

Advanced Mechatronics System for higher-level Performance & Flexibility

Giovanni Paladini Technical Support Engineer





Advanced Mechatronics: Independent Movers System

- Passive movers move along an active travel path consisting of motor modules.
- Movers are freely movable on the path and can be controlled independently of one another
 - Brake / Accelerate
 - Gearing
 - Electronic Cams
 - exert a constant force at a standstill and in motion.
- Modular System: Geometry and length of the travel path as well as the number of movers can be adapted to suit the application (> 100m, 200 movers)





Advanced Mechatronics: Planar System

- A passive mover containing permanent magnets levitates above XPlanar tiles that generate a magnetic field to control and to generate the movement
- The movers are independent of each other
- Six degree of freedom:
 - Positioning in X/Y up to 2m/s
 - Lifting, Lowering, weighing variable in height by up to 5mm
 - Tilting by 5°





Control System Architecture

The system must satisfy the following fundamental characteristics:

- Modularity
- Independence and controllability of movers at any point in the path/space
- Fast engineering: short time-to market
- Flexible operation through software & simple configuration



The optimal solution is centralized control where all the control algorithms and feedback ones reside in the controller itself

No drive is present in the control cabinet → Compact system for smaller machines



Control System Architecture





Control System Architecture







 All typical servo-drive control loops moved within IPC → Tcyc < 250us

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Realtime extension of the OS can manage in parallel multiple cores → Using multicore CPUs to increase number of movers and system length/area 7



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Industrial PC



CONTROL CABINET INDUSTRIAL PC

Intel[®] Core™ i7-9700E, 9th generation, 2.6 GHz, **8 cores**





EMBEDDED PC

- Intel[®] Xeon[®] D-1548, 8 cores, 2.0 GHz
- Intel[®] Xeon[®] D-1567, **12 cores**, 2.1 GHz

CONTROL CABINET INDUSTRIAL SERVER

- Two Intel[®] Xeon[®] Scalable processors with 8, 12, 16 or 20 cores each on one motherboard
- 64 GB DDR4 RAM EEC, expandable to 1024 GB
- graphic card, 1 DVI-I and 1 DVI-D connector 8



FieldBus: EtherCAT

EtherCAT (*Ethernet for Control Automation Technology*) is an Ethernet-based 100Mb/s fieldbus system High performance through on the fly data elaboration

Performance:

- 1000 digital distributed I/O in 30μs
- 100 servo-axes in 100μs
- EtherCAT integrated in I/O Slice, no Sub-Bus
- No extra Hardware is necessary: Optimal use of standard Ethernet port
- Accurate Synchronization (<< 1 μs) thanks to Distributed Clocks Technology





EtherCAT G

- Based on EtherCAT protocol
- Ethernet based on 1Gbit/s & 10Gbit/s



- 2,000 digital inputs/outputs every 15 μs
- 100 servo axes every 30 µs





- Advanced Mechatronics System through PC-Based Control & EtherCAT
- EtherCAT: high-performance fieldbus
- Real Time Tasks on Multicore Systems
- PC-Based Automation: possibility to implement a lot of functionalities in the controller



- Planar Transport System
- □ Linear Transport System
- Robotics
- Vision System
- □ MATLAB/Simulink
- Analytics
- Machine Learning



Thank you for your attention

Giovanni Paladini Technical Support Engineer

