

BA-4000-L2

Traffic and Bit Analyzer



EXFO

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Units of measurement in this publication conform to SI standards and practices.

Patents

The exhaustive list of patents is available at EXFO.com/patent.

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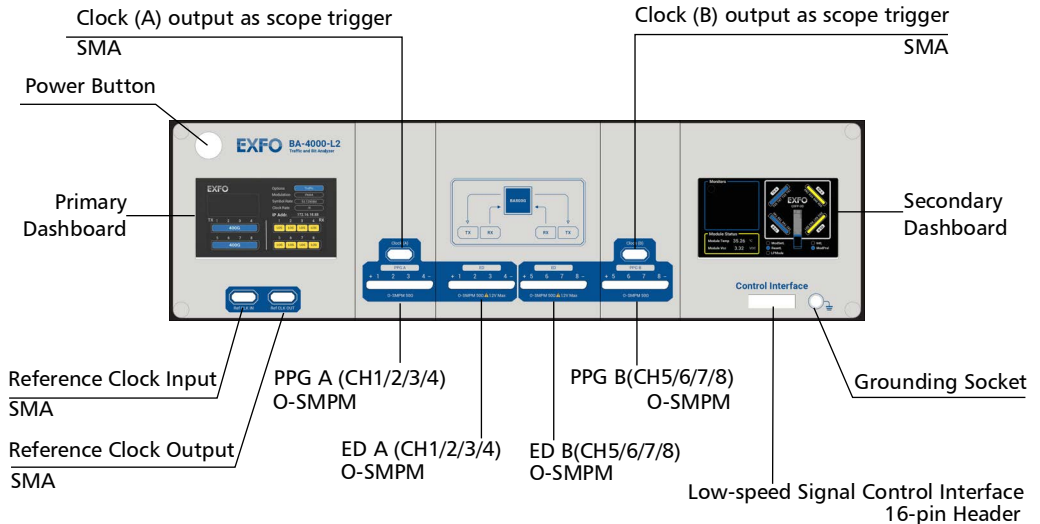
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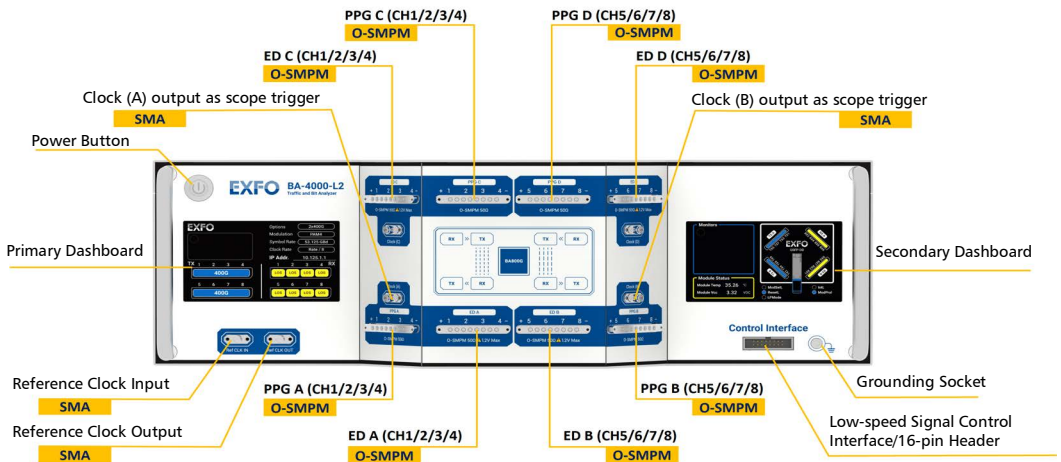
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1 Introduction

Front Panel



With RCNC Option



Introduction

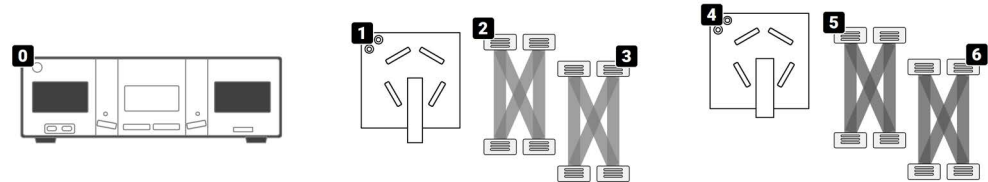
Rear Panel



Connection Guide

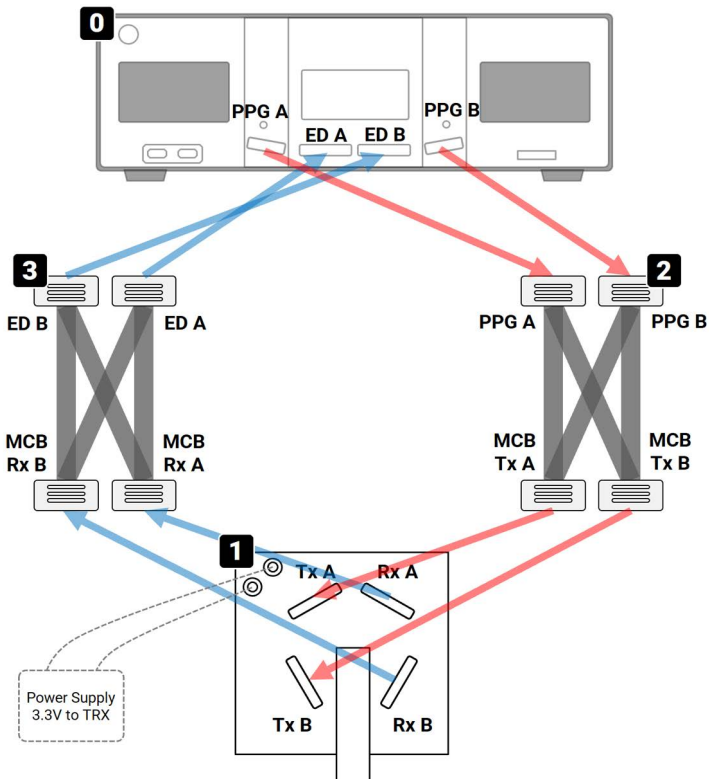
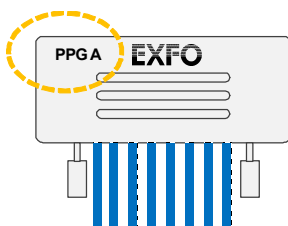
General Kit List of BA L2

	Model No.	Description	Quantity	Remark
0	BA-4000-L2	Bit and Traffic Analyzer	1	
1	MCB-QSFPDD-O	QSFP-DD Module Compliance Board (O-SMPM connectors)	1	
2	ICBOS-30-QDD-PPG	30cm O-SMPM Cable Pair specified for [MCB-QSFPDD-O TX]	1	PPG A ↔ TxA PPG B ↔ TxB
3	ICBOS-30-QDD-ED	30cm O-SMPM Cable Pair specified for [MCB-QSFPDD-O RX]	1	ED A ↔ RxA ED B ↔ RxB
4	MCB-OSFP-O	OSFP Module Compliance Board (O-SMPM connectors)	1	
5	ICBOS-30-OSFP-PPG	30cm O-SMPM Cable Pair specified for [MCB-OSFP-O TX]	1	PPG A ↔ TxA PPG B ↔ TxB
6	ICBOS-30-OSFP-ED	30cm O-SMPM Cable Pair specified for [MCB-OSFP-O RX]	1	ED A ↔ RxA ED B ↔ RxB



Test Configuration of QSFP-DD TRX

Model No.	
0	BA-4000-L2
1	MCB-QSFPDD-O
2	ICBOS-30-QDD-PPG
3	ICBOS-30-QDD-ED

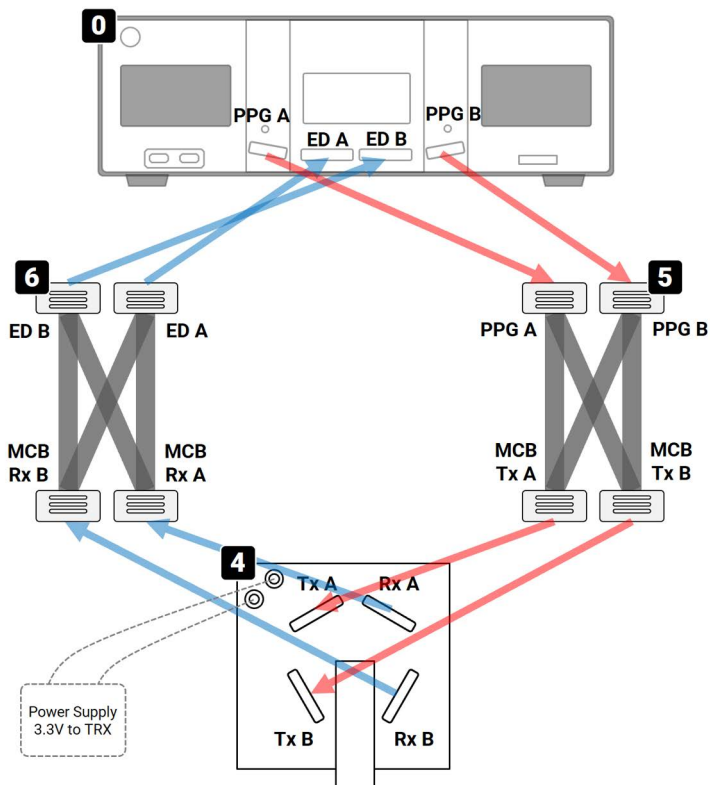
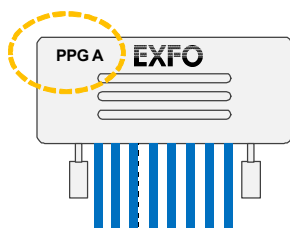


Introduction

Connection Guide

Test Configuration of OSFP TRX

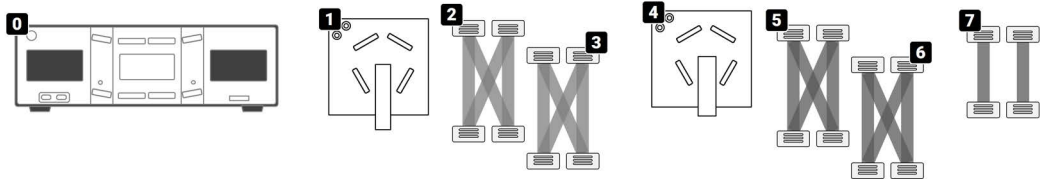
	Model No.
0	BA-4000-L2
4	MCB-OSFP-O
5	ICBOS-30-OSFP-PPG
6	ICBOS-30-OSFP-ED



Connection Guide with RCNC

General Kit List of BA L2

	Model No.	Description	Quantity	Remark
0	BA-4000-L2-RCNC	Bit and Traffic Analyzer with RCNC option	1	
1	MCB-QSFPDD-O	QSFP-DD Module Compliance Board (O-SMPM connectors)	1	
2	ICBOS-30-QDD-PPG	30cm O-SMPM Cable Pair specified for [MCB-QSFPDD-O TX]	1	PPG A ↔ TxA PPG B ↔ TxB
3	ICBOS-30-QDD-ED	30cm O-SMPM Cable Pair specified for [MCB-QSFPDD-O RX]	1	ED A ↔ RxA ED B ↔ RxB
4	MCB-OSFP-O	OSFP Module Compliance Board (O-SMPM connectors)	1	
5	ICBOS-30-OSFP-PPG	30cm O-SMPM Cable Pair specified for [MCB-OSFP-O TX]	1	PPG A ↔ TxA PPG B ↔ TxB
6	ICBOS-30-OSFP-ED	30cm O-SMPM Cable Pair specified for [MCB-OSFP-O RX]	1	ED A ↔ RxA ED B ↔ RxB
7	ICBOS-O5-20	20cm O-SMPM Loopback Cable	2	Standard accessories of RCNC option

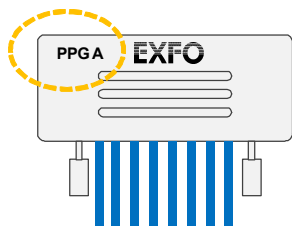


Introduction

Connection Guide with RCNC

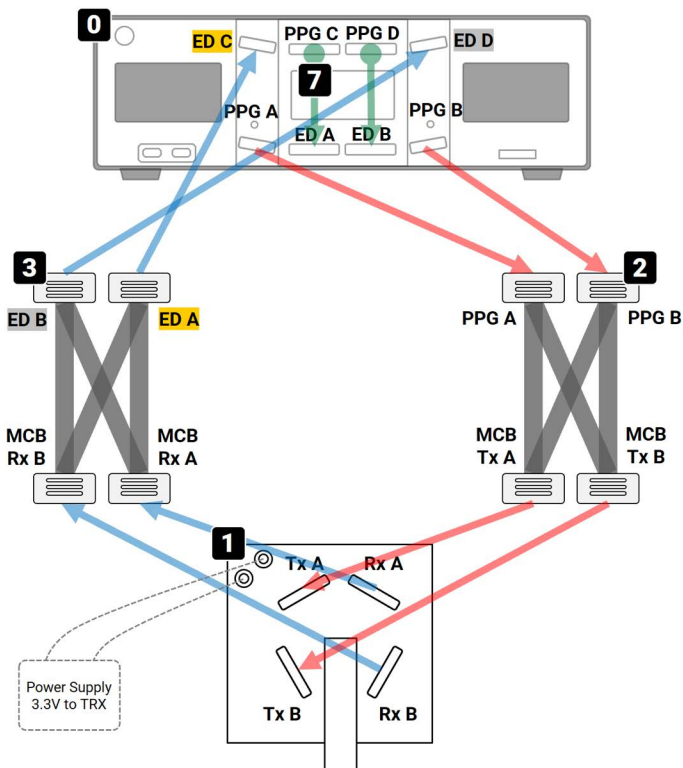
Test Configuration of QSFP-DD TRX

	Model No.
0	BA-4000-L2-RCNC
1	MCB-QSFPDD-O
2	ICBOS-30-QDD-PPG
3	ICBOS-30-QDD-ED
7	ICBOS-OS-20 (x2)



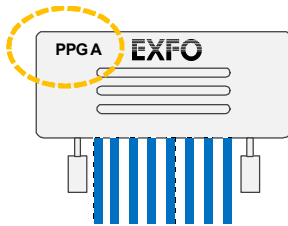
Connect from cable labeled **ED A** to the BA L2 **ED C**

