Falcon and Raptor Series
Application Note: Tech Support Frequently Asked Questions

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Contents

My Falcon or Raptor does not communicate with the controller PC. What can I do to troubleshoot?

1. Check your Thunderbolt 3 cable. All Thunderbolt 3 cables use the USB Type-C connector and support USB 3.0. However not all USB Type-C cables can support Thunderbolt 3, depending on cable length and quality. Verify that your connection cable is a Thunderbolt 3 cable, not just a USB Type-C cable. Thunderbolt 3 cables will carry the Thunderbolt 3 mark

   We recommend either StarTech (www.startech.com) or Sonnet (www.sonnetstore.com) Thunderbolt 3 cables; we have tested and verified both of these brands for compatibility. CableMatters brand cables are NOT compatible.

   For longer cables (>0.5m) we have verified that the following are compatible while supporting 40Gbps bandwidth:
   - StarTech Series TBLT3MM2MA Thunderbolt 3 Cable - 6 ft / 2m - 4K 60Hz - 40Gbps
   - Sonnet Thunderbolt 3 Cable (40Gbps; 1-meter)

   Background: Prior to Thunderbolt 3, Thunderbolt 2 and the original Thunderbolt shared the same cable type and Mini DisplayPort connector, with top data transfer speeds of 20Gbps and 10Gbps, respectively. Thunderbolt 3 has a top data transfer speed of 40Gbps as long as the cable is 0.5m (1.6 ft.) or shorter. For 1m (3.2 ft.) or longer cables, Thunderbolt 3 supports passive cables that have a top speed of 20Gbps and active cables that retain the 40Gbps speed.

2. Check that you are connecting to the Thunderbolt 3 connector on your controller PC. Since Thunderbolt 3 devices use discrete Thunderbolt chips to function, they will not work if they are plugged into a USB-C port unless that port specifically supports Thunderbolt 3.

3. Check the Thunderbolt 3 drivers on the controller PC. Ensure that the Thunderbolt 3 drivers are the latest supplied by your PC manufacturer. If your controller PC is a desktop using a PCIe-to-Thunderbolt 3 adaptor card, verify that the adaptor card is supported by the bios of your PC.

What is different with the new solder-down probe design?

1. Why did I/didn't I get solder-down probes as part of my order?

   A solder-down probe bundle for a x2 link is included with every Raptor order but must be ordered separately with Falcon.

2. Does the new solder-down probe design include/require a probe pod?

   No, the new solder-down probe design does not require a probe pod. It can be connected directly to the instrument front panel and is powered from the front panel probe power connector.

3. Are the new probes compatible with the original Falcon chassis?

   Yes, the new probes can be connected using SMP-to-SMA cables. However, the probe power cannot be supplied by the front panel connectors, so an alternative power supply is required. The most common approach is to order the probe pod to supply the power.

4. Are the new probe tips compatible with the older probe pod and cables?

   Yes, the tips connect to the Carlisle cable which connects either to the instrument front panel or to the pod.

5. Does the new solder-down probe only work for HS-G3 or HS-G4B? Are the probes the same for the Raptor Series and Falcon Series?

   The same probe is used with the Raptor and Falcon Series, and supports both HS-G3 and HS-G4B.

Is there a way to search for the errors in the UniPro or UFS Packet List?

With version 1.4.1 or later there are two Trace Validation tests in the SearchTVs folder, one for UniPro and one for UFS. These can be selected from the Analyzer Configuration or Exerciser+Configuration windows. Once the TV has been run click on a result in the TV Results window and then use the down arrow on the keyboard to move to successive errors in the trace.

You can also use Trace Validation to search for packets with errors or use Simple Packet Search to search for NACs and then look for the red packets.

How do the hardware counters in Instrument Status work in relation to analyzer trace capture?

The Hardware Counters in the Instrument Status window are unrelated to the analyzer trace capture. The hardware counters monitor the UniPro link and count the bits on the link to show if the link is active. Once the instrument obtains sync with the KCode symbols on UniPro link the hardware counters will start incrementing and will continue incrementing as long as there is traffic on the link.

