User Guide

BA-4000

Bit Analyzer

www.EXFO.com

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Patents

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

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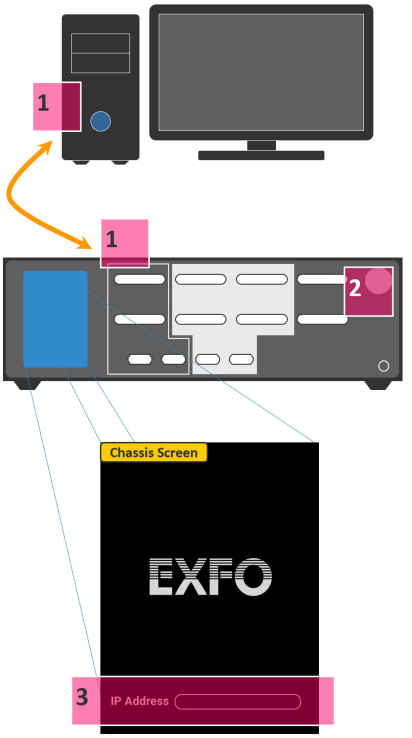
1 5 Steps to Measure BER

Step 1: Hardware Configuration

To power on the unit:

1. Connect the Ethernet cable from the control PC to the RJ45 port on the rear of the chassis.
2. Push power button on the front panel.
3. Wait for initialization including checking transmitter, receiver, detecting network, etc. Initialization is done when the IP address appears.

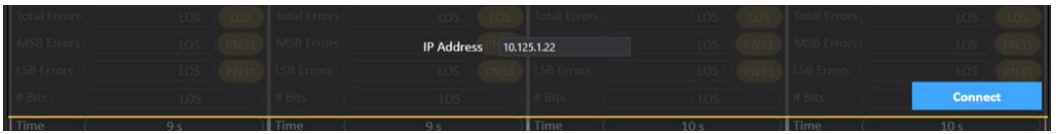
Note: *If the IP address does not appear after 5 min, it means the unit is not connected to an Ethernet device yet. Please check the Ethernet cable and RJ45 port on the PC.*



Step 2: Link to Bit Analyzer

To link to the BA (Bit Analyzer):

1. Input the IP address of the BA into the GUI, for example: 172.16.80.11. (An example of IP of control PC = 172.16.1.10, and subnet mask = 255.255.0.0.)

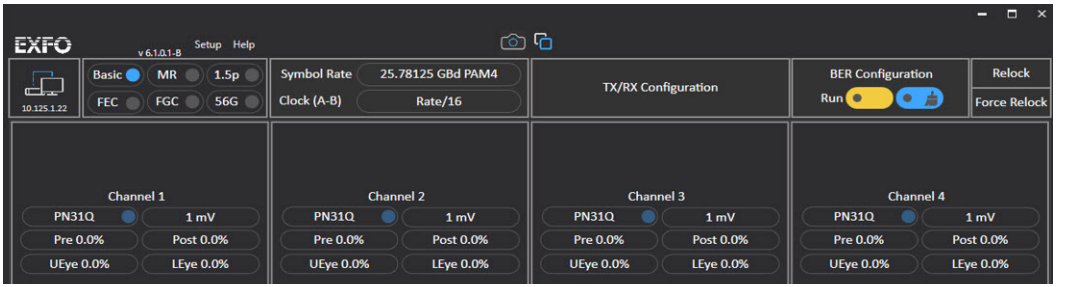


Note: *The IP address is shown on the chassis screen when initialization is completed.*

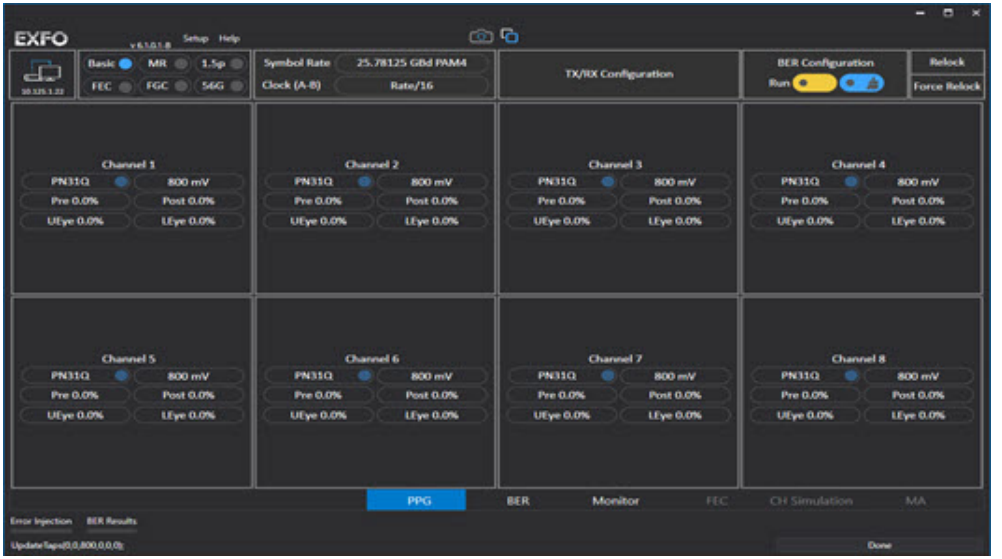
2. Click **Connect** button to enter the main control page.

There are 4 main areas to give you the whole control of the BA, across the top of the main control page, from left to right:

- Function Mode
- Modulation and Symbol Rate
- TX/RX Configuration
- BER Configuration
- Relock Method

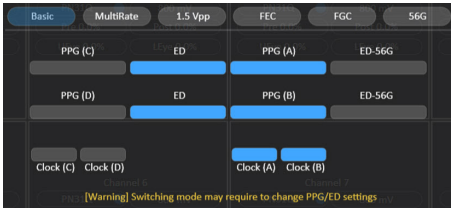


Step 3: Main Control Page



Function Mode

Click the Function Mode area (top-left side) of the main control page, to select the following options (dependent on purchased options):



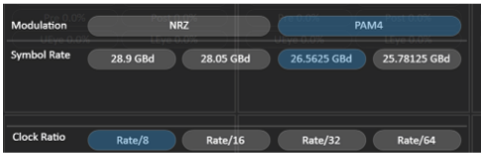
- **Basic** (default mode)
- **MultiRate** (option) enables specific rates from 10G to 28G.
- **1.5 Vpp** (option) activates max differential voltage peak to peak 1.5V.
- **FEC** (option) enables FEC simulator.
- **FGC** (option) enables FEC Generator and Checker functions.

Note: *After switching modes, changing PPG/ED connection may be required.*

Modulation and Symbol Rate

Clicking this area (second from left on the top of the control page) allows you to set the following items:

- **Modulation**
- **Symbol Rate**
- **Clock Ratio**



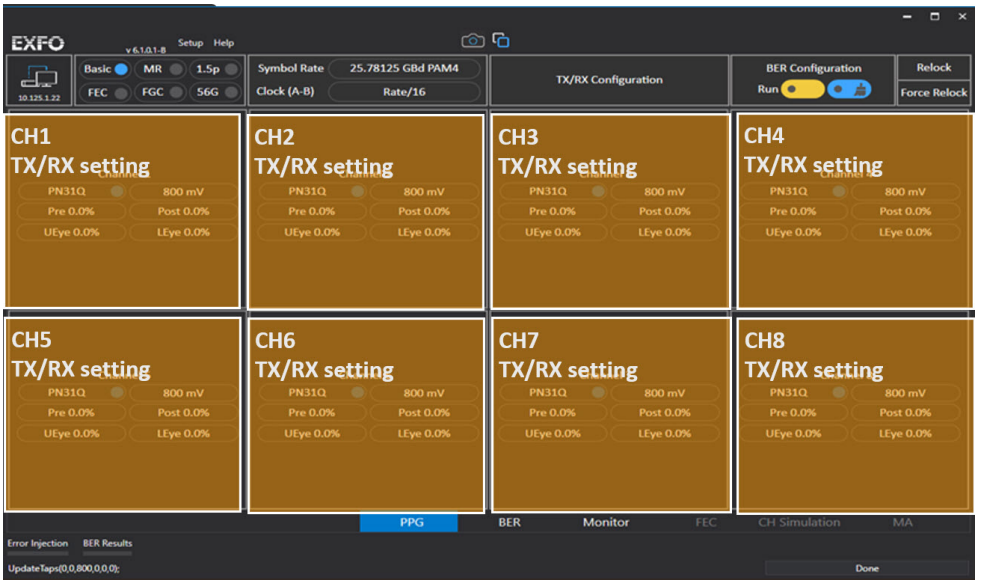
Note: *When selecting* ***Clock Ratio Rate/8*** *and* ***Symbol Rate 26.5625 GBd****, the output clock freq is 3.32 GHz.*

Step 4: TX/RX Configuration

Clicking this area (second from right on the top of the control page) allows you to set TX/RX configuration of all channels, as follows:

- **Test Pattern**
- **Amplitude**
- **Pre/Post-Cursor**
- **Upper/Lower Eye** (PAM4 only)
- **RX Polarity**

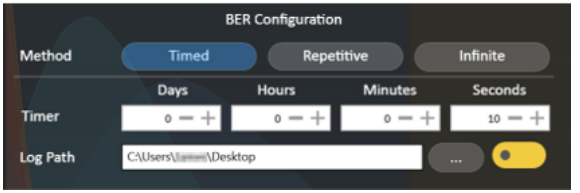
Note: *Individual channel settings are displayed below the 4 main areas (listed across the top of the main control page). Click on a channel to pop up an individual channel setting window.*



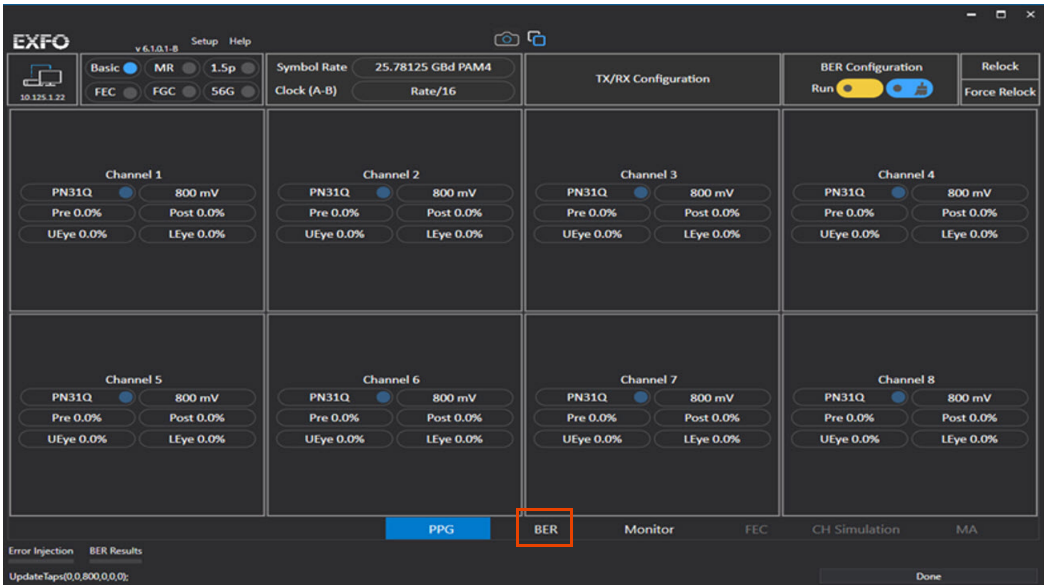
Step 5: BER Configuration

To set how to test BER of all channels:

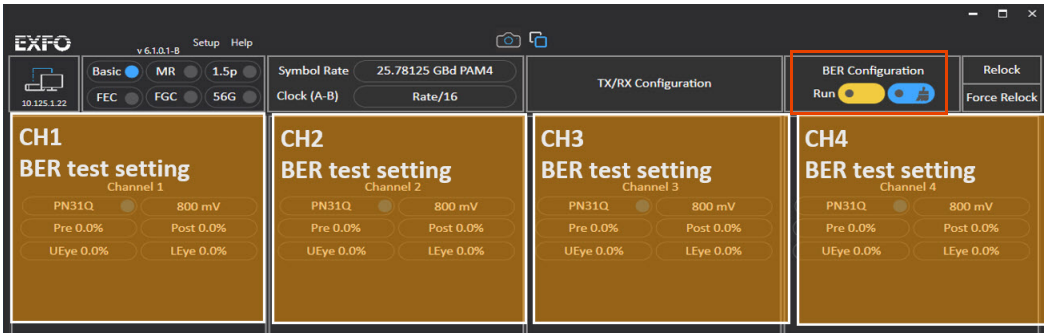
1. Click **BER Configuration** (top-right side) of the main control page.



2. Click **BER** tab to show BER Test Page.



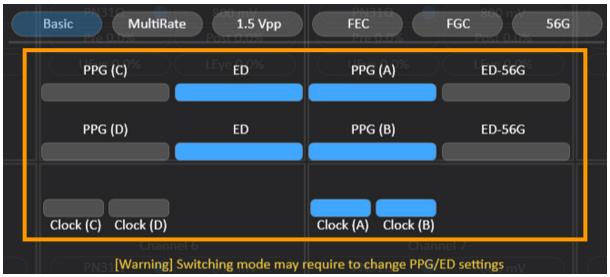
3. Switch on BER test to run test.



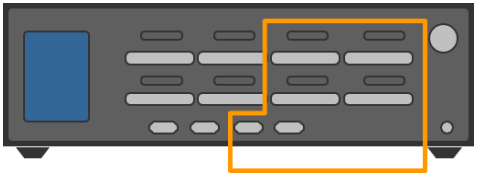
4. Click on a channel area to pop up an individual channel setting window.

2 GUI Indication

Guide to PPG/ED Connection

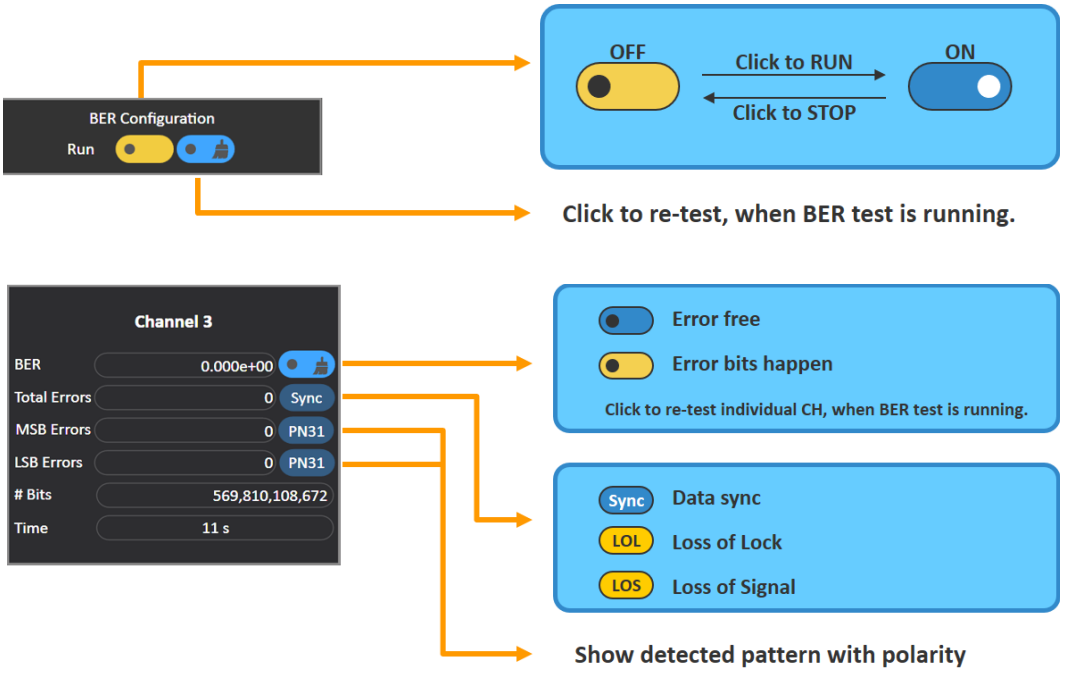


A different mode may require you to change the connection of PPG or ED. After selecting a mode, the GUI will show you how to connect PPG and ED. Please follow the layout.



BER Test Page

Switch and LED Indicators

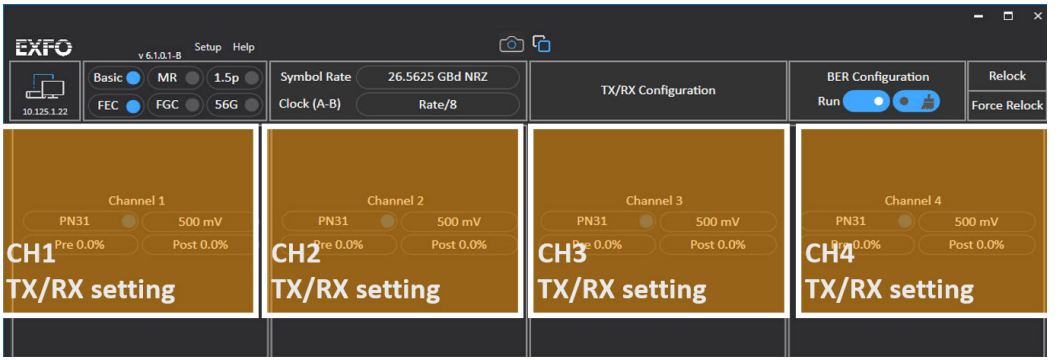


API Command and Progress Bar Status Info

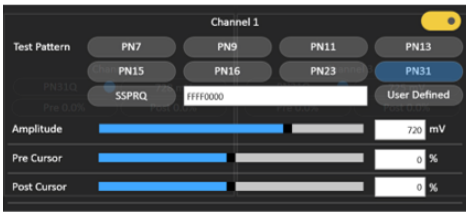
- The bottom left of the main control page displays the corresponding API command information during the process, for ease of use.
- The bottom-right progress bar displays the BA status information including whether or not the process is complete.

Channel ON/OFF Switch

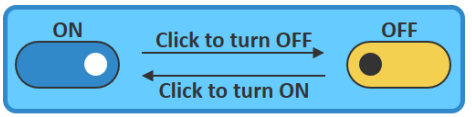
The PPG page allows you to switch individual channels on/off.



Click an individual channel box to enter its PPG setting window.



The switch is in the upper-right corner.



3 Advanced Guide

User Defined Test Pattern

To set the User Defined pattern as Clock:

1. Customize the pattern.
2. Click **User Defined**.

The **User Defined** pattern is always treated as NRZ, no matter what the data modulation is. Pattern length is 32-bit. Therefore, you can always get **/2 Clock Pattern** by $AAAAAAAA_{hex}$[1].

