EtherCAT Decisive Factors

Why do companies choose EtherCAT?

EtherCAT markets + applications

Why do companies choose EtherCAT?

High Performance

EtherCAT is the fastest Industrial Ethernet Technology

Flexible Topology

Benefit not only for widely distributed applications

Ease of Use

Easy configuration and maintenance

Low Cost

Inexpensive implementation + Infrastructure

Functional Safety

Safety communication integrated

Decisive Factors: Performance

High Performance
Flexible Topology
Ease of Use
Low Cost
Functional Safety

Performance

EtherCAT is the fastest Industrial Ethernet Technology

The need for speed:
Everything that is high end motion control

For example

- Robotics
- Hydraulic / Electric Presses
- Machine Tool Applications
- CNC functionality
- Printing
- Woodworking machines
- Packaging Machines
- Injection Molding
- Any measurement application
- Any closed loop control

Decisive Factors: Performance, Safety

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Robotics

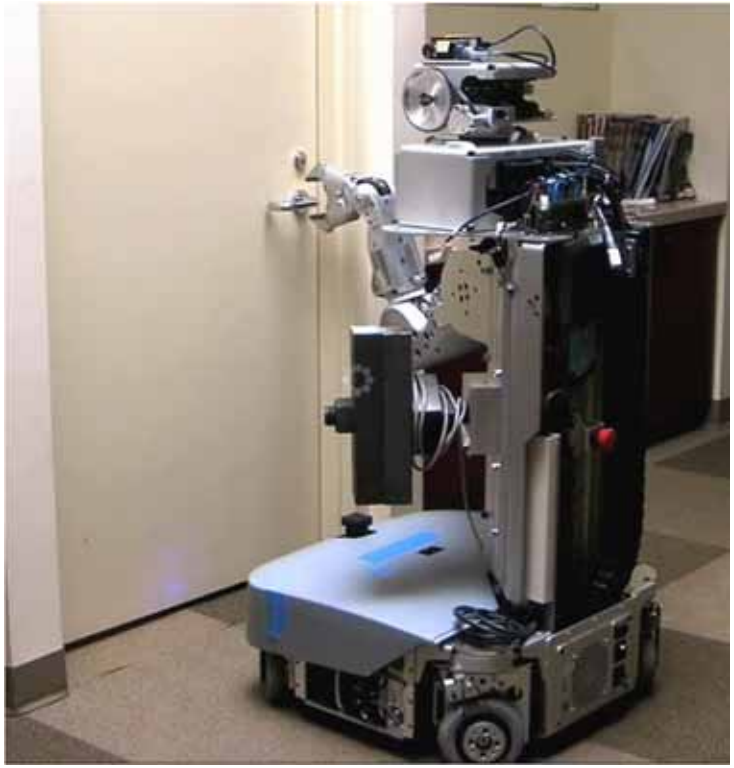
Kuka Robotics, Germany:
KR C4 Robot Controller features EtherCAT Master

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Robotics

Willowgarage, USA: Personal Robot 2



Decisive Factors: Performance, Integration

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Robotics

DLR, Germany: Rollin Justin

Decisive Factors: Performance, Integration

- High Performance
- Flexible Topology
- Ease of Use
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- Functional Safety

Example: Robotics

Redone Technologies, Korea

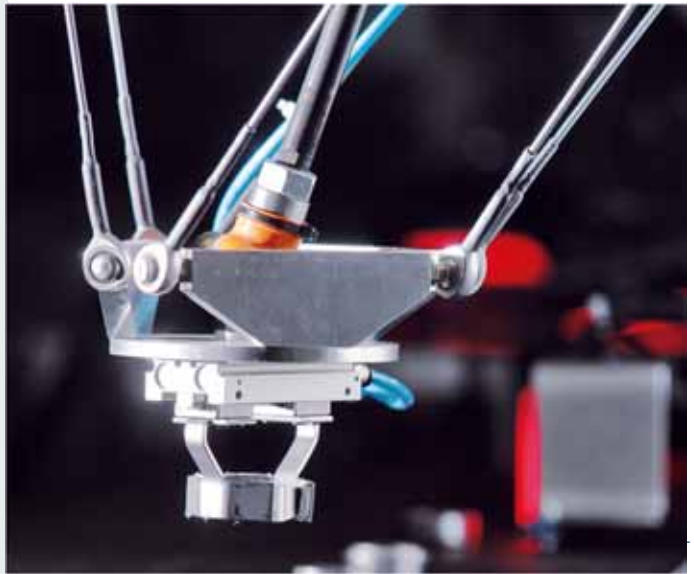
Decisive Factors: Performance, Ease of Use

