ES-Gripper Setup Manual in URCap Software

（ Installation instructions for Universal Robot e Series ）

2023/Mar.3

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

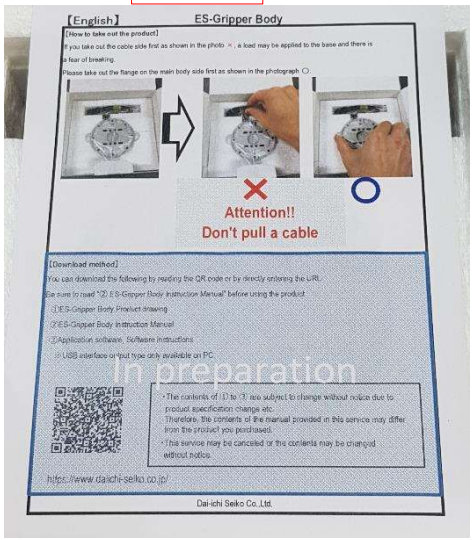
- Contents ……..03
- ES-Gripper Features ……04~10
- Installation Operation(Hardware) ……11~14
- URCap Software ……16~23

  (URCap version Pick (file name I-PEX_pick-0.2.3.urcap) / Insert (file name I-PEX_insert-0.2.12.urcap)
- Notice ……24

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.

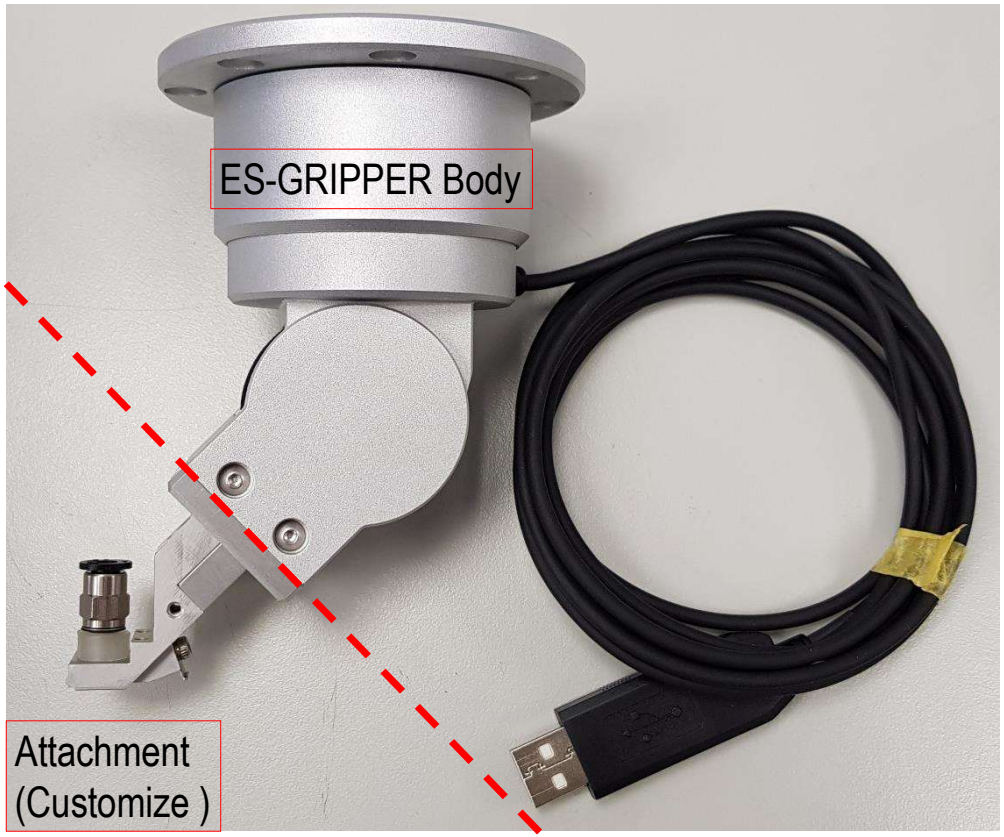
仕様
Spec

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 1 kHz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

