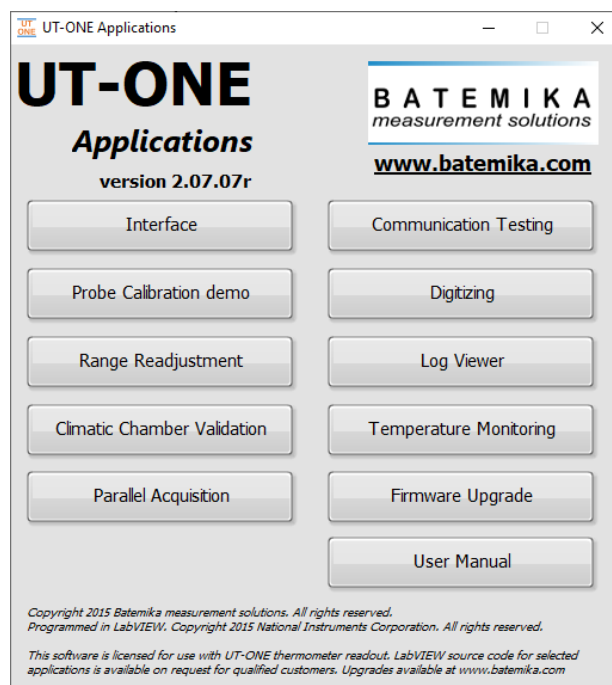


UT-ONE Applications

Acquisition and configuration software



User manual

Version 2.07.07r

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1 UT-ONE Applications Software

UT-ONE Applications is a software package for control and configuration of the UT-ONE thermometer readout via the remote communication interface. The aim of the UT-ONE Applications software is to provide a convenient general-purpose interface to the UT-ONE functionality from computer screen. UT-ONE Applications also demonstrate the capabilities of the UT-ONE thermometer readout and may be used as the starting point for developing user applications, covering a specific measurement solution.

UT-ONE Applications software is applicable to all models of the UT-ONE family of thermometer readouts, so certain features may not be available for your particular UT-ONE model.

UT-ONE Applications is based on LabVIEW platform and is distributed as an executable installer, so LabVIEW development environment or any other additional licenses are not required.

UT-ONE Applications software package is available for free-of-charge download at www.batemika.com. UT-ONE Applications is licensed for use only with the UT-ONE thermometer readouts. LabVIEW source code for selected applications and drivers is available on request for qualified customers. Development of derivative applications by the end-user is allowed only for use with UT-ONE thermometer readout. Commercial distribution of derivative applications to third parties is not allowed without a written permission from the Batemika.

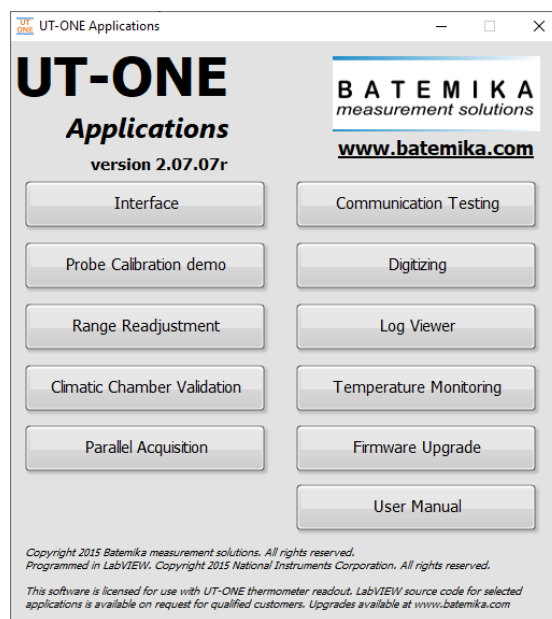


Figure 1: UT-ONE Applications launch panel

UT-ONE Applications starts with the launch panel, which enables the launching of individual applications. Applications may safely run in parallel, however some of the UT-ONE operations may interfere with each other, so some caution is required. After you launch the applications, you may safely close the launch panel and continue to use the launched applications. Launch panel can be reopened from the applications using the *UT-ONE Applications* button.

Interface, *Probe Calibration Demo*, *Climatic Chamber Validation* and *Temperature Monitoring* applications allow you to start and execute more than one instance of the application at the same time. To start another instance of the application, use the associated button in the UT-ONE Applications launch panel.

This user manual can be accessed in pdf format by clicking the *User Manual* button.

After you launch one of the UT-ONE applications using the launch panel, the application will first try to automatically establish the communication with UT-ONE using the last successfully used communication interface. If communication interface has not been selected before, or the communication with UT-ONE can't be established, the application will automatically switch to *UT-ONE* page and paint the *UT-ONE Communication interface* control to red. Use the right-click button to activate the popup menu with the list of available communication interfaces, which include USB interfaces, serial interfaces and GPIB interfaces.

After you select a communication interface from the list, the application will attempt to establish communication with UT-ONE over the selected interface. If communication is successfully established, the *UT-ONE Communication interface* control is painted grey and UT-ONE information is retrieved and displayed.

If communication is not established over the selected interface, *UT-ONE Communication interface* control will remain red and UT-ONE information will not be displayed. Check that communication cables are properly attached and that UT-ONE is switched. Also, check if any other application (outside *UT-ONE Applications*) is currently communicating with UT-ONE and has consequently locked the communication interface.

To change the interface or UT-ONE device after the communication was already established using the default interface, click the *Change Interface* button. The application will restart with blank *Communication Interface* box and you will be able to reselect it. Note that any data acquired so far using this application will be lost.

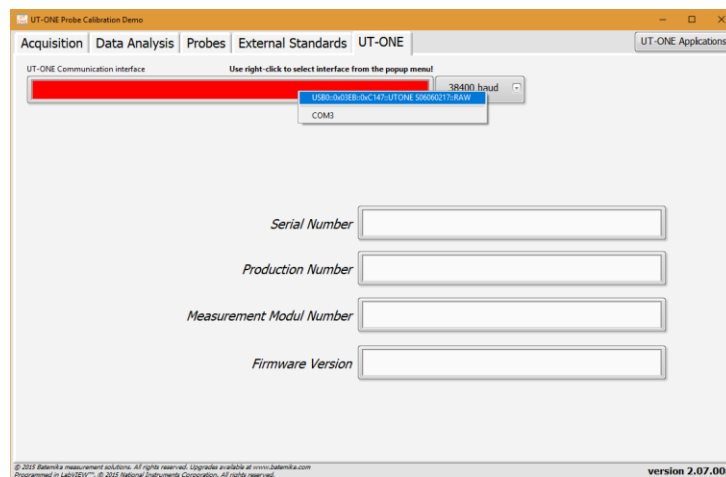


Figure 2: UT-ONE page before communication with UT-ONE is established

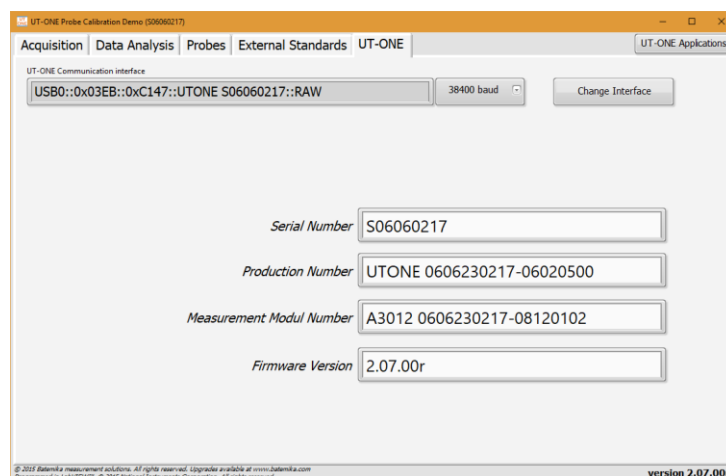


Figure 3: UT-ONE page after communication with UT-ONE is established

1.1 UT-ONE Interface

UT-ONE Interface is the application that implements the UT-ONE user interface on computer screen. The pages and views are organized in a similar way as in the UT-ONE B03x display, so the use is intuitive. UT-ONE Interface application is also applicable to models without display, but in this case functions that are related to UT-ONE display, internal logging and battery are not applicable.

Measurement can be controlled from the UT-ONE B03x display and from the UT-ONE Interface application at the same time, and both will adapt to the changes in the other interface.

You can choose between the Measurement and Configuration page using the tab selectors on the right-hand side of the window. You can choose between different views using the tab selectors on the top of the window. Measurements in continuous mode can be started and stopped using the green/red button in the bottom of the window. Clearing the readings will clear the readings from the graph, but not from the UT-ONE B03x display. You can download the readings that were logged in the UT-ONE B03x display memory using the *Download Measurements* button. Measurements in the graph can be exported to the text file, which is formatted for direct import in MS Excel.

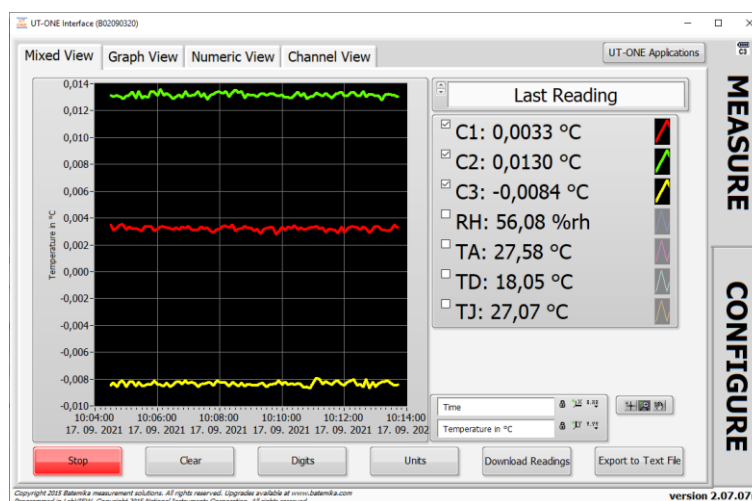


Figure 4: UT-ONE Interface mixed measurement view

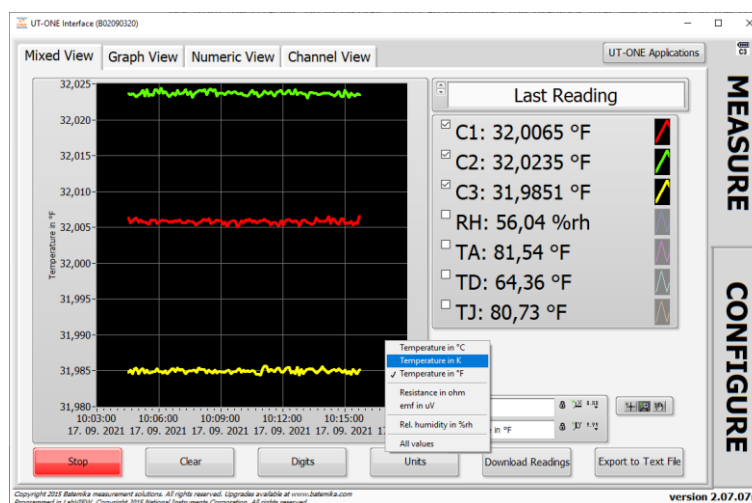


Figure 5: UT-ONE Interface selection of temperature unit

Temperature values on the graph can be displayed in °C, K or °F. Use the right-click to display the popup-menu and select the menu command for required unit. You can also choose to display raw values of main channels (resistance or emf) in units of Ω or μV , or the relative humidity. You can also display *All values* on the graph, regardless of the unit (for example you can display temperature, relative humidity, resistance and emf values). In this case, the scale is just a numeric value without a particular unit designation.

Temperature units on the numeric indicators can also be changed between °C, K and °F using the *Units* button.

UT-ONE Interface application by default displays the last measured values. Note that values are updated only if the continuous measurement is started. You can also choose to display the measurement statistics, which include minimum measured value, maximum measured value and the difference between the maximum and minimum measured value. Statistics is calculated from all values displayed on the graph. Statistics can be reinitialized by clicking the *Clear* button, which will also clear all data on the graph.

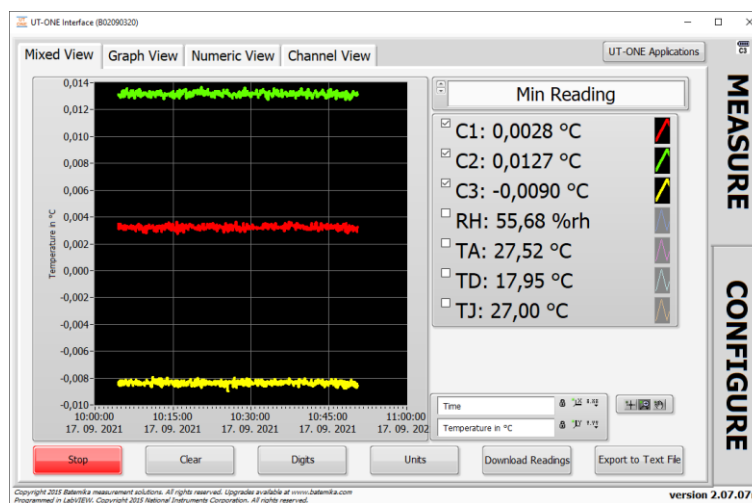


Figure 6: UT-ONE Interface statistics display

Measurement values from the main channels can be presented as the temperature difference between the channel value and the reference channel value. Reference channel can be selected using the command in the popup menu. Reference channel is marked with label Cxx and displays actual temperature value, difference channels are marked with label Dxx and display temperature difference in selected temperature unit. This is not applicable to ambient probe and TJ channels.

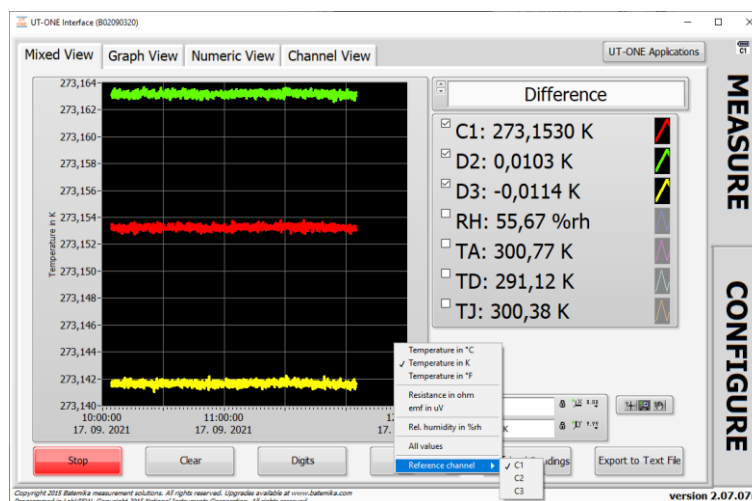


Figure 7: UT-ONE Interface channel difference display

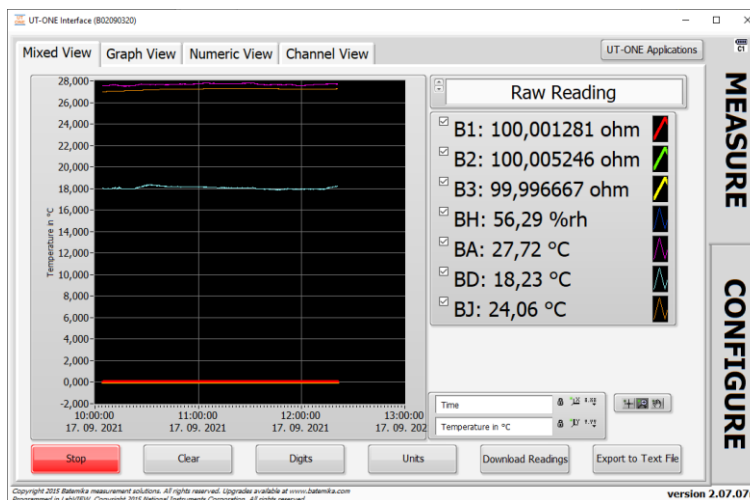


Figure 8: UT-ONE Interface Raw Reading display

UT-ONE Interface can display raw readings for the last acquired measurement. Note that this does not apply to readings on the graph, just to the displayed numeric values in *Mixed View*. For main channels the raw reading is the acquired probe resistance or emf in ohm or μV . For ambient probe, raw reading is displayed in %rh or $^{\circ}\text{C}$, but before the probe corrections are applied. Raw readings can be used for diagnostics and validation, and also during the probe recalibration procedure.

UT-ONE Interface application can display readings on a large graph in the *Graph View* display. All graph settings can be configured in the *Mixed View* display and are automatically applied after you change the view.

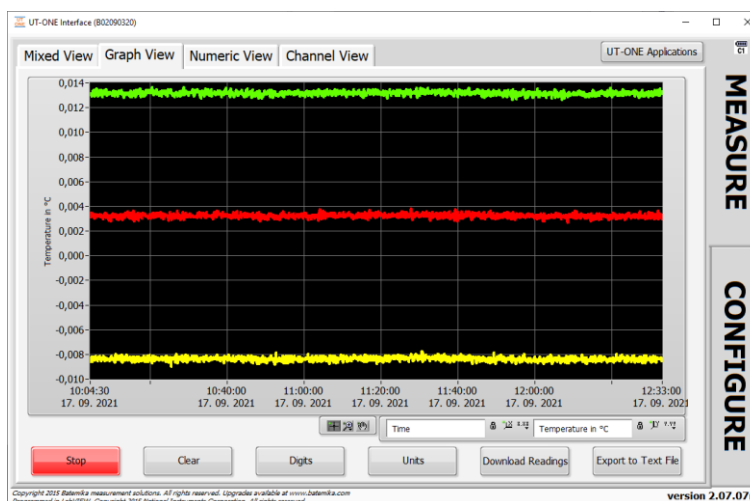


Figure 9: UT-ONE Interface Graph View

UT-ONE Interface application can display readings just as numeric values with a large font for easy reading. Values of up to four channels can be observed at the same time and you can use the vertical slider to view more channels if available. You can choose between observing the values of main channels and ambient probe readings using the page selector.

