

User's Manual

GTC 505

ENGINE IGNITION ANALYZER

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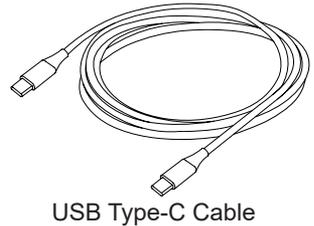
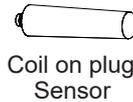
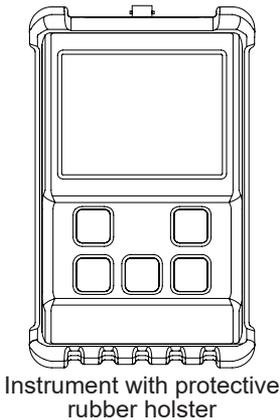
1. SAFETY RULES

- 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 sensor cable..
- Do not connect the instrument to anything other than the sensors, flexible probe, sensor cable or USB cable 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.

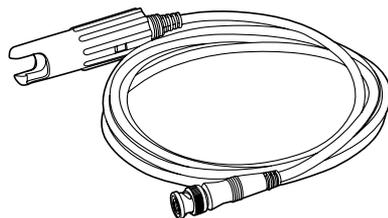
2. PARTS AND ACCESSORIES

2.1 Included with GTC505 and GTC505m Kits



2.2 Available Separately (Included with GTC505m)

Sensor cable 83.5" (212 cm) long and clip-on spark plug wire sensor



3. TECHNICAL SPECIFICATIONS

3.1 General Specifications

Display:	3.5" IPS LCD, 320 x 240 pixels resolution.
Frame rate:	Up to 30 times per second.
Ignition system type:	Coil on plug, coil near plug, distributorless, waste spark, conventional, rotary and magneto.
Power (internal):	3.2 volt/1600 mAh, rechargeable LiFePO4 battery.
Auto power off:	Automatically powers off after 3 minutes of inactivity.
Battery life:	Approximately 4 hours of continuous operation.
BNC Connector:	6.5V, 40 mA output, 20 V maximum input.
USB connector (input):	USB Type-C receptacle (5 volt / 1.0 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 BNC flexible probe.
Weight:	Approximately 14 oz. or 406 g without BNC flexible probe.

3.2 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. These specifications are subject to change without notice.

Measurement Mode	Measurement Range	Accuracy/Resolution
Spark burn (firing) time	0.3 to 13.3 ms (COP) 0.3 to 8 ms (SPW)	Resolution: 0.01 ms
Distributor Dwell	0 to 35.55% duty cycle (4-stroke / 600 RPM+)	Resolution: 0.01 %
Distributorless Dwell	0 to 17.77 ms (4-stroke / 600 RPM+)	Resolution: 0.01 ms
Tachometer	120 to 19999 RPM 2-stroke, 4-stroke and waste spark	Accuracy: 0.5% ± 1 LSD
Spark plug voltage	1.5 to 50 kV	Resolution: 0.01 kV