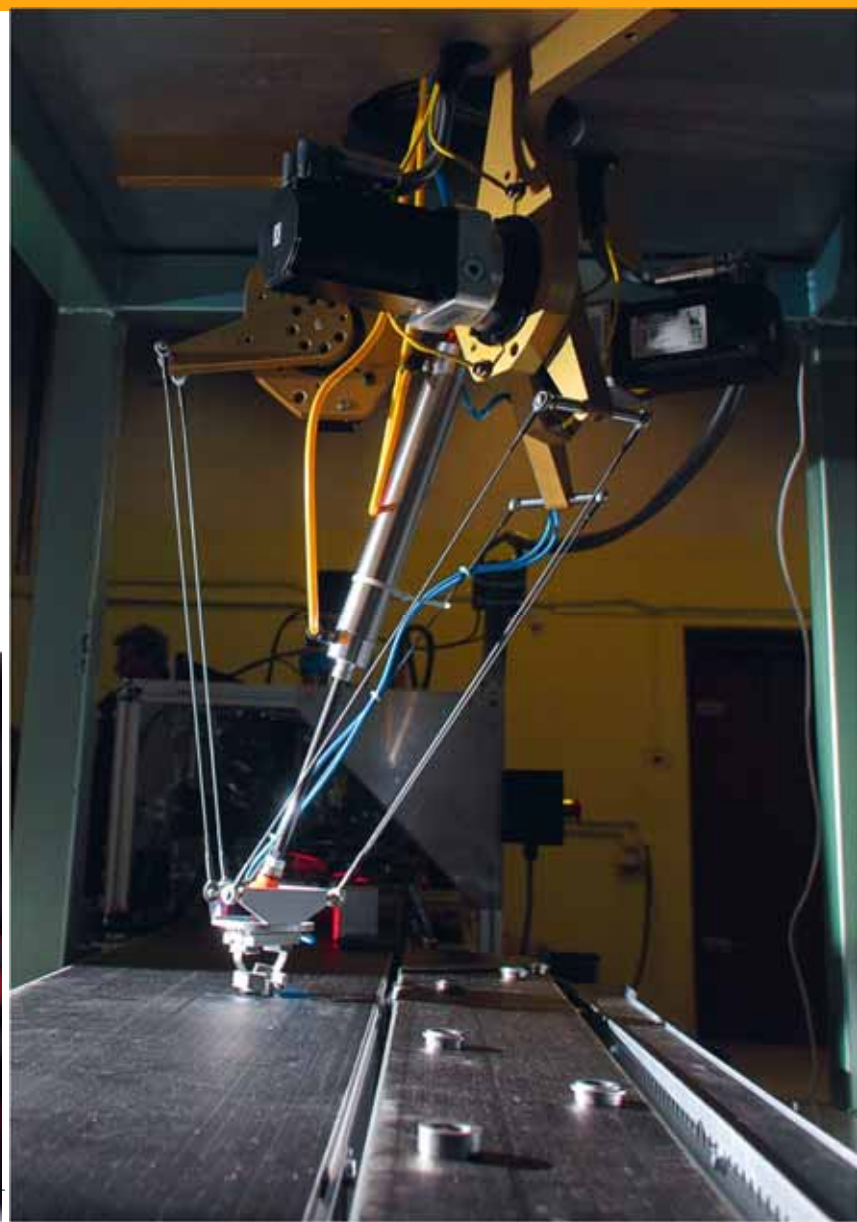
- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Robotics

AEMK Systems, Canada: DeltaBot

Amir Khajepour, AEMK President: *"Fast access to the I/O and ease of integrating remote I/O into our systems are among EtherCAT's key features. Plus, the seamless integration with the rest of the DeltaBot's system components is exactly what AEMK was looking for."*





Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety


BMW Research & Innovation Center, Munich, Germany

Example: Measurement Application

BMW AG: Engine Test Bed

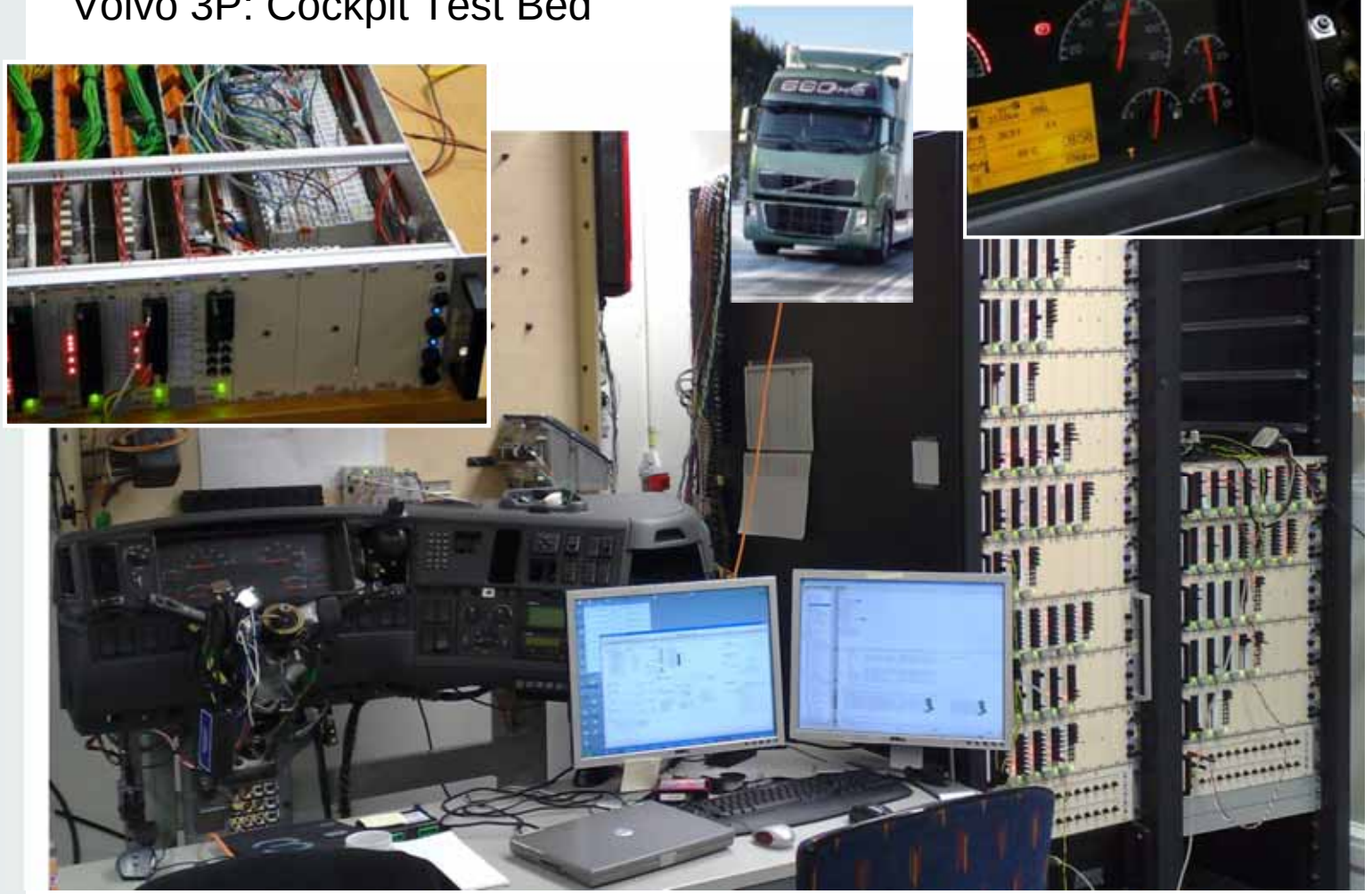
Photos: BMW AG

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Measurement Application

Volvo 3P: Cockpit Test Bed

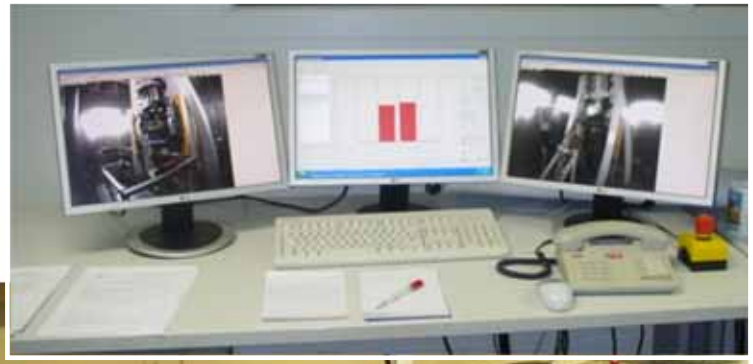


Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Measurement Application

IgH, Germany: Hydraulic Tool Test Bed for Atlas Copco



Decisive Factors: Performance

- High Performance
- Flexible Topology
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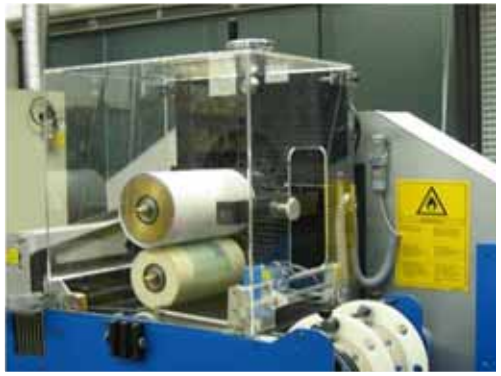
- Functional Safety

Examples: Printing Machines



Picture: Heidelberger Druckmaschinen AG

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Electric Presses

Synchropress:

Roller thread drives, driven by synchronous servomotors

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Metal Forming Application

Accurpress: Press brake

High Precision, High Speed Forming Technology with CNC control

Alex Kvyatkovski, Accurpress:

"Accurpress has decided to move to EtherCAT. This decision was originally driven by a custom application that required faster response times than what conventional fieldbus"

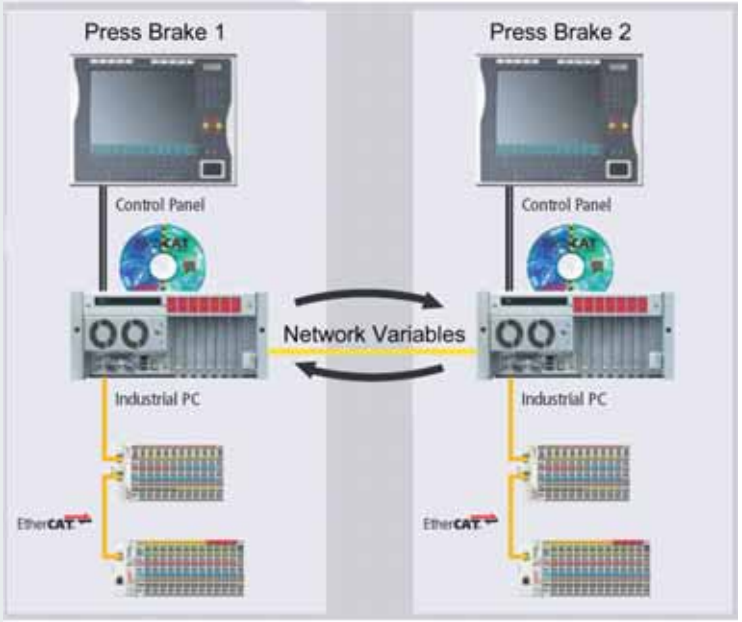
Decisive Factors: Performance

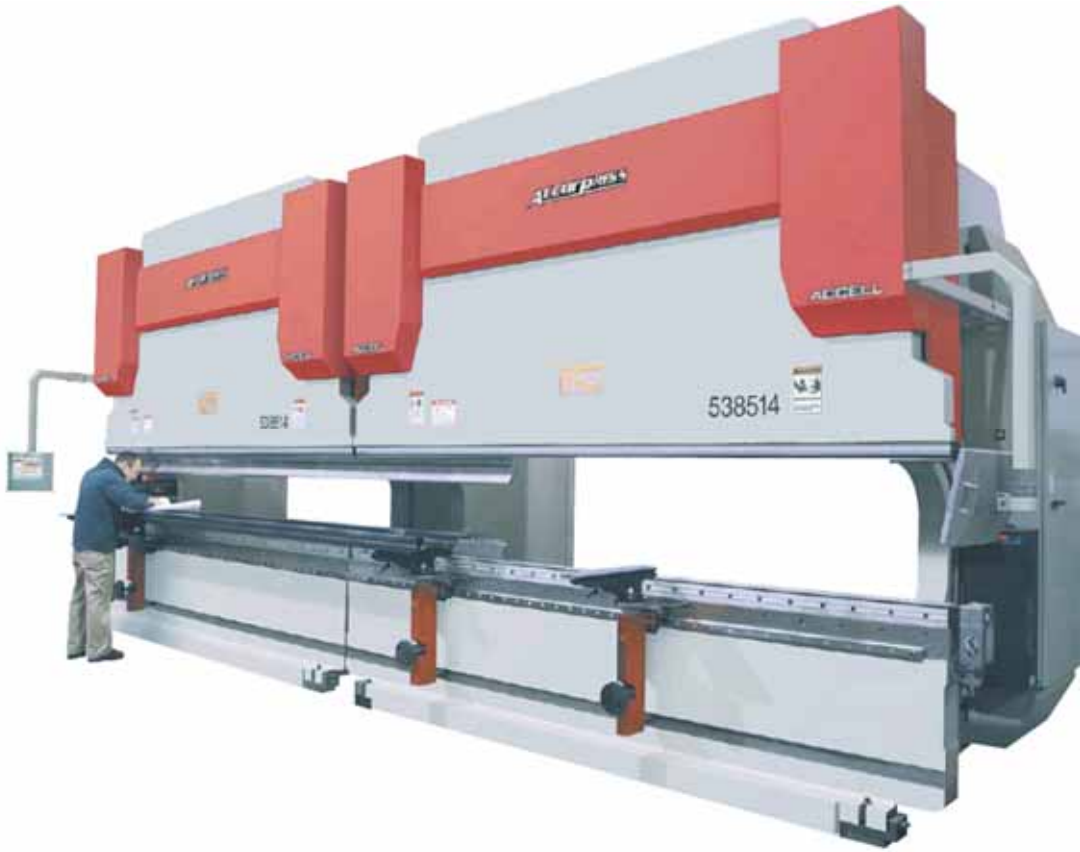
- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Metal Forming Application

