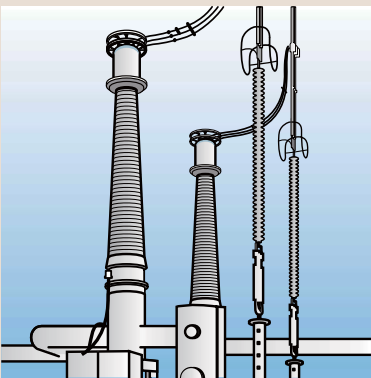


It greatly contributes to the development of power electronics equipment

Thunder

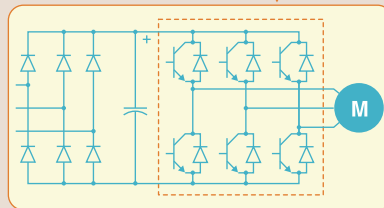
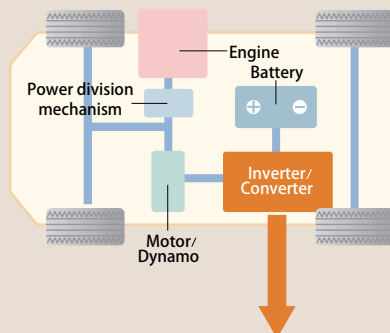
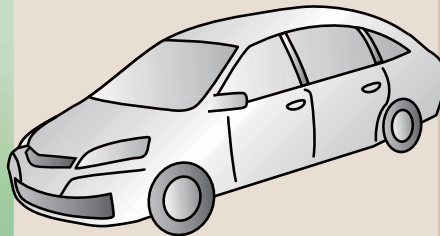


Switch Gear



High Voltage measurement

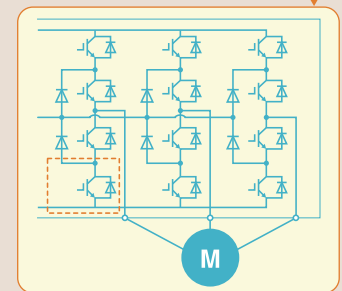
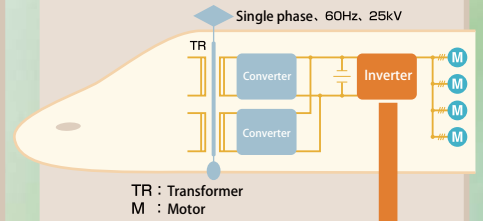
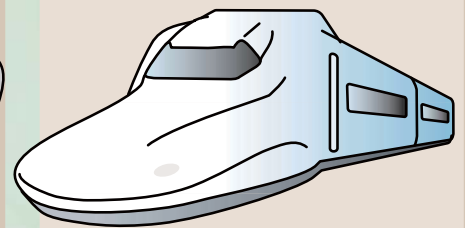
Electric Vehicle



Evaluation of devices

Evaluation of circuits

High-speed railway



Evaluation of materials

PWM control

Long-distance switch

Lightning surge

The high and low switch signals of inverters

large common mode voltage on signals

Inverter power

Inverter gate control

Power device characteristic

Power device switching

Semiconductor Curve Tracer CS-3000 Series

3

Best suited for measuring characteristics of different types of semiconductors including IGBTs, MOSFETs, transistors, and diodes



- Maximum peak voltage: 3,000 V (High voltage mode)
- Maximum peak current: 1,000 A (High current mode)
- LAN interface for remote control

Power curve tracer (custom mode)

Ultra-high voltage / high current

- Output current: 4,500A or more
- Output voltage: 10kV



Power device characteristic

Isolation measurement system DM-8000

7

Support for floating, broad bandwidth, multi-channel, and simultaneous measurements, as well as floating measurement of ultra-high voltage



- Frequency bandwidth: DC to 500 MHz
- The high voltage measurement unit is battery-driven. (The unit can continuously operate for approximately 12 hours.)
- The length of the optical fiber can be chosen from 2m to 200m.

The high and low switch signals of inverters

large common mode voltage on signals

Inverter power

Long-distance switch

Lightning surge

Delay Pattern Generator (6-channel pulse generator) DG-8000

13

This generator easily generates pulses for 6 independent channels, as well as complicated pulses required for testing inverters.



- Easy generation of PWM signal.
- Gap control to prevent the high and low-side switches of devices from being turned on at the same time.
- Variable control of the PWM signal frequency.
- Parallel operation of 3 generators to support output from 18 channels.

Inverter gate control

Power device switching

Semiconductor Curve Tracer CS-3000 Series

CS-3100

Best suited for measuring characteristics of different types of semiconductors including IGBTs, MOSFETs, transistors, and diodes

CS-3200

- Maximum peak voltage: 3,000 V (High voltage mode for all models)
- Maximum peak current: 1,000 A (CS-3300 High-current mode)
- All models support the Leakage mode (cursor resolution: 1 pA)
- USB for Screen copy and saving setups
- LAN interface for remote control

CS-3300



CS-3200 / CS-3300

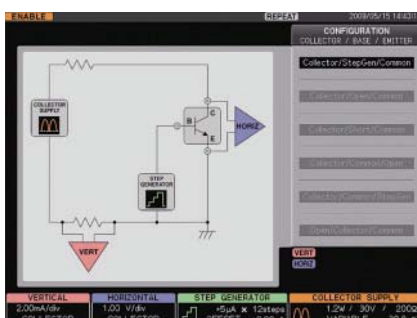


CS-3100

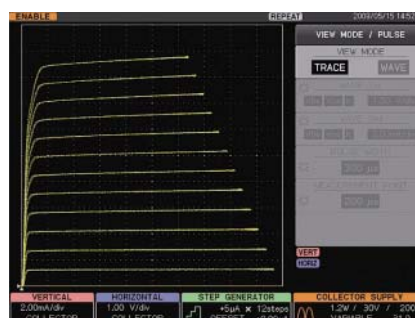
Lineup

	Product name	Model number	Remark
Main unit	Semiconductor curve tracer	CS-3100	3,000V / without HC mode - CS-301 / CS-500
	Semiconductor curve tracer	CS-3200	3,000V / 400A (HC mode) - CS-302 / CS-500
	Semiconductor curve tracer	CS-3300	3,000V / 1,000A (HC mode) - CS-302 / CS-500
Fixture	Fixture S	CS-301	Standard for CS-3100.
	Fixture M	CS-302	Standard for CS-3200 / CS-3300.
Test adapter	Test adapter	CS-500	1 test adapter comes with the main unit.
	TO type test adapter	CS-501	Socket suited to the TO type package (with 3 terminals)
Alligator clip	Small alligator clip (red) x 10	CS-001	Option for CS-302 M: CS-302.
	Small alligator clip (black) x 10	CS-002	Option for CS-302 M: CS-302.
Software option	Semiconductor parameter search	CS-800	This is a software option to be installed in the CS-3000 series.
	Semiconductor parameter measurement	CS-810	This option can be used on the (optional) PC when the CS-800 is installed in the main unit.

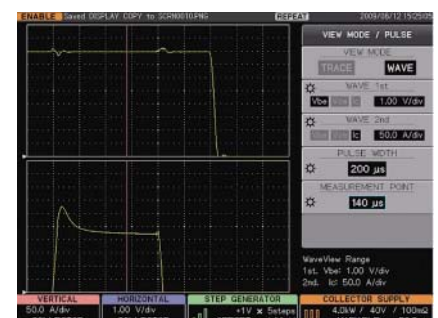
User-friendly measurement screen



Graphical configuration selection



Transistor V-I characteristic example (TRACE mode)



Vbe and Ic waveforms in the High-current pulse mode (WAVE mode)

Support of the maximum peak voltage of 3,000 V and the maximum peak current of 1,000 A

● Display

The 8.4-inch clear screen displays the waveform details. This large screen displays the menu and parameters without limiting the waveform grid.

