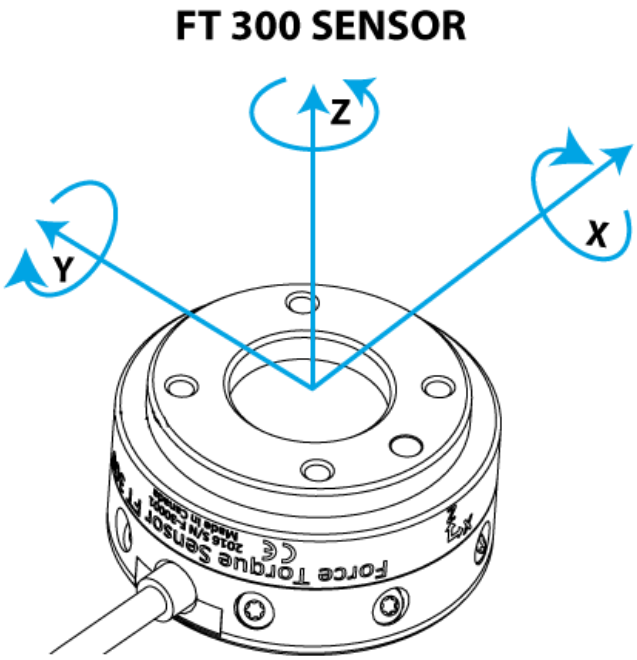
FAQ: Robotiq FT 300

Version of 2017-11

What is the Robotiq FT 300?

The Robotiq FT 300 is a 6-axis (3 forces and 3 torques) sensor that enables Universal Robots to perform force sensitive tasks. It detects and measures robot contacts with high sensitivity in order to improve the robot control as well as simplifying its programming.



What does FT 300 means?

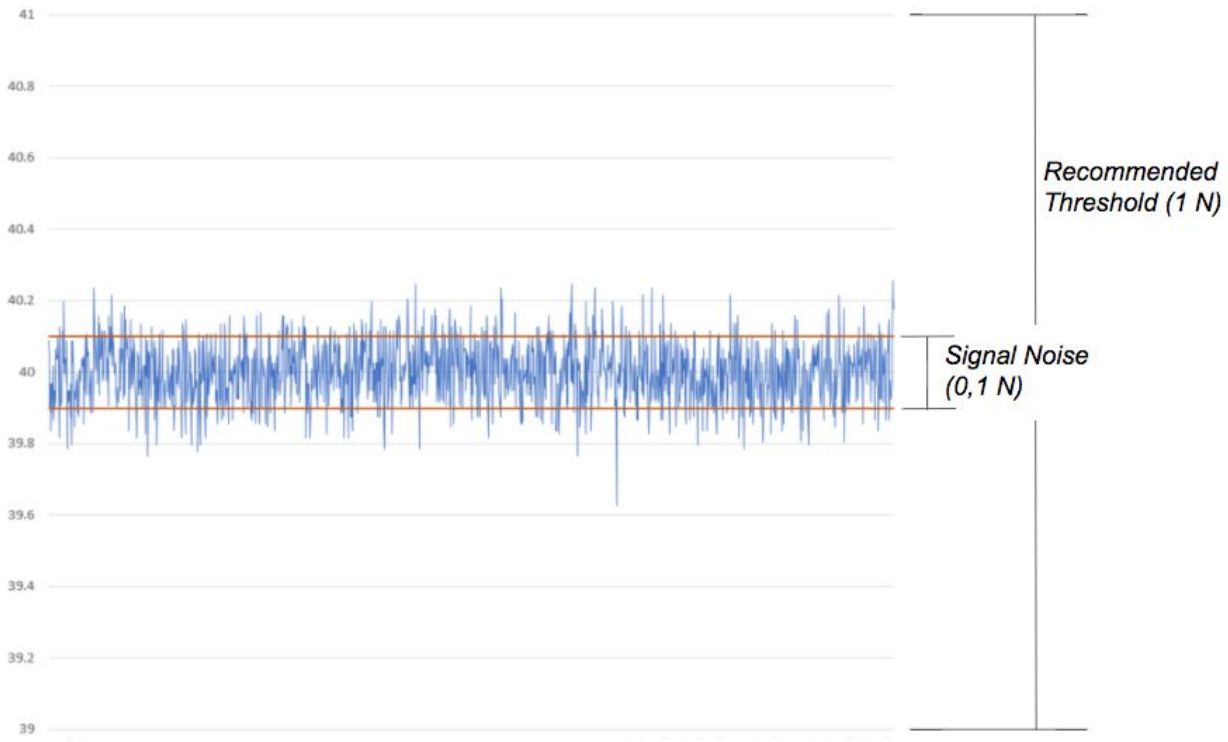
- “FT” refers to Force Torque;
- “300” refers to 300 Newtons, which is the sensor force range in all axis.

What is a signal noise?

