OSCILLOSCOPE

USER MANUAL

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SAFETY TERMS AND SYMBOLS

These terms may appear in this manual or on the product:

WARNING. **Warning statements identify condition or practices that could result in injury or loss of life.**

CAUTION. **Caution statements identify conditions or practices that could result in damage to this product or other property.**

The following symbols may appear in this manual or on the product:

DANGER High Voltage

ATTENTION refer to Manual

Protective Conductor Terminal

Earth(ground) Terminal

1.GENERAL

1.1 Description

The 20MHz/30MHz oscilloscope combined Real Time Analog, Ultra Low Sweep speed and Digital Storage Oscilloscope together. In DSO mode, the lowest sweep speed is expanded to 10s/DIV, it can display 100 seconds signal information on full screen. It has waveform storage and expand function, dual channels reference storage, can display four trace simultaneity. It is a good assistant for measure single shot events, non-periodic signal and ultra Low frequency signal.

1.2 Features

1) Maximum sample rate 20Ms/s, equivalent bandwidth 8MHz.
2)Verticals resolution 8bits(28 points/DIV); Horizontal resolution 10 bits (100 points/DIV)
3)Time base 0.2us~10s/DIV
4)Waveform storage for flexible waveform zoom In/Out
5)2 reference memories, simultaneous display 4 waveform information
6)RS-232 interface
7)Trigger level lock function makes the triggering adjustment unnecessary.
8)CHl Output:
Terminated 50Ωoutput of channel 1 signal available on rear panel for driving frequency counter or other instruments.
9)Z-Axis Input:
Intensity modulation capability permits time or frequency markers to be added.
Trace blank with positive signal, TTL compatible.
10)X-Y operation:
Set the switch to X-Y.Then the instrument works as an X-Y oscilloscope. CH l can be applied as horizontal Deflection (X-axis) while CH2 provide vertical deflection(Y-axis).

2. TECHNICAL SPECIFICATIONS

2.1 Specifications part one: Digital storage Oscilloscope

Vertical system	
Verticals resolution	8bits(28points/DIV)
Accuracy	+/-3% +/-0.4mm(X5MAG: +/-5% +/-0.4mm)
Equivalent bandwidth	DC~8MHz(X5MAG:DC~7MHz), 3db,Sine Interpolate
Interpolation	Sine/Line

Horizontal System	
Maximum Sample Rates	20Ms/s
Horizontal resolution	10 bits (l00 points/DIV)
Time base	0.2us/DIV~10s/DIV
Sweep mode	AUTO, NORM, ROLL
Saved waveform expand rate	Maximum 100

Trigger	
Trigger preset	DIV2, 5, 8

Acquisition	
Dual Channel Acquisition	10s/DIV~lms/DIV: CHOP;0.5ms/DIV~0.2us/DIV:ALT
Acquisition Length	1024Byte/CH

Display	
View time	0.2s~5s Adjustable
Display Memory Length	1024 Byte/CH
Reference Memory Length	1024 Byte/CH

Rs232 interface transfer rate	19200

2.2. SPECIFICATIONS part two: Analog Real Time

MODEL / SPECIFICATIONS		20MHz OSCILLOSCOPE	30MHz OSCILLOSCOPE
VERTICAL AXIS	Sensitivity	5mV~5V/DIV,10steps in 1-2-5 sequence	5mV~20V/DIV,10steps in 1-2-5 sequence
	Sensitivity accuracy	≤±3%(x5MAG: ≤±5%)（10° C-35° C）	
	Vernier Vertical sensitivity	To l/2.5 or less of panel-indicated value.	
	Frequency bandwidth	DC~20MHz (x5MAG:DC~7MHz)	DC~30MHz (x5MAG:DC~7MHz)
		AC coupling: Low limit frequency10Hz.(With reference to 100KHz, 8DIV.Frequency response with-3dB.)	
	Rise time	Approx.17.5nS(x5 MAG: Approx.50nS)	Approx.11.7nS(x5 MAG: Approx.50nS)
	Input impedance	Approx. 1 M ohm //Approx.25pF	
	DC balance shift	Adjustable on panel	
	Linearity	≤±0.l DIV of amplitude change when waveform of 2 DIV at graticule center is moved vertically.	
	Vertical modes	CHI :CH l single channel. CH2 :CH2 single channel. DUAL :CHI and CH2 are displayed simultaneously .ALT or CHOP selectable at any sweep rate. ADD:CH1+CH2 algebraic addition.	
	Chopping repetition frequency	Approx.250KHz	
	Input coupling	AC, GND, DC	
	Maximum input voltage	400V(DC+AC peak),AC:frequency l KHz or lower. When set probe switch at l:1,the maximum effective readout is 40Vpp(14Vrms at sine wave), or set probe switch at 10:1,the maximum effective readout is 400Vpp(140Vrms at sine wave).	
	Common mode rejection ratio	50:1or better at 50KHz sinusoidal wave-(When sensitivities of CH1 and CH2 are set equally)	
	Isolation between channels (At 5mV/DIV range)	>1000:l at 50KHz	
		>30:l at 15MHz	>30:l at 25MHz
	CHI signal output	At least 20 mV/DIV into a 50 ohm termination. Bandwidth is 50Hz to at least 5MHz.	
	CH2 INV BAL.	Balanced point variation: ≤1 DIV(Reference at center graticule.)	

(Specification part two continue)

SPECIFICATIONS \ MODEL		20MHz OSCILLOSCOPE	30MHz OSCILLOSCOPE
TRIGGERING	Triggering source	CH1, CH2, LINE, EXT(CH1 and CH2 can be selected only when the vertical mode is DUAL or ADD) In ALT mode, if the TRIG. ALT switch is pushed in, it can be use for alternate triggering of two different source.	
	Coupling	AC:20Hz to 20MHz	AC:20Hz to 30MHz
	Slope	+/-	
	Sensitivity.	20Hz~2MHz:0.5 DIV;TRIG-ALT:2DIV,EXT:200mV	
		2~20MHz:1.5 DIVTRIG-ALT:3DIV,EXT:800mV	20~30MHz:2.0 DIV TRIG-ALT:3DIV,EXT:800mV
		TV: Sync pulse more than l DIV(EXT:lV)	
	Triggering modes	AUTO: Sweeps run in the free mode when no triggering input signal is applied. (Applicable for repetitive signals of frequency 25Hz or over.) NORM: When no triggering signal is applied, the trace is in the ready state and not displayed. TV-V:This setting is used when observing the entire vertical picture of television signal. TV-H:This setting is used when observing the entire horizontal picture of television signal. (Both TV-V and TV-H synchronize only when the synchronizing signal is negative)	
	EXT triggering signal input Input impedance Max. input voltage	Approx.:lM ohm//approx.25pF 400V(DC+AC peak),AC:Frequency not higher than l KHz	
HORIZIONTAL AXIS	Sweep time	0.2 uSec~0.5Sec/DIV, 20steps in 1-2-5 sequence	
	Sweep time accuracy	±3% （10° C-35° C）	
	Vernier sweep time control	≤1/2.5 of panel-indicated value	
	Sweep magnification	10 times	
	x10MAG sweep time accuracy	5%(20nSec~50nSec are uncalibrated)	
	Linearity	±5%,xl0MAG: ±10%(0.2s and 1us)	
	Position shift caused by xl0MAG	Within 2 DIV at CRT screen center	
X-Y MODE	Sensitivity	Same as vertical axis.(X-axis:CHl input signal; Y-axis: CH2 input signal.)	
	Frequency bandwidth	DC to at least 500KHz	
	X-Y phase difference	≤3° at DC~50KHz	

SPECIFICATIONS \ MODEL		20/30MHz OSCILLOSCOPE
ZAXIS	Sensitivity	5Vp-p(Positive-going signal decreases intensity)
	Frequency bandwidth	DC~2MHz
	Input resistance	Approx.47K ohm
	Maximum input voltage	30V(DC+AC peak, AC frequency ≤ 1kHz)
CALIBRATION VOLTAGE	Waveform	Positive-going square wave
	Frequency	Approx. 1 kHz
	Duty ratio	Within 48:52
	Output voltage	2Vp-p ±2%
	Output impedance	Approx, 1 K ohm
CRT	Type	6-inch rectangular type, internal graticule
	Phosphor	P31
	Acceleration voltage	Approx.2kV
	Effective screen size	8x10 DIV(1 DIV=10mm(0.39in))
	Graticule	Internal
	Trace rotation	Provided

Line Power Requirements

Voltage: AC 110V/220V ± 10%
Note:AC110V needs to prearrange to my factory.
Frequency:50Hz or 60 Hz
Power consumption : Approx.40VA,35W(max.)

