Industrial network for monitoring and control of temperature processes “esa net 5.10”

The industrial network for monitoring and control of temperature processes “esa net 5.10” serves for reading and collecting temperature data in a given production, through devices called temperature-archivers and thermo-controller-archivers. The devices are connecting to a common network with a computer station (PC). The exchange of data between the devices and the computer station is done by a two-wire line. A standard RS485 protocol is used to exchange data between the devices and the computer station. The speed of data transmission on the line is 19,2 Kbps. The industrial network consists of the following units:

- Devices (temperature-archivers)
- connecting bus (network - two-wire line)
- computer station (PC)
- software (esa_net_5.10.exe)

1. Devices

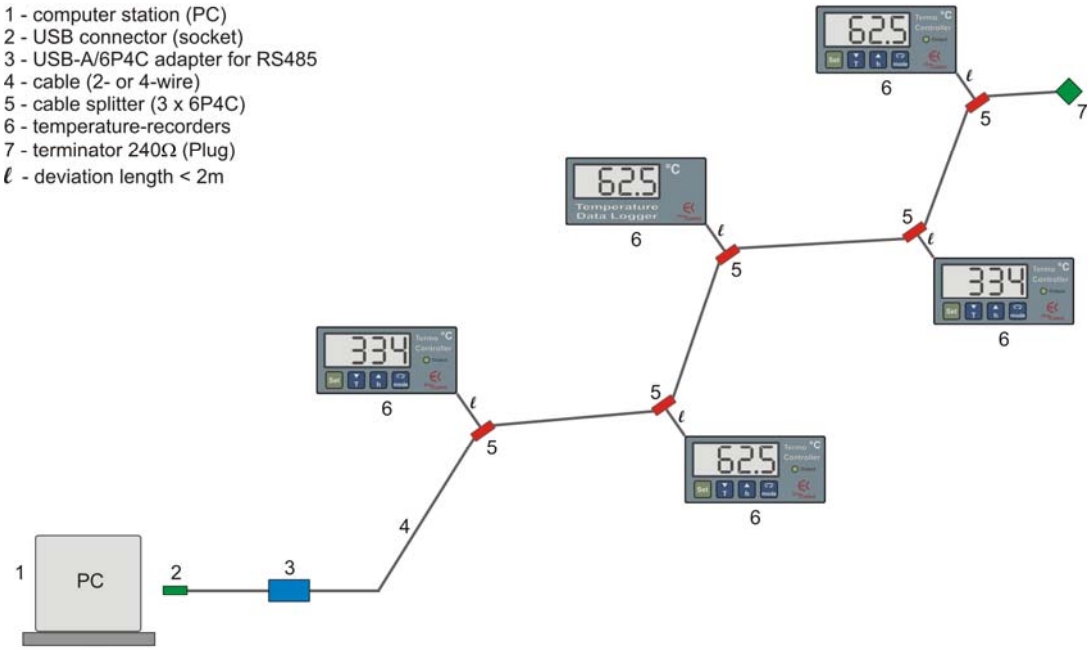
The devices included in the industrial network are temperature-archivers or thermo-controllers-archivers (fig.1) of the type: TCA4-1, TCA4-2, TCA4-1I, TCA4-2I. Each device has a 6P4C telephone socket on the back, which serves to connect the device to the industrial network. A standard RS485 protocol is used to exchange data over the two-wire network. The devices have built-in non-volatile memory for storing 8192 records (file size 586KBt). They have 3V power battery for support real-saving time and date (fig.2). When the supply voltage is on, every minute in the EEPROM memory of each device is recorded current temperature and condition of basic parameters (T, h, Mode). The maximum number of devices included in an industrial network to a USB-port of the computer station can not be more than 31.

fig.1

fig.2

2. Connecting bus

The connecting bus is a two-wire or four-wire flat telephone cable of the type "RJ11", "RJ12" which makes the physical connection between the individual devices and the computer station. The total length of the cables should not exceed 1000m. Each connecting cable ends with a “6P4C” telephone connector for quick and convenient connection between the devices. The bus is constructed as a "consistent" structure. It starts with an RS485 adapter (converter) “USB-A / 6P4C” and ends with a 240 Ohms terminator (fig.3). The bus connects to one of the USB ports on the PC station.



