



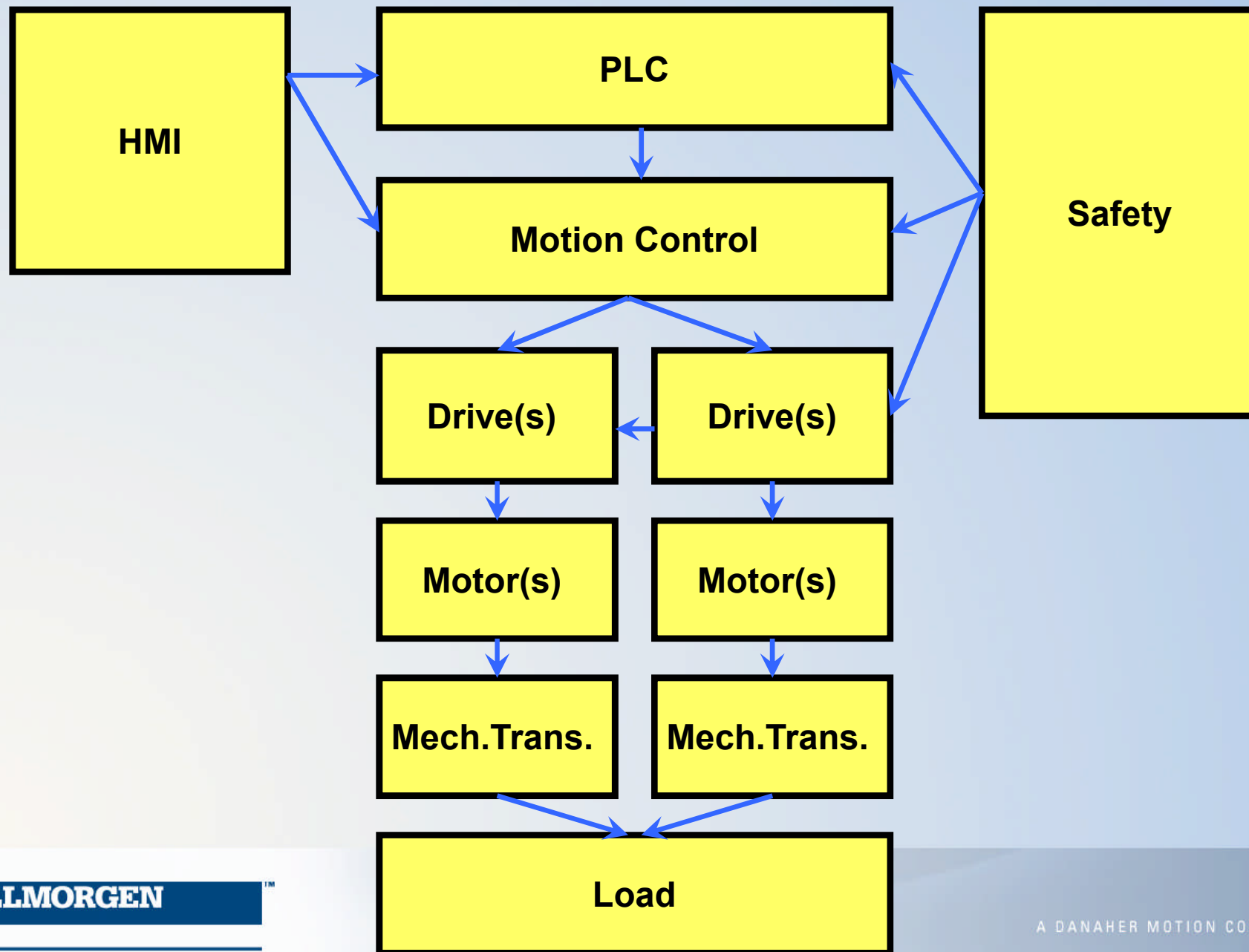
# Motion Control Chain

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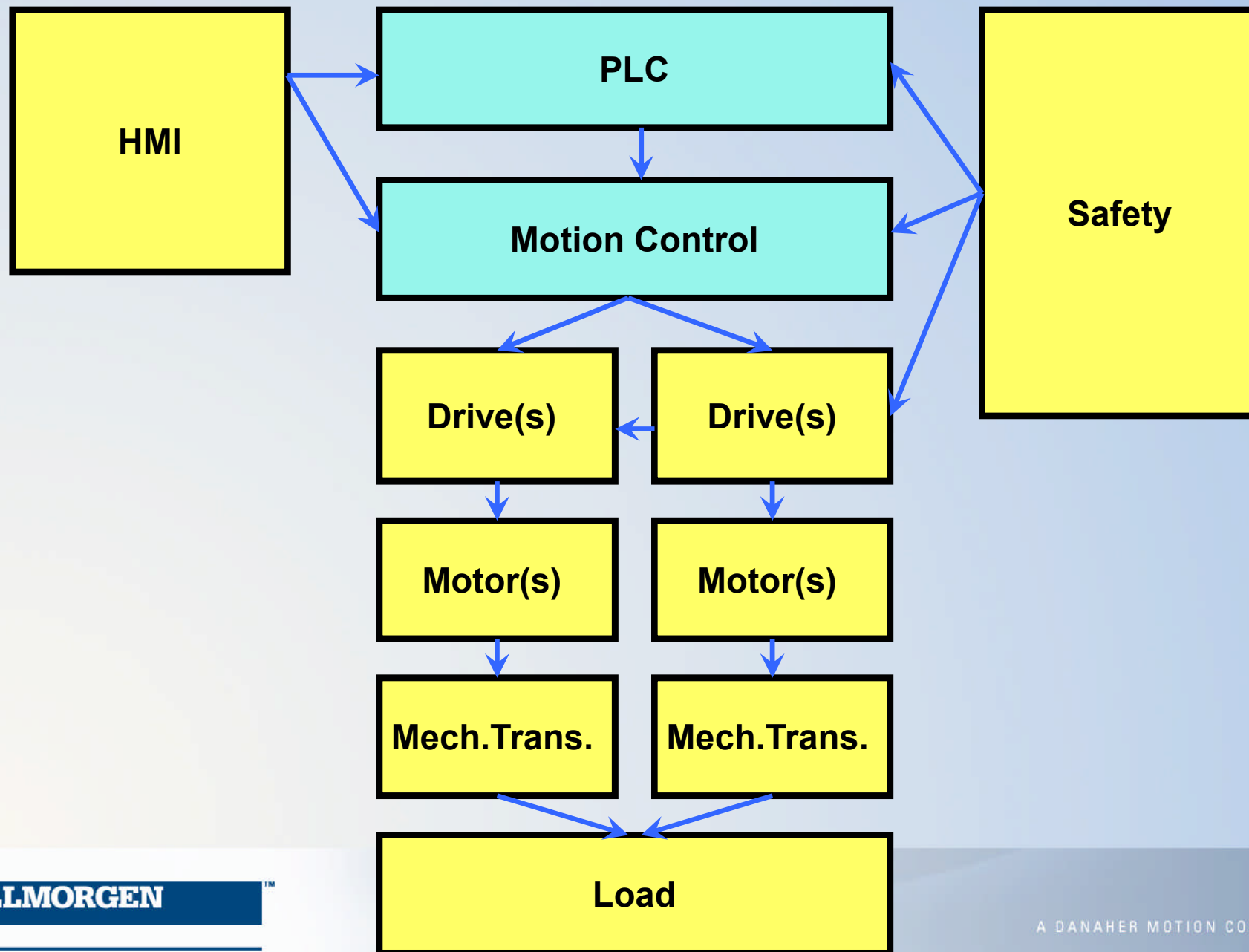
