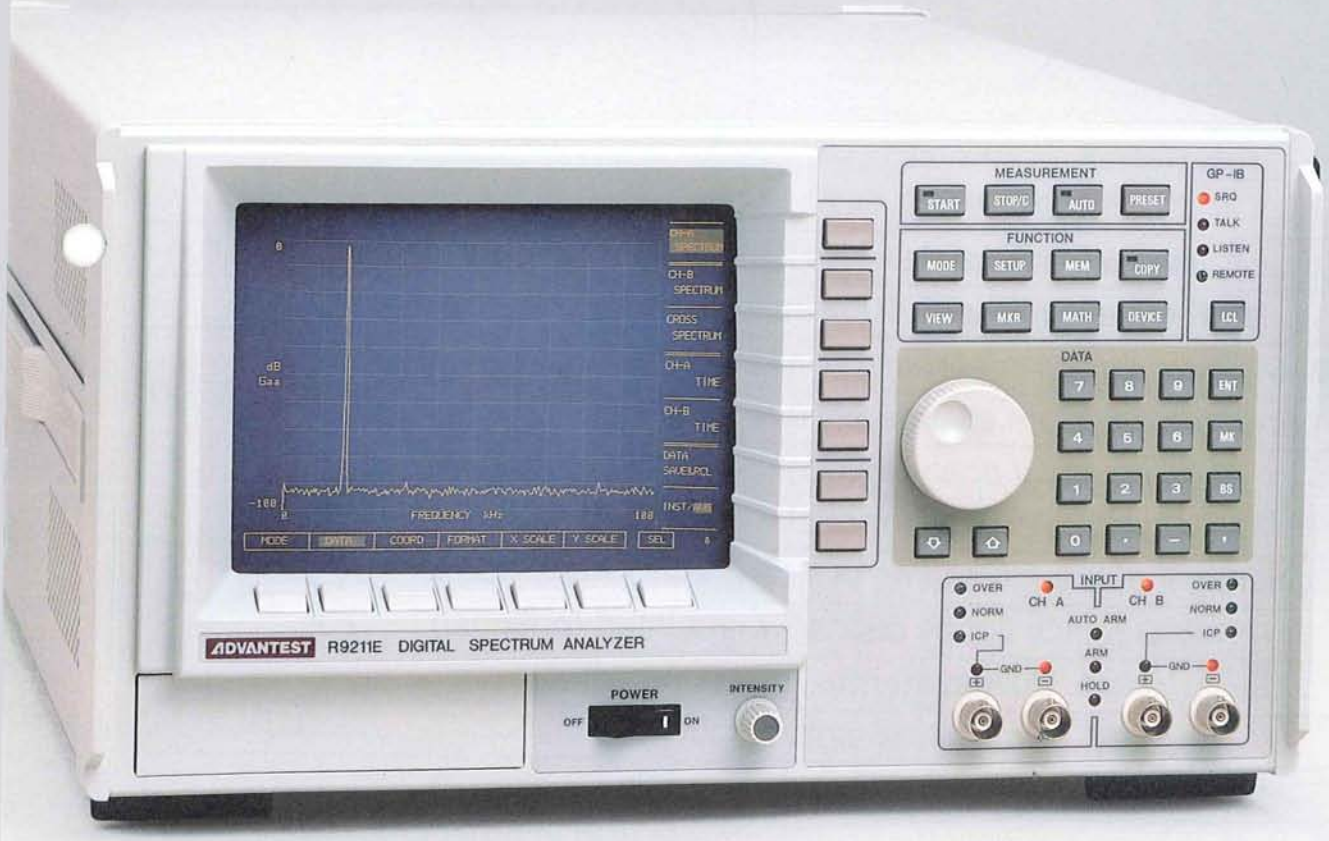
ADVANTEST
ADVANTEST CORPORATION

R9211E
Digital Spectrum Analyzer

9211 SERIES TYPE F

Economy-Type FFT Analyzer For Acoustic, Vibration, And Noise Signal Analysis



High-Performance FFT Analyzer Featuring 90 dB Wide

The R9211E is a high-performance digital spectrum analyzer weighing only 12 kg. It incorporates the latest ADVANTEST technology including a proprietary LSI, low-power-consumption electronic circuit, and high-density packaging.
This economical FFT analyzer is ideal for acoustic, vibration, and noise signal analyses.
The measuring frequency range is from 10 mHz to 100 kHz and the 16-bit high resolution realizes a 90 dB (typical value) wide dynamic range.
The R9211E analyzes weaker signals than conventional models can. The input sensitivity is −140 dBV (typical value in 2 kHz range) and the variable function enables the frequency resolution to be chaged from 25 lines to 3200 lines for high-speed spectrum analysis or approximate spectrum separation measurement.
In addition to these excellent characteristics, the epoch-making FFT analyzer has a unique four-domain (four measurement area modes) method structured for a wide range of user applications. You can select one of the four domain modes according to the type of analysis that you want to perform, whether waveform measurement, spectrum analysis, time-frequency analysis, or frequency response function measurement. These domain modes make measurement much quicker and easier.
A wide variety of options such as a large memory capacity, built-in floppy disk, and analysis by 16-bit direct digital input meet your applications.

