KUSAM-MECO®

An ISO 9001:2008 Company

# DIGITAL STORAGE OSCILLOSCOPE

## KM - 20 - 2025 CA - 25 MHz Colour CRT
## KM - 20 - 2040 CA - 40 MHz Colour CRT
## KM - 20 - 2100 CA - 100 MHz Colour CRT

NEW


**Preliminary Data**

### FEATURES :

- **Bandwidth : 25MHZ / 40MHz / 100MHz**
- **Dual channels /dual traces, X-Y mode**
- **6" display, high brightness Toshiba CRT tube**
- **High sensitivity of triggering,up to 1mV/divison**
- **TV synchronous separation circuit for displaying stable TV signal**
- **Trigger mode :** AUTO/ NORM / TV-V/ TV-H
- **Vertical :** CH1/ CH2 /ALT/ CHOP/ADD
- **X-x10 / Y-x5**
- **Polarity inversion**
- **CH1 Sync output**

### GENERAL & ELECTRICAL SPECIFICATIONS :

- **Channels :** 2 + Ext.Trigger (All Models)
- **Bandwidh :** 25 MHz (KM20 - 2025CA); 40 MHz (KM20 - 2040CA); 100 MHz (KM20 - 2100CA)
- **Rise Time :** 13.8ns (KM20 - 2025CA); 8.7ns (KM20 - 2040CA); 3.5ns (KM20 - 2100CA)
- **Time Base :** 5*ns* to 50*s / div* (KM20 - 2025CA & KM20 - 2040CA); *2ns* to 50*s / div* (KM20 - 2100CA)
- **Real time sample Rate :** 1GSa / s
- **Equivalent Sample Rate :** 50GSa / s
- **Input Impedence :** 1 Mega Ohms / 13pF
- **Input Coupling :** DC,AC,GND
- **Trigger :** Edge,Video,Pulse,Delay
- **Acquisition Modes :** Auto,Normal,Single
- **Trigger Sources :** CH1,CH2,Ext,Ext / 5,Ext (50 Ohms)
- **Horizontal Accuracy :** + / - 0.01%
- **Vertical Sensitivity :** 2m V / div to 5V / div
- **Vertical Resolution :** 8bit
- **Max I / p Voltage :** 400 V (DC + Acpeak) 5Vrms@ 50 Ohm
- **Auto Measurements :** Vpp,Vamp,Vrms,Vmax,Vmin,Vtop,Vbase,Vavg,Freg,Period,RiseTime,Fall Time,+ Width,- Width,Overshoot,Preshoot,+ Duty ,- Duty etc
- **Math :** + , - , x , / , FFT
- **Storage :** 10 Waveforms , 10 Set ups
- **FFT :** Window : Hanning ,Hamming , Blackman- Haris , Rectangular
  Sample Points : 1024 Points
- **X -Y :** Bandwidth : 25 MHz (KM20 - 2025CA); 40 MHz (KM20 - 2040CA); 100 MHz (KM20 - 2100CA)
  Phase Diff. : + / - 3 degrees
- **Display :** CA : Colour , 320 x 240 resolution.
- **Power Supply :** 100 - 225 V /AC 40VA Max
- **Interface :** USB Port
- **Dimension :** 303 (W)x145(H)x150(D)mm Approx.
- **Weight :** 4.5KG Approx.

### ACCESSORIES :

Probex2 , Power Cord , User's Manual

**All Specifications are subject to change without prior notice**

KUSAM-MECO®
An ISO 9001:2008 Company

G-17, Bharat Industrial Estate, T. J. Road, Sewree (W), Mumbai - 400 015. INDIA.
**Sales Direct.:** 022 -2 4156638, **Tel. :** 022-241224540, 24181649, **Fax :** 022 - 24149659
**Email :** kusam_meco@vsnl.net, **Website :** www.kusamelectrical.com

KUSAM-MECO

17, Bharat Industrial Estate, T. J. Road, Sewree (W),
Mumbai-400015. INDIA
**Sales Direct:** (022)24156638 **Tel.:**(022) 2412 4540, 2418 1649
**Fax:** 2414 9659 **E-mail :** kusam_meco@vsnl.net,
**Website :** www.kusamelectrical.com; www.kusam-meco.co.in

KUSAM-MECO

AN ISO 9001:2008 COMPANY

# DIGITAL STORAGE OSCILLOSCOPE

## MODEL - KM 20-2025CA
## KM 20-2040CA
## KM 20-2100CA

# OPERATION MANUAL

# Safety

Review the following safety precautions to avoid injury and prevent damage to this product on any products connected to it.

1. Use proper power cord. To avoid electric shock the grounding conductor must be connected to earth ground. Before using this product ensure that the product is properly grounded.
2. Connect the probe properly. The probe ground lead is at ground potential. Do not connect the ground lead to an elevated voltage.
3. Do not exceed the maximum ratings of this product when using it.
4. Do not operate this product with covers or panels removed.
5. Do not operate this product if there is damage to this product. Only qualified personnel should inspect it.
6. Keep product surfaces clean. Provide proper ventilation. Do not operate in wet conditions and an explosive atmosphere.

KUSAM-MECO

# Chapter 1: Beginning

## I. General-Purpose

1. Color LCD display 320*240 resolution.
2. Bandwidth : 25MHz (KM 20-2025CA),
   40MHz (KM 20-2040CA),
   100MHz (KM 20-2100CA) bandwidth restrained.
3. 4k/Channel Memory Depth.
4. 50Gsa/s equivalent sample rate.
5. Automatic setup of the menu.
6. Storage of the waveforms and setups.
7. Delayed scan function, can display both the full view and details of the waveforms.
8. 20 automatic measurements.
9. Cursor measurements and automatic cursor tracking measurements.
10. Built-in FFT function digital filter, frequency counter.
11. Mathematic functions.
12. Trigger on edger, video, pulse width, external and power.
13. Menu with multiple languages.

## II. The front panel and operation instruction

Figure 1-1 shows the front panel of . Figure 1-2 shows the Front panel controls. The front panel has knobs and keys.

The knobs are similar to the knobs on other oscilloscopes, such as POSITION, LEVEL, and VOLTS/DIV.

The keys allow you to access to different kinds of the function menus and controls.

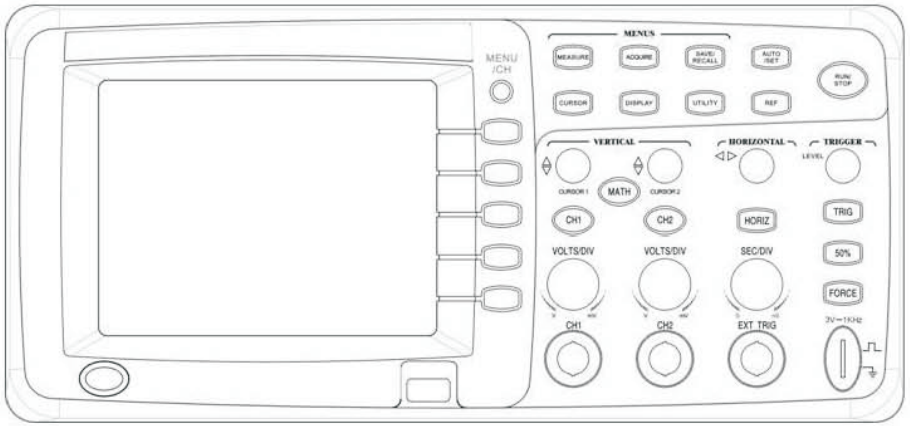



Figure 1-1 front panel of oscilloscope

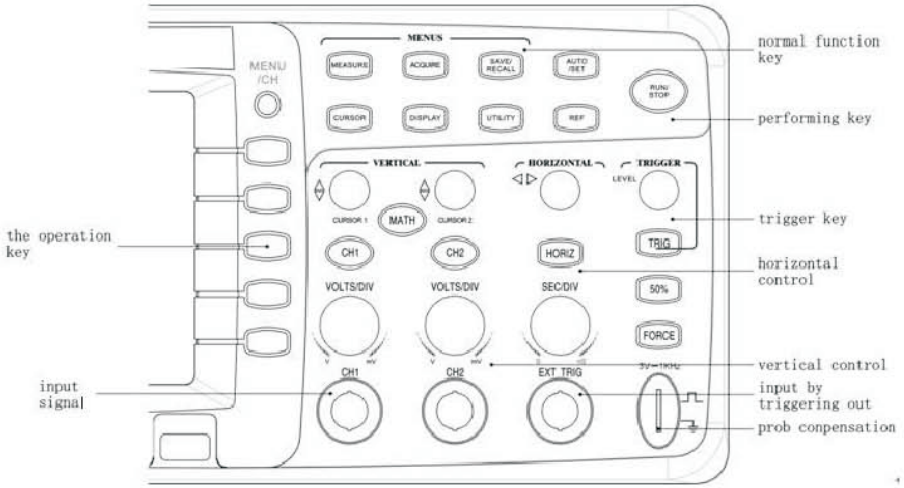







Figure 1-2 Front panel controls

Menu buttons: The 5 function buttons are on the right of the LCD screen. 2 methods are used to display the menu options in the oscilloscope, as shown in Figure 1-3.

a. Cycle list the oscilloscope will set the parameter to a different value when pressing option buttons.
b. The action type immediately occurs when pressing action option buttons.

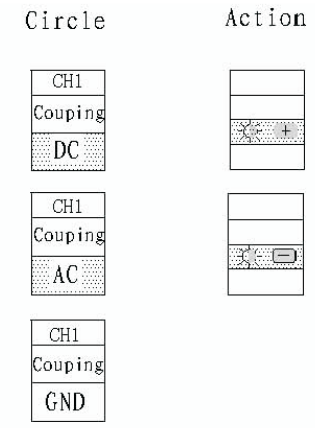



Figure 1-3

## III. Function check

1. Turn on the instruments, a moment later the display shows that all self-tests passed, as show in Figure 1-4.

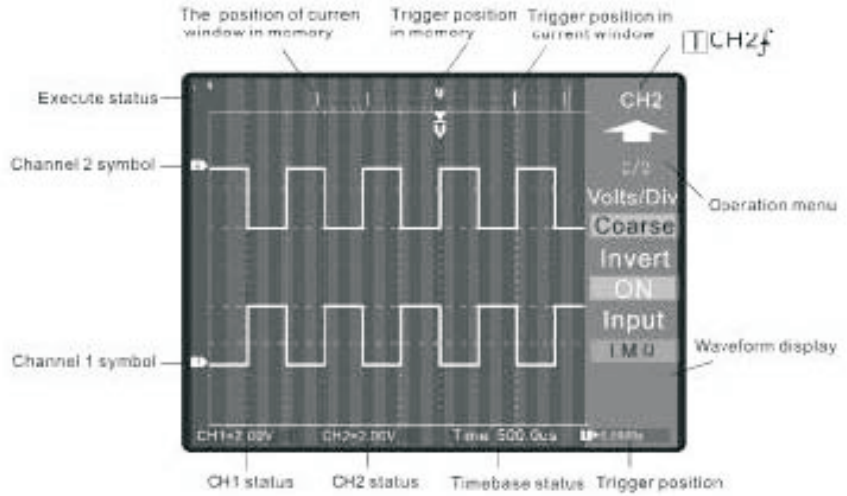



Figure 1-4. User Interface

2. Set the switch to 10× on the probe and connect the probe to channel 1 on the oscilloscope. To do this, align the slot in the probe connector with the key on CH 1 BNC, push to connect, and twist to the right to lock the probe in place, as shown in Figure 1-5.





