IWATSU

The Key to
Accuracy and Reliability

Experience the Ultimate Analog Purity.

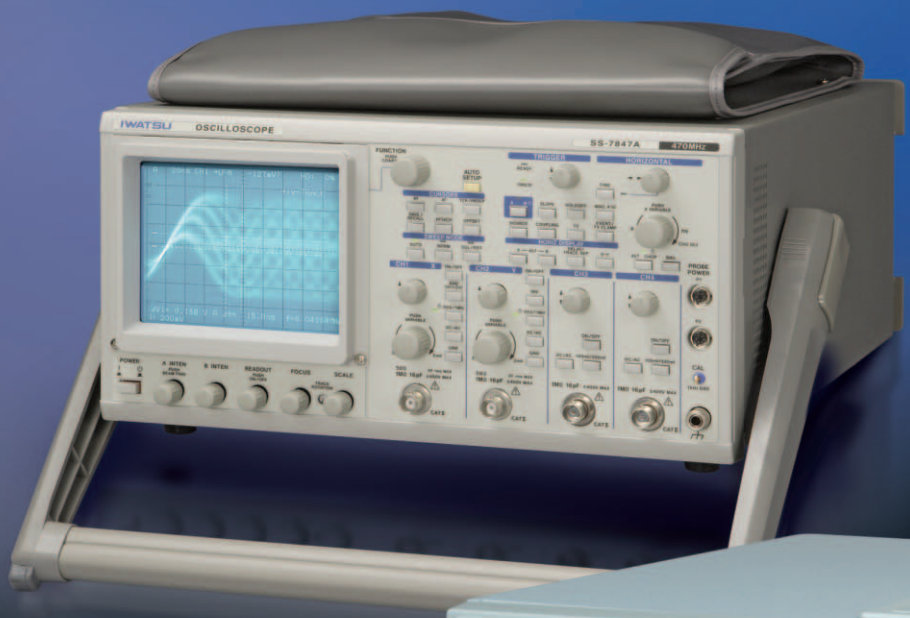
State-Of-The-Art Analog Oscilloscopes

Analog Storage Oscilloscope / TS-Series (1GHz / 600MHz)
Pure Analog Oscilloscope / SS-Series (20 - 470MHz)

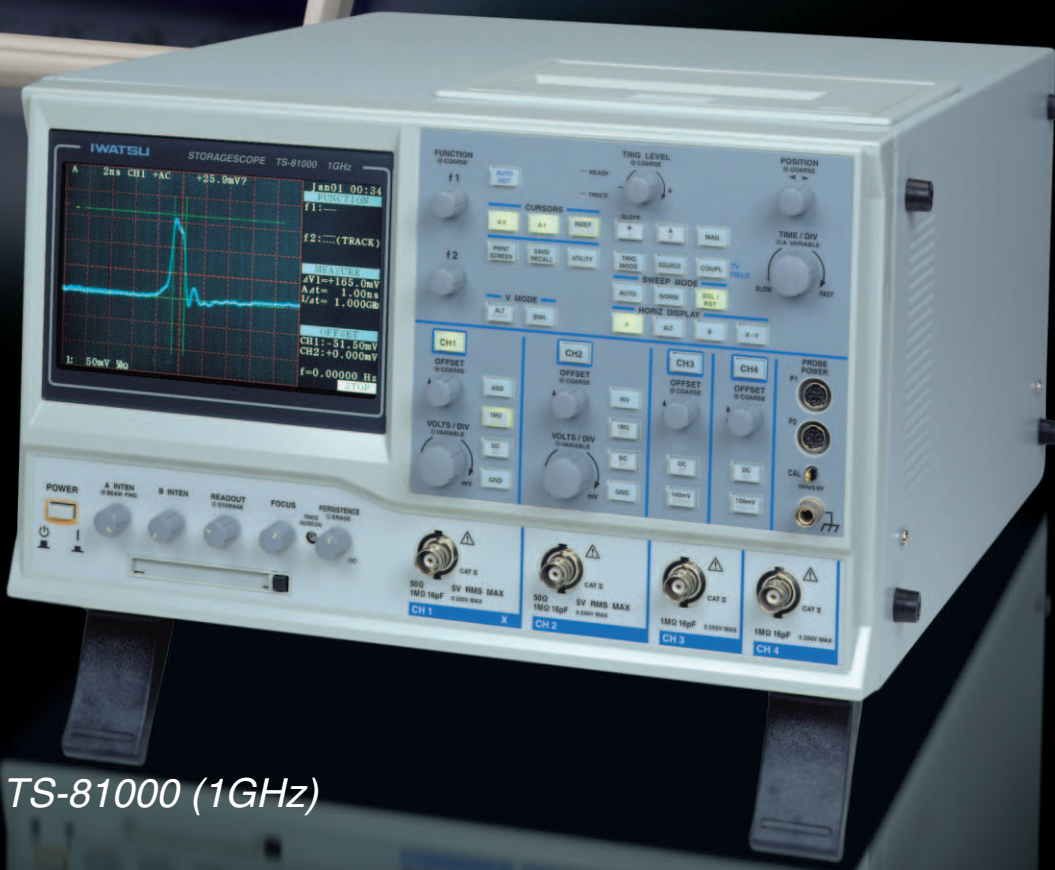
Unique Capabilities.
Ultimate Performance.
Ultra-High Precision.

Thanks to rapid advances in technology, accurate, real-time waveform analysis is more important than ever, especially in digital and IT applications. With its varying brightness and continuous acquisition, the analog scope brings a real-time statistical dimension to the viewed waveform that is simply not possible with digital storage oscilloscopes. Featuring ultra-high brightness and ultra-high speed response that surpasses even the latest digital oscilloscopes, Iwatsu's ultimate line of analog scopes make it possible to view natural waveforms across the widest possible frequency range with the highest-possible brightness in "real time". So give yourself the analog advantage with IWATSU. Nothing else measures up.

There's a world of waveforms that only Analog can capture!



SS-7847A (470MHz)



TS-81000 (1GHz)

Why Analog?

The Ultimate Analog Oscilloscope

In the more than a half a century since we introduced our first oscilloscopes, IWATSU has continued to hone its expertise in its quest to develop "the ultimate analog oscilloscope" – a scope capable of reproducing waveforms "as they are" across the broadest possible frequency spectrum. Today, the biggest problems facing engineers are that conventional analog oscilloscopes are simply not bright enough to effectively capture transient signal forms and digital oscilloscopes do not have a high enough sampling rate. To solve these problems, there is only one possible solution – the development of an analog oscilloscope with an ultra-wide bandwidth up to 1GHz. Now, IWATSU has developed just such a scope. Offering the reliability and durability that IWATSU's customers have come to expect, this is truly the ultimate analog oscilloscope.

Proven Quality and Traceability

In order to maintain the highest quality, IWATSU instruments are thoroughly tested at every stage of the production process – from design to manufacture – to ensure that they meet our stringent quality standards. IWATSU analog oscilloscopes are manufactured under a quality assurance system in a certified ISO9001 factory, and are also fully compliant with the Japanese national standards as well as international standards.

The Keys to Unlocking Ultimate Analog Performance

In addition to its expertise in high-frequency signal processing technology, IWATSU has a proven track record in the development of advanced device technologies. Leveraging this expertise has made it possible for us to come up with the ultimate design for an analog scope.

Extra-bright, extra-sharp, Japan-made, IWATSU-original CRT

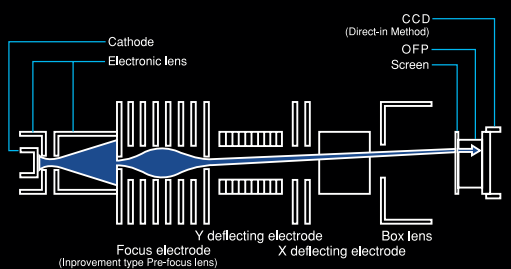
6-inch meshless CRT

A high-quality CRT is critical to the performance of analog oscilloscopes. To ensure the highest standards, Iwatsu designs and manufactures its own CRTs in its own factory. The Iwatsu-developed meshless box lens CRT allows waveforms to be observed as bright, sharp traces on the screen.

CCD scan converter tube

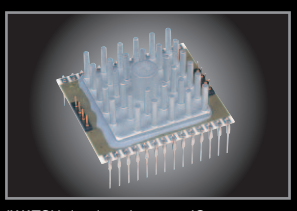
Based on our advanced CRT technology, Iwatsu developed a high-speed storage tube featuring mechanical reliability and durability. The newly-developed CCD (charge-coupled device) scan converter tube's simple design allows waveform information drawn on the screen at any sweep rate to be read directly via on optical fiber plate.

Cross-sectional block diagram



IWATSU-developed LSIs and ICs

The custom-made analog signal processing LSI used in the TS Series employs high-speed bipolar processing to ensure stable observation of wide-bandwidth signals, while a low-temperature sintering multi-layer ceramic package assures higher stability even in the high-frequency 1GHz range. All SS Series models use an original preamp IC for increased signal stability while a custom-designed gate array optimizes trigger and sweep control, as well as readout precision.



