



OCTANE-IM PORTABLE OCTANE METER

Operating manual

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This manual provides the information needed to operate the OCTANE-IM portable octane meter.

! *WARNING: The OCTANE-IM portable octane meters are NOT explosion-proof: reasonable care MUST be used in handling these instruments.*

INTRODUCTION

Intended Use

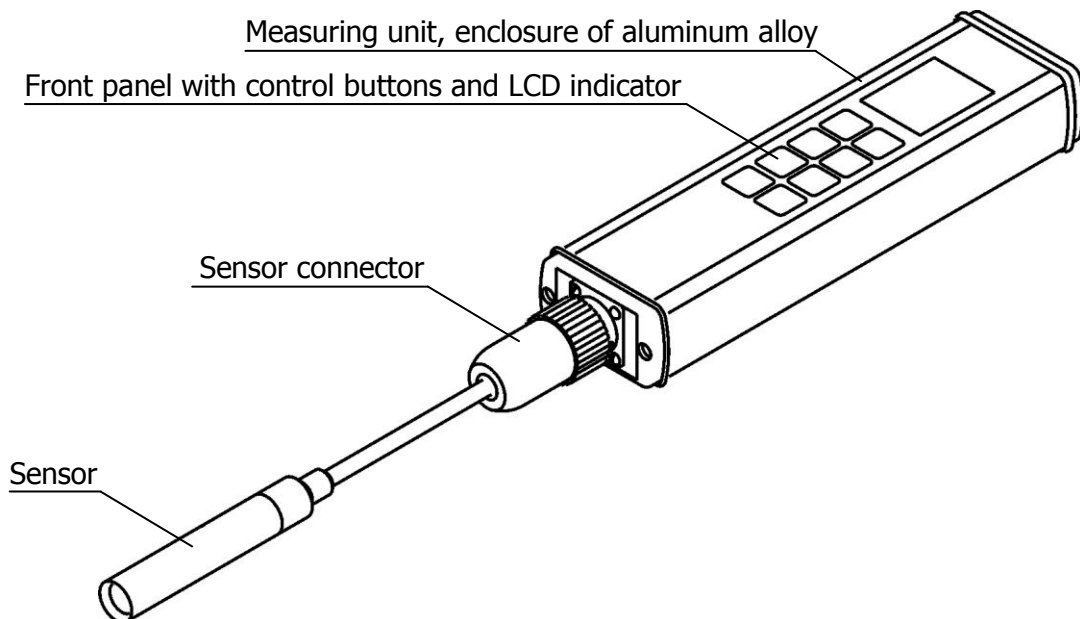
The OCTANE-IM portable octane meter is meant for defining:

- octane numbers of motor fuel, complying with octane numbers, calculated by research method (ASTM D2699) and motor method (ASTM D2700);
- cetane numbers of diesel fuel, complying with cetane numbers, calculated according to ASTM D613.

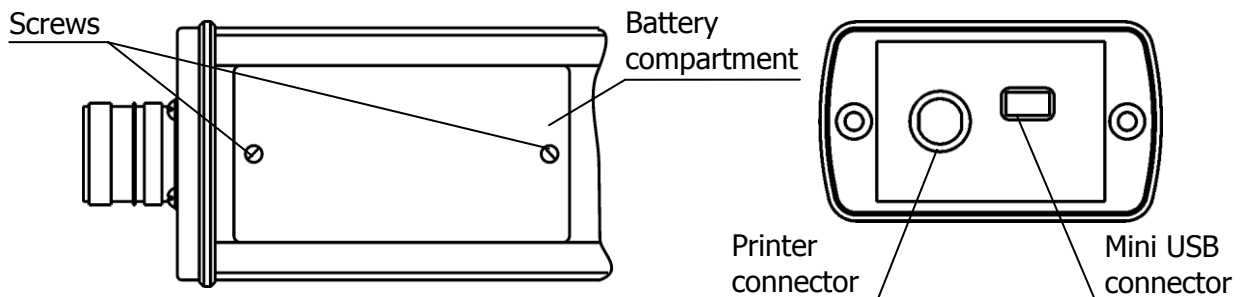
The OCTANE-IM is intended to be used:

- in refineries to control quality of fuel components and their blends;
- for fuel checking during transportation, storage and consumption.

