Test&Measurement

All Products Guide

Vol. 5

Precision Making

Yokogawa Meters & Instruments Corporation

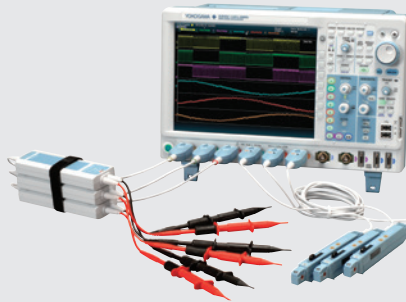# Main Products Line up

Oscilloscopes

ScopeCorder
DL850E/DL850EV

High-Speed Data Acquisition Unit
SL1000

Mixed Signal
Oscilloscopes
DLM2000 Series

Mixed Signal Oscilloscopes
DLM4000 Series

Digital Power Analyzer

Precision Power Analyzer
WT3000E

Precision Power Scope
PX8000

Precision Power Analyzer
WT1800

Power Analyzer
WT500

new

Digital Power Meters
WT300E Series

Generators, Sources, Manometers etc.

DC Voltage /
Current Source
GS200

AC Voltage
Current Standard
2558A

Precision DC
Calibrator
2553A

new

Precision DC
Calibrator
2560A

Optical Measuring Instruments

new

Optical Spectrum
Analyzer
AQ6370 Series

Optical Wavelength Meter
AQ6150 Series

Multi Application Test
System
AQ2200 Series

Optical Time Domain
Reflectmeter
AQ7280

Optical Loss Test Set
AQ1100

Multi Field Tester
OTDR
AQ1200 Series

1G/10G Ethernet Tester
AQ1300 Series

AQ2170
Series

AQ2180
Series

AQ4280
Series

Handy size
Optical Power Meter
/ Light Source

Calibrator

CA700   new   CA310   CA320   CA330   CA150   CA71   CA450

Digital Multimeter

TY700 Series   TY500 Series   732 Series   73101

Insulation Tester

MY40   MY10 Series   2406E Series   3213A Series

Illuminance Meter

510 Series

Earth Tester

EY200

Clamp-on Tester

CL150/155   CL220   300 Series   CL420

Thermometer

TM20   TX10 Series

Meters Products

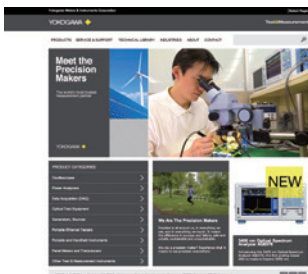201314   204102   205206

Clamp-on Power Meter

new   CW500   CW10

Internet Website

http://tmi.yokogawa.com

The Yokogawa website offers not only product and technical information but also campaign information, user registration, document download, free software download, e-mail news subscription, catalog request, price inquiry, and lots of other content.
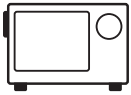
Precision Measuring Instruments

279301   276910

Contents

[Calibrator]
CA700, CA150, CA51/CA71, CA310, CA320, CA330, CA310, CA320, CA330, CA450, CW500

[Clamp-on Power Meter]
CW10

[Digital Multimeter]
TY700 Series, TY500 Series, 732 Series, 73101, 96095

[Clamp-on Tester]
CL100 Series, CL200 Series, 30031A/30032A, CL300 Series, CL400 Series

[Insulation Tester]
MY40, 2406E Series, MY10 Series, 3213A Series
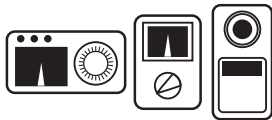
[Earth Tester, Other Products]
EY200, 322610, 510 Series

[Thermometer]
TM20, TX10 Series

[Precision Measuring Instruments]
2792A Series, 278610/278620, 2769, 279301/279303, 2755

[Meters Products]
Portable Instruments 2011 to 2053

CE Products with this mark conform to the EMC standards (regulations on electromagnetic interference) of European Community.

Oscilloscopes

Digital Power Analyzers

Generators, Sources, Manometers etc.

Optical Measuring Instruments

Calibrator

Clamp-on Power Meter

Digital Multimeter

Clamp-on Tester

Insulation Tester

Earth Tester, Other Products

Thermometer

Precision Measuring Instruments

Meters Products

Oscilloscopes

■ They can be used to capture single-shot or infrequently recurring signals.
They can also execute computations on repetitive waveforms, and automatically extract waveform parameters.

	Model	DL850E/DL850EV ...P8	High-Speed Data Acquisition Unit SL1000 ...P12
Item			

Features		• Powerful mobile data acquisition recorders
		• Measure & analyze dynamic behavior of electromechanical systems
		• Flexible modular inputs for voltage, current, sensors, CAN/LIN bus and SENT.
		• Trend & Trigger on electrical power calculations (optional)
			• Fast Acquisition, Transfer, and Storage
			• High-Performance Data Acquisition Unit
			• Easy to use
			  Easy to use Standard Acquisition Software
			• Max 128 ch Synchronized (16 ch x 8 units)
			  Data files recorded my multiple units, in synchronized mode, are all linked together by a common LINK file, thereby facilitating batch processing.

Max. sampling rate		100 MS/s (*2)	100 MS/s (*2)
Bandwidth		20 MHz (*2)	20 MHz (*2)
Number of analog input channels		128 ch max (when using eight 720220 modules)	16 ch max (when using any 2 ch input module.)
Logic input		128 bits max (when using eight 720230 modules)	
Max. vertical sensitivity (1:1)		100 µV/div (*2)	100 µV/div (*2)
Vertial axis resolution		16 bit (*2)	16 bit (*2)
Max. sweep sensitivity		100 ns/div (*2)	15 ns/div (Zoom display)
Max. record length	St'd	250 Mpts (MW) max / 10 Mpts (MW) (16 ch)	50 MW/ch (Single Trigger Mode)
	Optional	2 Gpts (GW) max / 100 Mpts (MW) (16 ch)	—
Internal media drive	St'd	SD memory card slot	—
Internal HDD	Optional	Internal 500 GB or external HDD (selectable)	Internal 500 GB
Interface	St'd	USB2.0/ Ethernet (1000BASE-T)	USB2.0
	Optional	GPIB	Ethernet (1000BASE-T)
Internal printer		112 mm width (optional)	—
Others	Optional	• 19 types of plug-in modules • Real time math function • IRIG interface • Probe power (4-output) • GPS interface • Power math function • User-defined math function • DC 12V Power drive (DL850EV only)	• 12 types of plug-in modules • Probe power (4-output) • Without Xviewer • With the Xviewer Math Edition (1 license) (701992-GP01)
Display (TFT LCD)		10.4-inch color XGA	(PC-based Acquisition Software)
External dimensions W × H × D (mm)		355 × 259 × 180	319 × 154 × 350
Weight (kg)		Approx. 6.5 (*3)	Approx. 6.0 (*3)

*1: See each product catalog for more detaled specifications   *2: Depends on input module   *3: Plug-in modules are not included

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Plug-in Module Selection Guide[1]

Input	Model No.	Sample rate	Resolution	Bandwidth	Number of channels	Isolation	Maximum input voltage (DC+ACpeak)	DC accuracy	Note
Analog Voltage	720211[9]	100 MS/s	12-Bit	20 MHz	2	Isolated	1000 V[2] 200 V[3]	±0.5%	High speed · High voltage · Isolated
	701250[5]	10 MS/s	12-Bit	3 MHz	2	Isolated	600 V[2] 200 V[3]	±0.5%	high noise immunity
	701251	1 MS/s	16-Bit	300 kHz	2	Isolated	600 V[2] 140 V[3]	±0.25%	High sensitivity range (1 mV/div), low noise (±100 μVtyp.), and high noise immunity
	720254	1 MS/s	16-Bit	300 kHz	4	Isolated	600 V[2] 200 V[3]	±0.25%	4 CH BNC input low noise, high noise immunity
	701255[5]	10 MS/s	12-Bit	3 MHz	2	Non-Isolated	600 V[4] 200 V[3]	±0.5%	non-isolation version of model 701250
	701267	100 kS/s	16-Bit	40 kHz	2	Isolated	850 V[10]	±0.25%	with RMS, and high noise immunity
	720220	200 kS/s	16-Bit	5 kHz	16	Isolated (GND-terminal) non-isolated (CH-CH)	42 V[3]	±0.3%	16 CH voltage measurement (Scan-type)
Analog Voltage & Temperature	701261	100 kS/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1°C (Temperature)	40 kHz (Voltage), 100 Hz (Temperature)	2	Isolated	42 V	±0.25% (Voltage)	thermocouple (K, E, J, T, L, U, N, R, S, B, W, iron-doped gold/chromel)
	701262	100 kS/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1°C (Temperature)	40 kHz (Voltage), 100 Hz (Temperature)	2	Isolated	42 V	±0.25% (Voltage)	thermocouple (K, E, J, T, L, U, N, R, S, B, W, iron-doped gold/chromel), with AAF
	701265	500 S/s (Voltage), 500 S/s (Temperature)	16-Bit (Voltage), 0.1°C (Temperature)	100 Hz	2	Isolated	42 V	±0.08 (Voltage)	thermocouple (K, E, J, T, L, U, N, R, S, B, W, iron-doped gold/chromel), high sensitivity range (0.1 mV/div), and low noise (±4 μVtyp.)
	720221[8]	10 S/s	16-Bit	600 Hz	16	Isolated	42 V	±0.15% (Voltage)	16-CH voltage or temperature measurement (scan method) Thermocouple (K, E, J, T, L, U, N, R, S, B, W, Au-Fe-chromel)
Strain	701270	100 kS/s	16-Bit	20 kHz	2	Isolated	10 V	±0.5% (Strain)	Supports strain NDIS, 2, 5, 10 V built-in bridge power supply
	701271	100 kS/s	16-Bit	20 kHz	2	Isolated	10 V	±0.5% (Strain)	Supports strain DSUB, 2, 5, 10 V built-in bridge power supply, and shunt CAL
Analog Voltage, Acceleration	701275	100 kS/s	16-Bit	40 kHz	2	Isolated	42 V	±0.25% (Voltage) ±0.5% (Acceleration)	built-in anti-aliasing filter, Supports built-in amp type acceleration sensors (4 mA/22 V)
Frequency	701281	1 MS/s	16-Bit	resolution 625 ps	2	Isolated	420 V[2] 42 V[3]	±0.1% (Frequency)	Measurement frequency of 0.01 Hz to 500 kHz, Measured parameters (frequency, rpm, period, duty, power supply frequency, distance, speed)
Logic	720230	10 MS/s	—	—	8-bit × 2 ports	non-isolated	depend on logic probe used.	—	(8-bit/port) × 2, compatible with four-type of logic probe (sold separately)
CAN	720240	100 kS/s	—	—	(60signals × 2) port	Isolated	10 V	—	CAN Data of max. 32-bit allowable It is available for DL850EV only. Max. two (2) modules can be installed in a main unit.[6][7]
CAN, LIN	720241	100 kS/s	—	—	(60signals × 2) port	Isolated	10 V (CAN port) 18 V (LIN port)	—	CAN port × 1, LIN port × 1 Available for DL850EV only, up to 2 modules[6][7]
SENT	720243	100 kS/s	—	—	11 data × 2 ports	Isolated	42 V	—	Supported protocol: SAE J2716. It is available for DL850EV only. Max. four (4) modules can be installed in a main unit.[6][7]

*1: Probes are not included with any modules.   *2: In combination with 700929, 702902 or 701947 probe.   *3: Direct input   *4: In combination with 10:1 probe model 701940
*5: Some of the models 701250/701255 shipped on or before July, 2007 may require factory rework.   *6: Any other modules can be installed in the remaining slots.
*7: Up to four CAN Bus Monitor Modules (720240), CAN & LIN Bus Monitor Modules (720241) or SENT Monitor Module (720243) in total can be used on a single main unit. For the CAN Bus Monitor Modules (720240) and CAN & LIN Bus Monitor Modules (720241), up to two in total can be used on a single main unit.   *8: The 16-CH Scanner Box (701953) is required for measurement.
*9: Class 1 Laser Product, IEC60825-1:2007   *10: In combination with 758933 and 701954.

Compatibility of the plug-in modules with the main units.

Plug-in Module		Main Unit		
Model	Name	DL850E	DL850EV	SL1000
701250	High-speed 10 MS/s 12-Bit Isolation Module	available	available	available
701251	High-speed 1 MS/s 16-Bit Isolation Module	available	available	available
701255	High-speed 10 MS/s 12-Bit non-Isolation Module	available	available	available
701261	Universal Module	available	available	available
701262	Universal Module (with Anti-Aliasing Filter)	available	available	available
701265	Temperature/high-precision voltage Module	available	available	available
701267	High-voltage 100 kS/s 16-Bit Isolation Module (with RMS)	available	available	available
701270	Strain Module (NDIS)	available	available	available
701271	Strain Module (DSUB, Shunt-CAL)	available	available	available
701275	Acceleration/Voltage Module (with Anti-Aliasing Filter)	available	available	available
701281	Frequency Module	available	available	available
720211	High-speed 100 MS/s 12-Bit Isolation Module	available	available	available
720220	16 CH Voltage Input Module	available	available	NA
720221	16 CH Temperature/Voltage Input Module	available	available	NA
720230	Logic Input Module	available	available	NA
720240	CAN Bus Monitor Module	NA	available	NA
720241	CAN & LIN Bus Monitor Module	NA	available	NA
720243	SENT Monitor Module	NA	available	NA
720254	4 CH 1 MS/s 16-Bit Isolation Module	available	available	NA

* Probes are not included with any modules.
* Up to four CAN Bus Monitor Modules (720240), CAN & LIN Bus Monitor Modules (720241) or SENT Monitor Module (720243) in total can be used on a single main unit. For the CAN Bus Monitor Modules (720240) and CAN & LIN Bus Monitor Modules (720241), up to two in total can be used on a single main unit. These modules are available for the DL850EV only.
* The use of a 720221 module always requires the External Scanner Box (model 701953).

ScopeCorder **DL850E/DL850EV**

Powerful data acquisition enables the research of dynamic behavior within your application

DL850EV

DL850E

CE

Overview

A ScopeCorder is a powerful portable data acquisition recorder that can capture and analyze both transient events and trends up to 200 days. Using flexible modular inputs it combines the measurements of electrical and physical (sensor) signals, such as from CAN, LIN, SENT and is also able to trigger on electrical power related calculations in real-time.

Flexible Inputs with Built-in Signal Conditioning
Choose from up to 19 input modules and gain a thorough insight into any application by synchronizing the measurement of multiple parameters.

- Voltage and Current
- Sensor Outputs
- Temperature, Vibration /Acceleration, Strain, Frequency
- Logic Signals & CAN / LIN and SENT

Basic Specifications

Max. sampling rate	100 MS/s (720211)[*1]
Frequency bandwidth	20 MHz (720211)[*1]
Number of channels	Max. 128 ch,
	Number of slots for the plug-in module: 8
Logic input	Max. 128 bits
	(When using eight 720230 modules)
A/D conversion resolution	16 or 12 bits [(1*)]
DC accuracy	±(0.5% of 10 div)
	(701250 and 701255)[*1]
Time axis setting	100 ns/div to 20-day/div
Time axis accuracy	±0.005%
Max. record length	Standard 10 Mpts (MW)/ch, total 250 Mpts
	(MW) (with /M2 option)
	100 Mpts (MW)/ch, total 2 Gpts (GW)
Channel-to-channel calculation function	Definable math waveforms 8
Automatic measurement of waveform parameters	Maximum number of measured parameters 32
Cycle statistical/historic process	Maximum number of cycles 64,000
	Maximum number of parameters 64,000
Internal media drive	SD memory card slot (standard)
	500 GB internal hard drive (option)
	External hard drive can be connected (option)
Communication interface	USB 2.0 (standard)/1000BASE-T Ethernet (standard)
	GP-IB (option)
Built-in printer(option)	112-mm width, A6 thermal printer
Other options	IRIG interface
	GPS interface
	User defined computation
	Real time math computation
	Power math computation
	Four probe power outputs
	DC 12 V power drive (DL850EV only)
Display	10.4-inch TFT color LCD monitor
Display resolution	1024 × 768 pixels (XGA)
External dimensions	355 (W) × 259 (H) × 180 (D) mm
	(excluding handle and protrusions)
Weight	Approx. 6.5 kg to 9 kg (varies depending on
	the types and the number of modules used)

(*1): Varies depending on the module.

● Large (2 GPoint) memory offers long duration measurement and two instantaneous zoom locations – 2 GPoint memory (/M2 option) –
Comes standard with 250 MPoints of memory, expandable with 1 or 2 GPoint options.
Large capacity memory does not only simply provide longer durations of measurement, but also higher sampling rate at the same measurement time or multi-channel at the same sampling rate.

Zoom to 2 locations instantaneously

GiGAZoom 2 ENGINE

Up to 2 million times!

Main screen:
20 days of recording
(2 days/div)

Zoom screen:
1 hour (12 min/div)
&
1 second (100 ms/div)

Instantly zooms 1 second (100 ms/div) even when the main screen is displaying 20 days of recording (2 days/div)

Long memory does not guarantee better efficiency if the memory handling and display engine is slow. Our faster than ever GiGAZoom 2 Engine instantaneously zooms into two locations.

● Long duration, continuous saving of waveforms – Hard disk recording (/HD0, /HD1 option) –
Measured data can be streamed directly to a built-in 500 GB hard disk (/HD1 option)[*1] or through the external HDD interface (/HD0 option)[*1]. With long periods of evaluation testing, measurements can be performed at 100 kS/s on 16 channels simultaneously for 10 hours[*2].

*1 The /HD0 and /HD1 options cannot be specified together.
*2 It depends on the external hard disk connected when using the /HD0 option.
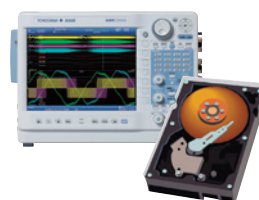
100 kS/sec with 16 ch simultaneously

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● Continuous data recording for durability test and/or surveillance test

Intuitive, user-friendly acquisition software comes standard. Continuous data recording into a PC Hard Disk Drive(HDD) can be performed by "free-run mode" with no restriction of recording time and file size. The Wizard automatically recognizes any connected DL850E and its' plug-in modules. Just click the Start button to start measuring right away--no complicated settings to enter.

DL850E ACQ Software

Ethernet or USB

PC-Internal HDD

DL850E (front-end)
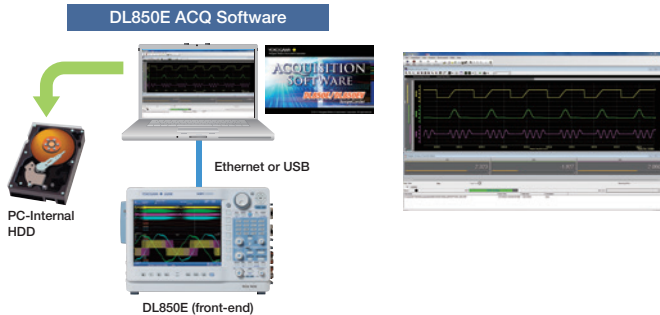
● Time synchronization for accurate measurements – GPS interface (/C30 option) –

A GPS antenna can be directly connected to the DL850E side panel. The DL850E time clock and the sampling clock can be adjusted accordingly.

GPS satellite

GPS antenna

Note: This option can be provided only for a nation that is not prohibited by the Radio Law.

● Trend waveform monitor for power and harmonic parameters in real time – /G5 option –

Max. 126-type power parameter can be calculated. The calculation results of these parameters can be displayed in DL850E screen as trend waveforms in real time. The raw signal waveforms along with calculated parameters(waveforms) can be displayed as trend waveforms with maximum data updating rate of 100 kS/s.
Trend waveforms of each orders of harmonics, bar-graphs and vector displays can be displayed.
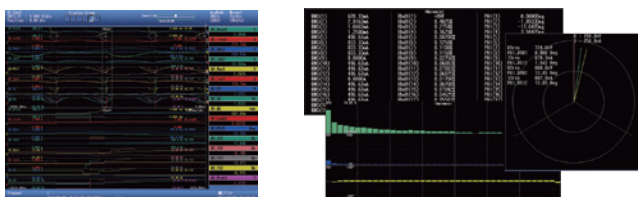
[Power parameter trend display example]

[Harmonic analysis example]

Once the "Analysis" key is pressed on the front panel, the dedicated set-up menu will appear on the screen which enables to setup easily.

For example, 6-input(3-voltage and 3-current) waveforms for 2-line, which are total 12 raw signal waveforms, can be monitored simultaneously along with max. 126-parameter/1-line (or 54-parameters/2- line) can be calculated.

Inverter

Input

Converter section
Drive circuit
Convert AC to DC signals
Modulate DC signal and convert to any AC signals

Inverter/Motor Testing

Motor
Torque/ rotation sensor
Load

3-Voltage and 3-Current

3-Voltage and 3-Current

DL850E /G5

DL850EV
VEHICLE EDITION

Enhanced capabilities for vehicle design and development such as CAN, LIN buses and SENT monitoring

The ScopeCorder Vehicle Edition is designed for engineers working in the automotive and railway industry. A common measurement challenge is to combine measurements of electrical signals, physical performance parameters indicated by sensors, together with CAN bus, LIN bus or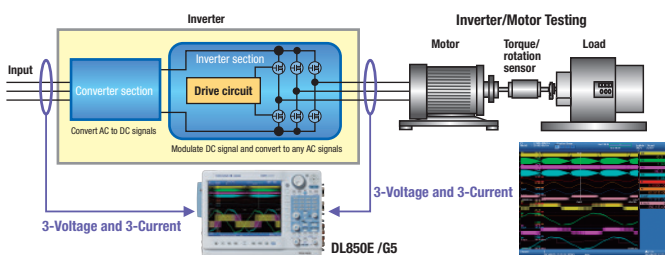 SENT data transmitted by the powertrain management system. A ScopeCorder Vehicle Edition addresses this challenge by combining the measurement of all signals to provide thorough insight into the dynamic behavior of the electromechanical system. The result is a considerable time saving compared to other approaches such as analysis on PC or other software.

[Example of comparison and verification of a measured signal and CAN bus signal]

Measurement by a module other than the CAN Bus Monitor Module

Physical signal input (analog voltage, command pulse)

Data frame input

1 frame output (CAN only)
(Data or remote frame)

CAN bus

I/O in CAN Bus Monitor Module
ECU
Module
Sensor 1
Sensor 2
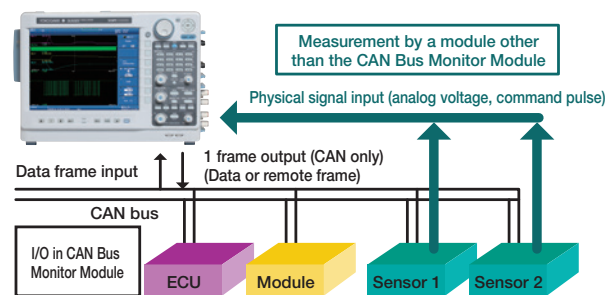
Note: There is a certain restriction when using the 720240, 720241 and/or 720243 modules together with the /G5 option. Please contact our sales representative.

Support for both AC and DC power
(/DC option, DL850EV only)

■ Low power consumption of 60 - 120 VA (typ.)

• Can be driven by external DC power such as the vehicle's battery
12 V DC (10 – 18 V)

■ Low noise compared to using an external inverter

• Can also be driven by AC power.
100 V AC (100 – 120 V)
200 V AC (200 – 240 V)
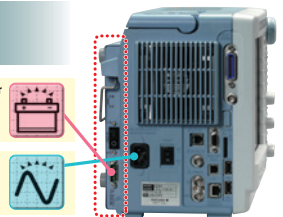
Model Number and Suffix Codes

Models and Suffix Codes

Model	Suffix Codes	Description
DL850E		DL850E main unit, 250 MPts(W) memory*1
DL850EV		DL850EV main unit, 250 MPts(W) memory*1
Power Cord	-D	UL and CSA standard
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
	-N	NBR standard
Languages	-HE	English menu and panel
	-HJ	Japanese menu and panel
	-HC	Chinese menu and panel
	-HK	Korean menu and panel
	-HG	German menu and panel
	-HF	French menu and panel
	-HL	Italian menu and panel
	-HS	Spanish menu and panel
Options	/B5	Built-in printer (112 mm)*5
	/DC	DC12 V power (10-18 V DC) (can be specified for DL850EV only)*5
	/M1	Memory expansion to 1 GPts(W)*2
	/M2	Memory expansion to 2 GPts(W)*2
	/HD0	External HDD interface*3
	/HD1	Internal HDD (500 GB)*3
	/C1	GP-IB interface*4
	/C20	IRIG and GP-IB interface*4
	/C30	GPS interface*4, *7
	/G2	User-defined math function
	/G3	Real time math function*6
	/G5	Power math function (with including Real time math function)*6
	/P4	Four probe power outputs

*1: The main unit is not supplied with a plug-in module.
*2, *3, *4, *5, and *6: When selecting these, specify one of them.
*7: The /C30 option can be provided only for a nation that is not prohibited by the Radio Law.

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Oscilloscopes

Waveform Measuring   ScopeCorder Accessories

Product	Model No.	Description[1]	
Differential Probe	700925	DC to 15 MHz, 1/10-1/100 selector switch, max. allowable differential voltage ±500 V (DC + ACpeak)	
Differential Probe	700924	DC to 100 MHz, 1/100-1/1000 selector switch, max. allowable differential voltage ±1400 V (DC + ACpeak) or 1000 Vrms (1/1000 range)	
Current Probe	701917	5 Arms, DC to 50 MHz, High-sensitivity	
Current Probe	701933	30 Arms, DC to 50 MHz, supports probe power	
Current Probe	701930	150 Arms, DC to 10 MHz, supports probe power	
Current Probe	701931	500 Arms, DC to 2 MHz, supports probe power	
Current Probe	701932	30 Arms, DC to 100 MHz, supports probe power	
Probe Power Supply	701934	Supply (4 outputs), large current output, external probe power	
10:1 Probe (for Isolated BNC Input)	700929	1000 Vpk-CAT II	
10:1 Probe (wide temperature range, for isolated BNC input)	702902	-40 to +85°C, DC to 60 MHz, 1000 Vpk-CAT II	
1:1 Safety BNC Adapter Lead (in combination with followings)	701901	1000 Vrms-CAT II	
	Safety mini-clip (Hook type)	B9852MM	1000 Vrms-CAT III, black
	Safety mini-clip (Hook type)	B9852MN	1000 Vrms-CAT III, red
	Large Alligator-Clips (Dolphin type)	701954	1000 Vrms-CAT II, 1 set each of red and black
Passive Probe (10:1)[2]	701940	Non-isolated 600 Vpk	
1:1 BNC-Alligator Cable	366926	Non-isolated 42 V or less, 1 m	

*1: Actual allowable voltage is the lower of the voltages specified for the main unit, probe and cable.
*2: 42 V is safe when using the 701940 with an isolated type BNC input.

Accessories Combinations

High-speed 100 MS/s
12-Bit Isolation Module
720211

Isolation probe
700929

Plug on clip
701948

High-speed 10 MS/s
12-bit Isolation Module
701250

Isolation probe
701947

Long Test Clips
701906

High-speed 1 MS/s
16-bit Isolation Module
701251

10:1 Passive Probe
702902

4 mm Conversion Adapter
**B8099NL/
B8099NM**

Large Alligator Clips
(Dolphin Type)
701954

High-Voltage 100 kS/s
16-Bit Isolation Module
701267

1:1 Safety BNC
Adapter Lead
701901

Safety mini clips
(Hook Type)
B9852MM/B9852MN

Measurement Lead Set
758933

Alligator Adapters
758922

Frequency Module
701281

Safety BNC Cable
1 m : **701902**
3 m : **701903**

Alligator Adapters
758929

Current Probe 30 Arms
DC-50 MHz
701933

Fork Terminal Adapters
758921

4CH 1 MS/s
16-bit Isolation Module
720254

Current Probe
150 Arms DC-10 MHz
701930

/P4, Probe Power
4-output (option)

Current Probe
500 Arms DC-2 MHz
701931

Probe Power
4-output
701934

Current Probe
5 Arms DC-50 MHz
701917

Strain Module (NDIS)
701270

Bridge Head (NDIS)
120 Ω : **701955**
350 Ω : **701956**

Strain Module
(DSUB Shunt-CAL)
701271

Bridge Head
(DSUB, Shunt-Cal)
120 Ω : **701957**
350 Ω : **701958**

Acceleration/Voltage
Module (with AAF)
701275

Passive Probe for
SL1400/DL750
701940

BNC cable
1 m: **366924**
2 m: **366925**

BNC-alligator cable
366926

High-speed 10 MS/s 12-bit
Non-isolation Module
701255

±500 V, 15 MHz
Differential Probe
700925

±1400 V, 100 MHz
Differential Probe
700924

Warning:
Connect the probe earth
cable to ground (grounding
potential) when using these
differential probes with
isolation modules.

7000 Vpk, 50 MHz
Differential Probe
701926

Universal Module
701261

1:1 Banana-alligator Cable
366961

Universal Module
(with AAF)
701262

Shunt Resister for 4-20 mA Measurement
250 Ω ± 0.1% : **438920**
100 Ω ± 0.1% : **438921**
10 Ω ± 0.1% : **438922**

Temperature/High-precision
Voltage Module
701265

High-speed Logic Probe
700986

Isolated Logic Probe
700987

Logic input
Module
720230

Logic Probe
(TTL level/Contact Input)
1 m : **702911**
3 m : **702912**

Scanner Box
701953
(Provided with a connecting cable)
Note:
This unit is always required for
measurement.

16 CH Temp./Voltage
Input Module
720221

11

Oscilloscopes

Fast Acquisition, Transfer, and Storage High-Performance Data Acquisition Unit

SL1000

GiGAZoom
E N G I N E ™

Basic Specifications

Plug & Play:	Auto-recognition of units and modules
Input type:	Plug-in module (A/D converters built in to each unit)
Maximum number of input channels:	
	16 (One unit operation)
	128 (8 units synchronous operation)
Maximum sample rate:	100 MS/s on all channels
Measuring mode:	Free Run and Triggered
Clock source:	Internal and external

Maximum record length (internal memory):
In Free Run mode 1 module: 32 MW/ch
2 modules: 16 MW/ch
3 to 4 modules: 8 MW/ch
5 to 8 modules: 4 MW/ch
In Single Trigger mode 1 module: 50 MW/ch
2 modules: 25 MW/ch
3 to 4 modules: 10 MW/ch
5 to 8 modules: 5 MW/ch
Measuring groups: Up to 4 groups definable with independent sample rates
Trigger mode: Normal, Single, and Single(N)
Trigger source: Input channel, External, LINE , Time
Record conditions:
For Free Run mode Immediate, abs. time, time divided, alarm, and external trigger
For Trigger mode Each trigger
Internal hard disk: 500 GB (with the /HD1 option)
Maximum real-time hard disk recording speed:
Internal hard disk 1.6 MS/s
(= 200 kS/s × 8 ch = 100 kS/s × 16 ch)

Maximum measuring time (unit: sec) at Single triggered measurement

		Number of Measuring Channels			
		2 ch	**4 ch**	**8 ch**	**16 ch**
Sampling rate	100 MS/s	0.5	0.25	0.1	0.05
	50 MS/s	1	0.5	0.2	0.1
	10 MS/s	2.5	1.25	0.5	0.25
	1 MS/s	25	12.5	5	2.5
	500 kS/s	100	50	20	10
	200 kS/s	250	125	50	25
	1 kS/s	50000	25000	10000	5000

Features

● **Fast Acquisition**
– Up to 100 MS/s on all channels (10 ns sampling interval)
– Supports parallel testing: Perform measurements with up to four simultaneously independent sample rates

● **Fast Transfer and Storage**
– Stream data to PC via high speed USB 2.0 or 1000BASE-T Gigabit Ethernet
– Stream data to a PC hard disk or the SL1000's internal hard disk in real time (at speeds of 1.6 MS/s = 100 kS/s × 16 ch)[1]
– Maximum 8 synchronized units
  1: Speed depends on PC performance and measuring conditions.

● **Easy to use**
– Easy to use Standard Acquisition Software
● **Max 128 ch Synchronized (16 ch x 8 units)**
– Data files recorded by multiple units, in synchronized mode, are all linked together by a common LINK file, thereby facilitating batch processing. Using this LINK file, data from all units can be processed and analyzed, as one, at the same time.

Ethernet/USB

SYNC IN   SYNC OUT

Unit 0 Waveform file   Unit 1 Waveform file   Unit 2 Waveform file   Unit 7 Waveform file

Unit 1-7 Data link file
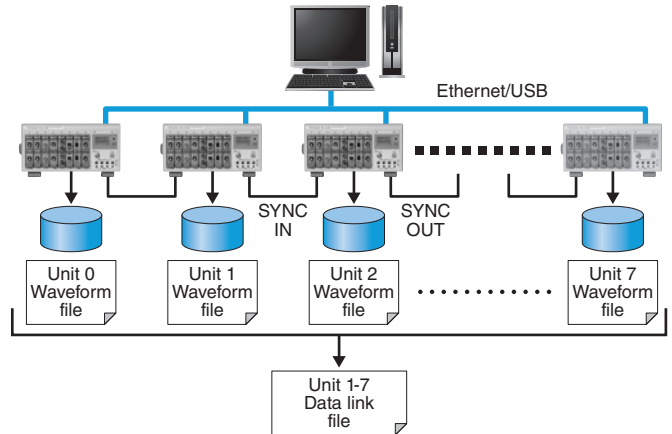
● **Stand-Alone Recording**
– Normally, SL1000 is controlled by PCs. However, SL1000 can record data even without PCs (/HD1 option is required). This stand-alone recording function is useful for the measurement in the severe environment.

Model Number and Suffix Codes

Model	Suffix Code	Description
720120		SL1000 High-Speed Data Acquisition Unit[1] Including Xviewer Standard Edition (1 license)(701992-SP01)
Power cord	-D	UL and CSA standard
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard (Complied with CCC)
Options	/HD1	Internal 500 GB HDD
	/C10	Ethernet Interface
	/P4	Probe power (4-output)
	/XV0	Without Xviewer
	/XV1	With the Xviewer Math Edition (1 license)(701992-GP01)

*1: Plug-in modules and PC not included with the SL1000.

Model	Description
720211	High-speed 100 MS/s 12-Bit Isolation Module (2 ch)
701250	High-speed 10 MS/s 12-Bit Isolation Module (2 ch)
701251	High-speed 1 MS/s 16-Bit Isolation Module (2 ch)
701255	High-speed 10 MS/s 12-Bit non-Isolation Module (2 ch)
701267	High-voltage 100 kS/s 16-Bit Isolation Module (with RMS, 2 ch)
701261	Universal Module (2 ch)
701262	Universal Module (with Anti-Aliasing Fileter, 2 ch)
701265	Temparature / High-precision voltage Module (2 ch)
701275	Acceleration / Volatage Module (with Anti-Aliasing Filter 2 ch)
701270	Strain Module (NDIS, 2 ch)
701271	Strain Module (DSUB, Shunt-CAL, 2 ch)
701281	Frequency Module

Product	Model No.	Description
Synchronized connection cable	720901-01	For SL1000 (1 m)
	720901-02	For SL1000 (3 m)
Rack mounting kit	751541-E4	EIA standard
	751541-J4	JIS standard

High-Speed Data Acquisition Unit **SL1000 Acquisition Software**

Easy to Use

Main Specifications of Acquisition Software

Plug and Play	Auto-recognition of units and modules
Measurement modes	Free Run and Triggered
ACQ modes	Normal, envelope, and box average
Clock sources	Internal and external
Measurement groups	Up to 4 groups definable with independent sample rates
Trigger modes	Normal, single, and single(N)
Trigger sources	CH1-CH16, LINE, Time, and External
Other trigger functions	Combination trigger, hold-off, pretriggers, and trigger delay
Save conditions	Manual operation, or based on time, or alarms
Other save functions	Manual save (file division), specify no. of saves, save all data in memory, and save simultaneously to PC's hard disk and SL1000's internal hard disk (with /HD1 option)
Save format	Binary data file (original, *.wdf)
Waveform data conversion (Xviewer)	Binary data file(s) can be converted to ASCII (*.csv) or Excel (*.xls) format
Maximum speed for saving in real time	
PC hard disk	1.6 MS/s (= 100 kS/s × 16 channels)[1]
Waveform monitor	Trend display (displays measured waveforms of different sample rates simultaneously)[2], and instantaneous value displays (digital, bar graph, meter, and thermometer)
X-Y display	X-axis channel settings, selection of main or zoomed waveform (in Triggered mode), and selection of the number of data points to draw (2 K, 10 K, 100 K)
Mark display (Free run mode)	Setting of marks (up to 128 marks, each mark can display up to 16 characters), display color setting, mark editing, deletion of marks, mark list, collectively saving mark data with the same file name as the waveform data, and loading mark data into Xviewer.
Accumulation display	Accumulates T-Y and X-Y waveforms
Snapshot	Waveform that is currently being displayed can be retained on the screen as a snapshot waveform. Display color setting and snapshot waveform deletion
Display groups	Up to 4 display groups
Other display functions	History waveform, arbitrary axis divisions, and horizontal axis scaling + specifiable units (external clock)
Waveform analysis	Cursor and parameter measurement[3]
Offline waveform computation (with /XV1 option)	
Max. Number of displayed waveforms (CHs)	10 waveforms (Math1 to Math 10)
Operations	+, -, ×, /, trigonometry, differentiation/integration, FFT, and others
Alarms	Channel (alarm display and alarm history analysis)[4], system alarm, and alarm output
GO/NO-GO determination[3]	Waveform parameter judgment and judgment output
System requirements	
OS	Windows XP (SP2 or later) /Windows 7 (32 bit /64 bit) / Windows 8 (32 bit /64 bit)
CPU	Core 2 Duo 2 GHz or better
Memory	1 GB or more
Hard disk	500 MB or more of free space (40 GB or more when using the auto-save function)
Communication interfaces	USB 2.0/Ethernet 1000BASE-T (with /C10 option)
Display	XGA or better, Color: 65536 colors or better
Other	CD-ROM drive and mouse

*1: Typical values. Actual values depend on PC performance and measurement conditions.
*2: When the measurement mode is Free Run, the trigger mode is Single(N), and the number of measurements is Infinite, there may be a limit to the number of channels that can be trend-displayed during measurement.
*3: Triggered measurement
*4: Free Run measurement

Intuitive Operation

Setup Wizard Makes It Easy

The four screens of the Setup Wizard guide you easily through detailed settings for configuring the system, measuring, saving, and displaying. You can save and recall your settings at any time.

Setup Wizard
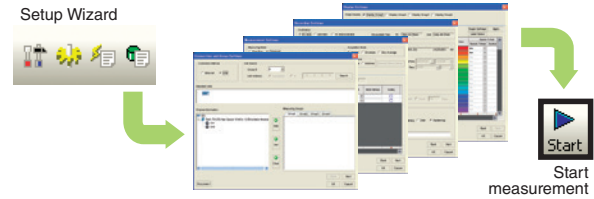
Start measurement

Control Buttons—Just Like Your DVD Remote

Measurement and saving can be started and stopped using the same familiar buttons found on a DVD remote control. Start using the instrument on the same day you receive it, with absolutely no programming required.

Displaying X-Y Waveforms

You can view both T-Y waveform display and X-Y waveform display. Using its fast update feature, you can evaluate data quickly and easily.
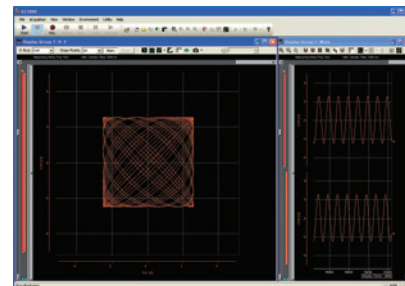
Accumulating Waveforms

Using the accumulation feature, you easily view unevenness of repetitive data.
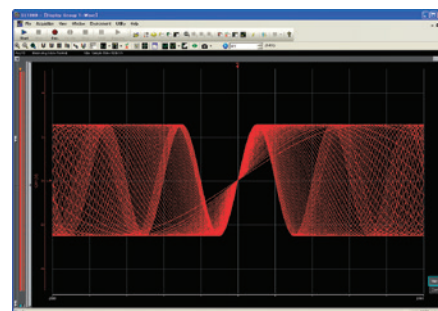
Setting Marks

You can enter comments in the Mark area when monitoring over long periods of time (Free Run mode).

13
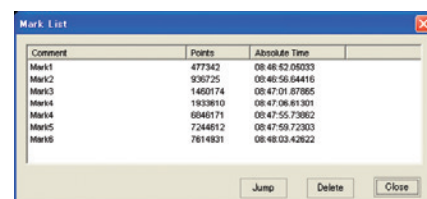
Oscilloscopes

■ The DLM series digital oscilloscopes have high-speed sampling and a wide range of bandwidths that can be utilized for design and development of electronic devices. They can also execute computations on repetitive waveforms and automatically extract waveform parameters.

The DLM series offers an extensive selection of digital oscilloscopes with large-capacity memories, powerful triggering functions, unique History Memory function and built-in printers. It also can save and load data to and from internal or external media.
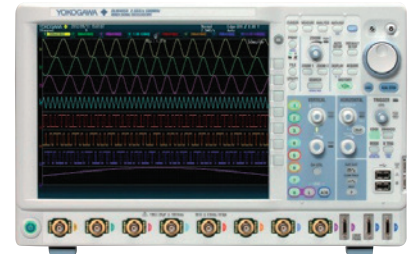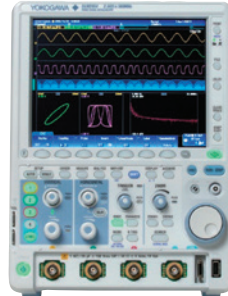
Item	Model	DLM2000 Series ...P16	DLM4000 Series ...P18
Features		Compact & lightweight Analog 4 ch/Analog 3 ch+Logic 8bits Long memory UART,I²C,SPI,CAN,CAN FD,LIN,FlexRay and SENT bus analysis functions Power supply analysis functions	Analog 8 ch+Logic 16bits/Analog 7 ch+Logic 24bits Long memory UART,I²C,SPI,CAN,CAN FD,LIN,FlexRay and SENT bus analysis functions Power supply analysis functions Large display
Max. sampling rate		2.5 GS/s	2.5 GS/s
Bandwidth		500 MHz[*2]	500 MHz[*2]
Number of analog input channels		DLM2022,DLM2032,DLM2052:2 DLM2024,DLM2034,DLM2054:4	8
Logic input	St'd	DLM2024, DLM2034, DLM2054: St'd 8 bits	8 bits
	Optional		24 bits
Max. vertical sensitivity (1:1)		2 mV/div	2 mV/div
Vertial axis resolution		8 bits	8 bits
Max. sweep sensitivity		1 ns/div	1 ns/div
Max. record length	St'd	62.5 Mpoints	12.5 Mpoints
	Optional	250 Mpoints	250 Mpoints
Internal storage	St'd	Approx. 300 MB	Approx. 1.8 GB
	Optional	Approx. 7.2 GB	Approx. 7.2 GB
Interface	St'd	USB	USB/Ethernet
	Optional	Ethernet/GP-IB	GP-IB
Built-in printer	Optional	112 mm width	112 mm width
Others	Optional	I²C bus analysis SPI bus analysis CAN, CAN FD and LIN bus analysis FlexRay bus analysis SENT bus analysis UART bus analysis Probe Power Power supply analysis functions User-defined math functions	I²C bus analysis SPI bus analysis CAN, CAN FD and LIN bus analysis FlexRay bus analysis SENT bus analysis UART bus analysis Probe Power Power Supply analysis functions User-defined math functions
Display (TFT LCD)		8.4-inch color, XGA	12.1-inch color XGA
External dimensions W × H × D (mm)		226 × 293 × 193	426 × 266 × 178
Weight (kg)		Approx. 4.2	Approx. 6.6

*1: See each product catalog for more detaled specifications.
*2: Depends on model

Common Features of DL/DLM Series

Multichannel

This feature meets the need to measure as many signals as possible simultaneously with one oscilloscope.

● DLM2000/DLM4000 series

The DLM2000 (DLM4000) series usually functions as 4 (8) channel analog, and is able to switch CH 4 (8) of analog input to 8-bit logic quickly whenever the need arises.

Analog → **Flexible MSO Input** → Logic
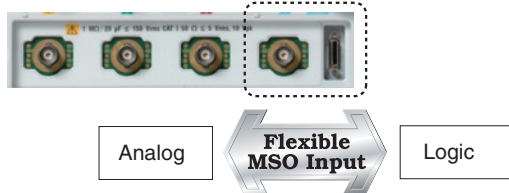
● DLM4000 series

Up to 8 channels of analog signals can be measured.

ScopeCorder Series is available for customers that require more channels for measurement (see page 6). The DL850E supports up to 128 channel measurement.

Long Memory

When the sample rate is increased with oscilloscopes with less memory, the observation time may run out. All of Yokogawa's oscilloscope models are equipped with large capacity memory. For example, the DLM2000/DLM4000 offers long memory of up to 250 Mpoints for measurement.
Even at a fast sample rate of 1.25 GS/s, waveforms for 0.2 seconds can be captured.
The history memory function that divides the long memory can redisplay past waveforms that have disappeared from the screen.
With the DLM2000/DLM4000 series, up to 50,000 previously captured waveforms can be saved in memory.

Waveform history
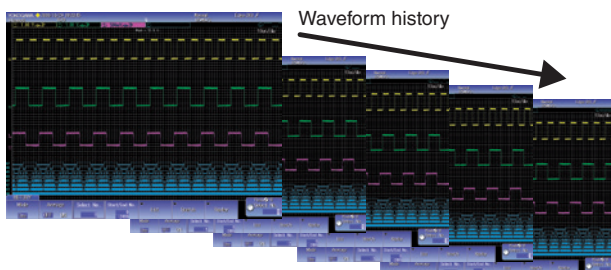
Since a large amount of data is also processed at high speed by dedicated hardware, the long memory can be used comfortably without sacrificing response time.

Connection with a PC

To facilitate the use of a PC, various interfaces such as USB, Ethernet, and GP-IB are available as standard or an option.
In addition, various software is available to support remote control, file transfer, and data processing on a PC.
USB memory and peripheral devices, such as keyboard and mouse, can be connected, and connecting to a PC using a USB cable enables it to be used as the external storage of the PC.

1000BASE-T/100BASE-TX compliant adapters (hubs and routers)

Sends waveform, screen, and settings data
Remote control
Mail transmission (GO/NO-GO action)

Sends waveform, screen, and settings data
Remote control

Ethernet (/C10 and /C11 options)

USB (standard on rear panel)

Internal storage (/C9 option)

USB memory   USB keyboard
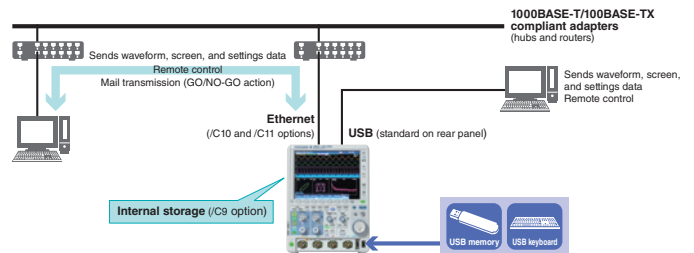
Built-in Printer

With a small built-in printer, measured waveforms can be printed to paper immediately.

