

## 1 Hand-held data logger ALMEMO 2590-9 in use at KNORR-BREMSE Sfs GmbH



Hand-held data logger ALMEMO 2590-9, following its highly successful introduction at Knorr-Bremse Sfs GmbH in Munich, is now being put to use there on a much wider scale.

Knorr-Bremse is the world's leading manufacturer of brake systems for commercial road vehicles and track-based transport. Knorr-Bremse is a technological pace-setter; the corporation has been a key player for over 95 years in the development, production, and marketing of state-of-the-art braking systems.

Newly developed systems, before entering series production, are tested in field trials with certain selected customers. The acquisition of measured data is a vital step in monitoring and evaluating performance in such trials. Data loggers from Ahlborn have proved their value at Knorr-Bremse over the years time and time again. Knorr-Bremse uses the ALMEMO 2590-9 data logger for example to measure and record the temperature and pressure characteristics of a newly developed air supply unit featuring the VV40-T oil-free compressor, which is now being used on the "Transrapid" magnetic levitation system. Multi-channel data acquisition, the possibility of saving data to smart media cards, and the compact design - these are just a few of the decisive advantages of this data logger over comparable Products. Knorr-Bremse is at present also testing this newly developed oil-free compressor technology for track-based vehicles in a "pendolino" operated by the Deutsche Bahn AG on its Nürnberg - Hof - Schwandorf line. For this project a VV180-T oil-free compressor, an air drying unit, and a tele-monitoring system have been installed. Measured data is transmitted from the moving train via radio and can thus be read out and checked online by operators working at company headquarters in Munich. The tele-monitoring system comprises inter alia an ALMEMO® 2590-9 data logger and a GSM modem - from Ahlborn. The measuring instrument and modem are fed from the train battery via a DC/DC converter specially designed and manufactured by Ahlborn. From this radio-transmitted data it is possible to deduce compressor-specific measured values, duty cycle, line characteristics, environmental conditions, and the vehicle's stationary times. And all this can be evaluated from the comfort of the operator's desk in Munich while the train races along the tracks - in the sizzling heat of summer or the icy cold of winter. Knorr-Bremse would like to express its gratitude to all the staff at Ahlborn in Holzkirchen not only for their help in putting together this tele-monitoring system but also for their extraordinary support in all other respects.

*Klaus-M. Schneider, Knorr-Bremse Sfs GmbH München*

## 2 Continuous monitoring of roller bearings



Fiber Mark Gessner GmbH, paper manufacturers, based in Bruckmühl in Upper Bavaria, Germany, needs to monitor no fewer than 220 different roller bearing temperatures.

Fiber Mark Gessner GmbH uses an ALMEMO 5990-1 data logger system to monitor these 220 or so bearing temperatures on the rollers of one of its paper machines. Any bearing that starts to overheat must be recognized in good time - so as to avoid expensive repairs and to avert the potential disaster of the machine grinding to a standstill during production. The measuring system comprises a two-tier 19" rack containing three ALMEMO 5990-1 devices with a total of 220 measuring points for Pt 100 temperature sensors. The measured data is transmitted via an ALMEMO network to the computer room, about 100 meters away, where a new ALMEMO field bus coupler type ZA5079 feeds it to a Siemens PLC (S7). This measured data is then further processed in the plant control computer. To avoid all possible EMC problems, the measuring points, photovoltaic relays, measuring system, data network, and the field bus coupler are all completely isolated electrically from one another by using optic fiber.

H. Trinczeck

## 3 Monitoring measured data in sensor production

At TEMIC, an electronics supplier for the automobile industry, ALMEMO data loggers are being used to monitor process-relevant media data and the thermal processes themselves.



Temic supplies virtually all the major automobile manufacturers worldwide with electronic systems for drives, safety systems, and driving convenience and comfort features. At its works in Kirchheim, in the Bundesland of Baden-Württemberg, Germany, Temic manufactures acceleration sensors used for airbags and for driving comfort features (chassis sensors for regulating the shock absorbers). With the ALMEMO 4290-7 data logger all in-house media can be monitored and all circuits (e.g. compressed air, water) can be continuously logged throughout the entire works. In its wafer processing Temic relies on high-purity water to avoid the build-up of electrostatic charges during the sawing stage. Thanks to ALMEMO technology the CO<sub>2</sub> gas needed for this purpose can be carefully monitored and dosed more accurately.

