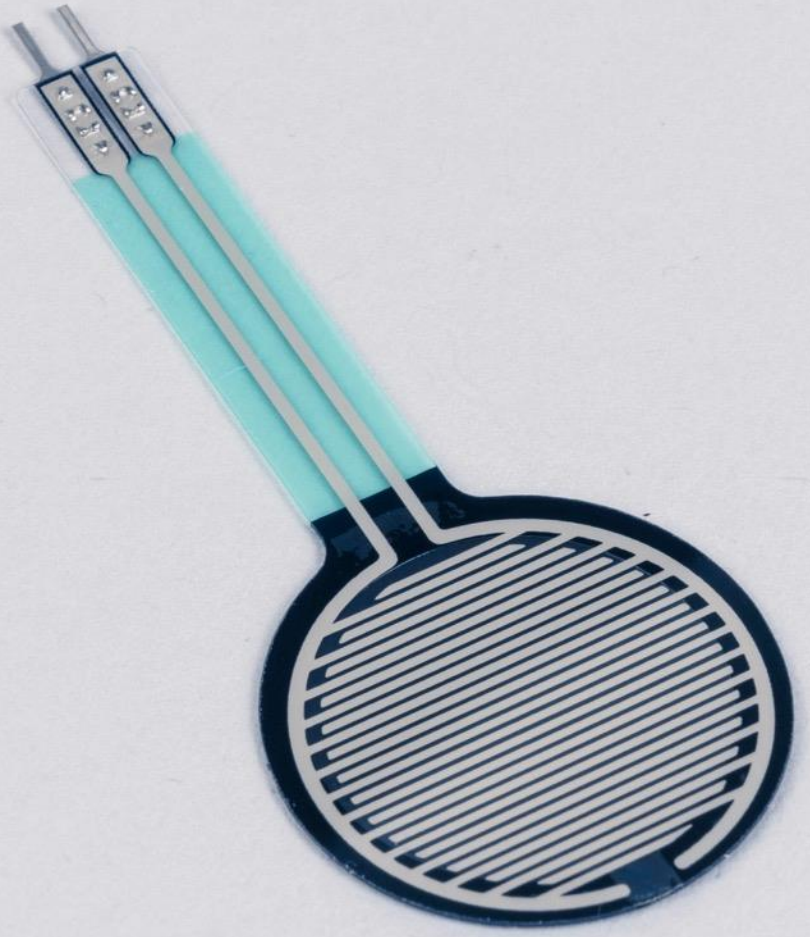

TECHNICAL INFORMATION SHEET:

SINGLE ZONE FORCE SENSITIVE RESISTOR [FSR] SENSOR

BY QUAD INDUSTRIES

Henkel Qhesive SOLUTIONS

TECHNICAL INFORMATION SHEET

SINGLE ZONE FORCE SENSITIVE RESISTOR [FSR] SENSOR BY QUAD INDUSTRIES

Force sensitive sensor INKxperience with one sensing zone enabled by Loctite® printed electronics inks.

The single zone FSR Sensor by Henkel Qhesive Solutions in collaboration with Quad Industries is enabled by a printed electronics force sensor and hardware allowing for the measurement of pressure distribution with one sensing zone. The setup of the FSR sensor equals a membrane switch with an added print layer of force sensitive material. The sensitivity of the FSR sensor is defined by the ratio of blend between a high resistance conductive ink with a non-conductive ink [50:50] printed onto a Polyethylene terephthalate [PET] substrate. Printed designs determine system sensitivity due to the physically thin sensor format.

Features

- **Easy installation**
- **Physically thin sensor format**
- **FSR Ratio, 50:50 between LOCTITE ECI 7004HR & NCI 7002**
- **Design freedom**

Operating Mode

The primary use case of this sensor is to sense pressure/ force being applied to the surface of the sensor. The single zone FSR sensor is ready to operate once connected with the Raspberry Pi / to power. The single zone FSR sensor dashboard on the Raspberry Pi shows the extent of pressure being applied to the single zone FSR sensor surface.

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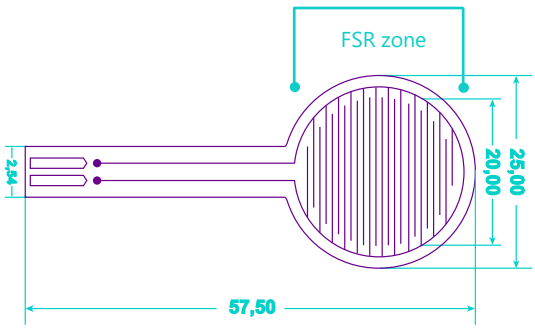
Product Nomenclature

The single zone FSR sensor INKxperience is composed of two main physical components, the electronic 'hardware' and printed 'single zone FSR sensor'. We refer to the Printed Circuit Board (PCB) and plastic enclosure as the 'hardware' and breakout board.



