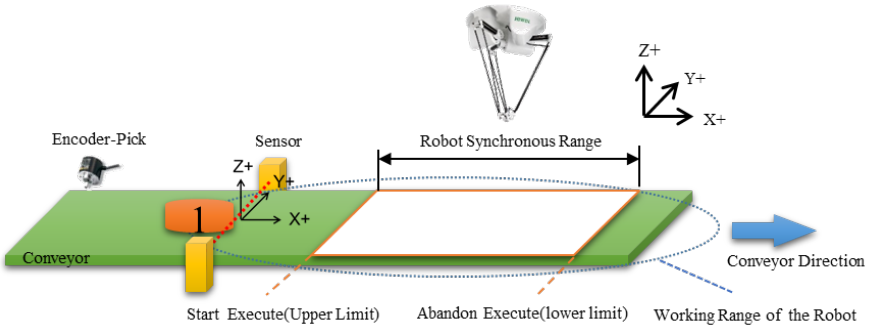
Object 1 is placed on the conveyor, and delivered via the conveyor. At this time, the encoder value is 50 pulse. When the sensor doesn't detect object 1, the robot will not receive the trigger signal. Therefore, there is no queue. The robot is in the standby state. The state is shown in the following table.



State of Robot	
Tracking signal for encoder	pulse=50
Signal to pick object by encoder	pulse=0
Queue	None
State	Ready

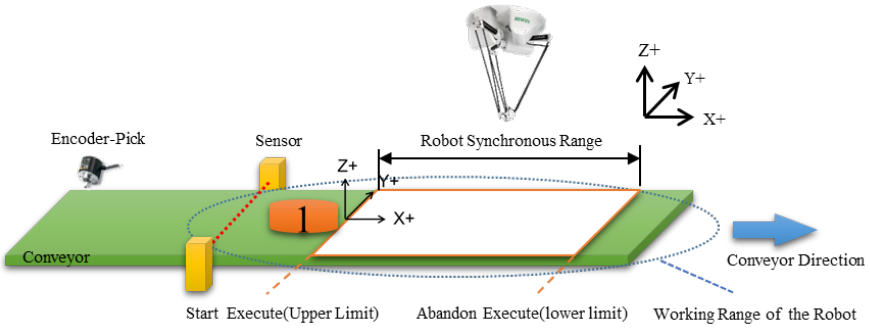
State when the sensor detects object 1:

Object 1 is placed on the conveyor, and delivered via conveyor. At this time, the value on the encoder is 100 pulse. When a sensor detects object 1, the robot will receive the trigger signal and record the value. The queue will count once more. However, the object has not entered the synchronous range. Therefore, the robot will be in the standby state shown in the following table:



State of Robot	
Tracking signal for encoder	pulse=100
Signal to pick object by encoder	pulse=100
Queue	Queue1
State	Ready

State when object 1 enters the synchronous range:

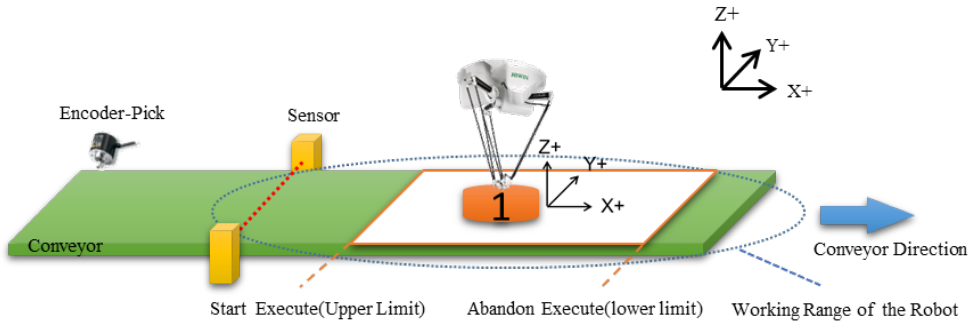


Object 1 is placed on the conveyor, and delivered via conveyor. At this time, the value on the encoder is 150 pulse. When object enters the synchronous range, the robot will start to execute. The state is shown in the following table:

State of Robot	
Tracking signal for encoder	pulse=150
Signal to pick object by encoder	Queue1 pulse=100+50
Queue	Queue1
State	Ready

State when the robot picks object 1:

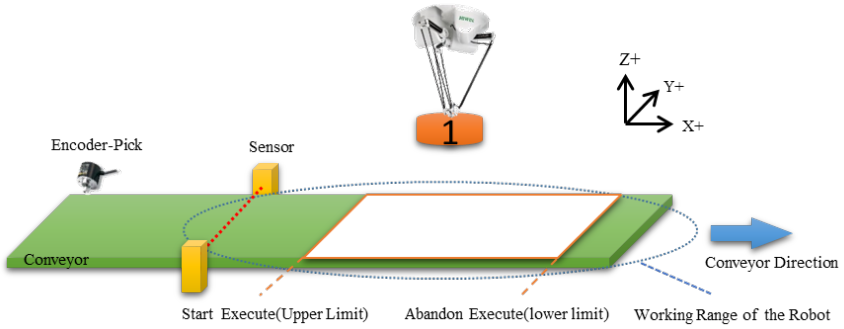
Object 1 is placed on the conveyor, and delivered via conveyor. At this time, the value on the encoder is 200 pulse. The robot operates pick. Because the robot has picked object 1, the encoder will temporarily hold the value. The state is shown in the following table:



State of Robot	
Tracking signal for encoder	pulse=200
Signal to pick object by encoder	Queue1 pulse=100+100
Queue	Queue1
State	Pick

State when the robot successfully picks object 1:

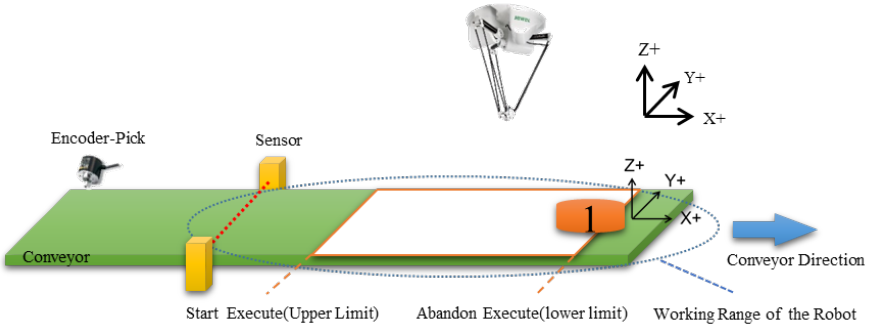
Object 1 is placed on the conveyor, and delivered via conveyor. At this time, the value on the encoder is 215 pulse. Because the robot has executed, the queue will be removed and counter will delete one. The state is shown in the following table:



State of Robot	
Tracking signal for encoder	pulse=215
Signal to pick object by encoder	Queue1 pulse=100+100
Queue	Remove
State	Place

State when object 1 goes out of the synchronous range:

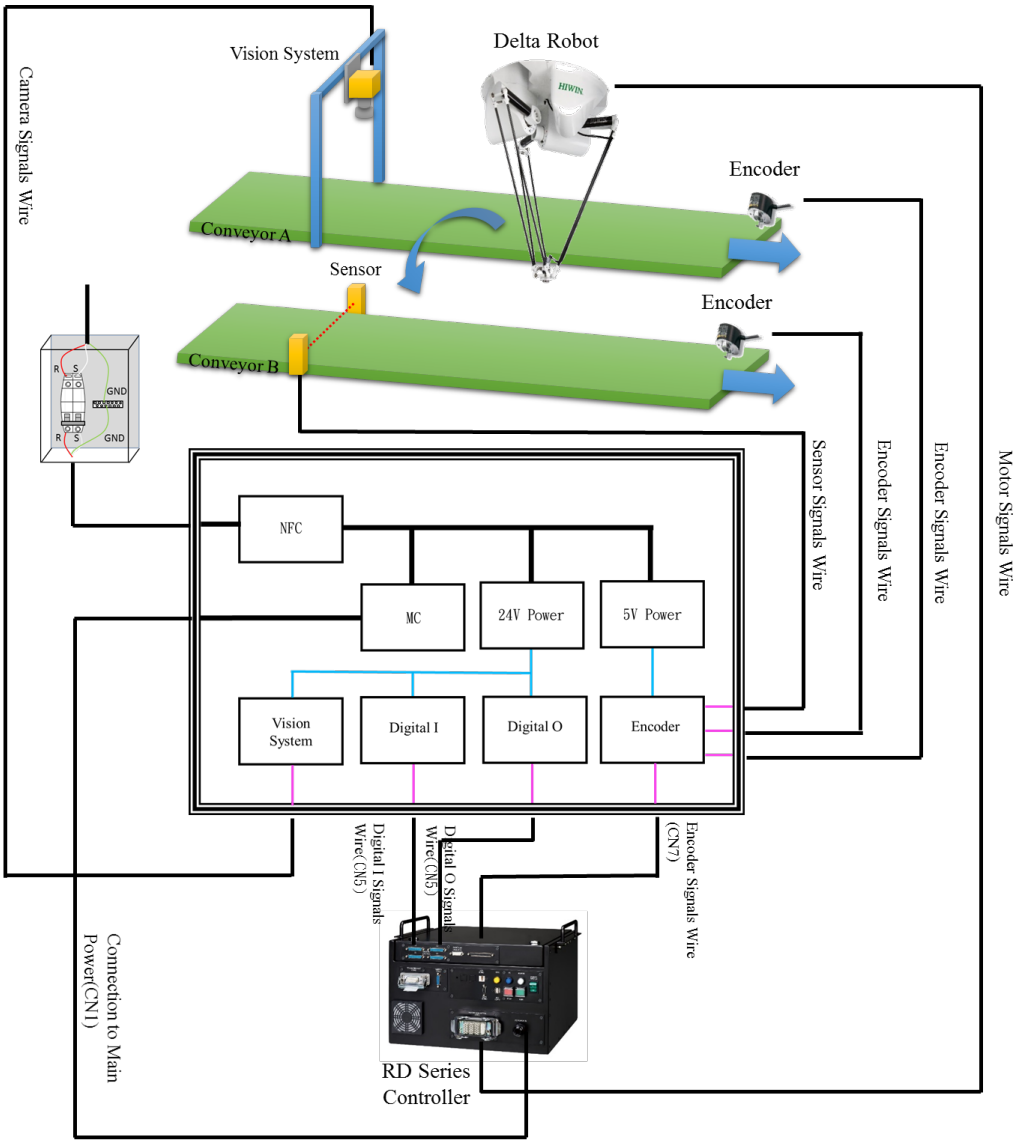
Object 1 is placed on the conveyor, and delivered via conveyor. At this time, the value on the encoder is 425 pulse. Because the object 1 has exceeded the synchronous range, the queue goes to quit. Therefore, the queue will quit. The counter will delete one. The state is shown in the following table:



State of Robot	
Tracking signal for encoder	pulse=425
Signal to pick object by encoder	Queue1 pulse=100+315
Queue	Queue1 remove
State	Queue1 quit

1.3 System Configuration

The basic system configuration is shown in the figure below:



1.4 System Specifications

Manipulator	The Delta robot series can be used. For details, please see C04U02-1612 Delta Operating Manual.
Controller	The specifications are needed to select with the Delta robot. For the details, please see C05UC101-1608_RD series controller.
Conveyor	All types of liner conveyor, such as roller conveyor, plane belt conveyor and timing synchronous conveyor can be used.
Encoder	An encoder with differential output increment can be used. Example: Omron with an external diameter of φ50 E6C2-C and a resolution of 2,000P/R.
Sensor	Comparison, reflection, regression and limited reflection sensors can be used. If accurate measurement is required, a laser sensor can be selected. Example: Omron comparison with E3T-ST31 2M.
Vision System	The communication format of the Vision System must conform to HRTS. Please see 1.5 Communication Format.

Note 1: For the specifications above, please select by user requirements.
Note 2: The Conveyor specification selection speed is constant speed.
Note 3: The encoder installation axis is parallel to the conveyor and cannot slip with the conveyor.
Note 4: The contents in the manuals above is subject to change without notification.

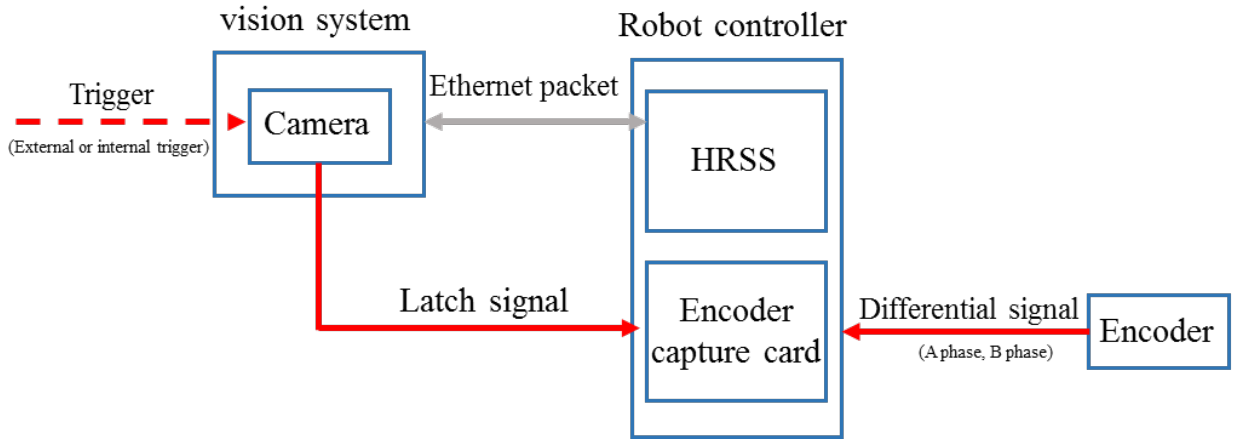
1.5 Communication format

HRSS Conveyor Belt Tracking and Machine Vision Communication Timing Description

For robot and machine vision communication, input and output trigger sequence series of actions, the use of communication architecture and communication timing diagram as a description.

◆ **Communication architecture diagram**

This communication architecture description content integrates robot controller, machine vision system, and encoder. Among them, robot controller includes encoder capture card and HIWIN robot software system HRSS (HIWIN ROBOT SOFTWARE SYSTEM), hereinafter referred to as HRSS. This machine vision system contains camera.



Above communication architecture, vision and robot communication method is network transmission (TCP/IP), definition of connection, visual system must be Server, HRSS is for Client.

Encoder and encoder capture card in robot controller is solid wire connection, transmission signals are differential signals.

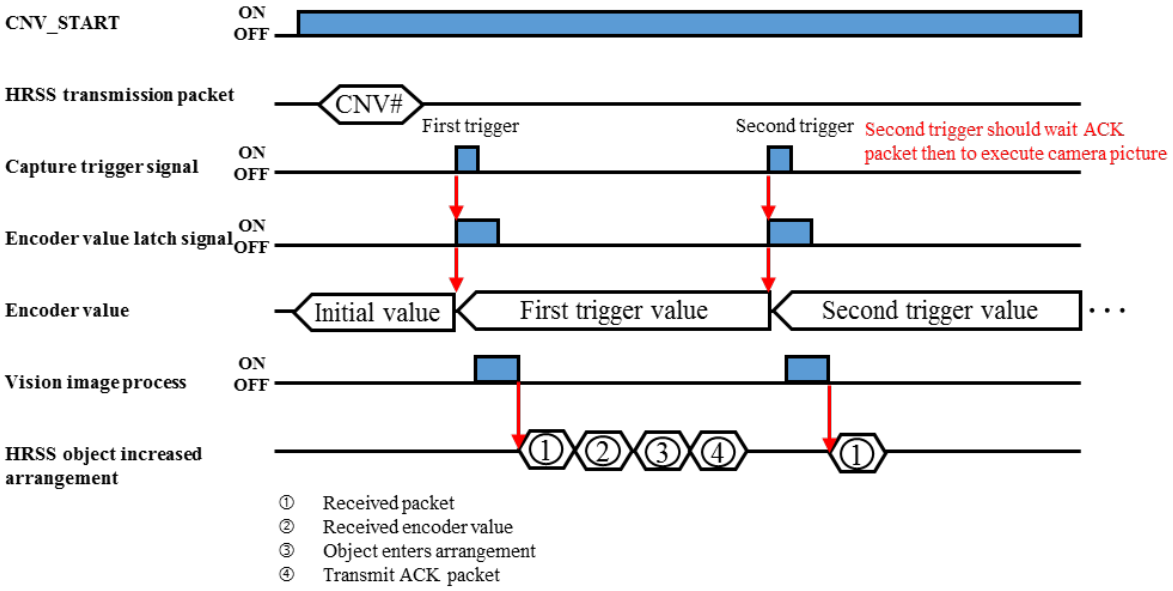
The capture action of encoder counter of encoder capture card of robot controller is trigger by encoder counter capture signal through camera, it is solid wire trigger.

User must confirm that encoder capture signal is triggered at the same time as camera taking picture time, and should avoid delay when triggered.

To confirm conveyor belt tracking action is accurate. In this case, encoder capture signal is through camera's exposure trigger signal as encoder counter value capture signal.

Communication timing diagram

This communication timing diagram illustrates integrated contents of robot controller, machine vision, and encoder. Depending on different application requirements, use sensor as camera trigger signal source, or add visual exposure signal. There are six steps to illustrate, as follows:



STEP1: Execute CNV_START

CNV_START instruction must be executed preferentially when robot performs conveyor tracking function. This command can be used to enable the setting and communication of tracking function. CNV_START can be stopped by three methods, namely: when CNV_STOP instruction is executed, error signal is triggered or program is actively stopped.

STEP2: HRSS and machine vision connection

When robot and machine vision connection is successful, HRSS will send packets {CNV #}, on behalf of acceptable visual system packet transmission, this packet will only be transmitted once in connection. Where CNV # in big brackets is the number of conveyor belts selected for tracking.

For example, if user selects to track conveyor belt number 2 (CNV = 2), when robot and machine vision connection is successful,-robot will return packet {2} to machine vision.

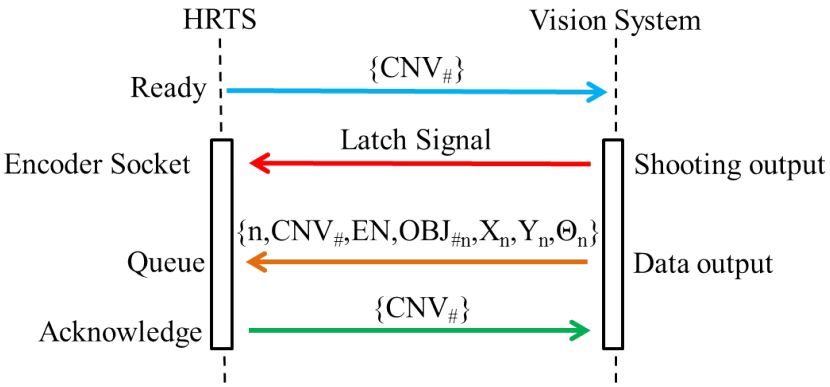
STEP3: Encoder counter value capture and camera taking picture

Since machine vision itself does not have an encoder capture card installed, camera timing and encoder counter value capture trigger signal must be triggered at the same time. Such as when the timing of capture and encoder counter value of trigger signal

generates a delay, robot in tracking, will cause the direction of conveyor belt lagging behind.
In this case, camera takes picture at the same time as exposure time, so exposure signal is used as capture trigger signal of encoder counter of robot controller.

STEP4: Encoder counter value capture signal and encoder trigger value
When encoder counter value trigger signal is triggered, encoder trigger value will update encoder value. Encoder triggers a numerical processing time of up to about 0.8ms.

STEP5: Machine Vision Transmission Packet and Encoding Numerical Readings
When machine vision processing image is completed, should be in accordance with communication format for packet transmission. After HRSS receives packet, it will read current encoder value and enters packet information and encoder value to array. If HRSS receives an error packet, HRSS ignores error packet.
If machine vision uses fixed time to take pictures, when camera frequency is faster than machine vision processing time or before HRSS obtains encoded value, encoder value has been updated, above reasons will cause packet and encoder value to get wrong alignment.
STEP6: Objects enter array and return ACK packets
When HRSS receives correct packet and completes the entry of objects, it will return ACK packet to machine vision, the contents of ACK packet are {CNV #}, where CNV # in large brackets is the number of selected track.
If user selects track conveyor belt number 1 (CNV = 1), when robot and machine vision connection is successful, robot will return packet {1} to machine vision. Machine vision should continue to trigger camera and encode value capture signal after receiving ACK packet.



Description:

Packet format when the Vision System sends to the HRTS:

{n,CNV$_{\#}$,EN,OBJ$_{\#n}$,X$_n$,Y$_n$,Θ$_n$}

n: total quantity of objects in this packet, which must be positive integer.

CNV$_{\#}$: Conveyor number corresponding to the packet data, where #=1, 2, 3, 4.

EN: The value of the encoder corresponding to the image, which must be positive integer.

OBJ$_{\#n}$: Object number, where #n=1~8.

X$_n$: X coordinate of object number in the nth order.

Y$_n$: Y coordinate of object number in the nth order.

Θ$_n$: Rotation angle Θ of object number in the nth order (This rotation axis is $\overrightarrow{U_Z} = \overrightarrow{U_X} \times \overrightarrow{U_Y}$).

Note 1: The total object number in single packet is 50. The length of packet string is a maximum of $2^{12} = 4096$ characters.

Note 2: If the packet data sent by the Vision System doesn't contain the EN value of the encoder, it will be expressed by NA.

Note 3: The positive value can be expressed by X$_n$ or + X$_n$, and the negative value can be expressed by - X$_n$. The number can be up to 14 characters.

Example 1:

Total object quantity	Conveyor Number	Value of encoder	Object Number	X coordinate	Y coordinate	Rotation angle
1	1	3000	1	X_1	Y_1	Θ_1

Description: The total object quantity in this packet is 1. The corresponding conveyor number is 1. The corresponding value of the encoder is 3000. The object number of the first object is the first type; the coordinate and angle can be expressed by X_1, Y_1, and Θ_1.

The packet data should be:

{1,1,3000,1,X_1,Y_1,Θ_1}

Example 2:

Total object quantity	Conveyor Number	Value of encoder	Object Number	X coordinate	Y coordinate	Rotation angle
2	1	NA	1	X_1	Y_1	Θ_1
			2	X_2	Y_2	Θ_2

Description: The total object quantity in this packet is 2. The corresponding conveyor number is 1, no corresponding encoder, representing as NA. The object number of the first object is the first type; the coordinate and angle can be expressed by X_1, Y_1, and Θ_1. The object number of the second object is the second type; the coordinate and angle can be expressed by X_2, Y_2, and Θ_2.

The packet data should be:

{2,1,NA,1,X_1,Y_1,Θ_1, 2,X_2,Y_2,Θ_2}

Example 3:

Total object quantity	Conveyor Number	Value of encoder	Object Number	X coordinate	Y coordinate	Rotation angle
4	1	3000	1	X_1	Y_1	Θ_1
			1	X_2	Y_2	Θ_2
			2	X_3	Y_3	Θ_3
			3	X_4	Y_4	Θ_4

Description: The total object quantity in this packet is 4. The corresponding conveyor number is 1. The corresponding value of the encoder is 3000. The object number of the first object is the first type; the coordinate and angle can be expressed by X_1, Y_1, and Θ_1. The object number of the second object is the first type; the coordinate and angle can be expressed by X_2, Y_2, and Θ_2. The object number of the third object is the second type; the coordinate and angle can be expressed by X_3, Y_3, and Θ_3. The object number of the fourth object is the third type; the coordinate and angle can be expressed by X_4, Y_4, and Θ_4.

The packet data should be:

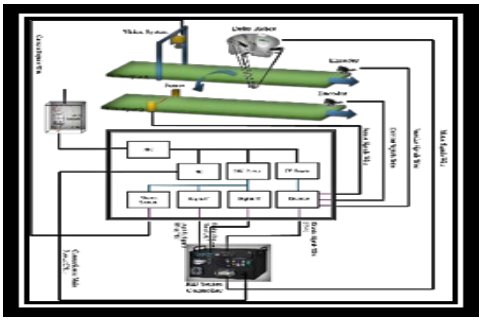
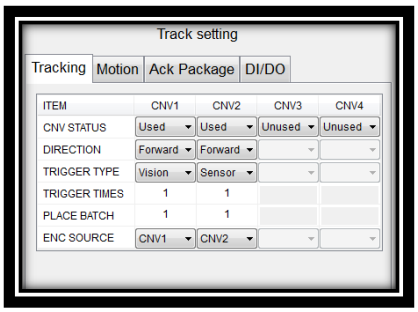
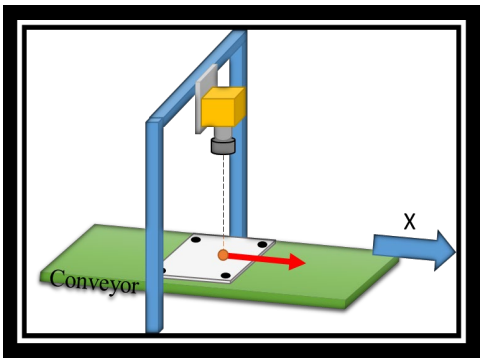
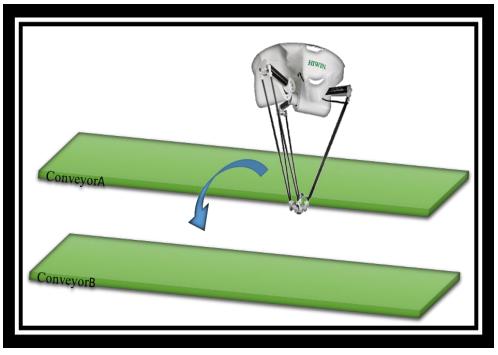
{4,1,3000,1,X_1,Y_1,Θ_1,1,X_2,Y_2,Θ_2,2,X_3,Y_3,Θ_3,3,X_4,Y_4,Θ_4}

2. System Installation

2.1 Installation Flow

Basic Installation Flow

1. System Configuration: The system configuration will be created to install the robot, arrange the conveyor, set up the Vision System and the system wiring in accordance with different applications.
2. Function Settings: Set the parameters related to conveyor tracking, and select the trigger type (Senor or Vision System), set the object height and IP address for the Vision System.
3. Calibration: Calibrate the coordinate system, the working range and conveyor encoder ratio. If a Vision System is used, the coordinate systems for the robot and the Vision System must be calibrated.
4. Programming: Program the commands for conveyor tracking and plan the motion for the robot according to the system configuration.

1. System Configuration	2. Function Setting
	
3. Calibration	4. Programming
	

For the installation of the robot, please see **C04UC02-1612_Delta_Operating Manual.**

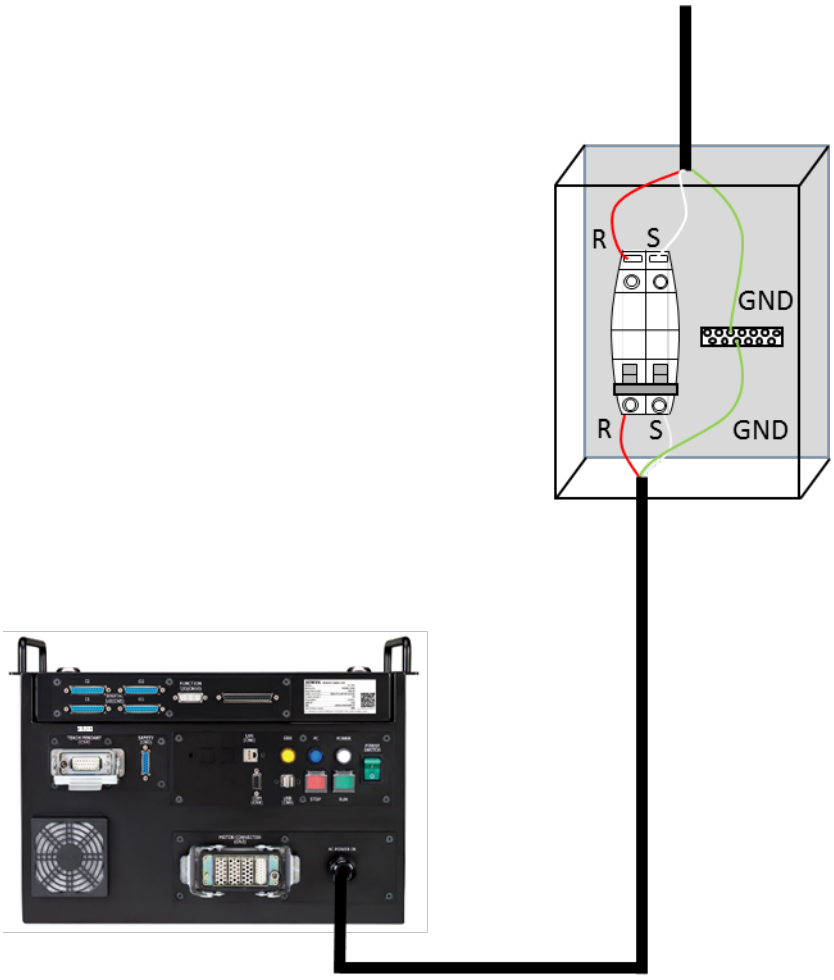
For the control box, please see **C05UC101-1608_RD Series Controller.**

2.2 Electric Connection

Connection to Main Power:

The power supply to the controller is 1P 200-240VAC. The current is selected according to the controller specifications.

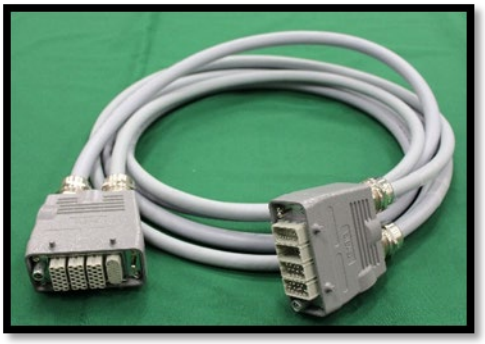
When the main power is connected, the grounding line should be separated from the main power breaker and indeed grounded. The incorrect phase connection should be avoided when the main power is connected. The phase R and S should not be reversely connected.



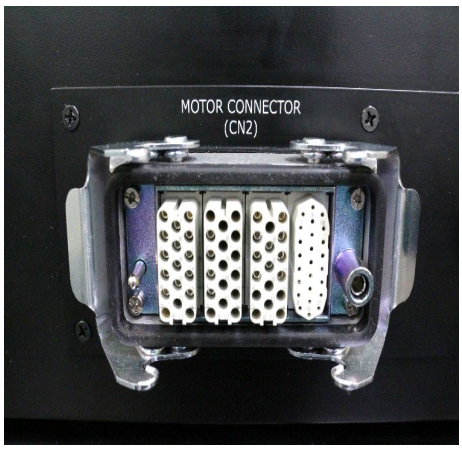
Motor Connector

Description:

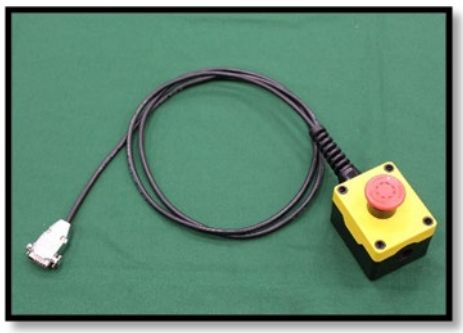
Power and signal lines that connect the robot with the controller (CN2).



Connection:

The motor connector for the controller is CN2 connector. Please outwardly unlock the safety lock, and connect the motor power signal cable. This connector is designed with a fail-safe. If it cannot be connected, please rotate and connect it.	
The motor power signal cable is connected to CN2 connector, and the safety lock is fastened.	

Connection of Emergency Stop Switch



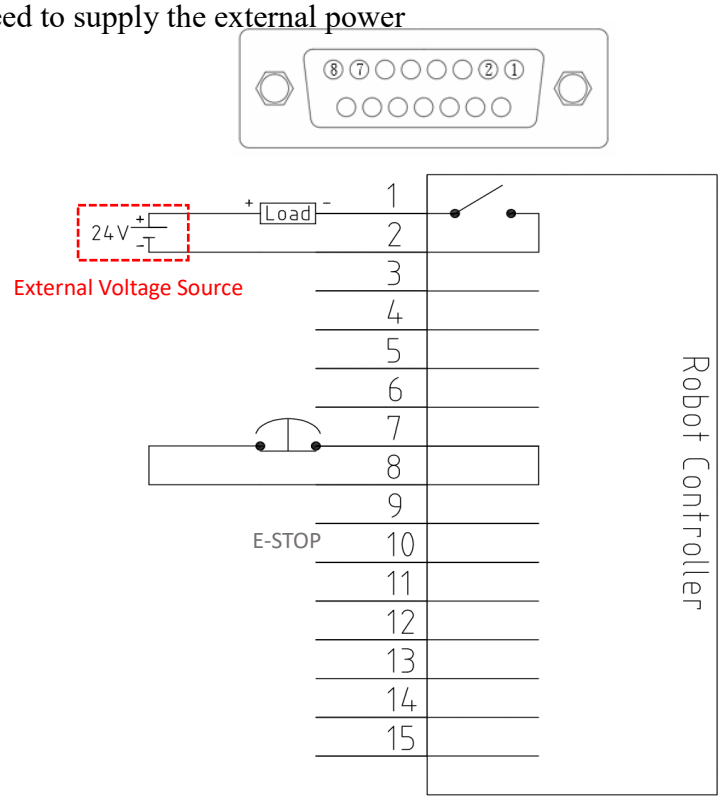
Description:

The emergency stop connector D-SUB 15P is the standard accessory.

The Emergency Stop Switch set includes the Emergency Stop button and connector are optional.

