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Description of the System's Software

The system's software runs under WINDOWS 2000/XP and may be conditionally divided into two parts:

- Software for viewing and saving the images of examined objects to PC memory – **TeleMicroscope** application;
- Software for storing and identifying recorded images – the **Bullets repository** and **Cartridge-cases repository** applications.

The user interface includes three main windows of the corresponding program applications: **TeleMicroscope**, **Bullets Repository**, and **Cartridge-Cases Repository**.

10. In case there are additional marks to be recorded after scanning the striker mark for each trace there shows the form **"Additional Mark Recording"**. The procedure of the additional marks recording is similar to that of recording the striker mark.

NOTE: The number of additional marks (not more than three) is set in the Firearm system form.

NOTE: Upon completing the recording operation the image is automatically loaded into the left window of the **Cartridge-Case Repository** application.

To change the circumference size, place the cursor on its border, press the left button and move the mouse holding the button pressed.

5. Superpose the red circumference with the striker mark using the mouse. For this place the cursor inside the circumference, press the left button and move the mouse holding the button pressed.

6. Superpose the red square with the required mark using the mouse. For this place the cursor inside the square, press the left button and move the mouse holding the button pressed.

7. Press the **Next >** button to start the striker mark recording. Press the **Cancel** button to stop the procedure.

NOTE: After pressing the **Next** button the scanner is automatically set to record the striker mark, and the **"Striker Mark Recording"** form appears.

8. Make adjustments for the striker mark recording:

- Set the center (the **Scanning** buttons),
- Focus the image (the **Focusing** buttons),
- Set the red-colored circumference exactly on the striker mark. For this set the mouse cursor on the element  , press the left mouse button and move the circumference holding the button down and moving the mouse.

9. Press the **Next >** button to complete the procedure of recording the cartridge-case butt-end surface.

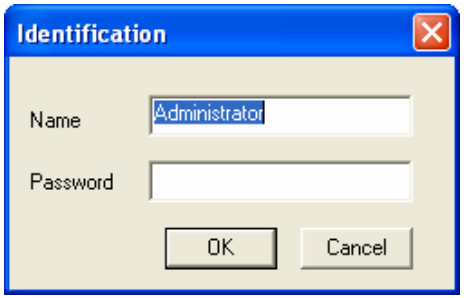
1. TeleMicroscope Application

The application is designed to manage the scanner's operations on viewing the objects under examination in the real time mode, as well as to record their surface images, select the firearm system of the "current" object and keep the database of these firearm systems.

The application window the can be opened in two ways:

1. Directly when starting the application by selecting the menu item **"TeleMicroscope"** in the **"Programs"** section; or with the help of the shortcut on the computer **desktop**  **.**

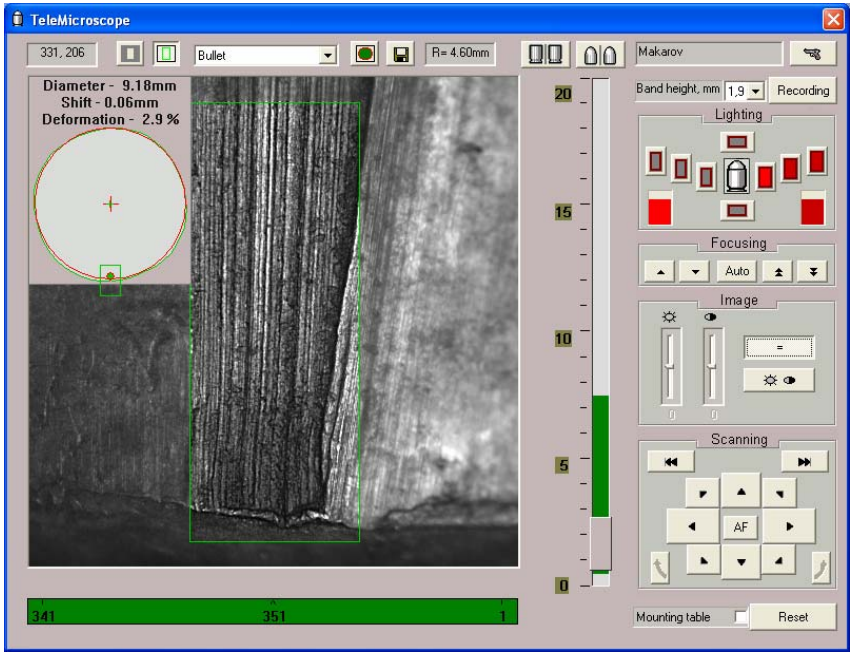
NOTE: As the Application is started there shows the **"Identification"** form containing fields for entering the user identifier and password, as well as the buttons to confirm or cancel the user parameters input.



Upon pressing the **OK** button the system checks for the presence of the user with the entered identifier in the database and the correctness of the password entered. The user is allowed three attempts to correctly enter the system. Pressing the **Cancel** button cancels the start of the **TeleMicroscope** application.