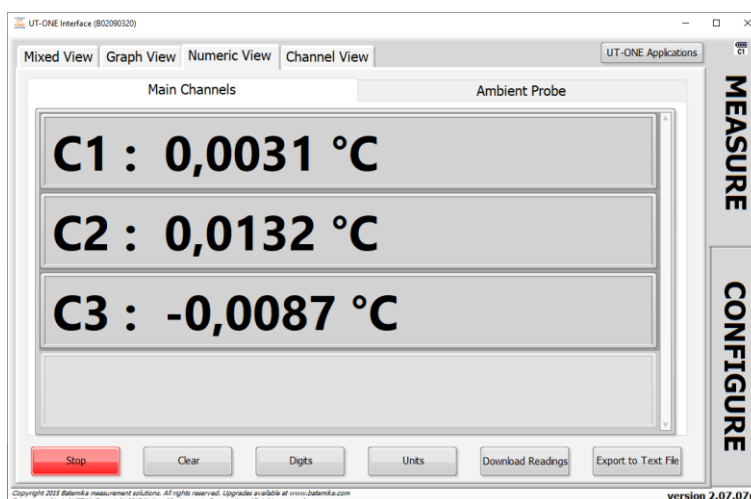


Figure 10: UT-ONE Interface Numeric View

UT-ONE Interface application can also display measurement results for each channel separately and with all associated information, including the last measured value, raw value, statistics, probe information and measurement range. You can use page selectors to choose between available channels.

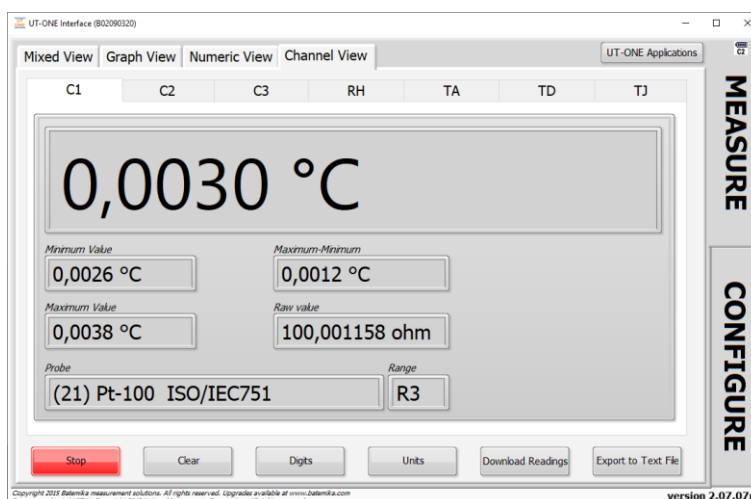


Figure 11: UT-ONE Interface Channel View

Configuration page has similar views as in the UT-ONE B03x user interface. User can change channel configuration, check the battery status and version information, synchronize UT-ONE time with the computer time, manage probe and range data, and take a snapshot of the UT-ONE display.

Channels view allows you to configure main channels in the continuous-measurement mode. It is recommended to select the probe first and the application will automatically select the default measurement range. Alternatively, you may also select a *Not Defined* empty probe and in this case you can select any measurement range with results presented without conversion to temperature. When you make the changes to UT-ONE channel configuration, a green *Save* button and a red *Cancel* button are displayed. Note that changes are applied only after you click the Save button. If you change channels or views, changes will be lost without warning.

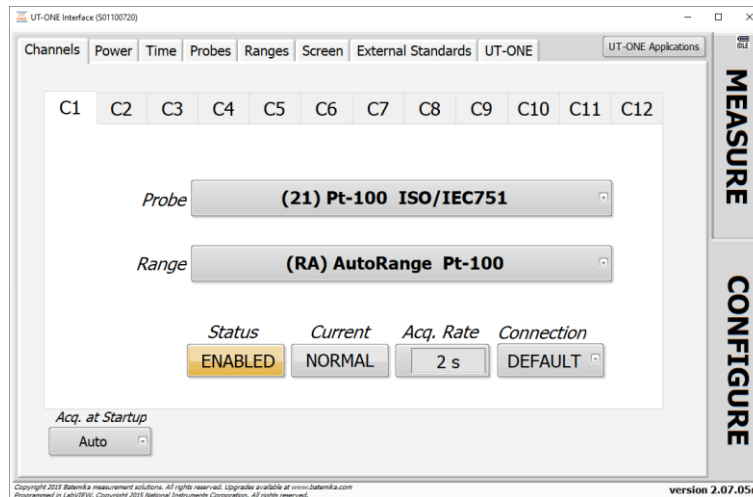


Figure 12: UT-ONE Interface Channels view

Power view present the information about the battery status (if available) and the power source. There are no configurable options available in this view.

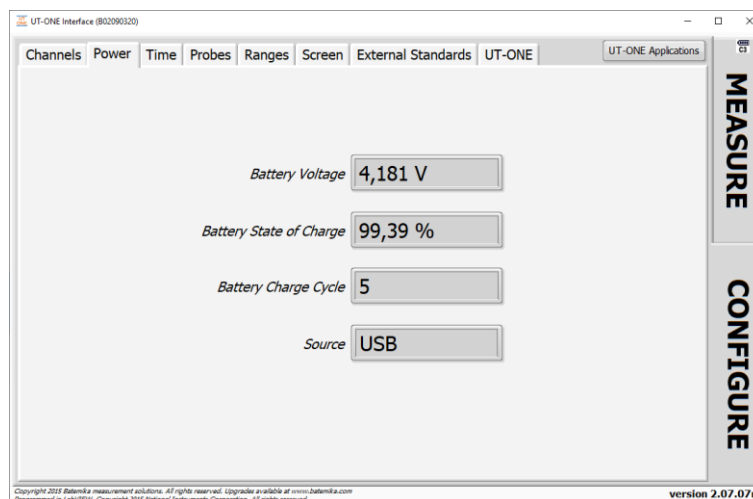


Figure 13: UT-ONE Interface Power view

Time view allows you to compare internal UT-ONE real-time clock with the computer clock. Internal clock may drift for a few seconds per day, so by clicking the *Synchronize Time* button you can set the device time to the computer time. The time and date format is determined by your computer Regional Settings, so the application window may look slightly different than the figure below.

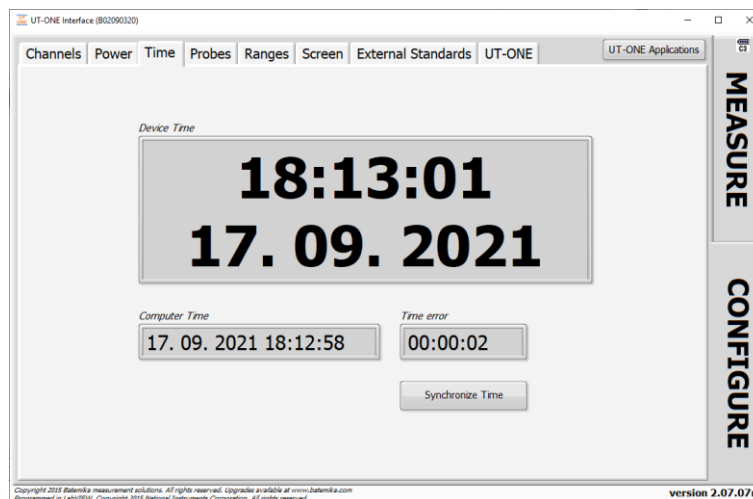


Figure 14: UT-ONE Interface Times view

User probes can be conveniently reviewed, deleted and edited in the *Probes* view. This enables you to use copy/paste operation to enter coefficient, therefore reducing the possibility of typing errors. Commands for probe manipulation are available in the popup menu. You can also save the probe data in a file, so it can be used as a backup or to be distributed to another UT-ONE device. Probe data can be saved as individual probes or as a group of all probes. Saving all probes in as single file provides a convenient way to use the same UT-ONE device with different probe sets.

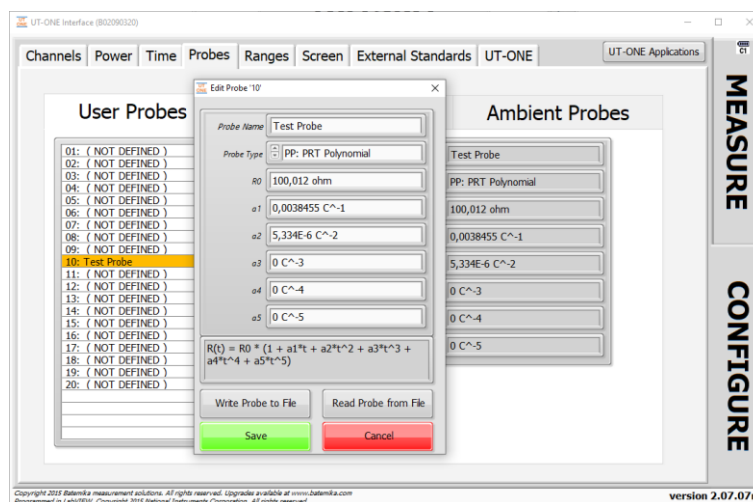


Figure 15: UT-ONE Interface Probes view with probe editing dialog

Ranges view can be used for reviewing UT-ONE internal calibration constants.

Range	Current	Reference Value	Linearity Correction	Temperature coefficient
R1	Man. Range 25 ohm NORMAL (1 mA)	31,260775 ohm	1,21E-14	9,4E-7
R2	Man. Range 50 ohm NORMAL (1 mA)	62,487558 ohm	7,9E-15	2,7E-7
R3	Man. Range 100 ohm NORMAL (1 mA)	125,03137 ohm	1,14E-14	3,9E-7
R4	Man. Range 200 ohm NORMAL (1 mA)	249,99717 ohm	6,8E-15	1,8E-7
R5	Man. Range 400 ohm NORMAL (1 mA)	499,96436 ohm	4,8E-15	8E-8
R6	Man. Range 800 ohm NORMAL (1 mA)	1002,2383 ohm	-1E-16	4,8E-7
r1	Man. Range 25 ohm REDUCED (0.7 mA)	31,260823 ohm	7E-15	9,5E-7
r2	Man. Range 50 ohm REDUCED (0.7 mA)	62,487773 ohm	4,4E-15	3,1E-7
r3	Man. Range 100 ohm REDUCED (0.7 mA)	125,03167 ohm	6,7E-15	4,1E-7
r4	Man. Range 200 ohm REDUCED (0.7 mA)	249,99833 ohm	3,9E-15	2,1E-7
r5	Man. Range 400 ohm REDUCED (0.7 mA)	499,96708 ohm	2,9E-15	9E-8
r6	Man. Range 800 ohm REDUCED (0.7 mA)	1002,245 ohm	-1,1E-15	5,2E-7
H1	Man. Range 2500 ohm NORMAL (10 uA)	3125,9293 ohm	1,2E-14	2,53E-6
H2	Man. Range 5000 ohm NORMAL (10 uA)	6248,4522 ohm	8E-15	1,84E-6
H3	Man. Range 10000 ohm NORMAL (10 uA)	12502,566 ohm	1,1E-14	1,94E-6
H4	Man. Range 20000 ohm NORMAL (10 uA)	24998,99 ohm	7E-15	1,64E-6
H5	Man. Range 40000 ohm NORMAL (10 uA)	49994,202 ohm	5E-15	1,53E-6
H6	Man. Range 80000 ohm NORMAL (10 uA)	100218,93 ohm	0E+0	2,01E-6
h1	Man. Range 2500 ohm REDUCED (7 uA)	3125,9505 ohm	7E-15	2,6E-6
h2	Man. Range 5000 ohm REDUCED (7 uA)	6248,5078 ohm	4E-15	1,87E-6
h3	Man. Range 10000 ohm REDUCED (7 uA)	12502,63 ohm	7E-15	2E-6
h4	Man. Range 20000 ohm REDUCED (7 uA)	24998,792 ohm	4E-15	1,68E-6

Figure 16: UT-ONE Interface Ranges view

Screen view can be used to acquire a screenshot of the image currently displayed on the UT-ONE built-in display. This feature is only applicable for UT-ONE models with screen. Acquired image can be saved in an image file and can be used for diagnostics or achieving purposes.

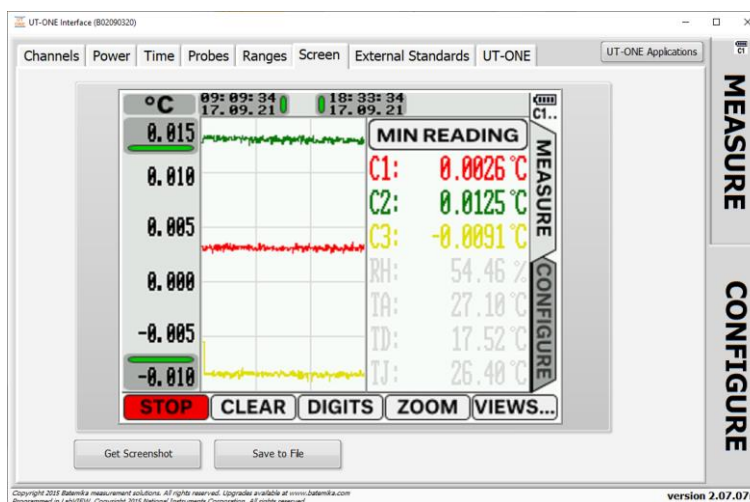


Figure 17: UT-ONE Interface Screen view

External Standards view is used to manage the properties of external standards that can be used to improve the accuracy of measurements in single-reading measurement mode. Use buttons in this view to store that to and from internal UT-ONE non-volatile memory and to store them in files on a computer.

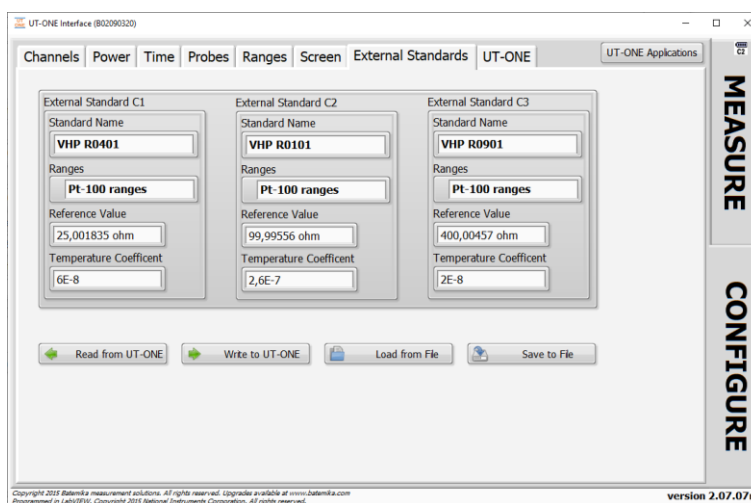


Figure 18: UT-ONE Interface External Standards view

UT-ONE view is used to select the UT-ONE communication interface and consequentially the particular UT-ONE device, if more UT-ONE devices are connected to a computer. After the communication is established, the application retrieves serial number and other device information from the device.

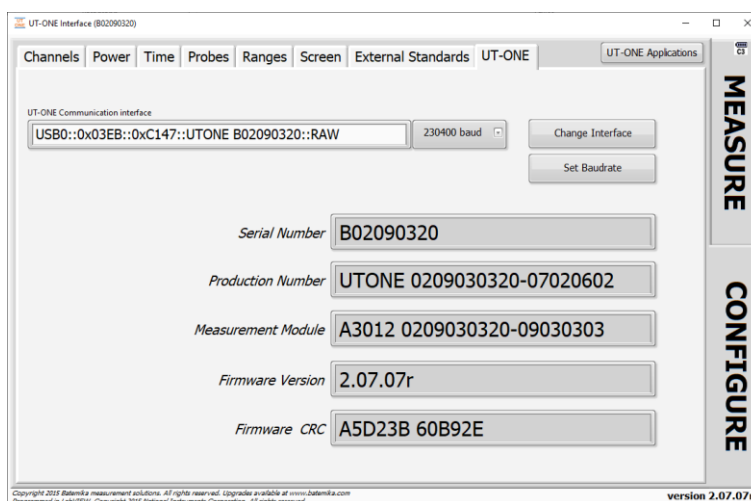


Figure 19: UT-ONE Interface UT-ONE view

1.2 UT-ONE Probe Calibration Demo

UT-ONE Probe Calibration Demo application is a simple and convenient tool for calibration by comparison of platinum-resistance, thermistor and thermocouple probes. This application performs the acquisition, data analysis and optionally stores the results to the UT-ONE non-volatile memory.

This application is a limited demo version of the Batemika calibration software, as it enables the calibration of only one probe at the same time, it has no uncertainty calculation and no printing of calibration certificates. Contact Batemika to get more information about the full version of our custom-made calibration software.

Calibration by comparison of a temperature probe is performed by placing a reference thermometer and a unit under test in stable and homogeneous calibration medium, typically a calibration bath, furnace or climatic chamber. The reading of the unit under test is then associated with the temperature measured with the reference thermometer. This is repeated at several calibration points within the required temperature range. Calibration points are then used to calculate calibration coefficients for the particular probe characterization.

The reference thermometer must be connected to one of the UT-ONE main channels and must be properly configured to measure true temperature. Make sure that probe data for the reference thermometer is valid.

Unit under test must be connected to one of the remaining UT-ONE main channels and must be configured to measure the resistance or emf. In most cases, it is most convenient to use the auto range for the Pt-100, thermistor or thermocouple. Selecting the UUT probe is recommended, as it will be used to indicate approximate UUT temperature and it is used in the visualization of results in data analysis. Note that UUT probe selection has no direct effect on final calibration results. If you are recalibrating the UUT, and the results of the previous calibration are stored in UT-ONE probe list, you can select the existing probe characterization, otherwise select one of the predefined probe characterizations that best fits your probe.

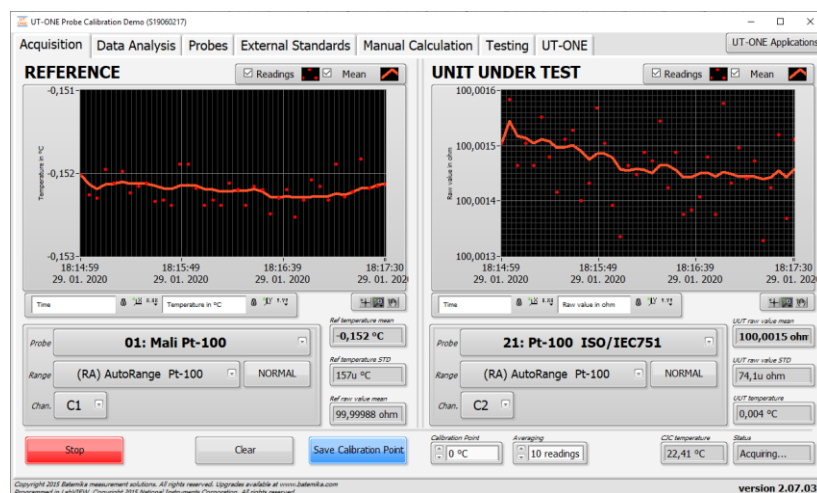


Figure 20: Acquisition window

Calibration uncertainty can be improved by using the external standard, which must be connected to one of the remaining UT-ONE main channels (C1, C2 or C3). To enable the use of external standards, go to the *External Standards* page and check the *Enable External Standards* checkbox. Verify that the correct external standards are set up and saved to the UT-ONE internal memory. You can now select the external standards in the channel configuration for the reference and UUT probe. Note that external standards must be enabled and set up before you make the first measurement.

