IT9121E Power Meter



Applications

Motors, household appliances, UPS , etc.

The IT9121E power meter can provide the maximum input of 600Vrms and 20Arms and measurement bandwidth of 100kHZ, and can be easily used for measuring the voltage, current, power, frequency, harmonics and other parameters. The standard configuration includes USB, GPIB, RS232 and LAN communication interfaces and also interfaces for USB-based peripheral devices. The user can save the measured parameters into the external storage medium. The basic voltage and current accuracy is 0.1%. Moreover, the power meter has rich integrating functions, such as the active power. It is widely applied in test of motors, household appliances, UPS, etc.

Feature

- 4.3-inch color LCD (TFT)
- The row number of matrix displayed on the screen can be set freely and common measurement parameters can be displayed
- Input range: 600Vrms / 20Arms
- The voltage, current, power, harmonics and other parameters can be measured at the same time
- The accuracy of voltage and current measurement is up to 0.1%
- The interfaces for USB-based peripheral devices are provided, and the user can save data into the external storage medium
- The power analyzer has rich and powerful integrating functions, and can be used for measuring electric energy which is bought or sold
- The power meter also has a function of frequency measurement
- Standard built-in USB, GPIB, RS232 and Ethernet communication interfaces

Model	Voltage	Current	Size
IT9121E	600V	20A	1/2 2U

Communication Interface

The standard configuration of the IT9121E power analyzer includes, the USB, GPIB, RS232 and Ethernet communication interfaces. Remote control of the power meter can be realized via these interfaces. In addition, IT9121E is also equipped with a USB-Host interface for connection of U discs and other devices, and the user can save screenshots into the U disc.

Rich Measurement Function

The IT9121E power meter can measure all AC and DC parameters, including the active power, reactive power, apparent power, power factor, voltage, current, frequency, phase difference, etc. It also has the function of integral measurement, and can be widely applied in tests of motors, household PCB, UPS, etc.

Integral Measurement Function

Due to the power integral function, the sold/bought electric energy in the interconnected power grids can be measured. The IT9121E power analyzer can provide the current integral and active power integral (Wh). Automatic range switching and accurate integral measurement can be carried out in the Buy and Sell mode, according to the input level.



Current Sensor Input

The IT9121E power analyzer can be used for measuring the voltage of 0-600V and current of 0-20A. For measurement of the current above 20A, the voltage input type current clamp or current transducer can be applied. When IT9121 is used, the user can select the 50mV-2V (EX1) or 2.5V-10V (EXT2).



Self-define Interface Display Style

IT9100 power meter provides a 4.3-inch color high-resolution TFT LCD for the user, and real-time values can be displayed with high brightness and remarkable colors even in a dark test environment. In addition, the IT9100 power meter provides multiple interface display styles (View1, View4 and View12). The user can customize the screen display parameter type and display sequence. The humanized design meets engineers' measurement demands in different tests.



IT-E185 Power meter fixture

IT-E185 is an optional accessory, it can facilitate wiring test of IT9100 power meter for users.



Abundant measurement function

IT9100 power meter can measure all AC and DC parameters, including active power, reactive power, apparent power, power factor, voltage, current, frequency, phase difference, etc.. IT9100 provides integrated measurement and up to 50 times of the harmonic measurement function. It is widely used in electronic motors, home appliances PCB board, UPS power supply and other test areas.

Specification

General Specification

Model	IT9121E
AC input voltage	100 VAC — 240 VAC 47-63 Hz
Warm-up time	Above 30 minutes
Operating environment	Temperature : 5℃— 40℃ Humidity : 30% RH— 75% RH（No condensation） Altitude : 2000 m or less 2000 m
Storage environment	Temperature : -20℃— 50℃ Humidity : 30% RH— 75% RH（No condensation） Altitude : 2000 m or less 2000 m
Installation	Indoors
Safety	IEC 61010-1, EN 61010-1, Measurement CAT Ⅱ
Maximum power consumption	50 VA

