

User Manual



eravap: Vapor Pressure Tester

Software Version: ≥ 8018
Document Revision: ERAVAP_m-8018

Warranty Extension Form ERAVAP

Please scan and e-mail this form (**3 pages**) to office@eralytics.com
or fax it to +43 1 890 50 33 - 15

DOUBLE YOUR WARRANTY COMPLETELY FREE OF CHARGE

Thank you for choosing eralytics and welcome to a new era of petroleum testing. Your eralytics analyzer includes a standard warranty period of 12 months from date of delivery. **To double your warranty period free of charge, complete this form together with the initial qualification form** and send it to eralytics. This extends the warranty period to 24 months from the date of installation.

Company Data:

Distributor company name: _____

End user company name: _____

Company address: _____

Company phone: _____

Contact person: _____

E-mail address: _____

Installation date: _____

Instrument serial number _____

Terms and conditions of 24 months warranty period (from date of installation)

1. Warranty services will be rendered upon valid warranty registration with complete warranty information within 30 days from date of delivery. The registration must be applied by the end-user of the analyzer. Without complete warranty registration the warranty period is limited to 12 months (from the date of delivery).
2. The Warranty shall cease immediately and become void, if unauthorized repair, tampering, alteration or modification is done on the product:
 - a. The Serial Number must not be defaced or altered in any way.
 - b. The owner is required to provide proof of purchase at the time of service.
 - c. The warranty does not cover:
 - i. Accessories, consumable items, wear and tear parts, corrosion, rusting or stains.
 - ii. Transportation costs incurred in sending the product for repair.
 - iii. Usage of wrong electrical supply/voltage.
 - iv. Usage not in accordance with the operation instruction manual.

The warranty expressly provide for herein is the sole warranty provided in connection with the product, and no other warranty expressly or implied, is provided. We disclaim any responsibilities for any other claims, with regards to other software and any other peripherals used with the product under warranty. Defective parts replaced shall remain at the disposal of eralytics.

Initial Qualification Test ERAVAP

Acknowledging the following points and completing the *instrument performance check* ensures that the **analyzer was installed successfully** and is fully operational.

By completing this form, it is made sure that the **operator was instructed on all essential parts of its operation** and that the analyzer meets our highest quality standards at the time of installation.

Instrument Model: _____

Serial No.: **EVP** _____

Software version: **8** _____

Information

Received manual and operations video _____

Received test report _____

Informed about cleaning when crude oil or other higher viscous samples are tested (see section "Cleaning") _____

Informed about handling of samples with high vapor pressure (e.g. LPG, live crude oils) _____

Instrument performance check

Perform a reference measurement using ASTM D5191 / EN13016-1 **or** ASTM D6378 **or** ASTM D6377 with n-Pentane (purity $\geq 99.5\%$) **or** ASTM D6897 with n-Butane (purity $\geq 99\%$) and fill in the actual measured values:

ASTM D5191, EN13016-1 & ASTM D6377:

Pentane (cooled to 0°C and air saturated): $P_{tot} = 112.8 \text{ kPa} \pm 1.2 \text{ kPa}$ _____ kPa

ASTM D6378:

Pentane: $VP_4 (P_{abs}) = 107.9 \text{ kPa} \pm 1.2 \text{ kPa}$ _____ kPa

ASTM D6897:

Butane: $VP_{tot} (37.8 \text{ °C, V/L 0.5:1}) = 356.6 \text{ kPa} \pm 6.0 \text{ kPa}$ _____ kPa

Handling

Received information about the different methods

Sample preparation (cooling & air saturation
for D5191, EN13016-1, D6377 and D5188) explained

Measurement performed

Location, Date

Customer operator name

Sales representative name

Customer operator signature

Sales representative signature

EC DECLARATION OF CONFORMITY

EG-KONFORMITÄTSEKTLÄRUNG | CERTIFICAT D'HOMOLOGATION DE
L'EQUIPEMENT



Manufacturer:

eralytics GmbH
Lohnergasse 3
1210 Vienna
Austria

Products:

eracheck pro oil in water analyzer (EC01)
eracheck eco oil in water analyzer (ECO01)
eraflash flash point tester (EF01, EF10)
eraflash LT low temperature flash point tester (EF02, EF20)
eraflash S10 flash point tester with auto-sampler (EFS01, EFS10)
eraspec FTIR fuel analyzer (ES01, ES10)
eraspec oil FTIR lubricant analyzer (EO01, EO10)
eravap vapor pressure testers (EV01, EV02, EV10, EV20)

The products to which this statement relates are manufactured and duly carried out in compliance with the provisions of European Community Directive 2014/35/EU, 2014/30/EU and 2011/65/EU. The products conform to the following standards:

EN61326-1:2013	Electrical equipment for measurement, control and laboratory use - EMC requirements
EN61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

eralytics GmbH, Austria

eralytics GmbH
Lohnergasse 3, 1210 Wien
Tel / fax: +43 / 8905063 0 / 15
E-mail: office@eralytics.com
Skype: eralytics hotline
www.eralytics.com

Niklas Christensson,
CEO | eralytics GmbH

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1 General Information

We wish to thank you for the purchase of the vapor pressure analyzer ERAVAP from eralytics.

The ERAVAP is the ultimate solution for the automated vapor pressure measurement of automotive and aviation gasoline, hydrocarbon solvents, crude oil and LPG as well as for the vapor/liquid ratio measurement of gasoline. It follows in each detail the requirements of the latest International standards EN 13016, ASTM D5188, D5191, D5482, D6377, D6378, D6897 and many more.

The unmatched precision, speed and versatility make it the preferred analyzer for volatility specification compliance testing, refining streams quality follow-up, fuel blending and research or mobile applications.

This Instruction Manual contains all essential information for installation of the instrument and measurements of standard sample types. Please contact your local eralytics supplier or eralytics GmbH for latest versions of the documents and firmware updates.

While every precaution has been taken in the preparation of these documents, eralytics GmbH assumes no responsibility for technical or printing errors or omissions.

Nor is any liability assumed for damages resulting from the use of the information contained in this manual.



Critical information for the operation of the instrument that might be necessary to prevent damage of the instrument or harm of the user is marked with a red “!” on the right side of the paragraph.



Important information for the operation of the instrument inside this manual is marked with a black “i” on the right side of the paragraph.

eralytics GmbH does not make a commitment to update the information in this manual. Specifications are subject to change without notice.

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Contact:

eralytics GmbH
Lohnergasse 3; 1210 Vienna, Austria
www.eralytics.com
support@eralytics.com
Telephone: +43 1 890 50 33 0

1.1 Safety and Warning



This instruction manual does not claim to address all of the safety issues associated with the use of the instrument and samples. It is the responsibility of the user to establish health and safety practices and determine the applicability of regulatory limitations prior to use.

Make sure you read and understand all instructions and safety precautions listed in this instruction manual before installing or operating the equipment to ensure smooth operation and avoid damage to the equipment or its accessories. If a malfunction occurs, consult chapter Errors and Warnings. If a problem persists or if there are any questions concerning the operation of the equipment or about the information in this manual, please contact your local eralytics distributor or eralytics.

Performance of installation, operation, or maintenance other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.

Never operate equipment that is not correctly installed. Ensure that all operators are fully trained to use the analyzer correctly and safely. Unqualified personnel must not operate the equipment. Avoid causing damage to the equipment or its accessories through incorrect operation.

Always consult the material safety datasheet for any sample, chemical used for measurement, cleaning and maintenance and ensure that proper safety equipment is available and used by the operator.



Follow the precautions below for the handling and measurement of flammable samples and cleaning agents:

- Observe all safety regulations regarding the handling of the samples to be measured, rinsing agents and waste liquids (e.g. use of safety glasses, gloves, respiratory protection...).
- Do not store inflammable material near the instrument.
- Do not leave sample/solvent containers uncovered.
- Clean all spillages immediately.
- Prior to starting a measurement, make sure that the filling and waste hoses and the cell connection tube are properly connected.
- Ensure that the ERAVAP is located in a sufficiently ventilated area, free from inflammable gases and vapors.
- Keep a fire extinguisher at hand.
- Keep any sources of ignition, like sparks and unshielded flames, at a safe distance from the instrument.



Important:



Read the manual before removing the metal casing. Never operate the instrument without the metal casing unless required to do so during service and maintenance. Always disconnect the line cord of the apparatus when performing maintenance or moving the apparatus. Do not use any accessories or wearing parts other than those supplied or approved by eralytics GmbH. If a problem persists, please call your supplier or eralytics GmbH. Repair and service procedures may only be carried out by authorized personnel or by eralytics GmbH.

1.2 Warranty terms

Any product manufactured by eralytics GmbH is sold to the purchaser (herein after referred to as Customer) on the following basis and none other. All implied warranties of merchantability and of fitness for a particular purpose are hereby expressly excluded.

- (a) Products are warranted against defects in material and workmanship for a period of one year (Warranty Period) from the date of purchase.
- (b) eralytics GmbH will, without charge, at its option, replace or repair Products that fail as a result of defective materials or workmanship within the Warranty Period.
- (c) None of the obligations assigned to eralytics GmbH by this paragraph shall apply to any Products which have been repaired, altered or modified at the instance of Customer, unless Customer has disclosed the nature and full extent to any proposed repair, alteration or modification to eralytics GmbH in writing before it has been effected, and obtained an undertaking from eralytics GmbH that any outstanding warranty obligations in respect of such Products will continue to apply to such Products despite such repair or alteration. eralytics GmbH retains an unfettered discretion to grant or refuse any such undertaking.
- (d) None of the obligations of eralytics GmbH in this Warranty shall apply to any Products which have been subjected to misuse, neglect, accident, or (without restricting the generality of the foregoing) any extreme environmental condition or improper handling.
- (e) If defective Products are returned to eralytics GmbH, the costs of such return will be borne by the customer, and those of delivering the repaired or replacement Products to the customer will be borne by eralytics GmbH.

eralytics GmbH 's sole liability hereunder shall be to repair or replace any product which proves to be defective. In no event shall eralytics GmbH be liable for any special incidental, consequential, indirect or other similar damages arising from failure of its Products.

LIMITATION OF REMEDIES

Neither eralytics GmbH nor the Customer will be liable to the other for any special, incidental, consequential, indirect or other similar damages arising from breach of warranty, indemnifications, breach of contract, negligence, strict liability or any other kind of civil liability. eralytics GmbH 's total liability in connection with this agreement shall in no event exceed the amount paid or payable by the Customer in respect of the product which is the cause of such liability on the part of the company.

OBLIGATION OF THE CUSTOMER

The Customer agrees, as a condition of purchase of a product from eralytics GmbH, not to reproduce any part of the Product. The Customer also agrees not to make unauthorized use of the proprietary information which belongs to eralytics GmbH.

1.3 Copyright

ERAVAP and this manual are protected by copyright. Reproduction of the unit will result in prosecution. All rights to the manual are reserved. Reproduction in any form, including in the form of excerpts, shall require written permission from the copyright holder.

We reserve the right to make technical and content changes including without prior notice.

1.4 Licenses

The kernel, operating system and application software of this device are based on open source projects licensed under GPL-v2 and/or GPL-v3. The complete list of libraries and their license used can be viewed in the detailed software version information field and in the update menu under "software licenses", respectively.

The source code required to build the above-mentioned libraries can be obtained on a DVD for a period of three years after the last shipment of this product by making a request to office@eralytics.com stating software version, device serial number and a postal address followed by a money transfer of €10 to:

eralytics GmbH
Raiffeisenbank Langenlois
Address: Kornplatz 9
3550 Langenlois
Austria

IBAN: AT433242600000063818
BIC: RLNWATWW426

This offer is valid to anyone in receipt of this information.

2 Unpacking

When unpacking the analyzer, please ensure the analyzer is not subjected to excessive vibration or shock and that the following items are available:

- EV10 ERAVAP OR EV20 ERAVAP LPG
- EV01-A001 Sampling tube with luer connector (**EV10 only**)
- EV01-A029a Quick-fit inlet nut (EV01-A039a) and Sampling tube with 1x Quick connector (EV01-A033a) (**EV20 only**)
- EV01-A002a Mesh inlet filter 80 µm (5 pcs, 1 already inside sample inlet)
- EV01-A003 Outlet tube
- EV01-A004 Waste container
- EV01-A005 Power cable
- EV01-A009 Test certificate
- EV01-A010 Instruction manual abstract & 1-page short version
- EV01-A011 Instruction manual (saved as PDF file on USB memory stick)

Operating range:

- EV10...up to 10bar
- EV20...up to 20bar
- Preinstalled software modules:
 - EV01-D6378 software module for VP-measurement of gasoline (D5191, D6378, EN13016-1, EN13016-2, IP394, IP409; excellent correlation to ASTM D323 & D4953)
 - EV01-D5188 Software module for the measurement of the vapor/liquid ratio according to ASTM D5188
 - EV01-D6377 Software module for the measurement of the vapor pressure of crude oil according to ASTM D6377; IP481; GOST 52340
 - EV01-D6897 Software module for the measurement of the vapor pressure of LPG according to ASTM D6897 (excellent correlation to ASTM D1267)
required optional accessory: EV10-A029a: Quick-connector inlet nut (EV10-A039a) and Sampling tube with 1 x Quick-connector with check valve (EV01-A033a)
- Optional modules:
 - EV01-COOL Low Temperature Module -20 to 0°C (-4 to 32°F)
 - EV01-VISC High Viscosity Module
 - EV01-VPL Low Vapor Pressure Module
 - EV01-RCS ERASOFT RCS - remote control Windows software for instrument remote control from a PC and for easy data exchange
 - EVx0-A031 Auto sampler 10 positions (x = 1 for gasoline and non-pressurized crude oil, x = 2 for LPG and pressurized crude oils)

If any of the items is missing or was damaged during shipment, please contact your local agent or eralytics GmbH (at +43 1 890 50 330 or office@eralytics.com) immediately.

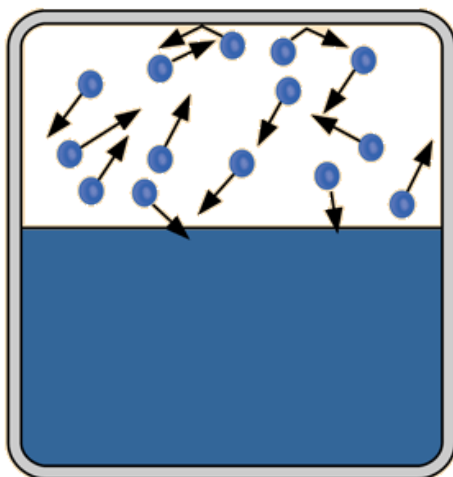
Retain and reuse the shipping boxes and packing materials as they provide optimal protection for the equipment(s) during transport (e.g. for service).

Reordering Supplies

Please refer to <http://eralytics.com/distribution/> or contact your local dealer if supplies are required.

3 Measuring principle

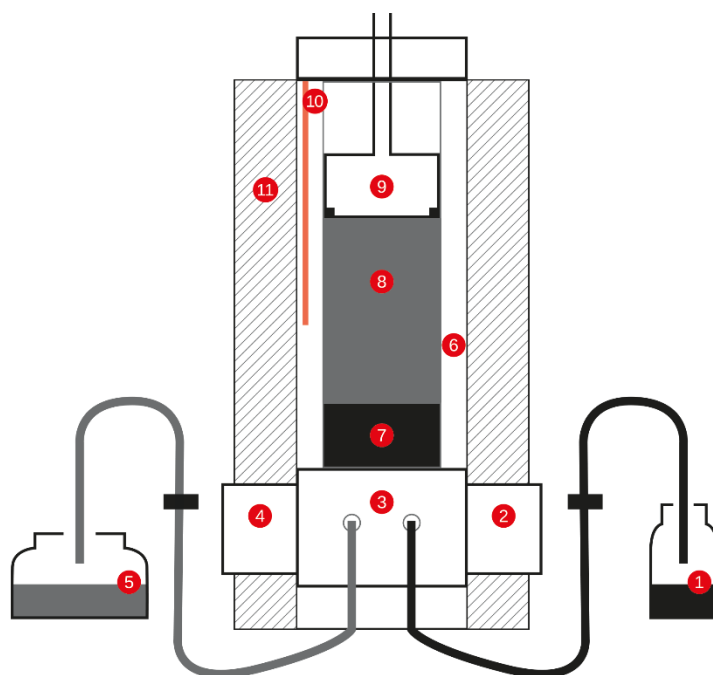
ERAVAP measured the vapor pressure of liquid materials. By definition, the vapor pressure, or equilibrium vapor pressure is the *pressure, exerted by a vapor in thermodynamic equilibrium with its condensed phases at a given temperature in a closed system.*



Within a measurement, the following parameters are controlled, pre-defined or measured:

- **V/L ratio**
As for of the filling parameters, the amount of liquid sample related to the total volume of the measuring cell is adjusted, or pre-defined by the used method.
- **Measuring time**
In order to ensure that the liquid and vapor phases are in a stable equilibrium state a measuring time is specified.
- **Temperature**
As the vapor pressure is a function of the temperature, this parameter is pre-defined and monitored, ensuring that the measuring cell is temperature regulated.
- **Pressure**
For most common methods the pressure in the measuring cell is determined.

A typical measurement with ERAVAP can be described as follows:



- | | | | |
|---------------|-------------------|-------------------------------|----------------------|
| ① sample | ④ outlet valve | ⑦ liquid phase | ⑩ temperature sensor |
| ② inlet valve | ⑤ waste container | ⑧ gas phase | ⑪ insulation |
| ③ manifold | ⑥ measuring cell | ⑨ piston with pressure sensor | |

The sample tube is put into the sample container (1). After starting the measurement, the measuring cell (6) is regulated to the specified filling temperature and the piston (9) moves to the down position simultaneously the outlet valve (4) is opened to release the pressure. The outlet valve is closed, the inlet valve (2) is opened and the piston moves upwards to introduce the sample into the measuring cell. The piston then is reset to the down position again to expel the liquid via the outlet valve.

After this rinsing procedure has been repeated a pre-defined number of times, the piston draws in a specified amount of sample, then the inlet valve is closed. The piston moves further up (extension against vacuum) and the measuring cell is regulated to the specified measuring temperature.

When a pre-defined measuring time is elapsed the pressure inside the measuring cell is determined by the pressure sensor (9) and used for calculating the method dependent result data.

3.1 Specifications

<u>Available Test Methods:</u>	ASTM D5188, D5191, D6377, D6378, D6897; EN 13016-1, EN 13016-2, EN 13016-3; IP 394, IP 409, IP 481; JIS K2258-2; SHT 0769, SHT 0794; SNT 2932; GOST 52340, EPA / CARB / CCQTA / US Military and NATO reference methods, TVP measurement VP-V/L Speed Test™ – Combined T(V/L) and vapor pressure measurement
<u>Correlation to:</u>	ASTM D323, D1267, D2533, D4953, D5190, D5482, D2879 (optional low vapor pressure extension)
<u>Fuel Specifications:</u>	ASTM D910, D1655, D4814, D6227, EN 228
<u>Hardware Feature:</u>	Built-in shaker for crude oil and accelerated V/L measurements Pure Sampling™ valve technology for minimized cross-contaminations
<u>Temperature Range:</u>	0°C – 120°C (32°F – 248°F) with Peltier technology – No external cooling required Optional extension EV01-COOL: -20°C – 120°C (-4°F – 248°F) – External cooling required Extrapolated range: -100°C – 300°C (-148°F – 572°F)
<u>Temperature Stability</u>	0.01°C (0.02°F)
<u>Pressure Range</u>	EV10 ERAVAP: 0 kPa – 1000 kPa (0 psi – 145 psi) – High precision pressure transducer EV20 ERAVAP LPG: 0 kPa – 2000 kPa (0 psi – 290 psi) – Extended range pressure transducer
<u>Pressure Resolution</u>	0.01 kPa (0.0014 psi)
<u>Vapor / Liquid Ratio</u>	Variable from 0.02/1 – 100/1 – Single-point, multi-point and curve measurements
<u>Precision</u>	Repeatability: $r \leq 0.15$ kPa (0.022 psi) measured with EV10 and cyclopentane at 37.8°C Reproducibility: $r \leq 0.5$ kPa (0.073 psi)
<u>Sample Introduction</u>	Automated via built-in piston – No external vacuum pump required; 80 µm reusable filter
<u>Sample Volume</u>	1 mL (2.2 mL per rinsing cycle)
<u>Measurement Time</u>	5 minutes for a standard measurement
<u>Display:</u>	Industry proven 8" color touchscreen
<u>Languages:</u>	English, German, French, Spanish, Russian, Chinese Additional languages available upon request


<u>Interfaces:</u>	Built-in PC with Ethernet, USB and RS232 interfaces Direct LIMS connectivity and output to printer or PC Optional input by external keyboard, mouse and barcode / QR-code reader
<u>Remote Control:</u>	Remote service capability via Ethernet interface
<u>PC Software:</u>	ERASOFT RCS - remote control Windows® software for multi-instrument remote control, convenient data transfer and result analysis
<u>Result Database:</u>	Over 100 000 detailed test reports stored in internal memory
<u>Alarm Tracking:</u>	All alarm messages are stored in the database together with the results
<u>Operating Conditions:</u>	Temperature range 10°C to 40°C Humidity up to 90% RH, non-condensing
<u>Power Requirements:</u>	Auto-switching 85-264 V AC, 47-63 Hz, max. 150 W (multi-voltage power supply) Field application: 12 V DC (vehicle battery) adapter available
<u>Dimensions / Weight:</u>	29 x 35 x 34 cm (11.4 x 13.8 x 13.4 in) / 9.7 kg (21.4 lb)

4 Getting started

4.1 Operating Environment

When setting up the analyzer, select a location away from heat, smoke, electrical interference and avoid any electrostatic discharges (ESD) to the analyzer unit. The bench top should be a level surface and free of vibration.

Ensure that the vent holes of the analyzer are not obstructed. The analyzer requires an environment with ambient room temperature in the range of 10°C to 45°C.

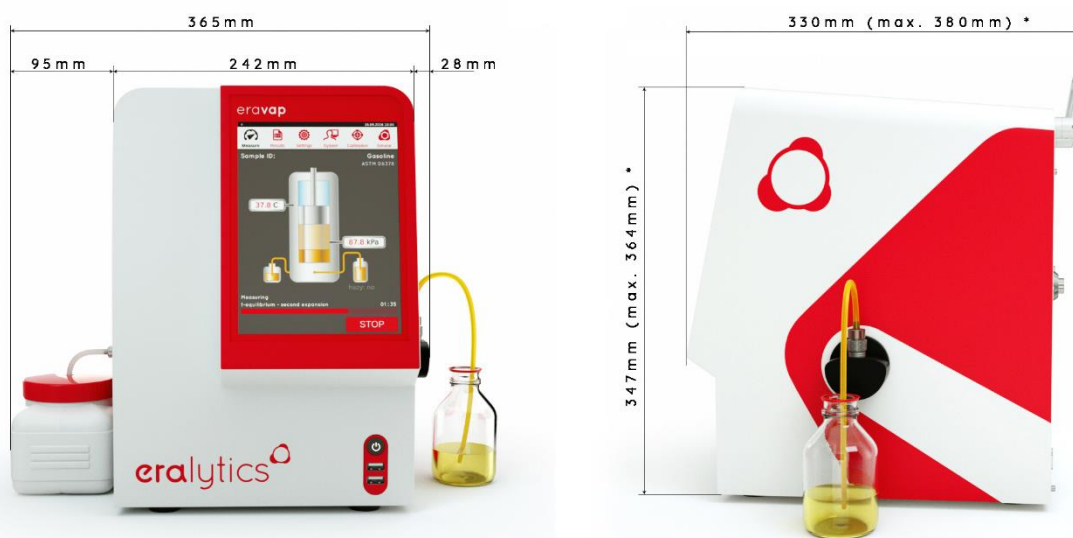
 Before making any connections, make sure that the power cable at the back of the analyzer is not plugged into an electrical outlet.

Only one set-up utility is required: an A.C. electrical outlet. It is recommended that the analyzer is plugged into its own circuit to avoid power line interference and voltage surges or drops, which may occur if the circuit is shared with devices with high electrical draw.

For protection against scratches and spills, it is recommended that the screen protection film is placed on the touch screen monitor – one protection film is already placed on the touch screen monitor! (to reorder, please contact your local agent or eralytics GmbH).

4.2 Dimensions & space requirement

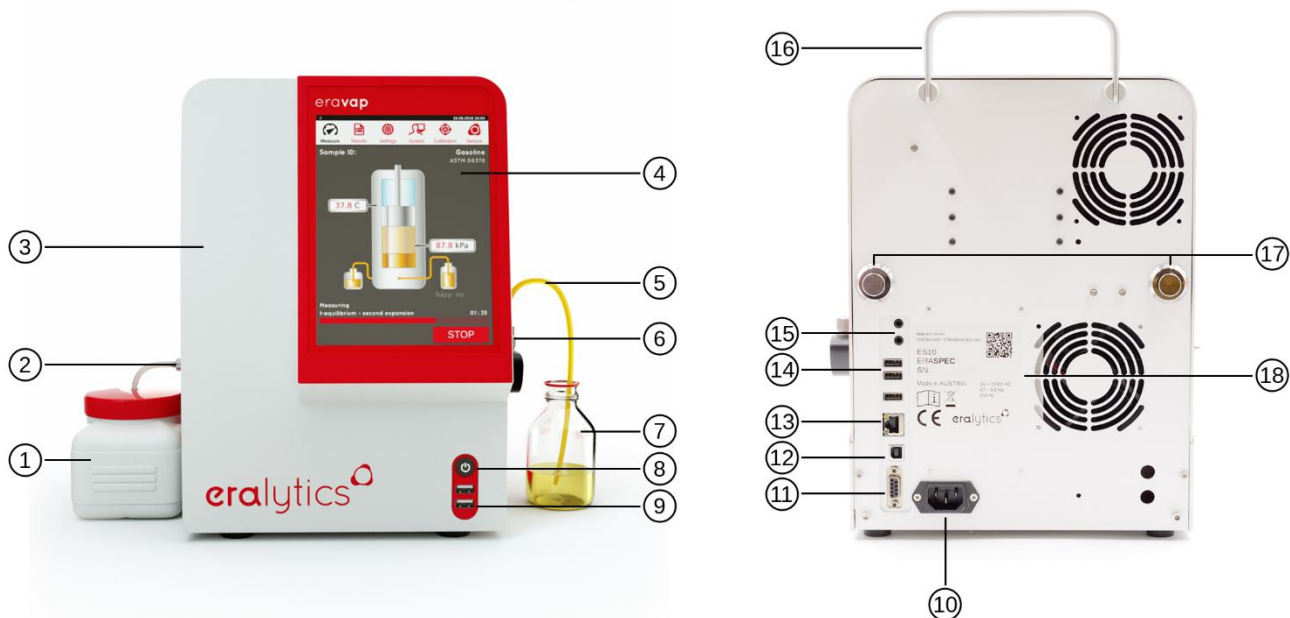
Below dimensions are valid for a single position instrument, without considering space needed for the user sample bottles. For dimensions of an instrument with autosampler, please contact your local eralytics distributor or eralytics GmbH.



*: dimensions in brackets are related to an extended handle in the corresponding direction

4.3 Connecting and starting the analyzer

Place the analyzer on a stable benchtop. Connect the power cable as well as the waste container and the inlet tube to the analyzer as described in the pictures below.



- ① Waste container
- ② Sample outlet
- ③ Housing
- ④ Display
- ⑤ Filling tube with Luer connector
- ⑥ Sample inlet
- ⑦ Sample container
- ⑧ On/Off button
- ⑨ 2x USB Type A plug (master)

- ⑩ Mains
- ⑪ RS232 interface
- ⑫ USB Type B plug (slave)
- ⑬ Ethernet connector
- ⑭ 3x USB Type A plug (master)
- ⑮ Audio connectors
- ⑯ Handle
- ⑰ 2x Buttons to remove housing
- ⑱ Serial number plate

If the instrument is used for measuring non-pressurized samples (e.g.: gasoline) the sampling tube with the Luer connector can be used:



For pressureized samples (e.g. LPG, crude oil with high amount of volatile substances) the sampling tube with quickconnector (right picture) must be used. Otherwise, volatile substances might be lost when exposing the sample to ambient pressure, thus leading to a too low result.



ERAVAP with 10 position autosampler:

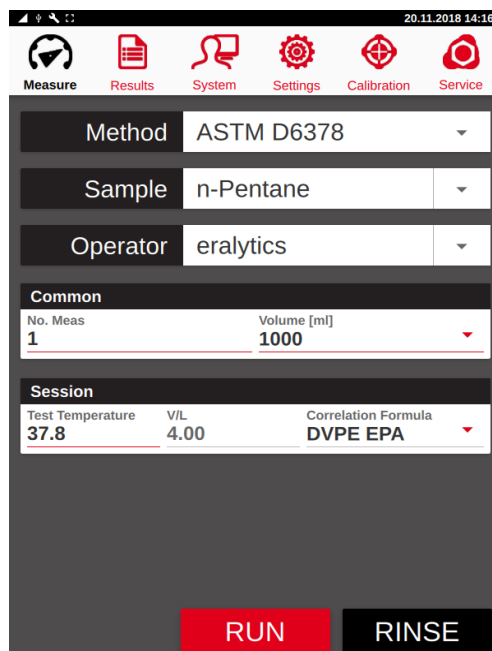


ERAVAP with FPC (Floating piston cylinder) connected:

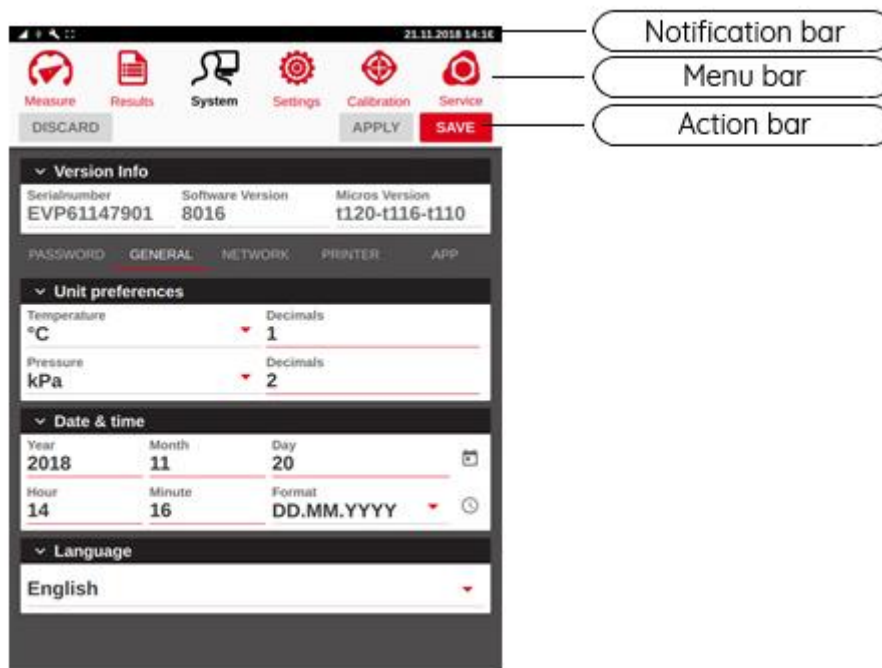


- ① Filling tube with quick connector
- ② Quick connector inlet nut
- ③ Example of pressurized sample container

Press the main power switch. The analyzer will load the firmware. During this process, the LED on the front is flashing. The startup takes approximately 15 seconds. After loading, the analyzer will automatically go to the “Measure” screen:

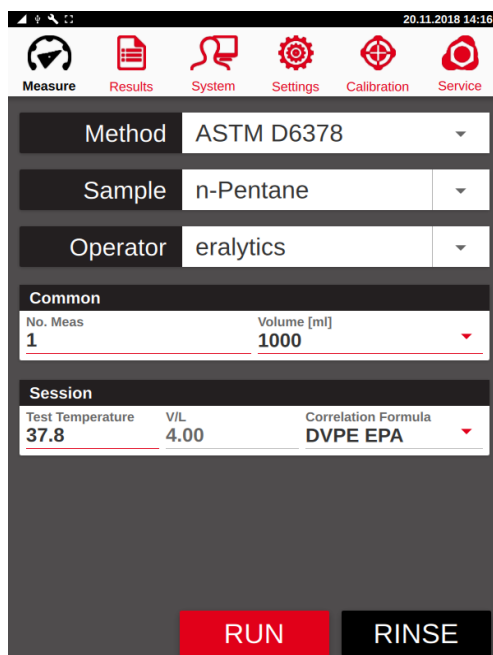


4.4 Software Overview



4.4.1 The menu bar

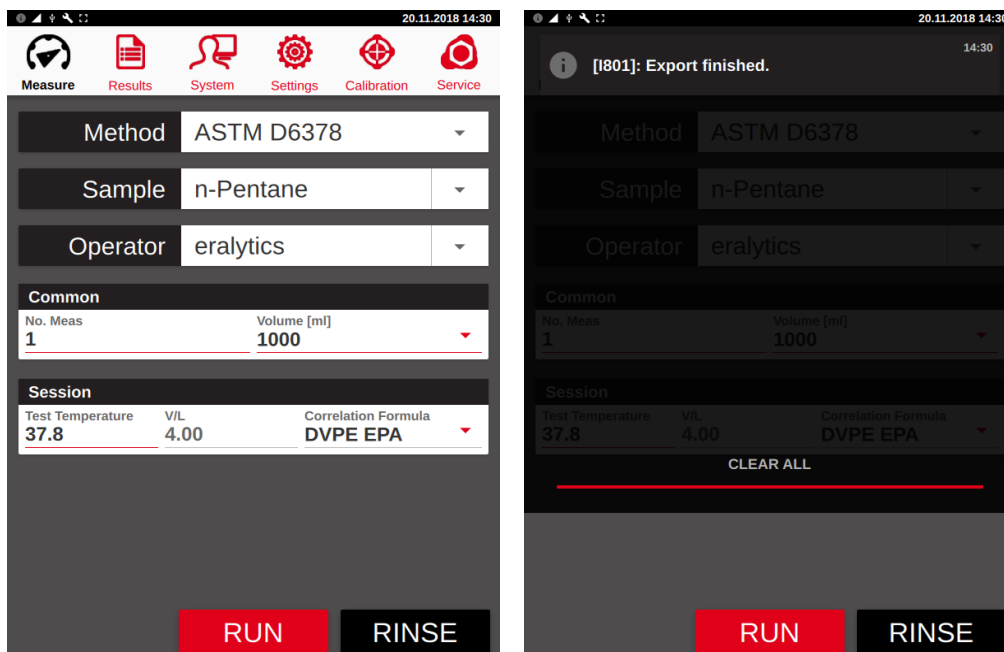
The instrument is controlled over the 8.4" color touchscreen. The main functions of the instrument are grouped in different menus. To facilitate quick navigation, the different menus are grouped together in the menu tab at the top of the touch screen. The appearance of the menu bar depends on the user level settings. For ERAVAP the menus “Measure”, “Result”, “System” and “Settings” by default (UL4) are visible.










- “Measure”: Make measurements, frequently changed measurement settings
- “Results”: View, print and export data stored on the instrument
- “System”: Control user levels, settings for network and printers, method codes
- “Settings”: View / access method defined settings and correlation formulas
- “Calibration”: Access the instruments calibrations
- “Service”: Advanced hardware settings and maintenance features

4.4.2 The notification bar

Above the menu bar is the notification bar. The notification bar displays network and USB connections as well as errors and warnings.

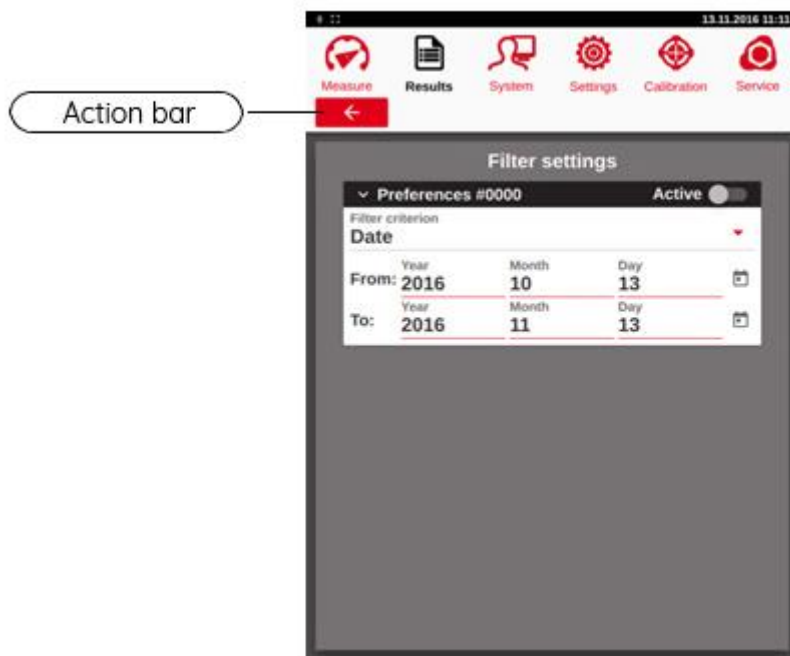


-  Warning. Each warning has a unique number and message
-  Error. Each error has a unique number and message.
-  USB connection
-  Network connection
-  Screenshot mode is active
-  VNC connection enabled
-  RCS Client is connected

By pressing the notification bar and sliding it down, the log file can be accessed. The log file is cleared every time the instrument is restarted. To clear the log file, press the clear all button above the red line. The log file is automatically cleared when the instrument is restarted.

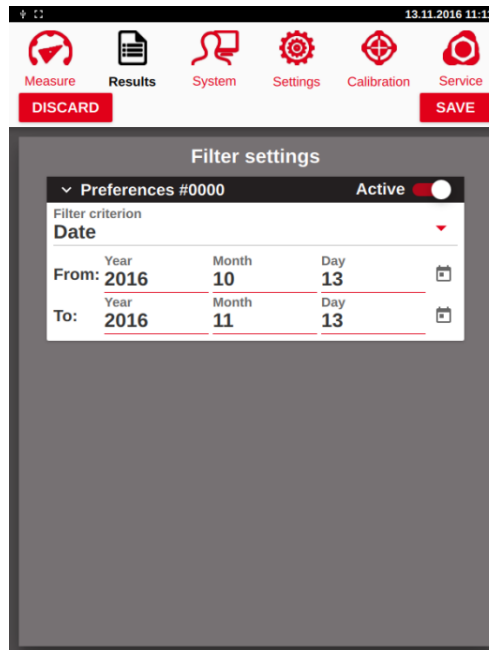
4.4.3 The action bar

When in a sub menu, the action bar becomes active.



To leave a sub menu, press either the back button or on any tab in the menu bar.

If a parameter is changed, a “SAVE” button will appear in the action bar.



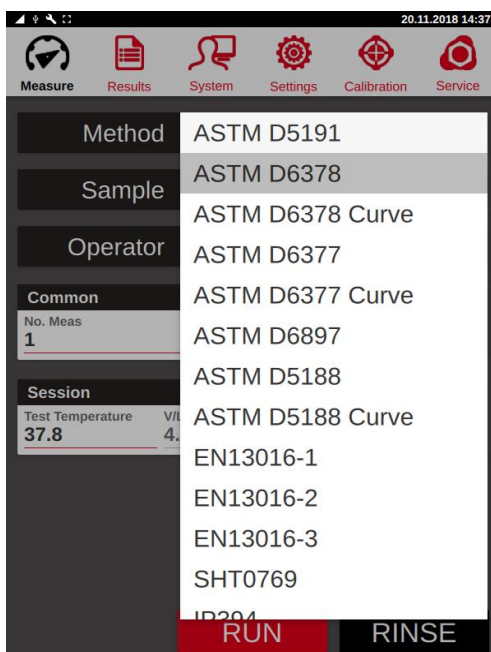
“SAVE”: Writes the current parameter set to the RAM and saves it to the flash memory.

“APPLY”: Writes the current parameter set to the RAM.

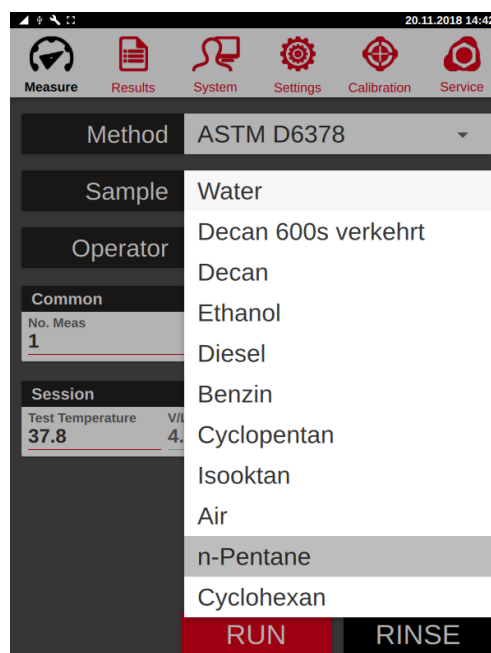
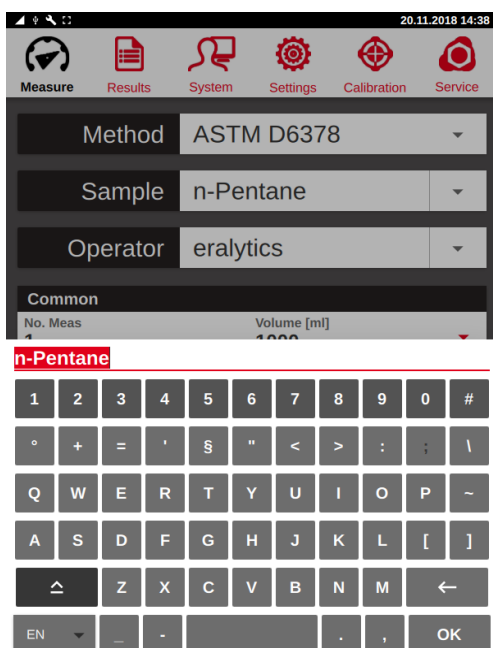
“DISCARD”: Discards the new settings; leave the menu without saving any parameters

4.4.4 Input fields

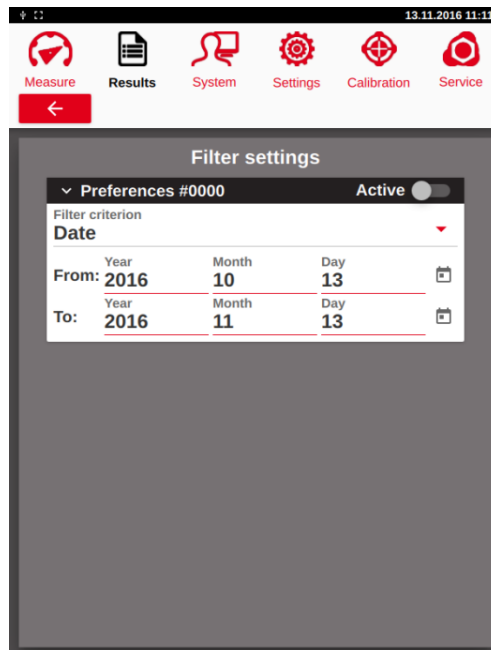
Many of the different types of fields for user input are present in the measure tab. Fields which only offers a selection, like Method, have a downward pointing arrow on the right side of the field. Pressing anywhere in the field will open a drop-down list displaying all possible choices.



