

SVIT

Infrared camera



INSTRUCTION FOR USE (User's guide)

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1. General guidelines

This Operating manual, including specifications, is a user's guide for the computer infrared imaging device for examinations in real-time, model TkVr-IfP "SVIT" (hereafter referring to as Infrared camera SVIT).

Read this Operating manual before utilizing the Infrared camera SVIT.

2. Utilization

- 2.1. Infrared camera SVIT is intended for obtaining of the thermal image of patients (thermogram) and measurement of the temperature at any point of the body of patient without the physical contact with him/her.

Infrared camera is used in: oncology, therapy, urology, mammalogy, traumatology, angiology and other regions of medicine for the early, preventive diagnosis of a whole series of diseases before the appearance of complaints of patient and destructive changes in the cloths

Infrared camera is developed with the use of latest achievements in the technology of the semiconductor detectors of infrared radiation.

The device has a number of new diagnostic abilities.

- 2.2. Utilization of the device is absolutely harmless for both the patients and medical personnel. Therefore the measurement procedure can be performed repeatedly.
The results of measurements are mapped onto the screen of personal computer, are processed by software of the camera and are memorized.
The infrared camera is intended for performing examinations in health centers and clinics.
- 2.3. The infrared camera is designed in accordance with climate conditions of EU standards, but shall be used at 22-26°C temperature, atmosphere pressure of 630-800 mm Hg and relative humidity shall not exceed 80%.
- 2.4. No outside sources of infrared radiation (electrical heating instruments, incandescent lamps) can be present in the diagnostic room. Straight sunlight also strongly influences the quality of the obtained thermograms; therefore blinds should be installed on the windows.

3. Technical Specifications

The technical specifications of the SVIT are the following:

| | |
|---|--|
| Range of the measurement of the temperature | 20 – 41 °C |
| Sensitivity | 0,03 °C (by the object temperature of 32 °C and the temperature of surrounding environment 24 ± 2 °C) |
| Absolute error of measurement of the temperature | $\pm 0,25$ °C (at instrument temperature 24 °C ± 2 °C) |
| Spectral range | 2,65 – 3,1 mkm |
| Type of the detector | Cooled matrix (InAs), dimensions: 128 x 128 elements |
| Optical field of the sight | 18° x 18° |
| Focusing | Manual |
| Frequency frames per second | Not less than 50 |
| Interface | USB 2.0 (High Speed) |
| Refrigerant | Liquid nitrogen |
| Time of output to operating conditions | Not more than 15 minutes |
| Time of continuous operation with the single filling of liquid nitrogen | Not less than 12 hour |
| Regimes of the measurement | They are determined by software |
| Record of the single thermograms | A quantity of written thermograms is determined by the accessible capacity of the hard drive of the computer |
| Record of the thermo-videos | A quantity and the length of each written thermo-film is determined by the accessible capacity of the hard drive of the computer |

The device complies with the requirements of the EU standards.

4. Delivery set

The device set consists of the following items:

| Item | Quantity | Note |
|---|----------|------|
| Thermal-vision camera | 1 pc | |
| SibTherm Software | 1 pc | |
| Pentium 4 type and higher laptop or PC * | 1 pc | |
| Monitor * | 1 pc | |
| Keyboard * | 1 pc | |
| Printer * | 1 pc | |
| Mouse * | 1 pc | |
| Equipment | | |
| Connecting cable | 1 pc | |
| Tripod stand ** | 1 pc | |
| Filling funnel of liquid nitrogen * | 1 pc | |
| Capacity for the filling of liquid nitrogen * | 1 pc | |
| Operating documents | | |
| Passport | 1 pc | |
| User's guide | 1 pc | |

* It is supplied after agreement with the user

** Replacement by another stand, intended for the equipment with more than 4 kg weight, is allowed

5. Device Structure and operation principles

The device set consists of the following items:

- Infrared photoreceiver device
- Controller of the photoreceiver device
- Module of working on the base of computer

All material bodies with the temperature above -273°K emit the electromagnetic radiation, which in accordance to the Planck formula can be presented in the form, shown on Fig. 1 (the dependence of the emission of photons on the wavelength at two temperatures of blackbody is shown). With an increase in the temperature of objects the number of emitted quanta of radiation (IR-radiation) with the fixed wavelength increases. A pure gain in the flow with an increase in the temperature increases with the decrease of wavelength and therefore short-waver photoreceiver with the registration of the thermal image of object can give a very high-contrast image. Photoreceiver devices, sensitive in the range of $2,65\text{-}3,1\text{ mkm}$ are used in the SVIT thermal imaging system.

