IWATSU

Semiconductor Curve Tracer

CS-8000 series

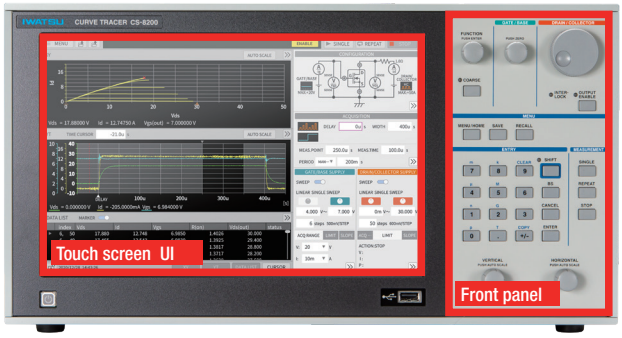
Semiconductor Curve Tracer

CS-8000 Series Technical datasheet

The CS-8000 series are equipped with a high voltage source of up to 5kV and a high current source of 2000A. With an optional SMU, the CS-8000 series can be used to measure the static characteristics of any power semiconductor. Equipped with pulse output, gate pattern, and very small current measurement functions, the CS-8000 series strongly supports design evaluation of wide bandgap semiconductors such as SiC and GaN.

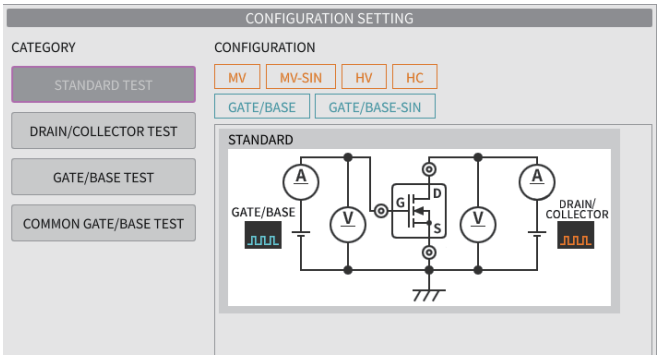
- Up to 5kV, 2kA High-Power Test
- Easy-to-operate graphical user interface
- Accurate very small current measurement (Resolution 250fA)
- Large 12.1-inch Touch Screen
- Variety of GATE Signal Output
- Enhanced Temperature Characteristic Measurement Option
- On-Wafer High-Power Testing with Wafer-Prober

UI designed for ease of use



The 12.1 inch Touch Screen, front panel buttons and rotary knob provide intuitive operation. The on-screen keyboard on the screen and the numeric keypad on the front panel allow you to enter settings, limit values, and so on. To enable operation by USB mouse/keyboard.

Configuration for various experiment



The graphical display of the measurement configuration makes easy to set various settings. The test fixture CS-322 HV/HC automatically switches the internal matrix switch to match the configuration settings, eliminatingthe need for a wiring swap. It is also not necessary to switch the connection between HV and HC units manually. Because the internal relay automatically switches through the configuration settings. These functions prevent incorrect wiring during measurement.

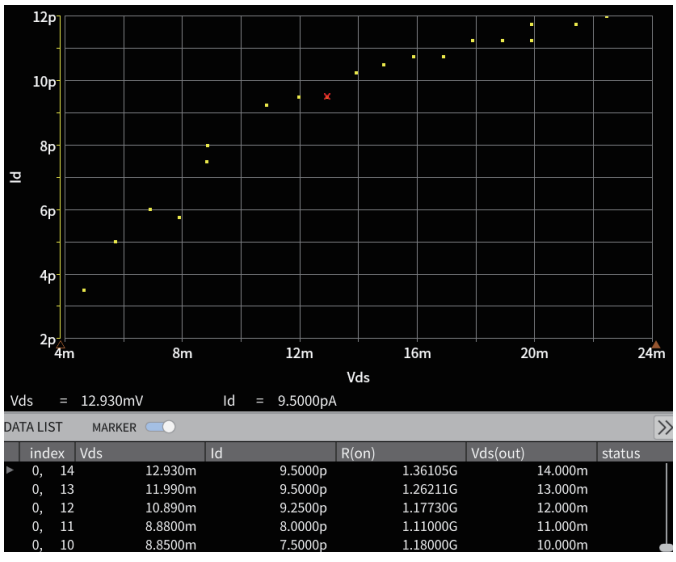
Improved on-wafer testing affinity

The output terminals are fitted with noise resistant triaxial for easy connection to wafer-prober.

Output sources for your application

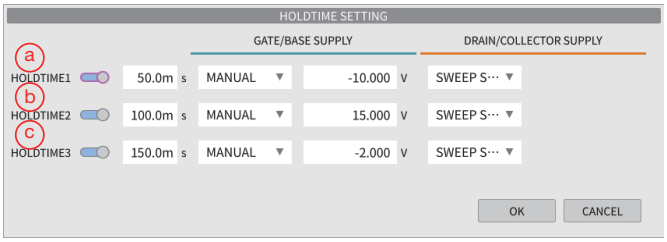
High-current SMU up to 2000 A. Because of the HC unit with the high current mode, high current measurements up to 2kA can be performed. The pulse width, measuring period and measuring range can be varied.
Pulse width, measurement cycle, and measurement range can be varied. SMU can be selected as desired for measurements of Ultra-high voltage SMU up to 15 kV, temperature sensors, backgates, etc.

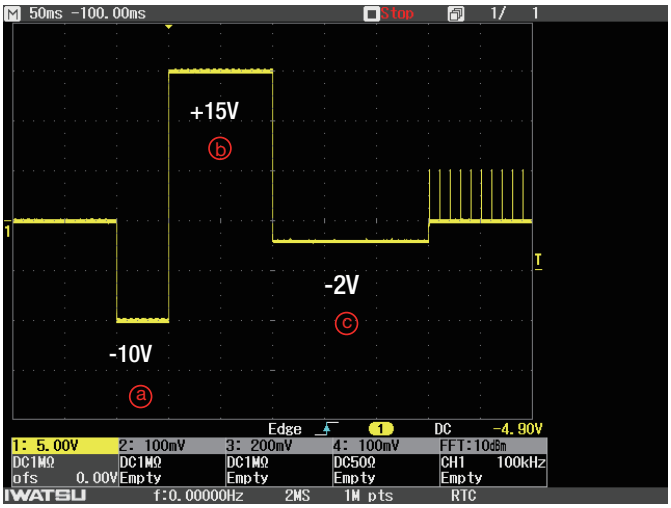
Minimum current resolution 250fA



The use of triaxial and the optimization of the measurement system has reduced leakage and noise in the equipment, so the stable measurement of very small currents canbe performed.

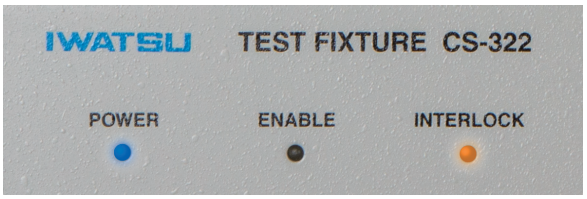
■ Flexible GATE signal output



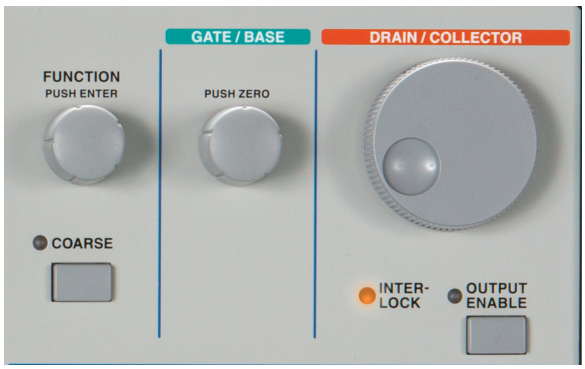


The gate signal can be sequenced and applied.
Hold-time variable range 0.000[s] ～ 5.000[s]
Pre-signal GATE voltage -40[V] ～ +40[V]

