uScope®

For **Professional Automotive Technicians**
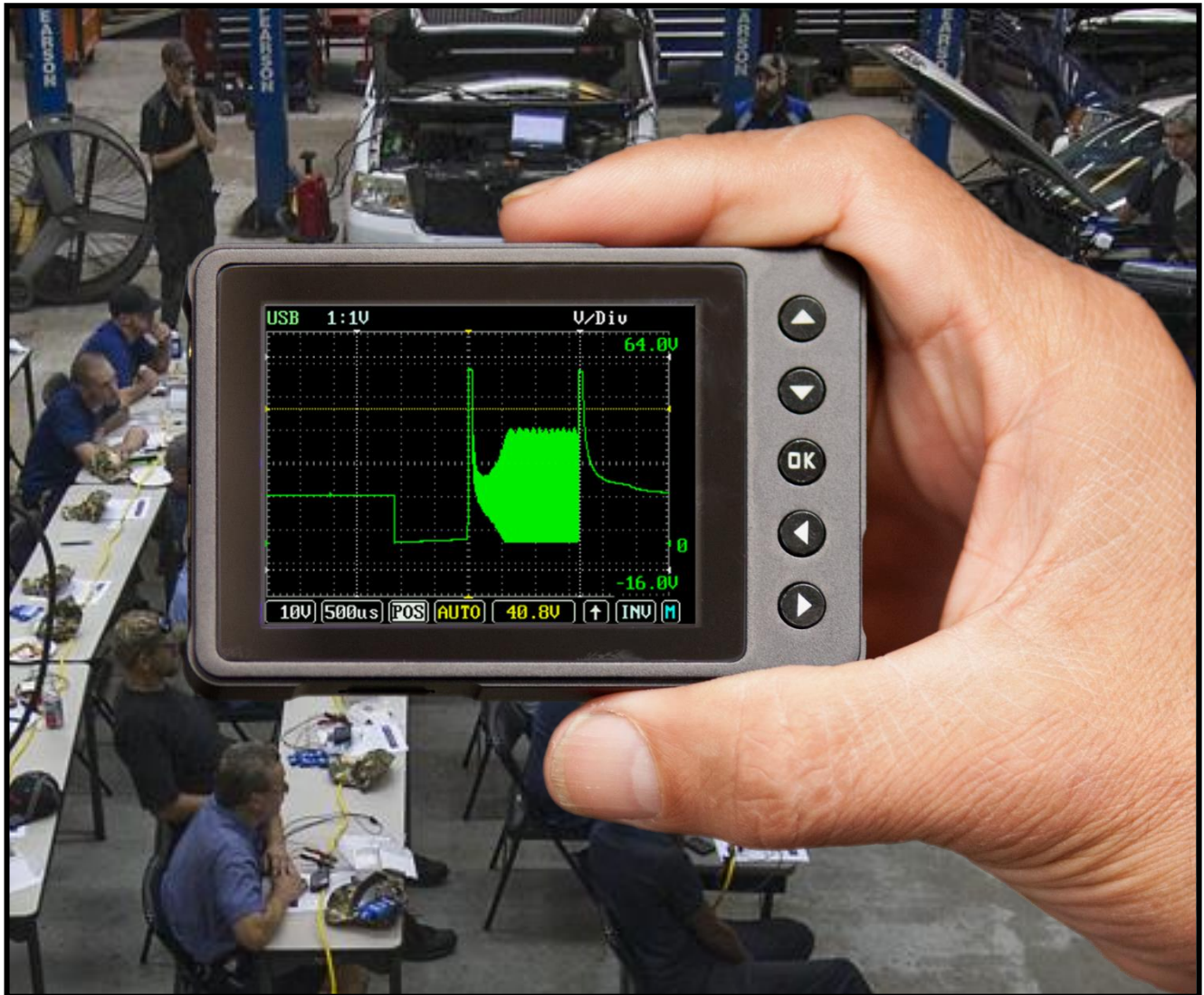
User's Reference Guide

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Compliance

This device complies with part 15 of the **FCC** Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Do not dispose this product in household waste.
Due to internal battery and electronic components, dispose only according to local law and regulations.

Safety Symbols

Warning statements identify conditions or practices that could result in injury, loss of life or damage to this equipment or other property.

Indicates an electrical shock hazard that could cause injury or loss of life.

About this Guide

The uScope User Reference Guide is designed to provide detailed information on the proper use and features available within the uScope. NOTE: This is not a waveform analysis manual.

Living Document

The uScope User Reference Guide is a 'living document' and may be updated at anytime. You are encouraged to point out any errors and to recommend additions. Please send messages to support@aeswave.com

Acknowledgements

AES thanks the following for their contributions to the development of this document:

- Dick Krieger
- Dave Crippen
- Justin Morgan
- Scott Andreson

Special Thanks to:

- Dick Krieger for his support and editing assistance
- Justin Morgan for the uScope Video Manual series

Images:

- Mike Reynolds – uScope and classroom images.
- Dick Krieger – School – in classroom images

Document Version

The features, operation and use of the uScope can vary based on the version of firmware installed on your unit. This manual was written based on firmware version 6.3.6 and 6.3.7. If your unit displays differently, we suggest you contact AESwave and upgrade your unit.

Edition: 1	**Version number:** 1.8	**Build:** November 12, 2020
Firmware: 6.3.6	**Part Number:** Uscope-M-17	**Printed in the USA**

Contact Support

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Fresno CA, 93727
(559) 292-7851
support@aeswave.com

Table of Contents

"As a mobile diagnostic tech I try my best to get in and out of shops as quickly as possible while still being thorough. The uScope from AESwave allows me to do just that! Being able to grab a waveform for coils, injectors, crank sensors and more with such a small and easy to use scope is truly a game changer!"

Tanner Brandt
Diagnostic Training
Worldpac Training Institute

Safety Summary

Carefully read the following safety precautions to avoid personal injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

To Avoid Fire or Personal Injury

- **Lead Connection:** Do not connect or disconnect test leads from uScope while connected to a circuit under test.
- **Lead Damage:** If test leads are damaged, repair or replace immediately.
- **Lead Routing:** All test probe leads and cables should be routed in such a way that they do not come in contact with moving objects such as vehicle fan blades. Keep away from hot surfaces such as exhaust pipes and radiators.
- **Test Probes:** Always use the appropriate test probes for test to be performed and adhere to all safety concerns to prevent shorting.
- **Voltage ratings:** The uScope is intended for testing automotive DC circuits below 100V DC with a maximum displayable voltage of 80V peak to peak.
- **Extreme Shock Hazard: DO NOT CONNECT TO AC LINE VOLTAGE CIRCUITS.**
- **Unit Damage:** If damage occurs to the device such as cracks or dents do not use. Contact AES for repair or replacement.
- **Charging:** It is not recommended to use the uScope while charging via the USB connector. Know that in doing so, the ground of the charging source will now be connected (via the USB and the uScope) to the ground of the test probes and to the circuit it is connected to.
- **Environment:**
  - Do not operate in flammable/explosive environments.
  - Keep the device clean and dry.
  - Do not use in temperatures below 32°F (0°C) or above 122°F (40°C)
  - Do not use when the temperature and relative humidity exceed 60%RH and 122°F or when relative humidity exceeds 90%RH below 122°F.

Automotive spark ignition systems can generate voltages high enough to stop your heart. Use extreme caution and follow all manufacture recommended procedures. Always ground the signal test lead first.

The uScope is intended for testing automotive DC and AC low voltage circuits **AND NOT** powerline AC voltage circuits For example: 120V wall socket voltage, hybrid vehicle high voltage circuits.
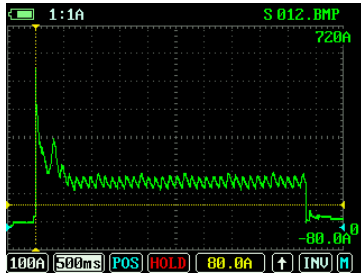
The maximum displayable voltage is ±40V (80V peak to peak). To view higher voltages, use a 10X probe. Contact AESwave for more information.
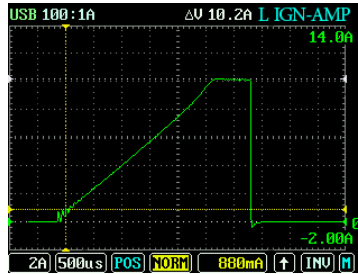
Primary Ignition 10X probe AES# 01-18-u
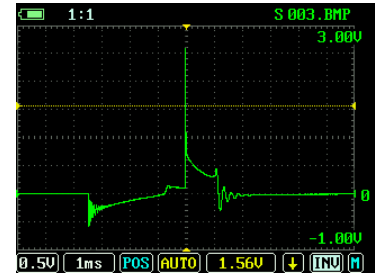
Introduction to the uScope

Congratulations on your decision to purchase the **uScope** from Automotive Electronic Services, Inc.
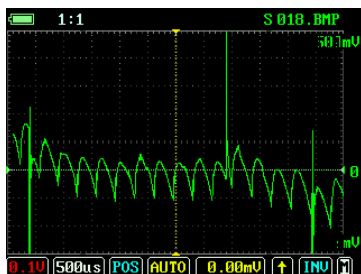

Cranking Compression – Current

Primary Ignition Current

Secondary Ignition

Alternator AC
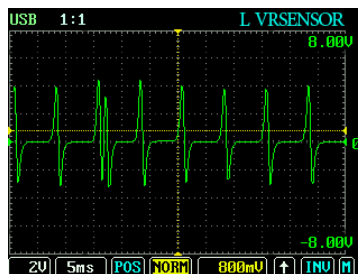
Wheel Speed Sensor
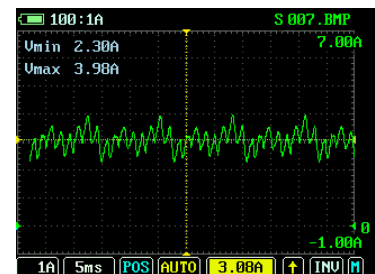
Fuel Pump Current

Efficiency through Convenience

Designed for professional automotive technicians, the uScope is a high-speed single channel pocket sized digital storage oscilloscope that is ***small, quick,*** and ***powerful.***

The uScope has a maximum 1 million samples per second and With Time/division settings as fast as 2uS/Div! Powerful features such as peak detect, invert, amp probe calibrations. It's ideal for ignition, including 2-stroke and is amp probe ready.

Customize and save your own pre-programmed setups. You can also define the default startup parameters turning your uScope into the ultimate ignition or amp probe companion – turn it on and start testing!

Video User Manual – Online

https://qrgo.page.link/VEr6x

Produced by and featuring Justin Morgan
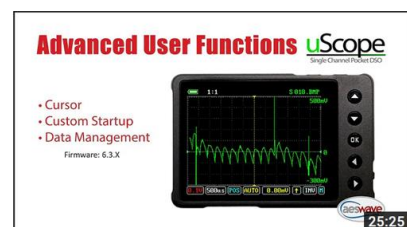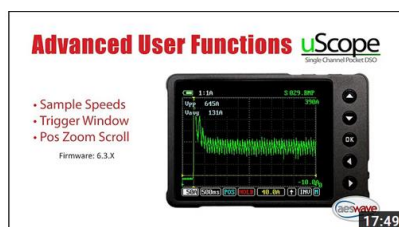
User Strategies

Power User – Experts technicians have a good idea of what is needed from a test — 'Do I have to roll out the 4 or 8 channel scope or can I do a uScope quick test and then decide if the multichannel is needed? Many times all you need is a quick test — the uScope is designed to fill that need. Speed is money!

Average Scope User – uScope — turn it on and connect in less than 60 seconds. With it being so easy, you will be more likely to 'scope it'. As a result, the more signals you look at, the deeper and more you will learn. The uScope can fit in your pocket and the setup is so simple you will not hesitate to *catch a wave…*form! Convenience is king!

Beginner Scope User - Low cost investment to get started and it remains a powerfully and useful tool as your skills advance and you add multi-channel to your scope arsenal. *It is an investment in yourself!*

Educator and Student – Put a scope in every student's hand and is ideal for teaching principles of scope controls and waveform analysis. Going one step further — Imagine the value to a student who goes to their first job interview and pulls out a lab scope they received in your program and says, "Let me show you what I can do with my uScope".
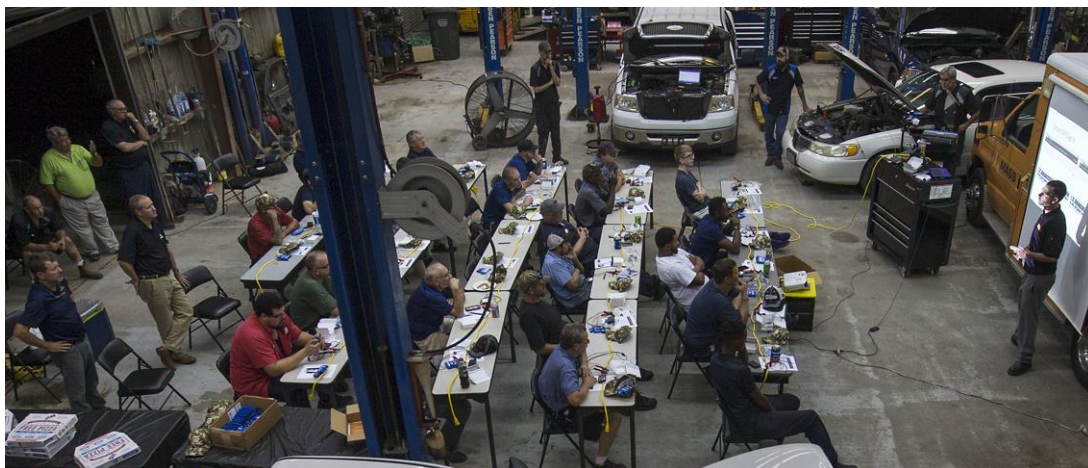
Testimonials

Some of the techs and educators of the [AESwave Techfeed Facebook Group](#) were asked to share how the uScope fits into their diagnostic tool strategies:

Nollan Worrell
"I don't know how I lived without it!"

Mike Robinson
Nollan Worrell Very true statement. I absolutely love the Uscope. I need to buy another for at home

Matthew Skundrich
"Being mobile and dragging a pico out is a long setup time to check a simple circuit. The uScope has significantly cut down the time. Now I find myself scoping more stuff due to the speed and ease of the uScope."

Mike Robinson
The uscope has increased diagnostic speed and accuracy.

Ronald Alexander
Uscope is the point and shoot scope for fast easy set up and usage. Accurate, compact and useful. A great beginner scope as well as a first in hand for experience technicians

Cliff Shenkel
The Uscope is tiny but a mighty powerful labscope that has most capabilities of the bigger 4 channel ones.

Mario Rojas
Hard to beat the convenience of the uscope. Turned on, set up and capturing in seconds.

Kumaren Govender
Its easy to use and not cumbersome to carry around. "Dynamite comes in small packages "

Rob Dotterer
You scope with uscope.

Mike Reynolds
Uscope saved my marriage!

Francisco Escalante
"Pocket size tool with full size results"

Eric Obrochta
The AES Wave U-Scope is great for the technician with the on the go lifestyle. It's small light weight and packs a punch. 😊 Best I've got haha

Rob Dotterer
You scope with uscope

Daryll Caughron
The Uscope has become my first step in getting a direction for diagnostics. The quick direction that I can acquire saves me a lot of time in knowing where to go next. It has become a critical tool in my workflow.

Bart Young
Superfast for checking fuel pump waveforms.

Harris Kohen
"Fits in my shirt pocket and can be used to find intermittent opens and shorts quickly."

Bob Leonard
Next to attending Vision KC, it's the best thing **Jim Morton** has ever recommended to me. A truly powerful tool in an easy to use format.

Richard Krieger
The uScope has provided an affordable option for both those wishing to start learning and using oscilloscopes as well as for experienced technicians wanting a feature packed diagnostic tool that is quick to use while still providing a full package of scope tools for quick diagnosis. No other scope offers nearly as much as the uScope in its price point.

Joe Caci
Portable and powerful tool. Nothing better for quick run and gun tests and anything requiring one channel. Just don't test your 110 power outlets with it.

Jay Quinlan
The uScope actually helped me learn scope patterns faster because I was able use it on everything because it so easy to use. With the bnc adapter I was able to use all my scope assesories with it.

William Adams
From a teaching point of view, the UScope takes away the intimidation factor that comes with bigger scopes. It allows a first timer to go in and see a pattern right away and allows a technician to hone their skills at their own pace. Very easy to use, affordable and very well built. Well done guys!

Authentic uScope

Just because it looks the same, does not mean it is the same. Other similar hardware is available but does not include the features available from AESwave uScope.

The best way to ensure you have an authentic uScope is to purchase directly from AES or from a trusted authorized AES reseller.