1. For BA-4000-x-28-NRZ, pattern length is 16 bits @10G signaling rate, and 40 bits @25G signaling rate. That is, $AAAA_{hex}$ @10G; $AAAAAAAAAA_{hex}$ @25G.

[Clock Pattern Frequency] = [Symbol Rate] x [Clock Ratio]

For example:

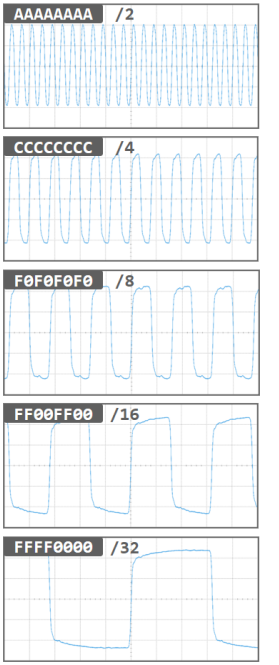
Symbol Rate = 26.5625 GBd

Clock Ratio = /8 ($F0F0F0F0_{hex}$)

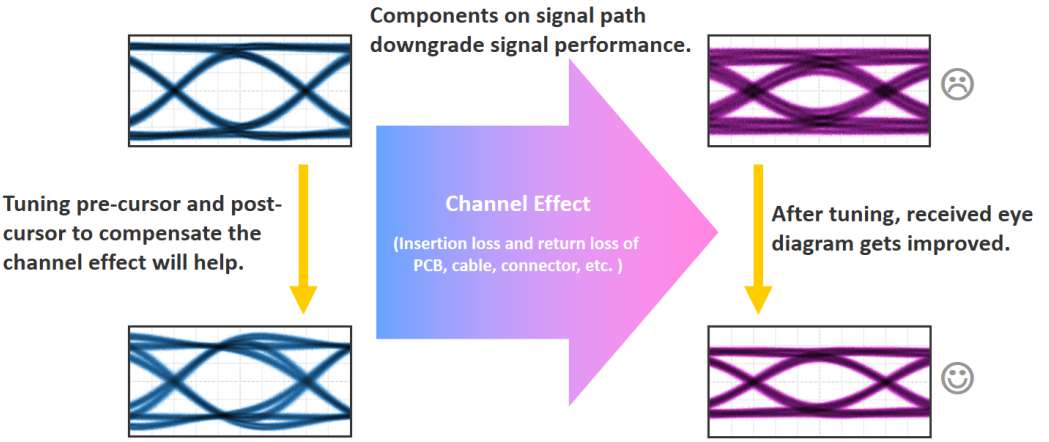
Clock Frequency = 3.32 GHz

Clock Ratio	Clock Pattern*
/2	AAAA AAAA
/4	CCCC CCCC
/8	F0F0 F0F0
/16	FF00 FF00
/32	FFFF 0000

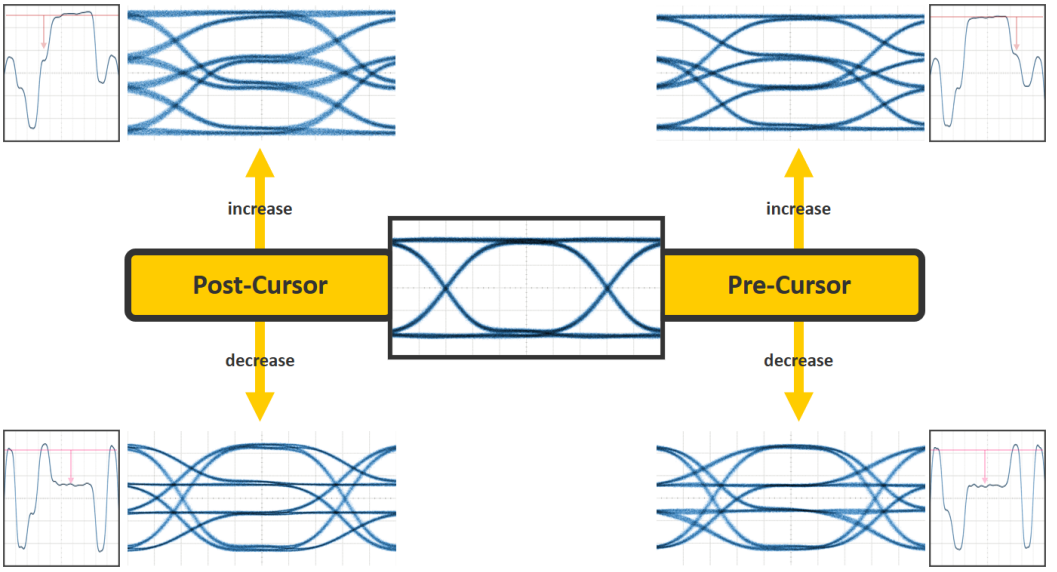
* Length of User Defined Pattern
= 32-bit long
= ☐☐☐☐☐☐☐☐ hex



Compensation of Channel Effect



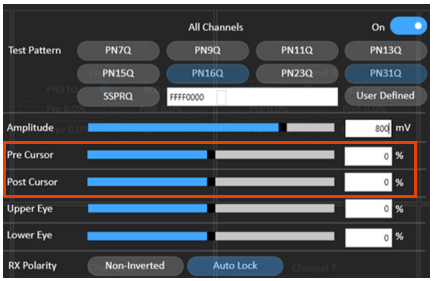
Pre-/Post-Cursor Behaviour



Tuning Emphasis

Pre/Post Cursor

When tuning **Pre Cursor** and **Post Cursor** on GUI, both are normalized, calibrated, and shown as a percentage from -100 % to +100 %.



The equalization is calculated by the following equation:

$$20 \times \log_{10}\left[\frac{\text{Amplitude} - (\text{Pre Cursor} + \text{Post Cursor}) \times 1000}{\text{Amplitude} + (\text{Pre Cursor} + \text{Post Cursor}) \times 1000}\right]$$

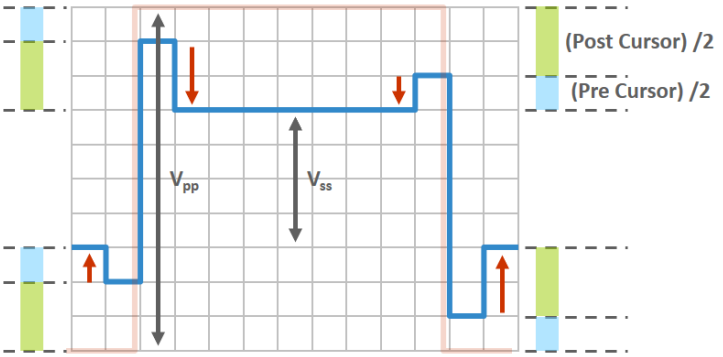
[Example]

Set Amplitude = 800mV, Pre Cursor = -5%, Post Cursor = -15%

Then EQ (dB) = $20 \times \log\left[\frac{800 - (-0.05 - 0.15) \times 1000}{800 + (-0.05 - 0.15) \times 1000}\right]$

$= 20 \times \log [1000/600] = \underline{4.4\ (dB)}$

The general definitions are displayed in the following:

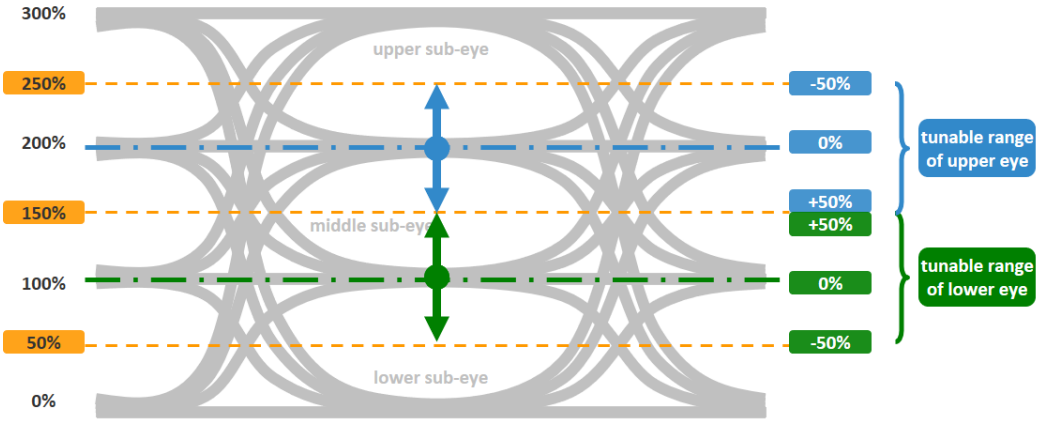


Sub-Eye Heights

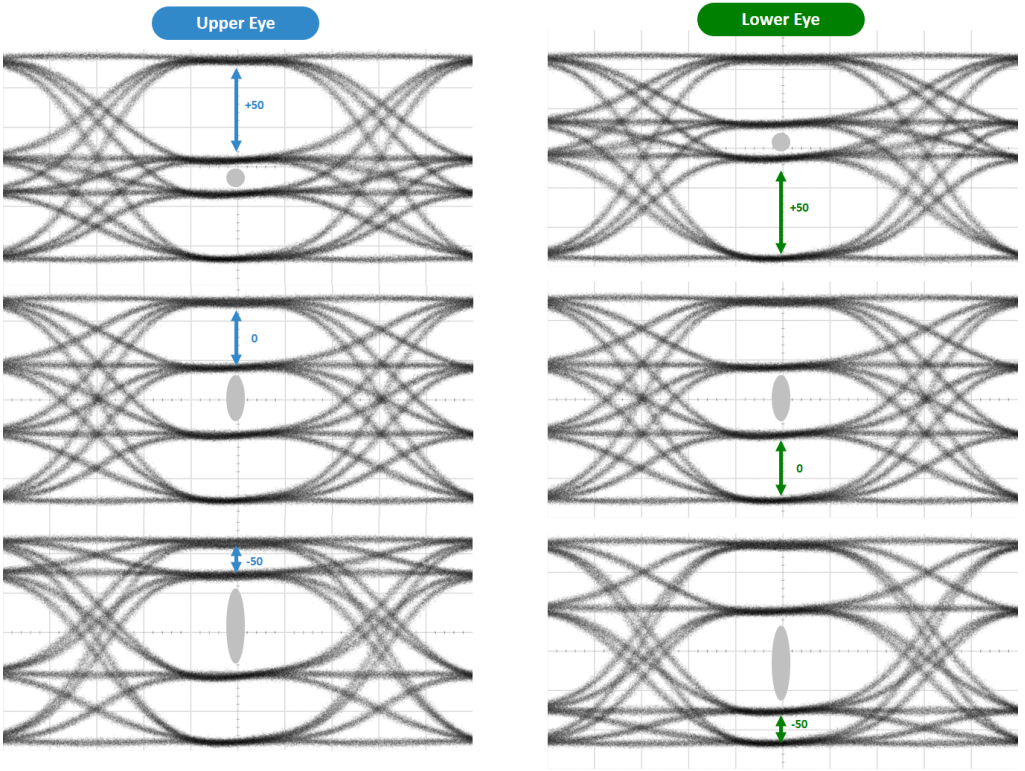
Upper Eye = Upper Sub-eye Height

Lower Eye = Lower Sub-eye Height

To enlarge sub-eye heights, increase the percentage when tuning. Both ranges of **Upper Eye** and **Lower Eye** are from -50 % to +50 %.



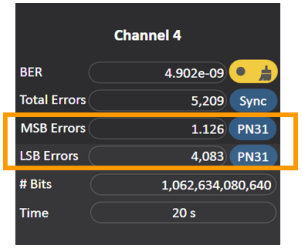
Sub-Eye Heights (cont'd)



MSB and LSB Errors

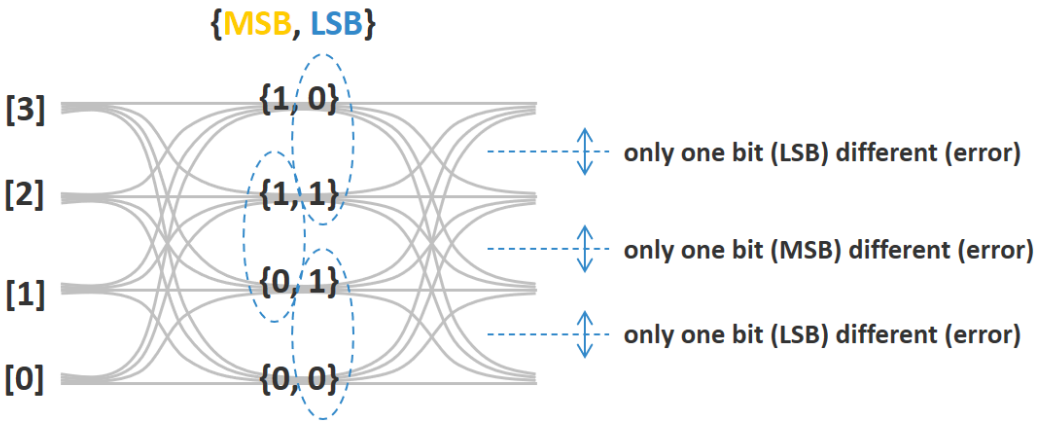
The details of **MSB/LSB Errors** are as follows:

- The PAM4 symbol maps to MSB, LSB.
  - MSB = Most Significant Bit
  - LSB = Least Significant Bit
  - **Total Errors = MSB Errors + LSB Errors**



- Better level linearity reduces error bits for both MSB and LSB errors.
- Tuning **Upper/Lower Eye** achieves better linearity.

Gray-coded Symbol



Selecting the Correct Mode of RX Sensitivity

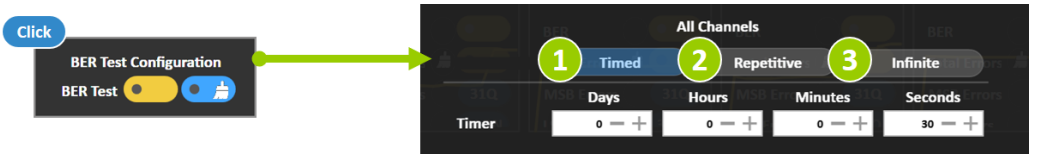
To achieve better receiving performance, there are 3 modes of **RX Sensitivity** to select:

- **High Sensitivity** when input amplitude is < 150 mV.
- **Optimized** for general case.
- **High Power** when input amplitude is > 750 mV.

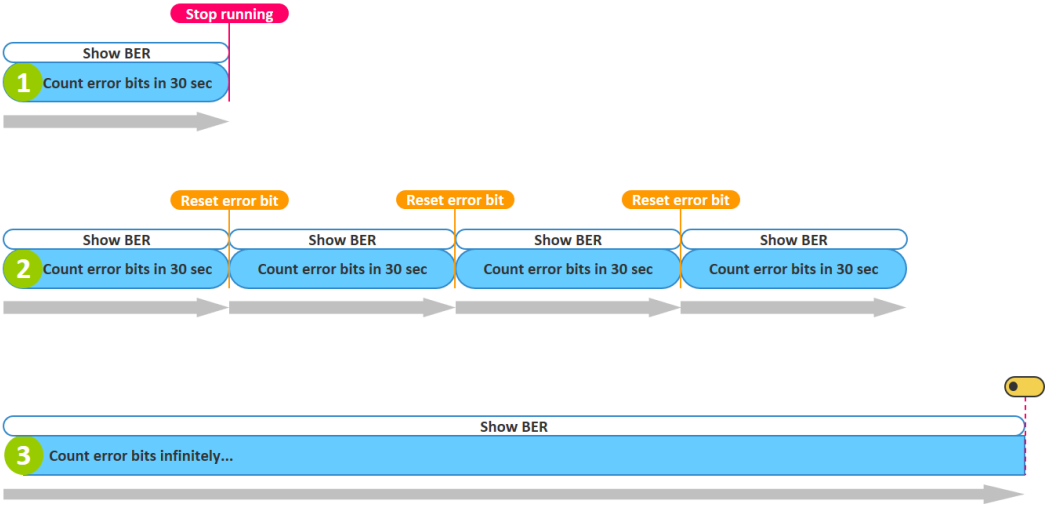
Testing BER

There are 3 methods to test BER:

- **Timed**
- **Repetitive**
- **Infinite**

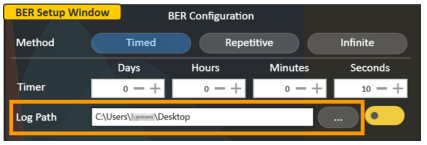


In the example, the **Timer** is set to 30 s.



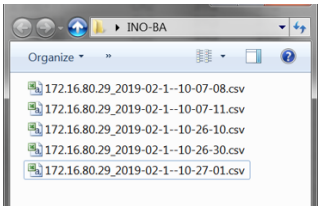
BER Test Results

To automatically log BER test results:

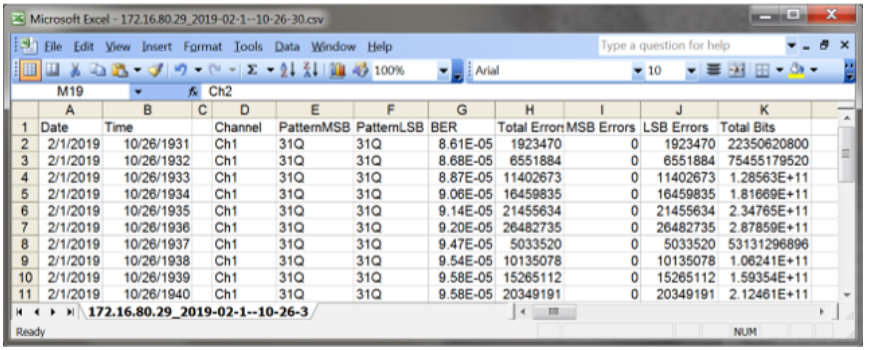


1. In the **Log Path**, enter where to create the folder **INO-BA** and save records.
2. Switch on Auto Log (switch is to the right of the Log Path).

   In this example, the auto-saved files are listed in the created folder.



