

# **AUTO WAVE II**



## **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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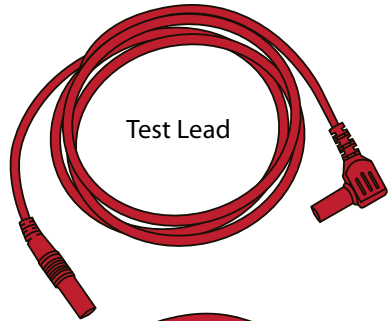
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# Components

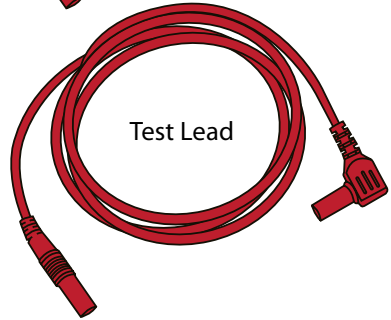
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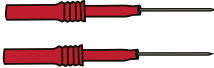
Auto Wave II



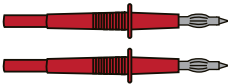
Test Lead



Test Lead



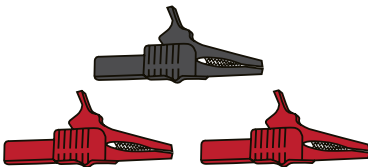
Flexible Back Probe Pins



Lantern Tip Test Probes



Test Lead



Alligator Clips



USB Cable

# Components

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## **Auto Wave II**

Use along with the supplied test leads and accessories. Allows you to view single or dual waveforms.

## **Red Test Leads**

Two 5ft right angle/straight shielded banana plug test leads for viewing single or dual waveforms.

## **Black Test Lead**

One 5ft right angle/straight shielded banana plug test lead for ground.

**Note:** *A good ground connection is required for obtaining clean waveforms.*

## **USB Cable**

One 3ft standard A male to mini-B USB cable. Cable is used to download Large and Small saved BMP waveform images for viewing on a PC.

## **Flexible Back Probe Pins**

Two red female shielded flexible slip on back probe pins.

## **Lantern Tip Test Probes**

Two red male banana plug tip test probes. Attach female banana plug test accessories to the tips or use as standard test probes.

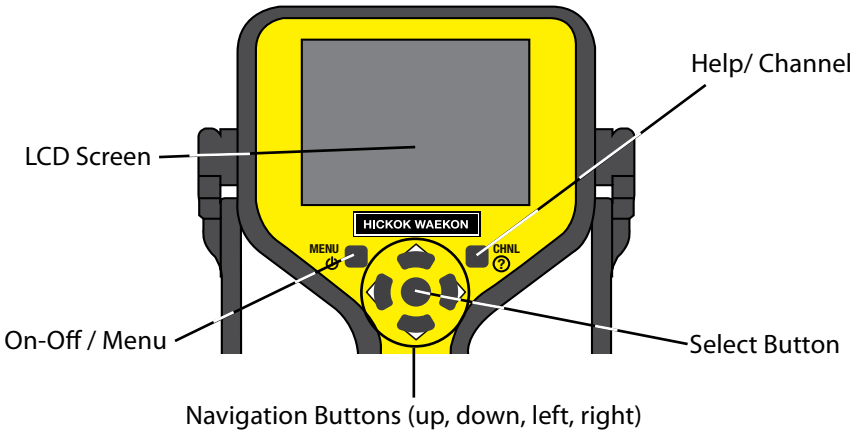
## **Alligator Clips**

Two red and one black female banana plug slip on alligator clips.

# Controls and Connections

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## Front View



### On-Off / Menu Button

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

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

- Press and release the Menu button again to return.

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

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

### Help / Channel Button

To display help on the current operation — press and release the Help /Channel 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 toggle between channel CH-1 and CH-2 for adjustments when viewing dual waves—press and release the Help / Channel button.

# Controls and Connections

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## 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.
- Toggle between Zoom and Pan modes.

