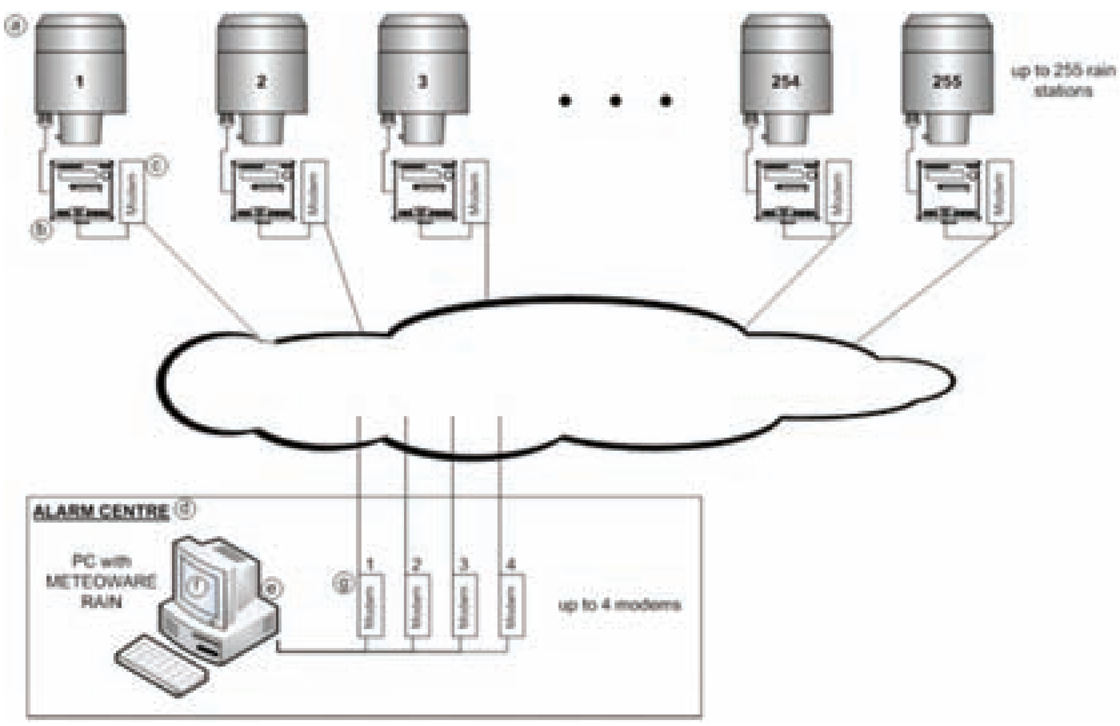
Rain Monitoring - Be Prepared for Torrential Rain

In 1859 Wilhelm Lambrecht started the production of meteorological instruments. Today Wilh. Lambrecht GmbH is the most experienced company in the branch. LAMBRECHT products which are characterized by excellent quality, performance and longevity, are supplied to 20.000 customers in more than 150 countries all over the world. The product range was extended by sensors and system solutions for medium budget. The company's ambition was to reduce the price but to hold the high quality. The result is a sensor portfolio of very best price- performance ratio.

Lambrecht's long term experience on various markets world wide as well as the successful combination of sales and service network together with highly motivated employees and reliable suppliers are the key and solid foundation for our continuous success and growth.

Further peripheral instruments and accessories can also be provided. The wide range of meteorological sensors and systems completes the product portfolio. The data loggers and software packages allow a comfortable and easy use. Substantial service packages in combination with an effective customer support and a long-term availability of spare parts distinguish Wilh. Lambrecht GmbH as a reliable supplier and partner.



Example of rain alarm network

Rain monitoring - alarm network

The change of global weather is an important matter and a daily discussed issue everywhere. Water and rain are the most important thing on earth and crucial for everybody's survival. The world is increasingly faced with dangerous and life-threatening heavy rain disasters.

The present flood cases and the related disasters all over the world draw the attention of the responsibles. More and more rain measuring systems are installed to realise an early flood warning.