Accurpress: Tandem Press brake

Two Presses coupled with Network Variables (EtherCAT Automation Protocol for Master/Master Communication)





Decisive Factors: Performance, Costs

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Machines with CNC functionality

Laserplus Oy: Welding Transfer line for steel sandwich-plates

Heikki Saariluoma, Laserplus:

"The pioneering technology and cost efficiency were important factors in the decision to implement EtherCAT"

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Machine Tooling

ECS, Italy: Milling Machine

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Machine Tooling

Vernet Behringer, France:
CNC Machining Center

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Woodworking Machines

Nobilia Werke: Kitchen Production

36 NC axes and
about 600 I/O points

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging Machines

Ferag: Postpress processing: modular strapping (SmartStrap)

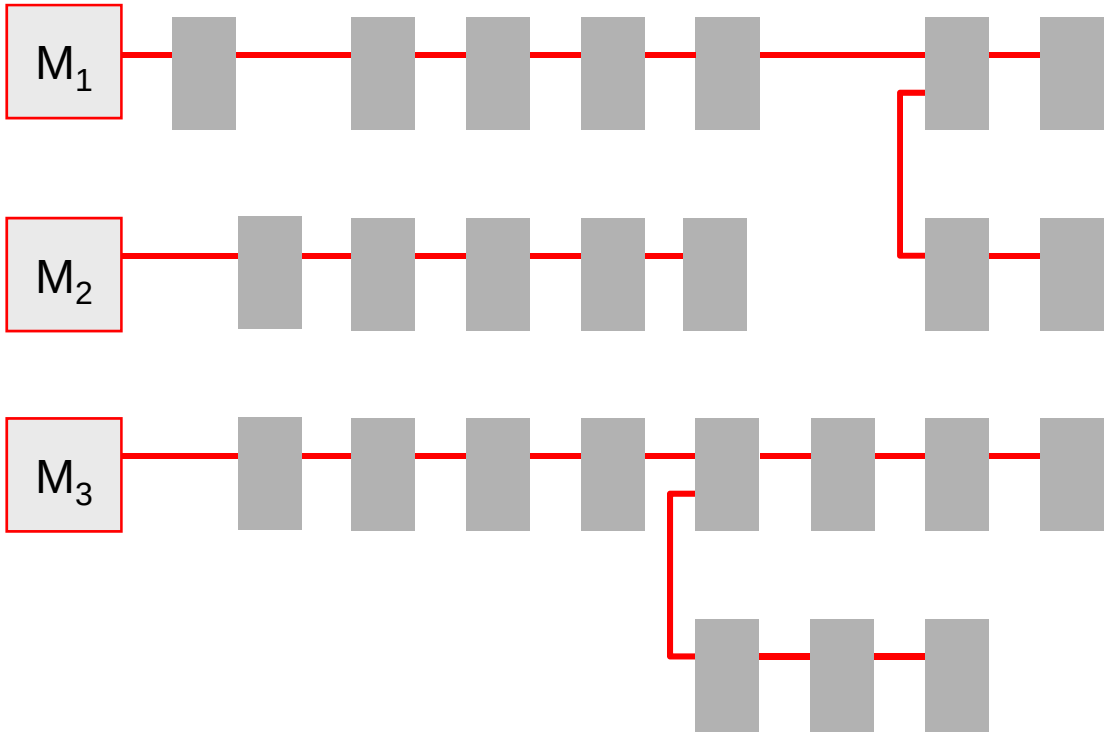
“Besides the real-time characteristics, the simple installation, ultra precise diagnostics and the possibility to communicate with older CAN-based devices in the plant via gateways have all proven to be important.”

