

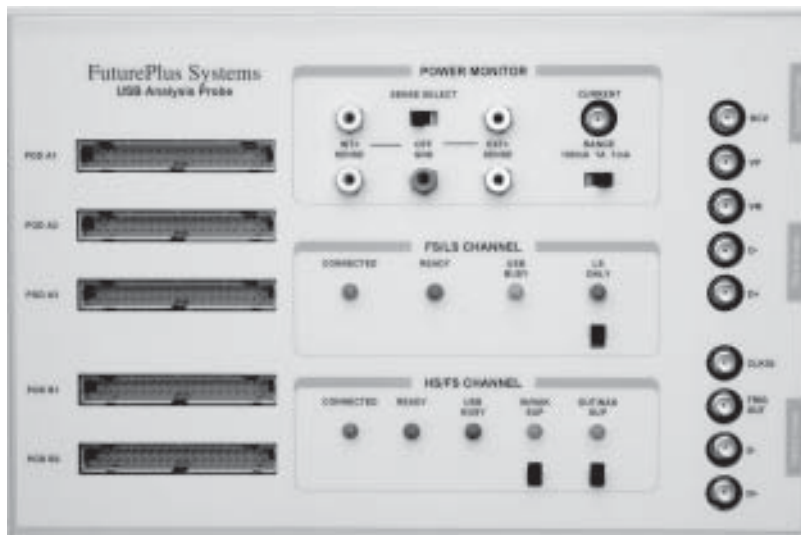
## Universal Serial Bus Analyzer

For use with Agilent Logic Analyzers

The FuturePlus® FS4120 is a USB 2.0 and 1.1 serial bus analyzer for peripheral devices, hubs, and controllers. It provides complete analysis of 480 Mb/s (high speed), 12 Mb/s (full speed) and 1.5 Mb/s (low speed) bus activity. Data is decoded and displayed at any level of detail from the protocol level to binary. The unique two-port design enables simultaneous testing of two hubs. The FS4120 is used with an Agilent Technologies logic analyzer. This combination provides powerful triggering, debug and compliance verification measurements.

### Features

- Complete serial-to-parallel decode providing a protocol level view of bus traffic
- Dual-bus operation with time-correlated displays for multiple hub analysis
- Supports all speeds of operation: 480 Mb/s, 12 Mb/s, and 1.5 Mb/s
- Automatic USB reset detection and dynamic hot swapping
- Address and end point specified in token packet held until transfer completes
- Easy triggering, store qualification and performance monitoring of specific address and end points
- Designed for use with Agilent 16700, 1680 and 1690 logic analyzers
- SMA connectors provide easy oscilloscope access to clock, current measurements, D+ and D- lines
- Provides current measurement capabilities, including inrush current
- Shows cycle identifiers and displays protocol transactions
- Event timing accurate to 4ns
- Supports all types of data transfers, including burst and isochronous transfers
- Easy triggering on multiple error conditions for all packet types: bad PID, serial bit stuffed error, CRC error, Start-of-frame tokens sent at slow speed, etc. An error summary is provided for these error conditions
- LED provide easy identification of key bus conditions



### FS4120 Universal Serial Bus Analyzer

The FS4120 USB analysis probe is compatible for USB 2.0 and 1.1 applications. It provides complete analysis of 480 Mb/s, 12 Mb/s and 1.5 Mb/s bus activity. The two-port design enables simultaneous testing of two hubs.

## FS4120 Description

The FS4120 USB analysis probe provides a quick, reliable electrical and mechanical interface between the USB bus and an Agilent logic analyzer. USB data is displayed on the logic analyzer in several levels of abstraction.

A variety of test jacks and connectors supply rapid access for signal integrity and current measurements using oscilloscopes and DVMS.

LED indicators provide immediate visual identification when USB traffic is occurring, IN-NAK polling is taking place, SOF PIDs are suppressed, and even when a LS device is illegally connected to an FS/HS port.

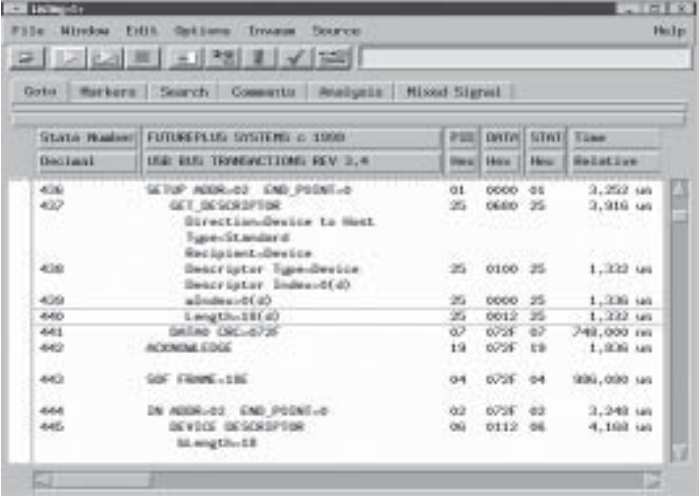
### State Analysis Mode

All software is included with the FS4120 and contains the USB Protocol transaction decode and complete configuration files for all supported Agilent logic analyzers.