Quick visual checks for an authentic uScope:

- Back Panel
  NOTE: Previous version of the uScope
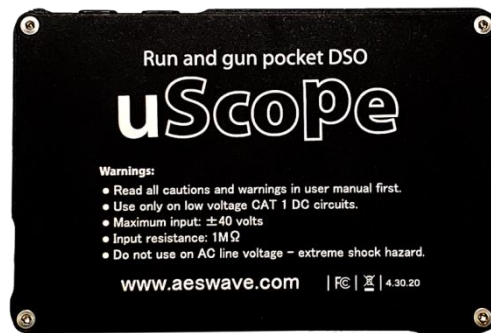
- Initial Startup Screen Identification

  To view:
  Hold DOWN ARROW button down when powering up the uScope

- Micro SD Card Slot

Key Features

- Built in presets with reference waveforms that can be superimposed over "live" waveform
- Save and add your own presets into the built-in file/menu system
- Share presets with other users
- Preset files save uScope setup and waveform data in XML format
- Save screen captures as BITMAPS for quick documentation
- Full featured Voltage and Time cursors
- Fully adjustable trigger window and left and center horizontal position
- Meter readings along with waveform display
- 4000-point buffer
- 12-bit vertical resolution
- Fast sample rate for capturing glitches
- Set custom default setup
- Free firmware updates

Specifications

Display	Full Color 2.8" TFT LCD 65K 320×240
Analog bandwidth	0 - 200KHz
Max sample rate	1MS/s and 12Bits vertical resolution
Sample memory depth	4096 Point
Horizontal sensitivity	1uS/Div~10S/Div
Horizontal position	Adjustable with indicator
Vertical sensitivity	10mV/Div~10V/Div (with ×1 probe)
	0.5V/Div~100V/Div (with ×10 probe)
Vertical position	Adjustable with indicator
Input impedance	>500KΩ
Max input voltage	±40V (by ×1 probe)
Coupling	DC (AC coupling with AC Filter probe)
Trig modes	Auto, Normal, Single, None and Scan
	Rising/Falling edge/level trigger
	Adjustable trigger level with indicator
	Trig sensitivity (Trigger Window) adjustable with indicator
Waveform Functions	Auto measurement of: frequency, cycle time, duty cycle, peak voltage, RMS voltage, Average voltage and DC voltage
	Precise vertical measurement cursors with markers
	Precise horizontal measurement cursors with markers
	Hold/Run
Onboard Frequency Generator	10Hz~1MHz square wave (For adjustable 10X probe calibration)
Waveform storage	Micro SD card
PC connection via USB	As USB storage or with USB card reader
Upgrade	USB
Power supply	500mAh 3.7V Lithium battery / USB
Charging	Recharge from USB connection or any cell phone charge adapter
Dimension (w/o probe)	3.58" x 2.5" x 0.51" (91mm x 62mm x 13mm)

Kit Contents

Note: The contents may change at any time. Check for the latest information or for missing or damaged items contact AES 559-292-7851 info@aeswave.com.

Item	AES#	uScope Master Kit	uScope Basic Kit
uScope 1-channel scope	uScope	1	1
AES uScope Software	-	Installed on uScope Unit	Installed on uScope Unit
Memory Card (microSD)	-	1	1
mini-USB Cable	-	1	1
Plastic Case	-	1	1
1:1 Test Lead (6-ft)	03-70-u	1	1
Universal Secondary Lead	01-10-u	1	0
Plug wire clamp	01-10-MP	1	0
COP Paddle & Rod	01-10-COP	1	0
Pin Tip Probe, Black	05-30-Blk	1	0
Pin Tip Probe, Green	05-30-Grn	1	0
Gator, Black	05-25-Blk	1	1
Gator, Green	05-25-Grn	1	1
EAP Back Probe Red	05-762-R	2	2
Adapter for BNC	08-87-BNCF	1	0
Adapter for Banana Plugs	08-87-BS	1	0
Low Current Amp Probe	07-60-BNC	1	0
AC Filter	03-90-u	1	0
Primary Probe (10:1)	01-18-U	1	0
SIlicone Protective Boot	uBoot	1	0

First Time Use

Protective Film

The uScope is shipped with a protective plastic film over the LCD screen. Remove the plastic film for the best LCD viewing quality. Or, leave it on!

Charge the Battery

Your uScope should arrive with some level of battery charge. Ideally, charge your new uScope for 2 hours before first use.

1. Find the supplied USB cable.
2. Locate and connect to the mini USB conenction on the left side of the uScope.
3. Plug the USB into a standard USB charging device or a PC USB port.

USB Type A-to-5-Pin Mini-B Cable

Battery Charge Indicator:

Charge indicator is located in the top left of the screen. When charging, USB will be displayed.

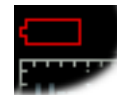| USB Charging	Charged	Low Charge	About to Die

Do not perform any test while the uScope is charging. Some test situations can present an extreme shock hazard.

DANGER: The uScope test lead ground is connected to USB ground and USB Ground to the ground of the system the USB connects to.

DANGER: Never probe an AC wall socket or other AC line voltages or AC based equipment such as motors with the uScope.

Walk Around
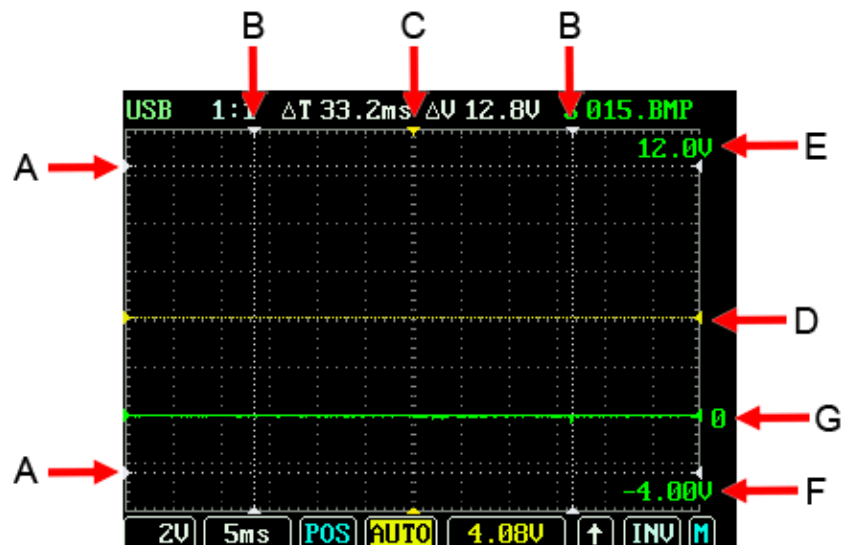
Display and Front Panel
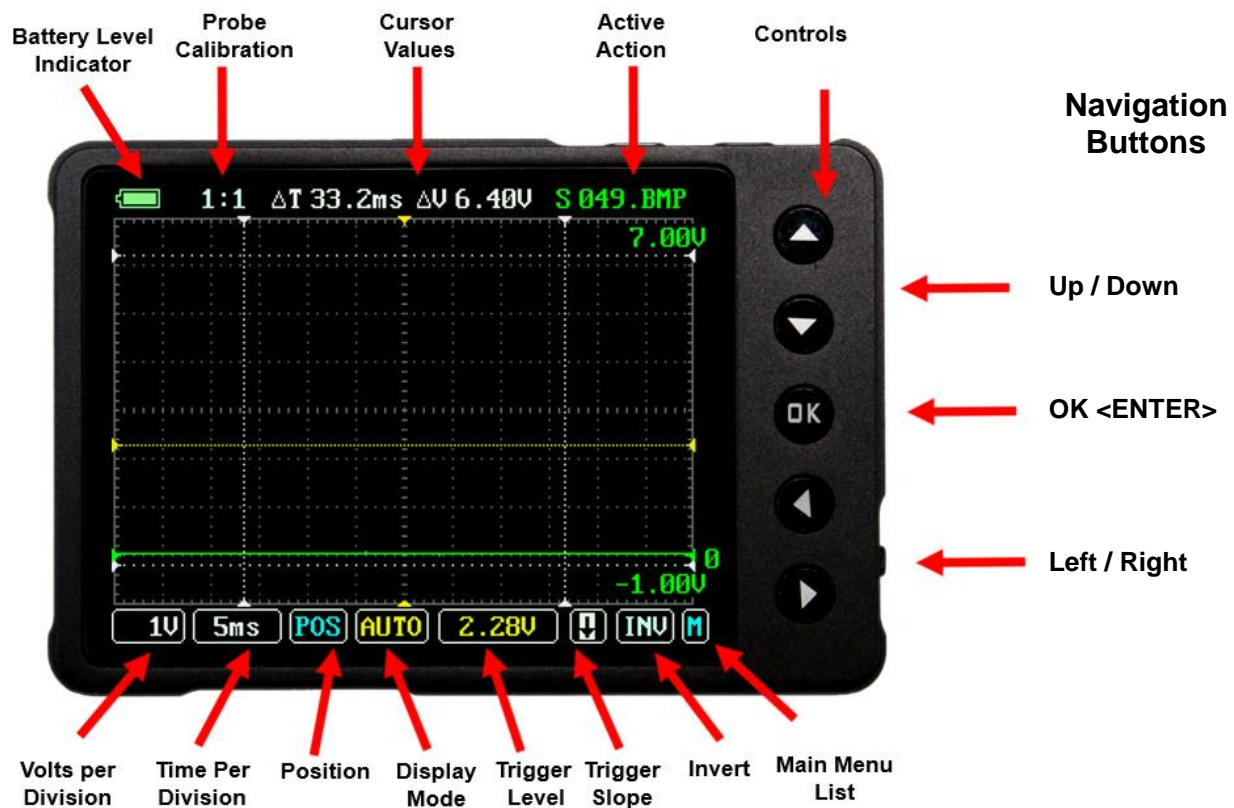
A: Voltage Cursors

B: Time Cursors

C: Trigger Horizontal Position

D: Trigger Level Position

E: Grid Maximum Value

F: Grid Minimum Value

G: 0 Volt Line

The Side Ports and Buttons

Right Side

On/Off Switch
Slide switch located at the bottom right of the unit.

UP = ON   DOWN = OFF

Left Side

CH
The signal channel input connector (MCX) for the test leads, adapters, and probes. Ensure that the MCX plug is inserted to the base.

USB (USB mini style connector)
Use for charging the uScope and for connecting to a PC to export images and presets and importing presets.

Wave Out
The 3.5 audio jack port it the output for the frequency generator. **DO NOT USE THIS PORT TO CONNECT DIRECTLY TO EXTERNAL CIRCUITS – damage may occur.**

Top

[A] Button – Used to toggle screen refresh between HOLD and RUN.
[B] Button – Saves active waveform as both a BMP image file and as a Data File into the PS_User directory.

Bottom

All files saved by the user are stored on the microSD card. Once connected to the PC, via the USB cable, the uScope memory card will show up as a removable storage card in Windows File Explorer.

To install the card, face the electrical connection gold tabs up and press in until fully seated. When properly installed the card will be just below flush.

NOTE: Removing the memory card will disable the ability to save and recall setups.

Memory Card – microSD Card

Location, Removing and Installing

The uScope incorporates a removable 2GB microSD memory card. The card port is located in the center of the bottom side of the unit. Note that the electrical connection pads face toward the screen side of the uscope for installation. Press in the card until fully seated. When properly installed the card will be just below flush.

Connecting to a PC

The uScope can be connected to your PC via a USB cable with mini USB for the uScope connection. Once connected to the PC, Windows File Explorer will open and display the memory card content.
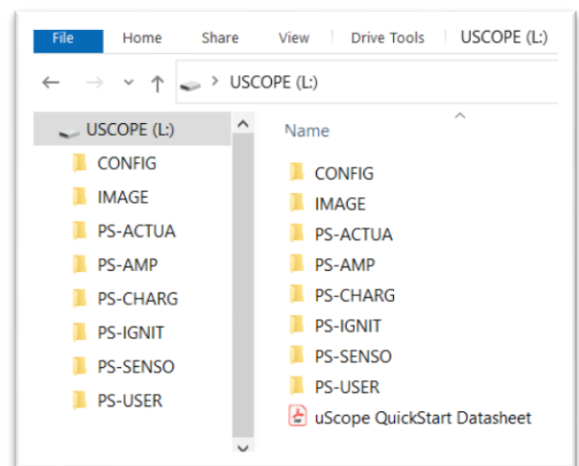
MicroSD card Content

CONFIG: Storage for internal program variables.

IMAGE: Storage for individual user saved BMP image files.

PS-**:** Storage for all presets. Each directory represents a preset menu selection in the pop-up menu.

    For example, all current related presets are located in the PS-AMP directory and will appear under the AMP preset menu.

PS-USER: Storage for all user saved presets and image files – typically saved when pressing the **<B>** button.

TIP:	*.AES user data files can be opened in MS Excel and at www.Scanshare.io. For Excel see section titled **HOW TO	Open AES Datafiles with MS Excel**

PDF Files: The files identified by the PDF icon can be opened on a PC by double clicking the filename. These files include a quick start guide located in the root directory and some preset datasheets located in the PS-*** directories.

Removing the memory card will disable the ability to save and recall setups.

Memory card maximum capacity 2GB.
Some newer memory cards will not work.

The \<A\> & \<B\> Buttons

The **\<A\>** and **\<B\>** buttons are located at the top right side

\<A\>   **Run/Hold Button**

Pressing the **\<A\>** button switches between HOLD and RUN mode.

- HOLD mode freezes the screen update and holds currently displayed waveform.
- RUN restores active update of the screen/waveform.

**NOTE:** When in HOLD mode, the TRIGGER MODE Toolbar Menu item will display "HOLD" in red text.

RUN   **HOLD**   TRIGGER MODE = Red

\<B\>   **Save File to Memory Card**

Pressing the **\<B\>** button always saves two files a datafile and an image file:

1. A setup and reference waveform data file identified by the **.AES** extension.
2. A corresponding screen capture – a bitmap image file with the **.BMP** extension.

NOTES:

- All user saved files are written to the **PS-USER** directory.
- The **.AES** file contains all of the scope setting and the datapoints for the waveform on display when the **\<B\>** button was pressed.
- The **.AES** file can be opened by the uScope as a preset.
- To view the full content of the **.AES** file, it can be displayed in MS Excel or ScanShare (https://www.scanshare.io/)
- Backup and rename your saved files onto a harddrive on your computer.
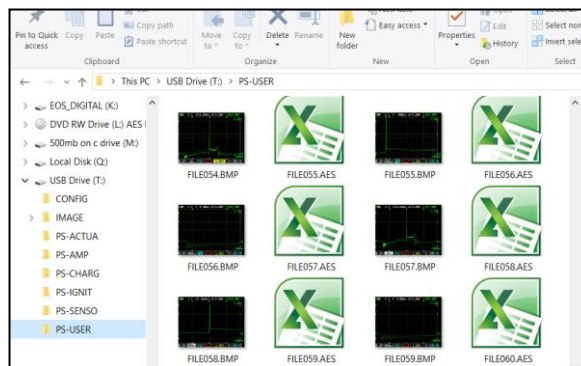
TIP: The uScope does not have an internal real-time clock. Therefore, file creation dates will all be the same and do not reflect the actual date the file was created.
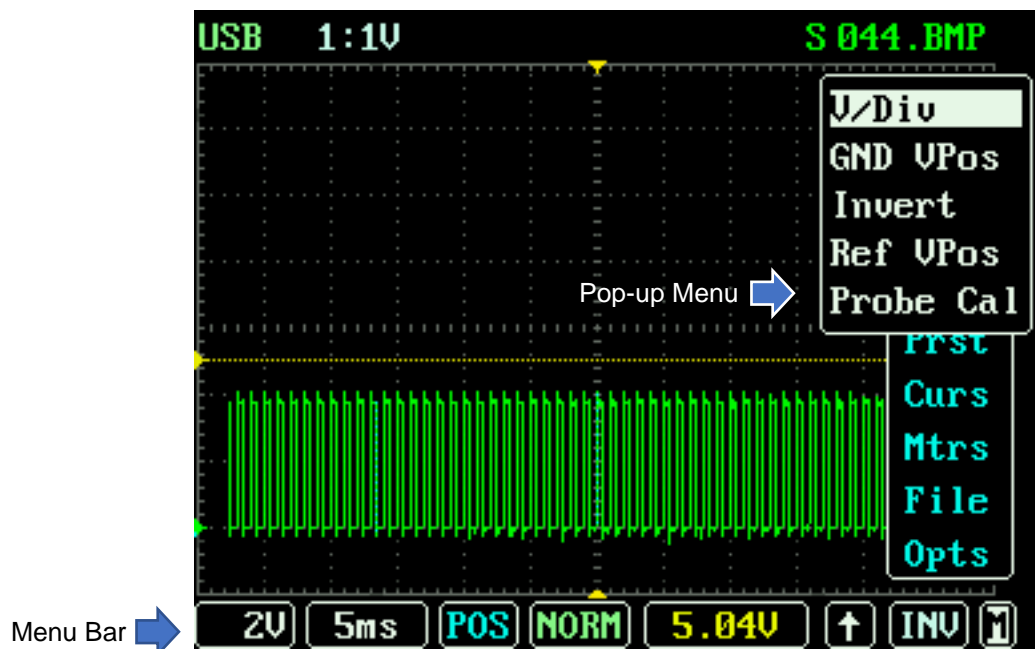
The Menu System

The uScope has two menu systems:

Menu Bar

Located at the bottom of the grid. Always active and provides quick access to the most common adjustments.
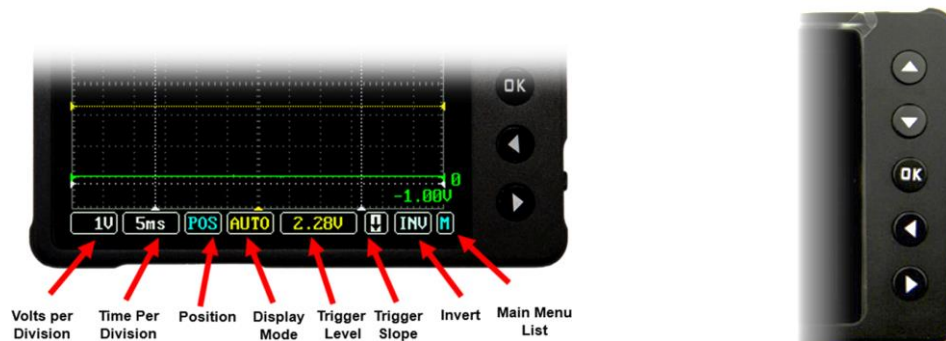
Pop-up Menu

The Pop-up Menu system consists of the main pop-up window and sub-menus and provides numerous options for getting the most from your uScope.

