VERWER TRAINING AND CONSULTANCY LTD
Supporting the PROFIBUS Group UK & PROFIBUS International

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Tutorial - Why do we need an analyser with PROFIBUS?

PROFIBUS is a robust and well-tried technology that has been around for 20 years. But there are many common errors and failures that can cause the network to fail. However, lots of faults do not cause control system failure. This is because PROFIBUS has many built-in mechanisms to keep the network going in the presence of occasional errors. Only when the error rate reaches a critical threshold does the dreaded red "bus fault light" to come on!

### *So how do we know how close we are to the cliff edge?*

The answer is to use a modern engineering tool like ProfiTrace Ultra. The built-in performance statistics and bar chart in ProfiTrace Ultra give a quick check that everything is OK with each and every device connected to the cable. Waveform visualisation (provided by the integrated high-speed oscilloscope) provides a simple check on the wave shape from each individual device. Distorted or weak signals can quickly be detected using the features built in to ProfiTrace Ultra.
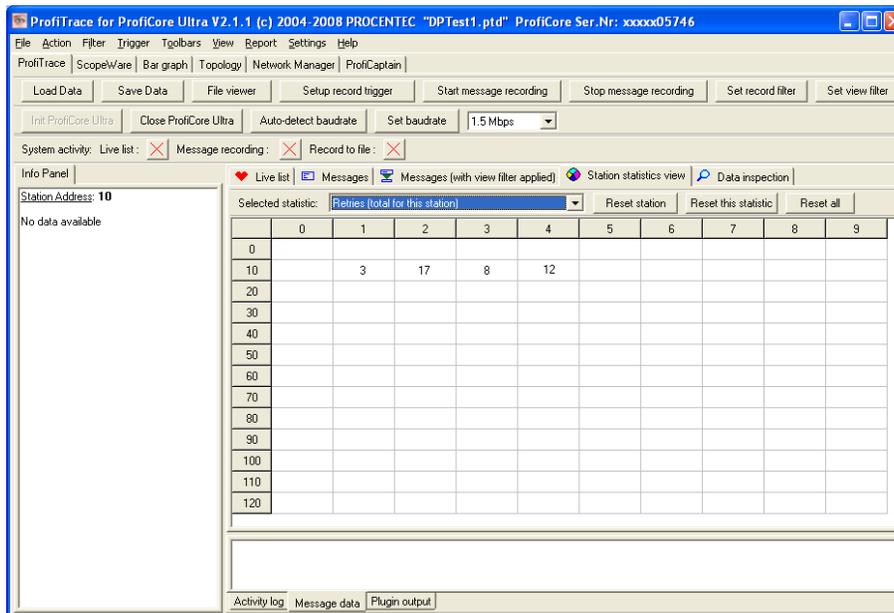
ProfiTrace statistics showing retries

Andy Verwer has many years of experience health checking and fault-finding networks on a wide range of applications and can cite many examples of networks that appear to be working well, yet show underlying errors when ProfiTrace Ultra is connected. Such examples include shorted wires, water ingress in connectors, high resistance connections, excessively long cables, wrong cable specification, spur lines, missing and faulty termination… the list goes on!

We teach the analysis of such faults on our PROFIBUS Commissioning & Maintenance course and Certified PROFIBUS Engineer course.
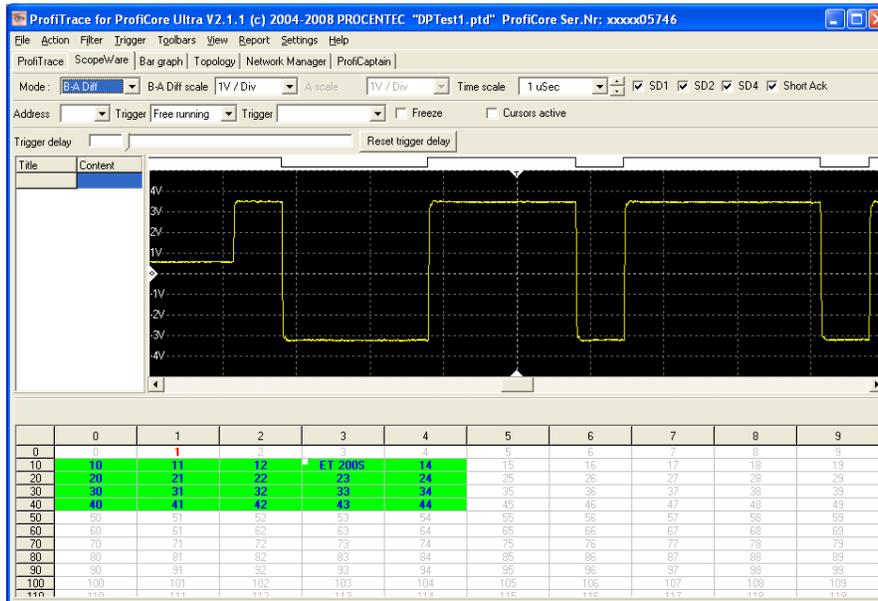

Oscilloscope built into ProfiTrace

Another problem is the location of faults, once detected, within the network. A network can have many devices spread around the plant connected with long cable runs, so the problem is quite difficult.