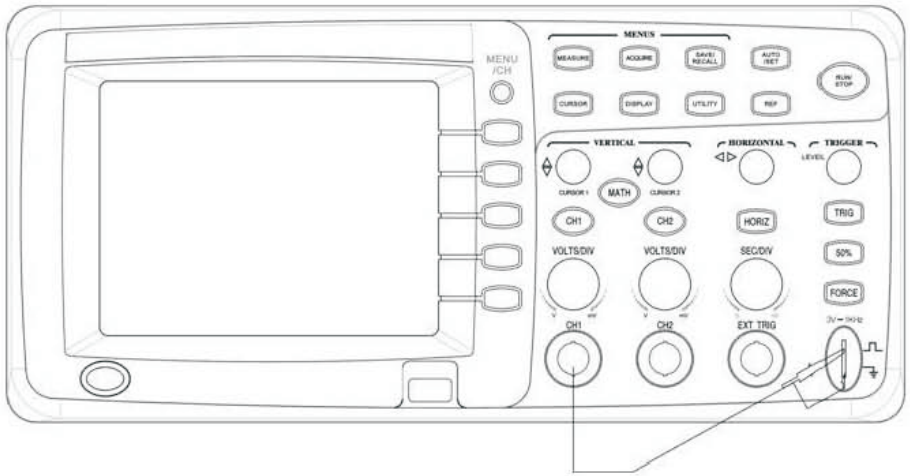



Figure 1-5 Probes Compensated

3. Attach the probe tip and reference lead to the PROBE COMP connector. Push the AUTOSET button. Within a few seconds, you could see a square wave in the display (3 V at 1 kHz peak-to-peak), as shown in Figure 1-6.

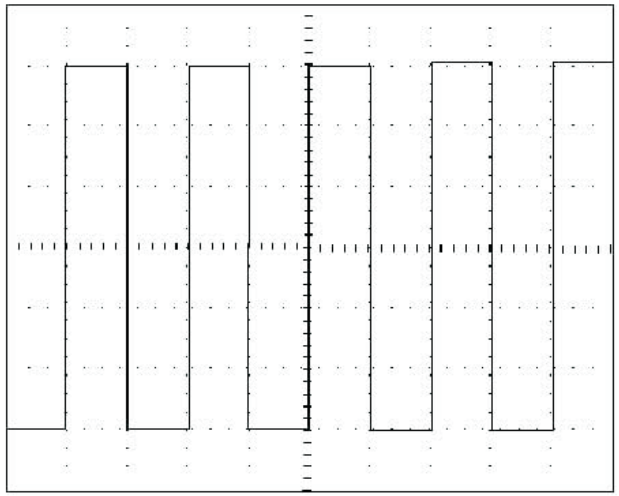


Figure 1-6 The wave of probes compensated

Figure 1-6 The wave of probes compensated

4. Using the same method to check CH2. Push the MENU/CH OFF button to turn off channel 1, push the CH2 button to turn on channel 2, repeat steps 2 and 3.

## IV. Probes compensation

1. Referring the steps above, attach the probe, and then press AUTO/SET
2. Check the shape of the displayed waveform, as shown in Figure 1-7.

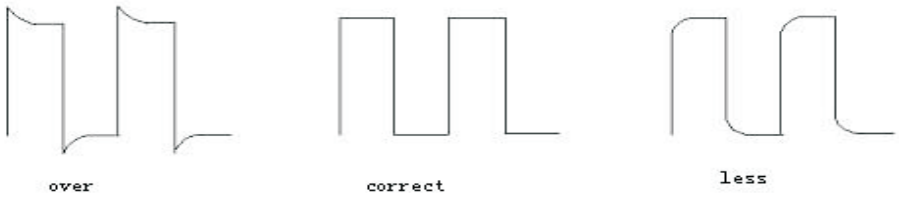



Figure 1-7 The shape of the displayed waveform

3. If necessary, use a nonmetallic tool to adjust the trimmer capacitor on the probe for the flattest square wave possible as displayed on the oscilloscope.

## V. Automatic setup

The oscilloscope has an Auto feature that automatically sets up the oscilloscope to best display the input signal. Using Auto requires signals with a frequency greater than or equal to 50 Hz and a duty cycle greater than 1%.





1. Connect a signal to the oscilloscope.
2. Press AUTO/SET button, the waveform will be displayed automatically. If necessary, you can adjust manually **for your choice.**

## □. Vertical system

Figure 1-8 shows the vertical control zone.

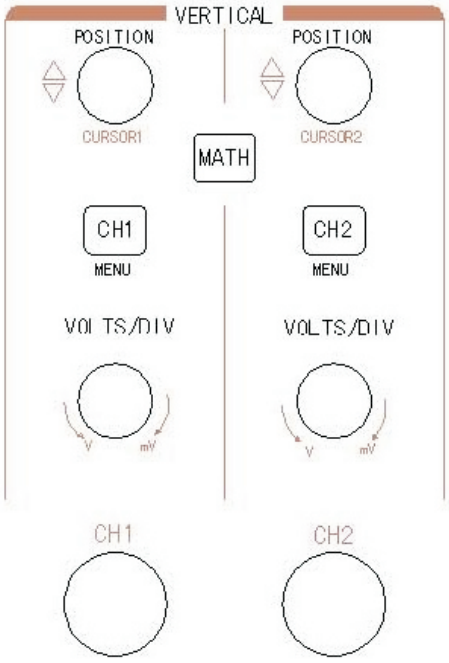



Figure 1-8 the vertical control zone

1. POSITION

The POSITION knob moves the waveform vertically.

2. Volts/DIV

This knob changes the vertical step size increments, and it has fine and coarse status.

3. CH1, CH2, MATH

These are menu keys, and display the corresponding menu in the LCD. The 5 menu control keys provide the corresponding operation.

## □. Time Base System

Figure 1-9 shows the time base control zone.


Figure 1-9 The time base control zone





1. POSITION

This knob adjusts horizontally signal on waveform window.

2. SEC/DIV

This knob changes the sweep speed from 5ns to 50s (KM 20-2025CA & KM 20-2040CA) & 2NS TO 50 NS (KM 20-2100CA) (the fastest speed is model dependent).

3. HORIZ

Press this key, you can enter or exit delayed scan, set the display to X-Y format and to Trig-Offset or Hold-off mode.

## □. Trigger System

Figure 1-10 shows the trigger control zone.

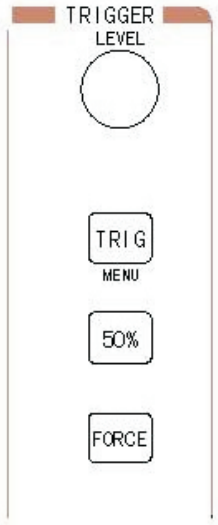



Figure1-10 The trigger control zone

1. LEVEL

As you turn this knob, the trigger line is displayed following a sign. When moving the trigger line, the trigger level or percentage of the trigger will change. (When trigger coupling is AC or low frequency reject, the trigger level value will be displayed as percentage)

2. TRIG

Press this button, you can choose trigger type, trigger source, edge type, trigger mode and coupling. When you change your choice, the trigger type, slope, and source change in conjunction with the status on the top-right of the screen.

3. 50%

Press this button; the oscilloscope sets the trigger level to the center of the signal.

4. FORCE

Press this button to start an acquisition regardless of the trigger signal. It is mainly used in “normal” and “single” of the trigger mode.





# Chapter 2: Operating your oscilloscope

By now you get a brief understanding of KM 20-2025CA, KM 20-2040CA, KM 20-2100CA oscilloscopes with the VERTICAL、HORIZONTAL and TRIGGER groups of the front panel buttons. You should also know how to determine the setup of the oscilloscope by viewing the status bar. This chapter takes you through all groups of front panel buttons、knobs and menus. We recommend you perform all of the exercises in the following chapter so you become familiar with the powerful measurement capabilities of the oscilloscope.

## □. Vertical system

Each channel has a corresponding operation menu. It is activated by pressing CH1 or CH2 key respectively. Each menu is divided into two pages and consists of seven selections.

Coupling: AC, DC, GND. The corresponding indication in the status bar is ∽, ⎓, ⏚

AC: AC blocks the DC component of the input signal.

DC: DC passes both AC and DC components of the input signal.

GND: disconnect the input signal.

BW limit

ON: Limit the channel bandwidth to 25MHz, 40MHz, 100MHz to reduce display noise.

OFF: To get use of full bandwidth, set "OFF".

Probe: Optional selections are 1X、10X、100X、1000X. You can set this to match your probe attenuation factor to make the vertical scale readout correct.

Digital filter: Setup digital filter.

Volts/Div: Selects the resolution of the vertical SCALE knob. COARSE defines a 1-2-5 sequence while FINE changes the resolution by small steps between the COARSE settings.

Invert: ON: Turn on the invert function

OFF: Restore to normal display of the waveform.

Input: 1MΩ: Set 1MΩ input impedance.

50Ω: Set 50Ω input impedance.

1. Function description

In the following, CH1 is used as an example. CH2 is similar.

Coupling: It determines how the input signal is coupled to oscilloscope. As Fig. 2-1.

AC: The DC component of the input signal is blocked. If the input signal is composed of small AC component and large DC component and you are only interested to view its AC component, this mode is proper. Typical usage is to observe the ripple of DC power source.

DC: Both AC and DC component of the input signal can be observed. You can measure the DC component of the input signal.

GND: The input signal is disconnected and Display is a line at ZERO position.





Status indication: The coupling mode is indicated at left bottom corner by following symbols: AC ∽, DC ⎓, GND ⏚.

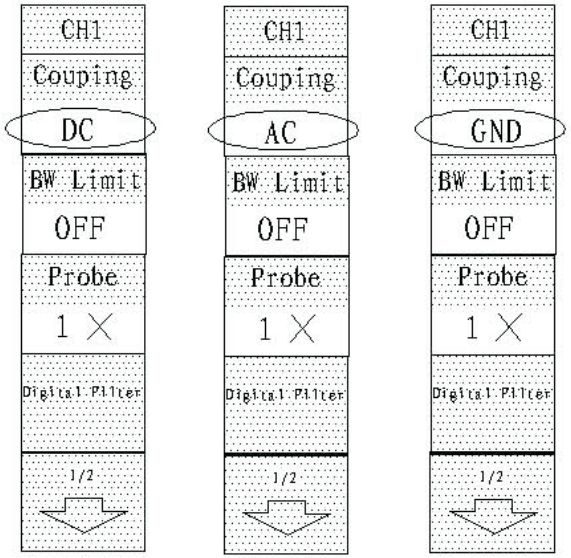



Figure 2-1

Setup the channel bandwidth limit, as Fig.2-2 shows.