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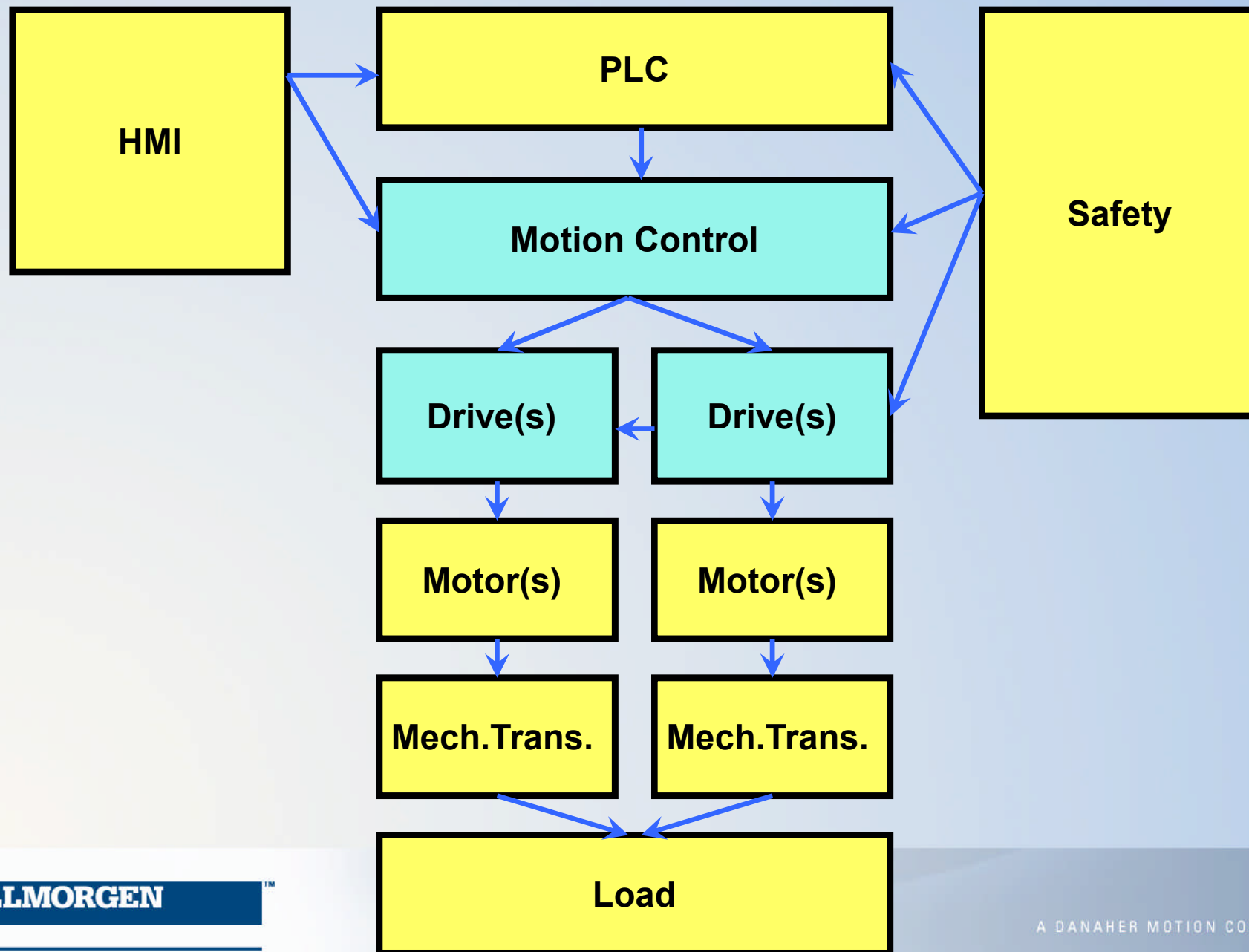
# The Motion Control Chain



