IWATSU

Test and Measuring Instruments Catalog

Vol. 3

Semiconductor Curve Tracer

Digital Oscilloscope

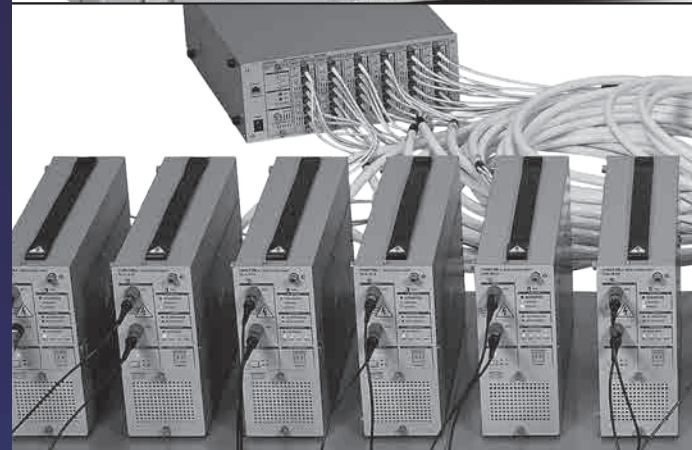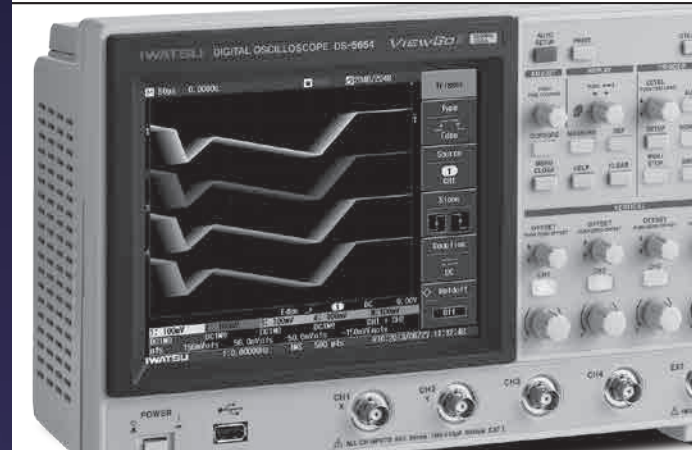Isolation Measurement System

Isolation Probe

Probe

Digital Multimeter

Universal Counter

Function Generator

Delay Pattern Generator

B-H Analyzer

Targeting tomorrow's electronics

At IWATSU, our focus is always on the future. With the relentless pace of development in the electronics industry, success demands innovation, creativity, and an unwavering commitment to research and development. Building on our solid base of accumulated basic research, we are expanding our cutting-edge R&D with high technology both domestically and overseas.

In addition to power electronics and it's managements such as inverters for train, PV(photovolatics), etc. we manufacture a wide range of electronic equipment and systems to cover various types of demands from industries and research for energy-efficient power managements.

1930's	1938	Iwatsu Electric Co., Ltd. founded in Shibuya, Tokyo.
1950's	1952	Grant-in-aid for industrial technology research was offered to our design of shock-wave measurement device. Two years later, Japan's first domestic oscilloscope was put on the market (trademark registered as SYNCHROSCOPE).
	1957	Listed on the first section of the Tokyo Stock Exchange.
1960's	1961	Development and manufacture of proprietary CRT for waveform observation started.
	1962	Development and manufacture of proprietary IC started.
1970's	1970	The first domestic IC oscilloscope released, providing a compact and light oscilloscope.
	1974	Colona-Denshi Co., Ltd., (present name: Iwatsu Test Instruments Corporation, Aizu factory) was established in Wakamatsu, Aizu, Fukushima as a production base for electric measurement equipment.
1980's	1980	World's fastest analog storage oscilloscope released.
1990's	1991	An overseas affiliate Iwatsu (Malaysia) Sdn. Bhd. (presently a consolidated subsidiary of Iwatsu Electric Co., Ltd.) was established.
	1999	Digital oscilloscopes were joint-developed with LeCroy Corporation.
2000's	2000	Iwatsu TME Service Co., Ltd., (present name: Iwatsu Test Instruments Corporation), a service company specializing in measurement equipment, was established.
	2002	Iwatsu Test Instruments Corporation was established from the measurement division of Iwatsu Electric Co., Ltd. The world's only 1GHz bandwidth analog storage oscilloscope, TS-81000 was released, featuring high speed high brightness writing.
	2004	50th anniversary of oscilloscope sales. Digital oscilloscopes to support Microsoft® Windows® OS were released. Digital multi-meter with two-channel input, VOAC7520 was released.
	2005	Full-scale entry into the field of measurement for the automobile industry.
	2006	Four models of digital oscilloscope DS-5100 series were released, providing high performance with low cost. Full-scale entry into the field of measurement for high performance electromagnetic steel sheets with the world's first V-H analyzer IE-1131B.
	2007	An isolation system for power electronics, DM-8000 was released, providing highly accurate measurement of ultra-high voltages.
	2009	Full-scale entry into the field of measurement for power semiconductors, with three models of CS-3000 series, a semiconductor curve tracer supporting high current at 1,000A. Capacitance displacement meter with high resolution and high stability, the ST-3541 series were released.
2010's	2010	Eight models of digital oscilloscope DS-5300 series were released.
	2011	Two models of CS-10000 series, a semiconductor curve tracer supporting ultra-high voltage high current, and three models of CS-5000 series were released, providing support to all needs in the field of measurement for power semiconductors. Genuinely domestic highly accurate measurement equipment, radiation dosimeter SV-1000/SV-2000 were released. B-H analyzer SY-8218 was released and eight models of digital oscilloscope DS-5500 series were released.
	2012	Rogowski-coil current probe SS-280 series and High voltage differential probe SS-320 were launched. Universal Counter SC-7217/7215 were released.
	2013	New Function Generator SG-4322/4321 were launched.
	2014	Eight models of digital oscilloscope DS-5600 series, new functions providing additional power, were released.

IWATSU
Test and Measuring Instruments

Multipurpose Unit Measures Leakage Current and High Current.
Auto Measurement Supported!

The best solution to properly measure semiconductors such as IGBTs, MOSFETs, TRANSISTORs and DIODEs from small to large quantities.

Semiconductor Curve Tracer

CS-10000 Series 10kV to 15kV, ~8,000A
CS-5000 Series 5kV, ~1,500A
CS-3000 Series 3kV, ~1,000A

Order Information

	Model Name	Model Number	Remarks
Main unit	Semi-conductor Curve tracer	CS-3100	3kV
		CS-3200	3kV, 400A
		CS-3300	3kV, 1,000A
		CS-5100	5kV
		CS-5200	5kV, 400A
		CS-5300	5kV, 1,000A
		CS-5400	5kV, 1,500A
		CS-10400	10kV, 4,000A
		CS-10800	10kV, 8,000A
		CS-12800	12kV, 8,000A
		CS-15800	15kV, 8,000A
Fixture	Fixture S	CS-301	Comes with CS-3100
	Fixture M	CS-302	Comes with CS-3200/3300
		CS-303	Comes with CS-5100/5200/5300
		CS-304	Comes with CS-5400
	Large Fixture	CS-307	
		CS-308	
Prober Cable	Fixture cable for CS-5400		Custom-made (Contact us)
	Prober cable		Custom-made (Contact us)
Alligator Clip	Small alligator clip Red 10pcs	CS-001	
	Small alligator clip Black 10pcs	CS-002	
Cable	High voltage wire Red 5pcs	CS-003	Banana clip, 5kV, 30cm
	Wire Black 5pcs	CS-004	Banana clip, 30cm
	Standard Lead Set	CS-005	Comes with Main unit except CS-3100, Banana cable 30cm (Red 2pcs for HV, Black 2pcs, Green 2pcs, and Yellow 1pc. Alligator Clip (Red 2pcs, Green 2pcs, Black 2pcs, and Yellow 1pc)
	Cable for High Current	CS-006	20cm,2pcs come with CS-5400
	Cable for High Current	CS-007	30cm,2pcs come with CS-10400/10800
Software	Semi-conductor parameter search	CS-800	Built in Main unit
	Semi-conductor parameter measurement	CS-810	Install in PC
Test Adapter	Test adaptor	CS-500	Comes with Main unit
	TO type test adaptor	CS-501A	
	AXIAL type adaptor	CS-502	
	TO-263-3(D2PAK) type adaptor	CS-503	
	TO-252-3 type adaptor	CS-504	
	TO-263-7 type adaptor	CS-505	
	TO-252-5 type adaptor	CS-506	
	SC-70-3(SOT-323-3) type adaptor	CS-507	
	SC-59A/SOT-23-3 type adaptor	CS-509	
	SC-62/SOT-89 type adaptor	CS-510	
Scanner unit	Switch control unit	CS-701	Integrated controller for each unit
	LV Relay unit	CS-702	300V/30A 10CH
	HV Relay unit	CS-703	5kV/3A 10CH
	HC Relay unit	CS-704	2kV/1,000A 10CH
	HV-HC Switch unit	CS-705	5kV/1,000A, Extension unit with HV/HC switch function
	Extension unit	CS-706	5kV/15A
	Gate/Short unit	CS-707	Curve tracer side:300V/8A Device side:5kV/8A 10CH
	HV-HC Relay unit 2CH	CS-708	5kV/1,500A 2CH
	HV-HC Relay unit 4CH	CS-709	5kV/1,500A 4CH
	HV-HC Switch unit (for CS-5400)	CS-710	5kV/1,500A, Extension unit with HV/HC switch function
	Fixture with hotplate function	CTJ1050	Heater surface 5kV insulating, Max. Temperature:200℃ , Interlock function
	Hotplate	PA3020	Dimension of Plate portion:200 × 200mm
		PA3040	Dimension of Plate portion:200 × 400mm

Advanced functions for your ease of use

The configuration is displayed in the setup display area under CONFIGURATION key sets.
Appropriate configuration can be selected for each device test.

Confirm applied voltage and current with waveforms in Wave mode.

· The pulse width and the measurement point can be specified even when you are confirming the applied waveform (current and voltage) to the device based on the time axis as with oscilloscopes.
· By confirming the waveform, appropriate pulse width and measurement timing can be decided.
· Since our products give no waveform influences such as probing of oscilloscopes, etc., abnormal signals are confirmable.
· This function also helps to confirm the anomalies caused by heat such as a oscillation, etc.
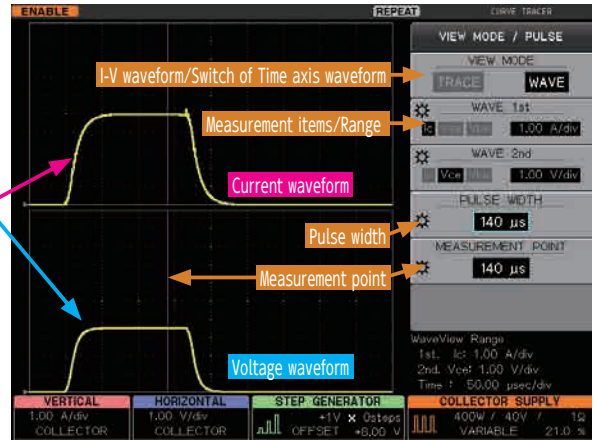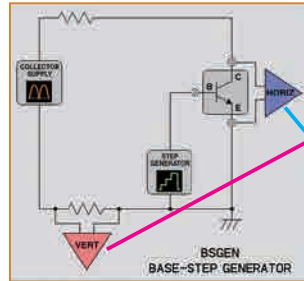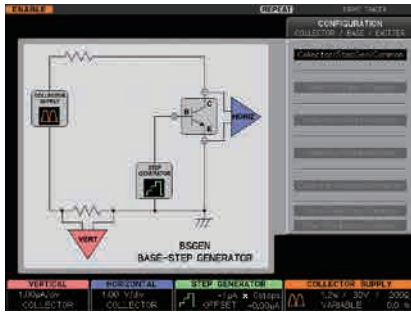
Full detailed automation with PC

Semiconductor parameter measurement with CS-810 (optional)
This software application performs various kinds of auto measurements through remote control of the main unit.
This software can execute stress test; which is difficult using traditional curve tracers, and can measure temperature characteristics of many devices, while controlling at the same time a hotplate and a thermostatic chamber.
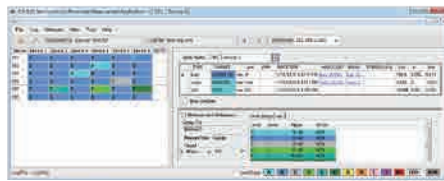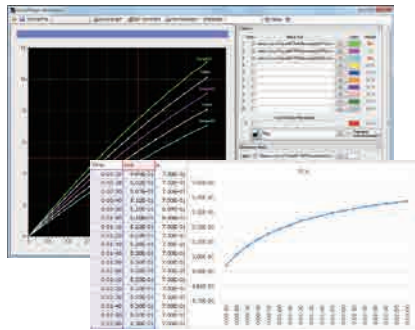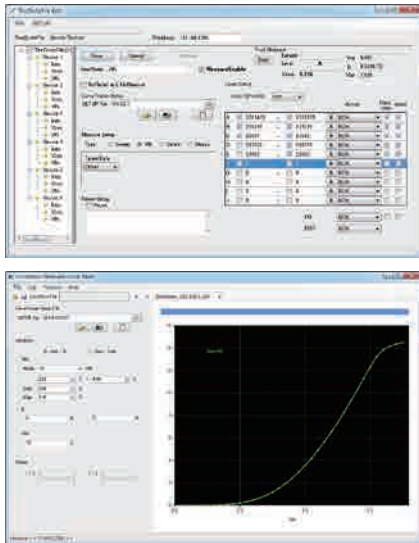
USB memory:
Graphic Images, Data, and Setup conditions can be saved. Graphic Images can be saved in various formats: TIFF,BMP,PNG. Black/White selection for color of background, color/monochrome selection are available.
Waveform data can be saved in Text and in Binary at the same time.

Remote Control tool (free download)
Where security policy restricts use of USB, the remote control tool for PC can be used.
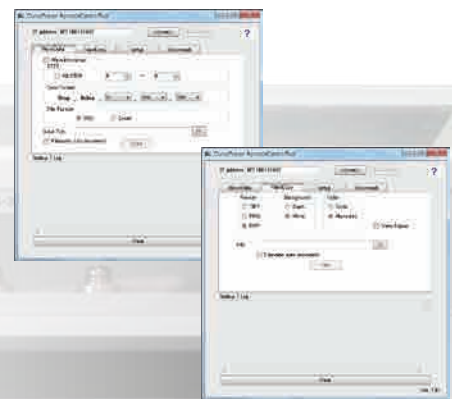
Ethernet:
Ethernet socket provided as a standard function (on the back side of Main unit)

Automatic measurement connecting with PC, Scanner, Thermostatic chamber, etc. are available.

Sweep

Number of points, sweeping speed, the resolution, and the direction of sweeping can be configured as needed. The custom sweep mode performs sweeping only on the specified range, high speed resolution measurement is performed at auto-measurement.

Limit-SWEEP function (requires optional CS-800)
This function puts limits on current and voltage produced through usual sweep measurement for device protection and stopping the sweep at the targeted value.

Vth-hFE auto search function (requires optional CS-800)
This function automatically finds the Vth-hFE. No complicated operations are needed.
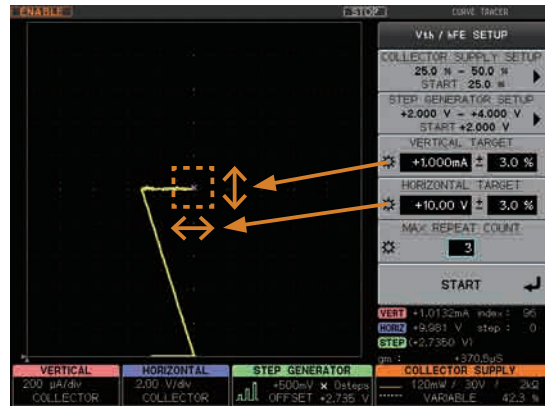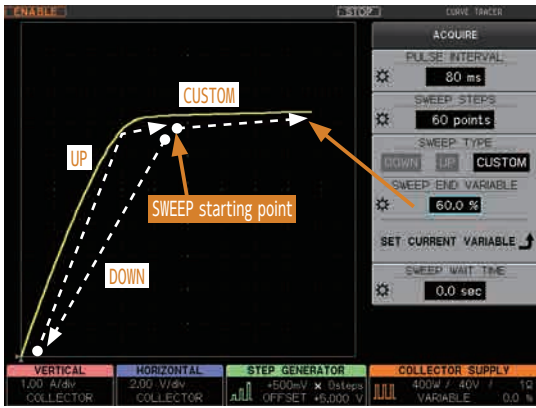
Separate knobs for easy operations

Separate Step Generator offset knob

Intuitive function keys

Separate keys

REPEAT STOP/SINGLE SWEEP

USBTerminal to input/output data from/to USB memory

One-touch hard-copying

Adjustable duty cycle minimizes heating. The output stops when Stop key is pushed.

Separate knobs for Current and Voltage range knobs

Breaker switch for COLLECTOR SUPPLY for protection of a measured device

CONSTANT function with CS-800 (optional)
Bias constant voltage or constant current.
With combination of semiconductor parameter measurement software CS-810, the curve tracer supports Auto stress test.

Semiconductor Curve Tracer 5kV
CS-5000 Series

Best suited for measuring the breakdown of a power device having 3,300V withstanding voltage

- Max. Peak Voltage: 5,000V (High-Voltage mode)
- Max. Peak Current: 1,500A（CS-5400 High-Current mode）
- All models support the LEAKAGE mode (Cursor resolution:1pA)

5kV
CS-5400
1,500A (HC mode pulse)

5kV
CS-5300
1,000A (HC mode pulse)
CS-5200
400A (HC mode pulse)

5kV
CS-5100
 (HC mode not equipped)

Collector supply HV mode

Model	CS-5000 series		
Mode/Polarity	Full-wave rectification/+－，DC/+－，LEAKAGE/+－，AC		
Max. Peak Voltage/Current	Max. Peak Voltage	Max. Peak Current (Max. Peak Pulse Current)	
	5kV	25mA (25mA)	
	300V	750mA (1.5A)	
	30V	7.5A (15A)	
Max. Peak Power	At 5kV : 320mW/3.2W/32W At 30V,300V : 120mW/1.2W/120W/390W		
Horizontal axis range	50mV to 500V/div		

Collector supply HC mode (CS-5100 does not equip with HC mode)

Model		CS-5100	CS-5200		CS-5300		CS-5400	
HC mode	Mode/Polarity		Pulse / +－					
	Max. Peak Current Max. Peak Power Max. Peak Voltage	No HC Mode equipped	Max. Peak Current/Power	Max. Peak Voltage	Max. Peak Current/Power	Max. Peak Voltage	Max. Peak Current/Power	Max. Peak Voltage
			400A / 4kW	40V	1,000A / 10kW	40V	1,500A / 12kW	30V
			40A / 400W	40V	400A / 4kW	40V	600A / 4.5kW	30V
					40A / 400W	40V	60A / 450W	30V
	Pulse width		Pulse width : variable between 50 μ s and 400 μ s (Resolution :10 μ s)					
	Measurement point		Measurement point can be specified. (Resolution :10 μ s)					
	Vertical range		100mA to 50A/div		100mA to 100A/div		100mA to 200A/div	
Fixture			CS-303				CS-304	

Semiconductor Curve Tracer
CS-3000 Series

3kV

Standard models suitable for parameter measurement of various semiconductors including IGBTs, MOSFETs, transistors and diodes, etc.

- Max. Peak Voltage 3,000V (High-Voltage mode)
- Max. Peak Current 1,000A (CS-3300 High-Current mode)
- All models support the LEAKAGE mode (Cursor resolution:1pA)
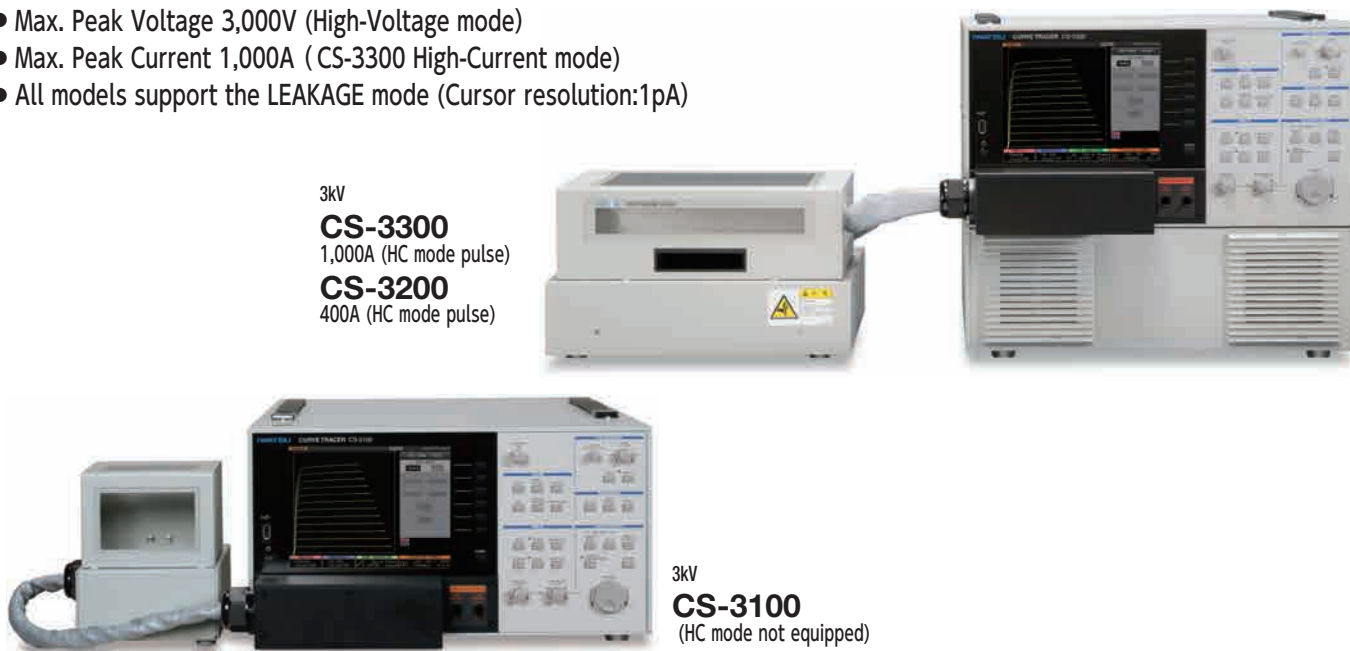
3kV
CS-3300
1,000A (HC mode pulse)
CS-3200
400A (HC mode pulse)

3kV
CS-3100
(HC mode not equipped)

Collector supply HV mode

Model	All CS-3000 Series	
Mode/Polarity	Full-wave rectification/+ − , DC/+ − , LEAKAGE/+ − , AC	
Max. Peak Voltage/Current	Max. Peak Voltage	Max. Peak Current (Max. Peak Pulse Current)
	3kV	75mA (150mA)
	300V	750mA (1.5A)
	30V	7.5A (15A)
Max. Peak Power	120mW / 1.2W / 120W / 390W* (*Setup is not available when Max. Peak Voltage 3kV is used.)	
Horizontal axis range	50mV to 500V/div	

Collector supply HC mode (CS-3100 does not equip with HC mode)

Model		CS-3100	CS-3200		CS-3300	
HC mode	Mode/Polarity		Pulse / + −			
	Max. Peak Current Max. Peak Power Max. Peak Voltage	No HC Mode equipped	Max. Peak Current/Power	Max. Peak Voltage	Max. Peak Current/Power	Max. Peak Voltage
			400A / 4kW	40V	1,000A / 10kW	40V
			40A / 400W	40V	400A / 4kW	40V
					40A / 400W	40V
	Pulse width		Pulse width: Changeable between 50 μ s to 400 μ s (Resolution: 10 μ s)			
	Measurement point		Measurement point can be specified. (Resolution: 10 μ s)			
	Vertical range		100mA to 50A/div		100mA to 100A/div	
Fixture		CS-301	CS-302			

Analog Curve Tracer

10kV ～

Best suited for the measurement of high voltage diodes and thyristors

Output	Voltage waveform	Commercial Power supply half-wave rectification waveform
	Max.Voltage	10kV Peak (when no loading)
	Max. Current	100mA Peak or 400mA
Display	Voltage range	50V/div to 1,000V/div (1-2-5 steps)
	Current range	0.1mA/div to 10mA/div or 50mA/div

Customers' special specifications are welcome. Please contact us.

Semiconductor Curve Tracer `10kV, 12kV and 15kV`
CS-10000 Series

Best suited for the chips with very high voltage and very high current, CS-3100 + UHV + HC

CS-15800 15kV / 8,000A
CS-12800 12kV / 8,000A
CS-10800 10kV / 8,000A
CS-10400 10kV / 4,000A

This series is sold-on-demand.
Please confirm the specification and
the delivery date at the time of estimation.
Requests for customization are welcome.

Optional Pulse Unit
This optional unit minimizes parameter variation caused by heat. Pulse rise time can be configured for 1, 3, or 5ms; pulse duration from 1ms to 20ms; and pulse interval from 100ms to 2 seconds. This option is installed at the factory. Any changes desired after purchase will require return to IWATSU factory.

Max Peak Voltage

Tr
< 1 / 3 / 5ms

Pulse Width
1ms to 20ms

Pulse Interval
100ms to 2s
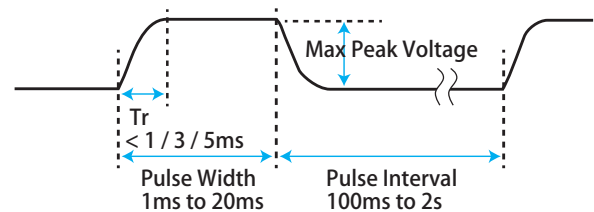
Collector supply HV mode

Model	CS-10000 series	
Mode/Polarity	Full-wave rectification/+ −, DC/+ −, LEAKAGE/+ −, AC	
Max. Peak Voltage/Current	Max. Peak Voltage	Max. Peak Current (Max. Peak Pulse Current)
	3kV	75mA (150mA)
	300V	750mA (1.5A)
	30V	7.5A (15A)
Max. Peak Power	120mW / 1.2W / 120W / 390W* (*Setup is not available when Max. Peak Voltage 3kV is used.)	

Collector Supply UHV mode

Model	CS-10400/CS-10800		CS-12800		CS-15800	
Mode/Polarity	DC / +					
Max. Peak Voltage/Current	Max. Peak Voltage	Max. Peak Current	Max. Peak Voltage	Max. Peak Current	Max. Peak Voltage	Max. Peak Current
	10kV	400mA	12kV	266mA	15kV	266mA
Max. Peak Power	40W / 400W / 4kW		32W / 320W / 3.2kW		40W /400W / 4kW	

Collector Supply HC mode

Model	CS-10400		CS-10800/12800/15800	
Mode/Polarity	Pulse / + −			
Max. Peak Current Max. Peak Power Max. Peak Voltage	Max. Peak Current / Power	Max. Peak Voltage	Max. Peak Current / Power	Max. Peak Voltage
	4,000A / 60kW	60V	8,000A / 80kW	40V
	400A / 6kW	60V	4,000A / 60kW	60V
	40A / 600W	60V	400A / 6kW	60V
			40A / 600W	60V
Pulse width	50 μs~900 μs , 50 μs~120 μs (at 8,000A) (Resolution:10 μs)			
Measurement point	Measurement point can be specified. (Resolution :10 μs)			
Horizontal axis range	100mA to 1,000A/div			

Test adaptors

Test adaptors for discrete packages

Test adaptor
CS-500 (Standard)
Used to connect your tool to Fixture.

Heat resistant TO Socket
200℃、350A (500 μs)

Fixture for TSSOP 14
※Fixture
Not for CS-301

Adaptor for SMD type
CS-508
※Fixture
Not for CS-301

Example:
Fixture attached

Connector portion on
the bottom of Socket

CS-501
TO-220/247

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-23-3

CS-510
SC-62/
SOT-89

Contact us if other types of sockets are needed.

Standard accessories

Use test adaptors on measurements of devices. Fixtures equips the safety mechanism in which the measurement stops when the cover opens.

Fixture S

Fixture M
This fixture can measure a device up to 235mm × 180mm. Place the patch panel attached when TO adaptor used.

(Note: Test adaptor is optional and does not
come with the unit.)

Fixture S
CS-301
comes with CS-3100

Fixture M
CS-302
comes with CS-3200/3300
CS-303
comes with CS-5100/5200/5300

Fixture M
CS-304
comes with CS-5400

Patch-panel for Fixture M
(comes with all units except for CS-3100)
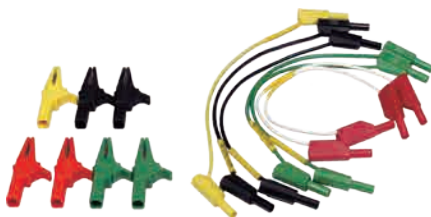
Standard set of leads
CS-005
come with all units except for CS-3100
Banana cables (2 red for HV, 2 green, 2 black, 1 yellow)
Alligator clip (2 Red , 2 green, 2 black, 1 yellow)

Cable for High Current (a set of two)
CS-006
comes with CS-5400
20cm

CS-007
comes with CS-10400/10800/12800/15800
30cm

Contact us for custom-made cables. We can change clips, lengths, withstand voltages, etc.

Scanner System
CS-700

The CS-810 software application provides automatic connection for multiple devices in a single package including commonly available modules containing 6 devices. It can also be used to individually connect to and test up to 10 single devices. CS -810 also controls relay units, thermostatic chambers and hot plates, so it can measure the temperature characteristics of each chip in 6 in 1 modules. (CS-800 and CS-810 required for scanner operation)
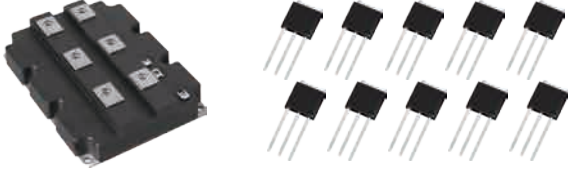
Switch Controlling Unit
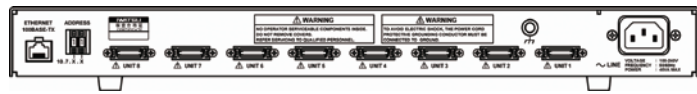
Switch Controlling Unit
CS-701
SC-701 is required so the CS810 software can control each CS-700 scanner unit up to 8 units, by connecting a PC through Ethernet. Multiple CS-701 (Max.10 units) can operate in parallel if given IP addresses.

Relay Unit

CH1
CH2
CH3

IN/OUT1
IN/OUT2

CH10
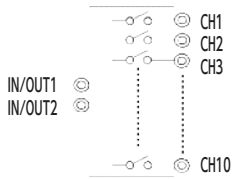
LV Relay Unit
CS-702
300V/7.5A/30A (Pulse)
10CH

HV Relay Unit
CS-703
5kV/0.5A
10CH

HC Relay Unit
CS-704
2kV/7.5A/1,000A (Pulse)
10CH

When 6 in 1 module is measured, this unit can short-circuit G and E, or C and G on unused circuits on the device.

IN/OUT1
IN/OUT2

BASE/GATE CH1
OPEN/SHORTCH1

BASE/GATE CH10
OPEN/SHORTCH10

Gate/Short Unit
CS-707
Curve racer side: 300V/7.5A/15A (Pulse)
Device side: 5kV/7.5A/15A (Pulse)
10CH

HV-HC Relay Unit
CS-708
5kV/7.5A/1,500A (Pulse)
2CH

HV-HC Relay Unit
CS-709
5kV/7.5A/1,500A (Pulse)
4CH

Extension Unit

Extension Unit
CS-706
5kV/1,000A (Pulse)
In case CS-5400 is used, modifications are required.

HV/HC Switch Unit
CS-705
5kV/1,000A (Pulse)
HV/HC switching (Auto/Manual) supported
・For CS-3200/3300/5200/5300

HV/HC Switch Unit
CS-710
5kV/1,500A (Pulse)
HV/HC switching (Auto/Manual) supported
・For CS-5400
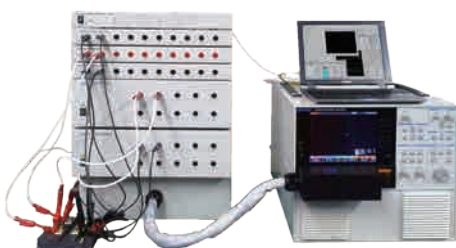
Example: connecting the unit to IGBT 2 in 1 module.

HC(CH2)
HC(CH1)

HIGH VOLTAGE or HIGH CURRENT
BASE/GATE
EMITTER

CS-3200/3300
CS-5200/5300

HC(CH2)
HC(CH1)

HIGH VOLTAGE or HIGH CURRENT
BASE/GATE
EMITTER

CS-5400
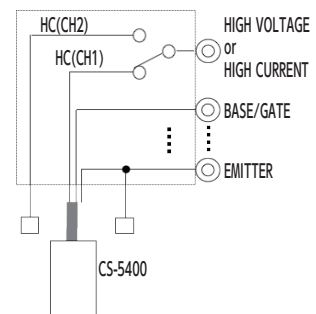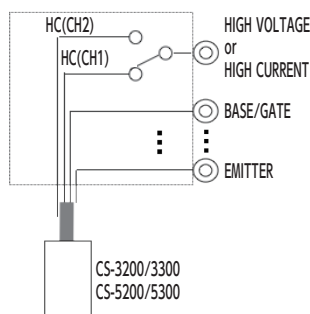
Temperature characteristics measurement

CS-810 automatically measures temperature characteristics, controlling the scanner system and hotplates, etc.

The picture on the right is a hotplate controllable combination of curve tracers, hotplates, and scanners. It provides a means to perform automatic measurement of multiple devices, 6 in 1 module, etc.
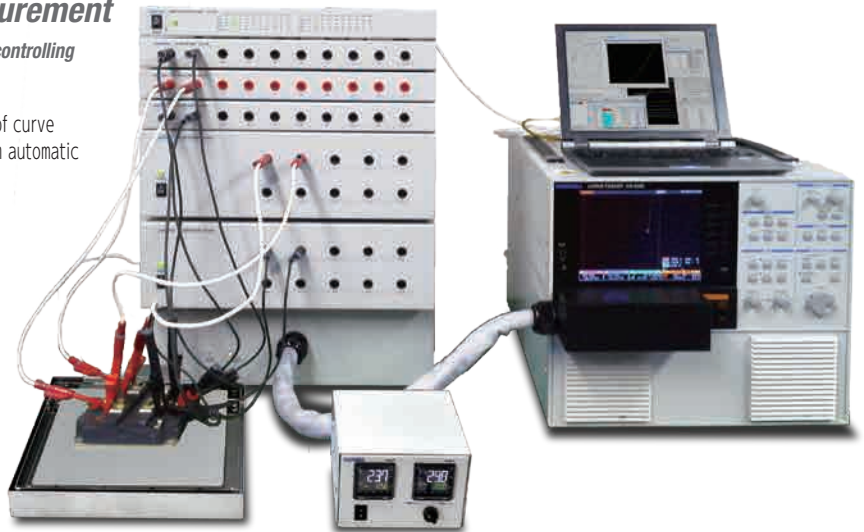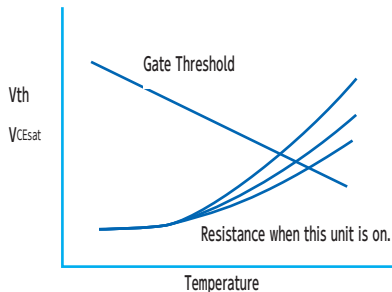
Fixture with hotplate functions
CTJ1050
Maker : CATS Inc.
Max. Temperature : 200℃
Max Voltage on devices 5kV (Insulating surface of heater 5kV)
Max. Current : 1,000A
Interlocking (when you open the cover, curve tracer stops outputting.)

Hot-Plate
PA3020/PA3040
Maker : MSA Factory Co., Ltd.
Max. Temperature : 300℃
Hot plate measurement :
PA3020 : 200 × 200
PA3040 : 200 × 400
Monitor Temperature by External temperature sensor.

Thermostatic chambers are available.

Contact us for the details.

For CS-5400

For CS-3xxx/5xxx
(Except CS-5400)

Prober cable
This is used to equip terminals of curve tracers inside Probers and large fixture.

Large Fixture
CS-305
Cooling fan, LED light, Warning light, Power supply outlet and Interlock are equipped.
External dimensions: 630Wx520Hx530D

Large Fixture
CS-307
Interlock equipped
External dimensions: 500Wx520Hx520D

Internal terminals portion

13

Software Application for parameter measurement of semiconductors : CS-810

CS-810 is an optional Software application that controls curve tracers, scanners, hotplates performing measurement and thereby automates the measurement. This makes improvement great in work efficiency.

