

UT-ONE SxxA

xx-Channel Thermometer Readout

BATEMIKA
measurement solutions

UT-ONE S12A

UT-ONE S04A



- ❖ 4 or 12 channel temperature measurement
- ❖ High accuracy, stability and repeatability
- ❖ Platinum resistance thermometers
- ❖ Thermistors
- ❖ Thermocouples
- ❖ Banana connectors for maximum flexibility
- ❖ USB communication interface
- ❖ GPIB+RS232 interface option
- ❖ Power supply via USB
- ❖ Single or continuous measurements
- ❖ Standard and custom probe characterization
- ❖ Acquisition software and LabVIEW drivers included free of charge

UT-ONE SxxA

UT-ONE S04A and S12A are precise multichannel thermometer readouts, which provides stable and accurate temperature measurements with thermistor, thermocouple and platinum resistance probes. Throughout this document, they will be referred to as UT-ONE SxxA, as the only major difference is the total number of main channels (xx).

UT-ONE SxxA is a very rugged and compact instrument, primarily applicable for integration in complex measurement systems under computer control. As UT-ONE SxxA has no built-in user interface, its configuration and acquisition functions are only accessible via remote communication interface.

UT-ONE SxxA measurement circuit is based on a precise 24 bit analog to digital converter, which in combination with internal ultra-stable resistance and voltage references, provides excellent performance characteristics.

UT-ONE SxxA is a member of the UT-ONE family of thermometer readouts, which share common accuracy specifications, remote interface commands and applications software, but have different display, interface and housing options, as well as different number of main channels to best suit end-user requirements and needs.

UT-ONE SxxA probes

UT-ONE SxxA supports all types of thermometer probes that are most commonly used in thermometry applications.

Platinum resistance probes

UT-ONE SxxA can measure platinum resistance thermometers in the range from 1 Ω to 800 Ω . This covers the full range of commonly used Pt-100 and Pt-25 sensors. Additionally, Pt-1000 sensors can be measured using the thermistor

ranges. UT-ONE SxxA supports both industrial and standard platinum resistance thermometers by providing Callendar-Van Dusen, polynomial and ITS-90 probe characterizations.

Thermistor probes

UT-ONE SxxA can measure thermistors in the range from 100 Ω to 40 k Ω . Recommended thermistor types are 3K and 10K. UT-ONE SxxA supports Steinhart-Hart and basic exponential probe characterization.

Thermocouple probes

UT-ONE SxxA can measure both base and noble metal thermocouples. Thermocouple cold-junction compensation can be performed using the internal temperature sensor or with external cold junction at fixed temperature (typically 0 $^{\circ}\text{C}$).

UT-ONE SxxA features

UT-ONE SxxA was designed with many specific features that simplify its use in both simple temperature measurements and advanced temperature-related procedures. You may now focus on your measurement problem, your instrument will work flawlessly in any situation.

Temperature coefficient correction

UT-ONE SxxA takes advantage of internal references with extremely low temperature coefficients, which are typically in the range of a few ppm/ $^{\circ}\text{C}$. In addition, each unit is individually calibrated in the temperature range from 10 $^{\circ}\text{C}$ to 36 $^{\circ}\text{C}$. The measured temperature coefficients are used in combination with the internal temperature sensor to automatically correct drifts due to temperature variations, resulting in temperature coefficients well below 1 ppm/ $^{\circ}\text{C}$.

Thermal emf compensation

Thermal emf is a parasitic voltage, which occurs with temperature gradients on junctions of

different metals. This may introduce significant errors in temperature measurements. UT-ONE SxxA is using the full current reversal technique to eliminate any influence of thermal emf in resistance measurements.

Cold junction compensation

Thermocouples are in principle differential thermometers, measuring the temperature difference between the hot and cold junction. To achieve best accuracy, cold junction can be placed in a mixture of water and ice, effectively fixing it at 0 °C. Although this method is the most accurate, it is also cumbersome and often impractical. UT-ONE SxxA features also the technique of internal cold-junction compensation. The temperature of the cold junction is measured using the internal temperature sensor and the measured emf reading is corrected accordingly in firmware. Although this method introduces additional errors, it is much more convenient for measurements with less stringent accuracy requirements.