4. GENERAL DESCRIPTION

4.1 Instrument Description

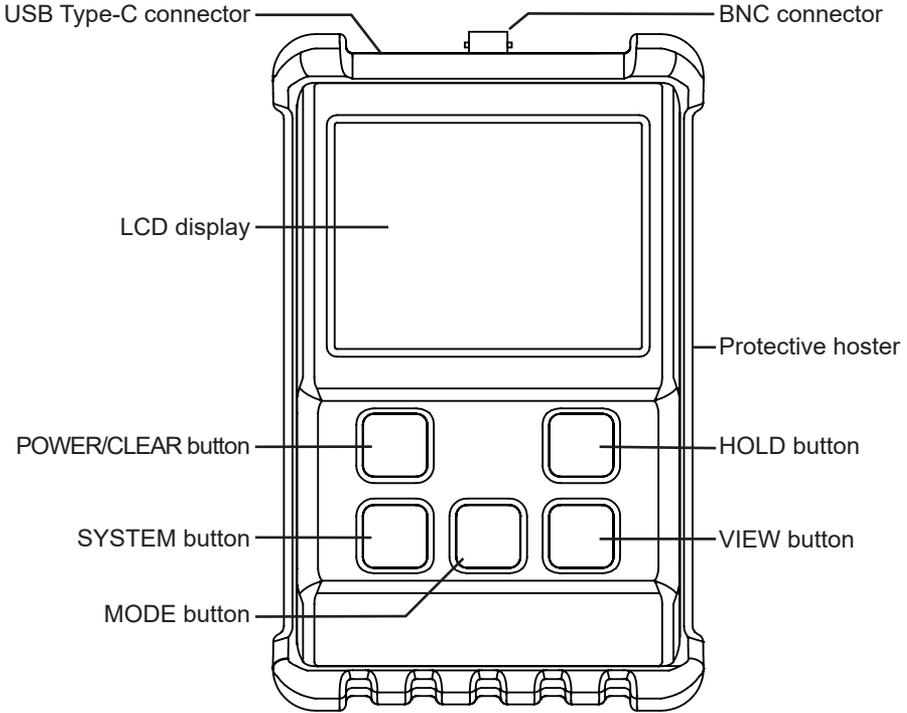


Fig. 1 - Instrument diagram

4.2 Display Description

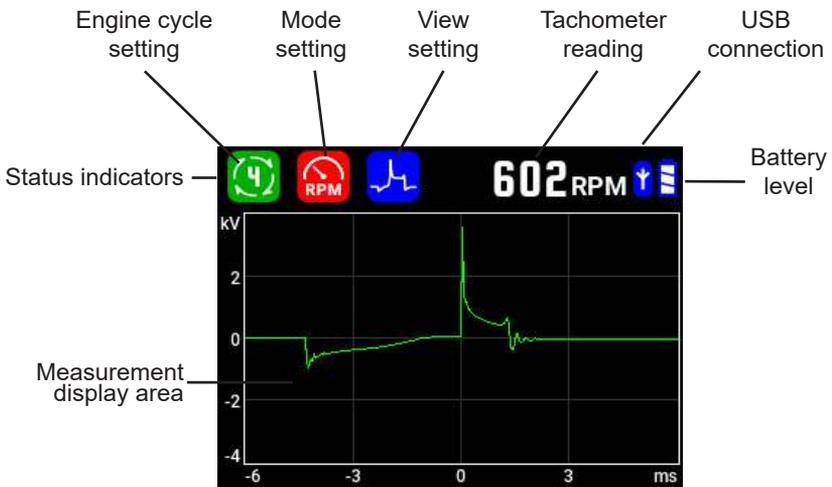


Fig. 2 - IPS LCD Display

5. BUTTONS, ICONS AND MENU OPERATION

5.1 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 2 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 three (3) minutes of no button being pressed and once this has expired 20 seconds after the last spark signal was detected. Turning the unit off manually when not in use will prolong battery life.

5.2 SYSTEM Button and Menu



- The SYSTEM button allows selection of the ignition system corresponding to the engine under measurement. Upon pressing this button, a drop-down menu will open, with options corresponding to the type of sensor detected and the current setting highlighted. To change the setting press the SYSTEM button repeatedly until the correct setting is highlighted, then wait until the drop-down menu closes. The new setting will be displayed as an icon at the top of the screen.