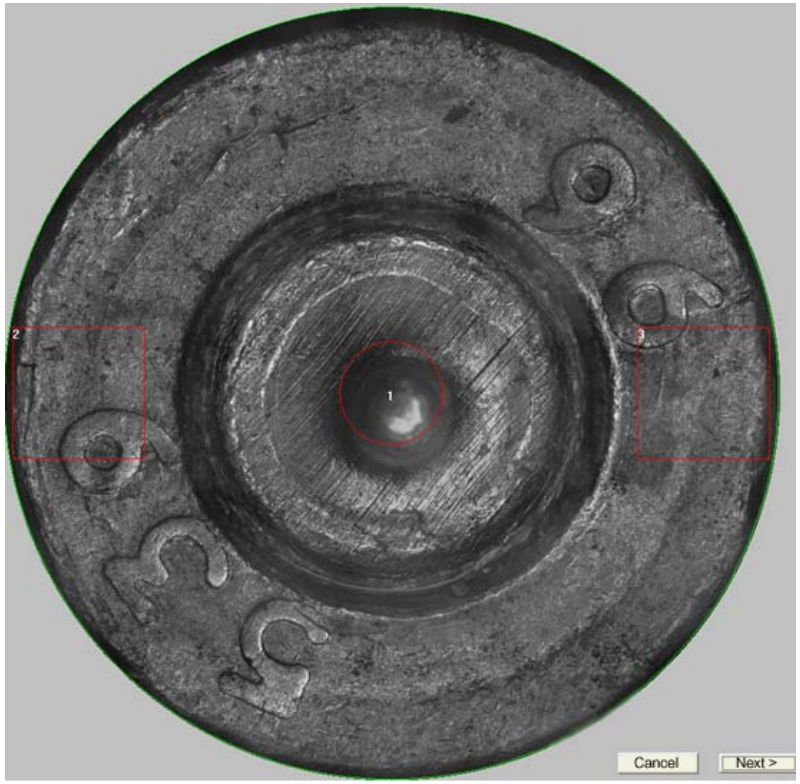
2. By pressing the appropriate button in the main window of the **Bullets repository** or **Cartridge-Cases Repository** applications;

The main window of the **TeleMicroscope** application contains the image output field, information elements and control buttons.



The field of image output transmitted by a CCD-camera with resolution of 464 x 464 pixels onto the monitor screen corresponds to 1.5 x 2.0 mm viewing field of an object.

current firearm system, - red squares. The green-colored circumference determines the area of the cartridge-case butt-end image (butt-end image). It can be moved by pressing the left mouse button inside the circumference, and the size can be changed by pressing the left mouse button on the circumference border. The red-colored circumference determines the striker mark area. The circumference diameter is fixed, determined by adjustments of the "current" firearm system. The squares determine the area of the additional marks to be recorded.



4. Superpose the green circumference with the cartridge-case butt-end image using the mouse. For this place the cursor inside the circumference, press the left button and move the circumference by holding down the button.

NOTE. There may be several fragments. The beginning and the end of the fragment may be outside the image output field during marking.

2.4. Press the **Recording** button to open the **"Recording"** forr
2.5. Set the record band height.
2.6. Set the evolvement recording height (number of bands) taking into account the selected band height – see above.
2.7. Press the **Start** button of the **"Recording"** form. The button is substituted for
the **Stop** button.

NOTE: Upon completing the recording and processing operations the image is automatically loaded into the upper window of the **Bullet Repository** application.

15.2. Recording mode for the cartridge-case butt-end surface

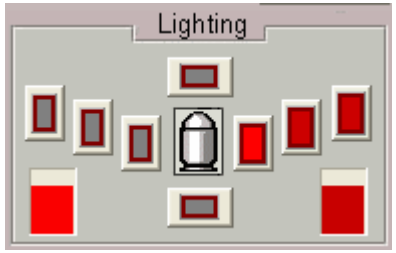
1. Press the **Reset** button and carry out the operation of determining the butt-end plane position – see **"Determination of Butt-End Plane Position"**.

NOTE. The object should correspond to the "current" firearm system.

2. Press the **Recording** button to open the **"Recording"** form
3. Press the **Start** button of the **"Recording"** form. The button is substituted for
the **Stop** button.

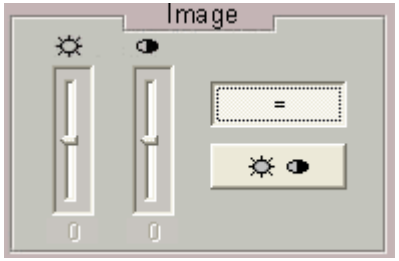
NOTE. Upon completing the recording the image is processed and loaded onto the monitor screen for viewing and initializing the striker mark recording procedure. There are two buttons on the screen - **Cancel** and **Next**, the cartridge-case butt-end image, two circumferences - green and red and, in case of additional marks set for the

2. Control buttons

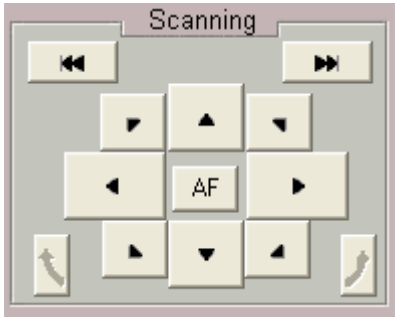


1. The **"Lighting"** tool bar contains:
– 8 double action buttons (one press – "on", one press – "off") with state indication, which serve to turn on and off the respective object lighters;
- 2 different-colored controls, which serve to set the lighters' brightness level. The controls are coloured the same as the lighters they correspond to. To raise the lighter's brightness level set the cursor on the border of the control's colored area (to lower the brightness level - place the cursor under the above-mentioned area) and click the left mouse button.

2. The **"Focusing"** tool bar contains single action buttons (one press corresponds to a single action): 1 automatic focusing button and 4 manual focusing buttons – two for rough and two for fine focusing.



3. The **"Image"** tool bar contains 2 slide controls ("brightness", "contrast") and 2 double action buttons to increase the image brightness and to activate subprograms for the object images digital processing (brightness, contrast).



4. The **"Scanning"** tool bar contains:

- 8 single action buttons corresponding to the optical scanner system movements when viewing an image – "up" – "down", "left" – "right" and diagonally,
- 2 single action buttons – accelerated bullet rotation up to the next rifling (shift to cartridge-case edge),
- 2 single action buttons corresponding to the optical scanner system movement when viewing the cartridge-case edge,
- A double action button switches on automatic focusing after each movement of the optical scanner system in the course of examination.

determined number.

