Digital Photogrammetric System

PHOTOMOD

Version 7.5

USER MANUAL

General information about system

RACURS

Table of Contents

1. About

1.1. Purpose of the document

This document contains detailed information about features of the *PHOTOMOD* system. This document contains general information about system, instructions for installing and setting up, and also preparing to work with the system. There are hardware requirements, projects workflow and brief description of modules and additional programs. It describes work with additional tools for work in stereo mode, features of distributed processing and also setting up of hotkeys.

1.2. Set of documentation

Besides this document there are user manuals in the set of documentation. These user manuals contain instructions of different processes while working in the system.

Table 1. Full set of documentation for the system

Document	Filename	Function
Index	contents.pdf	the list of user manuals and their correspondence to system modules and programs
General information about system		this documents which contains detailed information about system capabilities
The GeoCalculator program	geocalc.pdf	description of program to recalculate geodetic coordinates of points from one coordinate system to another and also to create and edit coordinate systems or its parameters
General system's parameters	settings.pdf	description of the **Parameters** window which allows to setup general system's parameters
Creating project	project.pdf	description of project creation stage: adding of images in a project, their radiometric correction, forming and editing of images block, manage of images in the system
Aerial triangulation	measurement.pdf	description of aerial triangulation stage, includes interior orientation of block images, measurement of tie points coordinates on images, relative orientation of block images, as well as input of ground control points (GCP) coordinates to catalogue and measurement of these points coordinates images or their import and using exterior orientation data
Block adjustment	solver.pdf	description of block adjustment stage: features of central projection and satellite scanner imagery blocks adjustment, adjustment accuracy control
Vectorization	vectorization.pdf	description of project processing stage – vectorization: processing of vector layers with/without classifier, features of creating and editing of vector layers, topology verifying and also import/export of vector objects
DTM Generation	DEM.pdf	description of project processing stage – DTM creation: processing of points layers, TIN, contours and DEM, features of DTM creation based on these layers

Document	Filename	Function
Three-dimensional modeling	3d-mod.pdf	description of project processing stage – 3D-modeling: creation of 3D-models based on vector objects, their export and editing
LIDAR Data processing	lidar.pdf	description of the lidar data processing: loading of lidar data, view modes, cutting for sheets and creation of DTM based on lidar data
Processing of UAS data	uas.pdf	description UAS data processing: creation of UAS project, image block forming, interior orientation of block images, automatic measurement of tie points coordinates on images, relative orientation of block images, and also image block adjustment
Orthorectification	ortho.pdf	description of project processing stage – orthomaps building, accuracy control of orthomap creation and also export of obtained data
Orthophotomaps creation	geomosaic.pdf	description of project processing – merge the georeferenced orthorectified imagery: creation of mosaic project, loading of source images, image block forming, image brightness adjustment, creation of cutlines, stitching images using tie points, building orthophoto and its accuracy control
ScanCorrect	sccor.pdf	description of compensation of metric errors occurred when scanning graphical data on flatbed polygraphic scanners
Hotkeys	hotkeys.pdf	description of hotkeys available to use in the system
EGM2008 Geoid installation	install_egm.pdf	description of the Geoid EGM2008 installation to use it in the system
StereoMeasure	stereomeasure.pdf	description of the *StereoMeasure* software module and *ForestInterpretation* program

1.3. Help

User Manual is available in the system.

User Manual is a set of documents with detailed information of project processing stages and about working of additional programs and modules.

To use the help system, choose the **Help › Help index** in the main system's window or press **F1**. The **Use Manual** opens. It is a PDF-file contains a table with available files.

To view the documentation set any software with support of PDF-file is required.

Some windows of the system contains tool tips. To obtain additional information, move the mouse to one of the following icons:

- – *tool tip* – additional information;
- – warning – important note about process or function.

To obtain additional information in the information window, click on one of the following icons:

-  – error – incorrect result of any process;
-  – *warning* – information about available processes;
-  – important information – note or tip;
-  – *additional information* -- e.g., elapsed time of operation.

1.4. Abbreviations and acronyms

Through this User Manual the following abbreviations and acronyms are used:

2D and **3D** (2/3 dimensional) – object/window which has tow or three dimensions (co-ordinates);

DEM – Digital Elevation Model;

DLT – Direct Linear Transformation;

dpi – dots per inc;

GPS – Global Positioning System;

GSD (Ground Sample Distance) – a pixel size on ground for satellite digital images;

GCP (Ground Control Point) – a point with known geodetic coordinates and which is a source point in aerial triangulation;

HSV – color model, Hue, Saturation, Value;

HTML (HyperText Markup Language) – is the standard markup language used to create web pages.

ID – unique identifier;

IP-address (Internet Protocol Address) – is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet Protocol for communication.

LZW (Lempel-Ziv-Welch) – is a lossless data compression algorithm;

RGB – color model based on three colors: Red, Green, Blue;

RPC (Rational Polynomial Coefficients) – is a sensor model commonly used to determine the ground coordinates of pixels in high resolution satellite imagery;

TIN – Triangulation Irregular Network;

WGS – is a standard the World Geodetic System;

WMS – Web Map Service, is a standard protocol for serving georeferenced map images over the Internet that are generated by a map server using data from a GIS database;

DB – data base;

UAS – Unmanned Aircraft Systems;

GIS – geoinformation system;

RSD – remote sensing data;

pix – pixels;

CS – coordinate system;

RMS – root mean square;

DTM – Digital Terrain Model.

1.5. Main conventions and terms

Through this User Manual various conventions and terms are used to describe processes and objects, which are used in the system.

There are the following terms on a step of data collection for aerial triangulation:

- *Workstation* – personal computer (operators place) with installed system;
- *Aerial triangulation* – is the mathematical process of establishing precise and accurate relationships between the individual image coordinate systems and a defined datum and projection (ground);
- *Block layout* – approximate scheme of terrain, obtained using projecting of matched images of a block on specified surface (Earth surface) considering images overlaps, relative position, rotation by angles in a space.
- *In-strip* stereopair is formed by two adjacent images in a strip;
- *Inter-strip* stereopair is formed by two adjacent images from different strips;
- *The active image* – image displayed in the window selected by mouse click. The *active* image window is highlighted by blue frame;

- *The 'left' image* – a status assigned to one of opened windows, that is considered during stereopair opening and is used to correlate other images with this one during measurement of tie points using correlator.

- *Exterior orientation parameters* of image are geometric parameters of image, that specify its position and orientation in relation to object of photogrammetric survey in a moment of the survey. There are linear and angular exterior orientation parameters:

  - *Linear exterior orientation parameters* of image – coordinates of center of optical image projection in coordinate system of photogrammetric survey object;

  - *Angular exterior orientation parameters* of image – parameters that define image angular orientation in coordinate system of photogrammetric survey object, slope and rotation angles of image.

- *Tie points* – the same points on the terrain on adjacent block images needed to build single models from stereopairs and then to merge them into triangulation networks.

- *Ground control point* – a point with known geodetic coordinates and which is a source point in aerial triangulation.

There are the following terms of vectorization on the project processing stage:

- *Vectorization* is a process of creation vector objects on a vector layer;

- *Stereovectorization* – an operation of terrain objects vectorization in stereo mode using stereo model, that allows to create digital elevation models and 3D topographic maps;

- *Stereo mode* – a mode when each eye can see only one of two images, with stereoscopic effect as a result. It is used for stereo viewing of stereo model, and it is provided by hardware devices and monitor technical features.

- *Pseudo-stereo* – is a stereo mode, where orthogonal projection is used for left eye, and for right eye – parallel projection with some angle to normal line. This mode allows to display to raster layers as one stereo image;

- *Stereo model* is generated using block stereopairs during adjustment operation;

- *Stereopair* – two images of one object with overlap (for aero survey – near to 60%), obtained from slightly different positions – with different positions of their centers of optical image projection;

- *Vector object* – 2D or 3D-object of vector graphics, described by mathematical function and belongs to one of the following objects types in the system:

  - *Point* – a point object, which is determined by XY coordinates in the plane and by XYZ coordinates in space;
  - *Polyline* – a broken line or a curve, containing a set of vertices, joined by straight or curve line pieces called segments;
  - *Polygon* – an areal object, which boundaries are closed polyline;
- *CAD-objects* – standard geometric figures, for example, ellipse, circle, rectangle, arc, that are polylines or polygons;
- *Vertex* – a point, connecting polyline or polygon segments;
- *Segment* – a straight or curve line, connecting two vertices;
- *Fragment* – a part of polyline/polygon, a set of adjacent vertices/segments of polyline/polygon;
- The *topology* is referred to as set of functions and operations, that define mutual location of vector objects and are used to create topologically correct vector data.

There are the following terms of DTM creation on the project processing stage:

- *Metadata* – structured information about data in the image file;
- *DEM* (Digital Elevation Model) – is digital cartographic representation of the earth's surface in the form of a regular grid of height values;
- *Triangulation Irregular Network* (TIN) – one of the models of spatially coordinated data, used during designing of digital terrain model as elevation points in nodes of irregular network of triangles, that corresponds to Delaunay triangulation;
- *Contour lines* – vector lines, that connect points with the same terrain altitude;
- *Quasi-contours* – isolines with specified step, which cross sides of TIN triangles;
- *Points* – point vector objects, located on relief surface;
- *Pre-regions* – vector layer which consists of polygons, drawn by images block;
- *Surges* – all points not lying on the relief surface (average smoothed terrain surface);

There are the following terms on a orthophoto creation step:

- *Orthoimage* is a georeferenced image prepared from a perspective photograph or other remotely-sensed data in which displacement of objects due to sensor orientation and terrain relief have been removed;

- *Orthomosaic* is an image created from source images during brightness adjustment and merging georeferenced orthoimages;
- *Cutline* is the boundaries of the specified area from the source image, which will be included in the output mosaic.
- *Sheet* is an area of output mosaic to save in separate file (in output format). The vector polygons are used for the cutlines creation;
- *Global brightness adjustment* means transformation equally applied to all pixels of each source image;
- *Local brightness adjustment* is a transformation applied along cutlines of images that are merged into mosaic with a smoothing going down to the image central point and mosaic edges.

1.6. The table of symbols

Through this User Manual are used the following symbols to highlight one or other information.

Table 2. Symbols used in this documentation

Symbol	Description
	tip about capabilities of system
	notes from theory
	warning with information about uncritical, but important consequences of actions
	caution with information about critical and important consequences of actions

1.7. About Racurs company

The Racurs company was founded in 1993. The main fields of application include photogrammetric production, cadastral mapping, cartography and remote sensing, academic photogrammetry, mining, architecture and construction.

PHOTOMOD was one of the first digital photogrammetric systems on the market that was designated for working on *PHOTOMOD* PCs. At the present time *PHOTOMOD* is the most popular digital photogrammetric software in Russia and well known all over the world.

Racurs company's business mission is to provide the world-wide geospatial community with advanced and cost-effective digital photogrammetry solutions and services for creation of wide range of output products from the available remote sensing data.

The official web-site of the Racurs company www.racurs.ru contains the following information:

- the latest news;
- recent activity;
- report about software development;
- information about provided RSD;
- list of photogrammetric service;
- training courses schedule and contents;
- free products and training data;
- articles and presentations;

1.8. Technical Support

The Racurs company technical support provides the actual information about system functionality, characteristics, price and services.

For technical support use one of the following ways:

- e-mail: support@racurs.ru;
- phone: +7 (495) 720-51-27;
- mail: RACURS Co., Ul. Yaroslavskaya, 13-A, office 15, Moscow, Russia.

2. About system

2.1. Purpose of the system

Digital photogrammetric system *PHOTOMOD* (further – *system*) is a digital system providing full photogrammetric production line from the aerial triangulation to output digital terrain models, vector maps and orthomosaics.

The system allows to obtain spatial information by images from different sensors, as digital and plane cameras, satellite scanner systems, lidar and SAR.

The system has module structure. It allows to find the best set of modules to solve current tasks.

One of the system features is possibility of distributed processing with additional work-stations to speedup of different project processing steps.

2.2. Brief description of system features

The system provides the following main features:

- preliminary preparing of source images;
- images interior orientation;
- relative orientation of images;
- input and measurement of GCP coordinates;
- images exterior orientation;
- vectorization;
- stereo vectorization;
- building DEM;
- creating orthomosaic;
- creating digital map;
- creating 3d-models.

3. Logical structure of the system

3.1. Workflow of project processing

The system has flexible structure, so it allows to find a module set to solve current type of tasks.

Each system module is used to perform number of tasks in appropriate stage of project processing.

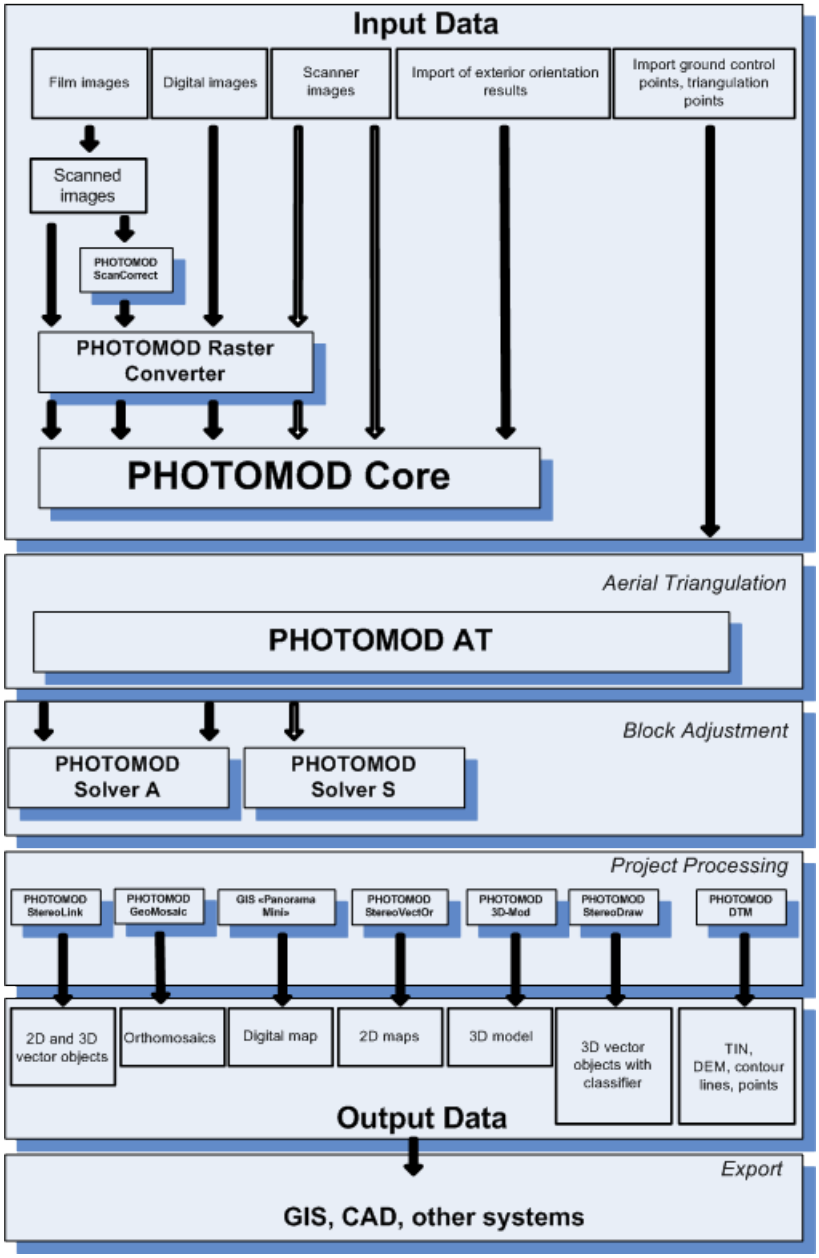


Fig. 1. Workflow of project processing

3.2. Brief description of modules and additional programs

The system consist of main program shell, main modules, additional modules and also stand-alone programs.

PHOTOMOD Core is the main program shell. Main features of *PHOTOMOD Core* are creating and managing of project, image block forming, managing of project cameras (see details in the “Project creation“User Manual).

The system consist of the following main modules:

- *PHOTOMOD Raster Converter* – allows to convert raster images to an inner MS-TIFF format without or with JPEG or LZW compression and also to convert MS-TIFF files to another formats (see Section 10).

- *PHOTOMOD AT* – allows to collect data for aerial triangulation workflow. The data collection process in the module consists of the following stages:

  - images interior orientation;

  - input and measurement of GCP coordinates;

  - measurements of tie points in areas of forward and lateral overlap;

  - parameters of images interior orientation calculation (see detailed description in the "Aerial triangulation" User Manual).

- *PHOTOMOD SolverA* – allows to adjust central projection image blocks, view results and perform an accuracy control (see the "Block adjustment" User Manual).

- *PHOTOMOD SolverS* – allows to adjust scanner image blocks, view results and perform an accuracy control (see the "Block adjustment" User Manual).

- *PHOTOMOD Geomosaic* – is used to merge the georeferenced orthorectified aero and space images and create the orthomosaic from them, cutting it for sheets and saving output files.

  Output data could be in TIFF, BMP, RSW, GeoTIFF, ERDAS Imagine, NITF, JPEG, PNG, DGN, JP2, PIX or PRF files. Georeference file could be saved in PHOTOMOD Geo, TWF and MapInfo TAB formats (detailed description see in the "Orthophotomaps creation" User Manual).

- *PHOTOMOD ScanCorrect* – allows to correct metric errors occurred when scanning graphical data on flatbed polygraphic scanners. Transformation of raster data considering scanner's disturbances field is used for errors compensation. Scanner's disturbances field is created using raster data obtained by scanning calibrated material (regular grid or regular set of crosses).

  Input and output data are raster images in TIFF or BMP files. Detailed description see in the "ScanCorrect program" User Manual.

- *PHOTOMOD StereoDraw* – allows to create and edit 3d-vector objects in stereomode with classifier. These 3D vector objects could be used to create digital maps, as a base-layer for DTM creation in the *PHOTOMOD DTM* module (detailed description see in the "Vectorization" User Manual)

- *PHOTOMOD 3D-Mod* – allows to create and edit 3D terrain models by vectors with classifier (see the "3D-modeling" User Manual).

- *PHOTOMOD DTM* – is used to create DTM by points, TIN, DEM and contours, edit it in mono and stereo modes and export for other formats (see the "DTM Generation" User Manual).

Besides, the system includes the following service module:

- *PHOTOMOD System Monitor* – allows to launch *PHOTOMOD Core* with double-click on the  icon in the *Windows* system tray and also allows to launch *Explorer*, *Control Panel module*, *Raster Converter*, *GeoMosaic* and *3D-Mod program* with the right-click menu. The right-click menu also allows to start the distributed processing control center, to choose an active profile (to the next work session), to setup mouse configuration and to obtain information about system version, serial number,build date and contains of the system (list of used modules) (see Section 9.5).

- *PHOTOMOD Control Panel* – allows to manage system resources, to organize of local or network processing (see Section 9.2.1).

- *PHOTOMOD Explorer* – allows to change active profile resources of the system (see Section 9.4).

- *PHOTOMOD ParProc* – is an extra license for distributed computing on 1 PC (see Section 12);

  The limit on the number of computers used in distributed computing is no more than one. To use more than one PC, user need an extra *PHOTOMOD ParProc* license.

  If *PHOTOMOD ParProc* licenses are available, the number of computers simultaneously involved in distributed computing increases by the number of *PHOTOMOD ParProc* licenses.

- *PHOTOMOD DiPro* – is an extra license for distributed computing for 20 cores (see Section 12);

  The limit on the number of processor cores used in distributed computing is no more than 20. To use more than 20 cores, user need an extra *PHOTOMOD DiPro* license.

  If an extra *PHOTOMOD DiPro* license is available, the number of workstation cores simultaneously involved in distributed processing increases by another 20.

- *PHOTOMOD ImageWizard* is used to matching project images with raster files, as well as control of correctness of this matching, allows to build pyramids, and perform images radiometric correction (see the "Project creation" User Manual).

- *Camera editor* – allows to define passport data for digital or film camera to use them in a project.

  To launch the module choose **Start › Programs › PHOTOMOD 7 x64 › Camera editor**.

Besides, the system includes the following stand-alone programs used for work with coordinate systems and georeferencing:

- *PHOTOMOD GeoCalculator* – allows to recalculate geodetic coordinates of points from one coordinate system to another and also to create and edit coordinate systems or its parameters (see the details in the "GeoCalculator" User Manual).

  The *GeoCalculator* program also allows to edit coordinate systems, to create new ones, to perform import and export of coordinate systems.

- *Calculation of datum parameters* – allows to calculate parameters of datum using two set of identical points in different coordinate system. In each set should be at least 3 points. These parameters include scale, 3 angular rotation parameters, 3 linear offset parameters.

- *Calculation of projection parameters* – allows to determine the unknown parameters of the Gauss-Krueger projection. It is necessary that the initial data be assigned to the same ellipsoid with the same orientation.

- *Direct Georeferencing* – allows to estimate accuracy assessment of terrain measurements based on information about survey (flying altitude, overlap, camera parameters) and specified accuracy of exterior orientation parameters.

And also, the system includes the software products used for solving forest taxation tasks (see the "*StereoMeasure* software module" User Manual):

- *PHOTOMOD StereoMeasure* software module – a software product, created on basis of *PHOTOMOD* digital photogrammetric system, and used for stereo interpretation and solving of forest taxation tasks. *PHOTOMOD StereoMeasure* software module includes *PHOTOMOD Core* (control shell of the digital photogrammetric system that is used to create, edit, import/export of vector objects without a classifier), and *PHOTOMOD StereoWindow* module (a window used to view, interpret, measure and vectorize objects in stereo mode by space and airborne data).

- The *ForestInterpretation* program extends the range of options of the *PHOTOMOD* system and the *PHOTOMOD StereoMeasure* module in analyzing the most meaningful interpretation patterns of forest species based on probabilistic approach. It is designed to specialists in sphere of remote sensing of forestry. The program is based on statistical analysis of interpretation patterns, meaning that features of a particular tree are correlated to those of a certain set that identifies a particular tree species and age group.

The *PHOTOMOD UAS* program is purposed to process data from unmanned aircraft system (UAS). There is a limit on using of the source data when working with program. Only central projection images with size not more than 100 Mpix could be used a source data (see the "Processing of UAS data" User Manual).

3.3. Input and output data

3.3.1. Input data

During the project creation, aerial triangulation and block adjustment, the following source data is used:

- *Camera passport* with interior orientation parameters to process central projection images – image focal length and principal point coordinates.

  For *film* cameras, depends on camera's type, principal point coordinates could be calculated by fiducial marks coordinates.

  For *digital* cameras principal points coordinates are set in relation to center or corner of image. Besides image focal length and principal points coordinates, the camera passport also could consist data about lens distortion, which should be considered.

- The *list of GCP coordinates* is necessary for block adjustment. The system provides opportunity to measure GCP coordinates manually and also to perform import of GCP list from a text file.

- The *list of projection centers* coordinates to process central projection images. The program also provides the ability to import on-board data (coordinates) about projection centers from CSV files.

  Block adjustment could be process only by projection centers without using ground control points. It is recommended to use GCP coordinates to increase adjustment accuracy.

- *Raster images*

  For working with images in program , it is recommended to use MS-TIFF internal raster format, which is the TIFF format with overview pyramid (set of subsampled images copies) for higher image display performance.

  The *Raster Converter module*. It is possible to convert image into internal format both manually, before creating project, and on the stage of adding images into project with saving converted images into active profile resources.

  The following image formats are available to process central projection images:

  - Tag Image File Format (TIFF) - TIFF и GeoTiff format, included tags for saving of georeferenced information;
  - Windows Bitmap File (BMP);
  - VectOr Raster Maps (RSW) – images of *PHOTOMOD VectOr*;

- ERDAS IMAGINE (IMG) - ERDAS system raster format;
- NITF (NITF);
- JPEG (JPEG);
- GIF (GIF);
- PNG (PNG);
- USGS DEM (DEM);
- PCIDSK (PIX) – raster format with georeference in the heading developed by PCI Geomatics company;
- JPEG2000 (JP2) – raster format with JPEG compression and georeference in the heading developed.

The limitation on output file size of JPEG2000 format – no greater then 500 Mb.

- *Information about coordinate system and map projection* – during project creation it is necessary to define coordinate system of GC points. By default there is an International coordinate system database and map projection (see the details in the 'GeoCalculator' User Manual);
- also it is possible to use the following *exterior data*:
  - import of triangulation points from PAT-B and X-POINTS;
  - import of ground control points from text files (`*.txt`, `*.csv`);
  - import of interior and exterior orientation data from metadata;
  - import of exterior orientation data from PAT-B and CSV-files;
  - GPS data;
  - import additional data from different formats.

To process satellite data in the system, ERS products with different processing level are supported.

Table 3. Generic (DLT and it's modifications)

Satellite	Format	Processing level	Stereo processing
ALOS (AVNIR-2)	CEOS	1B2	No

Satellite	Format	Processing level	Stereo processing
Landsat 8	TIFF	T	No
Landsat7/ETM+	TIFF/GeoTIFF, HDF	1R, 1G	No
IRS-1C, 1D/PAN	Super Structured, HDF, Fast C	1A, 1B	Yes, from the adjacent passes
Resourcesat-1(IRS P6)	Super Structured, HDF, Fast C	1, 2	Yes
Resours-DK	TIFF/GeoTIFF	0	No

Table 4. Rigorous algorithm

Satellite	Format	Processing level	Stereo processing
EROS A, B	RAW, TIFF	1A	Yes
FORMOSAT-2	DIMAP	1A	No
KazEOSat-1	DIMAP V2	1A	Yes
KazEOSat-2	TIFF/GeoTIFF	1R, 1G	Yes
KOMPSAT-2	TIFF/GeoTIFF	1R, 1G	Yes
Resours-DK	TIFF/GeoTIFF	0	Yes, from the adjacent passes
SPOT 1-5	CEOS (SISA, CAP), DIMAP	1A	Yes, same-pass
TERRA/ASTER	HDF	1A	Yes, same-pass
VNREDSAT1	TIFF	1A	Yes

Table 5. RPC-algorithm

Satellite	Format	Processing level	Stereo processing
ALOS (PRISM)	CEOS, GeoTIFF	1B1, 1B2	Yes, from the adjacent passes
Cartosat-1, 2 (IRS P5)	TIFF/GeoTIFF	Orthokit	Yes
Deimos 1	TIFF/GeoTIFF	1R, 2R	-
Deimos 2	TIFF/GeoTIFF	1B	Yes, from the adjacent passes
DubaiSat-2	TIFF/GeoTIFF	Radio	Yes
GaoFen-7	TIFF+XML	SC	Yes
GeoEye-1	TIFF/GeoTIFF	Geo, Basic, Standard, Standard Ortho Ready	Yes, same-pass
GF-1, 2	TIFF/GeoTIFF	1A	No
IKONOS	TIFF/GeoTIFF	Geo	Yes, same-pass
Jilin 1	TIFF/GeoTIFF	Standard Static Level 1	Yes

Satellite	Format	Processing level	Stereo processing
Kanopus-V	TIFF/GeoTIFF	1, 2, 3	Yes, from the adjacent passes
KazEOSat-1	TIFF/GeoTIFF	2A	Yes
KOMPSAT-2	TIFF/GeoTIFF	1R, 1G	Yes
KOMPSAT-3	TIFF/GeoTIFF	1R, 1G	Yes
KOMPSAT-3A	TIFF/GeoTIFF	1R, 1G, 1O	Yes
OrbView-3	TIFF/GeoTIFF	Basic	Yes, same-pass
Planetscope	TIFF/GeoTIFF	1B	No
Pleiades	DIMAP V2	Primary	Yes
PeruSat-1	DIMAP	Sensor	Yes, same-pass
QuickBird	TIFF/GeoTIFF, NITF	Basic, Standard, Standard Ortho Ready	No
RapidEye	GeoTIFF, NITF	1B	No
Resours-P	TIFF/GeoTIFF	1A, 2A	Yes, from the adjacent passes
SkySat	TIFF+json+RPC	Basic	Yes, same-pass
SPOT 6, 7	DIMAP V2 (JPEG2000 или GeoTIFF)	Primary	Yes
SuperView-1	TIFF/GeoTIFF	1A, 2B	Yes
TripleSat	TIFF/GeoTIFF	1A, 2A	Yes
TH-1	TIFF/GeoTIFF	1A, 1B	Yes
WorldView-1, 2, 3, 4	GeoTIFF, NITF	Basic, Standard, Standard Ortho Ready	Yes, from the adjacent passes
ZY-3	TIFF/GeoTIFF	-	Yes
АИСТ	TIFF/GeoTIFF	1A, 2A	No

3.3.2. Output data

The program allows to process UAS data and acquire all types of value added photogrammetric products: DEM, 2D and 3D-vectors, orthomosaics.

There are the main output products:

- *Digital Terrain Model (DTM)* – digital cartographic presentation of terrain surface both as regular grid of elevations (DEM) and as triangulated irregular network (TIN). They are used for solving applied research problems.

- *3D vector objects* – used for creating a topographical base for cartographic production or as source data for a mathematical representation of a scene in three-dimensional digital terrain modeling;

- *orthophoto production* – single raster images in the form of a single frame or a set of sheets in a selected map projection with marginalia. In the resulting image, geometric and photometric distortions are corrected, creating seamless, color-balanced orthophotos with uniform brightness as an output;

- *3D models of terrain* – can be used to solve applied research problems, as well as for creation of multimedia presentations and commercials.

There is opportunity to export all photogrammetric products to various formats.

4. Hardware requirements

Recommended configuration for comfortable work:

System Component	Recommended Configuration
CPU	*Intel Core i7*
Memory (RAM)	4 GB
Recommended graphics card	*NVIDIA Quadro P2200* (*P*, *K*, *M* and *RTX* series can also be used)
SATA (HDD/SSD)	4 TB
Operating system	*Microsoft Windows 7, 8.1, 10*
Display	Professional stereomonitors or supporting *nVidia 3D Vision Ready* Stereo glasses: *NVIDIA 3D Vision*

For the security key, an USB port is required (to use local) or network connection (to use system by network).

CPU

It is currently recommended to use systems based on*Intel Core i7* @ 3.00 GHz or equivalent. CPU productivity is generally not the most critical factor for the majority of operations in the system. To create many terrain models (TIN, DEM) using correlator you should choose faster model since the speed of points calculation is roughly proportional to CPU frequency.

The system is optimized to work on PC with multi-core processor. Work on such processors considerably reduces the execution time consuming processes and allows distributed processing at the same workstation using multiple processor cores.

RAM

Minimal requirements of RAM depend on use operating system. It is recommended at least 2 GB RAM for stable work in the system. If less, processes could take rather more time.

To create many terrain models (TIN, DEM) using correlator, not less than 4GB RAM is required.

Hard disk drive (HDD)

Hard disk speed is not vital and correct setup of operating system may give better result than just changing to the nominally faster hard drive. It is recommended to use SCSI-devices, RAID-arrays, etc. only if you have qualified specialist for their setup and maintenance. Otherwise there will be likely more troubles than advantages.

The system required 2 GB of free hard disk space.

If it is supposed to process projects with more than 500 – 1000 GB of data volume please consult with our Technical Support service (see *Section 1.8*).

The system provides possibility to place project data for several hard disks automatically.

In case of using distributed processing system (for several hard disks) it is recommended to use hard disks not less than 1 TB size.

Operating system

Stable work in the system is possible on PCs with *Windows XP*, *Windows Vista*, *Windows 7, Windows 8.1* or *Windows 10* operating systems.

