

USER GUIDE

HICKOK WAEKON

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Safety Information

Before using this equipment, carefully read, understand and follow instructions and safety messages on equipment and in this guide.

This guide cannot anticipate or provide advice and cautions for all situations encountered by technicians. With this in mind, always follow and refer to the manuals provided by the manufacturer of the vehicle or equipment being tested or used for all information and testing procedures whenever diagnosing, repairing or operating such vehicle or equipment.

Failure to follow the instructions, cautions and warnings provided here as well as those provided by the vehicle and equipment manufacturers can result in fire, explosion, bodily injury and property damage.

In addition to the information listed below, additional warnings and cautions are listed throughout the guide. Please read them carefully.

Fuel vapors are toxic and explosive, which can cause severe injury or death.

- Use proper ventilation to avoid breathing fuel vapors.
- Minimize contact with the skin with the use of gloves (such as nitrile gloves) when there is possibility of getting methanol fuel on your hands.
- If the skin is directly exposed, wash the area immediately and change any clothes that have become wet with fuel.
- Always wear approved safety glasses when testing. Should fuel get into eyes, flush eyes immediately with water and consult your physician.

Vehicles emit flammable vapors which can ignite.

- Keep flames, sparks, cigarettes and other ignition sources away from the vehicle at all times.
- In case of fire, never use water to fight flames caused by methanol or methanol blended gasoline. This will cause the flames to spread instead of extinguishing them.
- Use a dry chemical extinguisher to fight flames (preferably one marked ABC, though BC is acceptable). A foam extinguisher is acceptable only if it is ARF grade, which is resistant to alcohol.

Before beginning any tests, make sure the test environment is safe and the vehicle meets these conditions:

- Test area should be well ventilated.
- Vehicle should be in park.
- Wheels should be blocked.
- Engine should be at normal operating temperature.
- Vehicle should have normal exhaust flow.
- Keep all tester cables clear of exhaust manifolds and radiator fan blades.
- Use caution when testing on a vehicle while the engine is running (surfaces may become hot, electric cooling fans may turn on unexpectedly, etc.)

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Components



Auto Wave

Used along with the supplied cables and signal probe, allows you to view waveforms for analysis and pinpoint diagnostics.

Signal Probe

Used for testing signals and voltages. The signal probe can be conveniently stored in the ground jack port located on the back of the handle.

Extender Cable

The 3-Ft. Extender Cable (with the signal probe attached) is used when a longer reach is required.

Ground Cable

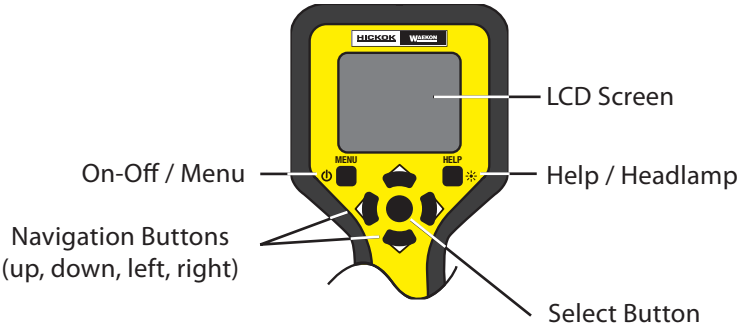
The 5-Ft. Ground Cable is used to safely ground the tester to the vehicle.
Note: A good ground connection is required for obtaining clean waveforms.

SD Card Adapter

Used with the 4GB SD card to download and view saved bitmaps

Controls and Connections

Front View



On-Off / Menu Button

To power on Auto Wave — press and release the On-Off / Menu button.

- Auto Wave always powers up in the Live Trending mode set at 200mS and 2v scales.

To access the Main Menu — press and release the On-Off / Menu button.

- Press and release the Menu button again to return to the current operation.

To power off Auto Wave — press and hold the On-Off / Menu button.

- Auto Wave automatically turns off after 2-minutes of no activity.

Help / Headlights Button

To display help on the current operation — press and release the Help / Headlamp button at any time.

