



# IQTransmitter

## Coherent Modulation Transmitter

Industry Leading Bandwidth of up to 40 GHz

### SPEC SHEET

- Choose from 11 GHz, 20 GHz, 23 GHz or 40 GHz of bandwidth
- Pattern independent Automatic Bias Control
- High repeatability and reliability of optimized optical signals
- Inbuilt narrow linewidth tunable laser
- Perfect for M-QAM, M-PSK and custom modulation formats
- Intuitive and user-friendly GUI
- Complete remote control capability
- Capable of supporting Baud rates beyond 64 GBaud



# Introducing the World's Highest Performing Coherent Optical Transmitter

At up to 40 GHz bandwidth, Coherent Solutions' IQTransmitter offers the highest commercially available bandwidth, and enables quick and simple generation of phase modulated optical signals in one, simple-to-use instrument. Plus, the IQTransmitter's unique range of customizations give you unrivalled flexibility and even greater value.

## The Ideal 'Golden' Optical Signal Source

Generating and controlling phase modulated optical signals is made easy with the IQTransmitter. The IQTransmitter is referred to as a 'Golden' reference optical signal source because of its high repeatability and reliability. Its unrivalled high bandwidth of 40 GHz ensures high quality optical signal generation, making it the ideal optical signal source for coherent communications applications.



### Generate 16QAM & more

The IQTransmitter uses high bandwidth linear RF amplifiers to enable generation of any multi-level optical modulation formats when used with RF Arbitrary Waveform Generators (AWG).



### Effective & user-friendly GUI

IQSignal-Manager (IQSM) provides simple set up and full software control. Automatically discover compatible instruments on the Local Area Network and control the IQTransmitter from the comfort of your own desk.



### High-quality signal generation

With industry-leading bandwidth of up to 40 GHz, generate baud rates up to 80 GBaud. 40 GHz bandwidth is perfect for 600 Gbps signals based on 56 GBaud 64QAM modulation format.



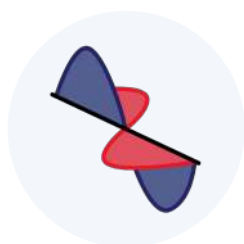
### Narrow linewidth laser

The built-in tunable laser with a narrow 100 KHz linewidth and 15 dBm of output power is an ideal laser source for coherent modulation formats. You can also use your own laser if preferred.



### High performance ABC

Modulation format and data independent Automatic Bias Controller tracks and compensates for any bias drifts so you can set and forget.



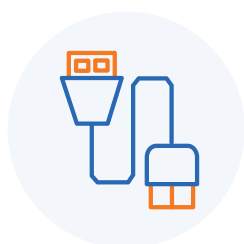
### Dual polarization emulator

Single polarization IQTransmitter models come with a dual polarization emulator which optically multiplexes a time delayed copy of the single polarization signal.



### Versatile configuration

Supports full dual polarization, emulated dual polarization or single polarization.

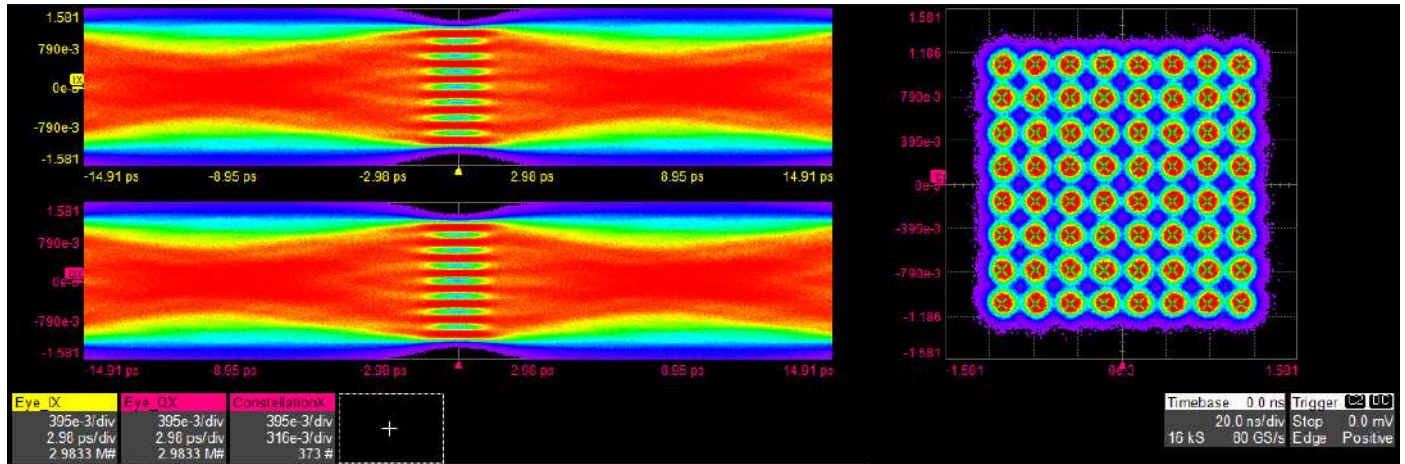


### USB and Ethernet operation

Connect with USB and/or Ethernet for simple setup and operation.