Connect from cable labeled **ED B** to the BA L2 **ED D**



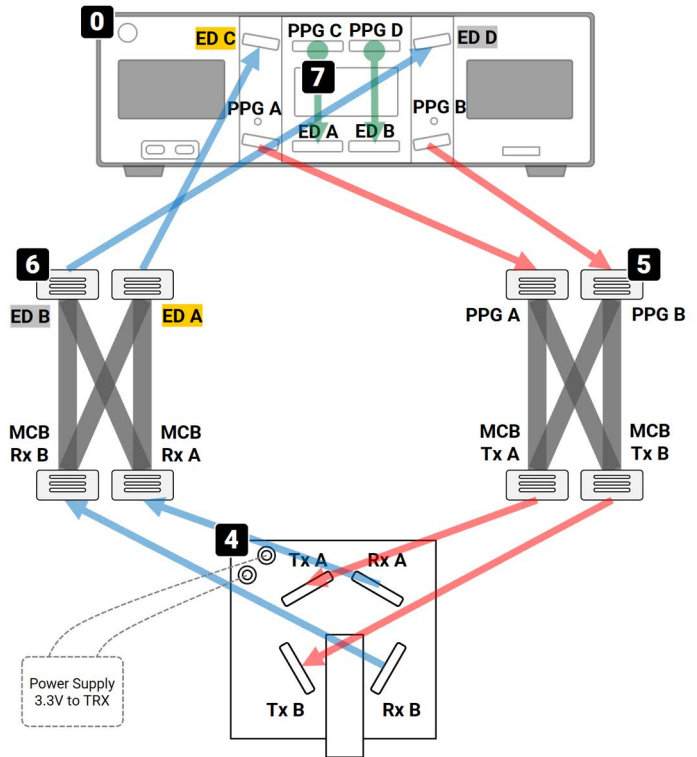
Test Configuration of OSFP TRX

	Model No.
0	BA-4000-L2-RCNC
4	MCB-OSFP-O
5	ICBOS-30-OSFP-PPG
6	ICBOS-30-OSFP-ED
7	ICBOS-OS-20 (x2)



Connect from cable labeled **ED A** to the BA L2 **ED C**

Connect from cable labeled **ED B** to the BA L2 **ED D**



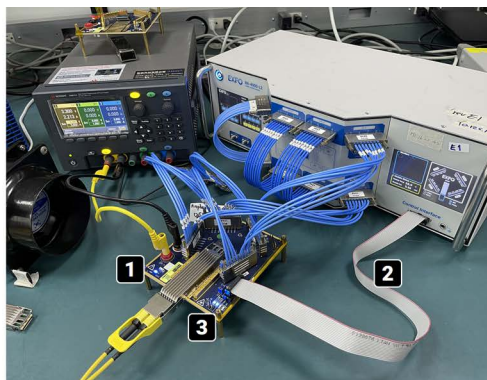
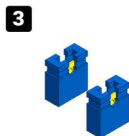
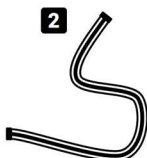
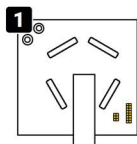
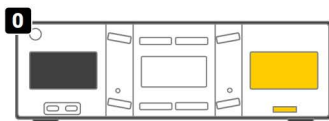
Introduction

Connection Guide with MCB

Connection Guide with MCB

List of Control Interfaces

	Model No.	Description	Quantity	Note
0	BA-4000-L2-RCNC	Bit and Traffic Analyzer with RCNC option	1	
1	MCB-OSFP-O	OSFP Module Compliance Board (O-SPMP connectors)	1	
2	N/A	Specific flat flexible cable	1	Standard accessory of BA L2
3	N/A	2.54mm Jumper cap	2	Standard accessory of BA L2 (after Sep. '25)



To connect and configure with the MCB:

1. Connect from [BA L2 Control Interface] to [MCB 16-pin header] by the flat cable.
2. Put one jumper cap on [SCL – SCL_IN].

3. Put the other jumper cap on [SDA – SDA_IN].

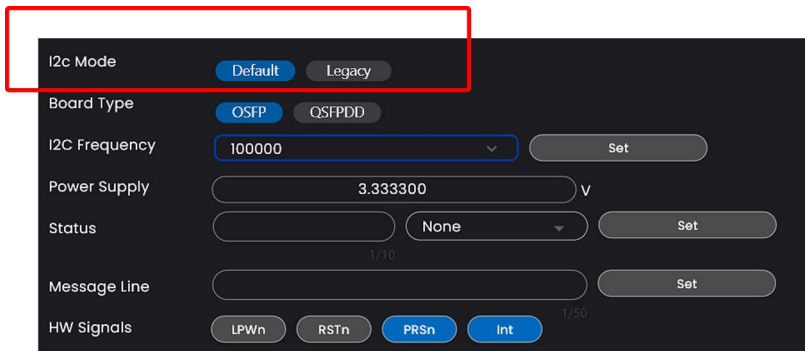


Module Temperature and Voltage

With correct connection and configuration, when the transceiver is on, module temperature and voltage are shown immediately on the 2nd dashboard of the front panel.



If it doesn't work, switch [I2C Mode] from [Default] to [Legacy] at MCB tab of the GUI.

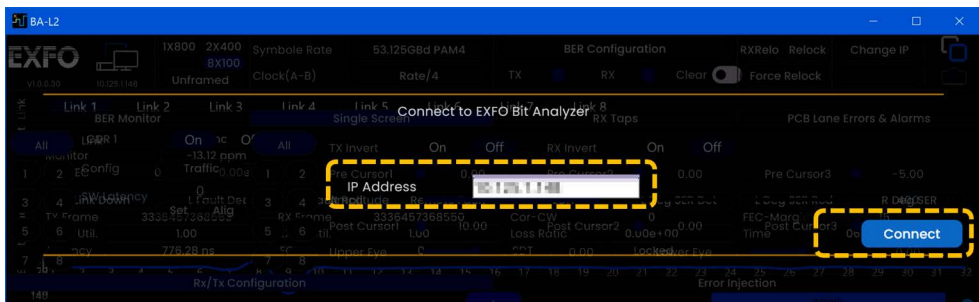
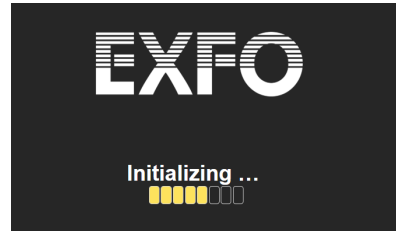


2 General GUI Operation

Quick Start

To power on and control with the GUI:

1. Connect the Ethernet cable from the control PC to the RJ45 port on the rear of the BA L2 chassis.
2. Push the power button on the front panel.
3. Wait for initialization. (Initialization is done when the IP address appears on the front-panel monitor)
4. Open the GUI. (The name of the desktop icon is BA-L2.)
5. Enter the IP address and click **Connect** to start controlling the machine.



General GUI Operation

Quick Start

To set the mode, PPG setting, and view results:

1. Select the operation mode.
2. Switch into RCNC hardware mode.
3. Set the PPG amplitude and cursors.
4. Switch functions to get all kinds of results.

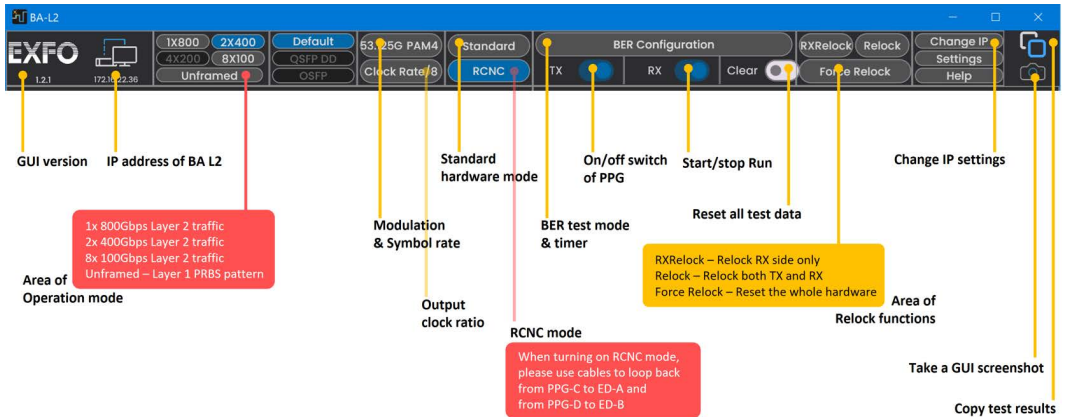


Here are two general settings to test LPO for your reference. Based on these, you can tune your settings.

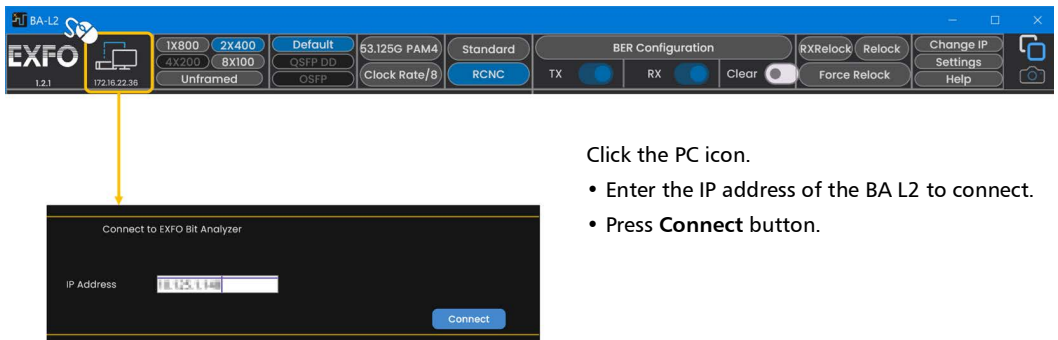
(pre3, pre2, pre1, main, post1, post2, post3, upper eye, lower eye)

- (-4, 12, -20, 500, 20, -10, -6, 3, 3)
- (-4, 12, -20, 500, 20, 0, -6, 3, 3)

Main Control Bar



Connecting the BA L2



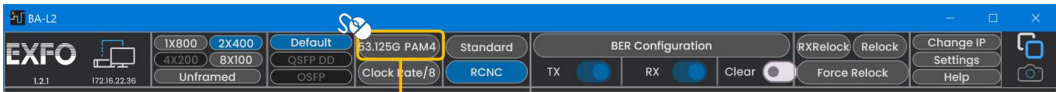
Click the PC icon.

- Enter the IP address of the BA L2 to connect.
- Press **Connect** button.

General GUI Operation

Connecting the BA L2

Symbol Rate and Clock Ratio



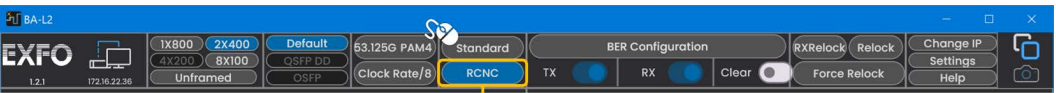
Click Symbol Rate 53.125GBd PAM4 button or Clock (A-B) Rate/8 button.
Select the clock ratio of output clock signal:

- Rate/8
- Rate/16
- Rate/32
- Rate/64

The output clock signal is generally used as the sampling scope's trigger.



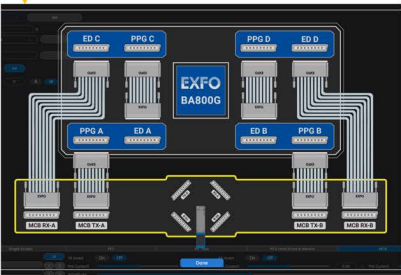
RCNC Mode



Click RCNC button to switch from Standard hardware mode to RCNC hardware mode.

RCNC (Reflection Cancellation and Noise Cancellation) is a hardware option with superior capabilities optimized for LPO transceivers.

You cannot switch on RCNC hardware without the option.



BER Configuration

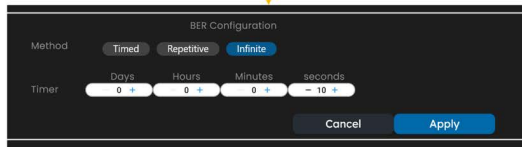


Click **BER Configuration** button and select BER test method:

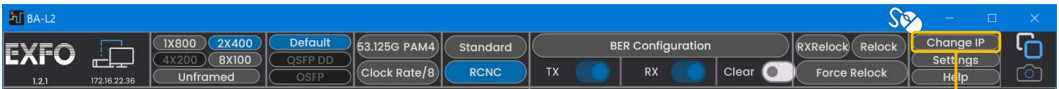
- **Timed**
- **Repetitive**
- **Infinite** (Nonstop until Run button is off)

Set Timer for **Timed** or **Repetitive** BER test method:

- **Days**
- **Hours**
- **Minutes**
- **Seconds**



Changing IP Address Settings



Click **Change IP** button.

Switch on DHCP to obtain an IP address automatically.

or

Set full IPv4 address.

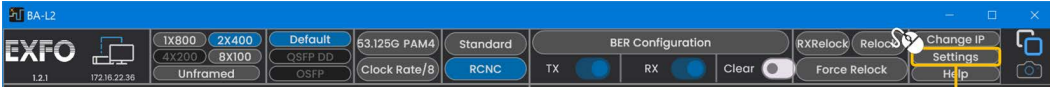
- **IP Address**
- **Subnet Mask**
- **Gateway**



General GUI Operation

Save/Load Settings

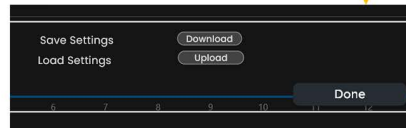
Save/Load Settings



Click **Setup** button.

Save Settings to save the current configuration as a file with a **.ba12** extension. This file will store all your selected settings, which can be reloaded later.

Load Settings to load a previously saved configuration file.



Configuration List

The **Save Settings** feature allows you to save the following options:

➤ **Selected Mode**

Options: 1x800, 2x400, 8x100, Unframed Mode

➤ **Data Rate**

➤ **TX and RX (Run) Enable/Disable**

➤ **Tap Values**

Pre Cursor 3, Pre Cursor 2, Pre Cursor 1, Amplitude, Post Cursor 1, Post Cursor 2, Post Cursor 3, Upper Eye, Lower Eye

➤ **Channel-Wise TX/RX Invert Settings**

Enable/Disable for each channel

➤ **Traffic Settings**

➤ Pattern – TX Inversion, RX Inversion

- Ethernet Frame – Fixed Size or EMIX Sequence Length, TX Rate (%)
- Latency and Excess Skew
- **Link On/Off and Channel Enable/Disable**
- **Unframed Mode Channel-Wise Pattern**
TX, RX pattern for each channel
- **BER Configuration Settings**

Once the settings are saved, they are stored in a file and can be retrieved for future use.

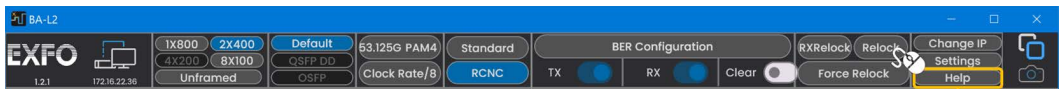
The **Load Settings** feature allows you to load a previously saved configuration file. The feature restores all the settings listed above, so manual configuration is not needed.

To load the settings:

Select the saved **.bal2** file.

The system will automatically apply all configurations from the file, including mode, data rate, tap values, invert settings, and more.

Help

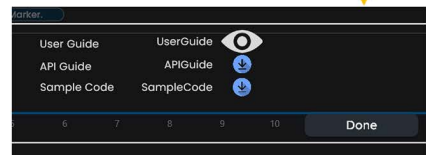


Click **Help** button.