Appearance and Part Names

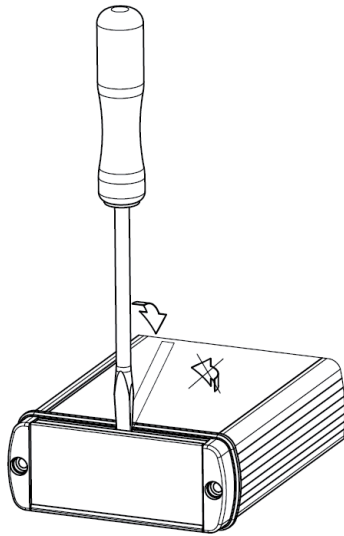


! *NOTE: The sensors of different instruments are not reciprocal.*



Mini USB connector is used for computer or AC adapter connection.

To open the lid, which protects the connectors, use a flat blade screwdriver as shown below:



List of Abbreviations

- DOI — dielectric octane index.
- DCI — dielectric cetane index.
- RON — octane number according to research method.
- MON — octane number according to motor method.
- CN — cetane number.

Indicator and Keypad Description

The diagram shows the LCD display and keypad of the OCTANE-IM portable octane meter. The LCD display shows the following information: 24.7 °C, USB icon, 01: LUKOIL, M2, RON=93.4, MON=88.3, DOI=90.17, and Menu and # Clb buttons. The keypad consists of the following buttons:

- Escape button** for cancellation of current action (Down arrow icon)
- Enter button** for confirmation of current action (Up arrow icon)
- Backlight button** (X icon)
- Store button** for saving results in the current memory cell (Left arrow icon)
- On/Off button** (Lightbulb icon)
- Print button** (MS icon)
- Power button (Power icon)
- Printer icon

Icons that demonstrate the functions of the func buttons are shown above the keypad. **Func** buttons that functions are determined by icons above* are also indicated.

* — when lack of icons, the buttons are used for moving the cursor or changing parameter values;

Other Parts and Accessories

The OCTANE-IM package includes the following parts and accessories:


- Measuring unit
- Detachable sensor
- A/C adapter
- Two AA-size rechargeable batteries
- Carrying case
- Operating manual

Contact TERMEX if you would like to purchase additional accessories:

- Mobile printer

Power




The OCTANE-IM can be powered by batteries, by USB or an AC Adapter.

When connecting to the AC adapter or computer, OCTANE-IM will automatically turn itself on even if there is not enough battery to operate the unit. In this case the symbol  will appear on the display.

If OCTANE-IM is in charging mode or connected to a computer it cannot be turned off.

Charging and Replacing of the Battery

The level of the battery is indicated. All of its possible states are shown in the table below.






	The battery is full. Charging is not necessary.
	The battery is partially charged. Charging is not necessary.
	The battery is low. Charge the battery.

The battery must be charged at temperature within +10 to +30 °C. If OCTANE-IM had been operated in the environment colder than 5 °C, it is necessary to let the unit sit in room temperature for 4 hours.

To charge the battery:

- connect the AC adapter cable to the Mini USB connector;
- plug the AC adapter to the power outlet.

! *WARNING: Don't use AC adapters from other devices.*

The charging process is indicated by alternate symbols , , ,  on the display. When the charge is complete the indication  will appear.

To stop the charging process:

- unplug the AC adapter from the power outlet;
- disconnect the AC adapter cable from the Mini USB connector.

Charging a completely discharged battery may take up to 8 hours or even more.

To replace the battery:

- turn OCTANE-IM off;
- undo the screws and take off the lid of the battery compartment, located on the back of the measuring unit;
- remove old batteries;
- put new batteries in; be sure that the batteries are oriented as indicated in the battery compartment;
- put the lid and screws back.

! *NOTE: Use ONLY NiMH batteries with initial capacity of 2100 to 2700 mAh.*

USING THE OCTANE-IM

! *NOTE: Throughout this manual, keystrokes are represented in **bold type**; references to messages on the OCTANE-IM display are in "quotes."*

Before using OCTANE-IM octane meter, carefully read the operating manual.

Preparation

Move sensor connector into its mating part on the unit case while aligning the clamps. Fix the sensor by screwing coupling nut.

Charge the battery if it is necessary.