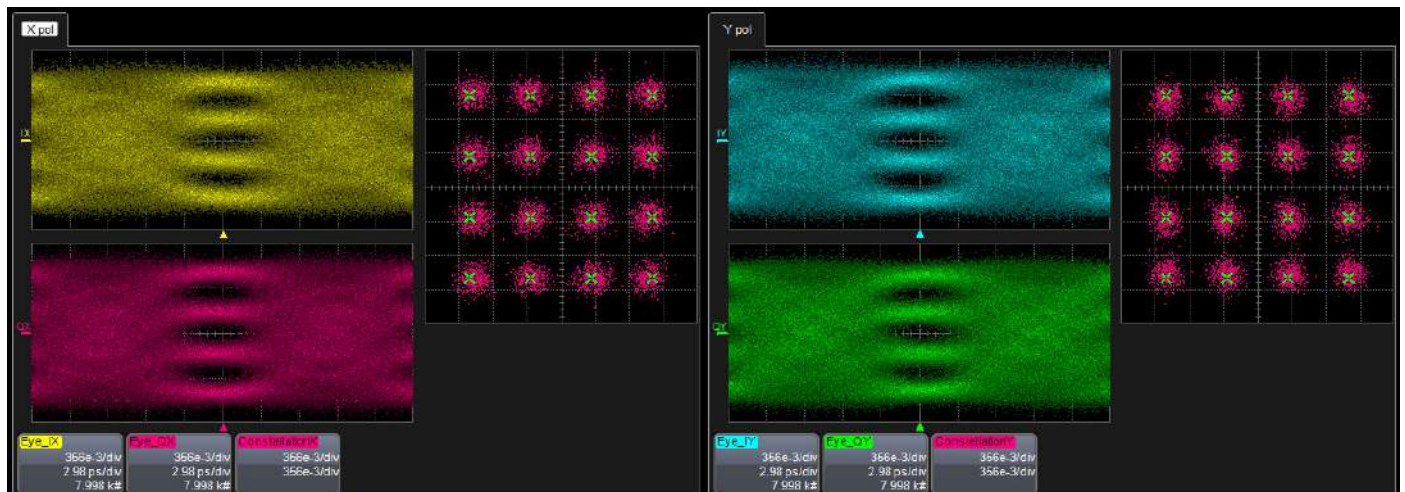
# Samples of Signals Generated with the IQTransmitter

## 56 GBaud 64QAM



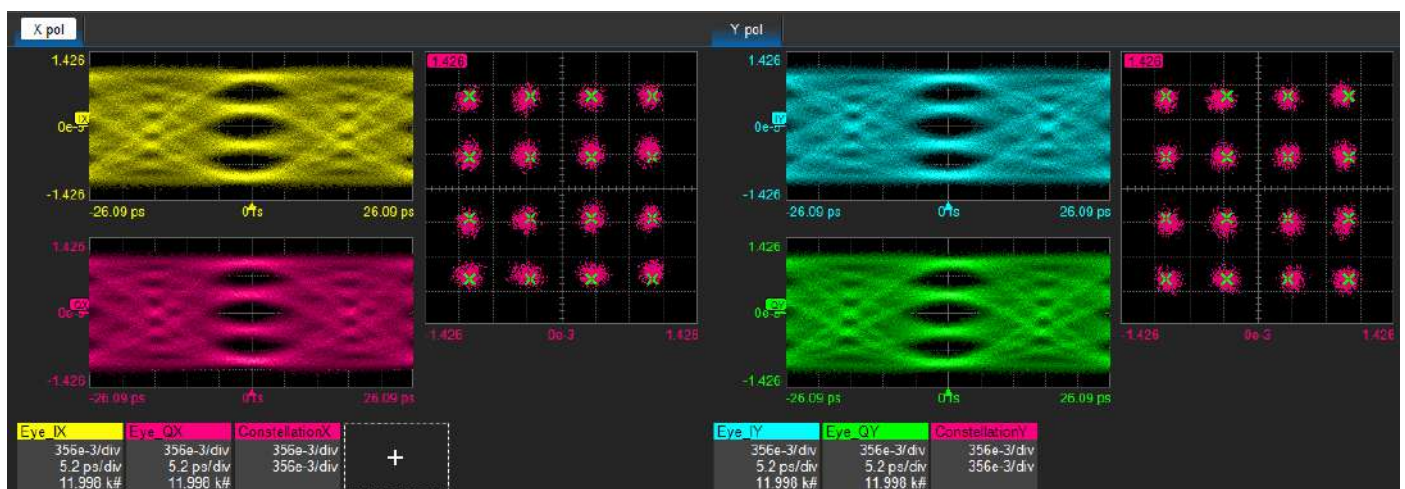
56GBaud 64QAM generated using 92GSa/s AWG and 40GHz Dual Polarization IQTransmitter. 6.2% EVM