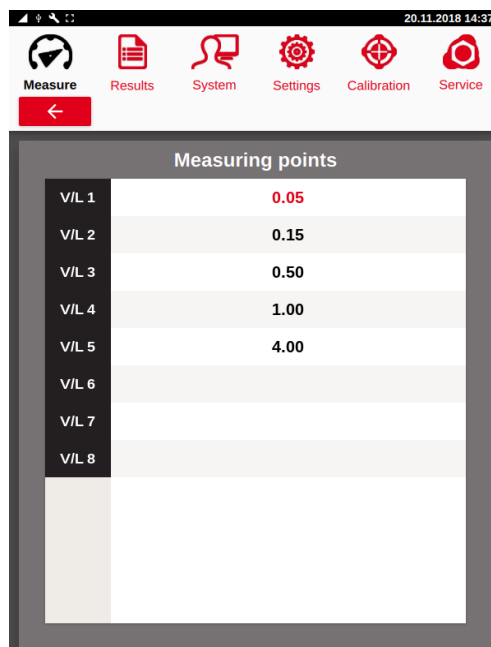
Fields that enables user editable input, like “Sample” name and “Operator”, have a line dividing the field. Pressing anywhere to the left of the line opens the keyboard, pressing to the right opens a drop-down list with stored names. This list contains the last 20 entries.



Fields that can be edited, like “*Test Temperature*”, have a red underline. Fields that display numbers that cannot be changed have a grey line.

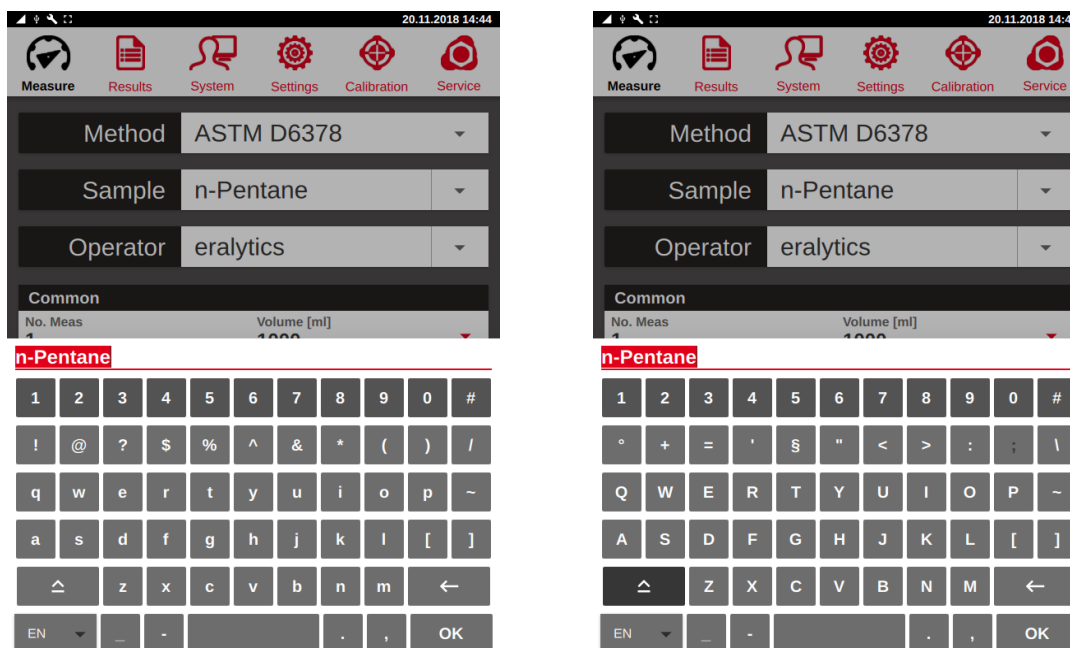


For tables with numbers that can be edited are written in bold font whereas other numbers are written in normal font.



4.4.5 Touch keyboard

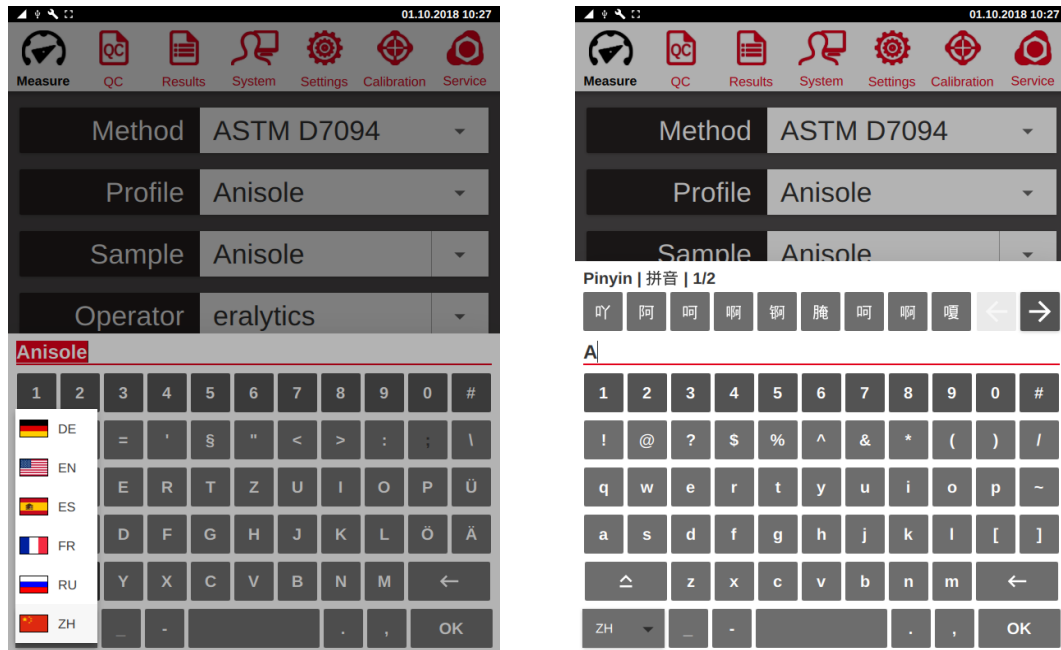
To change or select different settings on the instrument one can either use the drop-down lists or the touch keyboard. When a field only has pre-defined choices, the drop-down list will open when the field is pressed. For fields that can be edited, the drop-down list is opened by pressing the downward pointing arrow on the right side of the field. Pressing anywhere in the highlighted field will open the touch keyboard.



Use “upward arrow” to change to capital letters. You can change the language setting of the keyboard via the white button in the lower left corner. Depending on the field, a number of characters will be greyed out (like ; in sample name) preventing the use of illegal characters. For sample names ; is an illegal character. For file paths (printer settings) does not allow “,>,<?, \, /, “, * characters. Input fields with passwords and user names may contain any character.

For Chinese, the keyboard supports Pinyin.

It is possible to select the keyboard language by pressing the button in the lower left corner.

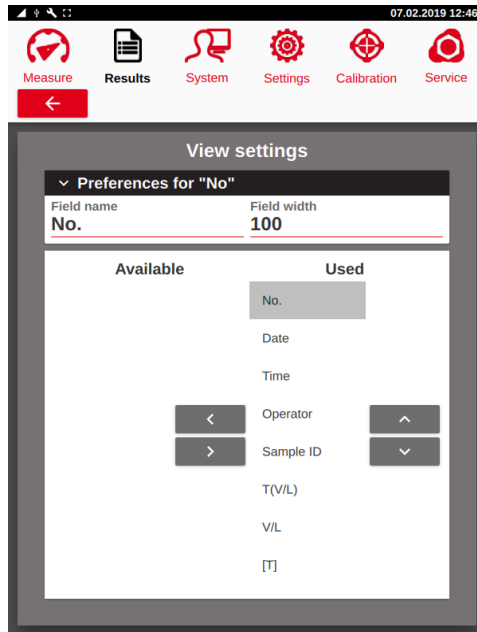


4.4.6 Deleting a name or operator

Select the name and press “back arrow”. Press “OK”. The name has now been removed from the drop-down list.

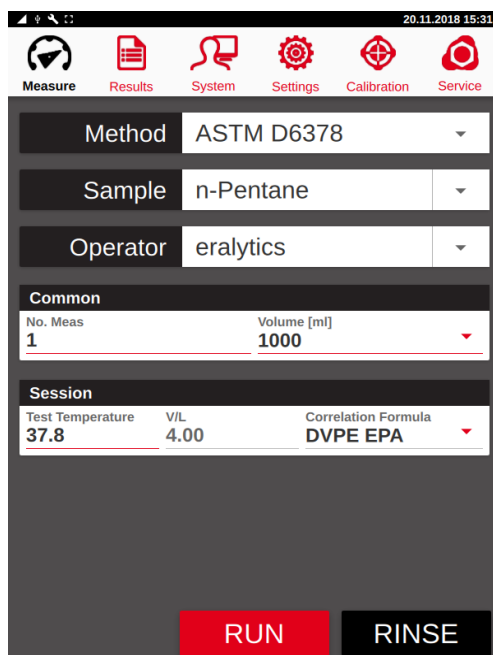
4.4.7 Selection Tables

The selection table is an important tool that is used throughout eralytics product line. It enables the user to select elements from a list of available items. To find an item, the user can scroll up and down within one table. Mark the specific item by clicking it. By moving an item from the left to the right column using the arrows, the item becomes active or selected. The up and down arrows show the item's position in the used column. For the "VIEW" menu, the position in the used table determined the column position on the screen.



4.5 External keyboard and mouse

Connect an external keyboard and mouse to any of the available USB slots. Press the “*Sample*” or “*Operator*” text field to open the keyboard. Type the name with the external keyboard and press enter. Alternatively, you can use the mouse to select the fields and to start measurements.



When an external keyboard is used, the instrument scans the input to remove any illegal characters in sample names and file paths. The illegal characters are listed in chapter 4.4.5.

4.6 Barcode scanner

Connect the barcode scanner to one of the USB ports on the back side of the instrument. When the instrument is in the *“Measure”* menu, any barcode that is scanned will be used for the sample name. When a barcode scanner is used, the code is not saved in the dropdown menu.

Please consult the specific instructions for how to configure the barcode scanner.

4.7 External Cooling System

The default temperature range of ERAVAP is from 0°C to 120°C. The optional EV01-COOL module extends this range to -20°C – 120°C by connecting an external cooling system to the instrument.

A circulator, tap water or cryostat can be used to pump the coolant (e.g. water glycol mixture) through the two connectors at the rear panel to cool the heat sink of the instrument. Use the lower connector as the INLET and the upper one as the OUTLET of the coolant!

The optimal temperature for the cooling liquid is -5°C – +5°C.



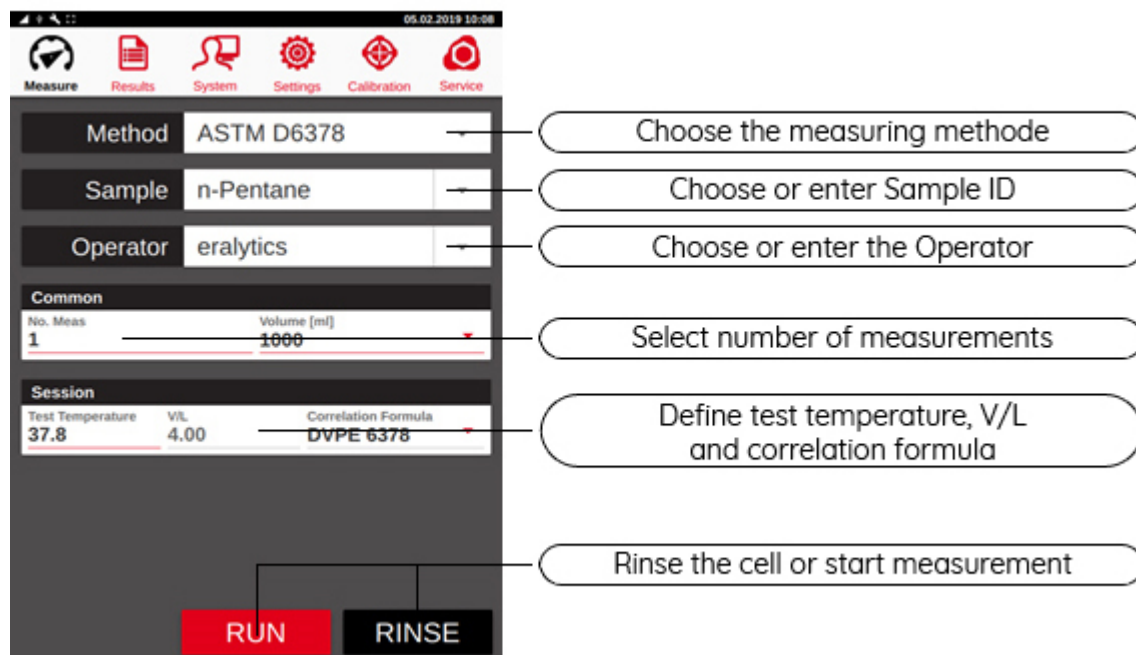
If connected to a tap water system, make sure to install a pressure reducer to match the instrument's requirements:

Flow rate [l/min]:	10 – 25 (without back pressure)
Pump flow pressure [mbar]:	0.30 – 0.45

5 Measure Menu

5.1 Running a measurement

After the instrument is powered and the software is loaded the *“Measure”* screen appears.



Use the touch keyboard to define *“Sample”* and *“Operator”*. The last 20 entries are stored in a list that can be selected by opening the dropdown list by pressing the arrow on the right side. The desired method can be chosen from a dropdown list.

Additional parameters like *“Test Temperature”*, *“No. Meas”* and *“Volume”* of the sampling container can be entered, too.

i This menu may appear differently since the displayed parameters depend in the selected method and the screen settings.

“RUN” Start the measurement

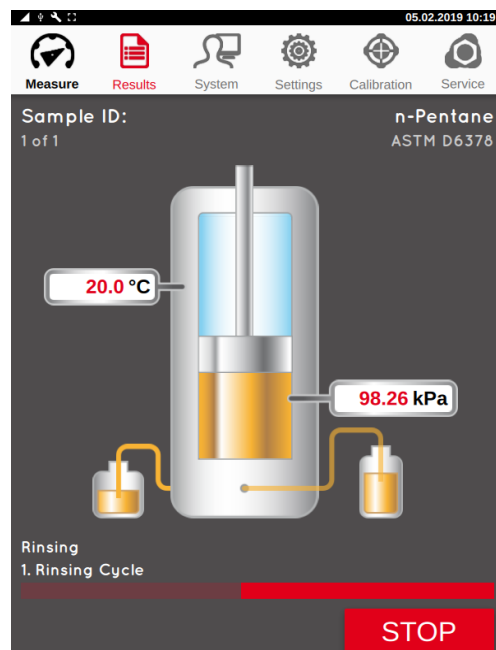
“RINSE” Perform manual rinsing cycles

“STOP” Abort the current measurement

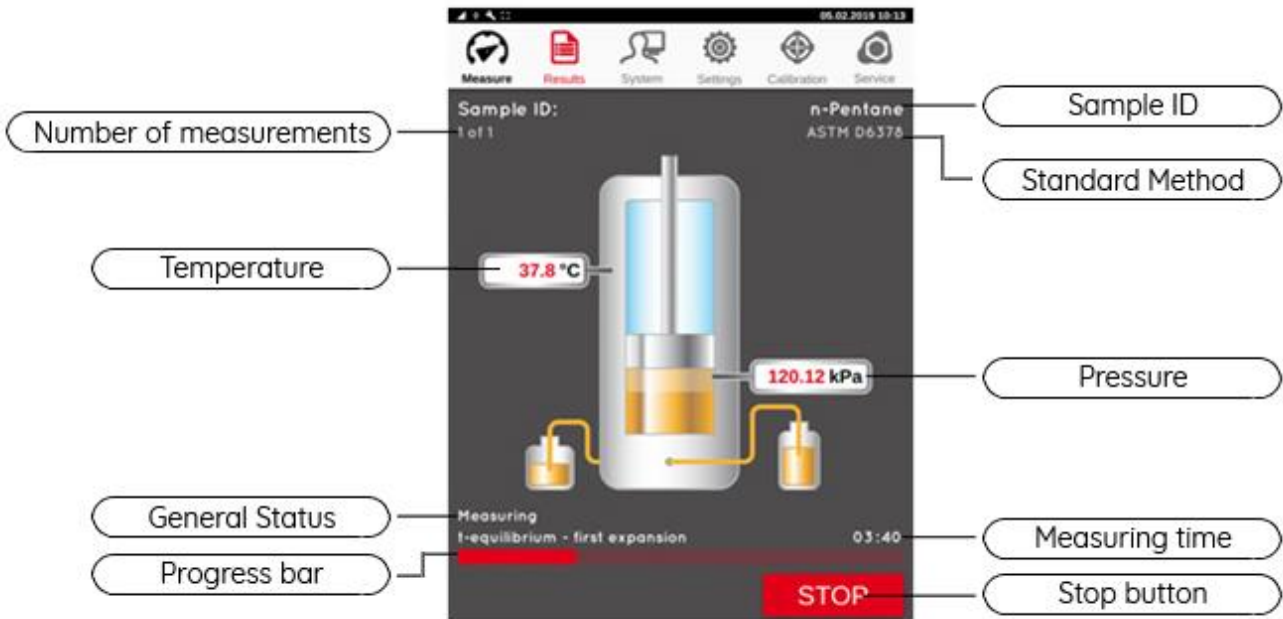
Insert the inlet tubing into the sampling container or use the quick connector to connect it to the instrument.



Start the measurement by pressing the “*RUN*” button. The instrument will automatically perform the defined rinsing cycles and measure the sample afterwards.



The measurement progress is indicated by the progress bar at the bottom of the measurement graphics, live temperature and pressure values are continuously displayed.

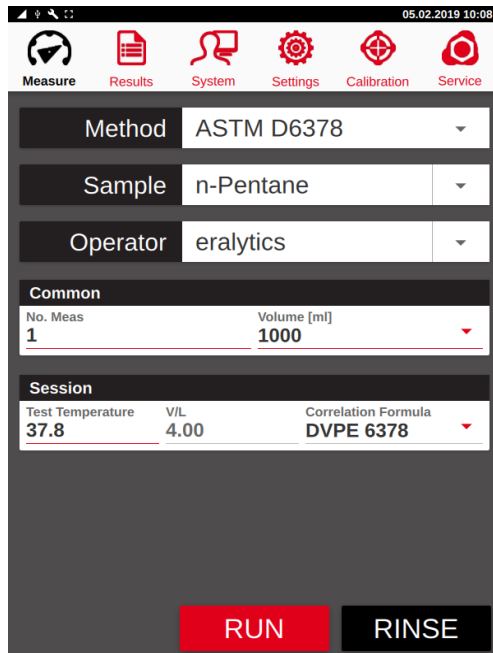


After the measurement is completed the result is shown on the display.

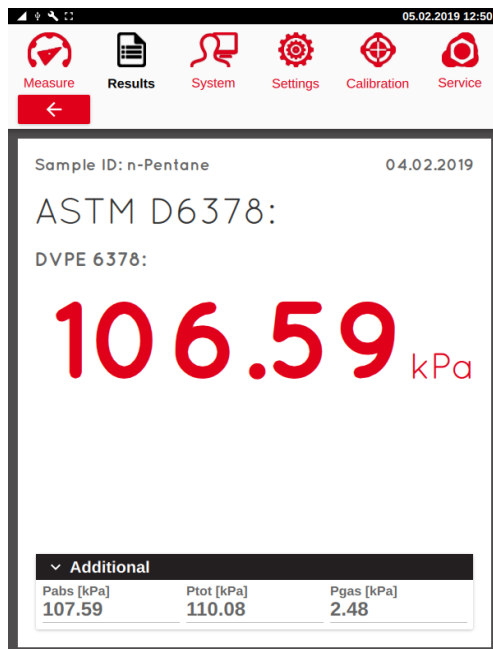


5.1.1 Single point measurements

Single point measurements allow setting one temperature or V/L point.

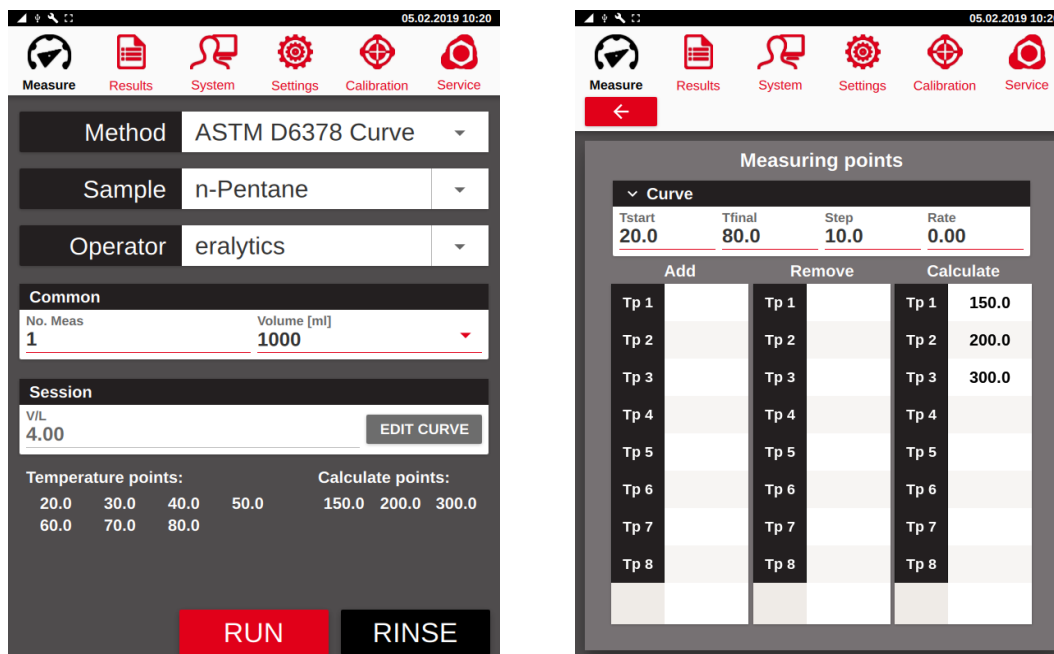


The result screen features the main result, depending on the used method and applied correlation formula and additional information, such as Ptot, Pabs, etc.



5.1.2 Curve measurements & result extrapolation

Similar to single point measurements, curve measurements can be performed. Depending on the method the user can define measurements at various temperatures or V/L ratios.



The parameters are displayed at the bottom of the screen and can be edited by clicking on the “*EDIT CURVE*” button.

The accessible temperature range is from 0°C (-20°C with low temperature module) to 120°C and the V/L range from 0.02/1 to 100/1, depending on the used method. Additionally, results can be extrapolated within a temperature range of -100°C to 300°C if at least 3 temperatures are measured.

“*T start*”: This setting defines the lowest temperature point.

“*T final*”: This parameter limits the maximum temperature for the measurement. Depending on the selected Step the actual T final may not be included as temperature point.

“*Step*”: Defines the steps between the temperature points.

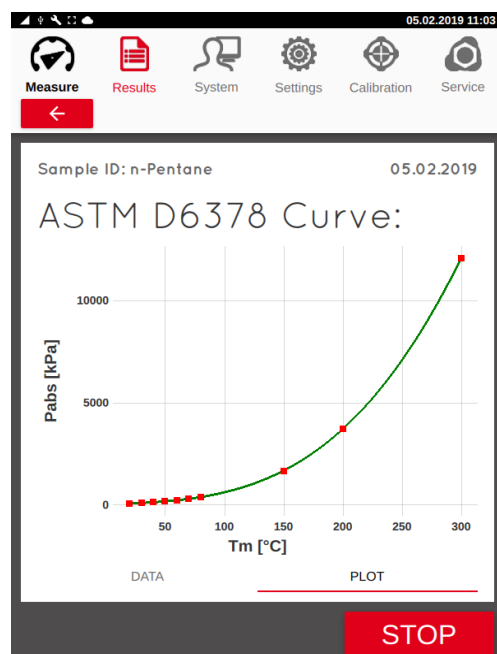
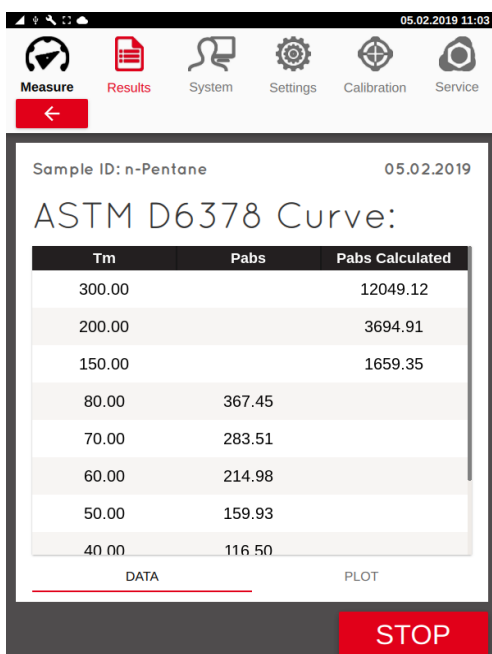
“*Rate*”: It is possible to set a heating rate (°C/min). If a heating rate of 0 is set the instrument will wait a specified time at each temperature point allowing the pressure to stabilize.

“Add”: Add an additional temperature point.

“Remove”: If a temperature point is entered it will be skipped during measurement.

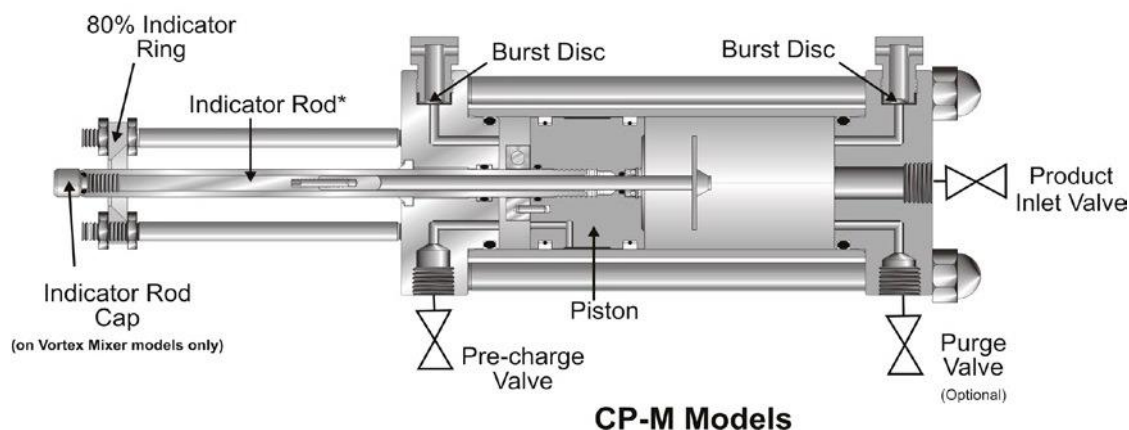
“Calculate”: Enter temperature points for calculating their absolute vapor pressure.

After the measurement a table with the measured results is displayed. Clicking on the sub-tabs “Data” or “Plot” allows to switch between the result table and measurement graph.



5.2 Measurement with the FPC

The picture below shows a FPC from Welker which can be used for crude oil and LPG measurements.



5.2.1 FPC filling procedure

Make sure that the FPC is free of contaminations and completely depressurized. Toluene may be used as cleaning agent for most crude oil applications.

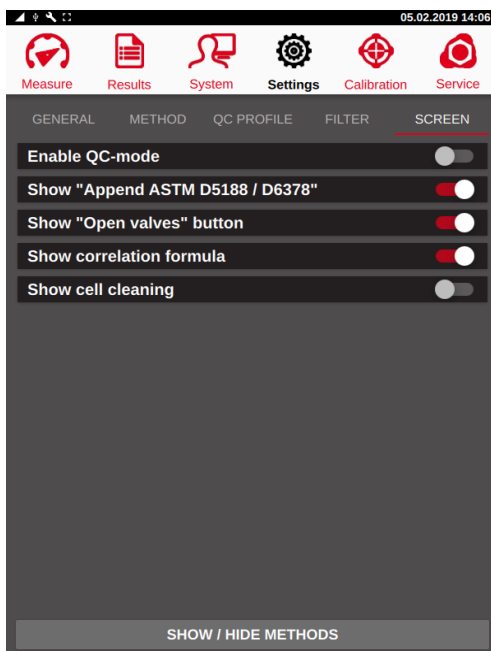
- 1) Open the purge or product valve and pressurize the cylinder (compressed air or nitrogen) through the pre-charge valve to move the piston forward. The applied pressure should exceed the vapor pressure of the sample for at least 100kPa.
- 2) Close the pre-charge valve.
- 3) Connect the LPG or crude with the purge or product valve.
- 4) Slowly open the purge or product valve to introduce the sample in the FPC. The indicator rod must move backwards until the pressure in the pre-charged chamber and the product chamber are equal. The final position of the indicator rod is dependent on the vapor pressure of the LPG or crude oil, respectively.
- 5) Close the purge valve.



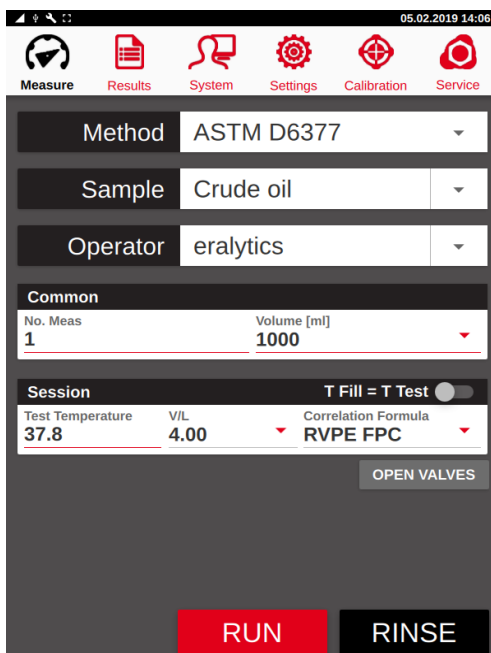
The maximum filling pressure for ERAVAP is 800kPa for EV10 and 1600kPa for EV20, respectively. If the pressure in the FPC exceeds this value slowly release some pressure by carefully opening the pre-charge valve. If the filling pressure cannot be matched without falling below the vapor pressure of the sample at ambient temperature the sample is not suitable for being measured with ERAVAP!

5.2.2 Settings

Make sure to enable the “Show “OPEN VALVES” button” in the “Settings > Screen” menu. This allows you to gently release the pressure from the inlet system after the measurement is finished.



If applicable, select the corresponding FPC correlation formula (e.g. for D6377 measurements):

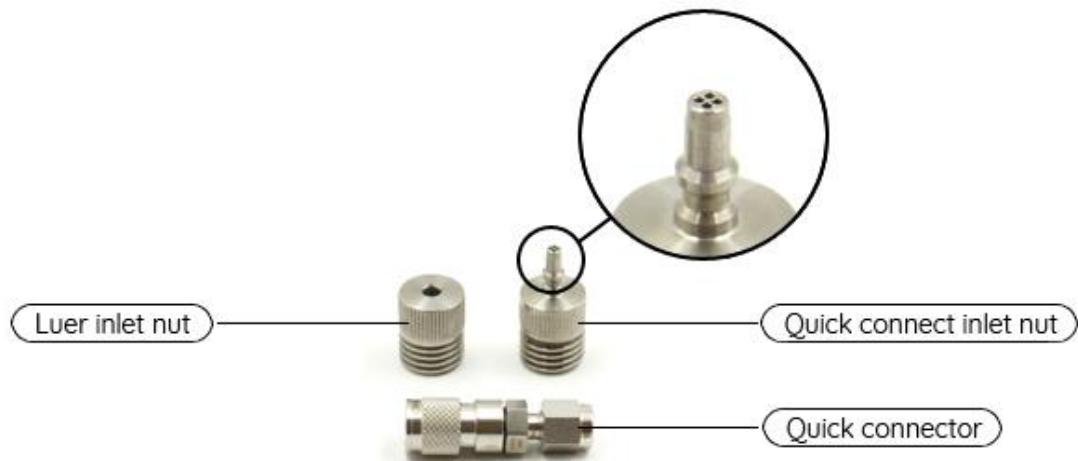


5.2.3 FPC measurement procedure

Enter the measurement parameters and place the FPC next to the ERAVAP.

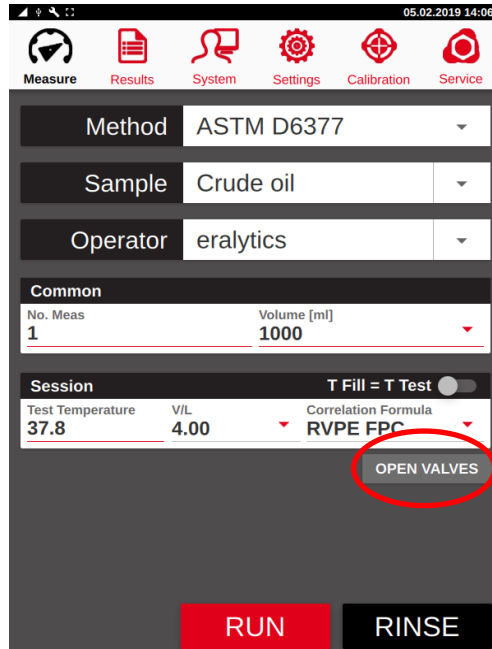


- 1) Make sure the quick connect inlet nut is installed:



- 2) Connect the FPC with the instrument by using the quick-connect inlet nut and the corresponding quick-connector.
- 3) Slowly open the product valve.
- 4) Start the measurement by pressing the "RUN" button.

- 5) Close the product valve after the measurement is finished. Press the “OPEN VALVES” button to release the pressure in the inlet tube before disconnecting the FPC from the instrument.

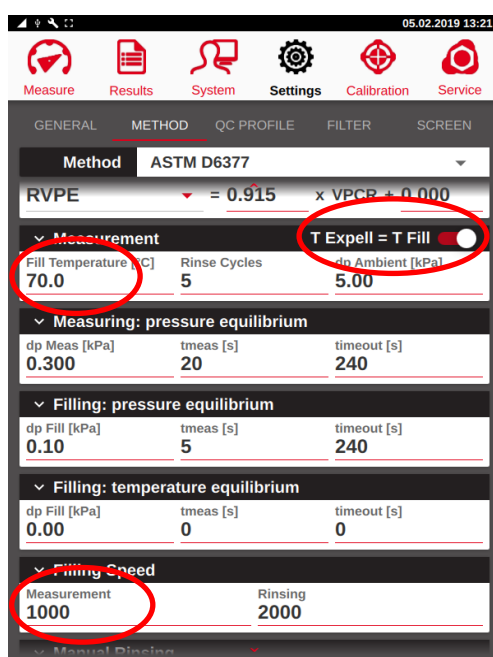


5.3 Measurement of highly viscous samples

When high viscous samples (>400cSt at 20°C) are measured the sample has to be heated in order to decrease the viscosity and ERAVAP must be equipped with the HVM (high viscosity module). The HVM ensures that the inlet assembly and both inlet and outlet tubes can be heated up to 70°C and thus the sample is kept liquified.

5.3.1 Settings

Select the designated method in the “Settings” menu:



Set the filling temperature accordingly and enable the option “*T Expell = T Fill*”. This feature regulates the temperature up to the starting temperature before the sample is expelled. Also, it is recommended to significantly decrease the piston speed, a plausible speed for viscous samples is < 1000.

5.3.2 Measuring

First heat up the sample to ensure its viscosity does not exceed 500cSt. Set the filling temperature and the HVM-temperature accordingly. The maximum allowed filling temperature is 80°C. If the sample needs to be heated up higher than 80°C it cannot be measured with ERAVAP. Set the HVM-temperature equal to the injection temperature. The maximum HVM-temperature is 70°C. If the injection temperature is higher (up to 80C) set the HVM-temperature to its maximum of 70°C.

Fill the sample in a disposable syringe or the provided glass syringe and connect it to the inlet assembly as shown in the picture:



After entering the measurement settings press the “RUN” button to start the measurement. Manually apply pressure on the syringe plunger every time the piston moves upwards to ensure proper filling. Release the pressure immediately as soon as the piston stops moving and ambient pressure is reached in the measuring cell. Repeat this for every rinsing and filling step.

Disconnect the syringe from the inlet assembly after the filling is completed.

5.3.3 Cleaning

By default, the cell temperature is regulated and kept at the filling temperature for 10 min after the measurement. Highly viscous samples may jam the piston and block the valves if allowed to cool down to room temperature in the instrument.

If no further measurements are performed within 10 min after the last measurement perform several rinsing cycles with a cleaning agent suitable for dissolving and thus removing the sample from the cell.

Afterwards perform a cell cleaning procedure with a vacuum pump to remove any residuals from the cleaning agent. The cleaning agents usually have a higher vapor pressure than the viscous samples, therefore not performing a proper cell cleaning procedure may influence the following measurements.



If the instrument is not cleaned sensitive parts like valves, piston tubes and filters can be blocked and may be irreversibly damaged!

6 General Description of the Standard Methods

In the following section you find a detailed description of all methods according to this analyzer is capable to measure.

6.1 ASTM D5191, EN13016-1, IP394, SHT0794

These standard methods are used for measuring the vapor pressure of gasoline. The instrument is measuring the total pressure P_{tot} against vacuum, which consist of the partial pressure of gasoline and the partial pressure of the dissolved air in gasoline.

$$P_{tot} = P_{gasoline} + P_{air}$$

Since only the $P_{gasoline}$ is of interest a correlation formula to the so-called Dry Reid bomb method D4953 (measurement of the vapor pressure of gasoline and gasoline oxygenated blends) has been developed based on a round robin test in 1991. Applying this empirically correlation formula the vapor pressure of gasoline is calculated.

This vapor pressure is called DVPE (Dry Vapor Pressure Equivalent).

$$DVPE = 0.965 \times P_{tot} - 3.78 \text{ kPa}$$

$$DVPE = 0.965 \times P_{tot} - 0.548 \text{ psi}$$

Another correlation formula has been developed by the US EPA. It correlates to ASTM D4953 but as reference instrument only the Herzog horizontal bath had been used.

$$DVPE \text{ EPA} = 0.956 \times P_{tot} - 2.39 \text{ kPa}$$

$$DVPE \text{ EPA} = 0.956 \times P_{tot} - 0.347 \text{ psi}$$

A third correlation formula has been developed by the US CARB to correlate to ASTM D323 (Reid Vapor Pressure, so called Wet Reid) which applies to non-oxygenated fuels only.

$$RVPE \text{ CARB} = 0.972 \times P_{tot} - 4.93 \text{ kPa} \quad RVPE \text{ CARB} = 0.972 \times P_{tot} - 0.715 \text{ psi}$$

These formulas are valid for gasoline measured at 37.8°C (100°F).

6.1.1 Sample preparation

Prior to the measurement the sample has to be brought to the defined condition as stated in D5191. Cool the sample to 0-1°C (32-34°F) in a 1l container filled to 70-80%. Open the cold bottle for several seconds to let some air in, close it again immediately and shake it vigorously for a few seconds. Put the bottle back into the refrigerator or ice bath. Let it sit there for 5 minutes and repeat this procedure twice. This procedure is the so-called air saturation at 0-1°C (32-34°F) for preparing the sample for the test.

An alternative method is ASTM D6378 which gives the DVPE as well but the sample preparation is not necessary.

6.1.2 Measurement

Select the desired standard method and make all necessary settings.

The screenshot shows the eralytics mobile application interface. At the top, there is a navigation bar with icons for Measure, Results, QC, System, Settings, Calibration, and Service. Below this, the main settings screen is displayed. The 'Method' is set to 'ASTM D5191', 'Sample' is 'n-Pentan', and 'Operator' is 'eralytics'. There is a toggle switch for 'Append ASTM D5188' which is currently turned off. Under the 'Common' section, 'No. Meas' is set to '1' and 'Volume [ml]' is set to '1000'. Under the 'Session' section, 'Test Temperature' is '37.80', 'V/L' is '4.00', and 'Correlation Formula' is 'DVPE 5191'. At the bottom, there are three buttons: 'QC', 'RUN', and 'RINSE'.

“Append D5188”: If an ASTM D5188 measurement shall be performed automatically immediately the vapor pressure measurement is finished then activate the switch “Append ASTM D5188”. Do not remove the sample tube from the inlet since a fresh sample is introduced for that test.

“Test temperature”: This temperature is defined by the method 37.8°C / 100°F and cannot be changed.