Wiring diagram for Emergency Stop Switch

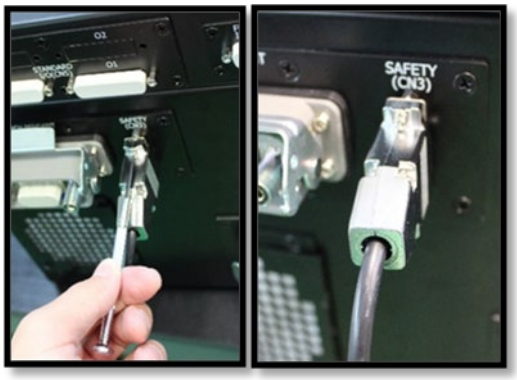
: Need to supply the external power



Remark: The pin 7 and 8 on the Emergency Stop Switch are normally short-circuited; if the pin is open-circuited, it will trigger the emergency stop signal.

CAUTION	Please fasten the emergency stop connector or the Emergency Stop Switch. When using the emergency stop connector, please ensure the contacts are firmly connected. The maximum permissible current for the contact is 6A.

Connection:

The emergency stop connector for the controller is a CN3 connector. Please remove the safety cover, and connect. This connector is designed with a fail-safe. If it cannot be connected, please rotate and connect it.	
The connector is connected to CN3 connector, and fastened with screws.	
Please ensure the Emergency Stop Buckle is in the reset state before the robot runs.	

DANGER	The Emergency Stop Switch must be located at a reachable position. When the robot runs incorrectly, it must be immediately stopped for safety.

CAUTION	Before the robot runs, please ensure this Emergency Stop Switch and the Emergency Stop Switch on the Teach Pendant are in the reset state.

External I/O

There are three types of external I/O for this controller:

(1) Function I/O→Specific Function I/O.

(2) Digital I/O→Configuration of External I/O by users.

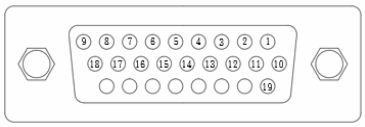
(3) Encoder I/O→Input by External Encoder.

Function I/O

Description:

This cable is a connection cable for Function I/O (CN10), which is used to connect the connector to the robot. There are eight input contacts and eight output contacts in a set.

Overview of Function I/O



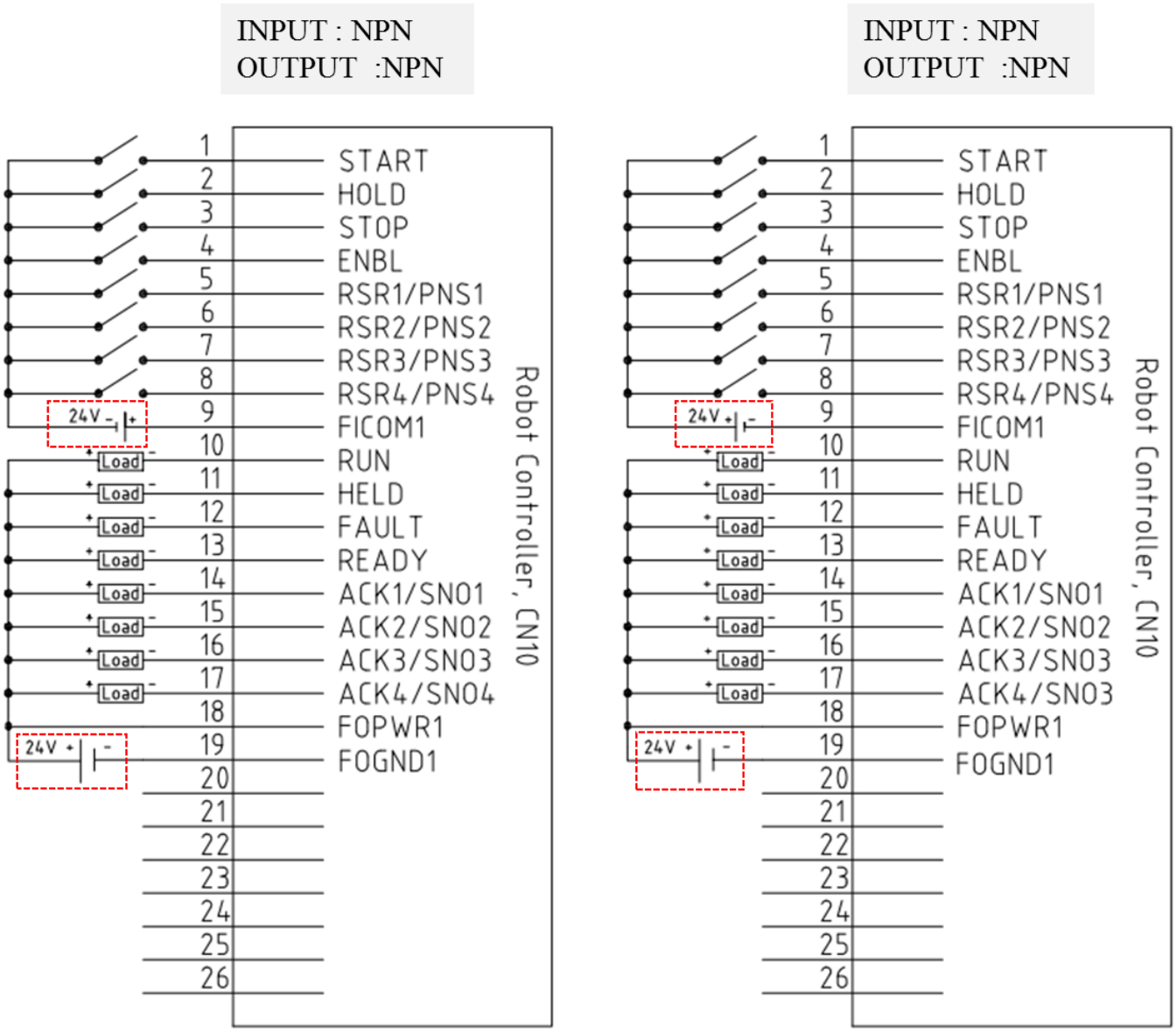
Input			Output		
Pin	Parameter Name	Function	Pin	Parameter Name	Function
1	START	Execute program	10	RUN	Signal output when running program
2	HOLD	Hold program	11	HELD	Signal output when holding program
3	STOP	Stop program	12	FAULT	Fault signal output from controller
4	ENBL	Need to enable this input when you want to use Function I/O.	13	READY	Controller ready to complete
5	RSR1/PNS1	Robot request 1/procedure selection 1	14	ACK1/SNO1	RSR 1 feedback signal/select the program No.1
6	RSR2/PNS2	Robot request 2/procedure selection 2	15	ACK2/SNO2	RSR 2 feedback signal/select the program No.2
7	RSR3/PNS3	Robot request 3/procedure selection 3	16	ACK3/SNO3	RSR 3 feedback signal/select the program

					No.3
8	RSR4/PNS4	Robot request 4/procedure selection 4	17	ACK4/SNO4	RSR 4 feedback signal/select the program No. 4
9	FICOM1	Common input	18	FOPWR1	External power input 24V(Note1)
			19	FOGND1	External power input 0V(Note1)

*Note 1: When function output is used, a set of external power inputs will be needed and the output is the NPN mode.

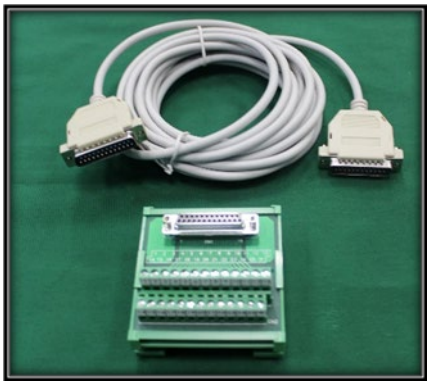
Wiring diagram for Function I/O (CN10)

: Need to supply external power



Remark: The output only supports NPN mode.

Digital I/O

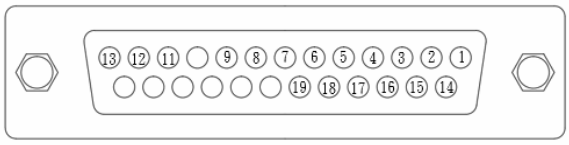


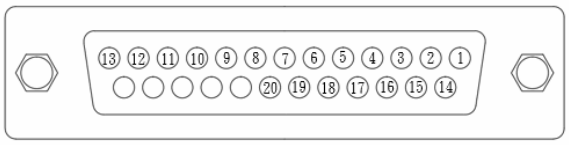
Description:

The connection set of Digital I/O includes a cable and a terminal. This cable is used for the connection of Digital I/O and the controller (CN5 connector), corresponding to 16 inputs or outputs. Therefore, two sets are needed if a set is used to correspond to output and input.

Overview of Digital I/O

There are 16 contacts for Digital I/O, as shown in the following table:





Input				Output			
Pin	Parameter Name	Pin	Parameter Name	Pin	Parameter Name	Pin	Parameter Name
1	DI[1]	11	DI[9]	1	DO[1]	11	DO[9]
2	DI[2]	12	DI[10]	2	DO[2]	12	DO[10]
3	DI[3]	13	DI[11]	3	DO[3]	13	DO[11]
4	DI[4]	14	DI[12]	4	DO[4]	14	DO[12]
5	DI[5]	15	DI[13]	5	DO[5]	15	DO[13]
6	DI[6]	16	DI[14]	6	DO[6]	16	DO[14]
7	DI[7]	17	DI[15]	7	DO[7]	17	DO[15]
8	DI[8]	18	DI[16]	8	DO[8]	18	DO[16]
9	DICOM1(Note1)	19	DICOM2(Note1)	9	DOGND1(Note2)	19	DOPWR2(Note2)
				10	DOPWR1(Note2)	20	DOGND2(Note2)

*Note 1: The common point of DI[1]~DI[8] is DICOM1, and that for DI[9]~DI[16] is DICOM2.

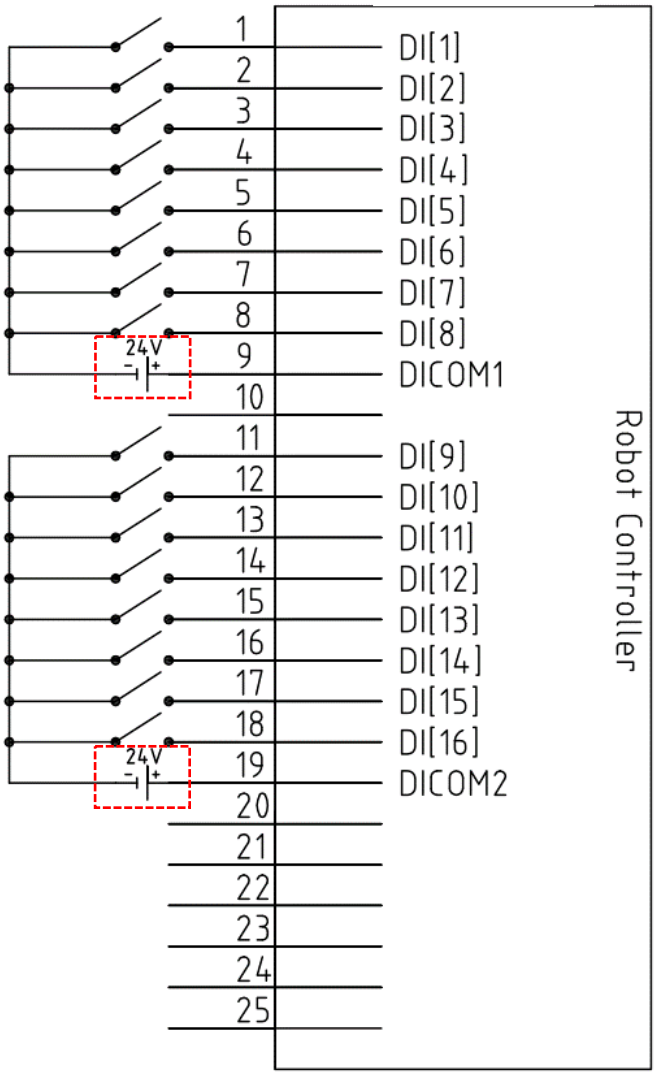
*Note 2: The common power of DO[1]~DO[8] is DOPWR1 and DOGND1, and that for DO[9]~DO[16] is DOPWR2 and DOGND2. A set of external power is needed when it is used. The output is NPN mode.

Wiring diagram for Digital Input

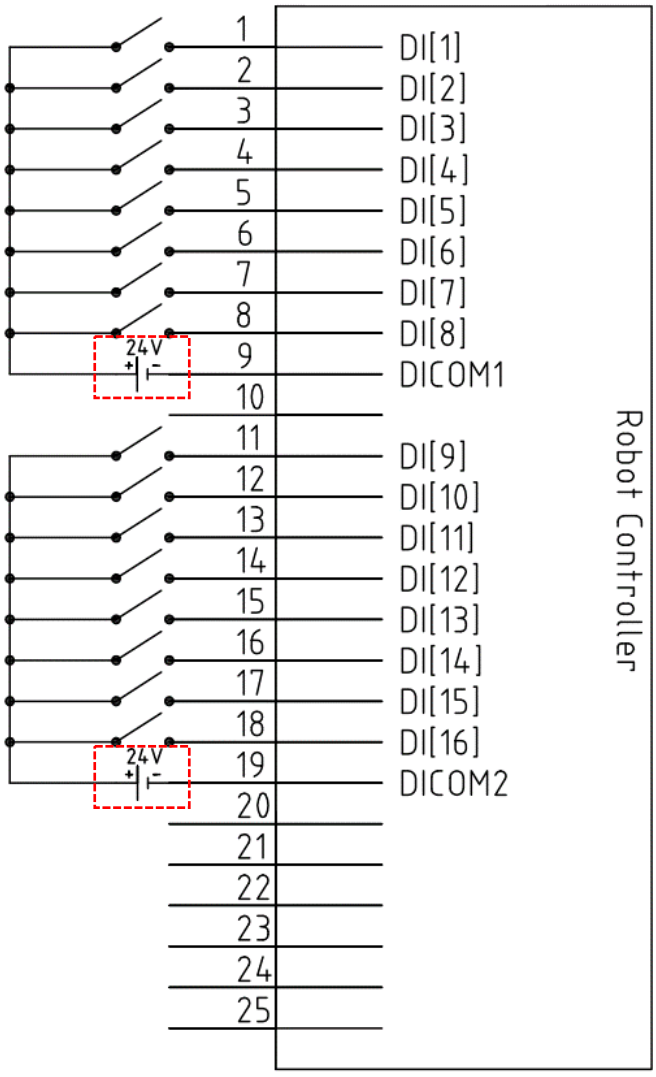
There are 16 contacts for Digital Input. The wiring diagram is shown in the figure below:

: Need to supply the external power

NPN input



PNP input

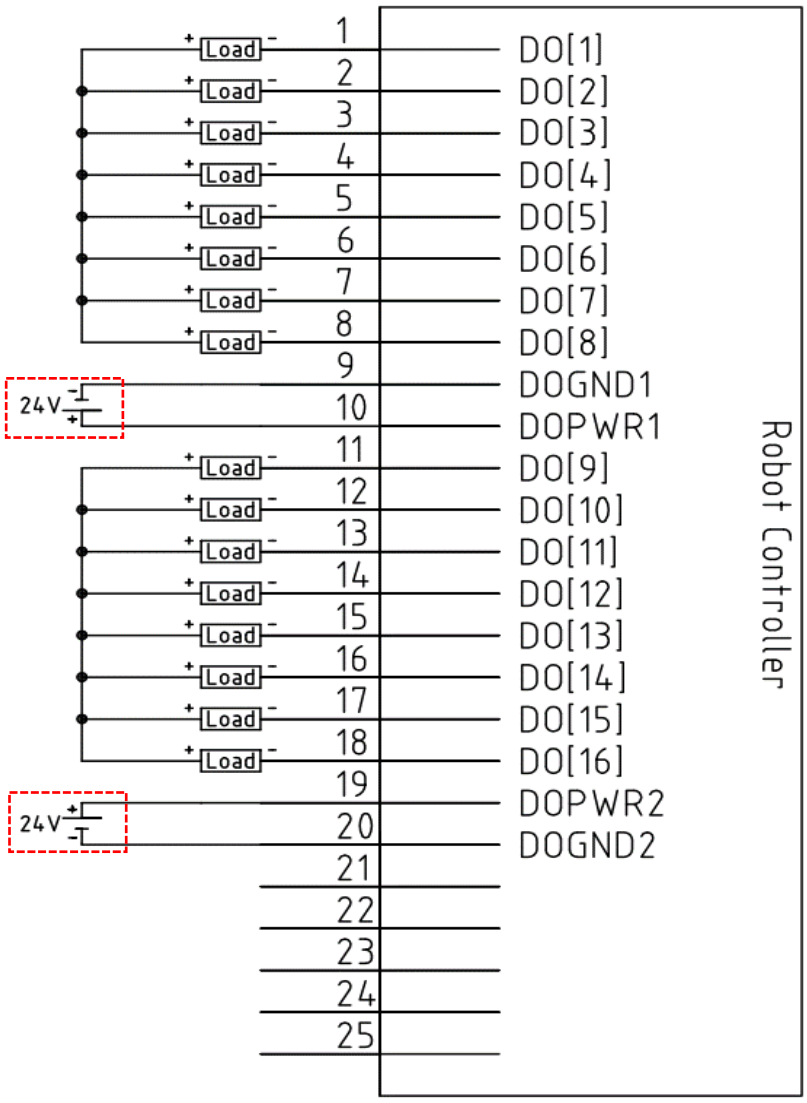


CAUTION	The current for each input contact must be at least 10mA.

Wiring diagram for Digital Output

There are 16 contacts for Digital Output. The wiring diagram is shown in the figure below:

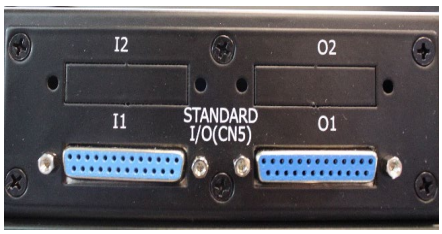
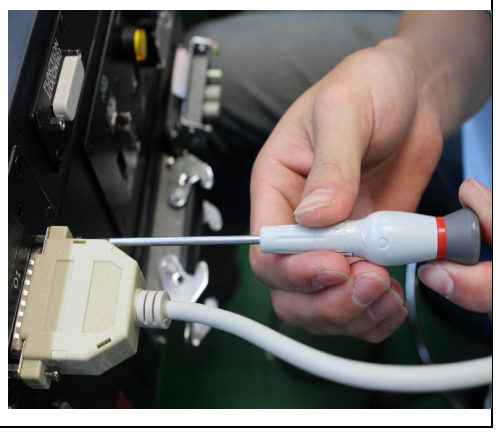
: Need to supply the external power



Remark: The output only supports NPN mode.

CAUTION	The maximum output current at single point is 100mA.

Connection:

The connection end of Digital I/O for the controller is a CN5 connector. Please remove the safety cover, and connect the connector. This connector is designed with a fail-safe. If it cannot be connected, please rotate and connect it.	
The connector is connected to CN5 connector, and fastened with screws.	

WARNING	Wires should be connected when the controller is disconnected, to prevent damage to internal components.

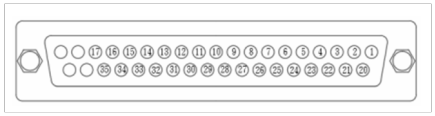
CAUTION	Please ensure the screws for the connector are securely fastened.

Encoder Socket

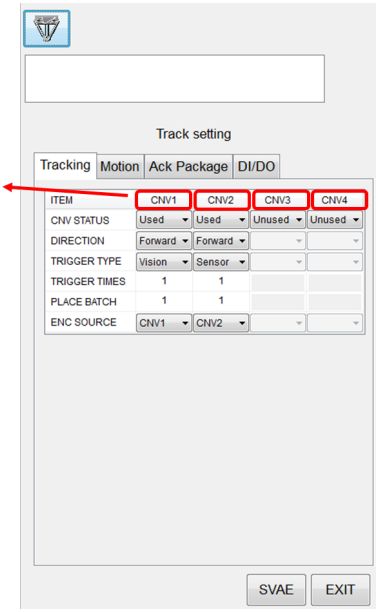
Description:

There are four channels in the encoder socket, CNV1~CNV4. Each phase is a differential signal. There are + and – in each phase. Each channel has a latch contact, where the signal specification is DC24V and pin assignments are IDI1 ~ IDI4. IDICOM can change the input to NPN or PNP according to the operation.

Overview of Encoder Socket:



Pin	Parameter Name	Pin	Parameter Name
1	EGND	20	CNV1A-
2	CNV1A+	21	CNV1B-
3	CNV1B+	22	CNV1Z-
4	CNV1Z+	23	CNV2A-
5	CNV2A+	24	CNV2B-
6	CNV2B+	25	CNV2Z-
7	CNV2Z+	26	CNV3A-
8	CNV3A+	27	CNV3B-
9	CNV3B+	28	CNV3Z-
10	CNV3Z+	29	CNV4A-
11	CNV4A+	30	CNV4B-
12	CNV4B+	31	CNV4Z-
13	CNV4Z+	32	EGND
14	IDICOM	33	IDI2
15	IDI1	34	IDI4
16	IDI3	35	EGND
17	EGND		



Note:

1. It is recommended that twisted pair cable to be used for the extension to reduce circuit interference.
2. There is a surge current of about 9A (time: about 0.3ms) when the power is connected.
3. The differential output is the data transmission circuit in compliance with RS-422A, which can be transmitted by the twisted pair cable at long distance.
4. If the sensor is NPN, IDICOM will be connected to 24V. If the sensor is PNP, IDICOM will be connected to 0V and IDI1~IDI4 must use the same voltage level to avoid the damage on the sensor or the contact.
5. EGND is internally connected to turn on. A user must connect to 0V as the low voltage level.
6. User would only need to connect phase A and phase B.

CAUTION	The current for each input contact must be at least 5mA. The maximum output current at a single point is 50mA.

Characteristics of extended cable:

The extended cable makes the rise time of output waveform longer, and influences the characteristics of phase difference according to frequency and noise.

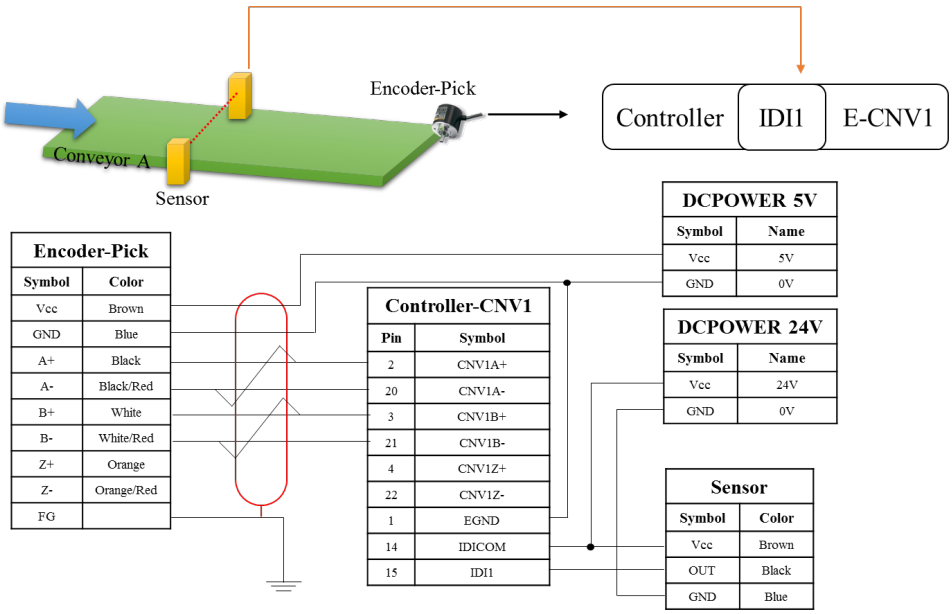
*** Recommended cable**

Cross-section of conductor: 0.2mm^2
With braided shield line
Conductor resistance: < 92Ω/km (20ºC)
Insulation resistance: > 5MΩ/km (20ºC)
Recommended cable: DYDEN E91337 AWM20276 80C 30V VW-1 1 A/B FT1

The rise time of output waveform may vary according to the cable length, load resistor and cable type.
The extended cable not only changes the rise time, but also increases the residual output voltage.

Encoder connection - Pick

It is recommended that the external device be connected as the figure below:



Encoder-Pick	
Symbol	Color
Vcc	Brown
GND	Blue
A+	Black
A-	Black/Red
B+	White
B-	White/Red
Z+	Orange
Z-	Orange/Red
FG	

Controller-CNV1	
Pin	Symbol
2	CNV1A+
20	CNV1A-
3	CNV1B+
21	CNV1B-
4	CNV1Z+
22	CNV1Z-
1	EGND
14	IDICOM
15	IDI1

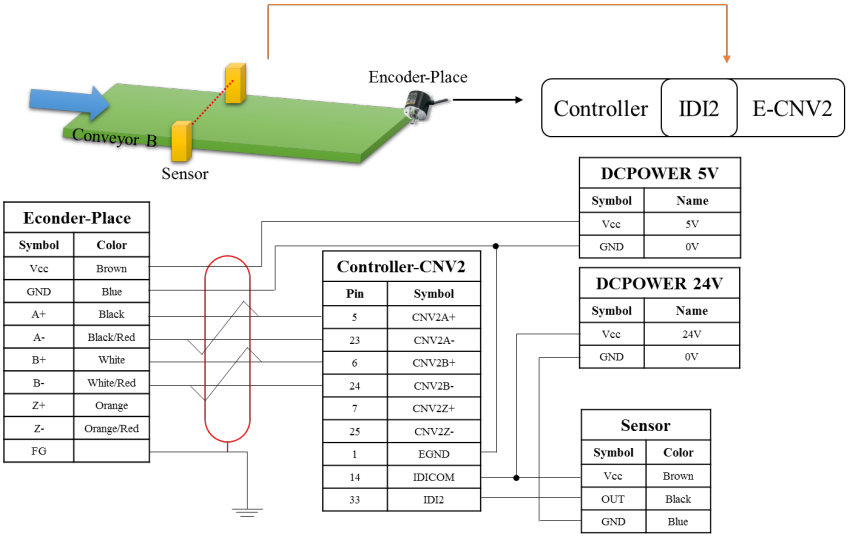
DCPOWER 5V	
Symbol	Name
Vcc	5V
GND	0V

DCPOWER 24V	
Symbol	Name
Vcc	24V
GND	0V

Sensor	
Symbol	Color
Vcc	Brown
OUT	Black
GND	Blue

Encoder connection - Place

It is recommended that the external device be connected as the figure below:



Econder-Place	
Symbol	Color
Vcc	Brown
GND	Blue
A+	Black
A-	Black/Red
B+	White
B-	White/Red
Z+	Orange
Z-	Orange/Red
FG	

Controller-CNV2	
Pin	Symbol
5	CNV2A+
23	CNV2A-
6	CNV2B+
24	CNV2B-
7	CNV2Z+
25	CNV2Z-
1	EGND
14	IDICOM
33	IDI2

DCPOWER 5V	
Symbol	Name
Vcc	5V
GND	0V

DCPOWER 24V	
Symbol	Name
Vcc	24V
GND	0V

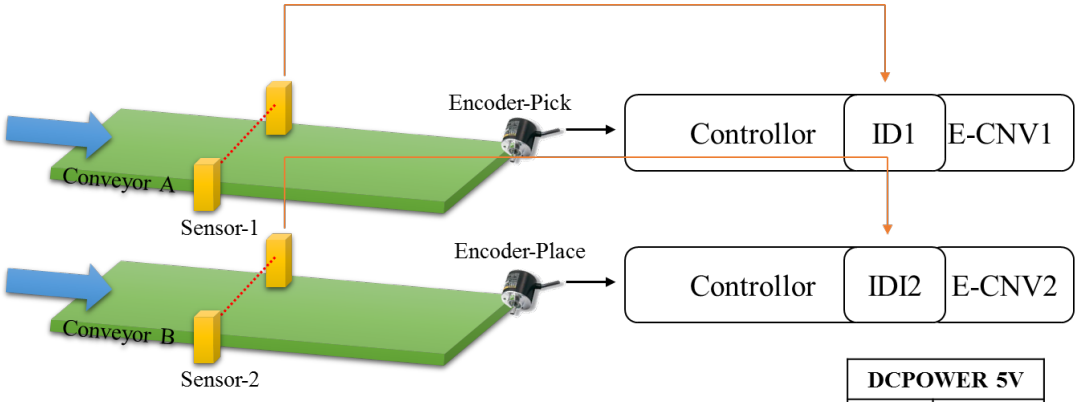
Sensor	
Symbol	Color
Vcc	Brown
OUT	Black
GND	Blue

Note:

1. The figure above is arranged as NPN. If it is changed to PNP (IDICOM needs to connect to 0V, and IDI1~IDI4 must use the same voltage level to avoid damage on the sensor or contact).
2. EGND is internally connected to turn on. A user must connect to 0V as the low voltage level.

Encoder connection – Pick and Place

It is recommended that the external device be connected as the figure below:



Encoder-Pick	
Symbol	**Color**
Vcc	Brown
GND	Blue
A+	Black
A-	Black/Red
B+	White
B-	White/Red
Z+	Orange
Z-	Orange/Red
FG	

Encoder-Place	
Symbol	**Color**
Vcc	Brown
GND	Blue
A+	Black
A-	Black/Red
B+	White
B-	White/Red
Z+	Orange
Z-	Orange/Red
FG	

Controllor-CNV1	
Pin	**Symbol**
2	CNV1A+
20	CNV1A-
3	CNV1B+
21	CNV1B-
4	CNV1Z+
22	CNV1Z-
1	EGND
14	IDICOM
15	IDI1

Controllor-CNV2	
5	CNV2A+
23	CNV2A-
6	CNV2B+
24	CNV2B-
7	CNV2Z+
25	CNV2Z-
33	IDI2

DCPOWER 5V	
Symbol	**Name**
Vcc	5V
GND	0V

DCPOWER 24V	
Symbol	**Name**
Vcc	24V
GND	0V

Sensor-1	
Symbol	**Color**
Vcc	Brown
OUT	Black
GND	Blue

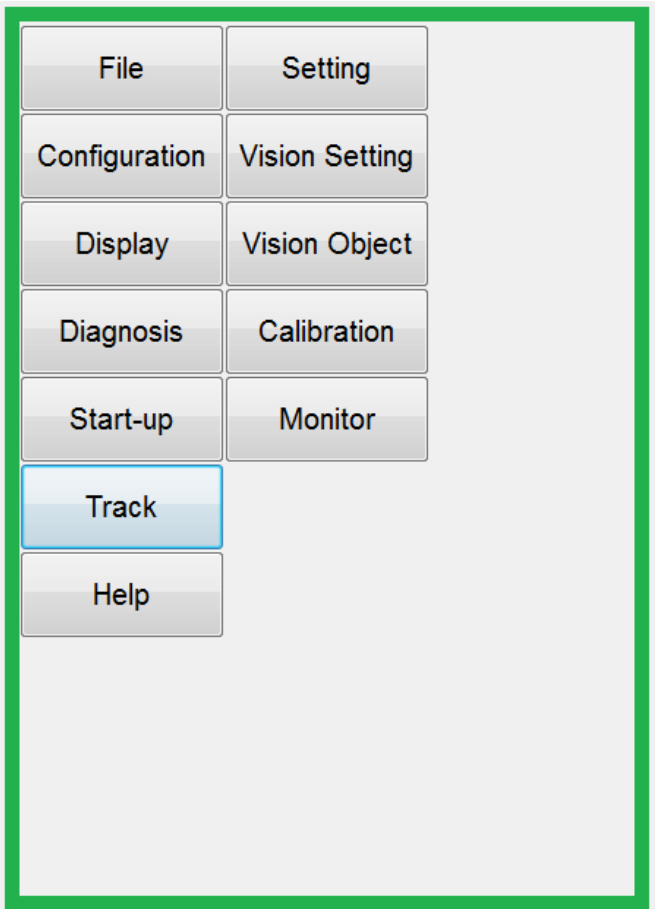
Sensor-2	
Symbol	**Color**
Vcc	Brown
OUT	Black
GND	Blue

Note:

1. The figure above is arranged as NPN. If it is changed as PNP (IDICOM needs to connect to 0V, and IDI1~IDI4 must use the same voltage level to avoid damage on the sensor or contact).
2. EGND is internally connected to turn on. A user must connect to 0V as the low voltage level.

3. System Setting

Main menu > Track



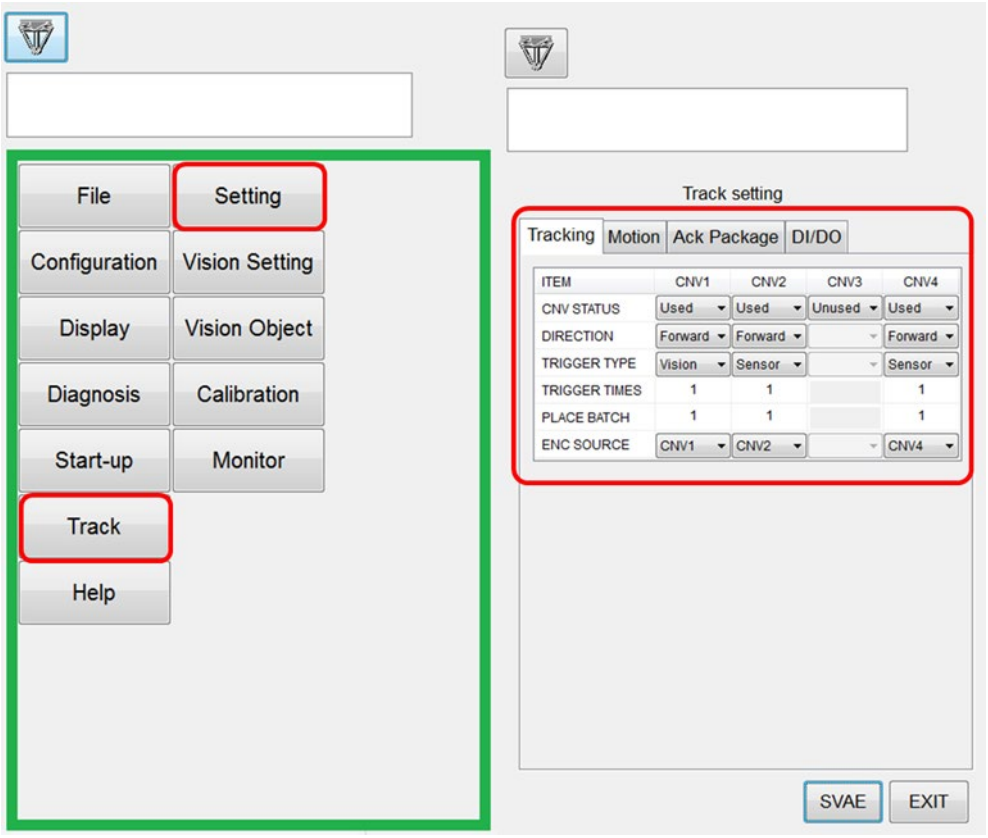
The HRTS settings can be classified as Function Settings, Calibration and Monitor.