■ Interlock Function



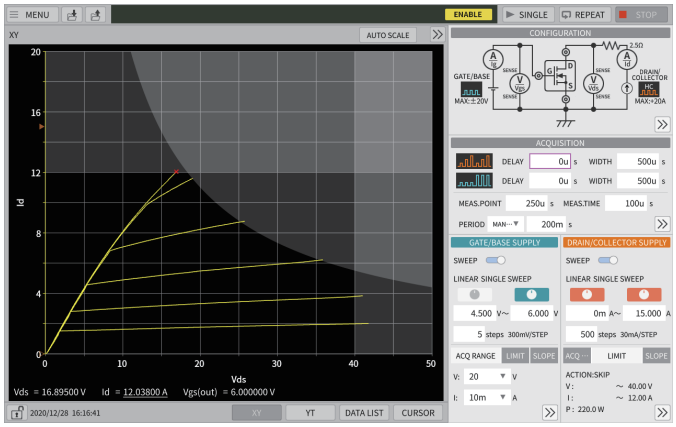
TEST FIXTURE



MAIN UNIT

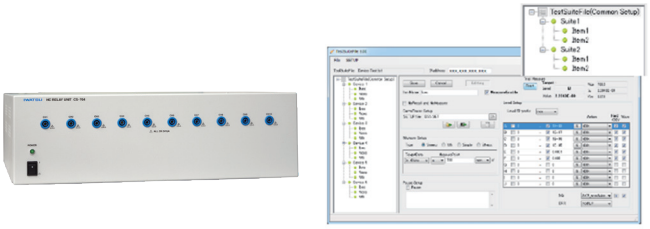
An interlock function is linked to the cover of the fixture. During interlock operation, the output is turned off to avoid the electric shock, and the curve tracer keeps safe measurements. Even when you use the prober or temperature chambers, the curve tracer keeps safe measurement in conjunction with external interlock terminal. The LEDs in main unit and test fixture indicate the state of the interlock.

■ Output Limit Function



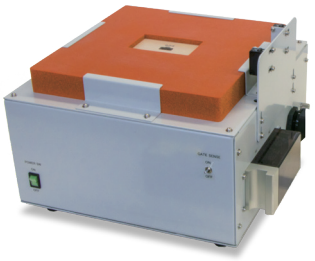
Voltage, current, and power limits can be set to prevent damage to the target. In addition, the hardware overcurrent protection function shuts off current when 1.4 times the current flow of the measuring range.

■ Automatic measurement for the multiple devices



The optional scanner system CS-700 series enables measurement of multiple devices. Automatic measurement is possible by controlling the curve tracer and scanner system with the automatic measurement software CS-830.

■ Temperature characteristic measurement

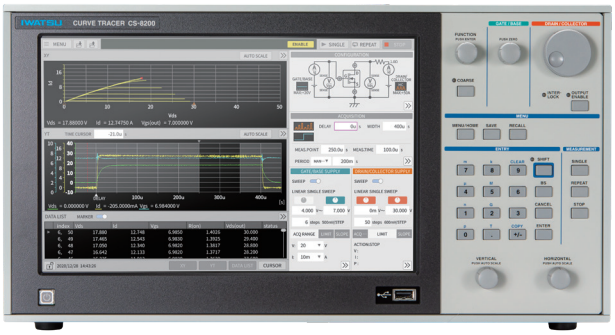


Evaluation of temperature characteristics is required for targets used in high and low temperature environments during actual operation. CS-8000 can be used in combination with hotplate and Thermo Stream to measure temperature characteristics. The use of Thermo Stream requires test fixture and adapters. Automatic measurement is also possible with software CS-830.

■ CS-830 Software

The CS-830 automatic measurement software enables automatic measurement of semiconductor parameters, temperature control of thermostreamers, thermostatic chambers, and hot plates, and automatic measurement by controlling the CS-700 scanner system.

■ Main Unit



Three types of main units can be selected depending on the required measurement voltage. The main unit includes the HV unit (not included in the CS-8020), MV unit, and gate unit. The high current unit, fixture, and optional SMU are operated from the main unit.

Model	CS-8500	CS-8200	CS-8020
HV UNIT	5kV(8mA)	2kV(20mA)	-
MV UNIT	200V(2A)		
GATE UNIT	40V(1A)		

■ HV UNIT(5kV)

OUTPUT PART

OUTPUT VOLTAGE				
Voltage Range	Setting Resolution	Mode	Polarity	Max. Peak Current
• 5kV	250mV	DC/PULSE	+ / −	8mA
• 2kV	100mV	DC/PULSE	+ / −	8mA
• 1kV	50mV	DC/PULSE	+ / −	8mA
• 500V	25mV	DC/PULSE	+ / −	8mA
• 200V	10mV	DC/PULSE	+ / −	8mA

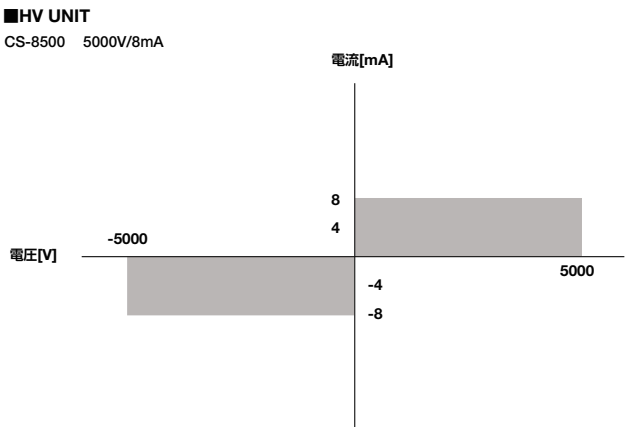
PULSE		
Pulse Mode	Pulse Width	Duty Cycle
PULSE	20mS ～ 1.6S	≦ 50% ～ 80%

※ It may not be possible to output up to the Max. voltage/current if the pulse width is narrow.

Setting Accuracy

DC/PULSE：± (Set Value x 1.5% + Set Range x 0.5%)

OUTPUT RANGE



MEASUREMENT PART

MEASUREMENT VOLTAGE			
Voltage Range	Setting Resolution	Voltage Range	Setting Resolution
• 5kV	250mV	200V	10mV
• 2kV	100mV	100V	5mV
• 1kV	50mV	50V	2.5mV
• 500V	25mV	-	-

Voltage Measurement Accuracy

DC/PULSE：± (Set Value x 1.5% + Set Range x 0.5%)

MEASUREMENT CURRENT			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 10mA	500nA	500μA	25nA
• 5mA	250nA	200μA	10nA
• 2mA	100nA	100μA	5nA
• 1mA	50nA	50μA	2.5nA

MEASUREMENT CURRENT (LEAKAGE MODE)			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 2mA	100nA	1μA	50pA
• 1mA	50nA	500nA	25pA
• 500μA	25nA	200nA	10pA
• 200μA	10nA	100nA	5pA
• 100μA	5nA	50nA	2.5pA
• 50μA	2.5nA	20nA	1pA
• 5μA	250pA	10nA	500fA
• 2μA	100pA	5nA	250fA

MEASUREMENT CURRENT ACCURACY

2A ～ 10μA range：
± (Measured value × 1.5%+Measurement range × 0.5%) ± (Measurement range × 0.002% × Output voltage)

20nA ～ 5nA range：
± (Measured value × 1.5%+Measurement range × 0.5%) ± (Measurement range × 0.002% × Output voltage) ± 200pA

DYNAMIC RANGE (MEASUREMENT CURRENT)

It is possible to measure within measurement current range.

■ HV UNIT(2kV)

OUTPUT PART

OUTPUT VOLTAGE				
Voltage Range	Setting Resolution	Mode	Polarity	Max. Peak Current
• 2kV	100mV	DC/PULSE	＋ / －	20mA
• 1kV	50mV	DC/PULSE	＋ / －	20mA
• 500V	25mV	DC/PULSE	＋ / －	20mA
• 200V	10mV	DC/PULSE	＋ / －	20mA

PULSE		
Pulse Mode	Pulse Width	Duty Cycle
PULSE	20mS ～ 1.6S	≦ 50% ～ 80%

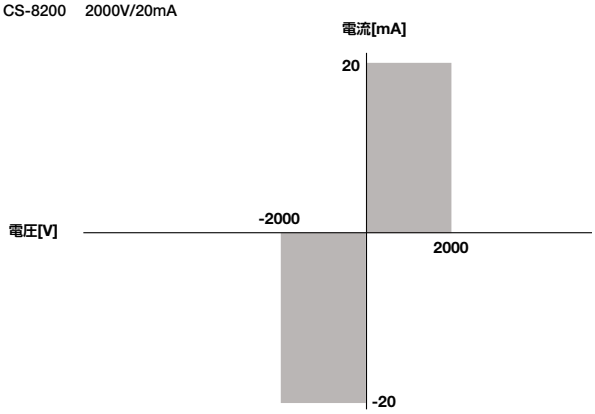
*It may not be possible to output up to the Max. voltage/current if the pulse width is narrow.

