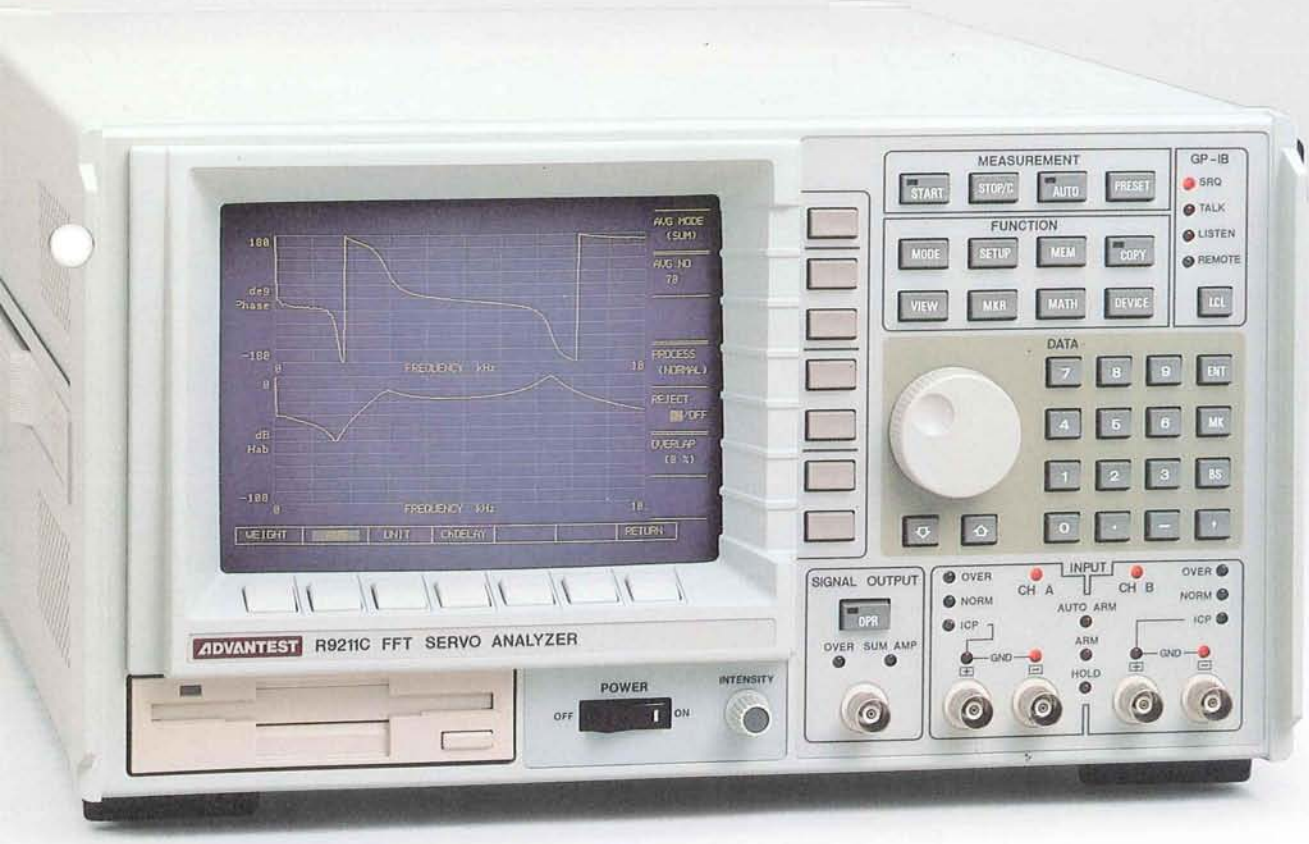
ADVANTEST
ADVANTEST CORPORATION

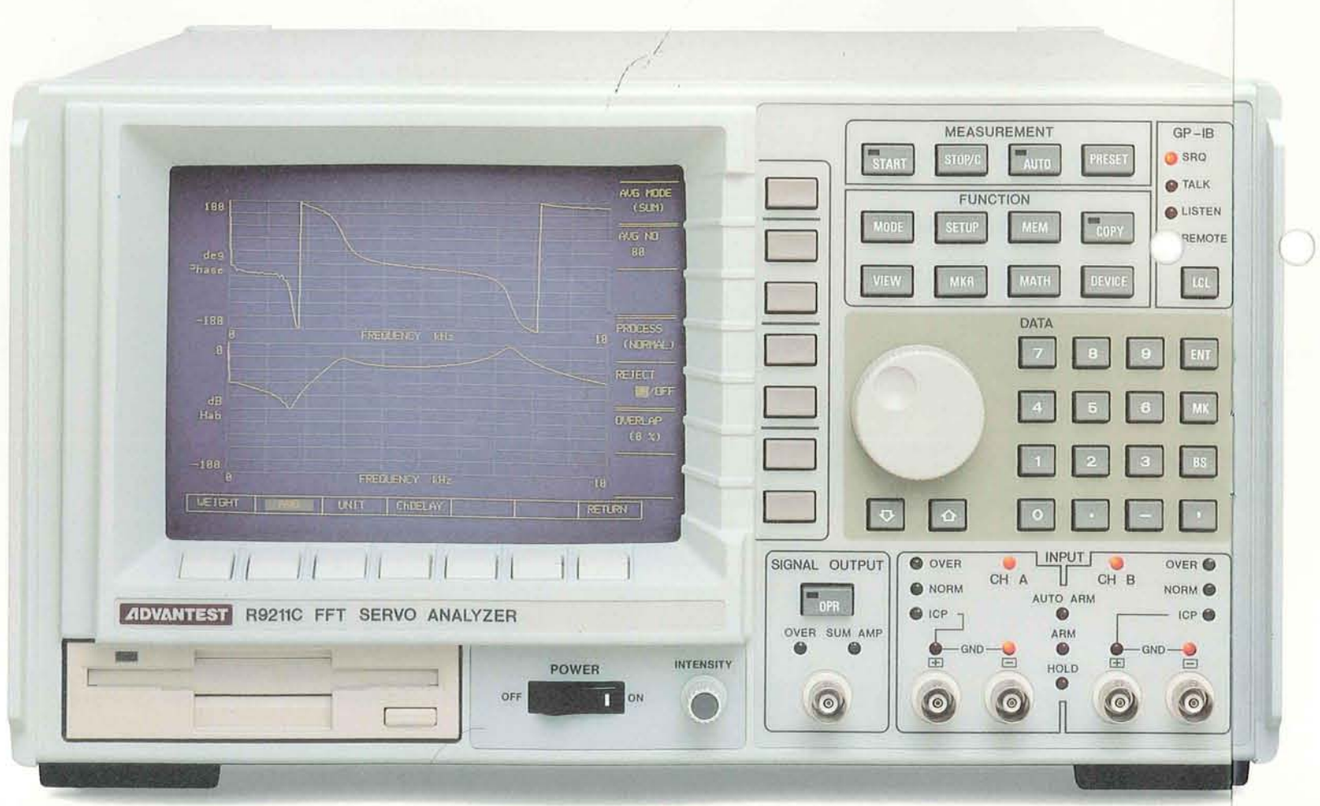
R9211C
FFT Servo Analyzer

9211 SERIES TYPE C

Top FFT Servo Analyzer Model With High-speed Servo Analysis And Curve Fit Functions



Equipped with Curve Fit, Frequency Response Synthesis, and Digital I/O Functions



The R9211C embodies servo management technology based on ADVANTEST's unique swept sine sweep (SSS). It achieves an inter-channel amplitude difference of ±0.1dB and an inter-channel phase difference of ±1.0 degree.
The measuring unit has an internal summing amplifier, curve fit function, frequency response synthesis function, and a servo measurement function with a frequency table. This is an ideal tool for the design and development of servo systems.

Analysis by output from the digital signal generator or digital input provide new applications.
In addition to many servo measurement and analysis functions, the epoch-making FFT analyzer has a unique five-domain (five measurement area modes) method, which means you can select one of the five domains according to the type of analysis that you want to perform. These domains make measurement much quicker and easier.

