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?
PROFIBUS PA fault finding, October 2010, Andy Verwer

The most common PROFIBUS problems

- Configuration faults.
- Wiring faults, reflections, wire breaks, short circuits.
- Device removal
- Interference pickup.
- Instrument or I/O failure
- Addressing faults

The reliability problem

- To understand the problem that faces system engineers, consider a modest installation with 1000 devices installed:
- Each device might exhibit a mean (average) time to failure of 20 years.
- On average we would therefore expect a failure every 20/1000 years
  which is approximately a failure each week!
- We must be able to locate and fix these failures quickly and efficiently.
Fault categorisation

- Operational faults can be categorised in several ways:
  - Peripheral faults
  - Communication faults

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

  - Faults prevent signals reaching their destination.
  - E.g. network wiring errors, interference pickup, reflections etc.
  - Communication is disrupted.

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, protocol analysers, etc.
- Modern intelligent devices incorporate self diagnostic features that can identify and highlight peripheral faults.
- However, tools are still required to access these extended diagnostics.
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.

- 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.
Fault categorisation

- Operational faults can therefore be categorised as to their criticality:

**Critical faults**
- Faults which prevent devices from functioning.
- E.g. sensor wire break, loss of device power, stuck valve, cut network cable etc.
- Can cause loss of production and/or unsafe situations and so must be immediately dealt with.

**Non-critical faults**
- Do not immediately prevent devices from working.
- E.g. sensor drift, valve stiction, corrosion in connectors etc.
- Can be tolerated for a short time because the device is still functioning, albeit with reduced accuracy or performance.

Fault categorisation

- **Installation faults**
  - Fix during commissioning
  - How do we make sure all is well?

- **Operational faults**
  - Fix during normal operation
  - Production stops - Rapid diagnostics and location required.

- **Critical faults**
- **Non-critical faults**
  - How can we detect, diagnose and locate these faults?
ProfiTrace2 (Procentec)

- ProfiTrace2 is the latest in a range of fault finding and health checking tools from Procentec.
  - High-speed analyser for both DP and PA.
    - Extensive triggering and filtering capability.
    - PA probe available for PA segment connection.
  - Decoding of all telegrams (DPV0 and DPV2).
  - Built-in high-speed oscilloscope.
    - DP scope shows RS485 waveform at bus interface.
    - PA probe Ultra allows MBP waveform to be measured.
  - Rapid overview of network health
    - live list and bar chart
    - Health-checking and performance statistics.
  - Report generation for documentation.

In addition, ProfiTrace2 can be used as a Class1 and Class2 master for setting up and testing of both DP & PA devices.
- DP/PA Coupler required for PA devices (MBP segments)
- Simple set up and commissioning of cyclic data exchange
- Acyclic services for DVP1 DP devices and PA devices.
**Fieldbus Diagnostic Module (Pepperl+Fuchs)**

- The Fieldbus Diagnostic Module from Pepperl+Fuchs provides communications monitoring and diagnostics for PA segments.
  - The device is available as a permanent fixture that plugs into a coupler base,
  - or as a mobile unit that can be plugged into any PA segment.

**Our Demo Setup**

- We have a small system set up to demonstrate some of the engineering tools that are available:
Our Demo Setup

- PA Probe Ultra
- ProfiTrace hardware
- USB cable to laptop
- PROFIBUS DP connection (RS485)
- PROFIBUS PA connections (MBP)
- Mobile Fieldbus Diagnostics Module

FDT/DTM

- The FDT (Field Device Tool) specification provides a standard interface between device specific Device Type Manager (DTM) software and the User.
- The DTM is a software component provided by the manufacturer of an intelligent device.
- The DTM provides all the functionality to configure, test and diagnose the device from a laptop or PC station.
Live Demonstration