HIOKI

Instruction Manual

3390-10

POWER ANALYZER

High Accuracy version

(Read first.)

HIOKI E. E. CORPORATION

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600361712

Introduction

Thank you for purchasing the HIOKI "3390-10 Power Analyzer".
This product is a high-accuracy version of the Model 3390 Power Analyzer that delivers accuracy of ±0.1% and a guaranteed accuracy period of one year when used in combination with dedicated current measurement options.

This instruction manual includes information that differs from the standard Model 3390 Power Analyzer. Please read this manual first and refer to the Model 3390 Power Analyzer instruction manual for information about basic specifications and operation.

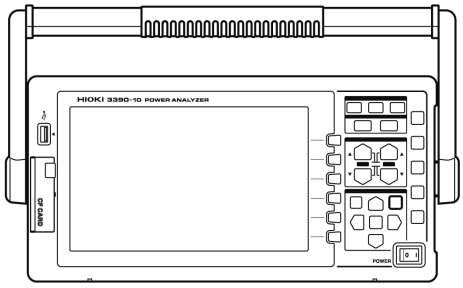
To obtain maximum performance from the product, please read this manual first, and keep it handy for future reference.

Confirming Package Contents

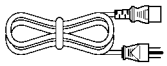
When you receive the instrument, inspect it carefully to ensure that no damage occurred during shipping. In particular, check the accessories, panel switches, and connectors. If damage is evident, or if it fails to operate according to the specifications, contact your dealer or Hioki representative.

Confirm that these contents are provided.

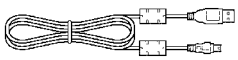
☐ 3390-10 Power Analyzer 1



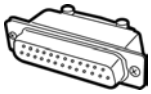
☐Grounded power cord 1



☐USB Cable 1



☐D-Sub Connector 1
(for use only with Model 9792 or
9793 D/A output options)



Accessories

☐3390-10 Instruction Manual..... 1

☐3390 Instruction Manual..... 1

☐Measurement Guide..... 1

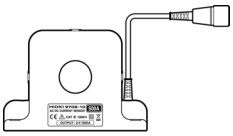
Please attach to the instrument before use.

☐Input Cable Labels..... 2
(to identify voltage cable leads and input channels)

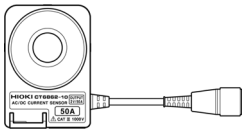
Option

Dedicated current measurement options

9709-10
AC/DC Current Sensor



CT6862-10, CT6863-10
AC/DC Current Sensor



For Voltage Measurement
- L9438-50 Voltage Cord
- 9243 Grabber Clip
- 9448 Concent Input Cord
- L1000 Voltage Cord
- PW9000 Wiring Adapter
- PW9001 Wiring Adapter

For Printing
- 9670 Printer (includes one thermal paper roll, Sanei Electric Model BL-80RS II)
- 9671 AC Adapter (Sanei Electric Model BL-100W)
- 9237 RECORDING PAPER (thermal paper 80 mm × 25 m, 4 rolls)
- 9638 RS-232C Cable

For Computer Connection
- 9642 LAN Cable
- 9727 PC Card 256M (256MB CFCard + Adapter)
- 9728 PC Card 512M (512MB CFCard + Adapter)
- 9729 PC Card 1GB (1GB CFCard + Adapter)
- 9830 PC Card 2GB (2GB CFCard + Adapter)

Others
- 9794 Carrying Case
- L9217 Connection Cord (for Model 9791 and the 9793)
- 9683 Connection Cable (for synchronization)

1. Features

High accuracy

Used in combination with dedicated current measurement options, the 3390-10 delivers high accuracy of up to ±0.1%, supporting efficiency improvements on the order of 0.1% in increasingly high-efficiency electrical devices.

While current and active power accuracy for the standard Model 3390 is determined in part by the accuracy of the current sensor, the 3390-10 delivers a maximum accuracy of ±0.1% when used with its dedicated current measurement options. The following measurement items benefit from improved accuracy with the 3390-10:

Voltage accuracy	DC
Current and active power accuracy	DC and 45 Hz to 66 Hz
Power factor influence	45 Hz to 66 Hz

- Accuracy for measurement items other than those listed above is the same as for the standard 3390.
- Accuracy is not defined for the above measurement items when the instrument is used in a standalone configuration.

