

THERMOSTAT DX2100

User Guide

PMTK 377.00.00 PЭ



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FOREWORD

This manual is intended for studying the thermostat DX2100 (hereinafter the Thermostat) and contains the necessary amount of information and illustrations, sufficient for its proper operation.

Only the personnel that is familiar with all the sections of this manual is allowed to operate the Thermostat.

Thermostat is designed to create different temperature modes of studied objects, which are placed in the Thermostat working chamber.

The operation of the Thermostat is based on thermoelectric modules. The heat is rejected from the modules by an air radiator or a coolant pumped through the liquid heat exchangers.

The Thermostat is to work in the laboratory conditions with the temperature 25 ± 3 °C and humidity 80%.

The Thermostat provides two modes of operation:

- maintaining a user-specified temperature (setpoint);
- maintaining several temperatures, each of which is kept during a certain pre-determined time. This mode is called work by program.

The thermostat may operate as a fully independent device, and either of the two modes can be chosen.

To prepare programs and record them to the Thermostat the computer software provided should be used.

By computer it is also possible to control the Thermostat with events logging, as well as logging and visualization of temperature changes over time.

For the case when the object implies certain temperature limits - the Thermostat offers two levels of alarm temperature set by a user. When exceeding this range, the control is stopped with an appropriate light and sound indication.

At the consumer request the Thermostat can have a cover to enable modules Z-metering at different temperatures using the block Z-Meter DX4190.

The block Z-Meter DX4190 provides the measurement of the following parameters of thermoelectric (TE) modules - see table 1.

Table 1

| <i>Parameter measured</i> | <i>Designation</i> | <i>Notes</i> |
|-------------------------------|--------------------|---------------------------|
| <i>Figure-of-merit</i> | <i>Z</i> | <i>Z-metering methods</i> |
| <i>AC electric resistance</i> | <i>R</i> | |
| <i>Time constant</i> | <i>t</i> | |

The measurements are carried out in correspondence with the User Guide Z-Meter DX4190.

1 DESCRIPTION AND OPERATION

1.1 Purpose and Specifications

1.1.1 Thermostat Objectives

Thermostat is designed to create different temperature modes of studied objects, which are placed in the Thermostat working chamber.

1.1.2 Thermostat Specifications

1.1.2.1 The Thermostat specifications are given in Table 2.

Table 2

| <i>Parameter</i> | <i>Units</i> | <i>Values</i> | <i>Notes</i> |
|--|-----------------------|-----------------------------------|---|
| <i>Dimensions (HeightxDepthxWidth)</i> | <i>mm²</i> | <i>227x247x234</i> | |
| <i>Mass</i> | <i>kg</i> | <i>5,9</i> | |
| <i>Supply voltage</i> | <i>VAC</i> | <i>100...240</i> | |
| <i>Power consumption</i> | <i>W</i> | <i>Less than 200</i> | |
| <i>Chamber thermal stabilization temperature range</i> | <i>°C</i> | <i>-30...+85</i> | <i>Temperature less than -10 °C is provided with liquid cooling</i> |
| <i>Chamber dimensions (LengthxWidthxDepth)</i> | <i>mm</i> | <i>170x100x80</i> | |
| <i>Coolant</i> | | <i>Water of temperature 24 °C</i> | |
| <i>Coolant flow</i> | <i>l/min</i> | <i>1,5...2,5</i> | |
| <i>Useful volume of the chamber</i> | <i>l</i> | <i>1,36</i> | |
| <i>Temperature accuracy</i> | <i>°C</i> | <i>±0,1</i> | <i>Chamber bottom</i> |
| <i>Setpoint accuracy</i> | <i>°C</i> | <i>±0,5</i> | <i>Chamber bottom</i> |
| <i>Noise</i> | <i>dBA</i> | <i>Less than 31</i> | <i>With fans working</i> |
| | | | |
| <i>Ability to work by program</i> | | <i>Yes</i> | |
| <i>Programs number</i> | | <i>Up to 10</i> | |
| <i>Number of lines in a program</i> | | <i>Up to 10</i> | |
| <i>Ability to cycle programs</i> | | <i>Yes</i> | |

1.1.2.2 Operational Conditions

The Thermostat is to work in the laboratory conditions with the temperature 25 ± 3 °C and humidity 80%.

1.2 The Thermostat consists of:

- Thermostat DX2100 PMTK 377. 00. 00 (Fig.1);
- Cover Z-meter PMTK 377.07.00 (Fig.2) (if required);
- Software;
- Cables (Fig.3).



Figure 1

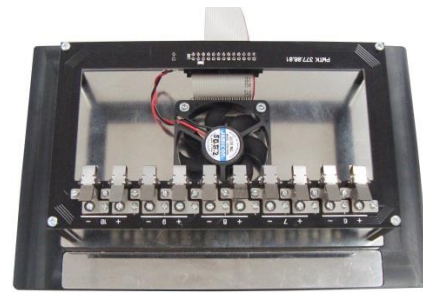


Figure 2

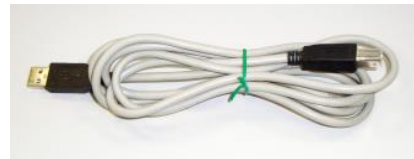


Figure 3

1.3 Arrangement and operation

1.3.1 Arrangement

- The Thermostat has a metal body with a front (1) and back panels (2) (Fig. 4).
- On the front panel there is a switch (3) a display (4), light indication - «Ready», «Alarm» (5) and a keyboard of the Thermostat control (6).
- On the back panel there is an AC Input Plug with an integrated fuse of the nominal 3.15 A (7), a USB connector (8) and two sockets (9) for the coolant input.
- A back and side panels have vents.
- On the top of the Thermostat there is an opening for the access to the chamber of the Thermostat. The top panel has a seal and magnetic locks to lock the cover (12).
- On the bottom of the Thermostat there are inlets for intake of cooled air and legs that provide a necessary clearance for it.
- The Thermostat working chamber is made of aluminum alloy and has 8 mm thick walls to make chamber temperature field homogeneous.
- The necessary temperature conditions of the chamber are provided by the thermoelectric modules located at the bottom of the chamber.
- The heat rejection from the TE modules is carried out by air blown through the air cooler or liquid passing through the liquid heat exchangers.
- The chamber is equipped with the 20mm thick thermal insulation.
- The TE modules are controlled by the control board powered by the AC-DC converter.
- The temperature sensor of the working chamber is located on its bottom.



Figure 4

- To measure TE modules Figure-of merit at different temperatures (at the customer's request) the Thermostat is equipped with Z-Meter cover (Fig. 5) and the block Z-Meter DX4190.
- The cover is equipped with a fiber-glass plastic frame (1) with ten two-pole clamps (2) to connect five TE modules having appropriate marking and commutation connectors.
- The fan (3) is mounted on the cover to uniform the temperature field in the volume of the working chamber. The fan power and control is performed by the block Z-Meter DX4190. The cover is connected to the Z-meter by cable (4). At the time of modules measurement, the fan stops.

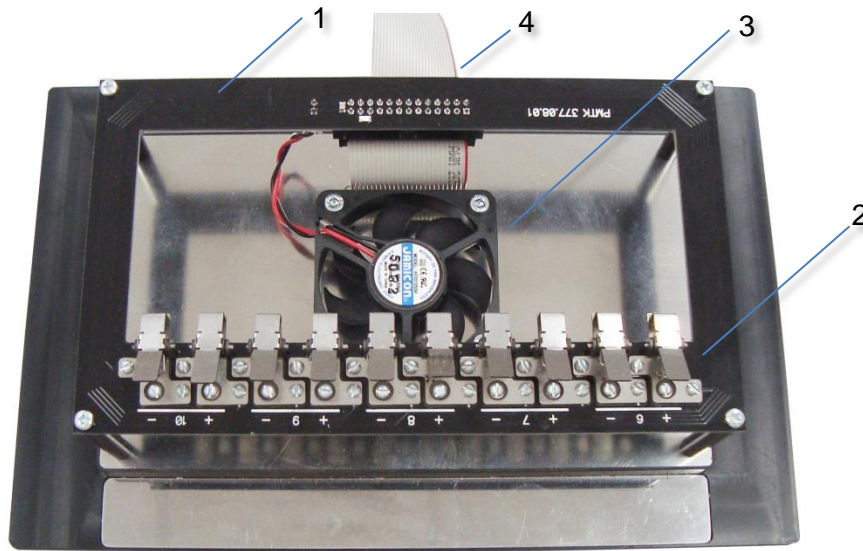
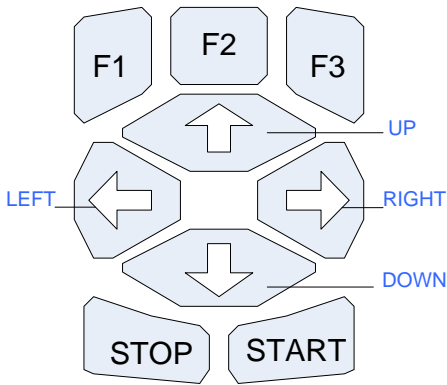


Figure 5

1.3.2 Units of Control and Indications



The keypad with 9 buttons is used to control the Thermostat. The information is displayed on the alphanumeric LCD display (2 lines of 16 characters each).

The output information is split into screens (windows).

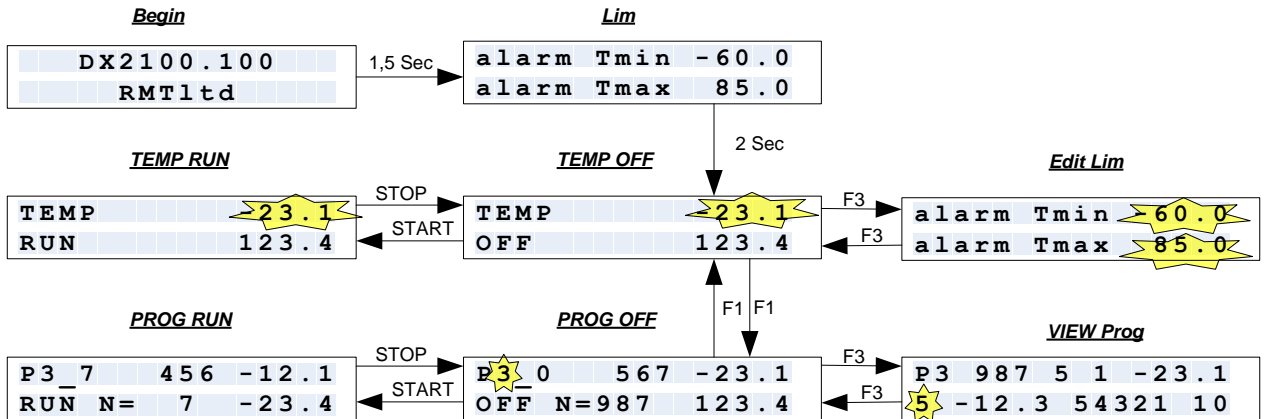
The control of the device can be local (by the front panel buttons) or from the computer.

