dap TECHNOLOGY

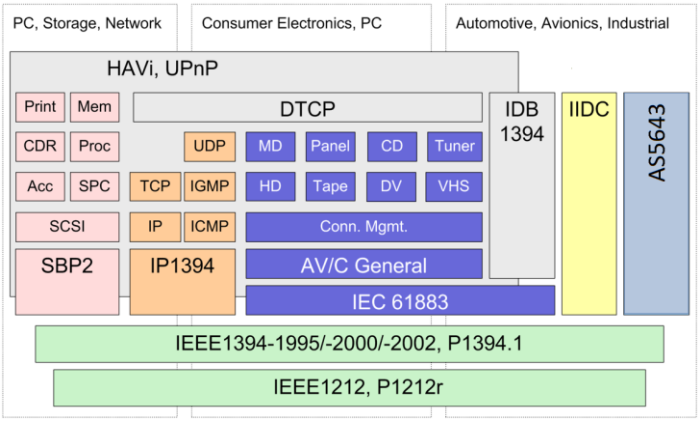
FIRESPY

SBP2
AV/C
IIDC
IP1394
AS5643

Protocol Options

1394SM

AS5643



Colored boxes represent (encapsulated) protocols supported by FireSpy analyzers.

GENERAL INFORMATION

The upper graphic shows a typical stack-up of the most commonly used protocols for IEEE1394. These data structures are encapsulated within the 1394 packet payload and carry specific information pertaining to their typical usage within their industry segments.

Some of these protocols (e.g. IP and SCSI) are widely used with other bus and networking technologies. Others (e.g. AV/C and IIDC) have been defined specifically for 1394 in order to take advantage of its unique feature set. It can be generalized that these protocols all live within layers 2-6 of the 7- layer OSI model.

DapTechnology strives to support as many protocols as possible. However, the vast number of protocols and the constantly expanding number of sub-specifications make it hard to keep up. Other protocols like SBP3, IPv6 are already in late specification stages and DapTechnology is committed to supporting them as soon as possible and as needs from our customers arise. Please contact DapTechnology if your project requires support for any other protocols.

With respect to DTCP (Digital Transmission Content Protection) DapTechnology regrets to inform you that the strict rules and regulations defined by the DTLA (Digital Transmission Licensing Administrator) do *not* allow us to support the decryption of encrypted data.

DapTechnology offers a series of highly integrated protocol decoding add-ons which greatly enhance the standard analysis and testing capabilities of the FireSpy data analyzers. Once the basic 1394 protocol has been mastered, typical analysis, debugging and testing requirements transition quickly into the protocol layer. Without proper tools this can be a painful and very time consuming task.

Common Characteristics

The different protocols require very different implementation details and are therefore very unique in their implementation. However, some key characteristics can be identified and are listed below:

- Nested protocol header decoding
- Protocol payload separation
- Handshake verification
- Logical grouping of related transactions
- Separate protocol view
- Protocol layer CRC and Parity Check verification
- Handshake timing analysis
- Customization of display details

Customization

As an added benefit, a separate application (Format Editor) allows for the modification and extension of the factory default decoding and identification definitions. This extremely powerful and versatile tool enables experienced users to build on top of the standard definitions, engage in early prototyping and benchmarking of protocols still in the specification development process, as well as add proprietary extensions.

Available Protocol Add-ons

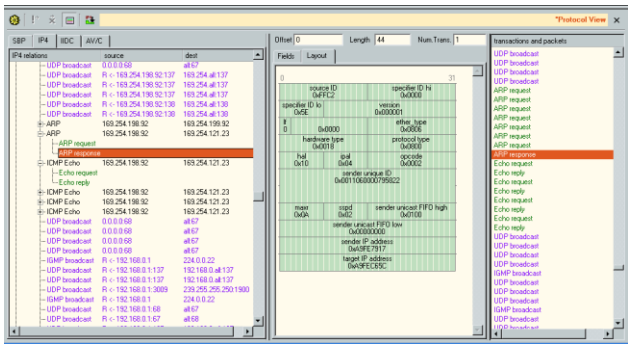
Currently DapTechnology supports the most commonly used protocols (but not limited to). As the need arises we will extend our supported set of protocols and enhance the list. Please see the following pages about detailed descriptions on the following protocols:

- IIDC
- AV/C
- SBP2
- IP1394
- AMI-C
- AS5643

STANDARD PROTOCOL FEATURES

Protocol Package Benefits

The Protocol package adds an additional view to the Recorder window. It consists of a toolbar on the top as well as three panes below it: the 'Relations' pane, the ‘Details’ pane and the ‘Transactions and Packets' panel.



Protocol View

Protocol View

The left pane of the Protocol View is the 'Relations' pane. It displays the results of the protocol analyzer in the terminology of the supported protocols. Each supported protocol has a tab page in the 'relations' pane. The tab page shows the results found for the protocol it supports and comprises a tree, which displays the hierarchy of the found results.

The middle pane of the Protocol View is the 'Detail' pane. It displays the details of a highlighted item of a tree in the 'Relations' pane.