It is the random short-term variation of the signal which is unwanted and unpredictable. It limits the lowest force detectable by the sensor.

What is the minimum threshold and why is this specification important to consider?

The “recommended minimum threshold” represents the smallest variation that the sensor can detect reliably (without filtering) when installed on a robot.



For the FT 300, as for most of the sensors on the market, the noise is greater than the resolution and that’s why we spec the noise instead of the resolution (the resolution is not what limits the applications).

		Sensor signal noise	Recommended minimum threshold for contact in robot static state
Signal noise*	Force in X, Y	0.1 N	1 N
	Force in Z	0.1 N	1 N
	Moment in X, Y	0.005 N·m	0.02 N·m
	Moment in Z	0.003 N·m	0.01 N·m

How accurate is the FT 300?

We do not have a specification for accuracy because it depends from one application to another. The FT 300's accuracy allows to perform most of product testing, assembly and force processes. Also, it should be noted that for most applications sensitivity and repeatability is more important than accuracy.

Why your data output rate is only 100Hz?

Considering the inertia of most robots, having a frequency over 100Hz would not improve the quality of the force control in most use cases. Moreover, on Universal Robots, the acquisition frequency is around 120Hz so there is no big benefit of having a sensor that can stream at a much higher rate.

How does the external noise affect the FT 300's precision?

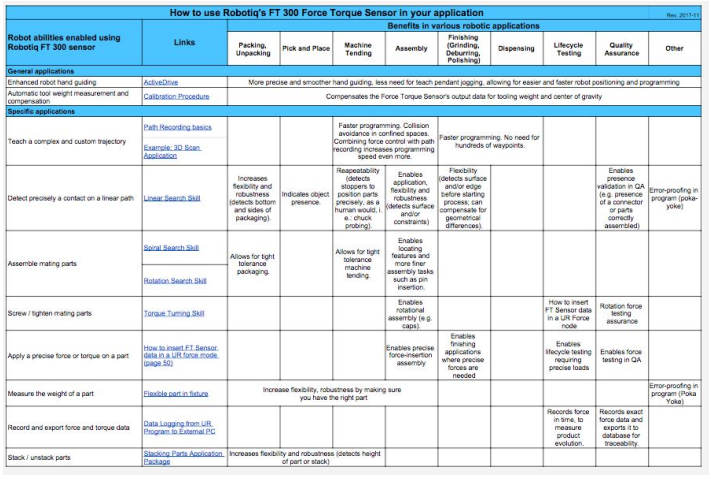
For a typical application, the FT 300 is immune to the external noise. This means that the quality of the signal is not affected by other industrial equipments located around the robot. As such, the increased sensitivity of the sensor improves the results for applications such as product testing, assembly and force processes, regardless of the industrial equipments around the sensor.

The sensor noise is the most important metric for achieving a good hand guiding and a good force control.

What can I do with a FT 300?

The FT 300 performs high repeatability precision force control tasks such as product testing, assembly, precise part insertion and many finishing applications where force control with high sensitivity is required (Available with Universal Robots CB3.1 controller only) such as polishing, sanding, deburring and grinding.

Check this matrix to get a complete overview of the FT 300's abilities and features.



How to use Robotiq's FT 300 Force Torque Sensor in your application — Rev. 2017-11

Robot abilities enabled using Robotiq FT 300 sensor	Links	Benefits in various robotic applications								
		Packing, Unpacking	Pick and Place	Machine Tending	Assembly	Finishing (Grinding, Deburring, Polishing)	Dispensing	Lifecycle Testing	Quality Assurance	Other
General applications										
Enhanced robot hand guiding	ActiveDrive	More precise and smoother hand guiding, less need for teach pendant jogging, allowing for easier and faster robot positioning and programming								
Automatic tool weight measurement and compensation	Calibration Procedure	Compensates the Force Torque Sensor's output data for tooling weight and center of gravity								
Specific applications										
Teach a complex and custom trajectory	Path Recording basics Example: 3D Scan Application			Faster programming. Collision avoidance in confined spaces. Combining force control with path recording increases programming speed even more.		Faster programming. No need for hundreds of waypoints.				
Detect precisely a contact on a linear path	Linear Search Skill	Increases flexibility and robustness (detects bottom and sides of packaging).	Indicates object presence.	Reapeatability (detects stoppers to position parts precisely, as a human would, i.e.: chuck probing).	Enables application, flexibility and robustness (detects surface and/or constraints)	Flexibility (detects surface and/or edge before starting process; can compensate for geometrical differences).			Enables presence validation in QA (e.g. presence of a connector or parts correctly assembled)	Error-proofing in program (poka-yoke)
Assemble mating parts	Spiral Search Skill Rotation Search Skill	Allows for tight tolerance packaging.		Allows for tight tolerance machine tending.	Enables locating features and more finer assembly tasks such as pin insertion.					
Screw / tighten mating parts	Torque Turning Skill				Enables rotational assembly (e.g. caps).			How to insert FT Sensor data in a UR Force node	Rotation force testing assurance	
Apply a precise force or torque on a part	How to insert FT Sensor data in a UR force mode (page 50)				Enables precise force-insertion assembly	Enables finishing applications where precise forces are needed		Enables lifecycle testing requiring precise loads	Enables force testing in QA	
Measure the weight of a part	Flexible part in fixture	Increase flexibility, robustness by making sure you have the right part								Error-proofing in program (Poka Yoke)
Record and export force and torque data	Data Logging from UR Program to External PC							Records force in time, to measure product evolution.	Records exact force data and exports it to database for traceability.	
Stack / unstack parts	Stacking Parts Application Package	Increases flexibility and robustness (detects height of part or stack)								

