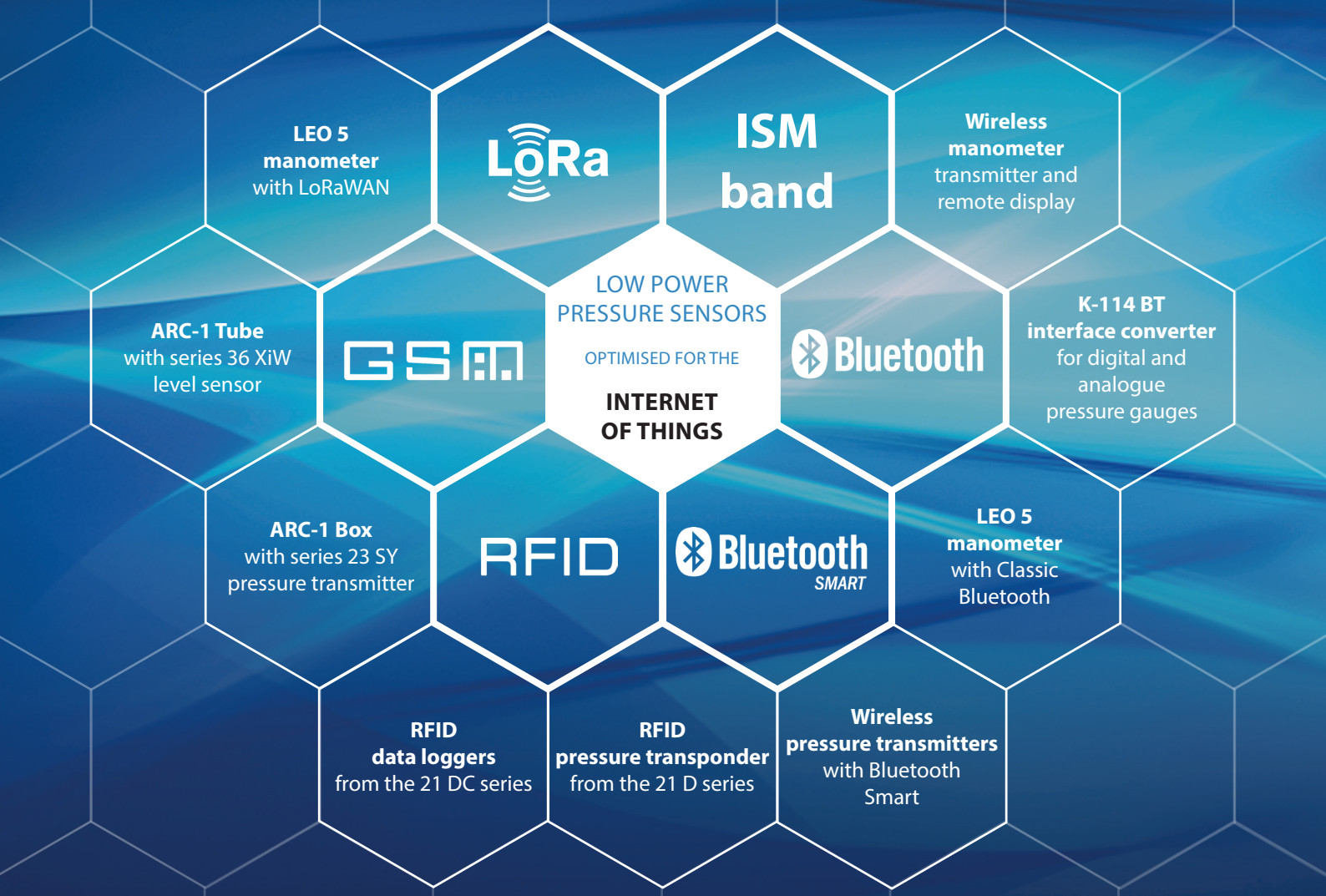


The Internet of Things starts with a sensor

The Internet of Things (IoT) always starts with a sensor. After all, things cannot capture states or carry out actions unless they are fitted with sensors. These two activities and a connection to the web are what make these objects "intelligent" without the help of humans. KELLER AG für Druckmesstechnik is Europe's leading manufacturer of pressure sensors, making it a key partner when it comes to implementing IoT solutions.