Acquisition can be started using the *Start/Stop* button in the bottom of the window. Measurements are acquired in the single-reading mode. If there is a problem with the acquisition, the *Status* box will

display the error message. Readings can be cleared from the graph using the *Clear* button. Application uses the specified number of readings to calculate the mean value and standard deviations. Specify the calibration point (nominal temperature) in the *Calibration Point* input box for each calibration medium setting. After the application acquires the specified number of readings, *Save Calibration Point* button becomes active and you can manually save the current measurement to the calibration point list.

After you save the calibration point, the application automatically displays it in the *Calibration Points* list, so you can review it. Note that you can make several calibration points at one temperature. You can later select/deselect each calibration point or even delete it from the list. Note that only selected calibration points (with the checkmark in the calibration point list) are used in the data analysis.

Calibration points can be selected/deselected and deleted using the popup menu on the calibration points list.

After you acquire all calibration points, you can start with the data analysis. First select one of the available probe types for your probe characterization. If applicable, select the function order for the fitting procedure. Application will automatically calculate the probe coefficients and display them in the *New Probe Data* box.

If you would like to save the probe data to UT-ONE non-volatile memory, enter the *Probe Name* and select an empty user-defined probe location. Note that any previous probe data at selected location will be overwritten. Click the *Save to UT-ONE* button to save the results to UT-ONE non-volatile memory.

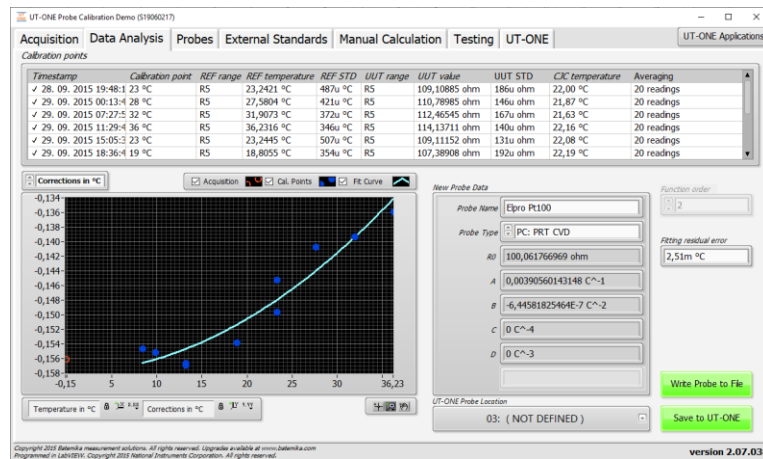


Figure 21: Data Analysis window with results of Pt-100 calibration

Calibration results can be conveniently visualized on a data analysis graph. The graph displays the currently acquired point as an orange ring, the selected calibration points as blue circles and the resulting probe characteristic as the light blue curve. You can view the data as the raw value (resistance or emf) against temperature, as fitting residuals or as a correction. Correction is calculated as the difference between actual values and nominal values according to selected UUT probe. Data visualization allows better evaluation of calibration results and detection of any faulty measurements.

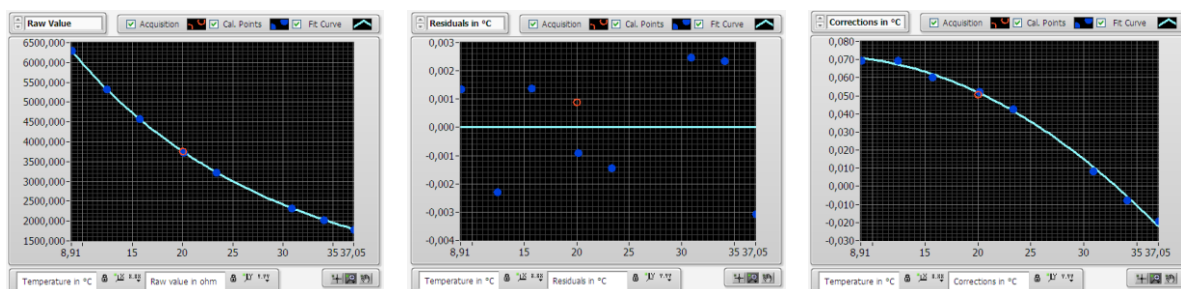


Figure 22: Visualization of data analysis results for NTC 3k calibration

If calibration results are obtained externally and are presented as a set of temperature and resistance/emf pairs, you can use the *Manual Calculation* tab to calculate the calibration coefficients and store them directly to the UT-ONE non-volatile memory.

Calibration data can be entered by typing in the values for reference temperature and UUT resistance/emf directly to the *Input Data*. Alternatively, you can copy and paste data directly from Excel (one column of data for reference temperature and one column of data for UUT resistance/emf). After you entered the data, check the values in the *Imported input data* indicator to verify that data was entered and imported correctly.

Note that this feature can be used even without the UT-ONE unit connected to the computer. To start calculation without UT-ONE unit, select OFFLINE option in the *Interface* selection.

To start with data analysis, first select the *Probe Template*. This will enable more convenient data presentation in the graph and will limit the available probe types to applicable values only. Alternatively, you can also select *No probe template* option, which will allow you to select any probe type for data analysis.

Next, select one of the available probe types for the selected probe template. If applicable, set the function order of the equation used in the fitting procedure. Check calculated fitting residual error and verify on the graph that the fit curve traces the calibration points. If some of the points significantly deviate from the fit curve, check for typing errors and verify your calibration procedure.

If you would like to store the calculated probe data to UT-ONE non-volatile memory, you will have to enter the *Probe Name* and click the *Write Probe to File* button. This will store the probe data in a *.prb file. If UT-ONE unit is connected to the computer, you can now select the *Probes* tab and read probe data from file and save it to the selected location in the UT-ONE non-volatile memory.

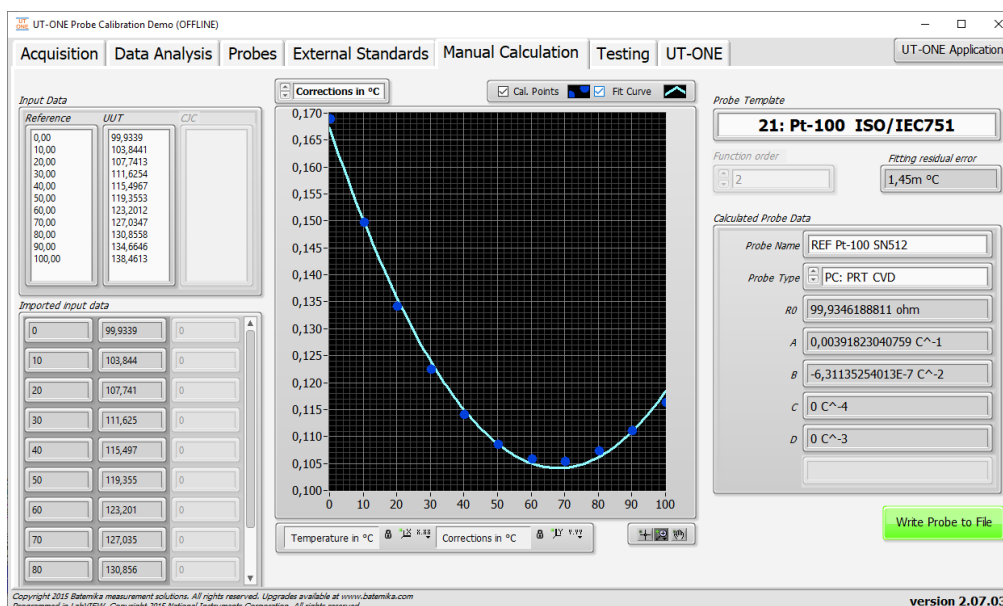


Figure 23: Manual Calculation window with results of Pt-100 calibration

UT-ONE internal calculation of temperature from probe resistance or emf can be verified in the *Testing* tab. This allows the user to check the accuracy of the calibration coefficients and to validate the internal conversions.

Probe coefficients must be first stored in one of the probe locations in the UT-ONE non-volatile memory. Select the probe in the *Probe testing* dropdown list and review its data.

You can now enter raw value (resistance or emf) in the *Raw Value in* and the application will send it to the UT-ONE unit and return the converted temperature value. The application will also calculate the temperature in the application software (computer), so you can check if there are any differences.

The calculation in the UT-ONE unit is possible only from raw value to temperature. The inverse calculation from temperature to raw value is possible only in application software.

Additional check can be performed by generating 1000 random measurement points in the specified calibration range and observing the difference between the UT-ONE and application calculations for the selected probe. This will give you a good indication of the numeric error that can be expected from calculations in the UT-ONE firmware.

Equations for conversion of temperature probes tend to be simple in one direction and more complicated in the inverse direction. For example, CVD equation is very simple for calculation of resistance from temperature, but is complicated for calculation of temperature from resistance. The validity of conversion in both directions can be checked by selecting *Difference between Forward and Backward Calculation*. This is applicable only to conversions in the application software.

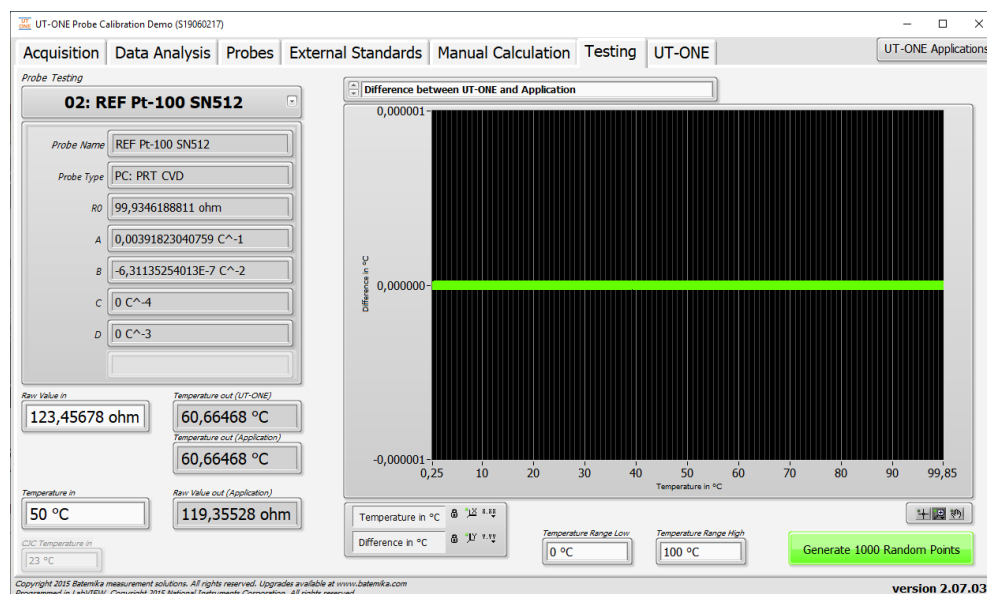


Figure 24: Testing window with results of Pt-100 calculation

1.3 UT-ONE Range Readjustment

UT-ONE Range Readjustment application is a tool for checking the internal drift of the UT-ONE measurement circuits and optional adjustment of the reference value for each measurement range. Note that adjustment removes the drift error, but it may also invalidate the traceability obtained from a UT-ONE calibration certificate, so depending on your requirements, a recalibration may also be required after readjustment procedure. If measured drift errors are within specified accuracy, it may therefore not be optimal to store them to UT-ONE non-volatile memory.

UT-ONE Range Readjustment application also feature a manual mode, which just measures and averages the raw value (resistance or DC voltage) on selected channel. The results are just recorded and there is no adjustment performed. This is a useful tool for the calibration of UT-ONE in an external calibration laboratory, especially for UT-ONE units with no display.

Range readjustment requires the connection of external standards, typically reference resistors or DC voltage sources. External standards must be connected to main channels and configured in the *External Standards* page before adjustment can start.

Range adjustment is always performed in three distinct levels:

- In the first level the value of configured external standards is measured and displayed in the list, together with the drift error in ppm. At this point there are no changes to UT-ONE and procedure may be stopped at any time. If you want just to check the drift of the UT-ONE, you should stop at this point
- In the second level, all or selected ranges with the READY TO SAVE status are stored to UT-ONE volatile memory. Changes take effect immediately, so the results of the adjustment can be observed. Note that at this point, if the UT-ONE is shut down, all changes will be lost and UT-ONE will return to original state
- In the third level, you may choose to save changes to non-volatile EEPROM memory in UT-ONE. Note that at this point changes are permanently stored and previous values may not be recovered.

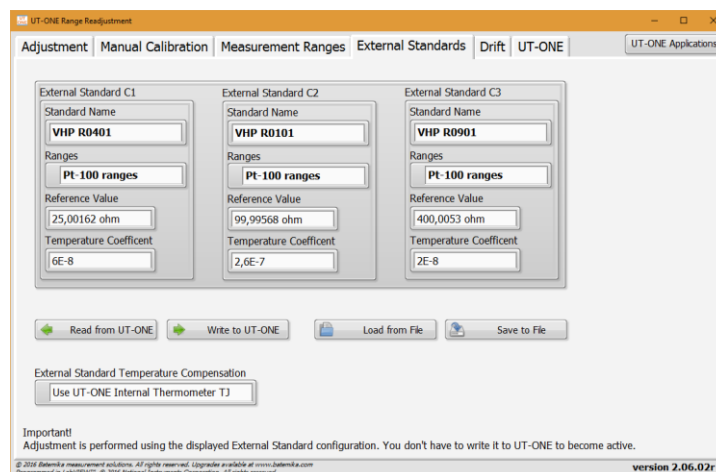


Figure 25: External Standards page

The first step is the configuration of the external standards. For each external standard, you must specify the name, range set, reference value and temperature coefficient. *Standard name* is used just for the user convenience and has no effect on adjustment. *Ranges* selects the set of ranges for which the external standard is applicable. If external standard is not connected, you should select the *Not used* option. *Reference Value* specifies the true value of the external standard at 23 °C. *Temperature coefficient* specifies the temperature coefficient of the external standard, which allows the automatic temperature compensation of the external standard. If temperature compensation is not applicable, use

0. The source of temperature for automatic compensation can be selected in *External Standard Temperature Compensation*. You may choose between no compensation, internal TJ thermometer or optional ambient conditions probe TA.

External standards configuration has the same format as the external standards configuration used in UT-ONE to improve measurement accuracy, but it can be used independently, so you don't have to write to UT-ONE memory to become active for the scope of adjustment. Nevertheless, you may read or write external configuration to UT-ONE memory, as well as to *.esc files on your local computer.

After the external standards are configured, you may proceed to *Adjustment* page to start the adjustment. First select the set of ranges (Pt-100 ranges, thermistor ranges or thermocouple ranges) that you wish to adjust. The range list will be automatically populated with applicable measurement ranges. Note that range set must match the range set selected in the external standard configuration, otherwise external standard won't be used.

Next select the number of readings that are acquired and averaged for each range adjustment. The default value is 40, which gives good results, but you may wish to choose higher or lower value according to your time and accuracy constraints.

Next select how the external standards are selected for each measurement range. You have three options:

- *Auto-select external standards* will select all external standards that are between 15% and 90% of the range reference value
- *Use all applicable external standards* will select all select all standards that are less than 100% of the range reference value
- *Use highest applicable external standard* will select only the largest external standard, which is less than 90% of the range reference value

Adjustment for a particular range will make measurements on one or more applicable external standards and use the weighted mean of all results, where external standards with higher value have a higher weight. If there is no applicable external standard for the particular range, an error will be reported and adjustment for the particular range will be stopped.

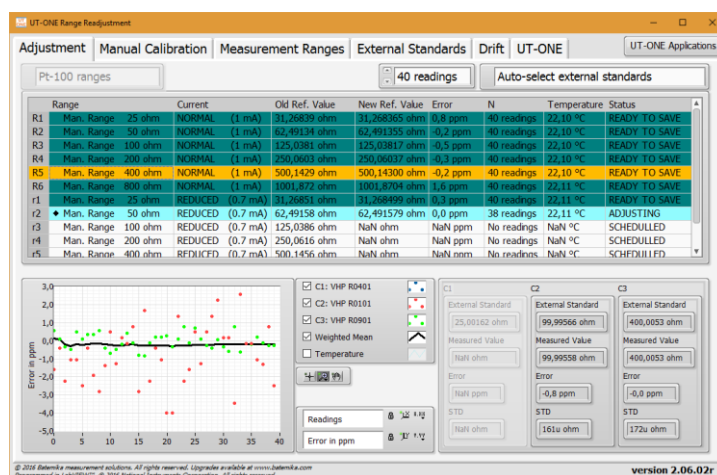


Figure 26: Adjustment page

Adjustment can be controlled using the popup menu on the range list. Popup menu consists of nine commands:

- *Monitor Selected Range* starts the acquisition for the selected range using the applicable external standards. Acquisition must be stopped manually using the popup menu command.
- *Adjust Selected Range* clears any existing data for the selected range, starts the acquisition using the applicable external standards and acquires specified number of readings. After the acquisition is completed, adjusted range is ready to be saved to UT-ONE memory.
- *Adjust ALL Ranges* schedules all ranges for adjustment procedure.
- *Stop Acquisition* stops the acquisition and clears and scheduled ranges

- *Clear Selected Range* clears the readings and status for the selected range
- *Clear ALL Ranges* clears the readings and status for all ranges
- *Save Selected Range* sends the adjusted reference value for the selected range to UT-ONE volatile memory
- *Save ALL Ranges* sends the adjusted reference value for all applicable ranges to UT-ONE volatile memory
- *Export Data to Clipboard* copies data presented in the range list to clipboard. Data is available for pasting to applications such as Notepad, MS Excel or MS word.

Measurements for the selected range are presented in graph and in numeric indicator.

Measurement Ranges page displays the information about calibration coefficients for all available ranges that are stored in the UT-ONE volatile memory. You can manually change the reference value for the selected range by double-clicking it or by using the popup menu command.

Measurement ranges can be written or read from a *.rng file on your local computer using the popup menu commands. It is recommended that you make a backup copy of the coefficients before you make the adjustment, so you can restore the previous state in case of a failed adjustment. Range coefficients in the *.rng file can also be used to evaluate the drift between consecutive adjustments.

Use the *Export Data to Clipboard* command in the popup menu to copy the data in the list to clipboard.

After you make any changes to range coefficients in the UT-ONE volatile memory (either manually or using the adjustment procedure), the green *Save to EEPROM* button and red *Discard Changes* button will appear. Use the *Save to EEPROM* button to permanently save the changes to UT-ONE non-volatile EEPROM memory. Use the *Discard Changes* button to restore the range coefficients from the non-volatile memory and therefore discard any changes in the volatile memory.

