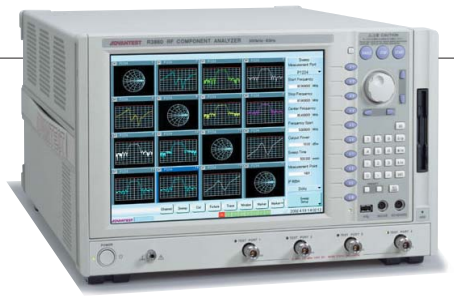
ADVANTEST®

R3860
RF Component Analyzer

World's Fastest RF Component Analyzer* **As of February 2002*



R3860

The R3860 RF Component Analyzer is most suitable for evaluating the performance of RF components in the frequency band from 300 kHz to 8 GHz. The R3860, which has functions for measuring multiport devices, such as balanced input/output devices and front-end modules.

ADVANTEST has been able to attain the world's fastest sweep of 10 µs/point, which is a tenfold increase over earlier ADVANTEST products. In addition, it is possible to greatly improve production throughput for mobile terminal components by using the removable panel, which can be installed at a location convenient for the operator, as a tool built into automatic inspection machines.

Up to four test ports can be built in for balanced multiport device measurements. In addition, up to 12 ports are available if an external test adapter is installed. The analyzer also provides many types of analysis functions, including impedance conversion, fixture circuits elimination, matching network, balanced level measurement, and time-domain analysis functions.

A large 12.1-inch color LCD display with touch-screen capability is used in the display section. A total of 32 different types of measurement results are clearly displayed on up to 16 split windows. Also, commercially available and easy-to-use Visual Basic can be used to create application software. Because interfaces such as GPIB and LAN are supported, an automated system is easy to build.

High-speed, High-accuracy Measurements Using the R3860 RF Component Analyzer

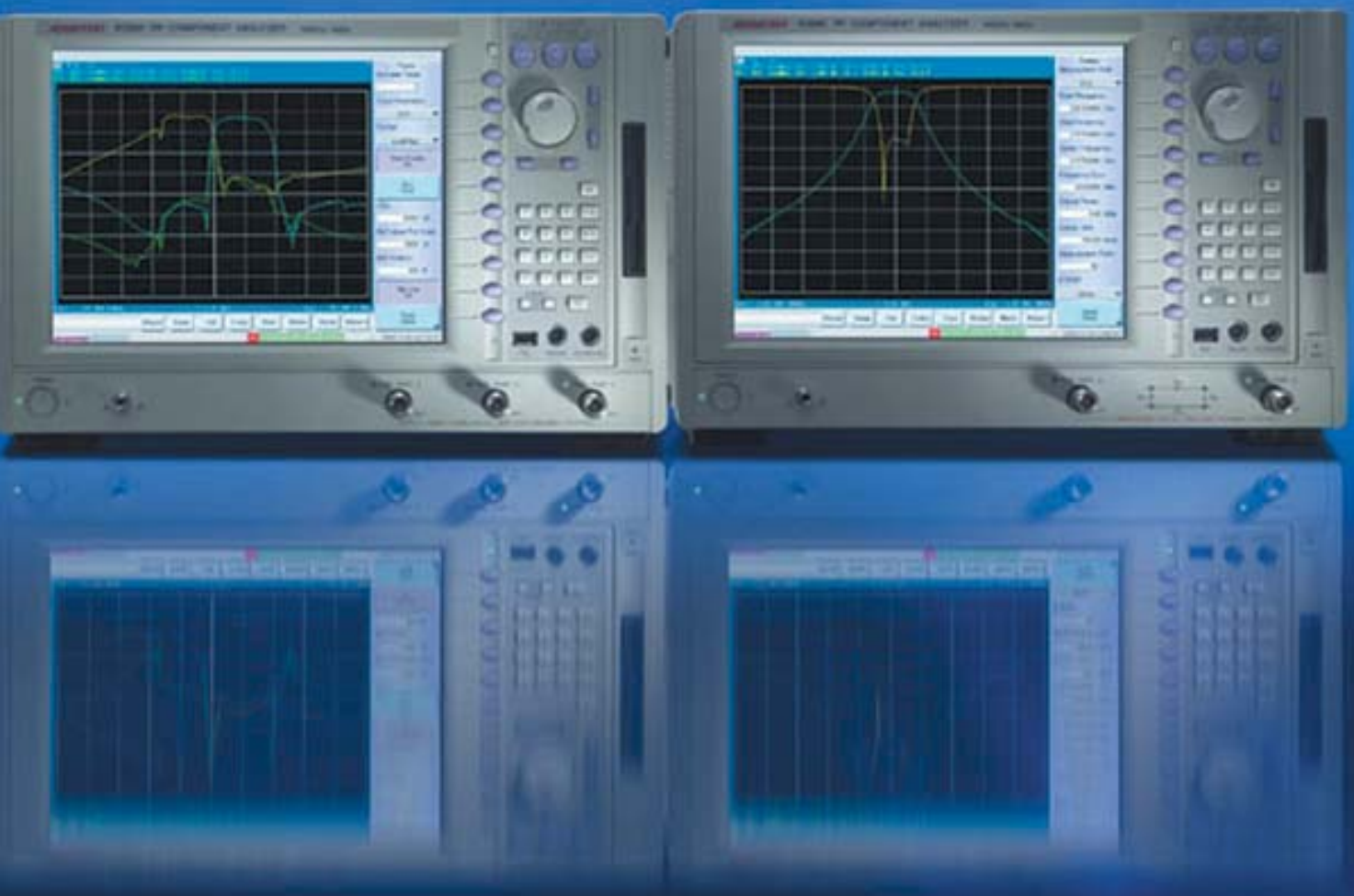
The R3860 is a component analyzer based on a new design concept. Because the R3860's measurement accuracy is at least three times greater than previous ADVANTEST products—the result of the low-noise design in the receiving section—high-speed sweeps are now possible with an extended resolution bandwidth. At the same level of accuracy as previous ADVANTEST products, your testing costs are significantly reduced.