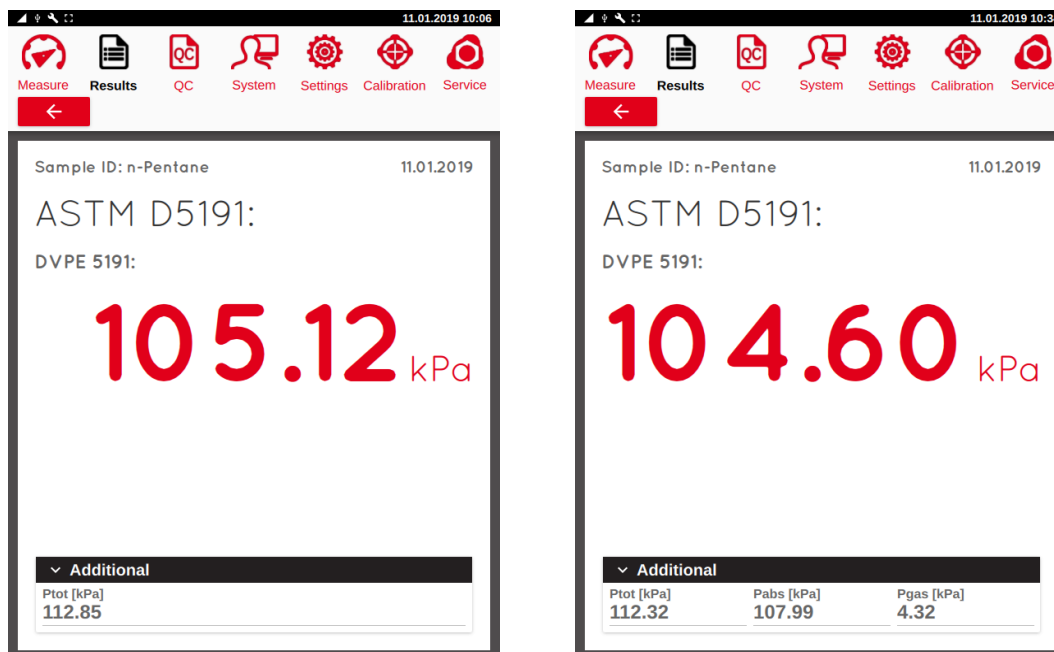
V/L: The V/L ratio is defined by the method with 4.00.



Prior to the measurement the sample has to be cooled and air saturated as stated in the standard method!

6.1.3 Result

At the end of the measurement the result screen will be displayed.



The additional information contains Ptot which is the total measured pressure. If the “*Triple Expansion*” option has been enabled before doing the measurement it will also contain Pabs (absolute vapor pressure) and Pgas.



As the determination of these parameters requires a triple expansion during the measurement it is not possible to view them afterwards, if the optional “*Triple Expansion*” has not been activated in the first place.

6.1.4 Quality control samples

There are some quality control samples recommended by ASTM D5191. If P_{tot} or DVPE is within the below mentioned range the instrument is well calibrated. The measurements are conducted at 37.8°C and the sample needs to be air saturated at 0°C.

Sample	P _{tot}	DVPE
n-Pentane	112.8 ± 1.2 kPa 16.36 ± 0.17 psi	105.1 ± 1.2 kPa 15.24 ± 0.17 psi
2,2-Dimethylbutane	74.1 ± 1.2 kPa 10.75 ± 0.17 psi	67.7 ± 1.2 kPa 9.82 ± 0.17 psi
2,3-Dimethylbutane	57.1 ± 1.2 kPa 8.28 ± 0.17 psi	51.3 ± 1.2 kPa 7.44 ± 0.17 psi
Cyclopentane	72.97 ± 1.95 kPa 10.58 ± 0.28 psi	66.6 ± 1.95 kPa 9.66 ± 0.28 psi

6.2 ASTM D6378, EN13016-3, JIS K2258-2, SHT0769

This standard method is used for measuring the vapor pressure of different kinds of liquids including gasoline, jet fuel and solvents. It is measuring the absolute vapor pressure P_{abs} against vacuum. By three pressure readings at different vapor to liquid ratios the partial pressure of the air dissolved in the liquid, named P_{gas} , is calculated and the total pressure P_{tot} is measured. Thus, the absolute vapor pressure P_{abs} of the liquid is calculated as following:

$$P_{abs} = P_{tot} - P_{gas}$$

A correlation formula to the so-called Dry Reid bomb method D4953 (measurement of the vapor pressure of gasoline and gasoline oxygenated blends) has been developed by the ASTM based on a round robin test in 1991. Applying this empirically developed correlation formula the DVPE (dry vapor pressure equivalent) of gasoline is calculated.

$$DVPE = P_{abs} - 1.005 \text{ kPa}$$

$$DVPE = P_{abs} - 0.146 \text{ psi}$$

Another correlation formula has been developed by the US EPA. It correlates to ASTM D4953 but as reference instrument only the Herzog horizontal bath had been used.

$$DVPE \text{ EPA} = P_{abs} - 0.137 \text{ kPa}$$

$$DVPE \text{ EPA} = P_{abs} - 0.02 \text{ psi}$$

A third correlation formula has been developed by US CARB to correlate to ASTM D323 (Reid Vapor Pressure, so called Wet Reid) which can be applied to non-oxygenated fuels only.

$$RVPE \text{ CARB} = P_{abs} - 1.575 \text{ kPa}$$

$$RVPE \text{ CARB} = P_{abs} - 0.23 \text{ psi}$$

These formulas are valid for gasoline measured at 37.8°C (100°F) only.

6.2.1 Sample preparation

No specific sample preparation is required for this method since the partial pressure of the air dissolved in the gasoline is determined and calculated.

6.2.2 Measurement

Select the desired standard method and make all necessary settings.

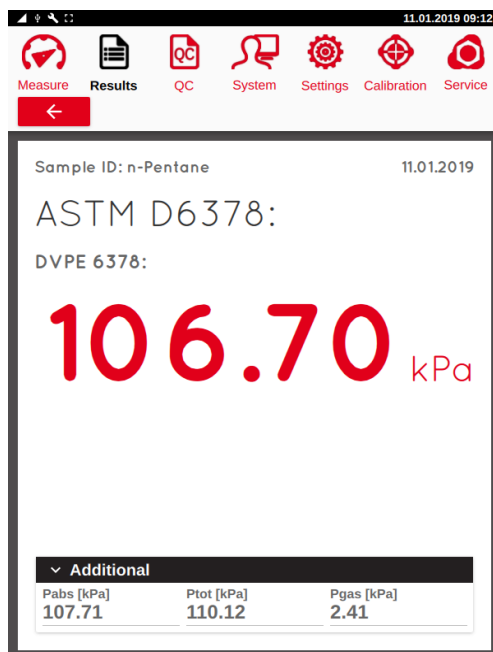
The screenshot shows the eralytics mobile application interface. At the top, there is a navigation bar with icons for Measure, Results, QC, System, Settings, Calibration, and Service. Below this, the 'Method' is set to 'ASTM D6378', 'Sample' is 'n-Pentane', and 'Operator' is 'eralytics'. The 'Common' section shows 'No. Meas' as 1 and 'Volume [ml]' as 1000. The 'Session' section shows 'Test Temperature' as 37.8, 'V/L' as 4.00, and 'Correlation Formula' as DVPE 6378. At the bottom, there are three buttons: 'QC', 'RUN', and 'RINSE'.

“Test temperature”: Set the temperature for the vapor pressure measurement

“V/L”: The V/L ratio is defined by the method with 4.00 and cannot be changed.

6.2.3 Result

At the end of the measurement the result screen will be displayed.



The main result is the applied correlation formula. If no formula is used Pabs will be shown instead.

The additional information contains Ptot which is the total measured pressure at the third expansion step, Pabs the absolute vapor pressure and Pgas.

6.2.4 Quality control samples

There are some quality control samples recommended by ASTM D6378. If Pabs within the below mentioned range the instrument is well calibrated. The measurements are conducted at 37.8°C.

Sample	Pabs
n-Pentane	107.9 ± 1.2 kPa 15.65 ± 0.17 psi
2,2-Dimethylbutane	68.8 ± 1.2 kPa 9.98 ± 0.17 psi
2,3-Dimethylbutane	51.7 ± 1.2 kPa 7.50 ± 0.17 psi

6.3 ASTM D6378 Curve

This method works similar to ASTM D6378 for measuring the absolute vapor pressure of gasoline or jet fuel type samples. Instead of only one temperature point, several test temperatures can be entered. The triple expansion (determination of the absolute vapor pressure) is performed at a specified temperature the total vapor pressure is then measured at all temperature points. Finally, the absolute vapor pressure is calculated for these other temperature points.



Single point measurements are in general more accurate than curve measurements due to the longer time such curve measurements take and the calculated gas correction for the additional points.

6.3.1 Measurement

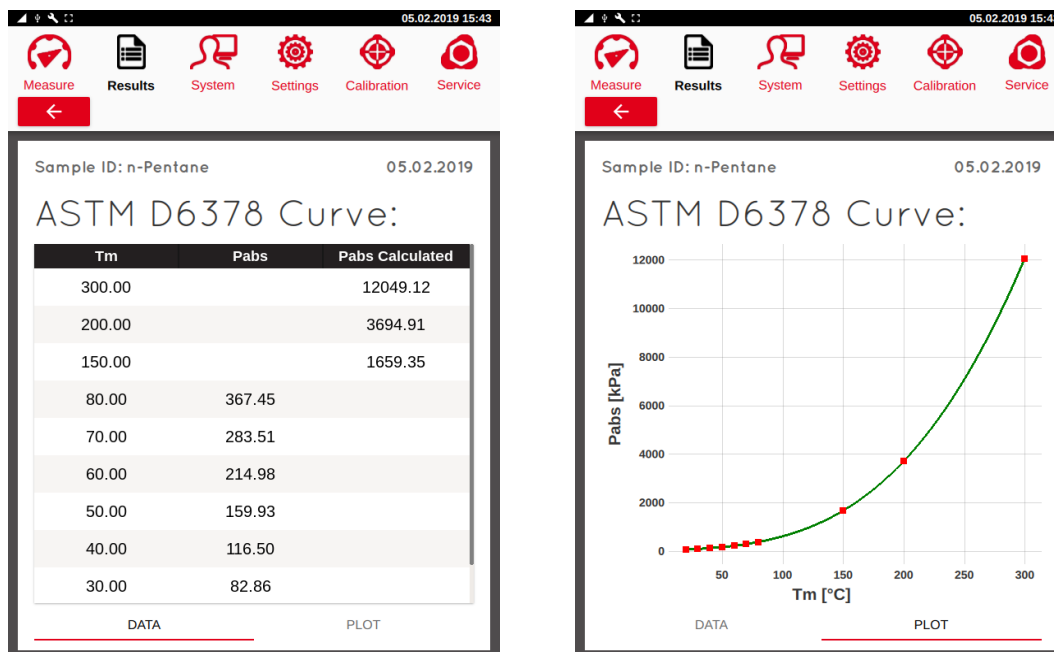
Select the desired standard method and make all necessary settings. Define the temperature points to be measured. Additional temperature points up to 300°C can be entered for extrapolated (=calculated) results.

“V/L” : The V/L ratio is defined by the method with 4.00 and cannot be changed.

“Temperature points”: Enter the temperatures for adding, removing or calculating the temperature points.

6.3.2 Results

At the end of the measurement the result screen will be displayed.



After the measurement the a table with the measured results is displayed. Clicking on the sub-tab “Data” or “Plot” allows to switch between the result table and measurement graph. The corresponding total pressure values can be viewed in the result tables.

6.4 ASTM D6377, IP481, GHOST52340

This standard method is used for measuring the vapor pressure of crude oil. It is measuring the total vapor pressure VPCR (Vapor Pressure Crude oil) against vacuum.

An old method often used for crude oil measurement is ASTM D323. The problem using this method is the sample preparation which can cause erroneous results depending on the crude. Light crude oil and life crude oil contains lots of high volatiles like gases which will be more or less lost doing the sample preparation as described in D323 (shaking the sample for air saturation). This is the biggest reason why the repeatability and reproducibility for crude oil using the D323 method is so bad.

Using the method ASTM D6377 the precision is much better and the results are not influenced by the sample preparation. This method is the only suitable method to give the correct result for crude oil samples. The sample is introduced into the instrument without doing any sample preparation. That keeps the high volatiles in the sample to ensure a correct result.

However, a correlation formula has been developed by the ASTM based on the most recent round robin test. Applying this empirically developed correlation formula based on the crude oil samples of this round robin the RVPE (Reid Vapor Pressure Equivalent) according D323 of crude oil is predicted as following:

Crude from non-pressurized container: $RVPE = 0.915 \times VPCR + 0.0 \text{ kPa}$
 $RVPE = 0.915 \times VPCR + 0.0 \text{ psi}$

Crude from floating piston cylinders: $RVPE = 0.834 \times VPCR + 0.0 \text{ kPa}$
 $RVPE = 0.834 \times VPCR + 0.0 \text{ psi}$

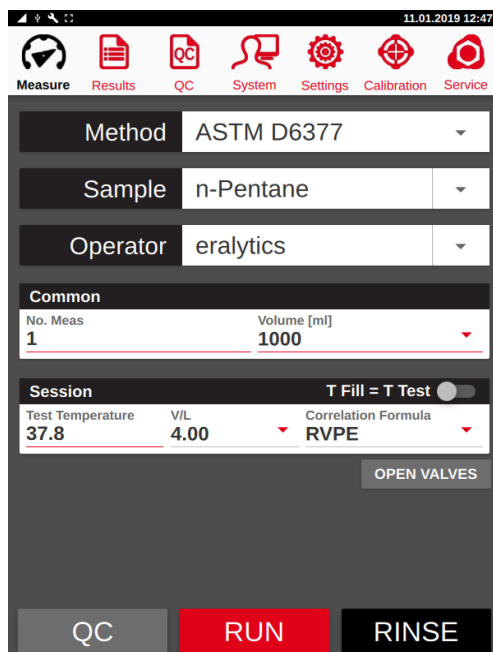
This formula is valid at 37.8°C (100°F) and a vapor to liquid ratio of 4/1 only.

6.4.1 Sample preparation

No special sample preparation is required, but make sure not to expose the sample to ambient atmosphere longer than necessary, otherwise volatile compounds may be lost. For quality control samples (n-pentane) the sample preparation has to be done in accordance to the sample preparation of D5191.

6.4.2 Measurement

Select the desired standard method and make all necessary settings. Make sure you have the correct settings for the crude oil and its container.



Higher viscous crude oil (dead crude) in non-pressurized containers:

- Use a tube or syringe for injection
- Set the filling temperature that the sample remains liquid, but below the boiling point and maximum the test temperature
- A HVM (high viscosity module) is probably required to heat the inlet, outlet and tubes to avoid clogging of these pieces.

Crude oil in non-pressurized containers:

- Make sure it is not live crude (below boiling point at ambient temperature), otherwise the sampling procedure is not correct and the light ends did already evaporate. Cooling the sample can help, but the Fill temperature must be set significantly below the boiling point.

Crude oil in pressurized containers:

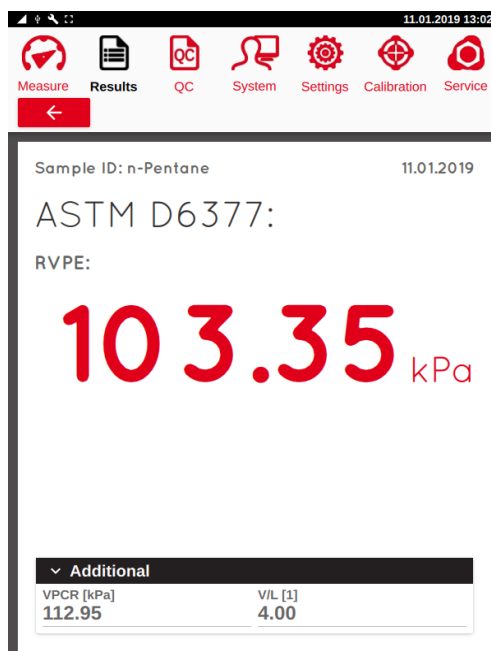
- This is actually the correct and only way to sample live crude
- For V/L ratios < 1 set T "Fill = T Test" and the "Filling: temperature equilibrium" parameters shall be set and will be applied.

“V/L”:
Two different V/L ratios can be selected. By default, a V/L of 4.00 is set, but for matching the conditions in (e.g.) a pipeline a smaller V/L ratio of 0.02 is available.

“OPEN VALVES”:
When a pressurized container is disconnected it is recommended to close the valve of the container first and then push the “OPEN VALVES” button to release the pressure in the line. Then the quick connector at the inlet can be safely removed.

6.4.3 Result

At the end of the measurement the result screen will be displayed.



The additional information contains total vapor pressure VPCR and the V/L ratio.

6.4.4 Quality control samples

There are some quality control samples recommended by ASTM 6377. If P_{tot} is within the below mentioned range the instrument is well calibrated. The measurements are conducted at 37.8°C and the sample needs to be air saturated at 0°C.

Sample	P_{tot}
n-Pentane	112.8 ± 1.2 kPa 16.36 ± 0.17 psi
2,2-Dimethylbutane	74.1 ± 1.2 kPa 10.75 ± 0.17 psi
2,3-Dimethylbutane	57.1 ± 1.2 kPa 8.28 ± 0.17 psi

6.5 ASTM D6377 Curve

This standard method works similar to D6377, but instead of one test temperature several temperature points are measured.

6.5.1 Measurement

Select the desired standard method and make all necessary settings. Make sure you have the correct settings for the crude oil and its container.

06.02.2019 12:36

Measure Results System Settings Calibration Service

Method: ASTM D6377 Curve

Sample: n-Pentane

Operator: eralytics

Common

No. Meas: 1 Volume [ml]: 1000

Session

V/L: 4.00 EDIT CURVE OPEN VALVES

Temperature points:

20.0	30.0	40.0	50.0
60.0	70.0	80.0	

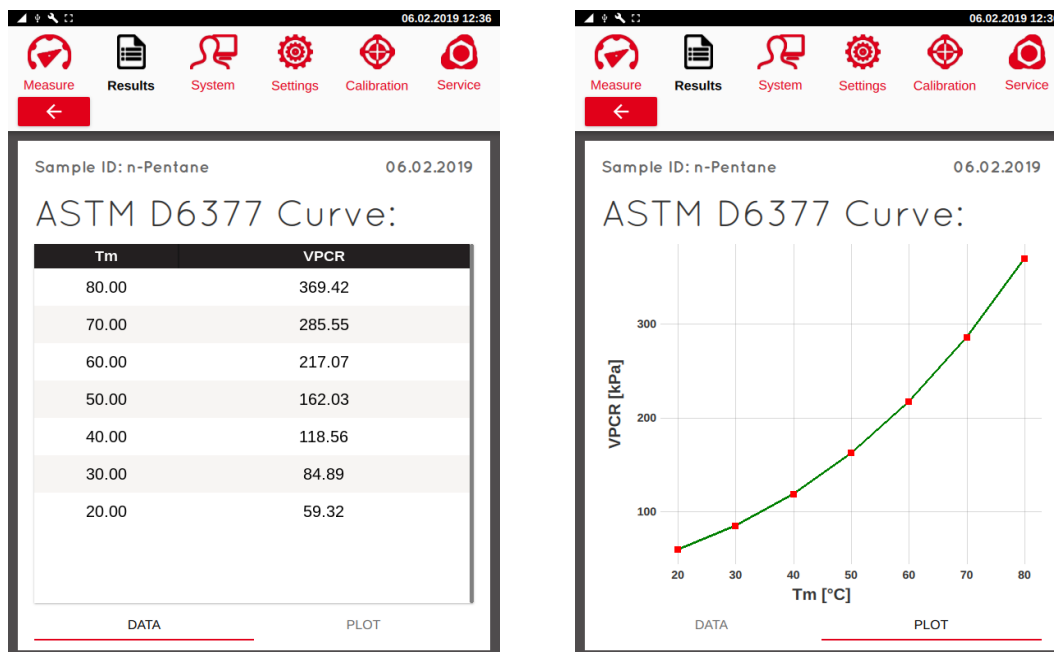
RUN RINSE

“V/L”:
The V/L ratio can be modified between 0.50 and 4.00 for this method.

“Temperature points”:
Enter the temperatures for adding, removing or calculating the temperature points.

6.5.2 Result

At the end of the measurement the result screen will be displayed.



After the measurement a table with the measured results is displayed. Clicking on the sub-tab "Data" or "Plot" allows to switch between the result table and measurement graph.

6.6 ASTM D6897

This standard method is used to determine the vapor pressure of Liquefied Petroleum Gas (LPG) at V/L ratios between 0.1:1 and 4:1, measured against vacuum. The result is reported relative to atmospheric pressure. Thus the measurement result is corrected using the following formula:

$$VP(\text{LPG}) = VP_{\text{tot}} - 101.3\text{kPa} \quad VP(\text{LPG}) = VP_{\text{tot}} - 14.69\text{psi}$$

In most cases a V/L ratio of 0.5:1 is used at a temperature of 37.8°C (100°F).

ERAVAP EV10 has a pressure range from 0-1000kPa.

ERAVAP EV20 has an extended pressure range from 0-2000kPa.



Do not use acetone for rinsing for EV20! Acetone will attack the sealing material of the high-pressure valves and they will be irreversibly damaged!

6.6.1 Sample preparation

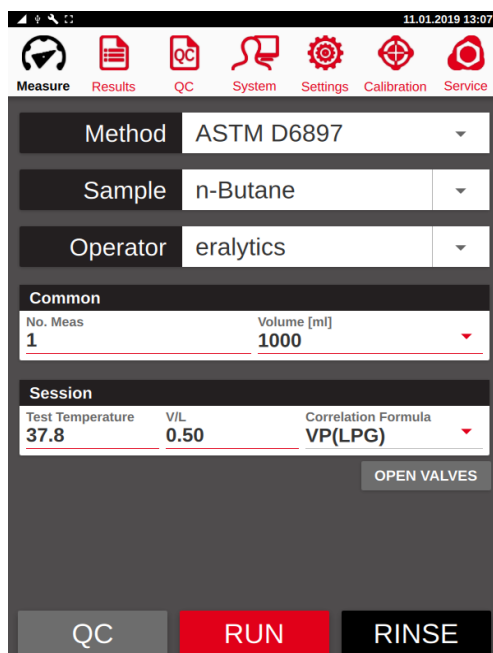
This method does not require special sample preparation.



Make sure that the sample itself has not been re-pressurized with inert gas (e.g. helium, nitrogen)! If the sample needs to be pressurized to keep it completely liquified the use of a FPC is recommended. Otherwise the vapor pressure result will be significantly higher than expected, additionally the results may vary, therefore the reproducibility will be bad.

6.6.2 Measurement

Select the desired standard method and make all necessary settings. Connect the pressurized container with the quick fit connector of ERAVAP. Hold the container upside down to fill the liquid LPG into the measurement cell after pressing RUN. Hold it until the rinsing and filling procedure is finished.



“V/L”:

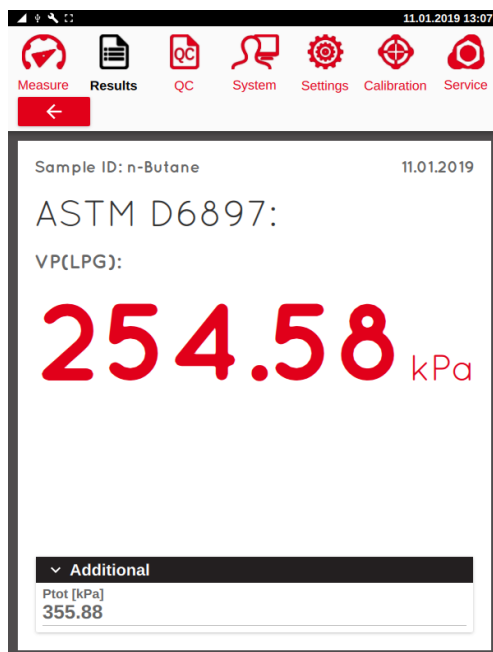
The V/L ratio is pre-set to 0.50 by the method but can be changed.

“OPEN VALVES”:

When a pressurized container is disconnected it is recommended to close the valve of the container first and then push the “OPEN VALVES” button to release the pressure in the line. Then the quick connector at the inlet can be safely removed.

6.6.3 Result

At the end of the measurement the result screen will be displayed.



The additional information contains P_{tot} which is the total measured pressure measured against vacuum. The result is then calculated relative to atmospheric pressure.

6.6.4 Quality control samples

There are several different quality control samples recommended by ASTM D6897. If P_{tot} is within the below mentioned range the instrument is well calibrated. For n-Pentane, the measurement is conducted at 70°C and the sample needs to be air saturated at 0°C. For n-Butane and n-Propane the measuring temperature is 37.8°C.

ATTENTION: Make sure that the LPG has not been pressurized directly with inert gas (e.g.: nitrogen, helium, etc.) otherwise the results may vary or be significantly higher than the stated limits!

Sample	P_{tot}
n-Pentane	310.0 ± 6.0 kPa 44.96 ± 0.87 psi
n-Butane	356.5 ± 6.0 kPa 51.71 ± 0.87 psi
n-Propane	1301.0 ± 7.0 kPa 188.69 ± 1.02 psi

6.7 ASTM D5188

This standard method is used to determine the temperature $T(V/L=20)$ where a cooled (0°C (32°F)) and air saturated sample in a closed chamber with a vapor to liquid ratio of 20 to 1 builds up a pressure of 101.3kPa (14.69psi).

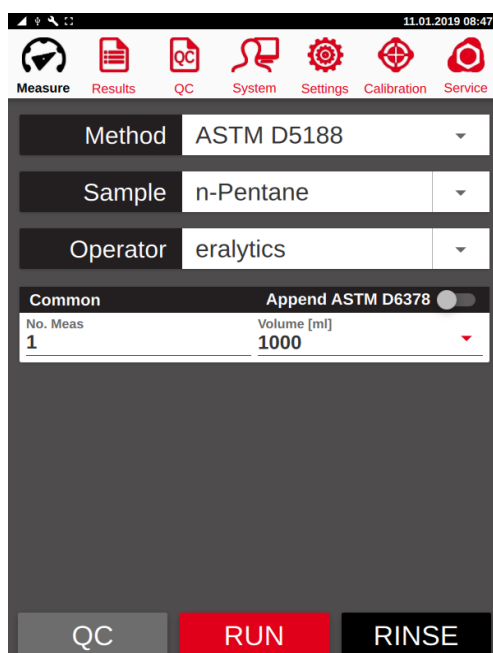
It resembles the initial boiling point of a sample.

6.7.1 Sample preparation

Prior to the measurement the sample has to be brought to the defined condition as stated in D5188. Cool the sample to $0-1^{\circ}\text{C}$ ($32-34^{\circ}\text{F}$) in a 1l container filled to 70-80%. Open the cold bottle for several seconds to let some air in, close it again immediately and shake it vigorously for a few seconds. Put the bottle back into the refrigerator or ice bath. Let it sit there for 5 minutes and repeat this procedure twice. This procedure is the so-called air saturation at $0-1^{\circ}\text{C}$ ($32-34^{\circ}\text{F}$) for preparing the sample for the test.

6.7.2 Measurement

Select the desired standard method and make all necessary settings.

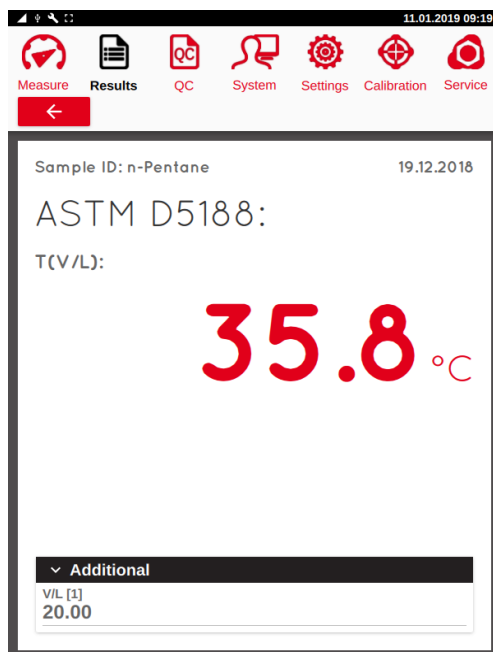


“Append ASTM D6378”:

If an ASTM D6378 measurement shall be performed automatically immediately the vapor pressure measurement is finished then activate the switch “Append ASTM D6378”. Do not remove the sample tube from the inlet since a fresh sample is introduced for that test.

6.7.3 Result

At the end of the measurement the result screen will be displayed.



The additional information contains the V/L ratio which must be 20 according to the method.

6.7.4 Quality control samples

There are some quality control samples recommended by ASTM D6378. If the resulting temperature is within the below mentioned range the instrument is well calibrated. The sample needs to be air saturated at 0°C.

Sample	T (V/L)
n-Pentane	35.7 ± 0.5 °C
10/90 (m/m) n-Pentane / Propane-2-ol blend	64.9 ± 2.9 °C
44/56 (m/m) n-Pentane / Toluene blend	53.5 ± 1.2 °C

6.8 ASTM D5188 Curve

This method works similar to D5188 to determine the temperature at different V/L ratios where a cooled (0°C (32°F)) and air saturated sample in a closed chamber builds up a pressure of 101.3kPa (14.69psi).

6.8.1 Sample preparation

Prior to the measurement the sample has to be brought to the defined condition as stated in D5188. Cool the sample to 0-1°C (32-34°F) in a 1l container filled to 70-80%. Open the cold bottle for several seconds to let some air in, close it again immediately and shake it vigorously for a few seconds. Put the bottle back into the refrigerator or ice bath. Let it sit there for 5 minutes and repeat this procedure twice. This procedure is the so-called air saturation at 0-1°C (32-34°F) for preparing the sample for the test.

6.8.2 Measurement

Select the desired standard method and make all necessary settings.

06.02.2019 10:42

Measure Results System Settings Calibration Service

Method ASTM D5188 Curve

Sample n-Pentane

Operator eralytics

Common

No. Meas	Volume [ml]
1	1000

Session

EDIT CURVE

V/L points:

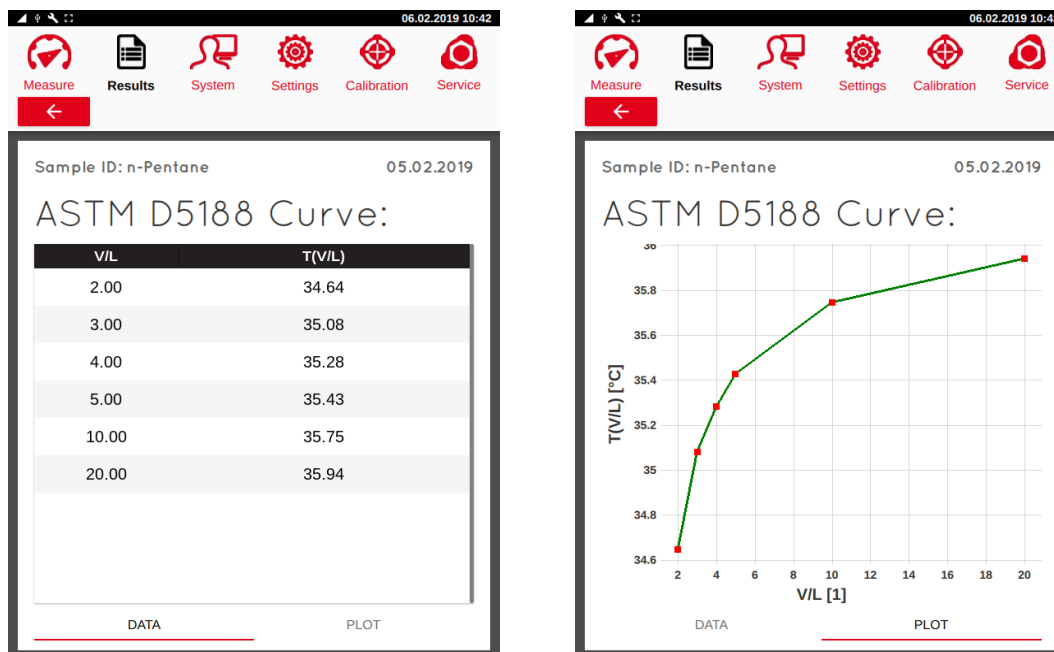
20.00 10.00 5.00 4.00 3.00

2.00

RUN RINSE

6.8.3 Result

At the end of the measurement the result screen will be displayed.



After the measurement a table with the measured results is displayed. Clicking on the sub-tabs "Data" or "Plot" allows to switch between the result table and measurement graph.

6.9 EN13016-2, IP409

This standard method is used to determine the vapor pressure of gasoline at temperatures between 40°C and 70°C with a vapor to liquid ratio of 3/2. The vapor pressure is measured against vacuum whereas the partial pressure of the air is measured and calculated at 37.8°C and then corrected for each further measuring temperature.

6.9.1 Sample preparation

Prior to the measurement the sample has to be brought to the defined condition as stated in EN13016-2. Cool the sample to 0-1°C (32-34°F) in a 1l container filled to 70-80%. Open the cold bottle for several seconds to let some air in, close it again immediately and shake it vigorously for a few seconds. Put the bottle back into the refrigerator or ice bath. Let it sit there for 5 minutes and repeat this procedure twice. This procedure is the so-called air saturation at 0-1°C (32-34°F) for preparing the sample for the test.

6.9.2 Measurement

Select the desired standard method and make all necessary settings.

The screenshot shows the eralytics mobile application interface. At the top, there is a navigation bar with icons for Measure, Results, QC, System, Settings, Calibration, and Service. The main screen displays the following settings:

- Method:** EN13016-2
- Sample:** n-Pentane
- Operator:** eralytics
- Common:**
 - No. Meas: 1
 - Volume [ml]: 1000
- Session:**
 - V/L: 1.50 (with an EDIT CURVE button)
- Temperature points:** 40.0, 50.0, 60.0, 70.0

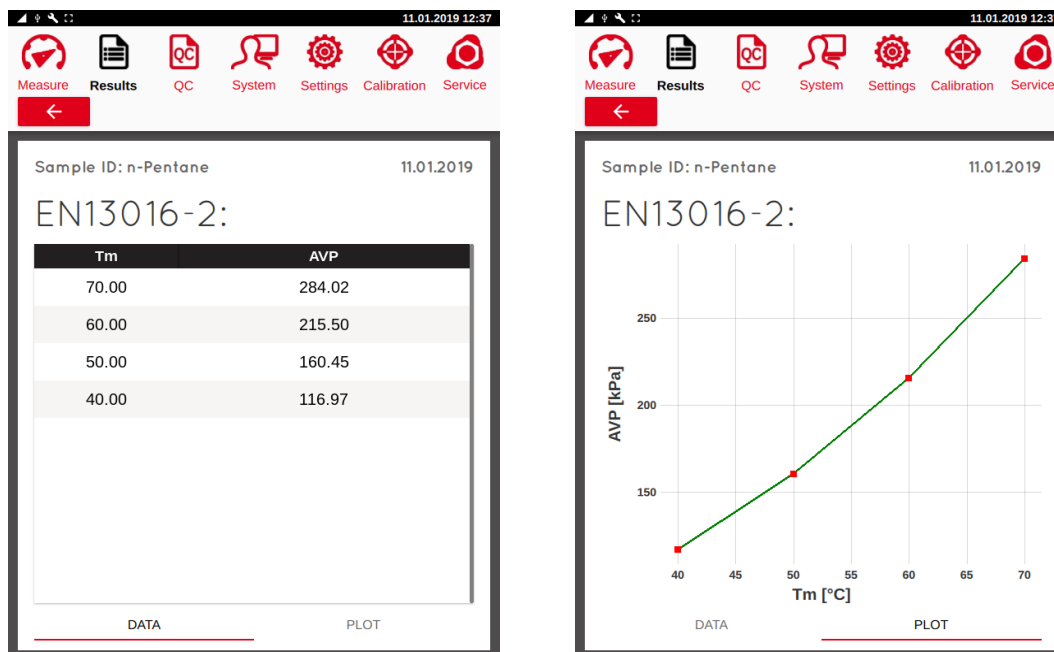
At the bottom of the screen, there are two large buttons: **RUN** (red) and **RINSE** (black).

“V/L”:
The V/L ratio is defined by the method with 1.50.

“Temperature points”:
The standard settings for the temperature points are displayed above, additional points can be added or removed if required.

6.9.3 Result

At the end of the measurement the result screen will be displayed.



The table contains the temperature points and their corresponding AVP (Pabs) pressure results. Additionally, the Curve can be graphically plotted.

6.9.4 Quality control samples

EN13016-2 recommends n-Pentane as quality control sample. A standard curve measurement is performed with temperature points set to 40-80°C and the step size set to 10°C per step. If AVP (Pabs) at 80°C is within the below mentioned range the instrument is well calibrated.

Sample	AVP (Pabs)
n-Pentane	367.0 ± 2.0 kPa 53.23 ± 0.27 psi

6.10 V/L Curve

This method does determine the total vapor pressure at a defined temperature at several V/L ratios. It is possible to enter V/L ratios between 0.02 – 4.00.

6.11 EN-ASTM-Curve

This method does determine the absolute vapor pressure and can cover EN methods like EN13016-2 as well as ASTM D6378. It is basically for the vapor pressure tendency determination of a liquid over a certain temperature range. The V/L ratio is selectable from 1:1 to 4:1.

6.12 CCQTA T Curve

This method is equivalent to ASTM D6377 Curve and installed for test measurements of the CCQTA (Canadian Crude Quality Technical Association).

6.13 CCQTA V/L Curve

This method does determine the total vapor pressure of crude oil and condensate at a defined temperature with various V/L ratios which can be freely programmed. It was installed for test measurements of the CCQTA (Canadian Crude Quality Technical Association).

6.14 CCQTA T(V/L) Curve

This method is similar to ASTM D5188 Curve and determines the temperature at different V/L ratios to reach atmospheric pressure of 101.3 kPa. It was installed for test measurements of the CCQTA (Canadian Crude Quality Technical Association).

6.15 Low VP & Low VP Curve - Low vapor pressure measurement based on D6378

This standard method is used for measuring very low vapor pressure of different kinds of liquids. It is based on ASTM D6378 with a few minor adaptations. It is measuring the absolute vapor pressure P_{abs} against vacuum. By three pressure readings at different vapor to liquid ratios the partial pressure of the air dissolved in the liquid, named P_{gas} , is calculated and the total pressure P_{tot} is measured. Thus, the absolute vapor pressure of the liquid is calculated as following:

$$P_{abs} = P_{tot} - P_{gas}$$

For Low VP Curve instead of only one test temperature several temperature points can be defined. The triple expansion (determination of the absolute vapor pressure) is performed at a specified temperature, the total vapor pressure is then measured at all temperature points. Finally, the absolute vapor pressure is calculated for these other temperature points.



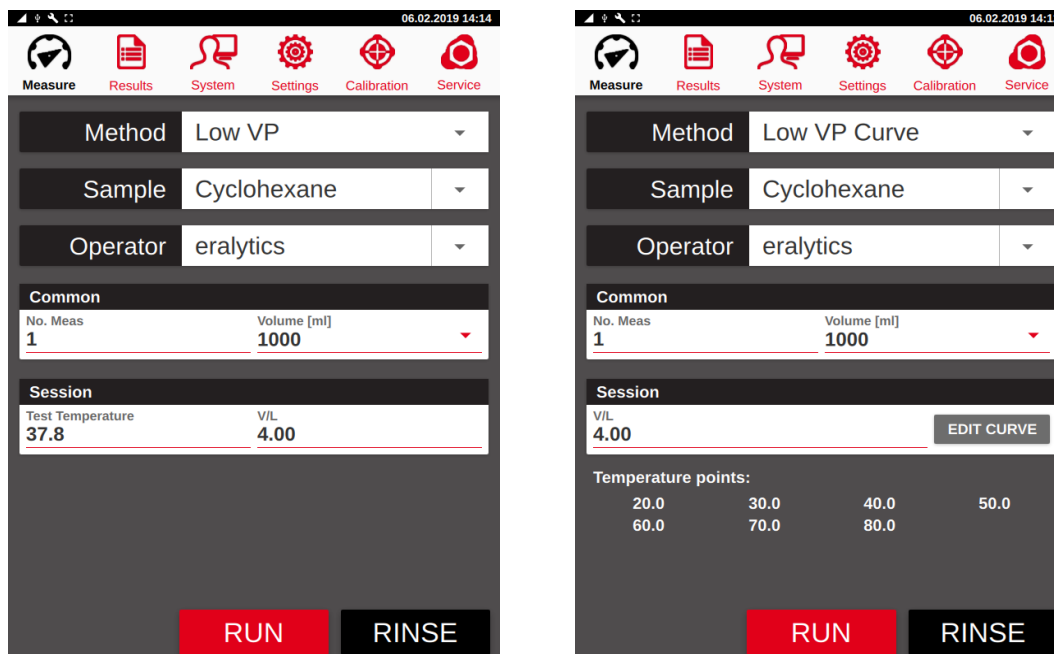
Single point measurements are in general more accurate than curve measurements due to the longer time such curve measurements take and the calculated gas correction for the additional points.

6.15.1 Sample preparation

No specific sample preparation is required for this method since the partial pressure of the air dissolved in the gasoline is determined and calculated.

6.15.2 Measurement

Select the desired standard method and make all necessary settings.



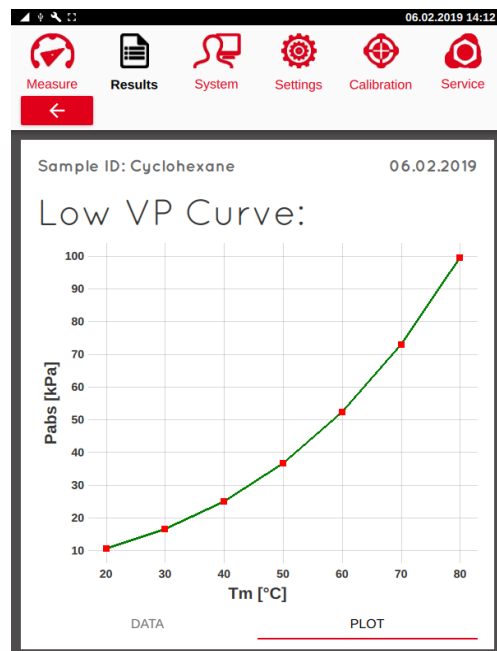
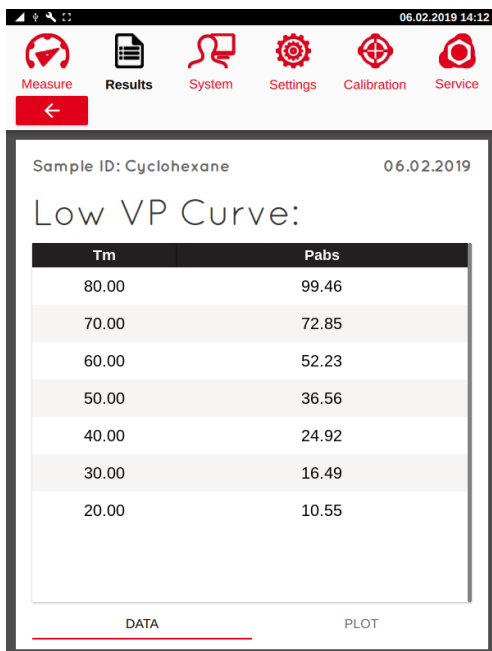
For Low VP Curve, define the temperature points to be measured. Additional temperature points up to 300°C can be entered for extrapolated (=calculated) results.

