Industrial PC gathers weather data for Formula 3 at German race track

→ Beckhoff Industrial PCs have been tried and tested for years in harsh industrial environments. During last year's Formula 3 race at Hockenheim in Germany, they demonstrated that they can even cope with demanding racing environments. Together with a radio-transmitting device called a radiosonde and a weather balloon, the Industrial PC helped speed Opel driver Timo Glock to victory.

With the weather balloon to victory

On take-off, the weather balloon with the radiosonde has a diameter of 1 to 2 m. With increasing height, the balloon becomes bigger and bigger until it finally bursts due to the decreasing air pressure.

During the Formula 3 race at Hockenheim in early October 2003, the drivers had to struggle with typical German autumn weather on a track wet from the rainy conditions. Despite the thick cloud cover and based on cloud information layering and the data received from the radiosonde transmitter, the meteorologists from the company Meteomedia AG, under manager Jörg Kachelmann, deduced that the rain would stop shortly after the start of the race. Jürgen Zürn, data technology manager of the OPC-DTM center operated by Opel Performance Center GmbH in Bobingen, Germany responded accordingly. "Based on this weather forecast, we decided to start the race with slicks, despite the rain. After all, the track was expected to dry very quickly. Our driver, Timo Glock won the race despite starting from the 17th position," Zürn said.

Balloon, sonde and ground station system must overcome extreme technical and environmental challenges

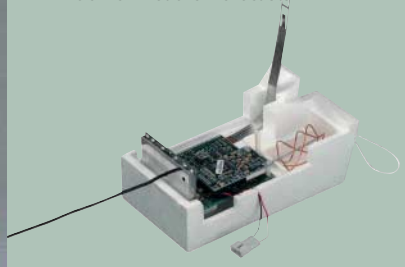
The radiosonde system from the company Graw Radiosondes GmbH & Co in Nuremberg consists of the weather balloon equipped with a transmitter – and a ground station outfitted with Industrial PC technology from Beckhoff.

The weather balloon is filled with helium or hydrogen and initially has a diameter of 1 to 2 m. At the height of the burst point, the diameter grows to no less than 10 to 20 m. After take-off, the balloon first releases a parachute, then a 30 m rope, and then the radiosonde into the air. The complete set reaches a height of approximately 30 km. Due to the decreasing air pressure, the balloon becomes

From 17th place to 1st: Despite difficult weather conditions, Timo Glock from the KMS Opel team achieved a dream finish in the Formula 3 Euroseries at Hockenheim in October 2003.

Weather information from the radiosonde

Graw radiosonde systems are generally used by meteorological services who use the weather profile data provided by the systems as a basis for mathematical models. While the balloon rises, the software in the ground station visualizes the vertical profiles of temperature, pressure, moisture content and wind in special meteorological diagrams (T log P diagram or tephigram). From these diagrams, meteorologists can determine information about cloud layering, atmospheric inversion and moisture content of the clouds and use the data for the preparation of weather forecasts.



The radiosonde electronics for measuring temperature, moisture content and air pressure are protected in a polystyrene housing.

bigger and bigger until it finally bursts. The complete set returns to the ground via a parachute and usually cannot be reused.

The radiosonde itself consists of a sensor carrier with a temperature sensor (thermistor) and a humidity sensor (polymer). In addition, there is a capacitive aneroid capsule that measures the air pressure and several reference sensors. A GPS board is used to determine the position, from which the sonde can calculate the wind direction and speed at any height. Further components include an integrated multiprocessor board for processing the measured data and a transmitter with programmable frequency (400 to 406 MHz) and a range of approximately 200 km.

As the radiosonde rises, it sends a data set containing all measured values to the receiving station on the ground every second. According to Florian Schmidmer, managing director of Graw, the most technically demanding features of this system are the precision of the sensor technology (temperature +/-0.1 °C, air pressure <0.5 hPa, moisture content <5%) at minimum costs (<250 euros) and under extreme ambient conditions (temperature at 30 km altitude as low as -90 °C). Furthermore, everything has to be battery-powered and has to operate with a transmitter that meets strict German regulations.

The customized C3340 built-in Industrial PC is used as a mobile ground station.

Mobile ground station with robust IPC technology

The central component of the ground station for receiving the sonde data is the customized C3340 built-in Industrial PC from Beckhoff. The standard motherboard was replaced with an ATX Pentium 4 board with ISA slots, since the two special plug-in cards used in the system (400-MHz receiver, radiosonde interface for take-off preparation) require this ISA bus, which is no longer supported as standard.

Beckhoff realized the complete customization of the front, the re-routing of the USB connection to the front panel and the integration of an electric on/off switch very quickly and flexibly. Florian Schmidmer, general manager from Graw Radiosondes GmbH & Co, said: "A major reason for the decision to use the Beckhoff IPC was that the C3340 offers drives that are accessible from the front and lockable as standard."

→ Graw Radiosondes GmbH & Co www.graw.de