When disabled, the high frequency component of the input signal can passes through.

When enabled, the bandwidth of oscilloscope is limited to 25MHz, so the high frequency noise greater than 25MHz is blocked.

BW limit indication: When enabled, 'B' will be displayed at left bottom corner.

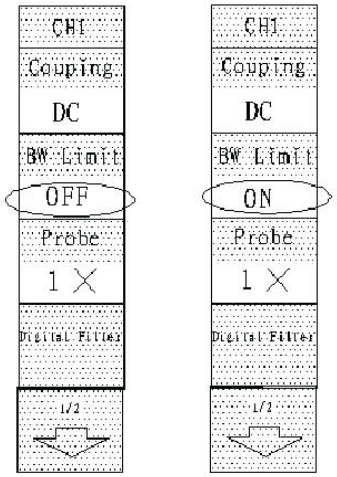



Figure2-2

Probe attenuation setting, see Fig.2-3.

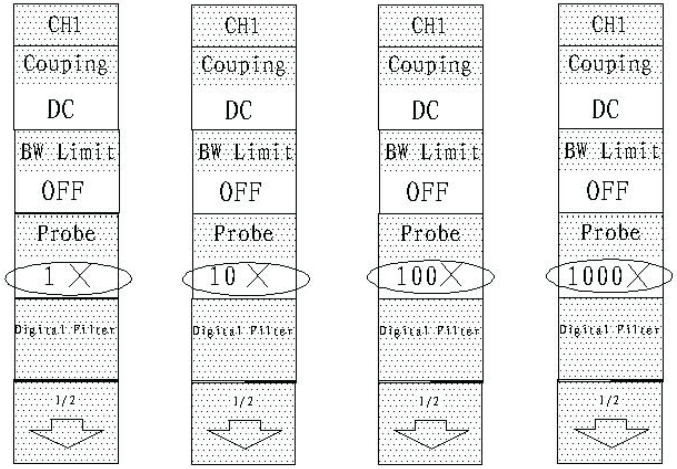



Figure2-3





Probe attenuation factor Menu setting

When probe attenuation factor changes, the corresponding Volts/DIV indication is also changed. For example, 1:1 setting corresponds to 1V/DIV, and then 10:1 setting changes to 10V/DIV.

Volts/DIV setting sees Fig.2-5

The Volts/DIV control has COARSE or FINE configuration.

COARSE: It is the default setting of Volts/DIV, and it makes the vertical scaling in a 1-2-5 step sequence from 2SV/DIV to 5V/DIV.

FINE: This setting changes the vertical scale to small steps between the COARSE settings. It will be helpful when you need to adjust the waveform's vertical size in smooth steps. For example, if COARSE setting is 2SV, so the sequence of FINE setting will be 2.05mV, 2.10mV, 2.15mV, etc.

a. To invert a waveform

Invert turns the display waveform 180 degrees, as respect to the ground level. As Figure 2-4 shows.

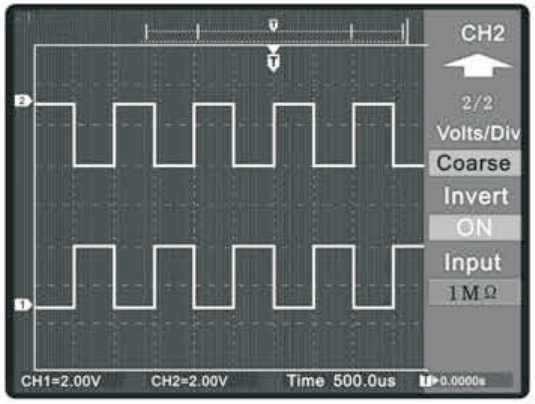



Figure 2-4

(1) Select input impedance, see Fig.2-5

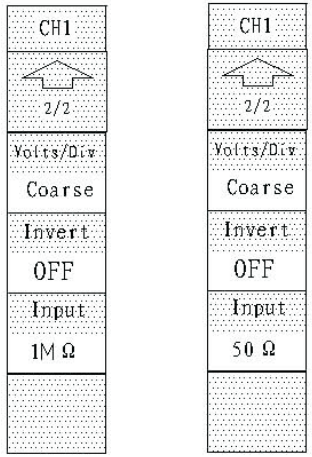



Figure 2-5

The input impedance of oscilloscope can be set to 1MΩ or 50Ω optionally. Setting 50Ω makes it easy to measure high frequency signal or examine the characteristic of fast circuit, as well as to match the characteristic resistance of 50Ω coaxial cable.

CAUTION: When 50Ω is selected, **ALWAYS ENSURE** the input voltage at BNC does **NOT** exceed the maximum voltage (5Vrms) to avoid damaging channel input components.

In case 50Ω is selected, a 'Ω' is displayed at left bottom corner.

(2) Digital filter, see Fig.2-6 and Fig.2-7

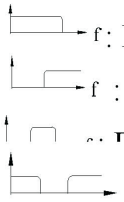
Press CH1→ **Digital filter**, display the digital filter menu. Turn horizontal POSITION knob to set high and low limit of frequency.





| MENU | Setting | Comments |
|---|---|---|
| Digital Filter | ON | Turn on the digital filter |
| | OFF | Turn off the digital filter |

Filter setting:



f: Low pass filter selected

f : High pass filter selected

: Band pass filter selected

f: Band resisting filer selected.

Up or low frequency limit adjustment: Turn the horizontal SEC/DIV or POSITION knob, the up limit or low limit can be changed respectively. (The function must be selected).

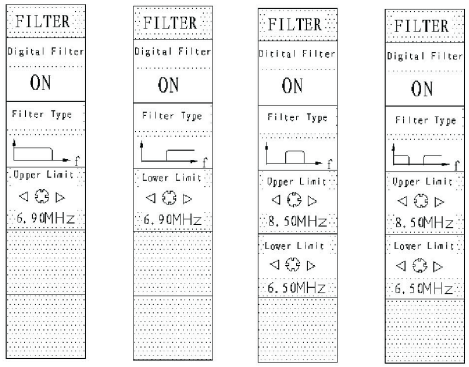



Figure 2-6

Unselected Selected

Figure 2-7

(a) Math functions

The mathematic functions include "add", "subtract", "multiply", "divide" and "FFT" for CH1 and CH2, as Fig.2-8 shows.

Operation: Optional selections are A+B, A-B, A×B, A÷B and FFT. Here A, B corresponds to the two signal sources respectively. It is selected by first pressing MATH to activate MATH function and then pressing F1 repeatedly to select desired operation.

Invert: Set "ON" to invert the MATH waveform. Set "OFF" to restore normal waveform display.

The amplitude of the MATH waveform can be adjusted by the vertical SCALE knob in a 1-2-5 step from 0.1% to 1000%. The scale will be displayed at the left bottom corner.

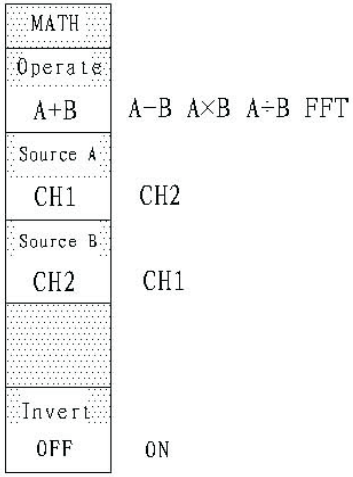



Figure 2-8





**Using FFT**

The FFT (fast Fourier transform) process mathematically converts a time-domain signal into its frequency components. FFT waveforms are useful in the following application:

- Measuring harmonic content and distortion in systems.
- Characterizing noise in DC power supplies.
- Analyzing vibration.
- Analyzing the characteristic of filter circuit or pulse response of the system

Fig.2-9 shows the FFT menu.

Display: Full screen: Display FFT waveform on full screen.

Split: Display FFT waveform on half screen.

Scale: $V_{rms}$: Set $V_{rms}$ as vertical unit

$dBV_{rms}$ : Set $dBV_{rms}$ as vertical unit.

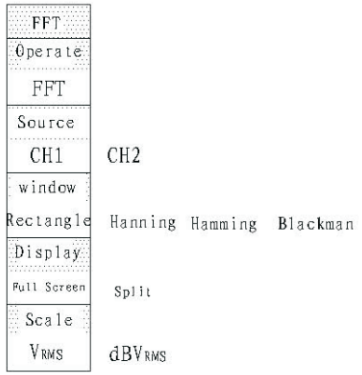



Figure 2-9

(b) Using vertical POSITION knob

The vertical position of the waveforms can be changed by moving them up or down on the screen.

When you change the vertical position, the position message is displayed on the left bottom of the screen, such as POS: -1.20V. The message will disappear after few seconds.

(c) Using vertical Volts/DIV knob

The vertical scale of a waveform can be changed. If the probe is set to 1× and the Volts/DIV is set to "COARSE", the waveform scales in a 1-2-5 step sequence from 2SV to 5V. If the Volts/DIV is set to "FINE", it scales to small steps between the coarse settings.

Volts/DIV status is displayed on the status bar, such as CH1~500mV. Color LCD uses different color to display different waveforms.

## II. Horizontal system

1. POSITION: The horizontal POSITION knob adjusts the horizontal position of all channels and math or REF waveforms. In other words, it changes the position of trigger point in the sampling memory. It can also be used to adjust the TRIGGER HOLDOFF. (The interval before the trigger circuit restart.)

2. SEC/DIV: To adjust the time-base to a horizontal scale that suits your purpose, use the horizontal scale knob. As for , the range of adjustment is from 50S/DIV to 2nS/DIV.





3. Horizontal menu, as Fig.2-10.

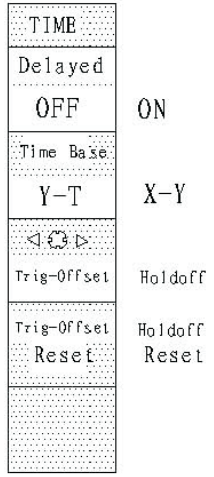



Fig.2-10

(1) Delayed scan: The Delayed Scan is a magnified portion of the main waveform window. You can use Delayed Scan to locate the horizontal expand part of the main waveform window for a more detailed (high horizontal resolution) analysis of signal.

Use POSITION and SEC/DIV knob to change the horizontal position and size of delayed scan portion in the main waveform window.

Because the screen is split into two parts vertically in the Delayed Scan mode, the amplitude of the display waveform reduce to half of the original or more, so the Volts/DIV changes accordingly.

(2) Trigger offset: Adjust horizontal position in memory by use of the POSITION knob. The adjusted time message is displayed on the

left bottom of the screen, such as T→200.0000ns. Pressing Trigger offset reset key can reset it to T→0.000000ns which corresponds to the middle point of the screen.

(3) Trigger HOLDOFF: Trigger HOLDOFF can stabilize waveform. Hold-off time is the oscilloscope's waiting period before starting a new trigger. During the hold-off oscilloscope will not trigger until hold-off ends. The Hold-off time can be adjusted from 100ns to 1.5s. By pressing Hold-off reset, the Hold-off time resets to its 100ns minimum value.