1.6. Set (cancel) the advanced automatic focusing mode.

NOTE. It is advisable to use the advanced automatic focusing mode when examining deformed bullets. In this case the evolvement recording time increases.

1.7. Press the **Start** button of the **"Recording"** form. The button is substituted for the **Stop** button.

NOTE. Upon completing the recording and processing operations the image is automatically loaded into the upper window of the **Bullet Repository** application.

15.1.2. Recording mode for the fragments of the side surface

2.1. Press the **Reset** button.
2.2. Press the **Record Frame Borders** button.

NOTE: The existence of record frame borders on the image output field does not affect the recording of the evolvement. Rather it serves as a reference point for setting the lower record border.

2.3. Set fragment marks on the limb (graduated dial) by rotating the object with the aid of the **Scanning** buttons. The beginning and the end of the fragments are marked in different colors (red and blue respectively) when the cursor is placed on the limb and the left mouse button is double-clicked. An example is given below.

15. Recording of images

15.1. Mode of the side surfaces recording

This mode has two versions. In both versions recording is carried out by bands, with the

band height of 0.6 mm, 1.3 mm or 1.9 mm from the bullet bottom upwards.

NOTE. By recording the surface of a deformed bullet it may happen so that the automatic focusing function is impossible. In this case the form **"Focus Control"** appears on the screen, and the user has to focus the image manually.

NOTE. In this mode the recording of the cartridge-case side surface can be carried out using special adapters in the cassette for bullets.

15.1.1. Recording mode for full evolvement of the side surface

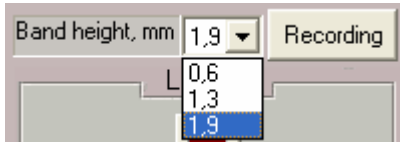
1.1. Press the **Reset** button.
1.2. Press the **Record Frame Borders** button.

NOTE. The presence of the record frame borders in the image output field does not affect the recording of the evolvement. Rather it serves as a reference point for setting the lower record border.

1.3. Press the **Recording** button to open the **"Recording"** forr
1.4. Set the record band height.
1.5. Set the evolvement recording height (number of bands) taking into account the selected band height.

NOTE. Set the number of record bands taking into account the "current" vertical scanner position and the height of the cylindrical part of the object under examination, but not larger than the automatically

5. Reset – a single action button – sets the optical scanner system in the initial position. If the **"Mounting Table"** field (accessible during examination of the side surface) is checked the form **"Setting on the Lower Edge"** will appear by resetting.



6. Recording – a single action button – switches on the scanner's image-recording mode. Depending on the cassette kind (determined by sensor or preset manually) there is choice of 2 modes: side surface recording or cartridge-case butt-end recording. On pressing the button there shows the form **"Recording"**. The form description is given below. The evolvement band height selection control (0.6 mm – 1.3 mm – 1.9 mm) is accessible by the side surface recording.

7. Firearm system is a single action button. On pressing this button there shows the form **"Firearm system"**. The form description is given below.

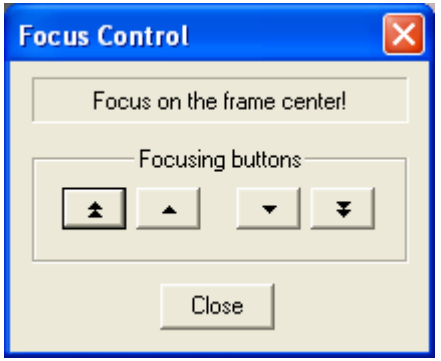
8. The **Switch to** tool bar contains 2 single action buttons calling either the **"Bullet Repository"** application or the **"Cartridge-Case Repository"** application respectively.

9. Scan Mode is a double action button to output a reduced image fragment. It allows to increase the scanning speed by examination.

10. Record Frame Borders is a double action button to display the borders of the recording frame being part of the evolvement. It also displays a horizontal bullet section.

11. Cross-Section Profile is a double action button to create a horizontal bullet section. The button is active only if the cassette with a bullet in. Pressing the button results in the creation of the horizontal bullet section. Repeated press interrupts the procedure.

12. Save Frame is a button for recording a full image frame in a file.



NOTE. The object under examination can be viewed regardless of the set "current" firearm system. However, it would be correct to set the firearm system corresponding to the examined object as the "current" one.

Setting of firearm system

1. Press the **Firearm system** button.

2. Select the required firearm system from the list.

3. Press the **Select** button.

Input of new firearm system

1. Press the **Firearm system** button.

2. Press the **Add** button.

3. Fill out the fields to be edited.

4. Press the **OK** button.

Editing of firearm system parameters

1. Press the **Firearm system** button.

2. Press the **Edit** button.

3. Fill out the fields to be edited.

4. Press the **OK** button.

The form appears also by activating the scanner if the cartridge-case cassette is inserted and the sensor for automatic cassette type determination is on (see the **"Parameters"** form).

For the correct operation of the automatic focusing function by examining the cartridge-case and recording the cartridge-case butt-end determine the coordinates of the cartridge-case butt-end plane (butt-end plane position) at three points.

Two modes of determining the butt-end plane are possible: automatic (the "Automatic Focusing" field is checked) and manual.

In case of the selecting the automatic mode after pressing the **Next** button the system automatically does the focusing at the control points.

By manual focusing (the **"Automatic Focusing**" field is not checked) use the focusing buttons to select the object position and focus the image in the frame center. Press the **Next** button to set the object at the next point. Upon completing the procedure the form closes.