What are the best ways to program the FT 300 along with a Universal Robot?

1. Get our Free URCap for the basic functionalities:
    - Installation tools
        - Simple one-minute sensor calibration wizard (including tool weight measurement and compensation)
        - Visual dashboard with all 6-axis real-time measurements
    - Programing and operating tools:
        - **ActiveDrive** toolbar enabling more precise and smoother hand guiding, less need for teach pendant jogging, allowing for easier and faster robot positioning and programming
        - **Path Recording** node enabling you to teach a complex and custom trajectory
        - Many embedded sub-functions giving you direct access to the sensor (sub-functions are simple to access from a scrolldown menu)
2. Get our free Skills for more advanced application-based sub-functions, i.e.:
    - **Linear Search** to detect precisely a contact on a linear path
    - **Spiral Search** and **Rotation Search** to assemble mating parts
    - **Torque Turning** to screw / tighten mating parts
3. Get our free Application Packages to learn "how to do it" and get templates, i.e.:
    - **Sensor to CSV File Streaming Data** to record and export the Sensor's measurements
    - **Stacking Parts** to speed up the programming of stacking parts
4. Ask specific questions on DoF community to accelerate your integration

How does the FT 300 work?

The FT 300 is composed of a movable frame attached to a fixed frame by a compliant member. In order to measure a force (or a torque), the Sensor measures the displacement of the movable frame relative to the fixed one and convert this information in force (or torque) for every axis.

How stiff is the FT 300?

Stiffness is very important since any tooling that will be attached to the FT 300 will move accordingly to the deformation of the compliant member of the Sensor. The stiffness of the Robotiq FT 300 Sensor is high, allowing the attached tooling to perform the task with high precision.

F_x, F_y	3.2 X 10^6 N/m
F_z	3.9 X 10^6 N/m
M_x, M_y	4700 Nm/rad
M_z	4600 Nm/rad

To give an order of magnitude, if a gripper of 10 cm long is attached to the FT 300 and if a perpendicular force of 50N (maximum force of a UR5) is applied to the tip of the gripper, this tip will only move by 0.1 mm.

Will the FT 300 wear over time?

The FT 300 is built using virtually wear-free technologies such as:

- Contact free capacitive sensing technology that won't deteriorate over time
- Creep-free and fatigue-free metallic compliant member (for instance, polymers use in the fabrication of compliant members in sensors tend to creep over time and significantly deteriorate the sensor's signal)

It means that your FT 300 Sensor won't wear over time and its signal won't deteriorate.

What happens if more than 300N are applied to the sensor?

The FT 300 is mechanically protected for overload. No damage will occur to the Sensor until five times the measuring range. This 500% overload protection is calculated considering the worst case scenario where the load applied to the sensor exceed the measuring range by 500% in all 6 axis at the same time.

See the details in the Instruction Manual.

Can I use Robotiq FT 300 on all robots?

The FT 300 is perfectly integrated for Universal Robots (mechanical connection, communication protocols, dedicated software, etc.). For all the other types of robots, some integration need to be done (as for any other type of peripheral) such as for the mechanical connection and the communication with the robot. For more information about other robot brands, visit our DoF community or contact our support team.

What about the calibration of the FT Sensor?

There are two types of calibration with the FT 300:

1. The "factory calibration", performed at Robotiq, allows the sensor to convert raw data into forces/torques outputs. This calibration is not required to be done by the user and it is not required to re-calibrate the sensor periodically since the signal of the FT 300 won't deteriorate over time; and
2. The "user calibration" done by the user at the installation process and which allows to:
    a. Compensate for any offset in the sensor signal caused by the physical installation; and
    b. Compensate for the tool weight and its center of mass.

This later "user calibration" is a simple step-by-step calibration procedure that last less than 2 minutes (Watch the Plug + Play calibration video here). Note that this calibration should be done each time the Sensor is reinstalled, the robot tool is changed or after and excessive impact.

What is the warranty?

The warranty is 12 months

Any other question?

- Read our Instruction Manual
- Contact our support team
- Contact us or Get a quote