(4) X-Y format.

This format compares the voltage of two waveform records point by point. It is useful for studying phase relationship between two waveforms.

This format only applies to channel 1 and 2. Choose X-Y display format to display channel 1 in the horizontal axis and channel 2 in the vertical axis. The oscilloscope uses the un-triggered sample acquisition mode and data displays as dots. The sampling rate can vary from 4KS/s to 100MS/s, and the default sampling rate is 1MS/s. See Fig.2-11.





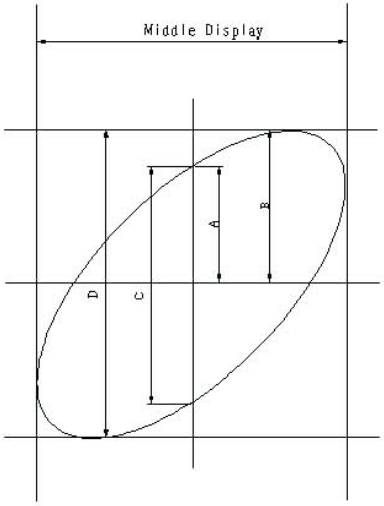



Figure 2-11

## III. Trigger system

The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, it can convert unstable displays or blank screens into meaningful waveforms.

Traditional analog oscilloscope can only display waveforms after the trigger point (Satisfying trigger condition). Modern digital oscilloscope overcomes this restriction. When the oscilloscope starts to acquire a waveform, it collects enough data so that it can draw the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. After it

detects a trigger, the oscilloscope continues to acquire enough data so that it can draw the waveform to the right of the trigger point. Because digital oscilloscope can observe the signal part before the trigger point, it is very useful in the research of component defects or relay contacts.

1. LEVEL: use the knob to set the trigger level.
2. 50%: The instant executing button sets the trigger level to the vertical midpoint between the peaks of the trigger signal.
3. Force: Starts an acquisition regardless of an adequate trigger signal. This button has no effect if the acquisition is already stopped.
4. MENU: The button that activates the trigger control menu.

a. Edge: Edge trigger can be used in analog and digital circuit analysis. An edge trigger occurs when the trigger input passes through a specified voltage level in the specified slope direction (rising or falling). See Fig. 2-12.

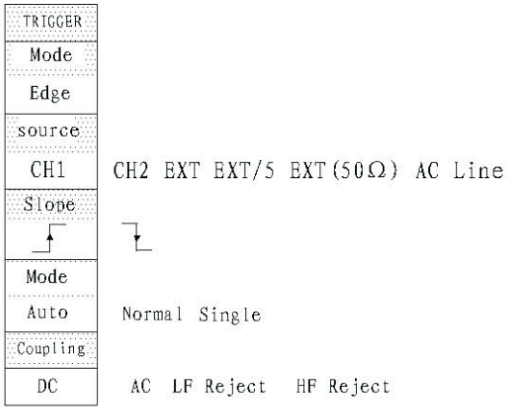



Figure 2-12

b. Video: Use video trigger on fields or lines for standard video signals.





See Fig.2-13.

c. Pulse: Use this trigger type to catch pulses with certain width. See Fig.2-16.

■ Setting for edge Trigger

The **SLOPE** and **LEVEL** controls help to define the trigger. The **SLOPE** control determines whether the oscilloscope finds the trigger point on the rising or the falling edge of the signal.

□ Source

CH1: Selects CH1 as the trigger signal.

CH2: Selects CH2 as the trigger signal.

EXT: Select EXT TRIG as the trigger signal.

EXT/5: Selects EXT TRIG/5 as the trigger signal.

AC line: Selects power line as the trigger signal.

EXT (50Ω) : Select EXT TRIG( Input impedance is set to 50Ω) as the trigger signal.

□ Slope

Rising: Trigger on the rising edge.

Falling: Trigger on the falling edge.

□ Mode:

Auto: Acquire waveform even no trigger occurred.

Normal: Acquire waveform when trigger occurred.

Single: When trigger occurs, acquire one waveform, then stop.

□ Coupling:

DC: Apply all components of the trigger signal to the trigger circuitry.

AC: The DC component and AC components (≤5Hz) of the trigger signal are blocked.

LF Reject: Permit the high frequency components of the trigger signal to pass through. The components (Below 8 kHz) of the trigger signal are attenuated.

HF Reject: Permit the low frequency components of the trigger signal to pass through. The components (Above 150 kHz) of the trigger signal are attenuated.

■ Setting for video trigger

Choose video triggering to trigger on fields or lines of NTSC、PAL、or SECAM standard video signals, as Fig.2-13. Trigger coupling presets AC.

□ Source:

CH1: Selects CH1 as the trigger signal.

CH2: Selects CH2 as the trigger signal.

EXT: Select EXT TRIG as the trigger signal.

EXT/5: Selects EXT TRIG/5 as the trigger signal.

AC line: Selects power line as the trigger signal.

EXT (50Ω) : Select EXT TRIG( Input impedance is set to 50Ω) as the trigger signal.

□ Polarity

Normal: Trigger on the negative edge of the sync pulse.

Inverted: Trigger on the positive edge of the sync pulse.

□ Sync:





All lines: Trigger on all lines.

Line Num: Trigger on an appointed line (Use the LEVEL knob to select the desired line number), as Fig.2-14.

Odd field: Trigger on odd field.

Even field: Trigger on even field, as Fig.2-15.

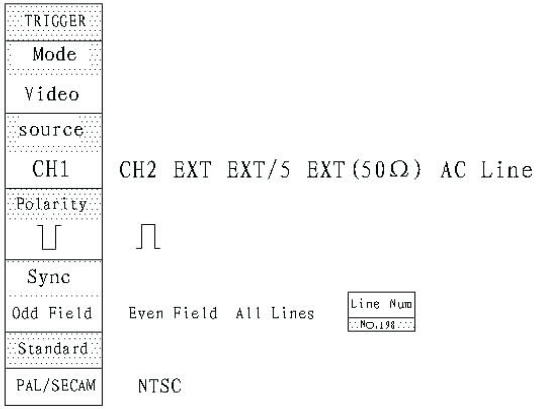



Figure 2-13

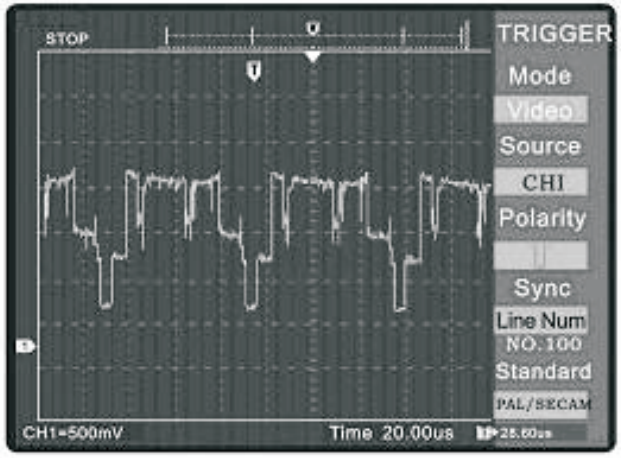



Figure 2-14 Synchronized on line 100

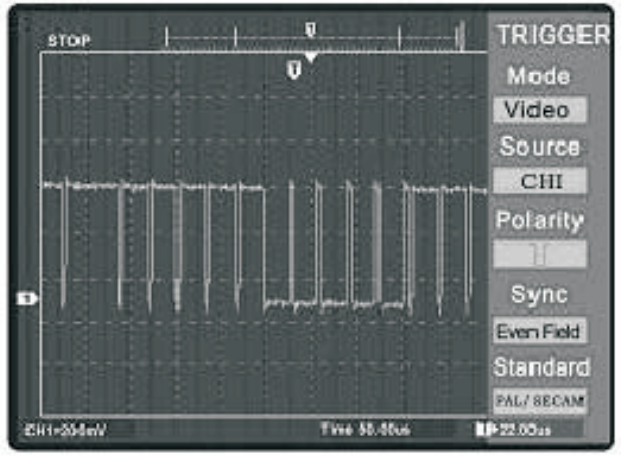


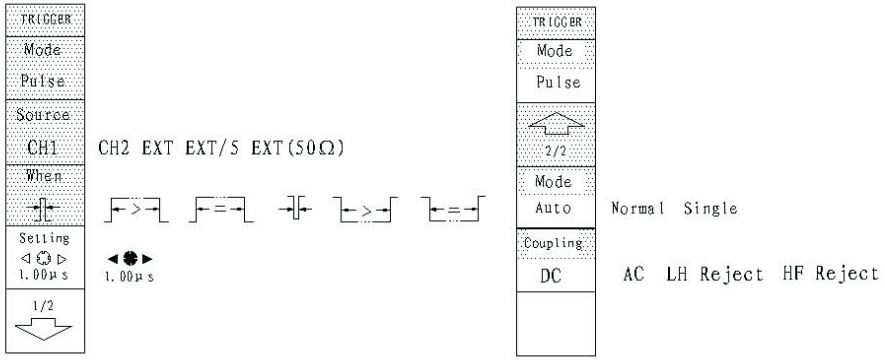

Figure 2-15 Field synchronization





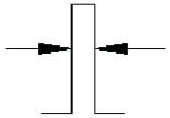
■ Setting for pulse width trigger

Pulse trigger occurs according to the width of pulse, which makes it easy to observe some complicate pulse combination.

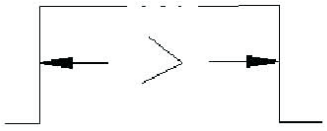



□ Source: The source of pulse trigger can select each of the following: CH1、CH2、EXT、EXT/5、EXT (50Ω).

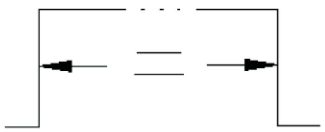
□ When: Set the trigger condition



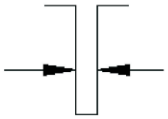
Positive pulse width less than



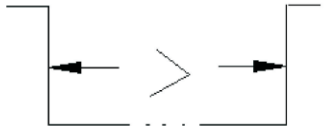
Positive pulse width greater than



Positive pulse width equal to



Negative pulse width less than



Negative pulse width greater than

Negative pulse width equal to

※ 1.00μs Setting: Adjust pulse width to desired value.

By pressing the corresponding function key, the color of the symbol ◄✽► 1.00μs reversed, and then you can turn the horizontal POSITION knob to change the pulse width.

※ Mode: There are three trigger modes: Auto, Normal, Single. Their function is the same as EDGE trigger.

※ Coupling: Includes DC, AC, HF Reject and LF Reject. Their function is the same as EDGE trigger.





# IV . Sampling system

The **ACQUIRE** button for sampling system is at the MENU area. Pressing **ACQUIRE** button, the setup menu of sampling system appears, as Fig.2-17.

