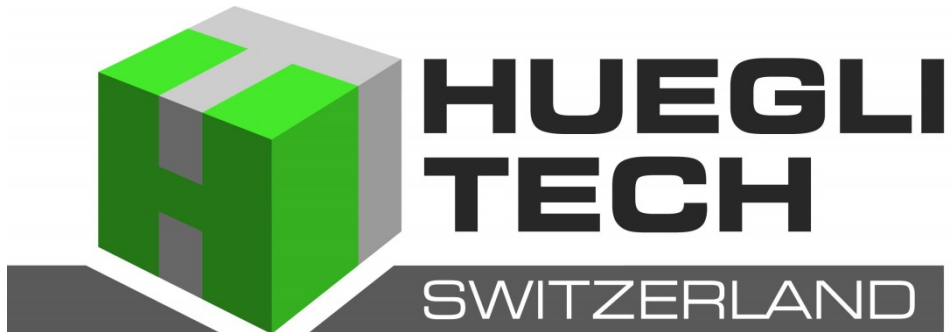


User's Handbook



ENGINE IGNITION ANALYZER

Table of Contents

1. Safety Rules	Page 1
2. Technical Specifications	Page 2
2.1 General specifications	Page 2
2.2 Electrical specifications	Page 2
3. General description	Page 3
3.1 Instrument description	Page 3
3.2 Display description	Page 3
4. Buttons, icons and menus operation	Page 4
4.1 POWER/CLEAR button and menu	Page 4
4.2 CYCLE button and menu	Page 4
4.3 MODE button and menu	Page 5
4.4 VIEW button and menu	Page 5
4.5 HOLD button and menu	Page 6
4.6 Tachometer readings	Page 6
4.7 Battery level indicator	Page 6
5. Measurement modes	Page 7
5.1 Engine RPM	Page 7
5.2 Spark burn (fi ring) time	Page 7
5.3 Spark plug voltage	Page 7
5.4 Dwell angle	Page 7
5.5 Ramp time	Page 7
6. Display views	Page 8
6.1 Chart view	Page 8
6.2 Comparison view	Page 8
6.3 Digital view	Page 9
6.4 Waveform View	Page 10
7. Measurement procedures	Page 11
7.1 Flexible probe and pick-up setup	Page 11
7.2 Measuring coil on plug and coil near plug ignition systems	Page 11
7.3 Measuring ignition systems with spark plug wires	Page 12
8. Recharging the instrument	Page 13
9. Maintenance	Page 14
10. Warranty	Page 14

1. SAFETY RULES

- This instrument is designed for indoor use at temperatures between 32° and 104° F (0°C and 40°C) and altitudes up to 6500 ft (2,000 meters).
- To ensure that the instrument is used safely, follow all safety and operating instructions in this operation manual. If the instrument is not used as described in this operation manual, the safety features of this instrument may be impaired.
- Do not use the instrument if the instrument, the pick-ups or the flexible probe looks damaged, or if you suspect that the instrument is not operating properly.
- When using the instrument, keep away from moving parts (fan, drive belts, etc) and hot objects (exhaust pipes, muffler, catalytic converter, etc.), to avoid personal injuries and damage to the instrument, the pick-ups and the flexible probe.
- Do not connect anything other than the pick-ups supplied with the instrument or apply more than AC or DC power to the pick-up or the flexible probe connectors.
- At all times, to avoid electrical shock, use CAUTION when working with electrical circuits above 60V DC or 25V AC rms. Such voltages pose a shock hazard.
- Do not operate this instrument while connected to the AC power adaptor or any other device.
- To avoid electrical shock or damage to the instrument, do not exceed the specified input limits.

Exceeding the limits listed above when using this apparatus, or not observing the precautions listed above can expose you to physical injury and permanently damage your instrument and/or parts and components of the vehicle under test.

