



AT-H150 Scope Meter

User's Manual

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Safety Instructions

1. Check the casing and accessories before use. Do not use the instrument with casing damaged. Check to see if there are any cracks or missing plastic parts. Pay special attention to the insulating layer of the instrument pen and connector. When using the instrument pen or oscilloscope probe, do not touch the metal part with your fingers.
2. The called waterproof seal design of the instrument means prevention against water splashing or short-time exposure to water only. Once this happens, you must wait until the instrument dries for normal use;
3. Do not use the instrument in high-temperature and flammable explosive environments or under wet conditions;
4. Do not apply voltage beyond the ultimate withstanding capacity of the instrument;

Measurement	Input terminal used	Maximum limit
DOS	input	30V p-p (probe X1), 300V p-p (probe X10)
DDS	out	Prohibit input voltage!

5. Before inserting and plugging the oscilloscope probe and powering on and off, make sure to separate the probe from the test point.

6. When using the oscilloscope and the signal source simultaneously, keep the oscilloscope probe and the earth terminal of the signal output wire at the same potential to avoid damage arising from floating measurements.
7. Do not modify or disassemble the products and accessories or use them for any purposes other than those authorized. All the fittings and accessories cannot be arbitrarily replaced.

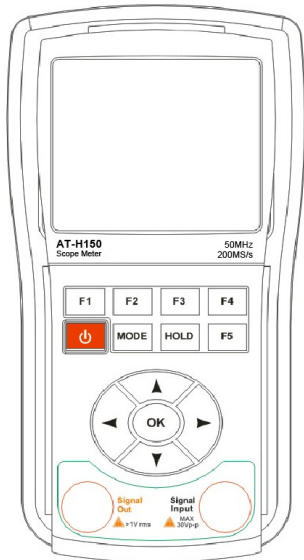
Safety sign



CAUTION/ DANGER: *When located near other signs or the socket terminal, this sign prompts users to follow the instructions in this manual to prevent instrument/personal injury.*

Instrument Introduction

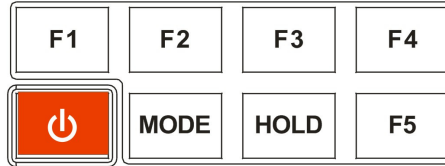
Main characteristics



- 50M digital storage oscilloscope (DSO)
- 10Hz~156kHz function signal generator (DDS)
- Digital/analog clock and calendar display
- Chinese help window to prompt key functions and measurement items
- DSO realizes one-click (AUTO) automatic measurement
- Automatic display of measured waveforms and automatic zero correction
- Digital readout of Vp-p, +Vp,-Vp, f, T, dV and dt and measurement setting parameters
- Memory/readout of up to 40 DSO waveforms
- Generate sine wave, triangular wave, sawtooth wave and square wave signals, used in conjunction with oscilloscope function to compose a test system
- Use internal 200 μ S/400 μ S to test square waves, facilitate the detection of HOT type inter-turn faults ringing signal
- Auto shutdown and continuous work modes to choose from, automatically select continuous work mode during charging

- 320X240 3.5-inch color LCD display with LED backlight
- Built-in 2300mAh lithium rechargeable battery pack and equipped with AC power supply adapter for external power source.

Panel features

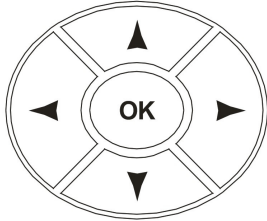


Key name	Main Function
F1~F5:	The function keys are used to adjust the oscilloscope settings, including system settings, home directory and settings in measurement mode.

⏻:	Power key
MODE:	System setting/regular/single selection key;
HOLD:	Hold/save key; trigger edge selection in single mode;

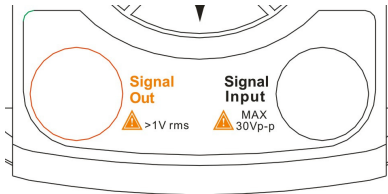
Tips: after the regular mode prompt menu is entered, it will automatically hide after 5 seconds of automatic prompt. Press the ⏻ key to lock (long time display) and press it again to close.