3. Open a file to view the listed BER Test Results.



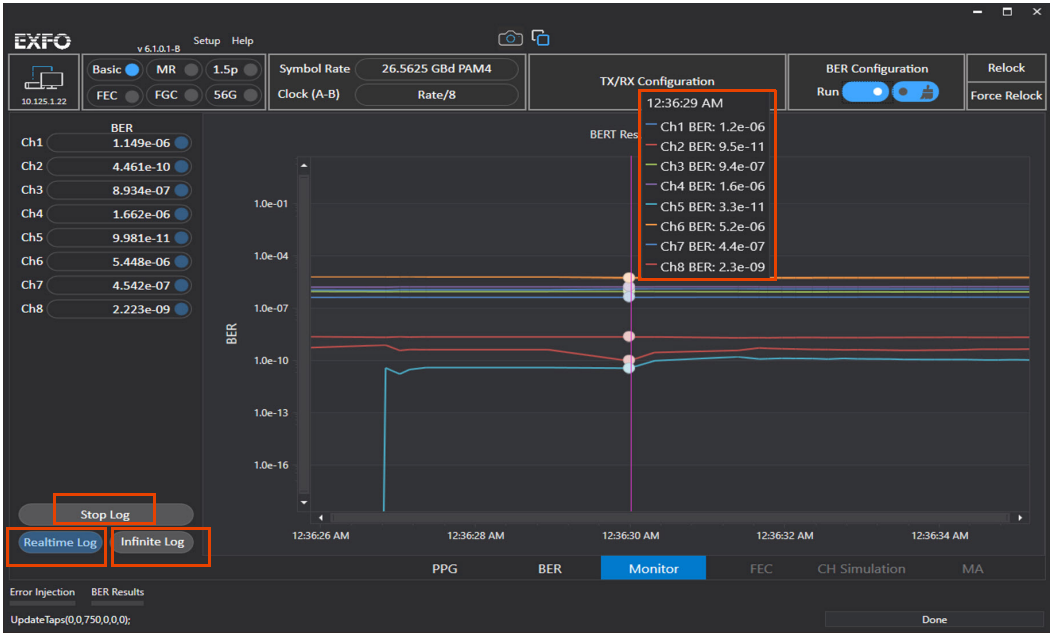
	A	B	C	D	E	F	G	H	I	J	K
1	Date	Time		Channel	PatternMSB	PatternLSB	BER	Total Errors	MSB Errors	LSB Errors	Total Bits
2	2/1/2019	10/26/1931		Ch1	31Q	31Q	8.61E-05	1923470	0	1923470	22350620800
3	2/1/2019	10/26/1932		Ch1	31Q	31Q	8.68E-05	6551884	0	6551884	75455179520
4	2/1/2019	10/26/1933		Ch1	31Q	31Q	8.87E-05	11402673	0	11402673	1.28563E+11
5	2/1/2019	10/26/1934		Ch1	31Q	31Q	9.06E-05	16459835	0	16459835	1.81669E+11
6	2/1/2019	10/26/1935		Ch1	31Q	31Q	9.14E-05	21455634	0	21455634	2.34765E+11
7	2/1/2019	10/26/1936		Ch1	31Q	31Q	9.20E-05	26482735	0	26482735	2.87859E+11
8	2/1/2019	10/26/1937		Ch1	31Q	31Q	9.47E-05	5033520	0	5033520	53131296896
9	2/1/2019	10/26/1938		Ch1	31Q	31Q	9.54E-05	10135078	0	10135078	1.06241E+11
10	2/1/2019	10/26/1939		Ch1	31Q	31Q	9.58E-05	15265112	0	15265112	1.59354E+11
11	2/1/2019	10/26/1940		Ch1	31Q	31Q	9.58E-05	20349191	0	20349191	2.12461E+11

BER Monitor Page

BER Monitor visualizes BER versus time, in order to track BER.

To monitor BER:

1. Move your mouse on the plot to show the BER information for all available channels.



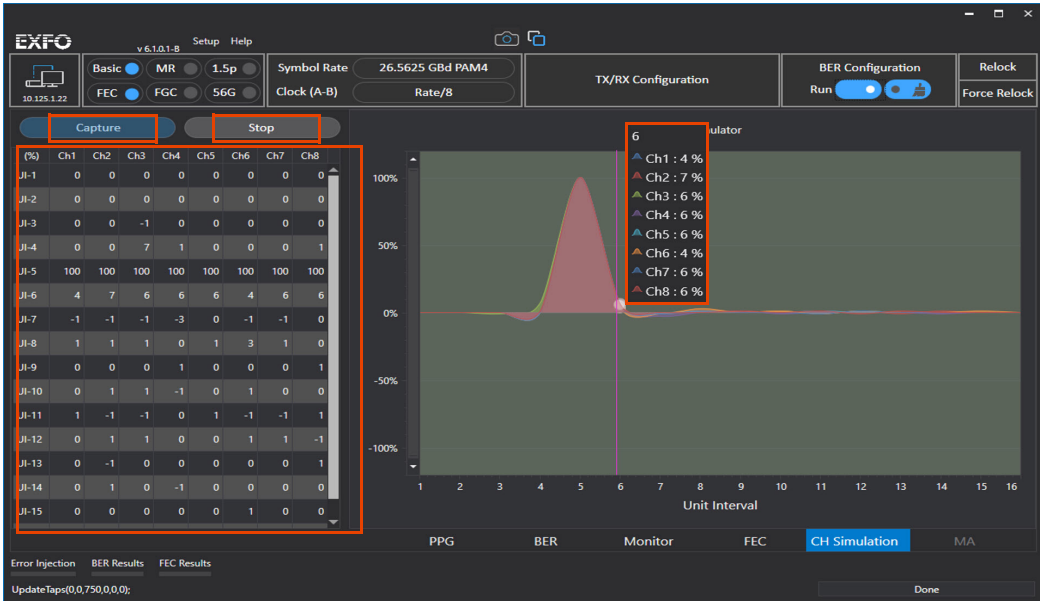
2. Start the **Realtime Log** to plot BER every second.
3. Start the **Infinite Log** to plot BER every 10 s.
4. Stop Logging (**Stop Log**)

CH Simulation Page

CH Simulator allows you to estimate the channel quality by identifying how to compensate channel response.

To start channel simulation:

1. Click **Capture** to get the signal and analyze.
2. Click **Stop** to end the capture.



The CH simulation table displays the normalized response for each UI of every channel.

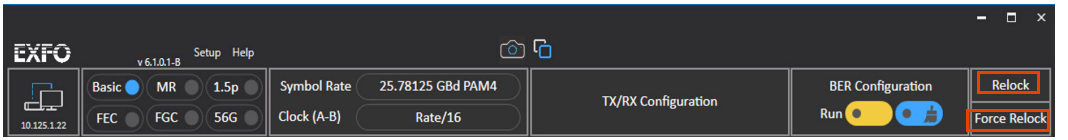
3. Move your mouse on the plot to show the UI response for all available channels.

Relock and Force Relock

Relock is the general function to re-lock the channels which get LOL or poor BER. Perform Relock when a TX signal or channel path is changed.

Note: *When signal quality is marginal, you may need to Relock several times.*

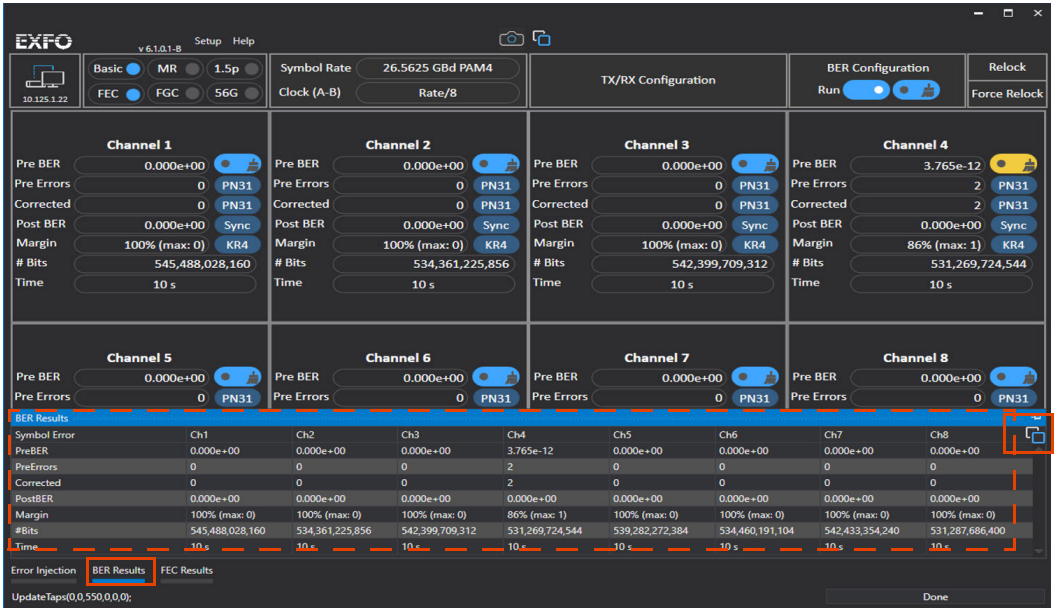
Force Relock is the advanced re-lock function to reset BA and re-lock all channels. This function is more powerful and takes a longer to perform.



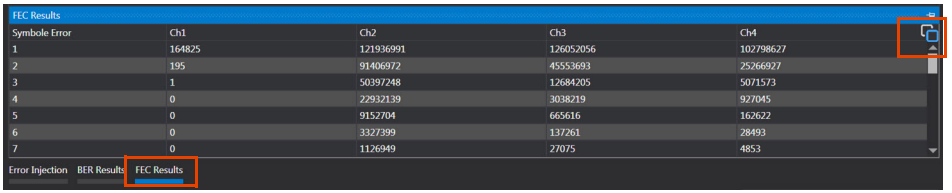
Quick View/Copy

To quickly view or copy results:

1. Move your mouse to the **BER Results** bar to display a quick view of BER results.



2. Click to copy BER or FEC results. You can paste copied data onto any text file. Values are tab-separated.

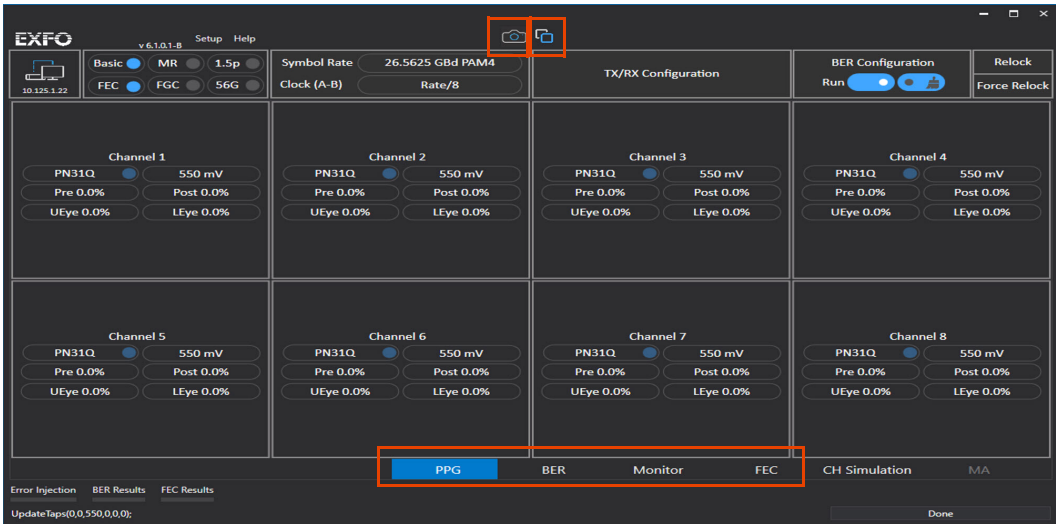


3. Move your mouse to the **FEC Results** bar to display a full table of symbol error distribution.

Quick Data Copy and Screen Capture

According to the page you select, click to copy the BER (**PPG**, **BER**, **Monitor**) or **FEC** results.

Clicking the camera icon, captures the GUI in PNG format.



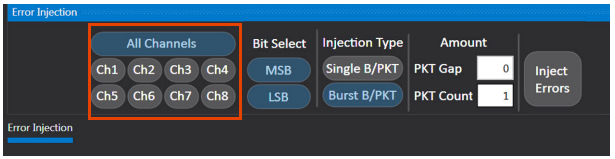
4 Error Injection Operation

Error Injection Control Panel

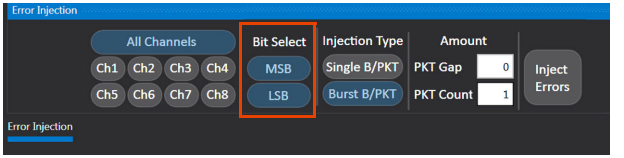
To inject errors:

1. Move mouse to lower-left corner of GUI to slide out the **Error Injection** control panel.

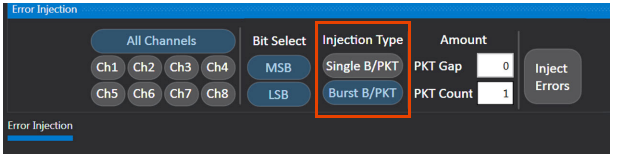
2. Select the channel(s) you want errors injected into or select **All Channels**.



3. When PAM4 modulation is selected, for **Bit Select**, you can inject errors on **MSB** and/or **LSB**.

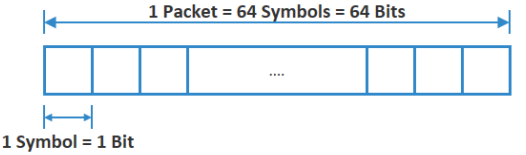


4. Define the packet Injection Type.

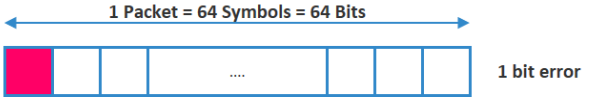


PKT = Packet

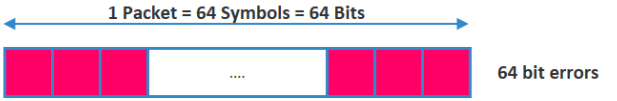
For **NRZ**:



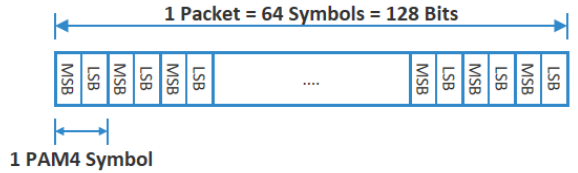
Single B/PKT



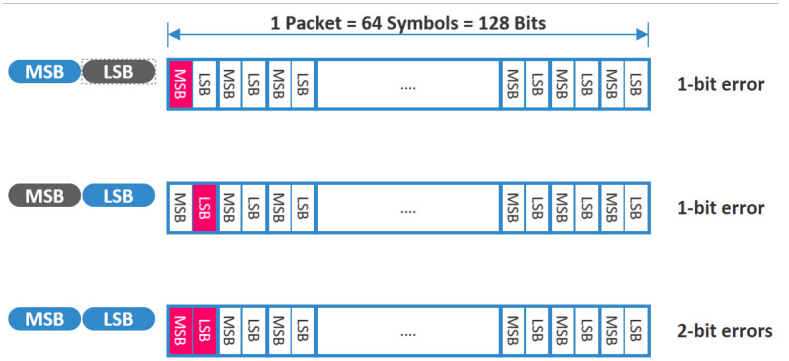
Burst B/PKT



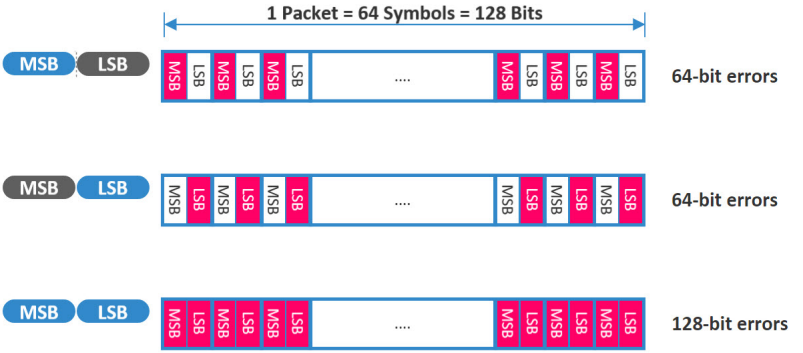
For **PAM4**:



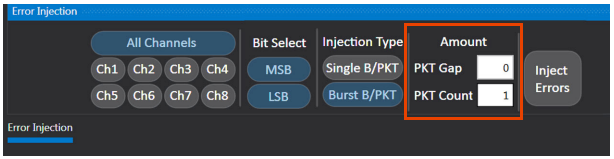
Single B/PKT



Burst B/PKT

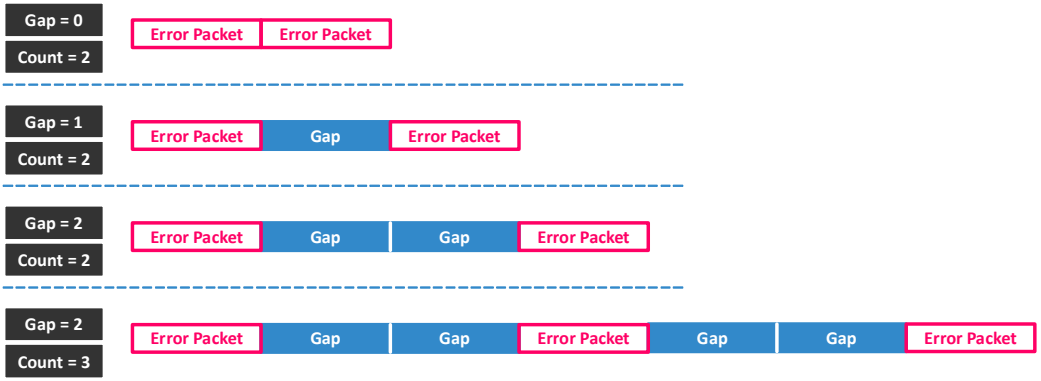


5. Select the Amount.

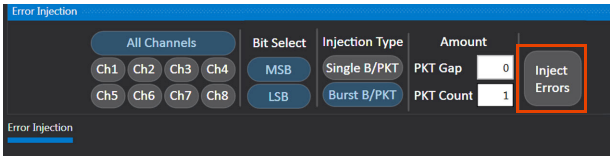


PKT Gap is the gap size between Error Packets; gap unit length is 64-symbols long.

PKT Count is the total number of Error Packets; packet unit length is 64-symbols long.



