

IT9121 Digital Power Analyzer

IT9121 Digital Power Analyzer는 최대입력 600Vrms와 20Arms, 100KHz의 측정대역을 가지고 있어 간단하게 전압, 전류, power, 주파수, harmonics(고조파) 등 다양한 파라미터를 측정할 수 있습니다.

기본 구성으로 USB, GPIB, RS232 및 LAN 통신이 가능하며 또한 USB를 기초로 한 관련 기기 등과 interface가 가능합니다. 기본적으로 전압과 전류는 0.1%의 정확도를 가지고 있으며 Power meter에는 Active power와 같은 다양한 기능이 내장되어 있습니다.

자동차, 가전기기, UPS 등 폭넓은 분야에 적용할 수 있습니다.

The accuracy of voltage and current measurement is up to 0.1%.



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Feature

- 4.3 inch color LCD(TFT)화면
- 일반적인 측정 파라미터 및 자료를 스크린에 행렬로 표시합니다
- 입력 범위: 600Vrms/20Arms
- 전압, 전류, power, 주파수, harmonics(고조파) 등 다양한 파라미터를 동시에 측정
- 전압 및 전류의 정확도: 0.1% 까지
- harmonics(고조파) 측정이 가능하며 50번차 harmonics(고조파)까지 측정 가능
- USB를 base로 한 관련 기기와 interface를 지원하며 사용자는 데이터를 저장 및 외부 저장기기로 보낼 수 있음
- Power meter는 풍부하고 강력한 기능이 내장되어 있으며 전기 에너지를 측정하는데도 사용 가능
- Power meter를 주파수 측정기기로도 활용 가능

Communication interface(통신 Interface)

IT9121 Digital Power Analyzer는 기본적으로 USB, GPIB, RS232와 Ethernet communication interfaces를 지원. 이와 같은 인터페이스를 통해 Power analyzer의 리모트 콘트롤을 체험할 수 있고 더욱이 IT9121는 USB-Host interface 기능을 갖고 있어 U discs와 기타 기기, 그리고 사용자는 screenshots을 U disc에 저장할 수 있습니다.



Rich measurement functions(풍부한 측정 기능)

IT9121 Digital Power Analyzer는 active power, reactive power, apparent power, power factor, voltage, current, frequency, phase difference 등 모든 AC와 DC 파라미터를 측정할 수 있습니다. 또한 내장된 측정 기능과 50th harmonic 측정을 각각의 harmonic 요소에 표시할 수 있어 자동차, 가전용 PCB, UPS 등 다양한 분야에 적용할 수 있습니다

Current transducer input(전류 변환 입력)

IT9121 Digital Power Analyzer는 전압은 0-600V 그리고 전류는 0-20A까지 측정할 수 있습니다. 그러나 20A 이상의 전류를 측정하고자 할 경우는 전압입력형 current clamp 또는 current transducer를 작용할 수 있습니다. IT9121 사용 시, 사용자가 50mV-2V (EX1) 또는 2.5V-10V (EXT2)의 범위를 선택하시면 됩니다.



Integral measurement function(내장된 측정 기능)

내장된 기능을 이용하여 서로 연결되어 있는 전력 grids를 측정하여 전력에너지의 매개가 가능합니다.

IT9121 Digital Power Analyzer는 제공하는 current integral과 active power integral (Wh), 자동 범위 절환(Automatic range switching)과 accurate integral 측정의 입력 레벨에 따라 매수/매도 모드를 실행할 수 있습니다.



TFT high-resolution LCD

IT9121에는 3.5-inch color high-resolution TFT LCD가 내장되어 있어 사용자는 고광도 디스플레이로 어두운 환경에서도 실시간으로 측정값을 확인할 수 있습니다.

더불어IT9121 Digital Power Analyzer는 다종의 인터페이스 화면을 제공합니다(View1,View4, View12).

사용자는 스크린 화면의 파라미터 타입과 시퀀스 표시, "Left"와 "Right" 키로 화면을 옮겨 볼 수 있습니다. 인체공학적인 설계는 엔지니어의 다양한 측정 수요를 만족시킬 것입니다.



Harmonic measurement(고조파 측정)

IT9121 Digital Power Analyzer는 100KHZ의 대역폭을 갖고 있다 이는 넓은 dynamic range내에서 고속의 harmonic(고조파) 측정이 가능함을 의미한다.

Harmonic 모드에서 전압, 전류, active power, reactive power와 각 harmonic의 상태, total harmonic factor(THD)를 테스트할 수 있다.

IT9121는 다종의 multiple harmonics 측정이 가능한데 최대 50개의 fundamental frequency harmonics 측정이 가능하다.