IoT is already a widely known and to some extent controversial term. Yet, the Internet of Things is all around us every day, whether we realise it or not. If, for example, you can control TV recordings or your lights at home using your smartphone, this falls under the category of the "smart home". If a company uses automatic, independent processes in its organisational measures, we call this a "smart factory" or "Industry 4.0". Other related terms include "smart energy", "smart mobility" and "smart health". No matter the sector, the sensor is ultimately the most important supplier of data and thus the key component of the IoT process. When fitted to an object, different sensors can be connected to local and global communication networks. The final step in the process is to analyse the data on networked computers or in a cloud.

IoT processes are highly customised and are undergoing continuous development. KELLER has already worked with international companies to develop numerous "smart", customer-specific total solutions in various sectors and applications. The following five examples illustrate how KELLER sensors fuel IoT progress:

Flash floods are sudden and unpredictable. Within minutes, floods can rise over the banks of streams and onto the roads, sweeping away cars, devastating houses, and killing people.

Although weather services usually issue warnings before severe weather hits, many towns are poorly prepared for flash flooding. This is hard to believe, since most regions have detailed special maps that deliberately highlight the danger zones so that the places at risk can prepare accordingly. However, these maps are rarely to be found in town halls, fire stations or the emergency services, which is why people largely fail to take proactive measures. Moreover, the special maps are relatively roughly drawn; obstructive buildings and roads acting as channels are not always shown. So, while the maps may identify a problem, they provide no viable solution.

Which is why an IoT solution is capable of identifying dangers early and reliably raise the alarm for imminent flooding is essential. This means emergency services can be notified automatically, in a matter of seconds, so the appropriate measures can be taken promptly, even in the most remote corners of the region.

KELLER's GSM-2* remote transmitter forms part of warning systems like these. The GSM-2* is a combination of an autonomous data logger and a remote transmitter in one device. When combined with a pressure transmitter or a level sensor, it reliably transmits water levels and pres- sure data via the GSM mobile phone network by SMS, e-mail or FTP to those responsible in order to issue flood warnings before tragedy strikes.

The US National Weather Service (NWS), for example, uses a GSM-2* solution with accurate level sensors (1), a remote transmitter (2) and a special type of software (3) adapted to its needs. KELLER also provides technical support for setting up, installing and programming the system, which sends the responsible community workers an SMS notification when water levels rise. After the system has been implemented, the infrastructure can be converted from manually positioned mobile barriers to permanently installed swing gates that close when flash flooding occurs.

1 *Highly accurate series 36 X level transmitter*

2 *Remote data transmitter and GSM-2* data logger*

3 *GSM software*

* The GSM-2 Remote Data Transmission Unit was further developed and replaced by the new product ARC-1: www.keller-druck.com/arc-1

A level measurement with a remote transmitter is not just highly practical for detecting hazards but also for other level and fill level applications. Take pubs, for instance, where an emptying beer tank could be equally dangerous.

In this application, two pressure sensors work at the heart of the solution to measure the level of liquid in the tank and to send a warning message to the brewery by e-mail via the GSM-2* remote transmitter, the mobile phone network, and the Internet. The brewery sends an automatic order proposal to the landlord, who simply has to confirm the order.

This automated, “smart” M2M (machine-to-machine) solution reduces stress for landlords and saves brewery drivers from profitless emergency weekend deliveries. Inaccurate order entries are now a thing of the past, shipping can be optimised and landlords have a continuous supply of fresh beer. Crisis averted.