Various thermal processes in the special furnaces also have to be monitored; for this purpose fifteen ALMEMO 8990-8 data loggers have been installed and networked. The processes involved here include e.g. the hardening stage when bonding chips onto ceramic substrates. These hardening processes are critically dependent on temperature and atmospheric humidity.

R. Böing

#### 4 Continuous Monitoring Using Networked Data Loggers ALMEMO 4290-7



The company KÄRCHER uses ALMEMO measuring technology to monitor the test run of high pressure cleaners.

High pressure cleaners for private customers are thoroughly tested by the company KÄRCHER in Winnenden, Baden Württemberg, Germany. The development of these products also includes an endurance test run monitoring. Different measurable variables are measured in a cyclic operating mode. The ALMEMO 4290-7 measuring instruments, which are used for this purpose, are linked to each other by means of network distributors with RS422 interfaces. The monitoring of the test pieces includes the measurable variables pressure, current, voltage and temperature. These measurements are used to determine the life span of components and devices in the course of the test. The AHLBORN software DATA CONTROL is used to administrate the 6 test setups. The software allows to directly address each measuring instrument. A computer is used to read out the measuring data from the instruments.

*Dörr and Hinrichs, KÄRCHER*

## 5 ALMEMO Data Acquisition and Monitoring Systems in Medicine



The high flexibility and operational reliability of ALMEMO data acquisition systems is demonstrated with their use in complex permanent monitoring systems for the assurance and proof of process, storage and status conditions during the processing of stored blood.

In close cooperation with the users an application was created that is expandable regarding the hardware and software and that particularly meets the immediate demands and requirements of transfusion medicine institutes and of the blood donation services of the German Red Cross. In this context a great debt of gratitude is owed to the specialists of the Institute for Transfusion Medicine in Suhl, the German Red Cross Institutes in Chemnitz, Dresden, Gera, Plauen and their branches in Zwickau and Görlitz, all of who contributed in an exemplary constructive cooperation to the successful introduction of the ALMEMO system in all the institutes mentioned above. The data acquisition is performed via separate sensors or existing interfaces within the individual cooling and laboratory devices such as deep-freeze cells, deep freezers, refrigerators, incubators, fumigation cabinets to freezing systems and PRISM devices. By additionally acquiring parameters of the room air conditions such as temperature, humidity, air pressure, O<sub>2</sub> and CO<sub>2</sub> concentration the proof is delivered that the guaranteed operating conditions of these devices are observed. Furthermore, it is possible to also monitor existing status signals such as alarm contacts of refrigerating sets, no-break power supply systems or the gas cylinder monitor of a fumigation cabinet. The ALMEMO system is ideally suitable for retrofitting in existing building structures at minimized installation efforts. All mentioned variables are, depending on the room conditions, decentrally stored in individual ALMEMO memory modules, which are combined in a RS422 or RS485 network and then provided to a central acquisition PC. A special version of the AMR WIN CONTROL software provides visualization, archiving and monitoring of the measuring data. Using remote software, further terminals can be used to indicate the monitoring status at any place within the building and to acknowledge alarms.

Freely adjustable limit values for each measuring point, subdivided into warning and main alarms, alarm delays, as well as reminder signals for a persisting alarm status allow for an optimized adaptation of the system to the technical requirements of the different cooling devices. By means of the relay trigger analog adapter ZA 8000 RTA the imminent violations of limit values are routed to visual and audible monitoring equipment. All events are stored in a non-erasable list, which is available as a daily printout. The acquired data can be automatically stored as daily and weekly files and, by means of specified format templates, can also be directly routed as daily or weekly reports via any printer within the network to various responsible departments.

The automatic program restart of the software, the continuation of measuring and storing after a power failure are integrated, as well as the password protection or the transfer of the alarm events to further applications, for example sending an

SMS message. The validation of the individual measuring tapes within the whole system is performed by means of DKD-certified comparison measuring chains, which can also be provided by AHLBORN. (The deviations, which were measured in comparison to a DKD certified comparison sensor and which relate to three measuring points, at  $-30^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$  and  $+20^{\circ}\text{C}$ , were less than 0.3 K) Additionally, plans exist regarding a solution for the automatic recording of freezing parameters for stored blood with defined interfaces or coupling to management systems such as PC Blood. As it is possible to transfer the marches of vitrification temperatures to the blood management system for each batch, the further processing of human or industrial plasma is defined and provable.

