Tactile Fingertip™

EXTREMELY SENSITIVE

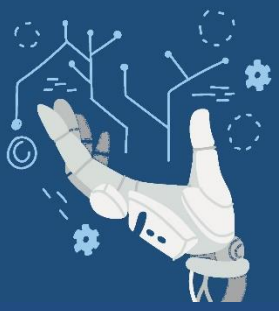
Highly sensitive to force and position changes, the Tactile Fingertip enables measurement of grasp force and pressure, pose, shape, and stability.

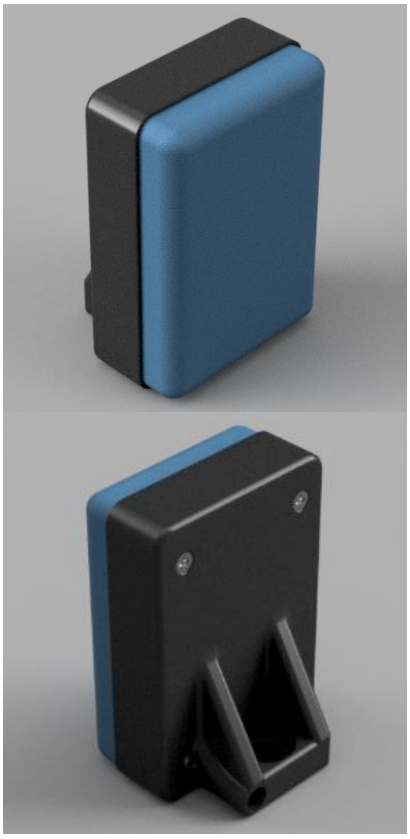
SOFT YET DURABLE

Soft and compliant yet tough and durable, our unique polymeric sensing material achieves exceptional manipulation of fragile objects.

COMPATIBLE

Compatible with a broad range of robotic grippers, both electric and pneumatic, Tactile Fingertips enable new applications in industrial and collaborative robotics.

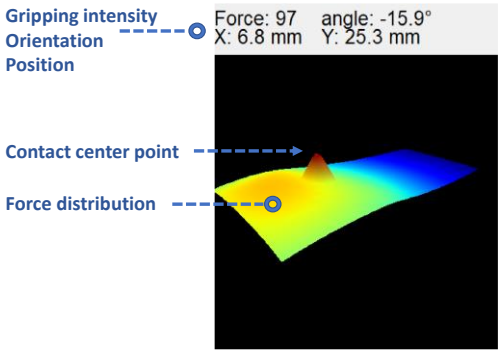




Ras Labs has combined material science innovation with data science and precision engineering to provide the first, state-of-the-art, tactile sensor for robotic gripper end of arm tooling (EOAT). The Tactile Fingertip™ is remarkedly like the human fingertip, providing for a grasp that is simultaneously gentle yet firm with tactile touch information and real time responsiveness.

Tactile Fingertips, though extremely sensitive (routinely to 0.05 Newtons and to 0.005 N in max sensitivity mode), also have a wide pressure range, up to 45 N (10 Pound-force) and over with high linearity. Because the elastomeric sensing pads provide a soft compliant interface, the point of contact does not apply excessive force, allowing for gentle object handling and control of the force applied to the object. The Tactile Fingertip can also detect a change in pressure location on its surface, i.e., directional glide provides real time feedback, making it possible to detect and prevent slippage by then proportionally adjusting the grip strength near instantaneously for perfect grip and for object identification along with the analysis of good grip (position, grip force, angle, any slip or wobble) and immediate correction for pick-and-place, unstructured bin sorting, and other applications.

Intelligrasp™ is a suite of programs for the gentle handling of objects.

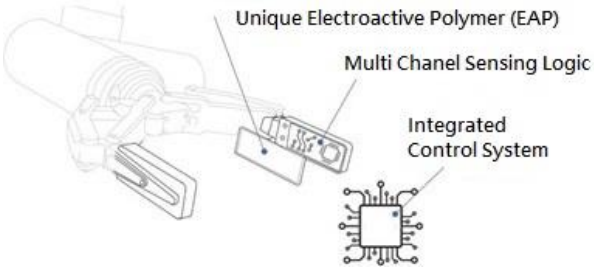


Smart Grip™ grips object gently and then increases grip force if it detects any incipient slip. Incrementally increases force relative to degree of slip until a stable grip is detected.

Tactile Grip™ grips objects to a designated degree of deformation.

Position Grip™ moves to a specific position or depth and communicates the sensing data, which can be used to determine the shape or softness of the object being handled.

Tactile Release™ releases the object once detected external force reaches a designated threshold, which can be used for stacking, binning/kitting, human-robot interactions, and hand-offs.



These unique Tactile Fingertips can reduce the need to expensive visual and 3D sensing tools as well as the need for tool changes when changing objects or processes and allow for the gentle handling of objects without having to sacrifice time.