The right pane of the Protocol View is the 'Transactions and Packets' pane. It displays all involved transactions and packets which are part of the results found by the protocol analyzer, as well as the bus resets. The transactions, packets and bus resets are displayed in chronological order.

Protocol Integration

Another great benefit is the seamless integration of high-level protocol support in the following FireSpy functions:

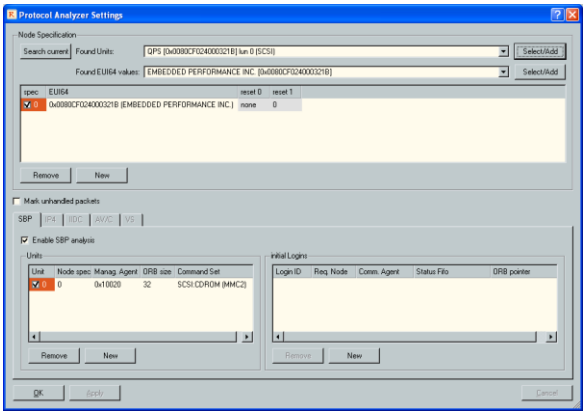
- Trigger
- Filter
- Search
- Data Generation
- Scriptor

Each protocol package offers a unique set of predefined packet payload definitions. Laid out according to the field definitions of each protocol, the package dramatically reduces the setup work for the above mentioned analysis functions.

Protocol Decode Settings

Each protocol analyzer needs information to do the protocol analysis correctly. Fortunately, this information can be found automatically. Using the **Protocol Settings** dialog, users can view the analyzer settings and change or add information manually.

In order to analyze the protocol for some Unit inside a node, the protocol analyzer needs information from the Unit. The information needed is protocol dependent. The protocol analyzer will scan the recorded data in the Recorder to retrieve this information automatically. This information is normally present in the Configuration ROM of a node, which is often read after a bus reset. If this information cannot be retrieved from the recorded data, it is to be provided manually. The Protocol Settings dialog shows all information needed by each protocol. It is filled initially with the information that could be found automatically. This information can be changed or new information can be added manually.



Protocol Settings for an SBP2 device

For example, the SBP protocol will need to know which nodes contain SBP Units and, for these Units, it needs to know the 'Management Agent, 'ORB size' and supported Command Set. All this information can be found in the Configuration ROM of the node. The analyzer will search for Configuration-ROM reads to find this information automatically. Only if the information is incomplete (e.g. incomplete Configuration ROM) or corrupted (e.g. incorrect Configuration ROM content) data will need to be entered manually.

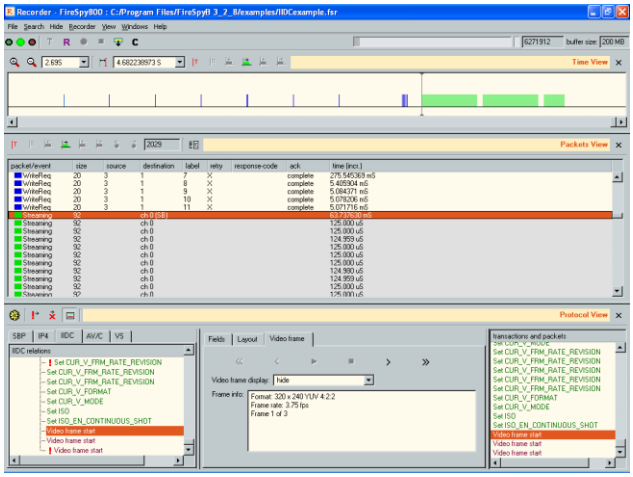
IIDC Protocol Option

General Information:

The IIDC (Industrial and Instrumentation Digital Camera) specification was developed within the 1394 Trade Association in order to standardize the control command set for industrial cameras. It is important to understand that this specification is not used for commercial camcorders.

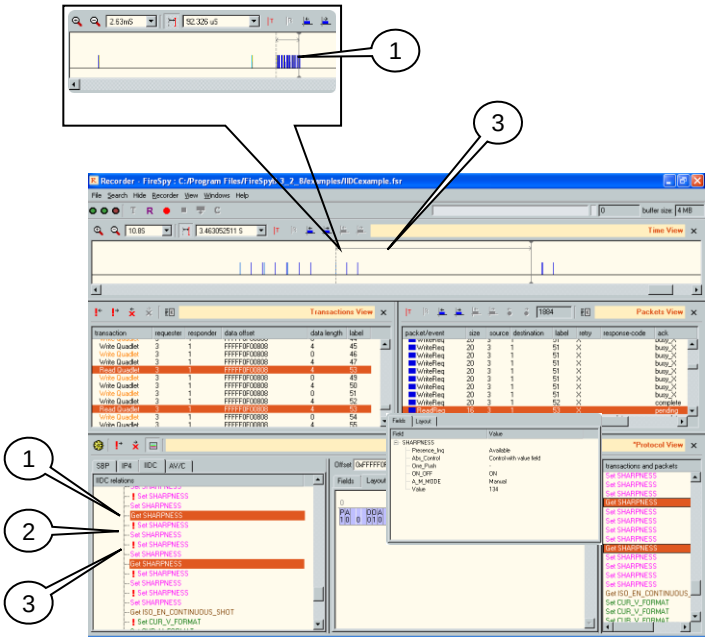
The following specification is supported by the FireSpys:

- IIDC 1394-based Digital Camera Specification, Version 1.30



Replay capability of recorded video stream

This IIDC protocol analysis screenshot shows a great example of how compression and re-organization of information can make protocol analysis a much easier task.