6. Click the **Inject Errors** button to generate errors.

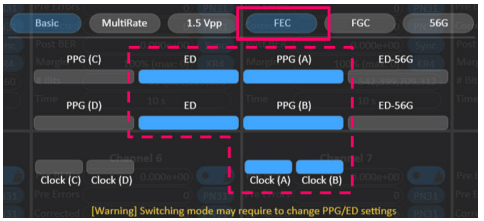


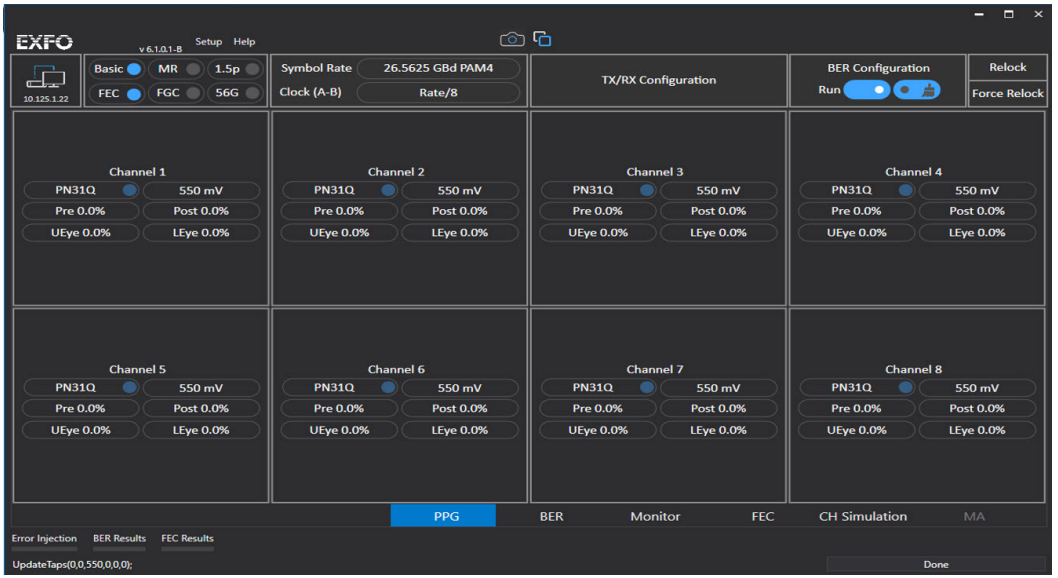
5 FEC Operation

FEC BER Page

To set and switch to the FEC BER page:

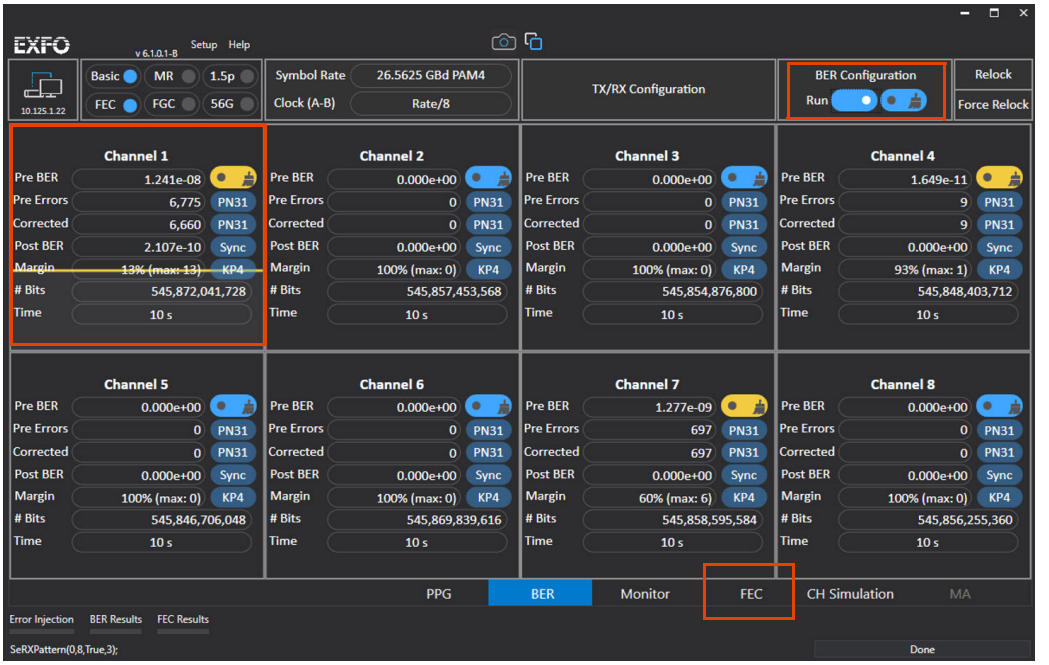
1. From the main control page, in the function mode area, select **FEC**.
2. Set the **Modulation** and **Symbol Rate**.
3. Set **TX/RX Configuration**.
4. Set BER test method.



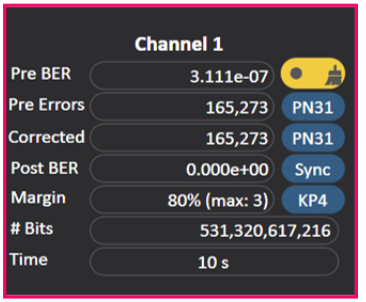


5. Click **BER** tab to display the FEC BER page.

6. Start/stop BER test with FEC.



The FEC BER page lists before/after FEC information for all channels.

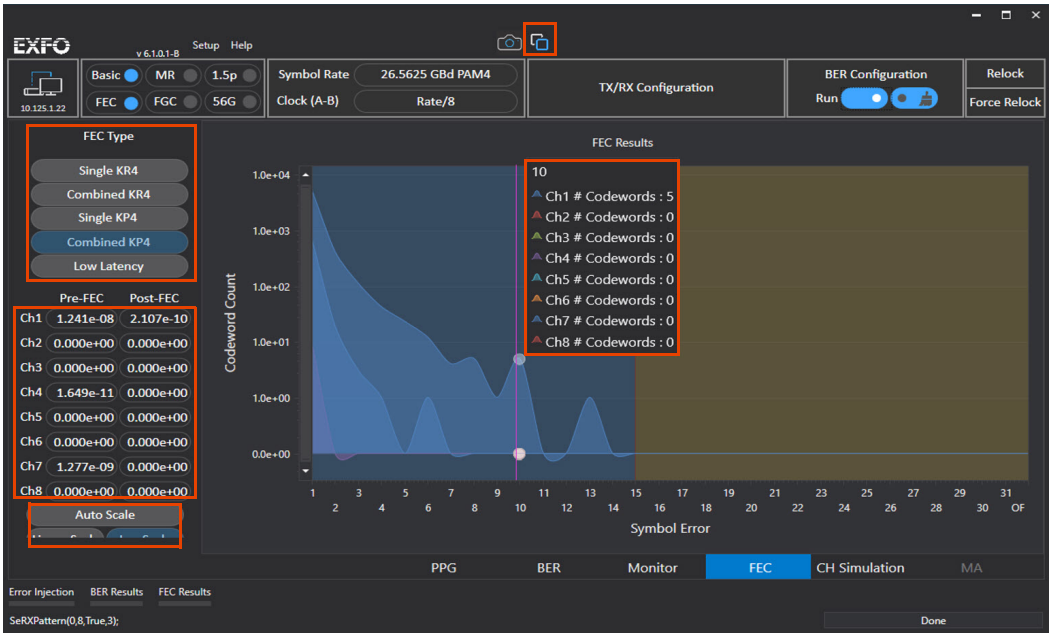


- **Pre BER**: Pre-FEC BER
- **Pre Errors**: Pre-FEC Bit Errors
- **Corrected** Bits by FEC
- **Post BER**: Post-FEC BER
- FEC **Margin**
- **# Bits**: Total test Bits

7. Click the **FEC** tab to show the FEC Plot page.

FEC Plot Page

This page displays the FEC plot of Symbol Errors per Codeword vs. **Codeword Count** depicting the behavior of error distribution. The full table of symbol error distribution can be copied by clicking .



- FEC Type allows you to set the type of FEC to **Single/Combined KR4/KP4**. Default is **Combined KP4**. Combined means striping to 4 channels.
- **Pre/Post-FEC** BER is displayed for each channel.
- The vertical axis scale can be set to Auto, Linear, or Log (Logarithmic).

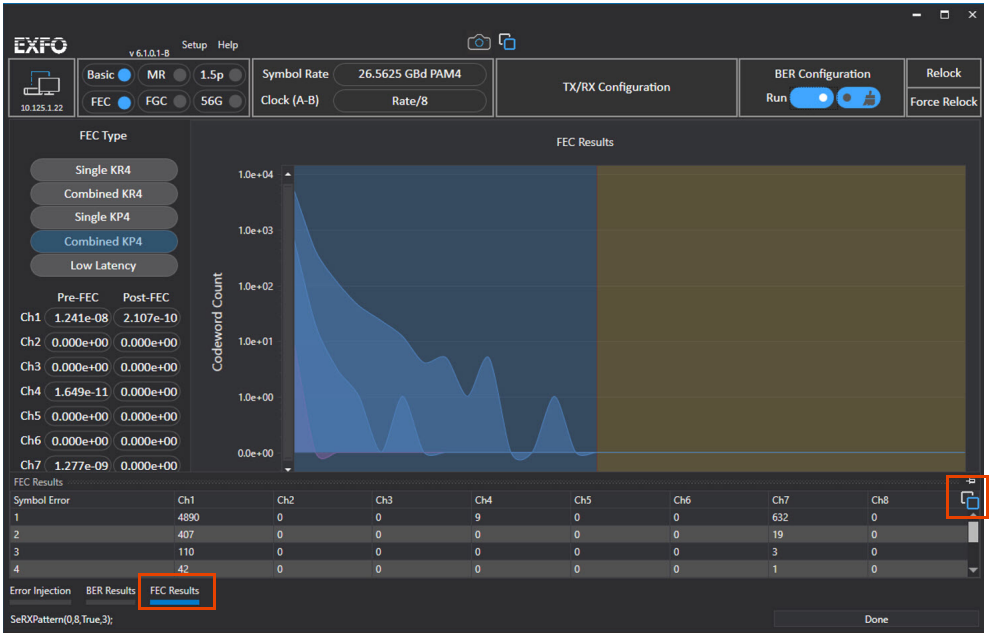
- In the **FEC Results**, move your mouse over the plot area to list the number of codewords with the amount of symbol errors. For example, in the above graphic, each codeword has **10** symbol errors with **CH1** having **5 Codewords**.
- Mouse controls:
  - Scroll to zoom in/out.
  - Drag up/down to move focus.
  - On the keyboard [Shift] + drag mouse down to zoom in the area.

Full Table of Symbol Error Distribution

A full table of Symbol Error distribution is also supported to make it easier to save test results.

To view the full table:

Move your mouse to the **FEC Results** bar.



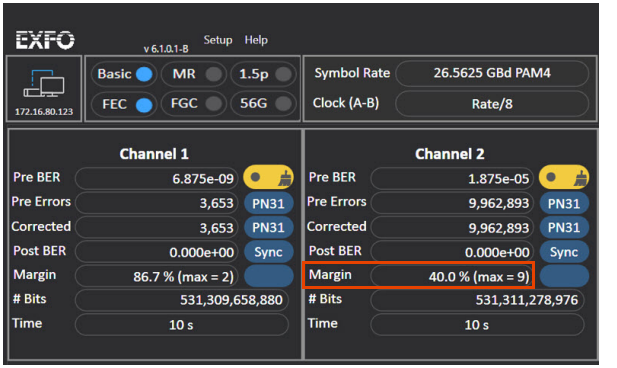
The full table can be copied by clicking .

You can paste copied data onto any text file. Values are tab-separated. For example, data to the right was pasted to Excel.

Symbol Error	Ch1	Ch2	Ch3	Ch4
1	164825	121936991	126052056	102798627
2	195	91406972	45553693	25266927
3	1	50397248	12684205	5071573
4	0	22932139	3038219	927045
5	0	9152704	665616	162622
6	0	3327399	137261	28493
7	0	1126949	27075	4853
8	0	361766	5371	882
9	0	111784	986	138
10	0	33443	194	26
11	0	9635	24	10
12	0	2673	5	2
13	0	766	3	0
14	0	223	0	0
15	0	58	0	0

FEC Margin and Log Scale

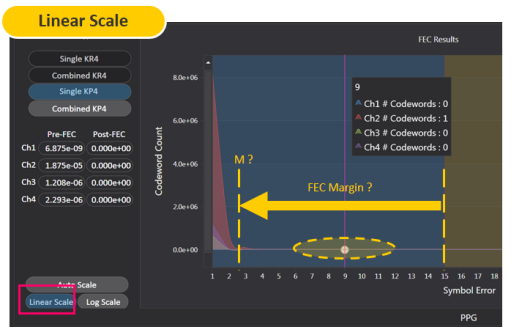
FEC **Margin** indicates how much margin is required to keep error symbols correctable.

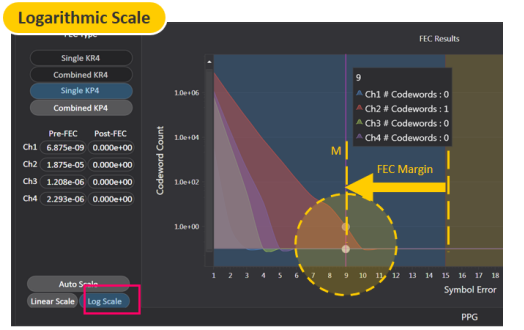


For KP4, it is defined as shown on the right, where M is the **max** (that is, maximum symbol errors per codeword).

$$\text{FEC margin} = \frac{15 - M}{15} \times 100\%$$

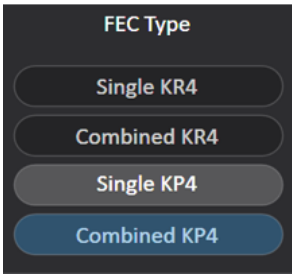
Switching from **Linear Scale** to **Log Scale** to show obvious minor errors makes it easier to identify the maximum symbol errors per codeword and FEC margin.



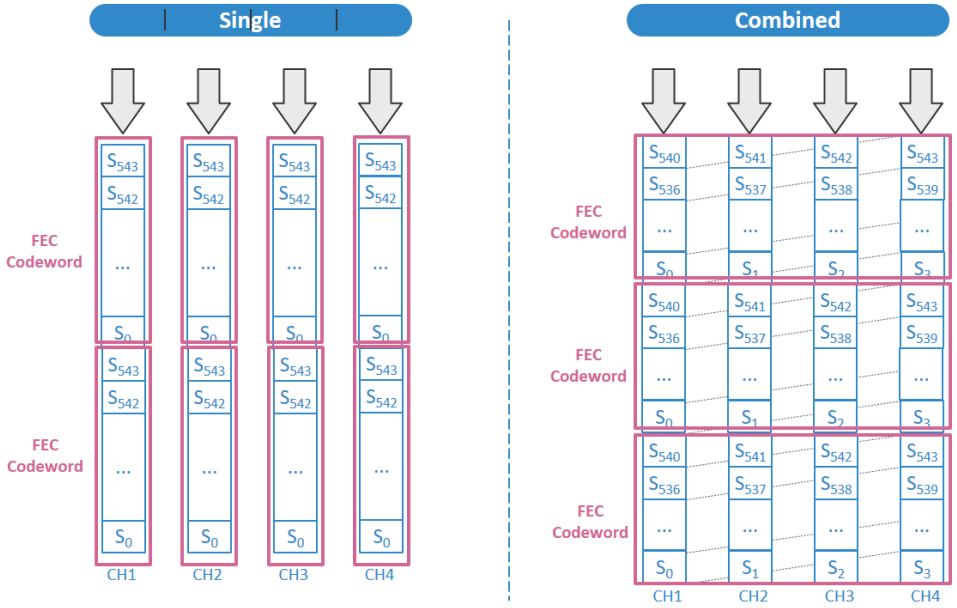


FEC Type

KR4 means KR4 RS-FEC. That is, RS(528, 514).
KP4 means KP4 RS-FEC. That is, RS(544, 514).

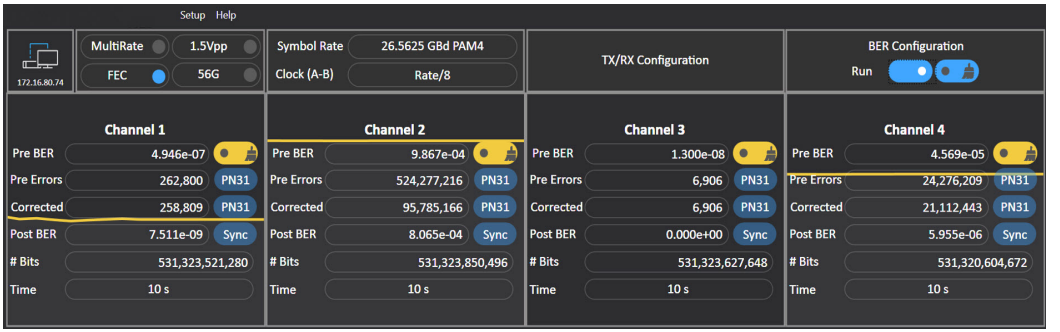


- **Single** calculates **FEC Codeword** by individual CH (channel).
- **Combined** calculates **FEC Codeword** by combining 4 channels.



