ES-Gripper Setup Manual in URCap Software

（Installation instructions for Universal Robot e Series）

2022/Jan.28

About this manual

This manual contains information on the "URCap" software. The software is used to easily integrate and control the following products in Universal Robots applications:

- **ES-Gripper for cobot**

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

This manual describes the software environment on an e-Series UR robot. Follow the instructions for the robot.

Applicable documents

- Assembly and operating manual for the product

Functional description of "URCap"

The "URCap" software is used for the simple commissioning and programming of the ES-Gripper in combination with robots from Universal Robots. The "URCap" software is integrated seamlessly into the "Polyscope" programming environment of Universal Robots. The programming and configuration of the gripper are supported via the control panel of the robot.

The "URCap" software has been tested under the Polyscope version 5.11.0 of Universal Robots. I-PEX recommends installing the current Polyscope version on the robot used. To avoid compatibility problems, check the operating software of the UR device before using the "URCap" software and update it if necessary.

The "URCap" software was tested at I-PEX with the following

system configuration:

- Starter Package for SDK 1.13.0
- URCAP SDK 1.13.0
- Polyscope version 5.11.0

Introduction

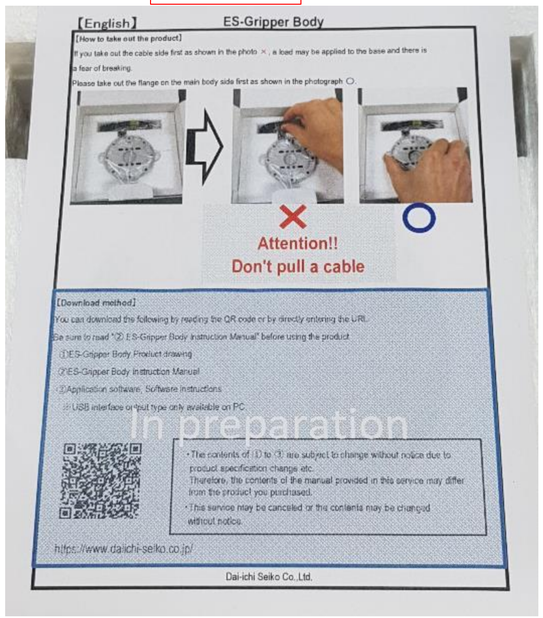
- Contents ……..03
- ES-Gripper Features ……04~10
- Installation Operation(Hardware) ……11~14
- URCap Software ……16~21

  (URCap version Pick (file name I-PEX_pick-0.2.3.urcap) / Insert (file name I-PEX_insert-0.2.12.urcap)
- Notice ……..23

Contents

- Manual
- ES-GRIPPER Body x1
- Pin x1 (6mm)
- Hexagon socket head cap screw (M4) x 4

Manual



ES-GRIPPER Body

Pin and screw

ES-Gripper feature1 （Sensor）

ES-TORQ

Electrostatic Capacitance Torque Sensor

- Simple construction, light weight & high durability due to adoption of electrostatic capacitance system
- Built-in micro computer, outer module for corrective process is not required
- Can be used without initial setup

Interface
USB
RS422
RS485

ES-TORQ spec.

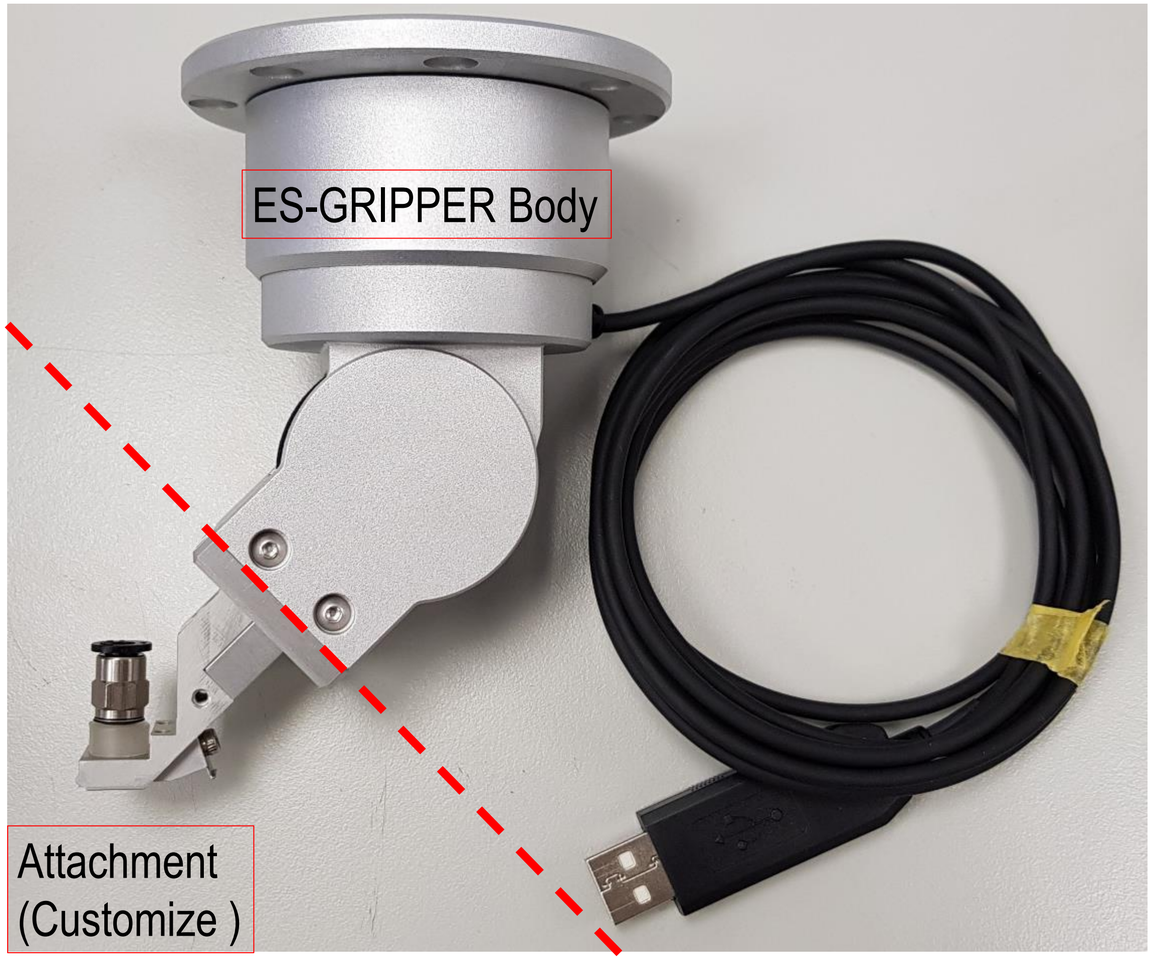
仕様
Spec

項目/Items	仕様/Spec
電源電圧/Power supply	DC5V
定格荷重/Measurable force	5Nm　※1
出力形態/Output form	RS422
消費電流/Current consumption	120mA　max.
使用温度範囲/Operating temp.limit	0 to 80 ℃（Non-condensing）
ボーレート/Baud rate	307.2kbps　※2
サンプリング周波数/Frequency response	5KHz　※2
外形寸法/External dimensions	Standard type：Φ80mm×H96.4mm / Vertical type；Φ80mm×H94mm
質量/Weight	415g（Except for Attachment）
標準ケーブル長/Standard length of cable	2.0m

※1　測定可能な荷重(N)範囲は、Body Type、Attachment形状によって値が変わります。
※2　ボーレートを115.2kbps、サンプリング周期を１kHzに変更可能です。

※1　The measurable load (N) range changes depending on the Body Type and Attachment shape.
※2　The baud rate and sampling period is changeable. Please kindly refer to the data as below.
Baud rate: 307.2 kbps → 115.2 kbps
Frequency response 5 kHz →　1 kHz

ES-Gripper Feature2 （Body）

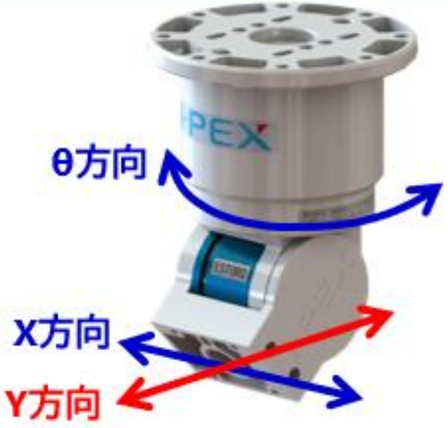


Built-in floating mechanism can be adapted to the offset problems caused by the jig/product positioning/robotic…etc. during product assembly on the production line

STANDARD TYPE
(標準タイプ)

変位量		
	X方向	±2 mm
	θ方向	±7 °

OMNIDIRECTIONAL TYPE
(全方向タイプ)