## 56 GBaud 16QAM



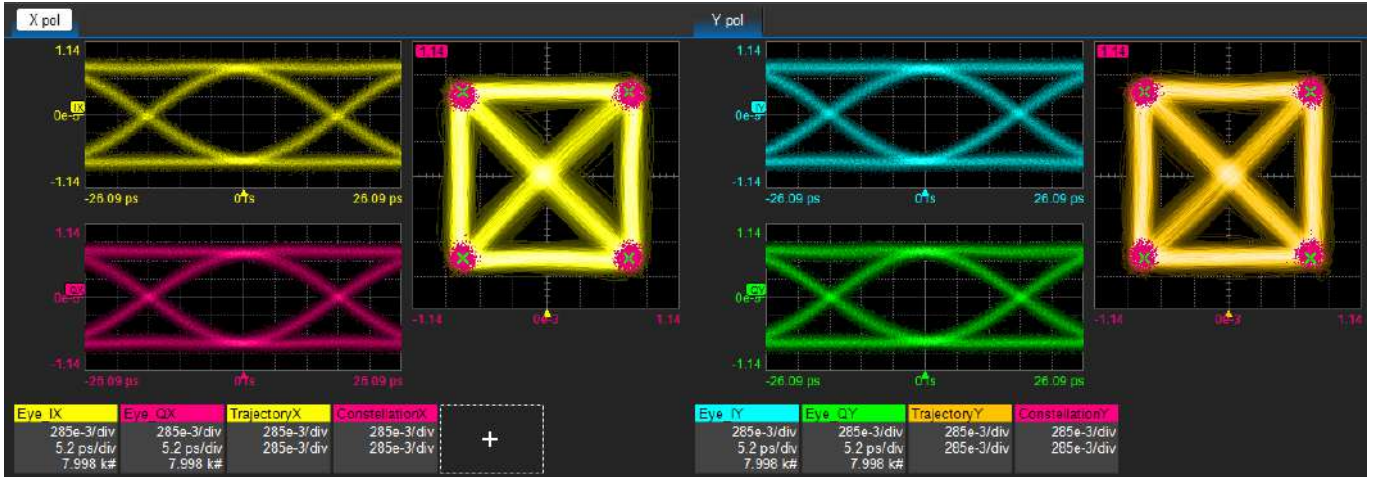
56GBaud 16QAM generated using a 3-bit PowerDAC and 40GHz Dual Polarization IQTransmitter. 9.5% EVM

## 32 GBaud 16QAM



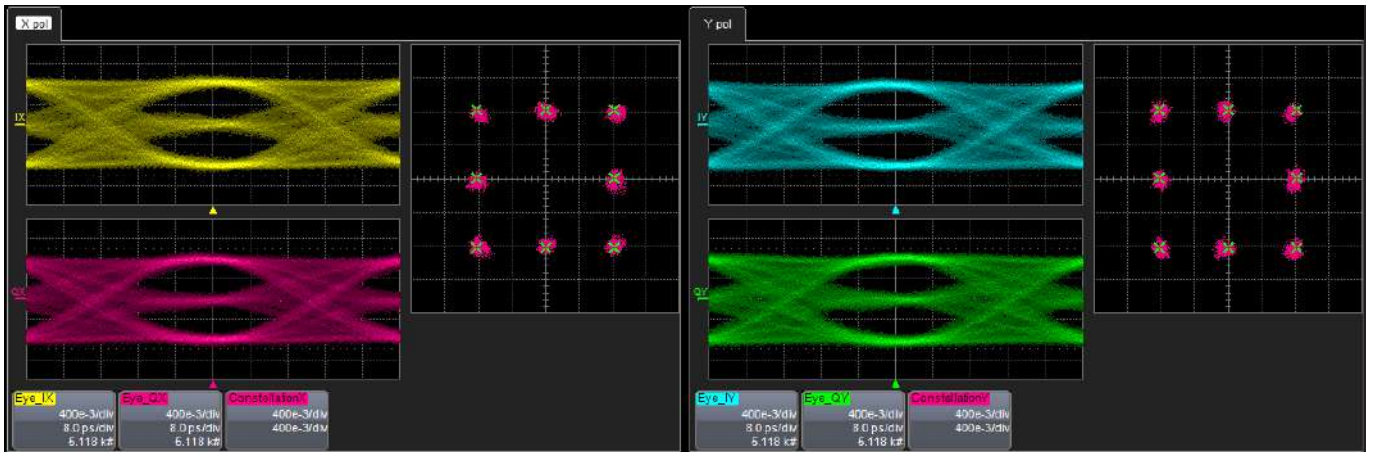
32GBaud 16QAM generated using a 65GSa/s AWG and 26GHz Single Polarization IQTransmitter with Dual Pol Emulator. 6.7% EVM

