Anritsu

Optical Wavelength/Frequency Counter

MF9630A

0.6 to 1.6 μm/500 to 187 THz

Because of rapid developments in optical communications, precise measurements of light sources oscillation frequency and wavelength have become necessary.
The MF9630A Optical Wavelength/Frequency Counter has an accuracy of ±0.5 ppm and a resolution of better than 0.1 pm/12 MHz. The MF9630A brings greater precision than ever before to the measurement of the oscillation frequency for frequency division multiplex communications (FDM) and to the evaluation of frequency-stabilized light sources.

±0.5 ppm High-Accuracy Measurement

Optical Wavelength/Frequency Calibration Using The $^{127}I_2$ Stabilized He-Ne Laser Light Source

The measurement accuracy of the MF9630A is determined by comparing MF9630A wavelength measurement to an iodine-stabilized He-Ne laser recommended by the CIPM** (International Metrology Committee) to define reference meter length. The uncertainty of the optical wavelength/frequency for the He-Ne laser source is 10^{-9}. When this is measured by the MF9630A, the error is ±70 fm, which is small enough compared to the specified accuracy of ±0.5 ppm (approx. 310 fm for every 0.633 μm).

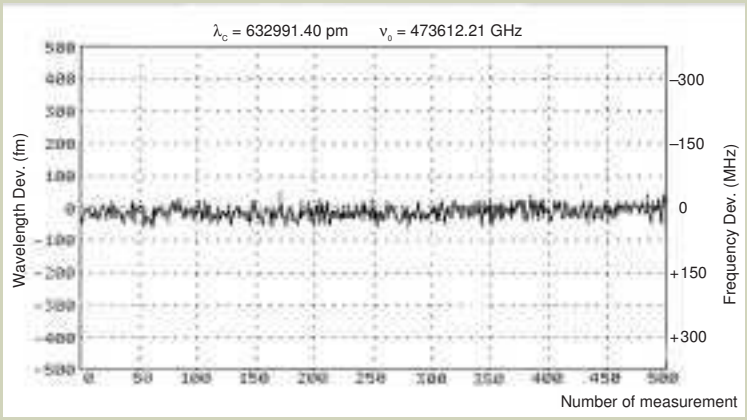
* These measurements were done under the technical guidance of the National Research Laboratory of Metrology (Japan), with a Ne-He laser tuned to the iodine absorption line [$^{127}I_2$, 11-band, i component of R(127)].

The following values were used as the vacuum wavelength λ_0 and frequency ν_0 of the oscillated He-Ne laser light.

λ_0 = 632 991 398. 1 fm

ν_0 = 473 612 214. 8 MHz

** CIPM: Comité International des Poids et Mesure



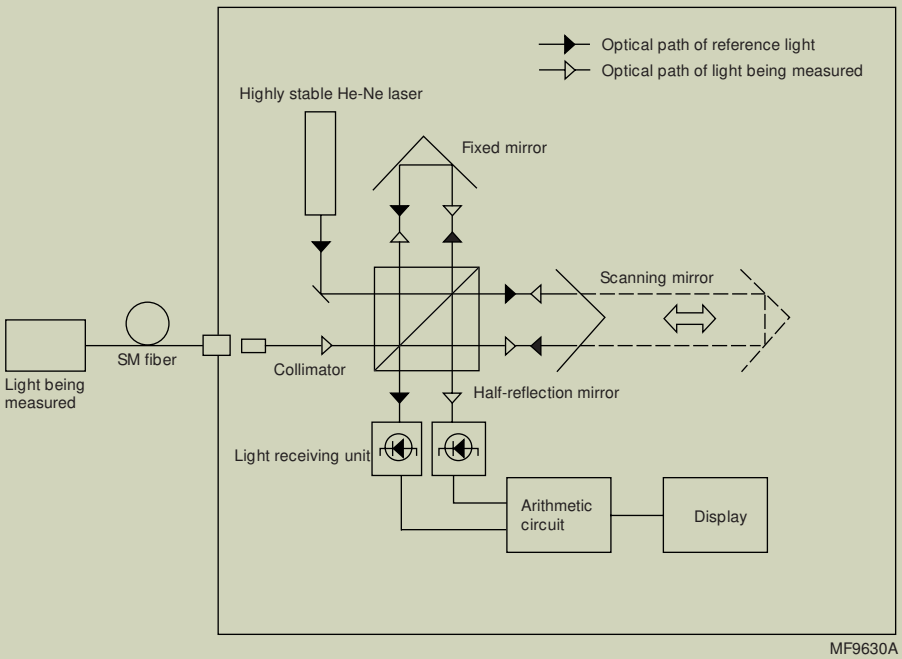
MF9630A Measurement repeatability data of iodine-stabilized He-Ne laser