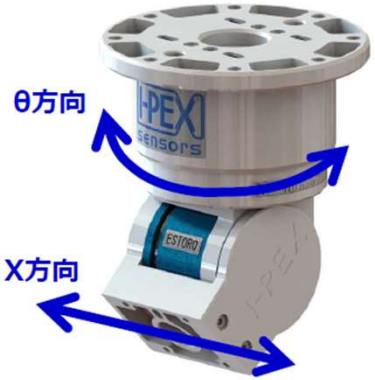
ES-Gripper Feature2 （ Body ）



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)>

【外観・フローティング方向】



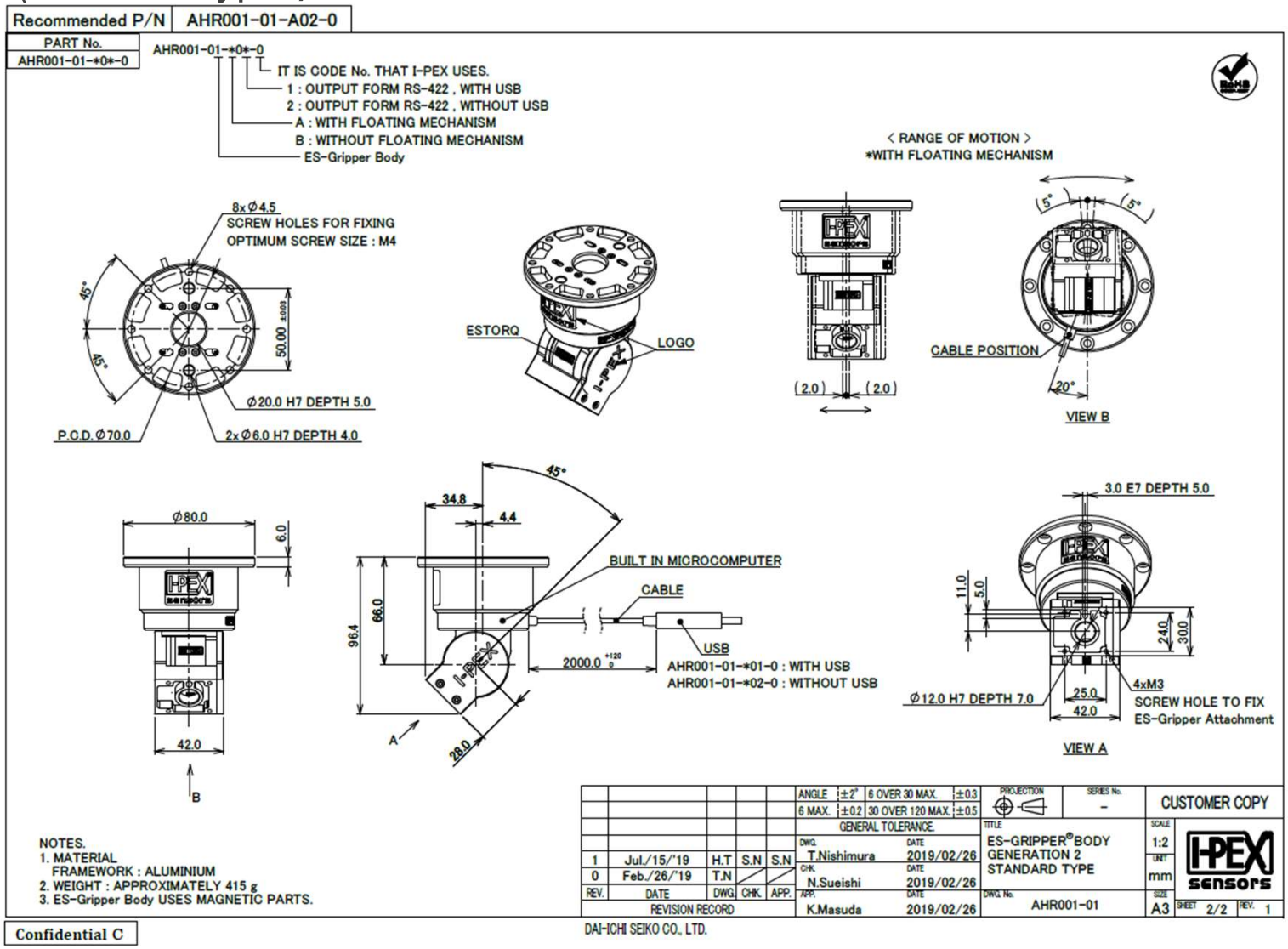
【フローティング仕様】

	フローティング量
X方向	±2.0mm
θ方向	±5°

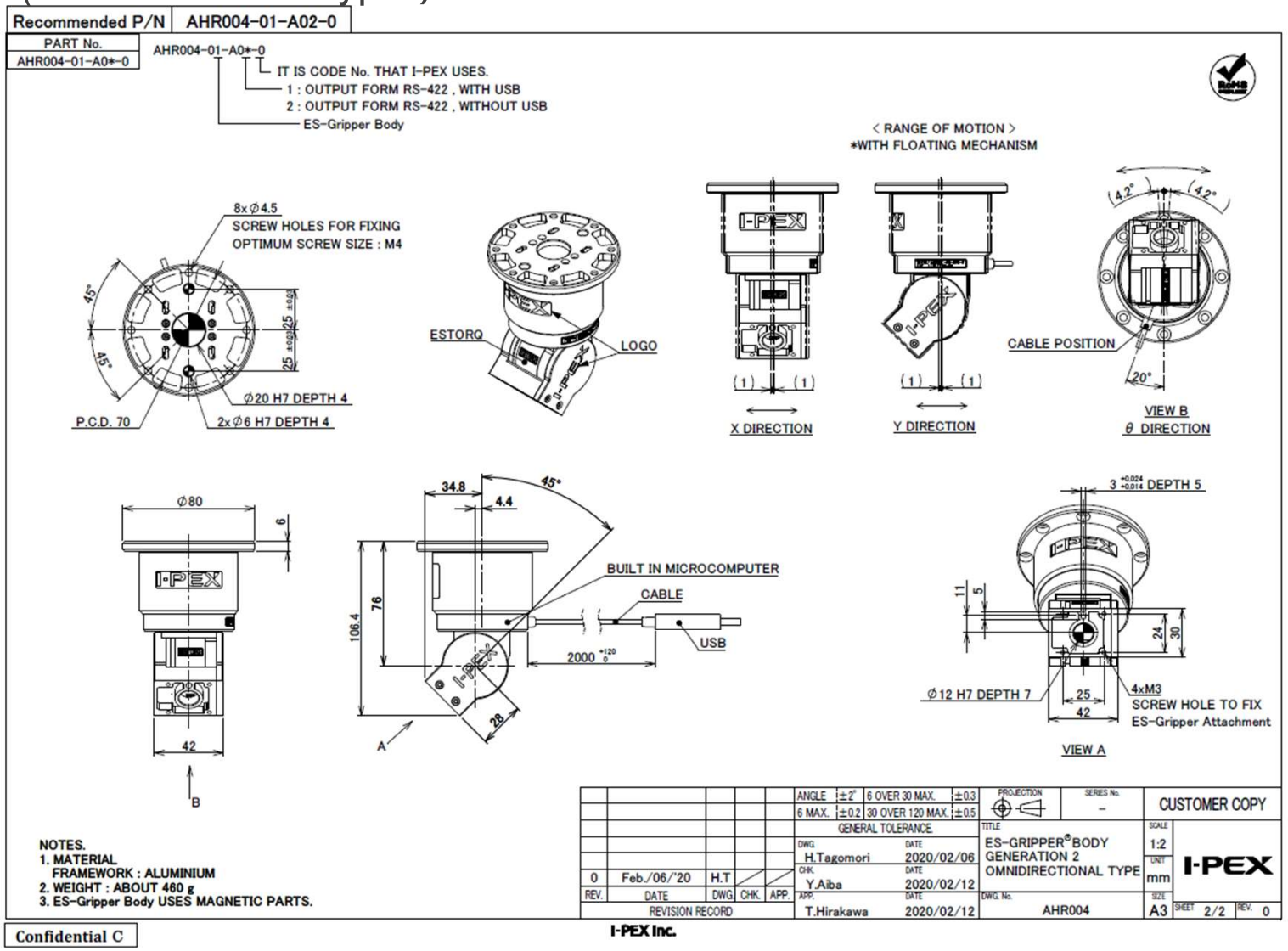
<Omnidirectional Type (全方向タイプ)>

	フローティング量
X方向	±1.0mm
Y方向	±1.0mm
θ方向	±4.2°

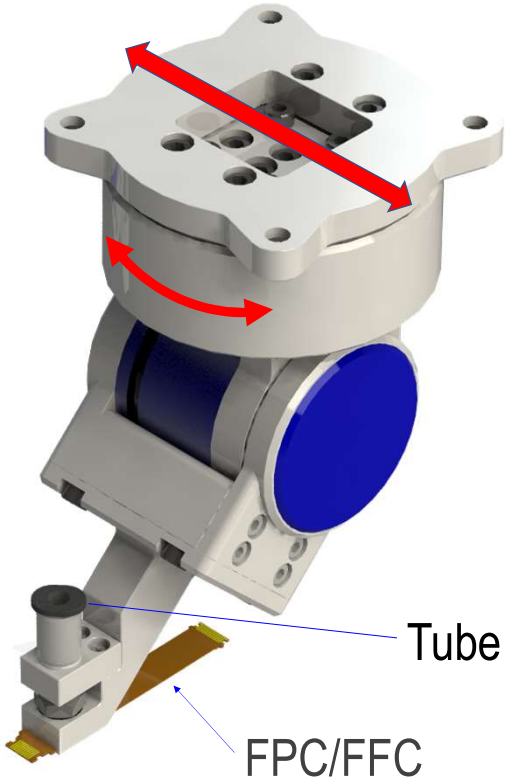
ES-Gripper(Standard type)



ES-Gripper(Omnidirectional type)



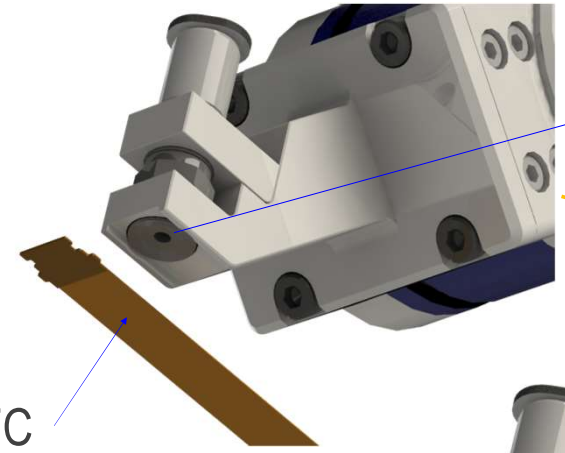
Connection assembly application（ Floating function for Pick up FPC ）