## 32 GBaud QPSK



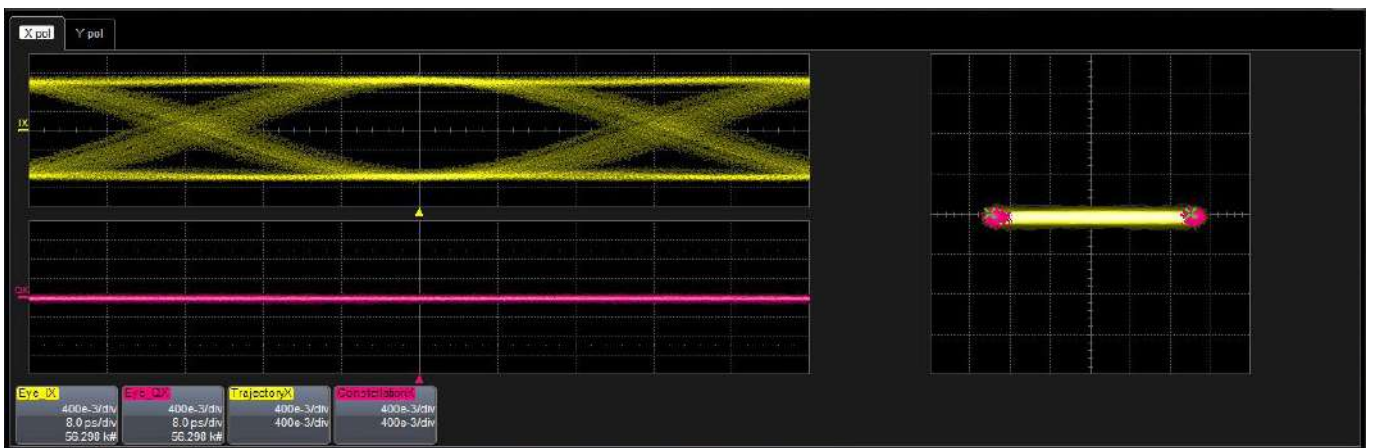
32GBaud QPSK generated using a 65GSa/s AWG and 26GHz Single Polarization IQTransmitter with Dual Pol Emulator. 6.8% EVM

## 21 GBaud DP-8QAM



High quality DP-8QAM signal at 21 GBaud. EVM ~ 6.53%

## 21 GBaud BPSK



High quality BPSK signal at 21 GBaud. EVM ~ 7.31%

# Example Applications

Optical communication R&D engineers need to be able to quickly and cost-effectively generate high-bandwidth optical signals such as 56 GBaud DP-QPSK to support development in fields such as:

- Coherent receiver design verification and testing
- 400 G, 600 G Coherent System development using multi-levelled modulation formats such as 16QAM and 64QAM
- Stable and repeatable DP-QPSK or DP-16QAM signal generation for ICR Testing
- Cost effective DWDM channel loading by modulating multiple carriers



## Pattern Independent Automatic Bias Controller

The IQTransmitter is an ideal 'Golden Standard' reference in terms of repeatability and reliability.

The built-in Automatic Bias Control (ABC) makes it easy for engineers to quickly generate optimized signals. The ABC's high stability ensures that bias points are maintained at the desired location and allows engineers to work with Arbitrary modulation formats including M-QAM, M-PSK, etc.

Our dedicated software for ABC offers complete remote operation capability allowing the user to control the setup. These features make the Coherent Solutions' IQTransmitter a superb plug-and-play R&D optical signal generator.

## Intuitive GUI

### Intuitive 'IQSignal-Manager' for More Flexibility in Modulator Bias Control

IQSignal-Manager is the dedicated bias control software to adjust individual bias settings or select automatic optimization, which lets you quickly and effortlessly generate optimized QPSK or QAM signals.



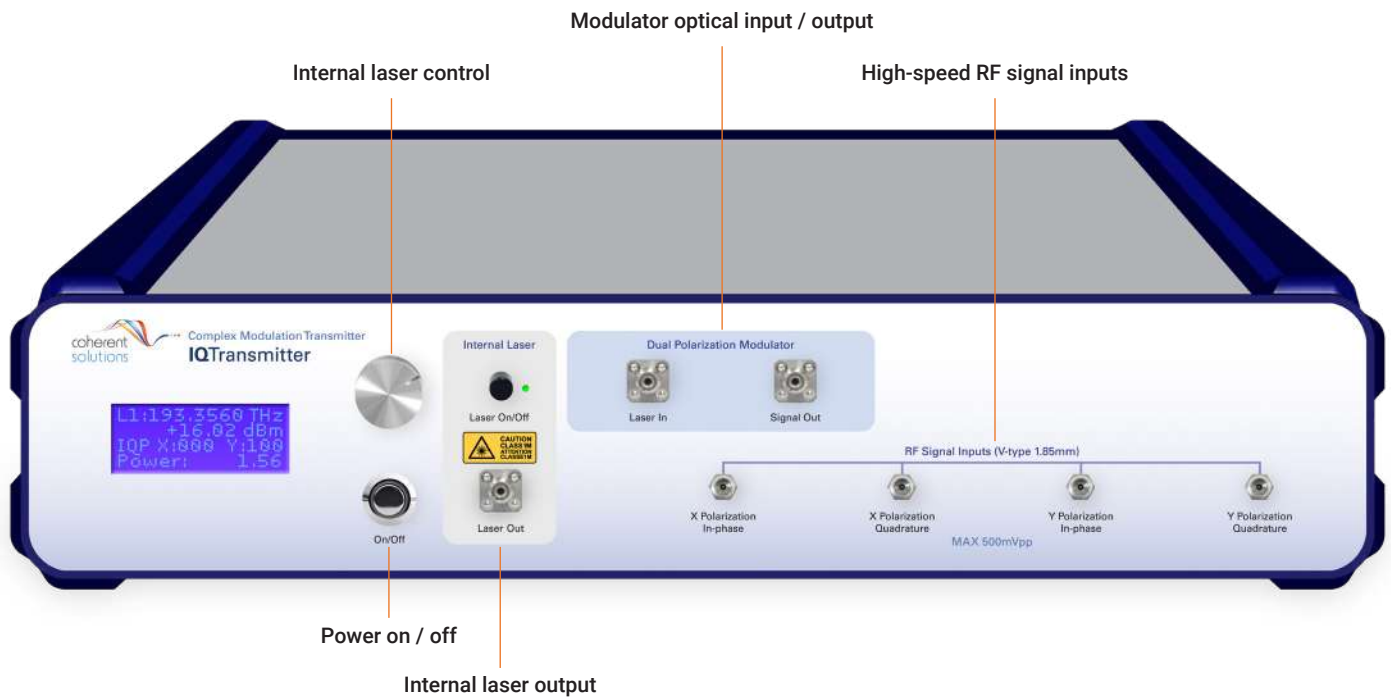
# IQTransmitter - Full Dual Polarization