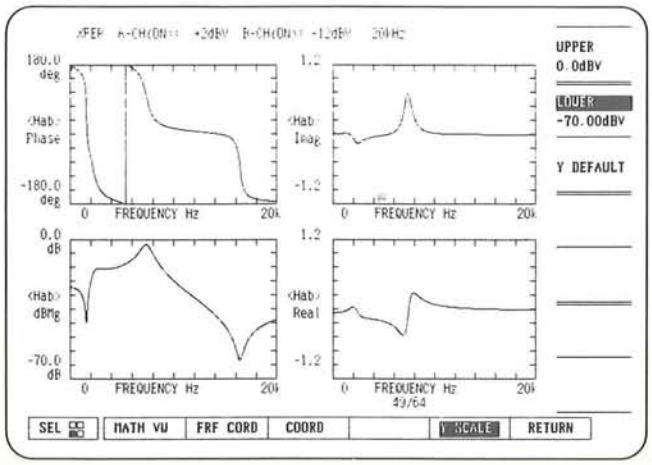
Features of Servo Analysis Mode

- High-speed auto range function, frequency resolution variable function (25 to 800 lines), and new SSS method for fast measurement
- Internal summing amplifier useful for open-loop characteristic measurement
- Signal generator of low output impedance (1Ω or less) for high actuator drive performance
- Independent setting of DC offset voltage and signal voltage
- New functions for servo measurement by up to five decades of log sweep and point servo measurement with frequency table of only specified frequency.
- Inter-channel amplitude difference of ±0.1dB, phase difference of ±1.0 degree, and dynamic range of 130dB
- Single-touch marker functions and many calculation functions for gain and phase margin measurement
- Curve fit function, frequency response synthesis function

Full Servo Analysis by Simple Operation

Simple Operation and Many Display Functions

The R9211C incorporates the start/stop frequency setting function and signal source bandwidth automatic measurement function, so it is simple to operate. Two-screen, three-screen and, four-screen simultaneous display functions are available for direct visual check of measurement data from any angle.



▲ Example of four-screen simultaneous display

High-speed Servo Measurement

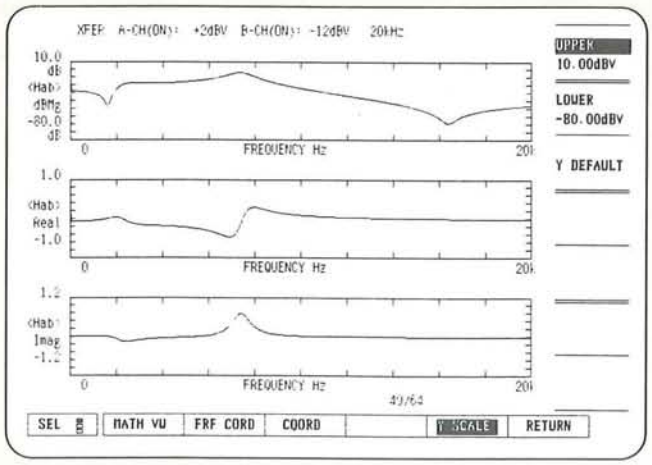
Auto range and signal processing speeds have been made much faster, so the R9211C is ideal for low-frequency servo analysis which requires a lot of time on conventional analyzers.

High-precision/wide-dynamic-range measurement

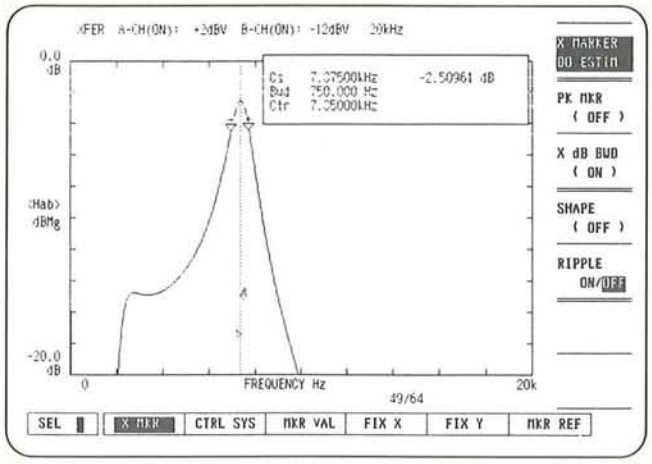
The channel-to-channel amplitude difference is ±0.1dB or less and the channel-to-channel phase difference is ±1.0 degree or less. So the servo analysis precision has been greatly improved. If the auto range function and the easy signal sequence function are used together, 130dB or wider dynamic servo analysis is available.

