LeCroy

Application Note: IF003

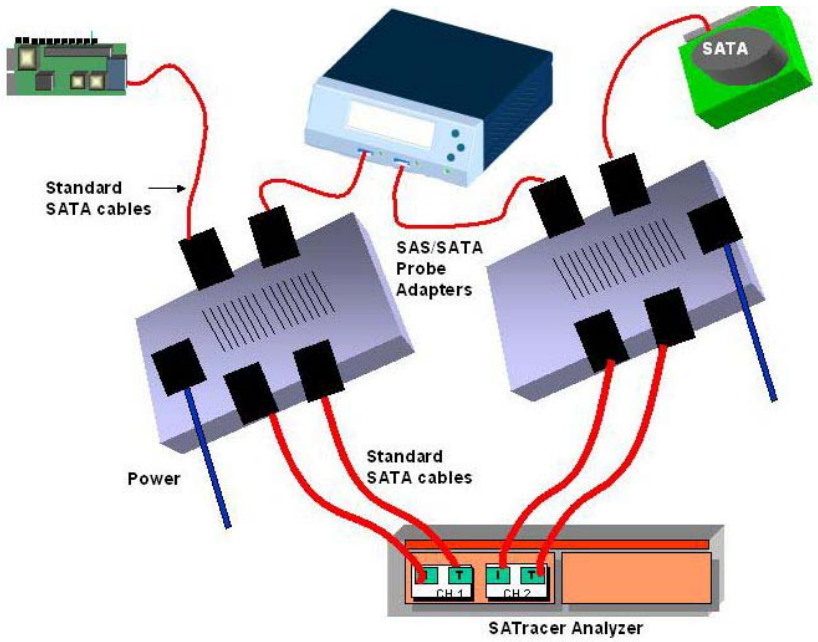
LeCroy InFusion
Trouble Shooting SATA Connectivity

LeCroy's InFusion error injection system is designed to sit in the data path between Serial ATA or SAS host and target devices. In some cases, SATA devices may have difficulty establishing a reliable connection with the InFusion in the line. Below are two possible solutions to this issue.

1. Passing Serial ATA OOB Sequence

When using InFusion in conjunction with a protocol analyzer (LeCroy's SATracer 3G or other 3rd party analyzers), some SATA devices may have difficulty completing the OOB sequence. Because analyzers and the InFusion system both act as passive signal repeaters, OOB detection latency can be introduced in the link. A small amount of latency may cause the receiver on the DUT to fail to detect the incoming OOB sequence.

This diagram illustrates connection between host and device through InFusion system using LeCroy's SAS/SATA PROBE ADAPTER KIT (**part number: SS001UCA-X**) to remove the additional signal repeaters from the link.



LeCroy offers the SAS / SATA Probe Adapter boards for users that encounter this issue. The probe adapter provides a high impedance front-end to any analyzer. With this board in front of the analyzer - instead of repeating the signal – the analyzer will only sample the signal (high value resistors contribute to reduction in amplitude ≈ 15%). This minimizes the impact on the native SATA signal, adds no latency to the link, and still allows the analyzer to record the exchange. Contact LeCroy Support to request SAS / SATA Probe Adapter boards when encountering link up problems using InFusion with Serial ATA.

2. Initiator High Swing Option

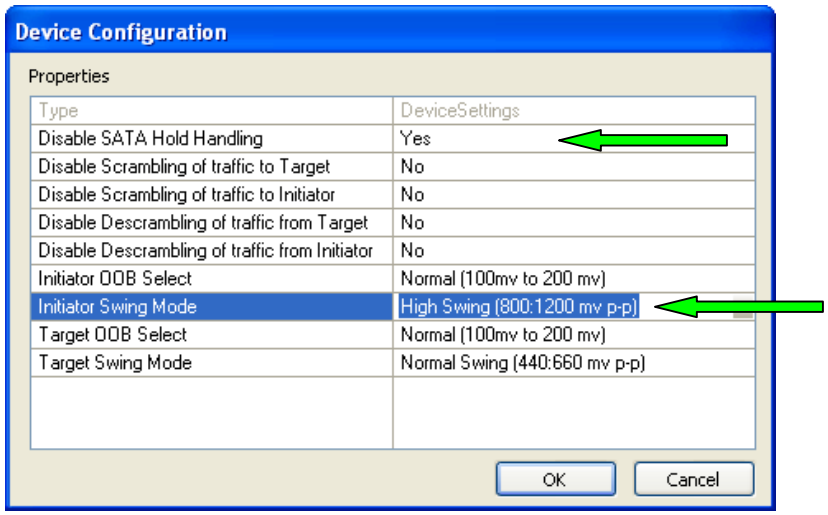
If using the InFusion system with the SAS SATA Probe Adapter boards (above) and SATA OOB is successful - but errors make the link unreliable, it may be beneficial to boost the differential output swing on the InFusion system. By using two of the Probe Adapters (as shown above) these high impedance taps can "drain off" a small amount of the signal amplitude. This can push the signal below the margin of some receiver PHYs. By adjusting the InFusion PHY to use the High Swing mode (SAS voltages: 800 – 1200mv), it changes the signal amplitude transmitted from the InFusion transmitter PHY to accommodate for the slight loss of amplitude due to the SAS / SATA probe adapter.

Note: The new SATracer Analyzer Module with External "Infiniband style" connector (SS004MA) uses high impedance probing natively and should not require use of the SAS / SATA probe adapter boards.

3. Serial ATA HOLD Handling

To minimize buffering requirements, Serial ATA devices use the HOLD primitive to perform flow control on inbound data stream. The Serial ATA specification requires that devices that issue the HOLD primitive, should receive the HOLDA primitive on the back channel from the attached device within 20 Dword times (533ns for Gen1; 273ns for Gen2). When operating in traffic impairment mode, InFusion is a repeater and must convert data in both directions from 10bit symbols to 8bit symbols. It then converts back to 10bit after making any modifications to the patterns. This process adds some latency to the link (approximately 500ns) which can break the 20 Dword limit required by the HOLD flow control protocol.

To address this case, special logic has been incorporated in the InFusion system to respond to the HOLD primitive by automatically inserting a HOLDA in response to the HOLD. If the SATA link completes OOB but periodically shows errors or repeatedly resets the link, ensure that the SATA HOLD handling is enabled. Go to the Device Configuration dialog to **enable** the SATA hold handling.



The HOLD handling option may be enabled and disabled through the InFusion software as well as the LCD.

The High Swing setting in InFusion may improve signal quality when using the SAS / SATA probe adapters and encountering link stability issues

Note: User may need to experiment with the SATA HOLD handling option by both enabling and disabling to see if connectivity improves. Be advised, if you change the HOLD settings, they only affect the current state of the InFusion system. You must select the Reboot or Shutdown item in the LCD Box Setup Options to save the changes to the flash memory on the InFusion hardware.