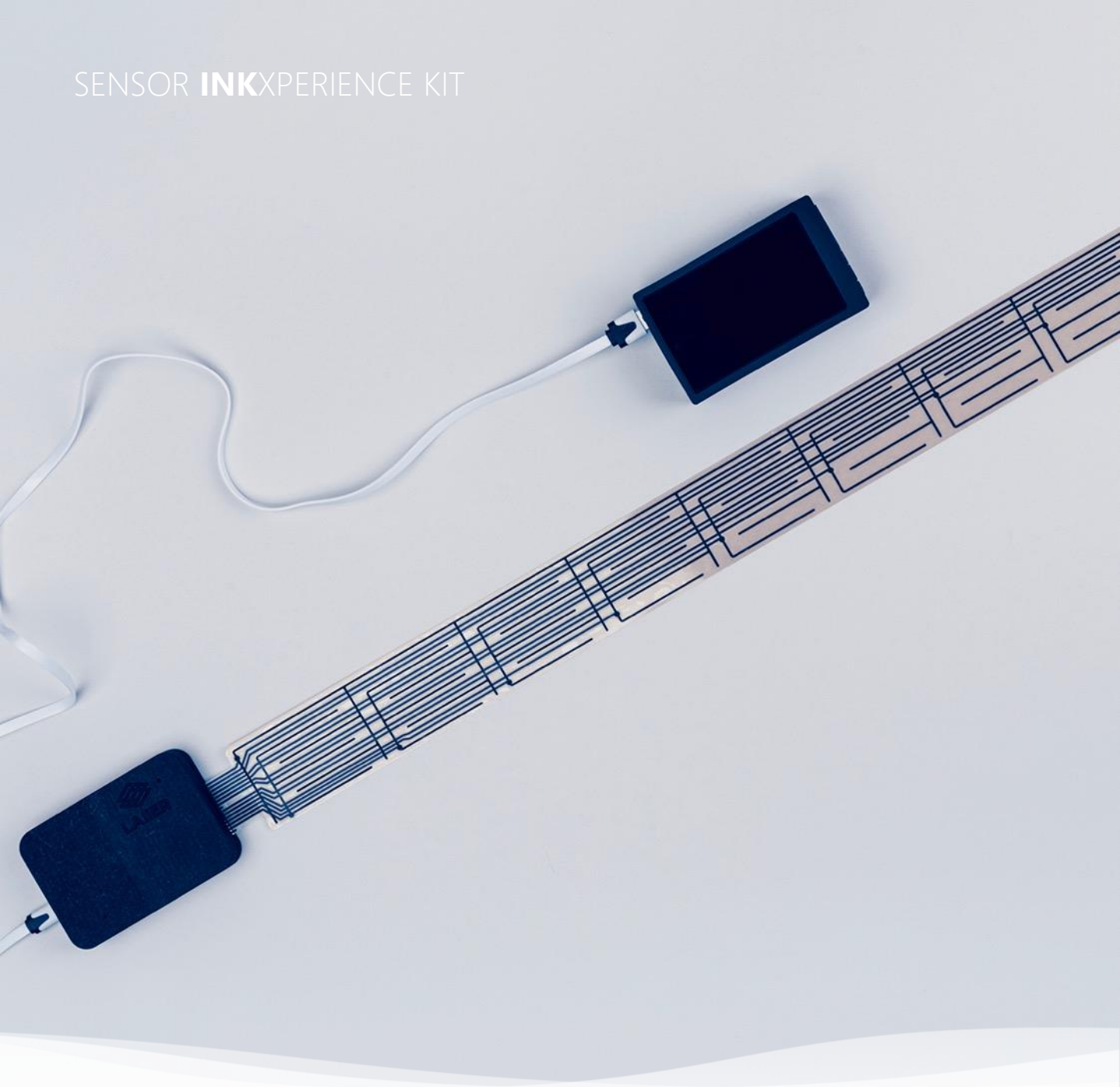
SENSOR **INK**XPERIENCE KIT



TECHNICAL INFORMATION SHEET:

LEAK DETECTION SENSOR

BY LAIIER®

Henkel Qhesive SOLUTIONS

TECHNICAL INFORMATION SHEET

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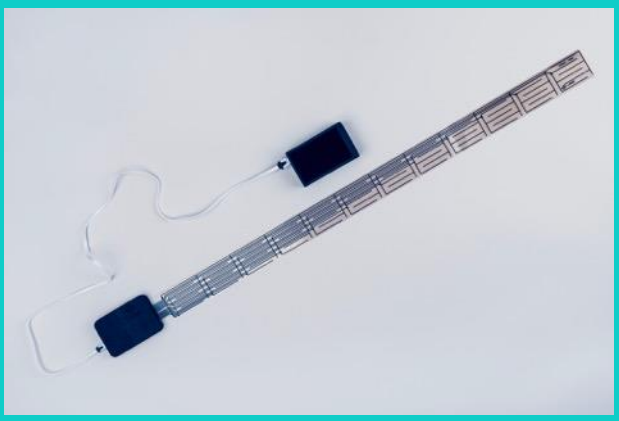
Water leak detection sensor INKxperience created by LAIIER enabled by Loctite® printed electronics inks.

The leak detection sensor showcased by Henkel Qhesive Solutions is engineered and created by LAIIER. The leak detection sensor is based on a combination of printed electronics and hardware creating a resistive printed sensor strip that can detect small amounts of water. The sensor and breakout board included within the Sensor INKxperience Kit were developed of the original LAIIER severn sensor technology which allows to transmit data to LAIIER's *Surface to Cloud™* online platform. The leak detection sensor is printed on polyethylene terephthalate [PET] substrate with



Loctite carbon and dielectric ink. The resistive leak detection sensor has up to twelve individual electrodes which report liquid contact to the Raspberry Pi. Printed designs determine system sensitivity due to the physically thin sensor format. The sensor is adapted self adhesive to one side and can be stuck to the surface.

Features

- **Easy installation**
- **Physically thin sensor format**
- **Self-adhesive mounting available**
- **Conformable to compound surface geometries**
- **Physically robust and chemically resistant**

Operating Mode

The primary use case of this sensor is to detect the presence of water. The event of water presence is defined when three adjacent sensor spots, located on each of the twelve electrodes along the sensor strip, report a change of resistance [past a pre-defined threshold within a one-minute period]. The event then triggers a transmission of a signal to the main dashboard. The extent of resistance change is an indicator for the extent of liquid. The resistance change and the location [electrode 0-11] can be read out on the Raspberry Pi.

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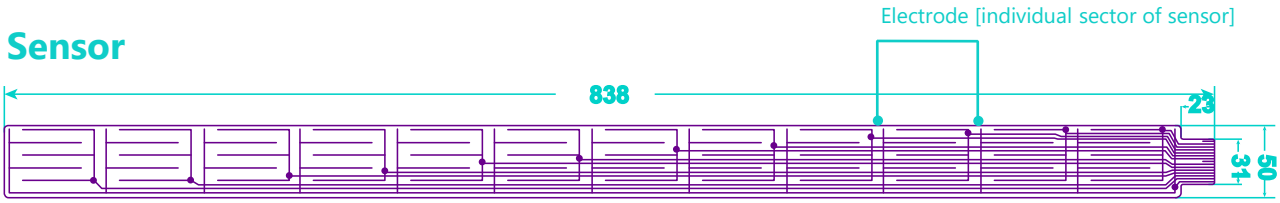
Product Nomenclature

The Leak Detection Sensor by LAIIER is composed of two main physical components, the electronic 'hardware' and printed 'sensors'. We refer to the Printed Circuit Board [PCB] and plastic enclosure as the 'hardware' and breakout board.

Sensor



A sensor is composed of individual electrodes as indicated below. Each electrode reports an individual value of 1023-0 to the hardware unit. The strip style sensor has twelve electrodes arranged linearly.