- 90 dB (typical value) wide dynamic range featuring 2 channels and 16-bit resolution
- Frequency range: 10 mHz to 100 kHz (1-2-5 step)
- Maximum input sensitivity: −140 dBV (2 kHz, typical value)
- Four-domain system exclusively available for each type of analysis
- Frequency analysis resolution: 25 to 3200 lines
- 12 kg portable model with big 8-inch CRT
- Optimum input range setting in 1 dBV steps from +30 to −60 dBV
- 3.5-inch floppy disk drive mounted (optional)
- Built-in thermal printer (optional)
- 16-bit direct digital input (optional)
- Up to 1M-word memory extension (optional)
- Built-in power supply for accelerometer with internal amplifier
- Differential input

Dynamic Range And −140 dBV High-Sensitivity Input

Wide Measuring Frequency Range from 10 mHz to 100 kHz

The combination of high-precision analog and digital filters enable an aliasing filter to be set for any frequency range from 10 mHz to 100 kHz.
The frequency resolution can be set from 25 lines to 3200 lines in each frequency range from 10 mHz to 100 kHz, according to the purpose of analysis.
The scale function enables you to display only the spectrum of the band that you are interested in.

16-bit Resolution, 90 dB (Typ.) Wide Dynamic Range

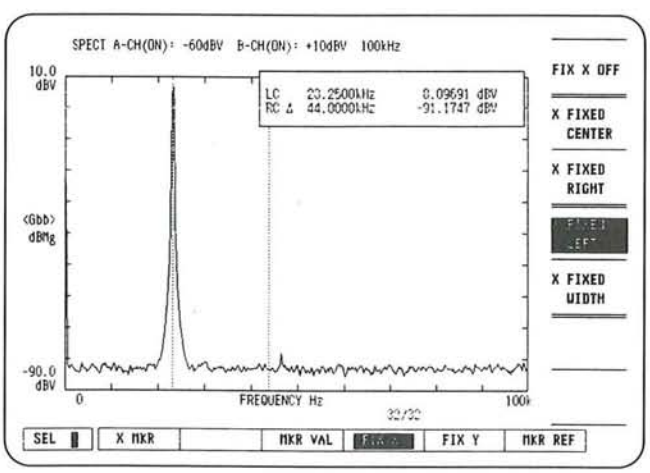
ADVANTEST's high-level analog/digital signal processing technology realized 90 dB (typical value) wide dynamic spectrum measurement. The input sensitivity range can be varied in 1 dB steps so that the internal A/D converter can be fully utilized. This makes the analyzer a powerful tool to measure the mechanical characteristics of an optical electromagnetic disk, to analyze an audio signal distortion or a transient signal, or to measure a transfer function by using the impulse hammer.

−140 dBV (Typ.) High-sensitivity Measurement

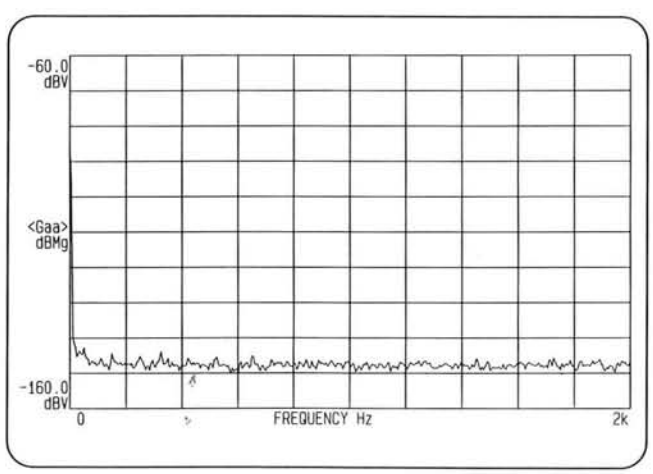
The R9211E realizes −140 dBV (0.1 μV, typical value in 2 kHz range) together with differential input. This makes it ideal for noise analysis on a semiconductor device.

12 kg Portable Model with Big 8-inch CRT

The R9211E is a high-performance portable analyzer. Weighing just 12 kg, it is easy to carry. The 8-inch amber CRT displays analysis data very clearly. To operate the R9211E, just select a measuring function from the software menu. The analyzer is ideal for maintenance or use on a vehicle.



