INO-EA GUI
Quick Start Guide

PC System Requirements to Run GUI

Minimum Hardware Requirements	
Process	1.67GHz CPU
Video	NVIDIA GeForce GPU (ex: MX150)
Memory	2GB RAM
Storage	500MB of available hard disk space
LAN	Gigabit Ethernet
Resolution	1366x768 display

Recommended Hardware Requirements	
Process	2.0GHz CPU
Video	NVIDIA GeForce GTX series
Memory	4GB RAM
Storage	1GB of available hard disk space
LAN	Gigabit Ethernet
Resolution	1920x1080 display

OS and .NET Framework Requirements to Run GUI

Supported Operating System

- **Microsoft Windows 7 SP1 (x86 and x64)**
- **Microsoft Windows 10 (x86 and x64)**

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/net461
or
https://www.microsoft.com/en-us/download/details.aspx?id=49982

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4 Steps to Measure Eye Diagram

Step 0 – Hardware Config. to Power On 1-CH EA

1

Connect a Cat 6 Ethernet cable* from control PC to RJ45 port on the rear of chassis

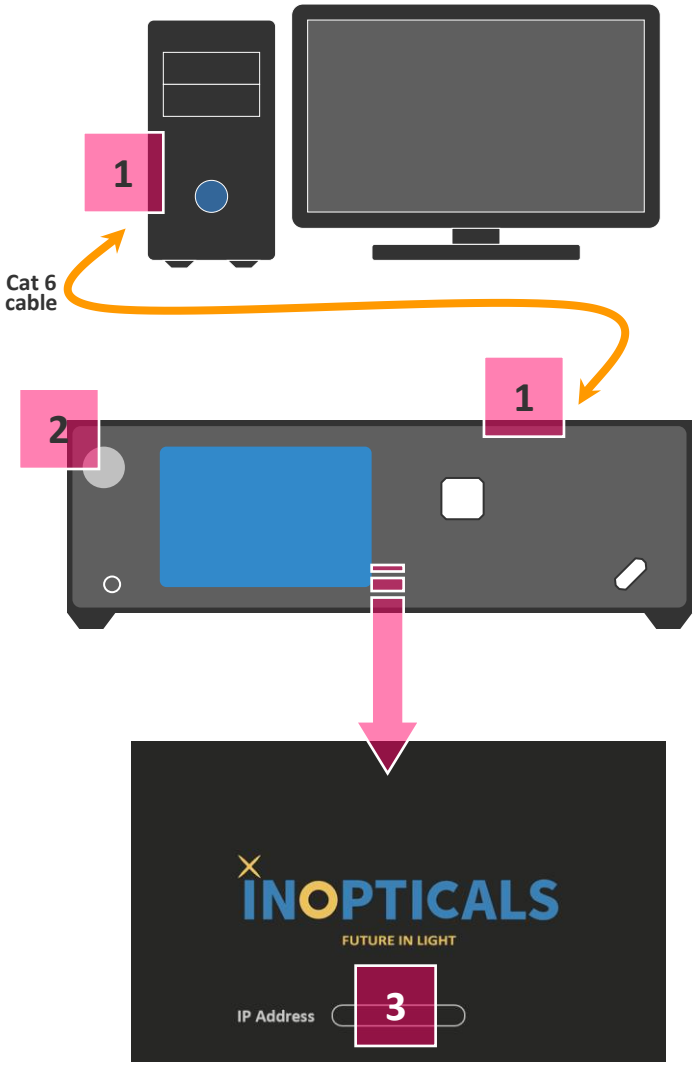
2

Push power button on the front panel

3

Wait for initialization including checking receiver, detecting network, etc.

Initialization is complete when IP address appears**



*Recommended is high-performance Ethernet cable, for example, Cat 6

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

Step 0 – Hardware Config. to Power On 2-CH EA

for 2-CH model

1

When using CH1, connect a Cat 6 Ethernet cable* from control PC to LAN1 port on the rear of chassis.

When using CH2, connect a Cat 6 Ethernet cable* from control PC to LAN2 port on the rear of chassis.

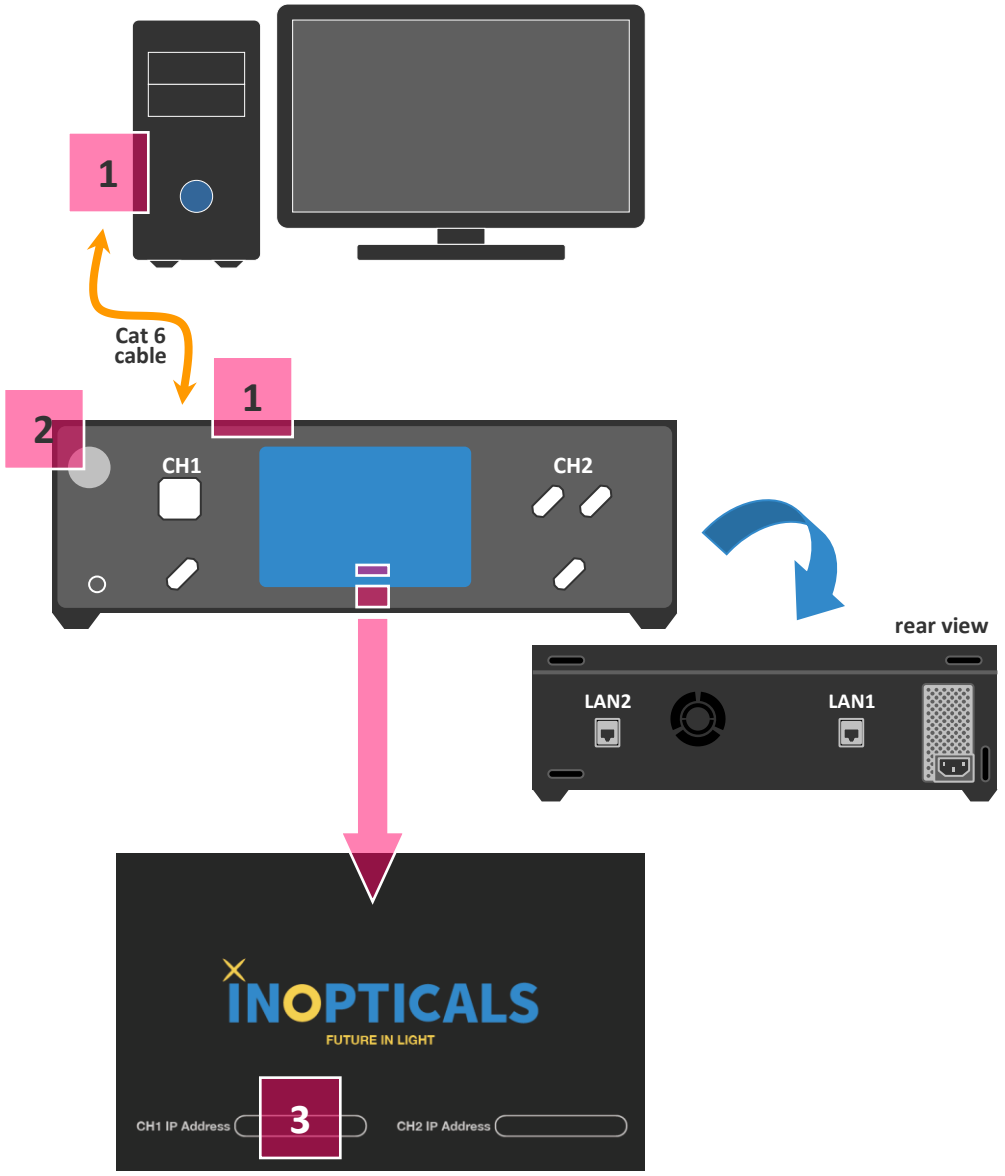
2

Push power button on the front panel

3

Wait for initialization including checking receiver, detecting network, etc.

Initialization is complete when IP address appears**



*Recommended is high-performance Ethernet cable, for example, Cat 6

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

Step 1 – Link to Eye Analyzer

1

Input IP address of Eye Analyzer Channel on GUI* ex: 172.16.8.20

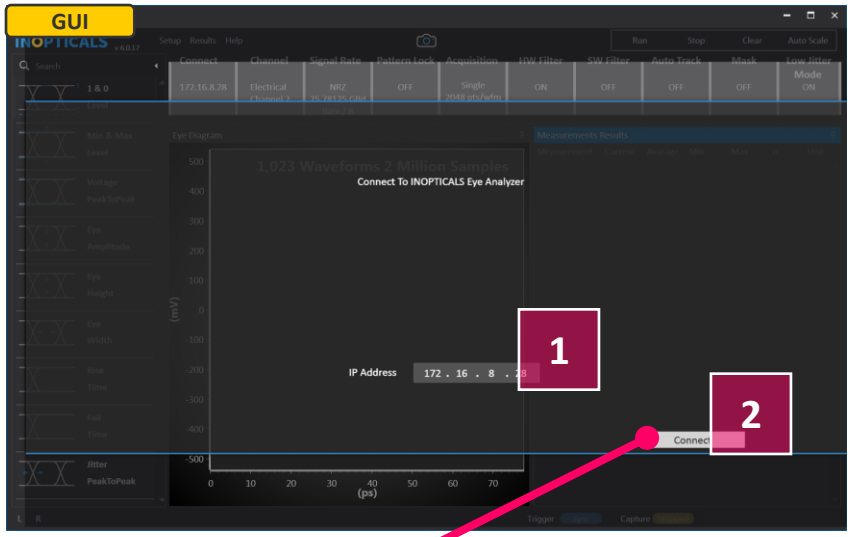
ⓘ **The IP is shown on chassis screen, when initialization is complete.**

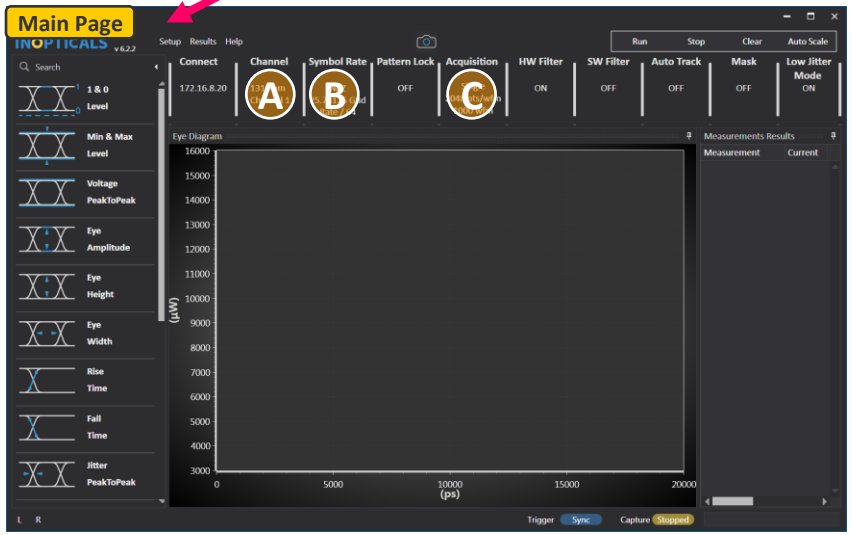
2

Press [Connect] button to enter <u>main page</u>

There are 3 main setups to enable eye diagram:

- **A – Channel setup**
- **B – Symbol Rate setup**
- **C – Acquisition setup**





*Example of control PC's IP= 172.16.1.10, and subnet mask = 255.255.0.0

Step 2 – Main Setups

1

Click [A] to select input signal type
- Electrical (signal into RF differential ports)
- 850nm (Multimode Fiber)
- 1310nm (Single Mode Fiber)
- 1550nm (Signal Mode Fiber)

After type selection, channel no. is automatically indicated to test.

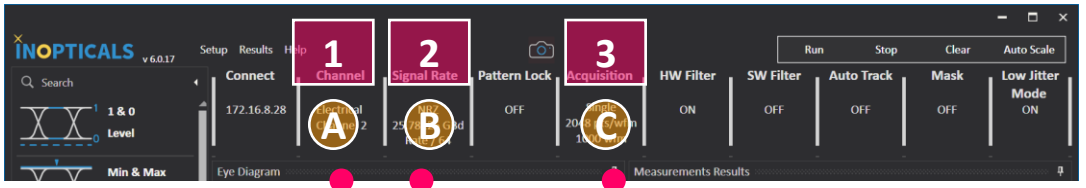
ⓘ Check if fiber/cable connects to the correct channel port or not.

