CONTENT

This operation manual covers the components, function, operation, maintenance, transportation and storage of UMT-01 well head pressure and temperature gauge (hereinafter referred to as the tool).

ATTENTION! Read this manual carefully before operating the tool.

1 TOOL DESCRIPTION AND OPERATION

1.1 Function and components

1.1.1 UMT-01 pressure and temperature gauge is used to measure pressure and temperature of liquids and gases.

1.1.2 The tool shall be used to monitor the technological status on the wellhead of oil producing wells.

1.1.3 The tool can be applied in oil and gas industry.

1.1.4 The operating conditions are as follows:

- The ambient temperature should be within the range of -40°C to +50°C;
- Relative humidity may be up to 98 % at the ambient temperature of +30°C;
- Atmospheric pressure should be within the range of 84 kPa to 106.7 kPa.

Note: When the ambient temperature is -40°C to -20°C, the tool remains functional, but measurement accuracy can be impaired.

1.1.5 The tool is manufactured in 3 versions: UMT-01-40, UMT-01-25, UMT-01-10.
The UMT-01 tool modifications are different from each other in terms of pressure measuring ranges.

1.1.6 The tool is able to store not less than 16 000 of single measurement records and not less then 2 170 000 of measured datapoint pairs.

1.2 Delivery set

The delivery set of the tool is given in Table 1.

Table 1

Item	Qty, pcs.
1 UMT-01 (main unit)	1[1]
2 PC software, CD: DB SIAM 2.5 version (or higher)	1
3 Operation manual	1
4 UMT-01 Certificate	1
5 Testing Instructions	1
6 PC interface cable with adapter	1
7 External charger UZ-01	1
8 Power adapter for External charger	1
9 Charging cable	1
10 Battery with insertable spring unit	1
11 Additional battery with insertable spring unit	1
12 External thermoprobe	1
13 Connector	1
14 Wrench	1
Note: [1] - a specific tool modification is supplied	

1.3 Specifications

1.3.1 The pressure measuring ranges are presented in Table 2.

Table 2

Tool modification	Pressure measuring range
UMT-01-40	0 to 5700 psi (0 to 40 MPa)
UMT-01-25	0 to 3500 psi (0 to 25 MPa)
UMT-01-10	0 to 1450 psi (0 to 10 MPa)

1.3.2 The permissible reduced error of pressure measuring is ± 0.15 %.

1.3.3 The lowest-order digit for pressure measuring (for all pressure ranges) is 0,02 psi.

1.3.4 Temperature measuring range is -40°C to +50°C (temperature measuring range with external thermoprobe ZT-1 is -55°C to +125°C).

1.3.5 The permissible reduced error of temperature measuring is within ± 0,2°C.

1.3.6 The lowest-order digit for temperature measuring is 0.001°C.

1.3.7 Time of continuous operation while powered by a fully charged built-in battery in data logging mode (display is not active) is not less then 280 hours.

1.3.8 Time required for pressure/temperature measuring is not more then 1 sec.

1.3.9 The tool is powered by 3 built-in Ni-Cd VSE batteries of a 4/5 A standard size. The total voltage of the batteries is 3.6 V, capacity of the battery is not less than 1.2 A/hour.

1.3.10 Overall dimensions are as follows:

- Tool case diameter, mm 65;
- Tool case length, mm 210.

1.3.11 Connection dimensions (outer thread), mm M20x1,5.

1.3.12 The tool weight is not more than 1.5 kg.

1.3.13 An average life time is not less than 5 years.

1.3.14 Tool case protection satisfies the international protection rate of IP 54.

1.4 Components and operating principle

1.4.1 Operating Principle

The UMT-01 tool is an autonomous measuring device able to process, correct and display the measured data, save it to the internal memory and export to an external device (e.g., a PC).

The tool is operated by an internal program executed by a built-in controller, which processes data received from primary transducers, displays operation modes and monitoring results, stores measurement parameters and results in a non-volatile memory and provides communication with external devices (a PC, a visual control unit).

Measurement procedures performed by the tool are based on conversion of pressure transducer resistance and temperature transducer resistance into an electric signal.