6.15.3 Result

At the end of the measurement the result screen will be displayed. The absolute vapor pressure is highlighted as the main result, the additional information contains Ptot and Pgas.



For Low VP Curve, clicking on the sub-tabs “Data” or “Plot” allows to switch between the result table and measurement graph. The corresponding total pressure values can be viewed in the result tables.



6.15.4 Quality control samples

There are some quality control samples recommended. If Pabs is within the below mentioned range the instrument is well calibrated.

Sample	Pabs
Decane @ 40°C	0.52 ± 0.1kPa 0.08 ± 0.02psi
Decane @ 60°C	1.6 ± 0.1kPa 0.23 ± 0.02psi
Isooctane @34°C	10.0 ± 0.3kPa 1.45 ± 0.04psi

6.16 TVP - True Vapor Pressure based on ASTM D6377

This method determines the True Vapor Pressure of a liquid at a V/L ratio = 0 at a constant temperature. Since a direct measurement at V/L=0 is impossible at least three vapor pressure measurements are automatically performed at low V/L ratios to calculate the vapor pressure at V/L=0.

The fitting is based on a model of the sample being composed of three components: one light component (air, methane etc.), one intermediate and one non-volatile fraction. Using Henry law one arrives at the equation:

$$A / (a*x+p) + B / (b*x+p) = 1.$$

This function is used to fit the V/L curve. It is recommended that only V/L values equal or above 0.05 are used. At least three different V/L ratios are required for the calculation of TVP at V/L=0. Further V/L ratios are mainly used to fit the curve at higher V/L ratios. The influence of higher V/L ratios on TVP is relatively small.

6.16.1 Sample preparation

For the determination of TVP it is required to sample the crude oil in pressurized containers. to avoid outgassing at the filling temperature and even more important at low V/L ratios the vapor pressure result is highly influenced by dissolved air. Due to that reason the sample should not be exposed to atmospheric pressure.

6.16.2 Measurement

Select the desired standard method and make all necessary settings.

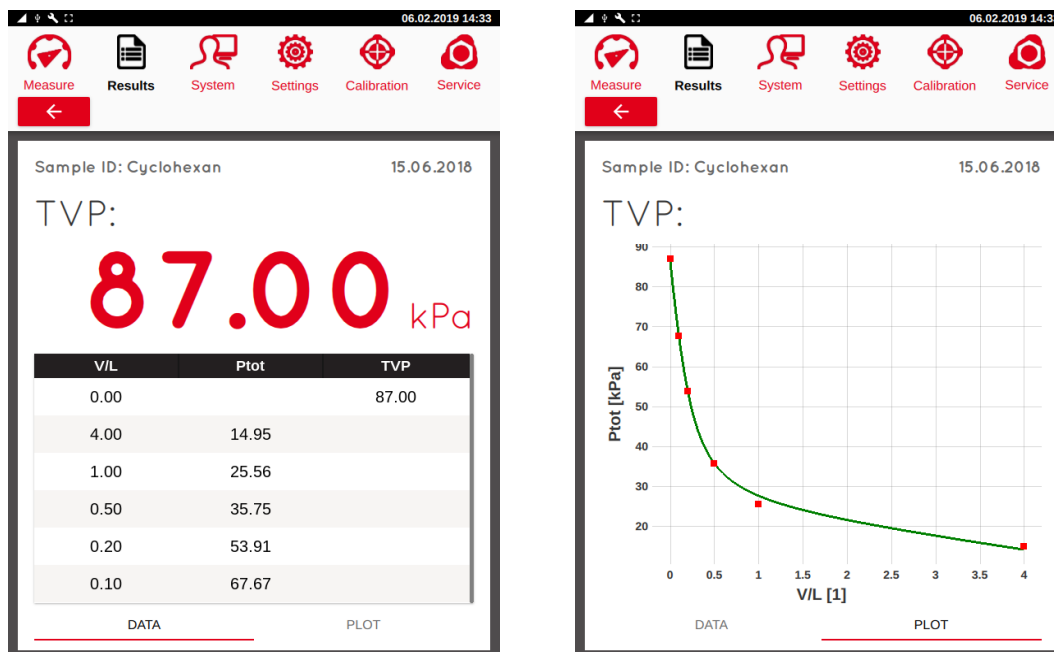
“T Fill = T Test”: This switch does override the settings for the “Fill temperature” in the settings menu. It is required to set TFill = Ttest since low V/L ratios ($V/L < 1$) are measured. Any temperature change of the sample during the measurement would heavily change the V/L ratio due to sample expansion.

“EDIT CURVE”: Press this button, a table appears where up to 8 V/L ratios can be programmed at which the vapor pressure measurements shall be performed for the TVP calculation. The V/L ratios of 0.05, 0.15, 0.5, 1.00 and 4.00 have shown a good repeatable curve measurement and thus TVP calculation. Other V/L ratios can be programmed and maybe also suitable.

“OPEN VALVES”: When a pressurized container is disconnected it is recommended to close the valve of the container first and the push the “OPEN VALVES” button to release the pressure in the line. Then the quick connector at the inlet can be safely removed.

6.16.3 Result

At the end of the test the measurement results and the calculated TVP (in red) is displayed.



Clicking on the sub-tabs “Data” or “Plot” allows to switch between the result table and measurement graph. The corresponding total pressure values can be viewed in the result tables.



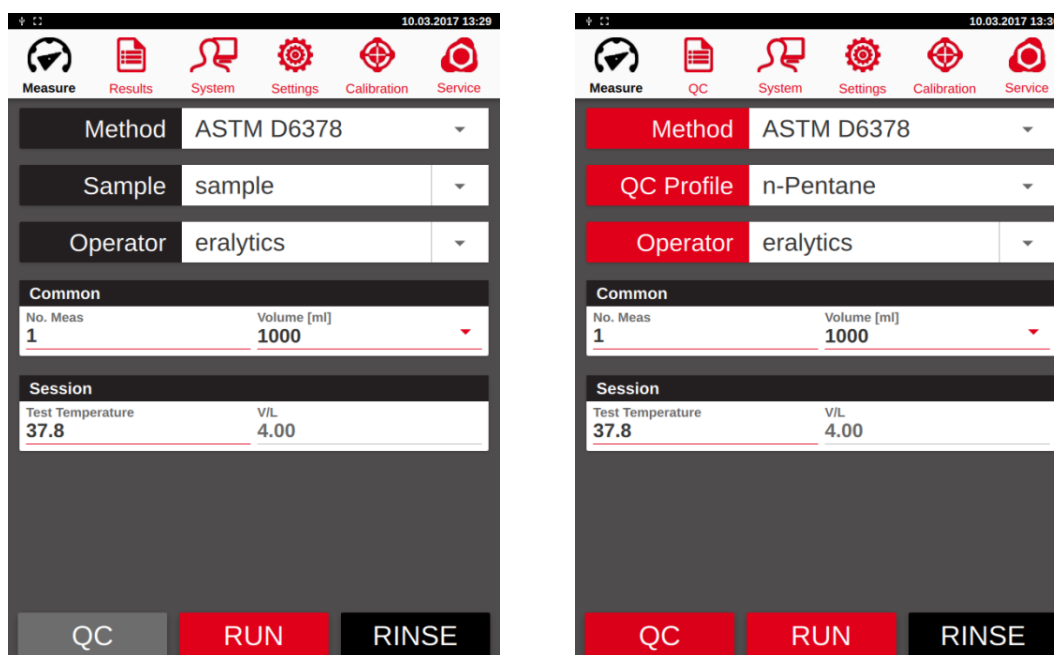
If the error message “W006 – Inconclusive result! Repeat measurement with fresh sample.” appears the filling has not been accordingly. Repeat the measurement by using a FPC to ensure proper filling or increase the back-pressure.

7 QC Mode

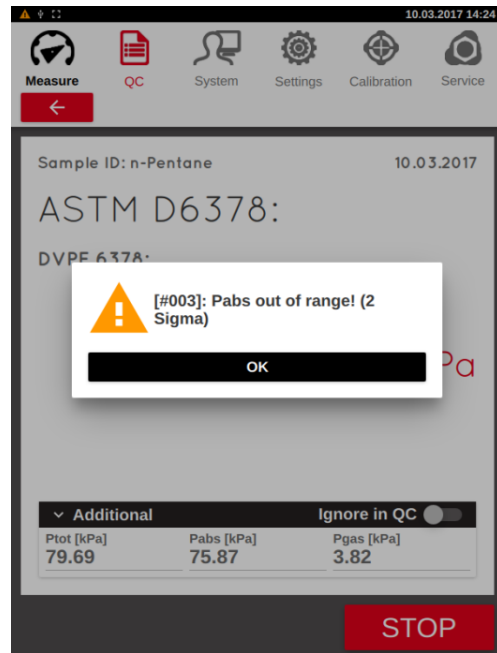
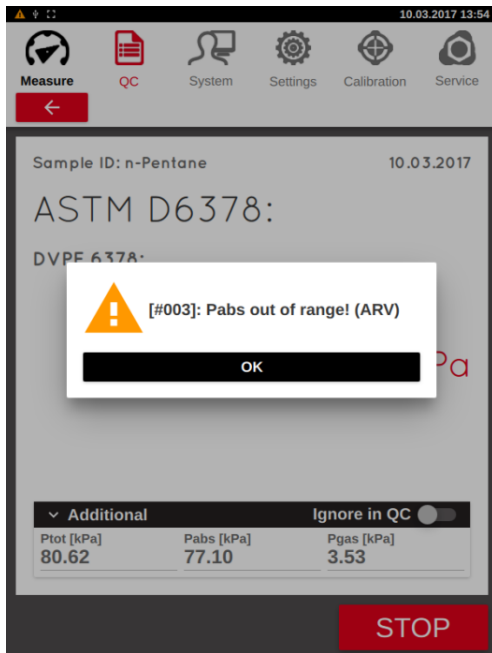
To facilitate quality control, ERAVAP features a quality control mode for all methods that have a substance with an accepted reference value in the respective standard. The QC mode can be applied to substances defined in the respective standards or for user defined substances and mixtures. The QC measurements are treated separately and warnings can be triggered either by statistical evaluation of previous measurements, by accepted reference values or user defined limits.

7.1 QC Measurement

Press the “QC” button to enter the QC mode. If the “QC” button is not visible, then go to the menu “Settings > Screen” to enable the button. The “QC” button as well as the three black bars turns red and the additional menu “QC” appears. At the same time, the sample name changes to “QC Profile”.

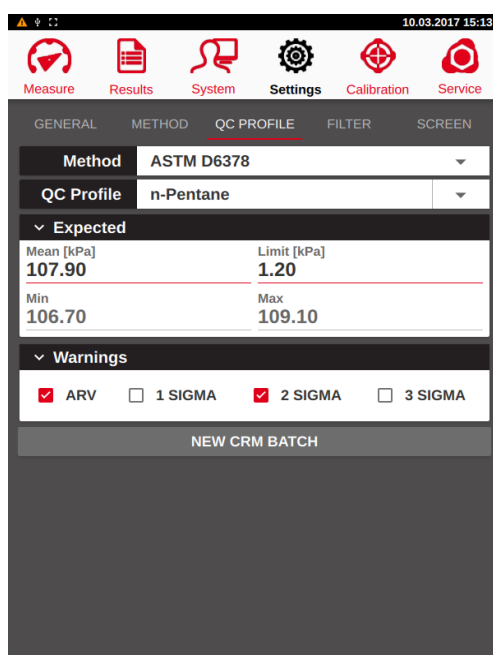


Select the suitable “QC Profile” and press “RUN”. The instrument performs a measurement according to the selected standard with the settings shown on the Screen and in the “Settings” menu for the specified method. When the measurement is finished, the result appears on the screen. If the result is outside the statistical limits, or the limits of the accepted reference value defined in the standard, a pop-up with a warning message is shown. The warning will also be listed in the notification bar and stored in the log file.



7.2 QC Profiles

The “QC Profiles” can be edited in the “*Settings*” menu. For the pre-defined profiles, the mean value together with the maximum and minimum accepted reference values defined in the respective standard is shown. The values always refer to the primary result as defined in the standard (i.e. Ptot for D5191 and Pabs for D6378) at the temperature defined in the standard (typically 100 F). Measurements at temperatures at other temperatures than the one defined in the standard will give results that are outside the ARV range. For user defined profile (like secondary working standards), the user can edit all values but should remember that the values refer to the primary result (not the correlated one like DVPE).



The profile can also be associated with warnings based either on statistical evaluation or limits of the accepted reference value. Each type of warning can be activated by the checkboxes in the warnings card.

The QC measurements for each profile are bunched in batches. To generate a new batch, press the “*NEW CRM BATCH*” button and make a new QC measurement.

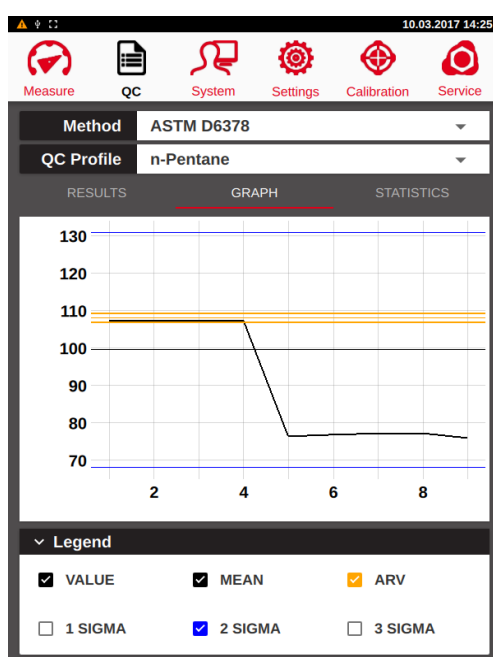
7.3 QC-Results

The results from all QC measurements are stored separately in the “QC”-Results tab. Here, the results can be viewed in the form of a table or as a graph. In the table mode, the

“FILTER”, “VIEW”, “EXPORT”, “PRINT” and “LIMS” buttons have the same functionality as in the normal “Results” menu.

Sample ID	No.	Tm	Pabs	Info
i	n-Pentane	37.8	107.17	EV
i	n-Pentane #00001	37.8	57.18	QC_IG...
i	n-Pentane	37.8	107.51	EV
i	n-Pentane	37.8	107.65	EV
i	n-Pentane	37.8	107.60	EV
i	n-Pentane	37.8	107.50	EV
i	n-Pentane	37.8	107.49	EV
i	n-Pentane	37.8	107.38	EV

In addition, the results can be viewed graphically. In the “Graph” sub-tab, it is possible to show the 1, 2 and 3 sigma limits as well as the AVR values defined in the menu “Setting > QC Profile”.



The sub-tab “Statistics” shows the number of measurements used, the number of measurements that are ignored and the mean value and standard deviation (of active measurements) for the current and previous batch.

Current batch			
Measured	Ignored	Mean	Sigma
9	5	99.41	15.70

Previous batch			
Measured	Ignored	Mean	Sigma
7	0	100.33	19.03

7.3.1 Ignoring a measurement in the QC mode

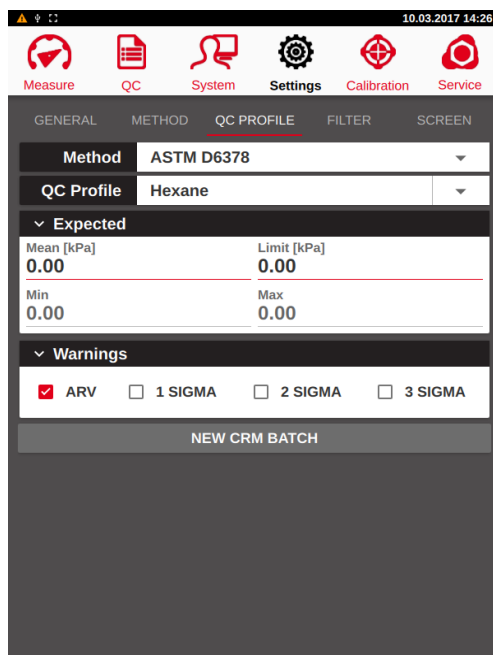
If a result is obviously implausible, this result can be removed from the calculations of the statistics. To do this, go to the results table and located the measurement. Click on the “i” to open the detailed result. Flip the switch “Ignore in QC”. Now the calculation is performed without this measurement. This is indicated by the increased number in “Ignored”.

Additional		
Ptot [kPa]	Pabs [kPa]	Pgas [kPa]
80.54	77.13	3.41

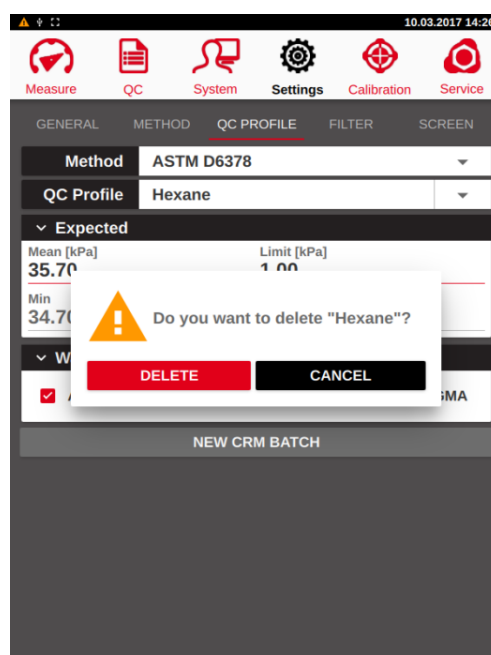
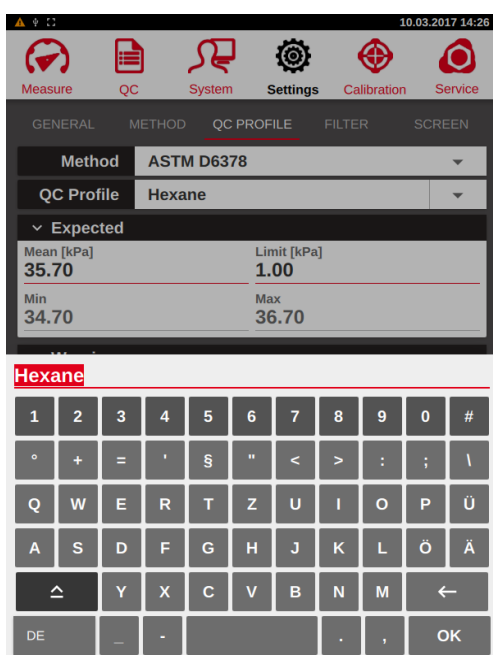
Ignore in QC

7.3.2 Add and delete a QC profile

A new “QC Profile” can be added by entering a new name in the menu *“Setting > QC Profile”*. Enter the accepted reference value and the limits (defined as \pm around the mean value) in the expected value card. The maximum and minimum value are calculated automatically when the mean and limit values are entered. The expected values always refer to the primary result as defined in the standard (i.e. Ptot for D5191 and Pabs for D6378). For user defined profiles (like secondary working standards), the user can edit all values but should remember that the values refer to the primary result (not the correlated one like DVPE).

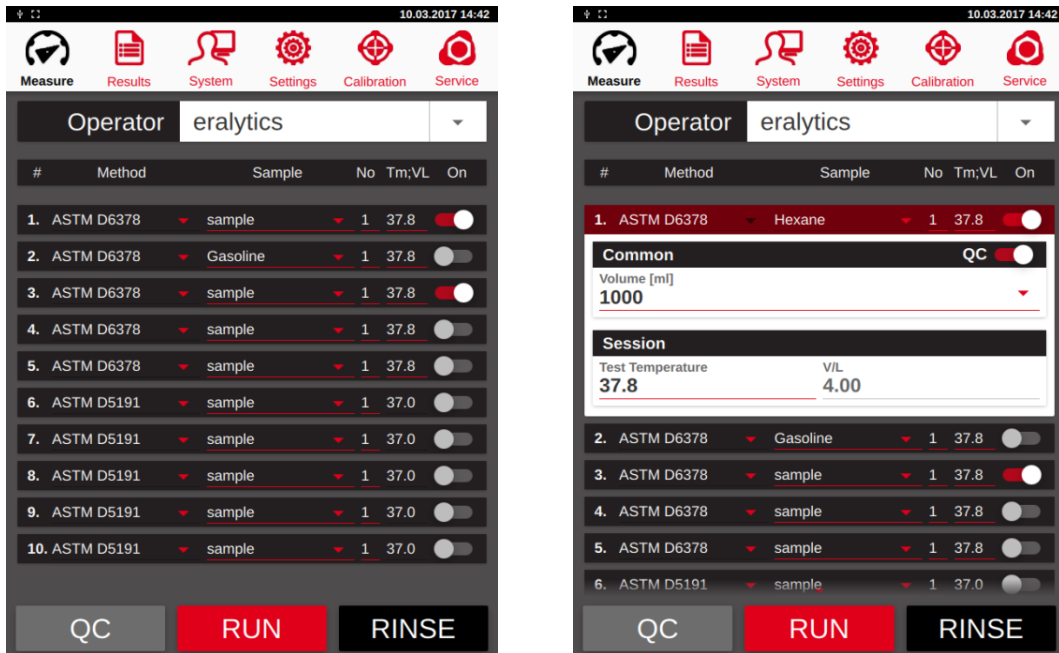


To delete the profile, select the name and erase it. Press the “ENTER” button to delete the profile. This will not only delete the profile, but also the results associated with it.

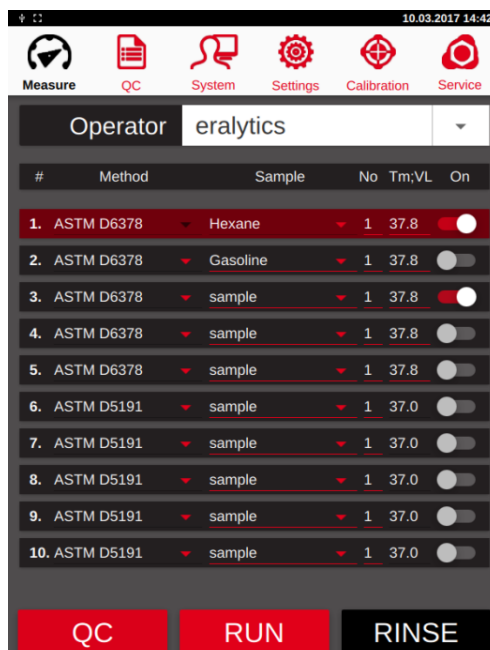


7.4 QC mode with autosampler

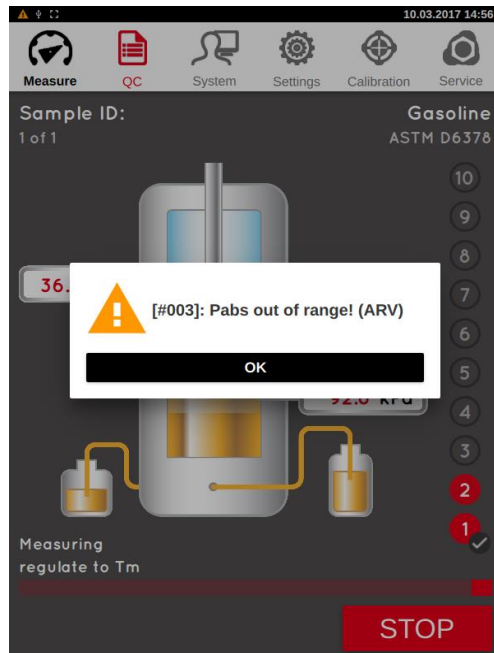
The QC mode can also be used with an autosampler. In this way, it is possible to run one or more QC samples with each autosampler batch. To define the measurement of one port as a QC sample, open the card by pressing the port number. Flip the switch to activate QC mode for this port. The bar turns red to indicate that this is a QC sample. The measurement from this port will land in the QC result and trigger any QC alarms as defined in the QC profile. The other measurements will be written to the normal results file.



To view the QC results, press the “QC” button to activate the QC mode and to access the QC results.



In this case, the measurement of the QC sample triggered the ARV warning.



8 Optional equipment

The following section contains information on optional equipment. Some of the stated modules can be installed anytime, others may require special support.

Please refer to your local distribution partner or eralytics if you intend to purchase optional equipment for ERAVAP!

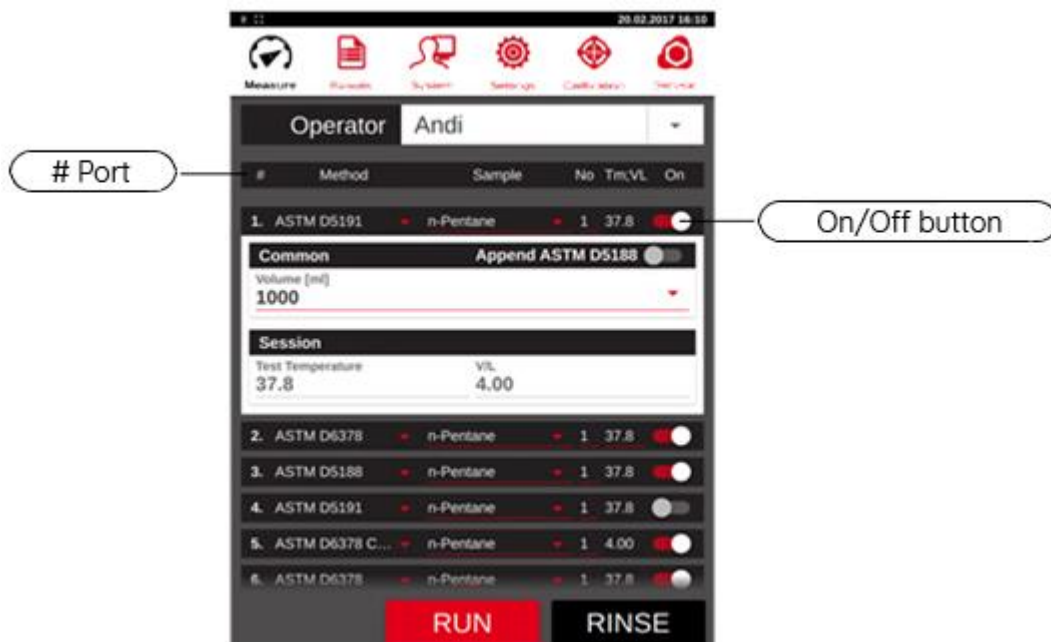
8.1 Autosampler

The autosampler is an optional accessory for ERAVAP allowing to connect up to 10 samples simultaneously. Each sample port can be programmed individually with all available parameters. The measurement principle is exactly the same as without the autosampler. The measurements are performed consecutively.



8.1.1 Measurement

If an autosampler is connected the “Measure” menu automatically is changed to the following:



“#”:

This describes port 1 to 10. In the columns to the left the settings are shown and can be individually changed. Press on the number of the port, more details can be programmed exactly like for the single position ERAVAP without autosampler.

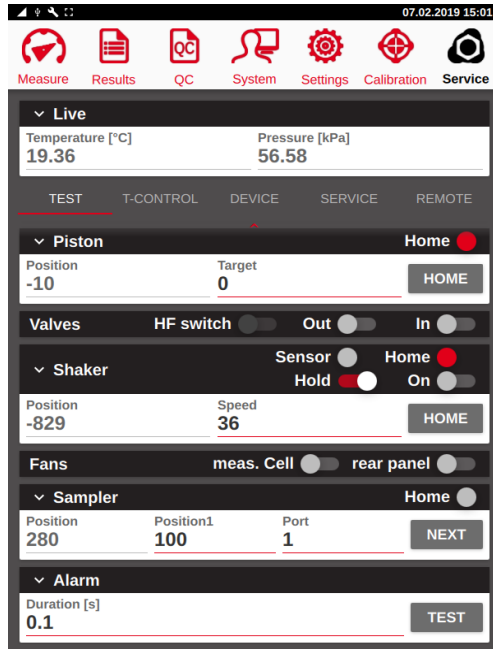
Touch the number to open and close details of the measurements.

“ON”:

Switch the individual ports on or off by pressing the buttons in the according rows. Not all ports have to be used.

8.1.2 Settings

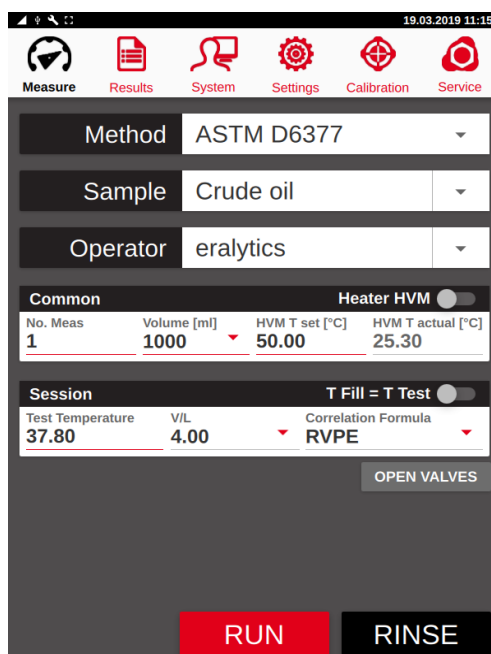
The position of port 1 for the autosampler is already adjusted by factory and usually does not need to be changed. On rare occasions it may be necessary to readjust the autosampler. This can be done in the menu “Service > Test > Sampler”.



Please refer to your local support or eralytics if the autosampler settings need to be changed!

8.2 HVM - High viscosity module

When samples like heavy crude oil or any other high viscous samples with a viscosity >400cSt at 20°C are tested then it is recommended to install a heater for inlet, inlet tube, outlet and outlet tube. This will help to keep the sample liquid enough for sample introduction and discharge. Also hardening and thus blocking the inlet and outlet can be reduced or even avoided with higher temperatures (e.g. wax or paraffin depositions of crude oil). Pre-heating the sample will also help for faster sample transportation. A filling tube with a bigger diameter is also available from eralytics for faster sample filling.



“HVM T set”: Adjust this parameter for settings the target temperature.

“HVM T actual”: This value shows the live temperature of the HVM.

The additional heater can heat from room temperature up to 70°C. Please be aware that the displayed temperature is just measured on the outlet. Not all components may be already at the shown temperature and probably require up to 5 more minutes. It is also possible that a few spots are up to 10°C lower than the shown temperature especially when the maximum temperature of 70°C is set.

8.3 TVM - Temperature verification module

Some methods require the sample to be pre-conditioned before the actual measurement. As for ASTM D5191 (e.g.):

“Prior to the measurement the sample has to be brought to the defined condition as stated in D5191. Cool the sample to 0-1°C (32-34°F) in a 1l container filled to 70-80%. Open the cold bottle for several seconds to let some air in, close it again immediately and shake it vigorously for a few seconds. Put the bottle back into the refrigerator or ice bath. Let it sit there for 5 minutes and repeat this procedure twice. This procedure is the so-called air saturation at 0-1°C (32-34°F) for preparing the sample for the test.”

As the sample temperature has a huge influence of the actual amount of dissolved air, proper cooling is required and the sample’s temperature has to be within a narrow temperature range.

To cope with this challenge, ERAVAP allows monitoring the sample temperature directly in the sample container by an external temperature probe.



8.3.1 Installation

The external temperature sensor is connected at the rear side of the instrument. Insert the inlet tube into the cone and the spacer and secure it slightly with an Allen-screw. Connect the inlet tube Luer connector to the inlet assembly.




The standard length of the inlet tube for ERAVAP is 30 cm, depending on the size of the sample container (especially 1000 mL) it is necessary to use a longer inlet tube. The sample temperature probe package includes a 50 cm inlet tube. If replaced, make sure to order the correct spare part (inlet tube): EV01-A001a.



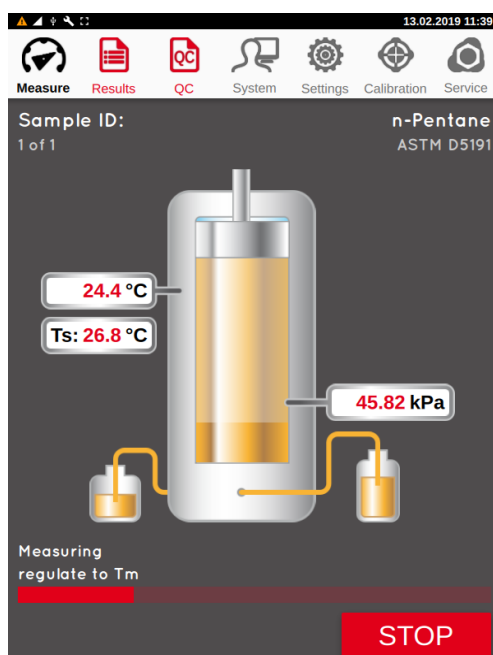
The sample sensor can be conveniently rested in the holder between the measurements. Put a beaker below the sensor to collect any residuals and avoid contamination of the equipment.

8.3.2 Measurement

Perform the sample preparation as required by the selected method. After the last air saturation step but the sample container next to the ERAVAP inlet, open it and fully insert the sample temperature probe into the container.

 As specified by most methods, the sample container has to be filled up to 70-80% of its capacity. If the filled volume drops below 40% the sample tube may not reach the sample and the filling will not be possible!

Make all selections in the “Measure” menu and start the measurement by pressing the “START” button.

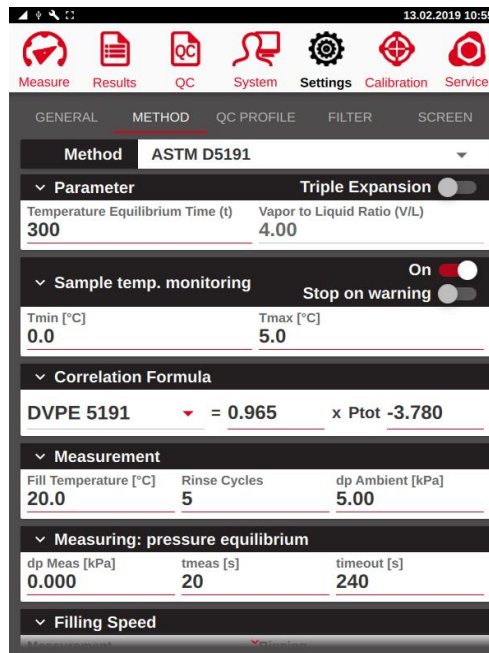


The live sample temperature is displayed below the cell temperature as “Ts:” and will be saved in the result file. Depending on the settings, a warning may be triggered or the measurement can be automatically aborted.

8.3.3 Settings

The sample temperature monitoring can be activated and configured for each method separately. By default, the temperature limit is set to 0°C – 5°C with the feature itself deactivated.

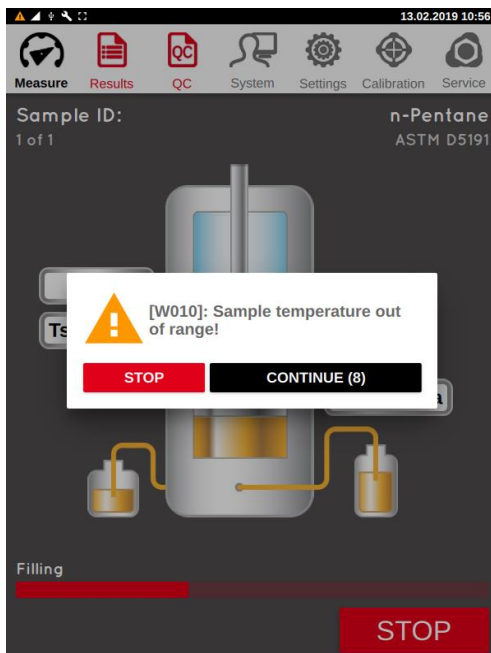
Go to Settings “Settings > Methods”, select the desired method (e.g. ASTM D5191) and switch on the feature:



The sample temperature sensor may take up to 45s to completely stabilize. If the measurement rinsing cycles are decreased below 3 the measured temperature may not have stabilized and thus may not be accurate.

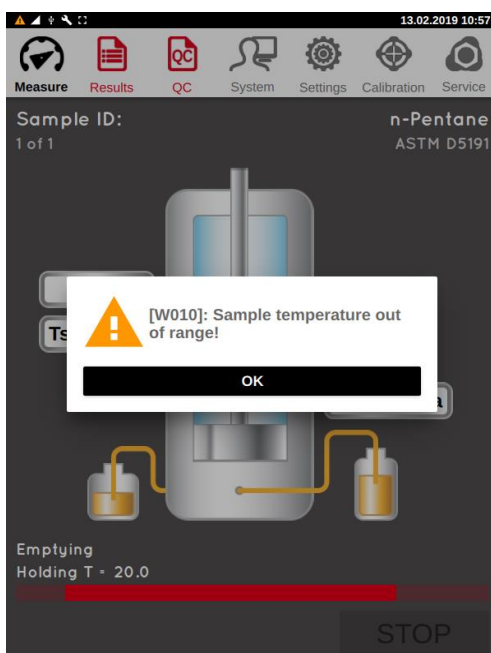
8.3.3.1 Sample temp. monitoring - On

When switched on, the sample temperature will be monitored and saved in the result file. If the sample temperature during the filling step is not within the specified limit (default: 0°C – 5°C) a warning will be shown, allowing the measurement to be manually aborted. After a 10s timeout the measurement continues automatically and the result file contains the warning in the “Info” column.



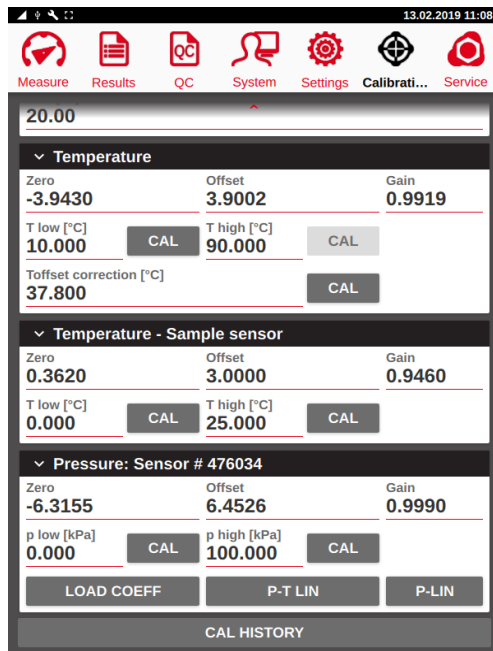
8.3.3.2 Sample temp. monitoring - Stop on warning

If this option is activated the measurement will be automatically aborted if the sample temperature is not within the specified limits during the filling step.



8.3.4 Calibration

Analogously to the measuring cell temperature sensor the sample sensor has to be calibrated. When activated a third sensor sub-tab appears in the “Calibration” menu.



The calibration is performed at 0°C and 25°C (ambient temperature).

1) *“T low”*:

Take the 4mm temperature calibration probe and insert it in the cone instead of the sample tube. Prepare an ice bath (crushed ice) put the sample sensor into the ice bath and make sure both sensors are fully covered with water/ice. Wait until both temperature readings are stable, enter the temperature value as *“T low”* and click the *“CAL”* button for T low.

2) *“T high”*:

Remove the sample sensor from the ice bath, dry both sensors with a soft tissue and let it rest at a stable bench for several minutes at ambient temperature. When the temperature readings are stable, enter the temperature value as *“T high”* and click the *“CAL”* button for T high.

Press *“SAVE”* to store the sample temperature sensor calibration!



This sample sensor calibration data will not be stored in the calibration history! The temperature sensor may drift overtime, it is recommended to recalibrate it while doing the standard calibration on ERAVAP.

9 Cleaning – Manual Rinsing

Rinsing of the measurement cell is very important to avoid cross contaminations from the previous sample. ERAVAP automatically rinses with the sample to be measured when a measurement is started. This is usually sufficient for gasoline type samples. However, additional rinses can be performed by pressing the “RINSE” button in order to clean the measuring cell. Once the “RINSE” button is pressed by default 5 rinsing cycles of the measurement cell are performed. The number of rinse cycles can be set in the “Settings” menu.

The screenshot shows the ERAVAP control interface with the following settings:

- Method: ASTM D5191
- Sample: Sample
- Operator: Andi
- Common: Append ASTM D5188 (toggle off)
- No. Meas: 1
- Volume [ml]: 1000
- Session: Test Temperature 37.80, V/L 4.00, Correlation Formula DVPE EPA
- Cell cleaning: use vacuum pump (toggle off), Cleaning temperature [°C] 85.00

At the bottom, there are two large buttons: **RUN** (red) and **RINSE** (black).



Do not use acetone for rinsing for EV20! Acetone will attack the sealing material of the high-pressure valves and they will be irreversibly damaged!

For EV10 acetone does not pose any eminent danger to the valves, but it is recommended using isopropanol instead.

9.1 Cleaning procedure for high Ethanol content samples

Gasoline samples with higher ethanol content may cause cross contaminations if low or non-ethanol content gasoline is measured afterwards. Residues of samples with elevated (>25Vol%) ethanol concentrations can cause a high-pressure bias for subsequently measured samples and about 3 rinses (3x5 rinse cycles) with a non-ethanol gasoline are required to purge the measurement cell.

9.2 Cleaning procedure for Crude oil samples

When measuring crude oil it is important to clean the system after the measurement to avoid clogging of the valves and to clean the measuring cell. Manually rinse the measurement cell twice (2x5 rinsing cycles) with toluene by pressing the “*RINSE*” button in the “*Measure*” menu. If the color of the toluene at the outlet of the instrument is still dark, repeat the rinsing. As soon as the toluene is almost colorless, rinse twice with air in order to clean the measurement cell properly.