Operating Environment

Indoor use
Altitude up to 2000 m
Ambient temperature:
To satisfy specifications:l0°to 35°C (50°to 95°F)
Maximum operating ranges: 0° to 40° C (32°to 104° F)
Relative humidity:75%RH(max.)non condensing
Installation Category II
Pollution degree 2

Accessories

Power cord---------- l
User manual---------- 1
Probes-------- ----------2
RS232 cable----------1
Software Cd----------1

Mechanical Specifications

Dimensions:310Wx150Hx455D(mm)
Weight : Approx.8kg(l7.6lbs.)

Storage Temperature &Humidity

-10° to 70°C,70%RH(maximum)

3.PRECAUTIONS BEFORE OPERATING THE OSCILLOSCOPE

3.1 Unpacking the Oscilloscope

The oscilloscope is shipped from the factory after being fully inspected and tested. Upon receiving the instrument, immediately unpack and inspect it for any damages that might have been sustained during transportation. If any sign of damage is found, immediately notify the bearer and/or the dealer.

3.2 Checking the Line voltage

These oscilloscopes will operate on AC 220V or 110V set by manufactory. Before connecting the power plug to an AC line outlet, make sure the voltage selector is set to the correct position corresponding to the line voltage. Note the oscilloscope may be damaged if it is connected to the wrong AC line voltage.

WARNING.To avoid electrical shock the power cord protective grounding conductor must be connected to ground.

Replace the required fuses shown below.

Line voltage	Range	Fuse
AC 220V	198~242	T 0.5A 250V
AC 110V	109~121	T 1.0A 250V

WARNING. To avoid personal injury, disconnect the power cord before removing the fuse holder

3.3 Environment

The normal ambient temperature range of this instrument is 0°to 40°C(32°to 104°F).Operation of the instrument above this temperature range may cause damage to the circuits.

Do not use the instrument in a place where strong magnetic or electric field exists, such fields may disturb the measurement.

3.4 Equipment Installation, and Operation

Ensure there is proper ventilation for the hole vents in the oscilloscope case.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

3.5 CRT Intensity

To prevent permanent damage to the CRT phosphor, do not make the CRT trace excessively bright or leave the spot stationary for an unreasonably long time.

3.6 Withstanding Voltages of Input Terminals

The withstanding voltages of the instrument input terminals and probe input terminals are as shown in the following table. Do not apply voltages higher than these limits. When set probe switch at 1:1,the maximum effective readout is 40Vpp (14Vrms at sine wave).When set probe switch at 10:1,the maximum effective readout is 400Vpp (140Vrms at sine wave).

Input terminal	Maximum input voltage
CH1, CH2,inputs	400V (DC+AC peak)
EXT TRLG IN input	400V (DC+AC peak)
Probe inputs	600V (DC+AC peak)
Z AXIS input	30Vpeak

CAUTI0N. To avoid instrument damage, do not exceed maximum input voltages. Maximum input voltages must have frequencies less than 1 KHz.

If an AC voltage which is superimposed on a DC voltage is applied, the maximum peak value of CH l and CH2 input voltages must not exceed + or - 300V.So for AC voltages with a mean value of zero volt the maximum peak to peak value is 600V.