In the pressure transducer, strain-gage resistors are assembled on the diaphragm and connected in a bridge circuit balanced at the atmospheric pressure. When the pressure different from the atmospheric pressure is applied to the diaphragm, the resistance of the strain-gage resistors varies proportionally to the pressure applied and, consequently, the bridge output voltage changes its value, too. The transducer digitizes and converts the voltage of the bridge unbalance into pressure values according to the calibrated dependencies of the strain-gage converter.

In the temperature transducer, dependence of resistance on temperature is used. The temperature transducer resistance is converted into voltage; the signal obtained is digitized and converted into a temperature value according to the calibrated dependencies of the transducer.

The microcontroller has a power saving mode which significantly prolongs battery life within one charging cycle. This mode is enabled when the tool is not operated, detached from the PC and is not measuring and storing data.

General view of UMT-01 with thermoprobe is presented in the Picture 1.

Picture 1 General view ofUMT-01 with thermoprobe

1.4.2 Components of the Tool

The tool is designed as a mono-unit.

The following components are located on the outer side of the case:

- threaded joint for mounting the tool;
- digital display;
- four keys;
- auxiliary slot to connect the tool to external devices;
- protective covers.

The external charger is used for charging the tool. To charge the tool take the batteries out of the tool and place it in the external charger. External charger provides such services as complete discharge of the battery before recharging then complete charge, and in addition it can be used for battery cycling.

1.4.3 Operating Modes

The tool operates in two simple modes or in a combined mode:

- power saving mode (standby mode when the display is off and measurements are not performed);
- current parameters displaying mode (the selected parameter and the current measurement result are displayed);
- measuring mode (combined mode).

The measuring mode, besides proper measuring, may include any combination of two other modes (power saving and displaying current parameters) in arbitrary sequence.

After the batteries have been inserted, the tool is continuously operating. For power saving purposes, if no measurements are performed and the display is not used, the tool switches to the power saving mode.

The display is switched on by pressing the MODE key. Subsequent pressing of this key cycles through the display operation modes in the following order:

- automatic repeated measurements mode;
- current pressure channel mode;
- current temperature channel mode;
- last measured pressure and temperature mode;
- set the field number;
- set the cluster number;
- set the well number;
- set the measurement type;
- set the automatic measuring interval;
- battery voltage and operation time mode;
- enhanced display modes;
- set the workshop number (enhanced display mode);
- set the operator number (enhanced display mode);
- current time mode (enhanced display mode) ;
- current mode (enhanced display mode);
- percentage of memory available (enhanced display mode).

The tool is capable of making several measurement types:

- Continuous measurements with displaying the measurement results of one of the channels selected (pressure or temperature) without saving the results to the tool's memory and/or with continuous data transfer to a PC;
- Single measurements (Measurement Types 1 and 2) with saving measurement results and ids to the tool's memory;
- Automatic multiple measurements taken with a time interval selected (Measurement Types 3 and 4) with saving measurement results and ids to the tool's memory.

The latter two measurement types may be carried out with a simultaneous displaying of the current data and/or transferring it to a PC.
During automatic multiple researches, the tool display is automatically shut down if none of its keys has been pressed within a 100-second period. In such a case, between measurements, the tool is in a power saving mode. Press the key MODE to turn on the display.

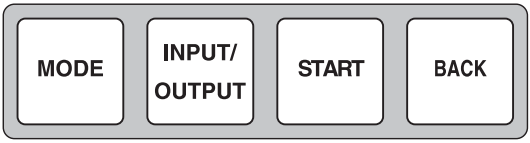
1.5 Tool marking

1.5.1 Basic marking can be found on the nameplate located on tool's panel; it includes the following information:

- trademark and manufacture name;
- type of the tool;
- serial number of the tool as per the system applied by the manufacturer;
- month and year of manufacture.

1.5.2 On tool's front panel there is additional marking containing the following information:

- name and type of the tool: Pressure and temperature gauge UMT-01-XX;
- key names.



1.5.3 External thermoprobe ZT-1 marking is on nameplate and contains manufacture's trademark and serial number of the tool.
1.5.4 On the shipping container there are notes “Handle with care” and “Keep out of wet” as per the State Standard.