Setting Accuracy

DC/PULSE：± (Set Value x 1.5% + Set Range x 0.5%)

OUTPUT RANGE

■HV UNIT
CS-8200　2000V/20mA



MEASUREMENT CURRENT			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 20mA	1μA	500μA	25nA
• 10mA	500nA	200μA	10nA
• 5mA	250nA	100μA	5nA
• 2mA	100nA	50μA	2.5nA
• 1mA	50nA	-	-

MEASUREMENT CURRENT （LEAKAGE MODE）			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 2mA	100nA	1μA	50pA
• 1mA	50nA	500nA	25pA
• 500μA	25nA	200nA	10pA
• 200μA	10nA	100nA	5pA
• 100μA	5nA	50nA	2.5pA
• 50μA	2.5nA	20nA	1pA
• 5μA	250pA	10nA	500fA
• 2μA	100pA	5nA	250fA

Current Measurement Accuracy

2mA ～ 50nA Range：
± (Set Value x 1.5% + Set Range x 0.5%) ± (Measurement range x 0.002% x Vo) (Vo is the output voltage [V])
20nA ～ 5nA Range：
± (Set Value x 1.5% + Set Range x 0.5%) ± (Measurement Range x 5.0% + 200pA)

Dynamic Range (Measurement Current)

It is possible to measure within measurement current range.

MEASUREMENT PART

MEASUREMENT VOLTAGE			
Voltage Range	Setting Resolution	Voltage Range	Setting Resolution
• 2kV	100mV	200V	10mV
• 1kV	50mV	100V	5mV
• 500V	25mV	50V	2.5mV

Voltage Measurement Accuracy

DC/PULSE：± (Set Value x 1.5% + Set Range x 0.5%)

Dynamic Range (Measurement Voltage)

It is possible to measure up to 125% of the measurement voltage range.

■ MV UNIT(200W)

OUTPUT PART

OUTPUT VOLTAGE

Voltage Range	Setting Resolution	Mode	Polarity	Max. Peak Current
• 200V	10mV	DC/AC/PULSE	+ / −	1A
• 100V	5mV	DC/AC/PULSE	+ / − / ±	2A
• 50V	2.5mV	DC/AC/PULSE	+ / − / ±	2A
• 20V	1mV	DC/AC/PULSE	+ / − / ±	2A

OUTPUT CURRENT

Current Range	Setting Resolution	Mode	Polarity	Max. Peak Voltage
• 2A	100μA	PULSE	+ / −	100V
• 1A	50μA	PULSE	+ / − / ±	100V
• 500mA	25μA	PULSE	+ / − / ±	100V
• 200mA	10μA	DC/AC/PULSE	+ / − / ±	100V
• 100mA	5μA	DC/AC/PULSE	+ / − / ±	100V
• 50mA	2.5μA	DC/AC/PULSE	+ / − / ±	100V
• 20mA	1μA	DC/AC/PULSE	+ / − / ±	100V
• 10mA	500nA	DC/AC/PULSE	+ / − / ±	100V
• 5mA	250nA	DC/AC/PULSE	+ / − / ±	100V
• 2mA	100nA	DC/AC/PULSE	+ / − / ±	100V
• 1mA	50nA	DC/AC/PULSE	+ / − / ±	100V
• 500μA	25nA	DC/AC/PULSE	+ / − / ±	100V
• 200μA	10nA	DC/AC/PULSE	+ / − / ±	100V
• 100μA	5nA	DC/AC/PULSE	+ / − / ±	100V
• 50μA	2.5nA	DC/AC/PULSE	+ / − / ±	100V
• 20μA	1nA	DC/AC/PULSE	+ / − / ±	100V
• 10μA	500pA	DC/AC/PULSE	+ / − / ±	100V
• 5μA	250pA	DC/AC/PULSE	+ / − / ±	100V
• 2μA	100pA	DC/AC/PULSE	+ / − / ±	100V
• 1μA	50pA	DC/AC/PULSE	+ / − / ±	100V
• 500nA	25pA	DC/AC/PULSE	+ / − / ±	100V
• 200nA	10pA	DC/AC/PULSE	+ / − / ±	100V
• 100nA	5pA	DC/AC/PULSE	+ / − / ±	100V
• 50nA	2.5pA	DC/AC/PULSE	+ / − / ±	100V
• 20nA	1pA	DC/AC/PULSE	+ / − / ±	100V
• 10nA	500fA	DC/AC/PULSE	+ / − / ±	100V
• 5nA	250fA	DC/AC/PULSE	+ / − / ±	100V

PULSE OUTPUT

Pulse Mode	Pulse Width	Duty Cycle
PULSE	20mS ～ 1.6S	≦ 50% ～ 80%

*When the pulse width is narrow, it may not be possible to output up to the maximum voltage / current.

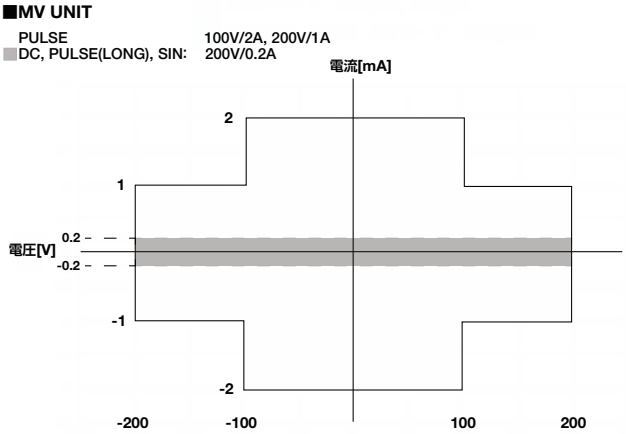
SINE OUTPUT

MODE: AC, Rectified (Full wave (1/1), Half wave (1/2), 1/3 ～ 1/50)

SETTING RESOLUTION

DC / PULSE: 1/ ± 20000 of Set range
AC: 1/ ± 1000 of Set range

OUTPUT RANGE



MEASUREMENT PART

MEASUREMENT CURRENT

Current Range	Setting Resolution	Current Range	Setting Resolution
• 2A	100μA	PULSE	+ / −
• 1A	50μA	PULSE	+ / − / ±
• 500mA	25μA	PULSE	+ / − / ±
• 200mA	10μA	DC/AC/PULSE	+ / − / ±
• 100mA	5μA	DC/AC/PULSE	+ / − / ±
• 50mA	2.5μA	DC/AC/PULSE	+ / − / ±
• 20mA	1μA	DC/AC/PULSE	+ / − / ±
• 10mA	500nA	DC/AC/PULSE	+ / − / ±
• 5mA	250nA	DC/AC/PULSE	+ / − / ±
• 2mA	100nA	DC/AC/PULSE	+ / − / ±
• 1mA	50nA	DC/AC/PULSE	+ / − / ±
• 500μA	25nA	DC/AC/PULSE	+ / − / ±
• 200μA	10nA	DC/AC/PULSE	+ / − / ±
• 100μA	5nA	DC/AC/PULSE	+ / − / ±
• 50μA	2.5nA	DC/AC/PULSE	+ / − / ±
• 20μA	1nA	DC/AC/PULSE	+ / − / ±
• 10μA	500pA	DC/AC/PULSE	+ / − / ±
• 5μA	250pA	DC/AC/PULSE	+ / − / ±
• 2μA	100pA	DC/AC/PULSE	+ / − / ±
• 1μA	50pA	DC/AC/PULSE	+ / − / ±
• 500nA	25pA	DC/AC/PULSE	+ / − / ±
• 200nA	10pA	DC/AC/PULSE	+ / − / ±
• 100nA	5pA	DC/AC/PULSE	+ / − / ±
• 50nA	2.5pA	DC/AC/PULSE	+ / − / ±
• 20nA	1pA	DC/AC/PULSE	+ / − / ±
• 10nA	500fA	DC/AC/PULSE	+ / − / ±
• 5nA	250fA	DC/AC/PULSE	+ / − / ±