変位量		
	X方向	±1 mm
	Y方向	±1 mm
	θ方向	±4 °

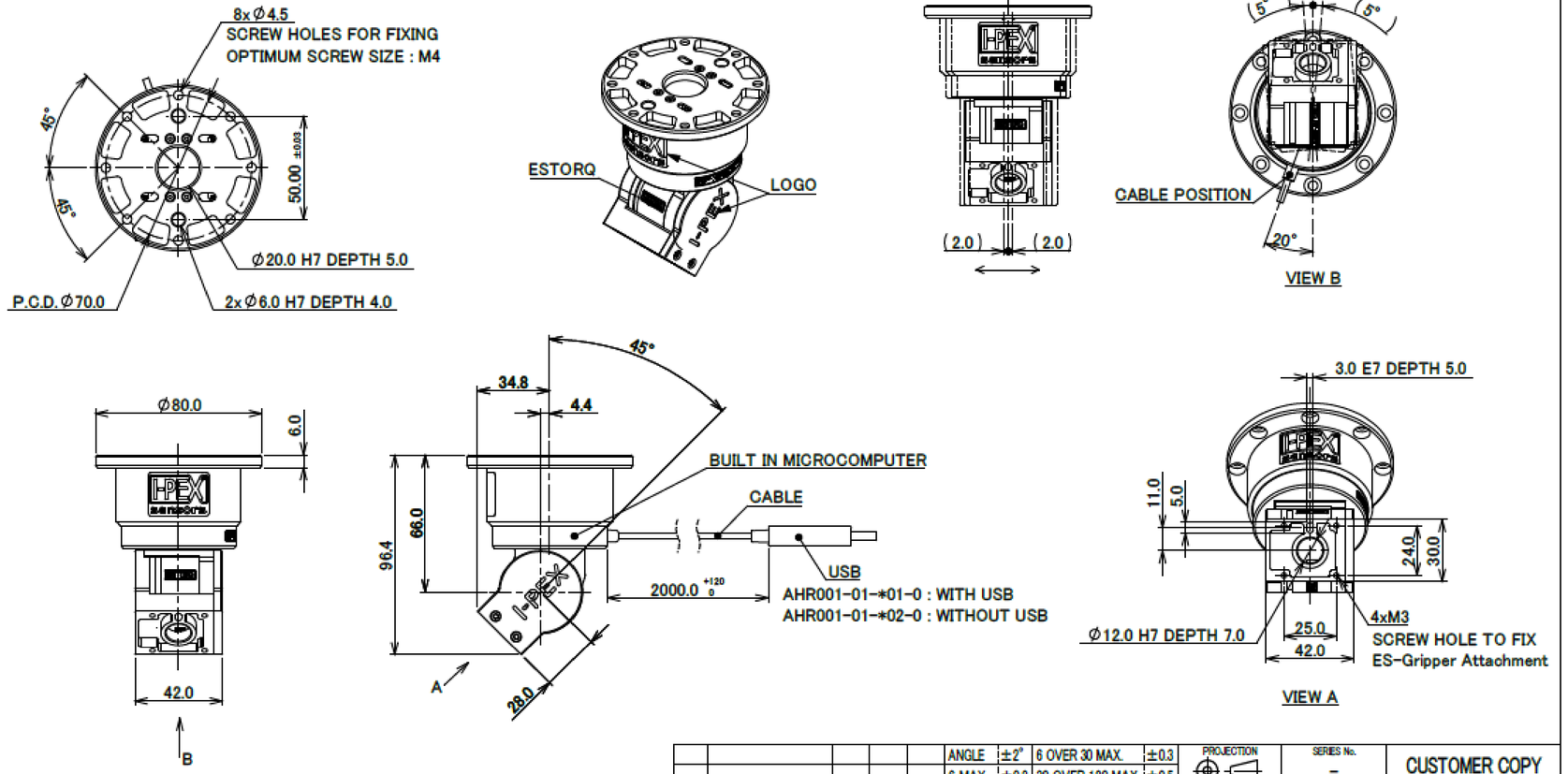
ES-Gripper(Standard type)

Recommended P/N	AHR001-01-A02-0

PART No.
AHR001-01-*0*-0

AHR001-01-*0*-0
- IT IS CODE No. THAT I-PEX USES.
- 1 : OUTPUT FORM RS-422 , WITH USB
- 2 : OUTPUT FORM RS-422 , WITHOUT USB
- A : WITH FLOATING MECHANISM
- B : WITHOUT FLOATING MECHANISM
- ES-Gripper Body

< RANGE OF MOTION >
*WITH FLOATING MECHANISM



NOTES.
1. MATERIAL
   FRAMEWORK : ALUMINIUM
2. WEIGHT : APPROXIMATELY 415 g
3. ES-Gripper Body USES MAGNETIC PARTS.

REV.	DATE	DWG.	CHK.	APP.
1	Jul./15/'19	H.T	S.N	S.N
0	Feb./26/'19	T.N		

REVISION RECORD

ANGLE	±2°	6 OVER 30 MAX. ±0.3
6 MAX.	±0.2	30 OVER 120 MAX. ±0.5

GENERAL TOLERANCE.

DWG.	T.Nishimura	DATE 2019/02/26
CHK.	N.Sueishi	DATE 2019/02/26
APP.	K.Masuda	DATE 2019/02/26

PROJECTION | SERIES No. –

TITLE: ES-GRIPPER® BODY GENERATION 2 STANDARD TYPE

DWG. No. AHR001-01

CUSTOMER COPY

SCALE 1:2 | UNIT mm | SIZE A3 | SHEET 2/2 | REV. 1

I-PEX sensors

DAI-ICHI SEIKO CO., LTD.

Confidential C

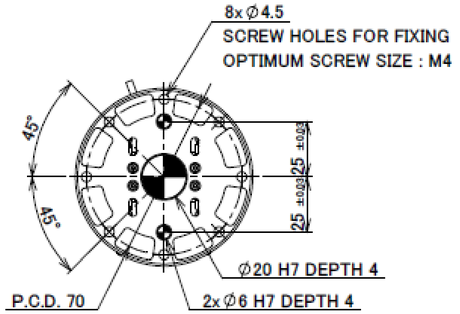
ES-Gripper(Omnidirectional type)

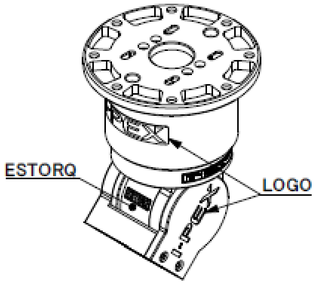
Recommended P/N	AHR004-01-A02-0

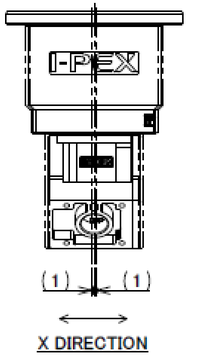
PART No.
AHR004-01-A0*-0

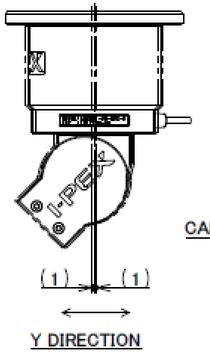
AHR004-01-A0*-0
- IT IS CODE No. THAT I-PEX USES.
- 1 : OUTPUT FORM RS-422 , WITH USB
- 2 : OUTPUT FORM RS-422 , WITHOUT USB
- ES-Gripper Body

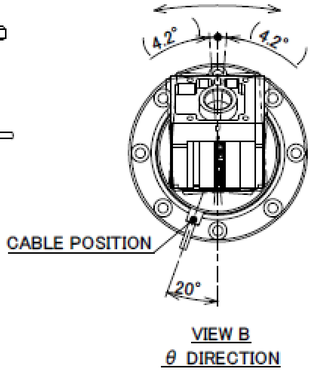
< RANGE OF MOTION >
*WITH FLOATING MECHANISM

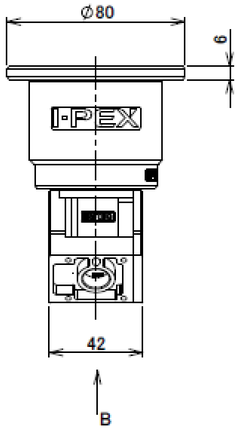


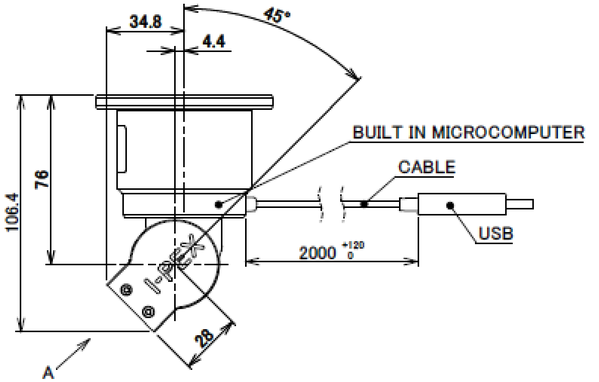


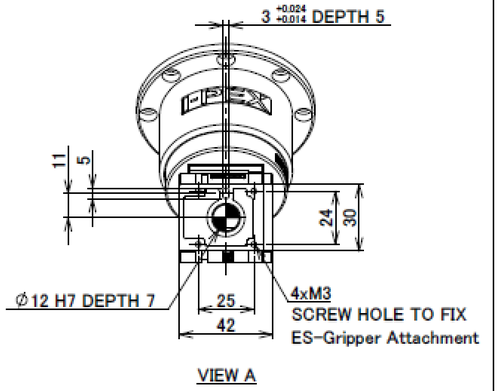












NOTES.
1. MATERIAL
FRAMEWORK : ALUMINIUM
2. WEIGHT : ABOUT 460 g
3. ES-Gripper Body USES MAGNETIC PARTS.