0.1 pm/12 MHz Ultra-High Resolution

■ Principle of operation

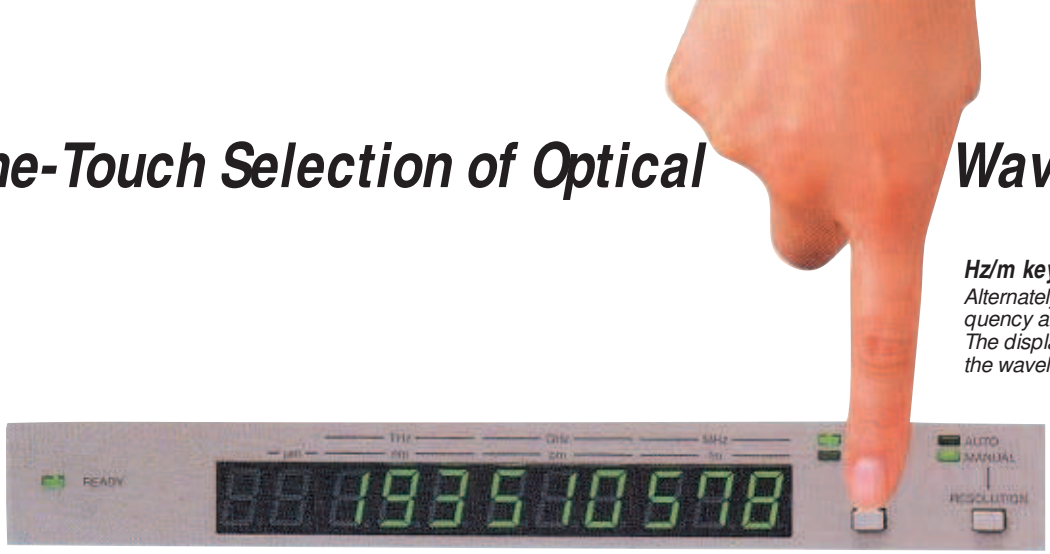
The MF9630A uses a Michelson interferometer to count the number of intensity fringes in the interference patterns of both the reference light source and the light source being measured. It then determines the wavelength and frequency of the light source being measured from the ratio of these numbers.

The MF9630A schematic diagram is shown below.



MF9630A

One-Touch Selection of Optical Wavelen



Hz/m key
Alternately switches be quency and wavelengt The displayed wavelen the wavelength in a va

Display section
The frequency is displayed as a 9 digit (max.) value, while the wavelength is displayed as a 10 digit (max.) value.
Nineth digit becomes effective at AVERAGE mode when measuring wavelength/frequency of light with ≤100 MHz spectral FWHM. The READY lamp comes on when measurement can be performed.

