

Digital Pocket Oscilloscope

HH972

OPERATING MANUAL



HH972



ST972



Oscilloscope Mode



Meter Mode



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WARRANTY

This instrument and accessories have a limited warranty against defects in material and workmanship for a period of one year from the date of sale. During the warranty period, Hirel Corporation or local representatives will repair or replace if products prove to be defective. Warranty shall not apply to defects resulting from tampering, abuse or mishandling. In such case the repair will be billed at the nominal cost. Any other cost directly or indirectly connected to the repair shall not be reimbursed.

For warranty service or repair, this instrument or accessories must be returned to a service facility or a local representative designated by Hirel.

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1. Safety instructions

-A- General safety informations

Before using the **HH972** oscilloscope and its accessories, read the following safety instructions carefully. This instrument is designed to observe electrical signals and some conditions and actions may present some hazards to the user.

- To avoid electrical shock:
 - Use caution when working above 60V DC or 30V AC RMS, such voltages pose a shock hazard.
 - Use caution when connecting the AC ADAPTER to the power lines.
 - Do not use defective test leads.
 - Do not operate with battery cover removed. Before removing cover, disconnect test leads, turn off power by releasing the **POWER** button, and remove the AC adapter jack from the unit.
- Use only the **AC ADAPTER** provided with the scope or the **ST972 BATTERY STAND** to supply the **HH972** unit. Use only the same adapter to charge the ST972 or ST972-EC internal 9V battery.
- Never permit water to enter the interior of the instrument and accessories and never subject them to severe mechanical shock.
- The ST972 and ST972-EC optional STAND accessories are only for use with the HH972 oscilloscope.

-B- Extreme caution to avoid electrical damage to the scope

- Do not apply electrical live sources between A and K terminals. Before attempting in-circuit testing, turn-off power to the test circuit and discharge all capacitors.
- Do not apply input voltage more than + or - 400V DC and 800V peak to peak AC between V and COM terminals.

2. FCC informations for the USA

Introduction: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off an on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Modifications: The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by the Manufacturer may void the user's authority to operate the equipment.

3. Pocket Scope overview

-A- General

The HH972 combines a digital oscilloscope with a multimeter. It offers the advanced features of an auto-set digital oscilloscope and a component curve tracer, in the size and for the price of a hand-held multimeter (3.6" x 7.1" x 1.4" (180 x 90 x 35 mm) / 12.7 oz (360g) with battery). It is equipped with a high contrast backlit LCD display with a wide-angle visibility (150(H) x 100(V) dots).

It has been designed to satisfy a wide range of requirements, from experts to novices, in homes, offices, laboratories, and in the field:

- Scope mode to observe voltage waveform from an active electric / electronic source.
- Meter mode to check a possibly damaged discrete or in-circuit component. It can also help test resistors or trace open/shorts in failing systems.
- 280V true RMS AC / + or - 400V DC maximum input voltage.
- 5MHz bandwidth (Digital sampling @20Ms/sec).
- Full auto setup / auto adjust / auto display of amplitude and time.
- Easy access to functions with front keys. HOLD key to freeze the display.
- 3-hour continuous operations with a 9V battery or 10-hours with the optional ST972 stand including a rechargeable battery.
- Test leads included (test probe not required).

Because of its low cost, small size and technical performances, the HH972 is well suited for educational purposes. Applications cover digital and analog signals, telecommunication, GPS, TV and audio, line-operated equipment, sensors, signal analysis in automotive (with optional ST972-EC), car stereo etc. It is especially convenient for technicians installing and maintaining equipment, working by themselves far from their factory, far from power sources.