In this example a controller tries to change a sharpness setting on an IIDC compliant camera. This sequence is started with a status read, followed by two status changes, and finishes with a status read-back. Both status reads are highlighted for demonstration purposes.

Detailed analysis of this recoding shows that the first status change attempt is rejected for about 92µs resulting in 16 retries. In the Protocol View this is indicated with an exclamation mark (see callouts #1). Only after a wait period of ~200ms another retry is finally successful (#2). This sequence is repeated with the same timing issues and only after ~3.5 seconds the read-back is completed successfully (#3).

Additionally, detailed information about the data structure used for the status read response is decoded either in a 32 bit field display (identical to the format used in the IIDC specification) or in an interpreted field display.

Using the advanced features of the protocol display for identification of the related transmission, together with the timing analysis and base 1394 analysis functions, dramatically streamlines and time-optimizes this engineering task.

All IIDC features, as described in version 1.30 of the IIDC standard, are supported by the protocol analysis. For video data it is possible to view the actual video frame content in a separate window, including the possibility to play back the video data at the rate used when the recording was made (if possible).

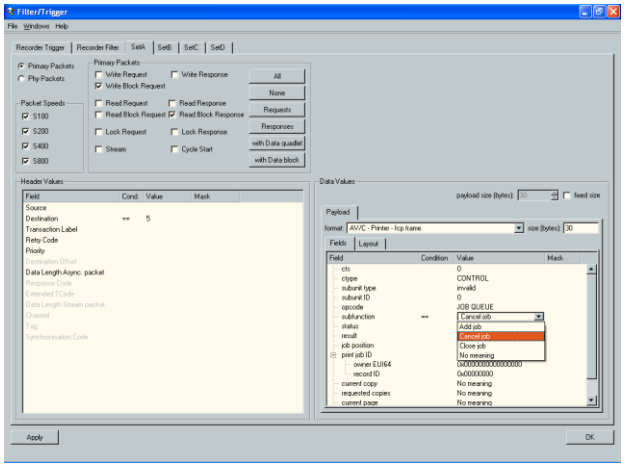
AVC Protocol Option

General Information:

The AV/C (Audio Video Command Set) specifications have been developed within the 1394 Trade Association. The General specification defines a framework for control and status commands targeted at audio/video devices using IEEE 1394. It is based on the Function Control Protocol (FCP) defined in IEC 61883-1. Beside the General Specification numerous specifications for AV/C sub-units have been developed.

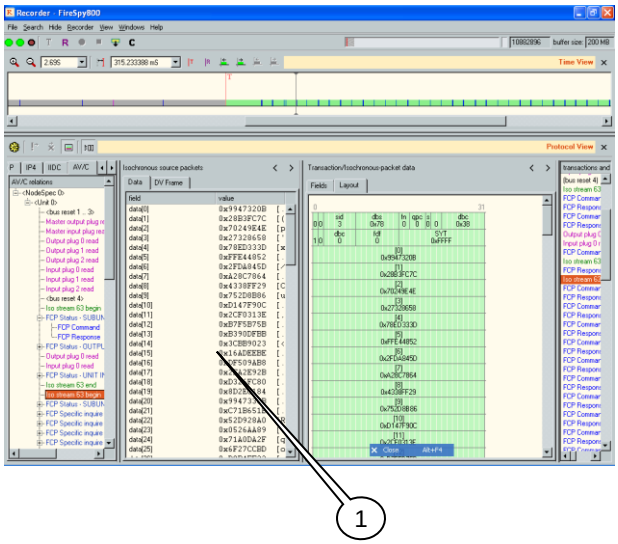
The following specifications are supported by the FireSpys:

- IEC 61883
- Digital Interface Command Set General Specification Version 4.0
- Connection and Compatibility Management Specification 1.0
- Monitor Subunit Model and Command Set Version 1.0
- Audio Subunit Specification 1.0
- AV/C Printer Subunit Specification 1.0
- Tape Recorder/Player Subunit Specification - version 2.1
- AV/C CA Subunit Specification - version 1.0
- Tuner Subunit Model and Command Set version 2.0, including:
- Tuner Broadcast System Specification - Analog Video version 1.0
- Tuner Broadcast System Specification - Analog Audio version 1.1
- Tuner Broadcast System Specification - Digital Video Broadcast (DVB) - version 1.0
- Tuner Broadcast System Specification - ATSC Digital Television System (DTV)
- Tuner Broadcast System Specification - Rec. ITU-R BO. 1294 System B