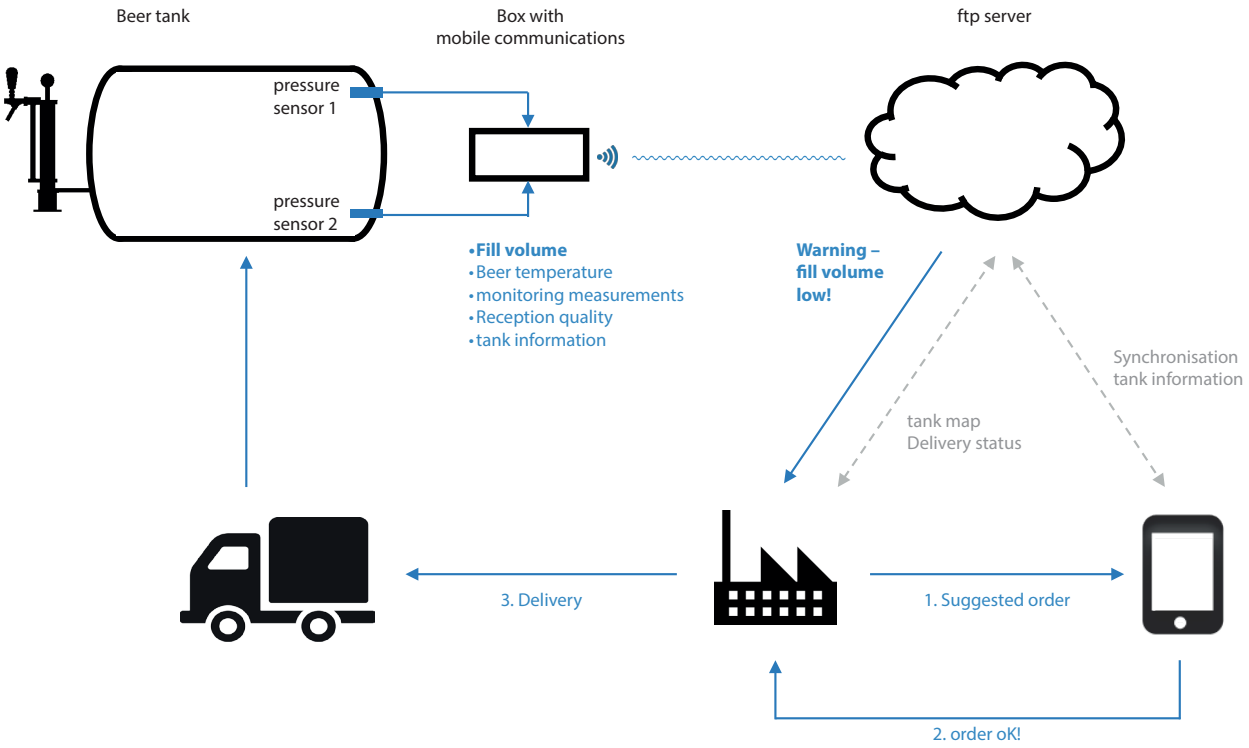


Diagram of the automatic beer order process

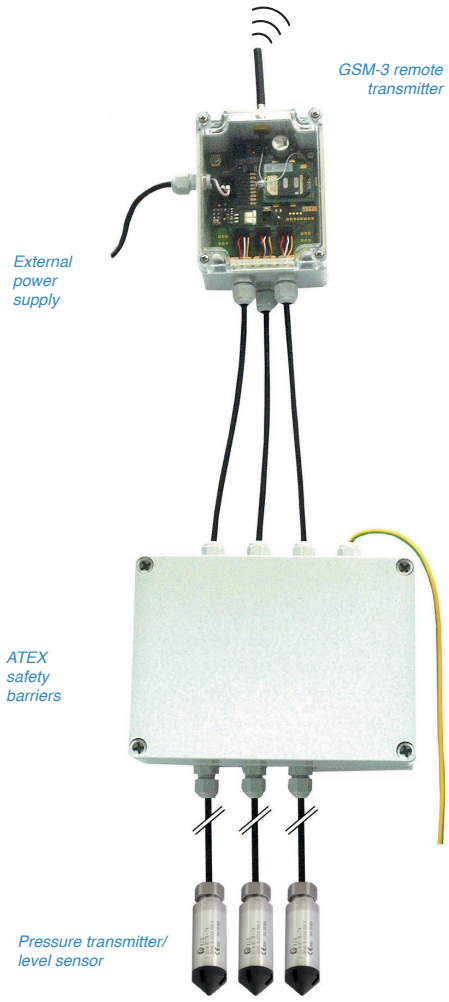
* The GSM-2 Remote Data Transmission Unit was further developed and replaced by the new product ARC-1: www.keller-druck.com/arc-1

Alongside water and drinks, fuels are another liquid ideally suited to being managed by means of automated, “smart” processes. The remote monitoring of fuel levels in heating oil, diesel, and petrol tanks is a great support to mineral oil companies, petrol station owners, and property managers alike.