EtherCAT: Synchronization of multiple networks

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

EtherCAT networks can be coupled via EtherCAT Bridge

Bridge provides hardware synchronization of several networks



EtherCAT: Synchronization of multiple networks

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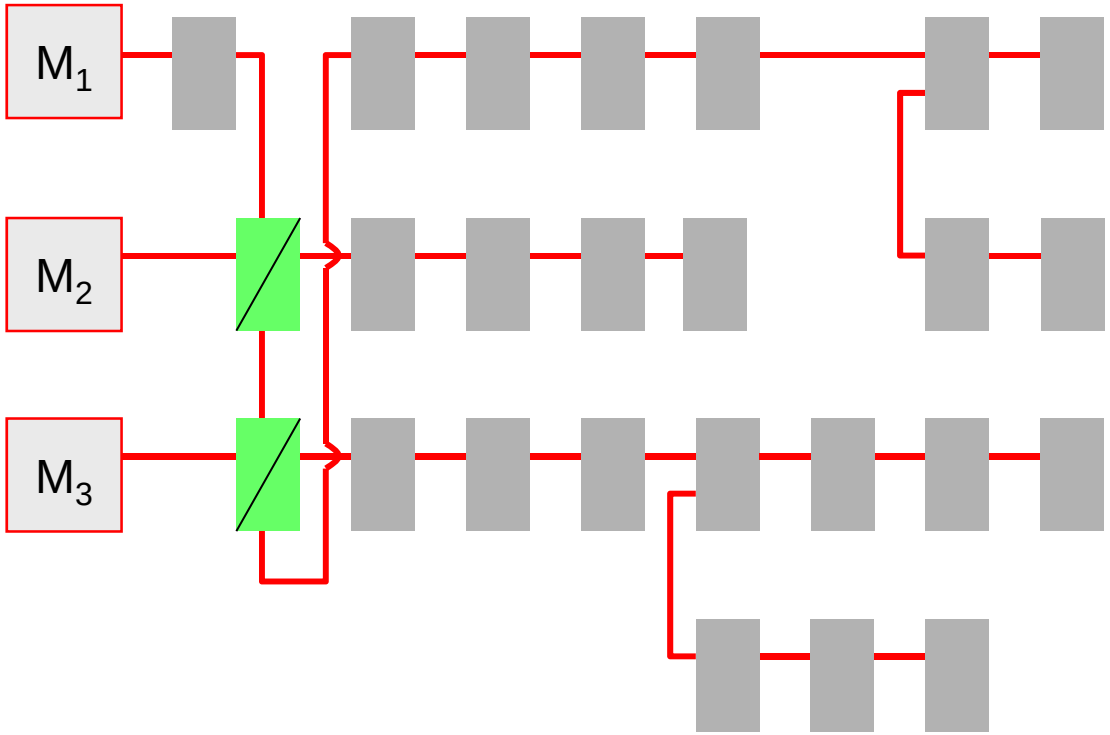


Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging Machines

Ferag: Postpress processing, Inserting Machine

"Previously, a great many special solutions were used with proprietary hardware and local I/O components. In contrast to that, EtherCAT offers flexible topology and extremely high performance. Specialized modules that were previously implemented in hardware form can now be realized in software."

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

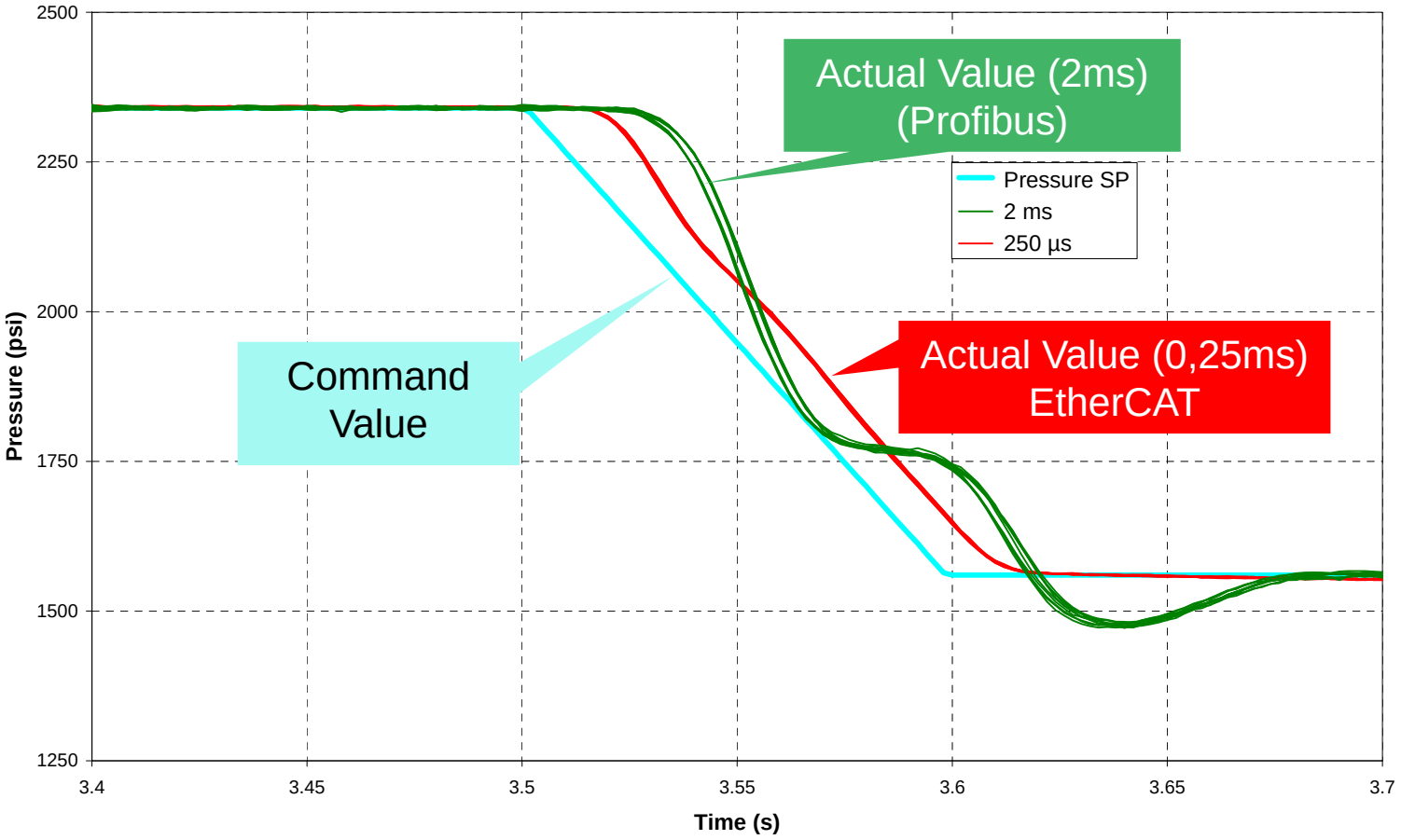
Example: Plastics Industry

Husky (Canada): HyPAC Injection Molding Machine

Better Performance leads to Better Precision

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Transition Pressure Control Plastics Machine



Source: Husky Injection Molding Systems Ltd.

Decisive Factors: Worldwide Availability

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Plastics Industry

Sumitomo Demag, Germany: IntElect Injection Molding Machine

Dr.-Ing. Etienne Nitidem, Sumitomo Demag:

Due to the wide deployment of the technology at any time support for the development tasks by various service providers both in Germany and Japan was available. Besides the system features that were achieved, the development time line was met with the choice for EtherCAT.

