

ES-Gripper Setup Manual in URCap Software

(Installation instructions for Universal Robot e Series)

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

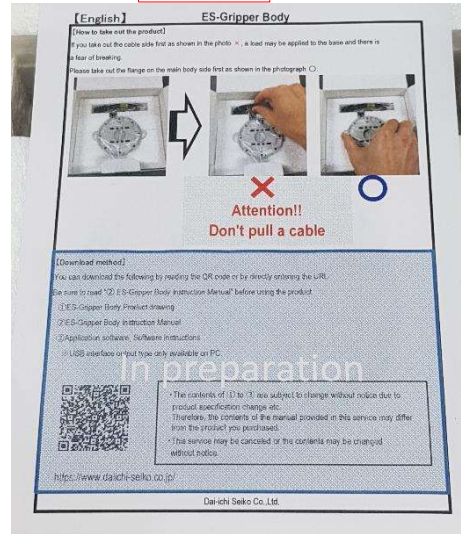
- Contents03
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(URCap version Pick (file name I-PEX_pick-0.2.3.urcap) / Insert (file name I-PEX_insert-0.2.12.urcap)
- Notice24

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 °C (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 : $\Phi 80\text{mm} \times \text{H}96.4\text{mm}$ / Vertical type ; $\Phi 80\text{mm} \times \text{H}94\text{mm}$
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)>

【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)

Recommended P/N AHR001-01-A02-0

PART No.
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

8x $\phi 4.5$
SCREW HOLES FOR FIXING
OPTIMUM SCREW SIZE : M4

$\phi 20.0$ H7 DEPTH 5.0
2x $\phi 6.0$ H7 DEPTH 4.0
P.C.D. $\phi 70.0$

ESTORG
LOGO

BUILT IN MICROCOMPUTER
CABLE
USB

AHR001-01-#01-0 : WITH USB
AHR001-01-#02-0 : WITHOUT USB

3.0 E7 DEPTH 5.0
11.0
5.0
2.40
3.00
4xM3
SCREW HOLE TO FIX
ES-Gripper Attachment
 $\phi 12.0$ H7 DEPTH 7.0
25.0
42.0

VIEW B

VIEW A

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

ANGLE	$\pm 2^\circ$	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.		DATE	
APP.	N.Sueishi	DATE	2019/02/26
REV.	DATE	DWG.	CHK.
REVISION RECORD			
		APP.	K.Masuda
		DATE	2019/02/26

PROJECTION	SERIES No.	CUSTOMER COPY
	-	
TITLE	SCALE	I-PEX sensors
ES-GRIPPER® BODY GENERATION 2 STANDARD TYPE	1:2	
DWG. No.	UNIT	mm
AHR001-01	SIZE	A3
	SHEET	2/2
	REV.	1

Confidential C

DAI-ICHI SEIKO CO., LTD.

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

8x $\phi 4.5$
SCREW HOLES FOR FIXING
OPTIMUM SCREW SIZE : M4

45° 45° 25 $\phi 20$ H7 DEPTH 4
P.C.D. 70 $2x \phi 6$ H7 DEPTH 4

ESTORQ LOGO

$\phi 80$ 6

I-PEX

42

B

34.8 4.4 45°

BUILT IN MICROCOMPUTER

CABLE

USB

106.4 76 2000 $^{+120}$ ₀ 28

A

CABLE POSITION

142° 142° 20°

VIEW B
 θ DIRECTION

$\phi 12$ H7 DEPTH 7

25 42 4xM3
SCREW HOLE TO FIX
ES-Gripper Attachment

VIEW A

3 $^{+0.004}$ _{$^{-0.014}$} DEPTH 5

11 5 24 30

NOTES

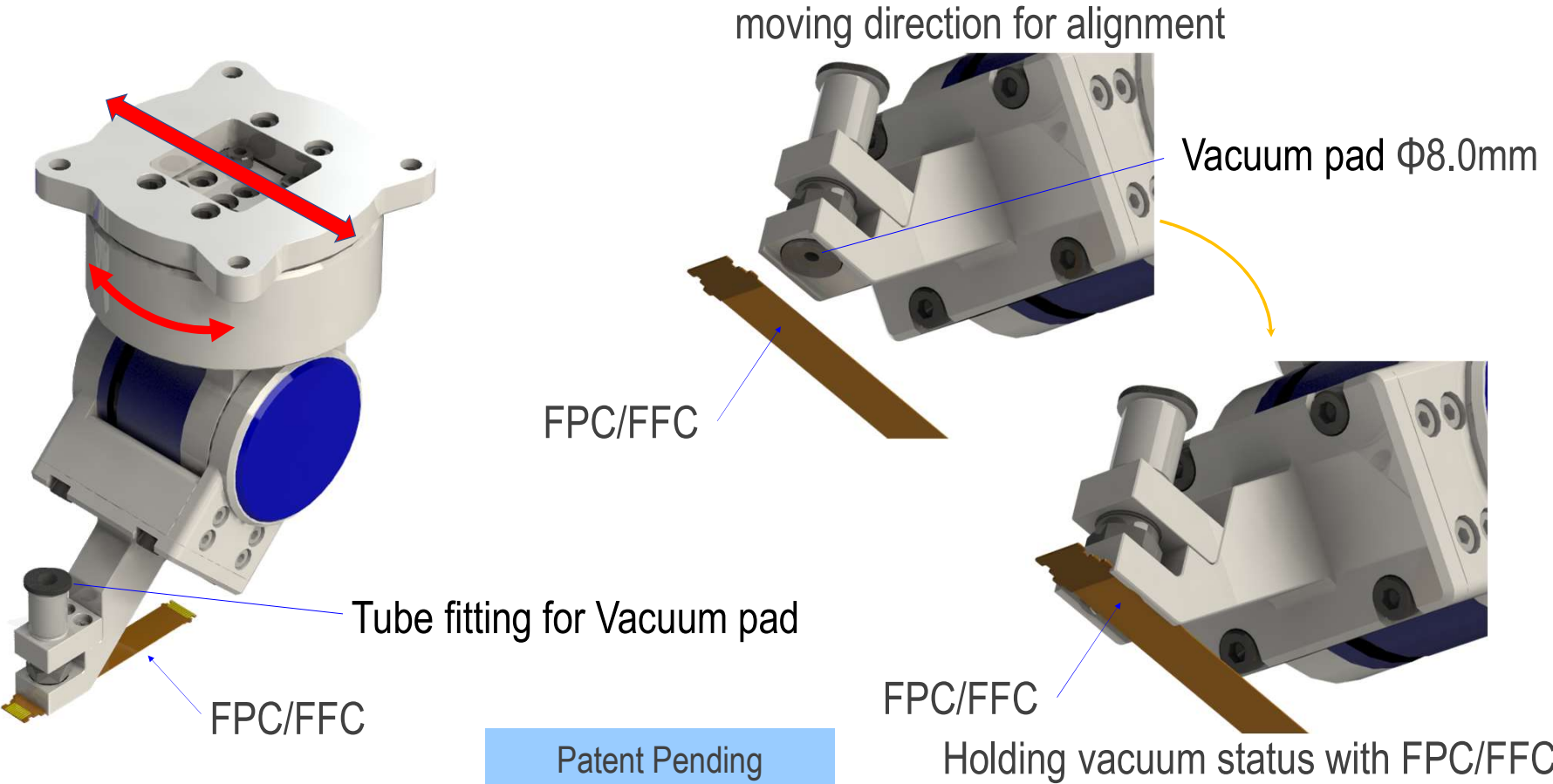
- MATERIAL FRAMEWORK : ALUMINIUM
- WEIGHT : ABOUT 460 g
- ES-Gripper Body USES MAGNETIC PARTS.