- Continue to press and release the Help button to scroll through the pages (if there is more than one) and to return to the current operation.

To turn the headlamp on— press and hold the Help / Headlamp button.

- Press and release the button again to turn the headlamp off.

Select Button

The function of this button varies depending on use and the mode of operation you are currently in.

Press and release to:

- Select Main Menu items.
- To switch between PAN and ZOOM during Live Trending/Camera functions.

Press and hold to:

- Capture and save the currently displayed wave.
- Display a list of options (Resume, Bitmap, Cancel, Delete) while viewing saved waveforms.

Navigation Buttons

The function of this button varies depending on the mode of operation you are currently in.

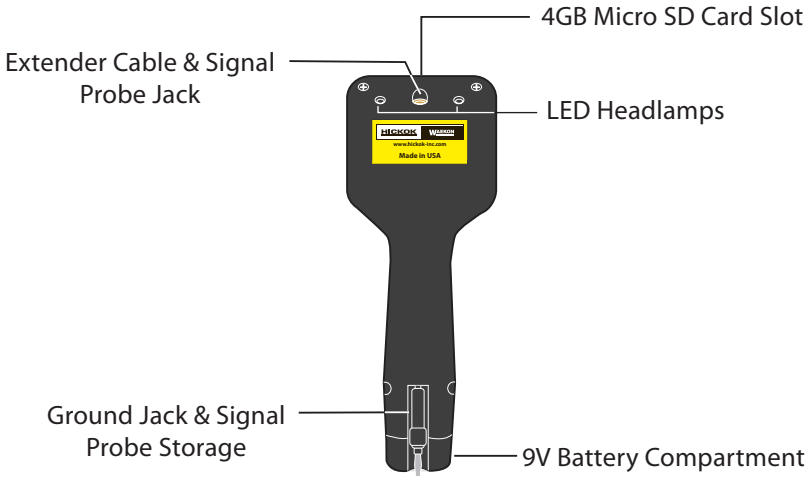
Up, Down, Left, Right buttons are used to:

- Navigate Main Menu items.
- Adjust time and voltage scales when viewing live or saved waveforms (ZOOM).
- Move waveform left, right, up or down when viewing live or saved waveforms (PAN).
- Toggle through File List and Browse Waves menu items.
- Clear min, max values in Voltmeter mode.
- Adjust Auto Trigger and Manual Trigger settings.

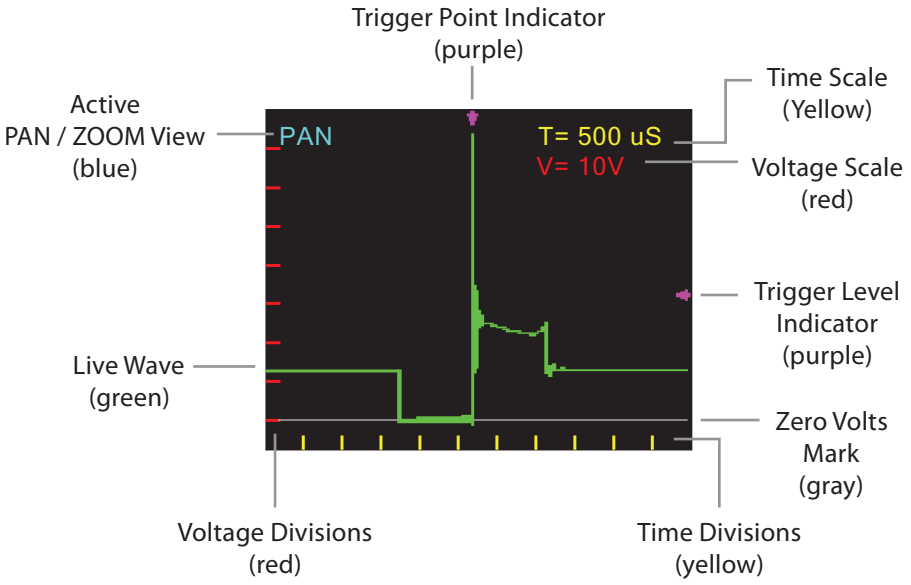
See *Main Menu* and *How To* sections for more detail

Controls and Connections

Back View



LCD Screen Symbols and Indicators



Without the Extender Cable

- Plug the Signal Probe directly into the signal probe input jack
- Plug the ground cable into the ground jack.