■ MV UNIT(200W)

MEASUREMENT VOLTAGE

Voltage Range	Setting Resolution	Voltage Range	Setting Resolution
• 200V	10mV	5V	250μV
• 100V	5mV	2V	100μV
• 50V	2.5mV	1V	50μV
• 20V	1mV	500mV	25μV
• 10V	500μV	200mV	10μV

MEASUREMENT VOLTAGE ACCURACY

DC/Pulse (200 m V range except) :
± (Measured value × 1.2%+Measurement range × 0.4%)

DC/Pulse (200 m V range) :
± (Measured value × 1.2%+Measurement range × 0.4 ± 10mV
AC : ± (Measured value × 2%+Measurement range × 0.5%)

DYNAMIC RANGE (MEASUREMENT CURRENT)

Up to 125% of the measurement range can be measured.
*Accuracy is specified only in the measurement range.

MEASUREMENT CURRENT ACCURACY

DC/Pulse (2A ～ 10μA range)
± (Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output voltage)

DC/Pulse (200mV range)
± (Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output voltage) ± 50pA
AC : ± (Measured value × 2%+Measurement range × 0.5%)

DYNAMIC RANGE (MEASUREMENT CURRENT)

Up to 125% of the measurement range can be measured.
*Accuracy is specified only in the measurement range.

■ GATE UNIT(40W)

OUTPUT PART

OUTPUT VOLTAGE

Voltage Range	Setting Resolution	Mode	Polarity	Max. Peak Current
• 40V	2mV	DC/AC/PULSE	+ / − / ±	1A
• 20V	1mV	DC/AC/PULSE	+ / − / ±	1A
• 10V	500μV	DC/AC/PULSE	+ / − / ±	1A
• 5V	200μV	DC/AC/PULSE	+ / − / ±	1A
• 2V	100μV	DC/AC/PULSE	+ / − / ±	1A
• 1V	50μV	DC/AC/PULSE	+ / − / ±	1A

PULSE OUTPUT

Pulse Mode	Pulse Width	Duty Cycle
PULSE	50μ0S ～ 10mS	≦ 10%
PULSE(LONG)	50μS ～ 1.6S	≦ 50% ～ 80%

*When the pulse width is narrow, it may not be possible to output up to the maximum voltage / current.

OUTPUT CURRENT

Current Range	Setting Resolution	Mode	Polarity	Max. Peak Voltage
• 1A	50μA	PULSE	+ / − / ±	40V
• 500mA	25μA	PULSE	+ / − / ±	40V
• 200mA	10μA	PULSE	+ / − / ±	40V
• 100mA	5μA	DC/AC/PULSE	+ / − / ±	40V
• 50mA	2.5μA	DC/AC/PULSE	+ / − / ±	40V
• 20mA	1μA	DC/AC/PULSE	+ / − / ±	40V
• 10mA	500nA	DC/AC/PULSE	+ / − / ±	40V
• 5mA	250nA	DC/AC/PULSE	+ / − / ±	40V
• 2mA	100nA	DC/AC/PULSE	+ / − / ±	40V
• 1mA	50nA	DC/AC/PULSE	+ / − / ±	40V
• 500μA	25nA	DC/AC/PULSE	+ / − / ±	40V
• 200μA	10nA	DC/AC/PULSE	+ / − / ±	40V
• 100μA	5nA	DC/AC/PULSE	+ / − / ±	40V
• 50μA	2.5nA	DC/AC/PULSE	+ / − / ±	40V
• 20μA	1nA	DC/AC/PULSE	+ / − / ±	40V
• 10μA	500pA	DC/AC/PULSE	+ / − / ±	40V
• 5μA	250pA	DC/AC/PULSE	+ / − / ±	40V
• 2μA	100pA	DC/AC/PULSE	+ / − / ±	40V
• 1μA	50pA	DC/AC/PULSE	+ / − / ±	40V
• 500nA	25pA	DC/AC/PULSE	+ / − / ±	40V
• 200nA	10pA	DC/AC/PULSE	+ / − / ±	40V
• 100nA	5pA	DC/AC/PULSE	+ / − / ±	40V
• 50nA	2.5pA	DC/AC/PULSE	+ / − / ±	40V
• 20nA	1pA	DC/AC/PULSE	+ / − / ±	40V
• 10nA	500fA	DC/AC/PULSE	+ / − / ±	40V
• 5nA	250fA	DC/AC/PULSE	+ / − / ±	40V

■ GATE UNIT(40W)

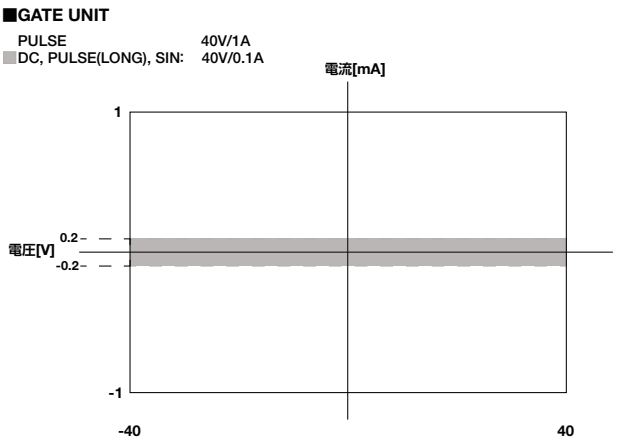
SINE OUTPUT

MODE: AC
FREQUENCY: 50Hz （AC）

SETTING ACCURACY

DC / PULSE: ± (Set value × 1.2% + Set range × 0.4%)
AC：± (Set value × 2% + Set range × 0.5%)

OUTPUT RANGE



OUTPUT PART

OUTPUT VOLTAGE			
Voltage Range	Setting Resolution	Voltage Range	Setting Resolution
• 50V	2.5mV	5V	250μV
• 20V	1mV	2V	100μV
• 10V	500μV	1V	50μV

SETTING ACCURACY

DC / PULSE: ± (Set value × 1.2% + Set range × 0.4%)
AC：± (Set value × 2% + Set range × 0.5%)

DYNAMIC RANGE （MEASUREMENT CURRENT）

Up to 125% of the measurement range can be measured.
*Accuracy is specified only in the measurement range.

MEASUREMENT PART

MEASUREMENT CURRENT			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 1A	50μA	50μA	2.5nA
• 500mA	25μA	20μA	1nA
• 200mA	10μA	10μA	500pA
• 100mA	5μA	5μA	250pA
• 50mA	2.5μA	2μA	100pA
• 20mA	1μA	1μA	50pA
• 10mA	500nA	500nA	25pA
• 5mA	250nA	200nA	10pA
• 2mA	100nA	100nA	5pA
• 1mA	50nA	50nA	2.5pA
• 500μA	25nA	20nA	1pA
• 200μA	10nA	10nA	500fA
• 100μA	5nA	5nA	250fA

MEASUREMENT CURRENT ACCURACY

2A ～ 50μA range:
± (Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output voltage)
20μA ～ 5nA range:
(Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output voltage)
± 50pA

DYNAMIC RANGE （MEASUREMENT CURRENT）

Up to 125% of the measurement range can be measured.
※ Accuracy is specified only in the measurement range.