Range	Current	Reference Value	Linearity Correction	Temperature coefficient
R1 Man. Range 25 ohm	NORMAL (1 mA)	31,28929 ohm	1,25E-14	3,23E-7
R2 Man. Range 50 ohm	NORMAL (1 mA)	62,53468 ohm	7,3E-15	-4,32E-7
R3 Man. Range 100 ohm	NORMAL (1 mA)	125,0563 ohm	1,06E-14	-9,87E-7
R4 Man. Range 200 ohm	NORMAL (1 mA)	250,1745 ohm	6,4E-15	-5,17E-7
R5 Man. Range 400 ohm	NORMAL (1 mA)	500,2739 ohm	4,8E-15	-7,2E-7
R6 Man. Range 800 ohm	NORMAL (1 mA)	1001,933 ohm	-1E-15	-3,2E-7
r1 Man. Range 25 ohm	REDUCED (0.7 mA)	31,28929 ohm	7,5E-15	5,28E-7
r2 Man. Range 50 ohm	REDUCED (0.7 mA)	62,53488 ohm	4,6E-15	-3,98E-7
r3 Man. Range 100 ohm	REDUCED (0.7 mA)	125,0566 ohm	6,9E-15	-9,74E-7
r4 Man. Range 200 ohm	REDUCED (0.7 mA)	250,1756 ohm	4,3E-15	-4,85E-7
r5 Man. Range 400 ohm	REDUCED (0.7 mA)	500,2766 ohm	3,8E-15	-7,1E-7
r6 Man. Range 800 ohm	REDUCED (0.7 mA)	1001,942 ohm	-2E-16	-2,83E-7
H1 Man. Range 1250 ohm	NORMAL (20 uA)	3128,781 ohm	1,2E-14	1,09E-6
H2 Man. Range 2500 ohm	NORMAL (20 uA)	6253,1822 ohm	7E-15	2,1E-7
H3 Man. Range 5000 ohm	NORMAL (20 uA)	12505,07 ohm	1,1E-14	-3E-7
H4 Man. Range 10000 ohm	NORMAL (20 uA)	25016,347 ohm	7E-15	8E-8
H5 Man. Range 20000 ohm	NORMAL (20 uA)	50025,167 ohm	5E-15	-2,1E-7
H6 Man. Range 40000 ohm	NORMAL (20 uA)	100189,17 ohm	-1E-15	2E-8
h1 Man. Range 1250 ohm	REDUCED (14 uA)	3128,8057 ohm	7E-15	9,7E-7
h2 Man. Range 2500 ohm	REDUCED (14 uA)	6253,2416 ohm	4E-15	9E-8
h3 Man. Range 5000 ohm	REDUCED (14 uA)	12505,184 ohm	7E-15	-4E-7
h4 Man. Range 10000 ohm	REDUCED (14 uA)	25016,595 ohm	4E-15	-3E-8
h5 Man. Range 20000 ohm	REDUCED (14 uA)	50025,77 ohm	4E-15	-3,1E-7

Figure 27: Measurement Ranges page

Drift page allows you to review the drift between the adjustments for the selected ranges. Use the popup menu to load range coefficients from the older *.rng files.

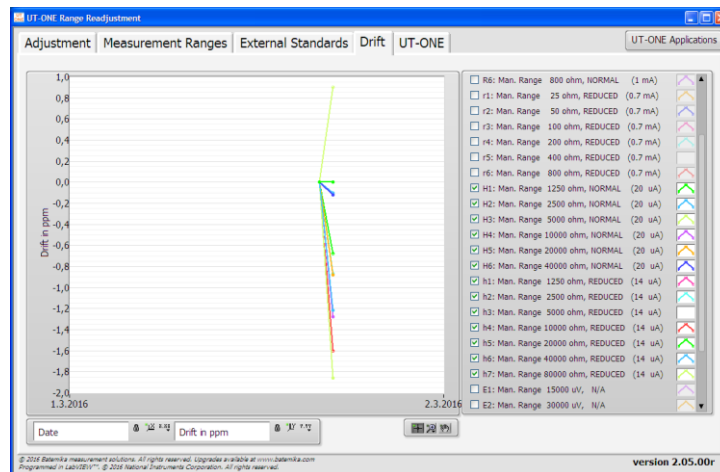


Figure 28: Drift page

The *Adjustment* page provides a fully automated procedure for routine readjustments and calibration checks for the UT-ONE thermometer readout. However, in many practical situations, especially when UT-ONE is sent to calibration in an accredited calibration laboratory, the setup of external standards and the complete adjustment procedure may be too complex, so a simpler alternative is provided in the *Manual Calibration* page.

To perform manual calibration, connect the reference resistance or DC voltage to one of the main channels and select that channel in the *Channel* dropdown list. Next select the manual range from the *Range* dropdown list. For resistance ranges you may also choose between the normal and reduced current. Click the green *Start* button to start the acquisition with given settings. The green *Start* button will change to red *Stop* button, which can be used to stop acquisition.

The acquired readings are displayed on the graph and in the numeric indicator. Average and standard deviation of the last N readings are calculated and displayed. N is specified in the *Averaging* input box.

Use the *Clear Graph* button to clear readings from graph and averaging memory.

You may change the channel and range during the acquisition. If you change the range between resistance and voltage ranges, readings are automatically cleared.

You can perform acquisition on either *Adjustment* or *Manual Calibration* page, but not on both at the same time. When you start acquisition, acquisition on the other page will be automatically stopped.

The displayed average reading for the selected range can be compared to the reference value of resistance or DC voltage standard and reported on the calibration certificate.

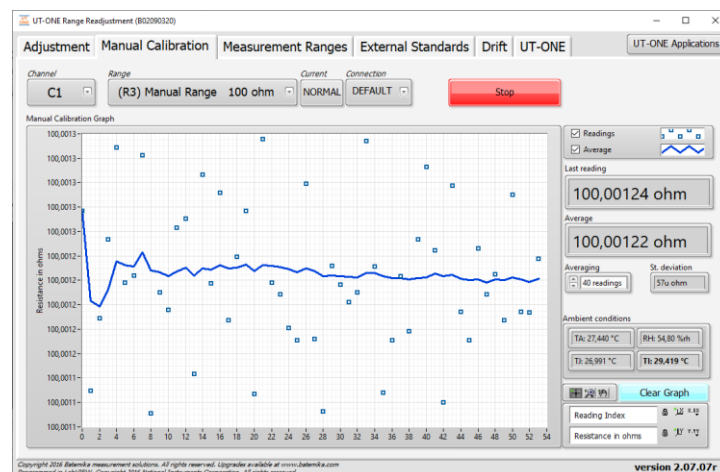


Figure 29: Manual Calibration page

1.4 UT-ONE Digitizing

UT-ONE Digitizing is the application for fast acquisition of raw data on temperature probes, connected to UT-ONE main channels. This application takes advantage of the special UT-ONE feature, which enables direct transfer of raw samples from the ADC to the USB interface. This feature enables fast sampling (digitizing) with up to 470 samples per second. Note that measurements in this mode have reduced accuracy and resolution, and there is no temperature coefficient correction, linearity correction, EMI rejection and parasitic emf compensation.

UT-ONE Digitizing application is primarily used to capture fast temperature transients in various temperature-related tests and experiments. Also, if you suspect your measurement configuration is prone to electromagnetic interference, you can analyse the raw samples before they are digitally filtered, so you can observe any traces of mains frequency interference.

This application is applicable only with communication via USB interface.

After launching the UT-ONE Digitizing application, select the USB interface, channel, measurement range and sampling frequency. Note that auto ranging is not supported in digitizing mode, so select an appropriate manual range.

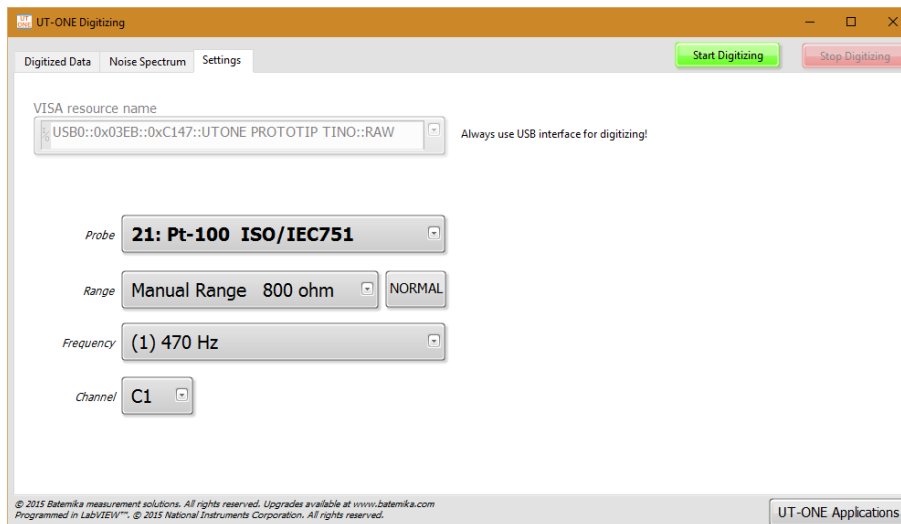


Figure 30: Settings for UT-ONE Digitizing application

Digitizing can be started using the green *Start Digitizing* button. Application will automatically switch to *Digitized Data* page and display acquired samples on graph. Note that samples are transferred in groups of 40 samples, so if low sampling frequency is selected, it may take up to 10 seconds to refresh the graph.

UT-ONE Digitizing application can display up to 65536 samples, which is approximately 140 seconds at the highest sampling frequency. After reaching this limit, older samples are discarded.

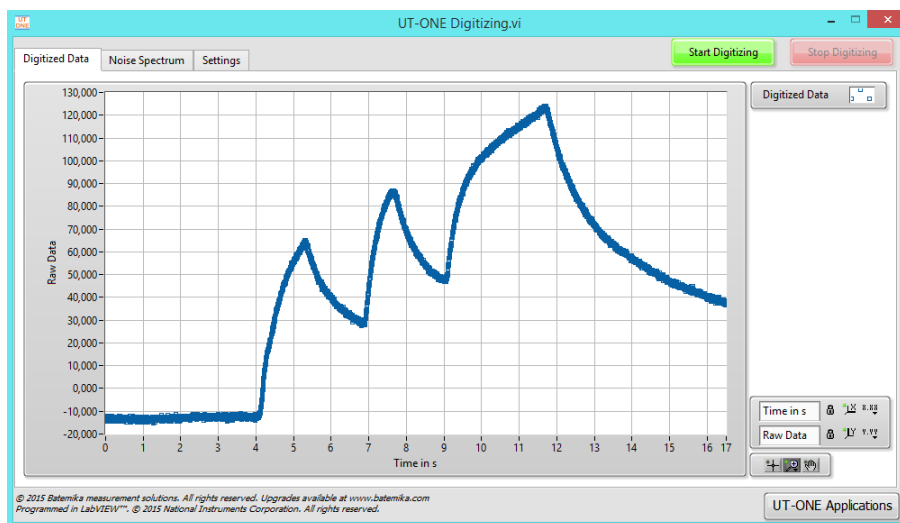


Figure 31: Observing of fast transients in digitizing mode

Noise Spectrum page presents the frequency spectrum of the acquired samples. This feature is especially useful for detecting any interference signals that are being acquired on the thermometer input. Most commonly, this effect is detected with unshielded thermocouple wires located near high-power electrical machines.

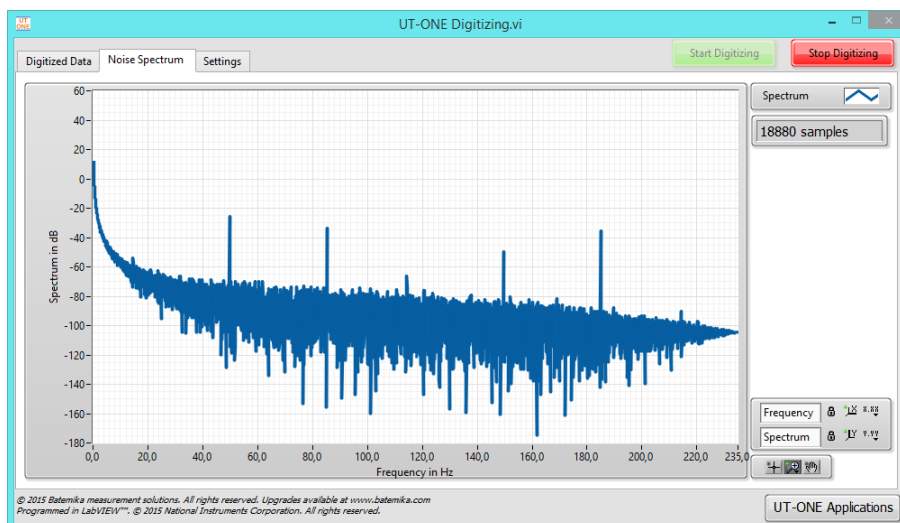


Figure 32: Noise spectrum with considerable 50 Hz interference

1.5 UT-ONE Communication Testing

UT-ONE Communication Testing is a simple application, which is used to directly establish the communication with the UT-ONE and to test the syntax of the commands and responses in the UT-ONE remote command set.

Enter the UT-ONE command in the *Command in* input box in ASCII text format. Optional binary data can be entered in the *Binary Block in* array for some commands. Note that the terminating line feed character is appended automatically. Send the command to UT-ONE using the *Execute Command* button. The application will generate the command, display it in the *Actual Data sent* box and send it to UT-ONE. After UT-ONE sends the command response, the application will display it in the *Actual Data received* box and extract the command status, ASCII text response and binary block. Application will also measure the time required to send, process and receive the command and display it in the *Execution time* box.

To check the precise timing and the performance of UT-ONE interface, you may click the *Execute Command 1000 times* button, which will execute the specified command 1000 times and display the average execution time. The application will display a progress bar with the number of errors and total number of messages. If the

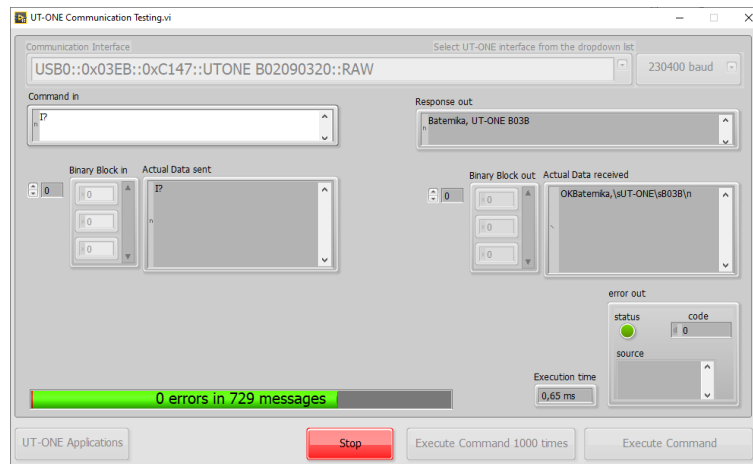


Figure 33: UT-ONE Communication Testing

1.6 UT-ONE Log Viewer

UT-ONE Log Viewer is a support application, which allows the user to browse the contents of the UT-ONE internal logging memory.

You may use the Log Viewer application during measurements, but this will result in slower data-transfer rates and newly acquired data will not be automatically refreshed.

Depending on your UT-ONE model, the device may support logging to internal SD card, internal flash memory or both. Logging to internal SD card is only supported on device with built-in display (UT-ONE B03A and UT-ONE B03B). Logging to internal flash memory is only supported on UT-ONE SxxB and selected UT-ONE B03B devices.

1.6.1 Logging to internal SD card

Internal SD card logging memory consists of 67 108 864 memory locations, which is equivalent to more than four years of logging at 2 seconds sampling rate. Each memory location can store the reading timestamp and temperatures/relative humidity for 7 channels. For UT-ONE B03A/B this corresponds to temperatures for three main channels, relative humidity, air temperature and dew-point temperature for the optional ambient probe and temperature of the internal CJC thermometer. Besides this main data log, UT-ONE logs also the raw data for each channel and statistics for blocks of 16 and 256 readings, which include average value, minimum value, maximum value and a time index. This auxiliary data is also accessible.

After you launch the application, you must first specify the VISA resource name for the communication interface to your UT-ONE device. If the application successfully detects a UT-ONE on the last used interface, this interface is automatically selected and no user interaction is required.

Log Viewer application first loads a preview of logged readings and displays it on the Preview graph. Preview load starts with the most recent readings and proceeds to older readings. If there is an overwhelming quantity of logged readings, you may click the *Stop Streaming* button to stop preview loading as soon as the date of interest is loaded.

Use the graph cursors to select the data of interest. Note that each data point on the preview graph corresponds to 16 readings. Each reading is identified by its memory location (unique ascending index within the logging memory). The *Memory Location* slider is a graphic representation of selected readings within the logging memory. You may use the *Min* and *Max* controls to select data by memory location or make a finer selection than with graph cursors.

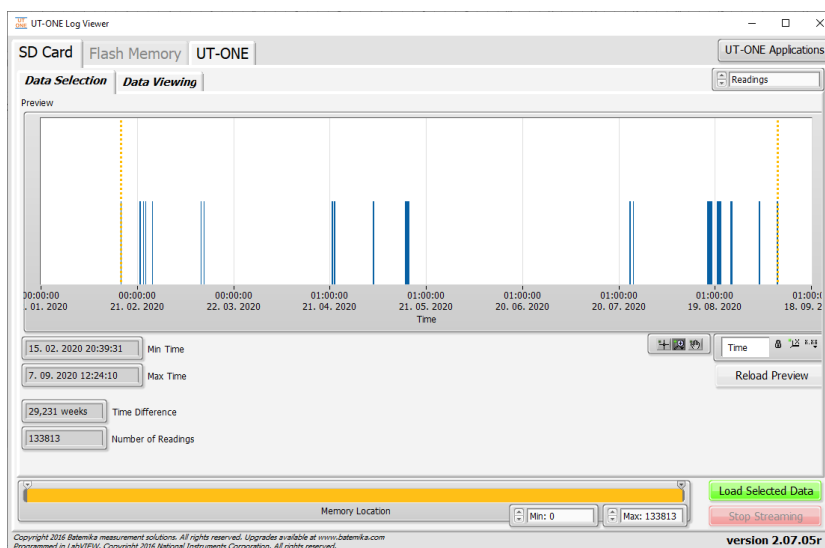


Figure 34: UT-ONE Log Viewer data selection page

After you select the data of interest, choose the data to be viewed. The default setting is *Readings*, which loads all temperature readings from selected memory locations. Other options include average of 16 or 256 readings, minimum and maximum of 16 or 256 readings and raw data. Averaged and minmax data is especially useful if there are too many readings, as this option significantly reduces the data to be downloaded from the UT-ONE.