With the Extender Cable

- Plug the Extender Cable directly into the signal probe input jack
- Plug the Signal Probe into the female end of the extender cable.
- Plug the ground cable into the ground jack.

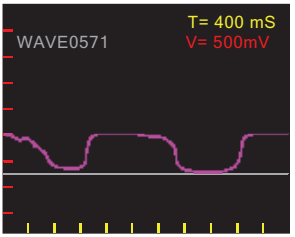


Note: When using the Extender Cable, make sure to keep it away from high noise sources to prevent noise from coupling into the wire and affecting the signal being viewed.

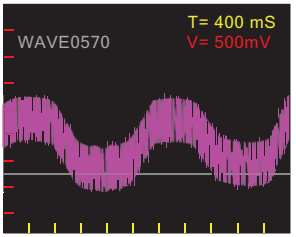
Why Ground Hookup Is Important

- Connecting a good ground point is important for obtaining clean waveforms.
- For most vehicle signals, the battery negative terminal or the engine block will provide a clean ground.
- A bad ground, such as the vehicle chassis, may add false noise to the signal.

The same O2 sensor signal with the Ground Cable connected in two different places:



Good Ground



Bad Ground

How To…

View a Live Waveform

Basic overview on how to use Auto Wave.

- Determine the setup you require (with / without extender cable) and connect the ground cable to a good ground on the vehicle.
- Turn Auto Wave on and probe the desired electrical signal or voltage on the vehicle. A waveform should appear on the LCD screen indicating the presence of a signal.
- If needed, go to the Main Menu and select a function to adjust how you acquire and view the signal (See *Main Menu* section for more details).

Pan or Zoom While Viewing Live or Saved Waveform

Press and release the navigation buttons to Pan or Zoom the screen view.

Zoom

- Left button decreases (Zoom in) the time setting (T=)
- Right button increases (Zoom out) the time setting (T=)
- Up button decreases (Zoom In) the voltage setting (V=)
- Down button increases (Zoom out) the voltage setting (V=)

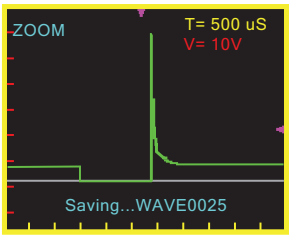
Pan

- Use the Navigation buttons to move the screen view in the desired direction.

Note: The time and voltage scale setting used during live waveform viewing sets the sample rate and the saved waveforms length.

Capture and Save a Waveform

A waveform can be captured and saved for further review.



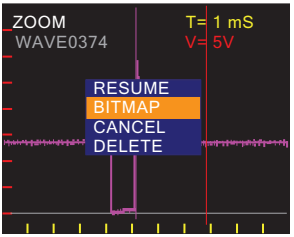
- While viewing a live waveform, press and hold the Select button to capture and save it.
- A yellow box appears around the waveform and displays the assigned filename (i.e. WAVE0025).
- To view saved waveforms on a PC they will need to be saved as a Bitmap file (See *Create Bitmaps*).
- To return to live waveform viewing, press and hold Select until the dialog box appears and then select RESUME.

Note: A saved waveform's resolution is determined by the Time and Voltage settings at the time a waveform is captured and cannot be adjusted once saved.

Create Bitmaps

While viewing saved waves, create a customized bitmap to show the attributes of a captured waveform for viewing on a PC.

- Position the waveform using PAN/ZOOM, then hold down the Select button until the File Option list appears.
- Select BITMAP and wait for the process to complete and return to the saved waveform view.
- Adjusting the PAN / ZOOM and resaving the file will overwrite the previous bitmap.



Note: Once saved, the bitmap retains the same filename except with a .BMP extension.