Sensor

The single zone FSR sensor is composed of one circular force sensitive area based on a 50:50 blend of high resistance FSR and non-conductive FSR inks, silver ink, spacer material and a dielectric coating. The single zone FSR sensor has male solder contacts. The FSR ink blend defines the sensitivity of the sensor. The FSR zone is indicated with green arrow above.

Technical Summary	
Hardware and Enclosure Dimensions	60 x 40 x 18 mm
Sensor Dimensions	FSR diameter: 20 mm
Hardware and Enclosure Weight	25 g small enclosure – 45 g large enclosure
Operating Temperature Range	From 0 to 45 °C
Minimum Sensitivity	approx. 200 g
Maximum Sensitivity	5 kg
Activation Method	Application of weight (min. 20 g)
Operating Voltage	Board: 5V, Sensor: 3.3V
Housing	LOCTITE® 3D 3843™
Mounting	n/a
Sensor Connector	2 x pins, 2.54mm pitch male solder contacts
Sensor Materials	Loctite ECI 7004HR, Loctite NCI 7002, Loctite ECI 1010, Loctite EDAG 965SS, Loctite EDAG PF-455B
Sensor Function	Resistive sensor

Sensor Limitations

The Single Zone FSR Sensor is designed to work in specific force range. Too low force will not be detected, and too high force will saturate the sensor response. The sensor performs a relative force measurement. For more accurate force measurement, calibration is required. X-Y accuracy is limited by the initial sensor design.

Please note that the sensor output might be inaccurate for objects that have no flat surface touching the sensor.

Hardware Limitations

The hardware is designed to work with the given setup. When modifying the PCB function and safety cannot be guaranteed.

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Data Output

The sensor data can be read out via the Raspberry Pi or the web app. Each sensor breakout board outputs data over USB serial. USB driver installation information is available here. The Multi Zone FSR Sensor breakout board outputs 3 signals over serial USB, 1 for each of the single zone sensors and 2 for the multizone sensors. The signals are raw analog readings every 100ms. For more reliable measurements the signal will have to be processed. The serial output format is 3 integers, between 0 to 1023, separated by commas per line. The first two values are from the single zone sensors, the last 2 values are from the multizone sensor. The breakout board is based on Seeduino Xiao with the serial protocol settings being: 115200 baud rate, no parity, 1 stop bit.

Data Read Out & Saving via Raspberry Pi

The included main board (Raspberry Pi) allows for immediate testing and data read out. Once you have connected the Raspberry Pi to a power source, one or more sensors can be connected at the same time. With a power supply in place the Henkel Qhesive Solutions dashboard will boot.

From the dashboard you can select the sensor technology you would like to use, for example the leak detection sensor. Detected sensors are highlighted in green while not connected sensors are grayed out. Once the leak detection sensor is connected, tap on the respective application to see the data readout in real time. Tap on exit to return to the menu.

The Raspberry Pi supports automatic saving of data on a USB stick. With the Sensor INKxperience Kit you will receive a USB stick with the required filesystem: FAT32. Once the USB stick is plugged in, a dialog window will open. Please select "Cancel".

While the USB drive is plugged in, every data reading session will save a new file on the drive. Filenames are in the form (SENSOR_NAME)_(timestamp).txt.
Each line in the file contains a timestamp (milliseconds since session start) and the analog data value read from the sensor. A data reading session starts when you tap an available sensor and ends when you tap "Exit".

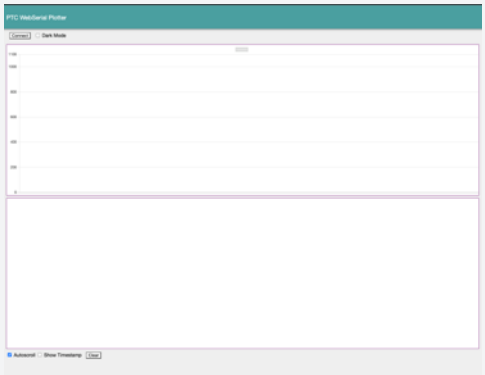
To shutdown the Raspberry Pi, unplug the power supply.

Data Read Out & Saving via Web App

The web app allows you to read data from the sensor breakout boards by directly connecting them to your computer, without needing to use the included Raspberry Pi. Supported browsers Chrome and Microsoft Edge.

After connecting a breakout board to an available USB port, go to Qhesive WebSerial Plotter (inkxperiencekit.com) and click on the type of sensor for which you want to see data. Next, click on "Connect" and select the correct board name from the popup window.