Mode	F1	F2	F3	F4	F5
Regular mode	Auto	Time base	Amplitude	Digital display	Save/adjust graphics
Single mode	Start	Time base/ amplitude/trigger	Measurement	Displacement	Save/adjust graphics
Save and adjust graphics	Save	Adjust graphics	Delete	Clear	Return



Key	Calendar/clock	Regular	Single	Signal source
↑(Help)	Numeral	Save position	Move the cursor	Adjust frequency
↓(Clock)	Numeral	Save position	Move the cursor	Adjust frequency
←	Time	Time base/ amplitude	Time base/ amplitude/trigger/ cursor	Adjust frequency
→	Time	Time base/ amplitude	Time base/ amplitude/trigger/ cursor	Adjust frequency
OK	Confirm	Signal source switch		

Input (output) jacks



Input oscilloscope input---input port of DC~50MHz waveforms measured
MAX30Vp-p

Out function output---output port of sine wave, triangular wave, sawtooth wave,
square wave and square wave T 1Vrms

Top diagram

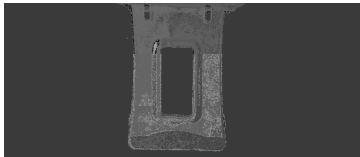


Externally connected to power socket and wires

Use 5V/1.5A special switching charging power supply

It is prohibited to use the computer USB port for direct power supply.

Bracket diagram



The bracket adopts secondary injection moulding to increase friction between soft rubber and the table so as to bond the instrument more solid.

The bracket and rear shell adopt “bone joint” structure positioning. Once stressed, the bracket supporting pole will not break and damage.

Basic Operation

Start and shutdown

Press the  key and hold for more than 1 second to turn on the power. Press the  key again and hold for more than 5 seconds to turn off the power.



Attention:


- *Be sure to keep the test probe away from the test point before shutdown.*
 - *Always power off in a timely manner after use.*
-

Auto shutdown


The instrument will automatically shut down if without any key pressed within 10 minutes after it is powered on. With key press actions in normal use, the shutdown time will be delayed for 10 minutes. To set or close the auto shutdown function, you may select or cancel auto shutdown from the oscilloscope system setting options. To protect the built-in battery from excessive discharge, when the battery power is about to run out, the instrument will also automatically shut down.



After auto shutdown or auto shutdown in low voltage is selected, when there are less than 60 seconds from the shutdown time, the instrument will buzz intermittently to prompt you.

Battery charging

When the instrument uses the built-in battery for power supply, the symbol  will appear on the top right corner of the LCD screen to approximately display the remaining capacity of the built-in battery at any time. (For reference)

Once connected to the AC power supply adapter, the built-in battery will be in charge or charge protection state, and the instrument automatically selects no shutdown state.


If the AC adapter is connected in the shutdown state, the instrument will automatically enter the charge state and the LED in the  key will light (orange) to indicate the charge state. When the battery is fully charged, the LED will turn to green.

If the AC adapter is connected after the instrument is powered on, power provided by the AC adapter allows the instrument to run and charges the built-in battery simultaneously. The symbol  for electric quantity indication on the top right corner of the LCD screen will change periodically to indicate the charge state. At the end of charging, the symbol  for electric quantity indication is full.

For safety, when using the AC adapter, first insert the connector plug of the AC adapter in the dedicated jack at the top of the instrument and then access to the mains supply. The plug indicator will light, which nevertheless does not necessarily mean the AC adapter is in reliable contact with the instrument socket, but if the plug indicator does not light, it indicates that access to the mains supply fails or the AC adapter is faulty.


If you want to fully charge the battery as soon as possible, it is advisable to charge in the shutdown state.



If the instrument is not in use over a long period of time, charge it once every 90 days for not less than 5 hours.

If you cannot start the instrument by pressing the  key, charge it promptly. And if it still cannot be started after being connected to the AC adapter, call our technical service center for more information.

Attention:



Avoid long-time extrusion of the  key during carrying;

If you cannot start it by pressing the  key, to press the  key repeatedly will result in over-discharge and even damage of the battery.

Use the AC adapter for power supply

The AC adapter is mainly used to charge the built-in rechargeable battery, but the instrument can also run through the power supply of the AC adapter.

The AC adapter is 5V/1.5A switching power supply characterized by anti-electromagnetic interference, low ripple voltage, wide input voltage range and short circuit protection and cannot be freely replaced.

Use special switching charging power supply. It is prohibited to use the computer USB port for direct power supply.



Tips: *When using the AC adapter for power supply, it is required to connect the instrument with AC power supply, which is likely to lower the safety indexes of the instrument and result in more electromagnetic interference;*

It is recommended to use the built-in battery for power supply as far as possible when measuring signals of below 500mV.

Calendar and Clock Operation

Enter calendar and clock mode

Press and hold the \odot key for more than 1 second to start, the LCD will display the calendar interface. Press the \rightarrow key to select analog clock/digital clock/calendar; press any key of F1~F4 to exit the calendar/clock mode and enter the oscilloscope state.

In the oscilloscope state, long press the \downarrow key to enter the calendar interface.