Network adapter

For project processing using network it is recommended to connect server to hub using at least 1 Gbit/s network interface.

5. System installation

5.1. Distribution kit

License software distribute in a branded box.

The company name is place on the front. On the reverse side are placed address, technical support service phone and e-mail, web-site of company.

The system distribution kit includes:

- CD-ROM containing the system setup files and the documentation files in PDF format;
- 'System installation Manual;
- Hardware lock key (see Section 5.3.1).

5.2. PHOTOMOD installation

Prior to the system installation it is desirable to insert *Sentinel HL* security key into the USB-socket of the workstation.

The system required 2 GB of free hard disk space.

To start the system installation, launch the `setup.exe` file or input the installation software and launch the `autorun.exe` file. The **PHOTOMOD** window opens.

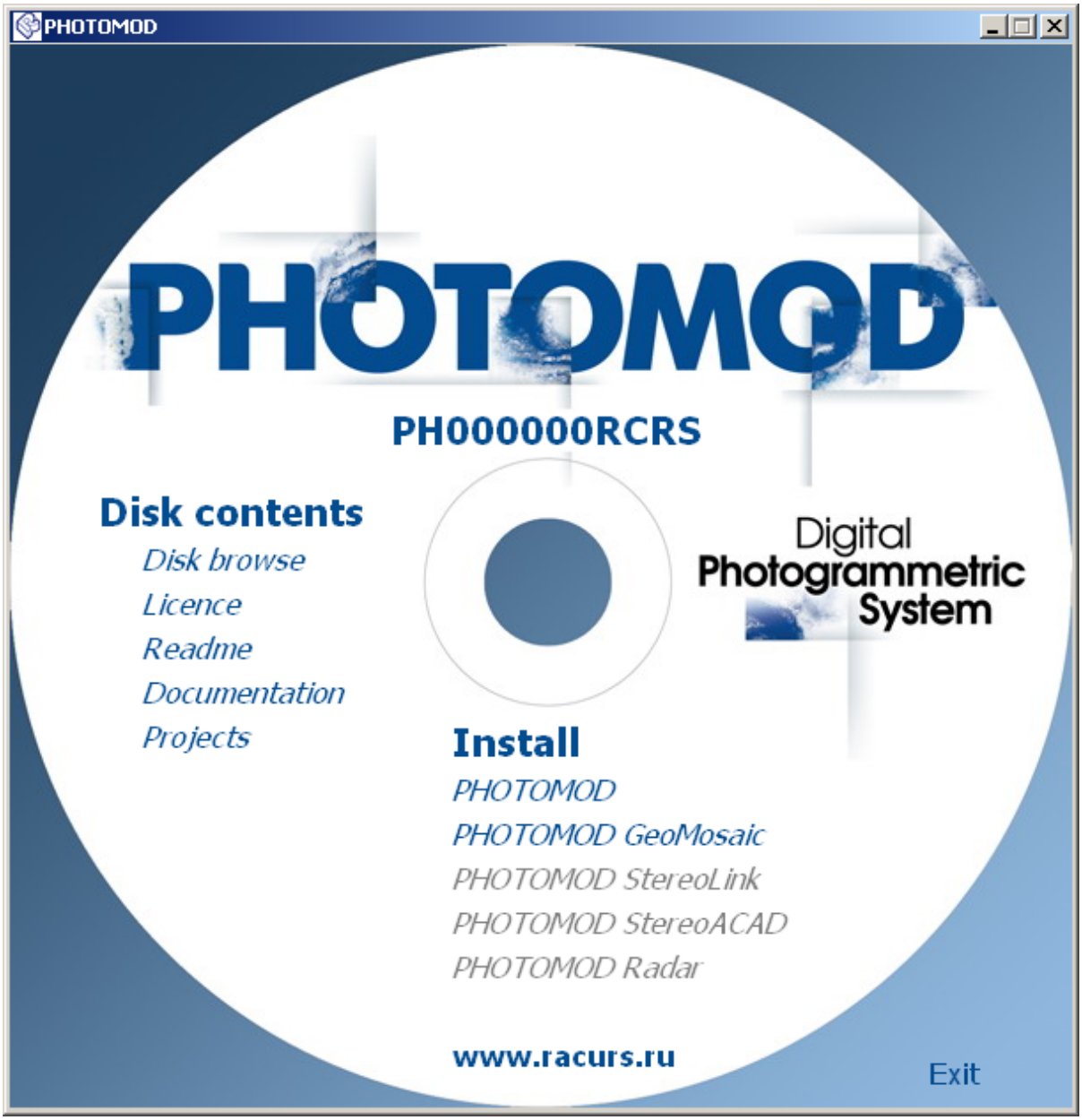


Fig. 2. The PHOTOMOD installation window

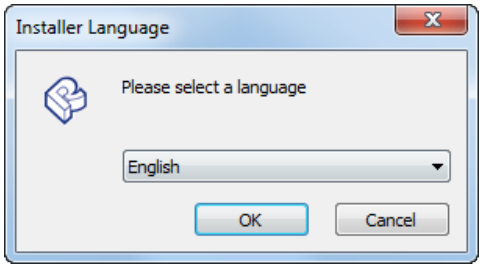
Click **Install › PHOTOMOD**. The **Installation PHOTOMOD 7** window opens.

The system initial installation process consists of a sequence of steps with instructions.

In case of cancel at any step, installed program files and data are not removed. To complete the system installation, restart the `autorun.exe` or `setup.exe` file and go through all steps again.

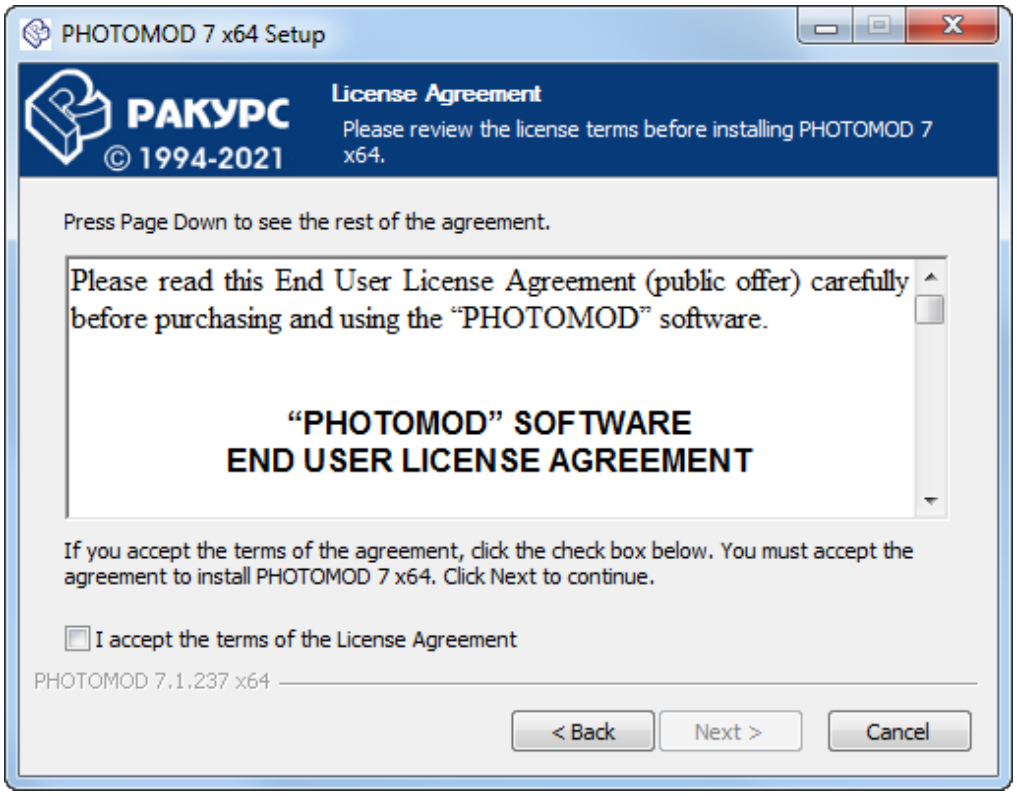
5.2.1. Preparation stage

1. Choose the installation language. Click OK;



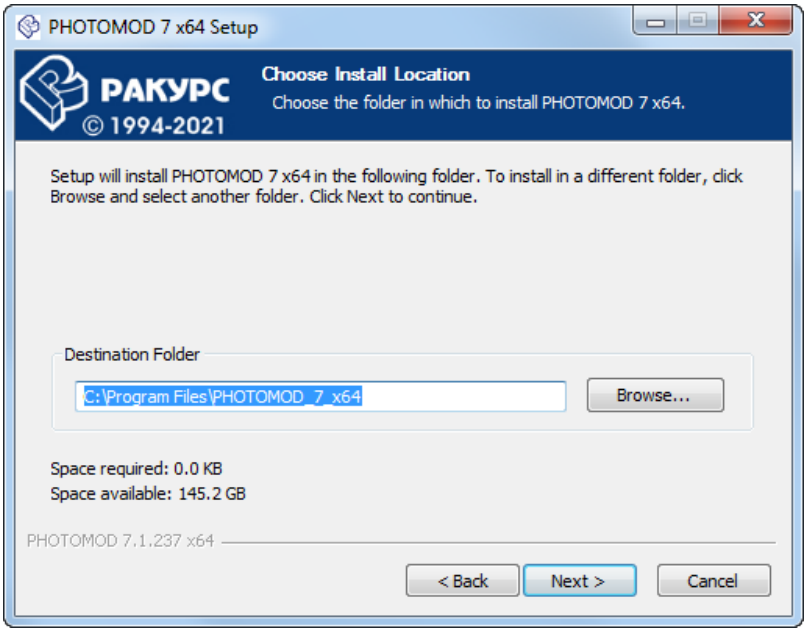
2. Read the welcome and warning messages. Click the **Next** button.

3. Read the license agreement. If you agree with it, set the **I accept the terms in the License Agreement** checkbox on and click the **Next** button.

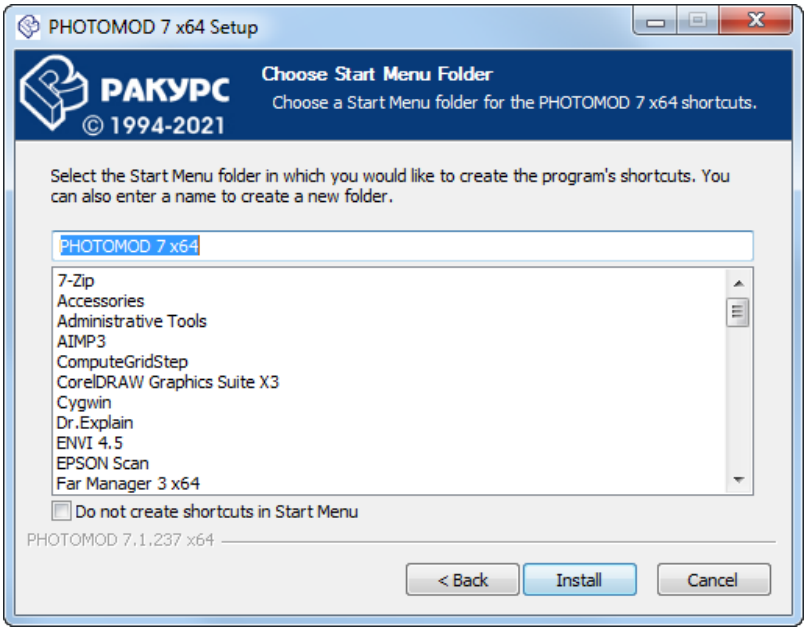


4. Define the folder to install the program files of the system. Click the **Next** button.

It is strongly not recommended to install the system in folder with name, which contains letters, different from Latin. By default for the program files the *C:\Program Files\PHOTOMOD7 x64* is used.

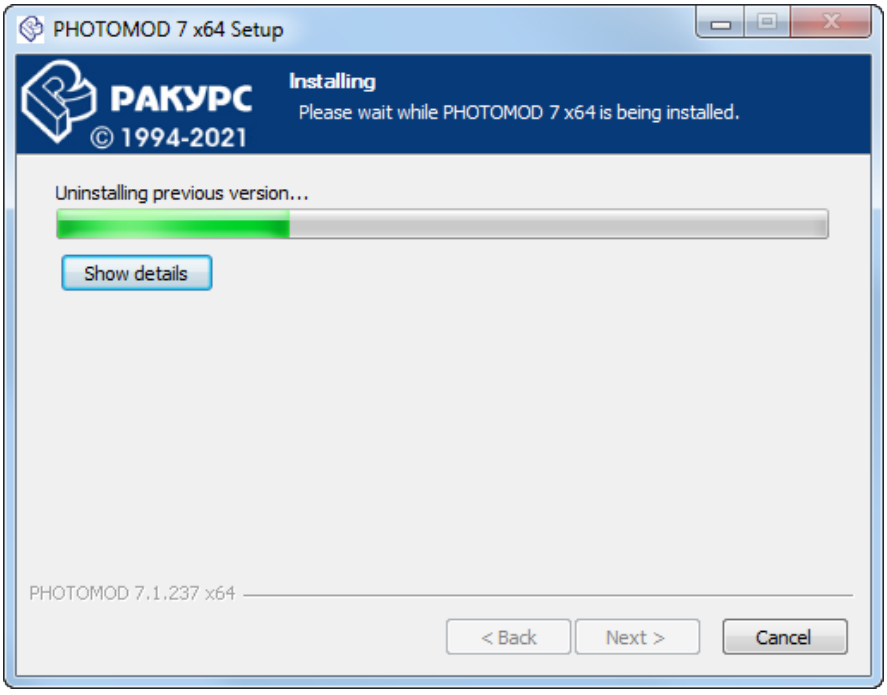


5. [optional] Enter a folder name for the *PHOTOMOD* program in the *Windows* **Start** menu. A shortcuts in the *Windows* **Start** menu will be created by default. Otherwise – clear the appropriate checkbox. Click the **Install** button.

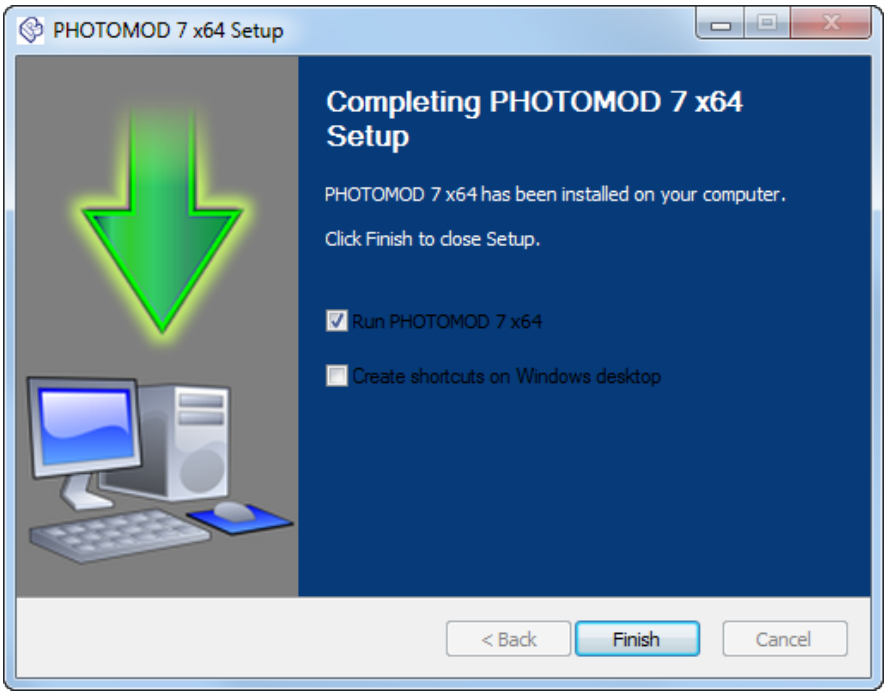


5.2.2. File copy stage

1. Wait until the installation is complete;



2. When installation complete perform one of the following actions:



- [optional] clear the **Run PHOTOMOD x64** checkbox and click the **Finish** button to complete the installation process without program launch;
- [optional] leave the **Run PHOTOMOD x64** checkbox set and click the **Finish** button to proceed to the system configuration stage.

The **Create shortcuts on Windows desktop** checkbox is set on by default. Clear it if needed.

If the **Run PHOTOMOD x64** checkbox is set, the *PHOTOMOD* program will launch automatically.

If the security key or security key drivers (they must be installed automatically during the program installation) were not found, the error message displays.

If the *Sentinel HL* hard lock key and file `PhConsts50.dll` do not congruity, the error message from protection system also displays.

Make sure that the *Sentinel HL* security key is inserted into the USB-socket of the workstation. Install the security key drivers manually. Copy the licence file `PhConsts50.dll` to the system folder (by default *C:\Program Files\ PHOTOMOD7 x64*) manually and re-start the system.

In case of problems contact the Racurs company technical support service (see *Section 1.8*).

5.2.3. System configuration stage

During the first launch of the system, the message about the required detailed configuration appears. The initial setup of the program can be performed in various ways, depending on the circumstances of the system installation on a particular workstation. The most common situations are the following:

- The system was installed on this workstation for the first time. The user needs to create a folder for storing settings, a resource system, and profiles for organizing local and/or network work. This procedure will be discussed in detail below in this chapter.

- If other *Racurs* software products (*PHOTOMOD Conveyor*, *PHOTOMOD UAS*) are already installed and configured on the workstation, the user can quickly connect the installed program to existing profiles and resource systems.

  If the connection did not occur automatically during the first launch of the installed program, then in the **Initial setup** window that opens (see below), an already existing **settings folder** used by previously installed software products is indicated;

- The system is installed and configured on several workstations connected to each other via a local network. A new computer is added to the local network where this program was installed for the first time. Connecting such a workstation to an existing network profile is described in Section 9.2.5.

More details about program resources, recommendations on organizing of local or network work, and about creating profiles and virtual folders connecting see in Section 9.2.

System initial setup

To do this, perform the following:

1. Click OK, close the **Warning** window.

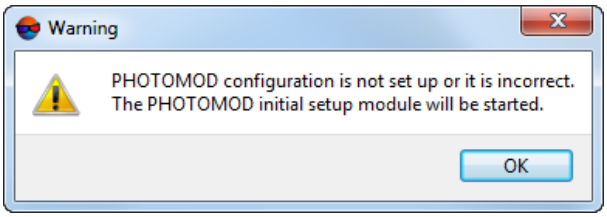


Fig. 3. Information message

2. The **Initial setup** window opens:

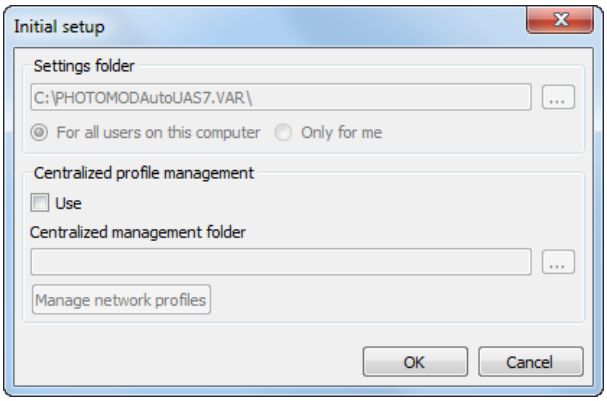


Fig. 4. The “Initial setup” window

In **Settings folder** section is displayed path to the *PHOTOMOD7.VAR* folder, that is used to store configuration and temp files. Click the ... button to change path to configuration folder.

If other *Racurs* software products (*PHOTOMOD Conveyor*, *PHOTOMOD UAS*) are already installed and configured on the workstation, the system provides for connecting the program to existing profiles and resource systems.

For this, the **settings folder** is to be specified which is used by these software products. In this case, the user will not be required to perform the steps described below to create a new local profile.

Choose **For all users on this computer** to use one configuration folder for all users of current workstation, otherwise choose **Only for me**.

[optional] To **Use** the **centralized profile management** set the appropriate checkbox and define the **centralized management folder**. Click OK.

Creation of a *local profile* is described in this Chapter. Network profiles management is described below.

3. The *Control Panel* module opens. An info message that at least one *local profile* is to be created appears. Click OK.

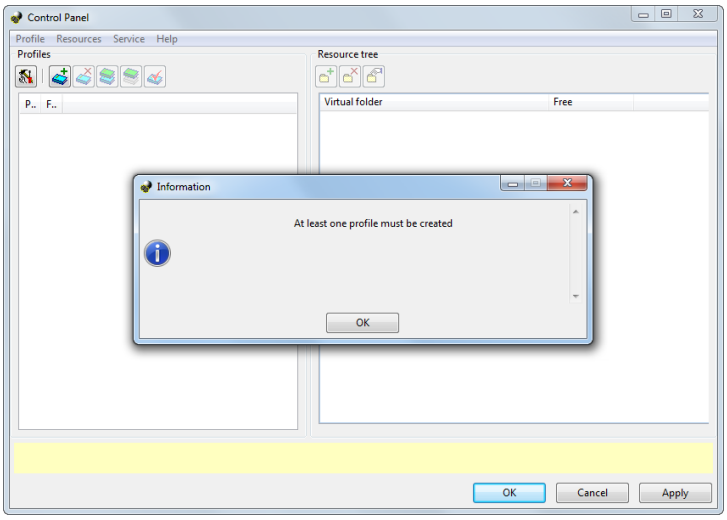


Fig. 5. Information message

The *Control Panel* module is used to configure detailed system settings during the further work.

4. Specify a *local profile* name in the **New profile** window and click OK.

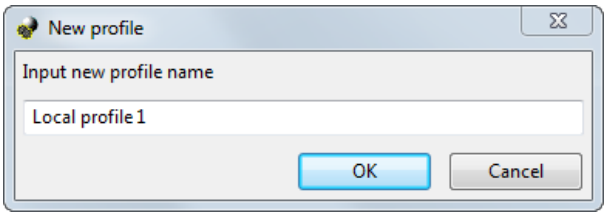


Fig. 6. Local profile name setup

5. The window allowing to **connect virtual folder** opens:

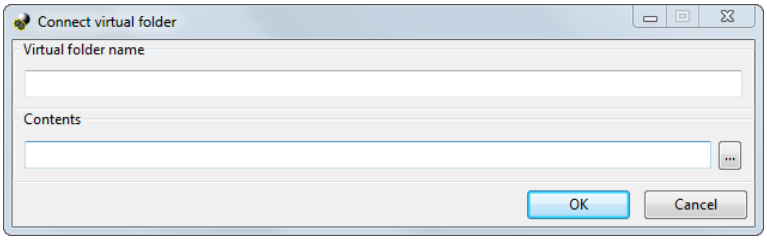


Fig. 7. The “Connect virtual folder” window

Input a **virtual folder name** – arbitrary text used to identify data in folder. In **Contents** field click the ... button to choose a physical space for connecting as a virtual folder. Click OK to close the **connect virtual folder** window.

It's impossible to use logical disk root folder.

To connect folder only read access for this folder is required.

Local profile folder could be placed both on a workstation, where the system runs, and on any workstation of the network.

6. Click OK in the **Control panel** window to finish system configuration. An info message that the system should be restarted appears. Click OK to restart *PHOTOMOD* program.

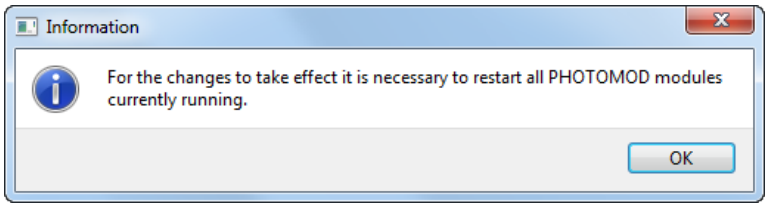


Fig. 8. Information message

5.2.4. System deinstallation

To remove the system from computer, close all modules of the system and choose **Start › Programs › PHOTOMOD 7 x64 › Uninstall PHOTOMOD** or use standard tools in **Control panel** of *Windows file system*.

5.3. Protection of the system

5.3.1. Local security hardlock key

The distribution kit includes the unique hard lock key from *Sentinel HL* (previous called *HASP*), to protect the system and data from software piracy and unauthorized dissemination. During the *PHOTOMOD* installation drivers of security key are installed automatically.

Also, during the *PHOTOMOD* installation the `PhConsts50.dll` file is copied to the system folder. This file is necessary to correct work of the system and it is a file of hard lock key from *Sentinel HL*.

If the *Sentinel HL* hard lock key, hard lock key drivers and/or file `PhConsts50.dll` are not found, the error message of protection system displays.

In case of problems with `PhConsts50.dll` file, copy it manually from the installation CD or contact the Racurs company technical support service (see *Section 1.8*), to obtain

this license file. After obtain the licence file copy it to the system folder (by default *C:\Program Files\ PHOTOMOD7 x64*).

In case of problems with installation of security key drivers, install it manually. To do this open the *Hasp\Sentinel_HASP_Run-time_setup* folder from the installation CD and launch the `HASPUserSetup.exe` file. Install security key drivers with default parameters. You can also download the last version of security key drivers on this link.

To check congruity of hard lock key and its file perform the following:

1. Choose **License info** in the right-click menu of the *System Monitor module* (the icon in the *Windows* system tray). Process of licences checking starts. After checking, the **PHOTOMOD Distribution info** windows opens.

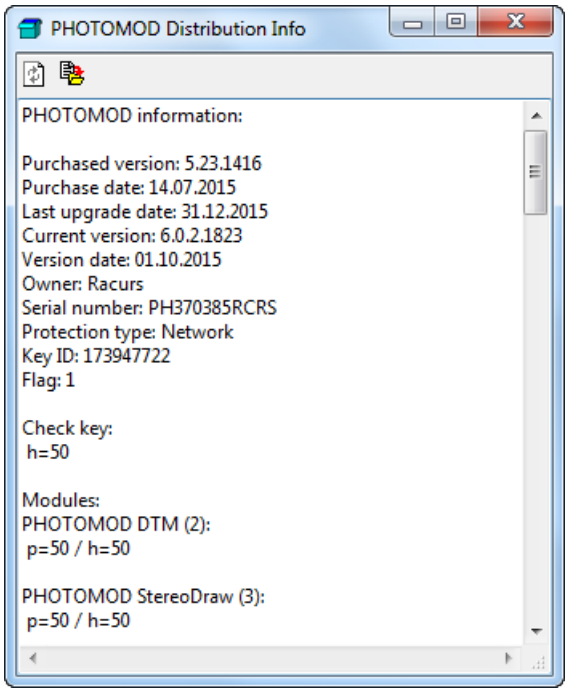


Fig. 9. Distribution Info

2. Compare the unique number of security key in the `Serial number` line with the number on hard lock key.

3. Compare quantity of license for modules in each line below the name of module. Quantity of licence in the hard lock key and in its file should be equal.

   'h' is quantity of licence in the hard lock key, *'p'* is quantity of licence in the `PhConsts50.dll` file.

4. If number are not equal contact the RACURS company technical support service.

To use network system version, security key drivers should be installed on every stand alone workstation. During the *PHOTOMOD* installation drivers of security key are installed automatically.

It is recommended to install the security key on computer which is not used to project processing, recording CD/DVD, etc.

If there is not enough RAM or resource-intensive tasks are performed on workstation with the secure key, The protection system failure or loss of data are possible.

5.3.2. Network security hardlock key

A network version of the *Sentinel HL* Hard Lock Key is intended to protect the system and data, and allows to use network (or floating) licences.

To use network system version, security key drivers should be installed on every stand alone workstation. During the *PHOTOMOD* installation drivers of security key are installed automatically.

The network *Sentinel HL* security key should be inserted into the USB-socket of the one of workstations. This workstation should be accessible to all network nodes.

When using multiple hard lock keys in a LAN, it is possible that start over of the system's modules on a separate computer could be slow. It is also possible that the hard lock key is inaccessible. In such a case it is recommended to change the hard lock key settings.

This situation can occur when several different versions of *PHOTOMOD* system are used in local network.

To set access to a proper hard lock key or to speed up start of the system modules, perform the following actions:

To set access to a hard lock key it is necessary to posses administrator's privileges.

Perform the following procedure on each *node* supposed to be used for processing.

1. Open a browser on a computer where the *PHOTOMOD* and hard lock key drivers are installed.

2. Input the following into browser address line `http://localhost:1947`. The **Sentinel Admin Control Center** window opens.

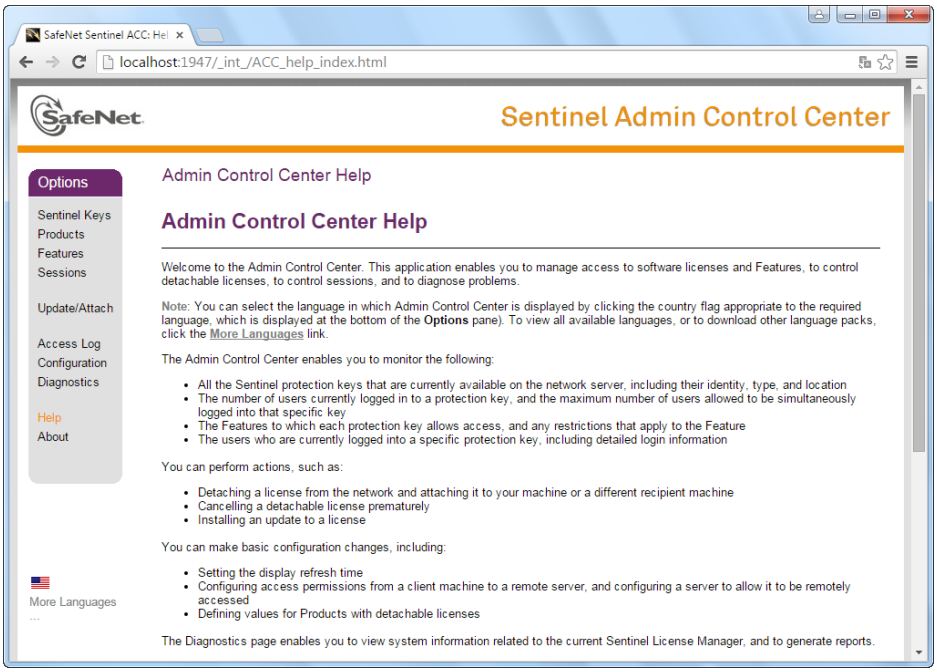


Fig. 10. Sentinel Admin Control Center

3. [optional] To obtain information about hard lock keys in local network, click **Sentinel Keys**. The table containing detailed information about hard lock keys opens.

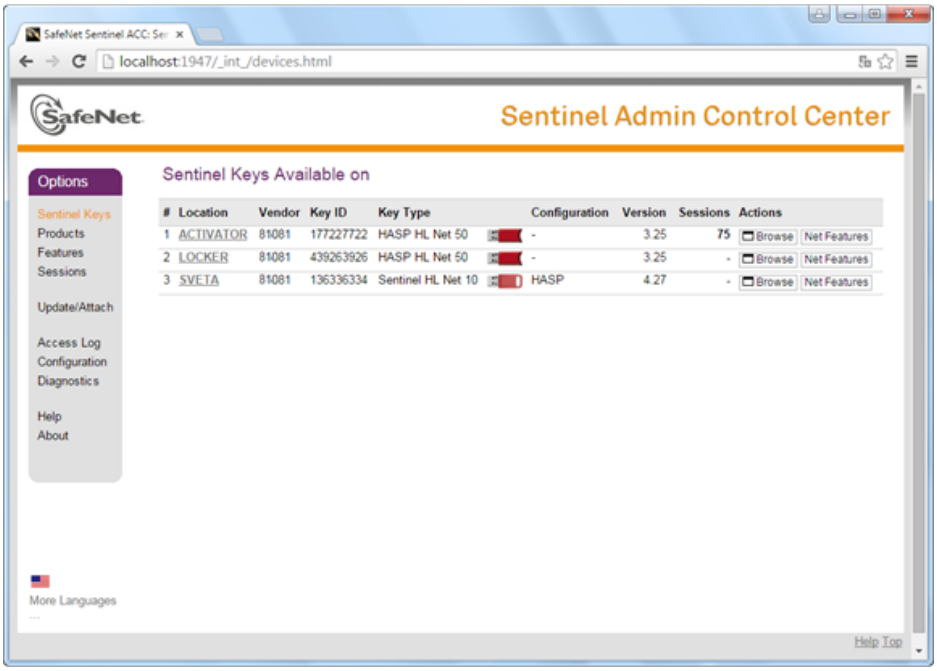


Fig. 11. Local Hard Lock Keys

4. Click **Configuration**. The **Basic Settings** tab of the **Configuration for Sentinel License Manager** window opens.