-B- Front side

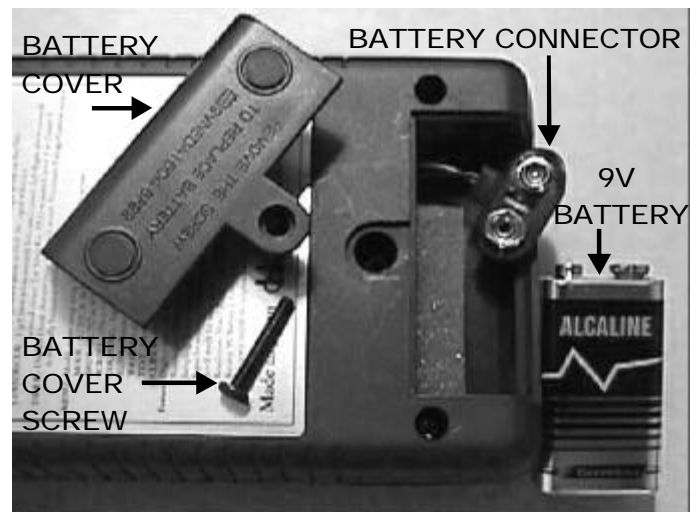
Feature	Function
POWER	Press ON or OFF to get scope powered or turned off.
AUTO	Auto ranging to get best fit in the display
	Use ◀ ▶ ▽ ▹ to manually change settings.
SELECT	1- Swapping synchro from (+) slope to (-) slope 2- Selection of cursor #1 or #2
HOLD	Press once to freeze the display for observation. Press again to return to <i>RUN</i> mode When depressed for > than 2s, display light gets turned on When depressed again for > than 2s, light gets turned off.
MENU	Access to menu to change default settings Use ◀ ▶ ▽ ▹ to change settings.
MODE	1- CURSOR to display amplitude and time 2- SCALE mode to adjust scale factors 3- OFFSET mode to change DC offset settings.
A-K terminals	METER mode for continuity testing.
COM-V terminals	OSCILLOSCOPE mode.



-C - Back side

To install or replace the 9V battery proceed as follow:

- After disconnecting test leads, and turning off the oscilloscope, remove the battery cover screw.
- Disconnect battery from instrument and replace with a **9V alkaline battery**. Or simply install the new battery for the first time.
- Replace back cover and secure with one screw.



Warning:

Use 9V alkaline batteries only. The HH972 wouldn't properly work with any other type.

4. How to operate the HH972

-A- Test Leads/ Input terminals

OSCILLOSCOPE mode:

To observe voltage waveform from an active electric / electronic source, attach test leads to the scope. Connect the black test lead to **COM**-labeled black terminal and the red one to **V**-labeled red terminal.

Warning: any mismatch can cause erroneous analysis.

METER mode:

To check continuity of a discrete or in-circuit component, connect the black test lead to **K**-labeled black terminal. and the red one to **A**-labeled red terminal.

Warning: do not apply live electrical sources between A and K terminals.

-B- Operating the HH972 in OSCILLOSCOPE mode

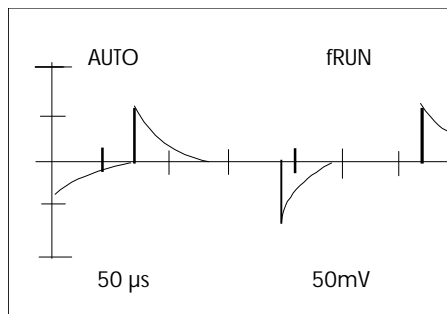


Figure 1

To start measurement, press the **POWER** button. Connect test leads across the electrical source to analyze. The HH972 automatically adjusts time and amplitude scales to best fit the incoming signal and displays the captured waveform. "AUTO" may be seen in the upper left corner of the display, meaning that the unit is in *AUTO* mode, in which, time and amplitude scales are automatically optimized.

The time and amplitude scales are shown along the lower edge of the display (50 μsec and 50mV in the example of Fig.1). "fRUN" in the upper right corner means that the HH972 is continuously catching and displaying the incoming signal.

For a clear view of the waveform, press the **HOLD** button. This causes the HH972 to store and display the waveform just captured. The mark "fRUN" changes to "fHOLD".

Depressing the **HOLD** button allows the user to alternate between capture and observation as instructed on the screen ("Press HOLD again for another capture" / "Press HOLD for clear view").