Horizontal Menu Bar

Navigation

- Use (◄►) arrows keys to navigate menu items. The currently selected menu item is identified by a highlighted white background.
- Use (▲▼) arrow keys to adjust the value of the currently selected menu item.

TIP: Each of the Horizontal Toolbar menu item can also be found in the Pop-up Menu. Pressing <OK> will open the active Menu Bar's related Pop-up Menu (with the exception of POS).

For example, when Volts/Div is the highlighted menu item, pressing <OK> will open the VERTICAL pop-up menu which may include other related settings.

Menu Bar Map

MAIN MENU		DESCRIPTION/ OPTIONS
V/Div	Volts/Division	Sets volts per division
T/Div	Time/Division	Sets time per division
POS	Position	Allows for vertical and horizontal adjustment of the waveform including the ability to reset the waveform to center position.
Trigger Mode	Trigger Mode	AUTO; NORM; SINGle; SCAN
Trigger Level	Trigger level	Trigger Level voltage setting
Trigger Slope	Up or down arrow	Direction signal must travel to trigger level to initiate a triggered event.
INV	Invert	Flips the signal upside down.
M	Menu	Opens the Pop-up Menu

Pop-up Menu

Opening

The main Pop-Up Menu can be opened anytime by pressing the <OK> button, except, when the POS menu item is highlighted. Or, by selecting the (M) in the Horizontal Menu Bar.

Navigation

Once open…

- Use (▲▼) arrow keys to highlight desired menu item. Press <OK> to open the pop-up sub-menu.
- Use (▲▼) arrow keys to highlight desired sub-menu item.
- Use (◄►) arrow keys to adjust values of currently selected sub-menu item.
  - **NOTE:** Some menu selections require a long 2-second press of the <OK> button to activate the selection. For example, when opening a selected preset.
- To exit the Pop-up menu press the <OK> button at any time.

Pop-up Menu Map

MAIN MENU	SUB MENU	DESCRIPTION/ OPTIONS
VERT (vertical)	V/Div	Sets volts per division
	GND POS	Vertically positions the waveform by moving the 0V marker position.
	Invert	Inverts the waveform.
	Ref VPOS	Sets vertical position of a reference waveform (purple)
	Probe Cal	Sets the probe calibration. For example, 1:1, 10:1, 10mv = 1amp
Horz (horizontal)	T/Div	Sets the time value of each horizontal grid block.
	HPos	Use to scroll the waveform left and right.
Trig (trigger)	T Mode	Sets the mode for a triggered update. For example, automatically update (AUTO) or only when all of the trigger requirements are met (NORM). Includes: AUTO; NORM; SINGle; SCAN
	T Level	Sets the voltage level the signal has to attain to initiate a triggered event.
	T Slope	Sets the direction the signal has to travel to reach the Trigger Level setting – rising or falling.
	T Window	Sets a voltage window that the signal has to pass through to initiate a triggered event.
	T HPos	Sets the horizontal position of the trigger point: Center screen or left margin.

Continued on next page…

MAIN MENU	SUB MENU	DESCRIPTION/ OPTIONS
Prst (presets)	Auto Setup	Initiate an attempt to automatically setup the volt and time settings based on the incoming signal.
	Sensors	Presets focused on sensors.
	Actuators	Presets focused on actuators.
	Amp	Presets using amp probes.
	Ignition	Presets dedicated to ignition.
	Charging	Presents for the charging system.
	User Setups	Storage place for user saved presets.
	Ref Show	Shows or hided the reference waveform that is stored in a preset.
Curs (cursors)	C V1	Used to move the top voltage cursor.
	C V2	Used to move the lower voltage cursor.
	C T1	Used to move the left time cursor.
	C T2	Used to move the right time cursor.
	V off	Turn on or off voltage cursors.
	T off	Turn on or off time cursors.
Mtrs (meters)	Freq	Frequency
	Duty	Duty Cycle
	Vrms	Voltage Root Mean Square - The effective value of a varying voltage or current.
	PCnt	Pulse Count - Pulse count of high or low going pulses – based on pulses in the buffer.
	Pwdt	Pulse Width – Time duration of a pulse.
	Vpp	Voltage Peak-to-Peak – The voltage in-between the highest and lowest voltage points.
	Vmin	Voltage Minimum – The lowest voltage point.
	Vmax	Voltage Maximum – The highest voltage point.
	Vavg	Voltage Average – Average of all voltage points on the grid display.
	Enable	Turn on or off the on-screen meter display.
File (file)	Save Image (BMP)	Save current screen as a BMP image file with the BMP extension. Note: Pressing the <B> button always saves both file formats to the PS-User directory using identical filename but with the appropriate extensions (*.AES and *.BMP).
	Save USER File	Save current screen and setup as a USERT file with the AES file extension. Note: Pressing the <B> button always saves both file formats to the PS-User directory using identical filename but with the appropriate extensions (*.AES and *.BMP)
Opts (options)	Sample Speed	Select between NORMAL or FAST sample speed.
	Grid Intensity	Sets brightness of the grid.
	Set Cstm Start	Sets the active scopes settings to be in place on startup.
	Reset Factory	Restore all factory startup settings.
	SigGen Freq	Sets the frequency of the signal generator.
	SigGen Duty	Sets the duty cycle of the signal generator.
	Calibrate	Routine to calibrate the voltage level.
	Save Cali	Save the calibration as the default.

Menu Bar Functions
Volt/Division (V/Div)

V/Div - First menu item on the left. Sets the voltage value for each of the vertical divisions. When selected, will have a white background.

Making Adjustments: With the V/Div menu item highlighted, use the (▲▼) arrow keys to adjust the value. The displayed value indicates the voltage for each of the 8 vertical grid division (blocks).

(Fig. 1) The V/Div is set to 5 volts. The grid has 8 vertical divisions. The maximum peak to peak voltage that can be displayed with this setting is 5.0V x 8div. = 40V.

Notice the voltage grid values along the right margin of the grid. The "0" and the small green arrowheads mark the 0 volt position. The -5.00V indicates the voltage at the bottom of the grid and 35.0V indicates the voltage at the top of the grid (5V below 0V + 35V above = 40V).

(Fig. 2) The V/Div is set to 10V allowing for a maximum peak to peak of 80V (-10.0V + 70V = 80V Peak). The waveform now appears shorter.

(Fig. 3) Shows the zero volt line moved to the center of the screen and the waveform moves up.

NOTES:

- The 0 volt position can be changed using the POS menu.
- Full range of V/Div options are: 10mv, 20mv, 50mv, 0.1V, 0.2V, 0.5V, 1V, 2V, 5V, and 10V per division.
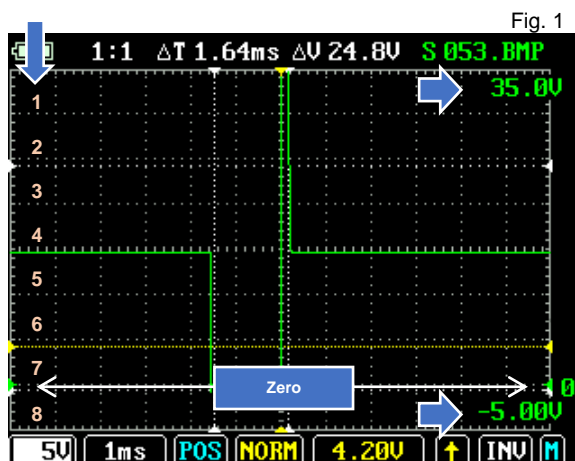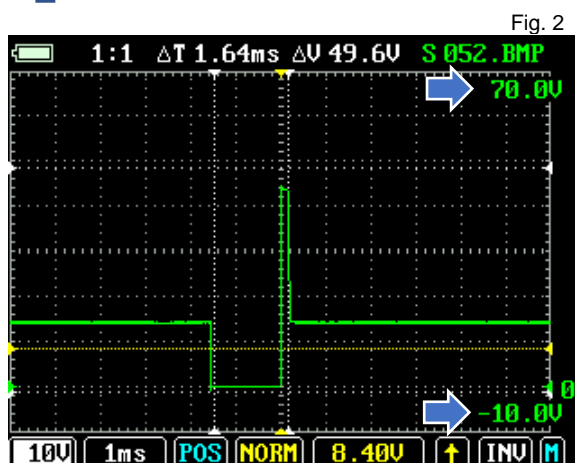- When the signal goes beyond the borders of the grid, the V/Div menu item will turn RED.

Fig. 1

Fig. 2
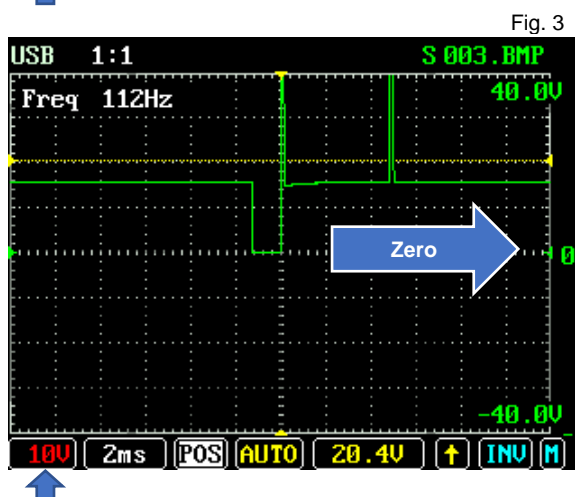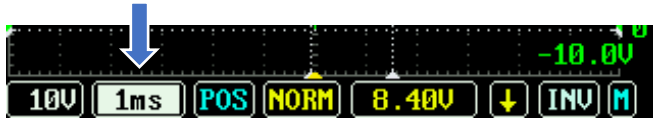

Fig. 3

Time per Division (T/Div)

T/Div - second menu item from the left. Sets the time value for the horizontal grid divisions across the screen. When selected it will have a white background.

Making Adjustments: With the T/Div menu item highlighted, use the (▲▼) arrow keys to adjust the value. The displayed value indicates the time for each horizontal grid division (block).

(Fig. 1) The display grid is made up of 12 divisions across the screen. A 1mS/Div setting results in a total of 12mS across the screen (1ms x 12 = 12mS)

(Fig. 2) the T/Div is changed from 1mS/Div to 5mS/Div and now displays 60mS across the screen. This increased overall time length of the waveform while also decreasing the detail.
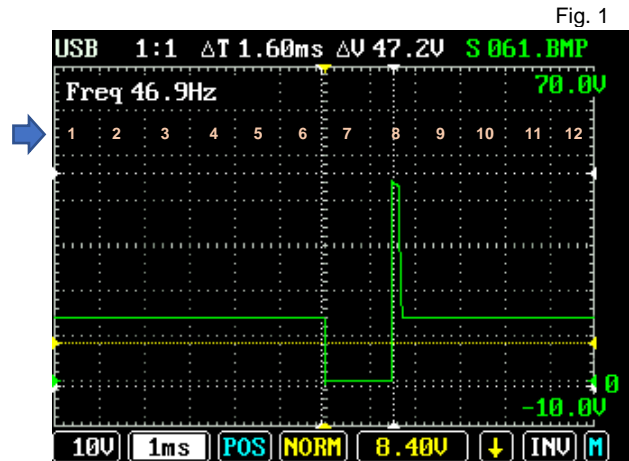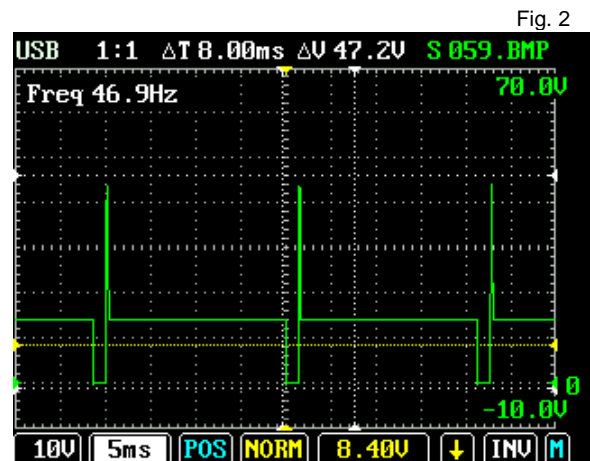
NOTES:

- Full range of T/Div options: 1us, 2us, 5us, 10us, 20us, 50us, 100us, 200us, 500us, 1ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 200ms, 500ms 1s, 2s, 5s, 10s.

- When the T/Div is 100mS or slower, the TRIGGER MODE will always change to SCAN. SCAN allows the screen to continuously update.

- The waveform data point buffer is 4000 data points in length.

Fig. 1

Fig. 2

- Only a maximum of 300 data-points are displayed onscreen at any time (each division is 25 x 25 pixels 25 pixels x 12 divisions = 300).

  The uScope maximizes the screen by offering two different display modes: NORMAL and FAST. For more details see these topics:

    o To turn on or off switches between FAST sample rate or NORMAL sample rate. See topic titled **POP-UP MENUS | OPTIONS | SAMPLE SPEED**

    o To scroll and zoom into the full buffer data see topic titled **HORIZONTAL POSITION | WAVEFORM POSITION POS POS**
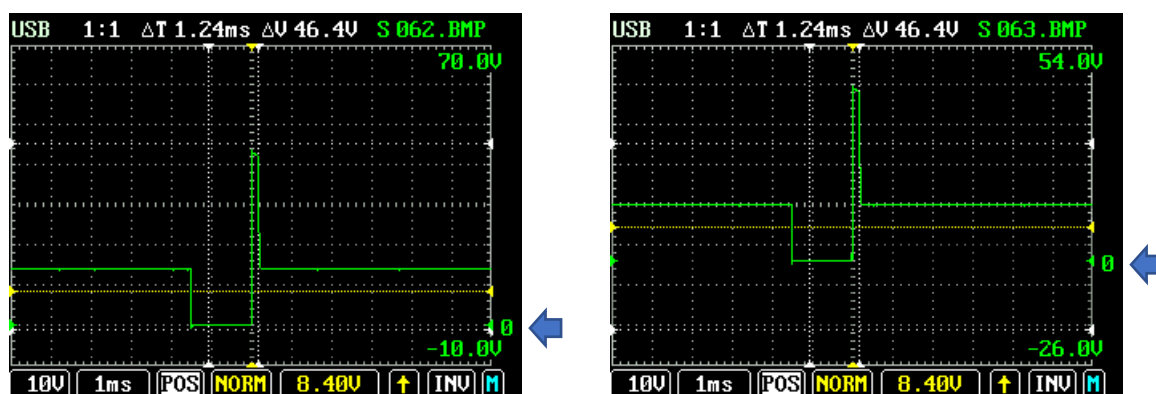
Waveform Position (POS)

POS - Third menu item from the left. Allows for scrolling the waveform vertically and horizontally and is used to reset the waveform horizontal position. When selected has white or blue background.

Move Waveform Vertical Position (The basic POS feature)

Use the (◄►) arrow keys to highlight the POS menu item. Then use the (▲▼) arrow keys to vertically position the waveform.

Move Waveform Vertical & Horizontal Position (The advanced POS feature)

This feature dedicates the (▲▼) and (◄►) keys for vertically and horizontally moving the waveform.

Activating the Advanced POS Function

POS is active when the menu item is blinking. A few steps must be accomplished for activation:

1. The signal acquisition must be in **HOLD** mode. Press the "A" button on the top of the scope.
2. To ZOOM in or out of signal detail adjust the TIME/DIV setting as desired.
3. Use the (◄►) arrow keys to highlight the POS menu item.
4. Press the <OK> button and the POS menu item will start blinking with a blue background.

   a. To SCROLL through the waveform use the (◄►) arrow keys.
   b. To set the VERTICAL Position, use the (▲▼) arrow keys.
   c. Always RESET the HORIZONTAL position when analysis is complete by pressing and holding the <OK> button for 2 seconds
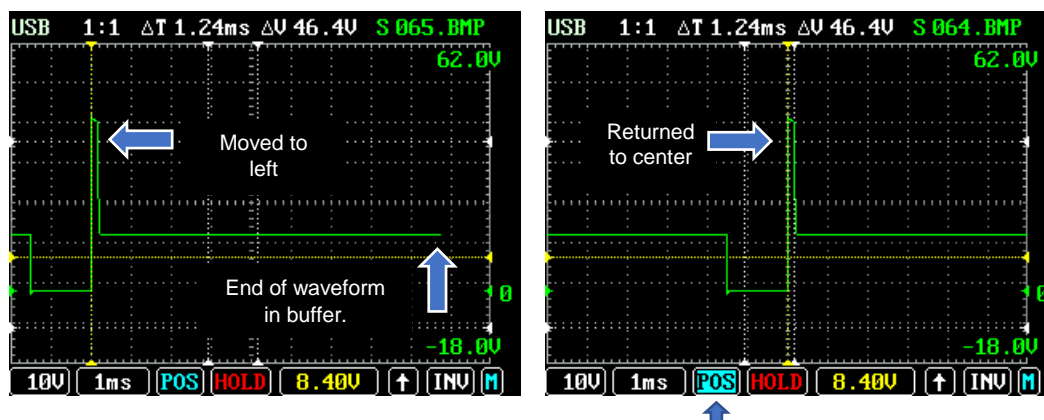
> ⚠️ The waveform horizontal position must be reset when viewing/analysis is complete. See next page.

