PROFIBUS diagnostics and network monitoring

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VTC

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Dale Fites

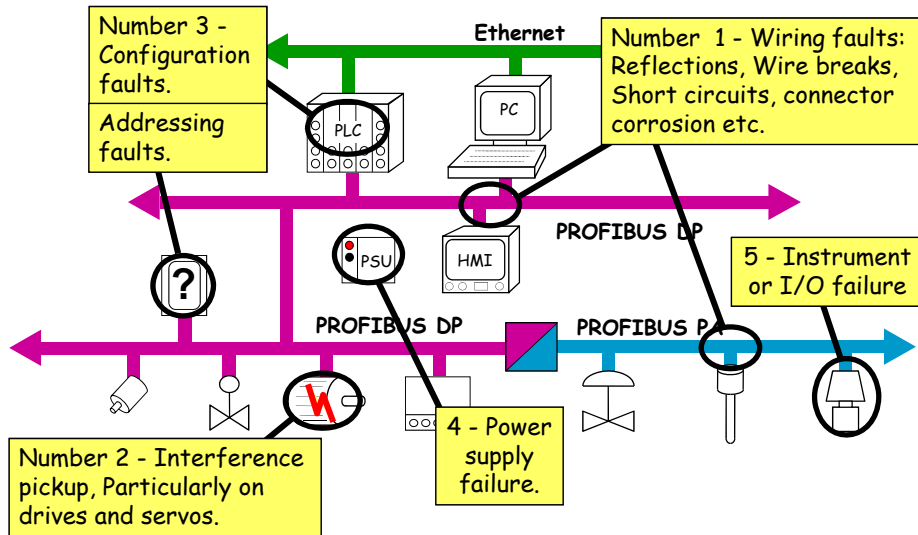Hitex UK

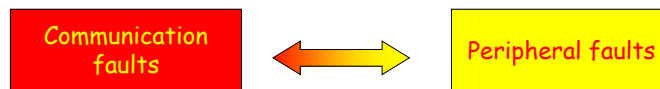**hitex** DEVELOPMENT TOOLS

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PROFIBUS

⇨ PROFIBUS is a very reliable and cost effective technology.

⇨ It is common to find extensive installations comprising thousands of PROFIBUS devices operating on complex networks which are connected together via industrial Ethernet.

⇨ The reliable operation of these networks is essential to maintaining plant productivity.

⇨ So, what can go wrong?

The Most Common Netwok Problems

Number 3 - Configuration faults.
Addressing faults.

Ethernet

Number 1 - Wiring faults: Reflections, Wire breaks, Short circuits, connector corrosion etc.

PLC

PC

PROFIBUS DP

PSU

HMI

5 - Instrument or I/O failure

?

PROFIBUS DP

PROFIBUS P.

Number 2 - Interference pickup, Particularly on drives and servos.

4 - Power supply failure.

Fault categorisation

⇨ These faults can be categorised in several ways:

Communication faults		Peripheral faults

- ⇨ These are "Bus Faults"
- ⇨ E.g. network wiring errors, interference pickup, reflections etc.
- ⇨ Communication is disrupted.

- ⇨ Concerned with the sensor or actuator.
- ⇨ E.g. sensor wire break, loss of output power, sticking valve etc.
- ⇨ Devices are still communicating.

Communication faults

⇨ Communication faults can be diagnosed using tools such as:

  ✓ Protocol analysers and diagnostic tools.

  ✓ Waveform visualisation tools such as oscilloscopes etc.

⇨ Communication errors do not always produce loss of control. This is because modern fieldbus technologies are very robust to errors that can corrupt data.

Communication faults

⇨ Quite often users are unaware that their system has communication errors because the robustness of PROFIBUS can hide these faults.

Green light – all must be ok!

⇨ Only when the rate of data corruption reaches a critical threshold will the fault become visible.

But by then it is too late!

Peripheral faults

⇨ Because the communication remains operational, peripheral faults can often be located and diagnosed using the communications system itself.