Tube fitting for Vacuum pad

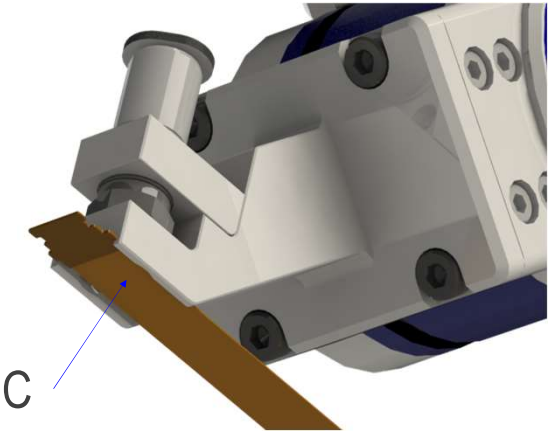
FPC/FFC

moving direction for alignment



Vacuum pad Φ8.0mm

FPC/FFC



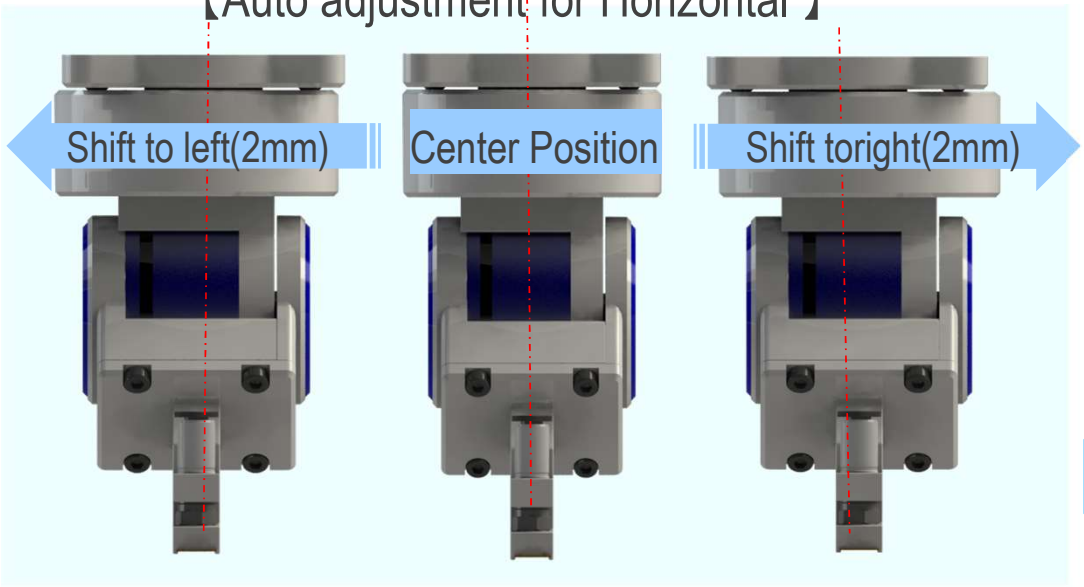
FPC/FFC

Holding vacuum status with FPC/FFC

Patent Pending

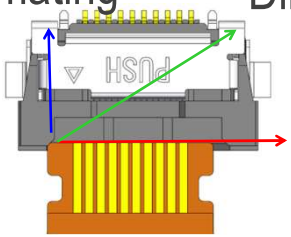
Connection assembly application (Floating function for misalignment of pitch and θ direction)

【Auto adjustment for Horizontal 】



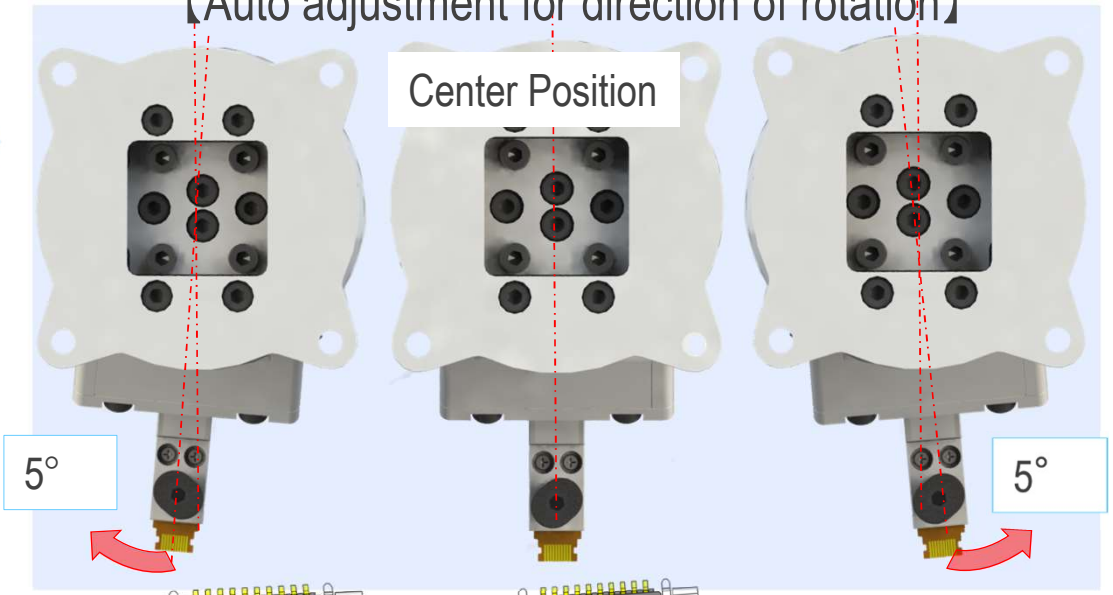
Direction for mating

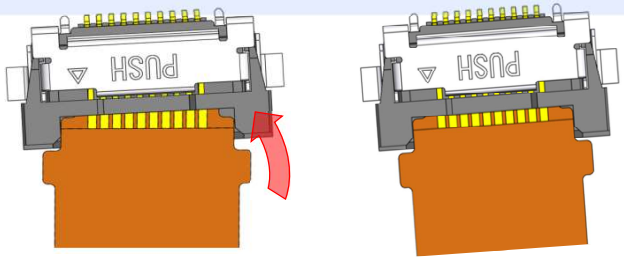
Direction of FPC/FFC



Direction for shift

【Auto adjustment for direction of rotation】





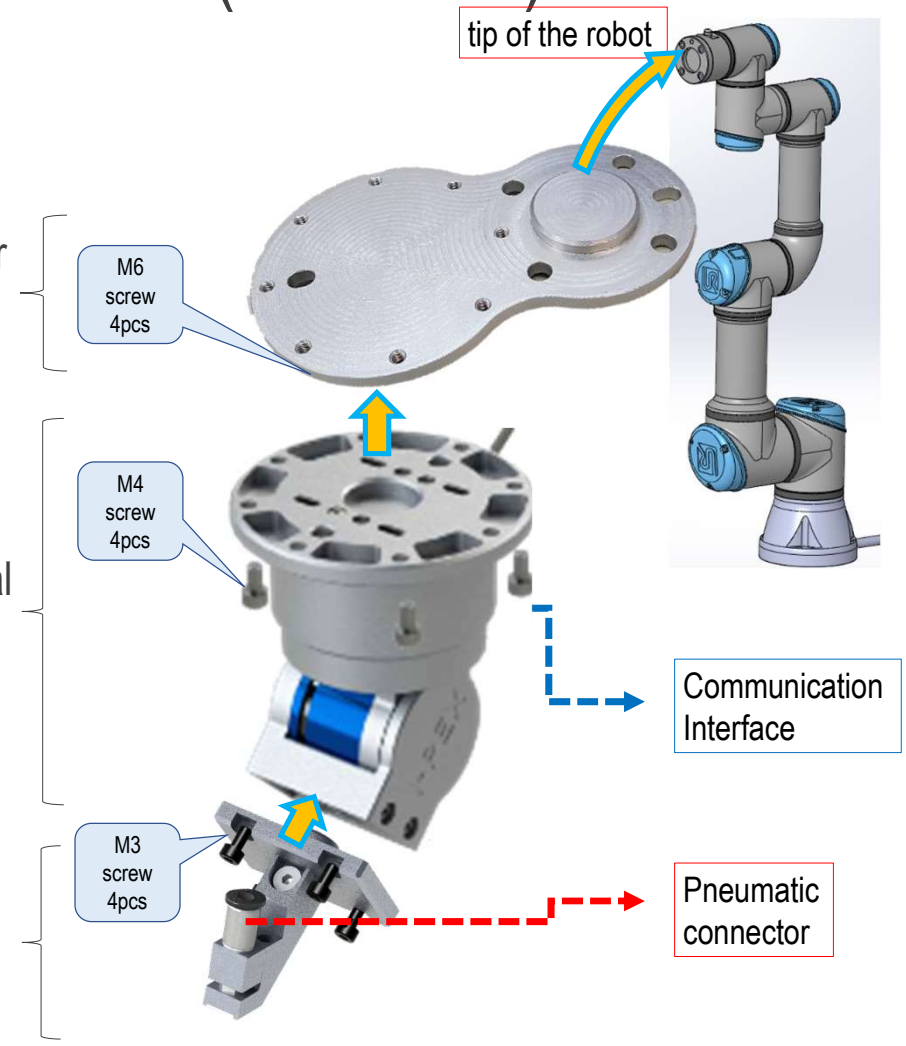
To adjust θ shift with floating of rotation by attachment head

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)

