

PGY-I3C-EX-PD and PGY-I3C-EX-PD Lite I3C Protocol Exerciser and Analyzer



I3C and I3C LITE Protocol Exerciser and Analyzer

I3C Serial bus interface is emerging as a chosen interface for all future sensor connectivity in mobile phone and automotive Industry. This could also be chosen for low cost, reliable interface for future embedded electronic applications to address the new data intensive applications.

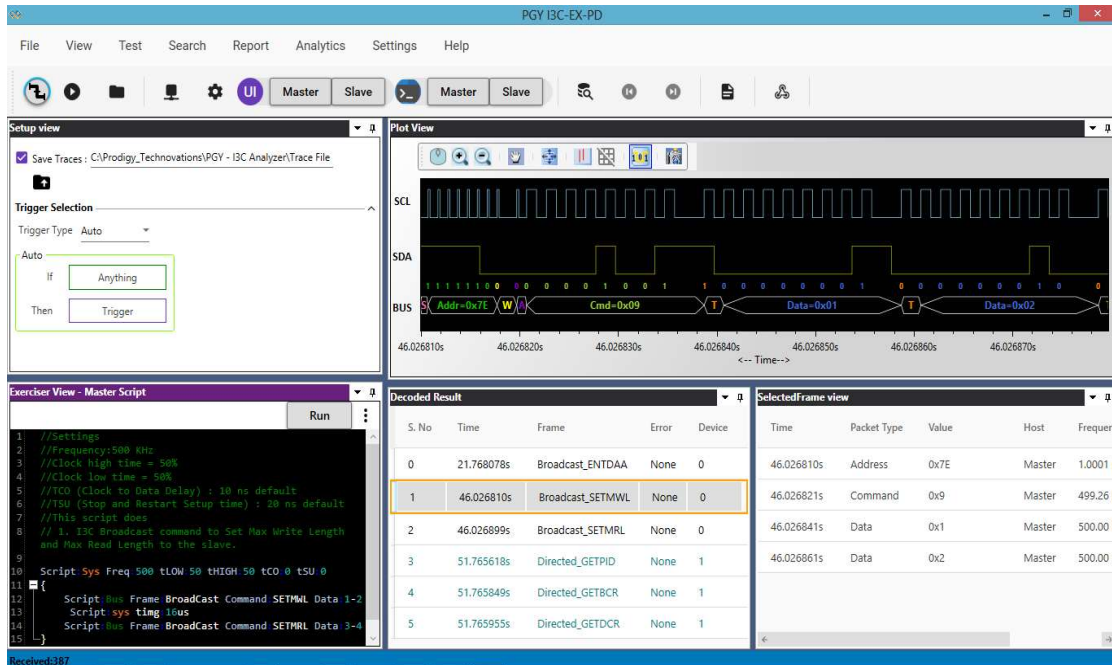
PGY-I3C-EX-PD is the leading instrument that enables the design and test engineers to test the I3C designs for its specifications by configuring PGY-I3C-EX-ED as master/slave, generating I3C traffic with error injection capability and decoding I3C Protocol decode packets.

Features:

- Supports v1.0/v1.1 Specifications¹
- Ability to configure it as Master or Slave
- Ability to configure BCR, LVR and DCR registers
- Simultaneously generate I3C traffic and Protocol decode of the Bus
- Optional Compliance Test Specifications (CTS) test script support
- Supports legacy I2C slaves and Master
- Generate different I3C SDR and HDR Packets
- Supports IBI and Hot Plug capabilities
- Error Injection such CRC errors, parity errors and ACK/NACK errors
- Variable I3C data speeds and duty cycle
- PMIC device support as per JEDEC DDR5 spec requirement
- Margin test capability: Voltage and timing variation
- Continuous streaming of protocol data between instrument and host computer.
- Timing diagram of Protocol decoded bus
- Listing view of Protocol activity
- Error Analysis in Protocol Decode
- Ability to write exerciser script to combine multiple data frame generation at different data speeds
- USB2/3 host computer interface
- API support for automation in Python or C++

¹ v1.1 supports only one lane commands

Multi-domain View



The screenshot displays the PGY I3C-EX-PD software interface. The main window is titled "PGY I3C-EX-PD" and features a menu bar (File, View, Test, Search, Report, Analytics, Settings, Help) and a toolbar with Master/Slave controls. The interface is divided into several panels:

- Setup view:** Contains "Save Traces" and "Trigger Selection" options. The Trigger Type is set to "Auto".
- Plot View:** Shows a timing diagram for SCL, SDA, and BUS. The SCL signal is a square wave. The SDA signal shows data being transmitted. The BUS signal shows a sequence of frames: Addr=0x7E, Cmd=0x09, Data=0x01, and Data=0x02.
- Exerciser View - Master Script:** Contains a script editor with the following code:


```

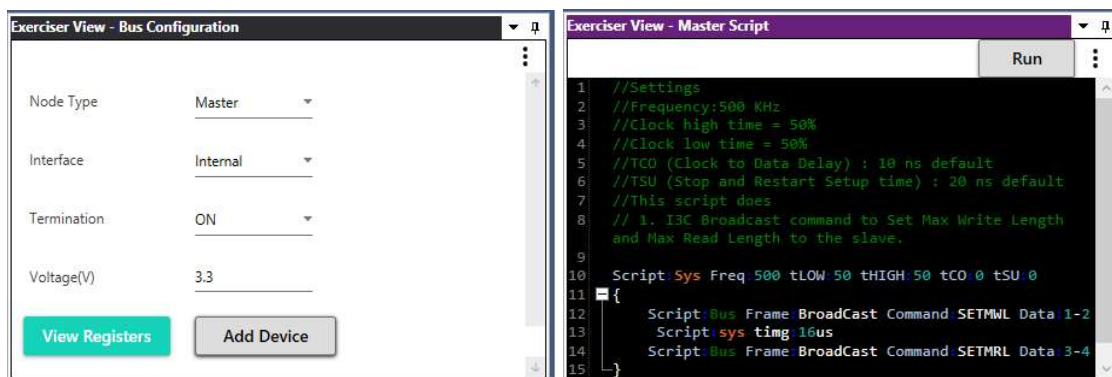
1 //Settings
2 //Frequency:500 KHz
3 //Clock high time = 50%
4 //Clock low time = 50%
5 //TCO (Clock to Data Delay) : 10 ns default
6 //TSU (Stop and Restart Setup time) : 20 ns default
7 //This script does
8 // 1. I3C Broadcast command to Set Max Write Length
9   and Max Read Length to the slave.
10 Script Sys Freq 500 tLOW 50 tHIGH 50 tCO 0 tSU 0
11 {
12   Script Bus Frame BroadCast Command SETMWL Data 1-2
13   Script sys tim 16us
14   Script Bus Frame BroadCast Command SETMRL Data 3-4
15 }
      
```
- Decoded Result:** A table showing the results of the captured frames:

S. No	Time	Frame	Error	Device
0	21.768078s	Broadcast_ENTDAA	None	0
1	46.026810s	Broadcast_SETMWL	None	0
2	46.026899s	Broadcast_SETMRL	None	0
3	51.765618s	Directed_GETPID	None	1
4	51.765849s	Directed_GETBCR	None	1
5	51.765955s	Directed_GETDCR	None	1
- SelectedFrame view:** A table showing the details of the selected frame (Frame 1):

Time	Packet Type	Value	Host	Frequen
46.026810s	Address	0x7E	Master	1.0001 M
46.026821s	Command	0x9	Master	499.26 K
46.026841s	Data	0x1	Master	500.00 K
46.026861s	Data	0x2	Master	500.00 K

Multidomain View provides the complete view of I3C Protocol activity in single GUI. User can easily setup the analyzer to generate I3C/I2C traffic using a GUI or script. User can set different trigger conditions from the setup menu to capture Protocol activity at specific event and decode the transition between Master and Slave. The decoded results can be viewed in timing diagram and Protocol listing window with autocorrelation. State machine view provides switching of state machine between master and slave for design validation. This comprehensive view of information makes it industry best, offering an easy to use solution to debug the I3C protocol activity.

Exerciser



The screenshot displays the PGY I3C-EX-PD software interface, focusing on the Exerciser configuration and script editor.