If the instrument is not rinsed within one hour after the measurement a warning message will be shown. This message also appears when trying to shut down the instrument without having it rinsed after a D6377 measurement.

9.3 Cleaning procedure water containing samples

If there is some water in the measurement cell it will certainly influence the measurement results. Additionally, it is difficult to remove water by solely purging the system with gasoline samples. Use ethanol or isopropanol to remove it from the measurement cell. Rinse about three times (3x5 rinse cycles) and then three times with gasoline. If the results are still influenced by water residue repeat the cleaning procedure.

9.4 Cleaning procedure for highly viscous samples

High viscous samples increase the risk of clogging the measuring system when the temperature of the cell is lowered (instrument turned off). For this reason, rinse the system after the measurement with 2-propanol, toluene or any other suitable substance that can dissolve the viscous sample at least two times.

10 Results Menu

The “*Result*” menu shows all measurements made on the instrument. The results are ordered by method. The drop-down menu enables selecting the different methods.

	Date	Time	No.	Sample ID	Op
i	13.02.2019	12:28	#00303	n-Pentane	era
i	13.02.2019	12:27	#00302	n-Pentane	era
i	13.02.2019	12:26	#00301	n-Pentane	era
i	13.02.2019	12:25	#00300	n-Pentane	era
i	13.02.2019	12:24	#00299	n-Pentane	era
i	13.02.2019	10:48	#00298	Benzin	era
i	13.02.2019	10:22	#00297	Benzin_butan_2	era
i	06.02.2019	15:24	#00296	Air	era
i	06.02.2019	15:23	#00295	Air	era
i	06.02.2019	15:22	#00294	Air	era
i	05.02.2019	08:27	#00293	Air	era

Swipe over the results table vertically to scroll down to view older measurements. Swipe over the results table horizontally to see more information about the currently displayed measurements.

Pressing the information button in front of the measurement shows the detailed result of this measurement as displayed after the measurement. It allows displaying the graph of a curve measurement. (Switch between table and graph by using the “*DATA*” and “*PLOT*” buttons).

To select measured results, press longer on the screen until it marked results turn red. Keep the finger pressed and scroll to select more results (for instance, for printing)

Alternatively, use the arrows to navigate the results table.



Move up / down one page (10 measurements)



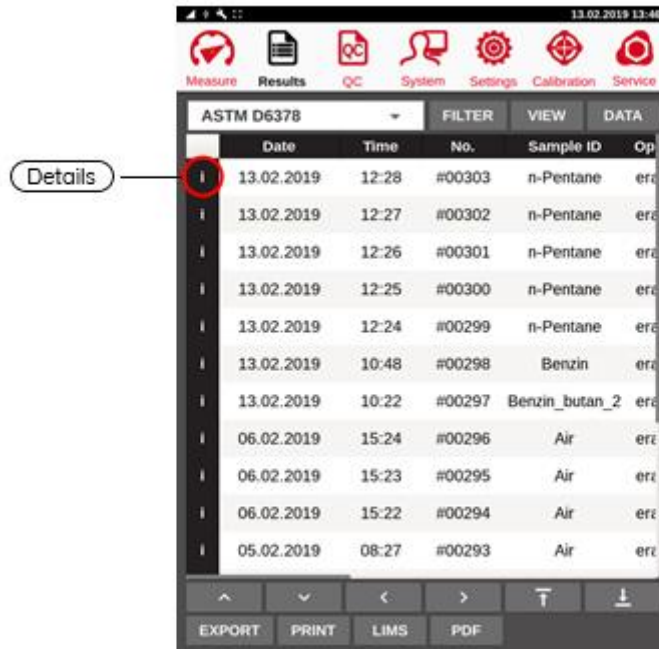
Move to beginning / end of the results table



Move one column to the left / right

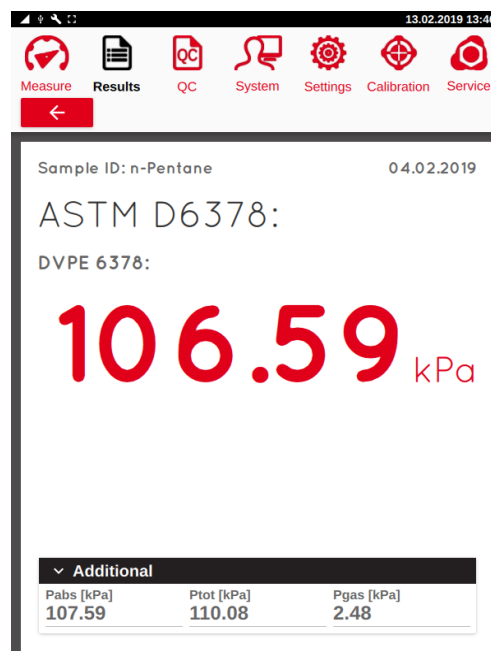
10.1 View result details

Press the very left field “i” of the result of interest to view more details of the measurement.



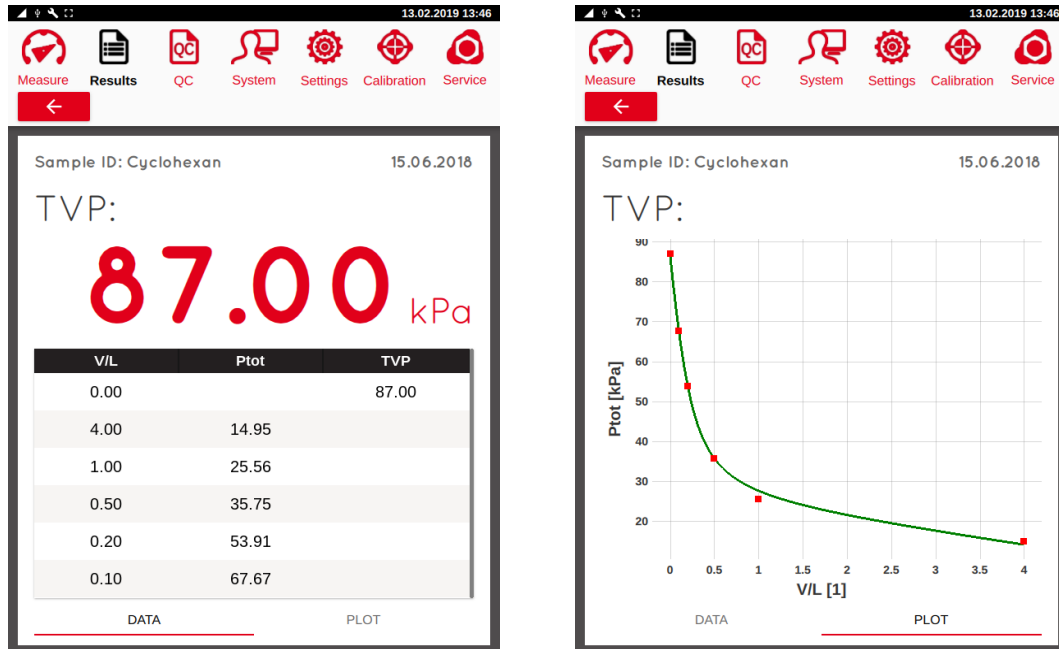
10.1.1 Main result

When opening the detail result screen, the main result will be highlighted in red. The subsection “Additional” contains additional information of the obtained data.



10.1.2 Data & Plot

For curve measurements the result details contain the measurement point tables and the graph.



Clicking on the sub-tabs "Data" or "Plot" allows to switch between the result table and measurement graph.

10.2 Result output

There are several options available for exporting the measured result data.

	Date	Time	No.	Sample ID	Op
i	13.02.2019	10:48	#00298	Benzin	era
i	13.02.2019	10:22	#00297	Benzin_butan_2	era
i	06.02.2019	15:24	#00296	Air	era
i	06.02.2019	15:23	#00295	Air	era
i	06.02.2019	15:22	#00294	Air	era
i	05.02.2019	08:27	#00293	Air	era
i	04.02.2019	16:03	#00292	n-Pentane	era
i	22.01.2019	11:16	#00291	n-Pentane	era
i	22.01.2019	11:04	#00290	n-Pentane	era
i	22.01.2019	10:53	#00289	n-Pentane	era
i	21.01.2019	14:01	#00288	Air	era

“EXPORT”: Export the results file to a connected USB stick (including archived files) to the folder *result/eravap/serial number/*. If no USB is connected, the button is inactive. The format of the exported files can be defined in the sub menu DATA. In addition to the results file, EXPORT also writes a zip file containing the journal file, raw data and files describing the instrument settings. If requested as part of service or troubleshooting, please send the entire zip file to eralytics. After exporting, a pop-up appears when the export is complete. Note that the USB is automatically unmounted after exporting. To mount the USB again, one must re-insert in into the USB connector.

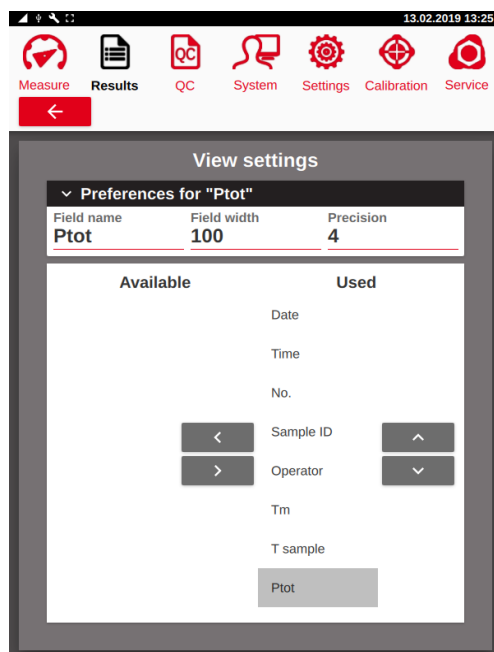
“PRINT”: Prints the selected results. The format of the printed results as well as the printer settings are controlled from the system menu.

“LIMS”: Sends the selected result to the LIMS system. The format of the LIMS file is defined in the sub-menu DATA. The LIMS communication settings and configuration of the LIMS file are controlled from the system menu.

“PDF”: Prints the selected results to a pdf stored on a connected USB stick in the folder *result/eravap/serial number/pdf/result.pdf*. Uses the format defined in the printer file pdf.print. Always overwrites any pdf in this folder.

10.3 View

The result grid can be modified individually for each method to display the most important data in the most useful order. Select the desired standard method from the dropdown menu and press the “VIEW” button.



Modify Result Table

The left column “Available” shows the parameters which can be selected and displayed dependent on the selected standard method. The column on the right-hand side “Used” shows the parameters which are displayed in the results grid. Select a parameter in the “Available” table and press the “>” button to move it to the “Used” table. Now this parameter is also displayed in the results grid. For removal, mark a parameter and press the “<” button. The parameters order can also be sorted in the results grid by highlighting a parameter in the table on the right-hand side and shifting the parameter up and down with the keys next to the table.



Info, Date and Time cannot be removed since it is needed for sorting the results in the result grid.

Change Parameter Name

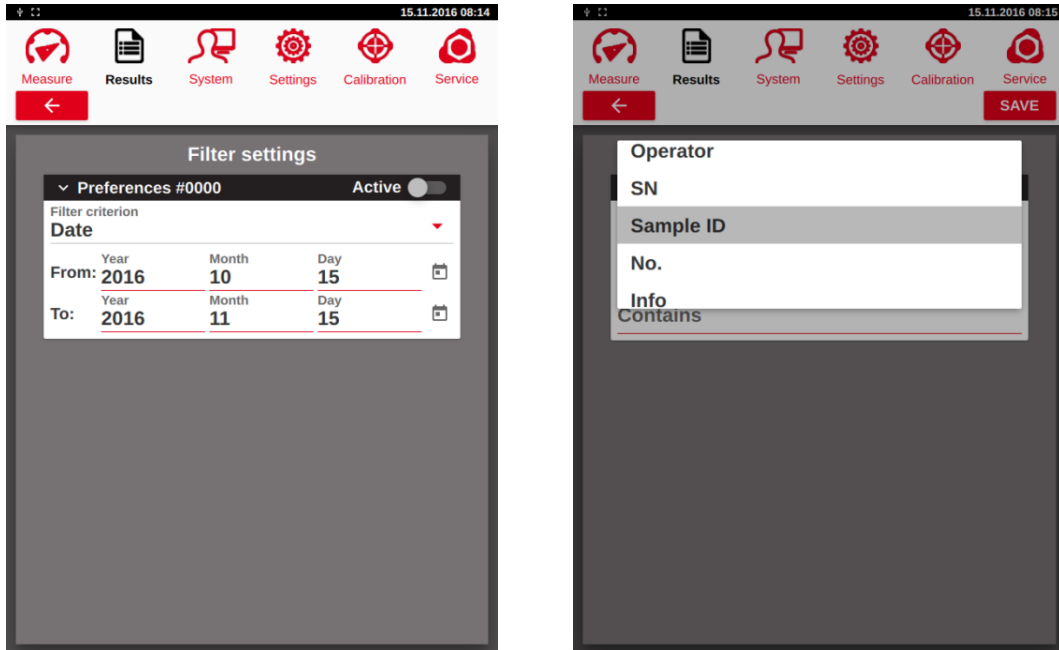
Select a column header in the right column of the selection section and enter a new synonym in the text field in the “Field name” section to change the title of the according column in the results grid.

Change the Column Field Width

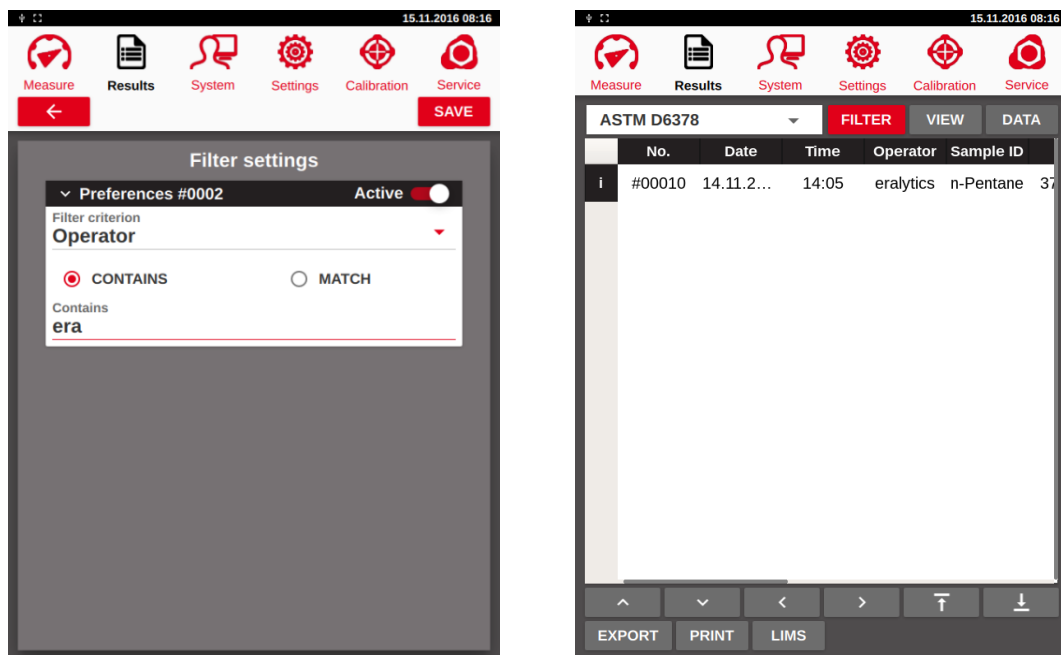
Select a parameter in “Used” and set the “Field width” individually for each parameter.

10.4 Filter

The sub menu *“Filter”* enables filtering of the data that is displayed in the results table. The filter is generic and can search all possible columns in the results file. The available options are shown by opening the drop-down menu. Depending on the selected parameter, the search options are adapted.



To search for measurements that were made between selected dates, use the *“From:”* and *“To:”* fields to define the search interval. When searching for a sample ID or user name, enter the name in the Match field. Select if you are searching for a direct *“MATCH”* (case sensitive) or any entry *“CONTAINS”* the search string (use for case in-sensitive search).



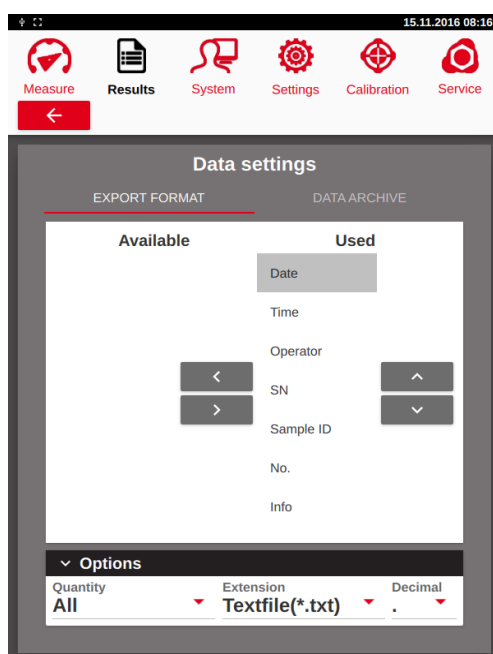
The filter is activated by the “Active” switch. Press “SAVE” to return to the results menu and view the filtered results. The red color of the filter button indicates that the filter is active. To deactivate the filter, enter the filter menu and turn off the “Active” switch.

10.5 Data

The submenu "Data" controls the format of files that are exported to a USB stick. In addition, it controls the results file archive.

10.5.1 Export options

The export options table defines the format and the content of the files exported to USB stick.



"Extension":

Select txt or csv (character separated value file) file format.

"Decimal":

Defines the delimiter of the output file. Select ",", "." Or *"from Result"*.



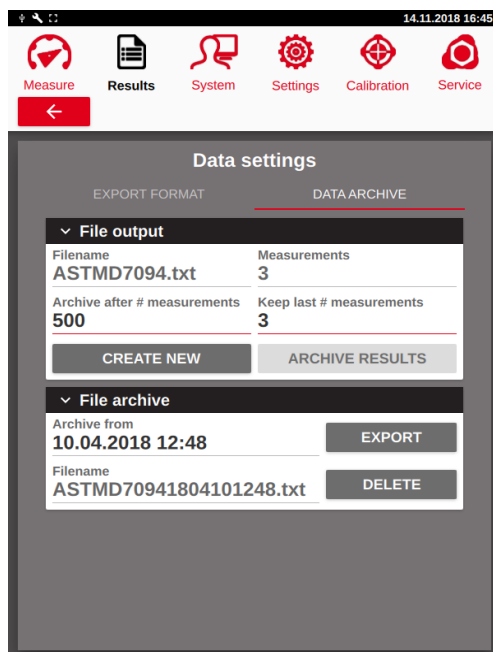
Move parameters to the *"Used"* column, to be exported or *"Available"* to be ignored during the export. By default, all parameters available are written to the results file.



Change the order within the exported result file.

10.5.2 Data Archive

In the sub tab "Data Archive" a new result file can be created, for which there are 3 different options:



"Measurements":

Number of total measurements in the current result file of the selected method.

"Archive after # measurements":

When the number of stored archives exceeds this setting, the instrument will automatically move the existing results into an archive file and create a new result file. Depending of the setting *"Keep last # measurements"* the new result file will contain previously obtained data.

"Keep last # measurements":

Specify the number of results which will be kept in the new result file.

"CREATE NEW":

This option forces creating a new result file and moves all data into an archive file.

"ARCHIVE RESULTS":

Pressing this button creates a new result file and keeps the specified number of results (*"Keep last # measurements"*) in the new file.

“Archive from”:

Select a file archive for export or deleting.

“EXPORT”:

Store the selected file on a connected memory stick.

“DELETE”:

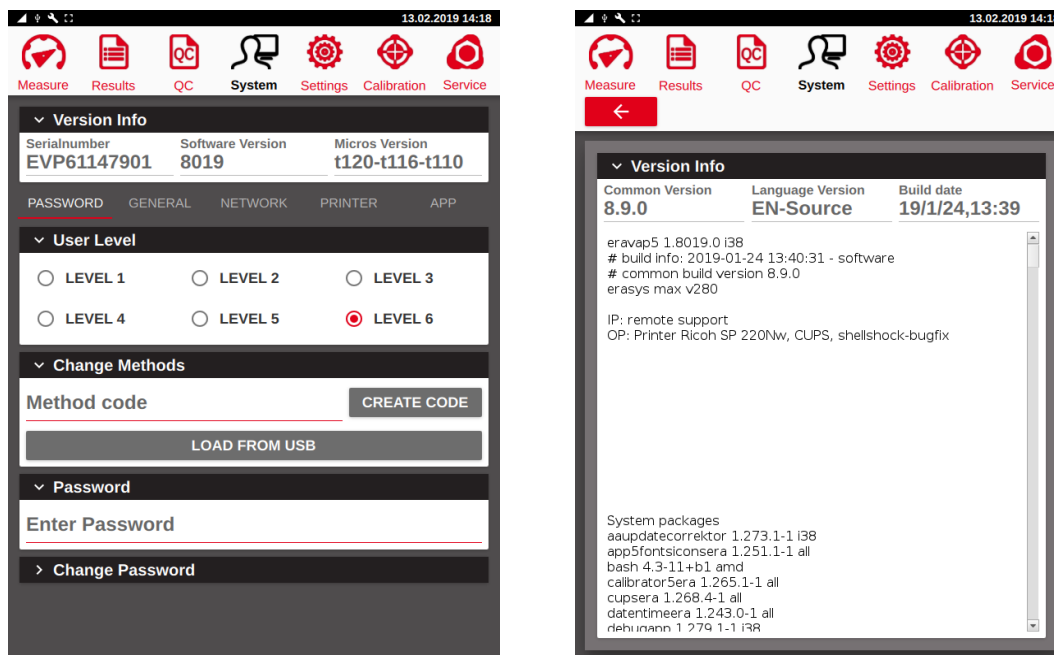
Delete the selected file.



Deleted files cannot be recovered anymore!

11 System Menu

The system menu provides information about the software version installed on the instrument. This menu also enables setting user levels, setting units, date and time, configure network and printers and entering of method codes.



The complete information about the software running on the instrument is provided in the “Version Info” box.

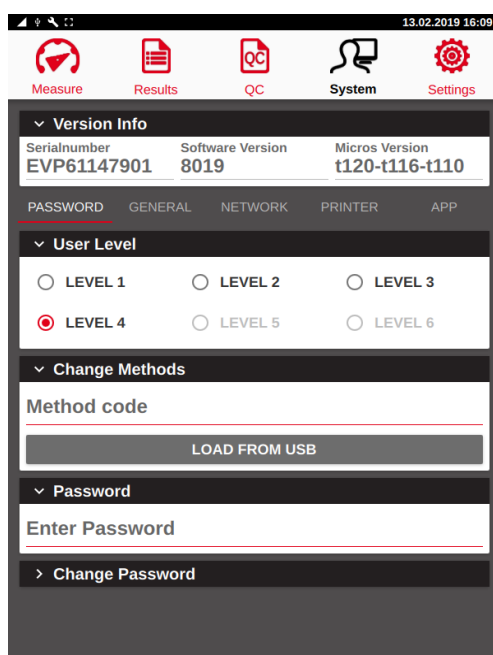
“Serialnumber”:	Serialnumber of the instrument
“Software Version”:	Version of the application software
“Micros Version”:	Micro controller software version(s)
“Common Version”:	Common code version
“Language Version”:	Version of the currently used language file
“erasys max”:	Version of operating system

11.1 Password Tab

11.1.1 User levels

In this section the user level can be set to limit the accessibility of the different menus. User level 1 is the lowest with most restrictions. Only a measurement can be performed. All other parameters are not accessible or are even not shown and thus cannot be modified. This level allows unskilled employees to run measurements without any risk of doing something wrong.

The higher the user level is set, the more menus are accessible. User Level 6 gives full accessibility to the instrument's software. To change the user level, you have to enter a password.



The instrument is shipped with User Level 4 activated which will give you access to the most common features.

11.1.1.1 Changing user level

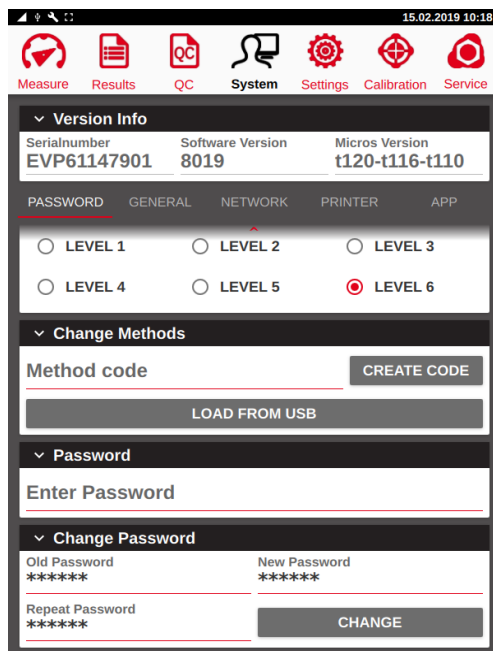
Lower user levels than the currently used one can be selected at any time. To change to a higher user level, it is necessary to enter a password. The default user level is “123456” and can be changed in the “System” menu. Enter the password in the text box *“Enter Password”* and select the desired user level by touching the white circle next to the respective level. Please find an overview of the different levels in the table below:

	User Level					
	1	2	3	4	5	6
Measure						
Select Method			X	X	X	X
Select Sample ID		X	X	X	X	X
Select Operator		X	X	X	X	X
Common & Session Settings			X	X	X	X
RUN / RINSE	X	X	X	X	X	X
Results						
Select Method	X	X	X	X	X	X
Filter			X	X	X	X
View			X	X	X	X
Data				X	X	X
Print/LIMS/PDF	X	X	X	X	X	X
Settings						
General				X	X	X
Method				X	X	X
Filter				X	X	X
Screen				X	X	X
System						
Password Tab	X	X	X	X	X	X
Change Methods	X	X	X	X	X	X
Create Code					X	X
Load from USB	X	X	X	X	X	X
Change Password					X	X
General				X	X	X
Network				X	X	X
Printer				X	X	X
App						X
Calibration						
					X	X
Service						
						X

11.1.2 Changing the Password

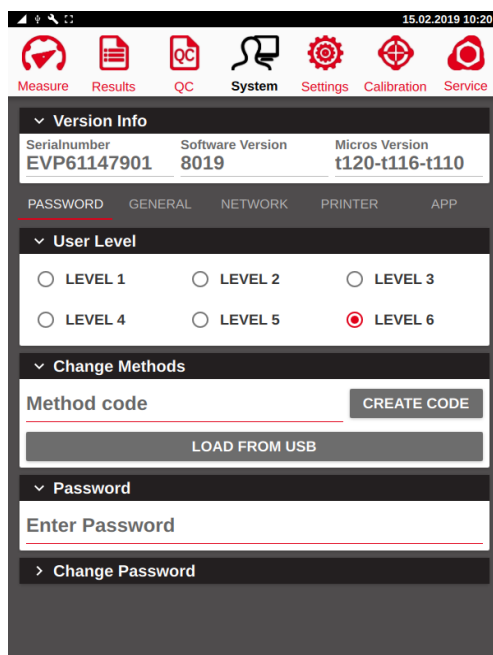
When the instrument is delivered, the default password is “123456”.

Enter the default password or the current one as “*Old Password*”. Enter the new password as “*New Password*”, re-enter the new password under “*Repeat Password*”. If the password is entered correctly, the “*CHANGE*” button becomes available. Press it to change the password.



11.1.3 Enter method codes

ERAVAP uses method codes to unlock additional features. The method code is supplied by eralytics or by a representative and is entered in the input field “*Method code*”. If the code is accepted, the method code field will change to “*Valid*”. If the method code is rejected, a message “*Invalid method code*” will be displayed.



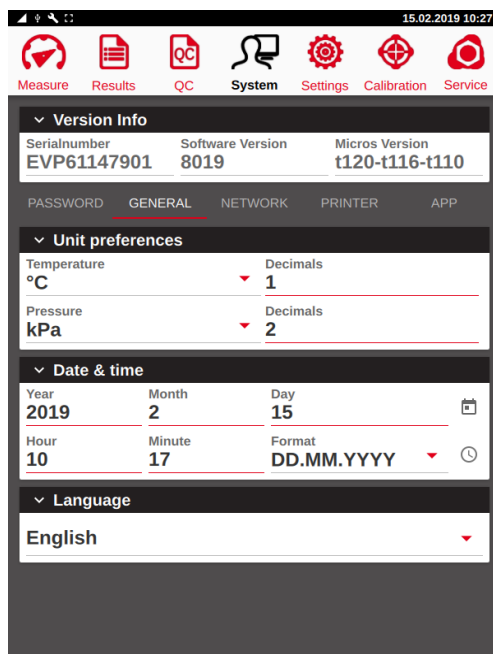
Instead of entering the code, the file supplied by eralytics can be loaded directly to a USB stick. To load the method code, insert the USB stick and press “*LOAD FROM USB*”. Successful reading of the file and code is confirmed by the valid message.



Each method code is valid for one use only. For some features a software update or upgrade of the hardware might be necessary to make them accessible. Please contact eralytics or your local eralytics representative for details.

11.2 General Tab

The general tab enables setting the unit preferences, date and time, as well as the instrument language.



11.2.1 Unit preferences

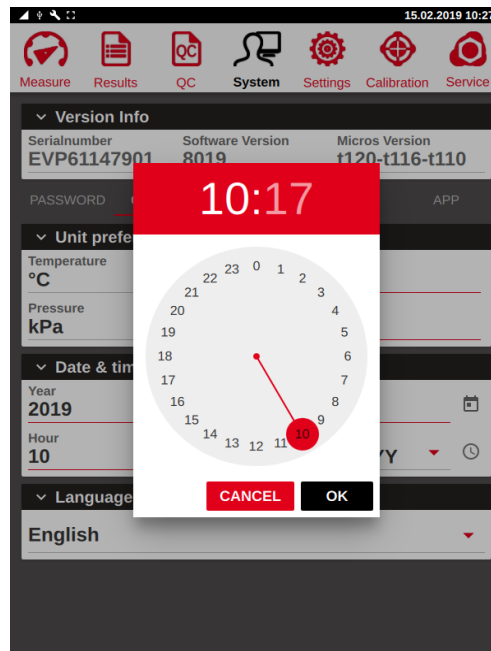
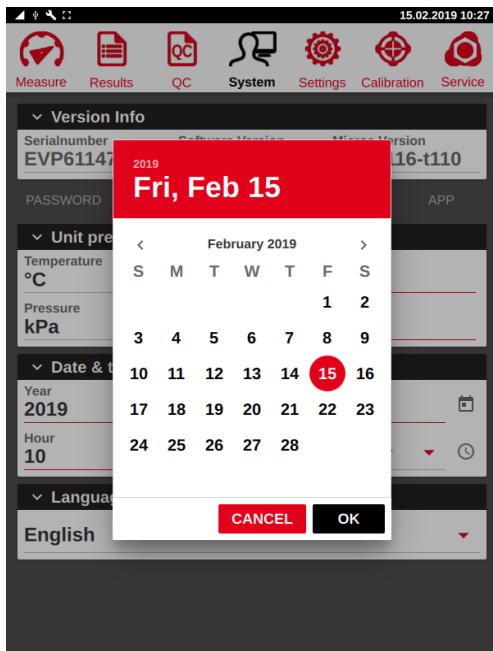
Use the drop-down menus to set the desired units.



Changing the decimals for the temperature or pressure units will only affect the displayed values during the measurements! The data in the result files will always be stored with the highest precision available (4 decimals).

11.2.2 Date & Time

To change the date and time, one can either enter the values manually or press the calendar or clock symbols on the right side.



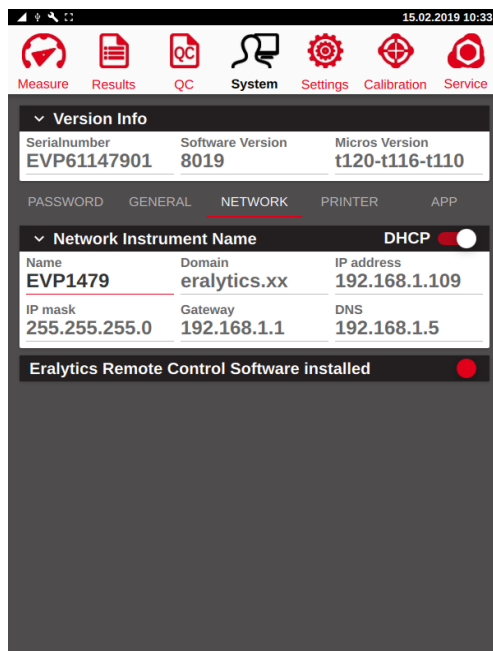
11.2.3 Change language

The language drop-down box enables selection of the instrument language. After switching to another language, the application software will restart.

If a language is not available, contact your eralytics representative to obtain the required translation into your language.

11.3 Network Tab

The tab "Network" defines connections to the local network.



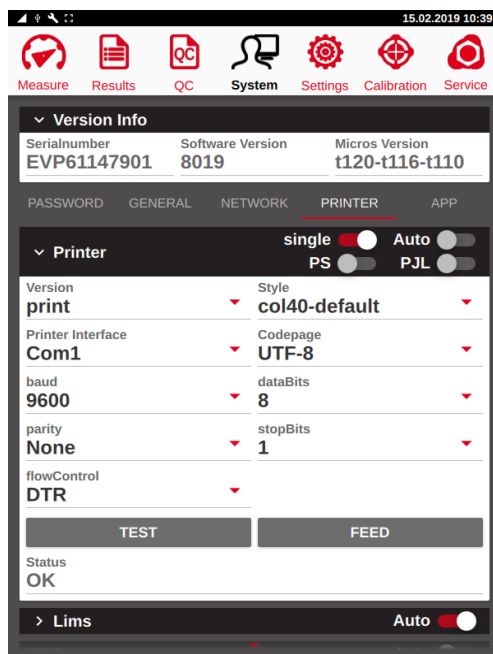
The instrument can be connected to a Local Area Network (LAN) or directly to a computer via the Ethernet connector on the rear panel. All necessary information for communication with a LAN or computer can be seen and entered in the sub-tab "Network". The name of the instrument is given in the box "Name", you can give it any name, but you can use only letters and numbers (and the underscore).

If you have a DHCP server in your network and you want to use it, then activate the DHCP switch. The instrument will then automatically get an IP address and connect to the LAN. All fields except for the Name field will be grayed since this information is given by the DHCP server. This allows recognizing the instrument by its name or IP address in the LAN. If you do not have a DHCP Server you must at least fill the IP Address and IP Mask field (Please ask your system administrator about this numbers).

The installation the remote-control software module is indicated as well (red = installed). If you require the full version, please contact your local dealer or eralytics.

11.4 Printer Settings

Use needle printers with a serial interface (e.g. Epson LX300), dot impact printers (e.g. Citizen CBM910) or printers talking PCL5 or higher connected by the USB interface (e.g. HP P2050).

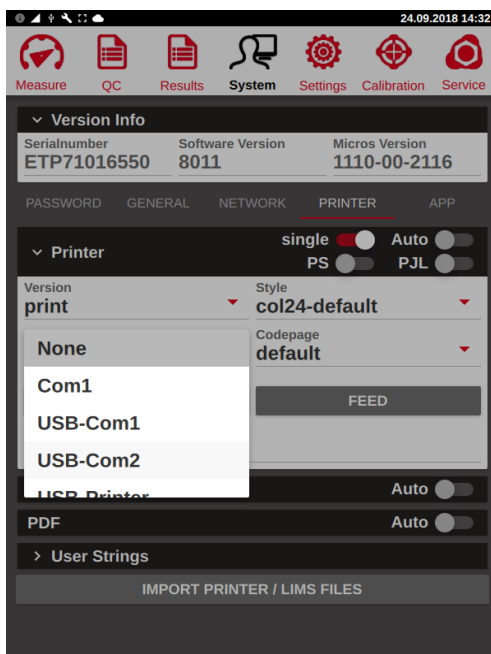


- “Single”:** Switch to get one page per measurement, unmark to get a result list. The page will be printed as soon as enough results are available to fill a complete page.
- “Auto”:** After the measurement is finished the result is transferred to the printer automatically.
- “PS”:** Post Script. For printers with USB or network connection being able to use post script, this option can be used to print e.g. Cyrillic, Chinese, Japanese etc. characters.
- “PJP”:** Printer Job Language. Some laser printers need that information to start the printing job. If marked, the instrument is sending a string to the printer before each printer job.
- “Style”:** Selects the type and style of the printer files loaded to the instrument.
- “Printer Interface”:** Printer interface or printer connection. Select between serial (COM), USB, USB-CUPS or network printing. The selected printer interface also defines the appearance of the Printer menu.
- “TEST”:** Print a test page
- “FEED”:** Force a printer feed.
- “Status”:** Returns the status after a test page has been printed. Press Test, the status of the sent test string will be shown. For successful data transfer, OK will be shown.

11.4.1 Serial printer

Eralytics instruments are compatible with the most common types of line printers, which can be connected via USB or RS232 (Com).

Connect the printer to the instrument and select either “Com1”, “USB-Com1” or “USB-Com2”:



“COM1”:

For printers with a 25pin port connect at the serial port of the instrument a serial cable (9 pin male to 9 pin female, non-cross over). Use a 9 pin to 25pin cross over converter to connect the printer. For printers with a 9 pin port, connect a 9 pin cross over serial cable only (this cable is not included in the scope of delivery).



“USB-Com1” or “USB-Com2”:

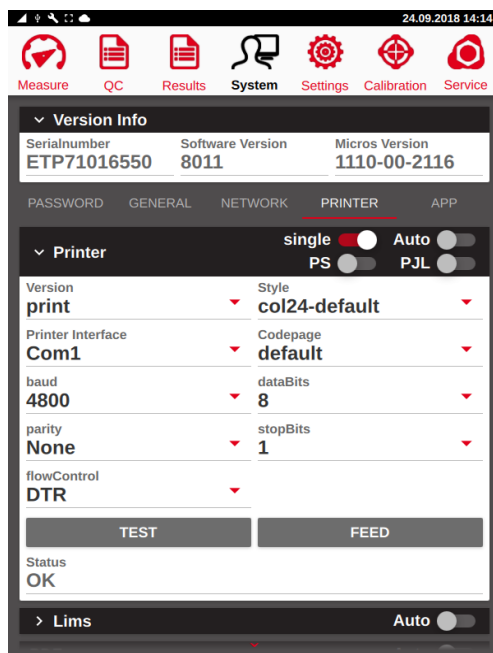
For printers with a 25pin port connect at the USB port of the instrument a USB to serial cable (not included in the scope of delivery). Then a 9 pin female to 9 pin female non cross over serial cable and a 9 pin to 25 pin non cross over adapter to connect a printer with a serial interface (or a cross over cable and a cross over adapter).



For printers with a 9pin port connect at the USB port of the instrument a USB to serial cable (not included in the scope of delivery). Then a 9 pin female to 9 pin female non cross over serial cable.



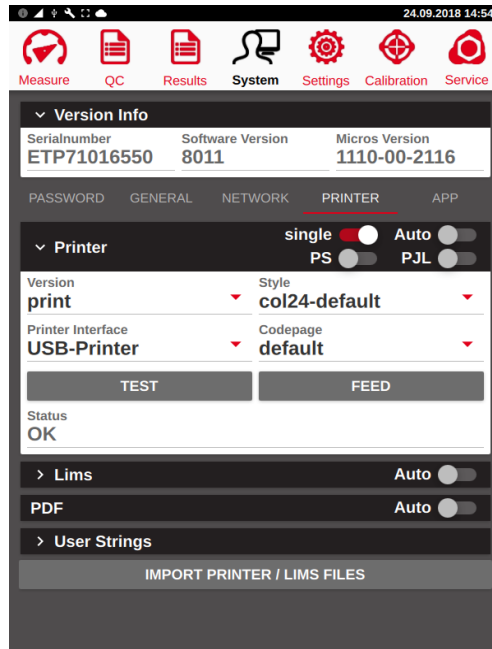
Enter the baud rate, data bits, stop bit, parity bit and the flow control in the respective fields to complete the printer installation. The serial line printer **100-240 V Citizen CBM 910** supplied by eralytics requires the configuration to match the shown screenshot:



Depending on the line printer type select the styles “col24-default” or “col40-default”. After the successful installation the printer can be tested by pushing the “TEST” button and the Status will switch to “OK”.

11.4.2 USB printer

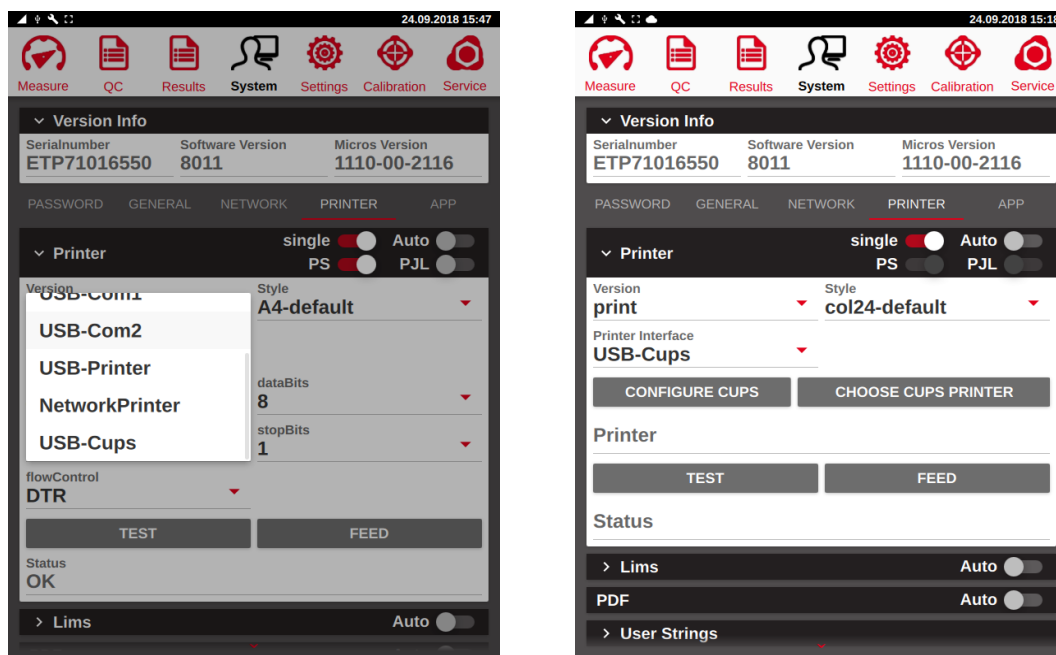
This Setting is suitable for USB printers that use PCL5 or higher and do not require the installation of selective printer drivers:



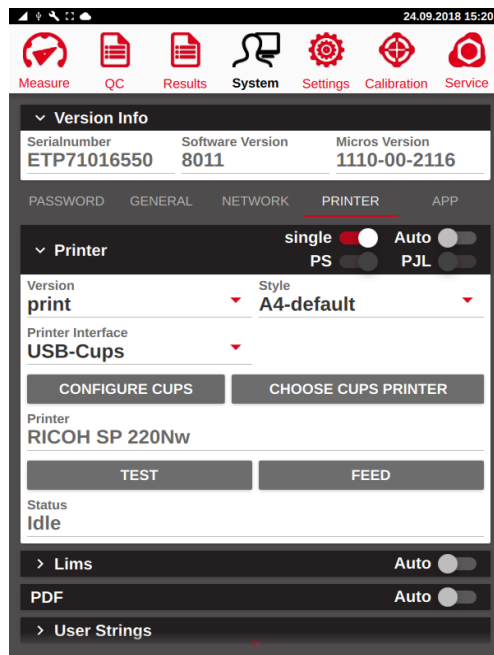
11.4.3 CUPS printer

Eralytics instruments provides CUPS (Common Unix Printing System) drivers for many different USB printers, however, not all printers support CUPS, thus eralytics cannot guarantee that a certain (not recommended) printer will work when using this feature.