ANGLE $\pm 2^\circ$ 6 OVER 30 MAX. ± 0.3			SERIES No. -	CUSTOMER COPY								
6 MAX. ± 0.2 30 OVER 120 MAX. ± 0.5												
GENERAL TOLERANCE												
DWG.	H.Tagomori	DATE	2020/02/06	TITLE ES-GRIPPER® BODY GENERATION 2 OMNIDIRECTIONAL TYPE								
CHK.	Y.Aiba	DATE	2020/02/12									
REV.	DATE	DWG.	CHK.	APP.	T.Hirakawa	DATE	2020/02/12	DWG. No.	AHR004	SCALE	1:2	
REVISION RECORD		SIZE		SHEET		REV.		0				

Confidential C

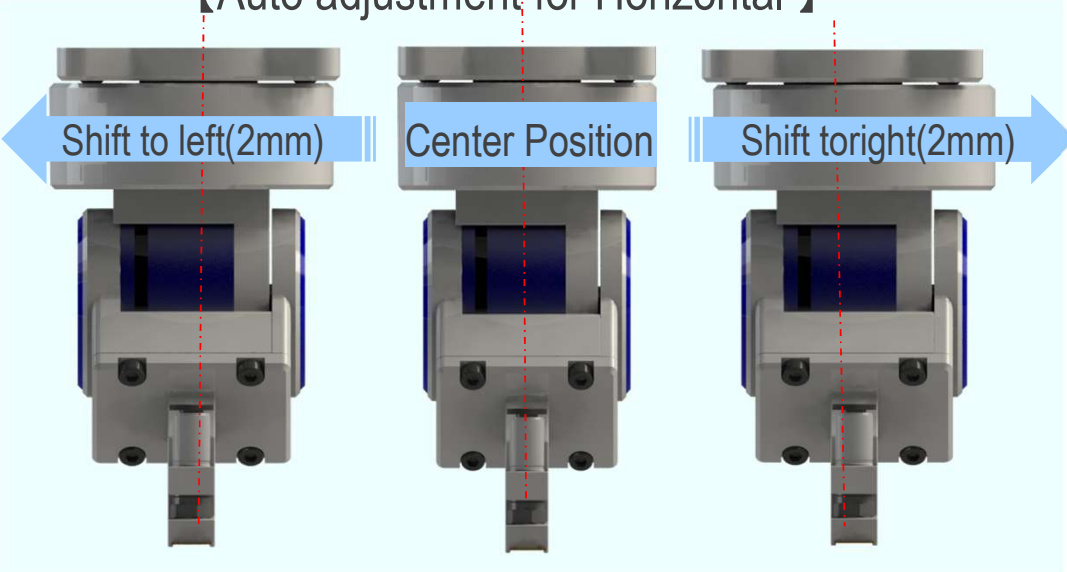
I-PEX Inc.

Connection assembly application (Floating function for Pick up FPC)

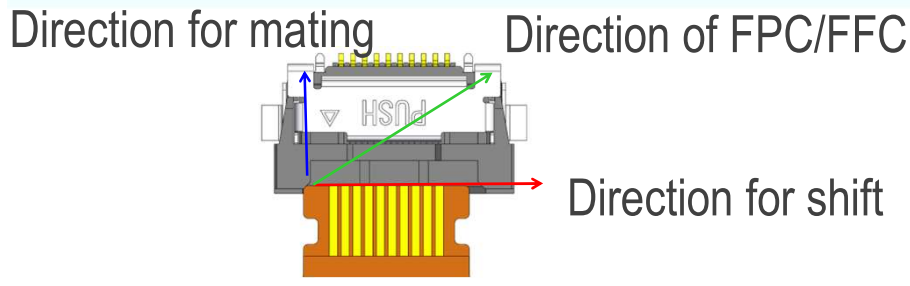
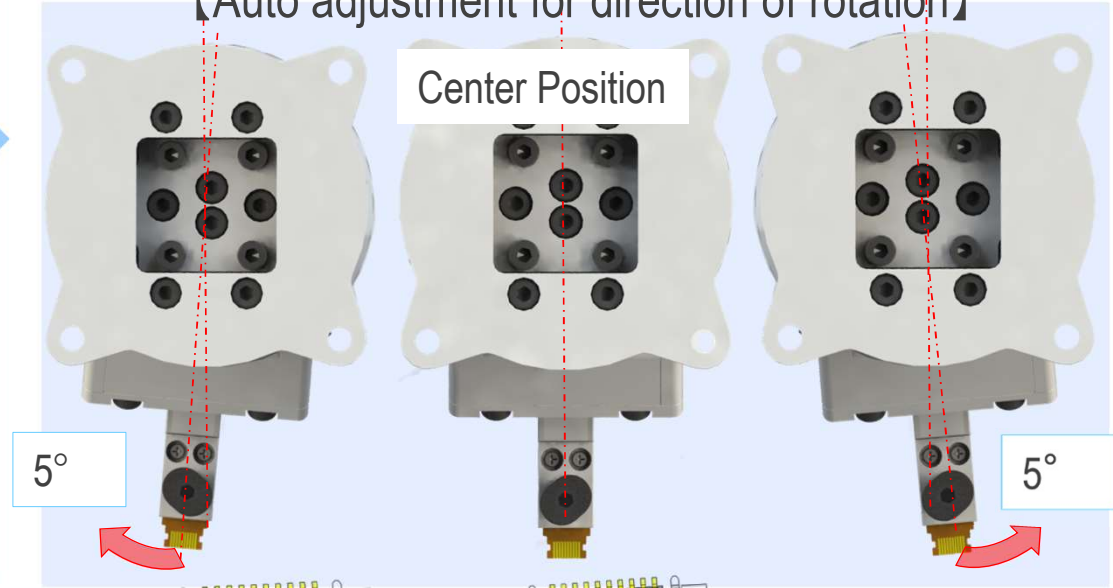