Decisive Factors: Performance, Costs

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Plastics Industry

SAB, Thailand: Extrusion Blow Molding Machine

"With PC based technology and fast EtherCAT I/O's, the machine cycle time was drastically reduced to less than 1ms. Hence, SAB was able to improve the machine process and produce faster and precise motion in Hydraulic systems.

SAB was also able to reduce the hardware costs since the EtherCAT performance and bandwidth paired with the PC based control processing power allowed one to replace several dedicated control boards by a single industrial PC."

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Solar Industry

Komax AG, Switzerland: Fully automated thin-film contacting system, Photovoltaic Module Manufacturing

Up to 30 Servo Axis per Machine

Decisive Factors: Performance, Ease of Use

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging

ITEC, Germany: Sausage Cutting
+ Handling Machine

Ralf Wiesbrock, ITEC Product Developer:
"Working with EtherCAT simply makes work enjoyable; the system is not only more powerful than before, it is also simple to configure,"

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging

Huhtamaki Molded Fiber Technology, the Netherlands: Packaging Machine

Jelle Post, Huhtamaki:

"We can now guarantee synchronous running of the spindles with a maximum deviation of the motor axis of 1.8°, irrespective of the load. Previously, with regard to precision, we consciously went to the limit, so we have switched from Lightbus and SERCOS to EtherCAT for the fieldbus communication"

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging

E-Star Packaging, China: hot-glue labeling Machine

Machine Performance: 24000…48000 Bottles per hour

"The main challenge is to detect the label length extremely quickly in realtime and adjust the loading speed accordingly to ensure the correct position of the cutting point.

The system ensures ultimate loading accuracy with < 0.01 mm deviation."

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Metal Forming

Hydropulsor, Sweden:
Ultra fast metal cutting machine

600…700 cuts/minute @ 0.02mm accuracy with hydraulic axes

Rolf Lahn, Hydropulsor:

"With EtherCAT as our fieldbus, we can achieve extremely high speeds, which is very important in highly dynamic hydraulic control systems",

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Mobile Machines

Doerfer Companies, USA:
Wheelift heavy transporter

Ron Howell, Doerfer Companies:
“The performance of EtherCAT is impressive and the equipment is very easy to integrate. EtherCAT can expertly handle high-speed Motion Control and work in parallel with many other fieldbus networks. Depending on the Wheelift transporter, 8 to 24 servo axes are individually controlled. Synchronous, coordinated motion would have been very difficult to accomplish on this scale using traditional PLC systems. Our cycle times for critical motion functions are 1 ms or less.”

Decisive Factors: Performance, Safety

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging

Multivac, Germany:
Packaging Machines

Alois Allgaier, Multivac:
"EtherCAT brings us a big step forward technologically. The signals are captured more quickly and the machine cycle times are optimized. This enables us to better exploit the potential of the PC-based control system with its high-performance processors and to control the axis modules of our plant more rapidly and precisely."

Picture shows typical EtherCAT Application. The specific system shown on this slide may not use EtherCAT (yet)

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Plastics Industry

Graham Engineering Corporation, USA: Blow Molding Machine

Paul Klinedinst, GEC:

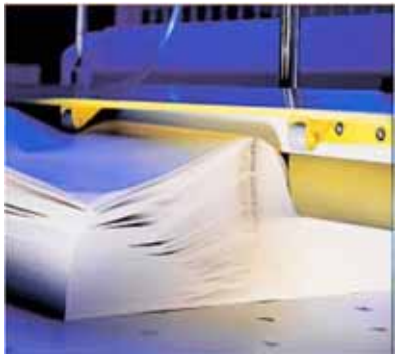
"The fastest we were able to close the loop on on the parison programmers of our previous machines was 1 ms. With EtherCAT, we can close the loop on the Lab Wheel as fast as 150 µs. We're getting better performance with more control over the parison programmer now."

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Printing Industry

Three Knife Trimmer for Print Products



Best in class machine:
90 cycles/min, 5400 books/h

20% faster than previous record-holding machine

Decisive Factors: Performance, Costs

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Woodworking Industry

Control Logic, USA: Rip Optimizing Machine

Chris Aiken, Control Logic:

"Networking with EtherCAT I/O Terminals provided industry-leading performance via real-time, high-speed updates at a lower cost than I/O technologies that aren't Ethernet-based."

Decisive Factors: Topology, Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Wind Energy

Multibrid GmbH:
5MW M5000 Turbine
for offshore application

Decisive Factors: Topology, Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Wind Energy

Renergy Electric Tianjin Ltd
1,5MW Turbine for large wind park application

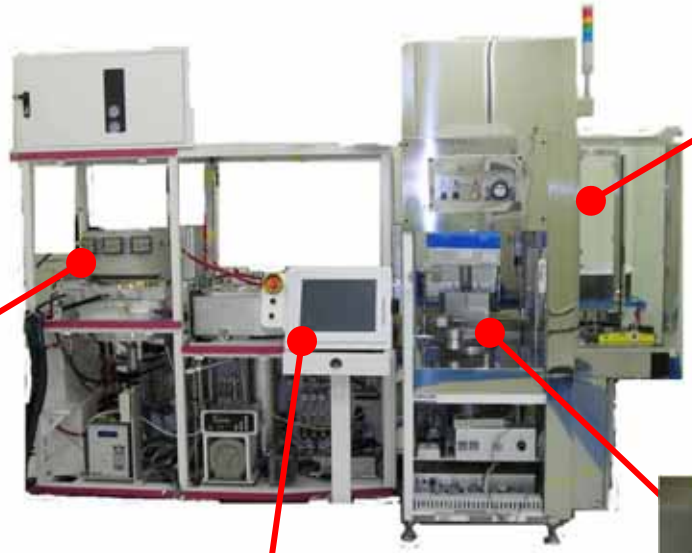
Decisive Factors: Performance

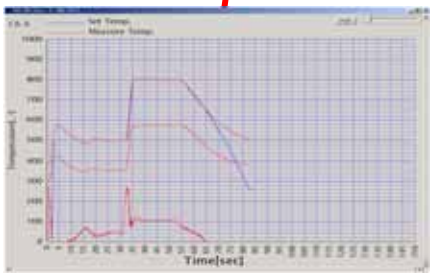
- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Semiconductor + FPD Manufacturing