2. TECHNICAL SPECIFICATIONS

2.1 General specifications

Display:	3.5" TFT LCD, 320 x 240 pixels resolution.
Frame rate:	Up to 30 times per second.
Ignition system comp.:	Coil on plug, coil near plug, DIS, waste spark, conventional, and magneto.
Engine cycle:	2 or 4 strokes.
Power (internal):	3.2 volt/1500 mAh, rechargeable LiFePO4 battery
Auto power off:	Automatically powers off after 3 min. of inactivity.
Battery life:	Approximately 6 hours of continuous operation.
USB connector (input):	Micro USB (5 Volt / 0.5 Amperes DC).
Probe length:	13.5" (34 cm) including pick-up.
Dimensions:	6.3" x 3.9" x 1.3" (160 x 99 x 34 mm) without probe.
Weight:	Approximately 14 oz. or 406 g without probe.
Included accessories:	Spark plug wire pick-up, coil on plug pick-up, BNC flexible probe, protective rubber holster, padded hard carrying case, micro USB cable, AC power adaptor and user's handbook.

2.2 Electrical Specifications

- The specifications below are typical at 23° C, and will vary slightly from device to device, and with temperature. The input voltage should not exceed the indicated

Measurement Mode	Measurement Range	Accuracy/Resolution
Tachometer	400 to 19999 RPM 2 and 4 cycles and DIS	Accuracy: 0.5% ± 1 LSD
Spark plug voltage (kV)	0 to 50 kV	Resolution: ± 0.01 kV
Spark burn (firing) time	0 to 12 ms	Resolution ± 0.05 ms
Dwell angle	0 to >270° (4 stroke / 600 RPM) 0 to >180° (2 stroke / 750 RPM)	Resolution: ± 0.1°
Ramp time (Ignition coil primary current ramp time)	0 to 35 ms	Accuracy: ± 0.05 ms

maximum values, to prevent personal injury or damage to the instrument.