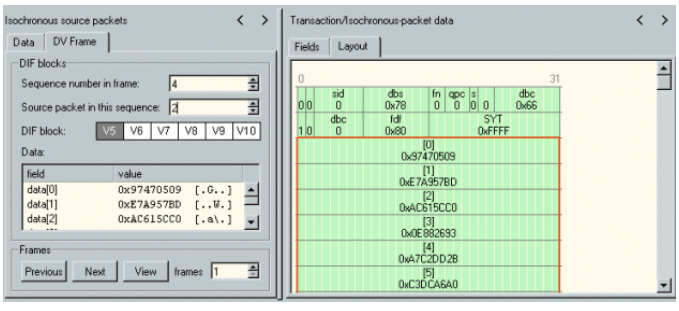
AV/C- level Filter and Trigger conditions setup

The AV/C protocol-analyzer software will scan through all transactions and packets to find AV/C-compliant Units and it will fill the 'relations' pane in the AV/C tab-page with AV/C-related items (including streams according to IEC 61883). An example of the resulting Protocol View is displayed below.



The *Isochronous Source Packet Pane* (callout #1) displays the isochronous source packet (as defined in IEC61883). One isochronous source packet can consist of data from a part of an isochronous packet, or from one or more complete isochronous packets. The graphic representation of the source packet (#2) as well as the DV video frame size (#3) greatly enhances the overall orientation.

The DV-Frame tab can be used to walk through the logical data inside an isochronous video-frame packet. Each source packet consists of a series of DIF blocks. With this tool it is possible to view the data inside a video frame. The screenshot below shows what the DV Frame tab can be used for:



SBP2 Protocol Option

General Information:

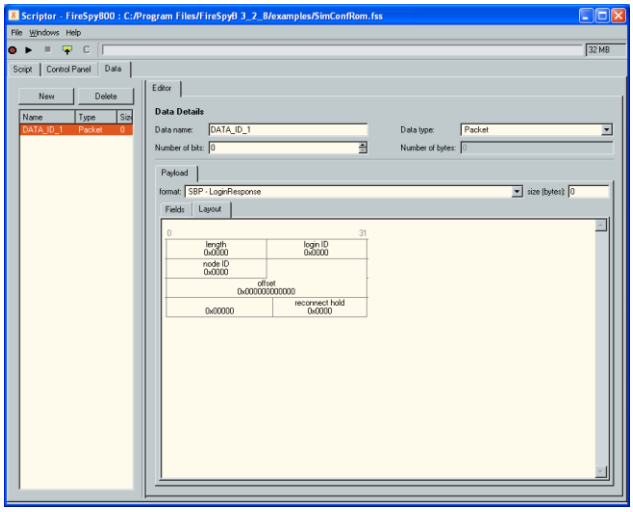
The SBP (serial bus) protocol is predominantly used for IEEE 1394 storage applications which utilize this protocol for the encapsulation of other command-based protocols and require the movement of large blocks of data. Examples of such encapsulated commands are the SCSI command sets.

The following specification is supported by the FireSpys:

- ANSI NCITS 325 1998

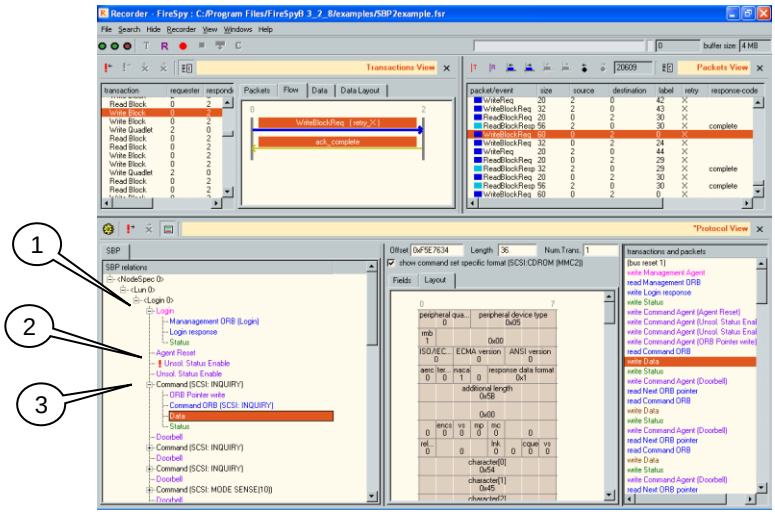
Additionally, the following SCSI command sets are supported:

- CDROM MMC2
- Direct-Access SBC
- Optical-Memory SBC
- Printer SSC
- Processor SPC
- Processor SPC2
- Sequential-Access SSC
- Simplified Direct-Access RBC
- SPC General
- SPC2 General
- Write-Once SBC



SBP2-level packet definition in Scriptor Data Editor

Using the SBP2 Protocol View, the user can view the different aspects of the Serial Bus Protocol 2, including management accesses, command agent accesses, ORB reads, data transfers (including data tables) and status writes (including unsolicited status). The FireSpy can analyze multiple SBP2 units and multiple logins simultaneously. All SBP2 transactions are displayed sequentially and the relation between them is displayed hierarchically.