POS – Restore Waveform Center Position

When the waveform has been moved left or right, it is important to **re-center the waveform** when analysis is complete. If not re-centered, the waveform might not appear on the screen when HOLD is released. Also, note that returning to a live waveform will use the currently active TIME/DIV setting.

To reset the horizontal position:

- With the POS menu item highlighted, press and hold the **<OK>** button for 2 seconds. The waveform will snap back to the center position.

The left screen capture shows a waveform that has been scrolled to the left. Also notice the TRIGGER HORIZONTAL POSITION marker (the vertical yellow line) is no longer in the center of the screen. In the right screen capture, the waveform and the trigger position have been re-centered!

When a waveform is scrolled, the TRIGGER HORIZONTAL POSITION (Tr HPos) scrolls with the waveform. This is not how the Tr HPos is set!

To learn more, refer to the Pop-up Menu section titled:
TRIGGER MENU | TRIGGER HORIZONTAL POSITION (Tr HPos)

TIP:

When the uScope sample rate is set to FAST, the displayed waveform has 10X more detail than is displayed onscreen if captured at a time/div settings of 500uS/div or slower. The 10X detail can be zoomed into revealing finer signal detail. For example, for full detail, a signal captured at 100ms/Div can be zoomed to 10ms/Div. If captured at 10ms/Div can be zoomed to 1ms/Div.

Note: It is possible to zoom in more than a factor of 10 but doing so begins to stretch and skew the display of the actual waveform.

See example on next page!

Also, For more information regarding **FAST** and **NORMAL** sample rates refer to the section - **POP-UP MENUS | OPTIONS | SAMPLE SPEED**

POS - Typical Application

A typical application of zooming into a waveform with the SAMPLE MODE set to **FAST**.

Steps:

1. **(Fig. 1)** Put waveform in HOLD mode by pressing the **<A>** button on the top right of the uScope.

Fig. 1

2. **(Fig. 2)** Change the time and voltage to zoom into the signal detail. In this example, the Time/Div was changed from 1ms to 100us (10X faster).

   NOTE: Captured with Sample Rate set to FAST.

Fig. 2

3. **(Fig. 3)** Activate the POS FULL FUNCTION by navigating to the POS menu item and hold the **<OK>** button. It is active when the background is flashing.

Fig. 3

4. **(Fig. 4)** Use the (▲▼) arrow keys to set the waveform vertical position. Use the (◄►) arrow keys to scroll waveform. Notice the TRIGGER HORIZONTAL position indicator (dotted vertical yellow line) scrolls with the waveform.

Fig. 4

5. **(Fig. 5)** EXTREMELY IMPORTANT STEP!
   When analysis is complete, re-center the waveform: Highlight the POS menu and press and hold the **<OK>** button for 2 seconds - the waveform will snap to center.
   If the waveform is not re-centered when HOLD is released, the live waveform might be offset to the point the signal will not show up on the screen at all. An indicator that the waveform is re-centered is the TRIGGER HORIZONTAL POSITION indictor returned to its original position.
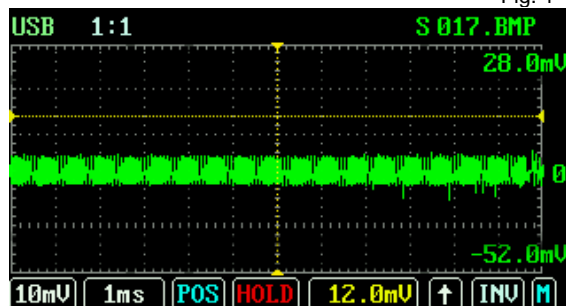

Fig. 5

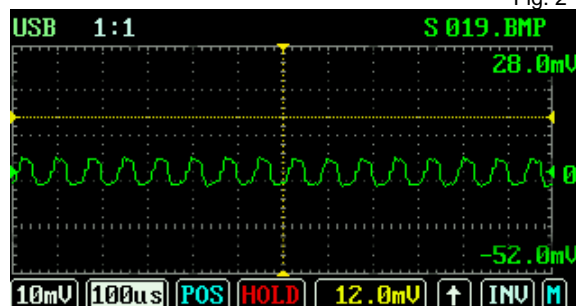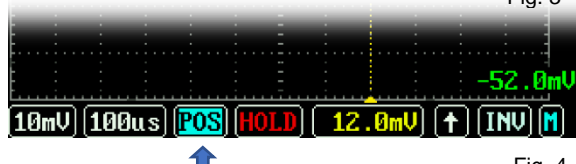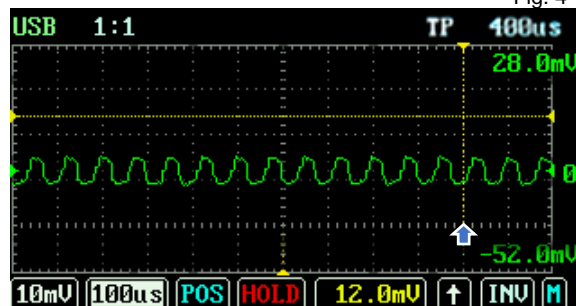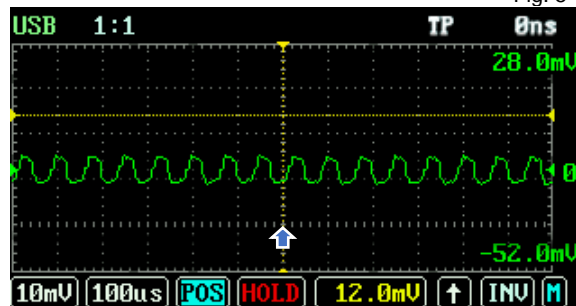# Trigger Mode (Tr Mode)

TRIGGER MODE - fourth menu item from the left. When selected has a yellow background. Set the base requirements that initiate the waveform update.

There are 4 possible selections:

AUTO - The waveform will always update regardless of other trigger settings. If the other trigger requirements are met, AUTO will use them. If the trigger requirements are not met, the waveform will update anyway but may drift across the screen 'unsynced".

This is typically the ideal start setting to confirm a connection to a circuit and that there is a signal present. The drawback is that AUTO may result in repetitive signals "walking across the screen". In these cases, the next step is to fine tune the other trigger settings and to also try the trigger mode setting of NORM.

NORM – The waveform will only refresh and update the waveform when the all trigger requirements, including LEVEL and SLOPE, are met. This mode is used to stabilize a waveform and prevent it from walking across the screen.

In the NORM trigger mode, it is extremely important to pay attention to the Trigger Slope arrow. With a successful trigger event the arrow is YELLOW. When the signal does not meet the trigger requirements, the display stays frozen and the arrow turns RED. When red, the last triggered waveform will freeze on the display or the display will be blank if no successful trigger event has taken place.

NOTE: It is recommended to always begin capturing a waveform using AUTO and adjust the basic settings…then go to NORM if needed.
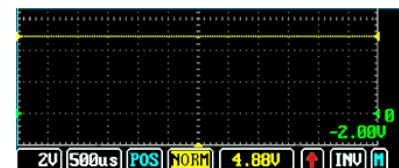
Trigger requirements met and signal updating.
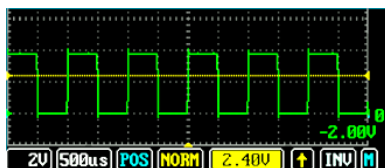
Test lead removed from circuit. Signal not updating.
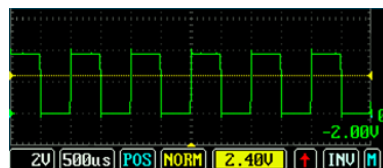
No triggered events and no updating.

SING – SING is short for single - the waveform will update only once when all the trigger requirements are met and then go into HOLD mode - freezing the waveform on the display for analysis. This is the ideal setting for capturing throttle position sweeps, cranking compression, and in some cases amperage waveforms, etc.

> **NOTE:** To re-arm SING after the waveform is captured and the scope is in HOLD mode, press the **<A>** button to release HOLD.

SCAN – The uScope will automatically revert to SCAN mode with Time/Division settings of 100mS or slower. SCAN mode keeps the update of the waveform constant without delay as the waveform buffer fills.

Trigger Level (Tr Level)

TR LEVEL - fifth menu item from the left. Sets the voltage level the signal has to reach to initiate a trigger event. When selected has a yellow background.

With the Tr Level menu item highlighted, use the (▲▼) arrow keys to adjust the trigger voltage level. The displayed value indicates the current voltage level and is identified on the waveform grid by the yellow dotted horizontal line which moves with the adjustment.
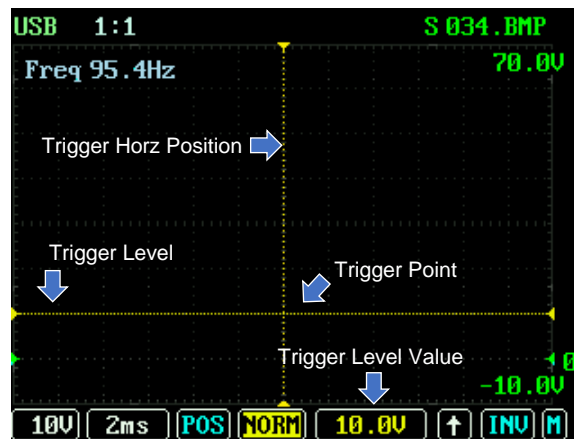
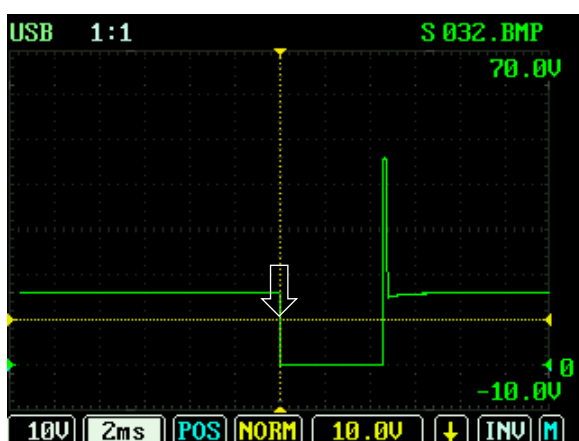| TIP:	The **Trigger Level Adjustment** can be used to take quick voltage measurements. Just move the trigger level to the point to be measured.
	Read the VOLTAGE value in the TRIGGER LEVEL Menu Bar!

Trigger Slope (Tr Slope)

TR SLOPE - sixth menu item from the left. Determines if the signal is triggered by rising up to or falling down to the trigger voltage level. When selected it has a yellow background.
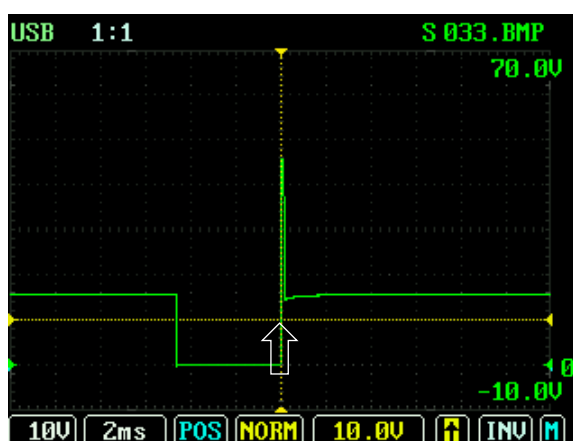

Highlight the Tr Slope menu item. Use the (▲▼) arrow keys to toggle between the up and down arrow. In the case of the injector captures below, you can see the result of changing the TRIGGER SLOPE – the waveform changes horizontal position on the screen based on the trigger point.

TRIGGER SLOPE = FALLING   TRIGGER SLOPE = RISING

Falling Slope

Rising Slope

No Trigger Indicator

When the trigger requirements are not met and the signal is no longer updating the Tr Level will turn red.

NOTE: If the TRIGGER MODE is set to **NORM** and the trigger requirements are not met, the TRIGGER SLOPE arrow will turn red, the screen will not update remaining blank or freezing the last good capture on the display until the next good trigger event occurs. Keep an eye on the TRIGGER SLOPE ARROW to ensure the signal is live!

NOT UPDATING
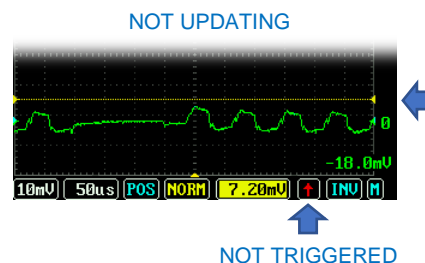
NOT TRIGGERED

Trigger Slope Terminology

Trigger Slope is often referred to by the following terms:

• Positive Slope	• Negative Slope
• Rising Edge	• Falling Edge
• Up Slope	• Down Slope

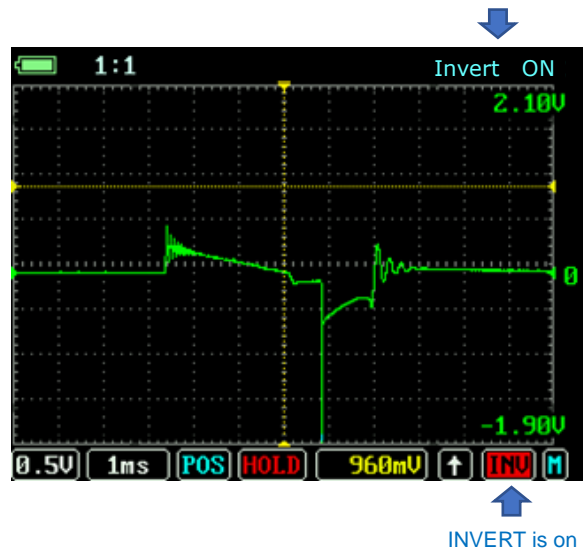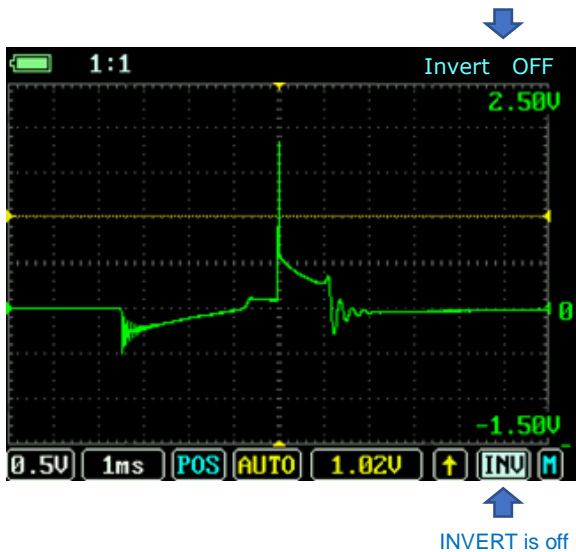# Invert (INV)

INVert - seventh menu item from the left. Inverts the waveform. This feature is commonly used for secondary ignition signals. When selected has a white background.

With the INV menu item highlighted, use the (▲▼) arrow keys to toggle between INVERT OFF and INVERT ON. When INVERT is not active the INVERT menu will have a cyan highlight. Red when INVERT is active. An indicator will also appear above the top right of the grid.

INVERT is off

INVERT is on

Typically, INVERT is used to turn a signal that is upside down…right side up. This is common with secondary ignition patterns.

NOTES:

- Inverting the waveform does not invert the TRIGGER LEVEL or measurement cursors.
- INVERT cannot be changed while in HOLD mode.

Open Pop-up Menu (M)

M - last menu item on the right. Opens the vertical Pop-up Menu.

Highlight then press the <OK> button to open the Pop-up Menu.

Pop-up Menu Functions

Vertical

Vert
Horz
Trig
Prst
Curs
Mtrs
File
Opts

The Vertical Menu includes items that have to do with the vertical display of the signal including PROBE CALIBRATION and Reference waveform vertical position.

Volt/Division (V/Div) Also available directly on the Horizontal Toolbar Menu

V/Div
Invert
GND Pos
Ref Vert Pos
Probe Cal
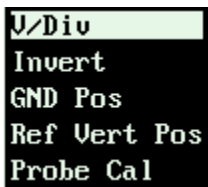
Sets the voltage of each block of the waveform grid and therefore determines the displayed height of the waveform. The higher the volts per division value: The shorter the waveform. The lower the value: The taller the waveform. There are 8 vertical divisions. For example, a 5-volt setting will display a maximum of 5 x 8 = 40 volts on the display. A 10V/Div setting will display a maximum of 80 volts.

- **To adjust:** Press the (◄►) arrow keys to set the desired value.
- **V/Div indicator:** Can be found in the first left menu item in the Toolbar menu.
- **V/Div options are:** 10mv, 20mv, 50mv, 0.1V, 0.2V, 0.5V, 1V, 2V, 5V, and 10V per division.

Waveform Invert (Invert) Also available directly on the Horizontal Toolbar Menu

V/Div
Invert
GND Pos
Ref Vert Pos
Probe Cal
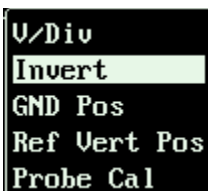
Inverts the waveform. This feature is commonly used to invert secondary ignition signals, so they display with the spike and burn-time up.