Calendar and clock setting

In the calendar and digital clock state, press the OK key to enter calendar and clock adjustment (the analog clock cannot be set). Press the $\leftarrow\rightarrow$ keys to select year, month, day, hour, minute and second, and press the $\uparrow\downarrow$ keys to adjust (\uparrow for increase and \downarrow for decrease); when you press the $\leftarrow\rightarrow$ keys to select the numeral to be set, the numeral will flash, then press the $\uparrow\downarrow$ keys to adjust to the numeral to be set and press the OK key to save settings.

Calendar and clock adjustment keys:

Key	Function prompt
OK key	Enter calendar and clock adjustment state and final confirmation
← key	Negative selection of year, month, day, hour, minute and second
→ key	Positive selection of year, month, day, hour, minute and second
↑ key	(Numeral increase) adjustment key
↓ key	(Numeral decrease) adjustment key

Oscilloscope Operation

Enter oscilloscope mode

In the calendar and clock state, press the F1~F4 keys to enter the oscilloscope (DSO) mode.

Tips:



- Use AT-H150 dedicated oscilloscope probe and see Chapter “Oscilloscope Probe Calibration” in this manual for probe calibration.
- The probe cable core is ultrafine high frequency material. Be especially careful when plug and use to avoid stretching and folding resulting in poor contact or damage of the probe.



Attention: The maximum voltage at the input terminal of the oscilloscope is 30Vp-p, and the maximum input is 300Vp-p when the probe attenuator is at X10; the measured signals shall not exceed the above voltage range.

System settings

Long press the MODE key for more than 3 seconds to enter system setting as shown in the figure:

系统参数设置	
<input checked="" type="radio"/> DC耦合 <input type="radio"/> AC耦合	<input type="radio"/> 探头 1: 1 <input checked="" type="radio"/> 10: 1 <input type="radio"/> 100: 1
<input checked="" type="radio"/> 上升沿 <input type="radio"/> 下降沿	<input checked="" type="checkbox"/> 自动关机 <input checked="" type="checkbox"/> 中文

- [1] Coupling mode selection (DC/AC)
- [2] Probe attenuation ratio selection (1:1, 10:1, 100:1)
- [3] Edge selection (rising edge/falling edge)
- [4] Auto shutdown selection (cancel for continuous work state)

Press the ←→/↑↓ keys to move the options to be set and press the OK key to confirm.

After setting, press F1 to save and exit and press F4 to exit directly.

Setting results

1. Auto shutdown selection: when you select the auto shutdown state, the instrument will automatically shut down if without any key pressed within 10 minutes. When you connect external power supply for charging, the instrument cannot automatically shut down. Cancel $\sqrt{\quad}$ to enter the manual shutdown state and long press the ⏻ key for more than 5 seconds to shut down.
2. Coupling mode selection: when DC coupling is selected, the AC and DC component in signals can pass; when AC coupling is selected, the DC component in signals is blocked and the dynamic AC component can pass. When measuring DC or DC + AC DC signals, you should select the DC state. When DC component in the measured signals is larger, the displayed waveforms will deviate from the display area.
3. Probe attenuator setting: its state should be consistent with the oscilloscope probe attenuator position. If the probe attenuator is at X1, the system setting should select 1:1; if the probe attenuator is at X10, the system setting should select 10:1; only when a probe (optional) of 100:1 is used, the system setting uses 100:1. The probe attenuator is generally at the X10 position (state recommended to set in normal use); when probe attenuation is different from system setting, the oscilloscope range or digital readout results will have deviations.
4. Edge selection: rising edge or falling edge. Select edge mode according to the needs of the measured signals.
5. Press the OK key to confirm; press the F1 key to save and exit, and press the F4 key to exit directly, but all the settings just made are not saved and thus invalid.

Regular mode

The instrument defaults to regular mode after entering the oscilloscope measurement state. Press the MODE key to return from the single measurement mode to the regular mode.

Regular measurement is generally used for repetitive waveforms. When automatic measurement is used, the oscilloscope will automatically select the appropriate scanning time base, input amplitude control and trigger conditions, display multi-cycle stable waveforms and simultaneously display such parameters as Vp-p, +Vp, -Vp, frequency and cycle by means of digital readout.

Key operation in regular mode

Key	Function prompt	Operation results	Remarks
F1	Automatic measurement	Automatically set time base, amplitude and trigger	Automatically display waveforms
F2	Time base	Manually adjust time base (←→ keys)	← for increasing time base
F3	Amplitude	Manually adjust amplitude (←→ keys)	← for increasing amplitude