KELLER developed the “EasyOil®” remote monitoring system in partnership with a Swiss mineral oil supplier. This system has really found its place in the market and is the key selling point for customers in 80% of the contracts concluded for heating oil deliveries.

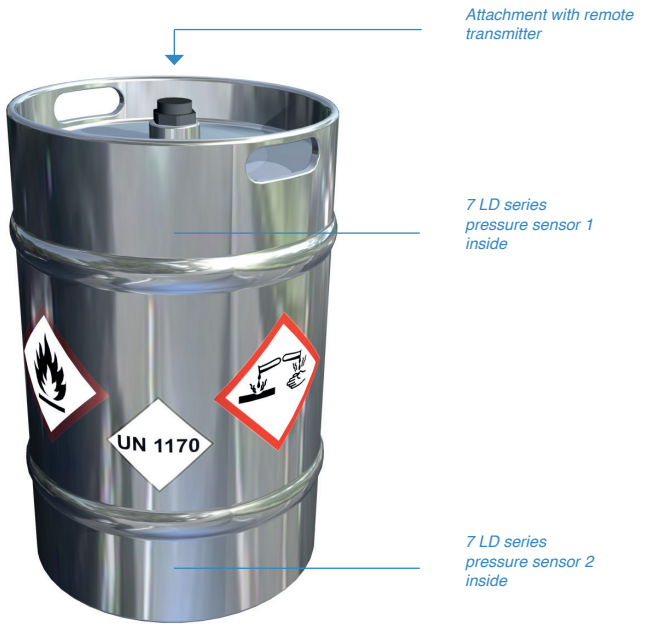
The order process is the same as for the beer tank: The pressure and level of oil are measured at the lowest point in the tank, the current content in litres is calculated according to the shape of the tank and the data is transmitted via GSM. A special feature of this application is the customer-specific software. In addition to the current data such as fill level, consumption and order history, it also contains oil prices, which are updated twice a day. This combined information optimises the order process, allowing customers to stockpile when the price of oil is low or the tanker is close by.

Because there is a risk at petrol stations that an electric spark could cause the gaseous atmosphere to explode, any pressure transmitter taking measurements in this type of environment must be intrinsically safe. For this application, the GSM-3 remote transmitter has been extended to include a box with built-in safety barriers that limit the electric output of the measurement system within the zone at risk of explosion (the ex zone), thus preventing sparks.



The risk of explosion is also a key issue when it comes to chemicals. Warehouses belonging to chemical manufacturers and distributors contain numerous different chemical containers holding all manner of different explosive and harmful contents.

More often than not, the fill level inside chemical containers is neither measured nor displayed visually on the outside. One option would be to install a highly resistant float gauge but this is not sufficient to guarantee safe transport or to monitor the contents of the tank continuously during transport. Yet continuous monitoring is an essential factor in guaranteeing a delivery in line with the relevant standards.



If the pressure within the container is measured as well as the fill level, it is possible to check whether the container is properly sealed or whether it was opened during transport. The log also indicates whether or not the container was subjected to excessive accelerations.

In this application, the fill level is also measured by two compact pressure transducers, the series 7LD. KELLER has assisted in finding a solution which integrates the transducers while allowing the container hold its original form. Since the container is under pressure, one transducer is affixed at the top of the container to measure the ullage pressure, and the other transducer affixed at the bottom to measure total container pressure. The differential pressure between the two 7LD transducers is equal to the chemical level within the container.