▲ 90 dB (typ.) wide dynamic range



▲ −140 dBV (typ.) high-sensitivity measurement
(Example of low-noise level measurement)

Four-domain System for Easy Operation

Easy-to-use Four-domain FFT Analyzer

Digital spectrum analyzers usually have many functions for a wide range of measurement purpose. They are hard to operate because everything must be included, even if only a few functions are needed at that time. The R9211E makes it much simpler. It has four measurement area modes. Just select the one you need and set the software keys for that mode alone. You don't have to worry about other analysis functions and setting conditions.

• Waveform Measurement Mode

In this mode, the analyzer can analyze a signal in the time domain faster than conventioanl models can. The anti-aliasing filter can be turned on or off, so you can use the analyzer as a 16-bit/256 kHz sampling digital osciloscope. This means that the analyzer is suitable for the analysis of transient sound phenomena on an acoustic instrument in the time domain, for a start characteristic test on an engine or motor, for POWER ON RESET signal waveform analysis, and for a differential linearity test on a D/A converter.

• Time-frequency Analysis Mode

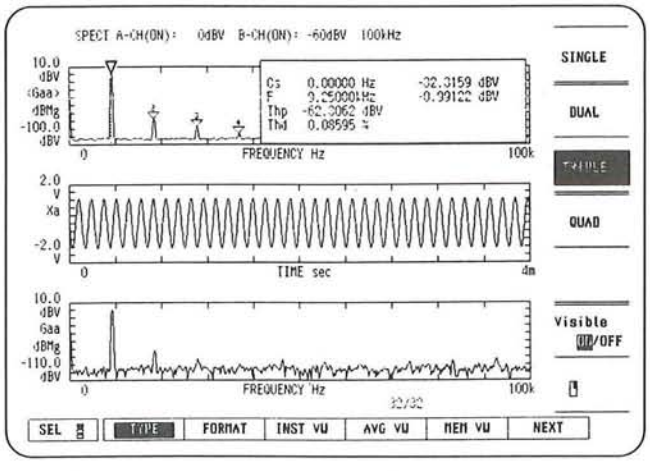
In this mode, the analyzer can evaluate the sounds of a musical instrument or the reverberant characteristic of a concert hall by analyzing the time fluctuation of a specific spectrum (level monitor function).
This mode can be used to analyze the spectrum fluctuation time characteristic of a VTR's wow and flutter component or the jitter phase fluctuation time characteristic (phase monitor function).

• Spectrum Measurement Mode

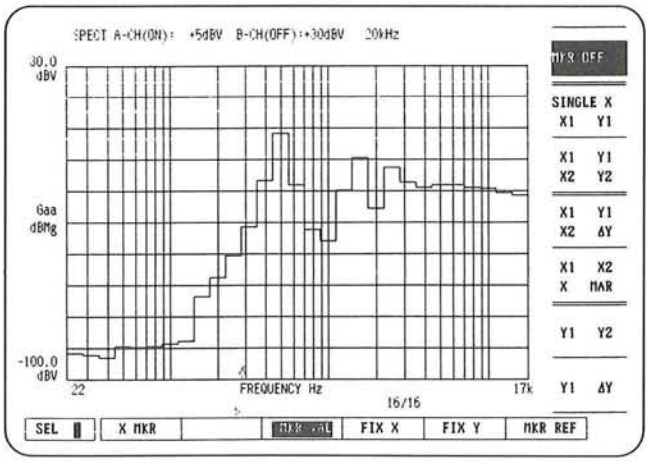
The analyzer has a 90 dB (typical value) wide dynamic measuring range and realizes −140 dBV (typical value in 2 kHz range). This is useful for approximate analysis of a spectrum.

• Frequency Response Function Measurement Mode

In the frequncy response function measurement mode, the frequency resolution can be varied from 25 lines to 800 lines.
In addition, a sensor with a built-in amplifier or an impulse hammer can be directly connected to the two channels of power supply built into the R9211E to provide an acceleration sensor to measure the transfer function of a structure.



▲ Example of three-screen simultaneous display



▲ Example of 1/3-octave analysis

Abundant Handy Analysis And Display Functions

Standard Memory 64K-byte/2-channel Memory Extension Possible

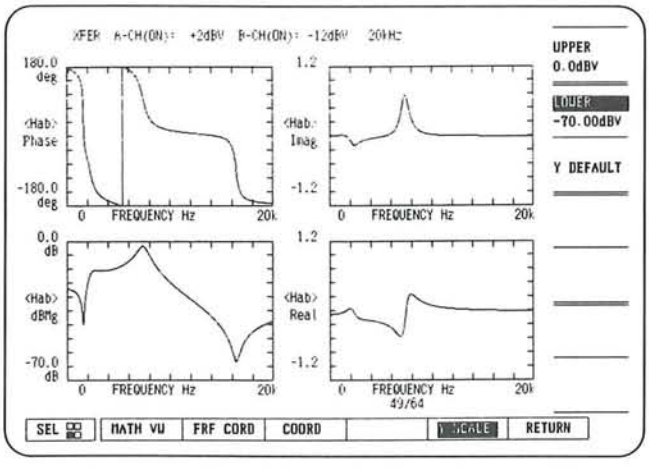
The R9211E has two channels of 64K-byte memory. If necessary, an I/O + memory or C-MOS memory can optionally be added up to 1M words. The C-MOS memory is particularly useful for analysis in vehicle or other test environments where a floppy disk memory cannot be used.
The R9211E can also store measurement data and panel settings in the internal 1M-byte 3.5-inch micro floppy disk. the MS-DOS format is used so that the data can be transferred to personal computer.

