5350
Digital Electrometer

For evaluation and testing of semiconductor, electronic components and optical devices
Competitive digital electrometer with 5½-digit display

- Wide current measurement range: 1 fA to 20 mA
- High input impedance of voltage measurement: 10^{13} Ω or more
- High-speed voltage measurement with driving guard
- High-speed measurement: max 1,000 readings/s
- Data memory capacity: 100,000 data
- Variable integration function: 500 µs to 3.2 s
- USB and GPIB inerfaces as standard

| GPIB | USB | LAN |

Factory option

Current Measurement

1 fA

resolution

High-Input Impedance Voltage Measurement
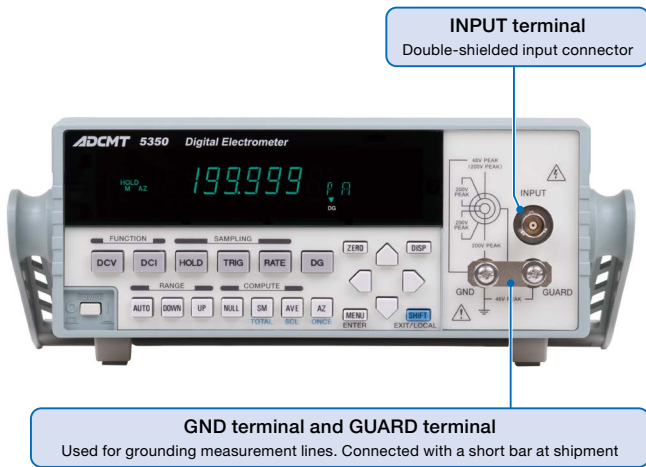
10^{13} Ω

or more

High-Speed Measurement

1000

readings/s

http://www.adcmt-e.com
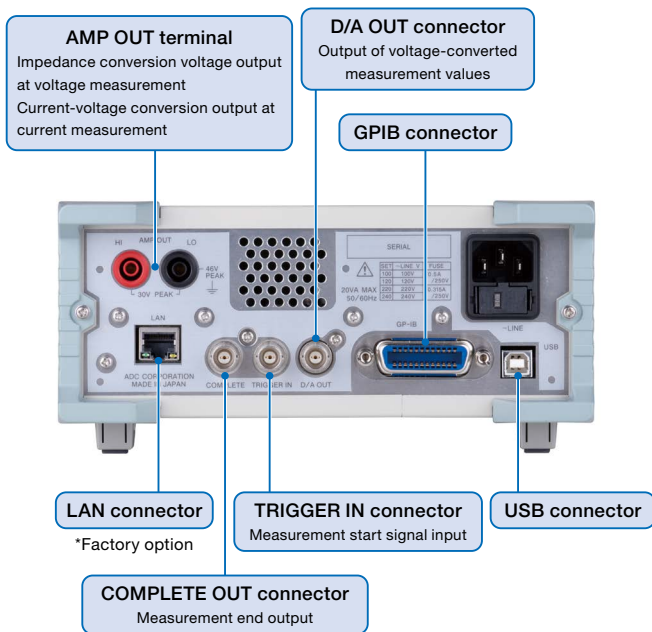
The 5350 is a low-priced digital electrometer with 5½-digit display. It can measure voltage with high input impedance of 10^{13} Ω or higher and wide-ranging current from 1 fA to 20 mA. The electrometer can be used for basic materials research, testing and selecting semiconductors and other electronics components, research and development of new element or materials and many other applications including biological research. For voltage measurement, the driving guard function makes it possible to measure responsively signal sources having high impedance. Moreover, the 5350 achieves high-speed sampling of up to 1,000 readings per second and stores 100,000 measurement data in the internal memory. USB and GPIB interfaces are standard and LAN is available as option, allowing flexible system configurations for your purposes.