Click the *Load Selected Data* button to start loading data. The tab control will automatically switch to *Data Viewing* page. The *Memory Location* slider will change to progress indicator, so you can observe the download progress. Use the *Stop Streaming* button to stop download before it is completed.

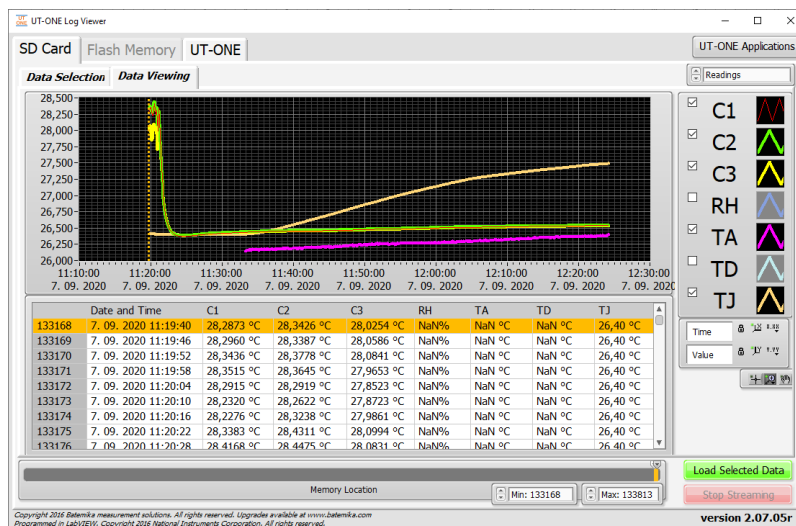


Figure 35: UT-ONE Log Viewer data viewing page

Loaded data is presented in the graph and in the list. You may use the graph cursors to select data on graph. Alternatively, you may use the shift and control keys to click and select ranges or individual readings in the list. Both modes of selection are related and result in a common block of readings.

UT-ONE supports the deletion of individual readings, which is especially useful for removal of readings that were erroneous or out of range. Note that the deleted reading is actually not deleted and memory location is not freed, it is just marked as deleted and therefore ignored by software. Also, deleted readings can still be reviewed and even restored, so data integrity is not jeopardized.

You may right-click on the readings graph or list to display the popup menu with the following menu items:

- *Copy Selected Data to Clipboard* copies the readings, selected with graph cursors, to the Windows clipboard using a tab-separated ASCII format, which can be pasted in a text editor or MS Excel.
- *Copy All Data to Clipboard* copies all readings to the Windows clipboard using a tab-separated ASCII format, which can be pasted in a text editor or MS Excel.
- *Export Selected Data to File* writes the readings, selected with graph cursors, to a specified file using a tab-separated ASCII format.
- *Export All Data to File* writes the all readings to a specified file using a tab-separated ASCII format.
- *Delete Selected Readings* marks selected readings as deleted and removes them from graph and list. This command is available only by selection in list control.
- *Undelete Selected Readings* restores the selected readings that were previously marked as deleted. This command is available only by selection in list control. To be able to view and select deleted readings, you must first choose to enable the display of deleted readings.
- *Display Deleted Readings* enables the option to display the readings that were previously marked as deleted. This option is useful if you would like to undelete some readings or check if the deletion was valid.
- *Show Selection* moves the current position in the list control to first selected readings. This command is useful if you select the readings using the graph cursors and you would like to review the selection in the list control.

- *Bring Cursor to Center* moves the graph cursor in to graph area that is currently displayed. This command is useful if you zoom-in to particular data and graph cursors are no longer visible.
- *Zoom Graph to Cursors* changes the graph scale settings so that the graph cursors are positions at 10% and 90% of the scale. Note that this operation does not change the selection of readings.

1.6.2 Logging to internal Flash Memory

Internal Flash Memory consists of 2 097 152 memory locations. Each memory location can store one reading. Readings can be acquired from main channels in single-reading or continuous-measurement mode, or from ambient probes (RH, TA, TD and TJ channels). Each stored reading consists of the timestamp, raw value (resistance, emf or uncorrected temperature/relative humidity), corrected value (temperature or relative humidity), channel name, measurement range and connection configuration, and probe index. A CRC8 byte is appended to each reading data to insure data integrity.

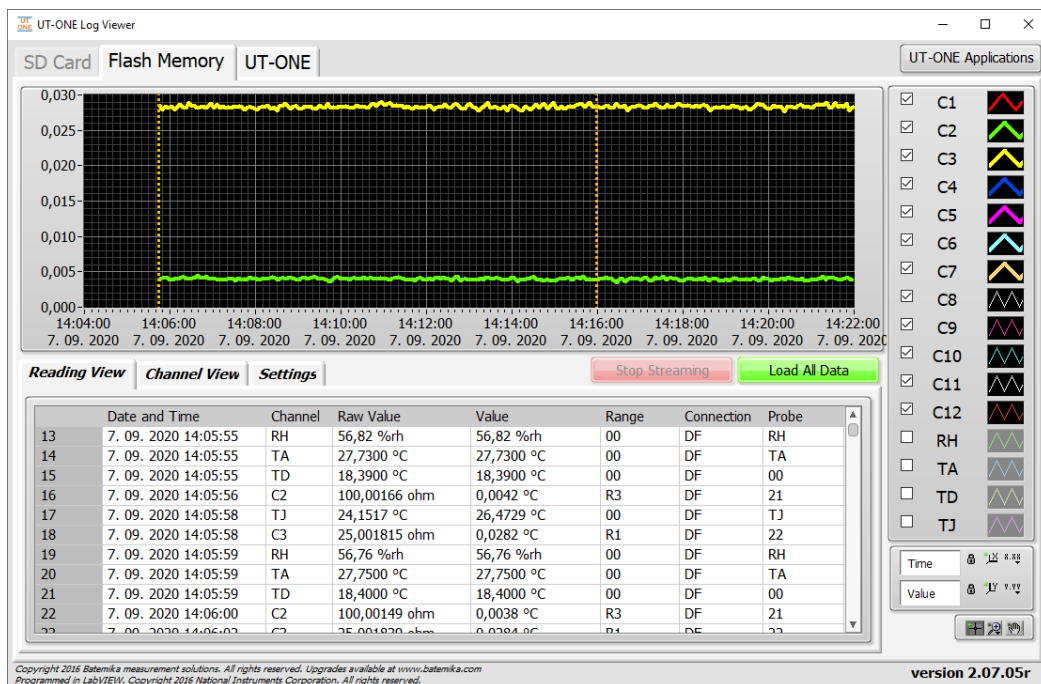


Figure 36: UT-ONE Flash Memory Viewer

Start loading data from the flash memory by clicking the green *Load All Data* button. Application will clear any existing data and start displaying the preview of the TJ channel data on the graph. When required data is loaded, click the red *Stop Streaming* button. Alternatively, you may load the entire content of the flash memory to the application memory. This takes six to seven minutes. After the data is loaded, it is displayed on the graph and in reading/channel view.

Readings can be stored to binary file using the popup menu command. You can later load and review the data from the file. Note that this is full data in the same format as stored in Flash Memory.

Readings can be exported to clipboard in various formats using popup menu commands. You can paste this data into other applications, such as MS Excel. Note that for large number of readings, copying of data can take a lot of time.

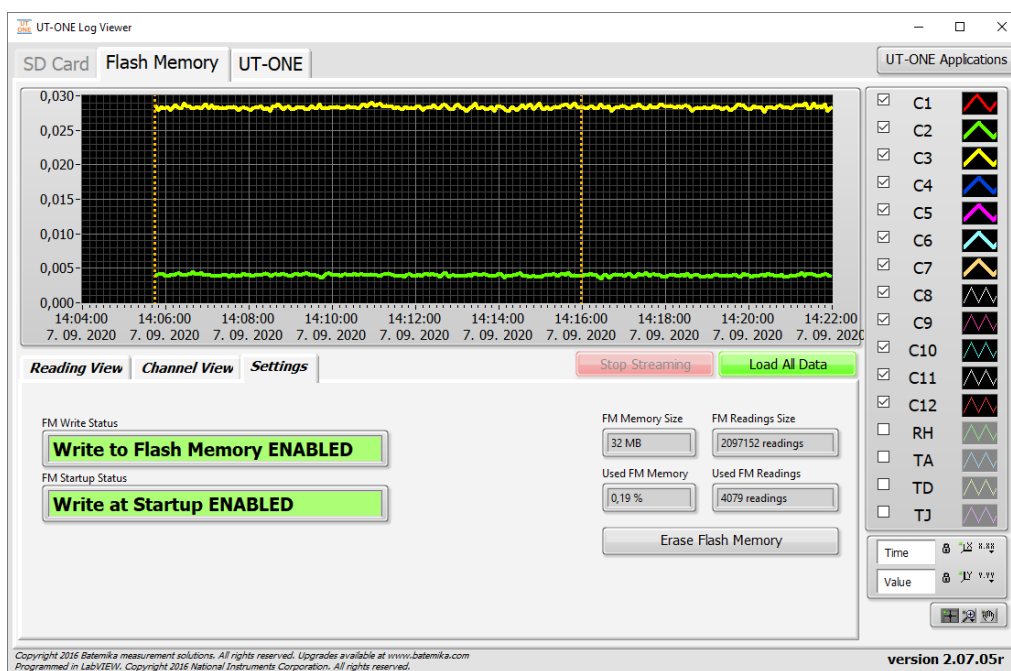


Figure 37: UT-ONE Flash Memory Settings

Write status and settings of the internal flash memory can be configured in the *Settings* tab.

Writing in flash memory can be temporarily enabled or disabled using the popup menu command on the *FM Write Status* indicator. Note that this is a temporary setting and will be lost after the device is switched off.

The setting of writing to flash memory at startup can be enabled or disabled using the popup menu on the *FM Startup Status* indicator. This enables you to configure the device for operation in standalone mode with enabled writing to flash memory at startup.

Total and used flash memory is displayed in four indicators on the right hand side. Note that after memory is full, the device will automatically overwrite the oldest readings.

The content of the flash memory can be erased by clicking the *Erase Flash Memory* button. This will erase all readings and it cannot be undone. To confirm this operation, the application will require you to confirm the operation with a password. Password for erasing entire flash memory is:

R0q11maH

1.7 UT-ONE Temperature Monitoring

UT-ONE Temperature Validation is a simple application that is capable of acquiring temperature from up to 12 probes connected to UT-ONE main channels. This application has a very straightforward configuration, so if you need an application with more complex configuration ability, you may consider also the *UT-ONE Climatic Chamber Validation* application.

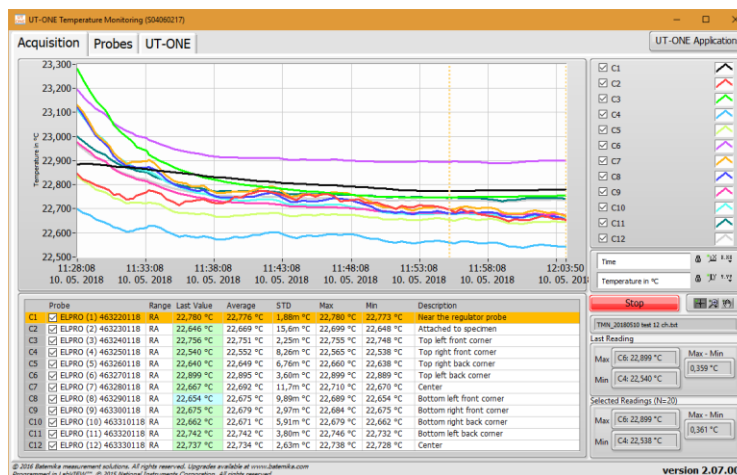


Figure 38: UT-ONE temperature monitoring

This application acquires temperature on UT-ONE main channels. Probes are automatically assigned to channels in ascending order from 1 to the number of available main channels (for example probe 01 is used for channel C1, probe 02 for channel C2, etc). Application will use probe data stored in internal UT-ONE memory to calculate the temperature from acquired raw data, so make sure that connected thermometer probes match the probe data in the *Probes* list and make sure that probe data is valid.

The application will perform acquisition in single-reading mode. Measurement range will be set automatically to autorange, which is default for the selected probe (for example range RA for Pt-100 probes, range EA for thermocouple and range HA for thermistors). Acquisition rate will be set to affixed value of 2 seconds.

Note that you don't have to provide probe data or connect actual probes for all available main channels. Unused channels can be removed from the acquisition sequence by double-clicking the checkbox in the channel list. If the checkbox is unchecked, the channel will be skipped in the acquisition sequence.

To add or change a description of the particular channel, double-click the channel *Description* column in the channel list. This will open a dialog box, which allows you to edit the channel description. It is recommended that you set all descriptions before you start the measurement, otherwise the descriptions stored in the measurement file may not be correct.

This application can store acquired temperatures in the measurement file. Data is stored in the tab-separated text format, which allows you to review data in a text editor such as Notepad or directly import it in the MS Excel. When you start the application you are immediately prompted to provide the path and name for the measurement file. By default, the application will use the UT-ONE root path for the current year and a default name, but you can manually change it. If you cancel the measurement file selection, data will not be saved to file and *Measurement File path* indicator will be painted in red. You can select the file path later using the command in the popup menu. Commands in the popup menu also allow you to open the file in the default text editor and to explore the file location. Note that after you start the acquisition and the measurement file is generated, you are no longer able to change its name or location.

If you select the existing measurement file, you can choose to load the data that was previously stored in the measurement file and review it on the graph. You may also choose to continue with the acquisition

and the data will be stored in the same file. In this case, you must assure that the current probe configuration is the same as used during the acquisition of the original measurements, otherwise a data inconsistency will occur.

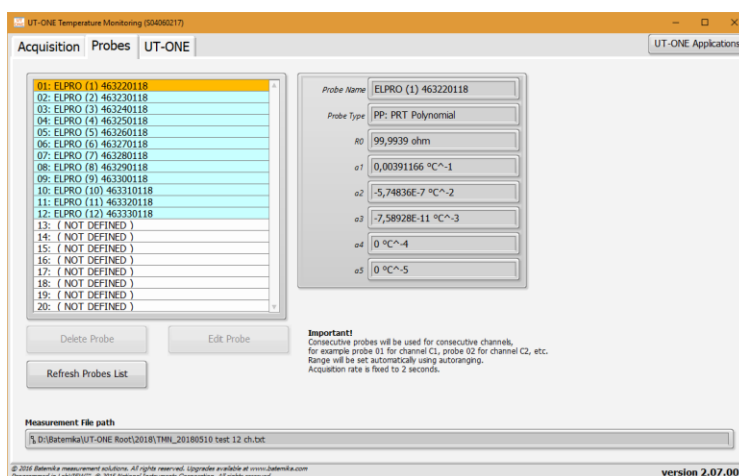


Figure 39: UT-ONE probe and measurement file configuration

You may use the *Probes* page to review the probe data. Use the *Edit Probe* button to open the *Edit Probe* dialog box to change the probe data or manage the backup copy of the probe data in a *.prb file. Note that changes that you make to probe data are permanently stored in the non-volatile memory of the UT-ONE device.

The acquisition is started by clicking the green *Start* button. After the acquisition is started, the green *Start* button changes to red *Stop* button. Acquisition can be stopped by clicking the red *Stop* button or by closing the application.

Measurement results can be observed on the graph, in the channel list and in two statistics indicators. Graph features two cursors, which can be used to select a portion of the measured data.

Right click on the graph area to display the popup menu with the following menu items:

- *Clear Selected Readings* removes the readings, selected with graph cursor, from the graph. Note that this operation can't be undone, but a copy of acquired data is saved in the autosaved file.
- *Clear All Readings* removes all readings from the graph
- *Copy Selected Readings to Clipboard* copies the readings, selected with graph cursors, to the Windows clipboard using a tab-separated ASCII format, which can be pasted in a text editor or MS Excel. The exported data includes also probe captions and channel descriptions.
- *Copy Statistics to Clipboard* copies the statistic information about selected readings to the Windows clipboard using a tab-separated ASCII format, which can be pasted in a text editor or MS Excel. The exported data includes also probe captions and channel descriptions. Statistics include average value, standard deviation, minimum value and maximum value.
- *Zoom Graph to Cursors* will change the graph X scale, so that graph cursors and selected data are visible in the graph. Note that the location of cursors and consequently selected data are not changed by this operation.
- *Move Cursors to Graph Center* will move the graph cursors and consequently the selected data to the middle of the currently visible portion of the X scale. Graph scaling is not changed by this operation.

1.8 UT-ONE Climatic Chamber Validation

UT-ONE Climatic Chamber Validation is a specialised application, which is used for the measurement of relative humidity and temperature distributions in a climatic chamber. This application is highly configurable and allows you to perform the validation in a wide variety of different ways.

1.8.1 Theoretical background

The operating principle of this application is based on the generally-accepted fact that although the temperature and relative humidity inside a climatic chamber may vary, the water vapour pressure (and also dew point) can be assumed to be constant over the entire volume of the climatic chamber. This assumption is valid if the following conditions are fulfilled:

- useful volume of the climatic chamber is not too large. For volumes larger than approximately 2 m³, you should consider measuring water vapour pressure in more than one point
- there is sufficient mixing of air in the useful volume of the climatic chamber
- there are no sources or sinks of water vapour in the useful volume of the climatic chamber
- there are no leaks that would lead to air being exchanged with the environment

As the vapour pressure is assumed to be constant over the entire useful volume of the climatic chamber, it is sufficient to measure it in a single location and just copy the measured value to all other measurement points. Note that dew-point temperature is directly related to vapour pressure and can be calculated using the Sonntag equation.

Temperature, relative humidity and vapour pressure at a given measurement point are also related with each other and if two of them are known, the third one can be calculated. For example, if relative humidity and temperature are known, vapour pressure (and dew point) can be calculated. Also, if vapour pressure and temperature are known, relative humidity can be calculated. Also, if you measure dew point using a mirror hygrometer, vapour pressure can be directly calculated.

Some of the calculations depend also on the air barometric pressure, most notably if psychrometers are used to measure relative humidity. The software allows you to enter the barometric pressure measured by the external barometer, however if the relative humidity is measured with a capacitive sensor or a mirror hygrometer, using normal barometric pressure will typically introduce a negligible error.

Note that all water vapour pressure values include enhancement factor for air at specified barometric pressure.

1.8.2 Measurement procedure

In accordance with the presented theoretical background, the following measurement procedure can be outlined. Please note that this procedure is automatically executed by software and is completely transparent to the user.