Auto ranging

UT-ONE SxxA has six subranges for any of the PRT, thermistor or thermocouple measurement range, allowing optimal measurements over a wide dynamic range. A complex acquisition algorithm determines the optimal subrange for each reading, at no time or accuracy cost. Optionally, a fixed subrange may be selected for advanced measurement requirements. Each subrange extends approximately 20% above nominal limits, further increasing flexibility and reliability.

Self-heating evaluation

Self-heating occurs when the measurement current dissipates heat and additionally warms up the sensor. This phenomenon is inherent to all resistance measurements and can result in errors ranging from a few mK to several tens of

mK. UT-ONE SxxA features two selectable measurements currents on each resistance range, which enable the evaluation and in some cases correction of the self-heating error.

External reference resistor

UT-ONE SxxA supports the use of external reference resistor, which can be connected to one of the three main channels. The acquisition algorithm measures both the unknown and reference resistance, which enables it to eliminate any internal short-term or long-term drifts. If the temperature coefficient of the reference resistor is provided, UT-ONE SxxA can even automatically compensate the temperature drift of the reference resistance.

Connectors

UT-ONE SxxA features gold-plated banana-style connectors for the connection of thermometer probes on three main channels. These connectors support the use of probes with banana plug, spade lug or bare wire termination. Thermocouples are also connected directly to voltage pair of connectors. These connectors provide the most flexible way to connect any thermometer probe, without being limited to a connector solution of a particular manufacturer.

Probe characterizations

UT-ONE SxxA supports all commonly used probe characterizations for PRTs, thermistors and thermocouples. User may choose between probe characterization with standard coefficients and probe characterizations with coefficients obtained in the calibration of particular probe.

Communication interfaces

UT-ONE SxxA provides a USB communication interface for the connection with a computer. UT-ONE SxxA can be fully controlled and configured via communication interface.

Communication protocol is fully described in the user manual, and a set of LabVIEW drivers is provided to accelerate custom software development.

As an optional upgrade, UT-ONE SxxA can be equipped with additional GPIB+RS232 interface option.

Where is applicable?

UT-ONE SxxA thermometer readout is designed as a multichannel high-precision thermometer readout with superb flexibility, which allows its use in many computer-controlled measurement system, ranging from large-volume thermometer calibrations to validation of climatic chambers.

Thermometer calibrations

UT-ONE SxxA can be used as a working standard in calibration by comparison of thermometers. Reference thermometer probe can be connected to one of the main channels to determine the true value of temperature. The thermometer under calibration can be connected to one of the remaining main channels or, in case of indication thermometers, it can be read directly. The calibration procedure can be performed by using a dedicated calibration software, which efficiently automates the entire calibration procedure.

Test procedures

UT-ONE SxxA can be used as a precise thermometer in a wide variety of test procedures, where accurate determination of temperature is relevant to the test result. Combining high accuracy with multichannel capacity provides an excellent tool for automating procedures with high throughput and reliable results.

Precise temperature measurement

Do you need to determine the precise value of temperature in your research and development activity? Maybe in more than one point? Perhaps you are also interested in observing the temperature trends in a convenient graph? You can do this and much more with UT-ONE SxxA in combination with dedicated measurement software on a connected computer.

Long-term monitoring

Do you need to make precise long-term monitoring of temperature in multiple measurement locations? UT-ONE SxxA can make measurements without interruptions for days, months or years, storing them directly to the controlling computer.

On-site measurements

Do you need precision measurement outside your laboratory? Compact and rugged chassis make UT-ONE SxxA a perfect choice for traceable on-site measurements. Connection of the measurement system is simple and quick, you only need to connect a single USB cable to a computer (this covers all communications and power supply).

Validation of climatic chambers

UT-ONE S12A was specifically designed to cover the requirements for the practical (on-site) validation of climatic chambers. Validation of a climatic chamber is typically performed by measuring temperature in 8 corners and in the middle of the chamber. Three remaining thermometers can be used to measure temperature in additionally specified locations (for example inside a specimen) or may serve as a redundancy. UT-ONE S12A can also be supplied with a set of 12 Pt-100 probes with a proven record of applicability for climatic chamber validation.