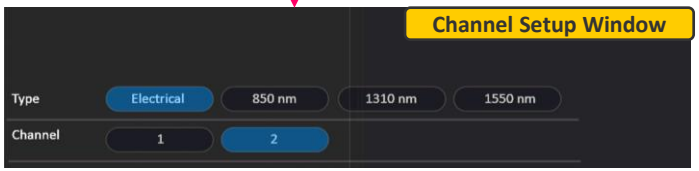
2

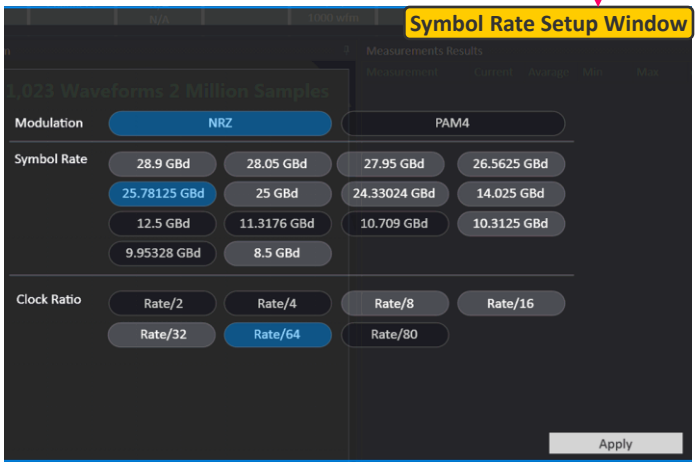
Click [B] to set the following items
- Modulation
- Symbol Rate
- Clock Ratio

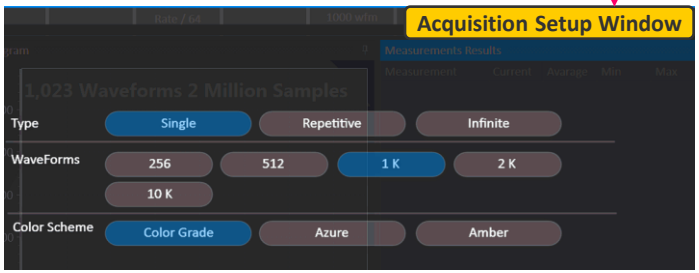
3

Click [C] to set the following items
- Acquisition Type
- Waveform Number
- Color Scheme









Step 3 – Show Eye Diagram

1

Click the button [Auto Scale]

2

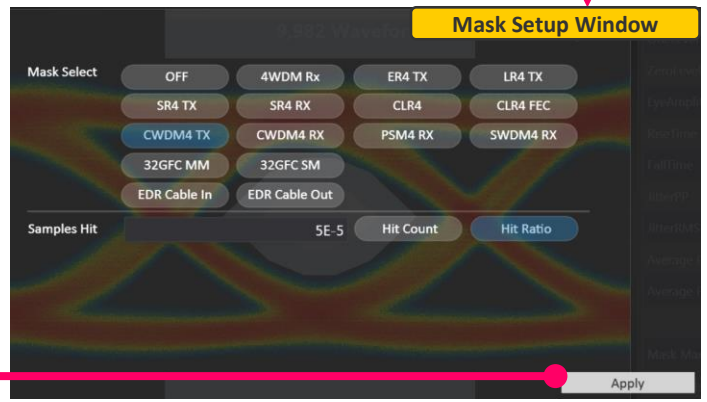
Click the button [Run] to show eye diagram

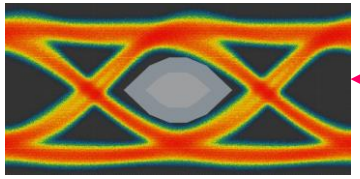
3

Click Measurement Icons to enable them

4

Click [D] to set the following items to enable mask
- Mask Type
- Hit Ratio



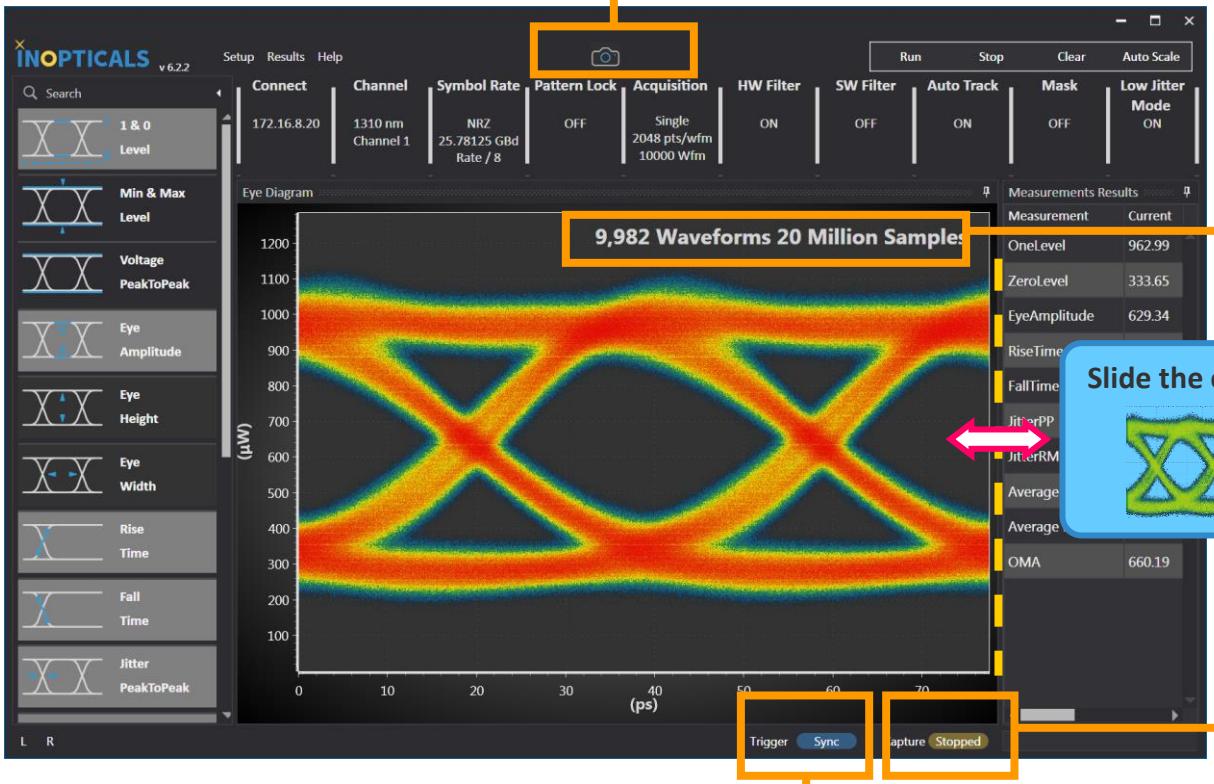


GUI Indication

Indication of Trigger/Capture/Camera

Screen Capture

Save GUI screen as PNG file



Number of total captured waveforms
Number of total sampling points

Slide the edge to tune the scale of eye diagram

Running Under capturing

Stopped Stopped capturing

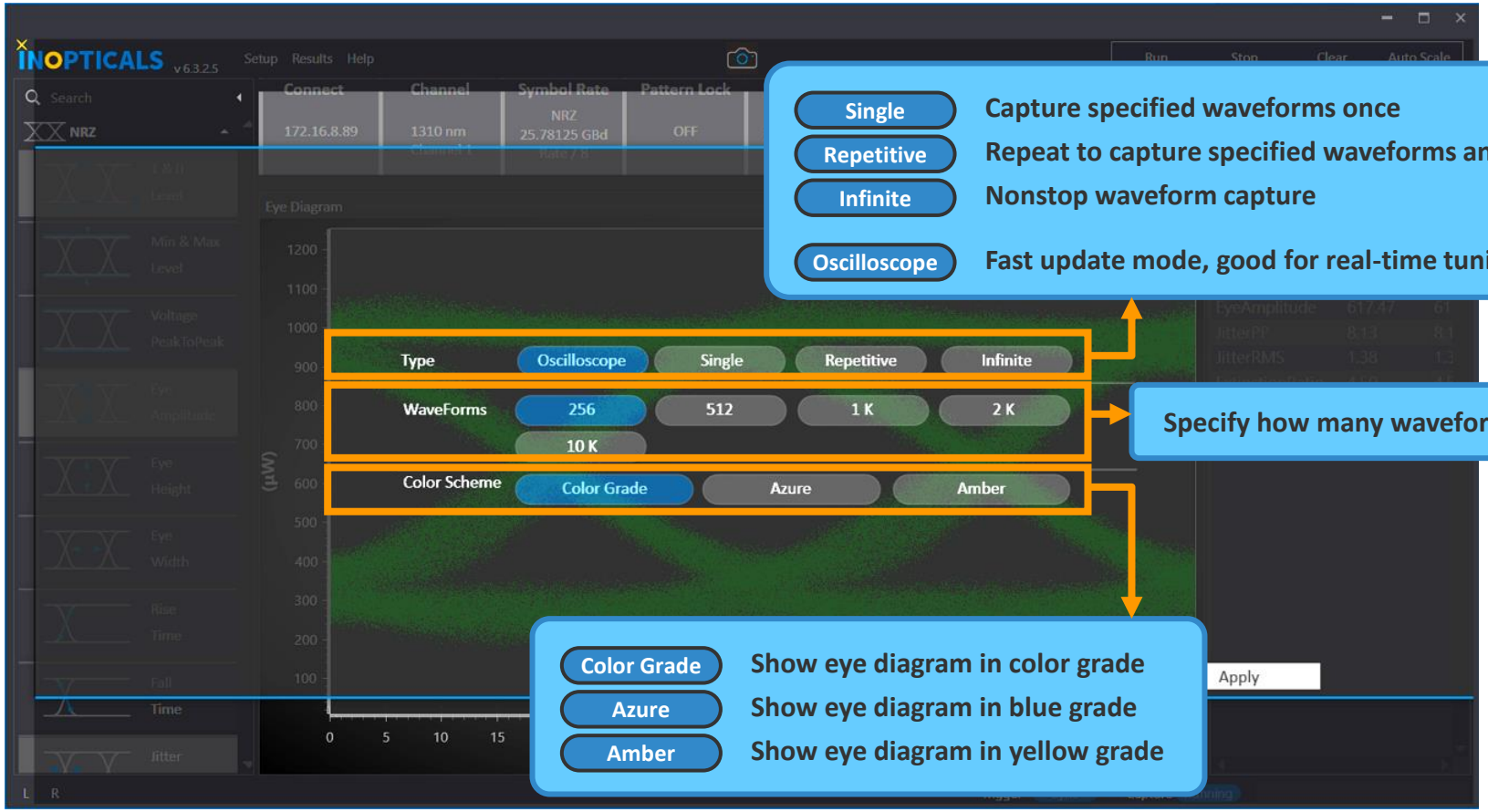
Sync Clock Sync

LOL Loss of Lock

Provide clock signal into [Clock IN] port,
and set correct symbol rate & clock ratio to get sync.

Advanced Guide

Acquisition Setup Window



Single Capture specified waveforms once

Repetitive Repeat to capture specified waveforms and clean

Infinite Nonstop waveform capture

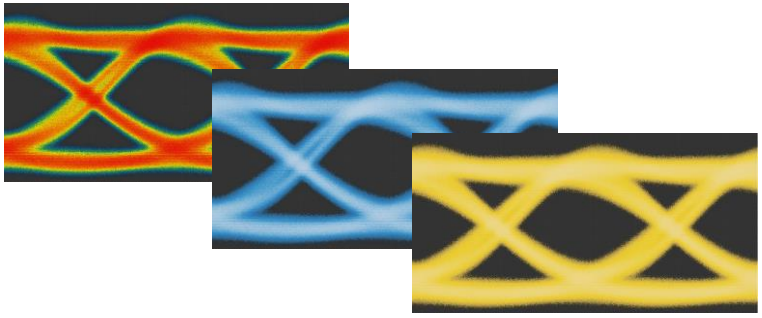
Oscilloscope Fast update mode, good for real-time tuning