3. GENERAL DESCRIPTION

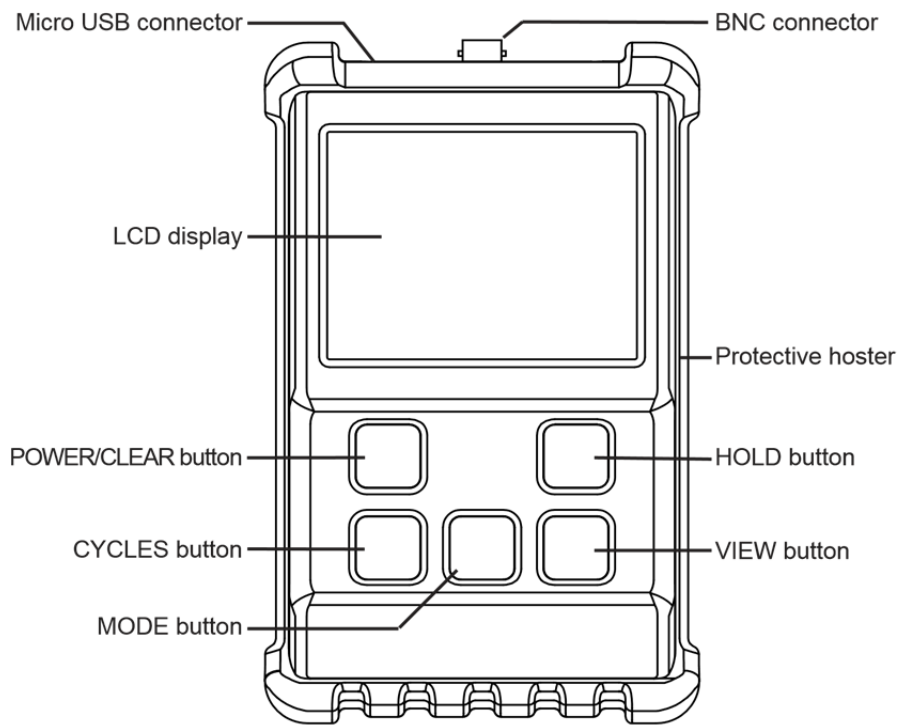


Fig. 1 - Instrument description

3.1 Instrument Description

3.2 Display description

4. BUTTONS, ICONS AND MENUS OPERATION

4.1 'POWER/CLEAR' button



- When the instrument is OFF, to turn it ON press and hold the 'POWER/CLEAR' button until the unit turns on (in approximately 1 second).
- When the instrument is ON, to turn it OFF press and hold the "POWER/CLEAR" button until the display turns OFF (in approximately 3 seconds).
- When the instrument is ON, press the 'POWER/CLEAR' button to clear all measurement data, and start a new measurement. This operation can be also performed to re-scale the measurements and optimize viewing in the display.
- The 'Auto Power Off' feature will automatically turn the instrument off after 3 minutes of no button being pressed or 15 seconds after the last spark signal was detected. Turning the unit off manually when not in use will prolong battery life.

4.2 'CYCLE' button and menu



- The 'CYCLE' button allows selection of the number of strokes corresponding to the engine under measurement. Upon pressing this button, a pull down menu will open with the current setting highlighted. To change the setting press the 'CYCLE' button repeatedly until the correct setting is highlighted, then wait until the pull down menu closes. The new setting will be displayed as the cycle icon at the top of the screen.

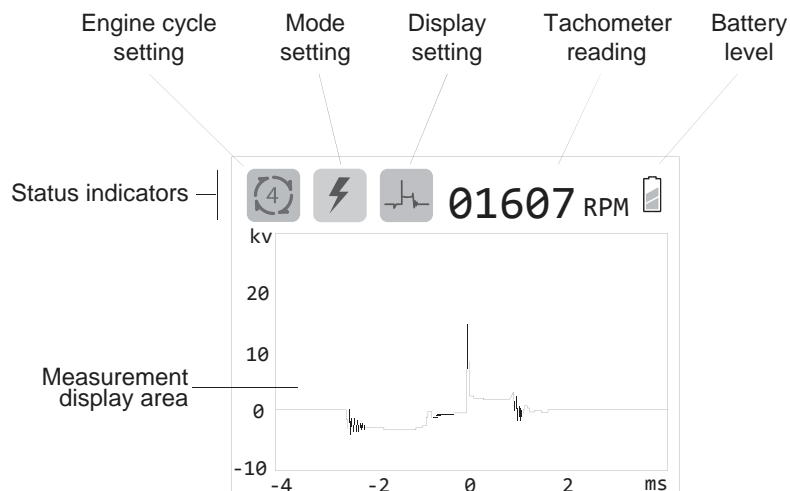


Fig. 2 - LCD Display

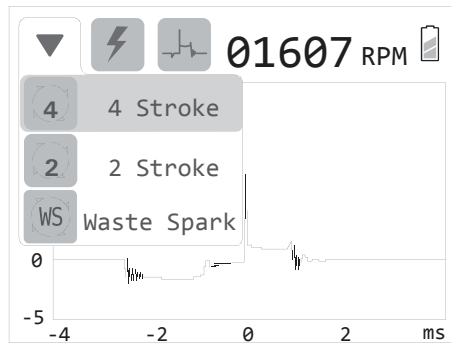


Fig. 3 - Engine cycle selection menu



2 stroke engine cycle



4 stroke engine cycle



DIS or waste spark ignition system

4.3 'MODE' button and menu



The 'MODE' button allows the selection of the type of measurement to be shown in the display. Upon pressing this button a pull down menu will open with the current setting highlighted. To change the setting press the 'MODE' button repeatedly until the desired setting is highlighted, then wait until the pull down menu closes. The new current setting will be displayed as the mode icon at the top of the screen.

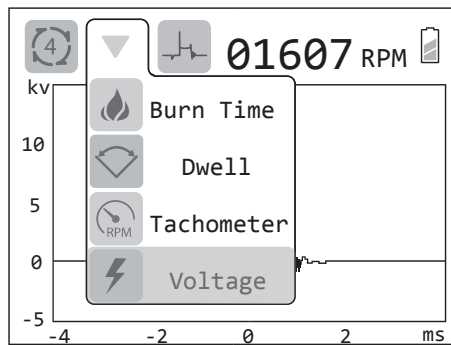


Fig. 4 - Measurement selection menu



Measuring/displaying spark burn (fi ring) time.



