



**Spectrocolorimeter
«TKA-VD»**

Operation manual



Saint Petersburg

TKA SCIENTIFIC INSTRUMENTS
OPTICAL RADIATION METERS



**SPECTROCOLORIMETER
«TKA-VD»/01**

(TU4437-007-16796024-2009)

OPERATION MANUAL

Saint Petersburg
2011



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Warning!

The producer reserves to itself a right to introduce some minor changes into construction and electric circuit of the device "TKA-VD" without indicating them in the instruction manual. Some elements different from those, indicated in the documentation, can be installed in the device, at that metrological and exploitation characteristics of the device won't worsen.

1. INTRODUCTION

This set of exploitation documents, consisting of the instruction manual and User manual Freeware Software, is compiled for studying of a principle of work of Spectrocolorimeter "TKA-VD"/01 (further in the text called "device") and also for being used as a guide while exploitation and servicing.

2. FEATURES

Spectrocolorimeter "TKA-VD"/01 is an instrument for the visible range of spectrum. The device is designed to measure chromaticity coordinates and correlated color temperature of the light sources. It can be used as luminance as well as illumination meter. They are for measurement of the color features, illuminance and luminance of the signal lights, light indicator panel, advertising screen, kino screen, traffic light and etc.

3. TECHNICAL SPECIFICATIONS**3.1. Measuring Ranges:**

- Luminance, cd/m^2 10 ... 20 000 ¹⁾
- Luminance, ftL 3 ... 5 000
- Corr. Colour Temp, K 1600 ... 16 000
- chromaticity coordinates $x = 0.004...0.734$
 $y = 0.005...0.834$.

3.2. Instrument Accuracy, %:.....10.0,
Accuracy (lum.), %, (@ 100cd/m²
and 3100 K) 2.
Repeatability (lum.), % ≤ 1.0 .

3.3. Maximum permissible basic relative measurement error for Corr. Colour Temp., % (not more than) 5.0.

3.4. Spectral Response 390 ... 750 nm,
Spectral resolution, nm (FWHM) 6.0.

3.5. Color Accuracy (for Illuminant A)
..... ± 0.0015 in CIE 1931 x,y.
Color repeatability, x, y..... 0.005.

3.6. Ambient temperature:

- To satisfy specifications..... 0° to +40°C.
Relative humidity, 85% RH (max) non condensing;

Atmospheric pressure, kPa 86...107.

3.7. Continuous running period, h , not less
..... 8.0.

3.8. Dimensions, not more:

- BOS165W×85D×35H (mm)
- Polychromator 240W×70D×70H (mm)

3.9. Weight, Approx, not more 2,5 Kg

3.10. Mean time between failures, h , not less 2000

4. DELIVERY SET

Spectrocolorimeter "TKA -VD"/01..... 1 pc
Rechargeable Battery NiMH 8,4 V1 pc
Battery charger 1 pc
Operation manual 1 copy
Certificate of Compliance 1 copy
Computer cable 1 pc
Software disc in a box..... 1 pc
Consumer packaging 1 pc
Industrial packaging..... 1 pc

5. CONSTRUCTION AND PRINCIPLE OF WORK

5.1 The principle of work of the device is based on measuring of radiation spectrum of a distant source of optical radiation in a visible range of (390...750) nm with further mathematical treatment of the results of measuring by microprocessor.

5.2. Construction

5.2.1. The device consists of two functional blocks: a BOS and a polychromator, connected with a 12-core cable.

5.2.2. Introduction of Front Panel:

«ON/ OFF» - MAIN POWER SWITCH OF THE INSTRUMENT;

«HOLD» - Data-Hold,

«MODE» - SELECT OPERATION MODES.

5.2.3. Introduction of Rear Panel: battery compartment.

6. PRECAUTIONS BEFORE OPERATING

6.1 Before setting to work a consumer should learn carefully the function of the device, its technical characteristics, structure, and principle of work and also the methods of carrying out of measuring.

¹⁾ – Sensitivities are for 10:1 signal to RMS noise against an Illuminant A based NIST traceable luminance standard.

Note: All specification are subject to change without notice.

6.2 Check the availability of a battery. For this purpose you should open the lid of the battery compartment and to insert a battery if necessary. If after switching on or when the device is in operation the sign "**Charge a battery!**" appears on the display you should charge a battery.

7. ORDER OF WORK

7.1. Turn on the device by pressing the button "**ON/OFF**"

7.2. Place an inlet opening of an objective lens of the optoelectronic block parallel to the plane of a measured object. Make sure that a shadow from an operator, carrying out measuring, or shadows from other objects don't fall onto the objective lens.

Wait for 5-8 sec and read the measured value on the digital display.

To switch over to another regime use the button "**MODE**". It goes around on circle:

To switch over to another regime use the button "**MODE**". It goes around a vicious circle:

1. Depicting of Luminance L , ftL and chromaticity coordinates (x , y) (CIE1931);
2. Depicting of Luminance L , cd/m^2 and chromaticity coordinates (r , g) (CIE RGB, with E white point);
3. Depicting of Luminance L , cd/m^2 and chromaticity coordinates (u' , v') (CIE1976);
4. Depicting of tristimulus values R , G , B ;
5. Depicting of tristimulus values X , Y , Z ;
6. Depicting of correlated colour temperature T_{cc} , K .

7.3. In case the signal, caused by the light flux, increases, numerical value, depicted in line **L**, changes automatically to kcd/m^2 .

7.4. If measurements are beyond the receiver sensitivity, a sign "**Luminance is out of limit**" will appear.

7.5. If it is impossible to determine a correlated color temperature a sign "**Corr. Colour is not defined**" (regime of work 6).

7.6. To keep the measured reading on a display press the button "**HOLD**". A letter "**H**" will appear in the right part of a display. To continue measuring press the button "**HOLD**" once more.

7.7. When in regime "**HOLD**" you press the button "**MODE**" - information on circle. To continue measuring press the button "**HOLD**" once more.

7.8. Switch off the device after use.

7.9. In this model to visualize when you hover on the measurement object can use a laser pointer, which is included the button "HOLD". The laser beam is shifted along the optical axis of the instrument to the left by 3/4".

8. MAINTENANCE

8.1 Installation and changing of batteries.

Before exploitation of a device install a battery which is in the set of accessories (If the enterprise-producer didn't do it).

Continued use with a low battery will lead to an abnormal reading.

Open the battery compartment. Please the battery into the insulation capsule and snap it onto the contacts.

If after switching on or when the device is in operation the sign "**Charge a battery!**" appears on the display you should charge a battery.

For charging a battery uses a battery charger, which is in the set of accessories. The time of charging is 5 hours.