5. Select the **Access to Remote License Managers** tab.

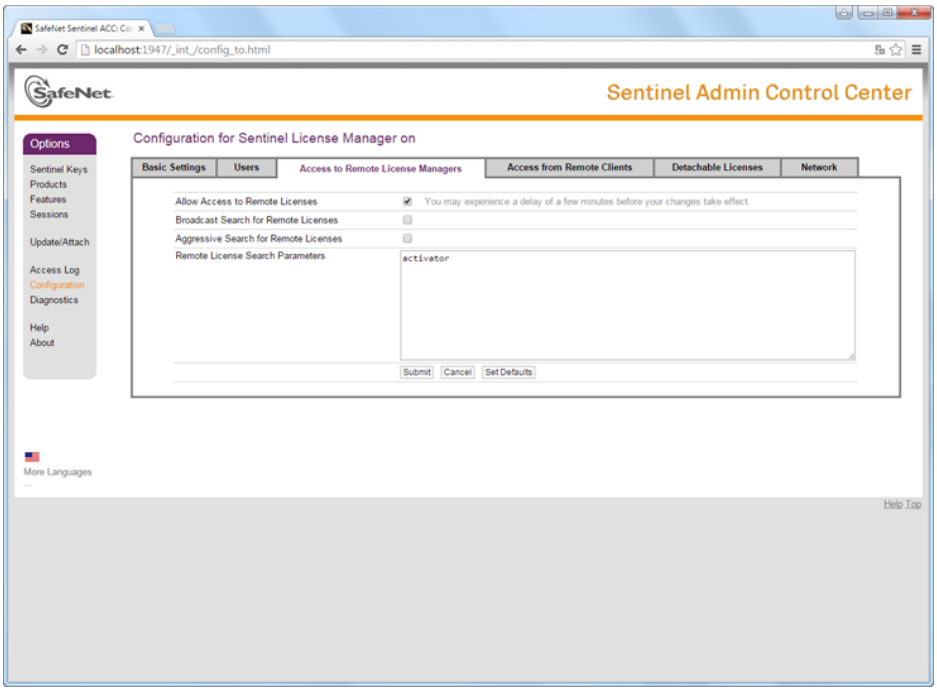


Fig. 12. Access configuration to remote license managers

6. Make sure that the **Allow Access to Remote Licenses** checkbox is set on.

7. Clear the **Broadcast Search for Remote Licenses** checkbox to turn off broadcast keys search.

8. Clear the **Aggressive Search for Remote Licenses** checkbox.

9. In the **Remote License Search Parameters** field input a computer network name (`activator` in the given example) where the proper hard lock key is inserted.

10. Click the **Submit** button.

Settings save operation could take a few minutes.

11. Click **Sentinel Keys**. The table containing the hard lock key on the selected computer is displayed.

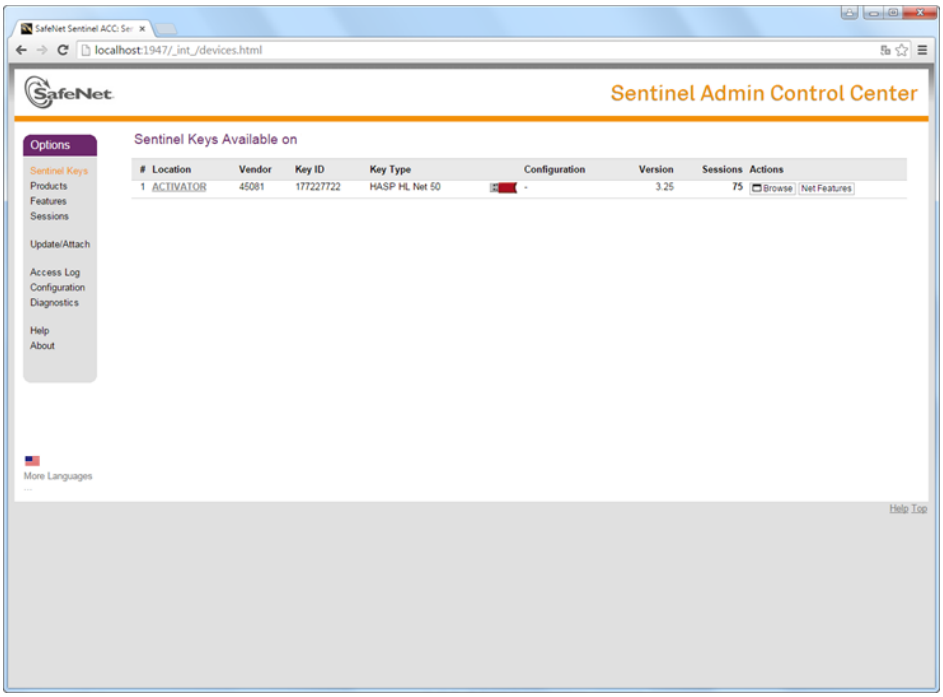


Fig. 13. Hard Lock Key on selected computer

6. Tools for work in stereo

6.1. Graphic cards

6.1.1. General information

It is important to configure videocard drivers correctly for effective project processing in stereomode.

It is recommended to use the following Nvidia video cards to work in stereomode:

- Nvidia Quadro 6000;
- Nvidia Quadro 5000;
- Nvidia Quadro 4000;
- Nvidia Quadro 2000;
- Nvidia Quadro 600;
- Nvidia Quadro K6000;
- Nvidia Quadro K5000;

- Nvidia Quadro K4000;
- Nvidia Quadro K2000;
- Nvidia Quadro K600.

To use videocard not from the list, additional setup and testing in stereomode are required.

Videocards Nvidia GeForce series do not support page-flipping stereo mode.

Depending on the monitor type there are some ways to setup drivers of videocard.

Detailed information about setup drivers of Planar, Omnia Technologias S.L., TRUE3Di and StereoPixel of the LcReflex-20 series stereomonitors, see in the Section 6.1.2.

Fig. 14. lcReflex 3D monitors

Information about setup drivers of stereomonitors supported nVidia 3D Vision Ready see in the Section 6.1.3

Fig. 15. Asus VG236H 3D-Ready LCD Monitor with nVidia 3D Vision Ready

The system also support the anaglyph stereo mode. This mode does not required special videoadapters and monitors and also configuration of videocard driver. To work in anaglyph stereo are used glass or plastic anaglyph glasses with red and blue filters.

Fig. 16. Anaglyph glasses

To show stereoimage on a IcReflex 3D monitor are used special polarized glasses. The glasses are wireless, and require recharging through USB port. The glasses are provided with USB IR-emitter.

Fig. 17. Polarized glasses

To use the monitor are required a special shutter glasses *GeForse 3D Vision* series. The glasses are wireless, and require recharging through USB port. The glasses are provided with USB IR-emitter.

Fig. 18. Shutter 3D Vision glasses

6.1.2. Videoadapter driver settings for reflex monitors

Perform the following to setup videoadapter driver for reflex monitors:

This example of setting up the Nvidia Quadro 600 videocard, v. 306.97. Windows could be slightly different to example, it depends on version and series of videocards.

1. Right click on a Windows desktop to open a context menu.

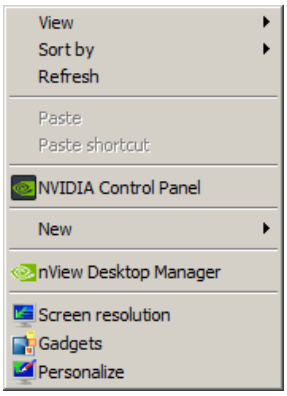


Fig. 19. Context menu

2. Choose **NVIDIA Control Panel**. The **NVIDIA Control Panel** window opens.

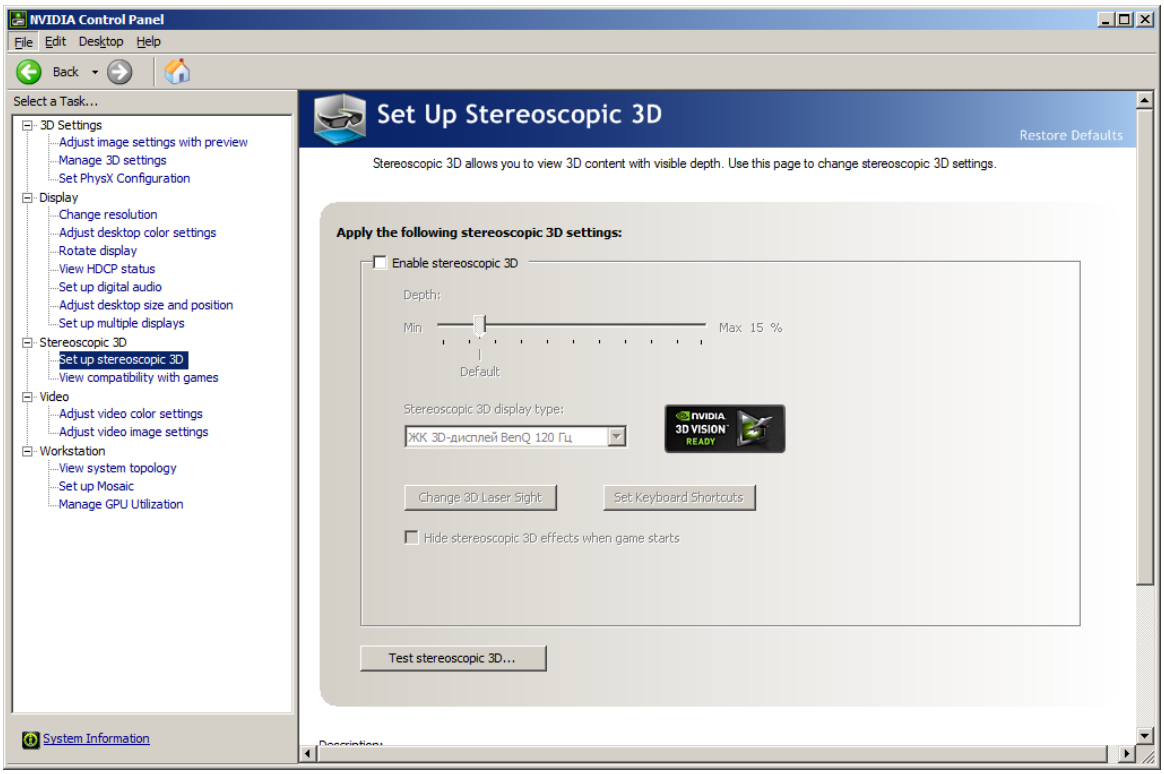


Fig. 20. Disable stereoscopic 3D

3. On the **Stereoscopic 3D › Set up stereoscopic 3D** tab in the **Apply the following stereoscopic 3D settings** set the **Enable stereoscopic 3D** checkbox off.

4. Move to **3D Settings › Manage 3D settings**. The **Manage 3D settings** on the **Global settings** tab opens.

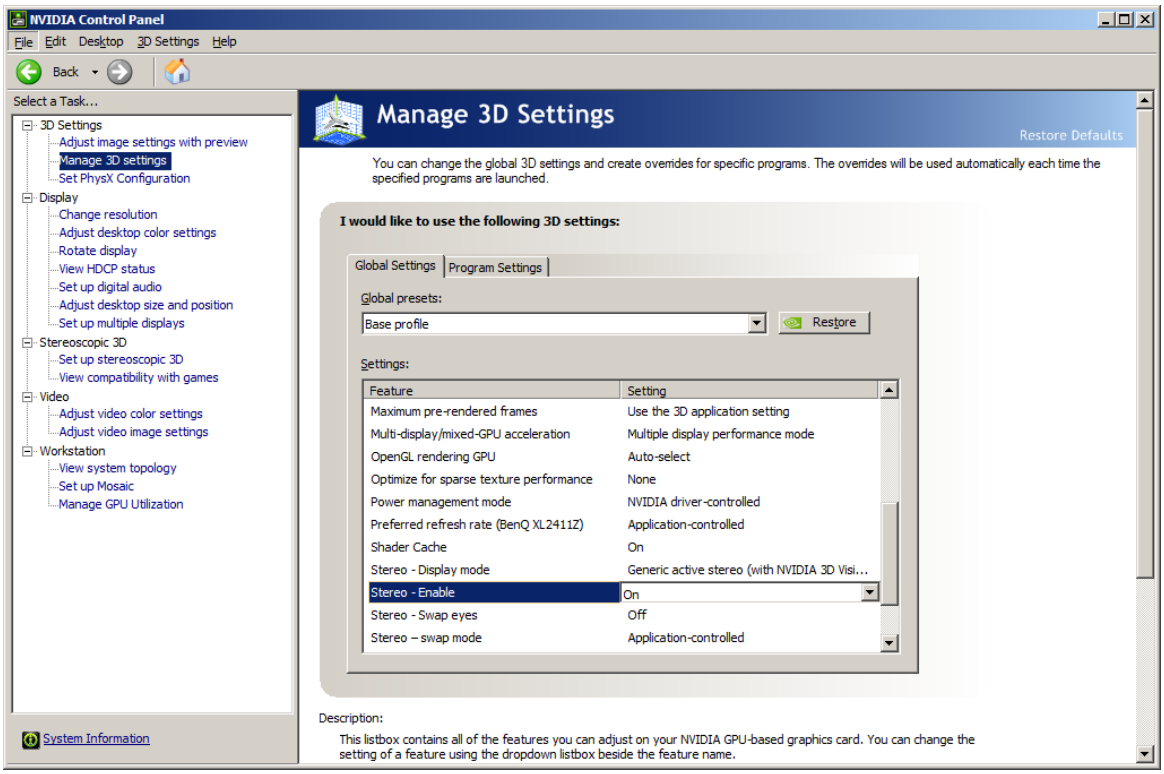


Fig. 21. Configuration of stereo mode

5. Set **On** to the **Stereo – Enable** line and set **nView clone mode** to the **Stereo – display mode** line.

6. Choose **Display › Set up multiple displays**.

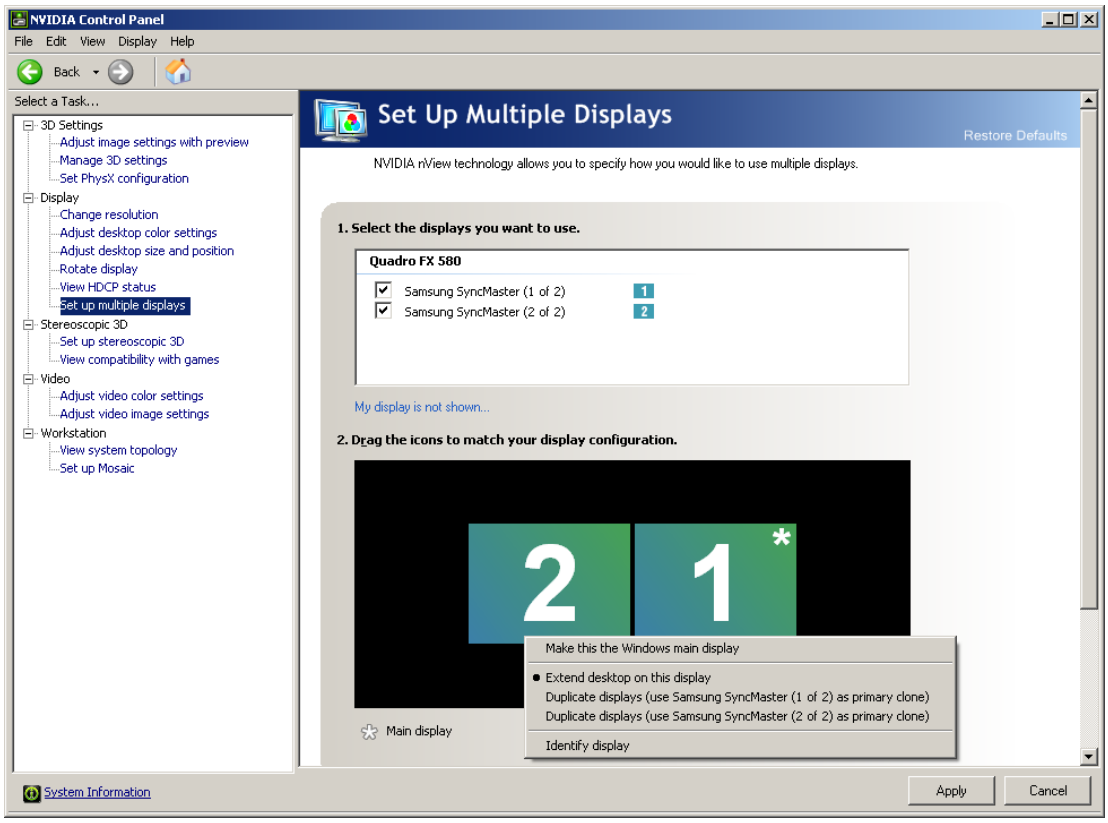


Fig. 22. Setting multiple displays – step 1

7. In the **2. Verify your display configuration** section right click on a block with ’1’ to open a context menu.

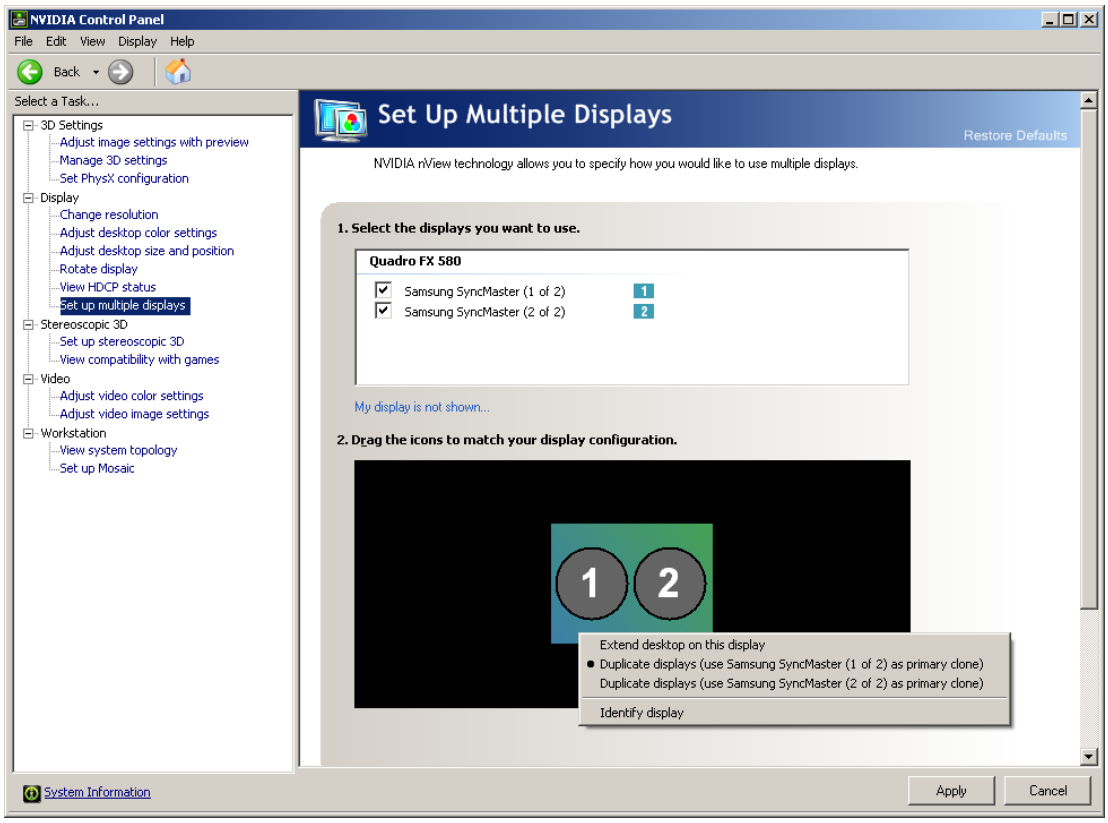


Fig. 23. Display context menu

8. Choose **Clone › 2** in the right-click menu. As a result both monitors are equal.

9. Click the **Apply** button to save changes.

6.1.3. Videoadapter driver settings

Perform the following to setup videoadapter driver:

This example of setting up the Nvidia Quadro 2000 videocard, v. 331.82. Windows could be slightly different to example, it depends on version and series of videocards.

1. Right click on a *Windows desktop* to open a context menu.

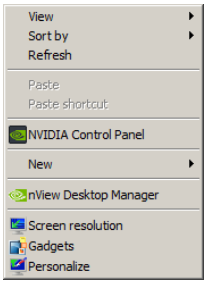


Fig. 24. Context menu

2. Choose **NVIDIA Control Panel**. The **NVIDIA Control Panel** window opens.

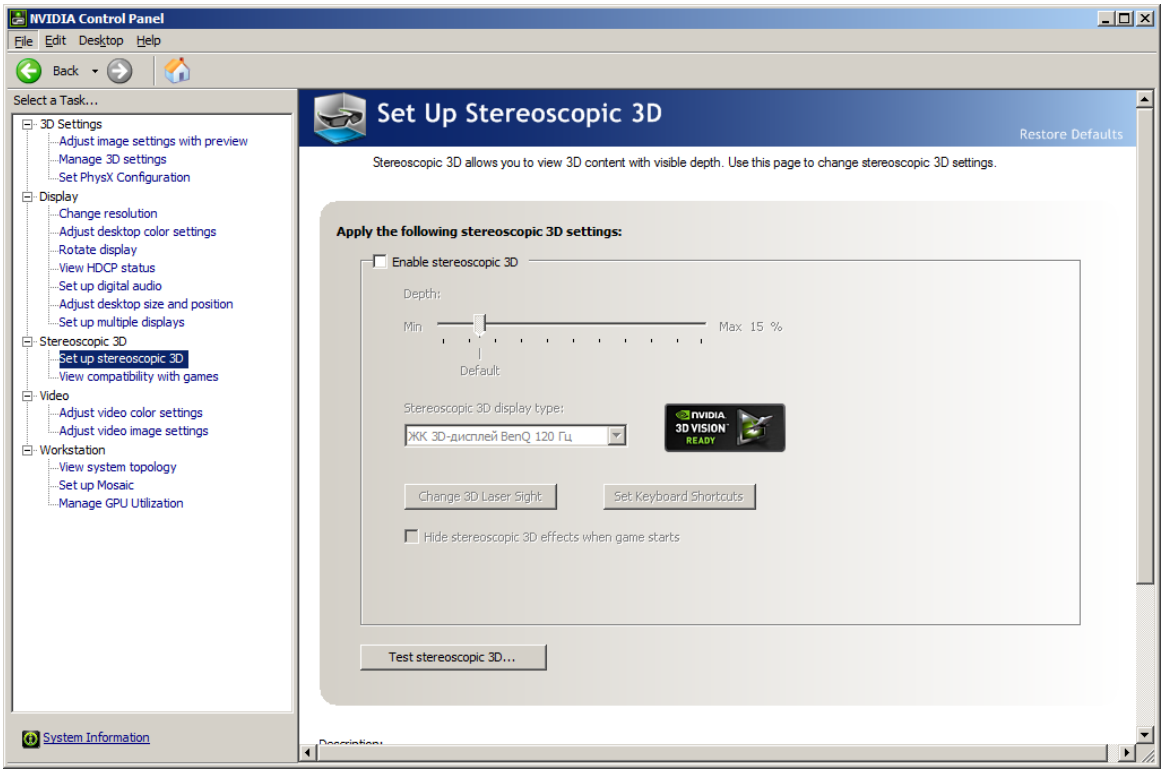


Fig. 25. Disable stereoscopic 3D

3. On the **Stereoscopic 3D › Set up stereoscopic 3D** tab in the **Apply the following stereoscopic 3D settings** set the **Enable stereoscopic 3D** checkbox off.

4. Click the **Apply** button to save changes.

5. Move to **3D Settings › Manage 3D settings**. Move to the **Global Settings** tab.

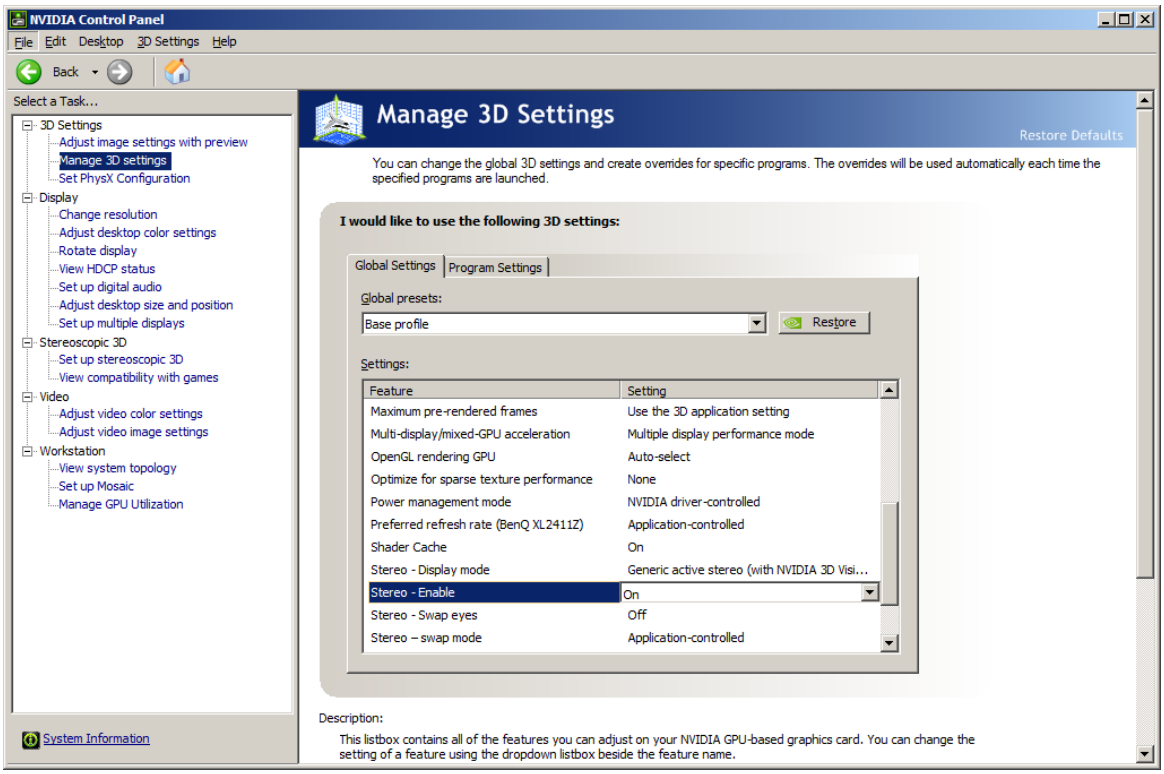


Fig. 26. Configuration of stereo mode

6. Set **On** to the **Stereo – Enable** mode.

7. Choose **Generic active stereo (with NVIDIA 3D Vision)** to the **Stereo – Display mode** feature.

8. Choose **Display › Change resolution**.

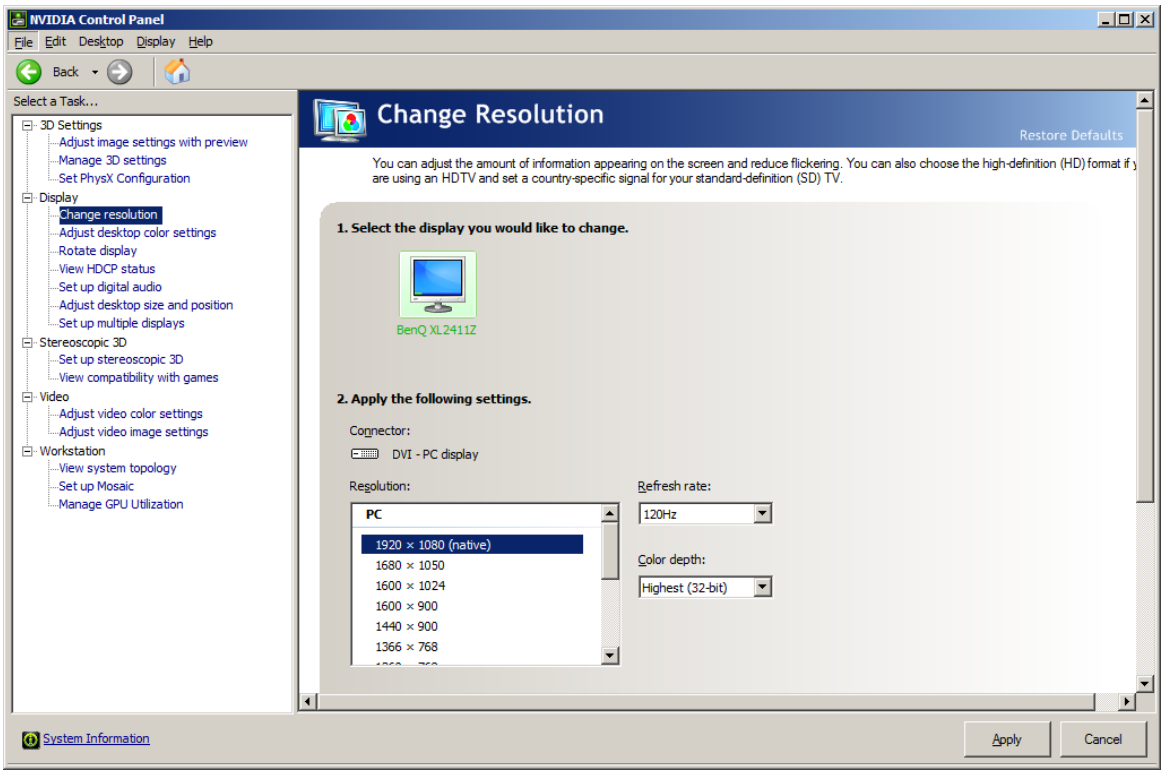


Fig. 27. Configuration of refresh rate

9. In the **2. Apply the following settings** section choose **120 Hz** in the **Refresh rate** list.

It is recommended to set the refresh rate not more than 120 Hz.

10. Click the **Apply** button to save changes.

6.2. Using of special mice, hand wheels and foot pedals in the system

6.2.1. Setup of mouse driver

To optimize the vectorization process it is possible to both use hotkeys, buttons on toolbars, menu items and also to program mouse buttons for different actions.

The system supports mice with 3 and 5 keys and also 3D-mice, hand wheels and foot pedals. The system provides possibility to customize any type of mice that supports emulation of standard five-button mouse.

To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens.

