

# PGY-UFS 4.0-PA MPHY, UniPro, UFS Protocol Analyzer



PGY-UFS 4.0-PA, UFS Protocol Analyzer is the industry first working and tested UFS 4.0 Protocol Analyzer. It offers protocol data capture and debug of data across MPHY, UniPro and UFS protocol layers. It allows for instantaneous decoding of UFS, UniPro and MPHY layers with flexibility to correlate decoded data across these protocol layers. PGY-UFS 4.0-PA supports PWMG1 to HSG5B data rates and two TX, two RX lane decode. The active probe has minimum electrical loading on device under test (DUT) and captures protocol data without affecting the performance of DUT. PGY-UFS 4.0-PA Protocol Analyzer support two lane data. Comprehensive on the fly decoding of UniPro & UFS data enables validation of communication between UFS host and device.

PGY-UFS 4.0-PA Protocol Analyzer allows Design and Test Engineers to obtain deep insight into UFS host and device communication. MPHY/UniPRO/UFS packet-based triggering allows specific protocol data capture and analysis. PGY-UFS Protocol analyzer instantaneously provides decoding of UFS, UniPro and MPHY layers with a correlation to MPHY, UniPro and UFS layers.

Solder down active probes allows probing the MPHY test points. This allows the design and test engineers to capture UFS traffic between the host and UFS memory with high signal fidelity. Today's test engineers need to test the use case scenarios in their labs that mimic real-life use cases. The PGY-UFS 4.0-PA, UFS Protocol Analyzer has been designed to enable engineers to closely monitor and analyze the traffic between the host and the device while executing the various use case scenarios.

PGY-MPHY-UniPRO-UFS Protocol Analysis Software

File Setup View Trigger Analytics Report Help

Connect Acquire Stop Acq Stop Transfer Stop Reset UPRO\_Mkr Δt1 MO M1 - 170.2375ms Δt2 MO M1 - 170.2375ms UFS\_Mkr Δt1 P0 P1 - 348.5025ms Δt2 P0 P1 -

UFSView	DeviceConfigView	Analytics View	PacpView	Report View	TriggerView	Color Settings	SymbolsView_HOST	SearchView		
Index	Timestamp	Host	Device	Gear	Task Tag	Total EHS Length	Segment Length	Data Offset	LUN	Status
8	531.9985ms		RESPONSE	HS_G5B	03	00	0000		01	Good
9	648.9097ms	WRITE_10		HS_G5B	04	00	0000		01	
10	673.8643ms		READY_TO_TRANSFER	HS_G5B	04	00	0000		01	
11	702.2748ms	DATA_OUT		HS_G5B	04	00	1000	00000000	01	
12	702.2782ms		RESPONSE	HS_G5B	04	00	0000		01	Good
13	777.6731ms	READ_10		HS_G5B	05	00	0000		01	
14	827.1691ms		DATA_IN	HS_G5B	05	00	1000	00000000	01	
15	827.1709ms		RESPONSE	HS_G5B	05	00	0000		01	Good
16	944.0402ms	WRITE_10		HS_G5B	06	00	0000		01	
17	968.9098ms		READY_TO_TRANSFER	HS_G5B	06	00	0000	15	01	
18	997.4088ms	DATA_OUT		HS_G5B	06	00	1000	00000000	01	
19	997.4122ms		RESPONSE	HS_G5B	06	00	0000		01	Good
20	1.072827s	READ_10		HS_G5B	07	00	0000		01	

Index	KVD Code	8 Bit	Lane	Gear
..862	D3.1	0x23	Tx	HS_G5B
..863	D3.1	0x23	Tx	HS_G5B
..864	D3.1	0x23	Tx	HS_G5B
..865	D3.1	0x23	Tx	HS_G5B
..866	D3.1	0x23	Tx	HS_G5B
..867	D3.1	0x23	Tx	HS_G5B
..868	D3.1	0x23	Tx	HS_G5B
..869	D3.1	0x23	Tx	HS_G5B
..870	D3.1	0x23	Tx	HS_G5B
..871	D3.1	0x23	Tx	HS_G5B
..872	D3.1	0x23	Tx	HS_G5B
..873	D3.1	0x23	Tx	HS_G5B
..874	K28.5	0x8C	Tx	HS_G5B
..875	D7.1	0x27	Tx	HS_G5B
..876	D5.1	0x25	Tx	HS_G5B
..877	D30.4	0x9E	Tx	HS_G5B
..878	K28.5	0x8C	Tx	HS_G5B