Example of Single and Combined FEC

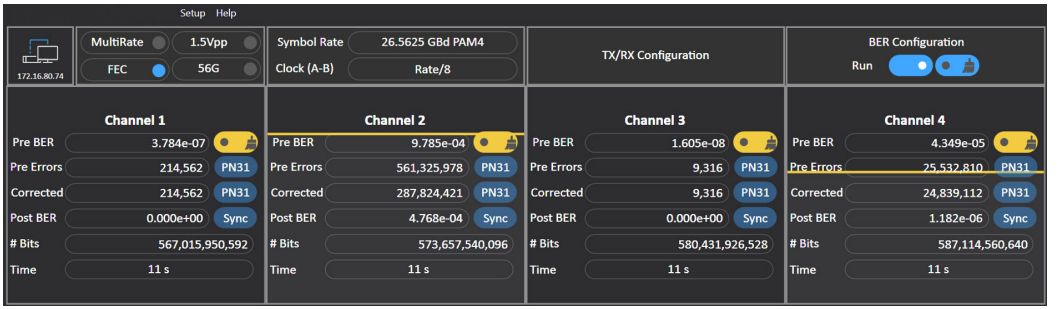
➤ Single KP4



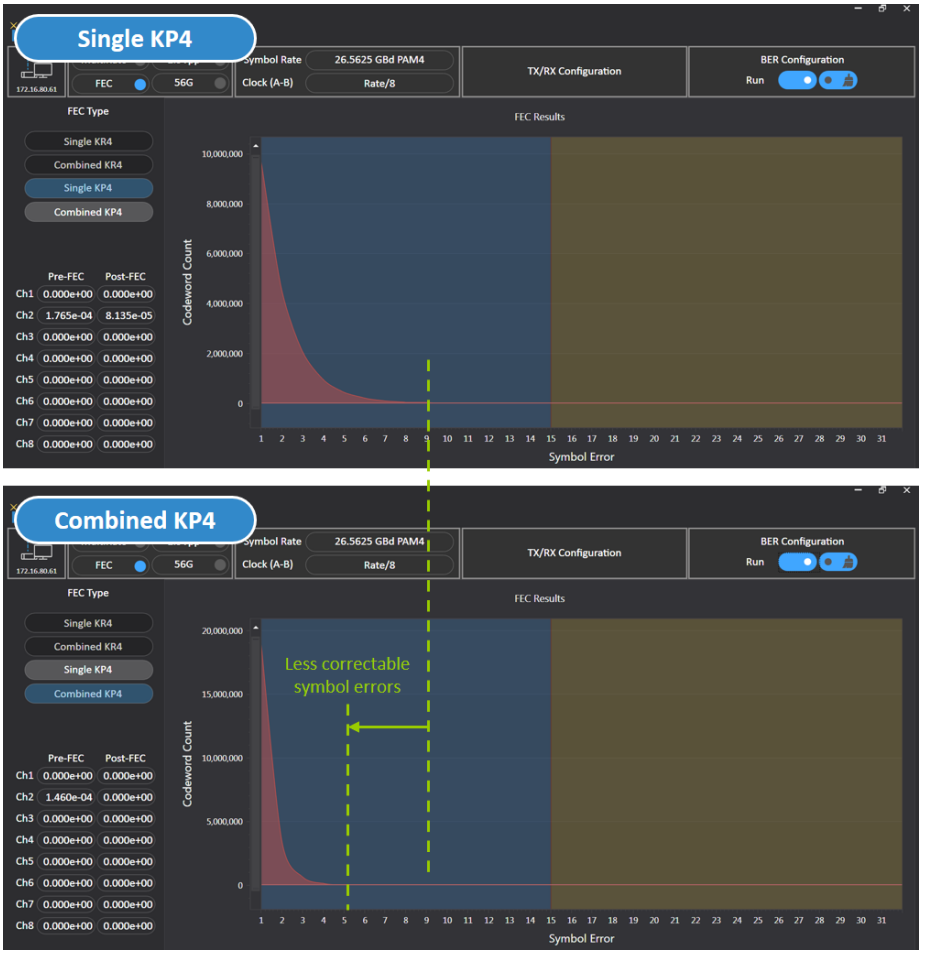
➤ Post-FEC BER

7.5×10^{-9}	8.0×10^{-4}	Error Free	5.9×10^{-6}
↓	↓	↓	↓
Error Free	4.7×10^{-4}	Error Free	1.1×10^{-6}

➤ Combined KP4



Example of Single and Combined FEC Cont'd

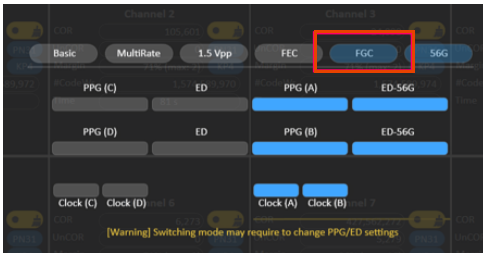


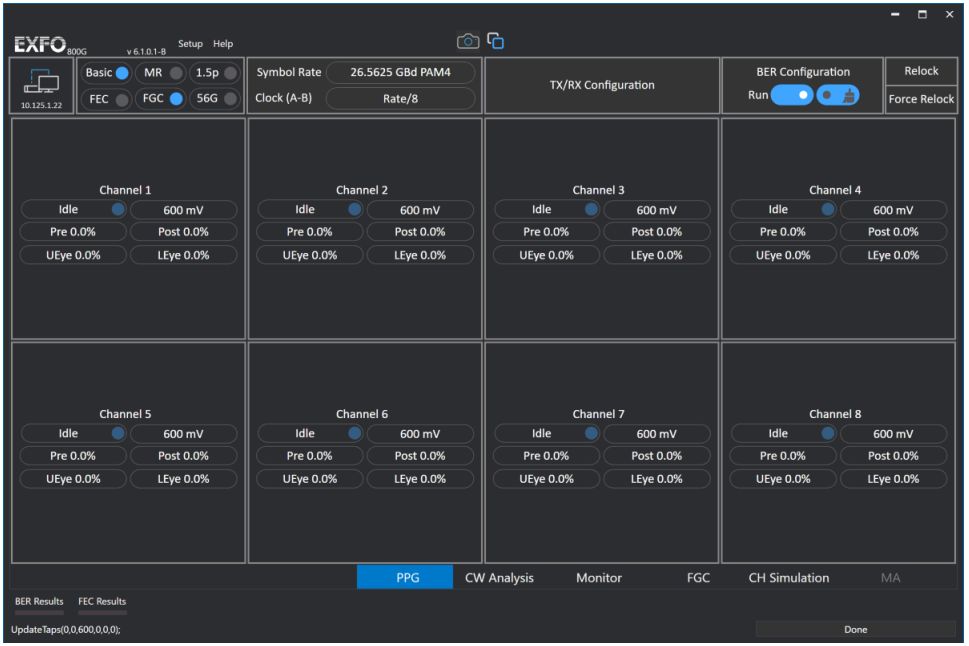
6 FGC Operation

FGC Pages

To set and switch to FGC pages:

1. From the main control page, select the mode **FGC**.
2. Set the **Modulation** and **Symbol Rate**.
3. Set **TX/RX Configuration**.
4. Set codeword test method.



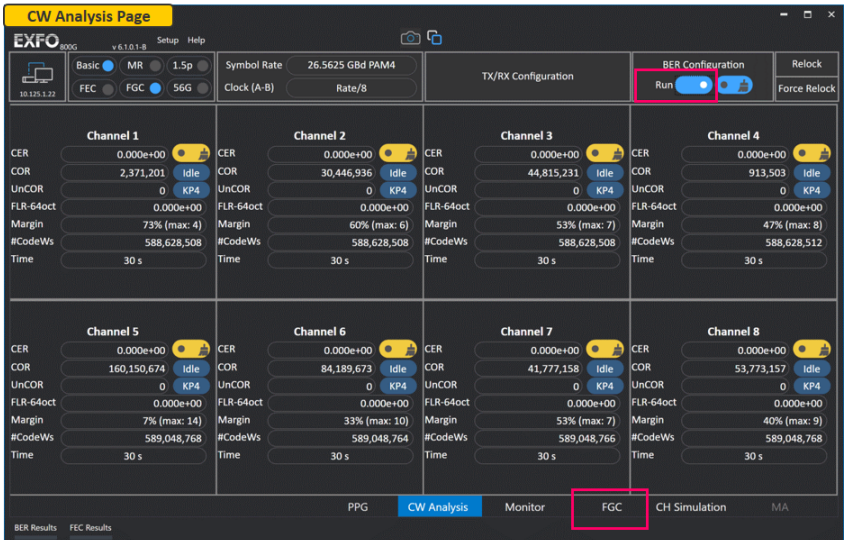


5. Click the **CW Analysis** tab to show the codeword analysis page.

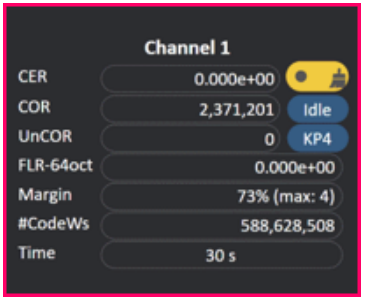
CW Analysis Page

To view the FGC information listed for all channels:

1. Start/stop BER test with FGC.



The **CW Analysis** page lists the following information for all channels:

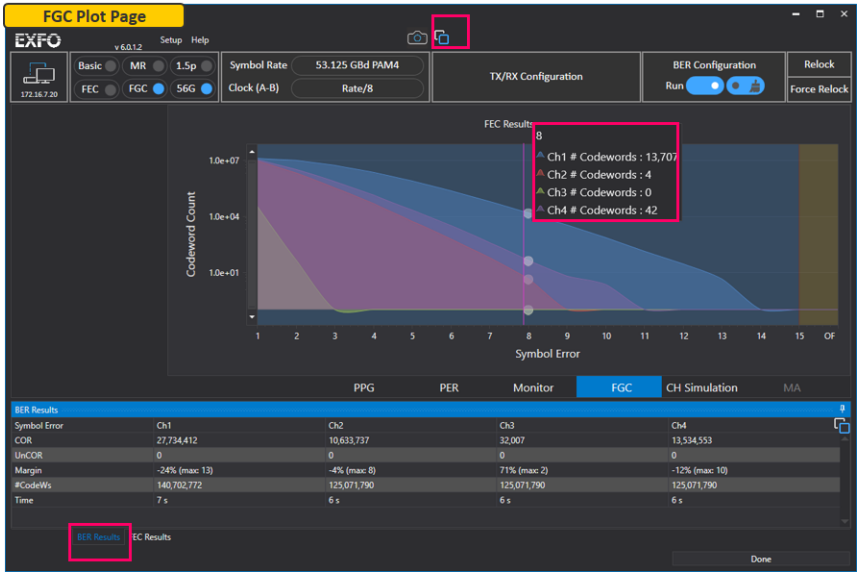


- **CER**: Uncorrected Codeword Ratio
- **COR**: Corrected codewords
- **UnCOR**: Uncorrected codewords
- **FLR-64oct**: Frame Loss Ratio (64-octet frames with minimum interpacket gap)
- FEC **Margin**
- **#CodeWs**: Total test codewords

2. Click the **FGC** tab to show the FGC Plot Page.

FGC Plot Page

This page displays the FGC plot of Symbol Errors per Codeword vs. **Codeword Count** depicting the behavior of error distribution. The full table of symbol error distribution can be copied by clicking .



To view results on the page:

1. Move the mouse to the **BER Results** bar to show the full CW Analysis info.
2. Move the mouse over the plot to show how many codewords with X symbol errors. For example, in the above graphic, each codeword has **8** symbol errors with **CH4** having **42 Codewords**.

Mouse controls:

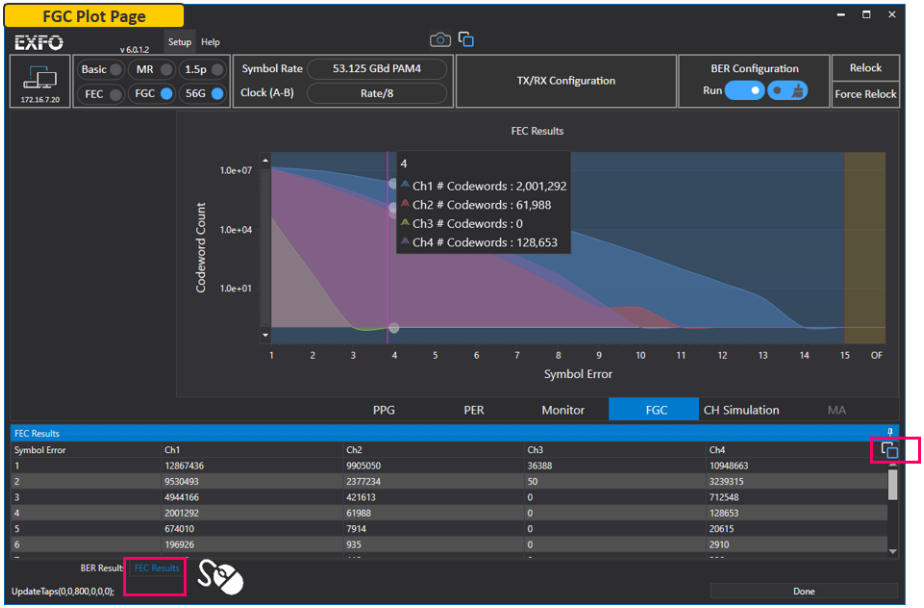
- Scroll to zoom in/out.
- Drag up/down to move focus.
- On the keyboard [Shift] + drag mouse down to zoom in the area.

Full Table of Symbol Error Distribution

A full table of Symbol Error distribution is also supported to make it easier to save test results.

To view the full table:

Move your mouse to the **FEC Results** bar.



The full table can be copied by clicking .

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Symbol Error	Ch1	Ch2	Ch3	Ch4
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6	0	3327399	137261	28493
7	0	1126949	27075	4853
8	0	361766	5371	882
9	0	111784	986	138
10	0	33443	194	26
11	0	9635	24	10
12	0	2673	5	2
13	0	766	3	0
14	0	223	0	0
15	0	58	0	0

A Reference Test Setups

This appendix displays the test setups for the following:

- BA-4000-8-56-PAM
  - PAM4

    26G with short/long cables

    53G with short/long cables

    57.8G with short cables
  - NRZ

    25G with short/long cables

    53G with short cables

    57.8G with short cables
- BA-4000-8-28-PAM
  - PAM4

    26G with short/long cables
  - NRZ

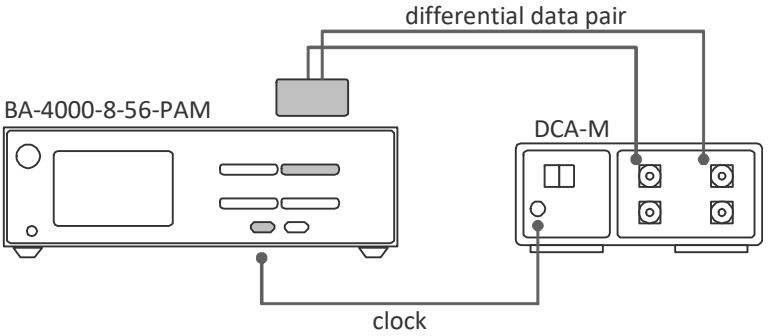
    25G with short/long cables
- BA-4000-8-28-NRZ
  - NRZ

    25G with short/long cables

8-56-PAM's PAM4 26G TX for Short Cables

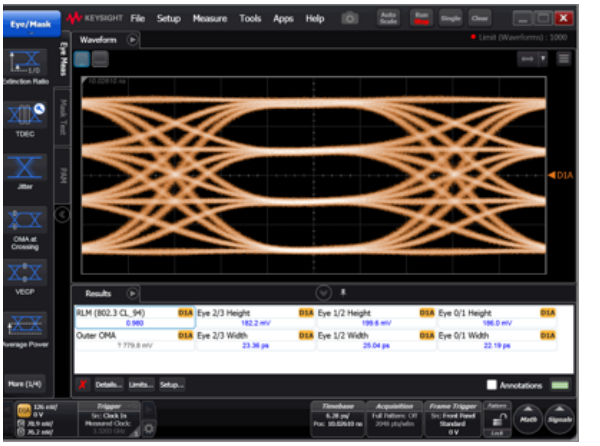
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set (to 2.92 mm connector)



GUI Setup

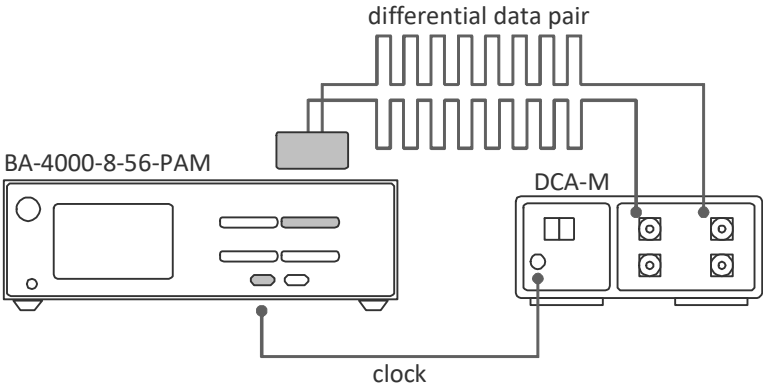
- Modulation PAM4
- Symbol Rate 26.5625 GBd
- PRBS31Q
- Amplitude 800 mV Differential
- Pre/Post-cursor 0
- Upper/Lower Eye 0



8-56-PAM's PAM4 26G TX for Long Cables

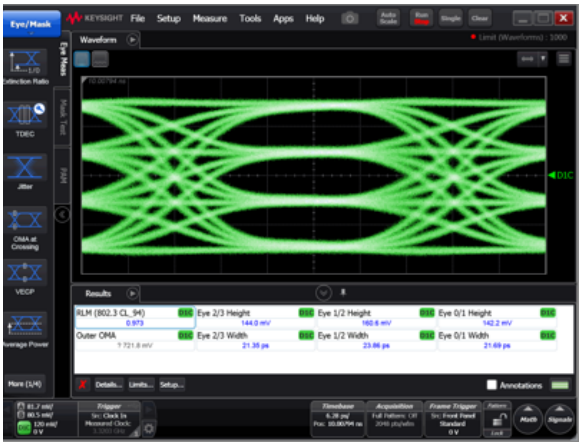
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set (to 2.92 mm connector)



GUI Setup

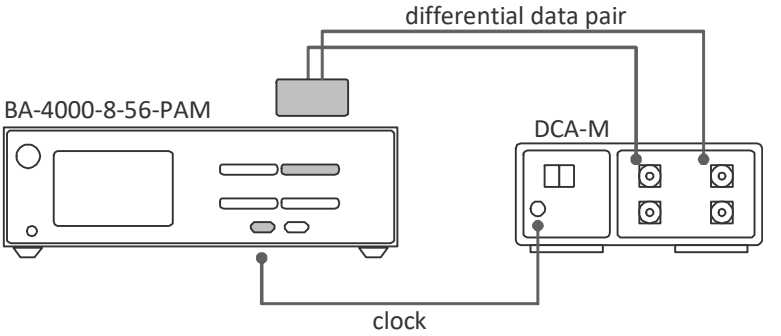
- Modulation PAM4
- Symbol Rate
  26.5625 GBd
- PRBS31Q
- Amplitude 800 mV
  Differential
- Pre-cursor 0
- Post-cursor -3
- Upper/Lower Eye 0



8-56-PAM's PAM4 53G TX for Short Cables

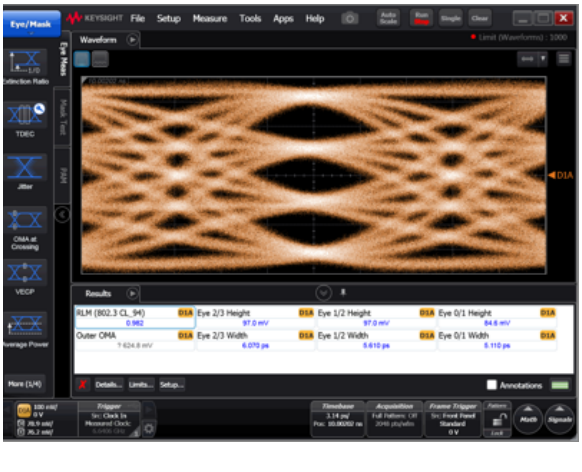
Hardware Configuration

- A-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMBPM™ cable set (to 2.4 mm connector)