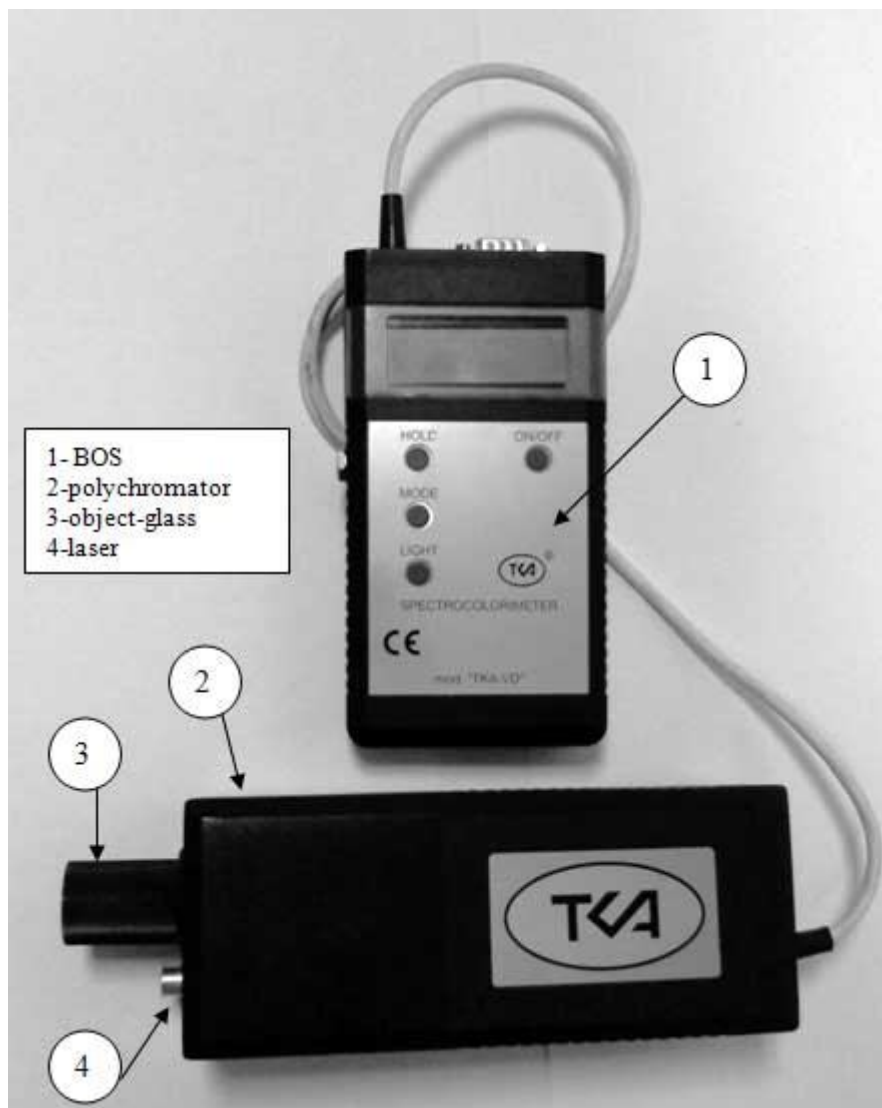
The device is switched off automatically; the LED indicator "Charge" on the back side of the housing will cancel in the end of charging.

When a battery charger is in operation you mustn't open the lid of a battery compartment.

9. STORAGE RULES

9.1. Storage Temperature & Humidity +5 to +40 °C, 85%RH (maximum).

The Spectrocolorimeter Structure (see figure 1)



1 – BOS
2 – Polychromator – 01 «Luminance»
3 – object-glass
4 – laser

10. WARRANTY

10.1. The producer guarantees operational capability of the device and its correspondence to the main technical and metrological characteristics if exploitation and storage rules are observed.

10.2. The warranty period is 18 months since the date of sale.

10.3. If the device goes wrong before termination of a warranty period it is necessary to compile an act in which indicate a kind of faultiness and the time, when the device went wrong and send.

10.4. In case of mechanical damages to the body of the device, interface cable or battery charger or in case the instruction manual is absent the producer doesn't have to fulfill the warranty.

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Valid through:
Действительно до
" 01 " апреля 2015
..... г.

Настоящее свидетельство удостоверяет, что на основании положительных
результатов испытаний утвержден тип спектроколориметров ТКА-ВД

The present certificate attests the pattern of spectrophotometers
TKA-VD on the base of the favorable test results
TKA SCIENTIFIC INSTRUMENTS, LLC Saint Petersburg
registered in the State register of measuring instruments with
No. 44179-10 and admitted for use in the Russian Federation.
Description of the measurement instrument pattern is given
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свидетельству.

Deputy Head
Заместитель
Руководителя



V.N. Krutikov
В.Н.Крутиков

" 31 " 05 20 10 г.

Продлено до

Заместитель
Руководителя

/stamp/: FEDERAL AGENCY FOR TECHNICAL
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Primary State Registration Number
(OGRN) 1047706634232

" " 20 г.

Technical support

Spectrocolorimeter “TKA-VD” is used with the special software.

If you have any problems concerning directly the device or means of calibration, contact the Service Department of LLC TKA SCIENTIFIC INSTRUMENTS.

E-mail of Technical Support: lab@tkaspb.ru

Phone/fax of the Service Department:

+7 (812) 331-19-82

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The service department of technical support of users of the device Spectrocolorimeter “TKA-VD” is fully comprised of qualified technicians for rendering assistance to you by phone or fax.

For such case please have the following information at hand:

- Serial No. of your device.
- Software version No.
- Name of the company and your name.
- Your phone No.
- Record any error messages and what led to them.

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In any correspondence related to the device, specify its serial number. The serial number is on the lower side of the device.

The manufacturer guarantees the operability of the device and conformity with the basic technical and metrological characteristics, provided the consumer complies with the operation and storage conditions.

The warranty is invalid when the serial number on the device is modified, erased, removed, or damaged. The warranty gives no right for recovery of indirect damage resulted from the failure of the devices under warranty.

When the device fails during the warranty period a Certificate should be drawn up specifying the nature of failure and the time when the device failed, and the device should be returned to the manufacturer with enclosed Operation Manual and Certificate. The device is replaced within the pre-agreed times only when it is impossible to repair it.

The manufacturer has no warranty obligations in the following cases:

during the maintenance and repair of the device, related to the replacement of the accessories after their natural wear and tear; after any reworks and improvements effected with a view to expanding the application of the device specified in the user manual; when the user repairs the device.

The warranty does not extend to any failed devices damaged as a result of improper operation, including but not limited to the following:

accidents, lightning strokes, flooding, fire, or other causes beyond the manufacturer's control;

use of the device not for its intended purpose or not in compliance with the user's manual.

The warranty obligations do not infringe upon the consumer's legal rights afforded him/her by the current law.

APPROVED BY
Head of the State Centre for Testing Measuring Instruments
Deputy Director of the Federal State Unitary Enterprise All-Russia
Research Institute of Optical and Physical Measurements

N.P. Muravskaya
December 24, 2009



Spectrocolorimeter «TKA-VD»

Calibration technique

COORDINATED BY

Chief Metrologist of the All-Russia Research
Institute of Optical and Physical Measurements

V.P. Kuznetsov
December 24, 2009

INTRODUCTION

The present technique applies to the Spectrocolorimeters "TKA-VD" of TKA SCIENTIFIC INSTRUMENTS, LLC, Russia (hereinafter referred to as spectrophotometers) and defines methods and means of initial and periodical check.

Calibration interval: 1 year.

1. CALIBRATION PROCEDURES

When performing calibration, the operations indicated in Table 1 are to be carried out.

Table 1

| Procedures | Calibration technique No. |
|--|---------------------------|
| 1. External examination | 7.1 |
| 2. Testing | 7.2 |
| 3. Determination of metrological properties of spectrophotometers | 7.3 |
| 3.1 Determination of limits of measurement absolute error in accordance with the chromaticity coordinate scale | 7.3.1 |
| 3.2 Determination of limits of luminance measurement relative error | 7.3.2 |
| 3.3 Determination of limits of illuminance measurement relative error | 7.3.3 |

2. CALIBRATION INSTRUMENTS

2.1. When performing calibration, the calibration instruments indicated in Table 2 should be used.

Table 2

| Calibration technique No. | Name and type of the basic or auxiliary calibration instrument; designation of the regulatory document controlling engineering requirements, and metrological and principal technical properties of the calibration instrument |
|---------------------------|--|
| 7.3 | <p><i>A set of self-luminous chromaticity coordinate measures included in the Working Standard of colour and chromaticity coordinate units BЭТ 81-1-2003.</i></p> <p>The measurement range by the chromaticity coordinate scale corresponds with GOST 8.205-90 (<i>Its name in russian: ГОСТ 8.205-90 Государственная поверочная схема для средств измерений координат цвета и координат цветности</i>)</p> <p>Measurement range by the chromaticity coordinate scale: $x=0.004 - 0.734$; $y=0.005 - 0.834$</p> <p>Absolute errors $S_{x\Sigma}=0.0007$; $S_{y\Sigma}=0.0007$</p> <p><i>Working Standard of category 0 of luminance and illuminance intensity units BЭТ 5-1-2009.</i></p> <p>Illuminance measurement range, lux 10 - 1000</p> <p>Relative measurement error $S_{\Sigma 0}=0.5 \cdot 10^{-2}$</p> <p><i>Luminance source included in BЭТ 5-1-2009.</i></p> <p>Luminance measurement range, cd/m^2 100 - 1000</p> <p>Relative measurement error $S_{\Sigma 0}=0.5 \cdot 10^{-2}$</p> |

2.2. The measurement instruments indicated in the table should be calibrated in due order. Use of other similar calibration instruments providing indicated metrological properties is allowed.