INPUT terminal
Double-shielded input connector

GND terminal and GUARD terminal
Used for grounding measurement lines. Connected with a short bar at shipment

Front Panel

AMP OUT terminal
Impedance conversion voltage output at voltage measurement
Current-voltage conversion output at current measurement

D/A OUT connector
Output of voltage-converted measurement values

GPIB connector

LAN connector
*Factory option

TRIGGER IN connector
Measurement start signal input

USB connector

COMPLETE OUT connector
Measurement end output

Rear Panel

Wide-Range Current Measurement from 1 fA to 20 mA

The 5350 provides a 1 fA current measurement resolution, which enables leakage current measurement of semiconductors such as MOSFET gate current and dark current measurement of optical devices. Meanwhile, as the maximum measurement current is 20 mA, it is suitable for I_B-V_{BE} or I_C-V_{BE} characteristic evaluation of small-signal transistors and diodes.

High-Input Impedance Voltage measurement of 10^{13} Ω or More

When using a general voltmeter for high-output impedance voltage measurement, the input impedance of the voltmeter around 10^9 Ω causes errors in measurement values. However, the 5350 has a high-input impedance of 10^{13} Ω or more, so that the influence of the output impedance of DUTs is reduced to 1/10,000 compared to the general voltmeter and high-precision measurement is possible.

High-Speed Voltage Measurement by Driving Guard

The response of DC voltage measurement becomes slow depending on the stray capacitance of an input cable when the output impedance of DUTs is high (100 MΩ or more). The 5350 adopts a double-shielded input connector and an input cable, allowing the inner shield to be driven at the same potential as the input voltage of the 5350. By using this driving guard function, the stray capacitance between the center line of the input cable and the outer shield becomes zero apparently and the response performance is improved.

Output of Input Signals as Voltage

The 5350 has the pre-amplifier output (AMP OUT) and the D/A OUT which output input signals to the outside of the unit as voltage values. The pre-amplifier output can output the output voltage of the measurement circuit of the 5350 without isolation. Thus, it can be used as impedance conversion output device for high-impedance voltage measurement and as current-to-voltage conversion device for current measurement. The D/A OUT converts A/D converted measurement values into voltage ±1 V and outputs them as isolated signals.

Variable Integration Function

The integration time on the 5350 can be set arbitrarily with a resolution of 100 μs between 500 μs and 3.2 s. This integration function makes it possible to measure easily the average of pulsed voltage or current. As the integration time of the A/D converter itself can be set arbitrarily, there are no omissions in waveforms, resulting in precise average measurement. The pre-set eight types of integration time are switchable by using the RATE key on the front panel.

Wide Range & High Speed Measuring

Specifications

Unless otherwise specified, all accuracies are guaranteed for one year at a temperature of 23 °C ±5 °C and a relative humidity of 70 % or less.

DC Voltage Measurement

Measurement range	Maximum display	Resolution	Accuracy ±(% of reading + digit)		Temperature coefficient ±(% of rdg ± digit)/°C[*1][*3]	Settling time (ms)[*4]
			Zero check OFF[*1]	Zero check ON[*1][*2]		
200 mV	199.999 mV	1µV	0.06+150	0.06+30	0.004+18	2.5
2000 mV	1999.99 mV	10µV	0.06+30	0.06+30	0.004+2	2.5
20 V	19.9999 V	100µV	0.06+20	0.06+20	0.004+1	2.5

*1   Integration time: 10 PLC, display: 5½-digit, Auto zero: ON
*2   Accuracy with the temperature change within ±1 °C for 24 hours after zero check
      Temperature: 23 °C ± 5 °C, relative humidity: 70 %
*3   Temperature: 0 °C to 50 °C, relative humidity: 70 %
*4   Time to settle to the full-scale value ± 1 % with the signal source resistance of 1 MΩ or less, excluding the range switching time

Additional error depending on the integration time

Integration time	Additional error ±(digit)		200 mV range	Other ranges
500µs ≤ IT < 1 PLC	—	4½-digit display	10	3
1 PLC ≤ IT < 10 PLC	Integer time of 1 PLC	5½-digit display	10	3
10 PLC < IT ≤ 3.2 s	Integer time of 1 PLC	5½-digit display	10	6

Input resistance: 1×10^{13} Ω or more
Input capacity: 30 pF or less

Noise rejection ratio (at 50/60 Hz ±0.08 %)

Integration time	NMRR	Effective CMRR[*5]
Integer time of 1 PLC	60 dB or more	120 dB or more
Other	0 dB	60 dB or more

