



IoT measuring system in pressure measurement technology for water level or fill level monitoring and general pressure measurement

All the talk seems to suggest we are heading towards complete digitalisation. But how do you get on this path and what is the right direction for your own company? KELLER Pressure has over 50 years of experience in recording and processing measurement data. Their service package ranging from pressure sensors to the finished web app helps you to find your own way to a customised IoT solution.

Industry 4.0 and Smart City are technology drivers behind the digitalisation of pressure sensors and pressure measuring solutions. The intention and the need to make processes more efficient are at the heart of digitalisation.

The path towards digitalisation begins with recording data, mostly with sensors. Pressure sensors also record

measured values. For machines or fill levels in containers and tanks, this takes the form of states. For lakes, rivers and groundwater, the levels are measured. The objects measured are connected to the Internet, save their data to a cloud and the data is mainly transmitted wirelessly via radio transmission. The technologies such as LoRa-WAN or mobile communications 4G, NB-IoT oder LTE-M

IoT measuring system from KELLER Pressure



are also used. The data can eventually be retrieved on all possible end devices such as computers, tablets or smartphones. This entire Internet environment of and with objects is called the Internet of Things (abbr. IoT).

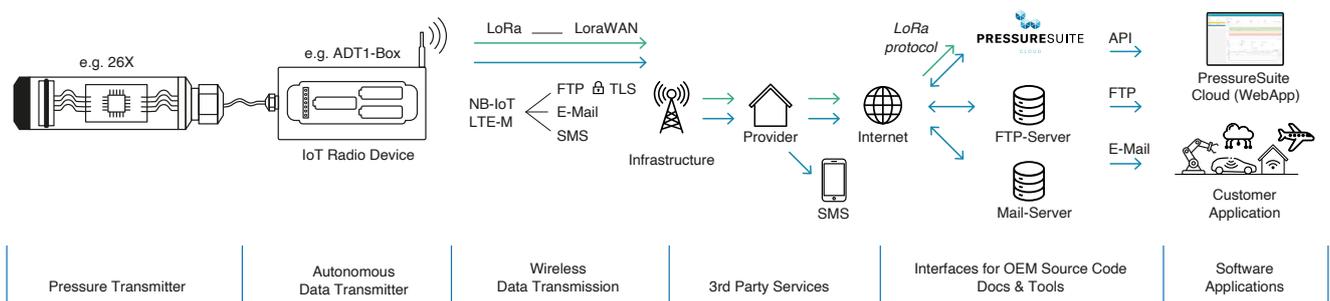
Comprehensive IoT service package

KELLER Pressure offers an integrated solution for an IoT measuring system, based on the latest technologies. This type of measuring solution allows the user to take an immediate step towards digitalisation, without much effort and at low cost:

- No software solutions or hardware need to be created.
- A working and tested measurement data recording system can be accessed.
- No separate, technically advanced training in the technologies is necessary.

KELLER Pressure’s measuring system is designed in such a way that each part of the measuring chain has a specific interface. Thanks to the open and well-documented cloud API (Application Programming Interface), the user can incorporate the measurement data processing system into their own information system and therefore start at exactly the point where the greatest benefits of digitalisation are revealed. KELLER Pressure makes available all individual interfaces so that users have free choice, in terms of implementation, as to whether they would like to set up the entire system or only parts of it, as required.

How deeply this vertical integration is implemented depends on the application and involves weighing the costs against the benefits. The lowest integration level is defining the pressure sensor signal. The following graph shows the individual integration levels from the pressure sensor up to the PressureSuite Cloud web app:



Here you can find out everything about the PressureSuite Cloud



Cost-effective water applications

Step-by-step digitalisation

including examples and products

1. Data recording points/measuring points

specify for a POC (proof of concept)

Available level measuring point

2. Suitable pressure transmitter

based on requirements such as accuracy, compatibility of media, etc.

Level sensor series 36XW for ground water levels

3. Transmission technology

LoRaWAN or mobile communications

Remote data transmission unit ADT1-Tube for

LoRaWAN or ARC1-Tube for mobile communications

Note: Check which network coverage is available at the measuring point for the selected technology. Verification of the measured values recorded should also be performed during operation at the measuring location.

4. Measuring points

operate closely with the help of a graphical representation in a cloud for a few weeks and monitor

PressureSuite Cloud

5. Expand the measuring system (POC)

with additional, possibly technically critical measuring points and close monitoring of any discrepancies

Level measuring points, with poor reception or technical measuring issues

Status Quo: According to this expanded concept, the entire system is to be fundamentally evaluated and assessed regarding whether the results correspond to expectations. Up until this stage, the IoT measuring system from KELLER Pressure was able to be used with little investment. It must now be assessed whether the system is to be kept as it is and, as such, the digitalisation project concluded, or whether a deeper integration of the system into the company's software is desired.