3. REQUIREMENTS FOR VERIFICATION OFFICER'S LEVEL OF PROFICIENCY

Only persons accredited as verification officers in due order and acknowledged with the Maintenance manual who had passed the complete safety training can be admitted for work with the spectrophotometers.

4. ENVIRONMENTAL SAFETY AND PROTECTION REQUIREMENTS

4.1. When operating the devices, the electrical safety should be observed in accordance with GOST 12.1.019-79.

(ГОСТ 12.1.019-79 Система стандартов безопасности труда. Электробезопасность. Общие требования и номенклатура видов защиты).

4.2. The room where the calibration is carried out should correspond with the fire safety requirements according to GOST 12.1.004-91 and be furnished with the fire-extinguishing means according to GOST 12.4.009-83.

(Its name in russian: ГОСТ 12.1.004-91 Пожарная безопасность. Общие требования. ГОСТ 12.4.009-83 Пожарная техника для защиты объектов).

5. CALIBRATION CONDITIONS

When performing calibration, the following conditions should be observed:

5.1. The calibration should be carried out under normal conditions according:

| | |
|-----------------------|--------------|
| ambient temperature | 22±2 °C |
| relative air humidity | 65±15% |
| atmospheric pressure | 86...107 kPa |

5.2. Any mechanical effects, external electric and magnetic fields influencing the metrological properties of the spectrophotometer should be eliminated.

6. PREPARATION FOR CALIBRATION

The spectrophotometer being calibrated should be prepared for work in compliance with the Maintenance manual.

7. CALIBRATION

7.1. External examination.

The following should be done during external examination:

- inspect visually the appearance of the spectrophotometer and ensure absence of evident damage influencing operability of the spectrophotometer;
- ensure the labelling with a clear specification of type and serial number of the spectrophotometer is available;
- check the package contents of the spectrophotometer.

The spectrophotometer should be considered suitable for use if its appearance corre-

sponds with the photographic images from the set of documentation; its housing, external elements, controls, and indications are not damaged; the package contents comply with the technical specification; and the type and serial number are clearly seen on the labelling.

7.2. Testing.

The spectrophotometer is tested by switching on in correspondence with the Maintenance manual. Calibrate the spectrophotometer.

The spectrophotometer is considered ready for operation if switching on and preparation of the spectrophotometer for work had been carried out without any deviations from requirements of the Maintenance manual.

7.3. Determination of metrological properties of the spectrophotometers.

7.3.1. Determination of limits of absolute error of chromaticity coordinates measurement.

In order to define the root mean square deviation of the chromaticity measurement result, direct measurements of the chromaticity coordinates of standard measures should be performed. The observation results are processed in compliance with the requirements of GOST 8.207-76 considering the confidence probability of 0.95 and the measuring count $n=5$. The arithmetic mean of the observation results separately for each measure is counted as the chromaticity coordinates measuring result.

$$\tilde{A}_k = \frac{1}{5} \sum A_{ki},$$

where A – chromaticity coordinates x and y,

i – number of observation,

k – number of measure.

The confidence limit of the residual bias of the device is calculated from the formula:

$$\Theta_A = 1,1\sqrt{S^2 + \Theta_{np}^2};$$

$$\Theta_{np} = |\tilde{A}_k - A_j|,$$

where S – error conditioned by the standard measure error ($S_{x\Sigma}=0.0007$; $S_{y\Sigma}=0.0007$),

Θ_{np} – error introduced by the device.

The spectrophotometer passes the inspection if the absolute error of measuring ac-

cording to the chromaticity coordinate scale does not exceed $\Delta_{x,y} = 0.02$.

7.3.2. Determination of limits of relative error of luminance measurement.

In order to determine the relative error of the luminance measurement, direct measurements of the standard measure luminance are carried out. The observation results are processed in compliance with the requirements of GOST 8.207-76 (*its name in russian: ГОСТ 8.207-76 Государственная система обеспечения единства измерений*) considering the confidence probability of 0.95 and the measuring count $n=5$. The arithmetic mean of the observation results is counted as the luminance measuring result:

$$\tilde{L}_k = \frac{1}{5} \sum L_{ki},$$

where L – luminance,

i – number of observation,

k – number of measure.

The confidence limit of the assumed value of the luminance measuring relative error is calculated from the formula:

$$\Delta_0 = 1,1\sqrt{S^2 + \delta_{np}^2};$$

$$\delta_{np} = \left| \frac{\tilde{L}_k - L_{\text{э}}}{L_{\text{э}}} \right| \times 100\%,$$

where S – error conditioned by the standard measure error

$$(S_{\Sigma 0} = 0.5 \cdot 10^{-2}),$$

δ_{np} – error introduced by the device.

The spectrophotometer passes the inspection if the relative error according to the luminance scale does not exceed 10%.

7.3.3. Determination of limits of relative error of illuminance measurement.

In order to determine the relative error of the illuminance measurement, direct measurements of the standard measure illuminance are carried out. The observation results are processed in compliance with the requirements of GOST 8.207-76 considering the confidence probability of 0.95 and the measuring count $n=5$. The arithmetic mean of the observation results is counted as the luminance measuring result:

$$\tilde{L}_k = \frac{1}{5} \sum E_{ki},$$

where E – illuminance,

i – number of observation,

k – number of measure.

The confidence limit of the assumed value of the illuminance measuring relative error is calculated from the formula:

$$\Delta_0 = 1,1\sqrt{S^2 + \delta_{np}^2};$$

$$\delta_{np} = \left| \frac{\tilde{L}_k - L_{\text{э}}}{L_{\text{э}}} \right| \times 100\%,$$

where S – error conditioned by the standard measure error

$$(S_{\Sigma 0} = 0.5 \cdot 10^{-2}),$$

δ_{np} – error introduced by the device.

The spectrophotometer passes the inspection if the relative error according to the illuminance scale does not exceed 10%.

8. CALIBRATION RESULTS EXECUTION

8.1. In case of a favourable calibration result, the calibration certificate in due form is issued in correspondence with PR 50.2.006-94. (*its name in russian: ПР 50.2.006-94 ПОРЯДОК ПРОВЕДЕНИЯ ПОВЕРКИ СРЕДСТВ ИЗМЕРЕНИЙ*).

8.2. If unfavourable results are obtained, the certificate of inadequacy is issued with specification of the reasons for inadequacy.

Head of Laboratory

T.B. Gorshkova

User manual

Freeware SOFTWARE “Spectrofotometer”

1. INTRODUCTION.

The following ways of information display are possible:

- 1) Output onto a built-in LCD;
- 2) Output to USB port.

Use the supplied USB cable A~B, settings are: 115200 Baud, 8 data bits, no parity, 1 stop bit, no handshake.

Platform: Microsoft Windows 95/98/NT/2000/XP/Vista.

2. ACCESSORIES

User manual Freeware SOFTWARE

USB Cable A~B

Software disc in a box

3. PROGRAM START

Install a compact disc with an automatic start in CD disk drive. A break for choosing of a version of a program for visible spectrum range will appear. To start a program manually you should choose the file RUN.BAT.

CD auto start launches system scan and software installation, device has to be PC connected, follow instructions.

Note: do not change installation directories to provide automatic device driver installation.