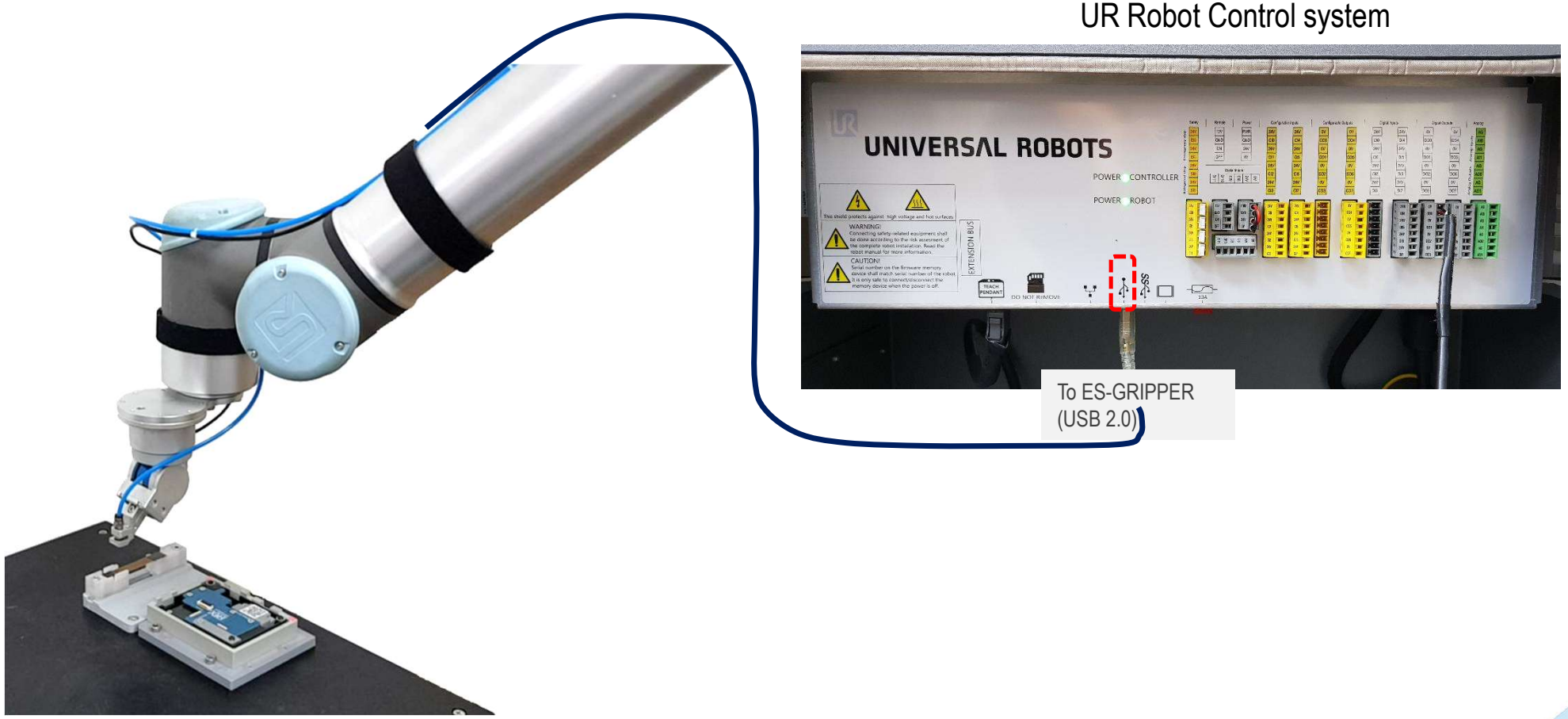
3. Place the Attachment on the ES-Gripper body and tighten it (M3 screw locking force 1.8T series is 1.14 Nm)

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

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

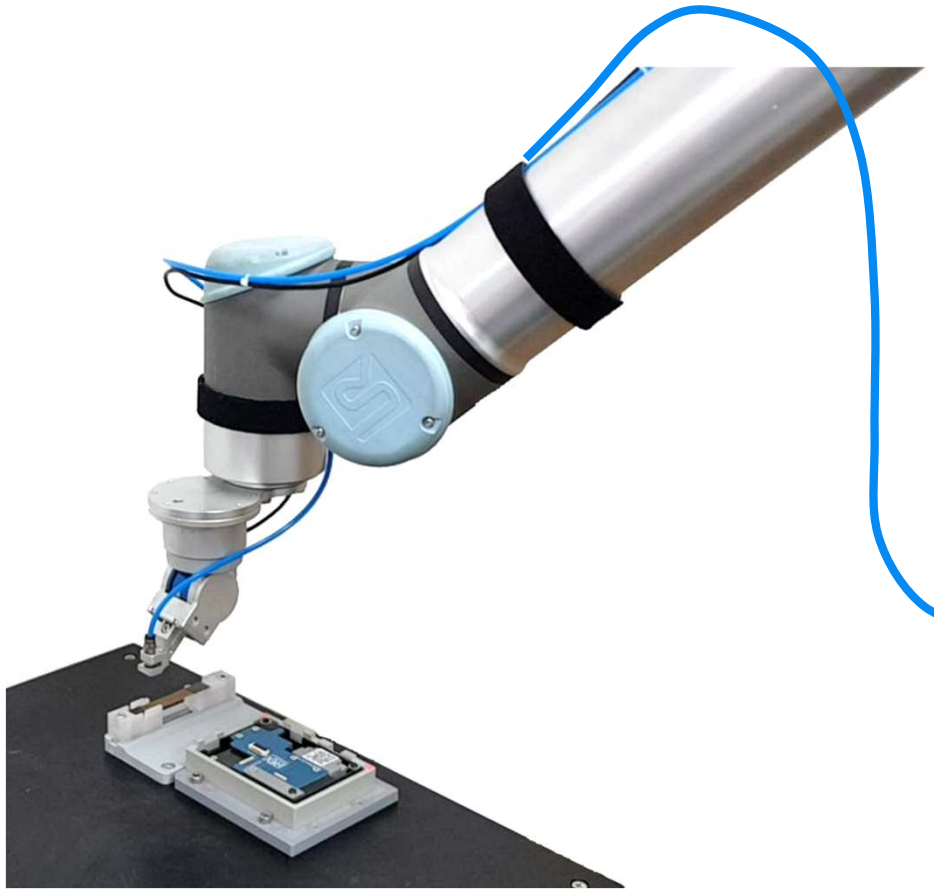
ES-Gripper Installation

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

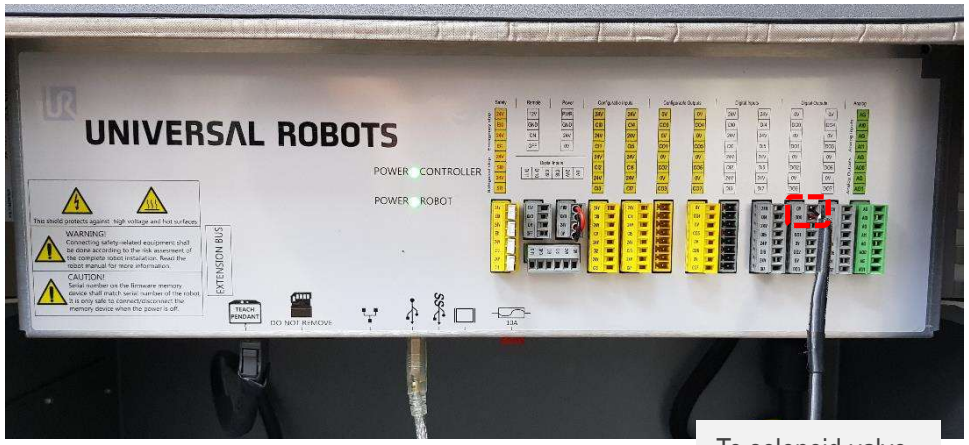


Solenoid valve Installation

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



UR Robot Control system



To solenoid valve

Vacuum generator

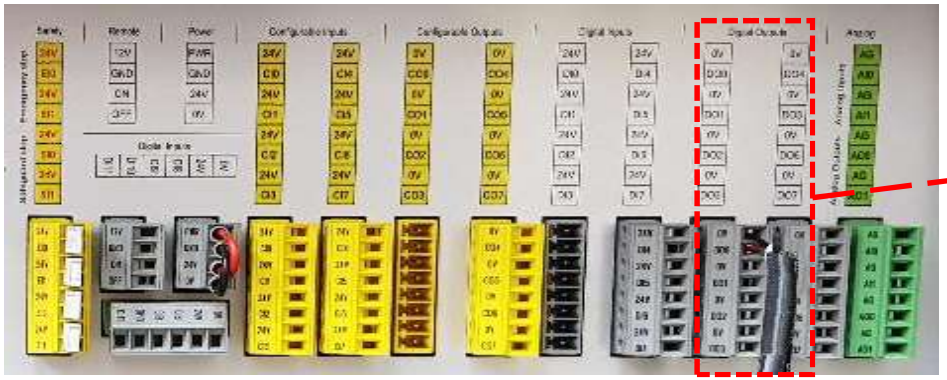
From Air compressor

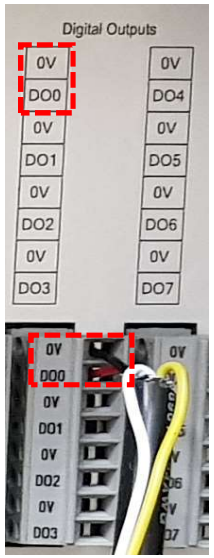
URCap setting for Vacuum generator control

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.