F4	Digital display	Display +Vp, -Vp, Vp-p frequency and cycle	Open and close
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1. Press the F1 key to enter automatic measurement, the oscilloscope will automatically select the appropriate scanning time base, amplitude control and trigger conditions and display stable waveforms. Automatic measurement is also called one-click measurement, reducing the complex adjustment processes and making the measured waveforms displayed at “one-click”. When automatic measurement encounters random signals or the interference of repetitive waveforms, synchronization instability will occur. You may select single measurement or press the F2 or F3 key to enter manual adjustment of time base/amplitude.
2. Press the F2 key to enter time base adjustment selection. After selecting time base adjustment, press the ←→ keys to change the horizontal scanning interval and observe the waveforms of the measured signals with the optimal time base.
3. Press the F3 key to enter amplitude adjustment selection. After selecting amplitude adjustment, press the ←→ keys to change the vertical amplitude range and observe the waveforms of the measured signals with the optimal amplitude.
4. Press the F4 key to enter digital readout. When you enter regular measurement, digital readout is open by default; if the display area has an impact on waveform measurement, you may press the F4 key to close the digital readout function.
5. Press the ↑ (help) for more than 3 seconds to enter help, i.e., the operation quick guide interface, and press the F5 key to exit the interface.

6. Press the ⏻ key for less than 1 second to retain selection F1~F4 function prompts on the display interface. Press the ⏻ key again to close the selection F1~F4 function prompts display interface.

Waveform storage and readout in regular mode

During measurement, press the HOLD key to maintain waveforms first and then press the F5 key (or directly press the F5 key) to enter the storage interface to select:

Key	Function prompt	Operation results
F1	Save	Select storage position via the “ $\leftarrow\rightarrow\uparrow\downarrow$ ” keys
F2	Adjust graphics	Select readout position via the “ $\leftarrow\rightarrow\uparrow\downarrow$ ” keys
F3	Delete	Delete graphics displayed under the selected position number
F4	Clear	Delete all stored graphics

Note: to maintain waveforms via the HOLD key, press the HOLD key until the HOLD symbol appears on the screen.

The $\uparrow\downarrow/\leftarrow\rightarrow$ keys are used to adjust the selected position number, the \uparrow key is used to increase by 10 position numbers, the \downarrow key is used to decrease by 10 position numbers, the \rightarrow key is used to increase by 1 position number and the \leftarrow key is used

to decrease by 1 position number. When you change the position, there are prompts about the current position and the availability of data on the screen; deletion, clear and position numbers repetitively saved all have prompt windows. Follow the prompts to operate.

Save

1. Press the F1 key to enter waveform storage, the display interface will prompt: "Position XX is not used" or "Position XX has stored data" on the top left corner.
2. If "Position XX has stored data", when pressing the F1 key to save, a window will pop up on the interface to prompt: "Are you sure to overwrite the current data?" Then press F1 to overwrite (prompt: data is being saved) and press F4 to cancel.

Adjust graphics

1. Press the F2 key to enter graphical adjustment, the display interface will prompt: "Position XX waveform" or "Position XX has not stored data", "Position XX is not used" or "Position XX has stored data" on the top left corner; the graphics saved or adjusted may be deleted and cleared.
2. In the case of "Position XX waveform", the interface will display the stored waveforms and measured data.

Delete

1. Press the F3 key to enter delete options, the display interface will prompt: "Position XX waveform" or "Position XX has not stored data" on the top left corner.

2. The display interface will prompt: “are you sure to delete the current data?” in the middle. Press F1 to delete and press F4 to cancel. When you press F1, it will prompt: data being deleted and data deleted successfully.

Clear

1. Press the F4 key to enter clear options, the display interface will prompt: “Position XX waveform” or “Position XX has not stored data”, “Position XX is not used” or “Position XX has stored data” on the top left corner; the graphics saved or adjusted may be deleted and cleared.
2. The display interface will prompt: “are you sure to delete all of the data?” in the middle. Press F1 to delete and press F4 to cancel. When you press F1, it will prompt: data being cleared and data cleared successfully.

Note: in Clear state, all of the stored data will be deleted.

Horizontal time base adjustment

In the regular measurement state, press the F2 key to select time base adjustment and press the ←→ keys to change scanning time base within the range of 5ns/div ~ 2.5s/div. When measuring a signal with unknown frequency, you should try to collect waveforms from the fastest time base and then gradually select slower time bases until the signal can be displayed correctly. Otherwise, due to “aliasing distortion effect”, the waveforms may not correctly reflect the actual situation of the signal.

There are many methods to avoid aliasing distortion effect: adjust time base or press the F1 key for automatic measurements.

Vertical amplitude control

In the regular measurement state, press the F3 key to select amplitude adjustment and press the \longleftrightarrow keys to adjust amplitude: if the system is set to 1:1, amplitude changes within 10mV/div \sim 5V/div; if the system is set to 10:1, amplitude changes within 100mV/div \sim 50V/div.