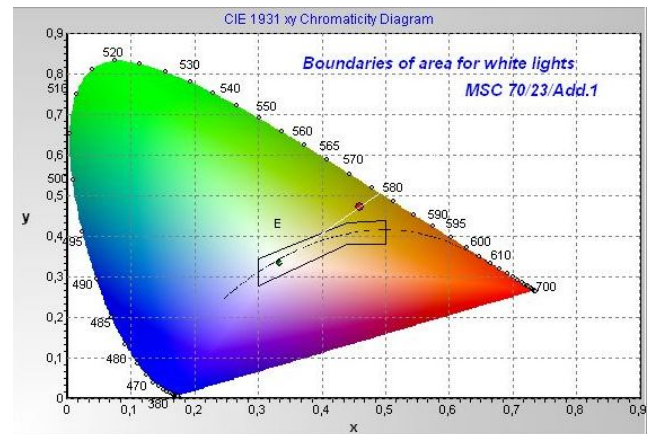
4. PRECAUTIONS BEFORE OPERATING

To carry out measuring connect the device to COM port of the computer and press the button **“ON/OFF”**. The status of this connection is **“Search of devices ...”**.

CAUTION!

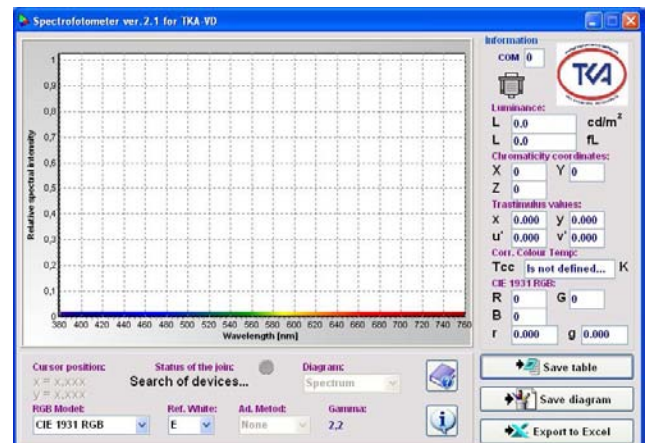
Before connection and switching the device on make sure it is logged off. If these rules are not observed it might result in exit from some components of a computer system. The warranty doesn't apply to devices, which broke down due to abuse!

Then connect a cable header to the device. The other end of the cable install into free USB-port on the PC. Make sure that contact pads entered the port up to the stop. After switching the device on the system is ready for exploitation.



5. WORK WITH A PROGRAM

After setting of connection the program's workspace will depict a spectrum and chromaticity coordinates of being measured object, a status of connection will change from **“Search of devices ...”** to **“Data's reception...”**. The program also provides control over errors in data transmission.



| | A | B | C | D | E | F |
|----|--|----------|---|---|---|---|
| 1 | Date: | Time: | | | | |
| 2 | 10.10.2010 | 11:41:10 | | | | |
| 3 | | | | | | |
| 4 | sRGB, Ref.White:D50, Ad.Metod:Bradford, Gamma: Apr.2,2 | | | | | |
| 5 | | | | | | |
| 6 | Chromaticity coordinates: | | | | | |
| 7 | X = | 106 | | | | |
| 8 | Y = | 100 | | | | |
| 9 | Z = | 41 | | | | |
| 10 | R = | 150 | | | | |
| 11 | G = | 89 | | | | |
| 12 | B = | 42 | | | | |
| 13 | Trastimulus values: | | | | | |
| 14 | x = | 0,431 | | | | |
| 15 | y = | 0,403 | | | | |
| 16 | u' = | 0,247 | | | | |
| 17 | v' = | 0,52 | | | | |
| 18 | r = | 0,533 | | | | |
| 19 | g = | 0,316 | | | | |
| 20 | Illuminance: | | | | | |
| 21 | E = | 339 lx | | | | |
| 22 | E = | 31,5 fc | | | | |
| 23 | | | | | | |
| 24 | Correlated colour temperature: | | | | | |
| 25 | TCC = | 3106 K | | | | |

If it is necessary to save the values of the measured spectrum in table-form press the button **"Save table"**, choose the necessary name of a document and a file and press the button **"Save"**.

To save a diagram of the spectrum in a document in Windows Bitmap press the button **"Save diagram"** (**"Save chart"**), choose the necessary name of a document and a file and then press **"Save"**. To go into Microsoft Excel and to be able to work with a data chart press the button **"Export to Excel"** (on condition Microsoft Excel is installed).

6. TECHNICAL SUPPORT

But if you still have a problem with Spectrocolorimeter "TKA-VD" and noting else helps, please contact for technical support at: lab@tkaspb.ru.

7. Protocol of data communication between the device and the PC via serial port means

The data is transmitted only from the device to the PC, while the communication is established at the speed of 115200 Baud with the standard port settings.

The communication protocol represents the following:

- first four bytes – device series identifier. Then the following is transmitted (274 data bytes):
- device model identifier – 1 byte
- tristimulus values: X, Y, Z – 4 bytes each,
- chromaticity coordinates: x, y, u', v' – 2 bytes each,
- luminance value, cd/m^2 , 4 bytes,
- number of request points, 1 byte,
- working points by the wavelength scale, μm , 2 bytes each,
- values of relative spectral distribution, 2 bytes each,
- correlated colour temperature, K, 4 bytes,
- in the end – one byte of the checksum, CRC.

The chromaticity and spectrum coordinate values are transmitted in two-byte format where the high byte is the first to be transmitted, and the low byte is the second.

The entire transmission is carried out in integer format (transfer of the number with a floating point to an integer number is performed).

The checksum CRC is calculated as a sum of all transmitted bytes with the following transmission of the low byte only. The entire transmission comprises 279 bytes (four bytes – identifier, 274 data bytes and one check byte).



Maintenance manual

Charger

Before operating the device, read the present manual carefully and keep it for the entire service period.

The charger consists of an external network adapter – power module, and a charging current control circuit located in the housing of the signal processing unit.

The charger is designed for charging the nickel-metal-hydride accumulators in the following types and quantities: Rechargeable Battery NiMH 8,4V / (Block/ 6F22).

OPERATING PROCEDURE

Connect the adapter to the BOS box socket. Cut the device into mains of 220-230V, 50-60Hz. In order to prevent from overcharging, charge only dead accumulators. A new device is supplied with a dead accumulator which is to be charged prior to use of the device.

Before an initial service (or after a long-term storage) of the device, the accumulator battery should be charged and discharged three or four times in order to gain its maximum capacity. During charging, the accumulators can get warm which is normal. The device is switched off automatically; the LED indicator "Charge" on the back side of the housing will cancel in the end of charging.

The approximate charging time of the dead accumulator battery is up to 5 hours.

The critical condition is the inspection of quality of the Rechargeable Battery (by its full discharging and the following full charging) each two or three months. Non-fulfilment of the given requirement can significantly shorten the life time of the battery. In order to discharge the accumulator battery, just let the device work by the accumulator till it switches off or till a warning message appears to inform about the low accumulator charge.

If the Rechargeable Battery is not in service, its charge will be consumed in the end. That is why a recharge of the battery can be required after a long-term storage.

PERFORMANCE SPECIFICATION

Mains voltage: 220-230V / 50-60Hz.

Output voltage: 24V, stabilized.

Maximum current 500 mA.

When the network adapter AC-220-Si-24-0.5 is used, an intelligent mode of charging is used with the LED indication of charging stages.

SAFETY INSTRUCTIONS

- Use the charger only for the nickel-metal-hydride Rechargeable Battery (NiMH).
- When the adapter is connected, it is strictly forbidden to open the battery compartment.
- Use the device only indoors. Do not leave the charger in a wet place or in the rain.
- Do not disassemble the charger; if the repair is required, address the specialized repair shop.
- In order to ensure proper operation of the device, clean the adapter plug from any contaminations using only dry cloth.
- Do not clean or repair the device connected to the socket.
- Do not cut the device into mains when it is damaged.
- Do not connect the adapter to a faulty socket and in case of damage of the electric cable.
- Disconnect the adapter from the power source after use.

MAINTENANCE AND CLEANUP

Disconnect the adapter from mains to clean it. In order to provide proper operation of the adapter, clean the contact plug from dust and dirt. Use a dry tissue.