A Variety of Triggers and Analysis Functions

- **A variety of triggers capture complex waveforms**
- **Real time digital filter with optimum noise reduction**
- **Zooms into two different points simultaneously**
- **Automated measurement of waveform parameters and statistical processing function**
- **Frequency analysis by FFT computation**
- **Go/No-Go function and action on trigger function to determine abnormal waveforms and save files.**
- **Analysis functions for specific applications, such as serial bus analysis and power supply analysis**

Oscilloscopes

Easy-to-Use, Portrait Body, Compact, and Large Screen Personal Mixed Signal Oscilloscope Offers Convenience with Logic Inputs

DLM2000

CE
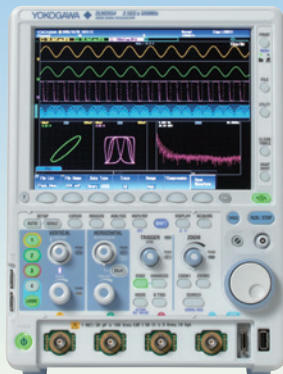
Basic Specifications

Analog Signal input

Input channels	Analog input	DLM20x2: CH1, CH2
		DLM20x4: CH1 to CH4
		(CH1 to CH3 when using logic input)
Input coupling setting		AC, DC, DC50 Ω, GND
Input impedance	Analog input	1 MΩ ±1.0%, approximately 20 pF
		50 Ω ±1.0% (VSWR 1.4 or less, DC to 500 MHz)
Voltage axis sensitivity	1 MΩ	2 mV/div to 10 V/div (steps of 1-2-5)
setting range	50 Ω	2 mV/div to 500 mV/div (steps of 1-2-5)
Max. input voltage	1 MΩ	150 Vrms (CAT I)
	50 Ω	Must not exceed 5 Vrms or 10 Vpeak

Frequency characteristics (-3 dB attenuation when inputting a sinewave of amplitude ±3 div)*1*2

	DLM202x	DLM203x	DLM205x
1 MΩ (when using passive probe)			
100 mV to 100 V/div	DC to 200 MHz	DC to 350 MHz	DC to 500 MHz
20 mV to 50 mV/div	DC to 150 MHz	DC to 300 MHz	DC to 400 MHz
50 Ω			
10 mV to 500 mV/div	DC to 200 MHz	DC to 350 MHz	DC to 500 MHz
2 mV to 5 mV/div	DC to 150 MHz	DC to 300 MHz	DC to 400 MHz

Maximum sample rate		
Real time sampling mode	Interleave OFF	1.25 GS/s
	Interleave ON	2.5 GS/s
Repetitive sampling mode		125 GS/s
Maximum record length	2 ch model (/M1S)	Repeat/Single/Single Interleave: 6.25 M/25 M/62.5 MPoints
	4 ch model (/M1)	Repeat/Single/Single Interleave: 6.25 M/25 M/62.5 MPoints
	4 ch model (/M2)	Repeat/Single/Single Interleave: 12.5 M/62.5 M/125 MPoints
	4 ch model (/M3)	Repeat/Single/Single Interleave: 25 M/125 M/250 MPoints

Logic Signal Input (4 ch model only)

Number of inputs	8 bit (excl. 4 ch input and logic input)
Maximum toggle frequency*1	Model 701988: 100 MHz
	Model 701989: 250 MHz
Compatible probes	701988, 701989 (8 bit input)
	(701980, 701981 can also be used)
Display	8.4-inch TFT color liquid crystal display 1024 × 768 (XGA)
Rated supply voltage	100 to 240 VAC
Rated supply frequency	50 Hz/60 Hz
Maximum power consumption	170 VA
External dimensions	226 (W) × 293 (H) × 193 (D) mm (when printer cover is closed, excluding protrusions)
Weight	Approx.4.2 kg With no options
Operating temperature range	5°C to 40°C

*1 Measured under standard operating conditions after a 30-minute warm-up followed by calibration.
*2 Value in the case of repetitive phenomenon.

Features

Easy-to-Use & Easy-to-See

● Easy to use. Portrait body + large screen makes display easy to see.

We elevated the large (8.4-inch) LCD screen up into the line of sight. Also, the portrait format saves space on the desk or test bench. A compact personal oscilloscope designed for easy viewing and ease of use.
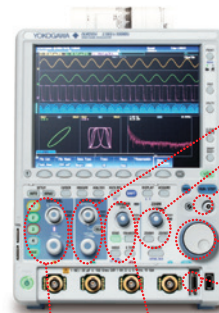
- Horizontal Postion and Scale Knob
- Dedicated Zoom Keys
- Four-Direction Selector Button
  Select key moves the cursor up/down/left/right
- Jog Shuttle and Rotary Knob
- Logic input connector
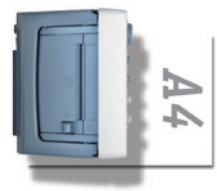
Vertical Postion and Scale Knob Trigger Control Keys and Level Knob

Signal observation on 4 channels or more...

● Flexible MSO Input

Four channels is not sufficient to view the functioning of digital control circuits. The DLM2000 series converts 4 channels of analog input to 8-bit logic, and functions as a 3 channel analog + 8-bit logic MSO (mixed signal oscilloscope).
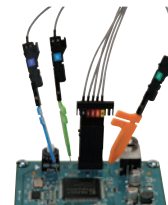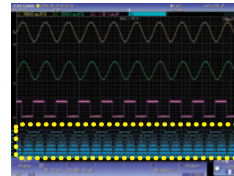
You can replay waveforms later on, so you'll never miss an abnormal waveform

● History function

With the DLM2000 series, up to 50,000 previously captured waveforms can be saved in the acquisition memory. With the History function, you can display just one or all of the previously captured waveforms (history waveforms) on screen. You can also perform cursor measurement, computation, and other operations on history waveforms. Using the History function, you can analyze rarely-occurring abnormal signals.

Waveform history

Abnormal signal
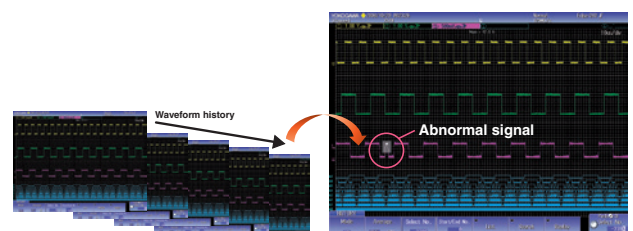
Even complex waveforms can be captured

● Variety of triggers combining analog and logic inputs

The DLM2000 series comes with a variety of triggers ranging from an easy and simple Edge trigger through to sophisticated Enhanced and B triggers. In particular, its ability to freely combine analog and logic inputs is a great feature of this mixed signal oscilloscope equipped with a hybrid channel.

Edge trigger —— Edge

Enhanced triggers —

Edge OR

Edge (qualified)

State

Pulse width

State width

Serial: (option)   FlexRay/CAN/CAN FD/LIN/
                    SENT/UART/I²C/SPI

: (standard) user-defined

TV: NTSC/PAL/SDTV/HDTV/user-defined

B triggers —

A Delay B

A to B(n)

Dual bus
(combination trigger of 2 serial busses)

Optimum noise reduction

● Real time filters and filters based on MATH functions

The DLM2000 series has two types of filters, one real time processed at the input circuit and one based on MATH functions. Since the cutoff frequency can also be finely set, these filters are effective in rejecting unwanted signals and observing only the desired signals.

Waveform zoom and search functions

● Zoom two locations simultaneously, zoom search and history search

Because the DLM2000 series lets you set zoom factors independently, you can display two zoomed waveforms with different time axis scales at the same time. Also, using the search functions, you can search the long memory and history memory and instantaneously find desired waveforms that meet the search criteria.

Can check functions with graphical help

● Graphical online help

You can view detailed graphical explanations of the oscilloscope's functions and operations by pressing the "?" key in the lower left of the screen. This lets you get help on functions and operations on screen without having to consult the user's manual.
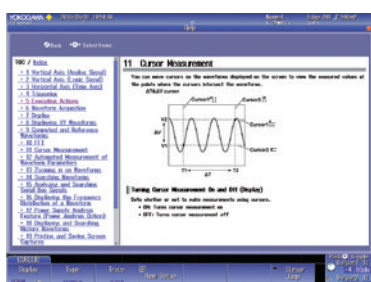
Analysis Functions

FlexRay/UART/CAN/CAN FD/LIN/SENT/I²C/SPI

● Serial analysis function options

A wide variety of trigger conditions can be set, such as ID/Data trigger combinations and combinations of serial bus triggers with normal edge triggers. Up to four busses with different types and speeds can be analyzed simultaneously and decode display can be shown in real time.

Switching loss, power measurement, joule integral, SOA analysis, and harmonic current based on EN61000-3-2

● Power supply analysis option

Utilizing the long memory capability, voltage and current waveforms over long cycles can be input for computation of switching loss (V(t) X i(t)). A wide variety of switching loss analyses are supported, including turn on/off loss calculation, loss including conduction loss, and loss over long cycles (50 Hz/60 Hz). Automated measurement of power parameters for up to two pairs of voltage and current waveforms, such as active power, apparent power, power factor and so on.

Models and Suffix Codes

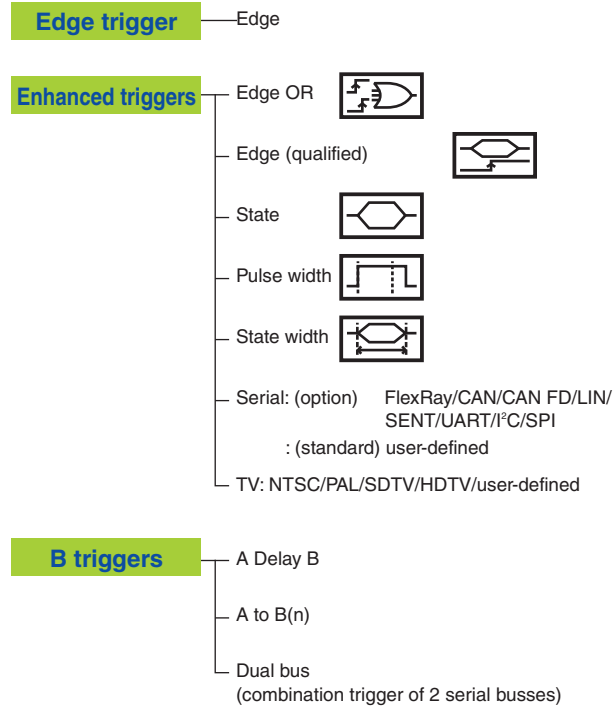| Model	Suffix code		Description
710105			Digital Oscilloscope DLM2022 2 ch, 200 MHz
710110[*1]			Mixed Signal Oscilloscope DLM2024 4 ch, 200 MHz
710115			Digital Oscilloscope DLM2032 2 ch, 350 MHz
710120[*1]			Mixed Signal Oscilloscope DLM2034 4 ch, 350 MHz
710125			Digital Oscilloscope DLM2052 2 ch, 500 MHz
710130[*1]			Mixed Signal Oscilloscope DLM2054 4 ch, 500 MHz
Power cord	-D		UL/CSA standard
	-F		VDE standard
	-Q		BS standard
	-R		AS standard
	-H		GB standard
	-N		NBR standard
Language	-HE		English Menu and Panel
	-HC		Chinese Menu and Panel
	-HK		Korean Menu and Panel
	-HG		German Menu and Panel
	-HF		French Menu and Panel
	-HL		Italian Menu and Panel
	-HS		Spanish Menu and Panel
Option	/LN		No switchable logic input (4 ch model only)
	/B5		Built-in printer
	/M1[*2] (standard)		Standard memory (4 ch model only) During continuous measurement: 6.25 Mpoints; Single mode: 25 Mpoints (when interleave mode ON: 62.5 Mpoints)
	/M2[*2]		Memory expansion (4 ch model only) During continuous measurement: 12.5 Mpoints; Single mode: 62.5 Mpoints (when interleave mode ON: 125 Mpoints)
	/M3[*2]		Memory expansion (4 ch model only) During continuous measurement: 25 Mpoints; Single mode: 125 Mpoints (when interleave mode ON: 250 Mpoints)
	/M1S (standard)		Standard memory (2 ch model only) During continuous measurement: 6.25 Mpoints; Single mode: 25 Mpoints (when interleave mode ON: 62.5 Mpoints)
	/P2[*3]		Probe power for 2 ch models
	/P4[*3]		Probe power for 4 ch models
	/C1[*4]		GP-IB Interface
	/C10[*4]		Ethernet Interface
	/C11[*4]		GP-IB + Ethernet Interface
	/C9		Internal storage (72 GB)
		/G2[*5]	User defined math (4 ch model only)
		/G3[*5]	Power supply analysis function (4 ch model only)
		/G4[*5]	Power supply analysis function (includes /G2) (4 ch model only)
		/F1[*6]	UART trigger and analysis (4 ch model only)
		/F2[*6]	I²C + SPI trigger and analysis (4 ch model only)
		/F3[*6]	UART + I²C + SPI trigger and analysis (4 ch model only)
		/F4[*7]	CAN + LIN trigger and analysis (4 ch model only)
		/F5[*7]	FlexRay trigger and analysis (4 ch model only)
		/F6[*7]	FlexRay+CAN+LIN trigger and analysis (4 ch model only)
		/F7[*7]	CAN+CAN FD+LIN trigger and analysis (4 ch model only)
		/F8[*7]	FlexRay+CAN+CAN FD+LIN trigger and analysis (4 ch model only)
		/F9	SENT analysis (4 ch model only)
		/EX22[*8]	Attach two 701946 probes (For 2 ch, 200 MHz models)
		/EX24[*8]	Attach four 701946 probes (For 4 ch, 200 MHz models)
		/EX52[*9]	Attach two 701946 probes (For 2 ch, 350/500 MHz models)
		/EX54[*9]	Attach four 701946 probes (For 4 ch, 350/500 MHz models)

*1: Logic probes sold separately. Please order the model 701988/701989 accessory logic probes separately.
*2: One of these must be selected.
*3: Specify this option when using current probes or differential probes that don't support probe interface.
*4: Only one of these may be selected at a time.
*5: Only one of these may be selected at a time.
*6: Only one of these may be selected at a time.
*7: Only one of these may be selected at a time.
*8: The 701938 probes are not included when this option is specified.
*9: The 701939 probes are not included when this option is specified.

Additional Option License for DLM2000*

Model	Suffix code	Description
709810	-G2	User defined math (4 ch model only)
	-G3	Power supply analysis function (4 ch model only)
	-G4	Power supply analysis function (includes G2) (4 ch model only)
	-F1	UART trigger and analysis (4 ch model only)
	-F2	I²C + SPI trigger and analysis (4 ch model only)
	-F3	UART + I²C + SPI trigger and analysis (4 ch model only)
	-F4	CAN + LIN trigger and analysis (4 ch model only)
	-F5	FlexRay trigger and analysis (4 ch model only)
	-F6	FlexRay + CAN + LIN trigger and analysis (4 ch model only)
	-F7	CAN+CAN FD+LIN trigger and analysis (4 ch model only)
	-F8	FlexRay+CAN+CAN FD+LIN trigger and analysis (4 ch model only)
	-F9	SENT analysis (4 ch model only)
	-X1	F4 -> F7/F6 -> F8 (add CAN FD)

*: Separately sold license product (customer-installable).

Oscilloscopes

Mixed Signal Oscilloscopes   **DLM4000**

The world's first eight analog channel 500 MHz oscilloscope for faster and more advanced power electronics, automobile electronics, and mechatronics development.

DLM4000

CE
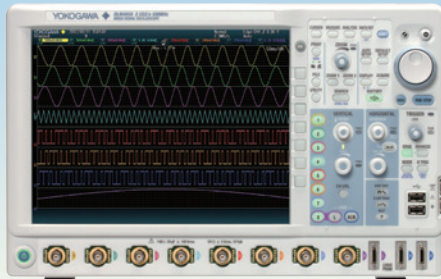
Features

Yokogawa's proprietary new enhanced eight channel oscilloscope comes with a larger display to enable waveforms to be easily viewed and the latest functions.

- 8 analog channels or 7 analog channels + 8-bit logic input
- Optional 16-bit logic input
- Up to 2.5 GS/s
- 350 MHz or 500 MHz frequency bandwidth
- 12.1-inch large display
- Large memory of up to 250 Mpoints
- Light, slim, and compact design

Applications

8ch

Motor Control and Inverter/IPM Circuit Development
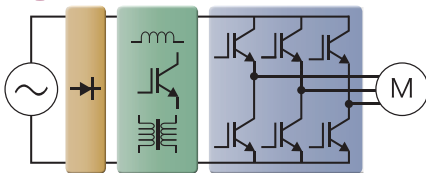
Simultaneous multi-channel measurements are a necessity for the development of control circuits, Intelligent Power Module (IPM), and inverter electronics, which are the key to more efficient, compact, and reliable high-performance motors. Up to 8-channel analog waveform measurement of the DLM4000 empowers engineers in this field.

Examples

- Simultaneous measurement of the 3-line voltage and 3-phase current of a 3-phase motor
- Simultaneous measurement of the gate control signals of 6 IGBTs within an inverter

4ch

Limitations of 4 ch Scope

Whole-system measurement is impossible due to a lack of analog input channels when, for example, measuring the overall timing of the control signals, checking an error of the phase-to-phase balance between 3 phases, and simultaneously measuring the I/O signals of a motor driver IC.

Limitations of Two Synchronized 4 ch Scopes

Eight channel measurement using two trigger-synchronized oscilloscopes is a possible solution but it does not help increase efficiency because there are various problems. For example, the data is not reliable due to the lack of guarantee of the synchronization of two oscilloscopes. Double the space is required and they are difficult to carry around. The different design and operations of each of the two oscilloscopes are cumbersome. The response is slow and handling of the measurement data is tricky.

8ch

Automobile ECU and Integrated Mechatronics Device Development
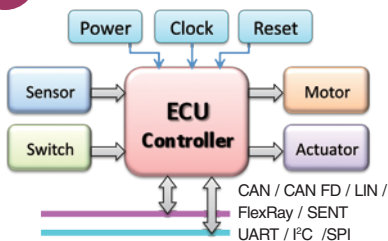
Electronic Control Unit (ECU) and controller I/O signals must be measured simultaneously at high speed. To meet this requirement, the DLM4000 offers eight analog channels, logic measurement, and protocol analysis (communication data decoding) functions such as UART (RS232), I²C, SPI, CAN, CAN FD, LIN, SENT and FlexRay to help speed up the R&D process.

Examples

- Simultaneous measurement of controller I/O signals and serial bus signals
- Measurement of the analog behavior of logic signals and serial bus signals

4ch

Limitations of 4 ch + 16-bit MSO

ECUs, controllers, and driver ICs handle many I/O signals but the 4-channel + 16-bit MSO cannot measure all the signals. Furthermore, it measures bus communication signals and digital signals using logic input so it cannot measure waveform quality and noise margin. Therefore, it is difficult to increase stability and reliability.

Recorder

Limitations of Memory Recorder

A memory recorder is generally suitable for long-time multi-channel measurement, but due to its low sampling rate and slow waveform update speed, its performance is not adequate for measuring high-speed signals and communication signals of CPUs and FPGAs, or detecting noise that causes problems or error signals.

The portable eight-channel DLM4000 is the daily instrument of choice. Maximum easiness of use coupled with minimum depth and weight

12.1-inch large LCD display enables eight waveforms to be easily viewed

Portable

Four-direction selection button

Jog shuttle for facilitating moving zoom position

Trigger level knob

Two USB terminals on front panel

Logic 16-bit input (option)

Eight analog input channels (Yokogawa probe interface compliant)

Channel 8 is convertible to 8-bit logic input (standard feature)

Approx. 6.6 kg

Soft carrying case (sold separately) available

178 mm
355 mm

Former model DL7480

**Modest 178 mm depth
About half of the former model DL7480**

Specifications

Input Channels: 8 analog channels, or 7 analog channels + 8 logic channels (standard)
8 analog channels + 16 logic channels, or 7 analog channels + 24 logic channels (/L16 option)

Analog Input:
Frequency bandwidth: 350 MHz (DLM4038) or 500 MHz(DLM4058)
Voltage axis sensitivity setting range:
2 mV/div to 10 V/div for 1 MΩ
2 mV/div to 500 m V/div for 50Ω
Voltage axis DC accuracy: ±(1.5% of 8 div + offset voltage accuracy)
A/D conversion resolution: 8-bit

Logic Input
Maximum toggle frequency: 100 MHz (701988) or 250 MHz (701989)
Probes that can be used: 701988 and 701989 (701980 and 701981)
Minimum input voltage: 500 mVp-p (701988) or 300 mVp-p (701989)
Input range: ±40 V (701988)
Threshold level ±6 V (701989)
Maximum non-destructive input voltage:
±40 V (DC + AC peak) or 28 Vrms (701989)
Threshold level setting range: ±40 V (701988) or ±6 V (701989)

Common Specifications
Maximum sampling rate
Real-time sampling mode: Interleave OFF: 1.25 GS/s
Interleave ON: 2.5 GS/s
Repetitive sampling mode: 125 GS/s
Time axis setting range: 1 ns/div to 500 s/div
Maximum record length: Repeat: 1.25 Mpoints, Single: 6.25 Mpoints,
Single Interleave: 12.5 Mpoints (standard)
Repeat: 25 Mpoints, Single: 125 Mpoints,
Single Interleave: 250 Mpoints (/M3 option)
History memory maximum data:
2,500 (record length 1.25 kPoints; standard)
50,000 (record length 1.25 kPoints; /M3 option)
Trigger modes: Auto, Auto Level, Normal, Single, N-Single
Trigger types: Edge, Edge OR, Edge Qualified, State, Pulse Width, State Width, TV, Serial Bus (I²C/SPI/UART/CAN/CAN FD/LIN/FlexRay/SENT/UserDefine), A Delay B, A to B (N), Dual Bus, Force
Internal storage: 1.8 GB (standard) or 7.2 GB (/C8 option)
Interfaces: USB peripheral connection terminal × 2
USB-PC connection terminal × 1
Ethernet (standard), GP-IB (option)
Build-in printer: 112 mm wide, monochrome, thermal
Display: 12.1-inch color TFT LCD 1024 × 768 (XGA)
Dimensions: 426 (W) × 266 (H) × 178 (D) mm
Weight: approx. 6.6 kg (with no options)

Models and Suffix Codes

Model	Suffix Code					Description
DLM4038[*1]						Mixed Signal Oscilloscope: 8 ch, 350 MHz
DLM4058[*1]						Mixed Signal Oscilloscope: 8 ch, 500 MHz
Power cord	-D					UL/CSA standard
	-F					VDE standard
	-Q					BS standard
	-R					AS standard
	-H					GB standard
	-N					NBR standard
Language	-HE					English Message and Panel
	-HC					Chinese Message and Panel
	-HK					Korean Message and Panel
	-HG					German Message and Panel
	-HF					French Message and Panel
	-HL					Italian Message and Panel
	-HS					Spanish Message and Panel
Option	/L16					Logic 16-bit
	/B5					Built-in printer
		/M1[*2]				Memory expansion During continuous measurement: 6.25 Mpoints; Single mode: 25 Mpoints (when interleave mode ON: 62.5 Mpoints)
		/M2[*2]				Memory expansion During continuous measurement: 12.5 Mpoints; Single mode: 62.5 Mpoints (when interleave mode ON: 125 Mpoints)
		/M3[*2]				Memory expansion During continuous measurement: 25 Mpoints; Single mode: 125 Mpoints (when interleave mode ON: 250 Mpoints)
		/P8[*3]				Eight probe power connectors
		/C1				GP-IB Interface
		/C8				Internal storage (7.2 GB)
			/G2[*4]			User defined math
			/G3[*4]			Power supply analysis function
			/G4[*4]			Power supply analysis function (includes /G2)
			/F1[*5]			UART trigger and analysis
			/F2[*5]			I²C+SPI trigger and analysis
			/F3[*5]			UART+I²C+SPI trigger and analysis
				/F4[*6]		CAN+LIN trigger and analysis
				/F5[*6]		FlexRay trigger and analysis
				/F6[*6]		FlexRay+CAN+LIN trigger and analysis
				/F7[*6]		CAN+CAN FD+LIN trigger and analysis
				/F8[*6]		FlexRay+CAN+CAN FD+LIN trigger and analysis
					/F9	SENT trigger and analysis
				/E1[*7]		Four additional passive probes (8 in total)
				/E2[*7]		Attach four 701946 probes[*8]
				/E3[*7]		Attach eight 701946 probes[*8]

*1: Logic probes are not included. Please order the accessory logic probe 701988/701989 sold separately.
*2: Only one of these options can be selected at a time.
*3: Specify this option when using current probes or differential probes that don't support probe interface.
*4: Only one of these options can be selected at a time.
*5: Only one of these options can be selected at a time.
*6: Only one of these options can be selected at a time.
*7: Only one of these options can be selected at a time.
*8: The 701939 passive probes are not included when this option is specified.
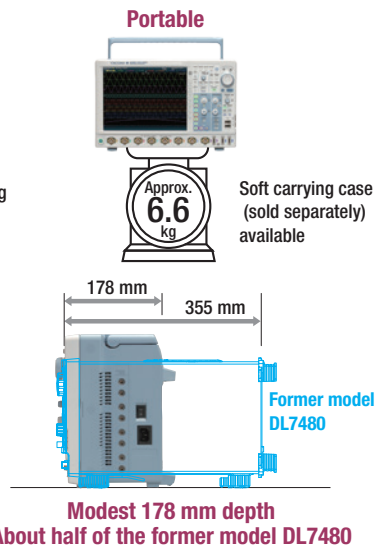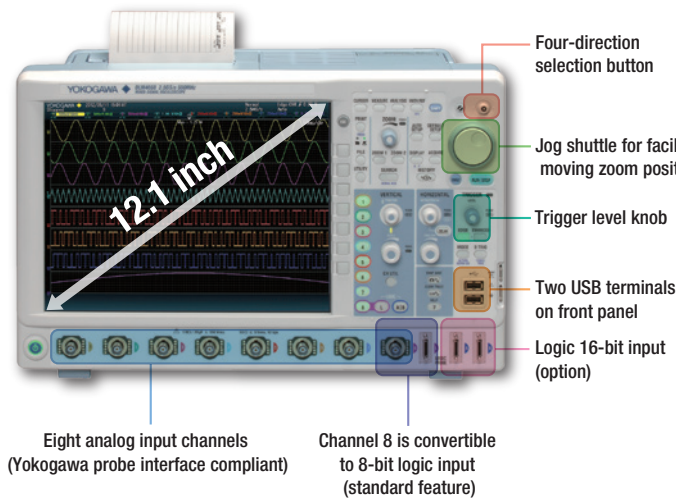
Additional Option License for DLM4000*

Model	Suffix code	Description
709820	-G2	User defined math
	-G3	Power supply analysis function
	-G4	Power supply analysis function (includes G2)
	-F1	UART trigger and analysis
	-F2	I²C + SPI trigger and analysis
	-F3	UART + I²C + SPI trigger and analysis
	-F4	CAN + LIN trigger and analysis
	-F5	FlexRay trigger and analysis
	-F6	FlexRay + CAN + LIN trigger and analysis
	-F7	CAN + CAN FD + LIN trigger and analysis
	-F8	FlexRay + CAN + CAN FD + LIN trigger and analysis
	-F9	SENT trigger and analysis
	-X1	F4 -> F7/F6 -> F8 (add CAN FD)

*: Separately sold license product (customer-installable).

Oscilloscopes

Waveform Measuring   Oscilloscopes Accessories

Classification	Product	Model No.	Power supply		Description	
			Probe interface terminal (front panel)[*2]	Probe power (option)/ probe power supply (sold separately)		
Passive	200 MHz passive probe	701938			DC to 200 MHz, 10:1, 1.5 meters	
	500 MHz passive probe	701939			DC to 500 MHz, 10:1, 1.3 meters	
	500 MHz Miniature passive probe	701946			DC to 500 MHz, 10:1, 1.2 meters	
	200 MHz passive probe (wide temperature range)	702906			DC to 200 MHz, 10:1, 2.5 meters -40°C to 85°C	
Passive (High-voltage)	100:1 High voltage probe	701944			DC to 400 MHz, 100:1, 1.2 meters	
	100:1 High voltage probe	701945			DC to 250 MHz, 100:1, 3.0 meters	
Active, FET	1.0 GHz active probe (PBA1000)	701912	○		DC to 1.0 GHz, 10:1, 1.2 meters	
	900 MHz FET Probe	700939		○	DC to 900 MHz, 1.5 meters	
Differential	1 GHz differential probe (PBDH 1000)	701924	○		DC to 1 GHz, 50:1 Max. differential input voltage: ±25 V	
	150 MHz differential probe (PBDH 0150)	701927	○		DC to 150 MHz, 50:1, 500:1 Max. differential input voltage: ±140 V (50:1), ±1400 V (500:1)	
	500 MHz differential probe	701920		○	DC to 500 MHz, 10:1, Max. differential input voltage: ±12 V	
	200 MHz differential probe	701922		○	DC to 200 MHz, 10:1, Max. differential input voltage: ±20 V	
	100 MHz differential probe	701921		○ (*3)	DC to 100 MHz, 10:1, 100:1, Max. differential input voltage: ±70 V (10:1), ±700 V (100:1)	
	100 MHz differential probe	700924		○ (*4)	DC to 100 MHz, 100:1, 1000:1, Max. differential input voltage: ±350 V (100:1), ±1400 V (1000:1)	
	50 MHz high voltage differential probe	701926		○ (*3)	DC to 50 MHz, 100:1, 1000:1, Max. differzntial input voltage: 700 Vpeak (100:1), 7000 Vpeak (1000:1)	
	15 MHz differential probe	700925		○ (*4)	DC to 15 MHz, 10:1, 100:1, Max. differential input voltage: ±50 V (10:1), ±500 V (100:1)	
Current	Current probe	701917		○	DC to 50 MHz 5 Arms, High-sensitivity	
	Current probe	701918		○	DC to 120 MHz 5 Arms, High-sensitivity	
	Current probe (PBC100)	701928	○		DC to 100 MHz 30 Arms	
	Current probe (PBC050)	701929	○		DC to 50 MHz 30 Arms	
	Current probe	701932		○	DC to 100 MHz, 30 Arms	
	Current probe	701933		○	DC to 50 MHz 30 Arms	
	Current probe	701931		○	DC to 2 MHz, 500 Arms	
	Current probe	701930		○	DC to 10 MHz 150 Arms	
Logic	100 MHz Logic probe (PBL100)	701988			Input impedance 1 MΩ Max. toggle frequency: 100 MHz	
	250 MHz Logic probe (PBL250)	701989			Input impedance: 100 kΩ Max. toggle frequency: 250 MHz	
Other	De-skew correction signal source	701936			Voltage/current signal de-skew Supports through-type current transformers and a variety of current probes, including large current probes	
	Probe power supply	701934			Large current output, external probe power supply (4 outputs)	
	Probe stand	701919			Diameter of attachable probe φ 8 to 13 mm Weight : Approx. 1.5 kg	

*1: These specifications are a summary. For details, please refer to the Web site, catalog, and other documentation. *2: Available as standard for the DLM2000, DLM6000, DL6000 and DLM4000 series.
*3: Can also be battery operated. *4: A power cable (B9852MJ) sold separately is required. Can also be battery operated.
In addition to those listed above, there are other accessories available. For details, please refer to the Web site.
When using multiple current probes using the probe power of the main unit, ensure that the total power supply current of the current probes does not exceed the maximum output current of the probe power.

Oscilloscope Application Software — Xviewer/MATLAB tool kit

Instrument control & data analysis on Your PC
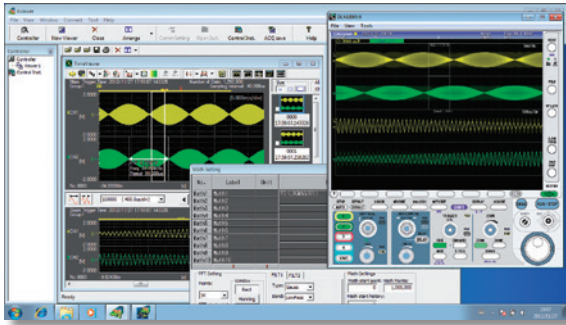
701992

Xviewer

Xviewer is a PC software application designed to work with Yokogawa's DL/DLM series and the ScopeCorders. Xviewer allows you to display DL-acquired waveform data (using the "Viewer" function), perform file transfers, and control DL/DLM series from a PC.

Free data viewer
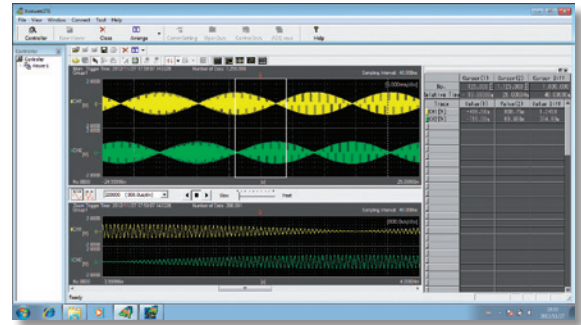
XviewerLITE
(Free software)

XviewerLITE is a free data viewer software with no restriction for period of service for DLM/DL/SL series. It allows you to display acquired ware form on a PC. Zoom, vertical cursor measuremet and CSV format conversion are possible.

Remote Control Measuring Instrument on Your PC
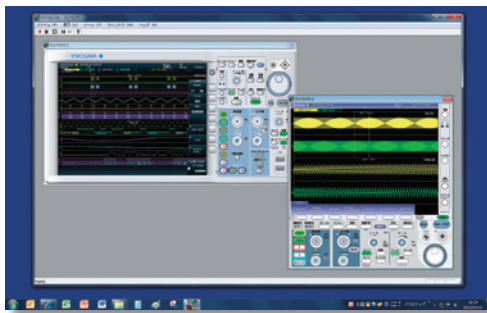
XWirepuller/Wirepuller
(Free software)

With this software, you can display the front panel of the DLM/DL/SL series on the screen of a PC, and monitor waveform signals. You can perform control from the PC using the mouse and keyboard in the same way as you operate the main unit.

Plug-in for MATLAB software
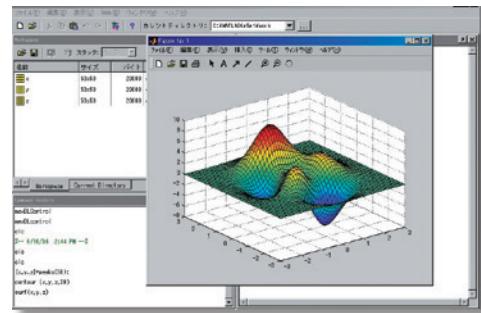
701991

MATLAB tool kit

The MATLAB tool kit for the DL series is a plug-in for MATLAB software. The toolkit can be used to control supported instruments using MATLAB or to acquire data from the instruments to use in MATLAB via a communication interface (GP-IB, USB, Ethernet).

In addition to the above, various kinds of accessory software, free software, LabVIEW drivers, and LabWindows/CVI drivers, can be downloaded from our web site.

Selection Guide

Digital Power Analyzers

Yokogawa's PX8000 and WT Series Power Meters and Power Analyzers:
Advanced Technology and High Reliability for a Wide Range of Power Measurement Solutions

WT Series

Models	WT310E/WT330E	WT500	WT3000E	WT1800	PX8000
Items	...P28	...P23	...P24	...P26	...P30
Features	New Entry Class Digital Power Meters 4 models line up, equipping 5 mA range (WT310E), 40 A range (WT310EH), and 2 or 3 CH inputs (WT332E/WT333E) Standard Communication I/F and auto-ranging under integration mode	Low-Middle Class Power Analyzer Compact half rack size and easy use Max. 1000 V and 40 A input Simultaneous measurement U, I, P and those harmonics components External USB memory for direct data saving	Top model of Digital Power Analyzer With basic power accuracy of ±0.04% of total DC and 0.1 Hz-1 MHz measurement bandwidth, and up to four input elements, the model provides higher-accuracy measurement of inverter Input/Output efficiency.	Middole Class Digital Power Analyzer Up to six Input elements in one instrument (3 phase power input from two systems in one unit) 8.4-Inch XGA TFT Color LCD Wide voltage and current input range	A power analyzer with capabilities of transient power measurement and waveform parameter measurement Fast sampling up to 100 MS/s, Broad bandwidth up to 20 MHz (-3 dB), Trend measurement of each cycle, Specified period measurement by cursors
Input elements	1(WT310E,WT310EH), 2 (WT332E), 3(WT333E)	1 to 3	1 to 4	1 to 6	Module structure, 1 to 4 power measurement element
Basic power accuracy (50/60 Hz)	± (0.1% of rdg + 0.05% of rng)	± (0.1% of rdg + 0.1% of rng)	± (0.01% of rdg + 0.03% of rng)	± (0.1% of rdg + 0.05% of rng)	± (0.1% of reading + 0.1% of range)
Power measurement frequency range	DC, 0.1 Hz to 100 kHz (WT310EH is up to 20 kHz)	DC, 0.5 Hz to 100 kHz	DC, 0.1 Hz to 1 MHz	DC, 0.1 Hz to 1 MHz	DC, 0.1 Hz to 1 MHz
Input voltage range (for crest factor 3)	15/30/60/150/300/600/ V	15/30/60/100/150/300/600/1000 V	15/30/60/100/150/300/600/1000 V	1.5/3/6/10/15/30/60/100/150/300/600/1000 V	1.5/3/6/10/15/30/60/100/150/300/600/1000 V
Input current range (for crest factor 3)	Direct input: 5 m/10 m/20 m/50 m/100 m/200 m/500 m/1/2/5/10/20 A (WT310E) Direct input: 1/2/5/10/20/40 A (WT310EH) Direct Input: 500m/1/2/5/10/20 A (WT332E,WT333E) External input(option): 2.5/5/10 V, or 50 m/100 m/200 m/500 m/1/2 V	Direct input: 500 m/1/2/5/10/20/40 A External sensor input (option): 50 m/100 m/200 m/500 m/1/2/5/10 V	Direct input: 0.5/1/2/5/10/20/30 A or 5 m/10 m/20 m/50 m/100 m/200 m/500 m/1/2 A External input: 50 m/100 m/200 m/500 m/1/2/5/10 V 30 A and 2 A can be mixed in one unit	Direct input: 10 m/20 m/50 m/100 m/200 m/500 m/1/2/5 A or 1/2/5/10/20/50 A External input (option): 50 m/100 m/250 m/500 m/1/2/5/10 V 5 A and 50 A can be mixed in one unit	Direct input: 10 m/20 m/50 m/100 m/200 m/500 m/1/2/5 A External sensor input: 50 m/100 m/250 m/500 m/1/2.5/5/10 V
Measurement parameters	Voltage, Current, Active power, Reactive power, Apparent power, Power factor, Phase angle. Peak voltage, Peak current, frequency, Crest factor, Integration (power and current), Harmonic distortion, Harmonic components	Voltage, Current, Active power, Reactive power, Apparent power, Power factor, Phase angle, Peak voltage, Peak current, Voltage frequency, Current frequency Active power integration and Current integration for both charge/discharge and sold/bought, crest factor, Efficiency, harmonic analysis	Voltage, Current, Active power, Reactive power, Apparent power, Power factor, Phase angle, Peak voltage, Peak current, Voltage frequency, Current frequency, Active power integration, Apparent power integration, Reative power integration, Current integration, Corrected power, Crest factor, Efficiency, Harmonic analysis	Voltage, Current, Active power, Apparent power, Reactive power, Power factor, Phase angle, Peak voltage, Peak current, Voltage frequency, Current frequency, Active power integration, Current integration, Crest factor, Form factor, Impedance, Resistance, Reactance, Corrected Power, Harmonic analysis	Voltage, Current, Active power, Reactive power, Apparent power, Power factor, Phase angle, Peak voltage, Peak current, Voltage frequency, Current frequency Transient voltage/current/power(Trend of waveform by cycle), Averaged voltage/current/power by cursor(waveform parameters calculation)
Display	7 Segment LED, 4 displays	5.7-inch TFT color LCD	8.4-inch TFT color LCD	8.4-inch XGA TFT color LCD	10.4 inch TFT color LCD (XGA)
External dimensions (mm) (W × H × D)	213 × 88 × 379 (WT310E and WT310EH) 213 × 132 × 379 (WT332E and WT333E)	213 × 177 × 408.5	426 × 177 × 459	426 × 177 × 459	355 × 259 × 180
Weight (kg)	3 (WT310E), 5 (WT330E)	6.5	15	15	6.5 (without any options and paper)

*About CW series Clamp-on Power Meters, please refer to the page 65.

Power Analyzer **WT500**

Compact and easy to use. The Power Analyzer for the renewable energy generation

WT500

Bulletin 7602-00E

CE

Overview of a Photovoltaic Power Conditioner

WT500 Power Analyzer

Overview

The WT500 is a low-middle class power analyzer and it features a 5.7-inch color TFT and half width racking compact body that enables single-phase and three-phase power measurement, achieving ±0.2% of total basic and DC accuracy, maximum input of 1000 Vrms, 40 Arms and a measurement bandwidth up to 100 kHz.

Features

• Accurate efficiency measurement of DC and AC signals
• RMS, MEAN, DC, AC and RMEAN of voltages and currents simultaneous measurement.
• Simultaneous measurement of normal U/I/P data and those harmonic data
• As fast as 100 ms data capturing and store data with all channels
• Separate integration functions for charge/discharge or bought/sold power
• Integration of power, reactive power, apparent power, and current enables you to determine a device's average power consumption
• Harmonics (DC-50th order) and Total harmonic distortion (THD) can be measured
• Saving measured data directly to external USB memory
• Measurement values can be saved as images or numerical data, and can be pasted into reports, analyzed in spreadsheet software, or used in a variety of other ways
• Easy setup with cursor keys
• GP-IB, USB and Ethernet communication are available

Basic Specifications

• Measurement voltage range: (for crest factor 3)
   15/30/60/100/150/300/600/1000 V
• Measurement current range: (for crest factor 3)
   Direct input 500 m/1/2/5/10/20/40 A
   External sensor input (option)
      50 m/100 m/200 m/500 m/1/2/5/10 V
• Frequency range:
   DC, 0.5 Hz to 100 kHz
• Measurement Accuracy:
   Basic Accuracy (45 Hz ≤ f ≤ 66 Hz and DC)
   Voltage/Current/Power
      ± (0.1% of rdg + 0.1% of rng)
• USB interface to PC is standard feature
• Ethernet communication function is available (optional)
• GP-IB communication function is available (optional)
• Effective of power factor (at cos φ =0)
      ± 0.2% of S (apparent power)
• External dimensions:
   Approx. 213(W) × 177(H) × 408.5(D) mm
• Weight: Approx. 6.5 kg (with 3-input element)

Model Number and Suffix Codes

Model	Suffix Codes		Description
760201			WT500 1 input element model
760202			WT500 2 input elements model
760203			WT500 3 input elements model
Power cord	-D		UL/CSA standard
	-F		VDE standard
	-R		SAA standard
	-Q		BS standard
	-H		GB standard
Options	/C1		GP-IB interface
	/C7		Ethernet interface
	/EX1		External sensor input for 760201
	/EX2		External sensor input for 760202
	/EX3		External sensor input for 760203
	/G5		Harmonic Measurement
	/DT		Delta computation (760202/03 only)
	/FQ		Add-on Frequency Measurement (760202/03 only)
	/V1		VGA Output

Note: Adding input modules after initial product delivery will require rework at the factory. Please choose your models and configurations carefully, and inquire with your sales representative if you have any questions.

Digital Power Analyzers

Precision Power Analyzer **WT3000E**

The World Highest Class[*1] Precision and Stability with Basic Power Accuracy: ±0.04% of total

(*1: As of May 2016, for power accuracy in a three-phase power meter as investigated by Yokogawa)

WT3000E

Bulletin WT3000E-01EN

C E

Features

The WT3000E has the highest precision of all the Yokogawa power analyzers in the WT series. The WT3000E can be used as a reference instrument for calibration and to measure the power and efficiency of converters such as an inverter. It helps increase efficiency in evaluation and testing.

- Basic power accuracy ±0.04% of total, the highest precision of all power analyzers in the WT series, 2 A and 30 A Input Element can be installed together
- Up to four input elements to achieve accurate measurement of input and output conversion efficiency
- Motor efficiency and total efficiency measurement of the motor option (/MTR)
- Simultaneous harmonic measurement without changing measuring modes (option)
- Wide bandwidth harmonic measurement between 0.1 Hz and 2.6 kHz of the fundamental waveform (option)
- Harmonic measurement compliant with IEC61000-3-2/12 (option)
- Voltage fluctuation/flicker measurement compliant with IEC61000-3-3/11 (option)

Applications to Utilize WT3000E Precision Power Analyzer's Capabilities

● **High-precision measurement of motor/inverter efficiency**

Growing interest in energy conservation of late increases the need to evaluate motor/inverter efficiency with high precision. The WT3000E offers up to four voltage and four current inputs and is capable of high-precision measurement of single-phase input and three-phase output to evaluate the inverter efficiency.

A motor evaluation function (/MTR option) allows you to observe changes in voltage, current, and power while at the same time observing changes in revolution speed and torque, and calculate and display mechanical power and total efficiency.

Also, you can synchronize two units and take measurements, and WTViewerE free software for data acquisition allows you to compare the power of the two units and calculate the efficiency.

Inverter   **Motor**   **Load**

Input waveform

Output waveform

Analog or pulse input
(Revolution speed and torque)
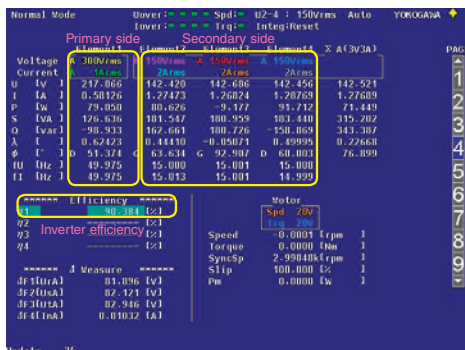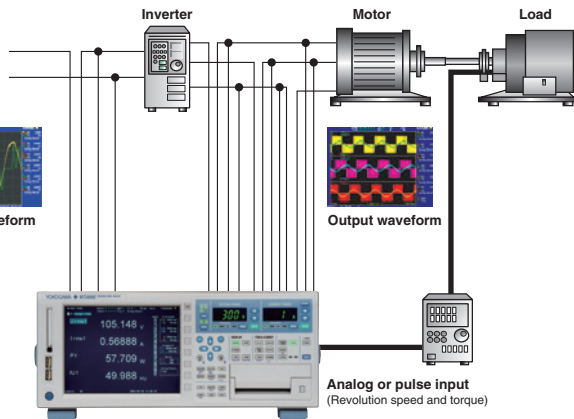
Example of measurement data display
on the primary and secondary sides

● **Measuring instantaneous peak power in photovoltaic power generation**

In photovoltaic power generation, MPPT control varies the voltage to maximize energy harvested from the solar panel. The WT3000E allows you to measure voltage, current, and power, as well as peak voltage and peak current (on the plus and minus sides, respectively). Also, the user-defined MATH allows you to measure the instantaneous peak power (on the plus and minus sides).

Peak power

Current

Power

Voltage

* This is just an illustration. The actual measurement may be affected by noise.

MPPT: Maximum Power Point Tracker
Example of measurement results of voltage, current, and power under control

P1 75.333 w
F1 537.887 w
F2 -73.0798 w
fU1 50.011 Hz
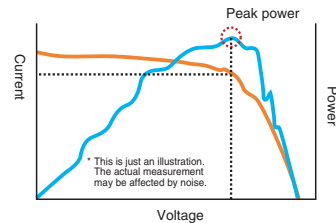
Example of power (P1) and instantaneous peak power on the plus (F1) and minus (F2) sides

● **Cycle-by-cycle function allows measuring voltage, current, and power for each cycle**

To observe the rising characteristic of a starting motor or the like, you may want to acquire data for each cycle instead of at specified time intervals. The cycle-by-cycle measurement function of the WT3000E allows you to measure the following parameters: voltage, current, active power, apparent power, reactive power, power factor, speed, torque, and mechanical power. Up to 3,000 periods of measurements can be taken.

Cycle-by-cycle data computation
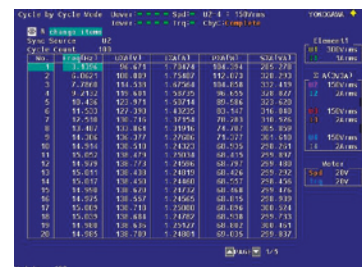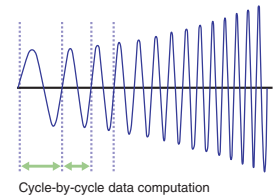
Example of cycle-by-cycle measurement of three-phase voltage, current, active power, and apparent power

24

● Example of LED driving circuit and measurement

Lighting equipment is shifting from incandescent to fluorescent lamps. Furthermore, in recent years, long-life, low power consumption LEDs are attracting attention. To increase the power conversion efficiency of an LED driving circuit (drive module), it is necessary to measure the voltage, current, and power of input and output with high precision. The WT3000E provides the best-in class accuracy to measure the power conversion efficiency of input and output.