⇨ Tools and techniques that are useful for locating peripheral faults on PROFIBUS systems include:

- ✓ Diagnostic reporting using on-line system diagnostics.
- ✓ Engineering tools such as FDT or EDD software.

⇨ Modern intelligent devices incorporate self diagnostic features that can identify and highlight peripheral faults.

⇨ However, tools are still required to access these extended diagnostics.

Intermittent Faults

⇨ Permanent faults are relatively easy to fix.

- ✓ Because the fault disappears when we've fixed it!

⇨ Intermittent faults can be a nightmare!

- ✓ Because we cannot be sure that we have fixed it.
- ✓ We may seem to have cured the problem, but then it comes back again later!

⇨ Intermittent faults require long-term monitoring to check that the fault is cured.

⇨ Statistical reporting over an extended period can be useful.

PA Device Diagnostics

⇨ The latest version PA Profile (V3.02, 2008) incorporates several features that make device maintenance much easier for the user.

⇨ Condensed Status and Diagnostics reporting.

  ✓ Simplifies status and diagnostics into four categories:

   ◆ Maintenance required

   ✖ Failure

   ▽ Functional check

   ⚠ Out of specification

PA Device Replacement

⇨ The GSD file that is used for configuration of cyclic communication is locked to the device by its ID number.

⇨ Changing a device for a different manufacturer's or even a different version can mean updating the configuration, which normally requires a network shutdown

⇨ Profile 3.02 incorporates a useful feature where a compatible device will adapt to the configured ID number.

⇨ This allows any device to be replaced with an off the self equivalent from any manufacturer without changing the controller configuration or shutting down the network.

⇨ The PA Profile GSD files ($97xx_{hex}$) are particularly useful for this.

  ✓ We recommend configuring devices using these GSD files where possible.

PA Device Replacement

Process Control System

Temperature transmitter configured using
The Profile GSD: "PA139700.GSD"

Device automatically adapts
to the configured ID

Temperature transmitter
default ID = 089A
Alternative ID = 9700

Temperature transmitter
default ID = 1523
Alternative ID = 9700

Failed device   Replacement device

**Troubleshooting &
health checking tools**

⇨ A protocol analyser is an essential tool for any high speed fieldbus network.

⇨ Modern analysers will show real time messages and other health checking information that can help the engineer diagnose and locate communications and peripheral errors.

⇨ Waveform visualisation is also an essential feature for an analyser allowing physical layer errors such as cabling and connector problems to be diagnosed and located.

⇨ Well designed analysers are easy to use, but some practical training is essential.

ProfiTrace

⇨ ProfiTrace is a very popular PROFIBUS analyser with extensive capability for fault finding, health checking and device and system testing.

⇨ High-speed analyser for both DP and PA;

⇨ DP Class-I master;

⇨ DP Class-II master (including DPV1);

⇨ High-speed oscilloscope for DP and PA waveform visualisation;

⇨ Health-checking and performance statistics;

⇨ Report generation;

⇨ Built in OPC server and CommDTM capability.

System Health Checking

⇨ Health checking is an important part of the commissioning and maintenance strategy for your plant.

⇨ The health check will help to find non-critical and intermittent faults that are not obvious.

⇨ A health check should be carried out immediately after commissioning. We also strongly recommend repeating the health check at intervals.

⇨ How much better to integrate the health checking tools into the network?

  ✓ To give permanent monitoring of system health.

  ✓ Automatically report failures.

  ✓ Give pre-warning of impending failures and performance degradation.

Permanent monitoring tools

⇨ A number of new tools have appeared on the market which are designed to be permanently connected to the network to provide 24/7 network monitoring.