When the analyzer Run button is clicked the analyzer will begin filling its trace memory and it will continue to fill memory with a circular FIFO buffer until triggered or Stopped. Then the memory stops filling and offloads to the GUI. However the hardware counters never stop incrementing, even after the analyzer Stop button is pressed or after a trigger event.

What is the difference between Symbol Errors in the Instrument Status window and red error packets in the UniPro and UFS Packet listing windows?

Symbol errors counted in the Instrument Status window are KCode raw bit capture errors, typically caused by signal integrity problems, probing issues or M-PHY issues.

Red packets in the List windows show protocol decode issues that typically occur when the host or device are not correctly transmitting data and the packet's protocol information is invalid. Red packets also mark any packets corrupted by symbol errors counted in the Instrument Status window.

Thus, invalid packet protocol errors are shown as red packets only in the List windows and not in the Instrument Status window, but KCode bit errors will show in both the Instrument Status and as red packets in the List windows.

How do I capture an analyzer trace when the UniPro link is already established?

The analyzer can capture a trace from an existing UniPro link, but the analyzer needs to be told what power mode the UniPro link is operating at. Once told what speed and link width to expect it can sync to the existing traffic on the bus provided it sees at least one Start of Burst.

The "Initial Power Mode" setting under Settings->Instrument Configuration is used to tell the analyzer the initial power mode to assume to sync to the link. Once the initial power mode is configured in the Instrument Configuration window the analyzer will remember that setting for the next time you hit Run and any subsequent Runs, but the GUI reverts to the default setting in the display.

How is analyzer trace memory displayed in Instrument Status window?
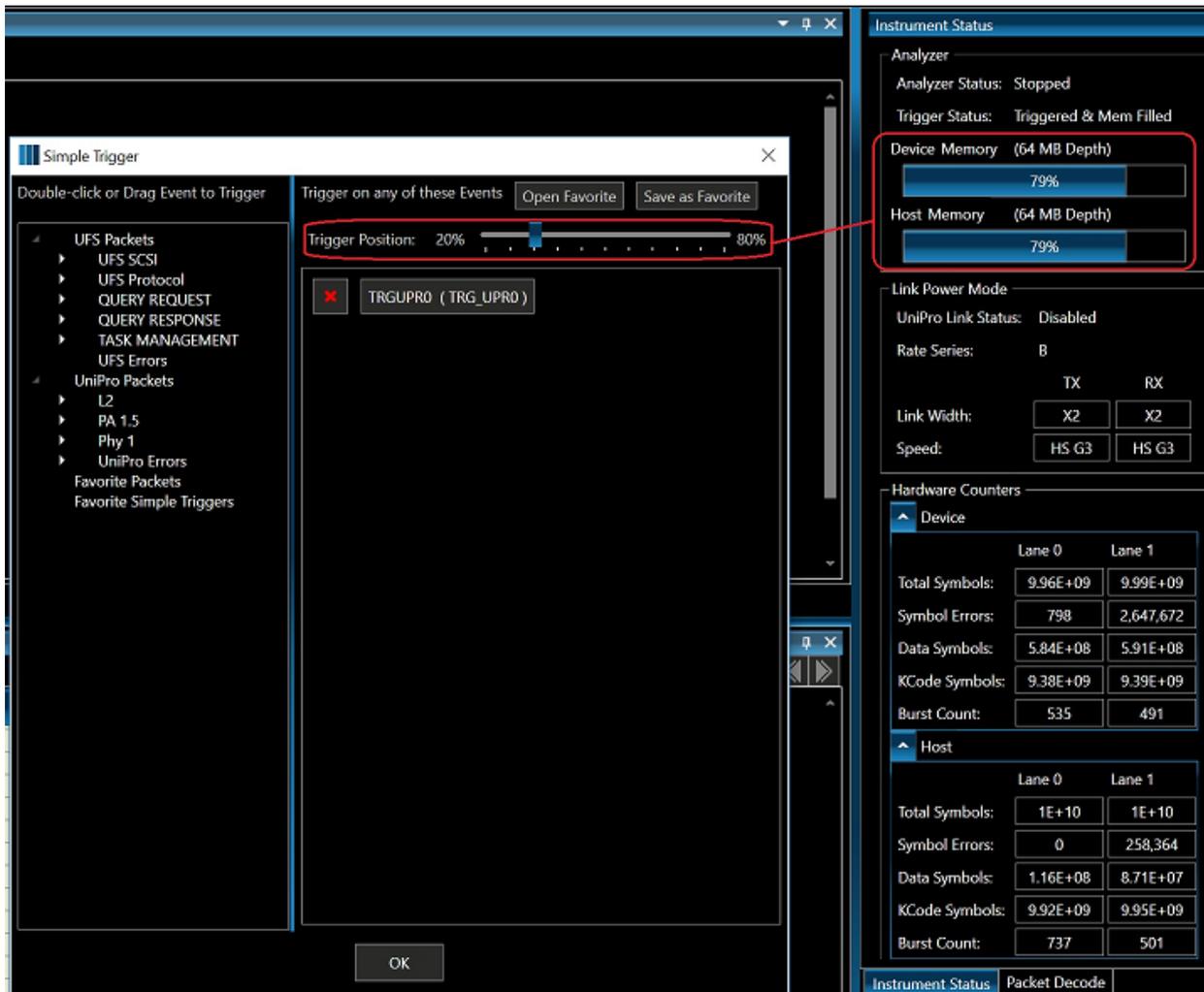
The analyzer always reserves the amount of memory after the trigger that you set with the Trigger Position in the Simple Trigger window. If a 20% trigger position is set the analyzer will reserve 80% of the memory for post-trigger fill. What this means is that if the trigger occurs deep in the trace you will fill 100% of the buffer, 20% before and 80% after. But if the trigger event occurs very early in the trace, say after only filling 5% of the total memory, the capture will total less than 100% because you will have 5% before the trigger and 80% after the trigger for 85% total.