Setting	Set conveyor tracking, motion and object filter
Vision Setting	Define the coordinate, encoder value and IP configuration corresponding to the Vision System.
Vision Object	Set the object height.
Calibration	Calibration on coordinate, working range and conveyor encoder ratio
Monitor	Display the information screen in real time, the encoder value, conveyor speed, total object quantity and successful object quantity

3.1 Function Setting

3.1.1 Track Setting

Main Menu > Track > Setting > Tracking



CNV STATUS : Set whether this conveyor is on tracking function.

Used	Open
Not Used	Close

DIRECTION : Set encoder counter direction for this conveyor.

Forward
Reverse

TRIGGER TYPE : Trigger conveyor tracking method.

Vision
Sensor

TRIGGER TIMES

Description:
Set the number of times sensor should be triggered, robot will get task QUEUE to carry out pick. Applies only to sensor triggering type.

Format Description:
Parameter is set to positive integer, if there is no specified number, default value is 1 and input range is 1 to 100.

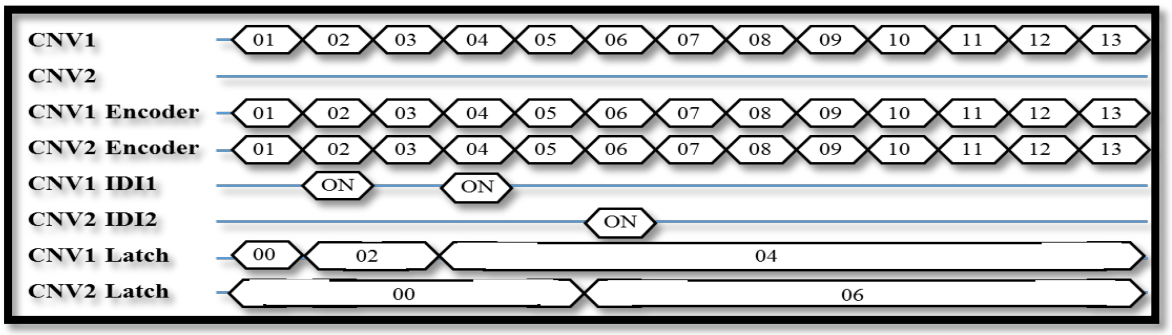
PLACE BATCH

Description:
Place status variables for situations where need to place multiple objects at the same job location. When sensor of releasing object conveyor is triggered, robot will receive a work position to execute place job, the maximum number of times that robot can place in job position can be set by this variable.

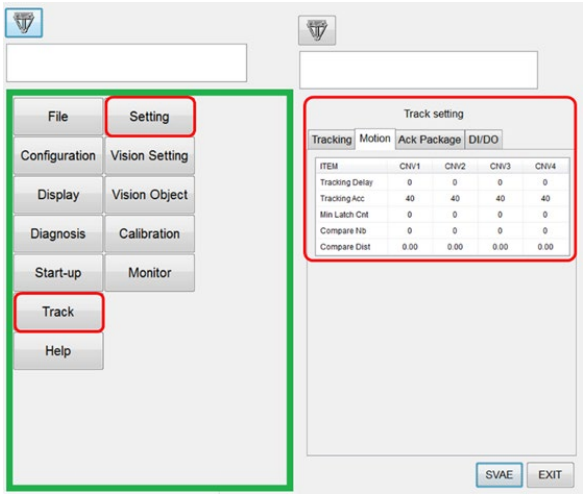
Format Description:
Parameter is set to positive integer. If there is no specified number, default value is 1 and input range is 1 to 100.

ENC SOURCE

Description:
Conveyor encoder copy function, only copy encoder value, does not copy IDI state or Latch value.
Format Description:
Default is its own number.
Example:
CNV1 connects entity signal, CNV2 copies CNV1 signal, triggers IDI1 and IDI2 respectively, and timing diagram is as follows:



Motion Setting



Tracking Delay : Set how long does it take to follow the object then return to action when object is tracked, unit is ms.

Tracking Acc : Synchronize acceleration/deceleration time in conjunction with conveyor belt, unit is ms.

Min latch Cnt : Applicable to sensor triggering, the minimum trigger interval after signal is triggered and delay (mask) next signal to receive, mainly used to prevent signal interference caused by false trigger, causing robot malfunction. This range of values is pulse, user can adjust based on actual operating conditions.

Compare Nb : It can only be used in the visual system triggering mode. The value of this setting determines the number of duplicate data for identifying the object filtering. The setting range is 0 ~ 20 and the default value is 0. To disable this function, it is recommended to set to single image. The maximum number of objects to be recorded within this function is only valid with Compare Dist.

Compare Dist : It can only be used in the visual system triggering mode. This setting determines the comparison threshold for object identification. The preset value is 0.00 in mm. It is recommended to set the inscribed circle diameter of the smallest object in a single image. With the function of Compare Nb to be effective.

After setting above, click SAVE function key to save.

For more information, refer to parameter settings.

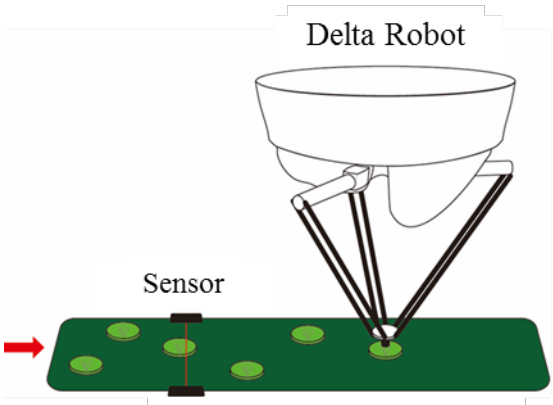
Note 1: above suggestions need to be adjusted according to actual application

Parameter setting analysis

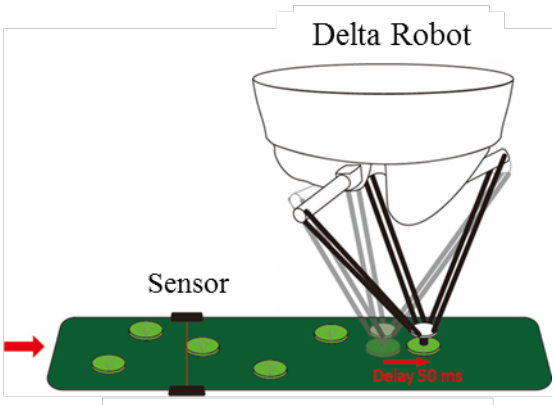
Tracking Delay:

Parameter setting is a positive number, default value is 0, and input range is 0 to 1500, unit is ms.

Example: Set 50ms



Robot in position diagram



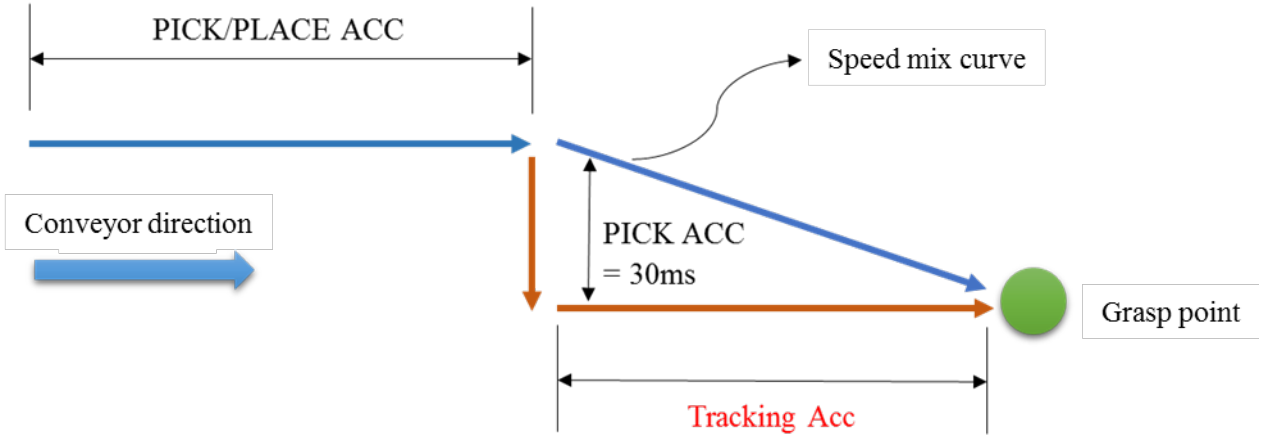
Robot follows 50ms diagram

Tracking Acc:

Default value is 30 and the input range is 10 to 100, unit is ms.

Format Description:

Parameter setting is positive number. If no preset value is specified, default is 40, input range is 10 to 100.

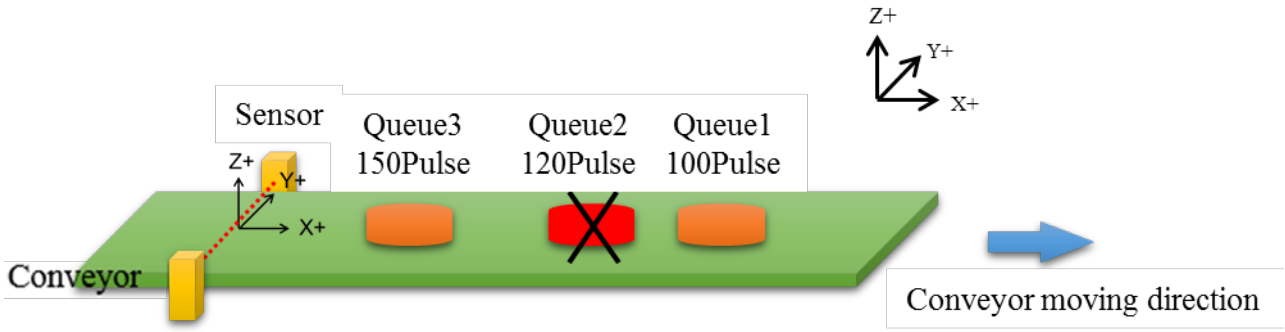


Min latch Cnt:

Format Description:

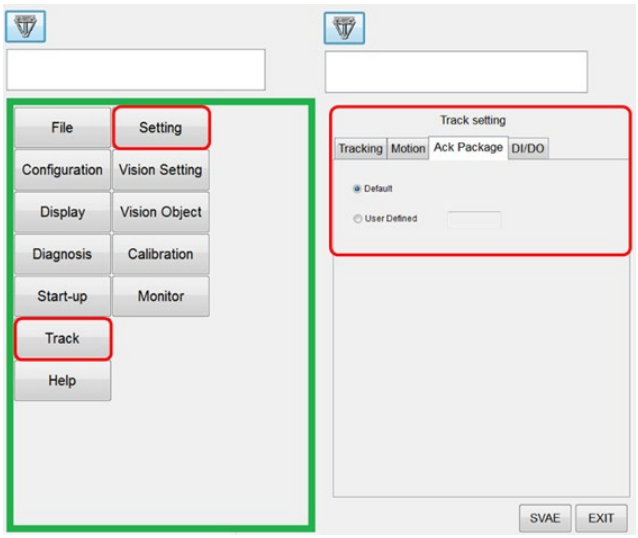
This value is pulse. If there is no specified number, default is 0. Input range 0≥, positive integer.

Assuming Min latch Cnt = 25, Queue1 differs from Queue2 Pulse by 20, less than set value, this information will be ignored, and Queue1 differs from the Queue3 Pulse by 50, which is greater than the set value, this information will be saved.



Ack Package Setting

Main Menu > Track > Setting > Ack Package



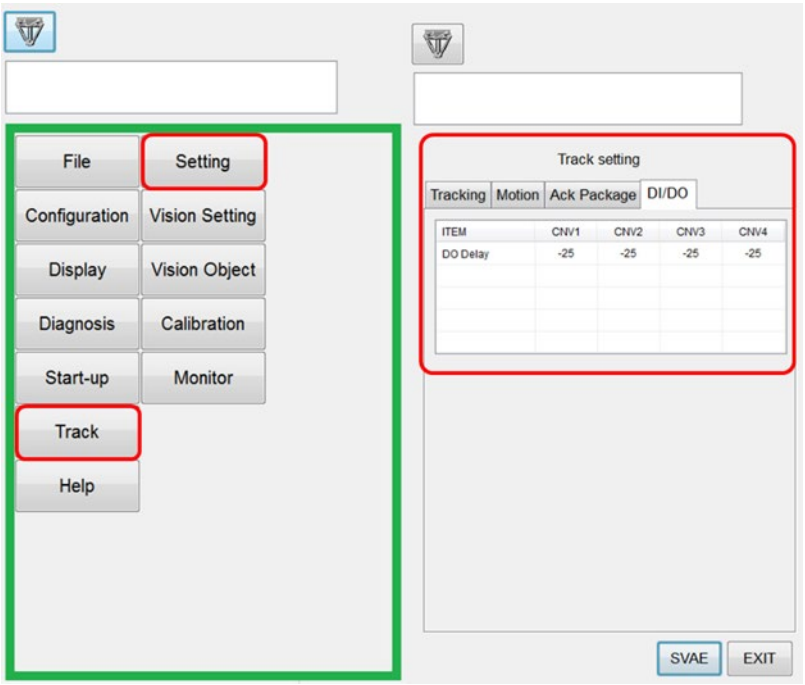
Ack Package Setting: set controller to receive packet of visual system, and then return packet to visual system so that visual system confirms that controller has received coordinates and is preset to [Default].

Default: is {Conveyor number}.

User Defined: sets self-defined packet contents. Upper limit is 200 digits.

DI/DO Setting

Main > Track > Setting > DI/DO



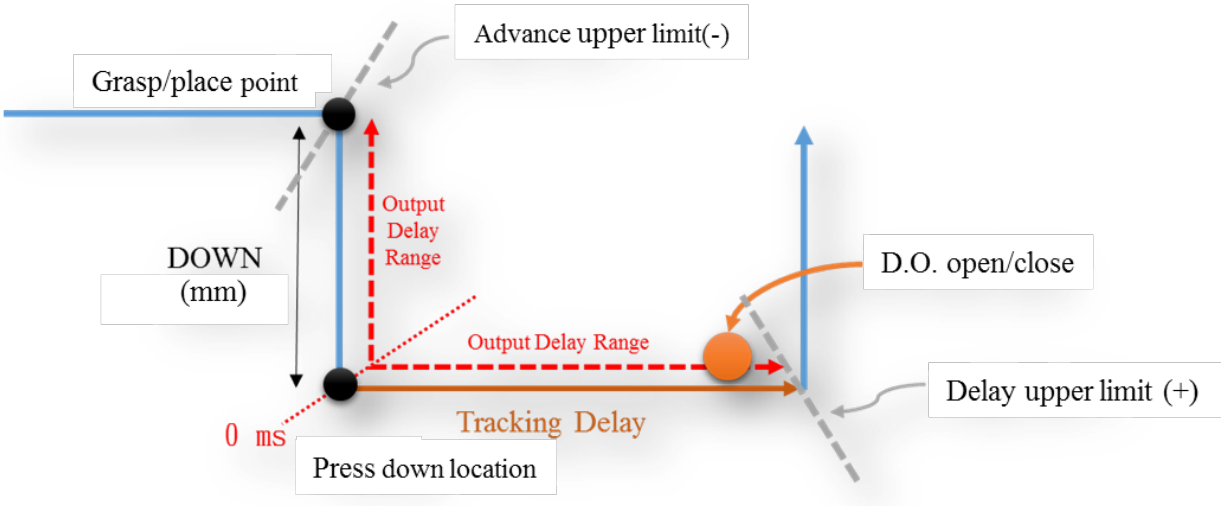
DO Delay : Set when robot tracking is in place to open D.O. time, it can be advanced/delay by positive/negative value, unit is ms.

Description:

When robot tracks to grasp/place points then opens D.O., user can set positive and negative values to advance or delay D.O. time.

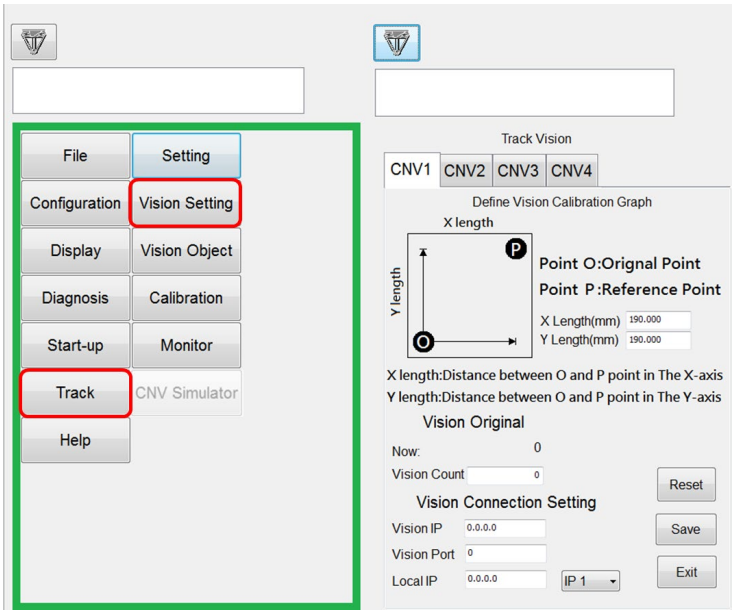
Format Description:

Parameter is set to integer. If there is no specified number, default value is -25 and input range is -1500 to 1500, unit is ms.



3.1.2 Vision Setting

Main Menu > Track > Vision Setting



1. Select the conveyor number (CNV1~CNV4) to track.
2. Set the values of POINT X Y as the line distance of XY on the P and O for the calibration fixture (The value is a positive integer.), as shown in the figure below.

Vision Original

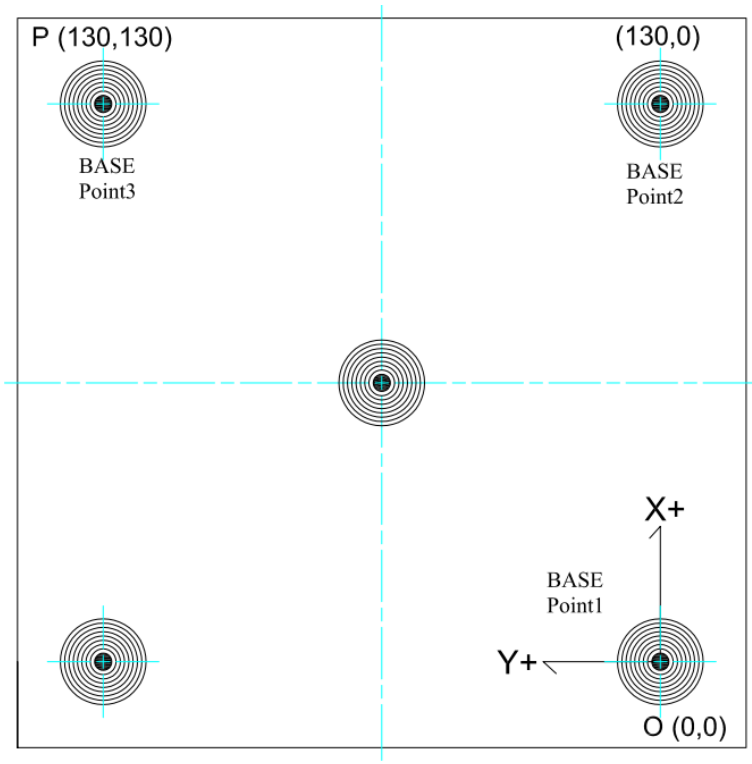
3. Clear the current value of the encoder to 0
   → Click the RESET key to confirm Now is 0.
4. Vision Count: If the Vision Count is needed to offset, it can be changed.
   If not, the value is set as 0.

Vision Connection Setting

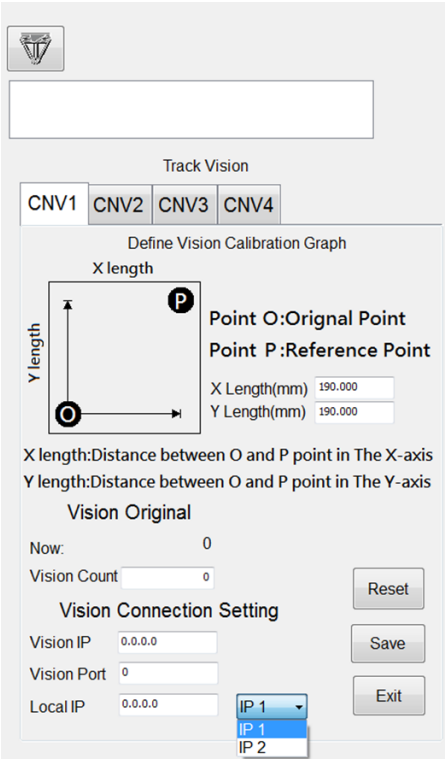
5. Vision IP is set to be consistent with IP Address for the Vision System.
6. Vision Port is set to be consistent with Port for the Vision System.
7. Local IP:
   Step 1: click drop-down menu, select IP1 or IP2.
   Step 2: Local IP is set to be consistent with My Computer IP Address. The first three bytes of IP set need to match IP of visual system, the 4th set can be compiled by user, but not the same as visual IP.

Note1: The coordinate system between Robot and Vision System must be consistent. The coordinate system is based on the right-handed principle.

Note 2: IP1 and IP2 cannot be used simultaneously as Socket (COPEN (ETH, ... instruction cannot be used twice).



8. After the settings above are completed, click the SAVE button.



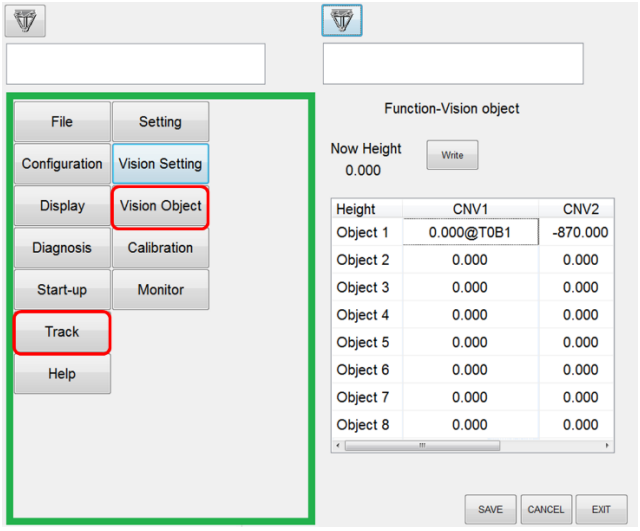
Example:
CONVEYOR is set as CNV1.
POINT X is set as 130.
POINT Y is set as 130.
COUNT is set as 0.
Vision IP Address is set as 192.168.0.101
PORT is set as 9876.
Local IP Address is set as 192.168.0.5

Note: Attachment 1 - Calibration plate1

3.1.3 Vision Object

Before conveyor tracking, the related parameters for conveyor tracking need to be adjusted.

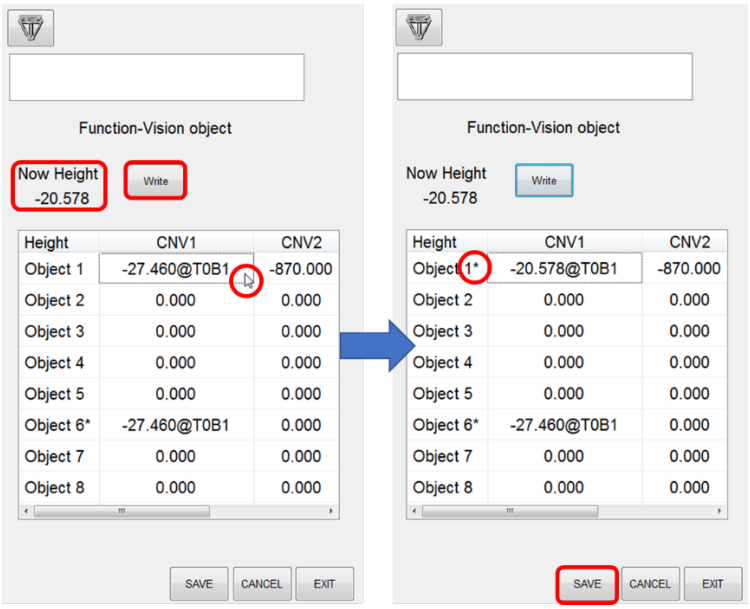
→ Main Menu > Track > Vision Object.



The object number (1~8) corresponding to the conveyor (1~4) is the down height when picking the object (used for vision trigger type).

Now Height: Height (Z-axis) for current TOOL and BASE coordinates.

A user adjusts the robot to the required height. After clicking the object height, press the Write button to write. At this time, there will be a * symbol next to the object. The number is the TOOL and BASE coordinates behind the height @.



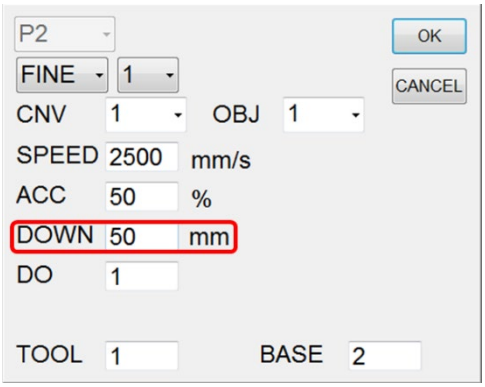
After the settings above are completed, click the SAVE button. If you want to cancel, press the CANCEL button.

Example:

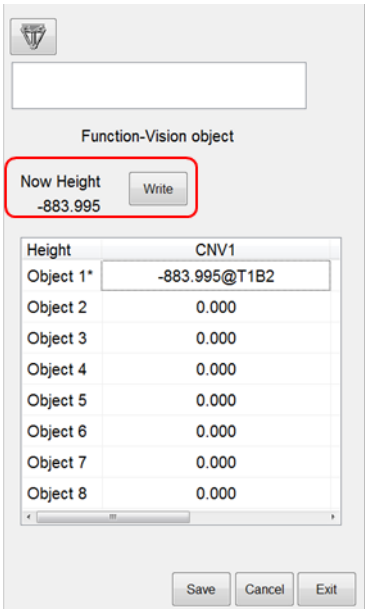
Step 1

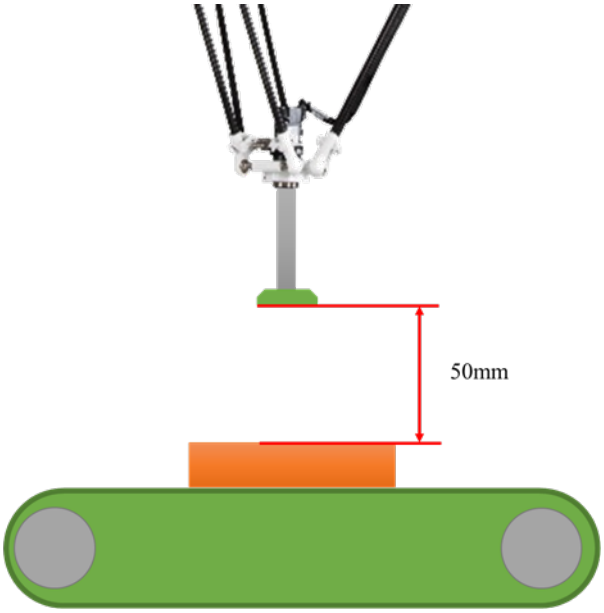
Program

CNV_PICK CNV=1 OBJ=1 $DO[1] Down=50mm FINE=1 Vel=2500mm/s Acc=50% TOOL[0] BASE[2]



Step 2 Move the Robot 50mm above the workpiece (DOWN value) Click the [Write]





3.2 Calibration

In conveyor belt tracking operation, it needs correction, if sensors are used to trigger, it needs to implement 1 to 3 procedures, if visual system is used to trigger then it needs to implement 1 to 4 procedures:

Sensor triggers

1. Base coordinate (user coordinate) correction.
2. Conveyor belt ratio correction.
3. Work range correction.

Visual system triggers

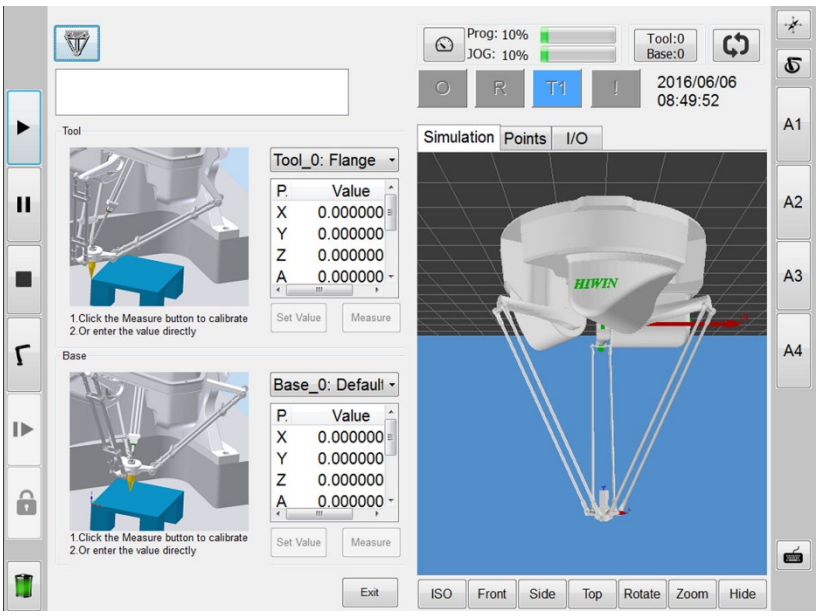
1. Visual system correction.
2. Conveyor belt ratio correction.
3. Visual and base coordinates (user coordinates) correction.
4. Work range correction.

Calibration of Base Coordinate (User Coordinate):

This procedure makes the coordinate system of the robot the same as that of the conveyor. In order to conveniently identify, the conveyance direction is defined as +X-Axis and +Z-Axis to up.

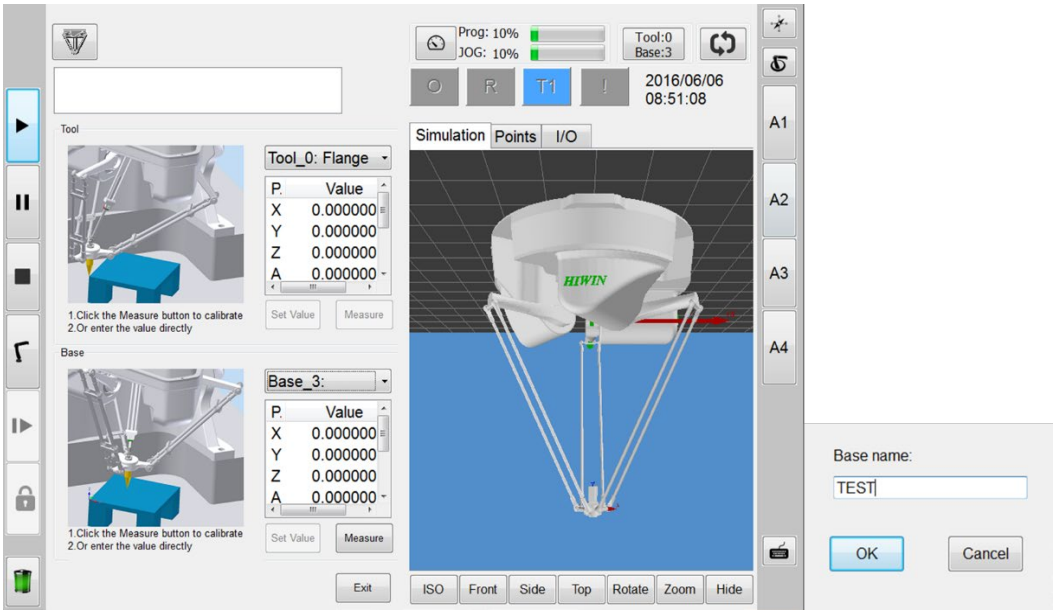
Step 1

Select Start-up > Calibrate, Base in the Main Menu.



Step 2

Select Base_(1 to 31) from the Base Coordinate System, and press [Measure] to edit the name of the coordinate system.