Connection assembly application (Floating function for misalignment of pitch and θ direction)

【Auto adjustment for Horizontal】

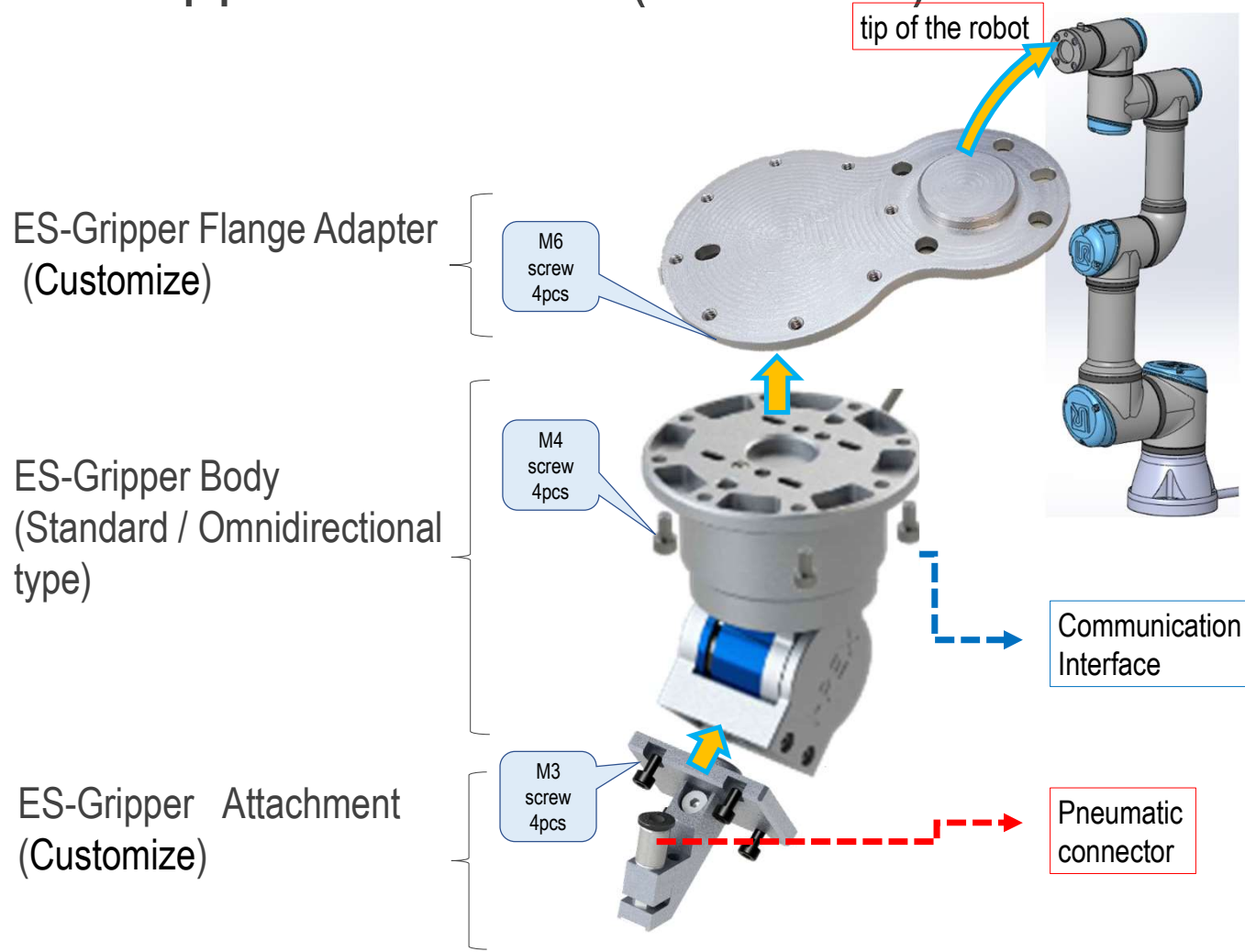


【Auto adjustment for direction of rotation】



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

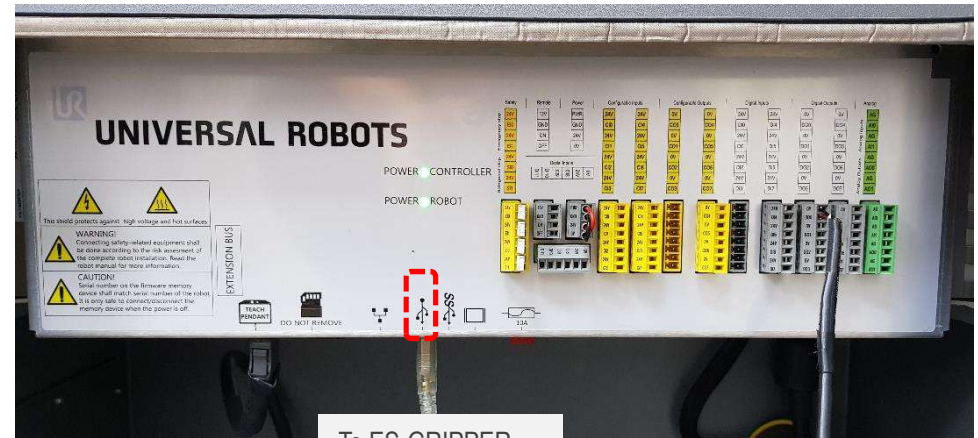
(Use $\phi 4$ air hoses connection to vacuum control valve here)