Switching between the local control and computer control is done by the button - F2. The difference is in a writing style on the LCD display. Capital letters are a sign of the local

control.

| Operational Mode | Control | |
|---------------------------|---------|----------|
| | Local | Computer |
| • Temperature maintaining | TEMP | Temp |
| • Work by program | P1_3 | p1_3 |

The scheme of switching between the screens (windows) is as follows.



This scheme shows the screens and buttons with which the navigation and control are done. The yellow highlight the parameters that can be changed. All the settings are changed using the buttons UP (increase) and DOWN (decrease), except the parameter "alarm Tmax" that is changed with the keys LEFT (decrease) and RIGHT (increase).

If the button is held down for 2 seconds, the parameter is accelerated. If you continue to hold the button down, for example, after changing the setpoint temperature by 2 degrees, the change acceleration will be greater.

Each mode of operation has two main windows and one additional.

The main windows are:

- RUN – the regulation in the mode selected is ON
- OFF – no regulation (the mode is OFF)

In the temperature maintenance mode one can look up and, if necessary, adjust alarm limits in the additional window (Edit Lim).

In the program mode, one can look a selected program line by line in the additional window (VIEW Prog).

The transition to the additional windows is done by pressing the F3 key from the window of the OFF mode.

Switching to another mode can only occur if a current mode is off. Switching between modes is done by pressing F1.

To start and stop the modes can be done by the buttons START and STOP, respectively.

In the window of the OFF mode of working by program (PROG OFF), you can change the program number by the UP and DOWN buttons.

In the mode of temperature maintenance you can change the temperature set point by the UP and DOWN buttons. It is possible both in cases the regulation is on and off.

| Button | Window (Condition) | Action when clicked |
|--------|--------------------|--|
| F1 | TEMP OFF | Mode switching (to PROG OFF) |
| | PROG OFF | Mode switching (to TEMP OFF) |
| F2 | Everywhere | Switching between local control and PC-control |
| F3 | TEMP OFF | Going to the window Edit Lim |

| | | |
|-------|-----------------------|--|
| | PROG OFF | Going to the window VIEW Prog |
| UP | TEMP OFF and TEMP RUN | Temperature setpoint increase |
| | PROG OFF | Program number increase |
| | Edit Lim | Increase in temperature upper alarm limit "alarm Tmax" |
| | VIEW Prog | Program line number increase |
| DOWN | TEMP OFF и TEMP RUN | Temperature setpoint decrease |
| | PROG OFF | Program number decrease |
| | Edit Lim | Decrease in temperature upper alarm limit "alarm Tmax" |
| | VIEW Prog | Program line number decrease |
| LEFT | Edit Lim | Decrease in temperature lower alarm limit "alarm Tmin" |
| RIGHT | Edit Lim | Increase in temperature lower alarm limit "alarm Tmin" |
| START | TEMP OFF | Starting temperature maintenance (in TEMP RUN) |
| | PROG OFF | Starting operation by program (in PROG RUN) |
| STOP | PROG RUN | Mode stop (in PROG OFF) |
| | TEMP RUN | Mode stop (in TEMP OFF) |

1.4 Switching ON

1.4.1 Select the method of heat rejection: either air cooling or liquid cooling.

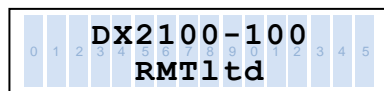
- At temperatures -10 ...+85 ° C air cooling is recommended.
- At temperatures below -10 °C liquid cooling is recommended.

1.4.2 When using the liquid cooling, connect the hoses of the fluid input and output to the pipes 9 (Figure 4).

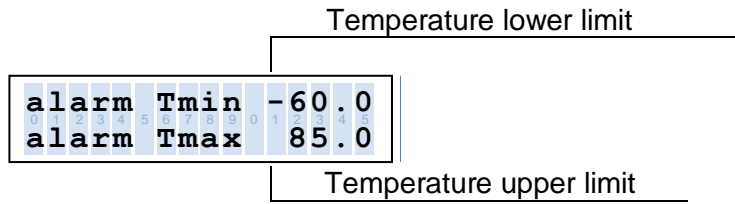
1.4.3 Connect the power cable to the connector 7 (Figure 4).

1.4.4 Put the Thermostat on by the switch 3 (Figure 4).

The display lights up and flashes light indication "Ready". The start screen displays the version of Firmware (during 1.5 seconds).



Then the screen is displayed with the values of alarm limits (during two seconds):



Where:

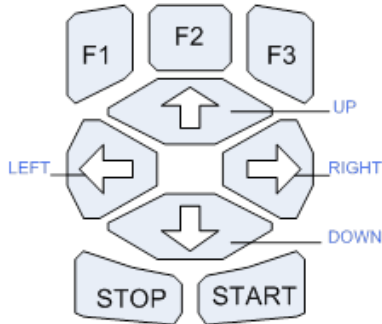
- «Tmin» - working chamber minimum temperature.
- «Tmax» - working chamber maximum temperature.

The output temperature of the chamber beyond, corresponding to Tmin and Tmax will disable the control, sound an alarm, flashing light and display an error message

If temperature outgoes beyond the limits Tmin and Tmax, the regulation stops, the alarm sound and light indication are on, the error message pops up.

Then the screen TEMP OFF is displayed.

1.4.5 If necessary, adjust the range of the limiting temperatures.



Button F3 – go to Edit Lim,

Button "UP" results in temperature "Tmax" increase,

Button "DOWN" results in temperature "Tmax" decrease,

Button "RIGHT" results in temperature "Tmin" increase,

Button "LEFT" results in temperature "Tmin" decrease.

Return to the window TEMP OFF is done by the button "F3".

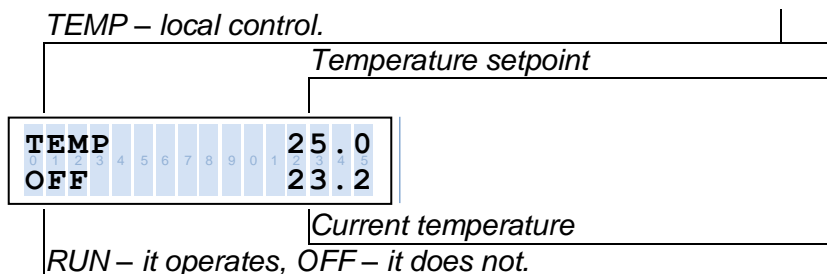


Hereinafter all the switches are described with the assumption that the Thermostat is in the window TEMP OFF

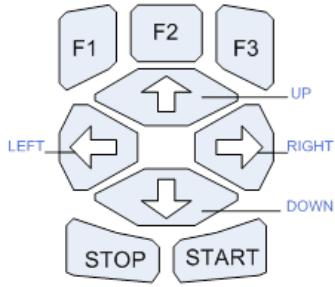
The Thermostat is in this window when it is switched on (if no further action is taken).

1.5 Temperature maintenance mode (local control).

The window TEMP OFF:



1.5.1 Set the temperature by the keyboard.



Clicking the button "UP" results in the setpoint increase.
Clicking the button "DOWN" decreases the setpoint.

1.5.2 Start the mode by the button "START".

The display window looks like this:



The inscription "RUN" means that the temperature control process is going on. After the temperature setpoint is achieved, the indication "Ready" lights continuously.

Note: in the case of air cooling, the fans mode is determined by the heat load of the air cooling radiator.

In the course of regulation, the temperature setpoint can be changed by the buttons "UP" and "DOWN".

1.5.3 After the work is over, click the button "STOP" and turn off the Thermostat.



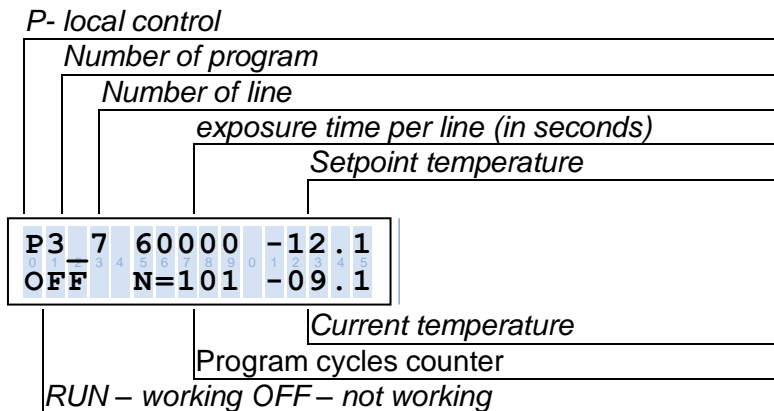
Attention! When working with liquid cooling, in order to prevent heat exchangers damage, turn off the Thermostat only if the chamber temperature is above +5 °C.

To ensure it, before turning off the Thermostat, set the setpoint above +5 °C, wait until reaching the desired temperature, then turn off the Thermostat and turn off the liquid coolant.