Automatic waveform trigger

During automatic waveform measurements, the auto trigger mode is used. Even if no trigger conditions are detected, the oscilloscope can still collect waveforms. In the absence of trigger conditions, the oscilloscope will automatically trigger and begin collecting data after waiting for some time; due to the absence of proper trigger, waveforms displayed by the oscilloscope cannot synchronize and thus scroll on the screen. Once the legitimate trigger signal is detected, waveforms can stabilize on the screen.

Waveform measurements in regular mode

Access to the measured signal from the oscilloscope input port and watch the LCD display screen (under normal circumstances, the probe attenuator switch should be at X10 and the system should be set to 10:1). If the measured waveforms appear, you may press the F1 key (auto) to stabilize the waveforms. The digital readout part will display the measurement results. If you need to change the quantity or amplitude of the displayed waveforms, you may press the F2 and \longleftrightarrow keys to change the time base (how many waveforms are displayed); press the F3 key to change setting to "amplitude" and press the \longleftrightarrow keys to change the amplitude of the displayed waveforms (waveform size).

During automatic measurements, in order to find the position accurately as soon as possible, there are not input signals or DC input and the system default is 100mV, 2.5 μ s (the system is set to 10:1).

Under stable display of waveforms, the digital readout of +Vp, -Vp and Vp-p intuitively reflects the measurement results of the measured signals. The absolute values of +Vp and -Vp indicate the symmetry of the measured waveforms; when you select the DC coupling mode, the difference between +Vp and -Vp reflects the DC component in the signals; if the measured waveforms are not of constant amplitude, what +Vp and -Vp record is the maximum or minimum peak that have appeared in the measured waveforms. Observe the signals of a particular cycle through the CH XX V (mV) and M XX ms (s, ms, μ s, ns) parameters displayed at the top of the display area. In the current state, each grid of the vertical axis represents XX V (mV) and each grid of the horizontal axis represents XX ms (s, ms, μ s, ns). Through "grid" counting, you will get the measurement parameters of the waveforms in this cycle.

By pressing the F1 auto key, you cannot capture stable waveforms. A, the waveform input amplitude is too small; B, the frequency of the measured signal is lower than 20Hz; C, the probe attenuator setting is wrong; D, exceed the measurement frequency range; E, the measured signal has large interference; F, the probe is damaged or wrong connections; G, machine failure. If machine failure is suspected, see Chapter "Oscilloscope Probe Calibration" in this manual and output 1kHz square waves from the signal generator to the input terminal of the oscilloscope directly for checking.



Tips: *The digital readout of measurement results comes from the calculation of the displayed waveforms. Obviously, the lower the frequency of the measured signal is, the greater the relative error of sampling calculation is. In the slow scan (30ms~2.5s) state, the frequency readout is displayed as "----", which prompts the users to make a correct analysis.*

Maintenance of signal waveform

With the ongoing data collection, the signal waveforms are constantly refreshed. The main role of waveform maintenance is to maintain the current data or waveforms in order to observe carefully. There are two methods to maintain waveforms: press the HOLD key or use the single trigger scan mode.

Waveform maintenance is different from waveform storage. It only maintains the displayed contents. Once you press the HOLD key again or change functions and settings or turn off the power, the maintenance contents displayed before will be lost. For long-term retention of graphics, you must enter the save mode and press the save key to store graphics in the memory.

If the measured signals have interference, non-constant-amplitude or non-repetitive waveforms, the display of waveforms will become unstable. At this point, press the HOLD key, the screen displays one of the graphics of the high-speed A/D capture measured signals to analyze the signal characteristics. This function is defined as "pause".

To detect irregular signals, you'd better select the single measurement mode.





Single mode

Press the MODE key to enter single measurement. The capture of complex waveforms or sporadic signal waveforms should use the single measurement mode. For single measurements, you need to set the horizontal time base and vertical amplitude control in advance and select the rising and falling edge trigger level settings aiming at the signal characteristics. Press the key to start measurement. Once the measured signals meet the set criteria, the screen displays a single-cycle or multi-cycle waveforms. Press the F4 key to enter the displacement adjustment submenu and press the ←→ keys to change the horizontal position and digital display horizontal position (XXXX ms, μ s and ns).

Main menu of function keys in the single measurement state:

Key	Operating function	Description
F1	Start	Enable eligible single measurement
F2	Time base, amplitude and trigger	Select time base, amplitude and trigger adjustment respectively
F3	Measure	Measure the corresponding voltage difference and time difference
F4	Displacement	Enter the horizontal position adjustment submenu

HOLD	Edge trigger	  trigger slope is not saved
------	--------------	--

1. Press the F1 key to start measurement, display state changes from "start" to "wait". Once the input signal meets preset trigger conditions, the screen will display stable waveforms. Press the F1 key again to end the wait state.
2. Press the F2 key to enter time base/amplitude/trigger setting and press the \longleftrightarrow keys to change the attenuation of horizontal scanning time base and input range and set trigger level to observe the waveforms of the measured signals by the best way.
3. Press the F3 key to enter the dV/dt measurement state for digital display of the corresponding voltage difference and time difference.
4. Press the F4 key to enter the displacement adjustment submenu and press the \longleftrightarrow keys to display the waveforms that are stored in the cache and have been sampled.
5. Press the HOLD key to select trigger edge  . As soon as you exit single measurement or shut down, trigger edge will be restored to the  or  state set for the system.
6. Press the \uparrow key for more than 3 seconds to enter the help interface, press the $\uparrow \downarrow$ keys to turn pages for display and press the F5 key to exit the help interface.