Measuring/displaying dwell angle or ramp time (automatically selected depending on the connected sensor).



Measuring/displaying RPM (tachometer).



Measuring/displaying spark plug voltages.

4.4 'VIEW' button and menu



The 'VIEW' button is used to select how the chosen measurement will be shown in the display. Upon pressing this button a pull down menu will open with the current setting highlighted. To change the setting press the 'VIEW' button repeatedly until the desired setting is highlighted, then wait until the pull down menu closes. The new setting will be displayed as the display icon at the top of the screen.

Page 5

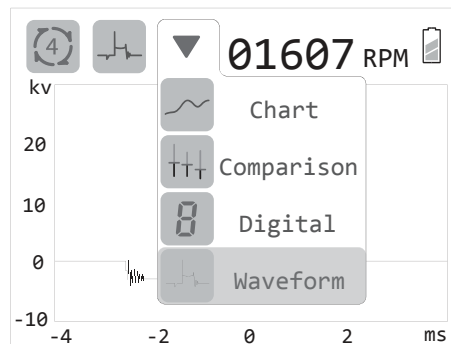


Fig. 5 - Display mode selection menu



Chart (i.e. trend line) view.



Comparison view.



Digital and analog gauge readouts.

Waveform (i.e. oscilloscope) view.

4.5 'HOLD' button



- When chart, digital or waveform display mode is selected, pressing the 'HOLD' button will pause the measurement, hold the current display, and the word "HOLD" will be shown in the measurement area of the display to indicate this status. Press the 'HOLD' button again to resume normal operation.
- When in the comparison display mode, this button is used to initiate and stop a measurement. For details see '6.2 Comparison view'.

4.6 Tachometer reading

Digital readout of the engine RPM.

4.7 Battery level indicator

The battery level indicator provides an approximate indication of the state of charge of the internal battery, as follows:



NOTE: The instrument will turn automatically off if the battery voltage falls below the absolute minimum.

Page 6

5. MEASURING MODES

There are four different ignition system parameters that can be selected for measurement, depending on the engine's ignition system:

- Engine RPM.
- Spark burn (fi ring) time.
- Spark plug voltage.
- Dwell angles (for ignition systems equipped with high voltage spark plug wires).
- Primary ignition coil current ramp time (for coil on plug and coil near plug ignition systems).

5.1 Engine RPM

Measures engine RPM (revolutions per minute) in 2 and 4 stroke engines, and may be used in combination with other measurements to evaluate ignition system performance at different engine speeds.

5.2 Spark burn (fi ring) time

The spark burn time, also called "fi ring time", is the measurement of the period from the moment a spark is initiated up to the point when it is extinguished, and is the most indicative measurement of performance of the ignition system. Abnormally long or short

burn times may indicate some problem in the ignition module, spark plug, fuel mixture, cylinder compression, etc.

5.3 Spark plug voltage

Spark plug voltage values are useful for comparing the performance of the ignition system between cylinders. This may be used to diagnose common problems like misfires, broken spark plug wires, etc. Spark plug peak voltages may vary widely, are less consistent and not always indicative of a properly working ignition system. On the other hand, observation of the spark plug voltage waveform or trend may prove useful in diagnosing ignition and mechanical problems.

5.4 Dwell angle (for ignition systems using spark plug wires only)

Dwell angle is a measurement of the angle of rotation of the crankshaft, between the moment in which the primary of the ignition coil is energized (e.g. point contacts closed) and the spark is generated (e.g. point contacts opened). Its main use is in determining if there is enough angle (or time) to energize the primary of the ignition, and not so much as to cause the ignition coil to overheat and fail. Dwell angles are specified for a particular engine and RPM, and usually adjusted in the mechanical distributor/point assembly.