User Guide to show the user guide on GUI.

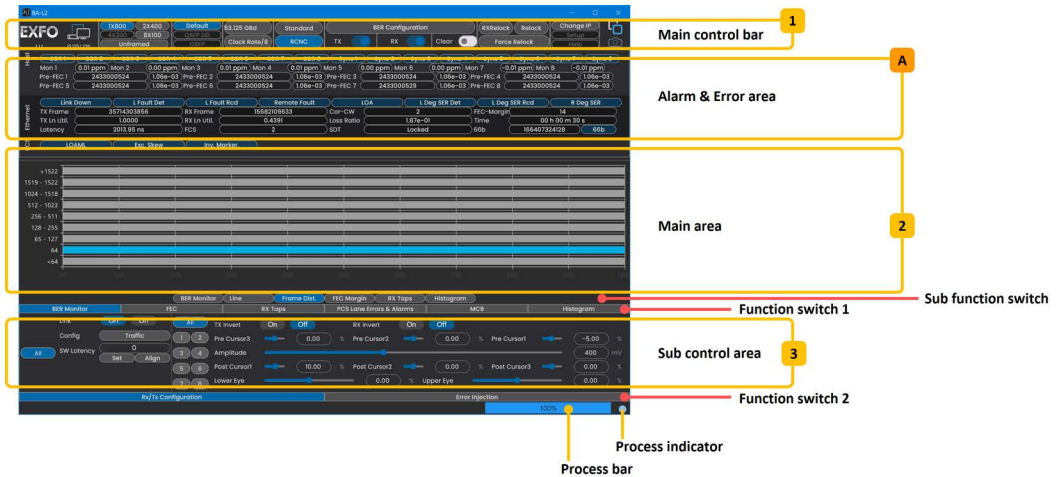
API Guide to download the programming guide of API commands.

Sample Code to download the sample code for reference.



3 1x 800G Mode

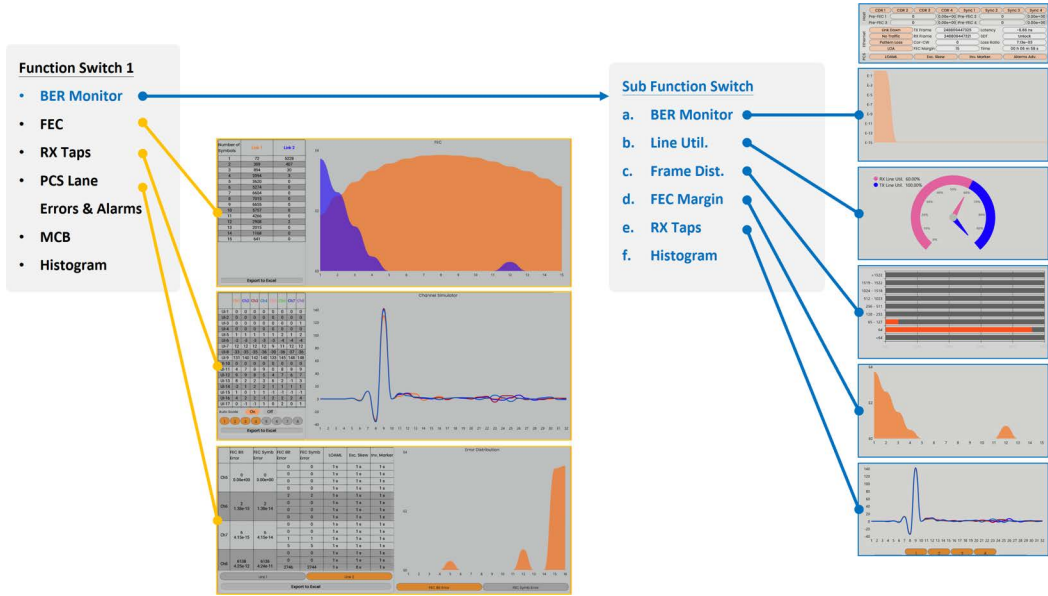
GUI Sections



1x 800G Mode

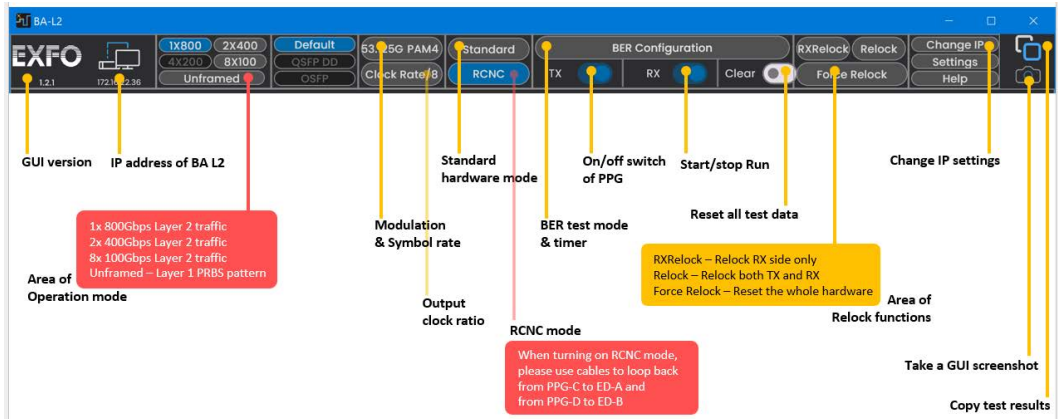
GUI Sections

GUI Map

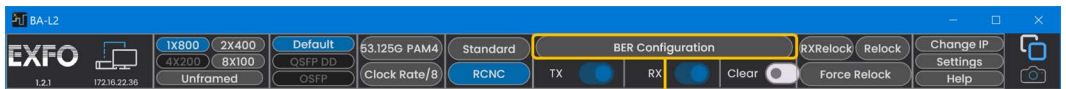


Main Control Bar

1



BER Configuration (1/2)

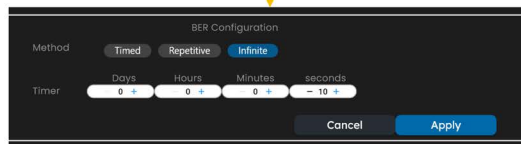


Click **BER Configuration** button and select test method:

- Timed
- Repetitive
- Infinite (Nonstop until RX button is off)

Set Timer for Timed or Repetitive test method:

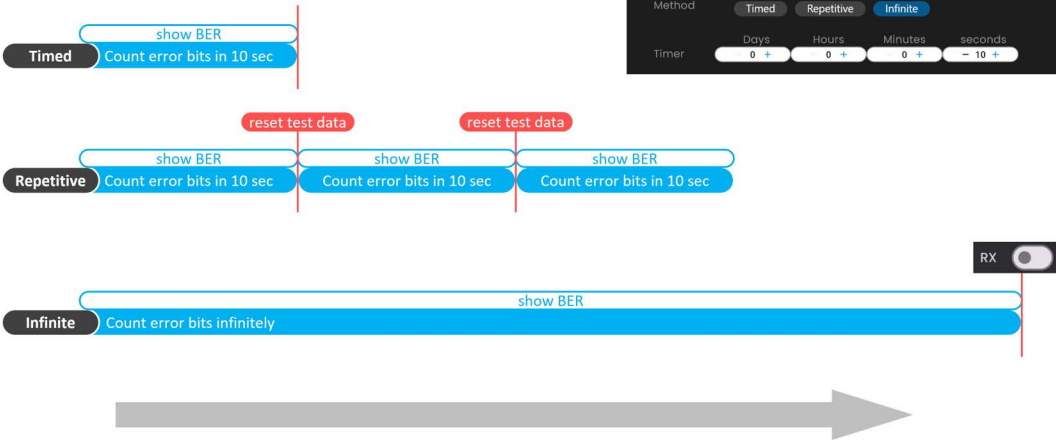
- Days
- Hours
- Minutes
- Seconds



1x 800G Mode

Alarm & Error Area

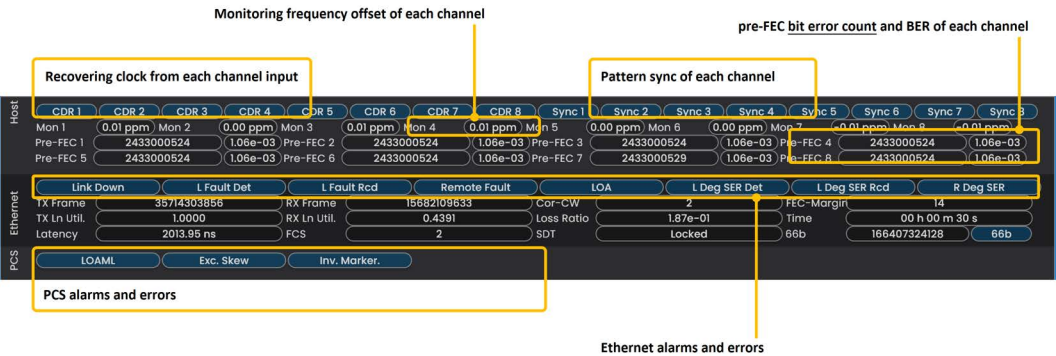
BER Configuration (2/2)



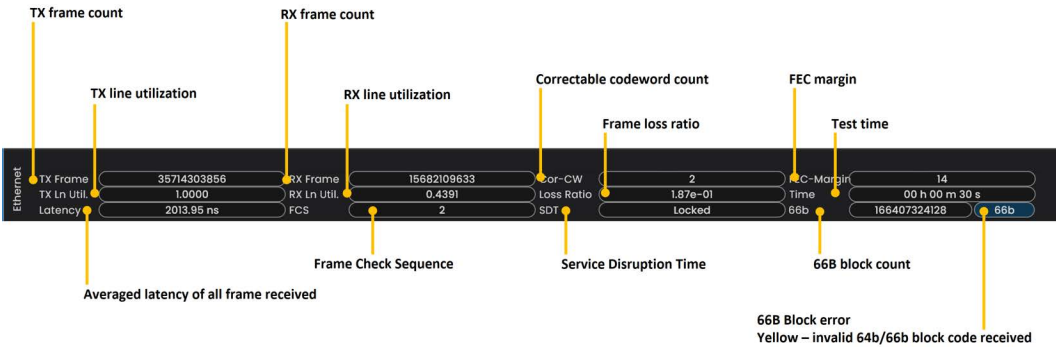
Alarm & Error Area

A

BER Monitor (1/3)



BER Monitor (2/3)



BER Monitor (3/3)

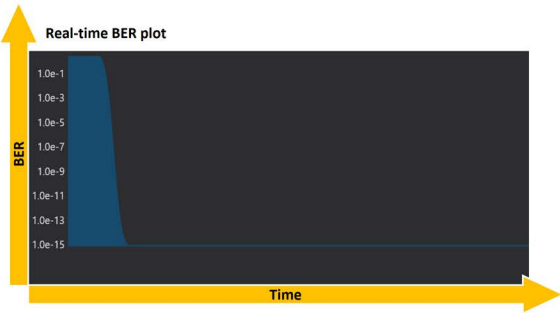
Layer	A/E	Alarm/Error	Note
Physical	A	CDR	Recover clock from input Blue – successfully recover clock Yellow – fail to recover clock (ex: LOS)
	A	Sync	Pattern sync Blue – successfully lock pattern Yellow – fail to lock pattern (ex: polarity inverted)
Ethernet	A	Link Down	There is a local/remote fault condition.
	A	L Fault Det	Local Fault Detected Loss of bit sync, Loss of Block sync, Link Down, or High BER
	A	L Fault Rcd	Local Fault Received Received data path contains Local Fault signal
	A	Remote Fault	Received data path contains Remote Fault status
	A	LOA	Loss of Alignment Alignment of codeword marker not found
	A	L Deg SER Det	Local Degraded SER Detected Local FEC degraded SER condition detected
	A	L Deg SER Rcd	Local Degraded SER Received Local degraded SER signal received
	A	R Deg SER	Remote Degraded SER Remote degraded SER signal detected
PCS	E	66B	An invalid 64b/66b block code is received, and declared when synchronization field has a value of 00 or 11.
	A	LOAML	Loss of Alignment Marker Lock In lock mode, four consecutive marker values received do not match the AM that the lane is currently locked to. LOAML is cleared when the PCS lane is declared Lock and two valid AM 16384 blocks (66b) apart are received.
	A	Exc. Skew	Excessive Skew Skew exceeds defined threshold.
	A	Inv. Marker	Invalid Marker There are errors in 66-bit block AM.