- **Frequency range: 300 kHz to 8 GHz**
- **Sweep time: 10 μs/point**
- **Resolution bandwidth: 10 Hz to 400 kHz**
- **Trace noise: 0.005 dBrms (typical) @ RBW of 100 kHz**

R3860+OPT12 — Type of built-in S-parameter test set

R3860+OPT13 — Type of built-in 3-port test set

R3860+OPT14 — Type of built-in 4-port test set



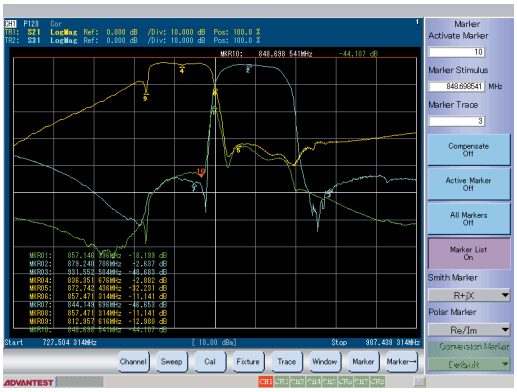
Easy-to-View Display Function and Simple Operation

Excellent Flexibility and Visibility

The R3860 is provided with a touch screen function that is installed in a large, 12.1-inch SVGA color LCD display. Up to 16 split windows and up to 32 measured traces can be displayed, giving you the capability to combine S-parameter and format. When adjusting the balanced type of multi-port devices and dielectric duplexer with many traces, and the marker function, operator efficiency improves because of the excellent visibility provided by the high-resolution, large-screen SVGA display.

Eight Independent Channels

The use of the R3860 increase significantly when split windows (up to 16) and measurement traces (up to 32) are used together with eight independent channels. For example, the R3860 is ideal for measuring devices such as multiport devices, each of which requires a set of unique measurement conditions for each channel since a set of measurement conditions and calibration data can be set for each channel. Because many parameter types and measurement results can be observed at a glance, test throughput is dramatically improved.



Simple Operation

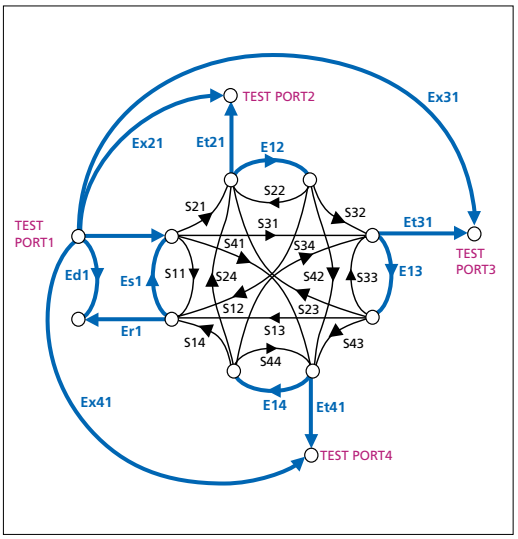
The R3860 can be operated either from the touch panel or with a mouse. Both capabilities are provided as standard. The R3860 is easy and simple to operate because measurement data, setting conditions, and other information are displayed on the display unit. Furthermore, you can change setting conditions on the touch panel via the Windows® GUI. These features make it possible for a new user of the R3860 to operate it easily.

** If you operate with a mouse, it must be connected to the analyzer before the analyzer is turned on.*

Superior Calibration Function

Four-port calibration

Two types of calibration are provided: normalizer calibration which normalizes frequency characteristics only, and full calibration which corrects for impedance mismatch errors in addition to normalizing frequency characteristics. The R3860 performs full calibration appropriate for each of its four ports. The full calibration connection must always be used if low-loss balanced RF devices or multiport devices must be measured with a high degree of accuracy.