There are four choices for the operating mode of acquisition:

- Normal: Fast sampling in a regular interval to construct waveforms based on trigger.
- Average: Multiple reconstructed waveforms are averaged to generate a waveform for display. In this case, noise is greatly reduced to recover the useful message, which is very useful in biological and medical field.
- Analog: Analog display mode, the brightness is corresponding to the possibility that data appear. The more often, the brighter.
- Peak detect: Multiple waveforms are acquired to detect and display the envelopes of the waveforms. The noise becomes greater in this mode.

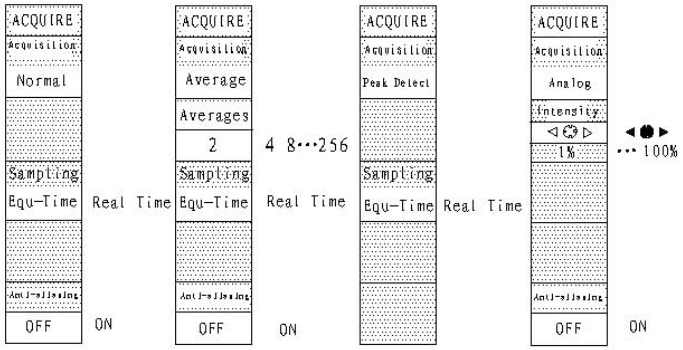



Figure 2-17

**Note:**

● Scan: When observing slow signal, if SEC/DIV is lower than 50ms/DIV and trigger mode is set "AUTO", oscilloscope is working at so-called SCAN mode, waveform is displayed rolling from left to right, while horizontal POSITION and trigger control has no effect. As to examine slow signal, coupling of the input channel should be set at "DC".

● In analog mode, when brightness is selected, it can be adjusted from 1% to 100% by horizontal POSITION knob. Available lowest time-base is 20ms/DIV.

● Anti-aliasing: If the sampling speed of the oscilloscope is not fast enough, the waveforms cannot be reconstructed accurately. Instead, aliasing occurs. Theoretically, the maximum frequency recoverable for the oscilloscope is half of the sampling frequency. When anti-aliasing is enabled, the artificial effect may be removed.

● Real-time or Equivalent: In real-time mode, each trigger leads the oscilloscope to sample a complete waveform, so non-periodical or one-shot signal can be captured. If the sampling speed is over 20ns, the oscilloscope automatically interpolates data to display waveforms. On the contrary, equivalent mode assumes that the input signal is periodical, it reconstruct a waveform based on many triggers. In equivalent mode, horizontal resolution is up to "20ps", i.e. 50GS/s equivalent sampling speed.





# V . Display system

The **DISPLAY** button is at the MENU area. Pressing **DISPLAY** button, the setup menu of display system appears.

■ Display type

Vector: The points between two adjacent sampling points are interpolated based on linear or sin(x)/x function. Sin(x)/x are used in real-time sampling mode when SEC/DIV is over 20ns/DIV.

Dot: Sampling data is displayed straightly.

■ Grid:

a. Display both grids and coordinates on the screen

b. Turn off the grids

c. Turn off the grids and coordinates.

■ Press ☼+ to increase display contrast; Press ☼- to decrease display contrast.

Persist:

Infinite: The sample points remain displayed until turn the persistence "OFF"

OFF: Waveform display is refreshed in high rate.

■ Menu Display: Optional selections are: 1s, 2s, 5s, 10s, 20s, Infinite. The menu will be hidden according to the time after last key pressing.

■ Screen:

Normal: Set to normal mode.

Invert: Set to invert color display mode.

## VI. Save and recall waveforms or setups.

The **SAVE/RECALL** button is at the MENU area. Pressing **SAVE/RECALL** button, the SAVE/RECALL menu appears, as Fig.2-18.

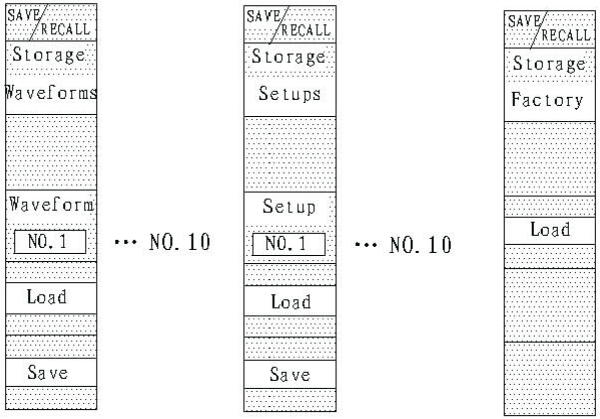



Figure 2-18





| Menu | Settings | Comments |
|---|---|---|
| Storage | Waveforms | Store or recall waveforms |
| | Factory | Recall factory setups |
| | Setups | Store or recall instrument setups |
| Waveform | No.1 | Select storage location of waveform |
| | No.2 | |
| | No.3 | |
| | ... | |
| | No.10 | |
| Setup | No.1 | Select storage location of setup |
| | No.2 | |
| | No.3 | |
| | ... | |
| | No.10 | |
| Load | | Recalling of Stored documents |
| Save | | Storage of waveform data |

■ **Factory Setup:** The oscilloscope is setup for normal operation when it is shipped from factory. You can recall the factory default setup any time you want to operate the oscilloscope.

■**Waveform:** You can save up to 10 waveforms of two channels and 10 settings in the nonvolatile memory of the oscilloscope and overwrite previously saved contents as needed. By default, the oscilloscope saves the setup each time it is powered off. The oscilloscope automatically recalls this setup the next time it is powered on.

■**Load:** The stored waveforms, setups and factory setup can be recalled out.

■**Save:** Store existing waveforms or setups.

Note: The **Save** stores not only the waveforms, but also the current settings of the oscilloscope.

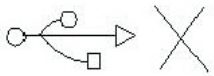
## VII . Auxiliary function UTILITY

Press **UTILITY** button, then enter the **UTILITY** menu.

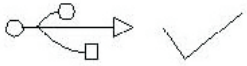
1. Interface setup

RS-232 baud rate: If ******* is displayed, it means that RS-232 communication is not available. Baud rate can be from 300 to 38400.

GPIB address: If ***** is displayed, it means that GPIB function is unavailable. Address can be 0, 1, 2, …… 30.

USB interface: 

Disconnected



Connected

2. Sound

Enable beep sound for key press

Disable beep sound for key press

3. Counter:

ON/OFF: Turn on/off frequency counter.

4. Language: Select language for menu and system message display. Such as simplified Chinese, traditional Chinese, English, Korean, Japanese… etc.

**5.** In the second page, other functions such as **PASS/FAIL**,





**Waveform recorder**, **Auto calibration** and **Auto test** can be activated.

● PASS/FAIL

Through detecting whether waveforms are in the preset area, PASS/FAIL module monitors the change of input signal continuously. See Fig.2-19

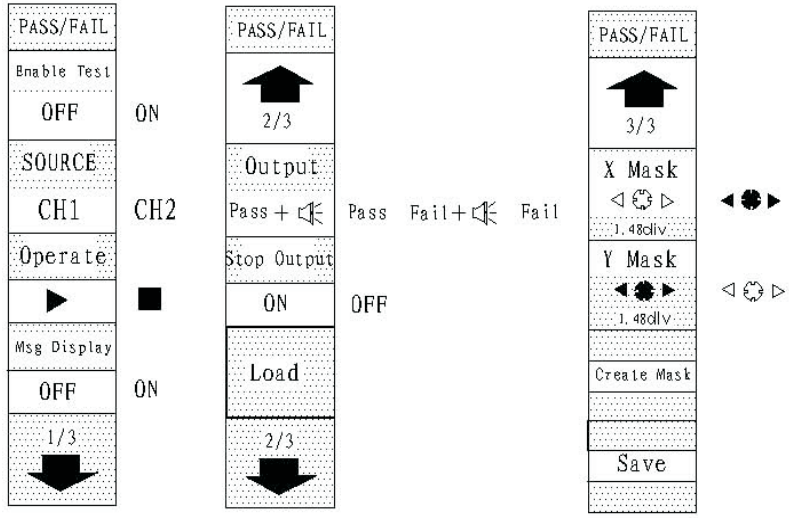



Figure 2-19

● 1/3 Menu:

Enable Test: On/Off: Turn on/off Pass/Fail test

Source: CH1/CH2: Select Pass/Fail test on CH1/CH2

Operation: ▶: Pass/Fail test stopped, press to run

■: Pass/Fail running, press to stop

Msg Display: On/Off: Turn on/off Pass/Fail information display

● 2/3 Menu:

Output: Fail: Output when fail condition detected

Fail+: Output and stop when fail condition detected

Pass: Output when pass condition detected

Pass+: Output and stop when pass condition detected

Stop On Output: On: Stop test when output occurs

Off: Continue test when output occur

Load: Load a pre-defined test mask

● 3/3 Menu:

X Mask: Set horizontal clearance to the waveform, (0.04div to 4.00div). When the item is activated, it can be adjusted by turning horizontal POSITION knob.

Y Mask: Set vertical clearance to the waveform,(0.04div to 4.00div). When the item is activated, it can be adjusted by turning horizontal POSITION knob.

Create Mask: Create a test mask according to the above clearance.

Save: Store created test mask.

**Note: In X-Y mode, Pass/Fail function is unavailable.**





# Waveform recorder

Waveform recorder can record output waveform from CHI and CH2 through setting up time interval between frames, with a maximum record length of 1000 frames. User can analysis waveform saved by playback. There are four kinds of recorder models: Record, Play back, Storage, Off. Figure 2-20

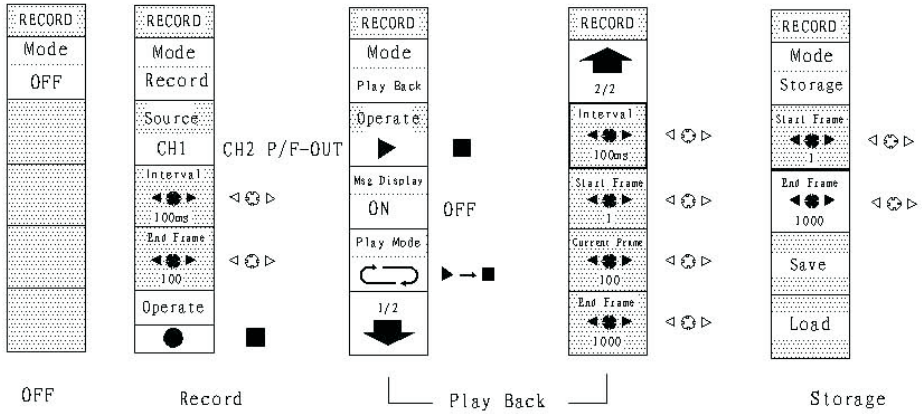



Figure 2-20

**Off:** Turning off all recorder function

**Recorder**:

1. Selecting RECORD MODE
2. Selecting record source channel CH1 or CH2
3. Setting time interval between frames from 1.00ns to 1000ns

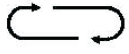
4. Setting number of record frames from 1 to 1000

5. Selecting ● to start recording or ■ to stop recording in the OPERATION menu.

**Play back:**

1. Selecting ■ to start playback or ▶ to stop in the OPERATION menu.

2. Selecting ON to display recorder information or OFF to turn off recorder information in the MSG DISPLAY menu.

3. Selecting  to set circular play mode or ▶ → ■ to set single time play mode in the PLAY MODE menu.

4. Selecting  to set time interval from 1.00ms to 20s between frames in the INTERVAL menu.

5. Selecting  to set start frame from 1 to 1000 in the START FRAME menu.

6. Clicking  to select current frame from 1 to 1000 to be played in the CURRENT FRAME menu.

7. Selecting  to set end frame from 1 to 1000 in the END FRAM menu.

The RUN/ STOP button can also control playback run/stop.