Figure 4-1

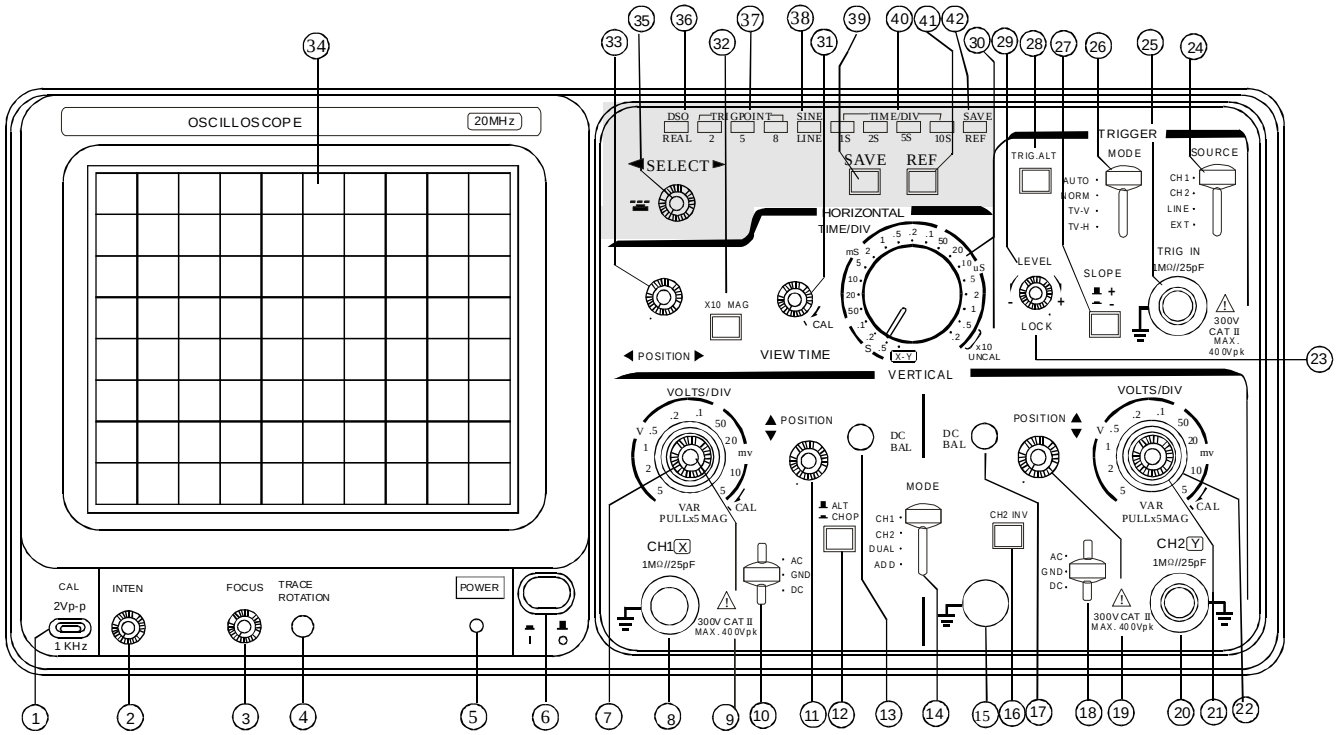

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Figure 4-1

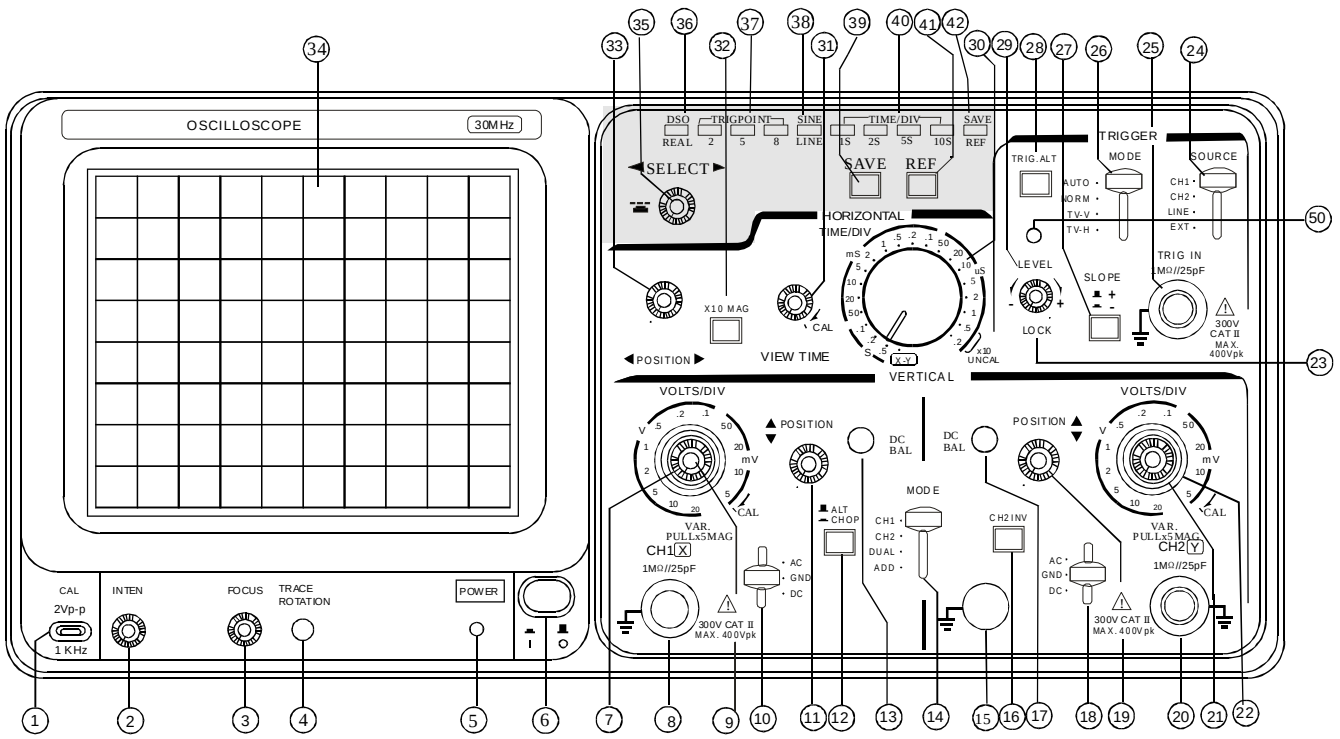

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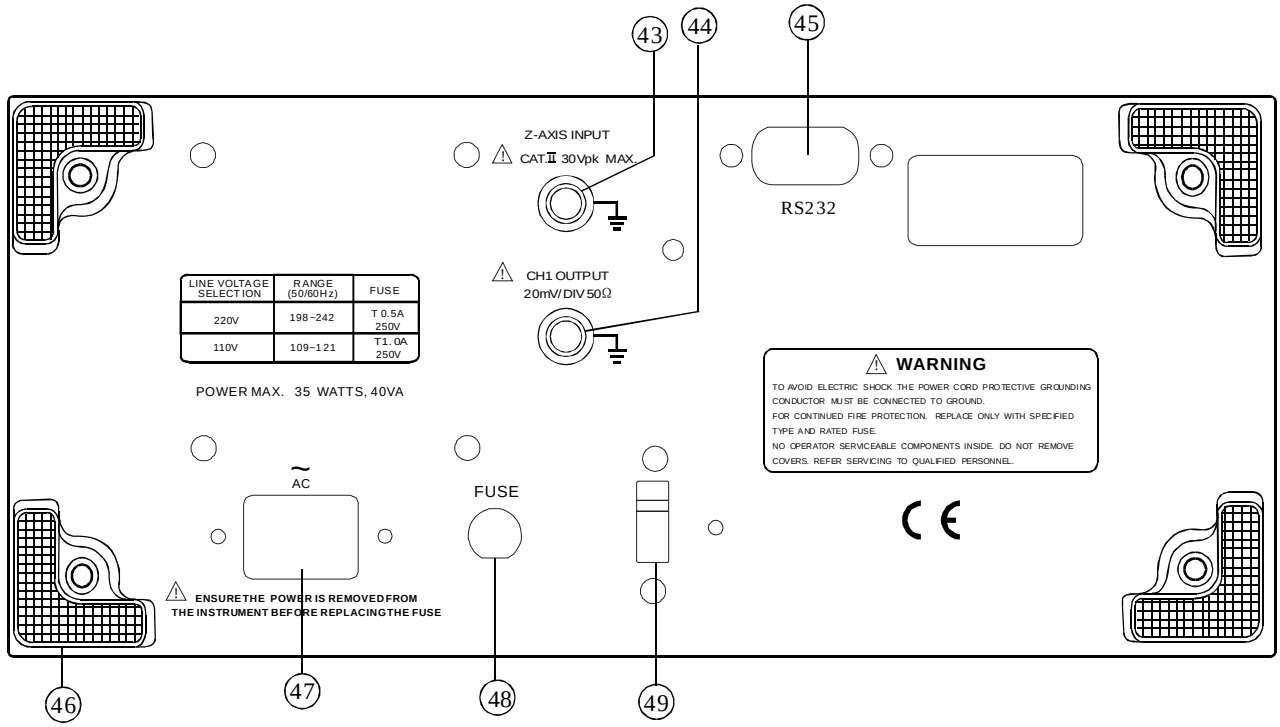
Figure 4-2



4.OPERATION METHOD-REAL TIME

4.1 Introduction of Front Panel

CRT:

POWER.....(6)

Main power switch of the instrument. When this switch is turned on, the LED (5) is also turned on.

INTEN.....(2)

Controls the brightness of the spot or trace.

FOCUS.....(3)

For focusing the trace to the sharpest image.

TRACE ROTATION.....(4)

Semi-fixed potentiometer for aligning the horizontal trace in parallel with graticule lines.

FILTER.....(34)

Filter for ease of waveform viewing

Vertical Axis:

CH 1 (X) input..... (8)

Vertical input terminal of CH1.When in X-Y operation, X-axis input terminal

CH2(Y)input..... (20)

Vertical input terminal of CH2.When in X-Y operation, Y-axis input terminal.

AC-GND-DC.....(10)(18)

Switch for selecting connection mode between input signal and vertical amplifier.

AC : AC coupling

GND : Vertical amplifier input is grounded and input terminals are disconnected.

DC : DC coupling

VOLTS/DIV.....(7)(22)

Select the vertical axis sensitivity, from 5mV/DIV to 5V/DIV in 10 ranges.

VARIABLE.....(9)(21)

Fine adjustment of sensitivity, with a factor of ⩾1/2.5 of the indicated value. When in the CAL position, sensitivity is calibrated to indicated value. When this knob is pulled out (x5 MAG state), the amplifier sensitivity is multiplied by 5.