UniProView	DeviceConfigView	Analytics View	PacpView	Report View	TriggerView	Color Settings	SymbolsView_DEVICE	SearchView		
Index	Timestamp	Host	Device	Gear	DestDeviceID	DestPortID	EOM	Frame Seq	Credit Value	CRC
1381	997.4094ms	DL_DATA		HS_G5B	01	00	00	00		
1382	997.4094ms		DL_AFC	HS_G5B				07	0B	
1383	997.4096ms		DL_AFC	HS_G5B				08	A4	
1384	997.4099ms	DL_DATA		HS_G5B	01	00	00	0A		
1385	997.4099ms		DL_AFC	HS_G5B				09	AC	
1386	997.4099ms	DL_DATA		HS_G5B	01	00	00	0B		
1387	997.41ms		DL_AFC	HS_G5B				0A	B5	
1388	997.4101ms	DL_DATA		HS_G5B	01	00	00	0C		
1389	997.4102ms		DL_AFC	HS_G5B				0B	B0	
1390	997.4103ms	DL_DATA		HS_G5B	01	00	00	0D		
1391	997.4105ms		DL_AFC	HS_G5B				0C	C6	
1392	997.4106ms	DL_DATA		HS_G5B	01	00	00	0E		
1393	997.4107ms		DL_AFC	HS_G5B				0D	CE	

Index	KVD Code	8 Bit	Lane	Gear
3028	D0.0	0x00	Rx	HS_G5B
3029	D0.0	0x00	Rx	HS_G5B
3030	D0.0	0x00	Rx	HS_G5B
3031	D0.0	0x00	Rx	HS_G5B
3032	D0.0	0x00	Rx	HS_G5B
3033	D0.0	0x00	Rx	HS_G5B
3034	K28.5	0x8C	Rx	HS_G5B
3035	D7.1	0x27	Rx	HS_G5B
3036	D5.3	0x65	Rx	HS_G5B
3037	D26.3	0x7A	Rx	HS_G5B
3038	K28.5	0x8C	Rx	HS_G5B
3039	D3.6	0xC3	Rx	HS_G5B
3040	D23.1	0x37	Rx	HS_G5B
3041	D18.4	0x92	Rx	HS_G5B
3042	D5.5	0xA5	Rx	HS_G5B
3043	D1.7	0xE1	Rx	HS_G5B
3044	K28.5	0x8C	Rx	HS_G5B

1.3.7.0 ● Received: 0 | Current Mem: 0.000GB Max Mem: 0.000GB HSG5B\_2

Analysis Completed..

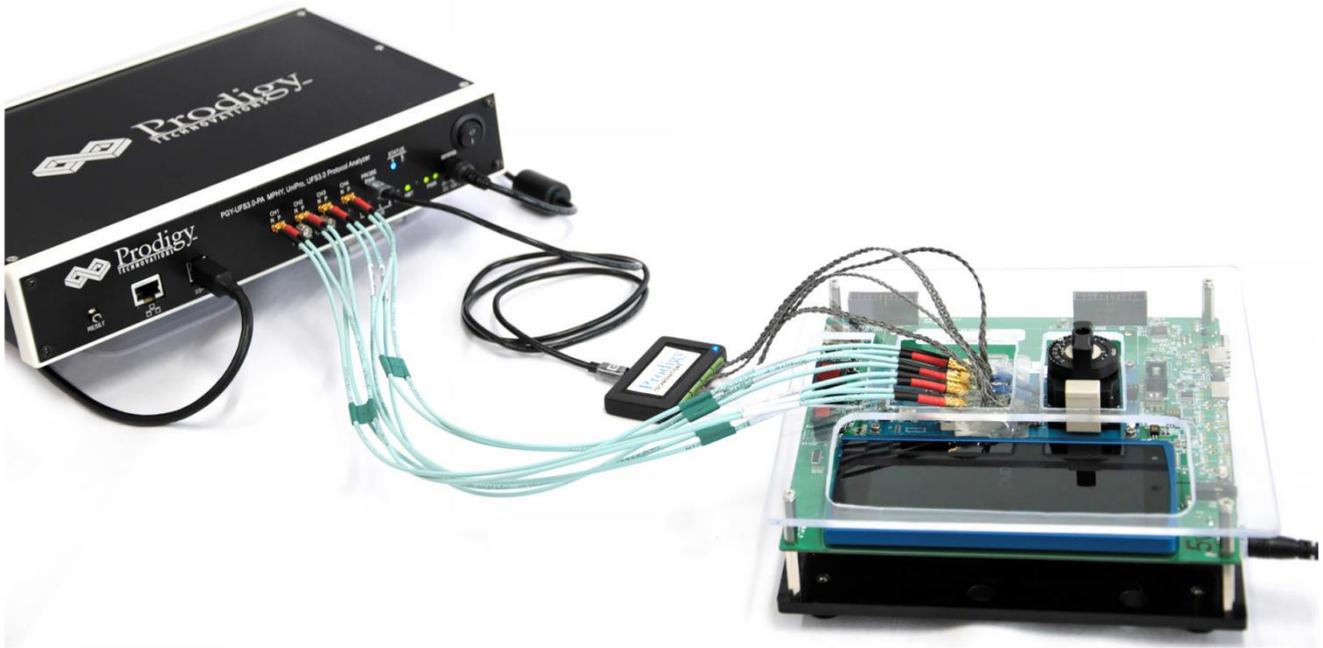
Windows based protocol analysis software provides industry best protocol correlation between UFS to UniPro and MPHY layers. Time correlation between the different protocol layers significantly reduces debug time of designs. Floating window design of this software allows engineers to view UFS view, UniPro view and MPHY view on different computer monitors and automatically correlate the UFS packets to MPHY layer. This makes analysis very easy while analyzing the gigabytes of Protocol information.