● Connectivity

The CS-3000 series features a USB port on the front panel, facilitating report creation. Screen images can be saved to a USB device by pressing the COPY button.

● Readout

The readout display, which is color-coded by function, displays operation settings in an easy-to-understand way.

● Breaker

Breakers for high voltage and high current (CS-3200/3300) are provided on the front panel.

● Fast activation

● Menu operation section

Use the function knob and function keys to operate the menu.

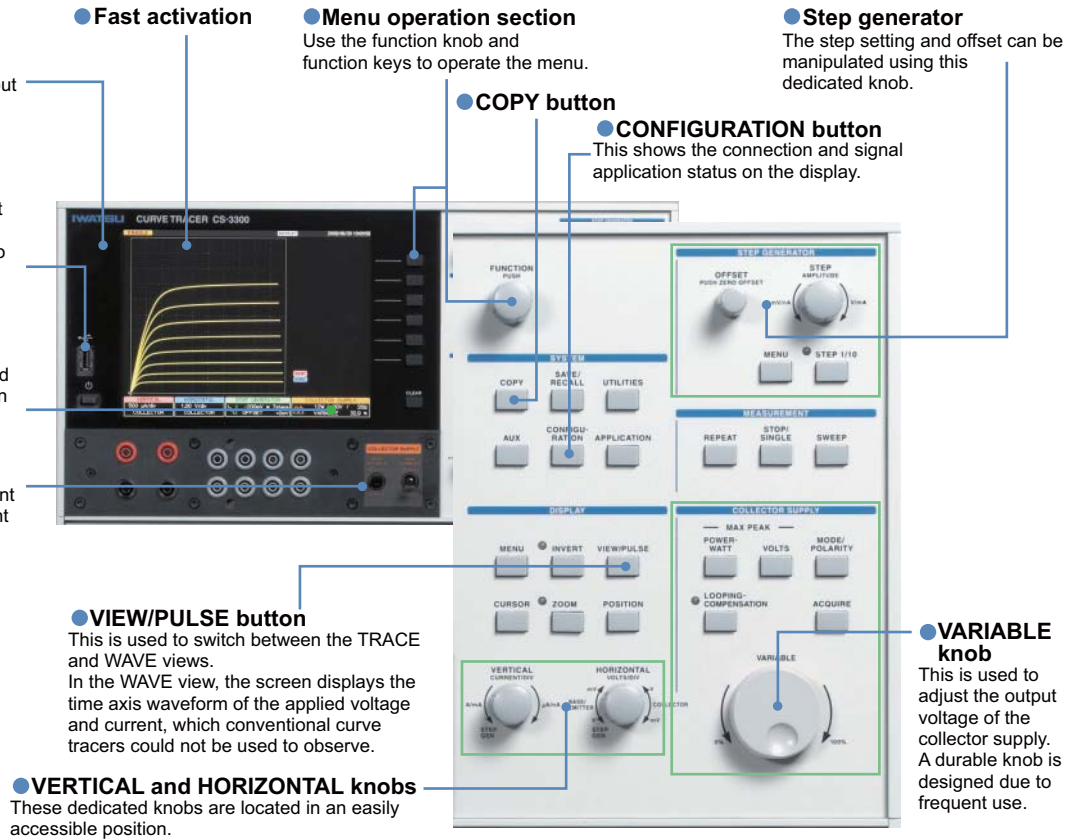
● COPY button

● CONFIGURATION button

This shows the connection and signal application status on the display.

● Step generator

The step setting and offset can be manipulated using this dedicated knob.



● VIEW/PULSE button

This is used to switch between the TRACE and WAVE views. In the WAVE view, the screen displays the time axis waveform of the applied voltage and current, which conventional curve tracers could not be used to observe.

● VERTICAL and HORIZONTAL knobs

These dedicated knobs are located in an easily accessible position.

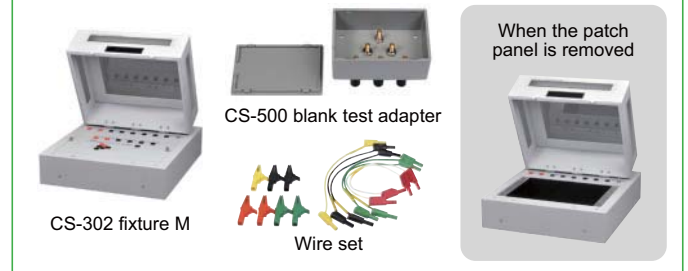
● VARIABLE knob

This is used to adjust the output voltage of the collector supply. A durable knob is designed due to frequent use.

Standard accessories for CS-3100



Standard accessories for CS-3200 and CS-3300



CS-500 test adapter

CS-500 Blank Test adapter comes with the product. Use this adapter to connect the prepared jig by customer to the fixture.



CS-501 TO type test adapter

This socket is suited to the TO type package (with 3 terminals). The supported lead distance is from 1.52 to 4.57 mm.



CS-001 (red x 10pcs.), CS-002 (black x 10pcs.) Small alligator clip

These small alligator clips can be attached to the wire set with the CS-302 fixture.



Power curve tracer (Custom made)

Ideal for measuring power device characteristics

High voltage mode

Output voltage : 500 V to 10 kV
Output current : Up to 500 mA
Output pulse width : 700 to 4,500 μ s (in 1 μ s steps)

High current mode

Output voltage: 0 V to 50 V
Output current: Up to 8,000 A can be supported.
Output pulse width: 700 μ s (fixed)



10 kV curve tracer (Custom made)

Ideal for measuring the withstand voltage characteristic of high voltage diode thyristors

Output section

Voltage waveform: Commercial power supply half-wave rectification waveform
Maximum voltage: 10 kV at peak (without load)
Maximum current: 100 mA at peak

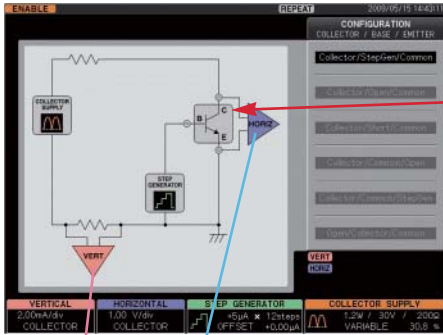
Display section

Voltage axis sensitivity: 50 V/div to 1,000 V/div, 5 ranges at 1-2-5 step
Current axis sensitivity: 0.1 mA/div to 10 mA/div, 7 ranges at 1-2-5 step



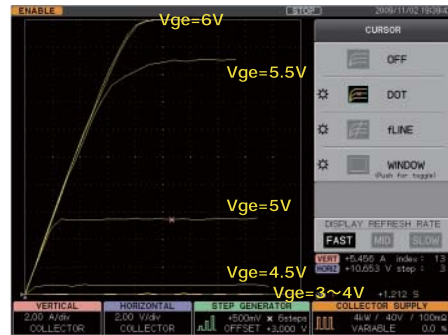
Observation of V-I curves as well as applied waveforms of voltage and current