CH1 & CH2 DC BAL. (13)(17)

These are used for the attenuator balance adjustment. See page 26 DC BAL adjustments for the details.)

▲▼ POSITION.....(11)(19)

Vertical positioning control of trace or spot.

VERT MODE.....(14)

Select operation modes of CH l and CH2 amplifiers.

CH1: The oscilloscope operates as a single-channel instrument with CH1 alone

CH2: The oscilloscope operates as a single-channel instrument with CH2 alone.

DUAL: The oscilloscope operates as a dual-channel instrument both CH1 and CH2.

ADD: The oscilloscope displays the algebraic sum (CH l+CH2) or difference(CH1 -CH2)of the two signals. The pushed in state of CH2 INV (16)button is for the difference (CHl-CH2).

ALT/CHOP .....(12)

When this switch is released in the dual- trace mode, the channel l and chame1 2 inputs are alternately displayed (normally used at faster sweep speeds).

When this switch is engaged in the dual-trace mode, the channel 1 and channel 2 inputs are chopped and displayed simultaneously (normally used at slower sweep speeds).

CH2 INV..... (16)

Inverts the CH2 input signal when the CH2 INV switch mode is pushed in The channel 2 input signal in ADD mode and the channel 2 trigger signal pick off are also inverted.

Triggering:

EXT TRIG IN input terminal.....(25)

Input terminal is used for external triggering signal. To use this terminal, set SOURCE switch(24)to the EXT position.

SOURCE..... (24)

Select the internal triggering source signal, and the EXT TRIG IN input signal.

CH l:When the VERT MODE switch (14) is set in the DUAL or ADD state, select CH l for the internal triggering source signal.

CH 2:When the VERT MODE switch (14) is set in the DUAL or ADD state, select CH2 for the internal triggering source Signal.

LINE: To select the AC power line frequency signal as the triggering signal.

EXT: The external signal applied through EXT TRIG IN input terminal (24) is used for the external triggering source signal.

TRIG. ALT.....(28):

When the VERT MODE switch (14) is set in the DUAL or ADD state, and the SOURCE switch(24)is selected at CH l or CH 2,with the engagement of the TRIG-ALT switch(28), it wil1 alternately select CH 1 & CH2 for the internal triggering source signal

SLOPE(27)

select the triggering slope.

"+":Triggering occurs when the triggering signal crosses the triggering level in positive-going direction.

"-":Triggering occurs when the triggering signal crosses the triggering level in negative-going direction.

LEVEL(29)

Towards: " + ": The triggering level moves upward on the display waveform.
Towards: " - ": The triggering level moves downward on the display waveform.
To display a synchronized stationary waveform and set a start point for the waveform. The LED (50) is MAX light (only for 30MHz oscilloscope).

LOCK.....(23)

Click (29)by fully clockwise position, then triggering level is automatically maintained at optimum value irrespective of the signal amplitude, requiring no manual adjustment of triggering level.

TRIGGER MODE.....(26)

Select the desired trigger mode.

AUTO :When no triggering signal is applied or when triggering signal frequency is less than 25Hz, sweep runs in the free run mode.

NORM :When no triggering signal is applied, sweep is in a ready state and the trace is blanked out. Used primarily for observation of signal <25Hz.

TV-V : This setting is used when observing the entire vertical picture of television signal.

TV-H: This setting is used when observing the entire horizontal picture of television signal.
(Both TV-V and TV-H synchronize only when the synchronizing signal is negative.)

Time Base

TIME/DIV.....(30)

Sweep time ranges are available in 20 steps from 0.2 uS/DIV to 0.5 S/DIV.
X-Y:This position is used when using the instrument as an X-Y oscilloscope.

SWP. VAR.....(31)

Vernier control of sweep time. This control works as CAL and the sweep time is calibrated to the value indicated by TIME/DIV of sweep can be varied continuously when shaft is out of CAL position. Then the control is rotated in the direction of arrow to the full, the CAL state is produced and the sweep time is calibrated to the value indicated by TIME/DIV. Counterclockwise rotation to the full delays the sweep by 2.5 time or more.

POSITION.....(33)

Horizontal positioning control of the trace or spot.

X10 MAG.....(32)

When the button is pushed in, a magnification of l0 occurs.

Others

CAL(1)

This terminal delivers the calibration voltage of 2Vp-p, approx. 1 KHz, positive square wave.

GND(15)

Ground terminal of oscilloscope mainframe.

4.2 1ntroduction of Rear Panel

Z AXIS INPUT ..... (43)

Input terminal for external intensity modulation signal.

CH1 SIGNAL OUTPUT..... (44)

Delivers the CH l signal with a voltage of approximately 20mV per 1 DIV into a 50- ohm termination. Suitable for frequency counting, etc.

RS232 interface.....(45)

Communication between computer and 20/30MHz oscilloscope.

STUDS.....(46)

For laying the oscilloscope on its back to operate it in the upward position. Also used to take up the power cord.

AC Power input connector(47)

AC Power input socket. Connect the AC power cord (supplied)to this connector.

FUSE HOLDER(48)

Fuse rating is shown in Page 5.

LINE VOLTAGE SELECTOR.....(49)

To select power sources

NOTE：needs to prearrange to my factory.

4.3 Basic Operation--Single-channel Operation

Before connecting the power cord to an AC line outlet, make sure that the voltage selector on the rear panel of the instrument is correctly set for the AC line voltage. After ensuring the voltage setting, set the switches and controls of the instrument as shown below:

Item	No	Setting
POWER	(6)	Disengage position (OFF)
INTEN	(2)	Mid-position
FOCUS	(3)	Mid-position
VERT MODE	(14)	CH l
ALT/CHOP	(12)	Released (ALT)
CH 2 INV	(16)	Released
▲▼ POSITION	(11)(19)	Mid-position
VOLTS/DIV	(7)(22)	0.5V/DIV
VARIABLE	(9)(21)	CAL (clockwise position)
AC-GND-DC	(10)(18)	GND
SOURCE	(24)	CH l

Item	No	Setting
SLOPE	(27)	+
TRIG.ALT	(28)	Released
TRIGGER MODE	(26)	AUTO
TIME/DIV	(30)	0.5mSec/DIV
SWP. VER	(31)	CAL position
◀▶ POSITION	(33)	Mid-position
Xl0 MAG	(32)	Released
LEVEL	(29)	Locked

After setting the switches and controls as mentioned, connect the power cord to the AC line outlet, and then continue as follows:

1) Engage the POWER switch and make sure that the power LED is turned on. In about 20 seconds,a trace will appear on theCRT screen. If no trace appears in about 60 seconds, counter check the switch and control setting.
2) Adjust the trace to an appropriate brightness and image with the INTEN contro1 and FOCUS control respectively.

3)Align the trace with the horizontal center line of the graticule by adjusting the CH1POSITION control and TRACE ROTATION control (adjustable by screw driver).

4)Connect the probe to the CH 1 INPUT terminal and apply the 2Vp-p CALIBRATOR signal to the probe tip.

5)Set the AC-GND-DC switch to the AC state. A waveform as shown in the figure 4-3 will be displayed on the CRT screen.

6)Adjust the FOCUS control so that the trace image appears sharply.

7)For signal viewing, set the VOLTS/DIV switch and TIME/DIV switch in appropriate positions so that signal waveform is displayed clearly.

8)Adjust the ▲▼ POSITION and ◄► POSITION controls in appropriate positions So that the displayed waveform is aligned with the graticule and voltage (Vp-p) and period (T)can be read conveniently.