Specify how many waveforms to capture

Color Grade Show eye diagram in color grade

Azure Show eye diagram in blue grade

Amber Show eye diagram in yellow grade

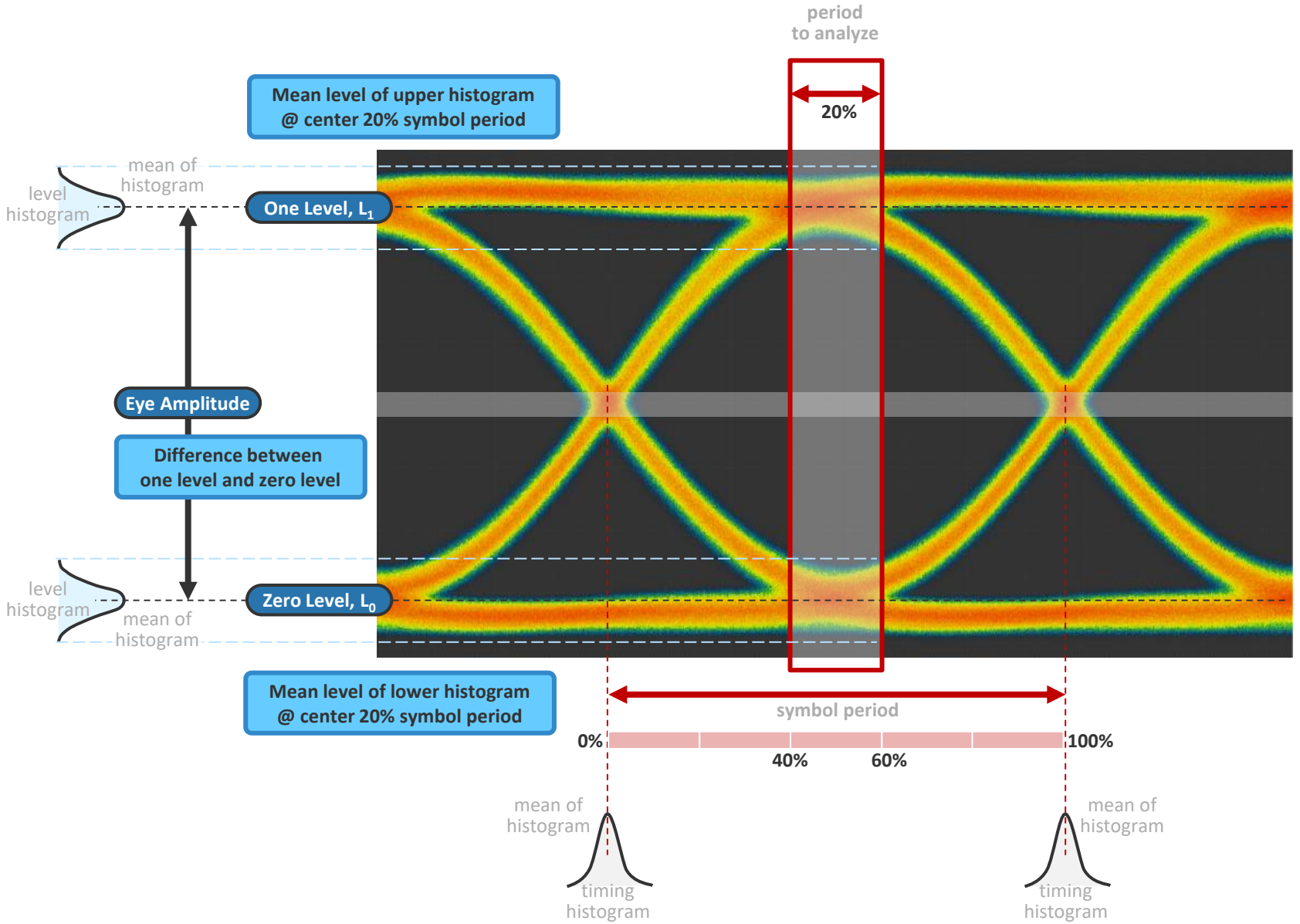


Mask List

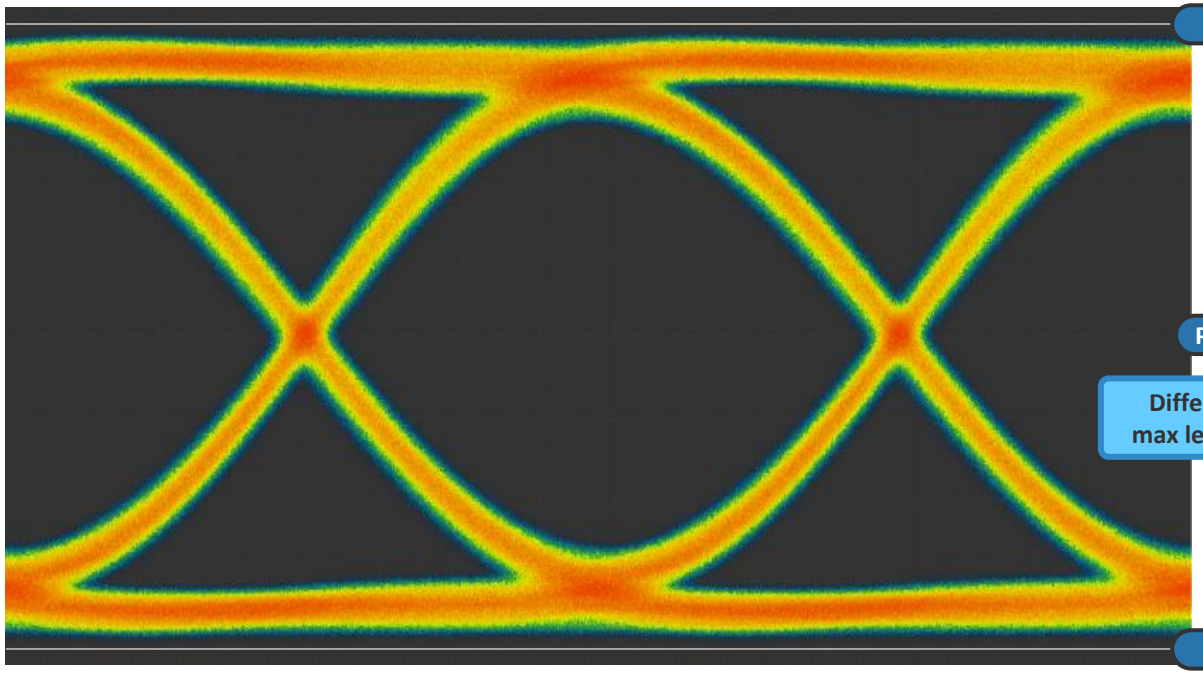
EA Mask Title	Full Name	Reference
4WDM Rx	100G 4WDM Rx	4-Wavelength WDM MSA
ER4 TX	100GBASE-ER4 Tx	IEEE Std 802.3ba-2010
LR4 TX	100GBASE-LR4 Tx	IEEE Std 802.3ba-2010
SR4 TX	100GBASE-SR4 Tx	IEEE Std 802.3ba-2010
SR4 RX	100GBASE-SR4 Rx	IEEE Std 802.3ba-2010
CLR4	100G-CLR4	based on 100GBASE-LR4
CLR4 FEC	100G-CLR4 FEC	
CWDM4 TX	100G CWDM4 Tx	CWDM4 MSA
CWDM4 RX	100G CWDM4 Rx	CWDM4 MSA
PSM4 RX	100G PSM4 Rx	PSM4 MSA, Parallel Single Mode 4 lane
SWDM4 RX	100G SWDM4 Rx	100G SWDM4 MSA
32GFC MM	32GFC MM Tx	FIBRE CHANNEL Physical Interface-6
32GFC SM	32GFC SM Tx	FC-PI-6
EDR Cable In	InfiniBand EDR Cable In	InfiniBand Trade Association
EDR Cable Out	InfiniBand EDR Cable Out	IBTA
25G LR	25GBASE-LR Tx	IEEE Std 802.3cc-2017
OUT4	OTU4	ITU-T G.959.1

Measurement Items

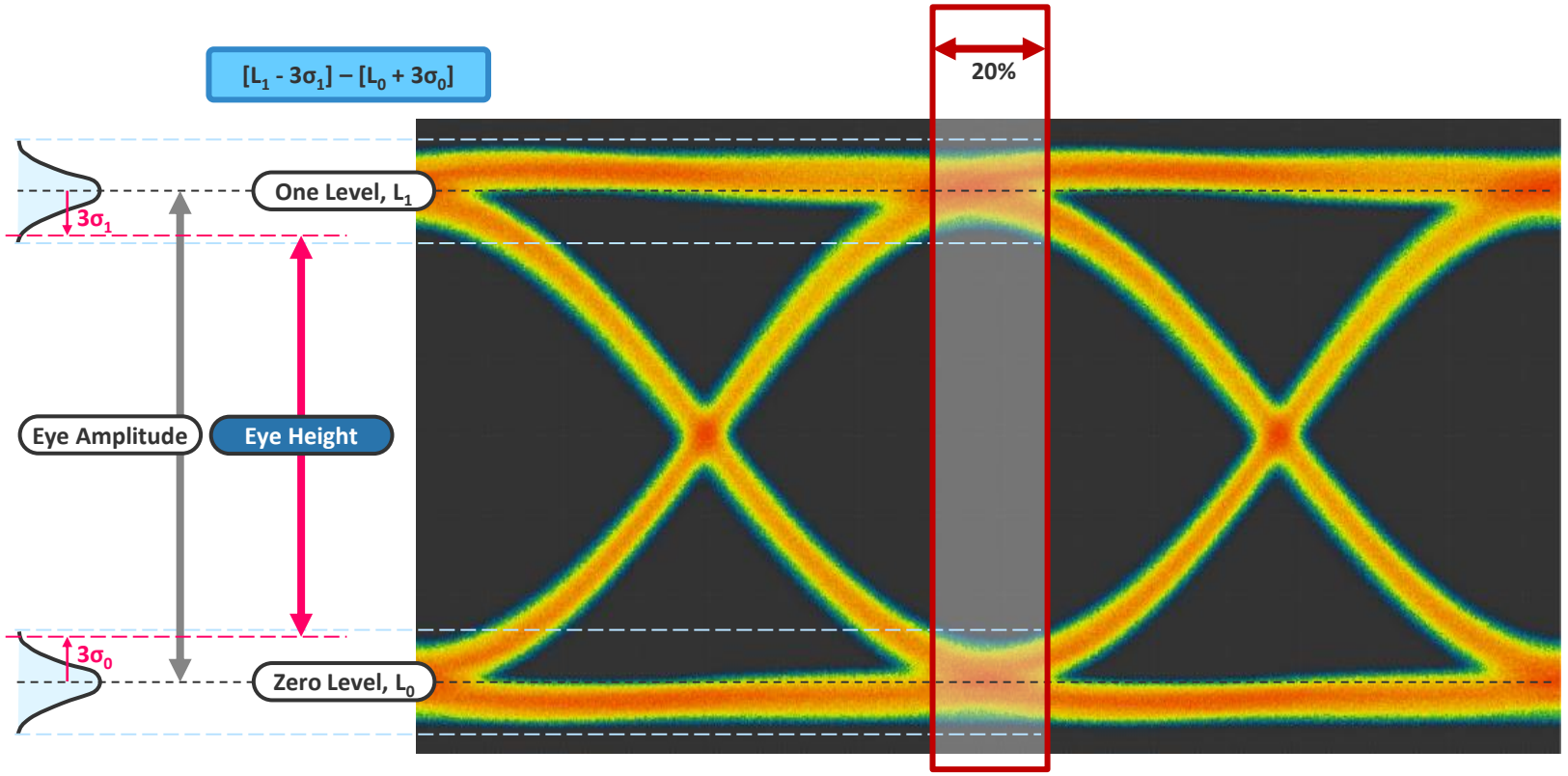
One Level, Zero Level & Eye Amplitude

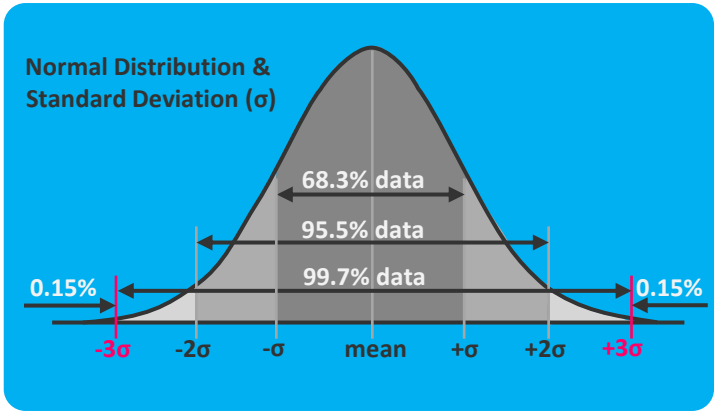


Max Level, Min Level & Peak-to-Peak Level

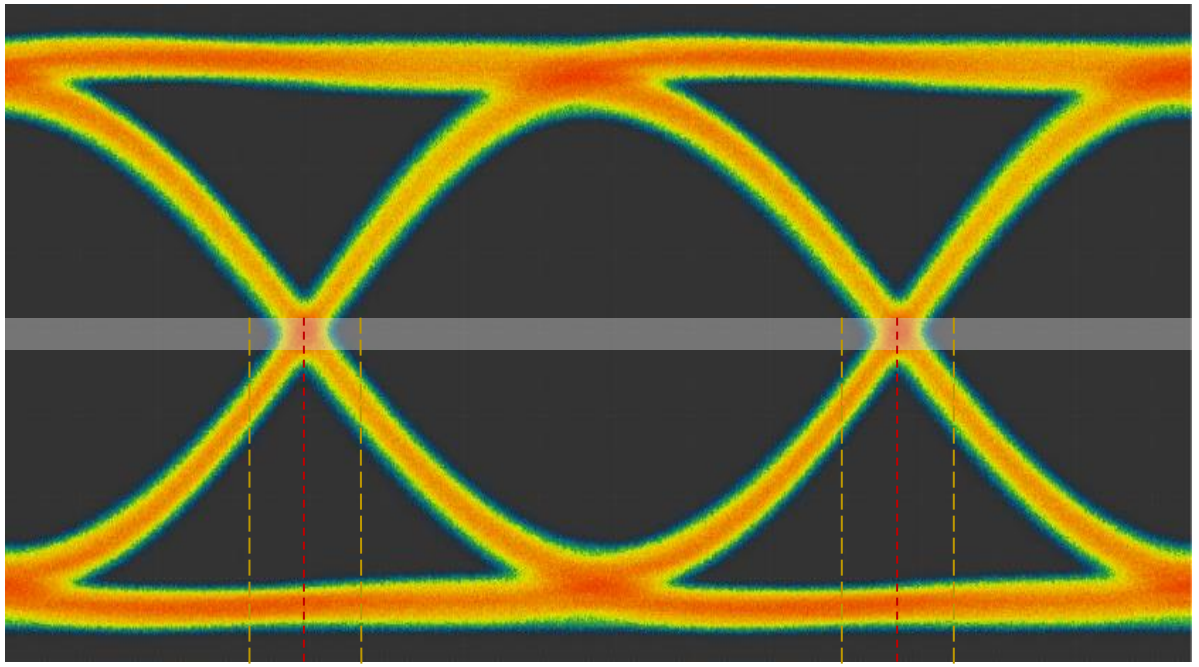


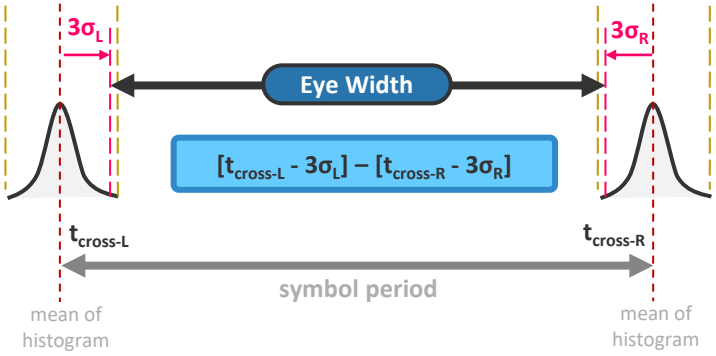
Eye Height

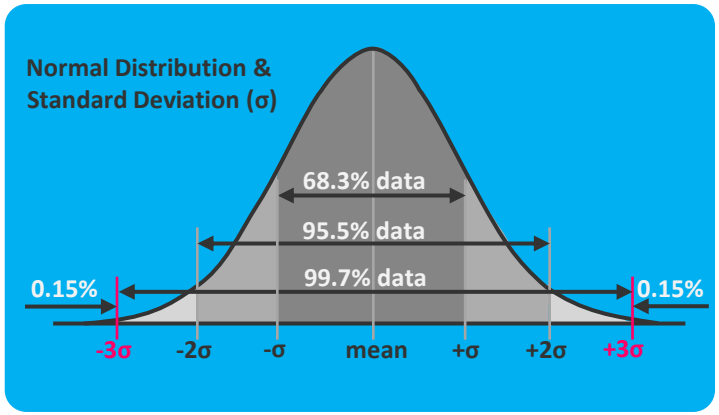

$[L_1 - 3\sigma_1] - [L_0 + 3\sigma_0]$
20%
One Level, L_1
$3\sigma_1$
Eye Amplitude
Eye Height
$3\sigma_0$
Zero Level, L_0