Application of the current and voltage pulses in the high current mode

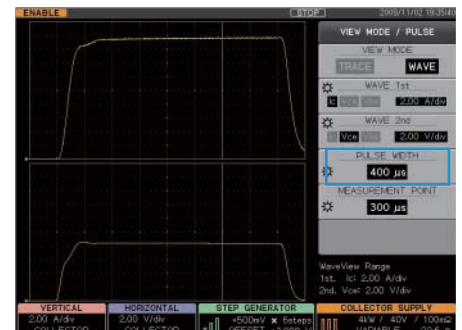
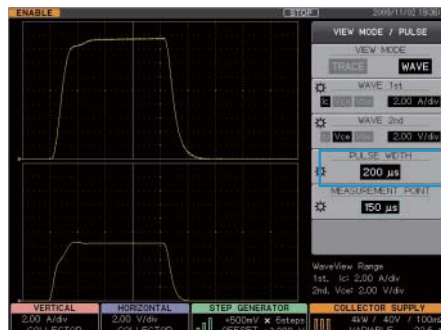
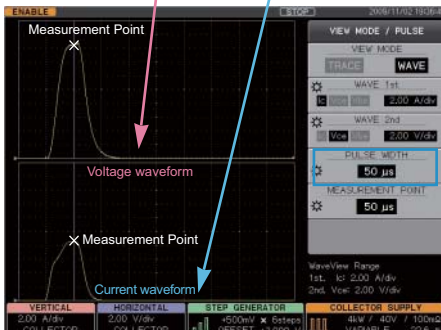


connection status of a measurement device

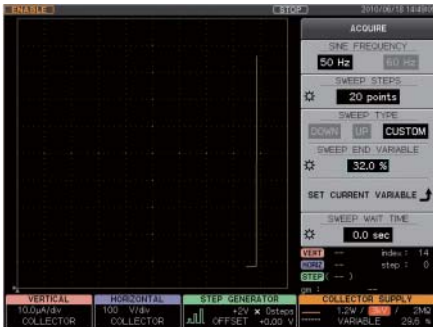
Example of measuring MOSFET "current - voltage" characteristics



The pulse widths of the applied current and voltage and the measurement point can be specified in the range from 50µs to 400 µs (CS-3200 and CS-3300).



SWEEP TYPE can be selected from DOWN, UP, and CUSTOM (all models). With CUSTOM specified, the range between specified values can be swept.



CS-800 semiconductor parameter search (optional)



LIMIT SWEEP
If voltage and current limit values are specified before the SWEEP operation, the operation stops at the next measurement point after the limit value is exceeded.

This is the main unit software option that supports the voltage and current limit function, as well as automatic Vth measurement.

Vth and hFE SETUP
Vth and hFE can be automatically measured.



Example of automatic Vth measurement

Remote tool

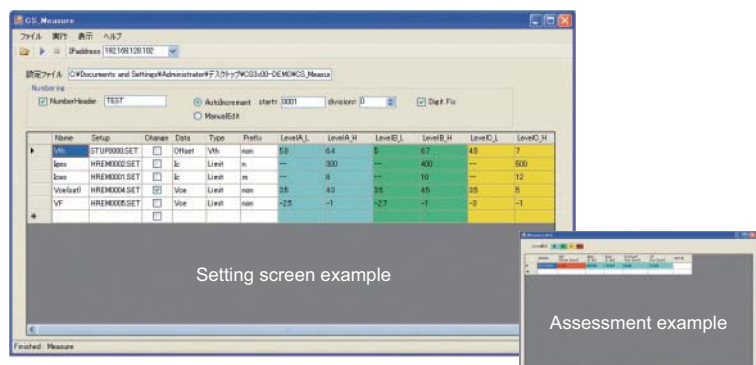
If the use of USB memory is not permitted for security reasons, a copy of the screen, measurement results in the CSV format, and other data can be directly transferred to the PC via LAN.

*The remote software is provided at free. However, an NI VISA library (which is not free) is necessary to use this software.



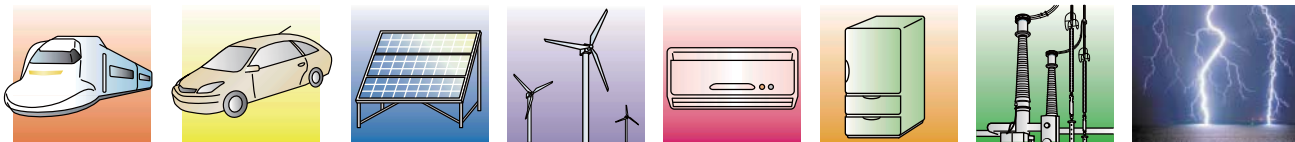
CS-810 semiconductor parameter measurement (optional)

This is a PC application used to connect the main unit incorporating CS-800 and an (optional) PC by LAN. This application automatically performs measurement by applying the measurement conditions specified using the PC to determine whether data is appropriate.



Semiconductor Curve Tracer CS-3000 Series

Model		CS-3100	CS-3200	CS-3300	
Collector supply					
Mode	High voltage	AC, ± Rectified SIN, ± DC, ± LEAKAGE			
	High current	—	Pulse only		
Maximum peak power	120 mW, 1.2 W, 12 W, 120 W, 390 W *390 W can be selected excluding the maximum peak voltage setting at 3,000 V range.				
	—	High current mode (400 W, 4 kW)	High current mode (400 W, 4 kW, 10 kW)		
High voltage mode	Maximum peak current(maximum peak pulse current)		Maximum peak voltage		
	75 mA (150 mA)		3,000 V (2,500 V for AC)		
	750 mA (1.5 A)		300 V		
	7.5 A (15 A)		30 V		
Loop compensation	The floating capacitance between the collector terminal and the ground of the fixture is compensated by the hardware in the high voltage mode. Digital compensation is also available.				
High current mode (pulse only)	—	Maximum peak current	Maximum peak voltage	Maximum peak current	Maximum peak voltage
		400 A	40 V	1,000 A	40 V
		40 A	40 V	400 A	40 V
				40 A	40 V
Pulse width/ measurement point	—	The pulse width is variable in the range from 50µs to 400 µs. Measurement points can be specified (with a resolution of 10 µs/step).			
Maximum data points	20 to 1,000 points can be specified per trace.				
Step generator					
Current mode	Amplitude range: 50 nA to 200 mA, 21 ranges, 1-2-5 step Maximum current: ±2A / Offset: ±10 times STEP AMPLITUDE setting				
Voltage mode	Amplitude range: 50 mV to 2 V, 6 ranges, at 1-2-5 step Maximum voltage:±40V / Offset: ±10 times STEP AMPLITUDE setting				
Step rate	Staircase wave: 2times of 50 Hz or 60 Hz (50 Hz or 60 Hz in the AC mode)	Staircase wave: 2times of 50 Hz or 60 Hz (50 Hz or 60 Hz in the AC mode) Pulse: The pulse changes in the range from 80ms to 1,000 ms. (The lowest frequency limited by the maximum peak power consumption setting.)			
Pulse step	The pulse width is variable in the range from 50 µs to 400 µs at 10µs resolution.				
Number of steps	0 to 20steps				
AUX output					
Range	OFF, -40 to +40 V, variable with at 100mV resolution				
Vertical axis					
Collector current	Range	High voltage mode: 1 µA/div to 2 A/div, 20 steps, 1-2-5 switching			
	—	High current mode: 100 mA/div to 50 A/div, 9 ranges, at 1-2-5 step	High current mode: 100 mA/div to 100 A/div, 10 ranges, at 1-2-5 step		
Accuracy	2% of readout + 0.05 × VERT/div setting or better (The internal loop correction error below must be added to the formula.) 3 kV range: 6 µA, 300 V range: 1 µA, 30 V range: 0.5 µA (Defined for the current level of 10% or larger of each voltage range.)				
Emitter current (LEAKAGE)	Range	1 nA/div - 2 mA/div, 20 ranges, at 1-2-5 steps			
	Accuracy	2% of readout + 0.05 × VERT/div setting +1nA or lower			
Horizontal axis					
Collector voltage	Range	High voltage mode: 50 mV/div to 500 V/div, 13 ranges, at 1-2-5 step			
	—	High current mode: 50 mV/div to 5 V/div, 7 ranges, at 1-2-5 step			
Accuracy	2% of readout + 0.05 × HORIZ/div setting or better				
Base/emitter voltage	Range	50 mV/div to 5 V/div, 7 ranges, at 1-2-5 step			
	Accuracy	2% of readout + 0.05 × HORIZ/div setting or better			
Miscellaneous					
Display	8.4-inch color TFT-LCD (SVGA 800 x 600 pixels)				
Data save / recall	Internal: Memory (setup: 256, REF waveform: 4) External: Removable storage connected to the USB port (setup, waveform save / recall, screen hard copy)				
USB	1 port (USB1.1)				
Remote control	Remote control by LAN: 1 port (100BASE-TX)				
Power supply/Power consumption	Power supply input range: 100V to 240 V AC, 50/60 Hz/ Power consumption: 500 VA				
Accessories	CS-301 (fixture S) / CS-500 (blank test adapter) / operation manual, power cord		CS-302 (fixture M) / CS-500 (blank test adapter) / wire set, operation manual, power cord		
Mechanism section					
Dimensions (mm)	424 (W) x 555.2 (L) x 221 (H) (without the external projection portion)		424 (W) x 555.2 (L) x 354.5 (H) (without the external projection portion)		
Weight	Approx. 28 kg (without optional accessories)		Approx. 43 kg (without optional accessories)		
Environmental conditions	Operating temperature: 0 to +40 °C, performance guarantee temperature: +10 to +35 °C				