Curve fit and frequency response synthesis functions

There are a wide selection of servo system designing and development tools; internal summing amplifier for open-loop measurement, arithmetic function for closed-loop to open-loop conversion, high-precision curve fit function for polling and zero extraction in Laplace area, and frequency response function synthesis function.



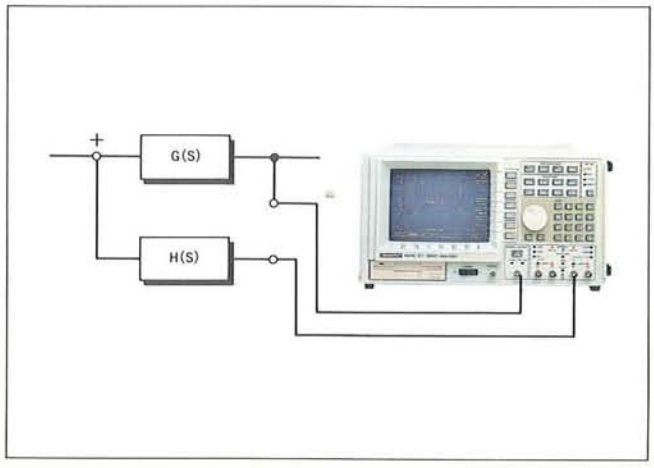
▲ Example of three-screen simultaneous display



▲ Example of marker analysis function (3dB bandwidth)

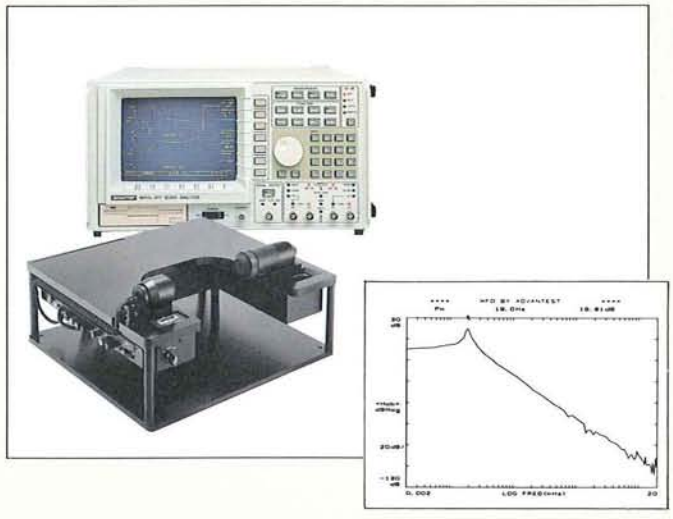
Internal Summing Amplifier Optimum for Servo Analysis

The servo technology is applied to ultra-high-precision control of the drive sections in robots, VCRs, CDs, and hard disks. Because of this advantage, FFT servo analyzers are widely used for analysis of servo mechanisms. To measure an open-loop characteristic, however, an external adding circuit must be created.
The R9211C has built-in summing amplifier so that it is possible to perform an open-loop characteristic from DC to 100 kHz.



S.G. Output for Low-impedance Drive

When the deviation characteristic of a CD actuator is measured, the S.G. output impedance lowers the drive capacity because the impedance is low near the resonance point. So the actuator cannot be driven properly.
The S.G. output from the R9211C has an output impedance of 1Ω or less and is optimum for this kind of application.
In addition, the DC offset voltage and signal output level can be set independently for an ideal mechanical servo analysis.



