RIKEN KEIKI

—For easy measurement of work function and ionization potential—

Atmospheric Photoelectron Yield Spectrometers

AC-2S Series

AC-2S / AC-2S Pro α / AC-2S Pro β

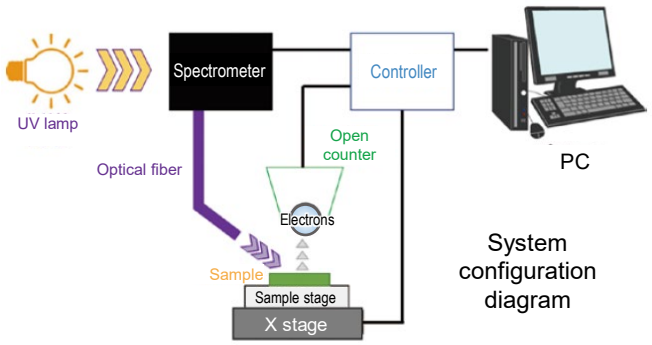
CE Marking (pending)

Features

- Allows easy measurement in the atmosphere without the need for producing a vacuum. (Samples can be easily inserted and removed, reducing measurement time.)
- Detects minute photoemission levels by subjecting samples to low-intensity ultraviolet radiation; offers high repeatability with minimal damage to samples.
- Compact size and light weight (approx. 21 % smaller footprint and 38 % lighter than the previous model)
  * Comparison of the new AC-2S to the previous AC-2
- Product range includes the AC-2S, which offers improved ease of use compared to the previous model, and the AC-2S Pro α and AC-2S Pro β, which offer expanded functionality (① High-temperature measurement, ② New light source, ③ Micro area measurement, ④ Low-energy measurement).

Principle

Ultraviolet light emitted from a UV lamp undergoes wavelength (energy) selection in a spectrometer before being focused on the surface of a sample placed on the sample stage. An open counter (electron counting device) counts electrons discharged by the photoelectric effect (phenomenon in which electrons are discharged from material surface when the material absorbs light). The wavelength λ of the ultraviolet light is converted into light energy *E* as described by the following equation:

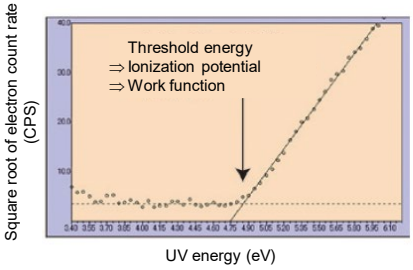


System configuration diagram

$E = hv = hc/\lambda$
(*h*: Planck constant, *v*: frequency of the light, *c*: speed of light, λ: wavelength)

Increasing the UV energy makes it possible to obtain the photoemission threshold energy (work function*1 and ionization potential*2) as shown on the PC screen to the right.

*1 Photoemission threshold energy for metals
*2 Photoemission threshold energy for semiconductors



PC screen

New Functions

The AC-2S Series includes the AC-2S Pro α/β models, which incorporate various new features not available with the previous model.

<High-temperature measurement> Capable of measurement at temperatures up to 100 °C
A heated sample stage allows measurement at user-specified temperatures up to 100 °C.
⇒ This makes it possible to evaluate characteristics at actual operating temperatures—for example, for new materials with temperature-dependent characteristics.

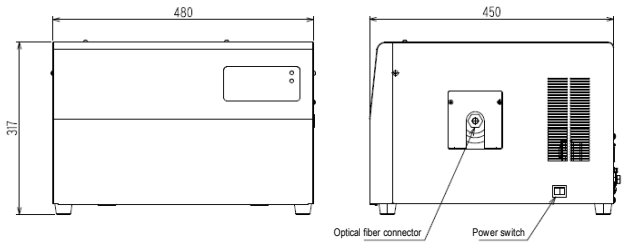
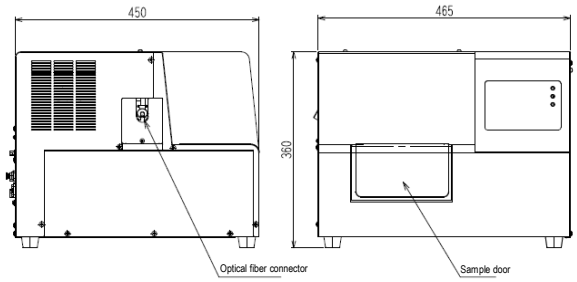
<New long-life, high-intensity light source> Lasts approx. ten times longer than the previous model
The laser-driven light source (LDLS) provides long service life (approx. ten times longer than the previous model), consistent measurements of materials requiring high light intensity (max. 2,500 nW: Pro α), and micro area measurement capability with easy spot focusing (Pro β).
⇒ Extended service life eliminates the need to replace the light source. It also allows measurements of a wide range of materials, including those requiring high light intensity.