Normal Distribution &
Standard Deviation (σ)
68.3% data
95.5% data
99.7% data
0.15%
0.15%
-3σ
-2σ
-σ
mean
+σ
+2σ
+3σ

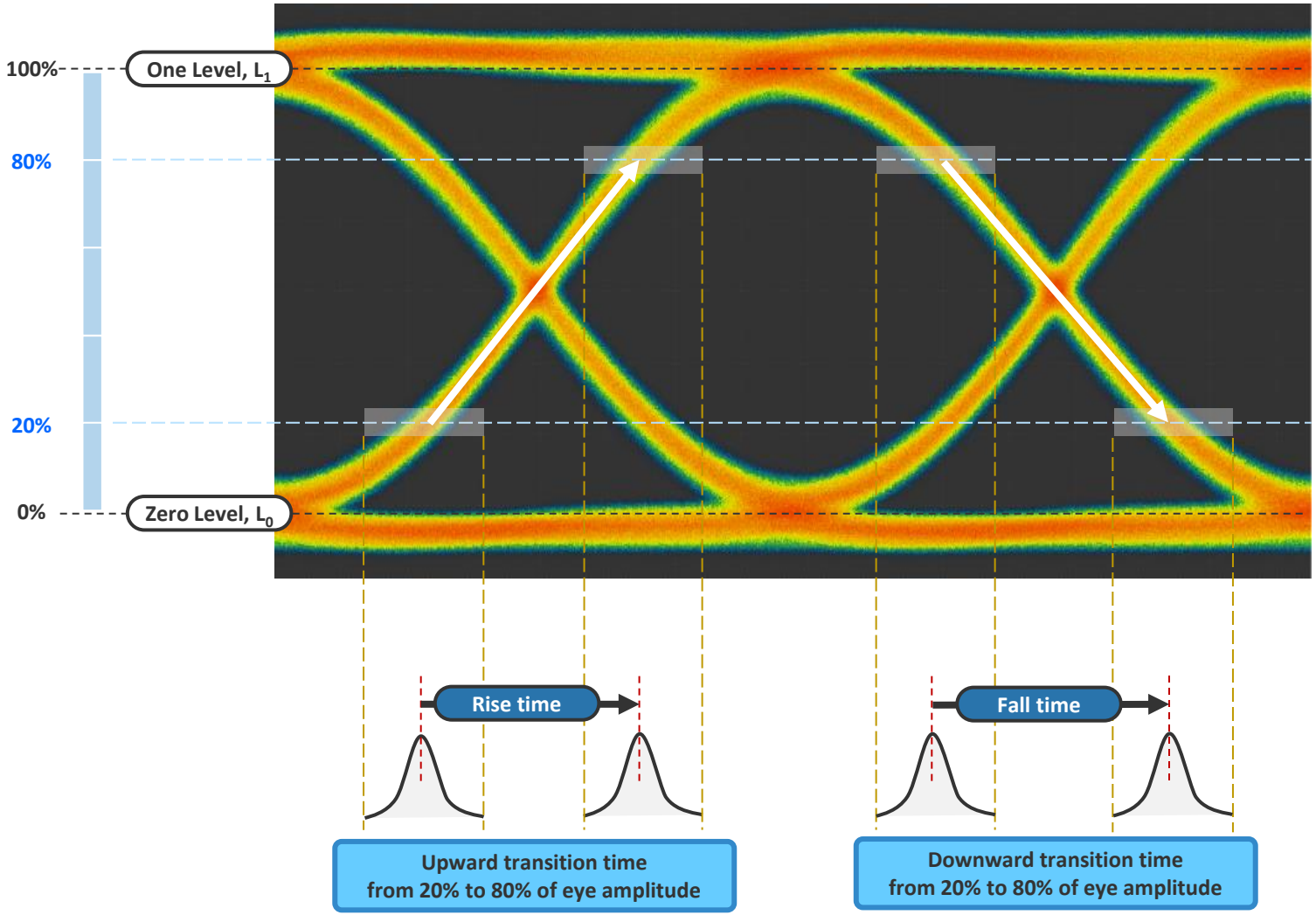
Eye Width



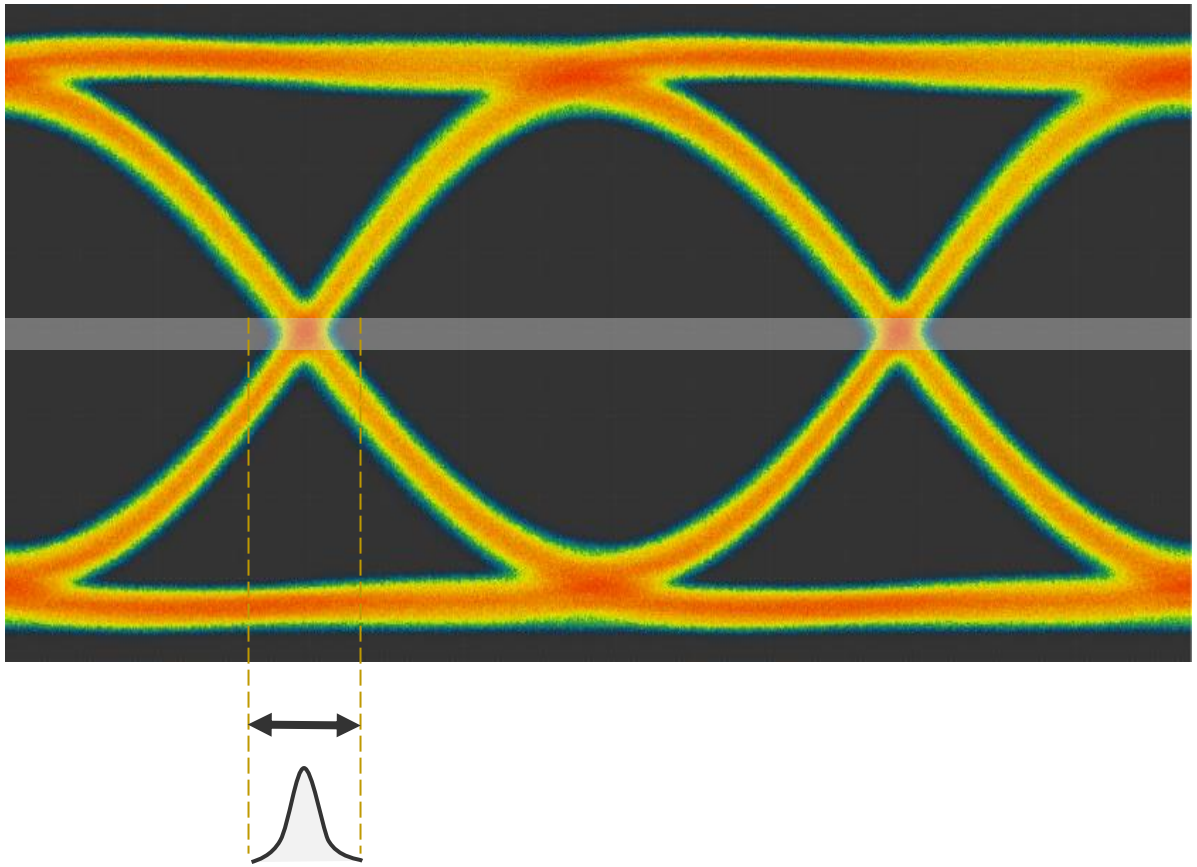

3σL
3σR
Eye Width
[tcross-L - 3σL] – [tcross-R - 3σR]
tcross-L
tcross-R
symbol period
mean of histogram
mean of histogram


Normal Distribution & Standard Deviation (σ)
68.3% data
95.5% data
99.7% data
0.15%
0.15%
-3σ
-2σ
-σ
mean
+σ
+2σ
+3σ