Example of DC voltage, current, and power at three points and conversion efficiency measurement.

Rear panel (4 input elements and options)

2 A and 30 A input Element can be installed together in one unit.

● Measuring battery charge and discharge (Ah/Wh)

For battery-powered equipment such as portable devices and electric-powered bicycles, engineers must often perform short-duration charge/discharge tests under actual operating conditions. Since the WT3000E employs a digital sampling system, each rapidly changing charge/discharge current and power can be integrated without gaps. This is effective in the evaluation of ampere-hours and watt-hours for calculating battery life.
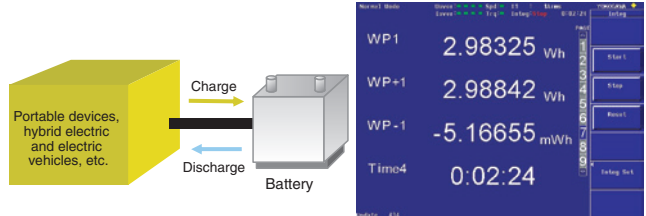
Example of display of total watt hours (on the plus and minus sides)

Specifications

Voltage direct input range	: 15/30/60/100/150/300/600/1000 V
Current direct input range	: 0.5/1/2/5/10/20/30 A or 5 m/10 m/20 m/ 50 m/100 m/200 m/500 m/1/2 A
Current sensor input range	: 50 m/100 m/200 m/500 m/1/2/5/10 V
Frequency bandwidth	: DC, 0.1 Hz to 1 MHz
Basic accuracy (45 Hz to 66 Hz)	(30 A input element)
Voltage/current	$\pm(0.01\%$ of rdg[*1] $+ 0.03\%$ of rng[*2]$)$
Power	$\pm(0.01\%$ of rdg[*1] $+ 0.03\%$ of rng[*2]$)$
Data update period	: Select from 50 ms, 100 ms, 250 ms, 500 ms, 1 s, 2 s, 10 s, and 20 s
Power factor influence:	$\pm0.03\%$ of S (apparent power) when $\cos\phi = 0$
A/D converter	Simultaneous voltage and current conversion, 16-bit resolution Conversion speed approx. 5 μs
Display	8.4-inch color TFT LCD monitor
Built-in printer (option)	Thermal line-dot, paper width 112 mm
PC card port, USB port (option)	
External dimensions	: Approx. 426 (W) × 177 (H) × 459 (D) mm (excluding protrusions)
Weight	: Approx. 15 kg (main unit, four input elements, options)

*1: 1 rdg: reading   *2: 1 rng: range

Model Number and Suffix Code

Model	Suffix code	Description
WT3001E		Precision Power Analyzer One Input Element Model
	-2A0 -30A1	None 2 A Input Element 30 A ×1 Input Element
	-2A1 -30A0	2 A ×1 Input Element None 30 A Input Element
WT3002E		Precision Power Analyzer Two Input Elements Model
	-2A0 -30A2	None 2 A Input Element 30 A ×2 Input Elements
	-2A1 -30A1	2 A ×1 Input Element 30 A ×1 Input Element
	-2A2 -30A0	2 A ×2 Input Elements None 30 A Input Element
WT3003E		Precision Power Analyzer Three Input Elements Model
	-2A0 -30A3	None 2 A Input Element 30 A ×3 Input Elements
	-2A1 -30A2	2 A ×1 Input Element 30 A ×2 Input Elements
	-2A2 -30A1	2 A ×2 Input Elements 30 A ×1 Input Element
	-2A3 -30A0	2 A ×3 Input Elements None 30 A Input Element
WT3004E		Precision Power Analyzer Four Input Elements Model
	-2A0 -30A4	None 2 A Input Element 30 A ×4 Input Elements
	-2A1 -30A3	2 A ×1 Input Element 30 A ×3 Input Elements
	-2A2 -30A2	2 A ×2 Input Elements 30 A ×2 Input Elements
	-2A3 -30A1	2 A ×3 Input Elements 30 A ×1 Input Element
	-2A4 -30A0	2 A ×4 Input Elements None 30 A Input Element
Power Cord	-D	UL/CSA standard, PSE compliant
	-F	VDE standard
	-H	GB standard
	-N	NBR standard
	-Q	BS standard
	-R	AS standard
Options	/G6	Advanced Calculation
	/B5	Built-in Printer
	/FQ	Add-On Frequency Measurement
	/DA	20 ch DA Output
	/V1	VGA Output
	/C12*	USB Port (PC)
	/C2*	Serial (RS-232) Interface
	/C7	Ethernet Interface
	/C5	USB Port (Peripheral)
	/FL	Voltage Fluctuation/Flicker
	/MTR	Motor Evaluation Function

* Only one can be selected.

High Performance Power Analyzer **WT1800**

Broad Ranges Power Measurement with One Unit

WT1800

Bulletin WT1800-00EN

CE

Overview

The WT1800 High performance power analyzer can measure both the small currents of products called energy saving designed as well as the large currents involved in large-sized loads. As it handles voltages ranging from 1.5 V to 1000 V, it has a wide variety of uses. Since 3 phase power can be input from two separate systems (6 inputs), you only need one WT1800 to simultaneously measure Input/Output signals from inverters with normal/harmonics data as fast as 50 ms.

- Basic Power Accuracy   ±0.15% of total
- DC Power Accuracy   ±0.15% of total
- Voltage/Current Bandwidth   5 MHz (-3 dB, typical)
                Voltage, 5 A direct input, external sensor input
- Sampling Rate   2 MS/s (16-bit resolution)
- Input Element number   Max. 6
- Current Measurement   100 µA to 55 Arms direct

Input/Output Efficiency Measurements of Inverters, Matrix converters, Motors, Fans, and Pumps

Inverter

Inverter section
Drive circuit

Input

Converter section
Convert AC to DC signals

Modulate DC signal and convert to any AC signals

Motor   Torque/rotation speed sensor   Load

① ②   ③   ④ ⑤ ⑥

● indicates measurement points and input to the power analyzer.
M indicates connecting the motor output to the motor signal input (/MTR) of the power analyzer
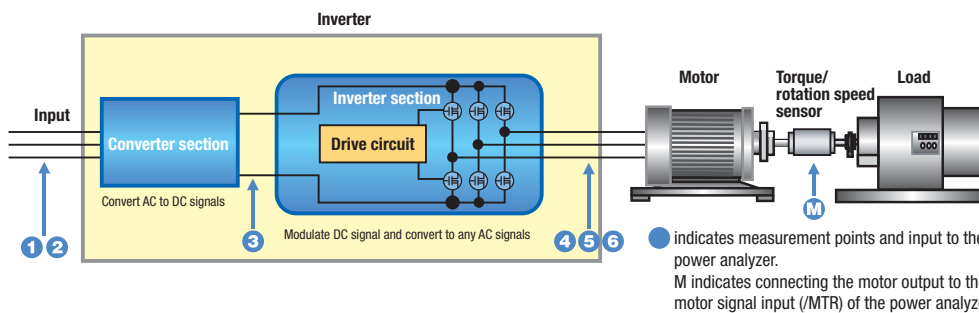
Overview The WT1800 is capable of performing up to 6 power input measurements to make it possible to perform an inverter efficiency test between the input and output in inverter evaluation. In addition, a motor evaluation function (option) makes it possible to simultaneously monitor voltage, current, and power changes, as well as rotation speed and torque changes.

Advantages of WT1800

• 5 MHz range and 2 MS/s high-speed sampling

The vertical resolution in power measurements is one of the important elements for high-precision measurements.

The WT1800 is capable of 16-bit high resolution and approximately 2 MHz sampling to make it possible to measure faster signals with higher precision.

Voltage/current range 5 MHz

Approx. 2 MS/s 16-bit

• Dual harmonic measurement (/G6 option)

The WT1800 is capable of performing two-line simultaneous harmonic measurements with one unit for the first time in the industry.
The ability to simultaneously measure harmonics for the input and output signals not only reduces the switching time but also makes it possible to perform simultaneous data analysis for the input and output, which has not been possible with the previous models.

The following measurements can be performed for up to the 500th order
Single harmonic measurement (/G5 option)
Dual harmonic measurement (/G6 option)

Dual harmonic measurement

Simultaneous input/output measurement

Up to the 500th order

• ms response capability (/HS Option)

ms response

HS filter

The High Speed data capturing /HS option can measure ΣUrms, ΣIrms and ΣP from single phase (DC signal) and three phase devices every 5 ms (When External Synchronization is OFF) or, 1 ms to 100 ms when External Synchronization is ON (depending on the frequency of the clock signal). It outputs data in 1 s blocks to internal/external memory or to a PC through a communications interface.

The average characteristic is set using the cutoff frequency of the HS filter for measured data during 5 ms or 1 ms to 100 ms period. The cutoff frequency can be varied from 1 Hz to 1,000 Hz in 1 Hz steps.

As three phase mean

One phase current waveform

Comparison between a phase current waveform and three phase current values of every 5 ms

Data analysis and graph drawing by data calculation software
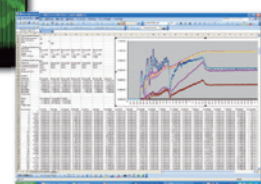
Power Generation and Conversion Efficiency Measurements in New Energy Markets, including Photovoltaic and Wind Power Generation

Power Flow of Photovoltaic Power Generation

● indicates measurement points and input to the power analyzer. (A) indicates connecting the sensor signals to the auxiliary input (/AUX) of the power analyzer.
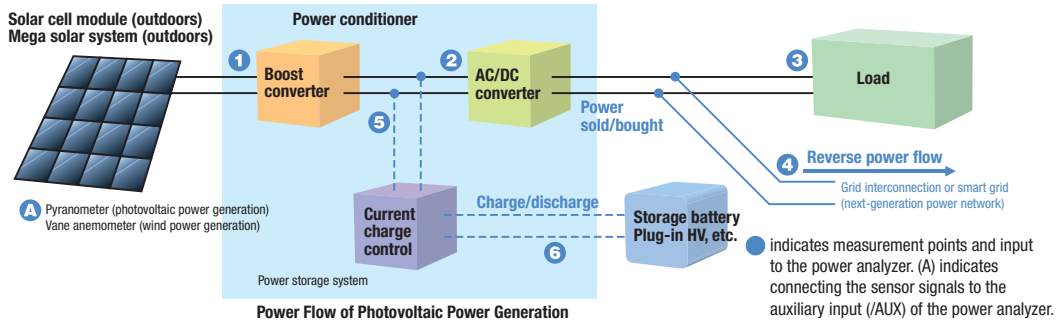
Overview
Energy generated by photovoltaic cell modules and wind turbines is converted from DC to AC by a power conditioner. Furthermore, the voltage is converted by a charge control unit for the storage battery. Minimizing losses in these conversions improves efficiency in the overall energy system. The WT1800 is capable of providing up to 6 channels of power inputs per unit to make it possible to measure the voltage, current, power, and frequency (for AC) before and after each converter, as well as converter efficiency and charging efficiency.

Advantages of WT1800

• Max. 1000 V/50 A x 6-line direct measurement

Wide voltage/current range

Efficiency measurement

Synchronized operation

Direct input terminals in a voltage range from 1.5 V to 1000 V and current range from 10 mA to 5 A or 1 A to 50 A make it possible to perform high-precision measurements without using a current sensor. Furthermore, power conditioner evaluation requires multiple-channel power measurements, such as inputs/outputs from a boost converter, inverter, and storage battery. The WT1800 is capable of providing up to 6 channels of power inputs to make it possible to simultaneously perform power measurements at multiple points with one unit. In addition, two units can be operated in synchronization for multi-channel power evaluation.

• Maximum Power Peak Tracking (MPPT) measurement

MPPT

Maximum power peak value

In photovoltaic power generation, an MPPT control is performed to effectively utilize voltage generated by photovoltaic cells in an attempt to maximize the harvested power.
The WT1800 is capable of measuring not only the voltage, current, and power but also the voltage, current, and power peak values (plus (+) and minus (-) sides, respectively). Also, the maximum power peak value (plus (+) and minus (-) sides) can be measured.

Typical voltage, current, and power measurements in MPPT control
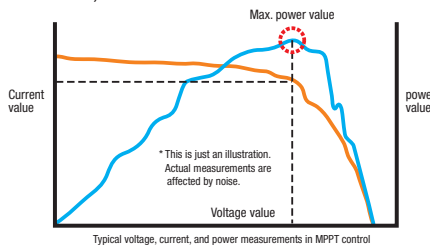
Basic Specifications

• Measurement Voltage range: (for Crest factor 3)
  1.5/3/6/10/15/30/60/100/150/300/600/1000 V
• Measurement Direct Current range: (for Crest factor 3)
  5 A input element
    10 m/20 m/50 m/100 m/200 m/500 m/1/2/5 A
  50 A input element
    1/2/5/10/20/50 A
• Measurement External Current Sensor range: (for Crest Factor 3)
  50 m/100 m/200 m/500 m/1/2/5/10 V
• Band width: DC, 0.1 Hz to 1 MHz
    (5 A direct Current input, External Current Sensor input)
    DC, 0.1 Hz to 200 kHz (50 A direct Current input)
• Basic Accuracy: (45 Hz ≤ f ≤ 66 Hz)
    ±(0.1% of reading + 0.05% of range)
• DC Accuracy: ±(0.05% of reading + 0.1% of range)
• A/D converter: Sampling frequency 2 MS/s
    Resolution 16 bit
• External dimensions: Approx. 426 (W) × 177 (H) × 459 (D) mm
• Weight: Approx. 15 kg (with 6-input element)

*5 A and 50 A Input Element can be installed in one unit

Model Number and Suffix Code

Model	Suffix codes	Description					
		WT1800 Single input element					
WT1801	-01	50 A					
	-10	5 A					
		WT1800 2 input elements					
WT1802	-02	50 A	50 A				
	-11	5 A	50 A				
	-20	5 A	5 A				
		WT1800 3 input elements					
WT1803	-03	50 A	50 A	50 A			
	-12	5 A	50 A	50 A			
	-21	5 A	5 A	50 A			
	-30	5 A	5 A	5 A			
		WT1800 4 input elements					
WT1804	-04	50 A	50 A	50 A	50 A		
	-13	5 A	50 A	50 A	50 A		
	-22	5 A	5 A	50 A	50 A		
	-31	5 A	5 A	5 A	50 A		
	-40	5 A	5 A	5 A	5 A		
		WT1800 5 input elements					
WT1805	-05	50 A	50 A	50 A	50 A	50 A	
	-14	5 A	50 A	50 A	50 A	50 A	
	-23	5 A	5 A	50 A	50 A	50 A	
	-32	5 A	5 A	5 A	50 A	50 A	
	-41	5 A	5 A	5 A	5 A	50 A	
	-50	5 A	5 A	5 A	5 A	5 A	
		WT1800 6 input elements					
WT1806	-06	50 A	50 A	50 A	50 A	50 A	50 A
	-15	5 A	50 A	50 A	50 A	50 A	50 A
	-24	5 A	5 A	50 A	50 A	50 A	50 A
	-33	5 A	5 A	5 A	50 A	50 A	50 A
	-42	5 A	5 A	5 A	5 A	50 A	50 A
	-51	5 A	5 A	5 A	5 A	5 A	50 A
	-60	5 A	5 A	5 A	5 A	5 A	5 A
		Standard option					
Power cord	-D	UL/CSA standard					
	-F	VDE standard					
	-R	AS standard					
	-Q	BS standard					
	-H	GB standard					
	-N	NBR standard					
Languages	-HE	Default setting English menu					
	-HG	Default setting German menu					
	-HC	Default setting Chinese menu					
	-HR	Default setting Russian menu					
		Additional option					
Options	/EX1	External current sensor input for WT1801					
	/EX2	External current sensor input for WT1802					
	/EX3	External current sensor input for WT1803					
	/EX4	External current sensor input for WT1804					
	/EX5	External current sensor input for WT1805					
	/EX6	External current sensor input for WT1806					
	/B5	Built-in printer					
	/G5	Harmonic Measurement	Only one can be selected				
	/G6	Simltaneous Dual Harmonic Measurement					
	/DT	Delta Computation					
	/FQ	Add-on Frequency Measurement					
	/V1	RGB output					
	/DA	20-channel DA Outputs					
	/MTR	Motor Evaluation Function	Only one can be selected				
	/AUX	Auxiliary Sensor Inputs					
	/HS	High Speed Data Capturing					

* The numbers in the "Description" column have the following meanings.
  50 A: 50 A input element, 5 A: 5 A input element
  Elements are inserted in the order shown starting on the left side on the back.
* GPIB, Ethernet and USB communication come standard.

Note: Adding input elements after initial product delivery will require rework at the factory. Please choose your models and configurations carefully, and inquire with your sales representative if you have any questions

New compact WT300E series for reliable power measurement

Useful in the development of home appliances and office equipment as well as in the measurement of power consumption and standby power on production line

WT310E (1 ch)

WT310EH (1 ch, MAX40A)

WT332E (2 ch)/ WT333E (3 ch)

CE

Bulletin WT310-01EN

The WT300E series is the enhanced 5th generation of Yokogawa's compact power meter portfolio.

Specifications

- Direct voltage input range
  15/30/60/150/300/600 V
- Direct current input range
  5/10/20/50/100/200 mA (WT310E only)
  0.5/1/2/5/10/20 A (Common for WT300E series)
  1/2/5/10/20/40 A (WT310EH only)
- External current input range (optional)
  2.5/5/10 V or 50 m/100 m/200 m/500 m/1/2V
- Frequency range: DC, 0.1 Hz to 100 kHz
  (up to 20 kHz for WT310EH)
- Basic accuracy (45 Hz to 66 Hz)
  Voltage/current $\pm(0.1\%$ of rdg*1 + 0.05% of rng*2)
  Power $\pm(0.1\%$ of rdg*1 + 0.05% of rng*2)
- Influence of power factor (when cos φ =0)
  Add ±0.1% of S
- Data update rate: 100 m/250 m/500 m/1/2/5/10/20s, Auto
- External dimensions
  · WT310E/WT310EH: Approx. 213(W) × 88(H) × 379(D) mm
    (excluding protrusions)
  · WT332E/WT333E: Approx. 213(W) × 132(H) × 379(D) mm
    (excluding protrusions)
- Weight: Approx. 3.0 kg (WT310E/WT310EH), approx. 5.0 kg (WT332E/WT333E)

*1 rdg: reading, *2 rng: range

New Functions to Improve Measurement Efficiency

● Range skip (range configuration) function

The WT300E series is equipped with the range skip (range configuration) function of the high-end models, which reduces the range-change time in auto-ranging mode that is long due to the wide voltage and current ranges.

This function skips the ranges other than the pre-selected range to speed up the change to the selected range in auto-ranging mode. (The included WTViewerFreePlus software is required for the setting)

Action of Yokogawa's previous model
Input signal changes
Range change ends
Change available ranges stepwise

Action of WT310E/WT330E series
Range change ends   Change to selected next range
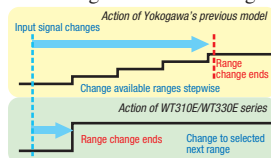
● Integration measurement auto-ranging function

This is the industry's first function to automatically change the range in response to changes of the consumption power and current values in integration mode. This function continues integration even if the level of the input exceeds the maximum of the selected range and the range is changed to a higher level as a result of a rapid change in the conditions. This function eliminates the need for repeating the test even if a range is exceeded, thus reducing the evaluation time. Furthermore, separate power integration for each polarity (±Wh), current integration (Ah), and DC integration (charge/discharge) are also available.
(The measurement accuracy depends on the input level and variation. It is recommended to set a fast data update rate.)

Features

- **Basic power accuracy: ±0.15% of total**
- **Measurement frequency range: DC, 0.1 Hz to 100 kHz (to 20 kHz for WT310EH)**
- **Fast data update rate: 100 ms**
- **Auto data update rate function for fluctuating input**
- **Small current measurement: 5 mA range available (WT310E)**
- **40 A large current available (WT310EH)**
- **Multiple communication interfaces: USB, GP-IB or RS-232 and Ethernet (option and supports the Modbus/TCP Protocol)**
  - Integration power measurement auto ranging function
  - Simultaneous measurement of harmonics with voltage, current, and power (mode switching is not required, but the included a PC software is required)
  - Compact half-rack mount size
  - The included standard PC software allows you to display values, harmonic bar graph, and waveforms

Models and Suffix Codes

Model	Suffix Code		Description
WT310E			1 Input element model
Communication Interface *USB is standard	-C1	select one	GP- IB
	-C2		RS- 232
Power Cord	-D		UL, CSA standard, PSE
	-F		VDE standard
	-R		AS standard
	-Q		BS standard
	-H		GB standard
	-N		NBR standard
Optional function	/C7		Ethernet interface
	/EX1	Only one can be selected	External sensor input 2.5 V/5 V/10 V
	/EX2		External sensor input 50 mV/100 mV/200 mV/500 mV 1 V/2 V
	/G5		Harmonics Measurement
	/DA4		D/A- output (4 CH)
Model	Suffix Code		Describe
WT310EH			1 Input element /High current model
Communication Interface *USB is standard	-C1	select one	GP- IB
	-C2		RS- 232
Power Cord	-D		UL, CSA standard, PSE
	-F		VDE standard
	-R		AS standard
	-Q		BS standard
	-H		GB standard
	-N		NBR standard
Optional function	/C7		Ethernet interface
	/EX1	Only one can be selected	External sensor input 2.5 V/5 V/10 V
	/EX2		External sensor input 50 mV/100 mV/200 mV/500 mV 1 V/2 V
	/G5		Harmonics Measurement
	/DA4		D/A- output (4 CH)
Model	Suffix Code		Describe
WT332E			2 Input elements model
WT333E			3 Input elements model
Communication Interface *USB is standard	-C1	select one	GP- IB
	-C2		RS- 232
Power Cord	-D		UL, CSA standard, PSE
	-F		VDE standard
	-R		AS standard
	-Q		BS standard
	-H		GB standard
	-N		NBR standard
Optional function	/C7		Ethernet interface
	/EX1	Only one can be selected	External sensor input 2.5 V/5 V/10 V
	/EX2		External sensor input 50 mV/100 mV/200 mV/500 mV/1 V/2 V
	/G5		Harmonics Measurement
	/DA12		D/A- output (12 CH)

Standard accessories
Power cord(1 set), Rubber foot(1 set), Current input protective cover(each 1 set), Start up guide(1 set), Connector (provided only with /DA4 or /DA12, each 1 set), Safety terminal adapter 758931(provided two adapters in a set times input element number), CD(1 piece,included the startup guide, user guide, instruction manual and the communication manual by PDF data, and Viewer Software)

WTViewerFreePlus For WT300E Series (included)
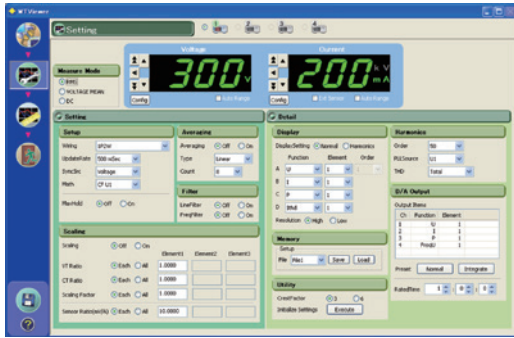
Setting Window
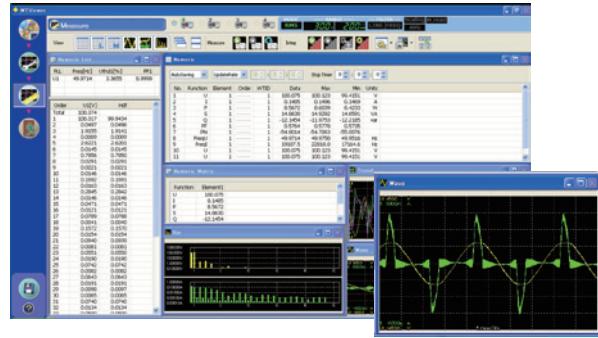
Measurement Window

The WTViewerFreePlus software installed on a PC uses a USB, GP-IB/RS-232, or Ethernet (optional) interface to capture, transfer, and display* five or more numeric values, bar graph of harmonic order components, trend graph of measurement data, or voltage/current waveforms that cannot be displayed on the LED display of the WT300E series. The use of this software extends the application range of the WT300E series.

With the aim of simplifying the connection and setup, the details were redesigned so that the communication function is recognized automatically, a dedicated setting window was added, and all measurement data can be displayed simultaneously.

* Waveform display requires the /G5 harmonic measurement option.

WT300E Series can be used for a Variety of Applications

Production line or QA testing of electric Devices

- Compact half rack mount size helps customers build smaller test systems with a better Return on Investment (ROI).
- D/A output function and Modbus/TCP Protocol (/C7 option) for data recording
- Multiple communication interfaces. USB, RS-232 or GP-IB and Ethernet capability.

The simultaneous measurement of power consumption parameters such as U, I, P, frequency, Power Factor and Harmonics for production line or QA testing results in reduced tact times. Thus testing is faster and cheaper. The DA output and communication interfaces enable data to be remotely and flexibly captured.
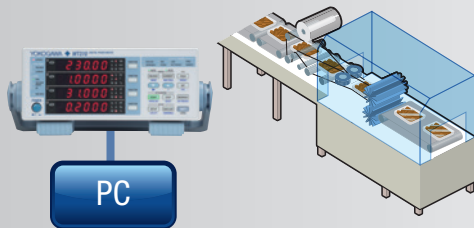
Duration testing and efficiency measurement for industrial motors and rotating machinery

- Integration measurement for long period
- D/A output function and Modbus/TCP Protocol (/C7 option) for data recording
- DC, 0.1 Hz to 100 kHz broad bandwidth capability

The WT300E series provides reliable current integration (Ah) and Energy (Wh) measurement for up to 10,000 hours (approx. 1 year). The D/A option is used to save and monitor the measurement results (WT310E/WT310EH: 4 ch, WT332E/WT333E: 12 ch). An external recorder or data logger like, a ScopeCorder, can be used to save this D/A function data along with other parameters such as temperatures, torque and rotation speed.
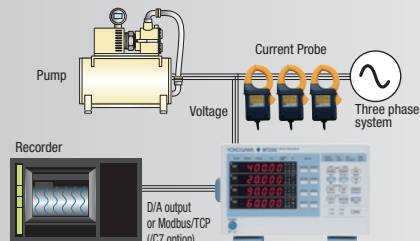
Comparison between WT210/230 series, WT300 series and WT300E series

		Enhancement points from the WT310/WT330		Changed points from the WT210/WT230	
	WT300E series		**WT300 series**		**WT210/WT230**
Basic power measurement accuracy (50/60 Hz)	0.1% of reading + 0.05% of range		0.1% of reading + 0.1% of range		0.1% of reading + 0.1% of range
Influence of power factor	When power factor (λ) = 0 (S: apparent power) ±0.1% of S for 45 Hz ≤ f ≤ 66 Hz		When power factor (λ) = 0 (S: apparent power) ±0.2% of S for 45 Hz ≤ f ≤ 66 Hz		When power factor (λ) = 0 (S: apparent power) ±0.2% of S for 45 Hz ≤ f ≤ 66 Hz
Frequency bandwidth	DC, 0.1 Hz to 100 kHz (WT310EH DC, 0.1 Hz to 20 kHz)		DC, 0.5 Hz to 100 kHz (WT310EH DC, 0.5 Hz to 20 kHz)		DC, 0.5 Hz to 100 kHz
Direct input Current range	WT310E: 12 ranges/5 mA to 20 A, WT310EH: 6 ranges/1 to 40 A WT332E/WT333E: 6 ranges/0.5 to 20 A		WT310: 12 ranges/5 mA to 20 A, WT310HC: 6 ranges/1 to 40 A WT332/WT333: 6 ranges/0.5 to 20 A		WT210: 12 ranges/5 mA to 20 A, WT230-2ch/WT230-3ch: 6 ranges/0.5 to 20 A
External current input	EX1: 2.5/5/10 [V] EX2: 50 m/100 m/200 m/500 m/1/2 [V] (OP.)		EX1: 2.5/5/10 [V] EX2: 50 m/100 m/200 m/500 m/1/2 [V] (OP.)		EX1: 2.5/5/10 [V] EX2: 50 m/100 m/200 m [V] (OP.)
Expansion of effective input range for voltage & current (CF = 6A)	2% to 260%*1		No		No
Expansion of maximum displaying value for voltage & current (CF = 6A)	2% to 280%*2		No		No
Simultaneous measurement of RMS, Voltage MEAN & DC	Yes*3		Yes*3		No
Frequency measurement	2 channels (voltage and current)		2 channels (voltage and current)		selected voltage or current (one)
Number of display item	4 items		4 items		3 items
Sampling rate	Approximately 100 kS/s		Approximately 100 kS/s		Approximately 50 kS/s
Data Update rate	100 m/250 m/500 m/1/2/5/10/20 sec, Auto		100 m/250 m/500 m/1/2/5 sec		100 m/250 m/500 m/1/2/5 sec
Harmonic measurement	Yes (OP, /G5)		Yes (OP, /G5)		Yes (OP, /HRM)
THD calculation maximum order setting	Yes (OP, 1 to 50th)		Yes (OP, 1 to 50th)		
Auto ranging of integration	Yes		Yes		No
Communication interface	USB	Yes	Yes		No
	GP-IB	Yes GP-IB or RS-232	Yes GP-IB or RS-232		Yes (OP) GP-IB or RS-232C
	RS-232	Yes GP-IB or RS-232	Yes GP-IB or RS-232		Yes (OP) GP-IB or RS-232C
	Ethernet	Yes (OP)	Yes (OP)		No
	Modbus/TCP (Ethernet)	Yes (OP, /C7)	No		No
IEEE standard for GP-IB	IEEE488.2		IEEE488.2		IEEE488.1 and IEEE488.2
Comparator function	Yes		Yes		Yes
Viewer software (setting & data capturing)	Free (included)		Free (included)		Free (download)

*1: WT310EH input range is 2% to 260% (20 A range only up to 200%)
*2: WT310EH input range is 2% to 280% (20 A range only up to 220%)
*3: Simultaneous, mode independent measurement using the WTViewerFreePlus PC software.

*A command compatible mode for the previous WT200 series is prepared. (IEEE488.2 only)
In that mode, the WT300E series and WT300 series works identically to a WT200 series except for the Store (and recall operation) and the Compare functions.
*Modbus/TCP communication requieres /C7 Ethernet option.

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Precision Power Scope **PX8000**

Power Analyzer Capable of Measuring Waveform Parameters and Transient Power

PX8000

Bulletin PX8000-01EN

The PX8000 is a compact sophisticated power analyzer that can incorporate up to four measurement power elements. It can calculate the transient voltage, current, and power for each cycle, the average voltage, current, and power between cursors, and measure waveform parameters.

Features

- High-speed sampling and wide range measurement
  The power of devices driven at a high frequency can be measured at a 100 MS/s sampling rate, at a 12-bit resolution, and in the 20 MHz range*1.
- Waveform measurement function
  Instantaneous power waveforms can be displayed as standard in addition to voltage and current waveforms, and power changes can be observed directly. Voltage, current, and power waveforms for each cycle can be calculated and numerical values can be displayed by cursor.
  The average voltage, current, and power values in a specified period by the cursor can be calculated.
  Acquisition memory is up to 100 M points per channel (when equipping the /M2 option), allowing for capturing and displaying detailed waveforms.
- Waveform analysis function
  Up to the 500th order harmonic components can be measured simultaneously (when installing the /G5 option).
  2-channel FFT function is available as standard.
- De-skew (phase compensation) function when using an external power sensor, etc. is available.
- Motor characteristics can be evaluated (mechanical output calculation with torque and rotation speed input, as well as analog and pulse input).

*1: Direct current input at 10 MHz (-3 dB typical)

Various functions to measure transient power*2

Simultaneous calculation and display of instantaneous power waveforms

The PX8000 calculates the instantaneous power waveform simultaneously with the voltage and current waveforms. The instantaneous waveform can be obtained as the product of the voltage and current waveforms that are sampled at the same time. This function is a standard function so no special setting is required. This instantaneous power value can be displayed using the cursor.

Waveform data in the displayed entire range can be displayed on the numerical display screen.

The instantaneous power waveform indicates the trend of power change. The value at any point in time can be displayed using the cursor.

Trend power calculation for each cycle

Power trend waveform for each cycle can be calculated using the User Defined Computation (waveform calculation, MATH) at up to 4 M points. The captured waveforms can be used to obtain the value for a particular cycle and calculate the difference between cycles using the cursor function.

Settings of the trend calculation using the User Defined Computation (MATH) function.

The cursor (horizontal, vertical, and marker) allows you to display the numerical data of trend waveform for each cycle calculated using the User Defined Calculation (MATH).

Power calculation in a range specified by the cursor

The average numerical values in a range specified by the cursor can be calculated. Values between cursors of waveforms displayed on the screen can be displayed on the upper numerical display screen. The MEASURE function cursor can be used for the measurement in the specified range.
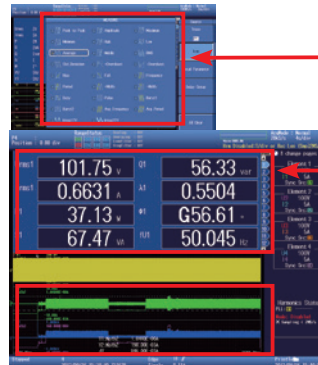
Waveform parameters to be calculated can be set in detail.

Measured values of waveforms displayed between cursors indicating the start and stop positions can be displayed on the numerical display screen.

Viewer software PowerViewerPlus

Start screen

Measurement results display screen
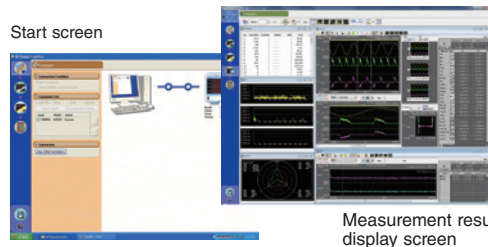
A PC application software for the PX8000, 760881 PowerViewerPlus allows you to transfer measurement data of the PX8000 to a PC to display and analyze a large amount of waveform data on the PC.

*2: Accuracy is not specified for the numerical data of the measured transient power.

Power measurement elements (voltage and current modules) and Auxiliary (AUX) module

Power measurement elements

Voltage module 760811

Current module 760813 760812

AUX module

Power measurement elements comprising a pair of the voltage module (760811) and current module (760812/760813) are required to measure power. You need to connect at least one set of power measurement element, the voltage module to slot 1 and the current module to slot 2.
Note: Up to 3 AUX modules can be connected to odd number slots 3, 5, and 7 except for slot 1.

Functions to prevent mismatch between the voltage and current modules

- Warning message
- Check on the overview screen '(you can check paired modules)

Safety design

Different types of voltage input terminal and current input terminal are used to keep the user from confusing one from the other.

Voltage input terminal type (female-type safety terminal)

Current input terminal type (male-type safety terminal)

Application example: Inverter evaluation using the PX8000 and DL850EV

PX8000

(1)   Measuring battery output (DC)
(2),(3) Inverter output measurement and transient power measurement
(4)   Mechanical output measurement of motor (torque and rotation speed measurements)

Inverter

Input (1)
Battery
Boost converter
Drive circuit
Modulate the DC signal to convert it to an arbitrary AC signal
(2) (3) Drive motor
Torque/ rotation speed sensor
Load
Vibration
Temperature
Voltage/current
Torque/rotation speed
CAN
DL850EV

Overview of the evaluation with the PX8000 and DL850EV

Electric vehicles (EVs) and hybrid electric vehicles (HEV) are made of a large number of electrical and mechanical parts. To evaluate their efficiency, electrical parts and mechanical parts must be measurement simultaneously. The DL850EV is a data acquisition instrument that can measure many types of physical quantities at multiple points simultaneously. On the other hand, the PX8000 measures the efficiency of the inverter and the motor, as well as transient changes at every moment based on the electrical signals of voltage and current and the mechanical output calculated from the torque and rotation speed.

Specifications

- Voltage direct input range: 1.5/3/6/10/15/30/60/100/150/300/600/1000 Vrms
- Current direct input range: 10 m/20 m/50 m/100 m/200 m/500 m/1/2/5 Arms
- Current sensor input range: 50 m/100 m/200 m/500 m/1/2/5/10 Vrms
- Frequency range: DC to 20 MHz (-3 dB, voltage and current sensor input)
  DC to 10 MHz (-3 dB, current direct input)
- Power basic accuracy (45 Hz to 66 Hz): ±(0.1% of reading + 0.1% of range)
- Influence of power factor error (cos ϕ = 0): ±0.15% of S (apparent power)
- A/D converter: Maximum sampling rate 100 MS/s Resolution 12-bit
- Acquisition memory: Standard: 10 M points per channel Max: 100 M points per channel (/M2 option)
- Maximum waveform viewing time: 20 minutes (not dependent on the memory size)
- History memory: This function can save up 1,000 records of waveform data and display and calculate them as needed(when the /M2 option installed)
- Waveform display: Up to 16 waveforms can be displayed. Voltage and current waveforms and simultaneous power waveform can be displayed.
- Snapshot: Waveform at an arbitrary moment on the screen can be saved.
- De-skew (phase compensation) function: Phase difference between the voltage and current modules is compensated.
- Trend measurement (waveform measurement, MATH): Voltage, current, and power waveform calculation for each cycle
- Calculation in the specified period (waveform parameter calculation, MEASURE): Average value between cursors can be measured.
- Simultaneous harmonic measurement: Up to the 500th order harmonic measurement (/G5 option)
- 2-channel FFT function available as standard
- Printer: Screens can be copied (/B5 option)
- External storage: USB port (×2), SD card
- Video output: RGB analog, video output
- Display unit: 10.4-inch color TFT XGA display
- GP-IB, Ethernet, and USB communication available as standard
- IRIG function: Data measured with multiple PX8000 units can be synchronized (/C20 option)
- Sensor power supply 4CH DC power supply ±15Vdc Max. of 1A/CH
- External dimensions: 355 (W) × 259 (H) × 180 (D) mm (excluding protrusions)
- Weight: Approximately 6.5 kg (main unit only, excluding paper and options)

* For common options and accessories, see Page 35.

PX8000 Model and Suffix Codes

Product name	Model	Suffix code	Description
Precision Power Scope	PX8000		Precision Power Scope main unit
		-D	UL and CSA standards (PSE compliant, 3-pole type)
		-F	VDE standard
		-R	AS standard
		-Q	BS standard
		-H	GB standard
		-N	NBR standard
		-HE	English menu language
		/B5	Built-in printer
		/C20	IRIG function
		/G5	Simultaneous harmonic measurement
		/M1*1	50 M point/CH memory extension
		/M2*1	100 M point/CH memory extension
		/P4	4 CH probe power output
		/PD	4 CH sensor power output

Product name	Model	Suffix code	Description
Voltage Module	760811 *2		Necessary to order the same number as that of the 760812/760813 Current Modules at the same time
Current Module	760812 *2		Necessary to order the same number of that of the 760811 Voltage Modules at the same time
	760813 *2		Necessary to order the same number of that of the 760811 Voltage Modules at the same time The 760813 is direct current input only.
Auxiliary (AUX) Module	760851		Can measure the sensor signals of torque and rotation speed on 2 channels

*1 Selection of both /M1 and /M2 is not available for one main frame. The standard memory length is 10 M points/CH.
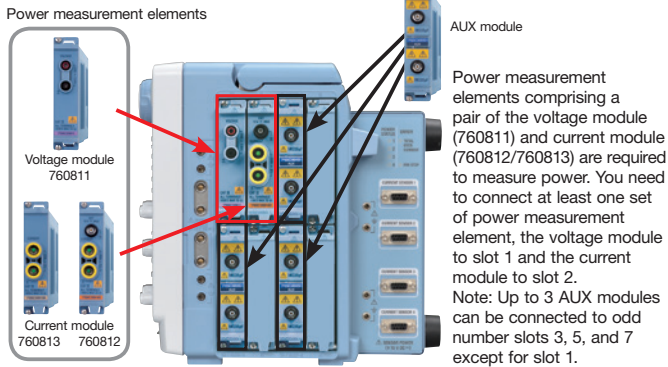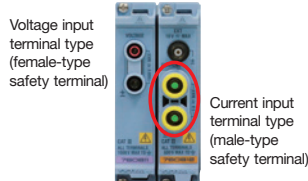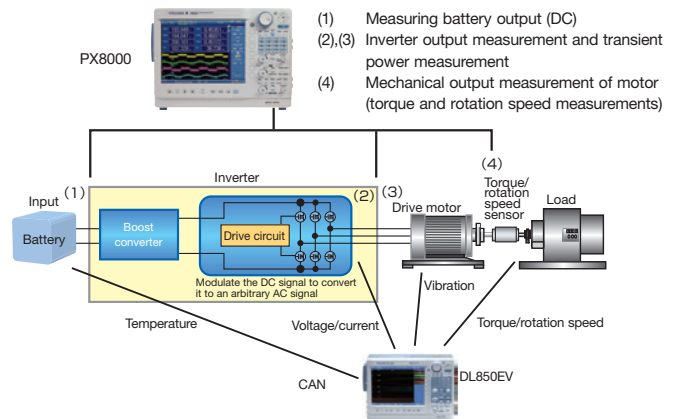
*2 The power value will be calibrated using a pair of Voltage (760811) and Current (760812/760813) modules, therefore an equal quantity of these must be ordered together.

Product name	Model	Suffix code	Description
Power Viewer Plus	760881		Dedicated PC application software for PX8000. It is a waveform data analysis software

<Cautions regarding the installation of modules and their location>
- The PX8000 has a maximum of 8 slots for installing modules.
- It is required to equip the PX8000 main frame with at least one Voltage Module and one Current Module in slots 1 and 2 to create one Power Measurement Element. The PX8000 can be equipped with a maximum of three additional Power Measurement Elements.
- When modules are ordered with the PX8000 main frame, the modules are factory installed in the main frame up to a combined maximum of 4 power measurement elements and auxiliary modules. Priority is given to the installation of power measurement elements.
- The location of modules can be changed by the customer. However, slot 1 must be always containing a Voltage Module and slot 2 must always contain a Current Module.
- Power values are calibrated using one Voltage Module and one Current Module, so the same number of these modules must be ordered together. In the case of service, repair or re-calibration, both modules must be sent together to the service department.
- Up to 3 Auxiliary (AUX) Modules can be installed in odd numbered slot only (3, 5 and 7). Odd numbered slots (3, 5 and 7) are also used to install additional Voltage Modules, and even numbered slots (4, 6 and 8) for additional Current Modules.

Digital Power Analyzers

Digital Power Analyzers

AC/DC Current Sensor CT60/CT200/CT1000

Wide Variety of precision Current Sensors for broad applications

Bulletin CT1000-00E

CT60/CT200/CT1000
AC/DC Current Sensors, DC, up to 800 kHz, up to 1000 A peak

- Rated Current
  - CT60   DC: 0 to 60 A, AC 60 A peak
  - CT200   DC: 0 to 200 A, AC 200 A peak
  - CT1000   DC: 0 to 1000 A, AC 1000 A peak
- Frequency bandwidth
  - CT60   DC to 800 kHz (-3 dB)
  - CT200   DC to 500 kHz (-3 dB)
  - CT1000   DC to 300 kHz (-3 dB)
- Measurement Accuracy
  - DC, 50/60 Hz: ± (0.05% of reading + 30 μA)
- Power Supply Voltage ± (15 V + 5%)

Current Probe 751552

Accessory for Digital Power Meters and Power Analyzer

758917   758921

Bulletin CT1000-00E

751552
Current Clamp-on Probe, AC 1000 Arms (1400 A Peak)

- Measurement bandwidth: 30 Hz to 5 kHz
- Basic accuracy: ± 0.3% of reading
- Maximum allowable input: AC 1000 Arms
                            1400 Apk (AC)
- Current output type: 1 mA/A

To connect this probe to the WT series, you need the Model 758921 (Fork terminal adapter) and Model 758917 (Measurement lead set) accessories sold separately. For details, please see the Power Meter Accessories Catalog (Bulletin CT1000-00E).

Current Sensor Unit 751522 / 751524

Accessories for Digital Power meters and Power Analyzers

751522 : For Single-Phase

751524 : For Three-Phase

Bulletin CT1000-00E

751522 / 751524
AC/DC Current Sensor Unit. DC, up to 100 kHz, up to 1000 A peak

- Large current measurement:
  DC: 0 to 1000 A / AC: 1000 A peak
- Wide measurement frequency range:
  DC to 100 kHz (-3 dB)
- High-precision fundamental accuracy:
  +/- (0.05% of rdg* + 40 μA)
- Superior noise withstanding ability and CMRR characteristic due to optimized casing design
- Calibration enabled in combination with WT Series

WT Series Accessory Software 760122 and Power Consumption Measurement Software

PC-based Control and Data Acquisition

WTViewer

760122

Main Features of WTViewer
- Numeric, waveform, harmonic, and trend displays
- Manual save function: With one click you can save only desired data at the right timing.
- Data conversion to CSV: You can save waveforms, numeric data, and screen images to a PC.
- You can control multiple WT series units of the same specifications from a PC.
  Note: The functionality differs slightly depending on the model. For details, please refer to the specifications of your desired model.

WTViewer is a software application that allows you to load numeric and waveform data measured with the WT1800 High performance Power Analyzer, or WT500 Power Analyzer to a PC via GP-IB, or USB (for WT1800/WT500) communications. It also lets you view the waveform data, and analyze and save the numeric data.

Communication functions supported by WTViewer 760122

Model number	GP-IB	Serial (RS-232)	Ethernet	USB
WT1800	○	×	○	○
WT500	●	×	●	○

○ : Supported (by WT as standard)   ● : Supported (by WT as an option)   × : Not supported (by WT)
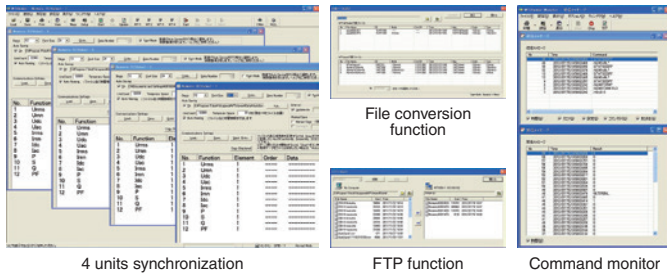
WT1800

	Maximum connections	FTP server/ client function
GP-IB connection	1 to 4 units	Not available
USB communication	1 to 4 units	Not available
Ethernet communication	1 to 4 units	Available

WT500

	Maximum connections	FTP server function
GP-IB connection	1 to 4 units	Not available
Ethernet communication	1 to 4 units	Available
USB communication	1 to 4 units	Not available

File conversion function

4 units synchronization

FTP function

Command monitor

Power Consumption Measurement Software

Power Consumption Measurement Software

Free Software

- The IEC62301 Ed 2.0 is a reference standard in the EN 50564: 2011 Directive. This software corresponds to a test method of those two standards.
- Allows you to acquire the necessary data such as a power value with simple operations such as just pressing the Start button.
- Allows you to print out a report on the measurement results.

(The free software can be downloaded from Yokogawa's website)

WT3000E

WT1800

WT310E

GP-IB
(WT1800/WT3000E/WT310E)
RS-232
(WT3000E/WT310E)

Ethernet
(WT1800/WT3000E/WT310E)
USB
(WT1800/WT3000E/WT310E)

Example of an initial setup screen

Example of a screen to set the measurement conditions

Example of a measurement screen

Example of a printed report
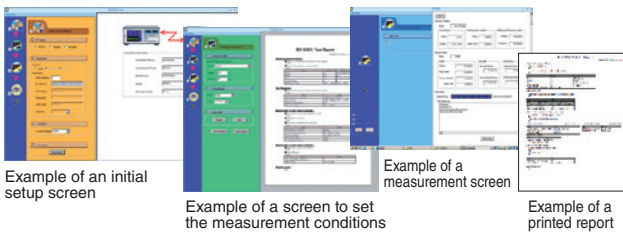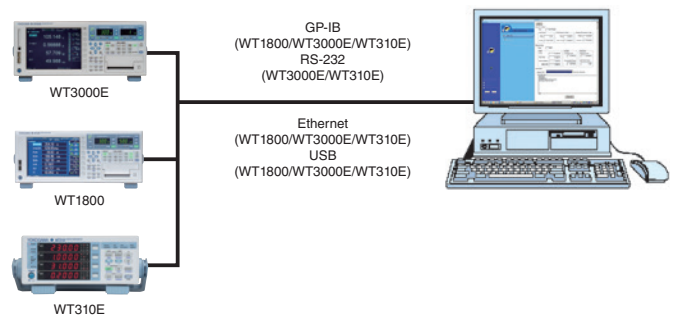
WT Series Accessory Software   761922 IEC regulation software

Support for IEC Standards Testing

Harmonic/Flicker Measurement Software

761922

■ Allows you to judge high current equipment with input current of 16 A or more per phase (IEC61000-3-11/-3-12)
■ Support for the method that does not consider interharmonics in the window of 16 cycles specified in IEC61000-4-7
■ Best-in-class high-precision current and voltage measurements (also allows you to calculate the limits of the standard)
■ All Judgment graph display shows a list of all the measurement results in a time series by order.

