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UFACTORY xARM

6 AXIS FORCE TORQUE SENSOR

SHENZHEN UFACTORY CO., LTD
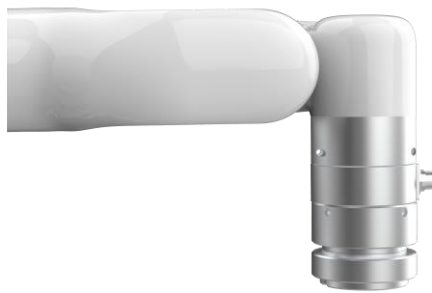
V 2.0.0

Table

1. General Presentation

1.1. Introduction

6 Axis Force Torque Sensor

The xArm 6 Axis Force Torque Sensor is designed for force and torque data acquisition on xArm, it can simultaneously measure the force and torque in three-dimensional space. It is installed on the xArm tool flange, a flexible cable is used for power and communications.

1.2. Singal Hub

The 6 Axis Force Torque Sensor needs to be used with the signal hub. The signal hub has five electrical interfaces.
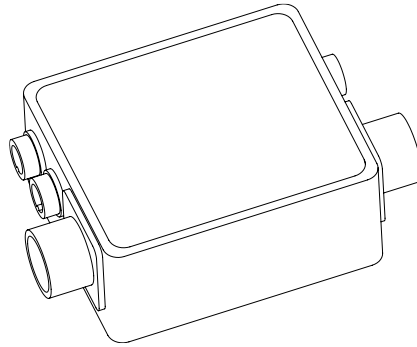
Singal Hub

2. Safety

The operator must read and understand all the instructions below before running the 6 Axis Force Torque Sensor.

2.1. Warning

1. The 6 Axis Force Torque Sensor needs to be properly installed before operating.

2. Do not install or operate the 6 Axis Force Torque Sensor that is damaged or lacking parts.

3. Never supply the 6 Axis Force Torque Sensor with an alternative current (AC) source.

4. Make sure all cord sets are always secured at both ends, the 6 Axis Force Torque Sensor end & Robot end.

5. Always satisfy the 6 Axis Force Torque Sensor's load specifications.

6. Be sure nothing is in the robot and the 6 Axis Force Torque Sensor path before using.

Caution

The term "operator" refers to anyone responsible for any of the following operations on the 6 Axis Force Torque Sensor:

● **Installation**

● **Control**

● **Maintenance**

● **Inspection**

● **Decommissioning**

● **Calibration**

This documentation explains the various components of the 6 Axis Force Torque Sensor and general operations regarding the whole life-cycle of the product from installation to operation and decommissioning.

The drawings and photos in this documentation are representative examples and differences may exist between them and the delivered product.

2.2. Risk Assessment and Final Application

The 6 Axis Force Torque Sensor is meant to be used on an industrial robot. The robot, force torque sensor and any other equipment used in the final application must be evaluated with a risk assessment. The robot

integrator must ensure that all local safety measures and regulations are

respected. Depending on the application, there may be risks that need

additional protection/safety measures, for example, the work-piece 6

Axis Force Torque Sensor is manipulating may be inherently dangerous

to the operator.

2.3. Validity and Responsibility

Always comply with local and/or national laws, regulations and

directives on automation safety and general machine safety.

The unit may be used only within the range of its technical data. Any

other use of the product is deemed improper and unintended use.

UFACTORY will not be liable for any damages resulting from any

improper or unintended use.

3. Installation

The following subsections will guide you through the installation and

general setup of 6 Axis Force Torque Sensor.

(1) The Scope of Delivery section

(2) The Mechanical Installation section

Warning

Before installing:

Read and understand the safety instructions related to the 6 Axis Force

Torque Sensor.

Verify your package according to the Scope of delivery and your order

info.

Have the required parts, equipment and tools listed in the requirements

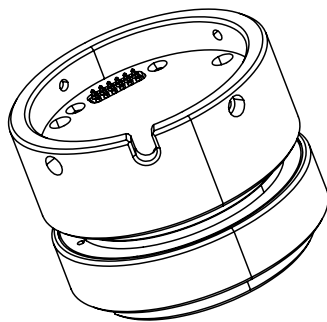readily available.

Installing:

Satisfy the environmental conditions.