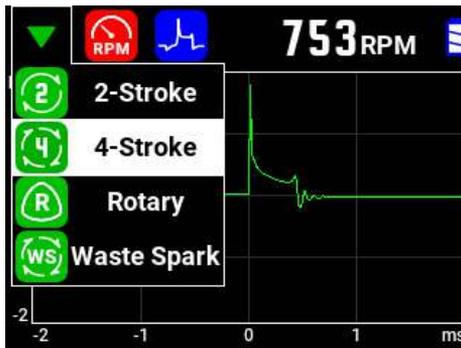


Fig. 3 - Ignition system selection menu for COP sensor



2-stroke engine cycle



4-stroke engine cycle



Rotary or Wankel engine



Waste spark ignition system

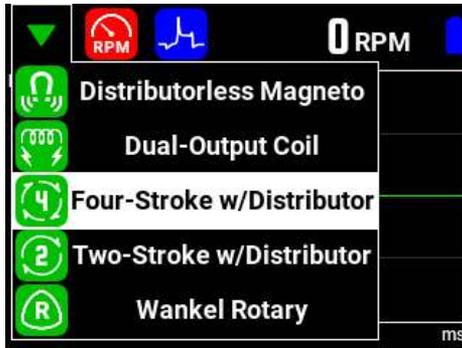


Fig 4 - Ignition system selection menu for SPW sensor



Distributorless Magneto



Dual-Output Ignition Coil (Waste Spark)



2-stroke Engine Cycle with Distributor



4-stroke Engine Cycle with Distributor



Rotary or Wankel Engine

5.3 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 drop-down menu will open with the options corresponding to the type of sensor detected and the current setting highlighted. To change the setting press the MODE button repeatedly until the desired setting is highlighted, then wait until the drop-down menu closes. The new current setting will be displayed as the mode icon at the top of the screen.

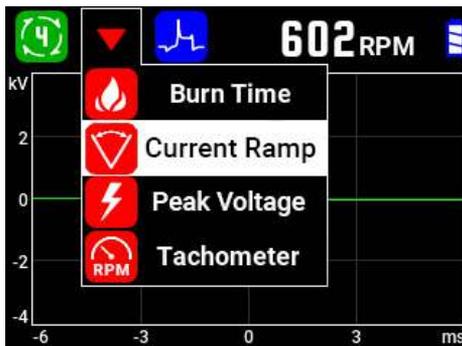


Fig 5 - Measurement mode selection menu for COP sensor

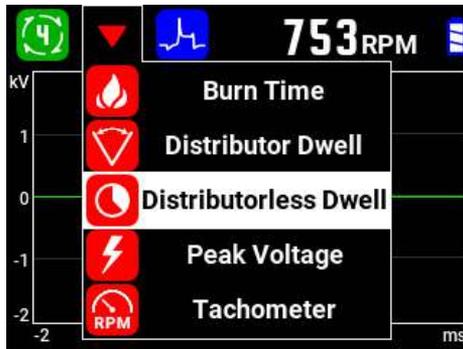


Fig. 6 - Measurement mode selection menu for SPW sensor



Measuring/Displaying Spark Burn (Firing) Time



COP Sensor: Measuring/Displaying Ramp Current
 SPW Sensor: Measuring/Displaying Distributor Dwell



SPW Sensor: Measuring/Displaying Distributorless Dwell



Measuring/Displaying RPM (Tachometer)



Measuring/Displaying Peak Voltage

5.4 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 drop-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 drop-down menu closes. The new setting will be displayed as the display icon at the top of the screen.
- To access the system information and language selection view press and hold the VIEW button, to exit press the VIEW button again and choose any option.

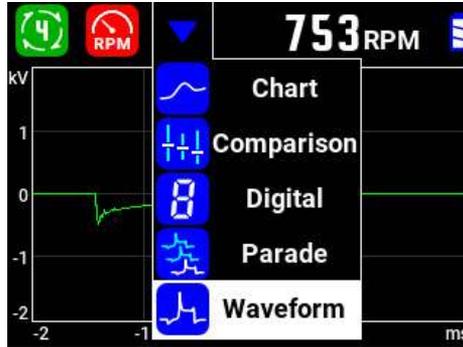


Fig. 7 - View selection menu



Chart (trend line) view.



Comparison view.



Analog gauge and digital readouts view.



Parade (waveform comparison) view.



Waveform (oscilloscope) view.



System information and language selection.

5.5 HOLD Button Functions

HOLD

- 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'.
- In addition to the above functionality, each time the HOLD button is pressed, and depending on the VIEW mode selected, the following is saved to the GTC505's internal memory:

VIEW mode	Files saved
Chart	JPEG screenshot and CSV file of all the data being collected.
Comparison	JPEG screenshot and CSV file of all the data being collected.
Digital	JPEG screenshot.
Parade	JPEG screenshot and CSV file with the data of all the waveforms.
Waveform	JPEG screenshot and CSV file with the data of the waveform.