View Saved Waveforms

Access and view saved waveforms on Auto Wave through the Main Menu options, on your PC, or immediately after saving a waveform.

Saved waveform file options

Press and hold the Select button to view the file options.

- Resume — Returns to the previous live settings
- Bitmap — Creates and saves a file as a bitmap (required for viewing on a PC)
- Cancel — Exit file option list (no action)
- Delete — Deletes the current saved waveform (cannot be undone).
- Press and release the Select button to choose desired option.

Viewing saved waveforms

Choose the waveform to be viewed and press Select.

- Voltage and time settings are shown as they appeared when the waveform was saved.
- Pan and Zoom functions can be used to get a more detailed view of the waveform.
- To view additional waveforms press and release the Menu button to be returned to the last Main Menu item selected.
- To exit viewing saved waveforms, press and hold the Select button. Selecting RESUME will take you back to the live waveform viewing screen.

How To…

Viewing waveforms saved as Bitmaps on a PC

- Remove the Micro SD Card from the top of Auto Wave and insert it into the provided SD Card Adapter
- Insert the adapter into the SD Card reader on your PC.
- Open the associated disk drive and folder related to the SD Card.
- Files saved as Bitmaps will have the .BMP file extension (ie. WAVE001.BMP).

IMPORTANT! ***It is recommended to only delete the WAVEFILE.DAT file if the card becomes corrupted or files are missing. Deleting this file forces the unit to scan all files and rebuild the missing or corrupted files.***

Remove the Micro SD Card

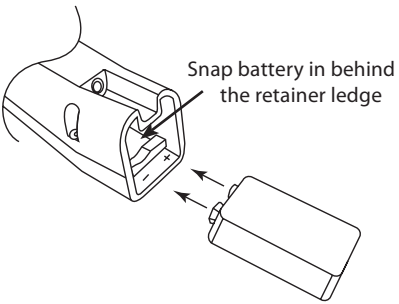
The card may be removed and installed on a PC to view saved bitmaps.

- Turn off Auto Wave and remove the SD Card slot cover on the top of the unit.
- Push the card down until it clicks and releases.
- Re-insert the card, with the printed surface facing the back of the unit. Make sure to re-insert the cover on the top of the unit.

Replace the Battery

Auto Wave uses a 9V Alkaline battery located in the bottom of the handle.

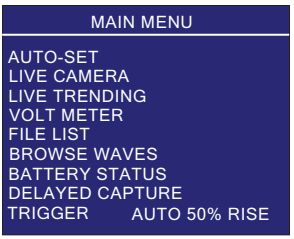
- Hold unit with LCD screen facing down and remove bottom plug.
- Lift the battery off the retainer ledge and slide battery out.
- Locate the plus (+) symbol in front of the retainer ledge and install the new battery with the + side to the right.
- Push down to snap the battery in behind the retainer ledge.
- Re-insert the bottom plug.



Main Menu

The Main Menu is available at ay time by pressing and releasing the Menu button.

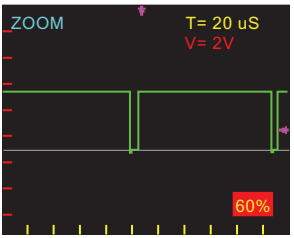
- Use the Up/Down Navigation buttons to scroll through the menu.
- Press and release the Select button to select or change the item.
- Press and release the Menu button again to return to the previous mode.



Auto-Set

Performs automatic time and voltage scales adjustment.

- Connect signal probe to desired signal or voltage.
- Go to the Main Menu and select Auto-Set.
- During the process the percent progress is displayed on the lower right corner of the LCD.
- Make sure to keep the Signal Probe in contact with the signal until it completes.
- Press and release Select at any time to abort the process leaving Auto Wave at the current settings.

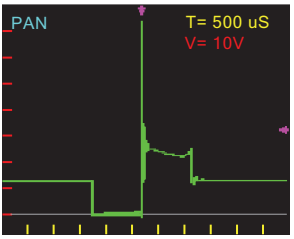


Live Camera

Use Live Camera viewing for high frequency signals or for revealing details in slower signals.