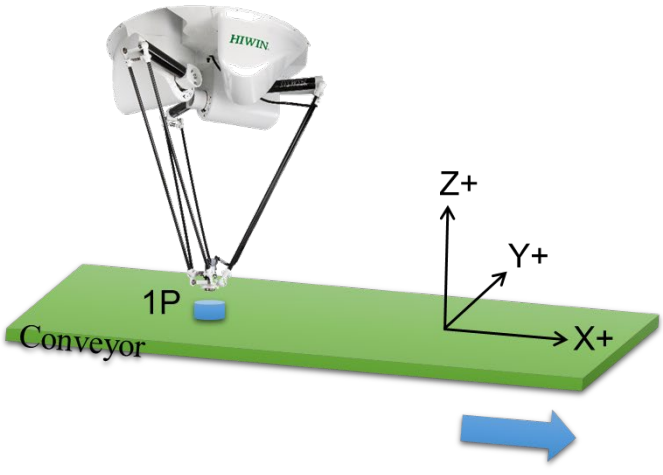


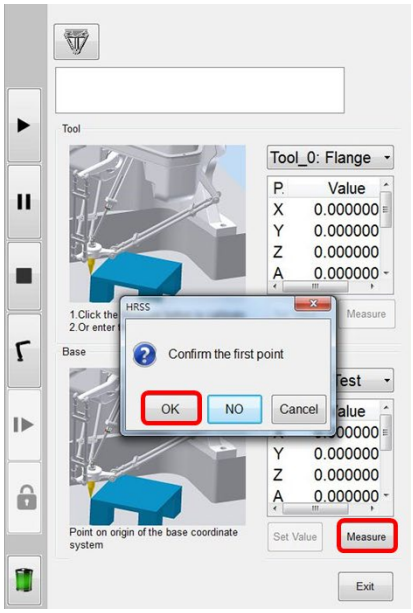
Note: Base[0] is the Base Coordinate System by default.

Step 3

Put the calibration fixture on the conveyor, and move the robot end to point (1P). This position is the first point; the calibration origin.

Click [Measure] to confirm the first point.



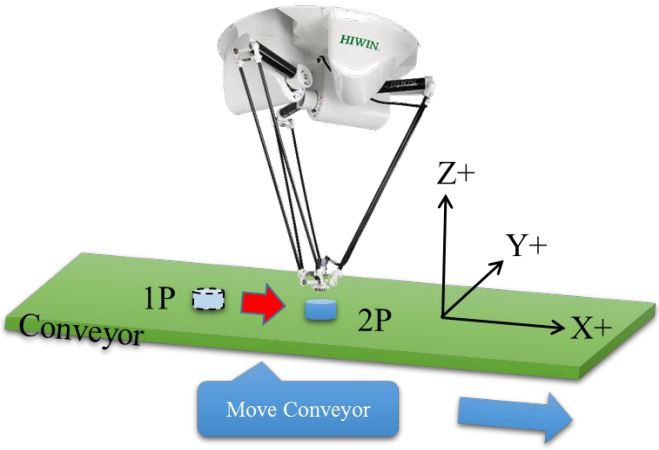


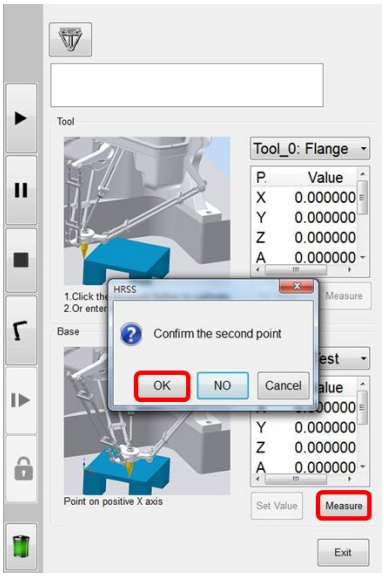
Note: The point (1P) needs to be in the range of the robot.

Step 4

Statically put the calibration fixture on the conveyor, downwardly move the conveyor, and then move the robot end to this point (2P). This position is the second point. This motion can allow the robot to obtain the coordinate of the conveyor in the X direction (+X-Axis).

Click [Measure], and confirm the second point.



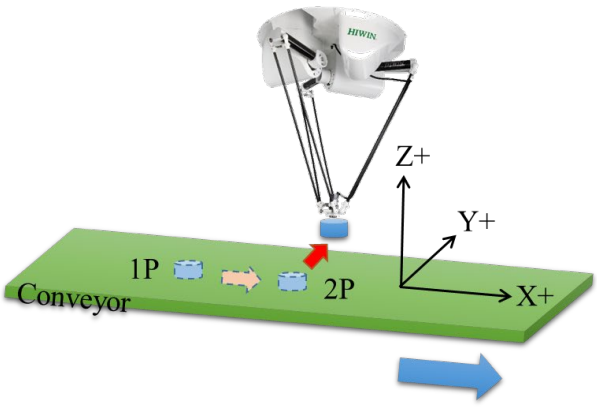


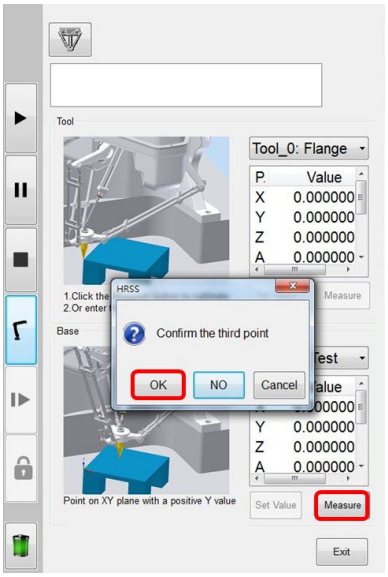
Note: Point (2P) needs to be in the range of the robot, and cannot be moved on the conveyor.

Step 5

According to the direction of the right-handed principle, the robot will move to any position (P3) in the Y+ direction. This position is the third point. This motion will allow the robot to obtain the coordinate of the conveyor in the Y direction (+Y-Axis).

Click [Measure], and confirm the third point.





Note: The point (P3) needs to be in the range of the robot.

Calibration of Sensor to Conveyor Ratio

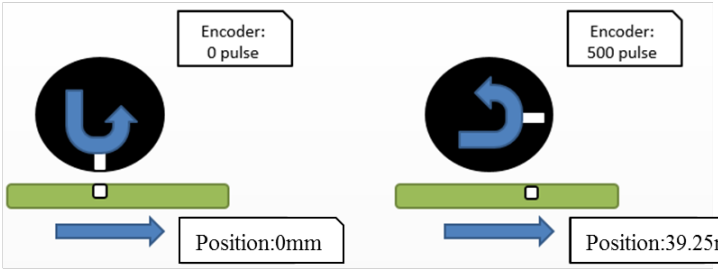
Make the same ratio of the robot coordinate and the conveyor encoder.

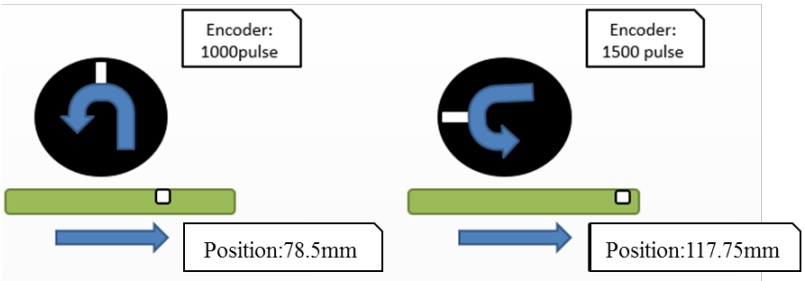
Basic Setting

→ Main Menu > Track > Setting

Track Setting

TRIGGER TYPE: The type to trigger the conveyor input must be changed as Sensor.

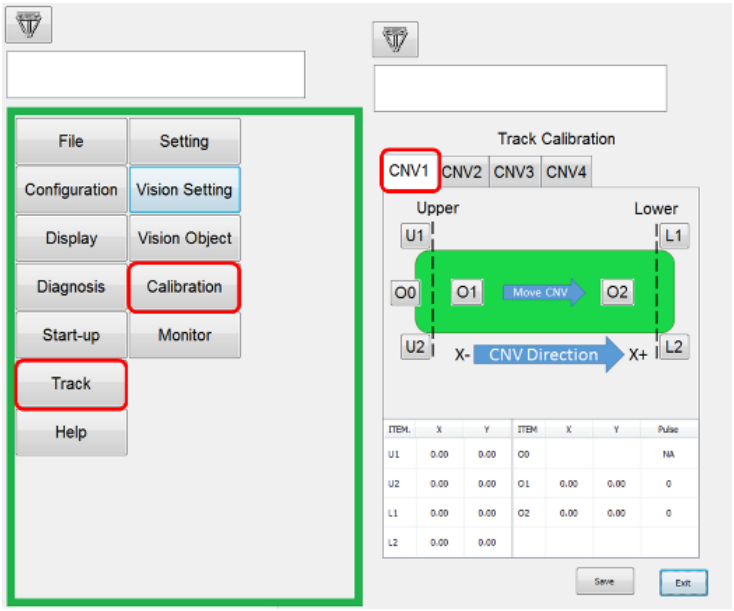




Circumference=πD
D=50mm
Circumference=157mm

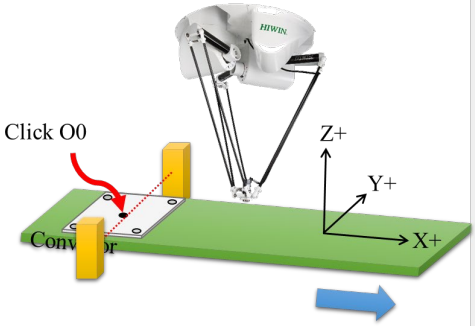
Step 1

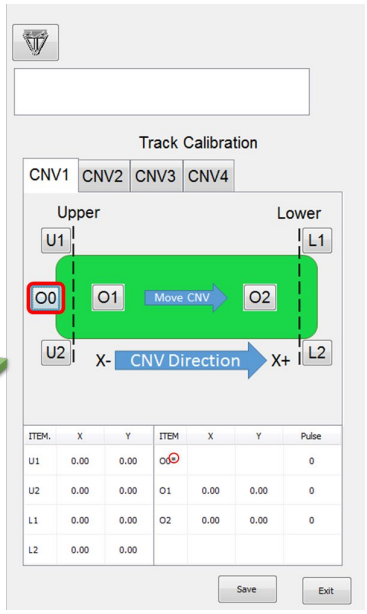
Main Menu > Track > Calibration> CONVEYOR (1 to 4), click the channel you need.



Step 2

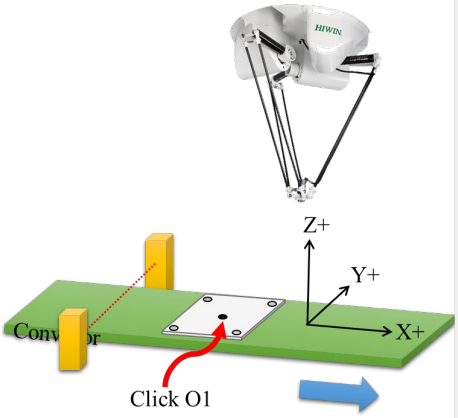
Place the calibration fixture on the conveyor and move the conveyor to the sensor trigger point, and the O0 button is clicked, check that there is a * symbol next to O0.

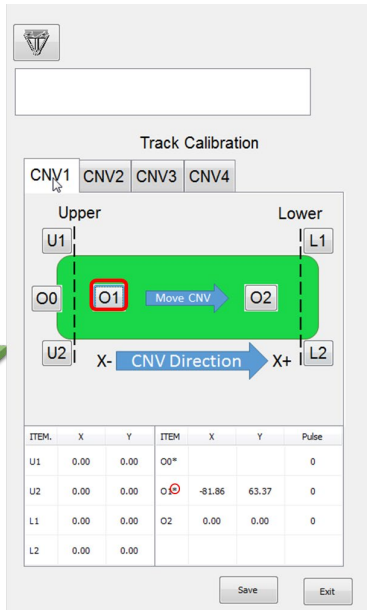




Step 3

Move the calibration fixture to the upstream position by moving the conveyor. This point will be set as point O, and the O1 button is clicked, check that there is a * symbol next to O1.

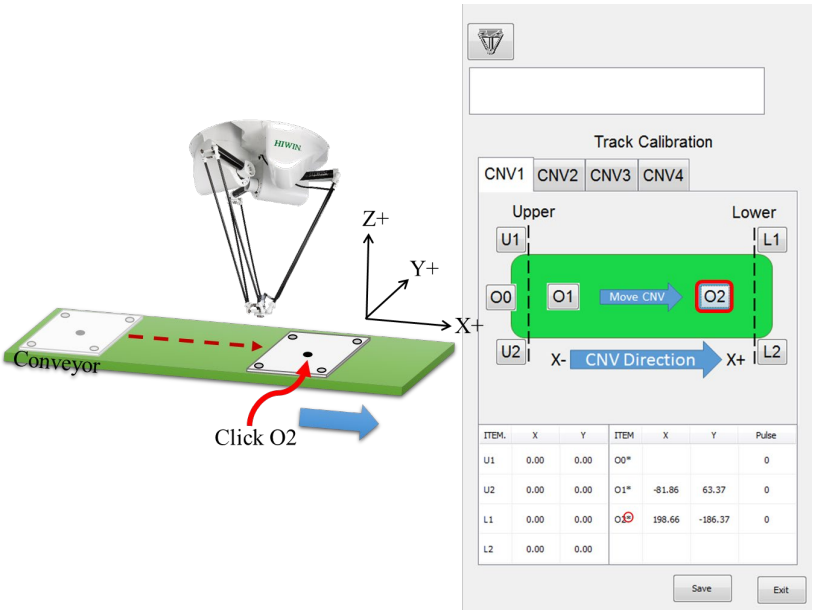




Note1 The points need to be in the range of the robot. O1 and O2 must be the same point.

Step 4

Moving the calibration fixture to the downstream position by moving the conveyor, This point will be set as point O, and the O2 button is clicked, check that there is a * symbol next to O2.After the settings above are completed, click the SAVE button to complete the calibration.



Note1 The points need to be in the range of the robot. O1 and O2 must be the same point.

Calibration of Vision System

Make the same ratio of the robot displacement and the value of the conveyor encoder.

Basic Setting

→ Main Menu > Track > Setting

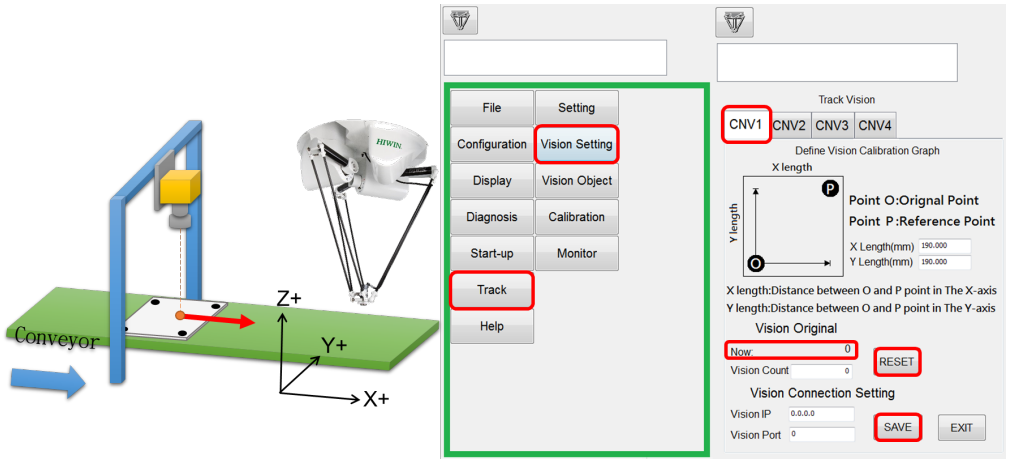
Track Setting

TRIGGER TYPE: The type to trigger the conveyor input must be changed as Vision.

Step 1

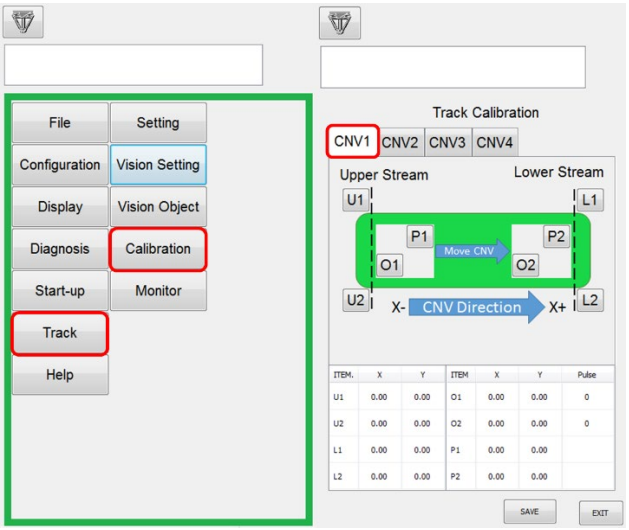
Please ensure the value of the encoder is cleared as 0 before calibrating the Vision System.

Main Menu > Track > Vision Setting > Vision Original > RESET



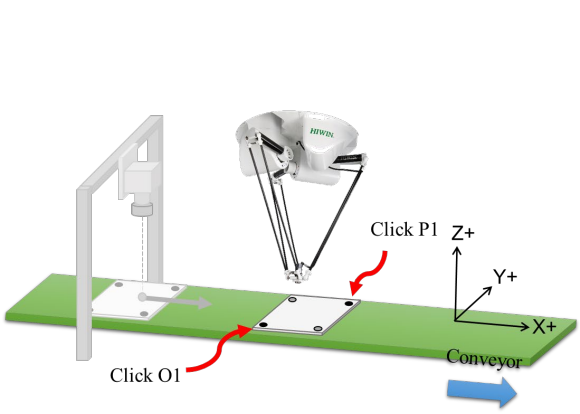
Step 2

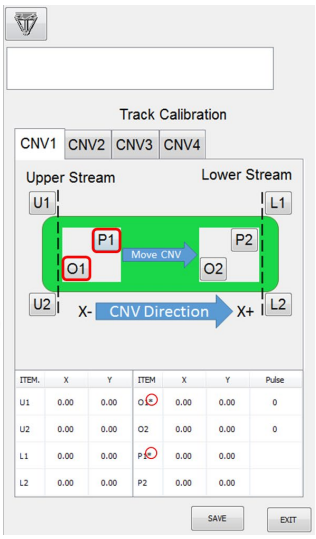
Main Menu > Track > Calibration> CONVEYOR (1 to 4), and click the channel you need.



Step 3

Move the robot end to the points O and P for the calibration fixture, click the O1 and P1 buttons, and check that there is a * symbol next to O1 and P1.

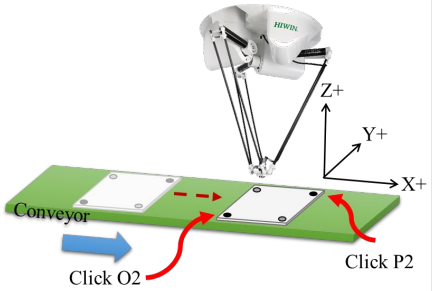


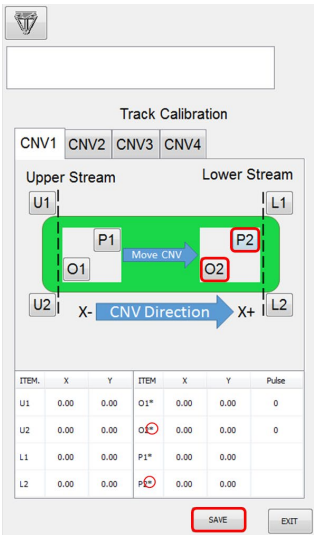


Note: The points need to be in the range of the robot.

Step 4

Downwardly move the conveyor, move the robot end to points O and P for the calibration fixture, and click the O2 and P2 button to check that there is a * symbol next to O2 and P2. After the settings above are completed, click the SAVE button to complete the calibration.





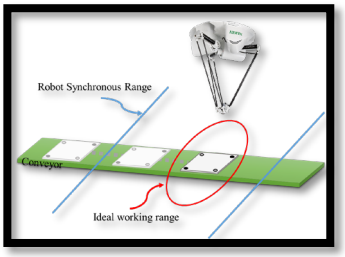
Note: The points need to be in the range of the robot.

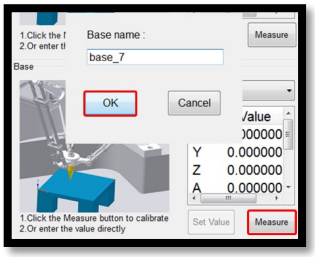
Visual and base coordinates (user coordinates) correction

Steps 4 Continuation (above)

Moving the conveyor displaces the calibration fixture to the ideal robot working range and correct the robot arm base coordinates.

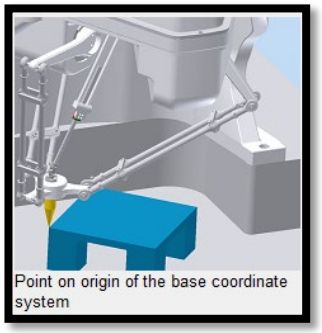
In the main menu select Start-up > Calibrate > Base

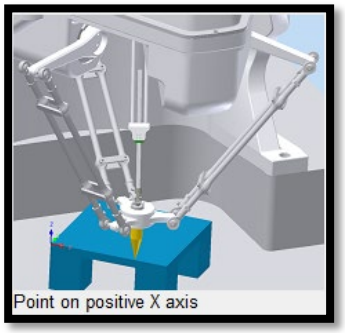


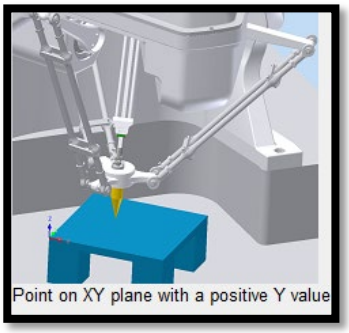


Step1: Move the conveyor to the ideal working range.

Step2: Give a name Base_(1 to 31)for the base to be calibrated and press click (Measure).



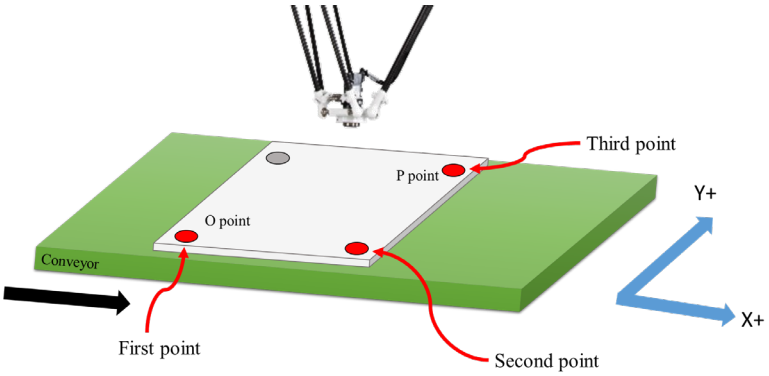




Step3: Set the origin of base coordinate system

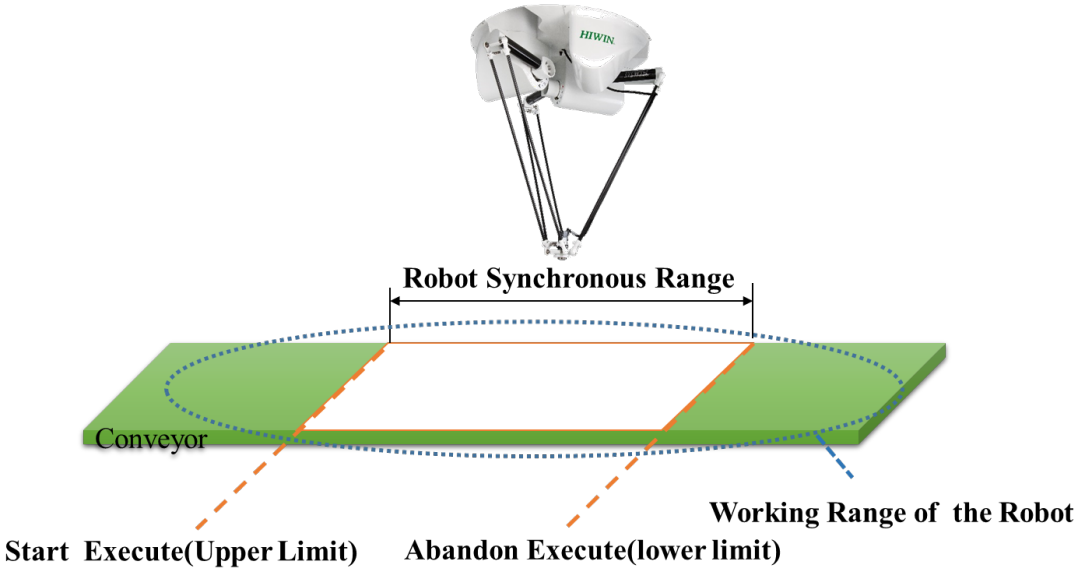
Step4: Set a point on positive X axis

Step5: Set a point with positive Y on XY plane

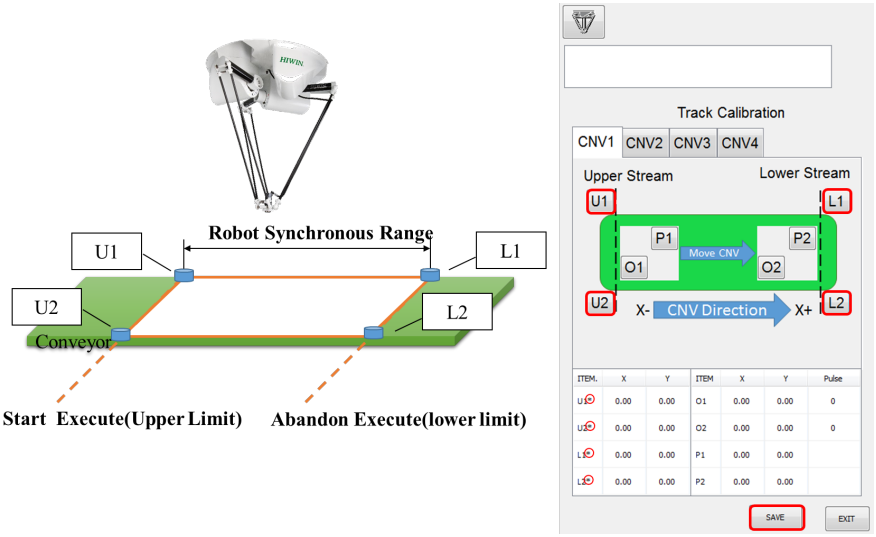


Calibration of Synchronous Range

Define the Synchronous Range of the robot. Set a range for start and quit tracking within workspace of the robot.



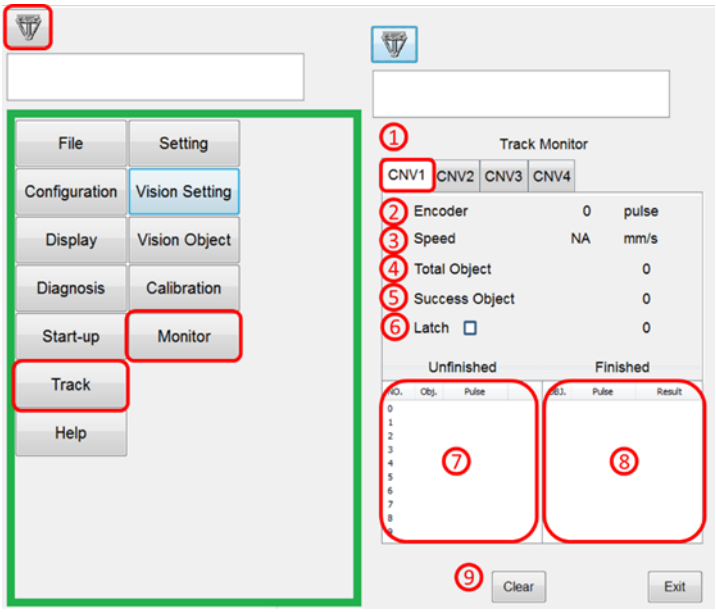
Upwardly move the robot to any two points, and click U1 and U2. Downwardly move the robot to any two points, and click L1 and L2, check that there is a * symbol next to U1, U2, L1 and L2. After the settings above are completed, click the SAVE button to complete the calibration. ◦



Note 1: The points (U1, U2, L1 and L2) need to be in range of the robot.
Note 2: The points U1 and U2 (L1 and L2) will form an infinite line.

3.3 Monitor

When performing conveyor tracking, this interface can monitor the state of the robot.
→ Main Menu > Track > Monitor



1. Select the conveyor number (CNV1~CNV4) to be monitored.
2. Encoder: The value of the encoder received by the current robot.
3. Speed: The speed of the current conveyor, in a unit of mm/s.
4. Total Object: The total queue quantity received by the robot.
5. Success Object: The accumulated queue quantity successfully picked by the robot.
6. Latch signal display.
7. The red area 1 is the not processed queue received by the robot.
8. The red area 2 is the processed queue received by the robot. When the robot successfully picks, it will display Success. If not, it will display Over_stream. Click the Clear button if you want to calculate again.
9. Clear the Queue.

4. List of Conveyor Tracking Commands

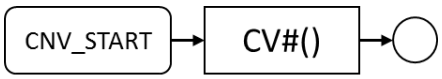
In the HRSS, there are commands for conveyor tracking. For the conveyor tracking commands, please see **RD Series_Robot System Software**.

4.1 Configure Command

The Configure Command is used to set the parameters, which are usually programmed at the head or in end, and must be executed once.

4.1.1 CNV_START

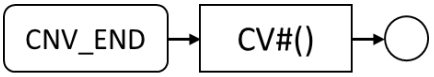
Description:
This is the setting command. The procedures to track the conveyor will be activated, and start to read the corresponding conveyor data (start to enter the value of the encoder). After starting this command, the rest of commands (CNV) then can start the motion, which is used in the beginning of program.



Format:
CNV_START CNV=1
…
CNV_END CNV=1
Format Description:
CNV is the parameter of the conveyor number, which can currently support CNV (1 to 4). The conveyor must correspond to the number assigned by **Conveyor Tracking Setting**.

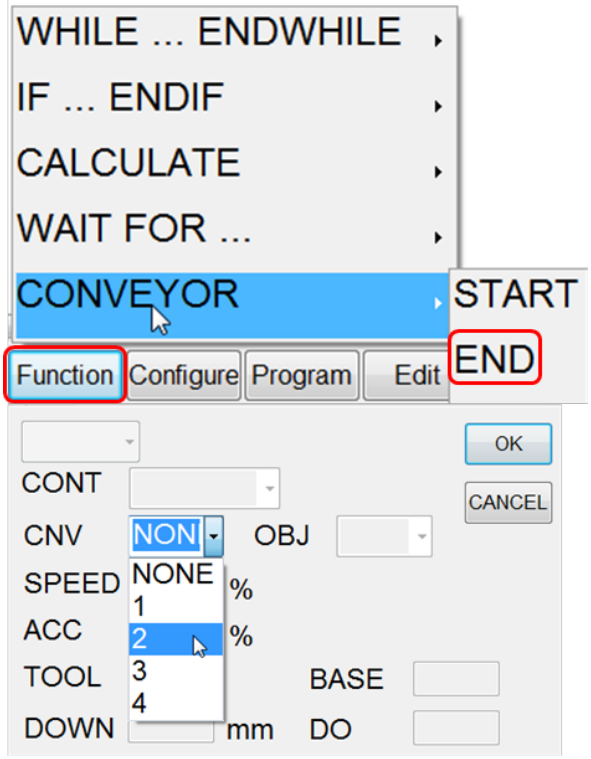
4.1.2 CNV_END

Description:
This is the setting command. End the conveyor command and the connection with the delivery system, which is used at the end of pick program.



Format:
CNV_START CNV=1
…
CNV_END CNV=1

Format Description:
CNV is the parameter for the conveyor number, which can currently support CNV (1 to 4). The conveyor must correspond to the number assigned by the **Conveyor Tracking Command**.



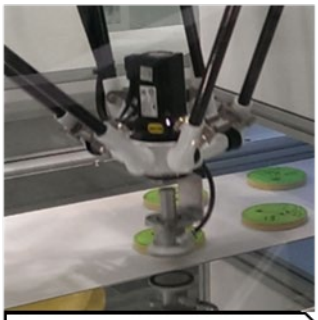
4.1.3 CNV_PICK_QUANTITY

Description:
This is the setting command. The variables of the robot state are used to set **the maximum quantity that the robot can pick of the object each time**. When the quantity reaches this value, the following commands will not be executed further. The default quantity is 1, and can be up to 8.

Format:
CNV_PICK_QUANTITY = n

Format Description:
n is an integer.

CNV_PICK_QUANTITY = 1

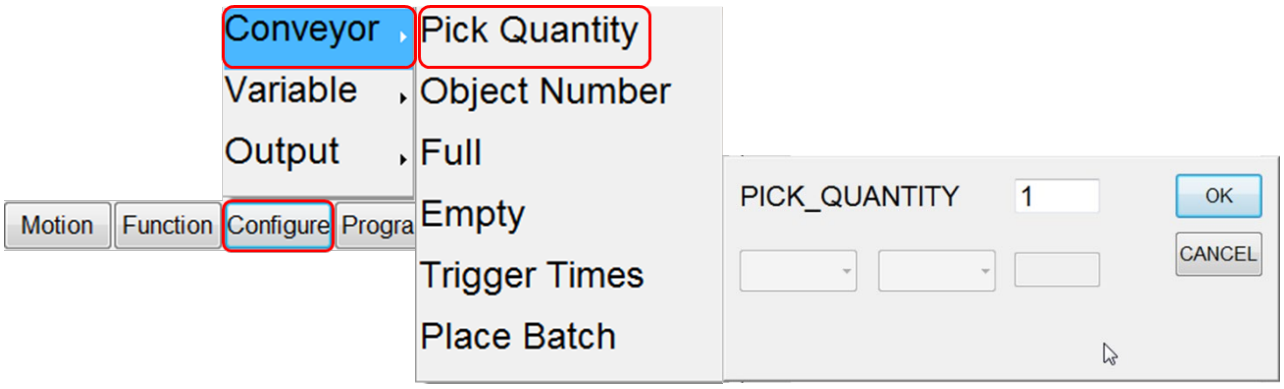


Vacuum chuck = 1

or

CNV_PICK_QUANTITY = 2

Vacuum chuck = 2

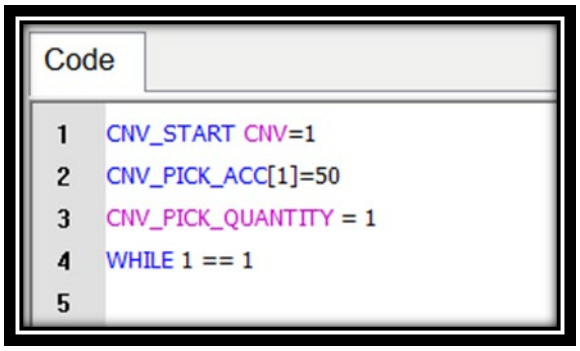


4.1.4 CNV_PICK_ACC[NUM]

Description:
Flying pick state variable. The user is able to configure the acceleration time of tracking push-down by using this instruction when writing program.