■ Allows you to measure harmonics for up to 24 hours, so capable of measuring equipment that needs more than one hour for one cycle.
■ Continuous data acquisition at a measurement interval of 200 ms ensures continuous measurement over a long period of time with no missing data
■ Support for the standard tests of single- and three-phase equipment

Example of a measurement screen
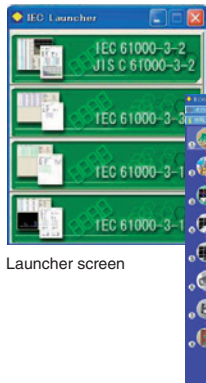
Launcher screen

Example of an initial setup screen

Example of a printed report

Less than 20 A single phase

AC Power Supply

Reference Impedance Network

WT3000E Precision Power Analyzer
Recommended model:
WT3001E-2A0-30A1-x/G6/FL

GP-IB or Ethernet

More than 20 A single phase

AC Power Supply

Reference Impedance Network

A special order model is available that includes a current transducer and shunt resistor set.
*You need to purchase the power supply and cable separately.

Current sensor

Current transducer power supply

Shunt resistor

WT3000E Precision Power Analyzer
Recommended model:
WT3003E-2A0-30A3-x/G6/FQ/FL

* The external sensor input of the WT3000E is used.

GP-IB or Ethernet

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Digital Power Analyzers Accessories List   **Accessories List**

Product	Part No.	Description		WT3000E	WT1800	WT500	WT310E/WT330E	PX8000
1:1 BNC safety adapter lead	701901	1000 Vrms-CAT II, 1.8 m long. Safety BNC (male) to safety banana (female) use in combination with 701959, 701954, 758921, 758922 or 758929		●	●	●	●	
Measurement leads	758917	Two leads in a set. Use 758917 in combination with 758922 or 758929. Total length: 75 cm. Rating: 1000 V, 32 A		●	●	●	●	●
Small alligator adapters	758922	For connection to measurement leads (758917). Two in a set. Rating: 300 V		●	●	●	●	●
Large alligator adapters	758929	For connection to measurement leads (758917). Two in a set. Rating: 1000 V		●	●	●	●	●
Safety terminal adapter set	758923	Spring-hold type. Two adapters in a set.		●	●	●	●	●
Safety terminal adapter set	B8213ZD	Screw-fastened adapters for voltage input. Two adapters in a set. 1.5 mm Allen wrench for tightening is required.		●	●	●	●	●
Safety terminal adapter set	B8213ZA	Screw-fastened adapters for current input of PX8000. Two adapters in a set. Allen wrench for tightening is required.						●
Fork terminal adapter	758921	Two adapters (red and black) to a set. Used when attaching banana plug to binding post.		●	●	●	●	
Conversion adapter	758924	For conversion between BNC and female banana plug		●	●	●	●	
Conversion adapter	366971	9-pin/25-pin conversion adapter		●				
External sensor cable	B9284LK	For the external input of the WT series. Length: 50 cm		●	●	●	●	●
BNC cable	366924	BNC cable BNC–BNC, 1 m		●	●	●		●
BNC cable	366925	BNC cable BNC–BNC, 2 m		●	●	●		●
26 pin cable	705926	For/DA4 and/DA12 option					●	
Current sensor cable	A1559WL	Cable length 3 m						●
Current sensor cable	A1560WL	Cable length 5 m						●
Shunt resistor box	A1323EZ	5 ohm ±0.05% for CT1000						●
Shunt resistor box	A1325EZ	20 ohm ±0.02% for CT200 and CT60						●
Rack mounting kit	751535-E4	For EIA		●	●	●		
Rack mounting kit	751535-J4	For JIS		●	●	●		
Rack mounting kit	751533-E2	For WT310E/WT310EH EIA standalone installation					●	
Rack mounting kit	751533-J2	For WT310E/WT310EH JIS standalone installation					●	
Rack mounting kit	751534-E2	For WT310E/WT310EH EIA connected installation					●	
Rack mounting kit	751534-J2	For WT310E/WT310EH JIS connected installation					●	
Rack mounting kit	751533-E3	For WT332E/WT333E EIA standalone installation					●	
Rack mounting kit	751533-J3	For WT332E/WT333E JIS standalone installation					●	
Rack mounting kit	751534-E3	For WT332E/WT333E EIA connected installation					●	
Rack mounting kit	751534-J3	For WT332E/WT333E JIS connected installation					●	

Digital Power Analyzers

DC Voltage/ Current Source   **GS200**

Higher Accuracy — The New Advanced DC Voltage/Current Source

USB STORAGE

Functions

The GS200 generates high accuracy, high stability, high resolution, and extremely low-noise DC voltage and current signals that are required for many applications.

• Voltage source up to ±32 V and current source up to ±200 mA
• 5 1/2-digit, ±120,000-count output resolution
• Voltage and current simple monitoring feature (optional)
• Programmable output up to 10,000 points
• Built-in USB mass storage device
• Channel expansion through synchronous operation

The monitoring feature can be used to:
• Check that current is flowing.
• Check and inspect current consumption
• Log fluctuations in the load current
• Record I-V characteristics

Load current measurement

Vcc application
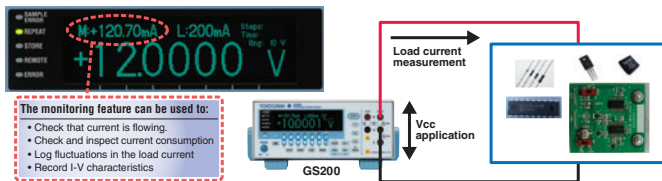
GS200

Voltage and Current Source Range

The GS200 can perform four-quadrant operation by operating as a current source or a current sink in the range of ±30 V and ±200 mA. When the GS200 is sinking current, it can operate over the exact same range as when it is operating as a current source. You can use the GS200 not just as a highly accurate voltage source but also as a highly accurate constant-current electronic load.
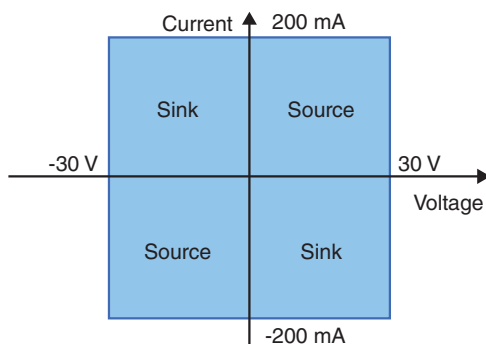
Functions and Specifications

■ Source

• Voltage source

Range	:	10 mV, 100 mV, 1 V, 10 V, 30 V (Use a highly accurate voltage divider at 10 mV and 100 mV ranges)
Maximum output	:	±200 mA (at 1 V, 10 V, and 30 V ranges)

• Current source

Range	:	1 mA, 10 mA, 100 mA, 200 mA
Maximum output	:	±30 V

• Program Feature

Maximum number of steps		
	:	10,000
Trigger source	:	Internal timer (0.1s resolution), External, Step input, measurement end

■ Monitoring (option)

Function	:	Voltage (during current generation), Current (during voltage generation)
Integration time	:	1 to 25 PLC (Power Line Cycle)
Trigger source	:	Internal timer (0.1 s resolution), READY, Communication and Immediate
Delay	:	0 to 999,999 ms (1 ms resolution)
Maximum storage	:	10,000 points

■ External Input and Output

Input signal	:	TRIG IN, OUTPUT IN
Output signal	:	TRIG OUT, OUTPUT OUT, READY OUT
Connector	:	RJ-11 connector
		BNC connector (Select any one of the signals for both the input and output)

Input and output level : TTL
Minimum pulse width : 10 μs

■ Interface

• GP-IB interface
• USB interface
• Ethernet interface (option) 100BASE-TX/10BASE-T

■ General Specifications

• Display	:	256 × 64 dot vacuum fluorescent display
• External dimensions	:	Approx. 213 (W) × 88 (H) × 350 (D) mm (excluding protrusions)
• Weight	:	Approx. 5 kg

GS200 Model and Suffix Codes

Model	Suffix Code		Description
GS210			DC voltage/current source (front panel output terminals)
GS211			DC voltage/current source (rear panel output terminals)
Supply voltage	-1		100 VAC, 50/60 Hz
	-4		120 VAC, 50/60 Hz
	-7		230 VAC, 50/60 Hz
Power cord	-D		UL/CSA standard
	-F		VDE standard
	-R		AS standard
	-Q		BS standard
	-H		GB standard
Options	/MON		Monitoring function
		/C10	Ethernet interface function

Multi Channel Source Measure Unit   **GS820**

Highly Accurate 2-Channel Voltage/Current Source Measure Unit

Drag & Drop

USB

Drag & Drop

USB STORAGE

Features

The GS820 is a highly accurate and highly functional 2-channel programmable DC voltage/current source that incorporates voltage/current generation and measurement functions.

• Isolated 2-channel source and measurement function
• Basic accuracy : ±0.02% (DC voltage source)
• 1 pA resolution at extremely small current range 200 nA
• Generate arbitrary waveforms consisting of up to 100,000 points at 100-µs intervals
• Channel expansion through master-slave synchronization link
• Fast test speeds
• 16-bit digital I/O (model 765602/765612)

Source and Measurement Range

Four-quadrant operation consisting of source operation (current source) and sink operation (current sink) is available. The output and measurement resolutions are 5.5 digits. Two models are available for your application.

18 V range model (765601/02)

Voltage ranges: 200 mV/2 V/7 V/18 V

Maximum output:

    ±3.2 A (at an output voltage of ±7 V or less)

    ±1.2 A (at an output voltage of ±18 V or less)

Current ranges: 200 nA/2 µA/20 µA/200 µA/ 2 mA/20 mA/200 mA/1 A/3 A

Maximum output: ±18 V (at an output current of ±1.2 A or less)
    ±7 V (at an output current of ±3.2 A or less)
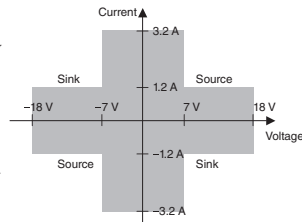
50 V range model (765611/12)

Voltage ranges:
    200 mV/2 V/20 V/50 V

Maximum output:

    ±1.2 A (at an output voltage of ±20 V or less)

    ±0.6 A (at an output voltage of ±50 V or less)

Current ranges: 200 nA/2 µA/20 µA/200 µA/2 mA/ 20 mA/200 mA/0.5 A/1 A

Maximum output: ±50 V (at an output current of ±0.6 A or less)
    ±20 V (at an output current of ±1.2 A or less)
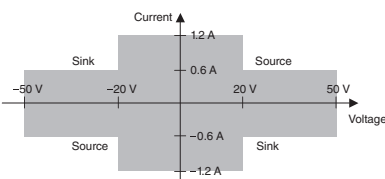
Functions

Source and Measurement Functions
• Voltage source and current measurement (VS&IM)
• Current source and voltage measurement (IS&VM)
• Voltage source (VS)
• Current source (IS)
• Voltmeter (VM)
• Ammeter (IM)
• Resistance meter (IS&VM)

Source

Function:	Voltage or current
Mode:	DC or pulse (pulse width: 50 µs to 3,600 s)
Sweep mode:	Linear, logarithmic or program (up to 100,000 steps)
Trigger source:	External or internal timers 1 and 2 (period: 100 µs to 3,600 s)
Sweep start source:	External or internal timers 1 and 2 (period: 100 µs to 3,600 s)
Source delay:	15 µ to 3,600 s
Response characteristics:	Normal or stable

Measurement

Function:	Voltage, current, auto, voltmeter mode, ammeter mode or resistance meter mode
Integration time:	0.001 to 25 PLC (Power Line Cycle)
Trigger source:	External or internal timers 1 and 2 (period: 100 µs to 3,600 s)
Measure delay:	0 µs to 3,600 s
Measurement data storage:	Up to 100,000 data points
Average:	Moving average (average count: 2 to 256)
Voltage sense:	Two-wire system or four-wire system
Auto zero:	Measure the internal zero reference every measurement and correct the measured value
NULL computation:	Computes the difference with respect to the current measuredvalue or user-defined value
User-defined computation:	Computes user-defined equations in real-time

External I/O and Communication Interface
• BNC I/O
• Digital I/O D-Sub 15-pin (model 765601/11)
    Half-pitch 50-pin (model 765602/12)
• I/O for synchronized Operation
    RJ-11 connector 6-pin, BNC connector
• GPIB
• RS232
• USB
• Ethernet   100 BASE-TX/10 BASE-T

Display	256 × 64 dot VFD
Dimensions	Approx. 213(W) × 132(H) × 450(D) mm
Weight	Approx. 8 kg

Model and Suffix code

Model	Suffix Code	Discription
765601		GS820 Multi Channel Source Measure Unit 18 V range/2-bit digital I/O model
765602		GS820 Multi Channel Source Measure Unit 18 V range/16-bit digital I/O model
765611		GS820 Multi Channel Source Measure Unit 50 V range/2-bit digital I/O model
765612		GS820 Multi Channel Source Measure Unit 50 V range/16-bit digital I/O model
Power cord	-D	UL/CSA standard, PSE compliant
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
	-N	NBR standard

Generators, Sources, Manometers etc.

Source Measure Unit   **GS610**

Combines High Accuracy and High Speed in a Single Unit

Drag & Drop

USB

Drag & Drop

USB STORAGE

CE

Features

The GS610 is a highly accurate and highly functional programmable voltage/current source that incorporates voltage/current generation and measurement functions. The maximum output voltage and current are 110 V and 3.2 A, respectively. Evaluation of over a wide range of basic electrical characteristics is possible, because the GS610 can operate as a current source or a current sink.

- Source and sink operation up to 110 V/3.2 A (four-quadrant operation)
- Basic accuracy: ±0.02% *1
- Sweep output at up to 100 µs intervals
- Comes with abundant sweep patterns (linear, logarithmic, and arbitrary)
- Stores up to 65,535 points of source measure data in the internal memory
- Easy file operation with the USB storage function
- Remote control and FTP using Web server function (Optional)

*1: DC voltage generation

Voltage/Current Generation and Measurement Range

Four-dimensional operation with source operation (current source) and sink operation (current sink) is possible at up to 110 V, 3.2 A, and 60 W. The output and measurement resolutions are 5.5 digits.

Voltage generation/measurement range: 200mV to 110 V
Current generation/measurement range: 20 µA to 3.2 A
Maximum output current:

  ±3.2 A (at an output voltage of ±12 V or less)
  ±2 A   (at an output voltage of ±30 V or less)
  ±1 A   (at an output voltage of ±60 V or less)
  ±0.5 A (at an output voltage of ±110 V or less)

Current (A)

3.2

Sink   2.0   Source

1.0

0.5

Voltage (V)

-110 -60 -30 -12 0 12 30 60 110

-0.5

-1.0

Source   -2.0   Sink

-3.2

Functions

■ Function

- Generation
  - Generation function : Voltage or current
  - Generation mode   : DC or pulse
  - Sweep mode   : Linear, logarithmic or program (up to 65,535 steps)
- Measurement
  - Measurement function : DC voltage, DC current and resistance
  - Measurement data storage : Up to 65,535 data points
  - Average   : Block average or moving average (Specified count: 2 to 256)
- Trigger
  - Trigger mode   : Internal, external and immediate
- Time setting
  - Pulse width   : 100 µs to 3,600 s, 1 µs resolution
  - Period time   : 1 ms to 3,600 s, 1 µs resolution (during source and measure operation) 100 µs to 3,600 s, 1 µs resolution (during source-only operation)
  - Source delay   : 1 µs to 3,600 s, 1 µs resolution
  - Measurement delay : 1 µs to 3,600 s, 1µs resolution
  - Integration time : 250 µs, 1 ms, 4 ms, 16.6 ms/20 ms,100 ms, 200 ms (auto detect from the power supply frequency when the power is turned ON for 16.6 ms/20 ms)
- Computation function
  - Operators: +[addition], -[subtraction], *[multiplication], /[division] and ^ [exponentiation]
  - Functions: ABS(), EXP(), LN(), LOG(), SQRT(), SIN(), COS(), TAN(), ASIN(), ACOS(), ATAN(), SINH(), COSH(), TANH(), RAND()

■ External Input/Output

- Synchronization signal input/output (TRIG, SWEEP, CTRL IN and OUT) (BNC)
- External input/output (D-Sub 15-pin)
- GP-IB interface
- RS-232 interface
- USB interface
- Ethernet interface (option) 100BASE-TX/10BASE-T

■ Internal memory

ROM	: 4 MB	Area for storing setup and output pattern files
RAM	: 4 MB	Area for storing the measured results (cleared when the power is turned OFF)

■ Display
: 256 × 64 dot vacuum fluorescent display

■ External dimensions
: Approx. 213 (W) × 132 (H) × 400 (D) mm (excluding protrusions)

■ Weight
: Approx. 7 kg

Model and Suffix code

Model	Suffix Codes	Description
765501		GS610 Source Measure Unit
Power cord	-D	UL/CSA standard
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
Option	/C10	Ethernet interface

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GS Series Accessory Software **765670 Curve Tracer Software for the GS series**
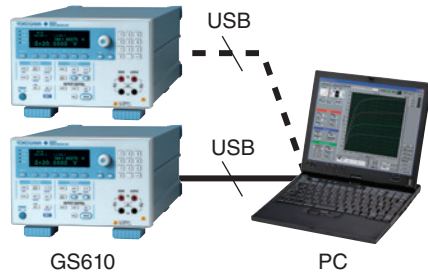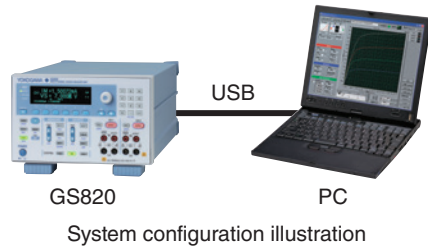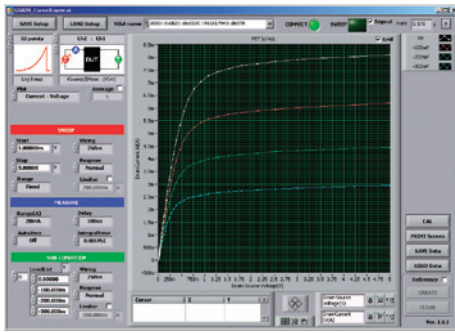
Product Overview

This product is a high-speed, high-accuracy real-time I-V curve tracer that consists of the GS series Source Measure Unit and the 765670 Curve Tracer Software. It is particularly well-suited to DC parametric tests of minute signals.

Features

■ **Simple system configuration, easy connection, compact and light**
This system is configured by connecting the GS series Source Measure Unit to a PC that contains the 765670 Curve Tracer Software via USB.
You can perform high speed, high-accuracy curve tracing despite its compact size, light weight, and simple system configuration.

■ **Real-time, High-Speed Drawing**
The GS series is high-speed communication and sweep features allow high-speed graph update rate up to 25 pages/s(GS820).
You can use the real-time curve tracer with comfort.

■ **Field of Applications**
• Discrete semiconductors such as transistors and diodes
• Analog ICs such as voltage regulators and op- amps
• MOS logic and other digital ICs
• LEDs and other optical devices
• Solar battery cells

Drawing Speed (times/s; reference values)

Plot Points	Model Number	
	GS610	GS820
20	20	25
50	10	16
100	5	11
200	3	6

Measurement conditions: Using Core2Duo CPU, 1.5 GHz, USB 2.0, and LabVIEW
Measurement integration time: 0.001 PLC for GS820 / 250 µs for GS610

http://tmi.yokogawa.com/products/generators-sources/
source-measure-units/765670-curve-tracer-software/

GS820   PC

System configuration illustration

GS610   PC

Specifications

• Graph drawing:
Voltage vs. current, voltage vs. voltage, gain vs. voltage, voltage vs. timestamp, current vs. voltage, current vs. current, gain vs. current, current vs. timestamp

Sweep axis:	Voltage source or current source
Measurement axis:	Voltage measurement or current measurement
Parameter:	Voltage source or current source
Sweep shape:	Ramp (linear or log), triangle (linear or log), rectangle
Sweep points:	5, 10, 20, 50, 100, 200, 1000
Scaling:	Auto scale or fixed scale
Averaging count:	2 to 100

• Analysis feature:
Cursor, zoom & scroll, reference curve designation

• File operations:
CSV data storage and loading, graphic image storage, panel image storage, setup storage and recall

Examples of Measurements of Characteristics

● FET V_{DS}-I_D characteristics

Connection diagram

Measurement results

Precision DC Calibrator	**2553A**
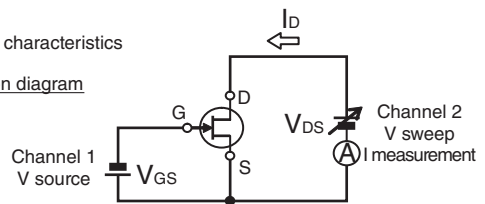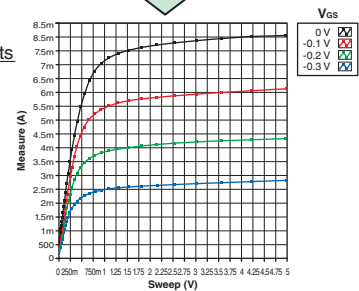
DC calibrator for temperature, voltage, and current

Features

The 2553A outputs DC voltage in the range of ±32 V and DC current in the range of ±120 mA. In addition to being able to calibrate analog meters, the 2553A can calibrate thermometers and temperature controllers that utilize a thermocouple or RTD.

- High accuracy   DC voltage : ±75 ppm (0.0075%)
                     DC current : ±120 ppm (0.012%)
- High stability   : ±15 ppm (0.0015%) / h
- Low noise   : 2 µVrms
- High resolution   : 5.5 digits
- Intuitive operation by dials
- 10 types of thermocouple and RTD Pt100
- User defined temperature calibration
- 3 RJC modes
- Calibration by temperature value

Calibration by temperature value

120.0℃
2553A

120℃
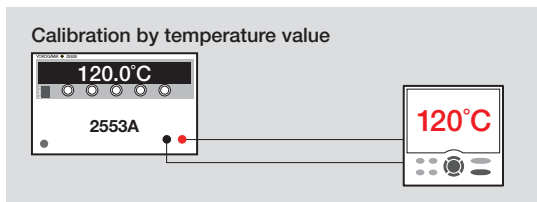
Main specification

Voltage, current generation

Range	Source range	Resolution
10 mV	±12.0000 mV	100 nV
100 mV	±120.000 mV	1 µV
1 V	±1.20000 V	10 µV
10 V	±12.0000 V	100 µV
30 V	±32.000 V	1 mV
1 mA	±1.20000 mA	10 nA
10 mA	±12.0000 mA	100 nA
30 mA	±32.000 mA	1 µA
100 mA	±120.000 mA	1 µA

Range	Accuracy (1 year) ± (ppm of setting + µV or µA)	Stability (1 hour) ± (ppm of setting + µV or µA)
10 mV	60 + 4	20 + 3
100 mV	60 + 4	20 + 3
1 V	60 + 15	5 + 10
10 V	60 + 150	5 + 100
30 V	60 + 450	5 + 300
1 mA	80 + 0.04	5 + 0.015
10 mA	100 + 0.5	5 + 0.15
30 mA	100 + 1.5	10 + 0.9
100 mA	100 + 5	10 + 3

Main specification

Temperature generation for Thermocouple

Setting temperature : Accuracy for 1 year (±°C)

R	S	B	J	T
-50°C: 1.10	-50°C: 1.03	400°C: 1.00	-210°C: 0.25	-250°C: 0.72
0°C: 0.80	0°C: 0.75	600°C: 0.70	-100°C: 0.11	-200°C: 0.29
100°C: 0.55	100°C: 0.56	1000°C: 0.50	0°C: 0.08	-100°C: 0.16
600°C: 0.40	400°C: 0.47	1200°C: 0.44	1200°C: 0.15	100°C: 0.10
1600°C: 0.40	1600°C: 0.44	1820°C: 0.44		400°C: 0.09
1768°C: 0.45	1768°C: 0.51			

E	K	N	C	A
-250°C: 0.50	-250°C: 0.94	-240°C: 1.00	0°C: 0.30	0°C: 0.34
-200°C: 0.20	-200°C: 0.30	-200°C: 0.44	200°C: 0.26	100°C: 0.29
-100°C: 0.10	-100°C: 0.15	-100°C: 0.21	600°C: 0.25	600°C: 0.28
0°C: 0.07	0°C: 0.11	0°C: 0.16	1000°C: 0.30	1600°C: 0.47
1000°C: 0.12	800°C: 0.15	800°C: 0.15	2000°C: 0.51	2500°C: 0.79
	1300°C: 0.21	1300°C: 0.20	2315°C: 0.70	

3 RJC modes
INT: Detect temperature of output terminal as compensation value
EXT: Detect compensation value by sensor connected to RJC terminal
MAN: Input compensation value

Temperature generation for RTD

Type	Source range	Resolution	Accuracy (1 year)
Pt100	-200.0 to 850.0°C	0.1°C	±0.15°C

Resistance generation

Range	Source range	Resolution	Accuracy (1 year) ± (ppm of setting +Ω)
400 Ω	18.00 to 400.00 Ω	0.01 Ω	75 + 0.015

Interface	: USB
	: Ethernet
	: GPIB
Warm-up time	: Approx. 30 minutes
Operating environment	: Temperature 5 to 40 °C
	: Humidity 20 to 80% RH
Storage environment	: Temperature -15 to 60 °C
	: Humidity 20 to 80% RH
Operating Height	: 2000 m or less
Operating Attitude	: Horizon
Rated power supply voltage	: 100 to 120 VAC/200 to 240 VAC
Allowable power supply voltage fluctuation range	
	: 90 to 132 VAC/180 to 264 VAC
Rated power supply frequency : 50/60 Hz	
Allowable power supply frequency fluctuation range	
	: 48 to 63 Hz
Max. power cunsumption	: 30 VA
Withstand voltage	: Between power and case 1500 VAC 1 min.
Dimensions	: 213(W) × 132(H) × 300(D) mm
Weight	: Approx. 3 kg

Model and Suffix code

Model	Suffix code		Description
2553A			Precision DC Calibrator
	–VA		Version A
		–UC	Deg C
		–UF	Deg C and F
		–D	UL/CSA standard, PSE
		–F	VDE standard
		–R	AS standard
		–Q	BS standard
		–H	GB standard
		–N	NBR standard

AC Voltage Current Standard **2558A**

AC Standard Source with Improved Performance and Usability

2558A

CE

Features

The wide output ranges of 1.00 mV to 1200.0 V AC and 1.00 mA to 60.00 A AC mean that the 2558A is the instrument of choice for the cost effective calibration of AC analog meters.

- Wide output range   AC voltage : 1.00 mV to 1200.0 V
         AC current : 1.00 mA to 60.00 A
- High accuracy   AC voltage : 0.04%
         AC current : 0.05%
- High output stability   : ±50 ppm/h
- Wide frequency range   : 40 to 1000 Hz
     Accuracy   : ±50 ppm
- Intuitive operation with dials for setting each digit
- Sweep function   : 8/16/32/64 sec. (selectable)
- Output divider function (Divided output of the main setting)
- Direct readout of the deviation (Displays the deviation from the main setting)

Functions and Specification

Output

Range	Output Range	Guaranteed Accuracy Range
100 mV	0 to 144.00 mV	1 to 120.00 mV
1 V	0 to 1.4400 V	0.01 to 1.2000 V
10 V	0 to 14.400 V	0.1 to 12.000 V
100 V	0 to 144.00 V	1 to 120.00 V
300 V	0 to 432.0 V	3 to 360.0 V
1000 V	0 to 1440.0 V	10 to 1200.0 V
100 mA	0 to 144.00 mA	1 to 120.00 mA
1 A	0 to 1.4400 A	0.01 to 1.2000 A
10 A	0 to 14.400 A	0.1 to 12.000 A
50 A	0 to 72.00 A	0.5 to 60.00 A

Accuracy (180 days)

     1 to 10% output of range ±(% of range)
         Voltage   50/60 Hz   : 0.013
                 40 to 400 Hz   : 0.015
                 400 to 1000 Hz   : 0.030
         Current   50/60 Hz   : 0.014
                  40 to 400 Hz   : 0.016
                 400 to 1000 Hz   : 0.032
     10 to 120% output of range ±(% of setting + % of range)
         Voltage   50/60 Hz   : 0.03 + 0.01
                 40 to 400 Hz   : 0.05 + 0.01
                 400 to 1000 Hz   : 0.10 + 0.02
         Current   50/60 Hz   : 0.04 + 0.01
                  40 to 400 Hz   : 0.06 + 0.01
                 400 to 1000 Hz   : 0.12 + 0.02

Functions and Specifications

Stability		: ±(20 ppm of setting + 30 ppm of range)/h
Distortion factor	Voltage	: 0.07% or less
	Current	: 0.18% or less
Frequency range		
Internal		: 50 / 60 / 400 Hz / VAR
		VAR: 40 to 1000 Hz (0.001 Hz resolution)
External		: EXT1/EXT2
		(Use the terminals for synchronized operations)
FREQUENCY METER		: MIN/MAX
		20 to 1000 Hz (0.001 Hz resolution)

Sweep, output divider and deviation functions are used for the frequency.

Sweep	Target	: Voltage / Current / Frequency
	Speed	: Approx. 8/16/32/64 sec. selectable
Output divider	Target	: Voltage / Current / Frequency
	Denominator range	: m4 to 15
	Numerator range	: n0 to 15 (n ≤ m)
Deviation	Target	: Voltage / Current / Frequency
	Variable range: ±20.00%	

         Operation : Two dials
                 Resolution of the first dial: 0.2% of the main setting
                 Resolution of the second dial: 0.01% of the main setting
         Deviation preset: OFF / 0 / 2% / 5%

Output terminal		
Type	Voltage	: Plug-in terminal (safety terminal)
	Current	: Binding post
	Selectable LO terminal to earth or floating	
	Max. floating voltage to earth: 12 Vpk	
Interface		: USB interface (for PC connection)
		: Ethernet
		: GP-IB interface (optional)
Warm-up time		: Approx. 30 minutes
Operating environment		Temperature : 5 to 40ºC
		Humidity : 20 to 80%RH (no condensation)
Rated power supply voltage		: 100 to 120 VAC / 200 to 240 VAC
Rated power supply frequency		: 50/60 Hz
Max. power consumption		: 200 VA
Weight		: Approx. 20 kg
Dimensions		: 426(W) × 132(H) × 400(D) mm

2558A Model and Suffix Codes

Model	Suffix Code	Description
2558A		AC Voltage Current Standard
Power cord	-D	UL/CSA standard, PSE
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
	-N	NBR standard
Option	/C1	GP-IB interface

Precision DC Calibrator	**2560A**

High-voltage and High-current Output and Intuitive Operation

Bulletin: 2560A-01EN

CE

Features

The 2560A can accurately and stably generate DC voltage of up to 1224 V and DC current of up to 36.72 A. In addition to voltage and current meters, the 2560A can calibrate thermometers and temperature controllers that use thermocouples and RTDs.

- Wide output range   DC voltage : ±1224 V
                                  DC current : −12.24 A to +36.72 A
- High accuracy   DC voltage : ±50 ppm (0.005%)
                                  DC current : ±70 ppm (0.007%)
- High stability   DC voltage : ±10 ppm (0.001%)/h
                                  DC current : ±20 ppm (0.002%)/h
- High resolution   : 5.5 digits, ±120,000 count display
                                    6.5 digits, ±1,200,000 count display
- Intuitive operability with dials for each digit
- Sweep, output division, deviation, scale setting
- Ten types of thermocouples, and RTD Pt100
- User-defined temperature calibration, three RJC modes

Main Specifications

Voltage and current generating parts

Range	Output range	Resolution
100 mV	±122.400 mV	1 µV
1 V	±1.22400 V	10 µV
10 V	±12.2400 V	100 µV
100 V	±122.400 V	1 mV
1000 V	±1224.00 V	10 mV
100 µA	±122.400 µA	1 nA
1 mA	±1.22400 mA	10 nA
10 mA	±12.2400 mA	100 nA
100 mA	±122.400 mA	1 µA
1 A	±1.22400 A	10 µA
10 A	±12.2400 A	100 µA
30 A	0 to +36.720 A	1 mA

Range	Accuracy (one year) ± (ppm of setting + V or A)	Stability (1 h) ± (ppm of setting + V or A)
100 mV	60 + 4 µV	20 + 3 µV
1 V	55 + 15 µV	5 + 5 µV
10 V	55 + 150 µV	5 + 50 µV
100 V	55 + 1.5 mV	5 + 500 µV
1000 V	55 + 15 mV	5 + 5 mV
100 µA	150 + 20 nA	50 + 5 nA
1 mA	70 + 30 nA	5 + 15 nA
10 mA	70 + 300 nA	5 + 150 nA
100 mA	90 + 3 µA	10 + 1.5 µA
1 A	350 + 70 µA	25 + 25 µA
10 A	380 + 1.2 mA	50 + 500 µA
30 A	540 + 1.8 mA	70 + 1.2 mA

Main Specifications

Temperature generation for thermocouples

Setting temperature: Accuracy for one year (±°C)

R	S	B	J	T
−50°C: 1.10	−50°C: 1.03	400°C: 1.00	−210°C: 0.25	−250°C: 0.72
0°C: 0.80	0°C: 0.75	600°C: 0.70	−100°C: 0.11	−200°C: 0.29
100°C: 0.55	100°C: 0.56	1000°C: 0.50	0°C: 0.08	−100°C: 0.16
600°C: 0.40	400°C: 0.47	1200°C: 0.44	1200°C: 0.15	100°C: 0.10
1600°C: 0.40	1600°C: 0.44	1820°C: 0.44		400°C: 0.09
1768°C: 0.45	1768°C: 0.51			

E	K	N	C	A
−250°C: 0.50	−250°C: 0.94	−240°C: 1.00	0°C: 0.30	0°C: 0.34
−200°C: 0.20	−200°C: 0.30	−200°C: 0.44	200°C: 0.26	100°C: 0.29
−100°C: 0.10	−100°C: 0.15	−100°C: 0.21	600°C: 0.25	600°C: 0.28
0°C: 0.07	0°C: 0.11	0°C: 0.16	1000°C: 0.30	1600°C: 0.47
1000°C: 0.12	800°C: 0.15	800°C: 0.15	2000°C: 0.51	2500°C: 0.79
	1300°C: 0.21	1300°C: 0.20	2315°C: 0.70	

Three RJC modes
INT: Uses a temperature measured at the output terminal as a compensation value.
EXT: Uses a temperature detected by a sensor connected to the RJ sensor terminal as a compensation value.
MAN: Uses a value input manually as a compensation value.

Temperature generation for RTDs

Type	Output range	Resolution	Accuracy (one year)
Pt100	−200.0 to 850.0°C	0.1°C	±0.12°C

Resistance generation

Range	Output range	Resolution	Accuracy (one year) ± (ppm of setting + Ω)
400 Ω	1.00 to 400.00 Ω	0.01 Ω	75 + 0.005

Interface   : USB interface (PC connection)
                                                   : Ethernet
                                                   : GP-IB
Warm-up time   : Approx. 30 min
Operating environment   : Temperature 5 to 40ºC
                                            Humidity 20 to 80%RH
                                            (no condensation)
Rated power supply voltage : 100 to 120 V AC/200 to 240 V AC
Rated power supply frequency : 50/60 Hz
Max. power consumption   : Approx. 200 V A
Dimensions   : 426 (W) × 177 (H) × 400 (D) mm
Weight   : Approx. 13 kg

Model and suffix codes

Model code	Suffix code		Description
2560A			Precision DC Calibrator
	−VA		Version A
	−UC		Deg C
	−UF		Deg C and F
		−D	UL/CSA standard, PSE compliant
		−F	VDE standard
		−R	AS standard
		−Q	BS standard
		−H	GB standard
		−N	NBR standard

Digital Multimeter **DM7560**

Bring new value by the multiple display formats and high sampling speed

Functions and Specifications

DC voltage (DCV)	Range: 100 mV to 1000 V
DC current (DCI)	Range: 1 mA to 3 A
AC voltage (ACV)	Range: 100 mV to 750 V
AC current (ACI)	Range: 1 A to 3 A
Resistance measurement (2 WΩ/4 WΩ)	Range: 100 Ω to 100 MΩ
Continuity test (CONT)	Resistance range: 1 kΩ
Diode	Measuring current: Approx. 1 mA
Temperature measurement (TEMP, TC)	Thermocouple type: R/K/T/J/E
Temperature measurement (TEMP, RTD)	Resistance temperature detector: Pt100, Jpt100
Frequency measurement (FREQ)	Range: 3 Hz to 300 kHz

Features

The DM7560 provides high sampling rates of up to 30 kS/s with high accuracy and provides all the basic functions of a Digital Multimeter. With its capability to monitor transitional voltage variations, it can be applied to a wide range of applications.

• Multiple display formats
• High speed data logging (Maximum 30 kS/s)
• High capacity internal memory up to 100 k points
• Offline browsing to provide trend and histogram analysis
• Productivity improvement by varied interfaces

Model and suffix codes

Model code	Suffix code		Description
DM7560			Digital Multimeter
Supply voltage	-1		100 VAC, 50/60 Hz
	-3		115 VAC, 50/60 Hz
	-6		220 VAC, 50/60 Hz
	-8		240 VAC, 50/60 Hz
Power cord	-D		UL/CSA standard, PSE compliant
	-F		VDE Standard
	-R		AS Standard
	-Q		BS Standard
	-H		GB Standard
	-N		NBR Standard
Options		/C1	GP-IB Interface*
		/C2	LAN & RS-232 Interface*
		/CMP	DIO Interface

* Only one can be selected.

Advange points

Comprehensive observation by multiple display formats

Annunciator
Indicates the status of the instrument status by icons.

Primary display (examples)

Trend display (Plots time domain variation)

Histogram display (Plots distribution)

Arc scale meter display (Shows values intuitively)

Secondary display (examples)

Analog meter display

Statistics display

LIMIT judgment display

High-speed data logging

The case of 10 ms pulse width, 2 Vpp measurement with DC voltage measuring function.
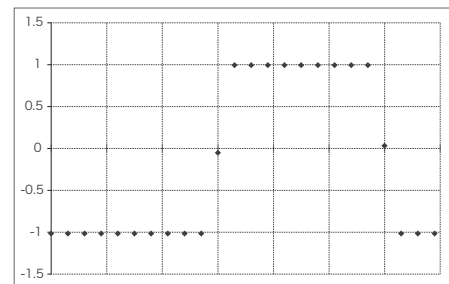
Sample of 1 kS/s
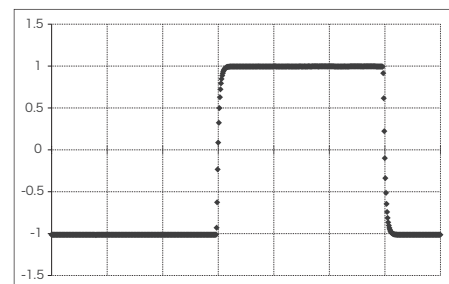
Sample of 30 kS/s

Fast signal change can be measured exactly with high sampling rate.

43

Digital Resistance Meter   7556

High-Speed Digital Resistance Meter for Production Line of Fixed Chip Resistors

The 7556 is designed to be mounted on a taping machine.

* When you use the 7556 for any purpose other than a production line, you need to be careful.
Please read the specifications carefully.

7556

• High-speed measurement (2.8 ms)
• High accuracy: ±(0.006% of reading + 3 digits)
• High resolution: 5.5 digits
• Wide range: 1 Ω range to 100 MΩ range
• Full remote control through serial (RS-232) or GP-IB interface
• Software-based calibration function
• Advanced contact check function

7556 Specifications

Range: 1 Ω, 10 Ω, 100 Ω, 1 kΩ, 10 kΩ, 100 kΩ,
1 MΩ, 10 MΩ, 100 MΩ
Resolution: Deviation display
755601: -99.99% to 19.99% or -99.9% to 199.9% (selectable)
755611: -99.999% to 19.999% or -99.99 to 199.99% (selectable)
Absolute value display
755601: 100 μΩ (at 1 Ω range)
755611: 10 μΩ (at 1 Ω range)
Measurement time:
Normal mode: 60 Hz power supply: 19.9 ms
50 Hz power supply: 23.2 ms
Fast mode: 5.7 ms
High-speed mode: 2.8 ms
Accuracy (at 1 kΩ range, 23±5°C in normal mode)
755601: ±(0.015% of reading + 1 digit)
755611: ±(0.006% of reading + 3 digits)
Contact check function
Check level: 1 Ω to 30 Ω (Selectable)
Execute checks before or after measurement (selectable)
Check current: 50 mA
Contact check error message with display panel and handler interface
Measured current abnormality detection function (Detect measured current abnormality caused by a
contact error)
Comparator function (both Hi and Lo)
Deviation setting range
755601: -9.99% to 9.99% or -99.9% to 99.9% (selectable)
755611: -9.999% to 9.999% or -99.99% to 99.99% (selectable)
Absolute value setting range
755601: 0.0000 Ω to 1.2000 Ω
755611: 0.00000 Ω to 1.20000 Ω

Temperature Measuring Instrument   7563

Precision Digital Thermometer

7563

Digital Thermometer, 6.5 Digits

• Thermometer has a 6.5-digits display
Twelve types of TC's and four types of RTD's
• Basic accuracy in temperature
measurement: 0.006% (TC)
• Basic accuracy in DCV measurement: 0.0045% (2000 mV range)
• Basic accuracy in resistance measurement: 0.006% (2000 Ω range)
• Number of sampling times: up to 100 times/s (4.5 digits)

7563 Specifications

Maximum display: ±1999999
Resolution: Voltage   100 nV
Resistance   100 μΩ
Thermocouple   0.1°C
RTD   0.01°C
Reference junction compensation accuracy:
±0.2°C
Various computation functions
Software calibration function
Memory function
• Internal memory up to 1000 data items
• IC memory up to 8000 data items
Communication function: GP-IB
Analog output (optional): code /DA specified
Power consumption: 20 VA
External dimensions: 213 (W) × 88 (H) × 350 (D) mm
Weight: approx. 3 kg

Arbitrary/Function Generator **FG400 Series**

Easily Generate Basic, Application Specific and Arbitrary Waveform

FG420

Features

The FG400 Arbitrary/Function Generator provides a wide variety of waveforms as standard and generates signals simply and easily. There are one channel (FG410) and two channel (FG420) models. As the output channels are isolated, an FG400 can also be used in the development of floating circuits. (up to 42 V)

• 0.01 µHz to 30 MHz output (sine wave)
• 20 Vp-p output/open, 10 Vp-p output/50 Ω
• Arbitrary waveform generation function
• 3.5-inch color display
• Up to 6 units (12 channels) can be synchronized
• A variety of sweeps, modulations and functions
• Parameter-variable waveforms

Functions and Specifications

• Number of channels	FG410: 1-channel model
	FG420: 2-channel model
• Output waveforms	Sine, square, pulse, ramp, DC, parameter-variable
	waveform (25 types), noise (Gaussian distribution),
	arbitrary waveform
• Oscillation modes	Continuous, modulation, sweep, burst, sequence
• Frequency	Sine 0.01 µHz to 30 MHz
	Square/pulse 0.01 µHz to 15 MHz
	Ramp/parameter-variable waveform
	0.01 µHz to 5 MHz
• Arbitrary waveform	Waveform length 4 K to 512 K words or 2 to
	10,000 control points
• Modulation type	FM, FSK, PM, PSK, AM, DC offset, PWM
• Sweep type	Frequency, phase, amplitude, DC offset, duty
• Synchronization	Sync operation is possible. Up to 6 units can be
of multiple units	connected with BNC cables in the form of master/
	slave connections, using the frequency reference
	output and external 10 MHz frequency reference
	input
• Power supply	AC 100 V to 230 V ± 10% (250 V max.)
	50 Hz/60 Hz ± 2 Hz
• Power consumption	FG410 50 VA or less
	FG420 75 VA or less
• Weight	Approx. 2.1 kg
• Dimensions	216 (W) × 88 (H) × 332 (D) mm

FG410/FG420 Models and Suffix Codes

Model	Suffix code	Description
FG410		Arbitrary /Function Generator, 1-Channel Model
FG420		Arbitrary /Function Generator. 2-Channel Model
Power cord	-D	UL/CSA standard, PSE
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
	-N	NBR standard

Related Software

XviewerLITE

This software allows you to display the waveforms and measurement results on a PC for the data measured with Yokogawa's DLM/DL/SL series. It allows you to clip part of a waveform and generate an arbitrary waveform with the FG400.
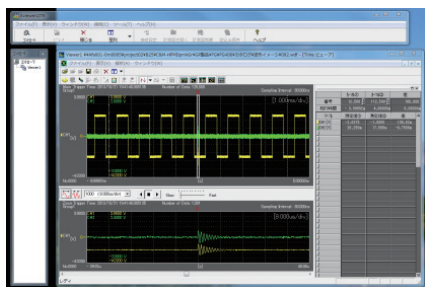
Arbitrary Waveform Editor

This software supports the arbitrary waveform function of the FG400. It allows you to edit waveforms and transfer data to the FG400. It also makes it easy to work on a pre-installed waveform to generate an arbitrary waveform.
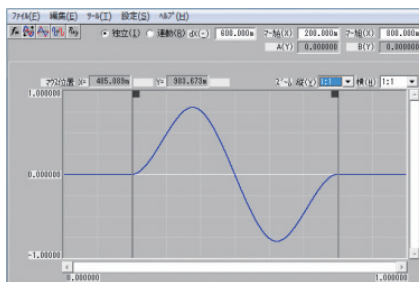
Sequence Editor

This software supports the sequence function of the FG400 that outputs different waveforms sequentially. It controls the edit, transfer, and execution of sequence data. Complex programs can also be created easily.