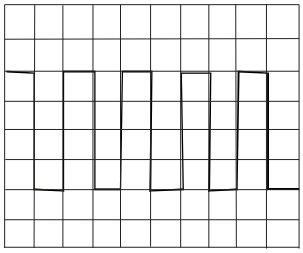


Figure 4-3

The above are the basic operating procedures of the oscilloscope. It is for single-channel operation with CH1.Single-channel operation with CH2 can also be achieved in a similar manner. Further operation methods are explained in the subsequent pages.

4.4 Dual-channel Operation

Change the VERT MODE switch to the DUAL states so that trace(CH2)is also displayed (The explanation in the proceeding section is of CH1).At this state of Procedure, the CH l trace is the square wave of the calibrator signal and the CH 2 trace is a straight line since no signal is applied to this channel yet.

Now, apply the calibrator signal to the vertical input terminal of CH 2 with the probe as is the case for CH1.Set the AC-GND-DC switch to the AC state. Adjust vertical POSITION knobs (11)and (19)so that both channel signals are displayed as shown in Figure4 -4

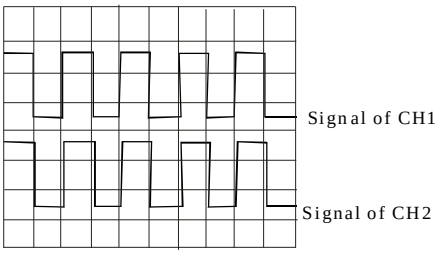


Figure 4-4

When ALT/CHOP switch is released (ALT MODE),the input signals applied respectively to CH l and CH2 appears on the screen alternatively at each sweep. This setting is used when the sweep time is short in 2-channel observation.

When ALT/CHOP switch is engaged (CHOP MODE),the input signals applied to CH1and CH2 are switched at about 250KHz independent and at the same time appear on the screen. This setting is used when the sweep time is long in 2-channel observation.

When in the dual channel operation (DUAL or ADD mode),the CH l or CH2 signal must be selected for the triggering source signal by means of the SOURCE switch. If both CH l and CH2 signals are in a synchronized relationship, both waveforms can be displayed stationary; if not, only the signal selected by the SOURCE switch can be stationary. If the TRIG. ALT push switch is engaged, both waveforms can be displayed stationary.

4.5 ADD Operation

An algebraic sum of the CH1and CH2 signals can be displayed on the screen by setting the VERT MODE switch to the ADD State. The displayed signal is the difference between CH1 and CH2 signals if the CH2 INV push switch is engaged.

For accurate addition or subtraction, it is a prerequisite that the sensitivities of the two channels are adjusted accurately at the same value by means of the VARIABLE knobs. Vertical positioning can be made with the ▲▼ POSITION knob of either channel. In view of the linearity of the vertical amplifiers, it is most advantage to set both knobs in their mid-positions.

4.6 Triggering

Proper triggering is essential for efficient operation of an oscilloscope. The user must be thoroughly familiar with the triggering functions and procedures.

(1)Functions of MODE switch:

AUTO: When the AUTO switch is engaged, automatic sweep operation is selected. in automatic sweep operation, the sweep generator free runs to generate a sweep without a trigger signal. However, it automatically switches to triggered sweep operation if an acceptable trigger source signal is present. The AUTO position is handy when first setting up the scope to observe a waveform; It provides sweep for waveform observation until other controls can proper1y set. Once the controls are set, operation is often switch back to the NORM triggering mode, since it is more sensitive. Automatic sweep must be used for DC measurements and signals of such low amplitude that they will not trigger the sweep.

NORM: The NORM switch provides normal triggered sweep operation. The sweep remains at rest until the selected trigger source signal crosses the threshold level set by the TRIG LEVEL control. The trigger causes one sweep to be generated, after which sweep again remains at rest until triggered. In the NORM position, there will be no trace unless an adequate trigger signal is present. In the ALT mode of dual trace operation with NORM sweep selected, there will be trace unless both channel 1 and 2 sig1als are adequate for triggering.

TV-V: Setting the MODE switch to the TV-V position permits selection of vertical sync pulses for sweep triggering when viewing composite video waveforms. Vertical sync pulses are selected as trigger to permit viewing of vertical fields and frames of video. A sweep time of 2 ms/DIV is appropriate for viewing fields of video and 5ms/DIV for complete frames(two interlaced fields)of video.

TV - H: Setting the MODE switch to the TV-H position permits selection of horizontals sync pulses for sweep triggering when viewing composite video waveforms. Horizontal sync pulses are selected as trigger to permit viewing of horizontal fields. of video. A sweep time of about 10us/DIV is appropriate for displaying lines of video. The SWP VAR control can be set to display the exact number of waveforms desired.

This oscilloscope synchronizes with only (-)polarity, that is, the sync pulses are negative and the video is positive as shown in Figure 4-5.

Figure 4-5

(2) Functions of SOURCE switch:

The displayed signal itself or a trigger signal which has a time relationship with the displayed signal is required to be applied to the trigger circuit to display a stationary signal on the CRT screen. The SOURCE switch is used for selecting such a triggering source.

CH l/CH2: The internal trigger method which is used most commonly. The signal applied to the vertical input terminal is branched off from the preamplifier and is fed to the trigger circuit through the VERT MODE switch. Since the triggering signal is the measured signal itself, a stable waveform can be readily displayed on the CRT screen. When in the DUAL or ADD operation, the signal selected by the SOURCE switch is used as the triggering source signa1.

Line: The AC power line frequency signal is used as the triggering signal. This method is effective when the measured signal has a relationship with the AC line frequency, especially, for measurements of low level AC noise of audio equipment, thyristor circuits, etc.

EXT: The sweep is triggered with an external signal applied to the external trigger input terminal. An external signal which has a periodic relationship with respect to the measured signal is used. Since the measured signal is not used as the triggering signal, the waveforms can be displayed more independent than the measured signal.

(3) Functions of TRIG LEVEL control and SLOPE switch:

A sweep trigger is developed when the trigger source signal crosses a preset threshold level. Rotation of the TRIG LEVEL control varies the threshold level. In the "+"direction, the triggering threshold shifts to a more positive value, and in the"-" direction, the triggering threshold shifts to a more negative value. When the control is centered, the threshold level is set at the approximate average of the signal used as the triggering source.

The TRIG LEVEL control adjusts the start of the sweep to almost any desired point on a waveform. On sine wave signals, the phase at which sweep begins is variable. Note that if the TRIG LEVEL control is rotated toward its extreme+or-setting, no sweep will be developed in the NORM trigger mode because the triggering threshold exceeds the peak amplitude of the sync signal.

When the TRIG SLOPE switch is set to the (+)position(up), the sweep is developed from the trigger source waveform as it crosses the threshold level in a positive-going direction. When the TRIG SLOPE control is set to the(-)position (down), a sweep trigger is developed from the trigger source waveform as it crosses the threshold level in a negative-going direction. This switch selects the slope (polarity) triggering signal as shown in Figure4-6.

LEVEL LOCK

Control level(29)to fully clockwise ,the triggering level is locked at a fixed Value, and stable triggering is made without requiring level adjustment.