■ GND UNIT

GND UNIT

Output voltage 0 V ± 100 μ V
Maximum sink current ± 2.5 A
Connecting terminal FORCE、SENSE （Triaxial）

AUX

Output voltage(※ 1) ± 40 V
Output current ± 50 mA （TYP）
※ 1: Output only during measurement

TRIG OUT

Output voltage 3.3 V CMOS output
Output at the start of the measurement cycle

DISPLAY

Display 12.1 inch TFT-LCD with touch panel
Dimensions (H × V) 261.12 mm × 163.2 mm
Number of pixcels 1280 × 800 (WXGA)
Screen display XY, YT, DATA LIST, CURSOR

Power Source

Power Voltage Range AC100V ～ 240 V ± 10%
Frequency 50/60Hz
Power line consumption 220 VA max (CS-8200/8500)
200 VA max (CS-8020)

Physical characteristics

Dimensions W424 mm × H221 mm × D556 mm
Weight About 21 kg (CS-8200/8500)
About 19 kg (CS-8020)

Accessory

Control interface terminator
Protective cover right
Protective cover left
Fixed belt
Instruction manual (this manual)
CD (Instruction Manual / Remote Control Manual)
Power Cord
Cord Strap

Compliance Information Low Voltage Directive (Safety)

EN61010-1: 2010/A1: 2019
Pollution degree 2
Overvoltage category (installation category) II
EMC Directive
EN61326-1: 2013 (Group1, ClassA)
RoHS Directive
EN IEC 63000: 2018

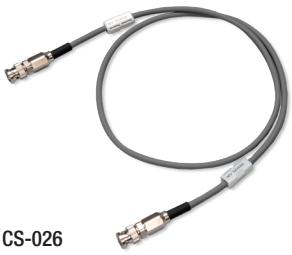
Accessory

Option cable

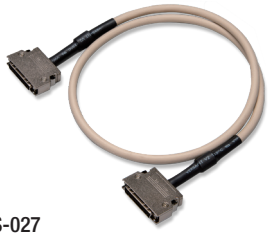
The cable will be required when connecting with HC unit, test fixture and CS-8000.

Cable set	Model	Item	
CS-020 MV Standard cable set (recommended for CS-320)	CS-026	Triaxial cable (L=1.0m)	7
	CS-027	Control I/F cable (L=1.0m)	1
	CS-028	Interlock/Sense cable(L=1.0m)	1
CS-021 HV Standard cable set (recommended for CS-322)	CS-025	HV cable(L=1.0m)	2
	CS-026	Triaxial cable (L=1.0m)	7
	CS-027	Control I/F cable (L=1.0m)	1
	CS-028	Interlock/Sense cable(L=1.0m)	1
CS-022 HC Standard cable set (recommended for HC unit)	CS-027	Control I/F cable (L=1.0m)	1
	CS-028	Interlock/Sense cable(L=1.0m)	1

CS-025
HV cable



CS-026
Triaxial Cable

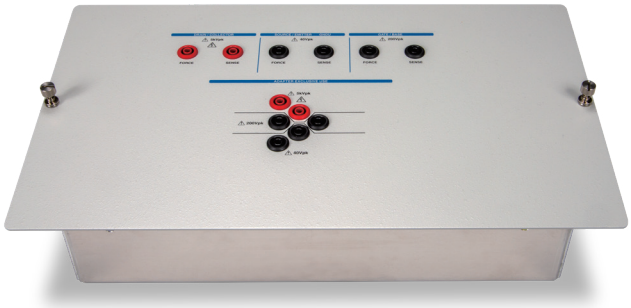


CS-027
Control I/F cable

CS-028
Interlock/Sense cable

CS-520 Patch panel

It does not come with CS-32x test fixture.



Adaptor installation imege

Adapter CS-500 series

Installation to test fixture and patch panel.

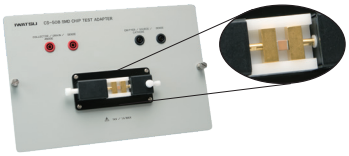
Heat resistance TO socket

200℃、350A (500μs)

Test Fixture for TSSOP 14

SMD type adaptor CS-508

Adaptor for SMD type



Bottm view
Banana plug

CS-501A

TO

CS-502

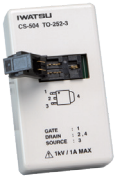
AXIAL

CS-503

TO-263-3/ D2PAK

CS-504

TO-252-3



CS-505

TO-263-7

CS-506

TO-252-5

CS-507

SC-70-3/ SOT-323-3

CS-509

SC-59A/ SOT-23-3L

CS-510

SC-62/ SOT-89

CS-512

TO-247-4L

Coming soon

CS-513

DFN-8(5×6)

■ CS-401 LPSMU(4W)

LPSMU CS-401

CS-401 is a Low Power SMU (LPSMU), which can output 100V / 200mA as maximum and can be operated from the main unit. CS-401 can be used as multiple additional SMUs for Emitter sense, Temperature sensor diode, Back-gate etc.

OUTPUT PART

OUTPUT VOLTAGE

Voltage Range	Setting Resolution	Mode	Polarity	Max. Peak Current
• 100V	5mV	DC	+ / −	40mA
• 50V	2.5mV	DC	+ / − / ±	80mA
• 20V	1mV	DC	+ / − / ±	200mA
• 10V	500μV	DC	+ / − / ±	200mA
• 5V	250μV	DC	+ / − / ±	200mA
• 2V	100μV	DC	+ / − / ±	200mA
• 1V	50μV	DC	+ / − / ±	200mA
• 500mV	25μV	DC	+ / − / ±	200mA

OUTPUT CURRENT

Current Range	Setting Resolution	Mode	Polarity	Max. Peak Voltage
• 200mA	10μA	DC	+ / − / ±	20V
• 100mA	5μA	DC	+ / − / ±	20V
• 50mA	2.5μA	DC	+ / − / ±	50V
• 20mA	1μA	DC	+ / − / ±	50V
• 10mA	500nA	DC	+ / − / ±	50V
• 5mA	250nA	DC	+ / − / ±	50V
• 2mA	100nA	DC	+ / − / ±	50V
• 1mA	50nA	DC	+ / − / ±	50V
• 500μA	25nA	DC	+ / − / ±	50V
• 200μA	10nA	DC	+ / − / ±	50V
• 100μA	5nA	DC	+ / − / ±	50V
• 50μA	2.5nA	DC	+ / − / ±	50V
• 20μA	1nA	DC	+ / − / ±	50V
• 10μA	500pA	DC	+ / − / ±	50V
• 5μA	250pA	DC	+ / − / ±	50V
• 2μA	100pA	DC	+ / − / ±	50V
• 1μA	50pA	DC	+ / − / ±	50V
• 500nA	25pA	DC	+ / − / ±	50V
• 200nA	10pA	DC	+ / − / ±	50V
• 100nA	5pA	DC	+ / − / ±	50V
• 50nA	2.5pA	DC	+ / − / ±	50V
• 20nA	1pA	DC	+ / − / ±	50V
• 10nA	500fA	DC	+ / − / ±	50V
• 5nA	250fA	DC	+ / − / ±	50V

*Max. voltage is 50V when polarity is set to BIPOLAR (±).

SETTING RESOLUTION

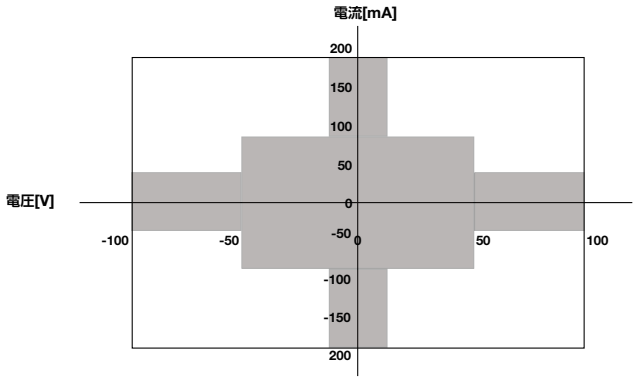
1/ ± 20000 of Set range

SETTING ACCURACY

± (Set value × 1.2% + Set range × 0.4%)

OUTPUT RANGE

■LP SMU



MEASUREMENT PART

MEASUREMENT VOLTAGE

Current Range	Setting Resolution	Current Range	Setting Resolution
• 100V	5mV	10V	500μV
• 50V	2.5mV	5V	250μV
• 20V	1mV	10V	500μV
• 5V	250μV	2V	100μV
• 1V	50μV	500mV	25μV

MEASUREMENT VOLTAGE ACCURACY

± (Measured value × 1.2%
+ Measurement Range × 0.4%)

DYNAMIC RANGE (MEASUREMENT VOLTAGE)

Up to 125% of the measurement range can be measured.
* Accuracy is specified only in the measurement range.

