Specifications

■ Analysis Processing

Basic mode	Impedance measurement function	Measures and displays the complex impedance and phase characteristics of a sample Graph format: Bode diagram, Nyquist diagram, Cole Cole plot Measurement item: |Z|, |Y|, θ, R, X, G, B Open/short correction function
	Gain-phase measurement function	Measures and displays the complex gain and phase Graph format: Bode diagram, Nyquist diagram Measurement items: |R|,θ, A (real part of gain), B (imaginary part of gain), Equalization function
Advanced mode		Refer to p. 3 to 6

■ Display Range and Measurement Accuracy

Conditions;
- 100 Hz < Measurement frequency range ≤ 20 kHz
- Immediately after calibration
- Measurement signal input voltages are from 100 mVpeak to 10 Vpeak (up to 2 Vpeak over 2.2 MHz)
- Accuracy when measuring impedances, using "Shunt Resistor PA-001-0370"

Parameters with a subscript x (θx, tanδx, Qx and kx) are obtained from actual measurements. Simbol " * " indicates accuracy of the value itself, not the percent (%).

▼Basic Mode

Impedance Measurement

Parameter	Display range	Measurement accuracy
|Z| [Ω]	± (1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5%
R [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx|>5 deg)
X [Ω]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
G [S]		±1.5% (|θx| ≤5 deg) ±1.5%/cosθx (|θx| >5 deg)
B [S]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg

Gain-Phase Measurement

Parameter	Display range	Measurement accuracy
Gain [dB]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.05 dB
Real part of gain A	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±0.5% (|θx| ≤ 5 deg, 175 deg ≤ |θx|) ±0.5%/cosθx (5 deg<|θx|<175 deg)
Imaginary part of gain B		±0.5% (85 deg ≤ |θx| ≤ 95 deg) ±0.5%/sinθx (|θx| < 85 deg, 95 deg < |θx|)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg

▼Advanced Mode

Piezoelectric Material

Parameter	Display range	Measurement accuracy
|Y| [S]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5%
G [S]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
B [S]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg

Dielectric Material

Parameter	Display range	Measurement accuracy
Cp [F]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Rp [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
εs		±1.5%
tanδ	±(0.000001 to 99,999.9) and 0, up to 6 digits	±0.015 (|tanδx| < 0.1) *
εs′	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|tanδx| ≤ 0.1) ±1.5%/sinθx (|tanδx| > 0.1)
εs″		±1.5% (|tanδx| ≥ 10) ±1.5%/cosθx (|tanδx| < 10)

Magnetic Material

Parameter	Display range	Measurement accuracy
Ls [H]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Rs [Ω]		±1.5% (|θx| ≤ 5deg) ±1.5%/cosθx (|θx| > 5 deg)
μs		±1.5%
tanδ	±(0.000001 to 99,999.9) and 0, up to 6 digits	±0.015 (|tanδx| < 0.1) *
μs'	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|tanδx| ≤ 0.1) ±1.5%/sinθx (|tanδx| > 0.1)
μs"		±1.5% (|tanδx| ≥ 10) ±1.5%/cosθx (|tanδx| < 10)

Inductor

Parameter	Display range	Measurement accuracy
Ls [H]	(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Lp [H]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Rs [Ω]		±1.5% (|θx|≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
Rp [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg
Q	(0.000001 to 99,999.9) and 0, up to 6 digits	±Qx²×0.0052 / (1-0.0052Qx) *

Capacitor

Parameter	Display range	Measurement Accuracy
Cs [F]	(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Cp [F]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Rs [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
Rp [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg
Q	±(0.000001 to 99,999.9) and 0, up to 6 digits	±Qx²×0.0052 / (1-0.0052Qx) *
D		±0.015 (|tanδx| < 0.1) *

Resistor

Parameter	Display range	Measurement accuracy
|Z| [Ω]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5%
R [Ω]		±1.5% (|θx| ≤ 5 deg) ±1.5%/cosθx (|θx| > 5 deg)
X [Ω]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg

Transformer

Parameter	Display range	Measurement accuracy
Leakage inductance Lleak [H]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Inductance at aiding/ opposing connection Inductance [H]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Mutual inductance M [H]		±1.5%/sinθx (Inductance at aiding connection) >(Inductance at opposing connection ×10)
Inductance when secondary side is shorted/opened Inductance [H]		±1.5% (|θx| ≥ 85 deg) ±1.5%/sinθx (|θx| < 85 deg)
Coupling coefficient k	0.000 to 1.000 with 0.001 resolution	±0.03×(1-kx)%
Turn ratio Nr	0.0001 to 9,999, up to 4 digits	±1.5%

