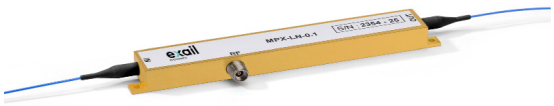
MODULATOR

MPX and MPZ series

Low frequencies to 40 GHz Phase Modulators

The MPX-LN and MPZ-LN series make up the most comprehensive range of electro-optic phase modulators available on the market for the 1550 nm wavelength band.

- The MPX-LN-0.1 has a high impedance input optimized for modulation frequencies up to 300 MHz.
- The MPZ-LN series are ideally suited for wide bandwidth operation to 40 GHz. Dedicated modulators bandwidths are proposed for an efficient electrical to optical conversion.



Designed using state-of-the-art and proven lithium niobate technology, MPX-LN and MPZ-LN phase modulators are easy to operate and to integrate. These modulators come with a comprehensive range of options (DC Coupled, Low Vπ, Low Insertion Loss, Embedded POLarizer, High Electronical Power) to offer the highest performance for a wide range of applications from laboratory experiments to demanding industrial systems.

Features

- Low to very wide EO bandwidth
- C & L bands
- Low Vπ
- Low insertion loss

Applications

- Side bands generation
- Spectral Beam Combining (SBC)
- Coherent Beam Combining (CBC)
- Optical Frequency Combs
- Interferometric sensing
- Frequency shifting / broadening
- Quantum Key Distribution (QKD)
- Pound-Drever-Hall locking (PDH)
- High data rate telecommunications

Options

- DC coupled
- Low residual modulation
- Low IL, High PER, Low Vπ (LVP)

Related Equipments

- Matched RF amplifiers
- Coherent Beam Combining ModBox

Low and Medium Bandwidth Phase Modulators Highlights [1]

Parameter	MPX-LN-0.1	MPZ-LN-01
Operating wavelength	1530 nm - 1625 nm	1530 nm - 1625 nm
Usable Electro-optical bandwidth	300 MHz	3 GHz
Vπ RF @50 kHz	3.5 V	3 V
Insertion loss	2.7 dB	2.5 dB

[1] Specifications given at 25 °C, 1550 nm

Wide Bandwidth Low Vπ Phase Modulators Highlights [1]

Parameter	MPZ-LN-10	MPZ-LN-10-LVP
Operating wavelength	1530 nm - 1625 nm	1530 nm - 1625 nm
Usable electro-optical bandwidth	16 GHz	20 GHz
Vπ RF @50 kHz	4 V	3 V
Insertion loss	2.5 dB	3 dB

[1] Specifications given at 25 °C, 1550 nm

Wide Bandwidth Phase Modulators Highlights [1]

Parameter	MPZ-LN-20	MPZ-LN-40
Operating wavelength	1530 nm - 1625 nm	1530 nm - 1625 nm
Usable electro-optical bandwidth	30 GHz	40 GHz
Vπ RF @50 kHz	4.5 V	6 V
Insertion loss	2.5 dB	2.5 dB

[1] Specifications given at 25 °C, 1550 nm

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MPX-LN-0.1

Up to 300 MHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB	100	150	-	MHz
Usabe electro-optical bandwidth	S_{21}	-	-	300	-	MHz
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	-	-	3.5	4	V
RF Input Impedance	Z_{in-RF}	-	-	10	-	kΩ

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate X-Cut Y-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors [1]	-	2.7	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified.
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Electrical voltage range	EV_{in}	-20	20	V
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

MPZ-LN-01

Up to 3 GHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB	1	1.5	-	GHz
Usable electro-optical bandwidth	S_{21}	-	-	3	-	GHz
Ripple S_{21}	ΔS_{21}	-	-	0.5	1	dB
Electrical return loss	S_{11}	-	-	-15	-12	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	-	-	3	3.5	V
Vπ RF @1 GHz / 3 GHz	$V\pi_{RF\ 1\ GHz/3\ GHz}$	-	-	3.1 / 4.5	-	V
RF port impedance matching	Z_{in-RF}	-	-	50	-	Ω
Vπ DC electrodes	$V\pi_{DC}$	DCC option, housing #B	-	3	6	V
DC port impedance matching	Z_{in-DC}	DCC option, housing #B	1	-	-	MΩ

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors [1]	-	2.5	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector.

Absolute Maximum Ratings

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Parameter	Symbol	Condition	Min	Max	Unit
RF High Electrical input Power	HEP_{in}		-	33	dBm
Optical input power	OP_{in}		-	20	dBm
Bias voltage	V_{DCC}	DCC option, housing #B	-15	+15	V
Operating temperature	OT		0	+70	°C
Storage temperature	ST		-40	+85	°C

MPZ-LN-10

Up to 16 GHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB, from 2 GHz	10	12	-	GHz
Usable electro-optical bandwidth	S_{21}	-	-	16	-	GHz
Ripple S_{21}	ΔS_{21}	-	-	0.5	1	dB
Electrical return loss	S_{11}	-	-	-17	-13	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	-	-	4	5	V
Vπ RF @10 GHz / 16 GHz	$V\pi_{RF\ 10\ GHz\ /\ 16\ GHz}$	-	-	6 / 9	-	V
RF impedance matching	Z_{in-RF}	-	-	50	-	Ω
Vπ DC electrodes	$V\pi_{DC}$	DCC option, housing #B	-	4	7	V
DC port impedance matching	Z_{in-DC}	DCC option, housing #B	1	-	-	MΩ