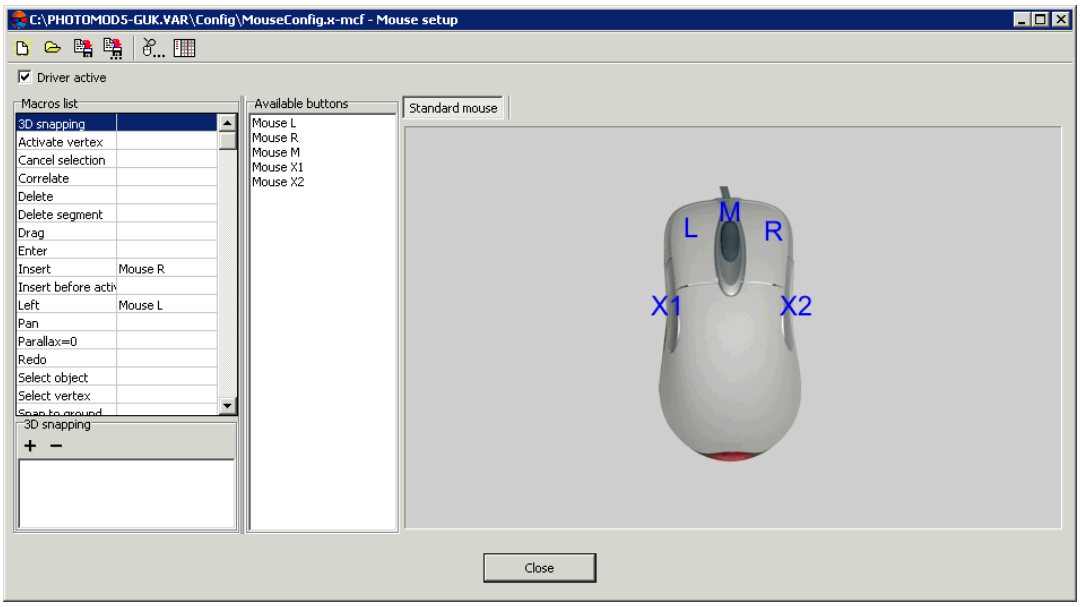


Fig. 28. Mouse setup window

The **Mouse setup** window is used to setup standard or special mice, hand wheels and foot pedals, connected to a computer.

By default driver with standard mouse settings is loaded. It could be used to create customer settings.

All actions with mouse in this User Manual are described for a standard mouse.

In the head of the window is shown path to configuration file of mouse. By default it is *PHOTOMOD7.VAR\Config\MouseConfig.x-mcf*.

In the **Macro list** is displayed a list of commands that could be added to selected mouse button or action of wheels/pedals. The list of buttons of selected mouse is displayed in the **Available buttons**.

In the right part of window are displayed tabs to choose devices for adjust. By default only **Standard mouse** is displayed.

If standard mouse and special devices are connected to a computer at the same time, all tabs of these devices are displayed in the **Mouse setup** window.

The toolbar of the **Mouse setup** window contains buttons used to perform the following operations:

- – allows to create new configuration of settings for selected mouse;
- – allows to load existed mouse driver from a file;

- – allows to save changes in mouse configuration and re-write current driver;
- – allows to save new mouse configuration or changes in current configuration in a new file;
- – allows to open the **Macro editor** window;
- – allows to open the **Mouse configuration** window to choose and adjust special mice or devices.

The **Mouse configuration** window also could be open from right-click menu of the *System Monitor module* (the icon in the *Windows* system tray).

To add current bind for a mouse button perform the following:

1. Choose an action for a button in the **Macros list**.

   Changes in the **Mouse configuration** window work on all operation system, while the *System Monitor module* is launched.

2. [optional] To create macros for action not from the list and add it to a mouse button, click the button (description of macros creation see in the Section 6.2.3).
3. Choose button to add an action in the **Available buttons** section.
4. Click the + button at the bottom of the window to add selected action to a list of actions for clicking of chosen mouse button. To delete action from this list, click the − button.

   To bind another action for selected button, repeat steps 1-3.

5. Repeat steps 1-3 to add actions for other mouse buttons.
6. [optional] To save macros configuration click the button.
7. Close the **Mouse setup** window.

6.2.2. Mouse configuration

The system allows to use special mice, hand wheels and foot pedals for stereovectorization.

The **Mouse configuration** window is used to choose mouse and setup its parameters. To open the **Mouse configuration** window, click the button in the **Mouse setup** window.

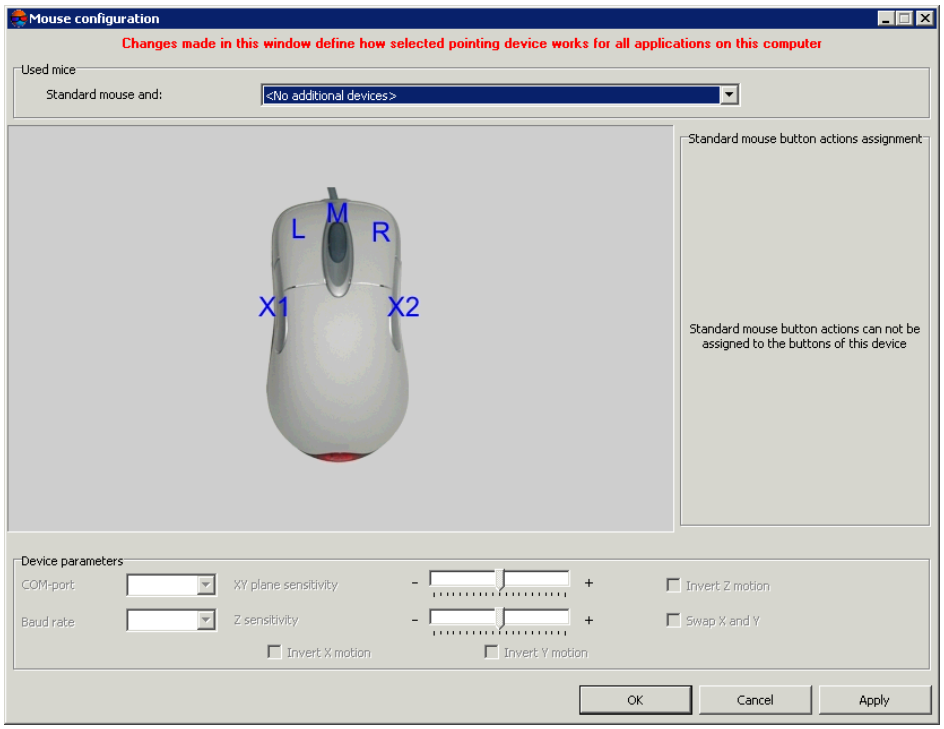


Fig. 29. The 'Mouse configuration' window

The list of available devices is displayed in the **Used mice** section:

- **No additional devices** – is used standard tree- or five-button mouse only;
- **Immersion SoftMouse** – specialised mouse from Immersion company that is used for stereovectorization;
- **Immersion compatible hand wheels/foot pedals** – additional devices to use with *Immersion SoftMouse*, distributed from 'Geosystem' company;
- **GeoMouse (EOMZ)** – photogrammetric 3D-mouse that is used to move and precise marker positioning by XYZ axis and to use buttons as hotkeys for most use functions.
- **Hand wheels/foot pedals 'Vector-A' (EOMZ)** – hand wheels and foot pedals, developed by EOMZ, that could be used to 3D processing data in the system.
- Stealth 3D Mouse devices – **Stealth 3D Mouse S1-U**, **Stealth 3D Mouse S2-U**, **Stealth 3D Mouse S1-Z** or **Stealth 3D Mouse S2-Z**;
- **Atlas 3D mouse** – specialised mouse from Uzman Engineering Co., Ltd company that is used for stereovectorization.

Type of chosen device, scheme and names of buttons are also displayed in the window.

For specialized mice or wheels in the **Device parameters** section could be adjusted the following parameters:

Set of parameters to adjust depends on chosen device.

- **COM-port** – allows to choose a port number used to connect device;
- **Baud rate** – allows to change rate of used COM-port (in kb/s);

It is recommended to use the default value.

- **XY plane sensitivity** – allows to change sensitivity of marker when moving special mouse or wheel rotation by X and Y axis;
- **Z plane sensitivity** – allows to change sensitivity of marker when moving special mouse or wheel rotation by Z-axis;
- **Invert Z motion** – allows to invert moving marker by Z-axis when using mouse or wheel rotation;
- **Swap X and Y** – allows to invert moving marker by XY-axis when using mouse or wheel rotation;
- **Invert X motion** – allows to invert moving marker by X-axis only, when using mouse or wheel rotation;
- **Invert Y motion** – allows to invert moving marker by Y-axis only, when using mouse or wheel rotation.

In the **Standard mouse button actions assignment** section is displayed table of buttons of chosen device and action for clicking this button.

Changes in the **Mouse configuration** window work on all operation system, while the *System Monitor module* is launched.

To detach action for buttons of standard mouse, double-click on row with button's action. Double-click allows to attach clicking of left mouse button, L is displayed in the row. Two double-clicks – right mouse button (R), three – middle mouse button (M).

To use device choose it in the list and click the **Apply** button to save changes.

The **Mouse setup** window is used to setup other buttons of special mice or wheels/pedals.

Immersion SoftMouse

Immersion SoftMouse – specialised mouse from Immersion company that is used for stereovectorization. Distribution kit includes power adapter and an interface device for connecting a mouse to the COM-port.

Connect **Immersion SoftMouse** to a computer when it is switched off!

Immersion SoftMouse has 10 custom buttons, any three of them could be used as buttons of standard mouse (see below).

Immersion SoftMouse and standard mouse could be used at the same time.

To choose **Immersion SoftMouse** and setup its parameters perform the following:

1. After installation of **Immersion SoftMouse** to your PC, turn PC on and run *PHOTOMOD* program;
2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;
3. In the **Mouse setup** window click the  button. The **Mouse configuration** window opens;
4. In the **Used mice** section select the **Immersion SoftMouse** device from the drop-down list;

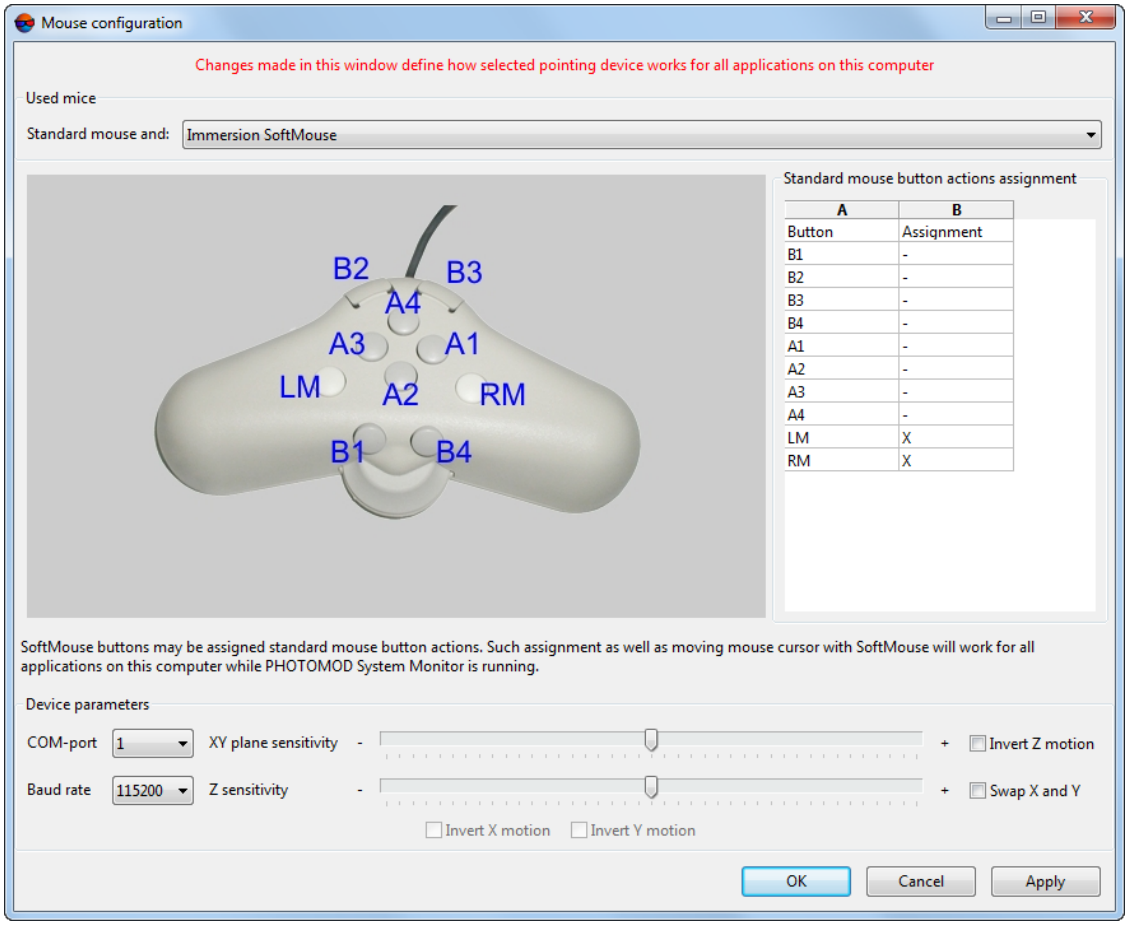


Fig. 30. Immersion SoftMouse chosen in the 'Configuration mouse' window

5. Set the **Device parameters** (see Section 6.2.2 above);

6. [optional] Perform the **Standard mouse button actions assignment** (see Section 6.2.2 above);

7. Click the **Apply** button to save changes;

8. Click OK to return to the **Mouse setup** window, to setup other buttons of special mice or wheels/pedals;

The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one (**Immersion SoftMouse**) – other buttons of special mice or wheels/pedals.

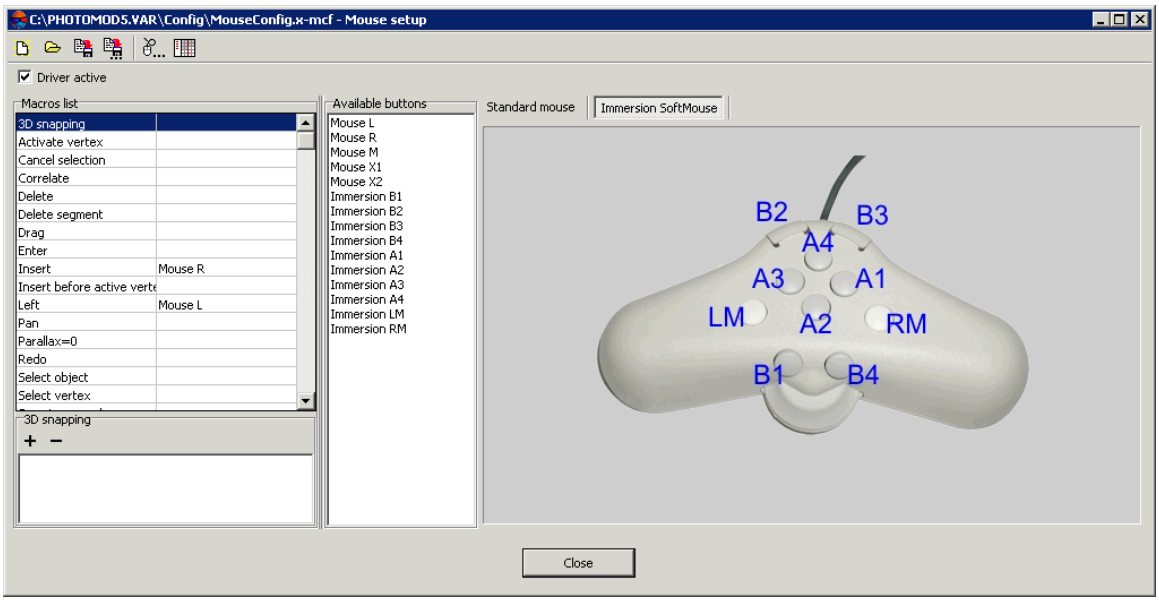


Fig. 31. Configuration of Immersion SoftMouse

9. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

Immersion compatible hand wheels/foot pedals

Immersion compatible hand wheels/foot pedals – additional devices to use with *Immersion SoftMouse*, distributed from 'Geosystem' company. Distribution kit includes right and left hand wheels, (to move marker by ne), foot wheel (to move marker by Z) and three foot pedals (for mouse button customized functions). Devices connect to computer with *Immersion Interface box* (see hardware installation details in equipment User Manual).

Connect **Immersion compatible hand wheels/foot pedals** to a computer when it is switched off!

To choose **Immersion compatible hand wheels/foot pedals** and setup its parameters perform the following:

1. After installation of **Immersion compatible hand wheels/foot pedals** to your PC, turn PC on and run *PHOTOMOD* program;

2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;

3. In the **Mouse setup** window click the button. The **Mouse configuration** window opens;

4. In the **Used mice** section select the **Immersion compatible hand wheels/foot pedals** device from the drop-down list;

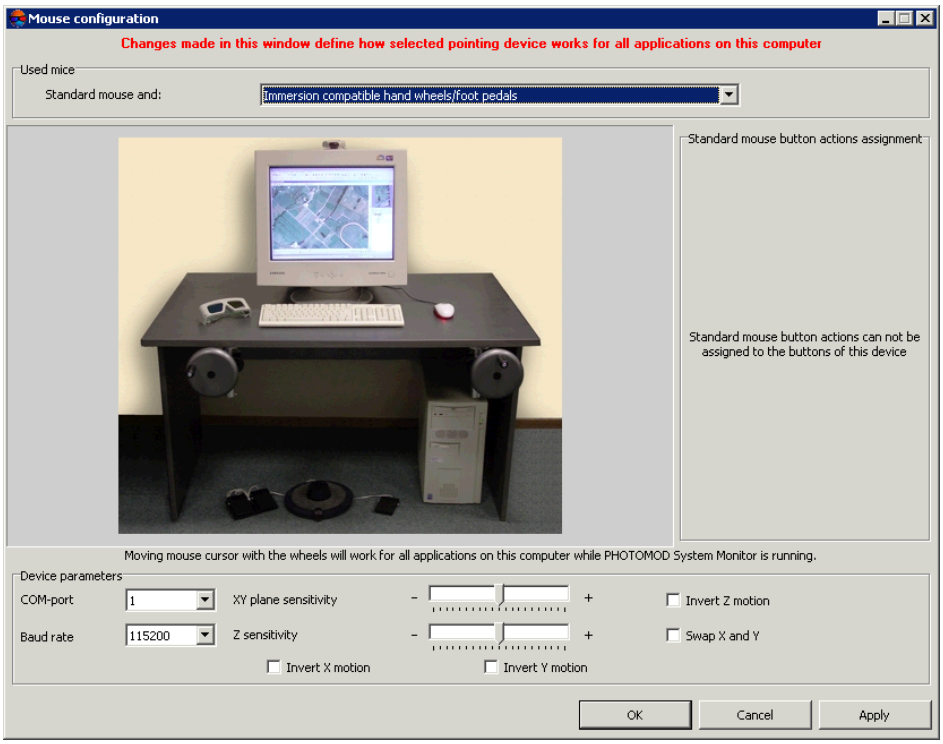


Fig. 32. Immersion compatible hand wheels/foot pedals chosen in the 'Configuration mouse' window

5. Set the **Device parameters** (see Section 6.2.2 above);

6. Click the **Apply** button to save changes;

7. Click OK to return to the **Mouse setup** window;

The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one (**Immersion compatible hand wheels/foot pedals**) – marker's actions after pressing each of three pedals.

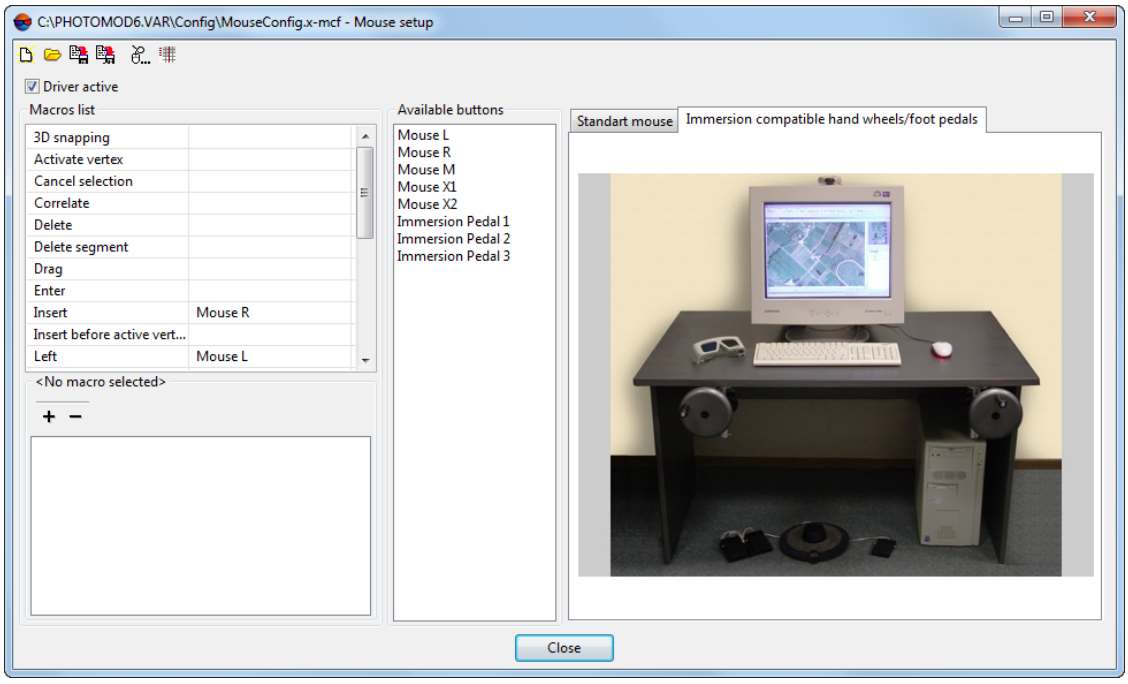


Fig. 33. Configuration of Immersion compatible hand wheels/foot pedals

8. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

GeoMouse (EOMZ)

GeoMouse (EOMZ) – photogrammetric 3D-mouse that is used to move and precise marker positioning by XYZ axis and to use buttons as hotkeys for most use functions.

Connect **GeoMouse (EOMZ)** to a computer when it is switched off! Connect mouse USB port to PS/2 port using adapter. At the same time connect RS 232 connector to COM port.

GeoMouse (EOMZ) has 16 custom buttons, any three of them could be used as buttons of standard mouse (see below).

GeoMouse (EOMZ) and standard mouse could be used at the same time.

To choose **GeoMouse (EOMZ)** and setup its parameters perform the following:

1. After installation of **GeoMouse (EOMZ)** to your PC, turn PC on and run *PHOTOMOD* program;

2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;

3. In the **Mouse setup** window click the button. The **Mouse configuration** window opens;

4. In the **Used mice** section select the **GeoMouse (EOMZ)** device from the drop-down list;

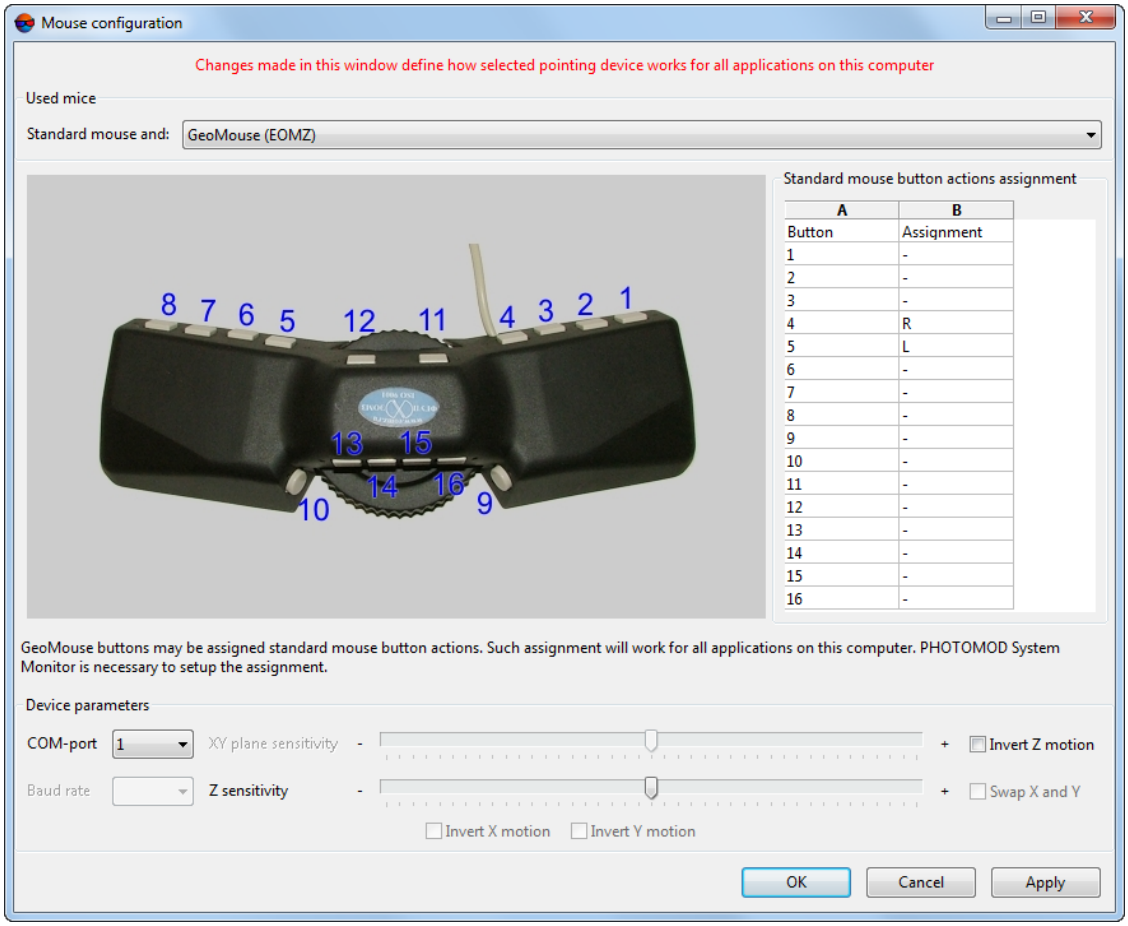


Fig. 34. GeoMouse (EOMZ) chosen in the 'Configuration mouse' window

5. Set the **Device parameters** (see Section 6.2.2 above);

6. [optional] Perform the **Standard mouse button actions assignment** (see Section 6.2.2 above);

7. Click the **Apply** button to save changes;

8. Click OK to return to the **Mouse setup** window, to setup other buttons of special mice or wheels/pedals;

The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one (**GeoMouse (EOMZ)**) – other buttons of special mice or wheels/pedals.

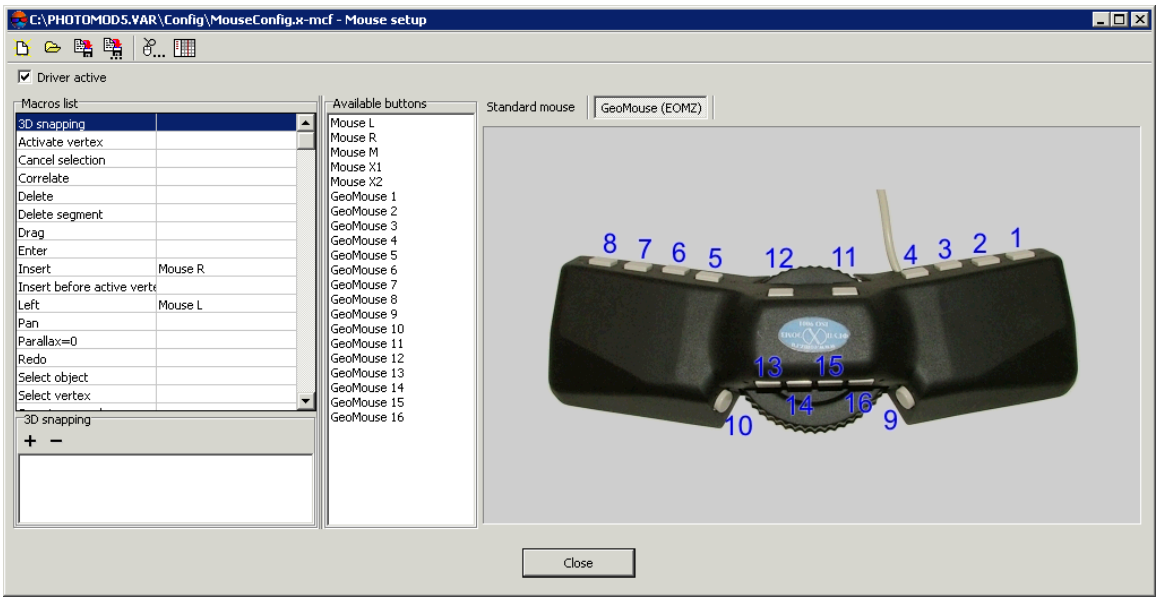


Fig. 35. Configuration of GeoMouse

9. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

Hand wheels/foot pedals ’Vector-A’ (EOMZ)

Hand wheels/foot pedals ’Vector-A’ (EOMZ) – hand wheels and foot pedals, developed by EOMZ, that could be used to 3D processing data in the system. Distribution kit includes right and left hand wheels, (to move marker by plane), foot wheel (to move marker by Z) and three foot pedals (for mouse button customized functions).

Connect **Hand wheels/foot pedals ’Vector-A’ (EOMZ)** to a computer when it is switched off!

To choose **Hand wheels/foot pedals ’Vector-A’ (EOMZ)** and setup its parameters perform the following:

1. After installation of **Hand wheels/foot pedals ’Vector-A’ (EOMZ)** to your PC, turn PC on and run *PHOTOMOD* program;

2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;

3. In the **Mouse setup** window click the button. The **Mouse configuration** window opens;

4. In the **Used mice** section select the **Hand wheels/foot pedals ’Vector-A’ (EOMZ)** device from the drop-down list;

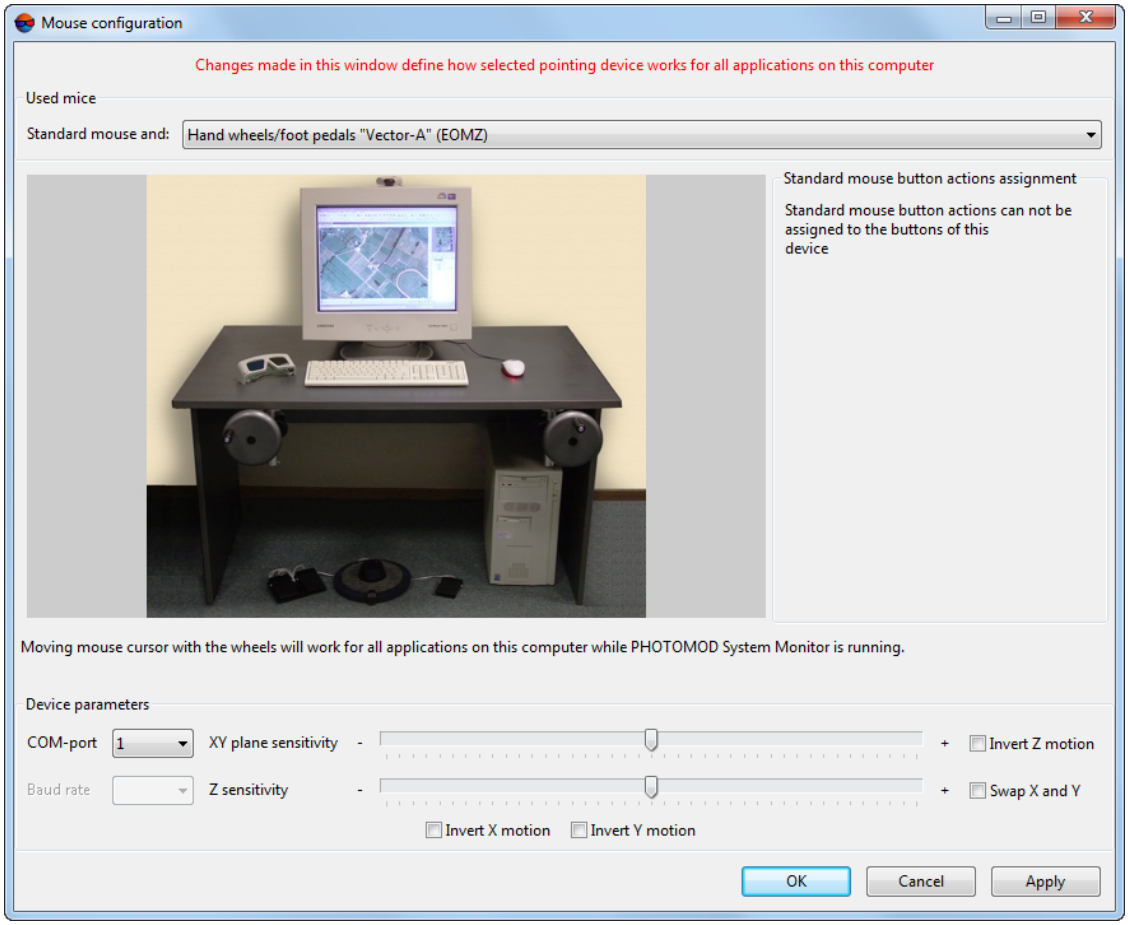


Fig. 36. Vector-A hand wheels/foot pedals chosen in the 'Configuration mouse' window

5. Set the **Device parameters** (see Section 6.2.2 above);

6. Click the **Apply** button to save changes;

7. Click OK to return to the **Mouse setup** window;

The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one (**Hand wheels/foot pedals 'Vector-A' (EOMZ)**) – marker's actions after pressing each of three pedals.