Use the (◄►) arrow keys to turn INV on and off.

- When the signal is inverted, the INV indicator in the toolbar will turn red INV and the status in the top right of the screen will read: **Invert ON**.
- When invert is not active, it will be white INV and the status will read: **Invert OFF**.

Ground Position (GND Pos) Also see POS on the Horizontal Toolbar Menu

V/Div
Invert
GND Pos
Ref Vert Pos
Probe Cal

Sets the vertical grid position of 0 volts, which also changes the vertical position of the displayed signal.

- **To adjust:** Press the (◄►) arrow keys.
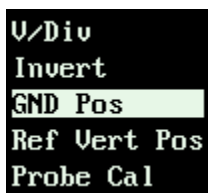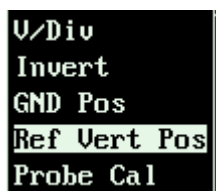- The zero volts position identifier is located along the right edge of the screen and is marked by a green colored "0" and small inward pointing arrowhead on both sides of the display area.
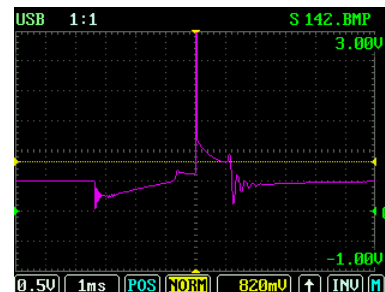
Reference Waveform Vertical Position (Ref Vert Pos)

V/Div
Invert
GND Pos
Ref Vert Pos
Probe Cal

Sets the vertical position of a reference waveform. A purple Reference waveform is displayed when a preset is opened and Ref Show = On is set.

- **To adjust:** Press the (◄►) arrow keys.

Probe Calibration Setting (Probe Cal)

V/Div
Invert
GND Pos
Ref Vert Pos
Probe Cal
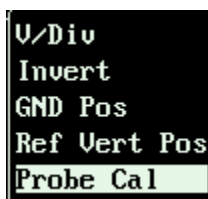
Probe Calibration Setting (Probe Cal) – Calibrates the displayed grid voltages to match the output of special probes such as 10:1 probe, amp probes and other transducers.

For example, a high voltage 10:1 probe will change a 10-volt input signal to 1 volt to the scope. By selecting the 10:1 probe calibration the scope will read the voltage correctly … every 1 volt entering the scope will be measured and displayed as 10 volts of actual signal.

- **To adjust:** Press the (◄►) arrow keys.
- **Probe Cal Indicator:** The active probe calibration setting is always on display to the right of the batery indicator located to the top left of the display.

Voltage:

- 1:1 (Default)
- 10:1

Amperage:

- 1:1A (Read as 1mv = 1A)
- 10:1A (Read as 10mv = 1A)
- 100:1A (Read as 100mV = 1 A)

Pressure (based on Pico pressure tranducer)**:** (on uScope version > 6.3.6)

- WP1:   -15 to 500 psi (100:1)
- WP2:   -15 to 50 psi (10:1)
- WP3:   -5 to 5 psi (1:1)

Horizontal

The Horizontal Menu includes items that have to do with the horizontal display of the signal.

Vert
Horz
Trig
Prst
Curs
Mtrs
File
Opts

**Time/Division (T/Div)** Also available directly on the Horizontal Toolbar Menu

T/Div
Horz Pos

Sets the time value for the grid blocks across the screen. This setting determines the time length of the waveform on the display grid. For example, a setting of 5mS/Div will display 5mS x 12 grid blocks = 60mS across the screen.

- **To adjust:** Press the (◄►) arrow keys to set the desired value.
- **T/Div indicator:** Can be found in the second for the left menu item in the Toolbar menu.

10V | 1ms | POS
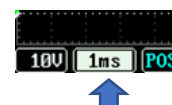
Horizontal Position (Horz Pos) Also see POS on the Horizontal Toolbar Menu

T/Div
Horz Pos

Used to scroll the waveform left or right across the screen. Commonly used to zoom in on a waveform and then scroll through it. For example, put the waveform in HOLD mode. Change the Time/Div setting to a faster setting to zoom into waveform detail. Next, use the Horz Pos to scroll the waveform left and right.

For detailed information see: **TYPICAL APPLICATION** under **Horizontal Toolbar Menu in Detail > Waveform Position (POS)**

- **To adjust:** Press the (◄►) arrow keys to scroll the waveform left and right.
- Always return the waveform to the original position. Do not confuse this feature with the TRIGGER POSITION!
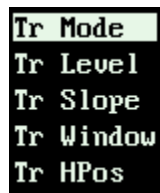
Trigger

Vert
Horz
Trig
Prst
Curs
Mtrs
File
Opts

The trigger setting sets the requirements that have to be met (or not) for the waveform to update. These settings can be used to:

- Stabilize a repetitive waveform - preventing it from walking across the screen.
- Determine when a waveform should update – all of the time or only when the trigger requirements are met.
- The trigger is also used to help set where the waveform is displayed on the grid.

Trigger Mode (Tr Mode) Also available directly on the Horizontal Toolbar Menu

Tr Mode
Tr Level
Tr Slope
Tr Window
Tr HPos

The triggering modes set the base requirements that initiate the waveform update. There are 4 possible selections:

AUTO - The waveform will always update regardless of any other trigger settings. If the other trigger requirements are met, AUTO will use them. If not met, the waveform will update anyway. This is the recommended setting to use when first connecting to a circuit. The AUTO update will make it easy to see if test connection has been made.

NORM – The waveform will update only when the other trigger requirements are met such as LEVEL and SLOPE. This mode is used to stabilize a waveform and prevent it from walking across the screen. For example, to always have an injector signal draw itself in the exact position as the previous update. **Be aware**, when a signal fails to meet the trigger requirements, when in the NORM mode, the screen will remain blank or the last triggered event will be frozen on the screen until the requirements are met again.

UPDATING   NOT UPDATING

TRIGGERED   NOT TRIGGERED
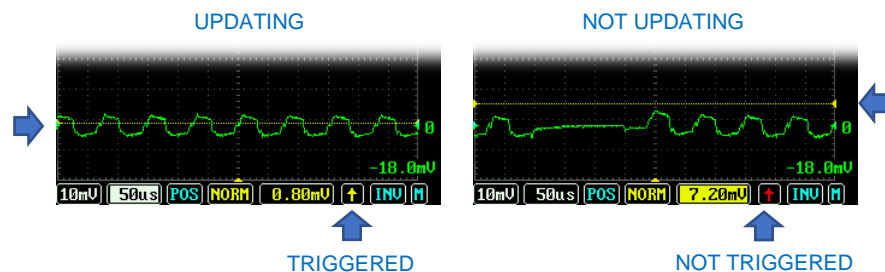
SING (Single) – The waveform will update only once when all the trigger requirements are met and then go into HOLD mode - freezing the waveform on the display for analysis. This is the ideal setting for capturing throttle position sweeps, cranking compression, and in some cases amperage waveforms, etc.

NOTE: To re-arm SING after the waveform is captured and the scope is in HOLD mode, press the **<A>** button to release HOLD.

SCAN – The uScope will automatically revert to SCAN mode at slower Time/Division setting of 100mS or slower. SCAN mode keeps the update of the waveform constant without delay as the waveform buffer fills.

Trigger Level (Tr Level) Also available directly on the Horizontal Toolbar Menu

```
Tr Mode
Tr Level
Tr Slope
Tr Window
Tr HPos
```

Sets the voltage level the signal has to reach to initiate a trigger event. Works in conjunction with TRIGGER SLOPE.

- **To adjust:** Press the (◄►) arrow keys to set the desired value.
- **Tr level indicator:** The trigger level voltage value can be read in the fifth menu item in the Horizontal Toolbar menu. The on-grid indicator is the dotted yellow horizontal line.

Trigger Slope (Tr Slope) Also available directly on the Horizontal Toolbar Menu

```
Tr Mode
Tr Level
Tr Slope
Tr Window
Tr HPos
```

Sets the direction the signal has to pass through the TRIGGER LEVEL to initiate a trigger event.

Positive slope identified by an up arrow – the signal has to go up through the TRIGGER LEVEL. **Negative slope** identified by a down arrow – the signal has to go down through the TRIGGER LEVEL.

- **To adjust:** Press the (◄►) arrow keys to set the desired value.
- **Tr Slope indicator:** The trigger slope can be read in the sixth item in the Horizontal Toolbar menu as an up or down arrow.

NOTE: When the signal is reaching the trigger level and slope requirements, the indicator arrow in the toolbar will be yellow. When the signal does not meet the trigger level and slope requirements, the arrow will turn red.

Trigger Window (Tr Window)

```
Tr Mode
Tr Level
Tr Slope
Tr Window
Tr HPos
```

The trigger level is displayed as one horizontal yellow dotted line(s). Selecting and adjusting the Trigger Window spreads the line into two, creating a window the signal must pass through to initiate a triggered event. The Tr Window adjustment sets how wide the window is. While the Trigger level adjustment sets the vertical position of the window.

(Fig. 1) The spike of the injector is passing through the trigger window and is resulting in a successful trigger. **(Fig. 2)** In the lower screen capture, the spike is not passing through the full trigger window and therefore the signal has not met the trigger requirements.
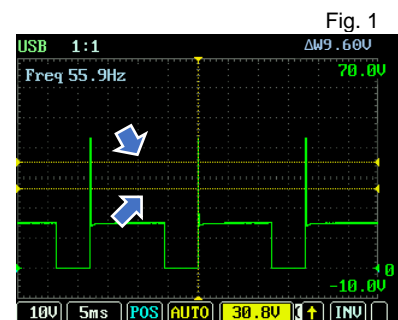
- **To adjust:** Press the RIGHT arrow key to open the window. The Left arrow key to close it. Once the desired window is set, use the TRIGGER LEVEL to set the overall vertical position of the trigger window.
- **Tr Window Indicator:** While adjusting the window, the delta voltage (voltage level between the cursors) will be displayed in the top right of the grid and the TRIGGER LEVEL value displayed in the Menu Bar is the trigger center point.

Fig. 1

Fig. 2

Trigger Horizontal Position (Tr HPos)

Tr Mode
Tr Level
Tr Slope
Tr Window
Tr HPos

Moves the horizontal trigger position from the center of the grid to one division from the grid left. The horizontal trigger position is indicated by the vertical dotted yellow line.
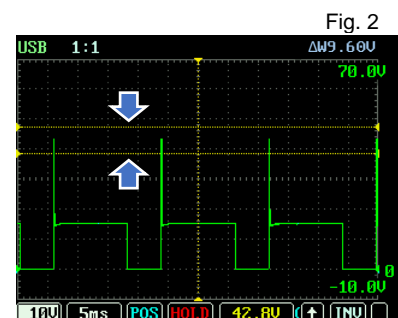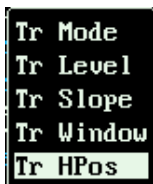
This is a powerful feature that allows the drawing of the waveform to be referenced from the left of the screen. For example, injector or current waveforms such as primary ignition current benefit greatly – allowing full use of the display area.

(Fig.1) This is an example of a potentiometer signal. Notice the yellow pointer and dotted vertical line identifying the Trigger Horizontal Position - Tr HPos is set to GRID CENTER. The TRIGGER SLOPE is set to positive.
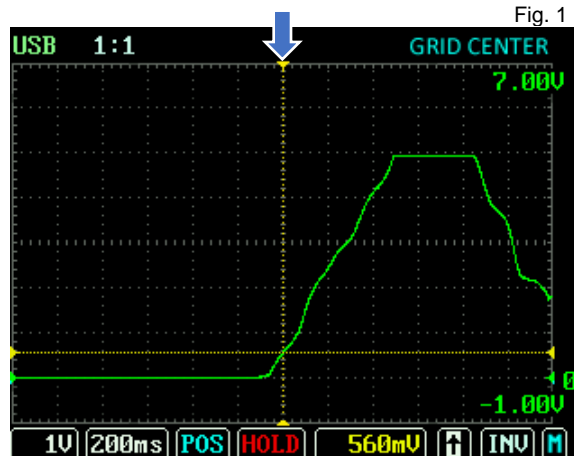
Fig. 1

(Fig. 2) In this capture, the Tr HPos is set to GRID LEFT. The GRID LEFT setting allows for the full screen real estate to be used to view the waveform - starting with triggered part of the waveform at the left.
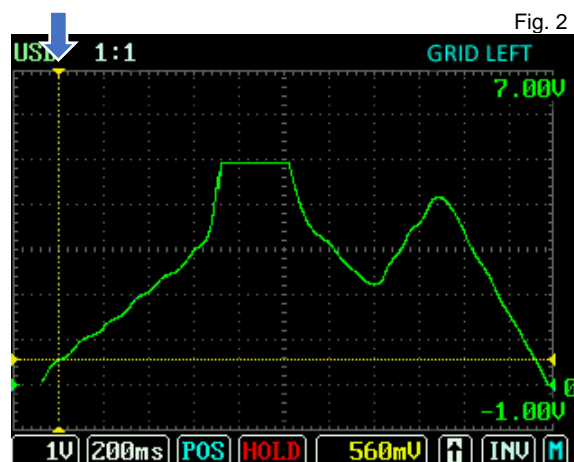
To adjust: Press the (◄►) arrow keys to set the desired position.

- **Tr HPos indicators:** The vertical yellow trigger position line will move from center screen to left and the top right of the screen will display accordingly Grid Left or Grid CENTER.

Fig. 2

Preset

Vert
Horz
Trig
Prst
Curs
Mtrs
File
Opts

Provides access to presets stored on the microSD card. Each preset contains all scope settings and a reference waveform. Each preset menu item (except AUTO SETUP and REF SHOW) represents a file directory on the microSD memory card where each preset is stored. Each filename is limited to 8 characters in length. For example, the description "Secondary DIS – Negative" is shortened to "SECDIS-N".

Note: You can create your own presets and add them to the menu system!

Opening a Preset

Auto Setup
Sensors
Actuators
Amp
Ignition
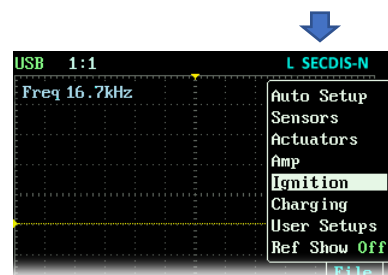Charging
User Setups
Ref Show On/Off

Each preset menu items (expect Auto Setup and Ref Show) has multiple selections.

Step 1: Use the (▲▼) arrow keys to select a preset directory.

Step 2: Use (◄►) arrow keys to view the stored presets. The preset name will appear in the top right of the display. The "L" displayed before the filename stands for "LOAD".

Step 3: Press and hold the <OK> button for 2 seconds to load the preset. When loading, the preset name, in the top right of the display, progressively turns green.

USB 1:1   L SECDIS-N
Freq 16.7kHz
                              Auto Setup
                              Sensors
                              Actuators
                              Amp
                              Ignition
                              Charging
                              User Setups
                              Ref Show Off
                                      File

Auto Setup

Auto Setup
Sensors
Actuators
Amp
Ignition
Charging

The uScope firmware attempts to determine the best voltage and time settings for the given signal.

• **To activate:** Press and hold down the <OK> button for 2 seconds.

Sensors Presets

Auto Setup
Sensors
Actuators
Amp
Ignition
Charging
User Setups
Ref Show On/Off

Filename

Filename	Description
L CAN-HIGH	CAN High to ground only
L CAN-HILO	CAN signals combine for 0-2 volt waveform
L CAN-LOW	CAN Low to ground only
L DIGTL-HF	Digital switching signal – High Frequency
L DIGTL-LF	Digital switching signal - Low Frequency
L MAF-5V	5V Mass air flow with frequency meter
L 02	O2 Sensor - 0 to 1 volt
L 02-Wrmup	O2 Sensor from cold to warmup - 0 to 1 volt
L TPS-5V	Throttle Position – analog signal
L Vrsensor	Variable Reluctance sensor such as wheel speed

Actuator Presets

Filename
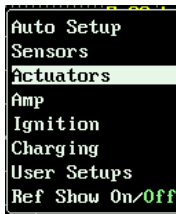
L INJ-PH   Fuel injector - Peak/Hold type
L INJ-SGND   Fuel injector – Saturation type
L INJ AMP   Fuel Injector current using 100mV/1Amp
L IDLE-SOL   Idle Control Solenoid

Amp Presets

L Crank-AMP   Relative Compression and starter current using 1mv/1Amp
L FPumpAmp   Fuel Pump current using a 100mV/1Amp calibration setting
L IGN-AMP   Primary Ignition current using a 100mV/1Amp calibration setting
L-INJ AMP   Fuel Injector current using 100mV/1Amp

Ignition Presets

L IGN-AMP   Primary Ignition current using a 100mV/1Amp calibration setting
L PRI-IGN   Primary Ignition voltage using 10:1 attenuator
L SECDIS-N   Secondary DIS Ignition – Negative slope
L SECDIS-P   Secondary DIS Ignition – Positive slope

Charging Presets

L ALT-AC   Alternator Diode waveform using AC Filter Adapter
L BAT-CRNK   Battery voltage cranking

User Setups (Presets)
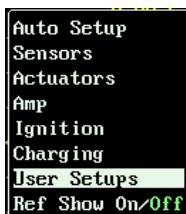
User Setups are setups/reference waveforms that have been saved by the user when pressing the **<B>** button. By default, these setups are saved and identified by a numbered filename. For example, 002.AES.
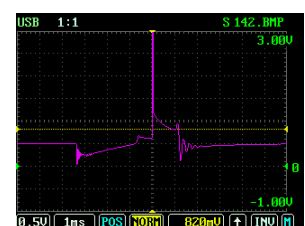
TIP: Saved User Setups can be renamed and moved to other preset menu directories on the microSD card. For more information see "**Rename and Move a Preset**" in the How-To section.