The Grand Prix picture of the Lightning Picture Contest in 2009 Presented by OTOWA Electric Co., Ltd.

Isolation measurement system

DM-8000

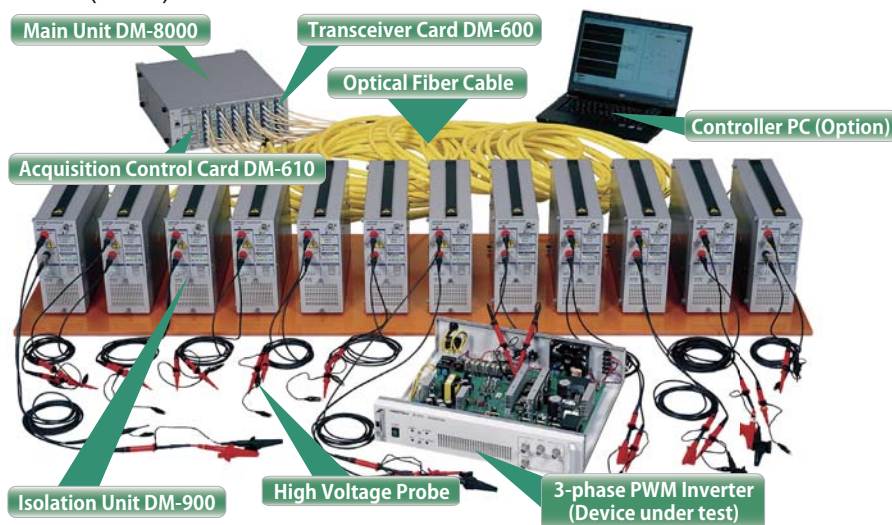
Support for floating, broad bandwidth, multi-channel, and simultaneous measurements, as well as floating measurement of ultra-high voltage

- The input block, control block and display block are isolated by optical fiber cable. (DM-900/L, DM-910/L.)
- Frequency bandwidth: DC to 500 MHz
- Simultaneous multi-channel measurement of 2 to 24 channels of different reference potentials (DM-900/L, DM-400/L.)
- Longtime battery drive. (The system can be driven by 3 batteries for about 12 hours.)(DM-900/L, DM-910/L.)
- Measurement using long memory (DM-900L, DM-910L, DM-400L.)
- Simultaneous measurements of the inverter's switching waveform and ON-voltage (DM-910/L.)
- Supports synchronous measurement as well with the non-isolated unit (DM-400/L.)

Applications



Example: Isolation Unit DM-900 x 12units (24ch)



Lineup

Items	Model
Main unit	DM-8000
High-speed main unit *1	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 (500 k points) *2	DM-900
Isolation unit (16 M points) *2	DM-900L
Isolation unit (high resolution, 500 k points) *3	DM-910
Isolation unit (high resolution, 16 M points) *3	DM-910L
Acquisition unit (500 k points) *4	DM-400
Acquisition unit (16 M points) *4	DM-400L

Items	Model
Optical fiber cable S (2m) *5	DM-002
Optical fiber cable S (5m) *5	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)	DM-010
Acquisition cable (2m)	DM-105
Acquisition cable (5m)	DM-106
Battery pack	DM-551
Battery pack (a set of 3 battery packs) *6	DM-553

*1 Performance us improved compared with DM-8000 when using 3 or more units with memory length of longer than 100k points.

*2 With insulation case, optional probes are required for measurement

*3 With insulation case, optional probe is required for voltage measurement

*4 Non-isolation type unit, driven by AC power only

*5 Optical cable set without case

*6 Standard item for isolation unit

Isolation measurement system

Isolation with Optical Fiber cable (2 m to 200 m)

DM-8000 main unit /High-speed DM-8000H main unit

Up to 12 isolation units and acquisition units can be connected. The acquisition control card for capture control and up to 6 specially designed transceiver cards can be installed to the main unit.

The gigabit Ethernet-enabled high-speed main unit (DM-8000) improves the waveform update speed when using 3 or more units.

The interlock control terminal is on the rear panel.

The input block, control block and display block are isolated by optical fiber cable.

Because isolation units are isolated from each other by optical fiber cable, 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-600 transceiver card

2 isolation units can be connected per card.

DM-620 optical and metal transceiver card

1 isolation unit and 1 acquisition unit can be connected per card.

DM-630 metal transceiver card

2 acquisition units can be connected per card.

DM-610 acquisition control card

This card controls waveform capture in the measurement unit.

This card provides a non-isolated external trigger input, which can be changed to an external trigger output terminal.

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

The units are operated by a built-in battery to perform floating measurement.

Frequency bandwidth: DC to 500 MHz, Max.sample rate: 2 GS/s, Memory length: 500 k points (DM-900), 16 M points (DM-900L), Input: 2 channels (not isolated), interface: optical interface

■Insulation case
Withstand voltage: 10 kV
(Standard accessory)

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

The units are operated by a built-in battery to perform floating measurement.

The high resolution unit enables the simultaneous measurement of a switching waveform and on-voltage.

Frequency bandwidth: DC to 500 MHz, Max.sample rate: 2 GS/s, Memory length: 500 k points (DM-910), 16 M points (DM-910L), Input: 1 channel, Interface: optical interface

■Insulation case
Withstand voltage: 10 kV
(Standard accessory)

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

The units can continuously operate by AC power source.

These units are best suited for non-isolated measurement of grounded power probes, for example.