Main Area - BER Monitor

2

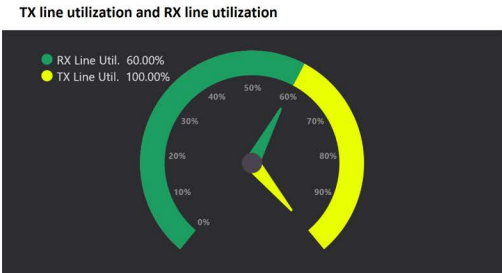
a

BER Monitor

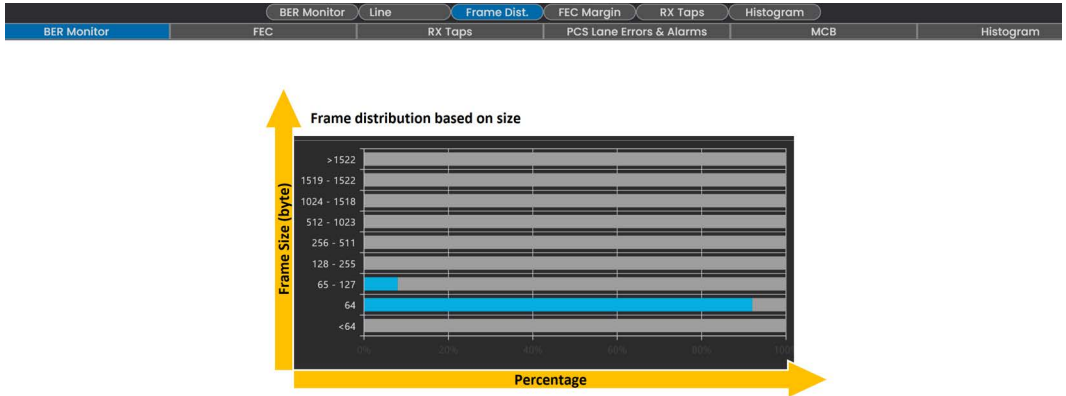


b

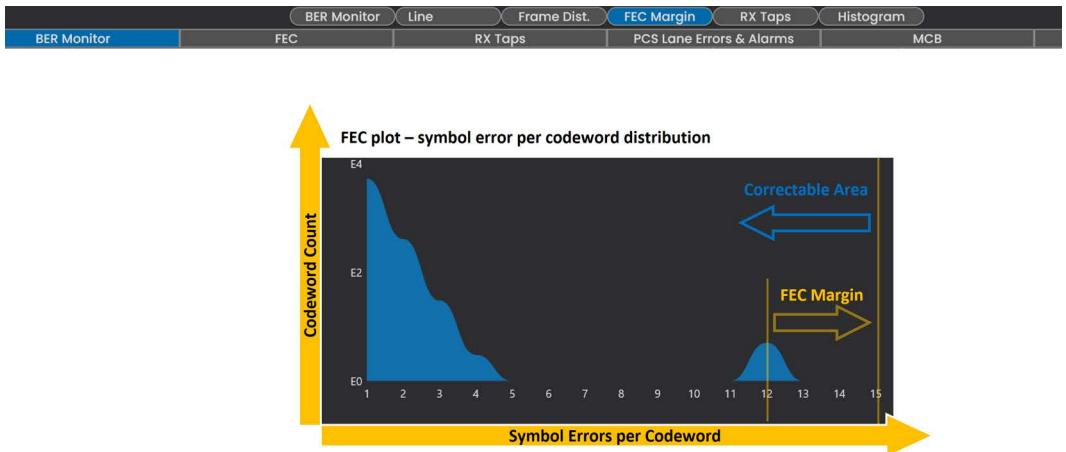
Line Utilization



c Frame Distribution



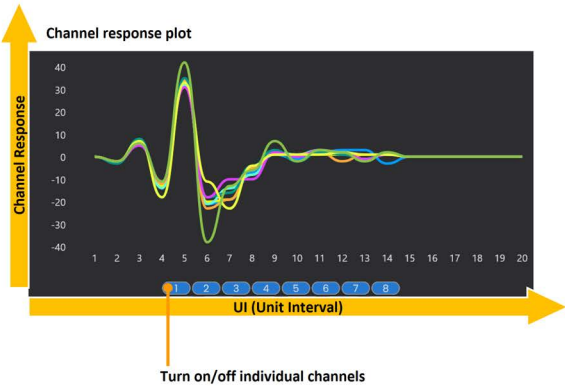
d FEC Margin



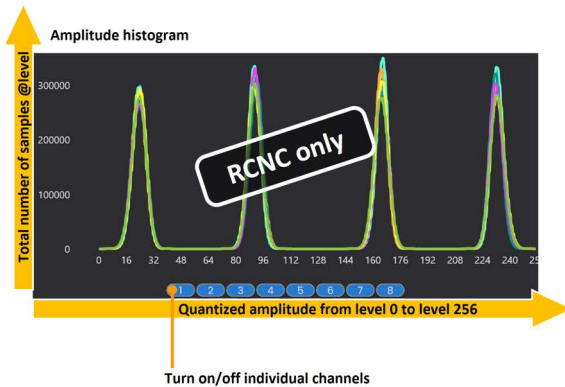
1x 800G Mode

Main Area - BER Monitor

e RX Taps



f Histogram

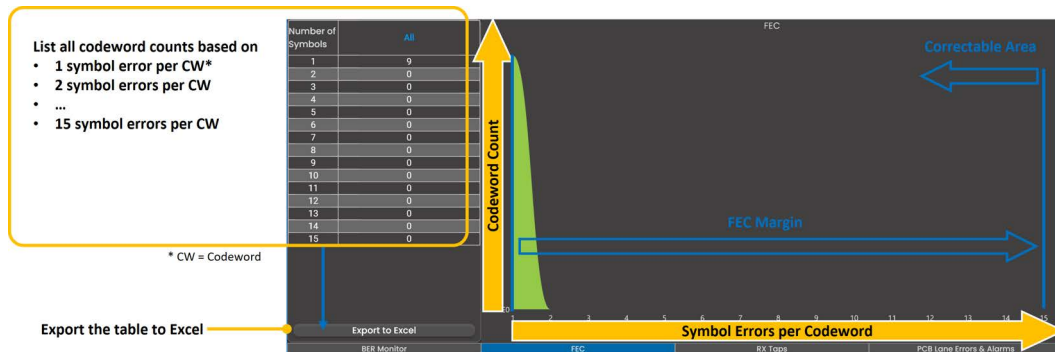


Main Area

2

FEC

The FEC plot of **Symbol Errors per Codeword** vs. **Codeword Count** helps you know the behavior of error distribution by getting a high or low FEC margin. There are symbol errors that are uncorrectable or not.



RX Taps

Intersymbol interference (ISI) affects BER. The less ISI, the better BER.

With the **Channel Simulator** function, you can know how serious the ISI of the input signal is. It provides impulse response within 8 pre-cursors, a main cursor, and 23 post-cursors. The 0 % axis is a reference. For all cursors except the main one, the further distance from 0 % axis, the worse signal quality.

1x 800G Mode

Main Area

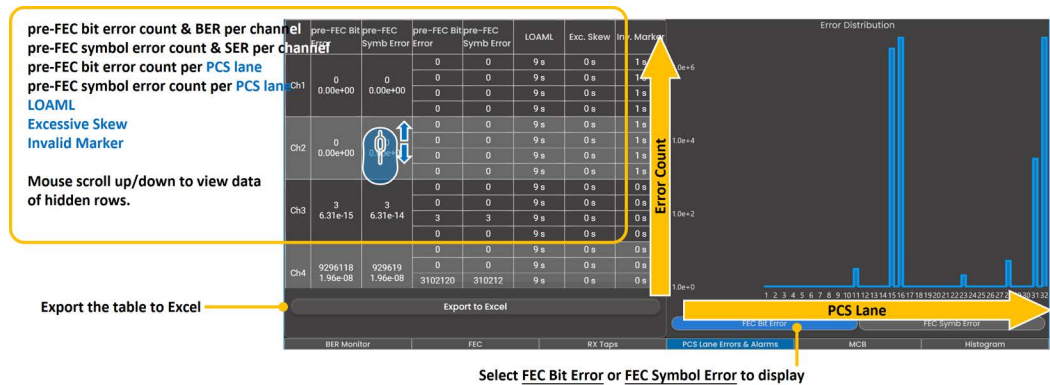
The **Channel Simulator** lists all cursor values of 8 channels. Based on the table, users can tune taps of the transmitter to compensate ISI.



PCS Lane Errors & Alarms

This function displays the channel’s bit error count, symbol error count, BER and SER in order to know error information.

It displays the PCS lane’s bit error count, symbol error count, and LOAML, Excessive Skew and Invalid Marker values.



MCB

Control Interface pin layout mode
Default = 800G MCB rev. H and after
Legacy = 800G MCB rev. G and before

MCB form factor

Read voltage from TRX

Display info on front-panel right screen

Display long info on the right screen

Low-speed signals (OSFP)

R = Directly read single Byte at address
W = Directly write single Byte at address

2c Mode: Default, Legacy

Board Type: OSFP, QSPDD

Power Supply: 0.000000 V

Status: None

Message Line: 1/10

HW Signals: LPWn, RSTn, PRSn, Int

2C register: Address, Value, R, W

Set LED color on front-panel right screen

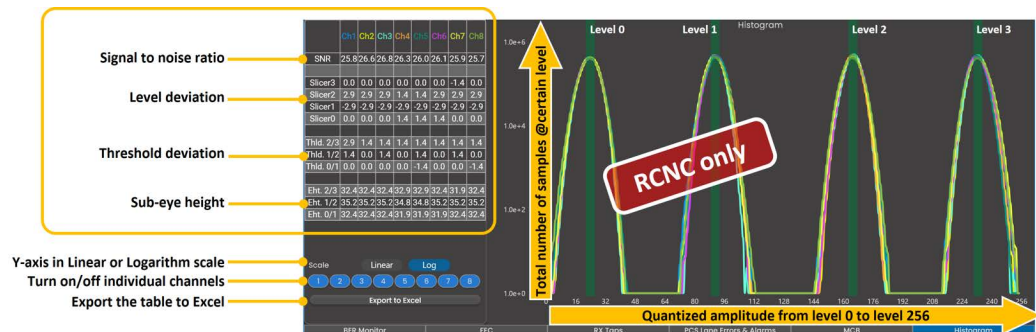
Show different low-speed signals based on Board Type, OSFP or QSPF-DD

How to Read
step 1. Type address in HEX
step 2. Press the button [R]
step 3. Read value (a byte) at the specified address

How to Write
step 1. Type address in HEX
step 2. Type value in HEX
step 3. Press the button [W]

Histogram

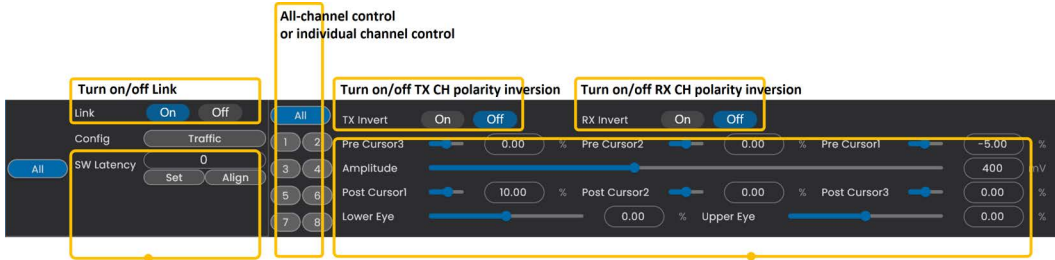
This function displays signal level distribution to get an idea of linearity.



Sub Control Area

3

RX/TX Configuration (1/3)



Software latency tuning

- Manually key latency in ns, and then press [Set] button

Latency(4.13 ns) → 5.87 (ns) → Set → Latency(10.00 ns)

- Automatically compensate latency to zero

Latency(4.13 ns) → Align → Latency(0.00 ns)

Set PPG

- amplitude in mV_{ppd}
- pre-cursors (3 taps)
- post-cursors (3 taps)
- upper sub-eye height
- lower sub-eye height

RX/TX Configuration (2/3)

Link

On

Off

Config

Traffic

All

SW Latency

Set

Align

Selected Port: All

Pattern

TX Pattern

PN31

☐ Invert

RX Pattern

PN31

☐ Invert

Apply

Ethernet Frame

Frame Size (byte)

Fixed

64

Min 64 - Max 16000

TX Rate (%)

100.00

%

Min 0.00 - Max 100.00

Apply

MAC

Source MAC Address

06:07:08:09:0a:0b

Destination MAC Address

00:01:02:03:04:05

EtherType

0x88b7

Apply

Latency & Exc. Skew

Latency

On

Off

Exc. Skew

4038

Set

Close

TX/RX pattern inversion

Set Ethernet frame size (byte)

• Fixed size

• EMIX (sequence length)

Traffic shaping –

Transmission rate in % of utilization

(100% by default)

Source MAC address

Destination MAC address

EtherType

Enable/disable latency info in frame

In some cases, disable latency to increase interoperability

Excessive skew threshold

0x0000 when Network Layer is set to None

0x0800 for IPv4

0x86DD for IPv6

0x8847 for MPLS

0x88b7 when Network Layer is set to None with EtherBERT test

0x8902 for S-OAM

0xAEFE for eCPRI Framed Layer 2 (no IP/UDP) and is not configurable

RX/TX Configuration (3/3)

EMIX

64

Min: 64

Max: 16000

1

2

3

4

5

6

7

8

9

0

⌂

OK

Cancel

Click to customize number

EMIX

Sequence Length: 8

EMIX Frame Size

64

128

256

512

1024

1280

1518

9600

Cancel

Apply

Link 2

Link 3

Link 4

Link 5

Link 6

Link 7

Link 8

EMIX frame sequence is repeated continuously.
How many frame size values to run
Default values below

- 1 [64]
- 2 [64] [128]
- 3 [64] [128] [256]
- 4 [64] [128] [256] [512]
- 5 [64] [128] [256] [512] [1024]
- 6 [64] [128] [256] [512] [1024] [1280]
- 7 [64] [128] [256] [512] [1024] [1280] [1518]
- 8 [64] [128] [256] [512] [1024] [1280] [1518] [9600]

1022

1518

1024

512

256

128

64

14

16

1022

1518

1024

512

256

128

64

14

16

Error Injection

All-link control

Ethernet error type

- FEC-UNCOR-CW
- 66B Block
- FEC-COR-CW
- FEC-SYMB

Injection type

- Rate | Value – X e-Y
- Burst | Value – burst count

Start to inject errors

All

TypeFEC-UNCOR-CW

DefectRate

Rate1e-06

Inject Error

Start

Stop

Active Error Type

FEC-UNCOR-CW

66B Block

FEC-COR-CW

FEC-SYMB

TypeFEC-SYMB

DefectBurst

Value10

Lane1Lane2Lane3Lane4Lane5Lane6Lane7Lane8

Lane9Lane10Lane11Lane12Lane13Lane14Lane15Lane16

Lane17Lane18Lane19Lane20Lane21Lane22Lane23Lane24

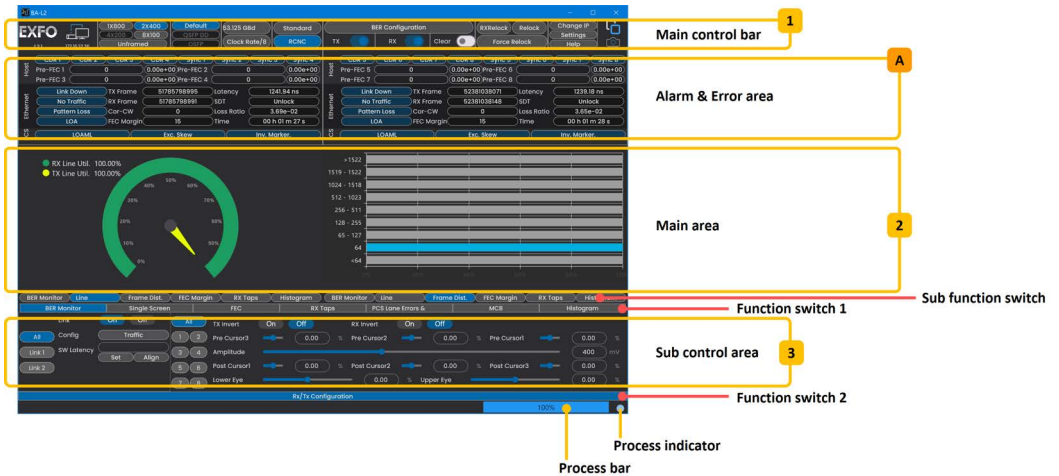
Lane25Lane26Lane27Lane28Lane29Lane30Lane31Lane32