5.5 Current ramp time (for coil on plug and coil near plug only)

Ramp time is measured from when the primary coil current first begins to increase to when it stops increasing. The current may stop increasing because the coil has reached its saturation point, or it is interrupted to generate a spark.

Ramp time measurements are useful for diagnosing problems in the primary circuit of the ignition module. Abnormally long ramp times may indicate excessive primary circuit resistance, low input voltage, that the wrong module is installed, etc. Shorter than normal ramp times may indicate a shorted primary coil, that the wrong module is installed, etc.

6. DISPLAY VIEWS

There are four views that can be selected to display measurements:

- Chart
- Comparison
- Digital
- Waveform

6.1 Chart view

This view displays the selected measurement's value corresponding to each of the last 276 sparks, with the left most measurement being the oldest, and the rightmost the newest. The measurement scale and units are located on the vertical axis, at the far left of the display.

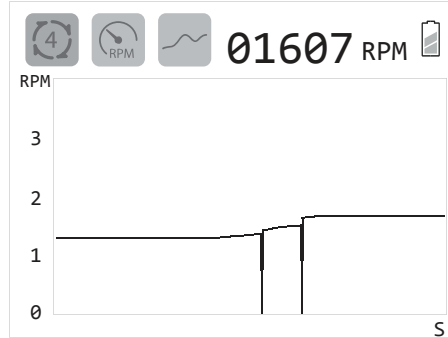


Fig 6 - Chart mode display

- **'POWER/CLEAR' button:**
Pressing the Power/Clear button clears all values in the chart, and re-scales the chart if necessary.
- **'MODE' button:**
Pressing the 'MODE' button once will open the mode menu, and highlight the measurement mode currently selected; pressing the 'MODE' button again while the menu is open will select the next available measurement mode. All four measurements (spark burn time, RPM, spark plug peak voltage, dwell angle and ramp time) are simultaneously tracked and stored, and are available for viewing at any time (without delay).
- **'HOLD' button:**
Pressing this button will pause the current measurement, and hold the display in it the current condition. Pressing the 'HOLD' button again will resume normal measurement.

6.2 Comparison view

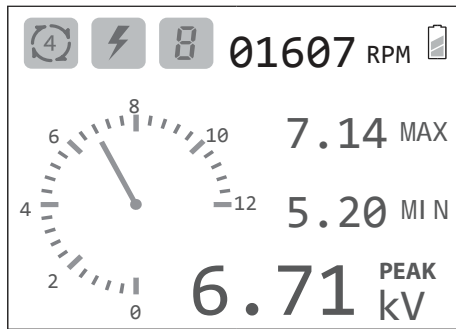
This mode allows the comparison of sets of values (minimum, average and maximum measurements) between several cylinders, under various testing conditions, and in many other situations. The measurements are displayed from left to right, with the left most set of values being the oldest, and the rightmost the newest. A new set of values is added every time the 'HOLD' button is pressed twice (start/stop) and up to the last 12 sets of values will be shown in the graph at once, if this maximum is exceeded, the oldest set will be deleted and a new set

added. The measurement scale and units are located on the vertical axis, at the far left of the display.

- **'POWER/CLEAR' button:**
Pressing the 'POWER/CLEAR' button clears all measurements, and re-scales the chart if necessary.
- **'MODE' button:**
Pressing the 'MODE' button once will open the mode menu, and highlight the measurement mode currently selected; pressing the 'MODE' button again while the menu is open will select the next available measurement mode. All four measurements (spark burn time, RPM, spark plug peak voltage and dwell angle and ramp time) are simultaneously tracked and stored, and are available for viewing at any time (without delay).
- **'HOLD' button:**
The 'HOLD' button when pressed once pauses measurement and holds the display in its current condition (while displaying a "HOLD" label in the center of the screen). Pressing the 'HOLD' button a second time will remove the pause (and label), and add a new set of values at the right of the screen, which will keep updating until the 'HOLD' button is pressed again. This cycle repeats every time the button is pressed twice (start/stop) and up to the last 12 set of values will be shown in the display at once, if this maximum is exceeded the oldest set will be deleted and a new set added.