Direct 16-bit Digital Input ("I/O + Memory" Optional)

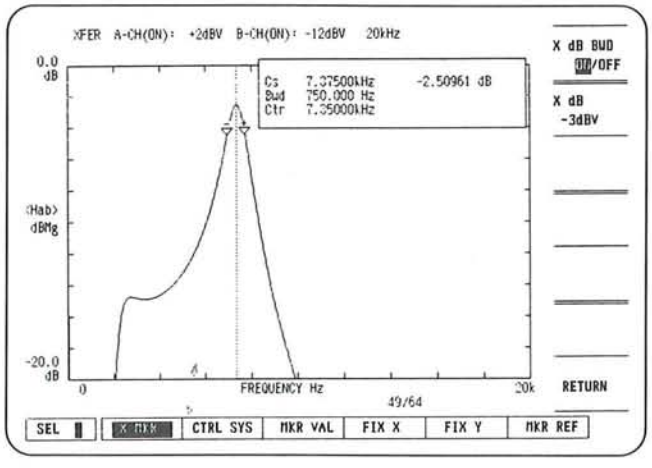
The I/O + memory is a useful option to evaluate digital audio A/D converters and DSPs for DAT and CD. To analyze a spectrum or distortion, digital signals can be inserted immediately after the R9211E A/D converter in the 16 bits + EOC data format (complement of 2).

Abundant Marker Functions and Various Display Functions

The R9211E has many marker analysis functions which can analyze and evaluate a peak marker, next peak marker, harmonic marker, band marker, overall power, attenuation power, partial power mean power, distribution, and XdB marker. These functions greatly reduce the measurement time. The CRT can display up to 4 screens at the same time, overlap data in the same area or analysis range, or display up to 50 lines in a three-dimensional format. With the bar display function, the overall power, partial power, mean power or power distribution can be checked easily.