Pressure Standard   **MC100**

Pneumatic Pressure Standard

MC100
Pneumatic Pressure Standard

- High accuracy: ±0.05% of full scale
- Output ranges and resolution
  0 to 200 kPa (resolution 0.01 kPa)
  0 to 25 kPa (resolution 0.001 kPa)
- Functions useful for instrument calibration
  Divider output, auto-step output, and sweep output
- Excellent temperature coefficient
  Zero point: ±0.003% of full scale/°C
  Span: ±0.002% of full scale/°C

MC100 Series Specifications

- Supply pressure
  0 to 200 kPa range model:
  280 kPa ±20 kPa
  0 to 25 kPa range model: 50 kPa ±10 kPa
- Accuracy
  ±0.05% of full scale (at 23°C ±3°C)
- Output noise: ±0.02% of full scale
- Effect of mounting orientation
  Forward/backward incline of 90°
  0 to 200 kPa range model: ±0.01% of full scale
  0 to 25 kPa range model:

±0.1% of full scale
Sideways incline of 30°
0 to 200 kPa range model: ±0.2% of full scale
0 to 25 kPa range model: ±2.5% of full scale
- Pressure display units (selectable):
  kPa, kgf/cm^2, mmH$_2$O, mmHg
  kPa, psi, inH$_2$O, inHg
- External dimensions:
  213 (W) × 132 (H) × 400 (D) mm
- Weight: approx. 9.5 kg

Manometers MT210/MT210F/MT220/MT10

Precision Digital Manometer

MT210
Digital Manometer

- High accuracy: ±(0.01% of reading + 3 digits) (130 kPa range gauge model)
- A wide range pressures, from a low differential pressure of 1 kPa to a high gauge pressure of 3000 kPa, and absolute pressure of 130 kPa
- D/A conversion output, comparator output, and external trigger input (optional)
- Both gases and liquids measurable
- External attachable battery pack (optional)

MT210 Series Specifications

- Measuring range (gauge pressure: positive)
  0 to 10 kPa, 130 kPa, 700 kPa and 3000 kPa
  Measuring range (gauge pressure: negative)
  -80 to 0 kPa, -10 to 0 kPa
- Measuring range (absolute pressure)
  0 to 130 kPa abs
- Measuring range (differential pressure)
  0 to 1 kPa, 10 kPa, 130 kPa and 700 kPa
- Accuracy (for 0 to 10 kPa range model)
  ±(0.01% of reading + 0.015% of full scale) (at positive pressure)
- Resolution
  0 to 1 kPa range model: 0.00001 kPa
  0 to 10 kPa range model: 0.0001 kPa
  0 to 130 kPa range model: 0.001 kPa
  0 to 700 kPa range model: 0.01 kPa
  0 to 3000 kPa range model: 0.01 kPa
- Maximum allowable input (for gauge pressure positive)
  0 to 10 kPa range model: 500 kPa gauge
  0 to 130 kPa range model: 500 kPa gauge
  0 to 700 kPa range model: 3000 kPa gauge
  0 to 3000 kPa range model: 4500 kPa gauge
- Pressure display units (selectable):
  psi, inH$_2$O, inHg, kPa, kgf/cm^2, mmH$_2$O, mmHg
- External dimensions:
  213 (W) × 132 (H) × 350 (D) mm
- Weight
  Approx. 6.5 kg (0 to 130 kPa range model)

Fast Response Digital Manometer

MT210F
Digital Manometer

- High accuracy: ±(0.01% of reading + 3 digits) (130 kPa range gauge model)
- Select from three measurement modes: normal speed, medium speed, and high speed
- D/A conversion output, comparator output, and external trigger input (optional)
- Both gases and liquids measurable
- External attachable battery pack (optional)

MT210F Series Specifications

- Measuring range (gauge pressure: positive)
  0 to 10 kPa, 130 kPa, 700 kPa and 3000 kPa
  Measuring range (gauge pressure: negative)
  -80 to 0 kPa, -10 to 0 kPa
- Measuring range (absolute pressure)
  0 to 130 kPa abs
- Accuracy (for 0 to 10 kPa range model)
  ±(0.01% of reading + 0.015% of full scale) (at positive pressure)
- Response time (0 to 130 kPa range model, at high speed mode)
  50 msec max.
- Readout update interval (at medium and high speed mode)
  100 msec
- Resolution
  0 to 10 kPa range model: 0.0001 kPa
  0 to 130 kPa range model: 0.001 kPa
  0 to 700 kPa range model: 0.01 kPa
  0 to 3000 kPa range model: 0.01 kPa
- Maximum allowable input (for gauge pressure positive)
  0 to 10 kPa range model: 500 kPa gauge
  0 to 130 kPa range model: 500 kPa gauge
  0 to 700 kPa range model: 3000 kPa gauge
  0 to 3000 kPa range model: 4500 kPa gauge
- Pressure display units (selectable):
  psi, inH$_2$O, inHg, kPa, kgf/cm^2, mmH$_2$O, mmHg
- External dimensions:
  213 (W) × 132 (H) × 350 (D) mm
- Weight
  Approx. 6.5 kg (0 to 130 kPa range model)

Digital Manometer For Efficient Field Calibration
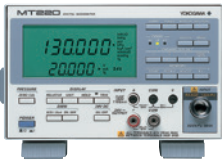
MT220
Digital Manometer

- The de facto standard of field celibrators for pressure and ditferential pressure transmitters
- High accuracy: ±(0.01% of reading + 3 digits) (130 kPa range gauge model)
- DCV/DCA measurement function (DMM function)
- 24 VDC power supply for driving the transmitter
- % display, error display, and measured data memory
- D/A conversion output, comparator output, and external trigger input (optional)
- Both gases and liquids measurable
- External attachable battery pack (optional)

MT220 Series Specifications

- Measuring range (gauge pressure: positive)
  0 to 10 kPa, 130 kPa, 700 kPa and 3000 kPa
  Measuring range (gauge pressure: negative)
  -80 to 0 kPa, -10 to 0 kPa
- Measuring range (absolute pressure)
  0 to 130 kPa abs
- Accuracy (for 0 to 10 kPa range model)
  ±(0.01% of reading + 0.015% of full scale) (at positive pressure)
- Resolution
  0 to 10 kPa range model: 0.0001 kPa
  0 to 130 kPa range model: 0.001 kPa
  0 to 700 kPa range model: 0.01 kPa
  0 to 3000 kPa range model: 0.01 kPa
- Maximum allowable input (for gauge pressure positive)
  0 to 10 kPa range model: 500 kPa gauge
  0 to 130 kPa range model: 500 kPa gauge
  0 to 700 kPa range model: 3000 kPa gauge
  0 to 3000 kPa range model: 4500 kPa gauge
- Pressure display units (selectable):
  psi, inH$_2$O, inHg, kPa, kgf/cm^2, mmH$_2$O, mmHg
- Measurement range of DCV/DCA measurement function
  0 to ±5.25 V
  0 to ±21 mA
- Accuracy of DCV/DCA measurement function (6 months after calibration)
  ±(0.05% of reading + 3 digits)
- 24 VDC output
  24 ± 1 VDC, 30 mA max.
- External dimensions:
  213 (W) × 132 (H) × 350 (D) mm
- Weight
  Approx. 7.0 kg (0 to 130 kPa range model)

Handheld Digital Manometer

MT10
Mini-Manometer

- Compact and lightweight (approx. 700 g), battery-operated
- High reliability (silicon resonant sensor adopted)
- Accuracy: ±(0.04% of rdg + 0.03% of FS) for 130 kPa model
- Three models for 130 kPa, 700 kPa, and 3000 kPa (gauge pressure)
- Data hold function
- RS-232-C interface
- Comes with carrying case

MT10 Series Specifications

- Type of pressure: gauge
- Three measuring ranges
  0 to 130 kPa, 0 to 700 kPa, and 0 to 3000 kPa
- Measurement display range:
  -2.5 to 110% of FS
- Accuracy:
  0 to 130 kPa range model
  ±(0.04% of rdg + 0.03% of FS)
  0 to 700 kPa and 0 to 3000 kPa range models
  ±0.1% of FS
- Resolution
  0 to 130 kPa range model: 0.01 kPa
  0 to 700 kPa range model: 0.1 kPa
  0 to 3000 kPa range model: 1 kPa
- Maximum allowable input
  0 to 130 kPa range model: 500 kPa
  0 to 700 kPa range model: 1000 kPa
  0 to 3000 kPa range model: 4500 kPa
- Effect of temperature
  Zero: ±0.02% of FS/10°C or less
  Span: ±0.02% of FS/10°C or less
- Pressure display units (specified at shipment)
  kPa, kgf/cm^2, mmH$_2$O, mmHg, Psi, inH$_2$O, inHg
- External dimensions:
  Approx. 72 (W) × 174 (H) × 60 (D) mm
  (excluding input connections)
- Weight: Approx. 700 g (including battery)

Optical Spectrum Analyzer **AQ6370 Series**

High Performance Optical Spectrum Analyzers Meeting Measurement Needs in a Broad Range of Applications

Features

- Best-in-class optical performance
  - High wavelength resolution and high dynamic range
  - High sensitivity
  - Free-space optical input
- Excellent measurement throughput
  - High-speed spectrum measurement
  - High-speed remote interface
  - High resolution and wide bandwidth batch measurement
- More user-friendly
  - USB interface available
    For mouse, keyboard, and external storage devices such as a memory device and hard disc drive (HDD).
  - Trace zooming function
  - More than 10 waveform analysis functions available
- Support for creating an automatic measurement system
  - GP-IB, RS-232C, and Ethernet interfaces available
  - Support for the remote commands and formats of the AQ6317 series
  - Macro programming function available
- Wavelength calibration reference light source or alignment light source available
- AQ6370 Viewer emulation and remote control software (option)

Three Models Converting a Wide Wavelength from 350 nm to 3400 nm

■ **AQ6370D (600 to 1700 nm)**
Standard model optimized to the wavelengths often used in telecommunication applications
■ **AQ6373B (350 to 1200 nm)**
Model for short-wavelength including visible light (VIS)
■ **AQ6375B (1200 to 2400 nm)/AQ6376 (1500 to 3400 nm)**
Model for emerging applications in exNIR+MWIR regions

Optical Applications

Today, optical technology is used in a wide variety of applications, which include biomedical application and environmental measurement, as well as information and communication, where demand for broadband connectivity is growing rapidly, driven by the popularity of the Internet, IP telephony, and video streaming. Yokogawa's optical spectrum measurement technology contributes to the development of such optical applications.

Main Optical Applications and Wavelength Bands Used

Medical Treatment – Biology – Information & Communication – Environmental Analysis – Sensing – Material Processing, etc.
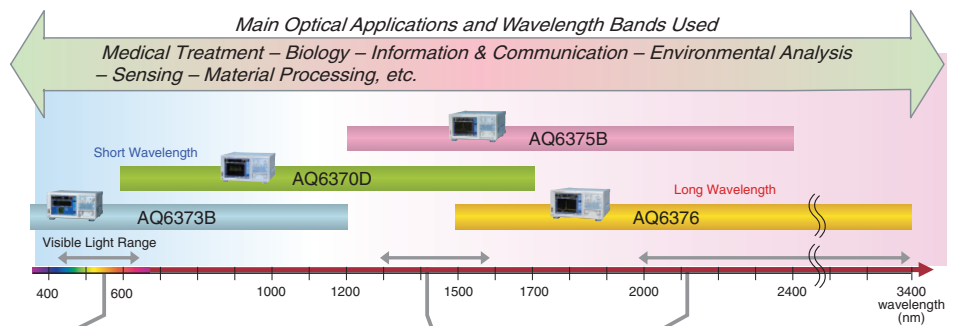
Biomedical Application

Example of a Configuration of a Scanning Confocal Microscope System
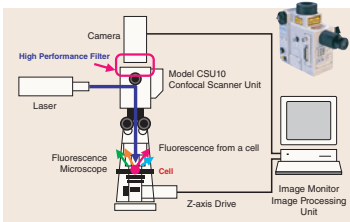
- Evaluating the performance of high performance filers for a visible light laser and fluorescence extraction

Information & Communication Application

Example of a Configuration of a Dense Wavelength Division Multiplexing (DWDM) Optical Communication System
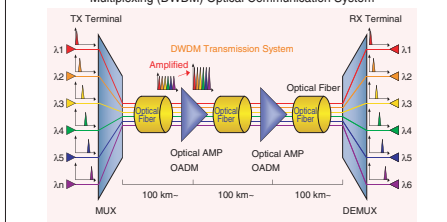
- Evaluating the performance of optical components, such as a laser, optical multiplexer, optical demultiplexer and optical amplifier, as well as the system as a whole

Environmental Measurement Application

Example of a Configuration of Simultaneous Multi-Wavelength Measurement of Gases Using the CDRS Technique
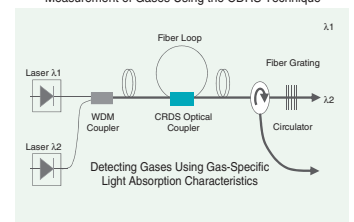
- Evaluating the performance of optical components such as a laser and grating
- Evaluating the light absorption characteristics of gases

AQ6370 Series of Optical Spectrum Analyzers Common Specifications

Items	Specifications
Electrical interface	GP-IB, RS-232, Ethernet, USB, SVGA output, Analog output port, Trigger input port, Trigger output port
Remote control *1	GP-IB, RS-232, Ethernet (TCP/IP), AQ6317 series compatible commands (IEEE488.1) and IEEE488.2
Purge gas input/ou tput terminals *3	Outer diameter 1/4 inch, nylon tube
Data storage	Internal storage: 512 MBytes, Internal memory: 64 Traces, 64 programs, 3 template lines, External storage: USB storage (memory/HDD), FAT32 format File types: CSV (text), Binary, BMP, TIFF
Display *2	10.4-inch color LCD (Resolution: 800 × 600)
Dimensions	Approx. 426 (W) × 221 (H) × 459 (D) mm (Excluding protector and handle)
Mass	AQ6370D/AQ6373B: Approx. 19 kg, AQ6375B/AQ6376: Approx. 23 kg
Power requirements	100 to 240 V AC, 50/60 Hz, approx. 100 VA
Environmental conditions	Performance guarantee temperature: +18 to +28°C, Operating temperature: +5 to +35°C, Storage temperature: –10 to +50°C, Humidity: 20 to 80%RH (no condensation)
RoHS	EN50581
Recommended calibration period	1 year

*1: Some AQ6317 series commands may not be compatible due to changes in specifications or functions. *2: Liquid crystal display may include a few defective pixels (within 0.002% with respect to the total number of pixels including RGB). There may be a few ixels on the liquid crystal display that do not emit all the time or remains ON all the time. These are not malfunctions. *3: AQ6375B and AQ6376 *4: With built-in calibration light source

Optical Spectrum Analyzer **AQ6370D**

Redefining Optical Spectrum Measurement Excellence
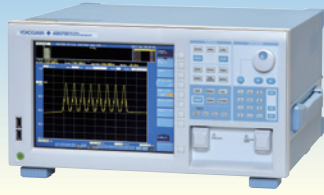
Features

- World Class Optical Performance & Flexibility
  High wavelength accuracy: ±0.01 nm
  High close-in dynamic range: 78 dB typ.
  Single and multimode fiber test capability (up to GI 62.5/125 μm)
- Improved Measurement Throughput
  Double-speed mode
  Fast measurement and fast data transfer
- Enhanced User Friendliness
  USB for Mouse, keyboard, and external storage devices
  Bright 10.4" LCD
  Trace zoom capability
  Various built-in analysis functions
- Expedites Development of Automated Test Systems
  Supports GP-IB, RS-232C, and Ethernet interfaces
  Compatible with SCPI and supports AQ6317 series remote commands
  Built-in simple macro programming function
- Includes Wavelength Calibration Source (Optional)
- AQ6370 Viewer: Emulation/Remote control software (Optional)

Enhanced functions

- Data logging function
  The Data Logging function records analysis results such as WDM analysis (OSNR, optical signal/noise ratio), distributed feedback laser diode (DFB-LD) analysis, and multi-peak measurements at up to 10,000 points per channel with time stamps. Recorded data can be displayed in table and graphical forms.
- Advanced marker function
  The Advanced Marker function adds markers to obtain the power density and the integrated power of a designated spectrum.
- Gate sampling function
  The Gate Sampling function facilitates the recirculating loop testing of optical transmission systems.
- Resolution calibration function
  The Resolution Calibration function is used to calibrate the noise equivalent bandwidth with an external light source.
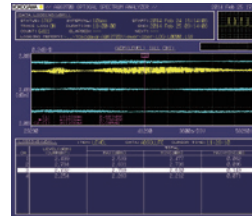
Data Logging display   Advanced marker display
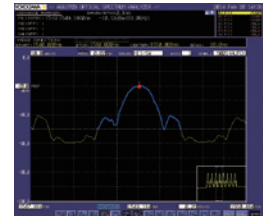
World-class optical performance

Peak ±1.0 nm

78dB
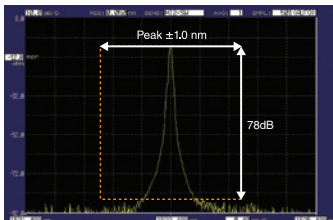
Example of the dynamic range

Peak±1.0 nm, Resolution setting 0.05 nm, High dynamic mode: ON, High performance model
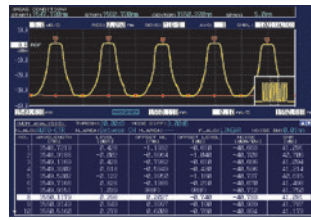
DWDM signal measurement

DWDM channels allocated at 50 GHz spacing can be measured and analyzed.

Enhanced User Friendliness

click

drag

Mouse
Keyboard
Memory
HDD
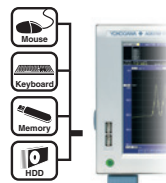
USB interface

Supports mouse, keyboard, and external storage devices.
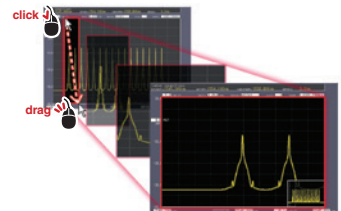
Trace zoom function

Enlarges a designated area

Main Specifications

Items		Specifications	
Spec-code		Standard (-10)	High performance (-20)
Wavelength range *1		600 to 1700 nm	
Span *1		0.1 nm to 1100 nm (Full span), and 0 nm	
Wavelength accuracy *1, *2, *5		±0.02 nm (1520 to 1620 nm)	±0.01 nm (1520 to 1580 nm), ±0.02 nm (1580 to 1620 nm)
Wavelength resolution setting *1, *2		0.02, 0.05, 0.1, 0.2, 0.5, 1 and 2 nm	
Number of sampling		101 to 50001, AUTO	
Level sensitivity setting		NORM_HOLD, NORM_AUTO, NORMAL, MID, HIGH1, HIGH2 and HIGH3	
High dynamic mode		SWITCH (Sensitivity: MID, HIGH1-3)	
Level sensitivity *2, *3, *4, *7		−90 dBm (1300 to 1620 nm), −85 dBm (1000 to 1300 nm), −60 dBm (600 to 1000 nm) (Sensitivity: HIGH3)	
Maximum input power *2, *3		+20 dBm (Per channel, full range)	
Level accuracy *2, *3, *4, *6		±0.4 dB (1310/1550 nm, Input level: −20 dBm, Sensitivity: MID, HIGH1-3)	
Dynamic range *1, *2, *8	Resolution: 0.02 nm	55 dB (Peak ±0.2 nm), 37 dB (Peak ±0.1 nm)	58 dB (Peak ±0.2 nm, Typ. 60 dB), 45 dB (Peak ±0.1 nm, Typ. 50 dB)
	Resolution: 0.1 nm	57 dB (Peak ±0.4 nm), 40 dB (Peak ±0.2 nm)	60 dB (Peak ±0.4 nm, Typ. 67 dB), 45 dB (Peak ±0.2 nm, Typ. 50 dB)
Stray-light suppression ratio *7, *10		73 dB	76 dB (Typ. 80 dB)
Applicable fiber		SM (9.5/125 μm), GI (50/125 μm, 62.5/125 μm)	
Optical connector		Optical input: AQ9447 (☐☐) Connector adapter (option) required. Calibration output: AQ9441 (☐☐) Universal adapter (option) required. (☐☐) Connector type FC or SC	
Built-in calibration light source *11		Wavelength reference source (For optical alignment and wavelength calibration)	
Sweep time *1, *7, *9		NORM_AUTO: 0.2 sec, NORMAL: 1 sec, MID: 2 sec, HIGH1: 5 sec, HIGH2: 20 sec, HIGH3: 75 sec	
Warm-up time		Minimum 1 hour (After warming up, optical alignment adjustments required.)	

*1: Horizontal scale: Wavelength display mode.
*2: With 9.5/125 μm single mode fiber with a PC type connector, after 1 hour of warm-up, after optical alignment with built-in reference light source or a single longitudinal mode laser (wavelength 1520 to 1560 nm, peak level ≥ −20 dBm, level stability ≤ 0.1 dBpp, and wavelength stability ≤ ±0.01 nm).
*3: Vertical scale: Absolute power display mode, Resolution setting: ≥ 0.05 nm, Resolution correction: OFF.
*4: With 9.5/125 μm single mode fiber (B1.1 type defined on IEC60793-2, PC polished, mode field diameter: 9.5 μm, NA: 0.104 to 0.107).
*5: After wavelength calibration with built-in reference light source or a single longitudinal mode laser (wavelength 1520 to 1560 nm, peak level ≥ −20 dBm and absolute wavelength accuracy ±0.003 nm).

*6: Temperature condition changes to 23 ±3°C at 0.05 nm resolution setting.
*7: High dynamic mode: OFF, Pulse light measurement mode: OFF, Resolution correction: OFF.
*8: 1523 nm, High dynamic mode: SWITCH, Resolution correction: OFF
*9: Span: ≤ 100 nm, Number of sampling: 1001, Average number: 1.
*10: With He-Ne laser (1523 nm), 0.1 nm resolution setting, 1520 nm to 1620 nm except for peak wavelength ±2 nm.
*11: Option.
"Typical" or "typ." in this document means "Typical value", which is for reference, not guaranteed specification.

Optical Spectrum Analyzer   **AQ6375B/AQ6376** NEW!

The OSA for emerging applications in exNIR + MWIR regions

Unparalleled Optical Performance

■ Measurement Example
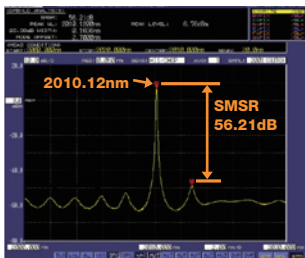
2010 nm DFB-LD with AQ6375B
(Res: 0.050 nm, Span: 20 nm)
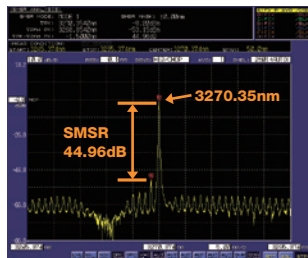
3270 nm DFB-LD with AQ6376
(Res: 0.1 nm, Span: 20 nm)

Features

- Unparalleled Performance
  Wavelength range: 1200 to 2400 nm (AQ6375B)
  1500 to 3400 nm (AQ6376)
  Wavelength resolution setting: 50 pm to 2 nm (AQ6375B)
  0.1 to 2 nm (AQ6376)
  Wide measurement level range: -70 to +20 dBm (AQ6375B)
  -65 to +13 dBm (AQ6376)

  Close-in dynamic range: 55 dB
- Greater Efficiency
  High speed measurement
  Fast command processing and data transfer
- Support Multimode Fiber
  Free-space optical input
- Intuitive Easy Operation
  Mouse & keyboard operation
  Trace zoom function
- Easy Calibration
  Built-in calibrator
- AQ6375&76 Viewer: Emulation/Remote control software (Optional)

Main specifications

Items	Specifications	
Model	AQ6375B	AQ6376
Wavelength range *1	1200 to 2400 nm	1500 to 3400 nm
Span *1	0.5 nm to 1200 nm (Full span), 0 nm	0.5 nm to 1900 nm (Full span), 0 nm
Wavelength accuracy *1,*2,*5	±0.05 nm (1520 to 1580 nm), ±0.10 nm (1580 to 1620 nm), ±0.50 nm (Full range)	±0.50 nm (Full range)
Wavelength repeatability *1,*2	±0.015 nm (1 min.)	
Wavelength resolution setting *1,*2	0.05, 0.1, 0.2, 0.5, 1 and 2 nm	0.1, 0.2, 0.5, 1 and 2 nm
Minimum sampling resolution *1	0.002 nm	0.003 nm
Number of sampling	101 to 50001, AUTO	
Level sensitivity setting	NORM_HOLD, NORM_AUTO, NORMAL, MID, HIGH1, HIGH2 and HIGH3 (Only High dynamic mode (/CHOP) in HIGH1-3)	
Level sensitivity *2,*3,*6	−70 dBm (1800 to 2200 nm), −67 dBm (1500 to 1800 nm, 2200 to 2400 nm), −62 dBm (1300 to 1500 nm) (Sensitivity: HIGH3)*4	−65 dBm (1500 to 2200 nm), −55 dBm (2200 to 3200 nm), −50 dBm (3200 to 3400 nm) (Sensitivity: HIGH3)
Maximum input power *2,*3	+20 dBm (Per channel, full wavelength range)	+13 dBm (Per channel, full wavelength range)
Maximum safe input power *2,*3	+25 dBm (Total input power)	+20 dBm (Total input power)
Level accuracy *2,*3,*4,*8	±1.0 dB (1550 nm, input level: −20 dBm, Sensitivity: MID, HIGH1-3)	±1.0 dB (1550 nm, input level: −20 dBm, Sensitivity: HIGH1-3)
Level linearity *2,*3	±0.05 dB (Input level: −30 to +10 dBm, Sensitivity: HIGH1-3)	±0.2 dB (Input level: −30 to +10 dBm, Sensitivity: HIGH1-3)
Polarization dependence *2,*3,*8	±0.1 dB (1550 nm)	—
Dynamic range *1,*2	45 dB (Peak ±0.4 nm, Resolution: 0.05 nm), 55 dB (Peak ±0.8 nm, Resolution: 0.05 nm) (1523 nm, Sensitivity: HIGH1-3)	40 dB (Peak ±1 nm, Resolution: 0.1 nm), 55 dB (Peak ±2 nm, Resolution: 0.1 nm) (1523 nm, Sensitivity: HIGH1-3)
Applicable fiber	SM (9.5/125 μm), GI (50/125 μm, 62.5/125 μm)	
Optical connector	Optical input: AQ9447 (□□) Connector adapter (option) required. Calibration output: AQ9441 (□□) Universal adapter (option) required. (□□) Connector type FC or SC	
Built-in calibration light source	Wavelength reference source (For optical alignment and wavelength calibration)	
Sweep time *1,*6,*7	NORM_AUTO: 0.5 sec, NORMAL: 1 sec, MID: 2 sec, HIGH1: 20 sec	
Warm-up time	Minimum 1 hour (After warming up, optical alignment adjustment with built-in light source required.)	

*1: Horizontal scale: Wavelength display mode.
*2: With 9.5/125 μm single mode fiber, after 2 hours of warm-up, after optical alignment with built-in reference light source, when the purge gas is not used.
*3: Vertical scale: Absolute power display mode, Resolution setting: ≥ 0.1 nm (AQ6375B)/ ≥ 0.2 nm (AQ6376).
*4: With 9.5/125 μm single mode fiber (B1.1 type defined on IEC60793-2, PC polished, mode field diameter: 9.5 μm, NA: 0.104 to 0.107).
*5: After wavelength calibration with built-in reference light source, Sampling resolution: ≤ 0.003 nm (AQ6375B)/AUTO (AQ6376), Sensitivity: MID, HIGH1-3
*6: Pulse light measurement mode: OFF.
*7: Span: ≤ 100 nm (The AQ6376 excluding 2200 to 2220 nm), Number of sampling: 1001, Average number: 1.
*8: Temperature condition changes to 23 ±3°C at 0.1 nm resolution setting (AQ6375B only).

Optical Spectrum Analyzer　**AQ6373B**

Short Wavelength OSA 350 - 1200 nm

- Wavelength accuracy: ±0.05 nm
- Wavelength resolution setting: 0.02 to 10 nm
  (Settable to 0.01 nm at 400 to 470 nm)
- Max. safe input power: +20 dBm
- Level sensitivity: -80 dBm
- Dynamic range: ≥60 dB
- Single-mode, multimode, and
  large-core fibers
- Built-in optical alignment source
- Automatic wavelength calibration
  with an external source
- Data logging function
- Built-in color analysis function
  for VIS

Example of 405 nm FP-LD measurement
(Resolution setting: 0.01 nm)

Higher resolution measurement is possible in 400 to
470 nm range.

FWHM = 0.011nm

Applications

■ **Active optical device (semiconductor laser, fiber laser, LED)**
■ **Passive active device (filter, FBG, special optical fiber)**
■ **Support for the development of optical devices**
- Medical and biological applications (medical laser treatment, DNA analysis, laser microscope)
- Industrial equipment (laser processing, laser marking)
- Home electronics (laser projector, next-generation optical disc, LED products)
- Measurement (LIDAR, interferometer)
- Communication (plastic optical fiber (POF) communication)

Visible LED Test

The optical spectrum of visible LEDs used in a wide variety of applications such as lighting, indication, and measurement can be measured and analyzed. By supporting the large core fiber input, the AQ6373B can efficiently acquire the LED light and measure its spectrum. The standard built-in color analysis function automatically evaluates a dominant wavelength and XYZ color coordinates.

AQ6373B

Optical fiber

Visible LED

Color analysis of white LED
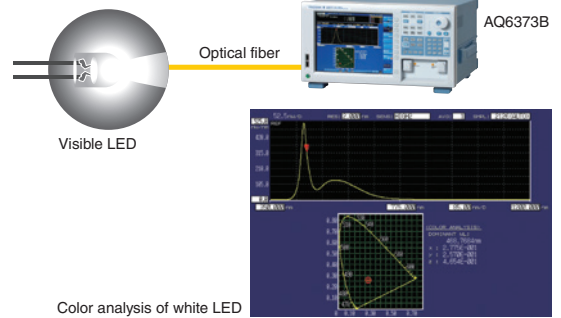
Main Specifications

Item	Specifications
Wavelength range *1	350 to 1200 nm
Span *1	0.5 nm to 850 nm (full span), and 0 nm
Wavelength accuracy *1	± 0.05 nm (633 nm), ± 0.20 nm (400 to 1100 nm) (after wavelength calibration with 633 nm He-Ne laser)
Wavelength resolution setting *1, *2	0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 nm (full range), and 0.01 nm (400 to 470 nm)
Minimum sampling resolution *1	0.001 nm
Number of sampling points	101 to 50001, AUTO
Level sensitivity setting	NORM_HOLD, NORM_AUTO, NORMAL, MID, HIGH1, HIGH2 and HIGH3
High dynamic mode	SWITCH (sensitivity setting: MID, HIGH1 to 3)
Level sensitivity *3	-80 dBm (500 to 1000 nm), -60 dBm (400 to 500 nm, 1000 to 1100 nm) (Typical, Resolution setting: ≥ 0.2 nm, Averaging: 10 times, Sensitivity: HIGH3)
Maximum safe input power *3	+ 20 dBm (550 to 1100 nm), + 10 dBm (400 to 550 nm) (total input power)
Level accuracy *2	± 1.0 dB (850 nm, Input level: -20 dBm, Resolution: ≥ 0.2 nm, Sensitivity: MID, HIGH1 to 3, SMF [MFD5 μm@850 nm, NA0.14]
Level linearity *3	± 0.2 dB (Input level: -40 to 0 dBm, Sensitivity: HIGH1-3)
Dynamic range *1	60 dB (Peak ± 0.5 nm, Resolution: 0.02 nm, 633 nm, Sensitivity: HIGH1 to 3)
Applicable fiber	SM, GI (50/125 μm, 62.5/125 μm), Large core fiber (up to 800 μm)
Optical connector	FC type (optical input and calibration light source output)
Built-in calibration light source	Optical alignment light source (not equipped with wavelength reference light source.)
Sweep time *1, *4	NORM_ AUTO: 0.5 sec, NORMAL: 1 sec, MID: 2 sec, HIGH1: 5 sec, HIGH2: 20 sec, HIGH3: 75 sec
Warm-up time	Minimum 1 hour (after warming up, optical alignment adjustment with built-in light source is required.)

Performance and functions can be limited by type of used fiber. The specifications are only guaranteed when a single mode fiber in which light travels in single mode at the measured wavelength is used. In the case in which the measured wavelength is less than the cut-off wavelength of the used fiber, or a multimode fiber is used, a measured spectrum may be inaccurate due to speckle noise. Please be careful especially when measuring high coherency sources like gas laser and laser diode.
*1: Horizontal scale: Wavelength display mode.
*2: Actual wavelength resolution varies according to the measured wavelength. Actual resolution at the 10 nm resolution setting is about 8 nm at most.
*3: Vertical scale: Absolute power display mode.
*4: High dynamic mode: OFF, Pulse light measurement mode: OFF, Number of sampling points: 1001, Average number: 1, Span: ≤ 100 nm excluding 450 to 470 nm and 690 to 700 nm.

Optical Measuring Instruments

Optical Wavelength Meter **AQ6150 series**

High performance and cost-effective Optical Wavelength Meter
Exceeding the testing needs of optical devices and transmission systems

Features

The AQ6150 series optical wavelength meter is an ideal instrument for accurately measuring the optical wavelength of optical devices and systems used in telecommunication applications from 1270 to 1650 nm. By employing a Michelson interferometer and a high speed Fast Fourier Transform (FFT) algorithm, the AQ6150 series can measure not only a single wavelength laser signal but also a multiple wavelength laser signal from a DWDM system and Fabry-Perot laser.

- Wavelength Range: 1270 to 1650 nm
- Wavelength accuracy: ±0.3 pm (AQ6151), ±1 pm (AQ6150)
- Simultaneous measurement of up to 1024 wavelengths
- Cope with modulated light and optical filter measurement
- Increase throughput with high speed measurement
- Reduce the lifetime ownership costs
- logging data function
- Add WDM (OSNR) analysis
- Abundant functions to increase work efficiency

Product Lineup

There are two models in the series. The High Accuracy AQ6151 model offers an accuracy of ±0.3 pm to meet the most demanding precision requirements. The Standard Accuracy AQ6150 offers a ± 1 pm accuracy for applications with less demanding requirements at a more affordable price.

Model	Accuracy	Key applications
AQ6150	± 1 pm	Inspection of DFB-LDs, Tunable lasers, Optical transceivers. WDM transmission systems
AQ6151	± 0.3 pm	Adjustment, characterization, and inspection of Laser chips, Tunable lasers, WDM transmission systems, etc.

Increase throughput with high speed measurement

Both models can acquire, analyze and transfer a measurement to a PC within 0.3 seconds. This vastly improves production throughput.

Send the command to initiate ▸ Measurement & Analysis ▸ Data transfer ➡ **0.3** sec

Various view modes

Multi wavelength view

Optical spectrum view

Other modes:
Single wavelength view, Delta wavelength view, Grid view, and List view

Applications

- **WDM transmission systems**
  - Simultaneous measurement of multi channel and narrow spacing WDM system
  - Precise adjustment and inspection of laser sources
  - Measurement of modulated signals
- **Lasers / optical transceivers**
  - Precise adjustment and inspection of tunable lasers
  - Modulated signal measurement of optical transceivers and transponders.
  - Measurement of all channels of 40 G and 100 G optical transceivers with WDM technology.
- **Calibration of test systems**
  - Calibration of optical spectrum analyzers.
  - Calibration of DFB lasers for optical amplifier test system.
  - Calibration of tunable lasers for passive component test systems.
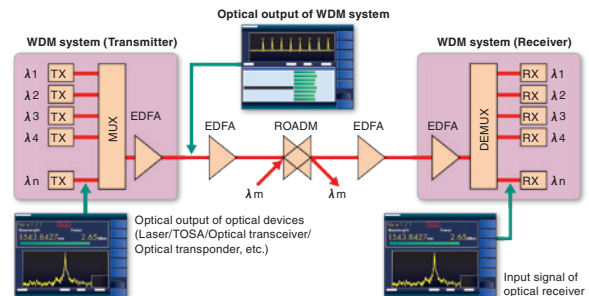
Specifications

Applicable optical fiber	SM (ITU-T G.652)
Wavelength range	1270 to 1650 nm
Wavelength accuracy	AQ6150: ±0.7 ppm (±1 pm at 1550 nm)
	AQ6151: ±0.2 ppm (±0.3 pm at 1550 nm)
Min. resolvable separation	5 GHz (40 pm at 1550 nm)
Display resolution (Wavelength)	0.0001 nm
Power accuracy	±0.5 dB (1550 nm, -10 dBm)
Linearity	±0.3 dB (1550 nm, -30 dBm or higher)
Polarization dependency	±0.5 dB (1550 nm)
Display resolution (Power)	0.01 dB
Max. number of wavelengths	1024
Min. input power	-40 dBm (1270 to 1600 nm, single line input)
	-30 dBm (1600 to 1650 nm, single line input)
Max. input power	+10 dBm (total of all lines)
Safe max. input power	+18 dBm (total of all lines)
Return loss	35 dB
Measurement time	0.3 s or less (single measurement)
Display	5.7-inch color LCD (640 × 480 dots)
Data storage	Internal: 256 MB or more, External: USB
Interfaces	GP-IB, ETHERNET, USB, VGA output
Remote control	GP-IB, ETHERNET
Optical connector	FC/PC or SC/PC (AQ9441 Universal adapter)
Dimensions	Approx. 426 (W) × 132 (H) × 450 (D) mm
Mass	Approx. 11 kg

Please refer to the product brochure for details.

Model and Suffix Codes

Model	Suffix	Descriptions
AQ6150		AQ6150 Optical Wavelength Meter
AQ6151		AQ6151 Optical Wavelength Meter
Spec code	-10	Base model
Power cord	-D	UL/CSA standard, and PSE standards
	-F	VDE standard
	-R	AS standard
	-Q	BS standard
	-H	GB standard
	-N	NBR standard
Optical connector	/FC	AQ9441(FC) Universal Adapter
(Factory option)	/SC	AQ9441(SC) Universal Adapter

Multi Application Test System   **AQ2200**

Build Your Own Test Configurations in Small Footprint

Features

The AQ2200 Multi Application Test System is the ideal system for measuring and evaluating a wide range of optical devices and optical transmitters.

• Flexible and space effective
• Easy-to-View TFT color display
• Remote operation through Ethernet network
• Built-in applications
    • Optical power stability measurement
    • Short-term optical power fluctuation measurement
• Wide variety of plug-in modules
• Hot-swappable modules

Applications

• GE-PON ONU/OLT measurement system
• GE-PON optical three wavelength filter measurement
• Optical amplifier measurement system
• Optical transceiver measurement system

Frame and Module Lineup

• Frame controllers
  AQ2211 Frame controller (3 slots for modules)
  AQ2212 Frame controller (9 slots for modules)
• Light source modules
  AQ2200-131 Grid TLS module (C/L-band, 1 channel)
  AQ2200-132 Grid TLS module (C/L-band, 2 channels)
• Sensor modules
  AQ2200-215 Sensor module (+30 dBm, 970-1660 nm, 1-slot)
  AQ2200-221 Sensor module (Dual sensor, 800-1700 nm, 1-slot)
• Optical attenuator modules
  AQ2200-311A ATTN module [w/ Monitor output (optional)] (SMF or MMF, 1-slot)
  AQ2200-331 ATTN module [w/ built-in monitor power meter] (SMF or MMF, 1-slot)
  AQ2200-342 DUAL ATTN module [w/ built-in monitor power meter] (SMF, 1-slot)
• Optical switch modules
  AQ2200-411 OSW module (1 × 4 or 1 × 8, SMF or MMF, 1-slot)
  AQ2200-412 OSW module (1 × 16, SMF, 2-slot)
  AQ2200-421 OSW module (1 × 2 or 2 × 2, SMF or MMF, 1-slot)
• Modules for Optical Transceiver
  AQ2200-642 Transceiver interface module (2-slot)
  AQ2200-651 SG module (2-slot)

Transceiver Measurement System

The 10 Gbit/s optical transceiver modules such as XFP or SFP+ are frequently used in transmission systems and Ethernet systems.
The measuring system for such modules requires many instruments including power supplies, multi-meters and the signal generators to control optical transceiver modules.
The AQ2200 Multi Application Test System allows for building a space saving test system with a variety of plug-in modules.
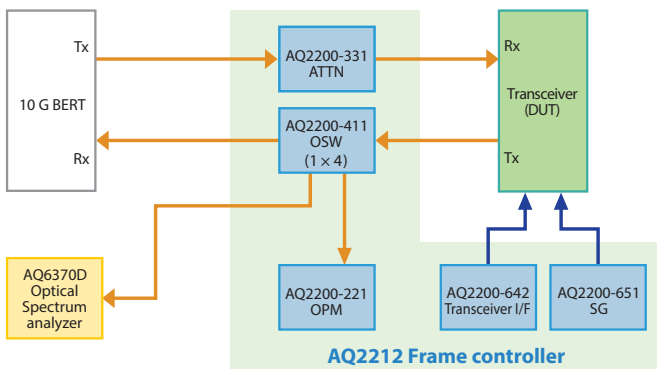
Optical Fiber Amplifier Measurement System

An optical fiber amplifier is an indispensable device for WDM transmission systems. This measurement system characterizes gains and noise figures (NF) of the fiber amplifier by measuring input light to an optical fiber amplifier, which was multiplexed using multiple light sources, as well as amplified output light with an optical spectrum analyzer. A high-power sensor allows for measuring total output power.
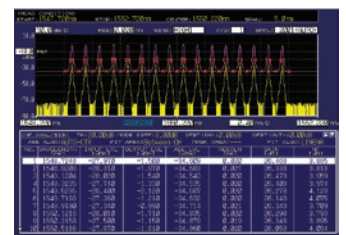
AQ6370D Measurement Screen

[Measurement items]
• Gain, NF, and total output power

Optical Time Domain Reflectmeter **AQ7280**
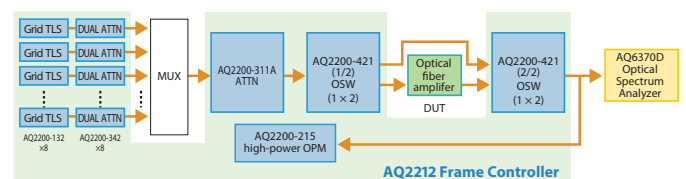
Features

The AQ7280 succeeds the high-end AQ7275 OTDR, which has been used for the installation and maintenance of a wide range of network systems, including core, metro, and access networks.

The AQ7280 has a best-in-class 8.4-inch capacitive touchscreen that supports the same intuitive multi-touch functionality found in smartphones and other handheld devices, allowing users to reposition and resize objects on the screen. The AQ7280 also has the same operation hard keys found on the preceding model. Users can opt to use either the touchscreen or the hard keys.

The AQ7280 series offers remarkable flexibility and convenience with modular measuring units that can be replaced in the field. As new measuring units are developed to keep up with advances in optical technology, the AQ7280 can be modified simply by replacing the measuring unit.

General Specifications

Display: 8.4-inch color TFT LCD Multi-touch capacitive touchscreen
Power supply: AC adapter voltage 100 to 120 VAC or 200 to 240 VAC (auto switching) Battery(Li-ion) operation time 15 hours (Telcordia GR-196-CORE Issue 2). 10 hours (continuous measurement)
Electrical I/F: Unit interface × 1, module interface × 1, USB 2.0 × 3, Ethernet × 1[*1], SD card slot × 1
Dimensions: 287 mm (W) × 210 mm (H) × 80 mm (D)
Weight: Approx. 2.2 kg (OTDR mainframe)
*1 option

Application Software

Models	Suffix codes	Descriptions
735070		AQ7932 Emulation Software (Ver. 5.01 or later)
	-EN	English
	-JA	Japanese
	-CH	Chinese
	-KO	Korean
735071		AQ7940 Optical Fiber Monitoring Software (Ver. 5.01 or later)
	-HE	English
	-HJ	Japanese
735050		Additional option license for AQ7280
	-FST	Fiber Surface Test function
	-MNT	Monitoring Function
	-SMP	Smart Mapper Function

Model and Suffix Code

OTDR Mainframe

Models		Suffix codes	Descriptions
AQ7280			AQ7280 OTDR Mainframe
	Language	-HJ	Japanese/English
		-HE	English (Multi language)
		-HM	Chinese
		-HC	Chinese/English
		-HK	Korean/English
		-HR	Russian/English
	Options	/FST	Fiber Surface Test function
		/MNT	Monitoring function
		/SMP	Smart Mapper function
		/LAN	Ethernet
		/SB	Shoulder Belt

Standard accessories; Battery pack, hand belt, user's manual (CD-ROM), operation guide

AC adapter (Not included in AQ7280. Please order separately.)

Models	Suffix codes	Descriptions
739871		AC Adapter[*1, *3]
739872		AC Adapter[*2, *3]

*1: For outside the US and the countries that require CE marking.
*2: For the US and the countries that require CE marking.
*3: Used with power cord. Refer the bulletin of AQ7280 OTDR for the select.

OTDR units

Models		Suffix codes	Descriptions
AQ7282A			2WL 1310/1550 nm 38/36 dB
AQ7283A			2WL 1310/1550 nm 42/40 dB
AQ7284A			2WL 1310/1550 nm 46/45 dB
AQ7285A			2WL 1310/1550 nm 50/50 dB
AQ7283E			3WL 1310/1550,1625 nm 42/40, 40 dB[*4]
AQ7283F			3WL 1310/1550,1650 nm 42/40, 40 dB (1650 nm port is equipped with a built-in filter)
AQ7283H			3WL 1310/1550/1625 nm 42/40/39 dB
AQ7284H			3WL 1310/1550/1625 nm 46/45/44 dB
AQ7282G			3WL 1310/1490/1550 nm 38/36/36 dB
AQ7283K			4WL 1310/1490/1550/1625 nm 42/38/40/40 dB
AQ7283J			4WL 1310/1383/1550/1625 nm 42/39/40/40 dB
AQ7282M			2WL 850/1300 nm (MM) 25/27 dB
	Optical connector	-USC	Universal Adapter (SC)
		-UFC	Universal Adapter (FC)
		-ULC	Universal Adapter (LC)
		-ASC	Universal Adapter (SC Angled-PC)[*1]
		-NUA	No universal adapter
	Options	/PC	Power Checker[*1, *2]
		/SLS	Stabilized Light Source[*3]

*1: Not applicable to AQ7282M
*2: Not applicable to the Port2 of AQ7283E and AQ7283F
*3: Not applicable to the wavelength 1383 nm of AQ7283J.
*4: The port for 1650 nm or 1625 nm is equipped with a built-in filter.

OPM/VLS modules

Models		Suffix codes	Descriptions
AQ2780			OPM Module
AQ2781			High Power OPM Module
AQ2780V			OPM & VLS Module
AQ2781V			High Power OPM & VLS Module
	Optical connector	-SCC	Universal Adapter (SC)
		-FCC	Universal Adapter (FC)
		-LMC	Ferrule Adapter (φ 1.25)

Models	Suffix codes	Descriptions
AQ4780		VLS Module

Specifications by Model

OTDR unit	Number of wavelength	Dynamic range (dB)								Test application			Fiber network				
		SM 1310 (nm)	SM 1383 (nm)	SM 1490 (nm)	SM 1550 (nm)	SM 1625 (nm)	SM 1650 (nm)	MM 850 (nm)	MM 1300 (nm)	Installation	Maintenance		Core	Metro	Access	PON	MM fiber
											Dark	Live					
AQ7282A	2	38			36					●	●				●	●	
AQ7283A	2	42			40					●	●			●	●	●	
AQ7284A	2	46			45					●	●		●	●			
AQ7285A	2	50			50					●	●		●	●			
AQ7283E	3	42			40	40[*1]				●	●	●			●	●	
AQ7283F	3	42			40		40[*1]			●	●	●			●	●	
AQ7283H	3	42			40	39				●	●	○[*2]		●	●	●	
AQ7284H	3	46			45	44				●	●	○[*2]	●	●			
AQ7282G	3	38		36	36					●	●			●	●	●	
AQ7283K	4	42		38	40	40				●	●	○[*2]		●	●	●	
AQ7283J	4	42	39		40	40				●	●	○[*2]		●	●	●	
AQ7282M	2							25	27	●	●						●

*1: Port2, Built-in filter
*2: Using an external filter

MFT-OTDR **AQ1200**

Features

The AQ1200 is a multifunctional handheld OTDR that combines all the necessary field test functions in one unit. It offers various functions, including an OTDR function that features short 80 cm event dead zone, a fault locator function that is effective in locating a fault, a loss test function (option) that combines light sources and an optical power meter in one unit, and a visible light source (option). You can also connect a fiber end-face inspection probe. The AQ1200 retains the interface of the very popular AQ7252 series. So you can use the variety of functions and the user-friendly interface.

