

# » Application Story «

V Panel Express in Automation



## Kontron Panel PC controls biogas plants with Open Source software from Awite

Open Source automation: Focusing on long-term availability and continuous improvements



For the smooth operation and economic success of biogas plants, robust and durable components with long-term availability are essential factors. Additionally, if the components could be optimized during operation, that would create an ideal situation. Software plays a decisive role here too and Awite Bioenergie GmbH relies upon Open Source software, which is employed on Kontron's automation PCs. The decision to use Kontron products was made due to the supported Embedded Linux for the hardware, the Linux support and the excellent Board Support Packages.

In Germany, there are approximately 4000 biogas plants which - according to data from the end of 2008 - produced approximately 11 billion kilowatt hours of electricity, enough for 3 million households. As biogas for electricity production can be gained from nearly all types of crops and organic waste, the majority of plants are situated close to farms and croplands, to minimize transport costs. Awite Bioenergie GmbH is specialized in the automation of such biogas plants. Awite's customers are both biogas plant builders and operators. The most cost-effective system design coupled with a high level of efficiency, system stability and automation are of the greatest importance to Awite. Besides the delivery and production of substrate and the routine maintenance jobs that have to be carried out, the plants are fully automated and even self-optimizing, provided that an optional expert system with fuzzy logic controls the processes during operation. The production of electricity and gas in biogas plants is a technology in which new insights are constantly being gained and new process optimization is permanently taking place, in order to increase efficiency - even in existing plants. In that respect every biogas plant could be compared to a racing car, which constantly has to be tweaked and tuned and its motor control continually improved, in order to achieve best results. Awite is also challenged to deliver the right know-how even during operation.



Image 1: In Germany, biogas plants like this one in Schweinspoint produced approx. 11 billion kilowatt hours of electricity in 2008 - enough for around 3 million households.

## Open Source and Linux

High efficiency requirements and the need for constant innovative developments form an ideal climate for open PC-based controls and Open Source software that has documented source code and which is available free of charge. The basic idea behind Open Source is that a large community is permanently co-developing the software, and other users - including the software developer - can profit from any developments. In this way, any available knowledge and potential can be used efficiently at lower costs and shortened development times. Individual adjustments of the software can be carried out quickly without any dependency on the licensor. In practical terms, that means that Awite's customers reap real monetary benefits thanks to lower software costs and higher total system efficiency. On top of this, any further developments validated by Awite are available for all biogas plant operators at short notice. And, as all the alterations have to be documented and Awite only uses validated source codes and binary files, the

risk of bugs is absolutely minimal. Following this efficiency and Open Source philosophy, the automation PC should be run under an Open Source operating system - in this case Embedded Linux. Awite was not only convinced of Embedded Linux due to the cost-saving aspect and license free implementation, there were additional reasons: In order to achieve a higher level of reliability and maintenance-free operation of the automation computer, it was stipulated that a CF module - with as little storage capacity as possible and thus inexpensive - was used instead of a hard disk. A Linux kernel compiled specifically for the hardware and not requiring a graphic shell results in an extremely compact operating system that - including all applications - does not exceed a memory capacity of 64 MB.

Further to this, Open Source architecture and a large community of developers is a guarantee for long-term driver support, which in case of any future software upgrades makes the installed hardware basis in however many years absolutely future-proof. That is an important factor, as a biogas plant is designed to run for 20 years or longer. Even when additional software is being implemented, Linux and Open Source offer further advantages: For example, the application Voice-Call via ISDN can be implemented without license fees. Awite's system solution saves customers several hundred euros in costs for software. A clear advantage in comparison to solutions which are license-based.