Reference Show (Ref Show)

When a preset is opened, this option allows you to choose to show or not to show the preset's stored reference waveform (purple).

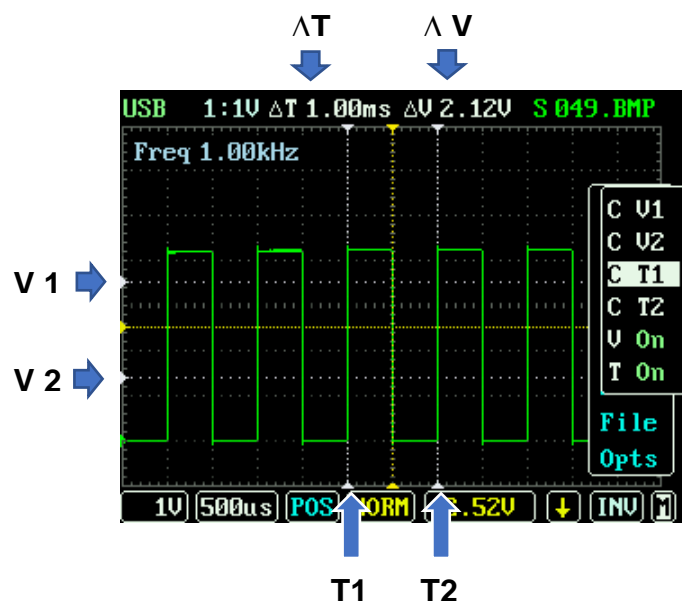- Use (◄►) arrow keys to select On or Off

Cursors (menu)

Use cursors to accurately measure pulse widths, time durations and voltage levels. The cursors, when displayed, are the white dotted lines across the grid.

- Vertical cursors measure time
- Horizontal cursors measure voltage
- The cursors are identified by the white dotted lines
- Delta (∆) values for Time and Volts will be displayed at the top of the screen

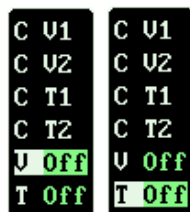∆**T** **Delta Time:** Time between cursors

∆**V** **Delta Volts:** Voltage between cursors

| **TIP:**	All cursor adjustments are made while the CURSOR pop-up menu is open. Once adjustments are accomplished, press <OK> to close the CURSOR menu.

Turning the Cursors On or Off

Use (▲▼) arrow keys to scroll to and highlight V or T. Use (◄►) arrow keys toggle and select meters On or Off.

V On/Off - Turns V1 & V2 voltage cursors on or off. Current status is shown in "green". Use the (◄►) arrow keys to toggle between on and off.

T On/Off - Turns T1 & T2 time cursors on or off. Current status is shown in "green". Use the (◄►) arrow keys to toggle between on and off.

Moving the Voltage Cursors
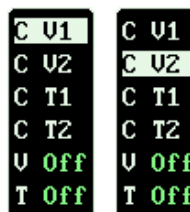
The voltage cursors are labeled V1 and V2. V1 is the top cursor and V2 is the lower cursor.

- Ensure the cursors are turned on
- **To select:** Use the (▲▼) arrow keys to select V1 or V2.
- **To adjust:** Tap the (◄) key to move the selected cursor up and the (►) arrow key move it down.
- **Voltage Cursor indicator:** The Delta (Δ) Voltage (voltage between the cursors) is displayed just right of center at the top of the display,

Moving the Time Cursor
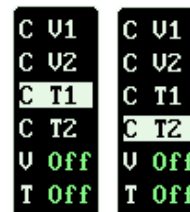
The time cursor are labeled T1 and T2. T1 is the left cursor and T2 the right.

- Ensure the cursors are turned on
- **To select:** Use the (▲▼) arrow keys to select T1 or T2.
- **To adjust:** Tap (◄) arrow key to move the selected cursor left. Tap (►) arrow key to move right.
- **Time Cursor Value:** The Delta (Δ) Time (time between the cursors) is displayed just left of center at the top of the display.

Meters (menu)

Curs
Mtrs
File
Opts

Displays active numeric measurements of signal.

Turn Meters On or Off

Freq	62.6Hz
Duty	62.5%
Vrms	2.41V
Pcnt	2
Pwdt	9.98ms
Vpp	4.99V
Vmin	-0.02V
Vmax	4.97V
Vavg	3.09V
Enable On/Off	

Use (▲▼) arrow keys to scroll to highlight ENABLE On/Off, then use (◄►) arrow keys to turn meters ON or Off.

When meter display is set to ON all applicable values will be displayed in this menu window.

If a measurement is not possible it will display xxxx.
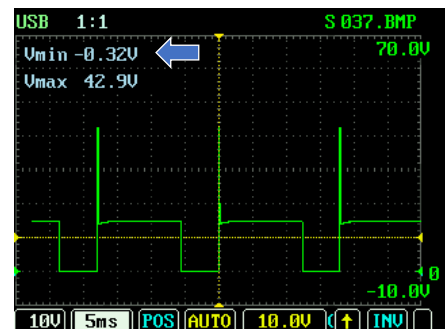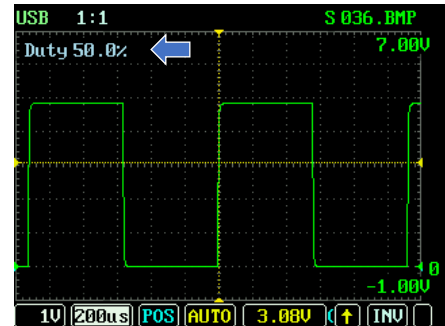
Display Meter Readings on the Waveform Grid

1. Turn Meters On
2. Use (▲▼)arrow keys to highlight the desired meter reading.
3. Push <OK>
4. The meter readings selected will display in the upper left corner of the screen.
5. To turn off the meter display: Select Meters / Disable On/Off and choose Off.

Setting Waveform Measurement Point

The TRIGGER LEVEL is used to set the measurement point of the signal. If the meter display is not updating, ensure that the TRIGGER LEVEL is within the area of the waveform – not above or below. And, for DUTY CYCLE and PULSE WIDTH, the TRIGGER SLOPE also plays a role as seen in the screen captures below. An up arrow reads the higher portion of the pulse and a down arrow reads the lower portion of the pulse.
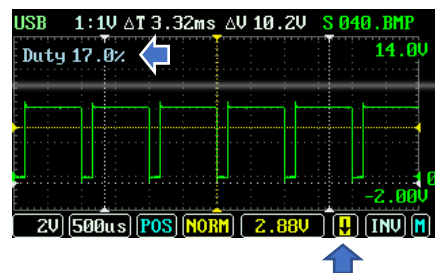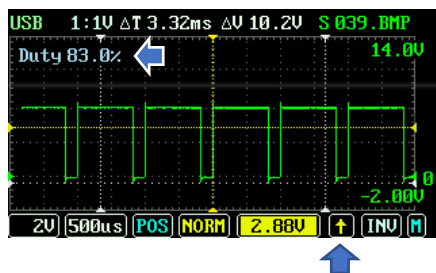
Meter Readings Definitions

- **Freq (Frequency)** How often an event occurs within a second.
- **Duty (Duty Cycle)** Within a single cycle of the signal, how long it is high versus how long low or vice versa.
- **Vrms (Voltage Root Mean Square)** The effective value of a varying voltage or current.
- **Pcnt (Pulse Count)** Pulse count of high or low going pulses – based on pulses in the buffer.
- **Pwdt (Pulse Width)** Time duration of a pulse.
- **Vpp (Voltage Peak-to-Peak)** The delta between the highest and lowest voltage points.
- **Vmin (Voltage Minimum)** Lowest voltage point.
- **Vmax (Voltage Maximum)** Highest voltage point.
- **Vavg (Voltage Average)** Average voltage of the complete waveform on the display.

File (menu)

The File Menu allows saving of two types of files to the microSD card:

1. Screen capture in BMP format.
2. A "User File" that saves all setup information and waveform data points.

The BMP file is ideal for use in documentation. The user file can be used as your own custom presets.

- BMP File Format: xxxxxxxx.BMP
- User File Format: xxxxxxxx.AES

NOTE: uScope files names exceeding 8 characters will not display properly.

Save as Image (BMP)

Highlight **Save to Image (BMP)** and press the **<OK>** button.

Saves the current screen as a bitmap image file with the BMP file extension. Use this option to create an image file of the screen that can be viewed on a PC and easily included in documentation.

- BMP File Format: xxxxxxxx.BMP
- Location on CF card: IMAGE directory

BMP files cannot be recalled and displayed on the uScope.

Save to USER File (AES & BMP)

Highlight **Save to USER File** and press the **<OK>** button.

This option is the same as pressing the **<B>** button. It saves the datafile with the AES extension. And a similar named screen capture image file with the BMP extension into the PS_USER directory:

1. A setup and reference waveform data file preset is identified by the **.AES** extension.
2. A corresponding screen capture – a bitmap image file with the **.BMP** extension.

The **.AES** files can be opened as a preset and to display a reference waveform by selecting the **Prst** pop-up menu and then selecting **USER SETUPS**. The user data files can also be shared with other uScope users!

- User File Format: xxxxxxxx.AES
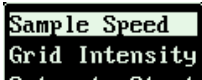- Location on CF card: PS_USER directory

TIP: | Learn how to open uScope User Files in MS Excel:
See section titled HOW TO | Open AES Datafiles with MS Excel

Options (menu)

Sample Speed

 The uScope has two sampling speeds: NORMAL and FAST.

- **To adjust:** (◄►) arrow key toggle between NORMAL and FAST.
- **Sample Speed indicator:** Sample speed selection appears in top right of screen.

Fast: Fast is equivalent to *peak detect*. Use this setting to capture and display high frequency events such as spikes and noise. Note that the waveform on display is representative of the whole buffer where 1 point on the grid represents 10 datapoints in the buffer.

Fast oversamples the signal by a factor of approximately 10 time more samples than when on NORMAL at settings of 500uS/div or less. The higher speed sample rate allows for the capture of higher frequency events that could be otherwise missed.
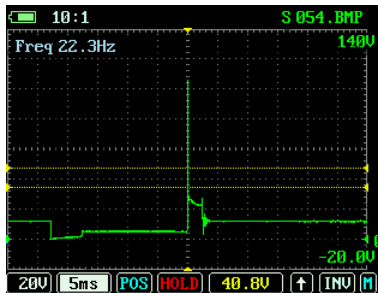
Normal: The waveform on the display represents approximately 1/10 of the continuous signal stored in the waveform buffer – one data point on the grid represents 1 datapoint in the buffer.
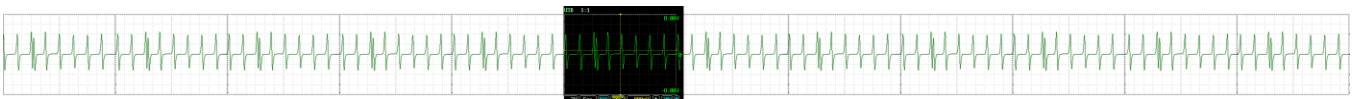
TIP:	To learn how to scroll and zoom into a waveform see the section titled **Menu Bar Function	Waveform Position (POS)**

Grid Intensity

```
Sample Speed
Grid Intensity
Set cstm Start
Reset Factory
SigGen Freq
```

Sets the brightness of the display grid. The default setting is 3.

- **To adjust:** (◄►) arrow keys.
- **Grid Intensity indicator:** Grid brightness value appears in top right of screen.

Set as Custom Startup

```
Sample Speed
Grid Intensity
Set cstm Start
Reset Factory
SigGen Freq
SigGen Duty
Calibrate
Save Calibr
```

Use this selection to save the current scope setup to be used as the default setup on every startup.

- **To set:** Set up scope to desired settings, then access "Set as Custom Startup" menu item. Then, press and hold OK button for 2 seconds".
- **Set as Custom Setup indicator:** SFlash is displayed in top right of screen. When operation is complete SFlash will briefly flash.

Reset Factory Startup

```
Sample Speed
Grid Intensity
Set cstm Start
Reset Factory
SigGen Freq
SigGen Duty
```

Resets the default startup settings to factory original.

- **To set:** Press and hold OK button for 2 seconds.
- **Set as Custom Setup indicator:** "L Factory" is displayed in top right of screen. When operation is complete "L Factory" will briefly flash.

Sig Gen Frequency

```
Sample Speed
Grid Intensity
Set cstm Start
Reset Factory
SigGen Freq
SigGen Duty
```

Sets the output frequency of the frequency generator.

- **To adjust:** (◄►) arrow keys to adjust frequency.
- **Generator Frequency indicator:** Setting appears in top right of screen.
- **Frequency Range:** 10Hz – 1MHz

⚠️ **Do not use to power circuits. Internal damage will occur.**

Sig Gen Duty

```
Sample Speed
Grid Intensity
Set cstm Start
Reset Factory
SigGen Freq
SigGen Duty
Calibrate
```

Sets the duty cycle of the signal generator output.

- **To adjust:** (◄►) arrow keys to adjust duty cycle.
- **Generator Duty Cycle indicator:** Setting appears in top right of screen.
- **Duty Cycle Range:** 0% to 100%

Calibrate & Save Calibration

```
SigGen Duty
Calibrate
Save Calibr
```

⚠️ This feature is not to be normally used by uScope owners. If your scope is performing abnormally, contact AES for assistance.

How To

View & Open Screen Capture Image Files on a PC

1. Turn-on uScope
2. Connect USB cable into the uScope and then to your PC via an available USB port
3. On a PC, Windows File Explorer should automatically open up and display the contents of the uScope memory card. If not, use File Explorer to locate the memory card drive.
4. Once located, navigate to the PS-USER directory and secondarily to the IMAGE directory.
5. Using the Windows File Explorer menu, set VIEW | EXTRA LARGE ICONS
6. Treat the BMP file as any image file.
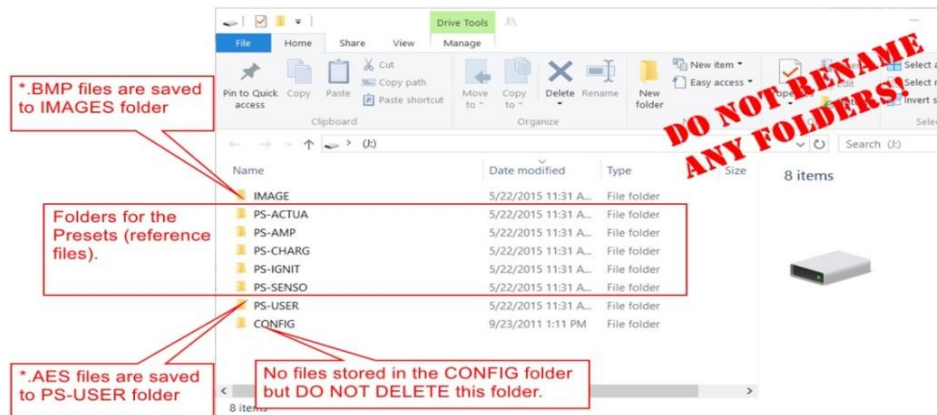
Open AES Datafiles with MS Excel

The uScope USER files (with AES extension and created by pressing the **<B>** button) contain all of the datapoints and the current setup information.

MS Excel can be used to view the file and plot the waveform displaying the full detail captured by the uScope.
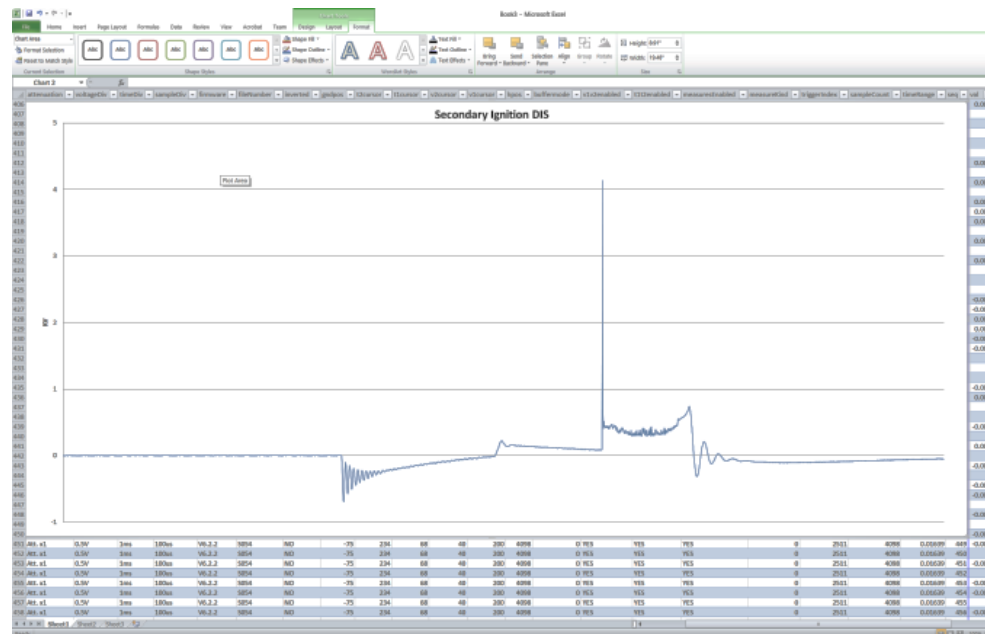
Steps to open and display the uScope waveform in Excel:

NOTE: Details may vary depending on Excel version.

