

Technical Specification

PART 1: Spectroradiometer_1.5m integrating sphere system for SSL luminaire testing and other required equipment

The system can test *Luminous Flux, Luminous efficacy, $P(\lambda)$, Chromaticity Coordinate, Correlated Color Temperature, Color Rendering Index, SDCM, Dominant Wavelength, Half length*, electrical characteristics etc.

1. HAAS-2000 High Accuracy Array Spectroradiometer (380nm~780nm) 1PC

➤ **Panted in USA and China, Research Achievement of China National 863 High-tech Program;**

➤ **World leading Specifications:**

- ◆ **Can measure the spectral of flash light $<1 \mu S$;**
- ◆ **0.3% Photometry Linearity;**
- ◆ **Up to 0.01mcd sensitivity;**
- ◆ **0.0015x, y accuracy;**
- ◆ **5.00E-05 stray light level;**

➤ **Overview:**

HAAS-2000 adopts the highest quality flat-field concave grating (designed by EVERFINE and OEM from the world top manufacturer) and scientific grade TE-cooled array CCDs (made by the world top manufacturer). Besides, EVERFINE has abundant experience in developing high-accuracy & high-speed spectroradiometer. We improve the design of the array detectors and gratings to make the optical matching more perfect, so that the system can obtain purer spectrum and better linearity.

In addition, with the special stray light controlling technology, dynamic range widening technology, precise electronic array detector driving technology and complex variable matrix software technology, and by adopting the patent Bandpass-filter Wheel Correcting Technique (BWCT) and modified NIST stray light correction technology, the spectroradiometer developed by EVERFINE can realize ultra low stray light of 5.00E-05 (Under illuminant A) and super photometry linearity of 0.3% in overall dynamic range. Its key specifications are leading in the world.

HAAS-2000 can reach scientific accuracy and very high measurement efficiency.

➤ **Measurement Functions:**

Due to the millisecond measurement speed, HAAS-2000 can be used for not only steady state (DC) measurement, but also the transient (Pulses) measurement of LEDs, and fully meets the requirement of the relevant standards like IESNA LM-79 and GB/T 24824.

At the stable measurement occasions such as the measurement for traditional lamps like CFL, HID lamps, Halogen Lamps, HAAS-2000 can reach scientific accuracy and very high measurement efficiency.

Measurement Items including:

- 1) Luminous Flux(lm);
- 2) Luminous efficacy(lm/W);
- 3) Spectral Power Distribution $P(\lambda)$;
- 4) Chromaticity Coordinate: (x,y), (u,v);
- 5) Correlated Color Temperature T_c , Color Rendering Index: R_a , R_i ($i=1\sim 15$);
- 6) Standard deviation of color matching (SDCM);
- 7) Peak Wavelength;
- 8) Dominant Wavelength;
- 9) Spectral Half Width;
- 10) Colorimetric Purity;
- 11) Radiant power;
- 12) The variety curve of the lumen/power/voltage/current VS time after the lamp is power on;
- 13) Automatic binning function according to the settable quantities such as voltage, current, luminous flux, wavelength and color temperature;
- 14) The software is optional for the self absorption measurement and correction.
- 15) Equipped with a temperature controller, HAAS-2000 can test photometric & colorimetric characteristics of LEDs at different case temperature.

➤ **Main specifications:**

Items	Main Specification
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Optical Bench	
Grating	Holographic grating with flat-field correction
Slit width	100μm (standard)
Optical input	Fiber Optics
Spectrograph	
Spectral range	380-780nm
Spectral resolution	2.0nm
Wavelength accuracy	± 0.3nm
Stray light (Illuminant A)	5.00E-05 (BWCT is applied)
Colorimetric Parameters	
Accuracy of chromatic (x, y)	±0.0015(standard light);(BWCT is applied)
Chromaticity (x, y) reproducibility	±0.0003(standard A light source); ±0.00015x, ±0.0002y (blue LED);
Range of CCT	1000~100000K
Electrical Data	
AD Converter	16bits/1.25MHz
PC interface	USB2.0
Integration Time	9mS-60S
Photometry	
Linearity	±0.3%
Luminous flux range	0.01-200,000lm(Equipped with appropriate integrating sphere)

2. Φ1.5m INTEGRATING SPHERE (SPEKTRON™ coating R98, with side opening Φ500mm) 1PC

It is an ideal light collector which is usually accompanied with a spectroradiometer for spectral, colorimetric, and photometric measurement of light sources, typically for LED modules and LED luminaires.