Common accuracy for all ranges

To provide high-accuracy measurement capability without regard to the current range, the 3390-10 delivers common accuracy for all ranges.

Within a frequency range of 45 Hz to 66 Hz, the 3390-10 offers full-scale accuracy for its ranges, without regard to the current sensor rating.

Guaranteed accuracy period of one year

To ensure operators' ability to use the instrument at its maximum level of accuracy with confidence and peace of mind with an annual calibration, the 3390-10 extends the guaranteed accuracy period from the standard instrument's six months to a full year.

The following special-order factory options also have the one-year guaranteed accuracy periods.
9791 Motor Testing Option
9792 D/A Output Option
9793 Motor Testing & D/A Output Option

Full support for all 3390 functionality

Users of the 3390-10 can take full advantage of all standard 3390 functionality.

2. Specifications

These specifications apply to the Model 3390-10 Power Analyzer used in combination with its dedicated current measurement options (the CT6862-10, CT6863-10, and 9709-10 AC/DC Current Sensors).
With the exception of "2.1 General Specifications" (p. 4) and "2.2 Basic Specifications" (p. 5), the Model 3390 Power Analyzer specifications apply.

When the 3390-10 is used with a current sensor other than one of its dedicated current measurement options, or when a dedicated current measurement option is used with an instrument other than the 3390-10, the specifications of the standard version of each product (the version within the "-10" suffix) apply.

*Underlined text indicates specifications that differ from the Model 3390 Power Analyzer.

2.1 General Specifications

Environmental Safety Specifications

Operating environment	Indoors, up to 2000 m (6562-ft.) Pollution degree 2
Storage temperature and humidity	-10 to 55°C (14 to 131°F) 80% RH or less (non-condensating)
Operating temperature and humidity	0 to 40°C (32 to 104°F) 80% RH or less (non-condensating)
Dielectric strength	@50/60 Hz, for 15 s 5.312 kVrms AC (1 mA sense current) Between voltage measurement jacks and instrument chassis 3.32 kVrms AC (1 mA sense current) Between voltage and current measurement jacks, and interface jacks 370 Vrms AC (1 mA sense current) 9791, 9793 input terminal (CH A, CH B, CH Z) - 3390 to instrument chassis, Between channels A, B, and Z
Applicable standards	Safety : EN61010 EMC : EN61326 Class A EN61000-3-2 EN61000-3-3
Rated supply voltage	100 V to 240 VA Anticipated transient overvoltage: 2500 V
Rated supply frequency	50/ 60 Hz
Maximum rated power	140 VA
Dimensions	Approx. 340 W× 170 H × 157 D mm (13.39" W × 6.69" H × 6.18" D) (excluding protrusions)
mass	Approx. 4.8 kg (169.3 oz.) (with Model 9793 installed)
Backup battery life	Clock, settings and integration values (Lithium battery), Approx. 10 years @23°C

Accessories and Options Specifications

Accessories	• 3390-10 Instruction Manual .....1 • 3390 Instruction Manual.....1 • Power cord.....1 • Measurement Guide .....1 • USB cable (USB 2.0, with ferrite core, approx. 0.9 m).....1 • Measurement cable label sheet .....2 • D-sub connector (for Model 9792 and 9793 D/A output options).....1
Special-order options (pre-shipping installation only)	9791 Motor Testing Option 9792 D/A Output Option 9793 Motor Testing & D/A Output Option
Dedicated current measurement options	9709-10 AC/DC Current Sensor (combination test report available) CT6862-10 AC/DC Current Sensor (combination test report available) CT6863-10 AC/DC Current Sensor (combination test report available)
Voltage measurement option	L9438-50 Voltage Cord (banana male-to-male with alligator clip, one each red and black, about 3m long) L1000 Voltage Cord Voltage Measurement Cable Leads (1 each for red, yellow, blue, and gray, and 4 black, cord length approx. 3 m, with alligator clips) PW9000 Wiring Adapter (for 3P3W) PW9001 Wiring Adapter (for 3P4W) 9243 Grabber Clip (one each red and black)
Printer option	9670 Printer 9671 AC Adapter (for Model 9670) 9638 RS-232C Cable (for Printer) 9237 Recording Paper (80 mm - 25 m, 4 rolls)
Computer connection option	9642 LAN Cable 9726 PC Card 128MB (128MB CompactFlash Card + Adapter) 9727 PC Card 256MB (256MB CompactFlash Card + Adapter) 9728 PC Card 512MB (512MB CompactFlash Card + Adapter) 9729 PC Card 1GB (1GB CompactFlash Card + Adapter) 9830 PC Card 2GB (2GB CompactFlash Card + Adapter)
Other Options	9794 Carrying Case L9217 Connection Cord (Insulated BNC male-to-male, 1.5 m (for Model 9791 and Model 9793) 9683 Connection Cable (for synchronization 1.5 m)