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Sensing Properties	Minimum	Maximum	Accuracy	Unit
Position (X and Y)	0	18(X), 36(Y)	1	mm
Width	0	36	4	mm
Angle	-45	45	5	degrees
Slip	0	10,000	50	µm
Data Rate		100		Hz

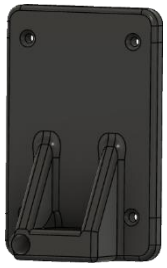
Packaging Characteristics*		Unit
Finger pad hardness/durometer	Available in 35 to 60	Shore OO
Finger dimensions (L x W x H)	48 x 32 x 28	mm
Finger weight	< 21	g
Finger pad (sensing area) dimensions	36 x 16 x 3	mm
Ingress protection (IP) rating	52	IP

* Other packaging dimensions, shapes, hardness, or IP available. Contact us for details.

Operating Conditions	
Power supply	5 V
Power consumption	< 0.1 W
Operating temperature	0 – 45 °C
Relative humidity (non-condensing)	0 – 95 %
MTBF (operating life)*	> 20,000,000 cycles

* Fatigue testing is combination of pick-and-release and shear. Depends on force and surface characteristics. Contact us for details.

Interfaces

Interfaces	
Software Interfaces	○ ROS ○ Local TCP
Electric Interfaces	○ USB ○ Modbus RTU (RS-485)
Compute engine	○ Linux ○ Windows
Gripper Adapter Plate	 Default is a single M5 Bolt. Finger adapter plates are available for many commercial grippers. The CAD design is also available for custom adapter designs. Contact us for details.

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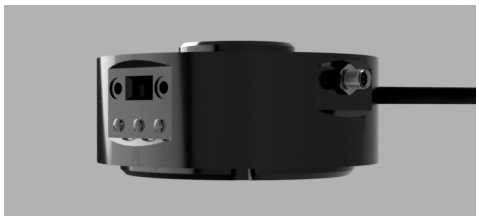
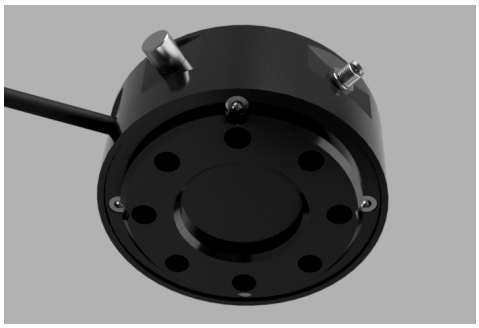
Tactile Control Wrist™

The Tactile Control Wrist™ (TCW) serves as the control center with the Tactile Fingertips™ when using electric gripper end of arm tooling (EOAT). Grasp data provided by the Tactile Fingertip™ Sensors at a rate of 100 Hz contains information about hardness, weight, shape, size, angle, position, and applied force. The TCW includes a selection of out-of-the-box gripping control features: Smart Grip™, Tactile Grip™, Positional Grip™, and Tactile Release™, described in the Tactile Fingertip datasheet. By facilitating these gripper capability features as well as intuitive manipulation of both actuation and algorithm parameters, the TCW affords excellent control and fidelity. Multiple ports and a UR cap are provided for universal use and can be customized.





- Universal Gripping Capability
- High-Fidelity Grip Visualization
- Slippery items (plastics, metals, etc)
- Fragile items (fruit, eggs, glass, etc)
- 10 millisecond micro-adjustment response times
- 7.5 cm x 3.5 cm, 0.10 kg
- Plug and play
- Connector cables included

Through its unique combination of sensitivity and compliance, Ras Labs' Tactile Fingertip™ Sensor enables the high-fidelity grip feedback and object surface mapping needed for the TCW to achieve universality of electric grip quality. This powerful solution for dynamic adjustment during each manipulation minimizes rates of item droppage from external disturbances and eliminates need for tool changes between consecutive grips of different workpieces. This improved yield and efficiency applies to both structured and unstructured grip environments, as well as a wide variety of difficult workpieces ranging from light and fragile to heavy and slippery.

REAL-TIME GRIP FEEDBACK

This system can visualize sensor feedback data to aid calibration of grip quality for a range of workpieces. This capability can be utilized in high volume deployment and potentially as an item-categorization tool.

FORCE COMPENSATION UPON SLIP DETECTION

When Tactile Fingertip™ Sensors are in contact with each workpiece and the object is being lifted, the TCW approximates object weight from the steady-state shear force detected to adjust aggression with which it corrects for object slip.

INTERFACE FLEXIBILITY

Users can either utilize the I/O screw terminals to send and receive signals through a robot's peripheral device ports or opt to send gripper commands via USB. Both interfaces support grip data visualization and characterization.