Format:
CNV_PICK_ACC[NUM]

Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, and represented by CNV1 to CNV4. The variable is a positive integer. If there is no specified number, default value is 30, range from 10 to 100, unit is ms.



4.2 State Command

The State Command is used for the state determination, which usually cooperates with WHILE, IF… for determining the state condition.

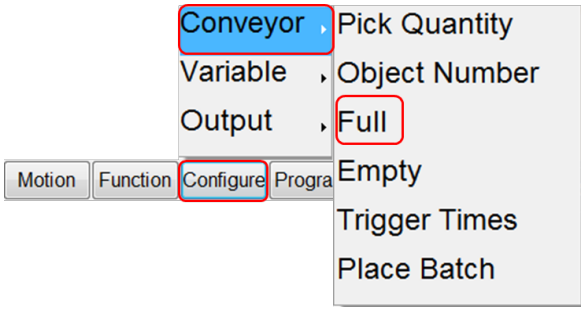
4.2.1 CNV_FULL

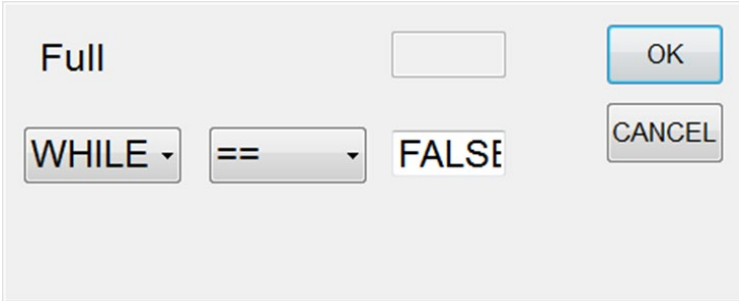
Description:
The state variable of the robot represents the object on the robot has reached the upper limit, which can be used to determine the pick procedures end. The upper limit is set by CNV_PICK_QUANTITY.

Format:
CNV_PICK_QUANTITY = 2 — Set the maximum pick quantity at the robot end as 2
WHILE CNV_FULL == FALSE — When the pick quantity at the robot end **doesn't reach** the maximum quantity of 2 (less than 2), it will execute…
…
ENDWHILE

WHILE CNV_FULL == TRUE — When the pick quantity at the robot end **has reached** the maximum quantity of 2 (equal to 2), it will execute…
…
ENDWHILE

Format Description:
When the quantity on the robot is 2, CNV_FULL will be TRUE. If not, it will be FALSE. When CNV_FULL is FALSE, it will go into WHILE.





4.2.2 CNV_EMPTY

Description:

This is the state command. The state variables of the robot represents the object quantity picked on the robot has been zeroed, which can be used to determine the place procedures end.

Format:

CNV_PICK_QUANTITY = 2 — Set the maximum pick quantity at the robot end as 2

WHILE CNV_EMPTY == TRUE — When the pick quantity at the robot end is 0, it will execute…

…

ENDWHILE

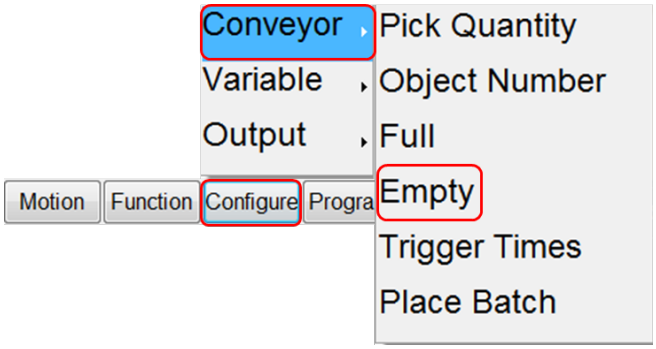
WHILE CNV_ EMPTY == FALSE — When the pick quantity at the robot end is not 0 (greater than 0), it will execute…

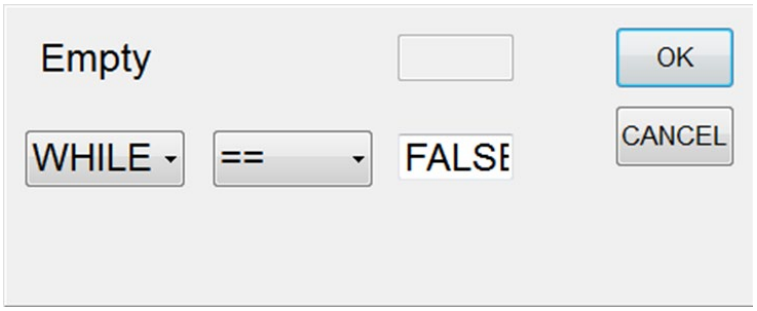
…

ENDWHILE

Format Description:

When the quantity on the robot is greater than 0, CNV_EMPTY will be FALSE. Otherwise, it will be TRUE. When CNV_EMPTY is FALSE, it will go to WHILE.



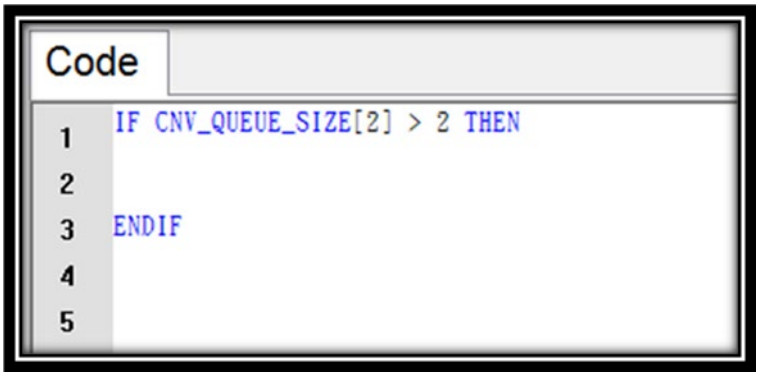


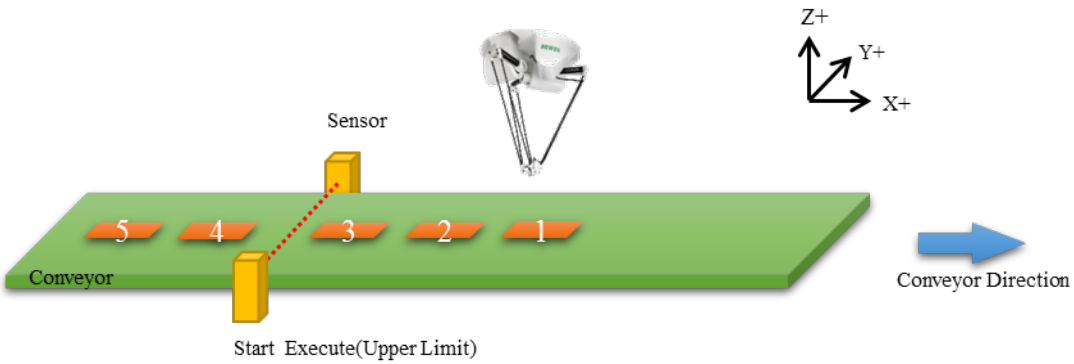
4.2.3 CNV_QUEUE_SIZE[NUM]

Description:
This is the state command, a user must enter by keyboard. NUM is the number of the conveyor. The robot will move when the sensor detects objects greater than the quantity of ###. An example is as follows.

Format:
IF CNV_QUEUE_SIZE[NUM] > ### THEN
…
ENDIF

Format Description:
[NUM]: Enter the conveyor number to be tracked, input range from 1 to 4,
represented by CNV1 to CNV4
###: Enter the quantity to be detected.





IF CNV_QUEUE_SIZE[2] > 2 THEN
…
ENDIF

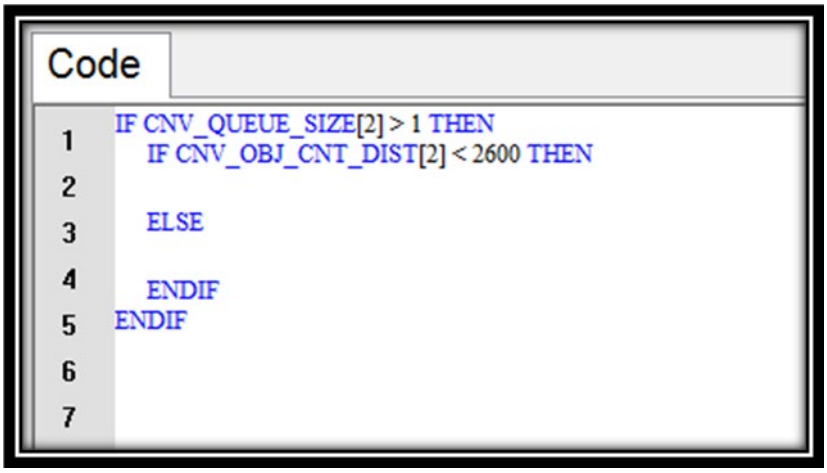
Description: After the sensor detects three objects, the robot will execute pick.

4.2.4 CNV_OBJ_CNT_DIST[NUM]

Description:
This is the state command, a user must enter by keyboard. When CNV_QUEUE_SIZE[NUM] is greater than or equal to 2 CNV_OBJ_CNT_DIST[NUM] can be used to display the different value of the encoder detected by the first sensor and the second sensor, used to determine whether the front and back objects are continuously detected, as well as used for the sensor application. NUM is the number of the conveyor.
Format:

```
IF CNV_QUEUE_SIZE[2] > 1 THEN
   IF CNV_OBJ_CNT_DIST[2] < 2600 THEN
   …
   ELSE
   …
   ENDIF
ENDIF
```

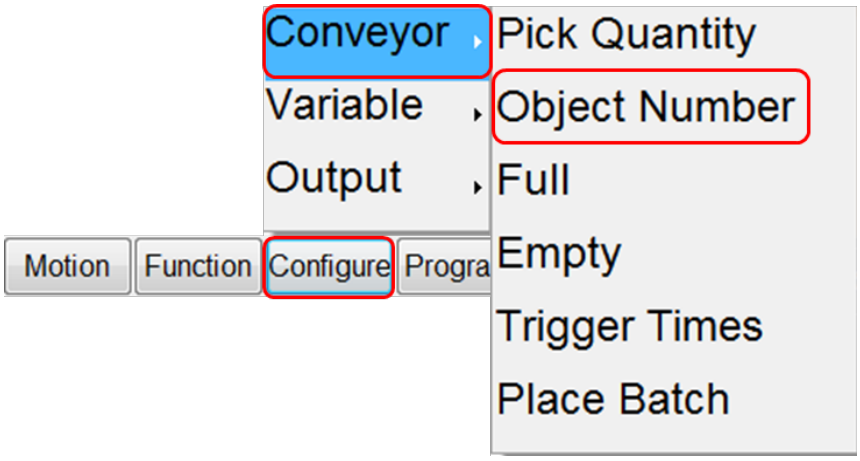
Format Description:
If the detected quantity is greater than 1, the values of the first sensor and the second sensor will be determined to be less than 2600 (2600 is the value measured by a user.). If yes, it will be continuous. If not, it will not be continuous latch.
[NUM]: Enter the conveyor number to be tracked, input range from 1 to 4, represented by CNV1 to CNV4

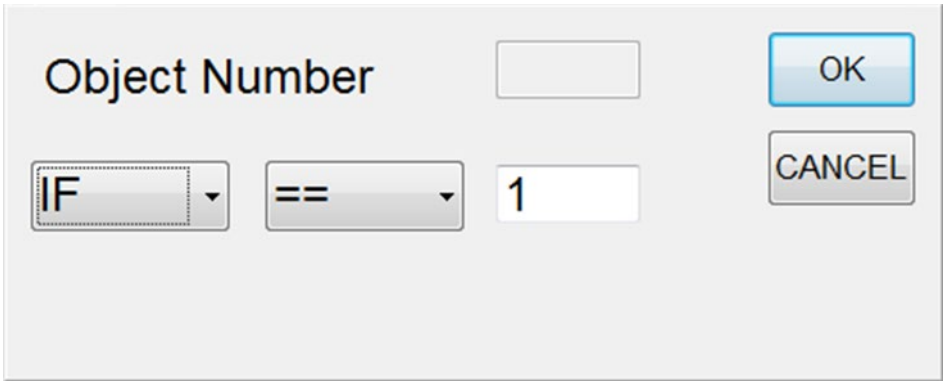


4.2.5CNV_OBJECT

Description:
Represents the object number of the latest pick and automatically reset after placed, which can be used to determine the current object and perform the specific procedures by this determination. Used only after CNV_PICK is determined. It is usually used for the **Vision Trigger** type.

Format:
IF CNV_OBJECT == 1 THEN
…
ENDIF



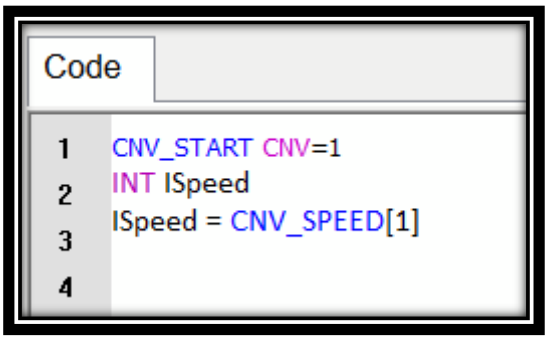


4.2.6 CNV_SPEED[NUM]

Description:
Conveyor state variable, user is able to read the current speed of conveyor.

Format:
INT ISpeed
ISpeed = CNV_SPEED[NUM]

Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, and represented by CNV1 to CNV4.

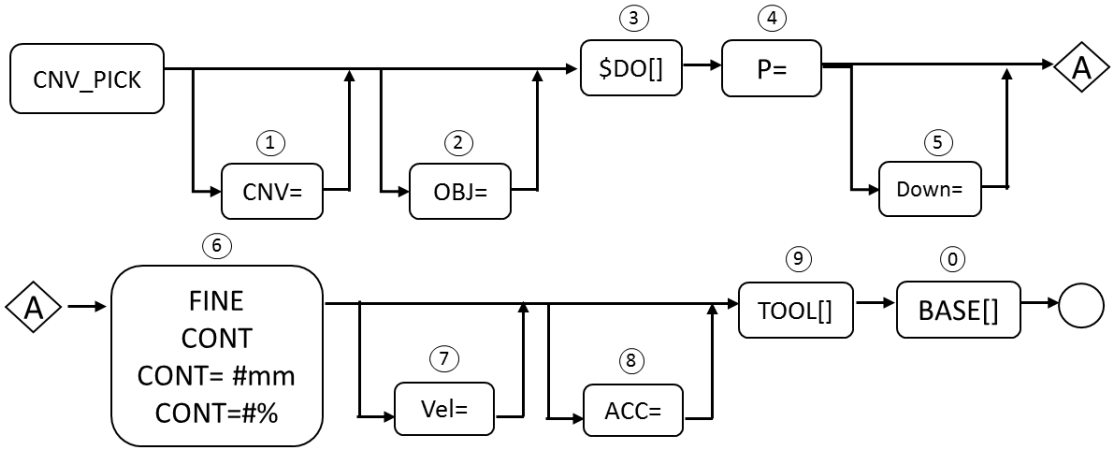


4.3 Motion Command

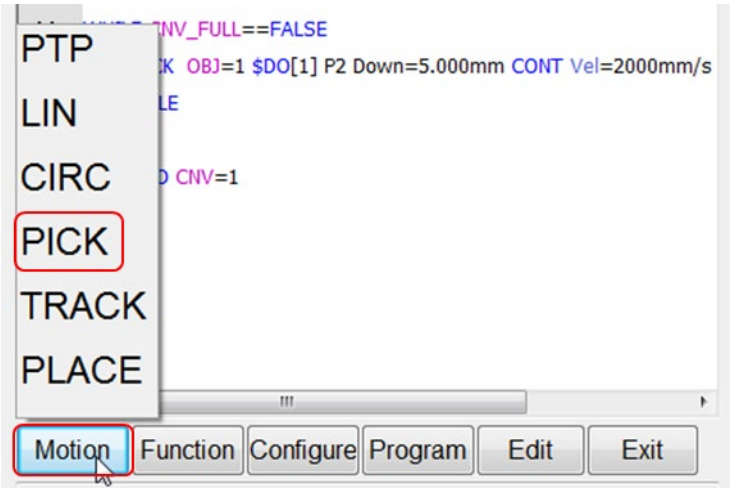
The Motion Command is used to edit robot tracking, and is usually used after determining the command.

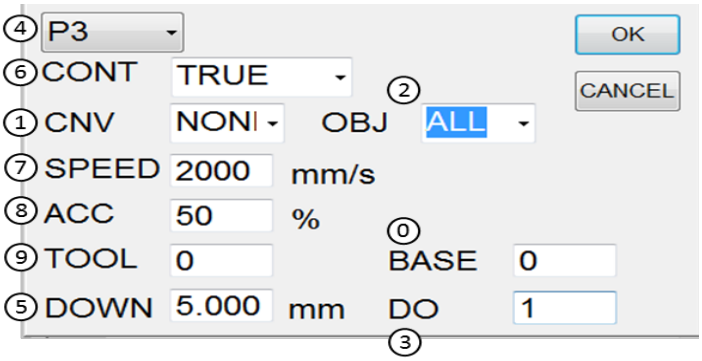
4.3.1 CNV_PICK

Description:
This is the motion command, which can perform the pick procedures for tracking the conveyor. The robot will return to the height ready to pick downwardly after a pick succeeds. It will return to the beginning position after a pick fails.
When a pick succeeds, the quantity picked by the end tool of the robot will increase by one.



Format:
CNV_PICK CNV=1 OBJ=1 $DO[1] P1 Down=5.000mm CONT Vel=2000mm/s Acc=50% TOOL[0] BASE[0]





①.Conveyor number (CNV)
②.Object (OBJ)
③.End tool number ($DO[])
④.Position (P)
⑤.Down height (Down=#.###mm)
⑥.Continuous (FINE, CONT, CONT=###% and CONT=##mm)
⑦.Velocity (Vel=)
⑧.Acceleration (Acc=)
⑨.Tool Coordinate (TOOL[ ])
⓪.Base Coordinate (BASE[ ])

Description:

①.Conveyor Number

Select the pick and the encoder, which can currently support 1~4.
When it is ignored, it will represent the conveyor number not assigned (none). The value of the encoder corresponding to the conveyor will not be tracked to directly move to the point P for pick.

②.Object (OBJ)

Currently support 1~8. When it is ignored, it will represent the object number not assigned (all). All objects will be picked. This function is usually used with the vision trigger.

③.End Tool Number ($DO[])

Represent the digital output of the end tool number used to pick the object at this time (Digital Output, currently select 16 points (expand to 32 points).
$DO is the number of DO not assigned, which represents to open DO for all ends.

④.Position (P0 to P4999)

Assign the position where the robot picks the object.
When the sensor is triggered, this position will be recorded in the coordinates corresponding to the conveyor;
When using the vision trigger type, it must be ignored.

⑤. Down Height (Down=#.###mm)

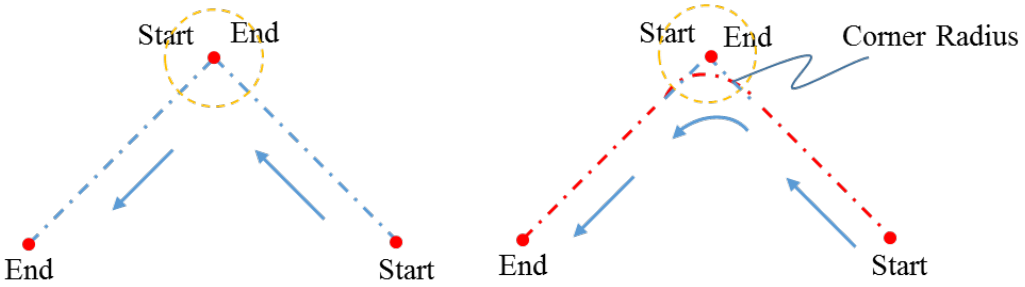
When picking, the robot will stop over the object (point P) and downwardly move according to the down height. This parameter is used to assign this down distance, which should be a positive integer.

⑥. Continuous (FINE, CONT, CONT=###% and CONT=##mm)

FINE for the discontinuous trace: Prioritize by the position accuracy, and lower the speed

CONT for continuous trace: Prioritize by the speed, and lower the position accuracy.

I. If CONT is not added into any control, the travelling path will vary according to the different speed and acceleration. (Preset mode).



II. CONT can be controlled by **the corner ratio (%) and the corner radius (mm)** (input by a keyboard):

1. **Corner ratio (%):**

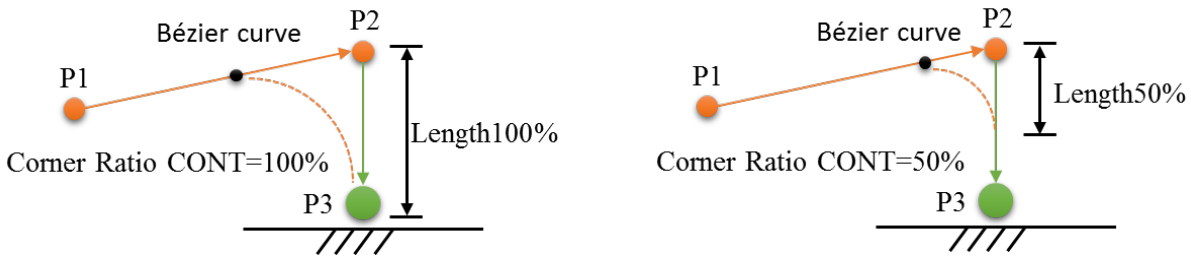
The value can be set from 0~100%.

The shortest path ratio in the traveling path will be used as the corner radius, as shown in the right figure. P1 is the beginning point, P2 is the passing point, and P3 is the destination point, where the length of P2-3 is less than P1-2. Therefore, the distance of P2-3 will be taken. If CONT=100%, the beginning point of the corner at P1-2 will be the length from P2 to forwardly extend P2-3.

The larger the corner ratio is, the larger the corner radius will be;

The longer the short side of the corner is, the larger the corner radius will be;

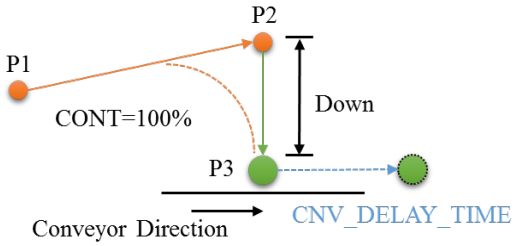
The faster the corner speed is, the larger the corner radius will be.



CNV_PICK CNV=1 OBJ=1 $DO[1] P1 **Down=5.000mm CONT=100%** Vel=2000mm/s Acc=50% TOOL[0] BASE[0]

In the robot commands, **CONT=100% is the corner ratio and Down=5.000mm is down 5mm.** This means the length of P2-3 is 5mm. It is assumed P2-3 is the shortest side when the length of P1-2 is greater than 5mm.

When pick is required for **straight up and down,** attention must be paid to CONT setting and the corner ratio should be converted according to the down distance. In addition, if it is necessary to ensure TCP indeed reaches P3 when the robot runs, CNV_DELAY_TIME[#] can be used with a unit of ms. The default is 0. TCP is set to pick, followed by the delay time of the object position.



2. **Corner radius (mm):**

The minimum value is set to 0, and the maximum value is set to the length of the shortest side.

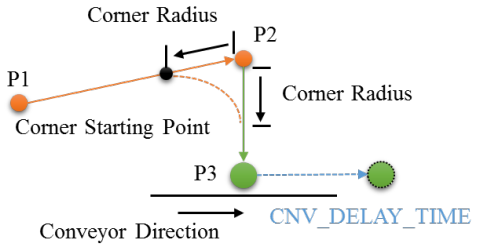
As shown in the right figure, P1 is the beginning point, P2 is the passing point, and P3 is the destination point. P2 in the traveling path is the basis point, and extends from the length of corner radius to obtain the beginning point of the corner.

Therefore, the larger corner radius is, the larger corner radius will be;

If the corner radius is set to be greater than the length of the shortest side, the corner radius will be kept at the length of the shortest side.

Note: If the speed is too fast, TCP could exceed the command path previously assigned when converting the path (P1-2 converting to P2-3). In order to keep TCP on the command path, TCP could lower the corner speed.

Therefore, special attention must be paid to the relationship among Vel, Acc and continuous path when planning the path.



⑦. Velocity (Vel=)

The value range 1-5000 mm/s, default as 3500mm/s.

⑧. Acceleration (Acc=)

The value range 0-100%, default as 70%.

⑨. Tool coordinate (TOOL[ ])

Offset the tool position when the multiple end tools are used, and currently support 0~15. The tool coordinates must be calibrated when used.

⓪. Base coordinate (BASE[ ])

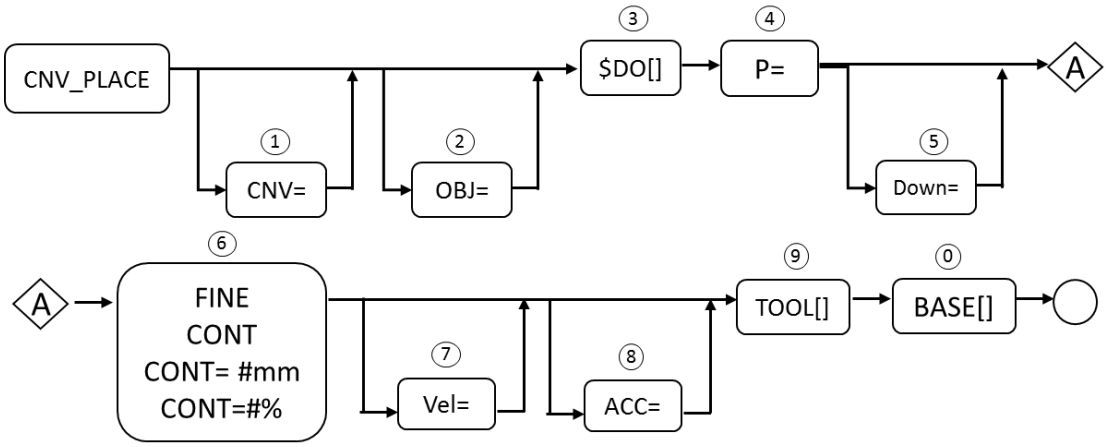
Set the coordinate system for a user, and currently support 0~31. The base coordinates must be calibrated when used.

4.3.2 CNV_PLACE

Description:

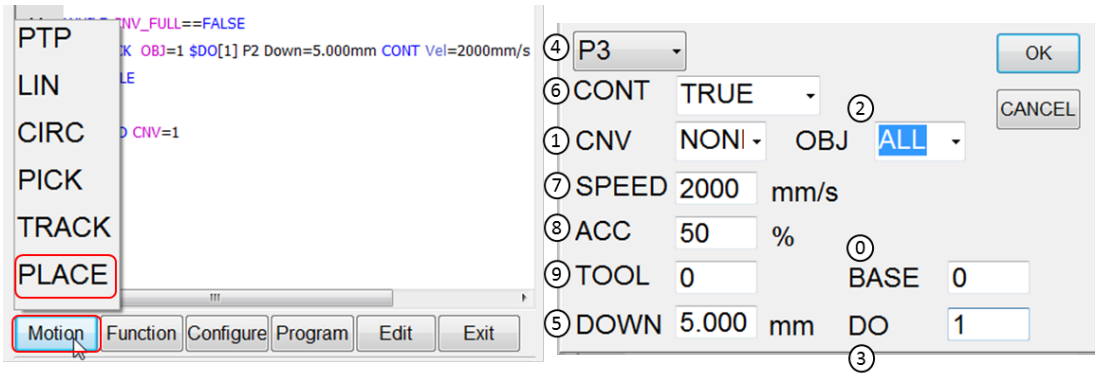
This is the motion command. In the state that can place the object, the procedures to track the conveyor place can be executed. After successfully placed, the robot will return to the safety height; if the robot fails to pick, it will return to the starting position.

After successfully placed, the quantity picked by the end tool will reduce once, and eliminate one queue.



Format:

CNV_PLACE CNV=1 OBJ=1 $DO[1] P1 Down=5.000mm CONT Vel=2000mm/s Acc=50% TOOL[0] BASE[0]



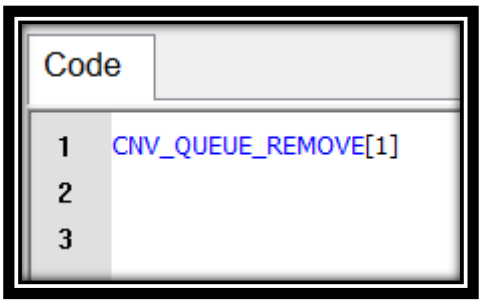
① Conveyor number (CNV)
② Object (OBJ)
③ End tool number ($DO[])
④ Position (P)
⑤ Down height (Down=#.###mm)
⑥ Continuous (FINE, CONT, CONT=###%, CONT=##mm)
⑦ Velocity (Vel=)
⑧ Acceleration (Acc=)
⑨ Tool coordinate (TOOL[ ])
⑩ Base coordinate (BASE[ ])

Format Description:
Description similar to CNV_PICK.

4.4 Function Command

4.4.1 CNV_QUEUE_REMOVE[NUM]

Description:
This is a function command, a user must enter by keyboard. Flying pick/flying place state variable, the user is able to remove the temporary value placed at the forefront of the waiting queue by using this instruction during the process of writing the program.
Format:
CNV_QUEUE_REMOVE[NUM]
Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, and represented by CNV1 to CNV4.

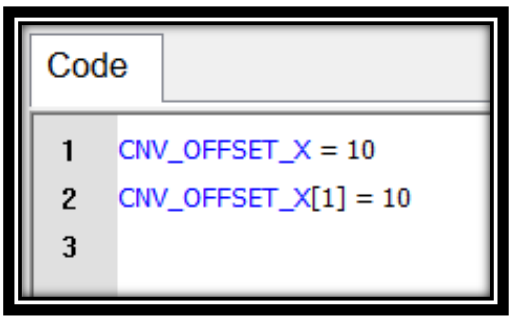


4.4.2 CNV_OFFSET_X[NUM]

Description:
This is a function command, a user must enter by keyboard. Flying pick/flying place state variable. The user is able to configure the offset
value of X by using this instruction when writing program.

Format:
All specified: CNV_OFFSET_X = 10
Single specified: CNV_OFFSET_X[NUM] = 10

Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, represented by CNV1 to CNV4.

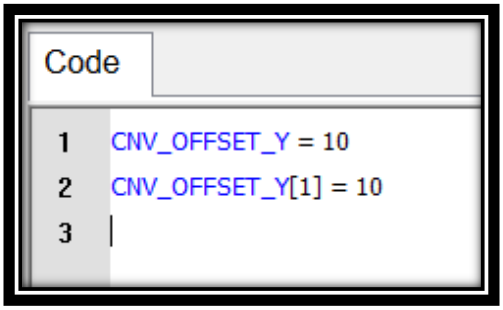


4.4.3 CNV_OFFSET_Y[NUM]

Description:
This is a function command, a user must enter by keyboard. Flying pick/flying place state variable. The user is able to configure the offset
value of Y by using this instruction when writing program.

Format:
All specified: CNV_OFFSET_Y = 10
Single specified: CNV_OFFSET_Y[NUM] = 10

Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, represented by CNV1 to CNV4.

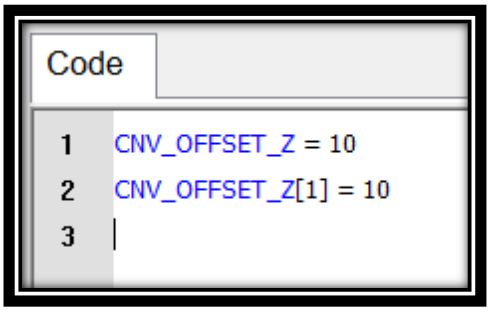


4.4.4 CNV_OFFSET_Z[NUM]

Description:
This is a function command, a user must enter by keyboard. Flying pick/flying place state variable. The user is able to configure the offset value of Z by using this instruction during the process of writing program.

Format:
All specified: CNV_OFFSET_Z = 10
Single specified: CNV_OFFSET_Z[NUM] = 10

Format Description:
NUM is the number of the conveyor. Input can be from 1 to 4, represented by CNV1 to CNV4.