Individual PCS lane control

Display which error type is active

4 2x 400G Mode

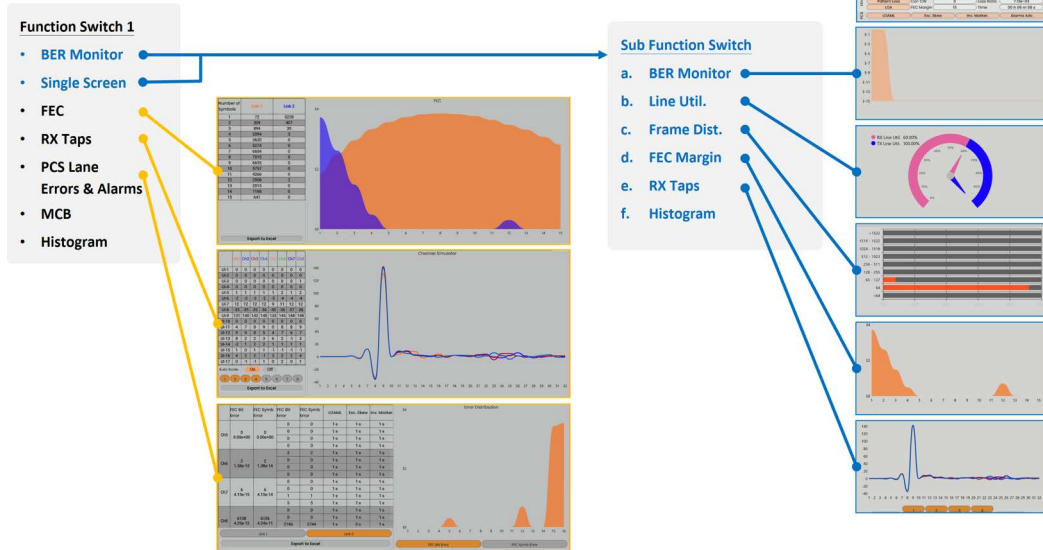
GUI Sections



2x 400G Mode

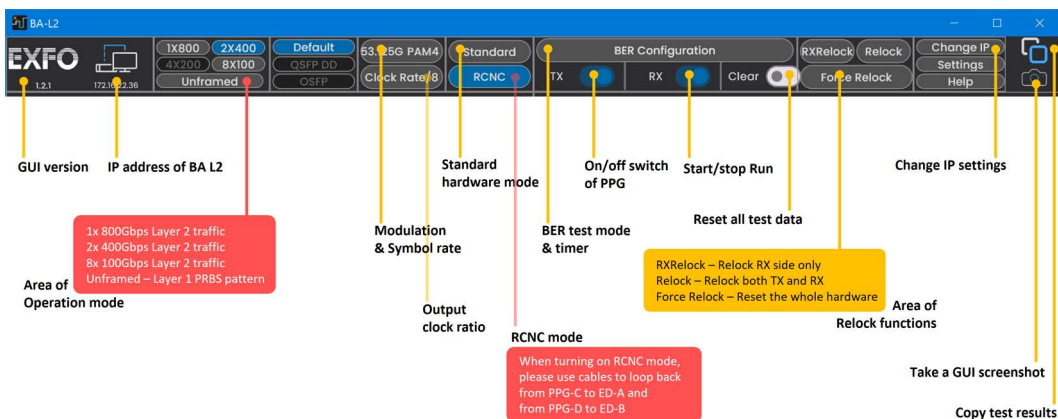
GUI Sections

GUI Map



Main Control Bar

1



BER Configuration (1/2)

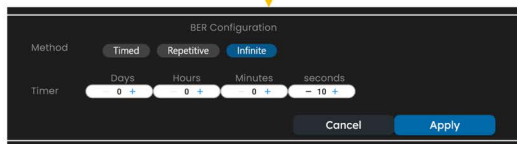


Click **BER Configuration** button and select test method:

- **Timed**
- **Repetitive**
- **Infinite** (Nonstop until RX button is off)

Set **Timer** for **Timed** or **Repetitive** test method:

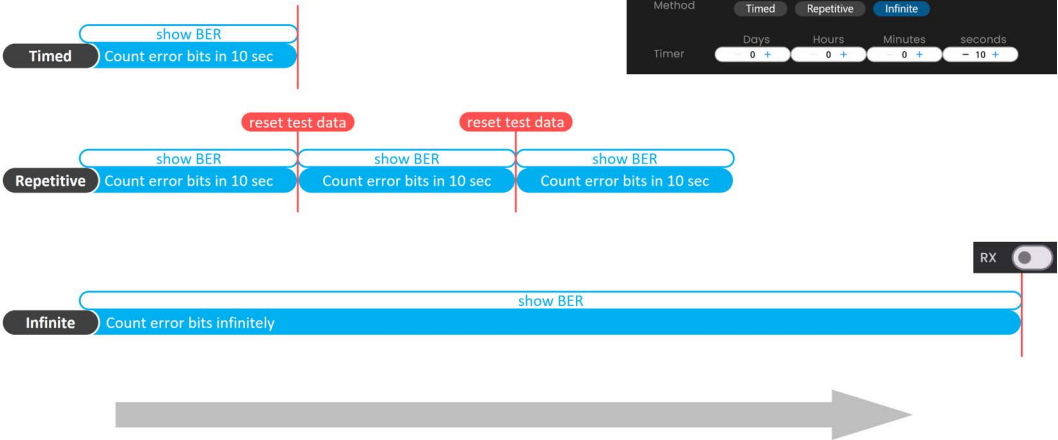
- **Days**
- **Hours**
- **Minutes**
- **Seconds**



2x 400G Mode

Alarm & Error Area

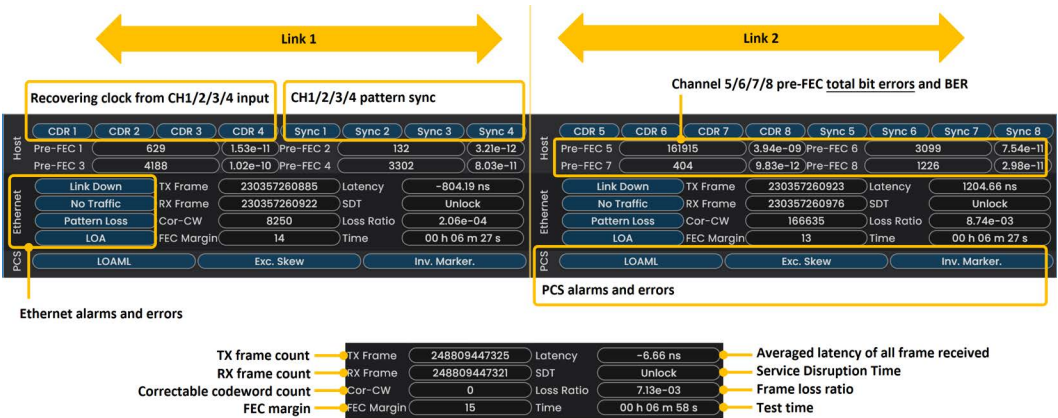
BER Configuration (2/2)



Alarm & Error Area

A

BER Monitor (1/2)



BER Monitor (2/2)

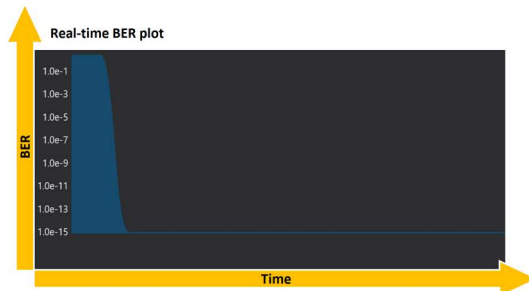
Layer	A/E	Alarm/Error	Note
Physical	A	CDR	Recover clock from input Blue – successfully recover clock Yellow – fail to recover clock (ex: LOS)
	A	Sync	Pattern sync Blue – successfully lock pattern Yellow – fail to lock pattern (ex: polarity inverted)
Ethernet	A	Link Down	There is a local/remote fault condition.
	A	No Traffic	Test is running but no pattern traffic received in the last second.
	A	Pattern Loss	>20% bit errors received Reference sequence unambiguously identified as out of phase Frame loss
PCS	A	LOA	Loss of Alignment Alignment of codeword marker not found
	A	LOAML	Loss of Alignment Marker Lock In lock mode, four consecutive marker values received do not match the AM that the lane is currently locked to. LOAML is cleared when the PCS lane is declared Lock and two valid AM 16384 blocks (66b) apart are received.
	A	Exc. Skew	Excessive Skew Skew exceeds defined threshold.
	A	Inv. Marker	Invalid Marker There are errors in 66-bit block AM.

Main Area - BER Monitor

2

a BER Monitor

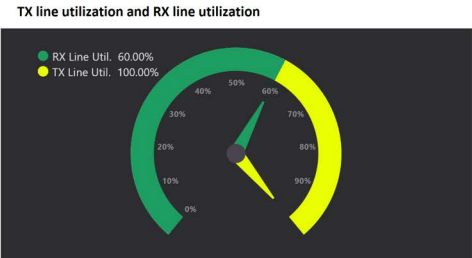
BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram	BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram
BER Monitor	Single Screen			FEC		RX Taps	PCS Lane Errors &		MCB		Histogram



b

Line Utilization

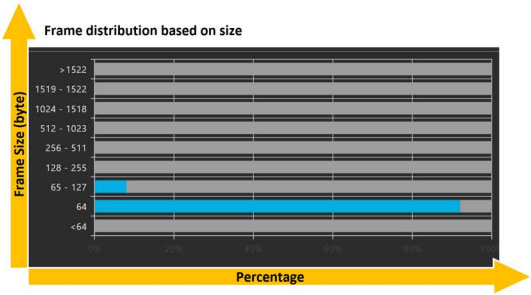
BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram	BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram
BER Monitor	Single Screen			FEC		RX Taps	PCS Lane Errors &		MCB		Histogram



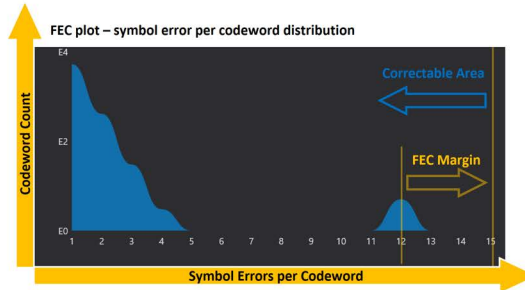
c

Frame Distribution

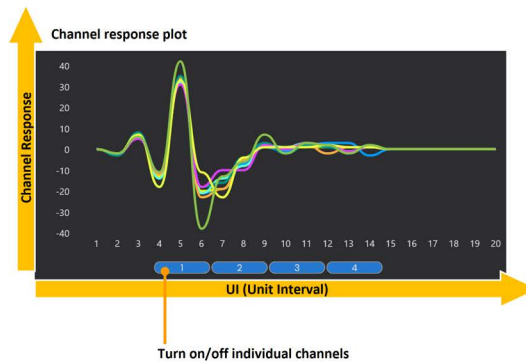
BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram	BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram
BER Monitor	Single Screen			FEC		RX Taps	PCS Lane Errors &		MCB		Histogram



d FEC Margin



e RX Taps

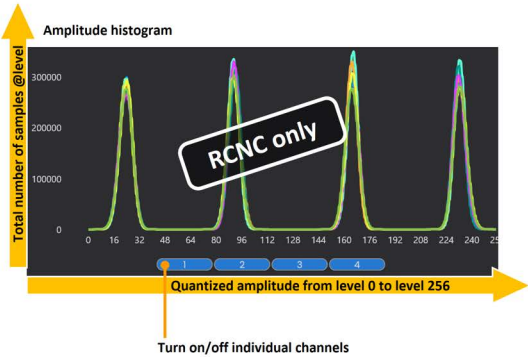


2x 400G Mode

Main Area - BER Monitor

f Histogram

BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram	BER Monitor	Line	Frame Dist.	FEC Margin	RX Taps	Histogram
BER Monitor	Single Screen			FEC	RX Taps	PCS Lane Errors &			MCB		Histogram



Main Area

2

Single Screen

BER Monitor and **Single Screen** display the same plot information. **Single Screen** plot is double in size of **BER Monitor** plot.

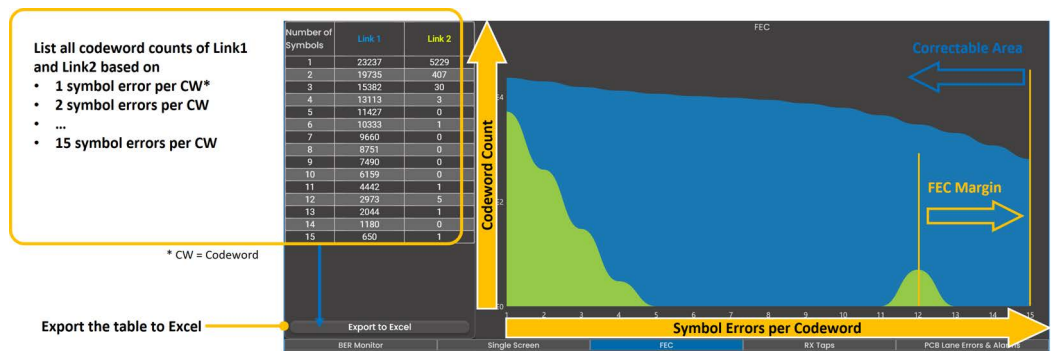
Select plot of **Link 1** or **Link 2** to display in main area



[BER Monitor] and [Single Screen] show the same plot information.
[Single Screen] plot is doubled size of [BER Monitor] plot.

FEC

The FEC plot of **Symbol Errors per Codeword** vs. **Codeword Count** helps you know the behavior of error distribution by getting a high or low FEC margin. There are symbol errors that are uncorrectable or not.



RX Taps

Intersymbol interference (ISI) affects BER. The less ISI, the better BER.

With the **Channel Simulator** function, you can know how serious the ISI of the input signal is. It provides impulse response within 8 pre-cursors, a main cursor, and 23 post-cursors. The 0 % axis is a reference. For all cursors except the main one, the further distance from 0 % axis, the worse signal quality.

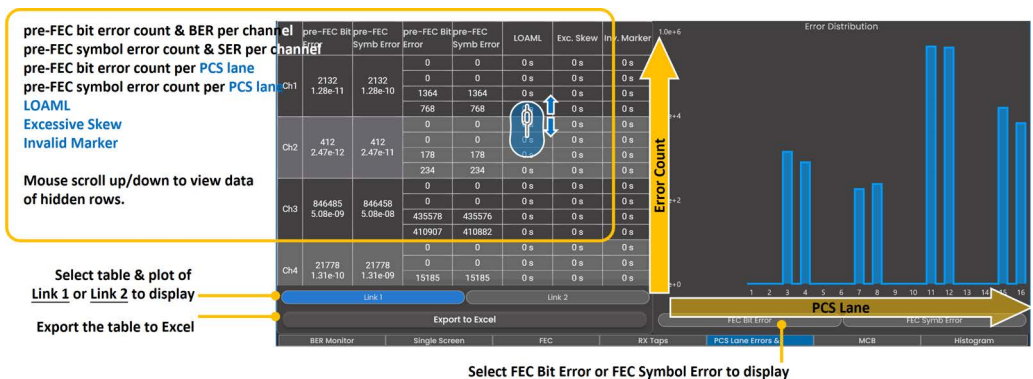
The **Channel Simulator** lists all cursor values of 8 channels. Based on the table, users can tune taps of the transmitter to compensate ISI.



PCS Lane Errors & Alarms

This function displays the channel's bit error count, symbol error count, BER and SER in order to know error information.

It displays the PCS lane's bit error count, symbol error count, and LOAML, Excessive Skew and Invalid Marker values.