- Diffuse reflectance coating, and appears lambertian (perfectly diffuse)

properties, non-toxic, durable and optically stable over time.

- Spektron™ inner coating R98, $\rho(\lambda) = 94\% - 97\%$ (380nm~500nm), $\rho(\lambda) = 96\% - 98\%$ (500nm~1500nm), The certificate of spectral reflectivity $\rho(\lambda)$ will be provided.
- The integrating sphere is capable of performing **4 π and 2 π geometry** measurements. The side opening is $\Phi 500\text{mm}$ for 2 π measurement, and equipped with lamp holder inside for 4 π measurement: E14, E27, E40, Gu10 (base-up), G13/G5.
- Material: cool-crush steel.
- Optional: auxiliary lamp socket and its barrier.

3. D204 (2856K) GENERAL STANDARD LAMP 3 PCS

A halogen lamp employed to calibrate the color temperature (spectral power distribution) and luminous flux.

- high repeatability and stability.
- NIM(China) traceable
- Optional: Provide a CNAS accredited calibration certificate (CNAS is the national accreditation body of China.)
- The data sheet as below are just for reference and the specific value would be found on the package of the lamp

Calibrated current: about 4A

Reference voltage: about 20V

Calibrated CCT: 2856K

Calibrated lumen: about 1400lm

4. WY305 Digital CC&CV DC Power Supply 1PC

WY305 is specially designed for the standard lamps and other light sources which require high stability DC power. It integrates together the constant current DC power, constant voltage DC power supply, and high accuracy digital

power meter. RS-232 interface, and the output can be controlled automatically by the computer.

- Maximum voltage output: 30V
- Maximum current output: 5A
- Maximum output power: 150VA
- Output voltage drift in full range: $\pm 0.01\%rdg/30mins$
(preheat 10mins after arriving in full range state)
- Output current drift in full range: $\pm 0.01\%rdg/30mins$
(preheat 10mins after arriving in full range state)
- Measurement range of Voltmeter: 5V/10V/25V/50V
- Measurement range of Ammeter: 0.5A/1A/2.5A/5A
- Voltmeter resolution: 0.0001V (0.0000V~50.0000V)
- Ammeter resolution: 0.00001A (0.00000A~5.00000A)
- Basic accuracy of Voltmeter and Ammeter:

CLASS 0.05: $\pm (0.03\%reading+0.02\%range+1digit)$

5. DPS1010 AC Testing Power Source 1PC

DPS serial AC power supply is designed according to the technical conditions of SJ/T10541, GB6587, and GB7260. It has advantages of high loading capacity, high stability, pure output waveform and convenient operation.

- 1) Output capacity: 1kVA
- 2) Input voltage: 110V \pm 11V/ 220V \pm 22V, 50Hz/60Hz
- 3) Output voltage: 2v~150v/2V~300V (1 Φ)
- 4) Stability of voltage: $\leq 0.2\%$
- 5) Maximum output current: 0-150V:9.2A, 0-300V:4.6A
- 6) Output frequency: 40~65Hz 40-450Hz (optional)
- 7) Stability of frequency $\leq 0.03\%reading+1$ digit
- 8) Measuring accuracy of voltage and current :

$\pm (0.4\%reading + 0.1\%range + 1digit)$

- 9) Range of voltmeter: 75V/150V/300V
- 10) Range of amperemeter: 0.5A/2A/10A
- 11) Output waveform: sine wave and THD: $\leq 0.5\%$
- 12) 4 displays: V, A, W/PF, Hz
- 13) Alarm when short circuit, overload or overheat
- 14) Efficiency: $\geq 80\%$

6. PF310 Digital Power Meter(Multifunction & wideband & high accuracy) 1PC

PF310 is a multifunction, wideband, high accuracy digital power meter. It covers functions including harmonic analysis, integration, scaling, averaging, data reviewing and communication, etc. It is suitable for measuring DC, and 0.5Hz-100 kHz signals. The accuracy can reach 0.15% at the frequency range of 45Hz-65Hz.