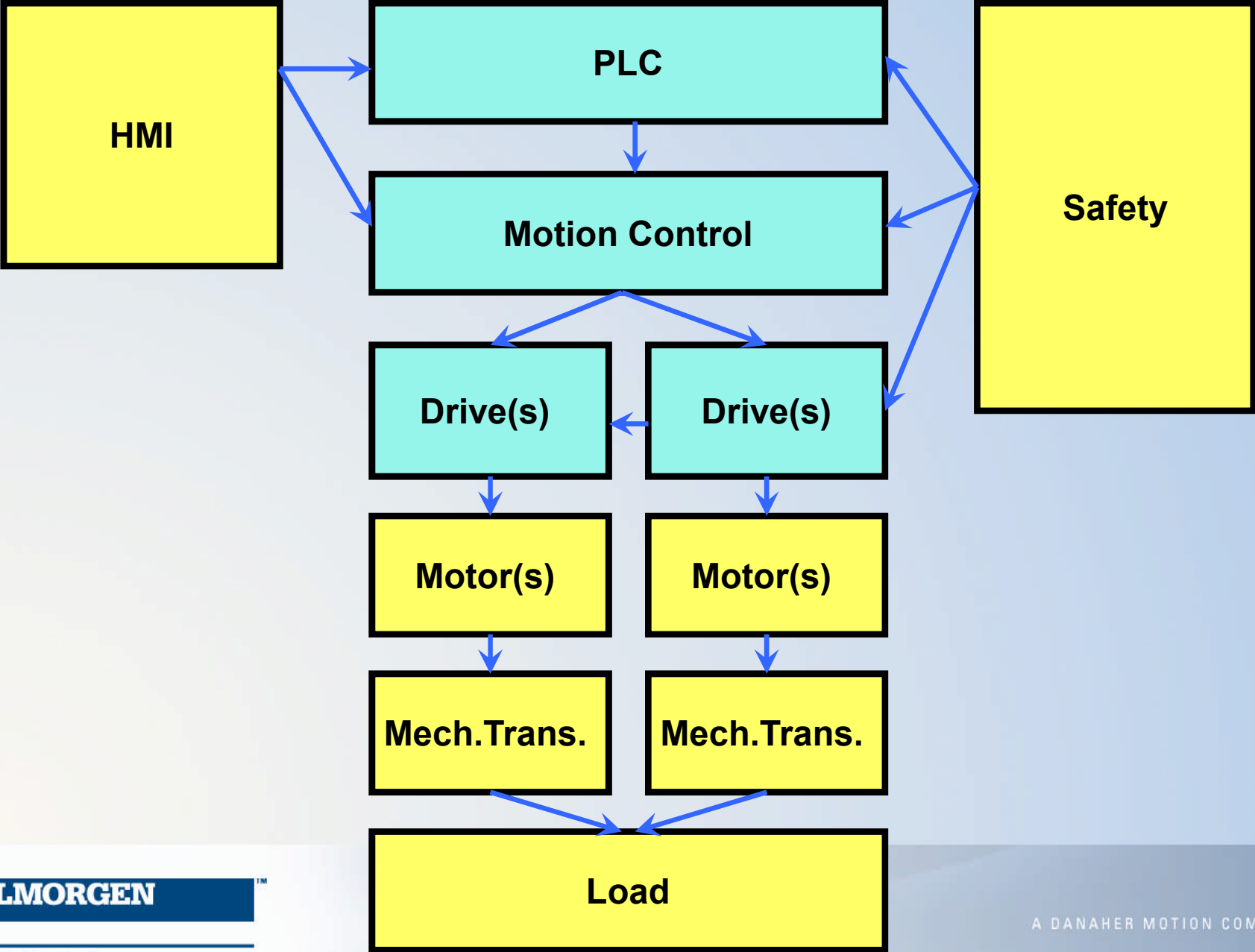
# The Motion Control Chain



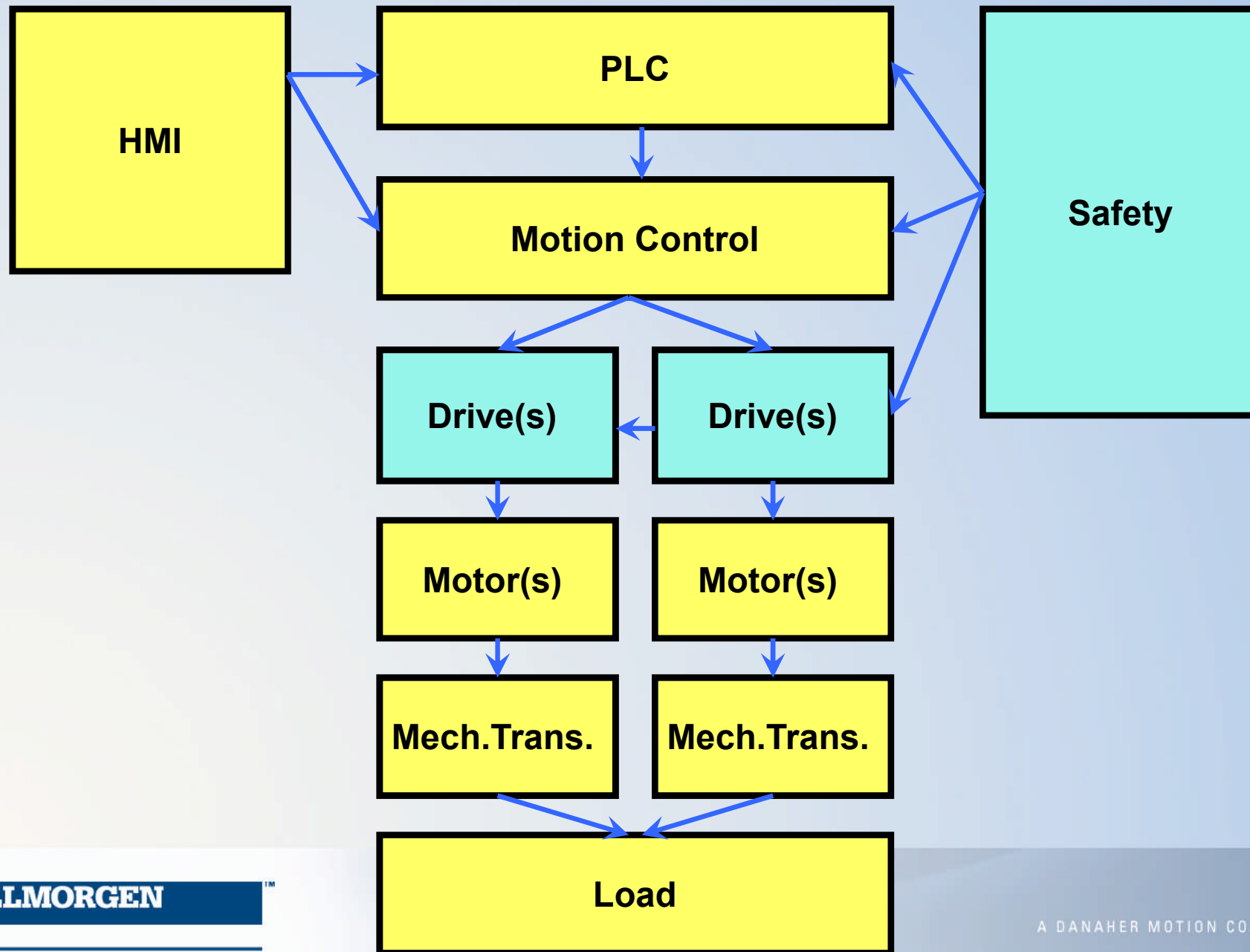
# The Motion Control Integrated into drives