REV.	DATE	DWG.	CHK.	APP.
0	Feb./06/'20	H.T		

REVISION RECORD

ANGLE	±2°	6 OVER 30 MAX.	±0.3
6 MAX.	±0.2	30 OVER 120 MAX.	±0.5

GENERAL TOLERANCE

DWG.	H.Tagomori	DATE	2020/02/06
CHK.	Y.Aiba	DATE	2020/02/12
APP.	T.Hirakawa	DATE	2020/02/12

PROJECTION | SERIES No. –

TITLE: ES-GRIPPER® BODY GENERATION 2 OMNIDIRECTIONAL TYPE

DWG. No. AHR004

CUSTOMER COPY

SCALE 1:2 | UNIT mm | SIZE A3 | SHEET 2/2 | REV. 0

I-PEX

I-PEX Inc.

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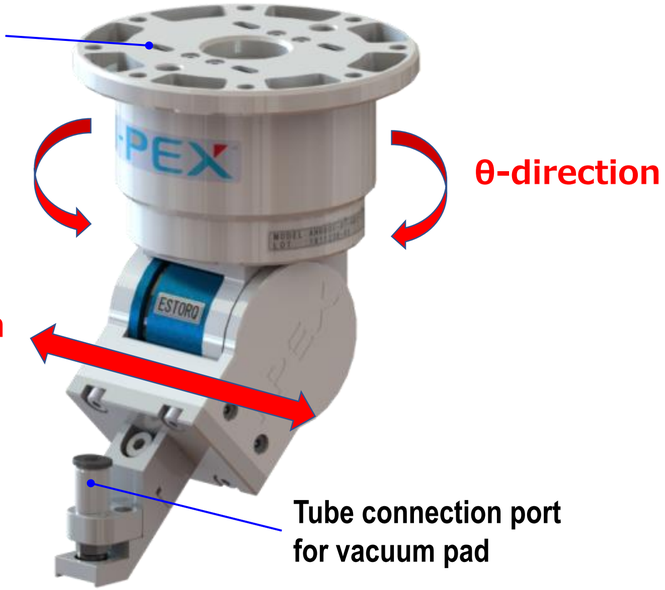
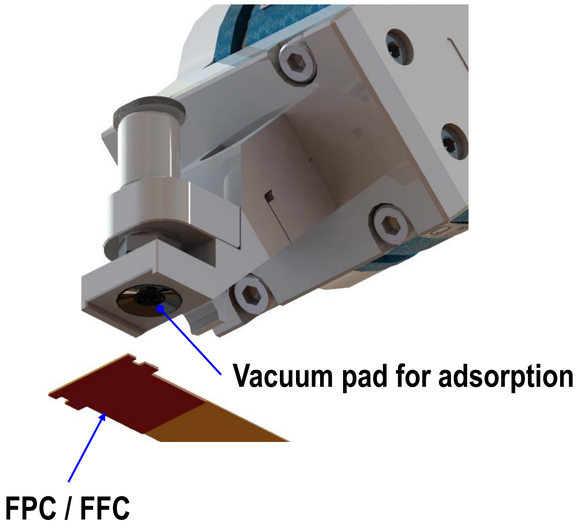
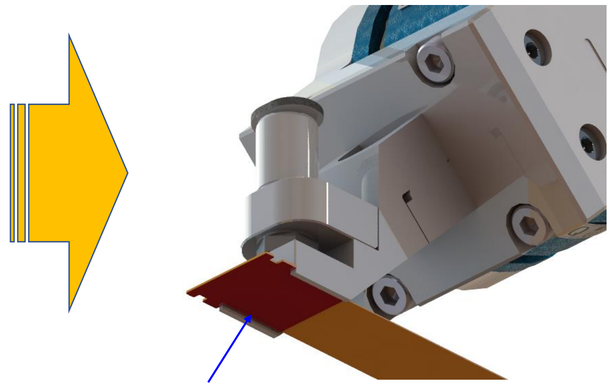
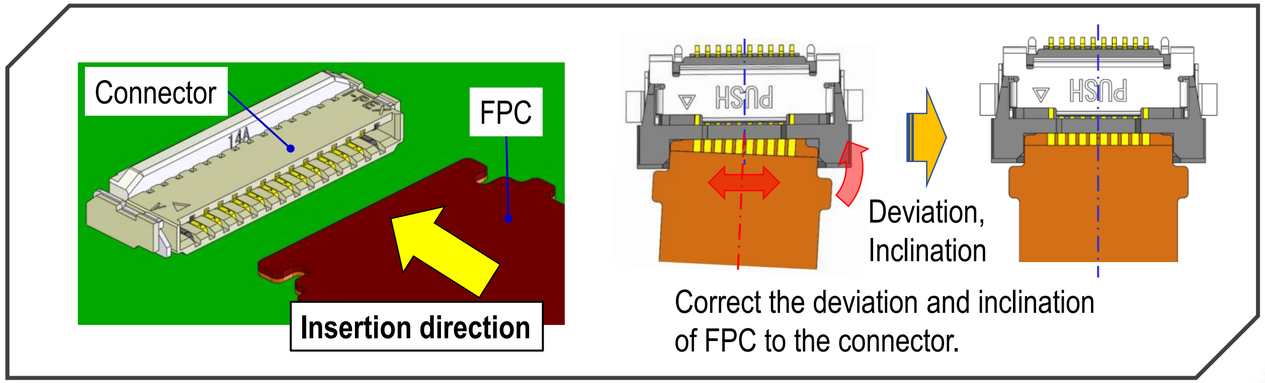
Connection assembly application （Floating function for Pick up FPC）

: Movement direction of alignment correction









Connection assembly application (Floating function for misalignment of pitch and θ direction)

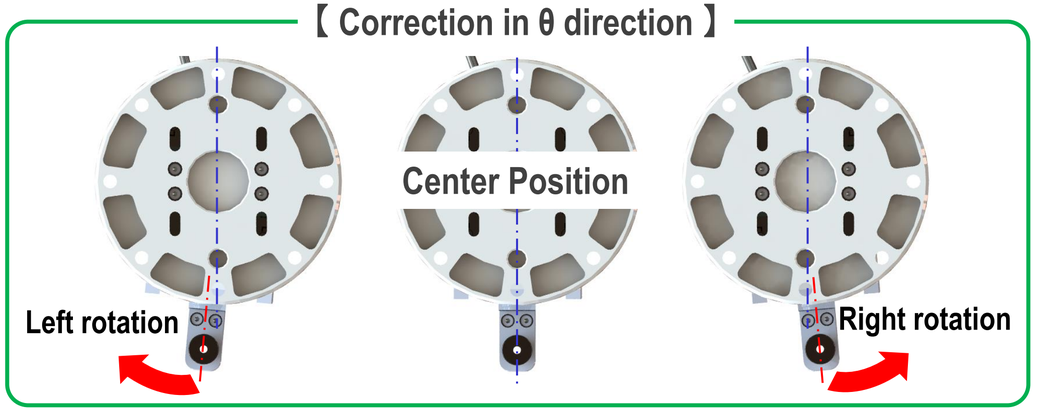
ES-Gripper automatic correction movement

	Correction direction
STANDARD TYPE	X, θ
VERTICAL TYPE	X, θ
OMNIDIRECTIONAL TYPE	X, Y, θ
FINE CONTROL DEVICE ASS'Y	X, θ or X, Y, θ

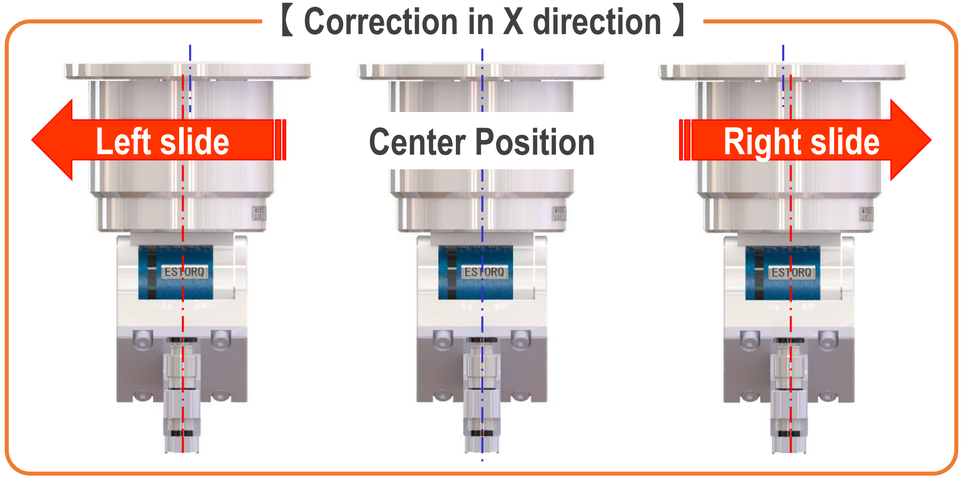
Technical notes

The position misalignment automatic correction function does not work beyond the allowable range of the design of the connector itself.
Originally, it is a function that ES-Gripper has realized the movement that humans naturally support by hand.
Please contact us for the allowable design range of each connector.

