

## Troubleshooting FOUNDATION™ Fieldbus with the Fluke ScopeMeter 190C Series

### Application Note

Fieldbus digital communications protocol provides powerful and flexible network communications interoperability to automation and control industries, including the world's massive global petroleum industry. FOUNDATION™ fieldbus allows control devices and instruments from a range of manufacturers to communicate with one another, resulting in seamless compatibility and a more efficient and effective operation.

Training is crucial to make the most of the business efficiencies fieldbus systems can offer. Conversion to a fieldbus system brings demonstrable benefits, but it also requires a whole new way of doing business. And that means proper equipment, new procedures and new ways of thinking. Fieldbus problems are more easily identified if they can be viewed. Viewing waveforms typically requires the use of an oscilloscope.

Because so much of a fieldbus technician's work is out in the field, a typical bench-top instrument is not practical. The Fluke ScopeMeter tool is a portable, handheld instrument that combines the capabilities of a bench-top scope with a DMM and paperless recorder. Because it can read Manchester encoding, weighs just 2 kg and has a four-hour battery life, the scope's power and portability make it ideal for fieldbus troubleshooting.

### Fieldbus troubleshooting made simple:

Fieldbus segments that are not set up properly or that have become corrupted by background noise broadcast garbled messages or shut down completely. And sometimes you don't even realize there's a problem until it has cascaded through an entire system, causing more problems.

When a device is not complying with FOUNDATION fieldbus specifications, the ScopeMeter helps spot and diagnose the problem by analyzing various components of DC waveform characterizations. This analysis provides a clear, graphic picture of a signal's integrity and allows technicians to locate hard-to-find problems such as noise interference, random glitches or drop-outs.

### Troubleshooting a FOUNDATION Fieldbus H-1 Segment

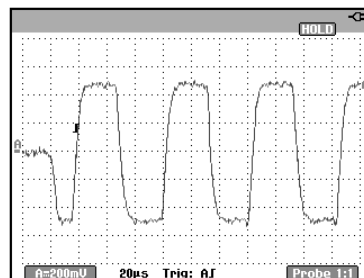
Troubleshooting a FOUNDATION fieldbus segment requires a basic knowledge of how a fieldbus is put together. A device operating outside the protocol is one that is broadcasting or communicating outside of the parameters regulated by the Link Active Scheduler (LAS). The information it transmits is broadcast garbled or it interrupts the communications of other devices on the segment, causing the information to be lost. Here's how to find a device that is not operating correctly, using an H-1 segment as an example:

- 1) A FOUNDATION fieldbus H-1 segment is a two-wire digital network. On one channel of the ScopeMeter, place the

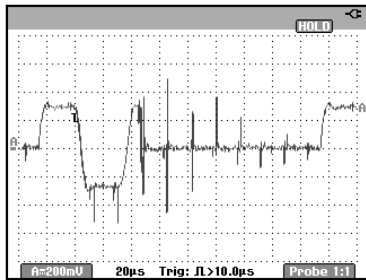
probe and its grounding lug across both wires of the H1 segment. It is important to note that the ScopeMeter is battery operated and is therefore isolated from earth ground when performing such analysis.

- 2) Set the scope to capture a 32-microsecond bit pattern.
- 3) Set the volt capability on the scope to capture .75 volts DC peak to peak.
- 4) Once the scope is placed on the H-1 segment and 24-volt DC power is present, the waveform will appear, as long as the Link Active Scheduler is actively communicating on the segment bus. If no waveforms appear, it indicates that the LAS itself is faulty – and the culprit is found.
- 5) If waveforms do appear, they should match the specified trapezoidal image characteristic of Manchester encoding.

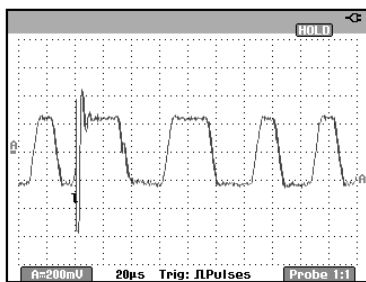
If it is degraded or has inadvertent spikes throughout, then a field or host device on the H-1 segment is misbehaving.



**Figure 1.** Ideal Manchester encoding waveform.



**Figure 2.** Broadcast signal with approximately 1 Volt p-p noise.



**Figure 3.** Broadcast signal with a voltage spike occurring at the waveform transition, corrupting the intended fieldbus message.

To isolate the problem device, remove one device at a time and watch for the suspect waveform to disappear. This eliminates all others as culprits and provides information on why the device is working improperly. Spikes present in the waveform typically indicate a faulty communication card in the field device or at the host LAS.

For more information about Fluke Scopemeter products, go to [www.fluke.com/scopemeter](http://www.fluke.com/scopemeter).

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