A window displays: V, A, W, Harmonic order (0~50), integration time

B window displays: V, A, W, Vi, Ai, Wi

C window displays: V, A, W, var, VA, Vpk, Apk, PF, deg

D window displays: V-CF, A-CF, V-Hz, A-Hz; Vi%, Ai% V%THD etc.

Measuring range:

Item	Voltage	Current
Input Range (RMS)	CF=3: 15/30/60/150/300/600V CF=6: 7.5/15/30/75/150/300	Direct Input: CF=3: 5/10/20/50/100/200mA 0.5/1/2/5/10/20A CF=6: 2.5/5/10/25/50/100mA 0.25/0.5/1/2.5/5/10A Exterior shunt Input: CF=3: 50/100/200mV CF=6: 25/50/100mV
Range Switch	Auto / Manual Operation	
Test Mode	RMS / MEAN / DC	

Frequency Range	DC, AC 0.5Hz~100kHz	
A/D Converter	Resolution: 16-bit	Maximum Converting rate: 100kHz

Measuring Accuracy:

Condition	Voltage (V)	Current (A)
Humidity:30~75%RH Temp.:23±5℃ source: 220V±5% Input waveform :sine waveform Input:10~100% range Common Mode: 0 V Power Factor: COSφ=1 Linearity Filter: cut-off Wave Crest Factor: CF=3 Within Half Year after leaving the factory.	DC ±(0.1%reading+0.1%range+1 digit)	DC ±(0.1%reading+0.2%range+1 digit)
	0.5Hz~45Hz: ±(0.1% reading+0.2%range+1 digit)	0.5Hz~45Hz: ±(0.3%reading+0.2%range+1 digit)
	45Hz~65Hz: ±(0.05%reading+0.1%range+1 digit)	45Hz~65Hz: ±(0.05%reading+0.1%range+1 digit)
	65Hz~1kHz: ±(0.1%reading+0.2%range+1 digit)	65Hz~1kHz: ±(0.2%reading+0.2%range+1 digit)
	1kHz~10kHz: ±(0.07*f%reading+0.3%range+1 digit)	1kHz~10kHz: ±
	10kHz~100kHz: ±	10kHz~100kHz: ±
	± {(0.5%reading+0.5%range)±(0.04*(f-10)%reading)+1 digit}	± {(0.1%reading+0.3%range)±(0.067*(f-1)%reading)+1 digit}
	±	±
	±	±
	±	±

- 1) **Harmonic analysis:** Total Harmonic Distortion(THD) and 2nd-50th sub-harmonic of fundamental frequency 20Hz~2kHz of voltage and current
- 2) **Scaling function:** when connecting external potential transformer(Optional) and current transformer, the scale data can be preset
- 3) **Averaging function:** Users can use the averaging (AVG) function due to the instability of signal
- 4) **Integration function:** Four kinds of integral models, and the integrating time can be preset
- 5) **Filtering function:** 500Hz、5kHz low-pass filter, linear filter and zero crossing filter selectable

- 6) **Display refreshing:** 0.1s,0.25s,0.5s,1s,2s,5s
- 7) **Save/call:** Save or call data under any measurement states
- 8) **Peak Holding:** Holding the peak value automatically
- 9) **Communication:** USB interface and equipped with special software
- 10) **Holding function:** Easy to read

7. YF1000 cabinet 1PC

Put the testing instruments into the cabinet as a whole and makes the operations more convenient.

8. SPIC-200B Spectral Irradiance Colorimeter 1PC

SPIC-200 adopts the international patents, and leads the mobile era for spectral measurement. It has compact size and high-end configuration. The measurement and analysis could be completed synchronously by only one touch.

Its portability and versatile functions make it widely applied in on-site test, such as building, plants growing, commercial and indoor lighting. Also, it can be used in the R&D and inspection laboratories, production lines for lighting products.