-C- Measure tools

To access *CURSOR* mode and adjust positions and values, use the following keys:

MODE button: used to display cursor lines and values of signal amplitude and time. In this mode, the cursor lines can be manually adjusted to desired locations.

SELECT button: used to select cursor # 1 or cursor #2 to be moved. While selected, the cursor can be moved with $\triangleleft \triangle \triangleright \triangleright$ in both *AUTO* and *HOLD* modes (\triangle/\triangleright for amplitude, $\triangleleft/\triangleright$ for time).

While running in *AUTO* mode, press the **MODE** button once, 4 cursor lines appear (Fig.2):

- 2 horizontal lines parallel to time scale (X-axis),
- 2 vertical lines parallel to amplitude scale (Y-axis).

▪ **Horizontal cursors (amplitude)**

The 2 cursor lines parallel to X-axis are automatically placed to show the peak to peak amplitude of the incoming waveform. If the incoming signal fluctuates in amplitude, these 2 lines move up and down accordingly. The peak to peak distance between these 2 cursor lines is denoted as ΔV_{1-2} and its value is displayed in the upper right corner of the LCD panel (108mV as shown in Fig.2.)

These 2 cursors could also be manually adjusted to measure the amplitude of any part of the signal. (similar operation than the one explained in the following time scale section)

▪ **Vertical cursors (time)**

The 2 « time » vertical cursor lines are to be settled manually to measure time length.

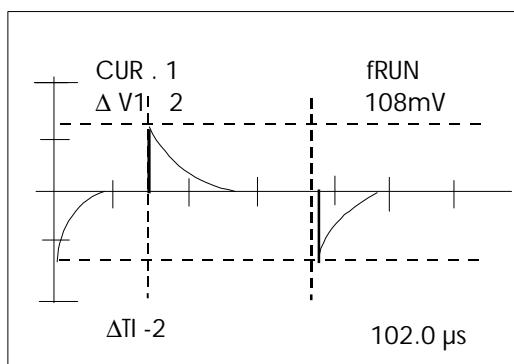


Figure 2

Press the **HOLD** button (measurement is usually easier when performed in *HOLD* mode). Press the **SELECT** button once or twice to select cursor #1 or #2. Use $\triangleleft/\triangleright$ to move the cursor to the appropriate location. Distance between these 2 cursor lines is denoted as ΔT_{1-2} and its value is displayed in the lower right corner of the LCD panel (102 μ s in the example of Fig. 2)

To resume the next measurement, press **AUTO**, then repeat.

-D- Manual settings of scales (Volt/Div – Time/Div)

The manual settings of scales can be operated by selecting *SCALE* mode or by directly using $\triangleleft \triangle \triangleright \triangleright$ when in *AUTO* mode. In the later case, the HH972 directly enters *SCALE* mode. Enter *AUTO* mode. In case it is desired to see displayed waveform in a different scale from what the HH972 automatically sets, press **MODE** twice to enter *SCALE* mode. "SCALE" replaces "AUTO" in the upper left corner when $\triangleleft \triangle \triangleright \triangleright$ buttons are used to manually

change Time/Amplitude settings by incremental or decremental steps. Users can quickly learn how Volt/Div – Time/Div can be changed.

Press the "**HOLD**" button when the desired scale has been set.

-E- DC offset control

When shifting the waveform upward or downward is necessary, start *AUTO* mode. Press the **MODE** button 3 times. "AUTO" mark in the upper left corner of the display changes successively to "CUR.1", "SCALE", and finally "POS."

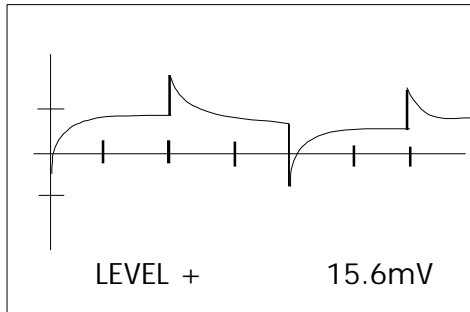


Figure 3

Use Δ/∇ buttons to shift waveform upward or downward. DC value used to shift the waveform is displayed along the lower edge of the display window. Press **HOLD** for measurement. (+15.6mV in Fig.3)

CAUTION: Be sure to bring DC offset back to "**ZERO**" before going back to *AUTO* mode. Otherwise

the HH972 may behave erroneously.