1. Acquire a waveform and press the **<A>** button to hold the waveform on the display.
2. Press **<B>** button to save the file to the uScope microSD card.

   Note the filename!

3. Connect uScope to PC via USB cable.
4. Open MS Excel and select FILE | OPEN from the main menu
5. In the bottom right hand corner of the FIle Open Dialog, set the file type to **ALL FILES.**

   **Note:** By default Excel does not recognize files with the *.AES extension.

6. Navigate to the *.AES file and select to Open.
7. Depending on your version of Excel, dialog boxes such as these might appear:
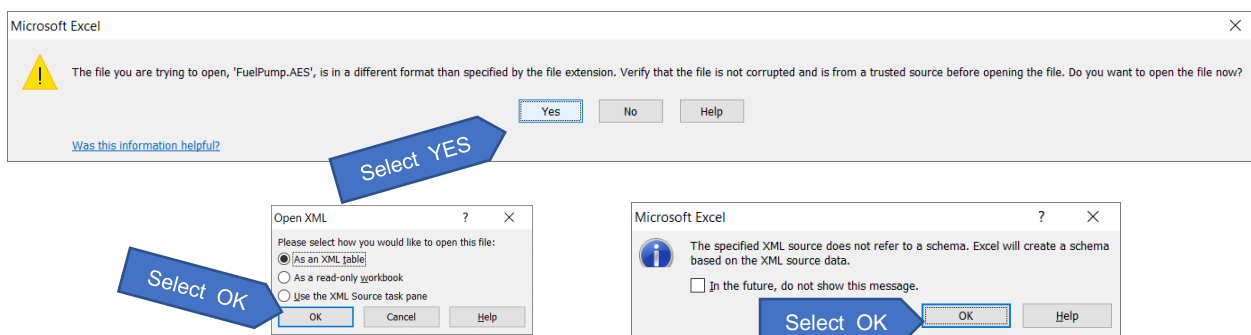
8. The file will open. Next, use the scroll bar in the bottom right of the Excel window and scroll all the way to the right to display the last column with the header **"val"**. This is the column of data points.
   Position mouse in the upper row labeled "**AA**", a down arrow will appear then left click to select all of the data. The data is selected when the background color for the complete column changes.
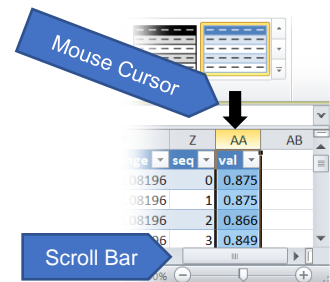
9. Next, select INSERT from the main menu.
10. Under CHARTS select LINE. Then select the first item in the 2-D chart list.

11. To enlarge the display of the waveform, use the mouse to grab the bottom or top corners and drag to enlarge.
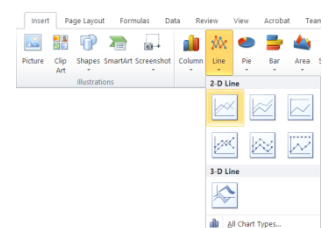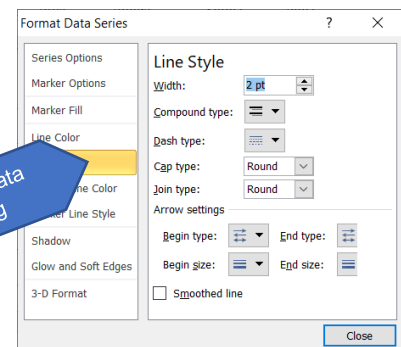
12. All of the items on display with the waveform are individual elements that can be edited. Click on the item to select it, then right click to open up the menu for the options. For example, for example you can change the header text or the color and line thickness of the waveform.

TIP: | Set the line width to 1!

Creating and Naming your Own Presets

uScope users can create their own presets for quick recall and waveform comparison.

A 'preset files' contains all of the scope settings and waveform data. It also can be re-opened within the uScope to restore all of the all control settings as well as display a reference waveform.

Following is a step by step to save a file to be used as a preset then rename and move into the optimal uScope menu for easy recall.

Initial step: Save a Preset

1. Make all adjustments to the uScope and connect to capture to a signal.
2. When ready, press the **<A>** button to HOLD the active waveform.
3. Once the desired waveform is on display, press the **<B>** button to initiate the file creation and save.
4. The filename will be displayed in the top right of the uScope display. Take note of the filename.
   - As the files are saved, the filename will progressively turn green.
   - Two files will be saved using an automatically generated filename, for example: S 026.AES and S 026.BMP (The 'S' signifies SAVE and is not part of the filename.)

Final steps: Accessing, Renaming and Moving Your Presets

1. Connect uScope to a computer with the supplied USB cable. Turn on the uScope.
2. If using a PC, Windows File Explorer should immediately open up and display the contents of the uScope microSD memory card. If not, use Windows Explorer to locate the uScope folder. NOTE: it will show up as a 'USB Drive'
3. Navigate to the PS-USER directory.
4. Locate the desired file. Note, that there should be two files with the same name – one with '.AES' extension and one with '.BMP'. The file with the '.AES' extension is the preset and the file to rename and move. The BMP is an image file of the screen when the preset was saved.
5. To rename the file: Use mouse to right click on the '.AES' filename and select RENAME from the popup menu.
6. Enter a filename with no more than 8 characters and include no spaces. Press <ENTER> when completed. The following are valid filenames:
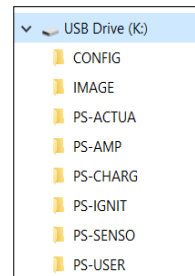
   INJ_POS.aes | INJ-NEG.aes | IGNITION.aes | IGN_COP.aes | TPS-1.aes | MYFILE24.aes

7. Use the mouse to move the preset to the desired menu location, using the mouse, simply drag and drop the file into the appropriate directory. The directories starting with 'PS-' represent the uScope Preset Menus. For example, if your preset is named STARTAMP.AES and you want to put it under the AMP menu item, drag and drop the file into the PS-AMP directory.

TIP: | You can share *.AES files with other uScope users. |

⚠️   Do not rename the file folders!

Updates

Firmware updates

The uScope Firmware may have an update at any time. To check for the latest version and a step by step tutorial available here:

www.uscope.aeswave.com/update

For help call: (559) 292-7851 or email support@aeswave.com

**NOTE:** The firmware will only load and operate on the uScope designed by AESwave.

The uScope firmware will only load and operate
on the uScope designed by AESwave

Frequency Generator

The Frequency Generator outputs approximately 4.2v digital signal that can be adjusted from 10Hz to 1MHz and the duty cycle from 0% to 100%.

The Frequency Generator is designed to be a built in reference signal for 10X probe adjustment and calibration. It should not be used as a signal simulator for circuit testing. Doing so will burn out the internal driver IC that creates the signal rendering it useless.

The uScope output generator is an ideal signal source for practicing the operation of your new uScope.
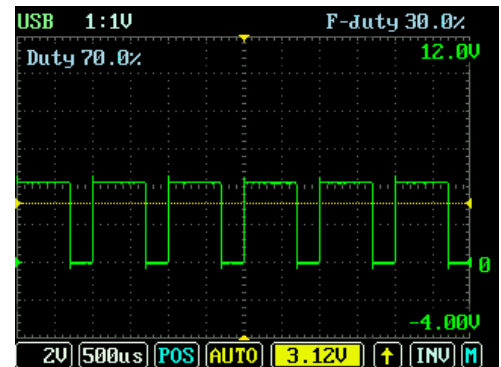
Connecting the Frequency Generator Test Leads

Locate the test lead with two small clips and 3.5mm audio plug. Locate the port labeled 'Wave Out' located on the right side of your uScope. Install the lead. Do not allow the leads clip tips make contact with each other.

To view the signal on the uScope, connect the uScope test lead and the green signal input connector to the white micro clip. The ground clip does not need to be connected.

Adjustments

Basic start scope adjustments:

<div align="center">2V/Div | 10mS/Div | AUTO (Trigger)</div>

Adjusting the frequency and duty cycle

1. Frequency and Duty Cycle Adjustment:
2. Press <OK> to open the Pop-up Menu.
3. Use the (▲▼) arrow keys and highlight OPTIONS.
4. Use the (▲▼) arrow keys and highlight **SigGen Freq** or **SigGen Duty**
- With your selection highlighted, use the (◄►) keys to lower or increase the settings. Note: The current setting will be displayed in the top right of the display.
5. Press <OK> to close the pop-up menu.
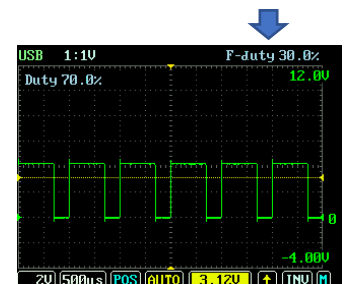
The signal output is **NOT** designed to be used as a circuit driver, or signal/sensor simulator.

Overloading the signal output will destroy the signal circuit driver.

Preset Datasheets

Presets Overview

The uScope comes with a handful of predefined automotive presets. The following pages contain datasheets for 8 of the presets. The presets are loaded to the CF card and accessible through the pop-up menu system. See section titled: **POP-UP MENU | PRESETS | USER SETUPS**

You can also make your own presets and share them with others! See section titled: **CREATING AND NAMING YOUR OWN PRESETS**

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uScope
Single Channel Pocket DSO

aeswave
.com

Fuel Pump Current
Use this setup to view the current in a fuel pump circuit.

2018-03-06

Activate Preset

| **<OK>** to open **Pop-up Menu** | Select **[Presets] > [Amp]** |
| Use **<Left/Right>** arrow keys to locate **FPUMPAMP.AES** |
| Press and hold the **<OK>** button for 2 seconds |

Overview

A fuel pump current waveform can provide important and unique diagnostic information. This setup is optimized to capture the initial turn-on of the pump and then display enough detail to allow for analysis of the brush bar contact.

Setup and Connections !Must use a low amp probe!

A low amp probe with a 100mV/1amp calibration such as the AES# 07-60 must be used. Adapters are available to connect BNC or banana plug amp probes to the uScope.

Low amp probe 100mv/1amp

- **Probe Setup:** With charged battery, set amp probe to 100mV/1Amp setting.
- **Circuit Connection:** Clamp amp probe around wire to fuel pump. The use of a fuse amp loop or relay amp loop can aid in this process.
- **NOTE:** If signal does not appear, flip the amp probe connection to the wire – the amp probe is current direction sensitive.
- **Trigger:** This presets defaults to TRIGGER MODE = SING (single) This means scope will not update until the trigger requirements are met, the scope will capture one waveform. Looking at the image above: When the signal rises up to 640mA the uScope will capture one full waveform and then go into HOLD mode. To rearm the trigger, simply press the <A> button to release the HOLD mode. To get the waveform to continuously update change the TRIGGER MODE = AUTO.

Waveform Analysis

- Consistency in the humps. Watch for repetitive unique features which will represent the integrity of a particular brush bar contact.
- Steady state current level
- Time from start up to steady state

Test Considerations

- Check good to know good
- Load the fuel system while monitoring current level for variations (TRIGGER MODE = AUTO).

If the voltage to the circuit is steady, then the current waveform can be considered a pretty complete picture of the energy the circuit is using. The initial rise in current indicates how much energy it takes to get the pump spinning. The slower it is spinning, the higher the current. As the pump RPM speeds up, the current comes down. The higher the current, the more work is being done and the lower the current the less work. For example: Out of gas = less work = higher pump RPM = lower current. Clogged filter = more work = less RPM = higher current.

- **NOTE:** New pumps can display a very erratic waveform until the brushes have a chance to seat in. Keep in mind that the waveform can be bad but that does not always mean the pressure and volume are bad.

Useful Links

Current Probes | Mastering Low Current Probes | AES TechFeed Support Group

uScope Preset Setting

2A/Div | 10ms/Div | Trig Mode: SING | Trig Level: 64.0mA | Trig Slope: Rising | Invert: NO | Probe Cal: 100mV/1A

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Alternator AC

### (Alternator Diode Waveform)

Use this setup to monitor the performance of the automotive alternator diodes.

Activate Preset

| **<OK>** to open **Pop-up Menu** | Select **[Presets]** > **[Charging]** |
| Use **(◄►)** arrow keys to locate **ALT-AC.AES** |
| Press and hold the **<OK>** button for 2 seconds |

Overview

The automotive charging system has to provide a clean charging voltage and current at all times. The alternator *rectifier* diodes are key for accomplishing this task. When failing, the alternator diodes can create noise that affects all systems and are often the source of "weird" problems.
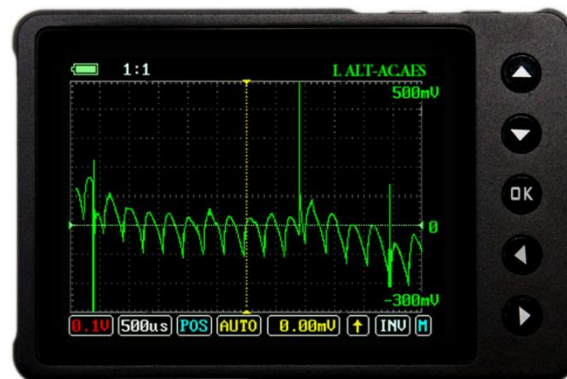
Setup and Connections Must use uScope AC Filter Adapter!

The AC Pass Filter adapter (AES# 03-90-u) must be used. The AC Filter blocks the DC steady portion of the signal allowing for the use of a low volt/div setting to zoom in on the always changing (AC) portion of the signal - the diode humps!

Must use uScope AC Filter Adapter!

- **Probe Setup:** Connect the AC Filter fits in between the signal test lead banana plug and the alligator clip.
- **Circuit Connection:** Connect the signal lead to the positive terminal on the alternator and the ground lead to the alternator housing.

Waveform Analysis

- Consistency in the humps.
- Signal amplitude.

Test Considerations

- Check good to know good!
- Load the alternator by running lights and fans when performing test.

Expect some ignition noise and a general wave to the overall signal. For this preset, also try adjusting the time from 500uS to 1mS/Division.

- When the charging system has little load expect the humps to be shorter than when loaded.
- Don't forget to also check the overall charging voltage - remove the AC Pass Filter and change the volt/division setting to 5 volts/division.

Useful Links

AC Filter Product Page **|** AC Filter Datasheet **|** AES TechFeed Support Group

uScope Preset Settings

0.1V/Div | 500us/Div | Trig Mode: AUTO | Trig Level: 0V | Trig Slope: Rising | Invert: NO | Probe Cal: 1:1

CAUTION

⚠ Do not use the AES AC Pass Filter on alternating current line voltage circuits such as the 120 V AC found in a standard wall socket. It is intended to be used on DC automotive circuits only.
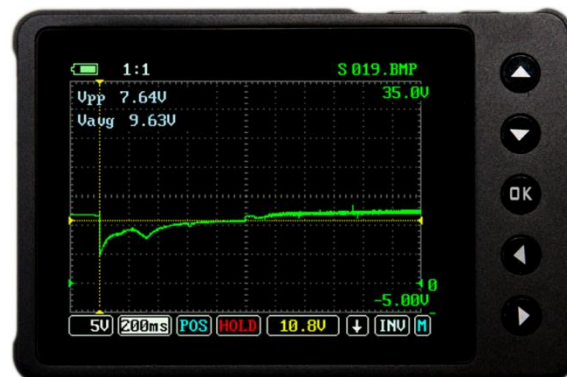
Battery Voltage Cranking

2018-03-06

Use this setup to monitor battery voltage drop during startup and alternator running voltage

Activate Preset

[<OK> to open **Pop-up Menu |** Select **[Presets]** > **[Charging] |**
| Use **(◄►)** arrow keys to locate **BAT-CRNK.AES |**
| Press and hold the **<OK>** button for 2 seconds **]**

Overview

This preset utilizes a slow time/division to graph the initial cranking battery voltage and then the running alternator voltage output. The cranking voltage drop can provide some indication of battery and start system health and the alternator output indicates charging health.

Setup and Connections

The key to this preset is the TRIGGER MODE set to SINGLE and the TRIGGER LEVEL is set just below the no-load battery voltage level @ 10.8v. When cranked, the battery voltage will drop below the trigger level triggering the capture of a single waveform for analysis.

- **Circuit Connection:** Connect directly on the battery posts.
- **Rerun Test:** Press the "A" button on the top right of the scope to re-arm the uScope to rerun the test.

Waveform Analysis & Test Considerations

Analysis rule of thumb: The greater the voltage drop during cranking, the more energy being used to spin the engine/the slower the starter is spinning. Check good to get an idea of what good look is like. And keep in mind that analysis of a cranking voltage test is a combination of what the waveform indicates and what you hear…was the starter struggling or spinning too fast?

Once the engine is started you can monitor the charging voltage. With these setting you can see if the charging votlage is within specifications under different loads such as no load and then with headlights and fans on.