STANDBY lamp (LED)

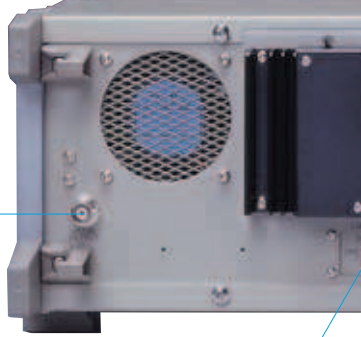
Power supply switch

GP-IB LOCAL key

AVERAGE C
When ON, th surements is

Measurement of Wavelength/frequency variation

RELATIVE ON/OFF key, 0.1 V/GHz OUTPUT connector
Used when measuring variations in optical wavelength/frequency. The value displayed before the RELATIVE key is pressed becomes the reference value. Therefore, deviations from this reference value are displayed. Moreover, an analog voltage corresponding to these deviations is output from the rear-panel BNC connector.
This analog voltage is output at a ratio of 0.1 V/GHz for both frequency and wavelength measurements to a maximum of ±10 Vdc.



LOCK lever
Set this lever to ON when transporting the MF9630A to secure the optical unit.

AC power supply input connector

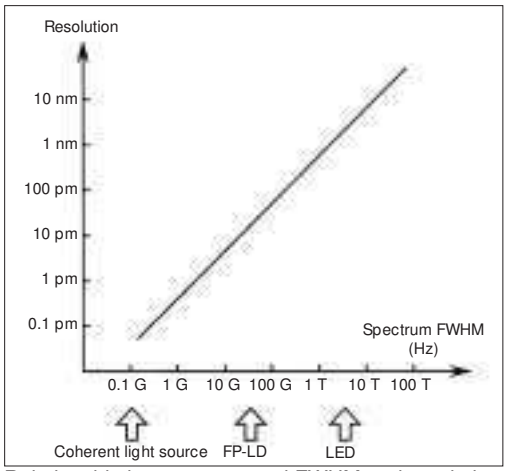
gth or Frequency Display

etween the fre-
th displays.
ngth denotes
cuum.

Automatic Setting of the Number of display digits According to the Characteristics of the light being Measured

RESOLUTION-AUTO/MANUAL key and BLANKING key

The measurement resolution is determined automatically from the spectral full width at half maximum (FWHM) of the lign to be measured and the number or displayed digits are set accordingly. Consequently, both incoherent (LED, etc.) and coherent light can be measured at optimum resolution. Also, in the MANUAL mode, the number of digits can be set from 4 to 10 via the BLANKING key.



Relationship between spectral FWHM and resolution

MONITOR

Alternately switches between optical level and polarization monitoring mode.

POLARIZATION ADJUST

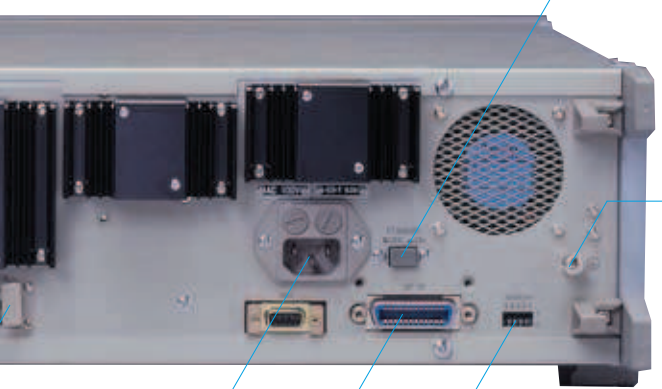
Adjusts polarization of light to be measured

OPTICAL INPUT

MEASURE ON/OFF key

ON/OFF key

*e average of the previous 10 mea-
displayed.*



STANDBY switch

Turns internal reference light source ON/OFF. The front STANDBY LED lights when this switch is ON. Generally, the internal reference light source must be warmed-up for about 30 minutes.