Screen Display

	Detailed Information
Display type	Dimension：4.3-inch color TFT display Full screen pixel：480（horizontal）*272（vertical）points Waveform display pixel： 384（horizontal）*194（vertical）points Operating temperature： -20℃~ 70℃ Storage temperature： -30℃~ 80℃ 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
Voltage	Crest factor 3	IT9121E：15V/30V/60V/150V/300V/600V
	Crest factor 6	IT9121E：7.5V/15V/30V/75V/150V/300V
Direct Current input	Crest factor 3	IT9121E：5mA/10mA /20mA /50mA /100mA / 200mA /0.5A/1A/2A/5A/10A/20A
	Crest factor 6	T9121E：2.5 mA /5mA/10mA/25mA/50mA/100mA/ 250mA/0.5A/1A/2.5A/5A/10A.
External Current sensor input (/EX1)	Crest factor 3	IT9121E：2.5V/5V/10 V
	Crest factor 6	IT9121E：1.25V/2.5V/5V
External Current sensor input (/EX2)	Crest factor 3	IT9121E：50mV/100mV/200mV/500mV/1V/2V
	Crest factor 6	IT9121E：25mV/50mV/100mV/250mV/500mV/1V

Input impedance

Voltage: Input resistance: Approx. 2 MΩ, input capacitace: Approx.13 pF (in parallel with the resistance)

current:

- Direct input range 5 mA ~ 200 mA:
  Input resistance: Appro x 505 mΩ
  Input inductance: Appro x 0.1 μH
- Direct input range 0.5A ~ 20 A:
  Input resistance: Appro x 5 mΩ
  Input inductance: Appro x 0.1 μH
- Sensor input:
  Input resistance:Appro x 100 kΩ（2.5 V ~ 10 V）
  Input resistance:Appro x 20 kΩ（50 mV ~ 2 V）

Input bandwidth	DC, 0.5 Hz ~ 100kHz
Line filter	select OFF, cut off frequency of 500 Hz
Frequency filter	select OFF, cut off frequency of 500 Hz
Range	range of each unit can be set separately
A/D converter	Simultaneous conversion voltage an current inputs Resolution: 18-bit Maximum conversion rate: 10 μs

Voltage and Current Accuracy

Item	Specifications
Requirements	temperature：23 ± 5℃ humidity：30~75% RH Input waveform: Sine wave crest factor: 3, common-mode voltage: 0 V Number of displayed digits: 5 digits (6 digits when including the decimal point) Frequency filter : Turn on to measure voltage or current of 200 Hz 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) 10 Hz ≤ f ＜ 45 Hz：± (0.1 % of reading + 0.2 % of range) 45 Hz ≤ f ≤ 66 Hz：± (0.1 % of reading + 0.1 % of range) 66 Hz ＜ f ≤ 1kHz：± (0.1 % of reading + 0.2 % of range) 1 kHz ＜ f ≤ 10 kHz： ± (0.07 *f) % of reading + 0.3% of range) 10 kHz ＜ f ≤ 100 kHz： ± (0.5 % of reading + 0.5 % of range) ± [{0.04x(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) 10Hz ≤ f ＜ 45 Hz：± (0.3 % of reading + 0.2 % of range) 45 Hz ≤ f ≤ 66 Hz：± (0.1 % of reading + 0.1 % of range) 66 Hz ＜ f ≤ 1kHz：± (0.2 % of reading + 0.2 % of range) 1 kHz ＜ f ≤ 10 kHz： ± (0.1 % of reading + 0.3 % of range) ± [{0.067x(f-1)}% of reading] 10 kHz ＜ f ≤ 100 kHz： ± (0.5 % of reading + 0.5 % of range) ± [{0.09x(f-10)}% of reading]
Influence of power factor	when power factor (λ)=0 (S:apparent power) • ± 0.2 % of S for 45 Hz ≤ f ≤ 66 Hz • ± {(0.2 + 0.2 × f) % of S } for up to 100 kHz 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=o)%}]
When the line filter is turned ON	45 ~ 66 Hz: Add 0.3 % of reading < 45 Hz: 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 - λ2) - (√1 - λ2)] ×100 %