Why did I get the message "State machine did not run" when running a Trace Validation test?

Trace Validation (TV) is a state machine analysis tool that analyzes captured traces using specific and|or logic and states to find problems and events. TV tests can be run against any captured trace as a complete post-capture analysis tool for search, pass/fail testing, stress test analysis or for general debug.

There are generally four types of TV tests that can be run: pre-defined CTS tests, debug tests, SearchTVs and custom tests. The application software library includes hundreds of pre-defined CTS, debug, and SearchTV test cases that can be used as-is or modified and saved as their own unique analysis test cases, and users can use Trace Validation Builder to create their own custom TV tests.

Pre-defined CTS tests are supplied with the application software library for most UniPro and UFS CTS tests defined by the respective standards organizations. There are three common reasons why CTS test cases will not run and the message **"State machine did not run"** is generated:

1. **The Test Configuration is not set correctly for the CTS test case being executed.**
   For example, when executing a UFS CTS test case to evaluate proper LUN behavior, the correct "Configured LUN" must be selected in the Configuration window, otherwise the "State machine did not run" message will be generated.

   To run all LUN tests select the following LUNs in the Configured LUN section of the Configuration pane: LUN 0, all four W-LUNs (the well known LUNs - Boot LUN, UFS Device LUN, RPMB, Report LUNs) and the NONE LUN (LU agnostic - for running tests against the device).

2. **The Device Under Test must be properly configured for the CTS tests to be executed.**
   Some tests will not run if the DUT settings (Menu->Settings->Device Configuration) are not set correctly. For example, UFS CTS test case 8.1.1 will not run if MaxContextID of a LUN is set to 0, this must be changed in the Settings->Device Config->UFS LUN Configuration->Miscellaneous section.

3. **No Protocol Insight CTS test case marker is present in the trace.**
   When the CTS tests are executed the Falcon Exerciser inserts a specific Protocol Insight marker packet into the trace to indicate the beginning of each CTS test in the trace. If TV does not find the marker packet then TV will not complete and will instead generate the message "State machine did not run". For this reason, the TV CTS tests supplied with the application software library should only be used to analyze traces generated with the Falcon Exerciser for the matching CTS Stim test case.

Debug tests are designed to analyze any trace for issues commonly associated with UniPro or UFS turn-on, not just traces generated by the Falcon Exerciser for CTS. Examples include Link Startup problems and UFS packet latency. Debug tests are intended to be used with traces captured in either exerciser or analyzer mode. If no states in the captured trace match the criteria of the debug TV the message **"State machine did not run"** will be generated.