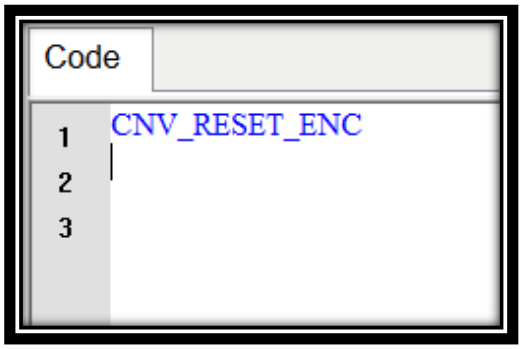


4.4.5 CNV_RESET_ENC

Description:
Conveyor Tracking Instruction. The user can use this instruction to clear the counting value of the external encoder when writing program. The effect of using this instruction is same as the effect of pressing “CLEAR” on the conveyor calibration interface.

Format:
CNV_RESET_ENC

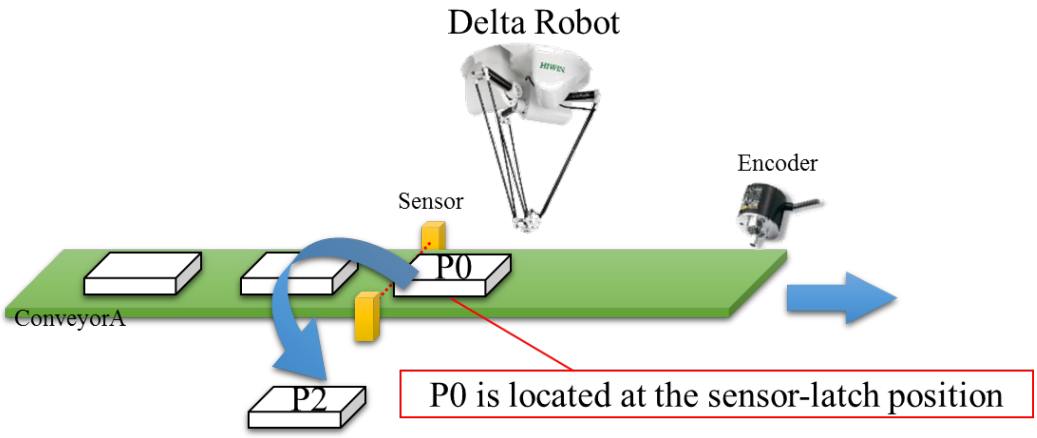
Format Description:
No need to enter parameter.



5. Example Program

5.1 Example 1

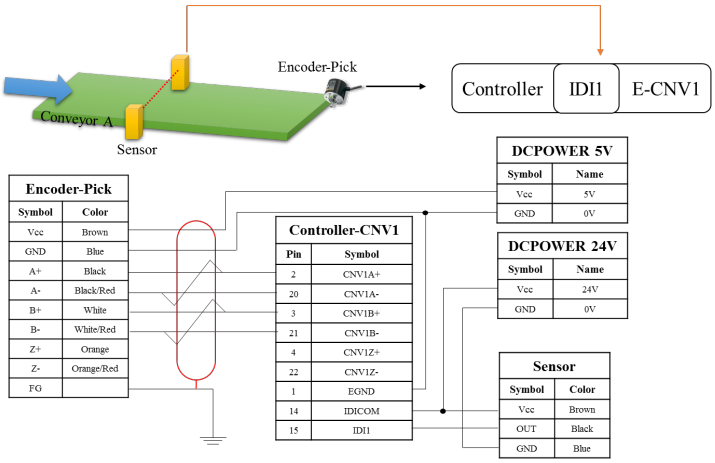
Layout



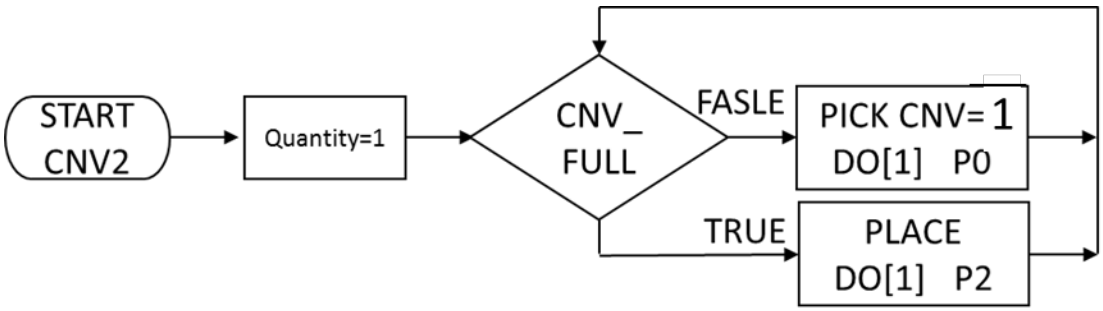
Description:

This example uses a RD403 and a vacuum cup at the end. A single conveyor is used for material feeding. The conveyor uses the encoder, which is connected to CNV1 for the controller. There is a red-light comparison sensor, and the trigger pin is connected to IDI1. P0 is the place to pick (tracking CNV=1), and P2 is to place (not tracking CNV).

Encoder connection



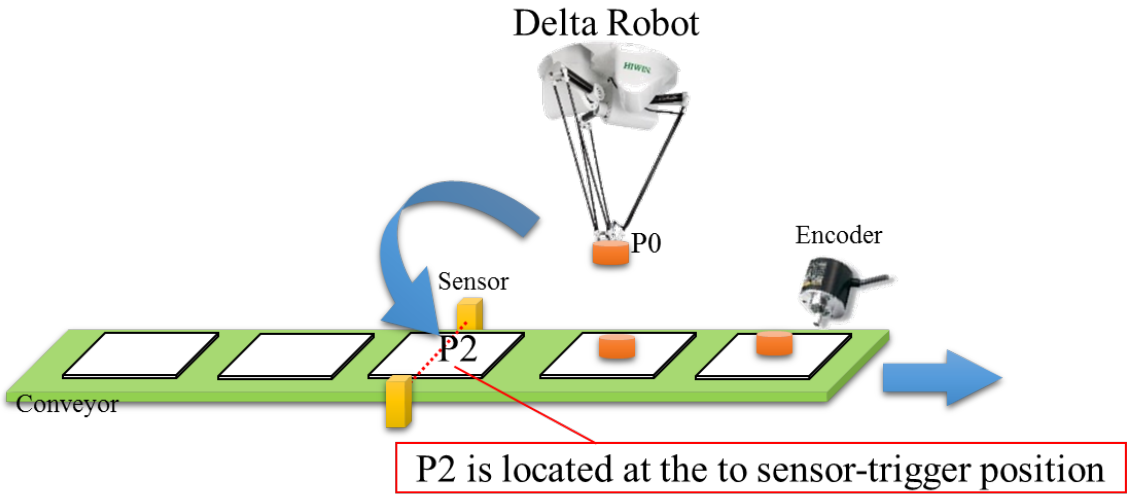
Program description:




```
CNV_START CNV=1                    ; start conveyor tracking, assigning CNV1
CNV_PICK_QUANTITY = 1              ; set the maximum quantity to pick
WHILE 1==1                         workpiece as 1
; pick-------------------------------
WHILE CNV_FULL == FALSE            ; go into the loop when the end quantity
                                   doesn't reach the upper limit
CNV_PICK CNV=1 $DO[1] P0 FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
; place-------------------------------
WHILE CNV_FULL== TRUE              ; go into the loop when the end quantity has
                                   reached the maximum quantity.
CNV_PLACE $DO[1] P2 FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
ENDWHILE
CNV_END CNV=1                      ; end conveyor tracking
```

5.2 Example 2

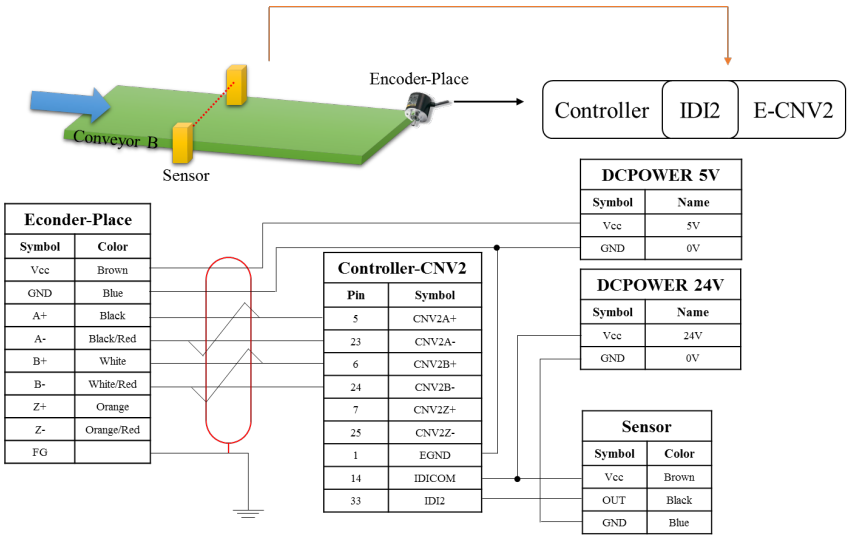
Layout



Description:

This example uses a parallel robot and a vacuum cup at the end. A single conveyor is used for material unloading. The conveyor uses the encoder, which is connected to CNV2 for RCD. There is a red-light comparison sensor, and the trigger pin is connected to IDI2. P0 is the place to pick (not tracking CNV), and P2 is to place (tracking CNV=2).

Encoder connection



Econder-Place	
Symbol	Color
Vcc	Brown
GND	Blue
A+	Black
A-	Black/Red
B+	White
B-	White/Red
Z+	Orange
Z-	Orange/Red
FG	

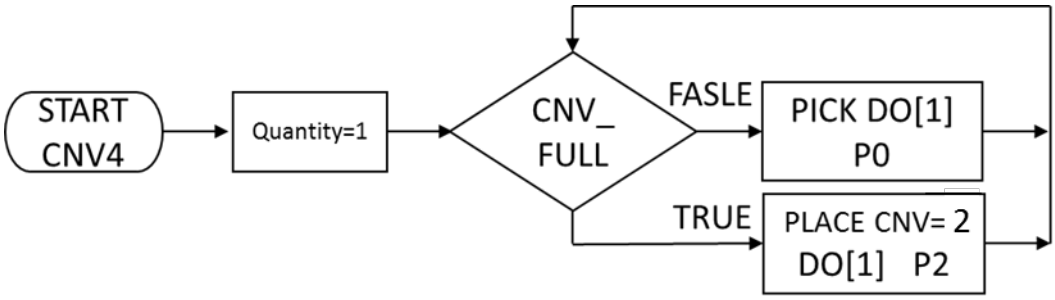
Controller-CNV2	
Pin	Symbol
5	CNV2A+
23	CNV2A-
6	CNV2B+
24	CNV2B-
7	CNV2Z+
25	CNV2Z-
1	EGND
14	IDICOM
33	IDI2

DCPOWER 5V	
Symbol	Name
Vcc	5V
GND	0V

DCPOWER 24V	
Symbol	Name
Vcc	24V
GND	0V

Sensor	
Symbol	Color
Vcc	Brown
OUT	Black
GND	Blue

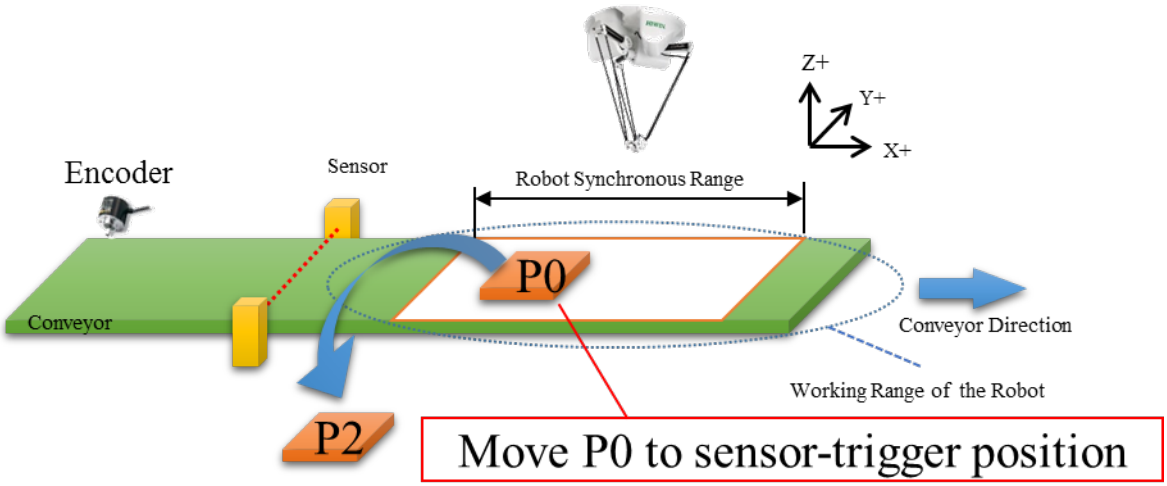
Program description:




```
CNV_START CNV=2                    ; start conveyor tracking, assigning CNV2
CNV_PICK_QUANTITY = 1              ; set the maximum quantity to pick
WHILE 1==1                         workpiece as 1
; pick----------------------------
WHILE CNV_FULL == FALSE            ; go into the loop when the end quantity
                                     doesn't reach the upper limit
CNV_PICK $DO[1] P0 FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
; place---------------------------
WHILE CNV_FULL== TRUE              ; go into the loop when the end quantity has
                                   reached the maximum quantity
CNV_PLACE CNV=2 $DO[1] P2 FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
ENDWHILE
CNV_END CNV=2                      ; end conveyor tracking
```

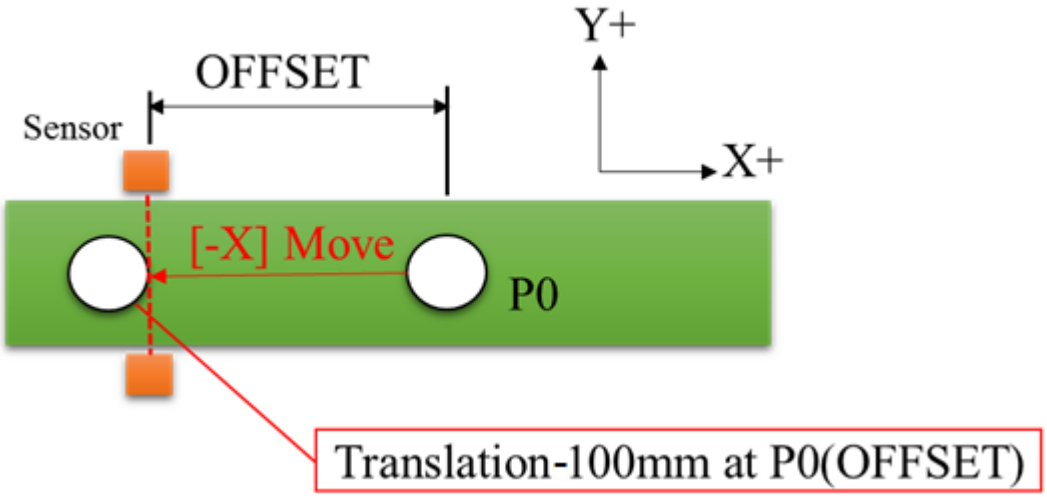
5.3 Example 3

Layout



Description:

This example the object sensor is away from the working range. Therefore, the point to pick or place cannot be taught. A parallel robot and a vacuum cup at the end are used. a single conveyor is used for material feeding. The conveyor uses the encoder, which is connected to CNV1 for the controller. There is a red-light sensor, and the trigger pin is connected to IDI1. P0 is the place to pick (tracking CNV=1), and P2 is to place (not tracking CNV).



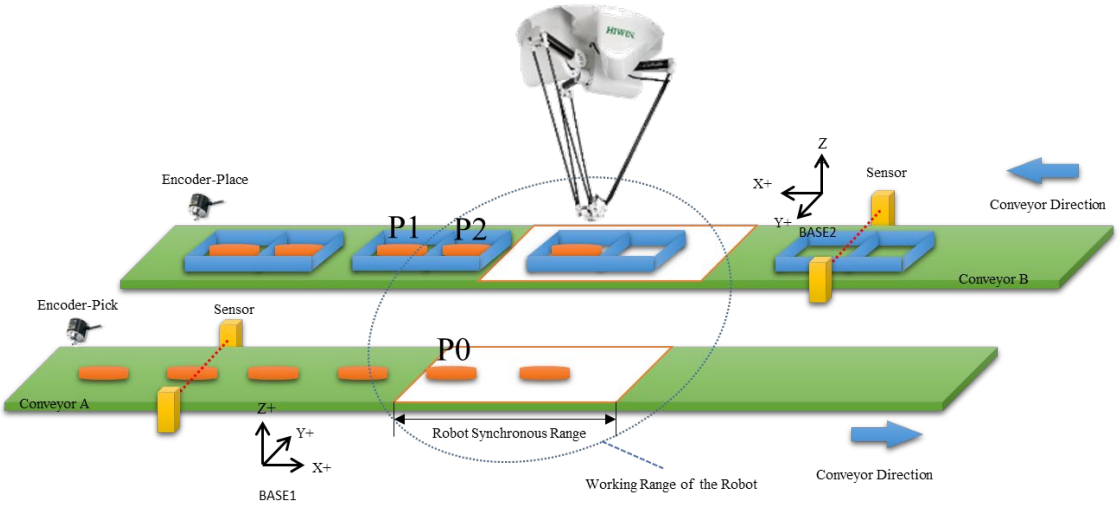
Program description:

```
E6POINT OFFSET
OFFSET = P0                          ; define OFFSET as P0
OFFSET.X= OFFSET.X-100               ; define OFFSET to offset 100 in the X-direction
OFFSET.Y= OFFSET.Y-0                 ; define OFFSET to offset 0 in the Y-direction
CNV_START CNV=1                      ; start conveyor tracking, assigning CNV1
CNV_PICK_QUANTITY = 1                ; set the maximum quantity to pick workpiece as 1
WHILE 1==1
; pick---------------------------------
WHILE CNV_FULL == FALSE              ; go into the loop when the end quantity doesn't reach the upper limit
CNV_PICK CNV=1 $DO[1] OFFSET FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
; place------------------------------
WHILE CNV_FULL== TRUE                ; go into the loop when the end quantity has reached the maximum quantity.
CNV_PLACE $DO[1] P2 FINE Vel=2000mm/s Acc=50% TOOL[0] BASE[3]
ENDWHILE
ENDWHILE
CNV_END CNV=1                        ; end conveyor tracking
```

5.4 Example 4

Layout

.



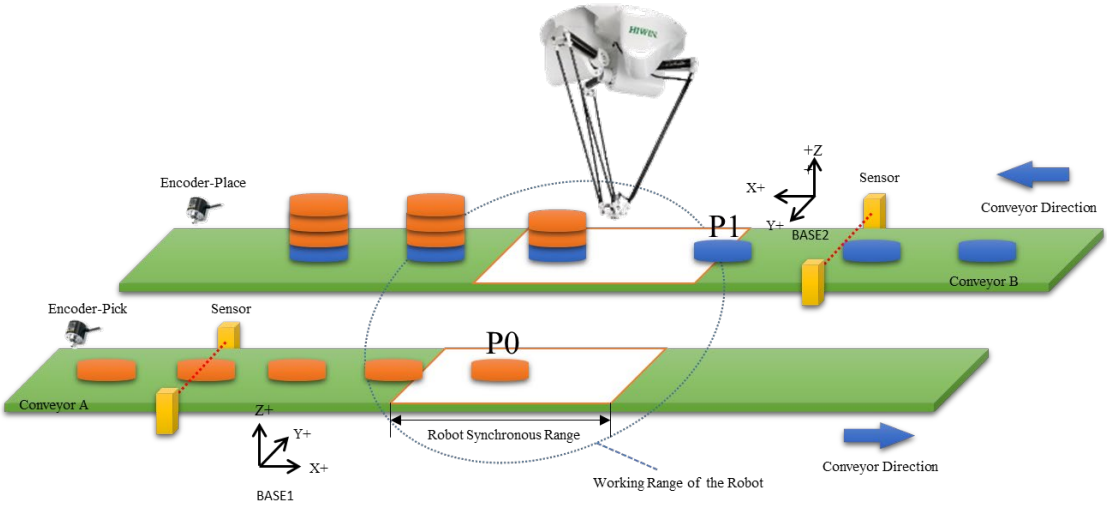
This example tracks pick and place by the conveyor. The robot tracks P0 as pick, and tracks P1 and P2 as place. A parallel robot and a vacuum cup at the end are used. Conveyor A and conveyor B are used for material feeding and unloading. The encoder - pick connects to CNV1 for the controller. The encoder - place connects to CNV2 for the controller. There are two sets of red-light sensor, and the trigger pins are connected to IDI1 and IDI2. P0 is the place to pick (tracking CNV=1). P1 and P2 are the places to place (tracking CNV2).

Program description:

```
E6POINT DROP
CNV_START CNV=1                 ; start conveyor tracking, assigning CNV1
CNV_START CNV=2                 ; start conveyor tracking, assigning CNV2
CNV_PICK_QUANTITY = 1           ; set the maximum quantity to pick
                                  workpiece as 1
CNV_PLACE_BATCH=2               ; set to place two workpieces
P0.X=P0.X-335                   ; offset P0 to X-335
P1.X=P1.X+200                   ; offset P1 to X+200
P2.X=P2.X+300                   ; offset P2 to X+300
$C[1]=1                         ; set value on the Counter 1 as 1
WHILE 1 == 1
; pick-------------------------
```

```
WHILE CNV_FULL == FALSE          ; go into the loop when the end quantity
                                   doesn't reach the upper limit
CNV_PICK CNV=1 $DO[1] P0 Down=6.0mm Vel=2000mm/s Acc=50% TOOL[0]
BASE[2]
ENDWHILE
IF $C[1] > 2 THEN
  $C[1]=1
ENDIF
; place----------------------------
WHILE CNV_FULL== TRUE            ; go into the loop when the end quantity has
                                   reached the maximum quantity
SWITCH $C[1]                       ; counter is 1 to place P1
CASE 1
DROP=P1
CASE 2
DROP=P2
ENDSWITCH
SYN $DO[1]=FALSE END DELAY=-20ms
CNV_PLACE CNV=2 $DO[1] DROP Down=6.0mm CONT Vel=2000mm/s
Acc=50% TOOL[0] BASE[2]
$C[1]=$C[1]+1                      ; counter plus 1 after placed
IF CNV_FULL == TRUE THEN           ; quit this tray if tracking to place P1 or P2
                                   fails
$C[1]=1
ENDIF
ENDWHILE
CNV_END CNV=2                      ; end conveyor tracking
CNV_END CNV=1                      ; end conveyor tracking
```

5.5 Example 5



This example tracks pick and place by the conveyor. The robot tracks P0 as pick, and tracks P1 as place. A parallel robot and a vacuum cup at the end are used. Conveyor A and conveyor B are used for material feeding and unloading. The encoder - pick connects to CNV1 for the controller. The encoder - place connects to CNV2 for the controller. There are two sets of red-light sensor, and the trigger pins are connected to IDI1 and IDI2. P0 is the place to pick (tracking CNV=1). P1 and P2 are the places to place (tracking CNV2).

Track Setting

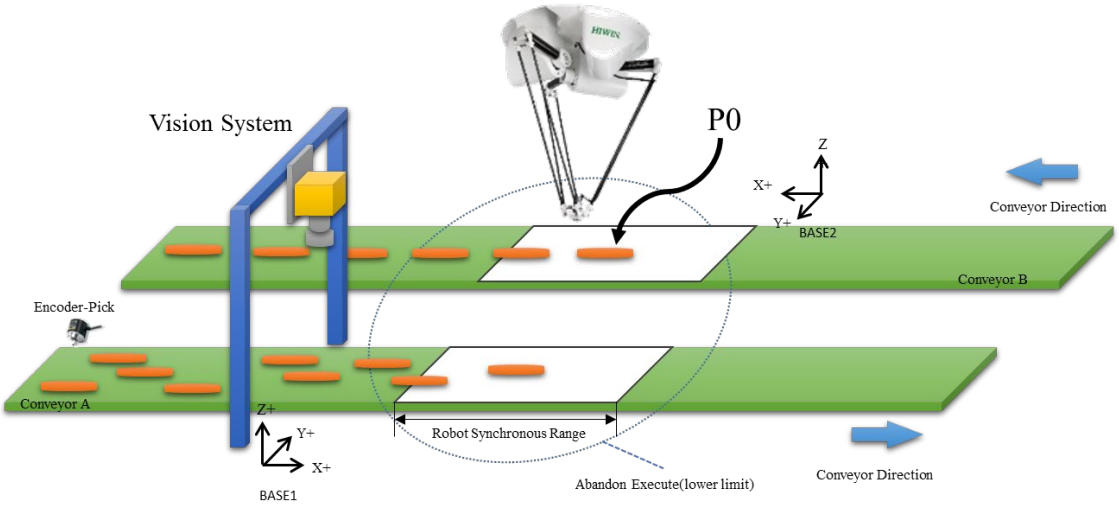
Track Setting

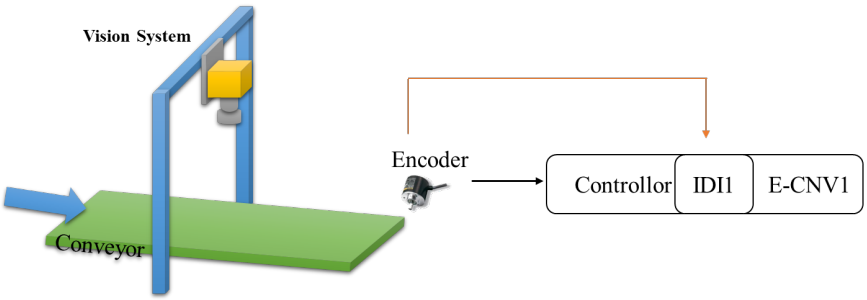
ITEM	CNV1	CNV2	CNV3	CNV4
CNV STATUS	Used	Used	Not use	Not use
DIRECTION	Forward	Forward		
TRIGGER TYPE	Sensor	Sensor		
TRIGGER TIMES	1	1		
PLACE BATCH	1	3		

Program description:

```
E6POINT STACK
STACK=P1                          ; define the stack as P1
CNV_START CNV=1                   ; start conveyor tracking, assigning CNV1
CNV_START CNV=2                   ; start conveyor tracking, assigning CNV2
CNV_PICK_QUANTITY = 1             ; set the maximum quantity to pick
                                  workpiece as 1
P1.X=P1.X+210                     ; offset P1 to X+210
$C[1]=0                           ; set value on the Counter 1 as 0
WHILE 1 == 1
; pick----------------------------
WHILE CNV_FULL == FALSE           ; go into the loop when the end quantity
                                  doesn't reach the upper limit
CNV_PICK CNV=1 $DO[1] P0 Down=5.0mm Vel=2000mm/s Acc=50% TOOL[0]
BASE[2]
ENDWHILE
; place----------------------
WHILE CNV_FULL== TRUE             ; go into the loop when the end quantity has
                                  reached the maximum quantity
CNV_PLACE CNV=2 $DO[1] STACK Down=5.0mm CONT Vel=2000mm/s
Acc=50% TOOL[0] BASE[2]
IF CNV_FULL != TRUE THEN
$C[1]=$C[1]+1                      ; Z offsets +15 if the end quantity is 0
STACK.Z=STACK.Z+15
ENDIF
IF CNV_OBJECT == 0 THEN
IF $C[1]==4 OR CNV_FULL==TRUE THEN
STACK=P1
$C[1]=0
ENDIF
ENDWHILE
ENDWHILE
CNV_END CNV=2                     ; end conveyor tracking
CNV_END CNV=1                     ; end conveyor tracking
```

5.6 Example 6





Encoder-Pick	
Symbol	Color
A+	Brown
A-	Blue
B+	Black
B-	Black/Red
Z+	White
Z-	White/Red
EN-GND	FG

Controllor-CNV1	
Pin	Color
2	CH1A+
20	CH1A-
3	CH1B+
21	CH1B-
4	CH1Z+
22	CH1Z-
1	FG
14	IDICOM
15	IDI1

24V
Vision Trigger Signal

Note: The figure above is arranged as NPN. If PNP is needed (IDICOM needs to connect 0V, and IDI1 ~ IDI4 must use the same voltage level.), the vision signals must be changed to PNP.

This example has the object on the conveyor A positioned by the Vision System. The object type is 1. The robot tracks and picks via the object positioned by the Vision System, and places it at P0 on the conveyor. A parallel robot and a vacuum cup at the end are used. Conveyor A and conveyor B are the material feeding and unloading. The encoder - pick connects to CNV1 for the controller, and the trigger pin from the Vision System is connected to IDI1. P0 is the place to place (not tracking CNV).

Program description:

```
CNV_START CNV=1                    ; start conveyor tracking, assigning CNV1
CNV_PICK_QUANTITY = 1              ; set the maximum quantity to pick as 1
; pick-------------------------
WHILE CNV_FULL == FALSE            ; go into the loop when the end quantity
                                   doesn't reach the upper limit.
CNV_PICK CNV=1 OBJ=1 $DO[1] Down=5.0mm Vel=2000mm/s Acc=50%
TOOL[0] BASE[1]
ENDWHILE
; place---------------------------------
WHILE CNV_FULL== TRUE              ; go into the loop when the end quantity has
                                     reached the maximum quantity.

CNV_PLACE $DO[1] P0 Down=5.0mm CONT Vel=2000mm/s Acc=50% TOOL[0]
BASE[2]
ENDWHILE
CNV_END CNV=1                      ; end conveyor tracking
```

6. Error Message

The error message with * symbol, on behalf of this error does not stop robot.

6.1 Robot System Software(01-XX-XX)

6.1.1 System Error Message(01-01-XX)

Error code	Error	Message	Reason	Solution
01-01-10	System initialization failure	System initialization failure	Software damaged or lost	1.Please turn off the power and then re-start. 2.If it is still unable to resolve, please contact engineer from the original equipment manufacturer.
01-01-11	Motion library load failure	Motion library load failure	Motion library damaged or lost	
01-01-12	Motion library initialization failure	Motion library initialization failure		
01-01-13	Motion library memory initialization failure			
01-01-14	Motion library start failure	Motion library start failure		
01-01-20	EtherCAT library loading failure	EtherCAT library loading failure	Software damaged	
01-01-21	EtherCAT disconnection	EtherCAT anomalies	EtherCAT connection anomalies	
01-01-22	EtherCAT initialization failure			

Error code	Error	Message	Reason	Solution
01-01-23	EtherCAT line crossing alarm	EtherCAT anomalies	EtherCAT connection anomalies	1 Please check if the connecting line
01-01-24	EtherCAT none slave alarm			
01-01-25	EtherCAT can't check slave			

01-01-26	EtherCAT slave none response			is correctly connected, and turn off the power and then re-start. 2. If it is still unable to resolve, please contact engineer from the original equipment manufacturer.
01-01-27	EtherCAT cycle alarm			
01-01-28	EtherCAT cycle jitter			
01-01-29	EtherCAT cycle counter error			
01-01-2A	EtherCAT cycle watchdog error			
01-01-2B	EtherCAT INIT changing error			
01-01-2C	EtherCAT PREOP changing error			
01-01-2D	EtherCAT SAFEOP changing error			
01-01-2E	EtherCAT OP changing error			
01-01-2F	EtherCAT master none response			
01-01-30	EtherCAT master initialization error			
Error code	Error	Message	Reason	Solution
01-01-31	EtherCAT busbar scan error	EtherCAT anomalies	EtherCAT connection anomalies	1.Please check if the connecting line is correctly connected, and turn off the power and then re-start. 2.If it is still unable to resolve, please contact engineer from the original equipment manufacturer.
01-01-32	EtherCAT frame response error			
01-01-33	EtherCAT frame lost			
01-01-34	EtherCAT master counter error of initialization command			
01-01-35	EtherCAT master response error of initialization command			
01-01-36	EtherCAT slave counter error of initialization command			
01-01-37	EtherCAT slave response error of initialization command			
01-01-38	EtherCAT mailbox time out			
01-01-39	EtherCAT mailbox SDO			

	cancel			
01-01-3A	EtherCAT mailbox COE counter recive error			
01-01-3B	EtherCAT mailbox COE counter send error			
01-01-3C	EtherCAT mailbox recive invaild data			
01-01-3D	EtherCAT master alarm			

Error code	Error	Message	Reason	Solution
01-01-40	Axis 1 parameter setting fail	System anomalies	Software damaged or lost	If reinstall software is requires, please contact engineer from the original equipment manufacturer.
01-01-41	Axis 2 parameter setting fail			
01-01-42	Axis 3 parameter setting fail			
01-01-43	Axis 4 parameter setting fail			
01-01-44	Axis 5 parameter setting fail			
01-01-45	Axis 6 parameter setting fail			
01-01-50	Conveyor 1 encoder initial fail			
01-01-51	Conveyor 2 encoder initial fail			
01-01-52	Conveyor 3 encoder initial fail			
01-01-53	Conveyor 4 encoder initial fail			
01-01-54	Extra parameter initial fail			

01-01-55	HRSS Loading fail			

6.1.2 Program Error(01-02-XX)

Error code	Error	Message	Reason	Solution
01-02-10	Program code incorrectness	Program code incorrectness	Syntax error.	Check robot language. Ref 6.1.11
01-02-11	Try to repair the corrupted file. Please confirm the program content is correct before execute.	Program file open failure.	Files are damaged or lost.	Use backup file or create new file.