Structural diagram of series connected devices in an industrial network for control of temperature processes

Fig.3

3. Computer station

For a computer station is use a standard PC that has at least one free USB port, and has installed platform Win98, Windows XP or Win7 ÷ Win10.

4. Software

The program which is use to communicate on all devices connected to the network with a computer station is called "esa_net_5.10.exe". It is designed to work in the middle of Win98, WinXP and Win7 ÷ Win10. The program does not require pre-installed and starts directly from the folder where it is located. Before starting the program, the USB driver “CDM v2.12.00 WHQL Certified.exe” must be installed on the computer. When you start the program, the following window dialog opens:

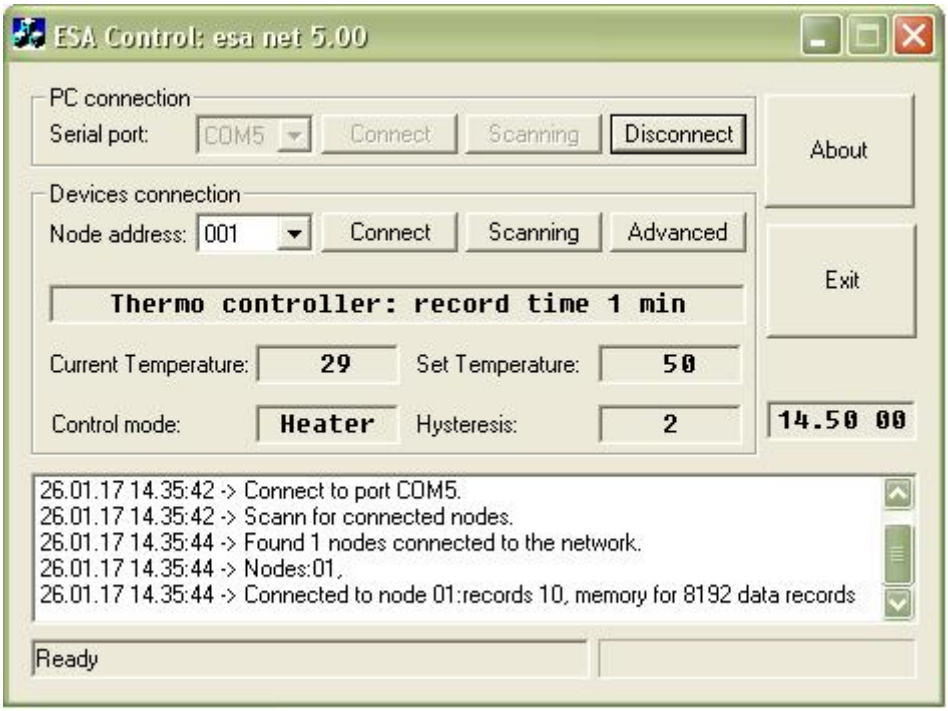


Рис.4

In the upper field of the program "PC connection" are located three buttons by which to select the USB port (input) of the computer to which the network (connection bus) is connected. The “Scanning” button scans all USB ports on your computer. The network must be previously included. By using the arrow in top left is selected the active port (for example COM5). The "Connect" button is pressed and the program is connected to the network to which the devices are connected. Using the button "Disconnect" can be interrupted network connection, and by pressing the "Exit" button is exited the application. The program can connect to USB ports with numbers from COM1 to COM64.