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.
- Select Voltage Ranges, Trigger Mode, Trigger Using, Trigger Level and Coupling modes.

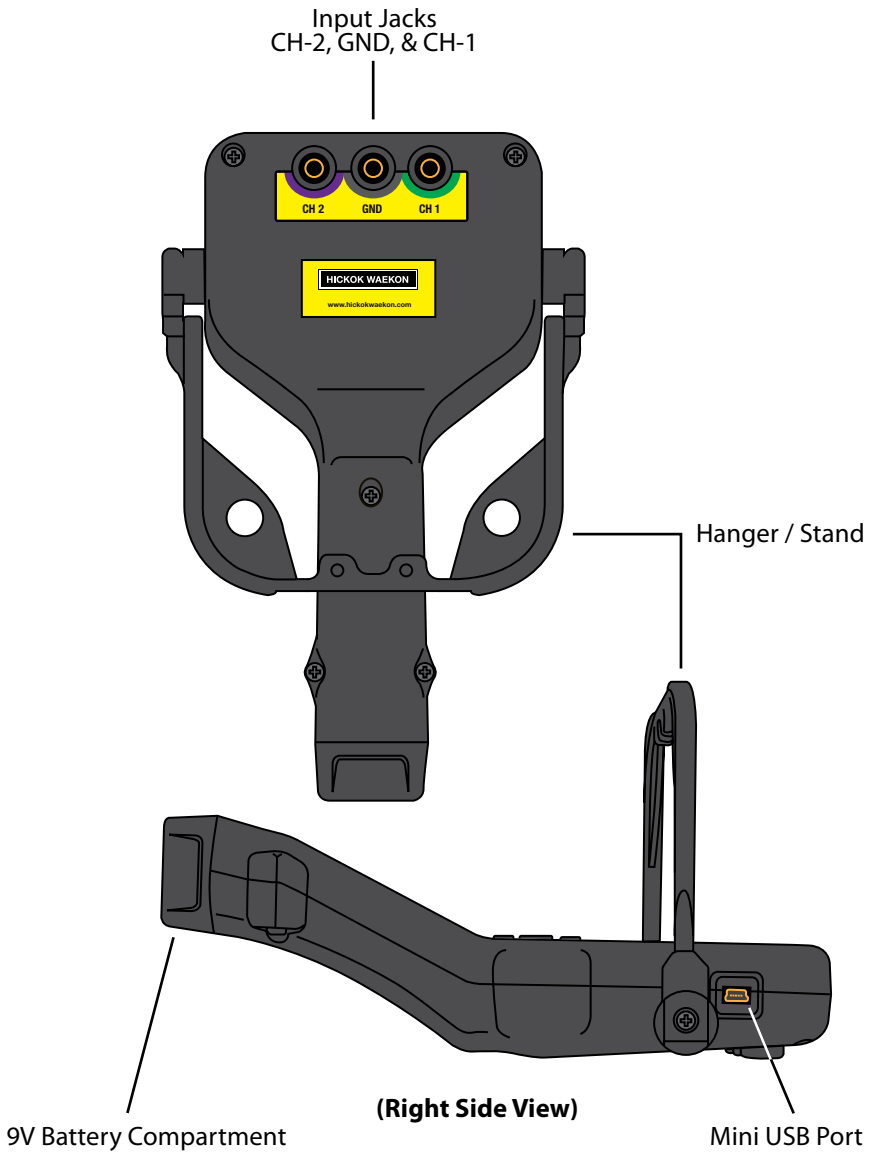
*See [Main Menu](#) and [How To](#) sections for more detail*