Safety regulations

Important information on safety engineering and health effects of the purchased device is given in this guide.

Attention! Improper connection, usage or maintenance of the product can result in serious injuries or death, and also cause damage of the device (-s). Read the present guide and keep all printed instructions for future reference. The contact information is given in the section "Technical assistance" and in the web-site www.tkaspb.ru.



The present document contains important data on different products manufactured by "TKA" Scientific Instrument, LLC. Read the guide sections related to your device.

Important information on safety engineering

AC power supply devices

Battery supply devices

Devices with laser pointers

For all devices

Laser properties

Utilization of used electric and electronic equipment

Options of technical assistance obtainment

IMPORTANT INFORMATION ON SAFETY ENGINEERING

AC POWER SUPPLY DEVICES

These safety precautions refer to all products connected through the standard wall socket.

Non-fulfilment of the following measures can result in serious injuries or death due to electrical shock or fire, and cause damage of the device.

In order to select the power source for the device properly, follow the instructions given below:



- Use only the power module and AC power cord supplied with the devices or received in the authorized service centre.
- Ensure the electrical socket provides the power supply parameters indicated on the power module (voltage [V] and frequency [Hz]). If you are not sure about the properties of your domestic or industrial power supply network, consult a qualified electrician.

- Do not use non-standard power supply sources such as generators or inverters even if their voltage and frequency seem to be acceptable. Connect the devices only to the standard AC socket.
- Do not overload the socket, extension cord, mains filter and other equipment with the power supply output. Ensure they are designed for the summed current (Amperes [A]) consumed by the device (indicated on the power module) and all other devices connected to the same mains.

In order to avoid damage of cables and power modules, follow the instructions given below:



- Lay the power cords in such a way that no one can step on them.
- Protect the cords against jamming and sharp bends, especially in the places of connection to the electric socket, power module, and to the device.
- Do not pull, tie, and avoid sharp bends or other misuse of the power cords.
- Do not expose the power cords to high temperatures.
- Keep children and pets away from the power cords. Do not let them bite and chew the cords.
- When disconnecting the power cord from the socket, pull the plug, not the cord. If the cord or the power module is damaged, stop using it immediately. Disconnect the device from mains during thunderstorm, or if it is not going to be used for a long period.

For the devices with the AC power cord connected to the power module, always connect the cord in the following order:



1. Insert the AC power cord into the power module against the stop.
2. Connect the second end of the cord to the wall AC socket.

BATTERY SUPPLY DEVICES

The following safety measures refer to all the products where rechargeable or disposable batteries are used.

Misuse of the batteries can result in electrolyte leakage, battery overheating or explosion. The electrolyte is a caustic substance and can be toxic as well. Electrolyte contact with the skin or eyes can cause burns. Swallowing the electrolyte is prohibited.

In order to reduce the risk of injury, follow the instructions given below:



- Keep the batteries away from children.
- Do not warm up, open, pierce or crush the batteries, and never throw them into an open flame.
- Avoid contact of metal items with the battery contacts in the device. This can result in their heating up and cause burns.
- Remove old batteries before you deposit the device for a long-term storage.
- Remove old, dead or damaged batteries in time and send them for reprocessing or destruction in compliance with the effective waste recovery regulations.
- In case of leakage of one of the batteries, remove all the batteries avoiding contact of the battery electrolyte with the skin and clothes. If the battery electrolyte contacts the skin or clothes, wash it off with water without delay. Before you insert new batteries, thoroughly wipe the battery compartment with a wet tissue or follow the cleaning recommendations of the battery manufacturer.

ONLY FOR DISPOSABLE BATTERIES (not rechargeable)

Attention! If the battery was replaced with a battery of improper type, an explosion can occur.

Use batteries of the same type and capacity as the batteries includes in the delivery set.

ONLY FOR ACCUMULATORS

Attention! If the battery was replaced with a battery of improper type, an explosion can occur.

Use batteries of the same type and capacity as the batteries includes in the delivery set.

- Charge the batteries only using the charger supplied.

DEVICES WITH LASER POINTERS

Attention! When carrying out settings or other procedures not specified in the documentation, you take the risk to be exposed to the dangerous radiation.

- Directing the ray at the eyes is forbidden.
- Do not direct the laser pointer at anyone. The laser pointers can be directed only at inanimate objects.
- Do not let children use the pointer without an attendance of adults. The laser pointers are not to be played with.
- Do not direct the laser pointer at specular (reflecting) surfaces. The reflected ray can affect the eyes as the direct ray.
- Do not disassemble the device.

- Do not use the device beyond the permitted temperature range: $+5^{\circ}\text{C}$ to $+35^{\circ}\text{C}$. If the device is under inadequate conditions, switch it off and do not use before the temperature stabilizes at the level within the working temperature range.

FOR ALL DEVICES

Never try to repair the device



Do not try to examine, open, adjust or modify the given device or the power source. If you do, there is a risk of an electrical shock and other danger. If the evidences of an attempt of device opening or modifying are present, including scratches, pinholes and removed labels, the warranty becomes void.

Usage and cleanup



Use the device in compliance with the maintenance manual and with the given instructions:

- Use only attachments/accessories approved by TKA Company for application.
- Clean only with a dry cloth.

Cables should not be located within reach of people and animals



Place all cables and cords in such a way that people and animals can not accidentally touch them when they stay close.

When the device is not used, you can disconnect all the cables and wires from it in order to prevent from children and animals touching them. Do not let children play with the wires and cables.

LASER PROPERTIES

Attention! Use of control elements beyond the recommendations of the given guide as well as other similar actions can result in radiation dangerous for health.

Laser devices

This device corresponds with the requirements of the international standard IEC60825-1:1993+A1+A2 (IEC 60825-1:2001-08) for laser devices of class 2. Additionally, this device corresponds with the standards 21 CFR 1040.10 and 21 CFR 1040.11, excluding provisions indicated in the Notification 50 on laser production dated June 24, 2007.

Class 2 laser devices

| | |
|---|---|
|  | <p><i>LASER EMISSION</i> <i>LOOKING AT THE CLASS 2 LASER PRODUCT RAY IS PROHIBITED</i> <i>WAVE LENGTH: 630-670 NM</i> <i>MAXIMUM OUTPUT: 1 mW</i> <i>IEC 60625-12001-08</i></p> |
|---|---|

Ray description: collimated (parallel) ray

This optical device does not contain any parts subject to maintenance or repair.

UTILIZATION OF USED ELECTRIC AND ELECTRONIC EQUIPMENT

Presence of this sign on the product, its batteries or package indicates that the given product and its batteries can not be recovered together with the domestic waste. The product must be delivered to the corresponding receiving and reprocessing point for batteries, electric and electronic equipment. The system of separate waste recovery and reprocessing assists in preserving environmental resources and preventing from possible unfavourable impact on human health and environment which can be caused by improper recovery due to presence of potentially hazardous substances in batteries, electric and electronic devices. In order to acquire additional information on battery, electric and electronic equipment receiving points, consult the local authorities, domestic waste collection service or the place of purchase of the given product.

**OPTIONS OF TECHNICAL ASSISTANCE OBTAINMENT**

If any problem directly related to the device or calibration instruments occurs, contact the Service Department of the enterprise "TKA" Scientific Instrument, LLC.

Technical assistance E-mail: lab@tkaspb.ru

"TKA" Scientific Instrument, LLC can provide services on software technical assistance. The technical assistance is performed under conditions stipulated by the manufacturer or indicated in the web-site www.tkaspb.ru, or described in the user manual or other documentation. When providing technical assistance services, the manufacturer can request information concerning performance specification of your equipment. The manufacturer can use the above mentioned information for business development including rendering technical assistance services.