6. Automatic data synchronisation

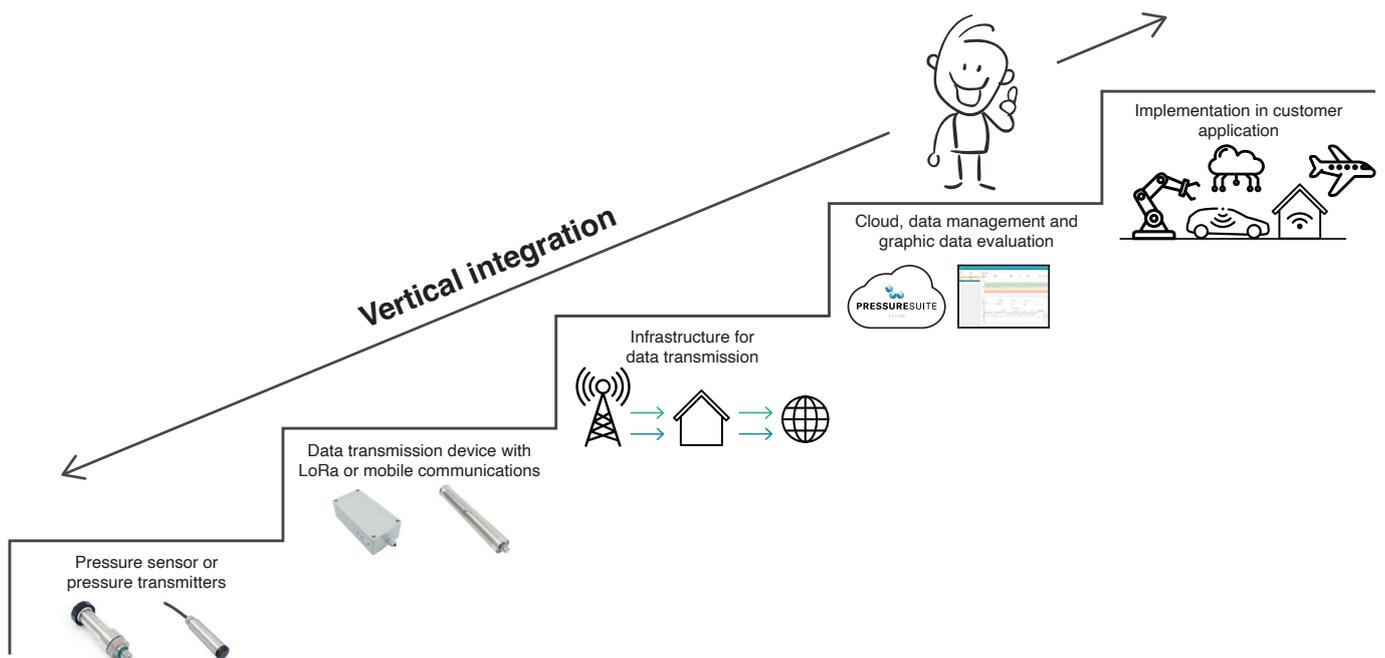
between the measuring system and the company's own cloud

API software interface

Note: The service providers of the company's own software often do not know the process of generating IoT measurement data. KELLER Pressure's many years of experience helps here to establish clear and concrete functional requirements for the measurement data it records in an external system.

7. Complete vertical integration

Pressure sensor or transmitter, remote data transmission unit, PressureSuite Cloud



Open interfaces for all components of the entire measurement chain

Digitalisation of the pressure sensor signal

The pressure sensor signals are processed and digitalised using an electronic circuit. This means they are converted into a number (pressure) that can be retrieved via an interface. Other useful information can also be taken from the pressure sensor in addition to pressure and temperature.

In many cases, too little attention is paid during the initial process considerations to the importance of an accurate, stable and reliable sensor. The sensor that records the data is one of the most important parts of the system because decisions are made and actions taken based on this sensor data:

- Switch off the machine
- Fill up the tank
- Ground water level too low = signals no supply of drinking water!
- Ground water level too high = signals flood!

Consequently, the sensor, which is at the start of the entire measuring chain, has the greatest influence on the quality of the data and must be selected or designed according to the requirements of the measuring system.

KELLER Pressure offers specifically developed and tested pressure sensors for the respective application and requirement. For the use of pressure transmitters with the user's own hardware to transmit the measured data, KELLER Pressure provides the communication protocols for the RS485 or I2C interfaces. For applications that are meant to use a pressure sensor without a standardised output signal, the calibration data is supplied to the sensor.

Remote transmission

Another important part of digitalisation is transmission of the recorded data. Often sensors are in places that are far away from the central collection and evaluation point, or the sensors cannot be connected to a local communication network.