Horizontal time base settings

Press the F2 key to select time base and press the \longleftrightarrow keys to change time base setting (the default is $2.5\mu s$). For single measurements, it is very important to select the appropriate time base. To broaden the measured waveforms, time base

should be faster and changed from 2.5 μ s to ns; to capture more waveform cycles, time base should be slower and changed from 2.5 μ s to ms (s); if time base is set too fast, you will not be able to see complete waveforms; if time base is set too slow, waveforms will be displayed too densely so as to affect the waveform analysis.



Attention: *When measuring a signal with unknown frequency, you should try to collect waveforms from the fastest time base and then gradually select slower time bases until the signal can be displayed correctly. Otherwise, due to “aliasing distortion effect”, the waveforms may not correctly reflect the actual situation of the signal.*

Vertical amplitude settings

Press the F2 key to select amplitude and press the $\leftarrow\rightarrow$ keys to change amplitude setting (default: 100mV, system: 10:1). For single measurements, you will completely observe the measured waveforms if you select the appropriate amplitude. The setting of amplitude should consider the maximum peak of single waveforms. If range is set small, waveforms will stretch out of the screen; if range is set large, the waveform display amplitude will be low, the measurement error will increase and observation will be made inconvenient.

Trigger edge settings

1. System setting; long press the MODE key for more than 3 seconds to enter system setting.

Edge selection: select rising edge or falling edge, press the OK key to confirm. After setting, press F1 to save and exit and press F4 to exit directly.

2. Measurement setting; in the single measurement state, press the HOLD key to select trigger edge $\lrcorner \llcorner$. As soon as you exit single measurement or shut down, trigger edge will be restored to the \lrcorner or \llcorner state set for the system.

To change the rising edge or falling edge trigger will not change the trigger level preset parameters.

Trigger condition settings

Press the F2 key to select trigger, and according to the characteristics of the measured waveforms, press the $\uparrow\leftarrow$ and $\downarrow\rightarrow$ keys to change trigger level (upward or downward), \updownarrow keys for rough adjustment and \longleftrightarrow keys for fine adjustment. The arrow at the right of the waveform display area points to the trigger level point; to trigger the rising edge or the falling edge, adjust the right arrow toward the horizontal middle axis position. After pressing F1 to start, once signal appears, the oscilloscope will be triggered and capture it. Once the trigger condition is set, press the F2 key to exit trigger setting, the parameters that have been set are saved.

Horizontal position adjustment

Upon stable display of waveforms, press the F4 (displacement) key to enter the horizontal position adjustment submenu. Press the \longleftrightarrow keys to adjust the horizontal position of waveforms. Each time you press the \longleftrightarrow keys, the waveforms stored in the cache will be replayed at 1/4 length of the display area. The number of sampling points is displayed at the bottom of the

waveform display area. Press the F1 key to return to the initial state, the sampling start point corresponds to the central perpendicular line of the screen; press the F2 key to enter the save state to save the contents currently displayed on the screen; press the F3 key to enter cursor measurement; press the F4 key to return to the single measurement page.

Horizontal position adjustment submenu:

Key	Function prompt	Operation results
F1	Initial point	Waveform returns to the initial position
F2	Save	Save waveforms in the screen area after displacement
F3	Measure	The cursor measures the waveforms after displacement
F4	Return	Return to the previous menu and restart single measurements

Cursor measurement readout function

In the single measurement state, press the F3 (measurement) key to enter the cursor measurement submenu:

Key	Function prompt	Operation results
F1	Upper cursor	The upper cursor for amplitude selection moves
F2	Lower cursor	The lower cursor for amplitude selection moves
F3	Left cursor	The left cursor for time selection moves
F4	Right cursor	The right cursor for time selection moves
F5	Return	Return to the single measurement menu

1. Press the F1 key to move the upper cursor for amplitude selection and press the $\uparrow\downarrow/\leftarrow\rightarrow$ keys to change the position of the upper cursor.
2. Press the F2 key to move the lower cursor for amplitude selection and press the $\uparrow\downarrow/\leftarrow\rightarrow$ keys to change the position of the lower cursor.
3. Press the F3 key to move the left cursor for time selection and press the $\uparrow\downarrow/\leftarrow\rightarrow$ keys to change the position of the left cursor.
4. Press the F4 key to move the right cursor for time selection and press the $\uparrow\downarrow/\leftarrow\rightarrow$ keys to change the position of the right cursor.
5. Press the F5 key to return and reenter the single measurement or displacement main menu.