IWATSU-developed preamp IC

Specially-designed gate array with built-in CPU

Wide-Bandwidth Analog Oscilloscope Lineup

TS-Series Analog Storage Oscilloscopes

TS-81000/TS-80600

- DC - 1GHz/600MHz (50Ω) wide frequency bandwidth
- Fastest sweep of 200 ps/div
- Ultra-fast writing speed of 10 div/ns can capture 6 div amplitude, 500 ps rise time pulse
- DC - 500MHz (1 MΩ, passive probes are optional), 4 CH
- Sharp traces and high-resolution color display 800 x 480 dots
- Versatile output interface and documentation functions

<Built-in printer, LAN interface, ATA card slot, video output (NTSC/PAL)>

SS-Series Analog Oscilloscopes

SS-7847A/SS-7840A/SS-7830A

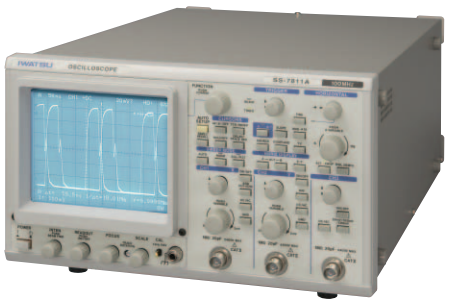
- DC - 470/400/300MHz, 4 CH, 10 traces
  [SS-7847A]
  * DC - 470MHz (-3 dB) at 5 mV - 50 mV/div
  * DC - 440MHz (-3 dB) at 2 mV, 100 mV - 5 V/div
- HDTV, NTSC, PAL/SECAM-compatible full TV triggering with clamping function
- ±2% accuracy for vertical axis sensitivity
- Bright and sharp display with 20 kV accelerating voltage CRT (Japan made)
- Maximum sensitivity of 2 mV/div
- Input offset function
- 6-digit frequency counter
- Quick auto setup
- Save/recall of up to 256 panel settings

SS-7821A

- DC - 200MHz, 3 CH, 8 traces
- CH3 sensitivities of 50 mV, 100 mV, 500 mV/div
- Save/recall of up to 32 panel settings
- Quick auto setup
- ±2% accuracy for vertical axis sensitivity
- Bright and sharp display with 16 kV accelerating voltage CRT (Japan made)
- Cursor measurement/panel settings readout function
- Full TV triggering with field and line selection, HDTV
- CH2 output
- Maximum sensitivity of 2 mV/div, fastest sweep of 1 ns/div
- 5-digit frequency counter

SS-7811A/SS-7810A

- DC - 100MHz, 3 CH, 8 traces
- CH3 sensitivities of 50 mV, 100 mV, 500 mV/div
- Save/recall of up to 32 panel settings (SS-7811A only)
- Quick auto setup
- ±2% accuracy for vertical axis sensitivity
- Bright and sharp display with 16 kV accelerating voltage CRT (Japan made)
- Cursor measurement/panel settings readout function
- Full TV triggering with field and line selection, HDTV
- CH2 output
- Maximum sensitivity of 2 mV/div, fastest sweep of 1 ns/div
- 5-digit frequency counter



SS-7805A/SS-7804A

- DC - 50MHz, 2 CH + ext. trigger input, 3 traces (SS-7805A) / DC - 40MHz, 2 CH + ext. trigger input, 3 traces (SS-7804A)
- Cursor measurement function
- CH2 output
- ±2% accuracy for vertical axis sensitivity
- Bright and sharp display with 16 kV accelerating voltage CRT (Japan made)
- Full TV triggering with TV line selection capability
- 5-digit frequency counter

SS-7802A

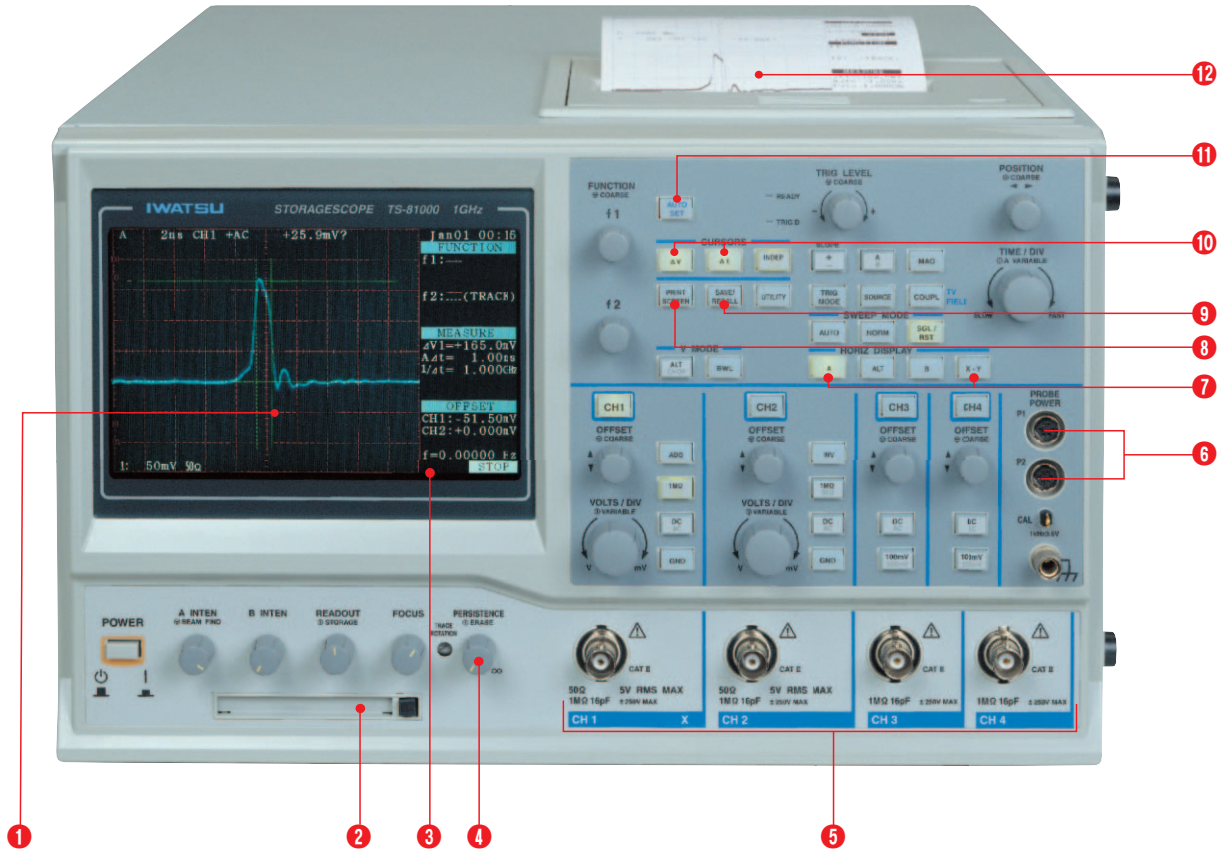
- DC - 20MHz, 2 CH + ext. trigger input, 2 traces
- Cursor measurement function
- ±2% accuracy for vertical axis sensitivity
- Full TV triggering with TV line selection capability
- 5-digit frequency counter
- Single-sweep function

See the difference.

— The only analog oscilloscopes to cross over into the gigahertz domain.

It is only fitting that IWATSU, the world's leading manufacturer of analog oscilloscopes, should now introduce the world's first ultra-wide bandwidth analog storage oscilloscopes. Featuring ultra-high brightness and ultra-high-speed writing, the TS-Series enables you to observe analog waveforms in real time with ultimate precision. The world's only analog 1-GHz oscilloscopes, the TS series makes it possible to capture waveforms that are out of the range of any other oscilloscopes – whether analog or digital.

TS-81000/80600



1 High-resolution, 5.8-inch color LCD (800 x 480 dpi)
Provides a sharp, bright waveform display, with color assignment from 7 colors (white, red, blue, yellow, magenta, cyan, green) for persistence and stored waveforms.

2 PC Card slot
For storage of display image and setup data.
* Please visit our Web site, and confirm our recommendation for the PCMCIA card.
http://www.iti.iwatsu.co.jp/e/

3 Built-in 6-digit frequency counter
(2Hz to 1GHz/600MHz, accuracy ±0.01%)

4 Persistence
Persistence time selectable from 0 to infinity. Color display also available.

5 1GHz maximum frequency bandwidth
1GHz/600MHz frequency bandwidth for CH1/CH2; 500MHz for CH3/CH4. (SS-101R passive probe is optionally available)

6 2 power supply connectors for active probes
FET probes SFP-5A (1GHz)/SFP-4A (800MHz), current probes SS-250 (100MHz)/SS-240A (50MHz) are available as an option.