**Storage:**

1. Selecting SAVE menu to store the waveforms between start frame to end frame

2. Selecting LOAD menu to recall the saved waveforms from non-volatile memory

3. Selecting  to set first frame to be saved

4. Selecting  to set last frame to be saved

**Self- Test**

Press SELF-TEST menu to choose System Info or Screen Test

1. Screen test: Press this soft button to run Screen Test program. Follow the prompt message on the screen "Press 'RUN' key to continue the Test". The screen of turns red, green and blue in sequence . when keep pressing the RUN/STOP button. You could check the screen for display failures.

2. System info: Press this soft button to display the basic information of oscilloscope.

**Self-adjustment**

Several months after the instrument has been working, user can amend it by pressing button to come into self-adjustment interface. Selecting RUN/STOP to start or end.

Attention: Any input terminal must not be shorted and connect to any signal

# VIII . How to measure automatically

The AUTO MEASURE button is in the menu area. You are able to choose the source signal from CHI or CH2 and the method of time measurement and voltage measurement. All the measurement parameter can be on or off on the screen, and deleted all clearly from it. Figure 2-21.

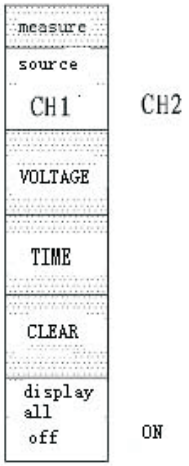



FIGURE 2-21





VOLTAGE MEASUREMENT

KM 20-2025CA, KM 20-2040CA, KM 20-2100CA provide over ten measurement function , including Vpp , Vmax , Vmin , Vavg , Vamp ,Vtop , Vbase , Vrms ,Overshoot , Preshoot . Figure 2-22.

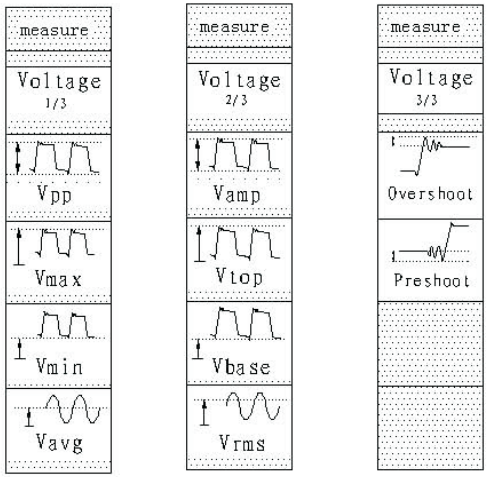



Figure2-22

TIME MEASUREMENT

KM 20-2025CA, KM 20-2040CA, KM 20-2100CA provide over ten measurement function , including Freq , Period , Rise time , Fall time , +Width , -Width , +Duty , -Duty , Delay1→ ⌜ (delay the time rising ) , Delay1→ ⌞ (delay the time falling) . Figure 2-23.

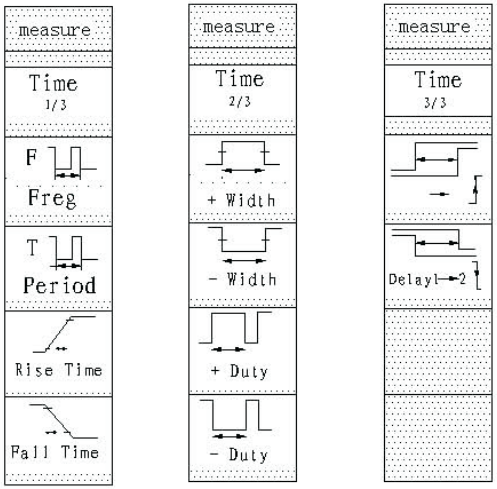



Figure 2-23

The results of the automatic measurements will be displayed the bottom of the screen, where no more than three parameters can be displayed at the same time, moving automatically toward left and being deleted by DELECTING MEASUREMENT button.

Press DISPLAY ALL to ON button to display 18 results of measurements in the center of the screen, if the data is displayed as"******", which means the parameter cannot be measured at present.





THE DEFINITION OF THE VOLTAGE PARAMETER FIGURE 2-24

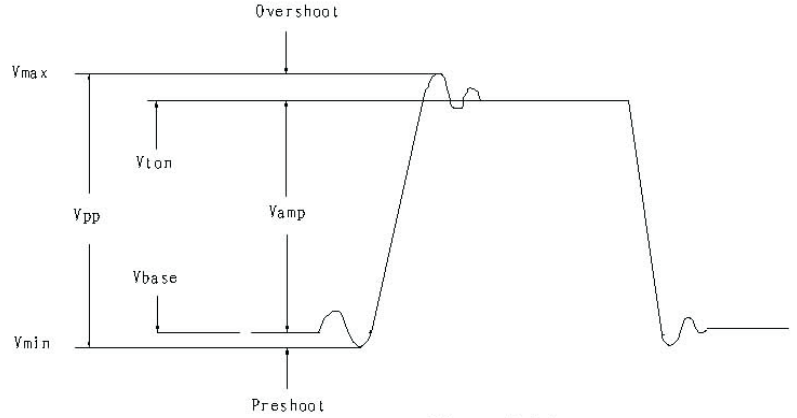



Figure2-24

Vpp : Peak-to-peak Voltage

Vmax: The maximum amplitude. The most positive peak voltage to GND in the waveform.

Vmin: The minimum amplitude. The most negative peak voltage to GND in the waveforms.

Vam: The voltage Vtop and Vbase of a waveform.

Vtop: The voltage to GND of the top of the waveform

Vbase : The voltage to GND of the botton of the waveform

Overshoot: Defined as (Vmax-Vtop ) / Vamp

Preshoot: Defined as ( Vmin- Vbase) / Vamp

Vaverage: The average of the signal

Vrms: The effect value of the signal

THE DEFINITION OF THE TIME PARAMETER FIGURE 2-25.

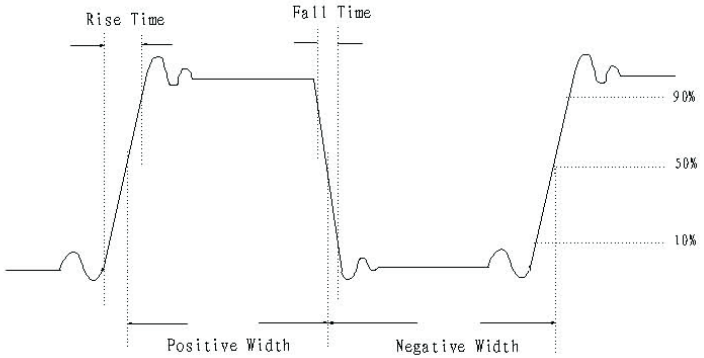



Figure2-25

Rise time: Time that the leading edge of the first pulse in the waveform takes to rise from 10% to 90% of its amplitude.

Fall time: Time that the falling edge of the first pulse in the waveform takes to fall from 90% to 10% of its amplitude.

Positive width: The width of the first positive pulse in 50% amplitude points.

Negative width: The width of the first negative pulse in 50% amplitude points.

Delay 1→ : The delay between the two channels 1.2 at the rising edge.

Delay 1→ : The delay between the two channels 1.2 at the falling edge.

+Duty: +Duty Cycle, defined as +Width/Period

-Duty: -Duty Cycle, defined as -Width/Period





# IX . How to measure with cursors

The cursor measurement has three modes: Manual, Track and Auto measure.

1. Manual: In this model, the screen displays two parallel cursors. You can move the cursors to make custom voltage or time measurements on the signal. The values are displayed on the boxes below the menu. Before using cursors, you should make sure that you have set the signal source as the channel for measuring.

2. Track: In this mode, the screen displays two cross cursors, the cross cursor set the position on the waveform automatically. You could adjust cursor's horizontal position on the waveform by turning the horizontal POSITION knob in conjunction with the cursor .The oscilloscope displays the values of the coordinates on the boxes below the menu.

3. Auto Measure: This mode will take effect with Automatic Measurements. The instruments will display cursors while measuring parameters automatically. These cursors demonstrate the physical meanings of these measurements.

Operations of Cursor Measurements

**To do manual mode Cursor Measurements, follow these steps**

**figure 2-26**

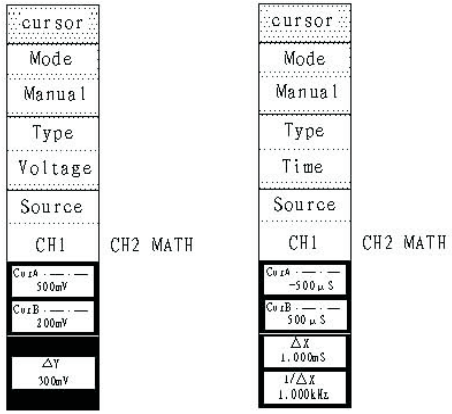



Figure2-26

(1). Select the Manual mode for cursor measurement by pressing soft button as: CURSOR→Mode→Manual.

(2). Select channel Source for measurements by pressing soft button as: CURSOR→Source→CH1, CH2 or MATH

(3). Select the cursors type by pressing soft button as CURSOR →Type→Voltage or Time.

(4). Move the cursors to adjust the increment between the cursors: Turn the vertical POSITION knob to move cursor A or B vertically; Turn the vertical POSITION knob to move cursor A or B horizontally.





(5). To gain measurement value:

Display Cursor 1 (time cursor centered around the midpoint of screen; voltage cursor centered around channel ground level)

Display Cursor 2(same as above)

Display horizontal space between cursor 1 and 2 (ΔX): Time between cursors

Display (1/ΔX), units in Hz, KHz, MHz, GHz

Display vertical space between cursor 1 and 2 (ΔY): Voltage between cursors

**To do Track mode Cursor Measurements, follow these steps:**

**figure 2-27**

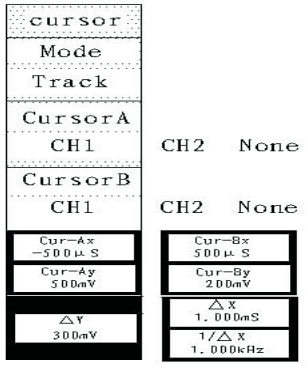



Figure2-27

(1). Select the Track mode for cursor measurement by pressing soft button as: CURSOR→Mode→Track.

(2). Select channel Source for Cursor A and Cursor B by pressing soft button as: CURSOR→Cursor A or Cursor B→CH1, CH2 or None.

(3). Move the cursors to adjust the horizontal positions of the cursors: Turn the vertical POSITION knob to move Cursor A or B horizontally.