# Controls and Connections

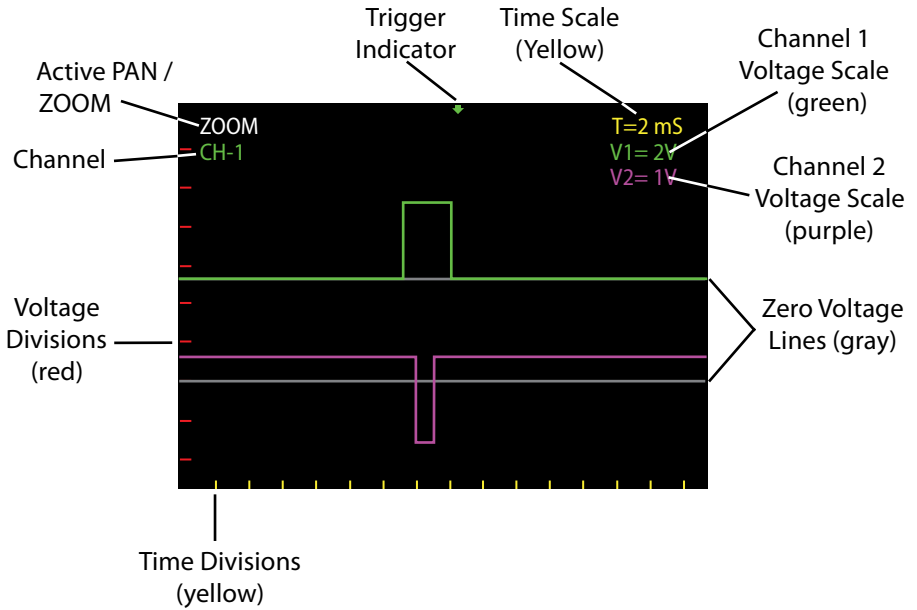
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## Back View



# Controls and Connections

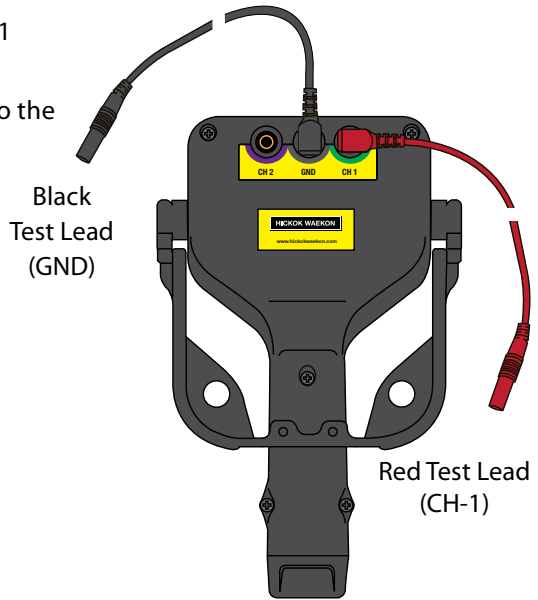
## LCD Screen Symbols and Indicators



# Setup Procedure

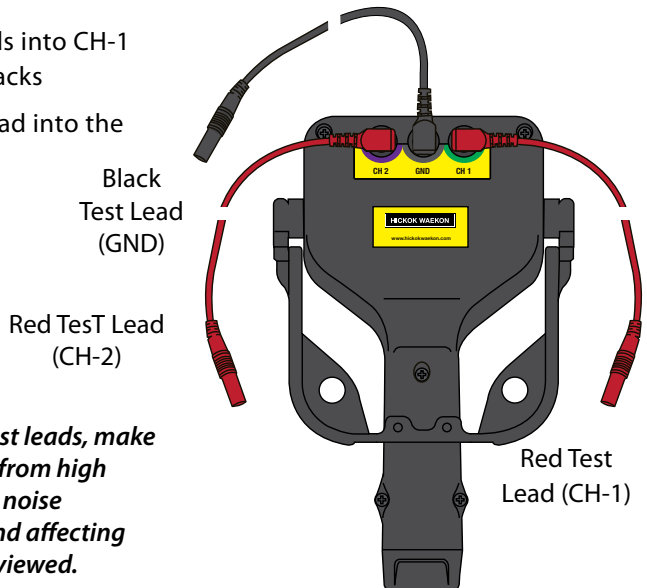
## For One Channel Use

- Plug red test lead into CH-1 input jack.
- Plug the black test lead into the ground jack.