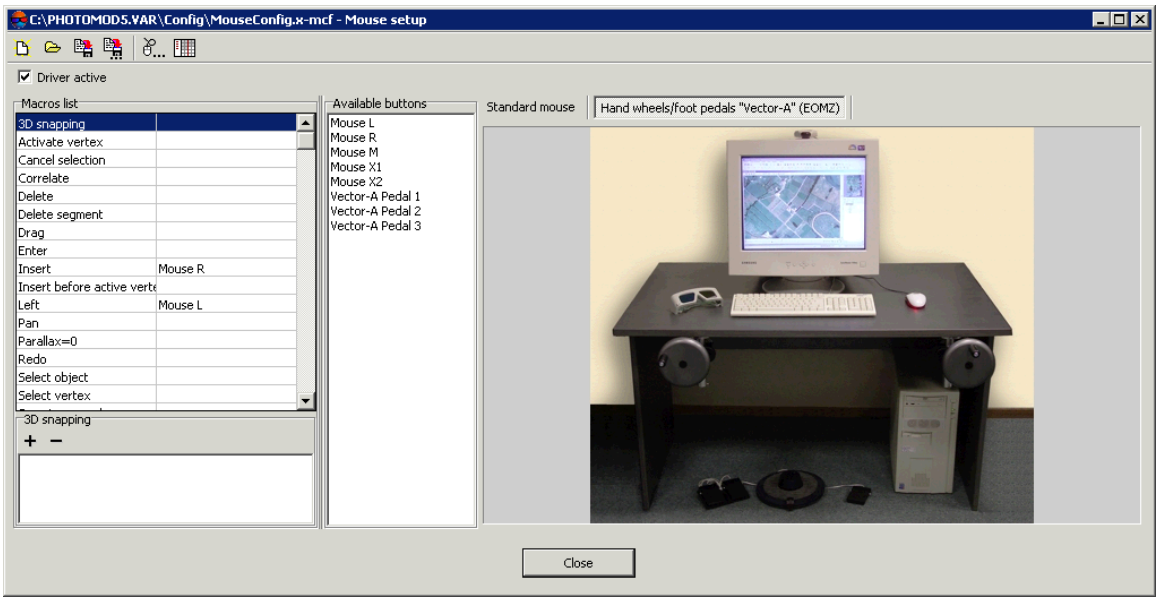


Fig. 37. Configuration of Vector-A hand wheels/foot pedals

8. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

Stealth 3D Mouse devices

The system supports the 3D mice of the Stealth 3D Mouse-U and the Stealth 3D Mouse-Z series of the *ABS software developers;*

Connect Stealth 3D Mouse devices to a computer when it is switched off! After connecting of Stealth 3D Mouse-Z series to PC through USB port, start mouse driver, using standard OS *Windows* operations.

Customizing buttons are not supported for the **Stealth 3D Mouse S1-U** and **Stealth 3D Mouse S2-U** devices.

To choose Stealth 3D Mouse devices and setup its parameters perform the following:

1. After installation of Stealth 3D Mouse devices to your PC, turn PC on and run *PHOTOMOD* program;

   After connecting of Stealth 3D Mouse-Z series to PC through USB port, start mouse driver, using standard OS *Windows* operations.

2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;

3. In the **Mouse setup** window click the button. The **Mouse configuration** window opens;

4. [optional]]In the **Used mice** section select the **Stealth 3D Mouse S1-U**, **Stealth 3D Mouse S2-U**, **Stealth 3D Mouse S1-Z** or **Stealth 3D Mouse S2-Z** device from the drop-down list;

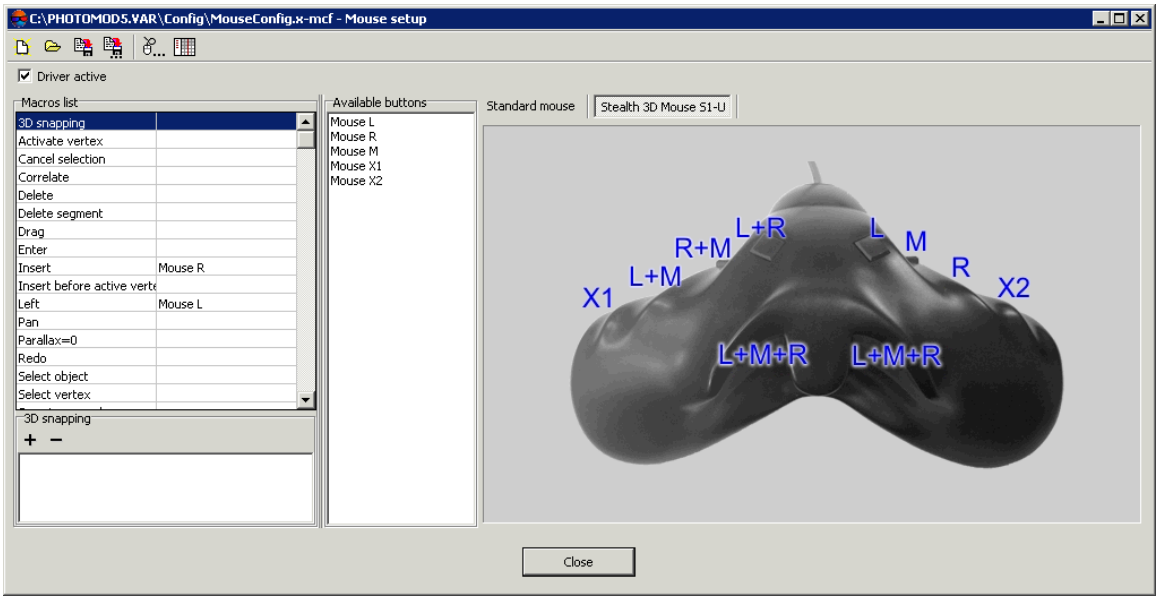


Fig. 38. Configuration of mouse buttons *Stealth 3D Mouse S1-U*

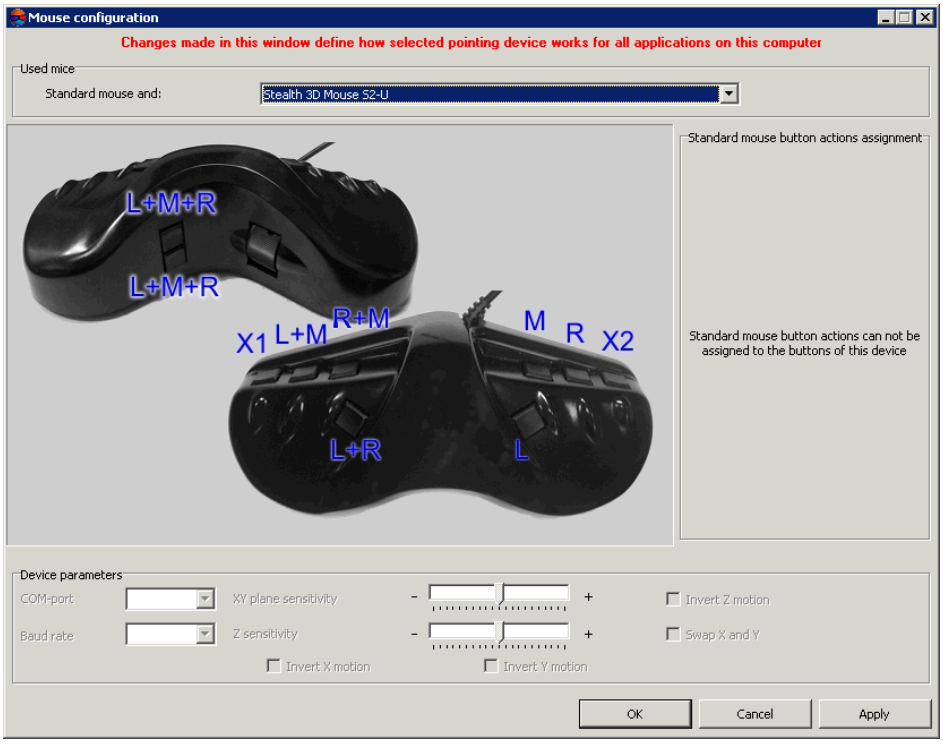


Fig. 39. Stealth 3D Mouse S1-U settings in the 'Configuration mouse' window

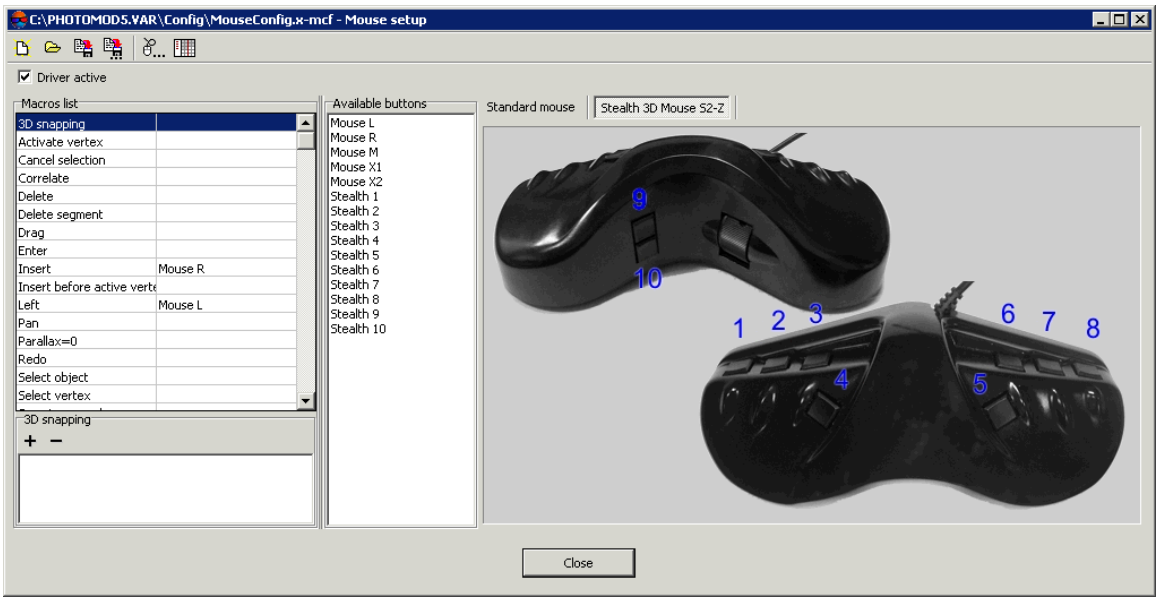


Fig. 40. Stealth 3D Mouse S2-Z settings in the ’Configuration mouse’ window

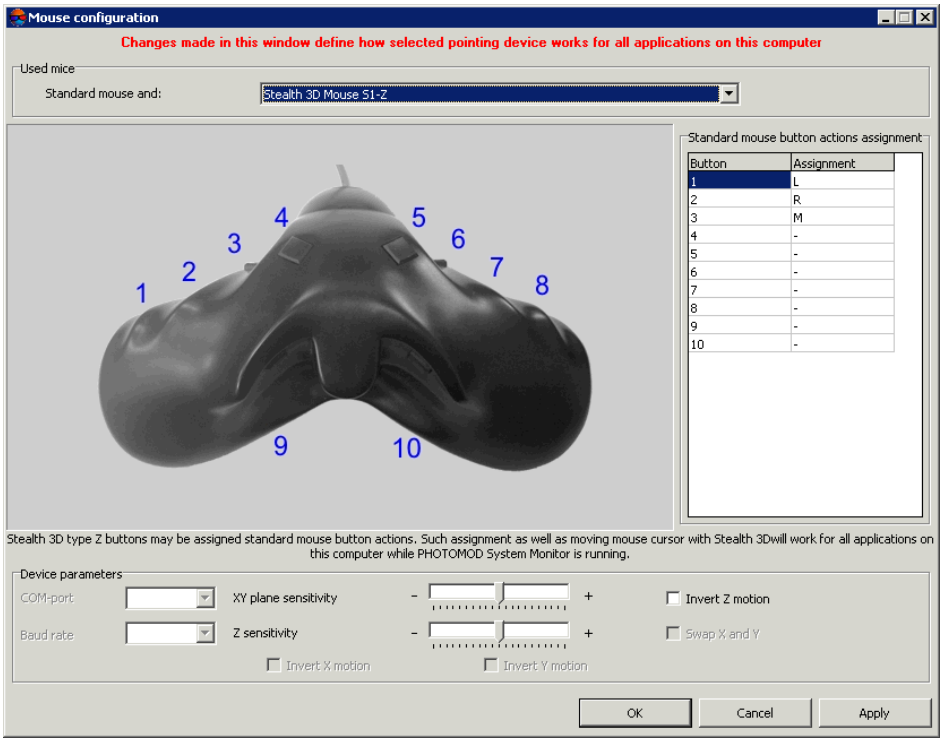


Fig. 41. Stealth 3D Mouse S1-Z settings in the ’Configuration mouse’ window

5. [optional] Set the **Device parameters** (for the **Stealth 3D Mouse S1-Z** or **Stealth 3D Mouse S2-Z** device, see Section 6.2.2 above);

6. [optional] Perform the **Standard mouse button actions assignment** (for the **Stealth 3D Mouse S1-Z** or **Stealth 3D Mouse S2-Z** device, see Section 6.2.2 above);

7. Click the **Apply** button to save changes;

8. Click OK to return to the **Mouse setup** window, to setup other buttons of special mice or wheels/pedals;

   The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one – other buttons of the **Stealth 3D Mouse S1-Z** or **Stealth 3D Mouse S2-Z** device.

9. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

Atlas 3D mouse

Atlas 3D mouse – specialised mouse from Uzman Engineering Co., Ltd company that is used for stereovectorization. Distribution kit includes power adapter and an interface device for connecting a mouse to the COM-port.

Connect **Atlas 3D mouse** to a computer when it is switched off!

Atlas 3D mouse has 10 custom buttons, any three of them could be used as buttons of standard mouse (see below).

Atlas 3D mouse and standard mouse could be used at the same time.

To choose **Atlas 3D mouse** and setup its parameters perform the following:

1. After installation of **Atlas 3D mouse** to your PC, turn PC on and run *PHOTOMOD* program;

2. To setup mouse choose **Service › Mouse setup**. The **Mouse setup** window opens;

3. In the **Mouse setup** window click the button. The **Mouse configuration** window opens;

4. In the **Used mice** section select the **Atlas 3D mouse** device from the drop-down list;

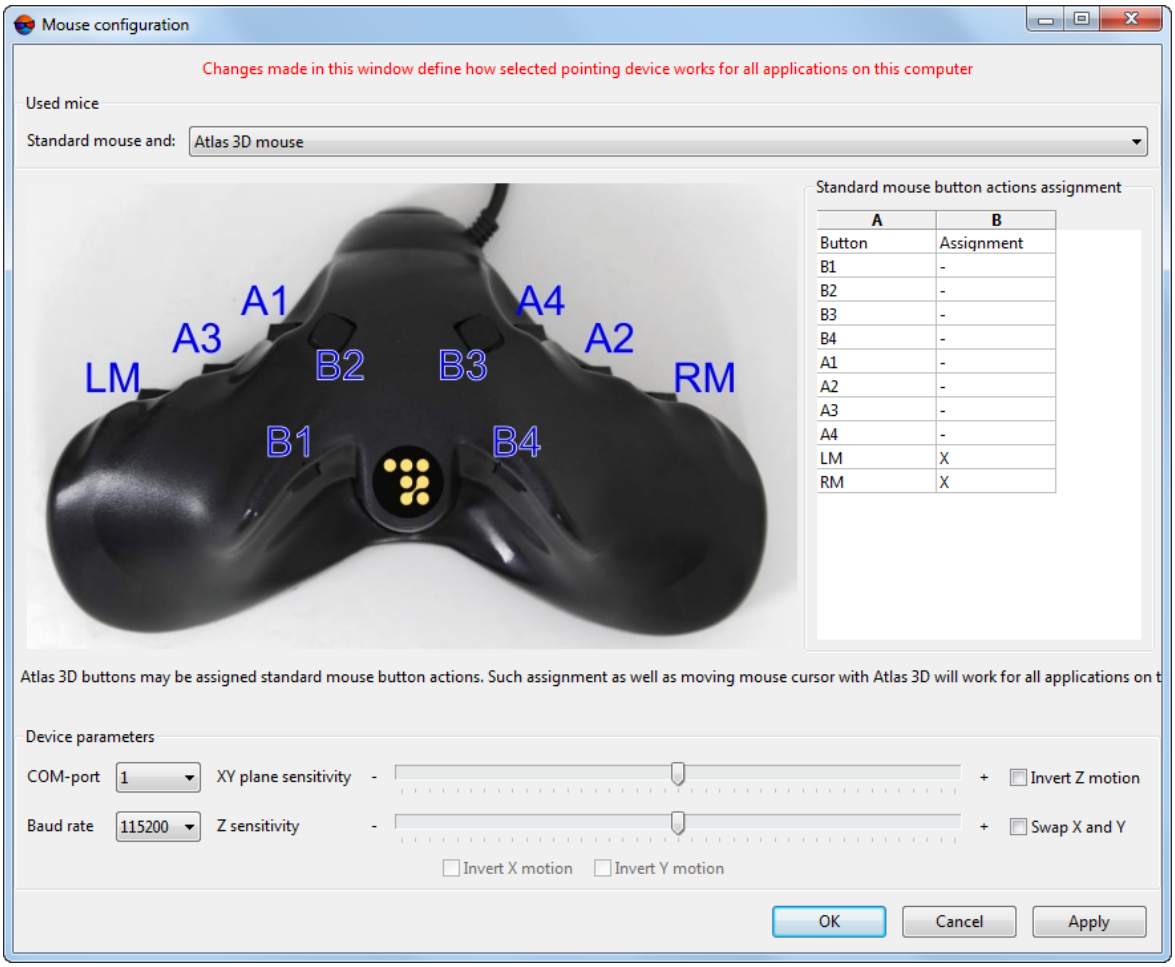


Fig. 42. Atlas 3D mouse chosen in the 'Configuration mouse' window

5. Set the **Device parameters** (see Section 6.2.2 above);

6. [optional] Perform the **Standard mouse button actions assignment** (see Section 6.2.2 above);

7. Click the **Apply** button to save changes;

8. Click OK to return to the **Mouse setup** window, to setup other buttons of special mice or wheels/pedals;

The rightmost part of **Mouse setup** window now consists of two tabs, one of which (**Standart Mouse**) allows to setup standard mouse buttons, and the second one (**Atlas 3D mouse**) – other buttons of special mice or wheels/pedals.

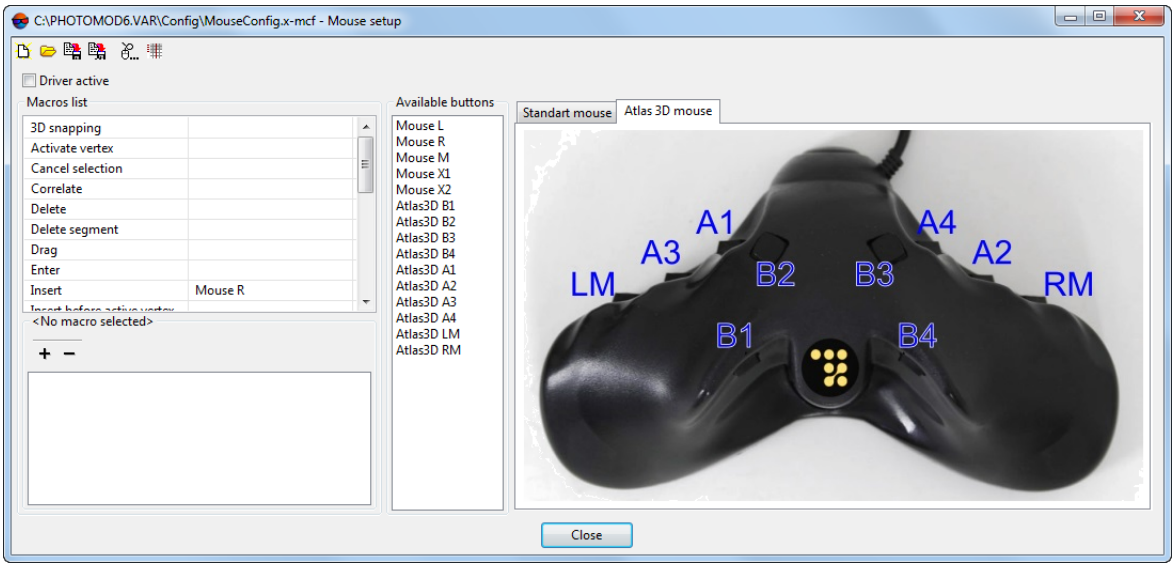


Fig. 43. Configuration of Atlas 3D mouse

9. [optional] click the button in **Mouse setup** window, to open the **Macro editor** and create new macro, if needed.

6.2.3. Macro editor

The system has set of macros for mouse buttons or pedals and there is a possibility to edit or create new macros.

Macro list – set of operations available to attach them to mouse buttons or pedals of specialized devices, if it is used in stereovectorization.

To view macro list is used the **Mouse setup :: Macro editor** window.

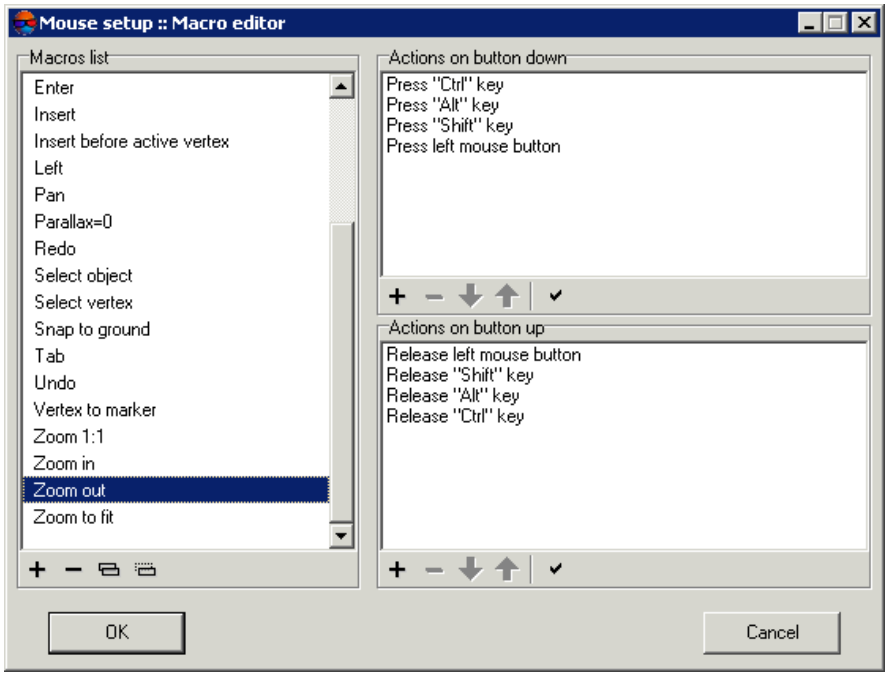


Fig. 44. The 'Macro editor' window

The list of macros, included in a standard mouse driver, is displayed In the **Macros list** section.

In the **Action on button down/up** sections is displayed a list of action sequence on button down/up to run the macro selected in the **Macros list**.

Toolbar of the **Macros list** section contains buttons used to perform the following operations:

- + – allows to create new macros with defined name;
- − – allows to remove selected macros from the list;
- – allows to create a copy of macros selected in the list;
- – allows to rename a macros selected in the list.

Toolbars of the **Action on button down/up** sections are similar and contain buttons used to perform the following operations:

- − – allows to remove action;
- – allows to move action down in the list;
- – allows to move action up in the list;

- – allows to automatically finish sequence for button down. E.g., if **Ctrl+Z** is attached to a button down, it is enough to attach **Ctrl** and **Z** keys down only and click the button of the **Action on button up** section. Releasing **Ctrl** and **Z** added to the Macros list automatically.

In order to create a new macros perform the following:

1. Click the button in the **Mouse setup** window. The **Mouse setup :: Macro editor**.

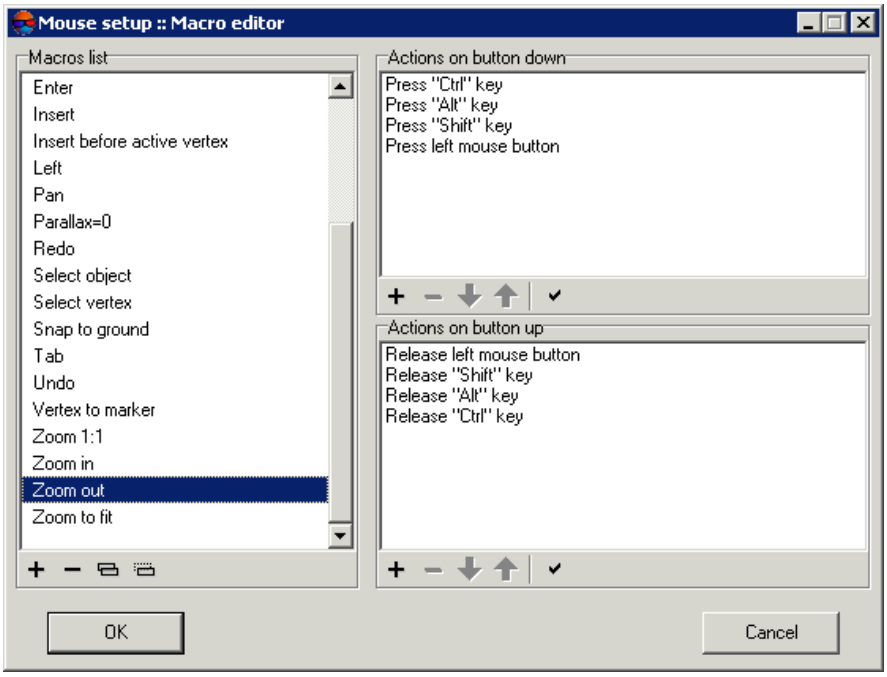


Fig. 45. The 'Macro editor' window

2. Click the + button in the **Macro list** section and input a name of a new macros.

3. Choose created macros in the **Macro list**.

4. Click the + button in the **Action on button down** section to choose action and add it into macros. The **New action** window opens.

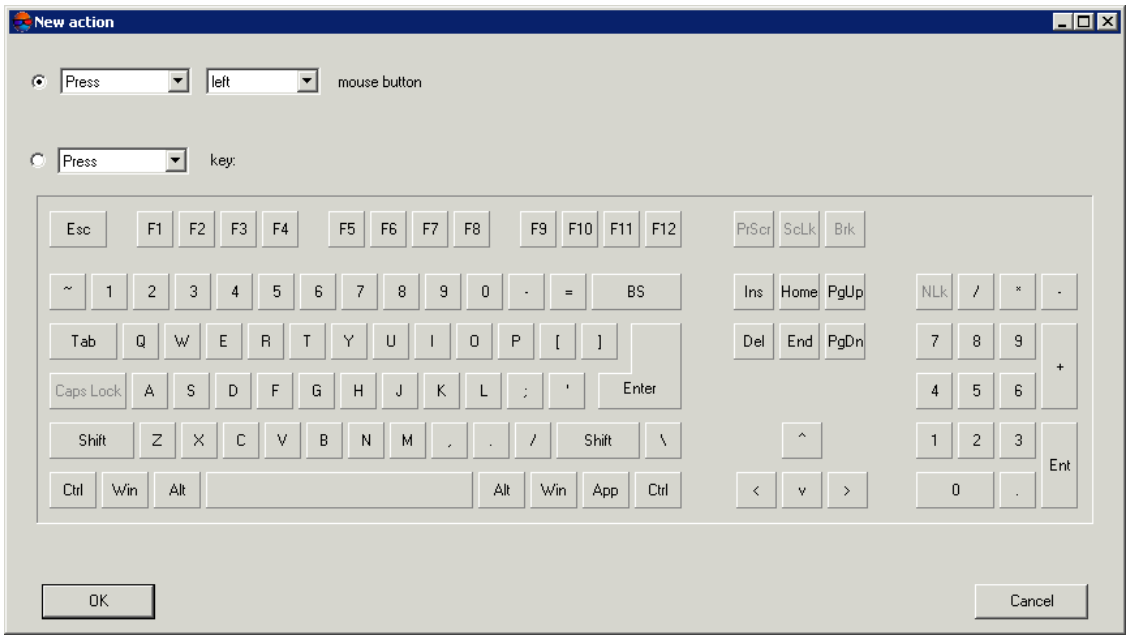


Fig. 46. Adding new action into macros

5. Choose an action:

   - **Press [chosen] mouse button** – choose in the list the mouse button should be pressed: left, right or middle;

   - **Press [chosen] key** – on keyboard image click to the chosen key. Selected key is marked by green color.

6. Click OK. Chosen action is displayed in the **Action on button down** section.

7. Repeat steps 4-6 to create more actions to macros.

8. [optional] Actions that will be performed during releasing selected mouse button, recorded in the macro in the **Actions on button up**. To add action automatically, click the ✔ button.

9. Click OK to save macros.

7. Interface and its elements

Some interface elements of the system may be displayed improperly with non-standard *Windows* font size settings. In order to configure *Windows* font size choose **Start › Control panel › Screen** in main panel of *Windows*. The **Screen** window opens. Make sure that there is enabled **Small - 100% (by default)** font size option.

7.1. Work area interface

On the stages of project processing 2D-window is work window. It is used to view, create and edit DTM, vector objects, TIN, etc.

Block scheme 2D-window opens automatically on startup. Contents of displayed objects depend on *Layer manager* parameters (see the Section 8.2.7).