Press the \uparrow \downarrow \leftarrow \rightarrow keys to change the position of the cursor. Each time you press the \leftarrow \rightarrow keys, the cursor will move for 1/25 grid; each time you press the \uparrow \downarrow keys, the cursor will move for 1/5 grid.

During cursor measurements, the display interface will generate a pair of horizontal cursors to measure dV and a pair of vertical cursors to measure dt. The digital readout function may be used to measure the voltage difference (dV) or time difference (dt) between the two cursors on the display screen that will be displayed on the screen at any time.

Waveform measurements in single mode

Press the MODE key to select the single mode and set time base, amplitude, trigger mode and trigger level according to the characteristics of the measured signals. Access to the measured signals from the oscilloscope input port and press the F1 start key, the function key “start” concaves down. Watch the LCD display screen, the measured waveforms are completely displayed in the effective area. Press the F3 key to enter the measurement function and analyze the characteristics of the measured waveforms; if the captured waveforms cannot be effectively observed, you should change related settings and repeat the steps above until satisfied with the test results. If the “wait” time during single measurements is too long, it indicates that the signals have not arrived or the connection is wrong. You may press the F1 key to end the “wait” state.

If the measured waveforms are not completely displayed in the effective area, you may press the F4 key to enter the displacement state and press the \leftarrow \rightarrow keys to adjust the horizontal position of the measured waveforms.

Entering single measurements, the instrument default is 100mV, 2.5 μ s (system setting: 10:1).

Waveform storage and readout in single mode

The DSO database has a memory space for 40 DSO waveform data. See Page 13 in this manual for Save/Readout/Delete/Clear operating methods.

Signal Source Operation

Enter signal source settings

Select oscilloscope (DSO) regular measurement mode to enter signal source setting; maintain signal output of set parameters in the DSO regular and single measurement state.

Warning:



- *It is prohibited to access any voltage signal to the signal source output wire.*
 - *When used in conjunction with the oscilloscope, keep the oscilloscope probe and the earth terminal of the signal output wire at the same level to avoid floating measurements.*
-

Signal generation

The signal source uses the DDS digital frequency synthesis technology to obtain 156.25kHz stable fundamental frequency through FPGA (programmable logic array) frequency division. Signal frequency output from the signal source is the frequency division result of 156.25kHz/n. The signal frequency regulation follows the following rules:

- For 10Hz~100Hz, stepped frequency interval is 1Hz.
- For 100Hz~1000Hz, stepped frequency interval is 10Hz.

- For 1kHz~10kHz, stepped frequency interval is 100Hz.
- For more than 10 kHz, 10427Hz, 11161Hz, 12019Hz, 13021Hz, 14205Hz, 15625Hz, 17361Hz, 19531Hz, 22321Hz, 26042Hz, 31250Hz, 39063Hz, 52083Hz, 78125Hz and 156250Hz.

Because the output signal frequency is the frequency division result of 156250Hz/n, the frequency below 10kHz is not possibly an ideal integer frequency.

The output signal amplitude is 1V.

Signal settings

In the oscilloscope regular mode, press the OK key for 3 seconds to enter the signal source setting interface.

- Press the F1 key to select to open and close the signal source.
- Press the F2 key to select the type of output signal. Each time you press the F2 key, the box under waveforms will display the type of waveforms: sine wave, triangular wave, forward sawtooth wave, backward sawtooth wave and square wave, etc.

Square wave T is specially used to generate special signals: for example, 1kHz square may be used to calibrate the oscilloscope probe; 200 μ s and 400 μ s signals are used to cooperate with the oscilloscope to detect the waveforms of HOT type inter-turn faults ringing signal; and 15625Hz square wave is used to substitute the line oscillation or line drive waveform signals.

Press the F4 key to exit or close the signal source help window. When the signal source is opened, a window will pop up at the top left corner of the interface to display waveform type and frequency.

Signal source adjustment

Press the F2 key to select the type of output signal and then press the ←↓ keys to select to decrease the output signal frequency, the ↓ key is for rough adjustment and the ← key is for fine adjustment; press the →↑ keys to select to increase the output signal frequency, the ↑ key is for rough adjustment and the → key is for fine adjustment.

Signal source close

In the oscilloscope regular mode, press the OK key for 3 seconds to enter the signal source setting interface. Press the F1 key to select to close the signal source and press the F4 key to exit.