7 Dual delay
Two delay times provided for B sweeps, allowing delay expansion at two positions.

8 Print screen
Hard copy to the built-in printer, ATA card and Network

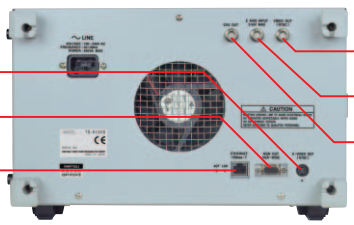
9 Save/Recall
Up to 256 panel setups and six reference waveforms can be save/recalled.

10 Cursor measurement
ΔV or Δt selectable. Simultaneous 4-cursors measurement also available.

11 Quick auto setup
Automatically displays the input waveform in the optimum range. Applicable to both CH1 and CH2 with a frequency range from 50Hz to 200MHz.

12 Built-in printer
Prints out the hard copy of displayed waveform. (Printer speed max. 10 mm/sec)

Rear panel



Ultimate in performance, Ultimate in operability, Ultimate in versatility

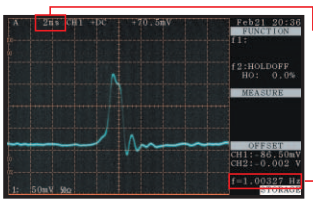
Major features of TS-Series

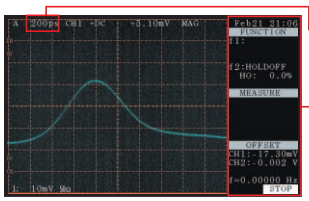
● 1GHz/600MHz 4CH wide frequency bandwidth analog oscilloscope

World's widest frequency bandwidth of DC - 1GHz/ TS-81000, DC - 600MHz/TS-80600 (50 Ω), DC - 500MHz (1 MΩ) with probe.

● Low-temperature Polycrystalline Silicon high-resolution color LCD (800 x 480 dots)

The high-resolution display shows cursor measurement status and other settings outside of waveform area, so there's nothing in the way when you're viewing displayed waveforms.





● Built-in thermal printer and versatile output interface

A built-in thermal printer and LAN interface (10Base-T) are provided so you can output measured data directly or transmit it through a network. An ATA card slot is provided so you can save display images and setting conditions to a card. Video capture/recording and monitoring are available with NTSC (with S-Video)/RGB signal output.

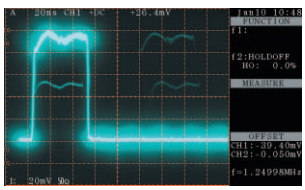
● Ultra-high writing speed storage 10div/ns

With the waveform storage function, observation of a high-speed, single-shot waveform is easy. TS-80000 Series can store a high-speed, single-shot waveform even below the maximum range of 200 ps/div (TS-81000), 500 ps/div (TS-80600).

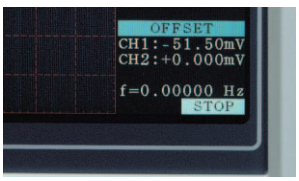
[Brightness is more than 1,000 times greater than on our previous analog models.]

● Persistence function allows you to overwrite waveforms

This convenient function is useful for comparing waveforms, observing single-shot waveforms, as well as for observing low-speed waveforms in the X-Y mode. It is especially effective at capturing rarely generated noises and jitter in repetitive signals.

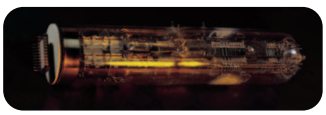


● High accuracy 6-digit frequency counter



● Burn-free and shock-free

Since the waveform is stored by the CCD, CRT phosphors are protected from burning. Durable construction provides excellent shock resistance.



Enhanced documentation functions

Built-in thermal printer, LAN environment, personal computers, external printers, video recorders, monitors, ATA cards, etc. Various output interfaces are provided.

- Remote control through LAN
Remote control available through LAN*.
Delivers video signal (NTSC/VGA) via network.
Real time waveform monitor is also available.

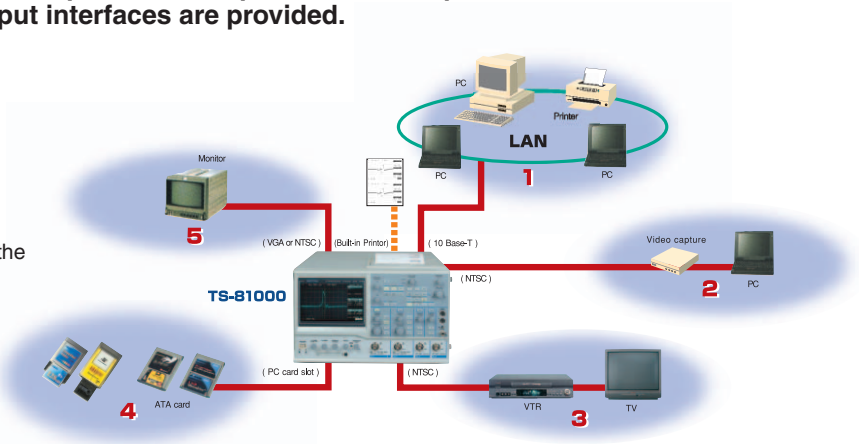
* Please visit our web site to download the software.
http://www.iti.iwatsu.co.jp/

- Network printer support
Hard copy to network printers, available by using the "Network Printer Gateway" software*.

* Please visit our web site to download the software.
http://www.iti.iwatsu.co.jp/

- NTSC output
Displayed waveforms can be stored as Moving Picture files using an optional video capture unit.

- Image file saving (BMP/JPEG)
It is possible to save displayed waveforms to an ATA card.

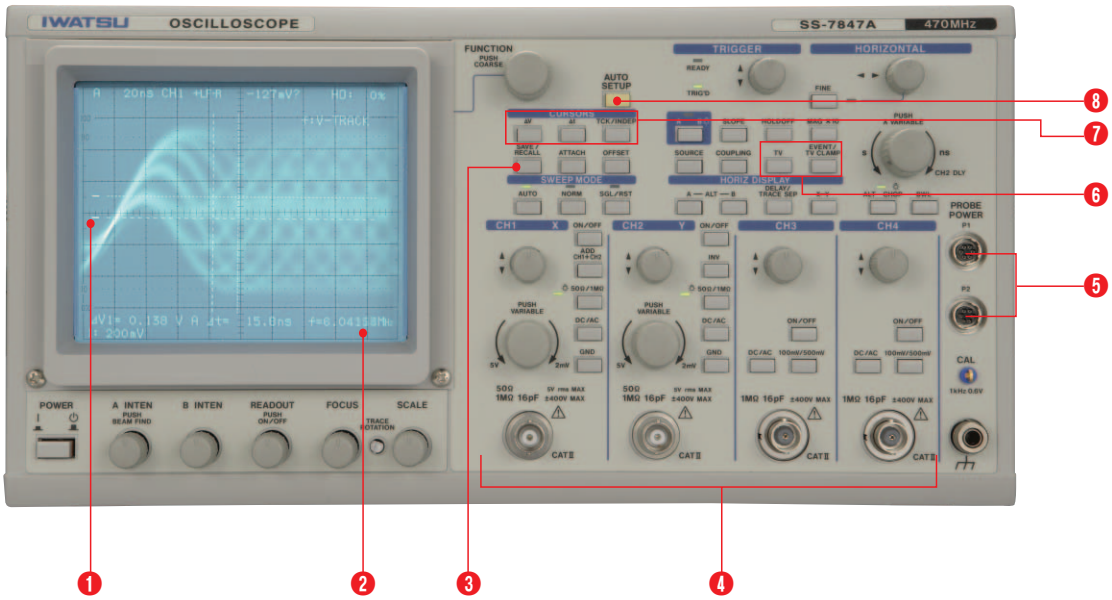


SS-Series Analog Oscilloscopes

Touch the reliability.
— Uncompromised performance you can count on.

With four channels with wide bandwidths up to 470MHz, the SS-Series oscilloscopes afford the highest level of performance in their class. Boasting Iwatsu-developed meshless CRT providing bright and clear waveform observation as well as comprehensive ergonomically designed controls and switches, the SS-Series offers the ultimate in versatility for your electronic testing applications. Now experience the ultimate in reliability.

SS-7847A/7840A/7830A



1 High-brightness CRT (Japan made)
6-inch, meshless CRT with internal graticule displays waveforms with bright and sharp traces.

2 High-accuracy 6-digit frequency counter
A frequency counter with ±0.0025% accuracy is built in.

3 Save/recall function
Up to 256 different setups with 12-character comments can be saved and recalled.

4 Wide frequency bandwidth of DC - 470MHz (SS-7847A)/400MHz (SS-7840A)/300MHz (SS-7830A)
CH1/CH2 sensitivity: 2 mV/div; CH3/CH4: 100 mV/div or 500 mV/div selectable (1 MΩ/50 Ω)

5 Power supply output terminals for FET or current probe
Optional SFP-5A/4A (DC - 1GHz/800MHz) FET probe and SS-250 (100MHz)/SS-240A (50MHz) current probe can be used.