1.6 Work by Program (Local Control)

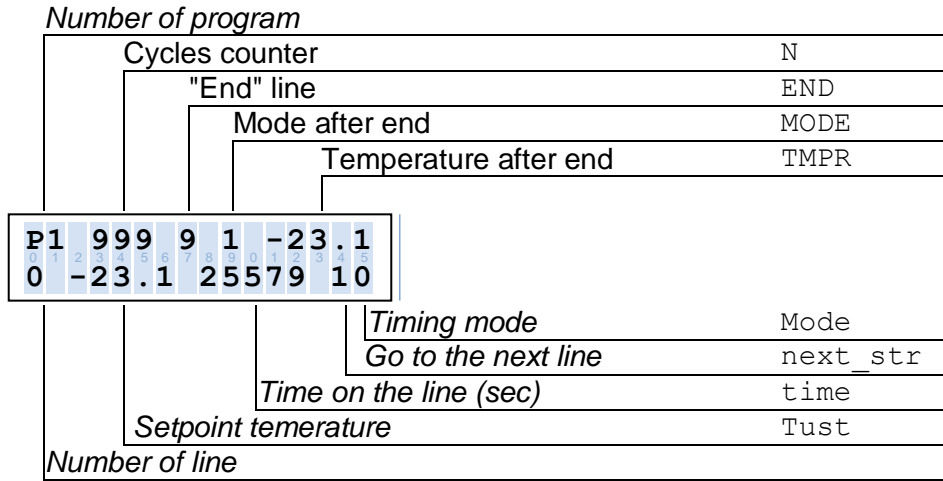
The Thermostat memory lets you save ten programs inputted from a PC. The Thermostat is switched to the mode "Work by Program" by the button "F1" on the control keyboard.

The window Prog OFF consists of:



- 1.6.1 Pressing the button "UP" or "DOWN" choose the necessary program.
- 1.6.2 You can view data stored in the program by clicking the button "F3" on the control keyboard. The viewing is line by line.

The window VIEW Prog (Program view):



Clicking "UP" or "DOWN" you can view all the lines of a program selected.

Each line consists of:

Table 3

| | | |
|----------|--|---------------|
| Tust | Temperature set point, °C | -99.9...100.0 |
| time | Delay on the line (sec). See Mode. | 1...65535 |
| next_str | line number to which to go after the waiting on the current line is over (address) | 0...9 |
| Mode | 0- the delay on the line starts at the moment it is transferred to 1- the delay on the line starts at the moment the setpoint is achieved | 0/1 |

Programs are always run starting with line 0.

Pressing "F3" for the second time in the program selected being ready for work.

- 1.6.3 Run the program by pressing the button "START".

The button "STOP" stops the program execution. When pressing the button "START" repeatedly, the program starts again (beginning with line 0).

- 1.6.4 Program Completing

The possible options for completing the program are:

- Program runs once (no cycling)
- Program is cycled and performed a limited number of times
- Program of control with time is cycled and runs for an unlimited period.

If the program is completed, the Thermostat switches to the mode of temperature regulation. Moreover, the regulation can be either enabled or disabled.

Note: During the execution of the program the parameters of the program cannot be changed.

- 1.7 Operation with Connected PC

The operation of the Thermostat when connected to a PC implies the following:

- Thermostat adjustment, writing new programs for the Thermostat and storing of new programs in the Thermostat memory;
- Status display and plotting graphs of temperature change over time.

- Events logging.



To work with the program in its entirety the Thermostat should be switched into the mode of the computer control.

The control from the computer is permitted by pressing F2. The sign is a style of writing mode on the LCD display.

The control is carried out by a special program.

1.7.1 Program Objective

The program **DX2100.exe** (*hereinafter the Program*) is used to adjust and control the operation of the Thermostat DX2100. The main goal is to simplify the process of setting up the device for the end user: collecting and displaying the results of measurements (plotting), and logging of the device operation.

The program offers a standard interface, which is typical the windows-applications.

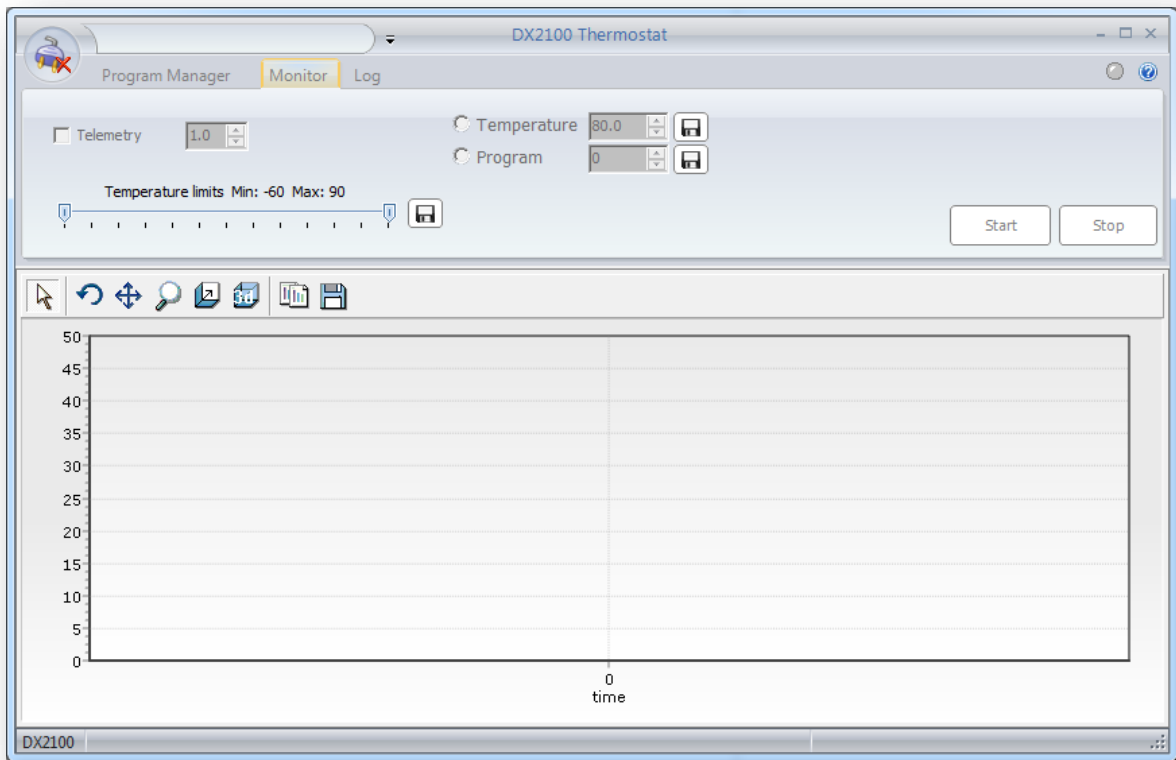
The program allows you to do the following.

- Setting the period of telemetry;
- Setting the temperature alarm limits¹;
- Viewing and recording the device states in a log file in real time;
- Reading and writing programs of time control;
- Monitoring: Plotting graphs of Chamber temperature in real time
- Displaying the status of the device (operating mode, setpoint);
- Changing the operating mode while monitoring;
- Storage the telemetry results in a file;
- Changing the temperature setpoint without PID restarting.

¹ Factory settings -60..+90 °C.

For the object protection you can limit the operating range, if necessary.

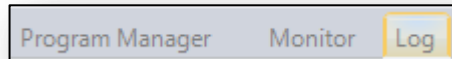
1.7.2 Interface



The main window can be divided into several parts:

- Interface control elements:

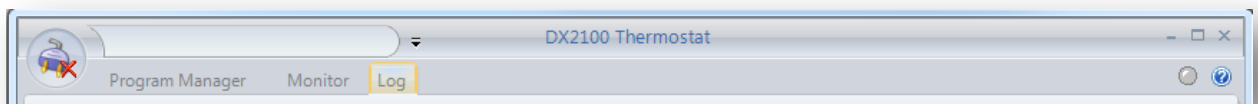
- Bookmarks;




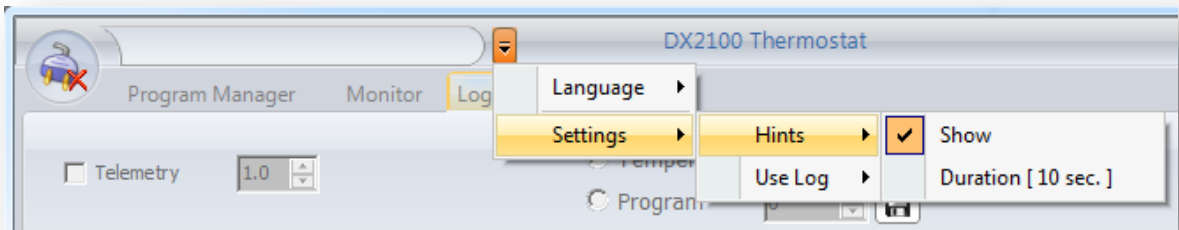
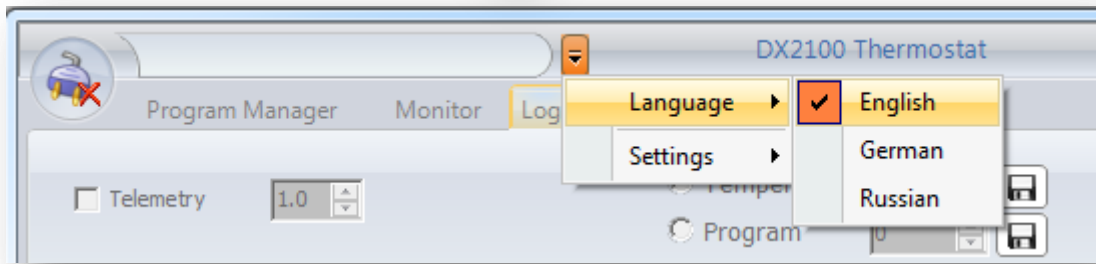
- Button of connection to the device;



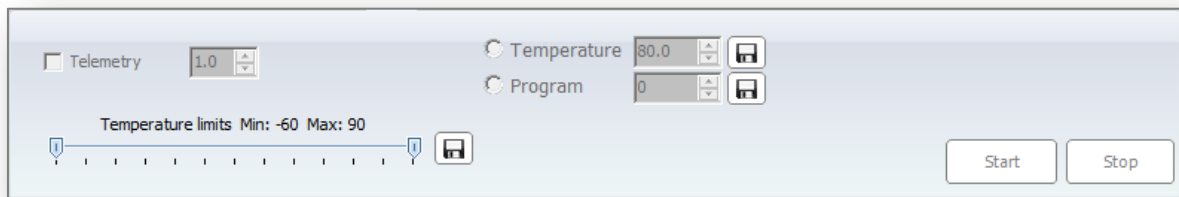
- Status of communication with the device;



