

1. BMXNRP0201 Technical Specifications from SE.com

Parameter	Variable	Value	Description
Operating Wavelength	WAVELENGTH_NRP	1310 nm	Nominal optical transmission wavelength supported by the BMXNRP0201 optical transceiver.
Fiber Type	FIBER_TYPE_NRP	Single-Mode Fiber (SMF) 9/125 μm	Fiber type required to achieve specified optical performance.
Optical Connector Type	CONNECTOR_TYPE_NRP	LC Duplex	Optical connector interface used by the transceiver.
Supported Bit Rate	BIT_RATE_NRP	125 to 155 Mbit/s	Supported communication data rate range.
Minimum Transmit Power	TX_POWER_MIN_NRP	-15 dBm	Minimum guaranteed optical output power used for optical budget calculations.
Maximum Transmit Power	TX_POWER_MAX_NRP	-8 dBm	Maximum optical output power that may be transmitted by the module.
Receiver Sensitivity	RX_SENSITIVITY_NRP	-28 dBm	Minimum received optical power required to guarantee correct operation.
Receiver Overload Level	RX_OVERLOAD_NRP	-8 dBm	Maximum received optical power within the guaranteed operating range.
Maximum Supported Distance	MAX_DISTANCE_NRP	15 km	Nominal maximum optical transmission distance.
Digital Diagnostics Monitoring	DDM_SUPPORT_NRP	Supported	Real-time monitoring of optical and environmental parameters.

2. Customer Optical Characteristics

The following optical characteristics shall be provided by the customer, the equipment manufacturer, or the system integrator to verify compatibility with the BMXNRP0201.

2.1. Technical Specifications

Parameter	Variable	Required / Recommended Value	Description
Operating Wavelength	WAVELENGTH_CUSTOMER	1310 nm	Nominal optical transmission wavelength of the customer transceiver.
Fiber Type	FIBER_TYPE_CUSTOMER	Single-Mode Fiber (SMF) 9/125 μ m	Optical fiber type supported by the transceiver.
Optical Connector Type	CONNECTOR_TYPE_CUSTOMER	LC Duplex	Optical connector interface used on the customer equipment.
Supported Bit Rate	BIT_RATE_CUSTOMER	125 to 155 Mbit/s	Supported communication data rate range.
Minimum Transmit Power	TX_POWER_MIN_CUSTOMER	To be provided by manufacturer	Minimum guaranteed optical output power used for optical budget calculation.
Maximum Transmit Power	TX_POWER_MAX_CUSTOMER	To be provided by manufacturer	Maximum optical output power that may be transmitted by the module.
Receiver Sensitivity	RX_SENSITIVITY_CUSTOMER	To be provided by manufacturer	Minimum received optical power required to guarantee correct receiver operation.
Receiver Overload Level	RX_OVERLOAD_CUSTOMER	To be provided by manufacturer	Maximum received optical power within the guaranteed operating range of the receiver.
Maximum Supported Link Distance	MAX_DISTANCE_CUSTOMER	Manufacturer specification	Maximum nominal transmission distance supported by the transceiver.

2.2. Minimum Compatibility Requirements

To ensure interoperability with all SFP transceivers supported by the BMXNRP0201, the customer equipment should comply with the following minimum requirements:

Parameter	Requirement
WAVELENGTH_CUSTOMER	1310 nm
FIBER_TYPE_CUSTOMER	Single-Mode Fiber (SMF) 9/125 μm
CONNECTOR_TYPE_CUSTOMER	LC Duplex
BIT_RATE_CUSTOMER	125 to 155 Mbit/s
RX_OVERLOAD_CUSTOMER	< -8 dBm
MAX_DISTANCE_CUSTOMER	≥ 15 km recommended

2.3. Customer Information Required for Link Engineering

Prior to commissioning, Schneider Electric recommends obtaining the following information from the customer equipment supplier:

Required Information	Variable
Optical wavelength	WAVELENGTH_CUSTOMER
Minimum transmit power	TX_POWER_MIN_CUSTOMER
Maximum transmit power	TX_POWER_MAX_CUSTOMER
Receiver sensitivity	RX_SENSITIVITY_CUSTOMER
Receiver overload level	RX_OVERLOAD_CUSTOMER
Supported fiber type	FIBER_TYPE_CUSTOMER
Supported connector type	CONNECTOR_TYPE_CUSTOMER
Maximum supported distance	MAX_DISTANCE_CUSTOMER

Design Note :

The parameters TX_POWER_MIN_CUSTOMER, TX_POWER_MAX_CUSTOMER, RX_SENSITIVITY_CUSTOMER, and RX_OVERLOAD_CUSTOMER are mandatory to:

- calculate the optical budget,
- verify link attenuation limits,
- validate the guaranteed operating range of both receivers,
- determine whether an optical attenuator is required,
- ensure interoperability with the BMXNRP0201.

3. Optical Budget Calculation

3.1. Calculation Formula

Parameter	Formula
Customer → NRP Optical Budget	$\text{OPTICAL_BUDGET_CUSTOMER_TO_NRP} = \text{TX_POWER_MIN_CUSTOMER} - \text{RX_SENSITIVITY_NRP}$
NRP → Customer Optical Budget	$\text{OPTICAL_BUDGET_NRP_TO_CUSTOMER} = \text{TX_POWER_MIN_NRP} - \text{RX_SENSITIVITY_CUSTOMER}$

3.2. BMXNRP0201 Design Reference

Parameter	Value Used
TX_POWER_MIN_NRP	-15 dBm
RX_SENSITIVITY_NRP	-28 dBm
OPTICAL_BUDGET_NRP	13 dB

3.3. Design Rule verification

TOTAL_LOSS_LINK < OPTICAL_BUDGET

4. Optical Link Loss Calculation

4.1. Fiber Loss

4.1.1. Formula

Parameter	Formula
Fiber Loss	$\text{FIBER_LOSS_LINK} = \text{FIBER_LENGTH_LINK} \times \text{FIBER_ATTENUATION_LINK}$

4.1.2. Typical Values

Parameter	Typical Value
FIBER_ATTENUATION_LINK	0.35 dB/km
CONNECTOR_LOSS_LINK	0.5 dB per connector
SPLICE_LOSS_LINK	0.1 dB per splice

4.1.3. Total Link Loss

Parameter	Formula
Total Loss	$\text{TOTAL_LOSS_LINK} = \text{FIBER_LOSS_LINK} + \text{CONNECTOR_LOSS_LINK} + \text{SPLICE_LOSS_LINK} + \text{ATTENUATOR_LOSS_LINK}$

4.1.4. Example

Item	Loss
Fiber (10 km)	3.5 dB
Connectors	1.0 dB
Splices	0.5 dB
Attenuator	0 dB
TOTAL_LOSS_LINK	5.0 dB

4.2. Received Optical Power Verification

4.2.1. Customer → NRP

Parameter	Formula
Received Power at NRP	$\text{RECEIVED_POWER_NRP} = \text{TX_POWER_CUSTOMER} - \text{TOTAL_LOSS_LINK}$

4.2.2. NRP → Customer

Parameter	Formula
Received Power at Customer	$\text{RECEIVED_POWER_CUSTOMER} = \text{TX_POWER_NRP} - \text{TOTAL_LOSS_LINK}$

4.2.3. Example

Parameter	Value
TX_POWER_CUSTOMER	-8 dBm
TOTAL_LOSS_LINK	5 dB
RECEIVED_POWER_NRP	-13 dBm