6 Powerful TV triggering
TV-H, ODD, EVEN or BOTH fields can be selected. Line selection is possible from NTSC: 1 - 525H, PAL (SECAM): 1 - 625 and HDTV: 1 - 1125.

7 Direct selection of the cursor measurement
Alternates Δt and ΔV. Up to four cursors can be displayed simultaneously.

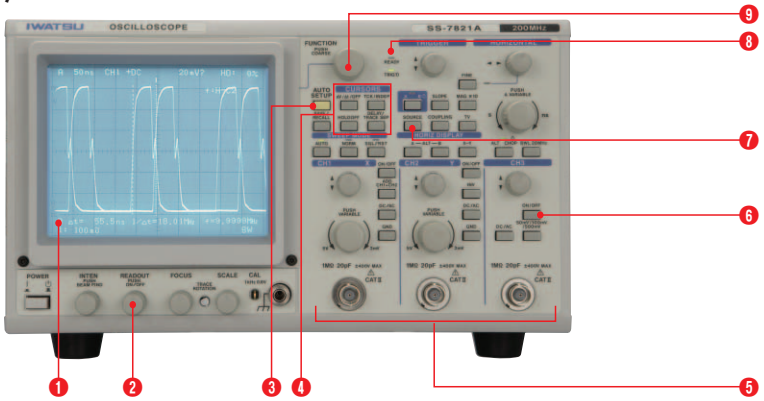
8 Quick auto setup
Automatically displays an optimum range for input waveform (CH1/CH2)

Rear panel

1 External intensity modulation signal input
0.5 Vp-p, DC - 5MHz, ±40 V

2 CH2 signal output
20 mV/div, DC - 200MHz/50 Ω

SS-7821A/7811A



1 Bright, sharp CRT (Japan made)

2 Readout cancel button

3 Quick auto setup

4 Cursor function select buttons

5 Inputs with probe sensor function (with SS-103R, SS-0130R)

6 Sensitivity select switch (50 mV/div, 100 mV/div, 500 mV/div)

7 Trigger source (VERT, CH1, CH2, CH3, LINE)

8 Trigger status indicators

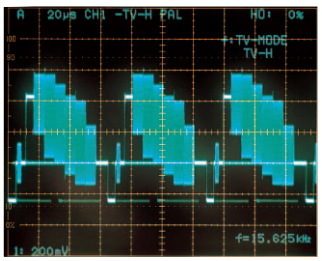
9 Multifunction control knob

The optimal integration of high precision and excellent operability

Major features of SS-Series

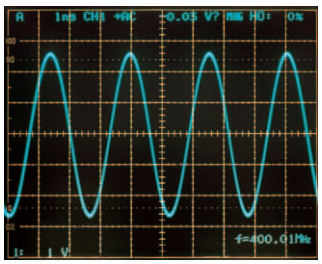
● Quick auto setup (CH1, CH2)
SS-7847A/7840A/7830A/7821A/7811A/7810A

Input signals are quickly shown in the optimum range.



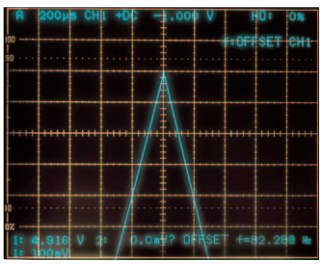
● Frequency counter
All models
6-digit: SS-7847A/7840A/7830A,
5-digit: SS-7821A/7811A/7805A/7804A/7802A

The built-in 6/5-digit counter is accurate within a range of ±0.0025% / ±0.01% and can measure frequencies between 2Hz and 400MHz. Also shows the trigger signal frequencies.



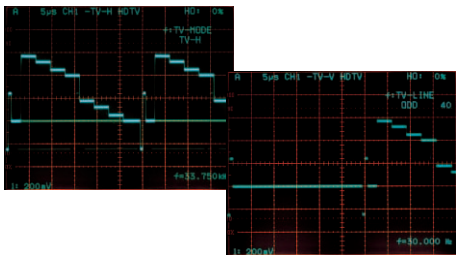
● DC offset function (CH1, CH2)
SS-7847A/7840A/7830A

Convenient when you need to observe a signal with very small amplitude superimposed over a signal with large amplitude. Especially useful when observing high-frequency noise superimposed over video signals or ripple of high-voltage DC power supply.



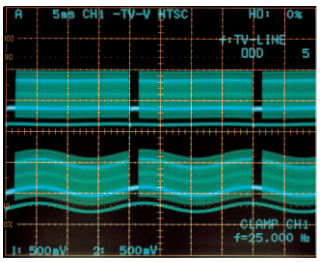
● TV/HDTV triggering
TV: All models, HDTV: SS-7847A/7840A/7830A/7821A/7811A/7810A

TV-V field (EVEN, ODD, BOTH) and line selection is possible for HDTV, NTSC, PAL/SECAM, meeting the needs of engineers who want to observe HDTV signals without any attenuation (even as low as 0.1 dB).



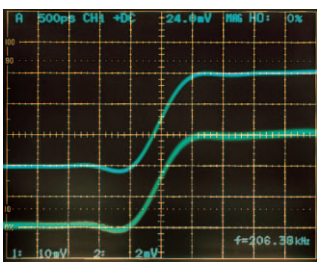
● Pedestal clamp function (CH1, CH2) for TV signals
SS-7847A/7840A/7830A

The amplitude of video signals varies dynamically depending on the picture. This function ensures stable observation.



● CH2 skew adjust
SS-7847A/7840A/7830A

The delay time of CH2 in response to CH1 can be adjusted with a range of 1 ns. Therefore, accurate measurement is possible by compensating for the delay time difference between the probes.



● DC - 470MHz/400MHz/300MHz (all channels), high-sensitivity of 2 mV/div (CH1, CH2)A
DC - 470MHz (SS-7847A)/DC - 400MHz (SS-7840A)/ DC - 300MHz (SS-7830A) for all channels. CH1 and CH2 have max. sensitivity of 2 mV/div, ensuring extremely high-quality waveforms.

● IWATSU-developed bright, sharp CRT (Japan made)
SS-7847A/7840A/7830A/7821A/7811A/7810A/7805A/7804A

Features superlative brightness and sharpness that even allows you to easily observe signals with slow repetition and a high-speed rise time transition.

● IWATSU-developed preamp IC for improved signal stability
All models

To increase signal stability, a preamp circuit has been provided for the IC.

● Panel settings save/recall function
SS-7847A/7840A/7830A (SS-7821A/7811A: up to 32 setups)

Up to 256 panel setups can be saved together with comments (up to 12 characters).

● Event trigger
SS-7847A/7840A/7830A

In addition to the event delay trigger which allows you to trigger events a specified number of times (1 - 65535), there's also a burst trigger mode which allows you to easily trigger a burst signal — something that is difficult to do with an ordinary oscilloscope.

● Probe power supply provided as standard
SS-7847A/7840A/7830A

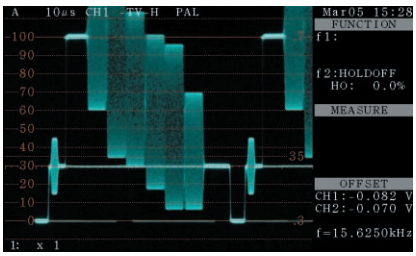
Two probe power supplies are provided for FET probe.
The DC offset voltage of each FET probe can be controlled (with DC offset control).

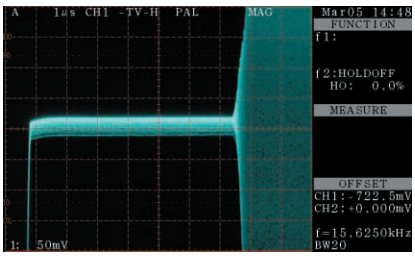
Waveform Examples

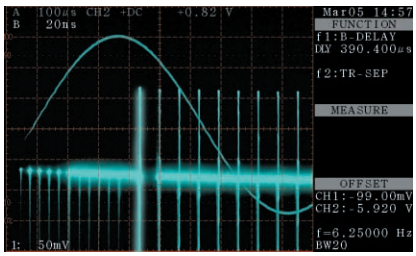
TS-Series: for observation of complex, intermittent signals

● Video signals

The TS-Series accurately displays details of video signals. It can clearly show slow-repetition video signals with ultra-high brightness via the persistence function. The TS-Series has suitable functions for video signals including an HDTV trigger, two types of video scales, a TV clamp, 4-field selector and dual delay.