➤ Measurement items

The relative spectral power distribution, illuminance, luminous flux, CRI, CCT, Chromaticity coordinate, SDCM, radiant power etc.

➤ Main specifications

Model	SPIC-200 B
Spectra range	(380~780) nm
Lighting area	(Φ8+Φ3.5)mm
CCD	256 pixels
Wavelength accuracy	±0.5nm
Illuminance accuracy	3% reading + 1 digit
Stray light	< 0.3%
Integrating time	5 ms - 60000 ms

Illuminance range	0.1 lux~200 klux
Color temperature range	1000 K~100000 K
Accuracy of chromaticity coordinate	± 0.001 (Relative to standard light source whose stability is better than ± 0.0001 and NIM traceable)
CRI	Ra; Ri (i=1~14) (Special for R ₁₅)
Power supply	Lithium battery(3.7V);more than 4hours running time
Communication	Main unit_detector: RS232&USB (blue tooth is optional) Main unit_PC: (WIFI is optional)
Data store	4G SD (expanded is available)
Weight (including battery)	200 g

PART 2: GO-2000A Goniophotometer

➤ Main Reference Standards:

CIE 70-1987 The measurement of absolute luminous intensity distributions;

CIE 84 Measurement of luminous flux;

CIE 102 Recommended file format for electronic transfer of luminaire photometric data;

CIE 121-1996 The photometry of goniophotometer of luminaries;

IEC/TR 61341 ed2.0 Method of measurement of centre beam intensity and beam angle(s) of reflector lamps(2010);

IESNA LM-75 Goniophotometer Types and Photometric Coordinates;

EN 13032-1 Light and lighting —Measurement and presentation of photometric data of lamps and luminaires;

Energy Star program requirements for Solid-state Lighting Luminaires;

LB/T 001-2009 Measurement Method for Integral LED Road Lights;

GB/T 24824-2009 Measurement Methods of LED modules for general lighting;

GB/T 24823-2009 LED Modules for general lighting – Performance Requirements;

➤ **Measurement function:**

1) Luminous intensity distribution curve, luminous intensity data, efficient luminescence angle, beam angle, luminous flux, luminous efficacy, luminaires efficiency, iso-illuminance diagrams, isocandela diagrams, maximum ratio of distance to height, available average illuminance curve (AAI curve), coefficient of utilization, luminance limitation curves, and etc.

2) Voltage, current, power, PF, frequency, harmonics and other electrical parameters.

3) Spectral and colorimetric quantities in various spatial directions, averaged chromaticity and spatial non-uniformity of chromaticity.

➤ **Application:**

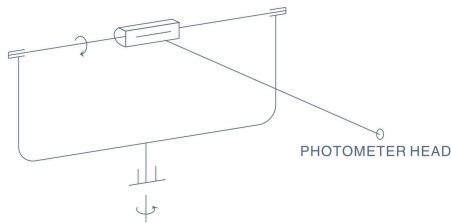
Luminous intensity distribution and total luminous flux measurement for all types of luminaires, e.g. CFL, FL, HID, incandescent lamps, LED modules, LED luminaires, street luminaires, flood luminaires, indoor luminaires, outdoor luminaires.

➤ **Basic Principle:**

GO-2000A is a goniophotometer with facility for turning the light source. The light source and the photometer head are laid horizontally. The lamp or luminaire rotates around the photometric center of itself while the photometer is fixed, therefore long measuring distance can easily be achieved with this kind of Goniophotometer. The changing of burning attitude may cause fluctuation of the irradiation of the light sources and affect the measurement precision, however, the goniometer itself is stable and reliable, it is widely applied in industry.

GO-2000A can realize both **CIE C- γ** solution, typically for the measurement for indoor and road lights, and **CIE B- β** solution, typically for the measurement

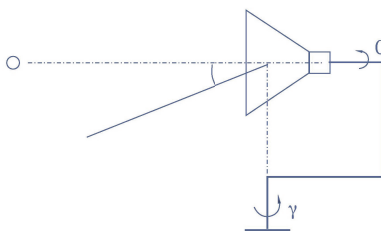
for flood lights.