(4). To gain measurement value:

Display Cursor 1 (time cursor centered on the midpoint of screen; voltage cursor centered on channel ground level)

Display Cursor 2(same as above)

Display horizontal space between cursor 1 and 2 (ΔX): Time between cursors

Display (1/ΔX), units in Hz, KHz, MHz, GHz

Display vertical space between cursor 1 and 2 (ΔY): Voltage between cursors

**To do Auto mode measurements. Figure 2-28**

There will be no cursor display if no parameter were chosen in MEASURE menu .This oscilloscope could move cursor automatically to measure 20 parameters in MEASURE menu.

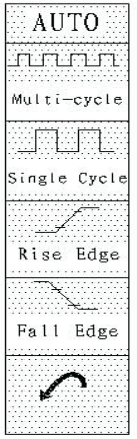

Figure2-28





# X . How to use instant execute buttons — AUTO, RUN AND STOP

The AUTO features automatic adjustments to produce a observable display of input signal. Figure 2-29




figuge2-29

Multi-cycle: To display several multicycle waveform automatically on the screen.

Single-cycle: To display single cycle waveform automatically on the screen.

Rise edge: To display the waveform's rising edge and measure its rise time automatically.

Fall edge : To display the waveform's falling edge and measure

its fall time automatically.

Cancel ↶ : To cancel all Auto Set actions

RUN/STOP: Run or Stop waveform acquiring

In STOP status, the volts/div and horizontal time base can be adjusted in a fixed limit.

Auto-set functions

After the AUTO is pressed the oscilloscope is configured to the following defaults.

Display format: Y- T

Sampling mode: Equal – time

Acquire mode: Normal

Vertical coupling: Adjust to AC or DC according to the signal

Vertical "V/div": Adjust to the right position according to the signal

Volts/Div: Coarse

Bandwidth limit: OFF

Signal Invert: OFF

Horizontal position: Center

Horizontal "S/div": Adjust to the right position according to the signal

Trigger type: Edge

Trigger source: measure the channel with input signal automatically

Trigger coupling: DC

Trigger voltage: midpoint set





Trigger mode: Auto

POS knob: Trigger offset

## XI . REF

Choose a waveform of channel as sample and save it which compare with the other one. When user press REF, the following menu will appear. Figure 2-30

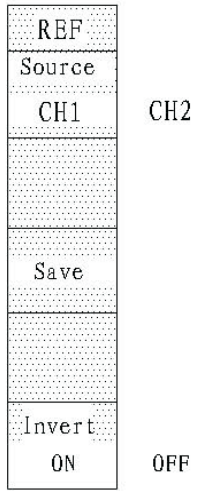



Figure2-30

Signal source: CH1 or CH2

Save: Saving the waveform chosen

Invert: Refer to the waveform invert

## XII . MENU/CH OFF OR ON

Press MENU/CH button to be on or off menu or waveform.

To observe the waveform clearly, please press OFF button twice to close menu and waveforms you don't want.

# Chapter 3: Application & Examples

**Example 1: Taking Simple Measurements**

To see a signal in a circuit, but the amplitude and frequency are unknown. You want to quickly display the waveform, please use automatic setup (AUTO).

1. Press the CH1 menu, set the probe menu attenuations to 10× ,and set the switch to 10× on the probe
2. Connect signal to the probe
3. Press the AUTO button

The oscilloscope sets the vertical, horizontal, and trigger controls automatically. To optimize the display of the waveform, you could adjust these controls manually.





**Example 2: Selecting Automatic Measurements**

The oscilloscope could take automatic measurements on most signals.

To measure the amplitude and frequency, do these steps as follow:

1. Measure amplitude

Press MEASURE → Select CH1 to set measurement source.

Press Voltage → Voltage 2/3 to set measurement page.

Press Vpp to select peak-to-peak amplitude and the result will be displayed on the left bottom of the screen.

2. Measure frequency

Press MEASURE → Select CH1 to set measurement source.

Press Time → Time1/3 to select measurement page.

Press Freq to select frequency measurements and the value will be displayed on the left bottom of the screen.

**Example 3: Measuring a signal delay and gain of the circuit**

If you want to measure the gain and signal delay of an amplifier, do the test as shown in Figure 3-1:

1. Connect signal to the probe.
2. Press the AUTO button.
3. Press the CH1 button to select CH1, adjust the VOLTS/DIV and POSITION to adjust the position of CH's waveform.

4. Measure the amplitude of the signal CH1 and CH2 according to the above example, Amplification Factor K = V2/V1.

5. Press MEASURE

Press Time to select measurement Type.

Press Time3/3 to select measurement page to select Delay1→2 ⌜. The value will be displayed on the left bottom corner of screen.

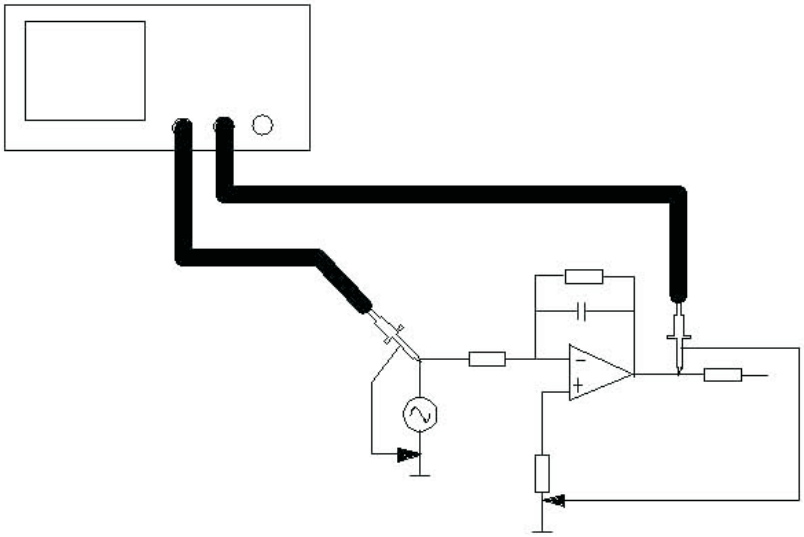


Figure 3-1

**Example 4: Cursor Measurements**

You could use the cursors to quickly make time and voltage measurements on a waveform.





To measure the ring frequency at the rising edge of a signal, do these steps:

1. Press CURSOR key to see the **Cursor menu** → Press Mode to set **Manual** mode → Press Type to select **Time** measurement → Rotate CH1 POSITION knob to place cursor 1 on the first peak of the ring. Rotate CH2 POSITION knob to place cursor 2 on the second peak of the ring. You can see the time between cursors (ΔX) and frequency (1/ΔX) in the Cursor menu. Figure 3-2 shows the measured ring frequency is 100MHz.

**Measuring Ring Amplitude**

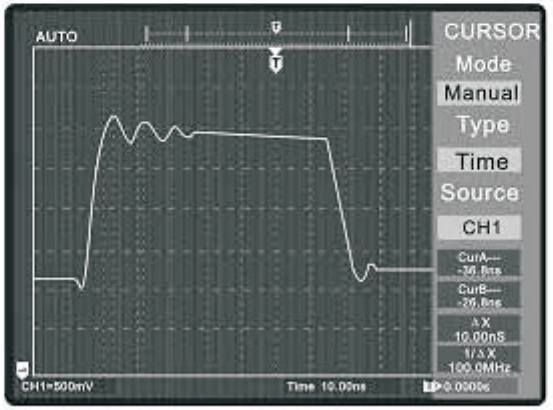



Figure 3-2

2. Press CURSOR key to see the **Cursor menu** → Press Mode to set **Manual** mode → Press Type to select **Voltage** → Rotate CH1 POSITION knob to place cursor 1 on the top of the first positive peak of the ring. Rotate CH2 POSITION knob to place cursor 2 on the bottom of the first negative peak of the ring.

You can see the voltage between cursors (□V) in the Cursor menu.

Figure 3-3 shows that the measured ring amplitude is 380mV.

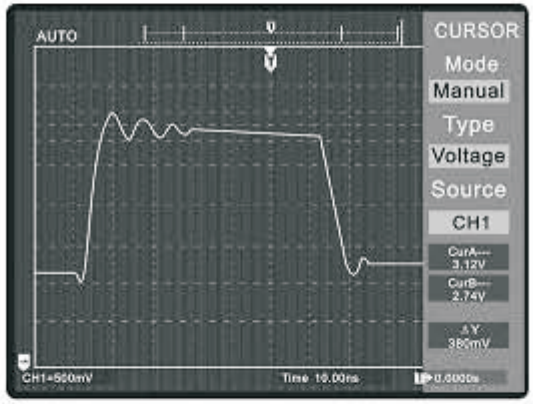



Figure 3-3





**Example 5: Analyzing Signal Detail**

When included peaks and noise in signal, Peak Detect in Menu ACQUIRE can separate the signal form the random noise.

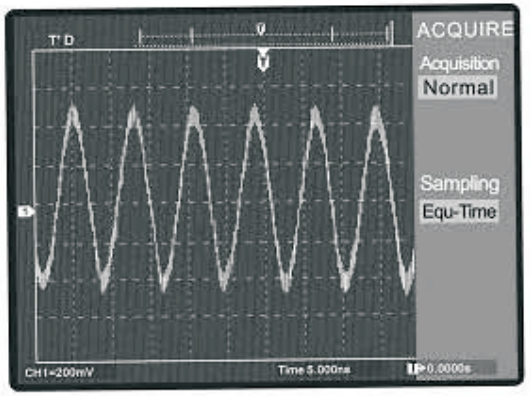



Figure 3-4

If the signal contains more random noise, observing and analyzing the waveform in difficulty, you can use Average in Menu ACQUIRE . The average function could reduce the random noise to check the signal detail easily.

Figure 3-5 shows the averaged waveform is a running average over the specified number of 64.

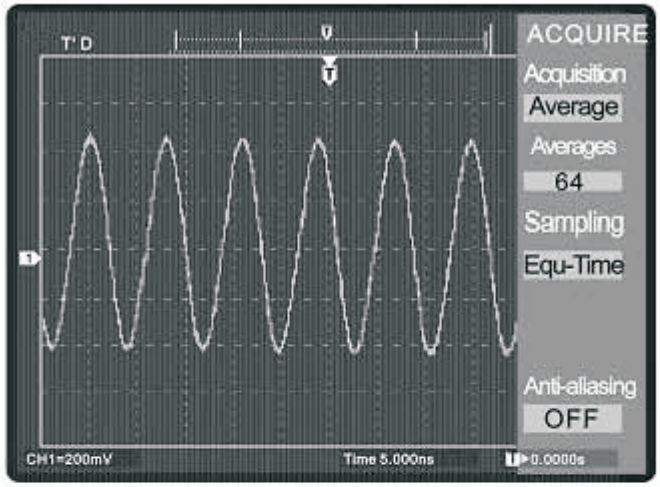



Figure 3-5

**Example 6: Displaying a Single-Shot Signal**

Capturing a Single-Shot Signal is an advantage of the digital oscilloscope.