## For Two Channel Use

- Plug red test leads into CH-1 and CH-2 input jacks
- Plug black test lead into the ground jack.



**Note:** When using the test leads, make sure to keep them away from high noise sources to prevent noise coupling into the wire and affecting the signal clarity being viewed.

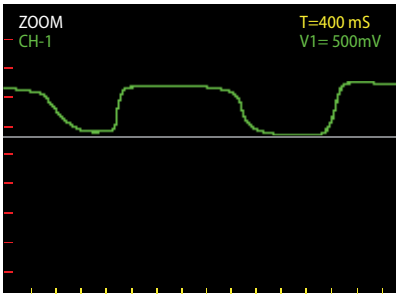
# Setup Procedure

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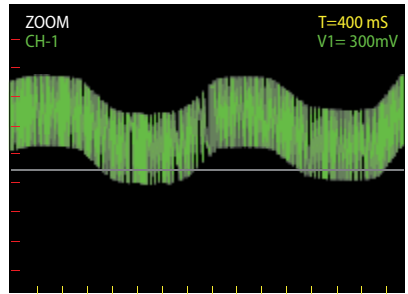
## Why Ground Hookup Is Important

- 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**

## View a Live Waveform

Basic overview on how to use Auto Wave II.

- Determine the setup you require (one or two channels) and connect the black test lead to a good ground on the vehicle.
- Turn Auto Wave II 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 Auto-Set.
- If needed, go to the Main Menu and adjust Trigger Mode.
- If needed, go to the Main Menu and adjust Trigger Level.
- If needed, go to the Main Menu and adjust Coupling.

## Zoom or Pan While Viewing Live or Saved Waveform

Press and release the navigation buttons to Zoom or Pan 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

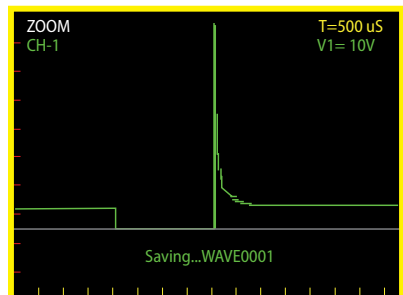
- Use the Navigation buttons to move the screen view in the desired direction.

**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

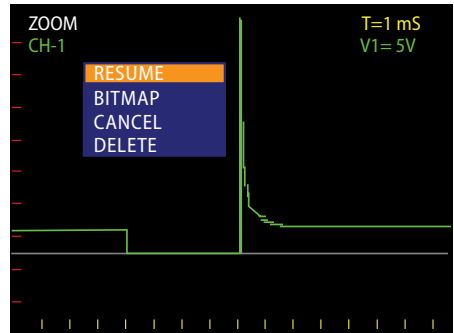


# How To...

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 file options list appears and then select RESUME.

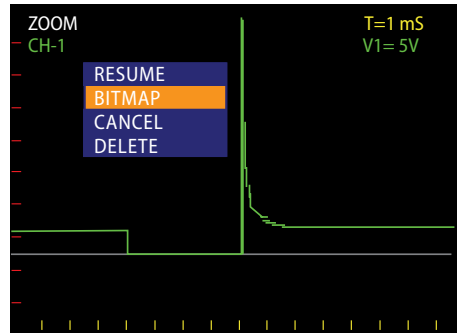
**Note:** A saved waveform's resolution is determined by the Time and Voltage settings at the time a waveform is captured and cannot be adjusted once saved.



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



**Note:** Once saved, the bitmap retains the same filename except with a .BMP extension. (LARG0000.BMP, SMAL0000.BMP)

## 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.
- Zoom and Pan 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.

## Viewing waveforms saved as Bitmaps on a PC

- Insert USB mini end of the cable into USB port on the side of the Auto Wave II.
- Insert other standard size A end of USB Cable into PC USB port.
- Select USB File Access from the Main Menu once the USB cable is connected to both.
- It may take up to a minute for full access to AUTOWAVE II media storage drive.
- Files saved as Bitmaps will have the .BMP file extension (ie. LARG0007.BMP,SMAL0007.BMP).
- When finished, eject the media storage drive from the PC. Then unplug the USB cable.

