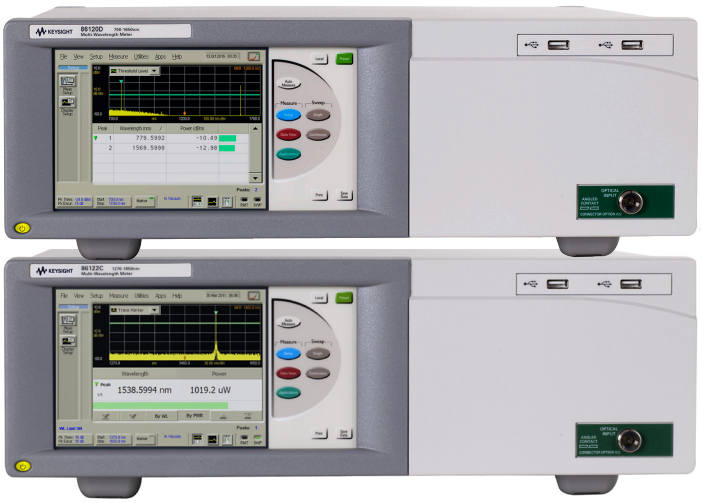
DATA SHEET

# Keysight 86120D and 86122C Multi-Wavelength Meters



KEYSIGHT TECHNOLOGIES

# Introduction

The 8612xx family of multi-wavelength meters is known for reliability and durability on the manufacturing floor, on engineer‘s benches, and even on ships. Statistical data from a large share of the industry’s installed wavelength meters enables Keysight to continuously fine-tune its instruments for lower cost of ownership and longer usage. Current updates include an extended recommended recalibration period of two years and a doubled lifetime of the built-in reference laser.

## NEW Fast Update Option for the 86122C Multi-Wavelength Meter

Our flagship model, the Keysight 86122C, is now available with a faster update rate. The new option 86122C-110 accelerates the update rate from 2 per second to 3 per second. The measurement cycle time is reduced from 0.5 seconds to 0.3 seconds. For compatibility, the previous update rate is still available under option 86122C-100.

## NEW 86120D Multi-Wavelength Meter

For the measurement of light sources and signals in the wavelength range from 700 nm to 1700 nm, the new 86120D model offers a compelling set of features with ±1.5 ppm accuracy and a measurement cycle time of 0.6 seconds. Like for the 86122C, all wavelength accuracy specifications apply to single-scan measurements - there is no averaging required. This makes them ideal for fast, automated wavelength adjustment procedures.

The 86120D has been qualified for “General Purpose” environmental operating conditions from 0 °C to +55 °C, including shock and vibration levels for use cases that require robust test equipment.

Keysight multi-wavelength meters are Michelson interferometer- based instruments that measure wavelength and optical power of laser light over a specified wavelength range. Simultaneous measurements of multiple laser lines are performed, allowing measurements of DWDM signals and multiple lines of Fabry-Perot lasers. Each laser line is assumed to have a linewidth (including modulation sidebands) of less than:

- 10 GHz for the 86120D, and
- 2.5 GHz for the 86122C

A broadband mode is also available for measuring the weighted center of wider lines.

This technical specifications sheet describes the measurement accuracy and operating conditions of the Keysight 86120D and 86122C Multi-Wavelength Meters. The specifications apply to all functions within the specified environmental conditions. All specifications apply after the instrument’s temperature has been stabilized after 15 minutes continuous operation.

# Definitions of Terms

## Characteristics and specifications

The distinction between specifications and characteristics is described as follows:

- Specifications describe warranted performance.
- Characteristics provide useful, but non-warranted information about the functions and performance of the instrument.
- General Characteristics give additional information for using the instrument. These are general descriptive terms that do not imply a level of performance.

Specifications apply for wavelengths not equal to any water absorption line.

## Wavelength

- Range refers to the allowable wavelength range of the optical input signal.
- Absolute accuracy indicates the maximum wavelength error over the allowed environmental conditions.
- Differential accuracy indicates the maximum wavelength error in measuring the wavelength difference between two signals that are simultaneously present.
- Minimum resolvable separation indicates the minimum wavelength separation of two laser lines input required to measure each wavelength simultaneously. Two laser lines closer in wavelength than the minimum resolvable separation are not resolved and one average wavelength is displayed.
- Display resolution indicates the minimum incremental change in displayed wavelength.