A particular problem occurs when reflections are present on the cable. Reflections can be caused by a wide range of faults or errors which cause the signal transmitted by a device to bounce back along the cable. The reflection, just like an echo, causes multiple signals to appear on the cable resulting in corrupted telegrams. The problem is that the devices that are most effected are those that are furthest from the fault that is causing the reflection (because the delay is greatest here).

Now turn the problem on its head - You are an engineer who sees a red bus fault light on a device. Where would you look for the problem? Near the device, of course! You would perhaps replace the device or connectors, but the bus fault light doesn't go off! Why? Because the reflection is caused by a fault at the other end of the cable!
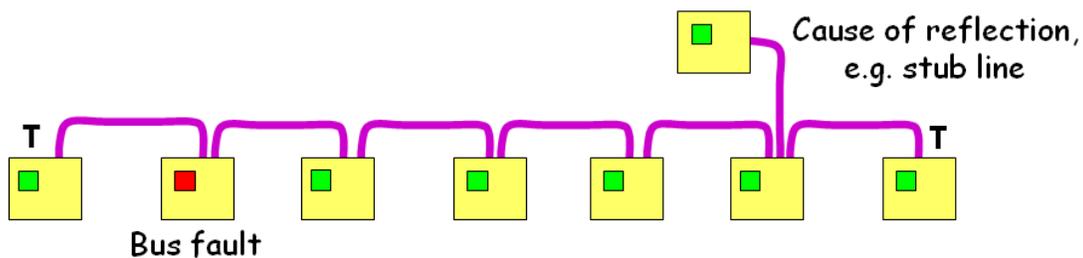
The reflection problem

How do we know where the fault is along the cable?

You guessed it! The answer is again to use ProfiTrace Ultra. Techniques that are taught on our PROFIBUS Commissioning & Maintenance course and Certified PROFIBUS Engineer course allow us not only to see the results of reflections and other errors, but provide an accurate location of where the fault is along the cable. Using a systematic approach, we can often locate wiring and connector faults to within +/- 1m.
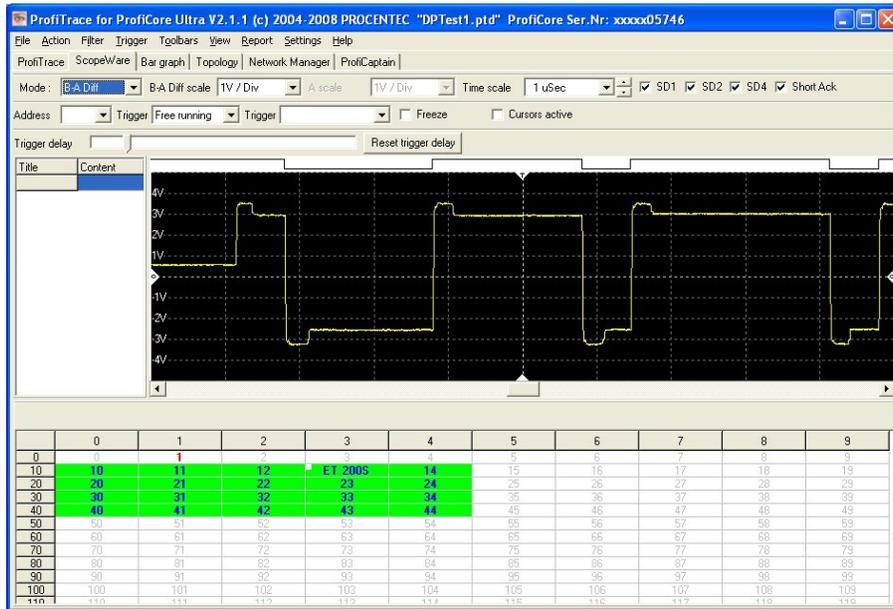

ProfiTrace 'scope showing reflection

Sometimes faults are intermittent, causing the network to fail only occasionally. In between times, the network runs perfectly. This situation is a real killer, because the engineer on seeing the failure will try to fix the fault, and it may disappear - not because it is fixed, but because it is intermittent!