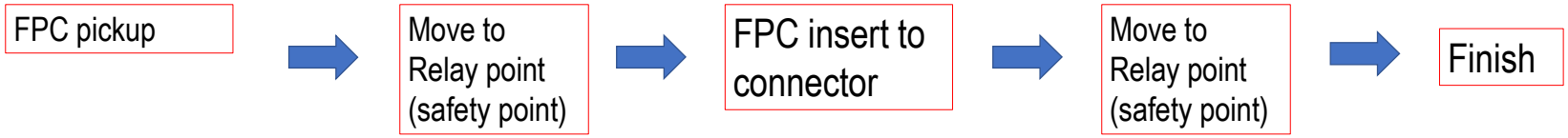




Control box output wiring

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



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

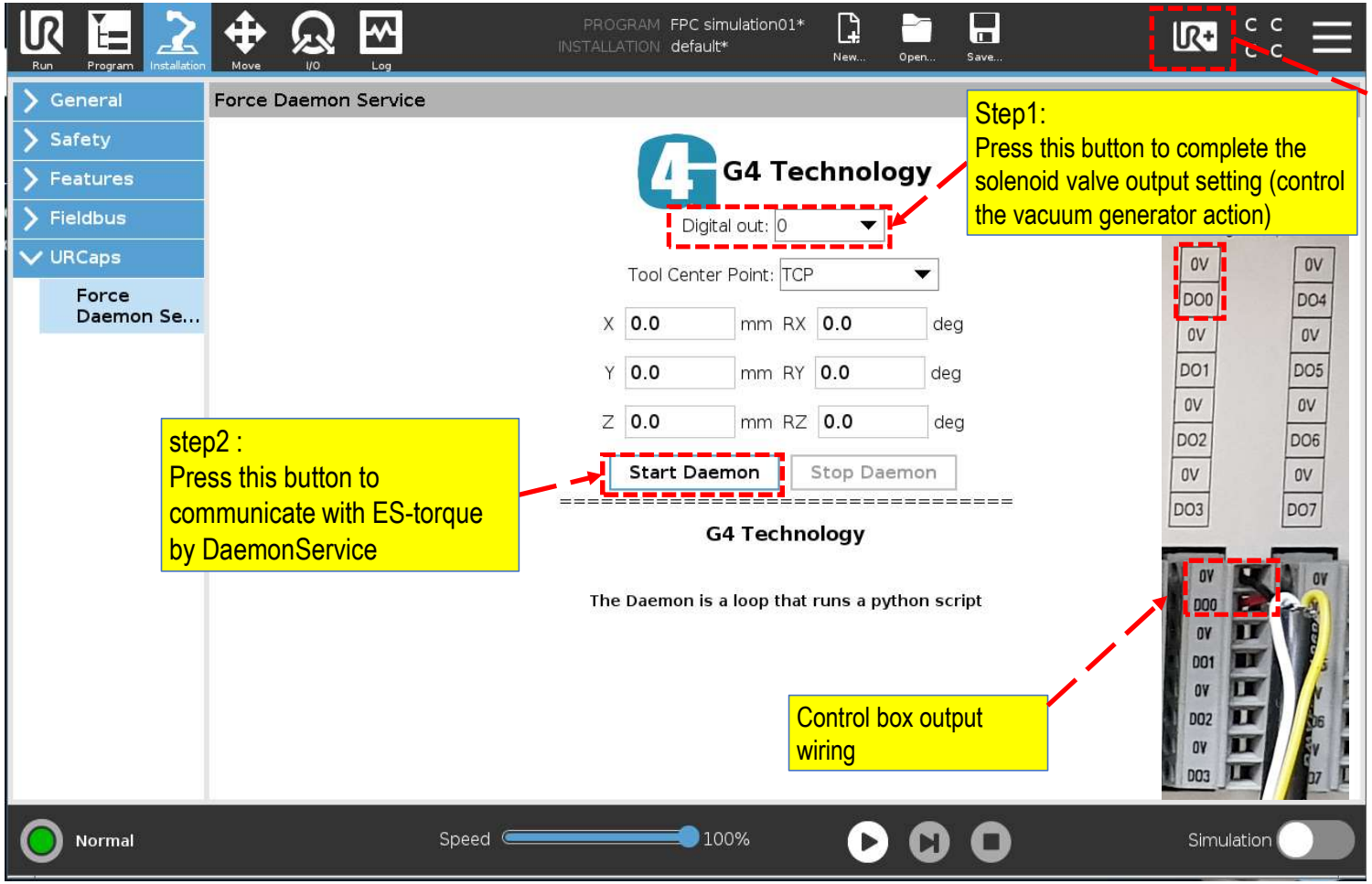
Set the following parameters in Insert page of URCAP

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 & ES-Gripper



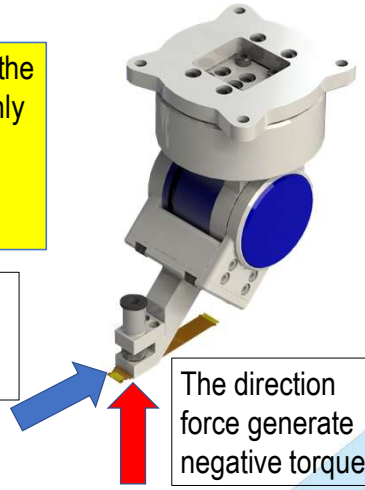
Step1:
Press this button to complete the solenoid valve output setting (control the vacuum generator action)

step2 :
Press this button to communicate with ES-torque by DaemonService

Control box output wiring

Can check the current data of ESTORQ.

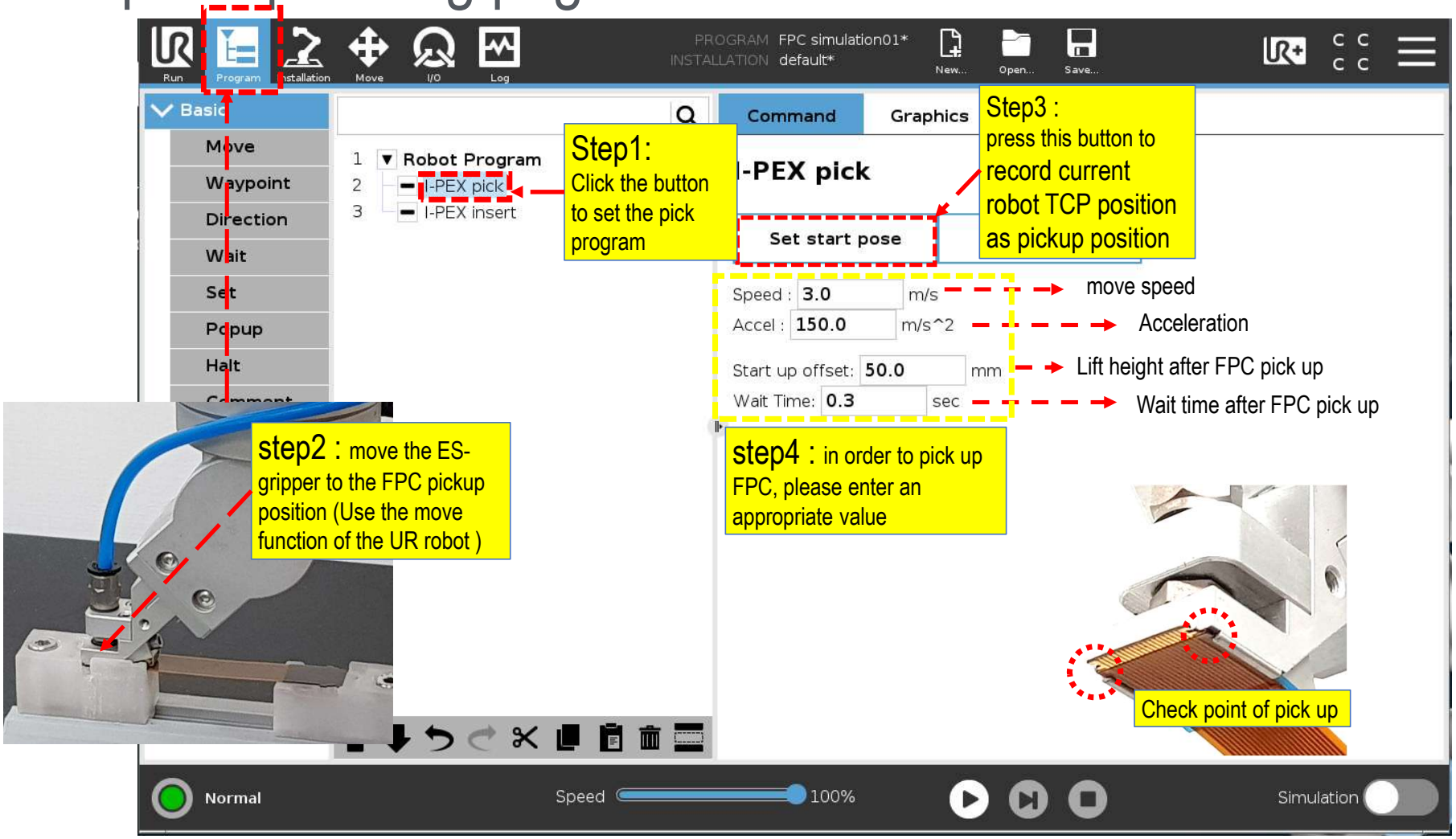
This version of the software can only run under the condition of positive torque.