Automates :
Measurement → Recording → Judgment
Improvements in efficiency to replace task that was traditionally performed manually

	Ices	Vces	VF	Vth	••••
Sample-1	xxxxA	xxxxV	xxxxV	xxxxV	••••
Sample-2	xxxxA	xxxxV	xxxxV	xxxxV	••••
Sample-3	xxxxA	xxxxV	xxxxV	xxxxV	••••
:	:	:	:	:	:

Switches automatically multiple-semiconductor modules and discrete devices to be targeted when you perform measurement
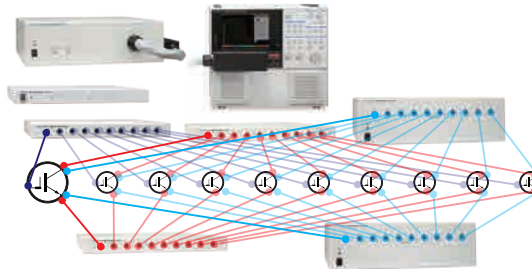
Hotplates are also remote-controllable, so Automatic measurement of 6 in 1 module can be performed too.
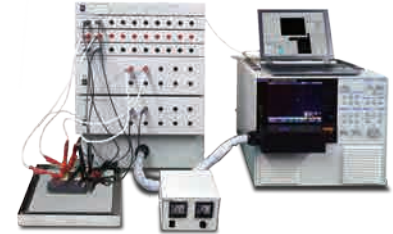
Easy to transfer the configuration measured to PC

By transferring the configuration measured manually on curve tracer to PC, you can set up the sequence. Programming knowledge is not required and anyone can set up it easily.

This key copies the configurations in the curve tracer to PC.

This key copies the configurations in PC to the Curve tracer.

This window is useful when you specify the threshold for the levels.
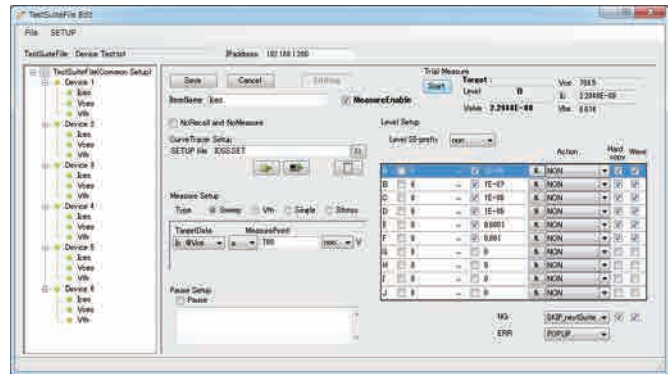
Categorization to the levels based on the measured value.
You can set 10 levels to which acquired result will be categorized.
For each levels, events to be performed, such as halting the measurement, skipping the measurement of such item
Showing an alert, Copying the waveform as an image, exporting to CSV files.

Measurement of static characteristics (Leakage current, Saturation voltage, VF, Vth, etc.)

Measurement type : Sweep
> Point with the larger data than the specified value.
< Point with the smaller data than the specified value.
≅ Point with the data closer to the specified value.
= Point with data equal to the specified value under interpolation.

Trial Measurement :
This is a function for debugging and the sequence can be confirmed.

Measurement type : Stress
Logging of voltage or current is available by biasing constant voltage or constant current for a long time. This is used for Stress test and reliability test.
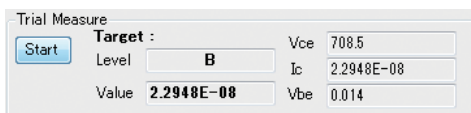
Measurement type : Vth
Makes measurement with the curve tracer's Vth Search function.
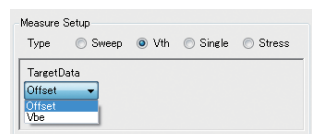
Output Window

A selection of export formats For the log file.

Details for selected test suite.

Shows the worst data for Item in each test

Configurations for selected item.

14
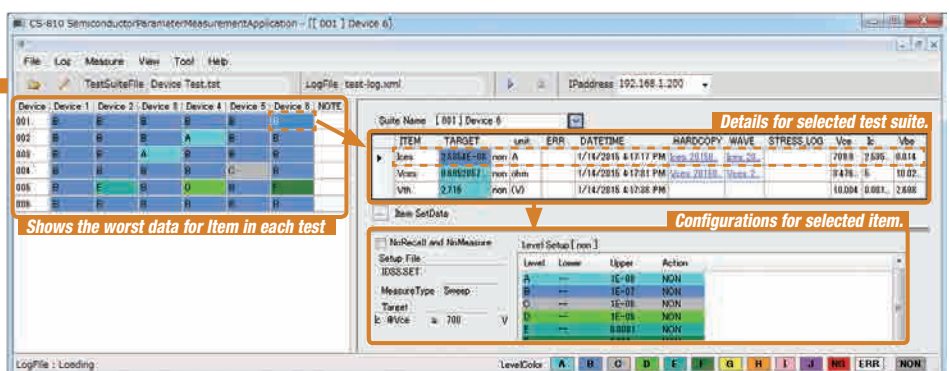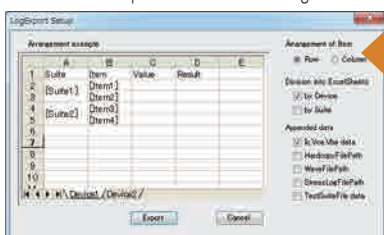
Software Application for parameter measurement of semiconductors : CS-810

Comparison among the curves

This application can compare a number of waveforms stored for the purpose of analysis of variation of characteristics and defects as well as Pass/Fail judgment.

Comparison between the waveforms and Judgment functions
This application can compare a waveform with reference waveform and judge whether the first waveform meets the specified condition.

Waveforms display
CSV files stored during past use, recall-waveforms stored in Curve tracer, and the waveforms currently monitored can be compared on the same graph up to 10 waveforms at the same time.

Rescaling
The displaying waveform can be stored in a CSV file at an arbitrary interval in voltage axis.

Cursor function
The displaying numerical numbers of waveforms are shown in a list. Besides the sampling points, this function interpolates the measured data.

Annotations
Annotations can be attached to the curves respectively.

Saving the images
Saving the images in various image format (PNG/BMP/JPG/TIFF) with a set of cursor values.

A selection of Graph styles
- Settable items
Chart title, background color, cursor color, line style (solid, dotted, broken)
For X and Y axes: Title, what data to be assigned, Scale (Log, linear) For Y axis only, intervals, min value, max value and grids.
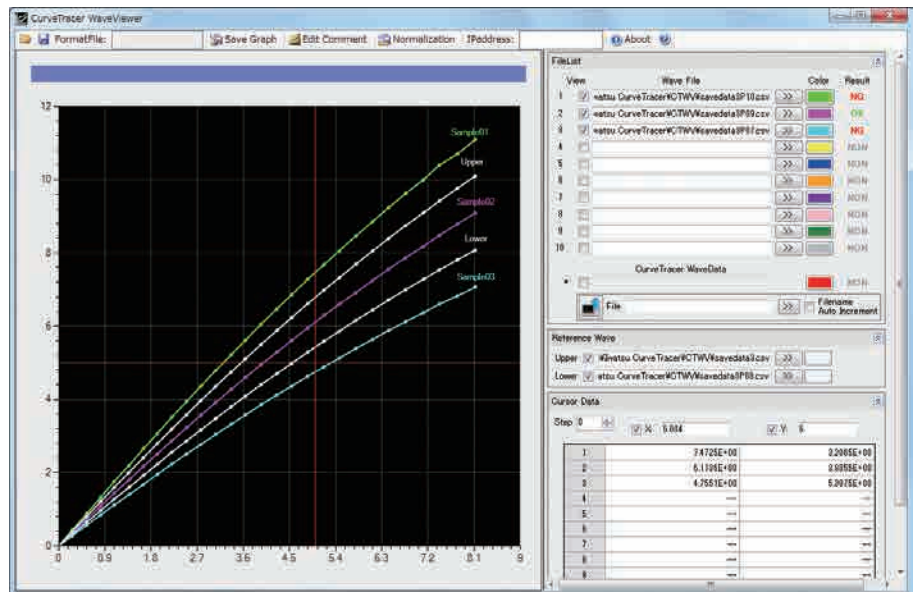
The measuring function for the transfer characteristics (Vge-Ic/Vge-Vce)

It used to be difficult for a curve tracer to measure transfer characteristics, however IWATSU can measure it now.

Various formats to save curves for characteristics
· Save the measured characteristics to CSV files.
· Save the curve image as PNG/BMP/JPG/TIFF

Cursor function
Cursors are displayed in X axis and Y axis interpolated value is displayed.

Customizable chart area
Chart title, axis label, background-color, and the axis ranges are all customizable.

Load/Save function of Configurations
This software can load/save the configurations for characteristics measurement and the customize done to the chart area.
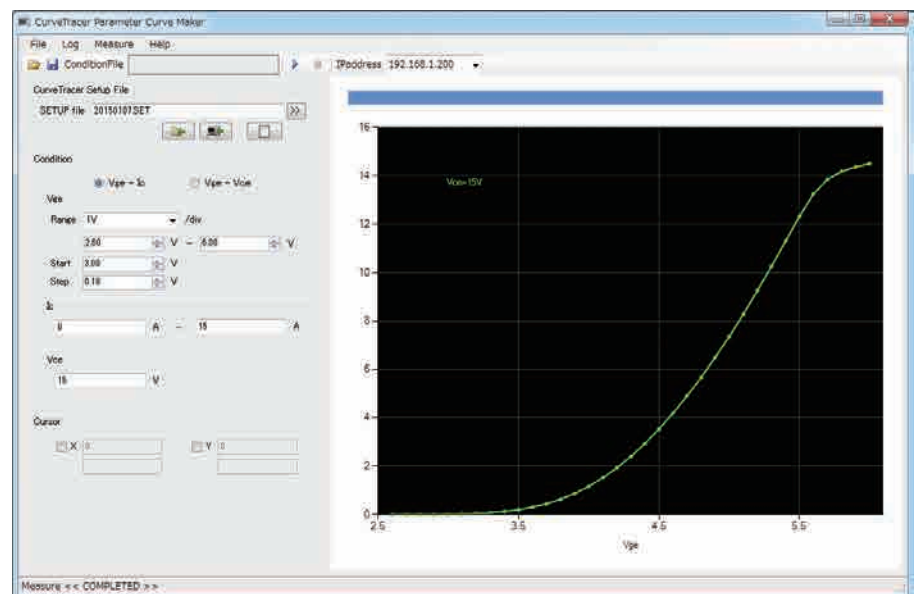
Software Application for parameter measurement of semiconductors : CS-810

Measurement of devices

Multiple devices measurement and recordings can be performed in a short time.

This software performs tests for multiple measurement items .
Operator simply need to input sample name according to the device replacements and connection changes, following the instructions on popups, to repeat measurement under the same conditions. Judgments (Pass/Fail) based on the requirements given will be shown for each measurement, and images and waveforms data also will be stored automatically.

1 Input sample name and set it to Fixture.

2 Displays the measured value and the judgment results during measurement.
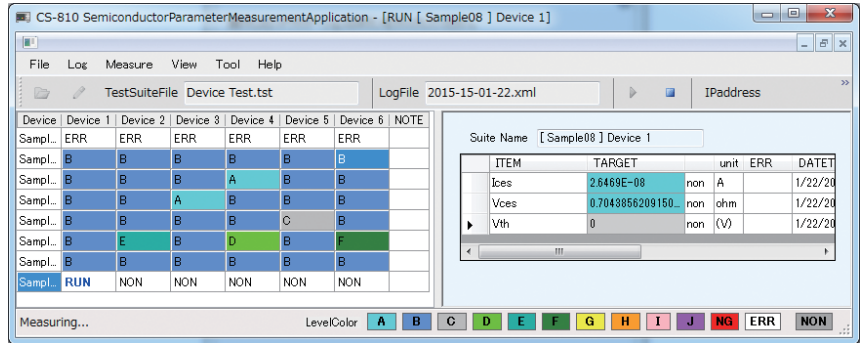
3 Popup stops the measurement or gives instructions based on the measurement results.

4 Popup stops the measurement or gives Instructions based on measured items.

5 Logs on the measurement can be exported to CSV file or Excel file afterwards. Logs on Stress test will be saved on separate files. Re-measurement of the selected item can be performed.
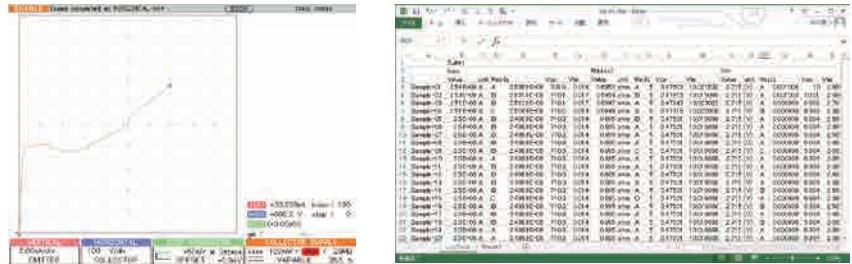
Measurement function of circuit modules

This software controls the scanner system as well as the curve tracer. The software also controls open/short and HV/VC. All the measurements for a module can be fully automatically performed without a need for unplugging.

Configuration on one-circuit can be applied to the other circuit as the application supports copy & paste.
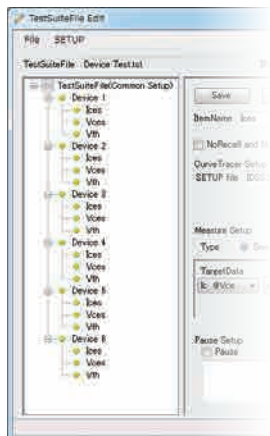
Unused Gates and Emitters can be short-circuited.

16
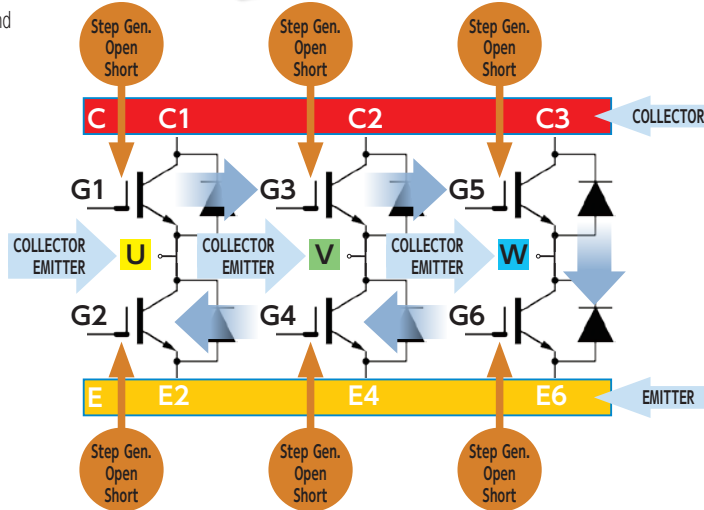
Software Application for parameter measurement of semiconductors : CS-810

Evaluation of Semiconductor Temperature characteristics measurement

CS-810 controls hotplates too. Even measurement that takes a long time such as per temperature can also be performed automatically.

Gate Threshold

V_{th}

V_{CEsat}

Resistance when this unit is on.

Temperature

Parameter measurement

Parameter measurement

Parameter measurement

Auto temperature controlling
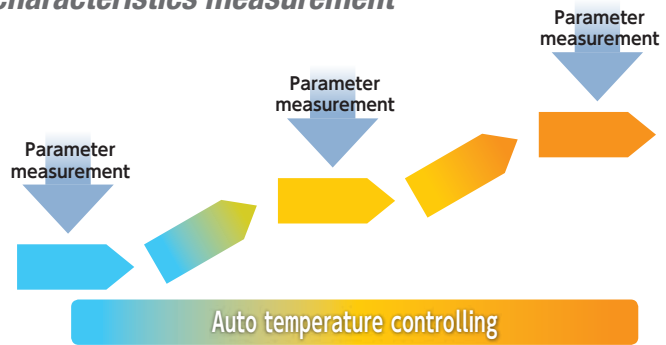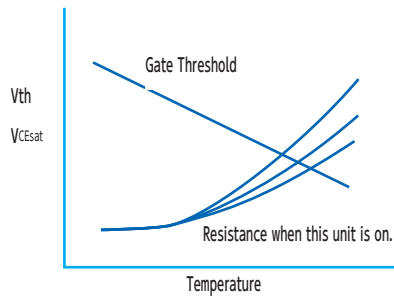
Currently, we just offer fixtures with hotplates, but we are trying our best to offer a unit simply provides hotplates or fixed-temperature chamber. For details on supported units, feel free to ask us.

Stress test

A wide variety of parameters can be incorporated in stress test.

This software supports long-time reliability tests. While the software monitors the voltage and the current via curve traces, differences of those traces are logged. Auto measurement of a wide variety of parameters is available for the stress test as illustrated below. The biasing will stop in excess of the limit value which is set for current or voltage as a lower and upper limit.

The software measures Ic or Vce (Interval: 10s to 2h) keeping a certain voltage or current (10s to 1,000h)

Parameter measurement

Logging changes in voltage or current at regular time intervals applying certain current or voltage.

Parameter measurement

Logging changes in voltage or current at regular time intervals applying certain current or voltage.

Parameter measurement

V_{CE}

Time
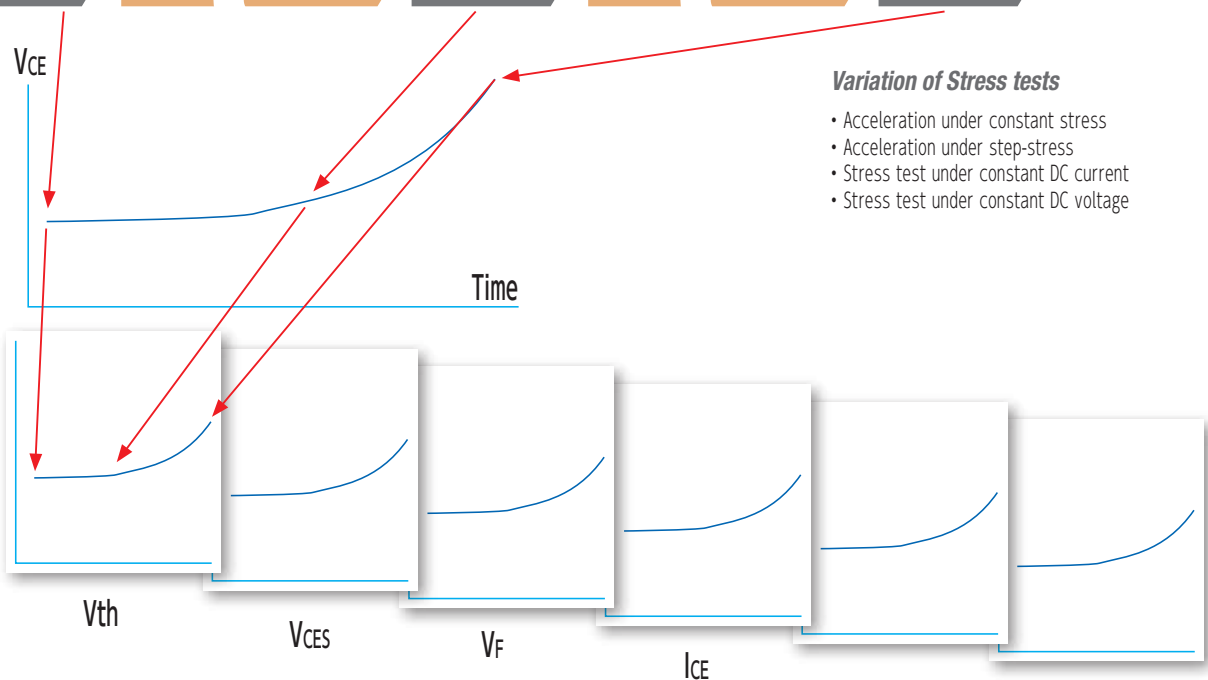
Variation of Stress tests

• Acceleration under constant stress
• Acceleration under step-stress
• Stress test under constant DC current
• Stress test under constant DC voltage

V_{th}

V_{CES}

V_F

I_{CE}

Software Application for parameter measurement of semiconductors : CS-810

Test of Discrete devices

Measurement of multiple devices with one touch operation after cable connection

CS-810 will let us copy the configuration for one circuits to the others up to 10CH*, making it easier to iterate the circuits and perform measurement for each Circuit.
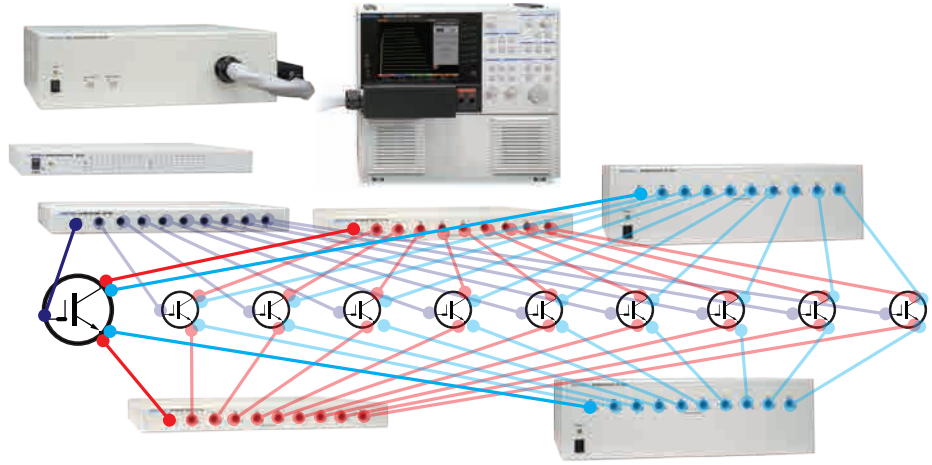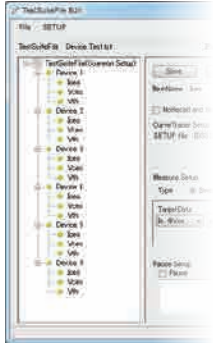
* Up to 10 systems operate in parallel on CS-700 Series.

Measurement of wafers

Devices on wafers can be measured by connecting a prober system.
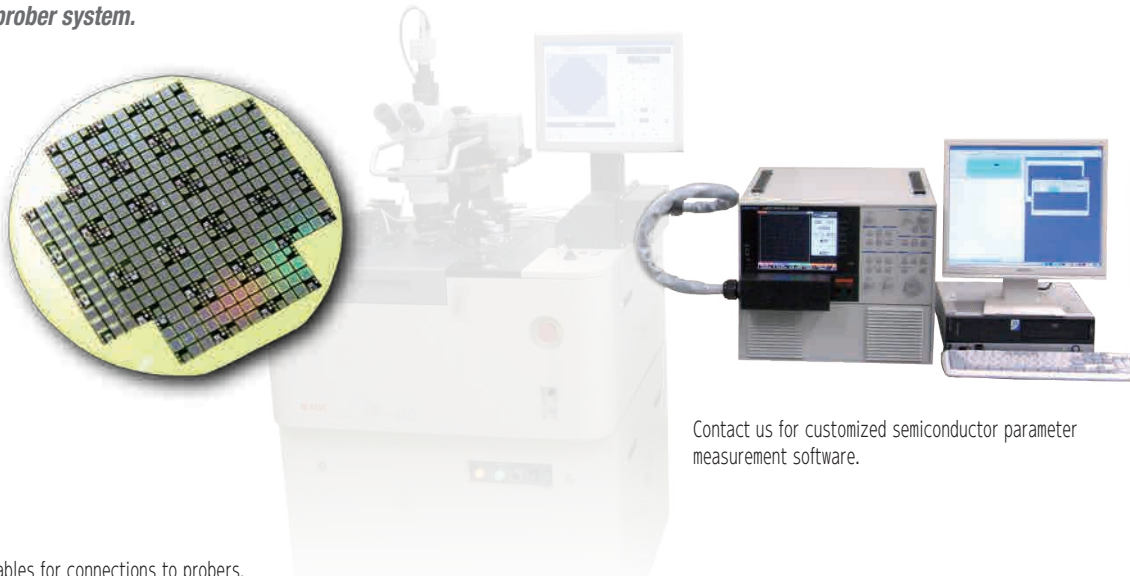
Contact us for customized semiconductor parameter measurement software.

We have cables for connections to probers.
Some terminals have an interlocking feature for safety.

Prober side

Curve tracer side

Prober cable

18
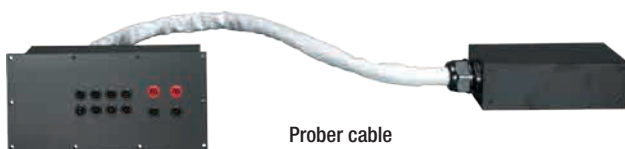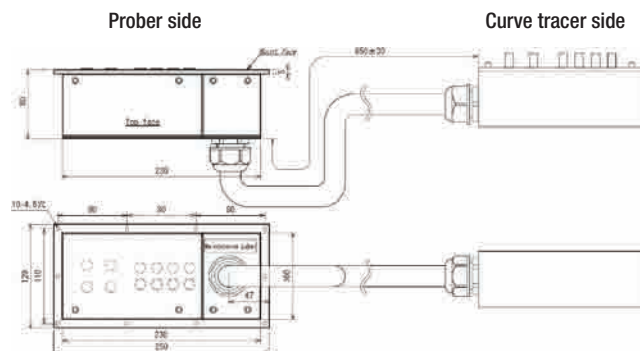
Output range for each model

HV mode Max. Peak Voltage/Max. Peak Current (Pulse current)

Model \ Mode	CS-3300 CS-3200 CS-3100	CS-5400 CS-5300 CS-5200 CS-5100	CS-10800 CS-10400	CS-12800	CS-15800
DC / +	–	–	10kV/400mA	12kV/266mA	15kV/266mA
LEAKAGE/DC full-wave rectification/ AC	3kV/75mA (150mA)	5kV/25mA (25mA)	3kV/75mA (150mA)		
	300V/750mA (1.5A)				
	30V/7.5A (15A)				

HC mode Max. Peak Current/Max. Peak Power/Max. Peak Voltage

Model \ Mode	CS-5100 CS-3100	CS-5200 CS-3200	CS-5300 CS-3300	CS-5400	CS-10400	CS-10800 CS-12800 CS-15800
Pulse / + -	– (HC mode not equipped)	–	1,000A/10kW/40V	1,500A/12kW/30V	–	8,000A/80kW/40V
					4,000A/60kW/60V	
		400A/4kW/40V		600A/4.5kW/30V	400A/6kW/60V	
		40A/400W/40V		60A/450W/30V	40A/600W/60V	

Common Specifications

Loop Correction	Hardware		Correction of floating capacitance between collector supply and ground
	Software		Simulated loop procedure by software thinning process
Step Generator	Offset	Setup range Resolution	-10 times to +10 times of SETTING UP of STEP AMPLITUDE 1% of SETTING UP of STEP AMPLITUDE
	Current mode	Amplitude range	21 steps /50nA to 200mA, 1-2-5 switchable
		Max. Current	2A
		Max. Voltage	More than 10V
	Voltage mode	Amplitude range	6 steps/50mV to 2V, 1-2-5 switchable
		Max. Current	± 40V
		Max. Voltage	500mA ~ (~ 8V), 200mA ~ (~ 15V), 10mA ~ (~ 40V)
	Step rate		Twice of 50Hz or 60Hz (the same rate when AC mode), Pulse interval when HC mode
	Pulse step	Pulse width	50 μ s to 400 μ s (10 μ s step) When HC mode set, approx.100 μ s wider-pulse width against collector supply pulse
	Number of steps		0 to 20 steps
AUX Output	Range		OFF, − 40V to 40V (Switchable at 100mV step)
Measurement Mode			REPEAT, STOP/SINGLE, SWEEP
Vertical axis (Full scale:10div)	Collector current	Range	HV Mode : 1 μ A/div to 2A/div, 20steps 1-2-5 switchable (HC mode written separately)
		Accuracy	Add 2% of Readout+0.05 × VERT/div to the loop correction error of the following max. peak voltage 0.5 μ A (30V), 1 μ A (300V), 6 μ A (3kV), 12 μ A (5kV), 30V,300V,3kV More than 10% of Max. Peak voltage, More than 30% (5kV)
	Emitter current(LEAKAGE)	Range	1nA/div to 2mA/div, 20steps 1-2-5 switchable (Collector Supply mode: LEAKAGE)
		Accuracy	2% of Readout + 0.05 × VERT/div + less than 1nA
Horizontal axis (Full scale:10div)	Collector voltage	Range	HC mode : 50mV/div to 5V/div, 7 steps 1-2-5 switchable (HV mode written separately)
		Accuracy	2% of Readout less than +0.05 × HORIZ/div
	Base/Emitter voltage	Range	50mV/div to 5V/div, 7 steps 1-2-5 switchable
		Accuracy	2% of Readout less than +0.05 × HORIZ/div
Screen	Display		8.4 inch TFT LCD
	Number of Data		1,000 points/trace (AC, Full-wave rectification) 20 to 1,000 points/trace (SWEEP mode)
	Trace display		Interpolation display between points, Dot display
	Average		OFF, 2 to 255 times
	Persistence		OFF, SHORT, LONG, unlimited length
	Internal waveform storage (REF)		4 screens
Cursor measurement	DOT		Vert, Horiz, β or gm
	fLINE		Vert, Horiz, 1/grad, intercept
	FREE		Vert, Horiz, β or gm
	WINDOW		Vert in WINDOW area, Horiz, β or gm
Data recording/Readout	Internal memory		Setup:256, REF : 4 screens
	External memory		USB1.1 : Setup, Waveform, Screen hardcopy (BMP,TIFF, PNG)
Remote			Remote on LAN 10BASE-T/100BASE-TX 1 port
Power supply	CS-3xxx,5xxx		AC100V-AC240V 50/60Hz, Max Power:500VA (operation), 7W Max (waiting)
	CS-1xxxx		AC200V single phase 50/60Hz, Max Power:10kVA (operation)
External dimensions (mm) (excluding projection portion and accessories) Weight (excluding accessories)	CS-3100,5100		424W x 220H x 555D, approx.28kg
	CS-3200,3300,5200,5300,5400		424W x 354H x 555D, approx.43kg
	CS-10400,10800,12800,15800		1,110W x 1,216H x 1,150D, approx.370kg

Digital Oscilloscope ✓IEWGoⅡ

New # DS-5600 Series
DS-5400 Series

3-year warranty when registered as a web user

New Functions Providing Additional Power

4-channel model DS-5654

2-channel model DS-5652

* We accept requests for calibration certificates, traceability network diagrams and inspection results on a chargeable basis.

DS-5600 Series

500MHz 4ch 2GS/s Max 5M points	**DS-5654**
500MHz 2ch 2GS/s Max 5M points	**DS-5652**
350MHz 4ch 2GS/s Max 5M points	**DS-5634**
350MHz 2ch 2GS/s Max 5M points	**DS-5632**
200MHz 4ch 2GS/s Max 5M points	**DS-5624**
200MHz 2ch 2GS/s Max 5M points	**DS-5622**
100MHz 4ch 2GS/s Max 5M points	**DS-5614**
100MHz 2ch 2GS/s Max 5M points	**DS-5612**

DS-5400 Series

200MHz 4ch 2GS/s 500k points	**DS-5424**
200MHz 2ch 2GS/s 500k points	**DS-5422**
100MHz 4ch 1GS/s 500k points	**DS-5414**
100MHz 2ch 1GS/s 500k points	**DS-5412**

Standard Probes Supplied Accessories

Model	Standard Probes Supplied		Standard Accessories (Miscellaneous)
	Quantity	Type	
DS-5654	4	SS-101R	• Power Cord x1 • Front Panel Cover x1 • CD (containing Instruction Manual, Remote Control Manual) x1 • User Guide x1
DS-5652	2		
DS-5634	4		
DS-5632	2		
DS-5624	4	SS-0130R	
DS-5622	2		
DS-5614	4		
DS-5612	2		
DS-5424	4		
DS-5422	2		
DS-5414	4		
DS-5412	2		

Long Memory up to a Maximum of 5M points
DS-5600 Series
[2.5M points/CH when all channels being used]
(Maximum of 500k/CH with the DS-5400 Series)

Enables long-term waveforms to be captured while maintaining high-speed sampling.
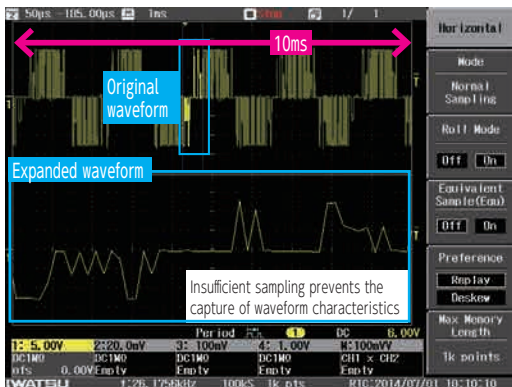
Memory Length: 1k points
Sampling Rate: 100kS/s
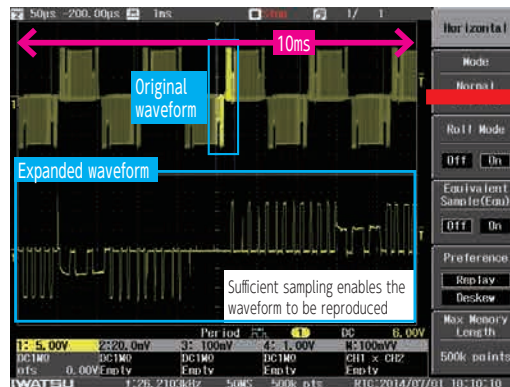
Memory Length: 500k points
Sampling Speed: 50MS/s

Waveform Capture Time x 10

The long memory is able to reproduce an even longer waveform capture time to ensure that the entire waveform is acquired so that it can be proportionally checked later.

Maximum Sampling Rate for the Waveform Capture Time (DS-5600 Series)

Waveform Capture Time	5M points when the channels are interleaved	2.5M points when all channels are in use
1s	5MS/s	2.5MS/s
100ms	50MS/s	25MS/s
10ms	500MS/s	250MS/s
2ms	2GS/s	1GS/s
1ms	2GS/s	1GS/s

Waveform Capture Time: The s/div x 10div time on the time axis range at the width of the time axis displayed on the oscilloscope.

Memory Length: 5M points
Sampling Speed: 50MS/s

Probe Selection Function
DS-5600 Series **DS-5400 Series**

Selecting probes manufactured by Iwatsu enables attenuation ratios and coupling to be automatically set. The model number, bandwidth of the vertical range and input coupling are displayed.

• Model name
• Unit, attenuation ratio
• Band, coupling

Eligible Probes

Current Probes:	SS-280 Series, SS-240A, SS-250, SS-260, SS-270
Voltage Probes:	SS-320, SFP-5A, SFP-4A, HV-P30, HV-P60, etc.

Four Waveform Parameter Simultaneous Judgment / Waveform Mask Judgment Functions `DS-5600 Series`

Pass/Fail judgment will be carried out automatically on masks and waveform parameters. Performing this on four parameters simultaneously enables strict conditions to be set.

NEW Pass parameters displayed in green, and Fail parameters displayed in red.

It is possible to perform judgment on a maximum of four waveform parameters set between A and D simultaneously.

Pass/Fail Judgment

Mask Judgment

Parameter Judgment

Operations during Pass/Fail Judgment

- Waveform capturing halted
- Data automatically saved
- Pulse output

- Screen automatically saved.

- Beep tone

When the AUX I/O option (DS-578) is used
* Only supported by the DS-5600 Series

Setup Example:
Non-judged item

Pass

PASS

FAIL

Fail

The pulse for the Pass/Fail measurement result is output from the BNC on the rear of the unit and automated.
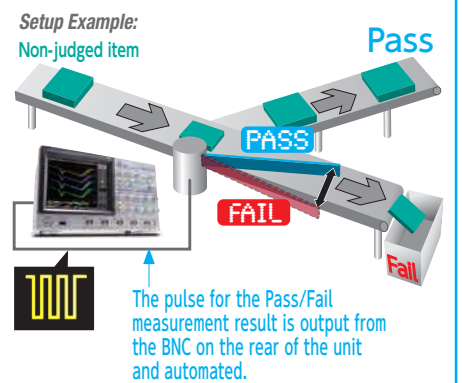
Reinforced Noise Reduction Functions `DS-5600 Series`

Simple Moving Average

The Simple Moving Average (SMA) enables smoothing and noise reduction at the sampling points of the specified width, through the digital filters that can be set for each channel.

This can also be used on non-repetitive single signals.

SMA: When OFF

SMA: When ON: Width = ± 3pts

SMA : When ON: Width = ± 20pts
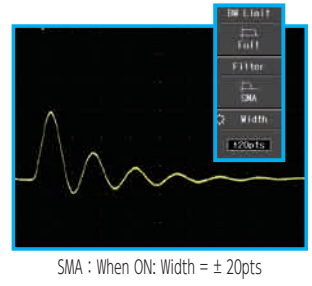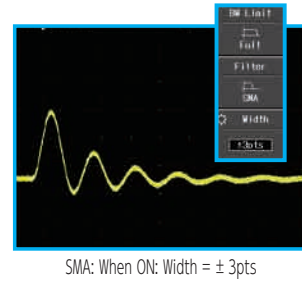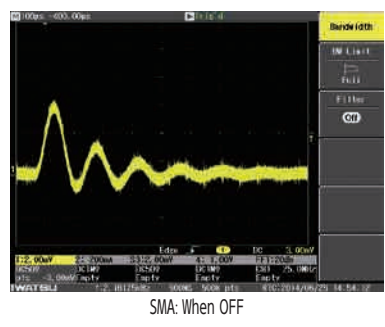
Averaging Count Increased

The averaging count setting has been increased from 256 times to 65,536 times. This enables non-synchronized random noise signals to be effectively reduced from measured repetitive signals.