! *WARNING: While using the unit in cold temperature make sure to wear gloves in order not to get frostbite.*

Powering Octane Meter On and Off



To turn OCTANE-IM on, press **On/Off** button. The instrument will turn on if the battery is charged enough.

To turn OCTANE-IM off, **On/Off** button again.

! *NOTE: The OCTANE-IM will automatically turn itself off in case of the battery being too low to operate. This precaution was made in order to make the life of the unit last longer and to prevent the battery total discharge.*

Powering Backlight On and Off



To turn the backlight on, push **Backlight** button.

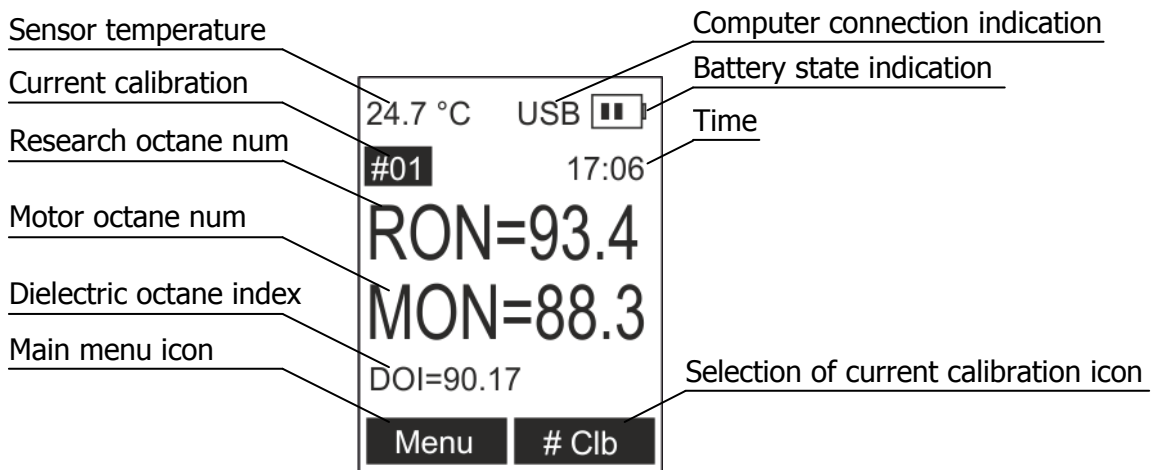
To turn the backlight off, push **Backlight** button again.

Display in the Basic Mode

Octane meter can work in two modes:

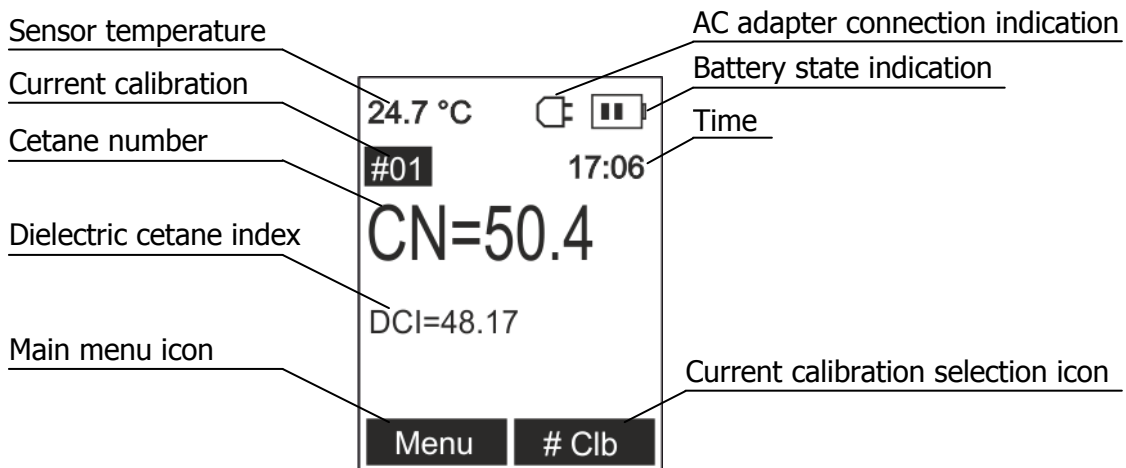
- octane number measuring;
- cetane number measuring.