ERAVAP supports the two printers **Ricoh SP 220Nw** and **HP Laser Jet Pro 1102w** which can be purchased optionally via our sales department.



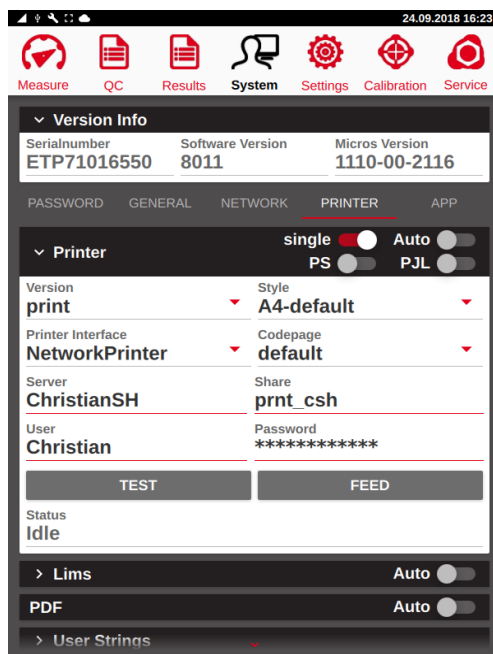
Select “*USB-Cups*” as Printer Interface and click “*SAVE*” to confirm. To start the auto-detect procedure of the printer, click on “*CHOOSE CUPS PRINTER*” and wait until the search is finished. Select the connected printer from the list and complete the installation by clicking “*CONFIGURE CUPS*”.



If successful, the printer status switches to “Idle” and the printer can be tested by either pushing the “TEST” button or printing results.

11.4.4 Network printer

ERAVAP allows printing over ethernet if the printer is shared via a PC or printer server. Select “*Network Printer*” to configure the printer:



“*Server*”: Name of the computer (PC) in the network where the share printer is installed. This computer must be turned on, so that the instrument can use the printer.

“*Share*”: Name of the shared network printer

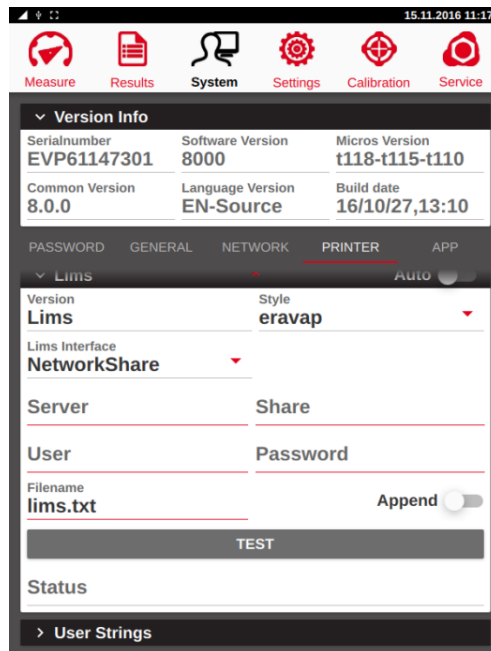
“*User*”: This is the login name of the computer where the network printer is installed.

“*Password*”: Password of the User.

Analogously to CUPS printers the Status “*Idle*” is displayed if the installation has been successful.

11.5 LIMS

After a measurement is finished a result string can be sent to the LIMS. LIMS share many similarities with printing and is configured in the same way as printing.



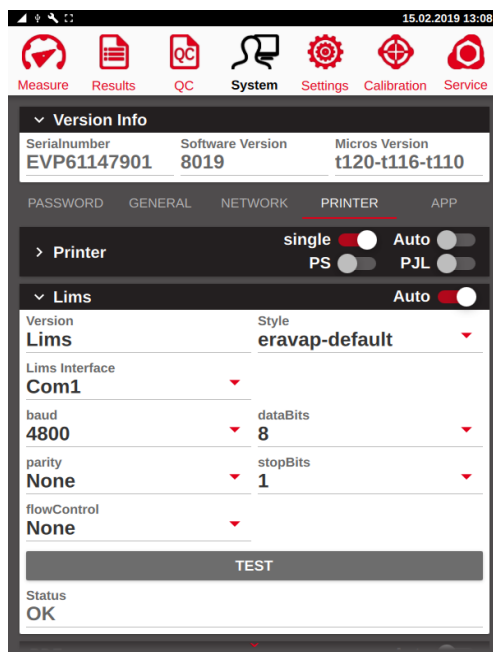
“Auto”: Send a LIMS string to the LIMS interface after each measurement.

“Style”: Select the file that defines the format of the LIMS output. This so called .comp file can be edited by the user.

“LIMS Interface”: LIMS interface or LIMS connection. Select between serial (COM), USB or network. The selected LIMS interface also defines the appearance of the LIMS menu.

11.5.1 Serial LIMS

Select the appropriate interface in the “*LIMS Interface*” drop-down menu.



“*Com1*”: Connect at the serial port of the instrument a serial cable (9 pin male to 9 pin female, non-cross over).



“*USB-Com1*”: Connect one of the USB ports of the instrument to the serial interface of a computer via a USB to serial converter. This is the first connected USB port.

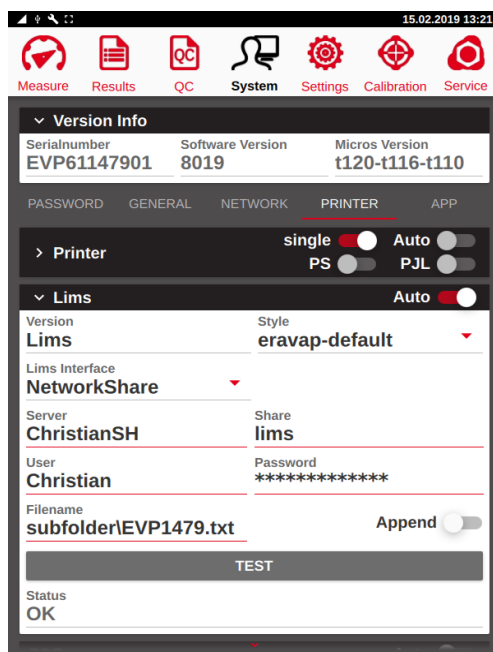
“*USB-Com2*”: This is the second connected USB port.

Set the baud rate, data bit, stop bit, parity bit and the flow control by pushing the respective dropdown list for the selected “*Com1*” or “*USB-Com*” interface.

“*TEST*”: A string will be sent to the selected Com1 Port to test the data transfer. If the file was sent successfully, the Status “*OK*” is displayed.

11.5.2 Network LIMS

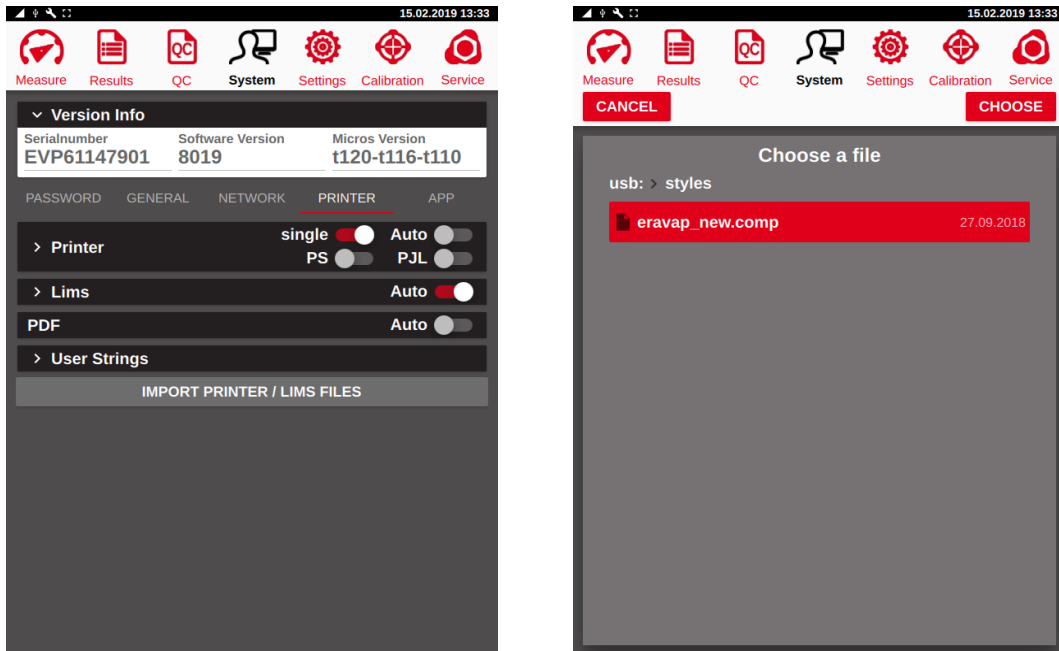
When the instrument is connected to a network (see chapter 11.3) then the “*Network Share*” option can be used for direct result file transfer to the network. The only requirement is that a folder on the computer is shared.



- “*Server*“: Name of the computer (PC) in the network where the share printer is installed. This computer must be turned on, so that the instrument can use the printer.
- “*Share*“: Name of the shared folder (only the name, the path is not required).
- “*User*“: This is the login name of the above mentioned computer.
- “*Password*“: Password of the User.
- “*Filename*“: Name of the LIMS file. If the data is to be exported into a sub-folder is has to be specified in this field.
- “*Append*“: Activate this option to continue to write into the same file.
- “*Test*“: A string will be sent to the selected computer and folder. If the file was sent successfully, the Status “OK” is displayed.

11.6 Import Printer/LIMS Files

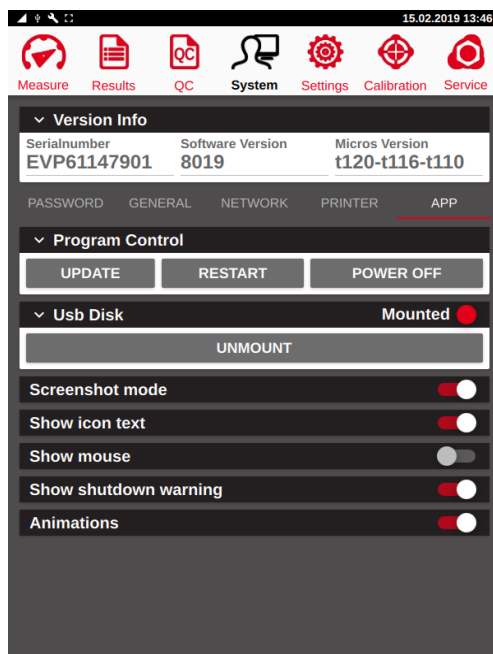
LIMS and printer files for the style of the LIMS string or printout can be loaded to the instrument. Connect a USB drive with the format file and press the “*IMPORT PRINTER / LIMS FILE*” button to upload the new format file.



A restart may be required to make the file available in the “*Style*” dropdown menu.

11.7 App Tab

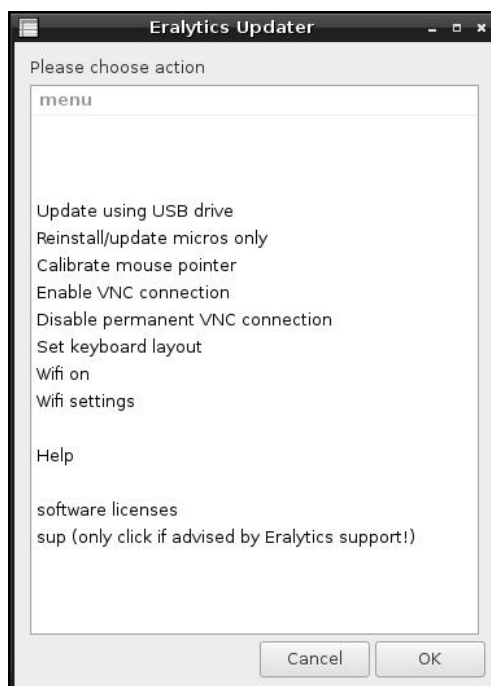
The sub-tab *“APP”* controls a number of external programs as well as the appearance of the application software.



- “UPDATE”*: Opens the update menu.
- “RESTART”*: Performs a restart of the application software.
- “POWER OFF”*: Turns off the instrument.
- “MOUNT / UNMOUNT”*: Unmounts a connected memory stick. If no memory stick is connected, this button is inactive.
- “Screenshot Mode”*: When active, pressing the main button makes a screenshot and stores it on an attached USB stick. This option can't be activated if no USB stick is connected. This feature is automatically deactivated if the USB is disconnected.
- “Show icon text”*: If activated, the icons and text will be shown for the menu tabs on the top of the display. If deactivated, only the icons will be displayed.
- “Show Mouse”*: If activated, a small black arrow will be shown on the display that indicates the current position of the cursor. If deactivated, no position indicator will be displayed.
- “Show shutdown warning”*: Shows a 5 second shutdown counter when the power button is pressed. If deactivated, the instrument will shut down immediately when the power button is pressed.
- “Animations”*: Activates animations.

11.7.1 Update menu

This button temporarily exits the application and opens an interface enabling update of software or micro controller software, defining language settings for periphery equipment (keyboard, barcode reader), VNC connections and touch screen calibration. The following functions are available:



“Update using USB drive”:

Plug in a USB flash drive containing a file called 'update_era[devicename]"sys"]' that you received from eralytics or your local eralytics representative and start the software update.

“Reinstall/update micros only”:

Updates the software on the micro controllers.

“Calibrate mouse pointer”:

Program to adjust the click accuracy of the touch screen.

“Enable VNC connection”:

Activates the VNC server on the instrument. Required to connect to the instrument via VNC viewer. After turning off the instrument this option will be inactive at the next instrument start.

“Enable permanent VNC connection”:

Enable/Disable the VNC server permanently (until deactivated again using this option).

“Set keyboard layout”:

Choose between keyboard layouts for periphery equipment. This language setting has to match the configuration on the barcode scanner in order to be recognized.

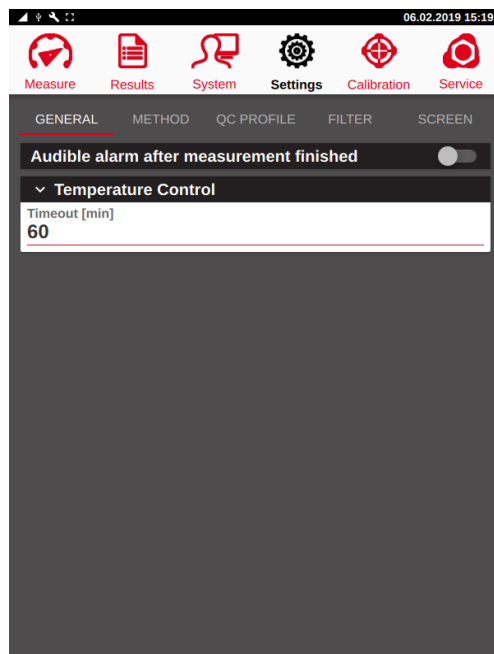
<i>"Wifi on":</i>	Works only with the optionally provided Wifi-dongle. Deactivates the LAN interface and uses Wifi instead.
<i>"Wifi settings":</i>	Opens the Wifi settings.
<i>"Help":</i>	Opens a pop-up window with additional information.
<i>"Software licenses":</i>	Provides information on the software licenses.
<i>"sup (only click if advised by Eralytics support!)"</i> :	You will be notified by the Eralytics support team if it is necessary to enter this special menu, the functionality of which is described in the service manual.

12 Settings Menu

In the “*Settings*” menu method parameters and filter settings can be specified. Furthermore, some general settings can be adjusted.

12.1 General

On this tab general settings are shown which apply for all methods.



12.1.1 Audible alarm after measurement finished

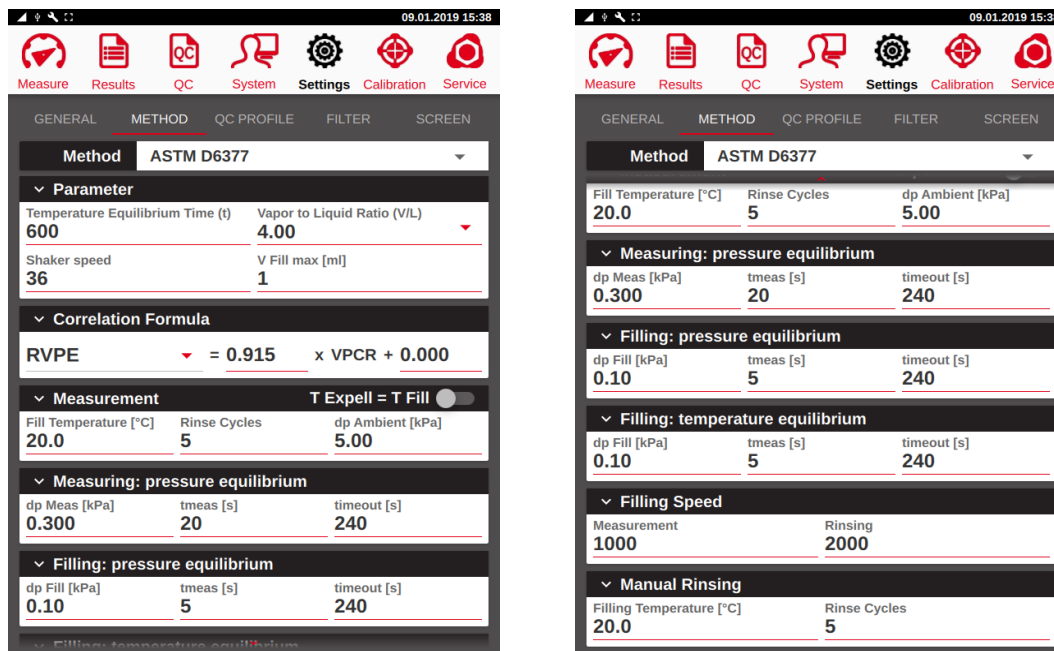
An alarm at the end of the measurement can be enabled here.

12.1.2 Temperature Control (Timeout)

After a measurement is finished the temperature control regulates the cell temperature to the last filling temperature and keep it stabilized for a specified time in order to be ready for the next measurement.

12.2 Method Settings - Parameters

Changes in the “*Method*” tab will only affect the selected method.



The available settings depend on the method itself. Typical parameters that are available for all methods are “*Filling Temperature*” or number of “*Rinsing Cycles*”. Changing these values may affect the results of your measurements. If you changed them by accident, either check the default settings listed in chapter 12.3 for each method or contact eralytics or your local representative for additional support.

12.2.1 Parameter

12.2.1.1 Triple Expansion

Only available for D5191, EN13016-1, IP394 and SHT0794. Provides the additional result parameters Pabs and Pgas by performing a triple expansion during the measurement.

12.2.1.2 Temperature equilibrium time

When the target temperature is reached a timer will start according to this setting to ensure a good outgassing of the sample. The default settings may vary depending on the method.

12.2.1.3 Equilibrium Time

Only available for Curve measurements featuring the triple expansion. Defines the equilibrium time for each curve step.

12.2.1.4 Vapor to Liquid Ratio

Defines the ratio between the liquid and vapor phase. For most methods this setting is predefined as $V/L = 4.00$ and cannot be changed.

12.2.1.5 Shaker speed

Sets the speed of the cell shaker. Default setting is 36 for all methods that require a shaker for sufficient outgassing, but can be modified for each method individually.

12.2.1.6 Dead Volume

This is the dead volume of the manifold and valves which is the minimum sample volume in the measurement chamber. This dead volume is determined by reference measurements. It must be determined again by trained personal when the manifold has been changed.

12.2.1.7 V Fill max

This is the maximum sample volume introduced into the measurement chamber. For V/L ratios < 4 more sample could be injected but the shortest measurement time and best reproducibility was achieved in several test measurements with a maximum volume of 1mL.

12.2.2 Correlation formula

Select the correlation formula shown in the standard method.

12.2.3 Measurement

12.2.3.1 T Expell = T Fill

Highly viscous samples may require the filling temperature to be set higher than the actual measuring temperature. Activate this switch to heat up the cell to the filling temperature again after the measurement is finished. This setting is ignored if $T_{fill} < T_{meas}$.

12.2.3.2 Fill Temperature

This is the temperature of the measurement cell which should be significantly lower than the boiling point of the sample. For gasoline samples a value of 20°C / 68°F is proven value.

12.2.3.3 Rinse Cycles

Defines the number of rinsing cycles prior to the filling step of the measurement.

12.2.3.4 dp ambient

When high viscous samples are used proper filling can take one or more minutes.

ERAVAP automatically monitors the status of the filling volume by checking the pressure inside the measurement cell. In this field the differential pressure to the barometric pressure can be entered where the filling is assumed to be sufficient.

e.g. barometric pressure = 100kPa (14.5psi), "*dp Fill*" = 5kPa (0.7psi)

The filling procedure is finished as soon as a pressure of 95kPa is reached inside the cell and an additional waiting period (1/3 of the time it took to reach 95kPa) has passed. This additional time assures that the pressure in the cell almost matches the barometric pressure.

"*dp Fill*" < 5kPa can cause very long filling procedures

"*dp Fill*" >100 the pressure monitoring is switched off

If the timeout is reached a warning will be shown and the measurement automatically continues.

12.2.4 Measuring: pressure equilibrium

This value is the maximum allowed pressure variation (“*dp Meas*”) in a certain time frame (“*t meas*”) during the measurement. If this stabilization criteria is not reached within the temperature equilibrium time the timeout timer (timeout) will start and a warning will be shown after the timeout is elapsed.

12.2.5 Filling: pressure equilibrium

After expanding the piston for introducing the sample into the measuring chamber the pressure variation is monitored to ensure a proper filling of the measuring cell. When the pressure reading is still increasing it is assumed that the sample is still not completely introduced into the measuring cell. A maximum pressure variation “*dp Fill*” must be reached within timeout (by default 240s) for the time period of “*t meas*”. If the timeout is reached without the above-mentioned criterion a warning is shown and the measurement is continued.

12.2.6 Filling: temperature equilibrium

For measurements with small V/L ratio (e.g.: V/L = 0.02 – 1) it is required to set the filling temperature equal to the test temperature due to the expansion of the liquid. To ensure that the sample temperature is equal to the filling temperature when the sample is introduced into the cell the pressure is monitored. After the pressure equilibrium is finished the inlet valve is closed to observe the pressure reading.

When the pressure is not increasing by more than specified by *dp Fill* in the time frame (“*t meas*”) the measurement is continued. If that criterion cannot be fulfilled after the timeout (e.g. 240s) is expired a warning will be shown and the measurement is continued.



If *Tfill* is not set equal to *Ttest* then this check is skipped. This can also be made in the Measurement menu.

12.2.7 Filling Speed

The piston speed for the measurement and rinsing procedure can be adjusted. The valid range is 300 – 2000 and the default setting is 2000 for both the measurement and rinsing parameter.

The piston speed can be reduced when samples with a high vapor pressure are introduced through the tube. This avoids outgassing during the sample introduction. Additionally, samples featuring a high viscosity also require a reduced piston speed.

12.2.8 Manual Rinsing

Additional rinses can be performed by pressing the “*RINSE*” button in the measurement menu to clean the measuring cell.

12.2.8.1 Filling temperature

This is the temperature of the measurement cell for the rinse cycle which should be lower than the boiling point of the sample.

12.2.8.2 Rinse cycles

Number of performed rinse cycles.

12.2.9 Gas correction

Only available for Curve measurements featuring a triple expansion. Defines the temperature at which the triple expansion will be performed. The Curve measurement will have the best precision at this temperature.

12.2.10 Pressure calibration 1

This feature is only available for JIS-K5558-2 and Low VP / Low VP Curve. It does not change the calibration in the “Calibration” menu and affects just the selected method. An offset can be programmed for the low range (e.g. -1kPa to match the reference materials like n-hexane exactly in the low range). Press the Gain button for automatic correction at barometric pressure

See chapter 12.3.10.1 for a detailed description of this feature.

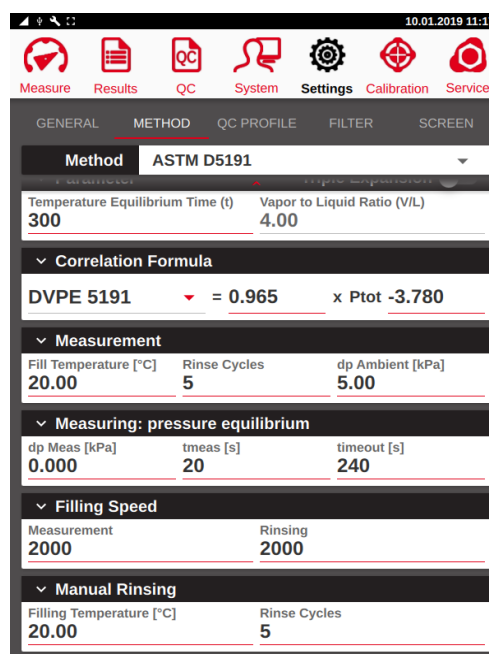
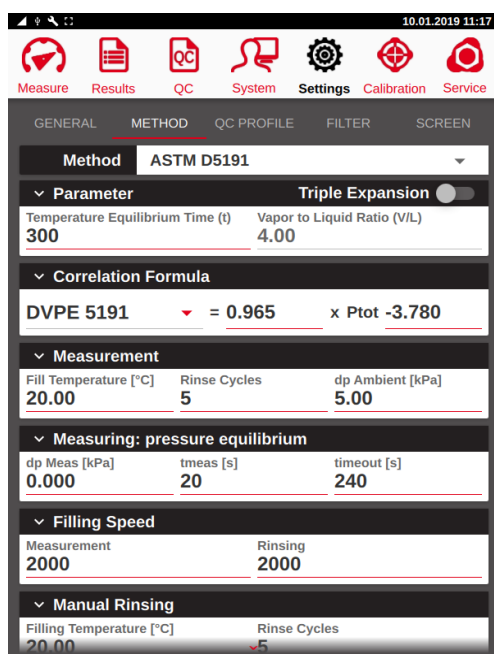
12.3 Method Settings - Methods

This menu hosts the settings and parameters for every method. Most of these parameters usually do not need to be adapted, however for certain methods or samples it may be necessary to modify some parameters.

The screenshots provided in the following chapter display the corresponding default values.

12.3.1 ASTM D5191, EN13016-1, IP394, SHT0794

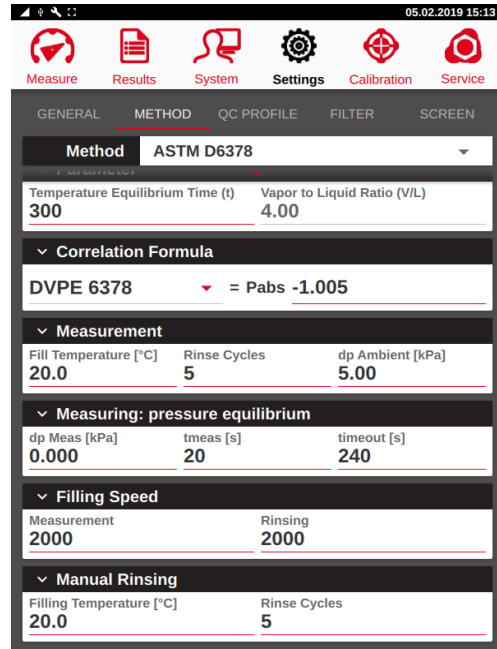
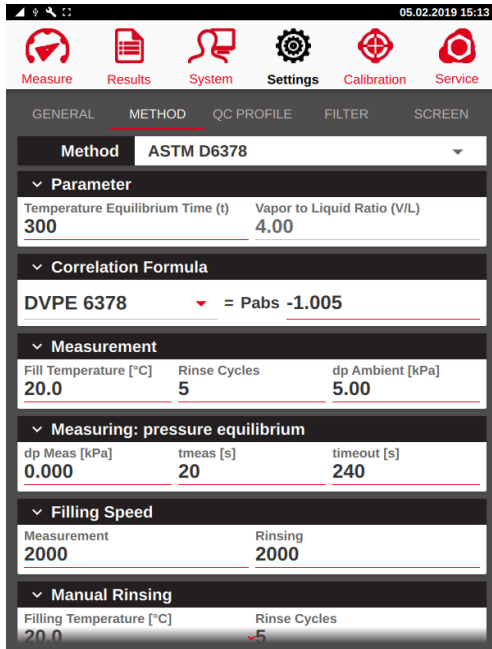
There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.



“Triple expansion”: When the switch is set for triple expansion the partial pressure of the dissolved air in the gasoline is calculated as well. An unusual high gas correction, e.g. $P_{gas} > 7\text{kPa} / 1\text{psi}$, will indicate that the sample tube was probably not immersed into the liquid and some air was drawn in. In such a case the measurement should be repeated, and attention should be paid to the immersion of the tube.

12.3.2 ASTM D6378, EN13016-3, JIS K2258-2, SHT0769

There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.

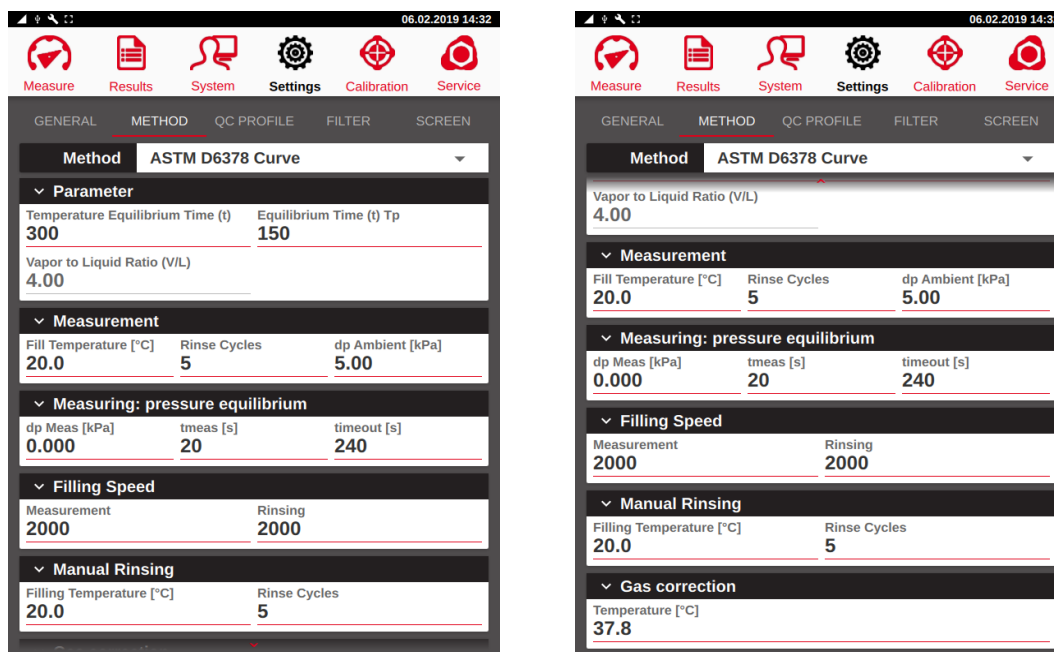


“Pressure Calibration 1”:

This option is just available for the JIS-K5558-2 method. It allows an additional calibration at low pressures.

12.3.3 ASTM D6378 Curve

There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt. The settings are similar to ASTM D6378.

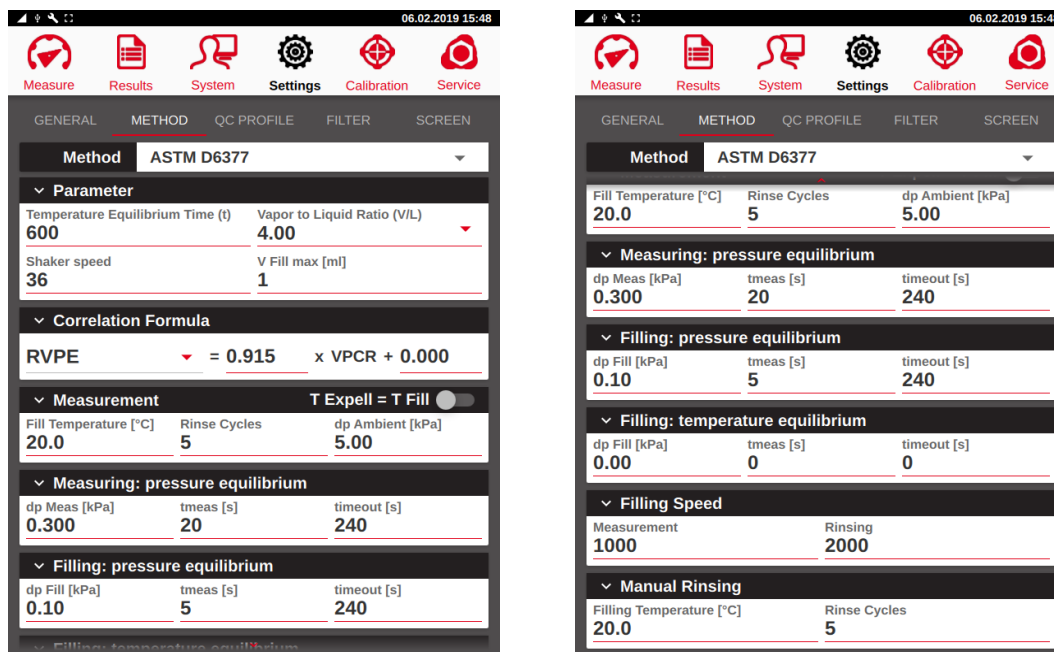


“Equilibrium time”: It is not recommended decreasing this parameter to a value lower than 120s, otherwise the temperature equilibrium may not be stable, causing drifting results.

“Gas correction”: Change the temperature of the triple expansion if the highest precision is required at a temperature other than 37.8°C.

12.3.4 ASTM D6377, IP481, GHOST52340

Several different settings may be adapted for these methods.



“Temperature equilibrium time”:

The default setting of 600s ensures proper degassing of the sample. However, for some crude oils having a lower viscosity this parameter may be decreased to shorten the overall measuring time.

“Filling: pressure equilibrium”:

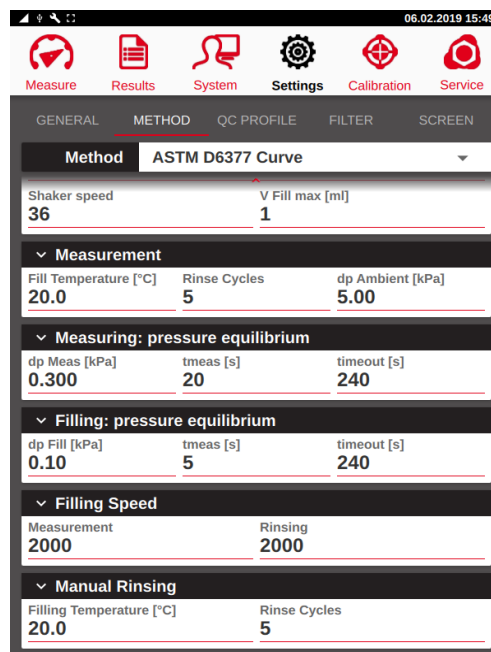
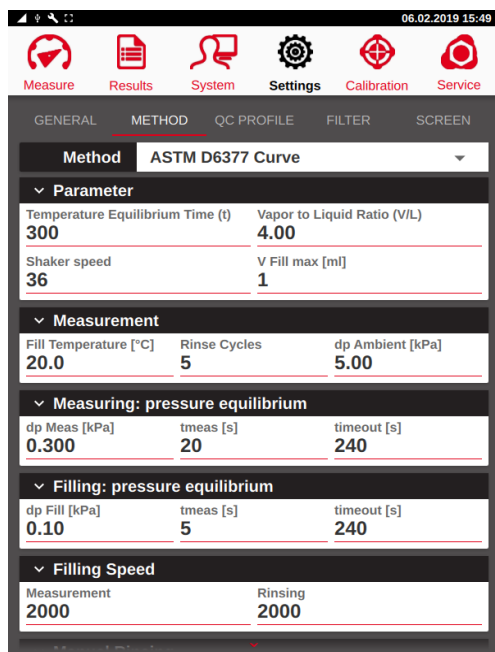
Depending on the back-pressure of the FPC it may be necessary to increase the parameter “*dp Fill*”, otherwise the filling can take up to 5 minutes or trigger a timeout warning.

“Measuring: pressure equilibrium”:

For most measurements the default settings work well, if higher precision it is required to decrease the parameter “*dp Meas*” to 0.1 kPa.

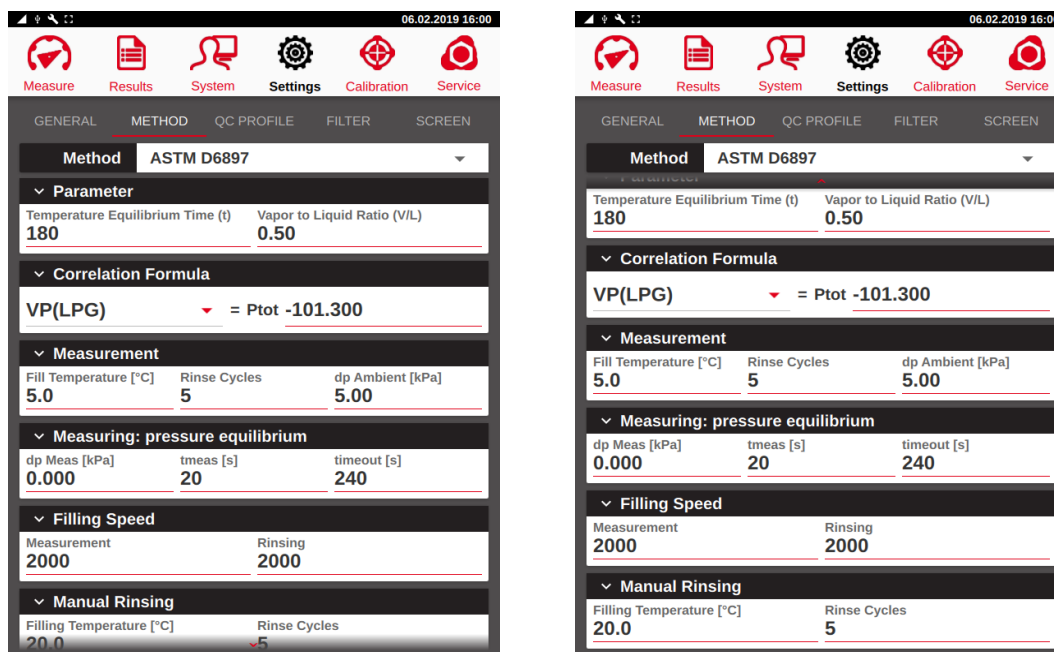
12.3.5 ASTM D6377 Curve

The settings for this method are similar to ASTM D6377.



12.3.6 ASTM D6897

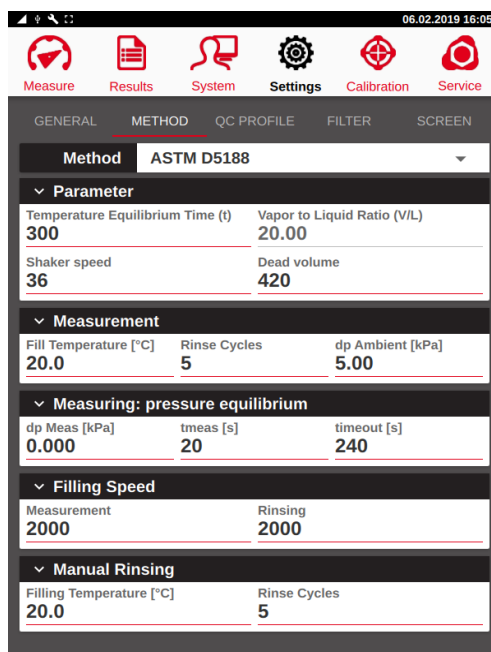
There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.



“Fill Temperature”: Note that the filling temperature is set to 5°C by default for the method. This ensures proper filling even if the sample reaches its boiling point. It is recommended not to change this value, even if it may take some minutes to reach the filling temperature.

12.3.7 ASTM D5188

There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.