2x 400G Mode

Main Area

MCB

Control Interface pin layout mode
Default = 800G MCB rev. H and after
Legacy = 800G MCB rev. G and before

MCB form factor

Read voltage from TRX

Display info on front-panel right screen

Display long info on the right screen

Low-speed signals (OSFP)

R = Directly read single Byte at address
W = Directly write single Byte at address

I2c Mode: Default, Legacy

Board Type: OSFP, OSFPDD

Power Supply: 0.000000 V

Status: None, Set

Message Line: Set

HW Signals: LPWn, RSTn, PRSn, Int

I2c register: Address, Value, R, W

Set LED color on front-panel right screen

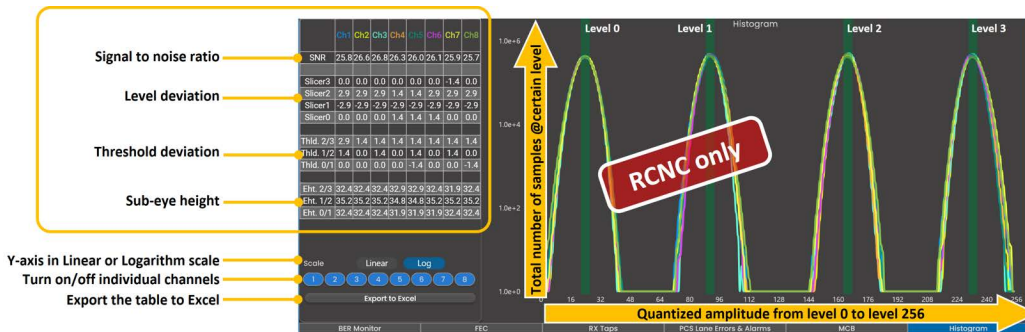
Show different low-speed signals based on Board Type, OSFP or OSFP-DD

How to Read
step 1. Type address in HEX
step 2. Press the button [R]
step 3. Read value (a byte) at the specified address

How to Write
step 1. Type address in HEX
step 2. Type value in HEX
step 3. Press the button [W]

Histogram

This function displays signal level distribution to get an idea of linearity.



Sub Control Area

3

RX/TX Configuration (1/3)

Turn on/off Link

Link: ☒ On ☐ Off

Config: ☒ Traffic

All: ☒ SW Latency: 0

Turn on/off TX CH polarity inversion

TX Invert: ☒ On ☐ Off

Turn on/off RX CH polarity inversion

RX Invert: ☒ On ☐ Off

Pre Cursor3: 0.00 % Pre Cursor2: 0.00 % Pre Cursor1: -5.00 %

Amplitude: 400 mV

Post Cursor1: 10.00 % Post Cursor2: 0.00 % Post Cursor3: 0.00 %

Lower Eye: 0.00 % Upper Eye: 0.00 %

Software latency tuning

- Manually key latency in ns, and then press [Set] button

Latency: 4.13 ns → 5.87 (ns) → Set → Latency: 10.00 ns

- Automatically compensate latency to zero

Latency: 4.13 ns → Align → Latency: 0.00 ns

Set PPG

- amplitude in mV_{ppd}
- pre-cursors (3 taps)
- post-cursors (3 taps)
- upper sub-eye height
- lower sub-eye height

RX/TX Configuration (2/3)

Link

On

Off

Config

Traffic

Link 1

Link 2

SW Latency

Set

Align

Selected Port: All

Pattern

Tx Pattern

PN31

☐ Invert

Rx Pattern

PN31

☐ Invert

Apply

Ethernet Frame

Frame Size (byte)

Fixed

64

Min 64 - Max 16000

TX Rate (%)

100.00

%

Min 0.00 - Max 100.00

Apply

MAC

Source MAC Address

06:07:08:09:0a:0b

Destination MAC Address

00:01:02:03:04:05

EtherType

0x88b7

Apply

Latency & Exc. Skew

Latency

On

Off

Exc. Skew

4038

Set

Close

TX/RX pattern inversion

Set Ethernet frame size (byte)

Fixed size

EMIX (sequence length)

Traffic shaping –

Transmission rate in % of utilization

(100% by default)

Source MAC address

Destination MAC address

EtherType

Enable/disable latency info in frame

In some cases, disable latency to increase interoperability

Excessive skew threshold

0x0000 when Network Layer is set to None

0x0000 for IPv4

0x86DD for IPv6

0x8847 for MPLS

0x88b7 when Network Layer is set to None with EtherBERT test

0x8902 for s-OAM

0xAEEF for eCPRI Framed Layer 2 (no IP/UDP) and is not configurable

Error Injection

All-link control
or individual link control

All
Link 1
Link 2

Type
FEC-UNCOR-CW

Defect
Rate

Ethernet error type

- FEC-UNCOR-CW
- 66B Block
- FEC-COR-CW
- FEC-SYMB

Rate1e-06

Injection type

- Rate | Value – X e-Y
- Burst | Value – burst count

Inject Error
Start
Stop

Active Error Type
FEC-UNCOR-CW
66B Block
FEC-COR-CW
FEC-SYMB

Display which error type is active

Type
FEC-SYMB

Defect
Burst

Value10

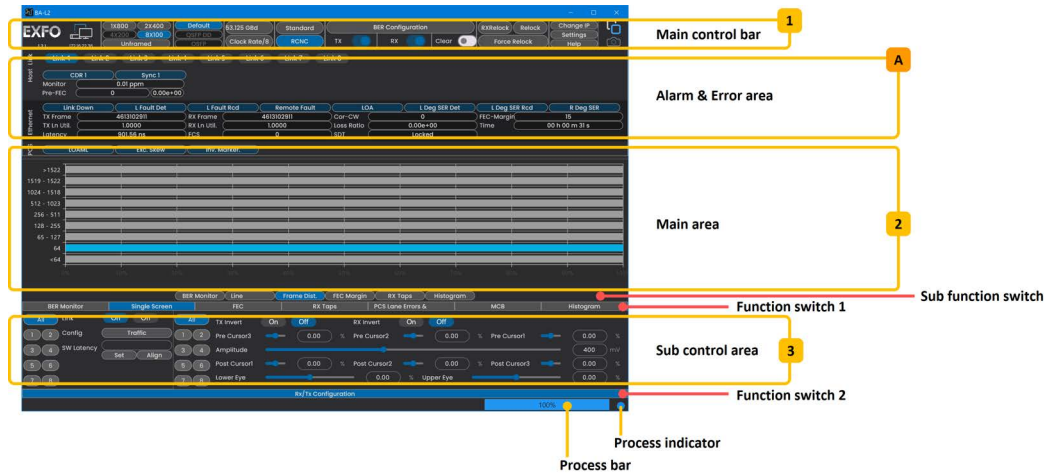
Lane1Lane2Lane3Lane4Lane5Lane6Lane7Lane8

Lane9Lane10Lane11Lane12Lane13Lane14Lane15Lane16

Individual PCS lane control

5 8x 100G Mode

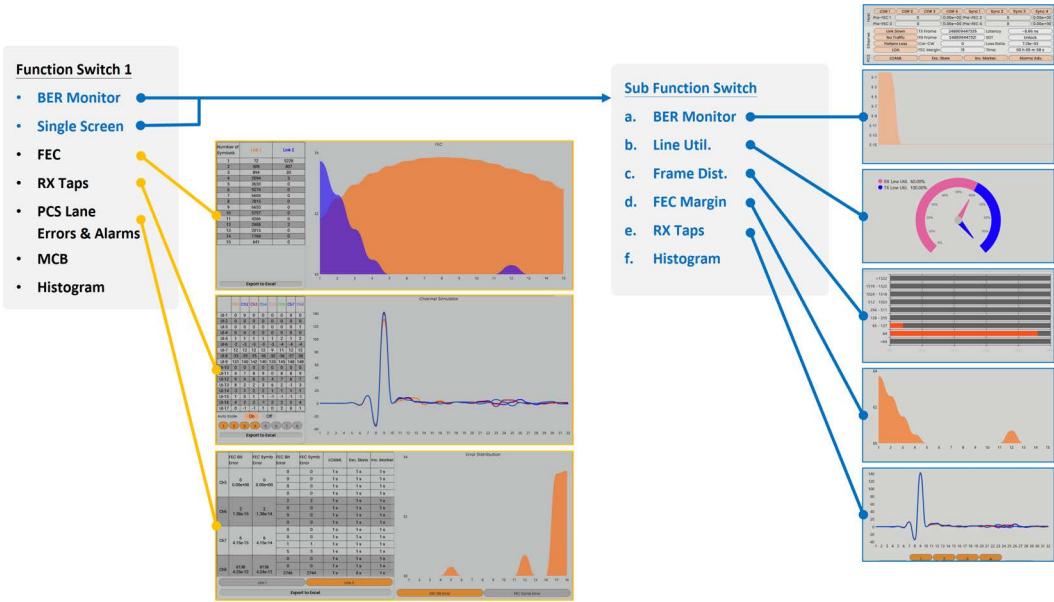
GUI Sections



8x 100G Mode

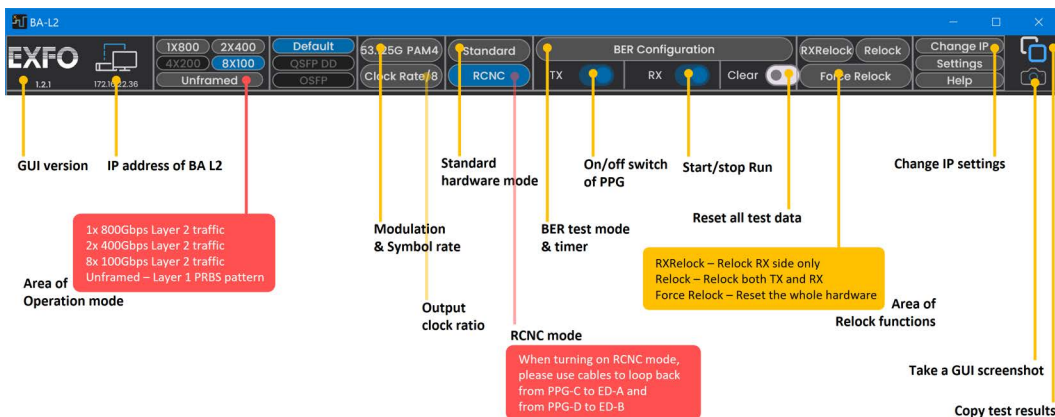
GUI Sections

GUI Map



Main Control Bar

1



BER Configuration (1/2)

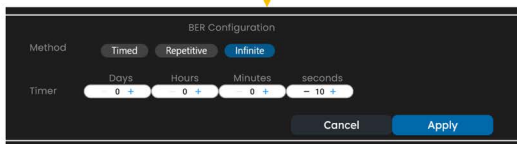


Click **BER Configuration** button and select test method:

- Timed
- Repetitive
- Infinite (Nonstop until RX button is off)

Set Timer for Timed or Repetitive test method:

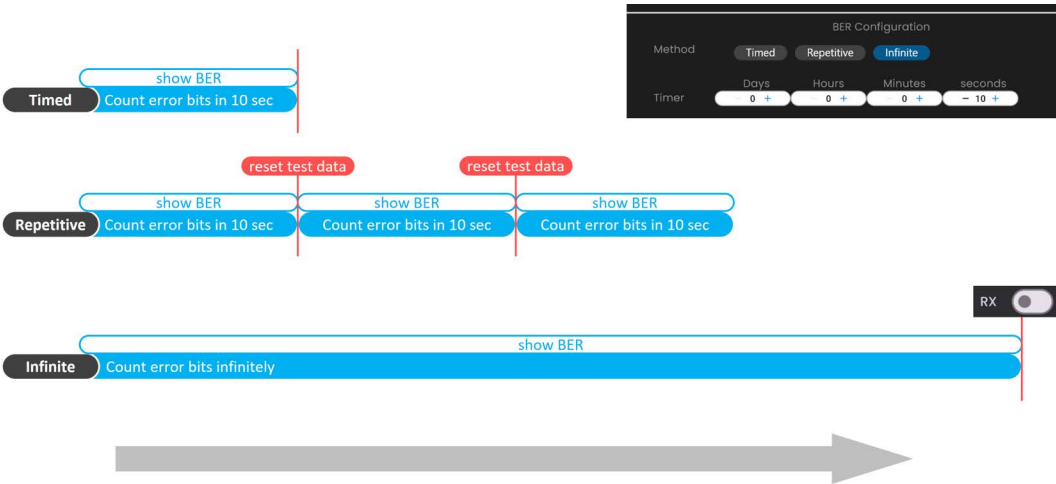
- Days
- Hours
- Minutes
- Seconds



8x 100G Mode

Alarm & Error Area

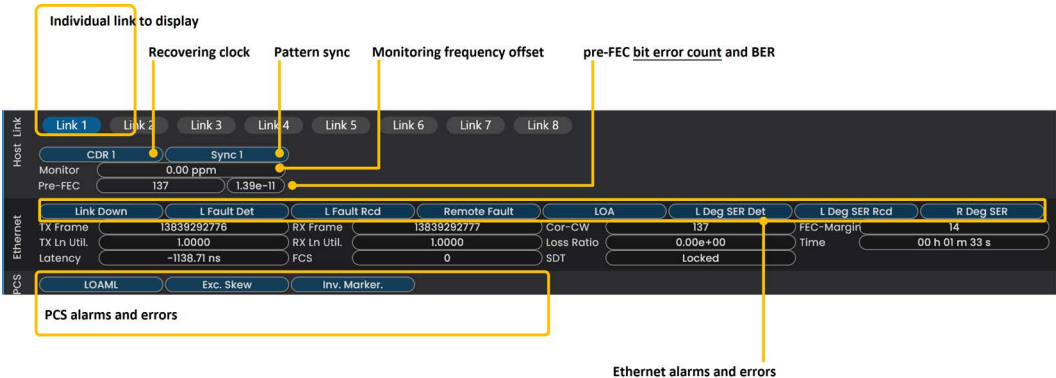
BER Configuration (2/2)



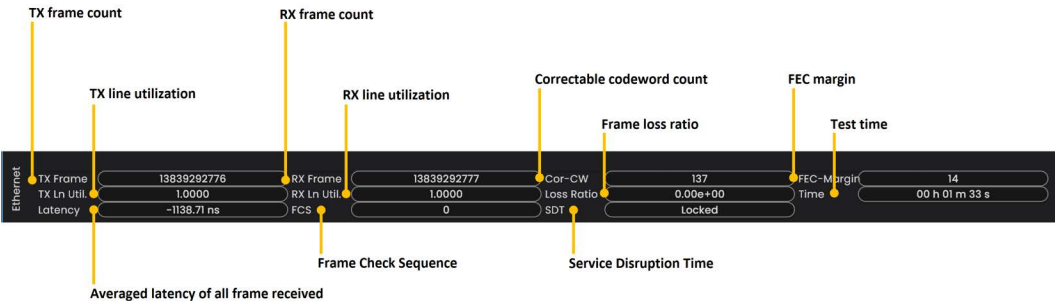
Alarm & Error Area

A

Single Screen (1/3)



Single Screen (2/3)