Frame grounding terminal

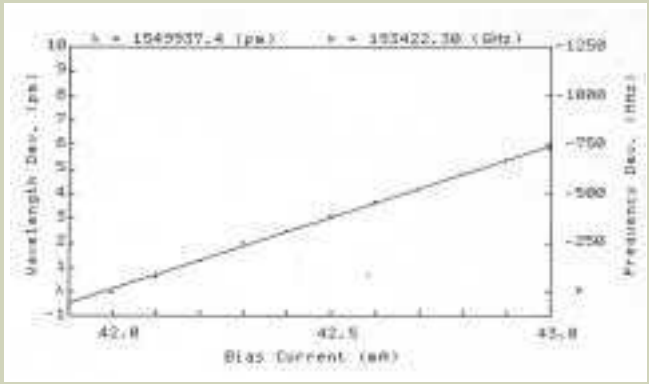
GP-IB address switch

GP-IB connector

▼ *Measurement Examples*

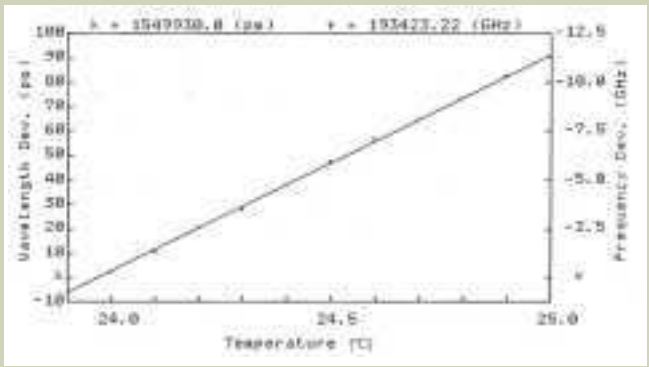
1. LD Bias Current vs. Oscillation Wavelength/Frequency Characteristics

It is known that the LD oscillation wavelength/frequency changes with the bias current.
The figure on the right shows the wavelength/frequency of a 1.55 μm LD as the bias current is changed in 0.1 mA steps over a 1 mA range.
Since the MF9630A has a resolution of 0.1 pm, it plays a powerful role in monitoring the wavelength/frequency of frequency-stabilized and variable wavelength light sources.



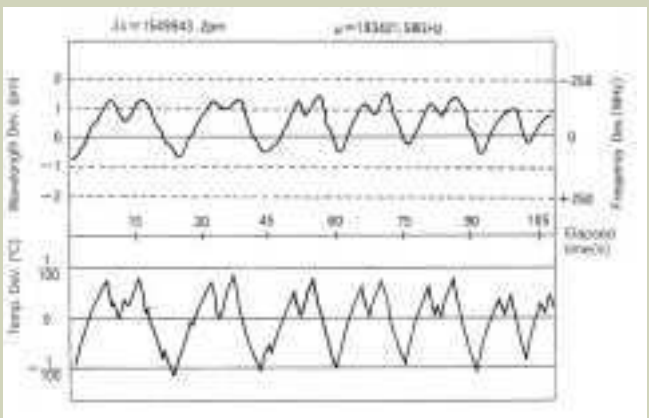
2. Temperature Characteristics of LD Oscillation Wavelength/Frequency

An important factor in frequency-stabilized light sources is temperature control.
The figure on the right shows the variation in wavelength/frequency of 1.55 μm LD when its temperature is changed over a 1°C range, in 0.1°C steps.



Bias current—Oscillation wavelength/frequency characteristics

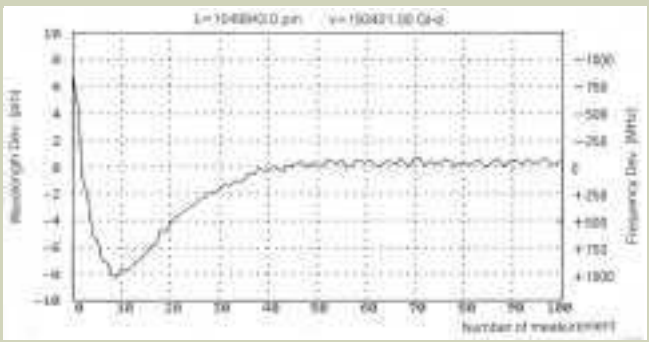
The figure on the right shows the variation in oscillation wavelength/frequency when the LD temperature is controlled to within ±1/100°C.