Frequency bandwidth: DC to 500 MHz, Max.sample rate: 2 GS/s, Memory length: 500 k points (DM-400), 16 M points (DM-400L), Input: 2 channels (not isolated), Interface: electric interface

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

This battery can be inserted or removed from the front of the isolation unit. Using 3 batteries enables the unit to continuously operate for twelve hours. The battery can be charged by using the main unit.

3 batteries come with DM-900/L DM-910/L

DM-002 to DM-010 optical fiber cables

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

Cable length: 2 to 200 m
*1.2-5 step length
Without cover: 2 m or 5 m
With sleeve: 5 m to 200 m

IE-1196 probe specially designed for DM-910 (custom made)

The probe is a low distortion probe that supports the DM-910/L's high resolution.

Frequency bandwidth: DC to 200 MHz
Probe ratio: 100:1
Cable length: 1.5 m

DM-105/DM-106 acquisition cables

These are interface cables specially designed for the acquisition unit. These cables connect the unit and transceiver by electrical signals for DM-400/L.

Cable length: 2 m or 5 m

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

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

A fundamental duty cycle (16 ms on the sample screen) can be captured at a rate of 1GS/s.

View with zoom display.

Gate driving waveform of U, V, and W phases on the high side of a 3-phase inverter

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

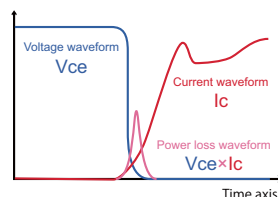


Control PC (optional)

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

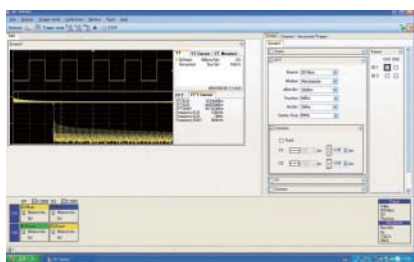
The many operation functions provided by the IS Viewer facilitate power loss and other measurement.

Switching loss at power-on



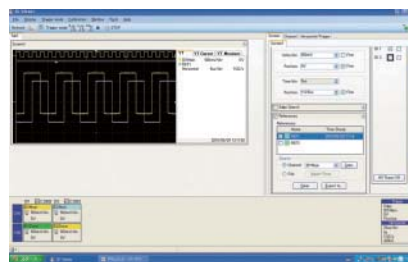
The V_{ce} , I_c , output voltage, and current waveform of the high and low-side switch of an inverter can be simultaneously measured. dv/dt , di/dt , and parameters such as power loss can be easily calculated from the measurement waveform.

functions of IS viewer



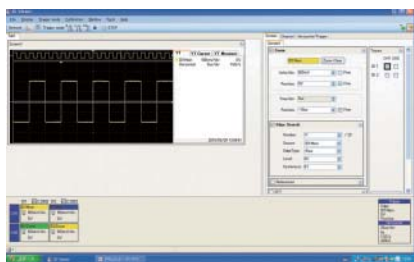
FFT function

This function can be used for the frequency analysis of a measured waveform.



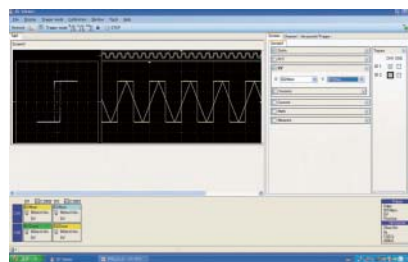
Reference display function

This function can be used to compare waveforms.



Edge search function

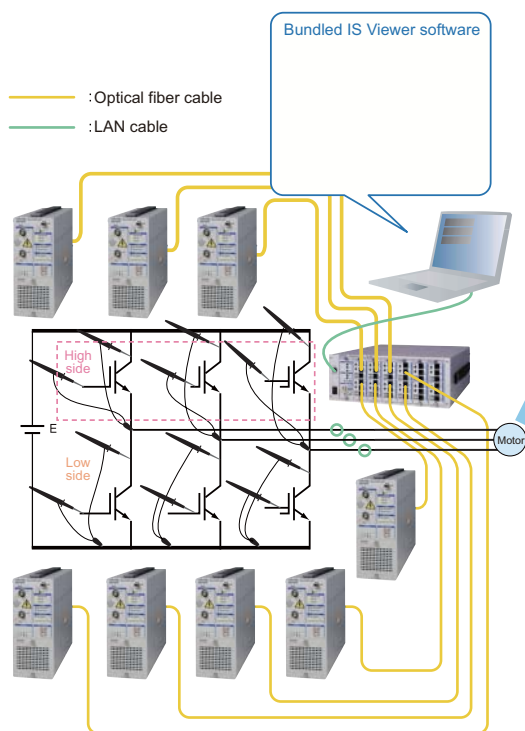
This function can be used to automatically detect the edge of a monitored waveform and display selected edges.



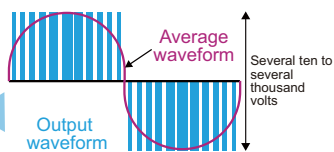
X-Y display function

This function can be used to evaluate the SOA (safe operation area) and other items.

Multi-channel floating measurement (example of the high and low-side switch of a 3-phase inverter)

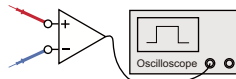


The waveform of output voltage from the 3-phase inverter that drives a motor or other device (shown in the left figure) is a pulse voltage waveform as shown in the figure below.

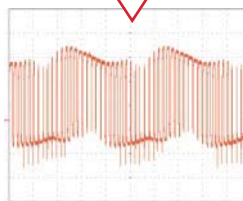


A differential probe was used for this type of measurement in the past, but the waveform was sometimes distorted, and it was sometimes difficult to ensure sufficient measurement bandwidth due to constraints of the common mode rejection ratio or withstand common mode voltage. With optical fiber isolation,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

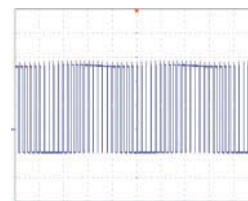
Measuring V_{ge} of the high-side switch with differential input



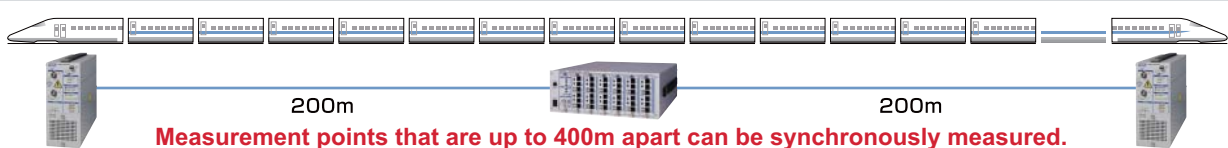
The common mode noise prevents accurate measurement.



Measuring V_{ge} of the high-side switch with isolation input



Long-distance measurement (up to 400m)

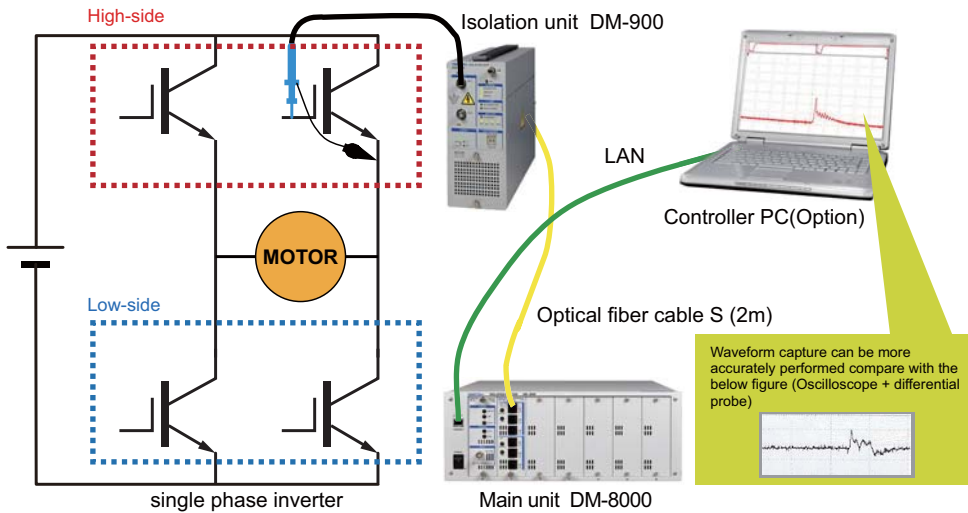


Measurement points that are up to 400m apart can be synchronously measured.