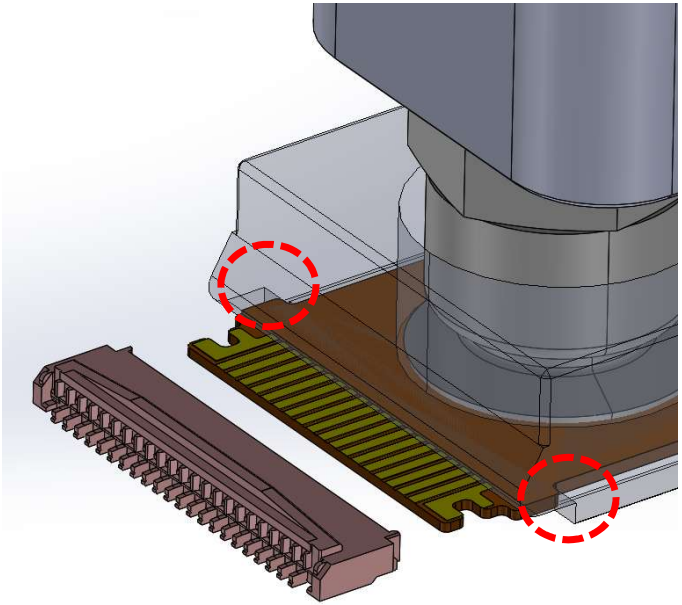
The direction force generate positive torque.

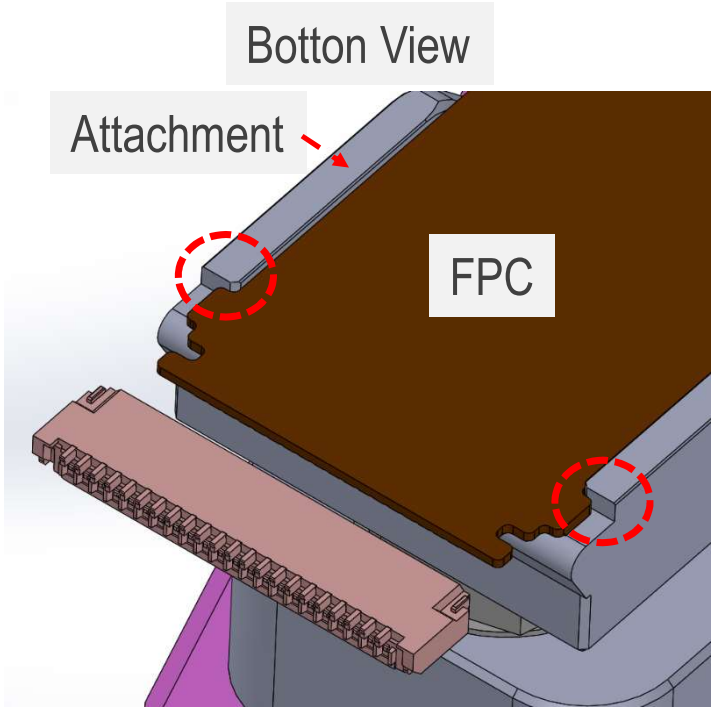
The direction force generate negative torque.