- The settings menu; 



1.7.2.1 Control Panel:

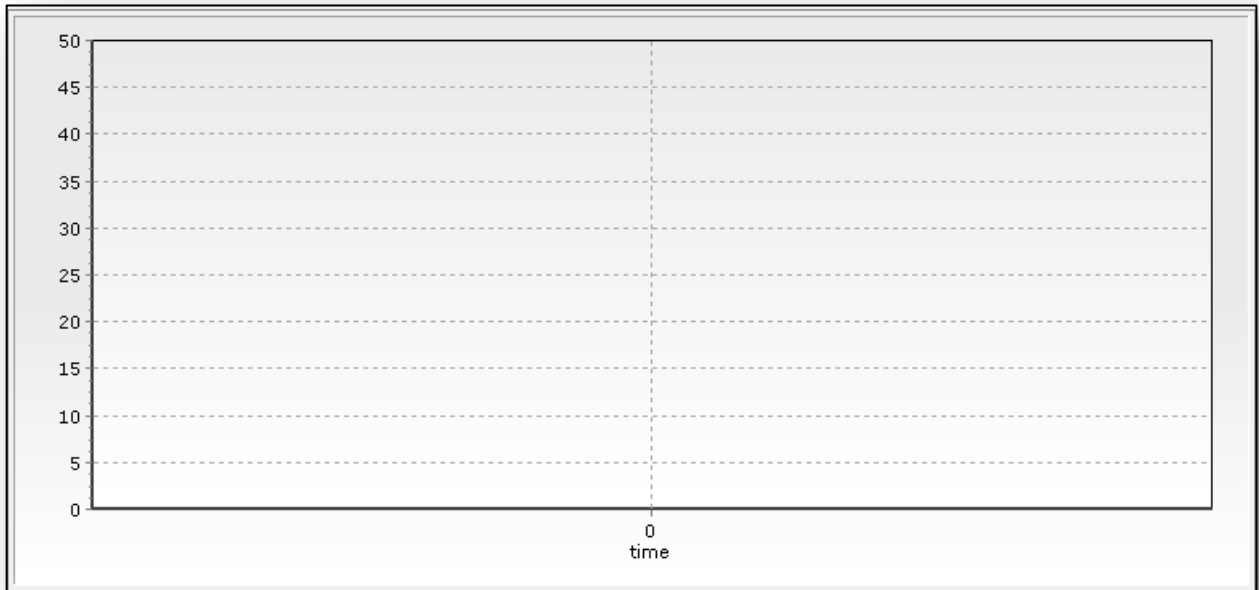


- Display area:

1.7.2.2 Events Logging:

| Time | Work mode | | | Temperature | | | State | Description state |
|------|-----------|-------|----------|-------------|----------|---------|-------|-------------------|
| | Mode | State | SetPoint | Main | Heatsink | Ambient | | |
| | | | | | | | | |

1.7.2.3 Monitor:



1.7.2.4 The Program Editor

See the description of "*Program Manager*"

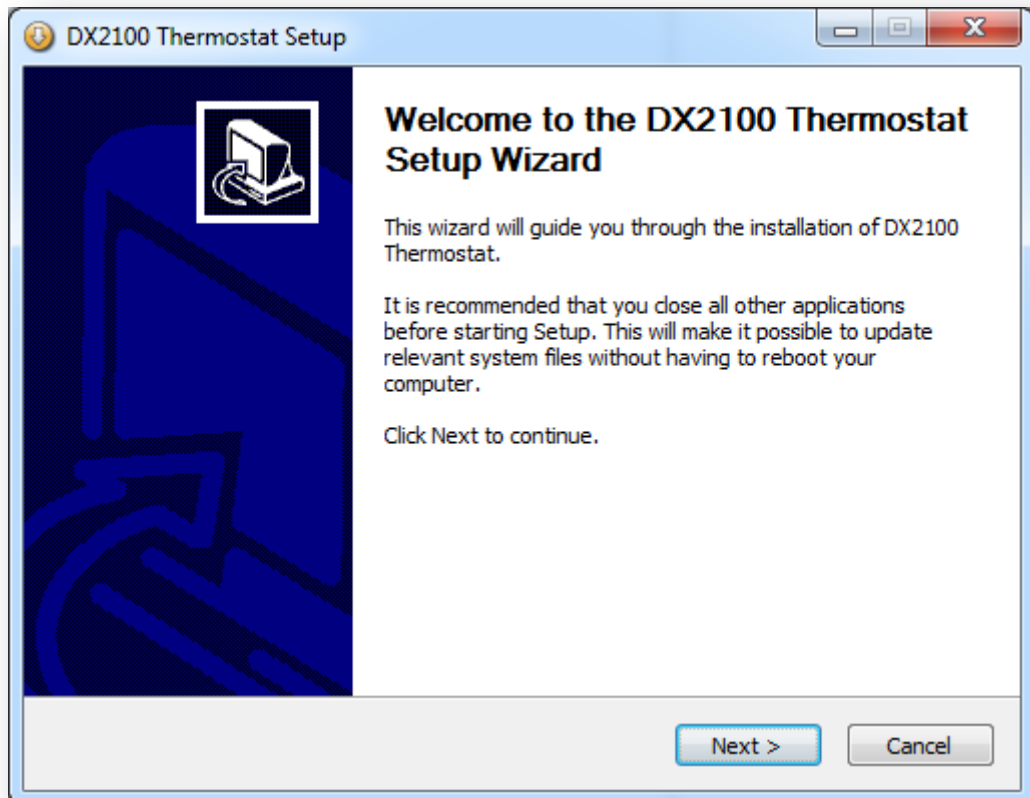
| PRG0 | PRG1 | PRG2 | PRG3 | PRG4 | PRG5 | PRG6 | PRG7 | PRG8 | PRG9 |
|---------|---------|----------|------|----------|------|------|------|------|------|
| ProgNum | LineNum | SetPoint | Time | NextLine | Mode | | | | |
| | | 0 | | | | | | | |
| | | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| | | 5 | | | | | | | |
| | | 6 | | | | | | | |
| | | 7 | | | | | | | |
| | | 8 | | | | | | | |
| | | 9 | | | | | | | |
| | | 10 | | | | | | | |

1.7.2.5 Status Panel:

DX2100.100 control by computer Device status: 0x0040

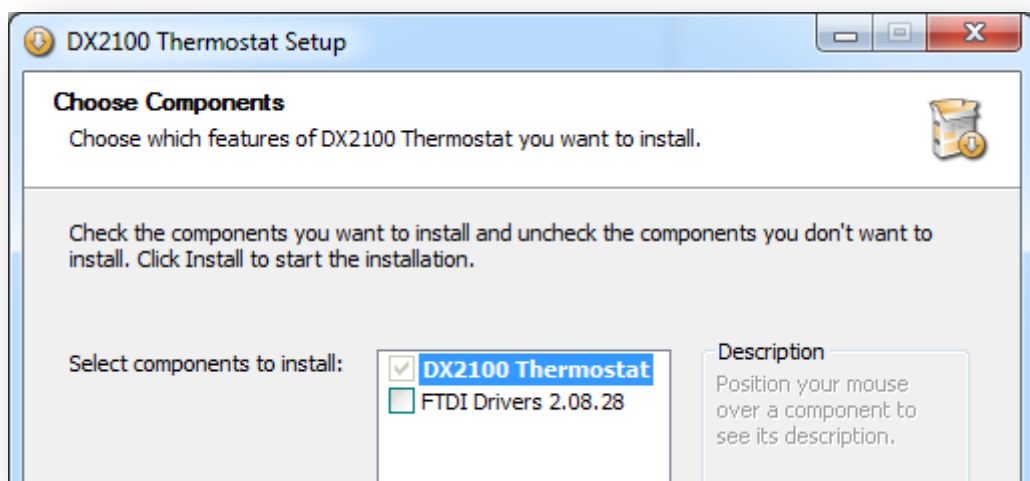
1.7.3 Software Installation

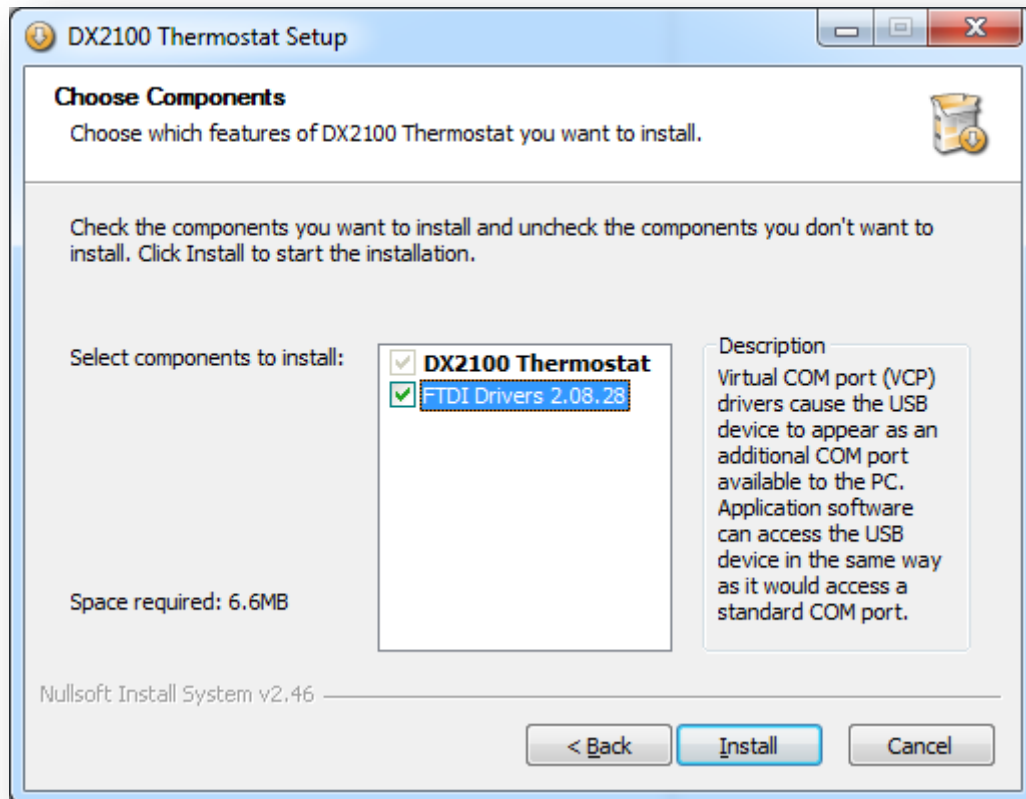
The installation wizard will help to install the program «**DX2100 Setup.exe**»:



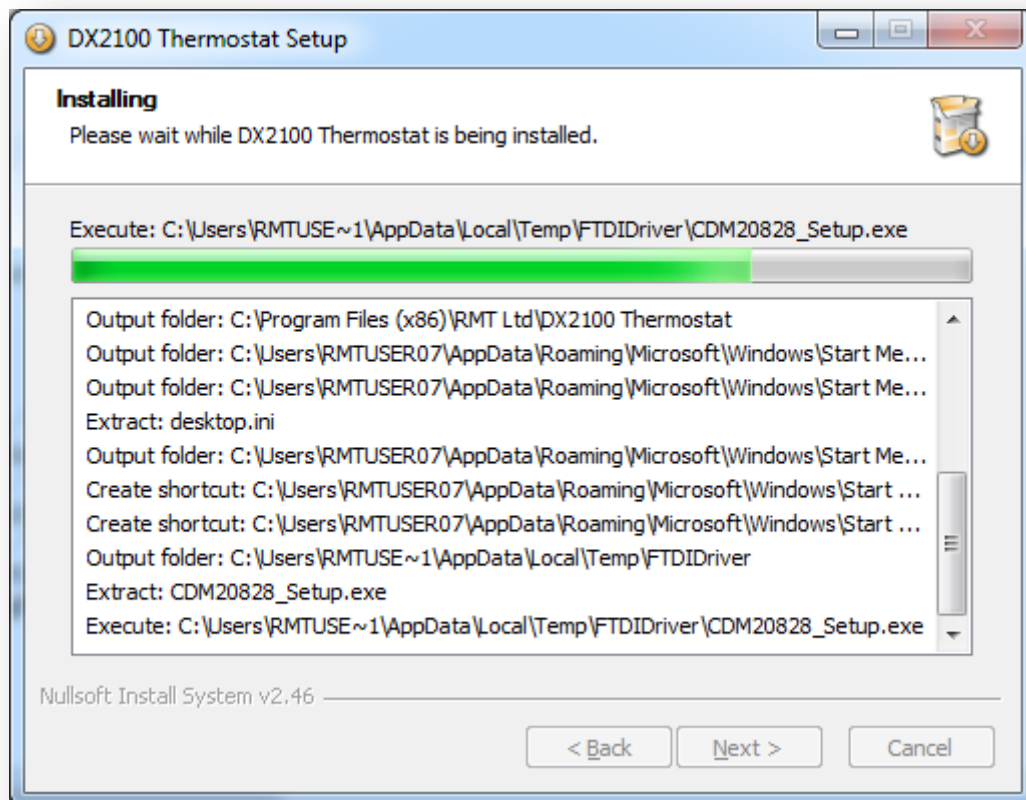
1.7.4 Drivers FTDI Installation

If you have not installed FTDI drivers, or if you are not sure, mark the appropriate option:

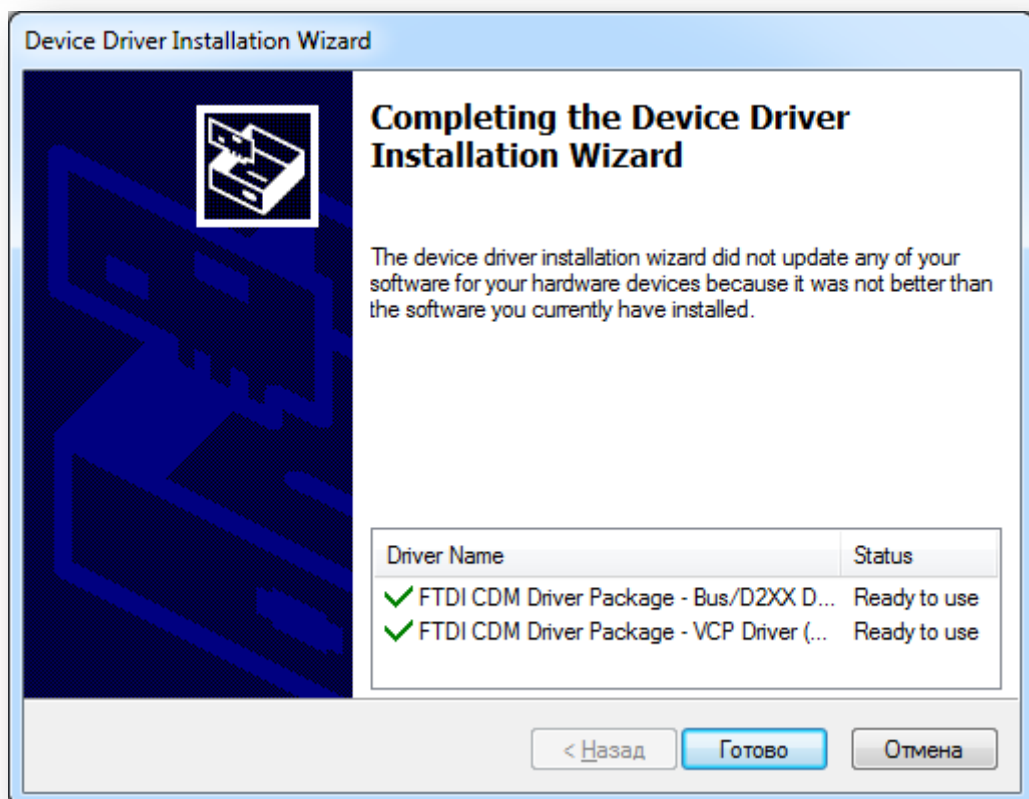
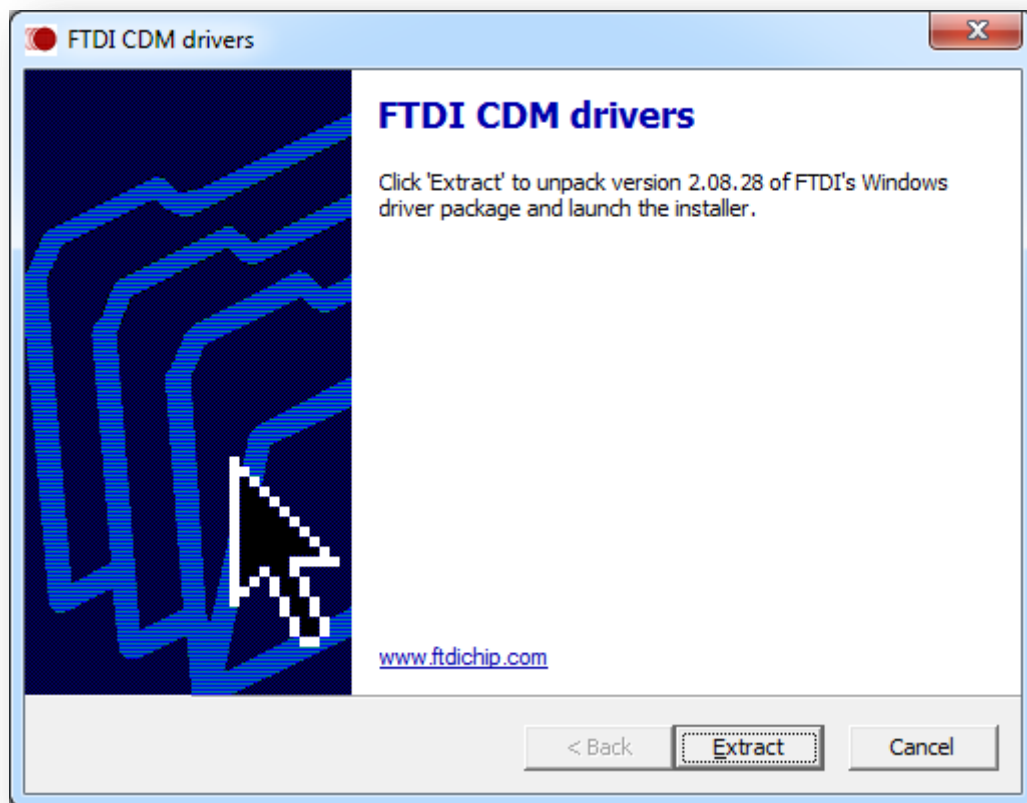