Rise Time & Fall Time



Peak-to-Peak Jitter & RMS Jitter



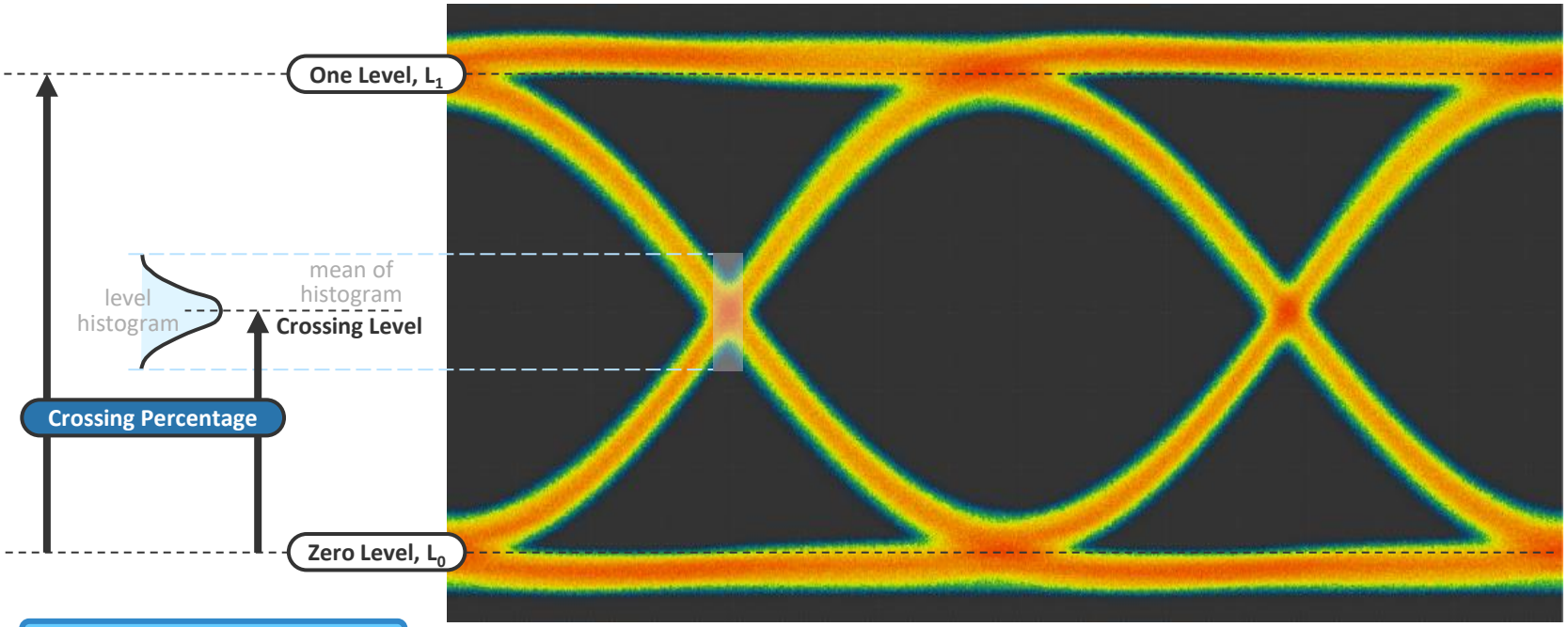
Peak-to-Peak Jitter, $Jitter_{pp}$

Full width of timing histogram @ crossing point

RMS Jitter, $Jitter_{RMS}$

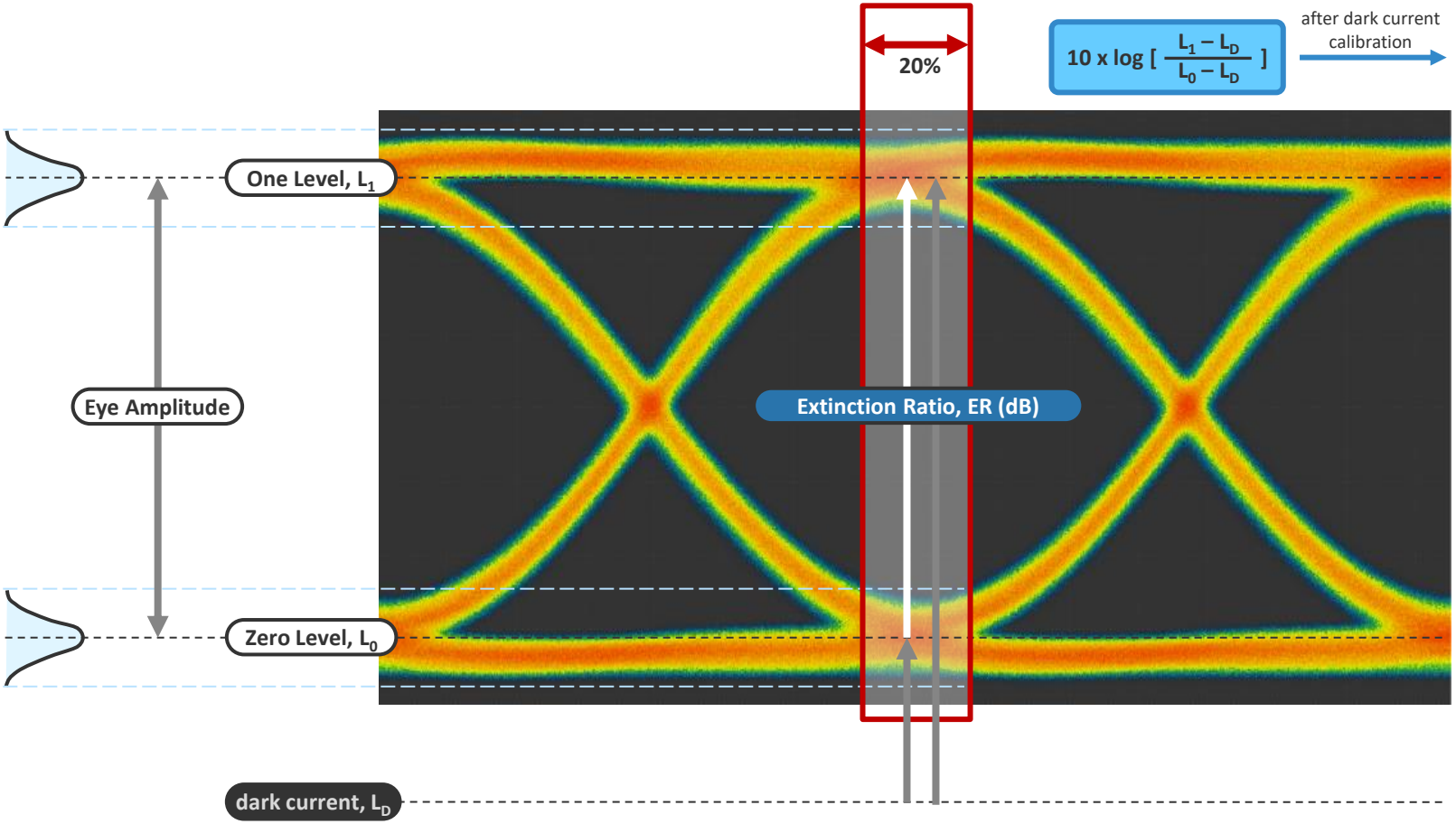
One standard deviation width of timing histogram @ crossing point

Crossing Percentage



$$100 \times \left[\frac{\text{Crossing Level} - L_0}{L_1 - L_0} \right]$$

Extinction Ratio*



*Before ER measurement, perform dark current calibration.

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Average Optical Power & Signal-to-Noise Ratio

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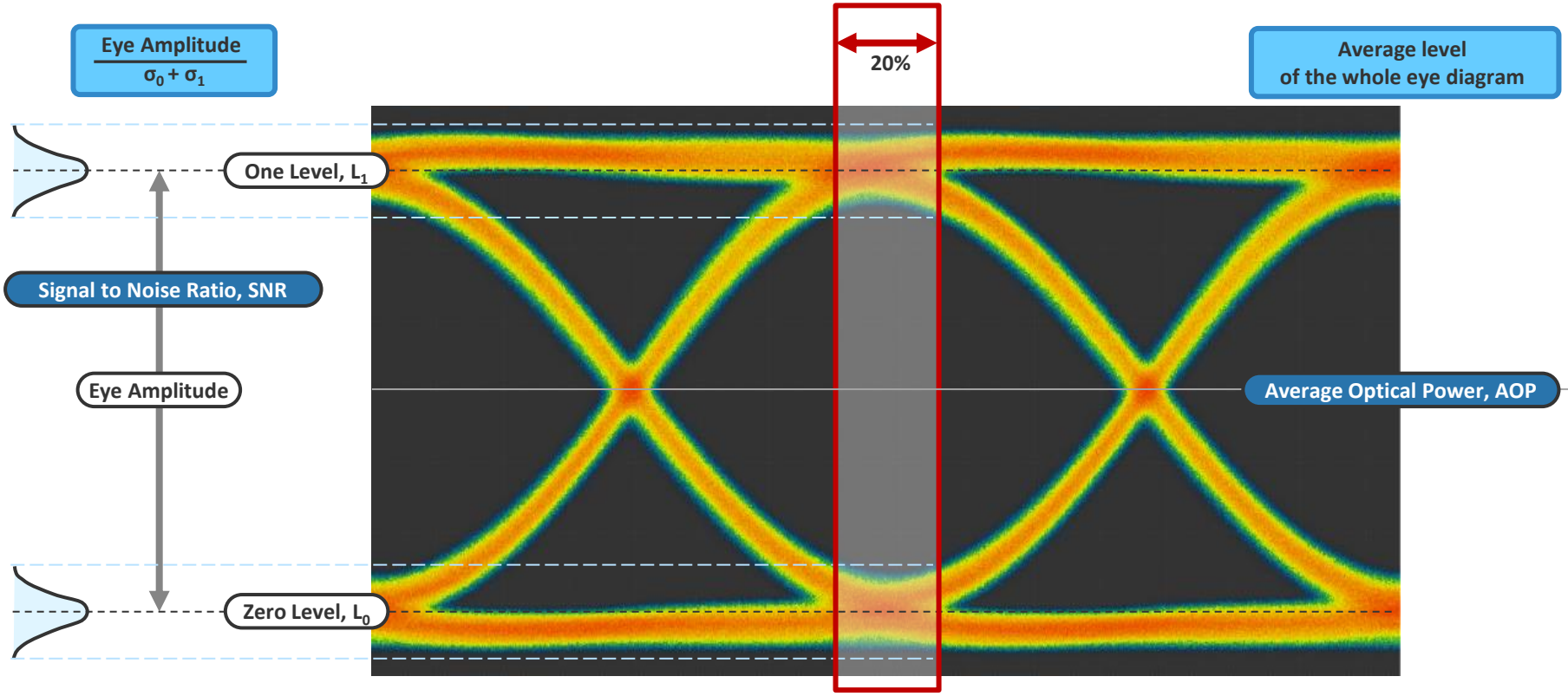
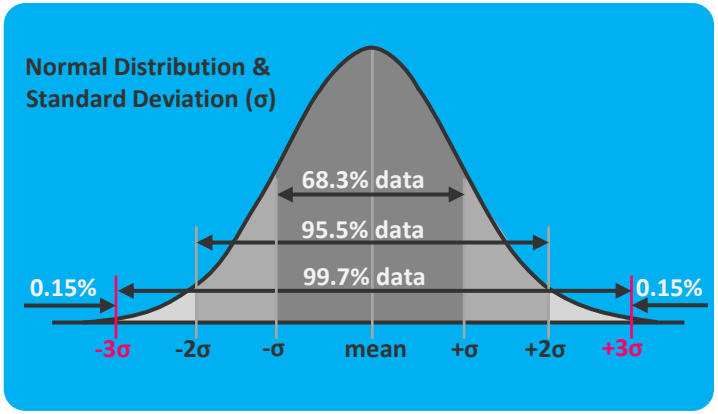
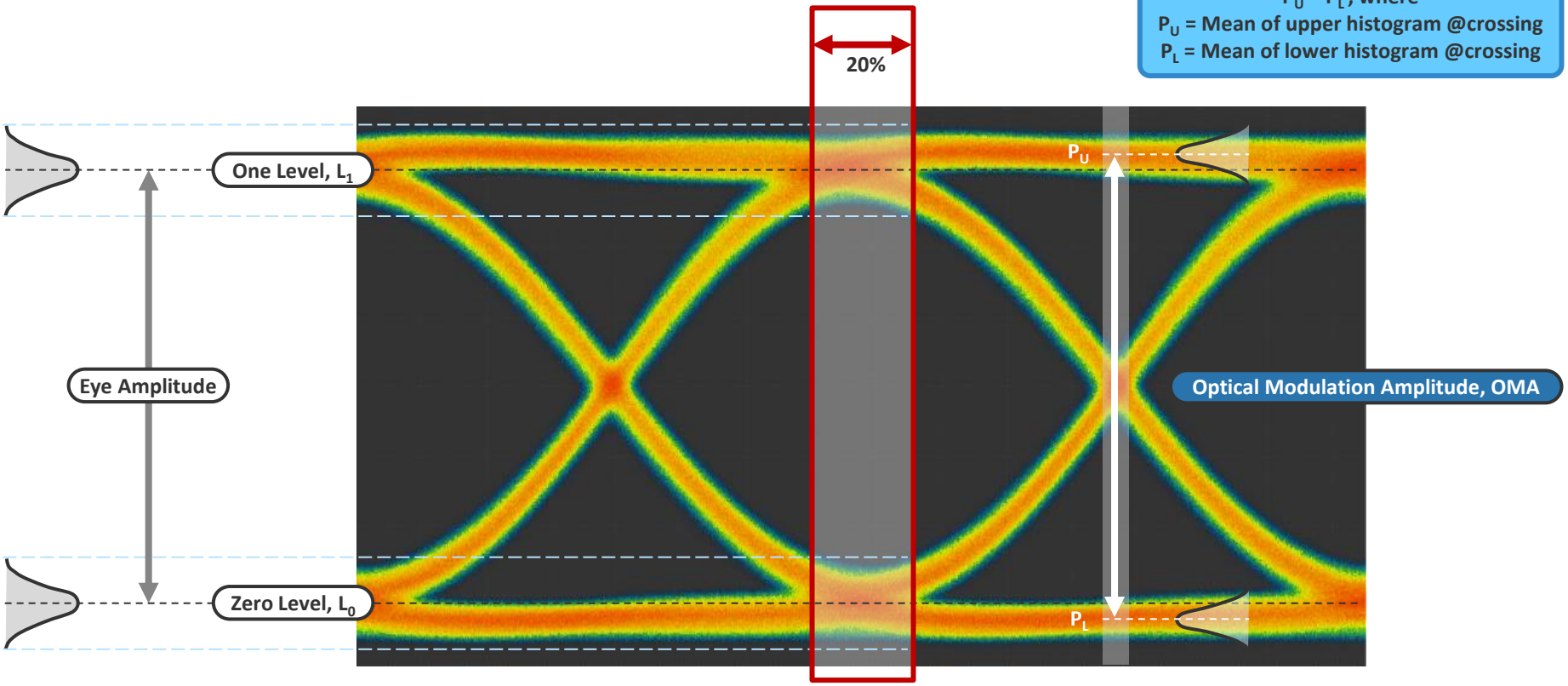


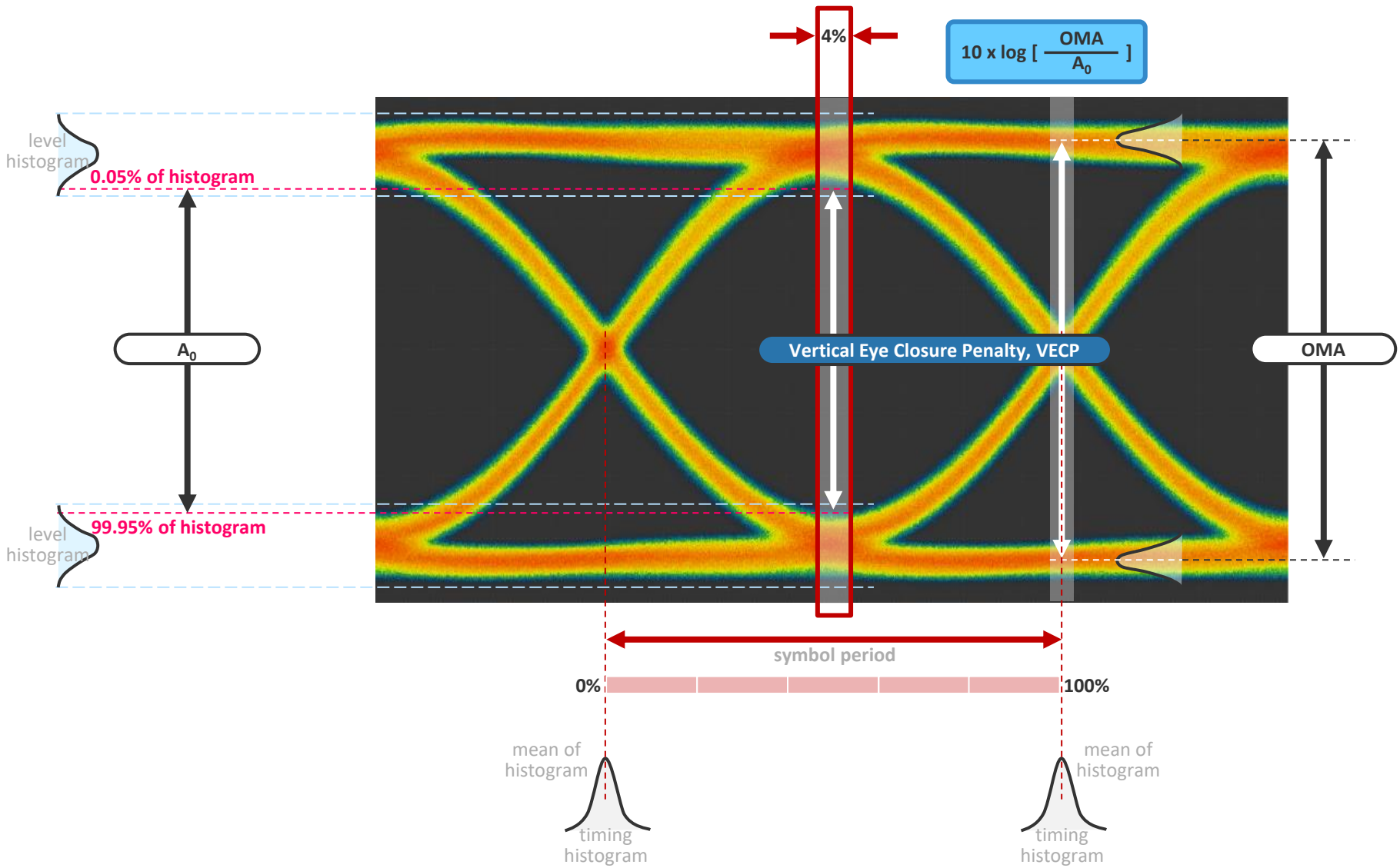


Optical Modulation Amplitude

$P_U - P_L$, where
P_U = Mean of upper histogram @crossing
P_L = Mean of lower histogram @crossing