This automatic level lock function is effective when the signal amplitude on the screen or the input voltage of the external triggering signal is with in the following range:

50Hz -- 5MHz: $\geqslant$ 0.5DIV
5MHz -- 20MHz: $\geqslant$ 1. 0DIV
20MHz -- 30MHz: $\geqslant$ 2. 0DIV

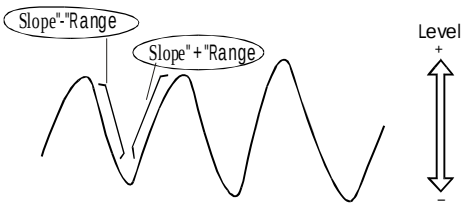


Figure 4--6

(4)Function of TRIG AIT switch:

The TRIG ALT switch is used to select alternate triggering and alternate display when the DUAL-trace VERT MODE is selected (the switch has on effect in the CH1,CH2,or ADD modes).In the alternate triggering mode (when dual-trace operation is selected),the trigger source alternates between channel l and channel 2 with each sweep. This is convenient for checking amplitudes, wave shape, or waveform period measurements, and even permits simultaneous observation of two waveforms which are not related in frequency or period. However, this setting is not suitable for phase or timing comparison measurements. For such measurements, both traces must be triggered by the same sync signal.

When the CHOP and the TRIG ALT switches are both engaged during dual-trace operation, synchronization of the display is not possible because the chopping signal becomes the trigger. Use the AIT mode by itself, or select CH1 or CH2 as trigger source.

4.7 TIME / DIV control

Set the TIME/DIV control to display the desired number of cycles of the waveform. If there are too many cycles displayed for good resolution, switch to a faster sweep speed. If only a line is displayed, try a slower sweep speed. When the sweep speed is faster than he waveform being observed, only part of it will be displayed, which may appear as a straight line for a square wave or pulse waveform.

4.8 Sweep Magnification

When a certain part of the displayed waveform is needed to be expanded time wise, a faster sweep speed may be used. However, if the required portion is apart from the starting point of the sweep, the required portion may run off the CRT screen. In such a case, push in the x10 MAG button. When this has been done, the displayed waveform will be expanded 10 times to the right and left with the center of screen as the center of expansion. The sweep time during the magnification operation is as follows:

(Value indicated by TIME/DIV switch)x1/10

Thus, the unmagnified maximum sweep speed(lu Sec/DIV)can be increased with the magnification as follows:

1u Sec/DIV x1/10=100n Sec/DIV

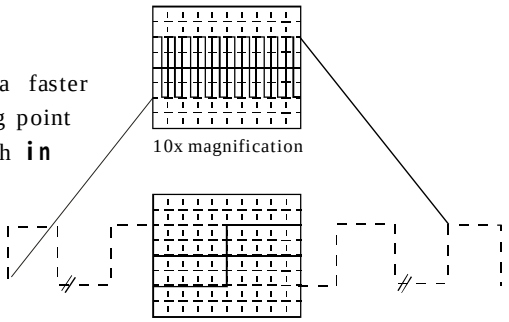


Figure 4-7

4.9 X-Y Operation

Set the TIME/DIV switch to X-Y position. Then the instrument works as an X-Y oscilloscope. Each input is applied to the instrument as follows.

X-axis signal(horizontal axis signal):CH1 INPUT.
Y-axis signal(vertical axis signal) :CH2 IN PUT.

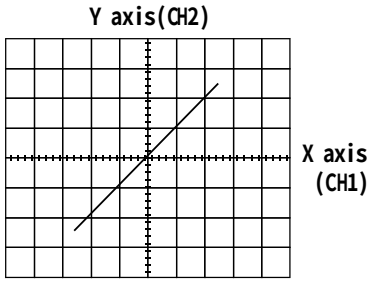


Figure 4-8

Note: When high frequency signals are displayed in the X-Y operation, pay attention to the frequency bandwidths and phase difference between X and Y-axis.

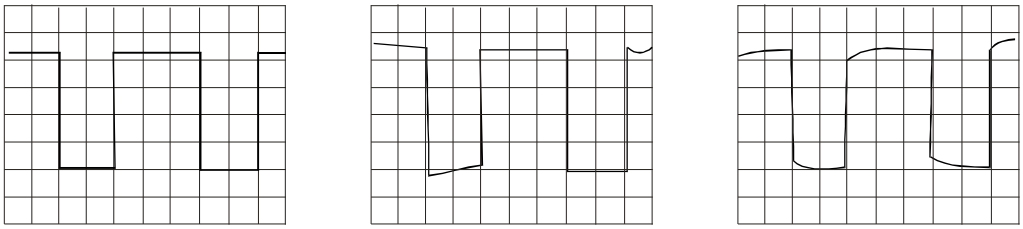
X-Y operation permits the oscilloscope to perform many measurements not possible with conventional sweep operation. The CRT display becomes an electronic graph of two instantaneous voltages. The display may be a direct comparison of the two voltages such as a vector scope display of video color bar patterns. However, the X-Y mode can be used to graph almost any dynamic characteristic if a transducer is used to change the characteristic(frequency, temperature, velocity, etc.)into a voltage. One common application is frequency response measurements, where the Y-axis corresponds to signal amplitude and the X-axis corresponds to frequency.

1.Set the TIME/DIV control to the X-Y position (fully counterclockwise).In this mode, channel 1 becomes the X-axis input and channel 2 becomes the Y-axis input.
2.The X and Y positions are now adjusted using the horizontal◄► POSITION and CH2▲▼ POSITION controls respectively.
3.Adjust the amount of vertical (Y-axis) deflection with the CH2 VOLTS/DIV and VAR controls.
4.Adjust the amount of horizontal (X-axis) deflection with the CH 1 VOLTS/DIV and VAR controls.

4.10 Calibration of Probe

As explained previously, the probe makes up a wide range attenuator. Unless phase compensation is properly done, the displayed waveform is distorted causing measurement errors. Therefore, the probe must be properly compensated before use. Connect the l0: l probe BNC to the INPUT terminal of CH1 or CH2 and set VOLTS/DIV switch at 50mV .Connect the Probe tip to the calibration voltage output terminal and adjust the compensation trimmer on probe for optimum square wave (minimum overshoot, rounding off and tilt).

Figure 4-9



(a)Correct compensation (b)Over compensation (c)Insufficient compensation

4.11 DC BAL Adjustments

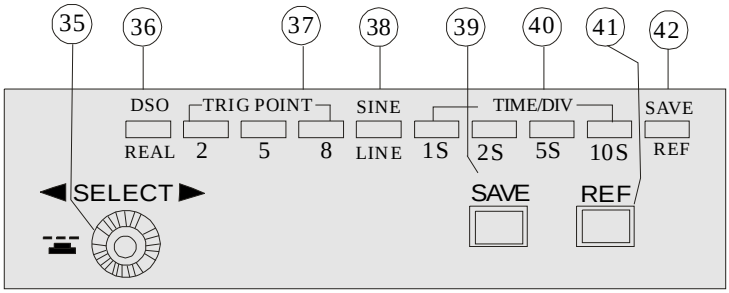
The ATT balance of the vertical axis can be made easily.

(1) Set the input coupling switches of CH1 and CH2 to GND and set the TRIG MODE to AUTO. Then position the base line to the center.

(2) Turn the VLOTS/DIV switch to 5mV-10mV and adjust so that the line does not move.

5.OPERATION METHOD-DSO

5.l Panel description:



35)Function selection,◄ SELECT ►tuning this button, move cursor from 36)to 42),press this button, the function be selected or quitted, detail describe as followed.

36)DSO/REAL:Digital Storage Oscilloscope or Real Time mode indicator LED. When power On, default mode is Real Time, green LED is On. Press button 35),the instrument will change into DSO mode. Then red or orange LED on.

Note: When LED is green, means this function or parameters is ready to be select.
When LED is red, means this function or parameter be selected.
When LED is orange (both green and red on) ,means this function or parameter is ready to quit or change.

37)TRIG POINT: Trigger point indicator. As the DSO can view the information before trigger event, so the trigger point has to be preset. When the LED of number 2,5,or 8 is on, it means pre-trigger point has been set at second division, fifth or eighth division. If machine is in SAVE mode (SAVE key 39 engaged and 42 LED is red or orange),then the preset trigger point be defined as waveform expand point. Means the signal on this point will always show on screen center, what ever the expand rate is. Other part of the waveform may move out of the screen as expand.