Model and suffix code

Model	Suffix codes		Description
AQ1200A			1310/1550 nm
AQ1200B			1625 nm
AQ1200C			1650 nm
AQ1200E			1310/1550, 1625 nm
AQ1205A			1310/1550 nm, High Dynamic Range
AQ1205E			1310/1550 nm, 1625 nm High Dynamic Range
AQ1205F			1310/1550 nm High Dynamic Range, 1650 nm
Language	-HE		English
	-HC		Chinese/English
	-HK		Korean/English
	-HR		Russian/English
Power cord	-D		UL/ CSA standard
	-F		VDE standard
	-R		AS standard
	-Q		BS, Singapore standard
	-H		GB standard, Complied with CCC
	-P		EK standard (S. Korea)
	-T		BSMI standard
	-N		Brazil standard
Optical connector	-USC		SC type
	-UFC		FC type
	-ASC		SC/Angled-PC type
light source & optical power meter		/SLT	Stabilized light source & Standard optical power meter
		/HLT	Stabilized light Source & High power optical power meter
		/PPM	Light source & PON Power meter
		/SLS	Stabilized light source
		/SPM	Standard optical power meter
Visible light source		/VLS	Optical connector: 2.5 φ ferrule
PON measurement[1]		/PN	PON measurement mode
Ethernet		/LAN	10BASE T/100BASE TX (PING test, Remote control)
Shoulder belt		/SB	Shoulder belt
AC adapter		/AC1	Attach 739872 AC adapter[2]

*1: Only for AQ1200A. AQ1200B/C/E and AQ1205A /E/F come equipped this function.
*2: For the US and the countries that require CE marking.

Specifications

Model	AQ1200A	AQ1200B	AQ1200C	AQ1200E	AQ1205A	AQ1205E	AQ1205F
Measured wavelength (nm)	1310±20(typ)/ 1550±20(typ)	1625±10	1650±5, 1650±10	1310±20(typ)/ 1550±20(typ), 1625±10	1310±20(typ)/ 1550±20(typ)	1310±20(typ)/ 1550±20(typ), 1625±20(typ)	1310±20(typ)/ 1550±20(typ), 1650±5, 1650±10
Optical Port	PORT2			PORT2, 3	PORT2	PORT2, 3	
Measured fiber	SM (ITU-T G.652)						
Distance range(km)	0.5, 1, 2, 5, 10, 20, 50, 100, 200, 300, 400, 512			0.5, 1, 2, 5, 10, 20, 50, 100, 200, 300, 400, 512			
Pulse width(ns)	3, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000			3, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000			
Event Dead zone (typ.)	0.75 m						
Attenuation Dead zone (typ.)	4 m/5 m	7 m		4 m/5 m, 7 m	4 m/5 m	4 m/5 m, 7 m	
Dynamic range(dB)(typ.)	34/32	33	34	38/36,36	42/40	42/40,38	42/40,37
Loss measurement accuracy	±0.05 dB or ±0.05 dB/dB						
Optical connector	Universal Adapter SC, FC						
Output power control	–	Normal/ Low			–	Normal/ Low	
Laser safety standard	Class 1M						

Factory Installed Options

● **Light source & Optical power meter option**

	Option	Optical Power Meter (/SPM)	Standard (/SLT)	High power (/HLT)	PON (/PPM)	Stabilized Light Source (/SLS)
Optical Power meter	Wavelength setting	850/1300/1310/1490/1550/1625/1650 nm, 800 to 1700 nm (1 nm steps), or CWDM wavelength (1270 to 1610 nm 20 nm steps)			1310/1490/1550 nm	–
	Applicable fiber	SM (ITU-T G 652), GI (50/125 μm), GI (62.5/125 μm)			SM (ITU-T G 652)	–
	Power range	+10 to -70 dBm (CW) +7 to -60 dBm (CHOP)		+27 to -50 dBm (CW) +24 to -50 dBm (CHOP)	+10 to -70 dBm (CW) +27 to -50 dBm (CW)	–
	Noise level	0.5 nW (-63 dBm, 1310 nm)		50 nW (-43 dBm, 1310 nm)	0.5 nW (-63 dBrn, 1310nm) 50 nW (-43 dBm, 1550nm)	–
	Uncertainty under standard conditions	±5 %			±0.5 dB	–
	Readout resolution	0.01				–
	Level unit	Absolute: dBm, mW, μW, nW, Relative: dB				–
	Modulation mode	CW, CHOP (270 Hz/1 kHz/2 kHz)				–
	Average function	1, 10, 50 and 100 times				–
Light source	Wavelength (nm)	–	1310/1550 ±0.25 nm (AQ1200A/E, AQ1205A/E/F), 1625 ±10nm (AO1200B/E), 1625 ±25nm (AO1205E), 1650 ±5 nm, 1650 ±10 nm (AQ1200C, AQ1205F)			
	Optical output level (dBm)	–	-3 ±1			
	Level stability (dB)	–	±0.05 (1310/1550 nm, AQ1200A/E, AQ1205A/E/F), ±0.15 (1625/1650 nm, AQ1200B/C/E, AQ1205E/F)			
	Modulation mode	–	CW, 270 Hz, 1 kHz, 2 kHz			
	Applicable fiber	–	SM (ITU-T G 652)			
Memory and logging function		–	Measurement data storage: 10 to 1000 data, Logging interval: 0.5, 1, 2, 5, or 10 sec			
Auto loss test function		–	Loss measurement with light source and optical power meter interlock		–	

● **Visible Light Source (/VLS) option**

Optical connector	2.5 mm type ferrule
Wavelength and optical output level	650 nm± 20 nm, -3 dBm or more (peak)
Modulation mode	CHOP approx. 2 Hz
Laser class	3R

● **Ethernet Interface (/LAN) option**

Interface	10BASE-T/100BASE-TX
Function	Ping test and remote control

Optical Measuring Instruments

AQ2170 *Optical Power Meter*

AQ2170
AQ2170H

AQ2180 *Optical Power Meter*

AQ2180
AQ2180H

AQ4280 *Optical Light Source*

AQ4280A
AQ4280B
AQ4280C

Features

Due to the increase in broadband services such as FTTH (Fiber To The Home), the communication carriers are reinforcing the infrastructure of optical fiber networks. In the introductory period of such networks, there is a strong need for handy OPM/LS for installation and maintenance together with OTDRs. the AQ2170, AQ2170H, AQ2180 and AQ2180H Optical Power Meters, and the AQ4280A, AQ4280B and AQ4280C Optical Light Sources to address installation and maintenance needs.

Specifications by model

Optical Power Meter

Model	AQ2170	AQ2170H	AQ2180	AQ2180H
Wavelength Setting	850/1300/1310/1490/1550/1625/1650 nm	1310/1490/1550/1625/1650 nm	850/1300/1310/1490/1550/1625/1650 nm	1310/1490/1550/1625/1650 nm
Photo Detector	InGaAs		InGaAs	
Optical Fiber	SM (ITU-T G.652), GI (50/125 µm), GI (62.5/125 µm) In fiber	SM (ITU-T G.652) In fiber	SM (ITU-T G.652), GI (50/125 µm), GI (62.5/125 µm) In fiber	SM (ITU-T G.652) In fiber
Optical Connector	FC, SC, LC, ferrule2.5, ferrule1.25 (Standard) FC,		FC, SC, LC, ferrule2.5, ferrule1.25 (Standard)	
Power Range	-70 to +10 dBm	-50 to +26 dBm	-70 to +10 dBm	-50 to +26 dBm
Noise Level	-60 dBm	-40 dBm	-60 dBm	-40 dBm
Uncertainty	±5%	±5%	±5%	±5%
Display Resolution	0.01 dB (> -60 dBm), 0.1 dB (-60 dBm)	0.01 dB (> -40 dBm), 0.1 dB (-40 dBm)	0.01 dB, 0.01 dBm, 0.0001 µW	
Unit	ABS value: dBm, mW, µW / Relative value: dB		ABS value: dBm, mW, µW / Relative value: dB	
Modulation	CW, CHOP (270 Hz, 1 kHz, 2 kHz)		CW, CHOP (270 Hz, 1 kHz, 2 kHz)	
Memory function	—		999 records	
I/O	—		USB-B (mini)	
Power Source	Four AAA Cell batteries		Two AA Cell batteries	
Battery life time	40 hours		40 hours	
Dimensions (mm) Weight	63 (W) × 116 (H) × 35 (D) approx.160 g		76 (W) × 153 (H) × 43 (D) approx.280 g	

Optical Light Source

Model	AQ4280A	AQ4280B	AQ4280C
Element	LD		
Fiber	SM (ITU-T G.652)		
Wavelength	1310/1550 ± 20 nm	1310/1550±20 nm, 1490±10 nm	1310/1550±20 nm, 1490/1625±10 nm
Spectral width	< 5 nm (1310 nm), < 10 nm (1550 nm)	< 5nm (1310 nm, 1490 nm), < 10nm (1550 nm)	< 5nm (1310 nm, 1490 nm, 1625 nm) < 10nm (1550 nm)
Output power level	-5 dBm ± 1 dB	-5 dBm ± 1 dB	-5 dBm ± 1dB
Power stability (15 min)	< ± 0.05 dB	< ± 0.05 dB (1310/1550 nm)< ± 0.1 dB (1490 nm)	< ± 0.05 dB (1310/1550 nm)< ± 0.1 dB (1490/1625 nm)
Modulation	CW, CHOP (270 Hz, 1 kHz, 2 kHz)		
Power Source	Three AA Cell batteries		
Battery life time	25 hours		
Laser Class	CLASS1 (IEC 60825-1)		
Dimensions (mm) Weight	76 (W) × 153 (H) × 43 (D) approx.300 g		

Standard Accessory

AQ2170 Optical Power Meter

Connector adapter (FC, SC, LC, ferrule2.5, ferrule 1.25), Four AAA Cell batteries, Carrying pouch, Protector, Operation Guide, User's Manual (CD)

AQ2180 Optical Power Meter

Connector adapter (FC, SC, LC, ferrule2.5, ferrule 1.25), Two AA Cell batteries, Carrying pouch, Protector, Operation Guide, User's Manual (CD)

AQ4280 Optical Light Source

Universal adapter (FC/PC, SC/PC, ST/PC Standard), Two AA Cell batteries, Carrying pouch, Protector, Operation Guide, User's Manual (CD)

MFT-OLTS **AQ1100**

Model and Suffix Codes

Model	Suffix codes		Description
AQ1100A			LS: 1310/1550 nm
AQ1100B			LS: 1310/1550/1625 nm
AQ1100D			LS: MM850/1300, SM1310/1550 nm
Language	-HJ		Japanese/English
	-HE		English
	-HC		Chinese/English
	-HK		Korean/English
	-HR		Russian/English
Power cord	-D		UL/ CSA standard
	-F		VDE standard
	-R		AS standard
	-Q		BS, Singapore standard
	-H		GB standard, Complied with CCC
	-P		KC standard (S. Korea)
Optical power meter		-SPM	Optical power meter
		-HPM	High power optical power meter
		-PPM (AQ1100A only)	PON Optical power meter
Optical connector		-USC	SC type (LS port, and OPM port)
		-UFC	FC type (LS port, and OPM port)
		-ULC	LC type (LS port, and OPM port for -PPM), φ 125 adapter(OPM port for -SPM and -HPM)
		-ASC (except AQ1100D)	SC/Angled-PC type (LS port, and OPM port for -PPM), SC type (OPM port for -SPM and -HPM)
Factory installed options		/VLS	Visible light source, optical connector: 2.5φ ferrule
		/LAN	Ethernet (10/100BASE-TX)
		/SB	Shoulder belt
AC adapter		/AC1	Attach 739872 AC adapter*

* For the US and the countries that require CE marking.
■ Standard Accessories
Power cord, AC adapter, battery pack, hand belt, user's manual (CD-ROM), operation guide

General Specifications

The AQ1100 is an optical loss test set combining an optical power meter and light sources in one unit. An optical power meter is a measuring instrument usually used for optical loss tests. The AQ1100 supports up to MM850/1300 nm and SM1310/1550/1625 nm. Also, you can select a +27 dBm high power optical meter. For the light source, three models are available depending on the wavelength and fiber type used. For the optical power meter, you can select from three models depending on the measurement power and the purpose of the optical power meter.

Features

Display: 5.7-inch color LCD (640 × 480)
    Loss test mode (only with /SPM or /HPM): Auto loss test, Loopback test, Multi-core loss test
External interface: USB1.1 Type A and Type B (mini) × 1
Power supply: AC adapter voltage 100 to 120 VAC or 200 to 240 VAC (auto-switching)
    Battery (Li-ion) operation time 6 hours and charging time 5 hours
External dimensions: Approx. 217.5 mm (W) × 157 mm (H) × 74 mm (D)
Weight: Approx. 1 kg or less (including internal battery)

Optional Accessories

Model	Suffix codes	Description
SU2006A		Soft carrying case
735480 (For opticalpower meters)	-SCC	Connector adapter (SC)
	-FCC	Connector adapter (FC)
735481	-LMC	Ferrule adapter (φ 125)
SU2005A (For LS and PON optical power meter)	-SCC	Universal adapter (SC)
	-FCC	Universal adapter (FC)
	-LCC	Universal adapter (LC)
739871 (AC adpter)	-D	UL/ CSA standard
	-F	VDE standard
	-R	AS standard
	-Q	BS, Singapore standard
	-H	GB standard, Complied with CCC
	-P	KC standard (S. Korea)
739872* (AC adpter)	-D	UL/CSA standard
	-F	VDE standard
	-Q	BS, Singapore standard
739882		Battery pack (Spare)
B8070CY		Shoulder belt

* For the US and the countries that require CE marking

Specifications by Model

Models		AQ1100A	AQ1100B	AQ1100D
Light source performance	Wavelength (nm) *1	1310/1550 ± 25	1310/1550/1625 ± 25	1310/1550 ± 25 (SM) 850/1300 ± 30 (GI)
	Light emitting device	LD	LD	LD(SM), LED(GI)
	SM (LD) spectral width (nm) *1 *2	<5 / <10	<5 / <10 / <10	<5 / <10
	GI (LED) spectral width (nm) *1 *3 (FWHM)	–	–	40(typ)/140(typ)
	Optical output level (dBm)	-3 ± 1	-3 ± 1	SM: -3 ± 1 GI: -20 ± 1
	Level stability (dB) *4	±0.05	±0.05	SM: ±0.05 GI: ±0.1
	Modulation mode	CW, CHOP(270 Hz, 1 kHz, 2 kHz) *5		
	Applicable fiber	SM (ITU-T G.652)		SM (ITU-T G.652)GI (50/125 μm)
	Optical connector	SC, FC, 1.25 mm ferrule, SC/Angled-PC		SC, FC, 1.25 mm ferrule
	Laser class	1		

Factory Installed Options			
Visible light source (/VLS)	Optical connector	2.5 mm ferrule type	
	Wavelength and optical output level	650 nm ±20 nm, peak value -3 dBm or more	
	Modulation frequency	Approx. 2 Hz	
	Laser class	3R	
LAN interface (/LAN)	10BASE-T/100BASE-TX RJ-45 connector	Ping test, PC remote control	

Optical Power Meter Performance and Functions	Standard (/SPM)	High power (/HMP)	PON (/PPM)
Wavelength setting	Simple mode: 850/1300/1310/1490/1550/1625/1650 nm Detail mode setting range: 850 nm to 1650 nm, 1 nm step CWDM mode setting range: 1270 nm to 1610 nm 20 nm step		1310/1490/1550 nm (1490 nm and 1550 nm can be measured separately)
Applicable fiber	SM (ITU-G.652) GI (50/125 μm)		SM (ITU-G.652)
Power range (dBm)	-70 to +10 (CW) -70 to +7 (CHOP)	-50 to +27 (CW) -50 to +24 (CHOP) *6	-70 to +10: 1310/1490 nm -50 to +27: 1550 nm
Noise level	0.5 nW (-63 dBm, 1310 nm)	50 nW (-43 dBm, 1310 nm)	0.5 nW(-63 dBm, 1310 nm) 50 nW(-43 dBm, 1550 nm)
Uncertainty under standard conditions *7	±5%	±5%	±0.5 dB (10%)
Readout resolution	0.01		
Level unit	Absolute: dBm, mW, μW, nW, Relative: dB		
Modulation mode	CW CHOP(270/1 k/2 kHz)	CW CHOP(270/1 k/2 kHz)	CW
Average function	1, 10, 50 and 100 times		
Logging function	Measurement intervals: 500 ms, 1 s, 2 s, 5 s, 10 s, Measurement count: 10 to 1000		

The specifications are at 23°C ±2°C unless otherwise noted.
*1: 23°C ±2°C, CW
*2: RMS (2σ, -20 dB)
*3: Envelope (-3 dB)
*4: for 15 minutes at a constant temperature within 23°C ±2°C
*5: CW and 270 Hz only at 850 nm and 1300 nm
*6: Except for 850 nm and 1650 nm.
*7: 23°C ±2°C , standard conditions (CW, 1310 nm, 100 μW, SMF), at 1550 nm for /PPM.
*8: LD ON. (in screen save mode)

Optical Measuring Instruments

MFT-1/10GbE   **AQ1300 Series**

General Specifications

Display: 5.7-inch color LCD (640 × 480)
External interface: USB1.1 Type A and Type B (mini), LAN (RJ-45) × 1
Power supply: AC adapter 100 to 240 V, 50 to 60 Hz
　　　　　　　Battery (Li-ion) operation time 1 hour
External dimensions: 217.5 (W) × 157 (H) × 74 (D) mm
Weight: Approx. 1.3 kg (including internal battery)

Features

The AQ1300 series is a compact and lightweight Ethernet tester that is designed to improve both work efficiency and quality at the same time, with function optimized for the network path testing and maintenance of Ethernet networks up to 1G or 10G depending on model chosen.
Easy operation prevents operational errors and stabilizes work quality for routine tasks such as network path testing.
Powerful analysis functions help isolate failures during maintenance work.
The AQ1300 series has two models, AQ1300 and AQ1301 to choose from depending on the measurement interface and bit rate. You can choose the model suitable for your test needs.

| AQ1301 | 10M | 100M | 1G | |
| AQ1300 | 10M | 100M | 1G | 10G |

Model and Suffix Codes

Model	Suffix Code			Description
AQ1301				AQ1301 MFT-1GbE
AQ1300				AQ1300 MFT-10GbE
Language	-HE			English
Power Coad		-D		UL/CSA standard
		-F		VDE standard
		-R		AS standard
		-Q		BS, Singapore Standard
		-H		GB standard, CCC correspondence
		-P		KC standard (South Korea)
		-T		BSMI, Taiwan Standard
Optical power meter[1]	/SPML			Standard Optical power meter
XFP module[1, 2]			/SR	10GBASE-SR XFP module
			/LR	10GBASE-LR XFP module
			/ER	10GBASE-ER XFP module
SFP module[2]			/SX	1000BASE-SX SFP module
			/LX	1000BASE-LX SFP module
RFC2544[3]			/BM	RFC2544 Function
Shoulder belt			/SB	Shoulder belt

*1: Cannot be specified for the AQ1301
*2: For the SFP and XFP modules, be sure to use the modules listed above.
　　If you use other than an SFP or XFP module from Yokogawa, the functionality and performance of this product are not guaranteed. Furthermore, the warranty will be void.
*3: Cannot be specified for the AQ1301 (this option is available for the AQ1301 as standard)

Optional Accessories

Model	Suffix codes		Description
735454			Optical transceiver module
	-SR[4]		10GBASE-SR XFP module
	-LR[4]		10GBASE-LR XFP module
	-ER[4]		10GBASE-ER XFP module
	-SX		1000BASE-SX SFP module
	-LX		1000BASE-LX SFP module
739882			Battery pack (reserve)
SU2006A			Soft carrying case
739871			AC Adapter[5]
	Power cord	-D	UL/CSA standard
		-F	VDE standard
		-R	AS standard
		-Q	BS standard
		-H	GB standard
		-P	KC standard
		-T	BSMI standard
739872			AC Adapter[6]
		-D	UL/CSA standard
		-F	VDE standard
		-Q	BS, Singapore standard
B8070CY			Shoulder belt
735480[4]	-SCC		SC connector adapter for optical power meters
	-FCC		FC connector adapter for optical power meters
735481	-LMC		ϕ 1.25 connector adapter for optical power meters
	-SFC		ϕ 2.5 connector adapter for optical power meters

*4: Cannot be used with the AQ1301.
*5: For outside the US and the countries that require CE making.
*6: For the US and the countries that require CE making.

Specifications

Item		Specifications
Interface	RJ-45	10BASE-T, 100BASE-TX, 1000BASE-T
	SFP	1000BASE-SX, 1000BASE-LX
	XFP[7]	10GBASE-SR, 10GBASE-LR, 10GBASE-ER
Measurement function	Measurement menu	Auto, Auto (Remote), Manual, OPM (Optical power meter)[8]
	Measurement mode	TRAFFIC, QoS, PING, Loop Back, BERT
	RFC2544	Throughput, Latency, Frame loss rate, Back-to-Back, Packet Jitter
Transmission function	Frame length	48 to 9999 bytes
	QoS transmission	Up to 8 channels (up to 4 ch in Auto and Auto (remote) mode)
Receive function	Receivable frame length	48 to 9999 bytes (Minimum IFG: 5 bytes)
	Latency time measurement resolution	100 ns
Loop back function	Field swap	DA/SA of MAC address, DA/SA of IP address, Dst/Src port of TCP/UDP
Remote control function	In-band remote	Remote test synchronization, Remote test start synchronization, Opposite tester automatic search(*), Opposite tester automatic addressing (*) (*: Applicable only within a segment)
Layer-1 measurement function	Receiving clock measurement	Measurement range: -100 to +100 ppm Measurement resolution: 0.1 ppm
	LFS generation[9]	Manual: Continuous transmission (Start/Stop), Auto: When a link down or LF is received, RF is transmitted automatically.

*7: Only available for the AQ1300　*8: Only available for the AQ1300 (option)　*9: When the interface is XFP (10 G)

Remote OTDR   AQ7277

High-performance OTDR Module for Remote Fiber Test Systems

Features

The AQ7277 is an OTDR module for RFTS (Remote Fiber Test System), which uses the advanced technology transferred from the AQ7275 high performance OTDR.

• Measurement at 1650 nm (Maintenance wavelength)
• Built-in 1310/1550 nm cut filter for live-fiber monitoring
• Allow to test PON system through high-port-count splitter
• Ethernet interface for fast data transfer

Specifications

Wavelength		1650 ±5 nm
Distance range (km)		0.5, 1, 2, 5, 10, 20, 50, 100, 200, 300, 400
Pulse width (ns)		3, 10, 20, 50, 100, 200, 500, 1,000, 2,000, 5,000, 10,000, 20,000
Sampling resolution		5 cm, 10 cm, 20 cm, 50 cm, 1 m, 2 m, 4 m, 8 m, 16 m, 32 m
Dynamic range		37 dB (typ.)
Event dead zone		0.8 m (typ.)
Attenuation dead zone		12 m (typ.)
Distance measurement accuracy		±1 m ±measurement distance x 2 x 10^{-5} ±1 sampling resolution
Number of sampling data		Max.100,000 points
Control interface		LAN (10BASE-T, 100BASE-TX), USB1.1 (Type B)
Alarm output		LED drive signal
Environmental conditions	Operating temperature	0 to +50°C
	Storage temperature	-20 to +60°C
	Humidity	20 to 85% (no condensation)
DC power supply		12 V DC to 19.5 V DC 1.5 A or less (at 12 V DC), 1 A or less (at 19.5 V DC)
Dimensions and weight		277 mm (W) × 190 mm (D) × 73 mm (H) (excluding protrusions), approx. 2 kg
Laser safety standards		Class 1M

Model and Suffix Code

Model and suffix code: AQ7277-B01

External View

DC input +12 V (square 4-pin connector with lock mechanism)

LED I/F connector (LED drive, PS-20PE)

LAN connector (RJ45)

OTDR optical connector (SC)

USB connector (Type B)

DC input +12 V (round jack)
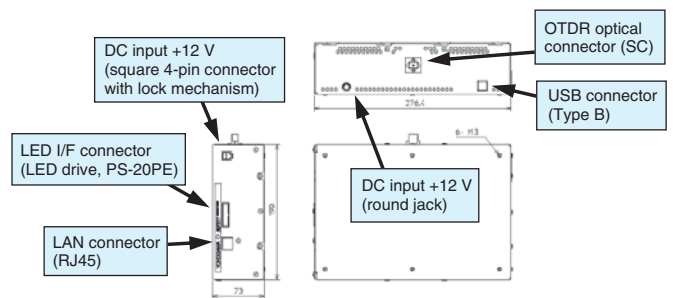
Note: Dimensions exclude protrusions

CA700 Pressure Calibrator

High Accurate and High Functional Pressure Calibrator Specially Designed for the Calibration of Differential Pressure and Pressure Transmitters.

CA700
Detailed catalog: Bulletin CA700-EN

Features

• Basic accuracy: Pressure (measurement)   0.01% rdg
                            Current (source/measurement)   0.015% rdg
                            Voltage (source/measurement)   0.015% rdg
• Widest range and highest resolution in class achieved
   200 kPa gauge pressure model (resolution 0.001 kPa)
   1000 kPa gauge pressure model (resolution 0.01 kPa)
   3500 kPa gauge model (resolution 0.01 kPa)
• DC mA signals can be measured by supplying power to the transmitter from a 24V DC power supply.
• Calibration procedures of pressure transmitters and pressure switches are embedded.
   "As Found", " As Left" data and error rate (%) can be recorded.
• IP54 dustproof and waterproof robust case enables use in harsh environments.
• Hart and Brain communication resistance is embedded.
• Dimensions: Approx. 264 (W) × 188 (H) × 96 (D) mm
   Weight: Approx. 2 kg (including 6 AA size batteries)

Main Specifications

Pressure Measurement

Model	CA700-E-01	CA700-E-02	CA700-E-03
Pressure type	Gauge		
Measurement range	Positive pressure 0 to 200 kPa Negative pressure -80 to 0 kPa	Positive pressure 0 to 1,000 kPa Negative pressure -80 to 0 kPa	Positive pressure 0 to 3,500 kPa Negative pressure -80 to 0 kPa
Measurement display range	Up to 240.000 kPa	Up to 1,200.00 kPa	Up to 4,200.00 kPa
Measurement accuracy (6 months after calibration) (Tested after zero calibration)	Positive pressure 20 to 200 kPa: ±(0.01% of reading + 0.003 kPa) 0 to 20 kPa: ±0.005 kPa	Positive pressure ±(0.01% of reading + 0.04 kPa)	Positive pressure ±(0.01% of reading + 0.15 kPa)
	Negative pressure ±(0.2% of reading + 0.090 kPa)	Negative pressure ±(0.2% of reading + 0.08 kPa)	Negative pressure ±(0.2% of reading + 0.08 kPa)
Measurement fluid	Gas and liquid (non-corrosive, non-flammable, non-explosive, and non-toxic fluids)		
Pressure display units	kPa and other units (Pa, hPa, MPa, mbar, bar, atm, mmHg, inHg, gf/cm², kgf/cm², mmH₂O@4℃, mmH₂O@20℃, ftH₂O@4℃, ftH₂O@20℃, inH₂O@4℃, inH₂O@20℃, Torr, psi)		
Input port	Rc 1/4 or 1/4 NPT female thread (selectable)		

Current and Voltage Measurement (common to all models)

DC current	0 to ±20.000 mA	±(0.015% of reading + 3 µA)
	0 to ±100.00 mA	±(0.015% of reading + 30 µA)
DC voltage	0 to ±5.0000 V	±(0.015% of reading + 0.5 mV)
	0 to ±50.000 V	±(0.015% of reading + 5 mV)

24 V Loop power supply

Supply voltage	24 V ± 1 V	Load current 24 mA when communication resistance OFF
	24 V ± 6 V	Load current 20 mA when communication resistance ON

Current and voltage source (common to all models)

DC current*	0 to 20.000 mA	±(0.015% of setting + 3 µA)
DC voltage	0 to 5.0000 V	±(0.015% of setting + 0.5 mV)

* External power supply for 20 mA SIMULATE: 5 to 28 V

Example of field calibration of differential pressure and pressure transmitter

Calibration of pressure transmitters is required to accurately measure the input and output values and to calculate the error rate.

The CA700 ensures reliable calibration with its function to accurately measure the input and output values of pressure and current. Additionally its embedded calibration procedures enable users to perform certain calibration following the prescribed procedure.

CA700   Hand pump   Differential pressure and pressure transmitter
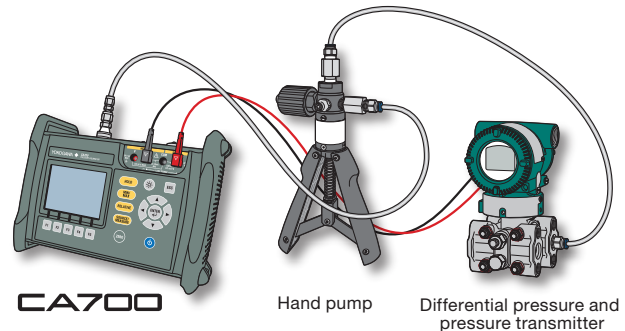
Hand Pump Series

Three High-Performance Hand Pump Models Available

Model 91050   Model 91055   Model 91060
Detailed catalog: Bulletin CA700-EN

Features

• Smooth pressurization with less internal leaking
• Strainer preventing debris from entering the pump included
• Low Pressure Hand Pump
   Pressure generation range: -83 to 700 kPa
   Ultra-compact hand pump
• Pneumatic Hand Pump
   Pressure generation range: -83 to 4,000 kPa
   High-performance small hand pump with a wide range of pressure generation
• Hydraulic Hand Pump
   Pressure generation range: 0 to 70 MPa
   High-performance hand pump capable of generating a pressure of up to 70 MPa

Product name	Model	Description of kit (individual models)
Hand Pump Kit (Low pressure)	91050	Hand Pump (91051), Connector Set (91052), Case (93052)
Hand Pump Kit (Pneumatic)	91055	Hand Pump (91056), Connector Set (91057), Case (93053)
Hand Pump Kit (Hydraulic)	91060	Hand Pump (91061), Connector Set (91062), Case (93053)

High accuracy and compact design

CA150
Handy Calibrator

Features

- Highly accurate within 0.02% of the DC voltage range for source and measure
- Source and measurement can be performed simultaneously
- Vertical body with large-screen display
- Loop power supply function (24 V DC at a load of max 22 mA)
  It is possible to measure current in the mA range while supplying power
- Sink function
- Sweep functions that allow 3 types of continuous outputs:
  Step sweep function
  Linear sweep function
  Program sweep function

General Specifications

Common source specifications

- Power supply: 6 AA size alkaline batteries
                                 AC adapter (sold separately) or dedicated NiMH battery (sold separately)
- Battery life Conditions: Simultaneous
                                 Source/measurement
                                 When 6 batteries are used: Approx. 8 hours
                                 When NiMH battery is used: Approx. 10 hours
- Auto power-off: Approx. 10 minutes
- Insulation resistance: Between input terminal and output terminal:
                                 500 V DC, 50 MΩ or more
- Withstand voltage: Between measurement terminal and generation terminal:
                                 350 V AC, 1 minute
- Operating temperature/humidity range:
                                 0 to 40°C, 20 to 80%RH (no condensation)
- Storage temperature range: -20 to 60°C 90%RH or less (no condensation)
- External dimensions: Approx. 251 × 124 × 70 mm
- Weight: Approx. 1000 g (with Batteries)
- Conforming Standards:
  Safety   EN61010-1, UL61010-1, CAN/ CSA C22.2 No. 61010-1
  EMC   EN 61326 Class B; EN 55011 Class B Group1
                                 EN 61000-3-2; EN 61000-3-3

Specifications

Source Unit Accuracy=±(% of setting + µV, mV, µA, Ω and °C) at 23°C±5°C

	Range	Resolution	Source range	Accuracy
DC voltage	100 mV	1 µV	0 to ±110.000 mV	±(0.02% + 10 µV)
	1 V	10 µV	0 to ±1.10000 V	±(0.02% + 0.05 mV)
	10 V	0.1 mV	0 to ±11.0000 V	±(0.02% + 0.5 mV)
	30 V	10 mV	0 to ±30.00 V	±(0.02% + 10 mV)
DC current mA SINK	20 mA	1 µA	0 to +22.000 mA	±(0.025% + 3 µA)
	20 mA SINK	1 µA	0 to -22.000 mA	±(0.025% + 6 µA)
Resistance	500 Ω	0.01 Ω	0 to 550.00 Ω	±(0.02% + 0.1 Ω)
	5 kΩ	0.1 Ω	0 to 5.5000 kΩ	±(0.05% + 1.5 Ω)
	50 kΩ	1 Ω	0 to 55.000 kΩ	±(0.1% + 50 Ω)
RTD	PT100	0.1°C	-200.0 to 850.0°C	±(0.025% + 0.3°C)
	JPT100		-200.0 to 500.0°C	
Thermocouple	K	0.1°C	-200.0 to -100.0°C	±(0.02% + 0.8°C)
			-100.0 to 1372.0°C	±(0.02% + 0.5°C)
	E		-200.0 to -100.0°C	±(0.02% + 0.6°C)
			-100.0 to 1000.0°C	±(0.02% + 0.4°C)
	J		-200.0 to -100.0°C	±(0.02% + 0.7°C)
			-100.0 to 1200.0°C	±(0.02% + 0.4°C)
	T		-200.0 to -100.0°C	±(0.02% + 0.8°C)
			-100.0 to 400.0°C	±(0.02% + 0.5°C)
	N		-200.0 to 0°C	±(0.02% + 1.0°C)
			0.0 to 1300.0°C	±(0.02% + 0.5°C)
	L		-200.0 to 900.0°C	±(0.02% + 0.5°C)
	U		-200.0 to 0°C	±(0.02% + 0.7°C)
			0 to 400.0°C	±(0.02% + 0.5°C)
	R	1°C	0 to 100°C	±(0.02% + 2°C)
			100 to 1768°C	±(0.02% + 1.2°C)
	S		0 to 100°C	±(0.02% + 2°C)
			100 to 1768°C	±(0.02% + 1.2°C)
	B		600 to 1000°C	±(0.02% + 1.5°C)
			1000 to 1820°C	±(0.02% + 1°C)
Frequency /pulse	100 Hz	0.01 Hz	1.00 to 110.00 Hz	±0.05 Hz
	1000 Hz	0.1 Hz	90.0 to 1100.0 Hz	±0.5 Hz
	10 kHz	0.1 kHz	0.9 kHz to 11.0 kHz	±0.1 kHz
	50 kHz	1 kHz	9 kHz to 50 kHz	±1 kHz
	CPM	0.1 CPM	1.0 to 1100.0 CPM	±0.5 CPM

Temperature coefficient: Accuracy above x (1/10)/°C
The temperature coefficient is added in the ranges from 0 to 18°C and from 28 to 40°C

Measurement Unit Accuracy=±(% of reading + µV, mV, µA, Ω or dgt(digit)) at 23°C±5°C

	Range	Resolution	Measurement range	Accuracy
DC voltage	500 mV	10 µV	0 to ±500.00 mV	±(0.02% + 50 µV)
	5 V	0.1 mV	0 to ±5.0000 V	±(0.02% + 0.5 mV)
	35 V	1 mV	0 to ±35.000 V	±(0.025% + 5 mV)
DC current	20 mA	1 µA	0 to ±20.000 mA	±(0.025% + 4 µA)
	100 mA	10 µA	0 to ±100.00 mA	±(0.04% + 30 µA)
Resistance	500 Ω	0.01 Ω	0 to 500.00 Ω	±(0.055% + 0.075 Ω)
	5 kΩ	0.1 Ω	0 to 5.0000 kΩ	±(0.055% + 0.75 Ω)
	50 kΩ	1 Ω	0 to 50.000 kΩ	±(0.055% + 10 Ω)
RTD *5	PT100	0.1°C	-200.0 to 850.0°C	±(0.05% + 0.6°C)
	JPT100		-200.0 to 500.0°C	
Thermocouple	K	0.1°C	-200.0 to 1372.0°C	±(0.05% + 1.5°C)/-100°C or more ±(0.05% + 2°C)/-100°C or less
	E		-200.0 to 1000.0°C	
	J		-200.0 to 1200.0°C	
	T		-200.0 to 400.0°C	
	N		-200.0 to 1300.0°C	
	L		-200.0 to 900.0°C	
	U		-200.0 to 400.0°C	
	R	1°C	0 to 1768°C	±(0.05% + 2°C)/100°C or more ±(0.05% + 3°C)/100°C or less
	S		0 to 1768°C	
	B		600 to 1800°C	
Pulse	100 Hz	0.01 Hz	1.00 to 110.00 Hz	±2 dgt
	1000 Hz	0.1 Hz	1.0 to 1100.0 Hz	
	10 kHz	0.001 kHz	0.001 to 11.000 kHz	
	CPM	1 CPM	0 to 100000 CPM	----
	CPH	1 CPH	0 to 100000 CPH	----
Loop power supply	24 V LOOP			24 V±2 V

Temperature coefficient: Accuracy above x (1/10)/°C
The temperature coefficient is added in the ranges from 0 to 18°C and from 28 to 40°C

Optional Accessories (sold separately)

Product name	AC adapter	RJ sensor	Accessory storage case	NiMH battery	Main body case	Lead cable for measurement
Model name	94010	B9108WA	B9108XA	94015	93027	98064
Remark	-D For UL/CSA Standard -F For VDE Standard -H For GB Standard -N For NBR Standard -P For KC Standard -R For AS Standard -S For BS Standard	For reference junction compensation	Lead cables, RJ sensor, etc. can be stored.	NiMH battery Dedicated	With strap and accessory storage case	Alligator clip, CAT I, for control signal only (under 70 V) One set of 1 red and 1 black cables Length: Approx. 1.7 m

Calibrator

Simultaneous Signal Source and Measurement Capability

CA51/CA71
Handy Calibrators

Features

- Source and measure operations can be performed at the same time.
  (Select from the following source signal and measurement signal options: voltage, current, resistance, thermocouple (TC), resistance temperature detector (RTD), frequency, pulse).
- AC voltages, including supply voltage, can be measured.
- Easy operation.
- Compact size and Lightweight
- Includes a wide array of additional functions.
  - Source
    Values set in steps of 4-20 mA
    24V DC Power Supply to Transmitter
  - Divided output (n/m) function
    Output settings are divided, eliminating the need for bothersome calculations for percentage output.
  - Autostep function
    Changes the output value in step form based on the setting from the divided output (n/m) function. Changes can be sourced automatically every 10% or 25%.
  - Online communication (CA71 only)
    RS-232C-compliant optically isolated interface
  - Sweep function
    Linearly increases or decrease the output. The increasing/decreasing time can be set to either 16 or 32 seconds.
  - Memory function
    Source values and measurements forming individual value sets can be saved to or read from the Handy Calibrator's internal memory (maximum 50 value sets).
  - Temperature monitor function

General Specifications

Parameter	Specifications
Power supply	Four AA alkaline batteries, or special AC adapter (sold separately)
Battery life	Measurement off, output 5 V DC/10 kΩ or greater: Approximately 40 hours Simultaneous signal generation/measurement, output 5 V DC/10 kΩ or greater: Approximately 20 hours Simultaneous signal generation/measurement, output 20 mA/5 V: Approximately 12 hours (using alkaline batteries, with backlight off)
Auto-power-off function	Approximately 10 minutes (auto-power-off can be disabled through a DIP switch setting)
Applicable standards	IEC61010-1, IEC61010-2-31 EN61326-1 EN55011, Class B, Group 1
Operating temperature and humidity ranges	0–50°C, 20–80% RH (no condensation)
External dimensions (WHD)	Approximately 190 × 120 × 55 mm
Weight	Approximately 730 g (including batteries)

Specifications

Source Unit

Parameter	Reference	Range	Accuracy (23±5°C per year)	Resolution
DC voltage	100 mV	-10.00–110.00 mV	±(0.02% + 15 µV)	10 µV
	1 V	0–1.1000 V	±(0.02% + 0.1 mV)	0.1 mV
	10 V	0–11.000 V	±(0.02% + 1 mV)	1 mV
	30 V	0–30.00 V	±(0.02% + 10 mV)	10 mV
DC current	20 mA	0–24.000 mA	±(0.025% + 3 µA)	1 µA
	4–20 mA	4/8/12/16/20 mA		4 mA
mA SINK	20 mA	0.1–24.000 mA	±(0.05% + 3 µA)	1 µA
Resistance	400 Ω	0–400.00 Ω	±(0.025% + 0.1 Ω)	0.01 Ω
RTD	Pt100	-200.0–850.0°C	±(0.025% + 0.3°C)	0.1°C
	JPt100	-200.0–500.0°C		
TC	K	-200.0–1372.0°C	±(0.02% + 0.5°C) (-100°C or greater) ±(0.02% + 1°C) (-100°C or less)	0.1°C
	E	-200.0–1000.0°C		
	J	-200.0–1200.0°C		
	T	-200.0–400.0°C	±(0.02% + 0.5°C) (0°C or greater) ±(0.02% + 1°C) (0°C or less)	
	N	-200.0–1300.0°C		
	L	-200.0–900.0°C		
	U	-200.0–400.0°C		
	R	0–1768°C	±(0.02% + 2.5°C) (100°C or less) ±(0.02% + 1.5°C) (100°C or greater)	1°C
	S			
	B	600–1800°C	±(0.02% + 2°C) (1000°C or less) ±(0.02% + 1.5°C) (1000°C or greater)	
Frequency, pulse	500 Hz	1.0–500.0 Hz	±0.2 Hz	0.1 Hz
	1000 Hz	90–1100 Hz	±1 Hz	1 Hz
	10 kHz	0.9 kHz–11.0 kHz	±0.1 kHz	0.1 kHz
	Pulse cycle	1–99,999 cycles	–	1 cycle

Measurement Unit

• Both CA51 and CA71

Parameter	Reference	Accuracy (23±5°C per year)	Resolution
DC voltage	100 mV	±(0.025% + 20 µV)	10 µV
	1 V	±(0.025% + 0.2 mV)	0.1 mV
	10 V	±(0.025% + 2 mV)	1 mV
	100 V	±(0.05% + 20 mV)	0.01 V
DC current	20 mA	±(0.025% + 4 µA)	1 µA
	100 mA	±(0.04% + 30 µA)	10 µA
Resistance	400 Ω	±(0.05% + 0.1 Ω)	0.01 Ω
AC voltage	1 V	±(0.5% + 5 dgt)	1 mV
	10 V		0.01 V
	100 V		0.1 V
	300 V	±(0.5% + 2 dgt)	1 V
Frequency, pulse	100 Hz	±2 dgt	0.01 Hz
	1000 Hz		0.1 Hz
	10 kHz		0.001 kHz
	CPM		1 CPM
	CPH		1 CPH

• CA71 only

Parameter	Reference	Accuracy (23±5°C per year)	Resolution
TC	K	±(0.05% + 1.5°C)(-100°C or greater) ±(0.05% + 2°C)(-100°C or less)	0.1°C
	E		
	J		
	T		
	N		
	L		
	U		
	R	±(0.05% + 2°C)(100°C or greater) ±(0.05% + 3°C)(100°C or less)	1°C
	S		
	B		
RTD	Pt100	±(0.05% + 0.6°C)	0.1°C
	JPt100		

Spare parts

Product	Source signal lead cable	Measurement lead cable	Carrying case	Terminal adapter
Model	**98020**	**RD031**	**93016**	**99021**

Optional accessories (sold separately)

Product	AC adapter			RJ sensor	Accessory storage case	Communication cable (RS232)
Model	**94013**	**94016-F**	**94016-S**	**B9108WA**	**B9108XA**	**91017**
Remarks	120 V AC	220 to 240 V AC VDE standard	220 to 240 V AC BS standard	For reference junction compensation	Lead cables, RJ sensor, etc. can be stored	D-sub 9-pin (female)

Process Calibrator **CA310, CA320, CA330**

High-performance Model Specialized for Loop Inspection

CA310
Volt mA calibrator

- Basic accuracy: 0.015% (source and measurement accuracy of voltage mA)
- 20 mA SIMULATE (SINK) function
- Simultaneously measures 24-V loop power and output signals with high accuracy
- Built-in HART/BRAIN communication resistance (250 Ω)
- Sub-display indicates span% of the source value.
- Handles various source patterns
  (Step sweep/linear sweep/manual step/span check)

Bulletin: CA300-EN

Specifications

Source   V DC   : 500 mV/5 V/30 V
           mA DC : 20 mA/20 mA SIMULATE
Measurement   V DC   : 500 mV/5 V/30 V/50 V
           mA DC : 20 mA/50 mA
           24-V loop power source:
           24 V±1 V (communication resistance: off)
           24 V±6 V (communication resistance: on)
General specifications
- Dimensions   : 90 (W) × 192 (H) × 42 (D) mm
- Weight   : Approx. 440 g
- Power source   : AA battery (LR6) × 4 or dedicated AC/DC adaptor (option)
- Sweep function : Step (25%)/linear
- Sweep time   : 15 sec/30 sec/45 sec/60 sec

High-performance Model Specialized for Simulating Thermocouples

CA320
TC calibrator

- Basic accuracy: 0.5ºC (typical of Type K)
  * Including the accuracy of an internal RJC
- Accepts 16 types of thermocouple (JIS/IEC/DIN/ASTM/GOST R)
- Sub-display indicates the voltage source value and span%.
- Simulates other types of thermocouple with the mV source function
- Works as a thermometer to measure the output from the TC sensor
- Handles various source patterns
  (Step sweep/linear sweep/manual step/span check)

Bulletin: CA300-EN

Specifications

Source   Thermocouple : K, E, J, T, N, L, U, R, S, B, C, XK, A, D, G, PLATINEL2
           mV DC   : 90 mV
Measurement   Thermocouple : K, E, J, T, N, L, U, R, S, B, C, XK, A, D, G, PLATINEL2
           mV DC   : 90 mV
General specifications
- Dimensions   : 90 (W) × 192 (H) × 42 (D) mm
- Weight   : Approx. 440 g
- Power source   : AA battery (LR6) × 4 or dedicated AC/DC adaptor (option)

High-performance Model Specialized for Simulating RTDs

CA330
RTD calibrator

- Basic accuracy: 0.3ºC (typical of PT100)
- Accepts 14 types of RTD (JIS/IEC/GOST R)
- Sub-display indicates the resistance source value and span%.
- Accepts 2-, 3-, 4-wire systems and simulates RTDs precisely
- Simulates other types of RTD with the resistance source function
- Works as a thermometer to measure the output from the RTD sensor
- Handles various source patterns
  (Step sweep/linear sweep/manual step/span check)

Bulletin: CA300-EN

Specifications

Source   RTD   : PT100 (four types), PT200, PT500, PT1000, Cu10, Ni120, Extra RTD (five types)
           Resistance : 500 Ω/3000 Ω
Measurement   RTD   : PT100 (four types), PT200, PT500, PT1000, Cu10, Ni120, Extra RTD (five types)
           Resistance : 500 Ω/3000 Ω
General specifications
- Dimensions   : 90 (W) × 192 (H) × 42 (D) mm
- Weight   : Approx. 440 g
- Power source   : AA battery (LR6) × 4 or dedicated AC/DC adaptor (option)

Loop Power and 4 to 20 mA Output function in a DMM

CA450
Process Multi Meter

Features

- Loop check functions
  - Simultaneous 24 V loop power and mA measurement
  - HART/BRAIN mode setting with loop power
    (Adds 250 ohm resistance internally)
- Generation functions
  - SIMULATE (SINK) function simulates transmitters
  - 4-20 mA span/step/auto-step/sweep output
- Measurement functions
  - High accuracy signal measurement:DC mA 0.05%/30.000 mA
  - Handheld DMM function
  - Peak Hold function for the peak voltage measurement of DCS power supply
  - Dedicated sensor modes for direct reading of many sensor signal types
- Enhanced Safety—helps eliminate electric shocks
  - Current terminal shutter prevents incorrect connections
  - 1 A or more of AC/DC current can be read directly using the optional clamp probe and scaling in SENSOR mode.*1
  - Measurement categories 600 V CAT. IV, 1000 V CAT. III
  *1: AC/DC 600 mV range only

Specifications

Measurement

Function	Range	Resolution	Max Accuracy
DCV	600 mV/6 V/60 V/600 V/1000 V	0.1 mV/0.001 V/0.01 V/0.1 V/1 V	0.09%+2 digits
ACV		0.1 mV/0.001 V/0.01 V/0.1 V/1 V	0.5%+5 digits
DCA	30 mA/60 mA	0.001 mA/0.01 mA	0.05%+2 digits
Resistance	600 Ω/6 kΩ/60 kΩ/600 kΩ/6 MΩ /60 MΩ	0.1 Ω/0.001 kΩ/0.01 kΩ/0.1 kΩ 0.001 MΩ/0.01 MΩ	0.2%+2 digits
Freq	10Hz to 199.99 Hz	0.01 Hz	0.005%+1 digits
	90Hz to 1999.9 Hz	0.1 Hz	
	0.900 kHz to 19.999 kHz	0.001 kHz	
Source			
DCmA	20 mA	0.001 mA	0.05% of range
Loop Power	24 V		24 VDC (typ.) Load current 20 mA

Other Functions and Spection
Functions Diode check, Continuity check, Data Hold, Peak Hold, Step mode, linear mode, Sesor mode, MIN/MAX, RELΔ%

General Specifications

Specificaton
- Display : 5-digit (7 Segment)
  Measurement DC current 33000, Frequency 19999, Other 6600
  Output DC current 25000
- Operating temperature and humidity: -20 to 55°C (80%RH or less) with no condensation
- Storage temperature and humidity: -40 to 70 (70%RH or less) with no condensation
- Battery life: DC voltage measurment: Appox.140 hours
  DC current output (SIMULATE) Approx.140 hours
  DC current output (SOURCE) 12 mA (500 Ω load) Approx.10 hours
- External dimensions: Approx. 90 (W) × 192 (H) × 49 (D) mm
- Weight: Approx. 600 g (including the batteries)
- Compliant standards:
- Safety standards: EN61010-1 and EN61010-031

Measurement Categories:
1000 V CATIII, 600 V CATIV
For current measurement and output: 48 V max, 100 mA max
Lead cables (98064): 70 VDC, 100 mA
Pollution degree 2, indoor use
Vibration: Sweep vibration frequencies 10 Hz to 5 Hz to 10 Hz Amplitude 0.15 mm (peak value)
Duration 30 minutes
Shock: 1 m drop test as defined by the safety standards
Altitude: 2000 m or less
EMC standards: EN61326-1 Class B, EN61326-2-2 EN55011 Class B Group 1
Influence of radiated immunity: In RF electromagnetic fields of 3 V/m
EN61326-1 AC voltage measurement, 600 mV range:1.5% of range
DC voltage measurement, 600 mV range:1% of range
DC current measurement, all ranges: 1.5% of range
DC current output: 1.5% of range
EN61326-2-2 AC voltage measurement (6 V range or higher): Within 5 times the accuracy
DC voltage measurement (6 V range or higher): Within 5 times the accuracy

Accessories

Test leads Model:98073	Lead Cables Model:98064	Fuse Model:99042	DMM Communication Package 92015 (*1)
Alligator Test leads Model:99014	AC/DC Clamp-on Probe Model:96095	Current Clamp-on Probe Model:96001	Carrying Case Model:93029

Magnet hook Model:99032	The Magnet hook can be attached to magnetic body (e.g. iron).	Carrying Case Model:93043-P1	The inner case with detachable straps can be hung on bar.