NewYoung Mtech, Korea, RTA (Rapid Thermal Anneal)
EtherCAT w. 570 DI/DO, 480 AI/AO

Heating Chamber





HMI

EFEM : End Front Equipment Module (Wafer Transfer System)

Wafer Transportation Robot

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Semiconductor + FPD Manufacturing

Kleo Halbleitertechnik GmbH, Germany:
Laser lithography system for LCD screen production

Stefan Scharl, Kleo:
"EtherCAT enables us to achieve short sampling rates, short cycle times of around 50 µs and stable real-time capability as the basis for high-precision positioning of the laser beams.
Thanks to the openness of EtherCAT, other protocols, such as Profibus, can easily be integrated"

Decisive Factors: Performance, Safety

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Metal Forming

IWM Automation, Germany: Tube-End Forming Machine

Olaf Klink, IWM Automation:

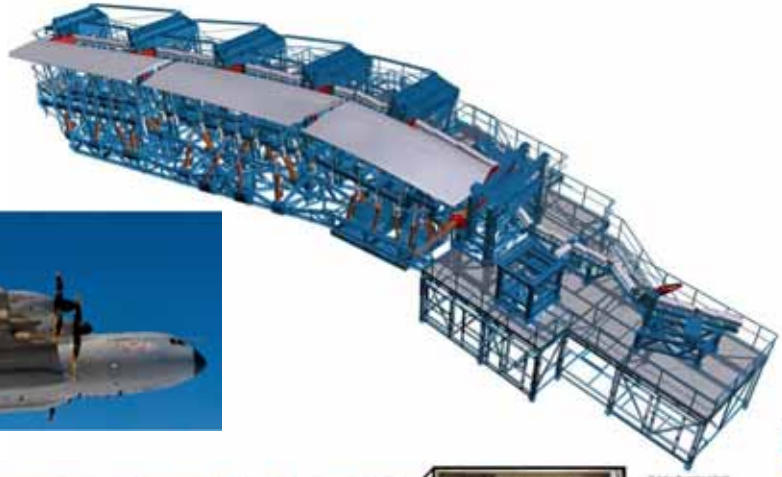
“Use of a fast Ethernet fieldbus system like EtherCAT is necessary for the sake of the total process control, as we are not controlling the movements by autonomous, distributed regulators, but centrally, in one controller.
This can only be done if data is exchanged at high speed.”

Decisive Factors: Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Testbed/ Measurement Application

Ingenieurgesellschaft IgH: High Lift Slat Flap Testrig (Airbus)



Decisive Factors: Performance, Flexibility

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging

Conflex, USA, Shrink packing machine

Joe Morrissey, Conflex:

"The Industrial Ethernet fieldbus, EtherCAT helped immensely in terms of ramping up our control speed on the ServoFlex machines," said. "Beyond top performance, Conflex had to choose a fieldbus that will be supported well into the future (like EtherCAT) and won't go obsolete in a few years."

Decisive Factors: Topology

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Logistics and Material Handling

Dürkopp Fördertechnik, Germany**:**

Automatic storage system, 5000 distributed I/O points

Decisive Factors: Topology + Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Logistics and Material Handling

Numina Group, USA:

Shipping bob labeling + handling system

Mark Woodworth, Numina:

"With EtherCAT we achieve the fastest realtime speeds throughout with a consistent performance, regardless of the number of I/Os."

Decisive Factors: Topology

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Bridge absorption system

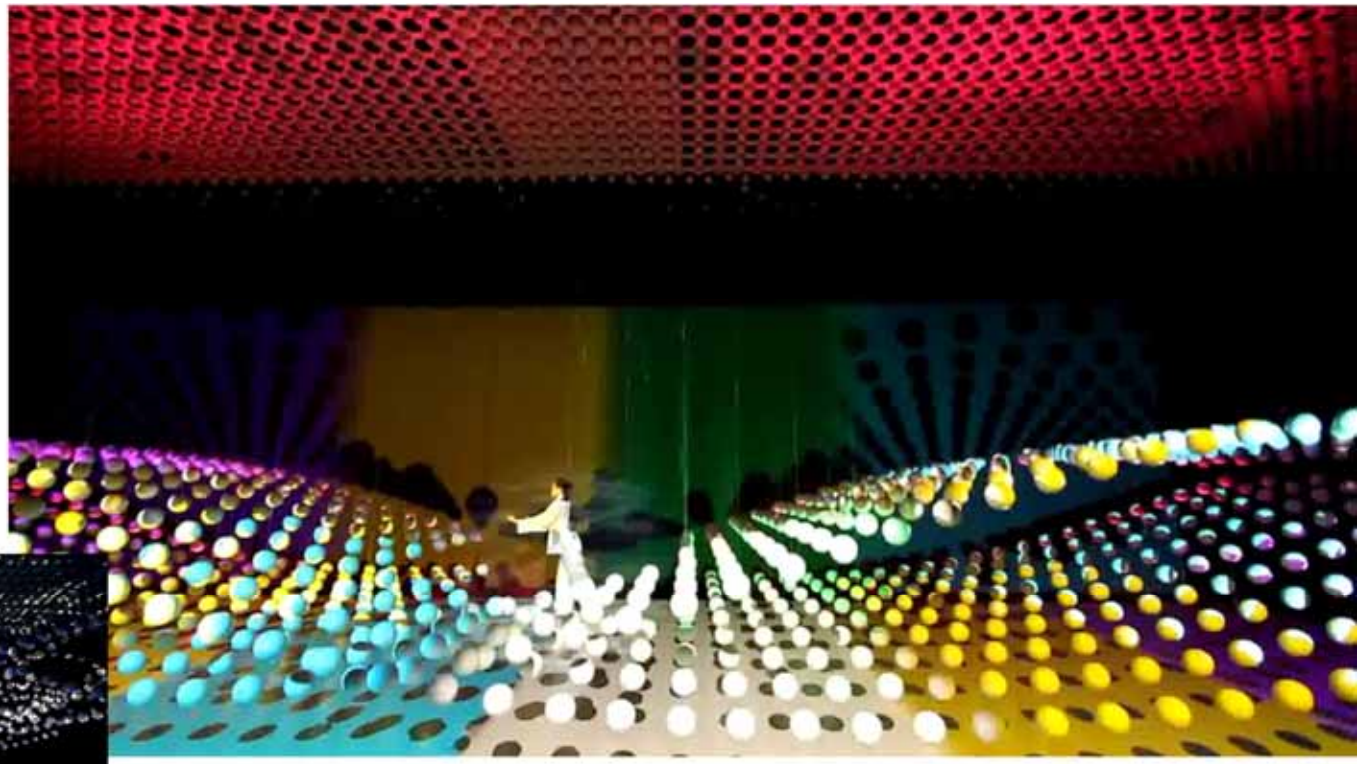
Dubrovnik (Croatia): Absorption of vibrations