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors [1]	-	2.5	3.5	dB
Low insertion loss option	LIL	Without optical connectors [1]	-	2	2.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified.
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

Absolute Maximum Ratings

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Parameter	Symbol	Condition	Min	Max	Unit
RF Electrical input Power	EP_{in}		-	28	dBm
Optical input power	OP_{in}		-	20	dBm
Bias voltage	V_{DCC}	DCC option, housing #B	-15	+15	V
Operating temperature	OT		0	+70	°C
Storage temperature	ST		-40	+85	°C

MPZ-LN-10-LVP

Up to 20 GHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB, from 2 GHz	10	12	-	GHz
Usable electro-optical bandwidth	S_{21}	-	-	20	-	GHz
Ripple S_{21}	ΔS_{21}	-	-	0.5	1	dB
Electrical return loss	S_{11}	-	-	-14	-10	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	LVP option, housing #C	-	3	4	V
Vπ RF @10 GHz	$V\pi_{RF\ 10\ GHz}$	LVP option, housing #C	-	5	-	V
RF impedance matching	Z_{in-RF}	-	-	50	-	Ω

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connector [1]	-	3	4	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified.
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
RF High Electrical input Power	HEP_{in}	-	33	dBm
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C
Vibration	Vib	MIL-STD-883K method 2007.3 - Test condition B		
Mechanical shock	Shock	MIL-STD-883K method 2002.5 - Test condition B		

MPZ-LN-20

Up to 30 GHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB, from 2 GHz	20	25	-	GHz
Usable electro-optical bandwidth	S_{21}	-	-	30	-	GHz
Ripple S_{21}	ΔS_{21}	-	-	0.5	1	dB
Electrical return loss	S_{11}	-	-	-12	-10	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	-	-	4.5	5.5	V
Vπ RF @20 GHz / 30 GHz	$V\pi_{RF\ 20\ GHz\ /\ 30\ GHz}$	-	-	6.5 / 10	-	V
Impedance matching	Z_{in-RF}	-	-	50	-	Ω

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors [1]	-	2.5	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified.
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
RF Electrical input Power	EP_{in}	-	28	dBm
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

MPZ-LN-40

Up to 40 GHz Phase Modulator

Electrical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Electro-optical bandwidth	S_{21}	-3 dB, from 2 GHz	30	33	-	GHz
Usable electro-optical bandwidth	S_{21}	-	-	40	-	GHz
Ripple S_{21}	ΔS_{21}	-	-	0.5	1	dB
Electrical return loss	S_{11}	-	-	-12	-9	dB
Vπ RF @50 kHz	$V\pi_{RF\ 50\ kHz}$	-	-	6	7	V
Vπ RF @30 GHz	$V\pi_{RF\ 30\ GHz}$	-	-	8.5	-	V
Impedance matching	Z_{in-RF}	-	-	50	-	Ω

Optical Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Crystal	-	-	Lithium Niobate Z-Cut X-Prop			
Waveguide process	-	-	Ti diffusion			
Operating wavelength	λ	-	1530	1550	1625	nm
Insertion loss	IL	Without optical connectors [1]	-	2.5	3.5	dB
Optical return loss	ORL	-	-40	-45	-	dB

All specifications given at 25 °C, 1550 nm, unless differently specified.
[1] Consider an extra-loss up to 0.25 dB for each FC/APC optical connector

Absolute Maximum Ratings

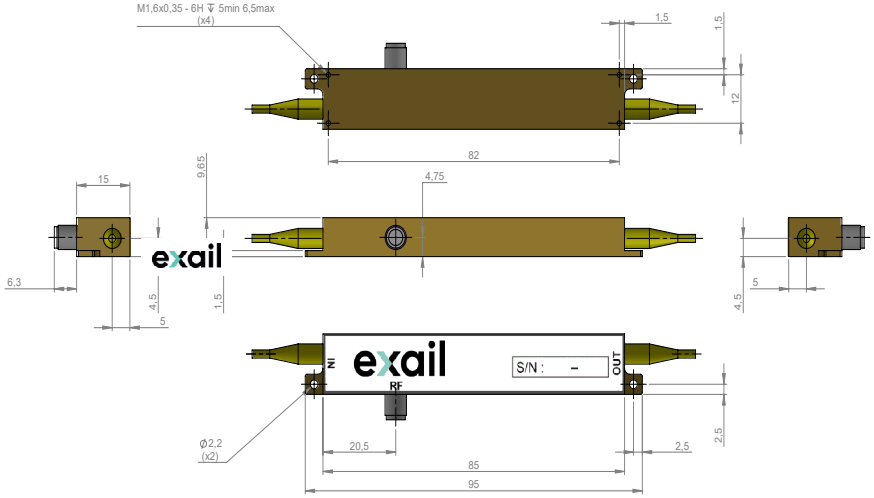
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Parameter	Symbol	Min	Max	Unit
RF Electrical input Power	EP_{in}	-	28	dBm
Optical input power	OP_{in}	-	20	dBm
Operating temperature	OT	0	+70	°C
Storage temperature	ST	-40	+85	°C