AVAILABLE ON REQUEST

Gripper Compatibility Support
Visualization / Software Support
Comprehensive Hardware Support
Maintenance / Mounting Support

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Tactile Pneumatic Controller™

The Tactile Pneumatic Controller™ (TPC) manipulates airflow through a pneumatic gripper according to both user commands and Tactile Fingertip™ Sensor feedback, which together enable immediate down-regulation of air pressure upon object detection while closing for optimal grip delicacy, along with up-regulation of air pressure to compensate proportionally for detected object slip (SmartGrip™). By facilitating these gripper capabilities as well as the standard directional control associated with a PLC (Programmable Logic Controller) and the intuitive manipulation of both actuation and algorithm parameters, the TPC affords pneumatic grippers a fidelity of motion control akin to that of an electric gripper without the complexities of programming and maintaining an electric gripper. This serves as the pneumatic analog to Ras Labs' Tactile Control Wrist™.

- Universal Gripping Capability
- Pressure Output: 0 – 0.5 MPa
- High-Fidelity Grip Visualization
- Slippery items (plastics, metals, etc)
- Fragile items (fruit, eggs, glass, etc)
- 12.2cm L, 9.8cm W, 10.8cm H, 0.73 kg
- One-touch fittings for 4mm-OD tubing
- 24VDC power supply included

Through its unique combination of sensitivity and compliance, Ras Labs' Tactile Fingertip™ Sensor enables the high-fidelity grip feedback and object surface mapping needed for the TPC to achieve universality of pneumatic grip quality. This powerful solution for dynamic pressure adjustment during each manipulation minimizes rates of item droppage from external disturbances and eliminates need for tool changes between consecutive grips of different workpieces. This improved yield and efficiency applies to both structured and unstructured grip environments, as well as a wide variety of difficult workpieces ranging from light and fragile to heavy and slippery.

REAL-TIME GRIP FEEDBACK

This system can visualize sensor feedback data to aid calibration of grip quality for a range of workpieces. This capability can be utilized in high volume deployment and potentially as an item-categorization tool.

FORCE COMPENSATION UPON SLIP DETECTION

When Tactile Fingertip™ Sensors are in contact with each workpiece and the object is being lifted, the TPC approximates object weight from the steady-state shear force detected to adjust aggression with which it corrects for object slip.

INTERFACE FLEXIBILITY

Users can either utilize the I/O screw terminals to send and receive signals through a robot's peripheral device ports or opt to send gripper commands via USB. Both interfaces support grip data visualization and characterization.

AVAILABLE ON REQUEST

Gripper Compatibility Support
Visualization / Software Support
Comprehensive Hardware Support
Maintenance / Mounting Support

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Tactile Pneumatic Controller™

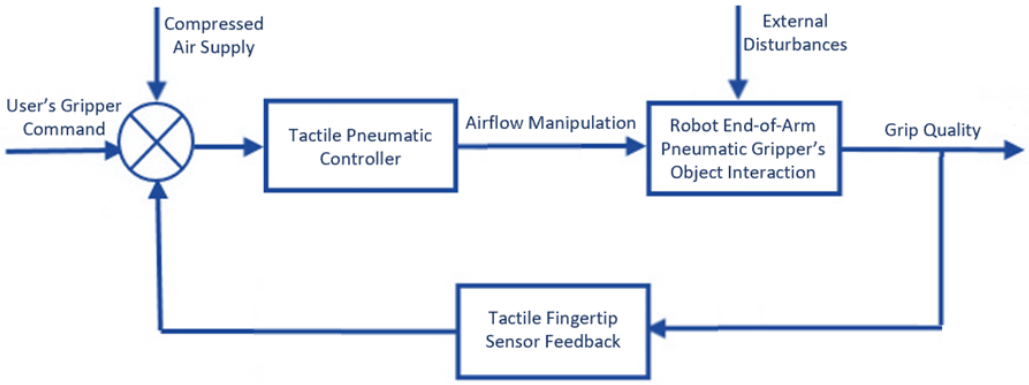
Hardware Specifications

	Min	Nom	Max	Flow Rating
Pressure Output (MPa)	0	N/A	0.5	Gripper-Dependent Force Output
Dry Air Supply* (MPa)	0.52	0.55	0.6	6 L/min Maximum
Power Supply (VDC)	23.0	24	26.4	1 Amp Minimum
I/O Terminal Logic (VDC)	21.6	24	25.5	5 mA Maximum
Operating Temp (℃)	0	20	50	N/A
Frequency (Grips/sec)	N/A	1	3	Subject to Grip Speed & Airflow
Response Time (ms)**	30	50	100	Subject to Tube Length & Airflow
Lifespan* (millions of cycles)	N/A	20	N/A	Subject to Air Supply Quality

* Moisture in the supply line can cause internal parts to malfunction and reduce system longevity (minimum lifespan before replacement among the pneumatic components). Please place TPC upstream of any lubricant and down-stream of a filter or mist separator rated ≤3 µm.

** Response time of pressure reaching the gripper quickens -and the quality of grip adjustments increases- the closer the box is to the gripper, for proper airflow delivery keep less than 3m of tubing between the TPC and gripper.

Control Block Diagram



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