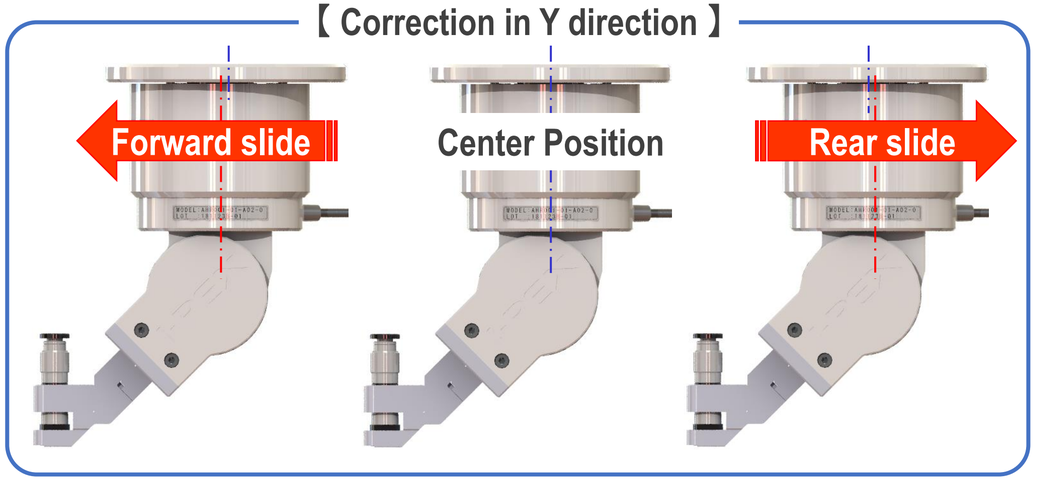
【 Correction in θ direction 】



【 Correction in X direction 】



【 Correction in Y direction 】

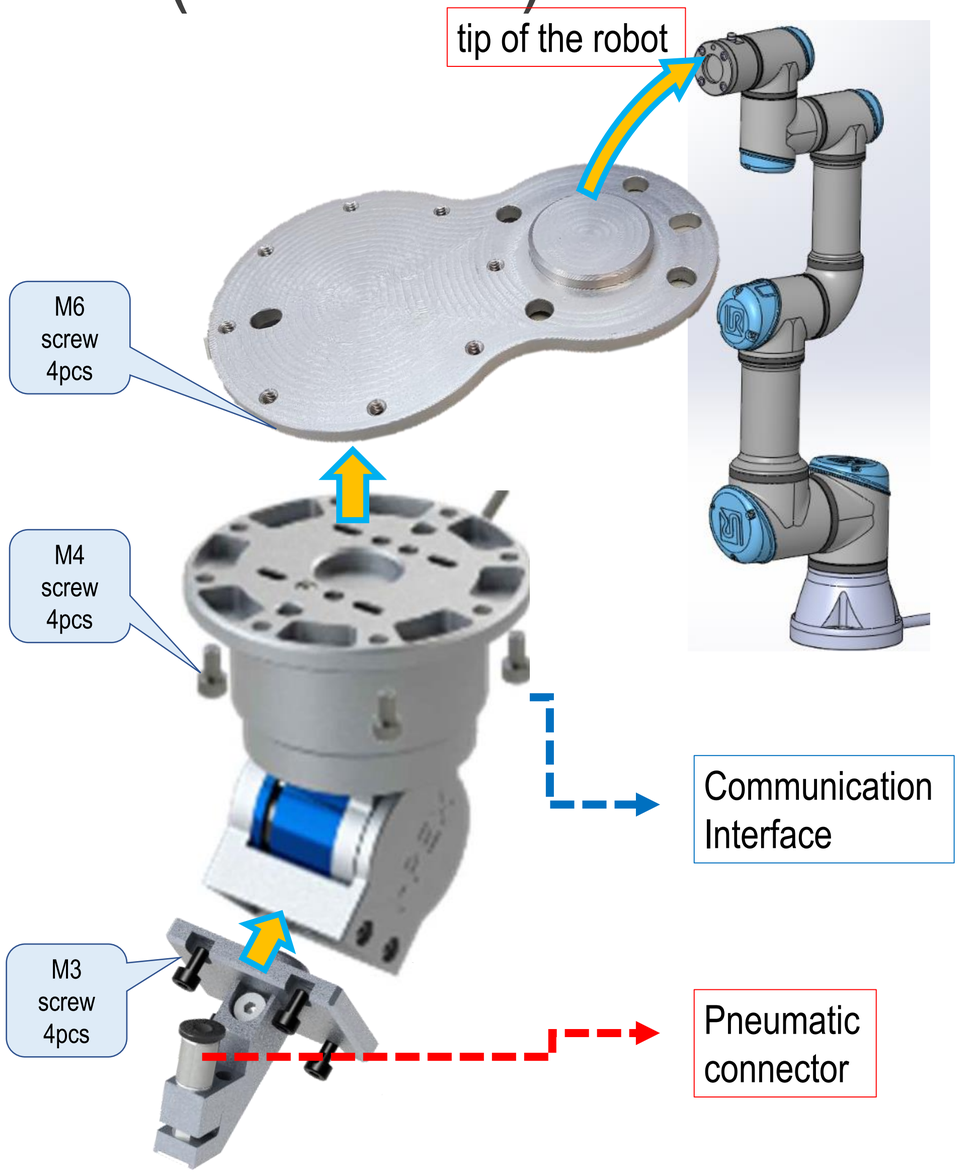


ES-Gripper installation(hardware)

ES-Gripper Flange Adapter
(Customize)

ES-Gripper Body
(Standard / Omnidirectional type)

ES-Gripper Attachment
(Customize)



Installation
1. Place the flange on the tip of the robot and lock it tightly
(refer robot manual , the M6 tightening torque is 8Nm)
Due to different robot suppliers, please refer to the manual of each robot for its screw tightening torque

2. Place the ES-Gripper body on the flange and tighten it (the tightening torque of the M4 screw 1.8T series is 2.70 Nm)

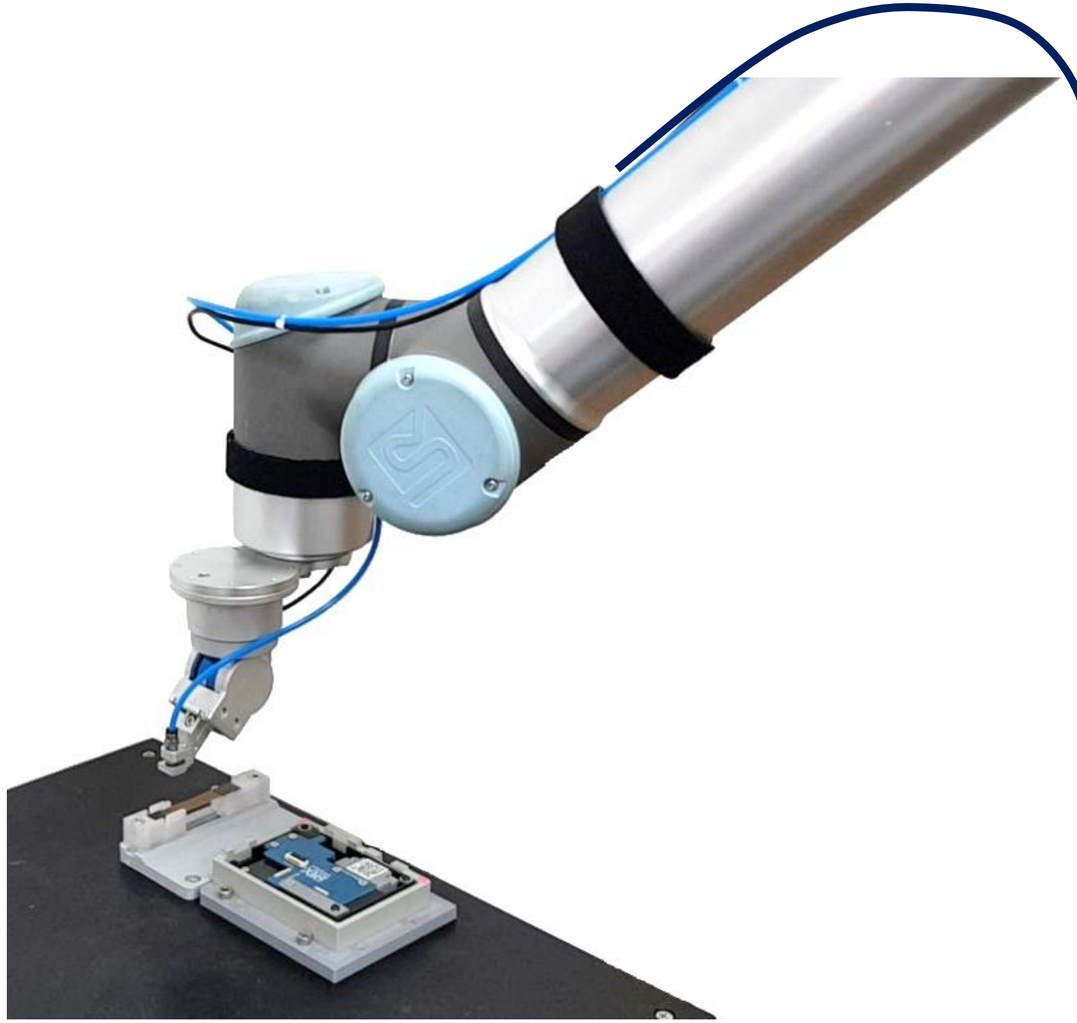
3. Place the Attachment on the ES-Gripper body and tighten it (M3 screw locking force 1.8T series is 1.14 Nm)

USB / RS422 / RS485 Connect the corresponding interface of the robot control unit