1. Temperature is acquired sequentially in all measurement points. This is applicable also to relative humidity probes, mirror hygrometers and psychrometers, which all feature also an associated temperature probe.
2. Relative humidity is acquired from the relative humidity probes and optionally from the mirror hygrometers.
3. Vapour pressure is acquired or calculated from the mirror hygrometers, relative humidity probes and psychrometers.
 - For the mirror hygrometers, vapour pressure is normally calculated from the directly measured dew-point temperature, but it can be also acquired directly from the mirror hygrometer or calculated from the acquired temperature and relative humidity.
 - For the relative humidity probes, vapour pressure is calculated from the acquired temperature and relative humidity

- For the psychrometers, vapour pressure is calculated using the psychrometric equation from the acquire temperature of the wet and dry thermometer and specified barometric pressure.
4. Vapour pressure is copied from the reference measurement point for all remaining measurement points. The value of vapour pressure at the reference measurement point was determined in step 3.
 5. Dew point is calculated directly from the vapour pressure using the Sonntag equation. For temperatures below 0 °C, saturation over ice and not over super-cooled water is assumed in the calculation.
 6. Relative humidity is calculated in the measurement points that were not processed in step 2. Relative humidity is calculated from the acquired temperature and acquired or copied vapour pressure.

This measurement procedure allows you to determine temperature, relative humidity, vapour pressure and dew point in all measurement points.

1.8.3 Configuration

UT-ONE Climatic Chamber Validation application was designed with the goal of being extremely flexible and configurable and it allows many different combinations of hygrometers and thermometers. Temperature can be acquired from one or more UT-ONE units, as well as an external mirror hygrometer and combined probes. Relative humidity and related vapour pressure can be determined from the external mirror hygrometer, combined probe (a capacitive relative humidity probe) or from psychrometer (wet and dry probe temperature is acquired by UT-ONE).

The configuration can be reviewed and changed on the *Configuration* page. Setting up the configuration for your particular measurement system takes some time and effort, so the most common configurations are usually configured only once and then stored in the configuration file, where they can be later retrieved. For your convenience, the application also automatically stores the last used configuration, which is automatically loaded at application startup.

Note that once you start the measurement, configuration is locked and can't be changed any more, except for the Description, which can be changed if the measurement is stopped.

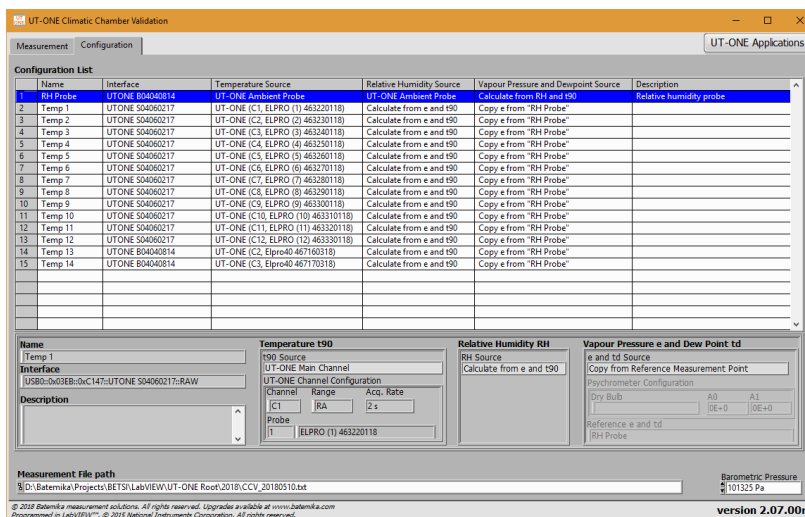


Figure 40: Configuration page

Setting up the configuration normally starts from an empty configuration list. If there are some entries in the configuration list, you can clear them using the *Clear Configuration* command from the popup menu.

New measurement point can be added by double-clicking an empty row in the configuration list or by selecting the *Add Measurement Point* command from the popup menu. The new measurement point is

always added at the end of the list and its position can't be changed later. New measurement point is added in the *Add New Measurement Point* dialog. Entries that are either missing or conflicting are painted in red. If you try to add a measurement point with some red entries, you will be warned before proceeding, but you can add the point anyway and correct it later before you start the measurement.

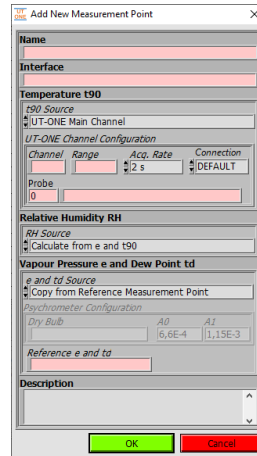


Figure 41: Dialog for adding a new measurement point

The dialog for the configuration of a measurement point has the following entries:

- *Name* is the unique label that is used to identify the measurement point. Name is used to identify the measurement point in graphs and lists and to reference the measurement point from other measurement points.
- *Interface* is the communication interface that used to communicate with the measurement instrument. Use the right-click to display a popup menu with a list of detected interface and select the correct entry. Note that some of the options for configuring the UT-ONE will only be available if UT-ONE is connected, switched on and the interface is not locked by another software package.
- *t90 Source* determines how the temperature is acquired for this measurement point using the specified communication interface. There are eight options available:
 - *UT-ONE Main Channel* will acquire the temperature from the UT-ONE over specified communication interface and with given channel configuration. Use right-click to select one of the available channels and probes from the popup menu. Range is selected automatically after you select the probe, but you can change it manually later. Acquisition rate is 2 seconds by default, but you can change from 1 to 5 seconds. Connection configuration allows you to configure the channel for 3-wire or 2-wire connection or thermocouple acquisition on the auxiliary input. Use Default for 4-wire resistance measurement or thermocouple measurement on voltage inputs.
 - *UT-ONE Ambient Probe* will acquire temperature from the ambient probe connected to UT-ONE with specified interface. No further configuration is required.
 - *External Hygrometer* will acquire temperature from the temperature probe of the MBW 473 mirror hygrometer connected to specified interface. No further configuration is required.
 - *External Combined Probe 1* will acquire temperature from the Rotronic HC2 probe connected to specified serial interface.
 - *External Combined Probe 2* will acquire temperature from the Rotronic HCD probe connected to specified serial interface.
 - *External Chamber (SetPoint)* will acquire SetPoint temperature from the Kambič Metrology climatic chamber connected to specified serial interface. Note you must configure one measurement point with this option in order to enable chamber control feature.
 - *External Chamber (Value)* will acquire current temperature from the Kambič Metrology climatic chamber connected to specified serial interface.

- *Not Used* will not acquire any temperatures. Use this option if you would like to acquire only relative humidity.
- *RH Source* determines how the relative humidity is acquired or calculated. There are nine options available:
 - *Calculate from e and t90* will calculate the relative humidity from acquired temperature and acquired or copied vapour pressure at this measurement point.
 - *UT-ONE Ambient Probe* will acquire relative humidity from the ambient probe connected to UT-ONE with specified interface.
 - *External Hygrometer* will acquire relative humidity from the MBW 473 mirror hygrometer connected to specified interface. Use this option if mirror hygrometer was calibrated to relative humidity and not to dew point. Using this option should give the same result as using *Calculate from e and t90*, if vapour pressure was acquired from hygrometer.
 - *External Combined Probe 1* will acquire relative humidity from the Rotronic HC2 probe connected to specified serial interface.
 - *External Combined Probe 2* will acquire relative humidity from the Rotronic HCD probe connected to specified serial interface.
 - *External Chamber (SetPoint)* will acquire SetPoint relative humidity from the Kambič Metrology climatic chamber connected to specified serial interface. Note that you must configure one measurement point with this option in order to enable setting RH setpoints with the chamber control feature.
 - *External Chamber (Value)* will acquire current relative humidity from the Kambič Metrology climatic chamber connected to specified serial interface.
 - *Psychrometer* will calculate relative humidity from the temperatures of wet and dry thermometer using the psychrometric equation. If you select this option, make sure you also select *Psychrometer* option for the vapour pressure source.
 - *Not Used* will not acquire or calculate relative humidity. Use this option if you would like to acquire only temperature.
- *e and td source* determines how water vapour pressure and associated dew-point temperature are acquired or calculated. There are five options available:
 - *Calculate from RH and t90* will calculate the water vapour pressure and dew-point temperature from acquired temperature and acquired relative humidity at this measurement point. Use this option if relative humidity was acquired using the UT-ONE ambient probe.
 - *Copy from Reference Measurement Point* will copy the vapour pressure and dew-point temperature from the measurement point that you specify in the *Reference e and td* box. You can select the name of the reference measurement point from the popup menu.
 - *External Hygrometer* will acquire dew-point temperature from the MBW 473 mirror hygrometer connected to specified interface. Vapour pressure will be calculated from the acquired dew point temperature using the Sonntag equation.
 - *Psychrometer* will calculate water vapour from the temperatures of wet and dry thermometer using the psychrometric equation. If you select this option, make sure you also select *Psychrometer* option for the relative humidity source. Temperature measured at this measurement point will be used for wet-bulb temperature. You must specify the measurement point where dry-bulb temperature was measured in the *Dry Bulb* control (you may use the popup menu to display a list of available names). Specify the value of the psychrometric constant ($A = A0 + A1 \cdot t_w$) or use the popup menu to select one of the commonly used values.
 - *Not Used* will not acquire or calculate vapour pressure and dew-point temperature. Use this option if you would like to acquire only temperature.
- *Description* is a longer text that usually describes the position or function of the measurement point. Description is often changed after the configuration is loaded from the configuration file to describe the particular measurement case. Description has no effect on measurement procedure, but it is stored in the measurement header in the measurement file and can be used to identify measurements.

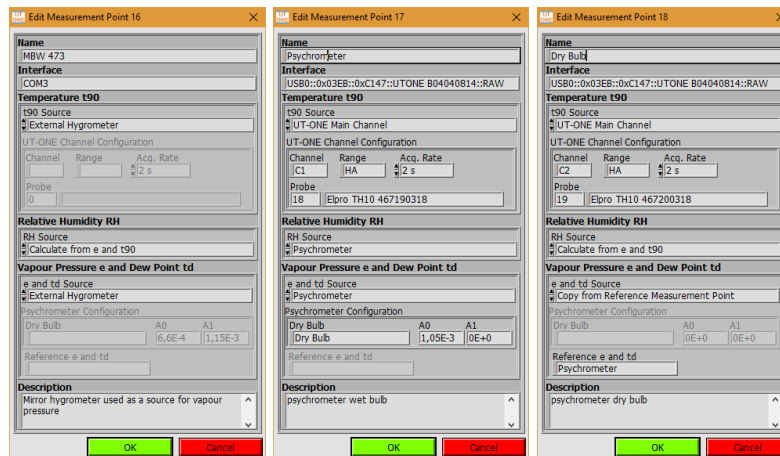


Figure 42: Examples of measurement point configuration

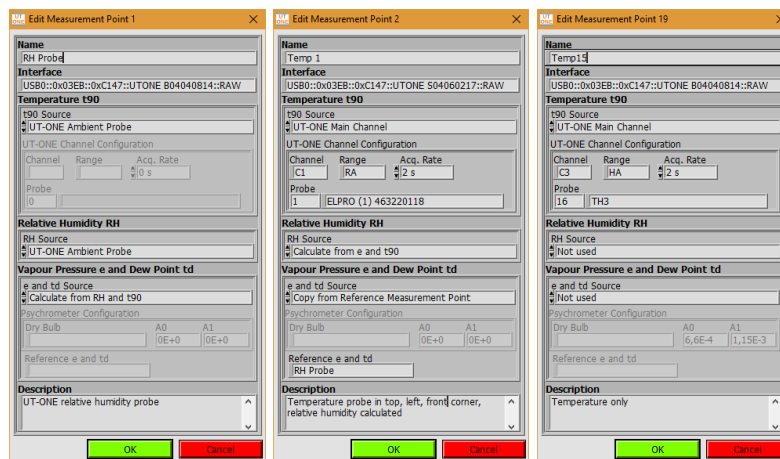


Figure 43: More examples of measurement point configuration

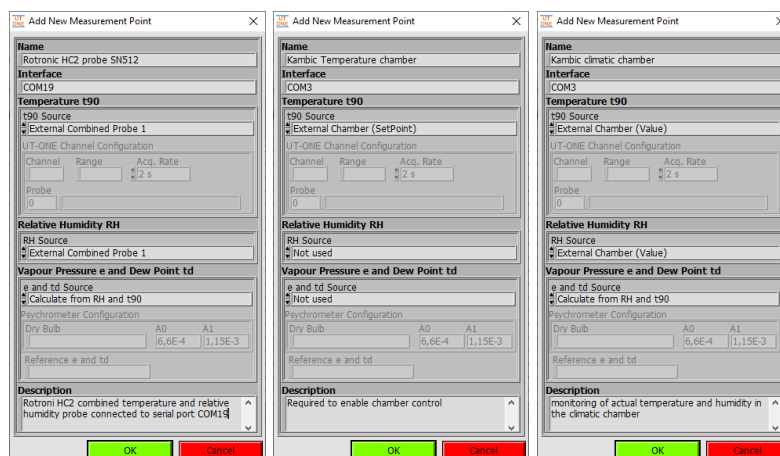


Figure 44: More examples of measurement point configuration

Most commonly, the first measurement point is the source of the vapour pressure value and is used as reference measurement point in the following measurement points. If you enter a temperature-only measurement point before the source of vapour pressure, you will not be able to choose the reference measurement point for vapour pressure, so you will have to readjust it after you finally enter the

reference measurement point. Note that the measurement procedure will be able to perform measurements regardless of the order of the measurement points.

The source of vapour pressure can be a relative humidity probe, mirror hygrometer or a psychrometer, as presented in the examples above. Note that you can measure vapour pressure at more than one point and that you can use any of them as a reference measurement point.

The rest of the measurement points acquire only temperature, while the relative humidity is calculated from the copied vapour pressure. Alternatively, you may also choose to ignore relative humidity, so only temperature is acquired and recorded.

If you would like to control the Kambič climatic chamber using the chamber control feature, you must configure one of the measurement points with the temperature source *External Chamber (SetPoint)* and specify the correct serial interface. This serial interface will be used to communicate with the chamber from the chamber control program. If you would like to set also the RH setpoint from the chamber control program, you must configure also the relative humidity source *External Chamber (SetPoint)*. This is not required if you are using temperature-only chamber.

Some of the most common configurations are presented in figures below. Note that there are many more valid configurations with different combinations of sensors and acquisition parameters.

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	Mirror Hygrome	COM3	External Hygrometer	Calculate from e and t90	External Hygrometer
2	Point 1	UTONE S04060217	UT-ONE (C1, ELPRO (1) 463220118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
3	Point 2	UTONE S04060217	UT-ONE (C2, ELPRO (2) 463230118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
4	Point 3	UTONE S04060217	UT-ONE (C3, ELPRO (3) 463240118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
5	Point 4	UTONE S04060217	UT-ONE (C4, ELPRO (4) 463250118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
6	Point 5	UTONE S04060217	UT-ONE (C5, ELPRO (5) 463260118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
7	Point 6	UTONE S04060217	UT-ONE (C6, ELPRO (6) 463270118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
8	Point 7	UTONE S04060217	UT-ONE (C7, ELPRO (7) 463280118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
9	Point 8	UTONE S04060217	UT-ONE (C8, ELPRO (8) 463290118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
10	Point 9	UTONE S04060217	UT-ONE (C9, ELPRO (9) 463300118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
11	Point 10	UTONE S04060217	UT-ONE (C10, ELPRO (10) 463310118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
12	Point 11	UTONE S04060217	UT-ONE (C11, ELPRO (11) 463320118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"
13	Point 12	UTONE S04060217	UT-ONE (C12, ELPRO (12) 463330118)	Calculate from e and t90	Copy e from "Mirror Hygrometer"

Figure 45: Configuration with external hygrometer and 12 thermometers

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	RH Probe	UTONE S04040814	UT-ONE Ambient Probe	Calculate from RH and t90	UT-ONE Relative humidity probe
2	Point 1	UTONE S04060217	UT-ONE (C7, ELPRO (1) 463220118)	Calculate from e and t90	Copy e from "RH Probe"
3	Point 2	UTONE S04060217	UT-ONE (C8, ELPRO (8) 463290118)	Calculate from e and t90	Copy e from "RH Probe"
4	Point 3	UTONE S04060217	UT-ONE (C9, ELPRO (9) 463300118)	Calculate from e and t90	Copy e from "RH Probe"
5	Point 4	UTONE S04060217	UT-ONE (C10, ELPRO (10) 463310118)	Calculate from e and t90	Copy e from "RH Probe"
6	Point 5	UTONE S04060217	UT-ONE (C11, ELPRO (11) 463320118)	Calculate from e and t90	Copy e from "RH Probe"
7	Point 6	UTONE S04060217	UT-ONE (C12, ELPRO (12) 463330118)	Calculate from e and t90	Copy e from "RH Probe"

Figure 46: Configuration with UT-ONE Ambient Probe and 6 thermometers

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	Wet Bulb	UTONE S04060217	UT-ONE (C1, Elpro TH10 467190318)	Psychrometer	Psychrometer (Dry Bulb= "Dry Bulb")
2	Dry Bulb	UTONE S04060217	UT-ONE (C2, Elpro TH10 467200318)	Calculate from e and t90	Copy e from "Wet Bulb"
3	Corner 1	UTONE S04060217	UT-ONE (C4, ELPRO (4) 463250118)	Calculate from e and t90	Copy e from "Wet Bulb"
4	Corner 2	UTONE S04060217	UT-ONE (C5, ELPRO (5) 463260118)	Calculate from e and t90	Copy e from "Wet Bulb"
5	Corner 3	UTONE S04060217	UT-ONE (C6, ELPRO (6) 463270118)	Calculate from e and t90	Copy e from "Wet Bulb"
6	Corner 4	UTONE S04060217	UT-ONE (C7, ELPRO (7) 463280118)	Calculate from e and t90	Copy e from "Wet Bulb"
7	Corner 5	UTONE S04060217	UT-ONE (C8, ELPRO (8) 463290118)	Calculate from e and t90	Copy e from "Wet Bulb"
8	Corner 6	UTONE S04060217	UT-ONE (C9, ELPRO (9) 463300118)	Calculate from e and t90	Copy e from "Wet Bulb"
9	Corner 7	UTONE S04060217	UT-ONE (C10, ELPRO (10) 463310118)	Calculate from e and t90	Copy e from "Wet Bulb"
10	Corner 8	UTONE S04060217	UT-ONE (C11, ELPRO (11) 463320118)	Calculate from e and t90	Copy e from "Wet Bulb"
11	Center	UTONE S04060217	UT-ONE (C3, ELPRO (3) 463240118)	Calculate from e and t90	Copy e from "Wet Bulb"