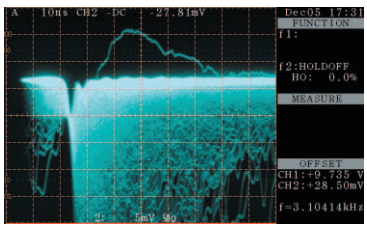






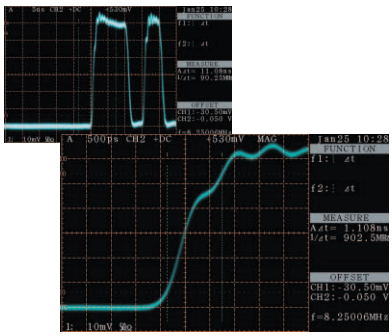
● Photo multiplier tube

Output signal voltage variation detected by the photo multiplier tube.
The TS-Series can display clusters of irregular single-shot signals at ultra-fast speeds and displayed in real time with slight brightness differences.



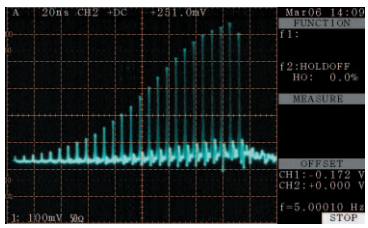
● Blue laser diode

The read/write signals of laser diodes are getting faster as the density of optical storage media increases.
The TS-Series can provide solutions for engineers due to its 1GHz/600MHz frequency bandwidth - the widest in the world.



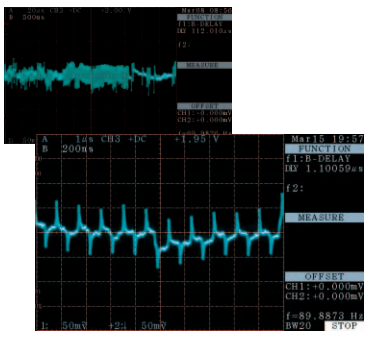
● High power laser waveform

High-brightness analog oscilloscopes are needed for continuous low-repetition rate pulse signals. The TS-Series can provide a new safety evaluation method as a high-power laser with video output and LAN interface.



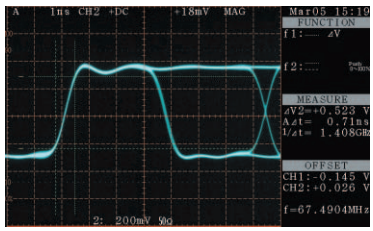
● HDD magnetic head measurement

Output waveforms from defective sectors on a hard disk where errors have occurred are magnified for observation.



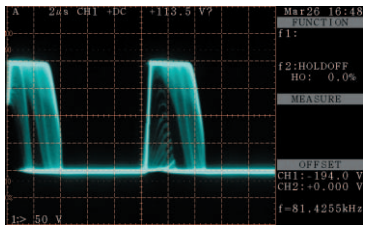
● Large-capacity transmission

Digitized video data is sent via a high-speed serial transmission line.
The TS-81000 accurately displays subtle variations, such as overshoot of serial data signal waveforms.



● Evaluation of power-factor improvement circuit (Power supply)

The TS-Series displays jitter-contained waveforms with brightness variations in real time.

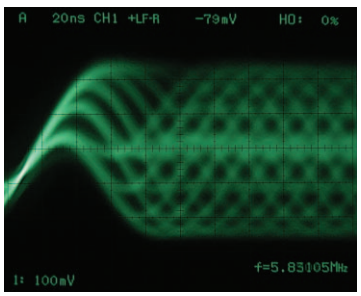


SS-Series: indispensable for a wide range of requirements

● Eye-patterns in optical disc manufacturing process

When evaluating optical discs such as Blu-ray Discs, HD-DVDs, CDs or DVDs, eye patterns need to be observed. With this analog oscilloscope, accurate observation of the eye patterns of high-speed and high-density media is easily possible.

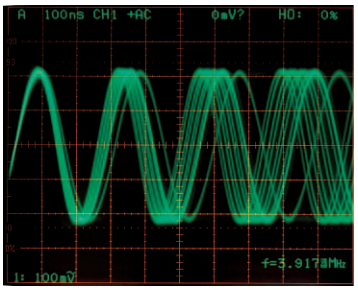
* Blu-ray Disc signal eye pattern waveform



● Video head frequency modulation signals

Input and output signals to/from video heads are frequency modulation waveforms. The voltage of recorded or read-out signals to/from the video heads is specified. To observe these FM signals, an analog oscilloscope is indispensable.

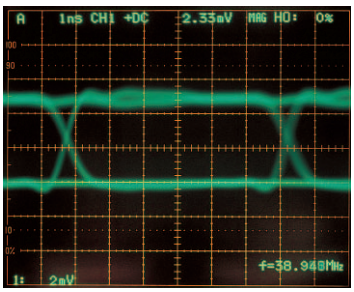
* VHS deck head signal waveform



● ATM 155 Mbps signal eye patterns

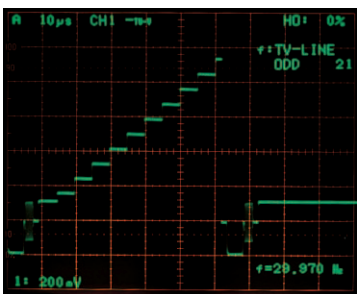
The standard transmission rate for most networked communication systems is 155 Mbps (STM-1). The amount of jitter can be estimated by observing the signal waveform with the eye pattern and following the pulse mask standard.

* 155 Mbps signal eye pattern waveform measured with SS-7847A (DC - 470MHz)



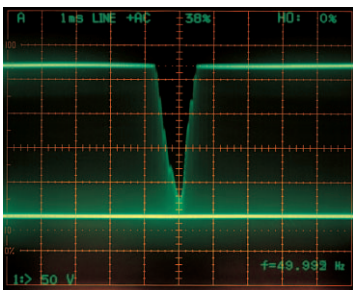
● Full TV triggering

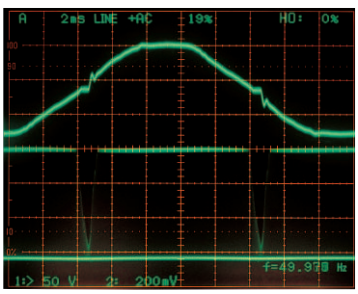
TV-V (ODD field, EVEN field, BOTH fields) and TV-H are available. Line number selection in TV-V mode is useful for detailed evaluation of video signals. HDTV can be selected, as well as NTSC or PAL/SECAM (except for SS-7805A/ 7804A/7802A)



● Switching power supply measurement

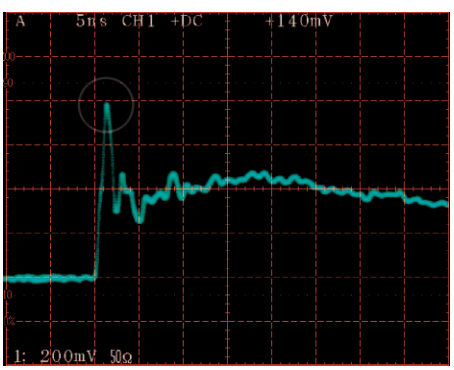
A switching power supply unit with a higher harmonics measure switches the voltage of a commercial power supply at high speed. In terms of circuit operation, switching stops at the zero cross of the AC power supply. To observe this condition, an analog oscilloscope is required. Analog oscilloscopes are also superior when simultaneously observing voltage and current waveforms. In addition, when magnifying a switching waveform for observation on an analog oscilloscope, no complicated operations are required to trigger the waveform.



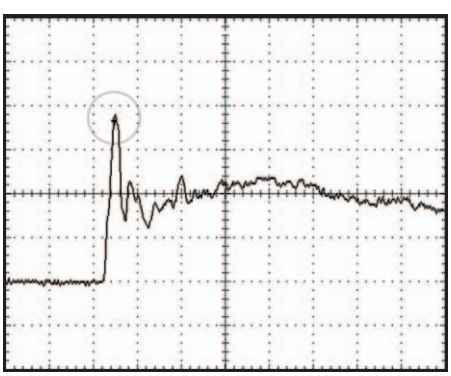


Comparing waveform observation of analog and digital oscilloscopes

The following shows a comparison of analog and digital waveforms, using calibration waveforms from the EMC static electricity discharging immunity testing equipment. The figure on the left shows a waveform captured by an analog storage oscilloscope, while the figure on the right shows a waveform captured by a digital oscilloscope with a 10 GS/s high-speed sampling frequency. When compared to the analog oscilloscope (on the left), you may see an apparent difference in peak level in the first pulse section. The observed object is a signal with an amplitude of approximately 800 mV. The peak signal is not captured by the digital oscilloscope, possibly because correct observation is not possible with the digital oscilloscope due to insufficient sampling speed, depending on the waveforms being observed. Although the static electricity discharging test is just an example, it shows that the TS-Series Analog Storage Oscilloscope can easily capture extra-high speed signals of this type and display the captured waveform “as it is” in real time.



Captured by analog storage oscilloscope



Captured by digital oscilloscope (10 GS/s)

Accessories

— A wide range of options for maximum efficiency and optimum performance

TS-Series and SS-Series Options

Probes

■ Passive Probes

- **SS-101R**
  Bandwidth: DC – 500MHz
  Input capacitance: 12 ± 2 pF
  Input R: 10 MΩ
  Attenuation: 10:1
  Cable length (approx.): 1.2 m
  *500MHz is guaranteed when used in combination with the TS-80000 Series.