Error Model for Four-Port Device

Automatic Calibration Kit (Option)

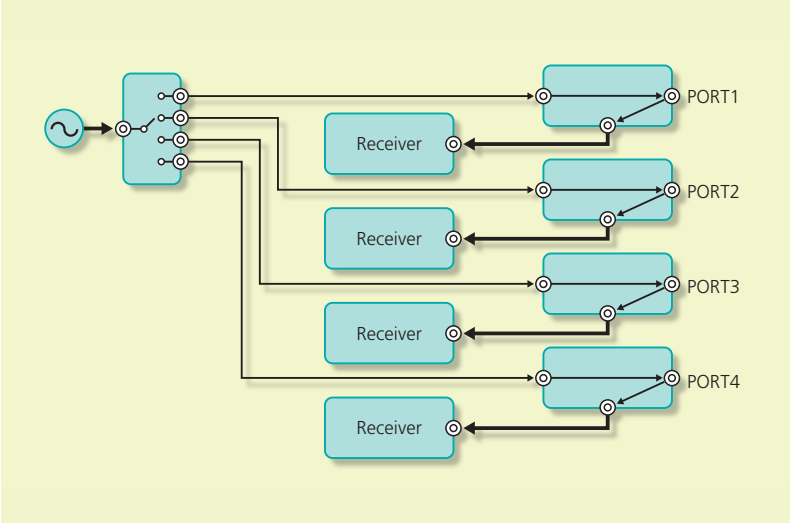
Calibration is always required before high-accuracy measurements are made. Automatic calibration kit enables the unit to obtain a set of stable and accurate calibration data, free of human error. The kit is especially useful for improving productivity because any operator can easily perform highly accurate error calibration. Measurement efficiency can also be improved with alarms generated by the verification function, which automatically and quickly checks whether error corrections are within the specified range, while it is being executed after automatic calibration has been completed.

Multiport Device Measurement

The following devices are available for three-port and four-port devices used in cellular phones in mobile telephone systems: duplexers, circulators, baluns, couplers, dual filters, and balanced input/output devices. In addition, antenna switch modules for five to 12 ports are available for multiband systems. Complexity of the S-parameter representing measurement paths in these multiport devices increase every year.

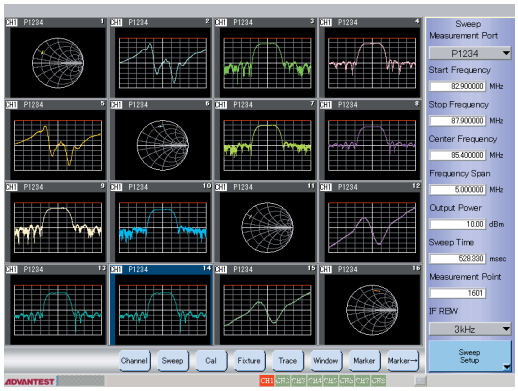
Per-port Architecture

The R3860 is compatible with up to 4 ports and is designed to simultaneously analyze the signal for each port. As a result, sweep and measurement times can be dramatically reduced. In addition, the combination of measurement paths for a multiport device can be optimized as needed for the purpose of each device.



Easy Display of Many S-parameters

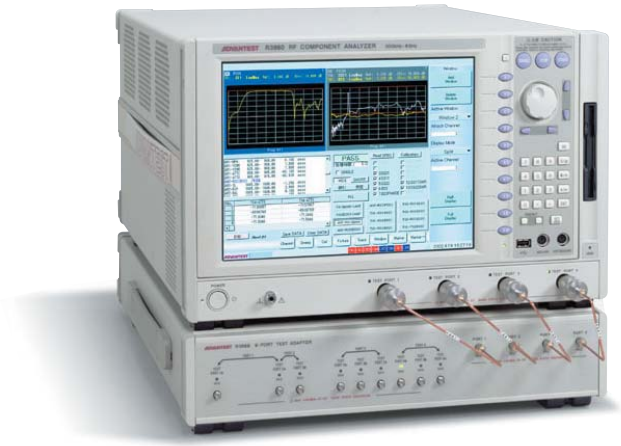
The R3860 is equipped with a large 12.1-inch screen and eight independent channels, each of which can be individually calibrated with a unique set of calibration data. In addition, up to 16 split windows and up to 32 traces can be displayed. When a four-port device is used, all measurement results can be acquired at the same time by combining all 16 S-parameters with the format function. The format function is suitable for multiport devices that have many measurement paths.



Test Adapter Compatible with Up to 12 Channels (Option)

The transmission and reflection characteristics of a multiport device which has a maximum of 12 channels can be measured if the R3968 Series Test Adapter is used together with a the R3860 RF Component Analyzer and OPT14 (four built-in ports).