MEASUREMENT CURRENT

Current Range	Setting Resolution	Current Range	Setting Resolution
• 200mA	10μA	20μA	1nA
• 100mA	5μA	10μA	500pA
• 50mA	2.5μA	5μA	250pA
• 20mA	1μA	2μA	100pA
• 10mA	500nA	1μA	50pA
• 5mA	250nA	500nA	25pA
• 2mA	100nA	200nA	10pA
• 1mA	50nA	100nA	5pA
• 500μA	25nA	50nA	2.5pA
• 200μA	10nA	20nA	1pA
• 100μA	5nA	10nA	500fA
• 50μA	2.5nA	5nA	250fA

■ CS-401 LPSMU(4W)

MEASUREMENT CURRENT ACCURACY

200mA ～ 50nA range:
± (Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output Voltage)
20nA ～ 5nA range:
± (Measured value × 1.2% + Measurement range × 0.4%)
± (Measurement range × 0.002% × Output voltage) ± 50pA

POWER SOURCE

Feed from Control Interface Input.

PHYSICAL

Dimensions (W × H × D)	424 mm × 44 mm × 220 mm
Weight	About 3 kg
Accessory	User's Guide

DYNAMIC RANGE (MEASUREMENT CURRENT)

Up to 125% of the measurement range can be measured.
* Accuracy is specified only in the measurement range.

■ CS-402 SEMU(4W)

SEMU CS-402

CS-402 is a measurement unit for Drain current (Sense Emitter output etc.), output current of current monitor from Collector etc. Measurement Sense current at same time as Main current enables to get several parameters, which includes Diversion ratio of current sense terminal, threshold voltage and saturation voltage.

MEASUREMENT UNIT

MEASUREMENT CURRENT RANGE			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 200mA	10μA	20μA	1nA
• 100mA	5μA	10μA	500pA
• 50mA	2.5μA	5μA	250pA
• 20mA	1μA	2μA	100pA
• 10mA	500nA	1μA	50pA
• 5mA	250nA	500nA	25pA

※1: Up to 125% of the measurement range can be measured.
※2: Specified within the measurement range.

MEASUREMENT CURRENT ACCURACY

± (Measured value × 1.2% + Measurement range × 0.4%)

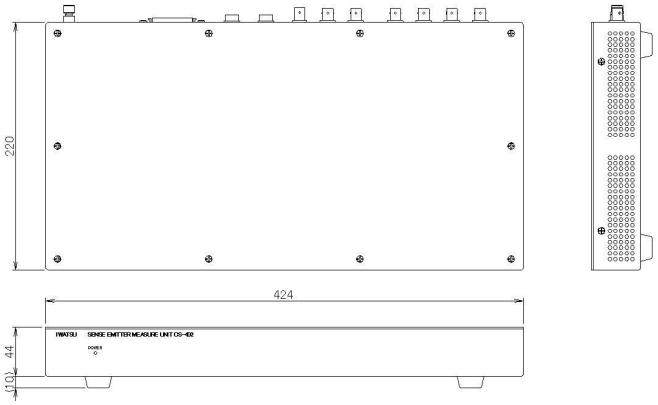
DYNAMIC RANGE (MEASUREMENT CURRENT)

Up to 125% of the measurement range can be measured.
* Accuracy is specified only in the measurement range.

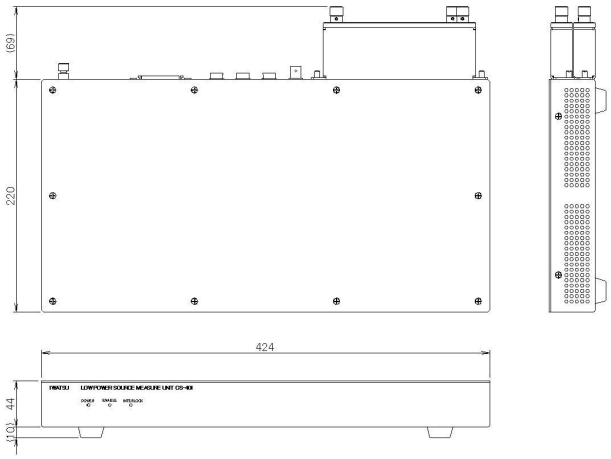
PHYSICAL

Dimensions (W × H × D)	424 mm × 44 mm × 220 mm
Weight	About 2.5 kg
Accessory	User's Guide

SEMU External dimensions



LPSMU External dimensions



■ CS-403 CMU

CMU CS-403

CS-403 provides capacitance measurement function with CS-8000 series. Main unit, CS-403 and CS-323 test fixture constitute High voltage CV measurement system.

MEASUREMENT UNIT

MEASUREMENT FREQUENCY RANGE
1 kHz ～ 100 kHz

MEASUREMENT ACCURACY		
Frequency	Measurement range	Accuracy(Additional error)
• 1kHz	100pF ～ 100nF	± 5% (± 20pF)
• 10k ～ 100kHz	10pF ～ 100nF	± 5% (± 2pF)

MEASUREMENT VOLTAGE RANGE

20 mV, 100 mV

POWER SOURCE

Feed from Control Interface Input.

PHYSICAL

Dimensions (W × H × D)	424 mm × 44 mm × 220 mm
Weight	About 2.2 kg

Accessories

User's Guide
CV cable

■ CS-404 SENSE SELECTOR UNIT

SENSE SELECTEOR UNIT CS-404

CS-404 provides seamless measurement without re-wiring when using multiple optional units.

POWER SOURCE

Fed from Control Interface Input.

PHYSICAL

Dimensions (W × H × D)	424 mm × 44 mm × 220 mm
Weight	About 3 kg
Accessory	User's Guide

■ CS-405 POWER EXPANDER UNIT

POWER EXPANDER UNIT CS-405

CS-405 feeds power to other CS-8000 series optional units. If a number of using optional units is over the limit, which is from power feeding from CS-8000 Series main unit, CS-405 can expand the feeding power and the maximum number. Power is fed to each optional unit via a control cable.

POWER SOURCE

Voltage range	AC 100 ～ 240 V ± 10%
Frequency	50/60Hz
Power Consumption	50 VA max

PHYSICAL

Dimensions (W × H × D)	424 mm × 44 mm × 220 mm
Weight	About 3 kg
Accessories	Instruction Manual (CD)
	User's Guide
	Power code

■ CS-200 series HC UNIT

CS-200 (High Current Unit) is a high current SMU with a maximum current of 2000A and a maximum current of 40V. This unit is operated by the main unit. Three types of lineups can be selected to match the DUT to be measured.

Model	Max Current	Max. Peak Power
CS-220	2kA	25kW
CS-210	1kA	12.5kW
CS-205	500A	6.25kW

OUTPUT PART

Output Current				
Current Range	Setting Resolution	Mode	Polarity	Max. Peak Voltage
• 2kA ※1	100mA	PULSE	+ / −	41V ※4
• 1kA ※2	50mA	PULSE	+ / −	50V
• 500A	25mA	PULSE	+ / −	50V
• 200A	10mA	PULSE	+ / −	50V
• 100A	5mA	PULSE	+ / −	50V
• 50A	2.5mA	PULSE	+ / −	50V
• 10A	1mA	PULSE	+ / −	50V
• 5A	500μA	PULSE	+ / −	50V

※1： The 2kA range is available on CS-220 only.
※2： 1kA range is available on CS-220 and CS-210.
※3： Voltage setting is specified with no load.
※4： Output setting is limited to 41V only when the 2kA current range is used.

Setting Accuracy

± (Set value × 2% + Set range × 0.1%)

Measurement Cycle

2ms ～ 5ms

Measurement Point

Arbitrary settings

Pulse Width

10μs ～ 500μs （2kA・1kA range）
10μs ～ 1ms （500 ～ 5A range）
*When the pulse width is narrow, it may not be possible to output up to the maximum voltage/current.