38)SINE/LINE:Sine or Line interpolation. In DSO mode, as the Maximum sample rate is 20Ms/s,when the sweep speed is higher than 5**u**s/DIV(include)or the saved waveform need expand, If we still want keep 100 point/DIV, then we need estimate the others value between two sample point. Then interpolation required.

Sine interpolation: Estimate the value between two sample points use sine function, It's suit for view sine waveform or other less harmonic waveform signal (LED is red or orange)

Line interpolation: Use line function to estimate value between two know points, it is suit for more harmonic signal Waveform (LED is green or off).

40)TIME/DIV:Low sweep speed indicator. As DSO can view ultra-low frequency signal, so the suitable sweep speed should be selected according the signal frequency. This machine expand time base to :
ls/DIV、2s/DIV 、5s/DIV 、l0s/DIV.

Set 30) to 0.5s/DIV first, then tuning 35)move cursor to the desired sweep speed; push down, the red LED is on, set is done. Use similar way can quit or move to other DIV of 40).

39)SAVE:Waveform save key. In DSO mode, if this key engaged, the waveform on screen will be saved. This saved waveform could be expanded or move on vertical. Quit from save mode, this waveform still stored in memory which can be used to compare with real time signal. On this mode, the LED 42)is red or orange.

Following operation is prohibited when SAVE key engaged and you will see a flash screen as warning.
a)The sweep time could not be set lower than the value when signal be saved.
b)The waveform can be expanded, but the maximum expand rate should not exceed l00.
c)The vertical input switch 14)could not be changed.

Note: In SAVE mode, machine will stop sampling or refreshing.

41)REF:Reference waveform storage key. In DSO mode, when this key engaged, the waveform on the screen will be stored in " reference memory".The stored waveform can be used to compare with the real time waveform. But it could not be expanded or moved on vertical.

Note: When power on or in Real Time mode, engaging "SAVE " and "REF"keys are prohibited. Otherwise, LED 42)will keep flashing indicate that you are under illegal operation.

31)SWP.VAR/VIEW TIME: Real Time sweep speed vary or DSO view time potentiometer with switch. In DSO mode, tum this switch off (end of clockwise), view time is zero, screen keeping refresh without suspend.
Tum this switch on and ad just it, sweep wills ceased for a while which can be adjusted between 200ms to 5s.User can use this period view the waveform clearly.

45)RS-232interface:Communication port between computer and 20/30MHz oscilloscope. The stored waveform transferred to COM port of computer by RS232 connector cable. Operation details as follow:
a)Connect 20/30MHz oscilloscope with computer by RS232 cable.
b)In DSO mode, save the waveform which will be transferred. Tuning 35)move cursor out off LED indicator (No led is green or orange except 42)
c)Run communication software.
d)When computer is ready, press 35)button starts transmission. While data is transmitting the 42) Led keep flashing, when it stop, communication finished.

Note: Communication cable and software is instrument accessory supplied with unit.

5.2 DSO operation tips

DSO basic operate is same as Real Time mode. To be familiar with Real Time operation before goes into DSO mode is recommended.

5.2.l.At following situation, sampling, testing and display are stopped.
a) SAVE key engaged.
For normal operation, this key should be released,42)LED is green or off.
b)TRIGGER MODE 26)switch is set to NORM but without triggering signal.
To avoid this thing happen, user can set the trigger level knob 29) to LOCK-end of clockwise, or tuning this knob so that The signal is triggered. If above two step still doesn`t work, set the trigger mode switch to AUTO then check signal Amplitude, trigger source etc. try to figure out the reason.

5.2.2.SAVE and REF
a)Release above two keys when power on, otherwise 42) indicator red or orange led will flashing and DSO operation are prohibited.
b)While machine is working on Real Time mode, press SAVE or REF key is prohibited 42) LED will flashing to indicate this illegal operation.

c)The stored waveform by SAVE or REF will keep in the memory while change working mode between REAL and DSO. If power off ,the memory will be reset.

d)To store a new waveform, the REF key should be released first, adjust other parameters to get a steady waveform on Screen, and then press REF again, the new waveform is stored in REF memory

5.2.3 .In DSO mode ,knob "31)"has a new definition: screen refresh time or VIEW TIME. When switch off, view time or screen refresh time is zero; When switch on, view time or screen refresh time can be adjusted between 0.2s~5s.

5.2.4.In DSO mode, if vertical mode switch is set to(DUAL),panel key "12)"(ALT/CHOP)be suspended. Switch between ALT and CHOP will be controlled by microprocessor automatically depends on sweep time.

Sweep time:10s~lms/DIV:CHOP

Sweep time:0.5ms~0.2us/DIV:ALT

5.2.5.AUTO and NORM trigger mode:

While the trigger mode is set to AUTO, it is automatically trigger mode. What ever trigger signal is available or not, the sweep circuit will keep running. It's suitable for middle or high frequency signal testing.

While the trigger mode is set to NORM, it is normal trigger mode. The sweep circuit will start only trigger signal is Presented.(Except ROLL mode).It suitable for low frequency, single shot, and non- periodic signals test

52.6.ROLL Mode

Roll mode operation is rather like a chart recorder, where a trace is written on a strip of paper being drawn at a steady rate from a roll of chart paper.

a. Use FIFO(first in first out)sample and display mode. Sampling, display and refreshing are synchronized and waiting for trigger signal. If no trigger signal presented, repeat this process. There is continuing waveform on screen. When a trigger Event was detected, goes into next step.

b. According the preset trigger point, counting sample length after trigger events, continue sampling and display till this process finished.

c. Display waveform until end of view time and start a)step again.

Note: adjust Sweep speeds and View time get the best result at Roll mode

5.2.7."SAVE"mode,X-Y function is not available.

5.3 Low frequency and single shot signal acquisition

1.Set pre-trigger point, so that you can view the waveform before and after trigger events.

2.Determine testing signal, set trigger SLOP and VLOT/DIV

3.Set Trigger Mode at NORM

4.While signal is low frequency signal:

a. Set Sweep speed at l0s~0. ls/DIV Roll mode,

b. Turn on View Time; adjust view time so that you can have a desired display

c. For a single shot signal, before end of view time press SAVE key, then the waveform is saved.

6.MAINTENANCE

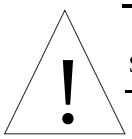
WARNING

The following instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than in the operating instructions unless you are qualified to do so.

6.1 Fuse Replacement

If the fuse blows, the power lamp indicators will not light and the oscilloscope will not operate. The fuse should not normally open unless a problem has developed in the unit. Try to determine and correct the cause of the blown fuse. The rep1ace only with a fuse of the correct rating and type (see page 9)

The fuse is located on the rear panel (see fig.4-2).



WARNING For continued fire protection. Replace fuse only with 250V fuse of the Specified type and rating, and disconnect power cord before replacing fuse.