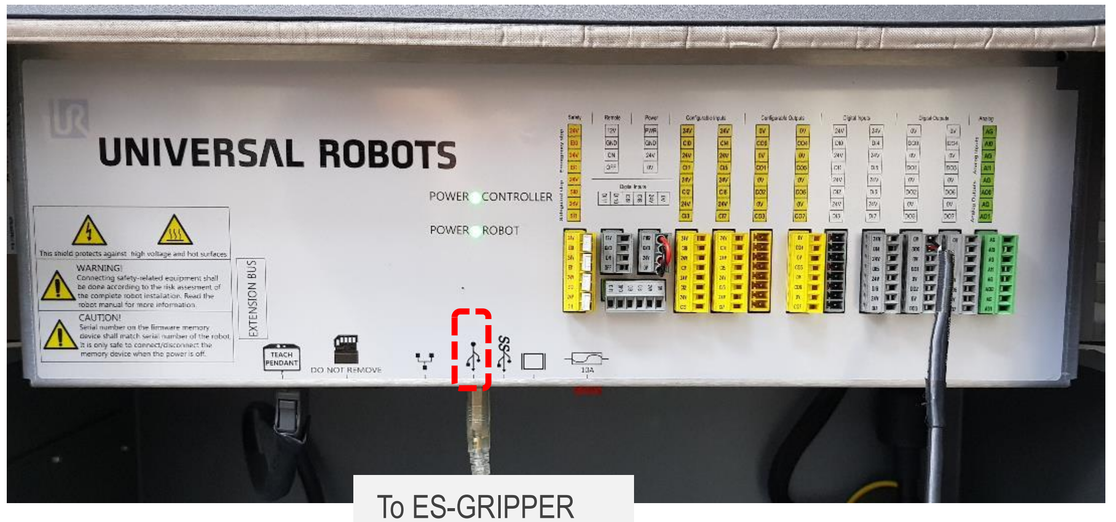
(Use Φ4 air hoses connection to vacuum control valve here)

ES-Gripper Installation

(USB cable connection to USB2.0 of UR Robot Control system)



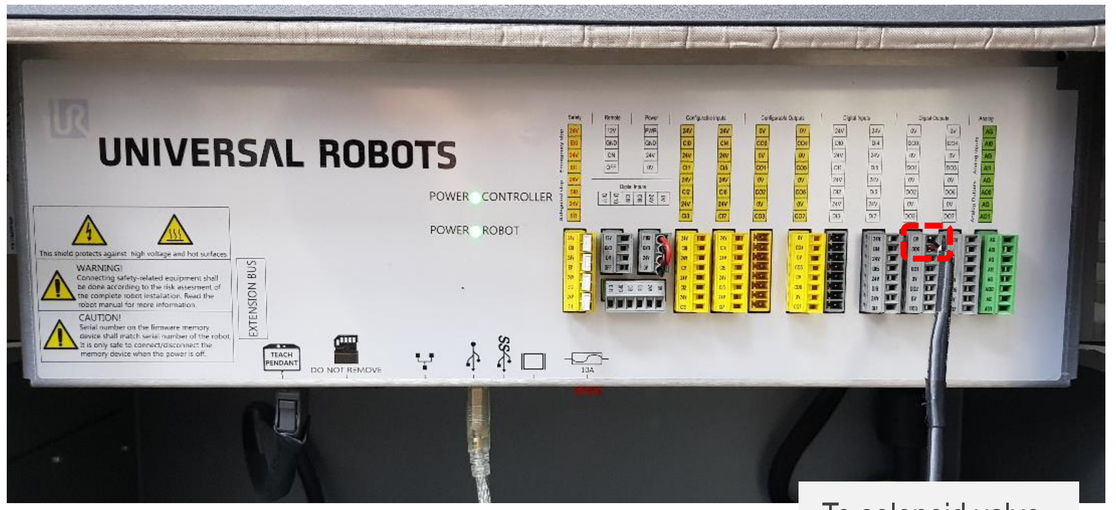
UR Robot Control system



Solenoid valve Installation

(solenoid valve connection to Digital Outputs of UR Robot Control system)

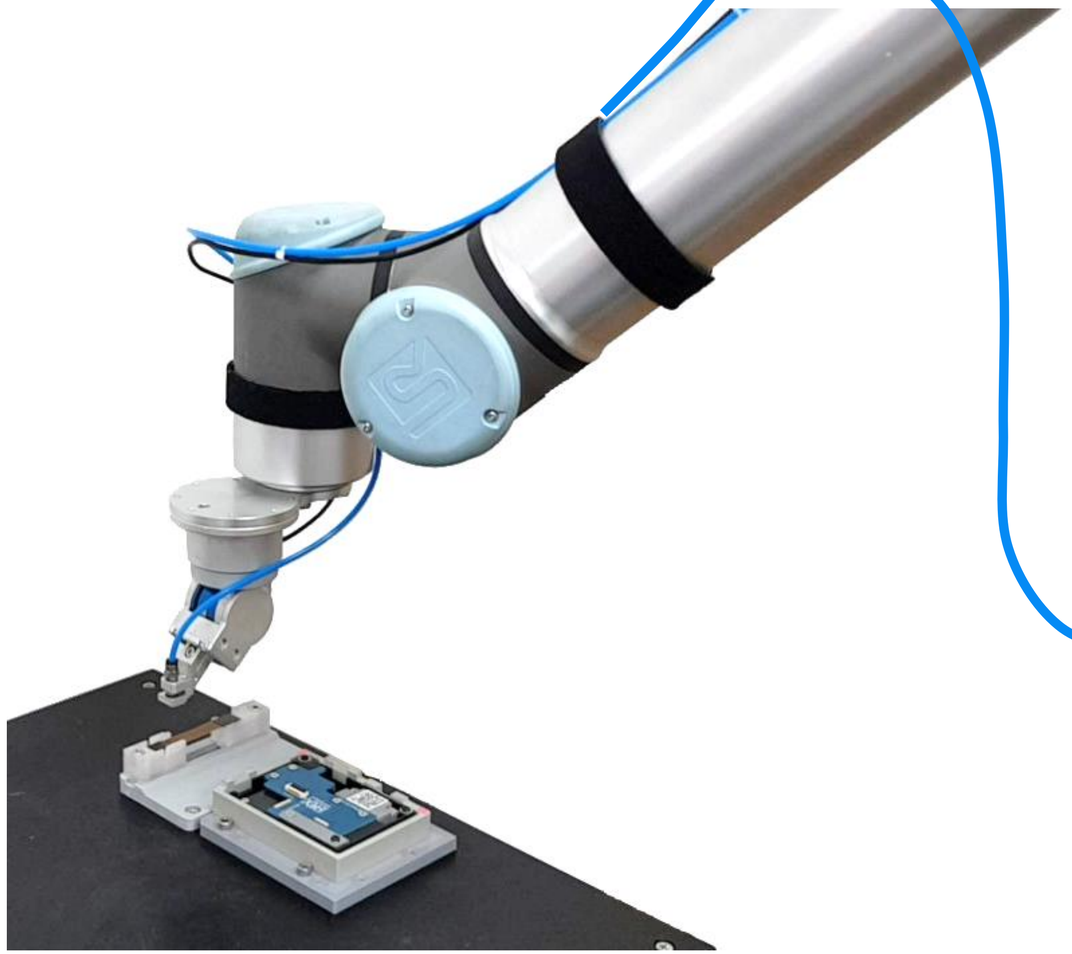
UR Robot Control system



To solenoid valve

Vacuum generator

From Air compressor

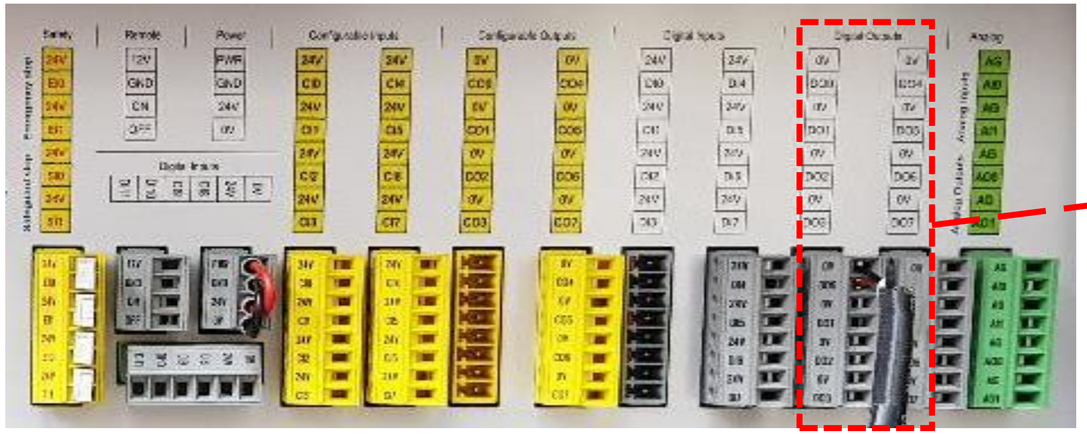


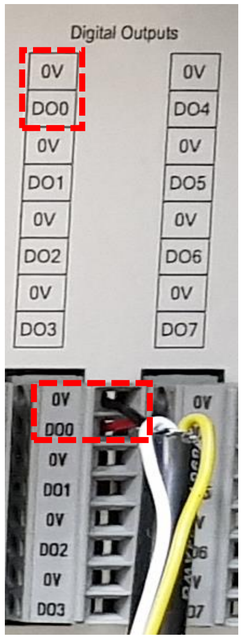
URCap setting for Vacuum generator control

Configuring digital output for the solenoid valve output setting (for Vacuum generator control)

Control of the solenoid value output is only possible via the separate digital supply lines. If the solenoid value output is deactivated, the digital outputs are not used in the program.