The data on the display for octane number measuring mode is shown below:



! *NOTE: In case of sensor not being connected to the unit or being out of order, the warning "Sensor out of order" instead of RON, MON and DOI will be indicated on the display.*

The data on the display for cetane number measuring mode is shown below:

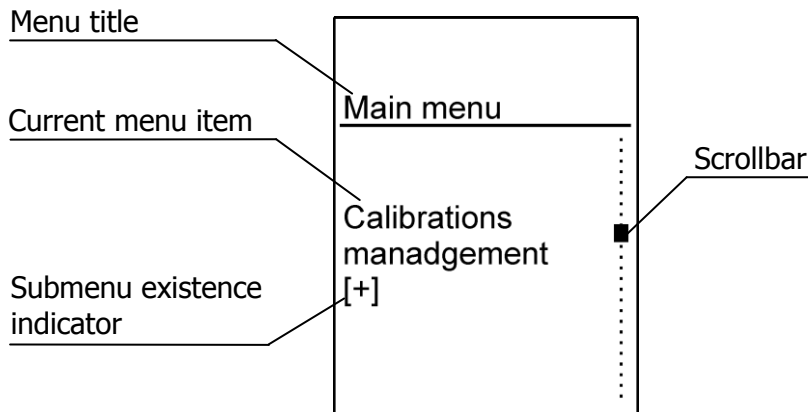


! *NOTE: In case of sensor not being connected to the unit or being out of order, the warning "Sensor out of order" instead of CN and DCI will be indicated on the display.*






Main Menu of Octane Meter

Mode operating and calibration of octane meter is realized through the main menu. Main menu is a set of items, which can be a command or submenu. To navigate the main menu and carry out different instructions, the \uparrow , \downarrow , \leftarrow , \times buttons are used. To select the main menu, use \downarrow button when appropriate icon for this func button is on the display. Pressing any active button is always accompanied by a short audible signal.

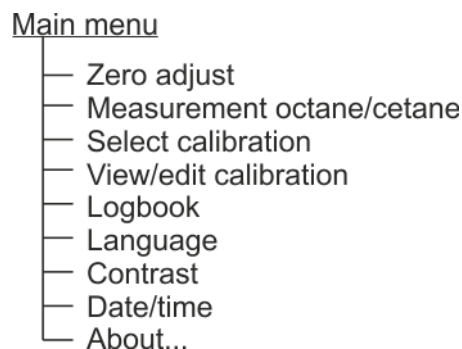
The display view while navigating through the main menu is shown below:



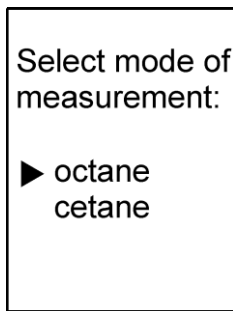
The table below contains the information of the buttons and their intended use:

<div style="border: 1px solid black; padding: 2px; display: inline-block;">Menu</div> 	Select the main menu
 	Moving between menu items
	Instruction execution or open submenu
	Cancel the instruction execution or return to the upper level of the menu

Main menu tree is shown below. A menu item with a [+] symbol means that it contains a submenu.



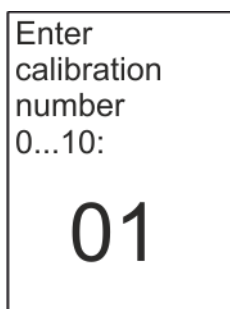
Measurement Mode Selection



The OCTANE-IM is meant to measure both octane number of gasoline and cetane number of diesel fuel. To select the type of measurement:

- select "Main menu" -> "Select measurement mode";
- select the measurement mode you need with \uparrow , \downarrow buttons;
- press \leftarrow for confirmation, \times — to cancel.

Current Calibration Selection



The OCTANE-IM is able to determine octane/cetane number according to the factory or one of the user's calibrations. To select the current calibration:

- select "Main menu" -> "Select calibration";
- select the calibration you need with \uparrow , \downarrow buttons;
- press \leftarrow for confirmation, \times — to cancel.

Number of the current calibration will be indicated on the display.

Clb



A shortcut to selecting the current calibration can be executed by pressing the \uparrow button when the correlating icon is indicated on the display. Pressing this button one time will open the calibration selector.