(*1) Settings for output is not capable.

Clamp Power Meter   **CW500**

High-end Model for Measuring Power Consumption and Power Quality

Bulletin: CW500-EN

CW500
Power quality analyzer

- Achieves various power measurements with simple operations
  - One press on direct keys switches to any of five measurement displays.
- Identifies power source malfunctions
  - Sampling with a 24-µs resolution can identify temporary malfunctions.
  - Measures harmonics and flickers
- User support
  - Easy wiring and setting with the start navigation function and automatic detection of clamp-on probes
- PC software for analysis and setting comes as standard.
  - Data can be compiled into graphs and reports with one click.

Specifications

Wiring connection:	1P2W (max. 4 systems), 1P3W (max. 2 systems), 3P3W 2 currents (max. 2 systems), 3P3W 3 currents, 3P4W
Input:	3 channels for voltage, 4 channels for current, 2 channels for DC voltage
Range:	AC voltage 600.0/1000 V
	AC current 2000 mA to 3000 A (depending on a clamp-on probe)
	AC power 3000 W to 3000 kW (depending on a clamp-on probe)
	DC voltage 100.0 mV/1.000 V/10.00 V
Accuracy:	Voltage ±0.2%rdg ± 0.2%rng
	Current ±0.2%rdg ± 0.2%rng + accuracy of clamp-on probes
	Power ±0.3%rdg ± 0.2%rng + accuracy of clamp-on probes
	Effect of power factor
	±1.0%rdg (reading at power factor 0.5 against 1.0)
Measurement items:	• Voltage, current, frequency, power factor, effective/reactive/apparent power
	• Consumption/generation of effective/apparent power, delay/progress of reactive power
	• Demand, maximum demand, load factor, estimated demand value
	• Temporary malfunction: voltage swell, voltage dip, voltage interrupt, transient overvoltage, inrush current
	• Continuous malfunction: components of up to the 50th harmonic (RMS, content rate, and phase angle of voltage, current, and power), total harmonic distortion rate, IEC flicker, voltage unbalance rate, current unbalance rate
Measurement display:	measurement values, trend graphs for all or each channel from the start of measurement, measured demand values, demand trend over a specific period or a whole period
Record interval:	1/2/5/10/15/20/30 sec, 1/2/5/15/20/30 min, 1 h/2 h
General specification:	Dimensions: 120 (W) × 175 (H) × 68 (D) mm
	Weight: Approx. 900 g (including batteries)
	Power source: 100 to 240 V AC /50 to 60 Hz/alkaline AA battery × 6/power supply adaptor (option)
Accessories:	Voltage probe, USB cable, power cord, carrying bag, SD card, startup guide, alkaline AA battery × 6, input terminal plate × 6, PC software

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Clamp power meter 96060 series
Clamp-on probes for the CW500 power meter

Model code	96060	96061	96062	96063	96064	96065	96066
Clamp-on probe							
Measurable diameter	φ40 mm	φ18 mm	φ24 mm	φ30 mm	φ40 mm	φ110 mm	φ150 mm
Measuring range	2 A AC	50 A AC	100 A AC	200 A AC	500 A AC	1000 A AC	300 A AC 1000 A AC 3000 A AC
Output voltage	50 mV AC (25 mV/A)	500 mV AC (10 mV/A)	500 mV AC	500 mV AC	500 mV AC	500 mV AC	500 mV AC For each range
Accuracy — Level — 50 Hz/60 Hz	±1.0% rdg ±0.05 mV	±0.5% rdg ±0.1 mV	±0.5% rdg ±0.1 mV	±0.5% rdg ±0.1 mV	±0.5% rdg ±0.1 mV	±0.8% rdg ±0.2 mV	±1.0% rdg*
Accuracy — Level — 40 Hz to 1 kHz	±2.0% rdg ±0.1 mV	±0.8% rdg ±0.2 mV	±1.0% rdg ±0.2 mV	±0.8% rdg ±0.2 mV	±1.0% rdg ±0.2 mV	±1.5% rdg ±0.4 mV	—
Accuracy — Level — 1 kHz to 3.5 kHz	±3.0% rdg ±0.2 mV	±1.0% rdg ±0.4 mV	—	±1.0% rdg ±0.4 mV	—	—	—
Accuracy Degree	—	Less than ±2.0° (0.5 to 50 A, 40 Hz to 3.5 kHz)	Less than ±2.0° (1 to 100 A, 45 Hz to 65 Hz)	Less than ±1.0° (2 to 200 A, 40Hz to 3.5kHz)	Less than ±1.0° (5 to 500 A, 45 Hz to 65 Hz)	Less than ±2.0° (45 Hz to 65 Hz) Less than ±3.0° (40 Hz to 1 kHz)	Less than ±1.0° (for each range/ 45 to 65 Hz)
Max Circuit voltage	AC 300 Vrms	AC 300 Vrms	AC 300 Vrms	AC 600 Vrms	AC 600 Vrms	AC 600 Vrms	AC 600 Vrms
Dimensions	70 × 120 × 25 mm	52 × 106 × 25 mm	60 × 100 × 26 mm	73 × 130 × 30 mm	81 × 128 × 36 mm	73 × 130 × 30 mm	61 × 111 × 43 mm
Weight	Approx. 250 g	Approx. 170 g	Approx. 160 g	Approx. 250 g	Approx. 260 g	Approx. 170 g	Approx. 950 g
Remarks	These probes are dedicated for the CW500 and cannot be used for the CW240/CW120/CW121.						

*45 to 65 Hz (measuring at the center of sensor)

A Powerful Power Measuring Tool

CW10
Clamp-on Power Meter

CE

Features

• AC / DC Power up to 600 kW
• True RMS for AC.
• Harmonics 1st to 25th order
• Power fluctuation using the ACA Inrush and Peak hold functions.
• AC / DC Voltage max. 1000 V
• AC / DC Current max. 600 A
• Frequency, Resistance, Continuity, Diode check, Power factor.
• Up to 9999 counts, approx. 37 mm max. diameter of measurable conductor (the jaw opens approx. 45 mm max.)

Specifications

Accuracy

23± 5ºC, 80%RH or less
Accuracy: ±(% of reading + digits)

Voltage
Rms-value detection

Function	Range	Resolution (Maximum reading)	Accuracy*
DCV	100 V	99.99 V	0.7% + 2
	1000 V	999.9 V	
ACV	100 V	99.99 V	1.0% + 5
	1000 V	999.9 V	50 to 500 Hz
LPF ACV	100 V	99.99 V	50 ≤ f ≤ 60 Hz: 1.0% + 5
	1000 V	999.9 V	60 < f ≤ 400 Hz: 5.0% + 5

* DCV<1000 digits: add 6 digits to accuracy
ACV<1000 digits: add 3 digits to accuracy
Maximum input voltage: 1000 Vrms, 1414.2 Vpk
Input impedance: approx. 3.5 MΩ, <100 pF
AC+DC Vrms accuracy=ACV accuracy + DCV accuracy

Crest factor effects
1.4 < CF ≤ 2.0: add 1.0% of reading to accuracy
2.0 < CF ≤ 2.5: add 2.5% of reading to accuracy
2.5 < CF ≤ 3.0: add 4.0% of reading to accuracy
Maximum input voltage: 690 Vrms CF=2 460 Vrms CF=3

Current
Rms-value detection

Function	Range	Resolution (Maximum reading)	Accuracy*
DCA	100 A	99.99 A	1.5% + 20
	600 A	600.0 A***	1.5% + 5*
ACA	100 A**	99.99 A	50 ≤ f ≤ 60 Hz : 1.5% + 5*
	600 A	600.0 A***	60 < f ≤ 400 Hz : 2.0% + 5*
LPF ACA	100 A**	99.99 A	50 ≤ f ≤ 60 Hz : 1.5% + 5
	600 A	600.0 A***	60 < f ≤ 400 Hz: 5.0% + 5

*The measured value <1000 digits: add 5 digits to accuracy
**Input current ≥ 0.10 A at 100 A range of ACA and LPF ACA
***600 A : Guaranteed accuracy (not maximum reading)
Maximum input current: 600 Arms, 848.5 Apk
Conductor position effects: ±1.0% of reading
AC+DC Arms accuracy=ACA accuracy + DCA accuracy

Crest factor effects
1.4 < CF ≤ 2.0: add 1.0% of reading to accuracy
2.0 < CF ≤ 2.5: add 2.5% of reading to accuracy
2.5 < CF ≤ 3.0: add 4.0% of reading to accuracy
Maximum input current: 420 Arms CF=2 280 Arms CF=3

Peak Hold (AC mode only)

Function	Range	Resolution (Maximum reading)	Accuracy
ACV	100 V	140.0 V	3.0% + 15
	1000 V	1400 V	
ACA	100 A	140.0 A	3.0% + 15
	600 A	850 A	

PEAK MAX: polarity+, polarity-
Maximum input voltage and current: 1000 Vrms, 600 Arms
Sine wave, ACV ≥ 5 Vrms, ACA ≥ 5 Arms, 50 to 400 Hz continuous wave

Frequency (Hz)

Function	Resolution (Measuring range)	Accuracy
100 Hz	20.00 to 99.99 Hz	0.5% + 3
1000 Hz	20.0 to 999.9 Hz	
10 kHz	0.020 to 9.999 kHz	

Maximum input voltage and current: 1000 Vrms, 600 Arms
Input condition; 100 V range: 10 to 100 Vrms
(Sine wave) 1000 V range: 100 to 1000 Vrms
100 A range: 10 to 100 Arms (<400 Hz)
600 A range: 100 to 600 Arms (<400 Hz)
The measured value < approx. 10 Hz: 0.00 Hz

Harmonic Measurement
Individual Harmonic

Harmonic order	Resolution (Maximum reading)	Accuracy
1st to 12th (h01- h12)	99.9%	5% + 10
13th to 25th (h01- h12)		10% + 10

Maximum input voltage and current: approx. 1000 Vrms, 600 Arms
The "rdy" is displayed at ACV < 10 Vrms, ACA < 10 Arms
The "OutF" is displayed at f < 45, 65 < f (f: fundamental frequency)

Inrush Current

Function	Range	Resolution (Maximum reading)	Accuracy
ACA	100 A	99.99 A	2.5% + 20
	600 A	600.0 A*	2.5% + 5

Maximum input current: approx. 600 Arms
*600 A : Guaranteed accuracy (not maximum reading)
100 A range: ACA1 ≥ 10 Arms (Sine wave, 50 Hz/60 Hz)
600 A range: ACA ≥ 100 Arms (Sine wave, 50 Hz/60 Hz)
Measurement time: approx. 100ms

Active Power

Function	Range	Resolution (Maximum reading)	Accuracy
ACW DCW	10 kW	9.999 kW*	ACW: 2.5% + 11**
	100 kW	99.99 kW	DCW: 2.2% + 22**
	600 kW	600.0 kW**	

* The measured value < 1.000 kW: add 10 digits to the accuracy.
**Conditions of accuracy (combination of Voltage and Current range)
10 kW range: 100 V and 100 A
100 kW range: 100 V and 600 A or 1000 V and 100 A
600 kW range: 1000 V and 600 A
Other combinations:
Accuracy: (Current accuracyVoltage reading) + (Voltage accuracyCurrent reading)

**600 kW : Guaranteed accuracy (not maximum reading)
Maximum input voltage and current: 1000 Vrms, 600 Arms
ACW: ACV ≥ 10 Vrms and ACA ≥ 5 Arms (Sine wave, 50 ≤ f ≤ 60 Hz, PF=1.00)
DCW: at DCV ≥ 10 V and DCA ≥ 5 A

Power Factor

Function	Resolution (Measuring range)	Accuracy
Power factor	-1.00 to 0.00 to 1.00	±(3°+2digits)

Maximum input voltage and current: 1000 Vrms, 600 Arms
PF: ACV ≥ 10 Vrms and ACA ≥ 5 Arms (Sine wave, 50 ≤ f ≤ 60 Hz)

Resistance/Continuity check

Function	Range	Resolution (Maximum reading)	Accuracy
Resistance Ω	1000 Ω	999.9 Ω	1.0% + 5
	10 kΩ	9.999 kΩ	1.0% + 3
	100 kΩ	99.99 kΩ	
Continuity check	1000 Ω	999.9 Ω	1.0% + 5
	The buzzer turns on for resistances lower than approx. 30 Ω. (Response time: approx. 100 msec)		

Maximum input voltage: 1000 Vrms
Maximum test current: approx. 0.5 mA
Open circuit voltage: approx. 3 V

Diode Test

Function	Resolution (Measuring range)	Accuracy
Diode Test	0.40 to 0.80 V	±0.1 V

Maximum test current: approx. 0.5 mA
Open circuit voltage: approx. 1.8 V

General Specifications

Display count: 9999 / 6000
Measuring rate: 3 times / sec.
Over range indicator: "OL" or "-OL"
Auto Power Off: Approx. 15 minute.
Low-battery indicator: (four steps)
Power supply: 9 V alkaline battery (6LR61)
Battery life: When using alkaline battery, backlight off Approx. 20 hours
Operating temperature and humidity: 0 to 50ºC (with no condensation)
≤ 80% RH (0 to 30ºC)
≤ 75% RH (30 to 40ºC)
≤ 45% RH (40 to 50ºC)
Temperature coefficient: At 0 to 18 ˚C and 28 to 50˚C
Add 23±5 ˚C accuracy x 0.2 /˚C
Storage temperature: -10 to 50 ˚C, 80% RH or less (remove the battery)
Withstand voltage: AC 6880 Vrms 5 sec. (between the core and the case)
AC 4300 Vrms 5 sec. (between the core and the voltage input terminals)
AC 6880 Vrms 5 sec. (between the voltage input terminals and the case)
Insulation resistance: 100 MΩ or greater at 1000 VDC
(between the core and the case, the core and the voltage input terminals and the voltage input terminals and the case)
Compliant standards:
Safety standards: EN 61010-1, EN 61010-2-032
1000V CAT.III, 600V CAT.IV
EN 61010-031 (the test leads)
Pollution degree 2, Indoor use, Altitude 2000m or less
EMC standards: EN 61326-1, EN 61326-2-1, EN 61326-2-2, EN 55011
Dimensions: Approx 87.5 mm(W) × 242 mm(L) × 51 mm(D)
Diameter of measurable conductors: φ 37mm (Maximum)
Weight: Approx. 435 g (including the battery)
Accessories: Test leads 1 set (Red and Black)
Carrying case
9 V alkaline battery (6LR61)
User's Manual
Accessories (Sold Separtely): Lead with Alligator Clip Model code 99014

Digital Multi Meter

Handheld Digital Multi Meter Sellection

Function item	Handhel Digital Multi Meter Models								
	TY710	TY720	TY520	TY530	73201	73202	73203	73204	73101
Measurment Function	Ture RMS	Ture RMS MEAN Sellect	RMS	RMS MEAN Sellect	MEAN	MEAN	MEAN	MEAN	MEAN
Max. Measurrement Accuracy at DCV	0.02%		0.09%		0.5%	0.5%	0.3%	0.5%	0.7%
Wide bandwidth	20 KHz	100 KHz	1 kHz		—				—
Display Digits(Uint:Digit)	5 digits		3.5 Digits		3.5 Digits				3.5 Digits
Max. Value	50000		6000		4300				4300
Bar Graph Dsiplay (Uints:Segment)	51		31		—				32
LCD Back Light	White LED		LED		—				—
Max.Measurement Voltage (AC/or DC)	50.000 mV to 1000.0 V	50.000 mV to 1000.0 V	600.0 mV to 1000 V	600.0 mV to 1000 V	4.000 V*3 to 600 V	4.000 V*3 to 600 V	4.000 V*3 to 600 V	4.000 V*3 to 600 V	4.000 V*3 to 600 V
Max.Measurement Currents (AC/or DC)	500.00 µA to 10.000 A	500.00 µA to 10.000 A	600.0 µA to 10.00 A	600.0 µA to 10.00 A	400.0 µA to 10.00 A	400.0 µA to 10.00 A	400.0 µA to 10.00 A	—	—
Max.Measurement Resistance	500.00 Ω to 50.000 MΩ	500.00 Ω to 50.000 MΩ	600.0 Ω to 60.00 MΩ	600.0 Ω to 60.00 MΩ	400.0 Ω to 40.00 MΩ	400.0 Ω to 40.00 MΩ	400.0 Ω to 40.00 MΩ	400.0 Ω to 40.00 MΩ	400.0 Ω to 40.00 MΩ
Max.Measurement Frequency	2.000 Hz to 99.99 kHz	2.000 Hz to 99.99 kHz	10.00 Hz to 99.99 kHz	10.00 Hz to 99.99 kHz	—	—	—	—	—
Max.Measurement Capcitance	5.000 nF to 50.00 mF	5.000 nF to 50.00 mF	10.00 nF to 1000 µF	10.00 nF to 1000 µF	—	20.00 nF to 200.0 µF	20.00 nF to 200.0 µF	—	—
Max.Measurement Temperature	+1372°C*1	+1372°C*1	+600°C*1	+600°C*1	—	—	—	—	—
Duty Ratio (%) Measuement	●	●	—	—	—	—	—	—	—
Low-Power	—	●	—	—	—	—	—	—	—
AC+DC Measurement	●	●	—	—	—	—	—	—	—
Max./Min./Ave. Value Memory	●	●	—	●	—	—	—	—	—
Diode Test	●	●	●	●	●	●	●	●	●
Continuity Check	●	●	●	●	●	●	●	●	●
Relative/Percentage (%) calculation	●	●	●	●	—	—	—	—	—
Decibel calculation	●	●	—	—	—	—	—	—	—
Selection Auto range or Manual range	●	●	●	●	●	●	●	●	—
Peak Hold	—	●	—	—	—	—	—	—	—
Data Hold	●*2	●	●	●	●	●	●	●	●
Auto Hold	●	●	●	●	●	●	●	●	
Communication for PC	●*2	●*2	—	●*2	—	—	—	—	—
Data Logging Memory	●*2	●*2	—	●*2	—	—	—	—	—
Data Memory	1000	10000	—	1600	—	—	—	—	—
Operating Temp. and Humidity	-20 to 55°C	-20 to 55°C	-10 to 55°C	-10 to 55°C	0 to 50°C	0 to 50°C	0 to 50°C	0 to 50°C	0 to 50°C
Electric Safety 1000 V	CAT III		CAT III		—				—
Electric Safety 600 V	CAT IV		CAT IV		CAT II			CAT III	CAT III
Electric Safety 300 V	—		—		CAT III			—	CAT II

*1 Temperature probe is necessary when measuring temperature.
*2 The communications package (model: 92015) for DMM is necessary when connecting it with PC.
*3 73101,732 Series minimum range of DCvoltage is 400.0 mVDC.

Simple selection for replacing discontinued products

Existing model	Discontinued products for replacing	4.5 Digits									3.5 Digits							
		73402	73401	754402	754401	73301	73302	73303	753801	753704	753703	753702	753701	7534series	7533series	753203	753202	753201	73101
TY720		●		●															
TY710			●		●														
TY530								●		●									
TY520						●	●		●		●	●	●	●	●				
73201																		●	
73202																	●		
73203																●			
73101																			●

A New De Facto Standard for Handheld DMM

TY700 Series
Digital Multimeters

• Maximum Measurement Accuracy: 0.020% rdg + 2 dgt
• Highly Reliable: Closed case calibration
• Full Support of Data Management: Measured data stored in internal memory
• Safe Design: Shutters prevent erroneous insertion of test leads into current measurementterminals (terminal shutters)
• Shockproof elastomer casing
• Wide operating temperature range: -20 °C to 55°C

General Specifications

Additional Functions	USB communication (optional adapter & software), data memory (TY720: 10,000 data, TY710: 1,000 data), max/min value memory, relative/percentage value computation, logarithm computation, data/auto hold, peak hold (TY720), overvoltage warning, backlight
Power Supply	Four AA (R6) dry cells
Battery Life	Approx. 120 hours
Dimensions	90 (W) × 192 (H) × 49 (D) mm
Weight	Approximately 560 g (including batteries)
Safety Standards	1000 V CAT. Ⅲ, 600 V CAT. Ⅳ

Detection		TY710			TY720		
		RMS			Switching detection (RMS or MEAN)		
Item	Range	Accuracy					
DCV	50 mV	0.05 + 10					
	500 mV/2400 mV	0.02 + 2					
	5 V	0.025 + 5					
	50 V/500 V/1000 V	0.03 + 2					
ACV [RMS]		Upper: 10 to 20 Hz Lower: 20 Hz to 1 kHz	Upper: 1 kHz to 10 kHz Lower: 10 kHz to 20 kHz	Upper: 20 kHz to 50 kHz Lower: 50 kHz to 100 kHz	Upper: 10 to 20 Hz Lower: 20 Hz to 1 kHz	Upper: 1 kHz to 10 kHz Lower: 10 kHz to 20 kHz	Upper: 20 kHz to 50 kHz Lower: 50 kHz to 100 kHz
	50 mV	— —	— —	— —	2 + 80 0.4 + 40	5 + 40 5.5 + 40	15 + 40 15 + 40
	50 mV/5 V/ 50 V/500 V	1.5 + 30	0.7 + 30 2 + 50	—	1 + 30	0.4 + 30 1 + 40	2 + 70 5 + 200
	1000 V	0.7 + 30	3 + 30	—	0.4 + 30	3 + 30 —	— —
ACV [MEAN]	50 mV	—			10 to 20 Hz 4 + 80	20 Hz to 500 Hz 1.5 + 30	500 Hz to 1 kHz 5 + 30
	50 mV/5 V/ 50 V/500 V/1000 V	—			2 + 30	1 + 30	3 + 30
DCV + ACV		Upper: DC, 10 to 20 Hz Lower: DC, 20 Hz to 1 kHz	Upper: DC, 1 kHz to 10 kHz Lower: DC, 10 kHz to 20 kHz	Upper: DC, 20 kHz to 50 kHz Lower: DC, 50 kHz to 100 kHz	Upper: DC, 10 to 20 Hz Lower: DC, 20 Hz to 1 kHz	Upper: DC, 1 kHz to 10 kHz Lower: DC, 10 kHz to 20 kHz	Upper: DC, 20 kHz to 50 kHz Lower: DC, 50 kHz to 100 kHz
	5 V/50 V/500 V	1.5 + 10 1 + 10	1 + 10 2 + 10	—	1.5 + 10 0.5 + 10	0.5 + 10 1 + 10	2 + 10 5 + 20
	1000 V	1.5 + 10 1 + 10	— —	— —	1.5 + 10 0.5 + 10	— —	— —
DCA	500 μA/5000 μA/ 50 mA/500 mA	0.2 + 5					
	5 A	0.6 + 10					
	10 A	0.6 + 5					
ACA [RMS]		10 Hz to 20 Hz	20 Hz to 1 kHz	1 kHz to 5 kHz	10 Hz to 20 Hz	20 Hz to 1 kHz	1 kHz to 5 kHz
	500 μA/5000 μA/ 50 mA/500 mA	1.5 + 20	1 + 20	—	1 + 20	0.75 + 20	1 + 30
	5 A/10 A				1.5 + 20	1 + 20	2 + 30
ACA [MEAN]					10 Hz to 20 Hz	20 Hz to 1 kHz	1 kHz to 5 kHz
	500 μA/5000 μA/ 50 mA/500 mA	—			2 + 20	1.5 + 20	2 + 30
	5 A/10 A	—			3 + 20	2 + 20	4 + 30
DCA + ACA		DC, 10 to 20 Hz	DC, 20 Hz to 1 kHz	DC, 1 kHz to 5 kHz	DC, 10 to 20 Hz	DC, 20 Hz to 1 kHz	DC, 1 kHz to 5 kHz
	500 μA/5000 μA/ 50 mA/500 mA	2 + 10	1.5 + 10	—	1.5 + 10	1 + 10	1.5 + 10
	5 A/10 A				2 + 10	1.5 + 10	3 + 10
Resistance	500 Ω/5 kΩ/50 kΩ 500 kΩ	0.1 + 2			0.05 + 2		
	5 MΩ	0.5 + 2					
	50 MΩ	1 + 2					
Low-power Resistance	5 kΩ/50 kΩ/500 kΩ	—			0.2 + 3		
	5 MΩ	—			1 + 3		
Frequency	2.0 Hz to 99.99k Hz	0.02 + 1					
Capacitance	5 nF/50 nF/500n F 5 μF/50 μF	1 + 5					
	500 μF	2 + 5					
	5 mF/50 mF	3 + 5					
Continuity check	550 Ω	Buzzer sounds at 100±50 Ω or less					
Diode test	2.4 V	1 + 2					
Temperature	-200 to 1372°C	1 + 1.5°C					

● **DMM of dedicated application software (Model: 92015)**
   DMM's and you can easily manage the data in memory. Is also capable of real-time communications

Features
• Data saved in the internal memory PC transfer is possible (Save memories or Logging Memories)
• DMM measurements show in real time monitor display is possible.
• Large amounts of data not covered by the internal memory PC communication with data transfer is possible. At the same time Excel transferable is also.
  Maximum incoming data: 32767
• Measurement data to Excel direct deployment is possible. Automatically creates a chart sheet.

92015 product specification:
Communication cable
Communications cable:	infrared communication adapter + communications cable (USB specifications) 2 m length
Interface standards:	USB specification conforms to the 1.1
Available models :	TY710, TY720, TY530

Application software
Operating environment of the personal computer
OS:	Windows XP / Vista / 7
CPU:	Pentium 133 MHz or higher
Memory:	64 MB
Hard disk has free space or more storage:	10 MB Over, CD drive
Excel:	since the Excel2000
Software:	CD, communication cable (including adapter), User's manual

Digital Multimeter

Provides Safety Levels Demanded in Field Work

TY500 Series Specifications

Accuracy: (23°C ±5°C, Less than 80% RH), ±(% rdg + dgt)

Item	Range	TY520		TY530	
Detection		RMS		Switching detection (RMS or MEAN)	
Item	Range	Accuracy			
DCV	600 mV/6 V/ 60 V/600 V	0.09 + 2			
	1000 V	0.15 + 2			
ACV	600 mV/6 V/60 V/600 V 1000 V	50/60 Hz	40 to 500 Hz	500 Hz to 1 kHz	
		0.5 + 5	1 + 5	1.5 + 5 —	
DCA	600 µA/6000 µA/60 mA	0.2 + 2			
	600 mA/6 A/10 A	0.5 + 5			
ACA	600 µA/6000 µA/60 mA/ 600 mA/6 A/10 A	50/60 Hz		40 Hz to 1 kHz	
		0.75 + 5		1.5 + 5	
Resistance	600 Ω/6 kΩ/60 kΩ/600 kΩ	0.4 + 1			
	6 MΩ	0.5 + 1			
	60 MΩ	1 + 2 (0 to 40 MΩ) 2 + 2 (40 to 60 MΩ)			
Frequency	10.0 Hz to 99.99 kHz	0.02 + 1			
Capacitance	10 nF	2 + 10			
	100 nF/1 µF/10 µF	2 + 5			
	100 µF/1000 µF	3 + 5			
Continuity check	600 Ω	Buzzer sounds at 50±30 Ω or less			
Diode test	2 V	1 + 2			
Temperature	-50 to 600°C	2 + 2°C			

TY500 Series
Digital Multimeters

3.5 digits (6,000-count, 31-segment bar graph display),
RMS type
Measurement Functions: Voltage, Current, Resistance,
Continuity Check, Diode Test, Frequency, Capacitance,
Temperature
Features: Closed case calibration, Hi-impact overmold case,
USB communication (optional adapter & software) (TY530
only), data memory (1,600 data for TY530 only)
Safety Standards: 1000 V CAT. Ⅲ , 600 V CAT. Ⅳ

General Specifications
• External dimensions:
  90 (W) × 192 (H) × 49 (D) mm
• Weight : Approx. 570 g
• Power Supply: Four AA (R6) dry cells

Low-cost Handheld DMM

732 Series Specifications

Accuracy: (23°C ±5°C, Less than 80% RH), ±(% rdg + dgt)

Model		73201	73202	73203	73204
Detection		Mean value			
Item	Range	Accuracy			
DCV	400.0 mV/4.000 V/ 40.00 V/400.0 V/600 V	0.5% + 1 0.75% + 1	0.5% + 1	0.3% + 1	0.5% + 1
ACV	4.000 V/40.00 V/ 400.0 V/600 V	1.0% + 5		0.75% + 5	
DCA	400.0 µA/4000 µA/ 40.00 mA/400.0 mA/ 10.00 A	1.0% + 2 2.0% + 2		–	
ACA (40 to 500 Hz)	400.0 µA/4000 µA/ 40.00 mA/400.0 mA/ 10.00 A	2.0% + 20 2.0% + 5 2.0% + 20 2.0% + 5 2.0% + 20		–	
Resistance	400.0 Ω/4.000 kΩ/ 40.00 kΩ/400.0 kΩ/ 4.000 MΩ/40.00 MΩ	0.75% + 2 0.75% + 1 2.0% + 1 5.0% + 2			

732 Series
Digital Multimeters

3.5 digits (4,300-count), Mean value type
Measurement Functions: Voltage, Current, Resistance,
Continuity Check, Diode Test, Capacitance
Features: Auto hold, Auto power-off

General Specifications
• External dimensions:
  74 (W) × 155 (H) × 31 (D) mm
• Weight: Approx. 240 g
• Power Supply:
  Two AAA (LR03 or R03) dry cells

Pocket DMM with Superb Portability

73101 Specifications

Accuracy: (23°C ±5°C, Less than 80% RH), ±(% rdg + dgt)

Item	Range	Accuracy	Input Resistance
DCV	400.0 mV 4.000 V 40.00/400.0/600 V	1.2% + 2 0.7% + 1 1.2% + 1	>100 MΩ 11 MΩ 10 MΩ
ACV	4.000 V 40.00/400.0/600 V	2.0% + 5	10 MΩ
Resistance	400.0 Ω 4.000 k/40.00 k/400.0 kΩ 4.000 MΩ 40.00 MΩ	1.2% + 2 2.0% + 3 5.0% + 3	
Continuity check	400.0 Ω	–	
Diode test	2.00 V	1.5% + 1	Open-circuit Voltage<3.4 V Testing Current<1.0 mA

73101
Pocket Digital Multimeter

4300 count display
Continuity Check and Diode Test
Auto Hold
Auto Power Off

Genetal Specifications
• External dimensions:
  76 (W) × 117 (H) × 18 (D) mm
• Weight: Approx. 110 g
• Power Supply: Two LR-44 dry cells

Specifications

96095
AD/DC Clamp-on Probe

- Light and compact, easy to carry and easy to clamp on crowded wirings.
- Expands measuring span of currents and assure safety when measuring with any kind of DMM.

Model	96095		
Conductor Size	φ 12mm		
Measurement range	Output voltage	Accuracy (at 23°C±5°C)	
		50/60 Hz	40 Hz to 1 kHz
AC 0.1 to 130 A	AC10 mV/A(AC 1 to 1300 mVrms)	1.2% + 0.4 mV	2.5% + 0.4 mV
DC 0 to ±180 A	DC10 mV/A (DC 0 to ±1800 mV)	1.2% + 0.4 mV	
General specifications			
Operating Temp&Humidity range	-10 to 55°C relative Humidity 85% or less (no condensation)		
Storage Temp&Humidity range	-30 to 70°C relative Humidity 85% or less (no condensation)		
Power source	DC3 V(Size AAA alkaline Battery LR03 × 2 pcs) Low battery warning: 2.2 V±0.2 V or less red LED flash 1.9 V±0.2 V or less Power off		
Continuous use	Approx. 35 Hours till a low battery indicator flashes[*1]		
Dimensions&Weight	127 (L) × 42 (W) × 22 (D) mm Cord length: Approx.1200 mm Weight: Approx 140 g		
Applicable standards	EN61010-1: CAT Ⅲ Pollution degree2, Altitude 2000 m or less for indoor use EN61326-1: ClassB,EN61326-2-032		
Accessories	Soft case(94030),Battery,User's Manual		

*1 From low battery warning to power off is about 5hours

Standerd Accessories

Name	Model	Specification	Applicable DMM Models							
			TY700		TY500		732			
			TY710	TY720	TY520	TY530	01	02	03	04
Test leads	98073	1000V CAT Ⅲ 600V CAT Ⅳ Red/Black(1set)	●	●	●	●				
	RD031	L-plug, Red/Black(1 set)					●	●	●	●
Fuse	99015	440 mA/1000 V	●	●	●	●				
	99016	10 A/1000 V	●	●	●	●				
	F02	15 A/250 V					●	●	●	●
	F05	500 mA/250 V					●	●	●	●

Accessorise

Name	Model	Specification	Applicable DMM Models							
			TY700		TY500		732			
			TY710	TY720	TY520	TY530	01	02	03	04
Communication Package for Digital Multimeters	92015	Communication Adapter for USB+cable+Application Software	●	●		●				
Test leads with Alligator Clip	99014	1000V CAT Ⅲ 600V CATⅣ Red/Black(1 set)	●	●		●				
Alligator Clips	B9646HF	Red/Black(1 set)	●	●	●	●	●	●	●	●
Rubber Case	93007						●	●	●	●
Carrying Case	93029	Hard case	●	●	●	●				
	B9646GB	Hard case	●	●	●	●	●	●	●	●
Temperature Probe (Thermocouple type K) (Banana plag output)	90050	-50 to 150°C for liquld	●	●	●	●				
	90051	-50 to 600°C for liquld	●	●	●	●				
	90055	-20 to 250°C for surface	●	●	●	●				
	90056	-20 to 500°C for surface	●	●	●	●				
Currents Clamp-on probe	96001	For 400 AAC Output: AC10 mV/A*1	●	●	●	●		●	●	●
	96095	For 130 AAC/180 ADC Output: AC10 mV/A or DC10 mV/A*2	●	●	●	●		●	●	●

*1 Please use it with the ACV range. It is necessary to read the indicated value in a different way as TY710 and the TY720,732 series. The example: In AC1V display = 100 A TY520 and TY530, it is possible to scale it. (Even 60 A or less display is possible in case of 96001.)
*2 Please use it with ACV or DCV range. It is necessary to read the indicated value in a different way as TY710 and the TY720,732 series. The example: In AC1V display = 100 A TY520 and TY530, it is possible to scale it. (Even 60 A or less display is possible in case of 96095.)

DMM Accessories

93029

92015

98073

96095

96001

RD031

90050

90051

90055

90056
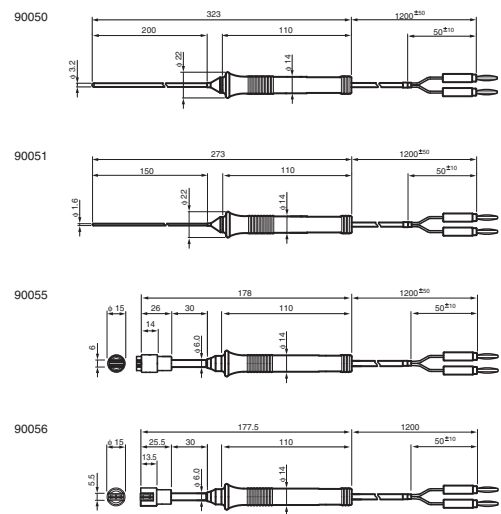
Digital Multimeter

Model	Diameter of measurable conductor	Range	Accuracy	AC current	DC current	Leak current	DC voltage	AC voltage	Resistance	Continuity check	Frequency	True RMS	Output	Data hold	Peak hold	Filter
CL120	φ 24	20 to 200 A	2.0 + 7	●										●		
CL130	φ 33	200 to 600 A	1.5 + 6	●				●	●	●				●		
CL135	φ 33	200 to 600 A	1.5 + 4	●				●	●	●		●		●		
CL150	φ 54	400 to 2000 A	1.0 + 3	●			●	●	●	●			●	●	●	
CL155	φ 54	400 to 2000 A	1.0 + 3	●			●	●	●	●		●	●	●	●	
CL220	φ 24	400 to 300 A	1.0 + 4	●	●									●		
CL235	φ 33	400 to 600 A	1.0 + 5	●	●		●	●	●	●	●			●		
CL250	φ 55	400 to 2000 A	1.5 + 2	●	●		●	●	●	●			●	●		
CL255	φ 55	400 to 2000 A	1.5 + 2	●	●		●	●	●	●		●	●	●	●	
CL320	φ 24	20 mA to 200 A	2.0 + 4	●		●								●		●
CL340	φ 40	40 mA to 400 A	1.0 + 5	●		●								●	●	●
CL345	φ 40	40 mA to 400 A	1.0 + 5	●		●						●		●	●	●
30031A	φ 40	3 mA to 60 A	1.0 + 5	●		●								●		
30032A	φ 40	3 mA to 60 A	1.0 + 5	●		●								●		●
CL360	φ 68	200 mA to 1000 A	1.0 + 2	●		●							●	●	●	●
CL420	φ 6	DC 20 to 100 mA	0.2 + 3		●									●	●	

Light weight & compact design

CL120
Clamp-on Tester

• ACA
• φ 24
• AC/20 to 200 A

CE

CL120 Specifications

		Accuracy: (23°C ±5°C, Less than 75% RH), ±(% rdg + dgt)
Item	Range	Accuracy
ACA	20 A	2.0 + 7 (50 to 1 kHz)
	200 A	2.0 + 5 (50/60 Hz)
		3.0 + 10 (40 to 1 kHz)

AC/DC Current Measurement

CL130/135
Clamp-on Testers

• ACA
• φ 33
• AC/200 to 600 A
• AC V/Ω
• RMS for CL135

CE

CL130/CL135 Specifications

		Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)	
Item	Range	Accuracy (CL130/CL135)	
ACA	200 A	1.5 + 6 (50/60 Hz)	1.5 + 4 (50/60 Hz)
		2.0 + 5 (40 to 1 kHz)	2.0 + 5 (40 to 1 kHz)
	600 A	1.0 + 3 (50/60 Hz)	1.5 + 4 (50/60 Hz)
		2.0 + 5 (40 to 1 kHz)	2.0 + 5 (40 to 1 kHz)
ACV	200 V/600 V	1.0 + 2 (50/60 Hz)	1.0 + 2 (50/60 Hz)
		1.5 + 4 (40 to 1 kHz)	1.5 + 4 (40 to 1 kHz)
Resistance	200 Ω	1.2 + 4, Beeps at below 30 Ω (continuity check)	

Wide Range of Current Measurement

CL150/CL155
Clamp-on Testers

• ACA
• φ 54
• AC/400 to 2000 A
• AC V/DC V/Ω
• DC Output
• RMS for CL155

CE

CL150/CL155 Specifications

		Accuracy: (23°C ±5°C, Less than 75% RH), ±(% rdg + dgt)
Item	Range	Accuracy
ACA	400 A	1.0 + 3 (50/60 Hz)
		2.0 + 3 (40 to 1 kHz)
	2000 A (0 to 1500 A)	1.0 + 3 (50/60 Hz)
		3.0 + 3 (40 to 1 kHz)
	2000 A (1500 to 2000 A)	3.0 (50/60 Hz)
ACV	40/400/750 V	1.0 + 2 (50/60 Hz)
		1.5 + 3 (40 to 1 kHz)
DCV	40/400/1000 V	1.0 + 2
Resistance	400/4 k/40 k/400 kΩ	1.5 + 2, Beep sound at less than 50 ±35 Ω

AC/DC Current Measurement

CL220
Clamp-on Tester

• ACA/DCA
• φ 24
• AC/40 to 300 A
• DC/40 to 300 A

CE

CL220 Specifications

		Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)
Item	Range	Accuracy
ACA	40 A	1.0 + 4
	300 A (20 to 200 A)	1.5 + 4
	300 A (200 to 300 A)	3.0
DCA	40 A	1.0 + 4 (50/60 Hz)
		2.5 + 4 (20 to 1 kHz)
	300 A (20 to 200 A)	1.5 + 4 (50/60 Hz)
		2.5 + 4 (20 to 1 kHz)
	300 A (200 to 300 A)	3.5 (50/60 Hz)
		4.0 (20 to 1 kHz)

Clamp-on Tester

RMS ACA/DCA measurement

CL235
Clamp-on Tester

- ACA/DCA
- φ 33
- AC/400 to 600 A, DC/400 to 1000 A
- AC V/DC V/Ω/Hz
- RMS

CL235 Specifications

Accuracy: (23°C ±5°C, Less than 75% RH), ±(% rdg + dgt)

Item	Range	Accuracy
ACA	400/600 A	1.5 + 5 (50/60 Hz) 3.5 + 5 (40 to 1 kHz)
DCA	400/1000 A	1.0 + 5
ACV	40/400/600 V	1.5 + 5 (50/60 Hz) 3.5 + 5 (40 to 1 kHz)
DCV	40/400/600 V	1.0 + 5
Resistance	400/4000 Ω	1.0 + 5, Beeps at below 20 Ω (continuity check)
Frequency	10 to 3000 Hz	1.5 + 5

Leakage Currents of 1 mA measurement

30031A/30032A
Leakage Clamp-on Tester

- ACA
- φ 40
- AC/3 mA to 60 A

30031A/30032A Specifications

Accuracy: (23°C ±5°C, Less than 80% RH), ±(% rdg + dgt)

Item	Range	Accuracy	
		30031 A, 30032 A Filter OFF	30032 A Filter ON
ACA	0 to 30 mA	1.0 + 5 (50±1.0 Hz/60±1.0 Hz)	1.5 + 5 (50±1.0 Hz/60±1.0 Hz)
	0 to 50 A		
	50 to 60 A	5.0 + 5 (50±1.0 Hz/60±1.0 Hz)	5.5 + 5 (50±1.0 Hz/60±1.0 Hz)

Compact design of Leakage current measurement

CL320
Leakage Clamp-on Tester

- ACA
- φ 24
- AC/20 mA to 200 A

CL320 Specifications

Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)

Item	Range	Accuracy	
		WIDE (40 to 400 Hz)	50/60 Hz
ACA	20 mA/200 mA	2.0 + 4 (50/60 Hz)	3.0 + 5 (50/60 Hz)
	200 A (0 to 100 A)	5.0 + 6 (40 to 400 Hz)	
	200 A (100.1 to 200 A)	5.0 + 4 (50/60 Hz)	5.0 + 5 (50/60 Hz)

Wide Range of Leakage current measurement

CL360
Leakage Clamp-on Tester

- ACA
- φ 68
- AC/200 mA to 1000 A
- DC/AC Output

CL360 Specifications

Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)

Item	Range	Accuracy	
		WIDE (40 to 1 kHz)	50/60 Hz
ACA	20 mA/2 A/20 A	1.0 + 2 (50/60 Hz) 3.0 + 2 (40 to 1 kHz)	1.5 + 2
	200 A	1.5 + 2 (50/60 Hz) 3.5 + 2 (40 to 1 kHz)	2.0 + 2
	1000 A (0 to 500 A)	1.5 + 2 (50/60 Hz) 3.5 + 2 (40 to 1 kHz)	2.0 + 2
	1000 A (501 to 1000 A)	5.0 (50/60 Hz) 10.0 (40 to 1 kHz)	5.5

Wide Range of ACA/DCA measurement

CL250/CL255
Clamp-on Testers

- ACA/DCA
- φ 55
- AC/400 to 2000 A, DC/400 to 2000 A
- AC V/DC V/Ω
- DC Output
- Hz, RMS for CL255

CL250 Specifications

Accuracy: (23°C ±5°C, Less than 75% RH), ±(% rdg + dgt)

Item	Range	Accuracy
DCA	400/2000 A	1.5 + 2
ACA	400 A/2000 A (0 to 1000 A)	1.5 + 2 (50/60 Hz) 3.0 + 4 (40 to 500 Hz) 5.0 + 4 (500 to 1 kHz)
	2000 A (1001 to 2000 A)	3.0 + 2 (50/60 Hz)

CL255 Specifications

Accuracy: (23°C ±5°C, Less than 75% RH), ±(% rdg + dgt)

Item	Range	Accuracy
DCA	400/2000 A	1.5 + 2
ACA	400 A/2000 A (150 to 1700 A)	1.5 + 3 (50/60 Hz) 3.0 + 4 (30 to 1 kHz)
	2000 A (1701 to 2000 A)	3.5 + 3 (50/60 Hz)

Leakage current measurement

CL340/CL345
Leakage Clamp-on Testers

- ACA
- φ 40
- AC/40 mA to 400 A
- RMS for CL345

CL340 Specifications

Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)

Item	Range	Accuracy	
		WIDE (20 Hz)	50/60 Hz
ACA	40 mA/400 mA	2.5 + 10 (20 to 1 kHz)	1.0 + 5 (50/60 Hz)
	400 A (0 to 350 A)	2.5 + 10 (40 to 1 kHz)	1.0 + 5 (50/60 Hz)
	400 A (350 to 400 A)	5.0 (40 to 1 kHz)	2.0 (50/60 Hz)

CL345 Specifications

Accuracy: (23°C ±5°C, Less than 85% RH), ±(% rdg + dgt)

Item	Range	Accuracy	
		WIDE (20 Hz)	50/60 Hz
ACA	40 mA/400 mA	2.5 + 10 (20 to 1 kHz)	1.0 + 5 (50/60 Hz)
	400 A (0 to 300 A)	2.5 + 10 (40 to 1 kHz)	1.0 + 5 (50/60 Hz)
	400 A (300 to 400 A)	5.0 (40 to 1 kHz)	2.0 (50/60 Hz)

DC signals of 4 to 20 mA measurement

CL420
Clamp-on Process Meter

- DCmA
- φ 6
- DC/20 mA to 100 mA
- DC Output

CL420 Specifications

Accuracy: (23°C ±5°C, Less than 80% RH), ±(% rdg + dgt)

Item	Range	Accuracy
DCmA	20 mA	0.2 + 5
	100 mA	1.0 + 5

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Insulation Tester

Selection Guide

Type	Series/Model	Suffix Code & Backlight	Rating	AC Voltage Measuring range	Display	Additional Function	External View	Page
Digital insulation testers 4 ranges	MY40 CE	01 (EL-illuminated)	125 V/200 MΩ 250 V/200 MΩ 500 V/2000 MΩ 1000 V/2000 MΩ	0 to 600 V	3 1/2-digit LCD	Automatic discharge Conductor resistance measurement Comparator function Memory function		P.75
Analog insulation testers 2 & 3 ranges	2406E	31	25 V/5 MΩ 50 V/10 MΩ 125 V/20 MΩ	0 to 300 V	Analog	Automatic discharge Battery check		P.76
		41 (EL-illuminated)						
		32	125 V/20 MΩ 250 V/50 MΩ	0 to 300 V				
		42 (EL-illuminated)						
		33	125 V/20 MΩ 250 V/50 MΩ 500 V/100 MΩ	0 to 600 V				
		43 (EL-illuminated)						
		34	250 V/50 MΩ 500 V/100 MΩ 1000 V/2000 MΩ	0 to 600 V				
		44 (EL-illuminated)						
		35	250 V/500 MΩ 500 V/1000 MΩ 1000 V/2000 MΩ	0 to 600 V				
		45 (EL-illuminated)						
	Single range MY10 CE	01 (afterglow-illuminated)	125 V/20 MΩ	0 to 250 V	Analog	Automatic discharge Battery check		P.76
		02 (afterglow-illuminated)	250 V/50 MΩ	0 to 300 V				
		03 (afterglow-illuminated)	500 V/100 MΩ	0 to 500 V				
		04 (afterglow-illuminated)	500 V/1000 MΩ	0 to 500 V				
		05 (afterglow-illuminated)	1000 V/2000 MΩ	0 to 500 V				
	Single range 3213A	41	100 V/20 MΩ	0 to 150 V	Analog	Battery check		P.76
		42	250 V/50 MΩ	0 to 250 V				
		43	500 V/100 MΩ	0 to 300 V				
		44	500 V/1000 MΩ	0 to 300 V				
		45	1000 V/2000 MΩ	0 to 300 V				

Points on How to Choose an Insulation Tester

1 Type

Two choices:
Choose an analog model if visual recognition is of utmost importance, or a digital model if precise numeric recognition is of utmost importance.