Goniophotometer with facility for turning the light source (B-β)
卧式分布光度计的原理示意图 (B-β)



CIE B-β Solution



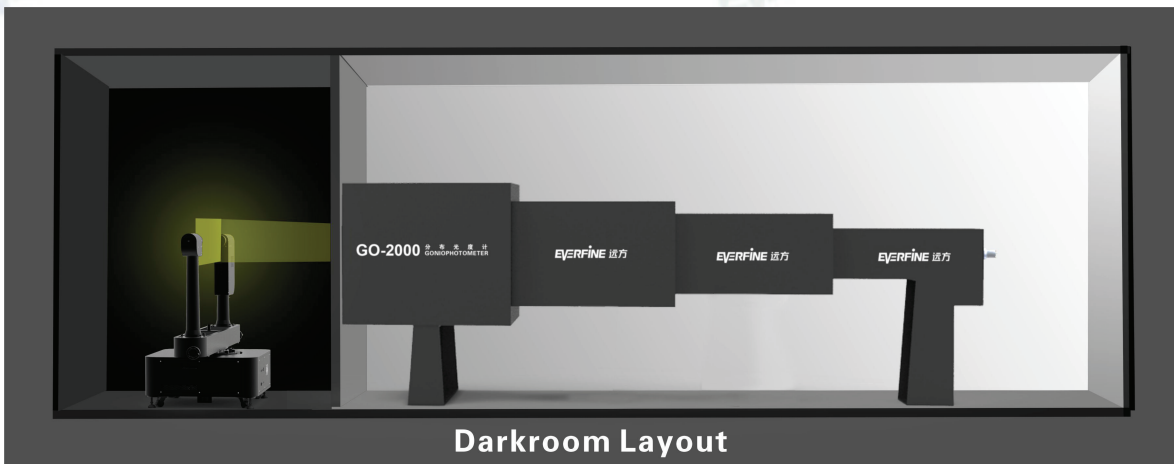
Goniophotometer with facility for turning the light source (C-γ)
卧式分布光度计的原理示意图 (C-γ)



CIE C-γ Solution

➤ **Dark room requirement:**

Recommended size of the darkroom: 2.8m(H)* 3.5m (W) * 10.0m (L) or above.



➤ **Technical specifications**

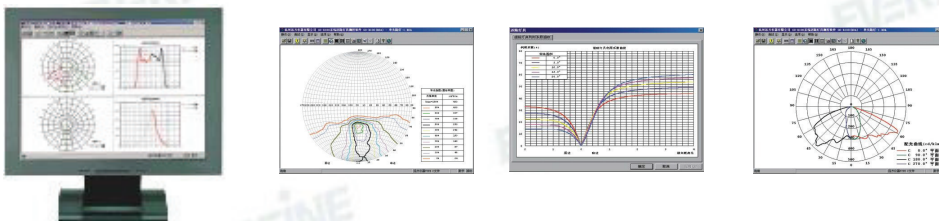
GO-2000A Goniophotometer

Including:

- 1) GO-2000A Goniometer (CIE B- β plus C- γ solution, 0.1°angle accuracy) 1PC
- 2) CT400 Goniophotometer Controller 1PC
- 3) ID-1000 Photometer Head (CLASS A) 1PC
- 4) YF1750 photometer head supporter 1PC
- 5) Precise Laser alignment system 1SET
- 6) GO-SOFT Software 1PC

Goniometer Parameters:

- 1) The light source rotates around both horizontal axis and vertical axis, while the photometer head is fixed. Range of rotation angle: $\pm 180^\circ$.
- 2) Accuracy of rotation angle: $\pm 0.1^\circ$.
- 3) Angle controlling resolution: 0.001° .
- 4) The angle encoder is located at the end out-put axis. The precise closing-ring mechanism make the goniophotometer realize the extremely high angle accuracy.
- 5) EVERFINE Patent (No.ZL200720184017.2) design for the rotation base, make the installation of the test luminaire more convenient, and make the rotation base more stable.
- 6) The maximum vertical distance from the slide-rail to the rotation center is 1000mm. The maximum horizontal distance from the rotation center to the triple clamp is 787mm. The above specifications determine the maximum size of the test lamps or luminaires including lamp holders: 1500mm(width) *2000mm(height) at CIE B- β Solution, or Dia. Φ 2000mm at CIE C- γ Solution.
- 7) The maximum load (include the test light source and its holder): 60kg.
- 8) The Go-software output the test result in CIE, IESNA 95,2001), EULUMDAT, CIBSE(TM14) file format. And the output file can directly match international Universal Lighting Design Software such as Dialux, AGI32, Lumen-Micro. Typical Test Report:



Photometer Parameters:

- Pre-amplified and constant-temperated photometer head, CLASS A ($f_1' < 3.0\%$) $V(\lambda)$ correction, temperature controlling accuracy: $\pm 0.05^\circ\text{C}$ (The constant point of temperature: $35^\circ\text{C} \pm 1^\circ\text{C}$).
- The measuring range of illuminance: 0.0001lx—200klx, auto range.
- The detecting ability of photometer: $1 \times 10^{-4}\text{lx}$.
- Photometry linearity: 0.2%
- Accuracy of photometry: $\pm 1.0\%$ (For the calibrated standard luminous intensity lamp).

Others:

- The slim holder of the light source blocks the tested light beam as little as possible
- Equipped with precise horizontal and vertical cross laser device, This makes the alignment of the goniophotometer itself and the tested light source very easily and with highest precise.
- Emergency stop function.
- Fast/ medial/ slow adjustable scanning speed, Measurement speed: up to 2 minutes/rotation.
- CAN communication mode, faster and more reliable.

2. Standard luminous Intensity lamp 1PC

Used to calibration the system and transfer photometric quantities.

- High repeatability and stability.
- NIM(China) traceable, NIST (USA) traceable is optional.
- Optional: Provide a CNAS accredited calibration certificate (CNAS is the national accreditation body of China.)
- Equipped with self alignment device.

3. WY3010 Digital CC&CV DC Power Supply 1PC

WY3010 is specially designed for the standard lamps and other light sources which require high stability DC power. It integrates together the constant current DC power, constant voltage DC power supply, and high accuracy digital

power meter.

- Maximum voltage output: 30V
- Maximum current output: 10A
- Maximum output power: 300VA
- Output voltage drift in full range: $\pm 0.01\%rdg/10mins$
- Output current drift in full range: $\pm 0.01\%rdg/10mins$
- Measurement range of Voltmeter: 5V/10V/25V/50V auto switch
- Measurement range of Ammeter: 1A/2A/5A/10A auto switch
- Voltmeter resolution: 0.0001V (0.0000V~10.000V)
0.001V (10.000~50.000V)
- Ammeter resolution: 0.0001A (0.0000A~10.0000A)
- Basic accuracy of Voltmeter and Ammeter:
 $\pm (0.03\%reading+0.02\%range+1digit)$

4.PF310 Digital Power Meter(Multifunction & wideband & high accuracy) 1PC

PF310 is a multifunction, wideband, high accuracy digital power meter. It covers functions including harmonic analysis, integration, scaling, averaging, data reviewing and communication, etc. It is suitable for measuring DC, and 0.5Hz-100 kHz signals. The accuracy can reach 0.15% at the frequency range of 45Hz-65Hz.

A window displays: V, A, W, Harmonic order (0~50), integration time

B window displays: V, A, W, Vi, Ai, Wi

C window displays: V, A, W, var, VA, Vpk, Apk, PF, deg

D window displays: V-CF, A-CF, V-Hz, A-Hz; Vi%, Ai% V%THD etc.