The combination of the R3968 and OPT11 (9-port test adapter) is most suitable for measuring multiport devices, such as dual band-compatible couplers and triple band-compatible antenna switch modules. In addition, the cost for software development can be cut dramatically if you also runs versatile application programs (written in Visual Basic) which come with the analyzer.

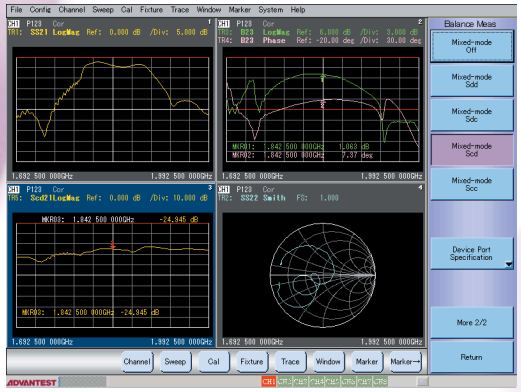


Balanced-Device Analysis Function for Cellular Phones

Analyzing Balanced SAW Filters

The software fixture analysis function provided by the R3860 RF Component Analyzer enables a DUT previously measured with an impedance of 50Ω to be converted to an arbitrary impedance with the impedance conversion function before the DUT is analyzed. The characteristics of a circuit with an arbitrary matching network added can also be analyzed using the matching network function. Furthermore, the characteristics of a circuit whose error factors, such as measuring jigs, have been completely eliminated can be accurately measured with the fixture circuits elimination function.

When the software fixture analysis function is used together with the R3860 and OPT13 (three built-in ports) or the R3860 and OPT14 (four built-in ports), balanced-type RF devices and floating devices can easily be analyzed as well as two-port unbalanced devices.

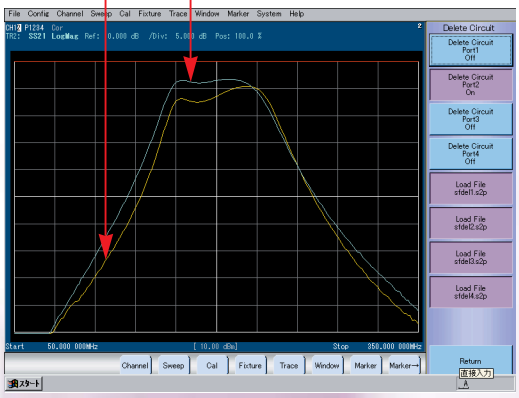


Evaluating Only the Characteristics of a DUT Using the Fixture Circuits Elimination Function

Given characteristics of a two-port circuit network can be deleted on each measuring port. The real DUT characteristics can be obtained after the fixture characteristics are deleted with the S-parameter file in a TS file format. Until now, the port extension function (electrical-length compensation) has been used to delete the fixture characteristics. This fixture circuit elimination function provides more accurate characteristics measurement because the calibration plane can be extended in eliminating the complete two port circuit network. This elimination includes phase, amplitude, and impedance.

Unwanted circuit is included

Unwanted circuit is removed



Software Fixture Function

In recent years, the signal transmission network has become increasingly differentiated because of the constantly increasing capacity and speed of digital signals. The demand for measuring highly differentiated transmission signals used in devices such as balanced input/output devices or high-speed digital LVDS balanced cables used for cellular phones, USB, IEEE1394, Rambus, and DDR-DRAM has been increasing. ADVANTEST Corp. has proposed that measurement methods be standardized to meet such demand. The R3860 RF Component Analyzer comes with a software fixture analysis function that allows you to quickly and accurately evaluate and analyze detailed S-parameters used with differential signals, including those for mode analysis.

Impedance Conversion Function

Whereas, in the past, a hardware impedance converter has been required, the R3860 converts measurement results acquired based on the 50Ω system to an impedance arbitrarily normalized in a computing process performed by an application program in real time.