The dual-polarization IQTransmitter is a leader in its class; providing more capability, more flexibility and greater ease of use.

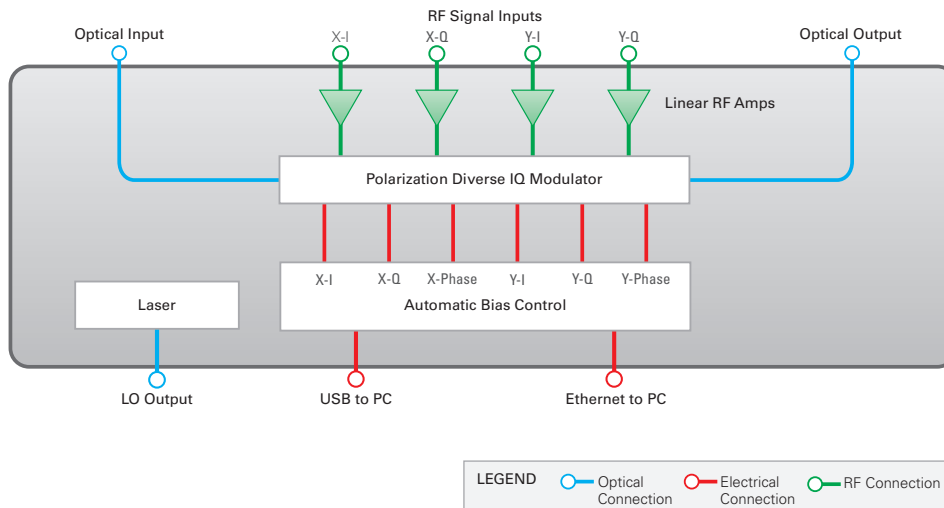
For applications requiring loading and transmission of true data, the dual-polarization IQTransmitter provides capability to transmit independent data on all four tributary RF channels. The full dual-polarization IQTransmitter is compatible with any 4 channel PPG or AWG; and a wide range of options are available to optimize your investment.

## Standard Features

- 40 GHz, 23 GHz or 11 GHz of system bandwidth
- 4 x high speed RF signal inputs
- Automatic Bias Control via the dedicated software controller
- Built-in C-band narrow linewidth tunable laser
- Automatic software modulator bias control
- High bandwidth linear RF amplifiers



## IQTransmitter - FDP Schematic Diagram



# Versatile Configuration Options - Full Dual Polarization

## Full Dual-Pol M-QAM, M-PSK & Arbitrary Signal Generation

When used in conjunction with an appropriate 4 channel AWG (or two dual-channel synchronized AWG's), fully independent Dual-Pol M-QAM optical signals can be synthesized. This enables engineers to generate optical data streams that reflect state-of-art long-haul optical communication systems.