2.2 Basic Specifications

1. Power Measurement Input Specifications

Measurement line type	Single-phase 2-wire (1P2W), Single-phase 3-wire (1P3W), 3-phase, 3-wire (3P3W2M, 3P3W3M), 3-phase, 4-wire (3P4W)

	CH1	CH2	CH3	CH4
Mode 1	1P2W	1P2W	1P2W	1P2W
Mode 2	1P3W		1P2W	1P2W
Mode 3	3P3W2M		1P2W	1P2W
Mode 4	1P3W		1P3W	
Mode 5	3P3W2M		1P3W	
Mode 6	3P3W2M		3P3W2M	
Mode 7	3P3W3M			1P2W
Mode 8	3P4W			1P2W

Number of input channels	Voltage .....4 channels U1 to U4 Current .....4 channels I1 to I4
Measurement input terminal type	Voltage .....Plug-in jacks (safety jacks) Current .....Dedicated custom connectors
Input methods	Voltage .....isolated inputs, resistive dividers Current .....Insulated current sensors (voltage output)
Voltage range	1500 V, 600 V, 300 V, 150 V, 60 V, 30 V, 15 V @selectable for each measured wiring system
Current range	20 A, 8 A, 4 A, 2 A 20 A, 8 A, 4 A, 2 A, 0.8 A, 0.4 A 200 A, 80 A, 40 A, 20 A, 8 A, 4 A (CT6863-10) 50 A, 20 A, 10 A, 5 A, 2 A, 1 A (CT6862-10) 500 A, 200 A, 100 A, 50 A, 20 A, 10 A (9709-10) selectable for each measurement channel (however, the same sensor type must be used for each channel in multiphase wiring systems)
Crest factor	3 (Voltage, Current) Except 1500 V range: 1.33
Input resistance (50/60 Hz)	Voltage input section ..... 2 MΩ ±40 kΩ (differential inputs) Current sensor input section ..... 1 MΩ ±50 kΩ
Maximum input voltage	Voltage input section ..... 1500 V, ±2000 Vpeak Current sensor input section ..... 5 V, ±10 Vpeak
Maximum rated voltage to earth	Voltage input terminal..... 1000 V (50/60 Hz) Measurement Categories III ..... 600 V (anticipated transient overvoltage 6000 V) Measurement Categories II ..... 1000 V (anticipated transient overvoltage 6000 V)
Measurement method	Simultaneous digital sampling of voltage and current, simultaneous zero-crossing calculation method
Sampling	500 kHz/ 16bit
Measurement frequency range	DC, 0.5 Hz to 150 kHz
Synchronization frequency range	0.5 Hz to 5 kHz Selectable lower limit measurement frequency (0.5 Hz, 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz)
Synchronization source	U1 to U4, I1 to I4, Ext (with the motor evaluation option installed and CH B set for pulse input), DC (50 or 100 ms fixed) Selectable for each measurement channel (U/I of each channel must be the same as the sync source) The zero-crossing filter automatically matches the digital LPF when U or I is selected. Two filter levels (strong or mild) Operation and accuracy are undetermined when the zero-crossing filter is disabled (off). Operation and accuracy are undetermined when U or I is selected and measured input is below 30% f.s.
Data update interval	50 ms
LPF	OFF, 500 Hz, 5 kHz, 100 kHz (selectable for each wiring system) 500 Hz .... Accurate to 60 Hz or better, With specified accuracy to +0.1% f.s. 5 kHz ..... Accurate to 500 Hz or better 100 kHz .. Accurate to 20 kHz or better, (add 1% rdg. from 10 kHz to 20 kHz)
Polarity discrimination	Voltage/current zero-crossing timing comparison method Zero-crossing filter provided by digital LPF
Measurement items	Voltage (U), Current (I), active power (P), apparent power (S), reactive power (Q), power factor (λ), power phase angle (ϕ), frequency (f), efficiency (η), loss (Loss), voltage ripple factor (Urf, current ripple factor (Irf), current integration (Ih), power integration (WP), peak voltage (Upk), peak current (Ipk)