- Exerciser View - Bus Configuration:** Contains configuration options for the node type, interface, termination, and voltage.
 - Node Type: Master
 - Interface: Internal
 - Termination: ON
 - Voltage(V): 3.3
- Exerciser View - Master Script:** Contains a script editor with the following code:


```

1 //Settings
2 //Frequency:500 KHz
3 //Clock high time = 50%
4 //Clock low time = 50%
5 //TCO (Clock to Data Delay) : 10 ns default
6 //TSU (Stop and Restart Setup time) : 20 ns default
7 //This script does
8 // 1. I3C Broadcast command to Set Max Write Length
9   and Max Read Length to the slave.
10 Script Sys Freq 500 tLOW 50 tHIGH 50 tCO 0 tSU 0
11 {
12   Script Bus Frame BroadCast Command SETMWL Data 1-2
13   Script sys tim 16us
14   Script Bus Frame BroadCast Command SETMRL Data 3-4
15 }
      
```

PGY-I3C-EX-PD supports I3C traffic generation using GUI and Script. User can generate simple traffic generation using the GUI to test the DUT. Script based GUI provides flexibility to emulate the complete expected traffic in real world including error injections. In this sample script user can generate I3C traffic as below:

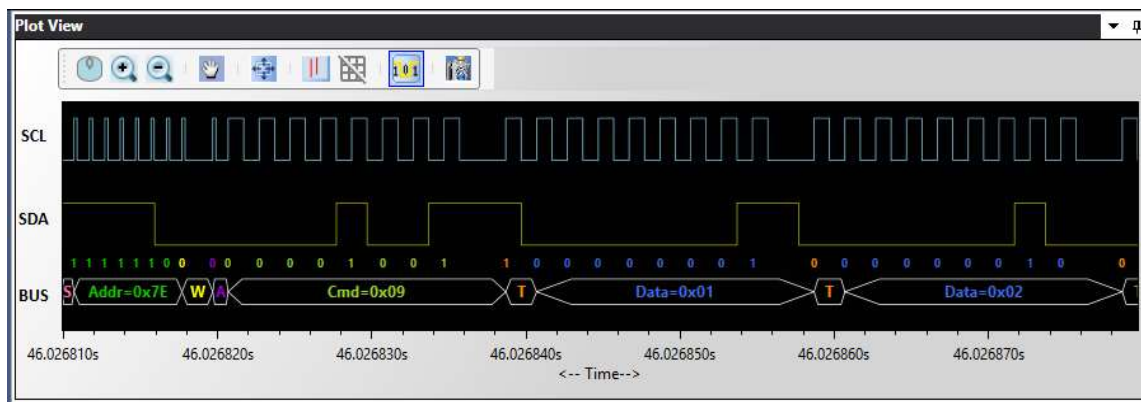
Script line #10: Set system Frequency 500KHz, Duty cycle to 50%, clk to data delay to 10ns (default), start to restart setup time to 20ns (default)

Script line #12: SETMWL

Script line #13: Set system inter message gap to 16us

Script line #14: SETMRL

Timing Diagram and Protocol Listing View



Timing view provides the plot of SCL and SDA signals with bus diagram. Overlaying of Protocol bits on the digital timing waveform will help easy debugging of Protocol decoded data. Cursor and Zoom features will make it convenient to analyze Protocol in timing diagram for any timing errors.

Decoded Result					SelectedFrame view				
S. No	Time	Frame	Error	Device	Time	Packet Type	Value	Host	Frequen
0	21.768078s	Broadcast_ENTDAA	None	0	46.026810s	Address	0x7E	Master	1.0001 k
1	46.026810s	Broadcast_SETMWL	None	0	46.026821s	Command	0x9	Master	499.26 k
2	46.026899s	Broadcast_SETMRL	None	0	46.026841s	Data	0x1	Master	500.00 k
3	51.765618s	Directed_GETPID	None	1	46.026861s	Data	0x2	Master	500.00 k
4	51.765849s	Directed_GETBCR	None	1					
5	51.765955s	Directed_GETDCR	None	1					

Protocol window provides the decoded packet information in each state and all packet details with error info in packet. Selected frame in Protocol listing window will be auto correlated in timing view to view the timing information of the packet.

Powerful Trigger Capabilities

Trigger Selection

Trigger Type **Advanced** ▾

Level Count **2** ▾

Level # 0

If

Broadcast	S	0x7E	W	ACK ▾	ENTDAA ▾	T
Directed					Data	T
Private						
Then	Action		Trigger ▾			

Else If

Broadcast	S	0x7E	W	ACK ▾	SETMWL ▾	T
Directed					Data 1-2	T
Private						
Then	Action		Nothing ▾		Go to Level	1 ▾

PGY-I3C-EX-PD supports Auto, simple and advanced trigger capabilities. Analyzer can trigger on any of the Protocol packets such as Broadcast, Directed or Private message. Advanced Trigger provides the flexibility to monitor Multiple trigger conditions and can set multiple state trigger machine.