# IQTransmitter - Single Polarization with Dual Polarization Emulator

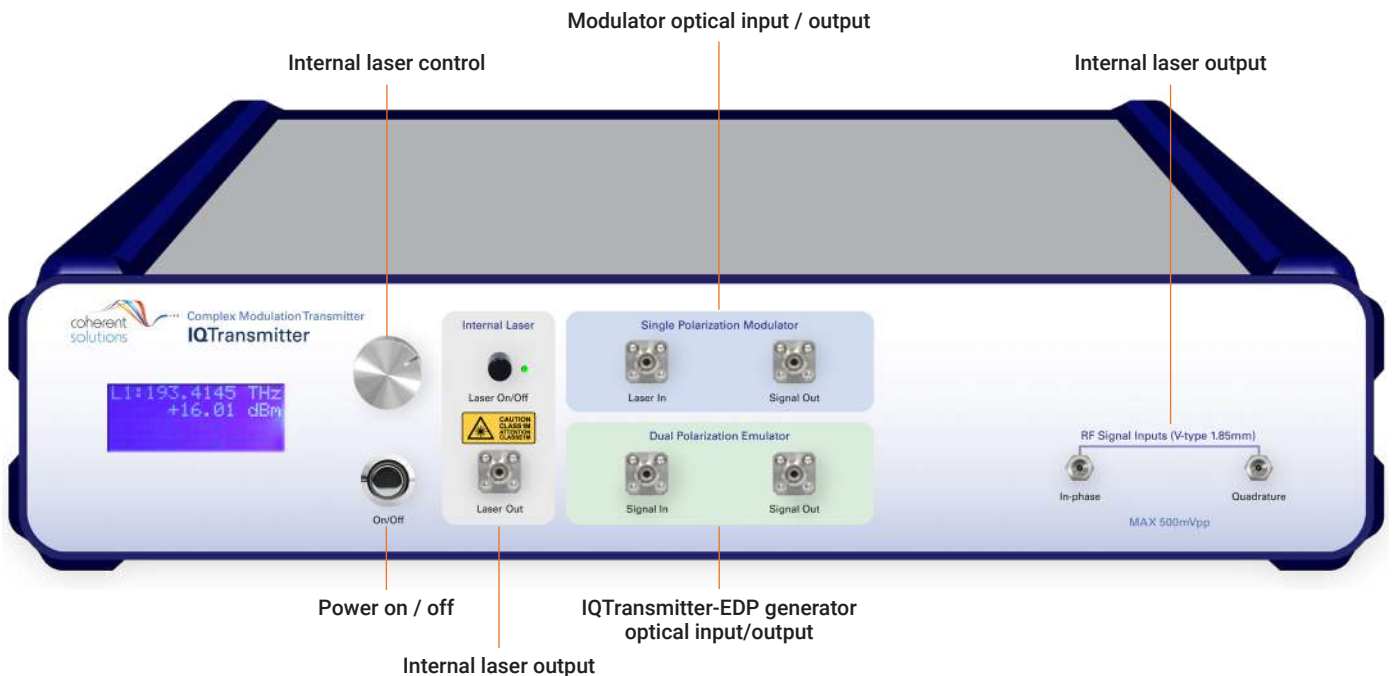
The single polarization IQTransmitter is a cost-effective solution - generating emulated dual-polarization phase modulated signals with just two RF input channels.

The emulated dual-polarization IQTransmitter can generate dual-polarization phase modulated signals by optically polarization multiplexing a delayed copy of the single-polarization modulated signal. The two RF inputs can be driven by differential outputs of a single channel data source.

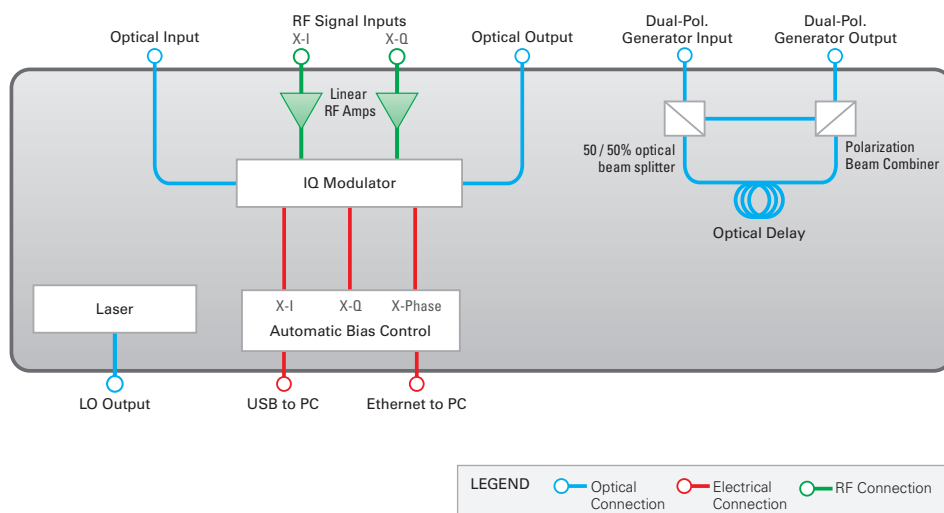
So with the emulated dual-polarization generator you can create DP-QPSK signals using two differential outputs of a single channel PPG - significantly reducing costs in applications which do not require independent data.

## Standard Features

- 20 GHz or 11 GHz of system bandwidth
- Emulated dual-polarization generator
- High bandwidth of up to 20 GHz (typical)
- 2 x high speed RF signal inputs
- Automatic Bias Control via the dedicated software controller
- Built-in C-band narrow linewidth tunable laser
- High bandwidth linear RF amplifiers