- When the amplitude ratio for the signal (triangular wave) and noise (random) is 1:1
- The example of the right shows a measurement with the sampling speed set at 200kS/s and the memory length set at 10k points.

Averaging process OFF

Averaging process ON (averaging count at 32,768)
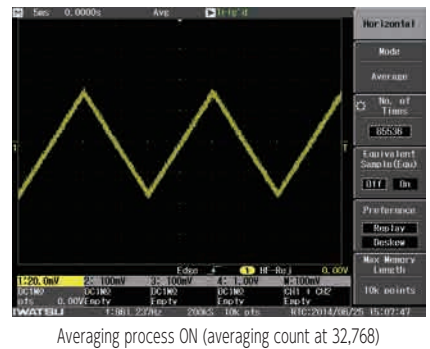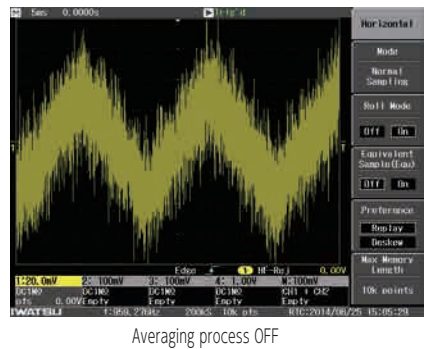
High Resolution

When measurements are taken at a sampling speed lower than the maximum sampling speed, it is possible to average the data captured at the maximum sampling speed, capture the waveforms, reduce random noise, and increase vertical resolution to a level equivalent to a maximum of 12 bits.

This can also be used on non-repetitive single signals.

Normal Sampling
(Sampling speed of 5MS/s, voltage range of 2mV/div)

When resolution is the equivalent of 12-bit high resolution
(Sampling speed of 5MS/s, voltage range of 2mV/div)
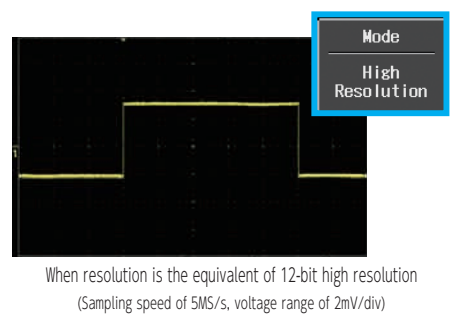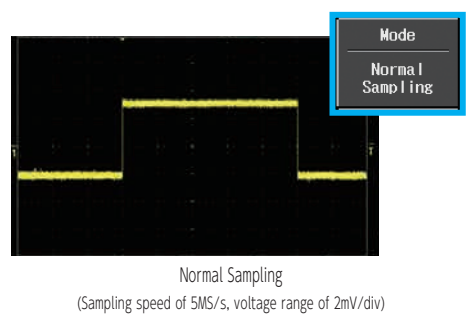
Improved Trigger Functions `DS-5600 Series` `DS-5400 Series`

The trigger function has been reinforced so that waveforms can be triggered with optimal conditions, even for complex logic signals and serial data signals.
Complex settings performed with pattern triggers can be smoothly set with the use of touch screen operations.

Trigger Types	DS-5600	DS-5400
Edge ALT, Edge OR	✓	
Cycle, Pulse width, Dropout, Edge, Pulse count, TV	✓	✓
Pattern	✓	
NEW Serial (UART, SPI, I²C)	✓	

Pulse Width Trigger
(Example: Detecting abnormal waveforms caused by glitches, etc.)
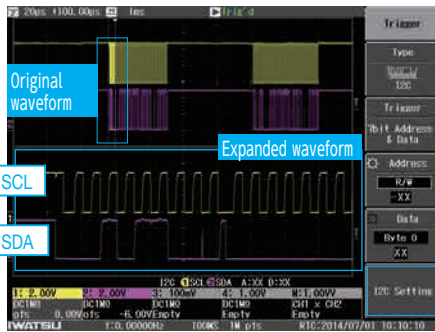
Serial Trigger
(Example: Observing I²C signals on the serial control bus)
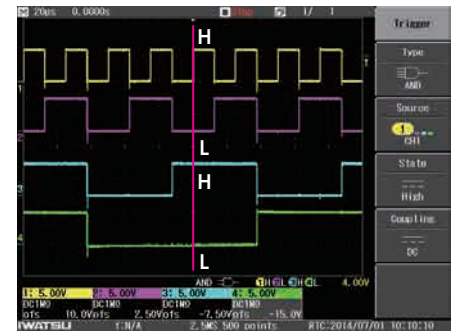
Pattern Trigger
(Example: Counter logic output signal)

Waveform Calculation Function `DS-5600 Series` `DS-5400 Series`

Adds, subtracts and multiplies two waveforms, and performs frequency analysis (FFT) on channel waveforms.
The DS-5600 Series supports differential and integral calculations.
The calculated waveforms can be saved as data, and can be set as the source for the automatic measurement of waveform parameters.

NEW *Supports double calculations*
(DS-5600 Series)
In addition to the results of addition, subtraction and multiplication, this function also supports the double calculation of FFT, differential calculus and integral calculus.

CH Waveforms	Single Operations	Double Operations
1 to 4CH (4CH unit) 1 to 2CH (2CH unit) 2CH among the above	Addition Subtraction Multiplication	FFT Differential calculus Integral calculus
1 to 4CH (4CH unit) 1 to 2CH (2CH unit) 1CH among the above	FFT Differential calculus Integral calculus	
DS-5600	✓	✓
DS-5400	✓ (Excluding differential calculus and integral calculus)	

[Examples of Usage]
- Addition/Subtraction: Evaluation of differential signals
- Multiplication: Evaluation of power waveforms from Voltage x Current
- FFT: Analysis of cyclic noise and vibrations, etc., in frequency domains

Supported by the DS-5600 Series

Differential calculation waveforms for square waveforms (rising 50ns, falling 100ns)
(Displays the size of the time fluctuations (dv/dt) for square waveform edges.)
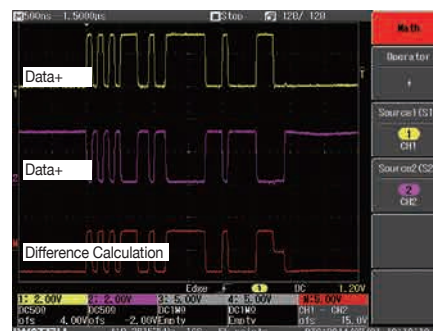
Measuring Differential Serial Signals

Supported by the DS-5600 Series
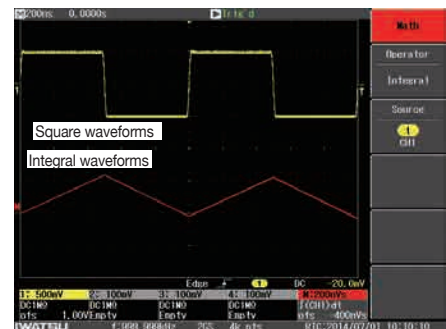
Integral calculation waveforms for square waveforms (Displays the results of integral calculus by time (∫ vdt) for the area of square waveforms.)
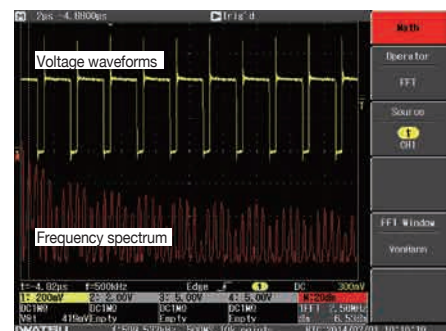
Frequency spectrum analysis (FFT calculations of switching voltage waveforms).

Remote Control Enables vast amounts of data to be collected and high-level analysis to be carried out on PCs.

■ *Scope Viewer (Supplied with Iwatsu Test Instruments Tools)*
Download the Iwatsu Test Instruments Tools (free of charge) from the Iwatsu website download page to enable the use of utility software for easily controlling ViewGo II remotely.
Functions: Oscilloscope operations, cursor measurement, waveform data file output, screen hard copies, printing, etc.

Optional Accessories *DS-576, 577, 578 and IE-1226 are factory-delivered options, so it is necessary to specify them when place your order.

GPIB Interface
DS-576
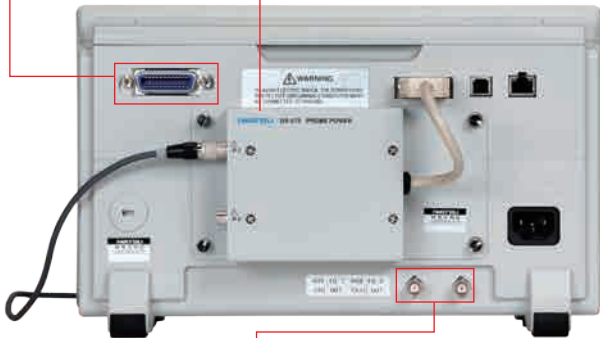
AUX I/O Option (2-way probe power source option)
DS-579
Can be used as a power source for probes
Supported Models: SS-240A/SS-250/SS-260/SS-270/
SS-320/SFP-5A/SFP-4A

Rear of DS-5654

AUX I/O Option (CH1/CH2 Output)
DS-577

AUX I/O Option (CH1/TRIG Output)
DS-578
* DS-5600 Series only
* The DS-577 and DS-578 cannot be mounted together.

VGA Video OUT
IE-1226 `Made to order`
VGA output on external displays for ViewGo Ⅱ is possible. In the inspection lines of factories, the efficiency will be improved and in schools, the image onto a large projector screen can be shown.
* The DS-579 cannot be used after the IE-1226 has been mounted.

Photograph of the Rear
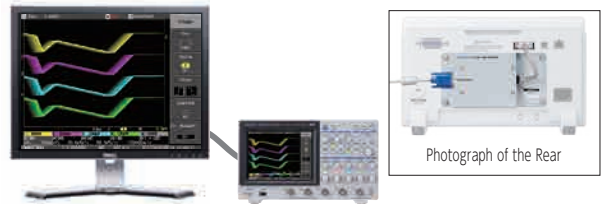
Recommended for ViewGo II
Carrying Bag

Models Supported
•DS-5600Series,
•DS-5500ASeries,
•DS-5500Series,
•DS-5400Series

Probe Accessories *The specifications here show the individual characteristics of each probe.(Contact our sales or distributor for details.)

Standard Probe
SS-0130R
Frequency BW: DC to 200MHz
Input RC: 10MΩ//12.5pF
Attenuation Ratio: 10:1
Length: 1.5m

SS-101R
Frequency BW: DC to 500MHz
Input RC: 10MΩ//12pF
Attenuation Ratio: 10:1
Length: 1.2m

High-Voltage Probe
HV-P30
30kV DC+AC peak or single-pulse 40kV
HV-P60
60kV DC+AC peak or single-pulse 80kV
* Check the de-rating characteristics of the high-voltage probes before selecting them.

High-Voltage Probe
SS-0170R
Frequency BW: DC to 400MHz
Maximum Input Voltage: 6kV (DC+ACpk, CAT I)
Input RC: 66.7MΩ± 1%//4pF or less
Attenuation Ratio: 100:1,
Cable Length: 2m

SS-0171R
Frequency BW: DC to 400MHz
Maximum Input Voltage: 4kV(DC+ACpk, CAT I)
Input RC: 66.7MΩ± 1%//4pF or less
Attenuation Ratio: 100:1,
Cable Length: 2m

High-Voltage Differential Probe
SS-320
DC to 100MHz (1kVrms)

High-Voltage Probe
PHV/PHVS Series

Type	BW	Length	Attenuation Ratio	Maximum Input Voltage	
				AC rms (CAT Ⅱ)	Impulse peak
PHV1000-RO	400MHz	2m	100:1	1kV	4kV
PHVS1000-RO	400MHz	2m	1000:1	1kV	6kV
PHV-641-LRO	380MHz	1.2m	100:1	2kV	4kV
PHV-642-LRO	300MHz	2m			
PHV-643-LRO	150MHz	3m			
PHV661-LRO	380MHz	1.2m	100:1	2.8kV	6kV
PHV662-LRO	300MHz	2m			
PHV663-LRO	150MHz	3m			
PHVS662-LRO	400MHz	2m	1000:1	2.8kV	6kV
PHVS663-LRO	250MHz	3m			

* Contact us with regard to specifications not listed

FET Probe

Model	Attenuation	Input RC	Bandwidth
SFP-5A	10:1	Approx. 1.9pF, Approx. 1MΩ	DC to 1GHz
SFP-4A	10:1	Approx. 2.15pF, Approx. 1MΩ	DC to 800MHz
PS-25	Power supply for SFP-4A, SFP-5A and SS-320 (Input voltage AC100V only)		

SFP-5A   PS-25

Current probe (Clamp type)
SS-250
Frequency Bandwidth : DC to 100MHz(-3dB), Maximum input range : 30A rms,
Maximum peak current : 50A peak, Measurable wire diameter : φ 5mm
SS-240A
Frequency Bandwidth : DC to 50MHz(-3dB), Maximum input range : 30A rms,
Maximum peak current : 50A peak, Measurable wire diameter : φ 5mm
SS-270
Frequency Bandwidth : DC to 2MHz(-3dB), Maximum input range : 500A rms,
Maximum peak current : 700A peak, Measurable wire diameter : φ 20mm
SS-260
Frequency Bandwidth : DC to 10MHz(-3dB), Maximum input range : 150A rms,
Maximum peak current : 300A peak, Measurable wire diameter : φ 20mm
PS-26 *Power Source for Current Probes*
Power supply for SS-240A, SS-250, SS-260 and SS-270(Input voltage AC100V(AC120V/AC200V/AC220V are factory- delivered options.)

Rogowski Coil Current Probe
SS-280A Series

Model	BW(-3dB)	Maximum current
SS-281A	110Hz to 30MHz	30A, peak
SS-282A	65Hz to 30MHz	60A, peak
SS-283A	32Hz to 30MHz	120A, peak
SS-284A	9Hz to 30MHz	300A, peak
SS-285A	6Hz to 30MHz	600A, peak
SS-286A	3Hz to 30MHz	1200A, peak

Common to all SS-280A series

Item	Specifications
Cable length	1.5m
Sensor Coil length	80mm
Sensor Coil wire diameter	φ 1.7mm
Temerature range	
Amplifier	0deg. to 40deg.
Coil&cable	-40deg. to 125deg.
Output	BNC connector
Power supply	AA battery *4pcs. or AC adaptor

ex. probe on TO-220 package

*Distribution of DS-5600 series are limited in Japan and Asian markets.

DS-5600 Series Specifications

	DS-5654	DS-5652	DS-5634	DS-5632	DS-5624	DS-5622	DS-5614	DS-5612
Frequency bandwidth (-3dB)	500MHz		350MHz		200MHz		100MHz	
Rise time (Typical)	750ps		1ns		1.75ns		3.5ns	
Input Channel Count	4	2	4	2	4	2	4	2
Maximum Sampling Rate	2GS/s (when 2 channels interleaved), 1GS/s (when all channels are in use)							
Equivalent Sampling Rate	100GS/s							
Peak detect resolution	1ns							
Averaging	2 to 65536 times (exponent of 2 step)							
Maximum Memory Length	5M points (when 2 channels interleaved), 2.5M points (when all channels are in use)							
Vertical Resolution	8-bit (When high-resolution calculation is valid: Maximum 12-bits)							
Input Voltage Range	2mV/div to 10V/div（1MΩ）, 2mV/div to 2V/div（50Ω）				2mV/div to 10V/div（1MΩ）			
Offset Voltage	2mV/div to 50mV/div：± 1V, 50.2mV/div to 500mV/div：± 10V, 502mV/div to 10V/div：± 100V							
DC Gain Accuracy	± (1.5% + 0.5% full scale)							
Maximum Input Voltage	± 400Vpeak CAT I（1MΩ）, 5Vrms（50Ω）				± 400Vpeak CAT I（1MΩ）			
Band-Limiting Filter	Analog Form: 100MHz, 20MHz, 2MHz, 200kHz Digital Form: Select either LPF, HPF or SMA, 4 independent channels				Analog Form: 20MHz, 2MHz, 200kHz Digital Form: Select either LPF, HPF or SMA, 4 independent channels			
Input Coupling	GND, DC 1MΩ, AC 1MΩ, DC 50Ω				GND, DC 1MΩ, AC 1MΩ			
Input Impedance	1MΩ ± 1% // 16pF, 50Ω ± 1%				1MΩ ± 1% // 20pF			
Probe Sense	Automatic Detection: 1:1, 10:1, 100:1, 1000:1, Manual Settings: 1:1, 5:1, 10:1, 20:1, 50:1, 100:1, 200:1, 500:1, 1000:1, 2000:1							
Time Axis Range	500ps/div to 50s/div		1ns/div to 50s/div		2ns/div to 50s/div		5ns/div to 50s/div	
Standard Probe	SS-101R (multi-channel supplied as standard)				SS-0130R (multi-channel supplied as standard)			
Roll Mode	50ms/div to 50s/div（100kS/s max）							
Clock Accuracy	± 10ppm							
Trigger Function	Edge, Edge ALT, Edge OR, Pulse Count, Pulse Width, Cycle, Dropout, TV, Pattern (OR, NOR, AND, NAND), Serial (UART, SPI, I²C)							
TV Trigger (Rated) / Line setting range selection / Field selection	NTSC, PAL, Custom / Up to 3,000 / 1, 2, 4, 8							
Pulse Count Trigger Setting Range	1 to 9,999 events							
Pulse Width Trigger Time Setting Range	15ns to 50s							
Cycle Trigger Time Setting Range	40ns to 50s							
Dropout Trigger Time Setting Range	50ns to 50s							
Pattern Trigger	OR, NOR, AND, NAND							
Trigger Source / State / Threshold Level	All Channels / HIGH, LOW, Don't Care / All Channel Independent Setting							
Serial Trigger								
UART — Trigger Selection	START, STOP, Parity Error, Data Pattern							
UART — Bit Rate	1,000bps to 1Mbps (set in units of 100bps)							
UART — Comparative Data Length	5 to 8 bits							
UART — Signal Source	CH1 to CH4, EXT (CH1, CH2, EXT for 2 channel function)							
SPI * CH1 input is reserved for SCK signal input: Maximum 20MHz — Trigger Selection	Data Pattern							
SPI — CS Selection	Idling time specified when no positive logic/negative logic or CS							
SPI — Comparative Data Length	4 to 64 bits							
SPI — Signal Source	CH1 to CH4, EXT (CH1, CH2, EXT for 2 channel function)							
I²C — Trigger Selection	START, STOP, RESTART, NACK, Data Pattern							
I²C — Address Mode	Selected from 7-bit / 10-bit / EEPROM read							
I²C — Comparative Data Length	1 to 5bytes when the address is 7-bit/10-bit, 1byte when EEPROM read (with shift comparison)							
I²C — Signal Source	CH1 to CH4, EXT (CH1, CH2, EXT for 2 channel function)							
Trigger Source	All channels, EXT (± 0.5V), EXT10 (± 5.0V), Line							
Trigger Slope / Coupling	+, - / AC, DC, High Frequency Rejection, Low Frequency Rejection, Noise Rejection							
Display / Resolution	7.5-inch Color TFT LCD (touch screen) / VGA: 640 × 480 Pixels							
Display Mode	Y-T, XY, XY Trigger							
Vector Connection	Sample Point Interpolation Display, Dot Display							
Analog Persistence	Monochrome Grayscale Display, Spectrum Display							
Persistence Display Time	100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, infinite							
Internal Waveform Storage (REF Memory)	5 Waveforms							
Front Panel Setting Storage	Possible to save five settings in the internal memory, USB memory							
Parameter Measurement, Cursor, Zoom, Calculation, Replay Functions								
Parameter Measurement	Maximum Value, Minimum Value, Peak-Peak, RMS, Cycle RMS, Average, Cycle Average, Top, Base, Top-Base, Rising Overshoot, Falling Overshoot, Rising Time 20-80%, Falling Time 80-20%, Rising Time 10-90%, Falling Time 90-10%, Frequency, Cycle, + Pulse Count, - Pulse Count, + Pulse Width, - Pulse Width, Duty Ratio, Integral, Skew (+, -), Skew at level							
Simultaneous Measurement Count / Statistic Value Display	Maximum 4 Parameters / Maximum Value, Minimum Value, Measurement Count							
Logging Items, Output Destination	Time, Parameter Measurement Results (Conditions A, B, C, D), Pass/Fail Judgment Results Recording Time: Pop-up menu, internal memory (maximum 86,400 records), After Recording: USB memory							
Pass/Fail Judgment	Judgment Mode: Parameter Judgment or Mask Judgment, Judgment Results: Saved on USB, Beep Tone, Pulse Output (DS-578 option required), Logging Page Search Function: Select Pass or Fail and search in ascent or descent							
Cursor	Time, Amplitude, Time & Amplitude, Value at Cursor Position							
Zoom	Press the Zoom button on the front panel to display an enlarged waveform on a new grid							
Calculation Function	Addition, Subtraction, Multiplication, Differential Calculus, Integral Calculus, (FFT (maximum 8k points, rectangular, hanning, flat-top window functions) Double calculation of the results of either addition, subtraction or multiplication possible with either differential calculus, integral calculus or FFT (9 patterns)							
Rescale / Unit Conversion	A: x + b (x: Input voltage, a, b: User defined) / volt, ampere, watt, ° C, no display							
Replay	Automatic waveform logging, storage for a maximum of 2,048 waveforms, replay possible							
Frequency Counter	6 characters							
Interface	Supports USB 2.0HS (device, host), LAN (100Base-TX), GPIB (factory-delivered option DS576)							
AUX Interface	Optional external connector							
Optional Accessories								
DS-577 AUX IO CH1/CH2 Output* (factory-delivered option)	AUX IO1: Outputs the CH1 input signal to which offset voltage has been applied, AUX IO2: Outputs the CH2 input signal to which offset voltage has been applied							
DS-578 AUX IO CH1/TRIG Output* (factory-delivered option)	AUX IO1: Outputs the CH1 input signal to which offset voltage has been applied, AUX IO2: Outputs the pulse signal set level H with the following conditions AUX IO2 Output Conditions: Output with trigger output (when TRIG output has been selected), Output when Pass/Fail/Pass or Fail has been detected (when Pass/Fail output has been selected)							
DS-576 GPIB Interface (factory-delivered option)	GPIB : IEEE488.2							
Power source options for the DS-579 probe	Two-way power source for use with Iwatsu active probes							

	DS-5654	DS-5652	DS-5634	DS-5632	DS-5624	DS-5622	DS-5614	DS-5612
Waveform Data Storage	Saved on the USB with binary, ASCII, Mathcad, calculation (ASCII), calculation (Mathcad)							
Hard copy Output	TIFF, BMP and PNG (supporting transparency) images saved on the USB or output to printers that support PictBridge®							
Calibration Signal Output	Square Waveform 1kHz, 3Vp-p							
Power Source / Power Consumption	AC90V to 264V(47Hz to 63Hz), AC90V to 132V(380Hz to 420Hz) / 95VA(60W)max							
Dimensions / Unit Weight	Approximately 330W x 190H x 124D mm / Approximately 3.7kg							
Guaranteed Performance Temperature	10℃ to 35℃							
Operating Temperature / Humidity / Altitude	Temperature 0 to 40°C / Humidity 5% to 80% RH ≦ 30°C (no condensation), RH 55% or less at 40°C or less (no condensation) / Altitude 2,000m or less							

DS-5400 Series Specifications

	DS-5424	DS-5422	DS-5414	DS-5412
Frequency bandwidth (-3dB)	200MHz		100MHz	
Rise time(Typical)	1.75ns		3.5ns	
Input Channel Count	4	2	4	2
Maximum Sampling Rate	2GS/s (when 2 channels interleaved), 1GS/s (when all channels are in use) 1GS/s		1GS/s	
Equivalent Sampling Rate	100GS/s			
Peak Detect Resolution	1ns			
Averaging Function	2 to 256 times			
Maximum Memory Length	500k points/ch			
Vertical Resolution	8-bit			
Input Voltage Range	2mV/div to 10V/div			
Offset Voltage	2mV/div to 50mV/div: ± 1V, 50.2mV/div to 500mV/div: ± 10V, 502mV/div to 10V/div: ± 100V			
DC Gain Accuracy	± (1.5% + 0.5% full scale)			
Maximum Input Voltage	± 400Vpeak CAT I			
Band-Limiting Filter	Analog Form: 20MHz, 2MHz, 200kHz			
Input Coupling	GND, DC 1MΩ, AC 1MΩ			
Input Impedance	1MΩ ± 1% // 20pF			
Probe Sense	Automatic Detection: 1:1, 10:1, 100:1, 1000:1, Manual Settings: 1:1, 5:1, 10:1, 20:1, 50:1, 100:1, 200:1, 500:1, 1000:1, 2000:1			
Time Axis Range	2ns/div to 50s/div		5ns/div to 50s/div	
Standard Probe	SS-0130R (multi-channel supplied as standard)			
Roll Mode	50ms/div to 50s/div (100kS/s max)			
Clock Accuracy	± 10ppm			
Trigger Function	Edge, Pulse Count, Pulse Width, Cycle, Dropout, TV			
TV Trigger (Rated) / Line setting range selection / Field selection	NTSC, PAL, Custom / Up to 3,000 / 1, 2, 4, 8			
Pulse Count Trigger Setting Range	1 to 9,999 events			
Pulse Width Trigger Time Setting Range	15ns to 50s			
Cycle Trigger Time Setting Range	40ns to 50s			
Dropout Trigger Time Setting Range	50ns to 50s			
Trigger Source	All channels, EXT (± 0.5V), EXT10 (± 5.0V), Line			
Trigger Slope / Coupling	+, - / AC, DC, High Frequency Rejection, Low Frequency Rejection, Noise Rejection			
Display / Resolution	7.5-inch Color TFT LCD (touch screen) / VGA: 640 × 480 Pixels			
Display Mode	Y-T, XY, XY Trigger			
Vector Connection	Sample Point Interpolation Display, Dot Display			
Analog Persistence	Monochrome Grayscale Display, Spectrum Display			
Persistence Display Time	100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, infinite			
Internal Waveform Storage (REF Memory)	5 Waveforms			
Front Panel Setting Storage	Possible to save five settings in the internal memory, USB memory			
Parameter Measurement, Cursor, Zoom, Calculation, Replay Functions				
Parameter Measurement	Maximum Value, Minimum Value, Peak-Peak, RMS, Cycle RMS, Average, Cycle Average, Top, Base, Top-Base, Rising Overshoot, Falling Overshoot, Rising Time 20-80%, Falling Time 80-20%, Rising Time 10-90%, Falling Time 90-10%, Frequency, Cycle, + Pulse Count, - Pulse Count, + Pulse Width, - Pulse Width, Duty Ratio, Integral, Skew (+, -), Skew at level			
Simultaneous Measurement Count / Statistic Value Display	Maximum 4 Parameters / Maximum Value, Minimum Value, Measurement Count			
Logging Items, Output Destination	–			
Pass/Fail Judgment	–			
Cursor	Time, Amplitude, Time & Amplitude, Value at Cursor Position			
Zoom	Press the Zoom button on the front panel to display an enlarged waveform on a new grid			
Calculation Function	Addition, Subtraction, Multiplication, FFT (maximum 8k points, rectangular, hanning, flat-top window functions)			
Rescale / Unit Conversion	a * x + b (x: Input voltage, a, b: User defined) / volt, ampere, watt, °C, no display			
Replay	Automatic waveform logging, storage for a maximum of 1,024 waveforms, replay possible			
Frequency Counter	6 characters			
Interface	Supports USB 2.0HS (device, host), GPIB (factory-delivered option DS576)			
AUX Interface	Optional external connector			
Optional Accessories				
DS-577 AUX IO CH1/CH2 Output	–			
DS-578 AUX IO CH1/TRIG Output	–			
DS-576 GPIB Interface	GPIB : IEEE488.2 (factory-delivered option)			
Power source options for the DS-579 probe	Two-way power source for use with Iwatsu active probes			
Waveform Data Storage	Saved on the USB with binary, ASCII, Mathcad, calculation (ASCII), calculation (Mathcad)			
Hard copy Output	TIFF, BMP and PNG images saved on the USB or output to printers that support PictBridge®			
Calibration Signal Output	Square Waveform 1kHz, 3Vp-p			
Power Source / Power Consumption	AC90V to 264V(47Hz to 63Hz), AC90V to 132V(380Hz to 420Hz) / 95VA(60W)max			
Dimensions / Unit Weight	Approximately 330W x 190H x 124D mm / Approximately 3.7kg			
Guaranteed Performance Temperature	10℃ to 35℃			
Operating Temperature / Humidity / Altitude	Temperature 0 to 40°C / Humidity 5% to 80% RH ≦ 30°C (no condensation), RH 55% or less at 40°C (no condensation) / Altitude 2,000m or less			

＊The DS-577 and DS-578 cannot be mounted together.
●External appearances and certain performance levels are subject to modification without prior notice for the purpose of product improvement, etc.

Isolation measurement system
DM-8000H

- The input block, control block and display block are isolated with optical fiber cables. (DM-900/L, DM-910/L)
- Frequency bandwidth: DC to 500MHz.
- Simultaneous multi-channel measurement of many channels of different reference potentials. (2 to 24 channels) (DM-900/L, DM-400/L)
- Long-life battery drive. (The system can be driven by three batteries for about 12 hours) (DM-900/L, DM-910/L)
- Measurement using long memory. (DM-900/L, DM-910/L, DM-400/L)
- Simultaneous measurements of the inverter's switching waveform and ON-voltage. (DM-910/L)
- Also supports synchronous measurements with the non-isolated unit. (DM-400/L)
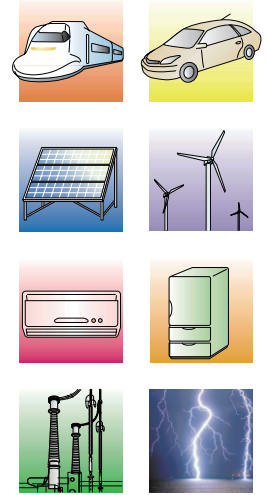
Example: Isolation Unit DM-900 x 12units (24ch)

- Controller PC (Option)
- Main Unit DM-8000H
- Transceiver Card DM-600
- Optical Fiber Cables
- Acquisition Control Card DM-610
- Isolation Unit DM-900
- High Voltage Probe
- 3-phase PWM Inverter (device under test)
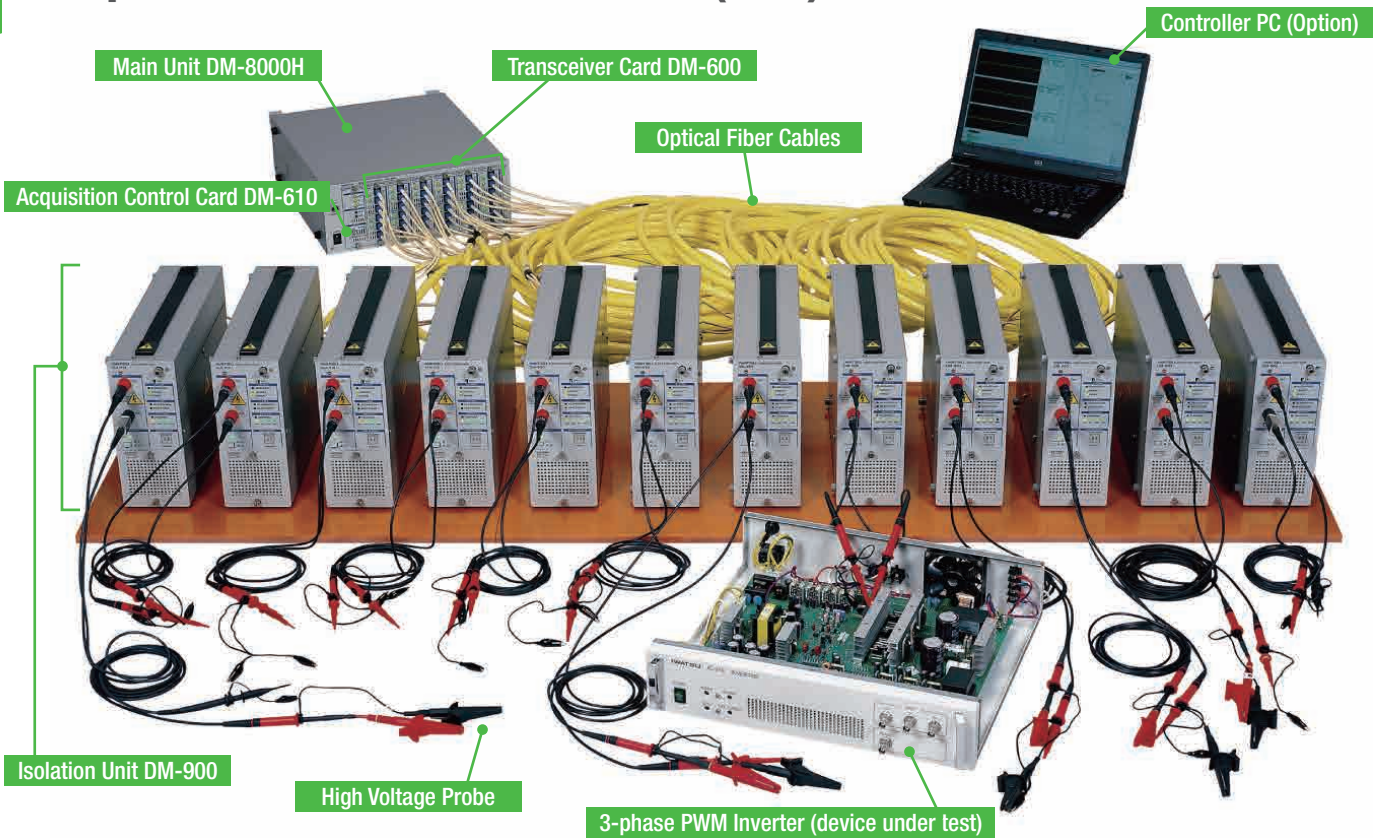
Lineup

Items	Model
Main unit	DM-8000H
Acquisition control card	DM-610
Transceiver card (optical x 2)	DM-600
Transceiver card (optical x 1, metal x 1)	DM-620
Transceiver card (metal x 2)	DM-630
Isolation unit (500k points) *1	DM-900
Isolation unit (16M points) *1	DM-900L
Isolation unit (high resolution, 500 k points) *2	DM-910
Isolation unit (high resolution, 16 M points) *2	DM-910L
Acquisition unit (500k points) *3	DM-400
Acquisition unit (16M points) *3	DM-400L

Items	Model
Optical fiber cable S (2m) *4	DM-002
Optical fiber cable S (5m) *4	DM-004
Optical fiber cable (5m)	DM-005
Optical fiber cable (10m)	DM-006
Optical fiber cable (20m)	DM-007
Optical fiber cable (50m)	DM-008
Optical fiber cable (100m)	DM-009
Optical fiber cable (200m) [Custom Order]	DM-010
Acquisition cable (2m)	DM-105
Acquisition cable (5m)	DM-106
Battery pack	DM-551
Battery pack (set of three battery packs) *5	DM-553

*1 With insulation case
*2 With insulation case. Optional probe is required for voltage measurements.
*3 Non-isolation type unit driven by AC power only.

*4 Optical cable set without sheath.
*5 Standard item for isolation unit.

Isolation with Optical Fiber cable (2 to 200 m)

The input block, control block and display block are isolated by an optical fiber cable. Owing to the fact that isolation units are isolated from each other by optical fiber cables, it is possible to simultaneously measure signals that have different reference potentials, such as signals from the high and low-side switch of an inverter or from the primary and secondary sides of a power converter.

DM-8000H main unit
Up to 12 isolation units and acquisition units can be connected. An acquisition control card for capture control and up to 6 specially designed transceiver cards can be installed onto the main unit. The gigabit Ethernet-enabled high-speed main unit improves the waveform update speed when using 3 or more units. The interlock control terminal is on the rear panel.

DM-600 transceiver card
Two isolation units can be connected per card.

DM-620 optical and metal transceiver card
One isolation unit and one acquisition unit can be connected per card.

DM-630 metal transceiver card
Two acquisition units can be connected per card.
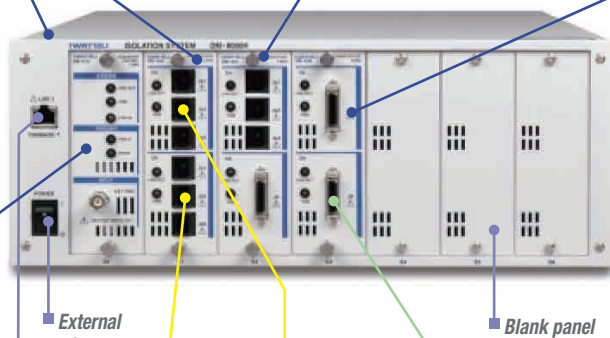
LAN cable

Control PC (optional)

DM-610 acquisition control card
This card controls waveform capture in measurement units. It also provides a non-isolated external trigger input, which can be changed to an external trigger output terminal.