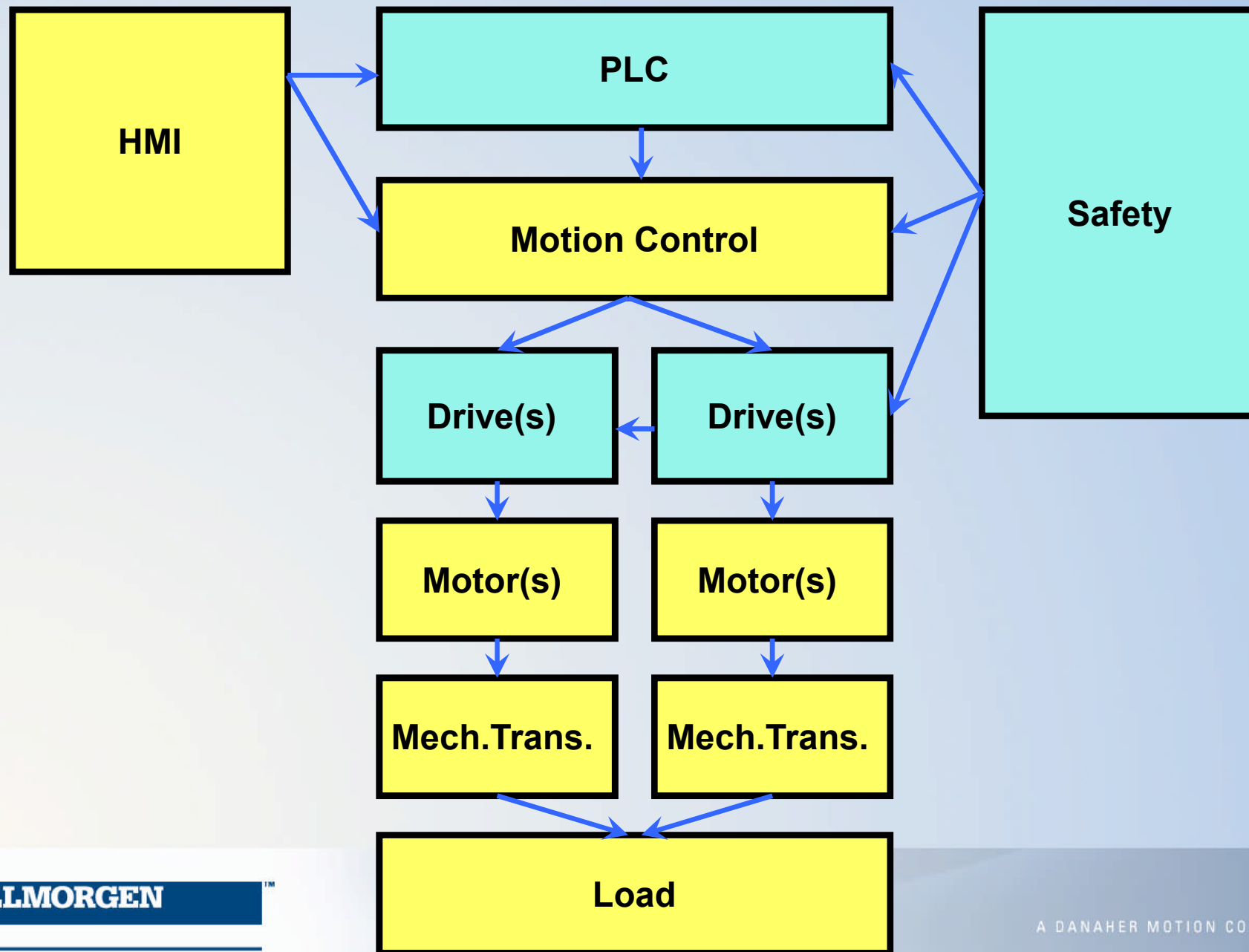
# PLC integrated into MC



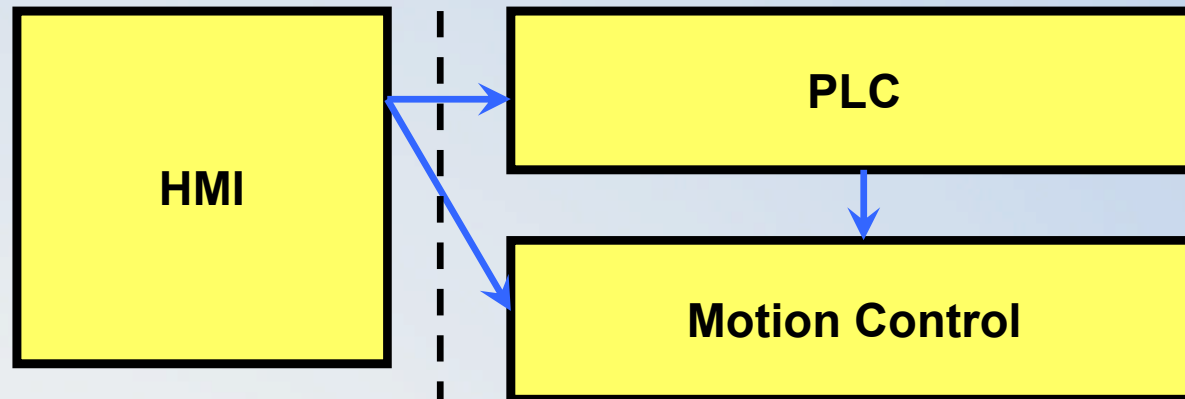
# Safety integrated into Drives



# Safety integrated into PLC



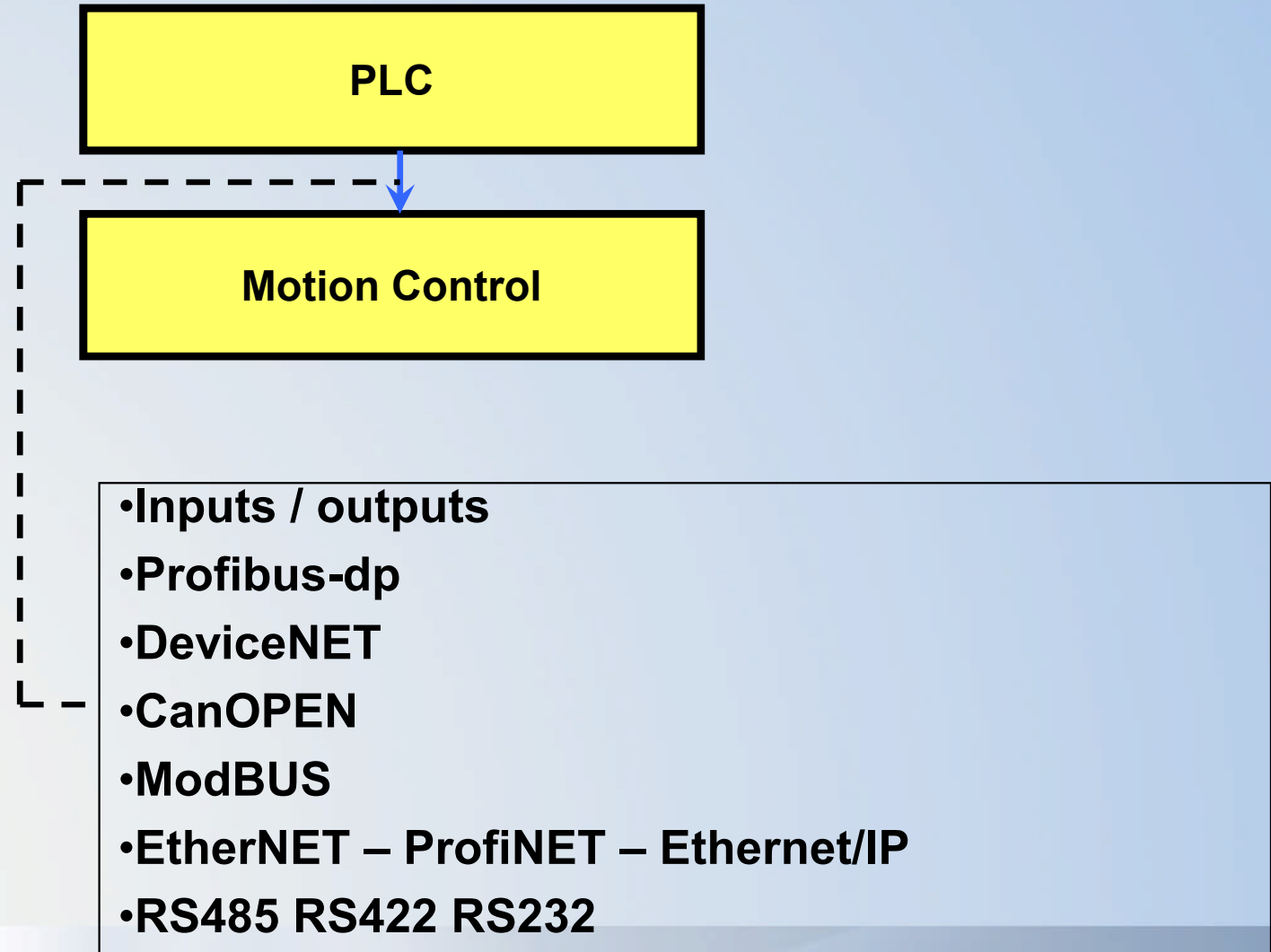
# HMI → PLC HMI → MC



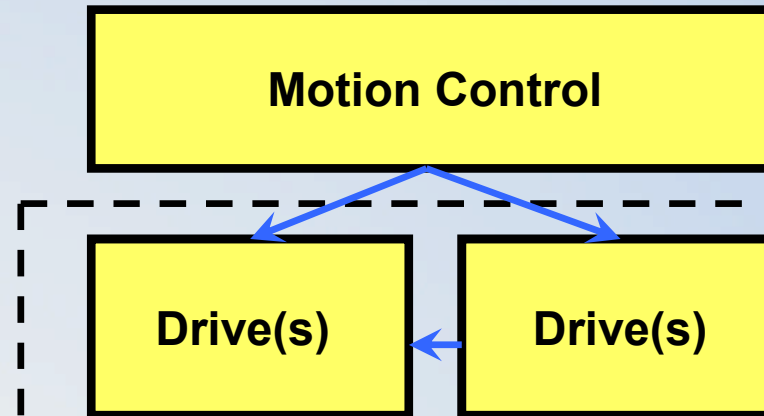
- Wires for Lamps, push buttons, switches
- ModBus
- Proprietary protocol based on RS485 / RS422 / RS232
- EtherNET
- Profibus-dp
- CanOPEN