*Christian Rinn, Andreas Fürtig, AHLBORN Field Service*

## **6 An earthquake warning system for the region around the Fethiye-Burdur fault in Turkey**

ALMEMO 3290-8 data loggers are being used in three measuring stations in the Burdur area in Turkey to help predict earthquakes in the region.



Many areas in Turkey live under the constant threat of earthquake. All of Turkey - but in particular the Fethiye-Burdur fault zone and the fault zones in North Anatolia, Southeast Anatolia, and all of West Anatolia - are designated as high-risk earthquake zones.

To be able to predict earthquakes three measuring stations have been set up around the Fethiye-Burdur fault zone - part of a project financed by the Burdur Valiligi (the governor's office) and the Süleyman-Demirel University in Isparta. These measuring stations are located in Yassigüme (at a fresh water source), in Baglar (at a well), and in Sifa (at a mineral water source).

At the first station (in Yassigüme) an Ahlborn ALMEMO 3290-8 data logger measures and records air temperature, atmospheric humidity, water temperature, pH level, redox, conductivity, oxygen content, and the ground water table.

At the second station (in Baglar) another device monitors the same characteristics, namely air temperature, atmospheric humidity, water temperature, pH level, redox, conductivity, oxygen content, and the ground water table.

At the third station (in Sifa) another ALMEMO data logger also measures the radon content in the atmosphere.

The distance station to station is approx. 12 kilometers. All these measured values are transmitted via modem to a central computer. Here the measured values are compared against current seismic behavior. The computer determines on this basis how these measured values behave - before, during, and after - an earthquake. The ways in which various parameters change and deviate before an earthquake are carefully evaluated. This information is invaluable; it shows us how to interpret

such behavior in the future and helps us in developing a system to warn the region of earthquakes before they happen.

In the period 21/March/2002 to 24/May/2002 at least eight earthquakes were measured with intensities ranging from 3.0 to 4.2 M. Some deviations in measured data were already recorded in earthquakes of this magnitude; e.g. the water table in the well at Baglar, compared with that in Yassigüme, behaved in a highly abnormal way.

We are fairly confident that the data measured over this period already provides a usable basis for developing a really reliable earthquake warning system for this region.

Prof. Dr. Nevzat Özgür  
Süleyman-Demirel University

## 7 Data Logger ALMEMO 8990-8 in Nuclear Power Stations



### Use of ALMEMO data loggers along with the ANP GmbH FAMOS Fatigue Monitoring System for the fatigue monitoring of components of nuclear power stations

For more than 10 years the FAMOS fatigue monitoring system has been used in many German nuclear power stations. It is used for the continuous monitoring of the fatigue state of the most important components of the primary and secondary coolant circuit. As the maintenance of the previously used electronics became more and more difficult due to the rapid advancements in computer technology, an exchange with new components had to be performed in the affected plants. Using ALMEMO data loggers for temporary measurements had already proven that the ALMEMO system is not only cost-efficient but that it can also be very flexibly adapted to specific requirements. Therefore, this system was optimised for the stationary plant in the power stations. The specific interests of the FAMOS fatigue monitoring system were considered by AHLBORN according to the ANP requirements. The illustration shows individual modules of the ALMEMO 8990-8 data loggers, which are used for temporary measuring tasks, and a 19" technology sub rack, which is installed in a cabinet and used as a stationary system. For the acquisition of the temperature signals the programmable input connectors NiCr-Ni ZA9020FS are used, which also contain information regarding the measuring point. The system currently operates at several plants in Germany, as well as in Mochovce in Slovakia and works error-free, around the clock, 365 days per year. For the PC-based data acquisition the software WIN-Control was specifically adapted to ANP interests and, today, represents a completely independent development that considers the special requirements of customers in the field of nuclear engineering. The illustration shows the temperature distribution at a feed water socket during the start-up of the plant. The measured temperature distributions allow to calculate the mechanical stress in the component and, from these results, to calculate the fatigue share for this process.