## x86 based Panel-PC with Embedded Linux

The two main criteria for Awite when selecting an automation PC which would be used as a panel PC with corresponding screen size for the clear display of local visualizations, were: the support of Embedded Linux and a low purchase price. Further typical requirements had to be fulfilled too: Basic qualifications like thermal (0 - 40 °C) and mechanical resistance, sufficient IP protection on the front side and excellent electro-magnetic compatibility, as - depending on the type of plant - a frequency converter which can be the source of a lot of interference is integrated in the control cabinet. As one of only a few companies, Kontron offered a x86 based Panel PC with extensive Linux support. For its first platform, Awite chose a Kontron Panel PC with Intel Celeron 650 processor, 15" screen size and Embedded Linux on a 128 MB compact flash as robust memory media. In its latest plants, Awite uses the latest successor Kontron V Panel Express 150 with 1.5 GHz Intel Celeron processor, 1 GByte RAM and 1 GB CF card, for which Kontron (along with Board Support Packages) also offers Runtime Images for eLinux which are already adapted and compiled. Kontron's customers profit from the reduced amount of time and effort needed for development and inexpensive Total Cost of Ownership (TCO). Currently, Awite is also evaluating a slimmer version of the popular OpenSuse Linux distribution and Ubuntu Linux for the Kontron V Panel Express. At least 95 percent of all controlling tasks are run on all Kontron Panel PCs and they also function as a process visualization server. All sensors and actuators, e. g. filling level meters, gas and temperature sensors and

engine control for the mixers in the bio-reactors are connected via a bus controller with WAGO clamps in the control cabinet and via Modbus-TCP to the Panel PC. On the bus controller – depending on the specific type of plant – only the hard real time requests are run, insofar as they are at all required. The plant and process control is carried out by the Open Source software AWIControl, which was written by Awite in C++ and which is constantly being developed, in order to increase the profitability of biogas plants.



Image 2: The Kontron Panel PC hosts at least 95 percent of the controlling tasks and simultaneously functions as a process visualization server.

"The most important criteria for us when selecting the automation computer was full Linux support and the possibility to apply Open Source software. At that time, the Kontron Panel PC was one of only a few systems which offered this

extensive support at an attractive price," explains Dr. Ernst Murnleitner, Managing Director of Awite GmbH. "The successor model Kontron V Panel Express now also offers the possibility of integrating remote maintenance including firewall and Voicemail via ISDN on the automation computer. In addition, with the ThinkIO, Kontron also offers a further system in its portfolio which includes this support. For those customers that only use the remote maintenance and operation, this system configuration would be ideal, as a panel is no longer needed on site and that would make the design of our automation solution even more compact and more efficient."

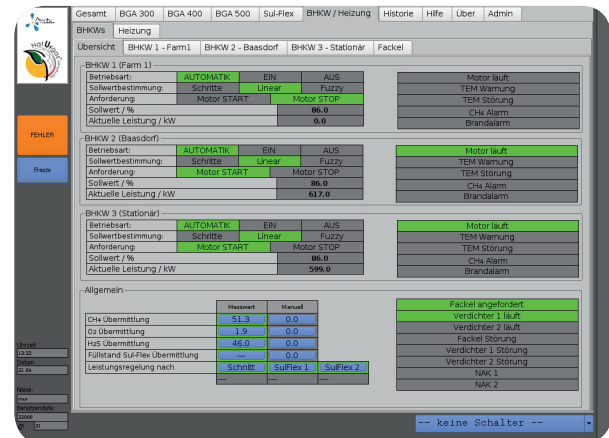
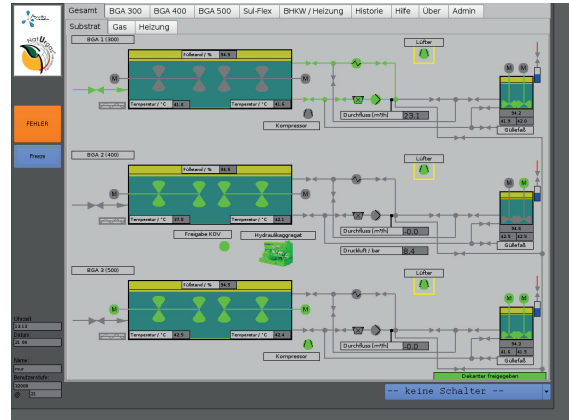


Image 4: An optional expert system with fuzzy logic controls the processes during operation.