Softing INspektor
DP network monitor
(one segment)

Pepperl+Fuchs ADM
PA segment monitor
(up to four segments)

Procentec COMbricks
DP network monitor
(up to four networks, 20 segments)

2. Profibus Diagnose Tools: *PROFIBUS Inspektor*

The Inspektor is the perfect tool for the maintenance manager:

It offers you:

- permanent web-based monitoring as a sniffer on
  - Error frames
  - Retries
  - Drop outs

- early indication if communication problems could cause a downtime

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COMbricks

⇨ COMbricks is a modular repeater and gateway system from Procentec with built-in ProfiTrace functionality accessible over Ethernet.
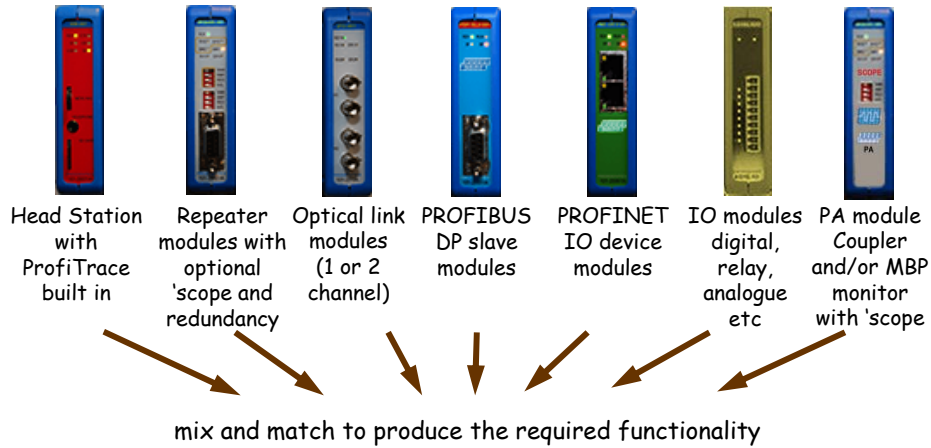
⇨ COMbricks provides:
- ✓ Networking,
  - PROFIBUS, PROFINET, Ethernet, copper and fibre-optic.
- ✓ Monitoring
  - ProfiTrace OE built-in and accessible over Ethernet (web based).
- ✓ Control
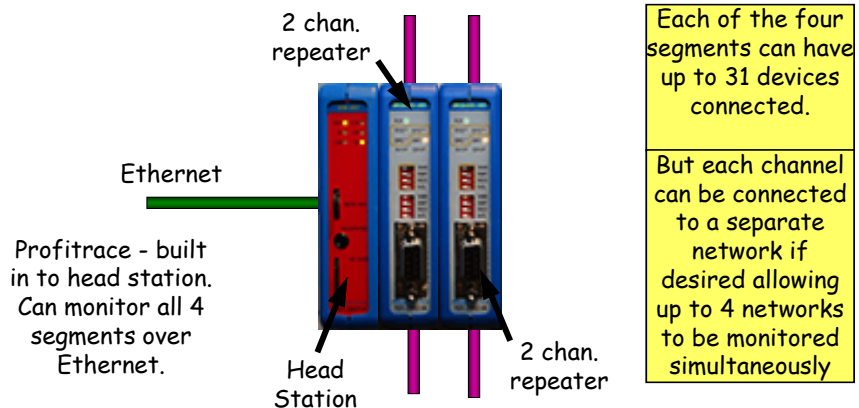 - Remote IO capability allowing low cost control and plant monitoring over the network.

Networking, Monitoring and Control

COMbricks

The Modules available include:

Head Station with ProfiTrace built in

Repeater modules with optional 'scope and redundancy

Optical link modules (1 or 2 channel)

PROFIBUS DP slave modules

PROFINET IO device modules

IO modules digital, relay, analogue etc

PA module Coupler and/or MBP monitor with 'scope

mix and match to produce the required functionality

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4 channel Repeater and Network Monitor

2 chan. repeater

Ethernet

Profitrace - built in to head station. Can monitor all 4 segments over Ethernet.

Head Station

2 chan. repeater

Each of the four segments can have up to 31 devices connected.

But each channel can be connected to a separate network if desired allowing up to 4 networks to be monitored simultaneously

⇨ The 1C Head Station which is supplied with the Supreme kit incorporates a commDTM which can be used within any FDT tool (i.e. FieldCare, PactWare etc).

⇨ This provides a particularly cost effective way of accessing PA device parameters and at the same time monitoring the health of the network 24/7 and providing configurable pre-warning of failure.

Live Demo