Vertical Eye Closure Penalty



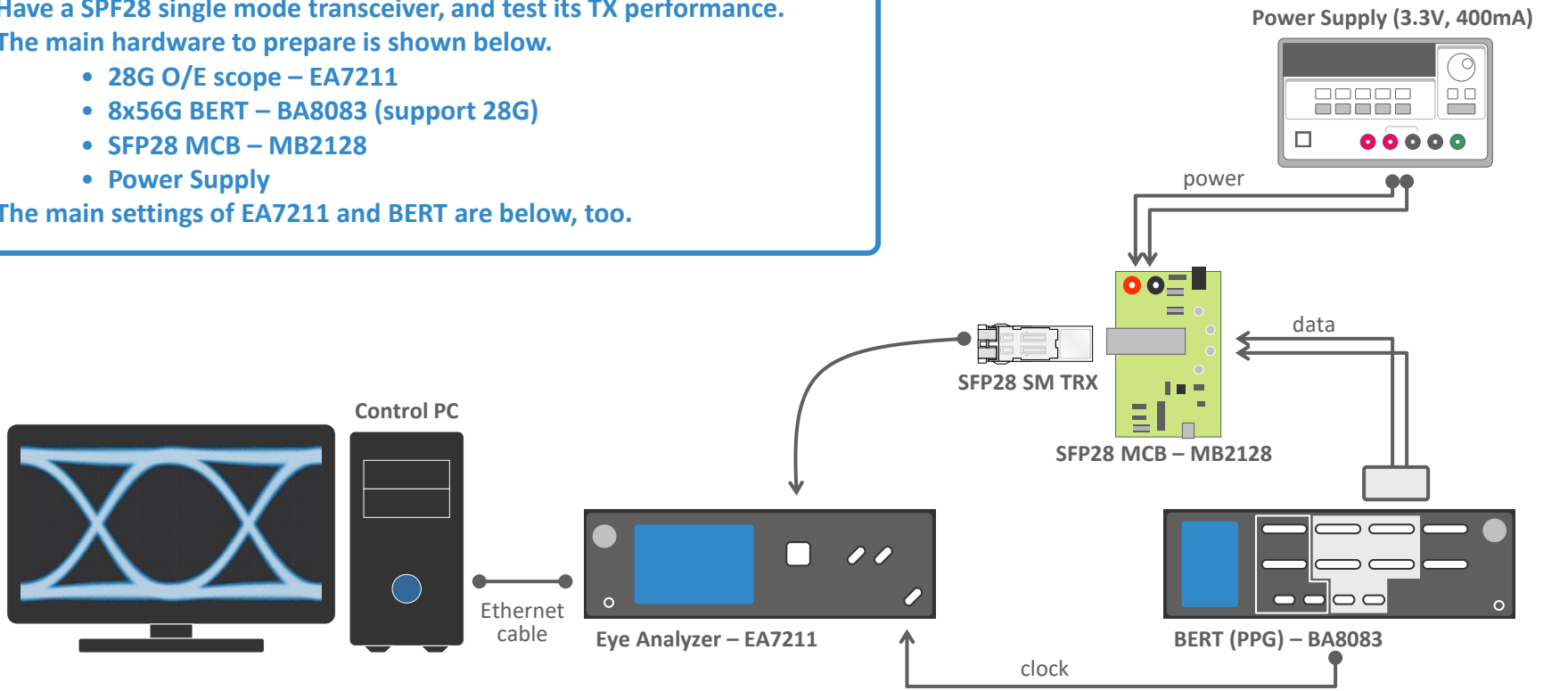
Appendix A – Example of Hardware Configuration for TRX Test

Measuring Eye of SFP28 SM Transceiver

Have a SPF28 single mode transceiver, and test its TX performance.
The main hardware to prepare is shown below.

- 28G O/E scope – EA7211
- 8x56G BERT – BA8083 (support 28G)
- SFP28 MCB – MB2128
- Power Supply

The main settings of EA7211 and BERT are below, too.



Settings of EA7211 – 28G O/E Scope

Channel Type = 1310nm
Modulation = NRZ
Symbol Rate = 25.78125GBd
Clock Ratio = /8
Acquisition Type = Single
Waveform Number = 1K (1,000)
Color Scheme = Color Grade

The settings should be the same.

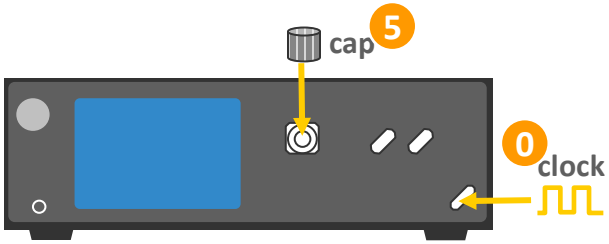
Settings of BA8083 – BERT

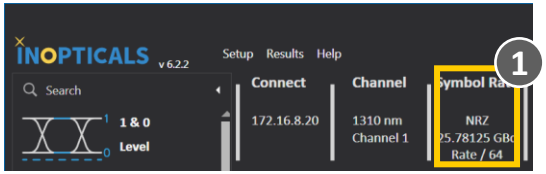
Mode = Basic
Modulation = NRZ
Symbol Rate = 25.78125GBd
Clock Ratio = /8
Test Pattern = PN31
Amplitude = 600mV

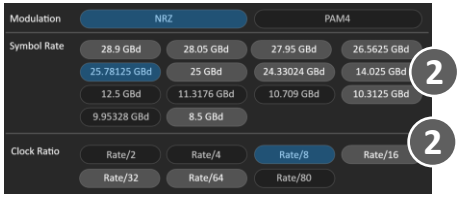
Appendix B –
Dark Current Compensation*

*It is recommended to perform dark current compensation every 30 days.

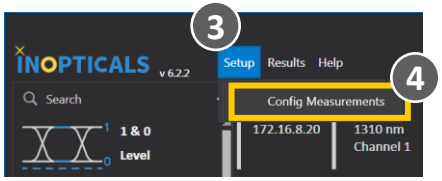
Procedure of Dark Current Compensation







Provide clock info



To open window of dark current compensation

Run compensation automatically

0 Provide clock signal into [Clock IN] port

[Please make sure to have a valid clock input] message is popped up

1 Click [Symbol Rate] area

2 Set correct Symbol Rate & Clock Ratio

3 Click [Setup] on the menu bar

4 Select [Config Measurements] to show compensation window

5 Use a cap to cover optical port on the front panel

[Please disconnect optical source] message is popped up

6 Press [Auto]

When the optical port is NOT covered well

No clock signal,
wrong symbol rate,
wrong clock ratio, etc.

7 [Press OK to start compensating] message is popped up

8 Press [OK] to compensate dark current automatically

wait 15 sec

9 [Successfully Compensated] message is popped up

10 Press [OK] to update the value of dark current compensation

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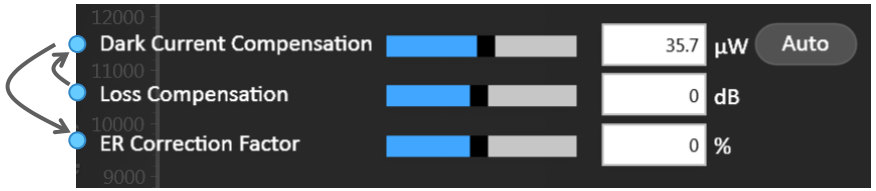
Appendix C –
How to Align EA with Referred Scope

Procedure of Aligning EA with Referred Scope

When users want to make EA complied with some reference scope, here are 3 steps to compensate the difference between EA and the reference scope.



1 Perform Loss Compensation

$$\text{Loss Compensation (dB)} = 10 \times \text{Log}_{10}\left[\frac{\text{Eye Amp}_{ref}}{\text{Eye Amp}_{ea}}\right]$$

where

Eye Amp_{ref} = Eye amplitude (µW) measured by reference scope;

Eye Amp_{ea} = Eye amplitude (µW) measured by Eye Analyzer

2 Perform Dark Current Compensation

$$\text{Dark Current Compensation (µW)} = \text{Power}_{avg,ref} - \text{Power}_{avg,ea}$$

where

$\text{Power}_{avg,ref}$ = Average power (µW) measured by reference scope;

$\text{Power}_{avg,ea}$ = Average power (µW) measured by Eye Analyzer

3 Perform ER Correction Factor

$$\text{ER Correct Factor (\%)} = \left[\frac{ER_{ref}}{ER_{ea}} - 1\right] \times 100$$

where

ER_{ref} = Extinction ratio (dB) measured by reference scope;

ER_{ea} = Extinction ratio (dB) measured by Eye Analyzer

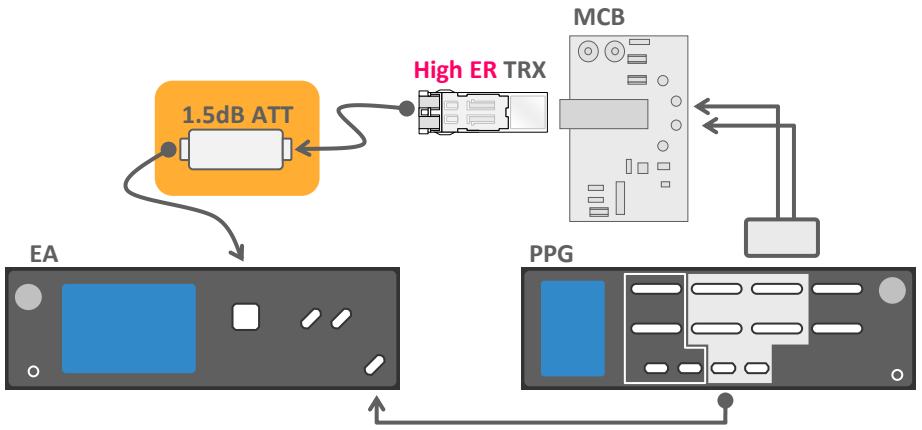
Appendix D –
One More Step to Test High ER TRX

How to Test High ER DUT

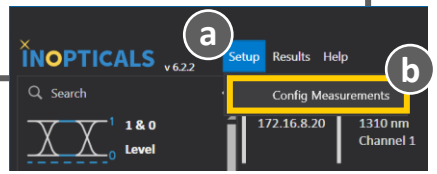
When transceiver ER is ≥ 5dB, we perform one more step to keep accurate measurement by insertion of a 1.5dB attenuator.