1.6 Safety measures

1.6.1 Tool assembling and disassembling on site allowed only in full operational conditions of Christmas tree. For tool assembling and disassembling the valve should be closed tightly.
1.6.2 For safe tool disassembling use connector, consistuent of delivery set. The connector installs between tool and
1.6.3 Tool voltage is not life dangerous. Operating tool does not liberate any harmful substances and does not have any harmful environment impact.

2 APPLICATION OF THE TOOL

2.1 Operating restrictions

2.1.1 The personnel permitted to operate the tool must be trained, examined and granted a work permit for the given job specifications: oil/gas production operators - 5th grade and above, well test operators - 4th grade and above.

Before proceeding to measurements, make sure that the tool is in running order.

2.1.2 The technological offset where the tool will be attached for measurements should be equipped with a high pressure tap valve and should have an internal metric joint thread M20x1.5. The technological offset should be 0.2 - 1.8 m above a working platform.

2.1.3 Before attaching the tool make sure that the tool and high pressure tap valve are in running order.

2.2 Preparing and operating the tool

2.2.0 Battery installment

1) Unscrew the lid of battery cell;
2) Insert the battery by lesser electrode forward into the cell;
3) Insert spring unit;
4) Screw down the lid.

2.2.1 Preparing the Tool

Before starting the tool:

- remove the end cap from the technological offset of the well pipeline to be monitored;
- clean the joint thread box from sludge, oil, sand, etc.;
- check if the thread box satisfies the requirements mentioned above;
- open the high pressure tap valve for a while (1 to 2 seconds) to blow it through (to clean it from condensate, ice, sludge and other possible plugs);
- install the tool by screwing it on the technological offset and turning it to the stop in order to avoid a displacement of the tool when under pressure;
- slowly, without causing a pneumatic or hydraulic impact, open the high pressure tap valve until gas reaches the primary converters of the tool.

To avoid a gas leakage through thread joints, use thread sealing lubrication or a sealing tape.

2.2.2 Operating the Tool

1) Turn on the tool by pressing the MODE key.

The display will show the current status of the tool. The information seen on the display can be of two types:

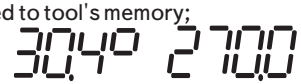
a) The tool is not saving data to its memory.

б) The tool is saving pressure and temperature to the memory. If a continuous data recording mode has been selected, the tool will also display the current quantity of datapoint pairs recorded.
If the tool is saving data to its memory, you need to stop the current mode before you are able to transfer the data to a PC.

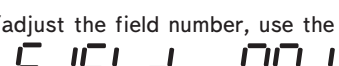
2) Press the MODE key to go to the pressure reading mode;
E.g., 270,02 psi.

By repeatedly pressing this key, you can cycle through the following modes:
- temperature reading mode; e.g., 26.157°C;

the mode displaying the latest datapoint pair measured and saved to tool's memory;
e.g., temperature - 30.4°C;
pressure 270,0 psi



3) Press the MODE key to set the field number. To set/adjust the field number, use the INPUT/OUTPUT key. The field number takes three digits and can be varied from 000 to 999.



4) Press the MODE key to set the cluster and well number.

The cluster number takes up five digits.
E.g.: the cluster number is 00002.

A well number takes up six digits. E.g.: the well number is 000003.

5) Press the INPUT/OUTPUT key to set the measurement type.
Measurement type number can be 1, 2, 3 or 4.

1 and 2 denote one-time measurements taken under static and dynamic condition of the well respectively. 3 and 4 denote continuous measurements conducted under static and dynamic condition of the well respectively. In Modes 3 and 4 the tool will save the measured data to its memory with the user-defined interval. E.g.: Measurement type 3 is selected.

6) Check the battery voltage and charge the battery if necessary.

The display will show the current battery voltage and time of battery service since it has been inserted into the tool. Time is displayed in the following format: <Days: Hours: Minutes>.
7) Check the current time and date and adjust if necessary. This can be done both from a PC (using the software included with the tool) or manually form the tool keyboard.

The INPUT/OUTPUT and BACK keys serve to enter/adjust information in all display modes. By pressing the INPUT/OUTPUT key you enter the setting/adjusting mode. By consecutively pressing the INPUT/OUTPUT key you cycle through the input options available in the ascending order. To reverse the cycling order, press the BACK + INPUT/OUTPUT simultaneously.