The upper example shows an example of a typical SBP2 sequence following a Bus Reset. The Login sequence (callout #1) is grouped for simplification. Followed by the Agent Reset and Status Enables (#2) the SBP2 initiator commences with typical SCSI inquiries and the appropriate return data by the SBP2 target (#3).

Additional features of this protocol option include:

- Analyzing multiple SBP2 LUNs and multiple logins at the same time
- Viewing all SBP2 transactions sequentially
- Viewing all SBP2 transaction relations hierarchically
- Displaying:
  - Management accesses
  - Command agent accesses
  - Orb reads and next orb pointer re-read
  - Data transfers including data tables
  - Orb status and unsolicited status

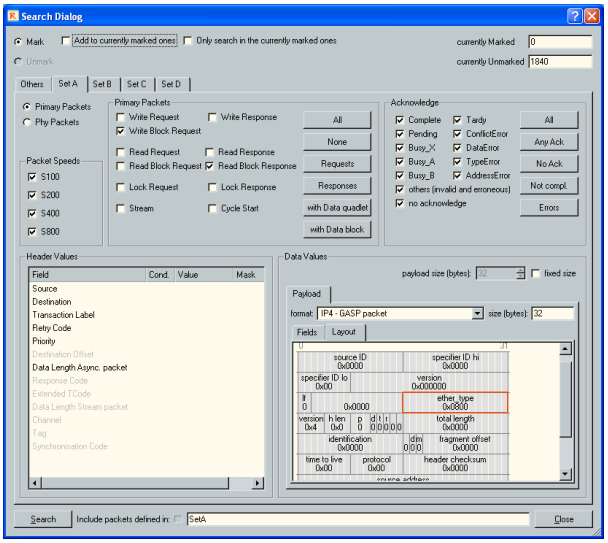
IP1394 Protocol Option

General Information:

The IP1394 specification was developed within the IETF (Internet Engineering Task Force) in order to define how to use IEEE 1394 for the transport of Internet Protocol Version 4 (IPv4) datagrams; it defines the necessary methods, data structures and codes for that purpose. These include not only packet formats and encapsulation methods for datagrams, but also an address resolution protocol (1394 ARP) and a multicast channel allocation protocol (MCAP). Both 1394 ARP and MCAP are specific to Serial Bus; the latter permits management of Serial Bus resources when used by IP multicast groups.

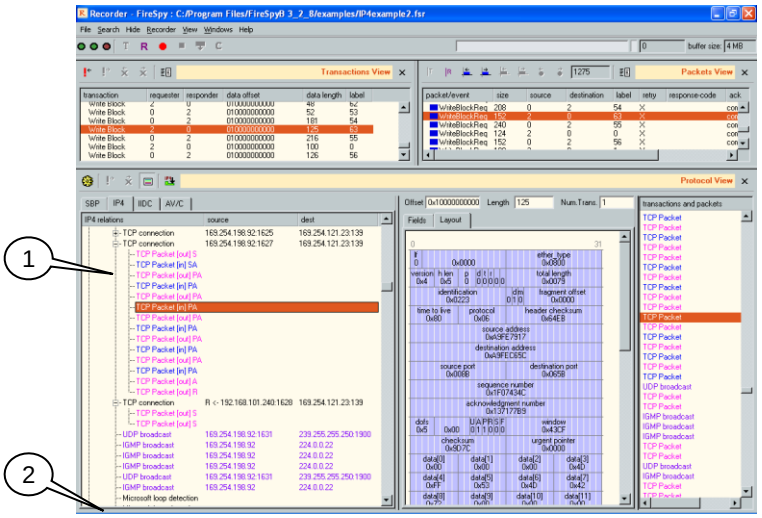
The following specifications are supported by the FireSpys:

- IETF RFC 2734, IPv4 over IEEE 1394
- IETF RFC 791, Internet Protocol (IP)
- IETF RFC 792, Internet Control Message Protocol (ICMP)
- IETF RFC 768, User Datagram Protocol (UDP)
- IETF RFC 793, Transmission Control Protocol (TCP)
- IETF RFC 1112, Host extensions for IP multicasting (IGMP)



IP-level Search criteria setup

Using the IP4 Protocol View, the user can view the different aspects of the Internet Protocol version 4 over IEEE1394. The analysis supports the following IP traffic: ARP, TCP, UDP, ICMP and IGMP. Where possible related packets are grouped, as can be seen in the image below. For TCP all packets for a single connection are grouped together. As an extra feature the software can export the entire IP part of a recording to a file, using the widely supported TCP-Dump format. This allows the use of other specialized software to do more detailed analysis of IP protocols that are encapsulated in, for example, TCP or UDP packets.



The upper example illustrates the effectiveness of grouping individual TCP transactions. The grouping characteristics are the IP numbers of the communicating nodes (callout #1). The example also shows UDP, IGMP and the non-standard Microsoft Loop Detection packet decoding (#2).