*Wilhelm Kleinöder  
Product Group Manager  
Fatigue Monitoring System FAMOS  
ANP GmbH*

## 8 Checking the hops harvest - with ALMEMO



A special sensor for checking hops has been developed for ALMEMO measuring technology.

After harvesting in September hops are dried and pressed in bales weighing approx. 60 kilograms ready for transport. Several thousand bales of this nature are delivered to the major hop processing companies every day. The hop bales must be carefully checked for residual moisture in order to ensure that they are stored sufficiently dry; if they are too damp there is a risk they might self-ignite and whole warehouses might be burned to the ground.

This moisture check must, for time reasons, be performed very quickly - and each bale has to be checked in several positions. A special hop sensor has now been developed for ALMEMO measuring technology, working in conjunction with one of Germany's hop processing companies, capable of measuring both moisture and temperature. First of all it measures the residual moisture level in the bale. If it finds that the moisture level is unusually high, it then proceeds to measure the temperature, thus determining whether the bale deep inside has already started to heat up. Bales of hops affected in this way can be quickly withdrawn from storage and specially treated.

H. Trinczek

## 9 Portable On-site measurement



Portable ALMEMO measurement technology for inspecting pipe insulation in central heating furnace.

Ahlborn engineers based in Ilmenau in collaboration with students of the department of energy supply technology from Lausitz Technical College have successfully optimised a method for measuring the thermal conductivity of insulation materials used in underground heating pipes. Moisture penetrating the insulation material causes huge losses of energy efficiency. Based on a novel idea this sensor for thermal conductivity enables on-site inspections of different Polyurethane foams of varying age and mixes. Compared with previous measurement methods and techniques such as weighing, using the Ahlborn technology offers a simpler, quicker, yet accurate measuring procedure.

## 10 Low Energy House of Zittau University, Germany



Intelligent ALMEMO transducers used for metrological data acquisition in the low energy house of Zittau University and setup of a corresponding control with ALMEMO relay adapters

Further to educational purposes the low energy house of the civil engineering faculty of Zittau University particularly serves for the research and development work in the field of domestic technique. For these projects the Zittau University will, in cooperation with AHLBORN, use the ALMEMO measuring system not only for the decentralized (local) data acquisition but also for testing new subassemblies of the ALMEMO control system. Apart from the decentralized (local) data acquisition these subassemblies also allow the decentralized (local) output of a switch status. The solution is based on the ALMEMO RS422 measuring network. Depending on the task and site it is possible to connect transducers or relay adapters to the network. The data acquisition, visualization, logical processing and control is centrally performed on a measuring computer using the software WIN CONTROL from AKROBIT, Gera, Germany. Currently, a relay adapter ZA8000 RTA is used to control the charging and discharging of the PCM device (Phase Change Material that stores heat) with thermal energy. Measuring data from the ALMEMO measuring network are logically linked and the switch status' are then provided as output via the network. The cooperation with Zittau University plus the interesting research projects regarding the development of new environmentally favourable energy systems will lead to more complex specifications of the current measurement and control design. Based on the comprehensive metrological acquisition and evaluation of the systems it serves, as a result, for the development of optimized suggestions regarding the open and closed loop control.

*Andreas Fürtig, AHLBORN Field Service*

## 11 Ahlborn measuring technology at work in the "etz" in Stuttgart



At the Elektro-Technologie Zentrum (etz) in Stuttgart training CDs are used to encourage students to use measuring equipment in an efficient and workmanlike way.

As part of a project supported and funded by the EU, the Elektro-Technologie Zentrum (etz) in Stuttgart has developed five training CDs to provide further training in all sectors of the electrical and electronics trade (special areas : construction physics, sanitary installations, heating, ventilation, solar heating, and photo-voltaic systems). With a view to providing a more practice-oriented, hands-on idea of measurements to be taken in the course of installing and servicing such systems, courses now include real pictures of various measuring operations. The adjacent example is a screen-shot from the training CD for refrigeration and climate. It includes a picture of an ALMEMO 2290-8 data logger listing the variables measured on a split climate device (incoming air temperature, outgoing air temperature, overheating). The most important objective of training courses given at the etz is to impart theory and practice - equally weighted. All measuring operations are therefore performed by course participants themselves on training and simulation systems in the etz. The results are analysed and the insights gained are discussed in the group with the instructor. In further education and training at the etz, the basic objective of encouraging efficient and workmanlike use of measuring technology is assigned a particularly high priority.