Once the connection is made, the program scans the network and connects to the device with the smallest address. In the squares of the field "Devices connection" is loading the address and the current data of the device. You can again scan the available devices on the network by pressing the “Scanning” button. With this command, the program adjusts the clock and date of each available device with those on the computer and connecting to the device with the smallest address, and typing it in the "Node address:" field (in this case 001). The computer clock is visible on the right side of the program. In the fields "Current Temperature:" (current temperature), "Set Temperature:" (set temperature), "Control mode:" (work mode) and "Hysteresis:" (hysteresis) are display the data stored in the selected device.
In the white box below displays the history of events resulting from operating the program, the number of entries and the memory capacity of the current device. When the program is started, a service file with the extension *.log is automatically created, where the history of the events that have occurred is recorded. The file name contains the current date (log_161202.log). It is planned to create a new service file with extension *.log every day after 00.00 (fig.5).

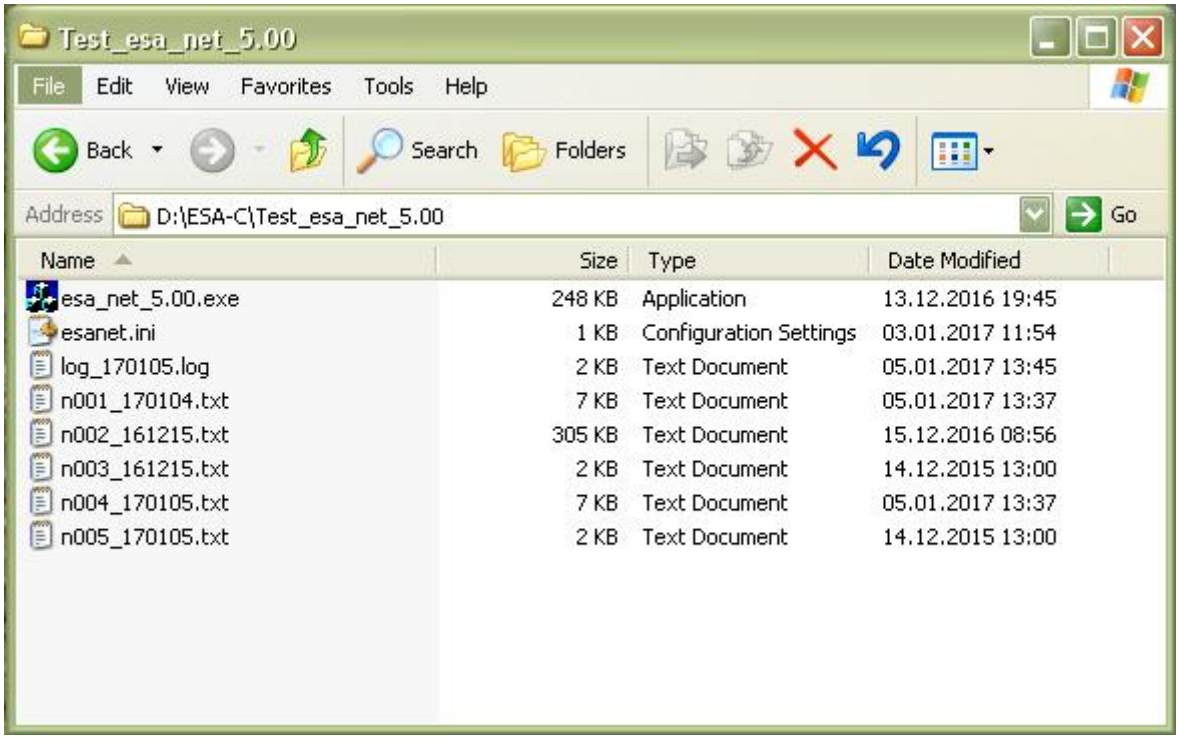


Рис.5

In the directory in which the program and the service files are located, the file "esanet.ini" is also located. It stores the title of the application, as well as the password for the operator's access to the additional features of the program ("Advanced" - functions). This file should not be deleted and must always be in the same folder with the program "esa_net_5.10.exe".