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

**Note:** *The first time you plug the USB Cable into your PC it may need to load drivers. Drivers are standard Microsoft Interface Drivers and should already be available on your PC.*

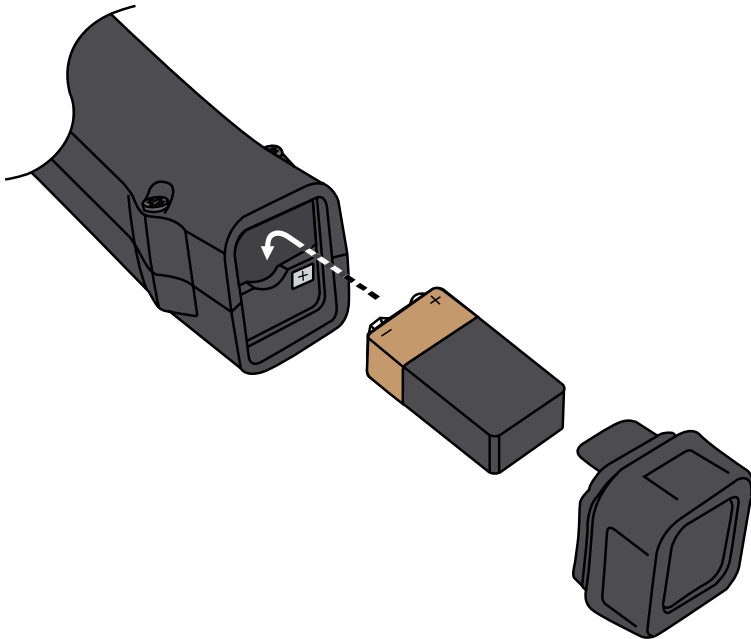
# How To...

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## Replace the Battery

Auto Wave II 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.



**Note:** Not all 9V batteries are exactly the same size. While most will fit correctly you may find one that does not snap in. Do not force the battery into the handle as you may damage the internal connectors.

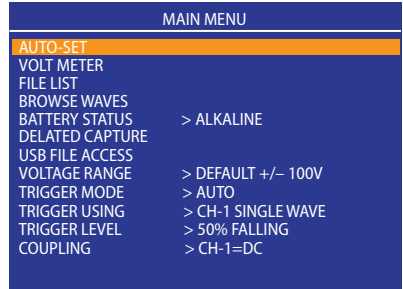


# Main Menu Functions

## Main Menu

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

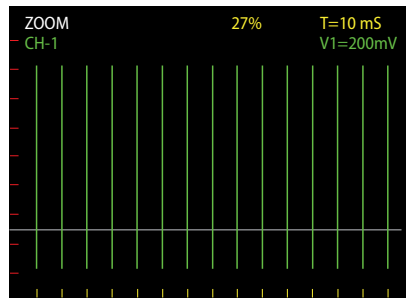
- Use the Up/Down Navigation buttons to scroll through the menu.
- Use the Left/Right Navigation buttons to change the item with an > next to them.
- Press and release the Select button to select or change the item.
- Press and release the Menu button again to return to the previous mode.



## Auto-Set

Performs automatic time and voltage scales adjustment.

- Connect Black Test Lead to known good ground.
- Connect Red Test Lead(s) to desired signals or voltages.
- Go to the Main Menu and select Auto-Set.
- During the process the percent progress is displayed on the top of the LCD next to the Time/ Voltage scale.
- Make sure to keep the Red Test Lead(s) in contact with the signal until it completes.
- Press and release Select at any time to abort the process leaving Auto Wave II at the current settings.

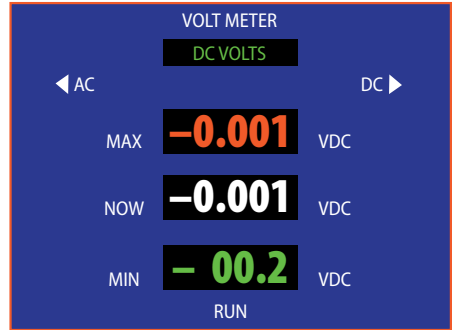


# Main Menu Functions

## Volt Meter

Provides basic auto-ranging digital volt meter functionality to read D/C or True RMS A/C voltage.