1. Power Measurement Input Specifications

Accuracy

	Voltage (U)	Current (I)	Active power (P)
DC	±0.07%rdg.±0.1%f.s.	±0.07%rdg.±0.1%f.s.	±0.07%rdg.±0.1%f.s.
45 Hz to 66 Hz	±0.05%rdg.±0.05%f.s.	±0.05%rdg.±0.05%f.s.	±0.05%rdg.±0.05%f.s.

In the above frequency range, the dedicated current measurement option combination accuracy applies (f.s.: 3390-10 range).
Values provided for voltages of 1,000 V and greater and active power are provided as reference values.

	Voltage (U)	Current (I)	Active power (P)
0.5 Hz to 30 Hz	±0.1%rdg.±0.2%f.s.	±0.1%rdg.±0.2%f.s.	±0.1%rdg.±0.2%f.s.
30 Hz to 45 Hz	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.
66 Hz to 1 kHz	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.	±0.1%rdg.±0.1%f.s.
1 kHz to 10 kHz	±0.2%rdg.±0.1%f.s.	±0.2%rdg.±0.1%f.s.	±0.2%rdg.±0.1%f.s.
10 kHz to 50 kHz	±0.3%rdg.±0.2%f.s.	±0.3%rdg.±0.2%f.s.	±0.4%rdg.±0.3%f.s.
50 kHz to 100 kHz	±1.0%rdg.±0.3%f.s.	±1.0%rdg.±0.3%f.s.	±1.5%rdg.±0.5%f.s.
100 kHz to 150 kHz	±20%f.s.	±20%f.s.	±20%f.s.

For current and active power readings in the above frequency range, the current sensor accuracy should be added to the above accuracy values.
From 0.5 to 10 Hz, voltage, current and active power values are for relative comparison only
From 10 to 16 Hz and over 220 V, voltage and active power values are for relative comparison only
From 30 kHz to 100 kHz and over 750 V, voltage and active power values are for relative comparison only
From 100 kHz to 150 kHz and over 22000/f [kHz], voltage and active power values are for relative comparison only
Over 1000 V, voltage and active power values are for relative comparison only