The BACK key simplifies the procedure of setting up a required parameter (such as cluster number, a well number, etc.). The combination of the BACK and MODE keys allows cycling through the operating modes in reverse order.

8) Check the memory available. If there is not enough memory space for the measurement to be made, and the information currently stored in the tool is valuable, be sure to transfer the data to a PC, after which you will be able to clear tool's memory from the PC.

E.g., 99.9 % of tool's memory is available.

2.2.3 Turning Off the Tool

The tool can be turned off by pressing the START key twice. If the tool is not in Measuring Modes 3 or 4, it will go off and no power will be consumed. The tool may remain in this state as long as it takes for the complete self-discharge of the battery. If the tool is in Measuring Modes 3 or 4 modes, the tool continues working but its display will go off.

2.2.4 Stopping the Current Measurement

To stop the current measurement, press the START and INPUT/OUTPUT keys consecutively. The tool will stop the measurement in progress and display the last temperature and pressure recorded.

2.2.5 Transferring Data to a PC

Data can be transferred to a PC via the RS-232 interface cable included with the tool. Connect the interface cable to the auxiliary slot of the tool and a serial port of the PC. Run the software supplied with the tool and import the data as described in the software User's Manual. You don't have to switch on the tool prior to importing data.

2.2.6 Charging the Battery

The battery is recharged with an external charger UZ-01.

To charge the tool take the batteries out of the tool and placed in the external charger. The external charger is connected with the 220V DC power adapter or with charging cable of the automobile electric cigar lighter. The external charger makes charging procedure automatic; it discharges the battery completely and does not let it to overcharge. Accelerated mode of charging reduces the battery recharging up to 8 hours.

For detailed information see Supplement 1 External charger UZ-01.

ATTENTION!

If during operating the tool the voltage of the battery falls lower 3.2 V, the tool will automatically stop saving data to its memory, but the current measurement will be stored in the tool memory. If the tool is saving data, it is prohibited to take the battery out as in this case current measurement will not be saved to its memory.

3 MAINTAINING AND REPAIRING THE TOOL

3.1 Only qualified personnel employed by the manufacturer or its official dealers is permitted to perform maintenance and repairs on the tool. It is imperative that the tool is checked after each repair.

3.2 The most frequently occurring malfunctions and their elimination are listed in Table 3.

Table 3

Symptom	Likely cause	Elimination
1. Display is dark	The battery is discharged	Recharge the battery
2. Clock failure	The clock was set incorrectly	Initialize the tool and set up the current date and time
3. Pressing the keys has no effect. One and the same message is displayed on the screen for a long time.	Firmware «hang-up» caused either by an unforeseen situation or by effect of a statistical potential exceeding acceptable characteristics of performance specifications	Turn off the tool. Wait for about 1 minute (time necessary for the internal circuits to reset) and then restart the tool.
Note: Malfunctions not listed here should be eliminated by the manufacturer or an experienced serviceman.		

4 STORAGE AND TRANSPORTATION

4.1 Storage

A new tool should be stored in manufacturer's packing in a storehouse at the ambient temperature of 0°C to + 40°C. Air relative humidity should be 80% at the temperature of 25°C. An unpacked tool should be stored at the ambient temperature of + 10°C to +36°C. Air relative humidity should be 80% at the temperature of 25°C.

Storage facilities should not be exposed to dust, acid and alkali vapors, corrosive gases and other destructive substances.

4.2 Transportation

The tool may be transported by any closed transport.

Please do not transport unpackaged tools.

SUPPLEMENTS

SUPPLEMENT 1. EXTERNAL CHARGER UZ-01

1.1 General product performance.

External charger (hereinafter UZ-01) is designed for accelerated and efficient charge of the cadmium-nickel battery of the 3VSE-4/5A type produced by the SAFT company which is a part of the wellhead pressure and temperature gauge UMT-01 produced by the SIAM Company. The UZ-01 can be used for the internal battery cycling to recover the battery capacity. UZ-01 is powered by the power adapter or charging cable of the automobile electric cigar lighter included into delivery set. Powering of UZ-01 by other current sources is not allowed. The device can be used at the ambient temperature from 5°C to 30°C and air humidity of no more then 80% at 20°C. The battery charging at the temperature less than 0 °C is not allowed.