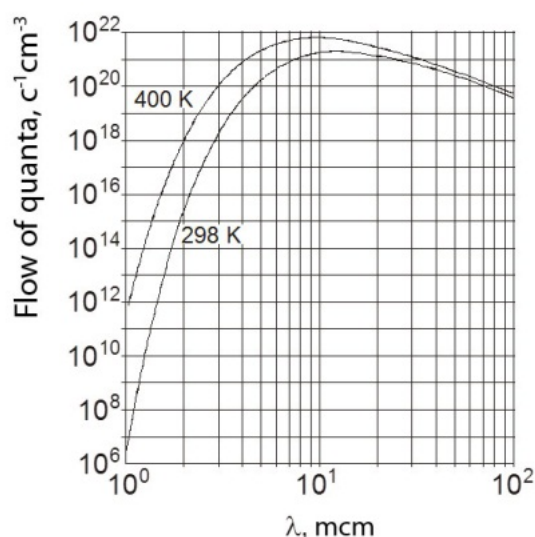


Fig.1. Dependence of the density of the flow of the quanta, emitted by blackbody at two temperatures, on the wavelength

The emitted light quanta, including invisible (infrared) with the wavelength $> 1\text{ mcm}$ can be registered by the sensors of infrared radiations. The thermal image of objects is formed with special infrared lens and is recorded by the photosensitive elements of the matrix, established in the focal plane of lens. The elements of focal matrix convert light quanta into the electric charges, which are read by multiplexer, are strengthened, they are preliminarily processed by electronic circuit and then transferred to the computer. As a result, the thermal-vision image of object is reflected on the screen of monitor. The software of the instrument allows examining of the temperature distribution over the surface of the skin of patient and measuring of the temperature in any point of image.

The techniques of diagnosing of diseases is explained in Doctor's Manual.

The functional diagram of the instrument is shown in Fig. 2. The measurement of the distribution of temperature over the body surface of patient is produced without any contact of instrument with the skin of patient. Instrument measures the natural radiation, radiated by patient, from distance.

Functional scheme of SVIT

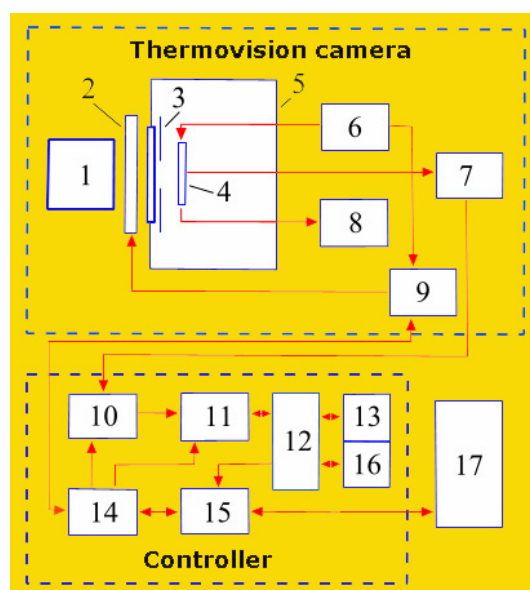


Fig. 2. The simplified scheme of the complete device set

1 - lens, 2 - the calibration device, 3 - cold diaphragm, 4 - matrix [FPU], 5 - vacuum cryostat with the clear window, 6 - generator of the managers of pulse and constant stresses, 7 - amplifier with the differential output, 8 - temperature gauge [FPU] - the automatic weapon of the switching on of the bias voltage of the InAs base layer, 9,14 - units for control and synchronization, 10 - ACP, 11 - adder, 12 - dispatcher of memory, 13,16 - memory banks, 15 - unit of connection to the computer, 17 - the computer

The thermal radiation of the observed scene is focused by lens (1) to the matrix of hybrid microcircuit (4), established in the vacuum cryostat (5). The level of background gating is limited by cold diaphragm (3). All constant and surge voltages necessary for the work of photoreceiver device are assigned by generator (6). The device of calibration consists of two mobile shutters (specular and black), controlled by electromagnets. Electromagnets are governed by the block (9), which also transfers into the block (14) the pulses, which synchronize the work of ATsP (10), adder (11), USB connection unit via USB port (15) and block of the transmission of information about the state of automate (8). Signal from the matrix photoreceiver device will be given to the entrance of amplifier (7). The amplified useful signal is transferred to the personal computer after processing in the controller (10 16).

On the housing of infrared camera there are: the ring of image focusing, USB 2.0 port for the connection to the computer, connector for synchronization (7-pin connector) and fastening for the installation of camera to the stand. The indicator of the readiness of instrument for the work is installed near the neck of cryostat.