- **SS-103R**
  Bandwidth: DC – 200MHz
  Input capacitance: 15 ± 2 pF
  Input R: 10 MΩ
  Attenuation: 10:1
  Cable length (approx.): 1.2 m

- **SS-0130R**
  Bandwidth: DC – 150MHz
  Input capacitance: 12.5 ± 2 pF
  Input R: 10 MΩ
  Attenuation: 10:1
  Cable length (approx.): 1.5 m

- **SS-0110**
  Bandwidth: DC - 60/6MHz
  Input capacitance: 13 ±2 pF/200 pF or less
  Input R: 10 MΩ/1 MΩ
  Attenuation: 10:1/1:1 (Switchable)
  Cable length: 1.5 m

■ FET Probes

- **SFP-5A**
  Bandwidth: DC - 1GHz
  Input capacitance: 1.9pF
  Input R: 1MΩ
  Attenuation: 10:1
  Cable length (approx.): 1.5 m

- **SFP-4A**
  Bandwidth: DC – 800MHz
  Input capacitance: 2.15 pF
  Input R: 1 MΩ
  Attenuation: 10:1
  Cable length (approx.): 1.5 m

■ Current Probes

- **SS-250**
  DC – 100MHz clamp type
  Probe MAX
  30A rms

- **SS-240A**
  DC – 50MHz clamp type
  Probe MAX
  30A rms

■ High-voltage Probes

- **HV-P60**
  2000:1, 60 kV (pulse 80 kV), 50MHz
- **HV-P30**
  1000:1, 30 kV (pulse 40 kV), 50MHz

Mini Clips

■ Clips

- **HP-2 (10-color set)**
  Corresponding pitch: 0.8 mm - 2.54 mm
- **FP-7L (10 sets)**
  Corresponding pitch: 0.3 mm - 1.25 mm
- **FP-2S (10 sets)**
  Corresponding pitch: 0.2 mm - 0.5 mm
- **FP-7 (10 sets)**
  Corresponding pitch: 0.3 mm - 1.25 mm
- **GR-CF (One)**

Scope Wagons

- **SK-2101A**
  Carrying capacity: Max. 17 kg or less
- **SK-201**
  Metal fitting kit for retaining the TS Series Oscilloscope.

Thermal Printer Paper

- **TF50KS-E2**
  112 mm wide, 25 m long, 10-roll set

* One roll is supplied as standard with the main unit.

Coaxial Parts

- **Termination BB-50M1**
  DC – 1GHz
  Impedance: 50 Ω
  Power rating: 0.5 W (Ave.), 500 W (Peak)

- **Termination BB-50M10**
  DC – 300MHz
  Impedance: 50 Ω
  Power rating: 5 W (Ave.)

- **Divider B-50D3**
  DC – 3GHz
  Impedance: 50 Ω
  Power rating: 2 W (Ave.)
  Number of terminals: 3

- **Coaxial attenuator AA-20B**
  DC – 2GHz
  Impedance: 50 Ω
  Attenuation: 20 dB
  Power rating: 0.5 W (Ave.)

- **Coaxial cable BB-120C**
  Length: 120 cm (4 ft)
  Impedance: 50 Ω
  Connectors: BNC type

- **Coaxial cable BB-150C**
  Length: 150 cm (4.75 ft)
  Impedance: 50 Ω
  Connectors: BNC type

TS-Series Specifications

	TS-81000	TS-80600
Display section		
Type	5.8-inch color LCD (800 x 480 dots) 8 div x 10 div (60 dots/div, Graticule selectable)	
Storage CRT		
Type	2-inch dia., CCD scan converter tube (380,000 pixels)	
Persistence characteristics		
Fastest writing speed	10 div/ns	
Persistence time	Variable, infinite persistence	
Vertical deflection system (Y axis)		
Mode	CH1, CH2, CH3, CH4, ADD (CH1±CH2), ALT/CHOP (555kHz±1%)	
CH1, CH2		
Sensitivity range	50 Ω: 5 mV/div - 1 V/div 8 steps (1-2-5) 1 MΩ: 5 mV - 5 V/div 10 steps (1-2-5)	
Variable	Adjustable less than 1/2.5	
Accuracy	±2%	
Frequency bandwidth (-3 dB) 50 Ω	DC - 1GHz (10 mV - 1 V/div) DC - 500MHz (5 mV - 9.9 mV/div)	DC - 600MHz (10 mV - 1 V/div) DC - 500MHz (5 mV - 9.9 mV/div)
Frequency bandwidth (-3 dB) 1 MΩ	DC - 500MHz (10 mV - 5 V/div) at the tip of SS-101R probe DC - 350MHz (5 mV - 9.9 mV) at the tip of SS-101R probe * Passive probe Model SS-101R is optional	
Rise time	350 ps (50 Ω 10 mV - 1 V/div)	583 ps (50 Ω 10 mV - 1 V/div)
	(Calculated from freq. bandwidth x rise time = 0.35)	
Offset voltage	5 mV - 50 mV/div : ±1 V 100 mV - 50 mV /div : ±10 V 1 V - 5 V/div : ±100 V	
Offset accuracy	±(1.5% + 0.5% of full scale + 1 mV)	
Input RC	50 Ω: ±2% 1 MΩ : ±1% // 16 pF (DC 1 MΩ 5 mV - 5 V/div, AC 1 MΩ 100 mV - 5V/div)	
Input coupling	DC 1 MΩ, DC 1 MΩ, AC 1 MΩ, GND	
Max. input voltage	50 Ω: 5 Vrms 1 MΩ : 250 Vmax (DC + Peak AC, 5kHz or less)	
CH3, CH4		
Sensitivity range	100 mV/div, 500 mV/div	
Accuracy	±2%	
Frequency bandwidth (-3 dB)	DC - 500MHz	
Offset voltage	100 mV/div : ±1 V 500 mV/div : ±5 V	
Input RC	1 MΩ: ±1% // 16 pF	
Input coupling	DC, AC	
Max. input voltage	1 MΩ: ±250 Vmax (DC + Peak AC, 5kHz or less)	
ADD		
Frequency bandwidth (-3 dB)	DC - 1GHz (10 mV - 1 V/div) at 50 Ω input	DC - 600MHz (10 mV - 1 V/div) at 50 Ω input
Lower cutoff for AC couple	10Hz (-3 dB)	
Bandwidth limit	20MHz, 200MHz	
CH skew	Adjustable CH1 to CH4 (1 MΩ)	
Probe sense	10:1, 100:1 detection	
Signal delay time	250 ns or more	
Trace separation	more than 4 div	
Triggering		
A triggering		
Frequency	DC - 1GHz	DC - 600MHz
Signal sources	CH1, CH2, CH3, CH4, LINE	
Coupling	DC: DC - fmax AC: 100Hz - fmax HF-REJ: attenuated at 10kHz or more LF-REJ: attenuated at 10kHz or less	
Slope	+, –	
Sensitivity	DC - 10MHz: 0.4 div; DC - 10MHz: 0.4 div - 100MHz: 1.0 div; - 100MHz: 1.0 div - fmax: 2.0 div; - fmax: 2.0 div 50 Ω 5 mV/div - 9.9 mV/div fmax: 500MHz; 50 Ω 5 mV/div - 9.9 mV/div fmax: 500MHz 50 Ω 10 mV/div - 1 V/div fmax: 1GHz; 50 Ω 10 mV/div - 1 V/div fmax: 600MHz	
B triggering		
Frequency	DC - 500MHz	
Signal sources	CH1, CH2, CH3, CH4	
Coupling	DC: DC - 500MHz AC: 100Hz - 500MHz HF-REJ: attenuated at 10kHz or more LF-REJ: attenuated at 10kHz or less	
Slope	+, –	
Sensitivity	DC - 10MHz: 0.4 div; DC - 10MHz: 0.4 div - 100MHz: 1.0 div; - 100MHz: 1.0 div - 500MHz: 2.0 div; - 500MHz: 2.0 div	
TV triggering	NTSC, PAL, CUSTOM Line select (1 to 3000), Field select (1, 2, 4, 8) CUSTOM (include HDTV)	
Slope	+, –	
Sensitivity	1.5 - 8.0 div TV clamp available	
Event trigger		
Count mode	Range: 1 - 65535 Max count frequency: 50MHz	
Burst mode	Range: 0.15 µs - 9.99 s	
Horizontal deflection system (Y axis)		
Horizontal display	A, ALT, B, X-Y	
A sweep		
Sweep mode	AUTO, NORMAL, SINGLE	
Max. sweep rate	200 ps/div	500 ps/div
Range	2 ns - 200 ms/div 25 steps, 1-2-5	5 ns - 200 ms/div 24 steps, 1-2-5
Variable	2 ns - 600 ms/div	5 ns - 600 ms/div
Accuracy I(*1)	±2% (5 ns - 200 ms/div) over center 8 div ±3% (2 ns) over center 8 div	
Accuracy II(*1)	±5% (5 ns - 200 ms/div) any 2 div within center 8 div ±6% (2 ns) over center 8 div (*1) 20 ns or 1 div for the beginning of the sweep and 20 ns for the end of sweep should be excluded. Add 1% when VARIABLE is ON.	