- Time settings ranging from 50mS/Div. to 100uS/Div. use a snapshot method for wave viewing.
- Data is sampled then displayed as a series of still snapshots according to the current trigger settings.

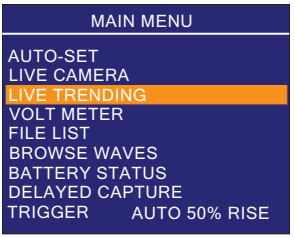
Note: To optimize intermittent signal analysis use the Live Trending setting



Main Menu Functions

Live Trending

Use Live Trending for watching slow voltage changes or for capturing intermittent dropouts on faster signals.

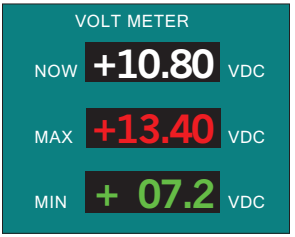


- Time settings between 100mS/Div. up to 20Sec/Div. data are displayed simultaneously so voltage changes appear in real time on the LCD trending from right to left.

Note: A saved waveform's resolution is determined by the Time and Voltage settings at the time a waveform is captured and cannot be adjusted once saved.

Volt Meter

Provides basic auto-ranging digital volt meter functionality.

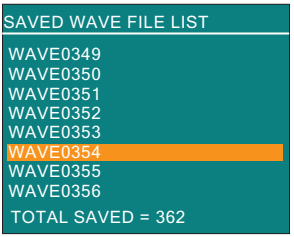


- Volt readings are updated 40/sec.
- The current voltage reading is displayed in the Now box.
- Max and Min boxes represent the highest and lowest voltages seen in the Now box.
- To clear the Max value, press and release the Up button.
- To clear the Min value, press and release the Down button.
- To clear both, press and release the Select button.

Note: For very low millivolt measurements zero the volt meter and leads by connecting (short) the ground lead to the probe tip, press and hold the Select button until the digits read 0.000 then release the Select button.

File List

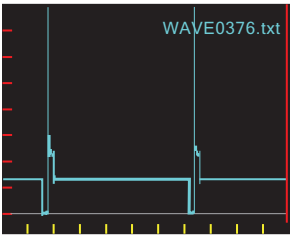
Displays a list of the waveform files currently stored on the SD card.



- Use the up/down navigation buttons to scroll through the list one file at a time or use the left/right buttons to scroll by page.
- Press and release Select to load the file for viewing.
- Press and hold the Select button to display a list of options (see File Options).
- The total files on the SD card is shown at the bottom of the list.

Browse Waves

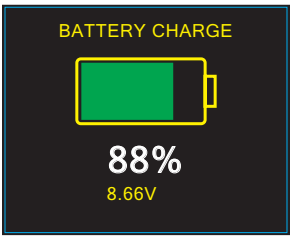
Displays a graphical preview of each wave in light blue.



- Use the Navigation buttons to preview the saved waveforms.
- Press and release Select to load the file for viewing.
- Press and hold the Select button to display a list of options (see *File Options*).

Battery Status

Displays the current battery charge level in percent and shows battery voltage.

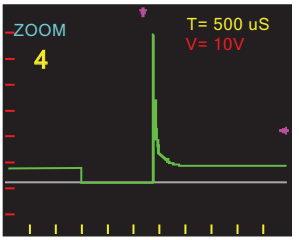


- Auto Wave needs 6V or more to operate. When the percentage charge reaches 0% the battery needs to be replaced.

Main Menu Functions

Delayed Capture

Sets a 10 second timer to automatically capture the waveform.

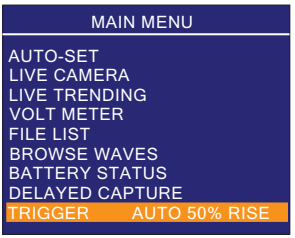


- When viewing a live waveform make any necessary adjustments to the time/ voltage scales and triggering.
- Go to the Main Menu and select Delayed Capture.
- A large countdown number appears in the upper left hand corner of the LCD screen showing the seconds remaining (starts at 10sec.).
- With 1sec. remaining the LED headlights will turn on.
- When the countdown reaches zero the waveform is captured, saved and the LED Headlights turn off.