6.1.3 Motion Error(01-03-XX)

Error code	Error	Message	Reason	Solution
01-03-10	Axis 1 following error too big	Axis 1 position over deviation	Motion speed too fast or actual position exceeded deviation	1. Reduce speed。 2. Reduce load. 3. Reduce acceleration.
01-03-11	Axis 2 following error too big	Axis 2 position over deviation		
01-03-12	Axis 3 following error too big	Axis 3 position over deviation		
01-03-13	Axis 4 following error too big	Axis 4 position over deviation		
01-03-14	Axis 5 following error too big	Axis 5 position over deviation		
01-03-15	Axis 6 following	Axis 6		

	error too big	position over deviation		
Error code	Error	Message	Reason	Solution
01-03-16	Axis 1 position overlimit of positive	Axis 1 exceeded positive rotation limit	Motion to Axis 1 reach positive limit	Axis 1 move negative
01-03-17	Axis 1 position overlimit of negative	Axis 1 exceeded negative rotation limit	Motion to Axis 1 reach negative limit	Axis 1 move positive
01-03-18	Axis 2 position overlimit of positive	Axis 2 exceeded positive rotation limit	Motion to Axis 2 reach positive limit	Axis 2 move negative
01-03-19	Axis 2 position overlimit of negative	Axis 2 exceeded negative rotation limit	Motion to Axis 2 reach negative limit	Axis 2 move positive
01-03-1A	Axis 3 position overlimit of positive	Axis 3 exceeded positive rotation limit	Motion to Axis 3 reach positive limit	Axis 3 move negative
01-03-1B	Axis 3 position overlimit of negative	Axis 3 exceeded negative rotation limit	Motion to Axis 3 reach negative limit	Axis 3 move positive
01-03-1C	Axis 4 position overlimit of positive	Axis 4 exceeded positive rotation limit	Motion to Axis 4 reach positive limit	Axis 4 move negative
01-03-1D	Axis 4 position overlimit of negative	Axis 4 exceeded negative rotation limit	Motion to Axis 4 reach negative limit	Axis 4 move positive
01-03-1E	Axis 5 position overlimit of positive	Axis 5 exceeded positive	Motion to Axis 5 reach positive limit	Axis 5 move negative

		rotation limit		
01-03-1F	Axis 5 position overlimit of negative	Axis 5 exceeded negative rotation limit	Motion to Axis 5 reach negative limit	Axis 5 move positive
01-03-20	Axis 6 position overlimit of positive	Axis 6 exceeded positive rotation limit	Motion to Axis 6 reach positive limit	Axis 6 move negative
01-03-21	Axis 6 position overlimit of negative	Axis 6 exceeded negative rotation limit	Motion to Axis 6 reach negative limit	Axis 6 move positive

Error code	Error	Message	Reason	Solution
01-03-30	XY coordinate overlimit of software	XY coordinates reached the limit	Move Motion to XY coordinate	Clear error and move in opposite limit
01-03-31	Joint overspeed	Shaft over speed	Reverse solution to determine a shaft speed too fast.	Clear error and use PTP motion
01-03-32	Wrist singularity	Near wrist singular point	Near wrist singular point	Try to avoid the singular point of motion
01-03-33	Shoulder singularity	Near shoulder singular point	Near shoulder singular point	
01-03-34	Elbow singularity	Near elbow singular point	Near elbow singular point	
01-03-40	Circle command 3 reference points on the same line	Circle command on the same line	Command setting error.	Check CIRC description.
01-03-41	Circle comm	Unable to		

	can't found center point	calculate center of circle in two point space		
01-03-42	Circle comm can't calculate transpose matrix	Circle command parameter error, unable to calculate transpose matrix		
01-03-50	Synchronize output queue overflow	Synchronize output command buffer overflow	Synchronize output command too much, causing buffer overflow	1. Please check if the connecting line is correctly connected, and turn off the power and then re-start. 2. Please contact engineer from the original equipment manufacturer.
01-03-51	Synchronize output overlimit	Synchronize output control command overlimit	Synchronize activate output command too much	
01-03-52	Found motion command when compliance teaching	During compliance tuning, send motion command。	Motion command cannot be performed during compliance tuning	Clear error and stop sending motion command

6.1.4 Operation Error(01-04-XX)

Error code	Error	Message	Reason	Solution
01-04-10	Read driver 1 encoder is abnormality	Axis 1 absolute encoder position error	Read axis encoder under moving status	Please confirm whether the brake shaft is falling.
01-04-11	Read driver 2 encoder is abnormality	Axis 2 absolute encoder		

		position error		
01-04-12	Read driver 3 encoder is abnormality	Axis 3 absolute encoder position error		
01-04-13	Read driver 4 encoder is abnormality	Axis 4 absolute encoder position error		
01-04-14	Read driver 5 encoder is abnormality	Axis 5 absolute encoder position error		
01-04-15	Read driver 6 encoder is abnormality	Axis 6 absolute encoder position error		
01-04-16	Write data to driver 1 is abnormality	Axis 1 driver parameter write back failed	Driver connection is abnormality	Check driver connection.
01-04-17	Write data to driver 2 is abnormality	Axis 2 driver parameter write back failed		
01-04-18	Write data to driver 3 is abnormality	Axis 3 driver parameter write back failed		
01-04-19	Write data to driver 4 is abnormality	Axis 4 driver parameter write back failed		
01-04-1A	Write data to driver 5 is abnormality	Axis 5 driver parameter write back failed		
01-04-1B	Write data	Axis 6 driver		

	to driver 6 is abnormality	parameter write back failed		

Error code	Error	Message	Reason	Solution
01-04-1C	Clear driver 1 encoder is abnormality	Clear Axis 1 driver encoder failed	1.Driver connect is abnormality. 2. The command is forbidden	1.Check driver connected. 2.Check driver status.
01-04-1D	Clear driver 2 encoder is abnormality	Clear Axis 2 driver encoder failed		
01-04-1E	Clear driver 3 encoder is abnormality	Clear Axis 3 driver encoder failed		
01-04-1F	Clear driver 4 encoder is abnormality	Clear Axis 4 driver encoder failed		
01-04-20	Clear driver 5 encoder is abnormality	Clear Axis 5 driver encoder failed		
01-04-21	Clear driver 6 encoder is abnormality	Clear Axis 6 driver encoder failed		
01-04-30	Start position declination is abnormality	Robot position declination	The robot's position is different from when it was last powered off.	Please move to the origin and confirm that the angle is correct.
01-04-31	A1 declination is abnormality			
01-04-32	A2 declination is abnormality			
01-04-33	A3 declination is abnormality			

01-04-34	A4 declination is abnormality			
01-04-35	A5 declination is abnormality			
01-04-36	A6 declination is abnormality			

Error code	Error	Message	Reason	Solution
01-04-40	RSR(&NUM) no file	RSR file not set	RSR execution file not set	Confirm that the execution file is set.
01-04-41	PNS(&NUM) no file	PNS file not set	PNS execution file not set	
01-04-50	ISR delay stack overflow	ISR delay buffer overflow	ISR delay buffer overflow	1.Please turn off the power and then re-start. 2.If it is still unable to resolve, please contact engineer from the original equipment manufacturer.
01-04-51	Motion command queue overflow	Motion command buffer overflow	Motion command too much, causing buffer overflow	
01-04-52	Jog queue overflow	Jog command buffer overflow	Jog command too much, causing buffer overflow	
01-04-53	Interpolation buffer overflow	Interpolation command buffer overflow	Interpolation command too much, causing buffer overflow	

01-04-60	Modify Time Setting	* Time is modified.	Time Setting is modified, will not shutdown	Inform user time setting is modified, will not shutdown
01-04-61	Modify NTP Setting	*NTP is modified.	NTP Setting is modified, will not shutdown	Inform user NTP is modified, will not shutdown

6.1.5 IO & Communication(01-05-XX)

Error code	Error	Message	Reason	Solution
01-05-10	Teach Pendant connection error	TP connection error	1.TP destroy. 2.TP connection is abnormal.	1.Change TP. 2.Check connect port.
01-05-20	ROBOT IO connection error	Robot IO connection error	Interference	Confirm RIO wire.
01-05-21	ROBOT IO disconnection	Robot IO disconnection	1.Robot IO destroy 2.Robot IO port is abnormal.	1. Change Robot IO. 2. Confirm RIO port.
01-05-30	Network disconnection	Network disconnection	Network is abnormal.	Check network connection.
01-05-31	Network connect failure	Network connect failure	Network server is abnormal.	1.Check network connection server. 2.Check network domain. 3.Check connection IP and PORT setting
01-05-32	Server opened failure	Server opened failure	Server opened failure	Check connection IP and PORT

				setting
01-05-33	Server closed the connection	Sever connection closed	Sever automatically closed connection	Prevent sever automatically disconnect from client
01-05-34	Network port setting error	Network port setting error	Network port setting error	Check port setting.
01-05-35	Network client disconnect time out	Network client disconnect time out	Network client disconnect time out	Check sever whether interact with client disconnect message

6.1.6 Operator Error (01-06-XX)

Error code	Error	Message	Reason	Solution
01-06-10	Motion delay command abnormality	Parameter cannot be set	Parameter is not within the range to be set	Check parameter.
01-06-11	Acceleration setting command abnormality	Parameter cannot be set		
01-06-12	PTP motion command abnormality	PTP motion failed	1.Command format error. 2.Unable to give motion command instruction	1. Confirm the command format. 2. Confirm the motion function status。
01-06-13	Circle motion command abnormality	CIRC motion failed		
01-06-14	Line motion command abnormality	LIN motion failed		
01-06-15	Feedspeed setting command abnormality	Parameter cannot be set	Parameter cannot be set.	Check parameter.

01-06-16	Path abnormality	Moving path abnormality	The moving path is out of working range.	Re-design the position of point and the action instruction, or check if the setting of Tool and Base has any error.
01-06-17	Setting conveyor tracking acceleration error	Parameter setting error	Parameter out of the range	Check the parameter setting is correct.
01-06-18	Setting conveyor pick acceleration error			
01-06-19	Enable smooth motion error			
01-06-1A	Disable smooth motion error			

Error code	Error	Message	Reason	Solution
01-06-20	Counter index abnormality	Parameter cannot be set	Index not within setting range	Confirm Index No.
01-06-21	Timer index abnormality	Parameter cannot be set		
01-06-22	Counter stop number abnormality	Parameter cannot be set		
01-06-23	DI index abnormality	Parameter cannot be set		
01-06-24	DO index abnormality	Parameter cannot be set		
01-06-25	RI index abnormality	Parameter cannot be set		
01-06-26	RO index abnormality	Parameter cannot be set		
01-06-27	VI index abnormality	Parameter cannot be set		
01-06-28	VO index abnormality	Parameter cannot be set		
01-06-29	SI index abnormality	Parameter cannot be set		
01-06-2A	SO index abnormality	Parameter cannot be set		
01-06-2B	SR index abnormality	Parameter cannot be set		

01-06-30	DI can't be setting	Parameter cannot be set	DI setting unavailable	DI not set
01-06-31	RI can't be setting	Parameter cannot be set	RI setting unavailable Parameter can’t be set.	RI not set
01-06-32	SI can't be setting	Parameter cannot be set	SI setting unavailable	SI not set

Error code	Error	Message	Reason	Solution
01-06-33	SO can't be setting	Parameter cannot be set	Specific SO setting not available	Specific SO not set
01-06-34	SRR can't be setting	Parameter cannot be set	SRR setting not available	SRR not set
01-06-35	SRW value abnormality	SRW value is abnormal.	Parameter error.	Check setting command.
01-06-36	Fieldbus Slot1 abnormality SRW value abnormality	Fieldbus Slot1 abnormality	1. Parameter setting error. 2. Driver is not installed. 3. Fieldbus connection abnormal.	1. Set the correct parameters. 2. Confirm that the driver installation is completed. 3Check the hardware wiring.
01-06-37	Fieldbus Slot2 abnormality Fieldbus Slot1 disconnected	Fieldbus Slot2 abnormality		

6.1.7 External Axis Error (01-07-XX)

Error code	Error	Message	Reason	Solution
01-07-10	E1 axis following error overlimit	E1 axis position over deviation	E1 axis motion command and actual position exceeded deviation The Axis speed can’t reach the pulses.	1. Reduce the speed 2. Reduce the load weight 3.Reduce acceleration in percentage
01-07-11	E2 axis following error overlimit	E2 axis position over deviation	E2 axis motion command and actual position exceeded deviation	

01-07-12	E3 axis following error overlimit	E3 axis position over deviation	E3 axis motion command and actual position exceeded deviation	

Error code	Error	Message	Reason	Solution
01-07-13	E1 axis position overlimit of positive	E1 axis exceeded positive rotation limit	Over the positive limit.	E1 axis move towards negative
01-07-14	E1 axis position overlimit of negative	E1 axis exceeded negative rotation limit	Over the negative limit.	E1 axis move towards positive
01-07-15	E2 axis position overlimit of positive	E2 axis exceeded positive rotation limit	Over the positive limit.	E2 axis move towards negative
01-07-16	E2 axis position overlimit of negative	E2 axis exceeded negative rotation limit	Over the negative limit.	E2 axis move towards positive
01-07-17	E3 axis position overlimit of positive	E3 axis exceeded positive rotation limit	Over the positive limit.	E3 axis move towards negative
01-07-18	E3 axis position overlimit of negative	E3 axis exceeded negative rotation limit	Over the negative limit.	E3 axis move towards positive

01-07-19	E1 axis clear encoder error	E1 axis driver clear encoder failed	1. Connection with axis is abnormal. 2. Axis prohibits this command.	1.Check Axis is connected. 2.Check Axis status.
01-07-1A	E2 axis clear encoder error	E2 axis driver clear encoder failed		
01-07-1B	E3 axis clear encoder error	E3 axis driver clear encoder failed		

6.1.8 Conveyor Tracking Error(01-08-XX)

Error code	Error	Message	Reason	Solution
01-08-10	Camera connection failure	Connection with the vision system is failed.	1.IP setting error. 2.PORT setting error.	1.Check IP setting. 2.Check Port setting.
01-08-11	Camera connection abnormality		Vision system no response.	Confirm the connection with the vision system.
01-08-12	Camera disconnect fail			
01-08-13	Pick command error	Execution instruction is failed.	Point setting error.	If the tracking function of conveyor is triggered by Sensor, the position of point is required to enter into the instruction. Please confirm if the
01-08-14	Place command error			

				information of point position is entered into the instruction.
01-08-15	Conveyor encoder clear error	Encoder clear failed.	Encoder clear failed.	Check the conveyor wiring is correct
01-08-16	Setting latch source error	Setting latch source error	Setting latch failed	
01-08-17	Start conveyor command error	Start conveyor failed	Conveyor setting failed	Check conveyor setting is correct.

Error code	Error	Message	Reason	Solution
01-08-18	Read encoder count error	Read encoder error	Encoder fault	Check encoder and wiring.
01-08-19	Clear place data error	Data clearing failed	Place clearing failed	Contact an engineer from the original equipment manufacturer.
01-08-1A	CNV_OBJECT can't be setting	Unavailable to set parameters	Unavailable to set parameters	Check Robot Language.
01-08-1B	CNV_FULL can't be setting	Unavailable to set parameters		
01-08-1C	CNV_EMPTY can't be setting	Unavailable to set parameters		
01-08-1E	Encoder latch value inconsistent	Encoder latch value inconsistent	Trigger sensor or encoder error.	Check the trigger sensor and the encoder is

				normal.

6.1.9 User-Defined Error (01-09-XX)

Error code	Error	Message	Reason	Solution
01-09-10	User-defined error 1	User-defined error 1	User-defined error.	User-defined error 1
01-09-11	User-defined error 2	User-defined error 2		User-defined error 2
01-09-12	User-defined error 3	User-defined error 3		User-defined error 3
01-09-13	User-defined error 4	User-defined error 4		User-defined error 4
01-09-14	User-defined error 5	User-defined error 5		User-defined error 5
01-09-15	User-defined error 6	User-defined error 6		User-defined error 6
01-09-16	User-defined error 7	User-defined error 7		User-defined error 7
01-09-17	User-defined error 8	User-defined error 8		User-defined error 8

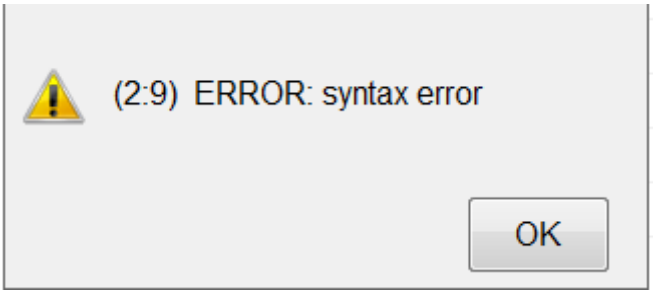
Error code	Error	Message	Reason	Solution
01-09-18	User-defined error 9	User-defined error 9	User-defined error.	User-defined error 9
01-09-19	User-defined error 10	User-defined error 10		User-defined error 10

6.1.10 Authorization Error(01-0B-XX)

Error code	Error	Message	Reason	Solution
01-0B-10	You have no license of HRSDK	You have no license of HRSDK	1. SDK is not enabled. 2. Function is not authorized.	1.With the original purchase authorization. 2. Check whether the authorized device is connected normally.
01-0B-11	You have no license of Fieldbus	You have no license of Fieldbus		
01-0B-12	You have no license of External Axis	You have no license of External Axis		
01-0B-13	You have no license of External TCP	You have no license of External TCP		
01-0B-14	You have no license of Continuous Turn	You have no license of Continuous Turn		

6.1.11 Windows Information

When the program is executed, if the program syntax is wrong, the following window will appear



The above figure as an example, the message is mainly two parts:

1. Error location: (2: 9), on behalf of 9th words on line 2 is wrong.
2. Error message: syntax error.

Error code	Error	Message	Reason	Solution
01-02-10	syntax error	Syntax error	Command spelling error. Wrong space.	Check spelling and spaces.
01-02-10	ID not exist	Variable not exist	Variable not declared.	Declare variable before use.
01-02-10	Unknown character	Character cannot be recognized	Use special symbols.	Change variable name.
01-02-10	… is not declared	Variable not declared	Variable not declared.	Declare variable before use.
01-02-10	Invalid value	Invalid value	Value out of range	Modify value according to instruction
01-02-10	Index of … is out of range	Index is out of range	Array index out of range	Modify array index
01-02-10	Type should be …	Type error	Type error.	Change to the correct type.
01-02-10	Fail in handling STRUC member expression	Structure member variable expression error	Struct member not declared.	Check the declaration of structure variables.

6.2 HIWIN Robot Controller(02-XX-XX)

6.2.1 Safety Input(02-01-XX)

Error code	Error	Message	Reason	Solution
02-01-10	Emergency input	Emergency stop signal disconnect	Emergency stop trigger.	Release the emergency stop and clear the error.
02-01-11	Enable switch down	Enable switch down	Enable switch is pressed to the third paragraph.	Release enable switch.

6.2.2 Hardware Error(02-02-XX)

Error code	Error	Message	Reason	Solution
02-02-11	No motor brake signal	Do not receive motor brake signal	1. Hardware abnormalities. 2. The emergency stop status is excluded within 500 milliseconds.	1. Contact with the engineer from the original equipment manufacturer. 2. Press emergency stop again, over 500 millisecond.

6.3 Axis Amplifier(03-XX-XX)

6.3.1 Function Name and Number Description

Function	No.	Description
Axis number(m)	0m	m: axis umber. ex 03-01-21：axis 1 alarm, 03-02-21：axis 2 alarm, and so on.
Ext axis number (n)	En	n: external axis number ex：03-E1-21-> external axis 1 alarm, 03-E2-21->external axis 2 alarm, and so on.

6.3.2 Driver Alert Number

Error code	Error	Message	Reason	Solution
03-0m(En)-21	overcurrent	Current exceeds the specified value	1. Driver is abnormal. 2. Motor U, V, W is short circuit. 3. Motor is broken.	1. Check the servomotor main circuit cable connection. 2. Replace the driver. 3. Replace the motor.
03-0m(En)-25	STO	Safety input protection.	Safety input signal.	Check the safety input signal status.

Error code	Error	Message	Reason	Solution
03-0m(En)-41	overload	Torque is too large.	1.The effective torque exceeds the rated torque. 2. The motor's hold brake is not released.	1. Change the motion plan, or reduce load. 2. Check that the wiring and the driver

			3. Power supply wiring is incorrect	voltage are correct.
03-0m(En)-43	regenerative resistor overload	Regenerative load rate is too large.	1. Insufficient external regenerative resistor capacity. 2. Amplifier is abnormal.	1. Replace the external regenerative resistor 2. Replace amplifier
03-0m(En)-45	overspeed	Exceeded average rotational speed	The servomotor speed is above the maximum rotational speed	Change operating conditions.
03-0m(En)-51	amplifier thermal abnormality	The amplifier temperature is too high.	1. Regenerative power is too large. 2. The surrounding air temperature is too high. 3. Built-in Fan in amplifier Stopped.	1. Change the amplifier installation conditions. 2. Check whether the cooling fan is running.

Error code	Error	Message	Reason	Solution
03-0m(En)-52	anti-surge resistor overheat	Surge resistor overheated.	1. Power switch frequency is too high. 2. Ambient temperature is too high.	1. Reduce the power switch frequency. 2-1. Check the cooling fan is running. 2-2. Change the amplifier installation conditions.
03-0m(En)-53	dynamic brake resistor overheat	Dynamic brake resistor overheated.	Dynamic brake action frequency is too high.	Used within the allowable operating frequency range
03-0m(En)-58	motor overheat	Motor overheated.	1. Motor overload.	1. Reduce the load weight.

			2. Motor speed too fast.	2. Reduce arm speed.
03-0m(En)-61	overvoltage	Main circuit DC voltage is excessively high.	1. The power supply is unstable. 2. The moment of inertia ratio exceeded the allowable value.	1. Measure the power supply voltage 2. Confirm that the moment of inertia ratio is within the allowable range.
03-0m(En)-62	undervoltage	Main circuit DC voltage is excessively low.	1. Input supply voltage is below the allowable range. 2. The power supply is unstable, or was influenced by a lightning surge.	Set AC power supply voltage within the specified range.

Error code	Error	Message	Reason	Solution
03-0m(En)-71	control power source voltage shortage	The voltage of the control power is too low.	1. Input supply voltage is below the allowable range. 2. The power supply is unstable, or was influenced by a lightning surge.	Set AC power supply voltage within the specified range.
03-0m(En)-72	control circuit voltage	The control circuit voltage is	1. Contact fault of connector or incorrect wiring	1. Re-insert the connector and confirm that the

	shortage	insufficient	for encoder cable. 2.The amplifier internal circuit is bad.	encoder is correctly wired. 2.Replace amplifier.
03-0m(En)-81	encoder disconnect	Encoder signal is disconnected.	1. Wrong connection. 2. Connector off. 3. Poor connection and connection.	1. Check the encoder cable. 2. Check the power supply voltage on the motor side.
03-0m(En)-84	encoder communication abnormality	Encoder Communications Error	1. Malfunction caused by noise interference. 2. Contact fault of connector or incorrect wiring for encoder cable.	1. Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the grounding and other wiring. 2. Check the encoder cable.

Error code	Error	Message	Reason	Solution
03-0m(En)-85	encoder initial error(5V abnormality)	Encoder initial error	1. Wrong connection. 2. Connector off. 3. Poor connection and connection.	1. Check the encoder cable. 2. Check the power supply voltage on the motor side.
03-0m(En)-87	encoder CS abnormality	Encoder CS signal disconnect.	1. Wrong connection. 2. Connector off. 3. Poor connection and	1. Check the encoder cable. 2. Check the power supply voltage on the motor side.

			connection.	
03-0m(En)-A1	encoder multiturn data error (battery abnormality)	Encoder Backup Error	1. The encoder cable disconnected, and connected again. 2. The battery voltage is low.	1. Check the encoder connector battery or the connect or contact status. 2. Measure the battery voltage.
03-0m(En)-A3	encoder overspeed	Servomotor speed is too high.	Motor acceleration exceeds allowable acceleration range.	Modify motion condition, increase acceleration/deceleration time
03-0m(En)-A5	encoder singleturn error	Detected encoder single turn error	1. Excessive noise to the encoder cable. 2. The amplifier internal circuit is bad.	1. Check noise in the cable between the SERVOPACK and the host controller. 2. Re-insert the connector and confirm that the encoder is correctly wired.
03-0m(En)-A6	encoder multiturn error	Detected encoder single turn error		

Error code	Error	Message	Reason	Solution
03-0m(En)-A9	encoder overheat	The amplifier temperature is too high.	1. The surrounding air temperature is too high. 2.Motor is overheated.	Change the way the motor is installed.
03-0m(En)-AB	encoder error	An encoder error was detected.	1. Excessive noise to the encoder cable. 2. The amplifier internal circuit is bad.	1. Check noise in the cable between 2. If the restart cannot be solved, please replace the motor.
03-0m(En)-C1	speed	The speed of	Overshoot too	1. Adjust the servo

	overlimit	the motor exceeds 120% of the maximum speed.	big.	parameters. 2. Slow command acceleration and deceleration mode.
03-0m(En)-D1	position error too big	Position deviation exceeded the set value	1. Load inertia is too large. 2. The brake is not released. 3. The position command frequency is too high.	1. Change the load conditions, or replace a larger capacity motor. 2. Check the encoder cable. 3. Change the controller's position command.

Error code	Error	Message	Reason	Solution
03-0m(En)-E1	EEPROM abnormality	EEPROM abnormality	The driver internal circuit is bad.	Replace the driver.
03-0m(En)-E2	EEPROM check is abnormality	EEPROM check is abnormality	The CPU cannot read the correct data from the drive's built-in EEPROM.	
03-0m(En)-EF	Motor not matching	The amplifier does not match the motor.	Use the wrong driver or motor.	Replace the correct driver or motor.
03-0m(En)-F3	amplifier error	amplifier error	amplifier error	According to the driver brand, compare the drive Error code.
03-0m(En)-F4	soft thermal reach limit	Motor reaches temperatur e limit.	Motor temperature is too high.	Reduce speed or reduce load.

03-0m(En)-F5	motor disconnect	Motor cannot connect.	Motor disconnect.	Check the motor cable.
03-0m(En)-F6	amplifier phase initial error	amplifier phase initial error	Phase initialization failed.	1. Replace motor or driver. 2. Check the cable.
03-0m(En)-F7	Hall sensor error	Hall sensor error.	Hall sensor error.	
03-0m(En)-F8	Hall phase error	Hall phase error.	Hall phase check error.	

Error code	Error	Message	Reason	Solution
03-0m(En)-F9	overload warning	* Overload warning. Robot will not stop	The effective torque exceeds the set torque.	Relax the conditions of use.
03-0m(En)-FA	amplifier overheating warning	*Amplifier overheated warning. Robot will not stop	The temperature around the amplifier is greater than the preset temperature range.	Reduce the ambient temperature.
03-0m(En)-FB	regenerated overload warning	*Regenerative overload warning. Robot will not stop	Regenerated resistance overload.	Relax the conditions of use.
03-0m(En)-FC	detecting power failure	* Detecting power failure. Robot will not stop.	Detected control power input voltage is insufficient.	1. Check if the input power supply has momentary or low voltage status. 2. Maybe the internal circuit of the amplifier is abnormal. If this alarm occurs for a

				long time, replace an amplifier.

Error code	Error	Message	Reason	Solution
03-0m(En)-FD	main circuit is abnormal	* Main voltage is abnormal.	Main power voltage exceeds DC 105V.	1. Check input mains voltage is within specifications. (Three-phase： AC200～230V+10，－15% ，50/60Hz± 3Hz) 2. The inertia of the load may be too large, reducing the load inertia. 3. For regenerative resistors, the wiring may not be correct or the impedance does not match the cause of the problem. Check that the impedance of the wiring or external resistor meets the specifications in this manual.
03-0m(En)-FE	battery insufficient	* The battery voltage is low.	Measure the battery voltage.	Replace the battery.
03-0m(En)-FF	battery empty	The battery voltage is low.		

6.3.3 DAC - Y Driver Alarm Code(Y-XXX)

Error code	Reason	Method	Solution
Y-020 Parameter Checksum Error 1 (The parameter data in the SERVOPACK is incorrect.)	The power supply voltage suddenly Dropped.	Measure the power supply voltage.	Set the power supply voltage within the specified range, and set Fn005 to initialize the parameter.
	The power supply went OFF while changing a parameter setting.	Check the circumstances when the power supply went OFF.	Set Fn005 to initialize the parameter and then set the parameter again.
	The number of times that parameters were written exceeded the limit.	Check to see if the parameters were frequently changed through the host controller.	The SERVOPACK may be faulty. Replace the SERVOPACK. Reconsider the method of writing parameters.
	Malfunction caused by noise from the AC power supply or grounding line, static electricity noise, etc.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the cause may be noise.	Take countermeasures against noise.
	Gas, water drops, or cutting oil entered the SERVOPACK and caused failure of the internal components.	Check the installation conditions.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	A SERVOPACK fault occurred.	Turn the power supply to the SERVOPACK OFF	The SERVOPACK may be faulty. Replace the SERVOPACK.

		and ON again. If the alarm still occurs, the SERVOPACK may be faulty.	
Y-021 Parameter Format Error 1 (The parameter data in the SERVOPACK is incorrect.)	The software version of SERVOPACK that caused the alarm is older than that of the written parameter.	Check Fn012 to see if the set software version agrees with that of the SERVOPACK. If not, an alarm may occur.	Write the parameter of another SERVOPACK of the same model with the same software version. Then turn the power OFF and then ON again.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-022 System Checksum Error 1 (The parameter data in the SERVOPACK is incorrect.)	The power supply voltage suddenly Dropped.	Measure the power supply voltage.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	The power supply went OFF while setting an utility function.	Check the circumstances when the power supply went OFF.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	A SERVOPACK fault occurred.	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty.	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-030 Main Circuit Detector Error	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-040 Parameter Setting Error 1 (The parameter setting was out of the setting range.)	The SERVOPACK and servomotor capacities do not match each other.	Check the combination of SERVOPACK and servomotor capacities.	Select the proper combination of SERVOPACK and servomotor capacities.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
	The parameter setting is out of the setting range.	Check the setting ranges of the parameters that have been changed.	Set the parameter to a value within the setting range.
	The electronic	Check the	Set the electronic gear ratio in

	gear ratio is out of the setting range.	electronic gear ratio. The ratio must satisfy: 0.001< (Pn20E/Pn210) < 4000.	the range: 0.001< (Pn20E/Pn210) < 4000.
Y-041 Encoder Output Pulse Setting Error	The encoder output pulse (Pn212) is out of the setting range and does not satisfy the setting conditions.	Check the parameter Pn212.	Set Pn212 to a correct value.

Error code	Reason	Method	Solution
Y-042 Parameter Combination Error	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the electronic gear ratio (Pn20E/Pn210) or the servomotor.	Check if the detection conditions are satisfied.*1	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).
	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the setting of the program JOG movement speed (Pn533).	Check if the detection conditions are satisfied.*1	Increase the setting of the program JOG movement speed (Pn533).
	The moving speed of advanced autotuning is lower than the setting range after having changed the electronic gear ratio (Pn20E/ Pn210) or the servomotor.	Check if the detection conditions are satisfied.*2	Decrease the setting of the electronic gear ratio (Pn20E/Pn210).
Y-044 Semi-closed/Fully closed Loop	The setting of the fully-closed module does not match with that of Pn002.3.	Check the settings of Pn002.3.	The setting of fully-closed module must be compatible with the setting of Pn002.3.

Control Parameter Setting Error			

∗1. Detection conditions

If one of the following conditions detected, an alarm occurs

- $\text{Pn533 [min}^{-1}\text{]} \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$
- $\text{Max Motor Speed [min}^{-1}\text{]} \times \frac{\text{Encoder resolution}}{\text{About } 3.66 \times 10^{12}} \geq \frac{\text{Pn20E}}{\text{Pn210}}$

∗2. Detection conditions

If one of the following conditions detected, an alarm occurs.

- $\text{Rated Motor Speed [min}^{-1}\text{]} \times 1/3 \times \frac{\text{Encoder resolution}}{6 \times 10^5} \leq \frac{\text{Pn20E}}{\text{Pn210}}$
- $\text{Max Motor Speed [min}^{-1}\text{]} \times \frac{\text{Encoder resolution}}{\text{About } 3.66 \times 10^{12}} \geq \frac{\text{Pn20E}}{\text{Pn210}}$

Error code	Reason	Method	Solution
Y-050 Combination Error (The SERVOPACK and servomotor capacities do not correspond.)	The SERVOPACK and servomotor capacities do not match each other.	Check the capacities to see if they satisfy the following condition: $\frac{1}{4} \leq \frac{\text{Servomotor capacity}}{\text{SERVOPACK capacity}} \leq 4$	Select the proper combination of SERVOPACK and servomotor capacities.
	An encoder fault occurred.	Replace the servomotor and see if the alarm occurs again.	Replace the servomotor (encoder).
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-051 Unsupported Device Alarm	An unsupported serial converter unit, encoder, or external encoder is connected to the SERVOPACK.	Check the product specifications, and select the correct model.	Select the correct combination of units.
Y-0B0 Canceled Servo ON Command Alarm	After executing the utility function to turn ON the power to the motor, the servo ON command was input from the host controller.	-	Turn the SERVOPACK power supply OFF and then ON again or execute a software reset.

Error code	Reason	Method	Solution
Y-100 Overcurrent or Heat Sink Overheated (An overcurrent flowed through the IGBT or heat sink of SERVOPACK overheated.)	Incorrect wiring or contact fault of main circuit cables.	Check the wiring.	Correct the wiring.
	Short-circuit or ground fault of main circuit cables.	Check for short-circuits across the servomotor terminal phases U, V, and W, or between the grounding and servomotor terminal phases U, V, or W.	The cable may be short-circuited. Replace the cable.
	Short-circuit or ground fault inside the servomotor.	Check for short-circuits across the servomotor terminal phases U, V, and W, or between the grounding and servomotor terminal phases U, V, or W.	The servomotor may be faulty. Replace the servomotor.
	Short-circuit or ground fault inside the SERVOPACK.	Check for short-circuits across the servomotor connection terminals U, V, and W on the SERVOPACK, or between the grounding and terminal U, V, or W.	The SERVOPACK may be faulty. Replace the SERVOPACK.
	Incorrect wiring or contact fault of the regenerative resistor.	Check the wiring.	Correct the wiring.
	The dynamic	Check the power	Change the SERVOPACK

	brake (DB: Emergency stop executed from the SERVOPACK) was frequently activated, or the DB overload alarm occurred.	consumed by DB resistance (Un00B) to see how many times the DB has been used.	model, operating conditions, or the mechanism so that the DB does not need to be used so frequently.
	The generated regenerative resistor value exceeded the SERVOPACK Regenerative energy processing capacity.	Check the regenerative load ratio (Un00A) to see how many times the regenerative resistor has been used.	Check the operating condition including overload, and reconsider the regenerative resistor value.
	The SERVOPACK regenerative resistance is too small.	Check the regenerative load ratio (Un00A) to see how many times the regenerative resistor has been used.	Change the regenerative resistance value to a value larger than the SERVOPACK minimum allowable resistance value.