GUI Setup

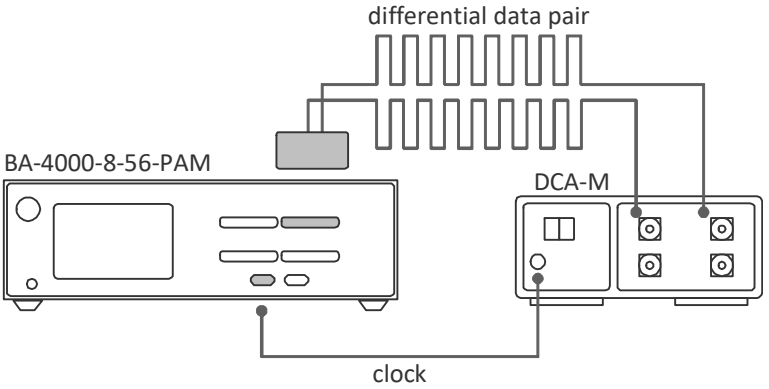
- Modulation PAM4
- Symbol Rate
  53.125 GBd
- PRBS31Q
- Amplitude 800 mV
  Differential
- Pre/Post-cursor 0
- Upper/Lower Eye 0



8-56-PAM's PAM4 53G TX for Long Cables

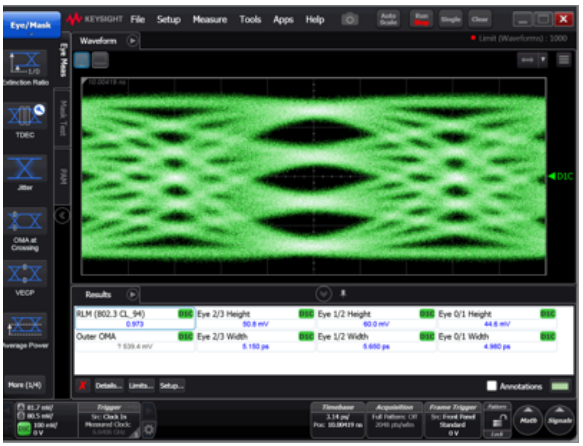
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set (to 2.4 mm connector



GUI Setup

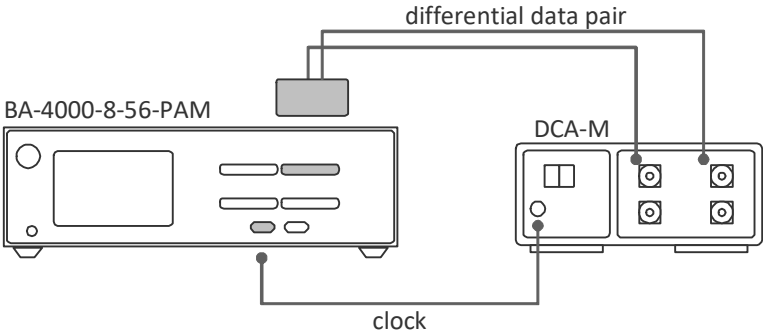
- Modulation PAM4
- Symbol Rate
  53.125 GBd
- PRBS31Q
- Amplitude 800 mV
  Differential
- Pre-cursor 0
- Post-cursor -8
- Upper/Lower Eye 0



8-56-PAM's PAM4 57.8G TX for Short Cables

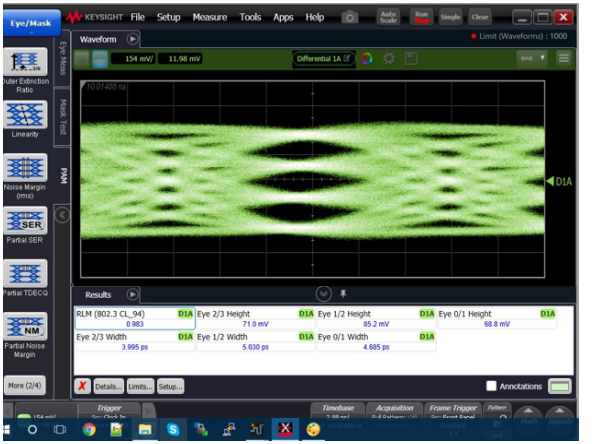
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set (to 2.4 mm connector)



GUI Setup

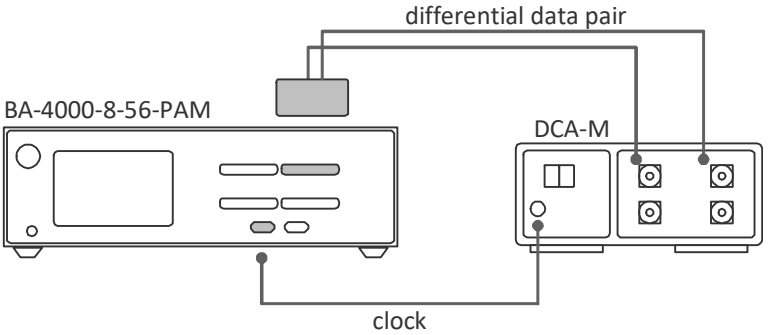
- Modulation PAM4
- Symbol Rate
  57.8 GBd
- PRBS31Q
- Amplitude 800 mV
  Differential
- Pre-cursor 0
- Post-cursor -3
- Upper/Lower Eye 0



8-56-PAM's NRZ 25G TX for Short Cables

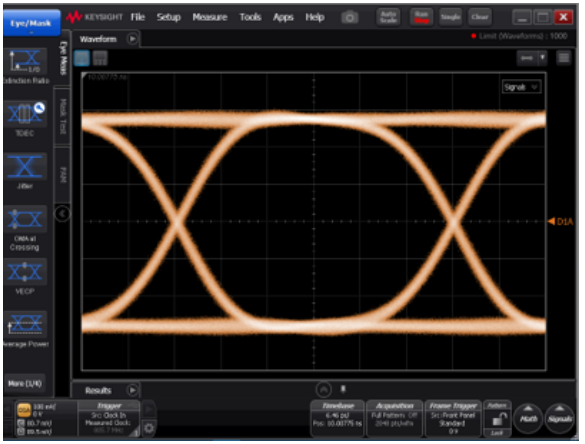
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set



GUI Setup

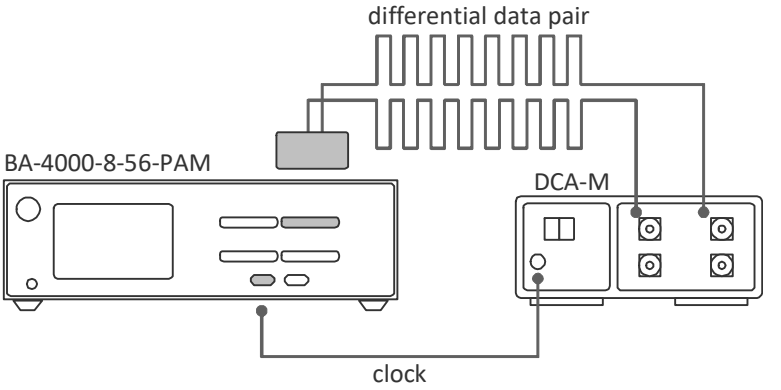
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre/Post-cursor 0



8-56-PAM's NRZ 25G TX for Long Cables

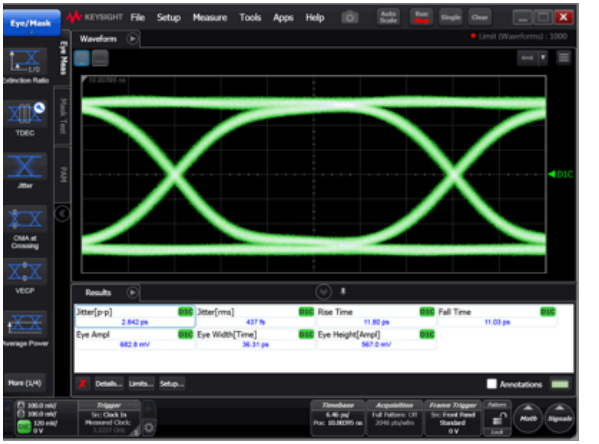
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set



GUI Setup

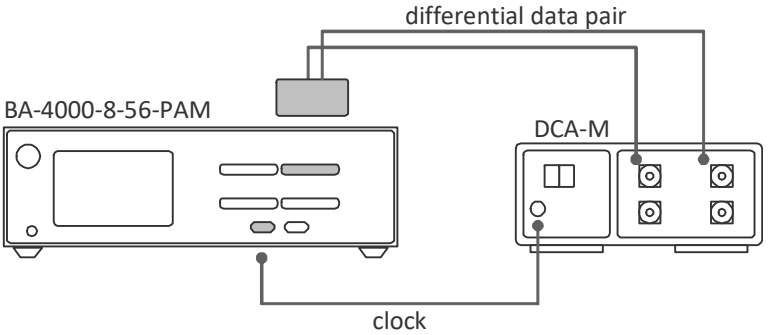
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre-cursor 0
- Post-cursor -4



8-56-PAM's NRZ 53G TX for Short Cables

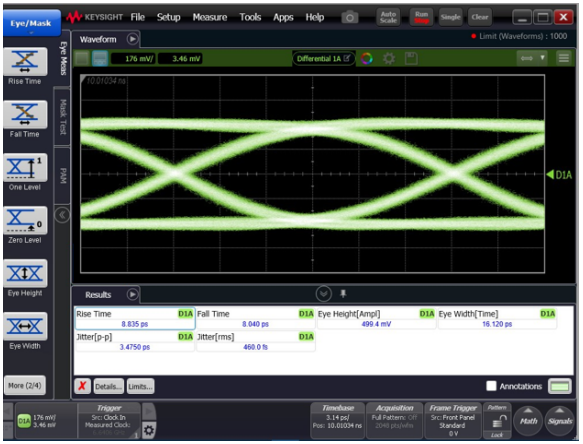
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set (to 2.4 mm connector)



GUI Setup

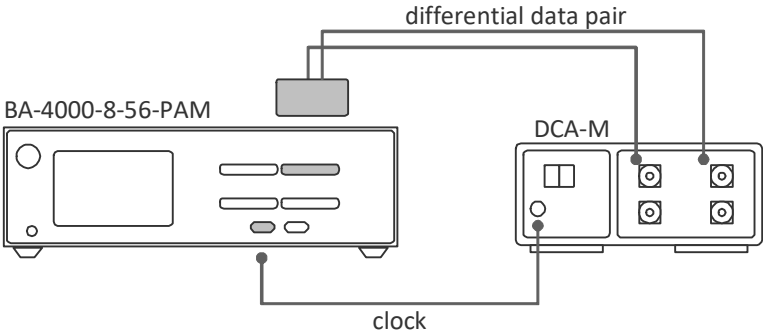
- Modulation NRZ
- Symbol Rate
  53.125 GBd
- PRBS31
- Amplitude 800 mV
  Differential
- Pre-cursor 0
- Post-cursor -2



8-56-PAM's NRZ 57.8G TX for Short Cables

Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set (to 2.4 mm connector)



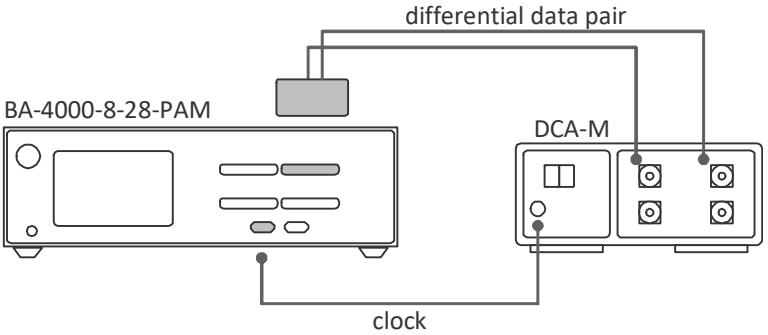
GUI Setup

- Modulation NRZ
- Symbol Rate
  57.8 GBd
- PRBS31
- Amplitude 800 mV
  Differential
- Pre-cursor -5
- Post-cursor -8

8-28-PAM's PAM4 26G TX for Short Cables

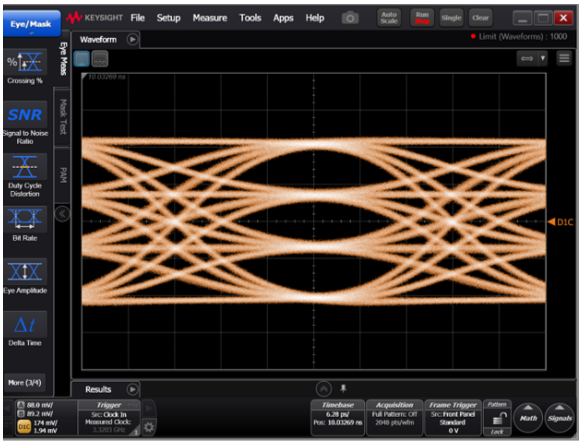
Hardware Configuration

- BA-4000-8-28-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set



GUI Setup

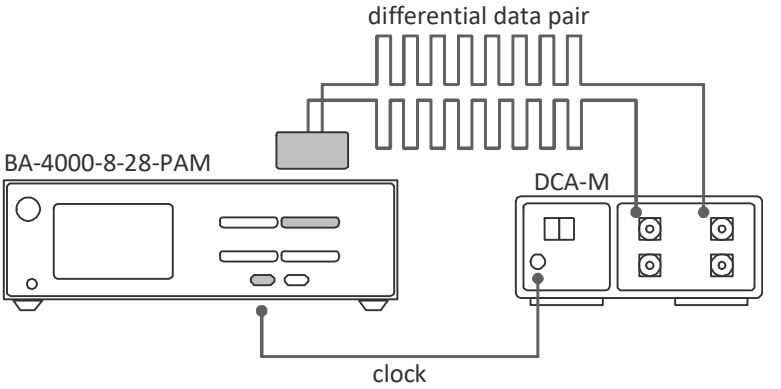
- Modulation PAM4
- Symbol Rate
  26.5625 GBd
- PRBS31Q
- Amplitude 800 mV
  Differential
- Pre/Post-cursor 0
- Upper/Lower Eye 0



8-28-PAM's PAM4 26G TX for Long Cables

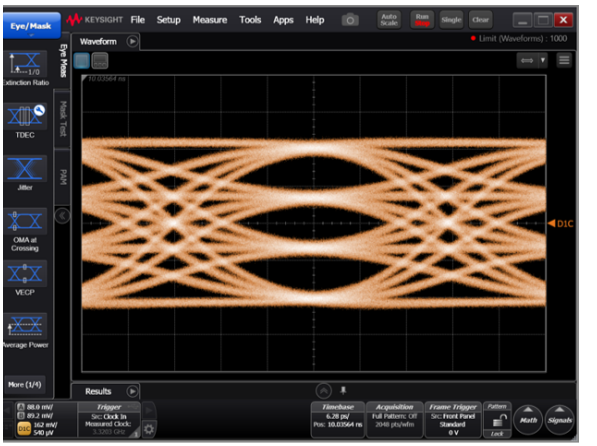
Hardware Configuration

- BA-4000-8-28-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set



GUI Setup

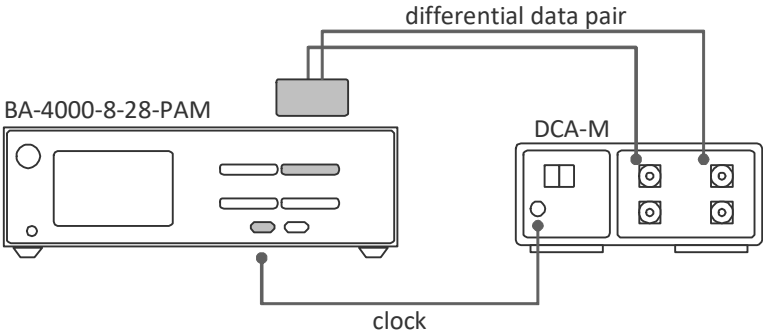
- Modulation PAM4
- Symbol Rate 26.5625 GBd
- PRBS31Q
- Amplitude 800 mV Differential
- Pre-cursor 0
- Post-cursor -1
- Upper/Lower Eye 0



8-28-PAM's NRZ 25G TX for Short Cables

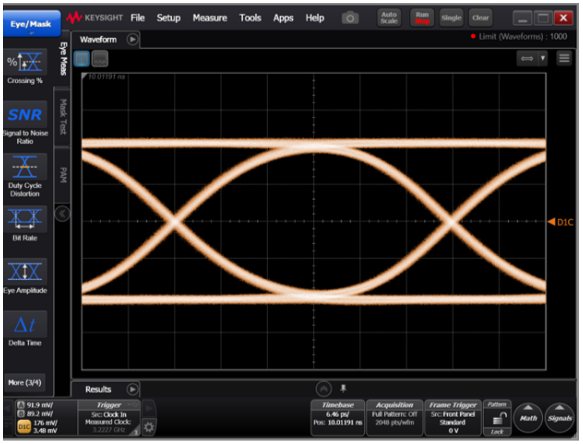
Hardware Configuration

- BA-4000-8-28-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set



GUI Setup

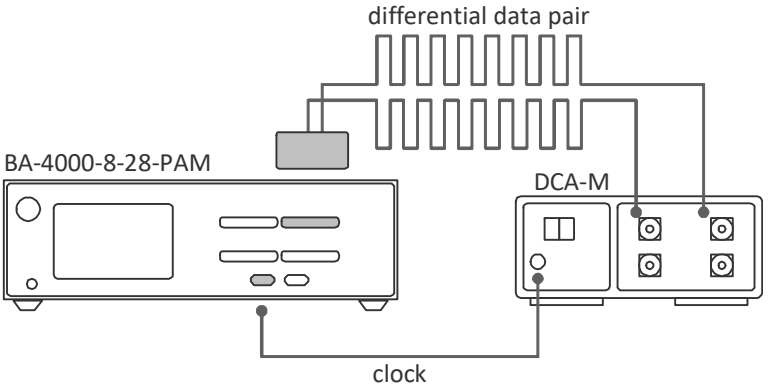
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre/Post-cursor 0