### Key Features

- ❖ Supports version MPHY 4.0, UniPro 1.8 and UFS v2.1/3.1/4.0
- ❖ Supports PWM G1 to G7 and HS G1,2,3, 4, 5 Rate A and B Series
- ❖ Supports one/two data lanes (2 TX and 2 RX)
- ❖ Flexibility to capture very large data using continuous streaming of Protocol data to host computer
- ❖ with 16GB Internal acquisition memory field upgradable up to 64GB
- ❖ Hardware based resizable circular buffer with pre/post trigger
- ❖ Flexibility to decode selected data from 16GB buffer
- ❖ Solder down active probe provide high signal fidelity
- ❖ Decoding at MPHY, UniPro and UFS layers
- ❖ Trigger based on MPHY, UniPro and UFS layers packet content
- ❖ Trigger out signal at trigger event allows the triggering of other instruments such as oscilloscope
- ❖ Interface to host system using USB 3.0
- ❖ Flexibility to upgrade the hardware firmware using GbE interface provides easy field up gradation of FPGA firmware
- ❖ Decoded data packets can be exported to txt file for further analysis
- ❖ Light weight and can be deployed for on-site/ field tests



## Test Setup



PGY-UFS 4.0-PA UFS Protocol Analyzer interfaces to solder down probe tips using mSMP flexi coax cables. The active probe tips are powered by power module which is powered by PGY-UFS4.0-PA. Protocol Analyzer is interfaced to host computer using USB3.0 interface. High-speed host connectivity and 16GB buffer enables continuous streaming of protocol data to host SSD and storage for longer period of time. Software offers multi-view such as MPHY view, UniPro view and UFS View. Each view lists the respective protocol packets and its details with correlation of each layer for easy debug. Lightweight Analyzer is easy to carry during field visit.

### Advanced Settings

Burst Speed Detection		Sync Wait Time		Host				Device			
<input type="radio"/> Sync Speed <input checked="" type="radio"/> PACP PWR Gear		Host	10	CTLE	MANUAL	Freq Boost	5	CTLE	MANUAL	Freq Boost	0
		Device	32	DFE Gain	MANUAL	Wide Band Gain	7	DFE Gain	MANUAL	Wide Band Gain	0
				DFEGain CFG	31	DFEGain CFG	31	DFEGain CFG	31	DFEGain CFG	31

### Acquisition/Error Analysis

Analyze	Hardware Filters	Buffer Type	CRC Error Count
<input type="radio"/> Live Decode <input checked="" type="radio"/> Post Capture	<input checked="" type="checkbox"/> AFC <input type="checkbox"/> DLData Payload Drop	<input checked="" type="radio"/> Continuous/8GB <input type="radio"/> Circular (H/W)	<input type="checkbox"/> DLData <input type="checkbox"/> AFC
		Buffer Size: 100 MB PreTrigger: 0 MB	
			