Isolation measurement system

System configuration

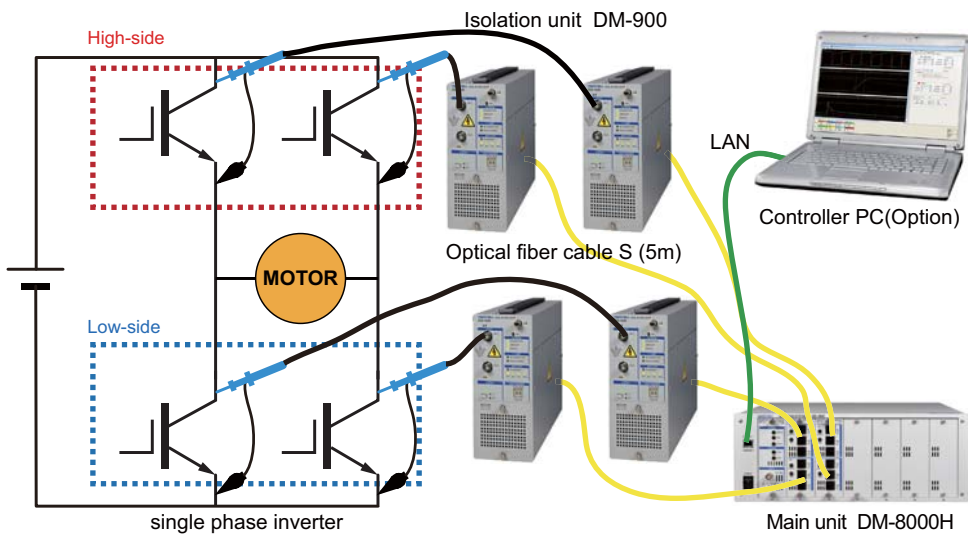
IGBT Gate voltage measurement in high-side switch of single phase inverter(1unit)



System configuration

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

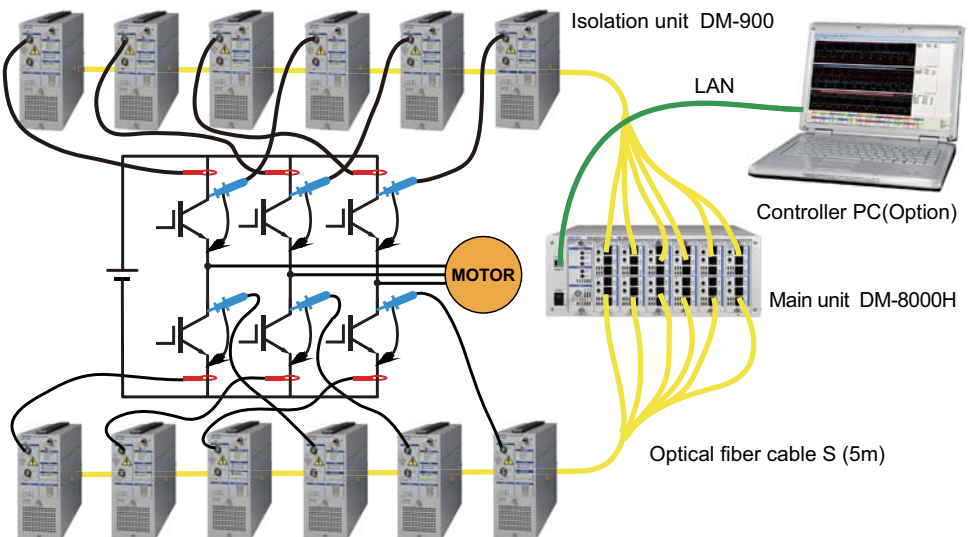
IGBT Vce voltage measurement in high-side switch of single phase inverter(4units)



System configuration

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

IGBT Vce voltage & Ic current measurement of 3-phase, 2-level inverter(12units)



System configuration

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

Isolation System DM-8000 Specifications

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

	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	1MΩ // 16pF				1MΩ // 16pF or 50Ω	
Maximum input voltage	400Vmax (DC+peakAC<=5kHz) CAT I					
Number of channels	2 (channels are not isolated)		1		2 (Not isolated)	
Input coupling	GND, DC1MΩ, AC1MΩ		GND, DC1MΩ		GND, DC1MΩ, AC1MΩ, DC50Ω	
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 fullscale)					
Probe sense	10:1,100:1,1000:1 (Auto detection/manual settings)					
Sample rate	1GS/s (2 GS/s during interleave)					
Vertical axis resolution	8 bits					
Maximum memory length	500kpoints/ch	16Mpoints/ch	500kpoints/ch	16Mpoints/ch	500kpoints/ch	16Mpoints/ch
Trigger system unit						
Trigger sources	CH1, CH2		CH1-MAIN		CH1, CH2	
Trigger slope	Positive/Negative					
Coupling	AC,DC,HFREJ, LFREJ					
Level range	125% of full-scale					
Interface						
Interface	One set of 3 optical interfaces (optical fiber cable: 2 m to 200 m)				One set of electrical interfaces (wire cable:2 m or 5 m)	
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	120 VAmx (when using AC power)				40 VAmx	
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 (50/60 Hz)					
Calibration signal						
Calibration signal	0.6V/6V (selectable)					
Mechanical unit						
Dimensions (mm)	122.4 (H) mm×258.4 (W) mm×544 (D) mm				96.4 (H) mm×171.6 (W) mm×322.6 (D) mm	
Weight	Approx. 7 kg (excluding battery packs and accessories) Battery pack weight: Approx. 660 g 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	1 ns/div to 20 s/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	DM-8000:(100BASE-TX)×3 DM-8000H:(1000BASE-T)×3
Power supply unit	
AC power supply	100V to 240V (50/60 Hz)
Power consumption	DM-8000:100 VA max DM-8000H:130 VA max
Mechanical unit	
Dimensions and weight	132(H)×351(W)×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)

Note1 : Intel and Pentium are registered trademarks or trademarks of Intel Corporation and its subsidiary companies in the United States of America and other countries.

Note2 : 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-8000)
Operating temperature	0°C to +40°C
Performance guaranteed temperature	+10°C to +35°C

IS Viewer DM-800 (provided with the DM-8000/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	+, -, ×, ÷, x , + , , dy/dx
Parameter measurements	Max, Min, p-p, Top, Base, Top-Base, RMS, CycleRMS, Mean, CycleMean, +/-Overshoot, TransitionTime, dv/dt, Freq, Period, +/-PulseCount, +/-PulseWidth, 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
RAM	2 GB or more
OS	Windows® XP Professional SP3 Windows® Vista Business SP2 / Windows® 7
Display	At least WXGA (1280 x 768 pixels) recommended (SXGA (1280 x 1024 pixels) is required for full display.)