On the **Windows** tab of the **Settings** windows the **Automatically open 2D window** checkbox is set on by default to open 2D-window on startup (see the Settings User Manual).

The GUI contains the following elements:

- title with name of opened project (*A*);
- the main menu bar (*B*);
- the main toolbar is used for quick main program functions access (C);
- the additional toolbars is used for quick miscellaneous program functions access (*O*);

Toolbars could be placed in one line, vertical or horizontally.

- the 2D-window, used for data displaying (*N*), contains the following elements:
  - the toolbar is used for the 2D-window modes managing (*D*);
  - the work area is used for viewing and processing with loaded data of mosaic project (*N*);
  - the axes direction of project coordinate system (*M*);
  - the navigation bar is used for fast moving on the specified block images area of mosaic project (*E*);
  - the *Layer manager* is used for managing of mosaic project layers (F);
  - current marker coordinates (*K*);

If a block scheme adjusted in free model is displayed in the window, the '#' symbol shows before current marker coordinates. If there is displayed a block scheme, created by tie points without layout, the '*' symbol shows.

  - the status bar is used to edit brightness, contrast and gamma-correction in a work area (*L*);

Shift+F8 hotkeys allow to show/hide this status bar.

- project coordinate system (*G*);

  Double-click on coordinate system to change it in case of work without project or to open the **Project properties** window in other cases.

  If the is lat/lon/alt coordinate system is used, in the status bar is displayed lat/lon in grade by XY and altitude in meters.

- scroll bar in 2D-window (*H*).

- the **Status** bar, near the current marker coordinates (*K*), displaying messages of error or success (e.g., after marker was not successfully placed to ground with correlator – `Bad point: correlation error`).

Navigation bar is used to center images in 2D-window. To do this, click on the chosen point in **Navigation bar**. To change scale and choose visible layers, move to the **Navi** tab in the *layer manager*.

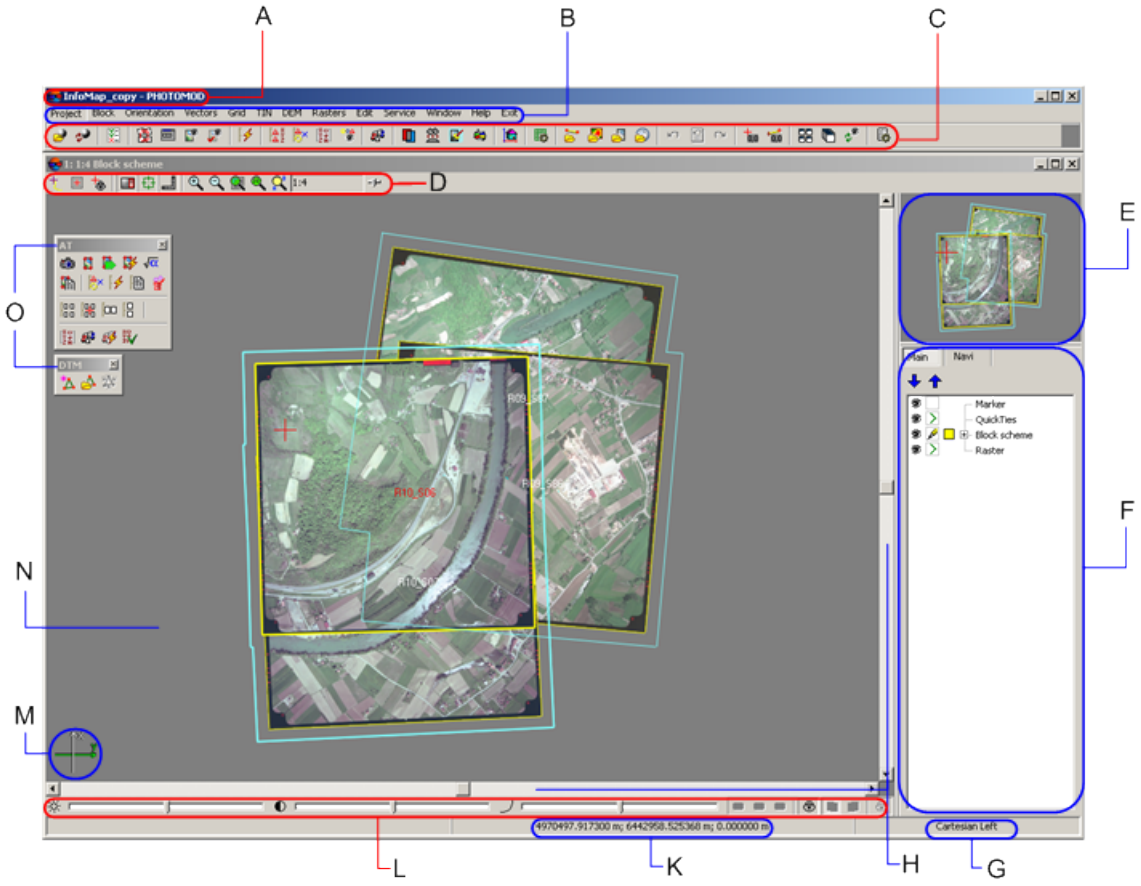


Fig. 47. Work area main elements

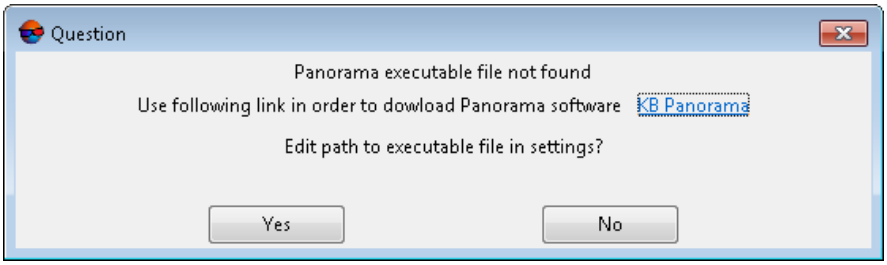
7.2. The main system toolbar

Table 6. Brief description of main toolbar

Buttons	Function
	allows to open block editor window (see the 'Project creation' User Manual)
	allows to reload project to display the last saved version of project
	allows to perform import of exterior orientation from metadata
	allows to open block layout window (see the 'Aerial triangulation' User Manual)
	allows to open block editor window (see the 'Project creation' User Manual)
	allows to display all images, loaded to project, in the **Block scheme** window
	allows to display only selected on scheme images in the **Block scheme** window
	allows to open catalogue of *all ground control points*, including non-measured on block images (see the 'Aerial triangulation' User Manual)
	allows to open catalogue of all *tie points* with their measurements (see the 'Aerial triangulation' User Manual)
	allows to open the Exterior orientation data list
	allows to load triangulation points
	allows to open the **adjustment** toolbar
	allows to open 2D-window for selected stereopair (see the 'Vectorization' User Manual)
	allows to open the **Orthorectification** toolbar to create orthoimages
	allows to launch the *DustCorrect module* to edit MS-TIFF images (see the Project creation User Manual)
	allows to launch the GeoMosaic programm to create othomosaic (see the "Orthophotomaps creation" User Manual)
	allows to run the *GIS Panorama Mini* (this software is not included with the *PHOTOMOD* but can be installed separately)
	allows to create dense digital elevation model (DTM), which cell size coordinates to one pixel of image, using SGM (Semi-Global Matching) method (see the "Dense DEM generation using SGM method" chapter in "Create DTM" User Manual)
	allows to launch the 3D-mod module

Buttons	Function
	allows to create, open and save regular nodes grid (see the “Create DTM” User Manual)
	allows to load vector file into the project (see the ’Vectorization’ User Manual)
	allows to load DEM file
	allows to load georeferenced raster image to project as a layer
	allows to load web-map
	allows to undo the last action (see the ’General system’s parameters’ User Manual)
	allows to display the list of last actions (see the ’General information about system’ User Manual)
	allows to redo the last undone action (see the ’General system’s parameters’ User Manual)
	allows to open the **Marker** window (see the menu description in ’Vectorization’ User Manual)
	allows to open the **Measurements** window (see the menu description in ’Vectorization’ User Manual)
	allows to tile 2D-windows
	allows to stack 2D-windows
	allows to refresh all opened 2D-windows
	allows to open the general program parameters window (see the ’General system’s parameters’ User Manual)

If the *GIS Panorama* executable file is not found, an appropriate system message will appear. The software description and URL hyperlink (for download) are indicated in this message.



Click **Yes** to go to path settings (see the “Paths settings” chapter of the “General system’s parameters” User Manual.

7.3. Brief description of system menus

The main menu bar contains set of menus used to create project, image orientation, to work with vectors, TIN, DEM and also to launch additional modules and setup of general system’s parameters.

Table 7. Main menu

Menu	Function
Project	contains menu items to create, open, save and convert project, and also to get an information about project
Block	allows to form images block of mosaic project
Orientation	contains menu items to interior orientation, load and use ground control and triangulation points, exterior orientation parameters and also to import and export triangulation points for various formats
Grid	allows to create, open and save regular nodes grid (see the "Create DTM" User Manual)
Terrain	contains **Points**, **TIN**, **DEM** and **Contours** submenus (see the "Create DTM" User Manual), **LAS** submenu (see the "LIDAR Data processing" User Manual) and **3D-Mod** submenu (see the "Three-dimensional modeling" User Manual)
Vectors	purposed for creating, editing, import/export of vector data (see the menu description in 'Vectorization' User Manual)
Rasters	allows to load and georeferenced raster images, and also to launch additional modules for editing and orthorectification images (see the "Creating project" User Manual)
Edit	purposed for modes choosing to select and draw vector objects, to transform curves, repeat/cancel the last operation (see the menu description in 'Vectorization' User Manual)
Service	allows to launch applications, load additional data, set general parameters and edit coordinate systems (see the General system's parameters User Manual)
Windows	allows to open additional toolbars and windows (new 2D-window, Marker and Measurements windows, window of Object Attributes)
Help	allows to start the *'Help'* system

8. General system's windows

8.1. The "Windows" menu

Table 8. Brief description of the "Windows" menu

Menu items	Function
Toolbars	contains menu items allows to open additional toolbars
Show all toolbars	allows to show all toolbars

Menu items	Function
Find all toolbars	allows to show all opened toolbars in visible part of the screen
temporarily hide toolbars (**TAB**)	allows to hide/show all opened toolbars
Block editor (**Ctrl+Alt+B**)	allows to open block editor window (see the 'Project creation' User Manual)
Block layout (**Ctrl+Alt+L**)	allows to open the block layout window (see the 'Aerial triangulation' User Manual)
Image list...	allows to open the **Images list** window (see the 'Creating project' User Manual)
New 2D-window (block)	allows to open window with a block scheme
New 2D-window (stereopair) (**Ctrl+Alt+W**)	allows to open window with a stereopair
New 2D-window (single image)	allows to open window with image selected on a block scheme
Open image under marker	allows to open all 2D-windows with marker place. Press and hold **Alt** key while clicking the menu item to open images with 1:1 zoom , otherwise, full images are displayed
Close all single image windows	allows to close all 2D-windows with images
Refresh all 2D-windows	allows to refresh information in all opened 2D-windows
Arrange	contains menu items allow to arrange opened 2D-windows in a work area with one of the following ways: • **Tile** (also on the main toolbar) – allows to tile 2D-windows; • **Row** – allows to row 2D-windows; • **Column** – allows to column 2D-windows; • **Stack** (also in the main toolbar) – allows to stack 2D-windows.
Stereopairs	contains menu items allows to move to other stereopairs (see the 'Vectorization' User Manual)
3D-window	allows to open the 3D-window
Marker window (**Ctrl+Alt+C**)	allows to open marker parameters window (see the 'Vectorization' User Manual)
Measurements window (**Ctrl+Alt+D**)	allows to open window that allows to perform measurements by images (see the 'Vectorization' User Manual)
Triangulation points coordinates	allows to show table with triangulation points coordinates
Triangulation points view control	allows to choose triangulation points to display

Menu items	Function
Contours classifier table	allows to open contours classifier window to edit parameters of contours display (see the 'DTM generation' User Manual)
Classifier	allows to open the **Classifier** window to show set of standard vector objects attributes (see the *Classifier* chapter in the 'Vectorization' User Manual)
Objects list	allows to display list of active layer vector objects (see the 'Vectorization' User Manual)
Objects attributes	allows to open the **Attributes** window to display attributes of selected vector objects (see the *Vector objects attributes* chapter in the 'Vectorization' User Manual)
Marker motion in pixel coordinates	allows to set on the mode allows to move marker in stereopair 2D-window in pixel coordinates
Zoom all in (**Shift+* NumPad**)	allows to zoom in all 2D-windows
Zoom all out (**Shift+/ NumPad**)	allows to zoom out all 2D-windows
Layer view mask	allows to use a view mask for active layer
Windows list	allows to view list of opened 2D-windows

8.2. 2D-window

8.2.1. General information

There are the following types of 2D-window, available in the system:

- block scheme window;
- stereopairs window;
- single window of selected image.

Choose **Windows › New 2D-window (block)** to open a block scheme window. It is also opened automatically when loading and creating a project.

To open stereopair 2D-window, place marker on image or select image in the **Block editor** window and choose **Windows › New 2D-window (stereopair)** (**Ctrl+Alt+W**) or click the button on the main system toolbar. As a result, 2D-window with stereopair of selected and next images opens.

In case of the last image in the strip was selected, stereopair consist of selected and previous images.

To open 2D-window of single image, select an image in the block scheme 2D-window or in the **Block editor** window and choose **Window › New 2D-window (single image)**.

It is possible to use more than one opened 2D-window at the same time.

To synchronize marker in all opened 2D-windows is used **Edit › Sync markers** menu item.

8.2.2. 2D-window toolbar

The toolbar of 2D-window contains the following buttons:

- – allows to turn on/off panning mode: press and hold down the mouse button to move image in 2D-window after mouse moving;
- **F4** – turn on/off 'marker=mouse' mode;
- – allows to center image on marker (move point with marker to the center of the 2D-window);
- **F6** – turn on/off fixed marker mode;
- (**Shift+F7**) – [only for stereopair 2D-window] turn on/off mode of fixed parallax marker;
- **F9** – [only for stereopair 2D-window] – turn on/off stereomode (anaglyph or page-flipping) (see the Vectorization User Manual);
- (**F11**) – [only for stereopair 2D-window] allows to switch stereo phase (to swap 'left' and 'right' images) in stereo mode, in mono mode allows to display left/right image of stereopair (see the Vectorization User Manual);
- (**F2**) – [only for stereopair 2D-window] – allows to set the 0 value for parallax in a marker position (see the Vectorization User Manual);
- (**F3**) – [only for stereopair 2D-window] is used to return parallax parameters to default after using the button (**F2**) (see the Vectorization User Manual);
- – show/hide the **Navigation bar** and *Layer manager*;
- – show/hide the **Navigation bar**;
- (**Ctrl+F8**) – show/hide scroll bars;
- , , , , and – buttons allowing to setup image scale in 2D-window;

  Description of buttons to setup image scale in 2D-window see in the Section 8.2.3.

- [optional] *shortcut commands* – are the custom button combinations for quick access to various functions when working with the layers of **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN** types. These buttons are available for a user when a layer of one of the above-

mentioned types is downloaded and editable ( ). *Shortcut commands* are similar to hotkeys and can be also customized.

Shortcut commands are described in Section 8.2.4.

Layer types are described in Section 8.2.7.

8.2.3. Image scaling in 2D-window

Image scaling of 2D-window is performed with the following buttons of 2D-window toolbar:

- – allows to zoom in an image by one step (*);
- – allows to zoom out an image by one step (/);
- – allows drag a rectangle by mouse to zoom in area of image;

Press **Ctrl+Alt** hotkeys (or click an appropriate button to enable the mode) and drag a rectangle by mouse to zoom in area of image. Press **Ctrl+Alt+Shift** hotkeys (or **Shift** key only, if the mode is already enabled) and drag a rectangle by mouse to zoom out area of image.

- – allows to fit to page data of opened layers (**Alt+Enter**);

To apply this function to a certain layer, select the layer in the *Layer manager* and select **Edit › Fit window to active layer** (or choose **Zoom to fit** in the shortcut menu for this layer in the *Layer manager*).

- – allows to display data in 1:1 scale, when one pixel of the image corresponds to one pixel on the screen (**Alt+1**);
- – allows to sequentially display preset zoom (**Alt+5**);

To edit preset zoom choose **Service › Settings** and move to **Windows | Zoom** tab (see the 'General parameters' User Manual).

Alt+0 hotkeys is used to return to previous scale.

To set scale manually, click the button and move slider.

Press and hold **Ctrl+Alt** hotkeys and click on image to zoom in or **Ctrl+Alt+Shift** to zoom out image in the window.

Press and hold **Alt** key and mouse button for panning. Slide bars are also used to move image.

To move fast in area of image is used the *Navigation bar*.

8.2.4. Shortcut commands

The system allows to use so called *shortcut commands*, the custom button combinations for quick access to various functions when working with the layers such as **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN**.

These buttons are placed in the right part of the 2D-window toolbar, after the buttons used to customize image scaling in the 2D-window (see the chapter above). These buttons are available for a user when a layer of one of the abovementioned types is downloaded and editable ( ).

Layer types are described in Section 8.2.7.

Shortcut commands have functionality similar to hotkeys' and are supposed to be used together with them. The *shortcut commands* are pre-installed for each of the abovementioned layers and are available for customizing. For this, perform the following:

1. Choose **Service › Customize fast commands**. The **Customize Shortcut Commands** window.

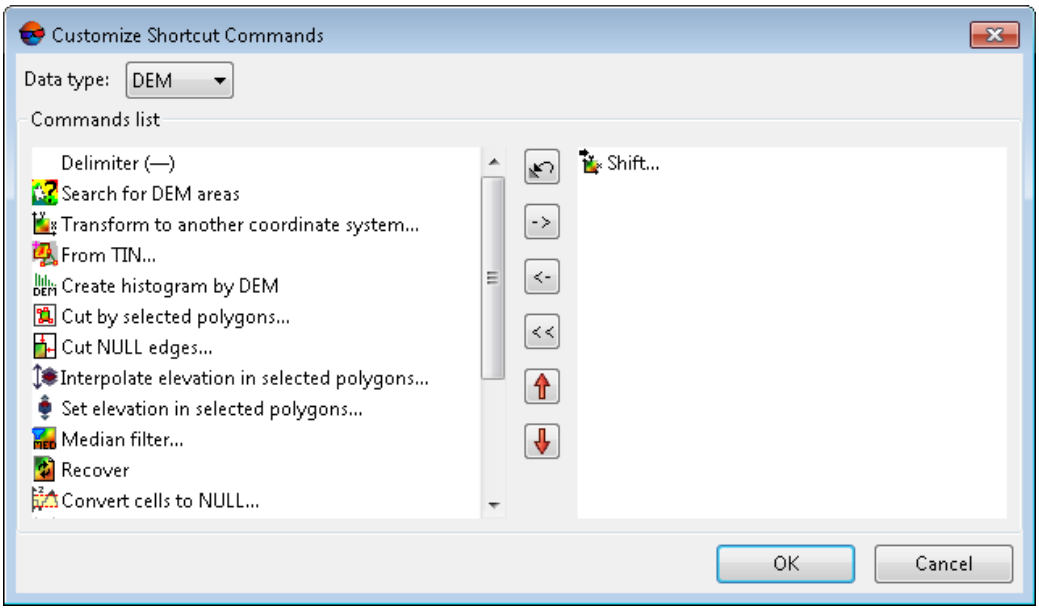


Fig. 48. The "Customize Shortcut Commands" window

2. Select **data type** – **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN**. The list of available commands applied when working with the selected type data is displayed in the left part

of the window. The list of commands to be displayed in the 2D-window toolbar are given in the right part of the window;

3. In the list places in the left part of the window, select one or more required commands and click the > button (or click the >> button to move all the commands). As a result, all the commands or the selected ones are moved to the list of displayed commands in the 2D-window toolbar (right);

   To cancel the command selection, choose this command in the right part of the window and click the < button (or click the << button, to clear out the list of commands displayed in the 2D-window toolbar).

   To move the selected command down in the list on the right, click the button; to move it up, click the button.

   The button allows to come back to default settings.

   Move the **Delimiter (—)** to the list of commands displayed in the 2D window the required number of times in order to visually group the commands as needed. Move the delimiters using the and buttons, similar to the shortcut buttons.

4. [optional] if required, customize shortcut commands for another type of data;

5. Click OK.

8.2.5. Stereopair 2D-window

Stereopair 2D-window is used to work in stereo mode.

To open a stereopair 2D-window, select images in the **Block scheme** or **Block editor** windows with one of the following ways:

- select two images with overlap;
- select one images. In the stereopair window opens the best stereopair, found with parametric search or stereopair consists of selected and next images in the strip.

  In case of the last image in the strip was selected, stereopair consist of selected and previous images.

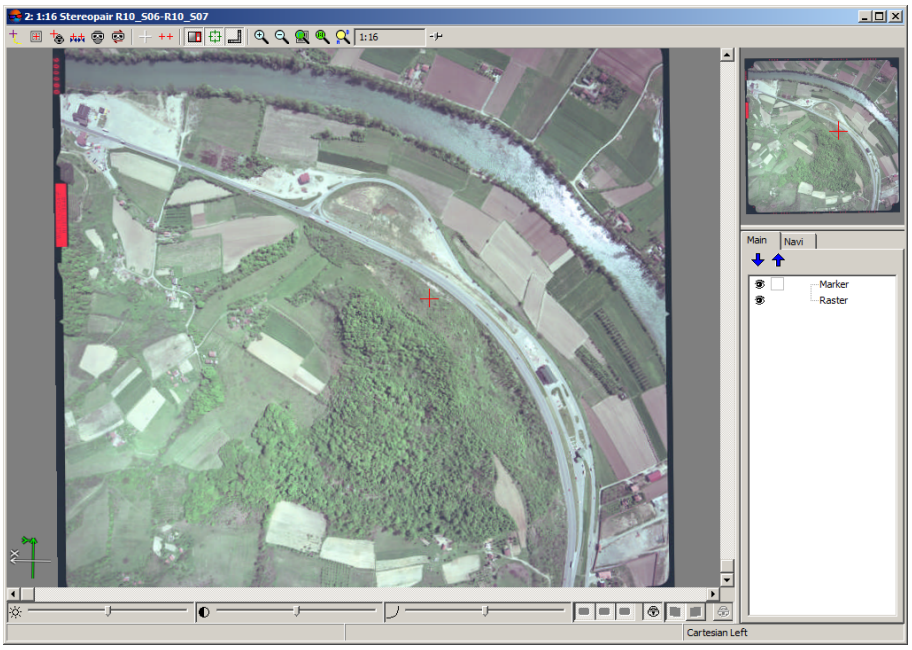


Fig. 49. Stereopair 2D-window

During displaying stereopair in 2D-window, the Navigation window displays the left image of the stereopair.

The system provides possibility to pass to the adjacent stereopair when working in 2D-window.

The **Change stereopair** toolbar, hotkeys and also **Window › Stereopairs** menu items are used to move to other stereopair.

Table 9. Brief description of the 'Stereopairs' menu

Buttons and menu items	Function
Shift one image forward	allows to open next stereopair in the strip
Shift one image backward	allows to open a stereopair with previous image in the strip
Stereopair up	allows to pass to a stereopair located on one strip up
Stereopair down	allows to pass to a stereopair located on one strip down
Select stereopair	allows to select an arbitrary stereopair to pass to
Auto change stereopair	allows to select a stereopair to pass to automatically
Open reverse stereopair	allows to swap images of opened stereopair and to rotate image by 180 degrees

Depending on the object of vectorization for different stereo vectorization methods the system provides the following modes of marker work:

- *moving marker mode* – The operator moves the marker arbitrarily by image 'fixed' in XY plane. In this mode operator moves moving marker in any direction in XY plane over 'fixed' image using mouse with pressed left button or arrow keys, to move the image in Z operator uses **Page Up**, **Page Down** hotkeys or mouse wheel;

  Moving marker mode is enabled in the system by default, besides, the system switches to it when any other mode of marker control is turned off.

- *fixed marker mode* (**F6**) – marker is always in the center of the screen, horizontal parallax on it is zero.

  In fixed marker mode a step of model move by Z is defined arbitrarily.

  Fixed marker mode is intended for users who have work experience on stereo devices. The advantage of the mode is the ability to vectorize extended objects continuously with a constant automatic moving of image.

  To place the marker on the surface of relief model in stereomode use the **Page Up** and **Page Down** hotkeys (in XY plane) or mouse wheel rotation to move marker by Z. To move image in XY plane use mouse or arrow keys.

  To change horizontal parallax in *fixed marker mode* it is possible to use **Shift+mouse wheel rotation** and **Ctrl+Shift+mouse wheel rotation** shortcuts by X and Y accordingly. To set parallax to zero in marker position the **F3** hotkey is used.

- *marker=mouse mode* (**F4**) – mouse cursor is invisible, all mouse moves lead to marker moving without additional clicks of mouse buttons;

  This mode is used for vectorization of extended objects breaklines.

  The marker=mouse mode is not available if the alignment mode is enabled.

- *fixed parallax marker mode* (**Shift+F7**) – in modes of moving or fixed marker allows to fix marker parallax value.

  To change marker parallax value.are used the same keys as in *fixed marker mode*.

To move marker on block scheme are also used keys of NumPad.

Step of marker moving along Z axis is discrete and inversely proportional to the current image increase when scaling. For fast marker moving along Z use mouse wheel rotation while holding pressed **Alt** key.

The system also allows to place marker on a model surface automatically using correlator. The **Space** key is used to do this.

- [optional] If the correlator failed to work the **Status** panel displays the `Bad point` message and the system produces warning audio signal;
- [optional] In case of successful correlator operation, correlation coefficient (`Corr`) and autocorrelation coefficient (`AQ`) values are displayed in the **Status** panel.

High autocorrelation coefficients may indicate that the marker is located in an area containing contrasting, but similar and adjacent objects, mainly of anthropogenic origin, for example sections of a railway track or road markings.

To configure threshold values of the correlation coefficient and autocorrelation coefficient, choose **Service › Settings**. The **Settings** window opens. Set the required values in the **Block scheme** section of the **Correlator** tab (see the "Correlator settings" in the "General system's parameters" User Manual).

To set up marker parameters choose the **Service › Settings**. The **Settings** window opens. In the **Window | Marker (stereopair)** tab choose type, color and size of marker.

To change horizontal parallax in stereo mode the system provides the **Shift+PgUp/PhDn** hotkeys, and **Shift+mouse wheel rotation**.

For fast parallax change for high values, move the mouse while holding **Alt+Shift+mouse middle button**.

8.2.6. Brightness and contrast settings

To display the status bar used to adjust the image brightness, contrast and gamma-correction for a single image or both images of a stereopair use the **Shift+F8** hotkeys.

The  ,  ,  sliders are used to adjust a brightness, contrast and gamma-correction of a stereoimage. Tools located in the right part allow to select color channels, which correction settings will be applied to.

If the  button is set on, adjustment settings is performed by all channels at the same time. Otherwise, adjustment settings is performed only for selected channel.

Fig. 50. Status bar used to adjust image brightness and contrast

Parameters in stereopair 2D-window changes at the same time for both images if the  button is pressed, otherwise – for left  or right  image of stereopair separately.

To invert image's colors, right click the settings panel and select the **Revert intensity** item.

To restore brightness and contrast settings to default values, right click the settings panel and select the **Reset** item.

Brightness, contrast and gamma settings are not restored after the module restart.

8.2.7. Layer manager

The system supports the following types of layers and their parameters:

- **Marker** – layer with marker and direction of the axis;
- **Raster** – layer contains loaded georeferenced images (see the Project creation User Manual);
- **Block scheme** – layer with a block scheme that consists of the following elements:
  - **Strip names** – names of strips displayed in the center of each strip;
  - **Image names** – names of loaded images displayed in the center of each image;
  - **Strip outlines** – outlines of each strip in a block scheme;
  - **Image outlines** – outlines of each image in a block scheme.
- **Triangulation points** – layer contains measured tie and ground control points (see the Aerial Triangulation User Manual);

  Choose **Orientation › Load triangulation points** to display triangulation points in the 2D-window. These points also could be saved to a vector layer and used to consider in DEM creation (see the DTM Generation User Manual).

- **Pre-regions** – layer contains pre-regions (vector layer);

  The name of a vector layer containing pre-regions is the following: `<Layer_name> (Pre-regions)`.

- **Layer border** – a vector layer containing a rectangle polygon that visualize borders of the selected layer of any type;

  A name of a vector layer with a border is the following: `* Border for layer <Layer_name>`.

- **Grid** – layer contains regular grid that is used to create points (see the DTM generation User Manual) with the following objects:
  - **Limits** – frame of created grid (red line);

  - **Nodes** – nodes of grid (green points).

- **TIN** – layer contains triangulation irregular network (see the DTM generation User Manual) with the following objects:
  - **Contours**;
  - **Triangles**.
- **DEM** – layer contains digital evaluating model (see the DTM generation User Manual) with the following objects:
  - **Selection** – frame of DEM selected area;
  - **Frame** – rectangle frame of DEM;
  - **Raster** – DEM.
- **Vectors** – layer contains vector objects (see the Vectorization User Manual) with the following objects:
  - **Selected objects** – vector objects, selected in a 2D-window;
  - **Labels** – labels for vector objects;
  - **Point objects** – only points of the layer;
  - **Line vertices** – vertices of linear/areal objects;
  - **Lines** – linear objects and frames of areal objects.
- **Contours** – vector layer with contours (see the DTM generation User Manual);

The name of a vector layer containing contours is the following: `<Layer_name> (Contours)`.

- **Points** – vector layer with points (see the DTM generation User Manual);
- Georeferenced external data – (see the “Georeferenced external data” section of the “Aerial triangulation” User Manual).

To change general parameters of displaying for layers are used corresponding tabs of the **Settings** window (see the ’General parameters’ User Manual).

The system provides possibility to manage layers, loaded in the project. *Layer manager* is used for that.

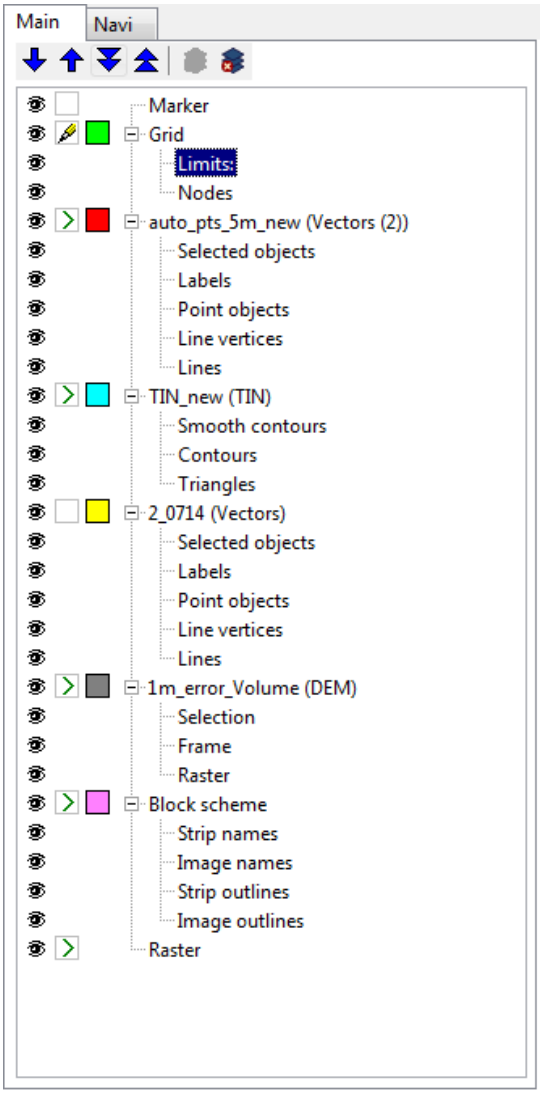


Fig. 51. Layer manager

The button of the 2D-window toolbar allows to show/hide *Layer manager* and *Navigation bar*.