Do not operate the 6 Axis Force Torque Sensor, or even turn on the power

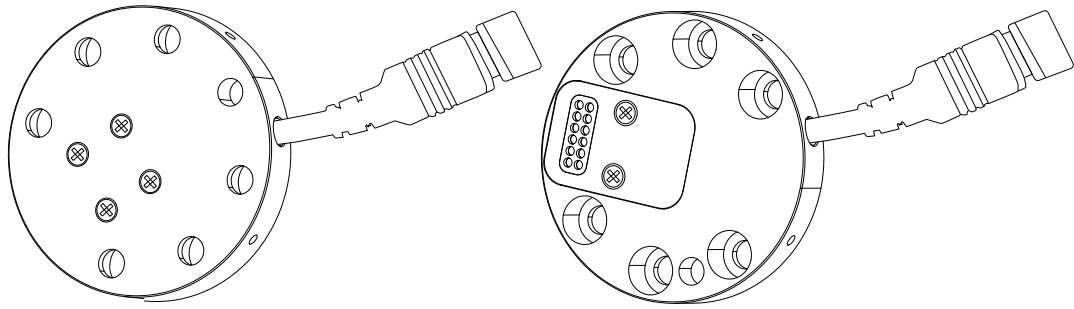supply, before it is firmly anchored and the danger zone is cleared.

3.1. Scope of Delivery

The 6 Axis Force Torque Sensor Kit generally includes these items:

① 6 Axis Force Torque Sensor *1

② Mounting Flange *1 (Both sides)

③ Signal Hub*1
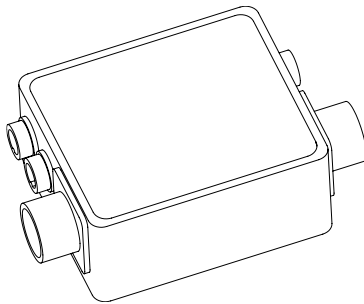
④ Power cable for the Robotic Arm*1

⑤ Communication cable for the Robotic Arm*1

⑥ Power/Communication cable for 6 Axis Force Torque Sensor*1

⑦ M3*8 Head hexagon socket screws (4) and M3 spring washer (4)

⑧ M6*8 Head hexagon socket screws (4) and M6 spring washer (4)

⑨ 2.5MM L type wrench*1

⑩ 5MM L type wrench*1

⑪ Velcro (3 meters)

3.2. Mechanical Installation

1. Press down the E stop button on the control box.

2. Install the Mounting Flange on the end flange using 4 M6*8 screws (spring washer must be used together).

M6*8 X4

Spring washer

Mounting adapter

UFACTORY xArm tool flange
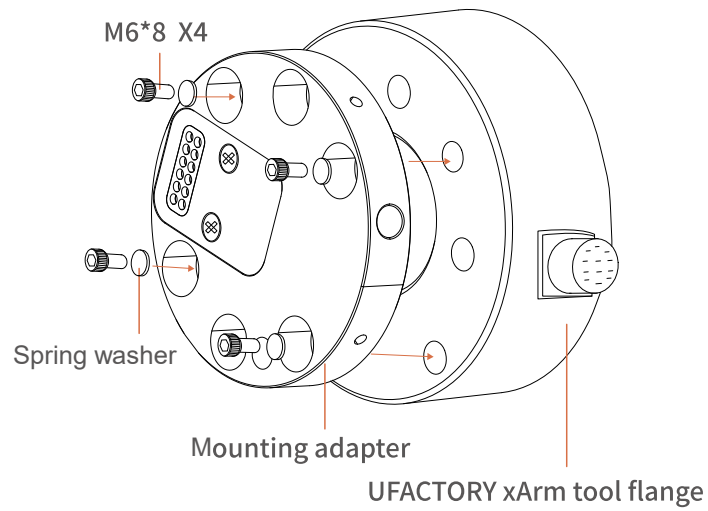
3. Install the 6 Axis Force Torque Sensor on the Mounting Flange using 4 M3*8 screws (spring washer must be used together).