SearchTVs are tests created by Protocol Insight to search a trace for specific conditions. The Application software library includes three search TVs, "Find UniPro Error Packets", "Find UFS Error Packets" and "Find Protocol Insight CTS Markers". If no states in the captured trace match the criteria of the SearchTV the message **"State machine did not run"** will be generated.

Custom TV tests can be created by the user, either from scratch or from a pre-defined test in the Application software library. See the separate Trace Validation Builder User Guide for more information.

If no states in the captured trace match the criteria of the custom TV the message **"State machine did not run"** will be generated.

What are the Sync Time requirements for the Falcon or Raptor Analyzer, and how do I set those for my device?

To increase the sync length of the DUT, <u>after</u> link startup write the following attributes (using DME_SET and DME_PEER_SET) to the peer and local device.

Falcon Analyzers shipped after January 22, 2018 and Raptor require:

Attribute	Spec	Typical
TxHsG1SyncLength (0x1552)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG2SyncLength (0x1555)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG3SyncLength (0x1556)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG4SyncLength (0x15D0)	256 Symbols, 0x48 Capability value	64 Symbols, 0x46 Capability value
TxHsG1PrepareLength(0x1553)	0xA Capability value	0x3 Capability value
TxHsG2PrepareLength(0x1554)	0xA Capability value	0x3 Capability value
TxHsG3PrepareLength(0x1557)	0xA Capability value	0x3 Capability value
TxHsG4PrepareLength(0x15D1)	0xA Capability value	0x3 Capability value
RxLsPrepareLength	0xA Capability value	0x1 Capability value
RxPwmBurstClosureLength	0x1F Capability value	0x10 Capability value
To sync to existing link	one Start of Burst	one Start of Burst

Falcon Analyzers shipped before January 22, 2018 require:

Attribute	Typical
TxHsG1SyncLength (0x1552)	16 symbols, 0x44 Capability value
TxHsG2SyncLength (0x1555)	16 symbols, 0x44 Capability value
TxHsG3SyncLength (0x1556)	16 symbols, 0x44 Capability value
TxHsG1PrepareLength(0x1553)	0xb capability value
TxHsG2PrepareLength(0x1554)	0xb capability value
TxHsG3PrepareLength(0x1557)	0xb Capability value
RxLsPrepareLength	0x8 Capability value
RxPwmBurstClosureLength	0x1f Capability value
To sync to existing link	one Start of Burst

The typical settings assume configuration with 50/50 splitter and recommended cables. Actual performance may vary depending on the probing and the signal integrity of the DUT.

Note: if you set these values before link startup the capabilities exchange phase of the link startup sequence will overwrite any values you set.

What are the UniPro Link Startup Sequence (LSS) requirements for the Falcon Exerciser to establish a UniPro link with the DUT?

The device must execute a UniPro 1.61 or 1.8 compliant Link Startup Sequence.

How do I adjust equalization settings for the PHY for my Falcon or Raptor?

Instruments shipped after January 22, 2018 do not require manual PHY equalization settings, however the PHY can be tuned from the Advanced Settings dialog on the Settings menu. This requires expert knowledge of the instrument, Device Under Test and test fixture configurations and should only be done on the advice and recommendation of Protocol Insight Support. For information on how to use the Advanced Settings contact your local Protocol Insight representative or support@protocolinsight.com.

For Falcon instruments shipped before January 22, 2018 there is no option to adjust PHY settings.

Why can't I save my trace?