New Feature-Spot Servo Analysis by Frequency Table

The R9211C has a new function for a servo analysis only at a set frequency point as well as the servo analysis functions by linear sweep and log sweep up to five decades. With the new function, data can be collected immediately only from the point that is under investigation.

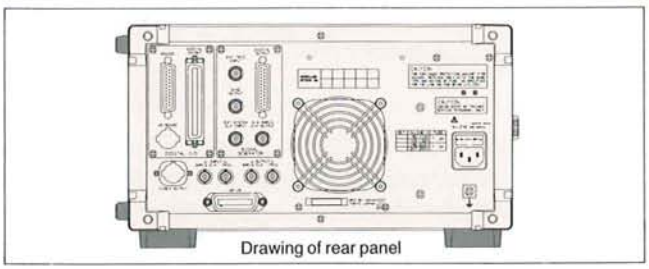
Direct Setting of Start/Stop Frequency

The R9211C has two servo analysis modes; the zero start mode and the other mode in which only the necessary measuring band is set. The band can be set simply by specifying the start and stop frequencies down to the minimum span of 10 mHz.

Digital S.G. Functions for More Applications

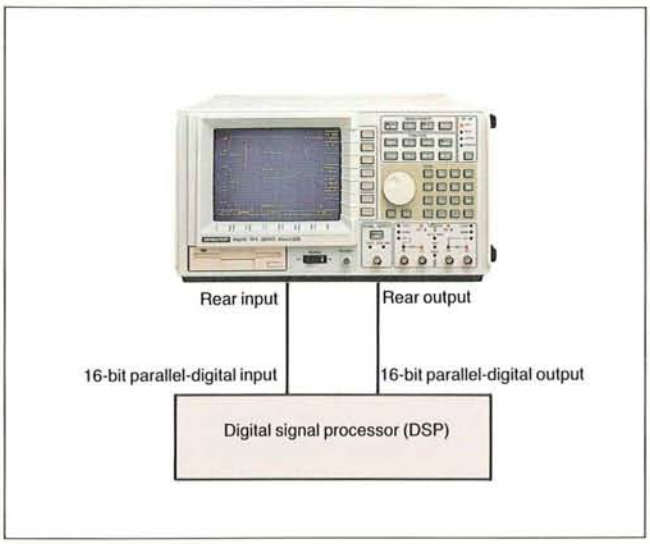
Internal Digital S.G. Output and Digital Input

The R9211C can perform spectrum analysis through digital S.G. signal output or single-channel digital signal input. This function enables a D/A converter, A/D converter,or digital amplifier to be evaluated.


Drawing of rear panel

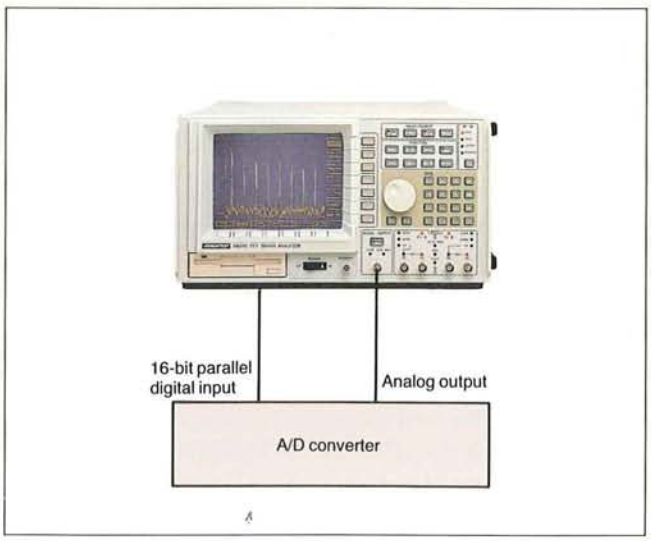
Optimum for Evaluation of Actual Digital Filter Operation

Audio equipment such as compact disks and DATs use many digital filters as well as analog filters. A digital filter is usually designed on the basis of the phase characteristics, frequency characteristic, and ripple. The R9211C is optimum for operation tests on the digital filter through this process. A conventional servo analyzer or spectrum analyzer measures digital signals after converting them into analog signals by a D/A converter. Therefore, noises from the D/A converter or the performance of peripheral circuit prevent high-precision measurement. The R9211C, however, has a digital I/O function to directly input digital signals for spectrum analysis or transfer function measurement using the S.G. output (analog or digital signal output).