ATTENTION! In the case of the procedure is cancelled the functions of automatic focusing and recording the cartridge-case butt-end image correct work is not guaranteed.

14. Object Surface Examination Mode – Television Microscope Mode

Object surfaces can be examined using the control buttons described above (**"TeleMicroscope"** window).

NOTE: By examining the side surface of a deformed bullet it may happen so that the automatic focusing function is impossible (the object is badly deformed). In this case the form **"Focus Control"** automatically appears on the screen, and the user has to focus the image manually. The form contains the focusing control buttons to focus the image in the central part of the **"TeleMicroscope"** window with.

3. Information elements

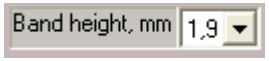
1. *Message windows*

1.1. Is located over the image output field. Displays information about the type of the object under examination – **"Bullet"** (available for side surfaces of bullets and cartridge-cases) or **"Cartridge-case"** (for cartridge-cases butt-end) or **"Empty"** (if cassettes for bullet or rifle cartridge-case is not installed). Object type is determined by a sensor or preset in this window manually depending on the selected mode in the form **"Parameters"**.

1.2. Is located by the **Firearm system** button and displays the name of the firearm system set at the given moment.

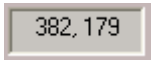
1.3. Is located in the center over the image output field and contains the current radius of the side surface of the set object (the image should be focused).

1.4. Is located to the left of the **Recording** button and contains the recording band height of the side surface evolvement image. There is a selection of three values: 0.6 mm, 1.3 mm or 1.9 mm.



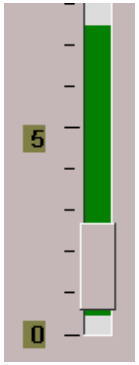
2. *Coordinates window*

Is located over the image output field. When the cursor is on the image output field, the cursor position coordinates are displayed in the window: x – column number, y – line number.



3. *Vertical scale*

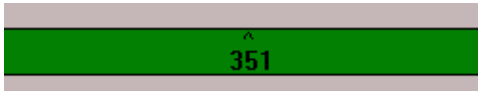
Located to the right of the image output field. Displays the position by the height of the scanning system (0 – 30 mm). The possible recording height of the side bullet surface image (cartridge-case diameter) of the set firearm system is marked with green background.



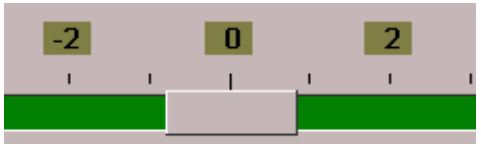
4. *Horizontal scale*

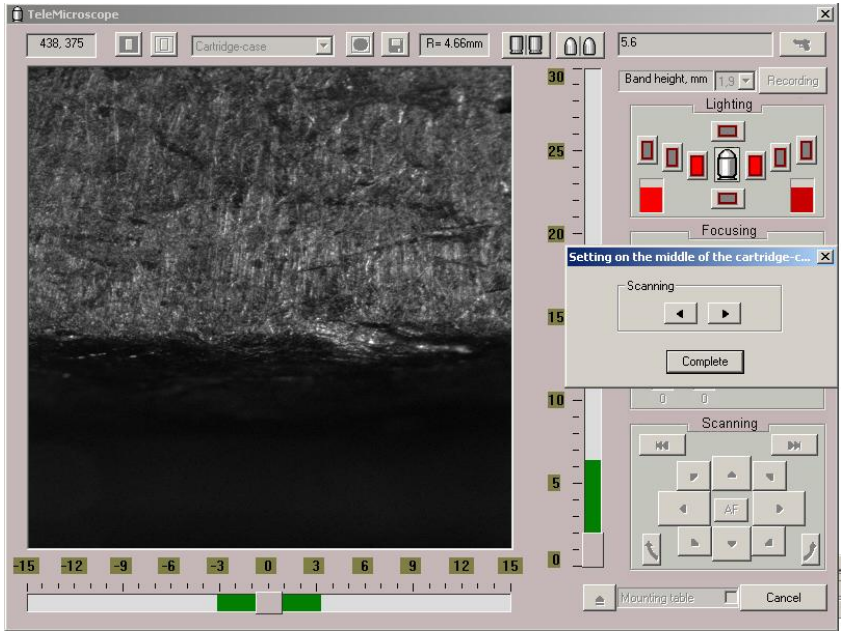
Located under the image output field. Displays object position:

- by working with the side surface – in degrees (0 – 360°) from the initial position (the initial position is the position of the object upon pressing the **Reset** button). It is also used for marking borders in case of the fragmentary recording of the bullet surface evolvement;



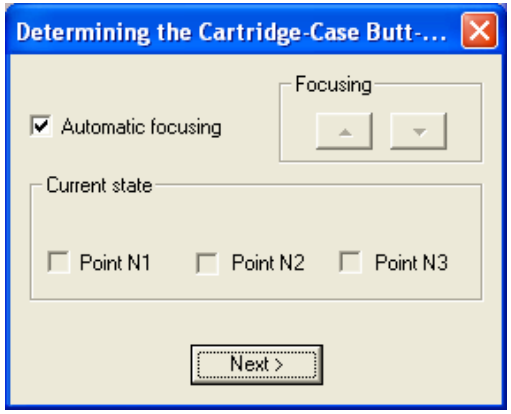
- by working with a cartridge-case – in linear measures (-15 mm, + 15 mm) from the cartridge-case butt-end center.