Error code	Reason	Method	Solution
Y-100 Overcurrent or Heat Sink Overheated (An overcurrent flowed through the IGBT or heat sink of SERVOPACK overheated.)	A heavy load was applied while the servomotor was stopped or running at a low speed.	Check to see if the operating conditions are outside servo drive specifications.	Reduce the load applied to the servomotor or increase the operating speed.
	Malfunction caused by noise interference.	Improve the wiring or installation environment, such as by reducing noise, and check to see if the alarm recurs.	Take countermeasures for noise.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-300 Regeneration Error	The regenerative resistor capacity (Pn600) is set to a value other than 0 for a SGDV-R70F, -R90F, -2R1F, -R70A, -R90A, -1R6A, or -2R8A SERVOPACK, and an external regenerative resistor is not connected.	Check the external regenerative resistor connection and the value of the Pn600.	Connect the external regenerative resistor, or set Pn600 to 0 if no regenerative resistor is required
	The jumper between the power supply terminals B2 and B3 has been removed for	Confirm that a jumper is mounted between the power supply terminals B2 and B3.	Correctly mount a jumper

	one of these SERVOPACKs: SGDV-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D.		
	The external regenerative resistor is incorrectly wired, or is removed or disconnected.	Check the external regenerative resistor connection.	Correctly connect the external regenerative resistor.

Error code	Reason	Method	Solution
Y-300 Regeneration Error	A SERVOPACK fault occurred.	-	Turn the SERVOPACK's control power supply OFF and ON again while the main circuit power supply is OFF. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-320 Regenerative Overload	The power supply voltage exceeds the specified limit.	Measure the power supply voltage.	Set the power supply voltage within the specified range
	Insufficient external regenerative resistance, regenerative resistor capacity, or SERVOPACK capacity. Or, regenerative power has been continuously flowing back.	Check the operating condition	Change the regenerative resistance, regenerative resistor capacity, or SERVOPACK capacity.
	Regenerative power continuously flowed back because negative load was continuously applied.	Check the load applied to the servomotor during operation.	Reconsider the system including servo, machine, and operating conditions.
	The setting of parameter Pn600 is smaller than the	Check the external regenerative resistor	Set the Pn600 to a correct value.

	external regenerative resistor's capacity.	connection and the value of the Pn600.	
	The external regenerative resistance is too high.	Check the regenerative resistance.	Change the regenerative resistance to a correct value or use an external regenerative resistor of appropriate capacity.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-330 Main Circuit Power Supply Wiring Error (Detected when the main circuit power supply is turned ON.)	The regenerative resistor disconnected when the SERVOPACK power supply voltage was high.	Measure the resistance of the regenerative resistor using a measuring instrument.	When using a regenerative resistor built in the SERVOPACK: Replace the SERVOPACK. When using an external regenerative resistor: Replace the external regenerative resistor.
	In the AC power input mode, DC power was supplied.	Check the power supply to see if it is a DC power supply.	Correct the settings to match the actual power supply specifications.
	In the DC power input mode, AC power was supplied.	Check the power supply to see if it is an AC power supply.	Correct the settings to match the actual power supply specifications.

Error code	Reason	Method	Solution
Y-330 Main Circuit Power Supply Wiring Error (Detected when the main circuit power supply is turned ON.)	The regenerative resistor capacity (Pn600) is set to a value other than 0 for a SGDV-R70F, -R90F, -2R1F, -R70A, -R90A, -1R6A, or -2R8A SERVOPACK, and an external regenerative resistor is not connected.	Check the external regenerative resistor connection and the value of the Pn600.	Connect the external regenerative resistor, or set Pn600 to 0 if no external regenerative resistor is required.
	The jumper between the power supply terminals B2 and B3 has been removed for one of these SERVOPACKs: SGDV-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -1R9D, -3R5D, -5R4D, -8R4D, -120D, and -170D.	Confirm that a jumper is mounted between the power supply terminals B2 and B3.	Correctly mount a jumper.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-400 Overvoltage (Detected in the SERVOPACK main circuit power supply section.)	• For 100-VAC SERVOPACKs: The AC power supply voltage exceeded 145 V. • For 200-VAC SERVOPACKs: The AC power supply voltage exceeded 290 V. • For 400-VAC SERVOPACKs: The AC power supply voltage exceeded 580 V. • For 200-VAC SERVOPACKs: with DC power supply input: The DC power supply voltage exceeded 410 V. • For 400-VAC SERVOPACKs: The DC power supply voltage exceeded 820 V.	Measure the power supply voltage.	Set AC/DC power supply voltage within the specified range.
	The power supply is unstable, or was influenced by a lightning surge.	Measure the power supply voltage	Improve the power supply conditions, e.g., by installing a surge absorber. Then, turn the SERVOPACK power supply OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
	Voltage for AC power	Check the	Set AC power supply

	supply was too high during acceleration or deceleration.	power supply voltage and the speed and torque during operation.	voltage within the specified range.
	The external regenerative resistance is too high for the actual operating conditions	Check the operating conditions and the regenerative resistance.	Select a regenerative resistance value appropriate for the operating conditions and load.

Error code	Reason	Method	Solution
Y-400 Overvoltage (Detected in the SERVOPACK main circuit power supply section.)	The moment of inertia ratio exceeded the allowable value.	Confirm that the moment of inertia ratio is within the allowable range.	Increase the deceleration time, or reduce the load.
	A SERVOPACK fault occurred.	-	Turn the SERVOPACK's control power supply OFF and ON again while the main circuit power supply is OFF. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-410 Undervoltage (Detected in the SERVOPACK main circuit power supply section.)	• For 100-VAC SERVOPACKs: The AC power supply voltage is 49 V or less. • For 200-VAC SERVOPACKs: The AC power supply voltage is 120 V or less. • For 400-VAC SERVOPACKs: The AC power supply voltage is 240 V or less.	Measure the power supply voltage.	Set the power supply voltage within the specified range.
	The power supply voltage dropped during operation.	Measure the power supply voltage.	Increase the power supply capacity

	Occurrence of instantaneous power interruption.	Measure the power supply voltage.	When the instantaneous power cut hold time (Pn509) is set, decrease the setting.
	The SERVOPACK fuse is blown out.	-	Replace the SERVOPACK, connect a reactor, and run the SERVOPACK.
	A SERVOPACK fault occurred	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-450 Main-Circuit Capacitor Overvoltage	A SERVOPACK fault occurred	-	Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-510 Overspeed (The servomotor speed exceeds the maximum.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the motor wiring.	Confirm that the servomotor is correctly wired.
	A reference value exceeding the overspeed detection level was input.	Check the input value.	Reduce the reference value or adjust the gain.
	The motor speed exceeded the maximum.	Check the motor speed waveform.	Reduce the speed reference input gain, adjust the servo gain, or reconsider the operating conditions.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-511 Overspeed of Encoder Output Pulse Rate	The encoder output pulse frequency exceeded the limit.	Check the encoder output pulse setting.	Decrease the setting of the encoder output pulse (Pn212).
	The encoder output pulse output frequency exceeded the limit because the motor speed was too high.	Check the encoder output pulse output setting and motor speed.	Decrease the motor speed
Y-520 Vibration Alarm	Abnormal vibration was detected at the motor speed.	Check for abnormal noise from the servomotor, and	Reduce the motor speed or reduce the speed loop gain (Pn100).

		check the speed and torque waveforms during operation.	
	The moment of inertia ratio (Pn103) value is greater than the actual value or is greatly changed.	Check the moment of inertia ratio.	Set the moment of inertia ratio (Pn103) to an appropriate value.
Y-521 Autotuning Alarm (Vibration was detected while executing the oneparameter tuning, EasyFFT, or tuning-less function.)	The servomotor vibrated considerably while performing tuningless function.	Check the motor speed waveform.	Reduce the load so that the moment of inertia ratio falls within the allowable value, or raise the load level using the tuning-less levels setting (Fn200) or reduce the rigidity level.
	The servomotor vibrated considerably during one-parameter tuning or EasyFFT.	Check the motor speed waveform.	Check the operation procedure of corresponding function and take a corrective action.

Error code	Reason	Method	Solution
Y-710 Overload (High Load) Y-720 Overload (Low Load)	Incorrect wiring or contact fault of servomotor and encoder.	Check the wiring.	Confirm that the servomotor and encoder are correctly wired.
	Operation beyond the overload protection characteristics.	Check the servomotor overload characteristics and executed run command.	Reconsider the load conditions and operating conditions. Or, increase the motor capacity
	Excessive load was applied during operation because the servomotor was not driven due to mechanical problems.	Check the executed operation reference and motor speed.	Remove the mechanical problems.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-730 Y-731 Dynamic Brake Overload (An excessive power consumption of dynamic brake was detected.)	The servomotor rotates because of external force.	Check the operation status.	Take measures to ensure the servomotor will not rotate because of external force.
	The rotating energy at a DB stop exceeds the DB resistance capacity.	Check the power consumed by DB resistance (Un00B) to see how many times the DB has been used.	Reconsider the following: • Reduce the motor reference speed. • Reduce the moment of inertia ratio. • Reduce the number of times of the DB stop operation.
	A SERVOPACK fault occurred	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-740 Overload of Surge	The inrush current limit resistor operation	-	Reduce the frequency of turning the main circuit power supply ON/OFF.

Current Limit Resistor (The main circuit power is turned ON/OFF too frequently.)	frequency at the main circuit power supply ON/OFF operation exceeds the allowable range.		
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-7A0 Heat Sink Overheated (Detected when the heat sink temperature exceeds 100°C.)	The surrounding air temperature is too high.	Check the surrounding air temperature using a thermostat.	Decrease the surrounding air temperature by improving the SERVOPACK installation conditions.
	The overload alarm has been reset by turning OFF the power too many times.	Check the alarm history display (Fn000) to see if the overload alarm was reported.	Change the method for resetting the alarm.
	Excessive load or operation beyond the regenerative energy processing capacity	Check the accumulated load ratio (Un009) to see the load during operation, and the regenerative load ratio (Un00A) to see the regenerative energy processing capacity.	Reconsider the load and operating conditions.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-7AB Built-in Fan in SERVOPACK Stopped	The fan inside the SERVOPACK stopped.	Check for foreign matter or debris inside the SERVOPACK.	Remove foreign matter or debris from the SERVOPACK. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-810 Encoder Backup Error (Only when an absolute encoder is connected.)	Alarm occurred when the power to the absolute encoder was initially turned ON.	Check to see if the power was turned ON initially.	Set up the encoder (Fn008).
	The encoder	Check to see if	Confirm the connection and set

(Detected on the encoder side.)	cable disconnected, and connected again.	the power was turned ON initially.	up the encoder (Fn008).
	The power from both the control power supply (+5 V) from the SERVOPACK and the battery power supply is not being supplied.	Check the encoder connector battery or the connector contact status.	Replace the battery or take similar measures to supply power to the encoder, and set up the encoder (Fn008).
	An absolute encoder fault occurred.	-	If the alarm cannot be reset by setting up the encoder again, replace the servomotor.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-820 Encoder Checksum Error (Detected on the encoder side.)	An encoder fault occurred.	-	• Absolute encoder Set up the encoder again using Fn008. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor. • Single-turn absolute encoder or incremental encoder The servomotor may be faulty. Replace the servomotor
	A SERVOPACK fault occurred	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-830 Absolute Encoder Battery Error (The absolute encoder battery voltage is lower than the specified value.)	The battery connection is incorrect.	Check the battery connection.	Reconnect the battery.
	The battery voltage is lower than the specified value 2.7 V.	Measure the battery voltage.	Replace the battery.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
Y-840 Encoder Data Error (Detected on the encoder side.)	An encoder malfunctioned.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	Malfunction of encoder because of noise interference, etc.	-	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the grounding and other wiring.
Y-850	The servomotor	Check the motor	Reduce the servomotor speed to

Encoder Overspeed (Detected when the control power supply was turned ON.) (Detected on the encoder side.)	speed is higher than 200min^{-1} when the control power supply was turned ON.	rotating speed (Un000) to confirm the servomotor speed when the power is turned ON.	a value less than 200 min-1, and turn ON the control power supply
	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-860 Encoder Overheated (Only when an absolute encoder is connected.) (Detected on the encoder side.)	The ambient operating temperature around the servomotor is too high.	Measure the ambient operating temperature around the servomotor.	Reduce the ambient operating temperature of the servomotor to 40°C or less.
	The motor load is greater than the rated load.	Check the accumulated load ratio (Un009) to see the load.	Operate the SERVOPACK so that the motor load remains within the specified range.
	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor
	A SERVOPACK fault occurred	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-B10 Speed reference A/D error (Detected when Servo is ON)	Speed reference input malfunctioned.	-	Operate when alarm is reset.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-B11 Speed reference A/D converter data error	Speed reference input malfunctioned.	-	Operate when alarm is reset.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Y-B20 Torque reference A/D error (Detected when Servo is ON)	Torque reference input malfunctioned	-	Operate when alarm is reset.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-B31 Current Detection Error 1	The current detection circuit for phase U is faulty	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-B32 Current Detection Error 2	The current detection circuit for phase V is faulty	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-B33 Current Detection Error 3	The detection circuit for the current is faulty.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
	The servomotor main circuit cable is disconnected.	Check for disconnection of the servomotor main circuit cable	Correct the servomotor wiring.
Y-BF0 System Alarm 0	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-BF1 System Alarm 1	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-BF2 System Alarm 2	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-BF3 System Alarm 3	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-BF4 System Alarm 4	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Y-C10 Servo Overrun Detected (Detected when the servomotor power is ON.)	The order of phases U, V, and W in the servomotor wiring is incorrect.	Check the motor wiring.	Confirm that the servomotor is correctly wired.
	An encoder fault occurred.	-	If the alarm still occurs after turning the power OFF and then ON again, even though the servomotor is correctly wired, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-C80 Absolute Encoder Clear Error and Multi-turn Limit Setting Error	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-C90 Encoder Communications Error	Contact fault of connector or incorrect wiring for encoder cable.	Check the connector contact status for encoder cable.	Re-insert the connector and confirm that the encoder is correctly wired.
	Cable disconnection for encoder cable or short-circuit. Or, incorrect cable impedance.	Check the encoder cable.	Use the cable with the specified rating.
	Corrosion caused by improper temperature, humidity, or gas, short-circuit caused by intrusion of water drops or cutting oil, or connector contact fault caused by vibration.	Check the operating environment.	Improve the operating environmental conditions, and replace the cable. If the alarm still occurs, replace the SERVOPACK.
	Malfunction caused by noise interference.	-	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the

			grounding and other wiring.
	A SERVOPACK fault occurred.	-	Connect the servomotor to another SERVOPACK, and turn ON the control power. If no alarm occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-C91 Encoder Communications Position Data Error	Noise interference occurred on the I/O signal line because the encoder cable is bent and the sheath is damaged.	Check the encoder cable and connector.	Confirm that there is no problem with the cable layout.
	The encoder cable is bundled with a high-current line or near a high-current line.	Check the cable layout for encoder cable.	Confirm that there is no surge voltage on the cable.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder.	Check the cable layout for encoder cable.	Properly ground the machines to separate from the encoder FG.
Y-C92 Encoder Communications Timer Error	Noise interference occurred on the I/O signal line from the encoder.	-	Take countermeasures against noise for the encoder wiring.
	Excessive vibration and shocks were applied to the encoder	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor
	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Y-CA0 Encoder Parameter Error	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-CB0 Encoder Echoback Error	The wiring and contact for encoder cable are incorrect.	Check the wiring.	Correct the wiring.
	Noise interference occurred due to incorrect cable specifications of encoder cable.	-	Use tinned annealed copper shielded twisted-pair or screened unshielded twisted-pair cable with a core of at least 0.12mm^2.
	Noise interference occurred because the wiring distance for the encoder cable is too long.	-	The wiring distance must be 50 m max.
	The FG potential varies because of influence from machines on the servomotor side, such as the welder	Check the cable layout for encoder cable.	Properly ground the machines to separate from encoder FG.
	Excessive vibration and shocks were applied to the encoder	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.
	An encoder fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-CC0 Multiturn Limit	The multi-turn limit value of DD motor (Pn205) is different	Check Pn205	Set the Pn205 to proper value (0~65535)

Disagreement	from that of multi-turn limit value of the encoder.		
	The multi-turn limit value of the encoder is different from that of the SERVOPACK. Or, the multi-turn limit value of the SERVOPACK has been changed.	Check the value of the Pn205 of the SERVOPACK.	Execute Fn013 at the occurrence of alarm.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Error code	Reason	Method	Solution
Y-D00 Position Error Overflow (Position error exceeded the value set in the excessive position error alarm level (Pn520).)	The servomotor U, V, and W wirings is faulty.	Check the servomotor main circuit cable connection.	Confirm that there is no contact fault in the motor wiring or encoder wiring.
	The position reference speed is too high.	Reduce the reference speed, and operate the SERVOPACK.	Reduce the position reference speed or acceleration of position reference. Or, reconsider the electronic gear ratio.
	The acceleration of the position reference is too high.	Reduce the reference acceleration, and operate the SERVOPACK.	Reduce the acceleration rate of the position reference.
	Setting of the excessive position error alarm level (Pn520) is low against the operating condition.	Check the alarm level (Pn520) to see if it is set to an appropriate value.	Set the Pn520 to proper value.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
Y-D01 Position Error Overflow Alarm at Servo ON	This alarm occurs if the servomotor power is turned ON when the position error is greater than the set value of Pn526 while the servomotor power is OFF.	Check the position error amount (Un008) while the servomotor power is OFF.	Correct the excessive position error alarm level at servo ON (Pn526).

Error code	Reason	Method	Solution
Y-D02 Position Error Overflow Alarm by Speed Limit at Servo ON	When the position errors remain in the error counter, Pn529 limits the speed if the servomotor power is ON. If Pn529 limits the speed in such a state, this alarm occurs when position references are input and the number of position errors exceeds the value set for the excessive position error alarm level (Pn520).	-	Correct the excessive position error alarm level (Pn520). Or, adjust the speed limit level at servo ON (Pn529).
Y-F10 Main Circuit Cable Open Phase (A low voltage continued for one second or longer in either phase R, S, or T when the main circuit power supply was ON.) (Detected when the main circuit power supply is turned ON.)	The three-phase power supply wiring is incorrect.	Check the power supply wiring.	Confirm that the power supply is correctly wired.
	The three-phase power supply is unbalanced.	Measure the voltage at each phase of the three-phase power supply.	Balance the power supply by changing phases.
	A single-phase power is input without setting Pn00B.2 (power supply method for three-phase SERVOPACK) to 1 (single-phase power supply).	Check the power supply and the parameter setting.	Match the parameter setting to the power supply.
	A SERVOPACK fault occurred.	-	Turn the power supply to the SERVOPACK OFF and

			ON again. If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.

Reference: YASKAWA AC Servo Drives USER'S MANUAL Design and Maintenance

6.3.4 DAC - S Driver Alarm Code(S-XXXX)

Error code	Error	Reason	Solution
S-3110	Power Over voltage	Excessive AC-voltage in main circuit	Confirm that the power supply is set within the specified range. Install the external regenerative resistance.
S-3130	Main Power Supply Fail Phase	1 phase of the 3 phase main circuit power supply disconnected	Check the wiring and repair if necessary. Replace the servo amplifier.
S-3211	Over-voltage	DC Excess voltage of main circuit	Replace the servo amplifier. Reduce the power supply voltage to within the specified range. Reduce the load inertia to within the specified range.
S-3212	Regenerative Overload	Regeneration load ratio exorbitance	Check the load and operating conditions.
S-3220	Main Circuit Under-voltage	DC Main circuit low voltage	Check the power supply and set it within the specified range. Replace the servo amplifier.
S-4110	Servo Amplifier Temperature Error	Overheating detection of amplifier ambient temperature	Replace the servo amplifier. Check if the temperature inside the control board (servo amplifier ambient temperature) exceeds 55°C.
S-4210	RS Overheat	Detection of in-rush prevention resistance overheating	Replace the servo amplifier. Check if the temperature inside the control board (servo amplifier ambient temperature) exceeds 55°C.
S-5113	Control Power Supply Under-	Under voltage of ±5V of control	Replace the servo amplifier. Restart the power supply after

	voltage 2	switching power supply	removing the connector; if alarm is not issued, check the external circuit.
S-5114	Control Power Supply Under-voltage	Control power supply low voltage or instantaneous stoppage occurred	Replace the servo amplifier. Confirm that the power supply is set within the specified range.

Error code	Error	Reason	Solution
S-5115	Control Power Supply Under-voltage 1	Under voltage of ±12V of control switching power supply	Replace the servo amplifier. Restart the power supply after removing the connector; if alarm is not issued, check the external circuit.
S-5210	Current Detection Error	Servo amplifier or motor abnormality	Replace servo amplifier or motor
S-5220	System Code Error	Control board code and encoder setting mismatch	Replace servo amplifier
S-5400	Main Circuit Power Device Error	* Over current of drive module * Abnormality in drive power supply * Overheating of drive module	Check the wiring conditions and restore if improper. Replace servo amplifier or motor. Confirm that the temperature of the control panel (ambient temperature of the servo amplifier) does not exceed 55°C.
S-5510	Memory Error	Access error in CPU built in RAM	Replace servo amplifier.
S-5530	EEPROM Error	Abnormality of amplifier with built-in EEPROM	Replace servo amplifier.
S-6010	Initial Process Time-Out	Initial process does not end within initial process time	Replace servo amplifier. Confirm proper grounding of the servo amplifier.
S-6310	EEPROM Check Sum Error	Access error in CPU built in RAM EPROM	Replace servo amplifier.
S-6320	System Parameter	System parameter	Replace servo

		abnormality	amplifier.
S-7120	Motor Temperature error	AC spindle motor overheat detected	Replace motor. Correct the wiring if any short-circuit. Check the load and operating conditions.
S-7122	Velocity Feedback Error	AC spindle motor power disconnection	Confirm that the power line is properly connected. Replace servo amplifier or motor.

Error code	Error	Reason	Solution
S-7300	Encoder Initial Process Error	Cable break	Check wiring and replace if necessary. Confirm that the encoder power supply voltage of the motor is above 4.75 V; increase it if below 4.75 V. Replace servo amplifier or motor.
S-7305	Encoder Connector 1 Disconnection	Power supply cable break	Check wiring and replace if necessary. Confirm that the encoder power supply voltage of the motor is above 4.75 V; increase it if below 4.75 V. Replace motor.
S-7510	Communication error	Communication abnormality	Check if there is contact failure in the communication cable wiring system. Replace servo amplifier.
S-7520	IN or OUT Lost link	Communication cable disconnected	Check the wiring of motor encoder and servo amplifier, and correct the wiring if needed.
S-8311	Overload	Failure of safe torque off circuit	Check the operating conditions and limit switch.
S-8312	Safe Torque (force) Off Error	Timing error of safe torque (force) off input	Check wiring of emergency button.
S-8400	Average continuous over speed	Over speed in average rotational speed	Review the operating conditions.
S-8500	Position Command Error	Position command input exceeded processing	Lower command input travel distance.

		range	
S-8611	Excessive Position Deviation	Position Deviation exceeds setup value.	Check wiring and replace if necessary. Check the power supply voltage. Replace servo amplifier or motor.
S-8700	Task Process Error	Error in interruption process of CPU	Replace servo amplifier.

Reference: SANMOTION-R-AD-EtherCAT-typeH Instruction Manual

6.4 Electric gripper(04-XX-XX)

6.4.1 Hardware Error (04-01-XX)

Error code	Error	Reason	Solution
04-01-10	Electric Gripper connect fail	EG connection fail, no data response.	Check the power supply is normal or serial port is set correctly.
04-01-11	Electric Gripper data return error	EG data return error.	Check USB port.
04-01-12	Electric Gripper power line error	Power line abnormality	Check the power line is normal and connected.
04-01-13	Electric Gripper connect error	EG connection fail, no data response.	Check connection state.
04-01-14	Serial port initial fail	Circuit abnormality	Reconnection or check the USB line is normal.
04-01-15	Serial port close	Serial port of connect EG is closed	Reconnection.
04-01-16	Serial port close error	Serial port of EG connection not closed	Close this serial port.

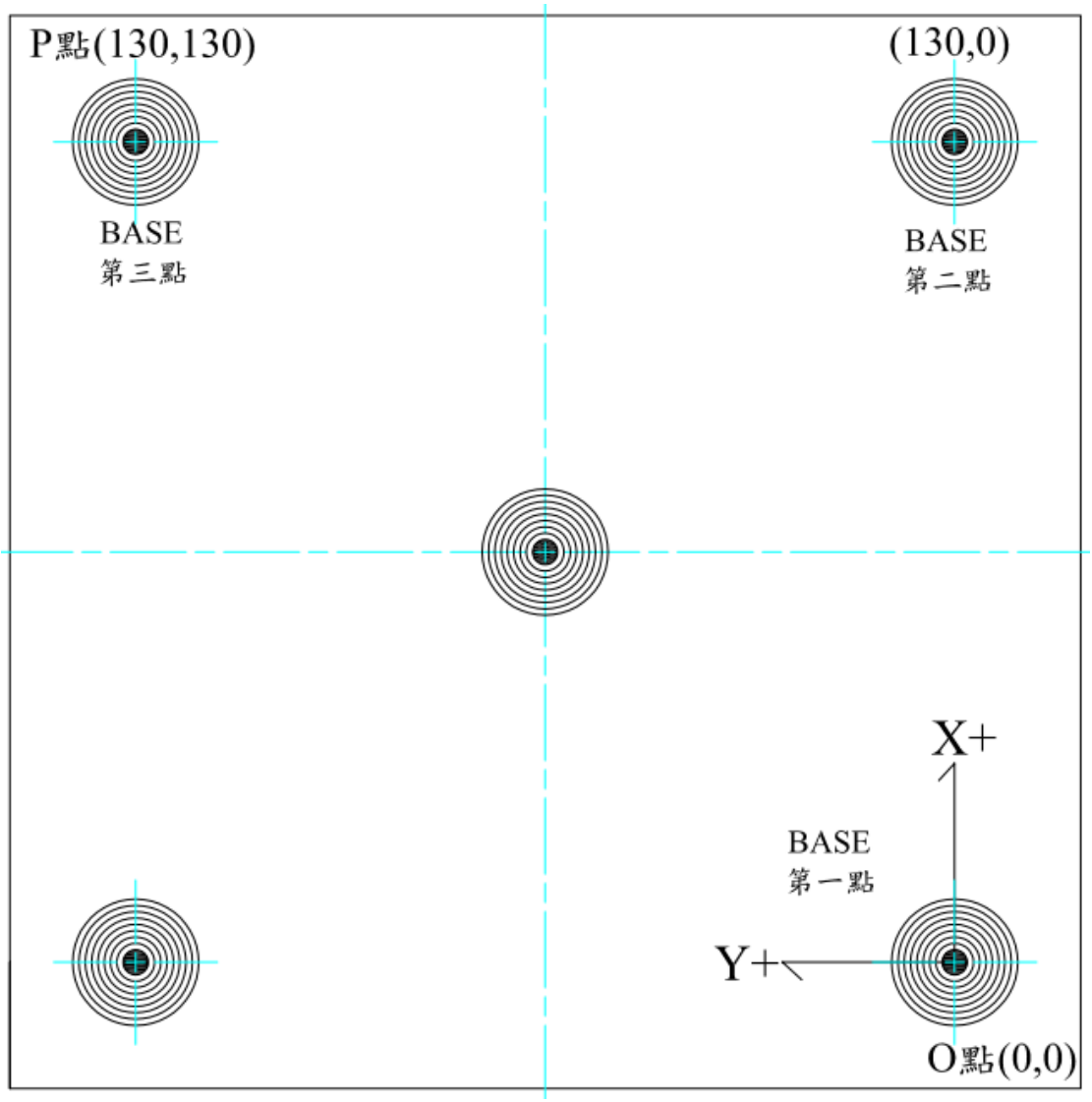
6.4.2 Operation Error (04-02-XX)

Error code	Error	Reason	Solution
04-02-10	Electric Gripper position error	EG type setting abnormality	Check that the EG type setting is correct.
04-02-11	Electric Gripper over stroke	EG position setting over stroke	Check that the EG movement position is entered correctly.

Error code	Error	Reason	Solution
04-02-12	Electric Gripper position setting less than zero	EG position setting less than zero	Check that the EG movement position is entered correctly.
04-02-13	Electric Gripper velocity setting over default range	EG velocity setting over default range	Check that the EG movement velocity is entered correctly.
04-02-14	Electric Gripper velocity setting less than default range	EG velocity setting less than default range	
04-02-15	Electric Gripper position direction setting error	EG position direction setting abnormality	Check that the EG movement position is entered correctly.
04-02-16	Grip displacement setting error	Grip displacement setting over range	Check that the EG grip displacement is entered correctly.
04-02-17		Grip displacement setting less than range	
04-02-18	Grip velocity setting error	Grip velocity setting over default range	Check that the EG grip velocity is entered correctly.
04-02-19		Grip velocity setting less than default range	
04-02-1A	Grip force setting error	Grip force setting over default range	Check that the EG grip force is entered correctly.
04-02-1B		Grip force setting over less than range	

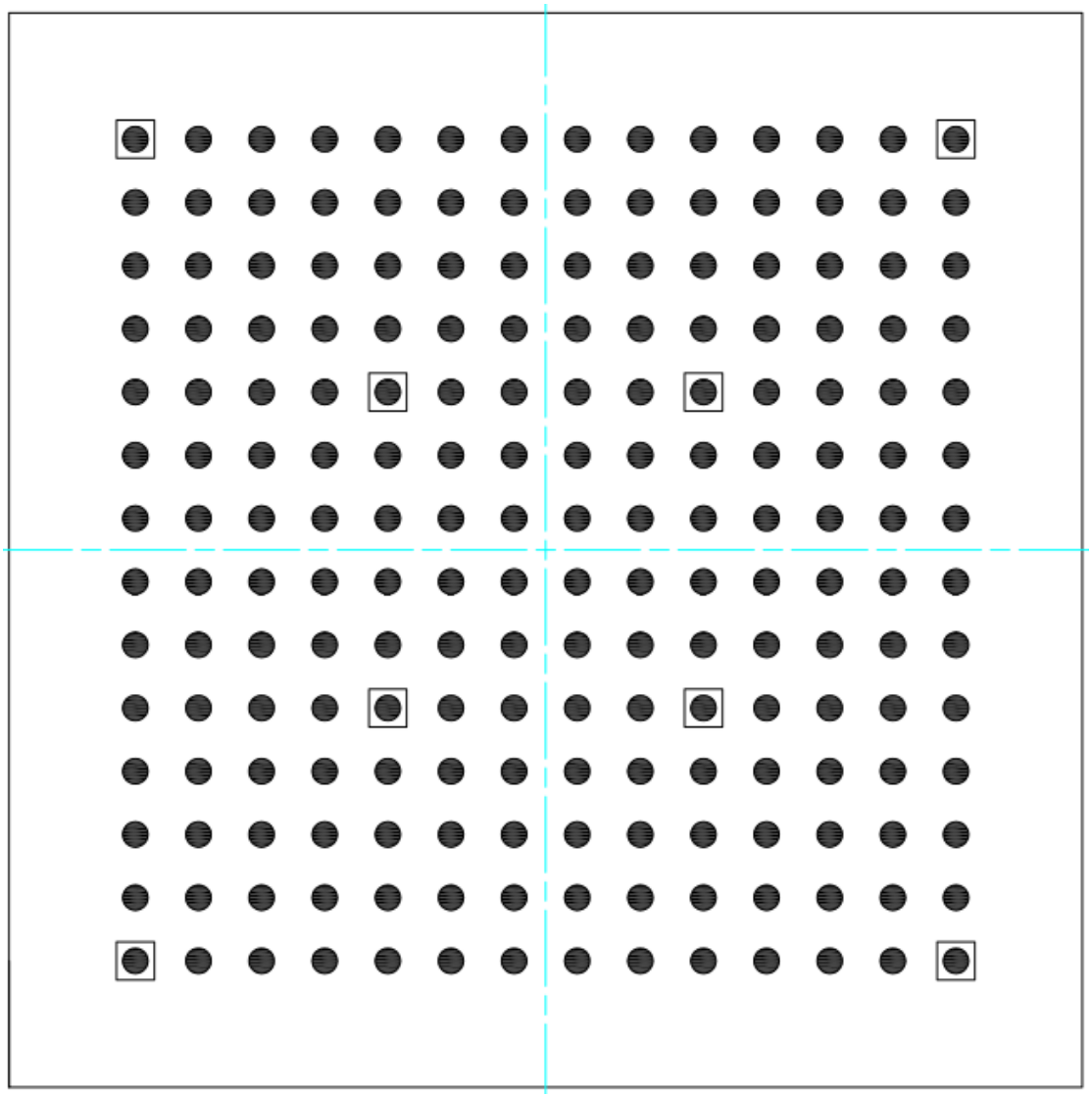
7. Appendix

Attachment 1 – Calibration plate 1



Remark:
Please use this conveyer belt tracking system operation manual for this calibration tool.

Attachment 2 – Calibration plate 2



Remark:

Each point spacing is 10 mm.

Conveyor Tracking System (Original Instruction) User Manual

Publication Date：November 2018, first edition

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