1. Connect the solenoid value to the robot control system .
2. Enter the corresponding ports of the digital outputs of the robot control system in the input field.





Control box output wiring

When using the robot control system, I-PEX recommends using the digital outputs of the "Digital I/O" group for general purposes to control the solenoid value . The output address to be configured refers to the numbering of the ports shown above.

Connector insertion process description

F P C pickup → Move to Relay point (safety point) → F P C insert to connector → Move to Relay point (safety point) → Finish

Set the following parameters in pick up page of URCAP

1. Move ES-gripper to touch the FPC and define this point as the pick up point
2. Set the solenoid valve to ON
3. Set arm movement speed/acceleration
4. Set the lift height parameters after FPC pick up
5. Set the waiting time parameter after FPC pick up

1. Use the move command to move ES-GRIPPER to safe location (relay point)
2. Relay point can be set More

P.S If doesn't set relay point , directly enter the process of FPC inserting the connector

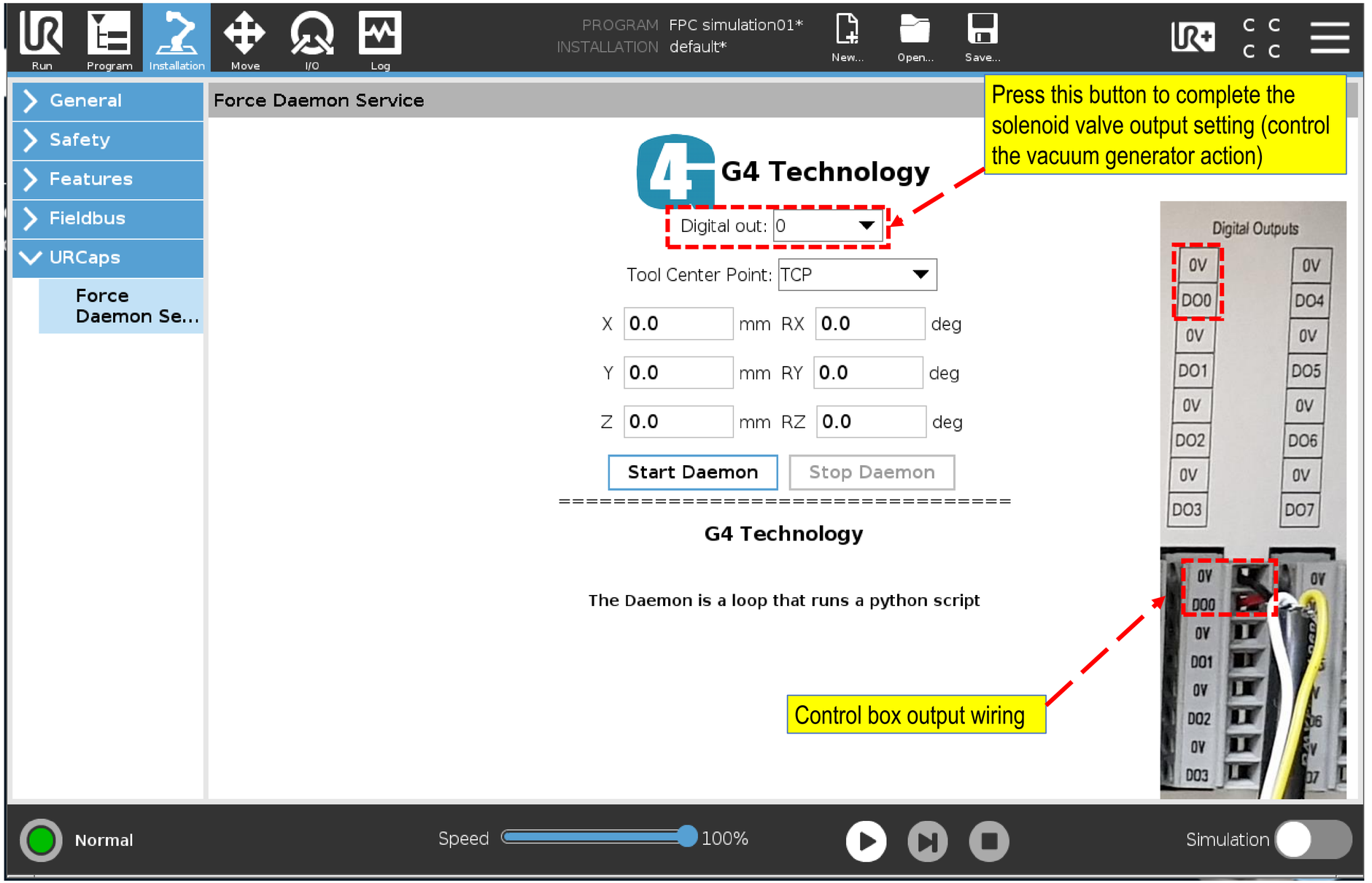
Set the following parameters in Insert page of URCAP

1. Move the FPC to the front of the connector ,insert connector slowly until completed and define this point as the insertion point
2. Set arm movement speed/acceleration
3. Lifting height parameters after insertion
4. Set the connector insertion depth parameter
5. Set the force value condition

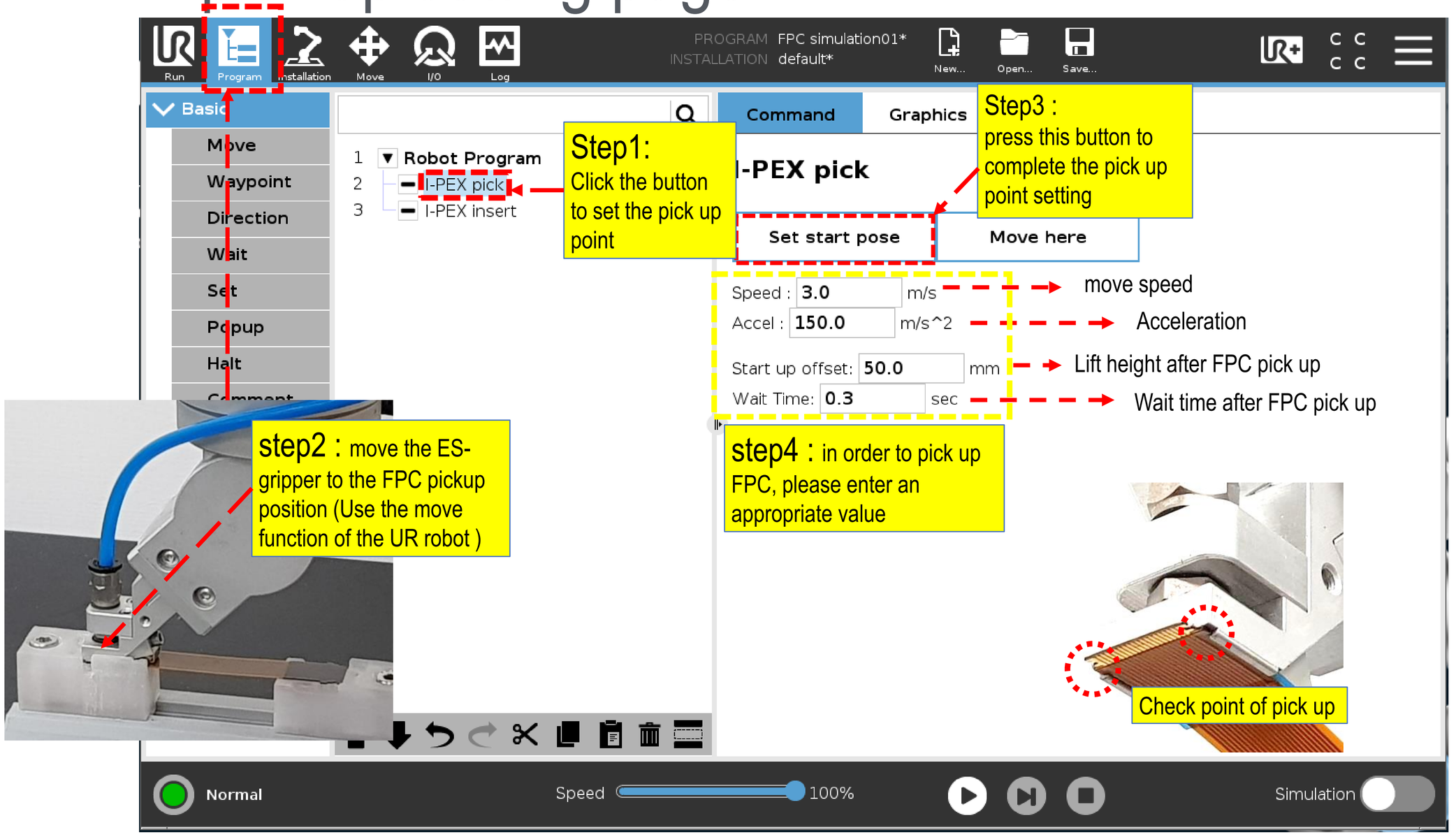
1. Use the move command to move ES-GRIPPER to safe location (relay point)
2. Relay point can be set More