- Volt readings are updated 40/sec.
- The voltage reading is displayed in the NOW box.
- MAX and MIN boxes represent the highest and lowest voltages seen in the NOW box.
- Press and hold the Left/Right navigation buttons to change A/C or D/C voltage reading.
- To clear the MAX value, press and release the Up button. To clear the MIN value, press and release the Down button.
- To clear NOW value, press and hold the Select button. Press and release the Select button a second time to clear MAX/MIN values at the same time.

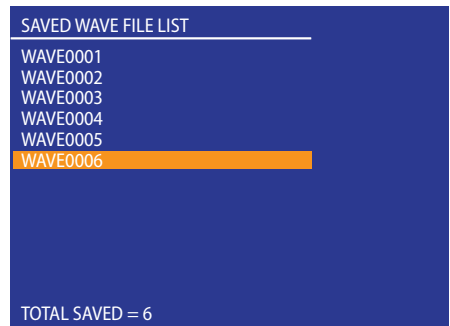


**Note:** For very low millivolt measurements zero the volt meter by connecting (short) the Black and Red Test leads together, press and hold the Select button until the digits read 0.000.

## File List

Displays a list of the waveform files currently stored in the Auto Wave II.

- 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 the Select button to load the file for viewing.
- Press and hold the Select button to display a list of file options.
- The total number of saved waveform files is shown at the bottom of the LCD.



# Main Menu Functions

## Browse Waves

Displays a graphical preview of each waveform.

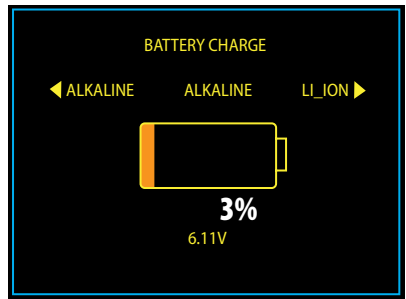
- Use the Left/Right Navigation buttons to preview the saved waveforms.
- Press and release Select to load the file for viewing.
- Press and hold the Select button to display a list of file options.

## Battery Status

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

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

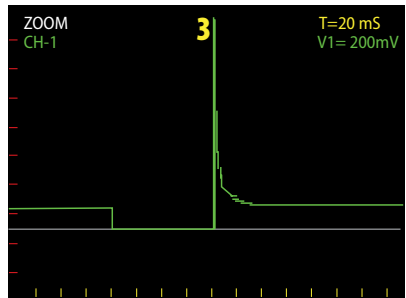
**Note: The Battery Charge status has two options Alkaline or Li-Ion (rechargeable). Choose the appropriate setting based on style of battery being used. Alkaline is the default setting.**



## 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 top center of the LCD display showing the seconds remaining until capture (starts at 10 sec.).
- When the countdown reaches zero the waveform is captured and saved.



**Note: Delayed Capture only works on a time base between 50 mS-100 uS.**

# Main Menu Functions

---

## USB File Access

Allows access to Auto Wave II media storage drive for viewing saved Bitmaps files on a PC.

- Two files are created when a waveform is saved as a Bitmap.
- The LARG0000.BMP larger 4096x1024 pixel file is a detailed panoramic view of the waveform. The SMAL0000.BMP is a smaller 320x240 pixel file which is actual LCD size view of the waveform.
- Files viewed on a PC may be renamed and saved to the PC only.

**Note: The WAVA0000.TXT & WAVB0000.TXT files are the raw wave data files used by Autowave II for storing/viewing saved waves. They cannot be viewed on a PC.**

## Voltage Range

Used to select voltage range of both channels. Highlight Voltage Range on the Main Menu and use the Left/Right Navigation buttons to change then press Select button to set.