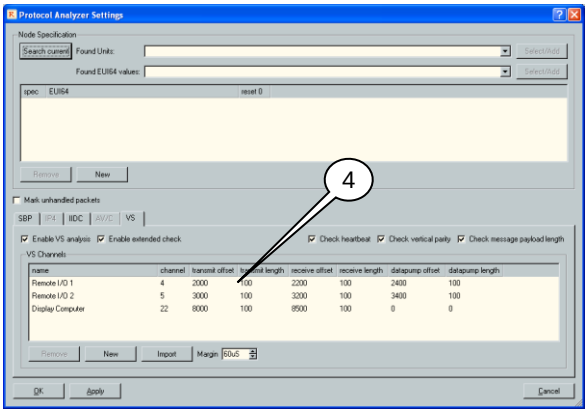
AS5643 Protocol Option

General Information:

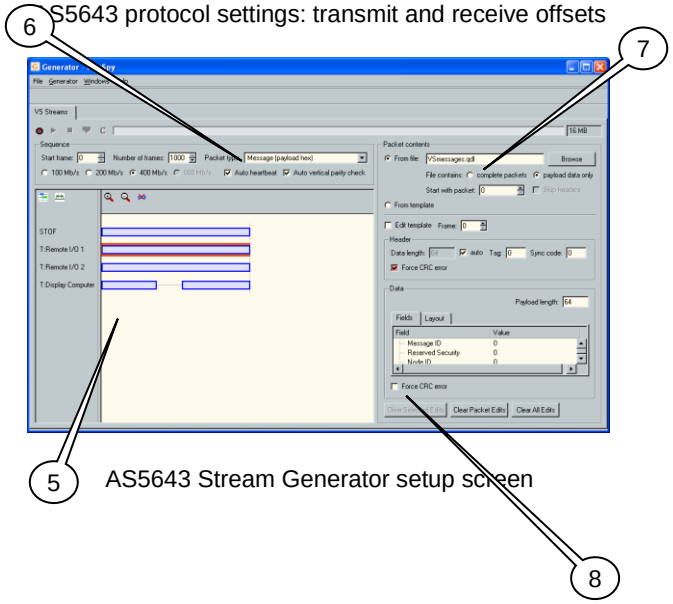
In order to standardize the usage of IEEE 1394b in safety-critical/ mission-critical applications for military and aerospace vehicles the SAE (Society of Automotive Engineers) started a standardization effort in 2002. The resulting specification deploys the ASM (Anonymous Subscriber Messaging) protocol, which is an upper level protocol tailored for the demands of highly modular embedded real time systems operating under a “data push” paradigm. ASM is designed to be independent of lower level protocols and, as such, does not utilize the 1394 header to transport ASM-particular information. ASM is tailored to support deterministic, secure, low-latency communication between processors, sensors, instrumentation, and displays in mission-critical applications.

The following specification is supported by the FireSpys:

- SAE AS5643, 2004

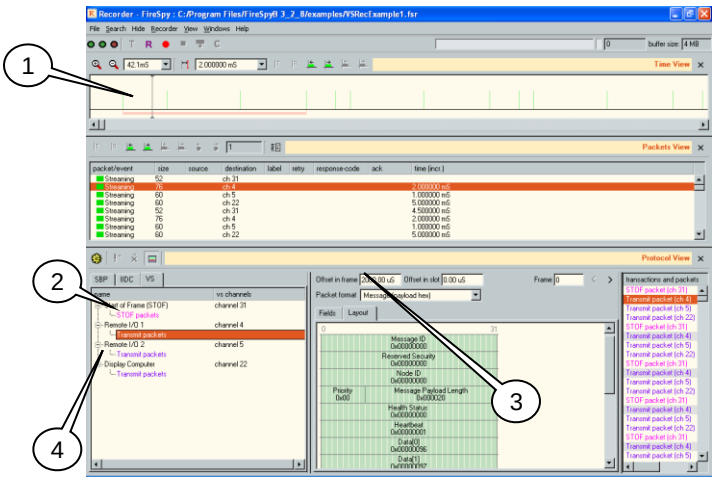


AS5643 protocol settings: transmit and receive offsets



AS5643 Stream Generator setup screen

In the Mil1394 protocol package, use of the SAE standard is supported in three different functional areas, i.e. the Recorder, the Generator and the Scriptor.



The upper example shows a typical Recorder representation with enabled AS5643 protocol view. Notice the 12.5 ms timeslot visualization in the Time View (callout #1), the grouping of asynchronous stream packets by channels numbers (#2), timeslot analysis referencing STOF timing (#3), remote node name assignment based on transmit/receive offset specification (#4), etc.