The Service Department of the user technical assistance is fully complete with the qualified engineering personnel for rendering assistance by phone or fax. In such situation, please, be ready to provide the following information:

- Serial number or your device
- Version number of the device software
- Company name and your name
- Your phone number
- Write down all error messages as well as the causes of the error messages

Instructions to restore the calibration values

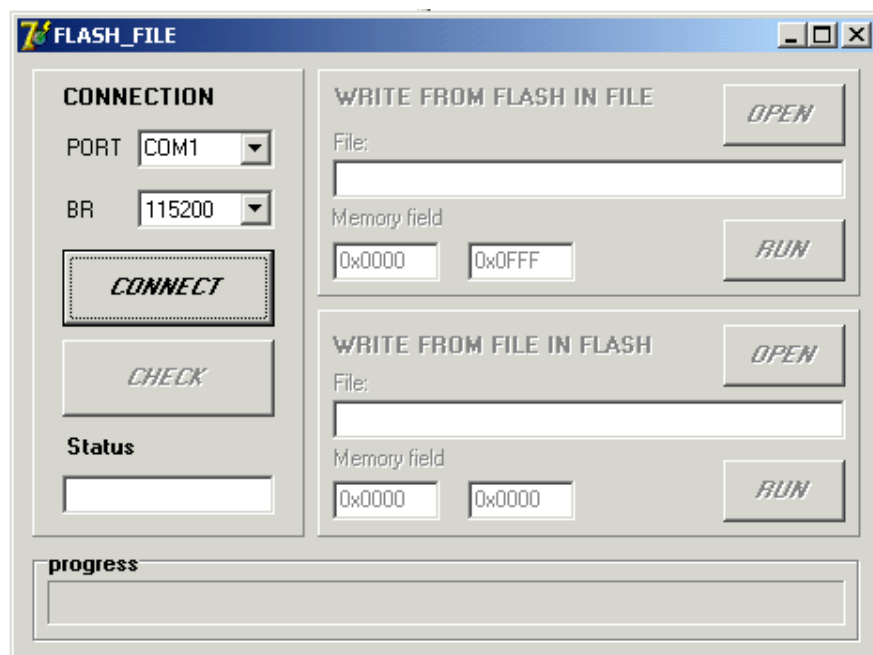
1. Connect device with your computer.

2. The device must be switched off.

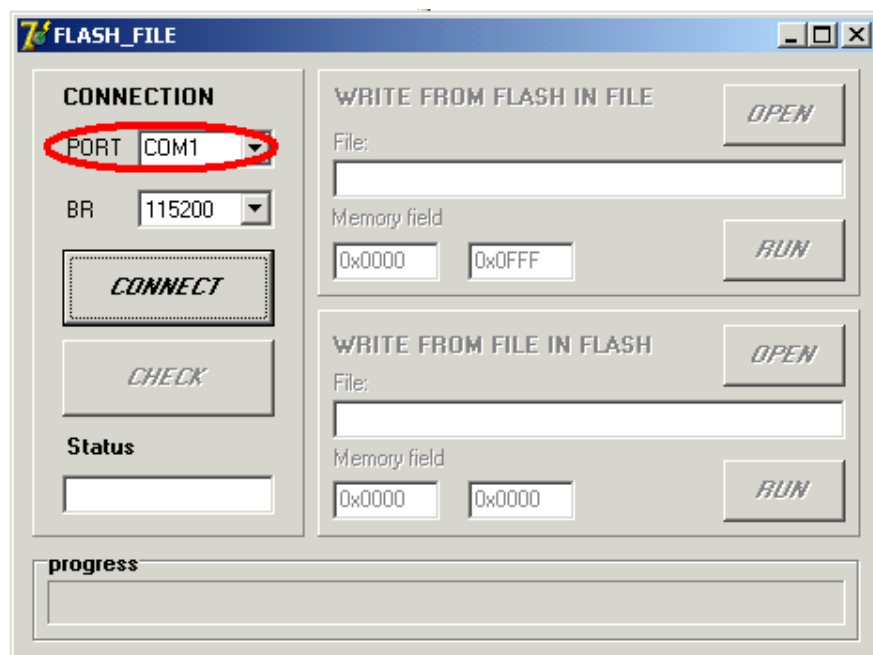
To enter a Flash Memory Mode press and hold simultaneously three keys:
Power, HOLD and MODE.

If done correctly, "FLASH MODE WORKING" will be displayed.

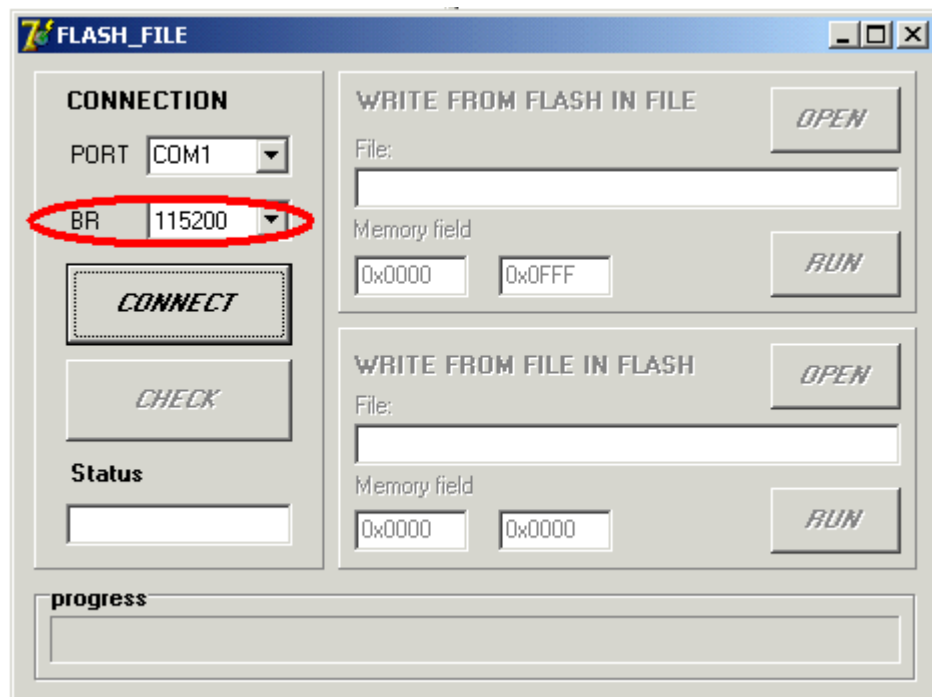
3. Run the program F2F (F2F_eng_v1.1).



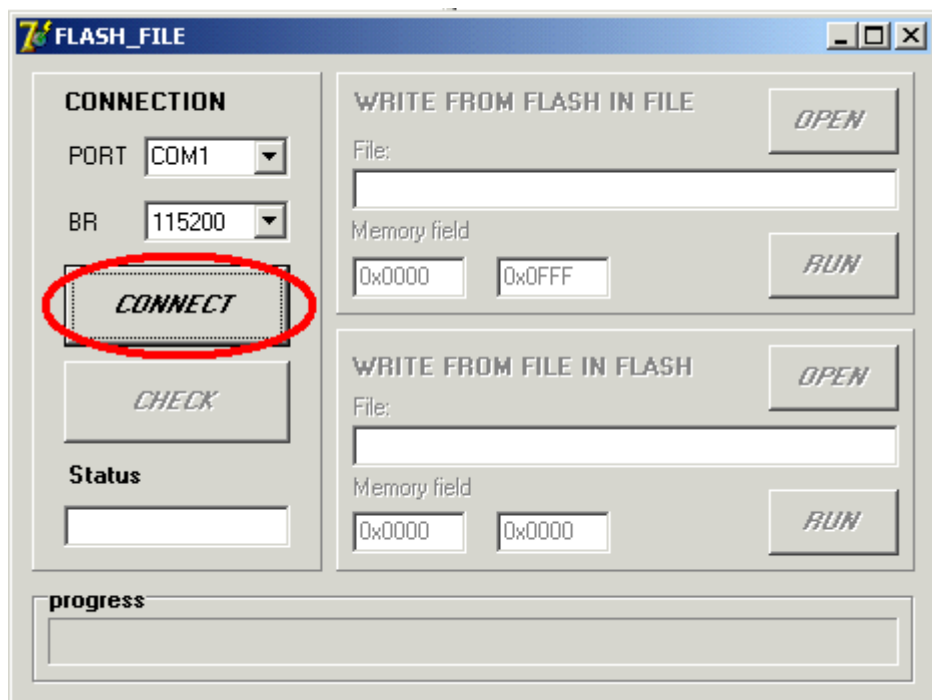
4. In the panel CONNECT select your COM port (In this example COM1).