6.3 Digital view

This view provides digital and analog gauge readouts for the selected measurement, as well



as digital readouts for the other three measurements.

Fig. 8 - Digital mode display

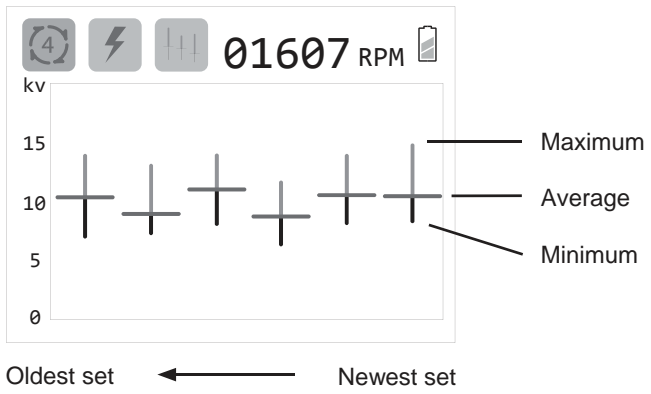


Fig. 7 - Comparison mode display

- **'POWER/CLEAR' button:**
Pressing the 'POWER/CLEAR' button clears all values in the graph, and re-scales the gauge if necessary.
- **'MODE' button:**
Pressing the 'MODE' button once will open the mode menu, and highlight the measurement mode currently selected; pressing the 'MODE' button again while the menu is open will select the next available measurement mode. All four measurements (spark burn time, RPM, spark plug peak voltage and dwell angle and ramp time) are simultaneously tracked and stored, and are available for viewing at any time (without delay).
- **'HOLD' button:**
Pressing this button will pause measurement, and hold the display in the current condition. Pressing the 'HOLD' button again will resume normal measurements.

6.4 Waveform View

This mode displays the signal amplitude over time (like an oscilloscope). The scale and units of the measurement are located on the vertical axis, at the far left of the display. The time scale and units are shown below the horizontal axis, at the bottom of the screen.



Fig. 9 - Waveform display

- **'POWER/CLEAR' button:**
Pressing the 'POWER/CLEAR' button clears all values in the graph, and re-scales the graph if necessary.
- **'MODE' button:**
Pressing the 'MODE' button once will open the mode menu, and highlight the measurement mode currently selected; pressing the 'MODE' button again while the menu is open will select the next available measurement mode. The waveform graph focuses on the area of the spark waveform which is most relevant to the mode selected.
- **'HOLD' button:**
Pressing this button will pause the current measurement, and hold the display in the current condition. Pressing the 'HOLD' button again will resume normal measurement.

7. MEASUREMENT PROCEDURES

CAUTION

To avoid personal injuries and damage to the instrument carefully inspect the spark plug wires, distributor cap, ignition coil, ignition module, and all other ignition system parts for damage or leaks, and avoid using this instrument in case any damage or leaks are found. Never touch the capacitive pick-up or flexible probe during a test. Wear insulating gloves when working around high voltage, and hot parts, and keep away from moving parts (fan, drive belts, etc.) and hot objects (exhaust manifold and pipes, muffler, catalytic converter, etc.)

7.1 Flexible probe and pick-up setup

This instrument is supplied with a flexible probe, and two types of pick-up sensors:

- Flexible probe: equipped with a BNC connector at one end and a barrel connector at the other.
- COP pick-up: for measuring coil on plug and coil near plug ignition systems.
- SPW pick-up: for all ignition systems which use high voltage wires (spark plug wires) to connect the ignition coil or distributor to the spark plug.