PGY-I3C Specification	Features	PGY-I3C-EX-PD	PGY-I3C-EX-PD-Lite
Exerciser:			
Configurable	1 Master + 3 Slaves OR 1 Secondary Master + 2 Slaves	✓	✓ 1 Master + 1 Slave
I3C / I2C Traffic Generation	Custom I3C / I2C traffic generation	✓	✓
	Simulate real world network traffic	✓	✗
SCL Frequency	400KHz to 13.5MHz	✓	✓
Voltage Drive Level	1V to 3.3V at steps of 100mV	✓	✗ Fixed to 1.2V, 1.8V, 2.5V & 3.3V
Hot Join	Yes, supported	✓	✓
IBI	Yes, supported	✓	✓
CCC Support	All CCC are supported in Master. All CCC are supported in Slave except SETXTIME, ENTMM, ENTAS*	✓	✓
SCL Duty Cycle variation	User Defined	✓	✗
SCL & SDA Delay	User Defined	✓	✗
Delay between two messages	User Defined	✓	✗
Error injection	S0 to S5 types of errors specified in I3C specifications CRC errors in DDR traffic Preamble errors in DDR traffic ACK / NACK Errors (Slave) Master Abort Non-Standard Frames Non-Standard Start, Stop and HDR exit patterns, slave reset Save and Load Scripts	✓	✗
API Support	Support for Automation of operation using Python or C++	✓	✗
Protocol Analysis:			
Supports	I3C & I2C protocol decode	✓	✓
Protocol Views	Timing Diagram View Protocol Listing View Bus-Diagram to display Protocol packets with timing diagram plot	✓	✓
Protocol Trigger	Auto (Trigger on any packet) Simple (Trigger on user defined I3C or I2C packet) Advanced (Multistate & Multilevel trigger with timer capability)	✓	✓ (No Advanced Trigger Support)
Capture Duration	Continuous streaming Protocol Data to host HDD/SSD	✓	✓
Protocol Error Report	S0 to S5 types of errors specified in the I3C specifications CRC errors in DDR traffic Preamble errors in DDR traffic ACK /NACK Errors (Slave) Master Abort Non-Standard frames Non-standard Start, Stop and HDR exit patterns.	✓	✓
Host Connectivity	USB 3.0 / 2.0 interface	✓	✓

Ordering Information

PGY-I3C-EX-PD (**v 1.0**): I3C Protocol Exerciser and Analyzer (supports v 1.0 specifications)
 PGY-I3C-EX-PD (**v 1.1**): I3C Protocol Exerciser and Analyzer (supports v 1.1 specifications)
 -Opt CTS (**v1.1**): Compliance test specifications for v 1.1 specifications
 PGY-I3C-UPG (**v1.0 to v 1.1**): Upgrade Option from version 1.0 to version 1.1 specifications

PGY-I3C-EX-PD-Lite (**v 1.0**): I3C Protocol Exerciser and Analyzer (lite version supports v 1.0 specifications)
 PGY-I3C-EX-PD-Lite (**v 1.1**): I3C Protocol Exerciser and Analyzer (lite version supports v 1.1 specifications)
 PGY-I3C-UPG-Lite (**v1.0 to v 1.1**): Upgrade Option from version 1.0 to version 1.1 specifications

Deliverables for PGY-I3C-EX-PD

PGY-I3C-EX-PD Unit
 USB3.0 cable
 PGY-I3C-EX-PD Software in CD
 12V DC adopter
 Flying lead probe cable with female connector to connect to DUT

Deliverables for PGY-I3C-EX-PD-Lite

PGY-I3C-EX-PD-Lite unit
 USB3.0 cable
 PGY-I3C-EX-PD-Lite Software in CD
 Flying Lead probe cable with connector

Contact Information

Website:	www.prodigytechno.com
Address:	Prodigy Technovations Pvt Ltd 294, 7 th Cross, 7 th main, BTM 2 nd Stage, Bengaluru – 560076. Karnataka India.
Technical Support:	contact@prodigytechno.com
Phone:	+91-80-42126100

About Prodigy Technovations Pvt Ltd

Prodigy Technovations Pvt Ltd (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.