8-28-PAM's NRZ 25G TX for Long Cables

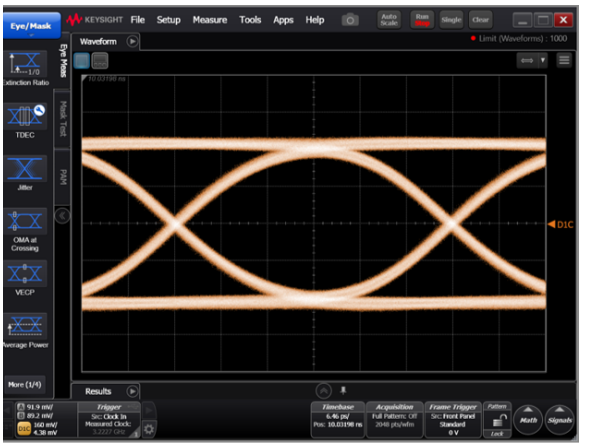
Hardware Configuration

- BA-4000-8-56-PAM 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set



GUI Setup

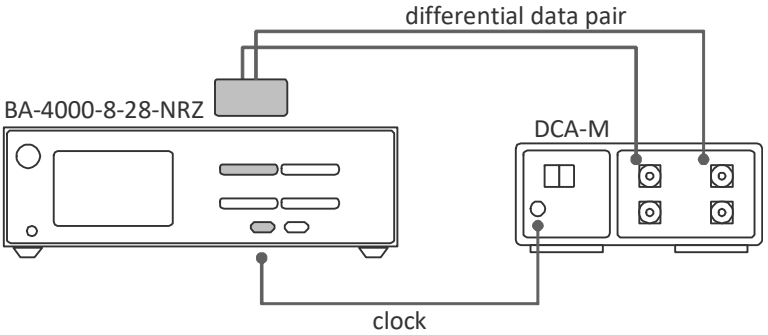
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre-cursor 0
- Post-cursor -1



8-28-NRZ's NRZ 25G TX for Short Cables

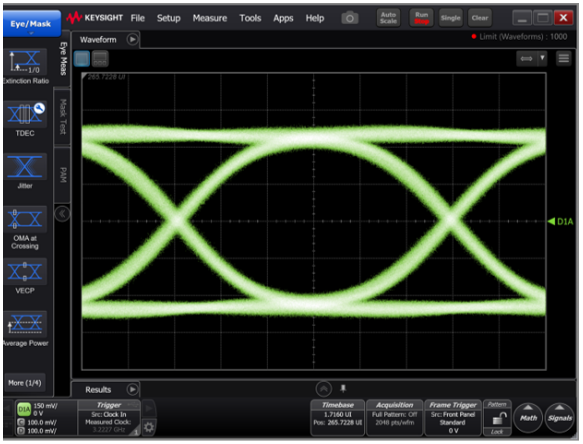
Hardware Configuration

- BA-4000-8-28-NRZ 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 15 cm O-SMPM™ cable set



GUI Setup

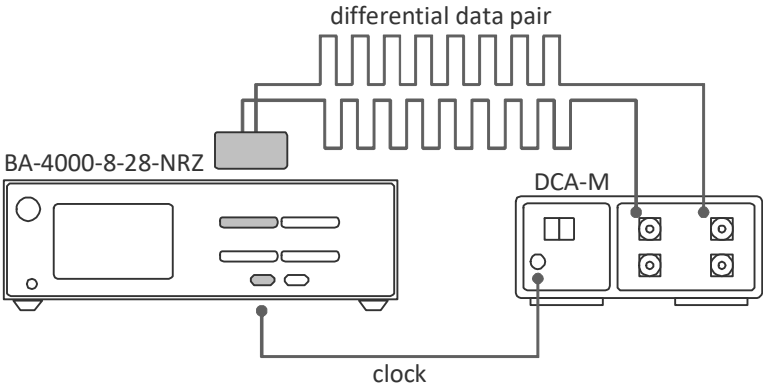
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre-cursor 0
- Post-cursor 28.6



8-28-NRZ's NRZ 25G TX for Long Cables

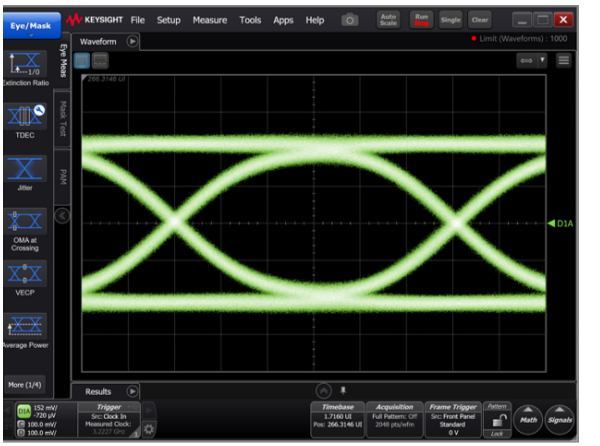
Hardware Configuration

- BA-4000-8-28-NRZ 8x56G PAM4 BERT
- DCA-M N1094B Sampling Scope (50 GHz Bandwidth)
- 60 cm O-SMPM™ cable set



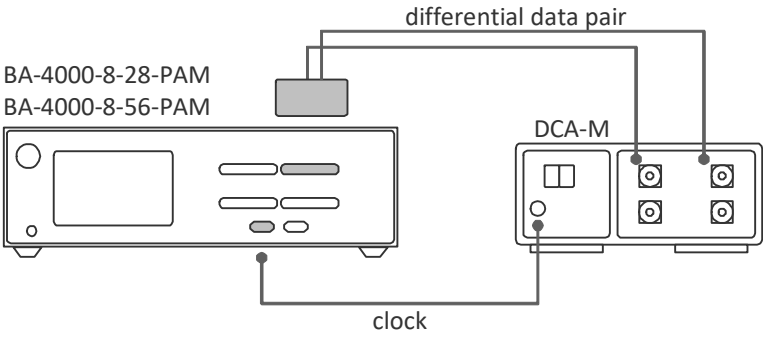
GUI Setup

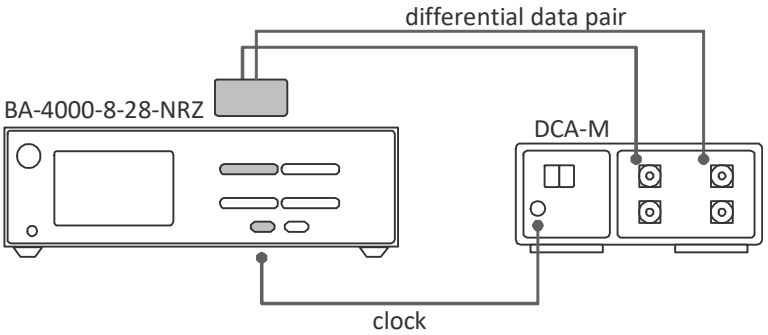
- Modulation NRZ
- Symbol Rate 25.78125 GBd
- PRBS31
- Amplitude 800 mV Differential
- Pre-cursor 0
- Post-cursor 28.6



Lookup Table

BA-4000	Modulation	PAM4						NRZ					
	Symbol Rate	26.5625 GBd		53.125 GBd		57.8 GBd		25.78125 GBd		53.125 GBd		57.8 GBd	
	Cable	short	long	short	long	short	long	short	long	short	Long	short	long
8-56-PAM	Pre-cursor	0	0	0	0	0	n/a	0	0	0	n/a	0	n/a
	Post-cursor	0	-3	0	-8	-3	n/a	0	-4	-2	n/a	-3	n/a
8-28-PAM	Pre-cursor	0	0					0	0				
	Post-cursor	0	-1					0	-1				
8-28-NRZ	Pre-cursor							0	0				
	Post-cursor							28.6	28.6				

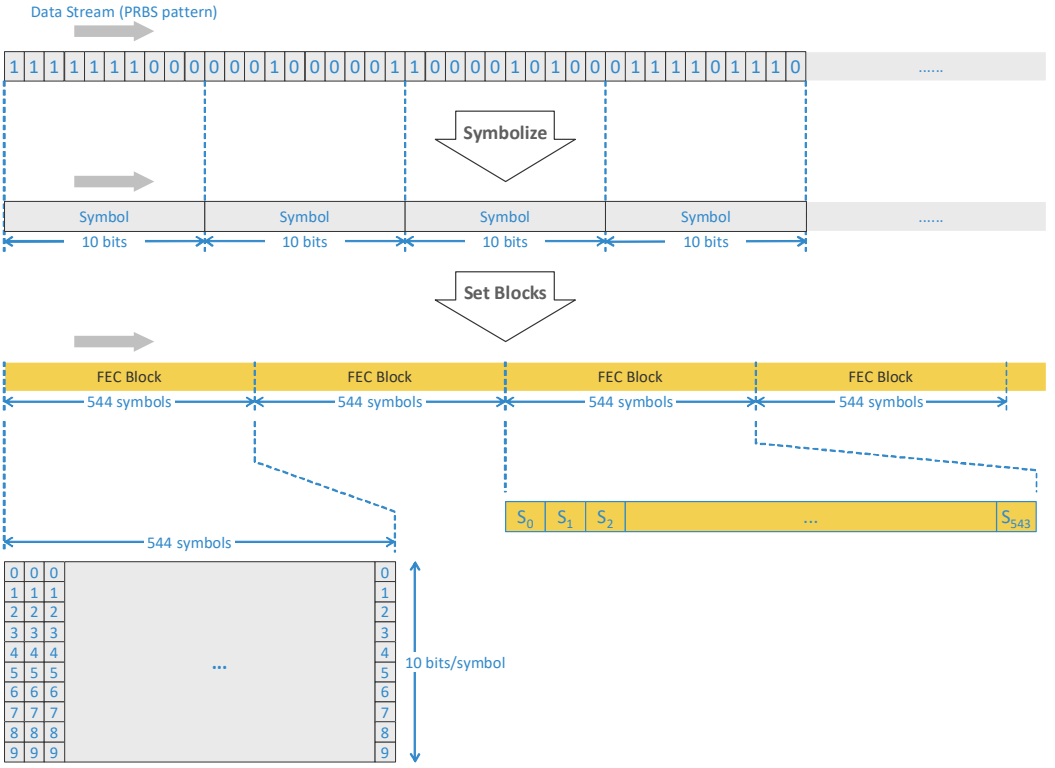




B Structure of FEC Simulation

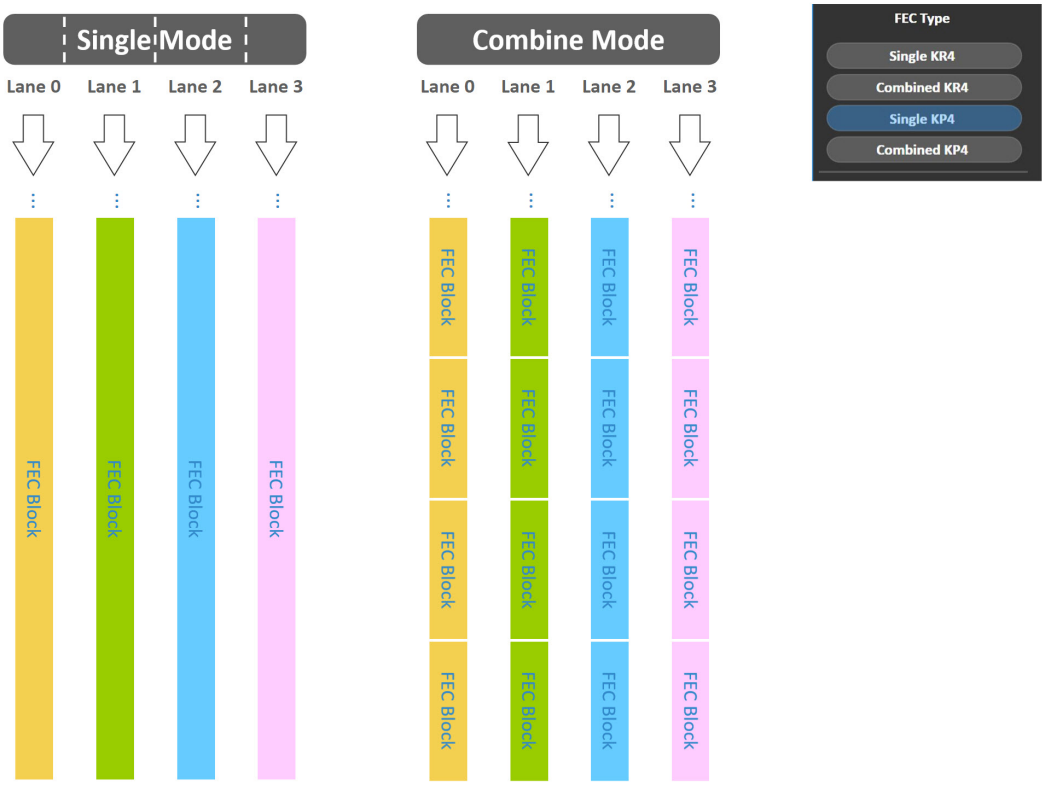
Symbol & Block

KP4 RS-FEC example:

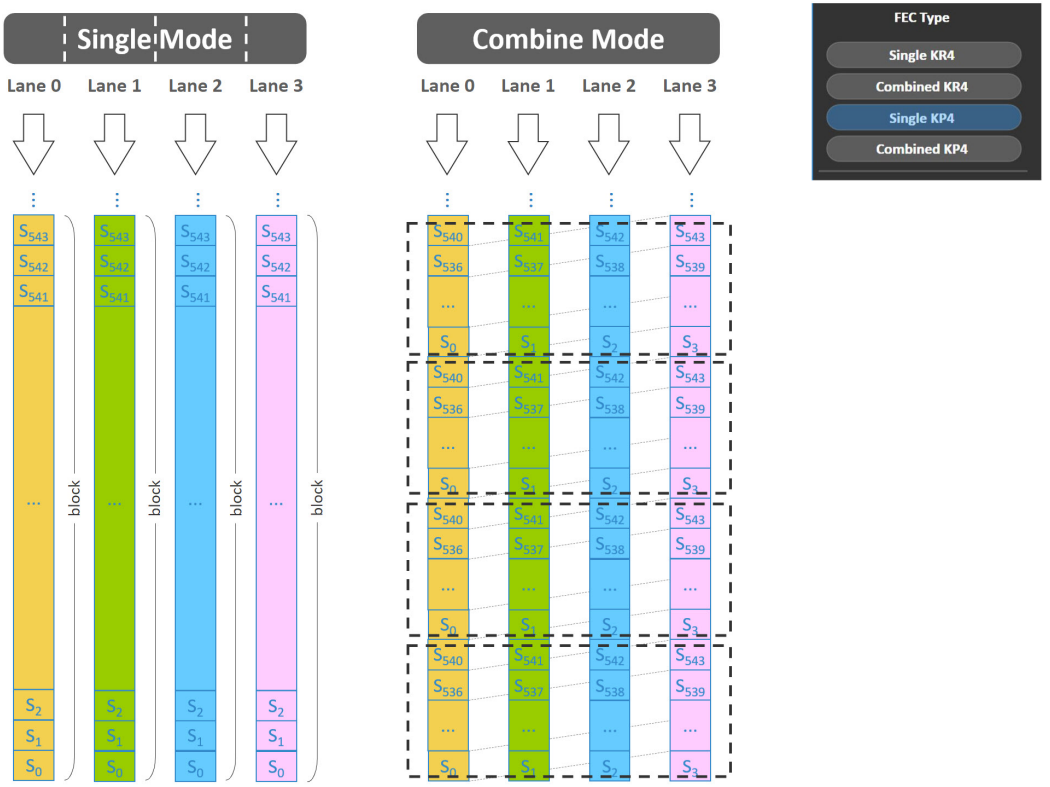


Striping

KP4 RS-FEC example:

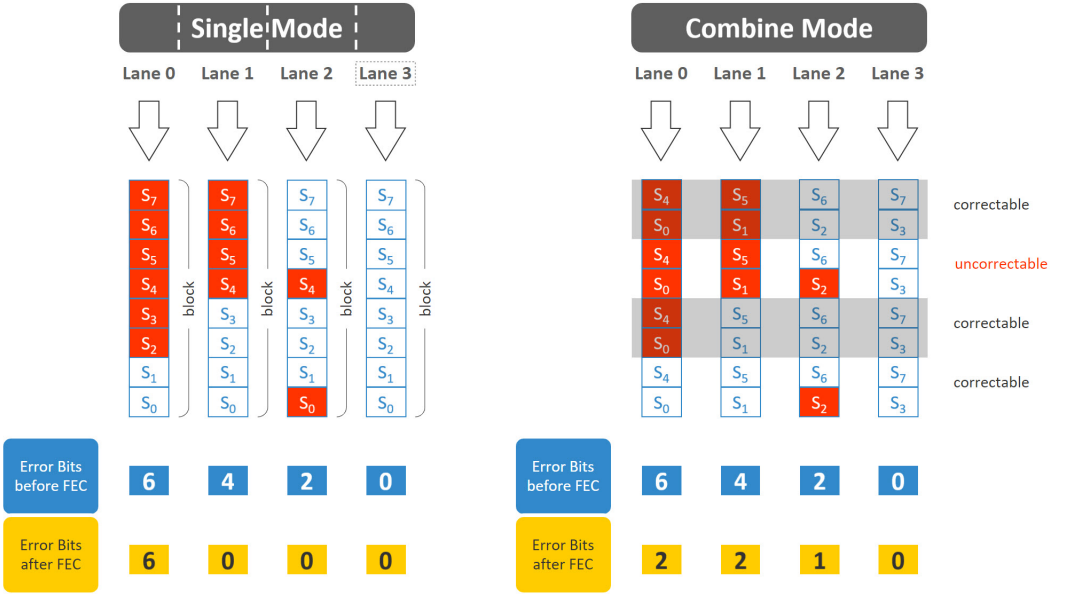


Striping cont'd



How Striping Works

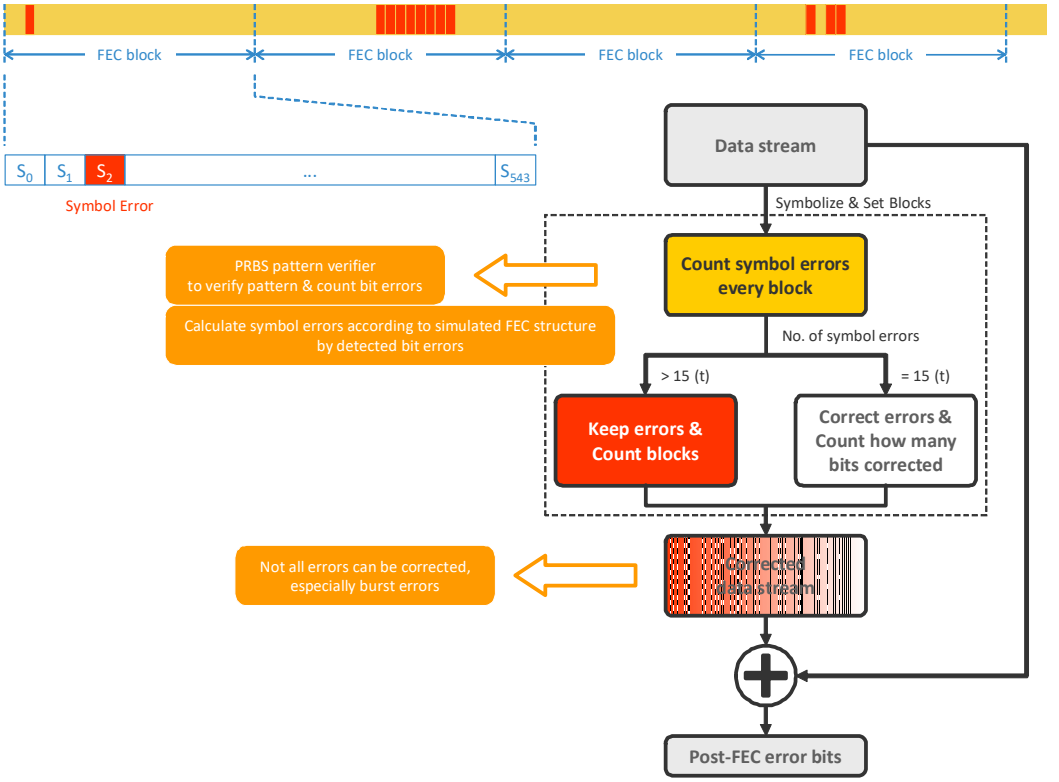
- Supposed
  - 8 Symbols = 1 Block
  - Max Correctable Symbols = 4