Technical Summary	
Hardware and Enclosure Dimensions	95 x 60 x 24 mm
Sensor Dimensions	838 x 50 mm
Hardware and Enclosure Weight	70 g
Operating Temperature Range	From -20 to – 55 °C
Sensitivity	Max resolution of 0.1 mL of water
Resolution	Twelve electrodes per sensor with theoretical range of 1023-0
Activation Method	Application of water
Operating Voltage	Hardware & sensor: 3.6 V
Housing	Nylon, not currently Ingress Protection [IP] rated
Mounting	Self-adhesive
Sensor Connector	Flat Flexible Cable [FFC]
Sensor Materials	Loctite EDAG PF-407A, Loctite EDAG PF-455BC
Sensor Function	Resistive Sensor

Sensor Limitations	Hardware Limitations
The leak detection sensor is designed to work to detect aqueous liquids. The sensor It cannot detect non-aqueous liquids, such as hydrocarbons [oils].	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 Leak Detection Sensor serial protocol settings are: 115200 baud rate, no parity, 1 stop bit and the serial output format (every 4-5 seconds):

TOUCH: 0 0 0 0 0 0 0 0 0 0 0 0
FDAT: 1023 1023 1023 1023 1023 1023 1023 1023 1023 1023 1023 1023
DIFF: 0 0 0 0 0 0 0 0 0 0 0 0

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".

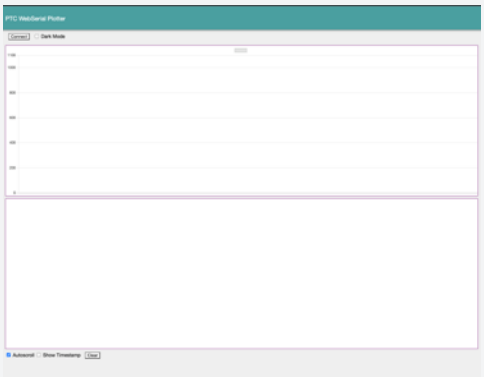
To shutdown the Raspberry Pi, unplug the power supply.

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

Open the breakout board hardware encapsulation case and connect the leak detection sensor to the breakout board.

2

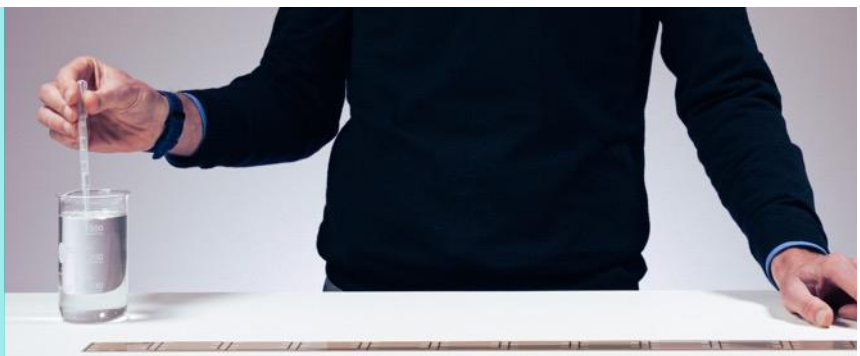
Turn the switch on the breakout board to "ON" and close the breakout encapsulation case. Apply power to the Raspberry Pi, by using the power cable. Connect the connector cable to the breakout board and the Raspberry Pi.

3

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

4

Fill a glass or container with water. Apply some drops of water to one of the electrodes as shown on the picture below. Take a closer look at the graph displayed on the Raspberry Pi. The resistance value indicated by the theoretical range threshold 1023 will drop within the section of the chosen electrode. The electrode indicates the location of the water detected.



5

Apply a second, more larger drop of water, to a different electrode. Again the graph on the Raspberry Pi will indicate the extent of water detected and the location of water.

6

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.

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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

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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.

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LAIIER

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

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.

IOX

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)	

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

FOR FURTHER INFORMATION:

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