ES-Gripper Installation

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



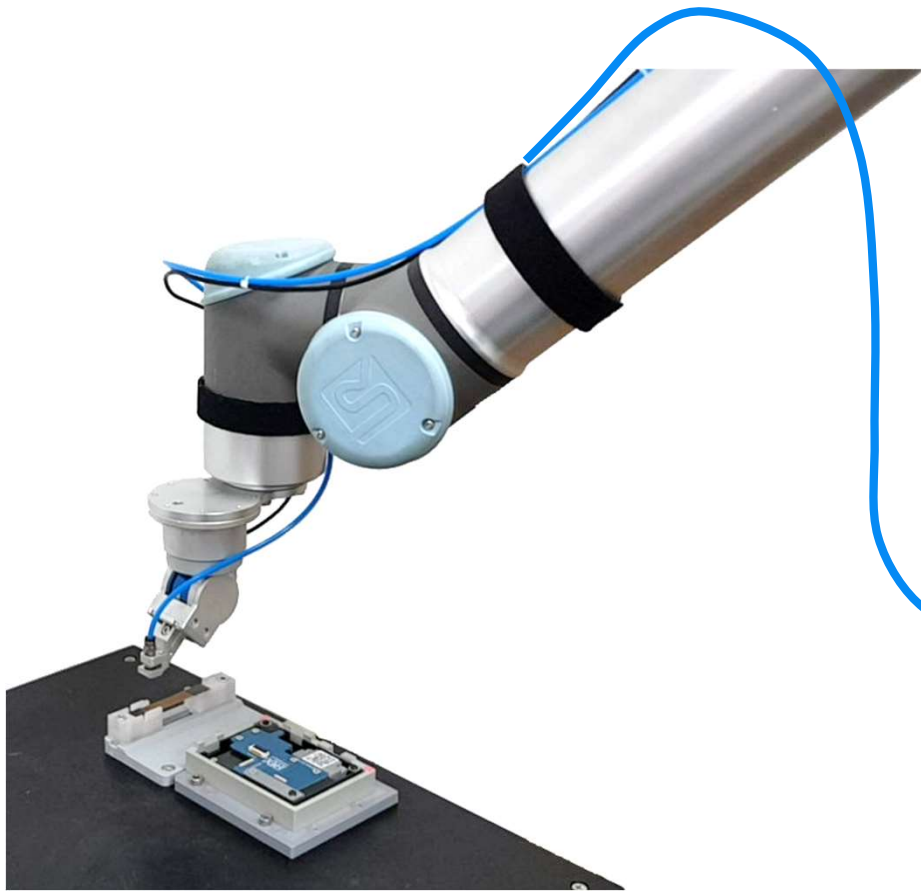
UR Robot Control system



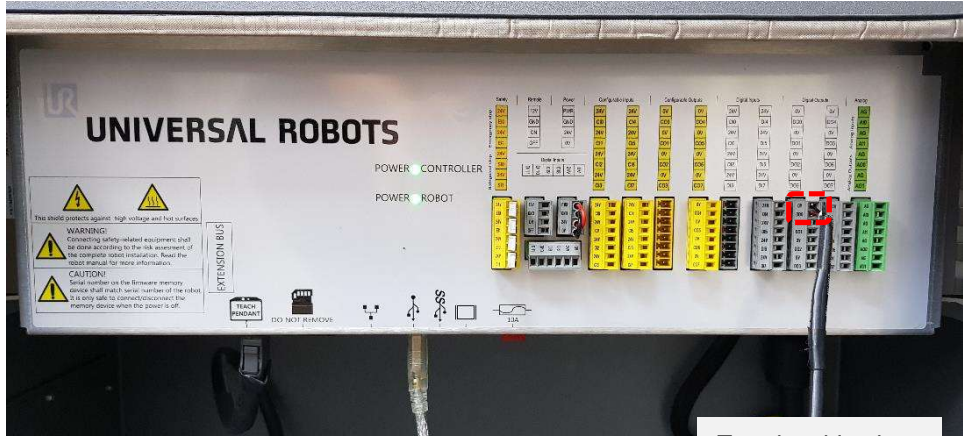
To ES-GRIPPER
(USB 2.0)