## 12 Portable case for wafer production



A special portable test case has been put together for EPCOS, a company based in Munich.

This portable case contains an ALMEMO 2290-8 data logger, a selection of various sensor types, and five wafers each with five Pt 100 sensors. The wafers, provided by EPCOS, have been fitted with an ALMEMO sensor, namely the Pt 100 sensor element PT802. These sensors incorporate a 4-wire Teflon cable, only 1-mm thick, and are attached, as per EPCOS specifications, using a 2-component adhesive and with a strain relief mechanism. These measuring wafers must be capable in normal operation conditions of withstanding a continuous temperature of around 120 °C. This system helps monitor the tempering and lamination processes involved in wafer production. This test equipment is used by EPCOS in Munich and in Singapore; it has proven to be a really worthwhile investment.

H. Trinczek

### 13 ALMEMO for PPD Value Measurements according to EN ISO 7730



#### Mobile measuring stand for evaluating the thermal comfort.

The German technical control board in Cologne, TÜV Rheinland, uses a mobile setup of ALMEMO measuring instruments to perform comfort index measurements. For this purpose the data logger ALMEMO 3290-8 with globe thermometer, humidity/temperature sensor and thermoanemometer is used. The special setup of the sensor technology allows the measurement of all physical parameters for assessment of the thermal comfort in 3 levels, simultaneously. A software application is used to calculate, during online and offline operation, the resulting PPD value (according to EN ISO 7730) and the turbulence degree (according to DIN 1946/Part 2) based on the acquired series of measurements, the operative temperature (globe temperature), the room temperature, the room air flow and relative air humidity, as well as the required input parameters such as clothing factor, activity level and mechanical power. The preset averaging number of 200 measuring points is a variable and can be changed. In conjunction with the software, the PPD value and the turbulence degree can be graphically presented and documented in a y/t or x/y diagram, either separately or together with other measuring variables.

## 14 ALMEMO 2290-4 to Measure Room Air Conditions



### Stationary temperature and humidity measurement with local display in network or standalone

All functions of various previous instruments have been implemented in the new ALMEMO 2290-4, including the double display (e.g. ALMEMO 2296-1K) of the temperature and humidity being displayed next to each other. Top hat rails are available as an option for wall mounting the instrument. The design of the new ALMEMO 2290-4 also considers the requirements regarding the stationary monitoring of room air conditions. As a result, the versatile measuring instrument meets all requirements for both, the computer-based central data acquisition and recording, as well as the use as a standalone device. When used as a stationary, networked instrument for measuring room air conditions the user will benefit from the convenient double display for temperature and humidity, and from the cost-effective, practical installation of the network and the central power supply in one single integrated setup. As a standalone device the data logger option is available, which can be used with exchangeable memory connectors to allow for a continuous monitoring of those objects that, due to technical reasons, cannot be networked. The memory connector contains a non-volatile memory, which can be read out from a PC using a read-out cable. Naturally, the system can also be combined with our DECT wireless modules. The instrument is also available with the top hat rail option for easy wall mounting.

## 15 ALMEMO 2290-4 used in Refrigeration Engineering



### The service device for the refrigeration engineer with refrigerant temperature measuring ranges

The SB 0000-R option allows the ALMEMO 2290-4 to measure the pressure values of the high-pressure and low-pressure sides of a refrigerating machine to calculate the corresponding temperatures of the refrigerant in the wet steam phase. The special option SB0000-R provides the ALMEMO measuring instrument with 8 additional measuring ranges for determining the temperature from the dew point pressure of different refrigerants. The measuring ranges are programmed as function channels in any absolute pressure sensor, which allows up to 3 different refrigerants per ALMEMO connector to be pre-programmed – further refrigerants can be quickly selected by changing the range. Depending on the equipment of the measuring instrument it is also possible to record series of measurements during continuous operation to determine the efficiency of a refrigerating machine or to isolate rare malfunctions without requiring the presence of personnel. The following refrigerant ranges have been realised: R22, R23, R134a, R404a, R407c, R410, R417a, R507 This special option is also available in combination with other ALMEMO instruments; for example, when additional inputs are required to measure the temperature or humidity values of the cooling room or the environment.