- To retrieve these files, use the USB Type C cable supplied to connect the GTC505 to a computer.
- The GTC505 will be recognized by the computer as a USB drive named "GTC505_#####" (where the ##### is your unit's unique identifier) and is where the files will be stored.
- File naming convention:

VIEW mode	Filename
All	GTC505_screenshot_####.jpg
Comparison	GTC505_comparison_####.csv
Chart	GTC505_trends_####.csv
Parade	GTC505_waveforms_####.csv
Waveform	GTC505_waveform_####.csv

The "#####" in the files names represent sequential file numbers which are the same for each set of screenshots and data files.

5.6 Tachometer Reading

12345 Digital readout of the engine RPM.

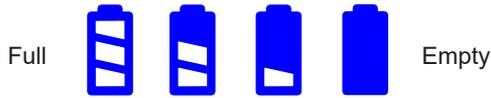
5.7 USB Connection Indicator



Displays if USB host is detected

5.8 Battery Level Indicator

The battery level indicator provides the state of charge of the internal battery as follows:



NOTE: The instrument will automatically turn off when the battery voltage is very low.

6. MEASURING MODES

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

- Spark burn (or firing) time.
- Distributor Dwell.
- Distributorless Dwell.
- Ignition coil primary ramp current..
- Engine RPM.
- Spark plug peak voltage.

6.1 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.

6.2 Distributor Dwell (for distributor ignition systems and spark plug wires)

Dwell measured as duty cycle is a measurement of the percentage of rotation of the camshaft, between the moment in which the primary of the ignition coil is energized (e.g. point contacts close) and the spark is generated (e.g. point contacts open). Its main use is in determining if there is enough time to energize the primary of the ignition, and not so much as to cause the ignition coil to overheat and fail. Dwell duty cycle can be used to calculate the dwell angles which usually are specified for a particular engine and RPM, and usually mechanically adjusted in the distributor/point assembly. To obtain the equivalent dwell in degrees from a duty cycle measurement you may use the following formula:

$$\text{Dwell [degrees]} = \frac{\text{Dwell [\%]} \times 360^\circ}{100 \times \text{No. of Cylinders}}$$

6.3 Distributorless Dwell (for distributorless ignition systems)

Dwell measured as time is a measurement of the time between the moment in which the primary of the ignition coil is energized and the spark is generated. Its main use is in determining if there is enough or time to energize the primary of the ignition, and not so much as to cause the ignition coil to overheat and fail. Dwell time are specified for a particular engine and RPM, and set by the electronic control module of the engine.

6.4 Ramp Current (Coil on Plug Ignition Systems)

Ramp current is measured as time, and is the measurement of the period from the moment in which the primary of the ignition coil of the Coil on Plug module is energized and the spark is generated. Its main use is in determining if there is enough or time to energize the primary of the ignition, and not so much as to cause the ignition coil to overheat and fail. It is not desirable to allow the primary of the ignition coil to saturate (flat line of the ramp just before the spark) because it generates heat and does not contribute to the ignition. The ramp current times are specified for a particular engine and RPM, and set by the electronic control module of the engine.

6.5 Engine RPM

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

6.6 Peak 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. Observation of the spark plug voltage waveform or trend may prove useful in diagnosing ignition and mechanical problems.

7. DISPLAY VIEWS

There are five views that can be selected to display measurements and one for system information and language selection:

- Chart.
- Comparison.
- Digital.
- Parade.
- Waveform.
- System information view and language selection.

7.1 Chart View

This view displays the selected measurement's value corresponding to each of the last 280 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.