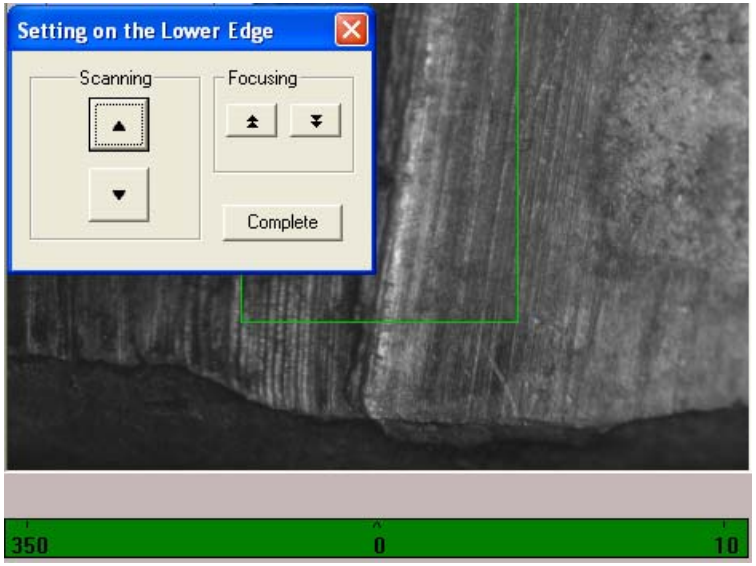




Using the navigation buttons, set the optical scanner system in a position, in which the middle of the cartridge-case edge is located over the image center, and press the **Complete** button.

NOTE. By the examination of the cartridge-case butt-end, the form **"Determining the Cartridge-Case Butt-End Plane Position"** appears by resetting.



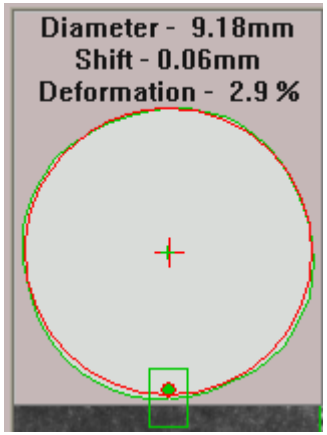


Using the navigation buttons, set the optical scanner system in a position, in which the lower edge of the object, is located in the lower part of the image window, and press the **Complete** button.

NOTE. By the examination of the cartridge-case butt-end, if the field **"Automatic Setting on the Cartridge-Case Center"** is not checked in the **"Parameters"** form, the form **"Setting on the Left Edge of the Cartridge-Case Stop" appears** by resetting.

***5.** Horizontal bullet section*

Shows in the upper left corner on the image output field on pressing the **Recording Frame Borders** button.

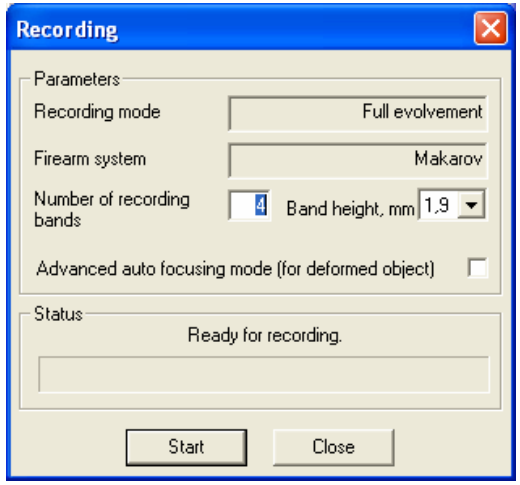


The given window displays the horizontal bullet section (green contour) obtained in the process of recording the first evolvement band, the bullet diameter value, displacement of the geometric cross-section center (green cross) relative to the rotation axis (red cross) and the bullet deformation extent (after recording the first evolvement band image), as well as the process of constructing the cross-section (by recording the first evolvement band).

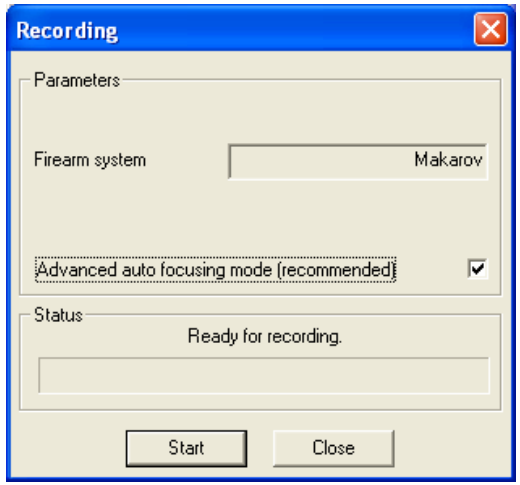
4. “Recording” form

Allows to initialize the process of the surface recording of the object under examination. It appears upon pressing the **Recording** button. It contains control buttons, information elements and the parameters setting field.

Form for the bullet side surfaces recording.



Form for the cartridge-case butt-end surfaces recording.



13. Working with the Scanner

The scanner operation (except for setting parameters from the keyboard by adjustment) is managed with the aid of the mouse.

Further description of the system's operation implies that the PC working as part of the system is activated in a standard way, while all the applications loading the above-described forms run under WINDOWS 2000/XP (see **Operations Manual**).

Switching on

1. Switch on the scanner (see **Operations Manual**).
2. Start the **TeleMicroscope** application.
3. Enter the user name and the password in the form **"Identification"**.