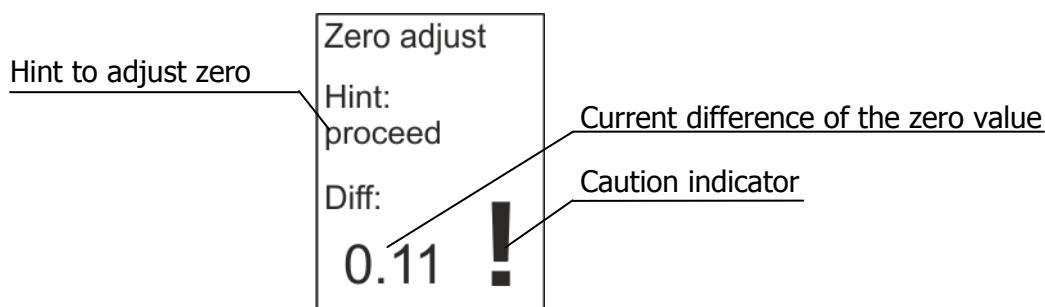
Zero Adjustment

Zero adjustment is meant to compensate for long-term sensor drift. Zero adjustment is performed by means of n-heptane which must be especially pure. Repeat zero adjustment procedure at least once a week.

To adjust zero:

- Select "Main menu" -> "Zero adjust".
- Immerse sensor into n-heptane and make a few movements in vertical direction to make sure that the sensor is completely submerged.

The display will indicate the information shown below:



In the bottom of the display you will see the difference between the zero value of the instrument and the current measured value of zero. Depending on the difference, in the middle of

the display you will see a recommendation: "proceed" — meaning the difference is significant, and you need to make zero adjustment; "refuse" — the difference is insignificant, no need in zero adjustment; "error" — the sensor is out of order or is not connected to the unit.

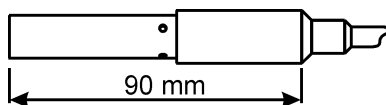
When the difference is exceptionally significant, an exclamation mark will appear in the right part of the display. This alerts the user to be extremely careful with the procedure of zero adjustment. Also the presence of this symbol should remind you to make sure that n-heptane is of required level of fineness.

- ! *NOTE: The presence of the caution symbol has no affect on the procedure of zero adjustment.*
- To complete the operation hold **←** button for 1 second or press **✕** button to cancel the operation.

When operation is finished, "Zero adjustment done" message appears.

- ! *NOTE: If zero adjustment proceeds after "error" indication, "Zero adjustment error" message appears, and the operation will be cancelled.*
- Press **✕** button 2 times to return to the basic mode.

Taking Measurements




- ! *NOTE: While taking measurements please keep the minimal dipping of the sensor.*

Before taking measurements:

- select measurement mode;
- adjust zero;
- select current calibration.

To take measurements:

- place sensor in the fuel, make sure that the sensor is completely submerged;
- take readings of octane/cetane number;
- if needed, save the result in logbook by pressing **MS** button;
- if needed, connect the portable printer and print the result by pressing  button;
- remove the sensor and wipe with a tissue;
- if needed, repeat the procedure for other fuels.

- ! *NOTE: Sometimes measured results may be equal to zero. That means that either the current calibration is empty or contains errors. To eliminate the errors see "Managing calibrations". In either case it is not a malfunction.*