# UFS Protocol Layer

Index	Timestamp	Host	Device	Gear	Task Tag	Total EHS Length	Segment Length	Data Offset	Expected Data	Logical Block Addr	Device In	Transfer Length	Response
..7809	17.45788104s	READ_10		HS_G4B	03	00	0000		00001000	005E2886		0001	
..7810	17.457897816s		DATA_IN	HS_G4B	00	00	1000	00000000					
..7811	17.457899632s		RESPONSE	HS_G4B	00	00	0000				00		Success (00)
..7812	17.457913712s		DATA_IN	HS_G4B	02	00	1000	00000000					
..7813	17.457915536s		RESPONSE	HS_G4B	02	00	0000				00		Success (00)
..7814	17.457919936s	READ_10		HS_G4B	01	00	0000		00001000	005E5B72		0001	
..7815	17.457937432s		DATA_IN	HS_G4B	03	00	1000	00000000					
..7816	17.457938208s	READ_10		HS_G4B	00	00	0000		00001000	005D0F2E		0001	
..7817	17.457939264s		RESPONSE	HS_G4B	03	00	0000				00		Success (00)
..7818	17.457974088s	READ_10		HS_G4B	02	00	0000		00001000	005E707A		0001	
..7819	17.457979048s		DATA_IN	HS_G4B	01	00	1000	00000000					
..7820	17.457980872s		RESPONSE	HS_G4B	01	00	0000				00		Success (00)
..7821	17.457981648s	READ_10		HS_G4B	03	00	0000		00001000	005E2517		0001	
..7822	17.457994964s		DATA_IN	HS_G4B	00	00	1000	00000000					
..7823	17.457996888s		RESPONSE	HS_G4B	00	00	0000				00		Success (00)
..7824	17.458019368s	READ_10		HS_G4B	01	00	0000		00001000	005E5B7C		0001	
..7825	17.458031576s		DATA_IN	HS_G4B	02	00	1000	00000000					
..7826	17.458031672s	READ_10		HS_G4B	00	00	0000		00001000	005DAD56		0001	
..7827	17.4580334s		RESPONSE	HS_G4B	02	00	0000				00		Success (00)
..7828	17.458037632s		DATA_IN	HS_G4B	03	00	1000	00000000					
..7829	17.458039448s		RESPONSE	HS_G4B	03	00	0000				00		Success (00)
..7830	17.458073704s	READ_10		HS_G4B	02	00	0000		00001000	005E8D79		0001	
..7831	17.458076264s		DATA_IN	HS_G4B	01	00	1000	00000000					
..7832	17.458078088s		RESPONSE	HS_G4B	01	00	0000				00		Success (00)
..7833	17.458083496s	READ_10		HS_G4B	03	00	0000		00001000	005E0192		0001	
..7834	17.458087656s		DATA_IN	HS_G4B	00	00	1000	00000000					
..7835	17.45808948s		RESPONSE	HS_G4B	00	00	0000				00		Success (00)
..7836	17.458116096s	READ_10		HS_G4B	01	00	0000		00001000	005E52A4		0001	
..7837	17.458127792s	READ_10		HS_G4B	00	00	0000		00001000	005D8026		0001	
..7838	17.45813994s		DATA_IN	HS_G4B	02	00	1000	00000000					
..7839	17.458132224s		RESPONSE	HS_G4B	02	00	0000				00		Success (00)
..7840	17.458140168s		DATA_IN	HS_G4B	03	00	1000	00000000					
..7841	17.458141992s		RESPONSE	HS_G4B	03	00	0000				00		Success (00)
..7842	17.458170272s	READ_10		HS_G4B	02	00	0000		00001000	005E7F40		0001	

PGY-UFS 4.0-PA Software can display each UFS packet parameters in a listing window. Right click lists all the packet parameter for user selection. User can color code the fonts or background color for easy identification for each UFS packet.

