

eXtreme Fast Control Technology

– Looking for the problem to the existing solution



If the automation requirements of current production machines are examined, they can be solved in most cases with established control technology. In conjunction with modular fieldbus technology, PC-based systems in particular offer more than enough reserves of power to satisfy the requirements made of them. However, traditional fieldbus technology could not keep pace with increasing CPU power in the past. Therefore, it became increasingly necessary to use several instances of a system or to use different systems that were specialized for respective tasks. That alone was reason enough for the development of EtherCAT, a new high-bandwidth fieldbus suitable for essentially all requirements.

These considerations are now a couple of years old. EtherCAT has been on the market since 2003 and enjoys global distribution – in particular, thanks to the support of the EtherCAT Technology Group (ETG). In developing EtherCAT, great importance was placed on the optimum utilization of the bandwidth available: simple, 2 bit digital terminals should be supported just as well as complex participants requiring acyclic communication in addition to a great deal of process data. Naturally, the participants should be synchronized with one another. After all, Motion Control applications represent a significant proportion of manufacturing automation.

The upshot is that a single EtherCAT bus is entirely sufficient for the automation of the machines. Even in more elaborate plants, considerably less than 10 percent of the bandwidth is exhausted. All EtherCAT participants are synchronized with one another much more precisely than would be required for normal Motion Control applications. Even if one assumes that part of the free bandwidth and accuracy will be consumed in the next few years by the constant progress in automation technology, there will still be enough capacity in reserve for completely new tasks. What, then, are the additional challenges that we can approach with this solution?

For some tasks, higher speed and improved accuracy help in classic control loops – and this is precisely where Beckhoff XFC (eXtreme Fast Control Technology) is applied.

Automation tasks that would otherwise be reserved for expensive special devices can now be accomplished in passing by a 'normal' controller. However, there is more to XFC than just a fast fieldbus system. The backbone of XFC is formed by the entire chain of precise I/O components with extremely short conversion times, fast communication via EtherCAT, powerful Industrial PCs and TwinCAT automation software.

Other tasks that go beyond pure automation, such as the monitoring of machines and tools or the documentation of work piece quality, can similarly be assumed by XFC. Techniques such as distributed clocks and oversampling, which combine the accuracy of the system with the available bandwidth, enable sampling rates which were previously only possible with oscilloscopes. The modern TwinCAT PLC, in accordance with IEC 61131, has no problem with the amount of incoming data – high-level language programming, huge data buffers, access to databases and the hardware resources of Industrial PCs make virtually any application possible.

However, there are many more tasks waiting for the appropriate solutions. The great tradition here at Beckhoff is that we, as a developer, also maintain contact to our customers at trade shows, which provides us not only with valuable feedback, but also with the impetus for new concepts and products. It is enjoyable and also makes us a little bit proud when we can present techniques that inspire our customers to ideas and comments such as "With this technique I can solve my ... problems very easily" or "I can save ... with that!" or even better: "This way, the quality of the parts produced by my machines can be improved without a great deal of additional expense."

Long-standing automation technology problems can be solved in a simple way today using XFC and EtherCAT. But besides that, there are a great many other technical measurement tasks and industry-, customer- or application-specific tasks. – We would like to inspire you to make use of the new techniques in solving your specific problems. – At the same time, of course, time does not stand still and Beckhoff will continue to develop the most useful products possible.

Dr. Dirk Janssen is Software Development Manager at Beckhoff and was instrumental in the development of EtherCAT and XFC.