Due to the integrated fire extinguishing system the datacenter sensors are integrated in the watertight EP3184 EtherCAT Box modules.

PC-based Control: Mobile, energy-efficient and exceptionally compact computing center

From fault to successful countermeasure in 30 milliseconds, thanks to EtherCAT

The Correct Power Institute (CPI) for technical safety and efficient energy use, based in Marsberg, Germany, was founded in 2004 as a private and independent technical institute. CPI does not offer standard products, but instead acts as a service provider for all-encompassing development work based on customer requirements. CPI offers solutions and ideas for cost- and energy-savings, designs systems and implements computing centers with capacities between 100 kW and 24 MW. In addition, customers can benefit from an extensive solution portfolio for fail-safe design of computing centers based on the Zero Defect Datacenter Design (zD^3) concept.

Water and electricity only: the "datacenter-in-a-box," a small computing center, enables a highly available IT infrastructure to be set up simply in any building or room. It is independent of building-specific cooling and fire extinguishing systems and the low-noise version can even be installed directly in the office.

More than 280 data points for fault indication are monitored and logged in the customized C6915 Industrial PC from Beckhoff. The customer can check the status of their datacenter at any time and from anywhere in the world via a smartphone app.

The Correct Power Institute believes strongly in using products "Made in Germany" designed with robust German engineering. Based on this company philosophy CPI also cooperates closely with the Beckhoff application division on projects requiring fail-safe converter technology and fieldbus redundancy.

Modular energy efficiency:
a fail-safe computing center in 1.2 m²

Electronic distribution channels such as Internet and telephone create new challenges for companies in the fast-paced retail business: Back rooms are no longer filled with ring binders and box files. Server racks have taken their place, and telephone systems are also IP-based. An advanced information and communication infrastructure forms the backbone of all business processes, with small computing centers at the core of every branch. For such clients CPI offers compact, energy-efficient computing centers based on the "datacenter-in-a-box" concept. High reliability of the computing center is ensured through the "Zero Defect Datacenter Design" (zD³) concept developed by CPI. ZD³ enables the "datacenter-in-a-box" to provide fail-safe and fault-tolerant cooling for mission-critical, high-density server racks with high specific heat loads.

The smallest version of the datacenter with one active and one passive rack takes up just 1.2 m² of space and is 2 m tall. In addition to the network connection it requires connections for the integrated water cooling and a power connection. The miniature computing center is not only energy-efficient, it is independent of building-specific cooling and fire extinguishing systems, can be installed in any room and ensures a consistent IT standard for customers worldwide. After a relocation, a branch can be back online again in no time. Leasing models are also suitable for these solutions.

Increasing profitability: reduction in electricity costs

At times of rising electricity prices the energy efficiency of the IT solution – determined by the "power usage effectiveness" – directly influences the overall productivity of the branch, just like rental and staff costs. Only 50 % of the supplied energy is used by the servers in the computing center, the other half is consumed by cooling, power distribution and other infrastructure. The datacenter enables simple allocation and effective management of IT infrastructure with high availability, taking into account advanced energy efficiency standards based on ASHRAE specifications.

Consuming around 37 % of total power, the server cooling uses almost as much energy as the actual servers. Based on its analyses and experience CPI derived the IEP® system (patent pending) for computing centers, through which electricity costs can be reduced via efficient positioning of components and encapsulation of modules. Cooling demand was reduced by separating hot and cold aisles and through consistent sealing of the racks. Energy savings of more than 90 % associated with air movements can be achieved through efficient fan speed control. In a large computing center the savings realized in this way can amount to more than 1 million euros per year. CPI bundles these findings in intelligent algorithms for controlling computing centers with PC-based control technology. Combined with a portfolio of standard components for air-conditioning, IT infrastructure and control cabinet construction, customers have a modular system available based on which they can configure an energy-efficient and fail-safe computing center tailored to their requirements.

PC-based Control helps drive efficiencies

Complex algorithms developed by CPI engineers control the climatic conditions within the computing center. CPI utilizes PC-based control to implement this technology. The C6915 Industrial PC offers maximum computing power in a very compact design. For computing centers of any size TwinCAT automation software logs fault indication data on the C6915. Starting with the smallest size of the "datacenter-in-a-box," the UPS, air-conditioning system, connected

[1] "Power usage effectiveness" (PUE) provides a reference standard for computing centers. The ratio between consumed total energy and energy used for actual IT purposes can be between one and infinite.

[2] ASHRAE, the "American Society of Heating, Refrigerating and Air-Conditioning Engineers", is an international professional association that sets building technology standards, among other activities.

IT systems, fused outlets, and the load shedding in case of overload – 280 data points in total – are all monitored. In a large computing center the number of logged data points can increase to more than 5,000. The downstream "business intelligence" developed by CPI analyzes and visualizes the data. The analysis algorithms demand maximum performance from the control hardware and require full compatibility with Microsoft business solutions such as Microsoft® SQL Server® 2012 and others.

The analog measurement signals from the humidity and temperature sensors are logged via customized EtherCAT Box I/O modules. The 4-channel EP3184 analog modules feature four single-ended inputs, which can be adjusted to the signal level of the sensors used, ranging from 0/4 to 20 mA or -10/0 to +10 V. In the EP3184-1002 custom version, two channels at a time are consolidated in a M12 socket. Climate control is based on a predefined target profile. In the event of deviations, countermeasures such as load reduction or external alarms via SMS or e-mail are triggered.

Building management as a bottleneck

For computing center operators it is important that faults are detected and problems are pinpointed quickly. Before complete failure occurs a defined state must be reached, so that transaction data can be saved or virtual machines transferred. Dipl.-Ing. Bernd Steinkühler, managing director of CPI, explains the key aspects: "Based on experiments we found that a complete failure of the cooling system would shut down a computing center within two and a half minutes. Conventional building management systems with response times of around one minute are much too slow, and standard fieldbuses without a redundancy concept are unsuitable. It is not possible to initiate a suitable counter-strategy if a whole minute of precious time is taken up just for detecting that a fault has occurred. Using EtherCAT as the communication system enables significantly shorter response times," said Bernd Steinkühler. "With a cycle time of ten milliseconds we can detect a fault in the first cycle, pinpoint it in the second cycle, and initiate a counter-strategy in the third cycle." In this way faults can be detected before they actually occur and preventive maintenance measures can be used to further increase the reliability of computing centers.

Analysis with TwinCAT

TwinCAT not only handles the intelligent algorithms, it also logs faults and failures in a database that can be used to reconcile and correlate performance reductions and malfunctions. In view of rising electricity costs, operators of computing centers must utilize their servers with optimum effectiveness. Monitoring of all components enables thorough analyses, which CPI offers its customers as after-sales services based on cloud-power monitoring in its TÜV-certified computing center.

Further Information:
www.cp-institute.de