Trigger

Use Trigger options to enhance the acquisition and visibility of a live waveform.

To Select Trigger Options:



- Highlight Trigger in the Main Menu (***do not*** press Select)
- Use the left/right navigation buttons to change the trigger setting.
- Press and release Menu or Select to keep the new setting and return to the current operation.

Trigger setting operation:

- When the time scale is set at 50mS or less, data is sampled then displayed as a series of still snapshots according to the current trigger settings.
- The still shots are displayed until another trigger event has been captured (up to 5/sec).
- Depending on the waveform trigger settings may need to be adjusted to enhance waveform acquisition and visibility.

- Auto Trigger settings have no adjustment. The trigger point is calculated and updated according to the signal in the buffer at the specified percentage.
- Manual Trigger settings remain fixed but must be adjusted manually by selecting PAN mode, then pressing and holding the Up/Down navigation buttons. The waveform can still be panned by pressing and releasing the Up/Down navigation buttons.
- The trigger level indicator arrow on the right of the LCD shows the current level setting. The level is fixed and is not affected by the signal.

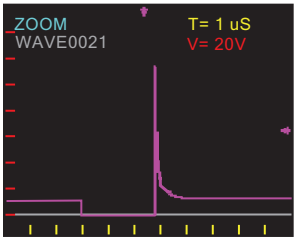
Note: Moving a live waveform up or down (see Navigation Buttons) will affect the trigger setting.

Tip: Use Auto Triggering first, if further adjustments are needed, select Manual Trigger since Manual Trigger uses the most recent Auto Trigger level setting. This will provide the most accurate acquisition of the signal or voltage.

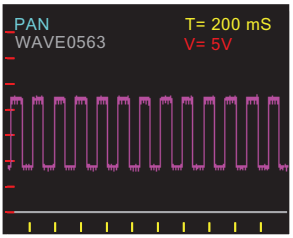
Trigger Setting Options

Type	Description
OFF	No trigger
AUTO RISE 10%	Automatic rising edge detect at 10% of signal span
AUTO RISE 50%	Automatic rising edge detect at 50% of signal span
AUTO RISE 90%	Automatic rising edge detect at 90% of signal span
MANUAL RISE	Manual rising edge detect at fixed adjustable level
AUTO FALL 10%	Automatic rising edge detect at 10% of signal span
AUTO FALL 50%	Automatic rising edge detect at 50% of signal span
AUTO FALL 90%	Automatic rising edge detect at 90% of signal span
MANUAL FALL	Manual falling edge detect at fixed adjustable level

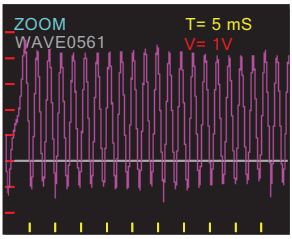
Example Waveforms



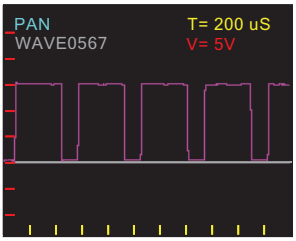
Fuel Injector Waveform



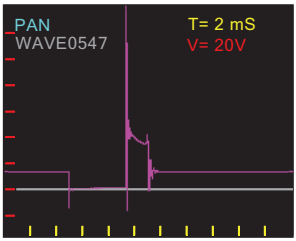
CAM Sensor



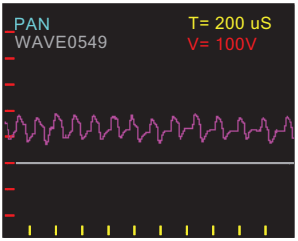
Crank Sensor



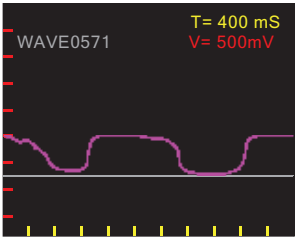
IAC Sensor



Ignition Primary



MAF Sensor



O2 Sensor

Time Scales

When setting the time scale for viewing and capturing a wave it is important to choose the right time scale. The chosen scale during live viewing sets the sample rate and the saved wave length since the wave buffer is always 4096 samples long.