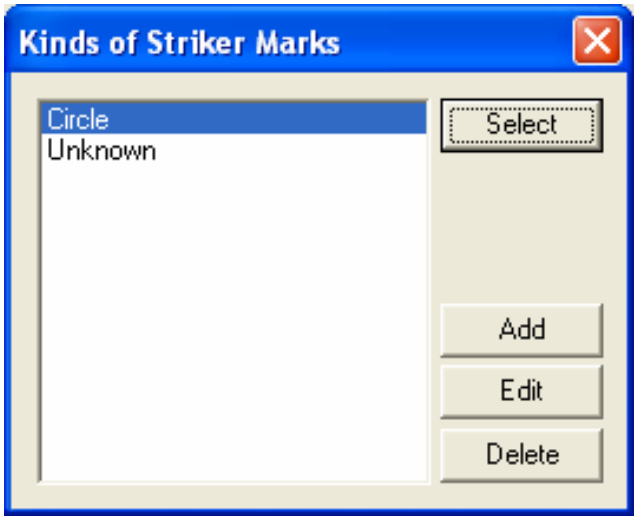
On the monitor screen there will show the warning: "Program start…". After checking the functionality of the scanner electromechanical units and setting them in the initial (working) position the window **TeleMicroscope** appears on the monitor screen.

4. Set the object under examination (see **Operations Manual**).
5. Press the **Reset** button.

NOTE. By the examination of the bullet side surface with usage of the mounting table if the field **“Mounting table”** is checked, the form "Setting on the Lower Edge" appears by resetting.

12. "Kinds of Striker Marks" form

One calls it by pressing the striker mark selection button in the **"Specimen Information"** form.



Control buttons:

Select - transfers the kind of striker mark into the **"Specimen Information"** form**;**

Add - allows to register the new kind of striker mark to add it to the database;

Edit - allows to edit the data on the kind of the striker mark, which is already in the database;

Delete deletes the information on the kind of striker mark from the database.

Control buttons

Start - initializes the process of recording the side surface evolvement (of a bullet, cartridge-case) or of a cartridge-case butt-end. On pressing the **Start** button substitutes the word **Start** for the word **Stop**. Pressing the **Stop** button stops the recording process, but does not close the form.

Close - cancels the recording process and closes the **"Recording"** form.

Parameters to be set

Advanced auto focusing mode: It is advisable to use this mode when examining deformed bullets, in which case the evolvement recording time increases.

NOTE: This mode is recommended whenever the cartridge-case butt-end evolvement is recorded.

Number of recording bands: The number of bands determined by the total recording height preset in the **"Firearm system"** form (see the section **"Scanner Operation"** below) is set by default, taking into account the "current" position of the scanner optical system and height of the recording frame **(only for side surfaces).**

Band height, mm: Three values are possible: - 0.6 mm, 1.3 mm and 1.9 mm **(only for the side surfaces)**.

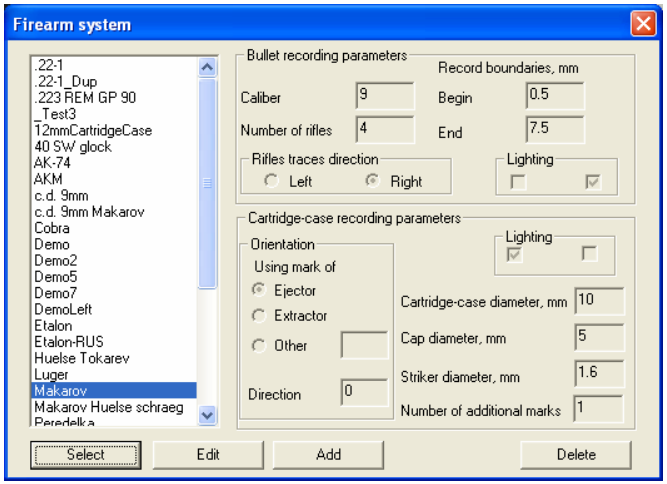
Information elements

The **"Parameters"** entry displays the firearm system corresponding to the object under examination and the evolvement recording option for the bullet: full or fragmentary (fragments).

The **"Status"** entry displays the process of the object surface recording and processing the recorded image.

5. “Firearm system” form

Allows to enter new firearm system, edit or delete firearm system from the list of already entered, select the "current" system from the database list. It appears on the screen upon pressing the **Firearm system** button. It contains control buttons, information elements and the list of the firearm systems entered by the expert.



Control buttons

All are single action buttons.
On pressing the **Select** button the highlighted firearm system will be selected as a "current" system, its name will be displayed in the message window of the **TeleMicroscope** application.

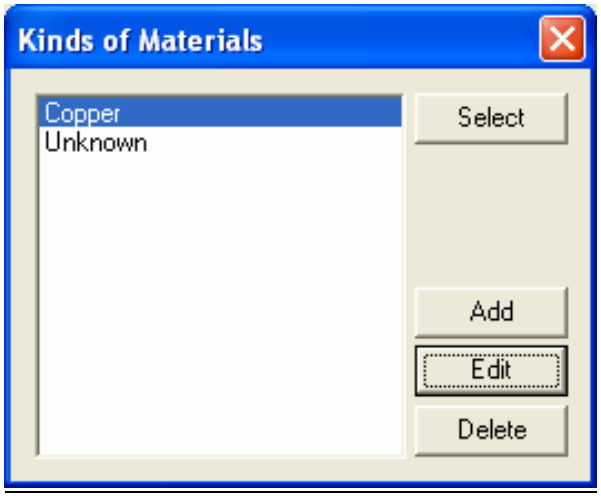
Edit - calls the **"Editing of Firearm system parameters"** form. The button is accessible for users having the right to edit information in the DB.

Add - calls the “**New Firearm system” form**. The button is accessible for users having the right to add information to the DB.

Delete - deletes the highlighted firearm system. The operation is to be confirmed by the user. The button is accessible only for users having the right to delete information from the DB.

11. "Kinds of Materials" form

One calls it by pressing the material selection button in the **"Specimen Information"** form.