*5   Unbalanced impedance of 1 kΩ

DC Current Measurement

Measurement range	Maximum display	Resolution	Accuracy ±(% of reading + digit)		Temperature coefficient ±(% of rdg ± digit)/°C[*6][*8]	Settling time (ms)[*9]
			Zero check OFF[*6]	Zero check ON[*6][*7]		
200 pA	199.999 pA	1 fA	0.7 + 70	0.7 + 60	0.03 + 7	450
2000 pA	1999.99 pA	10 fA	0.6 + 20	0.6 + 20	0.03 + 1	450
20 nA	19.9999 nA	100 fA	0.25 + 170	0.25 + 30	0.01 + 19	5
200 nA	199.999 nA	1 pA	0.2 + 30	0.2 + 20	0.01 + 2	5
2000 nA	1999.99 nA	10 pA	0.2 + 20	0.2 + 20	0.01 + 1	5
20 µA	19.9999 µA	100 pA	0.1 + 170	0.1 + 30	0.01 + 19	2.5
200 µA	199.999 µA	1 nA	0.1 + 30	0.1 + 20	0.01 + 2	2.5
2000 µA	1999.99 µA	10 nA	0.1 + 20	0.1 + 20	0.01 + 1	2.5
20 mA	19.9999 mA	100 nA	0.1 + 30	0.1 + 20	0.01 + 2	2

*6   Integration time: 10 PLC, display: 5½-digit, Auto zero: ON
*7   Accuracy with the temperature change within ±1 °C for 24 hours after zero check
      Temperature: 23 °C ±5 °C, relative humidity: 70 %
*8   Temperature: 0 °C to 50 °C, relative humidity: 70 %
      At a temperature of 40 °C to 50 °C, 20 fA/°C is added to the digit item.
*9   Time to settle to the full-scale value ± 1 %, excluding the range switching time

Additional error depending on the integration time

Integration time	Additional error ±(digit)		200 pA range	20 nA range	20 µA range	Other range
500µs ≤ IT < 1 PLC	—	4½-digit display	25	20	10	5
1 PLC ≤ IT < 10 PLC	Integer time of 1 PLC	5½-digit display	25	20	10	5
10 PLC < IT ≤ 3.2 s	Integer time of 1 PLC	5½-digit display	10	10	10	7

Input voltage drop

20 mA range	± (30 Ω × measurement current) or less
Other ranges	± (200 µV + 0.5 Ω × measurement current) or less

Input bias current: 30 fA or less

Noise rejection ratio (at 50/60 Hz ±0.08 %)

Integration time	NMRR
Integer time of 1 PLC	60 dB or more
Other	0 dB

Maximum allowable input: 0.1 µF

Measurement Time and Display Digits

Integration time		Sampling speed		Display Digits
		Power Frequency 50 Hz	Power Frequency 60 Hz	
500 µs	[*10]	1000 readings/s		
500 µs	[*11]	200 readings/s		19999
2 ms		77 readings/s		
1 PLC		29 readings/s	33 readings/s	
5 PLC		8 readings/s		
10 PLC		4 readings/s		199999
10 PLC×4		1 readings/s		
10 PLC×8		0.5 readings/s		
10 PLC×16		0.25 readings/s		

*10   Calculation OFF, measurement data display OFF, and other conditions
*11   Integration time set to RATE

Other Functions

Calculation function: NULL calculation, smoothing calculation, averaging calculation, totalizing calculation, scaling calculation

Extended function: Auto zero, zero check, measurement range upper limit and lower limit, measurement auto range level

Interface function:

● Remote command   Compliant to the ADC command system and the 8340A commands

● GPIB   1. Standard: IEEE488.2
          2. Connector: Amphenol 24 pins

● USB   1. Standard: USB2.0 Full-Speed
         2. Connector: Type B

● LAN (factory option)   1. Standard: IEEE802.3 (10BASE-T, 100BASE-TX)
                          2. Connector: RJ-45

● TRIGGER IN   1. Signal level: TTL, falling edge detection
(External trigger input)   2. Connector: BNC

● COMPLETE OUT   1. Signal level: TTL, negative pulse (open collector)
(Measurement end output)   2. Connector: BNC

● D/A OUT   1. Function: Outputs any 3 digits of measurement data as voltage.
             2. Connector: BNC