A/D or D/A Dynamic Test on DAT

The digital audio industry is producing CDs and DATs that are more and more advanced. The R9211C dynamically tests A/D and D/A converters, the main components of such audio equipment. For a linearity test on an A/D converter's static bits, converted digital data must again be coverted into analog data with a D/A converter.
This method, however, measures the D/A converter performance as well and cannot evaluate the A/D converter performance properly.
If built-in digital I/O enables digital output from the A/D coverter to be connected to the digital I/O of the R9211C. Then the R9211C internal digital signal function can perform spectrum analysis up to the Nyquist frequency. This enables the performance of the A/D converter alone to be evaluated.



Easy Data Storage and System Improvement

Floppy Disk Drive Meeting MS-DOS Format

The 3.5-inch FDD available for both 2HD and 2DD can record data in the MS-DOS format, so data can be collected or processed on a offline basis.

Direct Plot Output for Report Creation

The results of measurement and analysis can be plotted to any scale in a 1/2 or 1/4 arbitrary position through an external plotter.

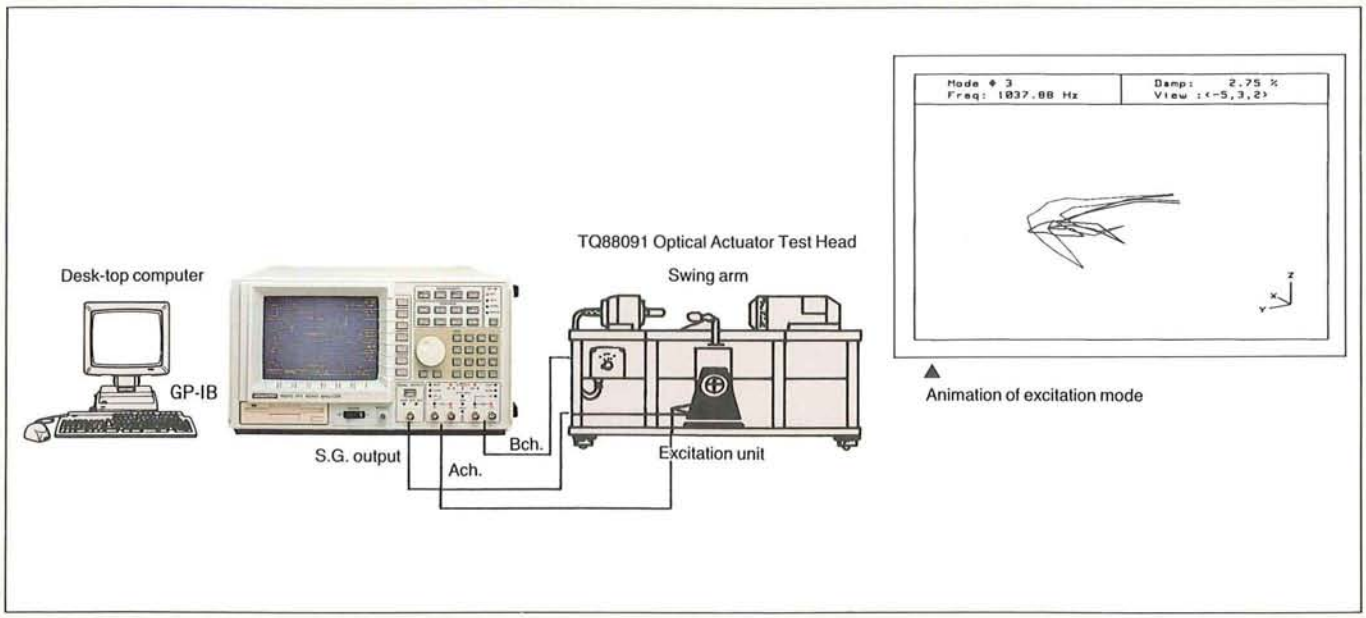
Data can also be plotted by using the automatic split function.
This function is useful for report creation.