Control buttons:

Select - transfers the name of the material of the bullet jacket into the **"Specimen Information"** form;

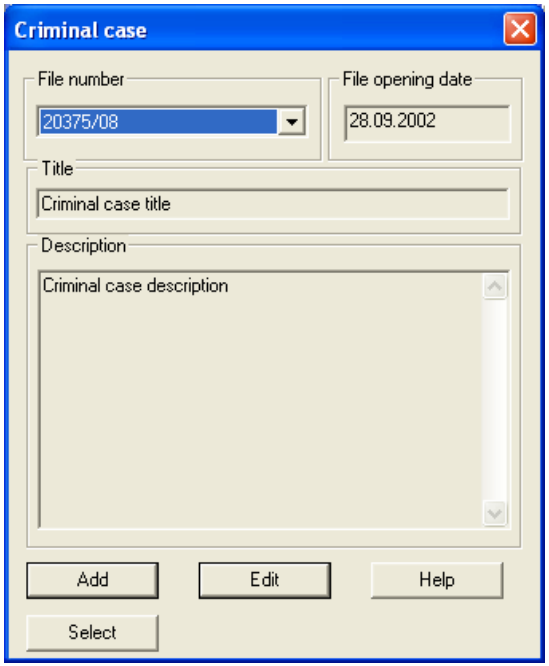
Add - allows to register the new material for adding it to the database;

Edit - allows to edit the data on the material, which is already in the database;

Delete - deletes the information on the material of the bullet jacket from the database.

10. “Criminal Case” form

One calls it by pressing the criminal case selection button in the **"Specimen Information"** form.



Control buttons:

Add - enables registration of a new criminal case in the database;

Select - transfers the selected criminal case into the **"Specimen Information"** form;

Edit - allows to edit the data on the criminal case, which is already in the database;

Help - provides the necessary information on the given form.

Information elements

The main parameters of the highlighted firearm system necessary for recording surface images are displayed in the message windows.

1. **Bullet recording parameters** – caliber, number of rifles, height of rifling field recording (borders of the informative bullet part), direction of rifling traces.
2. **Cartridge-case recording parameters**

   Parameters for setting a cartridge-case in the cassette:

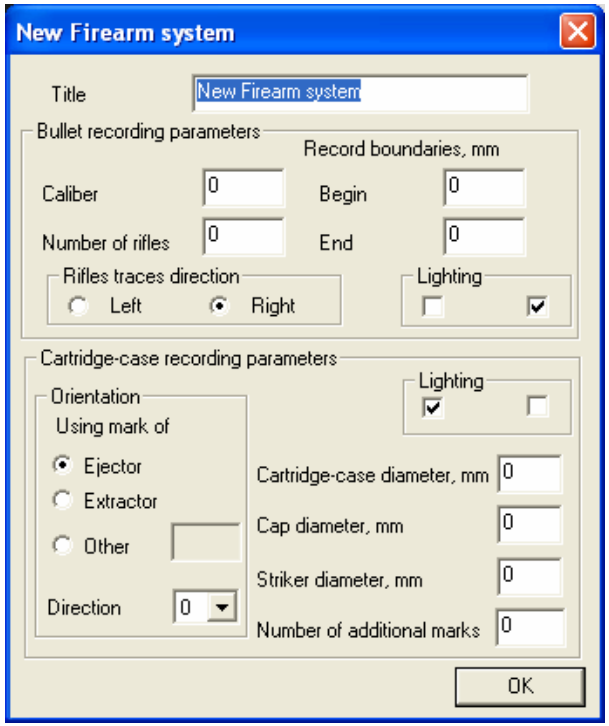
   - The mark by which the cartridge-case is oriented (extractor mark, ejector mark, etc.) by setting in the cassette,
   - Mark orientation direction (in "hours").

   Cartridge-case recording parameters

   - Cartridge-case, cap, striker trace diameters (in mm);
   - Number of additional marks to be recorded in case of lighting from four sides.
3. **Lighting** – determine the direction of lighting for this firearm system by evolvement recording. A flag means the lighters are on.

6. “New Firearm system” form

Allows to input a new firearm system in the database. It shows on the screen upon pressing the **Add** button in the **"Firearm system"** form. It contains the editable parameter fields of the new firearm system to be entered and the change confirmation button.

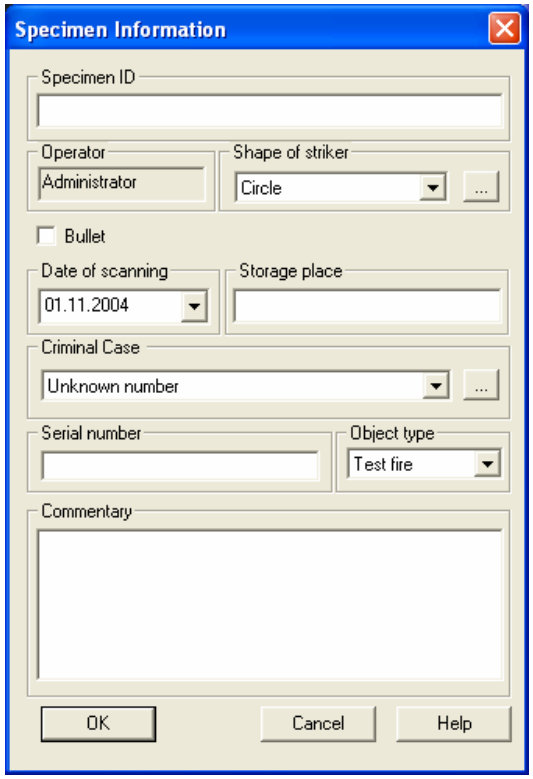


The parameters of the form are described above in the **"Information Elements"** section of the **"Firearm system"** form.