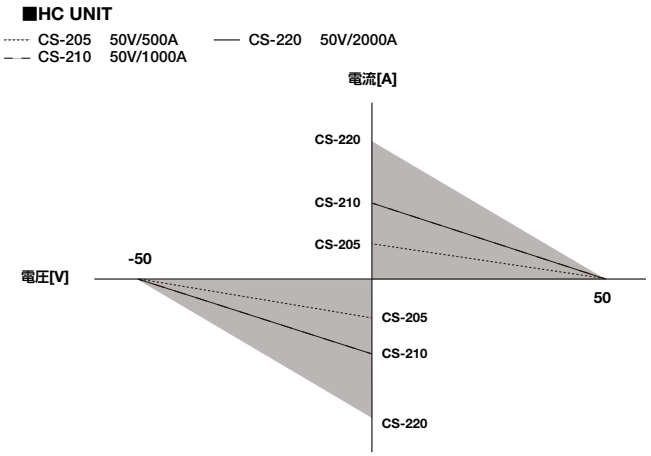
Duty Ratio

≦ 0.1 % (2 kA)
≦ 0.25 % (1 kA)
≦ 0.5 % (500 A, 200 A)
≦ 1 % (100 A ～ 5 A)

Output Resistance

25 m Ω (2 kA Range) (Typical value)
50 m Ω (1 kA Range) (Typical value)
100 m Ω (500 A Range) (Typical value)

Output Range



MEASUREMENT PART

Measurement Voltage			
Voltage Range ※1	Setting Resolution	Voltage Range	Setting Resolution
• 50V	2.5mV	2V	100μV
• 20V	1mV	1V	50μV
• 10V	500μV	500mV	25μV
• 5V	250μV	200mV	10μV

Current Measurement Accuracy ※2※3

± (Set value × 2 % + Set range × 0.1 %)

Dynamic Range （Measurement voltage）

Can measure up to 125% of the measurement range.

※ 1: Voltage measurement is measured at MAIN UNIT (using MV SENSE terminal).
※ 2: Specified within the measurement range.
※ 3: Specified in combination with MAIN UNIT.

Measurement Current			
Current Range	Setting Resolution	Current Range	Setting Resolution
• 1A	50μA	50μA	2.5nA
• 500mA	25μA	20μA	1nA
• 200mA	10μA	10μA	500pA
• 100mA	5μA	5μA	250pA

※1： The 2kA range is available only on the CS-220.
※2： The 1kA range is available on the CS-220 and CS-210.

Current Measurement Accuracy

± (Set value × 2 % + Set range × 0.1 %) ※1※2

Dynamic Range(Measurement current)

Can measure up to 125% of the measurement range.

Power Source

Power voltage range
AC 100 ～ 240 V ± 10%、50/60Hz

Power Consumption

300 VA max (CS-220)
270 VA max (CS-210/CS-205)

Physical Characteristics

Dimensions(W x H x D, Excluding accessories and projection)
424 mm x 176 mm x 556 mm (CS-220)
424 mm x 132 mm x 556 mm (CS-210/CS-205)
Weight
About 22kg (CS-220)
About 21kg (CS-210/CS-205)

Accessory

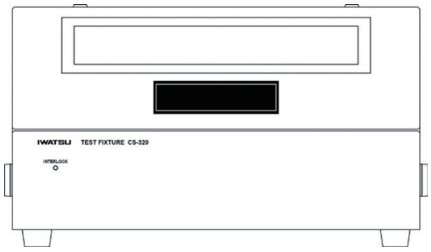
HC-FIXTURE Connection Unit : 1
Connecting Brackets : 4
Power Cord : 1
Cord Strap : 1
Instruction Manual : 1
Sales Network : 1

Notice:

HC standard cable set CS-022 is required to connect to CS-8000.

■ CS-32x series Test Fixture

Test Fixture CS-320



This product is a cutting-edge test fixture capable of operating at a maximum peak voltage of 200V and a maximum peak current of 2 A in combination with the CS-8000 series curve tracer and the CS-200 series HC unit. It is useful not only for measuring the characteristics of high-voltage, high-current power devices such as the latest IGBTs and power MOSFETs, but also for measuring the characteristics of various semiconductors such as transistors and diodes. It can also be combined with the CS-400 series using AUX.

Rear Terminal

Item	Specification
DRAIN/COLLECTOR	200 Vpk : FOURCE, SENSE(TRIAXAL)
GATE/BASE	40 Vpk : FOURCE, SENSE(TRIAXAL)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(TRIAXAL)
AUX1	40 Vpk : BNC
AUX2	40 Vpk : BNC

Terminal inside the cover

Item	Specification
DRAIN/COLLECTOR	5 kVpk : FORCE(4 ϕ Banana terminal & 6 ϕ Screw terminal) : SENSE(4 ϕ Banana terminal)
GATE/BASE	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
AUX1	40 Vpk : 4 ϕ Banana terminal
AUX2	40 Vpk : 4 ϕ Banana terminal
GNDU	- : 4 ϕ Banana terminal

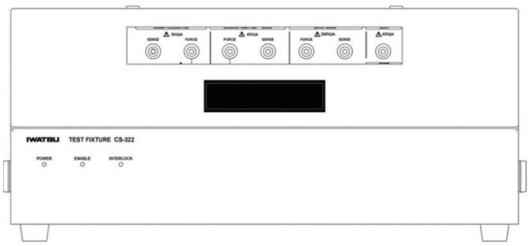
Indicator(LED)

Interlock・ENABLE

Control signal

Control interface input / output
Interlock
External interlock (HR10 connector: 10 pins)
Physical characteristics
Dimension(W × H × D) 330mm × 180mm × 370mm (Excluding accessories and projection)
Weight About 10 kg (Excluding accessories and options)

Test Fixture CS-322



This product is a cutting-edge test fixture capable of operating at a maximum peak voltage of 5 kV and a maximum peak current of 2 kA in combination with the CS-8000 series curve tracer and the CS-200 series HC unit. It is useful not only for measuring the characteristics of high-voltage, high-current power devices such as the latest IGBTs and power MOSFETs, but also for measuring the characteristics of various semiconductors such as transistors and diodes.
By placing the device to be measured inside the cover of the test fixture and making basic connections, the CS-8000 series can perform measurements while automatically switching the connection with the applied power supply by command from the CS-8000 series for each circuit to be measured. It can also be combined with the CS-400 series using AUX.

Rear terminal

Item	Specification
DRAIN/COLLECTOR	
MIDDLE VOLTAGE	200 Vpk : FOURCE, SENSE(triaxial)
HIGH VOLTAGE	5 kVpk : FORCE,SENSE(HV)
HIGH CURRENT	50 Vpk : HIGH, LOW(6 ϕ Banana terminal)
GATE/BASE	40 Vpk : FOURCE, SENSE(triaxial)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(triaxial)
GNDU	FORCE, SENSE(triaxial)
AUX1	40 Vpk : BNC
AUX2	40 Vpk : BNC

Terminal inside the cover

Item	Specification
DRAIN/COLLECTOR	5 kVpk : FORCE(4 ϕ Banana terminal & 6 ϕ Screw terminal) : SENSE(4 ϕ Banana terminal)
GATE/BASE	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
AUX1	40 Vpk : 4 ϕ Banana terminal
AUX2	40 Vpk : 4 ϕ Banana terminal
GND	- : 4 ϕ Banana terminal

CONFIGURATION

Internal wiring switching function
GATE / BASE RESISTOR connection function

Indicator(LED)

Interlock・ENABLE

Control signal

Control interface input / output

Interlock

External interlock (HR10 connector: 10 pins)

Power Source

Power Voltage Range AC 100 ～ 240 V ± 10%

Frequency 50/60Hz

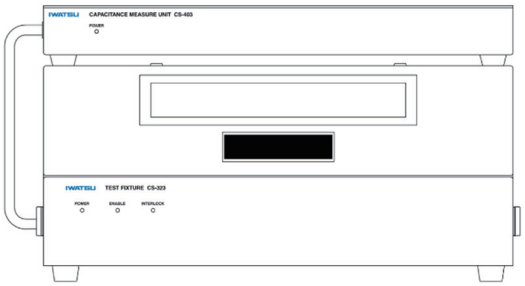
Power line consumption 50 VA max

Physical characteristics

Dimension(W X H X D) 424mm × 180mm × 555mm (Excluding accessories and projection)

Weight About 10 kg (Excluding accessories and options)

Test Fixture CS-323



The High Voltage C-V Measurement System consists of the CS-8000 series curve tracer, CS-403 and CS-323 test fixtures, and the CV Measurement Tool for CS-8000 application that remotely controls them.
The CS-8000 changes the DC bias voltage and measures the capacitance and resistance of the device with an LCR meter.
The CS-8000 can sweep the drain (collector) or gate (base) bias voltage values. This allows the user to examine the characteristics of the change in measured values due to changes in each DC bias. In addition, the CS-8000 can perform C-Time measurement, in which a constant DC bias voltage is applied at a specified time and the change in capacitance and resistance over time is measured, and Frequency Sweep measurement, in which the measurement frequency is swept.

