STAR-Dundee

Supporting SpaceWire Applications

SpaceWire Recorder Mk2

The Recorder Mk2 is designed to support the validation and debugging of complete SpaceWire systems. It can be used to unobtrusively record and view large quantities of traffic travelling over up to four SpaceWire links. The visibility this provides greatly helps to confirm a SpaceWire system is operating correctly and aids debugging when problems are detected.

The Recorder Mk2 is inserted inline on SpaceWire links of interest. When recording is started, packets, time-codes and link errors are written to solid-state disk (SSD) along with their time information. When recording is stopped, software indexes the recorded traffic to minimise access time, and then displays it in network and packet views ready to be inspected.

The SpaceWire Recorder Mk2 is a complete computer rack system. It consists of a cPCI chassis containing STAR-Dundee's SpaceWire Recorder board, a powerful CPU card with two solid-state disks, and a power supply.

SpaceWire Recorder Mk2

Key Features

Large recordings: The quantity of data that can be recorded and viewed is limited only by the size of the solid-state disks used (960GB at time of writing). This allows large volumes of SpaceWire traffic to be recorded over long periods of time.

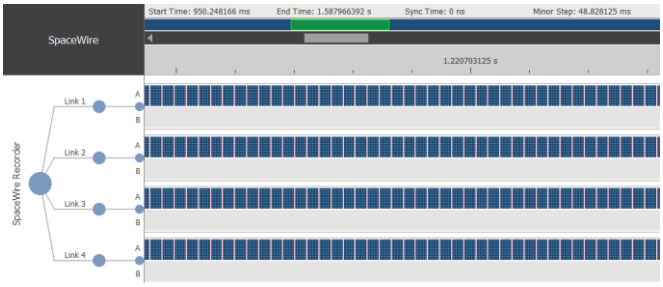
Supports four links: The SpaceWire traffic of up to four links can be recorded and displayed. This can show the interactions between many SpaceWire devices and can provide traffic visibility of complete SpaceWire systems, useful for validation and debug purposes.

Unobtrusive recording: The LVDS signals are buffered by the Recorder Mk2 to ensure the unit is transparent to the SpaceWire links being recorded.

Stop recording automatically: Recording can be stopped on demand or can occur automatically when a specific quantity is recorded, a pre-defined time elapses, or when the recording disk is full.

View entire recording: Intelligent software allows the entire recording to be viewed seamlessly, avoiding the need to manually open small sections at a time.

Network level view: The network level view provides a high-level overview of all recorded traffic, in varying quantities and detail depending on the zoom level. This is useful for navigating large quantities of traffic and for identifying and inspecting traffic trends and areas of interest. It is also excellent for visualising packet routing and time-code distribution between multiple SpaceWire nodes.



SpaceWire Network View

Packet level view: For each link with recorded SpaceWire traffic, a packet view is displayed. This shows the timing information of packets, time-codes and link errors travelling in both directions of the link. Packet size and content, time-code values and link error types can be inspected. This view can be used to monitor the flow of packets exchanged across a link, time distribution, the response of a system to errors, and the control of SpaceWire systems using control packets.

	Time Delta	End A	End A Events	End A Delta
11.96188 ms	1.98386 ms	Header: 00		1.98386 ms
11.96188 ms		Cargo Size: 255 bytes		
11.97452 ms	12.64 µs	EOP		12.64 µs
13.9594 ms	1.98488 ms	Header: 00		1.98488 ms
13.9594 ms		Cargo Size: 255 bytes		
13.97204 ms	12.64 µs	EOP		12.64 µs
15.9561 ms	1.98406 ms	Header: 00		1.98406 ms
15.9561 ms		Cargo Size: 255 bytes		
15.96874 ms	12.64 µs	EOP		12.64 µs
18.2056 ms	2.5182 ms	Header: 00		2.5182 ms
18.2056 ms		Cargo Size: 255 bytes		
18.332 ms	12.64 µs	EOP		12.64 µs
18.66282 ms	629.62 µs		Time-Code [15]	10.18 ms

SpaceWire Packet View

RMAP analysis: The packet view can optionally interpret and display the fields of packets conforming to the Remote Memory Access Protocol (RMAP) standard. RMAP transactions can be viewed and inspected, greatly simplifying RMAP analysis.

Search: Built-in search capabilities can help to navigate and validate recorded traffic. Specific data sequences, EOPs, EEPs, time-codes and different error types can quickly be located and displayed.

Selection synchronisation: Selecting traffic within the network or packet views automatically selects and displays the corresponding time in the other views. This simplifies traffic navigation and allows traffic items of multiple links around the same time to be inspected easily.

Statistics: Total and per-link-end recording statistics are shown. The number of data bytes, time-codes, EOPs, EEPs and errors are displayed alongside the recording start and end time. The statistics

quickly summarise the recording contents and can help highlight any concerns.