# PLC → MC

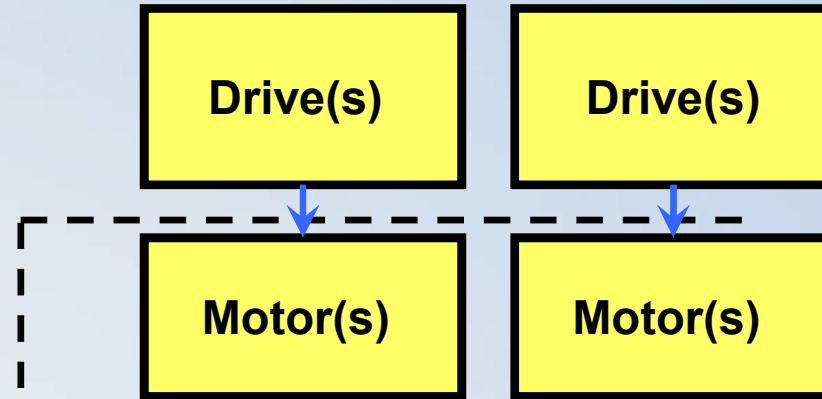


# MC → Drives



- Analogue command + Encoder simulation
- CanOPEN
- Sercos II
- CanOPEN
- EtherNET Based Motion Buses
  - EtherCAT
  - Powerlink
  - ProfiNET
  - SynqNET
  - EtherNET IP

# Drive → Motor



- NO
- Hall Sensors (Analogue / Digital)
- Resolver
- Encoder / Comcoder
- SinCos
- EnDat 2.1 & EnDat 2.2
- BiSS
- Hiperface

# Transmissions Typologies

**Mech.Trans.**

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- **NO (Direct Drive)**
- **Gearhead**
- **Timing Belt**
- **Leadscrew**
- **Conveyor**
- **Rack & Pinion**
- **Belt/Cable & pulley**

# Drive – Main Parameters

**Drive(s)**

**Drive(s)**

- **Input Voltage**
- **Rated current**
- **Peak current**
- **Which motors is able to drive**
- **Which feedback units is able to read**
- **Connectivity**
- **Features**

# Motor – Main Parameters

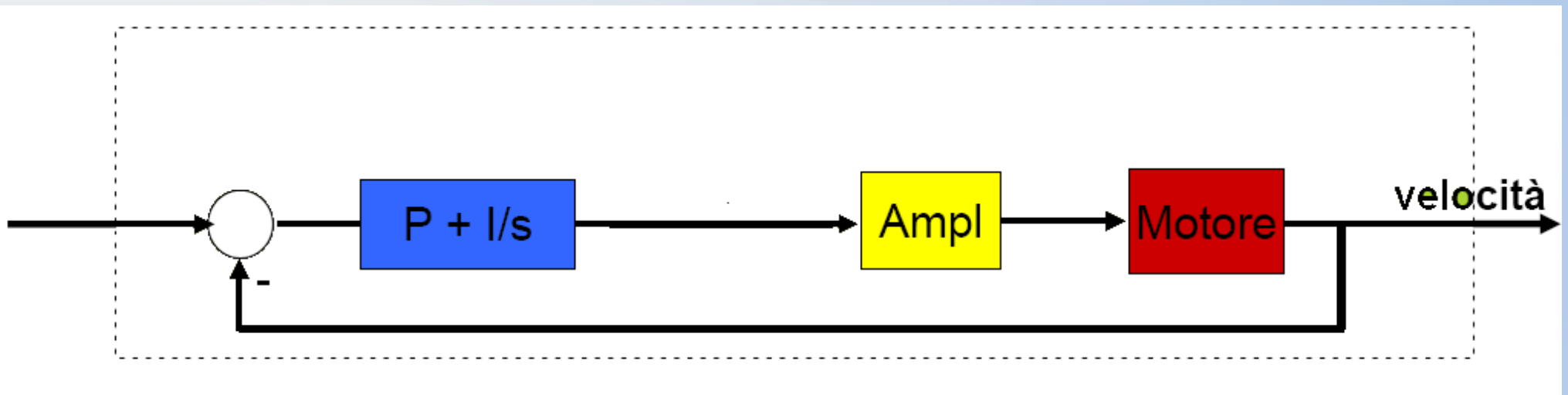
**Motor(s)**

**Motor(s)**

- **Rated speed**
- **Peak torque/current**
- **Rated Torque/current**
- **Stall torque/current**
- **Brake**
- **Inertia**
- **Motor type**

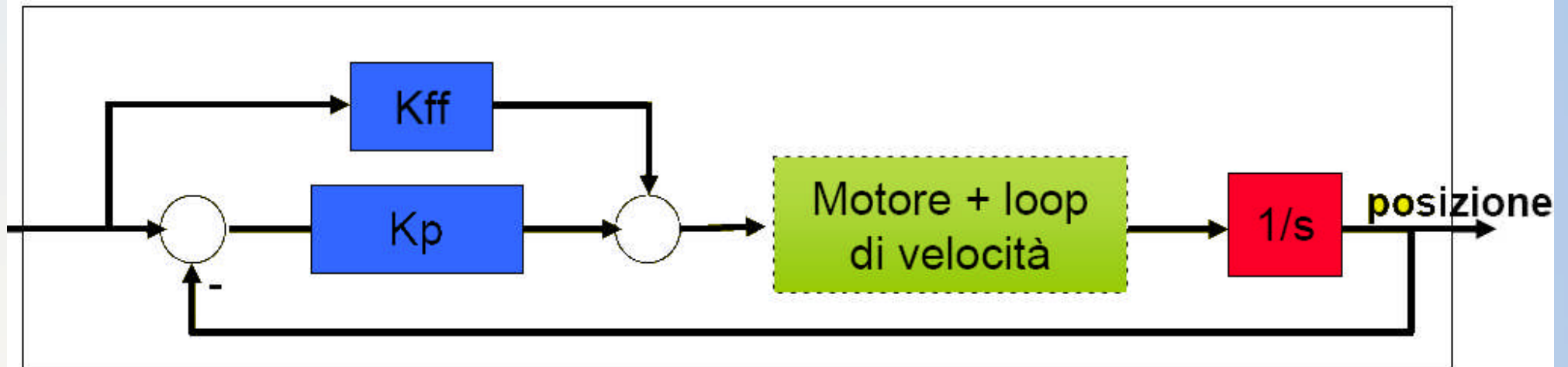
# Velocity loop

- «Gains»
  - Proportional ( $K_p$ )
  - Integral ( $K_i$ ) (often used  $T_n$ )
  - Massima corrente (positiva e negativa)