Extended packet verification includes:

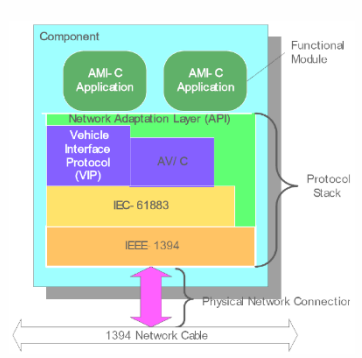
- Heartbeat check
- Vertical Parity Check
- Payload Length Check

As an additional function the AS563 package also includes a highly optimized AS5643 Stream Generator. Its capabilities include the generation of up to 31 “simultaneous” asynchronous streams (#5), automatic heartbeat and vertical parity check insertion option (#6), generation of data packets from file (#7), header and data CRC error insertion option (#8), etc. The AS5643 Stream Generator includes the following functions and capabilities:

- STOF packet generation including timing adjustments
- Time Slot definition for asynchronous streams
- Definitions for receive and transmit offsets
- Insertion of errors
- Automatic Vertical Parity Check calculation option
- Automatic Heartbeat calculation option

AMI-C Protocol Option

General Information:

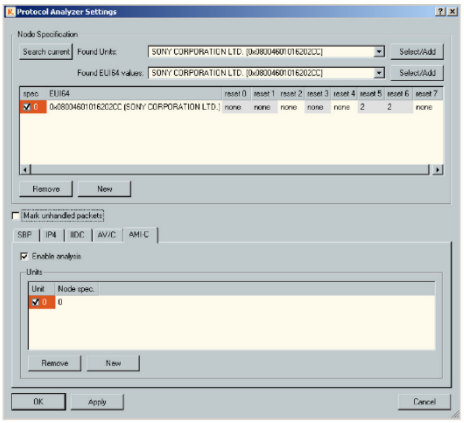


The AMI-C (Automotive Multimedia Interface Collaboration) network protocol defines the communication model for interoperable implementations involving heterogeneous AMI-C endorsed networks and vehicle service interfaces.

AMI-C was established to facilitate the development, promotion and standardization of automotive information and entertainment system interfaces to motor vehicle communication networks.

The following specification is supported by the FireSpys:

- ISO-22902-4, ISO-22902-5 en ASN.1 BER



For best performance the AMI-C-protocol analyzer needs some information from the Configuration ROM of a AMI-C device, to be able to analyze the AMI-C transactions and packets corresponding to this device. There are two ways the analyzer can get this information:

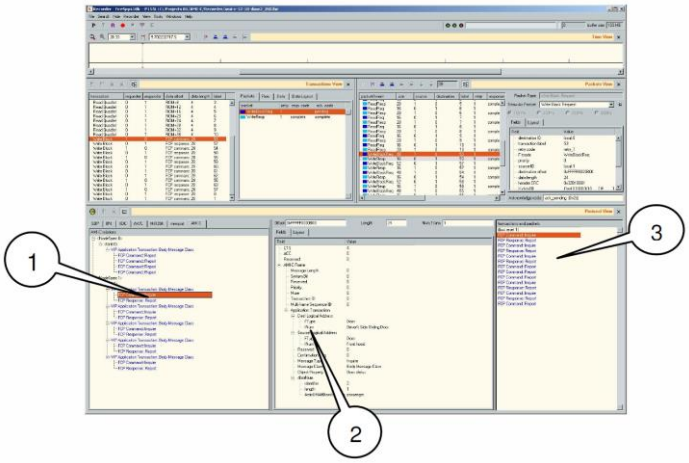
Automatically finding AMI-C information

To make sure the AMI-C analyzer finds the AMI-C information automatically, it is recommended that the reading of Configuration ROM for the node id of the unit is recorded. The Configuration-ROM information is normally read after a bus reset. One way to do this is to (re)connect the AMI-C device while the Recorder is recording data.

Manually inputting AMI-C information

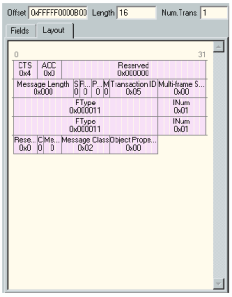
If no Configuration-ROM reads are recorded, it is recommend to input this information manually. This also applies it only part of this information can be found automatically. This information can be easily entered in the 'Protocol Settings' dialog.

Using the AMI-C Protocol View, the user can view the different aspects of the protocol decoder including VIP (Vehicle Interface Protocol) and FCP decoding, System and Application level messaging as well as extended field decoding.



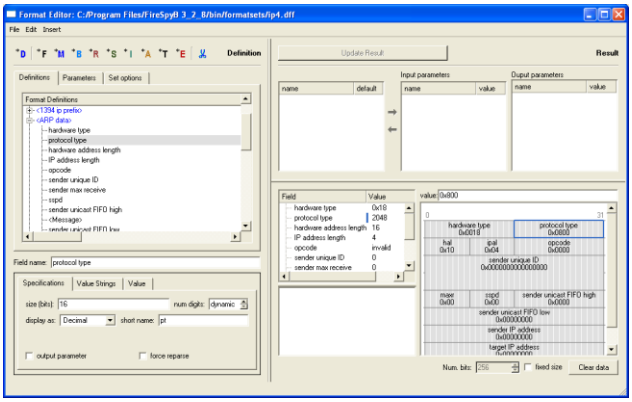
The upper example shows a typical Recorder representation with enabled AMI-C protocol view. Notice the hierarchical grouping of AMI-C messages in the Relations Pane (#1). It allows for easy isolation of any vehicle (AMI-C) traffic from other bus traffic as well as high-level translation into a protocol level messaging flow.