	TS-81000	TS-80600
B sweep		
Delay method	Triggered delay (TRIG'D DELAY) Continuous delay (RUNS AFTER DELAY)	
Max. sweep rate	200 ps/div	500 ps/div
Range	2 ns - 20 ms/div 22 steps, 1-2-5	5 ns - 20 ms/div 21 steps, 1-2-5
Accuracy I(*2)	±2% (5 ns - 20 ms/div) over center 8 div ±3% (2 ns) over center 8 div	
Accuracy II(*2)	±5% (5 ns - 20 ms/div) any 2 div within center 8 div ±6% (2 ns) over center 8 div (*2) 20 ns or 1 div for the beginning of the sweep and 20 ns for the end of sweep should be excluded.	
Dual delay	Available	
Sweep magnification	x 10	
Delay jitter	Less than 1/50000	
Hold off time	Variable 1 sec. max.	
X-Y		
X axis	CH1	
Sensitivity	Same as CH1	
Frequency bandwidth	10MHz (-3 dB)	
Y axis	CH1, CH2, CH3, CH4	
Sensitivity	Same as each CH	
Frequency bandwidth	Same as each CH	
X-Y phase difference	Within 3° (DC - 5MHz)	
CAL signal		
Waveform	Square-wave	
Frequency	1kHz ±0.1%	
Output voltage	0.6 V ±1%	
CH2 OUT		
Amplitude	20 mV/div ±20% (50 Ω)	
Frequency bandwidth	500MHz (-3 dB) 50 Ω, 10 mV/div	300MHz (-3 dB) 50 Ω, 10 mV/div
Output resistance	50 Ω ±10%	
Z AXIS IN		
Intensity modulation voltage	0.5 Vp-p	
Polarity	Dark with positive voltage and brighter with negative voltage	
Frequency range	DC - 5MHz	
Input resistance	5 kΩ ±20%	
Max. input voltage	±40 V max.	
Probe power supply		
Connectors	2	
Suitable probes	SFP-5A, SFP-4A, SS-250, SS-240	
Auto Setup		
Auto Setup	Input sensitivity, Offset, TIME/DIV, Trigger level Amplitude: 30 mV - 35 V Frequency: 50Hz - 200MHz	
Cursor measurement		
Δt	Relative time difference measurement with cursor Resolution 1/60 div	
ΔV	Relative voltage difference measurement with cursor Resolution 1/60 div	
Frequency counter		
Frequency bandwidth	2Hz - 1GHz	2Hz - 600MHz
Digit	6 digits, accuracy ±0.01%	
Clock		
Display	Month/Date/Time/Minute	
Accuracy	±50 ppm	
Interface		
Remote control	10Base-T (Ethernet)	
PC card slot	ATA card available (PCMCIA Type II)	
External monitor out	VGA WIDE	
NTSC output (Composite, S out)	Amplitude: 1 Vp-p ±0.3 V into 75 Ω Output resistance: approx. 75 Ω (AC coupling)	
Built-in printer	Line Thermal Printer Paper size: width 112 mm, length 25 m	
Power supply		
Voltage range	100 V - 240 V AC 50/60Hz	
Power consumption	200 VA max (with printer operation)	
In the Standby mode	Approx. 5 VA max.	
Weight and dimensions		
Dimensions	Approx. 198H x 332W x 406L mm (accessories and projec tions are not included)	
Weight	Approx. 10 kg (accessories and options are not included)	
Environmental conditions		
Performance guaranteed temperature	+10°C - +35°C	
Operating range temperature	0 - + 40°C +5°C - +40°C (Built-in printer operation temperature)	
Humidity	90% / +40°C	
Storage range temperature	-20°C - +60°C / 80%RH	
Operating	2,000 m, air pressure of approx. 79 kPa	
Non operating	15,000 m, air pressure of approx. 12 kPa	
Preheating time	These specifications are guaranteed after power has been on for 30 minutes or longer.	
Accessories		
	Instruction manual (1), Power cord (1), Printer thermal paper (1)	

SS-Series Specifications

	SS-7847A	SS-7840A	SS-7830A
Display			
CRT	6-inch rectangular, internal graticule (8 x 10 div, with scale illumination)- Japan made		
Accelerating voltage	Approx. 20 kV		
Vertical deflection system			
Mode	CH1, CH2, CH3, CH4, ADD, ALT, CHOP		
Frequency bandwidth			
2 mV/div - 5 V/div	-	DC - 400MHz	DC - 300MHz
5 mV/div - 50 mV/div	DC - 470MHz	-	-
2 mV, 100 mV/div - 5 V/div	DC - 440MHz	-	-
VSWR	Less than 1.35 through DC - 400MHz (with 50 Ω input)		Less than 1.35 through DC - 300MHz (with 50 Ω input)
Sensitivity (CH1, CH2)	2 mV/div - 5 V/div 11-step (1-2-5), 2 mV - 12.5 V/div (with vernier)		
Accuracy	±2%		
Bandwidth limiter	20MHz or 100MHz		20MHz
Rise time (Calculated from freq. bandwidth x rise time = 0.35)	745 ps at 20 mV	875 ps	1.17 ns
Signal delay	Available		
Input coupling	AC, DC, GND (The cut-off freq. is 4Hz with AC coupl.)		
Input RC: direct	1 MΩ ± 1.5% // 16 pF ±2 pF / 50 Ω input : 50 Ω ±1%		
Max. input	1 MΩ input : ± 400 V max. / 50 Ω input : 5 V RMS		
Polarity switching	Possible only for CH2		
Probe sensor	1:1, 1:10, 1:100 detection possible		
Sensitivity (CH3, CH4)	100 mV/div, 500 mV/div ±3%		
Input coupling	AC, DC		
Offset voltage variable range	Offset voltage: variable axis range ±1 V : 2 mV/div - 50 mV/div ±10 V : 0.1 mV/div - 0.5 mV/div ±100 V : 1 V/div - 5 V/div		
Triggering			
A triggering			
Source	CH1, CH2, CH3, CH4, LINE		
Coupling	AC, DC, HF-REJ, LF-REJ		
Level			
DC - 10 MHz	0.4 div		
10MHz - 100MHz	1.0 div		
100MHz - 400MHz (300MHz)	2.0 div		
B triggering			
Source	CH1, CH2, CH3, CH4		
Coupling	AC, DC, HF-REJ, LF-REJ		
TV triggering	NTSC, PAL/SECAM, HDTV		
Trigger mode	TV-V (ODD, EVEN, BOTH) line number selectable, TV-H		
TV clamp	Back porch level		
Event trigger			
Count	Setting range: 1 - 65535, Max. count freq.: 50 MHz		
Burst	Time setting range: 0.1 µs - 99.9 s		
X-Y			
X-axis	CH1		
Sensitivity	Same as CH1		
Accuracy	±2%		
Bandwidth	DC - 2MHz		
Y-axis			
Operating channel	CH1, CH2, CH3, CH4, ADD		
Horizontal deflection system			
Horizontal display	A, ALT, B, X-Y		
Mode	AUTO, NORM, SINGLE		
A sweep time			
Fastest range with mag.	500 psec/div		1 nsec/div
Slowest range	500 msec/div		
B sweep time			
Fastest range with mag.	500 psec/div		1 nsec/div
Slowest range	20 msec/div		
Accuracy A/B	±2%		
Delay	Triggered delay: CH1, CH2, CH3, CH4 Continuous delay: RUNS AFTER		
Delay jitters	1/20,000		
Magnifier	10 times		
Hold-off time	Variable (up to sweep length or longer)		
Auto setup	V/H position, V/H range, trigger		
Input channel	CH1, CH2		
Frequency response	50Hz - 100MHz		
CH2 signal output	DC - 200MHz		DC - 100MHz
Z-axis input	0.5 Vp-p		
Calibrator	Square-wave, 1kHz ±0.1%, 0.6 Vp-p ±1%		
Power supply for probe	Voltage: ±12 V, 2 FET or current probes connectable, Offset control possible		
CRT read-out			
Read-out	Attenuator range, ADD UNCAL, AC/DC/GND, vertical mode, CH2 polarity, A/B sweep range, x10 MAG, UNCAL, horizontal display mode, hold-off trigger coupling, trigger source, trigger slope, TV-field, TV-line, TV-system		
Cursor measurement	ΔV (voltage measurement), Δt (time measurement), 1/Δt (division calculation by Δt)		
Frequency counter	6-digit, ±0.0025%		
Frequency range	2Hz - 400MHz , reciprocal		
Save and recall	Up to 256-setup		
Power off set-up	Panel setting before switch is powered off		
Back-up	Battery back-up (approx. 30,000 hr)		
Power supply	AC 100 V - 240 V, 50/60Hz, max.130 VA		
Dimensions and weight	320W x 160H x 420L mm, approx. 8.5 kg		
Environment conditions			
Operating	0°C - +40°C, 90% RH (40°C)		
Performance guaranteed	+10°C - +35°C		
Standard accessories	Power cable (1), probe (2), fuse (2), panel cover (1), operation manual (1), accessory bag (1)		

Notes for TS-Series Oscilloscopes

Writing speed (maximum recording speed)

The writing speed indicates the ability to store the transition of a signal, and is expressed in units of div/ns which express the electron beam moving speed. The TS Series has a writing speed of 10 div/ns. In other words, it can store a 100 ps/div signal sweep trace when there is no
signal. When a 1000MHz sine wave is input, an amplitude [peak-peak div] of up to 3.18 [div] can be stored.