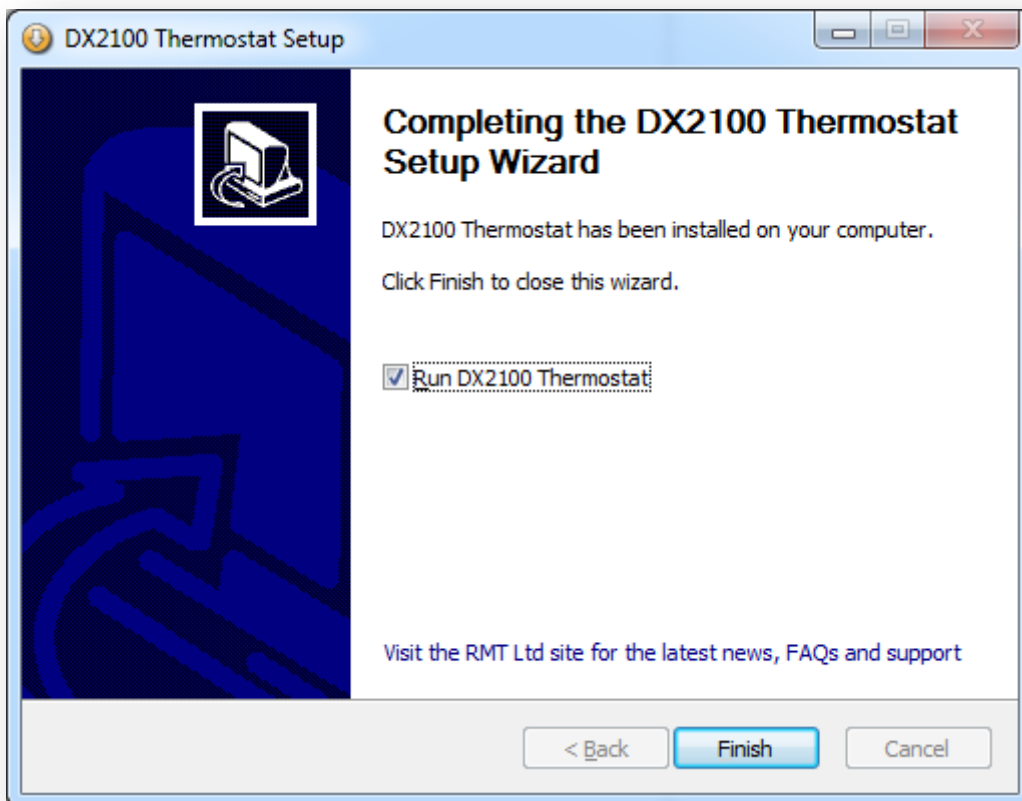
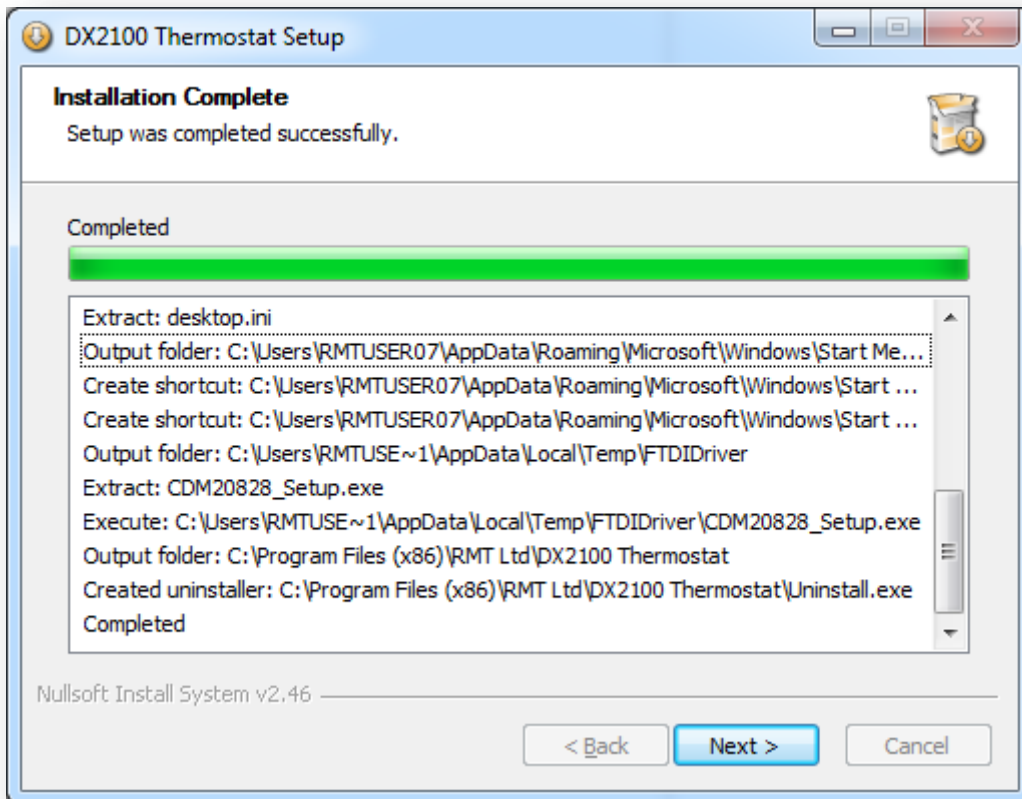


Then the installation program copies the necessary files to your computer:



And the installation of *FTDI CDM drivers* starts:

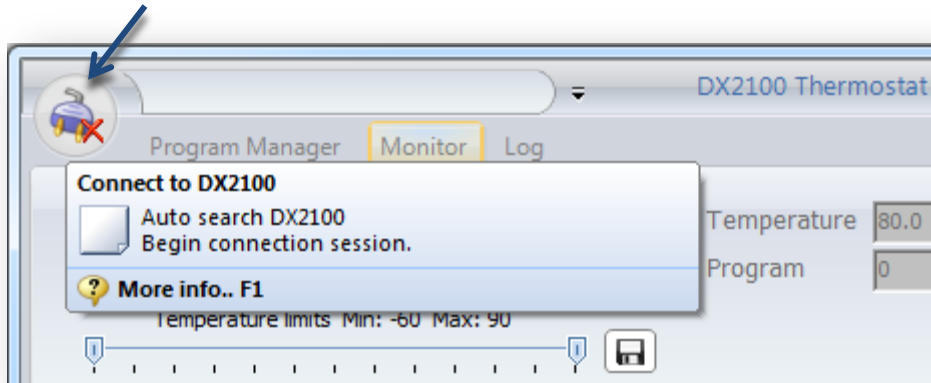





1.8 Work with the Program

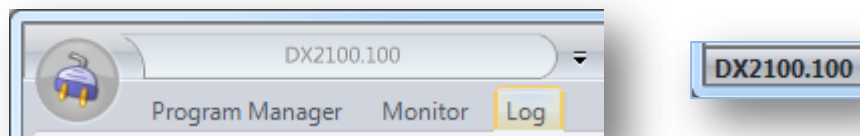
1.8.1 Connection

- Connect the device to your computer by the cable USB A -> mini USB.
- Run the program. Connect to the device by pressing the connection in the upper left corner:

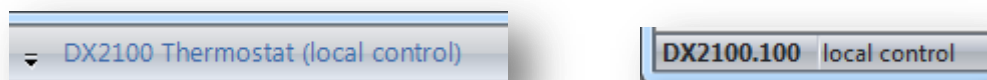



The program enables communication with the device, and displays the following information:

- Communication status: 
- Device identifier

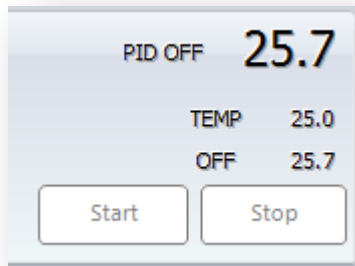


- current mode (selected by pressing the F2 button on the remote control):
 - Local control²:

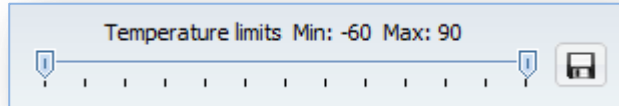


- Computer control:
 - 

² In this mode the device control by the program is not possible. Only displaying and logging can be done.



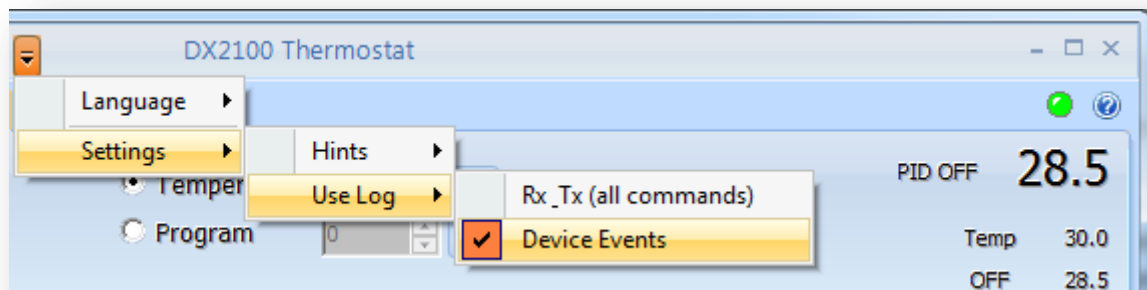
- temperature setpoint: 25.0
- chamber temperature: 25.7
- operating range:



- All the device parameters can be found in the log:

| Time | Work mode | | | Temperature | | | State | Description state |
|------------------|-----------|-------|----------|-------------|----------|---------|--------|--|
| | Mode | State | SetPoint | Main | Heatsink | Ambient | | |
| 9.4.2013 5:07:57 | PID | On | 25.0 | 25.0 | 28.7 | 30.7 | 0x0140 | the temperature within the setting; control by computer; |
| 9.4.2013 5:08:40 | PID | On | 30.0 | 25.0 | 28.7 | 30.7 | 0x0140 | the temperature within the setting; control by computer; |
| 9.4.2013 5:08:41 | PID | On | 30.0 | 25.0 | 28.7 | 30.7 | 0x0040 | control by computer; |
| 9.4.2013 5:09:11 | PID | On | 30.0 | 26.1 | 27.7 | 30.7 | 0x0000 | local control; |
| 9.4.2013 5:09:18 | PID | Off | 30.0 | 27.3 | 27.4 | 30.7 | 0x0000 | local control; |
| 9.4.2013 5:09:30 | PID | Off | 30.0 | 28.5 | 27.6 | 30.8 | 0x0040 | control by computer; |

- If in the main menu the option is chosen "Settings->Use Log->Devie Events", the *EventLog.log* will be stored.




| | | | | | | | | |
|--------------|-----|-----|------|------|------|------|--------|--|
| 17:07:57.957 | PID | RUN | 25.0 | 25.0 | 28.7 | 25.0 | 0x0140 | the temperature within the setting; control by computer; |
| 17:08:40.940 | PID | RUN | 30.0 | 25.0 | 28.7 | 25.0 | 0x0140 | the temperature within the setting; control by computer; |
| 17:08:41.941 | PID | RUN | 30.0 | 25.0 | 28.7 | 25.0 | 0x0040 | control by computer; |
| 17:09:11.911 | PID | RUN | 30.0 | 26.1 | 27.7 | 26.1 | 0x0000 | local control; |
| 17:09:18.918 | PID | OFF | 30.0 | 27.3 | 27.4 | 27.3 | 0x0000 | local control; |
| 17:09:30.930 | PID | OFF | 30.0 | 28.5 | 27.6 | 28.5 | 0x0040 | control by computer; |

1.8.2 Thermostat Control³

To control the operation of the device there are two modes: constant temperature maintenance and work by program.