## PACP And UniPro View

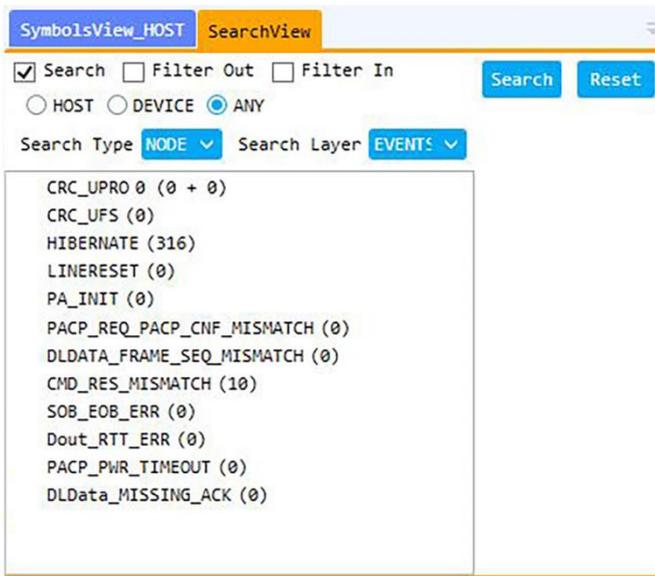
The screenshot displays the PGY-MPHY-UniPRO-UFS Protocol Analysis Software interface. It features a menu bar (File, Setup, View, Trigger, Analytics, Report, Help) and a toolbar with various acquisition and analysis controls. The main window is divided into several panes:

- Connection View:** Shows connection parameters like UFS\_Mkr Time, Δt1, M0, M1, Δt2, P0, P1.
- PACPView:** A table listing PACP packets with columns for Index, Timestamp, Direction, Description, Gear, Tx Gea, Tx Lane, Tx Mode, Rx Gear, Rx Lane, Rx Mode, Flags, CRC, MIBattribut, MIBValue, and LineReset. Packets include PACP\_GET\_req, PACP\_GET\_cnf, PACP\_PWR\_req, PACP\_PWR\_cnf, and PACP\_PWR\_req.
- UniProView:** A table listing UniPro packets with columns for Index, Timestamp, Host, Device, Gear, Flags, EOM, Frame Seq, Credit Value, and CRC. Packets include DL\_AFC, PACP\_PWR\_req, EOB, and DL\_AFC.
- SymbolView\_HOST and SymbolView\_DEVICE:** Hex dump views showing raw data for host and device respectively, with columns for Index, KVD Code, 8 Bit, Lane, and Gear.

At the bottom, the software version (1.2.8.0) and memory usage (Current Mem: 0.000GB, Max Mem: 2.839GB) are displayed, along with the status "Analysis Completed..".

PGY-UFS 4.0-PA Software separates the PACP packets in a separate view for easy analysis of power mode change packets and link to UniPro packets. Users can view the MPHY states stall, prepare, sync information in UniPro view apart from user selection for DL\_Data and AFC/NACK Packet details.

## Error Events, Search and Filter



PGY-UFS 4.0-PA Software does the live decode and list all the events. The list of events are shown in this picture. Users can easily note the errors in captured protocol data. In large buffer capture, it takes extremely difficult to locate the errors. But PGY-UFS4.0-PA software simplifies this by listing events while decoding the captured data. Search and Filter allows you directly locate the error events or UFS or UniPro or PACP packet in the protocol listing windows. Filter-in and Filter-out makes it easy view the data of interest in the protocol listing window.

## Comprehensive Protocol Analysis Using Multi-View



PGY-UFS 4.0-PA UFS Protocol Analyzer provides USB 3.0 interface for host computer connectivity. High-speed host connectivity enables continuous streaming of protocol data to host HDD and storage for long period of time. Software offers multi-view such as MPHY view, UniPro view and UFS View. Each view lists the respective protocol packets and its details with correlation of each layer for easy debug.

PGY Protocol Analyzer's easy to use interface, reduces the protocol analysis time. Time stamped view of protocol decode listing provides easy view of protocol activities between host and the device. At a click of a button, user can view the decode of each packet and the intended function. Floating window software architecture allows the user to view each protocol layer on separate monitors for easy debug. Autocorrelation of each selected packet from UFS to MPHY layers simplifies the debug activity

## Specifications

Data Rates Supported	PWM G1 to G7, High Speed Gear 1, Gear 2, Gear 3, Gear 4, Gear 5 and Rate A and B
Link width	Configurable for 1TX/1RX or 2TX/2RX
Probes	Solder Down Active Probes
Protocol Decode	MPHY, UniPro and UFS layers
Trace Capture Size	Supports Continuous streaming of Protocol data to Host computer SSD/HDD. Internal acquisition memory 16GB expandable up to 64GB
Trigger	Based MPHY, UniPro, UFS Packets
Front Panel Connectors	Interface for Active probes. Trigger in/out SMA connectors
Interface for Host Computer	USB 3.0 and Gigabit Ethernet interface
Host Computer Requirements	Windows 7/8.0/8.1/10 64bit operating System with i7/i9 intel processor. System RAM of minimum 16GB, the product would give a faster response for a 32GB. The minimum storage capacity of 100GB should be available in the hard disk drive. User can use more storage based on trace storage requirement. Display resolution of the monitor is 1024X768. Host computer should support USB3.0 interface.
Dimension	(W x H x D) (20.5X5X25) cms
Weight	Approx. 2.5Kg
Power Requirement	12V, 3A DC Power Supply (AC/DC Supplied along with Analyzer)

