User's Manual

GTC505
ENGINE IGNITION ANALYZER

General Technologies Corp.

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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 user's manual, the safety features of this instrument may be impaired.
- Do not use the instrument if the instrument, the sensors, or the flexible probe look 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 sensors, flexible probe and extension cable..
- Do not connect the instument to anything other than the sensors, flexible probe, extension cable, USB cable, or AC power adapter provided.
- At all times, to avoid electrical shock, use CAUTION when working with electrical circuits above 60 VDC or 25 VAC 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 type:	Coil on plug, coil near plug, DIS, waste spark, conventional, and magneto.
Engine cycle:	2-stroke and 4-stroke.
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 sensor.
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 sensor, coil on plug sensor, BNC flexible probe, protective rubber holster, padded hard carrying case, micro USB cable, AC power adaptor, and user’s manual. The model GTC505m also includes a 83.5” (212 cm) long coaxial extension cable and a clip-on spark plug wire sensor.

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

Measurement Mode	Measurement Range	Accuracy/Resolution
Tachometer	120 to 19999 RPM 2-stroke, 4-stroke and waste spark	Accuracy: 0.5% ± 1 LSD
Spark plug voltage	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: ± 0.1º
Ramp time (ignition coil primary current ramp time)	0 to 35 ms	Resolution: ± 0.05 ms

3. GENERAL DESCRIPTION

3.1 Instrument description

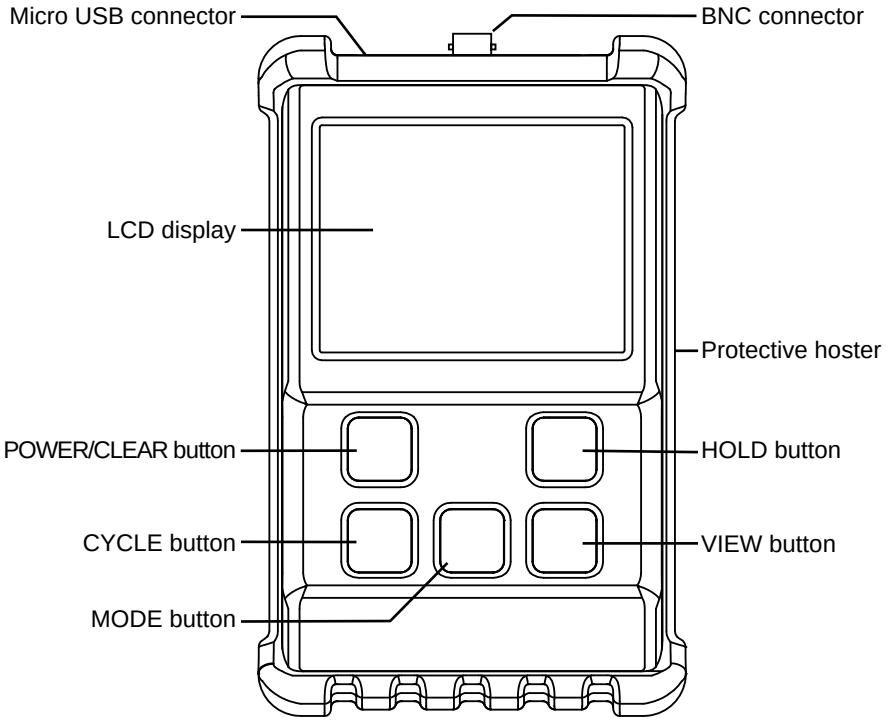

Fig. 1 - Instrument description

3.2 Display description

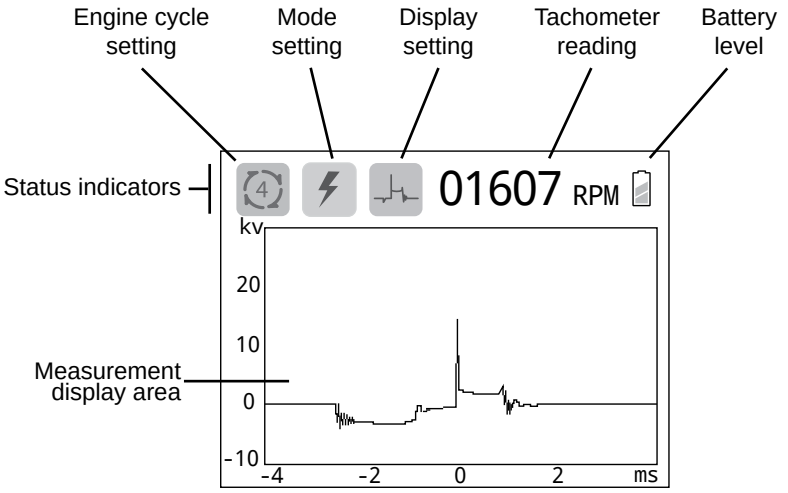

Fig. 2 - LCD Display

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 be 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.