The USB data is color-coded and organized in an easy-to-read protocol-level display. Three display modes are provided: compressed, expanded, and raw. Compressed Data Display shows a high-level protocol view. Expanded Data Display shows the high-level protocol and includes all of the detailed data states that are used to create the compressed protocol view. Raw Data Display presents an event-by-event listing of the data. In this mode, the data is displayed as HEX, ASCII, or binary. The FS4120 gives the user complete control over how the data is viewed.

The FS4120 supplies a variety of tools that simplify data capture, storage qualification, and triggering. For example, any USB resets are automatically detected. Triggering, store qualification, and performance monitoring of specific end-point addresses are made easy because the address and end point specified in the token packet are held until the transfer is complete.

For state analysis, the Agilent logic analyzer requires only two pods (34 channels). To analyze a second USB device, using the same FS4120, two additional logic analyzer pods are required.



The screenshot shows a software window titled "FuturePlus Systems v. 1000" with a menu bar (File, Window, Edit, Options, View, Source) and a toolbar. Below the menu bar are tabs for "Goto", "Markers", "Search", "Comments", "Analysis", and "Mixed Signal". The main display area contains a table with the following columns: "State Number", "Detail", "FID", "DATA", "STRT", and "Time". The table lists several USB transactions, including "SETUP ADDR=02 END\_POINT=0", "GET\_DESCRIPTOR", "Direction=Device to Host", "Type=Standard", "Recipient=Device", "Descriptor Type=Device", "Descriptor Index=0(0)", "wIndex=0(0)", "Length=0(0)", "SOF END=070F", "ACKNOWLEDGE", "SOF FRAME=18C", "IN ADDR=02 END\_POINT=0", and "DEVICE\_DESCRIPTOR Length=0B".

State Number	Detail	FID	DATA	STRT	Time
426	SETUP ADDR=02 END_POINT=0	01	0000 01		3,252 us
427	GET_DESCRIPTOR	25	0000 25		3,916 us
428	Direction=Device to Host Type=Standard Recipient=Device Descriptor Type=Device Descriptor Index=0(0)	25	0100 25		1,322 us
429	wIndex=0(0)	25	0000 25		1,326 us
430	Length=0(0)	25	0012 25		1,332 us
441	SOF END=070F	07	070F 07		748,000 us
442	ACKNOWLEDGE	19	070F 19		1,826 us
443	SOF FRAME=18C	04	070F 04		986,080 us
444	IN ADDR=02 END_POINT=0	02	070F 02		3,248 us
445	DEVICE_DESCRIPTOR Length=0B	06	0112 06		4,168 us

An easy-to-read, well organized protocol listing displays all the information you need to solve complex hardware and software problems on your Universal Serial Bus.

### Timing Analysis

Event timing analysis generates a 4-ns resolution time stamp, showing the user the relative time between bus events. This capability is available for all speeds, LS, FS, and HS.

When using only the FS/LS (USB 1.1) port of the FS4120, the logic analyzer can be used in asynchronous timing mode providing a 500-ps accurate timing waveform view of the USB data.

### Dual Channel Operation

The FS4120 has two independent USB channels. This gives the user the ability to simultaneously test two separate USB data paths, using only one FS4120 USB analysis probe. For example, a user could test both the upstream and downstream data from a hub.

### Power Requirements

Power for the FS4120 is supplied by the Agilent logic analyzer. The analysis probe does not require any power from the USB bus or an external power supply.

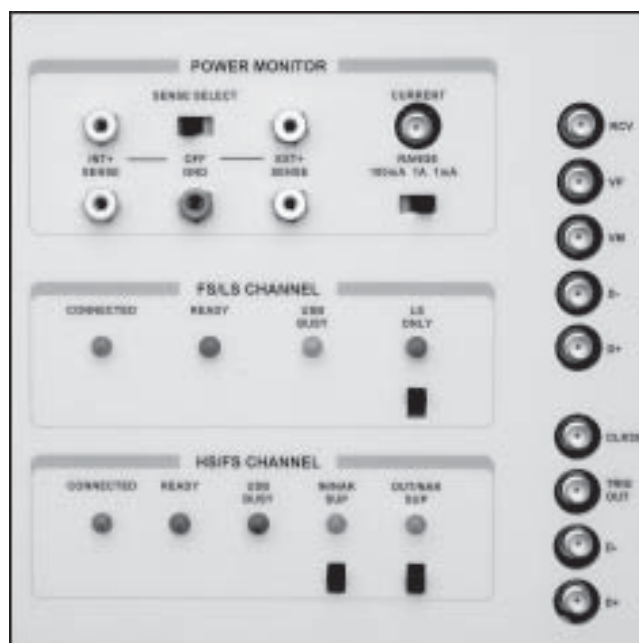
## Cross-Domain Analysis

Use a single Agilent 16700-series logic analyzer to simultaneously capture data from multiple buses. The user can create a custom measurement system with cross-domain triggering between different types of buses, and display the time-correlated data on a single screen, with common markers.