## IQTransmitter - Dual Polarization Emulator Schematic Diagram

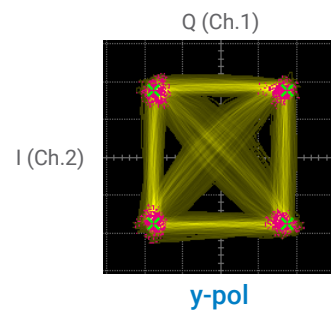
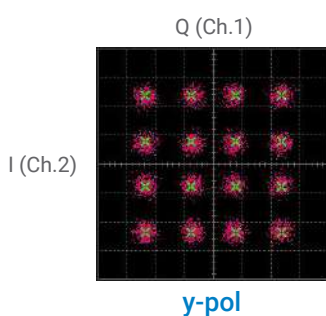
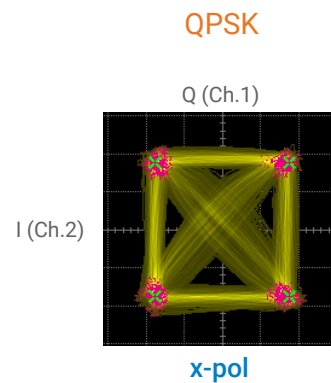
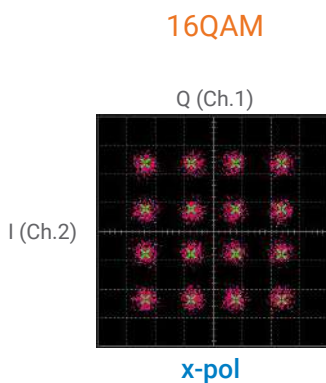
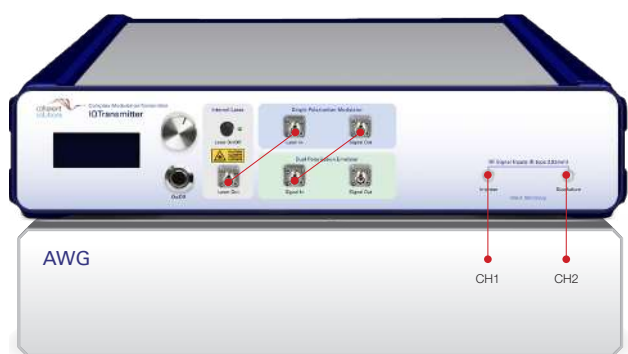




# Versatile Configuration Options - Emulated Dual Polarization

## Emulated Dual-Pol M-QAM, M-PSK & Arbitrary Signal Generation

For the majority of R&D applications it is not essential for two polarization states to contain different data, e.g. coherent receiver R&D. In such applications the EDP IQTransmitter offers a more cost-effective solution. If you need high-quality, high-bandwidth DP-QPSK optical signals, but don't need independent data on the X & Y polarizations, use a PPG to generate your signals. With the addition of an external delay-line, full control of the skew between I & Q channels in each polarization with one or two channels can be achieved.



# Technical Specifications

General Specifications	IQTransmitter
PC interface	USB 2.0, Ethernet
Operating system requirements	Windows 7, 8 or 10 (32 or 64 bit)
Dimensions (H x W x D)	440 x 390 x 97 mm   17.3 x 15.4 x 3.8 inches
Weight	9.5kg   20.9 lbs
Operating temperature range	5 °C to 45 °C   41 °F to 113 °F
Storage temperature range	-40 °C to 70 °C   -40 °F to 158 °F

## Emulated Dual Polarization

Modulator Specifications	1101	1102
Modulator type	Single-polarization LiNbO3 IQ Modulator	
Wavelength range	1528 to 1612 nm	
Insertion loss <sup>5</sup>	< 8.0 dB	
DC extinction ratio	> 20 dB	
Maximum optical input power	13 dBm	
Input optical connector type	PM FC/PC	
Output optical connector type	PM FC/PC	
RF bandwidth	11 GHz (Typical)	20 GHz (Typical)
Low frequency cutoff	<100 kHz	<40 kHz
Number of RF inputs	2	
RF connector type RF	2.92 mm female	
RF Vpi @1GHz	<200 mV (Typical)	
Maximum RF input voltage	800 mV	500 mV

Dual Polarization Emulator	1101	1102
Insertion loss	< 2dB	

ABC Specifications	1101	1102
Supported modulation formats	Any coherent modulation format	
Bias control options	Automatic locking and individual manual bias	
Maximum bias voltage range	28 V	
Number of bias control channels	6	
Startup time until settled	< 3 minutes (< 1minute Typical)	
Quadrature error	Averaged mean < ± 0.3°, Standard deviation > 24 hours: < 2°	
ABC impact on EVM	< 1%	

Laser Specifications	1101	1102
Tunable laser type	Thermally tuned External Cavity Diode Laser (ECDL)	
Tunable frequency range	1530 to 1565 nm	
Frequency tuning resolution (wavelength) <sup>2</sup>	1 MHz (~0.01 pm)	
Tuning time	< 25 s	
Maximum output power	15.4 dBm	

Laser Specifications Cont.	1101	1102
Optical power uncertainty after calibration <sup>2</sup>	± 0.4 dB	
Power stability over 24 hours	± 0.03 dB (Typical)	
Power flatness over entire wavelength range	± 0.25 dB	
Output power tuning resolution	0.01 dB	
Power monitoring	Built-in	
Polarization extinction ratio at the PM fiber output	> 20 dB	
Relative intensity noise RIN (for 13 dBm)	-145 dB/Hz (10 MHz - 40 GHz)	
Linewidth (FWHM), instantaneous <sup>4</sup>	< 100 kHz (25 kHz Typical)	
Side-mode suppression ratio	40 dB (55 dB Typical)	
Relative frequency accuracy <sup>4</sup>	1 to 1024 points per channel	
Absolute frequency accuracy <sup>4</sup>	0.01 Hz to 12 KHz	
Frequency stability (wavelength) over 24 hours <sup>3</sup>	± 0.3 GHz (± 3 pm)	