Depending on the topographical position of valuable goods or human life, rain must be measured at different points within the catchment area of the rain water. Valley rivers' volumes increase dramatically as a result of water flow from the mountains. Therefore the rain must be measured at different levels on the mountain and also in the valley. By knowing the topographical situation, the mass of water can be calculated based on continuous data support from automatic rain gauges with online data transfer. This is the only way to warn the population and protect goods against the flood in time.

A precipitation alarm station basically consists of a precipitation sensor (a), a data logger with capable intelligence (b), a communication unit (c), a suitable message receiver (d) and a corresponding software (f). (The commonly needed power supply will not be discussed in more detail at this point.)

LAMBRECHT supplies all these components and facilitates a simple design of a precipitation network. All components are approved high-quality measuring and evaluation systems for a most reliable and cost-efficient flood warning system.

The Precipitation Sensor (Rain Sensor)

Precipitation sensor 15189

A precipitation sensor is a measuring device used in meteorology and hydrology to measure and record precipitations over a defined period of time.

In this regard sometimes differences are made between rain gauges just for liquid precipitations and snow gauges designed for frozen precipitations only. Precipitation sensors with controlled heating can be used to measure liquid precipitations as well as frozen precipitations (past molten).

Rain gauges exist for many years. Around 500 B.C. the ancient Greeks already used to record precipitations. The first standardised rain gauge was established during the mid of the 15th century by king Sejong and crown prince Munjong in the present Korea. These standardised containers were used in the whole country as official gauges.

In 1662 the Briton Sir Christopher Wren invented the first rain gauge based on a mechanical self-emptying tipping bucket. Most of the currently used tipping buckets operate with two buckets which are designed like a seesaw, mirror-symmetrically arranged around a central tipping axis. The "tipping bucket" is designed in such a way that always one bucket is placed under an above fitted funnel. The collected precipitation runs through the funnel into the bucket. If a certain volume is exceeded the tipping bucket moves and the other bucket will be placed below the funnel. Typically at the tipping movement a magnet will be passed over a reed switch and cause a pulse. The ratio of collecting area of the funnel and the filing volume of the bucket results in metric areas for example in 0.1 millimetres precipitation per square metres (mm/m^2) or 0.2 mm/m^2 per pulse. In countries where the inch system is used this ratio is usually 0.01 inch per square metres per tipping.

The generated pulses are collected, recorded and summed up to a total quantity of precipitation per time period. Established units of precipitation intensities are millimetres per minute (mm/min.), per hour (mm/h) or per day (mm/d), in which the amount of precipitation always refers to one square metre ($1m^2$). Therefore the term "per square metre ($/m^2$)" generally will be ignored.

In general tipping buckets show an intensity- dependant error of measurement. This error can be minimised by mechanical techniques, but not totally eliminated. Such intensity- dependant deviations of precipitation amount can be electronically compensated directly by the sensor or by a following data logger.

A different method of measuring precipitation weighs the precipitations collected in a storage vessel. Normally such systems measure very precisely and with comparatively high resolution, but they require intensive maintenance and are mostly extremely expensive. (Furthermore non-precipitation events like bugs, leafs or small branches are measured by this sensor as precipitation too. Within the winter period these sensors need a special kind of antifreeze fluid.)

Other measuring systems work optically or even acoustically. The optical measurement often uses a light band and count the drops fallen through. The sensor simultaneously measures the drop diameter to compute the corresponding amount of precipitation. Since these optical precipitation sensors also detect the mode of precipitation and other parameters, they are also named disdrometers. This type of sensor is typically very high in price and suboptimal for quantity measurements, but they give a good response of current intensity of precipitation.

AUTHOR DETAILS

L. Wilhelm
Sales Department
Lambrecht
Friedländer Weg 65-67,
37085 Goettingen,
Germany
Tel: 0049 551 4958 0
Fax: 0049 551 4958 312
Email: info@lambrecht.net
Web: www.lambrecht.net

Acoustical precipitation sensors "hear" the precipitation impact, like a person under an umbrella hears whether it is raining heavily or slightly. However, with regard to snow or similar smooth precipitations this system shows its weakness.

Almost new on the market are precipitation sensors based on radar technique, but like the optical systems these devices are better suited to measure intensity of precipitation than for quantity of precipitation.