After a wave has been saved it can be zoomed in for more detail. Because a live wave is compressed to five samples per LCD pixel, zooming in after it is saved will show more actual detail than was observed in the live view.

Alternately, when viewing a live wave, the LCD only shows 1/4th of the data buffer that will be in the captured wave. This extended viewing capability means that you may want to zoom in more on a particular wave, even if part of the signal is not visible, knowing that it will be in the saved wave. This also provides more detail in the saved wave because of the faster sample rate.

Time Scales and Associated Sampling Characteristics

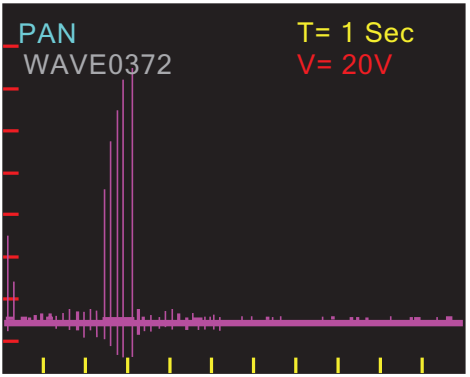
This chart shows the sampling and time relationships for all the Auto Wave ranges.

Horizontal Scale T=	Live Wave Mode	Samples Stored Per Sec	Saved Wave Length	Peak Detect Resolution
100 uS	Camera	1000000	4.096 mS	1 uS
200 uS	Camera	500000	8.192 mS	2 uS
500 uS	Camera	200000	20.48 mS	2.5 uS
1 mS	Camera	100000	40.96 mS	2 uS
2 mS	Camera	50000	81.92 mS	2 uS
5 mS	Camera	20000	204.8 mS	2 uS
10 mS	Camera	10000	409.6 mS	2 uS
20 mS	Camera	5000	819.2 mS	2 uS
50 mS	Camera	2000	2.048 Sec.	2 uS
100 mS	Trending	1000	4.096 Sec.	2 uS
200 mS	Trending	500	8.192 Sec.	2 uS
500 mS	Trending	200	20.48 Sec.	2 uS
1 Sec	Trending	100	40.96 Sec.	2 uS
2 Sec	Trending	50	81.92 Sec.	2 uS
5 Sec	Trending	20	204.8 Sec.	2 uS
10 Sec	Trending	10	409.6 Sec.	2 uS

Technical Information

For all the time scales, the Peak Detect resolution remains fast enough to catch transient events – even if the time scale is set much slower. This is possible because max and min voltage values are stored for each sample period.

When the saved wave is reviewed, the max / min voltages appears as a vertical line. You will not be able to zoom in on any details at a slow time scale but you will see the transient event.



Example of 5 uS transients using a slow sample rate (1 Sec/Div). In this case one pixel represents 50mS. but the 5uS transient still shows the voltage change.

Voltage Scales

During Live wave viewing there are eight Auto Wave amplifier gain settings. The voltage scale setting at the time a wave is captured determines the resolution of the digitized wave. Below is a chart that shows the scales and the resolution.

Vertical Scale V=	Unipolar Range	Bipolar Range	Volts Per A/D Bit
100 mV	1V	+/- 500 mV	1 mV
200 mV	2V	+/- 1V	2 mV
500 mV	5V	+/- 2.5V	5 mV
1V	10V	+/- 5V	10 mV
2V	20V	+/- 10V	20 mV
5V	50V	+/- 25V	50 mV
10V	100V	+/- 50V	100 mV
20V	150V	+/- 75V	200 mV

As with setting Time Scales, the Auto Wave Voltage Scales are compressed 5X for live viewing. The captured wave can be expanded to show more voltage detail than could be seen during the live viewing.