P.S If doesn't set relay point , directly enter the process of FPC inserting the connector

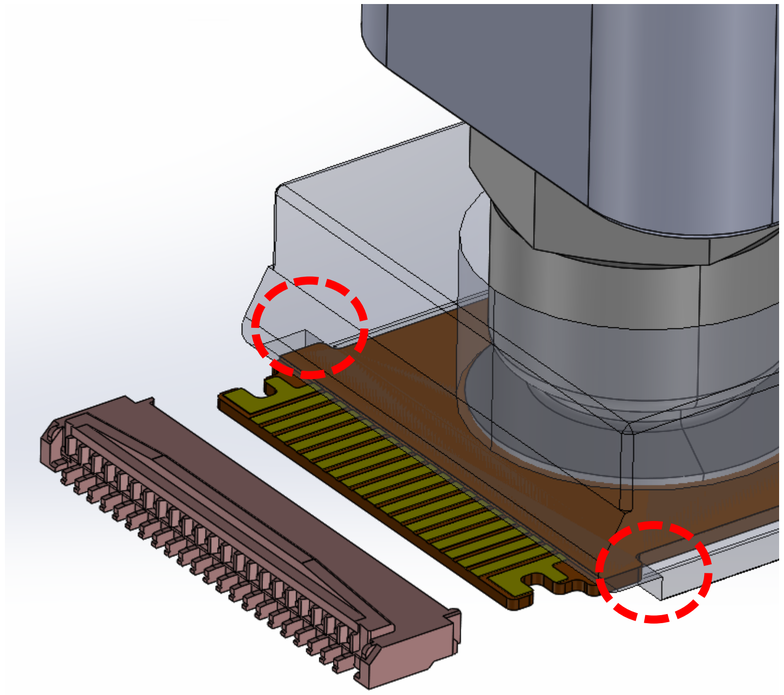
URCap setting for Vacuum generator control



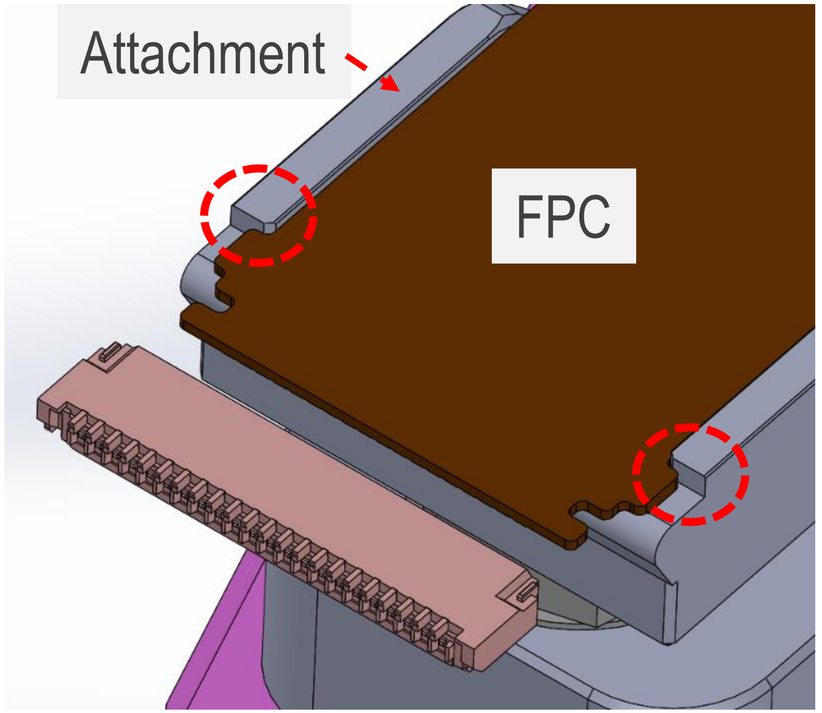
F P C pick up setting page



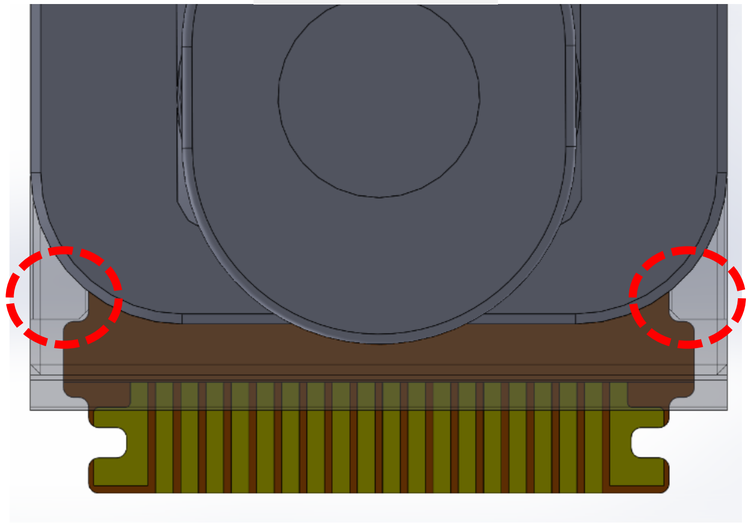
FPC pick up position



Botton View



Top View



F P C insert into connector setting page

step2 : move the ES-gripper to the connector position (Use the move function of the UR robot)

Step1: Click the button to set the insert point

Step3 : press this button to complete the insert point setting

step4 : Enter the suitable value

Move speed

Acceleration

The distance before the FPC insert into the connector

1st segment of the fpc insert into connector

2nd segment of the fpc insert into connector

Lift height after FPC pick up

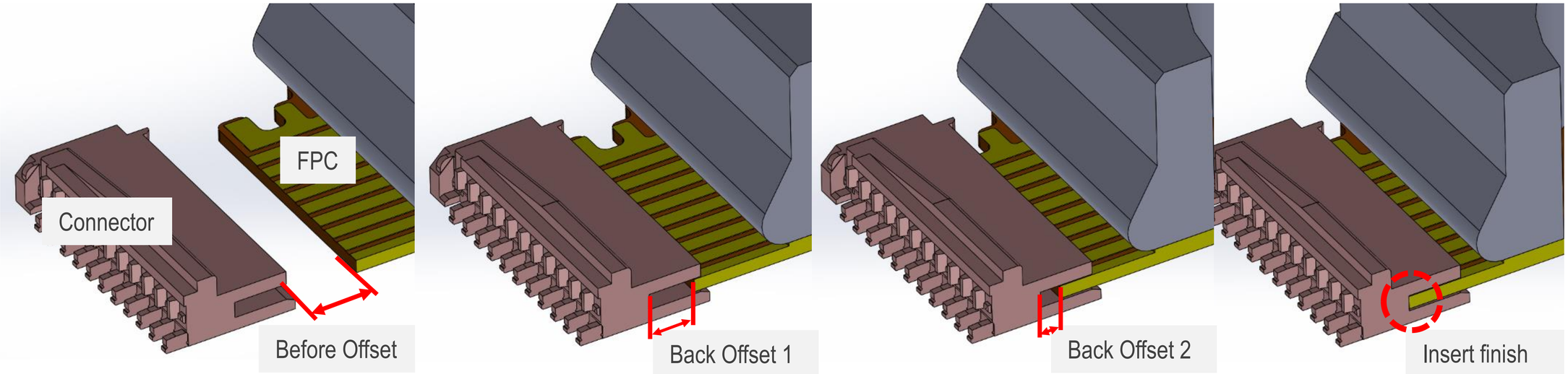
Wait time after FPC insert completed

The force value of Fpc insert into the first segment of the connector/Judgment condition

The force value of Fpc insert into the first segment of the connector/Judgment condition

Force value of Fpc insert completed/ Judgment condition

FPC insert connector parameter definition



When the fpc is insert into the connector, at the segment position (back offset 1 / Back Offset 2 / Insert Finish), the force value meets the judgment formula (Force1 value / Force 2 value / Force 3 value) and then enters the next program

FPC insert into Connector example

I-PEX insert

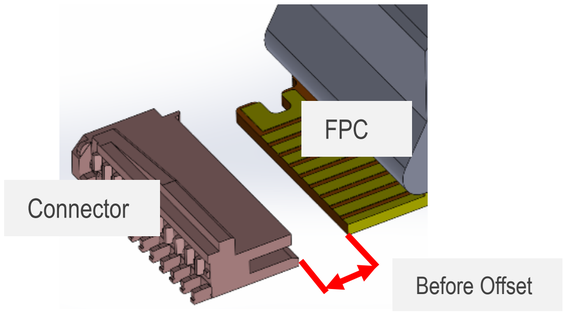
Set inserted pose	Move here

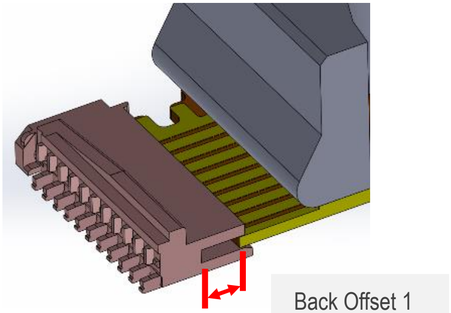
Speed : 1.0 m/s
Accel : 150.0 m/s^2

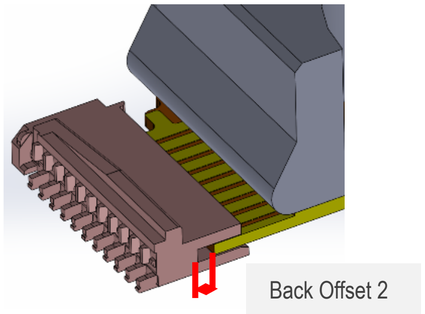
Before offset : 5.0 mm
Back offset1 : 0.8 mm
Back offset2 : 0.2 mm