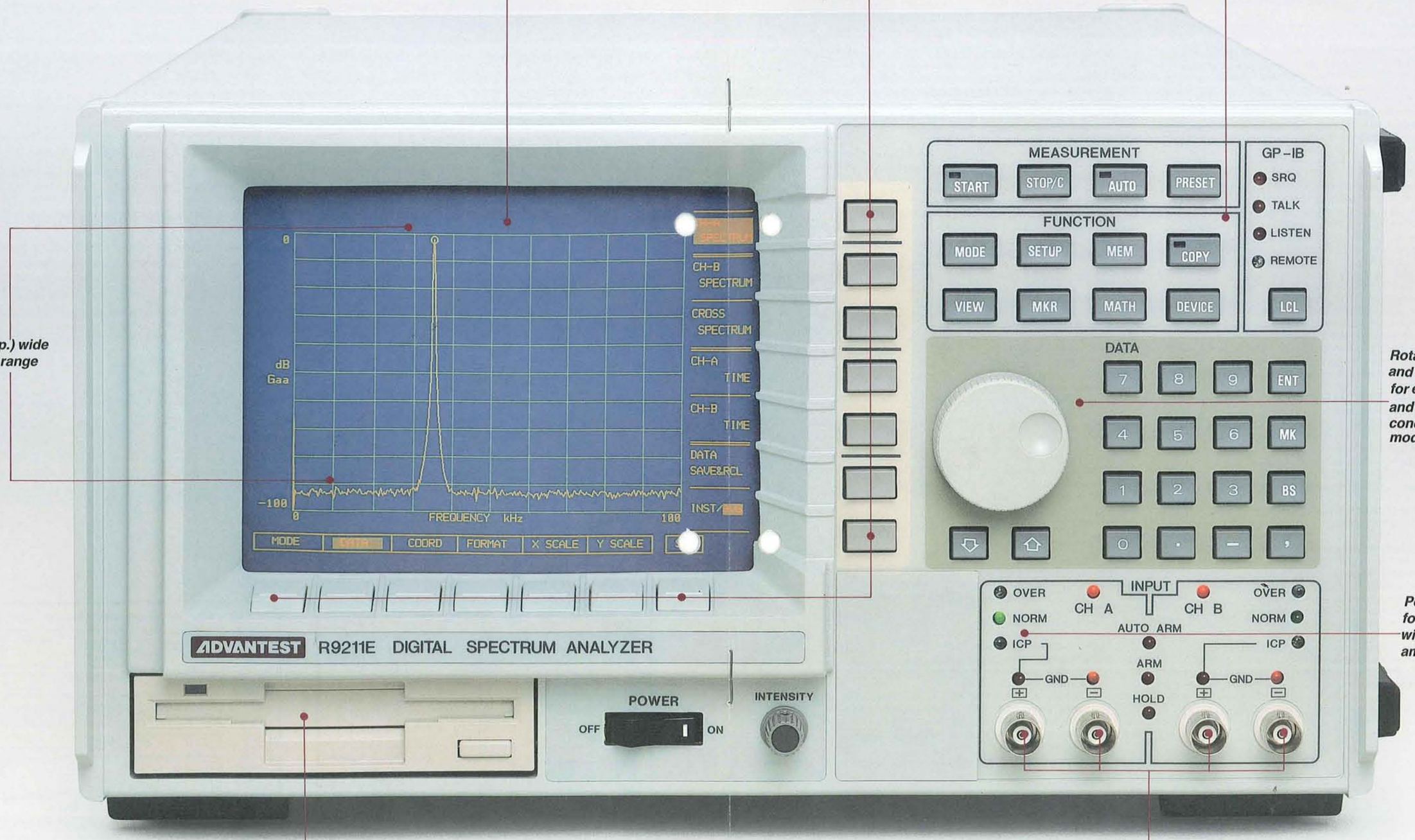


▲ Example of 4-screen simultaneous display



▲ Example of marker analysis function (XdB marker)

Compact, Lightweight FFT Analyzer, Easy To Carry For Field Measurement



Original Size

Specifications

Input and Analysis Characteristics

No. of input channels: 2
Input format: Differential input, single-ended input
Input impedance: Approx. 1 MΩ/100 pF (single-ended)
Input coupling: AC, DC, and GND
Common-mode rejection ratio (CMR): 50 dB or more (with DC coupling, 50/60 Hz)
Maximum differential input voltage: ±200 V
Maximum common-mode signal voltage: ±200 V
Input range: +30 dBV to −60 dBV (variable in 1-dB steps)
Voltage display 44.7 V to 1.41 mV
rms display 31.6 V to 1 mV
Auto range: Optimum setting in above range by signal input (in 5-dB steps)
Maximum common-mode signal voltage:
±14 V (−60 dBV range to −6 dBV range)
±140 V (−5 dBV range to +14 dBV range)
±200 V (+15 dBV range to +30 dBV range)
Maximum input sensitivity: −125 dBV (approx. 0.56μ Vrms) (typical value: −140 dBV in 2 kHz range)
Dynamic range: Range of values starting from full scale in spectrum mode; measured under the conditions of 32 times averaging, rectangular wave weighting, filter on, and 400 spectrum lines by inputting a sine wave of frequency range 0 to 90% and amplitude level −3 dB. (at 23°C ±5°C)
85 dB (+30 dBV ~ −40 dBV) (Typ. 90 dB)
75 dB (−41 dBV ~ −50 dBV)
65 dB (−51 dBV ~ −60 dBV)
Residual noise: Range of values starting from full scale in spectrum mode; measured under the conditions of 32 times averaging, rectangular wave weighting, filter on, and 400 spectrum lines by eliminating i/f noises; frequency range 0 to 90% (at 23°C ±5°C)
−85 dB (+30 dBV ~ −40 dBV)
−75 dB (−41 dBV ~ −45 dBV)
−60 dB (−46 dBV ~ −60 dBV)
Amplitude linearity: ±0.2 dB or less (from full scale to −40 dB, 23°C ±5°C)
Frequency levelness: ±0.3 dB or less (at 23°C ±5°C) (−3 dB point of AC coupling in frequency range from 0 to 90% is approx. 0.2 Hz)
Amplitude accuracy: Amplitude linearity + frequency levelness (at 23°C ±5°C)
Channel-to-channel amplitude difference: ±0.3 dB or less (at 23°C ±5°C) in the same sensitivity range and frequency range from 0 to 90%
Channel-to-channel phase difference: ±3.0 deg or less (at 23°C ±5°C) in the same sensitivity range and frequency range from 0 to 90%
Accelerometer power source: AC input only
4 mA current source Channel A/B + side
Maximum operating voltage + 18 V
Open circuit voltage +24 V or less
Overload display: LED
Test signal: In frequency range from 100 kHz to 2 kHz
Amplitude level Approx. −4 dBV
Frequency 8% rectangular wave in the range
A/D converter resolution: 16bits
Frequency range: 10 mHz to 100 kHz, 22 ranges in 1, 2, and 5 steps
Frequency accuracy: ±50 ppm ± measuring resolution in the frequency range (at 23°C ± 5°C)
Input filter: Anti-aliasing filter (roll-off characteristic: −148 dB/octave automatically set for each frequency range
External sampling input: Sampling from BNC connector of the rear panel by TTL-level external pulse (anti-aliasing filter on/off possible)
External sampling output: Sampling signal output to BNC connector of the rear panel