Export to CSV: All or part of a recording can be exported to comma-separated value (CSV) formatted files. CSV files can be opened directly in spreadsheet applications or easily interpreted by custom software.

Save and load: A project file is created with each recording that can be used to reopen the recorded traffic when required. This can be used to keep a record of SpaceWire traffic behaviour under different circumstances. Recorded traffic can be shared with others to help with debug efforts.

Traffic visibility: Multi-colour LEDs on each of the SpaceWire ports provide an immediate indication of the status of the connected SpaceWire links.

Powerful CPU board: The CPU board provided has an Intel Core i7 processor and 16 GB RAM. **Two monitors** can be connected by two mini DisplayPort connectors. Two gigabit Ethernet ports can be used to connect the Recorder Mk2 to a company network for **file sharing**, and allow **remote access** to the Recorder Mk2 system from a separate PC. Two USB 3.0 ports are available to connect common peripherals such as a keyboard and mouse.

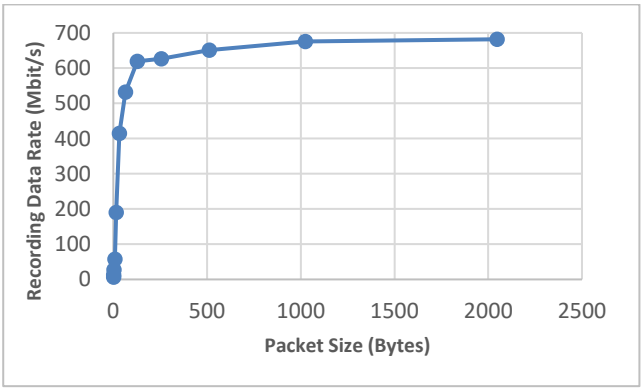
Compact and quiet chassis: The small size of the Recorder Mk2, and the quiet volume with which it operates, means it can be used with little disturbance. It has detachable feet, allowing it to be operated as a desktop unit or rack mounted (separate rack mounting kit required).

Field upgradability: The Recorder Mk2 board supports field upgradeability of the unit functionality. Any upgrades or requested customisations can be downloaded from the STAR-Dundee website and installed quickly and efficiently.

First class support: As with all of STAR-Dundee's products, a year's support and maintenance is included with the Recorder Mk2. This support is provided directly from the team that developed each product so that we can respond quickly with detailed answers to questions, give assistance with application development, and resolve any problems quickly.

Recording Performance

Each of the Recorder Mk2 SpaceWire interfaces support a maximum bit rate of 400 Mbit/s. **SpaceWire traffic can be recorded to disk at an aggregate data rate in excess of 600 Mbit/s**. However, the recording data rate depends on packet size (mainly due to the timestamp overhead) as illustrated in the chart below.



Packet Size vs Aggregate Recording Data Rate

If the rate at which data is transmitted exceeds the rate at which it can be recorded, software automatically stops recording and provides an **overflow detected alert**. There is no impact on the connected SpaceWire links.

The Recorder Mk2 board has a **large memory to/from which SpaceWire traffic is spooled**. This smooths out data rate fluctuations, helping to better support bursts of high-speed data.

The CPU board, SSDs and software all effect the recording performance. By supplying a complete computer rack system with all the necessary software pre-installed, we can ensure the best possible performance is achieved.

SpaceWire Recorder Mk2 Software

All required software comes pre-installed on the SpaceWire Recorder Mk2.

Recorder Mk2 application: This graphical user interface (GUI) application can be used to record and display SpaceWire link traffic. Recording size and time are configurable before recording starts. Once stopped, recorded SpaceWire traffic is indexed and displayed in network and packet views.

STAR-System: The SpaceWire Recorder Mk2 uses STAR-Dundee's device and operating system agnostic software stack, named STAR-System. This includes a high-performance PCI driver and API functions for device access, on which the Recorder Mk2 depends.

Windows 10 Pro: Windows 10 includes comprehensive driver support and is one of the most commonly used and familiar operating systems available.

Specifications

Part Number: 323
Size: Approx. 172 x 168 x 208 mm (4U/32HP 19" technology)
Power: Mains 110/240V AC
Software:

- Recorder Mk2 Application, STAR-System and Windows 10 Pro included

SpaceWire Ports:

- Compliant to ECSS-E50-12A, ECSS-E-ST-50-12C and ECSS-E-ST-50-12C Rev.1
- Number of SpaceWire Ports: 8
- Maximum Speed: 400 Mbit/s
- Connectors: 9-pin micro-miniature D-type

Storage:

- 1 x 960 GB SSD for recording
- 1 x 960 GB SSD for operating system files

Recording:

- Records SpaceWire packets, time-codes and link errors.
- Maximum aggregate recording data rate in excess of 600 Mbit/s (performance is dependent on packet size)
- For example:
  - Records 1024 byte packets on two links in both directions at 150 Mbit/s data rate
  - Records 1024 byte packets on all four links in both directions at 75 Mbit/s data rate

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