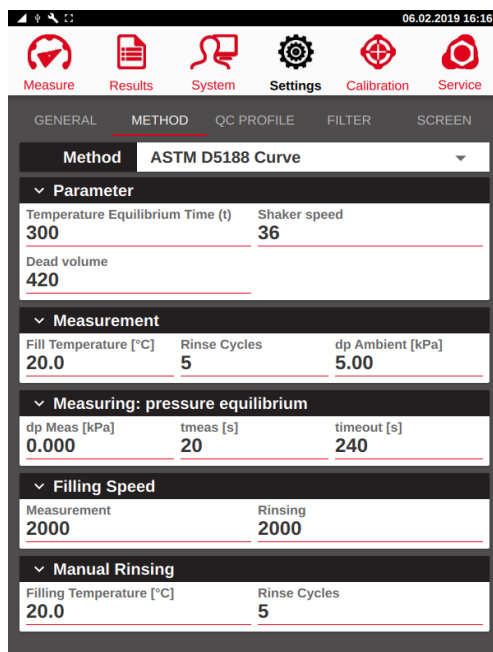
“Dead Volume”:

If the quality control samples are not within specifications it may be necessary to adapt the dead volume. Repeat measuring the quality control sample isopropanol/n-pentane (90%:10%) and slightly change the dead volume: increasing it by 40 increases the T(V/L) result by approximately 0.3°C.

“Measuring: pressure equilibrium”: For EV20 only, the parameter “dp Meas” is set to 0.3 kPa by default due to the increased electronic background noise of the 20bar pressure transducer.

12.3.8 ASTM D5188 Curve

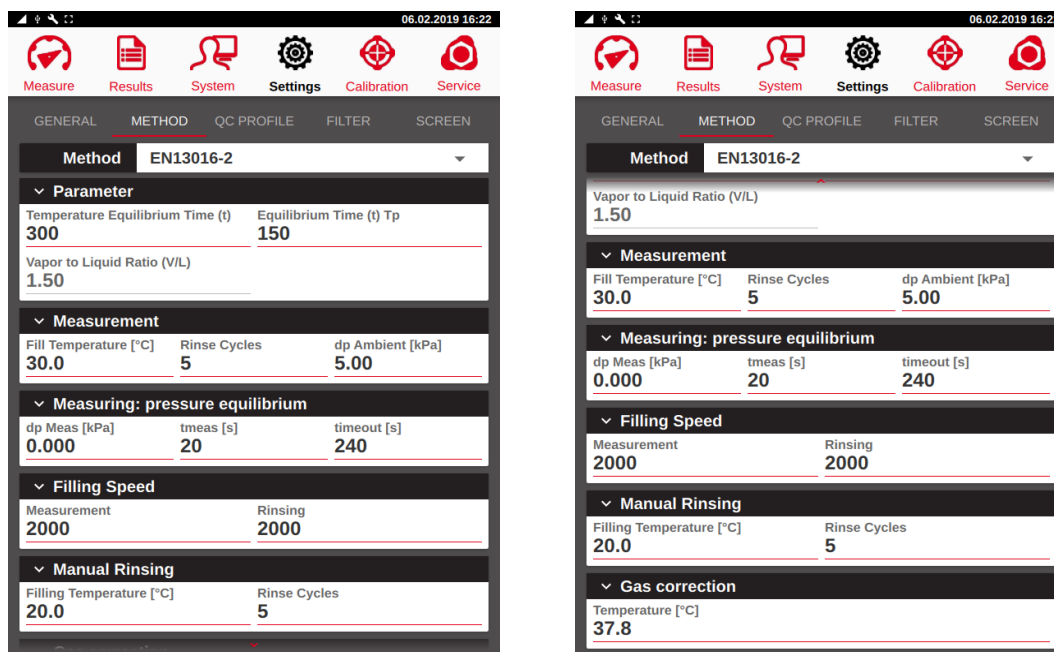
The settings for this method are similar to ASTM D5188.



“Dead Volume”: This parameter is shared with the dead volume of ASTM D5188.

12.3.9 EN13016-2, IP409

There are a few settings which are important for the measurement of these methods. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.

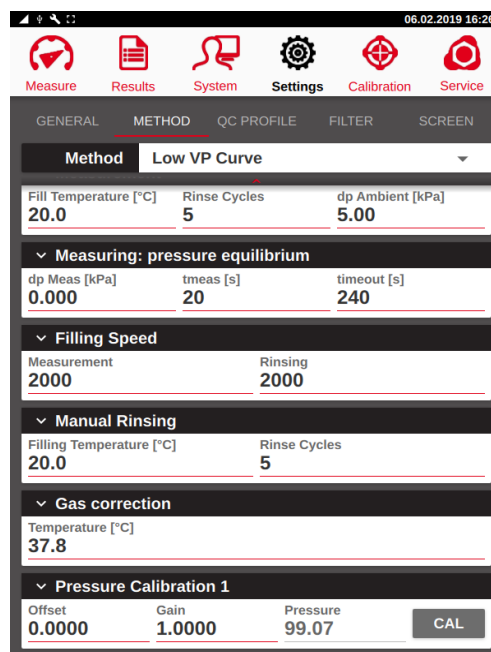
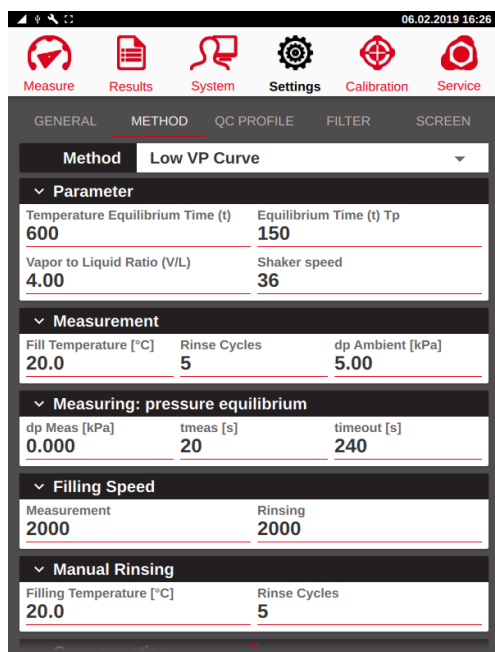


“Fill Temperature”: In contrast to most other methods the filling temperature has to be set to 30°C or 37.8°C. As n-pentane is the quality control sample for this method it is recommended to keep the filling temperature set to 30°C.

“Gas correction”: As a curve measurement the gas correction can be changed. However, in accordance to EN13016-2 the correction has to be performed at 37.8°C.

12.3.10 Low VP & Low VP Curve

There are a few settings which are important for the measurement of this method. Once they are set it is usually not necessary to change anymore. Just in rare cases it might be necessary to adapt.



“Temperature equilibrium time”: By default, this parameter is set to 600s to ensure complete degassing during the measurement. It may be decreased slightly to shorten the overall measuring time depending on the sample.

“Measuring: pressure equilibrium”: This feature is inactive by default but may be used for monitoring the pressure equilibrium. A value of 0.1 kPa for *“dp Meas”* is plausible for most applications.

“Gas correction”: Change the temperature of the triple expansion if the highest precision is required at a temperature other than 37.8°C.

12.3.10.1 Pressure calibration 1 - Low VP calibration in the low pressure range

Additional calibration with reference substances may be required for running ERAVAP in the very low-pressure range. For that reason, n-Decane with a purity $\geq 95\%$ is a suitable calibration substance since the vapor pressure is in the very low-pressure range.

First make sure that the standard temperature and pressure calibration including the “*P-T LIN*” was accurately performed. Furthermore, make sure the measurement cell is clean. Perform a cell cleaning procedure if necessary. Then run three VP Low vapor pressure measurements with n-Decane at 40°C and 60°C. Take the average of the three measurements at each temperature. Then calculate an average offset of the two temperatures. Below an example:

Ttest [°C]	Pabs [kPa]	P Literature [kPa]
40	0.77	0.52
40	0.81	0.52
40	0.79	0.52
60	1.91	1.60
60	1.95	1.60
60	1.89	1.60

The average of the three measurement of Pabs at 40°C = $(0.87 + 0.91 + 0.89) / 3 = 0.89$

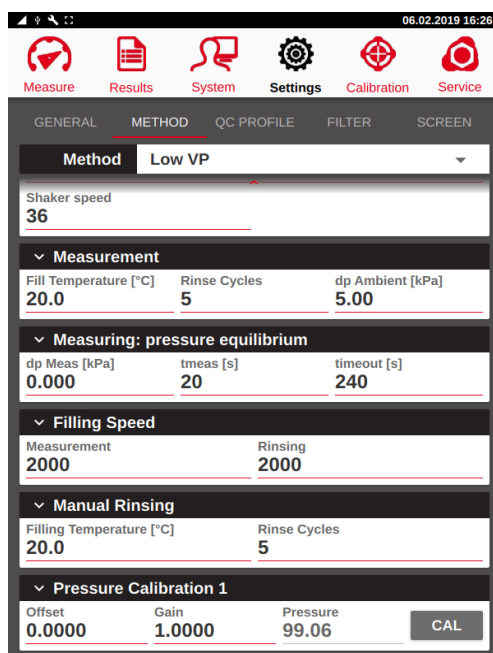
The offset to the Literature value of n-Decane at 40°C = $0.89 - 0.52 = 0.37\text{kPa}$

The average of the three measurement of Pabs at 60°C = $(2.01 + 2.05 + 1.99) / 3 = 2.02\text{kPa}$

The offset to the Literature value of n-Decane at 60°C = $2.02 - 1.60 = 0.42\text{kPa}$

The resulting average offset is $(0.37 + 0.42) / 2 = 0.4\text{kPa}$

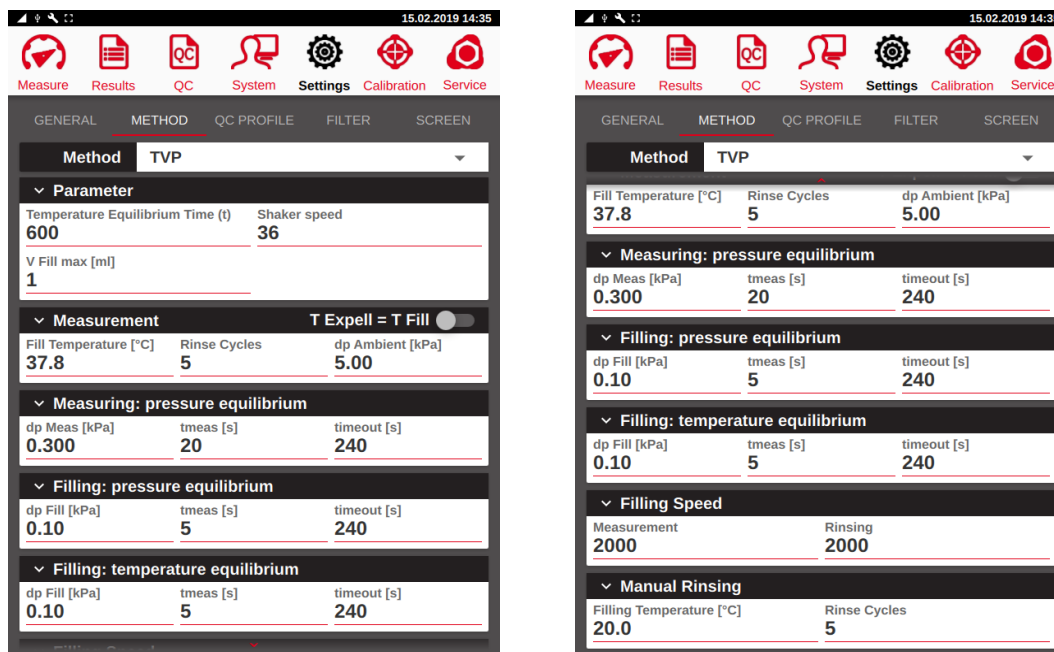
Make sure the outlet of the instrument is free, not pressurized and nothing connected. Go to the “Settings” menu of ERAVAP and choose method VP Low. Enter the calculated offset in the field “Pressure Calibration 1”.



Press the “CAL” button, the Gain is automatically calculated to show the same barometric pressure as before. The offset is at vacuum fully applied and linear reduced until it is zero at barometric pressure. If you want a linear offset over the full pressure range then set “Gain” back to 1.0000. Store the calibration with “SAVE”.

12.3.11 TVP

Several different settings may be adapted for these methods.



“Temperature equilibrium time”:

By default, this parameter is set to 600s to ensure complete degassing during the measurement. It may be decreased slightly to shorten the overall measuring time depending on the sample.

“Fill Temperature”:

As this method features very low V/L ratios (0.05) by default, the filling temperature has to match the testing temperature. If a test temperature other than 37.8°C is used this parameter should be changed accordingly, too.

“Measuring: pressure equilibrium”:

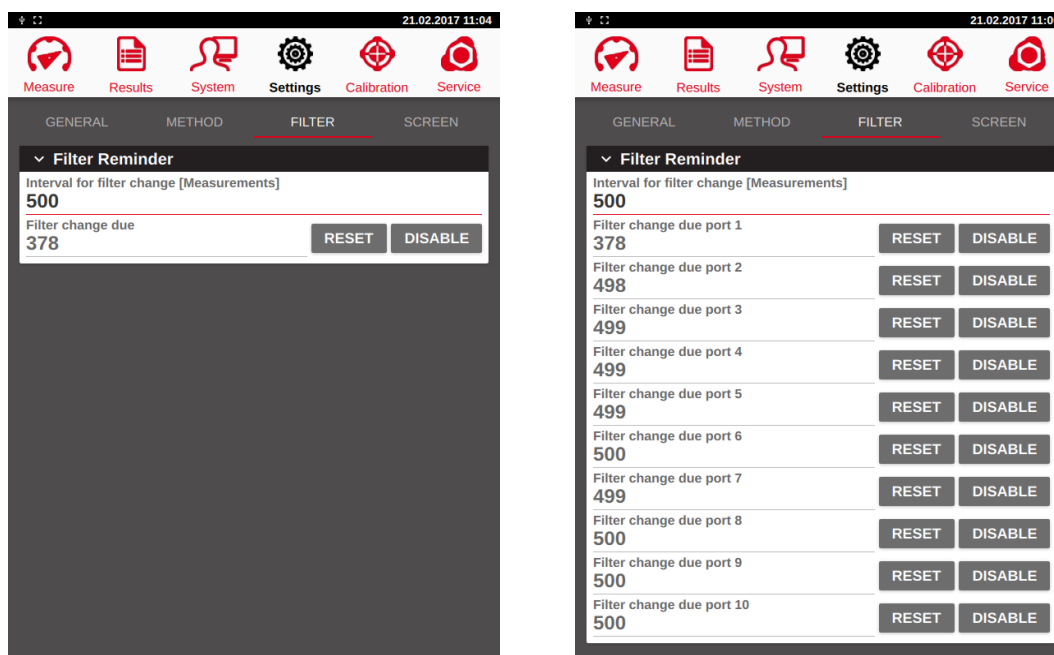
For most measurements the default settings work well, if higher precision it is required to decrease the parameter “dp Meas” to 0.1 kPa.

“Filling: pressure equilibrium”:

Depending on the back-pressure of the FPC it may be necessary to increase the parameter “dp Fill”, otherwise the filling can take up to 5 minutes or trigger a timeout warning.

12.4 Filter Settings

Depending on the cleanness of the samples the inlet filter has to be exchanged after a certain number of measurements. If that is not done, then either the results can be affected (e.g. vapor pressure of gasoline samples can drift low) or the measurement cell cannot be filled properly and the filling procedure is stopped. To avoid these and other effects a warning to change the filter can be set after a certain number of measurements. After each measurement the “*Filter change due*” value is reduced by one.



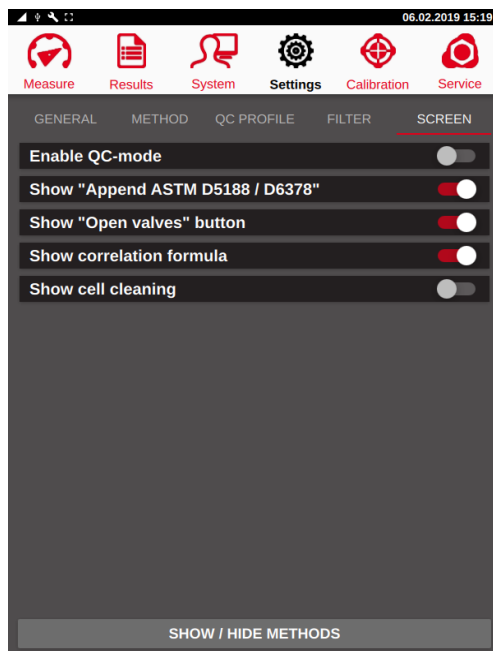
When an autosampler is connected the settings can be done for each port.

If the counter is down at zero a warning will be displayed in the measurement menu. Further measurements can still be performed but it is strongly recommended to exchange the filter, otherwise the effects described above can occur. After changing the inlet filter reset the “*Filter change due*” counter by pressing the “*RESET*” button to the predefined “*Interval for filter change*” value.

The “*Interval for filter change*” value e.g. 500 (either this number is set to low values as a precaution or determined experimentally with the products at site) can be set in the field on the right. The warning can be also disabled, and the counter switched off by the “*DISABLE*” button.

12.5 Screen Settings

In this menu, options can be enabled to be shown in the measurement menu as listed below.



12.5.1 Enable QC-mode

Activate this button for enabling the QC mode. See chapter 7 for further details.

12.5.2 Show “Append ASTM D5188 / D6378”

For ASTM D5191 and ASTM D5188 measurement and, respectively, for ASTM D5188 and ASTM D6378 measurement can be appended directly without pressing the RUN button for the following measurement.

12.5.3 Show “Open valves”

Crude oil or LPG methods may require pressurized sample containers. By pressing the OPEN VALVES button at the end of a measurement the pressure in the filling tube is released so the tube can safely be disconnected.

12.5.4 Show correlation formula:

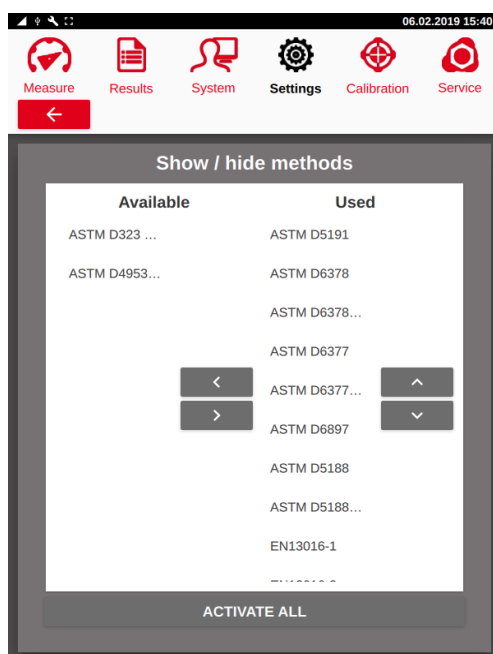
This allows the selection of the correlation formula (just available for certain methods like ASTM D5191 etc.) in the measurement screen.

12.5.5 Show cell cleaning:

Activate this button for accessing the cell cleaning procedure on the measure screen. See chapter 0 for further details.

12.5.6 Show / Hide methods

In the *“Measure”* menu all the methods are listed in the Method dropdown list. Usually not all methods are used in a lab. Therefore, it is possible just to display the important methods and reduce the list. The list can be fully equipped with all methods anytime again.



“Available”: These methods are currently hidden in the *“Measure”* menu

“Used”: This list contains the methods being shown in the *“Measure”* menu.

13 Calibration

The calibration of ERAVAP is performed in the "Calibration" menu. The analyzer is designed to operate over a long period of time without recalibration. However, annual factory calibration and service are highly recommended. Your company's quality assurance program may also require calibration at a more frequent interval. A simple method to verify that the analyzer is functioning correctly is to run a test using a known quality control sample. If the test fails to achieve the methods stated precision, calibration is required. Please contact your local agent or eralytics GmbH for service assistance.

The following tolerances for pressure and temperature are recommended for best test results:

Temperature @ 37.8C (100F): $\pm 0.05C$ (0.1F)

Pressure @ 37.8C (100F): $\pm 0.1kPa$ (0.015psi) at vacuum and barometric pressure

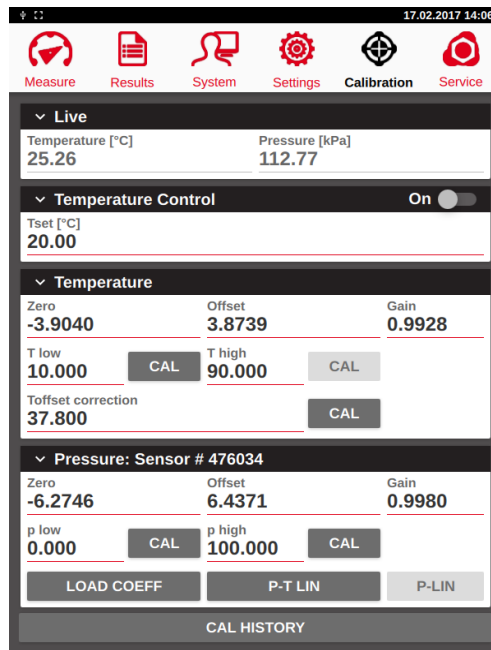


Measurements of samples with a very low vapor pressure might need an additional calibration in the low-pressure range.

To perform the calibration verification, eralytics GmbH recommends using ASTM crosscheck samples because these samples have gone through testing by a large number of participating laboratories; thus, they are very reliable. The results of the tests should match the average result of the quality control sample within the precision of the method.

Since the average result of a quality control sample is the average over a range of measurement values, it does not necessarily mean that every measurement gives the same result. As long as the analyzer result does not differ from the average value of the quality control sample by more than the method's standard limits the analyzer calibration is acceptable.

Enter the "Calibration" menu to make changes to the instrument calibration. In this menu the temperature and pressure calibration is performed.



13.1 Temperature Calibration

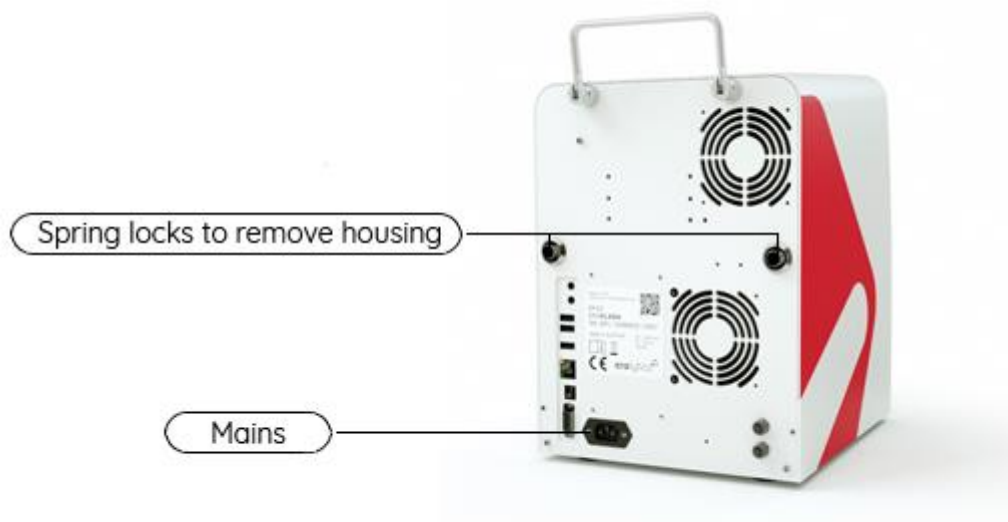
For the temperature calibration, use a certified reference sensor with an accuracy of at least 0.02°C (0.04°F). The sensor must have a diameter of 4mm (0.15") and a length of at least 150 mm (5.9").

The temperature calibration is performed at two calibration points, followed by an offset correction at 37.8°C (100°F).

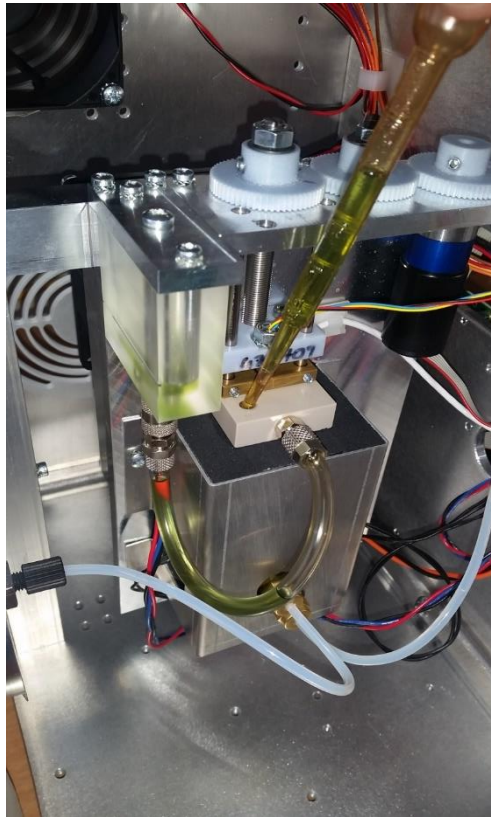
Switch off the instrument and disconnect it from mains. To remove the housing, press both spring lock buttons simultaneously while sliding the housing with your hands parallel to the side panel.



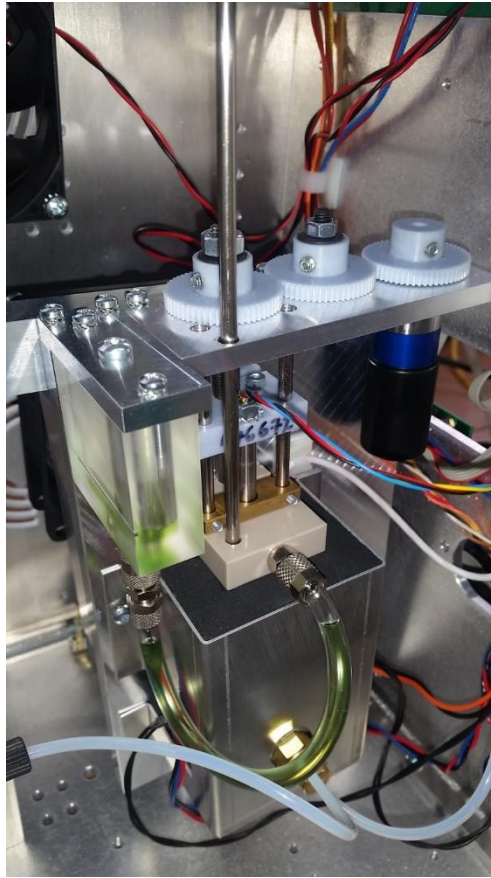
Trained personnel only may operate the instrument without the metal case. Be aware of **potential hazards** like high voltages, hot oven surfaces etc. when operating the instrument without the metal casing and in a service user level.



Put 1-2 drops of oil for good heat contact into the calibration bore (left front bore of the measurement cell).

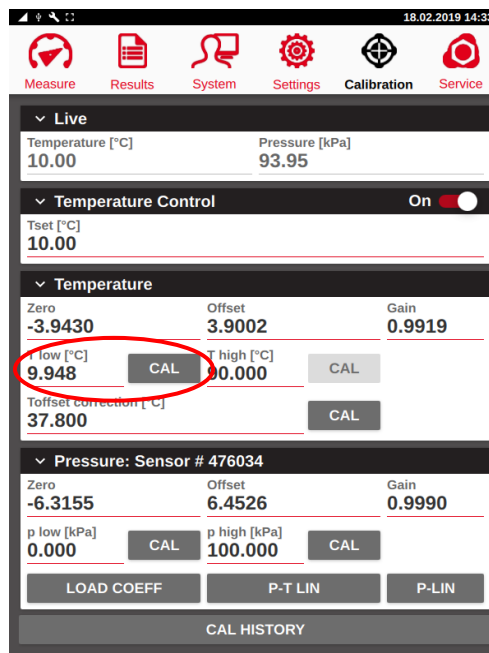


Insert the sensor through the bore of the aluminum plate with the three gear wheels into the calibration bore of the measurement cell.



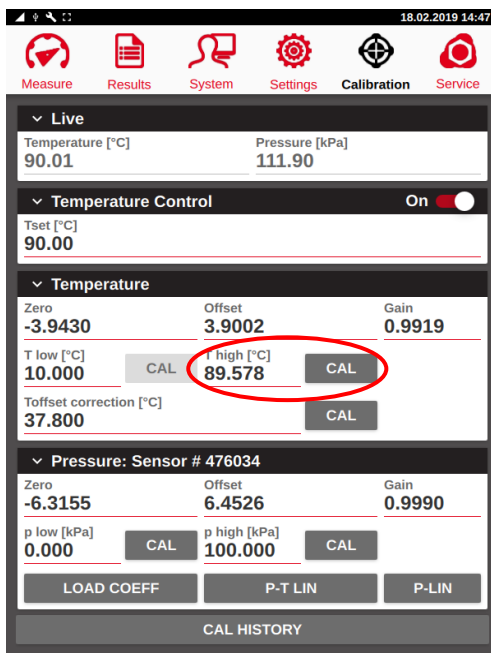
13.1.1 T low

- Set the temperature control “Tset” to 10°C (50°F) and switch it on. Wait until both the internal and external temperature readings are stable. This may take up to 10 min.
- Enter the temperature reading (e.g. 9.948°C) of the external sensor as “T low”.
- Click the “CAL” next to it button to calibrate the lower temperature point.
- Confirm by clicking the “SAVE” button.



13.1.2 T high

- Set the temperature control “*Tset*” to 90°C (194°F). Wait until both the internal and external temperature readings are stable. This may take up to 10 min.
- Enter the temperature reading (e.g. 89.578°C) of the external sensor as “*T high*”.
- Click the “*CAL*” button next to it to calibrate the upper temperature point.
- Confirm by clicking the “*SAVE*” button.

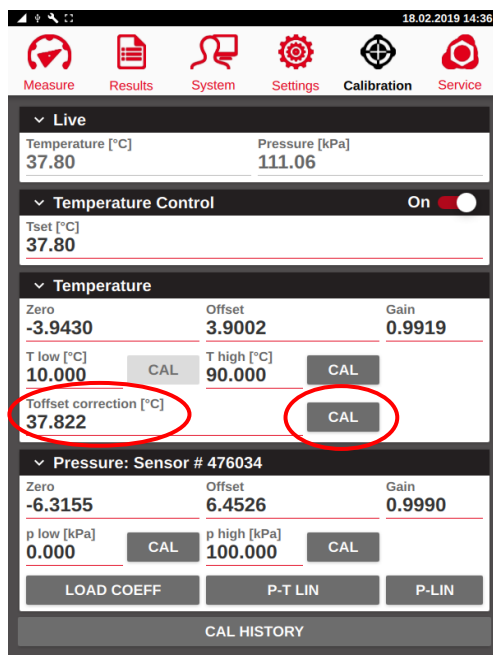


13.1.3 T offset correction

For many test methods the measurement temperature is 37.8°C (100°F). Minor non linearities of the temperature sensor can cause small deviations when the temperature sensor is calibrated at a high and low temperature. To achieve the highest accuracy of the instrument at 37.8°C an offset correction has to be performed at this temperature.

The procedure works analogously to the other two calibration points:

- Set the temperature control “*Tset*” to 37.8°C (100°F). Wait until both the internal and external temperature readings are stable. This may take up to 10 min.
- Enter the temperature reading (e.g. 37.822) of the external sensor as “*T offset correction*”.
- Click the “*CAL*” button next to it to calibrate the offset correction.
- Confirm by clicking the “*SAVE*” button.



13.2 Pressure Calibration

The pressure calibration is done at a temperature of 37.8°C (100°F). Make sure “Tset” is set to 37.8°C, the temperature control is active, and the temperature reading has stabilized.



The measuring cell has to be clean and absolutely dry for the pressure calibration to work accordingly. If the status of the measuring cell is unknown, clean the inlet assembly, renew the inlet filter, rinse the cell with n-pentane and perform a cell cleaning procedure!

13.2.1 Coefficient file

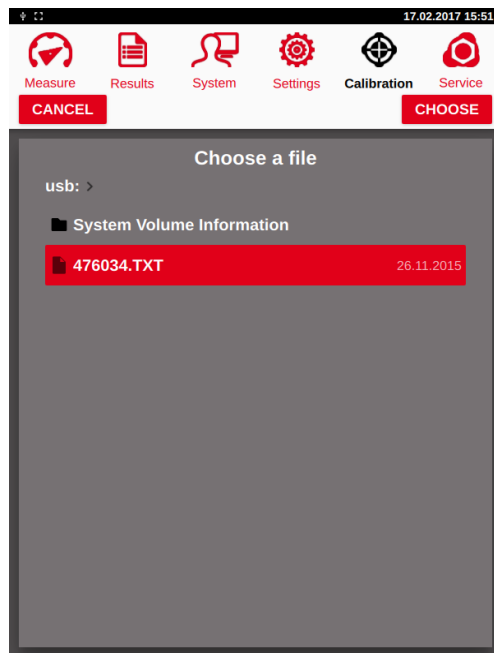
Before the pressure sensor is calibrated make sure the coefficient file for the mathematical pressure linearization is loaded. This can be seen by the serial number of the pressure sensor shown in the “Pressure” section.

Pressure: Sensor # 476034		
Zero	Offset	Gain
-6.2746	6.4371	0.9980
p low	p high	
0.000	100.000	
CAL	CAL	
LOAD COEFF	P-T LIN	P-LIN

If the serial number is 0 (Pressure: Sensor # 0000) or the pressure sensor was exchanged the linearization file must be loaded.

This file can be requested from eralytics GmbH and is automatically supplied with each pressure sensor. Copy this file to a memory stick and connect it to one of the USB slots of ERAVAP, wait about 10 seconds and then press the “LOAD COEFF” button.

Select the directory/file and press “CHOOSE”.



The file is loaded, and the serial number of the sensor should be shown in "Pressure" section. Press "SAVE" to store the file permanently.

Now the pressure sensor calibration which is performed at vacuum and barometric pressure can be performed. Set the temperature to 37.8°C (100°F) and wait until the reading is stable.

13.2.2 P low

Remove any filling tube from the inlet and then connect a vacuum pump to the outlet of the instrument. Make sure the vacuum pump is capable to reduce the pressure to at least 0.01kPa (0.001psi) and there is no leakage in the vacuum line.



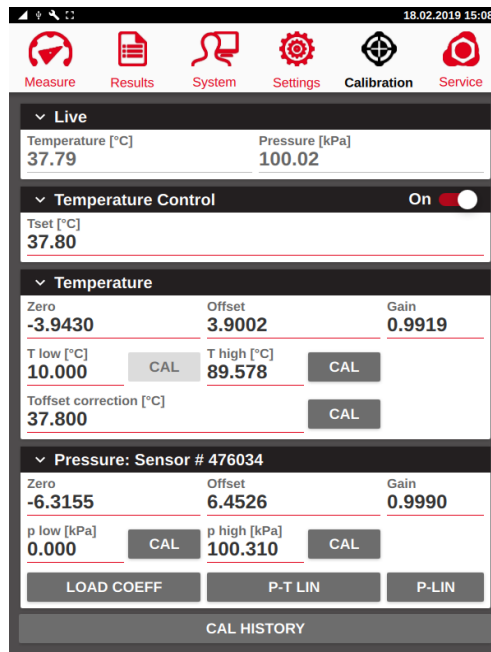
Switch the vacuum pump on and wait at least 60 seconds. Enter 0 (or the reading from a connected pressure gauge) into the field “*p low*” and press the “*CAL*” button next to “*p low*”. The inlet and outlet valves of the measurement cell are automatically opened and closed several times to flush the cell. Finally, the cell is evacuated for about 20 seconds. Then the calibration parameters are automatically adjusted to set the pressure reading to zero or the reference value from the gauge.

13.2.3 P high

Remove the vacuum pump, enter the barometric pressure (use a certified barometer) into the field “*p high*” (e.g. 100.31 kPa) and press the “CAL” button next to “*p high*”. The pressure reading is automatically adjusted to the entered barometric pressure.



Make sure that the barometer shows the actual pressure and not the pressure corrected to sea level!



Press the “SAVE” button to store the calibration.

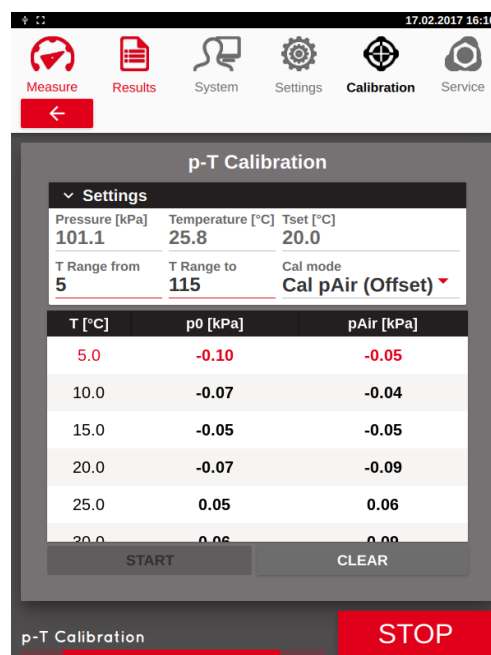
13.2.4 P-T LIN

(= Linearization of the Pressure Sensor over a Temp. Range).

The pressure sensor is not necessarily linear over the whole temperature range. Due to that reason the sensor must be linearized over the whole temperature range. This can be done in the "P-T LIN" submenu.

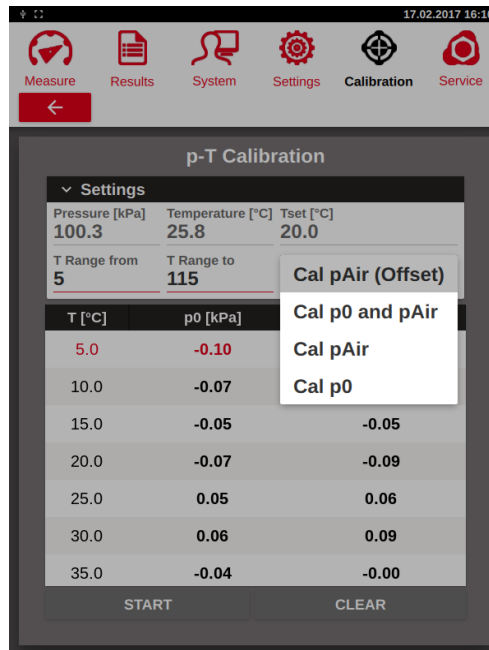
Before the linearization of the pressure sensor is performed make sure the pressure sensor is well calibrated.

After pressing the "P-T LIN" button, the following menu appears:



The linearization of the pressure sensor is performed in 5°C (10°F) steps at vacuum and barometric pressure. Select the desired pressure range ("*T Range from*" to "*T Range to*"). In many cases the non-linearity at a given temperature over the whole pressure range is only an offset. But in some cases, the non-linearity also depends on the pressure. Therefore, the correction can be performed at vacuum and barometric pressure to determine the non-linearity dependent on the pressure.

Select one of the following linearization options in the “Cal mode” section.



“Cal pAir (Offset)”: The non-linearity over the whole temperature range is determined at barometric pressure. The determined offset to the barometric pressure at the pressure calibration temperature is added for p0 and pAir. This kind of linearization is in many cases sufficient since the non-linearity of the pressure transducer at a given temperature is for the whole pressure range just an offset (and not a slope depending on the actual pressure). Furthermore, if a vacuum pump is not available it is the only option for the linearization of the pressure sensor.

“Cal p0 and pAir”: This is the most accurate form of the pressure sensor linearization. For this linearization a vacuum pump has to be connected to the outlet of the instrument. The instrument regulates to the linearization temperature points and applies automatically vacuum and barometric pressure to the pressure sensor. The non-linearity over the whole temperature range is determined at vacuum and barometric pressure. The pressure reading is then corrected according to the determined offset.

The following two options “Cal pAir” and “Cal p0” can be used for correction of either p0 or pAir

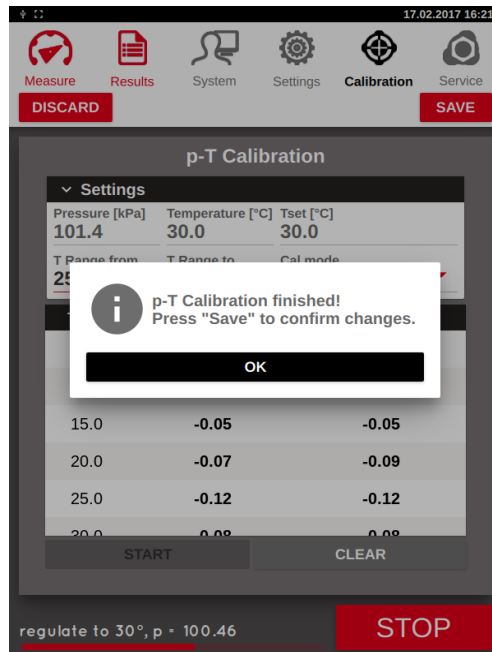
If you run p0 and then pAir it is equivalent to the option Cal p0 and pAir, but with two calibration runs.

“Cal pAir”: The non-linearity over the whole temperature range is determined at barometric pressure and only the pAir value is compensated.

“Cal p0”: The non-linearity over the whole temperature range is determined just at vacuum pressure. The vacuum pump must be connected to the outlet of ERAVAP and running.



After the calibration run is finished do not forget to store the calibration by pressing the “Save” button.



13.2.5 P-LIN

(= Linearization of the Pressure Sensor in the High-Pressure Range)

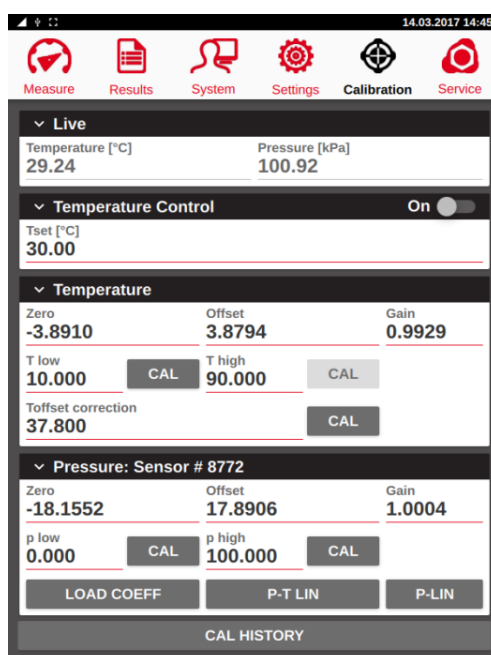
The pressure sensor is not necessarily linear over the whole pressure range at constant temperature. If required, the sensor can be linearized. This can be done in the "P-LIN" submenu.