Solenoid valve Installation

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



UR Robot Control system



To solenoid valve

Vacuum generator



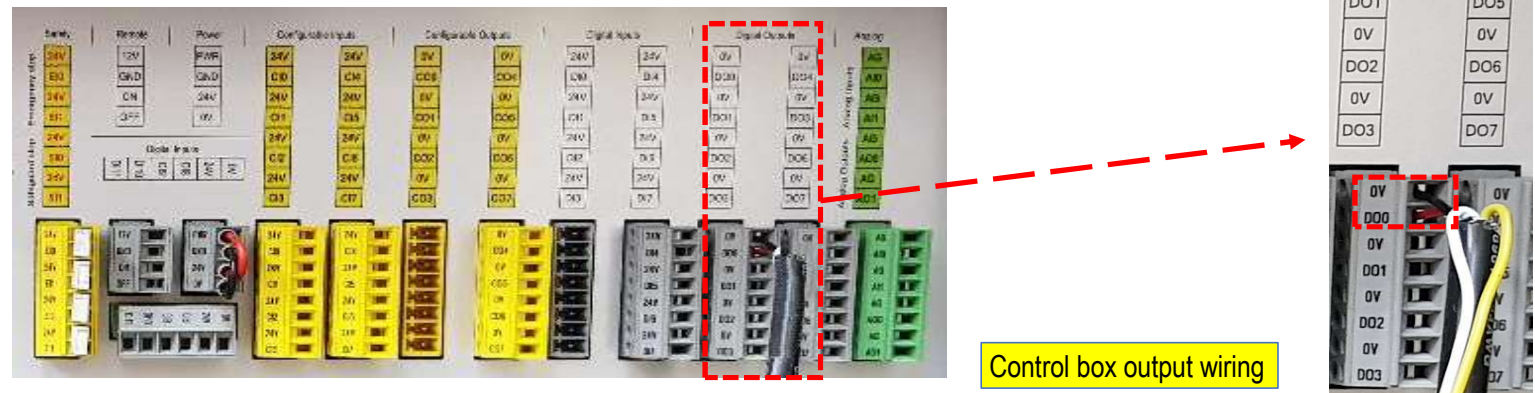
From Air compressor

URCap setting for Vacuum generator control

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

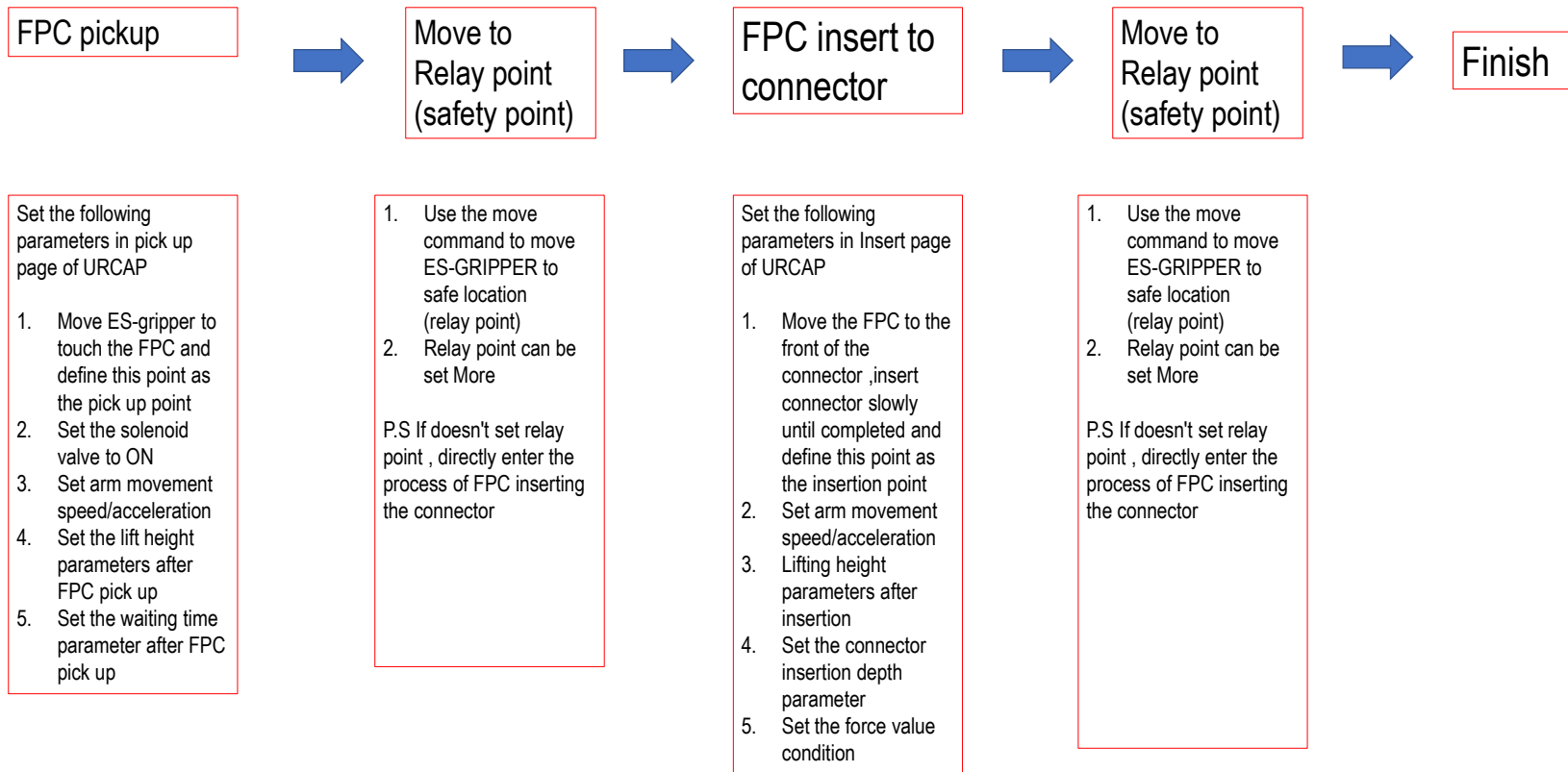
Control of the solenoid valve output is only possible via the separate digital supply lines. If the solenoid valve output is deactivated, the digital outputs are not used in the program.

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



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 valve . The output address to be configured refers to the numbering of the ports shown above.

Connector insertion process description



URCap setting for Vacuum generator control & ES-Gripper

The screenshot shows the URCap software interface for the 'Force Daemon Service'. The top menu bar includes 'Run', 'Program', 'Installation', 'Move', 'I/O', and 'Log'. The main window displays 'G4 Technology' settings, including a 'Digital out' dropdown set to '0', 'Tool Center Point' set to 'TCP', and coordinate fields for X, Y, Z, RX, RY, and RZ, all set to 0.0. Below these are 'Start Daemon' and 'Stop Daemon' buttons. A 'Control box output wiring' diagram shows a terminal block with terminals DO0 through DO7, with DO0 highlighted. A status bar at the bottom shows 'Normal' mode, a speed slider at 100%, and a 'Simulation' toggle.

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

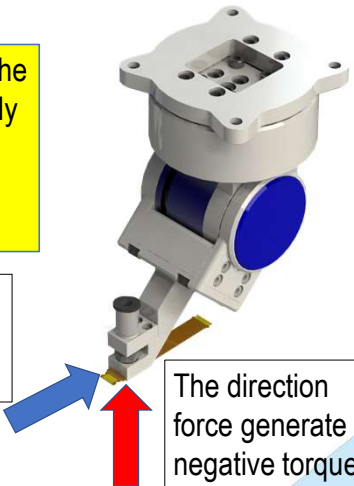
The screenshot shows the 'Force Toolbar' with the text 'Current Force: 0.0 N.m'.

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

Step1: Click the button to set the pick program

Step2: move the ES-gripper to the FPC pickup position (Use the move function of the UR robot)