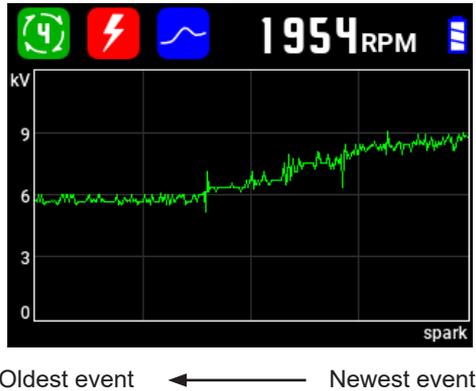


Fig 8 - Chart view

- **POWER/CLEAR Button:**

Pressing the POWER/CLEAR button clears all values from the chart, and re-scales the chart.

- **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 measurement modes are simultaneously tracked and stored, and 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.

7.2 Comparison View

This view allows the comparison of sets of values (minimum, average and maximum measurements) between several cylinders. The measurements are displayed from left to right, with the left most set of values 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.

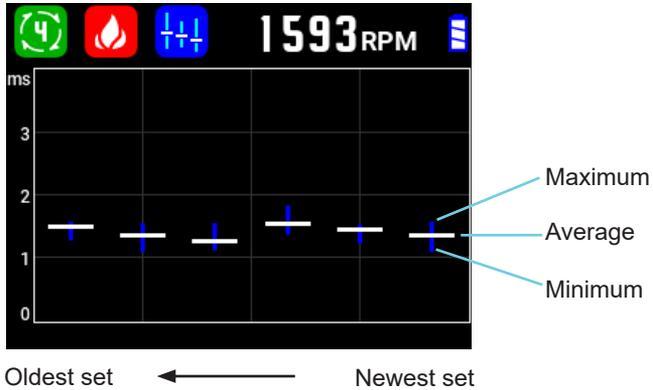


Fig. 9 - Comparison view

- **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 measurement modes are simultaneously tracked and stored, and 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 to 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 16 sets will be shown in the screen at once, if this maximum is exceeded, the oldest set will be deleted and a new waveform added.

7.3 Digital View

This view provides analog gauge and digital readouts for the selected measurement.



Fig. 10 - Digital view

- **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 measurement modes are simultaneously tracked and stored, and 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.

7.4 Parade View

This view allows the comparison of up to four waveforms between several cylinders. The waveforms are displayed from top to bottom, with the top most waveform being the oldest, and the bottom most the newest. A new waveform is added every time the HOLD button is pressed twice (start/stop) and up to the last four waveforms will be shown in the display at once, if this maximum is exceeded, the oldest waveform will be deleted and a new waveform added.



Fig. 11 - Parade view

- **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 measurement modes are simultaneously tracked and stored, and 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 waveform to 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 four (4) waveforms will be shown in the screen at once, if this maximum is exceeded, the oldest waveform will be deleted and a new waveform added.

7.5 Waveform View

This view 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. 12 - Waveform view

- **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. All measurement modes are simultaneously tracked and stored, and available for viewing at any time (without delay).

- **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.

7.6 System Information View and Language Selection

This view is not accessible from the view drop-down menu, but by pressing and holding the VIEW button for a couple of seconds, and allows for checking the status of the internal systems of the GTC505, and changing the user's interface language.



Fig. 13 - System information view and language selection

Battery	State of charge/capacity, current in/out @ battery voltage
Display	Backlight control, display driver
Sensor	Type of sensor detected, ADC resolution
Memory	Available of total internal memory and file system
Comms	Type of communication interface connected or in use
System	Hardware version running firmware version
Language	Selected user interface language

- **HOLD Button:**

To change the user's interface language press the HOLD button repeatedly until the desired language is shown.

8. 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.).

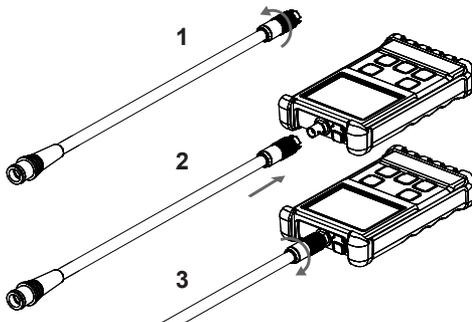
The instrument will automatically detect and configure according to the sensor connected to the probe or sensor cable. Using the wrong sensor for the ignition system under measurement may lead to erroneous readings, or no readings at all.