각기 측정된 harmonic 파라미터는 IT9121 Digital Power Analyzer의 bar chart에 표시되고 리시트되며 또한 측정 결과 분석에 활용된다.



Application advantages

■ **Power quality analysis of UPS**

통신 산업에서 전원 공급의 backup은 매우 중요하기 때문에 UPS의 안정적 속성과, 역학적 속성, 전원의 질 및 기타의 요소들은 필수 분석이 필요합니다.

내부가 nonlinear 기기이므로 UPS 전원 공급 중 많은 수의 harmonic 요소가 생성될 수 있고 이는 통신 시스템의 작동 중 간섭 원인이 될 수 있습니다.

IT9121 Digital Power Analyzer는 AC/DC 신호의 power factor, harmonics, frequency, distortion factor와 기타 UPS의 전원 속성을 종합적, 체계적으로 분석할 수 있습니다.

■ **Performance test of household electrical appliances**

환경친화적 에너지가 대대적으로 홍보되면서 이에 상응하는 각종의 기술이 도입되고 있는 가전기기의 개념에 맞추어 다양한 주파수 조절 기술이 필요하게 되었고 이를 통해 전력 소비를 줄일 수 있게 되었습니다.

IT9121 Digital Power Analyzer는 inrush current, active power, crest factor와 기타의 파라미터를 측정할 수 있습니다.

IT912X series AC power meter specification

General Specification

Model	IT9121
AC input voltage	100VAC—240VAC 50/60HZ
Warm-up time	Approx 30 minutes
Operating environment	Temperature : 5°C—40°C Humidity : 20%RH—80%RH (No condensation) Altitude : 2000m or less 2000m
Storage environment	Temperature : —20°C—50°C Humidity : 20%RH—80%RH (No condensation) Altitude : 2000m or less 2000m
Installation	Indoors
Safety	IEC 61010—1, EN 61010—1, Measurement CAT II
Maximum power consumption	50VA

Screen Display

	detailed information
Display type	Dimension: 4.3-inch color LCD (TFT) Full screen pixel: 480 (horizontal) *272 (vertical) points Waveform display pixel: 384 (horizontal) *194 (vertical) points Operating temperature: -20°C ~ 70°C Storage temperature: -30°C ~ 80°C Value display: matrix display

Input

Item	Specifications
Input terminal type	voltage; plug-in terminal(safety terminal)
Input type	Current Direct input: large binding post External current sensor input DB9 connector
Input type	Voltage: Floating input through resistive voltage divider Current: Floating input through shunt
Measure range	Voltage: 15V, 30V, 60V, 150V, 300V, 600V current : Direct input: 5mA, 10mA, 20mA, 50mA, 100mA, 200mA, 0.5A, 1A, 2A, 5A, 10A, 20A Sensor input : EX1: 50mV, 100mV, 200mV, 500mV, 1V, 2V; EX2: 2.5V, 5V, 10 V.
Input impedance	Voltage: Input resistance: Approx.2MΩ, input capacitance: Approx.13pF(in parallel with the resistance) current: <ul style="list-style-type: none"> Direct input range 5mA~200mA: Input resistance: Approx.505mΩ Input inductance: Approx0.1μH Direct input range 0.5A~20A: Input resistance: Approx 5mΩ Input inductance: Approx0.1μH Sensor input: Input resistance: Approx 100kΩ (2.5V~10V) Input resistance: Approx 20kΩ (50mV~2V)
Continuous maximum allowable input	Voltage: peak value of 1.5kV or RMS value of 1kV, whichever is less current: <ul style="list-style-type: none"> Direct input range 5mA~200mA: peak value of 30A or RMS value of 20A, whichever is less Direct input range 0.5A~20A: peak value of 100A or RMS value of 30A, whichever is less Sensor input : Peak value less than or equal to 5 times of the rated range
Instantaneous maximum allowable input (1s)	Voltage: peak value of 2kV or RMS value of 1.5kV, whichever is less

Instantaneous maximum allowable input (1s)

Current:

- Direct input range 5mA~200mA:
peak value of 30A or RMS value of 20A, whichever is less
 - Direct input range 0.5A~20A:
peak value of 150A or RMS value of 40A, whichever is less
- Sensor input :
- Peak value less than or equal to 10times of the rated range

Input bandwidth	DC, 0.5Hz~1MHz
Continuous maximum Common-mode voltage	600Vrms, CAT II
Line filter	select OFF, cutoff frequency of 500Hz
Frequency filter	select OFF, cutoff frequency of 500Hz
Range	range of each unit can be set separately
A/D converter	Simultaneous conversion voltage an current inputs Resolution: 18-bit Maximum conversion rate: 10μs