Ctrl+F11 hotkeys are also used for that.

The **Main** tab is used to adjust layer displaying in 2D-window, the **Navi** tab – to adjust objects displaying in *navigation bar*.

In the *Layer manager* is displayed the list of all opened layers and the following elements of layer management:

- , , and – is used to change layers order;
- – allows to close all the layers of the selected type;

- – allows to close the layer group (selected in the **Close selected layers** window):

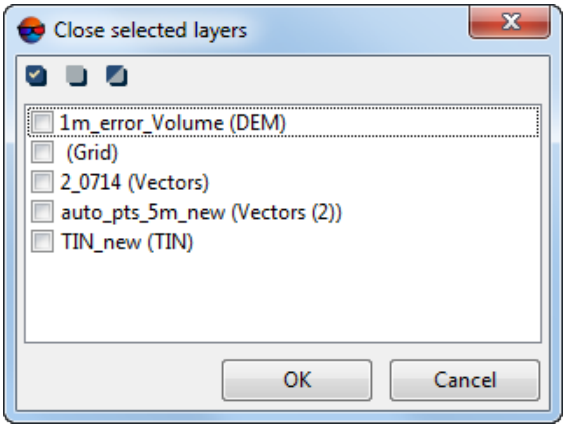


Fig. 52. The “Close selected layers” window

the **Close selected layers** window toolbar contains the following elements:

  - – allows to select all items;
  - – allows to deselect all items;
  - – allows to invert items selection.

  to close the layer group set the appropriate checkboxes and click OK.

- – layer is visible in 2D-window;
- – layer is invisible;

  If layer visibility changes, layer status (active/editable) does not change.

  Visibility of any layer element could be set separately.

- – layer is active and editable;
- – layer is active, but not editable;
- – displays general color of layer objects;
  - It is possible to adjust color, symbols and symbol size of objects in the *vector*, *points*, *pre-regions* and *contour lines* layers (see the “Vectorization” User Manual);
  - It is possible to adjust color, symbols and symbol size of grid nodes in the *grid* layers (see the “DTM Generation” User Manual);

- For *georeferenced raster* and *DEM* layers could be changed *transparency* of layer visibility in 2D-window (see the "DTM Generation" User Manual);

  Changing of layer transparency is possible only if the **Do not use textures for precision raster display** checkbox is set off on a **System** tab of the **Settings** window (see the General systems parameters User Manual).

- For a *TIN* layer could be changed colors of *triangles* and *contours* (see the "DTM Generation" User Manual);
- For a *triangulation points* layer could be changed colors of *points XY and Z coordinates* labels (see the "Triangulation points display in 2D-window" chapter of the "Aerial triangulation" User Manual);
- For the *Block scheme* layer could be adjusted color of the following objects:
  - images;
  - irregular strips;
  - image names;
  - regular strips;
  - names of selected images.

To change colors of objects (for example – for the *Block scheme* layer) perform the following:

1. Double-click on layer objects color button ( ) in a *Layer manager*. The **Raster layer parameters** window opens (for the *Block scheme* layer).

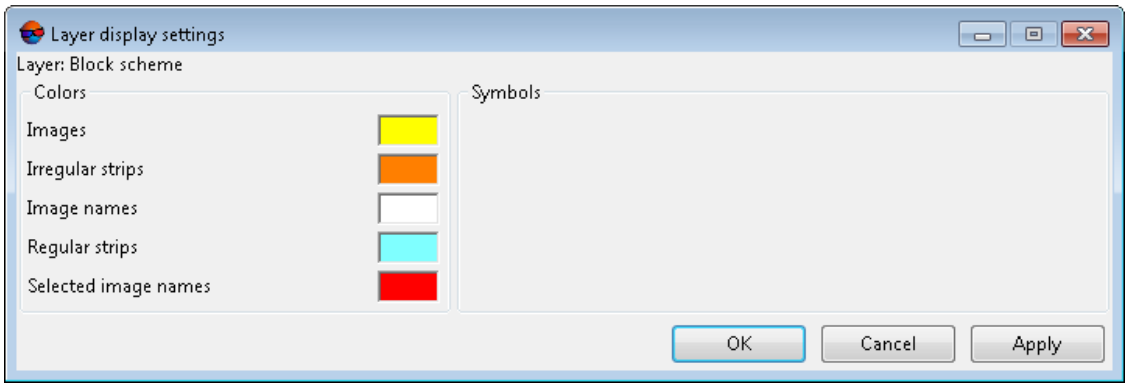


Fig. 53. Raster layer parameters ("*Block scheme*" layer)

2. Double-click on the object's color in the **Colors** section and choose necessary color from standard color palette.

3. Click the **Apply** button to display changes in 2D-window.

4. Click OK to save parameters.

Right-click menu is used to save, close or to obtain info about layer. Right-click on the name of layer in the *Layer manager* to open it.

Right-click menu of selected layer can contain the following menu items, depending of the layer type:

- **Information** – allows to open layer info image;
- [optional] **Properties** – allows to configure the settings of DEM display (see the "Settings of DEM display" chapter of the "General system's parameters" User Manual);

  This menu item is available for the DEM layers only.

- [optional] **Palette** – is used for the fast configuration of DEM coloring settings (see the "Settings of DEM display" chapter of the "General system's parameters" User Manual);

  This menu item is available for the DEM layers only.

- [optional] Georeferenced **raster layer parameters** (see the "Georeferenced external data" section of the "Aerial triangulation" User Manual and the "Pseudo-stereo mode" section of the "Vectorization" User Manual);
- **Zoom to fit** – allows to move the marker to the geometric center of the selected layer and show the entire layer in the 2D-window;

  See also **Edit › Fit window to active layer**.

- **Load layer border** – allows to create a vector layer containing a rectangle polygon that visualize borders of the selected layer (available for layers of any type);

  A name of a vector layer with a border is the following: `* Border for layer <Layer_name>`.

- **Save** – allows to save selected layer;

- **Save as** – allows to save file with new name;
- [optional] **Import** – is used for access to the menu items allowing to import vector objects (for the vector layers only, see the “Import of vector objects” chapter of the “Vectorization” User Manual);
- [optional] **Export** – is used for access to the menu items allowing to export vector objects (for the vector layers only, see the “Import of vector objects” chapter of the “Vectorization” User Manual);
- **Close** – allows to close selected layer;
- **Close all current type** – allows to close selected layer and all other layers of the same type;
- – allows to close the layer group (selected in the **Close selected layers** window, see above).

It is also possible to close all opened layers such as **Raster**, **Grid**, **TIN**, **DEM** or **Vectors** using the **Close all opened layers** command in the corresponding menus. For example, to close all opened vector layers, select **Vectors › Close all opened layers**.

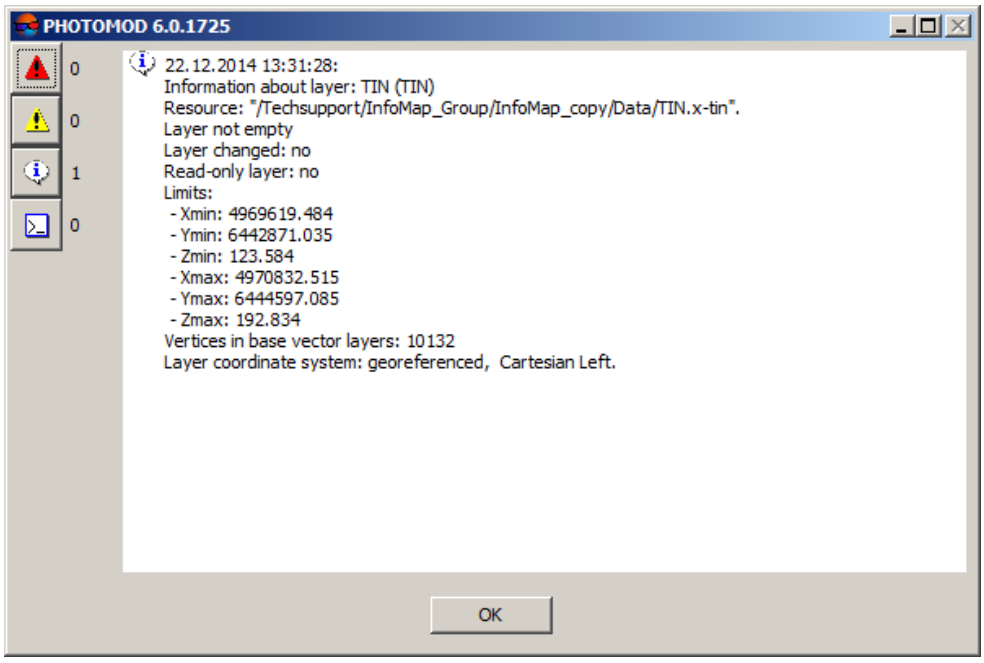


Fig. 54. TIN layer info

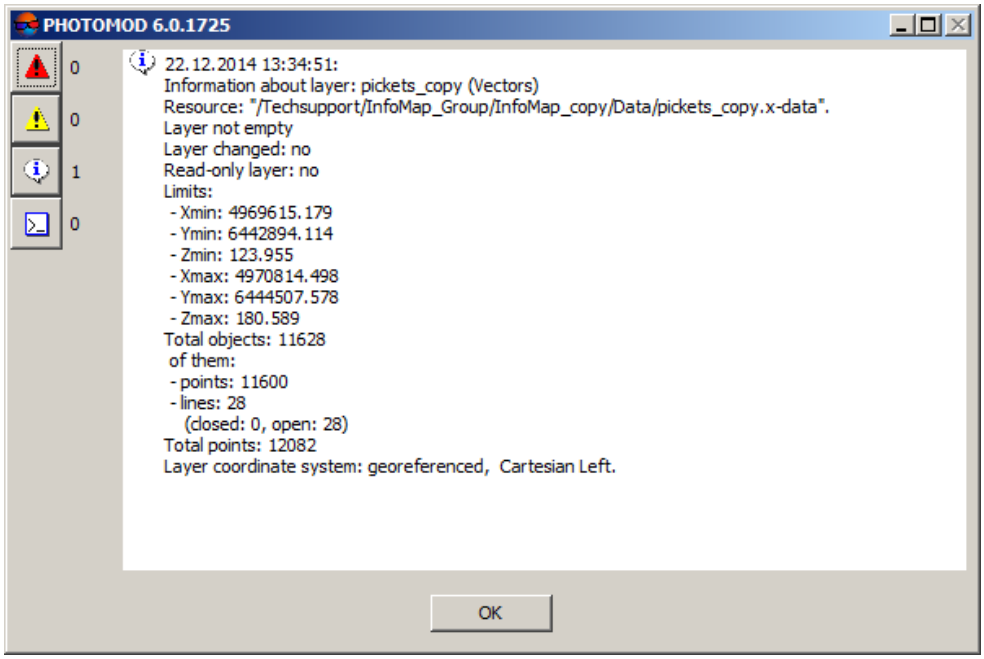


Fig. 55. Points layer info

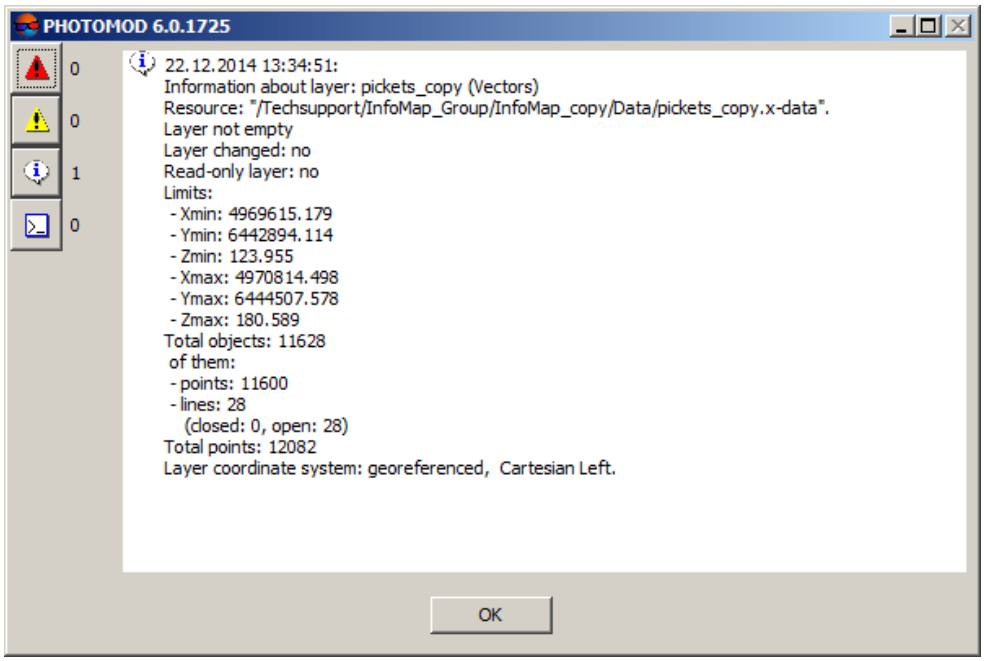


Fig. 56. Points layer info

If georeferenced raster files are downloaded into a single layer (without creation of a separate layer for each image), the GSD value average for all raster files will be displayed in the layer info window.

8.2.8. Save scene in 2D-window

The system provides possibility to save window content of 2D-window to a TIFF file with pyramid. At that content of active 2D-window saves considering to all settings in Layer manager, scale and order of raster displaying.

To save 2D-window content do the following:

1. Choose **Service › Save scene**. The **Save scene** window opens.

Visible (on a screen) part of 2D-window saves as a scene.

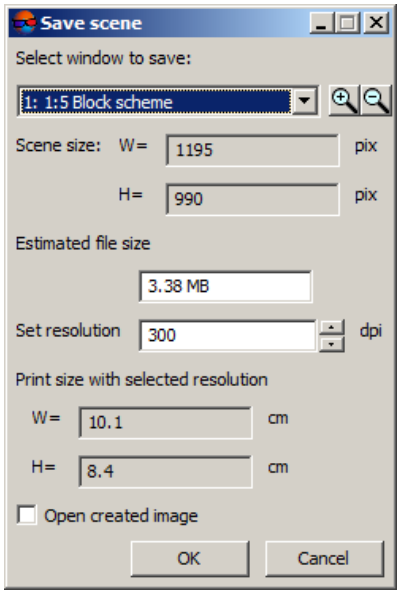


Fig. 57. Saving settings scenes

2. [optional] To save scene of a stereopair 2D-window in stereomode choose **Service › Settings** and choose anaglyph mode on the **Stereo** tab.

In case of saving scene of a stereopair 2D-window in mono mode, the button allows to save as left and right images separately.

3. Select window to save from the list.

4. Define scale of saving image with  and  buttons.

In case of big zoom of saving image is increased retention time and the output file size.

5. In the **Resolution set** field define resolution of the image in dpi.

Size in centimeters is displayed in the **Print size with selected resolution** field.

6. [optional] Set the **Open created image** checkbox on to quick view of image.
7. Click OK and define path and file name. As a result, visible part of 2D-window saves in a file.

   Is it possible to save scene with output file size less than 4 GB in `*.tiff` or `*.prf` (PHOTOMOD MegaTIFF) files. For output files with size more than 4 GB is used only `*.prf`.

At that also creates a `*.tab` file with georeference data in current project coordinate system.

8.2.9. Layer view mask

The system provides possibility to display two raster layers in one 2D-window.

The layer view mask is available not only for raster but for all other layer types (vectors, DEMs).

To set the mask on perform the following:

1. Open at least two layers in 2D-window.

Layer overlay mask could be used for two or more layers.

2. Make active a base layer.
3. Choose **Window › Layer view mask**. The **Layer overlay mask** window opens.

In the **Layer overlay mask** window the name of the layer to which the effect is applied.

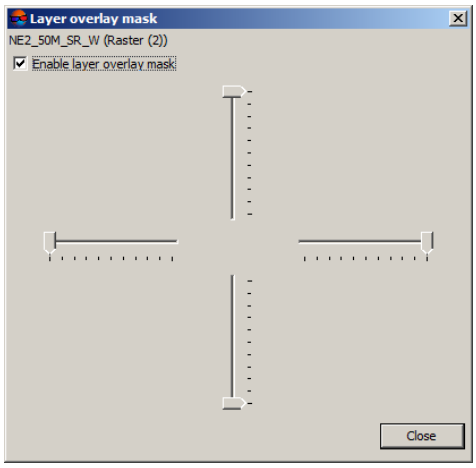


Fig. 58. Layer view mask

4. Set overlay with sliders. By moving the slider layer is partially hidden on the side on which the slider is moved.

Active layer in the *Layer manager* is marked by red frame around the icon.

If any of sliders is on the end position nearest to center of the window, layer is not displayed.

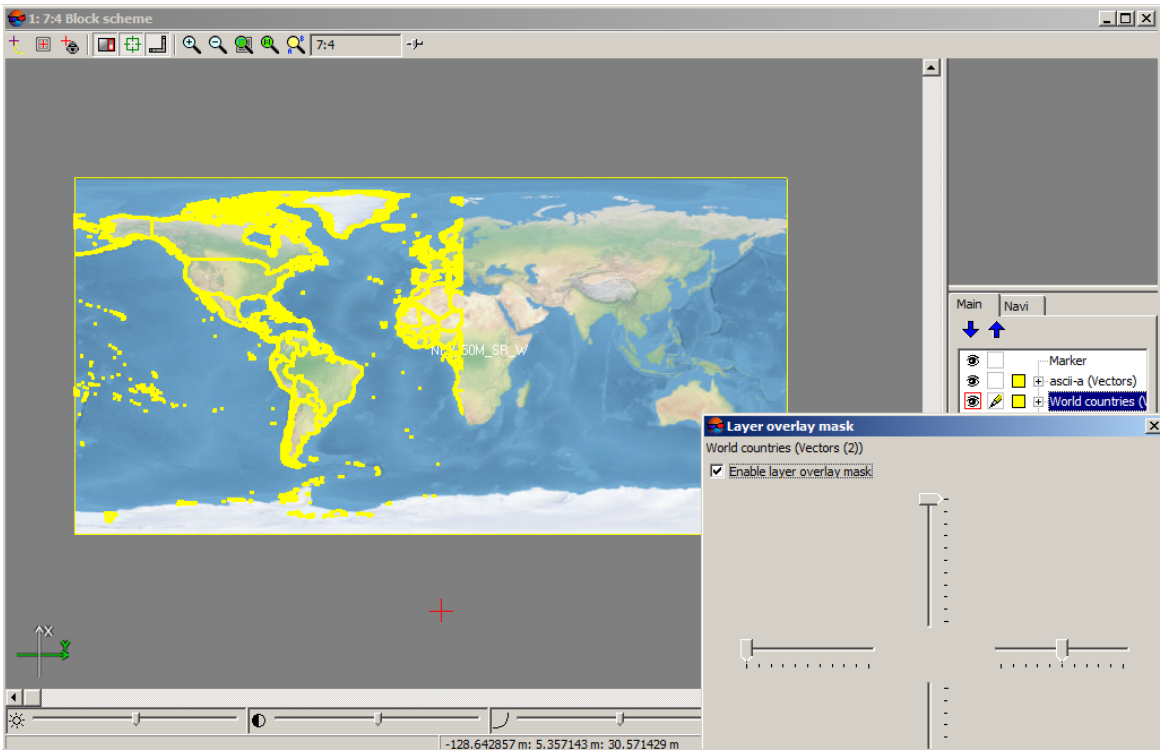


Fig. 59. Overlay the 'Countries of the world' layer to the raster layer

5. Click the **Close** button to continue. When the window is closed overlaying layer remains on.

To set this effect off perform the following:

1. Make active the layer for which the effect is set on.
2. Choose **Window › Layer view mask**. The **Layer overlay mask** window opens.
3. Set the **Enable layer overlay mask** checkbox off.
4. Click the **Close** button to continue.

The layer view mask is individual for a certain program 2D window (active at the moment of configuring). The system allows one to set various view masks for the same layers displayed in different 2D windows open at the same time.

The layer view mask parameters are saved when the 2D window is updated and are active until the specific 2D window is closed (if the layer view mask is not adjusted or disabled by the user).

8.3. 3D-window

8.3.1. 3D-window toolbar

Table 10. 3D-window toolbar

Buttons	Function
	allows to set moving mode on
	allows to set rotation mode on
	allows to change camera focus length
	allows to show/hide additional *draw circle*; if cursor inside of circle, rotation is around the global XY axes, otherwise – around Z-axis
	allows to use perspective projection for displaying
	allows to use orthogonal projection for displaying
	allows to set scaling mode on
	allows to move center scene with press and hold down mouse button and moving cursor
	allows to scaling along objects Z axis (**+**/**-**) with press and hold mouse button
	allows to select part of model, to do that press and hold the **Ctrl** key, while dragging a rectangular by mouse over the area
	the 'down arrow' on the right of the button allows to display list of the model or its part displaying modes:

Buttons	Function
	• **Full layers** – allows to display all model; • **Show selected** – allows to display only selected part of model; • **Points** – allows to display only selected part as points; • **At least one selected point** – allows to display selected part of model and select all model's elements, full or partly inside of selection area; • **Fully selected** – allows to display selected part of model with selection only model objects, fully inside of selection area.
	allows to save selected objects
	allows to animation mode
	allows to turn on/off anaglyph stereomode
	allows to turn on/off page-flipping stereomode; slider right to the button allows to adjust basis; to return to default parameters right click on the slider and choose **By default**
	allows to return settings to default
	[if model displays in perspective projection] allows to refresh model in 3D-window in case of changes in 2D-window if it does not occur automatically
	allows to display coordinates of selected point
	allows to specify coordinates of the start and end points of the segment to measure
	allows to remove current measure segment

8.3.2. Process in 3D-window

Is it possible to view DTM (vector objects, TIN, DEM) in a 3D-space in mono or stereo-mode (see the DTM generation User Manual). It is also possible to view model in animation mode.

DEM size must be less than 2000x2000 cells. Otherwise it does not possible to view it in a 3D-space.

Choose the **Window › 3D window** to open a new 3D-window. **3D-window** and **3D window** properties windows open.

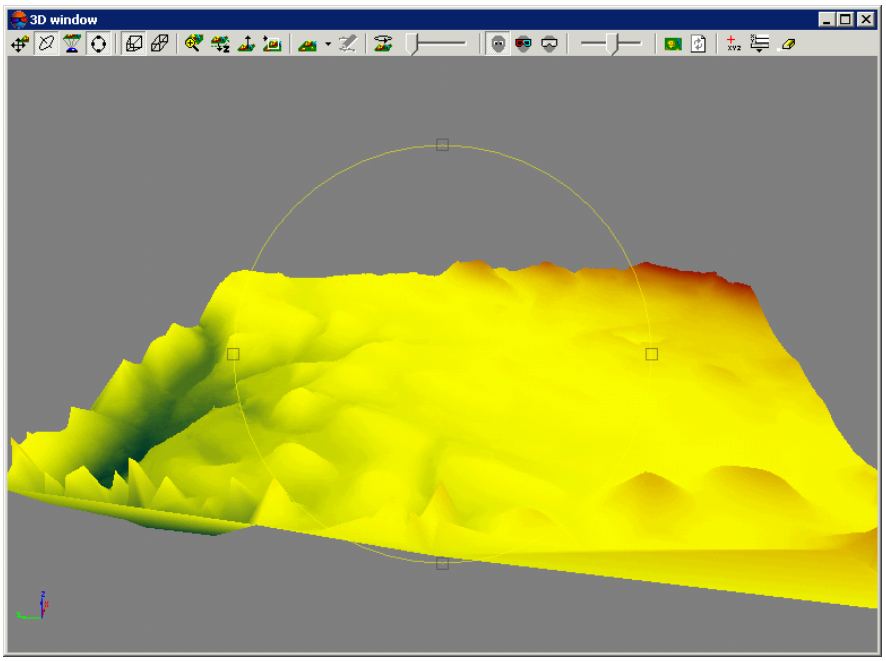


Fig. 60. 3D window

To move the view, move the mouse area, while holding the mouse button mode should be activated).

Move cursor while holding the mouse button and the **Alt** key for panning.

Чтобы вращать область просмотра, перемещайте область мышью (при это должен быть включен режим вращения области просмотра mode should be activated).

To view model in animation mode click the button.

The system allows to setup animation speed. To do this move the slider right to the button.

To adjust animation mode, right click on the button and choose in a right-click menu:

- **Animation** – allows to turn on/off the animation mode;
- **Around the X axis** – allows to run the model rotation around the X axis;
- **Around the Y axis** – allows to run the model rotation around the Y axis;
- **Around the Z axis** – allows to run the model rotation around the Z axis;
- **Change direction** – allows to change the direction of model rotation

8.3.3. 3D-window parameters

The **3D-window properties** window opens with 3D-window automatically. The window is used to manage layers in 3D-window.

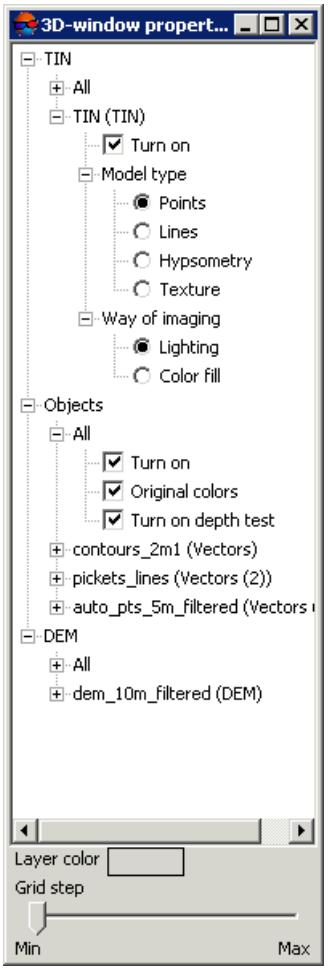


Fig. 61. 3D-window parameters

TIN – contains list of TIN layers and settings of displaying both for all layer and for each of opened TIN layer separately.

The system provides the following features to adjust TIN displaying:

- **All** – allows to show/hide all vector layers and objects;
- **Model type** – allows to display TIN as a set of one of the following objects:
  - **Points**;
  - **Lines** – as wire model;
  - **Hypsometry** – as hypsometry model;

- **Texture** – [for georeferenced source images only].

Maximal texture size couldn't be more than 4096x4096 points for correct displaying in a 3D-window.

`Objects` – contains list of vector layers and settings of displaying both for all layer and for each of opened layer separately.

The system provides the following parameters to adjust object's displaying of all vector layers:

- **All** – allows to show/hide all vector layers and objects;
- **Original colors** – allows to display vector objects in the 3D-window with the same colors as in 2D-window;

To change displaying colors of vector layer, set the checkbox off and choose color in the **Layer color** list.

- **Turn on depth test** – allows to show/hide vector objects above the DEM layer.

`DEM` – layer contains digital evaluating model (see the DTM generation User Manual) with the following objects:

- **All** – allows to show/hide all vector layers and objects;
- **Model type** – allows to display DEM as a set of one of the following objects:
  - **Points**;
  - **Lines** – as wire model;
  - **Hypsometry** – as hypsometry model;
  - **Color fill** – allows to display DEM with color filling layer-by-layer corresponding to altitude relief scale.
  - **Texture** – [for georeferenced source images only].

To change displaying colors of TIN or DEM layer, choose a color in the **Layer color** list at the bottom of the **3D-window parameters** window. The **Grid step** slider allows to change detail of model displaying.

In the left slider position, general view of DTM is displayed and in the right position – structure of separate DTM parts.

8.4. Loading progress window

Loading progress window is displayed while processing any time-consuming operation. Progress of loading, spent and estimates time and log are displayed in the window.

The progress bar blocks user's interaction with *PHOTOMOD* interface.

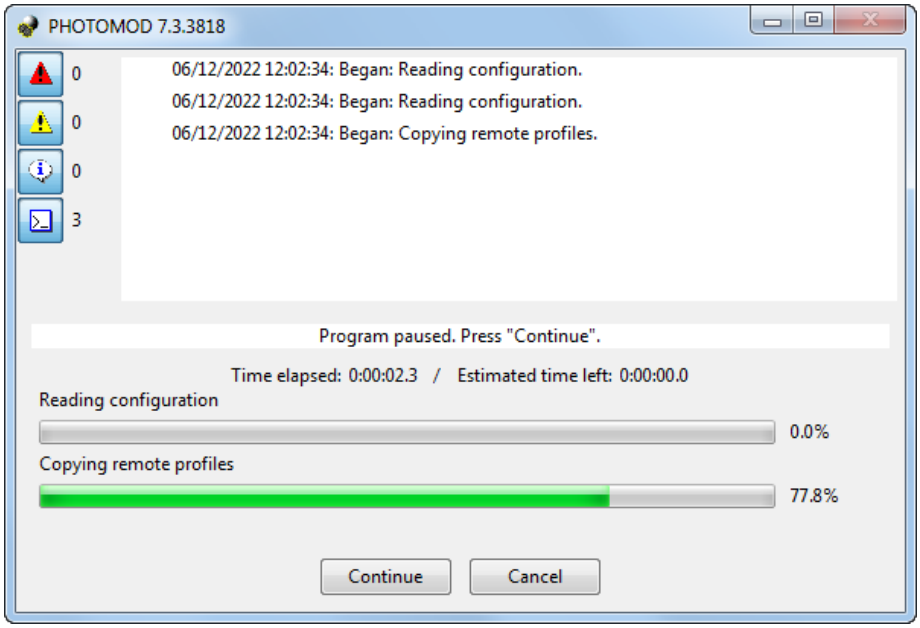


Fig. 62. The loading progress window

The loading progress window contains the following buttons:

- **Pause** – allows to pause performed operations;
  - **Continue** – allows to continue the operations.
- **Cancel** – allows to cancel performed operations.

The buttons of the window toolbar allows to enable/disable the visibility of an appropriate messages categories. The number of messages in the each category is displayed to the right of the corresponding button.

Table 11. The loading progress window toolbar

Buttons	Function
	allows to enable/disable the visibility of the error messages
	allows to enable/disable the visibility of the warnings
	allows to enable/disable the visibility of the information messages
	allows to enable/disable the visibility of all the messages

8.4.1. Progress bar for distributed processing

Distributed processing tasking process is displayed in the progress bar, which (in most cases) immediately closes automatically after the completion of this operation. The **Monitor for distributed processing** is used for further monitoring of the task execution progress and data processing control.

This is a standard way of distributed processing control for *PHOTOMOD*. Distributed processing is usually used when working with large amounts of data, what is quite time-consuming. Use of the monitor for distributed processing keeps *PHOTOMOD* interface available to the user, allowing them to carry on online operation (including another project).

PHOTOMOD interface becomes available after the distributed processing tasks have been created and the progress window is closed.

In some expressly stated cases, the ways of distributed processing control may differ from the described above:

Automatic measurement of tie points

Some methods of automatic measurement of tie points in the distributed processing mode involve the use of a progress bar for step-by-step setting of distributed processing tasks.

See “UAS” and “Feature based correlator” subsections (both for aerial data and scanner imagery) in the “Aerial triangulation” User Manual.