The additional functions of the program are seven (fig.7):

“Read node”	- reading the contents of the memory of the selected device,
“Read all nodes”	- automatically read at the contents of all devices,
“Set record time”	- setting the recording interval of current data (1 ÷ 30min),
“Set control mode”	- setting the operating mode (heating / cooling),
“Set temperature”	- setting the control temperature,
“Set hysteresis”	- setting hysteresis,
“Change password”	- changing the password to access additional features,
“Close”	- exit from additional features.

The operator access to the additional features of the program is possible after entering a password. At the pressing the “Advanced” button opens a new window (fig.6), where is entering the password and confirming with the “OK” button or with the “Enter” key. The initial access password is "esa".

fig.6

After entering the access password, a new field “Advanced:” is added to the bottom of the program (fig.7).

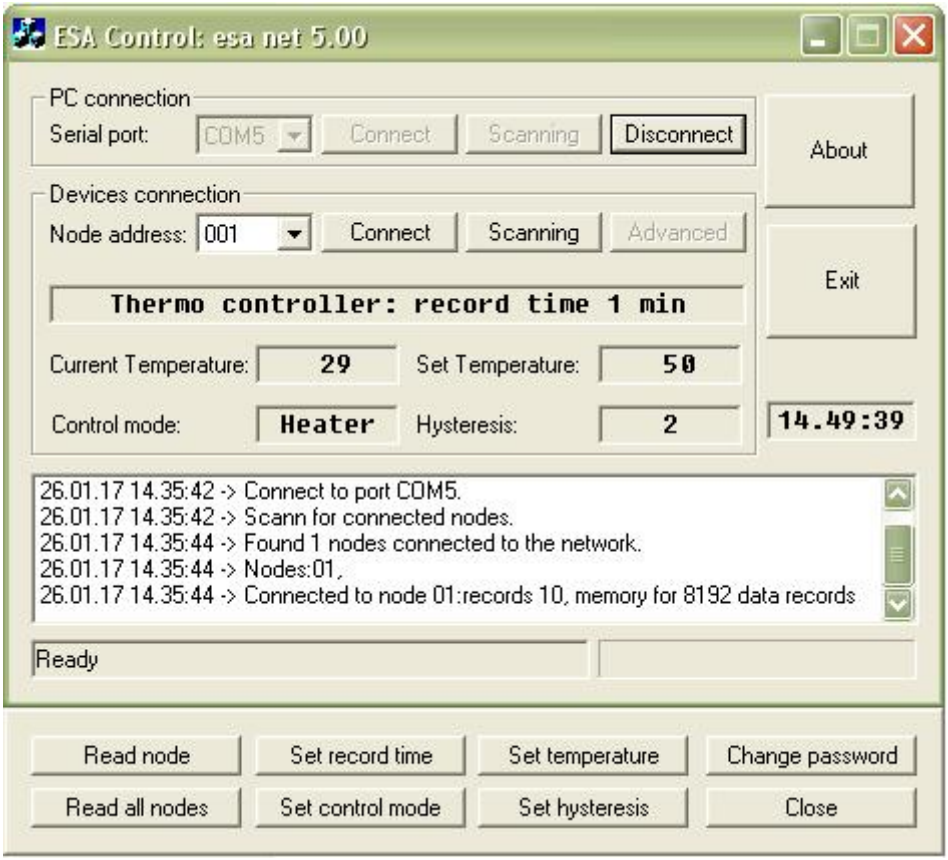


fig.7

At pressing the "Read node" button (reading on device), the program reads the contents of the memory of the selected device. Transfers the data to the computer memory. Resets the device memory. In the directory where the program starts, a text file is created with the data read by the device (fig.5). The name of the created file consists of the device number and the current date. The file has extension *.txt (Example: n004_170105.txt). If you need to read the device memory repeatedly during the day, the data is added to the already existing file of the selected device. **The text file must be closed before reading the device memory.**
When pressing the "Read all nodes" button (automatic reading of all device), the above procedure is automatically repeated for all devices, creating text files for each device connected to the network.
If, during reading, it interrupts the connection to the device or cuts the power, the program does not reset the device data. The created text file is incomplete and must be deleted. After reconnecting, when re-reading the device the program will create a new text file of the same name.
The created text files can be opened with various standard text programs, such as "Notepad", "Microsoft Word" and more. If Notepad is used, it is recommended to select a “Size 11” Courier New font.
The text files can be imported into Microsoft Excel.

The information contained in the text files is structured in tabular form (in columns), as the top is written the number of the device (fig.9):

- column ”Records” - record number (1 to 8192)
- column “Date” - current date
- column “Time” - current time
- column “Event” - event (operation)
- column “Real T” - current temperature
- column “Set T” - set temperature
- column “Hyst.” - set hysteresis
- column “Mode” - operating mode