External trigger terminal

LAN terminal

Blank panel

LAN terminal

Interlock contact

Optical fider cable

Optical fider cable

Acquisition cable

DM-900 (500k)/DM-900L (16M) isolation units

The units are operated by a built-in battery to perform floating measurements.
Frequency bandwidth: DC to 500MHz, highest sampling rate: 2GS/s, memory length: 500k points (DM-900), 16M points (DM-900L), input: 2channels (not isolated), interface: optical interface (set of three interfaces)

Insulation case
Withstand voltage: 10kV (Standard accessory)

DM-910 (500k)/DM-910L (16M) isolation units (high resolution)

The units are operated by a built-in battery to perform floating measurements.
The high resolution enables the simultaneous measurement of switching waveforms and on-voltage.
Frequency bandwidth: DC to 500MHz, highest sampling rate: 2GS/s, memory length: 500k points (DM-910), 16M points (DM-910L), input: 1channel, interface: optical interface (set of three interfaces)

Insulation case
Withstand voltage: 10kV (Standard accessory)

DM-400 (500k)/DM-400L (16M) acquisition units

The units can continuously operated with an AC power source. These units are best suited to the non-isolated measurement of grounded power probes, for example.
Frequency bandwidth: DC to 500MHz, highest sampling rate: 2GS/s, memory length: 500k points (DM-400), 16M points (DM-400L), input: 2channels (not isolated), interface: electric interface (one set)

DM-553 Li-ion battery (built-in)

The battery can be inserted or removed from the front of the isolation unit. It uses three batteries to enable the unit to continuously operate for 20hours.
The battery can be charged with the use of the main unit.

The DM-900/L and DM-910/L are supplied with three batteries.

DM-002 to DM-010 optical fiber cables

The optical fiber cables are resistant to bending and external pressure.

Cable length: 2m to 200m
*1-2-5 step length
Without cover: 2m or 5 m
With cover: 5m to 200m

DM-105/DM-106 acquisition cables

Interface cables especially designed for the acquisition unit. These cables are connected to the unit and transceiver by electrical signals from the DM-400/L.

Cable length: 2 or 5m

The DM-9xxL long memory isolation unit enables detailed analysis during a basic inverter duty cycle.

The DM-900L and DM-910L long memory isolation units enable detailed analysis of individual carrier signals while capturing a base duty cycle.

A fundamental duty cycle (16ms on the sample screen) can be captured at a rate of 1GS/s.
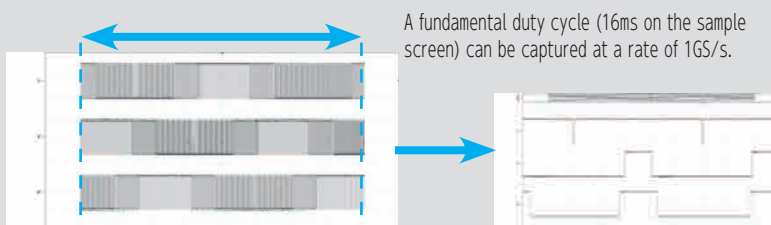
Gate driving waveform of the U, V, and W phases on the high side of a 3-phase inverter.

View with zoom display.

Up to 24 CH at a high voltage and wide bandwidth can be simultaneously measured.

Waveform monitoring and other system operations are remotely performed using the standard IS Viewer (software). The IS Viewer can be used off-line as well, and is therefore useful for data organization at locations remote from the measurement site.

The many operation functions provided by the IS Viewer facilitate power loss and other measurement.

Voltage waveform
Vce

Current waveform
Ic

Power loss waveform
Vce×Ic

Time axis
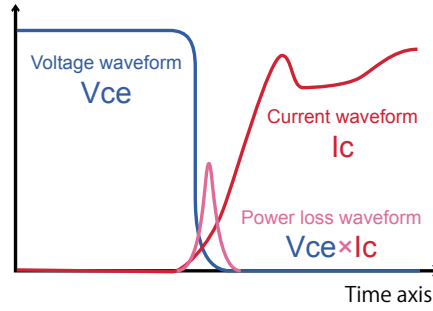
The Vce, Ic, output voltage and current waveforms of the upper and lower arms of an inverter can be simultaneously measured. dv/dt, di/dt, and other parameters, such as power loss, can be easily calculated from the measurement waveforms.

Functions of the IS viewer (DM-800)
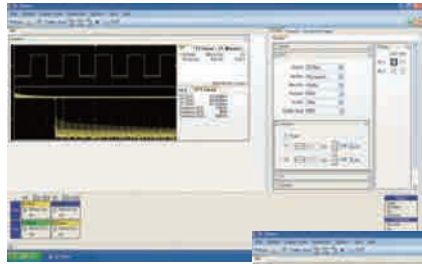
FFT function
This function is used for the frequency analysis of measured waveforms.
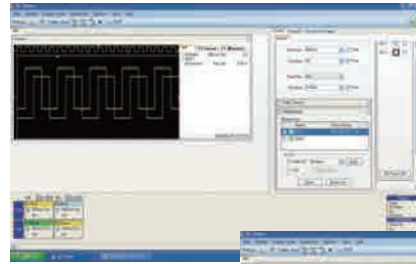
Reference display function
This function is used to compare waveforms.

Edge search function
This function is used to automatically detect the edge of a monitored waveform and display selected edges.
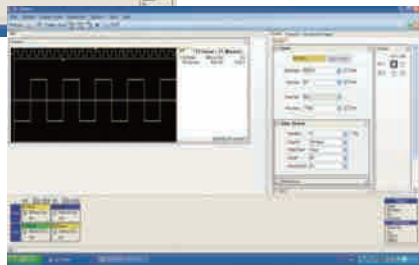
X-Y display function
This function is used to evaluate the SOA (safe operation area) and other items.
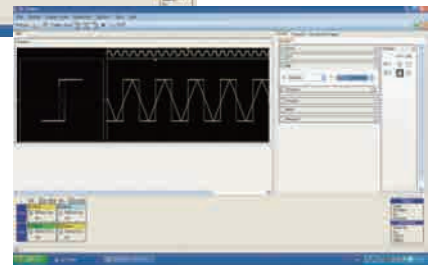
Multi-channel floating measurements (simultaneous measurement example of the upper and lower arms of a 3-phase inverter)

— : Optical fiber cable
— : LAN cable

Bandled IS Vewer software

Upper arm

Lower arm

E
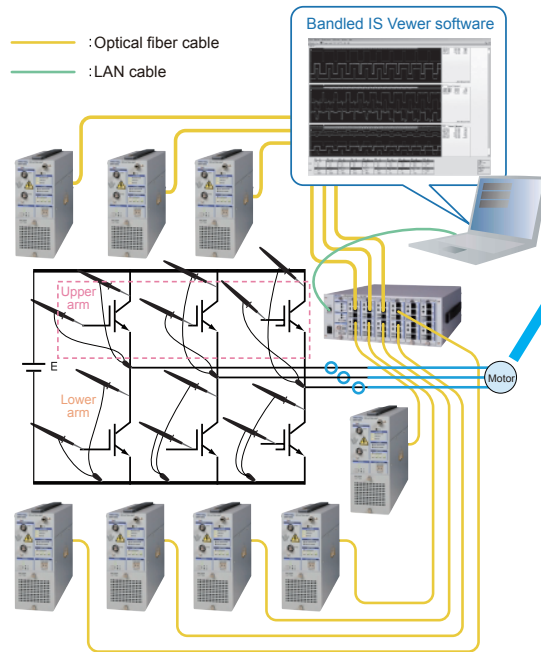
Motor

The waveform of voltage output from the 3-phase inverter that drives a motor or other device (shown in the left-hand figure) is a pulse voltage waveform, as shown in the figure below.

Average waveform

Several dozen to several thousand volts

Output waveform
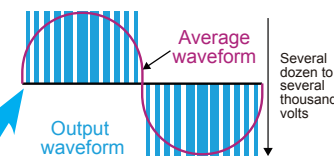
Differential probes were used for this type of measurement in the past, but this resulted in the waveform sometimes being distorted, and it was sometimes difficult to ensure sufficient measurement bandwidth due to constraints of the common mode rejection ratio or withstand common mode voltage. With optical fiber isolation, this isolation system can accurately monitor signals without being affected by these constraints.

Measuring Vge of the upper arm with differemtial input

Oscilloscope
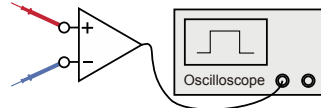
The common mode noise prevents accurate measurement.
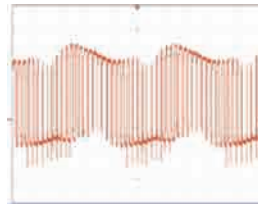
Measuring Vge of the upper arm with isolation input

Three built-in batteries

Optical isolation

Remote measurement (up to 400m)

200m

200m
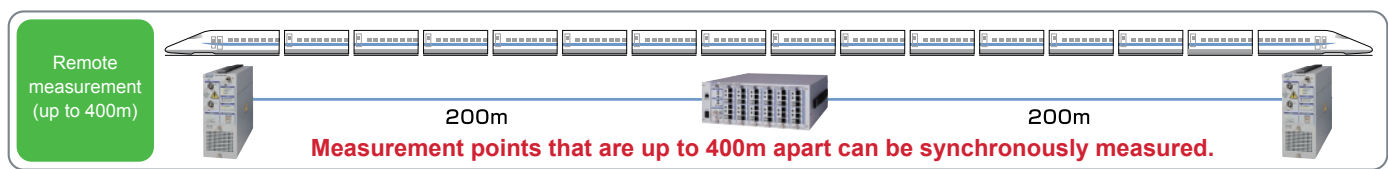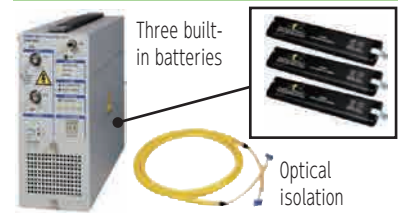
Measurement points that are up to 400m apart can be synchronously measured.

System configuration

IGBT Gate voltage measurements in the high-side switch of a single phase inverter (one unit)
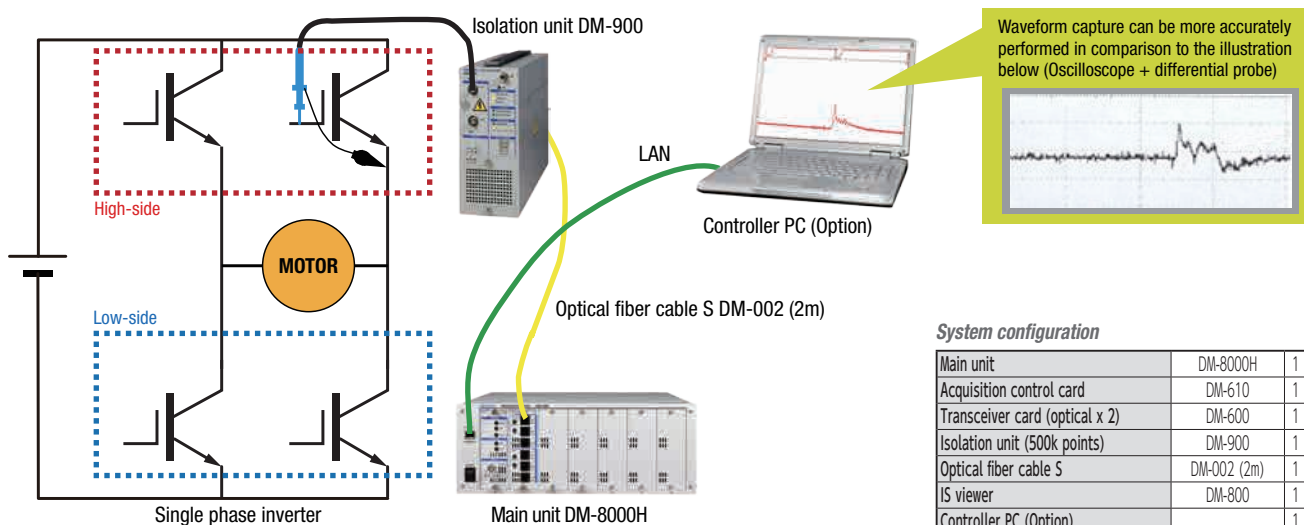
Isolation unit DM-900

LAN

Controller PC (Option)

Optical fiber cable S DM-002 (2m)

High-side

Low-side

MOTOR

Single phase inverter

Main unit DM-8000H

Waveform capture can be more accurately performed in comparison to the illustration below (Oscilloscope + differential probe)

System configuration

Main unit	DM-8000H	1
Acquisition control card	DM-610	1
Transceiver card (optical x 2)	DM-600	1
Isolation unit (500k points)	DM-900	1
Optical fiber cable S	DM-002 (2m)	1
IS viewer	DM-800	1
Controller PC (Option)		1

IGBT Vce voltage measurements in the high-side switch of single phase inverters (four units)
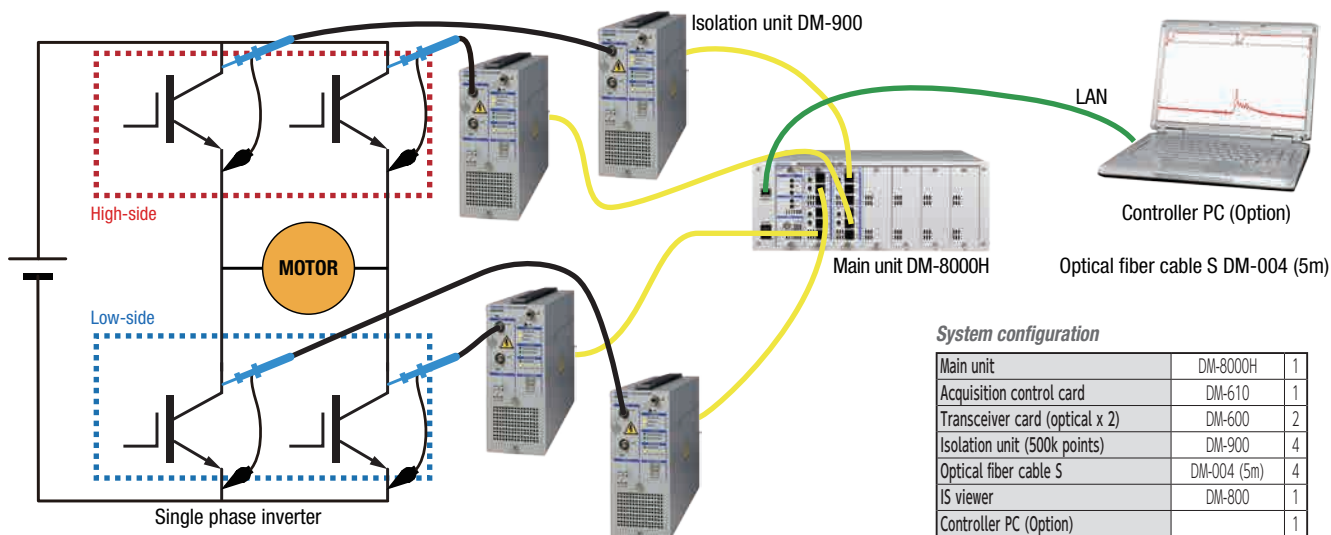
Isolation unit DM-900

LAN

Controller PC (Option)

High-side

Low-side

MOTOR

Single phase inverter

Main unit DM-8000H

Optical fiber cable S DM-004 (5m)

System configuration

Main unit	DM-8000H	1
Acquisition control card	DM-610	1
Transceiver card (optical x 2)	DM-600	2
Isolation unit (500k points)	DM-900	4
Optical fiber cable S	DM-004 (5m)	4
IS viewer	DM-800	1
Controller PC (Option)		1

IGBT Vce voltage & Ic current measurements of 3-phase, 2-level inverters (twelve units)
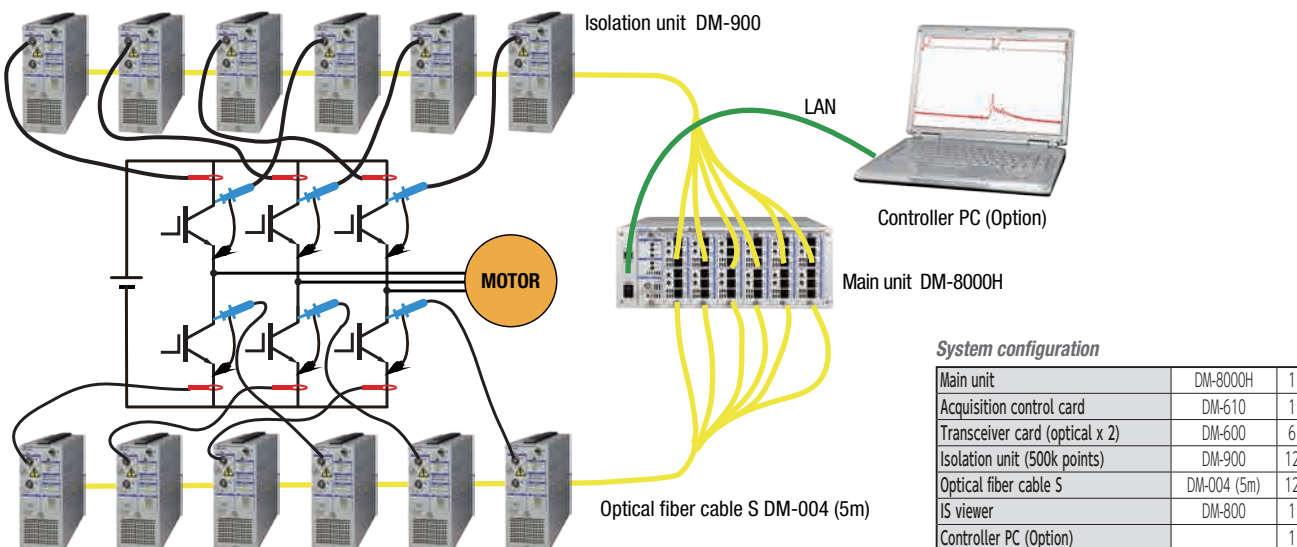
Isolation unit DM-900

LAN

Controller PC (Option)

MOTOR

Main unit DM-8000H

Optical fiber cable S DM-004 (5m)

System configuration

Main unit	DM-8000H	1
Acquisition control card	DM-610	1
Transceiver card (optical x 2)	DM-600	6
Isolation unit (500k points)	DM-900	12
Optical fiber cable S	DM-004 (5m)	12
IS viewer	DM-800	1
Controller PC (Option)		1

Isolation System DM-8000H Specifications

DM-900L/DM-910L Isolation Unit and DM-400/L Acquisition Unit

Model	DM-900	DM-900L	DM-910	DM-910L	DM-400	DM-400L
Signal input unit						
Frequency Bandwidth (-3 dB)	500MHz					
Bandwidth limiter	20MHz / 100MHz					
Input impedance	1M Ω // 16pF				1M Ω // 16pF or 50 Ω	
Maximum input voltage	400V max (DC+peakAC<=5kHz) CAT I					
Number of channels	2 (between channels are not isolated)		1		2 (Not isolated)	
Input coupling	GND, DC1M Ω , AC1M Ω		GND, DC1M Ω		GND, DC1M Ω , AC1M Ω , DC50 Ω	
Input sensitivity	2mV/div~10V/div, 1-2-5 steps		CH1-MAIN: 50mV/div~5V/div, 1-2-5 steps CH2-ZOOM: 2mV/div~1V/div, 1-2-5 steps		2mV/div~10V/div, 1-2-5 steps	
Offset range	2mV/div~50mV/div, ± 1V *[1] 100mV/div~500mV/div, ± 10V *[2] 1V/div~10V/div, ± 100V *[3]		CH1-MAIN: 50mV/div~500mV/div, ± 10V *[2] 1V/div~5V/div, ± 100V *[3] CH2-ZOOM: 2mV/div~20mV/div, ± 2V *[1] 50mV/div~1V/div, ± 20V *[2]		2mV/div~50mV/div, ± 1V *[1] 100mV/div~500mV/div, ± 10V *[2] 1V/div~10V/div, ± 100V *[3]	
Offset accuracy	± (1.0% + 0.5% of full-scale + X) X:*[1] 1mV, *[2] 10mV, *[3] 100mV					
DC gain accuracy	± (1.5% + 0.5% of full-scale)					
Probe sensitivity	10:1, 100:1, 1000:1 (Auto detection/manual settings)					
Sample rate	1GS/s (2GS/s during interleave)					
Vertical axis resolution	8bits					
Maximum memory length	500k points/ch	16M points/ch	500k points/ch	16M points/ch	500k points/ch	16M points/ch
Trigger system unit						
Trigger sources	CH1, CH2		CH-1-MAIN		CH1, CH2	
Trigger slope	Positive / Negative					
Coupling	AC, DC, HFREJ, LFREJ					
Level range	125% of full-scale					
Interface						
Interface	1 set of 3 optical interfaces (optical fiber cable: 2m to 200m)				1 set of electrical interfaces (wire cable:2 or 5m)	
Power supply and battery unit						
Internal battery	3 battery packs (unit can operate on one battery)				–	
Battery charging	Can be charged by the main unit				–	
Power consumption	120VAmax (when using AC power)				40VAmax	
Battery operation time	Approx. 12 hours of continuous operation (when using 3 batteries)				–	
Battery charging time	Approx. 6 hours				–	
AC power supply	AC100 to 240 (50/60Hz)					
Calibration signal						
Calibration signal	0.6V / 6V (selectable)					
Mechanical unit						
Dimensions (mm)	122.4 (H) X 258.4 (W) X 544 (D)				96.4 (H) X 171.6 (W) X 322.6 (D)	
Weight	Approx. 7kg (excluding battery packs and accessories) Battery pack weight: Approx. 660g per pack				2.6kg	
Operating temperature	0˚C to +40˚C					
Performance guaranteed temperature	+10˚C to +35˚C					
Accessories						
Battery pack	3				–	
Power supply cable	1					

DM-8000/DM-8000H Main Unit

*When the DM-610 acquisition control card is installed

Transceiver card connection

Number of slots	6 (Max. 12 isolation units and/or acquisition units can be connected.)

Time axis

Sweep range	1ns/div to 20s/div
Clock accuracy	10ppm
Acquisition mode	Normal, peak

Trigger system

Mode	Auto,Normal,Single,Stop
Source	Up to 24 CH
Type	Edge,Pulse width
Trigger delay	Available

Interface

Ethernet port	1000BASE-T X 3

Power supply unit

AC power supply	100V to 240V (50/60Hz)
Power consumption	130VA max

Mechanical unit

Dimensions (mm) and weight	132(H) X 351(W) X 420(D), Available. 6.9kg
Operating temperature	0˚C to +40˚C
Performance guaranteed temperature	+10˚C to +35˚C

Accessories

LAN cable	1
Power supply cable	1
Operation manual	CD-R(1)
Control software	IS Viewer DM-800 CD-R (1)

Note #1: Intel and Pentium are registered trademarks or trademarks of Intel Corporation and its subsidiary companies in the United States of America and other countries.
Note #2: Windows is a registered trademark or trademark of Microsoft Corporation in the United States of America and other countries.

DM-600/DM-620/DM-630 Transceiver Card

Number of isolation / acquisition units connected	DM-600: 2 (DM-900/L, DM-910/L) DM-620: 1 (DM-900/L, DM-910/L) +1 (DM-400/L) DM-630: 2 (DM-400/L)
Operation indicator	Status display via LED
Mechanism	Card inserted in main unit (DM-8000H)
Operating temperature	0˚C to +40˚C
Performance guaranteed temperature	+10˚C to +35˚C

IS Viewer DM-800

(supplied with the DM-8000H main unit)
* IS Viewer is installed in the controlling computer (option) and is used to operate the isolation system and to monitor waveforms.

Main function

Operations	+, -, ×, ÷, | × |, | ÷ |, ∫, dy/dx
Parameter measurements	Max, Min, p-p, Top, Base, Top-Base, RMS, Cycle RMS, Mean, Cycle Mean, +/-Overshoot, Transition Time, dv/dt, Freq, Period, +/-Pulse Count, +/-Pulse Width, Duty, Integral, Integral (abs), Integral (pos), Integral (neg), Skew (%), Skew (Level)
Other functions	XY display, FFT, Cursor, smoothing, channel de-skew, re-scale, off-line viewer
Waveform storage	CSV
Saving images	BMP,PNG,Clipboard
Saving setups	with / without waveforms

Controlling computer

CPU	Intel® Pentium®4 Processor or later[Note #1]
RAM	2GB or larger
OS	Windows® XP Professional SP3[Note #2] Windows® Vista Business SP2[Note #2]
Display	At least WXGA (1,280 x 768 pixels) recommended (SXGA (1,280 x 1,024 pixels) is required for full display.)

ISOLATION PROBE

ISOLATION AMP (Receiving side) ISOLATION UNIT (Sending side)

SE-6000   SE-6010

*Performs waveform measurements with high resolutions and in safe manner
under high voltage environment in systems that isolate output terminals through optical insulation*

- Contributes to the safety for the high voltage environment tests
- Increases measurement quality with differential probes
- Measures noise resistance very effectively
- Supports wide range of objects such as lightning surge and charging tests and etc.

- Measures Distant points (Switches, Transportation equipment and etc.)
- Analyzes failure factors when multiple abnormal operations happened at the distant places (The Isolation unit can be set at each place, up to 4 sets in total)

Ultra-high voltage measurement

Performs ultra-high voltage measurement in safe manner

High voltage divider
High voltage probe
Oscilloscope
Load
Impulse voltage source
SE-6010 (Sending side)
SE-6000 (Receiving side)
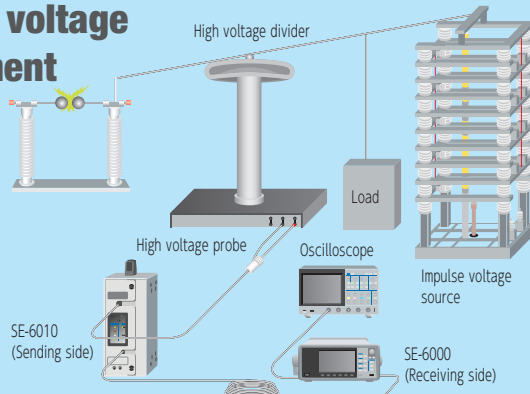
Wind-power generation

Isolation unit can be set at a distant place

Useful for a long time monitoring of an inverter and an UPS power supply

SE-6010 (Sending side)
Oscilloscope / Data logger
SE-6000 (Receiving side)
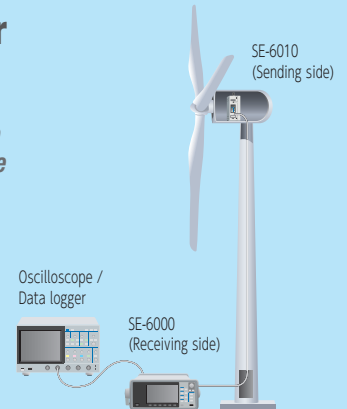
High-speed train

Performs simultaneous measurement at multiple distant points

High voltage probe
SE-6010 (Sending side)
SE-6000 (Receiving side)
Digitizer
Inverter
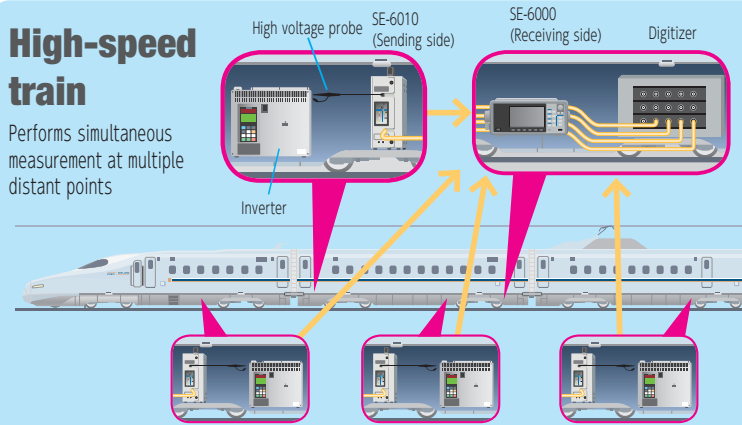
High-voltage transformer

Performs ultra-high voltage measurement in safe manner

High voltage probe
SE-6010 (Sending side)
SE-6000 (Receiving side)
Oscilloscope
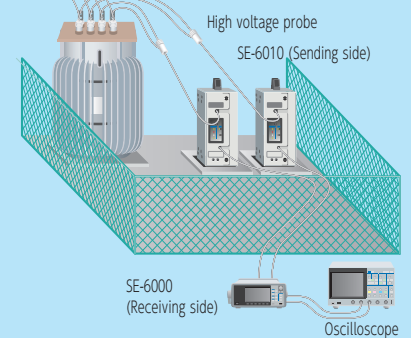
Various types of probes can be used, such as High voltage probes, current probes and passive proves

ISOLATION UNIT SE-6010 (sending side)
Amplifier
A/D conversion
Battery –powered (Max. 30 hours)

Optical fiber cable Max. cable length of 200m

ISOLATION AMP SE-6000 (Receiving side)
D/A conversion
Amplifier
Excellent combination with operation of an oscilloscope

- Oscilloscope
- Digitizer
- Others

ISOLATION AMP (Receiving side) Specifications

Number of channels	1
Frequency range (-3dB)	30MHz (Input to Unit ~ Output from AMP)
Input impedance	1M Ω //20pF
Input coupling	DC, AC, GND
Input range (Full scale)	at output range ± 1V (50-ohm), ± 2V (1M-ohm) ± 50mV, ± 100mV, ± 200mV, ± 500mV, ± 1V, ± 2V, ± 5V, ± 10V, ± 20V, ± 50V at output range ± 0.8V (50-ohm), ± 1.6V (1M-ohm) ± 40mV, ± 80mV, ± 200mV, ± 400mV, ± 800mV, ± 2V, ± 4V, ± 8V, ± 20V, ± 40V
Functions	Offset variable, Probe sense, Auto range, Self Cal. (Controlled from the SE-6000 [Receiving side])
Operation time	Battery 1pce: 12 hours Battery 2pces: 24 hours *1 pce equipped as standard

Model Name	Model Number
ISOLATION AMP (Receiver side)	SE-6000
ISOLATION UNIT (Sending side)	SE-6010
Battery charger (2-bay type)	SE-603
Battery	SE-601

ISOLATION AMP (Receiving side) Specifications

Number of channels	4
DAC	14bit 100MS/s
Output voltage (Impedance)	± 1V (50-ohm load), ± 2V (1M-ohm load) In DSO mode: ± 800mV (50-ohm load), ± 1.6V (1M-ohm load)
Monitor display	4.3" Color LCD back light : Select High / Low for display and selection of setting conditions of the SE-6010 (ISOLATION UNIT)
Auto range	Range, Offset auto detection
Input (Optical I/F Connector)	Twin LC connector x 4
Output	BNC x 4
Power Source	AC100 to 240V (50/60Hz)

Model Name			Model Number
Optical fiber cable		3m	SE-605
		10m	SE-606
		50m	SE-607
		200m	Custom order

High Voltage Differential Probe

BumbleBee® PMK

Wide bandwidth 400MHz

Attenuation Ratio(switchable)	Input voltage	50:1	100:1	250:1	500:1
Bandwidth(-3dB) Rise time(10%-90%)	50V	300MHz 1.2ns	300MHz 1.2ns	400MHz 0.875ns	400MHz 0.875ns
	500V	–	–	300MHz 1.2ns	300MHz 1.2ns
	1,000V	–	–	–	300MHz 1.2ns
RMS Noise level (Broadband noise at 30MHz bandwidth)		55mV	55mV	75mV	75mV
Typical Propagation Delay		10ns			
Max. Common Mode Voltage		± 2,000V pk(± 1,400V rms)			
Max. Input Voltage Measurement category (IEC61010-031)	Category I	2,000V eff. 6,000V transient Overvoltage			
	Category III	1,000V CATIII			
Max. Input Voltage		± 200V DC	± 400V DC	± 1,000V DC	± 2,000V DC
Common Mode Voltage		± 1,400Vpk(± 1,000Vrms)			
DC Gain accuracy		± 0.7%	± 0.7%	± 0.35%	± 0.35%
Offset Range 1)		± 4V			
Offset Resolution 1)		15 Bits / Minimum Step<125 μ V			
Offset Drift 1)		150 μ V/℃	150 μ V/℃	40 μ V/℃	40 μ V/℃
Input impedance at each input to GND		5M Ω //4pF			
Input impedance at differential inputs		10M Ω //2pF			
Input coupling of the measuring instrument		50 Ω			
Commonmode rejection ratio (typ. CMRR)	DC	>80dB			
	100kHz	>70dB			
	1MHz	>62dB			
	3.2MHz	>50dB			
Weight		370g			
Cable length		2m			
Input Leads Length		25cm			
Input Leads Connectors		2mm x 4mm(male)			
Output Connectors		BNC(male)			
Operating temperature range		0 ℃ to 50℃			
Temperature range for probe input leads		-40℃ to 85℃			
Power supply units(Optional)		PS-02(2CH), PS-03(4CH)			

1) Referred to Output
Bumble Bee® is registered trademark in Germany of PMK GmbH.