## Power

- Calibration accuracy indicates the maximum power calibration error at the specified wavelengths over the allowed environmental conditions.
- Flatness refers to the maximum amplitude error in a measurement between two lines that are separated in wavelength by no more than the specified amount.
- Linearity indicates the maximum power error in measuring the change in power of one laser line.
- Polarization dependence indicates the maximum displayed power variation as the polarization of the input signal is varied.
- Display resolution indicates the minimum incremental change in displayed power.

## Sensitivity

Sensitivity is defined as the minimum power level of a single laser line input to measure wavelength and power accurately. A laser line with less than the minimum power may be measured but with reduced wavelength and power accuracy. For multiple laser lines input, sensitivity may be limited by total input power.

## Selectivity

Selectivity indicates the ability to measure the wavelength and power of a weak laser line in the proximity of a specified stronger laser line and separated by the specified amount.

## Input power

- Maximum displayed level indicates the maximum total input power (total of all laser lines present) to accurately measure wavelength and power.
- Maximum safe input power indicates the maximum total input power (total of all laser lines present) to avoid permanent optical damage to the instrument.

## Maximum number of lines input

Maximum number of lines input is the maximum number of displayed lines. If more than the specified number of lines is input, only the longest wavelength lines are displayed.

## Input return loss

Input return loss indicates the optical power reflected back to the user's fiber cable relative to the input power. It is limited by the return loss of the front panel connector, and assumes the user's connector is good.

## Measurement cycle time

Measurement cycle time refers to the cycle time when measuring wavelength and power of laser lines. Specific advanced applications may require longer cycle times.

# Specifications

| | 86120D | 86122C | Notes |
|---|---|---|---|
| **Wavelength** | | | |
| Range<br>Operating range | 700 to 1650 nm (182 to 428 THz)<br>700 to 1700 nm (176 to 428 THz) | 1270 to 1650 nm (182 to 236 THz) | For lines separated by less than or linewidth greater than the specified amount, wavelength accuracy is reduced. For laser lines separated by ≥ 10 GHz (≥ 20 GHz for 86120D) and linewidths ≤ 2.5 GHz (≤ 10 GHz for 86120D). |
| **Absolute accuracy** | | | |
| | ± 1.5 ppm<br>typ. ± 1 ppm (within 15 °C to 35 °C) | ± 0.2 ppm (within 15°C to 35°C) | |
| At 1550 nm | ± 2.3 pm | ± 0.3 pm | |
| At 1310 nm | ± 2.1 pm | ± 0.3 pm | |
| Differential accuracy [1] | ± 0.4 ppm | ± 0.15 ppm | |
| **Minimum resolvable separation [1] (equal power lines input)** | | | |
| | 15 GHz | 5 GHz | |
| At 1550 nm | 0.12 nm | 0.04 nm | |
| At 1310 nm | 0.09 nm | 0.03 nm | |
| **Display resolution** | | | |
| | 0.0001 nm | | |
| Units | nm (vacuum or standard air), cm $^{-1}$, THz | | |
| **Power** | | | |
| Calibration accuracy [5] | ± 0.6 dB<br>(at ± 30 nm from 780 nm [1], 1310 nm, and 1550 nm) | ± 0.5 dB<br>(at ± 30 nm from 1310 nm and 1550 nm) | |
| Flatness [1] | ± 0.2 dB (1200 to 1600 nm) | ± 0.2 dB (1270 to 1600 nm) | 30 nm from any wavelength |
| | ± 0.5 dB (700 to 1650 nm) | ± 0.5 dB (1270 to 1650 nm) | |
| Linearity | ± 0.3 dB (1200 to 1600 nm) | ± 0.3 dB (1270 to 1600 nm) | Lines above –30 dBm |
| Polarization dependence | ± 0.6 dB(1200 to 1600 nm) | ± 0.6 dB (1270 to 1600 nm) | |
| | ± 1.5 dB [1] (700 to 1650 nm) | ± 1.0 dB [1] (1600 to 1650 nm) | |
| Display resolution | 0.01 dB | | |
| Units | dBm, mW, µW | | |
| **Sensitivity** | | | |
| Single line input | –20 dBm (700 to 900 nm) | NA | Single measurement, without averaging |
| | –25 dBm [1] (800 to 1200 nm) | NA | |
| | –40 dBm [6] (1200 to 1600 nm) | –32 dBm (1270 to 1600 nm) | |
| | –30 dBm [6] (1600 to 1650 nm) | –22 dBm (1600 to 1650 nm) | |
| Multiple lines input [1] | 30 dB below total input power, but not less than single line input sensitivity | | |
| Selectivity [1] | 25 dB spacing ≥ 100 GHz | 25 dB spacing ≥ 90 GHz | |
| | 10 dB spacing ≥ 25 GHz | 10 dB spacing ≥ 10 GHz | |