It can display clearly and stability after capture. To capture a single event, you need to gather some pre-test knowledge in order to correctly set up the vertical and horizontal mode, VOLTS/DIV and trigger mode.





The following steps show you how to use the oscilloscope to capture a single event.

1. Press the CH1 menu. Set the probe, the channel attenuation and VOLTS/DIV, SEC/DIV.
2. Press TRIGGER button in the Trigger control area to display the menu.

Press Edge to select trigger mode.

Press Slope to select **Rising.**

Press Source to select **CH1.**

Press Mode to select **Single.**

Press Coupling to select **DC.**

3. Turn the LEVEL knob to adjust trigger level.
4. Press RUN/STOP button. When the trigger conditions are met, data appears on the display representing the data points that the oscilloscope obtained with one acquisition.

Single-Shot function could capture an emergency spike more effective. If the trigger level is out of the range of the normal signal level, you can capture the spike and the signal waveform before and after the spike.

**Example 7: Triggering on a Video Signal**

The equipment with video trigger on fields or lines for standard video signals could display Sync signals and video signals on odd field or even field. Also you can select an appointed line of the video signal.

To trigger on the video fields, do these steps:

1. Press TRIGGER key, and push Mode to select **Video** mode
2. Press Source to select **CH1** as trigger source
3. Press Polarity to select **Video polarity**
4. Press Sync as **Odd Field**, **Even Field**, **All Lines** and **Line Num.**
5. Adjust the vertical POSITION, VOLTS/DIV, SEC/DIV to see a complete waveform on the screen. See Figure 3-6 and Figure 3-7.

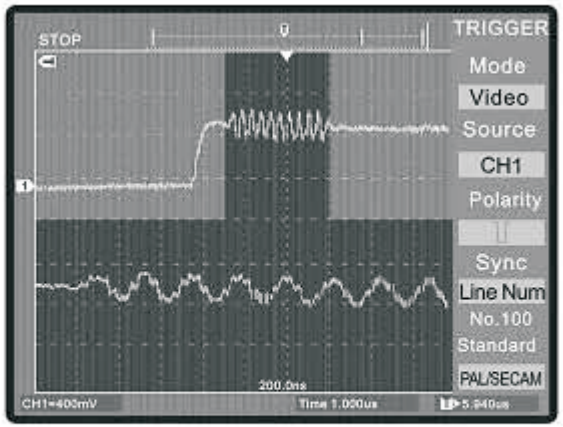



Figure 3-6 Demonstrating line100 color synchronization signal by delaying scan or video trigger mode





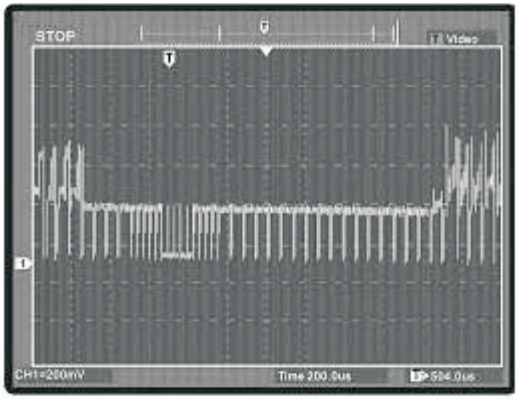



Figure 3-7 field synchronization signal

**Example 8: Pass/Fail Test**

Press X Mask and Y Mask to adjust the horizontal clearance and the vertical clearance of the signal. Comparing with the pre-defined mask, if the waveform "touches" mask, a " Fail " is occur, then counter once. It could output fail or pass waveform, and set Stop on Output test or not.

Working on the detection of the signal, the oscilloscope displays the data of Fail, pass and Total on the left upper corner of screen.

Do the steps as following:

1. Press UTILITY → 2/2 Menu → Press PASS/FALL.
2. Press Enable Test and select ON to open the test, select CH1 as source, and entry 3/3 menu.
3. Create mask in the 3/3 menu: Enable the X Mask, and turn horizontal POSITION to adjust the horizontal clearance. Enable the Y Mask; turn vertical POSITION to adjust the vertical clearance.

Press Create Mask to create a new mask. The mask can be saved and loaded. In Fail/Pass Test, you can create a new test mask; otherwise you can load a pre-defined test mask.

4. In the 2/3 menu: Press Output to select the output mode, fail; fail + , Pass; pass . Set Stop on Output test or not, and Press LOAD to load a pre-defined test mask (the vertical and horizontal clearance).

5. In the 1/3 menu: Select CH1 as source. The oscilloscope displays the data of Fail, Pass, Total, Wave Forms on the left upper corner of screen, or you can turn off the displayed signal.

6. Press Operate to start the test, the displayed information will be changed (See Figure 3-8).

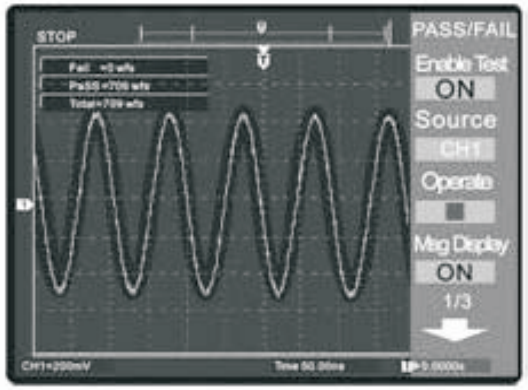



Figure 3-8 waveform failed





## Specification

□ Vertical system

a. Input

1. Coupling: DC, AC, GND
2. Input impedance: R: 1MΩ±2%; C: 15pF ± 2%
3. Probe attenuation factor: 1×, 10×, 100×, 1000×.
4. Maximum input voltage: 400V (DC + ACp-p).
5. Relative delay between two channels: About 150ps.

b. Characteristic

1. A/D resolution: 8 bit, each channel samples simultaneously.
2. Sensitivity (V/DIV): 2mV/DIV-5V/DIV.
3. Offset range: ±2V (2mV/DIV-100mV/DIV), ±40V (200mV-5V/DIV).
4. Analog bandwidth: 100MHz
5. One-shot bandwidth: 50MHz
6. Bandwidth limitation: 25MHz
7. AC coupling: 5Hz-maximum analog bandwidth.
8. Rising time: 13.8ns (KM 20-2025CA), 8.7ns (KM 20-2040CA), 3.5NS (KM 20-2100CA)
9. V/DIV error:
   2SV/DIV-5mV/DIV: ±4%
   10mV/DIV or above: ±3%

Note: (Normal or average acquisition).

□ Time-base system:

1. Sampling rate:
   1GSa/s (Real-time); 50GSa/s (Equivalent);
2. Waveform interpolation: sin(x)/x

3. Memory depth: 4K per channel or 1M per channel in **SCAN** mode.
4. SEC/DIV : 5ns to 50s/DIV (KM 20-2025CA & KM 20-2040CA), 2ns-50s/DIV (KM 20-2100CA) in 1-2-5 sequence;
5. Extend to 20ps/DIV while delayed scan enabled.

5. Sampling rate and delay accuracy: ± 100ppm (≥1ms timing interval).
6. Measurement accuracy of time interval (□T) (Full bandwidth):
Single: ± (1 sampling interval + 100ppm × readouts + 0.6ns);
≥16 averaged: ± (1 sampling interval + 100ppm × readouts + 0.4ns);

□ Trigger system
1. Sensitivity:
a. Edge:
DC coupling: 1DIV (DC-full bandwidth); For CH1 or CH2.
EXT: 100mV (DC-10MHz); 200mV (DC-full bandwidth).
EXT/5: 500mV (DC-full bandwidth).
AC coupling: If ≥ 50Hz, the same as DC coupling.
LF rejection: Component below 8kHz attenuated.
HF rejection: Component above 150kHz attenuated.
b. Level:
Internal: ±12DIV reference to the center of screen.
EXT: ± 2.4V
EXT/5: ± 12V
c. Video trigger:
Internal: 2DIV.
EXT: 400mV.
EXT/5: 2V.
**Note: standard NTSC, PAL, SECAM acceptable.**
2. Pulse:
Positive less than, equal to, greater than: width 20ns-10s.
Negative less than, equal to, greater than: width 20ns-10s.





Trigger offset: 1s for pre-trigger; 14DIV for delayed.
Hold-off: 100ns-1.5s
Set level to 50%: effective if input signal is ≥ 50Hz.

□ Measurement
Cursor:
Manual mode: Voltage difference □V, time difference □t, 1/□t (Frequency) between cursor.
Track mode: Voltage and time difference between two cross cursor.
Auto mode: Cursor displays when auto-measurement enabled.
Auto-measurement:
Following parameter measurable: Vp-p, Vamp, Vmax, Vmin, Vtop, Vbase, Vavg, Vrms, Vovr, Vpre, Frequency, Period, Rise time, Fall time, +Width, -Width, +Duty, -Duty, Delay 1-2.

□ Miscellaneous:
Display: 5.7" STN LCD, 320×240 dot matrix.
Color: Mono or 256 colors.
Contrast: Adjustable.
Brightness (Typical): 350cd/$m^2$ (Color LCD).
Backlight: CFL (Color), LED (Mono).
Probe compensation signal: 3V, 1kHz.
Power Supply: AC 100V-225V / 40VA Max
Power consumption: ≤ 50W.
Fuse: 2A, T class, 250V.

Environment requirements:
Operation temperature: 10□-40□.
Storage temperature: -20□-60□.
Humidity: ≤ 85%
Altitude: ≤ 3000m (Operation) or 15000m
Dimension: 303 (W) × 145 (H) ×150 (D)mm.

MUMBAI

# TEST CERTIFICATE

## DIGITAL STORAGE OSCILLOSCOPE

This Test Certificate warrantees that the product has been inspected and tested in accordance with the published specifications.

The instrument has been calibrated by using equipment which has already been calibrated to standards traceable to national standards.

MODEL NO. _____

SERIAL NO. _____

DATE: _____

ISO 9001
REGISTERED

QC
KUSAM-MECO
PASS





## *WARRANTY*

Each “KUSAM-MECO” product is warranted to be free from defects in material and workmanship under normal use & service. The warranty period is one year (12 months) and begins from the date of despatch of goods. In case any defect occurs in functioning of the instrument, under proper use, within the warranty period, the same will be rectified by us free of charges, provided the to and fro freight charges are borne by you.

This warranty extends only to the original buyer or end-user customer of a “KUSAM-MECO” authorized dealer.

This warranty does not apply for damaged Ic’s, fuses, burnt PCB's, disposable batteries, carrying case, test leads, or to any product which in “KUSAM-MECO’s” opinion, has been misused, altered, neglected, contaminated or damaged by accident or abnormal conditions of operation or handling.

“KUSAM-MECO” authorized dealer shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of “KUSAM-MECO”.

“KUSAM-MECO’s” warranty obligation is limited, at option, free of charge repair, or replacement of a defective product which is returned to a “KUSAM-MECO” authorized service center within the warranty period.

THIS WARRANTY IS BUYER’S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. “KUSAM-MECO” SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE WHATSOEVER.

All transaction are subject to Mumbai Jurisdiction.