## Full Dual Polarization

Modulator Specifications	1201	1202	1203
Modulator type	Dual-polarization LiNbO3 IQ Modulator		
Wavelength range	1528 to 1612 nm		
Insertion loss <sup>5</sup>	< 10 dB		
DC extinction ratio	> 20 dB		
Maximum optical input power	18 dBm	18 dBm	16 dBm
Input optical connector type	PM FC/PC		
Output optical connector type	PM FC/PC	PM FC/PC	SMF
RF bandwidth	11 GHz (Typical)	23 GHz (Typical)	40 GHz (Typical)
Low frequency cutoff	< 100 kHz	< 40 kHz	< 60 kHz
Number of RF inputs	4		
RF connector type RF	2.92 mm female	2.92 mm female	1.85 mm Female
RF V <sub>pi</sub> @1GHz	<200 mV (Typical)	<200 mV (Typical)	< 280 mV (Typical)
Maximum RF input voltage	800 mV	500 mV	500 mV
ABC Specifications	1201	1202	1203
Supported modulation formats	Any coherent modulation format		
Bias control options	Automatic locking and individual manual bias		
Maximum bias voltage range	28 V		
Number of bias control channels	6		
Startup time until settled	< 3 minutes (< 1minute Typical)		
Quadrature error	Averaged mean < ± 0.3°, Standard deviation > 24 hours: < 2°		
ABC impact on EVM	< 1%		

Laser Specifications	1201	1202	1203
Tunable laser type	Thermally tuned External Cavity Diode Laser (ECDL)		
Tunable frequency range	1530 to 1565 nm		
Frequency tuning resolution (wavelength) <sup>2</sup>	1 MHz (~0.01 pm)		
Tuning time	< 25 s		
Maximum output power	15.4 dBm		
Optical power uncertainty after calibration <sup>2</sup>	± 0.4 dB		
Power stability over 24 hours	± 0.03 dB (Typical)		
Power flatness over entire wavelength range	± 0.25 dB		
Output power tuning resolution	0.01 dB		
Power monitoring	Built-in		
Polarization extinction ratio at the PM fiber output	> 20 dB		
Relative intensity noise RIN (for 13 dBm)	-145 dB/Hz (10 MHz - 40 GHz)		
Linewidth (FWHM), instantaneous <sup>3</sup>	< 100 kHz (25 kHz Typical)		
Side-mode suppression ratio	40 dB (55 dB Typical)		
Relative frequency accuracy <sup>4</sup>	1 to 1024 points per channel		
Absolute frequency accuracy <sup>4</sup>	0.01 Hz to 12 KHz		
Frequency stability (wavelength) over 24 hours <sup>4</sup>	± 0.3 GHz (± 3 pm)		

#### SPECS AS OF MARCH 2020

##### Notes

1 Specifications are valid at 23 °C ± 3 °C.

2 At maximum output power.

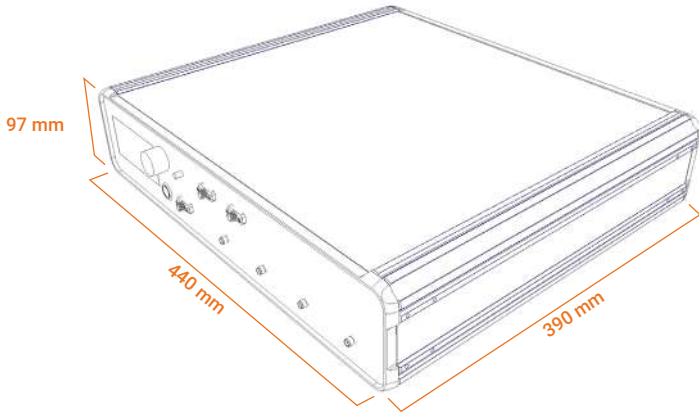
3 The laser uses a small FM dithering as part of its wavelength locking mechanism. The instantaneous linewidth is measured in 1 ms (integration time).

4 Varies slightly according to wavelength.

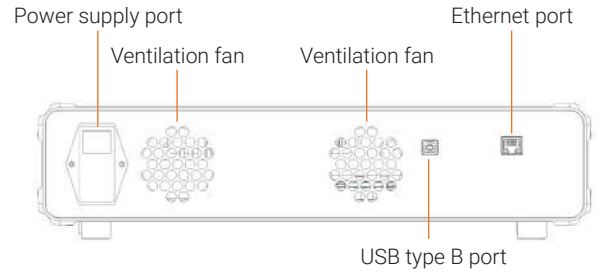
5 At maximum transmission bias setting.



# Instrument Dimensions



# Rear Panel Connections



# Ordering Information

**IQTX - XXXX - ABC - C - XX**

Model number

- 1101 = Emulated Dual Polarization 11 GHz
- 1102 = Emulated Dual Polarization 20 GHz
- 1201 = Full Dual Polarization 11 GHz
- 1202 = Full Dual Polarization 23 GHz
- 1203 = Full Dual Polarization 40 GHz

Bias control

ABC = Automatic Bias Control

Connector type

- FC = FC/PC
- FA = FC/APC

Built-in laser

C = C-band built-in laser



## Product Warranty

This product comes with a 3 year warranty.

# About Coherent Solutions

Coherent Solutions is a world-leader in photonics test and measurement. Our portfolio of benchtop and modular test instruments is rapidly expanding to meet the needs of scientists, engineers and manufacturers around the world. No matter where you are, we'll work with you to solve complex problems with simple, intuitive solutions.

To find out more, get in touch with us today.

Coherent Solutions Ltd

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