8.1 Flexible Probe and Sensors Setup (GTC505 and GTC505m)

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

- Flexible probe: 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)
- Clip-on SPW sensor and cable (GTC505m only): for all ignition systems which use high voltage wires (spark plug wires).

8.2 Connecting the Flexible Probe to the Instrument



- 1- Loosen by rotating the sleeve of the probe BNC connector counterclockwise.
- 2- Align the slots with the pins of the connectors, then insert and firmly press the probe connector into the instrument connector.
- 3- Fasten the connection by rotating the sleeve of the probe connector clockwise.

Fig. 14 -Connecting the flexible probe

8.3 Connecting the Sensors to the Flexible Probe

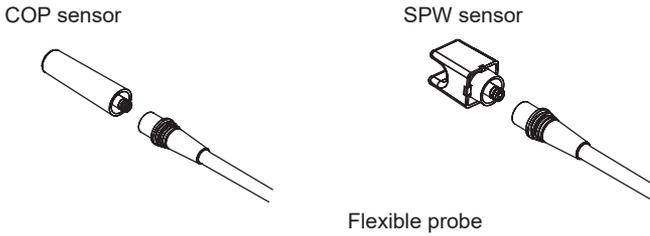


Fig.15 - Sensors connection to flexible probe

Use a twisting motion to press the appropriate COP or SPW sensor into the barrel connector of the probe.

8.4 Sensor Cable and Sensors Setup (GTC505m only)

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

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

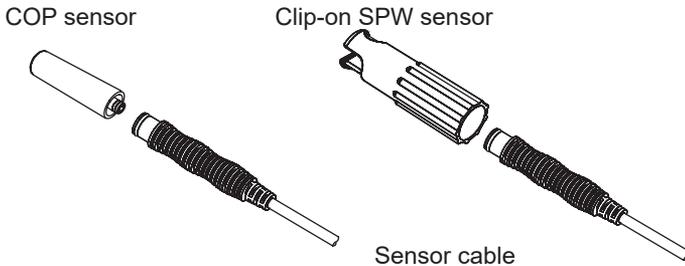


Fig.16 - Sensors connection to sensor cable

Connect the sensor cable to the instrument using their BNC connectors and with a twisting motion press the COP or clip-on SPW sensor into the barrel connector of the cable.

8.5 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 first the SPW sensor if necessary.
- 3- Turn the instrument on, select the appropriate ignition system for the engine under measurement, and the desired mode and view.
- 5- Place the COP sensor on the top and center of the ignition module (as shown in the Fig. 13), and observe whether the instrument is able to detect and display the desired measurement.

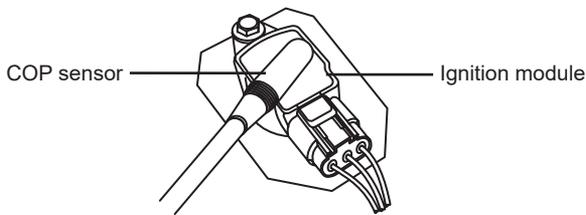


Fig. 17 - Using the COP sensor on an ignition module

- 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.

8.6 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, select the appropriate ignition system for the engine under measurement, and 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 while trying to maintain a right angle (90°) between the sensor and the wire.

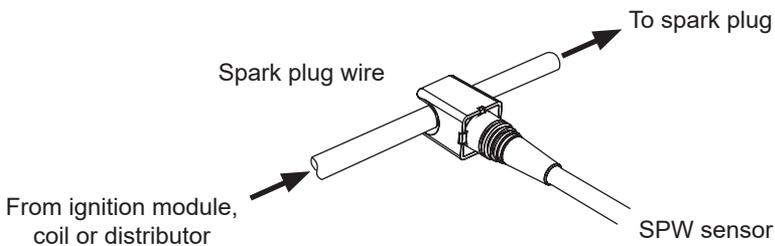


Fig. 18 - Using the SPW sensor on a spark plug wire

6- When measuring dwell in ignition systems with a distributor using the Distributor Dwell mode as described in “6.2 Dwell duty cycle (for distributor ignition systems and spark plug wires)”, the SPW sensor should be placed on the high voltage cable connecting the ignition coil to the distributor.