● Preamplifier output   1. Function: Outputs DC voltage according to input
(AMP OUT)   voltage or current.
                         2. Terminal: Safety

General Functions

Operating environment: Temperature 0 °C to +50 °C
                       Relative humidity 85% or less without condensation
Storage environment: Temperature -20 °C to +70 °C
                       Relative humidity 85% or less without condensation
Warm-up time: 60 minutes or longer
Display: 16 segments x decimal 6-digit vacuum fluorescent display
Input method: Floating

Measurement method: Integration
Over input display: OL display
Range switching: Auto or manual
Trigger function: Internal and external triggers
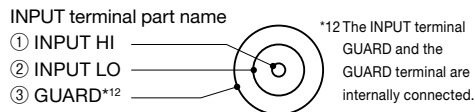   External trigger: external trigger input, panel key, remote

Memory: Data memory: Up to 100,000 data items
           Condition setting memory: 4 (USER0 to USER3)

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Measurement terminal/ AMP OUT terminal:	Terminal name	Connector
	INPUT terminal	TRIAX connector
	GUARD terminal*12, GND terminal	Screw-type terminal block
	AMP OUT HI	Red safety socket
	AMP OUT LO	Black safety socket

INPUT terminal part name
① INPUT HI
② INPUT LO
③ GUARD*12

*12 The INPUT terminal GUARD and the GUARD terminal are internally connected.

Maximum allowable input voltage: DCV driving guard ON/OFF
DCI driving guard OFF

			INPUT HI
		INPUT LO	200 Vpeak
	GUARD	200 Vpeak*13	200 Vpeak
GND	46 Vpeak	200 Vpeak*13	200 Vpeak

*13 46 Vpeak when the AMP OUT terminal is connected to the outside

DCI driving guard ON

			INPUT HI
		INPUT LO	200 Vpeak
	GUARD	20 mApeak*14	200 Vpeak
GND	46 Vpeak	46 Vpeak	200 Vpeak

*14 The INPUT LO and the GUARD are connected internally.

AMP OUT terminal

Maximum allowable input voltage: 46 Vpeak between the INPUT LO and the GUARD

		AMP OUT HI
	AMP OUT LO	30 Vpeak
GND	46 Vpeak	76 Vpeak

Power supply: AC power supply: 100 V/120 V/220 V/240 V (User selectable)

Option Number	Standard	OPT. 32	OPT. 42	OPT. 44
Power supply voltage	100 V	120 V	220 V	240 V

Specify the option when ordering.
Use a power cable and a fuse that are compliant with the safety standard when changing the power supply voltage.

Power supply frequency: 50 Hz/60 Hz
Power consumption: 20 VA or below
Dimensions: Approx. 212 (W) × 88 (H) × 340 (D) mm
Mass: 3.6 kg or less

Safety: IEC61010-1 Ed.3, IEC61010-2-30

EMC: EN61326-1 classA

Supplied accessories

Model	Quantity	Name
A01402	1	Power cable
A01010	1	Input cable
DFT-AAR5A-1	1	Power fuse (100 VAC/120 VAC)
DFT-AAR315A-1		Power fuse (220 VAC/240 VAC)

Optional accessories

Model	Name
A01009	Input cable (TRIAX-TRIAX)
A01011	Input cable (TRIAX-BNC)
A04201	Connector (TRIAXJ-TRIAXJ)
A04202	Connector (TRIAXJ-BNCP)
A04203	
A04207	Connector (BNCJ-MP)
CC015006	Connector (BNCJ-TRIAXP)
A04208	Connector (TRIAXJ receptacle)
MI-03	BNC-alligator clip
A01036-1500	Input/output cable (BNC-BNC 1.5 m)
A01044	Input/output cable, safety plug
A08531	Banana tip adapter for A01044
A08532	Alligator clip adapter for A01044
12602	Voltage divider probe
12603	Test lead
127XX series	Test fixture, resistivity chamber (Power supply required)
15042	
15702	
15045 series	Standard resistance (Power supply required)
A02263	JIS rack mount set
A02264	JIS rack mount set (twin)
A02463	EIA rack mount set
A02464	EIA rack mount set (twin)
A02039	Panel mount set
A02040	Panel mount set (twin)

• Please read through the operation manual carefully before using the products.
• All specifications are subject to change without notice.

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