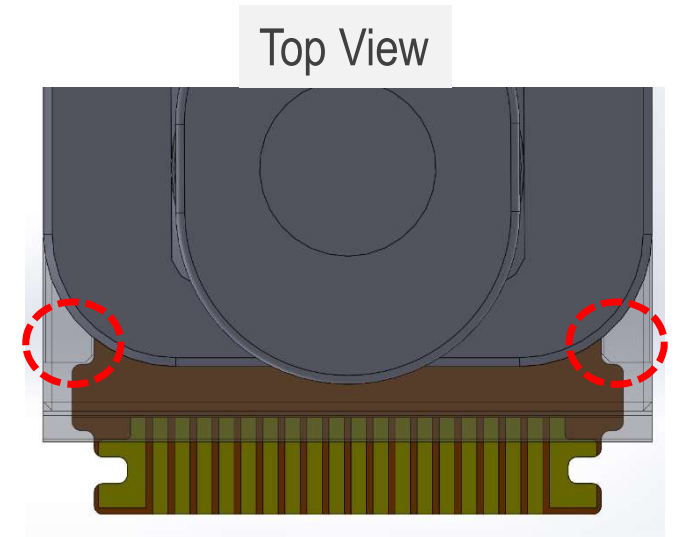
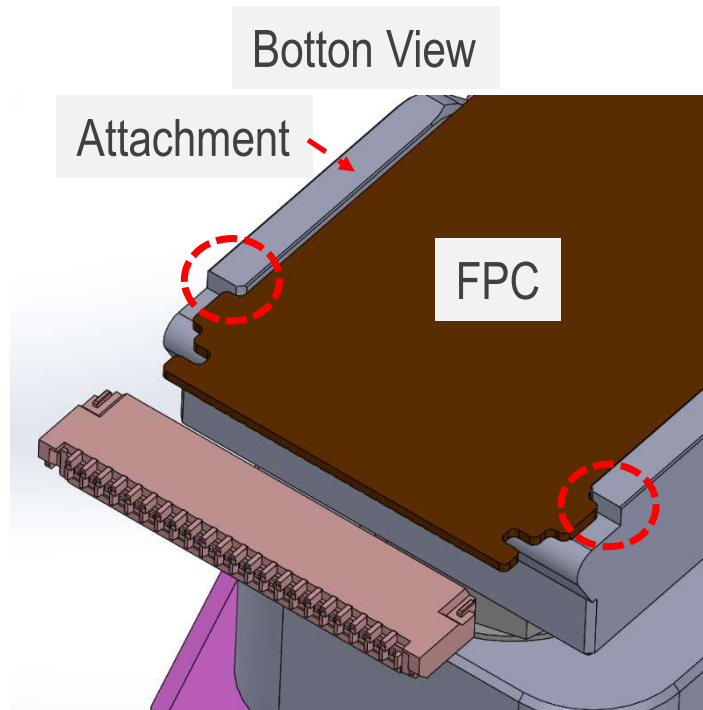
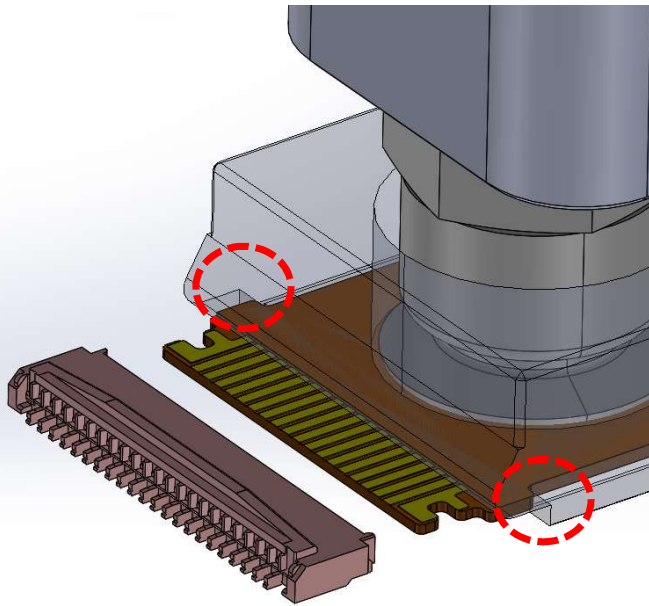
Step3: press this button to record current robot TCP position as pickup position

Step4: in order to pick up FPC, please enter an appropriate value

Check point of pick up

Speed : 3.0 m/s → move speed
Accel : 150.0 m/s² → Acceleration
Start up offset: 50.0 mm → Lift height after FPC pick up
Wait Time: 0.3 sec → Wait time after FPC pick up

FPC pick up position



FPC insert into connector setting page

Step1: Click the button to set the insert program

Step2: move the ES-gripper to the connector position (Use the move function of the UR robot)

Step3: press this button to record current robot TCP position as insert position

Step4: Enter the suitable value

Group1: Before offset, Back offset1, Back offset2

Group2: Force1, Force2, Force3

Speed: 1.0 m/s → Move speed

Accel: 150.0 m/s² → Acceleration

Before offset: 30.0 mm → The distance before the FPC insert into the connector

Back offset1: 5.0 mm → 1st segment of the fpc insert into connector

Back offset2: 5.0 mm → 2nd segment of the FPC insert into connector

Insert up offset: 50.0 mm → Lift height after FPC insert

Wait Time: 0.3 sec → Wait time after FPC insert completed

Force1: 0.2 N.m → The force value of Fpc insert into the first segment of the connector/Judgment condition

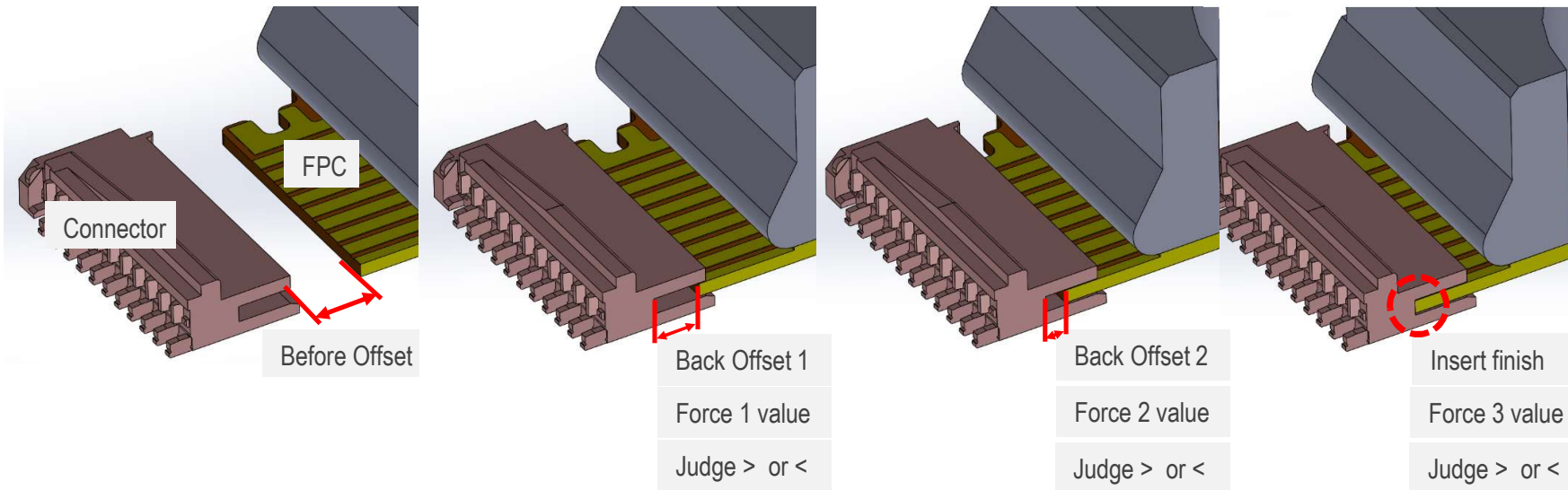
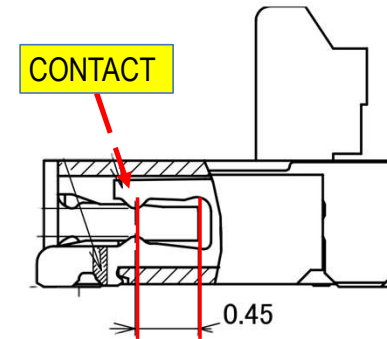
Force2: 0.15 N.m → The force value of FPC insert into the first segment of the connector/Judgment condition