Period of guaranteed accuracy	1 year
Conditions of Guaranteed Accuracy	Current input ..... When using a dedicated current measurement option (When using another current sensor, the 3390's accuracy specifications apply.) Temperature and humidity for guaranteed accuracy 23±3°C, 80%RH or less (3390-10) 23°C±5°C, 80%RH or less (when using the 9709-10's 50 A to 500 A range) ±1°C after zero adjustment at 23°C±5°C, 80% RH or less (when using the 9709-10's 10 A to 20 A range) 0 to 40°C, 80%RH or less (CT6862-10, CT6863-10) Warm-up time..... 30 minutes or more Input ..... Sine wave input, power factor of 1, terminal-to-ground voltage of 0 V, reading following zero adjustment at 23°C±3°C with current sensor, within range for which the fundamental wave satisfied the synchronized source conditions
Temperature coefficient	Add the following when using the instrument outside the operating temperature range and outside the guaranteed accuracy temperature and humidity range as described above. (f.s.: 3390-10 range) 3390-10 ..... ±0.01% f.s./°C or 0.01% f.s./°C (DC operation) 9709-10 ..... Current: ±0.01% rdg./°C or ±(0.005% + 2 mA)/°C (DC operation) Active power: ±0.01% rdg./°C DC operation: [Voltage reading × (0.005% f.s. + 2 mA)] CT6862-10, CT6863-10 ..... Current: ±0.01% rdg/°C or ±0.005% f.s./°C (DC operation) Active power: ±0.01% rdg./°C DC operation: ±[Voltage reading × 0.005% f.s.]/°C
Effect of common mode voltage	±0.01%f.s. or less (f.s.: 3390-10 range) (When applying 1,000 V [50/60 Hz] between the case and all voltage input pins as well as the conductor passing through the current sensor's pass-through window)
Magnetic field interference	±1%f.s. or less (in 400 A/m magnetic field, DC and 50/60 Hz) Add current sensor influence.
Power factor influence	±0.2%f.s. or less (45 Hz to 66 Hz with power factor = 0.0) with 500 Hz LPF, add ±0.45% f.s. (f.s.: 3390-10 range)
Susceptibility to conducted electromagnetic field	@3 V, current and active power not more than ±6% f.s., where f.s. current is the rated primary-side current of the current sensor f.s. active power equals the voltage range × the rated primary-side current of the current sensor
Susceptibility to radiated electromagnetic field	@10 V/m, current and active power not more than ±6% f.s., where f.s. current is the rated primary-side current of the current sensor, and f.s. active power equals the voltage range × the rated primary-side current of the current sensor
Effective measuring range	Voltage, Current, Power..... 1% to 110% of the range
Total display area	Voltage, Current, Power..... Voltage, current and power: from zero-suppression range setting to 120%
Zero-suppression ranges	Selectable OFF,0.1 or 0.5% f.s. When OFF, non-zero values may be displayed even with no measurement input
Zero adjustment	Voltage ±10%f.s., current ±10% f.s. with no more than ±4 mV zero-adjustment compensation

1. Power Measurement Input Specifications

Waveform peak measurement range	Within ±300% of each voltage and current range
Waveform peak measurement accuracy	Within ±2% f.s. of voltage and current display accuracy

2.Frequency Measurement Specifications

Measurement channels	Four (f1 to f4)
Measurement source	Select U/I for each measurement channel
Measurement method	Reciprocal method + zero-crossing sample value correction
Measuring range	Synchronous range from 0.5 Hz to 5 kHz (with 0.0000 Hz unmeasurable time) Selectable lower limit measurement frequency (0.5 Hz, 1 Hz, 2 Hz, 5 Hz, 10 Hz, 20 Hz)
Data update interval	50 ms (measurement-frequency-dependent at 45 Hz and below)
Accuracy	±0.05% rdg. ±1 dgt. (sine wave, amplitude at least 30% of measurement range)
Numerical display format	0.5000 Hz to 9.9999 Hz, 9.900 Hz to 99.999 Hz, 99.00 Hz to 999.99 Hz, 0.9900 kHz to 5.0000 kHz

3.Integration Measurement Specifications

Measurement Mode	Selectable RMS or DC for each wiring mode (DC is selectable only for 1P2W wiring and AC/DC sensors)
Measurement items	Current integration (Ih+, Ih-, and Ih), active power integration (WP+, WP-, and WP) Ih+ and Ih- only for DC mode measurements, and Ih only for RMS mode measurements
Measurement method	Digital calculation from each current and active power phase (when averaging, calculates with previous average value) In DC mode ..... Calculates current value at every sample, and integrates instantaneous power independent of polarity In RMS mode ..... Integrates current effective values between measurement intervals, and polarity-independent active power value
Measurement Interval	50 ms data update interval
Display resolution	999999 (6 digits + decimal)
Measuring range	0 to ±9999.99 TAh / TWh (limited to maximum integration time of 9999 hours, 59 minutes, and 59 seconds) Integration stops when either maximum integration value or time is exceeded.
Integration time accuracy	±50ppm±1dgt. (0°C to 40°C)
Integration accuracy	± (current and active power accuracy) ± integration time accuracy
Backup function	Integration automatically resumes after power outages.