Managing Calibrations

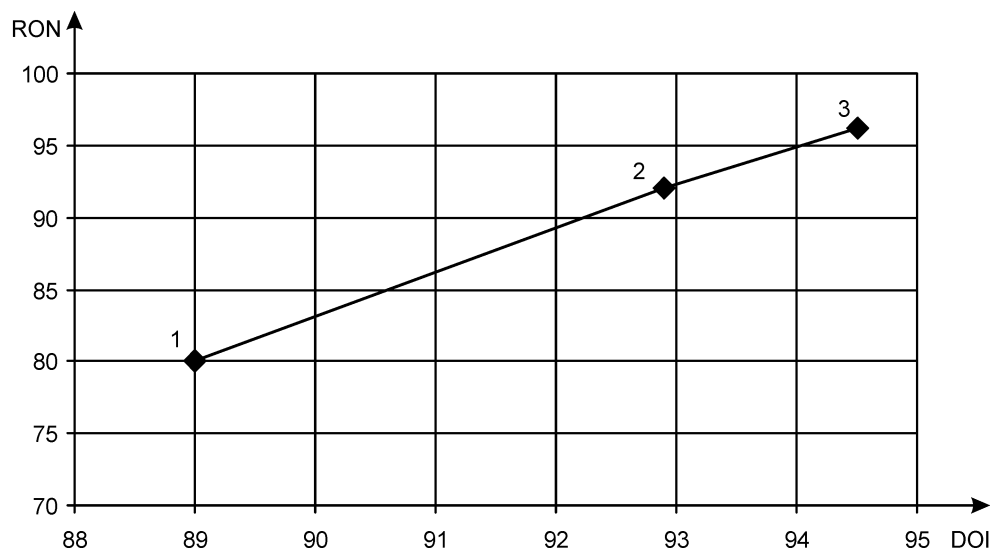
Calibration defines dependence of octane number (RON, MON) from dielectric octane index (DOI). Likewise for diesel fuel, calibration defines dependence of cetane number (CN) from dielectric cetane index (DCI).

Dielectric octane/cetane index is a value of dielectric permeability of the fuel brought to the range of:

- 84.25-104.00 for octane number measuring;
- 45.61-56.30 for cetane number measuring.

The dielectric octane/cetane index does not depend on the specific octane meter and serves as a measure when comparing the readings of different octane meters.

Example of the mentioned dependence is shown below. Octane meter, having measured DOI/DCI, calculates RON, MON (CN) using the stated dependence. This dependence is saved as one of the calibrations.



Octane meter can save up to 11 calibrations for each measurement mode, listed from 0 to 10. The calibration 0 is a factory calibration and cannot be modified by user. Calibrations from 1 to 10 are meant for customer's use and can be adjusted according to their needs.

Definition of the calibration is carried out according to the piecewise linear approximation of a set of experimental points. The ultimate amount of points should be from 1 to 4. The calibration points in figure above are marked with 1, 2 and 3.

To create calibration, it is necessary to have 1 to 4 fuel standards with known values of octane/cetane numbers.

The process of creating calibration is as follows:

- Step 1 – measuring by octane meter the values of DOI/DCI for each fuel standard;
- Step 2 – compiling of calibration table (see below);
- Step 3 – saving this table in the memory of the octane meter.

Creating calibration. Step 1:

- take readings of DOI/DCI of every fuel standard.

! *The value of octane/cetane number might be equal to zero, which is not considered to be an error.*

Creating calibration. Step 2:

- based on the measured values of DOI/DCI and known values of RON, MON (CN) of fuel standards, complete the following table:

	DOI	RON	MON		DCI	CN
1				1		
2				2		
3				3		
4				4		

If there are less than 4 fuel standards, leave the remaining lines empty.

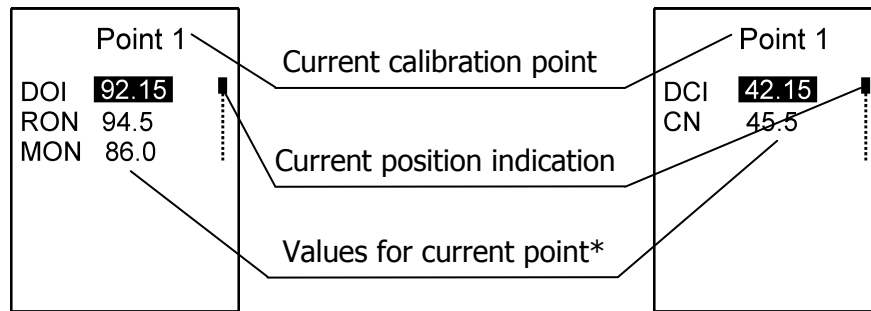
Creating calibration. Step 3:

- select "Main menu"->"View/edit calibration";
- set the calibration to be edited with \uparrow , \downarrow buttons, press \leftarrow for confirmation.

The information shown below will be indicated on the display. The actual view depends on the values of the current calibration.

For octane number measuring mode:

For cetane number measuring mode:



* — cursor highlights the current value that is being edited.