Andy has come across many cases where the poor engineer has been trying for many weeks and even months to locate and fix an intermittent fault.

How do we catch an intermittent fault and diagnose the problem?

This is getting boring - use ProfiTrace Ultra.
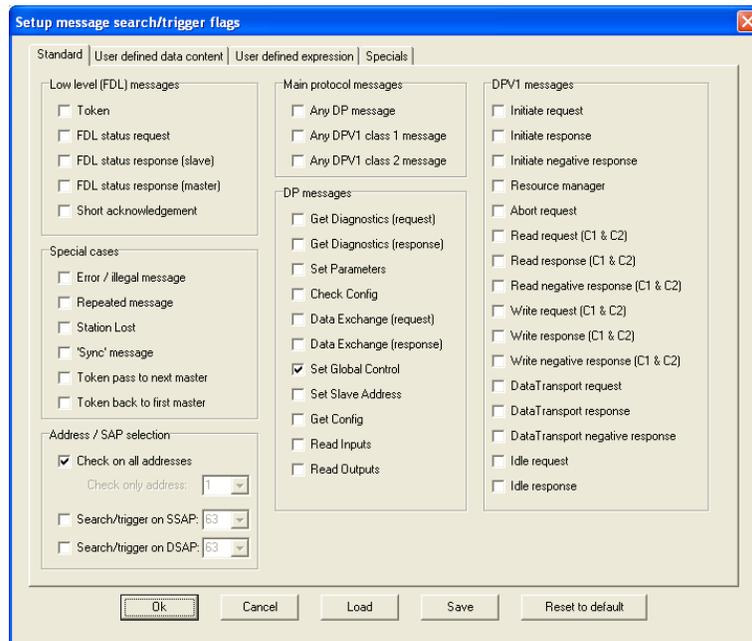
Extensive trigger options in ProfiTrace

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The extensive built-in triggering options on ProfiTrace Ultra allow the engineer to set a trap that will capture a block of data when the fault occurs. The captured block can include data from just before the event as well as just after, so we can identify the first sign of trouble before the network failed. The extensive filtering in ProfiTrace Ultra allows the unwanted data to be hidden so the engineer can concentrate on the device(s) that are causing the problem. The captured data can be saved are retrieved at a later time. Finally the automated decoding of telegrams allows us to quickly interpret the captured data and hopefully, diagnose the fault.

The techniques for setting traps for intermittent errors are taught on our PROFIBUS Commissioning & Maintenance course and Certified PROFIBUS Engineer course.

Sometimes errors occur which are outside the network. For example, sensor or actuator failure, power supply problems, or even mechanical problems like a sticking valve or misaligned sensor.

Can ProfiTrace help diagnose problems that are nothing to do with the network?

Well, the surprising answer is yes. Many PROFIBUS devices have built-in diagnostics that can help identify, so called "peripheral errors". Good old ProfiTrace Ultra can decode these diagnostic telegrams and thus provide a plain description of the fault.
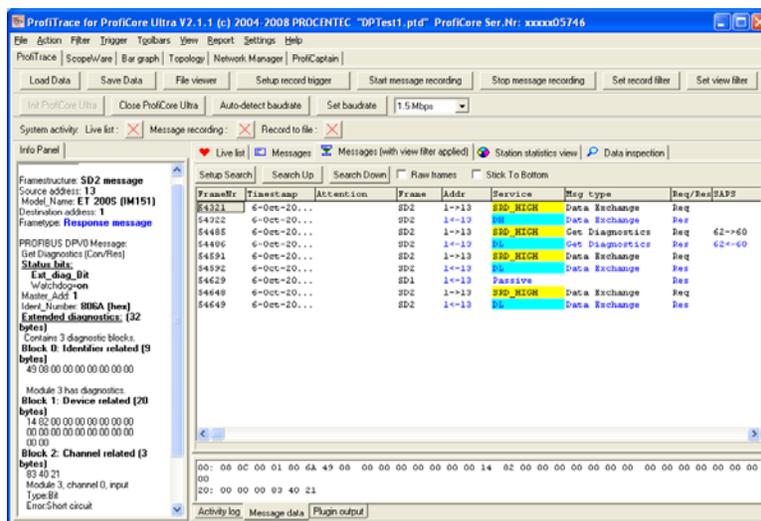
ProfiTrace interprets diagnostic telegrams showing peripheral errors

The extensive range of diagnostics within the PROFIBUS standard are taught on our Certified PROFIBUS Engineer course.