Insert up offset: 50.0 mm
Wait Time: 0.3 sec

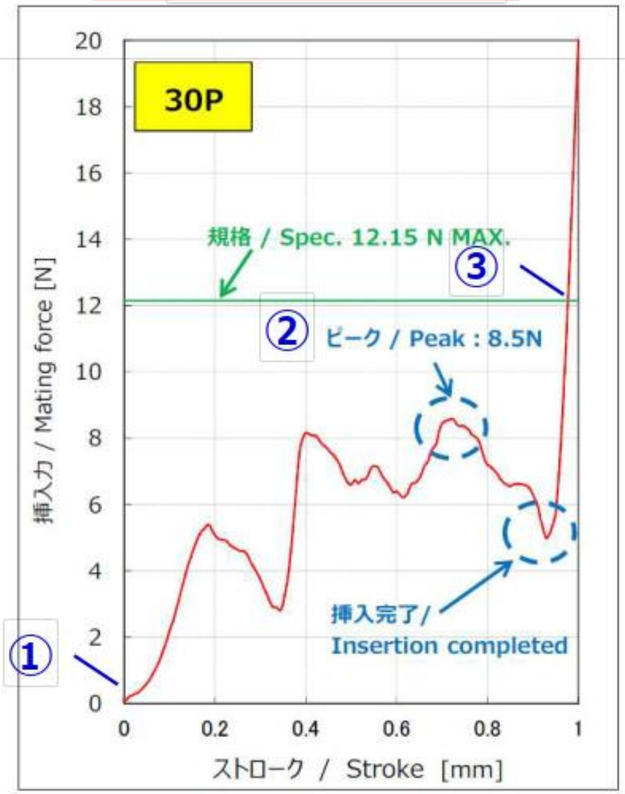
Force Type: Custom
Force1: > 0.0 N.m
Force2: < 0.442 N.m
Force3: < 0.632 N.m







Connector insertion waveform
(define by connector)

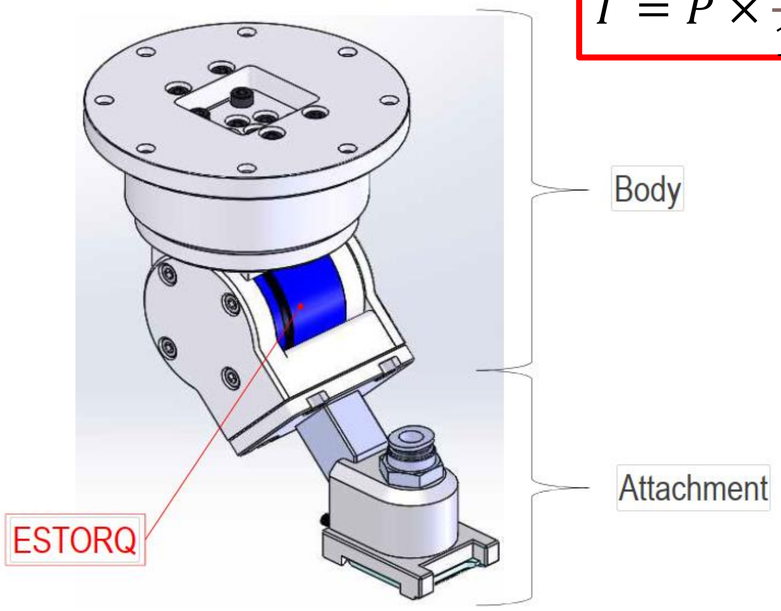


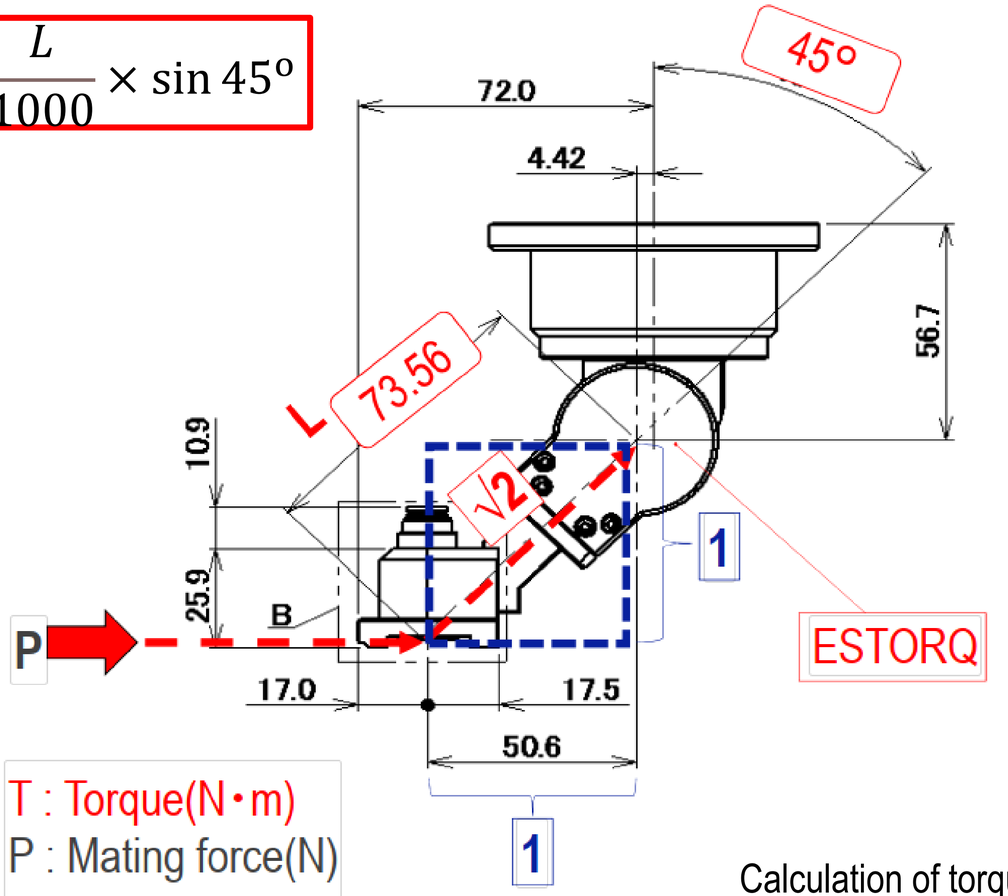
グラフ 3. 30P 挿入力波形 /
Graph3. 30P Mating force waveform

Calculation of torque at insertion
①Before PLUG insertion : 0N ⇒0N・m
②Peak : 8.5N ⇒0.442N・m
③Mating completed(Mating force standard) :12.15N ⇒0.632N・m
※Because torque setting beyond insertion force is necessary.

Torque calculation of connector insertion force)

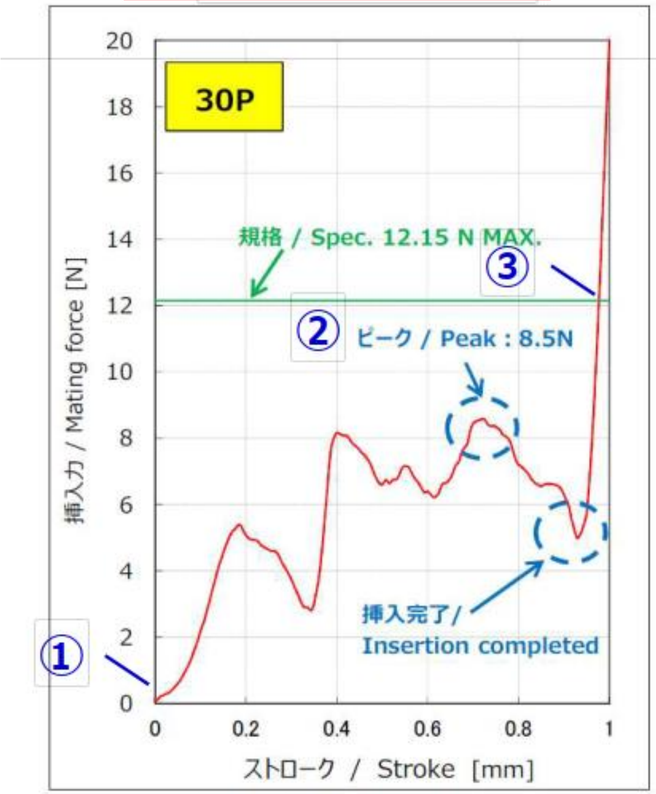
$$T = P \times \frac{L}{1000} \times \sin 45^{o}$$





T : Torque(N・m)
P : Mating force(N)
L : Distance(mm)

Connector insertion waveform
(define by connector)



グラフ 3. 30P 挿入力波形 /
Graph3. 30P Mating force waveform

Calculation of torque at insertion
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※Because torque setting beyond insertion force is necessary.

Notice

- Be sure to fix the cable and reserve the length of the cable at the arm joint to avoid breaking the cable when the robot is working.

I-PEX