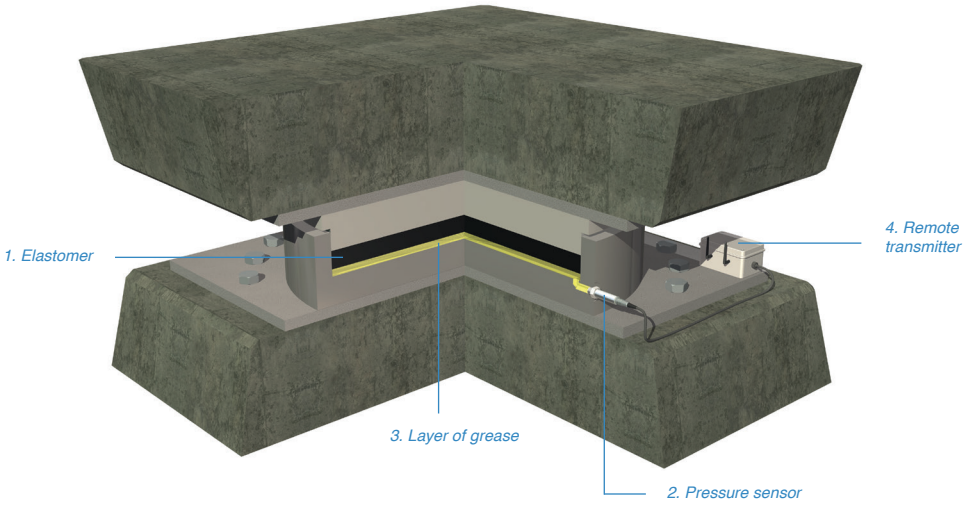
This information, along with temperature and container location, is transmitted, connecting to the Internet of Things that facilitates access to vital information where it is needed most to ensure proper chemical monitoring.

Another area in which sensors facilitate smart monitoring is in power measurement, where pressure sensors are employed to measure and record load distribution on bridges.

The volume of traffic on our roads is an unknown quantity and the growing proportion of lorries (or trucks) places increasing loads on bridges. But the ground is not a static feature either, since plate tectonics cause everything on the planet to move and the ground beneath our feet to change on a daily basis. These two variables will cause the load distribution on a bridge to change. To ensure continuing safety, it is necessary to continuously monitor and identify changes in the load distribution using sensors.

Previously, bridge loads were displayed using a mechanical indicator on the bridge bearings, which had to be read on site. KELLER has focused its attention on this central supporting element of the bridge and integrated a networked pressure measurement solution into the bearing. The bridge transfers the loads to an elastomer cushion (1). Between the pressure sensor (2) and the elastomer is a layer of grease (3) that functions as a pressure transfer medium and makes it possible to measure the internal pressure due to loading. This change in pressure is determined by a pressure transmitter whose customer-specific design integrates perfectly into the bridge bearing.

The GSM module (4) reads the data directly via a digital interface and sends a warning message to those responsible depending on the measured value. The use of stainless-steel-covered pressure sensors with an especially long service life guarantees decades of reliable measurements and functional safety. With the Internet of Things, bridges can be reliably and continuously monitored for changes in load distribution that pose a threat and closed off if necessary.



Bridge bearing with a built-in elastomer cushion, layer of grease and pressure sensor

The Internet of Things offers “smart” solutions that help make life easier and more convenient, improve and streamline processes, and receive information in good time that was previously unavailable or difficult to acquire. Smart solutions are highly personalised but always begin with an object and a sensor.

We would be happy to advise you on your own customised IoT requirements – info@keller-druck. com.

KELLER is a member of the LoRa Alliance

The long range wide area network “LoRaTM” connects objects via radio and offers safe, bidirectional communication within the Internet of Things. LoRaWAN is based on the open industry standard LoRa and has been set out by the non-profit organisation LoRa Alliance, of which KELLER AG für Druckmesstechnik is a member. This technology offers high coverage and a low level of energy consumption, which is especially suited to battery-operated applications.

LoRa also offers the benefit of installing your very own gateway (communication device between LoRa and the Internet), giving companies and private individuals the option of opening another radio cell in their network in order to connect independently of a network operator.