4.Harmonic Measurement Specifications

Number of measurement channels	4 Channels Harmonic measurements not available for multiple systems with different frequencies.
Measurement items	Harmonic rms voltage, harmonic voltage percentage, harmonic voltage phase angle, harmonic rms current, harmonic current percentage, harmonic current phase angle, harmonic active power, harmonic power percentage, harmonic voltage-current phase difference, total harmonic voltage distortion, total harmonic current distortion, voltage imbalance, current imbalance
Measurement method	Zero-crossing synchronous calculation (all channels in same window), with gap Fixed 500 kHz/s sampling, after digital anti-aliasing filter Equal thinning between zero crossings (with interpolation calculation)
Synchronization source	U1 to U4, I1 to I4, External (with motor evaluation option installed and CH B set for pulse input), DC selectable (50 or 100 ms)
FFT calculation word length	32 bits
Anti-aliasing filter	Digital filter (variable according to sync frequency)
Windows	Rectangular
Synchronization frequency range	As specified for power measurements
Data update interval	50 ms (measurement-frequency-dependent at 45 Hz and below)
Phase zero adjustment	Provided by key operation or external control command (only with external sync source)

4.Harmonic Measurement Specifications

Highest order analysis

Synchronization frequency range	Window waveforms	Analysis order
0.5 Hz to 40 Hz	1	100th
40 Hz to 80 Hz	1	100th
80 Hz to 160 Hz	2	80th
160 Hz to 320 Hz	4	40th
320 Hz to 640 Hz	8	20th
640 Hz to 1.2 kHz	16	10th
1.2 kHz to 2.5 kHz	32	5th
2.5 kHz to 5.0 kHz	64	3th

Accuracy

Frequency	Voltage (U), Current (I), Active Power (P)
0.5 Hz to 30 Hz	±0.4%rdg.±0.2%f.s.
30 Hz to 400 Hz	±0.3%rdg.±0.1%f.s.
400 Hz to 1 kHz	±0.4%rdg.±0.2%f.s.
1 kHz to 5 kHz	±1.0%rdg.±0.5%f.s.
5 kHz to 10 kHz	±2.0%rdg.±1.0%f.s.
10 kHz to 13 kHz	±5.0%rdg.±1.0%f.s.

Not specified for sync frequencies of 4.3 kHz and higher
Add the LPF accuracy to the above when using LPF.

5.Noise Measurement Specifications

Calculation channels	1 (Select one from CH1 to CH4)
Calculation parameters	Voltage/Current
Calculation type	RMS spectrum
Calculation method	Fixed 500 kHz/s sampling, thinning after digital anti-aliasing filter
FFT calculation word length	32 bits
FFT data points	1,000, 5,000, 10,000, or 50,000 (according to displayed waveform recording length)
Anti-aliasing filter	Automatic digital filter (varies with maximum analysis frequency)
Windows	Rectangular, Hanning, flat-top
Data update interval	Determined by FFT points within approx. 400 ms, 1s, 2s, or 15 s, with gap
Highest analysis frequency	100 kHz, 50 kHz, 20 kHz, 10 kHz, 5 kHz, 2 kHz
Frequency resolution	0.2 Hz to 500 Hz (Determined by FFT points and maximum analysis frequency)
Noise amplitude measurement	Calculates the ten highest level and frequency voltage and current peak values (local maxima). In FFT calculation results, peak values are recognized when data levels on either side are lower. The lower noise frequency limit can be specified.

6. Motor Evaluation Option Specifications (Models 9791 and 9793)

Number of input channels	3 channels CH A..... Analog DC input, Frequency input CH B..... Analog DC input, Pulse input CH Z..... Pulse input
Measurement input jacks	Insulated BNC jacks
Input impedance (DC)	1 MΩ ±100 kΩ
Input methods	Isolated and differential inputs (not isolated between channels B and Z)
Measurement parameters	Voltage, torque, rotation rate, frequency, slip, and motor power
Maximum input voltage	±20 V (during analog, frequency, and pulse input)
Maximum rated voltage to earth	50 V (50/ 60 Hz) 50 V (500 V anticipated transient overvoltage)
Period of guaranteed accuracy	1 year
Conditions of Guaranteed Accuracy	Temperature and humidity for guaranteed accuracy ....80%RH or less Warm-up time.....30 minutes or more Input ..... With 0 V to ground, after zero adjustment

(1) Analog DC Input (CH A/ CH B)