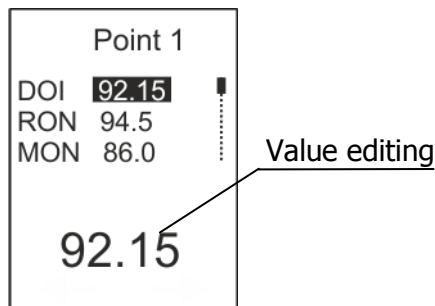
↑, ↓ buttons move the cursor inside the table. When the cursor reaches the lowest or highest position it goes over to the next or previous calibration point.

To enter a numerical value in the table:

- place the cursor on desired value of a desired point by means of ↑, ↓ buttons;
- press ← button to enter into number editing mode;
- enter the desired value with ↑, ↓ buttons. Hold the button to change number faster;
- press ← button to accept a new value or ✕ — to return a previous value.

Transfer the information from the calibration table to the octane meter as described above.

- for the unused points enter zero value of DOI (DCI);
- check all the entered values, correct if necessary;
- press **MS** button, the calibration will be saved with the entered values. Message "Saved" will appear for a short time;
- if needed, connect the portable printer and print the calibration by pressing button;
- to cancel the calibration creating press ✕ button.



The order of entering values does not matter. Octane meter will automatically put them in the increasing order according to the values of DOI or DCI.

! **NOTE:** A point that contains at least one zero value will not be included in the calibration.

! **WARNING:** Octane meter cannot verify if the entered values are right. So the values may be entered incorrectly. In this case, while measuring octane or cetane number, display will indicate the value as "RON=0.0" or "CN=0.0" while DOI or DCI values will be indicated right. In this case the calibration has to be recreated without entering wrong data. For example, a calibration that includes two or more points with the same values of DOI (DCI) is considered as wrong.

When creating a calibration, a message "Calibration contains errors" may be shown on the display. This happens when a user creates a calibration operating with only one point and its value of DOI or DCI equals 104.0 ± 1.0 or 56.3 ± 1.0 respectively. To eliminate the error do one of the following:

- change the value of the wrong DOI or DCI point to the value out of the 104.0 ± 1.0 or 56.3 ± 1.0 range respectively;
- or add at least one more point to the calibration.


To proceed after the error message, press ✕ button. The error message will also appear every time when selecting new current calibration if chosen one contains the mentioned error.

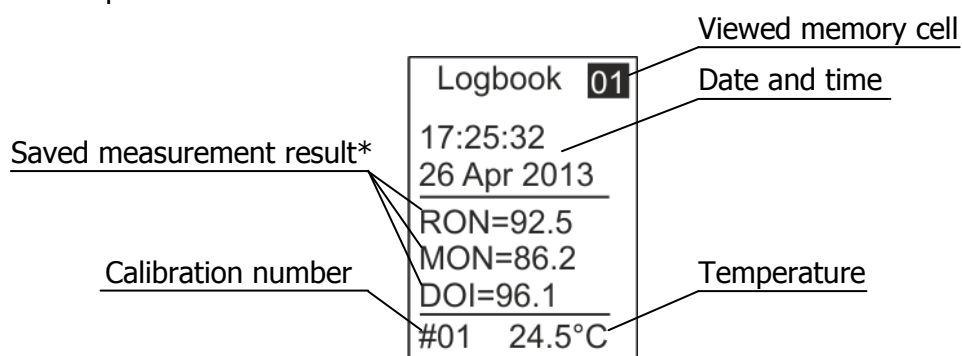
Working with Logbook

Octane meter can save up to 10 measurement results in the logbook, which consists of ten memory cells. A measurement result is a set of the following values: calibration number; DOI, RON, MON — for octane number measuring mode; DCI, CN — for cetane number measuring mode; temperature, time and date of taking measurement.

To save a result in the logbook, press **MS** button. The last result will be saved in the memory cell #01, the previous one will be shifted to memory cell #02 and so on.

To view the previously saved measurement results:

- select "Main menu" → "Logbook" → press **↵** button;
- select the desired memory cell with **↑**, **↓** buttons;
- if needed, connect the portable printer and print the logbook by pressing  button;
- press **X** button to exit.



* — DCI and CN will be shown in cetane number measuring mode.

Language selection

A user can select a language for octane meter:

- select "Main menu"->"Language" and press \leftarrow button;
- select desired language with \uparrow , \downarrow buttons;
- press \leftarrow button to confirm selection or \times — to cancel.