- Default +/- 100V
- Negative -200V
- Positive +200V

**Note: Voltage Range selections are 200V maximum.**

## Trigger Mode

Use to enhance the acquisition and visibility of live waveforms. Highlight Trigger Mode on the Main Menu and use the Left/Right Navigation buttons to change then press Select button to set.

- Auto
- Manual

## Trigger Using

Use to change Single or Dual channel viewing. Highlight Trigger Using on the Main Menu and use the Left/Right Navigation buttons to change then press Select button to set.

- CH-1 Single Wave - Trigger uses channel 1
- CH-2 Dual Waves - Trigger uses channel 2 with dual waveforms
- CH-1 Dual Waves - Trigger uses channel 1 with dual waveforms

# Main Menu Functions

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## Trigger Level

Use to enhance the acquisition and visibility of live waveforms. Highlight Trigger Level on the Main Menu and use the Left/Right Navigation buttons to change then press Select button to set.

Type	Description
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

## Coupling

Use to select voltage type for Single or Dual Wave viewing. Highlight Coupling on the Main Menu and use the Left/Right Navigation buttons to change then press Select button to set.

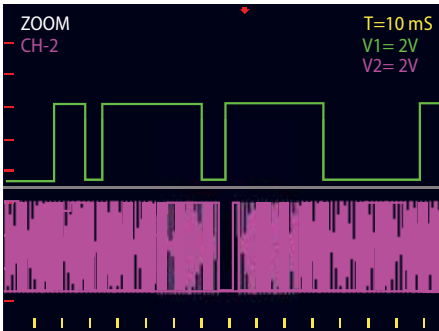
### Single Wave

- CH-1 DC
- CH-1 AC

### Dual Waves

- CH-1=DC CH-2=DC
- CH-1=AC CH-2=AC
- CH-1=AC CH-2=DC
- CH-1=DC CH-2=AC

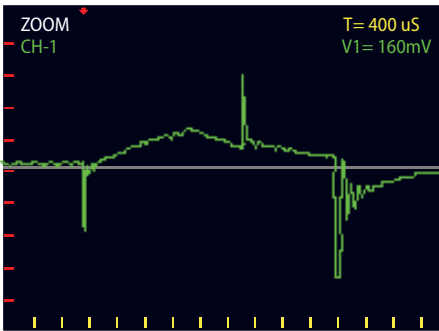
# Example Waveforms



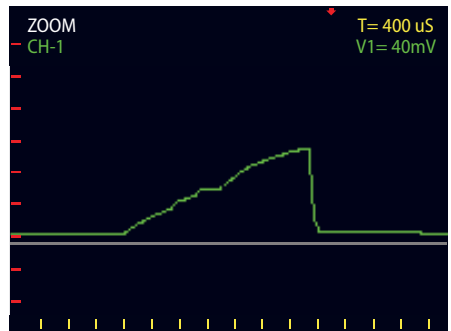
Crank and CAM Sensor



CAN Bus High-Low  
Communication



Secondary COP Ignition



Fuel Injector Amp Ramp



## 75300 Secondary Ignition Pickup

The Secondary Ignition Pickup is a high impedance active probe specifically designed to safely acquire detailed secondary ignition waveforms. Adjustable sensitivity allows the probe to acquire the most accurate waveform on a wide variety of ignition systems. The interchangeable probe adapter ends optimize the probes ability to work on spark plug wires and Coil On Plug.



## 77300 Flex Probe Combo Kit

The Flex Probe Combo Kit is a large assortment of matching male and female spade, round and micro terminal flexible probes. The kit includes universal multi-meter test leads with male banana plug ends for hands free solid connection and testing. The flexible probes are a perfect fit for most transportation industry connector pins providing safe diagnostic testing for today's complex computer and electrical systems without piercing wires.