-F- MENU selection

Use the **MENU** button, to access the HH972 operating modes. Refer to the contents displayed in the following table.

DIODE	OFF	\rightarrow	ON
SHOT	AUTO	\leftrightarrow	SINGLE
SCROLL	ON	\leftarrow	OFF
COUPLING	DC	\rightarrow	AC
SLOPE	POS.	\leftarrow	NEG.
VOLT/DIV	50mV	\rightarrow	200V (MAX)
TIME/DIV	100ns	\leftarrow	10s
WAVE	Not used in HH972		
TEXT	Not used in HH972		
CURSOR	Not used in HH972		

Figure 4

Use Δ/∇ buttons to move cursor to the item to be set. When underlined, the item is ready to be programmed in the range denoted in Fig.4. Use $\triangleleft/\triangleright$ buttons for this purpose.

When the **MENU** button is depressed again, the new selection of operating choices is activated.

SHOT

This parameter can be set to SINGLE or AUTO to capture the signal only at once or continuously. When set to SINGLE, incoming signal is captured from the trigger point and displayed for a full time-scale sweep, which can be set by TIME/DIV. Single sweep mode is active only in *CURSOR* or *SCALE* mode.

To use *SINGLE SWEEP* (one shot) mode:

- (1) Enter *AUTO* mode.
- (2) Enter *CURSOR* or *SCALE* mode by depressing **MODE** once or twice, as described in a former section.
- (3) Press **MENU** and set SHOT to SINGLE. Go back to operation depressing **MENU** again.

The waveform is now captured only once and displayed still. Note "fHOLD" mark in the upper right corner. Every time that the **HOLD** button is depressed, a new sweep takes place, capturing new incoming signal.

SCROLL

This mode is useful to emulate a pen-recorder. When TIME/DIV (time scale) is set larger than 200ms/div and SCROLL is set to ON, signal waveform trace can be seen scrolling leftwards at the speed of selected time scale.

Enter *SCALE* mode by depressing **MODE** twice.

Press the **MENU** button to access the SCROLL parameter that can be set to ON/OFF. Set SCROLL to ON. Set TIME/DIV to value beyond 200ms/div. Go back to *SCALE* mode, depressing **MENU** again. The HH972 now displays signal waveform trace scrolling leftwards. "SCROLL" mark appears in the center of the display top edge.

COUPLING

COUPLING can be set to DC (direct current) or AC (alternative current) depending upon incoming signal properties. Press the **MENU** button to access the COUPLING parameter. Select DC or AC by $\triangleleft / \triangleright$ buttons, according to your requirement.

SLOPE

Select POS. (positive) or NEG. (negative) slope for triggering point. The HH972 unit will capture the incoming waveform according to your choice, at a point close to zero, on the slope of the signal waveform specified here. To access SLOPE parameter, use the **MENU** button.

VOLT/DIV

This selection is active only when *MENU* mode is entered from *SCALE* or *CURSOR* mode. Use $\triangleleft / \triangleright$ buttons to changes value. When *AUTO* mode is again selected, settings are no longer valid. The HH972 will automatically set VOLT/DIV, TIME/DIV to best fit the signal into the display.

DIODE

User can select *OSCILLOSCOPE* mode (DIODE=OFF) or *METER* mode (DIODE=ON). Use $\triangleleft / \triangleright$ buttons to set to ON or OFF. For details see next section.

-G- Operating the HH972 in *METER* mode

This mode is useful to check a possibly damaged discrete or in-circuit component. It can also help test resistors or trace open/shorts in failing systems.

To perform continuity testing, plug the black test lead into **K**-labeled black terminal. and the red one into the **A**-labeled red terminal (as shown in Fig. 6).