Setting display contrast

Contrast setting might be needed in case of ambient temperature change:

- select "Main menu"->"Contrast" and press \leftarrow button;
- select desired contrast level with \uparrow , \downarrow buttons;
- press \leftarrow button to confirm selection or \times — to cancel.

If the display is blank with the current contrast set, follow these instructions:

- to make sure that the unit is on, turn the backlight on/off with lightbulb button. Turn octane meter on if it is off;
- press \times button 4 times;
- press \downarrow button 7 times;
- press \leftarrow button;
- make the image visible with \uparrow , \downarrow buttons;
- press \leftarrow button.

Setting date and time



- select "Main menu"->"Date/time" and press \leftarrow button;
- place the cursor on desired value by means of \uparrow , \downarrow buttons;
- press \leftarrow button to enter into editing mode;
- set the desired value with \uparrow , \downarrow buttons;
- press \leftarrow button to confirm selection or \times — to cancel;
- press **MS** button.

DIFFERENT APPROACHES OF CREATING AND APPLYING USER'S CALIBRATIONS

Depending on the use of octane meter, there are different approaches of creating and applying user's calibrations. This chapter provides two of the most common approaches. Their operation applies to both octane number measuring mode and cetane number measuring mode. The approaches are based on measuring fuel octane number.

Approach 1. Allows to determine octane number of a fuel if its manufacturer is known. This approach is realized by creation of a few calibrations. The number of calibrations is determined by the number of gasoline manufacturers in the particular region. Each calibration is based on 1-4 different types of gasoline from one manufacturer.

For example, let the following manufacturers functioning in the particular region be (names are imaginary): Rocket Fuel, Petrol Plus, Super Fuel and Gasoline Extra. For each manufacturer we chose the following types of gasoline:

- Regular, Premium, Super — for Rocket Fuel.
- Normal, Regular, Super — for Petrol Plus.
- Normal, Premium — for Super Fuel.
- Normal, Regular, Premium, Super — for Gasoline Extra.

For each manufacturer create a separate calibration according to their gasoline types. Calibration 1 should be created for Rocket Fuel and its gasoline types Regular, Premium, Super; calibration 2 for Petrol Plus — Normal, Regular, Super etc. To create calibrations "OMEN" software can be used. In that case name calibrations according to the manufacturers 1:"Rocket Fuel", 2:"Petrol Plus", 3:"Super Fuel", 4:"Gasoline Extra". To take measurements according to approach 1:

- select the appropriate calibration for desired manufacturer as current one;
- take measurements.

! *NOTE: Factory calibration #0 uses approach 1.*

Approach 2. Allows to determine octane number of a fuel if its manufacturer is unknown. This approach is realized by creation of a few calibrations. Number of calibrations depends on number of tested types of gasoline. Each calibration is based on of 1 to 4 different types of gasoline but from different manufacturers.

For example, as stated above, let the following manufacturers functioning in the particular region be (names are imaginary): Rocket Fuel, Petrol Plus, Super Fuel and Gasoline Extra. We chose the following gasoline types from each manufacturer: Normal, Regular, Premium. Based on 4 gasoline samples of Normal type we created calibration 5. Likewise, based on the gasoline samples of Regular we created calibration 6 and calibration 7 for gasoline samples of Premium. For creating calibrations, "OMEN" software can be used. In that case name calibrations according to their type: 5: Normal, 6: Regular, 7: Premium. To take measurements according to approach 2:

- select the appropriate calibration for desired gasoline type as current one;
- take measurements.

If the gasoline type is unknown, to determine it, approach 1 can be performed.

Both approaches can coexist in the instrument at the same time.

GENERAL SPECIFICATIONS

Measuring range:

Octane number (RON, MON)

67...120 units

Cetane number (CN)

30...60 units

Uncertainty of measurement:

Octane number (RON, MON)

±1.0 units

Cetane number (CN)

±1.0 units

Display resolution:

0.1 unit

Minimum volume of sample:

50 cm³

Minimum depth of sensor immersion:

90 mm

Measurement time:

If sample temperature differs from sensor's by no more than 10 °C

30 sec

If sample temperature differs from sensor's by no more than 50 °C

180 sec

Dimensions:

470×60×35 mm

Weight:

0.7 kg

Power supply: 2 NiMH AA-size rechargeable batteries

Warranty:

2 years