High Voltage Probes custom order

High Voltage Probes

Model	Bandwidth (MHz)	Attenuation ratio 1:x	Withstand voltage(duty 10%)	Withstand voltage(duty 50%)	DC	Length (m)	Remark
PHV1000-RO	400	100	6 kV (500 ms cycle)	3.5 kV (100 ms cycle)	1 kV	2	CAT I
PHVS1000-RO	400	1000	6 kV (duty 10% 500 ms cycle)	3.5 kV (100 ms cycle)	1 kV	2	CAT I
PHV641-LRO	380	100	4 kV (200 ms cycle)	3.5 kV (60 ms cycle)	3 kV (+AC peak)	1.2	AC rms 2 kV
PHV661-LRO	380	100	6 kV (200 ms cycle)	5 kV (60 ms cycle)	4 kV (+AC peak)	1.2	AC rms 2.8 kV
PHV4002-3/0,6RO	100	1000	40 kV (100 ms cycle)	30 kV (30 ms cycle)	20 kV (+AC peak)	3	AC rms 14 kV



PHV1000-RO



PHV6xx-L RO

High Voltage Probes

HV-P60

DC to 50 MHz, DC to 60 kV, pulse 80 kV

※ The probe stand (SK-301) is optional.



HV-P30

DC to 50 MHz, DC to 30 kV, pulse 40 kV



Specifications and performance

Input/output ratio ... 2000:1
Input RC 100MΩ, 5 pF ± 2 pF DC to 50 MHz

Specifications and performance

Input/output ratio ... 1000:1
Input RC 100MΩ, 5 pF ± 2 pF DC to 50 MHz

Current Probes



SS-250 
DC to 100 MHz, MAX 30 A rms



SS-240A 
DC to 50 MHz, MAX 30 A rms

PS-26

POWER supply for SS-250A



PS-26

POWER supply for SS-240A



Specifications and performance

Freq. Bandwidth
DC to 100 MHz (-3 dB)
Maximum input current
Maximum input range : 30 A rms
Maximum peak current : 50 A peak, non-continuous
Output sensitivity
0.1 V/A
Sensitivity accuracy:
• ±1.0% of reading ±10 mA for probes only (in the range from 0 to 30 A rms, DC, and AC 45 to 66 Hz)
• ±2.0% of reading for probes only (50 A peak or less and over 30 A rms, DC, and in the range of AC 45 to 66 Hz)
Noise
2.5 mA rms or less (observation using an oscilloscope with a 20 MHz band)
Measurable conductor diameter
φ 5 mm

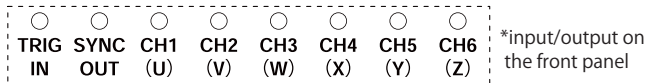
Specifications and performance

Freq. Bandwidth
DC to 50 MHz (-3 dB)
Maximum input current
Maximum input range : 30 A rms
Maximum peak current : 50 A peak, non-continuous
: 50 A peak at pulse width ≤ 10 μs
Output sensitivity
0.1 V/A
Sensitivity accuracy:
• ±1.0% of reading ±10 mA for probes only (in the range from 0 to 30 A rms, DC, and AC 45 to 66 Hz)
• ±2.0% of reading for probes only (50 A peak or less and over 30 A rms, DC, and in the range of AC 45 to 66 Hz)
Noise
2.5 mA rms or less (observation using an oscilloscope with a 20 MHz band)
Conductor diameter that can be measured
φ 5 mm

Delay Pattern Generator (6CH pulse generator)

DG-8000

The generator easily generates pulses for six independent outputs, as well as complicated pulses required for testing inverters.



- **Seamless change**
The frequency, pulse width, and other settings can be seamlessly changed during oscillation.
- **Tracking function**
Parameters can be changed at the same time 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.

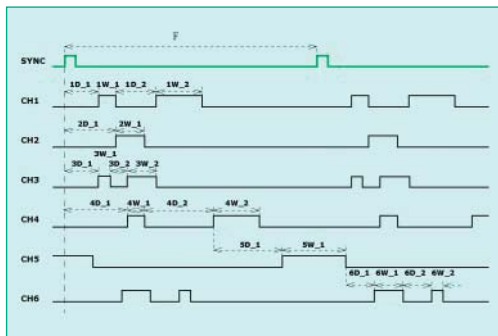


※Rear panel configuration of a standard model

Setting parameters and output examples of 6CH independent pulse output

BASIC mode

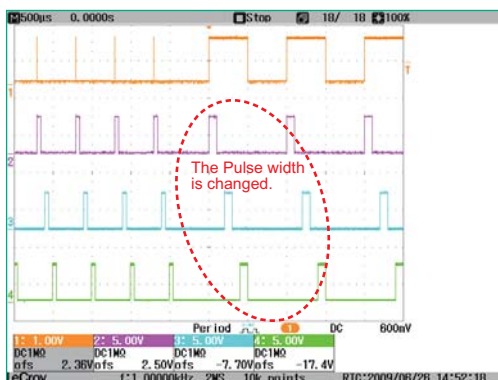
Pulses can be easily generated by specifying any dependency, delay value, and width value for each of 6CH. The output level can also be individually specified for each CH.



Tracking function

The pulse width, delay time, and other settings can be changed at the same time for any combination of CH.

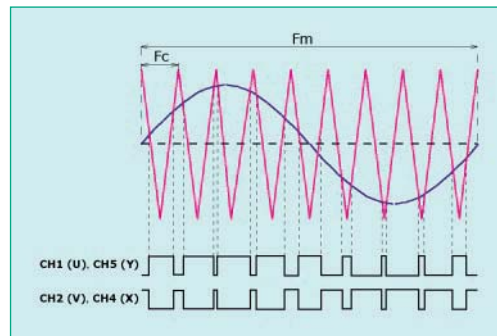
Output example when the pulse width of channels 1 to 3 is changed simultaneously



Signal generation method and output examples of the inverter option

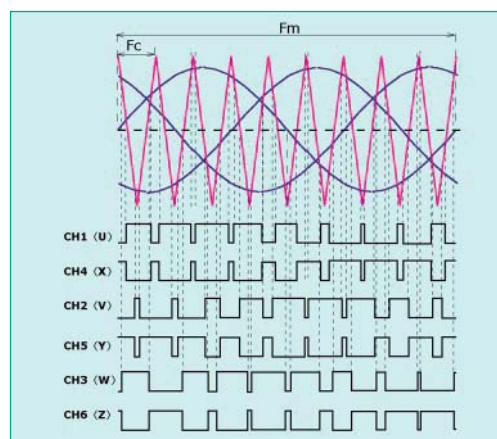
Single-phase bipolar output in the INVERTER mode

Pulses can be easily generated by specifying the carrier frequency (F_c), modulation signal frequency (F_m), 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 (F_c), modulation signal frequency (F_m), and modulation period (that is, the rate of the modulation signal amplitude to the carrier amplitude).