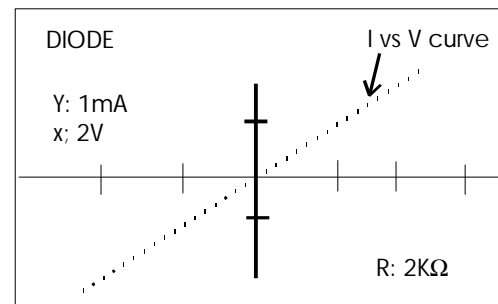
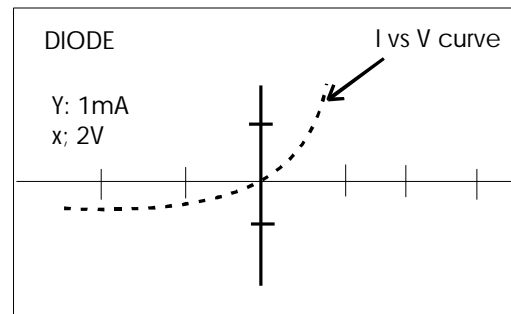
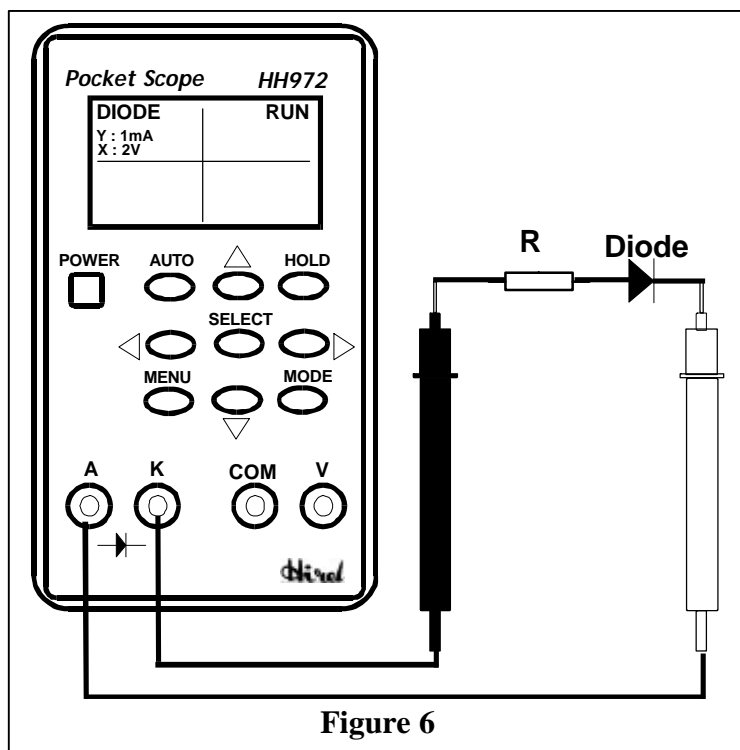
Then, press the **POWER** button. Connect test leads across the component under measurement through appropriate resistor ($200\Omega \sim 1K\Omega$ recommended) (see Fig. 6).

Press **MENU** to access *MENU* parameters, set **DIODE** to **ON** using $\triangleleft / \triangleright$. The HH972 displays a new window as shown in Fig.7 and Fig.8.

A and **K** plugs become active with a sweeping voltage of $\pm 5V$ on **A** plug, referenced to **K** plug. *I/V* curve is now shown as illustrated by dotted line in Fig.7, for diode testing.

For resistor testing, the HH972 displays a linear curve and a rounded value in the bottom right corner of the panel. (see Fig.8)

Warning: It is recommended to attach probes to semiconductor devices through a resistor for current limitation (as shown in Fig.6).



5. ST972 STAND with rechargeable battery: (Fig.9)

The optional **ST972 STAND** is very useful to hold the scope vertically. It frees user's hands and provides 10-hours of operating time on the included rechargeable battery.