Figure 47: Configuration with psychrometer and 9 thermometers

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	Temp 1	UTONE S04060217	UT-ONE (C1, ELPRO (1) 463220118)	NOT USED	Temperature in top left front corner
2	Temp 2	UTONE S04060217	UT-ONE (C2, ELPRO (2) 463230118)	NOT USED	Temperature in top left back corner
3	Temp 3	UTONE S04060217	UT-ONE (C3, ELPRO (3) 463240118)	NOT USED	Temperature in top right front corner
4	Temp 4	UTONE S04060217	UT-ONE (C4, ELPRO (4) 463250118)	NOT USED	Temperature in top right back corner
5	Temp 5	UTONE S04060217	UT-ONE (C5, ELPRO (5) 463260118)	NOT USED	Temperature in center
6	Temp 6	UTONE S04060217	UT-ONE (C6, ELPRO (6) 463270118)	NOT USED	Temperature in bottom left front corner
7	Temp 7	UTONE S04060217	UT-ONE (C7, ELPRO (7) 463280118)	NOT USED	Temperature in bottom left back corner
8	Temp 8	UTONE S04060217	UT-ONE (C8, ELPRO (8) 463290118)	NOT USED	Temperature in bottom right front corner
9	Temp 9	UTONE S04060217	UT-ONE (C9, ELPRO (9) 463300118)	NOT USED	Temperature in bottom right back corner

Figure 48: Configuration with 9 thermometers and no relative humidity

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	MBW 473	COM3	External Hygrometer	Calculate from e and t90	External Hygrometer
2	Ambient Probe	UTONE B04040814	UT-ONE Ambient Probe	UT-ONE Ambient Probe	Calculate from RH and t90
3	Wet Bulb	UTONE B04040814	UT-ONE (C2, Elpro TH10 467190318)	Psychrometer	Psychrometer (Dry Bulb="Dry Bulb")
4	Dry Bulb	UTONE B04040814	UT-ONE (C3, Elpro TH10 467200318)	Calculate from e and t90	Copy e from "Wet Bulb"
5	Corner 1	UTONE S04060217	UT-ONE (C1, ELPRO (1) 463220118)	Calculate from e and t90	Copy e from "MBW 473"
6	Corner 2	UTONE S04060217	UT-ONE (C2, ELPRO (2) 463230118)	Calculate from e and t90	Copy e from "MBW 473"
7	Corner 3	UTONE S04060217	UT-ONE (C3, ELPRO (3) 463240118)	Calculate from e and t90	Copy e from "MBW 473"
8	Corner 4	UTONE S04060217	UT-ONE (C4, ELPRO (4) 463250118)	Calculate from e and t90	Copy e from "MBW 473"
9	Center	UTONE S04060217	UT-ONE (C5, ELPRO (5) 463260118)	Calculate from e and t90	Copy e from "Ambient Probe"
10	Corner 5	UTONE S04060217	UT-ONE (C6, ELPRO (6) 463270118)	Calculate from e and t90	Copy e from "Wet Bulb"
11	Corner 6	UTONE S04060217	UT-ONE (C7, ELPRO (7) 463280118)	Calculate from e and t90	Copy e from "Wet Bulb"
12	Corner 7	UTONE S04060217	UT-ONE (C8, ELPRO (8) 463290118)	Calculate from e and t90	Copy e from "Wet Bulb"
13	Corner 8	UTONE S04060217	UT-ONE (C9, ELPRO (9) 463300118)	Calculate from e and t90	Copy e from "Wet Bulb"
14	Aux 1	UTONE S04060217	UT-ONE (C10, ELPRO (10) 463310118)	NOT USED	NOT USED

Figure 49: Configuration with three different vapour-pressure sources, two UT-ONE units and 10 thermometers

Configuration List					
Name	Interface	Temperature Source	Relative Humidity Source	Vapour Pressure and Dewpoint Source	Description
1	Kambic Chamber	COM19	External Chamber (SetPoint)	External Chamber (SetPoint)	NOT USED
2	Kambic Chamber Value	COM19	External Chamber (Value)	External Chamber (Value)	Calculate from RH and t90
3	Probe 1	UTONE S15060217	UT-ONE (C1, Pt-100 ISO/IEC751)	NOT USED	NOT USED

Figure 50: Configuration with Kambic climatic chamber and one thermometer probe

1.8.4 Measurement file

This application can store the results of measurements in a tab-separated text file, which can be opened in a text editor (such as Notepad) or imported to MS Excel or similar software package for further analysis and report generation.

When you start the application, you are immediately prompted to enter the measurement file path and name. You can change the default path and location. By default, measurement files are stored in a specified root path in a current year directory. Default file name consist of CCV prefix and date stamp. The first time you start this application you will be prompted to select the root path where measurement files will be stored by default. You can change the root path later by editing the "UT-ONE Settings.ini" file in the application directory.

If you select an existing file, you will be prompted to load the existing measurements and configuration from the file. New measurements will be appended to this file.

If you cancel the measurement file selection, the measurements will not be saved to the measurement file and the *Measurement File* control will be painted in red. You can use the popup menu to select the file later, but any previously made measurements will be lost.

Measurement file stores both the configuration and measurement data. Note that configuration files are basically measurement files with no measurement data. It is therefore possible to load the configuration in the configuration list from an existing measurement file.

Measurement file is created when you start the measurement for the first time. After the file is created, you can't change its name or path any more.

Use the popup menu on the *Measurement File* control to open the measurement file in the default text editor or explore its location in Windows Explorer.

Measurements can be reload from existing measurement files by selecting the file during the application startup. This allows you to perform data analysis, calculate statistics and export readings after you completed the measurements.

1.8.5 Measurement

After you load or configure measurement configuration and optionally select the measurement file, you can proceed with measurements. Note that measurements are performed automatically and the measurement procedure is completely transparent to the user.

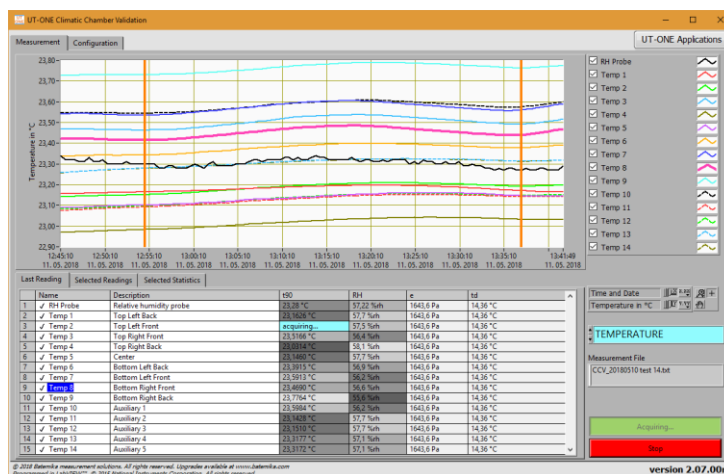


Figure 51: Measurement page with temperature display selected

To start the measurement, select the *Measurement* page and click the green *Start* button. The application will immediately start the acquisition and display the results in the measurement list. After all measurement points are acquired, the measurement is appended to the graph and optionally saved to the measurement file.

If you can't start the measurement because the green *Start* button is disabled, check that the configuration list was configured and all entries are valid. Invalid entries will be painted in red.

To stop the measurement, click the red *Stop* button. The acquisition will stop immediately and the last acquired readings will be discarded.

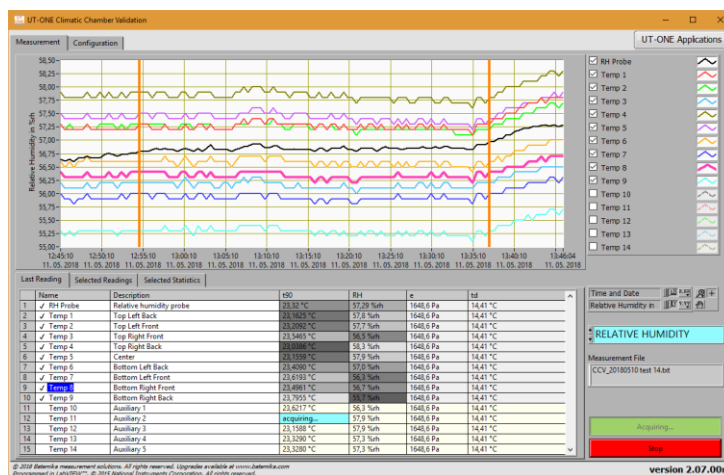


Figure 52: Measurement page with relative humidity display selected and auxiliary points excluded

1.8.6 Data analysis

Analysis of the measurement data can be performed during the acquisition or after the acquisition is completed, possibly even by reloading the measurement data from the measurement file.

The results for the current reading are displayed in the measurement list on the *Last Reading* page. Measurement list includes readings for all four acquired quantities. The readings are painted in grey scale according to their value. Some measurement points can be excluded from the graph and statistical analysis by unchecking the graph in the graph legend or by double clicking the measurement point in the measurement list. Note that the excluded measurement point will be normally acquired and stored, it will just not be displayed on graph and included in statistics.

Name	Description	t50	RH	e	td
1	RH Probe	23.40 °C	57.55 %rh	1663.1 Pa	14.55 °C
2	Temp 1	23.1168 °C	58.3 %rh	1663.1 Pa	14.55 °C
3	Temp 2	23.3308 °C	58.1 %rh	1663.1 Pa	14.55 °C
4	Temp 3	23.3804 °C	58.9 %rh	1663.1 Pa	14.55 °C
5	Temp 4	23.5988 °C	58.7 %rh	1663.1 Pa	14.55 °C
6	Temp 5	23.4367 °C	58.3 %rh	1663.1 Pa	14.55 °C
7	Temp 6	23.6511 °C	57.4 %rh	1663.1 Pa	14.55 °C
8	Temp 7	23.6511 °C	56.7 %rh	1663.1 Pa	14.55 °C
9	Temp 8	23.3278 °C	57.1 %rh	1663.1 Pa	14.55 °C
10	Temp 9	23.8188 °C	56.1 %rh	1663.1 Pa	14.55 °C
11	Temp 10	23.6490 °C	56.7 %rh	1663.1 Pa	14.55 °C
12	Temp 11	23.1682 °C	58.3 %rh	1663.1 Pa	14.55 °C
13	Temp 12	26.1795 °C	58.3 %rh	1663.1 Pa	14.55 °C
14	Temp 13	23.3622 °C	57.6 %rh	1663.1 Pa	14.55 °C
15	Temp 14	23.3812 °C	57.7 %rh	1663.1 Pa	14.55 °C

Figure 53: Last Reading page with "RH probe" excluded

The graph and statistics can display values only for one quantity, so use the blue display selector to select between temperature, relative humidity, vapour pressure and dew point. Note that although only one quantity is displayed, all quantities are acquired and stored according to the selected configuration.

The graph has two cursors, which allow you to select a range of measurements that are used in the analysis and for exporting the data. You can review selected readings in the *Selected Readings* page. Use the popup menu on the readings list to copy the readings to clipboard. This allows you to paste the readings directly to MS Excel and simply create graphs and reports.

Date and Time	Relative hum	Temp 1	Temp 2	Temp 3	Temp 4	Temp 5	Temp 6	Temp 7	Temp 8	Temp 9	Temp 10	Aux 1	Aux 2	Aux 3	Aux 4	Aux 5
11. 05. 2018 12:54:42	23.3000 °C	23.1648 °C	23.1509 °C	23.4403 °C	22.9838 °C	23.1027 °C	23.3437 °C	23.5353 °C	23.4143 °C	23.7905 °C						
11. 05. 2018 12:55:14	23.3000 °C	23.1651 °C	23.1520 °C	23.4638 °C	22.9838 °C	23.1014 °C	23.3427 °C	23.5350 °C	23.4142 °C	23.7309 °C						
11. 05. 2018 12:55:46	23.3000 °C	23.1656 °C	23.1526 °C	23.4636 °C	22.9843 °C	23.1021 °C	23.3429 °C	23.5356 °C	23.4150 °C	23.7311 °C						
11. 05. 2018 12:56:16	23.2800 °C	23.1661 °C	23.1531 °C	23.4639 °C	22.9845 °C	23.1025 °C	23.3442 °C	23.5367 °C	23.4163 °C	23.7317 °C						
11. 05. 2018 12:56:47	23.2800 °C	23.1670 °C	23.1544 °C	23.4644 °C	22.9858 °C	23.1038 °C	23.3448 °C	23.5372 °C	23.4165 °C	23.7319 °C						
11. 05. 2018 12:57:17	23.2900 °C	23.1672 °C	23.1549 °C	23.4653 °C	22.9866 °C	23.1038 °C	23.3457 °C	23.5386 °C	23.4175 °C	23.7327 °C						
11. 05. 2018 12:57:47	23.2900 °C	23.1679 °C	23.1562 °C	23.4658 °C	22.9877 °C	23.1054 °C	23.3470 °C	23.5400 °C	23.4192 °C	23.7327 °C						
11. 05. 2018 12:58:17	23.2800 °C	23.1675 °C	23.1572 °C	23.4676 °C	22.9882 °C	23.1059 °C	23.3485 °C	23.5418 °C	23.4207 °C	23.7337 °C						
11. 05. 2018 12:58:48	23.2800 °C	23.1685 °C	23.1585 °C	23.4692 °C	22.9891 °C	23.1060 °C	23.3500 °C	23.5437 °C	23.4224 °C	23.7344 °C						
11. 05. 2018 12:59:18	23.2800 °C	23.1694 °C	23.1598 °C	23.4707 °C	22.9900 °C	23.1073 °C	23.3509 °C	23.5458 °C	23.4246 °C	23.7351 °C						
11. 05. 2018 12:59:48	23.2900 °C	23.1701 °C	23.1614 °C	23.4730 °C	22.9914 °C	23.1079 °C	23.3528 °C	23.5473 °C	23.4265 °C	23.7367 °C						

Figure 54: Selected Readings page

The statistics for the selected readings, selected measurement points and selected display quantity is displayed in the *Selected Statistics* page. Note that excluded measurement points are not displayed in the statistics list at all. This allows you to eliminate some additional measurements points that are not supposed to be part of the climatic chamber validation (for example measurement at the fan inlet) or some auxiliary measurements, such as the temperature of the psychrometer wet bulb, which is not a temperature related to the performance of the climatic chamber. Use the popup menu to copy the selected statistics to the clipboard.

Name	Description	Mean	STD	Max	Min	Max-Min
Temp 1	Top Left Back	57.29 %rh	0.0940 %rh	57.40 %rh	57.10 %rh	0.300 %rh
Temp 2	Top Left Front	57.24 %rh	0.0690 %rh	57.40 %rh	57.10 %rh	0.300 %rh
Temp 3	Top Right Front	56.15 %rh	0.0628 %rh	56.30 %rh	56.00 %rh	0.300 %rh
Temp 4	Top Right Back	57.83 %rh	0.0822 %rh	58.00 %rh	57.60 %rh	0.400 %rh
Temp 5	Center	57.42 %rh	0.0829 %rh	57.60 %rh	57.20 %rh	0.400 %rh
Temp 6	Bottom Left Back	56.59 %rh	0.0662 %rh	56.70 %rh	56.40 %rh	0.300 %rh
Temp 7	Bottom Left Front	55.92 %rh	0.0549 %rh	56.00 %rh	55.80 %rh	0.200 %rh
Temp 8	Bottom Right Front	56.33 %rh	0.0569 %rh	56.40 %rh	56.20 %rh	0.200 %rh
Temp 9	Bottom Right Back	55.28 %rh	0.0687 %rh	55.40 %rh	55.10 %rh	0.300 %rh
Temp 10	Auxiliary 1	55.90 %rh	0.0606 %rh	56.00 %rh	55.80 %rh	0.200 %rh
Temp 11	Auxiliary 2	57.44 %rh	0.0763 %rh	57.60 %rh	57.30 %rh	0.300 %rh
Temp 12	Auxiliary 3	57.42 %rh	0.0797 %rh	57.60 %rh	57.20 %rh	0.400 %rh
Temp 13	Auxiliary 4	56.83 %rh	0.0701 %rh	57.00 %rh	56.70 %rh	0.300 %rh
Temp 14	Auxiliary 5	56.83 %rh	0.0687 %rh	57.00 %rh	56.70 %rh	0.300 %rh

Figure 55: Selected Statistics page

Use the popup menu on the graph to execute these menu commands:

- *Clear All Readings* will clear all acquired readings from graph and memory, but they will remain stored in the measurement file (if measurement file was selected). Use this command before you start a new set of measurements and the existing readings would interfere with graph autoscaling.
- *Clear Selected Readings* will clear readings that are selected between graph cursors. Readings will be removed from graph and memory, but they will remain stored in the measurement file (if measurement file was selected). Use this command if there are just a few readings that are either erroneous or out of scale.
- *Zoom Graph to Cursors* will change graph X scale so that the graph cursors are clearly visible in the middle of the graph area. Cursor position and consequently selected data will not be changed. Use this command if you would like to review the selected readings or if you would like to make a fine adjustment of the selected readings range.
- *Move Cursors to Graph Center* will move the cursors and consequently the selected data to the center of the graph area. Graph scaling is not changed by this operation. Use this command if you have zoomed in the graph and cursors are no longer visible in the currently visible graph area.
- *Graph Legend* allows you to select the label that is used to identify plots in the graph legend. You can choose between measurement point name, description and index.
- *Export ALL Readings to File* will create a new measurement file with the name and path that you specify and save all available readings to file. If any of the readings were previously cleared, they will not be exported. Note that this file is independent of the measurement file, which is used to save readings during measurement. This operation can take several minutes if there are a lot of readings. Graph cursors are used to indicate export progress. This command is only available when the measurement is stopped.
- *Export SELECTED Readings to File* is similar to the previous command, but instead of exporting all readings, it exports only readings that were selected with graph cursors.
- *Restore Readings from Current File* will reload all readings that were previously saved in the currently selected measurement file. Note that this command will overwrite any readings that may be currently displayed on the graph, so make sure that all required readings were actually stored in the measurement file. This command is useful if you have (accidentally) cleared some readings and you would like to restore them back. This command is only available when the measurement is stopped.

Readings can be reviewed in graphical format on the main graph. Main graph offers many features that are inherent to LabVIEW graphs, such as zooming, scaling and autoscaling the graph axes, changing graph colours and plot appearance, etc. Most of these features are accessible in the graph legend, axis legend and tools palette on the right-hand side of the main graph. If you are not familiar with LabVIEW and LabVIEW graph features, you may consider learning more about LabVIEW graphs in LabVIEW support at www.ni.com.

1.8.7 Chamber control

Chamber Control feature enables the user to synchronize the chamber setpoints and temperature/relative humidity acquisition from a single application. This feature enables simple manual setting of temperature and relative humidity setpoints, as well as a more complex chamber program, which enables setting several setpoints with adjustable time intervals.