- Name of the operator inputting the specimen;
- Shape of striker mark;
- Aavailability of the bullet corresponding to this cartridge-case;
- Registration date of the specimen being input;
- Object storage location;
- Number of the criminal case file;
- Serial firearm number;
- Object type;
- Commentary.

- Registration date of the specimen being input;
- Object storage location;
- Number of the criminal case file;
- Serial firearm number;
- Object type;
- Commentary.

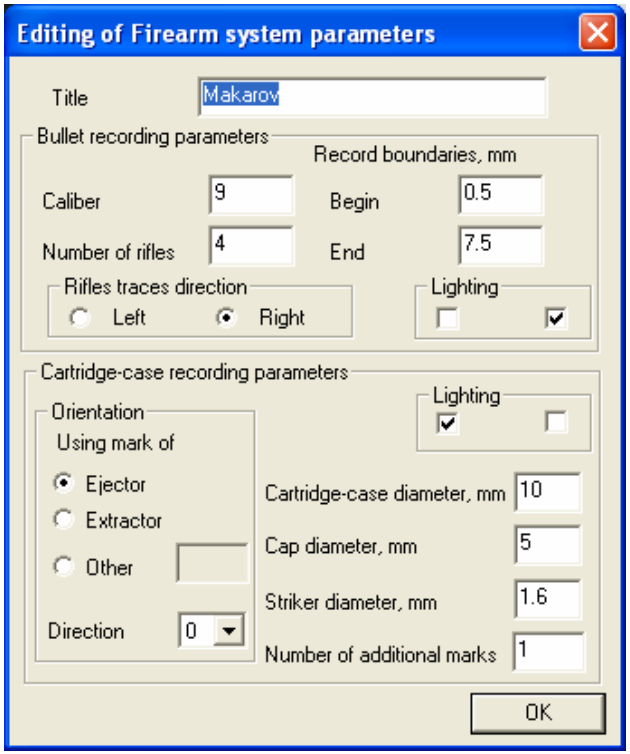
By recording the cartridge-case butt-end surface the form contains the following fields:



- Specimen identifier;

7. "Editing of firearm system parameters" form

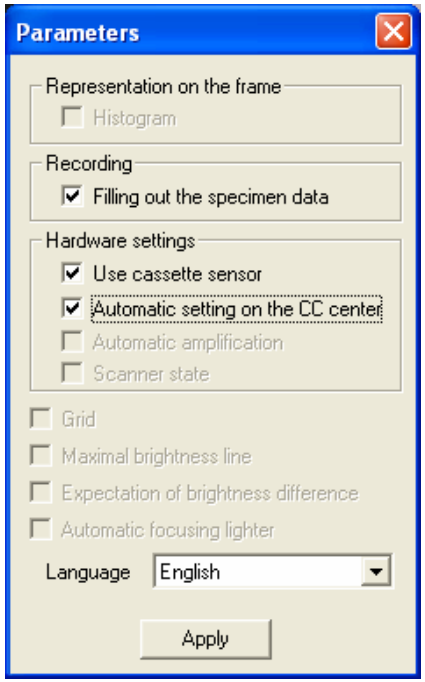
Allows to edit the parameters of the firearm system entered earlier in the database. It shows on the screen upon pressing the **Edit** button in the **"Firearm system"** form. It contains the editable parameter fields of the selected firearm system and the change confirmation button.



The parameters of the form are described above in the **"Information Elements"** section of the **"Firearm system"** form.

8. “Parameters” form

It is called out of the **TeleMicroscope** application system menu.

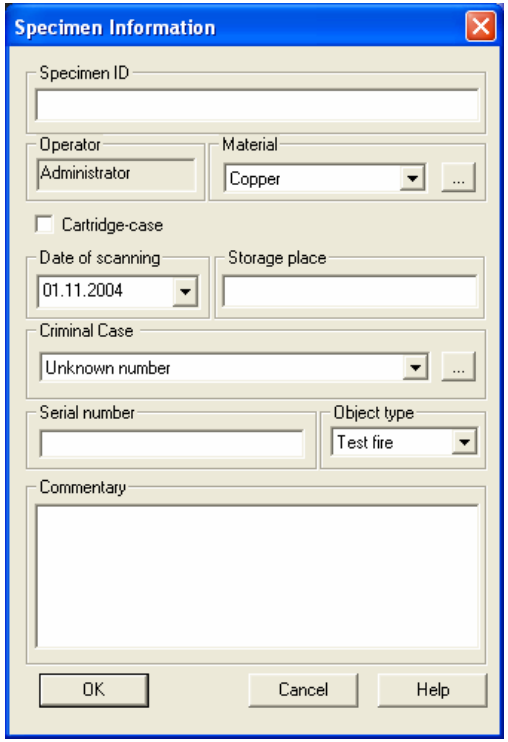


The form contains the following parameters:

- **Filling out the specimen data** - calls the form for filling out the specimen data before recording the image.
- **Use cassette sensor** - automatic determination of the cassette type with the object installed in the scanner.
- **Automatic setting on the cartridge-case center** – automatic search for the cartridge-case butt-end center by resetting**.**
- **Language –** selecting the user interface language (not included).

9. “Specimen Information” form

It appears on the screen after pressing the **Recording** button, if the **Filling of the Specimen Data** parameter has been marked in the **"Parameters"** form. This form is intended to enter the data on the specimen being recorded.
By recording the image of the side bullet surface the form contains the following fields:



- Specimen identifier;
- Name of the operator entering the specimen;
- Material from which the bullet jacket is made;
- Availability of the cartridge-case corresponding to this bullet;