For each sensor you can see the data graphically at the top of the page and the analog data output at the bottom of the page in real time.



To save the raw data read during the session, click the download button of the web app and save the file to your chosen location. Each line in the file contains a timestamp and the raw data read by the sensor.

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Getting Started - Use Case

1

Connect the Single Zone FSR Sensor to the breakout board. Apply power to the Raspberry Pi, by using the power cable. Connect the connector cable to the breakout board and the Raspberry Pi.

2

Once the screen of the Raspberry Pi has lit up and the Henkel Qhesive Solutions dashboard is visible, select the "Force Sensor" application and wait until the screen for data read out opens.

3

Apply pressure to the sensing zone by one finger to get familiar with the sensitivity of the sensor. On the screen of the Raspberry Pi you will see the graph representing the extent of pressure applied.

4

Place different type of small objects on the single zone FSR sensor to test the sensitivity.

5

To save the collected data throughout future experiments you can plug in a USB stick [Filesystem FAT32] to the Raspberry Pi. The raw data from your test setup will be saved automatically on the USB stick. Each sensor breakout board outputs data over USB Serial. Further information on how to output an save data can be found on page 4 of this document.

6

You are ready to start your ideation! For questions regarding the setup please contact:

printed.electronics@henkel.com

Check out our video tutorial on how to get the leak detection sensor INKxperience started:

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Legal Disclaimer

This product is a B2B product, intended for research and technical feasibility validation only. For installation and application follow the recommended processes carefully.
All pieces were selected by Henkel. The printed sensors were sourced and produced by Quad Industries and LAIIER. The later including also compatible hardware components. All remaining hardware components were sourced by IOX GmbH. The Loctite hardware cases are intended for protection only. All hardware cases can be opened for review of hardware components.

CAUTION: Please keep out of reach of children.

LAIIER makes wireless connected printed sensors that install like tape and detect leaks, occupancy, and more. They are building a Surface to Cloud™ Industrial IoT solution that is uniquely easy to install and scale in the smart building and smart facility. Their Surface to Cloud Industrial IoT sensor platform addresses critical use cases in the smart building, starting with liquid leaks, liquid level, moisture detection, and much more. LAIIER's solution prevents damage to structures, conserves precious resources, and reduces the release of hazardous chemicals into the environment.

Quad Industries has been at the forefront of printed electronics for more than 25 years, which makes them a reliable partner in the development and manufacturing of user interfaces and control panels for both consumer and industrial applications. In recent years, they have extended our activities in the domain of printed electronics, using their extensive knowledge to develop and manufacture printed, flexible sensor solutions. Their headquarters and production facilities in Europe are certified to the internationally recognized ISO 9001:2015 Quality Management Systems (QMS) standard. The QMS for Quad is the sum of all the processes, resources, properties, and cultural values that support the goal of customer satisfaction and productivity of the organization.

Leading companies have innovative IoT concepts but are challenged when it comes to turning them into reality. IOX LAB helps them and creates prototypes exceptionally fast: In 30 days from idea to prototype. To make this possible, the start-up uses IoT technologies as sensors, motors, 3D printing and artificial intelligence. The team covers the full stack of IoT. Make things, not slides: ioxlab.de

Summary of components

Component	Subcomponents	Certifications
FSR Sensor Breakout Board	PCB: • Seeeduino • Current sensor INA219 • Resistance • Solder	PCB: • Standard IPC-4101 • Flammability class V0 Seeeduino: • Certifications: CE & FCC Connectors: • Recognized E60389 • Certified LR20812 • 2R75087 Resistance: • RoHS 2011/65/EU • Solder: • Lead-free • 96.5% Sn, 3.0% Ag, 0.5% Cu
Leak Detection Breakout Board	PCB by LAIIER (Bare Conductive Ltd): SKU-8502 - Severn Evaluation Kit (containing Bravo Board PCB)	European Declaration of Conformity (08/02/2023) by Bare Conductive Ltd.: The EMC Directive 2014/30/EU and RoHS 3 Regulation (EU 2015/863). The components contained within the listed PCB boards are compliant with the • RoHS 3 Regulation (EU 2015/863) and • EMC Directive 2014/30/EU • Standards EN 55032:2015+A11:2020 and EN 55035:2017
Non-Contact Liquid Level Breakout Board	PCB by LAIIER (Bare Conductive Ltd): SKU-8403 - Trent Evaluation Kit (containing Alfa Board PCB)	

FROM PRINT TO UNBOX.
FROM IDEATION TO PROTOTYPE.
FROM TESTING TO ACCELERATION.

FOR FURTHER INFORMATION:

INKXPERIENCEKIT.COM
PRINTED.ELECTRONICS@HENKEL.COM

Henkel Qhesive
SOLUTIONS