Measuring range:

Item	Voltage	Current
Input Range (RMS)	CF=3: 15/30/60/150/300/600V CF=6: 7.5/15/30/75/150/300	Direct Input: CF=3: 5/10/20/50/100/200mA 0.5/1/2/5/10/20A CF=6: 2.5/5/10/25/50/100mA 0.25/0.5/1/2.5/5/10A Exterior shunt Input: CF=3: 50/100/200mV CF=6: 25/50/100mV
Range Switch	Auto / Manual Operation	
Test Mode	RMS / MEAN / DC	
Frequency Range	DC, AC 0.5Hz~100kHz	
A/D Converter	Resolution: 16-bit	Maximum Converting rate: 100kHz

Measuring Accuracy:

Condition	Voltage (V)	Current (A)
Humidity: 30~75%RH Temp.: 23±5°C source: 220V±5% Input waveform : sine wave Input: 10~100% range Common Mode: 0 V Power Factor: COSφ=1 Linearity Filter: cut-off Wave Crest Factor: CF=3 Within Half Year after leaving the factory.	DC ±(0.1%reading+0.1%range+1digit) 0.5Hz~45Hz: ±(0.1% reading+0.2%range+1 digit) 45Hz~65Hz: ±(0.05%reading+0.1%range+1digit) 65Hz~1kHz: ±(0.1%reading+0.2%range+1 digit) 1kHz~10kHz: ±(0.07*f%reading+0.3%range+1digit) 10kHz~100kHz:	DC ±(0.1%reading+0.2%range+1digit) 0.5Hz~45Hz: ±(0.3%reading+0.2%range+1digit) 45Hz~65Hz: ±(0.05%reading+0.1%range+1digit) 65Hz~1kHz: ±(0.2%reading+0.2%range+1digit) 1kHz~10kHz: ± {(0.1%reading+0.3%range)±(0.067*(f-1)%reading)+1 digit} 10kHz~100kHz:

	±	±
	{(0.5%reading+0.5%range)±(0.04*(f-10)%reading)+1 digit}	{(0.5%reading+0.5%range)±(0.04*(f-10)%reading)+1 digit}

- 11) **Harmonic analysis:** Total Harmonic Distortion(THD) and 2nd-50th sub-harmonic of fundamental frequency 20Hz~2kHz of voltage and current
- 12) **Scaling function:** when connecting external potential transformer(Optional) and current transformer, the scale data can be preset
- 13) **Averaging function:** Users can use the averaging (AVG) function due to the instability of signal
- 14) **Integration function:** Four kinds of integral models, and the integrating time can be preset
- 15) **Filtering function:** 500Hz、5kHz low-pass filter, linear filter and zero crossing filter selectable
- 16) **Display refreshing:** 0.1s,0.25s,0.5s,1s,2s,5s
- 17) **Save/call:** Save or call data under any measurement states
- 18) **Peak Holding:** Holding the peak value automatically
- 19) **Communication:** USB interface and equipped with special software
- 20) **Holding function:** Easy to read

5. DPS1010 PWM Type AC Power Supply 1PC

DPS serial AC power supply is designed according to the technological conditions of SJ/T 10541 and GB 7260. It has high loading capacity, good output waveform and convenient operation. The user can select the proper power according to actual conditions.

- 1) Output capacity: 1kVA
- 2) Input voltage: 110V±11V/ 220V±22V, 50Hz/60Hz
- 3) Output voltage: 0V~150V/0V~300V
- 4) Stability of voltage: 0.2%
- 5) Maximum output current: 110V: 9.2A, 220V: 4.6A
- 6) Output frequency: 45~65Hz 45-450Hz (option)
- 7) Stability of frequency: 0.03%
- 8) Measuring accuracy of voltage and current: ± (0.1%range + 0.4%reading + 1digit)
- 9) Output waveform: sine wave and THD: ≤0.5%

- 10) 4 displays: V, A, W/PF, Hz
- 11) Alarm when short circuit, overload or overheat
- 12) Efficiency: $\geq 85\%$

6. YF1000 Cabinet 1PC

Put the equipments into the cabinet as a whole and makes the operations more convenient, and equipped with dustproof glass door and fan for heat sinking.

7. Adapters for lamps, indoor luminaires, flood luminaires and road luminaires 1SET

Includes:

- 1) B type luminaire clamp(max characteristics of tested lamps:
1350mm(L)*640mm(W);
- 2) C type street luminaire clamp (max characteristics of tested lamps:
1200mm(L)*350mm(H);
- 3) E27 & Gu10 lamp clamp;
- 4) linear lamp clamp: max characteristics of tested lamps: 1900mm(L);
- 5) GU5.3 lamp clamp.