The IoT enables data to be exchanged via the internet, allowing sensor data from different locations to be brought together in a cloud system. The prerequisite for this is that the device or sensor has internet access. For the measuring solution from KELLER Pressure, we use autonomous, battery-operated IoT devices that transmit data via various radio interfaces.

One advantage is that these devices can be installed with little effort as there is no need for cabling and the measuring devices do not have to be incorporated into a company communication network. So that the devices and their batteries have a service life of several years, standardised radio technologies with low energy consumption and a long transmission range of 15 km and over are used alongside an intelligent, energy-saving electronics system. Whether LoRaWan or mobile communications are used depends on the requirements for the data recording or on the type of radio coverage available on site.

Data can be exchanged bidirectionally in both radio systems. Not only does this mean that measured values can be sent from the measuring point to the central collection point (cloud), but communication from the central collection point to each measuring point is also possible too. Communication to the device is used for configuration notifications, which, for example, change a measuring interval from a distance. The communication interface from KELLER Pressure devices with LoRaWAN (ARC1/vADT1) as well as mobile communications devices is well documented, and a software sample code is available for integration into the company's own application.

All devices are designed so that a software update can be installed on the devices. This is extremely helpful in the context of the extension of radio technologies or modifications of wireless protocols. The electronics of the mobile communications device (ARC1/ADT1) for data transmission have a modular design and allow replacement of the radio module in the event of future technology changes so that the transmission device can be adapted again to the latest mobile communications generation with a small intervention and without having to replace the entire device.

Features of LoRaWAN transmission

- The data is exchanged via gateways that are connected to the network server over the Internet. The measurement data is forwarded from the network server to the PressureSuite Cloud, or the application accesses the data from the network server. Individual measured values are transmitted at the shortest possible intervals of approximately 10 minutes.
- The transmission normally takes place without confirmation of whether it was successful.
- With LoRaWAN, radio transmission takes place via public networks (often belonging to mobile communications providers), private networks (a city has its own network) or an open network such as The Things Network (TTN).
- The transmission distances are up to 15 km or more, depending on local conditions.
- Operation without a SIM card.
- Transmission device must be registered to a network.
- Sent via a licence-free radio frequency. Everyone can establish their own radio system.
- There is (still) no global radio network.

Features of mobile communications transmission (4G/NB-IoT/LTE-M)

- Data is exchanged with the PressureSuite Cloud via standardised processes such as FTP or e-mail. It does not matter which technology is used (4G/NB-IoT/LTE-M).
- Lots of measured values can be recorded in a short interval (1 minute) Data is mostly transmitted in data packages that contain several measured values.
- Data is always transmitted with acknowledgement of receipt. The transmitter will see whether the transmission was successful.
- Radio transmission only uses networks of mobile communications providers.
- The transmission distances are up to 15 km or more, depending on local conditions.
- Operation with a SIM card or IoT-SIM-Card.
- Sent via licensed radio frequencies. Only mobile communications providers may operate these radio networks.
- A worldwide communication system is available.

Security

The data is transmitted in encrypted form for LoRaWAN and mobile communications, from the measuring point to the cloud. Current cryptographic processes are used here. The encryption can be stronger for mobile communications because of the higher data throughput and the choice of encryption types available.

Pressure Suite Cloud by KELLER Pressure offers simple and convenient access to the measurement data with your own personal login and SSL encryption.

With the WebApp, data is available without the need to set up and maintain a database. Measurement data can be displayed in graphic form in no time at all and the export function allows you to download your data as Excel or CSV files.

Measuring points are effortlessly and efficiently monitored with the integrated alarm system. For instance, a warning

can be triggered via e-mail if there is an increase in the water level or a battery is running low.

The cloud software interface (REST API) allows measured values from another software system to be called up in a standardised JSON format via HTTPS. This way, the data can be continuously transferred into the company's own software system, therefore making processes more efficient, which is the goal of digitalisation with IoT.

KELLER Pressure provides software developers with extensive documentation on the API.



Data stored in a structured way, accessible at any time and from any device via the browser.



State-of-the-art security.



LoRa and mobile communications data directly in the Cloud. It requires no PC software and no maintenance.



Use Cloud as data storage.



Supports various KELLER Pressure IoT products and IoT protocols: ADT1, ARC1, LoRaWAN, REST API



Set up and receive devices and system alarms.



Data can be viewed by multiple users at the same time and from anywhere.



Visualise and view stored data in the Cloud.



Flexible access to your cloud services or local databases via standard interfaces.



LoRa and mobile communications devices are supplied and customers have access to the data without having to configure or install anything.



Open source programs and tools with comprehensive documentation.



One Software, no installation, data presented in browser.