³ The Thermostat control is only possible unless it is not in the mode "Local Control". In this case the device only receives the commands from the remote control.

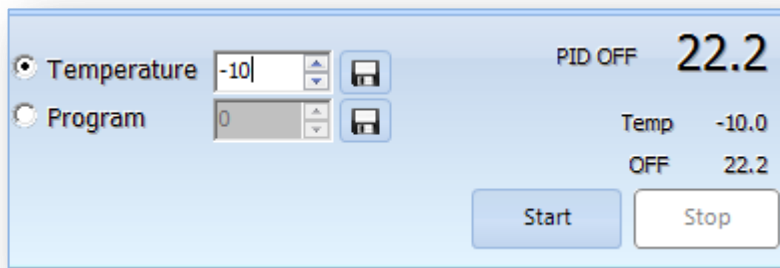
1.8.3 Temperature Maintenance

Select the radio button "Temperature", set the desired temperature, such as -10 °C. Clicking  stores this value in the device.

Run the control by pressing the button "Start":



After that, the regulation for a selected temperature starts, accessibility of the buttons "Start" and "Stop" changes, as well as the status record is added in the event log (if enabled).




| | | | | | | | | | |
|--------------------------------|------------------|-----|-----|-------|------|------|------|--------|---------------------------|
| ▶ | 9.5.2013 9:31:42 | PID | Off | -10.0 | 22.2 | 22.2 | 25.5 | 0x0040 | control by computer; |
| DX2100.100 control by computer | | | | | | | | | Device status: 0x0040 ..: |

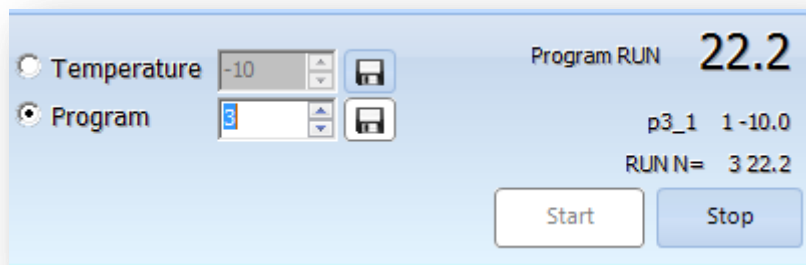
To stop the regulation, press the button "Stop".

1.8.4 Work by Program

To start the regulation by the program stored beforehand (see creating and editing programs in the next section), you must make the following steps:

Select the mode "Program", set the desired number, clicking .

Store the selection in the device and start the work by the button "Start".



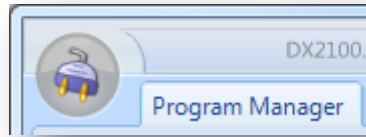
During the program execution, after going to the next line, the device automatically generates an event that is stored in the event log (if the event logging enabled).

When temperature setpoint (within +/-1 °C) is achieved, the record is also stored to the event log.

1.8.5 Program Manager

The device has a mode "Program" allowing a user to control time regulation. The programs are stored in non-volatile memory the controller.

To edit the time-controlling programs there is a tab "Program".

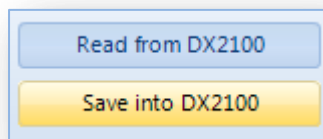


The device can store up to 10 programs, each of which can contain up to 10 lines (temperature setpoints). The program execution is accompanied by the transition from one line to another.

| PRG0 | PRG1 | PRG2 | PRG3 | PRG4 | PRG5 | PRG6 | PRG7 | PRG8 | PRG9 | |
|------|---------|---------|----------|------|----------|------|------|------|------|--|
| | ProgNum | LineNum | SetPoint | Time | NextLine | Mode | | | | |
| | 0 | 0 | 0.1 | 7 | 1 | 0 | | | | |
| | 0 | 1 | 20 | 10 | 0 | 1 | | | | |
| | 0 | 2 | 9 | 1 | 1 | 0 | | | | |
| | 0 | 3 | 999.9 | 1 | 11 | 2 | | | | |
| | 0 | 4 | 999.9 | 1 | 11 | 2 | | | | |
| | 0 | 5 | 24 | 1 | 1 | 0 | | | | |
| | 0 | 6 | 999.9 | 1 | 11 | 2 | | | | |
| | 0 | 7 | 16 | 1 | 3 | 1 | | | | |
| | 0 | 8 | 14 | 1 | 2 | 1 | | | | |
| | 0 | 9 | 999.9 | 1 | 11 | 2 | | | | |
| | 0 | 10 | 25 | 5 | 3 | 1 | | | | |

The program line that does not satisfy the requirements is highlighted by the red color.

The lines with a white background will be stored to the controller when clicking the button⁴:



⁴ **Attention:** You are supposed to check the logic of the program yourself. The software only controls if the input values are valid or not.

Each line consists of the following:

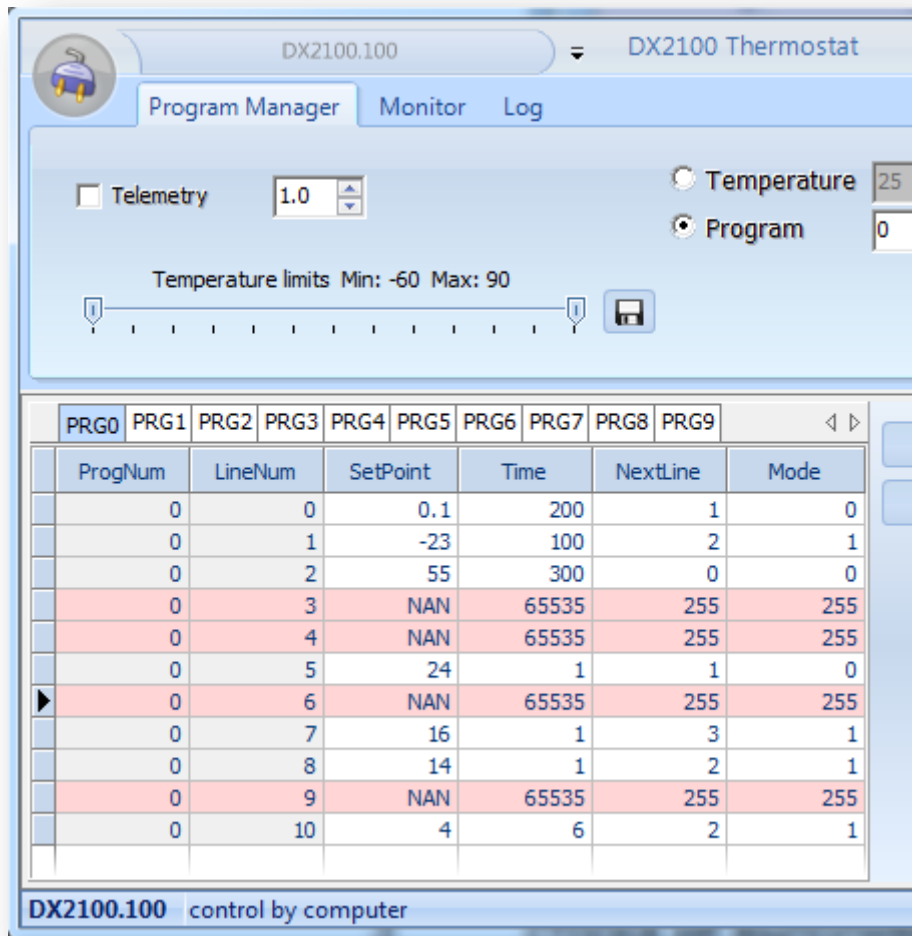
| Parameter | Description | Valid values |
|-----------|--|--------------|
| SetPoint | Temperature to maintain (setpoint) | |
| Time | Time delay before going to the next line (in seconds) - see Mode | 1...65535 |
| NextLine | The line number to go after the delay on the current line (address) | 0...9 |
| Mode | Way of timing 2- Counting of delay on a line begins the moment the line is transferred to. 3- Counting of delay on a line begins the moment the temperature setpoint is achieved | 0 / 1 |

The program is always run on line 0.

Since it is possible to cycle programs, in addition to ten lines with setpoints there is one more line, which defines a behavior of the program and its completion. Its structure is presented in the table below.

| Parameter | Description | Valid values |
|-----------|--|--------------|
| SetPoint | Temperature to maintain after the program is completed. (If MODE =1) | |
| Time | Cycles counter (if it equals zero, it is the competition sign). | 1...999 |
| NextLine | Number of the line on which the completion condition is verified (the "last" line). The completion condition is the equality to zero of the cycles counter Time . To arrange an infinite cycle we should set NextLine > 9. To execute the program once we should set the "last" line and NextLine =0 or NextLine =1. | 0...9 |
| MODE | Completion condition (if the regulation after the program completion is over) 0- No regulation (sleep mode) 1- Mode of maintaining SetPoint is ON | 0 / 1 |

1.8.6 Program Example



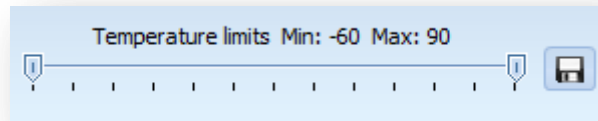
Storage of Program № 0

- 0 Line – setpoint is 0,°C, time 200 s, timing starts from the moment the line is transferred to ("Mode" – 0), the next line to perform - 1;
- 1 Line – setpoint is -23°C, time 100 s, timing starts from the moment the Thermostat reaches the setpoint ("Mode" – 1), the next line to perform - 2;
- 2 Line – setpoint is 55°C, time 300 s, timing starts from the moment the line is transferred to ("Mode" – 0), the next line to perform (cycling mode);
- 3 Line is not performed;
- 4 Line is not performed;
- 5 Line is not performed;
- 6 Line is not performed;
- 7 Line is not performed;
- 8 Line is not performed;
- 9 Line is not performed;
- 10 Line – "Last" line of the cycle – 2, cycles number 6, after a given number of cycles of the Thermostat, the temperature setpoint 4°C is achieved ("Mode" – 1) before switching OFF.

1.8.7 Temperature Limits

To protect your object, you can limit the working range of temperatures. When the limits are exceeded, the regulation is off.