Triggering

Trigger modes: Free-run, manual, external and internal trigger, automatically repeating trigger
Trigger sources: Channel A signal, Channel B signal and external signal triggering
Trigger levels:
Internal trigger Set by numeric keys with 1/256 resolution of the amplitude range
External trigger TTL signal rising or falling edge selected (BNC connector of rear panel)
Trigger slope: +, −, ± (input signal trigger)
Trigger position:
Single-channel mode Setting range of −128K to 1M with a resolution of 1 sampled data item
Dual-channel mode Setting range of −64K to +1M with a resolution of 1 sampled data item

Averaging

Frequency-domain averaging modes: Addition (SUM), subtraction (SUB), exponential function moving mean (EXP), and maximum detected value (PEAK)
Time-domain averaging mode: Addition (SUM)
Delay-domain averaging mode: Addition (SUM)
Amplitude-domain averaging mode: Addition (SUM)
No. of averages: 1 to 32767
Overlapping: 0%, 50%, 75%, max.
Averaging control: Start, stop, +1, continue (Erased automatically at start)

Measurement modes

- Waveform measurement mode
- Spectrum measurement mode
- Time-frequency analysis mode
- Frequency response function measurement mode

Waveform measurement mode
Measured items:
Time-domain instantaneous data
Time-domain average data
Auto-correlation function
Cross-correlation function
Probability density function
No. of analyzed data: 64 to 8192 points (1 channel)
64 to 4096 points (2 channels)
Averaging:
Time-domain averaging
Delay-domain averaging
Amplitude-domain averaging
Conversion function: In engineering unit
Marker analysis functions: Peak, rise time, fall time, pulse width, and effective value
Arithmetic functions: Differentiation, integration, smoothing, trend removal, addition, subtraction, multiplication, division, and pre-envelope
Display functions: Time-amplitude, amplitude-probability density, and orbit

Spectrum Measurement Mode
Measured items:
Complex spectrum
Power spectrum
Mutual spectrum

Averaging: Frequency-domain averaging
No. of analysis data: 64 to 8192 points (single-channel)
64 to 4096 points (dual-channel)
Frequency resolution:
Linear 25 to 3200 lines (single-channel)
25 to 1600 lines (dual-channel)
Logarithm 3 decades max., 80 lines/decade
Other 1/3 octave, 1/1 octave
Weighting: Rectangular, hanning, minimum, flat-pass, force/response
* Window function fixed to minimum for the logarithm frequency resolution or octave resolution
Conversion function: A/B/C characteristic correction in engineering unit
Marker analysis functions: Peak, next peak, band, harmonic, sideband, overall power, partial power, average power, and variance
Arithmetic functions: Addition, subtraction, multiplication, division, pre-envelope, liftered, spectrum, power cepstrum, jw, 1/jw, and smoothing
Display functions: Frequency-amplitude, frequency-phase, frequency-real part, frequency-virtual part, Nyquist diagram

Time-frequency analysis mode
Basic measured items: Time waveform, complex spectrum, power spectrum
Time-frequency analysis functions: Level monitor, phase monitor, frequency monitor
Averaging: Frequency-domain averaging
Transient waveform memory: 128K words (single-channel)
64K words (dual-channel)
No. of analysis data: 64 to 2048 points
Frequency resolution:
Linear: 25 to 800 lines
Logarithm: 3 decades max., 80 lines/decade
Other: 1/3 octave, 1/1 octave
Weighting: Rectangular, hanning, minimum, flat-pass, force/response
* Window function fixed to minimum for the logarithm frequency resolution or octave resolution
Conversion function: In engineering unit
Marker analysis functions: Peak, next peak, band, harmonic, sideband, overall power, attenuation power, partial power, average power, and variance
Arithmetic: Addition, subtraction, multiplication, division, pre-evelope, liftered, spectrum, power cepstrum, jw, 1/jw, smoothing, and level monitor accumulation
Display functions: Frequency-real part, frequency-virtual part, frequency-amplitude, frequency-phases, Nyquist diagram, time-level, time-phase, and time-frequency

Frequency response function measurement mode
Measured items:
Frequency response function
Group delay
Association degree function
Power spectrum
Mutual spectrum
Impulse response function
Averaging: Frequency-domain averaging
No. of analysis data: 64 to 2048 points
Frequency resolution:
Linear 25 to 800 lines
Weighting: Rectangular, hanning, minimum, flat-pass, force/response
Conversion function: In engineering unit
Marker analysis functions: Peak, next peak, band, harmonic, sideband, overall power, partial power, average power, and variance, positive peak, negative peak, XdB, shape factor, and ripple
Arithmetic functions: Addition, subtraction, multiplication, division, unwrapped phase, jw, 1/jw, inverse number, impulse response, equalizing, phase correction, coherent output power (COP)
Display functions: Frequency-amplitude, frequency-phase, frequency-real part, frequency-virtual part, frequency-group delay, frequency-association degree function, Nyquist diagram, cole-cole diagram, and Nichols diagram