After your Falcon or Raptor has captured a trace it is off-loaded to the application software and background calculations are initiated to update the Traffic Overview and Events windows. During these background calculations you will get the following dialog if you try to save the trace:
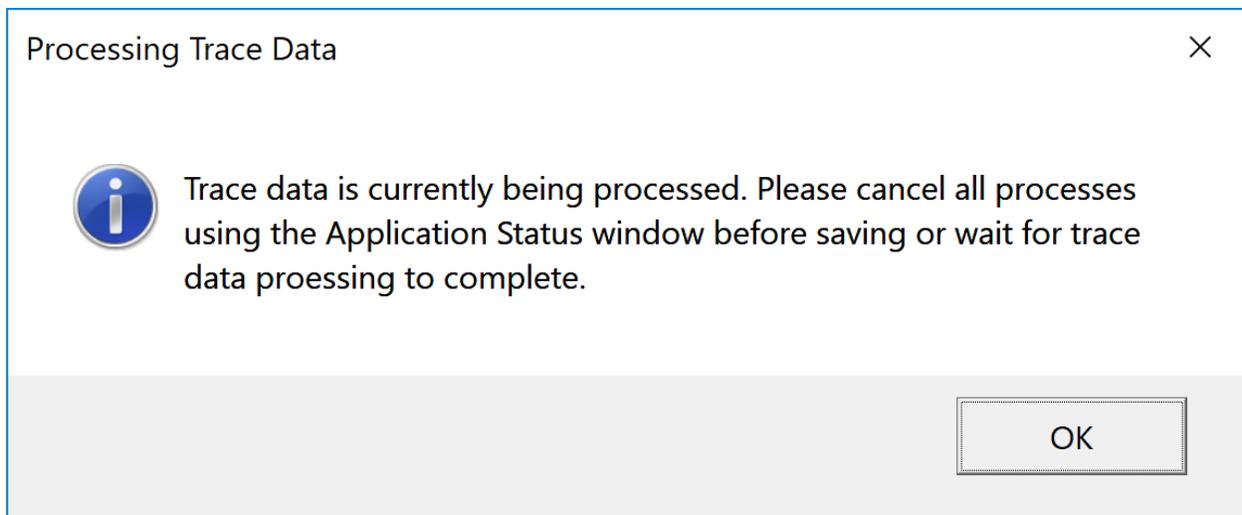
To save your trace you must cancel background calculations. **For application software version 1.4 or earlier** open the Application Status window by clicking the 🛈 button on the right side of the tool bar and cancel background calculations. Note, you might have to cancel several different processes. **For version 1.4.1 or later** click the cancel button next to the 🛈 icon on the tool bar.

For more information on background calculations see CAN I SPEED UP FILE SAVE TIMES? below.

Can I speed up File Save times?

After your Falcon or Raptor has captured a trace it is off-loaded to the application software and the Packet List, Packet Decode and Data View windows are immediately populated with decoded trace data.

Background calculations then are initiated to update the Traffic Overview and Events windows. Although the Packet List, Packet Decode and Data View windows are fully functional during background calculation you cannot save the trace file while calculation is taking place.

With version 1.6.0 or later, to disable automatic background calculation of the Traffic Overview and/or Events windows uncheck the appropriate box under Calculation Preferences in User Preferences from the Settings menu.

With version 1.4.5 or earlier, to disable automatic background calculation of the Traffic Overview and Events windows uncheck "Auto Calculate Events" from the Tools menu.

This will allow you to immediately save the file after it is offloaded from the instrument and will moderately reduce overall File Save times.

Note that until Traffic Overview is calculated the Simple Packet Search functionality will not be available.

Can I speed up File Open times?

With version 1.6.0 or later if a trace was saved without completing the calculation of the Traffic Overview and/or Events windows background calculation will automatically start when the file is re-opened if the appropriate box has been checked under Calculation Preferences in User Preferences from the Settings menu

With version 1.4.5 or earlier background calculation will begin automatically if "Auto Calculate Events" is checked on the Tools menu or was checked when the trace was originally saved (see CAN I SPEED UP FILE SAVE TIMES? above). Note that with version 1.4.5 or earlier if the file was originally saved with "Auto Calculate Events" checked the trace will automatically begin calculation regardless of the setting in the Tools menu.

Disabling automatic background calculation of the Traffic Overview and/or Events window will reduce the overall File Open time moderately, but more important it will make it possible to perform a File Save without having to wait for calculation to complete.

The application software will still be highly responsive while it is doing background calculation, and Packet List, Packet Decode and Data View windows are fully functional. However, until Traffic Overview is calculated the Simple Packet Search functionality will not be available.

Contact Information

1. For additional information, to request a demonstration or quote, or place an order, please contact your local Protocol Insight representative or sales@protocolinsight.com
2. Support materials and examples files are available at http://www.protocolinsight.com/support-materials/
3. For technical support please contact your local Protocol Insight representative or support@protocolinsight.com

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