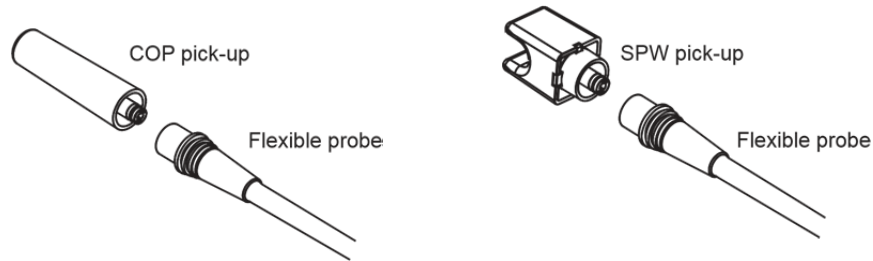


Fig.10 - Pick-up connection to flexible probe

- 1- Connect the probe to the instrument using their BNC connectors.
- 2- Insert and firmly press the appropriate COP or SPW pick-up into the barrel connector of the probe.

NOTE: The instrument will automatically detect and configure the pick-up connected to the probe. Using the wrong pick-up for the ignition system under measurement may lead to erroneous readings, or no readings at all.

7.2 Measuring coil on plug and coil near plug ignition systems

- 1- Ensure the instrument is turned off.
- 2- Insert the COP pick-up barrel connector plug into the flexible probe receptacle, removing the SPW pick-up if necessary.
- 3- Turn the instrument on and select the appropriate cycle for the engine under measurement.
- 4- Select the desired mode and view.
- 5- Place the COP pick-up on the top and center of the ignition module (as shown in the Fig. 11), and observe whether the instrument is able to detect and display the desired measurement.

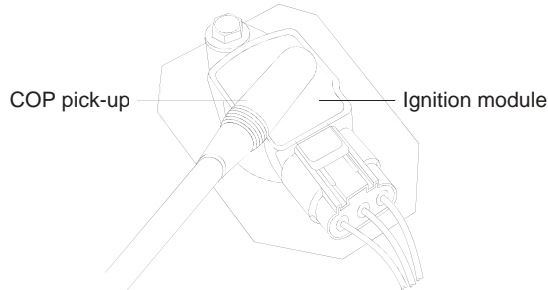


Fig. 11 - Using the COP pick-up on a ignition module

6- If the instrument is unable to detect the ignition system signal, it may be necessary to reposition the pick-up so that a consistent signal is detected and displayed.

NOTES

- The position of the pick-up and the particular design of the ignition module may affect the signal's shape shown when the waveform display is selected. In order to compare waveforms between several cylinders' ignition modules, the placement of the pick-up relative to the ignition module should be kept as consistent as possible for all the measurements.
- In some engines, the ignition modules are located very close together, and in rare occasions this could cause the instrument's pick-up to detect signals from nearby modules, leading to inconsistent measurements. This can usually be solved by changing the placement or orientation of the pick-up on the ignition module.

7.3 Measuring ignition systems with (high voltage) spark plug wires

- 1- Ensure the instrument is turned off.
- 2- Insert the SPW pick-up barrel connector plug into the flexible probe receptacle, first removing the COP pick-up if necessary.
- 3- Turn the instrument on, and select the appropriate cycle for the engine under measurement.
- 4- Select the desired mode and view.
- 5- Place the spark plug wire into the slot of the pick-up, and as far as possible from other spark plug wires trying to maintain a right angle (90°) between the pick-up and the

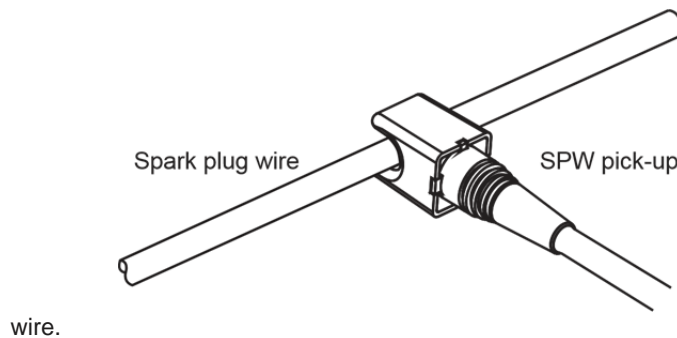


Fig. 12 - Using the SPW pick-up on a spark plug wire

6- If the instrument is unable to detect the ignition system signal, it may be necessary to reposition the pick-up so that a consistent signal is detected and displayed.