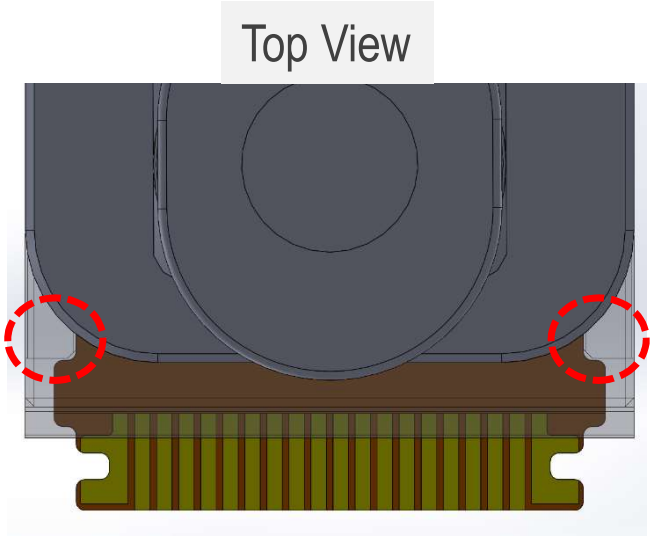
FPC pick up setting page



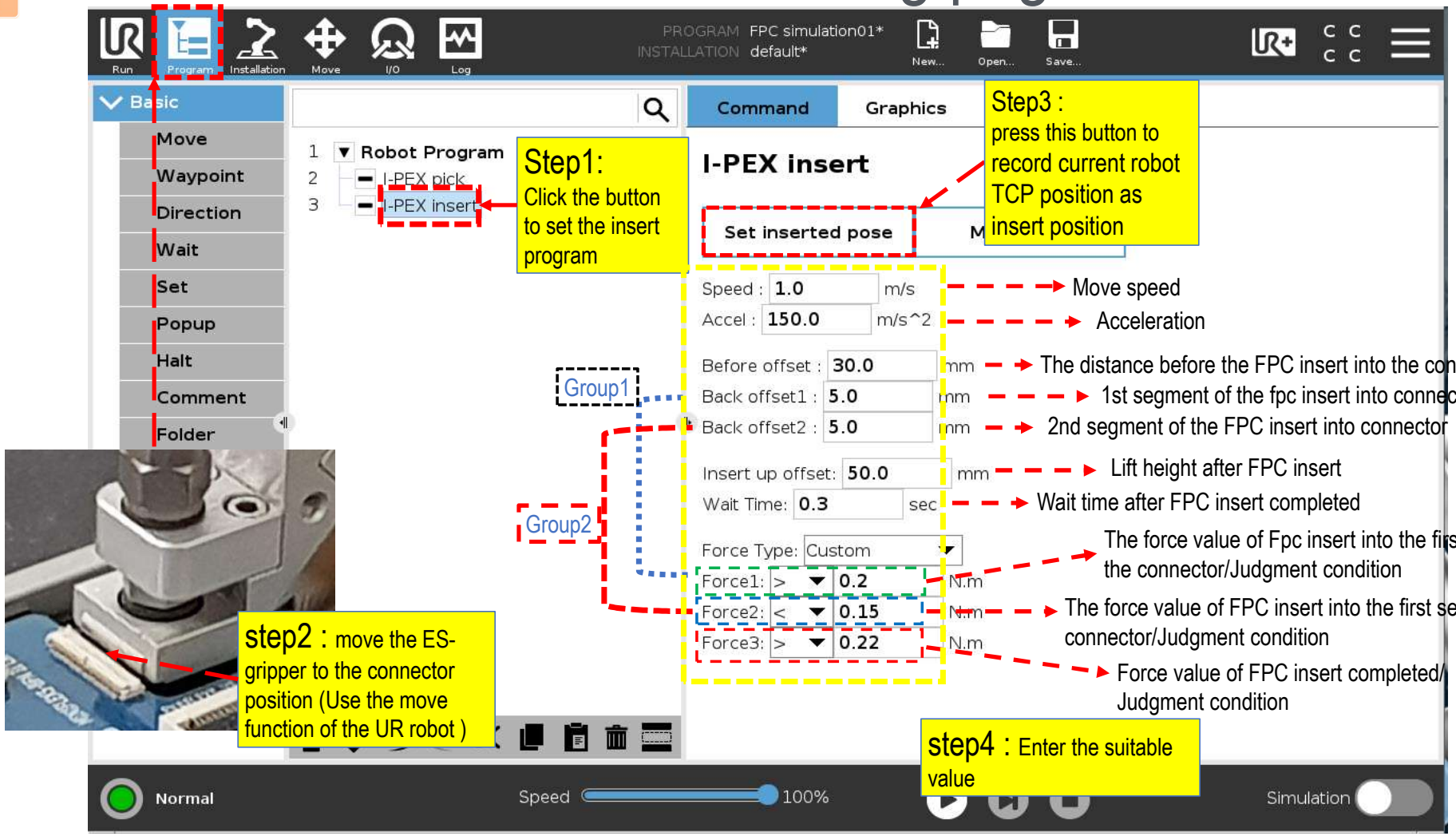
FPC pick up position







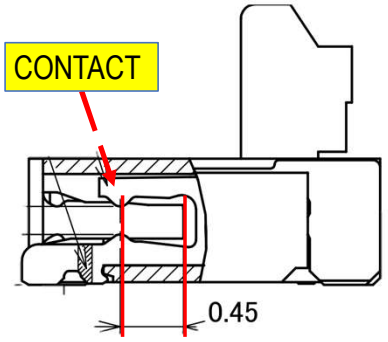
FPC insert into connector setting page

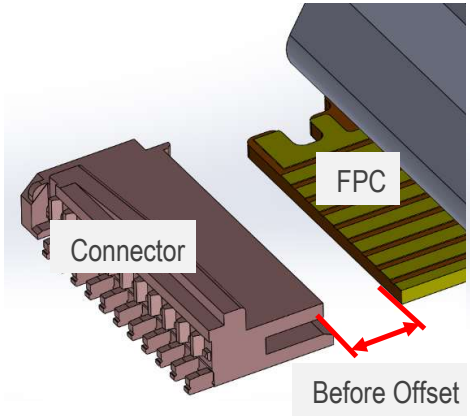


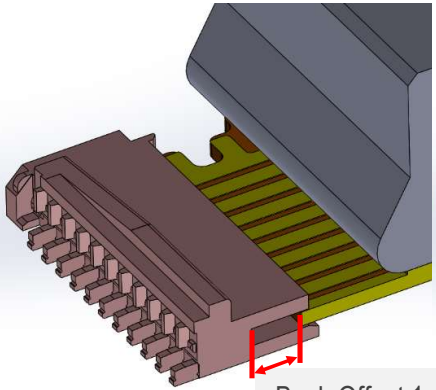
FPC insert connector parameter definition

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.

The parameter of Back Offset 2 can follow the 2D section drawing of connector like the right image.



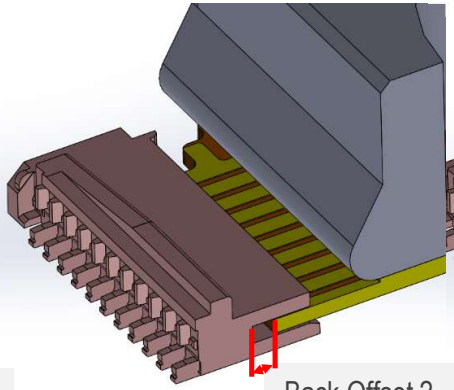




Back Offset 1

Force 1 value

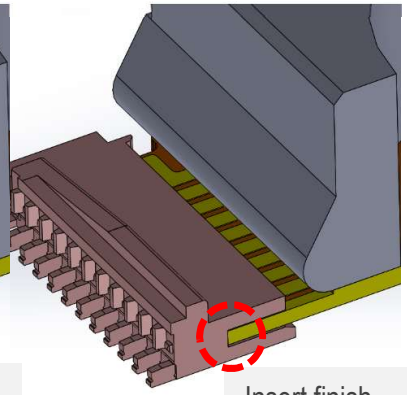
Judge > or <



Back Offset 2

Force 2 value

Judge > or <

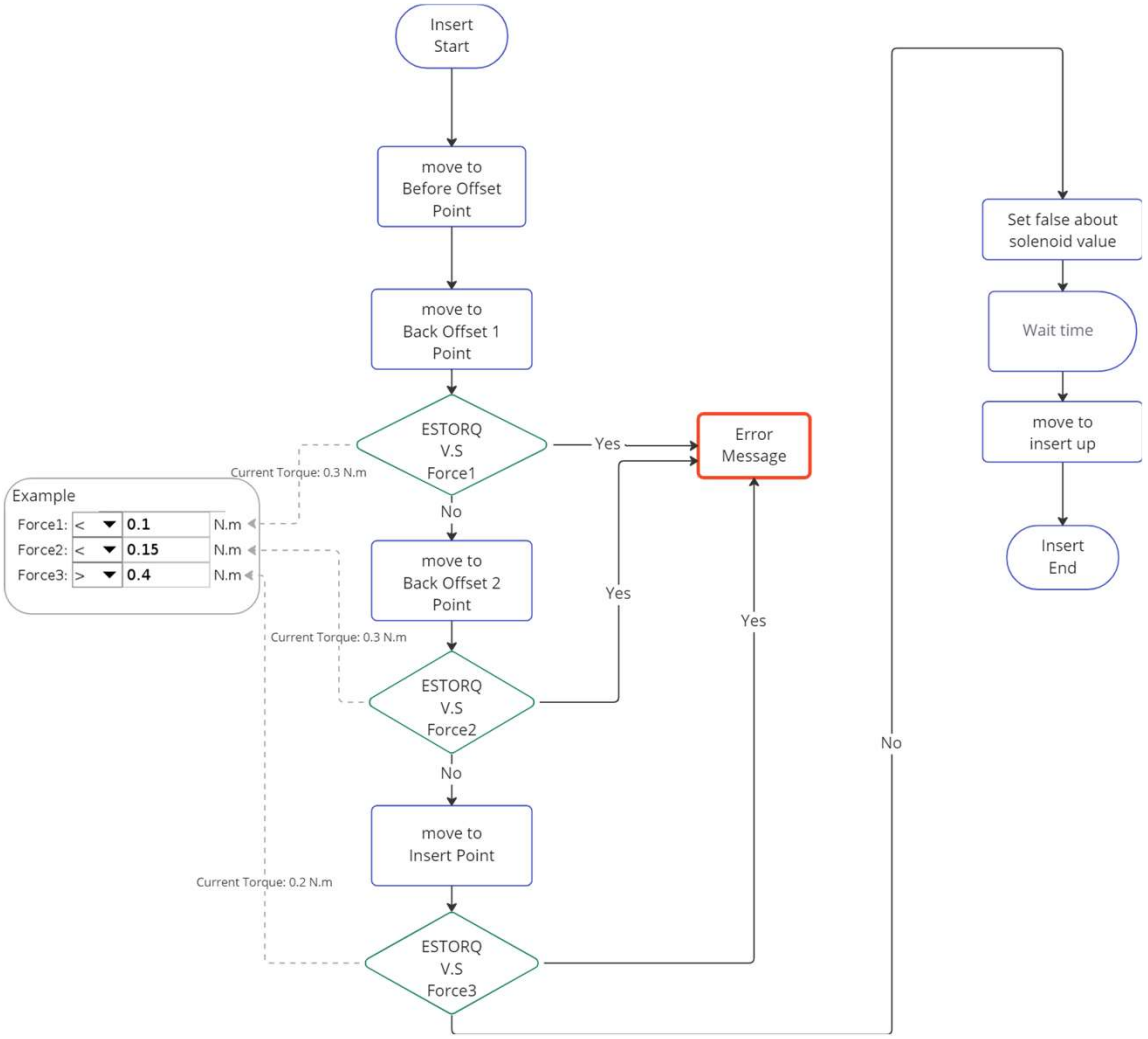


Insert finish

Force 3 value

Judge > or <

FPC insert program work flow



FPC insert into Connector example

I-PEX insert

Set inserted pose	Move here

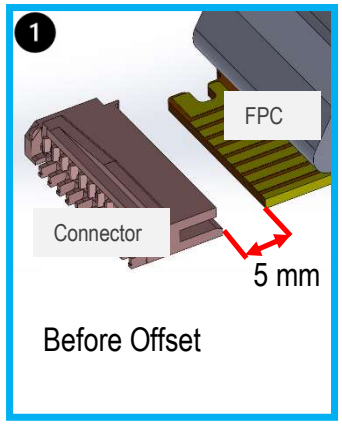
Speed : 0.25 m/s
Accel : 1.2 m/s^2

Before offset : 5.0 mm
Back offset1 : 2.3 mm
Back offset2 : 1.1 mm

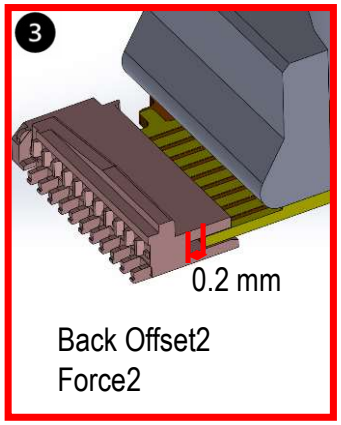
Insert up offset: 20.0 mm
Wait Time: 0.3 sec