For example, use the FS4120 to monitor the USB bus — then use another analysis probe to monitor a different bus. FuturePlus Systems has analysis probes for the DDR, PCI-X, PCI, SCSI, Rambus, and a wide variety of other buses.

## Oscilloscope Connections

SMA connectors are included for quick access to signal integrity measurements, without the use of a separate breakout board. Quickly access D+, D-, Clock and other signals. To assist the hardware engineer in the debug process a Trigger Out (TRIG OUT) SMA connector is provided. This supplies eight user-selectable triggers that can be used to externally trigger an oscilloscope. The triggers indicate when an IN, OUT, SOF, TOKEN, SPLIT, DATA, RX\_ACT, or ERR PID has occurred.



The FS4120 USB Analysis probe provides rapid access for signal-integrity measurements on oscilloscopes and DVMs. LED indicators give immediate identification of USB traffic, IN-NAK polling, suppressed SOF PID, and illegal connections of LS devices to a FS/HS port.

## Front Panel Switches and Connectors

### Current Range Switch

The full-scale current range is switch selectable for 1 Amp/volt, 100 mA/volt, and 1 mA/volt.

### Internal (Int.) Sense Connectors

These jacks allow current sense measurements across the selected internal current sense resistor using an oscilloscope or DVM.

### External (Ext.) Sense Connectors

These jacks provide an accurate way to measure inrush current by using a wire loop and a high-speed current probe.

An external power supply can be connected to these jacks and used to power a USB device.

## Indicators

### Connected Indicator

The Connected LED indicates that the logic analyzer power is connected to the FS4120.

### Ready Indicator

The FS/LS and the HS/FS Ready LEDs show when the connected channel is ready for operation. The HS/FS Ready LED blinks when a LS device is plugged in to the HS/FS port.

### USB Busy Indicator

The USB Busy LED illuminates when the USB Analysis Probe is actively detecting packets being sent from a USB device.

### Low Speed Indicator

The USB Low Speed LED illuminates when the low speed switch is set and the FS/LS channel is operating in LS mode only.

### IN/NAK SUP Indicator

This three-color indicator glows green when the IN/NAK suppression is enabled. When an IN PID is immediately followed by a NAK PID, the indicator flashes red to indicate that these two PIDs were not sent to the logic analyzer. In an extended polling sequence where many of these combinations are suppressed, the LED color changes to orange.

### SOF SUP Indicator

This three-color indicator is green when SOF suppression is enabled. This LED flashes red when an SOF is transmitted. In an extended polling sequence where multiple SOFs are suppressed, the LED color changes to orange.

## Ordering Information

**FS4120.....**Universal Serial Bus 2.0 Analysis Probe for use with Agilent Logic Analyzers

### Software included with the FS4120:

Configuration files for the Agilent logic analyzer

Protocol Decoder software, runs on the Agilent logic analyzer

## Logic Analyzer Requirements

1. The FS4120 supports 16700, 1680, 16800 and 16900 40-pin logic analyzer modules.
2. For protocol decode, the FS4120 requires 2 logic analyzer pods for 1.1 OR 2.0 modes.
3. For timing observation of the serial bit stream in 1.1 mode only, an additional pod is required
4. The FS4120 does not require Termination Adapters.
5. A logic analyzer pod has 17 channels.
6. **USB 1.1 Protocol Decode and Timing Analysis** - This configuration is used by the FS/LS channel only on a single logic analyzer card. This configuration provides both protocol decode (2 pods required) and timing analysis (an additional pod is required) with one logic analyzer card.
7. **USB 1.1 and 2.0 Protocol Decode** - This configuration is used by the HS/FS channel and the FS/LS channel. This configuration provides protocol decode (2 pods required) for both channels. In other words, you can simultaneously analyze protocol traffic on a HS/FS connection and a FS/LS connection with one logic analyzer card.
8. **USB 1.1 Protocol Decode and Timing Analysis and USB 2.0 Protocol Decode** - This configuration is used by the HS/FS channel and the FS/LS channel. This configuration provides protocol decode (2 cards and 5 pods required) for the HS/FS channel and timing analysis (1 pod required) for the FS/LS channel. In other words, you can simultaneously analyze protocol traffic on a HS/FS connection and do timing analysis on a FS/LS connection with two logic analyzer cards.

Please note: for the most up-to-date information about Agilent logic analyzer compatibility, please check the FuturePlus Systems website at:  
[http://www.futureplus.com/products/fs4120/fs4120\\_sysreq9.shtml](http://www.futureplus.com/products/fs4120/fs4120_sysreq9.shtml)



**We offer excellent technical support and quick delivery.**

More information and application notes are on the FuturePlus Systems website at:  
<http://www.futureplus.com/products/fs4120>

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