PS-03

SS-320   100MHz, 1.4kV
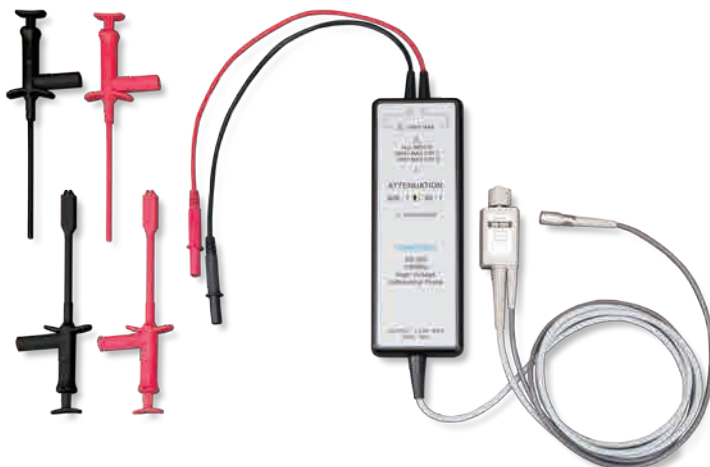
Freq. BW	DC to 100MHz
Maximum differential input voltage (DC+AC peak)	± 140V(50:1)/ ± 1.4kV(500:1)
CMRR(70dB)	500V DC
CMRR(80dB)	50/60Hz
CMRR(50dB)	1MHz
Input impedance	1M Ω
Input impedance at each input to GND	4M Ω //7.0pF
Input impedance at differential input	8M Ω //3.5pF
Cable length	1.5m
Power supply unit (optional)	PS-25(External) / DS-579

High Voltage Passive Probes

PHV1000 / PHVS1000

Model	Attenuation	Iinput RC		BW(-3dB)	Measurement Category I		Cable length
		R(MΩ)	C(pF)		rms(kV)	peak(kV)	
PHV1000-RO	100:1	50	7.5	400MHz	1	4	2m
PHV1000-3-RO				250MHz			3m
PHVS1000-RO	1000:1	50	7.5	400MHz	1	4	2m
PHVS1000-3-RO				250MHz			3m

RMS vs. Peak Pulse Voltage PHV 1000-RO
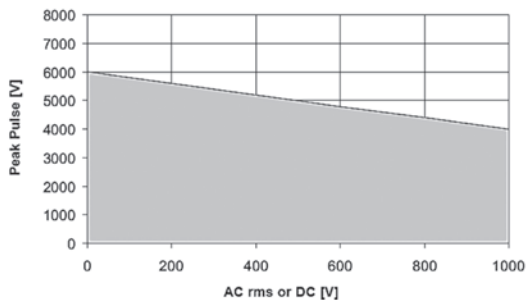
Typical Voltage Derating PHV 1000-RO
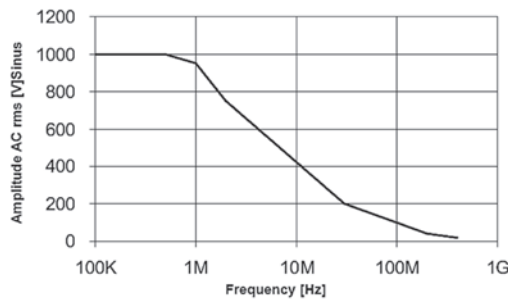
Maximum Pulse Derating PHV 1000-RO
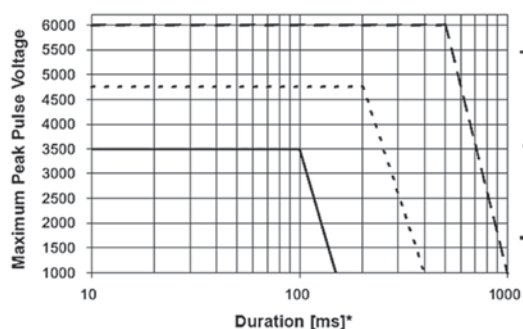
Duty Cycle
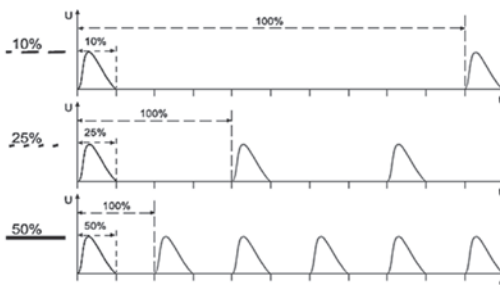
PHV6xx / PHVS6xx

PHV4002

Model	Attenuation	Iinput RC		BW(MHz at -3dB)	Max. Input Voltage(kV)			Comp. Range [pF]	Cable length
		R [MΩ]	C [pF]		CAT II AC rms	VDC Incl. pk AC	Impulse Peak		
PHV641-LRO	100:1	50	<6	380	2	3	4	10 - 50	1.2m
PHV642-LRO			<6.5	300					2.0m
PHV643-LRO			<7	150				15 - 55	3.0m
PHV661-LRO	100:1	50	<6	380	2.8	4	6	10 - 50	1.2m
PHV662-LRO			<6.5	300					2.0m
PHV663-LRO			<7	150				15 - 55	3.0m
PHVS662-LRO	1000:1	50	<6.5	400	2.8	4	6	10 - 50	2.0m
PHVS663-LRO			<7	250				15 - 55	3.0m
PHV4002-3-RO	1000:1	100	<2.5	100	14	20	40	10 - 50	3.0m
PHV4002-5-RO				—					
PHV4002-8-RO				—					
PHV4002-10-RO				10					

Passive Probes

Model	Attenuation	Input Impedance	System bandwidth(-3dB)	scope input capacity
SS-101R	10 : 1	10MΩ /12pF	500MHz	13 to 23pF
SS-0130R	10 : 1	10MΩ /12.5pF	200MHz	18 to 35pF
SS-0122	10 : 1	10MΩ /14pF	100MHz	10 – 32pF
	1 : 1	1MΩ /<150pF	6MHz	
SS-0112	10 : 1	10MΩ /22pF	60MHz	10 – 45pF
	1 : 1	1MΩ /<200pF	6MHz	
SS-0004	1 : 1	44pF ± 6pF	30MHz	

SS-0170R/ SS-0171R

HV-P30

HV-P60

Model	Attenuation	Input RC		System Bandwidth [MHz] (-3dB)	Cable Length [m]	Comp. Range [pF]	Max. Input Voltage [kV]	
		R [MΩ]	C [pF]				CAT Ⅱ DC+ACpeak	CAT Ⅰ DC+ACpeak
SS-0171R	100 : 1	66.7	<4	400	2.0	6 – 18	1.0	4.0
SS-0170R	100 : 1	66.7	<4	400	2.0	6 – 18	1.0	6.0
HV-P30	1000:1	100	<7	50	3.0	15 – 50	30	
HV-P60	2000:1	1,000	<7	50	4.0	20 – 50	60	

Pair Probes

Model	Attenuation	Input RC		System Bandwidth [MHz] (-3dB)	Cable Length [m]	Comp. Range [pF]	Max. Input Voltage [kV]		
		R [MΩ]	C [pF]				CAT Ⅱ AC rms	VDC Incl.pkA	Impuls
PDD4161-L	100 : 1	50	<6	380	1.2	10 – 50	2.8	4.0	6.0
PDD4162-L	100 : 1	50	<6.5	300	2.0	10 – 50	2.8	4.0	6.0
PDD4163-L	100 : 1	50	<7	150	3.0	15 – 55	2.8	4.0	6.0
PDDS4962-L	1000 : 1	50	<6	400	2.0	10 – 50	2.0	3.0	4.0
PDDS4963-L	1000 : 1	50	<6.5	250	3.0	10 – 50	2.0	3.0	4.0
PDD4002-3	1000 : 1	100	<2.5	100	3.0	10 – 50	14	20	40

Pair passive probes are paired of their performance for dynamic tests.

Current Probes

CLAMP TYPE CURRENT PROBE

Model	Maximum input current		Frequency bandwidth	Measurable wire diameter(max.)
SS-240A	30Arms	50Apk	DC-50MHz	5mm
SS-250	30Arms	50Apk	DC-100MHz	5mm
SS-260	150Arms	300Apk	DC-10MHz	20mm
SS-270	500Arms	700Apk	DC-2MHz	20mm

SS-270

ROGOWSKI COIL CURRENT PROBE Lineup

95mm
300mm
φ8.5mm
SS-290S

220mm
700mm
φ8.5mm
SS-290L

SS-290 series

25mm
80mm
φ1.7mm

SS-280A series
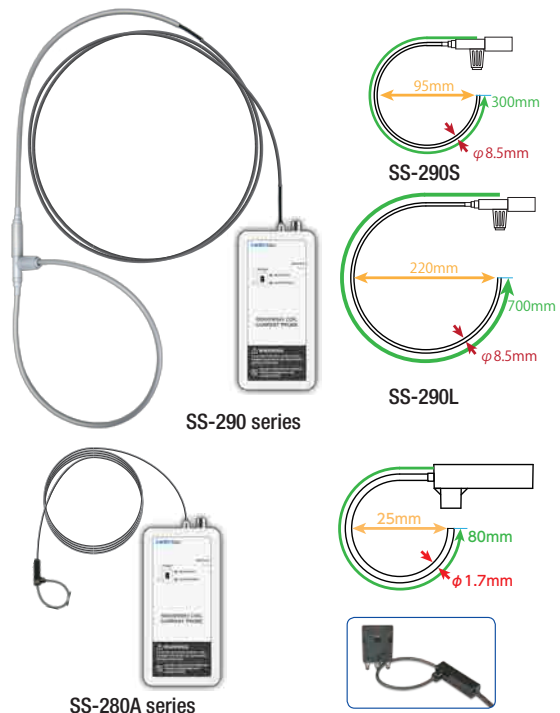
• High current 12kApk, Withstanding voltage 12kV max.
• Zero adjust function

Model	Peak Current	Max. Withstanding Voltage	Bandwidth (-3dB)	Sensor	Cut-off frequency	Sensitivity at mV/A	Noise level at mV rms	di/dt kA/us
SS-293S	1,200A		20MHz					
SS-293L			10MHz					
SS-294S	3,000A		20MHz					
SS-294L		10kV	10MHz	Cable length at 3meters		To be specified.		
SS-295S	6,000A		20MHz					
SS-295L			10MHz					
SS-296S	12,000A		20MHz					
SS-296L			10MHz					
SS-281A	30A				110Hz	200	3.5	2
SS-282A	60A				65Hz	100	2.5	4
SS-283A	120A			Cable length at 1.5meters Operation temperature at -40deg. to 125deg.	32Hz	50	2	8
SS-284A	300A	1,2kV	30MHz		9Hz	20		20
SS-285A	600A				6Hz	10	1.8	40
SS-286A	1,200A				3Hz	5		80
SS-287A	3,000A				To be specified.			

High voltage Probe Calibrators

PMK*

KHT1000C
100V/200V/500V/1000V, 50Hz

TK100C
100V, 100Hz

High voltage Probe Calibrators

PMK®

KSZ10B   0.05A/0.2A/0.5A/1A/2A/10A, 1Hz
KSZ100B 20A/50A/100A, 0.5Hz

Probing tools for Flat package (Ultra-mini clips)

3-D Probe Positioners

PMK®
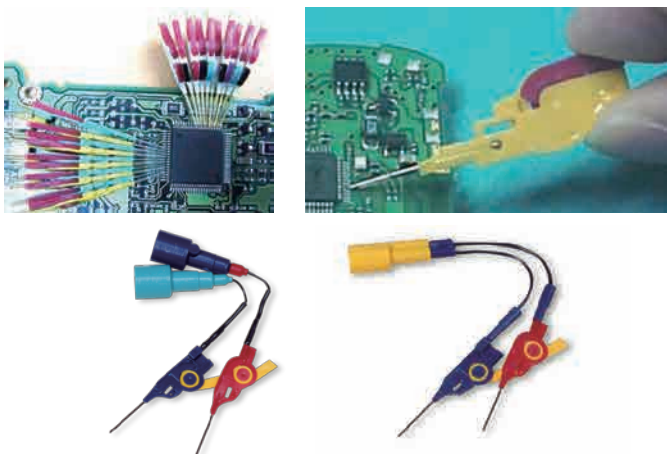
3D Positioners

Two foot Positioners
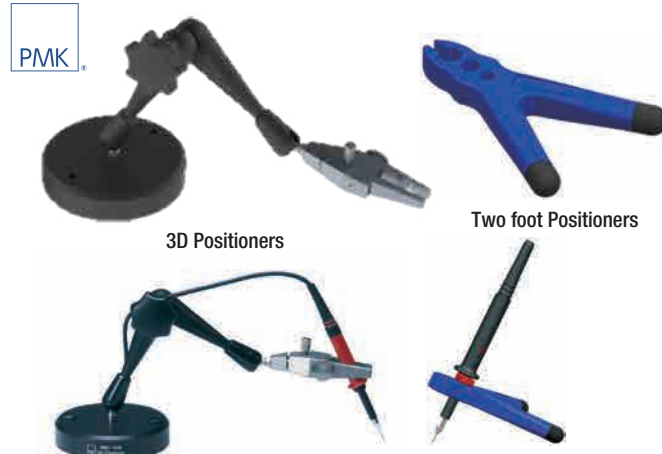
*Distribution of PMK probes and Rogowski coil current probes are limited in Japan and Asian markets.

6½ Digits Digital Multimeter
VOAC7602

White background mode : * The font for the digit display is selected with NORMAL (gothic) on DISPLAY.

User-friendly Operability
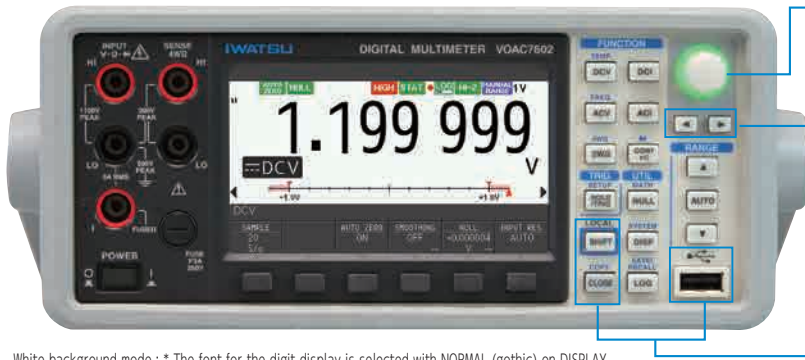
Illuminated when necessary
The input of numerals, characters and symbols, and list selection needed for parameter settings can be carried out speedily and directly. Simple rotate and push the knobs to set the parameters.

Arrow keys
These keys are used to move the cursor for numerical and character input. They can also be used for switching between the primary display of numerals, trend charts and histogram charts, etc., and the secondary displays of statistics and analog meters, etc.

Enables instantaneous copies of the screen to be taken

Display

Easy-to-see Large Screen
Equipped with a high-resolution, wide color LCD display. The display is bright and provides a wider field of view, which becomes apparent the more it is used. The font used for the digits can be selected from normal (gothic) type and seven segment type. It is also possible to choose the background color from two colors (white and black).

4.3-inch high-resolution LCD monitor 109mm

Black background mode :
* The font for the numerical display is selected with NORMAL(gothic) on DISPLAY.

New displays that make even better use of the judgment function

A larger screen for enhanced legibility

It is now possible to see the screen from a distance. Highly-acclaimed for enabling adjustment work to be carried out more easily and speedily.

Unique needle meters. Pseudo analog-like fluctuations are displayed digitally

In addition to the convenience of making estimated judgments, it is now possible to use combinations of the judgment function in a wide range of ways.
The color of the needle changes when the reading exceeds the judgment standards.

A myriad of analyses can now be carried out without the use of a PC. Performance and functionality levels without selecting fields enhance work quality. The VOAC7602 is equipped with a wide range of new functions, including trend chart and histogram chart displays and enhanced analysis accuracy through 30k sampling/s, which exceeds expectations for normal DMMs.

Real Time • Trend display + LIMIT judgment display	Real Time • Histogram display + LIMIT judgment display	Real Time • Trend display + Analog meter display
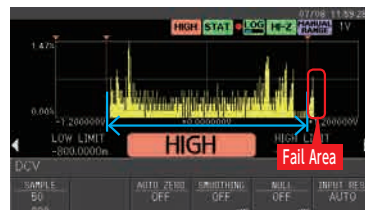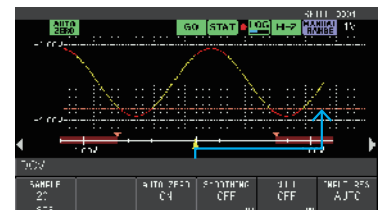
Real Time • Numerical display + LIMIT judgment display	Real Time • Trend display + Data Numerical display	Arc scale meter display + Data Numerical display
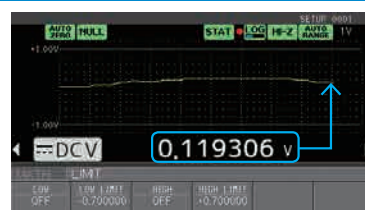
A myriad of analyses display combinations are now possible without the use of a PC

The primary display consists of several displays, including the numerical display, the trend charts, the histogram charts and the arc scale meter, and a secondary display to provide a wealth of information related to each of the primary displays is also available. A wide range of screen combinations can therefore be selected in alignment with measurement requirements.

Annunciator
(Displays indicators to show the operational status of the device)

Menu display area

Secondary display area
Secondary display
- Analog meter display
- Statistics display
- LIMIT judgment display
- Cursor measurement display
- Numerical display

Primary display area
Primary display
- Trend
- Histogram
- Arc scale meter

Accurate Sampling Rates Now Possible with the Bulk Mode.
This contributes greatly to improved analysis accuracy

A dedicated acquisition mode was added to enable 30k sampling/s. (DCV, DCI, 2W Ω and 4W Ω with 5½ digit displays) This has greatly improved the time resolution to load data, and is useful for transferring data across to other new DMM applications.

Sampling Rate Comparison

A comparison of data acquired with 1k sampling/s and 30k sampling/s using the same signals in the bulk mode.

Trend

30k sampling/s
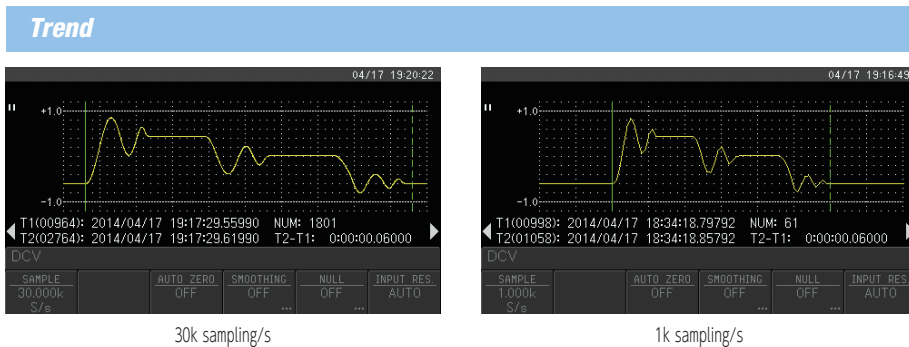
1k sampling/s

Bulk mode

The bulk mode is a mode that concentrates only on acquiring measurement data.
Accurate sampling rates up to a maximum of 30k sampling/s are guaranteed when the display of measurement data on the screen is switched off during data acquisition. The measurement data is stored in bulk in the log memory, and can be used for displaying trends and histograms with the use of the offline browser function. Data can also be saved onto USB memories.

Logging is Possible for Long Periods of Time with Long Memory

Equipped with a data size equivalent to 100k points of data to supports extended logging periods.
Example: Logging exceeding one full day is possible at a sampling speed of one per second.

Sampling Rate (Sampling/s)	1	4	20	100	500	1k	2k	7.5k	15k	30k
Loading Time (HH:MM:SS)	27:46:40	6:56:40	1:23:20	0:16:40	0:03:20	0:01:40	0:00:50	0:00:13	0:00:07	0:00:03

Using this in combination with the trigger function's interval setting will enable parameters that are longer than the sampling cycle to be set (0 to 3,600 seconds), and even longer logging times can be obtained by setting the interval at one second or longer.

Offline Browser Function Equipped with a Powerful Cursor

Offline Histogram Chart Display Useful for Measurement Yields

The data loaded into the log memory is displayed in a histogram so that the yields can be easily measured with the cursor.
This function is conventionally carried out through PC analyses, but allowing judgment to be performed where the work is being carried out drastically improves work efficiency.
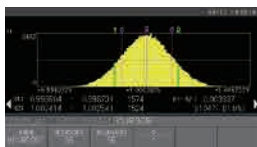
Off-line Trend Charts for Displaying the Time-Based Fluctuations in Measurements

In addition to an oscilloscope-like display, it is possible to recalculate the statistics within the range of the cursor to acquire statistical data within required ranges. It is also possible to perform this while copying the screens into the USB memory, which is very useful for improving work efficiency even further.

Vastly Upgraded Judgment Function

The VOAC7602 is capable of performing high-grade analyses based on the results of LIMIT judgment. The main feature here is the simple operations. The unit answers the questions that trouble operators, such as the number of defects occurring and the Date & Time of Occurrence.

"Occurrence Rate" Solution Screen

V0AC7602 Specifications

1. Common Performance

ADC method	ΔΣ ADC system
Measurement Mode	
Trigger Setting	AUTO / SINGLE (Switching)
Range	Selected from AUTO RANGE/MANUAL RANGE
Auto Range	Range increased over "1199999", and range decreased below "100000".
Screen	LCD
Size	4.3-inch
Dot Count	480 dots x 272 dots
Color	16bit, 65,536 colors
Drive System	TFT active matrix
Backlight	LED
Sampling Rate	

DC Range (DCV, DCI, 2W Ω , 4W Ω)

Power Supply Frequency: 50Hz		Power Supply Frequency: 60Hz		Display Digits	Remarks
Sampling Rate*[1](S/s) Screen Display	PLC Converted Value*[2]	Sampling Rate*[1](S/s) Screen Display	PLC Converted Value*[2]		
2.5(1)	20	2.5(1)	24	6½ digits	Figures within ( ) are with AUTOZERO set at ON or during 4W Ω
10(4)	5	10(4)	6		
50(20)	1	60(20)	1		
100	0.5	100	0.6	5½ digits	Cannot be selected during 4W Ω
500	0.1	500	0.12		
1k	0.05	1k	0.06		
2k	25m	2k	30m		
7.5k	6.67m	7.5k	8m		
15k	3.33m	15k	4m		
30k	1.67m	30k	2m		

*1.   The sampling rate is only guaranteed when loading data with the logging function MODE set at the BULK mode.

*2.   PLC Converted Value: Value equivalent to the sampling cycle/power source cycle

AC Range (ACV, ACI)

AC Filter	Sampling Rate		Display Digits	Response Time*[1]
	Power Supply Frequency: 50Hz	Power Supply Frequency: 60Hz		
MID	2.5S/s (20PLC)	2.5S/s (24PLC)	6½ digits	Within 3 seconds
HIGH	2.5S/s (20PLC)	2.5S/s (24PLC)	6½ digits	Within 2 seconds
	10S/s (5PLC)	10S/s (6PLC)		
	50S/s (1PLC)	60 /s (1PLC)		

Response time*[1] Time for accurate measurement at each range

Interface

USB2.0	Equipped as standard
LAN & RS-232	SC-361 (factory option)
GPIB	SC-363 (factory option)
DIO	SC-362 (factory option)

Rear Panel I/O (BNC and DIO)

Trigger Input (BNC)		
Level		H:2.4Vmin, L:0.9Vmax
Input Impedance		Approx. 10k Ω
Polarity		Selection possible for both edges
Pulse Width		1 μ s or more
Default Delay		Less than 1 μ s
COMPLETE output (BNC)		
Level		H:2.4Vmin, L:0.4Vmax
Output Impedance		Approx. 1k Ω
Polarity		Positive logic
Output Pulse Width	When LIMIT Judgment is OFF	10 μ s
	When LIMIT Judgment is ON	4.0ms or more
Trigger INHIBIT Input (DIO Option)		
Level		H:2.4Vmin, L:0.3Vmax
Input Impedance		Approx. 5k Ω
Polarity		POSITIVE (Positive Logic Operations)/NEGATIVE (Negative Logic Operations)
LIMIT Judgment Output (DIO Option)		COMPLETE, GO, HI, LO Only output when LIMIT judgment is at ON and DIO output is at ON.
Withstand Voltage Between Terminals		50V
Maximum Permissible Current		100 m A
Signal Timing		

COMPLETE   Approx. 1.4ms   4ms or more

GO/HI/LO   Judgment Result
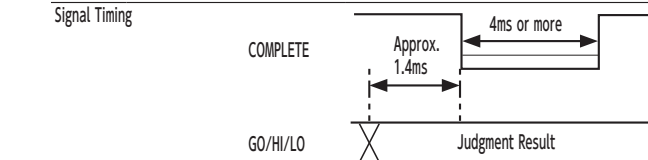
General Performance

Warm-up time	One hour after power switched on
Operation Guaranteed Temperature and Humidity	0ºC to 50ºC (less than 80% or equivalent moisture at 40ºC. No Condensation)
Storage Temperature and Humidity	-20ºC to 60ºC (less than 90% or equivalent moisture at 40ºC. No Condensation)
Power Supply	AC100V/110V/220V/240V ± 10%, 50Hz/60Hz All supplies with the exception of AC100V are optional (factory option)
Power Consumption	21VA or less (including options)
Withstand Voltage	DC ± 500V (between input terminals for all front panel measurements and the earth)
Installation (Over-Voltage) Category	Category Ⅱ (Local level, Electrical appliances, Portable appliances)
Contamination Level	Contamination level 2 *Must not be used in environments containing conductive contamination.
External Dimensions	225Wx100Hx366D mm (excluding the legs, handle, knobs and other protruding components)
Weight	Approx. 3.0kg (including the protector option.)
Expected Life Span	
LCD	LED backlight brightness reduced by half after Approx. 70,000 hours
Relays	Approx. 100,000 times (Maximum load with 1,000V applied) Approx. 10 million times (under normal usage conditions without excessive load)
Data Backup Battery	5 years

2. Standard Measurement Function Performance

Performance levels hereinafter depend on the following conditions and definitions.
Temperature/Humidity: 23 ± 5ºC, 80%RH or less. Accuracy for one year: ± (% of reading + % of range).
Response Time: Time for accurate measurement at each range

2-1. Direct Current Voltage Measurements (DCV)

2-1-1. Accuracy and Resolution
Unit: ± (% of reading + % of range)

Range	Full Scale when 6½ Digits in Use	Resolution	Accuracy ± (% of reading + % of range)	Temperature Coefficient ± (% of reading + % of range)/ºC	Input Impedance
100mV	119.9999	0.1 μ V	0.0050 + 0.0035	0.0005 + 0.0005	1G Ω or more, or 10M Ω± 1%
1V	1.199999	1 μ V	0.0040 + 0.0007	0.0005 + 0.0001	
10V	11.99999	10 μ V	0.0035 + 0.0005		
100V	119.9999	0.1mV	0.0045 + 0.0006		10M Ω± 1%
1000V	1100.000	1mV	0.0045 + 0.0010		

• Sampling Rate: 1S/s
• Maximum Permissible Voltage
  100mV to 100V Range: 800Vpeak (continuous), 1100Vpeak (for 1 minute)
  1000V Range: ±1100Vpeak (continuous)
• Response Time: within 1 second

2-1-2. Noise Reduction

PLC	NMRR 50Hz/60Hz ± 0.1 %	CMRR 50Hz/60Hz ± 0.1 % Unbalance Resistance 1k Ω
Integral Multiple for 1 PLC	55dB	120dB
Other than the above	0dB	−

* 50Hz/60Hz: Electrical Power Frequency

2-2. Alternating Current Voltage Measurements (ACV)

2-2-1. Resolution and Measurement Range
Actual Effective Value Detection Crest Factor: <5

Range	Full Scale	Resolution	Measurement Range		Input Impedance
			MID	HIGH	
100mV	119.9999	0.1 μ V	20Hz-300kHz	200Hz-300kHz	Approx. 1M Ω //100pF or less
1V	1.199999	1 μ V			
10V	11.99999	10 μ V			
100V	119.9999	0.1mV			
750V	750.000	1mV	20Hz-100kHz	200Hz-100kHz	

2-2-2. Accuracy
Rated at 5% to 100% for each range
Unit: ± (% of reading + % of range)

Range	Frequency	Accuracy	Temperature Coefficient
100.0000mV	20Hz to 45Hz	0.70 + 0.04	0.070 + 0.004
	45Hz to 100Hz	0.20 + 0.04	0.020 + 0.004
	100Hz to 20kHz	0.06 + 0.04	0.005 + 0.004
	20kHz to 50kHz	0.12 + 0.05	0.011 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008
	100kHz to 300kHz	4.00 + 0.50	0.200 + 0.020
1.000000V to 750.000V	20Hz to 45Hz	0.70 + 0.03	0.070 + 0.003
	45Hz to 100Hz	0.20 + 0.03	0.020 + 0.003
	100Hz to 20kHz	0.06 + 0.03	0.005 + 0.003
	20kHz to 50kHz	0.11 + 0.05	0.011 + 0.005
	50kHz to 100kHz	0.60 + 0.08	0.060 + 0.008
	100kHz to 300kHz	4.00 + 0.50	0.200 + 0.020

• Sine Wave Reliability.
• The maximum permissible voltage is 750Vrms or 1100Vpeak, but the DC component is ±500V or less.
• The 750V range is restricted to 100kHz or 8 x 10^{7} [V/Hz].
• The Crest Factor (CF) is guaranteed to either 5 during Full Scale input or the maximum input voltage, whichever is smaller.

2-2-3. Additional Margin of Error Caused by AC Filter Settings
Unit: ± (% of reading)

AC Filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Exceeds 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	0

2-2-4. Additional Margin of Error Caused by the Crest Factor

Unit: ± (% of reading)

Crest Factor	Additional Margin of Error
1-2	0.05
2-3	0.15
3-4	0.30
4-5	0.40

• Frequency: 20Hz to 300kHz.

2-3. Direct Current Measurements (DCI)
2-3-1. Accuracy and Resolution

Unit: ± (% of reading + % of range)

Range	Full Scale when 6.5 Digits in Use	Resolution	Accuracy	Temperature Coefficient	Shunt Resistance
1mA	1.199999	1nA	0.050 + 0.006	0.0020 + 0.0050	90 Ω
10mA	11.99999	10nA	0.050 + 0.020	0.0020 + 0.0020	5 Ω
100mA	119.9999	100nA	0.050 + 0.005	0.0020 + 0.0005	5 Ω
1A	1.199999	1 μ A	0.100 + 0.010	0.0050 + 0.0010	0.1 Ω
3A	3.00000	10 μ A	0.120 + 0.020	0.0050 + 0.0020	0.1 Ω

• Resolution: 6½ digits status applied.
• Maximum Permissible Current All Ranges: 3 A_DC or 3 Arms (Guaranteed with continual and 3A fuse)

2-4. Alternating Current Measurements (ACI)
2-4-1. Resolution and Measurement Range

Actual Effective Value Detection Crest Factor: <5

Range	Full Scale	Resolution	Measurement Range MID	Measurement Range HIGH	Shunt Resistance
1A	1.199999	1 μ A	20Hz to 5kHz	200Hz to 5kHz	0.1 Ω
3A	3.00000	10 μ A			

2-4-2. Accuracy
Rated at 5% to 100% for each range.

Unit: ± (% of reading + % of range)

Range	Frequency	Accuracy	Temperature Coefficient
1A	20Hz to 45Hz	0.70 + 0.04	0.100 + 0.006
	45Hz to 100Hz	0.30 + 0.04	0.035 + 0.006
	100Hz to 5kHz	0.10 + 0.04	0.015 + 0.006
3A	20Hz to 45Hz	0.70 + 0.06	0.100 + 0.006
	45Hz to 100Hz	0.35 + 0.06	0.035 + 0.006
	100Hz to 5kHz	0.15 + 0.06	0.015 + 0.006

• Sine Wave Accuracy.
• Maximum Permissible Current All Ranges: 3 Arms (Guaranteed with continual and 3A fuse)

2-4-3. Additional Margin of Error Caused by AC Filter Settings

Unit: ± (% of reading)

AC Filter	20Hz to 40Hz	40Hz to 100Hz	100Hz to 200Hz	200Hz to 1kHz	Exceeds 1kHz
MID	0.22	0.06	0.01	0	0
HIGH		0.73	0.22	0.18	

2-4-4. Additional Margin of Error Caused by the Crest Factor

Unit: ± (% of reading)

Crest Factor	Additional Margin of Error
1-2	0.05
2-3	0.15
3-4	0.30
4-5	0.40

• Frequency: 20Hz to 300kHz

2-5. 2 Terminal Resistance Measurements (2W Ω)/4 Terminal Resistance Measurements (4W Ω)
2-5-1. Resolution, Accuracy and Measurement Current

Unit: ± (% of reading + % of range)

Range	Full Scale	Resolution	Accuracy	Temperature Coefficient	Measurement Current
100 Ω	119.9999	0.1m Ω	0.010 + 0.004	0.0006 + 0.0005	Approx. 1mA
1k Ω	1.199999	1m Ω	0.010 + 0.001	0.0006 + 0.0001	Approx. 1mA
10k Ω	11.99999	10m Ω	0.010 + 0.001	0.0006 + 0.0001	Approx. 100 μ A
100k Ω	119.9999	0.1 Ω	0.010 + 0.001	0.0006 + 0.0001	Approx. 10 μ A
1M Ω	1.199999	1 Ω	0.010 + 0.001	0.0010 + 0.0002	Approx. 5 μ A
10M Ω	11.99999	10 Ω	0.040 + 0.001	0.0030 + 0.0004	Approx. 500nA
100M Ω	119.9999	100 Ω	0.800 + 0.010	0.1500 + 0.0002	Approx. 500nA //10M Ω

• Reliability related to 4 terminal resistance measurements or 2 terminal resistance measurements after zero compensation with the NULL operation when using 6½ digits resolution. A margin of error equalling 0.2Ω will be added to the 2 terminal resistance measurement if the NULL operation is not used.
• Maximum Permissible Voltage
  Between the Ω-COM Terminals: 800Vpeak (continuous), 1100Vpeak (for 1 minute)
  Between Sense Hi-Lo: 200 Vpeak
• Terminal Open-Circuit Voltage < 17 V

2-6. Continuity Tests (CONT ·II)
2-6-1. Accuracy, Resolution and Measurement Current

Unit: ± (% of reading + % of range)

Resistance Range	Resolution	Threshold	Accuracy	Temperature Coefficient	Measurement Current	Sampling Rate
1k Ω	1m Ω	1 Ω to 1000 Ω	0.010 + 0.020	0.001 + 0.002	Approx. 1mA	100 S/s

• Electronic Buzzer Tone
• Maximum Permissible Voltage: 800Vpeak (continual), 1100Vpeak (for 1 minute)

2-7. Diodes(▶)
2-7-1. Accuracy and Measurement Range

Unit: ± (% of reading + % of range)

Measurement Current	Measurement Range	Accuracy	Temperature Coefficient	Terminal Open-Circuit Voltage	Sampling Rate
Approx. 1mA	0.1mV to 1.1999V	0.010 + 0.020	0.001 + 0.002	<17V	100 S/s

• Maximum Permissible Voltage: 800Vpeak (continuous), 1100Vpeak (for 1 minute)

2-8. Temperature Measurement (TEMP, TC: Thermocouple)
2-8-1. Accuracy and Resolution

Unit: ± (% of reading + Digits)

Thermocouple	Measurement Range (ºC)	Accuracy	Resolution	Maximum Permissible Voltage
R	− 50 to 0	0.20+70	0.01℃	800Vpeak (continual) 1100Vpeak (for 1 minute)
	0 to 100	0.20+50		
	100 to 1765	0.20+30		
K(CA)	− 200 to − 100	0.15+50		
	− 100 to 0	0.15+35		
	0 to 1370	0.15+20		
T(CC)	− 200 to − 100	0.15+50		
	− 100 to 0	0.15+35		
	0 to 400	0.15+20		
J(IC)	− 200 to − 100	0.15+50		
	− 100 to 0	0.15+35		
	0 to 1200	0.15+20		
E(CRC)	− 200 to − 100	0.15+50		
	− 100 to 0	0.15+35		
	0 to 1000	0.15+20		

• The above reliability levels do not include thermocouple reliability.
• The cold junction temperature is input on the TEMP/SENSOR menu, and the margin of error for this is not included.
• ±0.1°C/°C (total thermocouple) is added to the guaranteed operating temperature between 0ºC to 18ºC, and between 28ºC to 50ºC.
• The standard thermoelectromotive force was acquired with piecewise linear approximation calculations in accordance with JIS C 1602-1995.

2-9. Temperature Measurements (TEMP, RTD: Measurement Temperature Resistance Detector)
2-9-1. Measurement Range, Accuracy and Resolution

RTD	Measurement Range (ºC)	Accuracy	Temperature Coefficient	Resolution
Pt100	− 200 to 850	0.06℃	0.003℃	0.01℃
JPt100	− 200 to 510			

• Pt100: Conforms to JIS C1604-1997 standards
• JPt100: Conforms to JIS C1604-1989 standards
• The 4 conductance cable equation does not include measurement cable (or probe) Accuracy.
• Maximum Permissible Voltage: 800Vpeak (continuous), 1100Vpeak (for 1 minute)

2-10. Frequency Measurement (FREQ)
Accuracy, Display Digit Count, Measurement Range

AC Coupling, Reciprocal System, Crest Factor < 5

Gate Time	Display Digit Count, Measurement Range	Accuracy (%) 3 to 5Hz	Accuracy (%) 5 to 10Hz	Accuracy (%) 10 to 40Hz	Accuracy (%) 40 to 300kHz
1 s	7 Digits: 3.000000kHz to 300.0000kHz	0.1	0.05	0.03	0.01
100ms	6 Digits: 3.00000kHz to 300.000kHz	0.1	0.05	0.03	0.01
10ms	5 Digits: 3.0000Hz to 300.00kHz	0.1	0.05	0.03	0.01
1ms	4 Digits: 3.000Hz to 300.0kHz	0.1	0.05	0.03	0.01

• Maximum Permissible Voltage: 750Vrms or 1100Vpeak, but the DC component is ±500V or less (continuous).
• It is possible to switch the input range between automatic and manual for a range between ACV 100mV and 750V.
• Input Range: 100mVrms to 750Vrms at between 3Hz and 100kHz
  * However, up to a maximum of 2.2x107 [V/HZ] between 100kHz and 300kHz
• Up to 100kHz is guaranteed for input of 200Vrms or more.
• Values that are less than 3Hz and more than 300kHz will be measured and displayed, but Accuracy is not guaranteed.

3. Trigger Functions

Trigger Mode	
AUTO	Automatic measurement in accordance with the sampling rate and interval
SINGLE	Measurement in accordance with TRIG input
Trigger Source	
Rear Panel TRIG Input	Possible to switch polarity and Valid/Invalid on the menu
HOLD/TRIG Key	Manual key input
REMOTE	Remote Commands
Trigger Sampling Count	Sets the number of data items to be measured continuously for each trigger
Setting Range	1 to 100,000
Trigger Delay	Sets the amount of delay from the TRIG input through to the measurement of the first item of data
Setting Range	0.00ms to 3,600 s
Resolution	10 μ s
Intervals	Sets the sampling measurement intervals * Validated when a larger value than the current sampling rate interval is set
Setting Range	0.00ms to 3,600 s
Resolution	10 μ s

4. Operation Functions

Can be set simultaneously, with the exception of combinations of scaling operations and decibel operations

4-1. Moving Average (SMOOTHING Operation)

Average Count	Can be set within a range of 2 to 100 (positive integers)
	* When the trigger is set as SINGLE, once the average count set has been reached, the trigger sample count set is acquired additionally.

4-2. Differential Operations (NULL Operation)

Operation Details	Operation result = RAW value - NULL value
RAW Value	Function measurement value at that point
NULL Value	Acquired through the following NULL value setting
Setting Details	
Operation ON/OFF	ON/OFF set with the [NULL] key or with the NULL menu available for each function
	* The measurement value set at that point for each function will be set as the NULL value when the [NULL] key is set at ON
NULL Value Setting	When setting the parameter from the NULL menus available for each function, it is possible to set in the three different types from DEFAULT value, Measurement Value and Value Input
	The Value Input parameter is set with the seven valid digits attached to the eight multipliers (p, n, μ, m, k, M, G, T)

4-3. Scaling Operations (SCALING Operations)

* Cannot be set at the same time at the decibel operation (dB operation) explained in section 4-4.