LD temperature vs. wavelength/frequency deviations

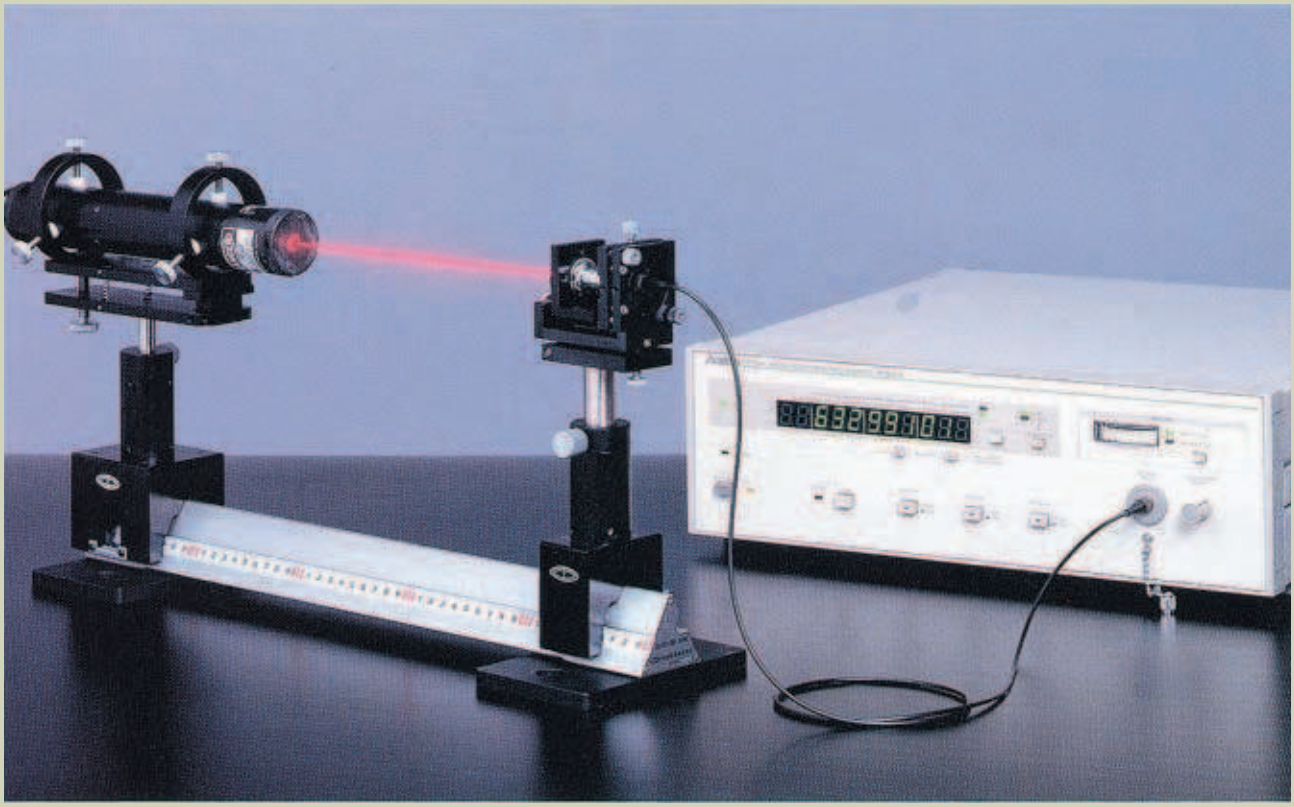
3. Wavelength/Frequency Variations After Power is Applied

The figure on the right illustrates the oscillation wavelength/frequency from the moment power is applied until characteristics are stable.