ER ≥ 5 dB

1. Insert 1.5dB attenuator
2. Compensate for the attenuation
3. Done and start testing



a. Click [Setup] on the menu bar
b. Select [Config Measurements] to show compensation window
c. Input 1.5dB on [Loss Compensation]



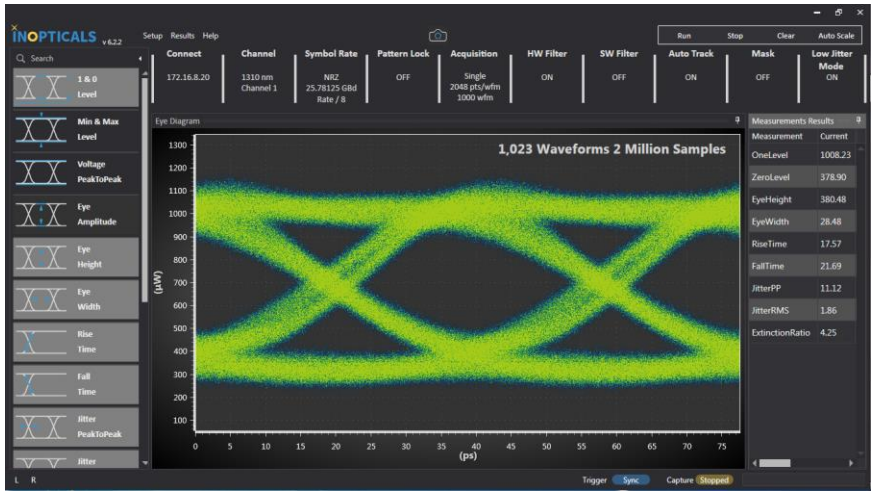
Appendix E –
Display Resolution Matters

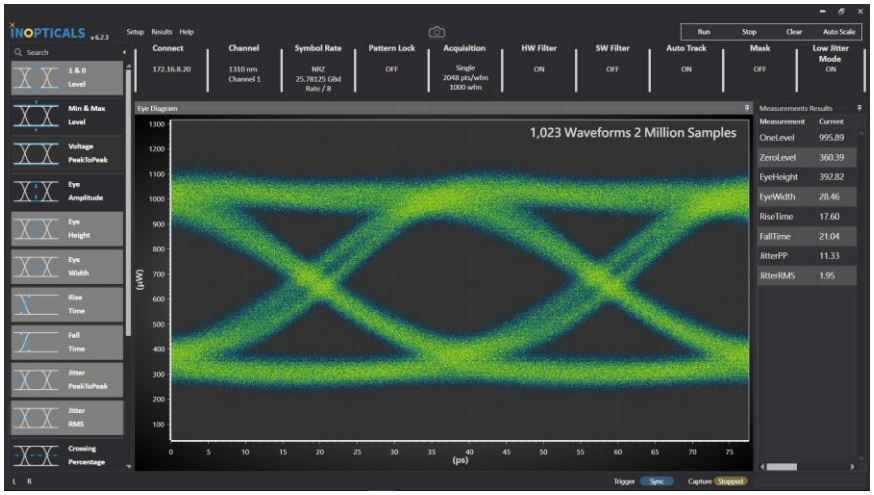
Resolution Matters

1920x1080 display provides more information and details. It is recommended to use full HD display.

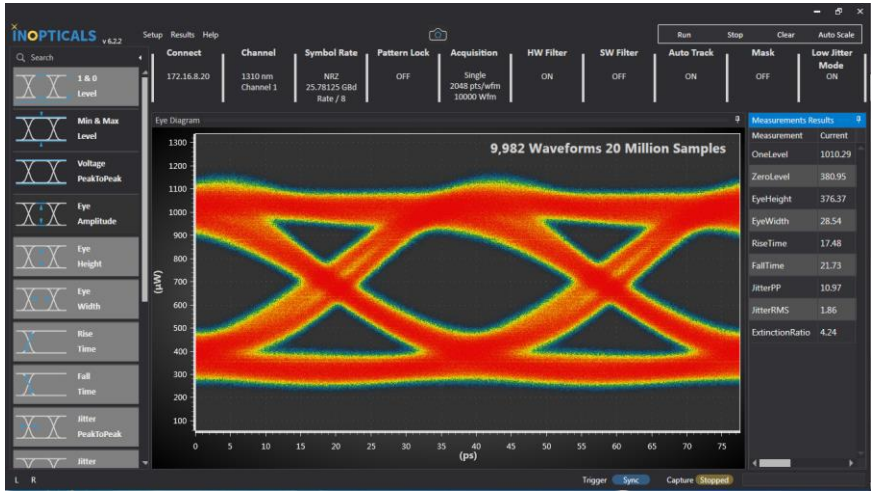
Minimum Requirement of Display Resolution	Recommended Requirement of Display Resolution
1366x768	1920x1080

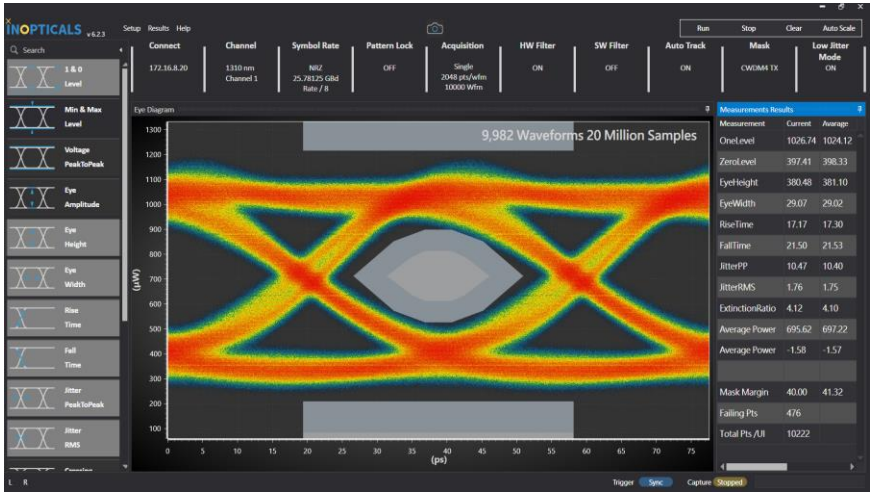
1,000 waveforms





10,000 waveforms





Appendix F – Set IP on Control PC

Quick Guide to Set IP Address

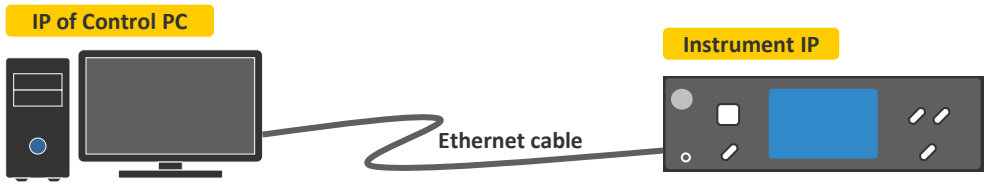
The IP address of instrument is 172.16.8.xxx (ex: 172.16.8.10)
Therefore, we set the IP Address of control PC as 172.16.yyy.zzz (ex: 172.16.1.10)
and set the Subnet Mask as 255.255.0.0

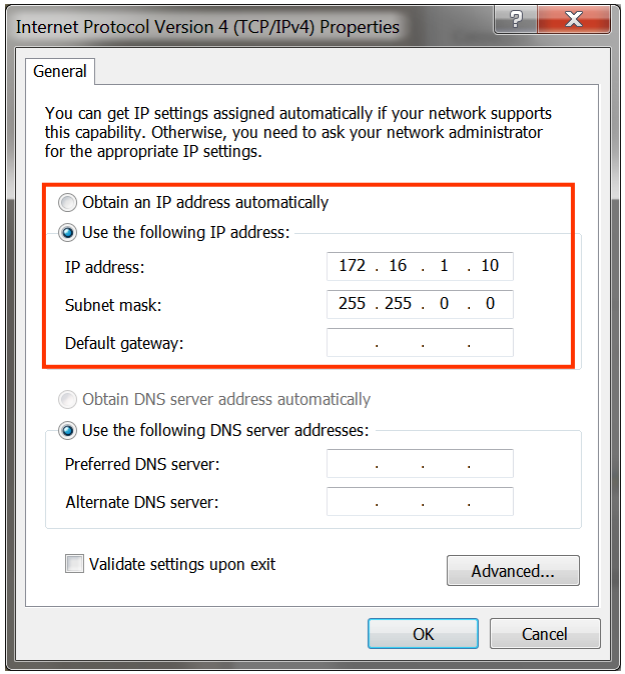
1. Open
TCP/IPv4 Properties of connected Ethernet Device

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

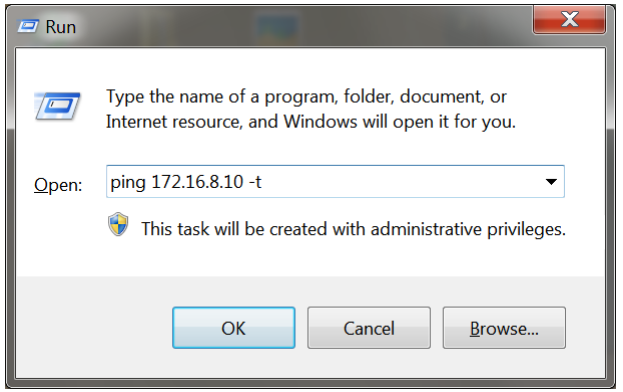




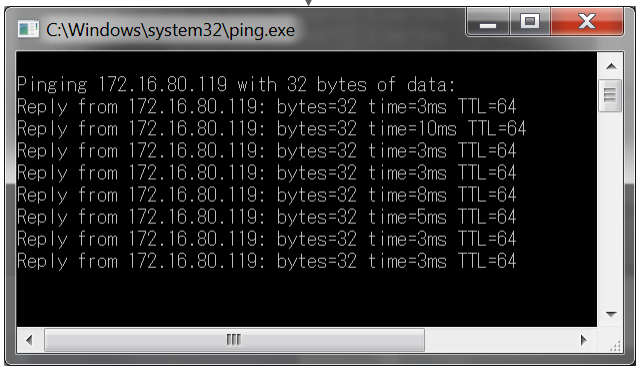
How to Ping Instrument

When users want to check IP settings is correct or not, can *ping* the instrument.
If getting reply less than 3 ms, the connection is correct.
If NOT, there must be something wrong.

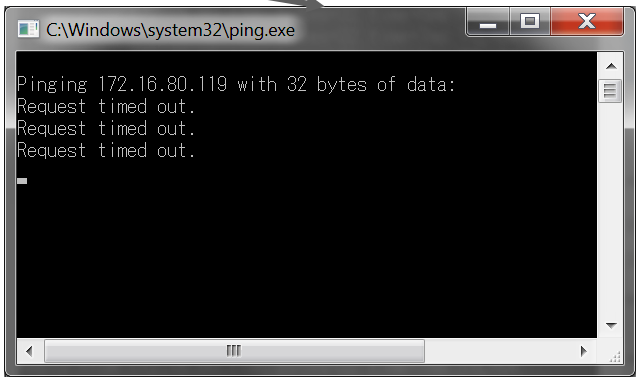
1. Press keyboard [Win] + [R] to open [Command Prompt]
2. Type the command below
   ping 172.16.8.10 -t
3. Click [OK]



well connected



disconnected

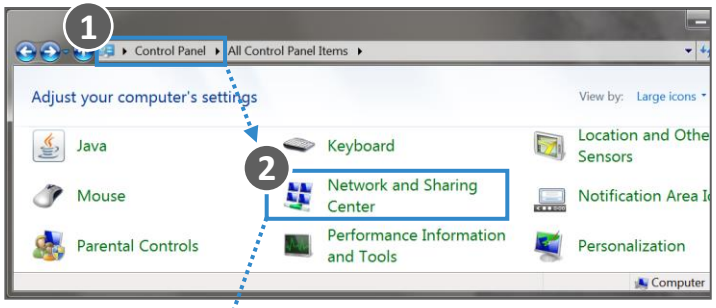


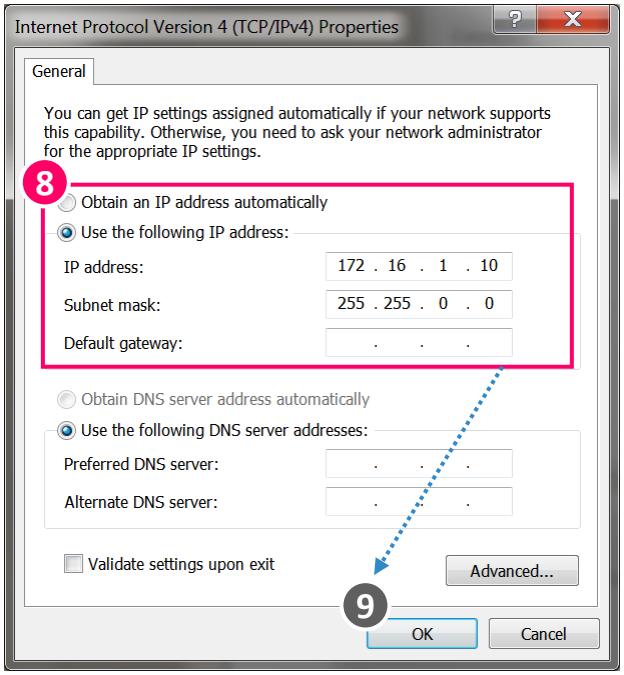
Procedure to Set IP Address on Windows 7

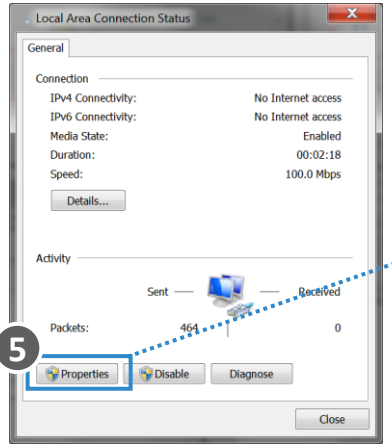
INOPTICALS

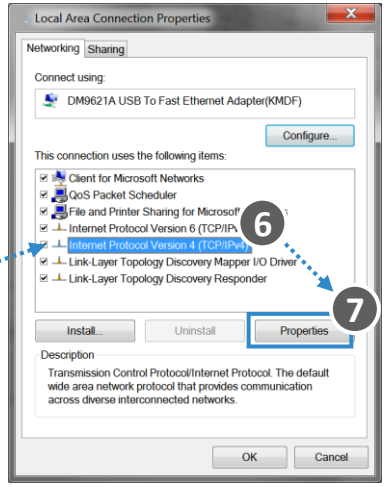
1. Open [Control Panel]
2. Enter [Network and Sharing Center]
3. Click [Change adapter settings]
4. Select Ethernet Device linked to Instrument already
5. Click [Properties]
6. Select [IPv4]
7. Click [Properties]
8. Setup IP address
9. Click [OK]