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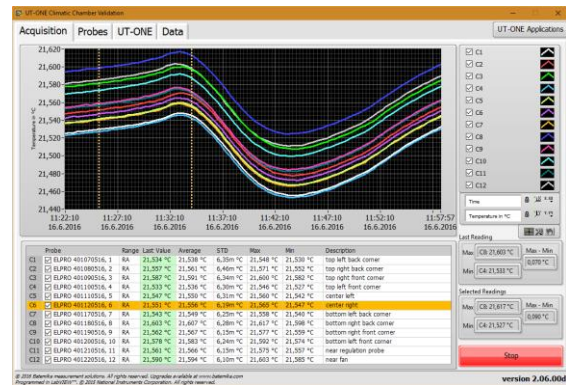
Demonstration of validation of climatic chamber with UT-ONE S12A, 12 Pt-100 probes and computer with acquisition software

UT-ONE Applications software

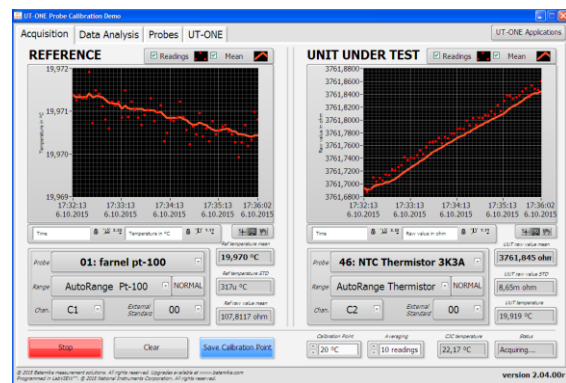
UT-ONE Applications is a software package that provides a basic tool for the PC control of any thermometer readout from the UT-ONE family.

UT-ONE Applications installer is included free-of-charge with your UT-ONE thermometer readout, and upgrades are available for download at www.batemika.com. Software is developed in NI LabVIEW and source code for selected applications is available on request for qualified customers. This makes a great starting point for developing your own derived applications to manage your particular measurement problem.

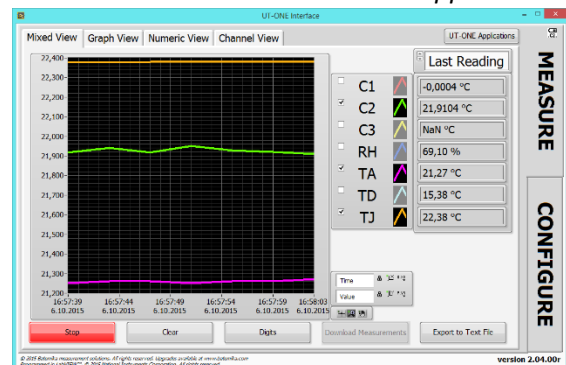
The UT-ONE Applications software package consist of 8 applications, which include basic interfacing and remote control, simple calibration-by-comparison demo, application for validation of climatic chambers, application for reviewing logged data, application for fast digitizing and application for checking of internal drifts and readjustment of internal measurement ranges.



UT-ONE Climatic Chamber Validation application



UT-ONE Probe Calibration Demo application



UT-ONE Interface application

Specifications

General specifications	
<i>Number of main channels</i>	4 or 12, consecutive sampling
<i>Probe types for main channels</i>	PRTs, thermistors, thermocouples
<i>Auxiliary channels</i>	Internal CJC thermometer
<i>Sampling period</i>	2 to 240 seconds per channel
<i>Measurement mode</i>	Single or continuous measurements
<i>Probe characterization</i>	Standard and user-defined coefficients
<i>Remote communication interface</i>	USB 2.0, GPIB+RS232 optional
<i>Operating conditions</i>	10 °C to 36 °C, 30% to 70% r.h., non-condensing
<i>Power supply</i>	USB bus
<i>Power consumption</i>	0.3 W typical, 0.5 W maximum
<i>Weight</i>	1.1 kg (UT-ONE S04A), 2.2 kg (UT-ONE S12A)
<i>External dimensions (W x H x D)</i>	140 x 90 x 155 mm (UT-ONE S04A) 380 x 90 x 155 mm (UT-ONE S12A)

Platinum resistance thermometers	
<i>Probe types</i>	Pt-100, Pt-25, Pt-200, Pt-1000
<i>Temperature range</i>	-200 to 961 °C max, limited by probe properties
<i>Measurement current</i>	1 mA and 0.707 mA DC, full current reversal
<i>Keep-warm current</i>	Automatically set on each main channel
<i>Measurement subranges</i>	25, 50, 100, 200, 400 and 800 Ω, with auto ranging
<i>Probe characterization</i>	Callendar-Van Dusen, polynomial, ITS-90
<i>Typical accuracy</i>	±0.006 °C, more info in detailed specifications
<i>Effective resolution</i>	1 ppm of subrange nominal limit (typical)
<i>Non-linearity</i>	±1 ppm of subrange nominal limit
<i>Short-term drift</i>	±6 ppm of value
<i>Long-term drift</i>	±15 ppm of value
<i>Temperature coefficient</i>	±0.25 ppm/°C