Display Specifications and Functions

Display function: 8-inch raster scan CRT
Measurement condition selection: Interactive menu selection
Engineering unit: Marker reading and X-axis scaling display in arbitrary physical quantity
Display modes: One-screen, two-screen, three-screen, and four-screen displays
Overlaid display mode: Two sets of data from the same domain and having the same analysis ranges may be displayed overlaid on the same display screen
Grid display: Switchable on/off
3-dimensional display: Up to 50 lines of selected data may be used to create a 3-dimensional display
Bar display: Overall power, partial power, average power, or power variance is displayed on the right side of the CRT
Label: Up to 40 arbitrary alphanumeric and special characters can be displayed or shifted vertically
List modes:
Single mode Digital listing of any 20 spectrum frequencies and corresponding levels, selected from the displayed spectrum using a cursor
Harmonic mode With the fundamental frequency selected by using the cursor, digital display of this and harmoni levels is made, along with THD (total harmonic distortion) and THP (total harmonic power)
X axis: Linear, logarithm
Y axis: Arbitrary setting by numeric input
Auto-scaling: Display data is automatically scaled for display
Plotter output: Direct output to R9833 or other plotter with HP-GL
Calendar clock function: Date (year/month/day) and time (hour/minute) display

Specifications *(continued)*

Storage Functions

Transient waveform data memory: This is used for the time-frequency analysis mode
Standard memory 128K words
I/O + memory (option 11) 1M words
CMOS memory (option 10) 1M words (battery backup)

Panel memory: This contains the panel conditions (Battery backup, storage for about one month)

I/O functions

Video signal output: Separate, TTL level
GPIB interface: Standard
Plotter output: Through GPIB
External sampling clock input: BNC type, TTL level
External trigger input: BNC type, TTL level
Sampling clock output: BNC type, TTL level
Trigger output signal: BNC type, TTL level

General Specifications

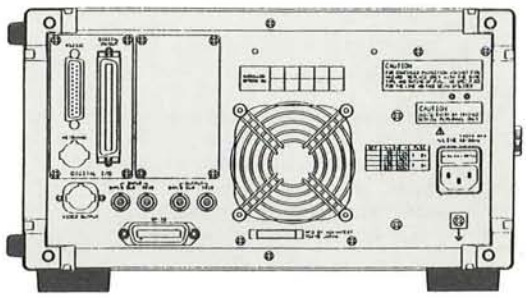
Operating temperature range:
Ambient temperature 0°C to +40°C
Relative humidity 80% or less
(+5°C to +35°C when the internal floppy disk or internal printer is used)

Storage temperature: Ambient temperature −20°C to +60°C
Power supply: Specify a type when ordering

Option No.	Standard	Option 32	Option 42	Option 44
Power-supply voltage	90 to 110 VAC	103 to 132 VAC	198 to 242 VAC	207 to 250 VAC

48 to 66Hz
Power consumption: 140 VA or less (standard)
Exterior dimensions: Approx. 330 (W) × 177 (H) × 450 (D) mm
Weight: 12 kg or less (mainframe)
Accessories

Item	Model	Product code	Remarks
Power cable	A01402		1 pc.
Input cable	MI-77		2 pcs.

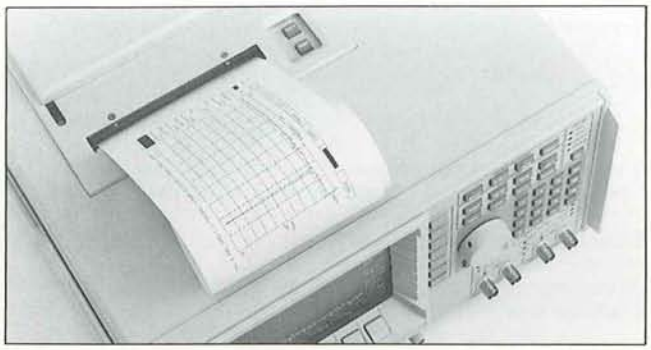


Drawing of rear panel

Options

Option 06 Internal floppy disk
Type 3.5-inch micro floppy disk
Media 2DD/2HD
Capacity 640K/720K/1M bytes (when formatted)
Format MS-DOS conversion possible
Data file Measured data and panel conditions
Data file operations Listing, generation, erasure, and copy

Option 07 Built-in printer
Hard copy output from CRT display
Print method Heat-sensitive line dot
Dot configuration 640 dots/line
Specified record form A09075
Form width 114 mm



Option 11 I/O + memory
This optional board has the following functions
Extension memory 1M words (2M bytes)
Digital input For digital signal input not through the internal A/D converter (Maximum sampling rate 256 kHz)
Data format 16 bits + EOC signal (complement of 2)
Digital output For data output from internal A/D converter
Data format 16 bits + channel identification signal + strobe signal (complement of 2)

Option 10 CMOS memory
1M-word (2M-byte) battery backup memory

* Only one of Options 6, 11, and 10 can be selected.