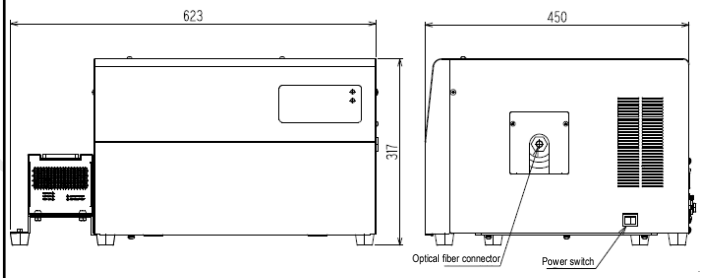
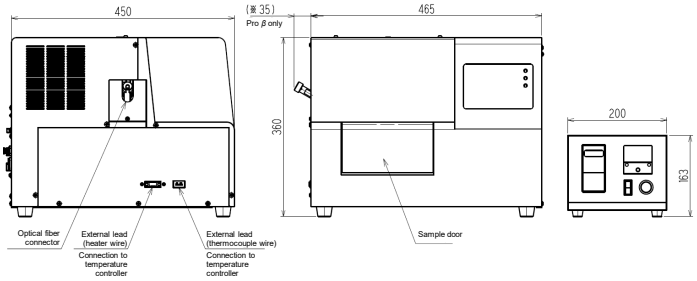
<Micro area measurement>
Allows measurements of small spots (not larger than 0.4 mm square).
⇒ Small spot measurement capability allows measurements of semiconductors and other small-sized materials.

<Low-energy measurement>
Capable of low-energy measurement as low as 2.0 eV
⇒ Allows measurements of new low-energy photoemission materials that previously could not be measured.

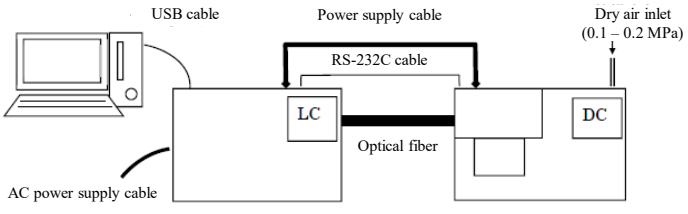
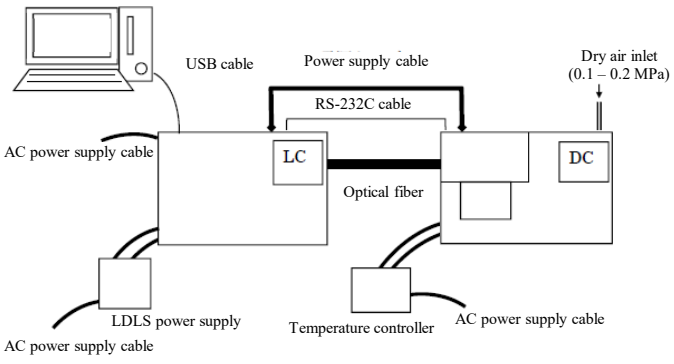
Function	AC-2S	AC-2S Pro α	AC-2S Pro β
High-temperature measurement	–	○	○
New long-life, high-intensity light source	–	○	○
Micro area measurement	–	–	○
Low-energy measurement	–	○	–

Exterior Drawings

AC-2S light source unit (LC)	AC-2S measuring unit (DC)
Front　Side (DC connection side)	Side (LC connection side)　Front
	

AC-2S Pro α/β light source unit (LC)	AC-2S Pro α/β measuring unit (DC)
Front　Side (DC connection side)	Side (LC connection side)　Front
	