Force Type: Custom

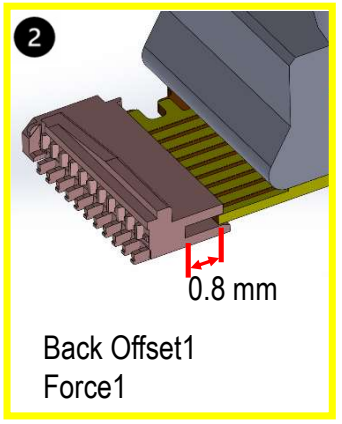
Force1: < 0.1 N.m
Force2: < 0.15 N.m
Force3: > 0.4 N.m



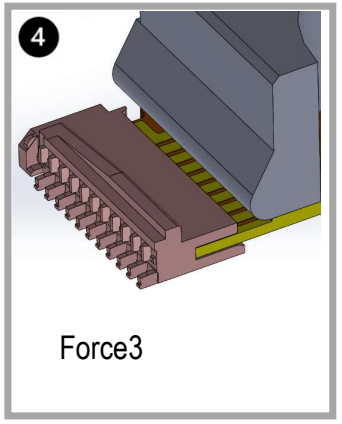
Before Offset



Back Offset2
Force2

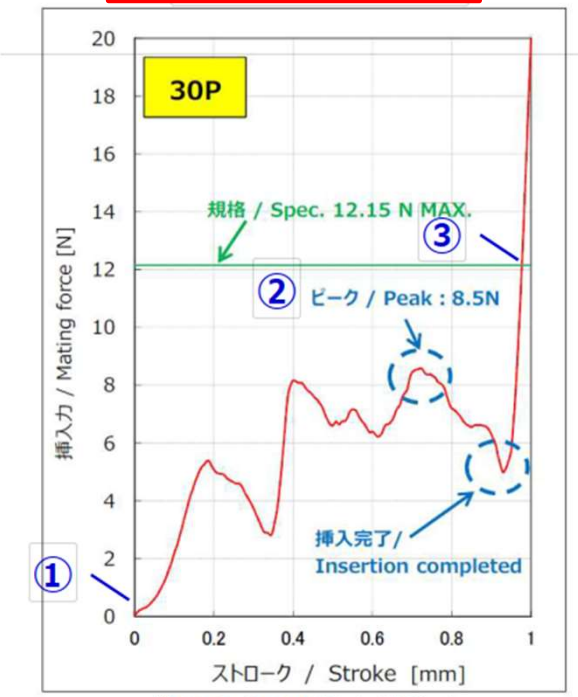


Back Offset1
Force1



Force3

Connector insertion waveform
(define by connector)

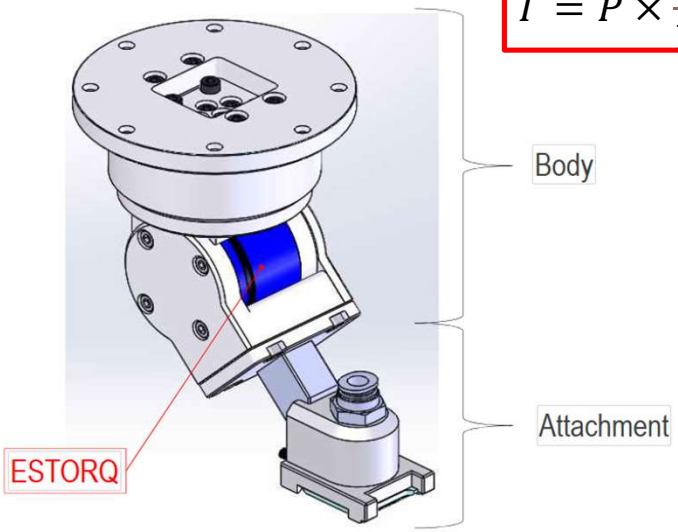


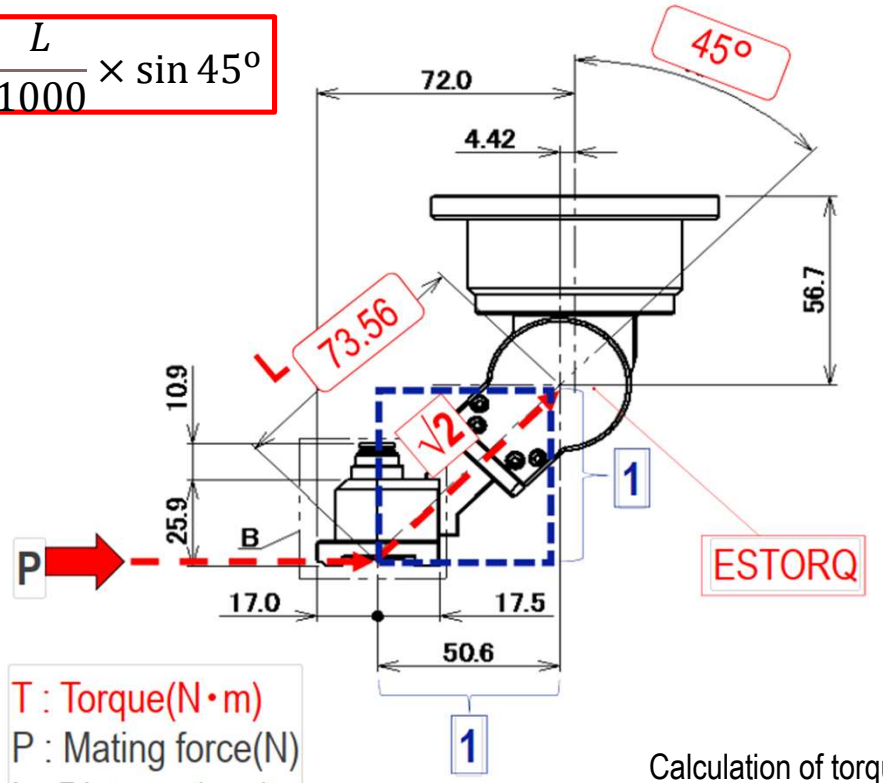
グラフ 3. 30P 挿入力波形 /
Graph3. 30P Mating force waveform

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)

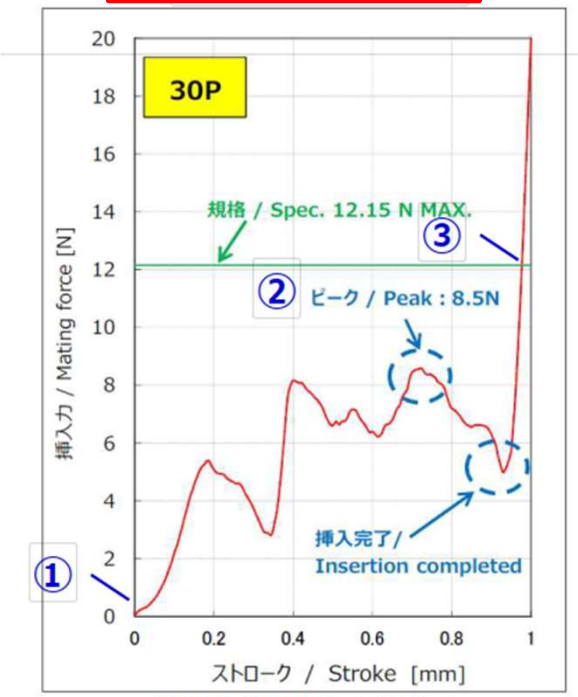
$$T = P \times \frac{L}{1000} \times \sin 45^{o}$$





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
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.

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.