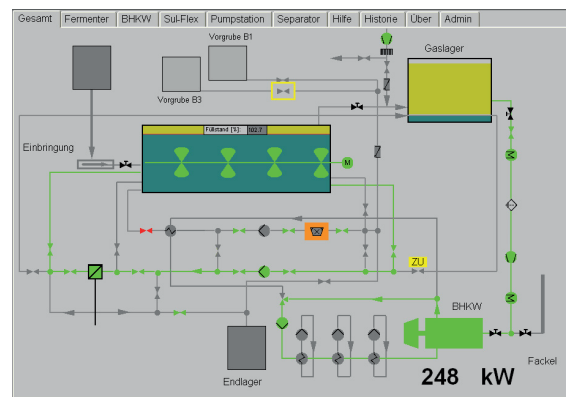
### A detailed view of the Open Source solution by

Using AwiControl all biogas plant parameters can be accessed and controlled. Furthermore, during biogas production an optional fuzzy logic system constantly evaluates different parameters, i. e. PH values, gas composition and progress chart and carries out selfoptimization within the limits specified by the operator. To heighten the efficiency and increase the time-saving aspect, the systems are equipped for remote maintenance and operation via ISDN and/or DSL which means that the operator can carry out remote data retrieval and adjustment of operation parameters from anywhere and does not have to be on-site. To realize this, Awite uses the Open Source software Processview server. Via a Processview client, the same user interface can be viewed on a system connected via LAN or WAN from anywhere in the world, where internet access is possible, after a log-in on the server it can be accessed and the system is available for remote operation. It even accommodates the simultaneous log-in of several users, each in his own national language. Due to the finely graded user administration, different rights can be granted to single users. An integrated software firewall protects the automation PC from threats from the network. Optionally, an alarm function can be installed on the systems to warn the operator if overstepping of measured values or malfunctions occur: Via a PCI ISDN card (Fritz!Card) Awicontrol transmits via Open Source software V-Box over Voice-Call distinct alarm signals to one or several operator-defined landline or mobile phone numbers. If a corresponding gateway is installed, this is also possible using VoIP over DSL. Alternatively, text messages can be sent via mail or SMS gateway. Regular control of the process visualization is no longer necessary, as the operator is actively informed of any imminent problems, further reducing overall maintenance times and operational costs of the biogas plant.



### Operation method of a biogas plant

From the finely chopped biomass in the hermetically sealed bio-reactors, the so called fermenters, methane, i. e. biogas, is produced by anaerobic fermentation. A stirring device in the fermenter which is operated sequentially ensures that an ideal mix of the heated fermented substrate is produced. However, the mechanical impact must not affect the micro organisms. Biogas is collected in the gas depot where desulfurization takes place. Energy recycling of the biogas takes place in a connected block heat power plant. Here a gas-operated combustion engine drives an electric generator. The electricity is fed to the national grid. The waste heat is used to serve different heating circuits, i. e. for maintaining the temperature of the fermenters, to dry the fermentation residue or other goods such as wood chips or for heating buildings.



## About Kontron

Kontron is a global leader in embedded computing technology. With more than 40% of its employees in research and development, Kontron creates many of the standards that drive the world's embedded computing platforms. Kontron's product longevity, local engineering and support, and value-added services, helps create a sustainable and viable embedded solution for OEMs and system integrators.

Kontron works closely with its customers on their embedded application-ready platforms and custom solutions, enabling them to focus on their core competencies. The result is an accelerated time-to-market, reduced total-cost-of-ownership and an improved overall application with leading-edge, highly-reliable embedded technology.

Kontron is listed on the German TecDAX stock exchanges under the symbol "KBC". For more information, please visit: [www.kontron.com](http://www.kontron.com)

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