Mode Analysis Function

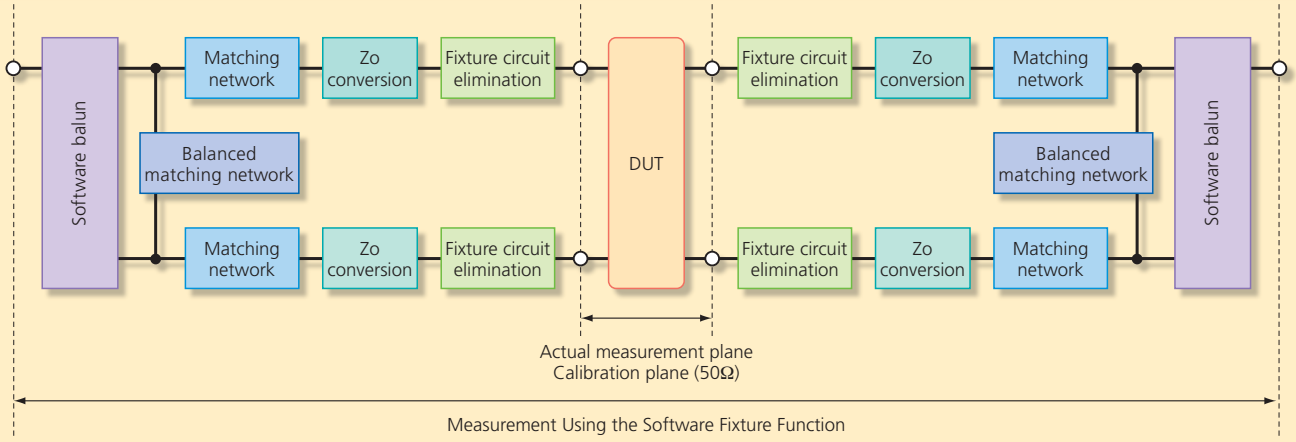
The R3860 can be used for common mode analysis. S-parameters containing in-phase and inverse-phase components are measured for a differential signal. The in-phase component is a signal component generated between the neutral point of a balanced port and GND. The inverse-phase component is generated between balanced ports.

Parameter of Balance Measurement Function

The parameter of balance of a signal in high-speed differential transmission is measured as values relative to the amplitude and the phase. For a perfectly balanced signal, the amplitude and phase must be zero.

Software Balun Function

This function can dramatically improve the efficiency of measurement for a balanced device. The characteristics of a balanced device are measured like the characteristics of an unbalanced two-port device after an ideal balun has been connected between the measurement ports by simulation. You can choose the type of ideal balun from floating and differential baluns.



Matching Network Function

The R3860 can be used to simulate the characteristics of each port in real time after the required matching network consisting of capacitances and inductances have been added by application program simulation between measurement ports. This replaces the usual procedure of physically connecting hardware matching circuits to filters or amplifiers.

Data Saving Functions

Measurement data can be saved onto a floppy disk in TS format. You can choose the S-parameter format from LogMag/Phase and Real/Imaginary before saving a file in text format.

Improving Test Throughput with High-Speed Measurements

Accurate High-Speed Measurements on Production Lines

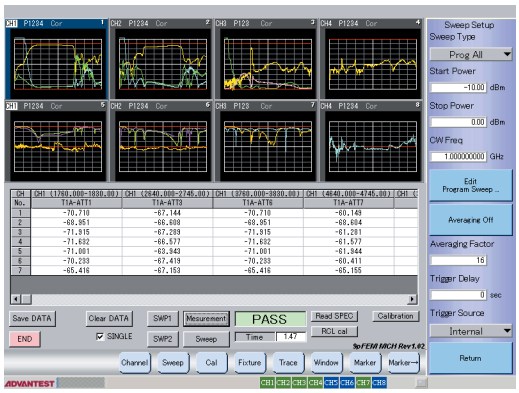
Accurate high-speed measurements are vital to production lines. The R3860 is an RF component analyzer developed by ADVANTEST using such company expertise as expansion of the resolution bandwidth in the receiving section. Testing costs on automatic RF-component production lines can be dramatically cut down because the analyzer has the world's fastest sweep speed and makes stable, accurate measurements.

Large Touch Screen and Removable Front Panel

The R3860 is equipped with the removable front panel to boost operator productivity. When the R3860 is installed on a test handler, the removable front panel makes it possible for an operator to create an optimum work environment by removing it from the analyzer and placing it wherever visibility and operability are best. In addition, a 12.1-inch, large SVGA-TFT touch panel provides an easy-to-operate and easy-to-view display with a variety of functions, making measurement results to observe.

Program Sweep Function

The program sweep function enables you to divide the measurement range into segments (intervals). You can then set the measurement frequency, RBW, and power the desired values for each measurement point within a specific segment. Measurement throughput is boosted because optimum measurement conditions can be set, improving measurement accuracy and thereby dramatically reducing the measurement time for a target DUT. In addition, segment information can be loaded from a CSV file with the CSV file loading function, simplifying the creation and editing of segments.



Versatile Visual Basic

The R3860 enables you to create control programs in the user program execution available in commercially available Visual Basic. Operator's workload is reduced because less time and labor is required to write test programs.