4.3. Guaranteed Receiver Operating Range

4.3.1. NRP Receiver

Condition	Requirement
Minimum Level	$\text{RECEIVED_POWER_NRP} > \text{RX_SENSITIVITY_NRP}$
Maximum Level	$\text{RECEIVED_POWER_NRP} < \text{RX_OVERLOAD_NRP}$
Guaranteed Operating Range	$\text{RX_SENSITIVITY_NRP} < \text{RECEIVED_POWER_NRP} < \text{RX_OVERLOAD_NRP}$

4.3.2. Customer Receiver

Condition	Requirement
Minimum Level	$\text{RECEIVED_POWER_CUSTOMER} > \text{RX_SENSITIVITY_CUSTOMER}$
Maximum Level	$\text{RECEIVED_POWER_CUSTOMER} < \text{RX_OVERLOAD_CUSTOMER}$
Guaranteed Operating Range	$\text{RX_SENSITIVITY_CUSTOMER} < \text{RECEIVED_POWER_CUSTOMER} < \text{RX_OVERLOAD_CUSTOMER}$

4.3.3. Important Note

Topic	Description
RX_OVERLOAD	Design limit defined by the transceiver manufacturer
Engineering Rule	Verify received optical power by calculation

4.4. Minimum Fiber Length Without Attenuator

4.4.1. Calculation Formula

Parameter	Formula
Minimum Fiber Length	$\text{MIN_FIBER_LENGTH} = (\text{TX_POWER_MAX} - \text{RX_OVERLOAD} - \text{CONNECTOR_LOSS} - \text{SPLICE_LOSS}) / \text{FIBER_ATTENUATION}$

4.4.2. BMXNRP0201 Example

Parameter	Variable	Value
Maximum transmit power	TX_POWER_MAX_NRP	-8 dBm
Receiver overload level	RX_OVERLOAD_NRP	-8 dBm
Typical connector loss	CONNECTOR_LOSS_LINK	1.0 dB (2 × 0.5 dB)
Typical splice loss	SPLICE_LOSS_LINK	0 dB
Fiber attenuation @1310 nm	FIBER_ATTENUATION_LINK	0.35 dB/km

4.4.3. Calculation Example

Step 1: Substitute the values

$$MIN_FIBER_LENGTH = \frac{(-8) - (-8) - 1 - 0}{0.35}$$

Step 2: Simplify

$$MIN_FIBER_LENGTH = \frac{-1}{0.35}$$

Step 3: Result

$$MIN_FIBER_LENGTH = -2.86 \text{ km}$$

Interpretation :

A negative fiber length has no physical meaning.

It indicates that the connector losses alone are already sufficient to keep the received optical power below the receiver overload limit.

Therefore:

Result	Interpretation
MIN_FIBER_LENGTH < 0	No minimum fiber length required
MIN_FIBER_LENGTH = 0	Direct connection allowed
MIN_FIBER_LENGTH > 0	Minimum fiber length required

For the BMXNRP0201:

Parameter	Result
MIN_FIBER_LENGTH_NRP	0 m
Additional Attenuator Required	No
Direct 1 m Patch Cord Connection	Allowed
Direct 5 m Patch Cord Connection	Allowed
Direct 10 m Patch Cord Connection	Allowed

Engineering Conclusion

Because:

$$TX_POWER_MAX_{NRP} = RX_OVERLOAD_{NRP} = -8 \text{ dBm}$$

and because any real optical link already introduces connector losses, the BMXNRP0201 does **not require a minimum fiber length** to protect the receiver.

A customer may therefore connect:

- a 1 m fiber patch cord,
- a 5 m fiber patch cord,
- a 50 m fiber link,

without using an optical attenuator, provided that all other optical parameters remain within the specified operating range.

4.4.4. Design Rule

Verification
MIN_FIBER_LENGTH $\leq$ 0 → No attenuator required
MIN_FIBER_LENGTH > 0 → Calculate and install an optical attenuator or increase fiber attenuation
Always verify: RX_SENSITIVITY < RECEIVED_POWER < RX_OVERLOAD

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