## Trigger Specifications

Stack	Protocol Analyzer	Packet Type
	Link Start-up Sequence	(TRG_UPRO0)
		(TRG_UPRO1)
		(TRG_UPRO2)
UniPRO	PHY Capability Adapter Packets (PACP)	PACP_PWR_reg
		PACP_PWR_cnf
		PAC_Cap_ind
		PACP_Cap_EXT1_ind
		PACO_EPR_ind
		PACP_TestMode_req
		PACP_GET_req
		PACP_GET_cnf
		PACP_SER_req
		PACP_SET_cnf
		PACP_TEST_Data_0
		PACP_TEST_Data_1
		PACP_TEST_Data_2
PACP_TEST_Data_3		
	Data Link Packets	SOF
		EOF
		EOF_ODD
		EOF_EVEN
		COF
		AFC/NAC
		Traffic class 0/Traffic class 1
UFS	UFS Layers Packets	NOP IN
		NOP OUT
		Commands
		Response
		Task Management Request
		Task Management Response
		Ready To Transfer
		Ready to Transfer

## Solder Down Probe Tips for UFS3.0 and 3.1



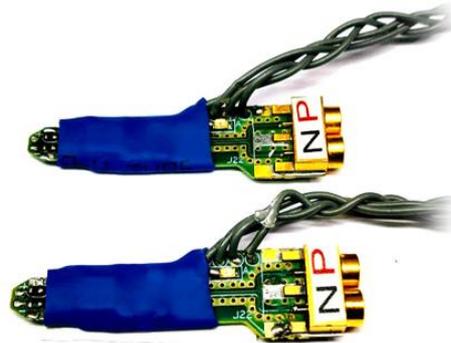
P5021-L-WE 14 Gbps probe tips  
with passive equalizer at input

P5021-L 14 Gbps probe tip  
with isolation resistor

P5021 14 Gbps probe tips for  
direct access to test points

Probing UFS signal is one of the key challenges in reliable UFS protocol decode. In most of the DUT, test points are located close to each other without enough space to solder the probe tips. Prodigy Technovations offers three type of 14 Gbps Probe tips which provides flexibility to choose the probe tips to meet the need. P5021-L and P5021-L-WE Probe tips has isolation resistor which can be changed based signal strength at test points. This helps in reducing reflections while accessing the test point and maintaining the signal integrity. The passive equalizer in P5021-L-WE helps in maintaining the differential impedance between the lanes. If test points are easily accessible, then P5021 probe tip can be used to probe the test points.

## Solder Down Probe Tips for UFS 4.0



Prodigy Technovations provides innovative solder down active probe tips, which can equalize the MPHY signals upto MPHY HSG5B speed and amplify the signal to support cable loss in mSMP cable and PCB trace in analyzer. These probe tips are tested with real world UFS4.0 host/device test and development platform.

If you need probe card/tips with mSMP connector to mate with device under test mSMP connector, please contact Prodigy Technovations at [contact@prodigytechno.com](mailto:contact@prodigytechno.com)

## Ordering Information

PGY-UFS 4.0-PA UFS 4.0 Protocol Analyzer

(Shipment includes Hardware, software CD, One set probe, USB 3.0, Ethernet Cable and Power adapter)

Note: Supports UFS2.0/2.1/3.0/3.1

## Warranty Information

Hardware and software carries a warranty of 1 year.

Probes are covered for a 3 month warranty for any manufacturing defects

## Contact Information



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## About Prodigy Technovations Pvt Ltd.

Prodigy Technovations Pvt Ltd ([www.prodigytechno.com](http://www.prodigytechno.com)) is a leading global technology provider of Protocol Decode, and Physical layer testing solutions on test and measurement equipment. The company's ongoing efforts include successful implementation of innovative and comprehensive protocol decode and physical Layer testing solutions that span the serial data, telecommunications, automotive, and defense electronics sectors worldwide.