Operation Equation	Can be selected from the following two types. •Display Value = (Measurement Value - A) * B/C •Display Value = D/Measurement Value
Constant	The four constants A, B, C and D are set
	The Value Input parameter is set with the seven valid digits attached to the eight multipliers (p, n, μ, m, k, M, G, T)

4-4. Decibel Operations (dB Operations)

* Cannot be set at the same time at the scaling operation (SCALING operation) explained in section 4-3.

Operation	Can be selected from dBV and dBm
d Bm	Operation Result = $10 \cdot \log_{10}$ {(measurement value^2/ standard resistance)/ (1.0×10^{-3})}
Standard Resistance Value	Unit: Ω Selected from 4, 8, 16, 32, 50, 75, 93, 110, 124, 125, 135, 150, 200, 250, 300, 500, 600, 800, 900, 1000, 1200 and 8000
d BV	Operation Result = $20 \cdot \log_{10}$(measurement |value|/ standard voltage)
Standard voltage Value	Units V: Selected from 1 μ V, 1mV and 1V
REL Operation	Either one of the above-mentioned decibel operations can be set. Displays the difference acquired through subtracting the standard dB value from the dB operation result.
Standard dB Value	It is possible to set the three different types from DEFAULT value, Measurement Value and Value Input Range of value input: ± 500.0000 (seven valid digits)
Response Functions	Only available at the DCV and ACV functions are valid

4-5. Statistic Operations (STATISTIC Operation)

Operations	Operations performed are maximum value (MAX), minimum value (MIN), average value (AVE) and standard deviation (σ)
ON/OFF	Set on the menu
Display	Can be displayed on the secondary display The average value cursor and σ cursor are displayed on the histogram chart

4-6. Limit Operations (LIMIT Operation)

Judgment	
ON/OFF	Both the upper limit and lower limit can be switched ON/OFF independently
LIMIT Value	Both the upper limit and lower limit values are set with the seven valid digits attached to the eight multipliers (p, n, μ, m, k, M, G, T)
HIGH	Measurement value > Upper Limit value, otherwise "GO"
LOW	Measurement value < Lower Limit value, otherwise "GO"
GO	Measurement value within Upper Limit and Lower Limit, otherwise "LOW" or "HIGH"
Display	
Trend Chart	The threshold line is displayed on the chart
Histogram Chart	The HIGH/LOW marks and the threshold line are displayed on the chart
LIMIT Judgment	HIGH/GO/LOW are displayed on the secondary display and at the top of the screen
	HIGH/GO/LOW are displayed on the primary display

5. Logging Function
Logging Mode: Can be switched between NORMAL and BULK

Data Size	NORMAL mode: Fixed at 100k Readings BULK mode: 1k, 2k, 5k, 10k, 20k ,50k and 100k Readings
Stored Data	The following contents are stored. •Measurement data •Date and time of logging •Names of each function •Configuration information on each function * Displays the operation names when the NULL, dB and SCALING operations in the ON status
Export Function	Enables data to be saved on USB memories
File Format	Text file
Data Saved	Function measurement data
Logging Times	Can be set to ON/OFF. * Date and time are stored when set at ON
Format	YYYY/MM/DD HH:MM:SS, xxxxxx *"xxxxxx" represent μsec
Attribute Information	Can be set to ON/OFF * Saves the name of the operation that is in the ON status out of the NULL, dB and SCALING operations
NORMAL Mode	A mode to store measurement data in the memory while monitoring it in the real-time. The sampling rate is not guaranteed
BULK Mode	A mode that cannot be used for monitoring measurement data in the real-time, but for which the sampling rate is guaranteed. SINGLE mode operations are not possible.
Log Start	Started with the START LOG menu key
Log Stop	Can be stopped in two different ways When the acquisition of post trigger count data has been completed after the STOP EVENT Stopped with the STOP LOG menu key
STOP EVENT	The following four ways Can be selected NONE : No setting (instantaneously stopped with the STOP LOG menu key) EXT TRIG : External TRIG input LEVEL : When the measurement value exceeds the threshold LIMIT : The four GO/NO GO (HIGH or LOW)/HIGH/LOW settings can be selected from the LIMIT judgment result
LEVEL Setting Conditions	Polarity: Can be selected from Positive/Negative Threshold: Seven valid digits attached to the eight multiplies (p,n, μ ,m,K,M,G,T)
Post Trigger Count	0 to 100% (resolution 1%)

6. Value Display Function

Font	Can be selected from 7 segments and NORMAL (gothic)
Size	Can be selected from NORMAL and LARGE
Sub-measurement Result Display	It is possible to set the size of the numerical display when NORMAL has been set.
RAW	Displays the raw data prior to the operation when the NULL operation has been set at ON (Only for functions other than CONT and DIODE)
NULL	Displays the NULL value when the NULL operation is set at ON (only for functions other than CONT and DIODE)
ACV	ACV voltage display (only for FREQ measurements)
FREQ	Frequency display (only for ACV measurements)
CONT	Continuity OPEN/CLOSE display (only for CONT measurements)

7. Trend Chart Display Function
7-1. Online Trend Chart Function

Displayed Data Count	Maximum of 100k Readings
Horizontal Axis	401 dots (10div)
Vertical Axis	121 dots (12div)
Display Method	The data is displayed from the left-hand side at the beginning, and the compressed data is displayed in full when the waveforms reach the right-hand side of the screen. The roll mode will be displayed once 100k worth of compression has been displayed.
VERTICAL (Vertical Axis)	
MANUAL	It is possible to specify the range and the offset.
Range	1p/div to 500T/div
Offset	− 100,000div to 100,000div
Offset Setting Resolution	1div
AUTO	The maximum and minimum values of the data acquired and measured automatically are refreshed and displayed at the displayable scale.
FULLSCALE	Displays the maximum and minimum values of the measurement range at the displayable scale. It is not possible to select FULLSCALE under the following conditions. (becomes AUTO if FULLSCALE has been set) • In the case of the function measuring frequency (FREQ) • In the case of the SCALING operation (d/X) being set.

7-2. Offline Trend Chart Function
With the trend chart display selected with the offline browsing mode

VERTICAL (Vertical Axis)	It is possible to make the same settings as online display
HORIZONTAL (Horizontal Axis)	* RDGs/div (data displayed per 1div: 1, 2, 5, 10, 20, 50, 100, 200, 500, 1k, 2k, 5k, 10k) * RDGs/div: Readings/div
CENTER ADDR	Data count from 0 to the count in the log memory
SHOW ALL	Displays all data
T1 and T2 Cursor Function	
SEARCH MODE (Edge Search)	A function to jump to the nearest item of data that matches up with the following conditions when the rotary knob is turned in either direction
	LIMITGO — GO LIMIT judgment
	LIMITNOGO — NOGO LIMIT judgment
	LIMITHIGH — HIGH LIMIT judgment
	LIMITLOW — LOW LIMIT judgment
	EDGEPOSITIVE — Data crossed to the edge level in a positive direction
	EDGENEGATIVE — Data crossed to the edge level in a negative direction
	EDGEBOTH — Data crossed to the edge level in a both directions

EDGE LEVEL	Can be set when EDGEPOSITIVE/EDGENEGATIVE/EDGEBOTH have been selected with the edge search function
Setting Range	Set with the seven valid digits attached to the eight multipliers (p, n, μ, m, k, M, G, T)

Secondary Display

Time Display	Time at the T1 and T2 cursor points
	Data count between the T1 and T2 cursors
	Time difference between the T1 and T2 cursors
Voltage Display	Measurement value at the T1 and T2 cursor points
	Maximum and minimum values of the measured data in the compressed display in the same column as the cursor point and screen

8. Histogram Chart Display Function
8-1. Online Histogram Function

Vertical Axis	The bin with the highest level of generation frequency is displayed as MAX 100 pix. The display unit can be selected in two types of COUNT and PERCENT.
Horizontal Axis	Three types available; MANUAL, AUTO and FULLSCALE.
BIN Count	Selected from below numbers 2,4,5,10,20,40,50,100,200,400

MANUAL	
Center Value	Set with the seven valid digits attached to the eight multipliers (p, n, μ, m, k, M, G, T)
Span	$\pm$ 100p to $\pm$ 500T (set with the 1-2-5 steps attached to the multiplier)
AUTO	The center value and span of the histogram are determined from the maximum and minimum values of the recorded data
FULLSCALE	The center value and span are determined in accordance with the fullscale of the measurement range Activated as the AUTO mode because it is not possible to determine the FULLSCALE maximum value and minimum value under the following conditions • When the function is FREQ or TEMP • When scaling (SCALING operation: d/X) has been set • When the decibel (dB) operation has been set

Statistics Cursor	The cursor is displayed at the average value x and standard deviation σ location (when the statistics operation is set at ON)	
	Standard Deviation σ	Can be selected from 1, 2 or 3
H1 and H2 Cursor Functions	Secondary Display	H1 and H2 cursor BIN measurement value range
		H1 and H2 cursor BIN count
		BIN count between the H1 and H2 cursors
		Count and percentage (%) between the H1 and H2 cursors

8-2. Offline Histogram Chart Display Function
With the histogram chart display selected with the offline browsing mode.
The methods for setting up the display mode, the BIN count, the vertical axis and the horizontal axis, and the cursor function are the same as with the online mode.

9. Meter Display Functions
9-1. Arc Scale Meter Display (can be selected on the primary display)

SCALE	It is possible to select AUTO, FULLSCALE, MANUAL and LOG
LOG	LOG MAX and LOG MIN are set within a range of x10 to x10^6
Other than LOG	Displays $\pm$ 3div of offset (the range and offset can be set voluntarily in the MANUAL mode) Range: 1.0p/div to 500.0T/div Offset: -100,000div to +100,000div

9-2. Analog Meter Display (can be selected on the secondary display)

Scale	It is possible to select AUTO, FULLSCALE, MANUAL and LOG
LOG	LOG MAX and LOG MIN are set within a range of x10 to x10^6
Other than LOG	Displays $\pm$ 3div of offset (the range and offset can be set voluntarily in the MANUAL mode) Range: 1.0p/div to 500.0T/div Offset: -100,000div to +100,000div

## 10. Save/Recall Settings on Setup Condition Parameters(SETUP)

POWER ON RECALL	The setup conditions when the power is switched on can be selected from the following three parameters.
LAST	Setup conditions in effect the last time the power was switched off
DEFAULT	Setup conditions preset in the factory prior to shipping
RECALL	Setup conditions recalled by specifying the number of the internal setup memory

SAVE/RECALL	
Save Destination	Internal or USB memory
Number of saves on the internal memory	Internal: 10

External Control	A function for performing the sequential RECALL of the internal setup memory with the use of external signals (the SC-361 LAN&RS-232 options are required)

Input Signals	
Level	H: +2.0Vmin, L: +0.8Vmax, maximum permissible voltage: $\pm$ 15V
Time Width	10ms or more
INC	Advances with the SETUP memory number and RECALL
DEC	Returns the SETUP memory number and RECALL
BEGIN	Returns the SETUP memory number to the default value and RECALL

Output Signals	
Level	H:+5.0 Vmin、L: -5.0 Vmax
BUSY	Displays whether it is possible or not to receive the input signal (receipt possible during the L level)

11. SYSTEM Settings

REMOTE	Can be selected from the following
Standard	USB2.0
OPTION	GPIB, or LAN & RS-232

Common Setup Parameters	
Delimiter	CR+LF、LF
Command	SCPI、IWATSU

GPIB IF Setup Parameters	
Address	0 to 30

LAN IF Setup Parameters	
Network Settings	DHCP (ON/OFF setting), IP address, gateway, sub-net mask

RS-232 IF Setup Parameters	
Parity	NONE, EVEN, ODD
Stop Bit	1bit, 2bit
Bit Rate	Selected from 300, 600, 1200, 2400, 4800, 9600, 19200 and 38400bps

BEEP Tone	It is possible to set the BEEP tones ON/OFF independently for key operations, errors and LIMIT judgment
COPY	Sets the operations for saving hard copies into the USB memory
Mode	Activated when the [COPY] key is pressed
Screen Hard Copy	Saves the screen hard copy
Value Data	Logs the measurement data, the date and the function in each line of the CSV file
Screen Data Format	Can be selected from the following 6 types PNG File: Color/Black&White BMP File: Color/Black&White TIFF File: Color/Black&White

Value Data Recording Format	
Date Information	ON/OFF
* Supplementary Information	ON/OFF * Use or non-use of the measurement function, and NULL, SCALING and dB operations

Miscellaneous	
DATE TIME	Set as MM/DD HH:MM
PLC	Display and setup of power frequency detection
AUTO	Automatically detected and setup when the power is switched on
MANUAL	Possible to manually switch between 50Hz/60Hz
Panel Lock	Sets key operations at ON/OFF when the keys are pressed
Calibration	Calibration to be carried out by the user.

12. External Appearance
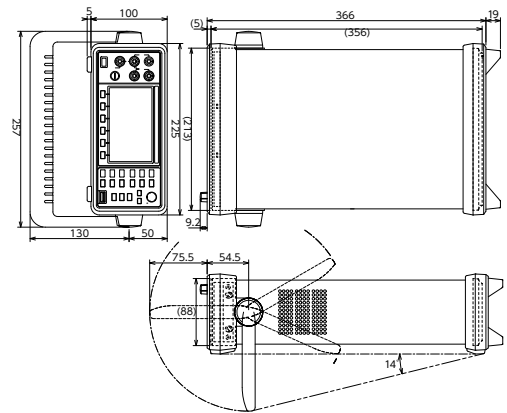
Optional Accessories

SC-363
GPIB Interface

* Factory option
* Cannot be mounted at the same time as the SC-361 (LAN&RS-232 Interface).

SC-362
DIO Interface

* Factory option

SC-361
LAN&RS-232 Interface

* Factory option
* Cannot be mounted at the same time as the SC-363 (GPIB Interface).

Digital Multimeter (portable type)
VOAC7500H Series

Isolate 2-channel input dual function
0.1µV, 509999, 5½ digits
VOAC7523H

Isolate 2-channel input dual function
1µV, 509999, 5½ digits
VOAC7520H

4-terminal resistance measurement
dual function 0.1µV, 509999, 5½ digits
VOAC7522H

4-terminal resistance measurement
dual function 1µV, 509999, 5½ digits
VOAC7521H

Digital Multimeters VOAC7523H/7522H/7520H/7521H Specifications

* Accuracy (±X% of reading +Y digits) indicated by X+Y
  The measuring accuracy indicated below can be obtained for a year following the calibration of the instrument.

1. Typical Sample Rate and Resolution

Sample Rate	Resolution	Reading Rate	Hum Rejection
SLOW	5.5-digit	approx. 4 times/sec	Yes
MID	5.5-digit	approx. 20 times/sec	Yes
FAST	4.5-digit	approx. 100 times/sec	N/A

2. DC Volt (DCV) 50mV range is for the VOAC7523H / 7522H only.

Range	Resolution		Input Resistance	Accuracy*	
	5.5-digit	4.5-digit		SLOW/MID	FAST
50mV	0.1µV	1µV	100MΩ or more	0.025+10	0.025+15
500mV	1µV	10µV	1000MΩ or more	0.012+5	0.012+10
5V	10µV	100µV	0.012+2	0.012+7	
50V	100µV	1mV		0.016+5	0.016+10
500V	1mV	10mV	approx. 10MΩ	0.016+2	0.016+7
1000V	10mV	100mV			

The accuracy in the 50mV and 500mV ranges is specified after zero compensation through the REL operation.
Sample rate in the 50mV range
SLOW/MID: Approx. 0.5 times/sec, FAST: Approx. 50 times/sec
Max. input voltage: 50mV to 5V range ± 800V (continuous) 50V to 1000V range ± 1100V (continuous)

Resolution and noise rejection

Resolution	Sample Rate	NMRR	CMRR
5.5-digit	SLOW	55dB or more	120dB or more
5.5-digit	MID	55dB or more	120dB or more
4.5-digit	FAST	0dB	55dB or more

3. CH-B DC Volt (DCV) VOAC7523H / 7520H only

Range	Resolution	Input Resistance	Accuracy*	
	4.5-digit		SLOW/MID	FAST
5V	100µV	CH-B:H to CH-B:L 10MΩ ± 3%		0.025+30
50V	1mV	CH-B:H to CH-A:L 5MΩ ± 3%	0.025+2	0.025+8
300V	10mV	CH-B:L to CH-A:L 5MΩ ± 3%		0.025+5

Max. input voltage: ± 300V, between CH-A L and CH-B ± 300V

Resolution and noise rejection

Resolution	Sample Rate	NMRR	CMRR	Isolation between CH-A and CH-B
4.5-digit	SLOW/MID	55dB or more	120dB or more	56dB or more
4.5-digit	FAST	0dB	55dB or more	

4. AC Volt (ACV, DC+ACV) detection of True RMS
Up to 100kHz for VOAC7521H / 7520H

Range	Resolution	Measurement Range		Input Resistance
	5.5-digit	SLOW	MID/FAST	
500mV	1µV	15Hz to 300kHz	200Hz to 300kHz	less than approx. 1MΩ // 100pF
5V	10µV			
50V	100µV			
500V	1mV	45Hz to 100kHz	200Hz to 100kHz	
750V	10mV	45Hz to 20kHz	200Hz to 20kHz	

Accuracy: SLOW Sample (Sine wave Amplitude at 5% to 100% of fullscale of range)

Frequency	Accuracy*
15Hz to 45Hz	0.5+150
45Hz to 100Hz	0.25+150
100Hz to 30kHz	0.2+150
30kHz to 100kHz	0.5+300
100kHz to 300kHz	2.5+1000

Coefficient to input other than sine wave

Crest Factor	Crest Factor		
	1 to 1.5	1.5 to 2	2 to 3
15Hz to 30kHz	0.05%	0.15%	0.30%
30kHz to 300kHz	0.20%	-	-

Resnponse time

Sample Rate	Resolution	Reading Rate	Response Time
SLOW	5.5-digit	4 times/sec	less than 3 sec
MID/FAST	5.5-digit	20 times/sec	less than 2 sec

Max. input voltage: 780Vrms, ± 1100V DC (continuous)
In the case of DC+ACV, 500 (less than 45Hz) or 300 (45Hz or higher) must be added to the value of Accuracy digit in above.
Sample rate of FAST becomes the same values as MID (approx. 20 times/sec).

5. DC Current (DCA)

Range	Resolution		Accuracy*		Input Resistance
	5.5-digit	4.5-digit	SLOW/MID	FAST	
5mA	10nA	100nA	0.05+7	0.05+17	150Ω or less
50mA	100nA	1µA			15W or less
500mA	1µA	10µA			2W or less
10A	100µA	1mA	0.2+7	0.2+17	0.1Ω or less

Auto range is not available between 5mA to 500mA range and 10A range because of using different input terminals.
Max. input current: 500mA at 5mA to 500mA ranges (FUSE 0.5A/250V)
　　　　　　　　　10A at 10A range (FUSE 15A/250V)

6. AC Current (ACA, DC+ACA)

Range	Resolution	Measurement Range		Input Resistance
	5.5-digit	SLOW/MID	FAST	
5mA	10nA	15Hz to 5kHz	200Hz to 5kHz	150Ω or less
50mA	100nA			15W or less
500mA	1µA	45Hz to 5kHz		2W or less
10A	100µA			0.1W or less

Accuracy: SLOW Sample (Sine wave) amplitude at 5% to 100% of fullscale (10% to 100% for10A range)

Frequency	Accuracy*	Crest Factor		
		1 to 1.5	1.5 to 2	2 to 3
15Hz to 45Hz	1+200	0.05%	0.15%	0.30%
45Hz to 1kHz	0.4+200			
1kHz to 5kHz	5.0+200			

Response time

Sample Rate	Resolution	Reading Range	Response time
SLOW	5.5-digit	4 times/sec	less than 3 sec
MID/FAST	5.5-digit	20 times/sec	less than 2 sec

Max. input current: 500mA for 5mA to 500mA ranges (FUSE 0.5A)
10A for 10A range (FUSE 15A)
DC Component on input current must be included in the Max. input current.
In the case of 10A range at 45Hz to 1kHz, 0.3 must be added to %.
In the case of DC+ACA, 500 (less than 45Hz) or 300 (45Hz or higher) must be added to the value of Accuracy in above.
Sample rate of FAST becomes the same value as MID (approx. 20 times/sec).

7. Resistance (2 Wire Ω /4 Wire Ω) 4 Wire Ω : VOAC7522H / 7521H only

Range	Resolution		Accuracy*		Test Current
	SLOW/MID	FAST	SLOW/MID	FAST	
50Ω	0.1mΩ	1mΩ	0.025+10	0.025+15	approx. 10mA
500Ω	1mΩ	10mΩ			approx. 10mA
5kΩ	10mΩ	0.1Ω	0.014+3	0.014+8	approx. 1mA
50kΩ	0.1Ω	1Ω			approx. 100µA
500kΩ	1Ω	10Ω	0.015+3	0.015+33	approx. 10µA
5MΩ	10Ω	10Ω	0.033+30	0.033+30	approx. 1µA
50MΩ	100Ω	100Ω	0.25+30	0.25+30	approx. 100nA
500MΩ	1kΩ	1kΩ	1.5+50	1.5+50	approx. 10nA

Max. input voltage: ± 500V peak Open circuit test voltage: 12V or less
The accuracy at 50Ω to 5kΩ range are specified after zero compensation through the REL operation.
Sample rate of FAST at 5MΩ to 500MΩ range becomes the same value as MID (approx. 20 times/sec.).

8. Low-Power Resistance (2 Wire Ω)

Range	Resolution	Accuracy*		Test Current
	SLOW/MID/FAST	SLOW/MID	FAST	
500Ω	10mΩ	0.1+5	0.1+15	approx. 1mA
5kΩ	0.1Ω			approx. 100µA
50kΩ	1Ω			approx. 10µA
500kΩ	10Ω	0.2+30	0.2+40	approx. 1µA
5MΩ	100Ω		0.2+30	approx. 100nA
50MΩ	1kΩ	1.5+30	1.5+30	approx. 10nA

Max. input voltage: ± 500V peak　　Open circuit test voltage: 12V or less
The accuracy at 500Ω to 5kΩ range are specified after zero compensation through the REL operation.
Sample rate of FAST at 5MΩ to 500MΩ range becomes the same value as MID (approx. 20 times/sec.).
Indications are in 4.5 digits for SLOW, MID, and FAST.

9. Diode

Test Current	Measurement Range	Accuracy*	Open Circuit Test Voltave	Max. Input Voltave
approx. 1mA or 10mA	0.1mV to 5.0999V	0.014+13	12V or less	± 500V peak

10. Temperature

Thermocouple	Temperature Range to be Measured	Accuracy*	Resolution	Max. Input Voltave
R	-50˚C to 0˚C	0.2+70		
	0˚C to +100˚C	0.2+50		
	+100˚C to +1768˚C	0.2+30		
K(CA)	-200˚C to -100˚C	0.15+50		
	-100˚C to 0˚C	0.15+35		
	0˚C to +1372˚C	0.15+20		
T(CC)	-200˚C to -100˚C	0.15+50	0.1˚C	± 500V peak
	-100˚C to 0˚C	0.15+35		
	0˚C to +400˚C	0.15+20		
J(IC)	-200˚C to -100˚C	0.15+50		
	-100˚C to 0˚C	0.15+35		
	0˚C to +1200˚C	0.15+20		
E(CRC)	-200˚C to -100˚C	0.15+50		
	-100˚C to 0˚C	0.15+35		
	0˚C to +1000˚C	0.15+20		

11. Frequency (AC couple, Crest Factor: less than 3)

Sample Rate	Reading Rate(Gate time)	Display Digits and Measurement Range		Accuracy*
SLOW	approx. 0.5 times/sec (1s)	6-digit	15.0000Hz to 1.00000MHz	
MID	approx. 4 times/sec (100ms)	5-digit	15.000Hz to 1.0000MHz	0.02+2
FAST	approx. 10 times/sec (10ms)	4-digit	150.00Hz to 1.000MHz	

12. Chart for combination of Dual Function

	DCV	CH-B DCV (*1)	ACV	DC+ACV	DCA	ACA	DC+ACA	2 WireW	4 WireW(*2)	Hz	˚C
DCV	X	○	△	△	△	△	△	X	X	△	△
CH-BDCV (*1)	○	X	○	○	○	○	○	○	-	△	△
ACV	△	○	X	○	○	△	△	X	X	○	X
DC+ACV	△	○	○	X	○	△	△	X	X	○	X
DCA	△	○	○	○	X	△	△	△	△	○	X
ACA	△	○	△	△	△	X	○	△	△	△	X
DC+ACA	△	○	△	△	△	○	X	△	△	○	X
2 WireW	X	○	X	X	△	△	△	X	△	X	X
4 WireW(*2)	X	-	X	X	△	△	△	△	X	X	X
Hz	△	○	○	○	○	△	○	X	X	X	X
˚C	△	○	X	X	X	X	X	X	X	X	X

○: Available　△: have a limitation　✕: N/A　- : not provided
(*1) CH-B DCV: VOAC7523H / 7520H only (*2) 4 WireΩ: VOAC7522H / 7521H only

13. General

MATH		Moving Average, Scale, Decibel (dBm, dBμ), Difference, Statistics (MAX, MIN, X, s), Comparison (COMP), Arithmetic Calculation between Dual Function
Memory	DATA	Max. 3000 data with 10 msec resolution time mark (Elapsed time)
	SET UP	10
Interfaces (Full Remote)	Standard	RS-232
	Option	LAN, GPIB
Power Supply	Voltage	AC100V, 110V, 220V, 240V
	Frequency	50Hz, 60Hz
	Power Consumption	21 VA (includes options) or less

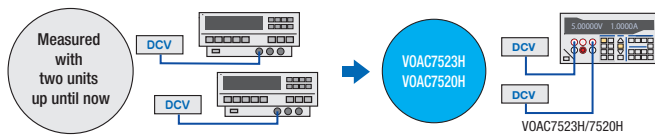| Operation Temperature and Humidity		0°C to +50°C (less than 80%RH) no condensation, 70%RH or less at +40°C to +50°C
Storage Temperature and Humidity		-20°C to +60°C (70%RH or less) no condensation, includes operation temperature
Size	Dimensions (mm)	210(W) x 99(H) x 353(D) (Options are built into the main unit)
	Weight	3.5kg (includes options) or less
Standard Accessories		Fuse, Test Leads, Alignment Screwdriver, Operation Manual(CD-ROM), Power cable

Isolate 2-channel input
(VOAC7523H/7520H)
• If the CH-A and CH-B input is from an insulated VOAC7523H or 7520H, the electrical potential for different circuits can be measured simultaneously.
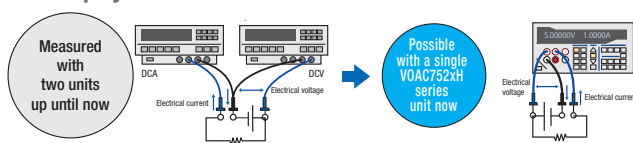
5.00000V 3.0000V

CH-A   CH-B
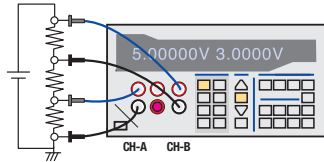
Dual Channels
• Measurements that conventionally require two oscilloscopes can now be performed simultaneously with a single unit to greatly improve efficiency.
A connection example is shown below. Simultaneous display and simultaneous measurements are being performed here

Measured with two units up until now
DCV
DCV

VOAC7523H VOAC7520H

5.00000V 1.0000A
DCV
DCV

VOAC7523H/7520H

Dual Display / Dual Function

Measured with two units up until now
DCA   DCV
Electrical current   Electrical voltage

Possible with a single VOAC752xH series unit now

5.00000V 1.0000A
Electrical voltage   Electrical current

Accurate Root-Mean-Square (RMS)
• Accurate root-mean-square values for AC voltage and AC current can be measured. Root-mean-square values for direct current can also be measured (DC+AC) V, (DC+AC) A

Abundant Interfaces
• **LAN Interface: SC-351**
10BASE-T (cannot be connected at the same time as the GPIB)
• **GPIB Interface: SC-353**
To create a familiar system
• **DIO Interface: SC-352**
Useful for judging acceptable and non-acceptable waveforms. Open collector output.
• **D/A Output: SC-354**
Output can be selected from three patterns of 10V, 1V and 0.1V.
Cannot be connected at the same time as the DIO.
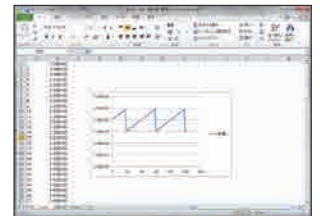See the following website for further details.
www.iti.iwatsu.co.jp/jp/products/voac/voac752xh_opt.html
• **RS USB Converter: SC-525**
USB can be used when connected with a RS-232 connector.

Trend Graphs Using the Interface
Data can be loaded into Excel and other spreadsheet software when connected to a PC with the interface. This enables trend graphs, etc., to be easily made.

Programming not required!
Download the software from the following.

Click here for the sample software
URL http://www.iti.iwatsu.co.jp/ → Support

Options

Product Name	Part Number	Image of Product
LAN interface [1]	SC-351	**SC-351 or SC-353**
DIO interface [2]	SC-352	
GPIB interface [1]	SC-353	
D/A Converter interface [2]	SC-354	**SC-352 or SC-354**
RS232-USB Converter (WindowsXP,Vista,7)	SC-525	
4-wire kelvin test leads	SC-028	
	SC-026	
High-voltage probe 30kVdc max. (can be used only in the Zin of 10MΩ range)	SC-003	
Clamp-on current probe DC ± 200A MAX AC150A rms MAX (40Hz to 500Hz)	SC-011	
Sheath-type thermocouple (Type K) -200°C to +800°C	SC-0107	
Surface thermocouple (Type K) 0°C to +500°C	SC-0116	

Product Name	Part Number	Image of Product
Banana plug (Can be used to connect a thermocouple)	POMONA1286	
High-resistance test lead	SC-004	
Test leads	SC-020	
Arrow clip For SC-020 (AC30V/DC60V/DC3A)	SC-021	
Alligator clip For SC-020 (AC30V/DC60V/DC10A)	SC-022	
Alligator clip H For SC-020 (600Vrms, CAT II/10A)	SC-023	

[1] The LAN interface SC-351 and GPIB interface SC-353 cannot be installed at the same time.
[2] The DIO interface SC-352 and D/A Converter interface SC-354 cannot be installed at the same time.

Digital Multimeter (Handy type)
1μV, 50000, 4½ digits
VOAC22

0.0022

CE

Universal Counter
SC-7200H Series

A new lineup of high-performance counters that transcend their class!

GPIB

3GHz x 1ch &
230MHz x 2ch
Universal Counter
SC-7207H

GPIB

2GHz x 1ch &
230MHz x 1ch
Universal Counter
SC-7206H

GPIB

[Option]

230MHz x 2ch
Universal Counter
SC-7205H

Useful functions based on the need for a maximum of 3GHz and easy use.

- Enables frequency measurements for two independent channels
  (SC-7207H, SC-7205H.)
- Pulse width measurements and time interval measurements greatly broaden the scope
  of single-gate measurement.
- Easy operations with single key strokes for each action.
- Easy-to-see fluorescent display area. Detailed information displayed with 5 x 7 dot
  resolution.
- * A full-spelling guide provides powerful support for operations.
- Auto-trigger function that eradicates the need for setting the trigger level. Manual
  setup is, of course, also possible.
- Making line inspection tasks more efficient is a simple chore with the comparison and
  statistic calculation functions.
- The scaling calculation function enables single unit conversion (revolutions, speed,
  etc.)
- Input signal peak voltage measurements make it easy to confirm the waveform
  amplitude.
- The save/recall function for panel setup makes predetermined inspection tasks more
  efficient.
- The GPIB (optional for the SC-7205H: SC-701) and RS-232 interfaces provide full remote
  control.

* Transmission is performed in the real-time at a high speed of a maximum 200 items of data/second, which
  contributes to improved line throughput.

- Full lineup of options to provide greater expandability
- Comparator output (open collector) with digital I/O (SC-702.) External trigger input.
* 150mA can be used for line monitoring equipment without modification to provide a
  margin of 50V.
- The high-stability standard oscilloscope (SC-703A) provides highly accurate
  measurements.

Specifications and Performance

Output Interfaces	RS-232: Fitted as standard. GPIB Fitted as standard (optional for the SC-7205H: SC-701) Digital I/O: Optional (SC-702)
Dimensions (mm) and Weight	Approximately 210(W) x 99(H) x 353(D) (excluding options and protrusions) 4.0kg or less (when mounted with the SC-701, 702 and 703 options)
High-stability Standard Oscillator (manufactured on request)	Two types of options available (only one type may be mounted) Temperature Characteristics: +/-0.05ppm, Oscillation Frequency: 10MHz

Universal Counter Option

GPIB Interface
SC-701

For use with the SC-7205H

- Mounting the SC-701 onto the SC-7207H, 7206H and 7205H Universal Counters (fitted as standard to the SC-7207H and 7206H) enables measurements taken with external GPIB controllers to be reset, the remote setup of measurement functions, time base functions and calculations, etc., and the results of measurements to be transmitted as data to external sources.

* This is a factory option and needs to be ordered at the same time as the main unit. Ordering factory installation at a later date will be chargeable.

Digital I/O
SC-702

For use with the SC-7207H, SC-7206H and SC-7205H

- Installing the SC-702 onto the SC-7207H, SC-7206H and SC-7205H Universal Counters will enable control over the start of measurement and the output of comparison calculation results. (open collector) Connecting an external lamp also allows parts to be selected and inspection results to be easily browsed.

* This is a factory option and needs to be ordered at the same time as the main unit. Ordering factory installation at a later date will be chargeable.
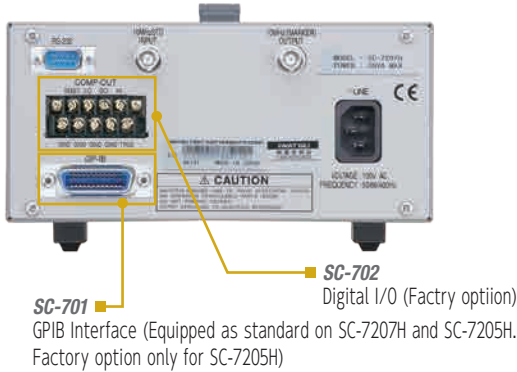

SC-702
Digital I/O (Factry optiion)

SC-701
GPIB Interface (Equipped as standard on SC-7207H and SC-7205H. Factory option only for SC-7205H)

Main Performance

Maximum Output Terminal Rating	Withstand voltage	DC50V
	Withstand current	DC150mA
	Frequency response	DC to 1kHz
Maximum Input Terminal Rating	Withstand voltage	DC5V
	Frequency response	DC to 1kHz

RS-USB Converter
SC-525

For use with the SC-7207H, SC-7206H and SC-7205H

- The cable for connecting the RS-232 measurement unit to a personal computer's USB port.
- Overall length approximately 85cm.
* Can also be used with the VOAC 7500H series, the SG-4115 and the SG-4105.