High-speed Hard Copy Function (Option 07)

If the optional thermal printer is built in, a hard copy of data can be made easily at high speed. The 640-dots/line thermal printer produces very fine resolution.

System Improvement for Modal Analysis

An external desk-top computer can be connected through the standard GP-IB interface for modal analysis. The 16 bits/90dB dynamic range performance of the R9211C provides a very powerful means of measuring accurate transfer function by using an impulse hammer.



▲ Animation of excitation mode

Optimum High-performance FFT Analyzer

High-performance Spectrum Analyzer

The FFT servo analyzer features 16-bit resolution, 90dB (typical value) wide dynamic range, and −140dBV (typical value) high sensitivity. It is an effective tool for analysis of an audio signal's S/N ratio, for analysis of a transient signal, and for measurement of device noise. The frequency resolution can also be extended down to the minimum span of 10 mHz in an arbitrary bandwidth.

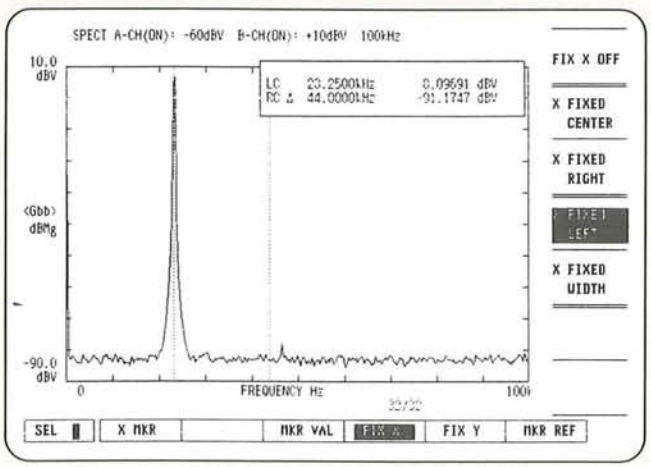
Large-capacity Digital Oscilloscope

If the anti-aliasing filter is turned off, the FFT servo analyzer becomes a 16-bit, 256 kHz-sampling high-resolution digital oscilloscope. For long-time signal collection, the large 1M-word memory can be used optionally.

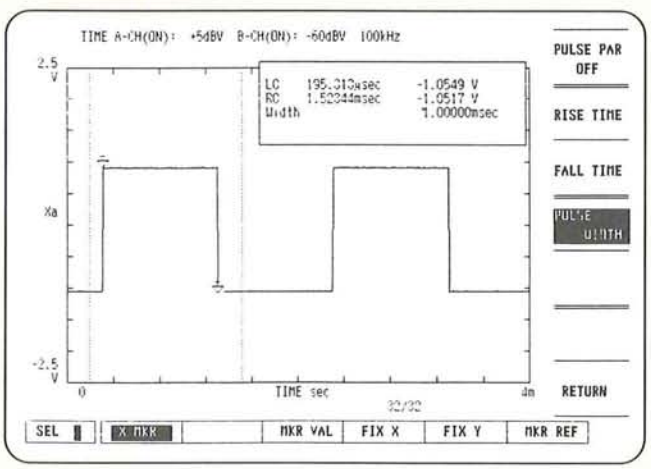
Signal Analysis in New Domain

In the time-frequency analysis 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 VCR's wow and flutter component (frequency monitor function or the jitter phase fluctuation time characteristic (phase monitor function).