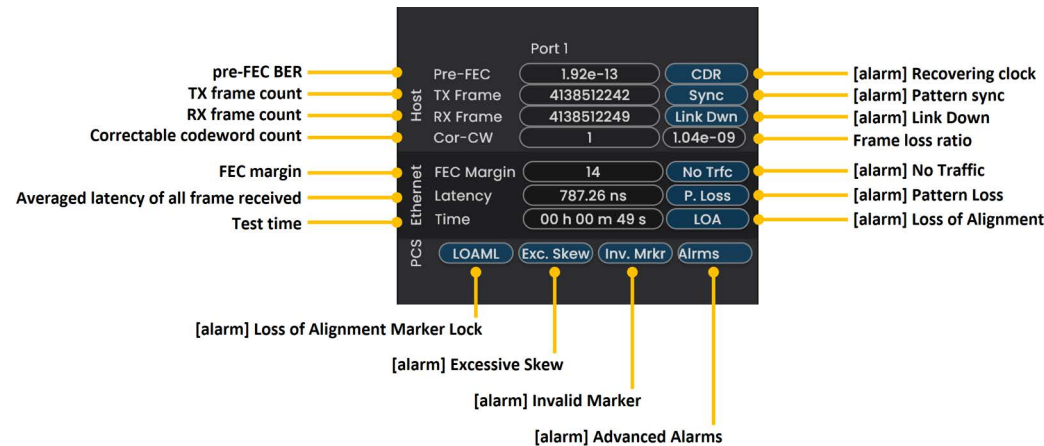


Single Screen (3/3)

Layer	A/E	Alarm/Error	Note
Physical	A	CDR	Recover clock from input Blue – successfully recover clock Yellow – fail to recover clock (ex: LOS)
	A	Sync	Pattern sync Blue – successfully lock pattern Yellow – fail to lock pattern (ex: polarity inverted)
Ethernet	A	Link Down	There is a local/remote fault condition.
	A	L Fault Det	Local Fault Detected Loss of bit sync, Loss of Block sync, Link Down, or High BER
	A	L Fault Rcd	Local Fault Received Received data path contains Local Fault signal
	A	Remote Fault	Received data path contains Remote Fault status
	A	LOA	Loss of Alignment Alignment of codeword marker not found
	A	L Deg SER Det	Local Degraded SER Detected Local FEC degraded SER condition detected
	A	L Deg SER Rcd	Local Degraded SER Received Local degraded SER signal received
PCS	A	R Deg SER	Remote Degraded SER Remote degraded SER signal detected
	A	LOAML	Loss of Alignment Marker Lock In lock mode, four consecutive marker values received do not match the AM that the lane is currently locked to. LOAML is cleared when the PCS lane is declared Lock and two valid AM 16384 blocks (66b) apart are received.
	A	Exc. Skew	Excessive Skew Skew exceeds defined threshold.
	A	Inv. Marker	Invalid Marker There are errors in 66-bit block AM.

Main Area

BER Monitor (1/2)

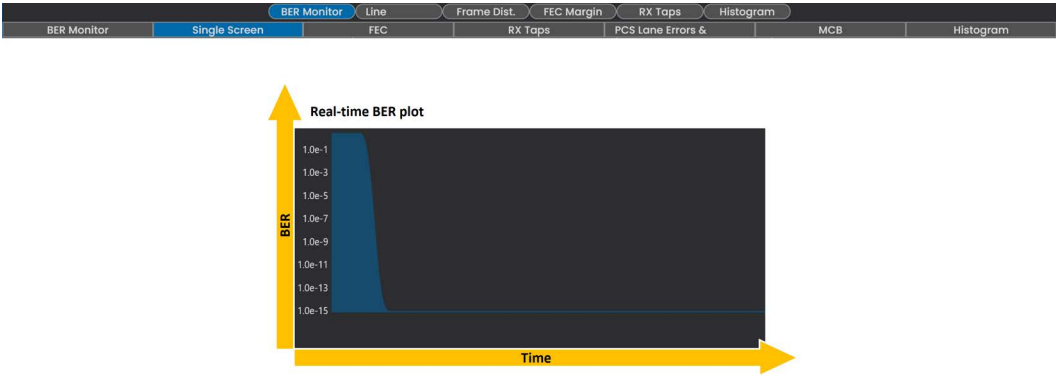


BER Monitor (2/2)

Layer	A/E	Alarm/Error	Note
Physical	A	CDR	Recover clock from input Blue – successfully recover clock Yellow – fail to recover clock (ex: LOS)
	A	Sync	Pattern sync Blue – successfully lock pattern Yellow – fail to lock pattern (ex: polarity inverted)
Ethernet	A	Link Down	There is a local/remote fault condition.
	A	No Traffic	Test is running but no pattern traffic received in the last second.
	A	Pattern Loss	>20% bit errors received Reference sequence unambiguously identified as out of phase Frame loss
	A	LOA	Loss of Alignment Alignment of codeword marker not found
PCS	A	LOAML	Loss of Alignment Marker Lock In lock mode, four consecutive marker values received do not match the AM that the lane is currently locked to. LOAML is cleared when the PCS lane is declared Lock and two valid AM 16384 blocks (66b) apart are received.
	A	Exc. Skew	Excessive Skew Skew exceeds defined threshold.
	A	Inv. Marker	Invalid Marker There are errors in 66-bit block AM.
	A	Alarms Adv.	Advanced Alarms

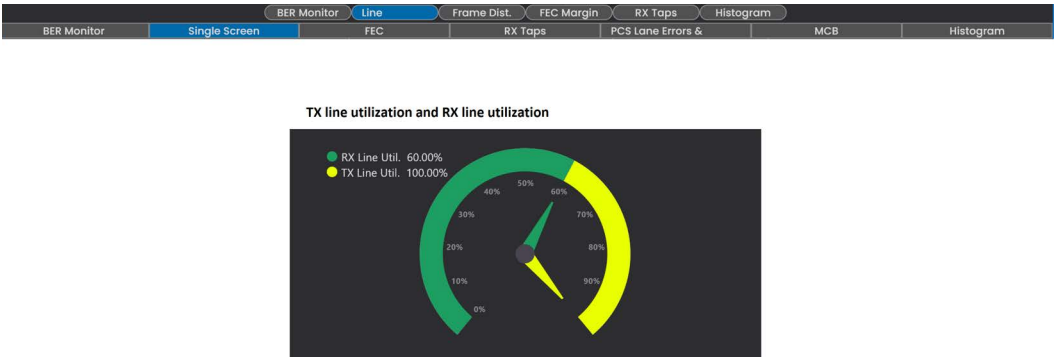
a

Single Screen - BER Monitor

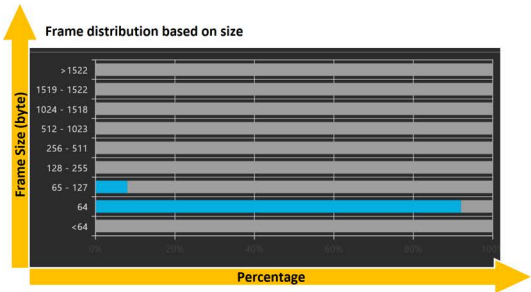


b

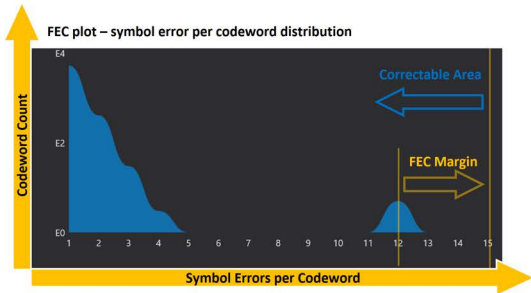
Single Screen - Line Utilization

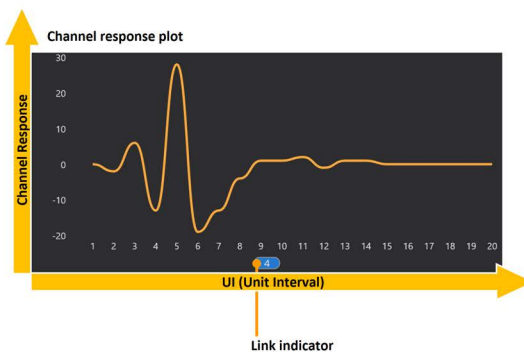
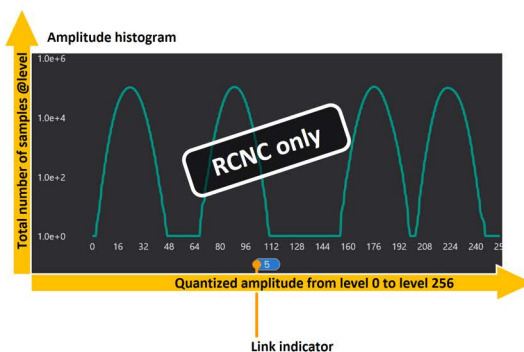


c Single Screen - Frame Distribution



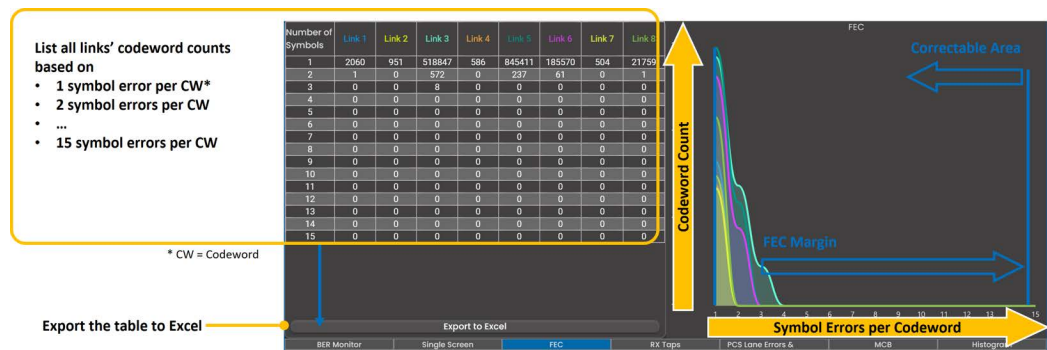
d Single Screen - FEC Margin



e Single Screen - RX Taps**f** Single Screen - Histogram (RNC Only)

FEC

The FEC plot of **Symbol Errors per Codeword** vs. **Codeword Count** helps you know the behavior of error distribution by getting a high or low FEC margin. There are symbol errors that are uncorrectable or not.



RX Taps

Intersymbol interference (ISI) affects BER. The less ISI, the better BER.

With the **Channel Simulator** function, you can know how serious the ISI of the input signal is. It provides impulse response within 8 pre-cursors, a main cursor, and 23 post-cursors. The 0 % axis is a reference. For all cursors except the main one, the further distance from 0 % axis, the worse signal quality.

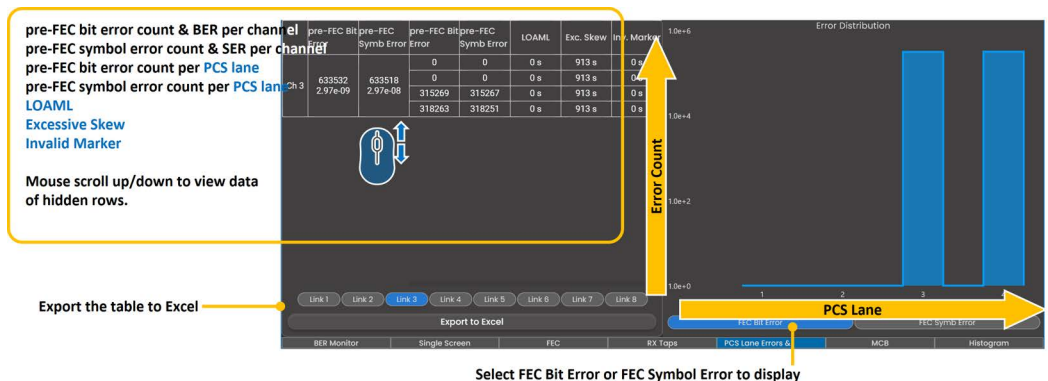
The **Channel Simulator** lists all cursor values of 8 channels. Based on the table, users can tune taps of the transmitter to compensate ISI.



PCS Lane Errors & Alarms

This function displays the channel's bit error count, symbol error count, BER and SER in order to know error information.

It displays the PCS lane's bit error count, symbol error count, and LOAML, Excessive Skew and Invalid Marker values.



8x 100G Mode

Main Area

MCB

Control Interface pin layout mode
Default = 800G MCB rev. H and after
Legacy = 800G MCB rev. G and before

MCB form factor

Read voltage from TRX

Display info on front-panel right screen

Display long info on the right screen

Low-speed signals (OSFP)

R = Directly read single Byte at address
W = Directly write single Byte at address

I2c Mode: Default, Legacy

Board Type: OSFP, QSFPDD

Power Supply: 0.000000 V

Status: None, **Set** (Set LED color on front-panel right screen)

Message Line: Set

HW Signals: LPWn, RSTn, PRSn, Int

I2c register: Address, null, Value, null, R, W

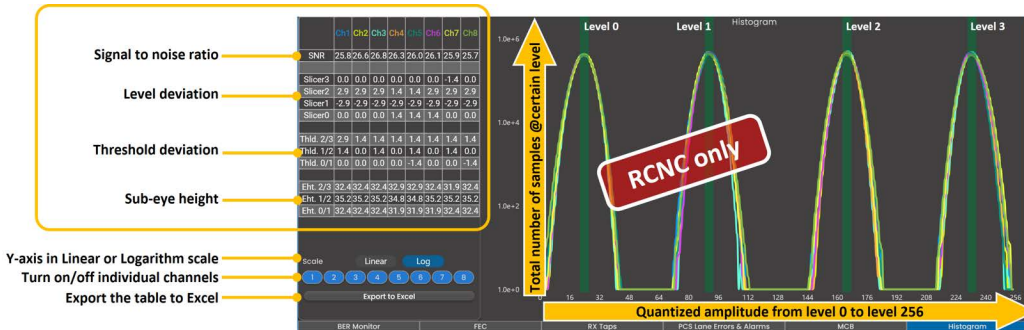
Show different low-speed signals based on Board Type, OSFP or QSFP-DD

How to Read
step 1. Type address in HEX
step 2. Press the button [R]
step 3. Read value (a byte) at the specified address

How to Write
step 1. Type address in HEX
step 2. Type value in HEX
step 3. Press the button [W]

Histogram

This function displays signal level distribution to get an idea of linearity.



Sub Control Area

3

RX/TX Configuration (1/3)

The screenshot shows the RX/TX Configuration interface with several key areas highlighted by yellow boxes and lines:

- Turn on/off Link:** A box around the 'Link' toggle (On/Off) and the 'All' button.
- All-channel control or individual channel control:** A box around the 'All' button and the channel selection buttons (1-8).
- Turn on/off TX CH polarity inversion:** A box around the 'TX Invert' toggle (On/Off).
- Turn on/off RX CH polarity inversion:** A box around the 'RX Invert' toggle (On/Off).
- SW Latency:** A box around the 'SW Latency' field (0) and the 'Set' and 'Align' buttons.
- Set PPG:** A box around the 'Pre Cursor3', 'Pre Cursor2', 'Pre Cursor1', 'Post Cursor1', 'Post Cursor2', 'Post Cursor3', 'Lower Eye', and 'Upper Eye' sliders and their corresponding numerical values.