Voltage and Current Accuracy

Item	Specifications
Requirements	temperature: 23±5° C, humidity: 30 ~ 75%RH. Input waveform : Sine wave crest factor: 3, common-mode voltage: 0V Number of displayed digits : 5digits (6 digits when including the decimal point) Frequency filter : Turn on to measure voltage or current of 200Hz or 30 minutes after warm-up time has passed After zero-level compensation or measurement range is changed
Accuracy	DC: ±(0.1% of reading+0.2% of range) 0.5Hz ≤ f < 45Hz: ± (0.1% of reading+0.2% of range) 45Hz ≤ f ≤ 66Hz: ± (0.1% of reading+0.2% of range) 66Hz < f ≤ 1kHz: ± (0.1% of reading+0.2% of range) 1kHz < f ≤ 10kHz: (0.1% of reading+0.2% of range) ±(0.07*f)% of reading+0.3% of range 10kHz < f ≤ 100kHz: ±(0.5% of reading+0.5% of range) ±{(0.04*(f-10))% of reading]

Active Power Accuracy

Item	Specifications
Requirements	same as the conditions for voltage and current. Power factor: 1
Accuracy	DC: (0.1% of reading+0.2% of range) 0.5Hz ≤ f < 45Hz : ±(0.3% of reading+0.2% of range) 45Hz ≤ f ≤ 66Hz : ±(0.1% of reading+0.1% of range) 66Hz < f ≤ 1kHz : ±(0.2% of reading+0.2% of range) 1kHz < f ≤ 10kHz: ±(0.1% of reading+0.3% of range) ±{(0.067*(f-1))% of reacr 10kHz < f ≤ 100kHz: ±(0.5% of reading+0.5% of range) ±{(0.09*(f-10))% of reacr
Influence of power factor	when power factor (λ)=0 (S: apparent power) <ul style="list-style-type: none"> ±0.2% of S for 45Hz ≤ f ≤ 66Hz ±{(0.2+0.2*f)% of S }for up to 100kHz as reference data f is frequency of input signal in kHz when 0 < λ < 1 (Φ: phase angle of the Voltage and current) (power reading) × [(power reading error%) + (power range (power range/indicated apparent power value) + {tanΦ × (influence when λ=0)})]
When the line filter is turned ON	45~66Hz: Add 0.3% of reading <45Hz: Add 1% of reading
Temperature coefficient	same as the temperature coefficient for voltage and current
Accuracy when the crest factor is set to 6	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3
Accuracy of apparent power S	voltage accuracy + current accuracy
Accuracy of reactive power Q	accuracy of apparent power + (√(1.0004-λ ²)-(√(1-λ ²)) × 100%

Accuracy of power Factor λ	$\pm[(\lambda-1/1.0002)+ \cos\theta-\cos(\theta\pm\sin^{-1}(\text{influence from the power factor when } \lambda=0\%/100))]$ ± 1 digit when voltage and current are at the measurement range rated input
Accuracy of phase difference Φ	$\pm[\theta-\cos^{-1}(\lambda/1.0002) +\sin^{-1}(\text{influence from the power factor when } \lambda=0\%/100)]$ ± 1 digit when voltage and current are at the measurement range rated input

Voltage current and power measurements

Item	specifications
Measurement method	digital sampling method
Crest factor	3 or 6
Wiring system	(one element model):single-phase ,two-wire(1P2W)
Range select	select manual or auto ranging
Auto range	Range increase Range increase

	Name	Symbols and meanings
Measurement parameters	voltage current	Select RMS(the true RMS value of voltage and current) - MEAN:(the rectified mean value calibrated to the RMS value of the voltage and the true RMS value of the current) - RMN (rectified mean value of voltage and current DC:(simple average of voltage and current)- AC: alternating current. PP: (peak value of voltage and peak value of current)
	Active power [W]	P
	reactive power [var]	Q
	apparent power [VA]	S
	power factor	λ
	phase difference (°)	ϕ
	frequency (Hz)	fU (FreqU) : voltage frequency fI (FreqI): current frequency
	max/mix of voltage (V)	Upk+: voltage positive peak Upk-: voltage negative peak
	max/mix of current (A)	Ipk+: current positive peak Ipk-: current negative peak
	crest factor	cIU: crest factor of voltage cII: crest factor of current
integration	TM:integration time- WP: sum of positive and negative watt hour- WP+: positive power sum - WP-: negative power sum- q:sum of positive and negative ampere-hour- q+:positive ampere -hour sum- q-:negative ampere-hour sum	
Measurement synchronization source	Select voltage , current, or the entire period of the data update interval for the signal used to achieve synchronization during measurement.	
Line filter	select OFF or ON (cutoff frequency at 500Hz)	
Peak measurement	measures the peak (max,min) value of voltage,current or power from the instantaneous current or instantaneous power that is sampled.	