1. Characteristic.
2. Number of laser lines may be limited by signal power requirements for accurate wavelength measurements.
3. Type tested means tested, but not warranted, for continuous operation.
4. At 1550 nm.
5. Excluding polarization effects.
6. Spurious free under Preset conditions.

# Specifications (continued)

| | 86120D | 86122C | Notes |
|---|---|---|---|
| **Input power** | | | |
| Maximum displayed level | +10 dBm | +10 dBm | Sum of all lines input |
| Maximum safe input level | +18 dBm | +18 dBm | |
| **Return loss** | | | |
| – With non-angled (PC) connectors (Option 021) | 35 dB | 35 dB | For wavelengths above 1200 nm |
| – With angled (APC) connectors (Option 022) | 50 dB | 50 dB | |
| **Measurement cycle time** | 0.6 s | 0.5 s (86122C-100) | |
| | | 0.3 s (86122C-110) | |
| **Maximum number of lines** | 1000 [2] | 1000 [2] | |
| Measurement modes | List by wavelength table, list by power table, signal wavelength and power, average wavelength and total power | | Data logging and sorting by any parameter are included |
| Delta modes | Delta wavelength, delta power, delta wavelength and power | | |
| **Built in automatic measurement applications** | | | |
| **Signal to noise ratio** [1,4,7] | | | |
| Channel spacing | | | 0.1 nm noise bandwidth, lines above –25 dBm |
| – ≥ 200 GHz | > 35 dB with 100 averages | | |
| – ≥ 100 GHz | | > 35 dB with 100 averages | |
| – ≥ 50 GHz | | > 27 dB with 100 averages | |
| **Drift** | | | |
| | Maximum, minimum, total drift (max-min) of wavelengths and powers over time | | |
| **Fabry-Perot characterization** | | | |
| | Mean wavelength, peak wavelength, mode spacing, full-width half maximum, peak amplitude, total power, sigma | | |
| **Additional features** | | | |
| | Power offset, power bars (on or off), user adjustable peak excursion and peak threshold, user adjustable start and stop wavelength limits, graphical display, save and recall instrument states. | | |
| **Inputs/outputs** | | | |
| Optical input | 9 µm/125 µm single-mode fiber | | |
| Rear panel connectors | LAN, PS/2 for keyboard and mouse, SVGA and DVI for external monitor, GPIB, USB, AC Line | | |

1. Characteristic.
2. Number of laser lines may be limited by signal power requirements for accurate wavelength measurements.
3. Type tested means tested, but not warranted, for continuous operation.
4. At 1550 nm.
5. Excluding polarization effects.
6. Spurious free under Preset conditions.
7. For laser lines separated by ≥ 10 GHz (≥ 20 GHz for 86120D) and linewidths ≤ 2.5 GHz (≤ 10 GHz for 86120D).