5. In the field BR Set 115200.



6. In the panel CONNECTION click CONNECT.



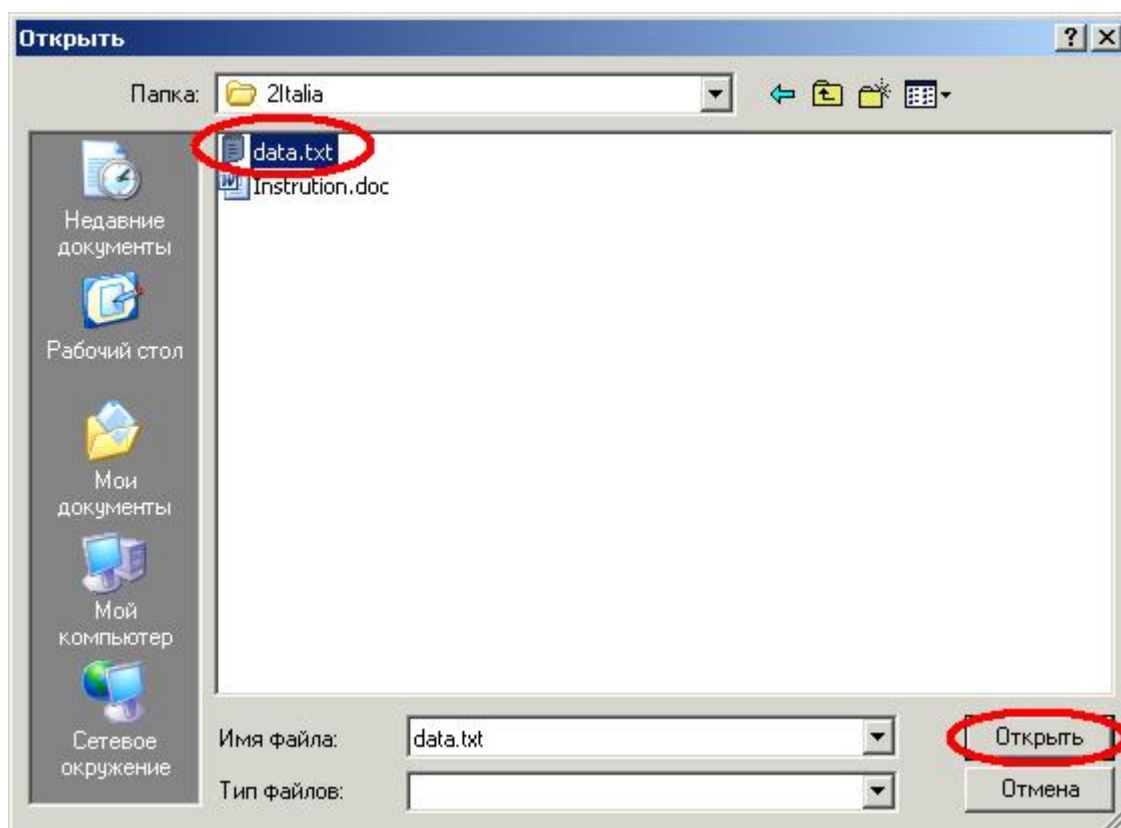
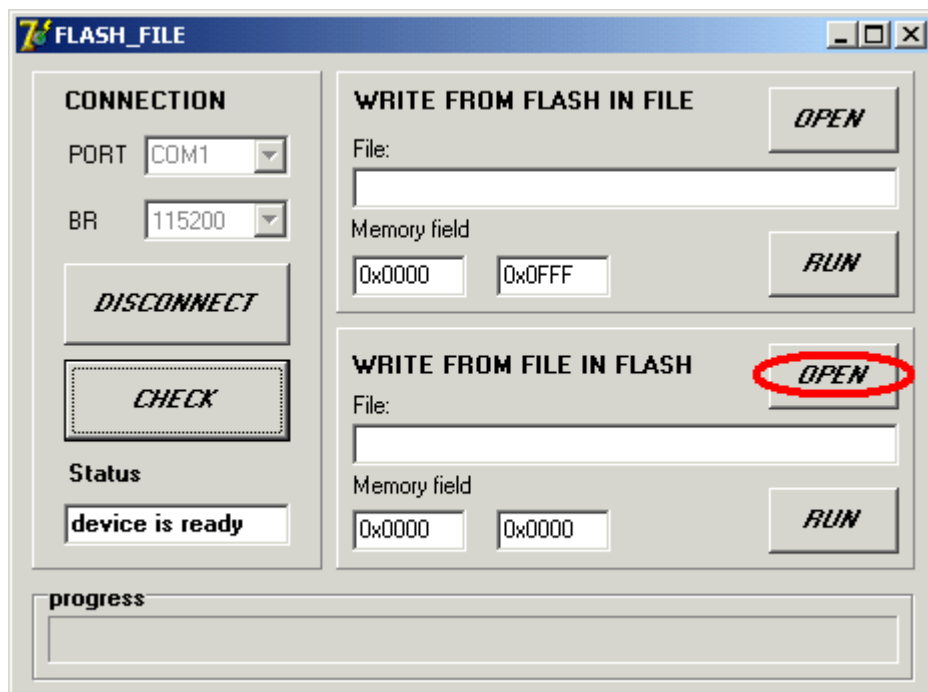
7. Check the connection to the device. To do click CHECK.

The screenshot shows the 'FLASH_FILE' application window. On the left, the 'CONNECTION' section contains a 'PORT' dropdown set to 'COM1', a 'BR' dropdown set to '115200', a 'DISCONNECT' button, and a 'CHECK' button which is circled in red. Below these is a 'Status' label and an empty text field. On the right, there are two sections: 'WRITE FROM FLASH IN FILE' and 'WRITE FROM FILE IN FLASH'. Each section has a 'File:' text field, a 'Memory field' with two input boxes (0x0000 and 0x0FFF for the first, 0x0000 and 0x0000 for the second), and 'OPEN' and 'RUN' buttons. At the bottom is a 'progress' bar.

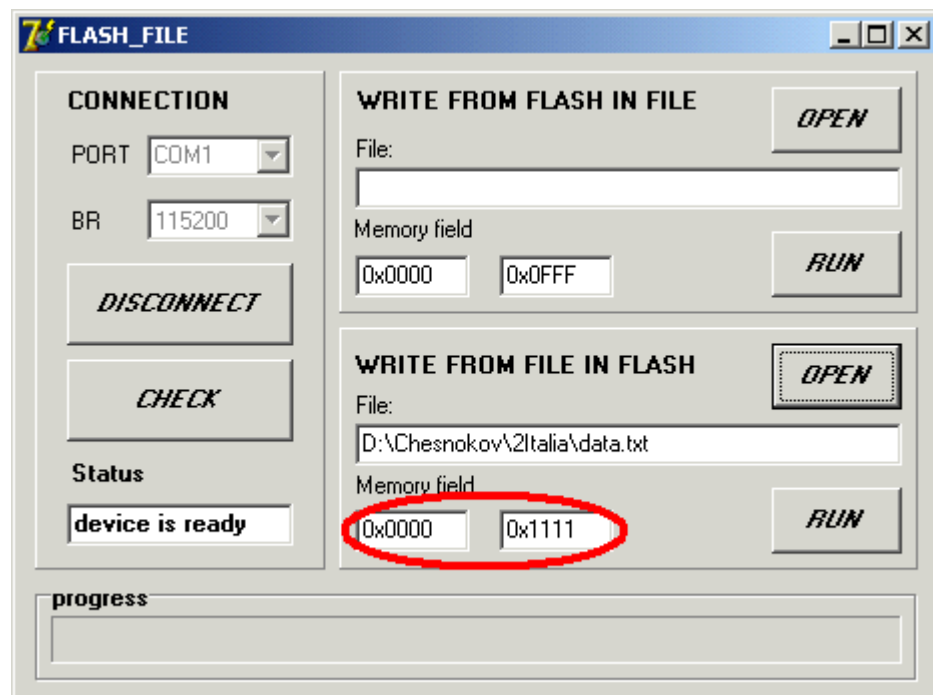
If everything is correct, then the Status field will show «device is ready».