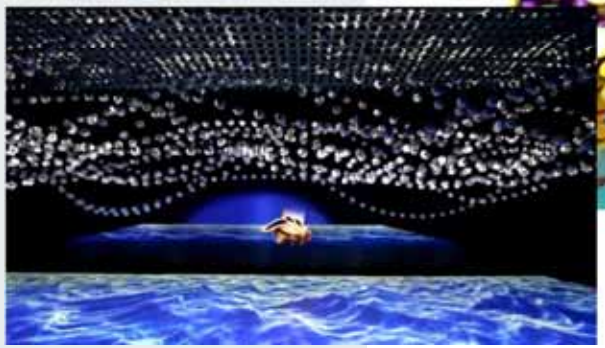
Decisive Factors: Integration, Performance

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Entertainment Industry

EXPO, China: The World's Largest Dynamic Sphere Array:
1,008 axis kinetic sculpture, by FTSI Automation





Decisive Factors: Topology, Fieldbus Integration

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Logistics

Constructor Finland Oy, Finland, Automated Warehousing

EtherCAT I/O with EtherCAT/DeviceNet Gateway and DeviceNet Inverters

Decisive Factors: Topology

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Snow Blower Control

Berchtold, Austria:

Systems of up to 1000 snow makers

Decisive Factors: Costs

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Packaging Machines

Radiator Specialty, (NC), USA: Filling and Packaging Line

Murray Williamson,
Radiator Specialty:

"One key factor to use EtherCAT was that we didn't have to use switches: CAT-5e cabling goes right to the EtherCAT I/O Bus Couplers. We feel that it's the most versatile network out there."

Decisive Factors: Costs

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Woodworking Machine

IMA: Novimat Concept edge-banding machine

Decisive Factors: Ease of Use

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Special Machinery

Progress, Italy: Mat Welding Machine

Decisive Factors: Ease of Use

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Special Machinery

Progress, Italy:

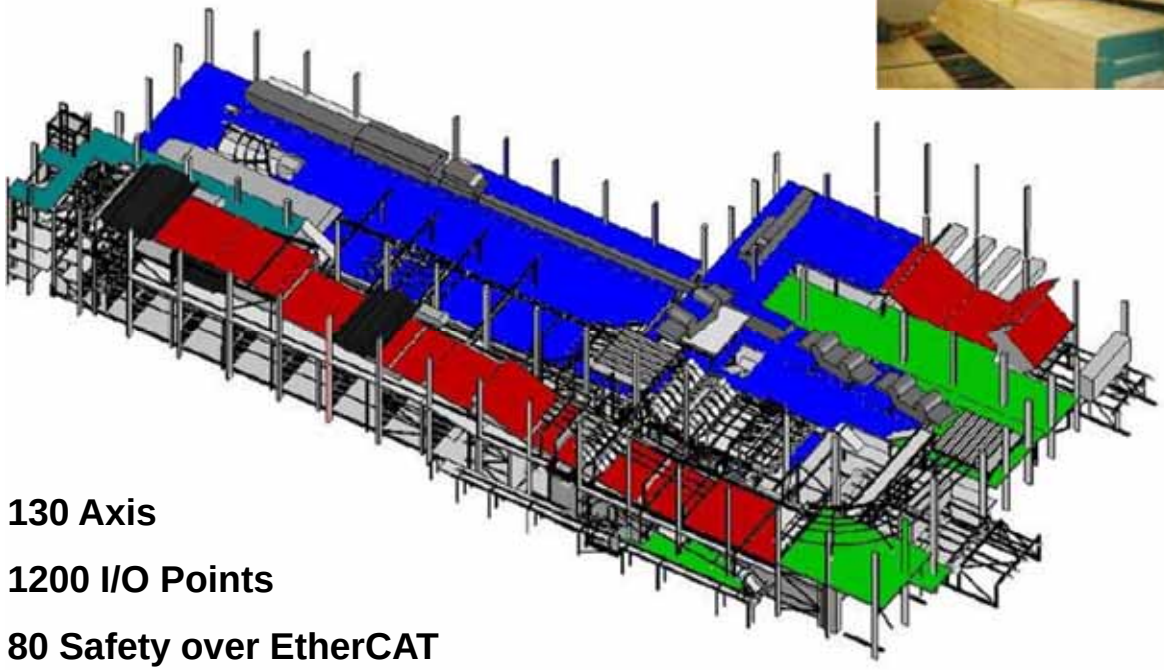
Coil Wire Processing Machine

Decisive Factors: Performance, Safety

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Material Handling

C. Gunnarssons, Sweden, Board handling plant



130 Axis

1200 I/O Points

80 Safety over EtherCAT devices

Decisive Factors: Functional Safety

- High Performance
- Flexible Topology
- Ease of Use
- Low Cost
- Functional Safety

Example: Tire Testing System

Seichter: Tire Uniformity Tester

Johann Klassen, Seichter:

“EtherCAT makes the machine more streamlined, faster and more precise.

Thanks to EtherCAT, networking additional emergency stops can be installed at a later stage as required.”

High Performance

Flexible Topology

Ease of Use

Low Cost

Functional Safety

Thank you for your attention!

Contact Info:

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