Diode

Parameter	Display range	Measurement accuracy
Cp [F]	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±1.5% (Qx ≥ 10) ±1.5%/sinθx (Qx < 10)
Q	±(0.000001 to 99,999.9) and 0, up to 6 digits	±Qx²×0.0052 / (1-0.0052Qx) *

Servo

Parameter	Display range	Measurement accuracy
Loop gain Gloop [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05 dB
Real part of loop gain Real (Gloop)	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±0.5% (|θx| ≤ 5 deg, 175 deg ≤ |θx|) ±0.5%/cosθx (5 deg < |θx| < 175 deg)
Imaginary part of loop Imag (Gloop)		±0.5% (85 deg ≤ |θx| ≤ 95 deg) ±0.5%/sinθx (|θx| < 85 deg, 95 deg < |θx|)
Feedback gain Gfbk [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05 dB
Real part of feedback gain Real (Gfbk)	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±0.5% (|θx| ≤ 5 deg, 175 deg ≤ |θx|) ±0.5%/cosθx (5 deg < |θx| < 175 deg)
Imaginary part of feedback gain Imag (Gfbk)		±0.5% (85 deg ≤ |θx| ≤ 95 deg) ±0.5%/sinθx (|θx| < 85 deg, 95 deg < |θx|)
Closed loop gain Gclose [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05dB
Real part of closed loop gain Real (Gclose)	±(1E-18 to 999.999E+15) and 0, up to 6 digits	±0.5% (|θx| ≤ 5 deg, 175 deg ≤ |θx|) ±0.5%/cosθx (5 deg < |θx| <175 deg)
Imaginary part of loop Imag (Gclose)		±0.5% (85 deg ≤ |θx| ≤ 95 deg) ±0.5%/sinθx (|θx| < 85 deg, 95 deg < |θx|)
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 dB resolution	±0.3 deg

Amplifier Circuit

Parameter	Display range	Measurement accuracy
Gain [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05 dB
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg
Group delay GD [s]	±(1E-15 to 9,999.99) s and 0 s, up to 6 digits	$\pm \frac{1}{1200\times APT}$ s *1
Common-mode gain GainCOM [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05 dB
Normal-mode gain GainNORM [dB]		±0.05 dB
CMRR [dB] (When normal-mode gain are measured)		±0.1 dB
CMRR [dB] (When normal-mode gain are setting constant)		±0.05 dB
PSRR [dB]		±0.05 dB
Differential gain DG [dB]		±0.05 dB
Differential phase DP [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg
ΔGain [dB] (circuit saturation characteristics measurement)	999.999 to +999.999 dB with 0.001 dB resolution	±0.1 dB

Filter Circuit

Parameter	Display range	Measurement accuracy
Gain [dB]	-999.999 to +999.999 dB with 0.001 dB resolution	±0.05 dB
θ [deg]	-9,999.999 to +9,999.999 deg with 0.001 deg resolution	±0.3 deg
Group delay GD [s]	±(1E-15 to 9,999.99) s and 0 s, up to 6 digits	$\pm \frac{1}{1200\times APT}$ s *1

*1 APT: aperture setting (Δf[Hz])

■ Measurement Processing

Auto ranging	Switches the input range in accordance with the input signal level.
Delay	Delays time until start of measurement following switching of frequency.
Integration	Integrates data for measurement, eliminating the noise.
Frequency axis high-density sweep (automatic slow high-density sweep)	When there is a wide variation in the measurement data, the sweep density is automatically increased for the adjacent frequency areas.
Amplitude compression	Controls the oscillation level so that the amplitude level of DUT may stay at certain value in order to keep the DUT from saturation and damage
Equalization (Gain-phase measurement)	Measures the gain-phase frequency response of measurement systems such as sensors and cables beforehand and then removes the error of the system in measurement to obtain the characteristics of the DUT only.
Open/short correction (Impedance measurement)	Measures the frequency response of the residual impedance and residual admittance for measurement systems such as shunt resistors and cables beforehand and then excludes the measurement system residual values in measurement to obtain the characteristics of the DUT only.
Calibration	System checking and self-error correction.