# Position Loop

- Proportional ( $K_v$ )
  - feedforward gain (velocity) ( $K_{ff}$ )



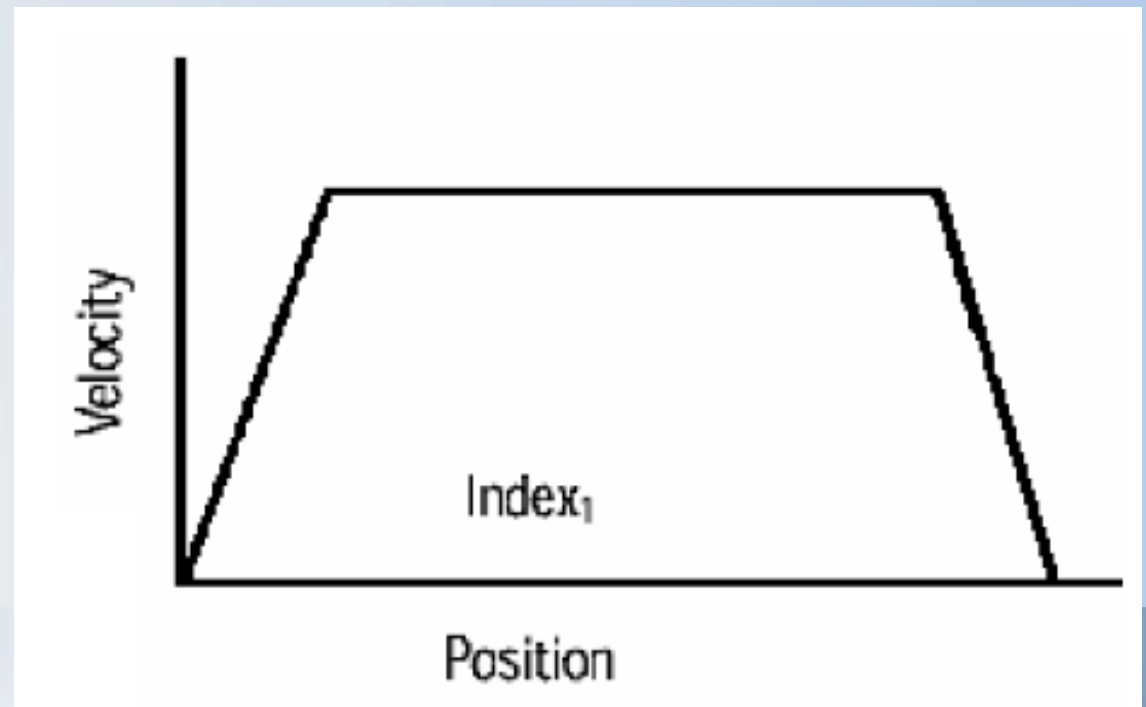


# Jog

- Jog means to move the motor @ a predefined speed, normally during manual operations.
- Commands
  - Start/stop, forward/reverse.
- Status
  - Still, Forward, Reverse
- Parameters
  - Speed, Acc., Dec.

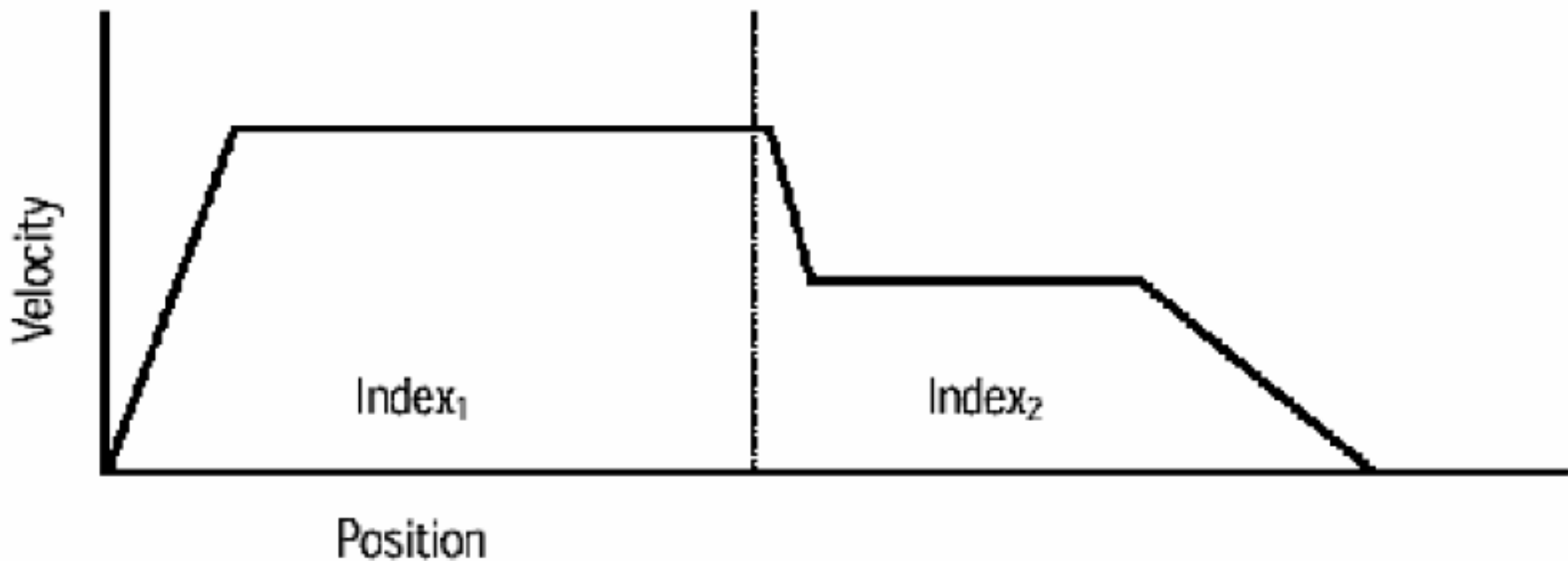
# Move

- Move means to do a point to point positioning.
- Parameters
  - Displacement or end position, speed/acc/dec
- Status
  - Idle
  - moving
  - Locked



# Indexing

- Capability to move the axis in several pre stored positions.
- Belended profiles are permitted.