Frequency measurement

Item	Specifications	
Measurement item	voltage or current frequencies applied to one selected input element can be measured	
Frequency filter	vates depending on the data update interval (see description given later)as follows	
	Data update interval	measurement range
	0.1s	$25\text{Hz} \leq f \leq 100\text{kHz}$
	0.25s	$10\text{Hz} \leq f \leq 100\text{kHz}$
	0.5s	$5\text{Hz} \leq f \leq 100\text{kHz}$
	1s	$2.5\text{Hz} \leq f \leq 100\text{kHz}$
	2s	$1.5\text{Hz} \leq f \leq 50\text{kHz}$
5s	$0.5\text{Hz} \leq f \leq 20\text{kHz}$	
Frequency filter	select OFF or ON (cutoff frequency of 500Hz)	
Accuracy	requirements : When the input signal level is 30% or more of the measurement range if the crest factor is set to 3 (60% or more if the crest factor is set to 6) ,Frequency filter is ON when measuring voltage or current of 200Hz or less. Accuracy: $\pm(0.06\%$ of reading)	

Harmonic measurement

Measured item	all installed elements
Method	PLL synchronization method
Frequency range	fundamental frequency of the PLL source is in the range of 10Hz to 1.2kHz
PLL source	select voltage of current of each input element
FFT data length	1024

	Name	Symbols and meanings
measurement parameter	Voltage (V)	U(k) : voltage effective value of Kth harmonic U(Total) : voltage effective value
	Current (A)	I(k) : current effective value of Kth harmonic I(Total) : current effective value
	Active power (W)	P(k) : active power of Kth harmonic P(Total) : Active power
	Apparent power (VA)	S(k) : apparent power of Kth harmonic S(Total) : total apparent power
	Reactive power(var)	Q(k) : reactive power of Kth harmonic Q(Total) : total reactive power
	power factor	$\lambda(k)$: power factor of Kth harmonic $\lambda(\text{Total})$: Total power factor
	phase difference	$\phi(k)$: phase difference between voltage and current of Kth harmonic $\phi U(k)$: voltage phase difference between Kth harmonic(UK) and fundamental wave(U1) $\phi I(k)$: current phase difference between Kth harmonic(IK) and fundamental wave(I1) ϕ : total phase difference
	harmonic distortion factor (%)	Uhd(k): Voltage ratio of Kth harmonic(Uk) and fundamental wave(U1) or total distortion wave(Utotal) Ihd(k): current ratio of Kth harmonic (Ik) and fundamental wave(I1) or total distortion wave(Itotal) Phd(k): active power ratio of Kth harmonic(Pk)and fundamental wave (P1) or total distortion wave(Ptotal)
	(THD) total harmonic distortion	Uthd: voltage ratio of total harmonic and fundamental wave(U1) or total distortion wave(Utotal) Ithd: current ratio of total harmonic and fundamental wave(I1) or total distortion wave(Itotal) Pthd: active power ratio of total harmonic and fundamental wave(P1) or total distortion wave(Ptotal)
	Window function	Optional signal voltage, current or data update cycle is the interval as the synchronization source when measuring

Note:K is a integer from 0 to upper limit of harmonic analyse times.0th means DC parameter.User can configure the maximum number of harmonic times manually or auto-decided by equipment,taking the minimum value between the two methods.IT9121 can measure up to 50th harmonic.

Fundamental frequency

Fundamental frequency	sample rate	window width	upper limit of* analysis orders
10Hz ~ 75Hz	f*1024	1	50
75Hz ~ 150Hz	f*512	2	32
150Hz ~ 300Hz	f*256	4	16
300Hz ~ 600Hz	f*128	8	8
600Hz ~ 1200Hz	f*64	16	4

*the upper limit of analysis orders can be decrease

Accuracy

*When line filter is off, the accuracy shown below is the sum of reading and range errors

Frequency	Voltage	Current	Power
10Hz $\leq f < 45$ Hz	0.15% of reading +0.35% of range	0.15% of reading +0.35% of range	0.15% of reading +0.50% of range
45Hz $\leq f \leq 440$ Hz	0.15% of reading +0.35% of range	0.15% of reading +0.35% of range	0.20% of reading +0.50% of range
440Hz $< f \leq 1$ kHz	0.20% of reading +0.35% of range	0.20% of reading +0.35% of range	0.40% of reading +0.50% of range
1kHz $< f \leq 2.5$ kHz	0.80% of reading +0.45% of range	0.80% of reading +0.45% of range	1.56% of reading +0.60% of range
2.5kHz $< f \leq 5$ kHz	3.05% of reading +0.45% of range	3.05% of reading +0.45% of range	5.77% of reading +0.60% of range

Interface

- USB interface
- Ethernet interface
- GP-IB interface
- RS232 interface