▲ 90dB (typical value) wide dynamic range



▲ Example of pulse parameter analysis function (pulse width measurement)

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: ±0.1 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: ±1.0 degrees 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 display frequency range from 100 kHz to 2 kHz
Amplitude level Approx. −4 dBV
Frequency 8% rectangular wave in the range
A/D converter resolution: 16 bits
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
- Servo analysis mode

Waveform measurement mode

Measured items:
Time-domain instantaneous data
Time-domain average data
Auto-correlation function
Cross-correlation function
Probability density function
Cumulative distribution function
No. of analyzed data: 64 to 8192 points (single-channel)
64 to 4096 points (dual-channel)
No. of delay-domain data: 64 to 2048 points
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)

Specifications (continued)

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, partical 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
Phase 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, partical 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

Servo analysis mode
Measured items:
Frequency response function
Group delay
Association degree function
Power spectrum
Mutual spectrum
Sweep modes: Linear sweep or logarithmic sweep
Average count: Fixed or automatic
Signal source bandwidth: Fixed or automatic
Signal sequence function: Combination measurement of output waveform, output voltage, DC offset, signal source bandwidth, measuring frequency range, and average count
Frequency range specification: Start/stop frequency
0 start/span frequency
Conversion function: In engineering unit
Marker analysis functions: Peak, next peak, band, harmonic, sideband, overall power, partial power, average power, variance, positive peak, negative peak, XdB, shape factor, ripple, resonant frequency/attenuation, open-loop diagram, and closed-loop gain
Arithmetic functions: Addition, subtraction, multiplication, division, unwrapped phase, jw, 1/jw, inverse number, impulse response, step response, equalizing, phase correction, coherent output power (COP), and open/closed-loop conversion
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

Signal generator

Output waveforms: Sine, multiple sine, impulse, random, and arbitrary
Output characteristics:
Frequency range 0 to 100 kHz
Output impedance 1 Ω or less, or 50 Ω
DA converter resolution 16 bits
Clock frequency 2.048MHz max. (interlocked with mainframe analysis range)
Maximum output voltage ±15V (with 1 Ω or less output impedance)
Maximum input current 0.1A (with 1Ω or less output impedance)
Offset ±10V with 0.1V resolution
Waveform data length 64K words
Operation mode: Continuous, internal trigger, external trigger, manual trigger, gate, tone burst, and burst random

Internal summing amplifier

Band translation function (corresponding to running zoom function)
Output protection function (Taper function)
Output signal: BNC (front)
Digital output: DSUB (16 bits + strobe signal)
External output of digital waveform

External trigger input (with external gate signal input): BNC
Trigger signal input: BNC
Sampling clock input: BNC
Sampling clock output: BNC

Display Specifications and Functions

Display function: 8-inch raster scan CRT
Measurement condition selection: Interactive menu selection
Engineering unit: Marker reading and Y-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 harmonic 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 plotter with GP-IB interface or GP-GL through GP-IB cable
Calendar clock function: Date (year/month/day) and time (hour/minute) display

Storage Functions

Transient waveform data memory: This is used for the time-frequency analysis mode
I/O + memory 1M words
CMOS memory (option 10) 1M words (battery backup)
Panel memory: This contains the panel conditions (Battery backup, storage for about one month)
Comparator memory: Upper and lower limit setting by broken lines; CRT or external output of comparison results (optional)

I/O functions

Video signal output: Separate, TTL level
GP-IB interface: Standard
Plotter output: GP-IB
External sampling clock input: BNC, TTL level
External trigger input: BNC, TTL level
Sampling clock output: BNC, TTL level
Trigger output signal: BNC, TTL level

Extended measurement/analysis function

Curve fit and frequency response function synthesis

Internal floppy disk function

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

I/O + memory function

Memory 1M words (2M bytes)
Keyboard interface; For an external keyboard (accessory)
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)
Comparator output Open collector output by comparator function

Running zoom analysis function

Zoom analysis down to minimum span of 10 mHz in arbitrary frequency range

General Specifications

Operating temperature range:
Ambient temperature +5°C to +35°C
Relative humidity 80% or less
Storage temperature range: 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: 190 VA or less (standard)
Outer dimensions: Approx. 330 (W) × 177 (H) × 450 (D) mm
Weight: 14 kg or less (mainframe)
Accessories

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

Options

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 114mm
Option 10 CMOS memory
1M-word (2M-byte) battery backup memory

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.

Economy-type model
R9211E Digital Spectrum Analyzer

This inexpensive mode is optimum for signal analyses such as acoustic, vibration, and noise analyses.

Revolution degree analysis
R9211D FFT Tracking Analyzer

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

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

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

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