This feature currently support Kambič metrology climatic chambers with serial communication interface. Other chamber types may be included by integrating a suitable communication driver.

To enable chamber control feature, you must first configure one measurement point with the temperature source set to *External Chamber*. Make sure you select the correct serial communication interface. Climatic chamber must have the serial interface baud rate set to 19200 bauds.

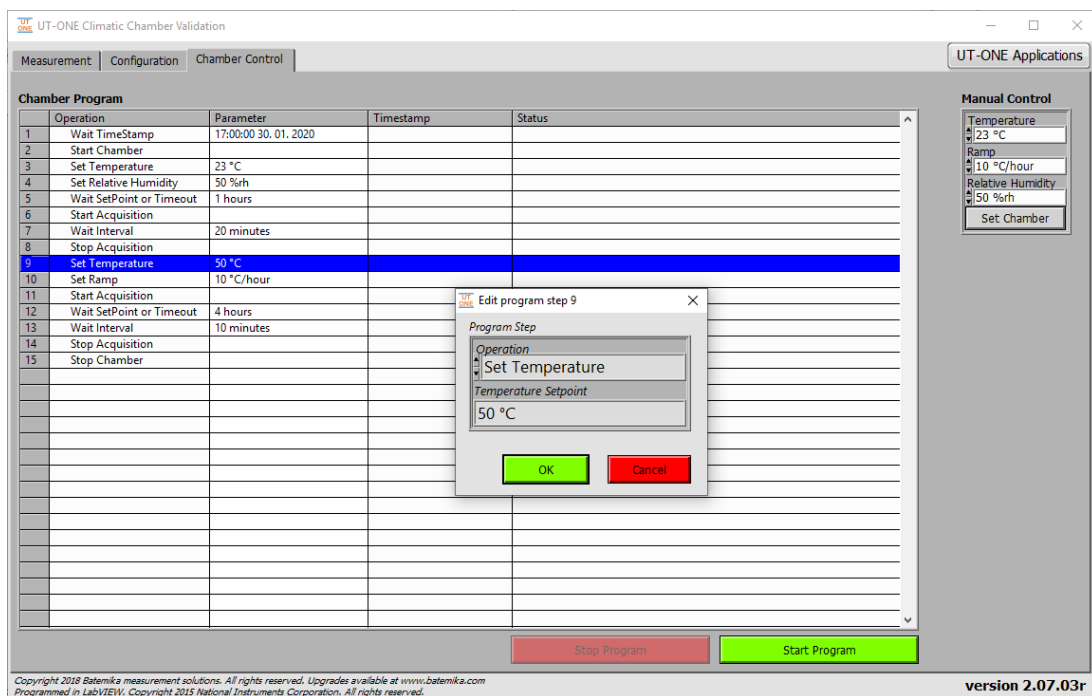


Figure 56: Chamber Control page

Chamber program consists of a set of program steps. A program step can be added by double-clicking an empty row. Alternatively, steps can be managed using commands from the popup menu.

Each program step consists of the operation and parameter, which can be edited in the Program Step dialog. The following operations are available:

- *Set Temperature* will send a new temperature setpoint to the chamber. Application will read the setpoint back from the chamber and compare it to the new setting. If there is a difference, a warning is displayed in the step status. Make sure that setpoints are within the temperature range of the particular climatic chamber, otherwise unexpected behaviour may occur.
- *Set Ramp* will send a new temperature ramp to the chamber. Application will read the ramp back from the chamber and compare it to the new setting. If there is a difference, a warning is displayed in the step status.
- *Set Relative Humidity* will send a new relative humidity setpoint to the chamber. Application will read the setpoint back from the chamber and compare it to the new setting. If there is a difference, a warning is displayed in the step status. Make sure that setpoints are within the relative humidity range of the particular climatic chamber, otherwise unexpected behaviour may occur. Note that relative humidity limits may vary with temperature setpoint for a specific chamber type.
- *Wait Interval* will wait for a specified fixed time interval, for example 30 minutes. After the time expires, the program will continue execution with the next step. If configured, the acquisition of measurement points will proceed normally during waiting period.
- *Wait TimeStamp* will wait until the specified absolute time. This command is especially useful for tests with a delayed start. For example, you may configure the application to start the program at midnight, so the chamber is already stable and ready for work in the morning.
- *Wait SetPoint or Timeout* will continuously monitor the chamber temperature setpoint and value, until they are the same for a period of 10 minutes. This gives a rough indication of a stable state. The application will allow some scatter in the temperature values by checking the median of readings and not the mean value. As a safeguard, you can set the timeout interval, which will allow the program to proceed to next program step after the timeout has elapsed. This is useful in cases when the stability criteria of the chamber is not met.
- *Start Chamber* will instruct chamber to start chamber operation.

- *Stop Chamber* will instruct chamber to stop chamber operation.
- *Start Acquisition* will start the main acquisition of configured measurement points. This is equivalent to clicking the green *Start* button on the *Measurement* page. This operation allows you to delay the start of acquisition and you can avoid storing irrelevant data (for example before the chamber is stable).
- *Stop Acquisition* will stop the main acquisition of configured measurement points. This is equivalent to clicking the red *Stop* button on the *Measurement* page.

Program is started by clicking the green *Start Program* button. Alternatively, you can use the command from the popup menu, which allows you also to start the program at any program step.

Program can be saved or loaded from the program file using the popup menu command. Also, after you start the program, the application will create an autosave copy of the program, which will be automatically loaded at next application start.

After the program is started, you can observe the status of the current and previous steps. In case of detected issues, the application will display a warning or error status.

Program steps can be skipped or paused using the command from the popup menu. You can also select any program step and use the popup menu command to continue program execution at selected step.

Note that chamber program execution is essentially independent of measurement acquisition. This allows you to start the program with or without measurement acquisition and start/stop measurement acquisition during program execution.

1.9 UT-ONE Parallel Acquisition

UT-ONE Parallel Acquisition is a specialised application that allows fast parallel acquisition from multiple UT-ONE units. It was primarily designed for use with UT-ONE S01A 1-channel units, but it can work normally with any UT-ONE thermometer readout.

This application is applicable for procedures where multiple temperature probes must be acquired at the same time and with a very short sampling time, so consecutive acquisition on a multi-channel device is not fast enough. This application allows acquisition rates of up to 2 samples per second on all probes.

Acquired readings are presented on the graph and stored in a measurement file.

The number of UT-ONE devices that can be acquired by this application is limited only with operating system resources. Note that USB standard allows the connection of up to 127 devices and some of them are already used by other computer peripherals. Available computer memory and processing power can also limit the total number of devices. The system was tested with 10 UT-ONE devices and performed flawlessly. A system with up to 30 devices should be able to work, but it would require some additional testing and optimization.

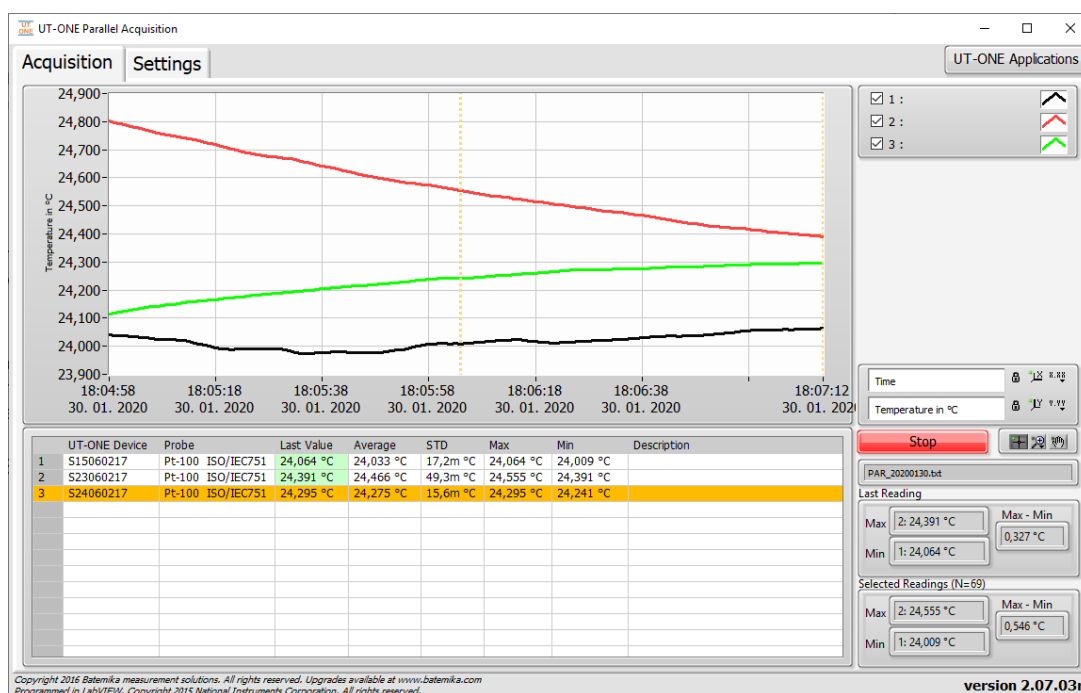


Figure 57: Parallel Acquisition application

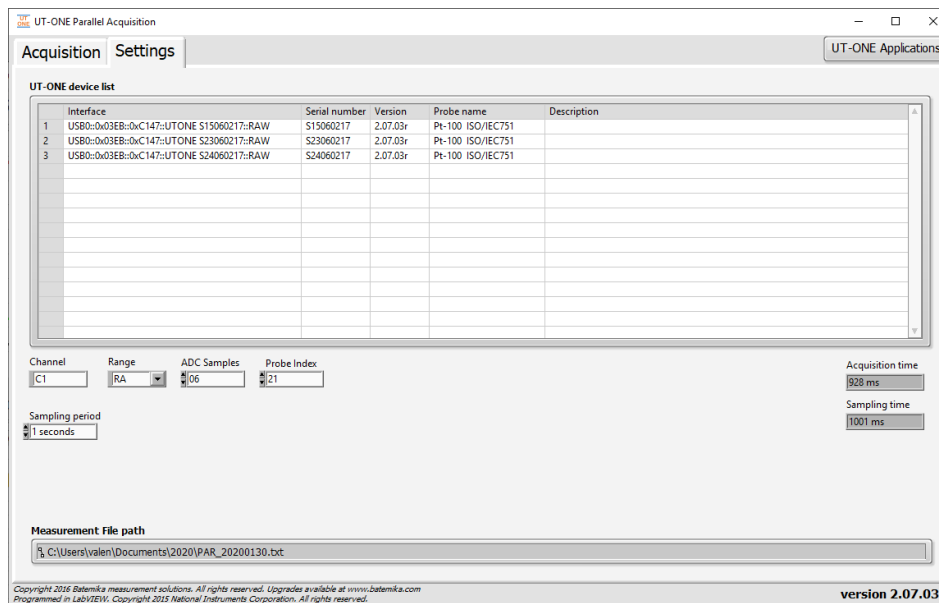


Figure 58: Settings page for Parallel Acquisition

To configure your parallel acquisition system, you must first add UT-ONE devices in the *UT-ONE device list* using the command from the popup menu. The system will autodetect all connected UT-ONE devices and display their USB addresses in a submenu. Note that you can only select a particular UT-ONE device once and use for acquisition on one main channel.

The acquisition settings are common for all UT-ONE devices. You can select channel (typically C1), measurement range (typically autorange RA for Pt-100 probes) and Probe Index used for conversion of acquired raw value to temperature. If you are using user-defined probe coefficients, make sure you store them under the same probe index on all UT-ONE devices.

Sampling rate is primarily determined by the *ADC Samples* parameter, which determines how many ADC samples are acquired and averaged to produce one temperature reading. You can between 1 and 40 samples. Recommended value is 6 samples, which will result in 1 temperature reading per second.

Sampling period parameter allows you to synchronize readings with computer clock. Make sure sampling time is larger than acquisition time, otherwise the acquisition rate will be determined by *ADC Samples parameter* and readings will be acquired asynchronously at maximum possible acquisition rate.

1.10 UT-ONE Firmware Upgrade

UT-ONE Firmware Upgrade is a support application used to upgrade the UT-ONE firmware. At Batemika we are constantly improving our products and this application allows you to update your existing unit with new features.

UT-ONE firmware upgrade is applicable to all models of the UT-ONE family of thermometer readouts.

On some models, firmware upgrade can only be performed using the RS232 serial interface. Always use the communication cable supplied with the UT-ONE unit. Always use 38400 baud rate setting, other baud rates are not supported by the upgrade application. If your UT-ONE unit is configured for another baud rate, change it to 38400 bauds first and then proceed with upgrade. Note that full upgrade takes about two hours at maximum baud rate for units with built-in display.

On models with no RS232 interface, upgrade must be performed using USB interface. This includes models with GPIB+RS232 interface option.

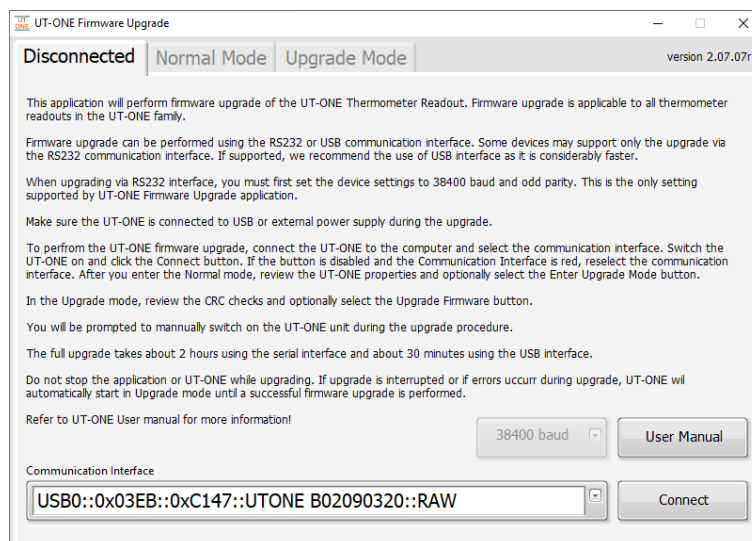


Figure 59: UT-ONE Firmware Upgrade

Start the upgrade procedure by closing all other applications that are communicating with UT-ONE. To avoid confusion, connect only one UT-ONE unit at a time during the upgrade.

Select the *VISA resource name* for your particular UT-ONE and communication interface. If UT-ONE is successfully detected on selected *VISA resource name*, the colour of the input box will change from red to white and the *Connect* button will be enabled.

Click the *Connect* button to proceed to *Normal Mode* or *Upgrade Mode* screen. Note that you can safely connect, the application will ask you later to confirm any changes to UT-ONE firmware.

If UT-ONE is running normally, application will connect to *Normal Mode* and display the UT-ONE information. Application also checks the firmware version in the device and compares it the version in the upgrade. If versions are identical, the box is coloured in green, otherwise in red. If you decide to proceed with the upgrade, click the *Enter Upgrade Mode* button. The application will set the upgrade flag in the UT-ONE and shut it down. You have to manually switch it back on. UT-ONE starts in the upgrade mode, displaying the message "Firmware is ready for update!". Click the *Connect* button to enter the *Upgrade mode*.

If you are using the USB interface, the VISA resource name of your UT-ONE device will change to "USB0::0x03EB::0xC147::BOOT::RAW". Select this entry to proceed with upgrade.

After the applications connects to upgrade mode, it checks the cyclic redundancy check (CRC) of the firmware in the device and in the upgrade and displays it in the table. Note that firmware consists of the boot section and application section, each having a separate CRC. Firmware upgrade will only update the application section. If there is a mismatch in the boot section CRC, upgrade may not be possible.

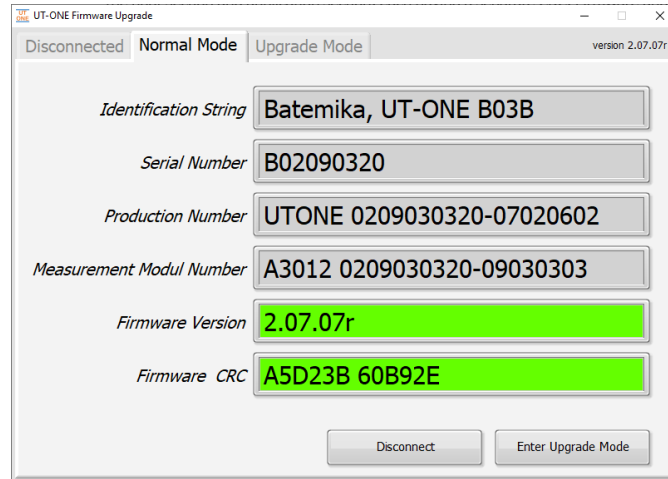


Figure 60: UT-ONE Firmware Upgrade in normal mode

To start the upgrade, click the *Upgrade Firmware* button. Upgrade procedure consist of three steps. Do not interrupt the upgrade during the first and second step. In the first step main processor firmware is upgraded. In the second step, the display firmware is updated and in the third step display data is updated. This step can be safely aborted by clicking the *Abort Upgrade* button. This is particularly useful in case of minor upgrades or bug fixes, as display data consists mainly of images, which are rarely changed. UT-ONE models without the display will finalize the upgrade after the first step.

The full upgrade takes about 2 hours using RS232 interface and 30 minutes using the USB interface.

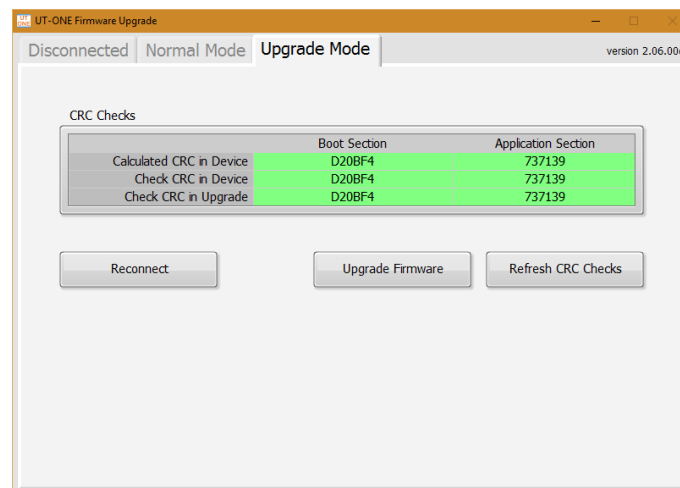


Figure 61: UT-ONE Firmware Upgrade during upgrade

After the upgraded is completed, click the *Reconnect* button to shut down the UT-ONE unit. After you manually restart the device, it will launch with the upgraded firmware.

Always connect the UT-ONE to external power supply during the update. Power consumption during update is considerably higher than normal, so battery may drain out faster than expected, resulting in data corruption