Force3: 0.22 N.m → Force value of FPC insert completed/Judgment condition

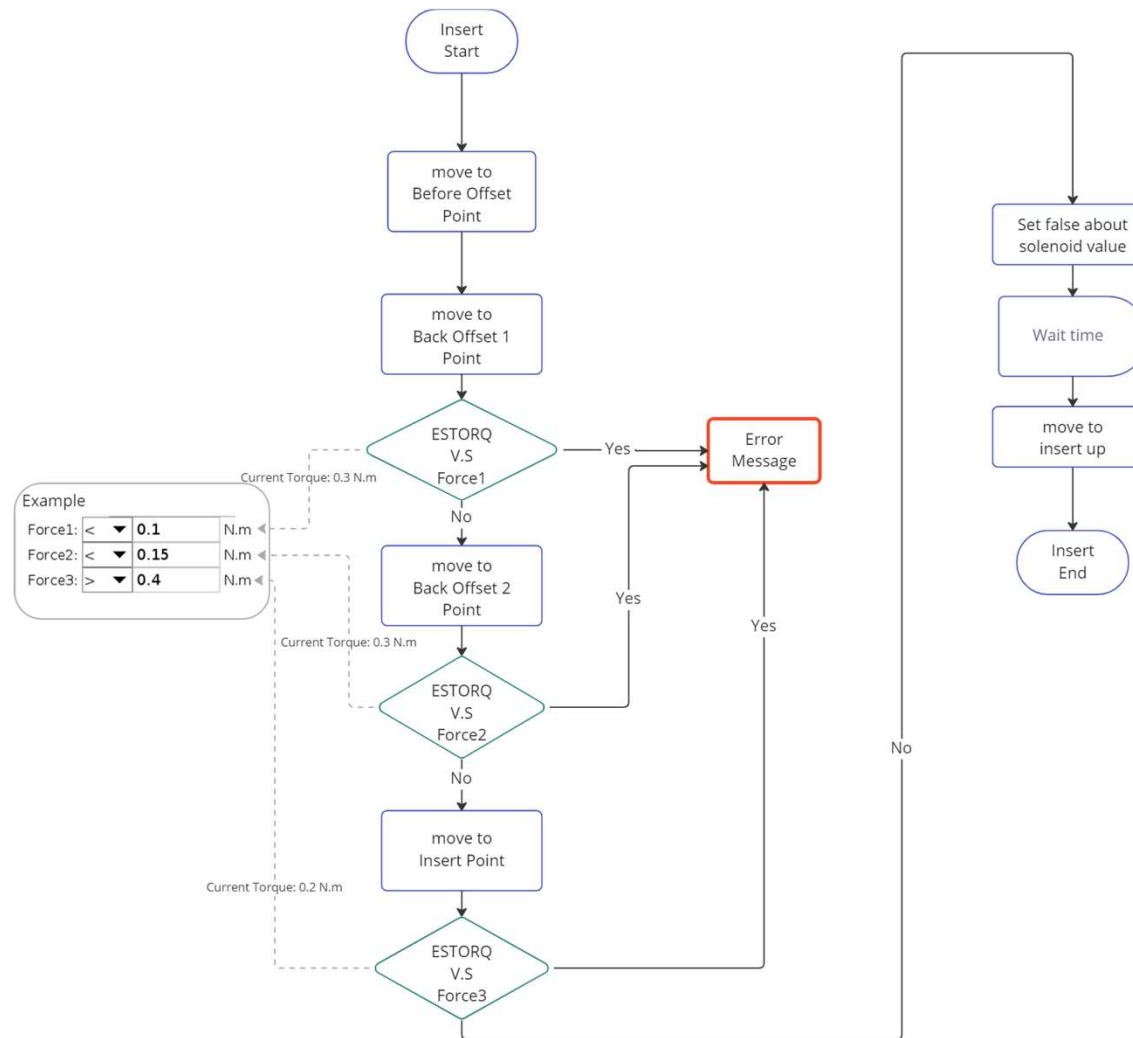
FPC insert connector parameter definition

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.

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



FPC insert program work flow



FPC insert into Connector example

I-PEX insert

Set inserted pose	Move here
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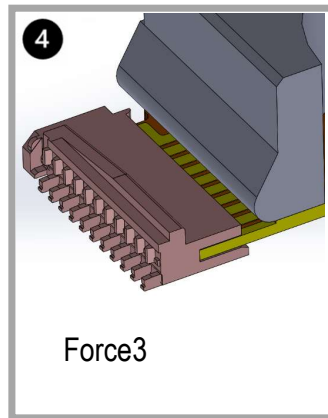
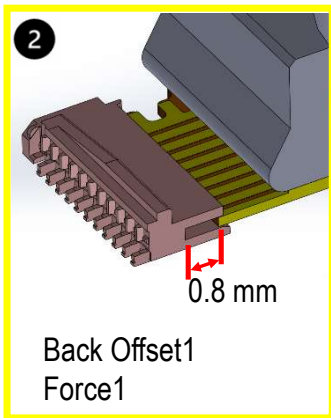
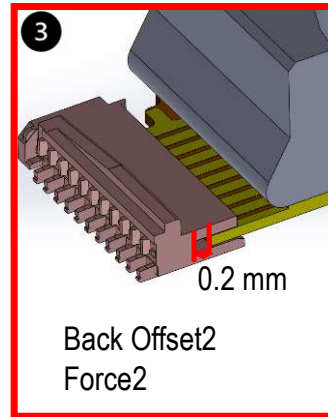
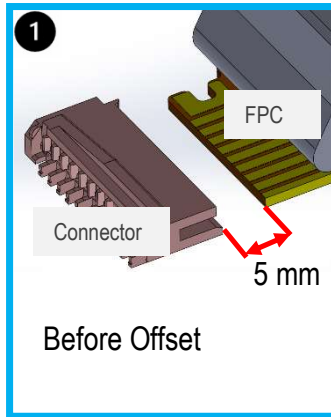
Speed : 0.25 m/s
 Accel : 1.2 m/s²