Accuracy of power factor λ	± [(λ-λ/1.0002)+ | cosø-cos{ø+sin-1 (influence from the power factor when λ = 0%/100)} |] ±1digit when voltage and current are at the measurement range rated input
Accuracy of phase difference Φ	± [| ø-cos-1(λ/1.0002) | +sin-1(influence from the power factor when λ = 0 %/100)] ± 1digit 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(1 P2 W)
Range select	select manual or auto ranging
Auto range	auto-range increase auto-range decline

	Name	Symbols And Meanings
Measurement parameters	Voltage current	Select RMS (the effective RMS value of voltage andcurrent)、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 di fference (°)	φ
	Frequency (Hz)	fU(FreqU) : voltage frequency fI(FreqI) : current frequency
	Max/min of voltage (V)	Upk+: voltage positive peak Upk-: voltage negative peak
	Max/min of current (A)	Ipk+: current positive peak Ipk-: current negative peak
	Crest factor	CfU: crest factor of voltage CfI: 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 updata interval for the signal used to achieve synchronization during measurement.	
Line filter	Select OFF or ON (cut off frequency at 500 Hz)	
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 test range	Vaties depending on the data update interval (see description given later) as follows	
	Data update interval	Measurement range
	0.1 s	25 Hz ≤ f ≤ 100 kHz
	0.25 s	10 Hz ≤ f ≤ 100 kHz
	0.5 s	5 Hz ≤ f ≤ 100 kHz
	1 s	2.5 Hz ≤ f ≤ 100 kHz
	2 s	1.5 Hz ≤ f ≤ 50 kHz
	5 s	0.5 Hz ≤ f ≤ 20 kHz
Frequency filter	Select OFF or ON (cut off frequency of 500 Hz)	
Accuracy	Requirements : When the input signal level is 20 % or more of the measurement range and the crest factor is set to 3 (40 % or more if the crest factor is set to 6).	

Harmonic Measurement

Measured item	All installed elements
Method	PLL synchronization method
Frequency range	Fundamental frequency of the PLL source is in the range of 10 Hz to 1.2 kHz
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) : curent effective value of Kth harmonic	I(Total) : curent 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	λ(k) : power factor of Kth harmonic	λ(Total) : Total power factor
	Phase difference	φ(k) : phase difference between voltage and current of Kth harmonic φU(k) voltage phase difference between Kth harmonic(UK) and fundamental wave(U1) φI(k) : current phase difference between Kth harmonic(IK) and fundamental wave(I1)	φ:total phase difference
	Harmonic distortion factor(%)	Uhdf(k) : Voltage ratio of Kth harmonic(Uk) and fundmental wave(U1) current Ihdf(k) : ratio of Kth harmonic（Ik）and fundmental wave(I1） active power Phdf(k) : ratio of Kth harmonic(Pk)and fundmental wave (P1)or total distortion wave(Ptotal) or Total distortion wave(Itotal）or total distortion wave(Utotal)	
	（THD）total harmonic distortion	Uthd : voltage ratio of total harmonic and fundmental wave(U1) or total distortion wave(Utotal). Ithd : current ratio of total harmonic and fundmental wave(I1) or total distortion wave(Itotal). Pthd : active power ratio of total harmonic and fundmental wave(P1) or total distortion wave(Ptotal)	
Window function	Rectangle		

Note

- This function is only available for IT9121, optional function for IT9121E.
- 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 minmum 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
10 Hz ~ 75 Hz	f * 1024	1	50
75 Hz ~ 150 Hz	f * 512	2	32
150 Hz ~ 300 Hz	f * 256	4	16
300 Hz ~ 600 Hz	f * 128	8	8
600 Hz ~ 1200 Hz	f * 64	16	4

* the upper limit of analysis orders can be decreased

Accuracy

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

Frequency	Voltage	Current	Power
10 Hz ≤ f ＜ 45 kHz	0.15%of reading +0.35%of range	0.15%of reading +0.35%of range	0.15%of reading +0.50%of range
45 Hz ≤ f ≤ 440 kHz	0.15%of reading +0.35%of range	0.15%of reading +0.35%of range	0.20%of reading +0.50%of range
440 Hz ＜ f ≤ 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
1 kHz ＜ f ≤ 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
2.5 kHz＜ f ≤ 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
- GPIB
- Ethernet
- RS232