UFACTORY xArm tool flange

Mounting adapter

M3*8X4

6 Axis Force Torque Sensor
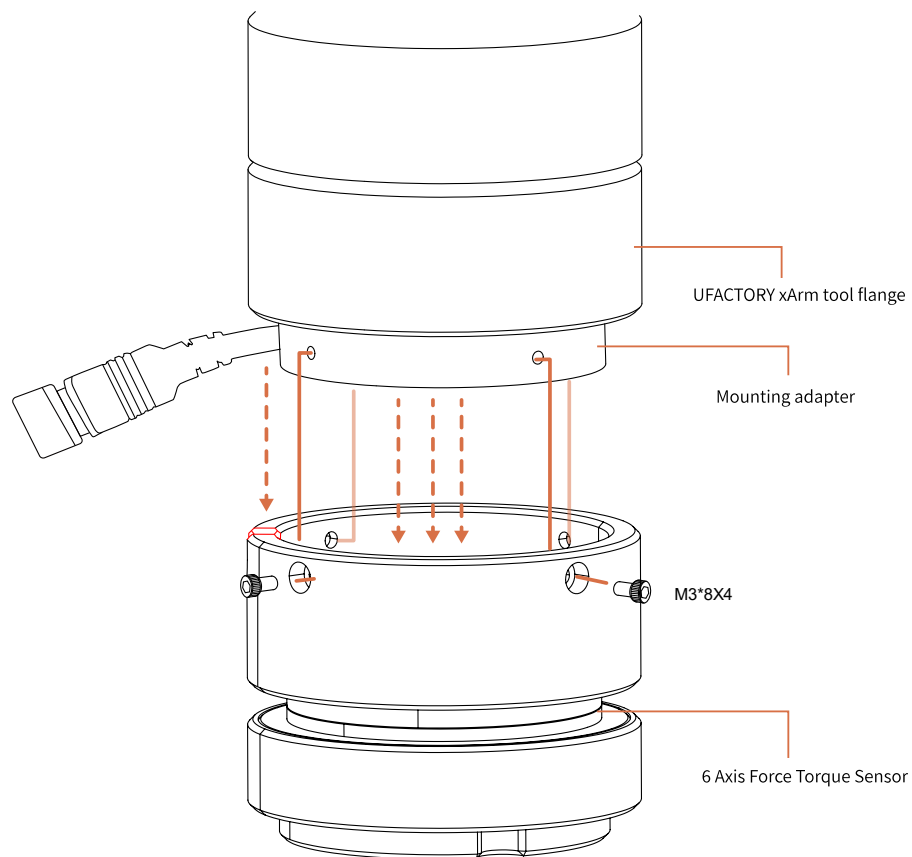
4. Cable connection with Signal Hub:

Connect 5 cables in sequence according to the electrical interface definition of the Signal Hub.

Power and communication cable of Force Torque Sensor

Communication cable of the robot

Power cable of the robot

Communication cable of the control box

Power cable of the control box
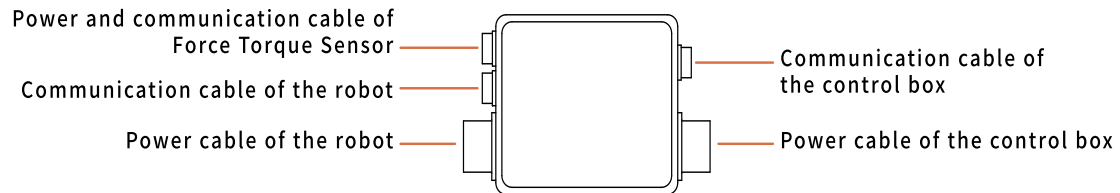
5. Using Velcro to stick the power/communication flexible cable to the robotic arm.

(Don't stick it too tight, don't stick the Velcro on the torque sensor)

Velcro

Power/Communication cable for 6 Axis Force Torque Sensor

Singal Hub
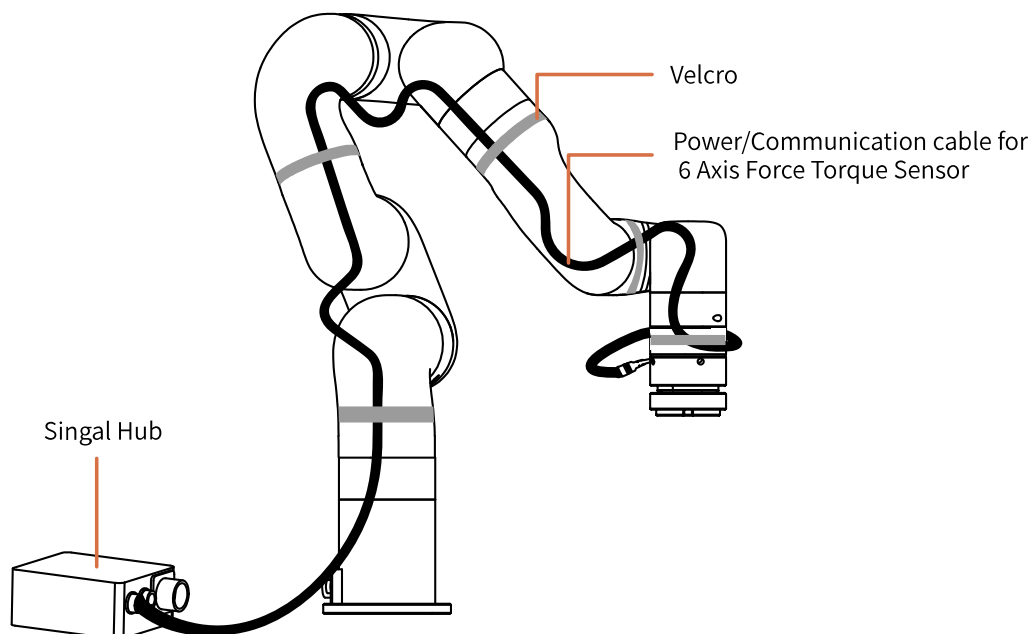
6. Release the E-stop button on the control box.