6. Safety measures

The Infrared camera SVIT complies with the requirements of the EU standards. The safety measures for Infrared camera SVIT are similar to the general safety measures for any electronics. The Infrared camera SVIT is grounded by contacting solder pads that are in the two-pin plug. Devices connected to the infrared camera SVIT (printer) must comply with the requirements of the EU standards.

The infrared camera must be connected to the power supply by tripolar separated sockets.

7. Setup

The infrared camera SVIT must be used indoors and all climatic requirements defined in Operating manual must be met. The infrared camera SVIT is transported in a plastic box. The device must be unpacked indoors at room temperature.

- 7.1. Open the box and take off the polyethylene cover from the camera.
- 7.2. Fasten thermal-vision camera to the stand.
- 7.3. Connect the camera to the computer by the standard USB 2.0 cable.
- 7.4. Fill the cryostat with liquid nitrogen.
- 7.5. Start the computer.
- 7.6. Start the SibTherm software.
- 7.7. Begin the measurements (in accordance with the instructions for the instrument)
- 7.8. At the end of measurements disconnect the instrument (after turning off the instrument, close the SibTherm software and turn off the computer by standard means.

8. Measurement procedure

For conducting of the measurements the infrared camera is directed to patient. The contact of patient with the camera is not required. The distance between the camera and the patient is determined by the size of region, which is going to be visualized on the thermogram.

After the appearance of an image, by the rotation of the focus ring, which is located under the device lens (in the front section of the instrument), it is necessary to focus image to become sharp.

Control of infrared camera and conducting of measurements is carried out through the dialogue with the SibTherm software.

9. Maintenance

Maintenance shall be carried out in order to prevent damages. Read Safety Measures section of Passport before carrying out maintenance.

Following maintenance types are required:

Day-to-day maintenance is performed by medical personnel according to section 7;

Annual maintenance is performed by technical personnel once a year.

Annual maintenance includes examining of camera units, and technical condition of camera.

In case of malfunction, the device is repaired by representatives of the manufacturer.

10. Troubleshooting

Possible problems include:

| No | Problem | Resolving |
|----|--|---|
| 1 | SibTherm software shows an error and does not work | Reboot SibTherm software |
| 2 | The thermogram is wrong | Check coolant, lens cover, ambient temperature, USB connection, system power supply. Make a calibration process. Check the device driver. |
| 3 | Frame rate is low | Disable interpolation. Type 1 as accumulation parameter |
| 4 | SibTherm software is not executed | Check SibTherm.exe file path. |

When other problems occur, contact the representant of the manufacturer.

11. Packing and transporting

For delivery the camera is packed into a polyethylene film and box.

The documentation is packed into polyethylene film and included in the box with the device.

The camera can be transported by any flight transport excluding non-heated airplane sections, climatic conditions must correspond to the EU standards.

12. Storage

For short term the infrared camera must be stored indoors at 10 - 35 °C temperature, and relative humidity must be 80 % (per cent) at temperature of 25 °C.

For long term the infrared camera must be stored at a warehouse of the manufacturer or customer in accordance with storage conditions of the EU standards.

13. Service & Warranty

The manufacturer guarantees that the Infrared camera SVIT corresponds to indicated specifications when all conditions and use, maintenance, transporting and storing requirements indicated in the device documents are met.

The warranty period is 24 months, it begins once the Acceptance protocol is signed.

The warranty service is carried out by a representant of the manufacturer at no cost to the customer. If the camera is damaged as a result of wrong usage of the device, the warranty service is carried out by the representant of the manufacturer at customer's cost.

14. Warranty claim

All warranty claims must be filled in the following form:

| <i>Initial date of usage (date of signing of the acceptance protocol)</i> | <i>Problem appearance Data</i> | <i>Problem Brief Description</i> | <i>Comments</i> |
|---|------------------------------------|----------------------------------|-----------------|
| | | | |

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WARRANTY CERTIFICATE

for repair (change) within the warranty term

Medical device - Infrared camera SVIT

Number and production data _____

Purchased _____

(data, signature and stamp of seller)

Set in operation _____

(date, signature)

Accepted for warranty _____

(date, signature, malfunction description)

The statement of the representative of the manufacturer: _____

(date, signature, statement)

Acceptance protocol

The Infrared camera SVIT , factory # _____ complies with the technical requirements, contains a complete set of accessories and is serviceable.

Warranty period is 24 months, it begins once this acceptance protocol is signed.

Date: _____

(signature and stamp of seller)

(name of seller)

(signature of buyer)

(name of buyer)