# Move types

- Incremental
  - Displacement from actual position.
- Absolute
  - Displacement from the home position.
- Registration
  - Displacement from an external sensor.

# Gear

- The controlled axis (slave) follow the main axis (master) with a predefined ratio.
- Parameter
  - Gear ratio



# Advanced features

- Not linear ramps
- Camming
- Interpolated moves
- Probing
- Changes of parameters value on the fly
- .....

# The Motion Configurations

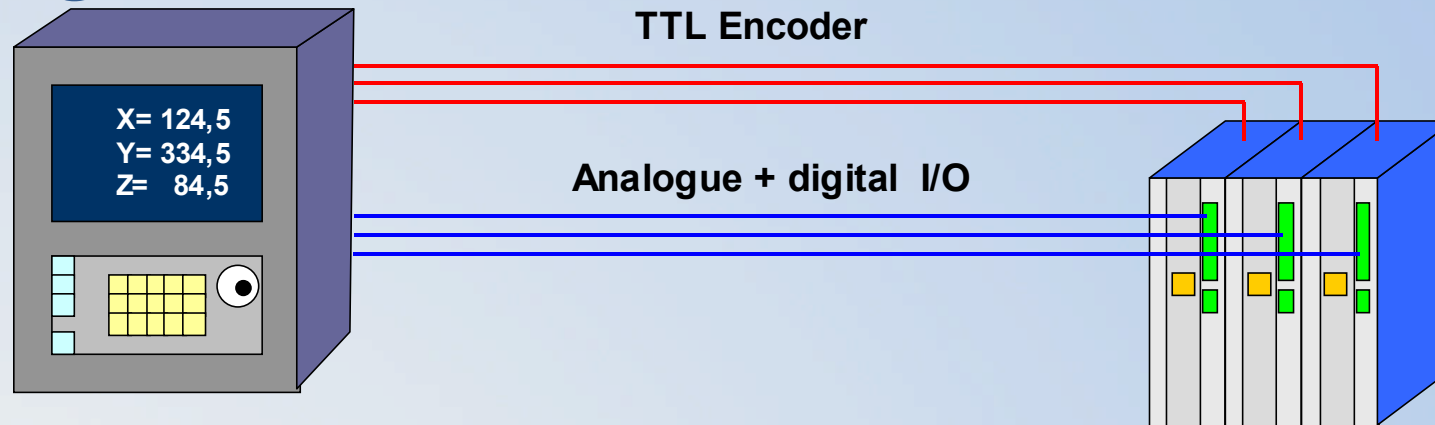
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# Analogue ref – Encoder feedback



## Goodness

- High level of compatibility
- it is possible to link almost any CNC
- Good performances

## Weakness

- **Several connection wires are needed** increasing the number of the drives the cables increases too
- **Tuning of the analogue input is needed (offset and gain)**



# CNC based



**EtherCAT**  
Technology Group

**SERCOS**  
interface

**SynQNet**  
INTERESTGROUP

**KOLLMORGEN**

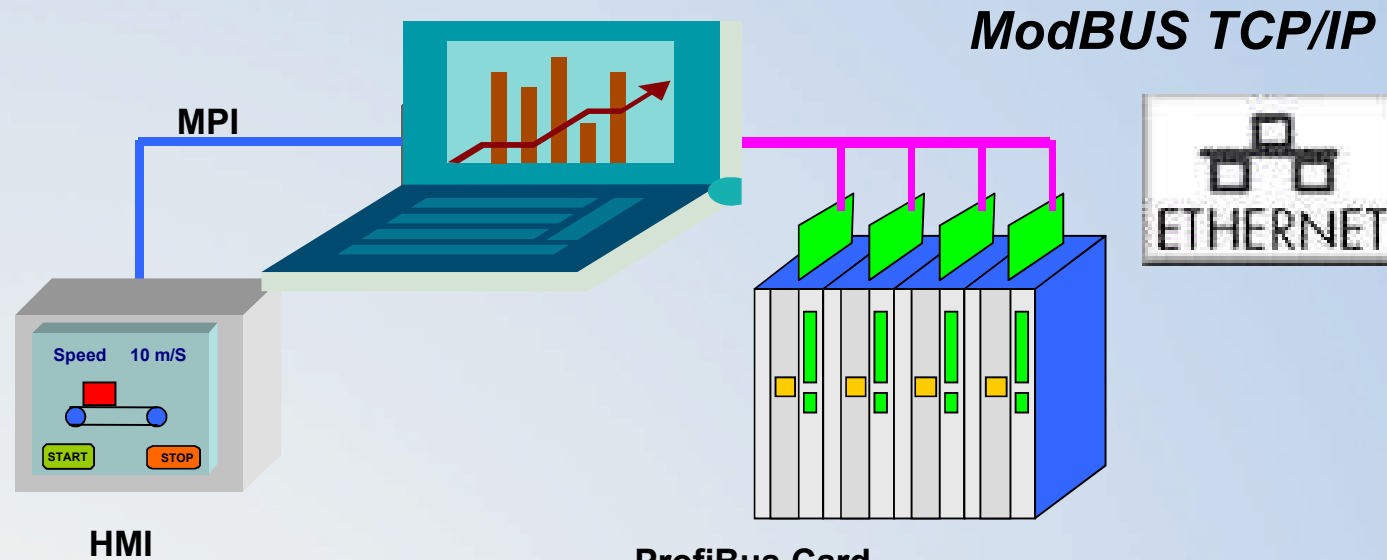
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# PC based



## Profibus Card

- Speed control
- Torque control
- Electronic gear
- Point to point positioner

# Q & A



## Your Questions?

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