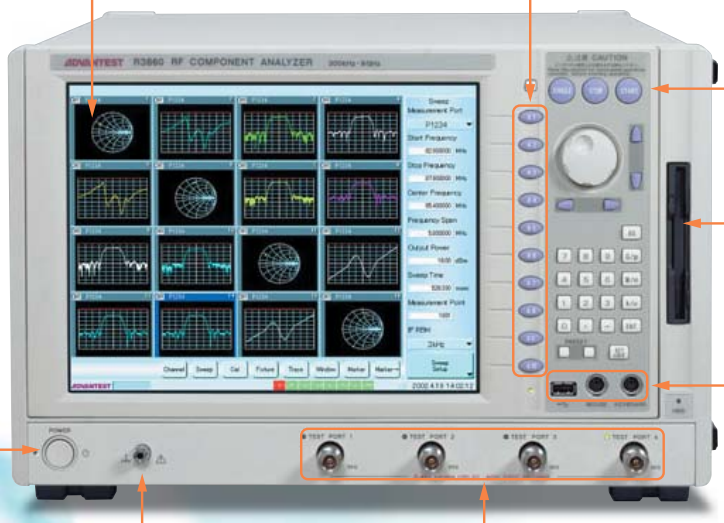
Flexibility with Compound Device Test

It can be expected that, in the future, RF devices currently in use, such as SAW filters, laminated modules, amplifiers, and MMICs, will become compound devices as lamination technologies move forward. The R3860 RF Component Analyzer provides a platform in which the simple addition of modules ensures quick compatibility with a variety of RF device application programs.

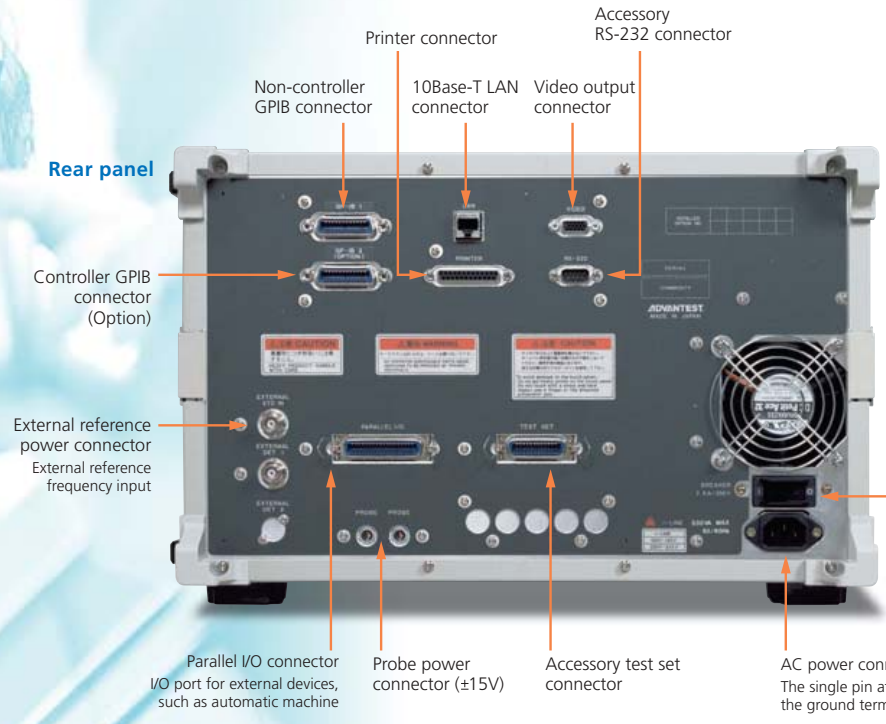
Connection between Interfaces and External Devices

The analyzer provides you with several interfaces that can be connected to a variety of external instruments. As standard equipment, the front panel has mouse and keyboard connectors, and the rear panel has GPIB, RS-232, LAN, printer port, and VGA monitor output connectors. In addition, the parallel port for external devices, such as an automatic machine instead of an external controller, provides an 8-bit output port for two systems or 4-bit input and output ports for two systems.

Front panel



Rear panel



Specifications

Listed below are the functions of the R3860, performance information, and specifications. The performance information applies to operation at 23°C ±5°C.

Measurement functions

Measurement channels:	8
Display window:	16
Tracing:	16 traces/channel (up to 16 traces can be displayed simultaneously)
Measurement parameters	
OPT12:	S11, S21, S12, S22
OPT13:	S11, S22, S33, S21, S12, S31, S13, S23, S32
OPT14:	S11, S22, S33, S44, S21, S31, S41, S12, S32, S42, S13, S23, S43, S14, S24, S34 Can be converted to impedances (Z) or admittances (Y) if required by the parameter conversion function
Measurement format	
Orthogonal coordinates display:	Amplitude (linear/logarithmic), phase, group delay, VSWR, complex number (real number/imaginary number)
Smith chart:	Marker reading values are linear/logarithmic amplitude, phase, complex number (real number/imaginary number) R + jX, G + jB
Polar coordinate display:	Marker reading values are linear/logarithmic amplitude, phase, complex number (real number/imaginary number)