Rear terminal

Item	Specification	
DRAIN/COLLECTOR		
MIDDLE VOLTAGE	200 Vpk : FOURCE, SENSE(triaxial)	
HIGH VOLTAGE	5 kVpk : FORCE,SENSE(HV)	
HIGH CURRENT	50 Vpk : HIGH, LOW(6 ϕ Banana terminal)	
GATE/BASE	40 Vpk : FOURCE, SENSE(triaxial)	
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(triaxial)	
GNDU	FORCE, SENSE(triaxial)	
LCUR,LPOT,HPOT,HCUR	-	Connect to LCR meter through CV CABLE
J1 TERMINAL	-	Detects if CV CABLE is properly installed
AUX1	40 Vpk : BNC	
AUX2	40 Vpk : BNC	

Terminal inside the cover

Item	Specification
DRAIN/COLLECTOR	5 kVpk : FORCE(4 ϕ Banana terminal & 6 ϕ Screw terminal) : SENSE(4 ϕ Banana terminal)
GATE/BASE	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
CV	
DRAIN/COLLECTOR/CATHODE	5 kVpk : SHV-Banana cable
SOURCE/EMITTER/ANODE	BNC-Banana cable
GATE/BASE	40 Vpk : BNC-Banana cable
AUX1	40 Vpk : 4 ϕ Banana terminal
AUX2	40 Vpk : 4 ϕ Banana terminal
GND	- : 4 ϕ Banana terminal

CONFIGURATION

Internal wiring switching function
GATE / BASE RESISTOR connection function

Indicator(LED)

Interlock・ENABLE

Control signal

Control interface input / output

Interlock

External interlock (HR10 connector: 10 pins)

Power Source

Power Voltage Range AC 100 ～ 240 V ± 10%

Frequency 50/60Hz

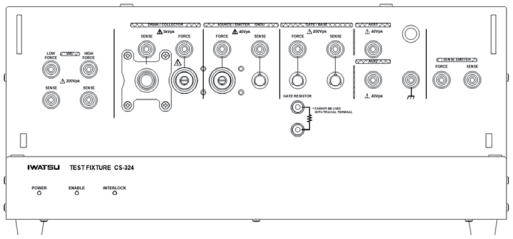
Power line consumption 50 VA max

Physical characteristics

Dimension(W X H X D) 424mm × 180mm × 555mm (Excluding accessories and projection)

Weight About 10 kg (Excluding accessories and options)

Test Fixture CS-324



This product is a unit designed to be used in conjunction with the CS-8000 series and to connect to test fixtures other than ours, such as probers. It can be used in combination with the CS-8000 series curve tracer and the CS-200 series HC unit to handle peak voltages up to 5 kV and peak currents up to 2 kA. The CS-8000 series can automatically switch the connection with the applied power supply according to the circuit to be measured. The Test Fixture CS-324 is a test fixture with dedicated connection terminals for use with the CS-401 and CS-402. It can also be combined with CS-400 series using SMU and AUX.

Rear terminal

Item	Specification
DRAIN/COLLECTOR	
MIDDLE VOLTAGE	200 Vpk : FOURCE, SENSE(triaxial)
HIGH VOLTAGE	5 kVpk : FORCE,SENSE(HV)
HIGH CURRENT	50 Vpk : HIGH, LOW(6 ϕ Banana terminal)
GATE/BASE	40 Vpk : FOURCE, SENSE(triaxial)
SMU	200 Vpk : FOURCE, SENSE(triaxial)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(triaxial)
GNDU	FORCE, SENSE(triaxial)
AUX1	40 Vpk : BNC
AUX2	40 Vpk : BNC

Terminal inside the cover

Item	Specification
DRAIN/COLLECTOR	5 kVpk : FORCE(4 ϕ Banana terminal & 6 ϕ Screw terminal) : SENSE(4 ϕ Banana terminal)
GATE/BASE	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal & triaxial)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(4 ϕ Banana terminal & triaxial)
SMU	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal & triaxial)
AUX1	40 Vpk : 4 ϕ Banana terminal
AUX2	40 Vpk : 4 ϕ Banana terminal
GND	- : 4 ϕ Banana terminal

CONFIGURATION

Internal wiring switching function
GATE / BASE RESISTOR connection function

Indicator(LED)

Interlock・ENABLE

Control signal

Control interface input / output

Interlock

External interlock (HR10 connector: 10 pins)

Power Source

Power Voltage Range AC 100 ～ 240 V ± 10%

Frequency 50/60Hz

Power line consumption 50 VA max

Physical characteristics

Dimension(W X H X D) 424mm × 180mm × 555mm (Excluding accessories and projection)

Weight About 9 kg (Excluding accessories and options)

IWATSU https://www.iwatsu.co.jp/tme/
IWATSU ELECTRIC CO., LTD.
Overseas Sales Sect.
Test & Measurement Solution Sales Dept.
7-41, 1-Chome Kugayama, Suginami-ku,
Tokyo, 168-8501 Japan
Tel: +81-3-5370-5483 Fax: +81-3-5370-5492

Test Fixture CS-325

This product is a cutting-edge test fixture capable of operating at a maximum peak voltage of 5 kV and a maximum peak current of 2 kA in combination with the CS-8000 series curve tracer and the CS-200 series HC unit. It is useful not only for measuring the characteristics of high-voltage, high-current power devices such as the latest IGBTs and power MOSFETs, but also for measuring the characteristics of various semiconductors such as transistors and diodes.
By placing the device to be measured inside the cover of the test fixture and making basic connections, the CS-8000 series can perform measurements while automatically switching the connection with the applied power supply by command from the CS-8000 series for each circuit to be measured.
Test Fixture CS-325 is a test fixture with dedicated connection terminals for use with CS-401 and CS-402. It can also be combined with the CS-400 series using SMU and AUX.

Rear terminal

Item	Specification
DRAIN/COLLECTOR	
MIDDLE VOLTAGE	200 Vpk : FOURCE, SENSE(triaxial)
HIGH VOLTAGE	5 kVpk : FORCE,SENSE(HV)
HIGH CURRENT	50 Vpk : HIGH, LOW(6 ϕ Banana terminal)
GATE/BASE	40 Vpk : FOURCE, SENSE(triaxial)
SMU	200 Vpk : FOURCE, SENSE(triaxial)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(triaxial)
GNDU	FORCE, SENSE(triaxial)
AUX1	40 Vpk : BNC
AUX2	40 Vpk : BNC

Terminal inside the cover

Item	Specification
DRAIN/COLLECTOR	5 kVpk : FORCE(4 ϕ Banana terminal & 6 ϕ Screw terminal) : SENSE(4 ϕ Banana terminal)
GATE/BASE	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
SOURCE/EMITTER	40 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
SMU	200 Vpk : FOURCE, SENSE(4 ϕ Banana terminal)
AUX1	40 Vpk : 4 ϕ Banana terminal
AUX2	40 Vpk : 4 ϕ Banana terminal
GND	- : 4 ϕ Banana terminal

CONFIGURATION

Internal wiring switching function
GATE / BASE RESISTOR connection function

Indicator(LED)

Interlock・ENABLE

Control signal

Control interface input / output

Interlock

External interlock (HR10 connector: 10 pins)

Power Source

Power Voltage Range AC 100 ～ 240 V ± 10%

Frequency 50/60Hz

Power line consumption 50 VA max

Physical characteristics

Dimension(W X H X D) 424mm × 180mm × 555mm (Excluding accessories and projection)

Weight About 11 kg (Excluding accessories and options)