Select [Use the following IP address]
IP address = 172.16.1.10
Subnet mask = 255.255.0.0









Procedure to Set IP Address on Windows 10

INOPTICALS

The procedure is
the same as Windows 7
on the previous slide

1. Open [Control Panel]
2. Enter [Network and Sharing Center]
3. Click [Change adapter settings]
4. Select Ethernet Device linked to Instrument already
5. Click [Properties]
6. Select [IPv4]
7. Click [Properties]
8. Setup IP address
9. Click [OK]

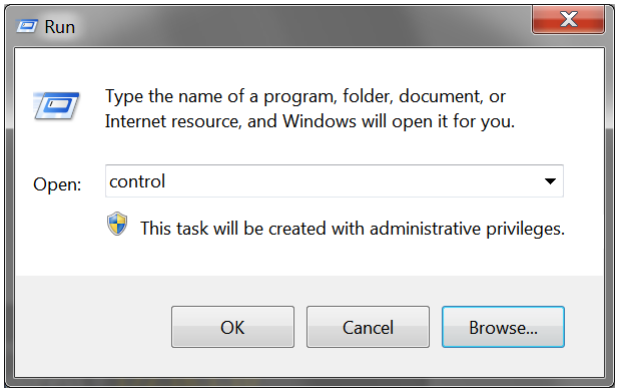
Select [Use the following IP address]
IP address = 172.16.1.10
Subnet mask = 255.255.0.0

How to Open Control Panel

INOPTICALS

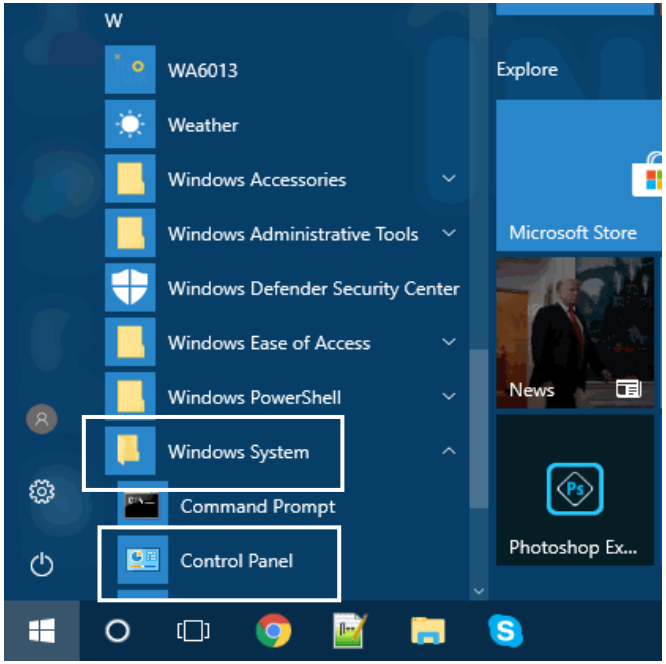
Windows 7
Windows 10

1. Press keyboard [Win] + [R] to open [Command Prompt]
2. Type the name below *control*
3. Click [OK]



Windows 10

1. Expand [Start Menu]
2. Select [Windows System] folder
3. Select [Control Panel]



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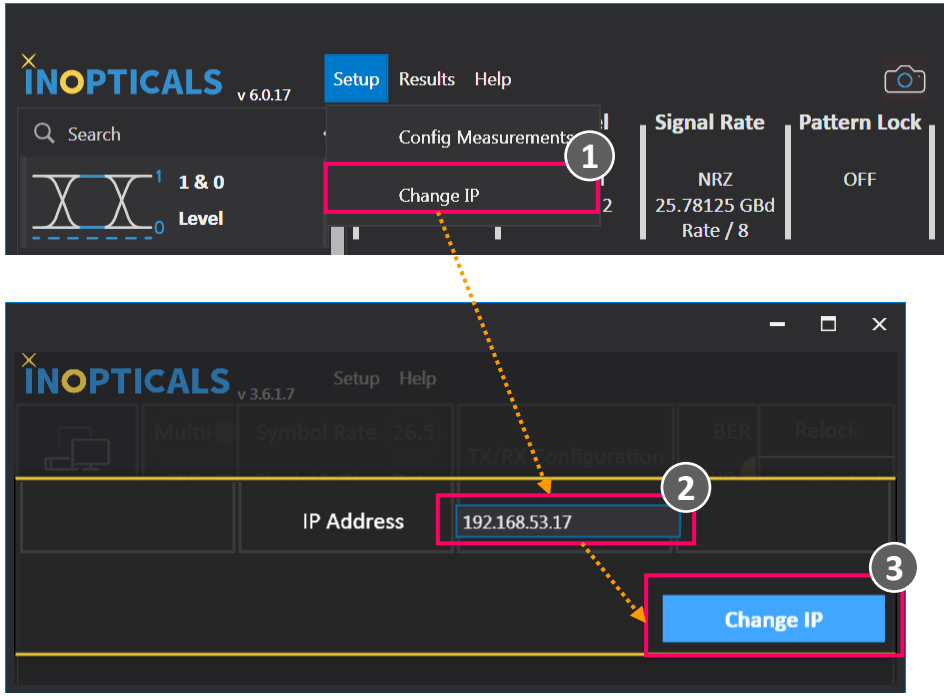
Change IP Address

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

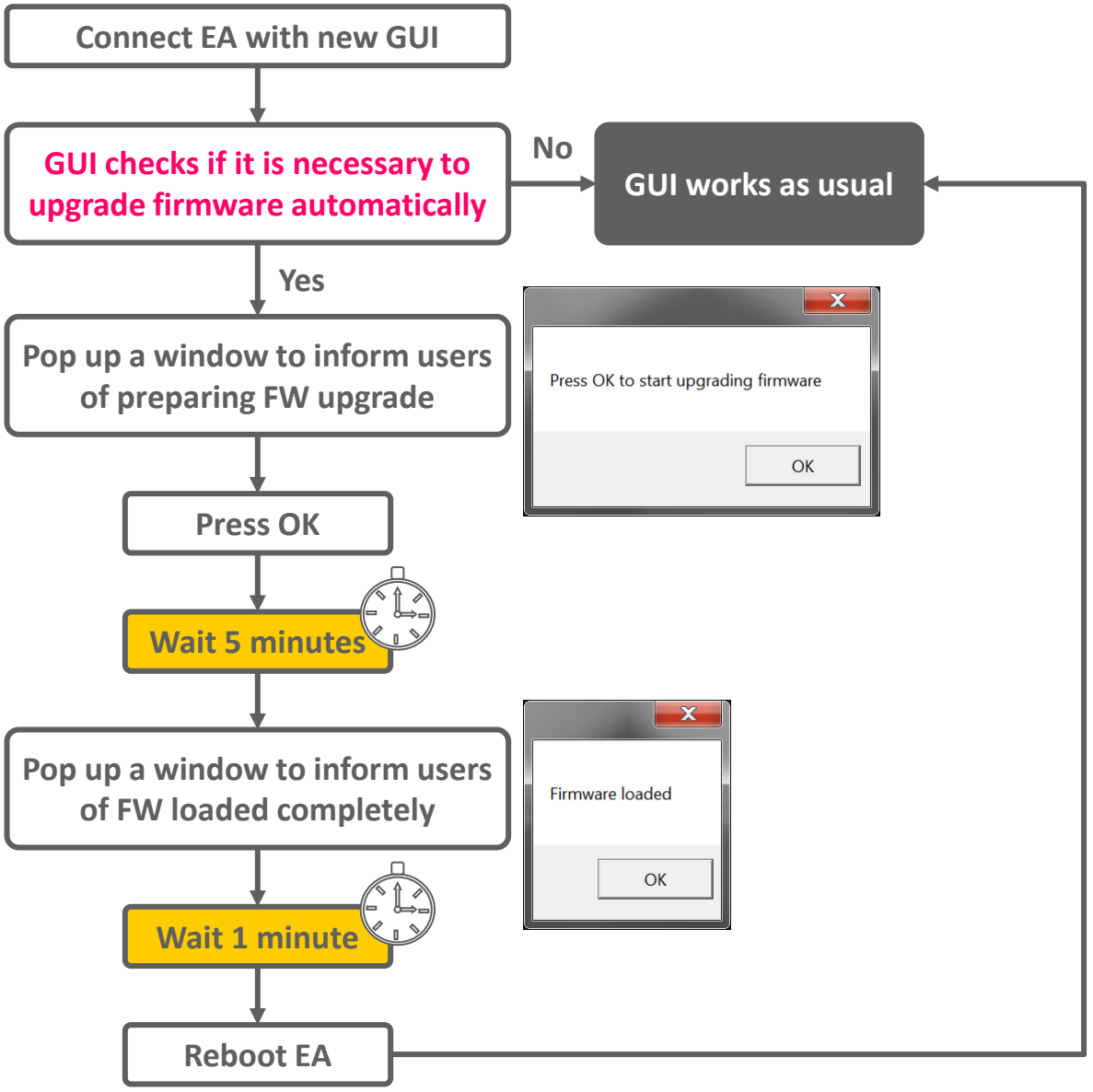
0. Connect the instrument
1. Click [Change IP] @ Setup Menu
2. Input desired IP Address
3. Click [Change IP] button
4. Wait 10 seconds
5. Reboot the instrument (IP is already changed)



When users want to check IP is changed or not, can *ping* the instrument.
If getting reply, the IP is changed.
If NOT, IP is not changed successfully.

Appendix G – Firmware Upgrade

Process of Auto Firmware Upgrade



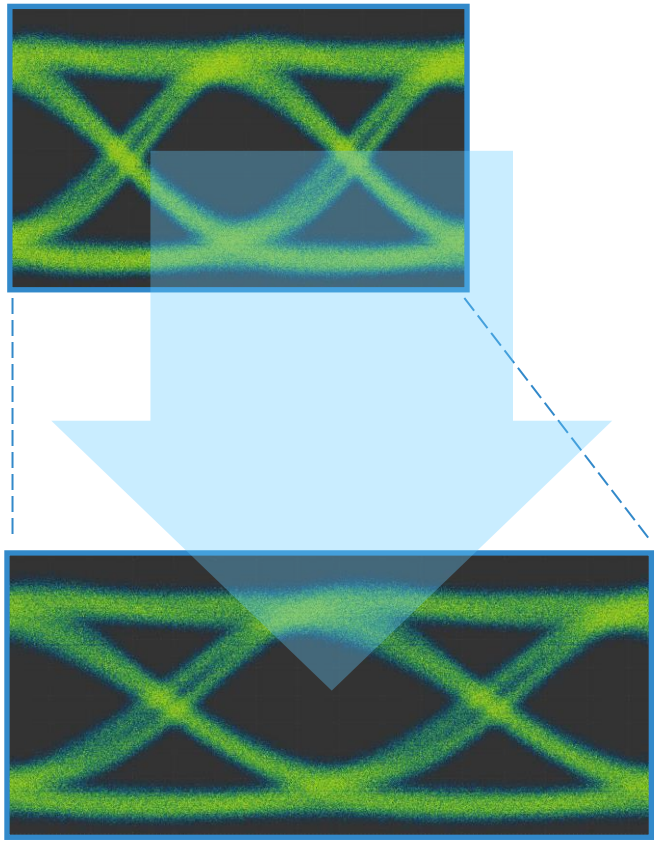
Appendix H – Tune Eye Diagram Scale

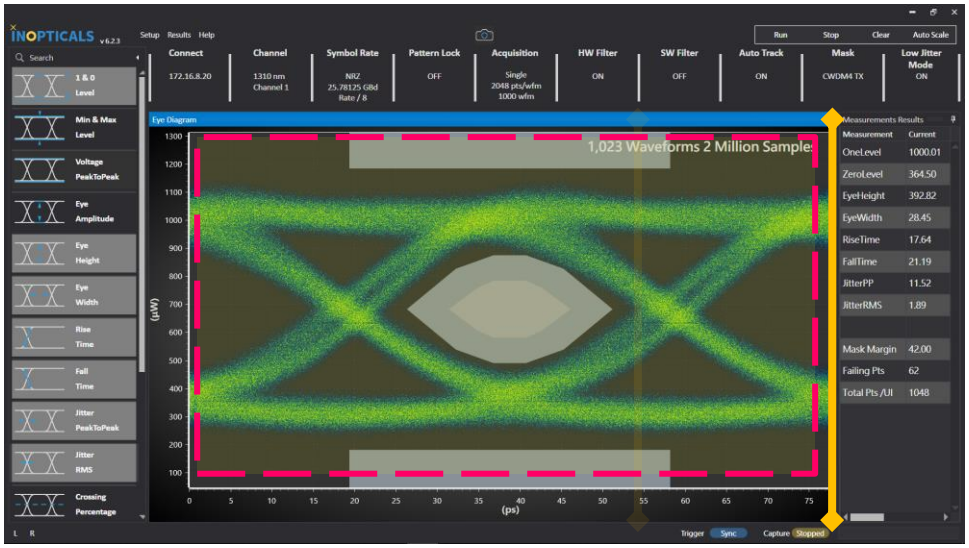
Tune Scale of Eye Diagram

Step 1.
Use mouse button to drag the right edge of eye diagram

Step 2.
Move mouse rightward (or leftward)

Step 3.
Release mouse button to take effect





FUTURE IN LIGHT