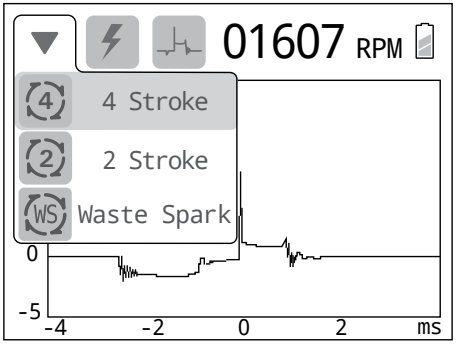

Fig. 3 - Engine cycle selection menu

2-stroke engine cycle

4-stroke engine cycle

DIS or waste spark ignition system

4.3 ‘MODE’ button and menu

MODE

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.

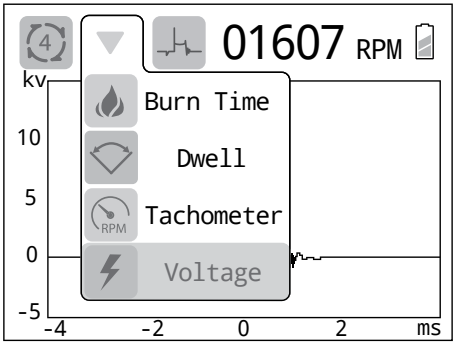

Fig. 4 - Measurement mode selection menu

Measuring/displaying spark burn (firing) 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

VIEW

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.

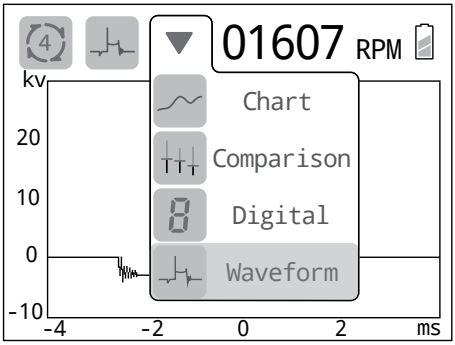

Fig. 5 - Display mode selection menu

Chart (i.e. trend line) view.

Comparison view.

Analog gauge and digital 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 automatically turn off if the battery voltage falls below its minimum safe level.

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 (firing) 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-stroke 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 (firing) time

The spark burn time, also called "firing 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 right most the newest. The measurement scale and units are located on the vertical axis, at the far left of the display.

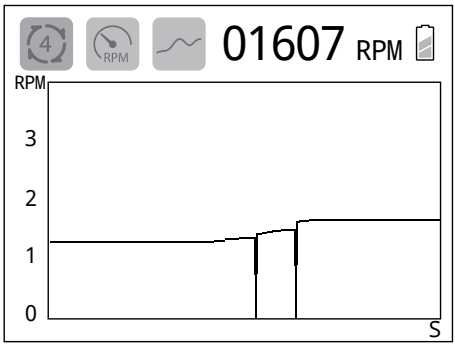

Fig 6 - Chart view display

- **'POWER/CLEAR' button:**
  Pressing the Power/Clear button clears all values from 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, and dwell angle or 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 measurement, and hold the display in its 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, or other situations. The measurements are displayed from left to right, with the left most set of values being the oldest, and the right most the newest . A new set of values is added every time the 'HOLD' button is pressed twice (stop/start) and up to the last 16 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.