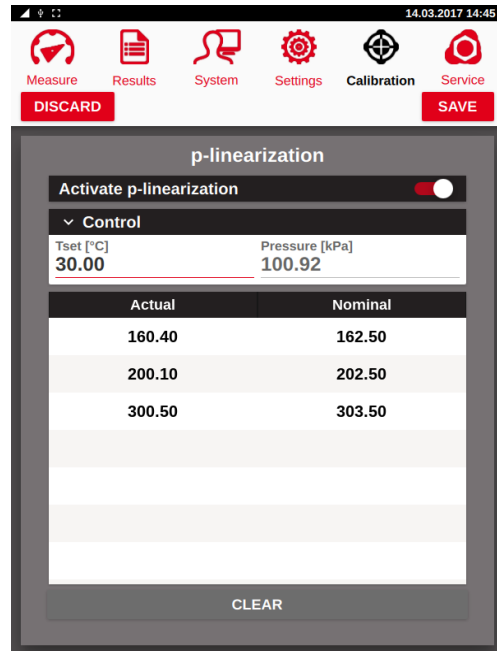
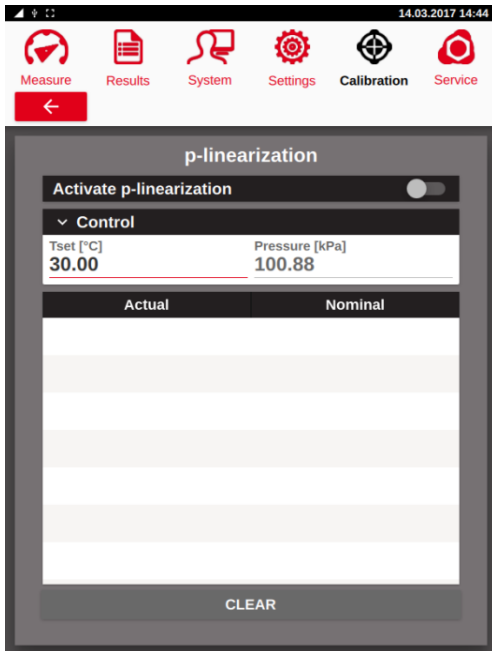
Before the linearization of the pressure sensor is performed make sure the pressure sensor and temperature sensor are well calibrated.

Perform a few test measurements with Pentane, Propane or Butane (>99.94% purity) first using a standard method in the "Measure" menu. Note the results and compare them to literature values. If the results deviate from the literature values, you can correct the pressure sensor's linearity as follows:

Enter the "Calibration" menu and press the "P-LIN" button

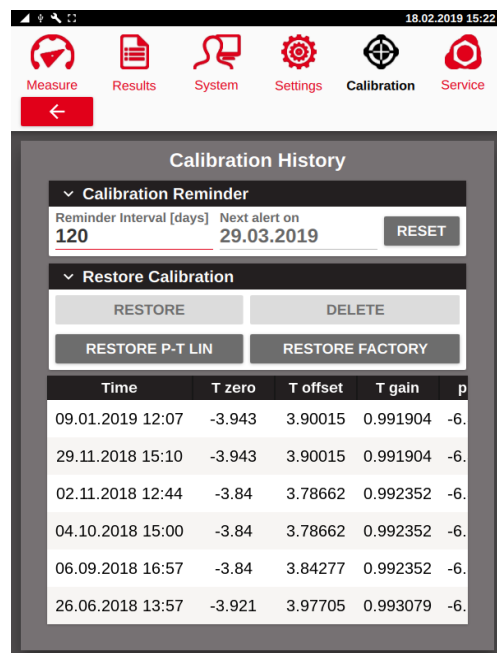
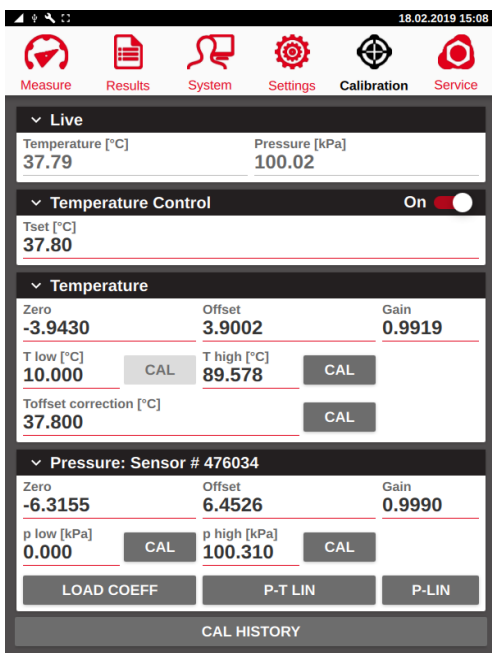


Enter the measured values in the column “Actual” and the literature values in the “Nominal” column. If the pressures is below 150 kPa, or actual and nominal values differ by more than 10%, the line will turn red indicating an error. After you have noted all the values, activate the linearization by activating the switch “Activate p-linearization”. Store the programmed linearization by pressing the “Save” button.



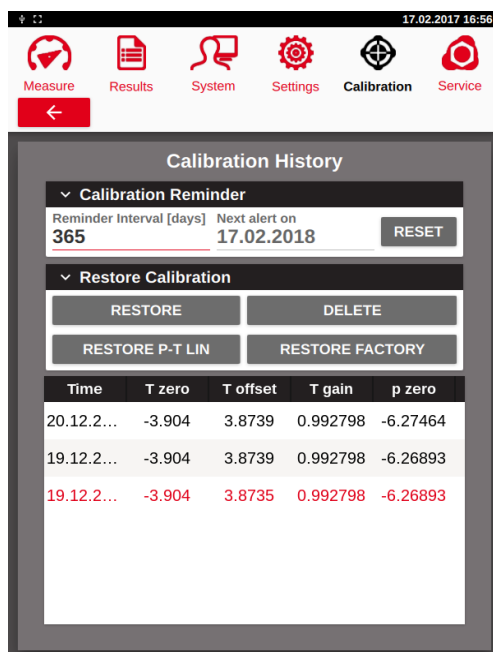
13.3 Calibration History

Go to the “Calibration” menu and press the “CAL HISTORY” button. The calibration reminder can be set in this menu as well as previous calibrations restored.



13.3.1 Calibration Reminder Interval

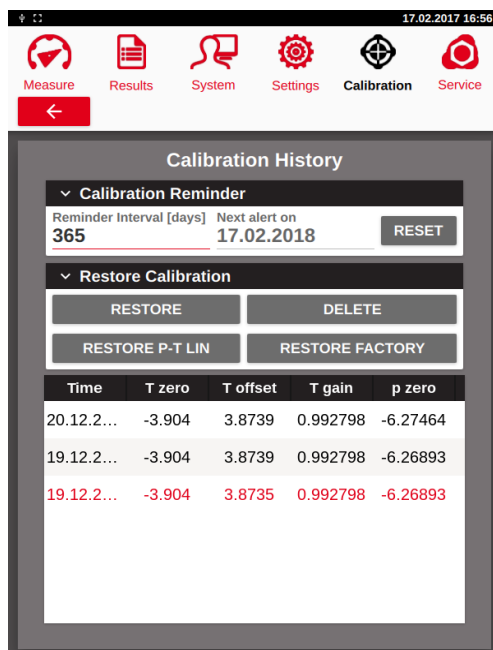
In the “*Calibration reminder*” section the interval is shown as well as the date of the next alert. Depending on your requirements set the reminder interval. Most standard methods recommend a half year or an annual calibration interval.



The new reminder interval is stored when the “*RESET*” button is pressed. When the calibration is due according to the set interval a warning will be displayed.

13.3.2 Restore Calibration

In this menu previous calibration data can be restored as well as reset to the factory calibration.



“RESTORE”:

Select one of the listed temperatures and pressure calibrations (touch one of them for about second until it is red highlighted) and press the **“RESTORE”** button. The selected values are restored. Press **“SAVE”** to store or **“DISCARD”** to dismiss.

“DELETE”:

Select one of the listed calibrations (touch one of them for about second until it is red highlighted) and press the **“DELETE”** button. The selected values are deleted.

“RESTORE P-T LIN”:

The factory p-T Lin calibration values can be restored. Press **“SAVE”** to store or **“DISCARD”** to dismiss.

“RESTORE FACTORY”:

The factory calibration values for pressure and temperature can be restored. Press **„SAVE“** to store or **“DISCARD”** to dismiss.

14 Service Menu

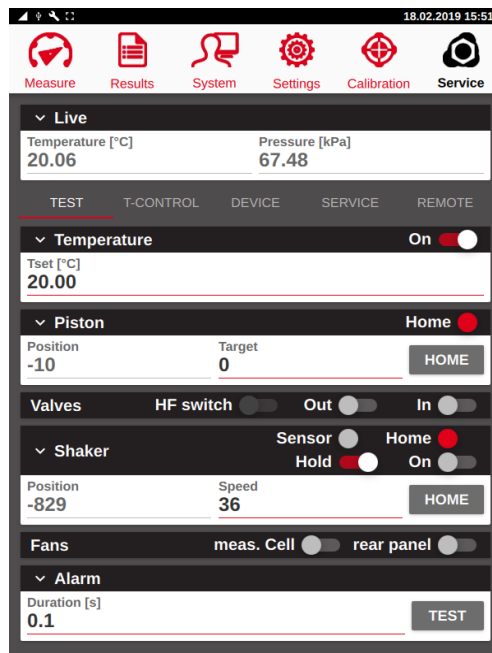
In the “Service” menu advanced settings and feature test are available.



The “Service” menu is intended for service only and requires user level 6. NEVER change any parameters or settings in this menu without consulting your local representative or eralytics as it may destroy the instrument or its components!

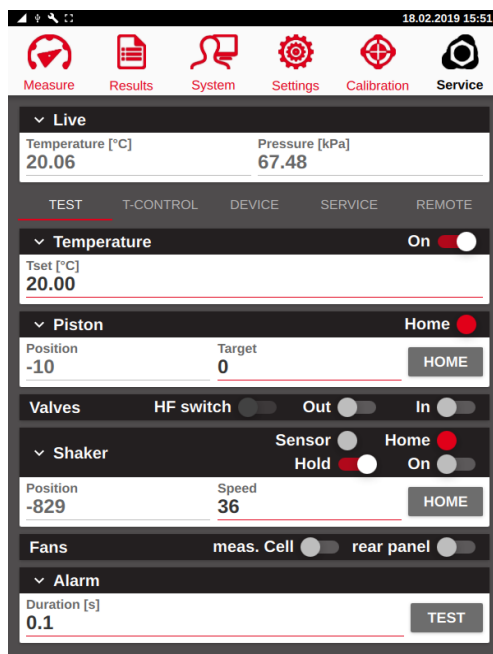
14.1 Live sensor values

Independent which submenu is selected the live readings of the temperature and pressure sensor are always shown.



14.2 Test

In the menu "Service > Test" the function of all components can be tested. For more details beside the short description below please consult the ERAVAP service manual.



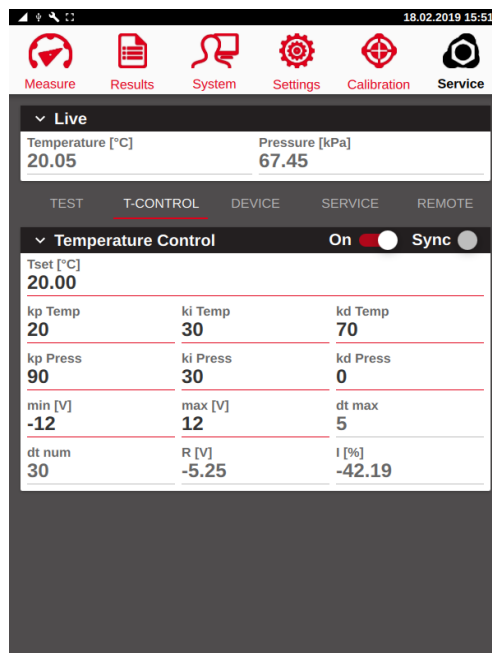
- "Temperature": The temperature control is switched On/Off.
- "Piston": The piston can be manually moved to a specified position.
- "Valves": Click to manually open or close the valves. If the "HF switch" is activated the selected valve will frequently open and close.
- "Shaker": The shaker motor can be enabled or the measuring cell can be horizontally repositioned.
- "Fans": Click to switch on the fans.
- "Alarm": The audible alarm can be tested.

14.3 T-Control

This submenu shows the temperature regulation parameters.



These parameters should not be changed! Otherwise the temperature (or pressure) regulation may not work accordingly, leading to false results. In extreme cases changing the voltage parameters may lead to destruction of the peltier element!



“Tset”:
Enter the target temperature.

“On”:
Switches on the temperature control.

“Synch”:
The status “Synch” reached when all “dT num” readings are within “Tset” ± “dT max”.

“kp / ki / kd Temp”:
Temperature regulation parameters (default: 20 / 30 / 70)

“kp / ki / kd Press”:
Pressure regulation parameters (default: 90 / 30 / 0)

“min [V]”:
Peltier element lower power limit

“Max [V]”:
Peltier element upper power limit

“dt max”:
temperature window in 1/10°C for synch status

“dt num”:
number of readings for synch status

“R [V]”:
Live regulator power

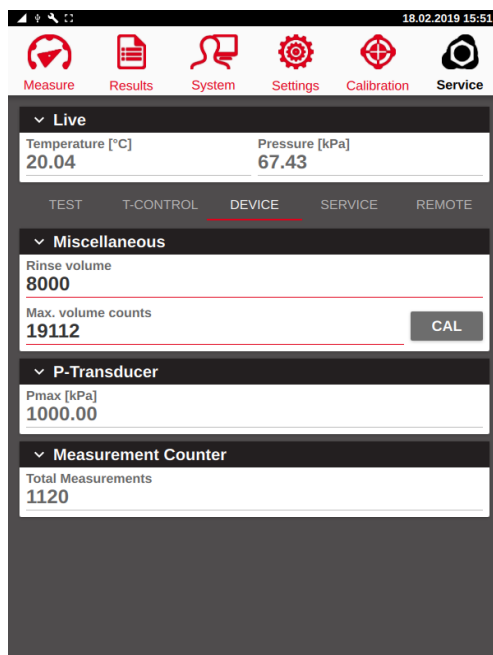
“I [%]”:
Live regulator integral part

14.4 Device

This menu shows some advanced hardware settings.



Do not change these parameters without consulting your local support partner or eralytics, otherwise it may lead to destruction of the pressure sensor or piston motor!



“Rinse volume”:

The rinse volume can be changed, but a value of 8000 (about 2.5 mL) is usually sufficient.

“Max. volume counts”:

The maximum volume counts need to be set individually for each instrument. See the service manual for further instructions.

“Pmax”:

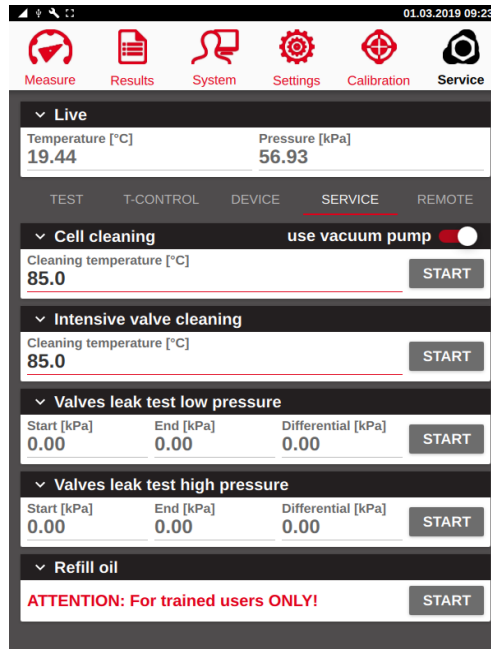
The maximum pressure range is shown for the corresponding pressure sensor for EV10 (1000 kPa) and EV20 (2000 kPa).

“Total measurements”:

Shows the number of performed measurements.

14.5 Service

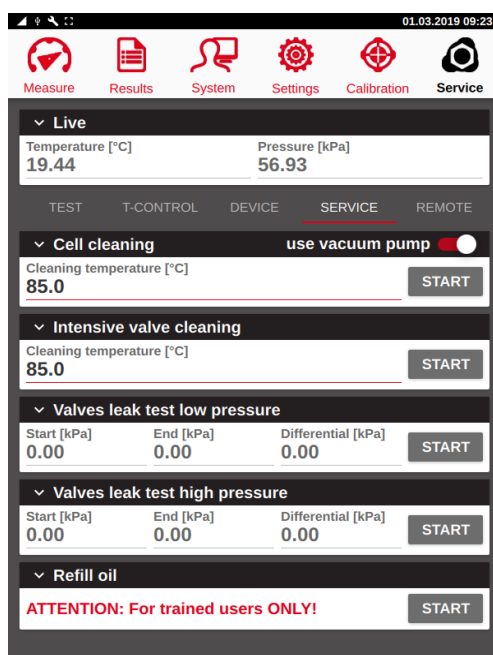
The sub-menu “Service > Service” features several hardware testing procedures.



14.5.1 Cell Cleaning Procedure

If the measurement needs to be free of any (volatile) residues for a pending calibration or for measuring samples featuring a low vapor pressure this fully automatic cleaning procedure can be performed. The measuring cell is heated up to the specified temperature (default: 85°C) and by connecting a vacuum pump the volatiles are removed from the cell.

This cleaning procedure can be enabled in the *“Measure”* menu. Go to *“Settings > Screen”* and activate *“Show cell cleaning”*.



For effectively cleaning and drying the cell rinse the device 5x with n-pentane before starting the procedure. If crude oil or other non-volatile material is present rinse the measurement cell with toluene or other suitable solvent first, followed by n-pentane. In case the measurement cell is contaminated with water remove it by rinsing the cell at least 5x with isopropanol first.

“use vacuum pump”:

As an alternative, this feature can be used without a vacuum pump, however, the cleaning and drying of the measuring cell will be by far more efficient if a vacuum pump is used. Make sure the switch is activated, connect the vacuum pump to the outlet of the instrument and switch it on before starting the procedure.

After rinsing the cell click the *“START”* button to perform the automatic cleaning procedure.

14.5.2 Intensive valve cleaning procedure

The intensive valve cleaning method was developed to help cleaning the cell from crude oil residues to extend the life of the valves. When the crude remains static for long periods inside the valves it can cause leak problems or even permanent damages to the valves. In many situations the common cleaning procedure using a vacuum pump is not enough to remove completely the crude oil residues, the use of specific solvents as toluene are necessary to dissolve the waxes deposited in the cell.

If a leak is detected by one of the two leak tests described in chapter 14.5.3 which is caused by crude oil residue on the valves' membranes this procedure may be able to retrieve a leaking valve.

The procedure consists on rinsing forward and backward at high temperature and flapping the valves with toluene. The intensive rinsing procedure requires at least 250 ml toluene.

An additional longer outlet tube is needed for this purpose:

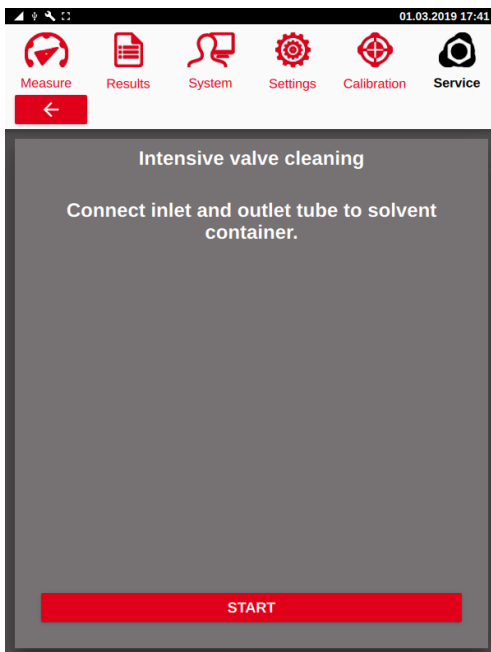


Before starting the automatic procedure remove the inlet filter and thoroughly clean the inlet assembly.

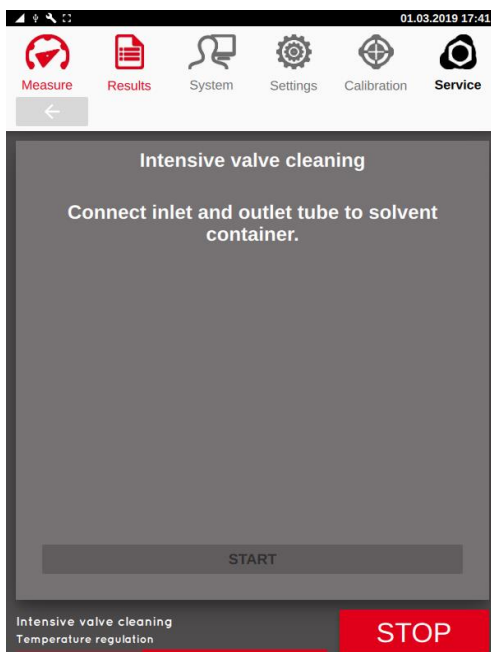
Both the inlet and the outlet tubes have to be introduced in the toluene bottle using the outlet extension tube for this purpose.



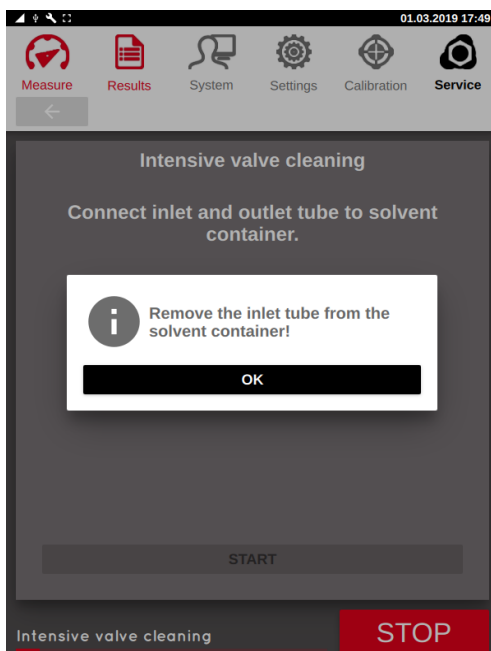
Go to the menu “Service > Service”, set the cleaning temperature to 85°C and start the automatic procedure by pressing the “START” button.



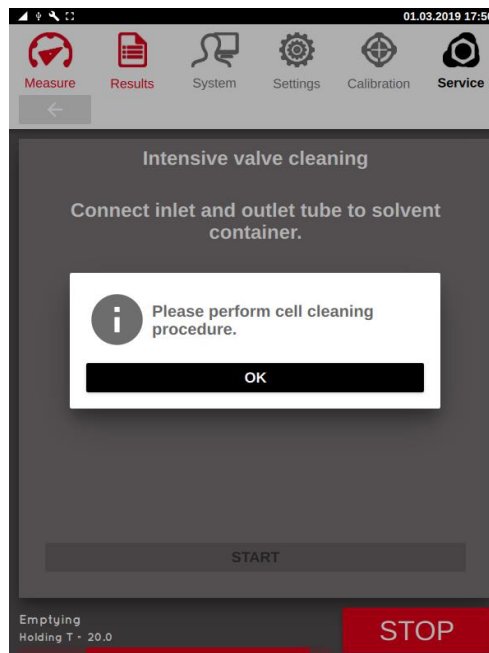
Once the specified temperature is reached the valves are flushed and reverse flushed several times, including flapping of the valves.



As soon as this procedure is finished a pop-up message is shown and the inlet tube has to be removed from the toluene container. Confirm by clicking the "OK" button.



After finishing the rinsing process another pop-up message is shown, recommending the cell cleaning procedure described in chapter 14.5.1.



Install a new inlet filter once the cleaning procedure is finished, otherwise particles may enter the measuring cell and the valves and lead to destruction of the equipment!

14.5.3 Leak Test

ERAVAP has a very high-quality valve system installed. Furthermore, the valves are protected by an inlet filter to remove particles. A leakage is very unlikely as long as no sticky or very high viscous (>300mPas) samples are measured. Make sure to rinse the instrument after measuring crude oil, otherwise it could lead to deposit on the valves' membranes.

A leak can be usually detected by measuring a reference sample on a regular basis and compare the results. Therefore, it is not necessary to perform this procedure more often than every one or two years by a factory trained technician during as part of the testing procedure during maintenance.

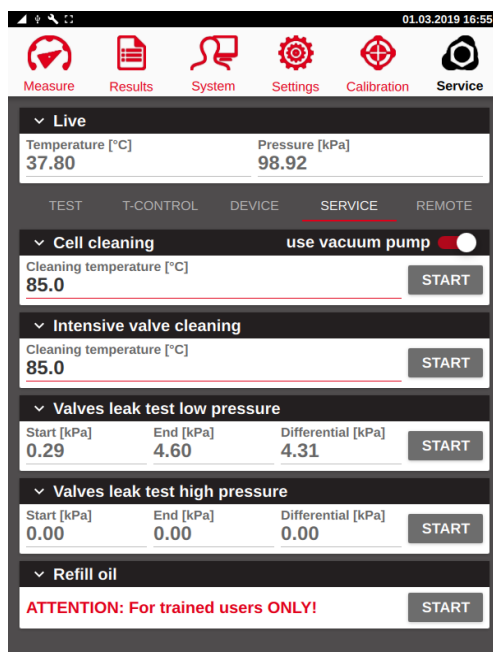


Before a leakage test can be performed the measurement, cell must be thoroughly clean and dry. Residues must be evaporated and removed using the procedure explained in chapter 14.5.1. Otherwise the leakage test will be significantly influenced by the residue's vapor pressure.

14.5.3.1 Valves leak test low pressure

Connect a vacuum pump to the outlet of ERAVAP, switch it on and start the low-pressure leak test by pressing the "START" button. Disconnect the vacuum pump again once the corresponding message is shown. The pressure reading at the beginning and at the end of the leak test as well as the differential pressure will be displayed after about 5 minutes.

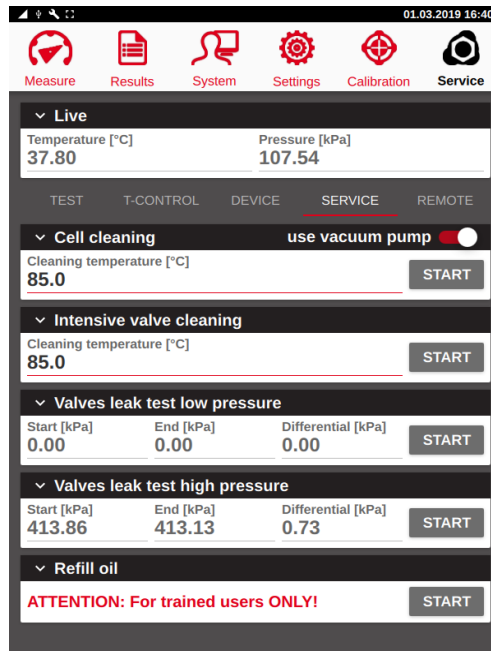
A leakage is indicated by a differential pressure of **> 1.5kPa** for the low-pressure leak test.



14.5.3.2 Valves leak test high pressure

Make sure the outlet is free and not connected to the vacuum pump or the waste container. Switch on the high-pressure leak test by pressing the “START” button. The pressure reading at the beginning and at the end of the leak test as well as the differential pressure will be displayed after about 5 minutes.

A leakage is indicated by a differential pressure of **> 5.0kPa** for the high-pressure leak test.

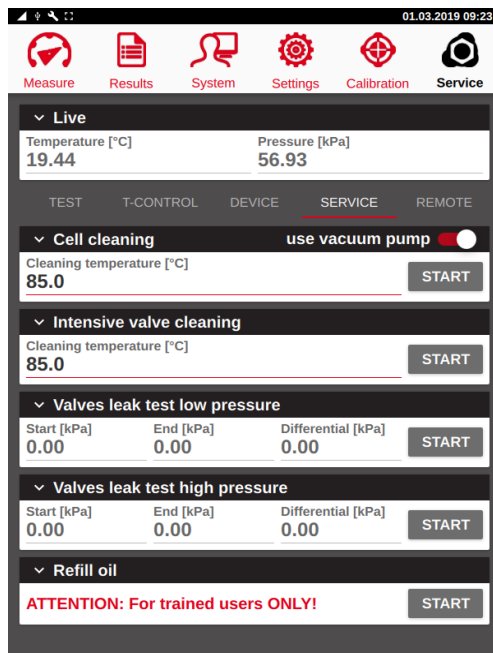


14.5.4 Refill Oil

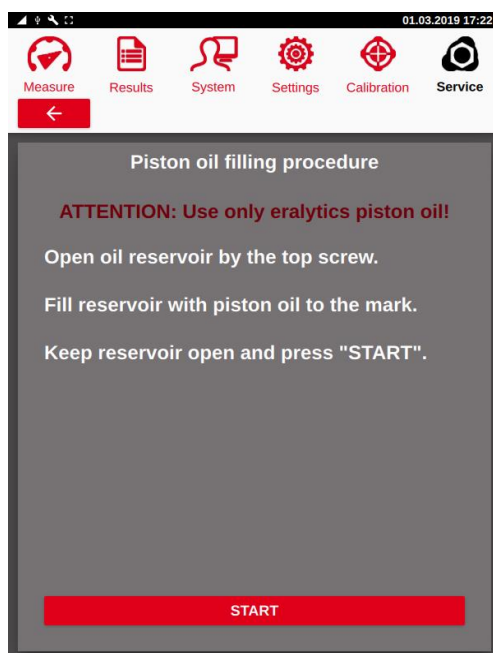


If the oil level drops below the marking on the oil reservoir it has to be refilled, otherwise lacking lubrication can lead to a damaged piston O-ring. Use eralytics piston oil only. Any other piston oil may damage the system. Please contact your local support or eralytics if you require assistance for this procedure.

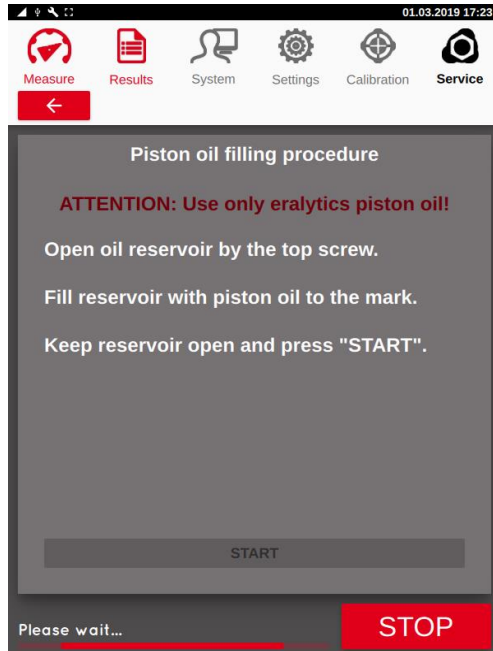
Go to the menu **“Service > Service”** and perform the refilling procedure by clicking the corresponding grey **“START”** button.



Once pressed, a new window will appear:

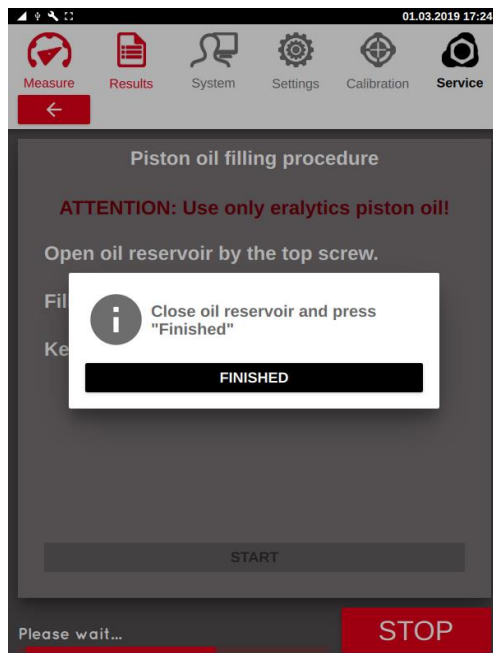


Open the oil reservoir and fill it up to the mark (~4.5mL when the reservoir is empty). Continue by pressing the red “START” button. The piston is then moved up and down several times to remove any air bubbles in the tube.



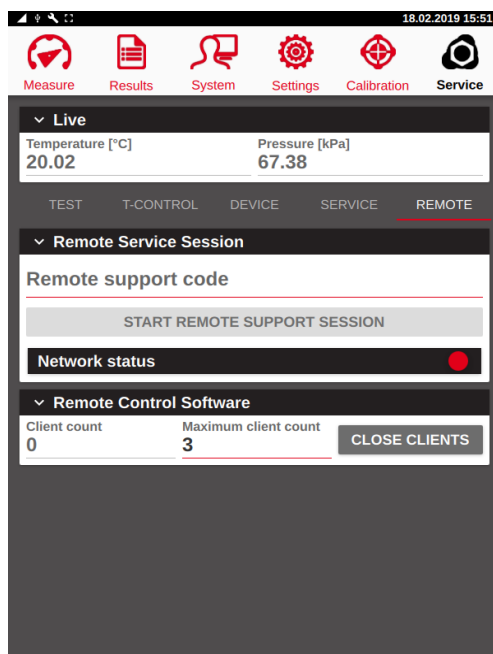
Do not close the oil reservoir during this process.

Upon finishing, a pop-up message is shown, and the oil reservoir can be closed again.



14.6 Remote Service

The instrument can connect to an eralytics server and be controlled remotely. For this, the instrument must be connected to the internet. To initiate a remote service session a code provided by eralytics must be entered in the remote session field.



“Remote support code”:

Enter the support code provided by eralytics.

“START REMOTE SUPPORT SESSION”: If a valid code is entered the session can be started by clicking this button.

“Network status”:

If a connection is available the *“Network status”* is active and becomes red.

“Remote Control Software”:

This section controls the connections over the RCS software. For connecting over the COM port only one computer can be connected to the instrument. For network connections the maximum client count defines the number of computers that can be connected to the instrument. Press the *“CLOSE CLIENTS”* button to disconnect all computers.

15 Preventive Maintenance



Please refer to your local distributor for (preventive) maintenance of the equipment. Most standard methods require a calibration interval of 6 months, it is recommended to thoroughly check the instrument on this occasion.

15.1 Changing the Inlet Filter

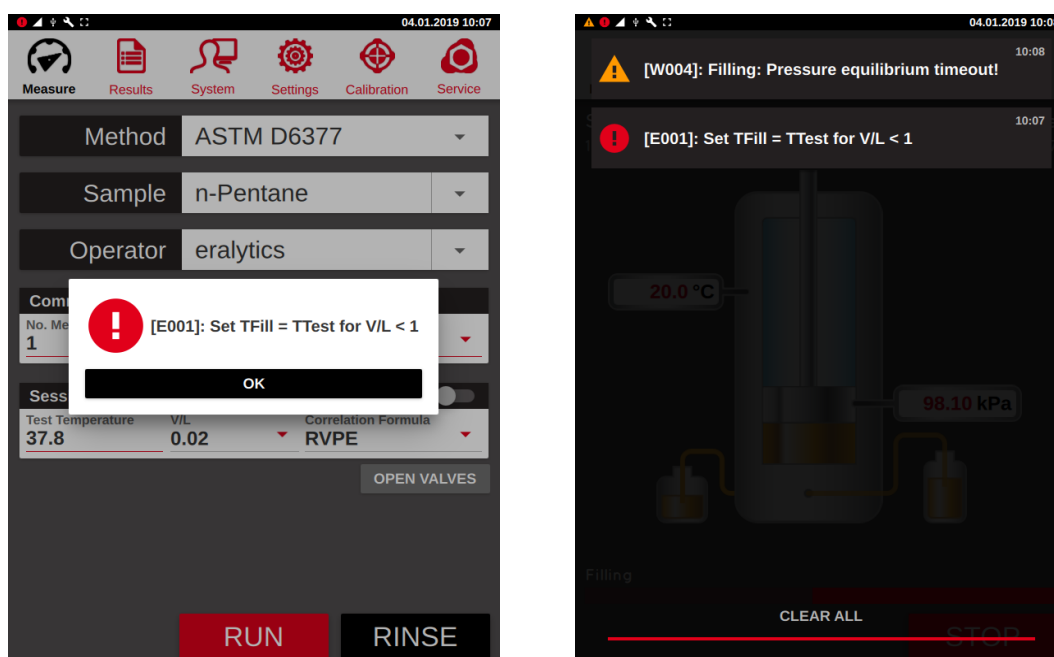
If a warning for filter change appears the inlet filter must be exchanged. Remove the inlet tube and unscrew the metal filter holder anti clockwise. The filter can be exchanged now. Reset the measurement counter for filter exchange in case it is active (see section “Filter Change Settings”).



16 Warnings & Errors

ERAVAP uses an error system to track and log errors and warning. When an error takes place a popup message will appear. This popup contains the error number, a short description of the error and as well parameters associated with that particular error.

When an error or warning has occurred, it is stored in a log file and an indicator is shown in the notification bar.



The log file is accessed by touching the notification bar in the top of the touch screen and pulling it down. You can clear the log file by pressing an error and moving it to the right. When communicating with eralytics or with local representatives please state the error number as well as any parameters that are shown together with that error.

16.1 Error messages

16.1.1 [E001]: Set TFill = TTest for V/L < 1

The filling temperature needs to match the measuring temperature if a V/L < 1 is applied.

16.1.2 [E002]: At least one measurement point needed.

This error message pops up if no measurement point for a curve measurement is defined.

16.1.3 [E003]: No QC profile available

Go to "Settings / QC profiles" to make sure a QC profile is available for the specified method.

16.1.4 [E004]: Pressure limit exceeded

The pressure limit is 1000kPa for EV10 and 2000kPa for EV20. This error indicates that the pressure reading exceeds this upper limit, which may be caused by a high vapor pressure of the measured sample or by a defective pressure sensor or valve. Please contact eralytics or your local representative if this error occurs.

16.1.5 [E005]: Pgas calculation error. Repeat measurement

If the calculated value for Pgas is inconclusive (negative) this error will be shown. To avoid it, readjust the temperature equilibrium time or the pressure equilibrium criteria.

16.1.6 [E801]: Unknown error!

Please contact eralytics or your local representative if this error occurs.

16.1.7 [E802]: Please activate at least one port!

This message is shown if no port of the auto sampler has been activated.

16.1.8 [E803]: Method is still active on the Measure Screen. Deselect first!

When hiding the methods in the menu "Settings > Screen" the selected method must not be active on the "Measure" screen.

16.2 Warning messages

16.2.1 [W001]: Check inlet filter

Triggered by the filter cleaning counter. Check the filter by removing the inlet nut. Replace the filter if large amounts of residue are present.



Do not clean or re-use the filter! Otherwise it is possible for particles to enter the valves and the measuring cell, causing damage to the equipment.

16.2.2 [W002]: Check piston motor

If the target position of the piston cannot be reached this warning will be shown. In many cases this warning is triggered during the expelling procedure if the sample is too viscous. Adjust the expelling temperature to avoid this warning.

Please contact eralytics or your local representative if this warning occurs frequently.

16.2.3 [W003]: xx out of range! (xx)

When using the QC mode and defining limits this warning message is shown if a certain limit is exceeded.

16.2.4 [W004]: Filling: Pressure equilibrium timeout!

If the pressure equilibrium for the filling procedure is not reached within the specified timeout (default: 240s) this warning will pop up and the measurement is continued. In most cases the sample's viscosity may be too high, or the parameters do not match the requires. Either use a pressurized filling system or adjust the parameters, see chapter 12.2 for further information.

16.2.5 [W005]: Filling temperature equilibrium timeout!

For measurements with a $V/L < 1$ the temperature equilibrium of the sample is check during filling. If not reached within the specified timeout (default: 240s) this warning will pop up and the measurement is continued. Adjust the parameters described in chapter 12.2.6.

16.2.6 [W006]: Inconclusive result! Repeat measurement with fresh sample

For measurements with a calculated result (e.g.: TVP) this warning is shown if the result is inconclusive. In most cases the filling temperature ha to be adjusted or a pressurized filling system (FPC) has to be used.

16.2.7 [W007]: Instrument calibration due!

This message pops up if the calibration reminding time has elapsed.

16.2.8 [W008]: Measuring: Pressure equilibrium timeout!

If the pressure equilibrium criterion during the measurement is not reached within the specified timeout (default: 240s) this message is shown. Either decrease the sensitivity described in chapter 12.2.4 or increase the parameter temperature equilibrium time, see chapter 12.2.1.2.

16.2.9 [W009]: No sample temperature sensor found.

If the module “Sample Temperature Sensor” is activated but no temperature sensor is connected this message will be shown and stored in the result file.

16.2.10 [W010]: Sample temperature out of range!

If the module “Sample Temperature Sensor” is activated and the measured sample temperature not within the specified temperature range this warning is shown during the measurement.

16.2.11 [W011]: Rinsing with Toluene recommended.

To avoid clotting of the valves after measuring crude oil this message is shown one hour after measuring according to D6377 or when shutting down the instrument without rinsing.

16.2.12 [W801]: Cannot load printer file

The printer files cannot be loaded. Contact eralytics to receive printer files and upload them via a USB stick.

16.2.13 [W802]: Network printing error

Ensure that the instrument is connected to the LAN.

16.2.14 [W803]: Cannot open port.

If the instrument is set to COM printer (or LIMS) but no printer is connected, this warning is triggered. Verify that the printer is connected and switched on.

16.3 Information messages

16.3.1 [I801]: Export finished.

Shown after exporting data to an USB-drive.

16.3.2 [I802]: Results archived.

Shown when creating a new file archive.

16.3.3 [I803]: Demo version activated: x day(s) left.

A demo code received from eralytics enables certain features for a period of 30 days. Every time the instrument is started the remaining interval will be shown.

16.3.4 [I804]: Demo expired.

This message is shown as soon as the demo code is expired.

17 Supplies Re-ordering Information

Please refer to www.eralytics.com or contact your local dealer.

18 Summary of Changes

<u>Version</u>	<u>Date</u>	<u>Changes</u>
8000	20.02.2017	First Version
8002	20.04.2017	Screen menu; cell cleaning procedure added
8003	02.05.2017	Remote control software indication added
8016	26.11.2018	New layout
8018	04.03.2019	Major revisions