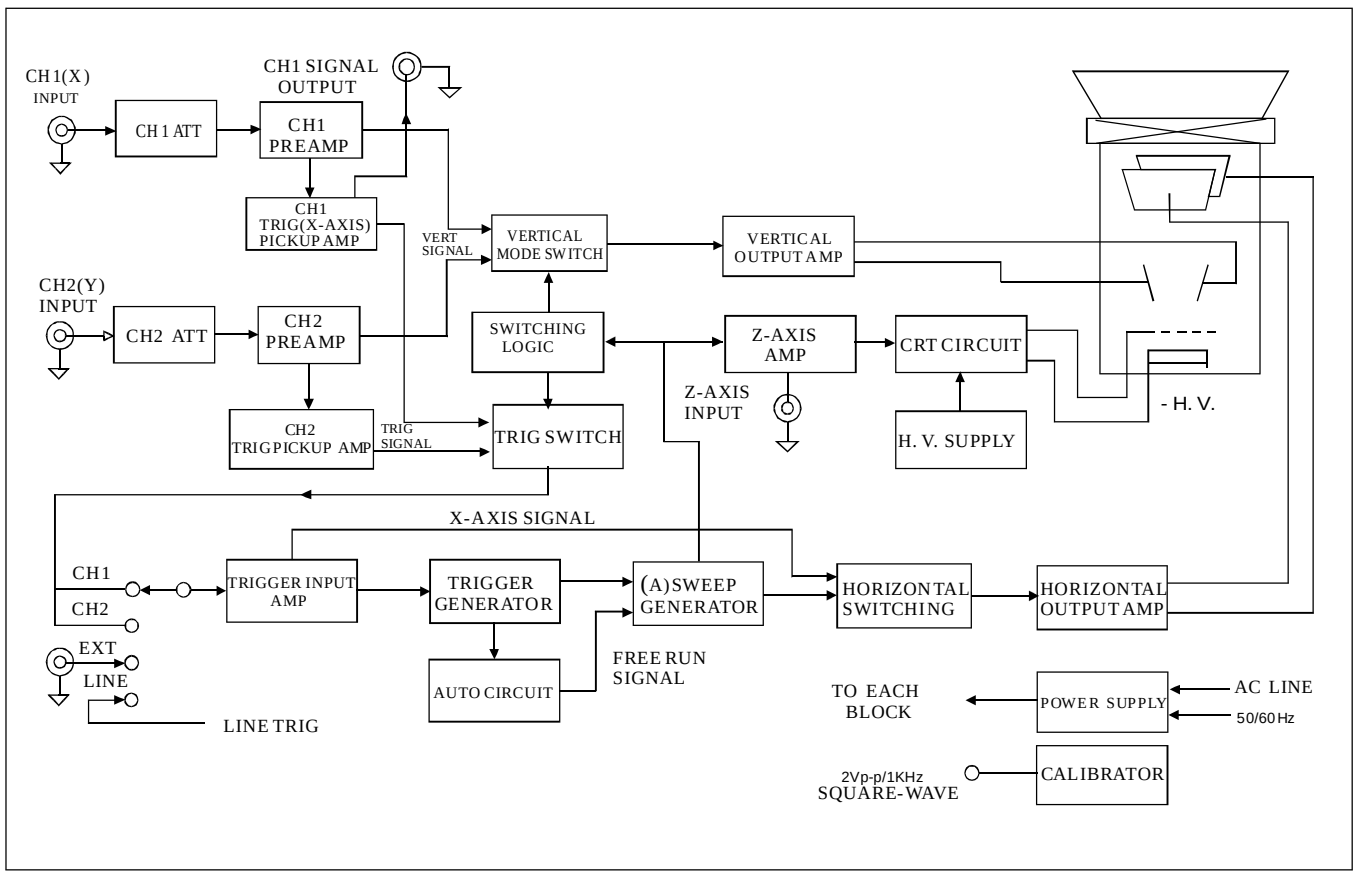
6.2 Cleaning

To clean the oscilloscope, use a soft cloth dampened in a solution of mild detergent and water. Do not spray cleaner directly on to the oscilloscope because it may leak into the cabinet and cause damage.

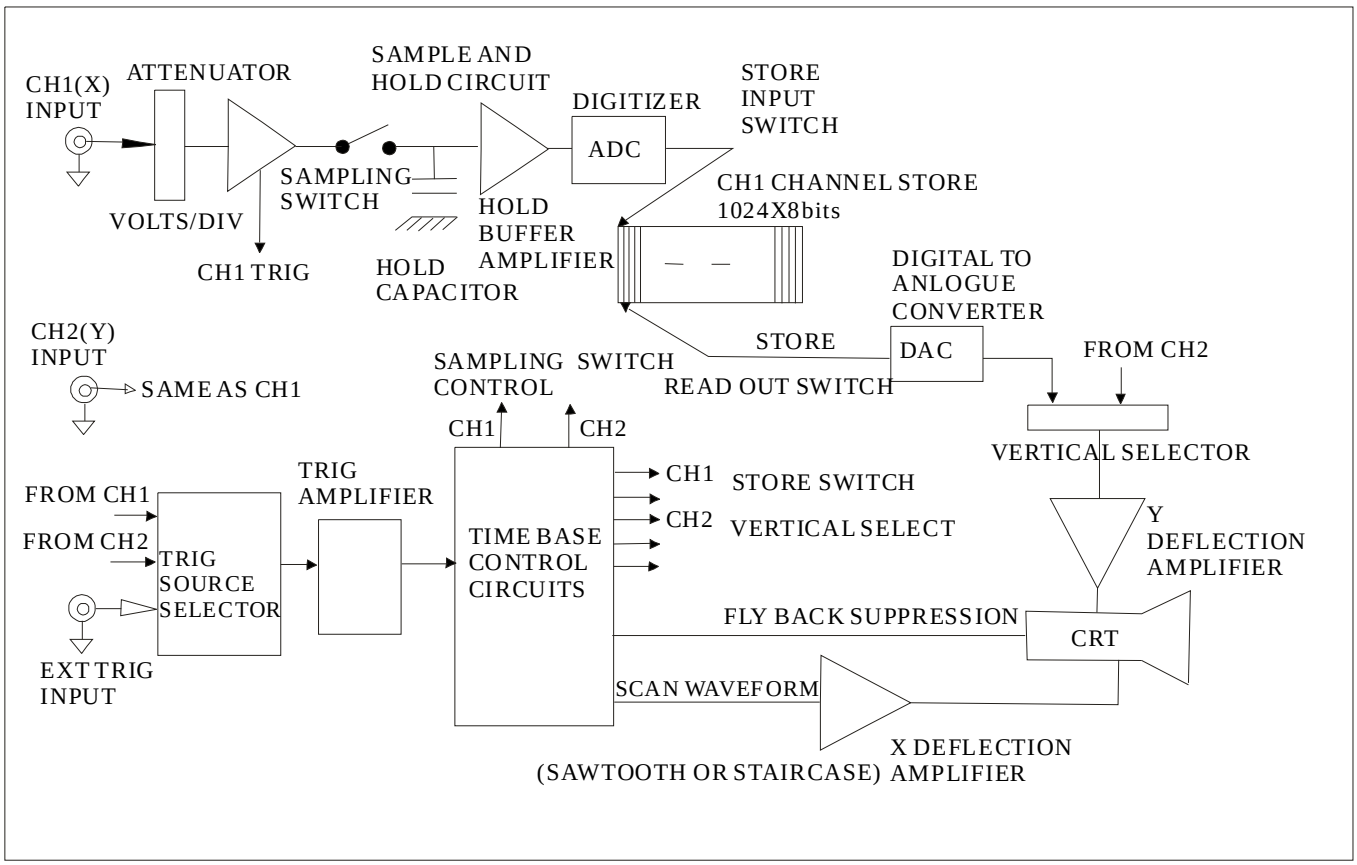
Do not use chemicals containing benzine, benzene, toluene, xylene, acetone, or similar solvents.

Do not use abrasive cleaners on any portion of the oscilloscope.

7.BLOCK DIAGRAM



BLOCK DIAGRAM DSO



Specifications are subject to change without notice