Insert the HH972 unit into the ST972 holder, making sure to properly align the registration pins during the insertion (see Fig.10). Pins are positioned to hold the scope in place. Then, plug the left-hand side 9V battery output jack into the HH972 connector to get it powered (see Fig.11).

To charge the battery, connect the AC adapter to the mains lines, plug the adapter jack into the right-hand side connector. A red LED will turn-on until the battery is fully charged. Then it naturally turns-off when the battery is charged. (see Fig. 12)

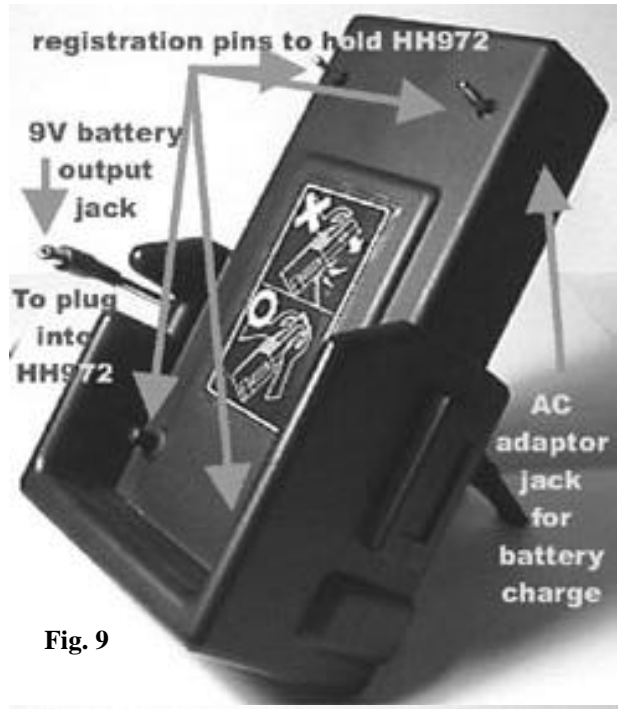


Fig. 9



Fig.10



Fig.11



Fig.12

6. Specifications

Model	HH972
Display	Black and white EL backlit LCD type, 150(H) x 100(V) dots. Light is turned on and off when the HOLD button is depressed longer than 2 sec each time.
Bandwidth	DC to 5MHz. Digital sampling @20Ms/sec.
Display Resolution	6 bit to provide very smooth waveforms and text.
Vertical Range	50mV/div ~ 200V/div.
Horizontal Range	100nsec/div ~ 10sec/div.
Input Impedance	1Mohm (F= 1KHz).
Basic Functions	<ul style="list-style-type: none">•<i>OSCILLOSCOPE</i> mode, using COM and V terminals: Automatic capture mode. Automatic display mode. Continuous peak to peak measurement mode. <i>CURSOR / SCROLL / HOLD</i> functions.•<i>METER</i> mode using A and K terminals: I / V curves displayed.
Battery	9V alkaline battery (auto power-off in 10min for power saving) Approx. 3-hour lifetime in continuous operation.
Size	3.6" x 7.1" x 1.4" (180 x 90 x 35 mm)
Weight	12.7 oz (360g) with battery.
AC power adapter (INCLUDED)	120V, 60 Hz or 230V, 50Hz (No automatic power-off when the HH972 is used with AC power adapter).
ST972 Battery Stand (OPTIONAL)	This Vertical Stand includes an approx. 10-hour rechargeable battery with the AC adapter. It provides an easy way to handle the HH972 and see the display. Size: 7.9" x 4.5" x 3" (20 x 11.4 x 7.6 mm).
ST972-EC (OPTIONAL)	Basic stand as above with an event catcher electronic module for car ignition analysis. Associated with the stand, the HH972 catches the ignition event sequence.
Temperature:	
Operating	0°C ~ 40°C (below 80% RH) (32°F ~ 104°F)
Storage	-10°C ~ 50°C (below 70% RH) (14°F ~ 122°F)

Max input voltage	+ or - 400V DC, 800V peak to peak AC.
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