Notes

- Meter reading in display
  - **Vpp:** Voltage Peak to Peak – The (highest voltage) – (lowest voltage) = Voltage Peak to Peak
  - **Vavg:** Voltage Average – Average of all of the voltage sample points.

Useful Links

- AES TechFeed Support Group
- For information regarding checking the alternator Diodes: AC Filter Product Page **|** AC Filter Datasheet

uScope Preset Settings

5V/Div **|** 200ms/Div **|** Trig Mode: SING **|** Trig Level: 10.8V **|** Trig Slope: Falling Edge **|** Invert: NO **|** Probe Cal: 1:1

CAN High + Low

2018-03-06

Use this setup to view the full CAN signal – combining both signals into one.

Activate Preset

| **<OK>** to open **Pop-up Menu** **|** Select **[Presets]** >
[Sensors] **|** Use (◄►) keys to locate **CAN-HL.AES** **|**
| Press and hold the **<OK>** button for 2 seconds **|**

Overview

The CAN bus system is a key part of the information report and
command data pipeline. The CAN signal is composed of two
mirroring signals which can be viewed individually or combined
as one.

CAN High & Low combined

Setup and Connections

- **CAN High plus Low:** To display the combined CAN signal; install the signal lead into CAN HIGH (DLC 6) and the ground lead into CAN LOW (DLC 14).
- **CAN – Individual Signals:** Connect the signal lead to CAN HIGH (DLC 6) or CAN LOW (DLC 14) and the ground lead to signal ground (DLC 5).

Test Considerations ⚠

The TIME/DIV setting for this preset is at 2ms. Fast enough to show data packets. It is possible to go to a faster
TIME/DIV to see more detail but the maximum of 100uS/DIV is recommended since the sample rate of the
uScope is not fast enough to accurately recreate the individual pulses of the data packets.

Waveform Analysis

To become familiar with CAN signals, examine the High and Low individually and then combined waveform. The
strategy of a circuit having a high and low mirrored signals is that if a similar noise is present in both signals it will
be subtracted when both signals are recombined.

Useful Links

AES TechFeed Support Group

uScope Preset Settings

1V/Div | 2ms/Div | Trig Mode: AUTO | Trig Level: 1.36V | Trig Slope: Rising | Invert: NO | Probe Cal: 1:1

Fuel Pump Current

2018-03-06

Use this setup to view the current in a fuel pump circuit.

Activate Preset

| **<OK>** to open **Pop-up Menu** | Select **[Presets]** > **[Amp]** |
| Use (◄►) arrow keys to locate **FPUMPAMP.AES** |
| Press and hold the **<OK>** button for 2 seconds |

Overview

Fuel pump current waveforms can provide important and unique diagnostic information. This setup is optimized to capture the initial turn-on of the pump and then display enough detail to allow for analysis of the brush bar contact.
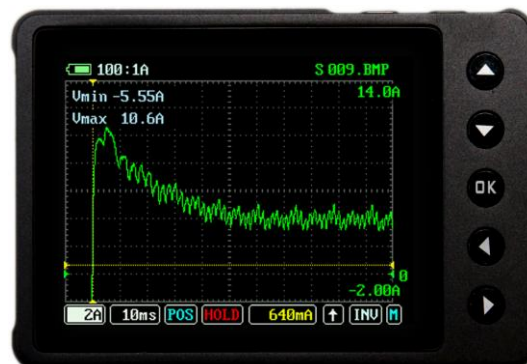
Setup and Connections !Must use a low amp probe!

Low amp probe 100mv/1amp

A low amp probe with a 100mV/1amp calibration such as the AES# 07-60 must be used. Adapters are available to connect BNC or banana plug amp probes to the uScope.

- **Probe Setup:** With charged battery, set amp probe to 100mV/1Amp setting.
- **Circuit Connection:** Clamp amp probe around wire to fuel pump. The use of a fuse amp loop or relay amp loop can aid in this process.
- **NOTE:** If signal does not appear, flip the amp probe connection to the wire – the amp probe is current direction sensitive.
- **Trigger:** This presets defaults to TRIGGER MODE = SING(single) This means scope will not update until the trigger requirements are met, the scope will capture one waveform. Looking at the image above: When the signal rises up to 640mA the uScope will capture one full waveform and then go into HOLD mode. To re-arm the trigger, simply press the **<A>** button to release the HOLD mode. To get the waveform to continuously update change the TRIGGER MODE = AUTO.

Waveform Analysis

- Consistency in the humps. Watch for repetitive unique features which will represent the integrity of a particular brush bar contact
- Steady state current level
- Time from startup (in rush current) to steady current level

Test Considerations

- Check good to know good
- Load the fuel system while monitoring current level for variations (TRIGGER MODE = AUTO).

NOTE: These suggestions are for traditional brush bar type of pumps.

If the voltage to the circuit is steady, then the current waveform can be considered a pretty complete picture of the energy the circuit is using. The initial rise in current indicates how much energy it takes to get the pump spinning. The slower it is spinning, the higher the current. As the pump RPM speeds up, the current comes down. The higher the current, the more work is being done and the lower the current the less work. For example: Out of gas = less work = higher pump RPM = lower current. Clogged filter = more work = less RPM = higher current.

- **NOTE:** New pumps can display a very erratic waveform until the brushes have a chance to seat in. Keep in mind that the waveform can be bad but that does not always mean the pressure and volume are bad.

Useful Links

Current Probes | Mastering Low Current Probes | AES TechFeed Support Group

uScope Preset Setting

2A/Div | 10ms/Div | Trig Mode: SING | Trig Level: 64.0mA | Trig Slope: Rising | Invert: NO | Probe Cal: 100mV/1A

Idle Solenoid

(Voltage Waveform)

Activate Preset

| **<OK>** to open **Pop-up Menu** | Select **[Presets]** >
[Actuators]
| Use **(◄►)** arrow keys to locate **IDLE-SOL.AES**
| Press and hold the **<OK>** button for 2 seconds |

Overview

Idle solenoids are typically digitally controlled to vary the current/magnetic field to open and close the valve. The adjustments for this setup are designed to view the activity of the voltage/digital switching. Different systems may have different strategies as to exactly how the current is controlled. Some systems have 3 or more wires.
Refer to the vehicle system diagram.
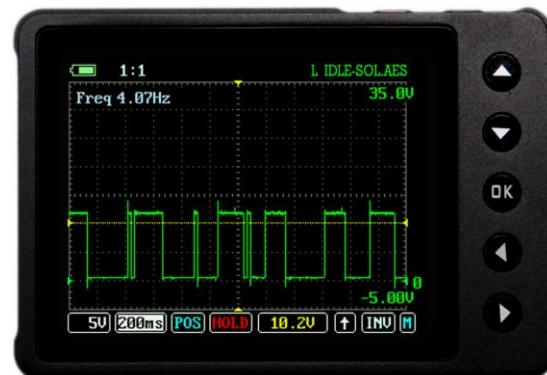
Setup and Connections

Testing is fairly straight forward. Connect to a known good system ground and probe each wire individually. If the wiring diagram references a "High" and a "Low" side signal, the signals might mirror each other.

Waveform Analysis

- Comparative analysis.
- Sharp switch-to-ON transitions.

Test Considerations

- Check good to know good.
- Action and reaction - Change the idle load and watch for a reaction.

Expect some spike noise to be present in the signal. Ideally the Trigger LEVEL is set below the spikes and along the main body of the signal. If voltage switching looks okay it might be helpful to also view a current waveform.

uScope Preset Settings

5V/Div | 200ms/Div | Trig Mode: SCAN | Trig Level: 10.2V | Trig Slope: Rising | Invert: NO | Probe Cal: 1:1

Useful Links

AES TechFeed Support Group

Injector

(Traditional Switch to Ground Injector - Voltage)

2018-03-06

Use this setup to view a traditional switch to ground injector voltage waveform.

Activate Preset

| **<OK>** to open **Pop-up Menu** | Select **[Presets]** > **[Actuators]** |
| Use **(◄►)** arrow keys to locate **INJ-SGND.AES** |
| Press and hold the **<OK>** button for 2 seconds |

Overview

An injector voltage waveform allows for an easy measurement of the injector on-time (pulse width), integrity of the injector driver switching. The spike gives an indication of the combination of the integrity of the coil, the circuit's ability to deliver the needed current and the driver's ability to switch.
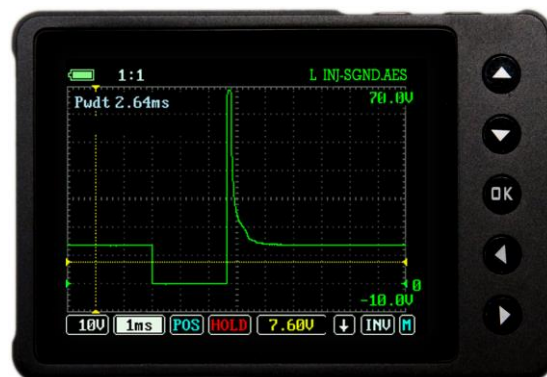
Setup and Connections

- **Circuit Connection:** Scope ground to known good system ground. Back pin the injector connection. If no signal, try the other wire.
- **Probe Considerations:** The maximum voltage that can be displayed by the uScope is 80 volts. Most standard 12 volt injector spikes range from 40 volts to 80 volts and are regulated by a clipping diode. Some injectors such as GDI have spikes that go much higher.
- To fully display injector signals that reach over 80 volts the AES Primary Ignition Probe can be used as a 10:1 probe effectively turning the 10V/DIV max to 100V/DIV max allowing the full signal to be displayed. To add the use of the Primary Ignition probe to this setup, change the PROBE CALIBRATION to 10:1

Waveform Analysis

- Comparative analysis.
- Sharp switching transitions.

Test Considerations

- Check good to know good.
- Action and reaction – Test at different RPMs.

This preset has the TRIGGER MODE = AUTO. This means the screen will update regardless of the TRIGGER requirements being met. In some cases, it might be advisable to change the TRIGGER MODE = NORM resulting in the display updating only when the TRIGGER requirements are met. Do note, in the NORM setting, if the injector signal does not meet the trigger requirements, such as might happens if the injector circuit does not switch, the last good signal will remain on the screen.

This setup also has the TRIGGER HORZ POSITION = LEFT resulting in all triggered evens starting on the left side of the screen. This allows you to use the full screen real-estate giving room for the injector to "open" or for use of a slower TIME/DIV setting to view multiple events.

Notes
- Meter reading in display

  o **Pwdt:** Pulsewidth – injector on-time. **NOTE:** The uScope uses the TRIGGER settings to determine the parameters used for the Pulse Width measurement. In this case, the TRIGGER MODE = NEGATIVE initiates the measurement and the rise in the spike completes it.

Useful Links

Primary Ignition Probe **|** AES TechFeed Support Group

uScope Preset Settings

10V/Div | 1ms/Div | Trig Mode: AUTO | Trig Level: 7.60V | Trig Slope: Falling | Invert: NO | Probe Cal: 1:1

Primary Ignition Voltage
Use this setup to view the current in a fuel pump circuit.

2018-03-06

Activate Preset

| **<OK>** to open **Pop-up Menu |** Select **[Presets]** > **[Ignition] |**
| Use **(◄ ►)** arrow keys to locate **PRI-IGN.AES |**
| Press and hold the **<OK>** button for 2 seconds |

Overview

When accessible, the primary ignition can provide a detailed ignition waveform.

Setup and Connections !Must use primary ignition probe!

The primary ignition can create voltages up to 400 volts or more. Therefore, it is important to use the Primary Ignition Probe part number AES# 01-18-u. The Primary Ignition Probe is a 10:1 divider probe specifically adjusted to view primary ignition.

- **Probe Setup:** Install the Primary Ignition Probe in-between the connection probe and the test lead.
- **Circuit Connection:** Clamp to the negative side of the ignition coil. Consult the wiring diagram if needed. Also, ensure the scope ground lead is securely connected to an engine ground point.
- **NOTE:** This setup uses a probe calibration of 10:1.
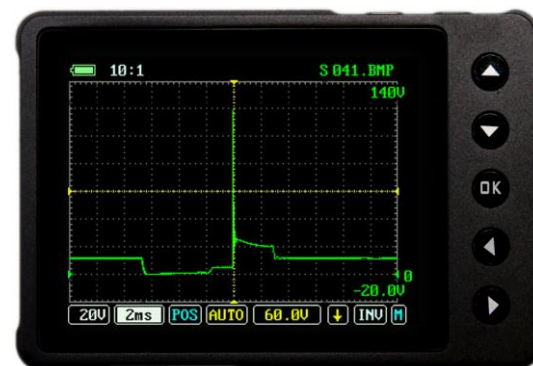
Must use Primary Ignition Probe!

Waveform Analysis

- Analysis can be broken down into defined pieces:
  - Overall dwell period
  - Time to current control (if applicable)
  - Spark line - burn time/voltage
  - KV (spike); consistency.

This preset has the TRIGGER MODE = AUTO. This means the screen will update on the TRIGGER requirements but will also continue to update when the TRIGGER requirements are not met. In some cases, it might be necessary to change the TRIGGER LEVEL or switch to TRIGGER MODE = NORM.

Useful Links

Primary Ignition Probe | Case Study | AESwave Youtube | AES TechFeed Support Group

uScope Preset Setting

20V/Div | 2ms/Div | Trig Mode: AUTO | Trig Level: 60.0V | Trig Slope: Falling | Invert: NO | Probe Cal: 10:1

# Secondary Ignition

2018-03-06

Use this setup to view secondary ignition signals such as DIS and distributor systems.
Use the INVert menu item to flip the waveform as needed.

Activate Preset

[<OK> to open **Pop-up Menu |** Select **[Presets] > [Ignition] |**
| Use **(◄►)** arrow keys to locate **SEC-IGN.AES |**
| Press and hold the **<OK>** button for 2 seconds **]**

Overview

A secondary ignition waveform can be a quick way to determine the basic health of the ignition system – burn time, burn voltage and dwell.
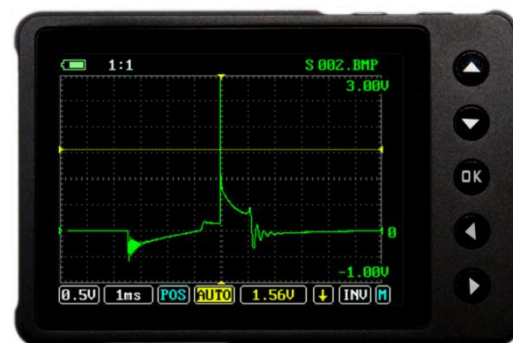
Setup and Connections

A secondary pickup must be used such as the AES# 01-10-u. The AES secondary pickup is capacitive pickup eliminating the need to directly access the high voltage.

Circuit Connection

COP: Ideally, use paddle probe. Start with easiest coil to access. Position the probe over the coil until the best signal is achieved. Repeat on the other coils. Some COP will not show a signal. In these cases, lift the coil module and install a plug wire and use the clip instead of the paddle. Invert the waveform as needed.
DIS: Connect secondary clip to plug wire or touch the paddle probe to the plug wire. On each coil, one wire will have an inverted signal. Invert the waveform as needed.
Distributor: Connect to coil wire. Plug wire signal is not ideal. Invert as needed.
HEI: Central location on distributor cap. Invert the waveform as needed.

INVert [INV]

On some systems the secondary pattern will need to be inverted. To INVert:
[Use (◄►) arrow keys to highlight INV **|** use the (▲▼) arrow keys to toggle between INV=on INV=OFF **]**

Waveform Analysis

In general, examine burn time, voltage and dwell. It is important to look at good waveforms to develop an expectation and to develop confidence in your ability to capture a secondary waveform. Do not forget to do a comparative analysis and to also relate the engine performance to the signal – the signal might not look good but the engine might be running great. Check online to learn more about ignition analysis.

Notes

⚠
- Some system will not show a signal. Others will be so weak that it is necessary to use a lower volt/division setting.
- Do not connect the AES secondary pickup directly to high voltage and *always use the ground connection*.
- The uScope does not have a kV probe calibration setting for ignition. As a rule of thumb consider 1V = 1Kv. With the wide variety of ignition systems and varying signals it is not possible to have an accurate general calibration setting.

uScope Preset Settings

0.5V/Div **|** 1ms/Div **|** Trig Mode: AUTO **|** Trig Level: 1.56V **|** Trig Slope: Falling **|** Invert: NO **|** Probe Cal: 1:1

Useful Links

Secondary Probe Product Page **>** Click Video TAB on product page.   **|**   AES TechFeed Support Group

Online Resources

uScope Video Library

**Video Manual produced and starring AES ambassador,
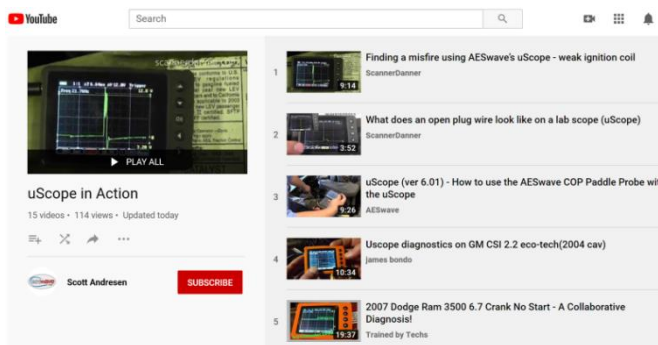friend and uScope expert Justin Morgan**

https://qrgo.page.link/VEr6x

A collection of in-action uScope videos created by technicians from all around the USA and beyond.

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