The Auto Wave input has an adjustable bias that allows maximum use of the full dynamic voltage range. If viewing bipolar AC the zero voltage reference line should be set in the middle of the LCD to allow bipolar viewing.

If the signal is AC but biased positive (most automotive signals) the zero line can be moved to near the bottom of the LCD window. When this is done the effective input voltage for each range is doubled. This allows waves to be saved with more detail (less volts per bit) by zooming in more without over scaling.

Specifications

Voltage Input Range	+/-150V (approx. 170V P/P viewable on LCD)
Input Impedance	100K ohms
Sample Rate	1 Ms/Sec @ 100uS/Division
Voltage resolution	1024 points (10-bit)
Peak Detect	2uS resolution on all ranges below 100uS.
Volt Meter	+/-150V DC
Accuracy	+/-2% FS (per range)
Current	Approx. 50 mA
Voltage Resolution	1mV (1V range)
Voltage Ranges	150V, 100V, 50V, 20V, 10V, 5V, 2V, 1V
Trend Time Ranges	20S,15S, 10S, 5S, 2S, 1S, .5S, .2S, .1S
Camera Time Ranges	50mS, 20mS, 10mS, 5mS, 2mS, 1mS, 500uS, 200us, 100 us.
Zoom	20X zoom in to 1/20 zoom out (range dependent)
Sample Depth	4096 sample buffer (min/max storage)
Storage	up to 9999 waves on SD card
Bitmaps	Color 220X176 pixels – saved on SD card

Contact Information

If you have any questions about our products including technical assistance, call our customer care department during standard business hours EST. If a customer care representative directs you to return any equipment, be sure to include these items:

- a written description of the problem;
- the name and telephone number of your contact person;
- your shipping address, and
- our return authorization number (from customer care).

Customer care and tech support:	**800/342-5080**
Service and repair center:	**662/453-6212**
Fax:	**216/761-9879**
E-mail:	**support@hickok-inc.com** **repaircenter@hickok-inc.com**
Service address:	**Hickok Inc.** **Automotive Group** **1716 Carrollton Avenue Dock E** **Greenwood, MS 38930**



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Warranty

Subject to the conditions that follow and are noted below, this product is warranted to be free from defects in material and workmanship, under proper use and in accordance with the manufacturer's written recommendation and specifications, for a period designated below on all products:

- This product carries a one year limited warranty.

The manufacturer's obligation under this warranty is limited to unaltered products returned to the manufacturer by the initial end user of the new products. Therefore, this warranty does not cover any products resold by the end user to third parties, nor any reconditioned products sold as such, by the manufacturer. The sole remedy for any such defect shall be the repair, or replacement, of the product at the sole discretion of the manufacturer. This warranty does not cover expendable parts, such as batteries, nor does it cover shipping or handling. In addition, manufacturer is not liable for any loss or damage to product during shipping.

In the event it is determined that the product has been tampered with, or altered in any way, this warranty is void and all claims against the product will not be honored. All warranty claims must be submitted as outlined by the manufacturer and shall be processed in accordance with the manufacturer's established warranty claim procedures. These procedures include provisions that proof of purchase must be established (by either warranty card from the seller or by point of purchase receipt) and that the manufacturer will make every attempt to return ship the product within one business day from receipt of the returned product, freight prepaid.

In addition, all maintenance procedures, as outlined by the product manuals, should be followed for the warranty to be kept in force. Should the product not be used in accordance with procedures as specified, or if the product otherwise fails outside of the warranty, the manufacturer reserves the right to make such judgment and the party returning the product will be notified that written notification will be necessary to repair the product at a cost which the manufacturer deems as reasonable. The product will then be shipped back to the customer, COD; or as the manufacturer deems appropriate.

This is the only authorized manufacturer's warranty and is in lieu of all other expressed, or implied, warranties or representations, including but not limited to any implied warranties of merchantability or fitness or any other obligations on the part of the manufacturer. In no event will the manufacturer be liable for business interruptions, loss of profit, personal injury, costs of delays, or any special, indirect, incidental or consequential damages, costs or losses.