■ Analyzer Input (CH1/CH2)

Number of input channels	2 channels (The impedance measurement assumes the CH-1 as voltage and the CH-2 as a value converted from current to voltage.)
Connector	Insulated BNC connector
Input impedance	1 MΩ ±2%, 25 pF ±5 pF (parallel)
IMRR (Isolation mode rejection ratio)	Max. 120 dB (DC to 60 Hz) Applicable if a signal source impedance is smaller than 1 Ω
Isolation withstand voltage	250 Vrms continuous (between signal/ground and cabinet, between signal/ground and oscillator, between analysis input channels)
Max. measurement voltage	250 Vrms (when a supplied BNC cable is used)
Dynamic range	140 dB typ. (10Hz to 1MHz)

■ Oscillator (OSC)

Number of output channels	1
Connector	Insulated BNC connector
Output waveform/ Frequency range	Sine wave 0.1 mHz to 15 MHz, 0.1 mHz resolution
AC amplitude	0 V to 10 Vpeak (at no load)
DC bias	-10 V to +10 V (at no load)
Output impedance	50 Ω ±2% (at 1 kHz) , unbalanced (BNC junction)
Max. output voltage (AC+DC)	±10 V (at no load)
Sweep	Any of Frequency, Amplitude, DC bias, and Zero span (time)
Isolation withstand voltage	250 Vrms continuous (between signal/ground and cabinet, between signal/ground and analysis input)

■ Internal Storage

Measurement recipe, measurement result data, setting information, correction data, data logger data

■ External Storage

External memory	USB1.1 or USB2.0 compliant USB memory
Connector	Front panel, USB-A connector
File system	FAT32
Maximum capacity	32 GB
File type	Report output: PDF format Graph output: BMP format (hardcopy of graph area) Measurement recipe: XML format Measurement result data: XML format, transfer function: text format Data logger: WDB format (a proprietary binary file format)

■ Peripheral Input/Output Function

USB (host)	USB2.0, 6 ports, USB-A connector
USB (function) *2	USB1.1, 1 port, USB-B connector (USBTMC)
LAN (Ethernet)	10 BASE-T/100 BASE-TX/1000 BASE-T, 1 port, RJ-45 type, 8-pin modular jack
VGA	Analog RGB, Number of ports: 1, mini D-Sub 15-pin, female
DC power output	Power output connected to Signal Injector Probe 5055 *3
Control I/O	Control external devices and operate them in conjunction Signal input: 8 channels, TTL Input signals: Start measuring, abort measuring, output ON/OFF Output signals: Start measuring, complete measuring, elapsed time since the start of measurement, output ON/OFF, measuring/Idle
Analog signal input	Perform data logging in concert with measurements 1 channel, ±10 V, DC to 10 kHz

*2 Connect with an external PC when using ZGA5920 as an FRA compatible unit. *3 Sold separately

■ Miscellaneous Specifications

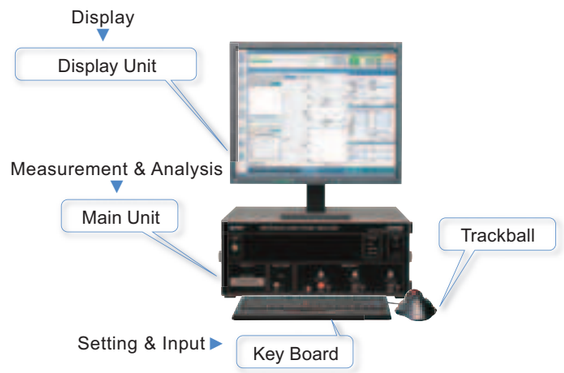
▼System common specifications

Power input	AC100 V to 132 V/180 V to 240 V, 50 Hz/60 Hz Overvoltage category: II
Ambient temperature/ humidity range (excluding printer)	Performance guaranteed *3 : +5˚C to +35˚C, 30% to 80% RH Storage conditions *3 : -10˚C to +50˚C, 30% to 80% RH Pollution degree: 2

Main unit	Power consumption: Max. 150 VA, Weight: approx. 12.5 kg Dimension: 430 (W) ×173 (H) ×438 (D) mm (without protrusions)
Monitor unit	1280×1024 dot, 19 inch, Power consumption: Max. 45 W Dimension: 405 (W) ×416 (H) ×205 (D) mm, Weight: approx. 6 kg
Key board unit	Power source: supplied from the main unit USB port Dimension: 338 (W) ×37 (H) ×251 (D) mm
Trackball unit	Power source: supplied from the keyboard USB port Dimension: 87 (W) ×43 (H) ×166 (D) mm

*3 no condensation

Configuration



Accessories

- CD-ROM 1
  ZGA5920 Utility Software
  ZGA5920 Software Developer Kit (SDK)
- ZGA5920 Instruction Manual 1
- Signal Cable (BNC-BNC 50 Ω, 1 m, 250 Vrms CAT I) 3
- BNC T-Branch (250 Vrms) 1
- Ferrite Core (clamp type) 1
- Power Code Set (2 m, with 3-prong plug) 1

Can be connected a printer to the main unit.
Recommended printer: HP Officejet 100, HP Officejet H470
*Inquire us about other connectable printers.