During battery charging continuous external power voltage is required. It is not allowed to remove battery from the device until the end of charging. It is not allowed to place the UZ-01 in use close to heat sources such as radiators, filament lamps etc.

Battery voltage before its charging must be within the limits from 0.5 volt to 3.9 volt. Otherwise charging will not occur.

1.2 General specification

Battery voltage, V	
standard	3,6
minimum, pre-charge	0,5
maximum, after-charge	4,3
Average battery discharge rate, mA	240
Average battery charge rate, mA At the first stage	500
At the second stage	250
Standard charge time, hour	
(without time of the pre-discharge)	5±0,5

1.3 Device structure and function

1.3.1. The Charger is a metal box with a niche containing electrical contacts for the battery 3VSE-4/5A installation. The contacts are on the profile planes of the battery niche on its narrow side. Minus contact represents a spring, plus contact represents a

disk. The plus contact is marked "+". There is a socket for the power adapter connection on the side of the UZ-01. There is an operation regime display on the upper plane of the device.

1.3.2 To switch on the device connect it to the power adapter (or charging cable) and connect the latter to the electric network of 220 V, 50 hertz. Switching off is in the inverse order. There are no any additional switches.

1.3.3 To install battery in the device put it into the niche with the minus contact to the spring (minus) contact. Push the end of the battery (plus battery terminal). The minus contact spring will compress and allow full fitting of the battery into the niche. There is an opening in the bottom of the battery niche for easy removal of the battery. After battery is installed into the charger niche it is automatically connected to the charge electric circuit. Do not apply excessive force when assembling and dismantling.

1.3.4 The external charger UZ-01 can work in the regimes stated in Table 1.

Table 1 Work regimes of Charger

№	**Charging regime**	**Indicator regime**
1	Power is on. No battery. Charger operational.	Steady green
2	Battery installed. Charging on, average charging current I_p= 240 мА.	Blinking green (0.75 Hz)
3	Battery installed. Charging on – 1st stage, average charging current $I_{з1}$=500 мА.	Blinking red (0.75 Hz)
4	Battery installed. Charging on – 2nd stage, average charging current $I_{з1}$=250 мА.	Blinking red (1.25 Hz)
5	Battery installed. Charging complete	Steady green

When the battery is installed and the external charger UZ-01 switched on the charging regimes from 2nd to 5th are changed sequentially, i.e. the charging begins with preliminary battery discharging to 2.9 V voltages. Discharging may take 0-8 hours subject to capacity (current charge) of the battery.

If battery voltage is equal to or lower than 2.9 V than the preliminary discharging is not necessary. Battery charging is performed in two stages with pulse currents (average values are represented in Table 1).

If the power is down (or the battery is removed from the socket) at any charging stage even for the short time, the process must be started from the 2nd regime.

The first stage of charging takes 3...4 hours subject to the characteristics of the storage battery, thus the charging ratio comes to 80...90%. The 2nd and the 3rd stages are actually intended to increase the charging ratio to 100% and take 1..2 hours.

1.3.5 To provide minimum charging time it is recommended to charge totally discharged batteries with voltage close to 3V.

1.3.6 It is not recommended to use batteries to the point when the voltage becomes lower than 2.9V, this will decrease their operation life.

1.3.7 Recommended battery charging sequence:

- Connect the external charger UZ-01 to the power adapter (or charging cable);
- Connect the power adapter to 220V,50Hz (or connect the charging cable to car cigarette lighter);
- Check that the external charger UZ-01 is working properly (steady green indicator light);
- Insert the battery into the battery niche, mind the polarity ('minus' to 'minus', 'plus' to 'plus');
- Wait until the regimes 2-6 (see Table 1) are completed;
- Remove the battery from the charger;
- Unplug the power adapter from 220V, 50Hz AC (or disconnect the charging cable from the car cigarette lighter).
- Disconnect the power adapter (or the charging cable) from the external charger UZ-01

Service information: 02-11-07