# Specifications (continued)

| | 86120D | 86122C | Notes |
|---|---|---|---|
| **Reliability** | | | |
| Recommended re-calibration | 2 years | 2 years | |
| **Environmental** | | | |
| **Operational** | | | |
| Temperature | 0 to +55 °C | 15 to 35 °C | |
| Humidity [1] | < 95% R.H. at +40 °C | < 75% R.H. at 35 °C Indoor use only | |
| **Storage** | | | |
| Temperature | –40 °C to +70 °C | –40 °C to +70 °C | |
| Humidity [1] | < 90% R.H. at +65 °C for 24 hrs. | < 95% R.H. at +40 °C for 5 day cycle | Non-condensing |
| **Dimensions and weight** | | | |
| Dimensions (H x W x D) | 138 mm x 425 mm x 520 mm (5.2 in x 16.7 in x 20.5 in) | | |
| | 14.5 kg (32 lb) | | |
| **Power requirements** | | | |
| Voltage and frequency | 100 V / 115 V / 230 V / 240 V~, 50 Hz / 60 Hz | | |
| Maximum power | 310 VA max | | |

1. Type tested means tested, but not warranted, for continuous operation.

# General Characteristics

The 8612x wavelength meters contain HeNe reference lasers, which have limited operating lifetimes, like all gas-discharge lasers. With the latest enhancement of the reference lasers used in the new 86122C, the average laser lifetime has doubled. The 2-year recommended re-calibration period helps minimize planned and unplanned downtimes and cost of ownership.

# Ordering Information

For the most up-to-date ordering information, please contact your Keysight sales representative.

| **86120D Multi-wavelength meter** | |
|---|---|
| **Optical connectors** | |
| 86120D-021 | Straight (non-angled) connector interface-PC |
| 86120D-022 | Angled contact interface-APC |
| **Accessories** | |
| 86122A-1CM | Rack mount kit without handles |
| 86122A-1CN | Handle kit |
| 86122A-1CP | Rack mount kit plus handles |
| 86120D-UK6 | Commercial calibration certificate with test data |
| **Calibration** | |
| R-50C-011-3 | Calibration Assurance Plan – Return to Keysight – 3 years |
| R-50C-011-5 | Calibration Assurance Plan – Return to Keysight – 5 years |
| R-50C-021-3 | ANSI Z540-1-1994 Calibration – 3 years |
| R-50C-021-5 | ANSI Z540-1-1994 Calibration – 5 years |

# Ordering Information (continued)

For the most up-to-date ordering information, please contact your Keysight sales representative.

| | |
|---|---|
| **Connector interfaces (order separately)** | |
| 81000FI | FC connector interface (FC/PC) |
| 81000HI | E-2000 connector interface |
| 81000KI | SC connector interface |
| 81000LI | LC connector interface |
| 81000MI | MU connector interface |
| 81000NI | FC connector interface (FC/APC with narrow key) |
| 81000SI | DIN connector interface |
| 81000VI | ST connector interface |
| **86122C Multi-wavelength meter** | |
| 86122C-100 | Wavelengths 1270 nm to 1650 nm, ± 0.2 ppm |
| 86122C-110 | Wavelengths 1270 nm to 1650 nm, Fast Update, ± 0.2 ppm |
| **Optical connectors** | |
| 86122C-021 | Straight (non-angled) connector interface-PC |
| 86122C-022 | Angled contact interface-APC |
| **Accessories** | |
| 86122A-1CM | Rack mount kit without handles |
| 86122A-1CN | Handle kit |
| 86122A-1CP | Rack mount kit plus handles |
| 86122C-UK6 | Commercial calibration certificate with test data |
| **Calibration** | |
| R-50C-011-3 | Calibration Assurance Plan – Return to Keysight – 3 years |
| R-50C-011-5 | Calibration Assurance Plan – Return to Keysight – 5 years |
| R-50C-021-3 | ANSI Z540-1-1994 Calibration – 3 years |
| R-50C-021-5 | ANSI Z540-1-1994 Calibration – 5 years |


# Optical Instruments Online Information

| | |
|---|---|
| Optical test instruments | www.keysight.com/find/oct |
| Lightwave component analyzers | www.keysight.com/find/lca |
| Polarization solutions | www.keysight.com/find/pol |
| Spectral analysis products | www.keysight.com/find/mwm |
| Electro-optical converters | www.keysight.com/find/ref |
| Optical test instruments accessories | www.keysight.com/find/octaccessories |
| Firmware and driver download | www.keysight.com/find/octfirmware |
| Keysight photonic discussion forum | www.keysight.com/find/photonic_forum |

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