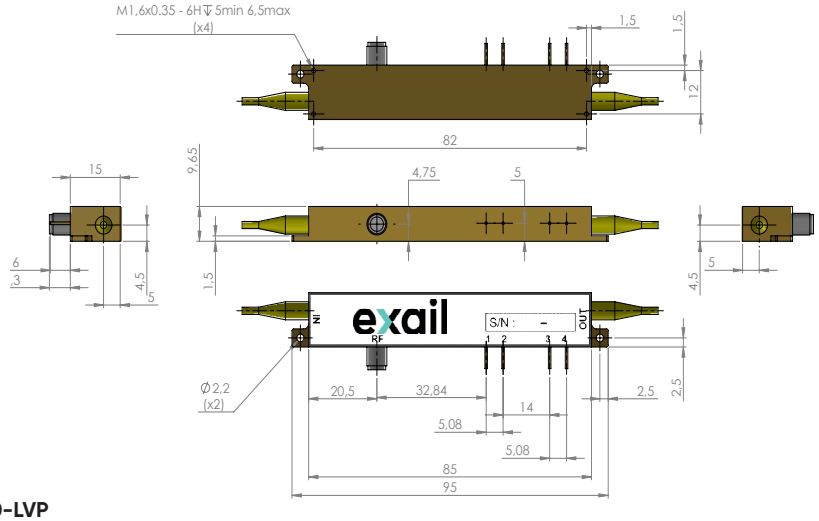
Mechanical Diagram and Pinout

All measurements in mm

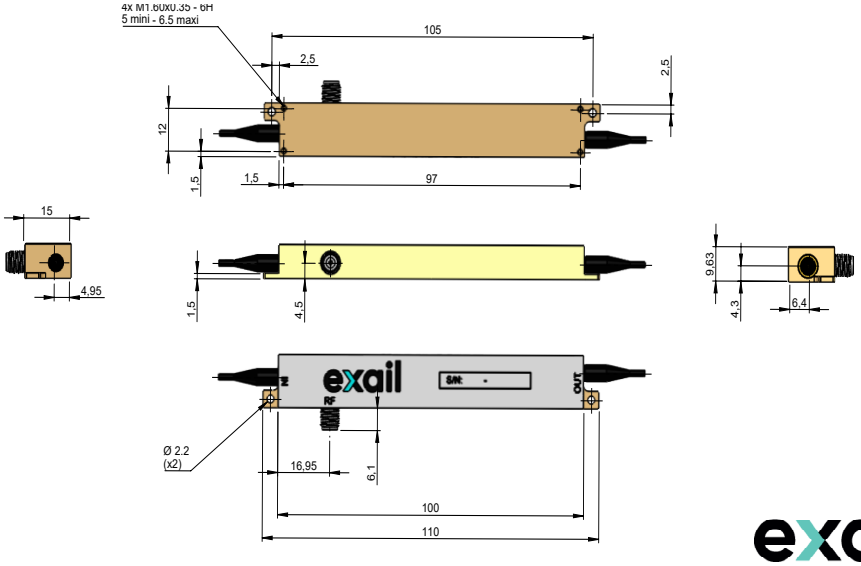
Housing #A: Standard Modulator housing



Housing #B: Modulator housing with DCC



Housing #C: Modulator housing for the MPZ-LN-10-LVP



Port	Function	Note
IN	Optical input port	Polarization maintaining fiber 1550 nm Corning PM 15-U25D Length: 1.5 meter, buffer diameter: 900 µm
OUT	Optical output port	Polarization maintaining fiber 1550 nm, Corning PM 15-U25D Length: 1.5 meter, buffer diameter: 900 µm
RF	RF input port	Female K (SMA comptatible) MPZ-LN-40: female 2.4 mm, compatible to mate with V / 1.85 mm
PINS 1 / 2	Ground / DC	Pin feed through diameter 1.0 mm - For DCC option with housing #B
PINS 3 / 4	Not connected / Not connected	Pin feed through diameter 1.0 mm - For DCC option with housing #B

Ordering Information

MPX/MPZ-LN-□-00-□-□-□-□-□

- Bandwidth: **X-cut: 0.1** (150 MHz), **Z-cut: 01** (1 GHz), **10** (10 GHz), **20** (20 GHz), **40** (40 GHz)
- Input fiber: **P**: Single Mode and Polarisation maintaining Fiber
- Output fiber: **P**: Single Mode and Polarisation maintaining Fiber
- Input connector: **00** (bare fiber), **FA** (FC/APC)
- Output connector: **00** (bare fiber), **FA** (FC/APC)
- Embedded in-line POLarizer: **POL**
Low Insertion Loss: **LIL** (for MPZ-LN-10 only)
DC Coupled: **DCC** (for MPZ-LN-01 and MPZ-LN-10 only)
Low Vπ option: **LVP** (for MPZ-LN-10 only)

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