This screenshot shows the same 'FLASH_FILE' application window after a successful connection. The 'CHECK' button in the 'CONNECTION' section is now disabled and circled in red. The 'Status' text field now displays 'device is ready', which is also circled in red. All other elements, including the file and memory fields on the right and the progress bar at the bottom, remain the same as in the previous screenshot.

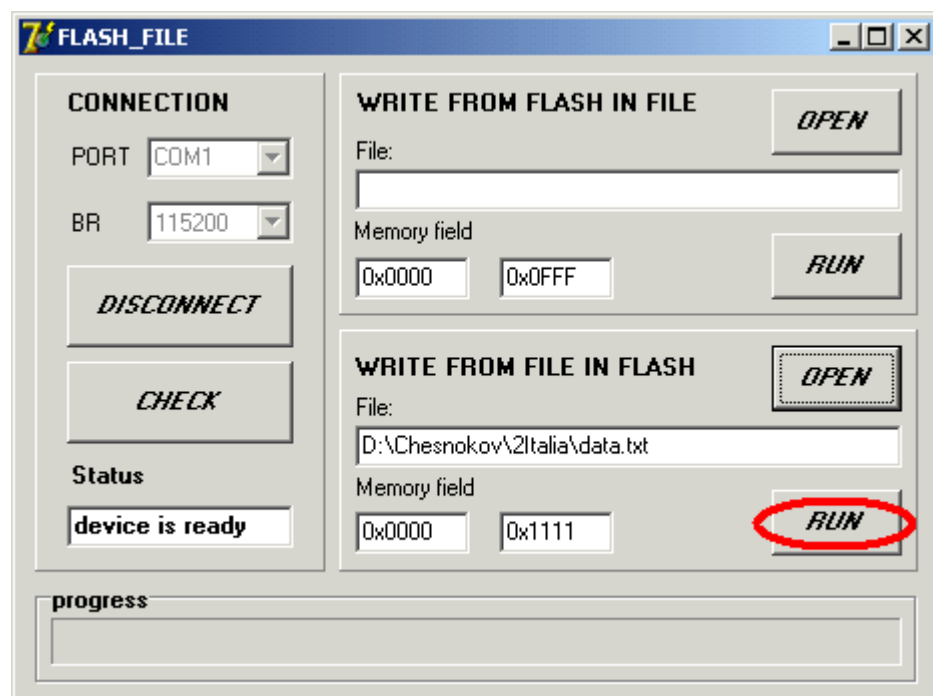
8. In the panel WRITE FROM FILE IN FLASH, click OPEN and select a file with calibration data.



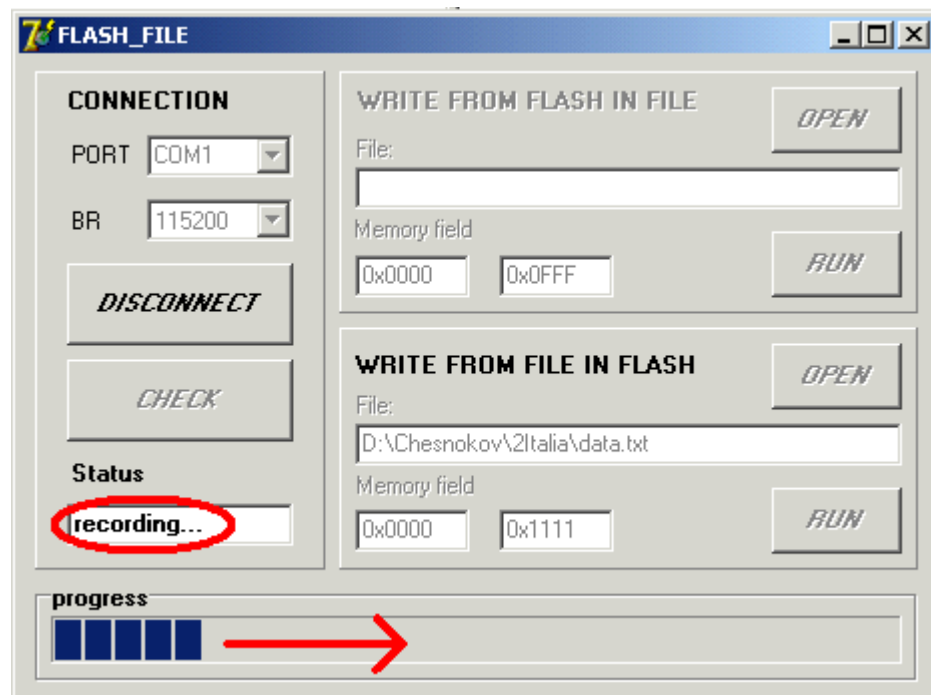
If everything is correct the memory fiels will display data file address.



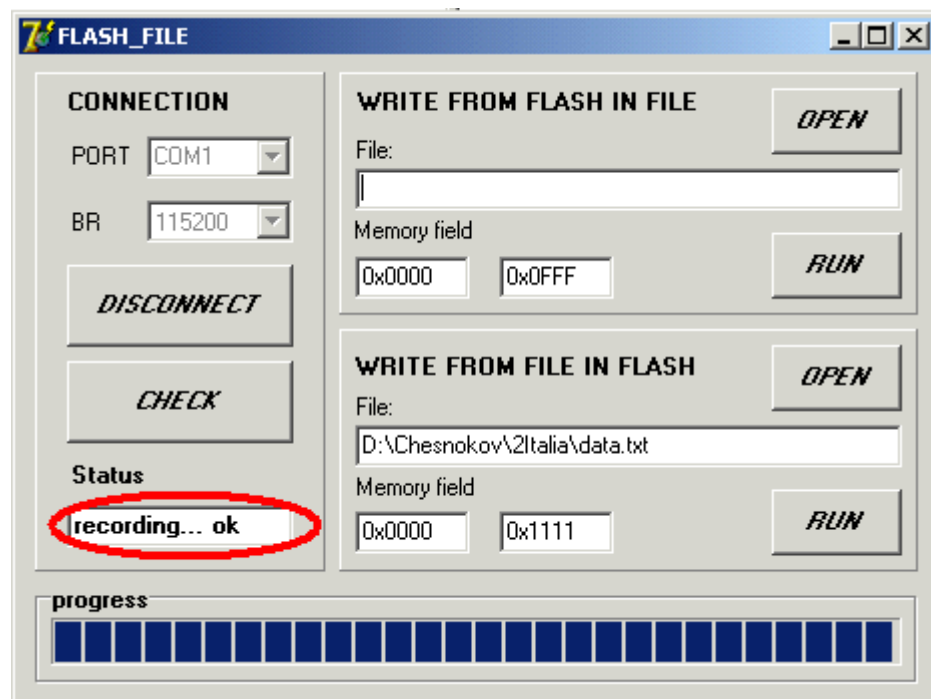
9. In the panel WRITE FROM FILE IN FLASH click RUN.



If the recording process is correct, then in the field "status" shows "recording ...".



If the recording is completed correctly, then the "status", would display "recording ... ok".



10. Close the program and reboot device.

Legal and Post address: 192289, RUSSIA, St. Petersburg,
Gruzovoy proezd, d.33, korp.1, liter B
Phone/fax: 007-812-331-19-81
phone: 007-812-331-19-82

In the interest of constantly perfecting its products, the manufacturer reserves the right to make changes to the technical characteristics of the device without prior consumer notice.

Service live - not less than 3 years.

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