Measurement range	±1 V, ±5 V, ±10 V (when inputting analog DC)
Valid input range	1% to 110%f.s.
Sampling	10 kHz / 16bit
Response time	1 ms (measuring zero to full scale, with LPF off)
Measurement method	Simultaneous digital sampling and zero-crossing synchronous calculation system (cumulative average of intervals between zero crossings)
Synchronization source	Same as 3390 power measurement input specification (common to CH A and CH B)
Measurement accuracy	±0.1%rdg. ±0.1%f.s.
Temperature coefficient	±0.03%f.s./°C
Effect of common mode voltage	Not more than ±0.01% f.s. (with 50 V [DC or 50/60 Hz] between measurement jacks and 3390 chassis)
Effect of external magnetic field	Not more than ±0.1% f.s. (at 400 A/m DC and 50/60 Hz magnetic fields)
LPF	OFF/ ON (OFF: 4 kHz, ON: 1 kHz)
Total display area	Zero-suppression range setting ±120%
Zero adjustment	Zero-corrected input offset of voltage ±10% f.s. or less

(2) Frequency Input (CH A only)

Valid amplitude range	±5 Vpeak
Max. measurement frequency	100 kHz
Measurement range	1 kHz to 100 kHz
Synchronization source	3390 Same as accuracy specifications
Data output interval	According to synchronization source
Measurement accuracy	±0.05%rdg. ±3dgt.
Total display area	1.000 kHz to 99.999 kHz

(3) Pulse Input (CH B only)

Detection level	Not more than 0.5 V Low, and at least 2.0 V High
Measurement range	1 Hz to 200 kHz (at 50% duty)
Division setting range	1 to 60000
Measurement frequency range	0.5 Hz to 5.0 kHz (limited to measured pulse frequency divided by selected no. of divisions)
Minimum detectable pulse width	2.5 µs or better
Measurement accuracy	±0.05%rdg. ±3dgt.

(4) Pulse Input (CH Z only)

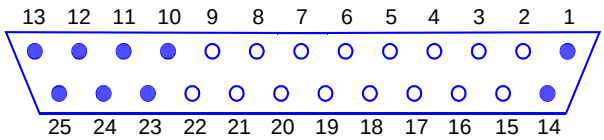
Detection level	Not more than 0.5 V Low, and at least 2.0 V High
Measurement range	0.1 Hz to 200 kHz
Minimum detectable pulse width	2.5 µs or better
Settings	OFF/Z Phase/B Phase (clear counts of CHB in rising edge during Z Phase, detect polar code for number of rotations during B Phase)

7. D/A Output Option Specifications (Models 9792 and 9793)

Number of output channels	16 channels
Output contents	Selectable waveform/analog outputs (from basic measurement parameters) Waveform output only on Channels 1 to 8
Output connector	One 25-pin female D-sub
D/A conversion resolution	16 bits (polarity + 15 bits)
Output accuracy	Analog output ..... Measurement accuracy ±0.2%f.s. (DC level) Waveform output ... Measurement accuracy±0.5%f.s. (rms level within synchronous frequency range)
Output update interval	Analog output ..... 50 ms (according to input data update interval of selected parameter) Waveform output ... 500 kHz
Output voltage	Analog output ..... ±5 V DC nom. (approx. ±12 V DC max.) Waveform output .. ±2 V (crest factor at least 2.5)
Output impedance	100 Ω ±5 Ω
Period of guaranteed accuracy	1 year
Conditions of Guaranteed Accuracy	Temperature and humidity .....23±3°C 80% RH or less Warm-up time.....30 minutes or more, After zero adjustment of the 3390
Temperature Coefficient	±0.05%f.s./°C

7. D/A Output Option Specifications (Models 9792 and 9793)

Pinout



Pin No.	Output (Waveform)	Pin No.	Output (Waveform)
1	GND	14	GND
2	D/A1 (U1)	15	D/A9
3	D/A2 (I1)	16	D/A10
4	D/A3 (U2)	17	D/A11
5	D/A4 (I2)	18	D/A12
6	D/A5 (U3)	19	D/A13
7	D/A6 (I3)	20	D/A14
8	D/A7 (U4)	21	D/A15
9	D/A8 (I4)	22	D/A16
10	GND	23	GND
11	GND	24	GND
12	GND	25	GND
13	GND	- -	- - - - - - - - - -