NOTES

- The absolute spark plug voltage reading will depend on the position of the pick-up, the particular characteristics of the wire, etc.. Therefore the placement of the pick-up relative to the wire should be kept as consistent as possible for all the measurements in order to compare voltage readings between several cylinders' spark plug wires.
- Spark burn time, dwell angle and RPM measurements are not sensitive to the exact position of the pick-up relative to the spark plug wire, but the pick-up must be positioned so the instrument is capable of detecting the signal.
- When several spark plug wires are routed or bunched close together, the capacitive pick-up may receive signals from two or more wires simultaneously, which could cause erroneous measurements. In these situations it is necessary to separate the wire under measurement from the others, in order to reduce interference and obtain an accurate measurement.

8. RECHARGING THE INSTRUMENT

1. If still operating, turn the instrument power off.
2. Locate and lift the rubber cap (attached to the protective holster and located besides the BNC connector) to reveal the micro USB receptacle.

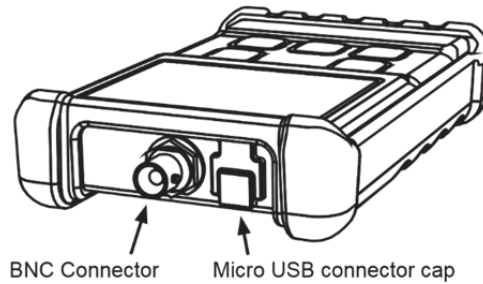


Fig. 13 - Instrument's connectors

3. Insert the USB charger cable's micro USB plug into the receptacle of the instrument matching the orientation of the connectors.
4. Insert the USB type A connector of the cable into the USB port of the supplied USB power charger adapter, and plug the power adapter into an AC power outlet.
5. Upon start of charging the battery, the display will show the charging in progress icon and the screen will turn off after a few seconds.



Charging in progress Charging complete

Fig. 14 - Charging indicators

6. If the instrument is turned on (by pressing the 'POWER/CLEAR' button) at any time while connected to the power adapter, the instrument will display the charging status.
7. The USB type A connector can be also plugged into a USB port of a personal computer, powered USB hub, or any other USB compliant power source.
8. The recharge time will depend on the state of charge of the battery, and it may take up to 6 hours to fully recharge a depleted battery.

NOTES

- If the instrument has not been used for a long time, or the state of charge of the battery has fallen to a critically low level, a period of pre-conditioning of the battery is automatically added to the normal charging cycle, which increases the charging time in order to restore the battery capacity to its maximum, No user intervention is needed, and this process is automatically carried out by the instrument.
- If the battery is completely depleted, pressing the power on button will not turn the instrument on, and it must be recharged before it can be used again.

9. MAINTENANCE

Keep the instrument in its carrying case when not in use and do not subject it to dampness or severe heat or cold. Do not use the instrument in the rain, if it should accidentally get wet, dry it off with a clean paper towel before storing it away.

Protect the unit from contact with any solvents. Never clean with a solvent or petroleum based medium such as gasoline, as these chemicals may attack the plastic parts and cause permanent damage. Never use an abrasive cleaner. Cleaning should be limited to wiping with a clean damp paper towel and a small amount of soap if required. Dry the unit thoroughly after any cleaning.

The unit is a sealed instrument, and contains no user serviceable parts. Opening this instrument will void the warranty.

10. WARRANTY

This instrument carries a one (1) year warranty (from the date of purchase by the original owner) against defects of material or workmanship. For details see our Standard Warranty Information on our web page at www.huegli-tech.com or, request a printed copy.

To visit our website,

type in your browser

www.huegli-tech.com