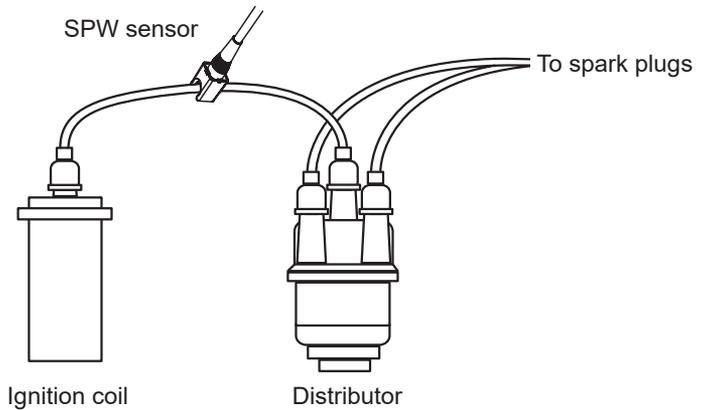


Fig. 19 - Measuring dwell duty cycle in an ignition system with distributor

7- 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 sensor body clockwise 60° to lock onto the spark plug wire. To unlock, turn the body of the sensor 60° counterclockwise.

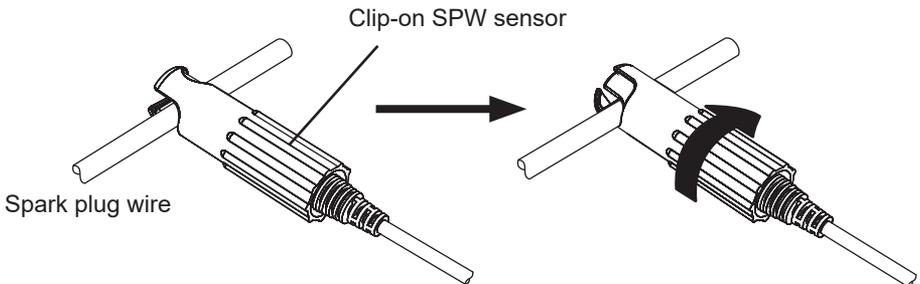


Fig. 20 - Using the clip-on SPW sensor on a spark plug wire

8- 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 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 duty cycle or time 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.

9. 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 USB Type-C receptacle.
- 3- Insert the USB charger cable's USB Type C plug into the receptacle of the instrument.
- 4- Insert the other end of the USB cable into a USB Type-C port or using the Type-C to Type-A adapter to a USB charger or computer..

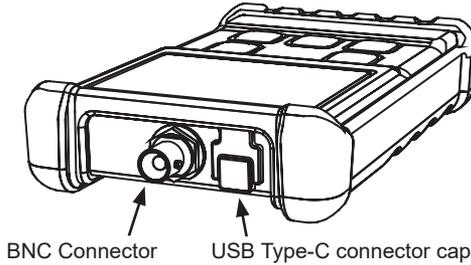


Fig. 21 - Instrument's connectors

- 5- Upon start of charging the battery, after a moment the display will show the charging in progress icon and the screen will turn off after a few seconds.

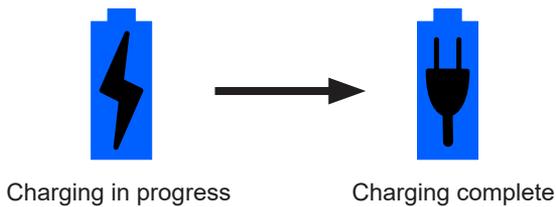


Fig. 22 - Charging indicators

- 6- If the instrument is turned on (by pressing the POWER/CLEAR button) at any time while connected to a power adapter, or computer the instrument will display the charging status .
- 7- The USB Type-C 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 required 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.

10. 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.

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

11. 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.gtc.ca, or request a printed copy.

Part # GTC505MN2512EN

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