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

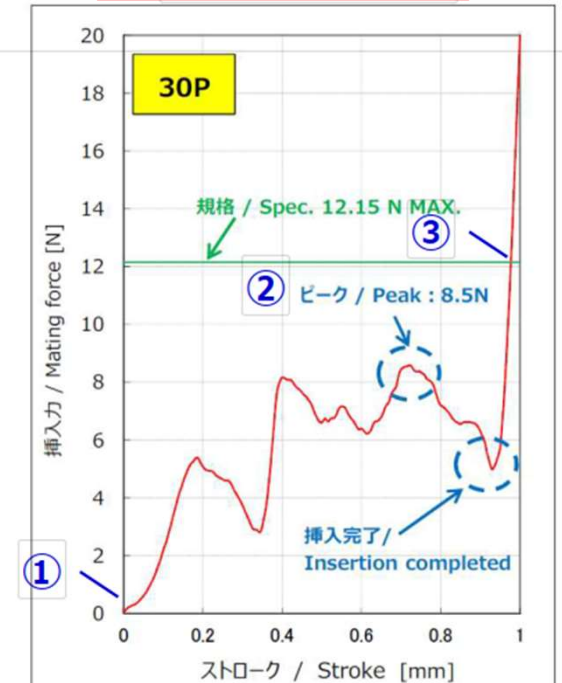
Insert up offset: 20.0 mm
 Wait Time: 0.3 sec

Force Type: Custom

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



Connector insertion waveform (define by connector)

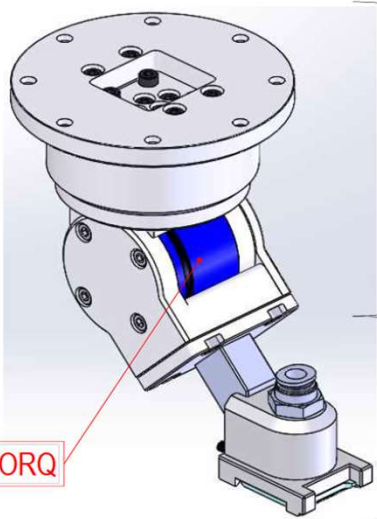


グラフ3. 30P 挿入力波形 / Graph3. 30P Mating force waveform

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

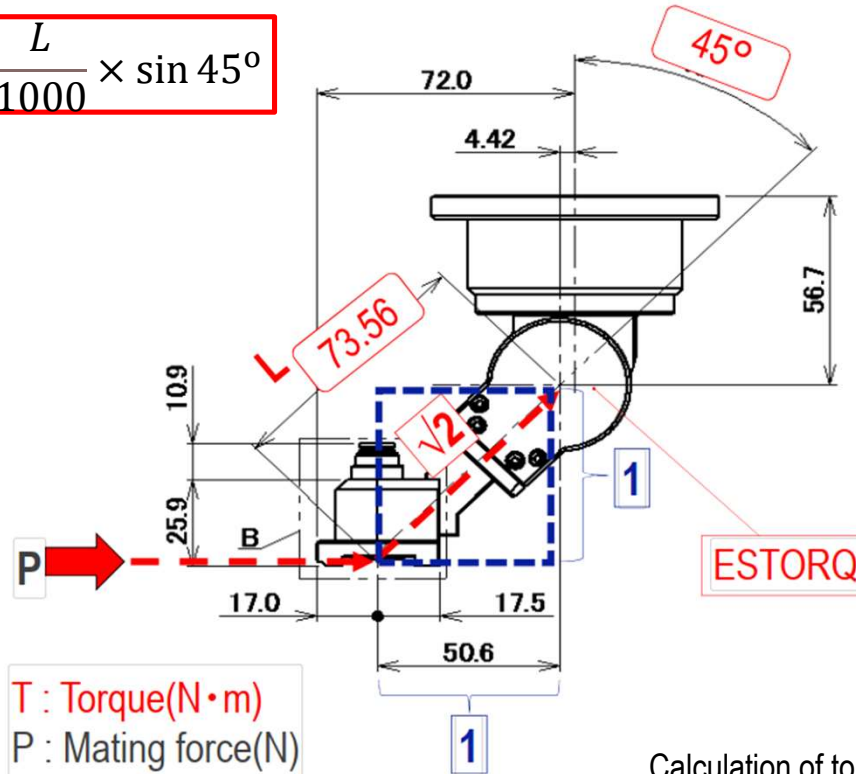
Torque calculation of connector insertion force)

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

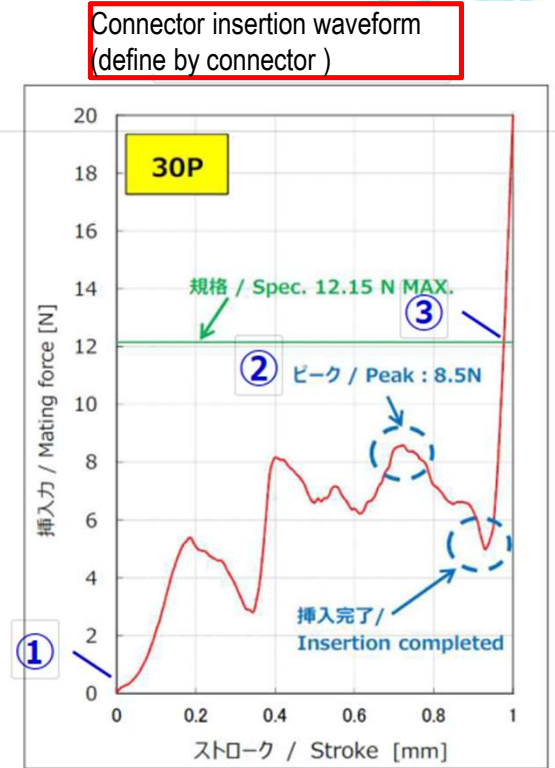


Body

Attachment



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



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

- Calculation of torque at insertion
- ① Before PLUG insertion : 0N ⇒ 0N · m
 - ② Peak : 8.5N = 0.442N · m
 - ③ Mating 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.

I-PEX