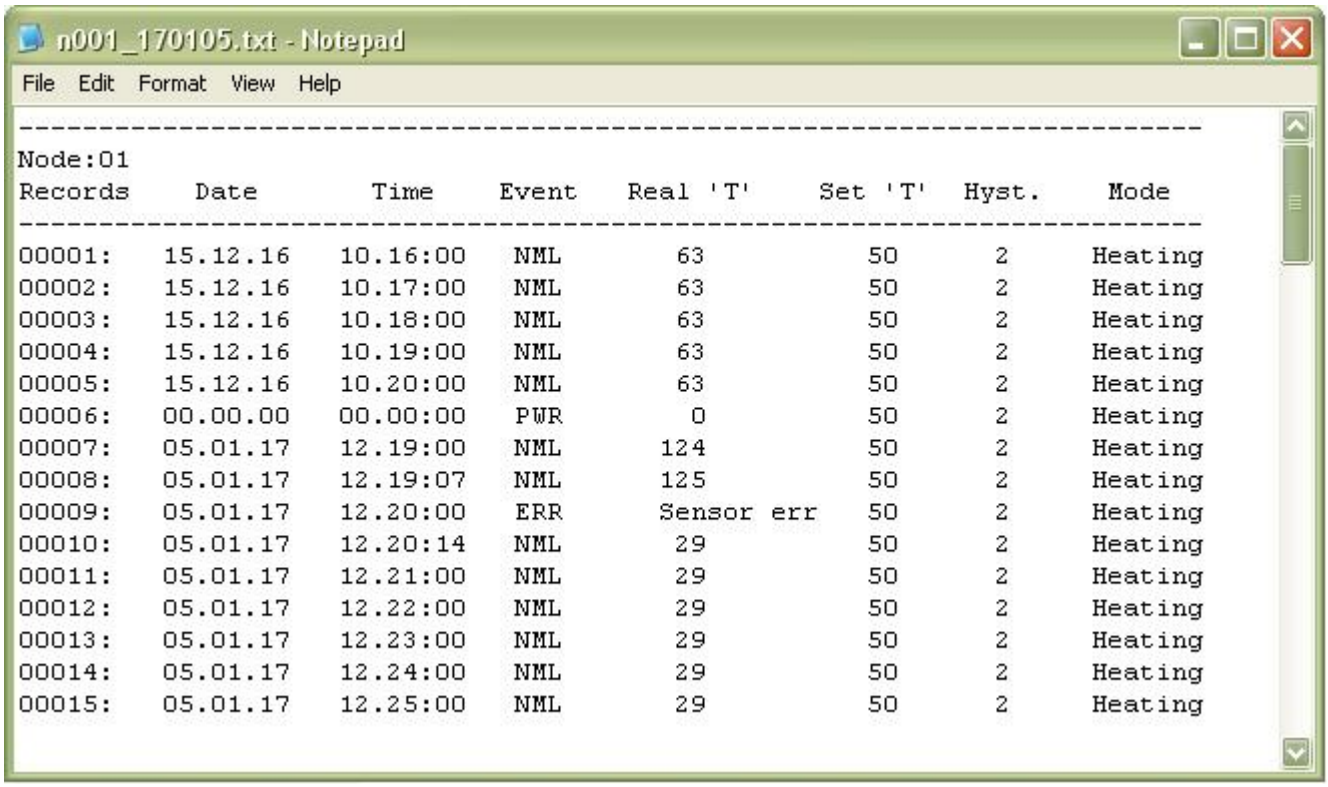


fig.9

The current data is record in the device memory every minute. This can be seen in “Time” column of the text file (fig.9). Apart from every minute, in the device memory is also recorded and when adjustments are made to any of the programmable parameters when the power supply interrupt or when there are problems with the temperature sensor.

Events legend:

NML	-	normal operation (data recording at every minute)
SET	-	parameter setting (T, h, mode, record time)
PWR	-	power supply interruption
ERR	-	broken or shorted temperature sensor

Changing the recording interval “tr” of the selected device is made by pressing the “Set record time” button. A dialog window opens (fig.10), wherein is introduced the desired time interval for the recording of temperature data in the range of 1 to 30 minutes.

fig.10

Changing the operating mode of the selected device is made by pressing the “Set mode” button. A dialog window opens (fig.11), wherein is selected "Heater" (heating) or "Cooling" (Cooling).

fig.11

Changing the control temperature of the selected device is made by pressing the “Set temperature” button. A dialog window opens (fig.12) wherein is selected desired temperature in the specified range. (According to the type of device, the program automatically determines the specified range).

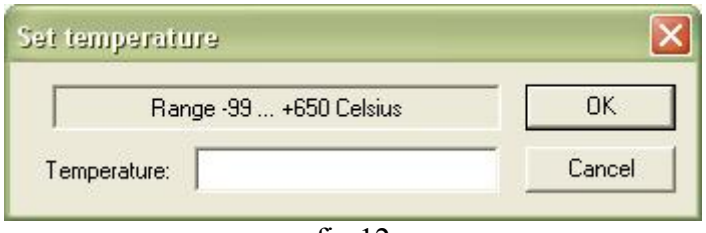