# Technical Information

## Time Scales

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

Horizontal Scale T=	Samples Stored Per Sec	Saved Wave Length	Peak Detect Resolution
100 $\mu$ S	1,000,000	4.096 mS	1 $\mu$ S
200 $\mu$ S	500,000	8.192 mS	2 $\mu$ S
500 $\mu$ S	200,000	20.48 mS	2.5 $\mu$ S
1 mS	100,000	40.96 mS	2 $\mu$ S
2 mS	50,000	81.92 mS	2 $\mu$ S
5 mS	20,000	204.8 mS	2 $\mu$ S
10 mS	10,000	409.6 mS	2 $\mu$ S
20 mS	5,000	819.2 mS	2 $\mu$ S
50 mS	2,000	2.048 Sec.	2 $\mu$ S
100 mS	1,000	40.96 Sec.	2 $\mu$ S
200 mS	500	8.192 Sec.	2 $\mu$ S
500 mS	200	20.48 Sec.	2 $\mu$ S
1 Sec.	100	40.96 Sec.	2 $\mu$ S
2 Sec.	50	81.92 Sec.	2 $\mu$ S
5 Sec.	20	204.8 Sec.	2 $\mu$ S
10 Sec.	10	409.6 Sec.	2 $\mu$ S
15 Sec.	7.5	546.1 Sec.	2 $\mu$ S
20 Sec.	5	819.2 Sec.	2 $\mu$ S

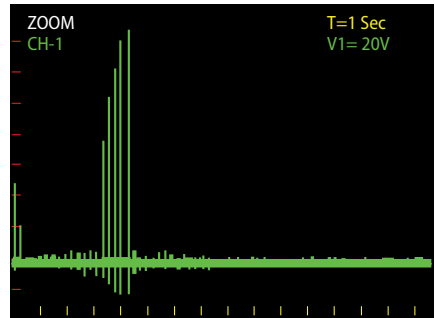


# Technical Information

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



## Voltage Scales

During Live wave viewing there are eight Auto Wave II 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	200V	+/- 100V	200 mV

Auto Wave II Voltage Scales are compressed 4X for live viewing. The captured wave can be expanded to show more voltage detail than could be seen during the live viewing.

A main menu Voltage Range selection sets the dynamic range for both channels. The Default +/-100V is used for dual polarity (plus and minus) signal viewing. This setting will display the five voltage divisions in either direction (see chart above). Exceeding five divisions will cause the wave to be clipped. The single polarity settings Positive +200V and Negative -200V will display ten voltage divisions in single polarity.

# Specifications

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Voltage Input Range	200V 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	+/-200 VDC, True RMS 150 VAC
Accuracy	+/-2% FS (per range)
Operating Current	90 mA
Voltage Resolution	1mV (1V range)
Voltage Ranges P/P	200V, 100V, 50V, 20V, 10V, 5V, 2V, 1V
Untriggered Ranges	20S,15S, 10S, 5S, 2S, 1S, 500mS, 200mS, 100mS
Triggered Ranges	50mS, 20mS, 10mS, 5mS, 2mS, 1mS, 500uS, 200uS, 100uS
Zoom	20X zoom in to 1/20 zoom out (range dependent)
Sample Depth	4096 sample buffer (min/max storage)
Media Storage	up to 9999 waveforms
Bitmaps	Color 4096x1024 pixels & 320x240 pixels

# Contact Information

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If you have any questions about our products including technical assistance, repair or warranty, call or email our Customer Care department during standard business hours 8am-5pm EST. If a Customer Care representative directs you to return any equipment for repair, be sure to include these items:

- A written description of the problem
- Your name, telephone number and email address
- Your shipping address
- Return authorization number from Customer Care or [www.hickok-inc.com](http://www.hickok-inc.com)

**Customer Care and Tech Support:** 800/342-5080 8am-5pm EST  
**E-mail:** [support@hickok-inc.com](mailto:support@hickok-inc.com)  
**Fax:** 216/761-9879

**Repair Center:** 662/453-6212 ext. 130 7am-5pm M-Th CST  
**E-mail:** [repaircenter@hickok-inc.com](mailto:repaircenter@hickok-inc.com)  
**Repair Center address:** Hickok/Waekon Repair Center  
1716 Carrollton Avenue Dock E  
Greenwood, MS 38930



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# Warranty

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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.