Oscilloscope probe calibration

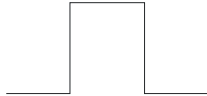
When use the oscilloscope probe for the first time or renew it, you must recalibrate it in the following way. Select the oscilloscope (DSO) regular measurement mode.



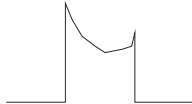
Attention: Insert the oscilloscope probe in the oscilloscope input port and set the probe attenuator at X10 position.

See the signal source using methods. Select signal type as square wave T and press the F2 key to adjust the output signal frequency to 1.00kHz. Press the F4 key to confirm and exit the signal source window. Set the oscilloscope probe attenuator

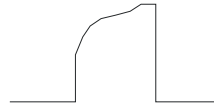
at X10 position, keep the probe in direct contact with the signal source output port and press the F1 key (auto) to get stable square wave display. Observe the square wave display that may have the following three types:



Normal compensation waveform



Overcompensation waveform



Under-compensation waveform

Use a non-inductive screwdriver to adjust compensation capacitance (at the opening position at the front end of the probe test bar) of the oscilloscope probe to display normal square waves and finish calibration.



Tips: When the oscilloscope probe attenuator is at X1, the bandwidth of the probe itself is less than 6MHz. Only after being calibrated and set the probe attenuator to X10, the probe can satisfy the bandwidth of 50MHz (in response to sine wave signals).

TECHNICAL SPECIFICATIONS

General Specifications

Display	320 × 240 dot matrix graphic color LCD	View area	70mm x 53mm
Backlight	White	Auto shutdown	10 minutes
Low power symbol	☐	Charge time	More than 4 hours
Continuous service time	About 120 minutes	Storage capacity	40 groups of waveform records
Application environment	0°C~+40°C; <75%RH	Storage conditions	-10°C~+60°C; <90%RH
Dimensions	200mm × 135 mm × 52mm	Weight	About 490g (excluding other accessories)
Battery	Built-in 2300mAh lithium battery pack	Power supply adaptor	110V~250V, 5V/1.5A, protection switching power supply

Oscilloscope Specifications

Analog bandwidth	DC~50MHz probe X10; DC~5MHz probe X1 (3db bandwidth, sine wave response)		
Maximum real-time sampling rate	200Mpsps	Vertical resolution	8 bits
Coupling mode	DC/AC	Graduation	Vertical ± 4 div; horizontal 12div
Vertical sensitivity range	10mV/div ~ 50V/div 1-2-5 10mV/div~50V/div 1-2-5 binary switch	Time base range	5ns/div~2.5s/div 1-2.5-5 binary switch
Vertical amplitude accuracy	$\pm(5\% + 0.1\text{div})$	Time base accuracy	$\pm(0.01\% + 0.1\text{div})$
Automatic zero correction	Yes	Measurement mode	Regular, single
Trigger level	± 3.8 div (0.04div per step)	Single trigger slope selection	Rising/falling edge
Trigger position adjustment	± 3.8 div (0.04div per step)	Automatic setting	Automatically set time base and vertical amplitude
Cursor measurements	dV, dt,	Automatic measurements	Vp-p, +Vp, -Vp, f, T



Automatic measurement accuracy	$\pm(5\% + 0.1\text{div})$	Waveform interpolation	$(\sin x)/x$
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Oscilloscope probe specification

Position X1	Input resistance: 1M Ω ; input capacitance: 46pF; Bandwidth: DC~6MHz; attenuation ratio: 1:1; input voltage: 30Vp-p
Position X10	Input resistance: 10M Ω ; input capacitance: 15pF; Bandwidth: DC~60MHz; attenuation ratio: 10:1; input voltage: 300Vp-p

Symbols and icons

$\lrcorner \llcorner$	Trigger slope (rising/falling edge)	div	Graduation (oscilloscope mode)
Hz	Hertz (frequency unit)	HOLD	Waveform maintenance
f/T	Frequency/cycle	V	Volt
mV	Millivolt	ms	Millisecond
ns	Nanosecond	μs	Microsecond

dt	Signal time difference width	dV	Voltage difference
	Power/switch		Battery remaining capacity

Instrument package

AT-H150 Scope meter	1 pc
AT-H150 oscilloscope probe	1 pc
Signal output wire	1 pc
Power supply adaptor,	1 pc
Carrying Case	1 piece
Product manual (containing product warranty regulations and user receipt).	1 set

Nanjing Glarun Atten Technology Co Ltd.

Building A8, Tanglang Industrial Zone, Xili,

Nanshan, Shenzhen, 518055, P. R. China

Tel: +86-755-6161 8252 / 6161 8291 / 2655 9660

Fax: +86-755-6161 8298

e-mail: atten@atten.com.cn

Web: <http://www.attenelectronics.com>

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