Product Configurations

AC-2S	AC-2S Pro α/AC-2S Pro β
[Overview] The product consists of the light source unit (LC), measuring unit (DC), and PC used for measurement. Supply compressed air (0.1 - 0.2 MPa) via the dry air inlet during measurement. [Installation/Dimensions] ・ Width: Approx. 1,100 mm (LC + optical fiber + DC) ・ Depth: Approx. 600 mm (LC/DC + rear cables)	[Overview] The product consists of the light source unit (LC), measuring unit (DC), laser-driven light source (LDLS) power supply, temperature controller, and PC used for measurement. Supply compressed air (0.1 - 0.2 MPa) via the dry air inlet during measurement. [Installation/Dimensions] ・ Width: Approx. 1,400 mm (LDLS power supply + LC + optical fiber + DC + temperature controller) ・ Depth: Approx. 600 mm (LC/DC + rear cables)
	

Specifications

Model	AC-2S	AC-2S Pro α	AC-2S Pro β
Measurement principle	Photoemission yield spectroscopy in air (PYSA) (Detector: Low-energy electron count method)		
Measurement energy scanning range	3.4 - 6.2 eV (364 - 200 nm)	2.0 - 6.2 eV (620 - 200 nm)	3.4 - 6.2 eV (364 - 200 nm)
Repeatability (standard deviation)	Work function 0.02 eV (sample: Au sheet)		
Measurement time	Standard time required for work function measurement: 10 seconds per unit energy		
Maximum count	4,000 cps		
UV lamp	Deuterium (D2) lamp	Laser-driven light source (LDLS)	
Minimum light intensity	Up to 1.0 nW (at 5.9 eV)	Up to 5.0 nW (at 5.9 eV)	Up to 1.0 nW (at 5.9 eV)
Maximum light intensity	At least 500 nW (at 5.9 eV)	At least 2,500 nW (at 5.9 eV)	At least 200 nW (at 5.9 eV)
UV spot size	Not larger than 4 mm square	Not larger than 4 mm square	Not larger than 0.4 mm square
Spectrometer	Grating-type monochromator		
Maximum sample size	50 mm × 50 mm, thickness 10 mm		
Sample stage	115 mm × 122 mm	120 mm × 122 mm Heated sample stage	120 mm × 122 mm Heated sample stage
Operating temperature/ humidity range	15 °C - 35 °C (no sudden changes), up to 60 % RH (no condensation), dew point -30 °C or higher		
Power supply	100 - 240 V AC 50/60 Hz, 5 A (max)	Main unit: 100 - 240 V AC, 50/60 Hz, 5 A (max) LDLS (AC adapter): 100 - 240 V AC, 50 - 60 Hz, 2.5 A LDLS (main unit): 12 V DC, 120 W Temperature controller: 100 V (±10 %) AC, 50/60 Hz, 1 A (max)	
Compressed air supply conditions	0.1 - 0.2 MPa		
External dimensions	LC (light source unit): Approx. 480 (W) × 450 (D) × 317 (H) mm DC (measuring unit): Approx. 465 (W) × 450 (D) × 360 (H) mm	LC (light source unit)*: Approx. 623 (W) × 450 (D) × 317 (H) mm DC (measuring unit): Approx. 465 (W) × 450 (D) × 360 (H) mm Temperature controller: Approx. 200 (W) × 150 (D) × 280 (H) mm * The LDLS power supply is housed in the LC (light source unit).	
Weight	AC-2S LC (light source unit): Approx. 25 kg AC-2S DC (measuring unit): Approx. 31 kg	AC-2S LC (light source unit): Approx. 30 kg AC-2S DC (measuring unit): Approx. 31 kg Temperature controller: Approx. 5 kg	

Accessories

- Display
- PC
- Power supply cable (for LC)
- Power supply cable (LC-DC)
- Adapter plug (3-pin → 2-pin + ground wire)
  * AC-2S: ×1, Pro α/β: ×3
- USB interface cable (PC-LC)
- RS-232C interface cable (LC-DC)
- Detector
- Optical fiber
- Accessory sample set
- Tweezers
- Measurement/analysis/data conversion software (CD-ROM)

Optional Accessories (sold separately)

- Tray for powder samples (1.0 mm deep)
- Tray for powder samples (0.5 mm deep)
- Compressor (with dry air generator)
- Optical fiber protective acrylic cover
- Different-diameter union joint (for dry air)
- Detector (for replacement)
- Optical fiber (for AC-2S/Pro α)
- Optical fiber (for Pro β)
- D2 lamp (for AC-2S)
- Ozone filter