Signal source characteristics

Frequency	
Range:	300 kHz to 8.0 GHz
Set resolution;	1 Hz
Measurement resolution:	±0.01 ppm
Accuracy:	±10 ppm
Temperature stability:	±15 ppm (5 to 40°C, typical)
Aging:	±3 ppm (year, typical)
Output power	
Range:	OPT12/13: +7 to -13 dBm OPT12/14: +5 to -13 dBm
Resolution:	0.01 dB
Accuracy:	±0.5 dB (50 MHz, 0 dB) Specified at TEST PORT 1
Flatness:	2.0 dBp-p Specified at TEST PORT 1
Linearity	
OPT12/13	300 kHz to 15 MHz ±0.4 dB (-8 to +2 dBm, with respect to 0 dBm) ±0.8 dB (-13 to +7 dBm, with respect to 0 dBm) 15 MHz to 8 GHz ±0.2 dB (-8 to +2 dBm, with respect to 0 dBm) ±0.4 dB (-13 to +7 dBm, with respect to 0 dBm)
OPT14	300 kHz to 15 MHz ±0.4 dB (-8 to +2 dBm, with respect to 0 dBm) ±0.8 dB (-13 to +5 dBm, with respect to 0 dBm) 15 MHz to 8 GHz ±0.2 dB (-8 to +2 dBm, with respect to 0 dBm) ±0.4 dB (-13 to +5 dBm, with respect to 0 dBm)

Signal purity	
Higher harmonic spurious:	-20 dBc (at the maximum output)
Non-higher harmonic spurious:	-30 dBc (at the maximum output)
Phase noise (10 kHz off):	-106 dBc/Hz (300 kHz to 990 MHz) -100 dBc/Hz (990 kHz to 1.98 GHz) -94 dBc/Hz (1.98 GHz to 3.96 GHz) -88 dBc/Hz (3.96 GHz to 8 GHz)
Sweep function	
Sweep type:	Linear sweep, log sweep Program sweep, power sweep
Sweep time:	10 µs/point (RBW 400 kHz)
Number of points:	3 to 1601 points
Sweep trigger:	Continuous, single, hold, external trigger

Receiving section characteristics

Resolution bandwidth:	400 kHz, 200 kHz, 150 kHz, 100 kHz 100 kHz to 10 Hz (variable in steps of 1, 1.5, 2, 3, 4, 5, and 7)
Stability	
Trace noise:	0.005 dBrms (300 kHz to 15 MHz, RBW 10 kHz, typical) 0.005 dBrms (15 MHz to 990 MHz, RBW 100 kHz, typical) 0.010 dBrms (990 MHz to 1.98 GHz, RBW 100 kHz, typical) 0.020 dBrms (1.98 GHz to 3.96 GHz, RBW 100 kHz, typical) 0.040 dBrms (3.96 GHz to 8.0 GHz, RBW 100 kHz, typical)
Temperature stability:	0.01 dB/°C (300 kHz to 2.6 GHz, typical) 0.02 dB/°C (2.6 GHz to 8.0 GHz, typical)
Aging stability:	0.005 dB/week (typical)
Amplitude characteristics	
Amplitude resolution:	0.001 dB
Frequency characteristics:	±1.0 dB
Dynamic accuracy:	With respect to an input range of the maximum input to -20 dB ±0.20 dB (0 to -10 dB, 300 kHz to 3.8 GHz) ±0.40 dB (0 to -10 dB, 3.8 to 8.0 GHz) ±0.05 dB (-10 to -50 dB) ±0.10 dB (-50 to -60 dB) ±0.40 dB (-60 to -70 dB) ±1.00 dB (-70 to -90 dB)
Phase characteristics	
Phase resolution:	0.01°
Dynamic accuracy:	With respect to an input range of the maximum input to -20 dB ±0.20° (0 to -10 dB, 300 kHz to 3.8 GHz) ±0.40° (0 to -10 dB, 3.8 to 8.0 GHz) ±0.3° (-10 to -50 dB) ±0.4° (-50 to -60 dB) ±1.5° (-60 to -70 dB) ±4.0° (-70 to -80 dB) ±8.0° (-80 to -90 dB)
Group delay characteristics:	The group delay (τ) is calculated using the following formula: $\tau = \frac{\Delta ø}{360 \times \Delta f}$ $\Delta ø$: Phase difference Δf: Frequency difference (Aperture frequency)
Group delay time resolution:	1 pS
Aperture frequency:	[100/(Measurement point - 1)] x [2% to 50%] of setting frequency range can be set
Accuracy:	$\text{Accuracy} = \frac{\text{Phase accuracy}}{360 \times \text{Aperture frequency (Hz)}}$