Flow Chart

KP4 RS-FEC example:

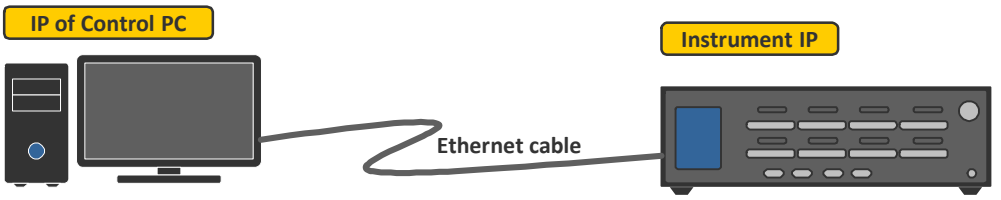
- Bits per symbol (m) = 10
- Total symbols (n) = 544
- Message symbols (k) = 514
- Parity symbols (2t) = 30
- Max correctable symbols (t) = 15



C Setup IP on Control PC

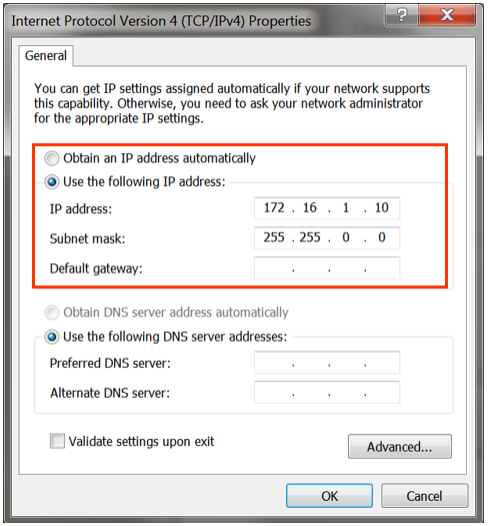
Quick Guide to Set IP Address

The IP address of the unit is 172.16.80.xxx (for example, 172.16.80.51). Therefore, set the IP Address of control PC as 172.16.yyy.zzz (for example,172.16.1.1) and set the Subnet Mask as 255.255.0.0.



To set the IP address:

1. Open **TCP/IPv4 Properties** of the connected Ethernet device.
2. Select **Use the following IP address:**.
3. Type **IP address** as **172.16.1.10**.
4. Type **Subnet mask** as **255.255.0.0**.

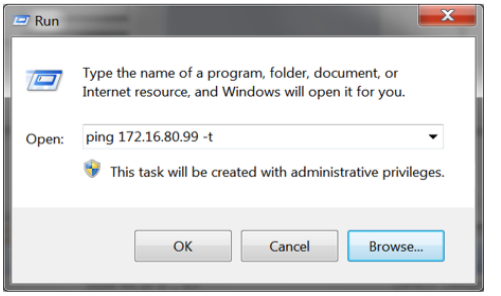


Pinging the Unit

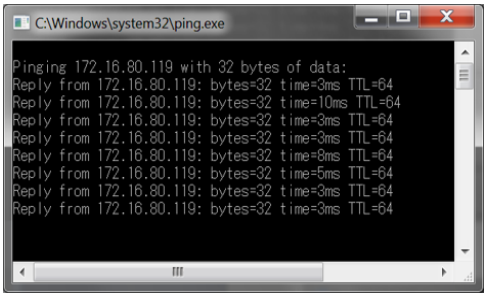
In order to check that the IP settings are correct, you can ping the unit. Getting a reply under 3 ms means the connection is correct. Otherwise, something is wrong.

To ping the unit:

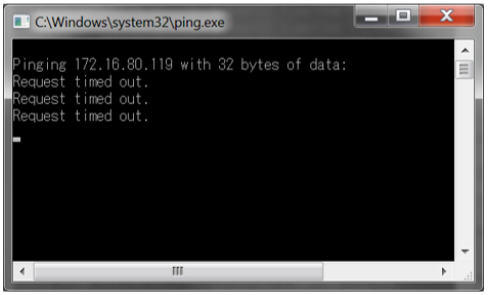
1. On your keyboard, click [Win] + [R] to open the Command Prompt.
2. Type the command **ping 172.16.80.99 -t**.
3. Click **OK**.



If well connected, this screen is displayed.



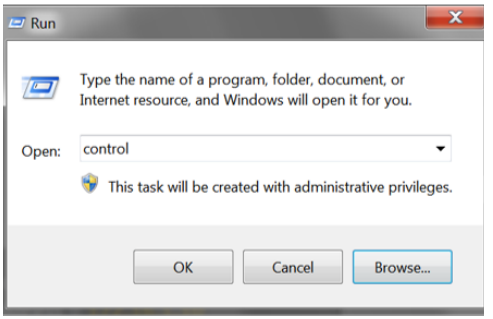
If disconnected, this screen is displayed.



Accessing the Control Panel in Windows

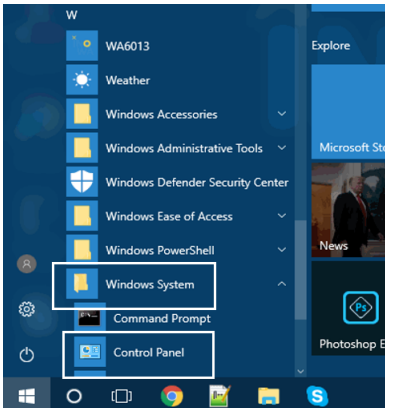
To open the control panel in Windows 7 and 10:

1. On your keyboard, click [Win] + [R] to open the Command Prompt.
2. Type **control** in the **Open** field.
3. Click **OK**.



To open the control panel in Windows 10 only:

1. Expand the Start menu.
2. Select **Windows System** folder.
3. Select **Control Panel**.



Note: *The supported Operating Systems are Microsoft Windows 7 SP1 (x86 and x64) and Microsoft Windows 10 (x86 and x64).*

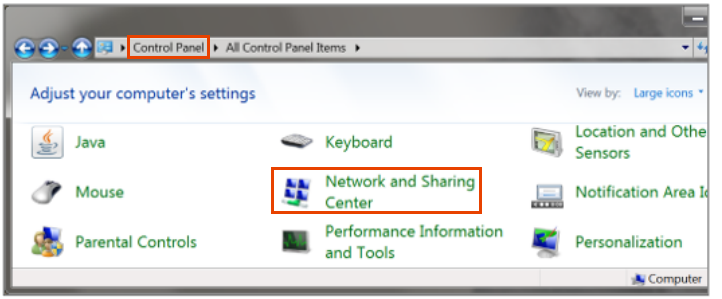
Note: *The GUI requires .NET Framework 4.6.1 to work. It is Microsoft official resource. The link is below:*
https://dotnet.microsoft.com/download/thank-you/net461or
https://www.microsoft.com/en-us/download/details.aspx?id=49982

Setting the IP Address in Windows 7 and 10

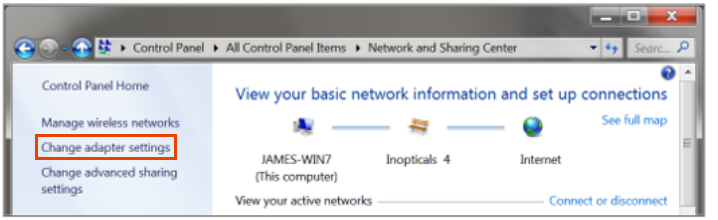
The procedure is the same for both Windows 7 and 10. Windows 7 screen shots are used as examples.

To set the IP address:

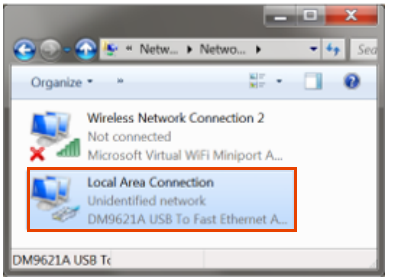
1. Open the **Control Panel** and enter **Network and Sharing Center**.



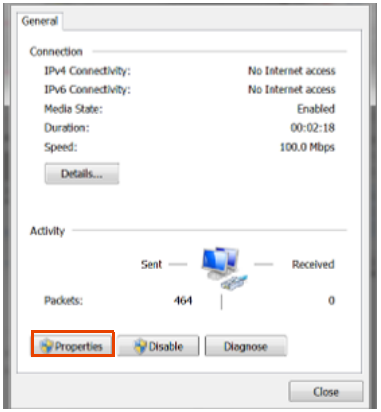
2. Click **Change adapter settings**.



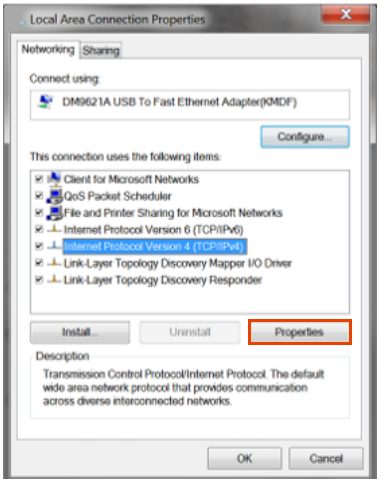
3. Select the Ethernet device already linked to the unit.



4. Click **Properties**.



5. Select **IPv4** and click **Properties**.

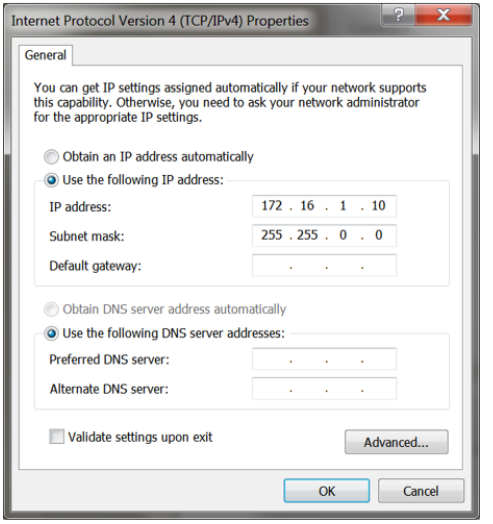


6. Setup IP address by selecting **Use the following IP address:**

   IP address = 172.16.1.10

   Subnet mask = 255.255.0.0

7. Click **OK**.

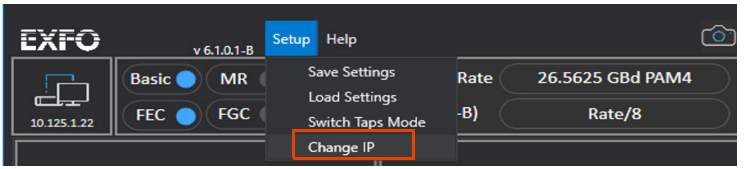


Changing the IP Address

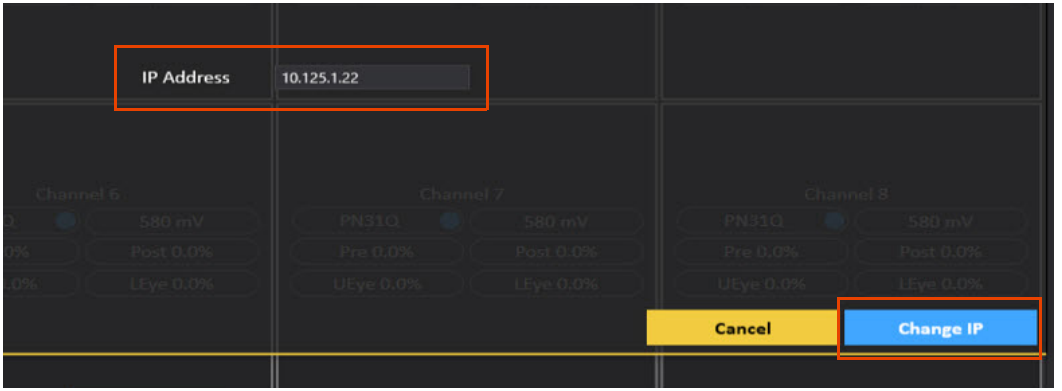
The tool of changing the unit's IP address is already integrated in the GUI.

To change the IP address of the unit:

1. Connect the unit.
2. Click **Change IP** in the **Setup** menu.



3. Input the desired **IP Address**.



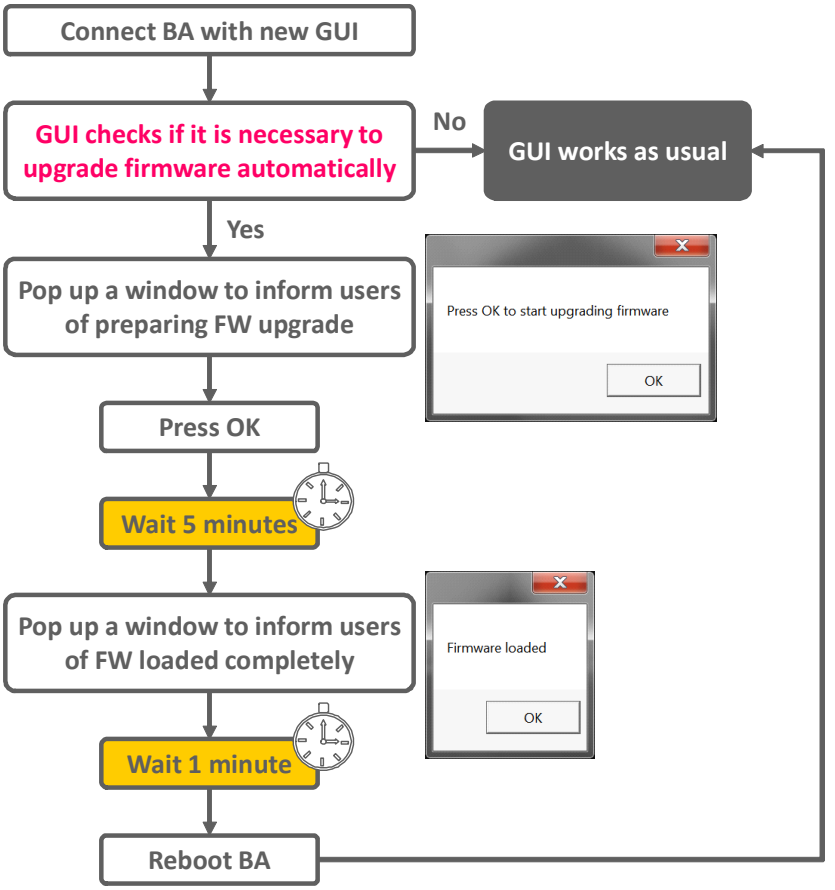
4. Click the **Change IP** button.
5. Wait 10 seconds and reboot the unit (IP is already changed).

To confirm if the IP was changed, ping the unit. If a reply is received, the address was changed successfully.

D Firmware Upgrade and API Update

You can download the latest GUI to upgrade and run the BA (Bit Analyzer) with new functions. The upgrade process is displayed as follows.

Note: *If you have already programmed the BA by API, after upgrading the FW (firmware), the API must be updated. See Downloading the API* on page 80.

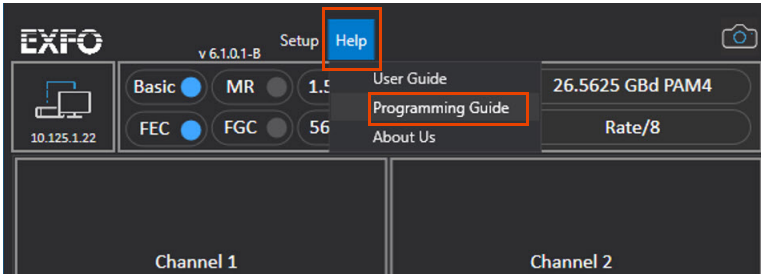


Downloading the API

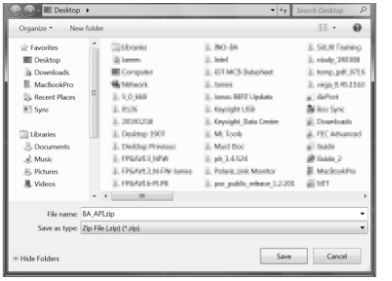
You can program and develop tools to control the BA by API. The API is downloadable from the GUI itself.

To download the API:

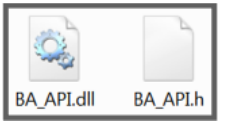
1. Click **Help** on the top bar then **Programming Guide**.



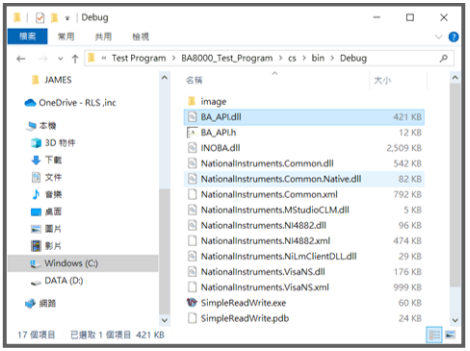
2. Save **BA_API.zip**.



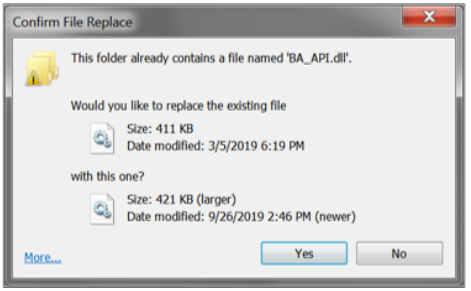
3. Extract **BA_API.dll** and **BA_API.h**.



4. Open the folder of the programming language.



5. Replace the existing (old) API files with the new ones.



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P/N: 1.0.0.1

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