High-stability Standard Oscilloscope
SC-703A Custom Order

	New Crystal (SC-703A)
Oscillation Frequency	10MHz
Temperature Characteristics	+/-0.05ppm Range of 0 ˚C to 40 ˚C with +25 ˚C as the standard.
Rising Time	+/-0.05ppm 10 minutes for power switch-on with the frequency 1 hour after power switch-on as the standard
Time Fluctuations (per day)	+/-0.02ppm Value at 72 hours after power switch-on with 48 hours after power switch-on as the standard
Time Fluctuations (per year)	+/-0.02ppm Value at one year after power switch-on with 10 days after power switch-on as the standard

Universal Counters SC-7207H / SC-7206H / SC-7205H Specifications

Frequency A (FREQ-A)
•Measuring range and resolution   * SC-7206H is not equipped with EXT-B gate

		SC-7207H		SC-7206H, SC-7205H	
Reference time (reference frequency)		10ns (100MHz)		100ns (10MHz)	
Range	DC	6mHz to 230MHz		0.6mHz to 230MHz	
	AC	10Hz to 230MHz			
Resolution and count method	Frequency	Below 100MHz	100MHz or more	Below 10MHz	10MHz or more
	Count method	Reciprocal count	Direct count	Reciprocal count	Direct count
	1ms gate	5 digits	1kHz	4 digits	1kHz
	10ms gate	6 digits	100Hz	5 digits	100Hz
	0.1s gate	7 digits	10Hz	6 digits	10Hz
	1s gate	8 digits	1Hz	7 digits	1Hz
	10s gate	9 digits	0.1Hz	8 digits	0.1Hz
	EXT-B gate *	Reciprocal count method: The number of digits is determined by external gate time			
	SGL gate	Reciprocal count method: The number of digits is determined by measured signal			

AC Line Frequency (FREQ-LINE) (for SC-7207H and SC-7205H only)
•Measuring range and resolution

		SC-7207H	SC-7205H
Reference time		10ns	100ns
Range		45Hz to 440Hz	
Resolution	0.1s gate	7 digits	6 digits
	1s gate	8 digits	7 digits
	10s gate	9 digits	8 digits

Frequency C (FREQ-C) (for SC-7207H and SC-7206H only)
•Measuring range and resolution

		SC-7207H		SC-7206H	
Reference time(reference frequency)		10ns (100MHz)		100ns (10MHz)	
Range(for AC coupling only)		100MHz to 3GHz 1/16 prescaler		100MHz to 2GHz 1/16 prescaler	
Resolution and count method	Measured signal	Below 1.6GHz	1.6GHz or more	Below 160MHz	160MHz or more
	Count method	Reciprocal count	Direct count	Reciprocal count	Direct count
	1ms gate	5 digits	10kHz	4 digits	10kHz
	10ms gate	6 digits	1kHz	5 digits	1kHz
	0.1s gate	7 digits	100Hz	6 digits	100Hz
	1s gate	8 digits	10Hz	7 digits	10Hz
	10s gate	9 digits	1Hz	8 digits	1Hz
	EXT-B gate	Reciprocal count method: The number of digits is determined by external gate time		Not equipped with EXT-B	

Period A (PERI-A)
•Measuring range and resolution   *SC-7206H is not equipped with EXT-B gate

		SC-7207H	SC-7206H, SC-7205H
Reference time		10ns	100ns
Range	DC couple	5ns to 171s	5ns to 1,717s
	AC couple	5ns to 0.1s	
Resolution	1ms gate	5 digits	4 digits
	10ms gate	6 digits	5 digits
	0.1s gate	7 digits	6 digits
	1s gate	8 digits	7 digits
	10s gate	9 digits	8 digits
	EXT-B gate *	The number of digits is determined by external gate time	
	SGL gate	The number of digits is determined by measured signal	

Duty ratio A (DUTY-A)

		SC-7207H	SC-7206H, SC-7205H
		•Measuring range and resolution	
Input signal frequency range		Same as FREQ-A	
Measuring range	SGL gate	0.01µ to 99.999,999,99 [%]	
	Internal gate	0.2µ to 99.999,999,8 [%]	2µ to 99.999,998 [%]
Measuring resolution	Average count of internal gate	SGL gate	10ns/input period x 100 [%]	100ns/input period x 100 [%]
		1 to 24	10ns/average input period x 100 [%]	100ns/average input period x 100 [%]
		25 to 2,499	1ns/average input period x 100 [%]	10ns/average input period x 100 [%]
		2,500 to 249,999	100ps/average input period x 100 [%]	1ns/average input period x 100 [%]
		250,000 to 24,999,999	10ps/average input period x 100 [%]	100ps/average input period x 100 [%]
		25,000,000 or more	1ps/average input period x 100 [%]	10ps/average input period x 100 [%]

Pulse width A (P.W-A)
•Minimum pulse width: 6ns •Maximum repetitive frequency: 80MHz •Measuring range and resolution

		SC-7207H	SC-7206H, SC-7205H
Reference time		10ns	100ns
Measuring range	SGL gate	10ns to 171s	100ns to 1,717s
	Internal gate (1ms to 10s)	10ns to approx. 1/2 gate time	100ns to approx. 1/2 gate time
Measuring resolution	Average count of internal gate	SGL gate	10ns to 100ns	100ns to 1ms
		1 to 24	10ns	100ns
		25 to 2,499	1ns	10ns
		2,500 to 249,999	100ps	1ns
		250,000 to 24,999,999	10ps	100ps
		25,000,000 or more	1ps	10ps

Time interval A --> B (T.INT A --> B) (for SC-7207H and SC-7205H only)
•Minimum time interval: 6ns •Maximum repetitive frequency: 80MHz •Measuring range and resolution

		SC-7207H	SC-7205H
Reference time		10ns	100ns
Measuring range	SGL gate	10ns to 10,955s	100ns to 109,951s
	Internal gate (1ms to 10s)	10ns to approx. 1/2 gate time	100ns to approx. 1/2 gate time
Measuring resolution	Average count of internal gate	SGL gate	10ns to 10µs	100ns to 100µs
		1 to 24	10ns	100ns
		25 to 2,499	1ns	10ns
		2,500 to 249,999	100ps	1ns
		250,000 to 24,999,999	10ps	100ps
		25,000,000 or more	1ps	10ps

Frequency ratio A/B (FREQ A/B) (for SC-7207H and SC-7205H only)
•Measuring range and resolution

		SC-7207H	SC-7205H
Input signal frequency range		Both CH-A and CH-B are the same as that for FREQ-A	
Measuring range	Internal gate (1ms to 10s)	1E-9 to 1E+9	
Measuring resolution	Internal gate (1ms to 10s)	1+LOG (CH-A input frequency x gate time) digits	

Phase measuring A --> B (PHAS A --> B) (for SC-7207H and SC-7205H only)
•Minimum time interval: 6ns •Maximum repetitive frequency: 80MHz •Measuring range and resolution

			SC-7207H	SC-7205H
Reference time			10ns	100ns
Measuring range		SGL gate	0.1μ to 359.999,999,9 [°]	
		Internal gate	1μ to 359.999,999 [°]	10μ to 359.999,99 [°]
Measuring resolution	Average count of internal gate	SGL gate	0ns/input period x 360 [°]	100ns/input period x 360 [°]
		1 to 24	10ns/average input period x 360 [°]	100ns/average input period x 360 [°]
		25 to 2,499	1ns/average input period x 360 [°]	10ns/average input period x 360 [°]
		2,500 to 249,999	100ps/average input period x 360 [°]	1ns/average input period x 360 [°]
		250,000 to 24,999,999	10ps/average input period x 360 [°]	100ps/average input period x 360 [°]
		25,000,000 or more	1ps/average input period x 360 [°]	10ps/average input period x 360 [°]

Peak voltage measuring (SC-7206H is not equipped with CH-B)
Measures and displays in real-time the voltage amplitude of the measured signal at CH-A or CH-B.

Frequency range	150Hz ≤ input frequency ≤ 50MHz
Response time	2 seconds or less
Voltage range	±2.50V (ATT off, resolution: 10mV), ±50.0V (ATT on, resolution: 100mV)
Measuring error	ATT off: 10% of indication ±50mV ATT on: not specified

CH-A, CH-B input terminal (SC-7206H is not equipped with CH-B)

Input RC			Approx. 1MΩ//20pF or less
Coupling			AC or DC
Low pass filter			Off, 10kHz
Attenuator			Off, 26dB (1/20)
Trigger level	Measuring Range	ATT off	-2.50V to +2.50V (resolution: 10mV)
		ATT on	-50.0V to +50.0V (resolution: 100mV)
	accuracy (0˚C to +40˚C)	ATT off	10% ±30mV of the set value (±3% when +2V to -2 V)
		ATT on	10% ±300mV of the set value (±3% when +40V to -40 V)
Operating input voltage range		ATT off	±2.5V
		ATT on	±50V
Input sensitivity	Manual trigger	ATT off	30mVrms (DC to 230MHz)
		ATT on	0.6Vrms (DC to 230MHz)
	Auto trigger	ATT off	200mVrms (10kHz to 230MHz, sine wave)
		ATT on	4Vrms (10kHz to 230MHz, sine wave)

CH-C input terminal (for SC-7207H and SC-7206H only)

Maximum input power			+30dBm (approx. 7Vrms when 1mΩ/50Ω = 0dBm as a reference)	
Impedance			Approx. 50Ω	
Coupling			AC	
VSWR			2.0 or less (SC-7207H: 100MHz to 3GHz, SC-7206H: 100MHz to 2GHz)	
Input sensitivity			(Sine wave: up to 2 GHz for SC-7206H)	
AGC off/on		-20dBm	(100MHz ≤ input frequency ≤ 300MHz)	
		-25dBm	(300MHz < input frequency ≤ 1.5GHz)	
		-20dBm	(1.5GHz < input frequency ≤ 3.0GHz)	
Burst detection	Detection frequency range		SC-7207H	SC-7206H
			100MHz to 3GHz	100MHz to 2GHz
	Input sensitivity		(Sine wave: up to 2GHz for SC-7206H)	
	AGC off	-20dBm	(100MHz ≤ input frequency ≤ 1.2GHz)	
		-10dBm	(1.2GHz < input frequency ≤ 3.0GHz)	
	Detection delay time		500μs (Burst period ≥ set gate + 500μs)	

10MHz STD IN
BNC terminal for more stable input of the external reference frequency

Frequency	10MHz±50Hz (±5ppm)
Amplitude	1Vrms to 5Vrms, threshold = 0V
Input resistance	Approx. 6.4kΩ
Input coupling	AC

10MHz STD OUT/(MARKER OUT)
BNC terminal for output of internal reference oscillator or marker signal.
Marker signal is a signal that presupposes the brightness modulation (Z axis) of the analog oscilloscope for example. It is enabled at the SGL gate when the function is in between the time interval (T.INT A --> B) and phase (PHAS A --> B). Output is "Lo level" from the start of CH-A measuring to the start of CH-B measuring.

Output	CMOS level
Reference frequency output	10MHz: Stability is the same as that for the internal reference oscillator.
Marker output	In the 5MHz band, L-state is output during actual measuring. (for SC-7207H and SC-7205H only.)

Output interface	Environmental conditions
•RS-232 is equipped as standard •GPIB is equipped as standard (option SC-701 for SC-7205H) •Digital I/O option can be installed (SC-702)	•Warm-up time: 60 minutes or more •Operating temperature/humidity: 0˚C to +40˚C/85%R.H or less (no condensation) •Storage temperature/humidity: -20˚C to +60˚C/90%R.H or less (no condensation)

Reference oscillator
Equipped with SC-7207H, SC-7206H and SC-7205H as standard
Output is possible to the 10MHz OUT BNC terminal on the rear panel of the main unit.
•Oscillation frequency: 10MHz •Temperature characteristics: ± 2.5ppm/unit environmental temperature: 0˚C to +40˚C •Aging rate: ± 1.0ppm/year

Power supply conditions and power supply voltage changes (factory option)
•Voltage: AC100V / 110V to 120V / 220V to 240V •Frequency: 50Hz, 60Hz, 400Hz
•Power consumption: At AC100V with optional SC-701 and SC-702 are installed.

	SC-7207H	SC-7206H	SC-7205H
Power Consumption	36VA MAX	33VA MAX	31VA MAX

Dimensions (mm)	(210 ± 2)W x (99 ± 2)H x (353 ± 2)D (excluding options and protruded parts)
Weight	4.0kg or less (including optional SC-701 and SC-702)
Accessory	Power cable (1), operation manual CD-ROM (1)

Universal Counter

SC-7217
SC-7215

GPIB
[Option]

A Maximum of 3GHz, and the Digit Display Greatly Increased to Accommodate a Maximum of 12Digits/sec

- USB, LAN, RS-232 (option) and full remote control with GPIB (option)
- Comparate output with digital I/O
- Full lineup of options to provide greater expandability
  - Data stored on USB storage memories.
  - High-stability clock oscillator option.

SC-7217 / SC-7215 Specifications

			SC-7217	SC-7215
CH-A、CH-B	Input impedance		50Ω ±1.5% / 1MΩ± 1.5% //16pF ±3pF	
	Input withstand pressure	50Ω/ 1MΩ	7Vrms / 200Vpk	
	Frequency band	DC / AC	DC to 450MHz / 10Hz to 450MHz	
	Input voltage range	ATT OFF / ON	±2.5V / ±50V	
	Trigger level accuracy	ATT OFF / ON	±2%±25mV / ±2.5%±500mV	
	Slope switching		+/−	
	Band limitter		10kHz	
	Noise rejection		OFF/ON	
EXT-B	Input signal range	Pulse width / frequency	500ns min / 1MHz max	
CH-C	Input impedance / SWR / Maximum input electrical power		50Ω, AC coupling / 2.0 or less / +30dBm	–
	Frequency band		100MHz to 3GHz	–
	AGC		ON/OFF	–
	Burst detection		ON/OFF	–
		Detection sensitivity	Up until 1.2GHz: -20dBm, up until 3GHz: -10dBm	–
		Burst detection delay time	10μs	–
Measurement Functions	FREQ A、FREQ B		Max. 13-digit, 12-digit/sec (at 1second gate)	
		Measurement range	Single: 6mHz to 250MHz, time / EXT-B gate: 12mHz to 450MHz	
		Gate selection	Single / EXT-B / Time (set at 10μs to 10s 10^n) (n: integer)	
	FREQ C		Max. 13-digit, 12-digit/sec (at 1second gate)	–
		Measurement range	100MHz to 3GHz, 1/16 pre-scaler	–
		Gate selection	EXT-B / Time (set at 10μs to 10s 10^n) (n: integer)	–
	FREQ LINE	Measurement range / Gate selection	45Hz to 440Hz / 0.1s/1s/10s	
	PERIOD A	Measurement range	Single: 4ns to 166s	
			Time / EXT-B gate: 2.2ns to 83s	
		Gate selection	Single / EXT-B / Time (set at 10μs to 10s 10^n) (n: integer)	
	DUTY A	Input signal range	Pulse width / Frequency	6ns min / 80MHz max	
		Measurement range	Single / Time	0.01μ to 99.999,999,99% / 0.2μ to 99.999,999,8%	
		Gate selection		Single / Time (set at 10μs to 10s 10^n) (n: integer)	
	PULSE WIDTH A	Input signal range	Pulse width / Frequency	6ns min / 80MHz max	
		Measurement range	Single / Time	6ns to 171s / 6ns to approximately ½ gate time	
		Gate selection		Single / Time (set at 10μs to 10s 10^n) (n: integer)	
	TIME INTERVAL A→B	Input signal range	Pulse width / Frequency	6ns min / 80MHz max	
		Measurement range	Single / Time	6ns to 10,995s / 6ns to approximately ½ gate time	
		Gate selection		Single / Time (set at 10μs to 10s 10^n) (n: integer)	
	FREQ A/B	Input signal range, Frequency		250MHz max	
		Measurement range / Gate Selection		1 E-9 to 1 E+9 / Time (set at 10μs to 10s 10^n) (n: integer)	
	PHAS A→B	Input signal range	Pulse width / Frequency	6ns min / 80MHz max	
		Measurement range	Single / Time	0.1μ to 359.999,999,9˚/ 1μ to 359.999,999˚ (However, it is necessary or this to be less than half of the gate for non-measurable signal cycles)	
		Gate selection		Single / Time (set at 10μs to 10s 10^n) (n: integer)	
	TOT A	Input signal range	Pulse width / Frequency	2ns min / 250MHz max	
		Gate selection		MANUAL / EXT-B / Time (set at 10μs to 10s 10^n) (n: integer)	
		Measurement range		0 to 4,294,967,295 count	
	Peak voltage measurement	Measurement frequency / Measurement speed		150Hz to 150MHz / 2 seconds or less	
		Measurement voltage range	ATT OFF / ATT ON	±2.5V / ±50V	
Measurement operations			Repeat / Single / HOLD	
Calculation			Smoothing (moving average), scaling, compare, statistics (MAX, MIN, σ, average)	
Pulse setup			Internal memory (10) or USB memory	
DATA save memory			MAX. 500,000kinds (volatile memory)	
Internal standard clock	Temperature characteristics		+/- 1ppm (range of 0 to +40˚C with +25˚C as the standard)	
	Temporal change / Short-term stability		±0.1ppm/month、 ±1ppm/year / ±1ppb/s	
Interface	USB / LAN / DIO		USB2.0 HS / 100base-TX / Output: HI/LO/GO/BUSY	
10MHz STD IN	Input impedance / Input frequency / Input sensitivity		Approximately 850 Ωs (at 10MHz), AC coupling / 10MHz +/- 50Hz / 100mVrms	
Marker / STD output			STD / Marker selected and output with the setting	
	Output impedance / Marker output / STD output		50Ωs +/- 10% / +1Vo-p (0V output during measurement) / 10 MHz sine wave 1Vp-p or more (with 50Ωs at the terminal)	
Options (OP when shipped)	OCXO	Medium stability	Temperature characteristics	+/- 20ppb (range of 0 to +40˚C with +25˚C as the standard)	
			Temporal change	+/- 10ppb/day (fluctuations in one day's frequencies with the standard frequency being that measured after 48 hours. At +25˚C)	
				+/- 100ppb/year (fluctuations in one year's frequencies with the standard frequency being that measured 10 days after the power has been switched on. At +25˚C)	
		High stability	Temperature characteristics	+/- 5ppb (range of 0 to +40˚C with +25˚C as the standard)	
			Temporal change	+/- 0.5ppb/day (fluctuations in one day's frequencies with the standard frequency being that measured 30 days after the power has been switched on. At +25˚C)	
				+/- 50ppb/year (fluctuations in one year's frequencies with the standard frequency being that measured 30 days after the power has been switched on. At +25 ˚C)	
	Interface		GPIB (conforming to IEEE488-1 with full remote functions,) RS-232C, host for connecting the USB memory (for storage only)	
Electric power	Voltage / Frequency		AC 100V to AC 240V ±10% / 50 to 60Hz±5%(100V to 240V) / 400Hz±10%(100V to 120V)	
	Power consumption		70VA(35W) max	
External dimensions (mm)			(210±2)W ×(99±2)H×(353±2)D	
Accessories			Product users'guide x 1, instructions (CD) x 1, power cable x 1.	
Environment			0˚C to +40˚C with 80%RH or less and no condensation	

47

30MHz FUNCTION GENERATOR
SG-4300 Series

Various types of output waveforms

30MHz 2ch
SG-4322 CE

30MHz 1ch
SG-4321 CE

Various Oscillation Modes

•Sine •Square •Pulse •Ramp •Parameter-variable •Arbitrary

Standerd waveforms, Large capacity arbitrary,Standerd parameter variable waveforms(25 waveforms)

Versatile Functions

•Sweep •Modulation •Burst •Trigger •Gate •Sequence •Synchronus operation •Variable duty •Variable rise •Variablr fall

Equipped with program operation, parameter-variable waveforms etc,.
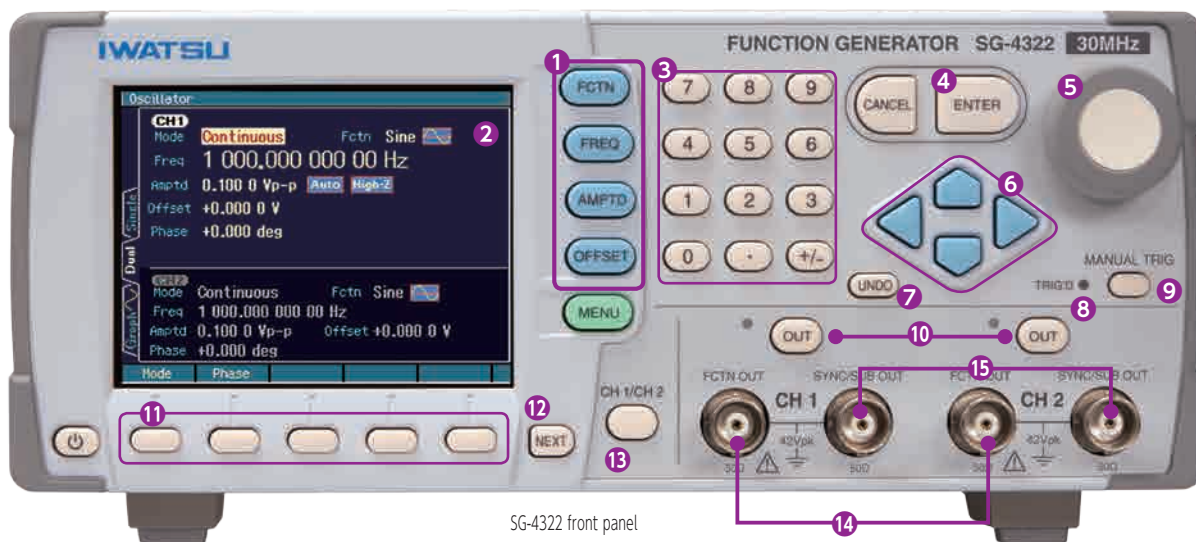
SG-4322 front panel

❶ Basic Parameters / Shortcut keys
❷ 3.5# QVGA TFT Color LCD display
❸ Ten-key for direct input
❹ Enter key : Execute each setting
❺ Function knob for selecting items and values
❻ Arrow keys
❼ UNDO key for undo
❽ Triggered indication light
❾ Manual Triggering key
❿ OUT : Output on/off key
⓫ Soft keys for setting selectable functions
⓬ NEXT key for selecting from multiple setting pages
⓭ CH1/CH2 key for switching CH1 or CH2

⓮ CH1 and CH2 signal outputs Isolated by each channel
 • Independent setting by each channel
 • Phase shift control between 2 channels
 • Synchronized output in different phase
 • Frequency variable between 2 channels
 • Different frequency output between 2 channels
 • Differential output

⓯ CH1 and CH2 synchronized signal outputs Reference phase synchronization
 • Synchronized signal with internal frequency modification
 • Burst synchronization signal
 • Sweep synchronization signal
 • Sequence step synchronization signal
 • Synchronized signal with internal modification signal
 • Sweep X driving signal for X axes of oscilloscope/recorder

⓰ CH1 Trigger input BNC
⓱ CH2 Trigger input BNC
⓲ CH1 Output modification/Adder input BNC
⓳ CH2 Output modification/Adder input BNC
⓴ Outer 10MHz reference frequency signal input BNC
㉑ Frequency reference signal output BNC
㉒ Multiple I/O connector for sweep, sequence control and synchronization code output
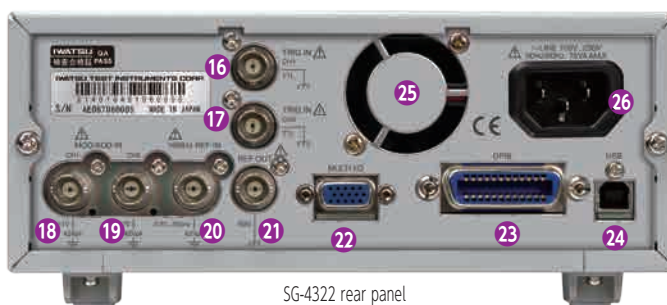
SG-4322 rear panel

㉓ GPIB interface connector
㉔ USB interface connector
㉕ Fan motor
㉖ AC inlet(AC90V to AC250V)

Sequence control function

Programmable each signal waveform pattern

Sequence oscillation is used to program combination of multiple pattern outputs such and Waveform type, frequency, amplitude, duty cycle and offset. It can be used together with parameter variable function at complicated and long timeframe waveform patterns for sudden frequency/sweep variable.
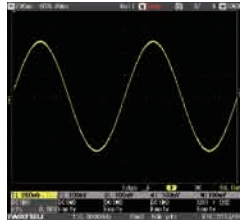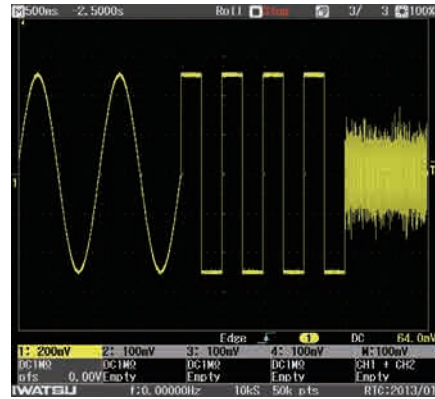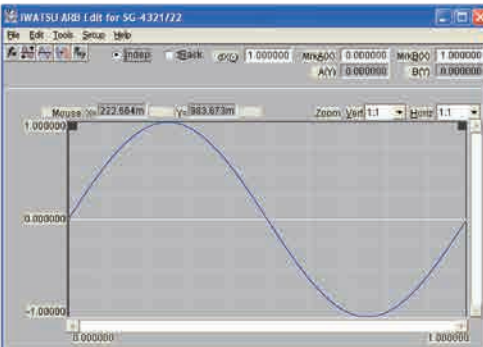

Waveforms 1
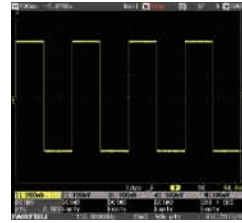
Waveforms 2
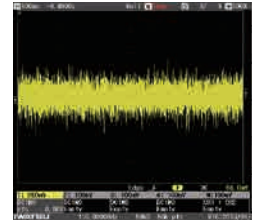
Waveforms 3


Waveform 1+2+3 at long memory

Arbitrary signal waveform with free-download software

4M-word waveform memory for 512k-word/waveform, max.

Maximum 512k-word/waveform outputs are available with arbitrary waveform generating software for example;
• Copy and paste of pre-set waveform shapes for complex signal waveforms.
• Waveform generation from waveform formula
• Expansion and compression of signal waveforms
• Computation between waveforms

Arbitrary waveform generating software ARB Edit
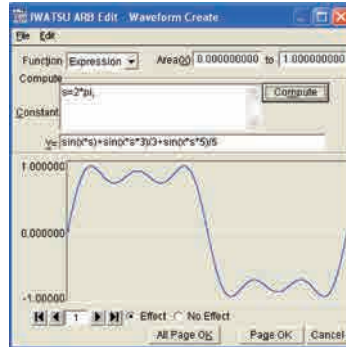
Waveform formula setting and waveform

Computation between waveforms

Specifications

		SG-4322	SG-4321
Product name		Function Generator	
Oscillation frequency		0.01 μHz to 30MHz	
Number of channels		2 ch	1 ch
Vertical resolution for waveform		14bit	
Waveform and frequency range	∿	0.01 μHz to 30MHz	
	⊓⊔ (duty fixed)	0.01 μHz to 15MHz	
	⊓⊔ (duty variable)	0.01 μHz to 15MHz	
	⊓	0.01 μHz to 15MHz	
	∿ (symmetry variable)	0.01 μHz to 5MHz	
	Parameter-variable waveforms (25 types)	0.01 μHz to 5MHz	
	Arbitrary waveform	0.01 μHz to 5MHz	
	Noise	Bandwidth 26MHz	
Frequency setting resolution		0.01 μHz	
Rising/falling variable		Pulse 15.0ns to 58.8Ms	
Arbitrary waveform data length/number of waves		512K words / 128 waves, 4Mwords	
Maximum output voltage/resolution		20 Vp-p/open, 10 Vp-p/50Ω , Resolution: 0.1 mVp-p or 1 mVp-p (depending on conditions)	
User-defined unit		○	○
Input/output floating		○	○
Isolation between channels		○	—

		SG-4322	SG-4321
Oscillation mode	Continuous oscillation	○	○
	Burst/trigger/gate/ triggered gate	○	○
	Sweep	Frequency, phase, amplitude, DC offset, duty ratio	
	Internal modulation External modulation	FM, FSK, PM, PSK, AM,DC offset and PWM	
	Sequence	○	○
	Two channel mode	○	—
Synchronous operation		○	○
External addition		○	○
Setting storage		○	○
GPIB interface		○	○
USB interface		○	○
Color LCD display		○	○
Arbitrary Waveform Editor		○	○
Sequence Editor		○	○
Power supply		AC90V to 250V	
Power consumption		75VA以下	50VA以下
External dimensions (mm) *2		216 (W) × 88 (H) × 332 (D)	
Weight		approx. 2.1 kg	approx. 2.1 kg
Application Software		Sequence Editing Software	
Option		SG-510 Multi Cable for input and output	

Function Generator
SG-4100 Series

GPIB

10mHz - 15MHz 1ch
SG-4105

10mHz - 5MHz 1ch
SG-4104

- Wide oscillation bandwidth from 10mHz to 15MHz (SG-4105)
- High accuracy (50ppm: SG-4105, SG-4104) and high stability waveform output by employing DDS (Direct Digital Synthesizer) system
- Max 20Vp-p (Output terminal open)
- 0.0% to 100.0% duty control/ Up to 65,536 Burst waveforms
- Offset control +10V to -10V (output terminal open)
- Waveform outputs are connected continuously when vary the frequency
- Linear / Log sweep function
- Simultaneous display of the frequency and output voltage
- Easy operation (set performance can be checked at a glance)
- PMC option (SG-506: SG-4105) best suited for evaluating pulse motor control
- Provides Small-amplitude on Large-offset

PMC function(Factory option)*
Pulse motor control function SG-506 (SG-4105)
Pulse motor control function
PMC option function controls pulse motor. Pulse motor acceleration or braking controls need to be reviewed not only by position control, but also under loaded condition. The PMC option simplifies the evaluation.
Pulse outputs in open collector (50V) are output from rear panel with PMC option.
Common motor driver circuit connected with PMC.

*PMC (Pulse Motor Control) is coined word by IWATSU TEST INSTRUMENT CORPORATION.
(Order any factory options when ordering the main unit. Additional orders after the delivery of the main unit require a separate fee.)
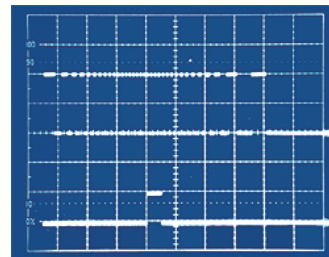
Upper waveform shows drive pulse for pulse motor, lower waveform shows sensor input waveform. After reaching maximum frequency while specified accelerating period, starts braking by sensor input signal. Then stops at specified pulse counts.

Boost Amp
SG-300

A useful drive amp that boosts signal generator output at 1MHz full power band.
The SG-300 is an amplifier for converting function generator output.
This amplifire can be used for a wide range of purposes, including the development of inverters and other mechatronic equipment.
The amplifire has a low impedance (Lo Ω) output, which enables it to be used with low power loss even driving low impedance loads.
It also supports amplitude modulation only at the positive side or only at the negative side, which enables zero level adjustment.

RS-USB Converter
SC-525

For use with the SG-4105
- The cable for connecting the RS-232 measurement unit to a personal computer's USB port.
- Overall length approximately 85cm.

* Can also be used with the VOAC 7500H series, SC-7200H series.

SG-300 Specifications

Maximum Voltage	24Vp-p (with 50 Ω load) / 48Vp-p (without load)
Maximum Current	DC or Peak 240mA (with 50 Ω load) / Continuous DC or Peak 300mA (with Lo Ω output)
Full Power Band width	1MHz (with a 50 Ω load and 24Vp-p output)

Delay Pattern Generator (6 channel pulse generator)

DG-8000

GPIB
CE

Seamless change
The frequency, pulse width, and other settings can be seamlessly changed during oscillation.

Tracking function
Parameters can be changed simultaneously for each channel.

Operation pattern control (DG-802)
The operation pattern option enables continuous operation testing.

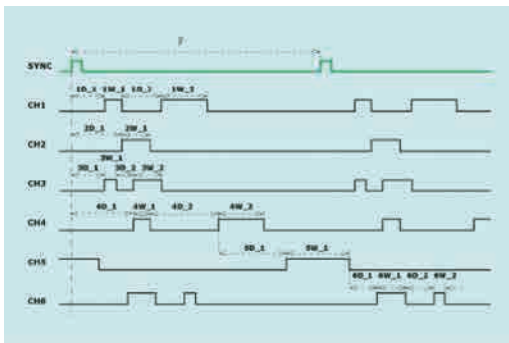## Synchronization of multiple generators (DG-602)
The quick synchronization option enables three generators (18 channels) to synchronously output data.

*input/output on the front

| TRIG IN | SYNC OUT | CH1 (U) | CH2 (V) | CH3 (W) | CH4 (X) | CH5 (Y) | CH6 (Z) |
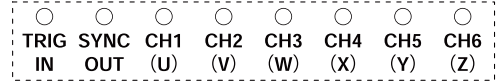
Rear panel configuration of a standard model

Setting parameters and output examples of 6 channel independent pulse output

BASIC mode
Pulses can be easily generated by specifying any dependency, delay value, and width value for each of 6CH. The output level can also be individually specified for each CH.
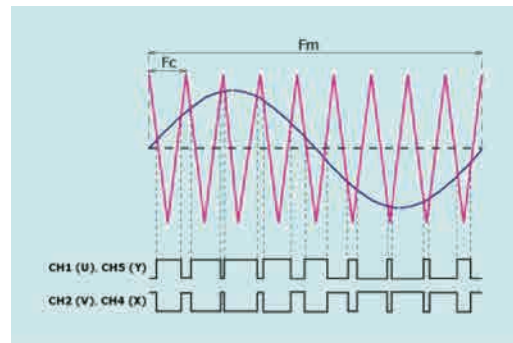

The pulse width is changed
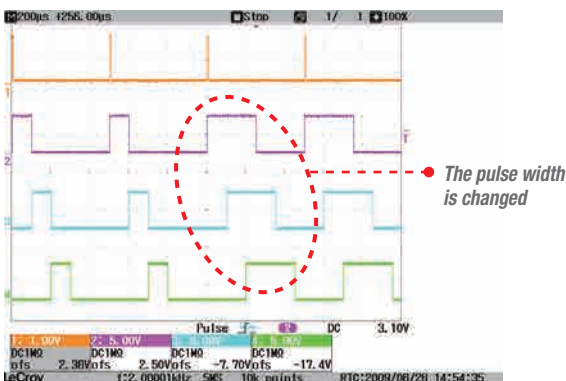
Tracking function
The pulse width, delay time, and other settings can be changed simultaneously for any combination of CH. Output example when the pulse width of channels 1 to 3 is changed simultaneously.
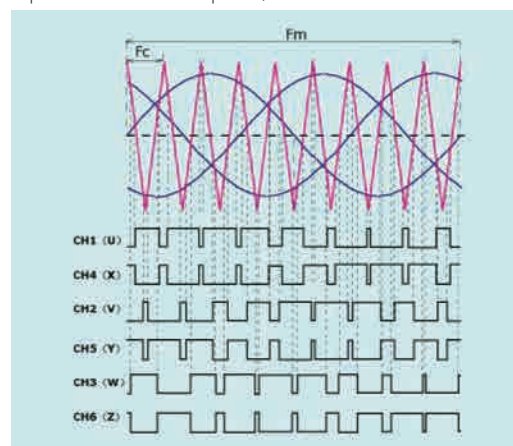
Signal generation method and output examples of the inverter option

Single-phase bipolar output in the INVERTER mode
Pulses can be easily generated by specifying the carrier frequency (Fc), modulation signal frequency (Fm), and modulation depth (that is, the rate of the modulation signal amplitude to the carrier amplitude).
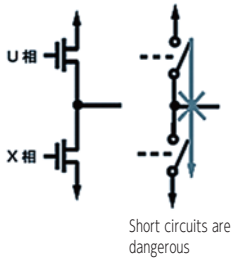

3-phase 2-level in the INVERTER mode
Pulses can be easily generated by specifying the carrier frequency (Fc), modulation signal frequency (Fm), and modulation period (that is, the rate of the modulation signal amplitude to the carrier amplitude).

Lineup

Items	Product name	Model number	Incorporated function
Main unit	Delay pattern generator	DG-8000	–
Software option	Inverter and PPG option	DG-801	INVERTER mode
			PPG mode
	Test adapter	DG-802	Operation pattern function
Hardware option	External modulation option	DG-601	External modulation function
	Quick synchronization option	DG-602	Quick synchronization function

Gap control to prevent the high and low side switches of devices from being turned on simultaneously

Short circuits are dangerous

If the phase U and X devices in the above illustration are turned on at the same time, they short-circuit, causing danger and damage.

The DG-8000 gap time control function automatically generates the specified dead time as shown in the illustration. Even if the frequency or cycle changes, the dead time remains constant. The gap time can be changed even during oscillation. It is also possible to turn devices on at the same time by specifying a negative value.

Independent control of the time axis and vertical axis

Changing the frequency

Changing the output level

The parameters related to the time axis and those related to the vertical axis are separately controlled. These parameters can be changed manually or by using remote commands.

Support of ORed output on channel 1

Channel 1 has an ORed output function, which logically adds up to 6 sets of double pulses, making twelve pulses of specified channels, and outputs the result.

Easy generation of PWM signals

The inverter and PPG option (DG-801) enables you to output control signals for the buck chopper, single-phase uni-polar, single-phase bi-polar, and 3-phase 2-level. The modulation frequency and modulation depth can be changed even during oscillation. This is convenient for testing inverters because it is possible to obtain output to which pulse width modulation created from the inner sine wave and triangle wave is applied.
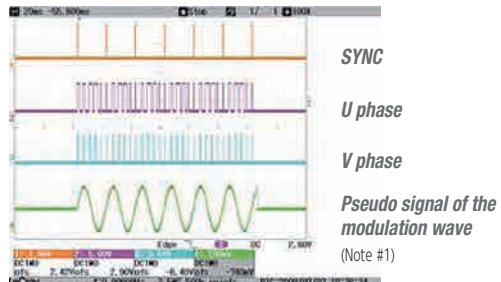
SYNC

U phase

V phase
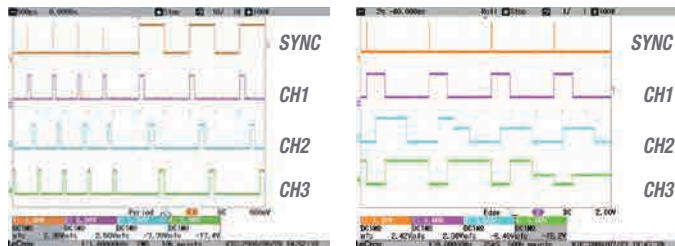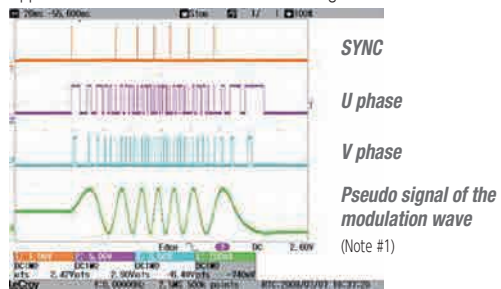
Pseudo signal of the modulation wave
(Note #1)

Note #1:
The modulation signal is shown only for explanatory purposes. This signal is not output from the DG-8000.