Test port characteristics

Load match:	-16 dB (300 kHz to 40 MHz) -20 dB (40 MHz to 2.6 GHz) -16 dB (2.6 to 3.8 GHz) -14 dB (3.8 to 8.0 GHz)
Source match:	-14 dB (300 kHz to 40 MHz) -18 dB (40 MHz to 2.6 GHz) -15 dB (2.6 to 3.8 GHz) -12 dB (3.8 to 8.0 GHz)
Polarity:	-28 dB (300 kHz to 40 MHz) -30 dB (40 MHz to 2.6 GHz) -26 dB (2.6 to 3.8 GHz) -22 dB (3.8 to 8.0 GHz)
Crosstalk:	-90 dB (300 kHz to 40 MHz) -100 dB (40 MHz to 2.6 GHz) -90 dB (2.6 to 3.8 GHz) -80 dB (3.8 to 5.0 GHz) -70 dB (5.0 to 8.0 GHz)
Maximum input level:	+5 dBm
Noise level (at the maximum input level)	
In a range of 300 kHz to 15 MHz:	-82 dB at an RBW of 10 kHz.
In a range of 15 MHz to 8 GHz:	At an RBW of 10 kHz, -77 dB (15 to 100 MHz) -85 dB (100 MHz to 2.6 GHz) -75 dB (2.6 to 8.0 GHz)
Input damage level:	+21 dBm, 30 Vdc
Test port connector:	N-type connector (female)

Other functions

Display section	
Display:	12.1-inch SVGA-TFT color LCD
Backlight:	Brightness half-life 40,000 hours (typical)
Error correction:	Normalize, 1-port correction 2-port correction, 3-port correction (OPT13/14 only) 4-port correction (OPT14 only) Averaging, smoothing, electric length correction, phase offset correction
Marker function:	16 multimarkers Δ marker function, search function, marker → function
Save/recall function:	Register format: Saves data to a hard disk (20 GB). File format: Saves data to a floppy disk or hard disk (20 GB).
Program execution environment:	Execution format created with Visual Basic is operational.
Floppy disk drive function:	Complies with MS-DOS FAT format. Two modes (DD: 720 KB, HD: 1.2 MB/1.4 MB)

Connections to external devices

External display signals:	15-pin D-SUB connector (VGA)
GPIB:	Compliant with IEEE488.2
Parallel port:	TTL level Output port (8 bits x 2 ports) Input/Output port (4 bits x 2 ports)
Serial port:	Accessory serial I/O
Printer port:	Complies with IEEE-1284-1994.
LAN port:	10Base-T
Keyboard:	PS/2 101/106 keyboard
Mouse:	PS/2 mouse
External reference frequency input:	1 MHz, 2 MHz, 5 MHz, 10 MHz (±10 ppm) 0 dBm (50Ω or more)
Probe power:	±15 V ±0.5 V, 300 mA

General specifications

Operating environment:	Temperature range +5 to +40°C Relative humidity of 80% or less (without condensation)
Storage environment:	-20 to +60°C
Power source:	100 to 120 VAC, 50/60 Hz 220 to 240 VAC, 50/60 Hz (automatic switching between the 100 VAC and 200 VAC systems)
External dimensions:	Approx. 424 (W) x 266 (H) x 530 (D) mm
Mass:	Approx. 36 kg or less
Power consumption:	500 VA or less
Accessories:	Instruction manual, power cable, pen for touch panel

Ordering Information

Main unit

RF component analyzer	R3860+OPT12	R3860+OPT13	R3860+OPT14
Test port	Built-in 2-port test set	Built-in 3-port test set	Built-in 4-port test set
Frequency range	300 kHz to 8 GHz	300 kHz to 8 GHz	300 kHz to 8 GHz
Measurement S-parameters	S11 to S22	S11 to S33	S11 to S44

Options/Accessories

OPT10 (Electronic output attenuator)

Rack-mount kit

A02724 (EIA type)
A02725 (JIS type)

Extension cable for the removable front panel

A01203-50 (500 mm)
A01203-100 (1,000 mm)
A01203-200 (2,000 mm)

OPT10 is not retrofitable.

Calibration kit for error correction

	Model 9617A3*	Model 9617F3*	R17050+04	R17051+01	R17051+21
Impedance	50Ω	50Ω	50Ω	50Ω	50Ω
Connector type	N type	3.5 mm	3.5 mm	3.5 mm	N type
Frequency	DC to 18 GHz	DC to 18 GHz	40 MHz to 8 GHz	300 kHz to 8 GHz	300 kHz to 8 GHz
Configuration	N (m) open	3.5 mm (m) open	For two ports	For four ports	For four ports
	N (f) open	3.5 mm (f) open	3.5 mm (f) - (f)	3.5 mm (f) - (f)	N type (f) - (f)
	N (m) short	3.5 mm (m) short			
	N (f) short	3.5 mm (f) short			
	N (m) load	3.5 mm (m) load	Connecting cable	Connecting cable	Connecting cable
	N (f) load	3.5 mm (f) load	Torque wrench	Torque wrench	Torque wrench
	Container	Container	Container	Container	Container

** The manual calibration kit is manufactured by Maury Corporation*

Please be sure to read the product manual thoroughly before using the products.
Specifications may change without notification.

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