Thermistors	
<i>Probe types</i>	NTC or PTC with nominal resistance 2kΩ, 3kΩ, 10kΩ, ...
<i>Temperature range</i>	-100 to 200 °C max, limited by probe properties
<i>Measurement current</i>	20 μA and 14.1 μA DC, full current reversal
<i>Keep-warm current</i>	Automatically set on each main channel
<i>Measurement subranges</i>	1.25, 2.5, 5, 10, 20 and 40 kΩ, with auto ranging
<i>Probe characterization</i>	Steinhart-Hart, exponential
<i>Typical accuracy</i>	±0.001 °C, more info in detailed specifications
<i>Effective resolution</i>	1 ppm of subrange nominal limit (typical)
<i>Non-linearity</i>	±5 ppm of subrange nominal limit
<i>Short-term drift</i>	±8 ppm of value
<i>Long-term drift</i>	±20 ppm of value
<i>Temperature coefficient</i>	±1 ppm/°C (UT-ONE S04A), ±2 ppm/°C (UT-ONE S12A)

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Thermocouples	
<i>Probe types</i>	Type K, J, T, E, N, S, R, B
<i>Temperature range</i>	-200 to 1800 °C max, limited by probe properties
<i>Cold junction compensation</i>	Fixed temperature or internal CJC thermometer
<i>Measurement subranges</i>	15, 30, 60, 125, 250 and 500 mV, with auto ranging
<i>Probe characterization</i>	Differential polynomial for each type
<i>Typical accuracy</i>	±0.1 °C, more info in detailed specifications
<i>Effective resolution</i>	2 ppm of subrange nominal limit (typical)
<i>Non-linearity</i>	±10 ppm of subrange nominal limit
<i>Short-term drift</i>	±30 ppm of value
<i>Long-term drift</i>	±60 ppm of value
<i>Temperature coefficient</i>	±2 ppm/°C
<i>Parasitic emf</i>	±0.5 µV, independent of subrange

Internal CJC thermometer	
<i>Sensor type</i>	Digital temperature sensor
<i>Sampling period</i>	1 second
<i>Response time</i>	10 minutes (typical)
<i>Probe characterization</i>	Polynomial correction function
<i>Temperature range</i>	5 to 45 °C
<i>Temperature resolution</i>	0.01 °C
<i>Temperature accuracy</i>	±0.4 °C
<i>CJC accuracy</i>	±0.5 °C

Specifications apply to UT-ONE readout only and do not include the properties of thermometer probes. Detailed specifications are available at our website.

Batemika is dedicated to constant improvement of our products and associated measurement procedures. We reserve the right to changes without prior notice.

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Ordering Information

UT-ONE SxxA thermometer readout can be ordered in basic configuration, which includes:

- the thermometer readout unit UT-ONE S04A or UT-ONE S12A
- the USB communication cable
- factory adjustment certificate
- LabVIEW drivers and UT-ONE Applications software

Batemika recommends the following items to be ordered with UT-ONE SxxA as optional accessories:

- External reference resistor
- Rugged plastic carrying case
- GPIB+RS232 interface option
- Elpro and AccuMac temperature probes

Description	Order code
<i>UT-ONE S04A thermometer readout</i>	BH-B008
<i>UT-ONE S12A thermometer readout</i>	BH-B007
<i>External reference resistor</i>	BH-B006
<i>Plastic carrying case</i>	BA-G012
<i>LabVIEW driver and applications</i>	BS-B005
<i>GPIB+RS232 interface option</i>	BH-B009
<i>Elpro Pt-100 probe for climatic chamber validation</i>	BH-P035
<i>AccuMac temperature probes</i>	BH-P030

For more information on pricing and ordering our products, visit our website www.batemika.com or send an inquiry to info@batemika.com.

As additional service, we can provide an ISO/IEC 17025 accredited calibration certificate from our partners for the UT-ONE SxxA unit and for the ambient conditions probe.

If you require a custom measurement software for automating your calibration or test procedure, contact us at info@batemika.com.



Contact

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