4. Control

4.1. Control 6 Axis Force Torque Sensor through Python-SDK

For details on controlling 6 Axis Force Torque Sensor with python-SDK, please refer to the link below:

https://github.com/xArm-Developer/xArm-Python-SDK/blob/master/example/wrapper/common/8003-force_control.py

`Common interface:`

ft_sensor_enable()：enable force torque sensor

ft_sensor_set_zero()：set the current state as zero point of FT sensor

ft_sensor_app_set() ：set control mode of the force torque sensor

get_ft_sensor_data()：get the data of the force torque sensor

ft_ext_force：get the data after filtering, load and offset compensation

ft_raw_force：get the raw data of the force torque sensor

4.2. Control 6 Axis Force Torque Sensor through C++ SDK

https://github.com/xArm-Developer/xArm-CPLUS-SDK/blob/master/example/8003-force_control.cc

5. Axis Force Torque Sensor Error Code

Software Error Code	Error Handling
C50	Six-axis Force Torque Sensor Error Please check the sensor error code, locate the problem, and power on again. If it cannot be resolved, please contact technical support.
C51	Six-axis Force Torque Sensor Mode Setting Error Please make sure that the robotic arm is not in Manual Mode, check whether the given value of this command is 0/1/2
C52	Six-axis Force Torque Sensor Zero Setting Error Please check the sensor communication wiring and whether the power is normal.
C53	Six-axis Force Torque Sensor Overload Please reduce the payload or applied external force.
SDK Error Code	Error Handling
40	Six-axis Force Torque Sensor Communication Failure Please check whether the wire between the Data Collector and the Six-axis Force Torque Sensor is connected properly
41	The Data detected by the Six-axis Force Torque Sensor is Abnormal Please contact technical support
42	Six-axis Force Torque Sensor X-direction Torque Exceeds Limit Please reduce the force applied in the X direction
43	Six-axis Force Torque Sensor Y-direction Torque Exceeds Limit Please reduce the force applied in the Y direction
44	Six-axis Force Torque Sensor Z-direction Torque Exceeds Limit Please reduce the force applied in the Z direction
45	Six-axis Force Torque Sensor Tx Torque Exceeds Limit Please reduce the torque applied around the X axis
46	Six-axis Force Torque Sensor Ty direction Torque Exceeds Limit Please reduce the torque applied around the Y axis

47	Six-axis Force Torque Sensor Tz direction Torque Exceeds Limit Please reduce the torque applied around the Z axis
49	Six-axis Force Torque Sensor Failed to Initialize Please check 1. Whether the baud rate of the Data Collector and the Six-axis Force Torque Sensor are the same. 2. Whether the wire between the Data Collector and the Six-axis Force Torque Sensor is connected properly.
For error codes that are not listed in the above table: Please click "Clear Error" clear the error. If it reports the same error repeatedly, please contact technical support.	

6. Axis Force Torque Sensor Specifications

	Fx, Fy	Fz	Tx, Ty, Tz	
Load capacity	150N	200N	4Nm	
Resolution	100mN	150mN	5mNm	
Hysteresis	2.5%FS	1%FS	1%FS	
Crosstalk	3%FS	3%FS	3%FS	
Overload capacity	150%	150%（Fz+） 300%（Fz-）	150%	
weight				445g

7. After-sales Service

1. After-sales policy:

For the detailed after-sales policy of the product, see the official website:

https://www.ufactory.cc/pages/warranty-returns

1. The general process of after-sales service is:

(1) Contact UFACTORY technical support (support@ufactory.cc) to confirm whether the product needs to repair and which part should be sent back to UFACTORY.

(2) After the bill of lading on UPS/DHL, we will send the invoice and label to you by mail. You need to make an appointment with the local UPS/DHL and then send the product to us.

(3) UFACTORY will check the product warranty status according to the after-sales policy.

(4) Generally, the process takes around 1-2 weeks except for shipment.

Note:

1. Please keep the original packaging materials of the product. When you need to send the product back to get repaired, please pack the

product with the original box to protect the product during the transportation.