Drilling deeper into the individual messages is done in the protocol details pane (#2) which visualizes the encapsulated data payload in individual fields as defines by AMI-C. Optionally, this view can also be displayed in a graphic representation (packet fields) for more convenient analysis.



The right-most part of the Protocol View (#3) shows the sequence of all found protocol packets and transactions (including those for AMI-C). The order of items in this list corresponds to the order of recording.

Format Editor

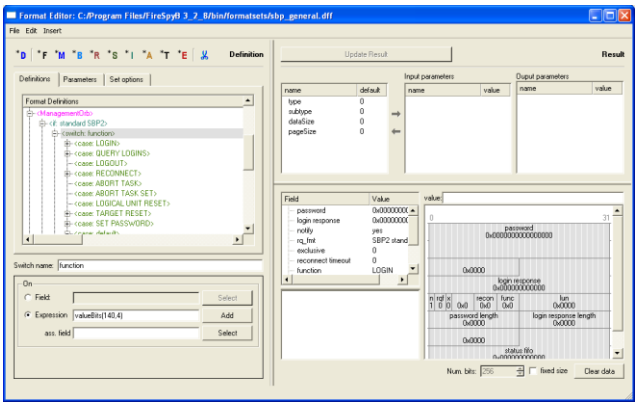


Format Editor with IP1394 ARP field definitions

Some of the protocols supported by the FireSpy are constantly evolving and growing. These changes could be needed due to technology progressions, revisions to new standards or proprietary extensions/ modifications to existing standards.

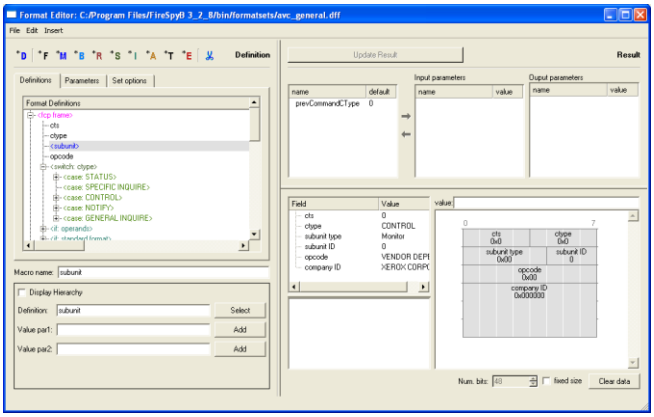
Striving to provide the most flexible solution for our customers DapTechnology provides the stand-alone application *Format Editor*. It allows experienced users to customize protocol definitions for all high-level protocols.

The *Format Editor* is an easy-to-work-with application; however, it gives the user all options to define, extend and modify pre-existing protocol definitions provided by DapTechnology. The following functionalities summaries the application's main function:



Switch Statement for different SBP2 management ORBs

- Definition of packet header/payload fields
  - Name
  - Length
  - Value
  - Value Type
- Assignment of constant field values
- Capability to calculate field values
- Repeat statements for dynamic adjustment of field lengths depending on other field values (e.g. dynamic payload field length)
- Conditional statement (if, else) for appending optional fields (e.g. dataCRC, if payload length is greater than 0)
- Switch Statements for changing entire packet structure depending on certain field values
- Macro Insertion for stacking of multilevel protocols
- Grouping of individual field through Block insertion
- Graphical representation of resulting packet definitions
- Value String assignment for referencing field values with textual descriptions



AV/C FCP frame with subunit macro insertion

SUMMARY

Protocol Package Features:

- Extension of protocol layer functionality in the following functions:
  - Recorder
    - Protocol View
      - Relations pane
      - Details pane
      - Transactions and Details pane
    - Manual unit property entry possibility
    - Predefined data pattern criteria for
      - Filter
      - Trigger
      - Search
  - AS5643 Stream Generator
    - STOF packet generation including timing adjustments
    - Frame Length adjustment
      - preset to 12.5 ms
      - adjustable from 10 – 20 ms with 1 μs resolution
    - Time Slot definition for asynchronous streams generation with 1 μs resolution
    - Definitions for receive and transmit offsets
    - Insertion of transmission errors
    - Automatic Vertical Parity Check calculation option
    - Automatic Heartbeat calculation option
  - Scriptor
    - Predefined data pattern criteria for generation of asynchronous packets
- Supported protocols
  - IIDC
  - AV/C
  - SBP2
  - IP1394
  - AMI-C
  - AS5643

Format Editor:

- Separate Application for modification and extension of encapsulated protocol sets:
  - AV/C
  - SBP2
  - AMI-C
  - AS5643

SPECIFICATION:

Package Content: License key

Product warranty: 24 month limited warranty

Part Numbers:

IIDC: FSP1
AVC: FSP2
SBP2: FSP3
IP1394: FSP4
AMI-C: FSP11
AS5643: FSP5

AS5643 Triple: FSP6
SBP2 Triple: FSP7
IIDC Triple: FSP8
AVC Triple: FSP9
AMI-C Triple: FSP12
IP1394 Triple: FSP10

Extended Software warranty packages can be obtained individually for each protocol package.

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