Software latency tuning

- Manually key latency in ns, and then press [Set] button


```
Latency( 4.13 ns ) → 5.87 (ns) → Set → Latency( 10.00 ns )
```
- Automatically compensate latency to zero


```
Latency( 4.13 ns ) → Align → Latency( 0.00 ns )
```

Set PPG

- amplitude in mV_{ppd}
- pre-cursors (3 taps)
- post-cursors (3 taps)
- upper sub-eye height
- lower sub-eye height

RX/TX Configuration (2/3)

TX/RX pattern inversion

Set Ethernet frame size (byte)

- Fixed size
- EMIX (sequence length)

Traffic shaping – Transmission rate in % of utilization (100% by default)

Source MAC address
Destination MAC address
EtherType

Enable/disable latency info in frame
In some cases, disable latency to increase interoperability

Excessive skew threshold

Line Config Traffic On Off

SW Latency set Align

Selected Port: All

Pattern TX Pattern PN31 Invert RX Pattern PN31 Invert Apply

Ethernet Frame Frame Size (byte) Fixed 64 Min 64 - Max 10000 TX Rate (%) 100.00 % Min 0.00 - Max 100.00 Apply

MAC Source MAC Address 08:07:08:09:0a:0b Destination MAC Address 08:01:02:03:04:05 EtherType 0x88b7 Apply

Latency & Exc. Skew Latency On Off Exc. Skew 4038 set Close

0x0000 when Network Layer is set to None
0x0800 for IPv4
0x86DD for IPv6
0x8847 for MPLS
0x88b7 when Network Layer is set to None with EtherBERT test
0x8902 for S-OAM
0xAEEF for eCPRI Framed Layer 2 (no IP/UDP) and is not configurable

64 (CONFIDENTIAL - for EXFO customer only)

BA-4000-L2

RX/TX Configuration (3/3)

EMIX

64

Min: 64

Max: 16000

1

2

3

4

5

6

7

8

9

0

⌂

OK

Cancel

Click to customize number

EMIX

Sequence Length

8

EMIX Frame Size

64

128

256

512

1024

1280

1518

9600

Link 2

Link 3

Link 4

Link 5

Link 6

Link 7

Link 8

Cancel

Apply

EMIX frame sequence is repeated continuously.

How many frame size values to run

Default values below

• 1 [64]

• 2 [64] [128]

• 3 [64] [128] [256]

• 4 [64] [128] [256] [512]

• 5 [64] [128] [256] [512] [1024]

• 6 [64] [128] [256] [512] [1024] [1280]

• 7 [64] [128] [256] [512] [1024] [1280] [1518]

• 8 [64] [128] [256] [512] [1024] [1280] [1518] [9600]

1122

1118

1114

1110

1106

1102

1098

1094

1090

1086

1082

1078

1074

1070

1066

1062

1058

1054

1050

1046

1042

1038

1034

1030

1026

1022

1018

1014

1010

1006

1002

998

994

990

986

982

978

974

970

966

962

958

954

950

946

942

938

934

930

926

922

918

914

910

906

902

898

894

890

886

882

878

874

870

866

862

858

854

850

846

842

838

834

830

826

822

818

814

810

806

802

798

794

790

786

782

778

774

770

766

762

758

754

750

746

742

738

734

730

726

722

718

714

710

706

702

698

694

690

686

682

678

674

670

666

662

658

654

650

646

642

638

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626

622

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606

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446

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430

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422

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226

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218

214

210

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202

198

194

190

186

182

178

174

170

166

162

158

154

150

146

142

138

134

130

126

122

118

114

110

106

102

98

94

90

86

82

78

74

70

66

62

58

54

50

46

42

38

34

30

26

22

18

14

10

6

2

8x 100G Mode

Sub Control Area

Error Injection

All-link control or individual link control

Ethernet error type

- FEC-UNCOR-CW
- FEC-COR-CW
- FEC-SYMB

Injection type

- Rate | Value – X e-Y
- Burst | Value – burst count

Start to inject errors

Active Error Type

FEC-UNCOR-CW

FEC-COR-CW

FEC-SYMB

Display which error type is active

Individual PCS lane control

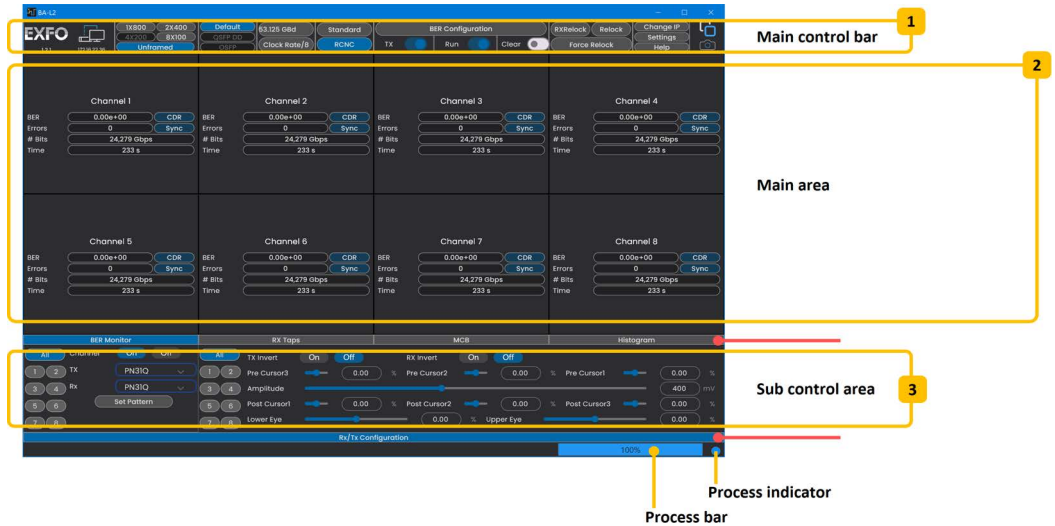
Value: 10

Lane1 Lane2 Lane3 Lane4 Lane5 Lane6 Lane7 Lane8

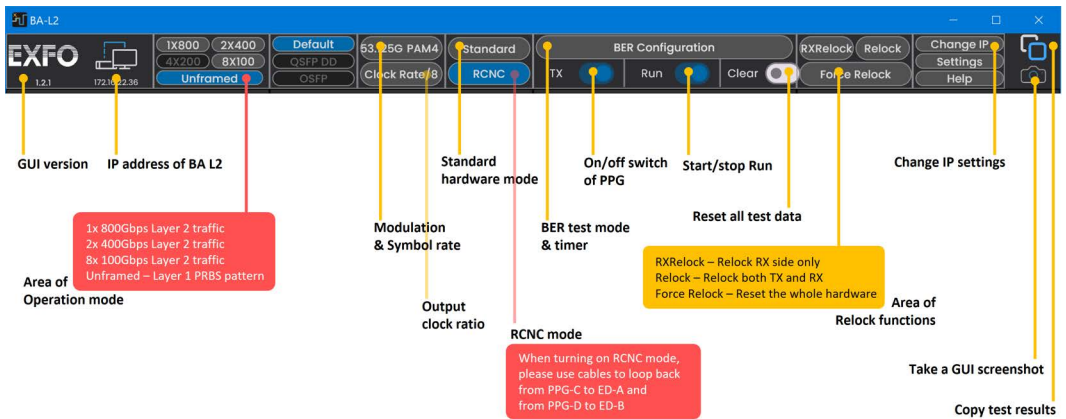
Lane9 Lane10 Lane11 Lane12 Lane13 Lane14 Lane15 Lane16

6 Unframed Mode

GUI Sections



Main Control Bar



Unframed Mode

Main Control Bar

BER Configuration (1/2)

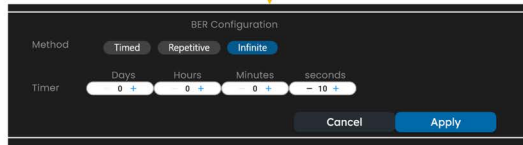


Click **BER Configuration** button and select test method:

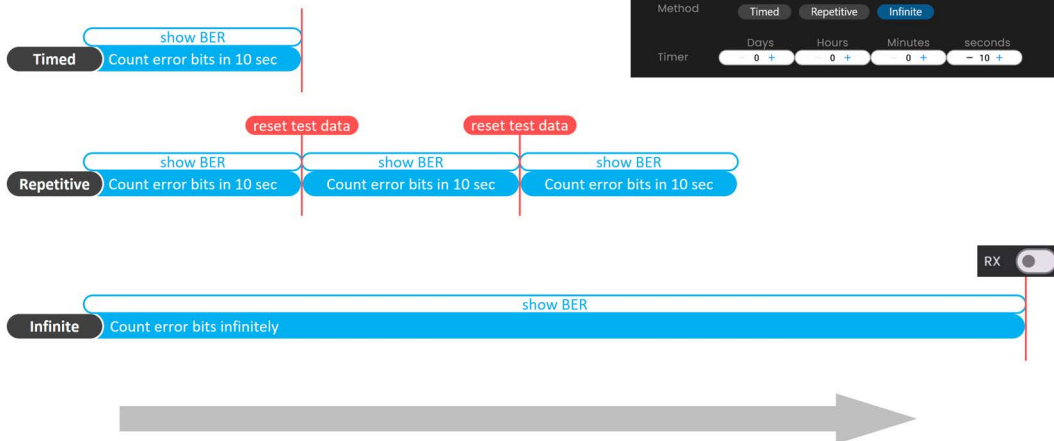
- **Timed**
- **Repetitive**
- **Infinite** (Nonstop until RX button is off)

Set Timer for **Timed** or **Repetitive** test method:

- **Days**
- **Hours**
- **Minutes**
- **Seconds**

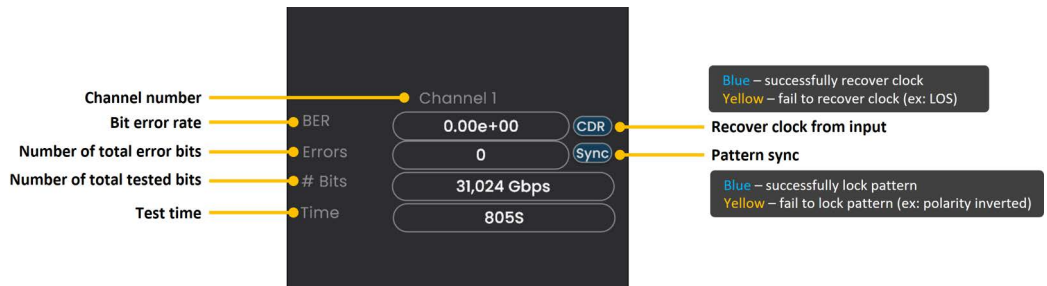


BER Configuration (2/2)



Main Area

BER Monitor



RX Taps

Intersymbol interference (ISI) affects BER. The less ISI, the better BER.

With the **Channel Simulator** function, you can know how serious the ISI of the input signal is. It provides impulse response within 8 pre-cursors, a main cursor, and 23 post-cursors. The 0 % axis is a reference. For all cursors except the main one, the further distance from 0 % axis, the worse signal quality.

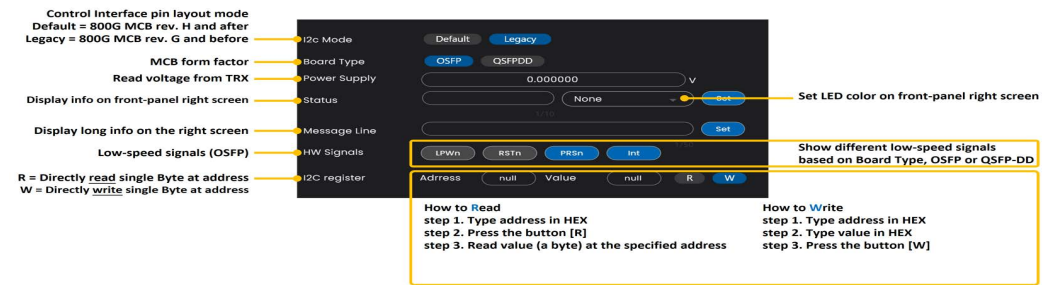
Unframed Mode

Main Area

The **Channel Simulator** lists all cursor values of 8 channels. Based on the table, users can tune taps of the transmitter to compensate ISI.

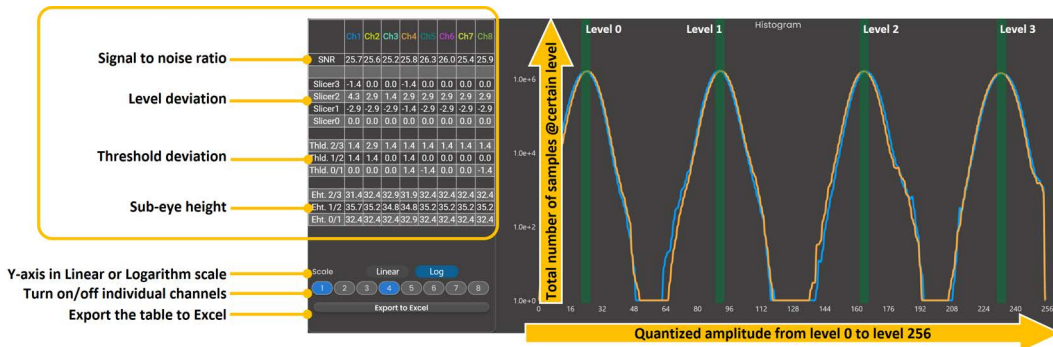


MCB



Histogram

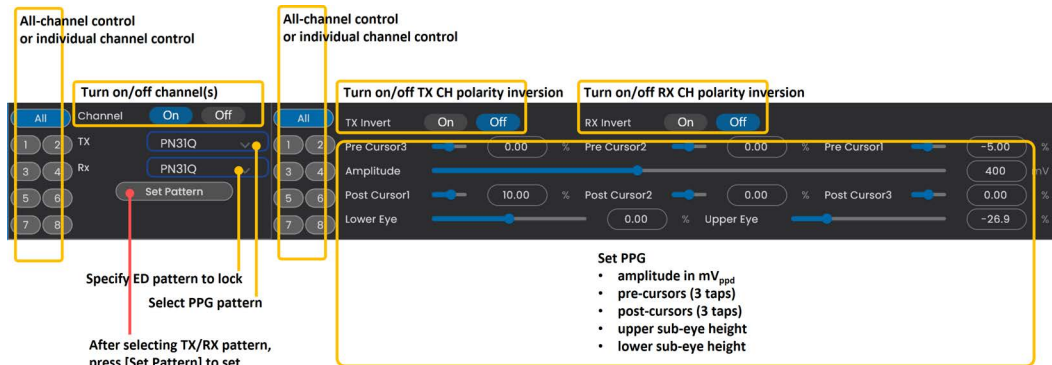
This function displays signal level distribution to get an idea of linearity.



Sub Control Area

3

RX/TX Configuration



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