EE4009 Mechatronics Profibus

c) Profibus Physical Profiles

The application area of a fieldbus system is largely determined by the choice of transmission technology available as well as the general demands on the system, e.g. transmission speed, safety requirements, reliability. The following transmission methods may be used:

① RS-485 Transmission
→ Twisted pair shielded copper cable
→ Transmission speeds of 9.6kbps → 12Mbps
→ Range decreases as transmission speed increases, 1200m → 100m.
→ Bus structure allows easy addition/removal of components

② IEC 1158-2
→ Transmission speed constant @ 31.25Kbps
→ Intrinsically safe
→ Data & fieldbus power fed through same cable
→ Range up to 1900m
→ Field Devices act as current sinks

③ Fibre Optics
→ High speed
→ Long Range
→ Very low EMI

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DP Communications Profile

Designed for the efficient exchange of data at the field.

① Bus Access

→ Token passing between master & master-slave procedure.
→ Mono-master or multi-master system is possible
→ Max of 126 devices per bus

② Communications

→ P2P or multicast
→ Cyclic master/slave → user data communication

③ Operating States

→ Operate: Cyclic transmission of I/O data
→ Clear: I/P read, O/P in fail-safe mode
→ Stop: No user data, diagnostics/parameterization

④ Synchronisation

→ Sync. mode → O/Ps synchronise
→ Freeze mode → I/Ps synchronise

⑤ Functions

→ Cyclic user data transfer
→ Dynamic activation/deactivation of individual slaves
→ Diagnostics ⇒ 3 levels
→ Synchronisation of I/P, O/P data
→ Address assignment for slaves (optional) via the bus.

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⑥ Protective Functions:

→ Messages transmitted with Hamming distance of 4
→ Watchdog control of DP slave detects failure of the assigned master
→ Access protection of I/Ps & O/Ps of slaves
→ Monitoring of user & data communication with adjustable monitoring in the master

⑦ Device Types

→ DP Master class 2 (DPM2)
→ DCM2 PICs PCs
→ DP slave: devices with binary or analog I/O.

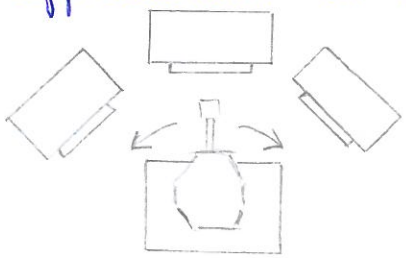
Role of Application Profiles

- PA (Process Automation)
- Building Automation
- Encoders
- Robots / Numerical Controllers
- Drives
- HMI (Human Machine Interface)
- Profi-safe, emergency stops, interlocks, etc
- Defining device parameters & behaviour
- Interchangeability of devices between vendors

P.A. ⇒ · 40% cost saving on planning capability commissioning
· Use most profibus standards
· Specs are vendor independent
· Analogue I/Ps, O/Ps
· Digital I/Ps, O/Ps

Robot Centred Cell

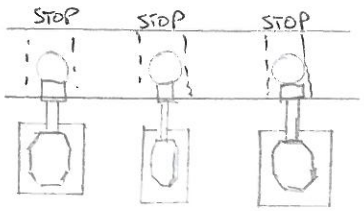
→ Robot positioned at centre of cell
→ Machines serviced by the robot surround it
→ Ensures good utilisation of the robot:
  - Servicing multiple machines
  - Rarely idle
→ Difficult part delivery: parts must be supplied at a discrete location
→ One typical application is die casting



In-Line Cell

Intermittent

→ Conveyor stops when part is in front of each robot
→ Robot must register the part location:
  - Requires either an observer or accurate control of part positioning
→ Robot complexity is reduced as the part is stationary

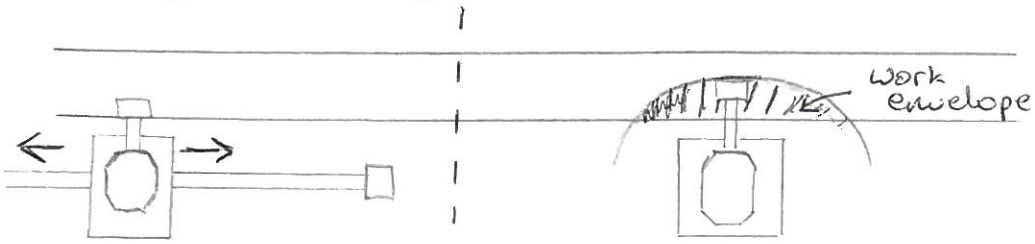


Continuous Cell

→ Part moves at a constant velocity while robot performs its task

→ Part registering is difficult & is accomplished in one of two ways:

- The entire robot moves along with the part at the same velocity (using moving baseline tracking)
  - This requires careful mechanical layout & collision avoidance control
- The base of the robot is stationary & the tool is controlled to move at the part velocity
  - Requires complex control



Non-Synchronous

→ Optimised use of Resources: Each part moves independently from work cell to work cell

→ Requires a more complicated conveyor system but less complex

→ Widely used in the automotive industry

Mobile Robot Cell

→ Robot moves to the part or machine on an overhead or floor-mounted rail

→ Costly to set up

→ Robot can service a number of cells

→ Overhead rail system saves floor space