FFT Accessories

• Impulse hammer

With the impulse hammer, the mechanical impedance or resonance characteristic of a structure can easily be measured. The hammer is very easy to use. Simply attach an accelerometer to the item and hit the item with special hammer. The transfer function and mechanical impedance can be measured on a realtime basis by inputting the signals from the hammer and accelerometer to the R9211 model. Several different hammers are available; choose the best one for your purpose. Contact your nearest sales office or the sales promotion department of ADVANTEST.

Impulse Hammer (Low output impedance, voltage output model) (Made by DYTRAN)



Model	5800SL super-light model	5801A-series high-range model	5850A three-range model
Head weight (g)	2.0	150	150
Force range (16-F)	50	500, 1000, 5000	50, 500, 5000
Nominal sensitivity (mV/lb)	100	10, 5, 1	100, 10, 1
Sensor resonance frequency (kHz)	300	50	50
Head diameter (mm)	11	19	19
Impact tip diameter (mm)	2.5	6.4	6.4
Hammer length (cm)	11.4	22	22
Head weight (g) (including extender)	5.5	210 (270)	210 (270)
Sensor rigidity(1bF/μin)	1.5	8.0	8.0
Output connector	#10-32	#10-32	#10-32
Material: Sensor	17-4 PHs.s	17-4 PHs.s	17-4 PHs.s
Head	Derlyn	303s.s	303s.s
Handle	Polyurethane/Aluminum	Fiberglass	Fiberglass

• Accelerometer

During the development of a structure or an equipment unit, vibration and shock measurements are very important means of testing or monitoring their operations. Using the accelerometer to sense vibrations gives high sensitivity and excellent frequency and amplitude characteristics. The accelerometer is compact, lightweight and has a long service life. It is easy to use for many purposes. There is also a wide selection of vibration detection elements, just a few are shown here. For further information about them and their connection to ADVANTEST's digital spectrum analyzer, contact your nearest sales office or the sales promotion department of ADVANTEST.

Acceleration Sensors with Internal Amplifiers (Made by ENDEVCO)




Model	2250A-10/2250AMI-10	7250A/7250AMI	7254-10, −100	7259A-1, −10	7251-10, −100	2251A-1, −10	2256-10, −100
Sensitivity (mV/g)	10	2/10	10/100	1/10	10/100	1/10	10/100
Response frequency (Hz)	4~15,000	4~20,000	1~10,000	5~30,000±1dB	1~10,000	2~15,000/5~8,000	1~5,000
Resonance frequency (Hz)	80,000	85,000	45,000	150,000/100,000	45,000	90,000/40,000	20,000
Anti-G (G)	2,000	5,000	5,000	10,000	5,000	20,000/5,000	2,000
Operating temperature range (°C)	−55~+125	−55~+125	−55~+125	−55~+125	−55~+125	−55~+125	−55~+125
Casing	Grounded	Grounded	Grounded	Grounded	Grounded	Grounded	Grounded
Casing and mounting place	Insulated	Insulated	Grounded	Grounded	Insulated	Insulated	Insulated
Size (mm)	5.8×3.8	9.5×5.8	15.9×16.0	9.5×12.0	15.3×10.7	10.2×11.9	11.1×10.1
Weight (g)	Stuck	1.8	10-32 Studded	10-32 Studded	6-32 Screwed	2-56 Screwed or stuck	5
Mounting	2-56 Screwed	10-32 Studded	10-32 Studded	6-32 Screwed	2-56 Screwed or stuck	Stuck	Stuck
Seal	Epoxy	Welded	Welded	Epoxy	Welded	Welded	Epoxy
Accessory cable	3006-120	3091E-120	3090C-120	3091E-120	3090C-120	3007-120	3060A-120

Conversion connector EJ21 (For micro dot − BNC conversion)

Introduction of R9211 Series

Optimum model for servo analysis
R9211B FFT Servo Analyzer

This model contains a floppy disk and a signal generator, so it is ideal for vibration analysis of a structure or for measurement of a servo circuit.

10 mHz (minimum) running zoom function
R9211A Digital Spectrum Analyzer

This model has an internal floppy disk and a running zoom function and is optimum for voice and noise spectrum analysis.

Available for curve-fit analysis
R9211C FFT Servo Analyzer

This is the top model of the series featuring curve-fit, frequency response synthesis, digital I/O, and high-speed servo analysis functions.

Revolution degree analysis
R9211D FFT Tracking Analyzer

This model is ideal for evaluation of vibrations and noises from running engines or motors

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