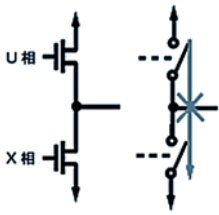


Lineup

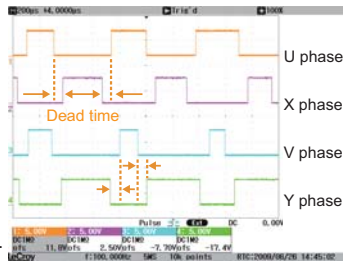
	Product name	Model number	Incorporated function
Main unit	Delay pattern generator	DG-8000	—
Software option	Inverter and PPG option	DG-801	INVERTER mode PPG mode
	Operation pattern option	DG-802	Operation pattern function
Hardware option	External modulation option	DG-601	External modulation function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

Delay Pattern Generator(6CH pulses generator)

Gap control to prevent the high and low-side switches of devices from being turned on at the same time

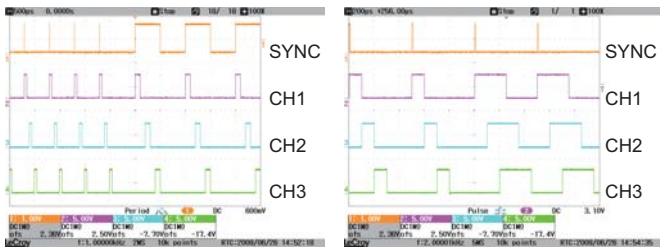


A short circuit is dangerous.



If the phase U and X devices in the above figure are turned on at the same time, they short-circuit, causing danger and damage. Using the DG-8000 gap time control function automatically generates the specified dead time as shown in the figure. 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 make devices turn 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

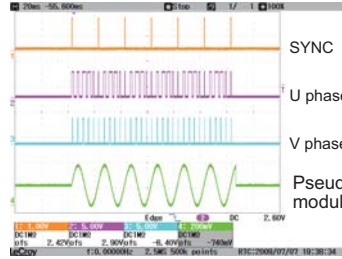
The parameters related to the time axis and those related to the vertical axis are separately controlled. These parameters can be changed manually or by using remote commands.

Support of ORed output on channel 1

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

Easy generation of PWM signal

The inverter and PPG option(DG-801) enables you to output control signals for the buck chopper, single-phase unipolar, single-phase bipolar, 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.



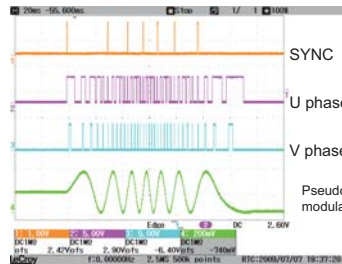
<Configuration example>
DG-8000 main unit : 1
DG-801 inverter and PPG option : 1

Note1: The modulation signal is shown only for explanation. This signal is not output from DG-8000

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

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 at free



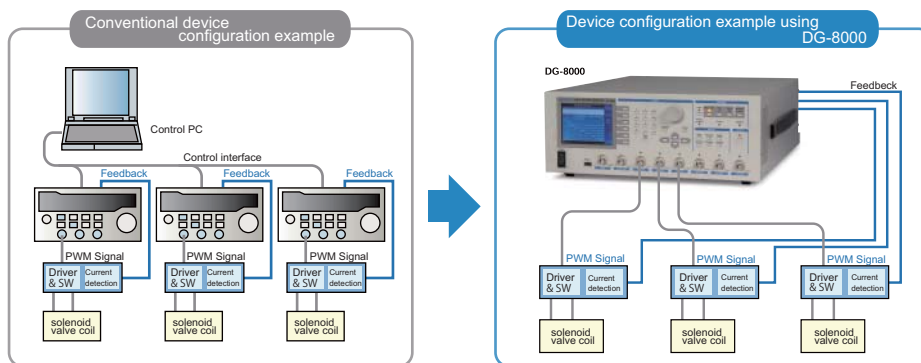
<Configuration example>
DG-8000 main unit : 1
DG-801 inverter and PPG option : 1
DG-802 operation pattern option : 1

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

Note1: The modulation signal is shown only for explanation. This signal is not output from DG-8000

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

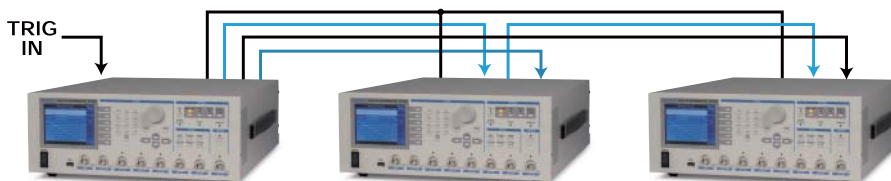
Application example: continuous operation test of a solenoid and other elements that control an electromagnetic valve



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 option : 1

Parallel operation of three generators to support 18-channel outputs



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 outputs as a fail safe when this function is used.

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

Delay Pattern Generator DG-8000 Specifications

General specifications

Pulse output terminal	
Number of CH	6CH
Output level	±10 V (open) / ±5 V (50 ohm)
Output range	Two ranges (large/small)
Output logic	Positive/negative
Output impedance	50 ohm
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: ±5 V,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 ±100 ppm or less required
Frequency control input	For External modulation option(DG-601) and operation pattern option(DG-802), BNC terminal (1)
External modulation (PWM)	For External modulation option(DG-601), BNC terminal (3)
REAR TRIG input	For Quick synchronization operation option(DG-602), BNC terminal (1)
ALARM SENSE input	For Quick synchronization operation option(DG-602), BNC terminal (1)
Output control	
Oscillation start/stop	A 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 indication	
TRIG'd	Indicates when TRIG is applied.
OUTPUT, CH 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 pixels
Others	
SETUP save/recall	Supported (10 internal memories)
Power-saving mode	Supported
Beep function	Supported
Status display	Supported
Power supply unit	
AC power supply	AC100 V to AC240V (50/60 Hz)
Power consumption	190 VA,max
Mechanical section	
External dimensions (mm)	400 (W) x 150 (H) x 497 (D) (without external projections)
Weight	Approx. 8 kg
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-R(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	1 mHz to 10 MHz (1 mHz or 9-digit resolution) 100 ns to 1,000 s (10 ns or 9-digit resolution)
Frequency/cycle accuracy	±50 ppm
Standard CH	Select SYNC or both edges of a channel which smaller
Delay	0 ns, 10 ns to 1,000 s (10 ns or 9-digit resolution)
Pulse width	0 ns, 50 ns to 1,000 s (10 ns 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 1 s, 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 at the same time.
Internal modulation	PWM modulation and delay modulation
3-phase pattern A	
Oscillation mode	CONT, TRIG'd CONT, GATE
Cycle (Tc)	Determined by setting Tw2. $Tc = (Tw1 + Tw2) \times 3$
Tw1 and Tw2 setting range	0 ns, 100 ns to 100 s
Tw3 setting range	0 ns, 100 ns or more (Tc - TW1)
Pulse width setting resolution	100 ns or 9 digits
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	0 ns, 100 ns to 100 s
Tw2 setting range	0 ns, 100 ns or more (Tc - 2 x TW1)
Tw3 setting range	100 ns to 100 s
Pulse width setting resolution	100 ns or 9 digits
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 unipolar, single-phase bipolar 3-phase 2-level
Common setting parameters	
Carrier frequency	100 mHz to 1 MHz
Modulation frequency	1 mHz to 10 kHz
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	1 mHz to 10 MHz (1 mHz or 6-digit resolution)
Memory length	10 kW or 100 kW
Clock specifying mode	
CK frequency	100 Hz to 100 MHz (resolution: 1 mHz or 6 digits)
Memory length	10 kW or 100 kW
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 ohm
Resolution	12 bits
Frequency characteristics	100 kHz, amplitude of 90% or more (1 kHz 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)

IWATSU http://www.it.iwatsu.co.jp/index_e.html
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8201-5501-0
C.S(OK)2010-10-02