LAMBRECHT offers a range of proven tipping bucket rain sensors, which are necessary for the precipitation survey in a precipitation network (in accordance with the Joss-Tognini principle). The operation mode of these resembles the other tipping buckets on the market, but a special optimised design distinguishes the LAMBRECHT tipping buckets. The low- priced but professional precipitation sensor of LAMBRECHT is model 15189. The compact and robust design characterises this sensor and is available with or without heating device. Model 15188, apart from the optimised heating, offers options with analogue output and integrated linearisation. Especially for high mountain applications the company offers model 1518H3 with three independently regulated heating circuits whereby this device is perfectly dedicated to measure also water volume of hail and snow.

The Data logger

Data logger TROPOS100

The core of a precipitation station is the data logger TROPOS-100 which records, linearises and stores the precipitation quantities on an ex-changeable memory card. For the linearisation the data logger detects the precipitation intensities over a fixed period of time and amends the precipitation quantities depending on the actual intensity. The storage of the data can be carried out in permanent or event-driven manner. At the event-driven storage the logger just memorises the days with rainfall. That way, the storage volume will be minimised and data graves filled with zeros can be avoided. Depending on the configuration the data will be called-up and collected by the control centre. There, as described below, a corresponding alarm will be generated (alarm-function-1). Alternatively the data logger actively contacts the alarm centre, after exceeding the adjusted threshold (alarm-function-2). Certainly the data can be read on site from the memory card.

The Alarm centre

All data from the rain gauge network are to be collected at the central office of the disaster management authority. The alarm control centre of the introduced example consists of a PC including evaluation software and up to 4 modems (+1 modem for direct access to the stations only). The communication with the alarm control centre can be carried out via GSM modem for example. GSM modems represent the most cost-effective communication alternative and are absolutely sufficient as the data volume is very small.

The Software METEOWARE RAIN

The precipitation software METEOWARE RAIN allows the operation of a meteorological network up to 255 precipitation stations. The software permits a graphical and a tabular evaluation of the collected precipitations and offers the possibility to export the data to other software applications. By means of the METEOWARE RAIN, the meteorological network can be monitored from afar. For the alerting at certain precipitation incidences, the software disposes of two construction stages. Generally an alarm will be generated, when a certain precipitation quantity is trespassed within a certain period of time. An corresponding message can be generated at the beginning and at the end of a precipitation event.

Alarm function 1

In the basic construction stage, the alarm control centre calls the chosen precipitation stations and asks for the data which have been recorded on the data logger (TROPOS-100) since the last recall. In case any of the recalled data exceeds the threshold values adjusted in the METEOWARE RAIN, a visual and acoustical warning will be emitted.

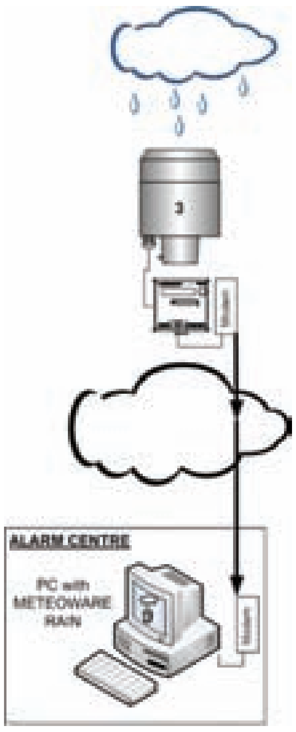
Alarm function 2

In the second construction stage, a data- receive service as a windows system service is running on the PC in the alarm centre, which is in receiving mode. In this case, the threshold values have been deposed directly on the data logger, which always "calls" the PC via a free telephone line if the adjusted threshold values are exceeded. Depending on the configuration, the precipitation station transfers the alarm message respectively the stored data. The alarm message can be released visually and acoustically on the PC. In both cases, the software can administrate up to 4 modems and the control centre receives the data respectively the alarm messages via these modems.

Conclusion

Due to the global climate change it becomes more and more important to be well prepared against possible inundations. The most reliable flood warning system with the best price-performance ratio can be designed by the high quality LAMBRECHT tipping bucket rain gauges together with data logger and individual modem for data transfer. This common and well-proven system requires just a little maintenance and works most reliably. In consequence, the LAMBRECHT tipping buckets are the most recommendable precipitation sensors.

Alarm function 1



Alarm function 2