fig.12

Changing the hysteresis of the selected device is made by pressing the “Set hysteresis” button. A dialog window opens (fig.13) wherein is selected desired hysteresis in the specified range. (According to the type of device, the program automatically determines the specified range).

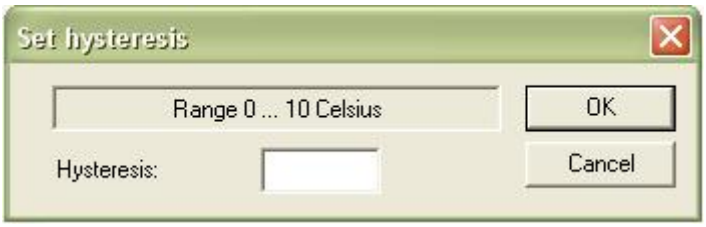


fig.13

Changing the operator access password is made by pressing the “Change password” button. A dialog window opens with two fields, in which is written twice the new password. Confirm with “OK” (fig.14). The password length can be from 1 to 32 characters.

fig.14

Attention: For the correct exchange of the information between a computer station and the devices on the network, the following conditions must be met:

- to be provided power supply to the devices
- to be made physical (electrical) connection between the devices and the computer station.
- to be installed the driver in the computer station: “Driver_FT232R.exe” or “CDM v2.12.00 WHQL Certified.exe”
- the computer is switched on and is running the program "esa_net_5.10".

If any of the above conditions were not met when running "esa_net_5.10", the following message will appear on the monitor:

fig.15

The “OK” button should be pressed. Identify and remedy the cause of the broken information exchange and press the “Scanning” button to restore the connection.