2 Ratings

A wide choice of voltage/resistance ratings, from 25 V/5 MΩ to 1000 V/2000 MΩ
Some models have two or three ranges; thus, you need not take more than one instrument to the site.

3 Functionality

Each series includes a model or models with a backlight for working in dark places. Multifunctional models are capable of AC voltage measurement also.

4 Accessories

Optional test probes and probe tips are available for a variety of test environments.

Insulation Tester

Simple selection for replacing discontinued products

	Type	Series /Models	Suffix Code (BackLight)	Rating	Series/Models	References and notes
Digital insulation testers	4 ranges	MY40 CE	01 (EL-illuminated)	125 V/200 MΩ 250 V/200 MΩ 500 V/2000 MΩ 1000 V/2000 MΩ	240651 to 55[1] 240661 to 65[1] 3213D31 to D35[2]	*1 2406D series is single or 2 range. *2 3213D series is single range.
Analog insulation testers	2 & 3 ranges	2406E	31	25 V/5 MΩ 50 V/10 MΩ 125 V/20 MΩ	240631	
			41 (EL-illuminated)			
			32	125 V/20 MΩ 250 V/50 MΩ	–	
			42 (EL-illuminated)			
			33	125 V/20 MΩ 250 V/50 MΩ 500 V/100 MΩ	240622	
			43 (EL-illuminated)		240626	
			34	250 V/50 MΩ 500 V/100 MΩ 1000 V/2000 MΩ	240623/25	
			44 (EL-illuminated)			
			35	250 V/500 MΩ 500 V/1000 MΩ 1000 V/2000 MΩ	240621	
			45 (EL-illuminated)			
	Single range	MY10 CE	01	125 V/20 MΩ	321346	
			02	250 V/50 MΩ	240301	
			03	500 V/100 MΩ	240302	
			04	500 V/1000 MΩ	–	
			05	1000 V/2000 MΩ	240305	
	Single range	3213A	41	100 V/20 MΩ	321321	
			42	250 V/50 MΩ	321322	
			43	500 V/100 MΩ	321323	
			44	500 V/1000 MΩ	321324	
			45	1000 V/2000 MΩ	321325	

Digital model with 4 voltage/resistance ratings

MY40
Digital Insulation Tester

CE

Features

• Multifunction
  Insulation resistance, AC voltage and conductor resistance measurement
  Insulation test mode: Comparator, memory, auto-hold and discharge functions
  All test modes: Live-line alarm (excluding AC voltage measurement), battery check and automatic power-off
• Easy-to-view, fluctuation-free display
• Double-action safety mechanism

General Specifications

Dimensions: 125 (W) × 103 (H) × 53 (D) (mm)
Weight: 420 g (main unit and batteries only)
Batteries: Four AA (R6P) batteries

Testing Performance Specifications

Model	Rating	Range Option	Resolution	Measuring Range	Tolerance	Lower Limit of measured Ω	Rated Current	Central Scale Value
MY40-01	125 V/200 MΩ	.4000	.1 kΩ	0 to .0199 MΩ	± (5% of rdg+6 dgt)	0.125 MΩ	1 mA	5 MΩ
		4.000	1 kΩ	.0200 to 10.00 MΩ*	± (2% of rdg+6 dgt)			
		40.00	10 kΩ	10.01 to 200.0 MΩ	± 5% of rdg			
		200.0	100kΩ					
	250 V/200 MΩ	.4000	.1 kΩ	0 to .0499 MΩ	± (5% of rdg+6 dgt)	0.25 MΩ	1 mA	5 MΩ
		4.000	1 kΩ	.0500 to 20.00 MΩ*	± (2% of rdg+6 dgt)			
		40.00	10 kΩ	20.01 to 200.0 MΩ	± 5% of rdg			
		200.0	100 kΩ					
	500 V/2000 MΩ	4.000	1 kΩ	0 to 0.999 MΩ	± (5% of rdg+6 dgt)	0.5 MΩ	1 mA	50 MΩ
		40.00	10 kΩ	1.000 to 500 MΩ*	± (2% of rdg+6 dgt)			
		400.0	100 kΩ	501 to 2000 MΩ	± 5% of rdg			
		2000	1 MΩ					
	1000 V/2000 MΩ	4.000	1 kΩ	0 to 1.999 MΩ	± (5% of rdg+6 dgt)	2 MΩ	0.5 mA	50 MΩ
		40.00	10 kΩ	2.000 to 1000 MΩ*	± (2% of rdg+6 dgt)			
		400.0	100 kΩ	1001 to 2000 MΩ	± 5% of rdg			
		2000	1 MΩ					

* First effective measuring range; ** The minimum value at which the rated voltage can be maintained

Standard test conditions
Ambient temperature/humidity ranges: 23 ±5°C/45-75% RH

Tolerances under the above-mentioned conditions:
Deviation from zero scale value: 6 digits maximum
Indication of ∞ mark on bar graph: Approx. 4000 MΩ min. (500 V/1000 V)
Approx. 400 MΩ min. (125 V/250 V)
Open circuit voltage: 130% max. of rated voltage
Rated measuring current: 1 mA (0 to 20%) when in first effective measuring range
Short-circuit Current: 2 mA max.

AC voltage measurement (45-400 Hz)

Model	Range	Resolution	Accuracy	Input Impedance
MY40-01	600 V	1 V	±(2% of rdg + 6 dgt)	Approx. 2 MΩ

Conductor resistance measurement

Model	Range	Resolution	Accuracy	Open-circuit Voltage
MY40-01	400 Ω	0.1 Ω	±(2% of rdg + 8 dgt)	Buzzer sound resistance: <40 Ω.

Insulation Tester

75

Insulation Tester

Analog models with two and three ratings

2406E Series
Analog Insulation Testers

Features

• AC voltage measurement
• Automatic discharge
• Sky blue EL backlight
• Increased safety (covered battery charger)

General Specifications

Dimensions (main unit): Approx. 120 (W) × 110 (H) × 60 (D) (mm)
Weight: Approx. 500 g (including batteries)
Batteries: Six AA (R6P) batteries

Testing Performance Specifications

Model	Rating	Effective Measuring range	Central Scale Value	AC Voltage Measuring range	Lower limit of measured Ω	Rated Current
240631	25 V/5 MΩ	0.001 to 5 MΩ	0.1 MΩ	0 to 300 V	0.025 MΩ	1 mA
240641	50 V/10 MΩ	0.005 to 10 MΩ	0.2 MΩ		0.05 MΩ	1 mA
	125 V/20 MΩ	0.01 to 20 MΩ	0.5 MΩ		0.125 MΩ	1 mA
240632	125 V/20 MΩ	0.01 to 20 MΩ	0.5 MΩ	0 to 300 V	0.125 MΩ	1 mA
240642	250 V/50 MΩ	0.01 to 50 MΩ	1 MΩ		0.25 MΩ	1 mA
240633	125 V/20 MΩ	0.01 to 20 MΩ	0.5 MΩ	0 to 600 V	0.125 MΩ	1 mA
	250 V/50 MΩ	0.01 to 50 MΩ	1 MΩ		0.25 MΩ	1 mA
240643	500 V/100 MΩ	0.05 to 100 MΩ	2 MΩ		0.5 MΩ	1 mA
240634	250 V/50 MΩ	0.01 to 50 MΩ	1 MΩ	0 to 600 V	0.25 MΩ	1 mA
	500 V/100 MΩ	0.05 to 100 MΩ	2 MΩ		0.5 MΩ	1 mA
240644	1000 V/2000 MΩ	1 to 2000 MΩ	50 MΩ		1 MΩ	1 mA**
240635	250 V/500 MΩ	0.1 to 500 MΩ	10 MΩ	0 to 600 V	0.25 MΩ	1 mA**
	500 V/1000 MΩ	0.5 to 1000 MΩ	20 MΩ		0.5 MΩ	1 mA**
240645	1000 V/2000 MΩ	1 to 2000 MΩ	50 MΩ		1 MΩ	1 mA**

EL-Back-Light	Non-Back-Light

* The minimum value at which the rated voltage can be maintained;
** 0.55 mA in the case of the first effective measuring range

Analog models with single rating

MY10 Series
Analog Insulation Testers

CE

Features

• AC voltage measurement
• Automatic discharge
• A wide choice of accessories
  –Designed for shared use with the MY40

General Specifications

Dimensions: Approx. 125 (W) × 103 (H) × 53 (D) (mm)
Weight: Approx. 400 g (main unit and batteries only)
Batteries: Four AA (R6P) batteries

Testing Performance Specifications

Model	Rating	Effective Measuring Range	Central Scale Value	AC Voltage Measuring Range	Lower Limit of Measured Ω*	Rated Current
MY10-01	125 V/20 MΩ	0.01 to 20 MΩ	0.5 MΩ	0 to 250 V	0.125 MΩ	1 to 1.2 mA
MY10-02	250 V/50 MΩ	0.01 to 50 MΩ	1 MΩ	0 to 300 V	0.25 MΩ	1 to 1.2 mA
MY10-03	500 V/100 MΩ	0.05 to 100 MΩ	2 MΩ	0 to 500 V	0.5 MΩ	1 to 1.2 mA
MY10-04	500 V/1000 MΩ	0.5 to 1000 MΩ	20 MΩ	0 to 500 V	1 MΩ	0.5 to 0.6 mA
MY10-05	1000 V/2000 MΩ	1 to 2000 MΩ	50 MΩ	0 to 500 V	2 MΩ	0.5 to 0.6 mA

* The minimum value at which the rated voltage can be maintained

Analog models with single rating

3213A Series
Analog Insulation Testers

Features

• AC voltage measurement and check live lines such as motive power lines
• One-touch operation Press-and-lock switch for continuous measurement
• A wide choice of accessories to meet various testing requirements
• Vibration- and shock-resistant hand-held compact testers

General Specifications

Dimensions: Approx. 110 (W) × 180 (H) × 60 (D) (mm)
Weight: Approx. 700 g including batteries, or approx. 1.2 kg including hard case, handle, test leads and batteries
Batteries: Eight AA (R6P) batteries

Testing Performance Specifications

Model	Rating	Effective Measuring Range	Central Scale Value	AC Voltage Measuring Range	Lower Limit of measured Ω	Rated Current
321341	100 V/20 MΩ	0.02 to 20 MΩ	0.5M Ω	0 to 150 V	0.1 MΩ	1 mA
321342	250 V/50 MΩ	0.05 to 50 MΩ	1M Ω	0 to 250 V	0.25 MΩ	1 mA
321343	500 V/100 MΩ	0.1 to 100 MΩ	2M Ω	0 to 300 V	0.5 MΩ	1 mA
321344	500 V/1000 MΩ	1 to 1000 MΩ	20M Ω	0 to 300 V	0.5 MΩ	1 mA**
321345	1000 V/2000 MΩ	2 to 2000 MΩ	50M Ω	0 to 300 V	1 MΩ	1 mA**

* The minimum value at which the rated voltage can be maintained; ** 0.55 mA in the case of the first effective measuring range

Quick-reference Table of Accessories

	Series/Model	3213A	2406E	MY10	MY40
Spare probe tip	For breaker pins	–	–	99011	
	General-purpose	B9600GN		B9600GN *2	
	Extended	B9600NX		B9600NX *2	
	Sharp-pointed	B9600NZ		B9600NZ *2	
Probe	Line probe	–	98007	98001	
	Earth probe	–	Earth and Line probes	98002	
	Measuring Lead unit (Paired earth/line terminals)	98050	–	–	–
	Replaceable type Line Probe	–	–	–	
Case *1	Bag for housing spare probe tips	B9600NV	–	–	–
	Accessory-housing case	B9646CA	B9108XA	B9108XA	
	Carrying case	B9600HA w/accessory-housing case	B9075MU(hard case) B9075MV(soft case) Note: Includes an accessory-housing case.	93015 Store main unit /accessories	93015 Store main unit /accessories
Others	Protection cover	–	–	93013	
	Shoulder strap	–	–	99005	
	Handle	B9303XE	–	–	–
	Lead for guard terminals	321803		–	–

Note that the color of the plastic part of a probe tip may not always match that of the probe, depending on the combination.

*1 Regarding external dimensions of cases, Pls refer to each product specification.

*2 For using with MYSeries, 98052 is necessary.

Spare Probe Tips
Unit: mm

99011

B9600GN

B9600NZ

B9600NX
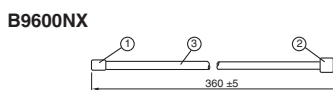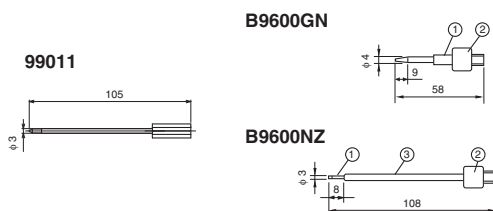
No.	Description	Remarks
①	Testing shank	Metal shank with φ6 screw
②	Fastening nut	ABS resin
③	PVC-clad	
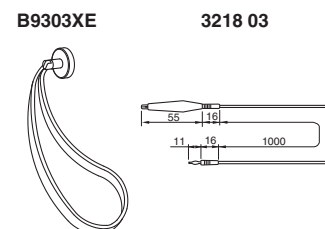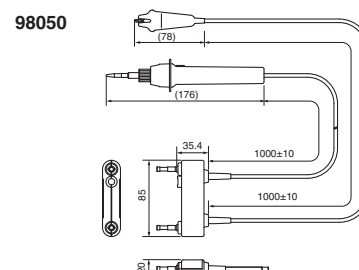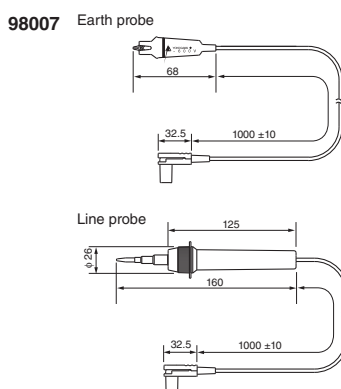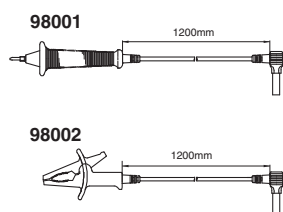
Others
Unit: mm

B9303XE

3218 03

Probes
Unit: mm

98001

98002

98007 Earth probe

Line probe

98050

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Earth Tester Capable to Measure by 3 Pole or 2 Pole Method

EY200
Digital Earth Tester

• Capable to measure by 3-pole or 2-pole measuring
• Easy to measure with one touch button and dedicated test lead
• Small and lightweight
• Dust and drip proof (designed to IEC60529 IP54)

EY200 Specifications

Display	LCD Digital Display: 1999-count digital reading
Measuring Range	Earth Resistance: 2000 Ω LSD: 0.01 to 1 Ω
	Earth Voltage: 200 V
Accuracy	Earth Resistance: 20 Ω range: ±2%rdg±0.1 Ω
	200 Ω range: ±2%rdg±3 dgt
	2000 Ω range: ±2%rdg±3 dgt
	Earth Voltage: ±1%rdg±4 dgt
Measuring Frequency	Approx. 820 Hz
Measuring Current	Approx. 3 mA (at 20 Ω range)
Battery Life	Approx. 4.5 hours (at 5 second measuring 3300 times)
Operating Temp.	0 to 40°C, 85%Rh or less
and Humidity	0 to 40°C, 85%Rh or less
Dimensions	Approx. 105 × 158 × 70 mm
Weight	Approx. 550 g

Handy Universal Tester for Checking Electrical Appliances

322610
Leakage Current Tester

• Three input resistance ranges – 1, 1.5 and 2 kΩ
• Four functions – AC current, DC current, DC + AC current and AC voltage measurements
• ±2.5% full scale accuracy
• 100 µA full scale value
• Shockproof indicator using taut band movement
• Built-in overload protection circuit
• Handy and easy to carry
• Shielded case, resistant to high-frequency fields

322610 Specifications

Range: DC current ... 0.1, 1, 10 mA,
    AC current .... 0.1, 1, 10 mA,
    (DC + AC) current ... 0.1, 1, 10 mA,
    AC Voltage ... 150, 300 V (50 and 60 Hz)
Accuracy: ±2.5% of full scale value on current and voltage ranges
Input Impedance: Current range; 1 kΩ, 1.5 kΩ, and 2 kΩ
    Voltage range; More than 100 kΩ
Frequency Range: 20 Hz to 5 kHz
Power Source: Two 9 V dry cells,
    Continuous Operating Time; Approx. 290 hours
Overload Protection: Up to 30 mA AC for one minute will not damage instrument on current
    ranges
Dimensions: Approx. 190 × 124 × 90 mm not including handle
Weight: Approx. 1.0 kg

Excellent Performance, Multiple Functions

510 Series
Digital Lux Meter

• Wide range, High Accuracy
• Average illuminance computation function
• Timer hold
• USB communication

510 Series Specifications

Photoelectric Element: Silicon Photodiode
Measuring Range:
  0.0 to 99.9/999/9,990/99,900/999,000lX
Response Time: 5 sec. (Auto Range)
        2 sec. (Manual Range)
Accuracy: ±4% rdg. ±1 dgt. (51011)
        ±2% rdg. ±1 dgt. (51012, 51021)
General Specifications
  • External dimensions (main unit):
    Approx. 67 (W) × 177 (H) × 38 (D) (mm)
  • Weight: Approx. 260 g
  • Batteries: AA (LR6) × 2

Handy temperature data logger

TM20
Thermo-collectors

- Effective for HACCP program implementation.
- Collect up to 5000 data items with time-stamp, tag name and inspector name.
- Save 2 weeks continuous data logging with 1 minute interval, (up to 20000 data items, measuring interval is 1sec. to 24 houres.)
  Information on **when**, **by whom** and **what** is measured is saved along with the data.

TM20 Specifications

Product name (Model)	TM20 Thermo-collector Thermocouple model (54011)
Number of measuring channels	2
Measuring range (only the main unit)	Thermocouple Type K : -200°C to 1372°C Type J : -200°C to 1000°C Type E : -200°C to 700°C Type T : -200°C to 400°C Voltage input ±100 mV, ±1 V
Accuracy (only the main unit)	Thermocouple -200.0 to 100.1°C : ±(0.1% of rdg + 0.7°C) -100.0°C or above : ±(0.1% of rdg + 1.0°C) Voltage input ±(0.1% of rdg + 0.2% of range)
Measuring interval	Collector mode: 0.5 seconds or longer when 1 channel is used. Logging mode: 1 second to 24 hours when 1 channel is used.
Data capacity	5000 data items when used in collector mode only, 20000 data items when used in logging mode only.
External dimensions	Approx. 151(H) × 56(W) × 33(D) mm (excluding protrusions) Weight: Approx. 180 g (including batteries)
Supplied accessories	Software, two AA-size alkaline dry batteries (LR6), a waterproof cover, and an instruction manual

Optional Accessories for TM20

Product name	Model
RS-232C cable for PC connection (9-pin)	91011

Simplified Thermometer with easy operation

TX10 Series
Digital Thermometers

TX1001:
 1-channel Single-function with data hold function
TX1002:
 1-channel Multifunction with data hold, internal memory, user-calibration and relative display function
TX1003:
 2-channel Multifunction with data hold, internal memory, user-calibration and relative display function

TX10 Series Specifications
- Thermocouple measurement ranges
  Type K: -200 to 1372 deg.C
  Type J: -200 to 1000 deg.C
  Type E: -200 to 700 deg.C
  Type T: -200 to 400 deg.C
- Resolution
  -200.0 to 199.9 deg.C: 0.1 deg.C, 200 deg.C: 1 deg.C (TX1001)
  -200.0 to 199.9 deg.C: 0.1 deg.C or 1 deg.C (when resolution is set at 1 deg.C), 200 deg.C: 1 deg.C (TX1002, 03)
- Accuracy
  -200.0 to -100.1 deg.C: +/-(0.1% of rdg + 1.0 deg.C);
  -100.0 to 199.9 deg.C: +/-(0.1% of rdg + 0.7 deg.C);
  200 deg.C and when resolution is set at 1 deg.C:+/-(0.2% of rdg + 1 deg.deg.C)
General Specifications
- External dimensions:
  56 (W) × 151 (H) × 33 (D) mm
- Weight: Approx. 180 g
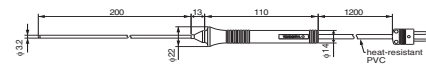- Power: Two AA size (LR6) dry batteries

Probes for TM20/TX10

Temperature Probe (for type K)

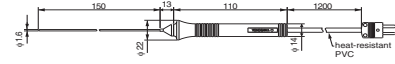| Model	Probe type	Measuring range	Accuracy	Response time (second)	Sensor Dimenter / Length (m/m)
90020	rounded end	-50 to 600°C	0.4% or ±1.5°C	1.4	φ 3.2 / 200
90021	rounded end	-50 to 600°C	0.4% or ±1.5°C	0.4	φ 1.6 / 150
90022	rounded end	-50 to 600°C	0.4% or ±1.5°C	1.4	φ 3.2 / 500
90023	needle	-50 to 500°C	0.4% or ±1.5°C	0.4	φ 1.6 / 100
90024	needle	-50 to 500°C	0.4% or ±1.5°C	1	φ 2.1 / 100
90030	Surface straight	-20 to 250°C	0.75% or ±2.5°C	2	φ 15 (temp. sensing portion)
90031	Surface angled	-20 to 250°C	0.75% or ±2.5°C	2	φ 15 (temp. sensing portion)
90032	Surface straight	-20 to 500°C	0.75% or ±2.5°C	2	φ 15 (temp. sensing portion)
90033	Surface angled	-20 to 500°C	0.75% or ±2.5°C	2	φ 15 (temp. sensing portion)
245907	Bead TC	-40 to 260°C	0.75% or ±2.5°C		1200 (included cord)

(90% response)

NOTE: 90030 is using polyimide to insulate from objects to be measured.
Manufacturers of polyimide are announcing not to apply polyimide directly for food, internal and body fluid.
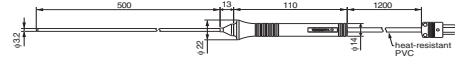
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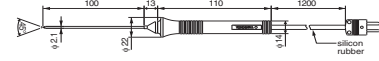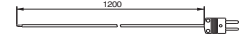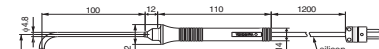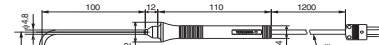
Metal foil resistors
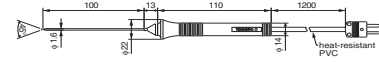

2792A Series
Standard Resistors

- Traced to the national standard for high accuracy; test (calibrated) accuracy of ±5 ppm
- Resistance temperature coefficient
- A variety of models
  Eight models with nominal resistance values ranging between 0.001 Ω and 10 kΩ
- Precision temperature control equipment, such as an oil bath, not needed for calibration due to marked improvement in resistance temperature coefficient
- Included document: Test certificate

2792A series Specifications

Model	Nominal value	Accuracy 23℃±2℃
2792A01	0.001 Ω	±100 ppm
2792A02	0.01 Ω	±75 ppm
2792A03	0.1 Ω	±50 ppm
2792A04	1 Ω	±30 ppm
2792A05	10 Ω	±30 ppm
2792A06	100 Ω	±30 ppm
2792A07	1 kΩ	±30 ppm
2792A08	10 kΩ	±30 ppm

Operating temperature and humidity ranges: 0 to 50℃ / 20 to 80% RH
Maximum allowable power: 3 W
Test (calibrated) accuracy: ±5 ppm
Power characteristics: ±100 ppm/W
Insulation resistance:
More than 1000 MΩ at 500 V DC
Withstand voltage: 1.5 kV for one minute between measurement terminal and casing
Terminal construction: 4 terminals
External dimensions: Approximately ϕ 104 × 150 mm (current terminal width: approximately 174 mm)
Weight: Approximately 1.2 kg
Accessories: User'S Manual, One Test Certificate

High-accuracy, DC variable resistor with 6 dials

279301/279303
Decade Resistance Boxes

279301
- High accuracy and stability
- High reproducibility
- 1 mΩ resolution

279303
- Up to 100 MΩ in 100 Ω step
- Low voltage coefficient
- Shock- and vibration-proof construction

279301 Specifications

Resistance Range: 0.100 to 1,111.210 Ω (Minimum resistance is 0.100 Ω).
Dial Composition: 0.001 × 10 + 0.01 Ω × 10 + 0.1 Ω × 11 + 1 Ω × 10 + 10 Ω × 10 + 100 Ω × 10
Resolution: 0.001 Ω
Accuracy: ± (0.01% + 2 mΩ) at temperature 23 ± 2℃, humidity 45 to 75%, and 0.1 W power application

279303 Specifications

Resistance Range: 0 to 111. 1110 MΩ.
Dial Composition: 100 Ω × 10 + 1 kΩ × 10 + 10 kΩ × 10 + 100 kΩ × 10 + 1 MΩ × 10 + 10 MΩ × 10.
Accuracy: 100 Ω, 1 kΩ, 10 kΩ and 100 kΩ steps ... ± (0.05% + 0.05 Ω)
1 MΩ and 10 MΩ steps ... ±0.2%
(At temperature 23 ± 2℃, humidity below 75%, including residual resistance of approx. 0.05 Ω).

Quick and easy setting

278610/278620
Decade Resistance Boxes

Models 278610 and 278620 six-dial decade resistance boxes allow quick and easy setting of a wide range of resistance. These resistance boxes are used in combination with voltage or current standards to adjust voltage or current, as dummy load resistances or as an arm of AC bridges.

278610/278620 Specifications

Available Models:

Model Number	Resistance Range
278610	0.1 to 111,111 Ω (six decade dials)
278620	1 to 1,111,110 Ω (six decade dials)

Residual Resistance: Less than 23 mΩ.
Power Rating: 0.3 W/step, within 3 W for overall instrument.
Maximum Allowable Input: 0.5 W/step, 5 W for overall instrument.
Maximum Circuit Voltage: 250 V.
Operating Temperature Range: 0 to 40℃
Storage Temperature Range: -10 to 50℃
Humidity Range: 25 to 85%, relative humidity.
Insulation Resistance: More than 500 MΩ at 500 V DC.
Dielectric Strength: 1,500 V AC for one minute.

1 Ω to 10 MΩ by operation of dials and switches

2755
Portable Wheatstone Bridge

Model 2755 measures resistances from 1 Ω to 10 MΩ by operation of dials and switches. Batteries and a galvanometer are self-contained. The front control panel is provided with power and galvanometer circuit selectors, one ratio arm dial, and four measuring arm dials.

2755 Specifications

Measuring Range: 1,000 Ω to 10.00 Ω.
Measuring Arms: 1 Ω × 10 + 10 Ω × 10 + 100 Ω × 10 + 1,000 Ω × 10 (min. one step: 1 Ω).
Ratio Arms (Multiplier): × 0.001, × 0.01, × 0.1, × 1, × 10, × 100, × 1,000 (M10, M100, M1000 ... Murray & Varley loop testing).
Accuracy: ±0.1% of reading on 100 Ω to 100 kΩ range, ±0.3% of reading on 10 Ω to 1 MΩ range, ±0.6% of reading on 1Ω to 10 MΩ range.
Temperature Coefficient of Resistance Elements:
±5 × 10^{-5}/℃ at ambient temperature of 5 to 35℃, ±2 × 10^{-5}/℃ at ambient temperature 20 to 35℃.
Galvanometer: Sensitivity ... 0.9 µA/div., internal resistance ... Approx. 150 Ω, external critical damping resistance ... Approx. 800 Ω, period ... within 1.5 seconds.
Power Source: Three 1.5 V batteries (built-in).
Operating Temperature Range: 5 to 35℃.
Humidity Range: 85% max., relative humidity.
Outer Case: ABS resin.
Accessory supplied at no extra cost:
Carrying case.

0.1 mΩ to 110 Ω with four plugs and one measuring dial

2769
Portable Double Bridge

Model 2769 is a compact, portable Kelvin double bridge designed for measuring low resistance from 0.1 mΩ to 110 Ω with four multiplication plugs and one measuring dial. It has built-in standard resistors, bridge power source and high-sensitivity taut-band suspension system electronic DC galvanometer.

2769 Specifications

Measuring Range: 0.1 mΩ* to 110 Ω.
Measuring Dial: 1.00 to 11.00 Ω at × 1.
Multipliers: × 0.0001*, × 0.001, × 0.01, × 0.1, × 1, × 10 (plug-in system).
Min. Division: 0.005 mΩ at × 0.0001*, 0.05 mΩ at × 0.001, 0.5 mΩ at × 0.01, 5 mΩ at × 0.1, 50 mΩ at × 1, 0.5 Ω at × 10.
Accuracy: ± (0.05 Ω × multiplier + 0.01 mΩ)
Current Rating: 10 A at × 0.0001* (0.01 Ω), 3 A at × 0.001 (0.1 Ω), 1 A at × 0.01 (1 Ω). 0.3 A at × 0.1 (10 Ω), 0.1 A at × 1 (100 Ω), 0.01 A at × 10 (1,000 Ω).
Galvanometer: Built-in electronic DC galvanometer, voltage sensitivity ... approx. 20 µV/div.
sensitivity changeover;
G_0 ... (Input resistance: approx. 11 kΩ).
G_1 ... approx. 1/11 of G_0 sensitivity.
G_2 ... approx. 1/110 of G_0 sensitivity.
Operating Temperature Range: 5 to 35℃
Humidity Range: Less than 85%
Bridge Power Source: Tow 1.5 V batteries, External power source is also usable.
*Note: Standard Resistor (Model 2771) is required for measurement on 0.1 to 1.1 mΩ range at 0.0001 multiplier.

Precision Measuring Instruments

Portable Instruments


201314

205206

2011 to 2053
Portable Instruments

- Taut-band suspension system eliminates friction and provides strong resistance to shock impact.
- Stable performance for long term use.
- Products have been widely used over many years as an industry standard at various customers such as industries, power plants, research laboratories and schools, etc.

Line-up

DC Ammeters and Voltmeters	2011, 2012
AC Ammeters and Voltmeters	2013, 2014
Audio-frequency AC Voltmeters	2017
Frequency Meters	2038
Power Factor Meters	2039
Wattmeters	2041, 2042
Miniature DC Ammeters and Voltmeters	
	2051
Miniature AC Ammeters and Voltmeters	
	2052, 2053

Recorders and Data Loggers

SMARTDAC+ Paperless Recorder GP Series, Data Acquisition System GM

A Next-generation Data Acquisition and Control System with Excellent Operability and Expandability
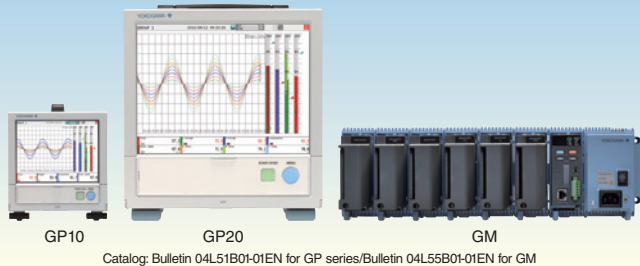
GP10　GP20　GM

Catalog: Bulletin 04L51B01-01EN for GP series/Bulletin 04L55B01-01EN for GM

Specifications

Model	GP10	GP20-1	GP20-2	GM10-1	GM10-2
Mounting	Desktop			Desktop, DIN rail, vertical panel mount (screws)	
Display (TFT color LCD)	5.7" (640 × 480 dots)	12.1" (800 × 600 dots)			
Touch screen	4-wire resistive touch screen, 2-point touch detection				
No. of connectable modules	3	10		10 (Up to 8 when GX90XA-10-T1 is mounted)	
Max. (with expansion units)	10	10	45	10	42
No. of connectable expansion (sub) units	6	6	6	6	6
Max. no. of I/O channels	100	100	500	100	500
No. of connectable WT communication units (/E2*)	8	16	16	16	16
No. of communication channels (/MC*)	50	300	500	300	500
No. of channels allocatable to WT (/E2*)	50	300	300	300	300
No. of mathematical channels (MT*)	50	100	200	100	200
No. of recording channels	500	500	1000	500	1000
Internal memory (flash)	500 MB	500 MB	1.2 GB	500 MB	1.2 GB
Communication interface	Ethernet, RS-232 (/C2*), RS-422/485 (/C3*), USB host (/UH*)			Ethernet, USB, RS-422/485 (/C3*), Bluetooth (/C8*)	
Rated supply voltage — AC model	100 to 240 VAC			100 to 240 VAC	
Rated supply voltage — DC model	12 VDC			12 to 28 VDC	
Dimensions (W × H × D) with modules mounted	144 × 168 × 248 (mm)	288 × 318 × 248 (mm)		Max. 638 × 137.7 × 146 (mm)	
Ambient temperature	0 to 50°C			-20 to 60°C (-20 to 50°C for some configurations)	

Measurement interval: 100/200/500 ms, 1/2/5 s
(Some intervals are not available depending on system configurations and modules.)
External storage media: 1 to 32 GB SD/SDHC memory card (a 1 GB card is included)
Format: FAT32 or FAT16
Data format: Binary or text
Ethernet: 10Base-T/100Base-TX (E-mail, FTP, Web, SNTP, etc.)
WT communication (/E2*): Supported models: WT1800, WT500, WT300
Supported communication: Ethernet
Communication interval: 500 ms, 1/2/5/10/15/20/30 s
USB host for GP (/UH*): Complies with USB 2.0
(USB memory; keyboard or mouse complying with HID Class Ver. 1.1)
USB communication for GM: Complies with USB 2.0 (recognized as a serial port by a PC)
Bluetooth for GM (/C8*): Bluetooth® Ver 2.1+EDR compliant, SPP (serial port profile),
Class 2 (communication range: approx. 10 m depending on the usage environment)
*: Option code

Expansion (sub) unit specifications		GX60	GM configuration
Construction		Desktop, vertical panel mount (screws)	Desktop, DIN rail, vertical panel mount (screws)
No. of connectable modules		6	6
Rated supply voltage	AC model	100 to 240 VAC	100 to 240 VAC
	DC model		12 to 28 VDC
Dimensions (W × H × D) with modules mounted		412.5 × 164.7 × 147 (mm)	Max. 438 × 137.7 × 146 (mm)
Ambient temperature		0 to 50°C	-20 to 60°C (-20 to 50°C for some configurations)

Smart user interface for intuitive operation (GP series)

Review historical data easily

Display digital values at any location

Zoom in/out horizontally and vertically

Monitoring and setting on a tablet (GM10)

Supports Bluetooth (option code/C8). There is no need to bring a PC to the site; you can use a tablet for setting and monitoring.

Multi-unit configuration by connecting expansion units

Supports measurements at up to 450 ch (GP20) and 420 ch (GM10)

Main unit　Up to 6 expansion (sub) units

LAN cable (CAT5 or later)

The maximum distance between units is 100 m.

Acquire data from power measuring instruments

The GP recorder and the GM system can acquire data from power measuring instruments (WT series power analyzers) without loss of fidelity and record and display with their own data (option codes /E2 and /MC).

Temperature　Ethernet　Power

I/O Modules and GX90EX (I/O expansion module)

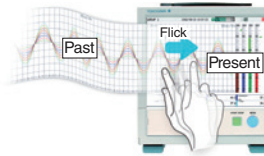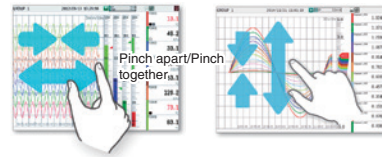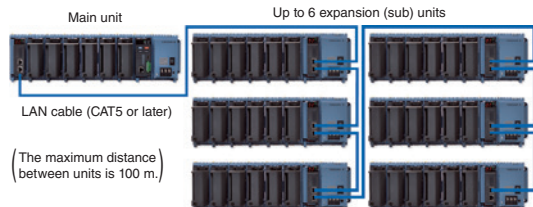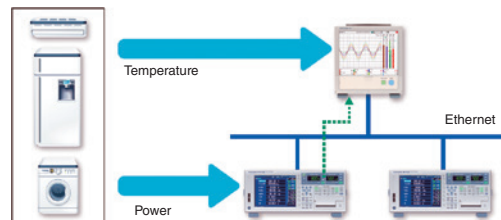| Model	Suffix code	Name	Specification/Application		Shortest cycle
GX90XA	-10-U2N-□N	Analog input module	10 ch, universal, SSR scanner type (RTD b-terminal common)	DCV: ±20/60/200 mV, 1/2/6/20/50 V, etc.	100 ms
	-10-L1N-□N		10 ch, low withstand voltage, DCV/TC/DI, SSR scanner type (isolated between channels)	TC: R/S/B/K/E/J/T/N, etc.	500 ms
	-10-T1N-□N		10 ch, DCV/TC/DI, electromagnetic relay scanner type (isolated between channels)	RTD: Pt100/JPt100, etc. DI: Voltage/contact	1 s
	-10-C1N-□N		10 ch, current (mA), SSR scanner type (isolated between channels)	Current (mA): 0 to 20/4 to 20 mA	100 ms
GX90YA	-04-C1N-□N	Analog output module	4 ch, current (mA), (isolated between channels)	Current (mA): 0 to 20/4 to 20 mA	100 ms
GX90XD	-16-11N-□N	Digital input module	16 ch (shared common)	Input: Open collector or non-voltage contact Application: Remote control or operation recording/pulse (125 Hz when filter is ON)	100 ms
GX90YD	-06-11N-3N	Digital output module	6 ch	Output: Form C relay (SPDT) Application: Alarm output	100 ms
GX90WD	-0806-01N-3N	Digital I/O module	Input 8 ch (shared common), output 6 ch		100 ms
GX90XP	-10-11N-□N	Pulse input module	10 ch (shared common)	DC Voltage, Open collector or non-voltage contact Application: Pulse (up to 20 kHz)	100 ms
GX90EX	-02-TP1N-N	I/O expansion module	Each of GP main body, GM main unit, and expansion (sub) unit can mount one GX90EX. (One GX90EX is provided with a GX60.)		

The "-□" in the suffix code represents the terminal form (-3: M3 screw terminal, -C: Clamp terminal).
Up to 10 modules of GX90YD and GX90WD can be mounted in a system. Each of the GP main body, GM main unit, and expansion (sub) unit can mount one GX90WD.
The /MT option (MATH) is required for GX/GP/GM main unit to perform pulse measurement/integration on GX90XD/GX90WD, or pulse integration on GX90XP.

For details, please contact Yokogawa Electric Corporation: Phone: (81)-422-52-7179 / E-mail: ns@cs.jp.yokogawa.com

Models, Suffix Codes, and Configurations

Please contact us for the prices.

Model	Suffix Code		Description	
GP10			Paperless recorder (portable type with a small display)	
GP20			Paperless recorder (portable type with a large display)	
Type	-1		Standard (max. measurement channels: 100)	
	-2		Large memory (max. measurement channels: 500) (GP20 only)	
Display Language	E		English, degF, DST (summer/winter time)	
Power Supply	1		100 VAC, 240 VAC	Power cord W cannot be specified
	2		12 VDC (GP10 only)	With power cord W only
Power Cord		D	Power cord UL/CSA standard	
		F	Power cord VDE standard	
		R	Power cord AS standard	
		Q	Power cord BS standard	
		H	Power cord GB standard	
		N	Power cord NBR standard	
		W	Screw terminal, power cord not included	
Optional Features		/AH	Aerospace heat treatment	
		/AS	Advanced security function (Part 11)	
		/BT	Multi-batch function	
		/C2	RS-232	Cannot be specified together.
		/C3	RS-422/485	
		/CG	Custom display	
		/D5	VGA output (only for GP20)	
		/E1	EtherNet/IP communication (PLC communication protocol)	
		/E2	WT communication	/MC option must be specified.
		/E3	OPC-UA server	
		/E4	SLMP communication (Mitsubishi PLC)	
		/FL	Fail output (1 point)	
		/LG	Log scale	
		/MC	Communication channel function	
		/MT	Mathematical function (with report function)	
		/UH	USB interface (2 host ports)	

Recorders can be shipped with specified I/O modules mounted (optional).

Model	Suffix Code		Description	
GM10			Data Acquisition Module for SMARTDAC+ GM	
Type	-1		Standard (Max. measurement channels: 100)	
	-2		Large memory (Max. measurement channels: 500)	
Area	E		General (temp. unit: Cel, degF)	
—		0	Always 0	
Optional Features		/AH	Aerospace heat treatment	
		/AS	Advanced security function (Part 11)	
		/BT	Multi-batch function	
		/C3	RS-422/485	
		/C8	Bluetooth	
		/E1	EtherNet/IP communication (PLC communication protocol)	
		/E2	WT communication	/MC option must be specified.
		/E3	OPC-UA server	
		/E4	SLMP communication (Mitsubishi PLC)	
		/LG	Log scale	
		/MC	Communication channel function	
		/MT	Mathematical function (with report function)	

Model	Suffix Code		Description	
GM90PS			Power Supply Module for SMARTDAC+ GM	
Type	-1		Always -1	
Region	N		General	
Supply Voltage		1	100 to 240 VAC	
		2	12 to 28 VDC	Power Supply Connection: W only
Power Supply Connection	D		Power inlet with UL/CSA cable	
	F		Power inlet with VDE cable	
	H		Power inlet with GB cable	
	N		Power inlet with NBR cable	
	Q		Power inlet with BS cable	
	R		Power inlet with AS cable	
	W		Screw terminal (without power cable)	
—		0	Always 0	

Model	Suffix Code	Description
GM90MB	-01N0	Module Base for SMARTDAC+ GM

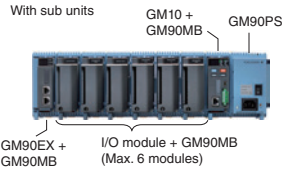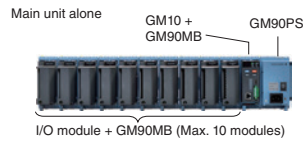| Model	Suffix Code		Description
GX60			I/O base unit
Type	-EX		I/O expansion
Area	N		General
Power Supply		1	100 VAC, 240 VAC
Power Cord		D	Power cord UL/CSA standard
		F	Power cord VDE standard
		R	Power cord AS standard
		Q	Power cord BS standard
		H	Power cord GB standard
		N	Power cord NBR standard
		W	Screw terminal (power cord not included)

GP main body configuration

Main body alone:
Up to 3 I/O modules
With expansion units:
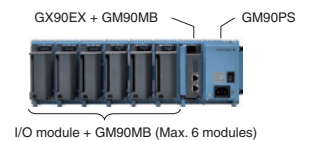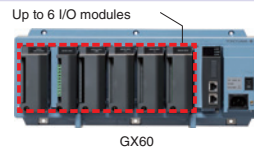Up to 2 I/O modules +
GX90EX

GP10 (rear view)

Main body alone:
Up to 10 I/O modules
With expansion units:
Up to 9 I/O modules +
GX90EX

GP20 (rear view)

GM main unit configuration

Main unit alone

GM10 + GM90MB   GM90PS

I/O module + GM90MB (Max. 10 modules)

With sub units

GM10 + GM90MB   GM90PS

GM90EX + GM90MB   I/O module + GM90MB (Max. 6 modules)

Expansion (sub) unit configuration

Up to 6 I/O modules

GX60

GX90EX + GM90MB   GM90PS

I/O module + GM90MB (Max. 6 modules)


SMARTDAC+ GA10 Data Logging Software

Monitors and records data from power meters, recorders, and data loggers

GA10 is a PC based software package that acquires data from multiple devices – such as power meters (WT series), recorders, and data loggers. Connected PCs can monitor real time and historical data, which can be stored on a PC hard drive.

GA10

Ethernet or Serial

Recorder   Data Logger   Power meter (WT series)

Aggregate data for monitoring!
Easy to read screen provides operator friendly monitoring

Save the data all together!
Acquired data can be stored on a PC.

Hard Drive

Excel format supported
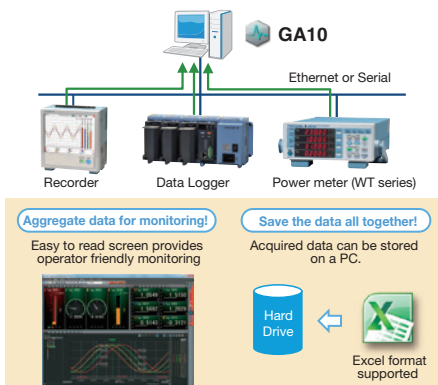
Multi-logging

Multi-logging function enables acquisition of multiple data at different timing. Data for each testing instrument can be processed separately.
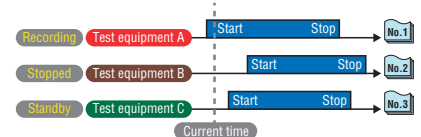
Reporting/printing

Reports can be printed automatically. The layout can be customized. The insertion of waveforms and images, and the creation of spreadsheets in PDF or Excel format are supported (suffix code /RP).

Specifications

Max. connectable devices:	100
Max connectable clients:	Unlimited (Connection with up to 32 units has been verified.)
Max. recording tags (channels):	Tags: 2000 ch
	Mathematical tags (option code/MT): 200 ch
Scan interval:	100 ms at shortest (depending on the scan interval of each instrument when using instrument time)

Models and Suffix Codes

Please contact us for the prices.

Data logging software

Model	Suffix Code		Description
GA10			Data Logging Software License
Number of Channels	-01		100 ch
	-02		200 ch
	-05		500 ch
	-10		1000 ch
	-20		2000 ch
Optional Features		/RP	Reporting/printing function
		/MT	Math function
		/UA	OPC-UA server function

* Channels can be added.

Additional monitoring PCs (clients)

Model	Suffix Code	Description
GA10CL		Client License for GA10
Number of Licenses	-01	1 license
	-05	5 licenses
	-10	10 licenses
	-50	50 licenses

Catalog: Bulletin 04L65B01-01EN

For details, please contact Yokogawa Electric Corporation: Phone: (81)-422-52-7179 / E-mail: ns@cs.jp.yokogawa.com   **http://www.smartdacplus.com/**

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