The writing speed at the point where the sinewave crosses 0°, 180° and 360° is calculated with the following equation.

$WS = A\pi f$

WS: Write speed [div], A: Amplitude (peak-peak div),
π: 3.14, f: Frequency (Hz)
10 div/ns = 10 x 1-E9 div/s
10 x 10E9 = A[div] x 3.14 x 1000 x 10E6, where A = 3.18[div]

Pulse rise time is defined as the time it takes the pulse to rise from 10% to 90% of its amplitude, assuming that the pulse transition is a straight line. The equation for amplitude is A = 1.25 x WS x Tr, where Tr = rise time.

	SS-7821A	SS-7811A/7810A	SS-7805A	SS-7804A	SS-7802A
Display					
CRT	6-inch rectangular, internal graticule (8 x 10 div, with scale illumination) - Japan made				6-inch rectangular, internal graticule (8 x 10 div)
Accelerating voltage	Approx. 16 kV				2 kV
Vertical deflection system					
Mode	CH1, CH2, CH3, ADD, ALT, CHOP		CH1, CH2, ADD, ALT, CHOP		
Frequency bandwidth					
5 mV/div - 5 V/div	DC - 200MHz	DC - 100MHz	DC - 50MHz	DC - 40MHz	DC - 20MHz
2 mV/div	DC - 50MHz	DC - 50MHz	DC - 20MHz	DC - 20MHz	DC - 10MHz
Sensitivity (CH1, CH2)	2 mV/div - 5 V/div 11-step (1-2-5), 2 mV - 12.5 V/div (with vernier)				
Accuracy	±2%				
Bandwidth limiter	20MHz		Not provided		
Rise time (Calculated from freq bandwidth x rise time = 0.35)	1.75 nsec	3.5 nsec	7.0 nsec	8.75 nsec	17.5 nsec
Signal delay	Available				Not provided
Input coupling	AC, DC, GND (The cut-off freq. Is 4Hz with AC coupl.)				
Input RC: direct	1 MΩ ±1.5% // 20 pF ±2 pF		1 MΩ ±1.5% // 25 pF±2 pF		
Max. input	1 MΩ input : 400 V (DC + AC peak), with 10:1 probe : 600 V (DC + AC peak)				
Polarity switching	Possible only for CH2				
Probe sensor	1:1, 1:10, 1:100 detection possible				
Sensitivity (CH3)	50 mV/div, 100 mV/div, 500 mV/div, ±2%		–		
Input coupling	AC, DC		–		
Triggering					
A triggering					
Source	VERT, CH1, CH2, CH3, LINE		VERT, CH1, CH2, EXT, LINE		
Coupling	AC, DC, HF-REJ, LF-REJ				
Level					
DC - 5MHz	0.4 div	0.4 div	0.4 div	0.4 div	0.4 div
5MHz - 10MHz	0.4 div	0.4 div	1.0 div	1.0 div	1.0 div
10MHz - 40MHz	1.0 div	1.0 div	1.0 div	1.0 div	1.0 div (-20MHz)
40MHz - 50MHz	1.0 div	1.0 div	1.0 div	–	
50MHz - 100MHz	1.0 div	1.0 div	–		
100MHz - 200MHz	1.5 div	–	–		
B triggering			Not provided		
Source	CH1, CH2, CH3, LINE		–		
Coupling	AC, DC, HF-REJ, LF-REJ		–		
TV triggering	NTSC, PAL/SECAM, HDTV		NTSC, PAL/SECAM		
Trigger mode	TV-V (ODD, EVEN, BOTH) line number selectable, TV-H				
EXT triggering input					
Level					
DC - 5MHz	–		80 mV	80 mV	80 mV
5MHz - 20MHz	–		200 mV	200 mV	200 mV
20MHz - 40MHz	–		–	200 mV	–
20MHz - 50MHz	–		200 mV	–	–
Max. input voltage	–		1 MΩ : 400 V (DC + AC peak)		
X-Y					
X-axis	CH1				
Sensitivity	Same as CH1				
Accuracy	±3%				
Bandwidth	DC - 2MHz				DC - 1MHz
Y-axis					
Operating channel	CH1, CH2, CH3, ADD		CH1, CH2		
Horizontal deflection system					
Horizontal display	A, ALT, B, X-Y		A, X-Y		
Mode	AUTO, NORM, SINGLE				
A sweep time					
Fastest range with mag.	1 nsec/div	2 nsec/div	10 nsec/div	10 nsec/div	20 nsec/div
Slowest range	500 msec/div				
B sweep time			Not provided		
Fastest range with mag.	1 nsec/div	2 nsec/div	–		
Slowest range	5 msec/div				
Accuracy A/B	±2%				
Delay	Triggered delay: CH1, CH2, CH3 Continuous delay: RUNS AFTER		–		
Delay jitters	1/20,000		–		
Magnifier	10 times				
Hold-off time	Variable (up to sweep length or longer)				
Auto setup	V/H position, V/H range, trigger		Not provided		
Input channel	CH1, CH2				–
Frequency response	50Hz - 50MHz				–
CH2 signal output	DC - 100MHz	DC - 100MHz	DC - 20MHz	DC - 20MHz	DC - 10MHz
Calibratorr	Square-wave, 1kHz±0.1%, 0.6 Vp-p±1%				
CRT read-out					
Read-out	Attenuator range, ADD UNCAL, AC/DC/GND, vertical mode, CH2 polarity, A/B sweep range, x10 MAG, UNCAL, horizontal display mode, hold-off Trigger coupling, trigger source, trigger slope, TV -field, TV-line, TV-system				
Cursor measurement	ΔV (voltage measurement), Δt (time measurement), 1/Δt (division calculation by Δt)				
Frequency counter	5-digit, 0.01%				
Frequency range	2Hz - 200MHz, reciprocal	2Hz - 100MHz, reciprocal	2Hz - 50MHz, reciprocal	2Hz - 40MHz, reciprocal	2Hz - 20MHz, reciprocal
Save and recall	Up to 32-setup (only for SS-7821A/SS-7811A)		Not provided		
Power off set-up	Panel setting before switch is powered off				
Back-up	Battery back-up (approx. 30,000 hr)				
Power supply	AC 90 V - 132 V/180 V - 250 V, 50Hz - 400Hz, max. 110 VA			AC 100 V/110 V - 120 V/220 V/	230 V - 240 V, 50Hz - 60Hz
Dimensions and weight	272W x 152H x 390L mm, approx. 7.5 kg				272W x 152H x 390L mm, approx. 8.5 kg
Environment conditions					
Operating	0°C - +40°C, 90% RH (40°C)				
Performance guaranteed	+10°C - +35°C				
Standard accessories	Power cable (x 1), probe (x2), fuse (x2), panel cover (x1), operation manual (x 1)				Power cable (x 1),probe (x 2), panel cover (x 1),operation manual (x 1)

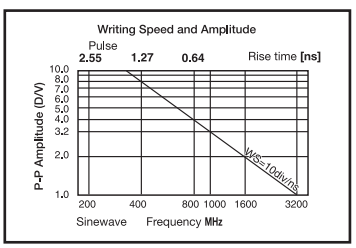
Relation between writing speed and amplitude

Sinewave: WS = πAf

A = WS/πf

Pulse: WS = A/(1.25 x Tr)

A = WS(1.25 x Tr)



Notice regarding defective pixels in TFT display

The TFT (thin-film transistor) color liquid crystal display is carefully manufactured using advanced technology. Nonetheless, it may contain several display defects such as pixels that are constantly dark or constantly bright. This is not a malfunction of the instrument.

Design and specifications subject to change without notice.

IWATSU TEST INSTRUMENTS CORP.

SALES DEPT.: 7-41, KUGAYAMA 1-CHOME,
SUGINAMI-KU, TOKYO, 168-8511 JAPAN
TEL: +81-3-5370-5483, FAX: +81-3-5370-5492
Homepage : http://www.iti.iwatsu.co.jp
E-mail Address : info-tme@iwatsu.co.jp

Distributor

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