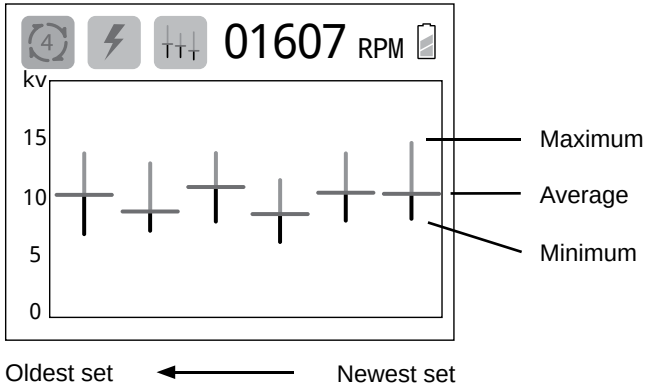

Fig. 7 - Comparison mode display

- **'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 (stop/start) and up to the last 16 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 analog gauge and digital readouts for the selected measurement, as well as digital readouts for the three other measurements.

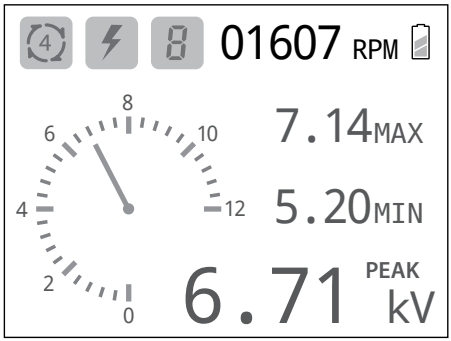

Fig. 8 - Digital mode display

- **'POWER/CLEAR' button:**
  Pressing the 'POWER/CLEAR' button clears all digital readout values, 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.

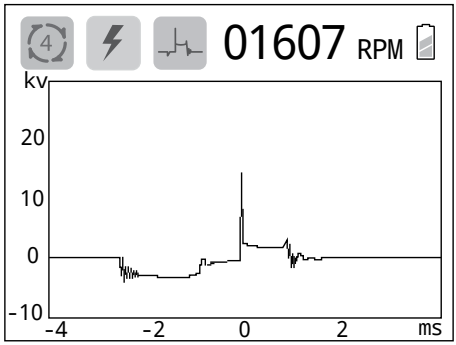

Fig. 9 - Waveform display

- **'POWER/CLEAR' button:**
  Pressing the 'POWER/CLEAR' button clears the graph, and re-scales 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 modules and all other ignition system parts for damage or leaks, and avoid using the instrument in case any damage or leaks are found. Never touch the sensor, flexible probe or cable 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.).

The instrument will automatically detect and configure according to the sensor connected to the probe or extension cable. Using the wrong sensor for the ignition system under measurement may lead to erroneous readings, or no readings at all.

7.1 Flexible probe and sensor setup (GTC505 and GTC505m)

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

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

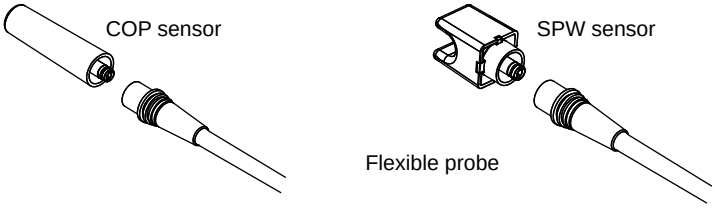

Fig.10 - Sensors connection to flexible probe

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

7.2 Extension cable and sensor setup (GTC505m only)

The GTC505m is also supplied with a extension cable and clip-on spark plug wire sensor to allow for remote measurements:

- Extension cable: 83.5” (212 cm) long coaxial cable equipped with a BNC connector at one end and a barrel connector at the other. This extension cable can be used with COP, SPW and the clip-on SPW sensor.
- Clip-on SPW sensor: for all ignition systems which use high voltage wires (spark plug wires) to connect the ignition coil or distributor to the spark plug.

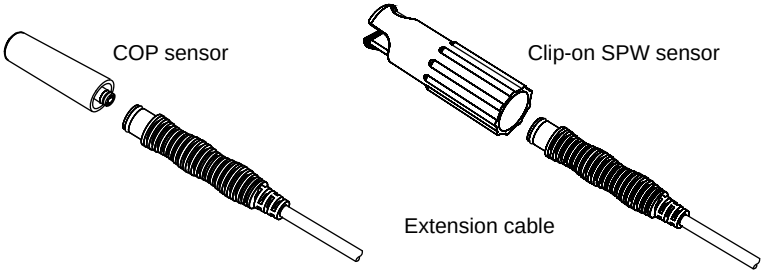

Fig.11 - Sensors connection to extension cable

1- Connect the extension cable to the instrument using their BNC connectors.
2- Insert and firmly press the appropriate COP or clip-on SPW sensor into the barrel connector of the extension cable.