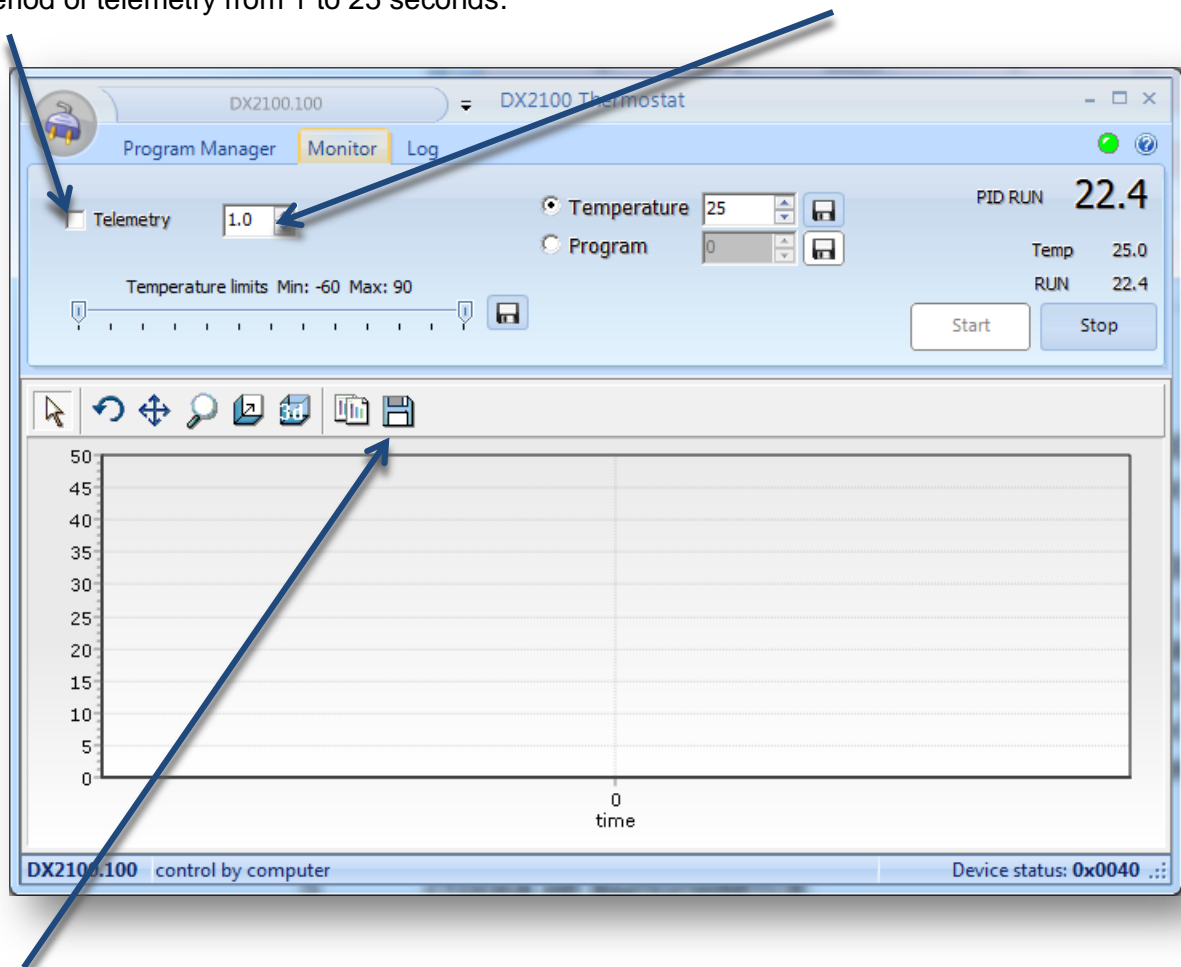
To set new values, use the regulator:



For storage into the device use the button  .

1.8.8 Telemetry and Monitoring

By ticking you can initiate the device telemetry output. It is also possible to set the period of telemetry from 1 to 25 seconds.



The toolbar will help you to save the data and change the appearance of the graph.

1.9 Thermostat State Control

The Thermostat has the parameters control. If a parameter value is not valid, an error is generated. Error code should be regarded as a combination of bit fields. Each bit corresponds to a specific error.

Table 6

| Error reason | bit | mnemonics |
|--|------|------------|
| Heat sink temperature exceeds its limits | 0x01 | ErrFAN |
| Temperature exceeds its limits | 0x02 | ErrLimTemp |
| Program error | 0x04 | ErrProg |
| Attempt to run at non-valid temperature | 0x08 | ErrTempSet |
| ADC error | 0x10 | ErrADC |
| Error of DC/DC converter | 0x20 | ErrDCDC |

In case of one of the above errors - the error code in the form EXX appears at the beginning of the bottom line of the display, where XX is a hexadecimal representation of the byte errors. The error code is flashing in sync with the red LED. The sound beeps at the same time.

For example:



The sound stops when you press any button on the remote control. Also, pressing a button resets the errors ErrTempSet and ErrProg, which may occur during the program execution.

The error DC/DC converter is not reset and requires switching off the device.

The remaining errors are reset after the disappearance of their reason, but the logging of events goes on when connected to the computer and running the program.

1.9.1 Error Codes

It is possible to identify errors by the codes with the help of Table 7.

| ERROR | ErrDCDC | ErrADC | ErrTempSet | ErrProg | ErrLimTemp | ErrFAN |
|-------|---------|--------|------------|---------|------------|--------|
| E01 | | | | | | + |
| E02 | | | | | + | |
| E03 | | | | | + | + |
| E04 | | | | + | | |
| E05 | | | | + | | + |
| E06 | | | | + | + | |
| E07 | | | | + | + | + |
| E08 | | | + | | | |
| E09 | | | + | | | + |
| E0A | | | + | | + | |
| E0B | | | + | | + | + |
| E0C | | | + | + | | |
| E0D | | | + | + | | + |
| E0E | | | + | + | + | |
| E0F | | | + | + | + | + |
| E10 | | + | | | | |

| ERROR | ErrDCDC | ErrADC | ErrTempSet | ErrProg | ErrLimTemp | ErrFAN |
|-------|---------|--------|------------|---------|------------|--------|
| E20 | + | | | | | |
| E21 | + | | | | | + |
| E22 | + | | | | + | |
| E23 | + | | | | + | + |
| E24 | + | | | + | | |
| E25 | + | | | + | | + |
| E26 | + | | | + | + | |
| E27 | + | | | + | + | + |
| E28 | + | | + | | | |
| E29 | + | | + | | | + |
| E2A | + | | + | | + | |
| E2B | + | | + | | + | + |
| E2C | + | | + | + | | |
| E2D | + | | + | + | | + |
| E2E | + | | + | + | + | |
| E2F | + | | + | + | + | + |
| E30 | + | + | | | | |

| | | | | | | |
|-----|--|---|---|---|---|---|
| E11 | | + | | | | + |
| E12 | | + | | | + | |
| E13 | | + | | | + | + |
| E14 | | + | | + | | |
| E15 | | + | | + | | + |
| E16 | | + | | + | + | |
| E17 | | + | | + | + | + |
| E18 | | + | + | | | |
| E19 | | + | + | | | + |
| E1A | | + | + | | + | |
| E1B | | + | + | | + | + |
| E1C | | + | + | + | | |
| E1D | | + | + | + | | + |
| E1E | | + | + | + | + | |
| E1F | | + | + | + | + | + |

| | | | | | | |
|-----|---|---|---|---|---|---|
| E31 | + | + | | | | + |
| E32 | + | + | | | + | |
| E33 | + | + | | | + | + |
| E34 | + | + | | + | | |
| E35 | + | + | | + | | + |
| E36 | + | + | | + | + | |
| E37 | + | + | | + | + | + |
| E38 | + | + | + | | | |
| E39 | + | + | + | | | + |
| E3A | + | + | + | | + | |
| E3B | + | + | + | | + | + |
| E3C | + | + | + | + | | |
| E3D | + | + | + | + | | + |
| E3E | + | + | + | + | + | |
| E3F | + | + | + | + | + | + |

2 STORAGE

The Thermostat should be stored in stock in the manufacturer's original package at the ambient temperature 5 - 40 °C and relative humidity up to 80%.

Dust, vapors, acids and alkalis corrosive gases and other substances in the storage room, that may cause corrosion should not exceed corrosive agents in the atmosphere of type 1 according to the Russian State Standard 15150-69.

3 Shipment

The Thermostat in the manufacturer's package may be shipped in closed vehicles of any land transport and in heated and pressurized cargo compartment.

Limit climatic conditions of shipment:

Ambient temperature – from -30 to +50°C;

Relative humidity – not more than 95% at 25°C.

Placement and fastening of the packed devices in a vehicle must ensure their steady position and prevent a movement during the transportation.

4 UTILIZATION

The Thermostat does not contain any hazardous particles and environmentally harmful substances. Recycling is done in the way adopted by the consumer enterprise.

5 WARRANTY

The company-manufacturer guarantees that the device parameters and specifications correspond to those given here, if the consumer observes the conditions of use, shipment and storage.

The shelf life is 6 months from the date of manufacturing.

The warranty period is 12 months from the date of delivery to the customer.

The delivery date is indicated in this manual. In the absence of a mark on the delivery date, the warranty shall be calculated from the date of the device manufacturing.

The customer cannot be provided with a warranty repair in the case of a disobedience of the rules of operation, transportation and storage.

6 PACKAGE CERTIFICATE

Thermostat DX2100 _____

Serial number _____

Packed _____

(Name or code of manufacturer)
according to the requirements of the existing technical documentation

(personal signature)

(printed name)

(year, month, date)

7 ACCEPTANCE CERTIFICATE

Thermostat DX2100,

Serial number _____

manufactured and accepted in accordance with the requirements of the technical documentation and found fit for service.

Quality department representative

locus sigilli

(personal signature)

(printed name)

(year, month, date)

Initial verification carried out

Verification officer

(personal signature)

(printed name)

(year, month, date)

8 CERTIFICATE OF DELIVERY

Thermostat DX2100 _____

Serial number _____

Delivered _____

(Name or code of costumer)

Delivery date _____

Head of Sales RMT Llc.

(personal signature)

(printed name)