When using the PPG function, this generator functions as a signal generator for complicated logic modulation waves on 6 channels using predetermined pulse patterns. Waveform patterns can be created using the waveform creation application (which is available free of charge.)

Configuration example
DG-8000 main unit: 1
DG-801 inverter and PPG option: 1

Variable control of the PWM signal frequency

The operation pattern option (DG-802) is convenient for continuous operation testing because it enables variable control of the frequency and modulation depth (in the inverter mode only). The patterns for such control are controlled using predetermined arbitrary waveforms. These waveforms can be created using the waveform creation application (which is available free of charge.)

SYNC

U phase

V phase

Pseudo signal of the modulation wave
(Note #1)

The illustration on the left shows an example of when a trapezoid waveform signal is used to apply frequency modulation.

Note #1:
The modulation signal is shown only for explanatory purposes. This signal is not output from the DG-8000.

Configuration example
DG-8000 main unit: 1
DG-801 inverter and PPG option: 1
DG-802 operation pattern option: 1

In the inverter mode, faulty patterns during the gap time can be inserted intentionally at regular intervals by using the error insertion function.

Application example: Continuous operation test of solenoid and other elements that control electromagnetic valves

Conventional device configuration example

Device configuration example using the DG-8000
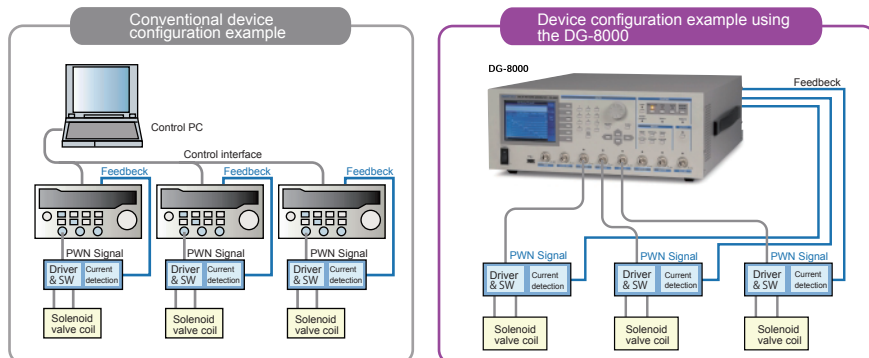
The external modulation option (DG-601) enables external control of the following functions:
- Modulation of the pulse width and delay in the basic mode
- Control of the modulation depth in the inverter mode
- Control of the frequency and modulation depth for operation patterns

Configuration example
DG-8000 main unit: 1
DG-802 operation pattern option: 1
DG-601 external modulation options

Parallel operation of three generators to support output from 18 channels

6 channels + 6 channels + 6 channels = 18 channels
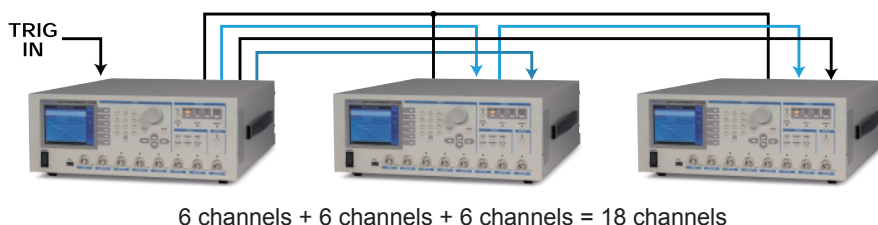
The quick synchronization option (DG-602) quickly enables up to 3 generators to synchronously operate by connecting BNC cables to the rear panel. If one of the generators goes down, the remaining two generators also shut down their output as a failsafe when this function is used.

Configuration example
DG-8000 main unit: 1
DG-602 quick synchronization options: 3

Delay Pattern Generator DG-8000 Specifications

Common specifications

Pulse output terminal

Number of channels	6CH
Output level	± 10V (open) / ± 5V (50 Ω)
Output range	2 ranges (large/small)
Output logic	Positive/negative
Output impedance	50 Ω
ORed output	Effective channels among channels 1 to 6 are ORed and the result is output (from channel 1)

Other output terminals

SYNC OUT output	BNC terminal (1)
IRREGULAR output	BNC terminal (1)
ALARM output	BNC terminal (1)
10 MHz REF output	BNC terminal (1)
REAR TRIG output	Quick synchronization operation option (DG-602), BNC terminal (1)

Input terminals

TRIG	BNC terminal (1), input: ± 5V,max., threshold: ± 1/2 of input level, variable
TRIG INH/RDY	BNC terminal (1), TTL level
Emergency stop input	BNC terminal (1), TTL level
10 MHz REF input	BNC terminal (1), 1V P-P ± 100ppm or less required
Frequency control input	For the external modulation option (DG-601) and operation pattern option (DG-802), BNC terminal (1)
External modulation (PWM)	For the external modulation option (DG-601), BNC terminal (3)
REAR TRIG input	For the quick synchronization operation option (DG-602), BNC terminal (1)
ALARM SENSE input	For the quick synchronization operation option (DG-602), BNC terminal (1)

Output control

Oscillation start/stop	The button to turn all channels on or off immediately
Individual setting	To turn all channels on or off immediately
When oscillation stops	Select relay OFF or set the output level to 0.

LED indicators

TRIG'd	Indicates when TRIG is applied.
OUTPUT, channels 1 to 6	Indicates when output is enabled and on.
REMOTE	Indicates up in the REMOTE status.
INHIBIT/READY	Indicates up when oscillation is READY.

Pulse generation

Oscillation mode	CONT, TRIG'd CONT, TRIG, GATE
Gap control	Supported. *Gap control is a function that ensures non-overlapping time when phases V and X, phases U and Y, and phases W and Z overlap each other by specifying a delay or pulse width. This function can be also used to intentionally make these phases overlapped.

Interface

TRIG'd	USB1.1 storage function only (Waveform file and Setup file)
Remote (LAN)	100BASE-TX, 10BASE-T
Remote (GPIB)	Supported as standard

Screen display

LCD	4.7-inch color LCD
Resolution	320 x 240 pixcels

Others

SETUP save/recall	Supported (10 internal memories)
Power-saving mode	Supported
Beep function	Supported
Status display	Supported

Power supply unit

AC power supply	AC 100V to AC 240V (50/60 Hz)
Power consumption	190VA,max

Mechanical section

External dimensions (mm)	Approx. 400 (W) x 150 (H) x 497 (D) (without external projections)
Weight	Approx. 8kg

Environment

Operating temperature	0°C to +40°C (without condensation)
Operating humidity	85% R.H. or less at +40°C
Storage temperature	-20°C to +60°C

Accessories

Power cable	1
Operation manual	CD-ROM (1)

The following modulations can be applied by using the DG-601 external modulation option when the main unit function is in the Basic mode:

PWM modulation
The pulse width can be changed by an external input signal. The modulation depth can be individually specified for each external input channel (U/V/W) and freely allocated to output channels.

Delay modulation
The delay value can be changed by an external input signal. The modulation depth can be individually specified for each external input channel (U/V/W) and freely allocated to output channels.

Other specifications

BASIC mode

Mode	Independent control of 6CH, 3-phase pattern A/B

6 independent channels

Number of pulses	SINGLE pulse/ DOUBLE pulse
Frequency/cycle	1mHz to 10MHz (1mHz or 9-digit resolution) 100ns to 1,000s (10ns or 9-digit resolution)
Frequency/cycle accuracy	± 50ppm
Standard channel	Select SYNC or both edges of the smallest channel
Delay	0ns, 10ns to 1,000s (10ns or 9-digit resolution)
Pulse width	0ns, 50ns to 1,000s (10ns or 9-digit resolution)
PHASE	0° to 360° (minimum resolution: 0.01°, frequency-dependent) 0% to 100% (minimum resolution: 0.001%, frequency-dependent)
DUTY	0° to 360° (minimum resolution: 0.01°, frequency-dependent) 0% to 100% (minimum resolution: 0.001%, frequency-dependent)
Gap time setting	0 to ± 1 cycle or 1s, max.
Gap resolution	Frequency specifying : Gap in 20 ns or 6 digits Cycle specifying : Gap in 10 ns or 6 digits
Frequency dividing function	Supported
Frequency dividing setting range	1 to 65,535
Tracking	Multiple parameters can be changed simultaneously.
Internal modulation	PWM modulation and delay modulation

3-phase pattern A

Oscillation mode	CONT, TRIG'd CONT, GATE
Cycle (Tc)	Determined by setting Tw1 and Tw2. Tc = (Tw1+Tw2) x 3
Tw1 and Tw2 setting range	0ns, 100ns to 100s
Tw3 setting range	0ns, 100ns or more (Fc minus- Tw1)
Pulse width setting resolution	100ns or 9digits
Gap control	By setting Tw3.
Operation change during oscillation	Parameters can be seamlessly changed.

3-phase pattern B

Oscillation mode	CONT, TRIG'd CONT, GATE
Cycle (Tc)	Determined by setting Tw and Tw3. Tc = Tw2+Tw3
Tw1 setting range	0ns, 100ns to 100s
Tw2 setting range	0ns, 100ns or up to more (Fc-2 x Tw1)
Tw3 setting range	100ns to 100s
Pulse width setting resolution	100ns or 9digits
Gap control	Realized by setting Tw2.
Operation change during oscillation	Parameters can be seamlessly changed.

Inverter mode (with the DG-801 inverter and PPG option mounted)

Mode	Buck chopper, single-phase uni-polar, single-phase bi-polar 3-phase 2-level

Common setting parameters

Carrier frequency	100mHz to 1MHz
Modulation frequency	1mHz to 10kHz
Other parameters	Modulation depth, modulation steps, gap time, and others

PPG mode (with the DG-801 inverter and PPG option mounted)

Frequency specifying mode

Frequency	1mHz to 10MHz (1mHz or 6-digit resolution)
Memory length	10kW or 100kW

Clock specifying mode

CK frequency	100Hz to 100MHz (resolution: 1mHz or 6digits)
Memory length	10kW or 100kW

Operation pattern (with the DG-802 operation pattern option mounted)

Frequency control	The frequency (cycle) can be controlled using any waveform or external input.
Frequency control input	BNC terminal (1)
Modulation control	INVERTER mode only. The modulation can be controlled using any waveform or external input.
Faulty pattern insertion	Supported

External modulation (with the DG-601 external modulation option mounted)

External modulation input	BNC terminal (3)
Frequency control input	BNC terminal (1)
Input range	2 ranges (-2 to +2V or 0 to +2V)
Input impedance	Approx. 1M Ω
Resolution	12 bits
Frequency characteristics	100kHz, amplitude of 90% or more (1kHz standard)

External modulation (with the DG-601 external modulation option mounted)

REAR TRIG output	BNC terminal (2)
REAR TRIG input	BNC terminal (1)
ALARM SENSE input	BNC terminal (1)

B-H Analyzer
SY-8210 Series

SY-8218 10Hz - 10MHz
SY-8219 10Hz - 1MHz

Best suited for measuring magnetic properties of soft magnetic materials such as Silicon-steel plates, ferrites, and amorphous materials
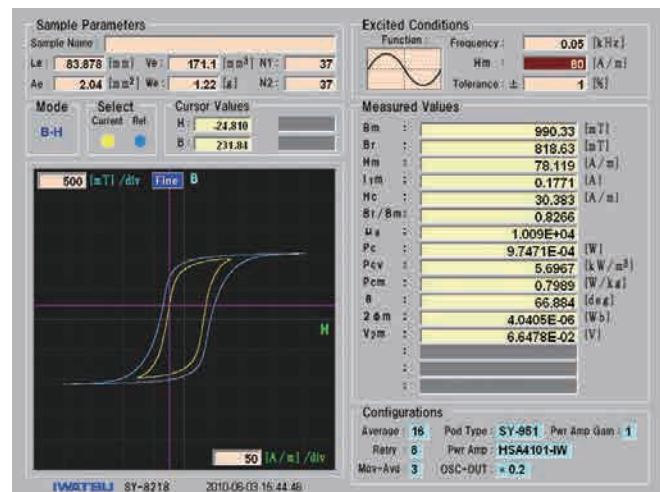

GPIB
[Option]

SY-8218

GPIB
[Option]

SY-8219

Main features

▌ Wide measurement frequency for materials analysis which used in high frequencies
SY-8218: SINE from 10Hz to 10MHz, Pulse at Duty 50:50 from 10Hz to 1MHz
SY-8219: SINE from 10Hz to 1MHz, Pulse at Duty 50:50 from 10Hz to 1MHz

▌ 16times of acquisition data(comparing with former Iwatsu models)
Acquisition data at 8,192points/cycle perform precise measurement on parameters such as Hc(Coersive force), Br(Residual flux density), and other parameters.

▌ Pulse excitation function
Both SINE(Sinusoidal) and Pulse(at Duty 50:50, 1MHz,max.) excitation are available as a standard function

▌ Temperature characteristic test with Scanner Chamber System

Optional Items
• Power Amplifiers •DC bias power supply* •Single sheet measurement tester •High-current POD*

*under development

SY-8200 Series Specifications

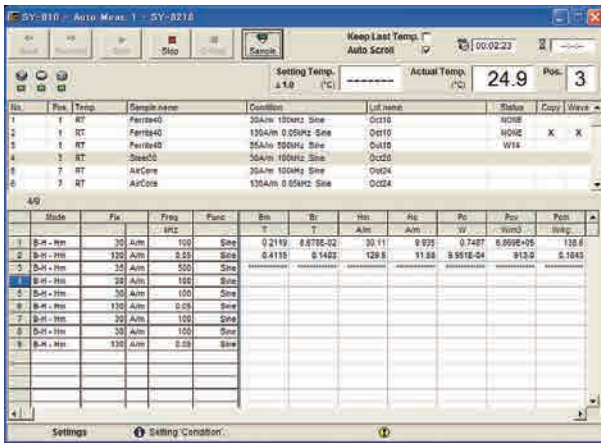| Model	SY-8218	SY-8219
Measurement method	CROSS-POWER method (conformance to IEC62044-3)	
Measurement mode	B-H measurement, Pc measurement, μ measurement	
Measurement item(Symbol)	Max. magnetic flux density (Bm), residual magnetic flux density (Br), max. magnetic field (Hm), coersive force (Hc), rectangular ratio (Br/Bm), relative amplitude permeability (μa), core loss (Pc, Pcv, Pcm), Current (I, m)/Voltage (V2m), phase (θ), total magnetic flux linkage (2Øm), apparent power (VA), impedance permeability (μz), complex permeability (μ, μ"), loss coefficient (tanδ), inductance (L), resistance (R), impedance (|Z|), quality factor (Q), Total harmonic distortion (THD)　　note)	
Waveform display	B-H curve, waveforms of excitation current, induced voltage, magnetic field, magnetic flux density	
Measurement frequency	10Hz to 10MHz	10Hz to 1MHz
Magnetic field signal detection	Voltage drop at both edges of non-inductive resistor Maximum signal detection current: 6A	
Magnetic flux density signal detection	Voltage detection at both edges of induced voltage detection coil Maximum signal detection voltage: ± 200 V	
Digitizer resolution	16 bits (8,192 points/cycle)	
Sample connection method	2 or 1 coil (winding) method	
Display	Color LCD display (800 x 600 pixels)	
Power supply	AC100V to 240 V, 50/60Hz, Power consumption: Approx. 130VA MAX	
Weight and dimensions (mm)	Main unit: Approx. 12.5kg, 420 (W) x 266 (H) x 480 (D) ± 2 (without the projection section)	
Interface	USB (data storage)	

note) See page 59 for detailed explanation of measurement items.
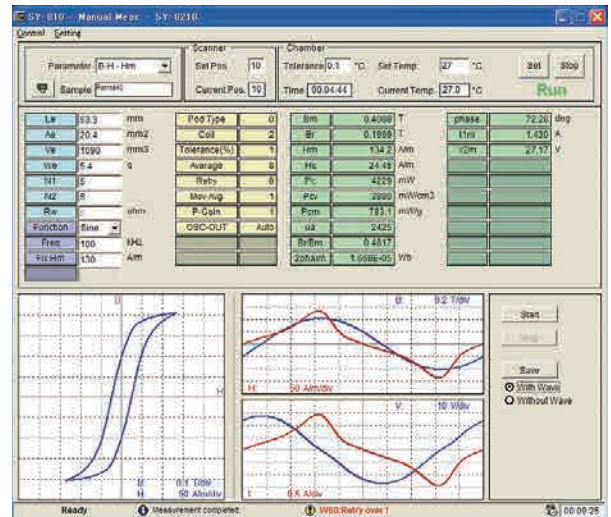
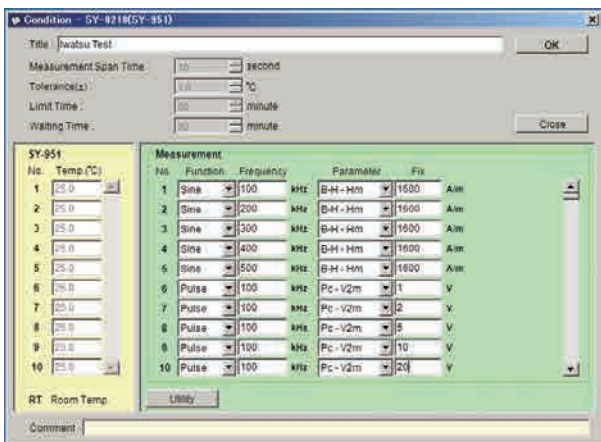## SY-810 Remote Control Software
SY-810

Main Functions
• Enables auto-program measurements for temperature characteristics in combination with constant-temperature scanner systems.
• Auto-program measurements also possible with just the B-H analyzer.

ex. Auto-program measurment display
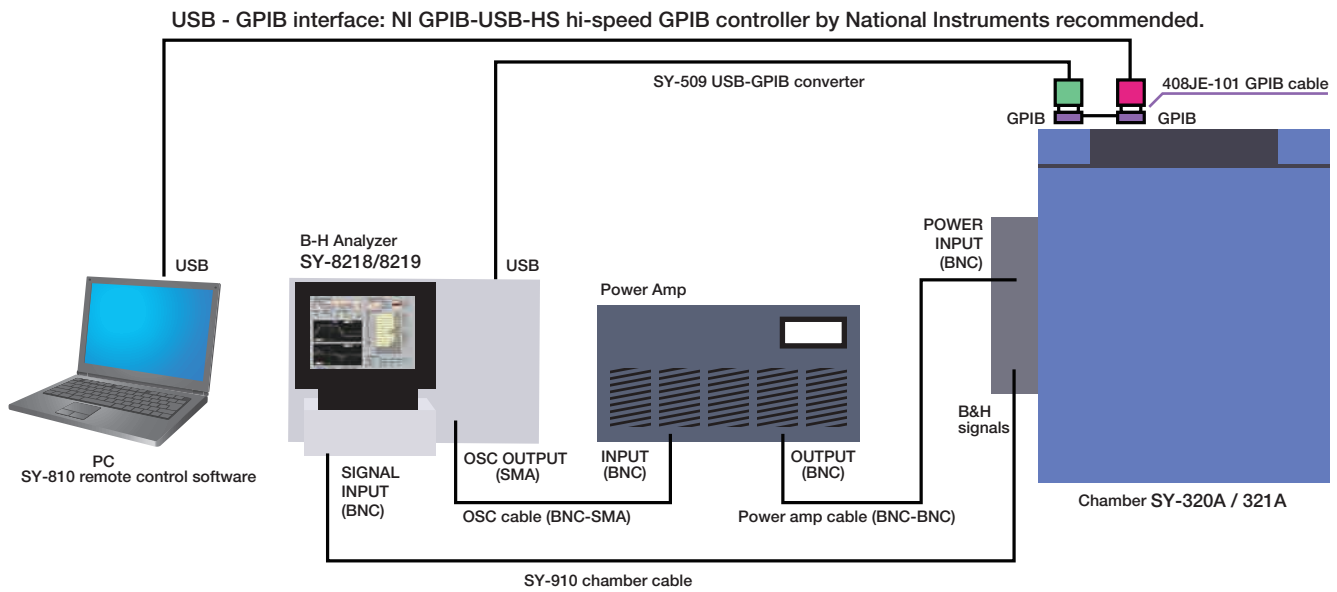

ex. Measurment result

Test condition menu

Schedule menu

Features
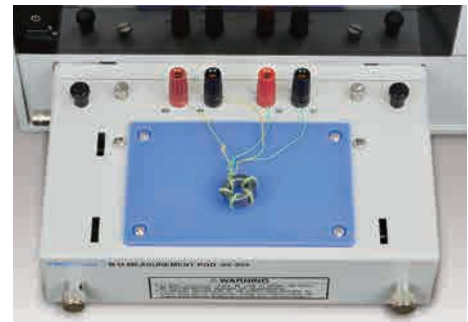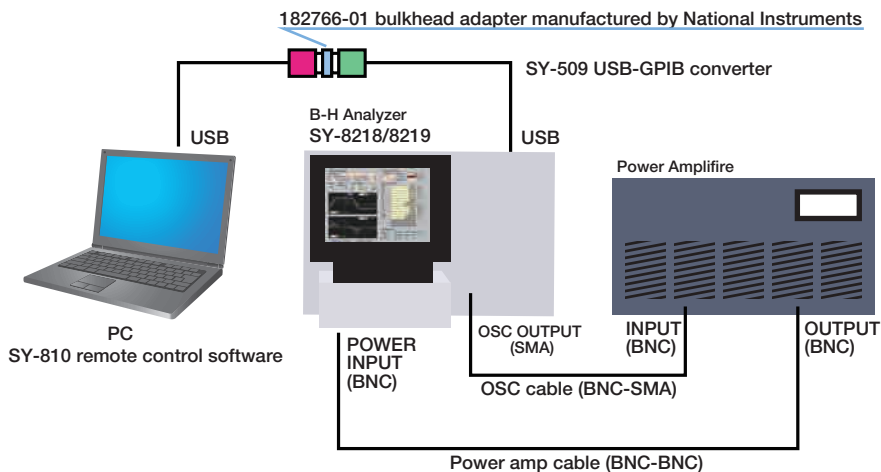• A maximum of twenty temperature conditions and a maximum of fourty excitation conditions can be set for a single test sample, which enables 800 (= 20 x 40) different types of programming for the measurement conditions.

• Pulse excitation for the B-H analyzer can also be remotely controlled.

• Hard copies of the B-H analyzer measurement screen can also be automatically saved onto a USB memory in the JPEG or PNG formats.

System configuration of the constant-temperature scanner system remote control

USB - GPIB interface: NI GPIB-USB-HS hi-speed GPIB controller by National Instruments recommended.

SY-509 USB-GPIB converter

408JE-101 GPIB cable

GPIB   GPIB

USB

B-H Analyzer
SY-8218/8219

USB

Power Amp

POWER
INPUT
(BNC)

PC
SY-810 remote control software

SIGNAL
INPUT
(BNC)

OSC OUTPUT
(SMA)

INPUT
(BNC)

OUTPUT
(BNC)

B&H
signals

OSC cable (BNC-SMA)

Power amp cable (BNC-BNC)

Chamber SY-320A / 321A

SY-910 chamber cable

System configuration of just the B-H analyzer remote control

USB - GPIB interface: NI GPIB-USB-HS hi-speed GPIB controller by National Instruments recommended.

182766-01 bulkhead adapter manufactured by National Instruments

SY-509 USB-GPIB converter

USB

B-H Analyzer
SY-8218/8219

USB

Power Amplifire

PC
SY-810 remote control software

POWER
INPUT
(BNC)

OSC OUTPUT
(SMA)

INPUT
(BNC)

OUTPUT
(BNC)

OSC cable (BNC-SMA)

Power amp cable (BNC-BNC)

Example of Full-automatic B-H Analyzer with Constant Temperature Scanner System for various evaluations

Temperature range : -30℃ to 150℃

Max. number of samples 20 : SY-320A

Max. number of samples 41 : SY-321A

Remote control PC software SY-810(option)

Control PC


Power Amplifier
IE-1125B
350VA,140V,5A

B-H Analyzer
SY-8219
10Hz-1MHz

Constant Temperature Chamber
Scanner System
SY-321A for Max. 41 samples
Temperature range : -30℃ to 150℃
(SY-320A: 20samples)

Interrior of SY-320A
(Scanner mechanizm)

Mini Single Sheet Tester (SST)
SY-956

## The best Magnetic Measurement for Single Sheet shape such as Magnetic Steel Sheets

Main features

▌ Wideband Measurement Frequency:10Hz-20kHz

▌ Max applied Magnetic field(Intensity): 10,000 A/m

▌ Sample size: Support to Measurement of Small Single Sheet:
 Width: less than 35mm, Length:more than 36mm,
 Thickness: less than 3mm
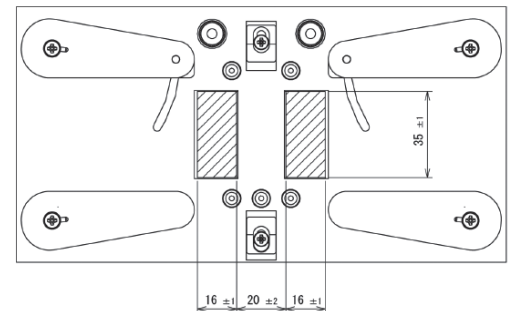
▌ High Accuracy core loss measurement by new method
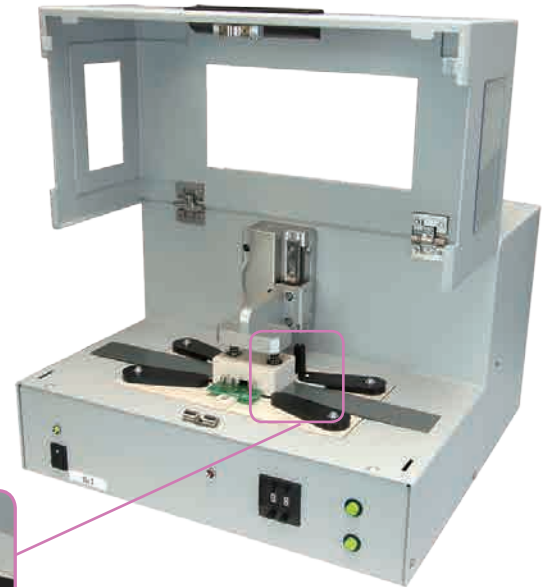
Example of Ferrite(8mm) measurement
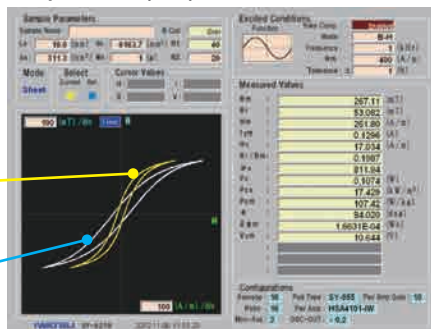
Measurement result cancelling the loss of Yoke when SST used

Measurement result including the loss of Yoke when SST used

Specimen

UNIT : mm

Example of Single sheets

SY-956 Series Specifications

Items		Specifications
Measurement	Measurement Method(Standards)	Excitation current method with vertical single yoke single sheet magnetic property test system / IEC60404-3 compatible with Yoke compensation function
	Excitation(primary) windings	40turns
	Maximum applied magnetic field strength	Approx. 10,000*1 A/m
	Measurement frequency range	Sine : 10Hz to 20kHz
	Specimen dimemsions	Width 35mm or less, Length 36mm(L) or more and Thickness 3mm(H) or less. (1mm(H) or less when using provided B coil as standard accessory)
Signal detection	Current detection resistor	Approx 1ohm
	Maximum measurement current	6A
	Maximum measurement voltage	200V
Measurement accuracy	Amplitude	+/-2% (Typical f=10kHz, 200 mA, 00 mV or larger amplitudes)
	Phase angle — Phase angle (Yoke compensation disabled) *2	+/-0.15 deg (Typical f=10kHz, 200 mA, 200 mV range or larger amplitudes)
	Phase angle — Phase angle (Yoke compensation enabled) *3	+/-0.15 deg (Typical f=10kHz, 200 mA, 200 mV range or larger amplitudes)
	Core loss — Phase angle (Yoke compensation disabled) *2	± 5.6 % (Typical f=10kHz, 200 mA, 200 mV or larger amplitudes)
	Core loss — Phase angle (Yoke compensation enabled) *3	± 5.6 % (Typical f=10kHz, 200 mA, 200 mV or larger amplitudes)
Power	Power Supply Voltage	AC100V to AC240V
	Frequency Range	50Hz/60Hz
	Power Consumption	27VA, max.
Environmental conditions	Operating temperature	5℃ to 35℃
	Specifications guaranteed temperature	18℃ to 28℃
	Operating humidity	85%RH(35℃ , non-condensation)
	Warm-up time	Measurement accuracy is a guaranteed value more than 30 minutes after power on
Outer dimensions		330(W) x 320(D) x 200(H) mm, not including projections
Weight		Approx. 8.5kg
Accessories		Single Sheet measurement system cable : SY-957*1 B coil 01(Windings : 35turns, slit size : 12+/-0.1 * 1.5+/-0.1 * Bobbin length : 17+/-0.15(mm)*1pc. B coil 02(Windings : 100turns, slit size : 32+/-0.1 * 1.5+/-0.1 * Bobbin length : 17+/-0.15(mm)*1pc. Thumbscrews for the terminal block *2, Tweezers *1, Blower blush * 1, Accessory storage box *1, Power cable *1, Cord strap*1 and Instruction manual *1

*1 : Excitation current at 5A
*2 : Measurement accuracies of a composite magnet of a sample and a yoke.
*3 : Measurement accuracy of a sample.

Main Options and System Examples

Constant-temperature Chamber scanner system
SY-320A / SY-321A

For evaluations of samples' magnetic characteristics vs temperature

Automatic measurements possible with the SY-810 (software.)

Temperature Range		-30℃ to 150℃
Sample Quantity	SY-320A	20pcs
	SY-321A	41pcs
Maximum Measurement Current		6Apk

Spare turntable
SY-510/SY-511

A table for mounting samples

	Scanner	Number of samples
SY-510	SY-320A	20pcs
SY-511	SY-321A	41pcs

*Supplied 1set with the SY-320A and SY-321A as standard

SY-321A

SY-511

Spare contact pin set
SY-512

Consumable Components for Maintenance Purposes

Consumable products for carrying out maintenance on constant-temperature scanner systems SY-320A and SY-321A.

*Supplied 1set (4pcs) with the SY-320A and SY-321A as standard

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PC Software
SY-810

Remote Control Software

(Supplied with the SY-509 and bulk head adaptor as standard accessories.)
The NI GPIB-USD-HS manufactured by National Instruments is required separately for PC connection purposes. (see page 55)

Interface
NI* GPIB-USB-HS

GPIB Controller Supporting Hi-Speed USB

A USB-GPIB converter for use with controllers connected to PCs when the SY-810 remote control software is being used.

*NI : National Instruments

Interface
SY-509

USB-GPIB Conversion Adaptor

*Supplied with the SY-810 as standard equipment.

Power Amplifiers

Model		Frequency	Output Current	Output Voltage	Power Consumption
HSA4101-IW		DC to 10MHz	± 1A(MAX)	± 71V(MAX)	50VA(MAX)
HSA4014-IW		DC to 1MHz	± 5.6A(MAX)	± 75V(MAX)	200VA(MAX)
IE-1125B		DC to 3MHz	± 5.2A(MAX)	± 140V(MAX)	350VA(MAX)

DC bias power supply
SY-931

SY-931 injects DC bias current(10A, max.) on choke transformer and Filter reactor for SWPS at 1MHz, max.

Empty toroidal coil
SY-513

A toroidal-shaped empty case. It is used for measurement of a powder sample, sheet troid, etc.

Options for BH analyzer system

DC bias power source	
Model	**Descriptions**
SY-931	10A,max. DC biasing power source with eliminating AC component interferences

Single Sheet Tester	
Model	**Descriptions**
SY-956	10Hz to 20kHz, 10,000A/m,max. 35mm(W),max. * 36mm(L),min. * 3mm(Thickness),max.

Highspeed Power Amplifiers	
Model	**Descriptions**
HSA4101-IW	71Vzero-peak, 1Azero-peak, 50VA
HSA4014-IW	75Vzero-peak, 5.6Azero-peak, 200VA
IE-1125B	140Vzero-peak, 5.2Azero-peak, 350VA
SY-911	Connection cable for IE-1125B

Constant-temperature Scanner Systems	
Model	**Descriptions**
SY-320A	-30deg to 150deg, max. 20pcs. with SY-510 turntable
SY-321A	-30deg to 150deg, max. 41pcs. with SY-511 turntable
SY-510	Spare turntable for SY-320A
SY-511	Spare turntable for SY-321A
SY-910	Connection cable (standard for SY-320A/SY-321A)
SY-512	Spere contact pin set for SY-320A/SY-321A

Software&Interfaces	
Model	**Descriptions**
SY-810	Remote control software
SY-811	Continous excitation function
SY-509	GPIB-USB conversion adaptor (provided as standard accessory for SY-810 software)
NI GPIB-USB-HS	GPIB-USB interface between USB port of PC and SY-8218/SY-8219 via SY-509.

Others	
Model	**Descriptions**
SY-513	Blank Toroidal plastic case

Symbols for magnetic properties

| Measurement items		
Symbol	**Typical unit**	**Meaning**
Bm	[T]	Max. magnetic flux density
Br	[T]	Residual magnetic flux density
Hm	[A/m]	Max. magnetic field
I_1m	[A]	Max. exciting current
Hc	[A/m]	Coersive force
Br/Bm	–	Rectangular ratio
μa	–	Relative amplitude permeability
Pc	[W]	Core loss
Pcv	[W/m³]	Core loss per volume
Pcm	[W/kg]	Core loss per mass
θ	[deg]	Phase angle
2 Φ m	[Wb]	Total flux linkage
V2m	[V]	Max. induced voltage
VA	[VA]	Apparent power
L	[H]	Inductance
R	[Ω]	Resistance
| Z |	[Ω]	Impedance
μ'	–	Complex perrmeability (real part)
μ''	–	Complex perrmeability (imaginary part)
$μ_z$	–	Impedance permeability
tan δ	–	Loss coefficient
θ	[deg]	Phase angle
Q	–	Quality factor
THD	–	Total harmonic distortion
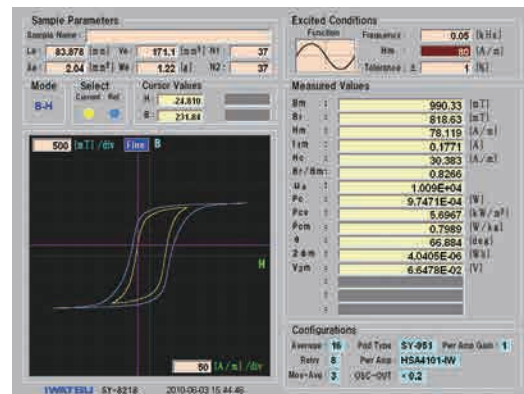
Reference function
It remembers a measurement condition, a characteristcs value, and measurement waveform data (for each time of measurement).
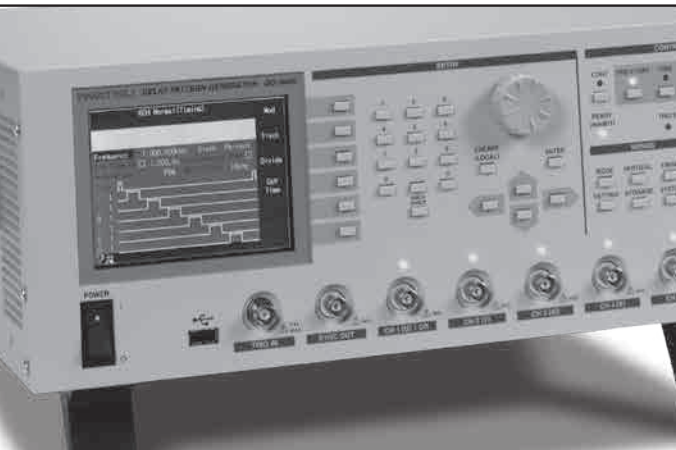
Cursor measurement
Cross, Grad
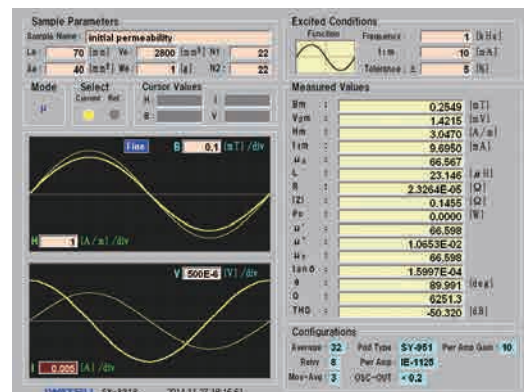
Graphic display
B–t, H–t, V-t, I-t, B–H

IWATSU

http://www.iti.iwatsu.co.jp/

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