8.Display Specifications

Languages	Japanese, English, Chinese
Display type	9-inch TFT color LCD (800×480 dots)
Dot pitch	0.246(V) mm×0.246(H) mm
LCDbacklight	Always ON, Auto OFF (after 1, 5, 10, 30, or 60 minutes)
Display numerical resolution	99999 counts (999999 counts for integration) 99999 counts (999999 counts)
Display refresh interval	Measurement values.....200 ms (independent of internal data update interval) Waveforms, FFT .....screen-dependent
Screens	Measurement, Setting, and File Operation screens

9.External Interface Specifications

(1) USB Interface (Functions)

Connector	Mini-B receptacle
Compliance standard	USB2.0 (Full Speed/High Speed)
No. of ports	1
Class	Individual (USB488h)
Connection destination	Computer (Windows 7 (32bit, 64bit), XP, Vista 32bit only)
Function	Data transfer, remote operation and command control Not for simultaneous use with Ethernet: USB has priority when both interfaces used

(2) USB Memory Interface

Connector	USB type A connector
Compliance standard	USB2.0
USB power supply	500 mA maximum
No. of ports	1
USB storage device support	USB Mass Storage Class
Recordable content	Save and load settings files Copy measurement values and recorded data (from CF card) Save waveform data Screen captures

(3) LAN Interface

Connector	RJ-45 connector × 1
Compliance standard	IEEE802.3 compliamt
Transmission method	10BASE-T/ 100BASE-TX Auto detected
Protocol	TCP/IP
Function	HTTP server (remote operation), Dedicated port (data transfer and command control) Not for simultaneous use with USB (functions): USB has priority when both interfaces used

(4) CF Card Interface

Slot	One Type 1
Compatible card	CompactFlash memory card (32MB or higher)
Supported memory capacity	Up to 2 GB
Data format	MS-DOS format (FAT16/ FAT32)
Recordable content	Save and load settings files Save measurement voltage and auto-recorded data (CSV format) Copy measurements/recorded data (from USB storage) Save waveform data Screen captures

(5) RS-232CInterface

Method	RS-232C, [EIA RS-232D], [CCITT V.24], [JIS X5101] compliamt
Connector	D-sub9 pin connector ×1
Connection destination	Printer, Temperature tester
Communication format	Full duplex, start-stop synchronization, 8-bit data, no parity, one stop bit, hardware flow control, CR+LF delimiter
Communication speeds	2400, 9600, 19200, 38400bps (2400 bps for thermometers)

(6) Synchronization Control Interface

Signal contents	One-second clock, integration start/stop, DATA RESET, EVENT
Connector types	IN.....One 9-pin female mini-DIN jack OUT.....One 8-pin female mini-DIN jack
Signal	5V CMOS
Max. input	±20 V
Max. signal delay	2 μs (rising edge)

MEMO

HIOKI

HIOKI E. E. CORPORATION

Headquarters
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568 E-mail: os-com@hioki.co.jp
URL http://www.hioki.com/
(International Sales and Marketing Department)

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 FAX +1-609-409-9108 E-mail: hioki@hiokiusa.com
URL http://www.hiokiusa.com

HIOKI (Shanghai) Sales & Trading Co., Ltd.
1608-1610, Shanghai Times Square Office 93 Huaihai Zhong Road Shanghai,
P.R.China POSTCODE: 200021
TEL +86-21-63910090 FAX +86-21-63910360 E-mail: info@hioki.com.cn
URL http://www.hioki.cn

HIOKI INDIA PRIVATE LIMITED
Khandela House, 24 Gulmohar Colony Indore 452 018 (M.P.), India
TEL +91-731-6548081 FAX +91-731-4020083 E-mail: info@hioki.in
URL http://www.hioki.in

HIOKI SINGAPORE PTE. LTD.
33 Ubi Avenue 3, #03-02 Vertex Singapore 408868
TEL +65-6634-7677 FAX +65-6634-7477 E-mail: info@hioki.com.sg

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