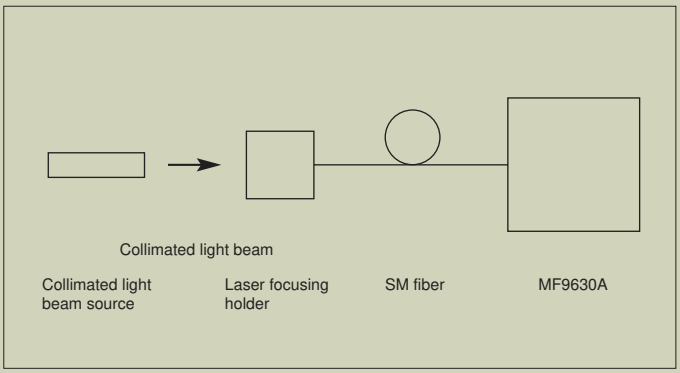
Wavelength/frequency variations after power is applied

▼ *Applications*



Laser Beam Measurement

When measuring the wavelength/frequency of collimated light beam sources such as He-Ne laser, use a laser focusing holder to concentrate light at the tip of the optical fiber to be input to the MF9630A.



▼ Specifications

Range	**Wavelength**	0.6 to 1.6 μm
	Frequency	187 to 500 THz
Optical input level		–25 to 0 dBm (CW)
Applicable light sources		LD, LED, GAS laser, etc.*1
Accuracy		±0.5 ppm*2
Resolution		<0.1 pm*3
Measuring interval		<1.5 s
Connector		FC-type*4

Modulation signal		AM, >5 MHz
Display	**Frequency**	9 digits (LSD 1 MHz)
	Wavelength	10 digits (LSD 1 fm)
Ambient temperature		0° to 40°C (Usable)
		25°±5°C (Spec. meet)
GP-IB		Conforms to IEEE-488. I
Power		*Vac +10/–15%, 50/60 Hz
Dimensions and weight		426W×132.5H×451D mm, <22 kg

* Please specify a line voltage between 100 and 240 V when ordering.
Maximum operating voltage is 250 V.

*1 When spectral FWHM <20 THz (corresponds to approx. 112 and 160 nm for every 1.3 and 1.55 μm)

*2 For λ = 0.633 μm and relative humidity 50%. The accuracy for other wavelength conditions was not investigated, but was confirmed theoretically.
(Using a highly stable light source whose wavelength = 1.53 μm and whose frequency stability 5×10^{-9}, the repeatability was shown to be <±0.3 pm)
For accurate measurement, the optical fiber must be a single-mode fiber matched to the wavelength of the DUT.
Built-in reference light source; Frequency stability 1×10^{-9} He-Ne laser.

*3 Depends on FWHM of light source (See the graph on 5 page.)

*4 Optical connector of standard model is FC-type. For other connectors, please consult nearest Anritsu representative.
(For precise measurements, the optical fiber must be a single-mode fiber that is matched to the wavelength of DUT.)

▼ Ordering Information

Please specify the model/order no. name and quantity when ordering

Model/Order No.	Name	Remarks
	– Main frame –	
MF9630A	Optical Wavelength/Frequency Counter	
	– Standard accessories –	
	Power cord, 2.5 m: 1 pc	
F0014	Fuse, 6.3 A: 2 pcs	T6.3A250V
W0591AE	MF9630A operation manual: 1 copy	
	– Optional accessories –	
MZ7005A	Stand	
G0041	Rail	
J0056A	Optical fiber cord, 1 m	For 1.3 μm, 1.55 μm
J0581	Optical fiber cord, 1 m	For 0.63 μm, 0.85 μm
G0046	Laser Focusing Holder	Sigma KOHKI (Σ-77F)
J0008	GP-IB cable, 2 m:	408JE-102

Anritsu

Specifications are subject to change without notice.

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