7.3 Measuring coil on plug and coil near plug ignition systems

1- Ensure the instrument is turned off.
2- Insert the COP sensor barrel connector plug into the flexible probe receptacle, removing the SPW sensor 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 sensor on the top and center of the ignition module (as shown in the Fig. 12), and observe whether the instrument is able to detect and display the desired measurement.

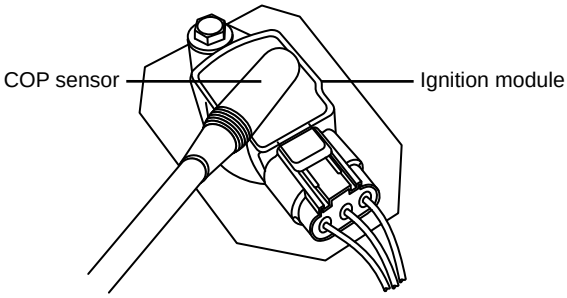

Fig. 12 - Using the COP sensor on a ignition module

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

NOTES

- The position of the sensor 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 sensor 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 sensor to detect signals from nearby modules, leading to inconsistent measurements. This can usually be solved by changing the placement or orientation of the sensor on the ignition module.

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

1- Ensure the instrument is turned off.

2- Insert the SPW or Clip-on SPW sensor barrel connector plug into the flexible probe or extension cable receptacle.

3- Turn the instrument on, and select the appropriate cycle for the engine under measurement.

4- Select the desired mode and view.

5- If using the SPW sensor, place the spark plug wire into the slot of the sensor, and as far as possible from other spark plug wires trying to maintain a right angle (90°) between the sensor and the wire.

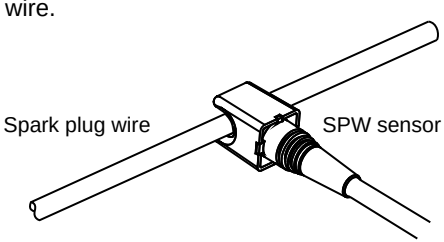

Fig. 13 - Using the SPW sensor on a spark plug wire

6- If using the clip-on SPW sensor, place the spark plug wire into the slot of the sensor, as far as possible from other spark plug wires, and turn the body clockwise 60° to lock the sensor on the spark plug wire. To unlock, turn the body of the sensor 60° counterclockwise.

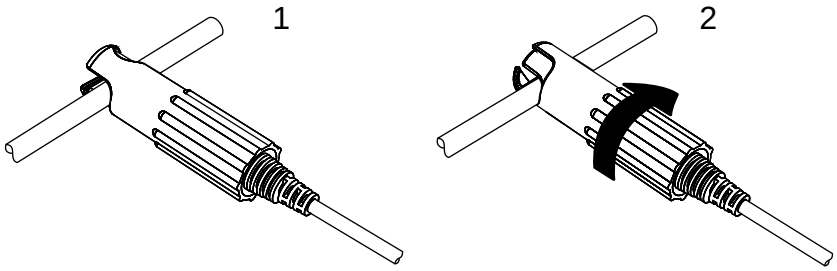

Fig. 14 - Using the clip-on SPW sensor on a spark plug wire

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

NOTES

- The absolute spark plug voltage reading will depend on the position of the sensor, the particular characteristics of the wire, etc.. Therefore the placement of the sensor relative to the wire should be keep 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 sensor relative to the spark plug wire, but the sensor 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 sensor 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.

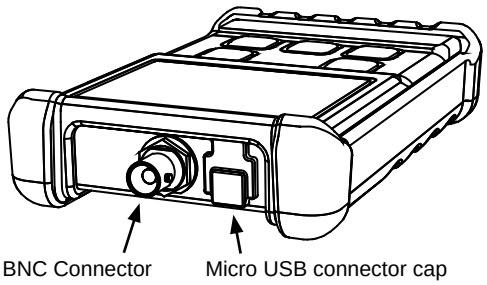

Fig. 15 - Instrument's connectors

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. 16 - 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.

5- 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, 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.