In case of step-by-step distributed processing task setting, the progress bar remains open during the entire operation running, allowing the user to directly monitor the progress of data processing from the *PHOTOMOD* interface without opening the **Monitor for distributed processing**.

In this case, suspending the currently-running operation from the progress window (by clicking the **Pause** button) means pausing the process of creating new distributed processing tasks (at the same time, already created tasks will keep running).

Direct control of each task execution progress is available in the Monitor for distributed processing.

Distributed orthomosaic creation

With distributed orthomosaic creation, the user can customize the progress bar display:

- If the progress bar is displayed only during distributed processing task list creation, the user can keep working in *PHOTOMOD Geomosaic*, simultaneously with the execution of distributed processing tasks;

- If the progress bar is displayed during the entire operation, the user can monitor the progress of data processing in the program interface without opening the **monitor for distributed processing**, but access to the *PHOTOMOD Geomosaic* user interface remains blocked.

  In this case, suspending the currently-running operation from the progress window (by clicking the **Pause** button) means pausing the process of creating new distributed processing tasks (at the same time, already created tasks will keep running)

Direct control of each task execution progress is available in the monitor for distributed processing.

See “Distributed processing” in the “Orthophotomaps creation” User Manual.

9. Prepare to processing

9.1. Data storing

9.1.1. Main definitions of resources system

Resources system is a way to store data with possibility of network distributed project processing. Operator has access for an unified system with all available profiles, nod depends on PC using for storing data and processing. Data could be stored in optimal way for processing a current task.

The following main definitions are used in the resources system:

- *Profile* – independent group of projects relative to one or several projects;
- *Virtual folders* is a virtual names of real local/network folders (hard disks) or group of folders, chosen by user to store profile resources;

One profile could use data placed on several computers.

9.1.2. Profiles and virtual folders

Configuration of resources depends on profile settings. Profile has a virtual name and do not equal to real file system. This name is a common root of the resources tree that connects all branches (resources) profile.

Profile resources could be placed on any workstations and hard disks in a local network.

It is recommended to create one profile for one project or group of projects.

The profile resources system contains all subfolders and files (except `*.meta`-files) of real folder, defined as virtual.

Configuration files that describe a set of local profiles and its structure are stored in the *PHOTOMOD7.VAR folder.*

The Control Panel module is used to create and manage profiles. The *Control Panel module* is used to create and edit profiles, connect virtual folders, create/connect network profiles folder, change active profile and so on.

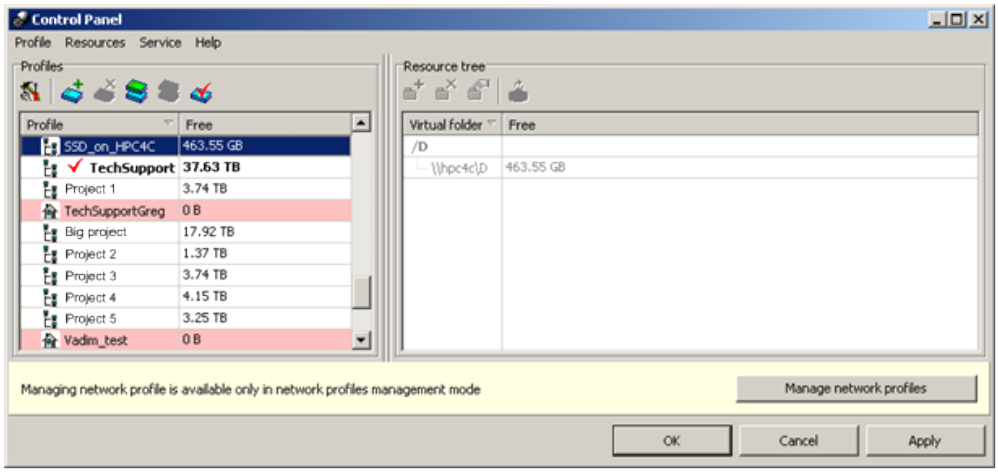


Fig. 63. Control Panel window

The system provides possibility to create and manage local and network profiles.

Profile, available to use only on one PC, is called *local* profile. Local profile is marked with leftward to profile name.

Network profile is available on all workstations in the system to process project at the same time. Network profile is marked with leftward to profile name. When selecting a network profile, its configuration is copied automatically to a local PC to provide independent work if storage is unavailable.

In one session could be used only one active profile. Any local or network profile available profile could be chosen as active.

The *PHOTOMOD Explorer module*is a service module for resources management. All active profile resources are displayed in the module – contents of virtual folders (including subfolders and files). The module also allows to edit resource structure.

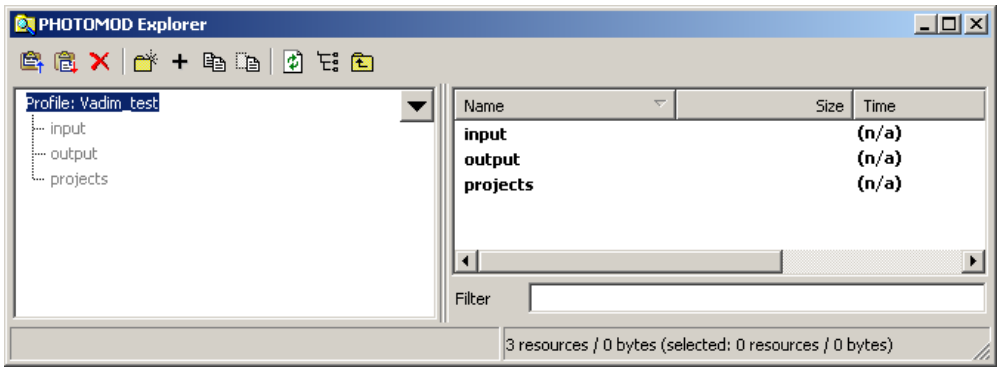


Fig. 64. ' PHOTOMOD Explorer' window

9.2. Profiles

9.2.1. Control Panel. Profiles management

The *Control Panel module* is used to manage profile structures to work in the system.

To launch the system at least *one* profile is required. Creation of profile is performed in the *Control Panel module*.

During the first launch of the system, the **PHOTOMOD initial setup** windows opens that allows to define settings folder and create profile.

Profile separate place for project files. It is a resources tree with the following structure:

- *Root* – profile virtual name.
- *Top level branches* – profile virtual folders – virtual names of physical local or network folders/disks.

  One physical folder could be specified as a virtual folder.

- *Resources* – the whole content of selected folder of a profile – all subfolders and files. Only images source files from active profile resources could be matched with images of current project.

In the Lite-version of the system it is possible to create *only local* profiles and to process project only by *one operator* in one time. In the full version could be created any local or network profiles and organized network processing of project with a lot of operators. In both versions project data could be stored on any computers of the net (including servers).

To launch the *Control Panel module* perform one of the following actions:

- choose **Start › Programs › PHOTOMOD 7 x64 › Control Panel**;

- Choose **Control Panel** in the right-click menu of the *System Monitor module* (the icon in the *Windows* system tray);
- click the button in the **Project management** window in the system (see the Project creation User Manual).

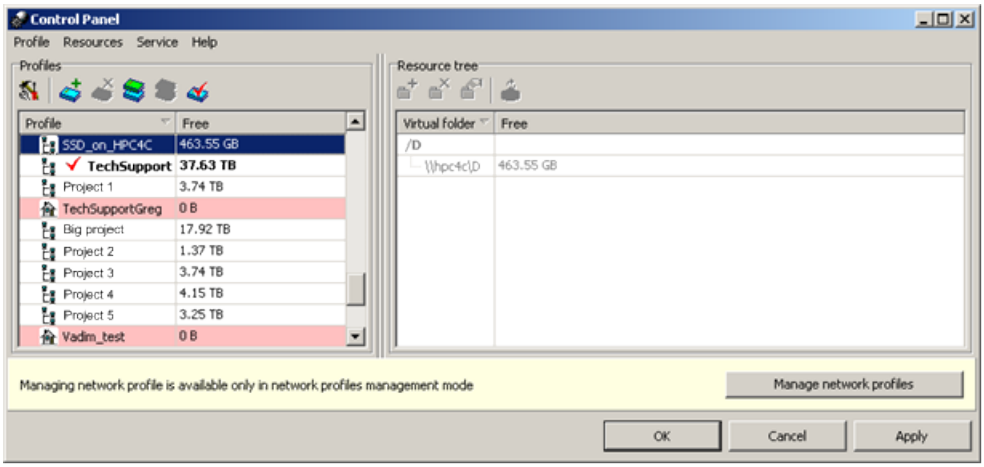


Fig. 65. Control Panel window

Loading progress with a log-file are displayed while module is launching.

If module launches too slowly, remove all incorrect profiles, because delay is due to attempts to access a non-existent folders.

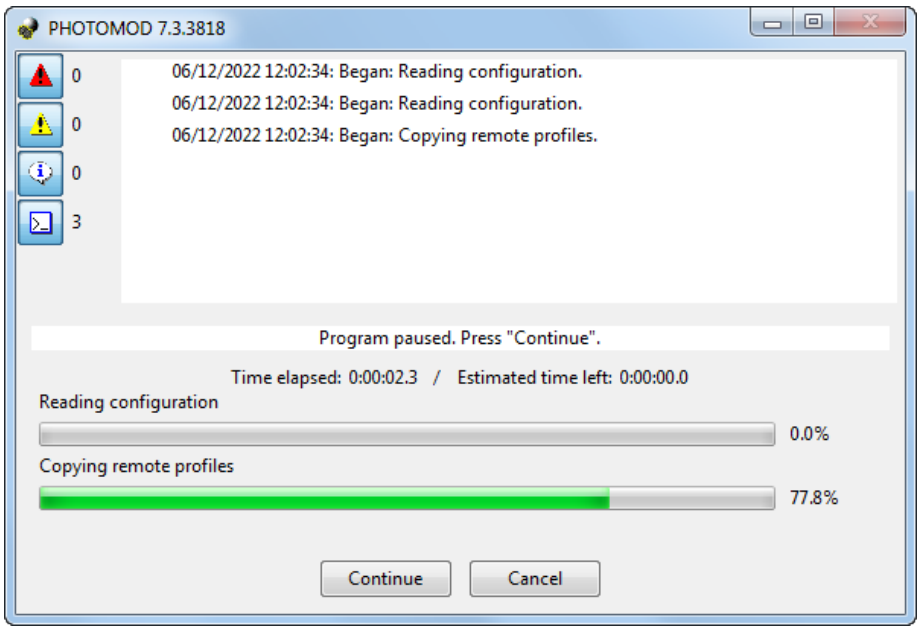


Fig. 66. Control panel module loading

In the *Control Panel module* window the resources system, allowed to work in the system, is displayed. Each profile has resource structure – list of virtual folder compared to real folders on hard disks of different computers in the network used to store system's data.

Only one chosen *'active'* profile could be used at the same time.

Unavailable profiles and profiles with unavailable resources or virtual folders are marked by red color in the table. To remove these profiles from the table choose **Profile › Delete uncorrect profiles**.

Table of profiles with size of common free space of each profile is displayed in the **Profiles** section. Common free space of profile is a sum of free places on all hard disks with connected folders. Profiles could be local or network and marked by different icons in the table. For detailed information see the Creating and connecting profiles chapter.

Table of virtual folders is displayed in the **Resource**. It contains list of real folders, corresponding to virtual folders and information about free space on all involved hard disks.

Points sorting in columns of the list is performed by mouse click on the column header.

If the selected profile is editable in the **Control panel** window (no infotip to go to the **Control Panel – network profiles management** window), double click the appropriate line of the **Resource tree** table to view **Virtual folder properties** (in a separate window).

To copy the physical folder location data from a line in the **Resource tree** table, open the **Virtual folder properties** window and copy data from the **Folder** field.

The system provides possibility of additional placement of project folder in subfolder (e.g. *Projects/InfoMap/InfoMap_copy*). For example, to place project folder in the *InfoMap_copy* folder, create a new folder in the *InfoMap_copy* with ***project.tag*** name. It is possible to place projects in the *projects.tag* folder.

Table 12. Brief description of Control Panel window toolbar and menu items

Buttons and menu items	Function
Service › Initial setup	allows to specify initial settings of access and management of network profiles, which configurations are stored in the centralized management folder
Profile › Create	is used to create the new local profile
Profile › Delete	allows to remove from the table local profile and its resources structure; at fact files and folders *do not delete* and could be used again in new or existed profiles
Profile › Delete uncorrect profiles	allows to remove from the table all profiles (local or network) that are linked to unavailable of nonexistent profiles
Profile › Copy	allows to copy selected profile with its its resources structure and save it with a new name

Buttons and menu items	Function
Profile › Rename	allows to to rename selected profile
Profile › Activate	allows to make selected profile active and use it in the next system's launch
Resources › Connect folder	allows to create virtual folder and connect it to a selected profile
Resources › Disconnect folder	allows to disconnect folder selected in the list from profile; real folder does not changes
Resources › Modify folder	allows to rename virtual folder or change path to its real folder on a hard drive

9.2.2. Creating local profile

Profile, available to use only on one PC, is called *local* profile. This profile is not displayed in the list of profiles on other PCs in the network. Local profile is marked with leftward to profile name.

Perform the following actions to create a local profile:

1. Choose the **Profile › Create** or click the button. The **New profile** window opens.

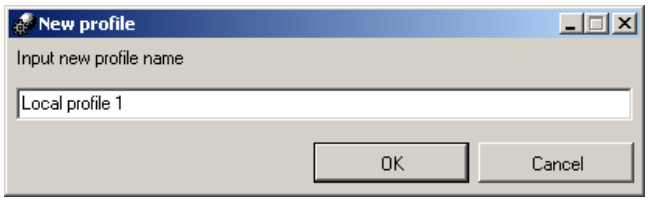


Fig. 67. Creating profile

2. Input a name of new local profile.
3. Click OK. The **Connect virtual folder** window opens.

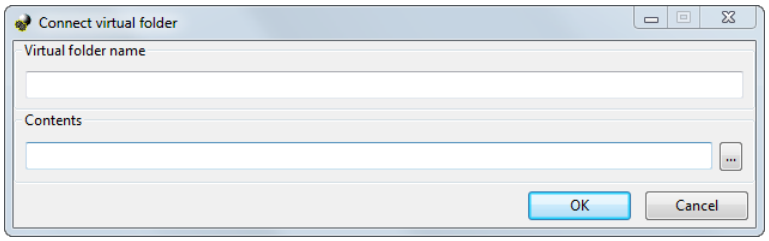


Fig. 68. The "Connect virtual folder" window

4. Define name and path to virtual folder.

It's impossible to use logical disk root folder.

5. Click OK. Local profile creates and also defined virtual folder connects to this profile.

Local profile is marked with leftward to profile name.

6. Make profile active by double-clicking on its name. Leftward to profile name is shown the red mark. It marks an active profile.

Restart all opened modules of the system to apply changes.

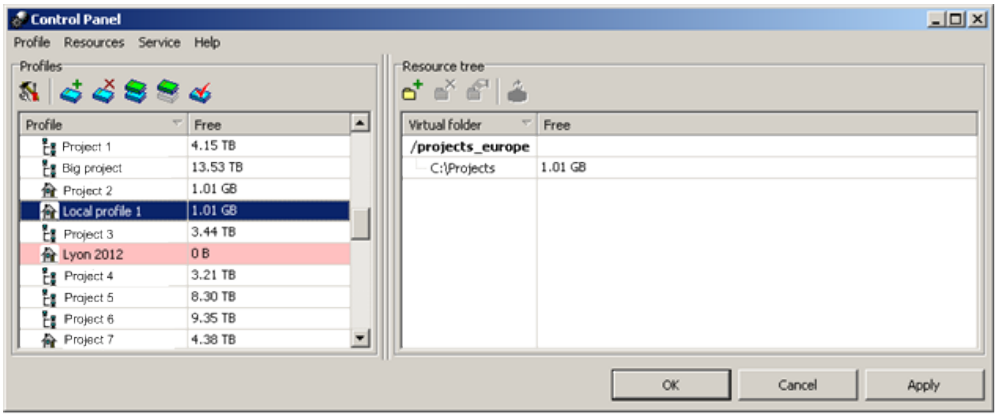


Fig. 69. Control Panel window

7. Click OK.

8. Run the system. All space in active network profile resources is available in the system on a current workstation. The **Project management** window opens allows to choose active or create, copy, remove, import and backup profiles (see the Project creation User Manual)

9.2.3. Connect virtual folder

To connect virtual folder to selected profile perform the following:

1. In the Control panel window choose the **Resources › Connect folder** or click the button. The **Connect virtual folder** window opens.

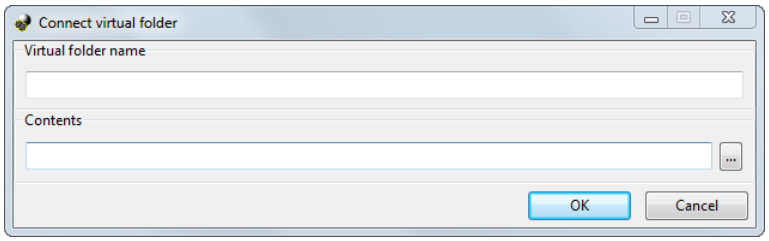


Fig. 70. The “Connect virtual folder” window

2. Input a **virtual folder name** – arbitrary text used to identify data in folder.

3. In **Contents** field click the ... button to choose a physical space for connecting as a virtual folder. Click OK to close the **connect virtual folder** window.

It’s impossible to use logical disk root folder.

To connect folder only read access for this folder is required.

Local profile folder could be placed both on a workstation, where the system runs, and on any workstation of the network.

4. Click OK. Folder connects to the active profile.

To disconnect virtual folder form a local profile, choose **Resources › Disconnect folder** or click the button. At that, physical folder *is not deleted*, only the *virtual folder name* is remove (cleared the path to this folder).

To disconnect virtual folder form a network profile, choose **Resources › Disconnect folder** or click the button in the Network profiles **management**.

When disconnecting the *network* profile it is converted to *local*. *This local* profile is available on all workstation of the network.

9.2.4. Creating network profile

Network profile is available on all workstations in the system to process project at the same time. Network profile is marked with leftward to profile name. When selecting a network profile, its configuration is copied automatically to a local PC to provide independent work if storage is unavailable.

The **PHOTOMOD initial setup** window is used to create/edit network profiles and network profiles accessing. Network profiles are used to process one project with several operators, at the same time as well.

Centralized management folder and network profiles create and adjust only on one of the workstations with installed system.

Perform the following actions to create a local profile:

1. Choose **Control Panel** in the right-click menu of the *System Monitor module* (the icon in the *Windows* system tray). The **Control Panel** window opens.

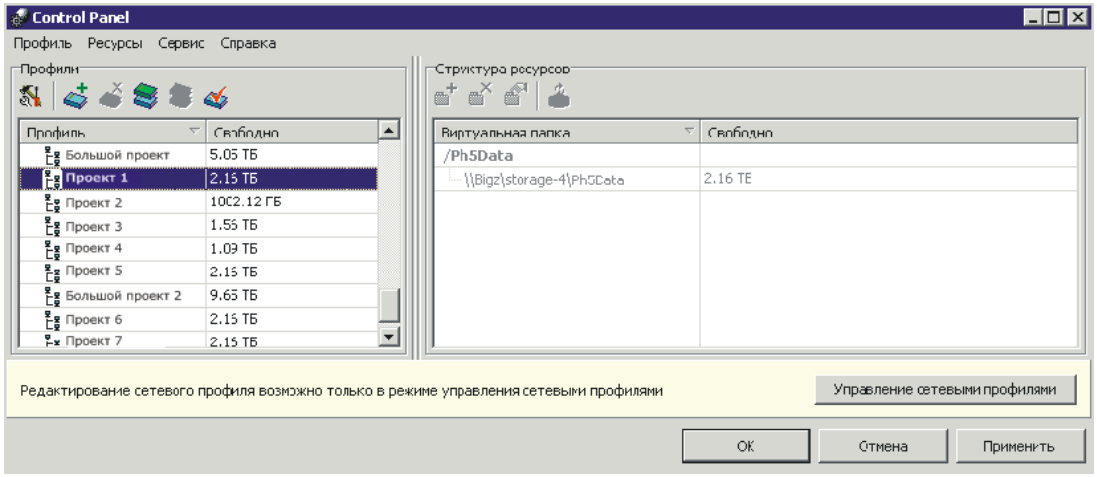


Fig. 71. Control Panel window

2. Click the button. The **PHOTOMOD initial setup** window opens.

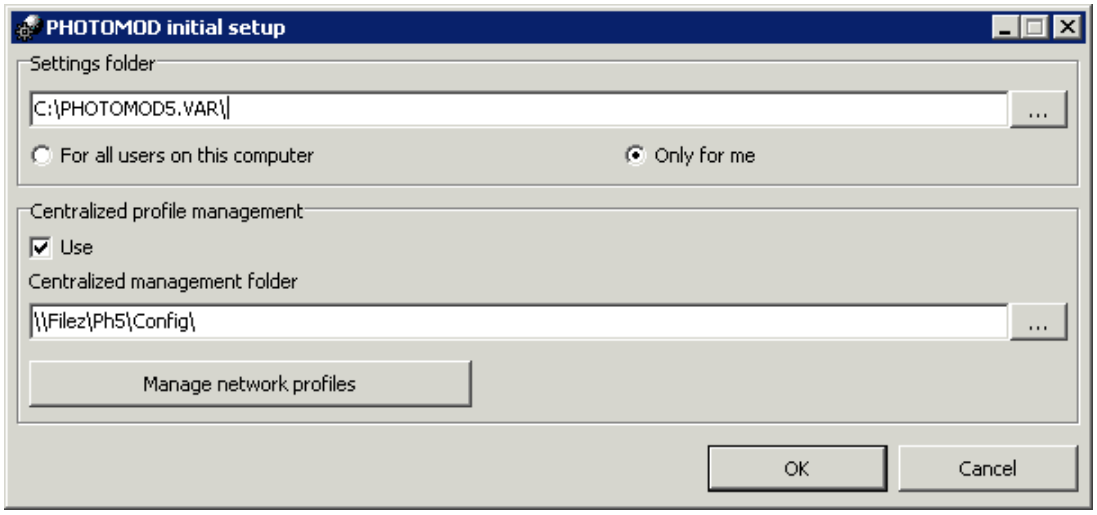


Fig. 72. PHOTOMOD initial setup window

In the **Settings folder** section is displayed path to the *PHOTOMOD7.VAR* folder, that is used to store configuration and temp files. Click the ... button to change path to configuration folder.

Choose **For all users on this computer** to use one configuration folder for all users of current workstation, otherwise choose **Only for me**.

3. In the **Centralized management folder** section set the **Use** checkbox on and define a folder.

4. Click the **Manage network profiles** button. The **Control Panel – network profiles management** window opens.

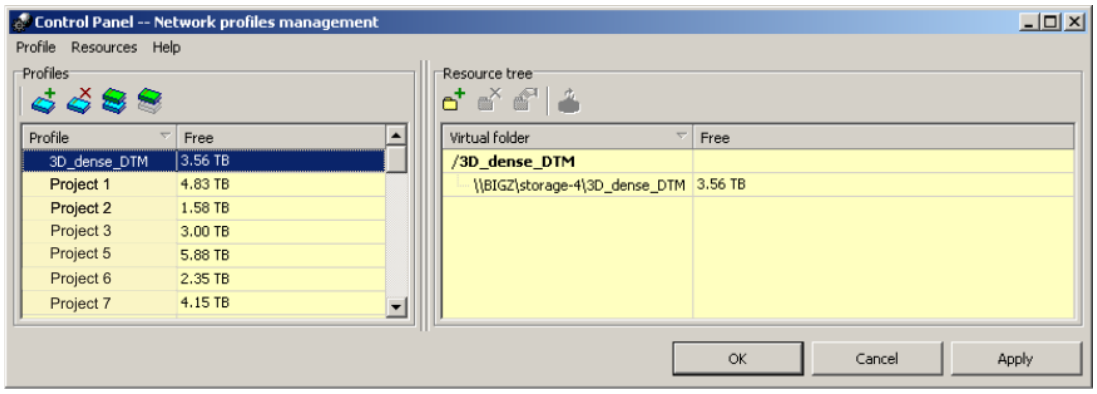


Fig. 73. Network profiles management

5. Click the button. The **New profile** window opens. Input a network profile name for project or independent group of projects. Click OK.

6. In the **Resource tree** section create a resource structure for a new network profile.

Network profiles could be edited/created in the **Control Panel – network profiles management** window the same way as local profiles in the **Control Panel** window. Structure type of local and network profiles are the same.

Network profile could be edited *only in the network profiles management mode*.

7. Click OK. Network profile saves in the centralized management folder. Created profile could be used on a current workplace straight away.

At creation of network profile in a centralized management folder following files creates:

- *profiles.x-ini* file with list of all network profile;
- subfolders with names equal to profile names; they contains files of configuration *profiles.x-ini* profile resources. Each *profiles.x-ini* file (relative to concrete profile) contains description of profile resources structure tree: list of virtual folders and its absolute path to physical folders.

9.2.5. Connecting to existing network profiles

Network profile should be connected to other workplaces to use this profile. Perform the following actions to do this:

1. [optional] On a workstation choose **Control Panel** in the right-click menu of the *System Monitor module* (the icon in the *Windows* system tray). The **Control Panel** window opens. Click the button.

2. The **Initial setup** window opens:

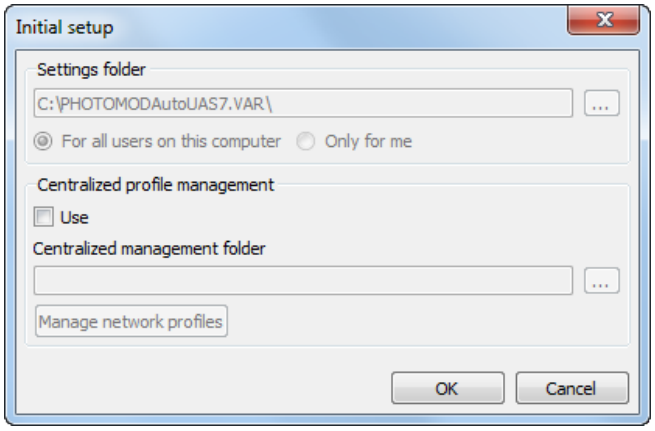


Fig. 74. The “Initial setup” window

3. In the **Centralized management folder** section set the **Use** checkbox on and choose a path to centralized management folder that was defined on a network resource structure creation step.

   During connecting of centralized management folder all network profiles configuration are copied to a local workstation into the *PHOTOMOD7.VAR* folder.

4. Click OK. Network profiles are displayed in the **Profiles** table of the **Control panel** window:

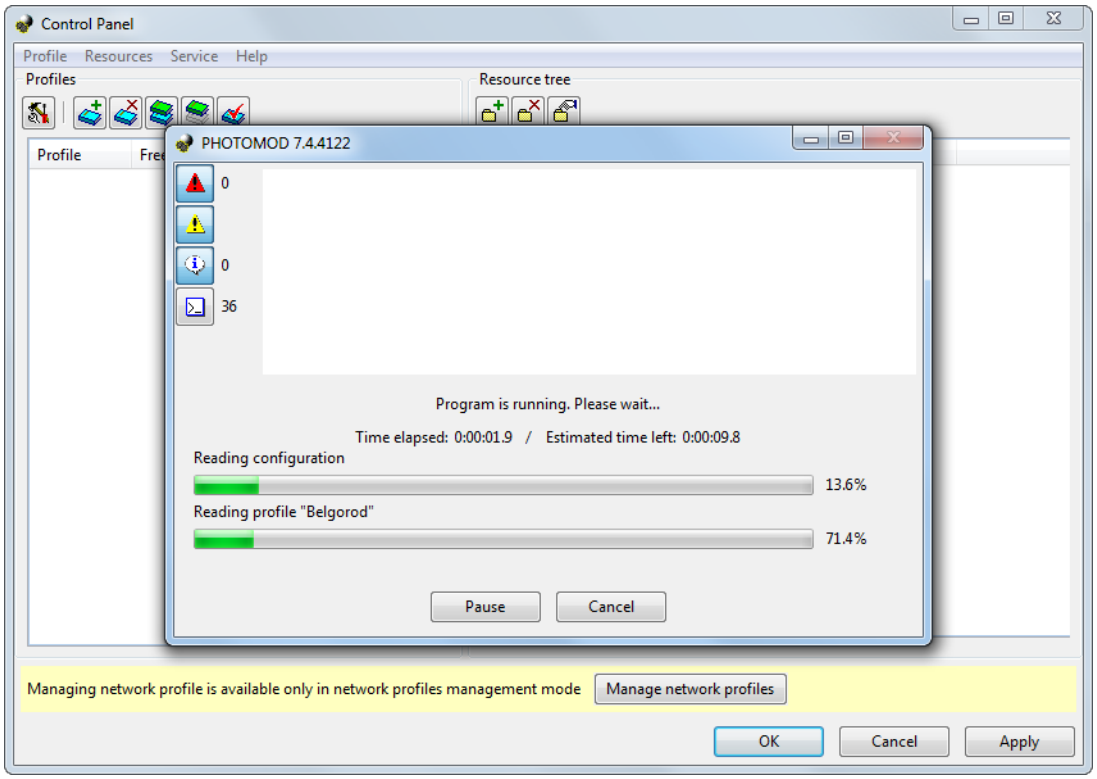


Fig. 75. Connecting to network profiles

5. Make profile active by double-clicking on its name. Leftward to profile name is shown the red mark. It marks an active profile. Click **Apply**.

6. An info message that the system should be restarted appears. Click OK to close the window. Click OK in the **Control panel** window to finish system configuration and restart *PHOTOMOD* program.

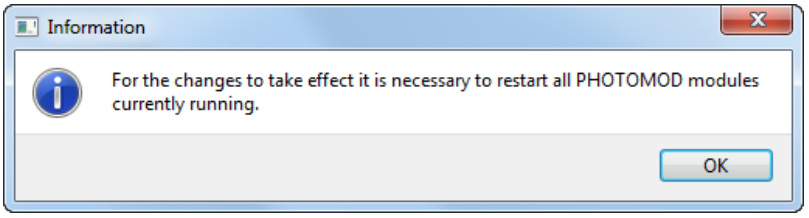


Fig. 76. Information message

7. Wait until the system starts. All space in active network profile resources is available in the system on a current workstation.

8. [optional] Repeat the **2**–**7** steps on other workstations to add access to network profile resources.

9.3. Processing setup

9.3.1. Local processing

The system implements not only local, but network processing of one o several projects at the same time.

When working on a single workstation, and if at the same time with each project is only one operator, it is recommended to create a separate local profile with all the resources for each workstation. It allows to take advantage of the access speed to hard disk compared with access through the network (if the virtual profile folders are located on the server or on another workstation).

9.3.2. Network processing

One of the main features of the system is way to store data and possibility of distributed network processing. Network processing is a joint project processing by several operators at several workstations. For network processing resources could be placed both on workplaces and servers.

Distribution of resources on workstation

Profile resources could be placed on several workstation in a local network. Read and write public access is required for all folders with data.

Any number of profiles could be created in the network.

The following recommendations for the allocation of resources on the network workstations:

- use to store data computers that are not used as a workplace to decrease risks of failed access;
- place resource on different hard disks to most effective use of free space;
- to install hard lock key on a separate computer, which does not has resource-intensive tasks, which can lead to failures in protection and failures of system processing on workstations.

For simultaneous editing of the same files there is always a rule, except for explicit messages and warnings, the rule of *'the last saved data is stored'*.

There is no limitation for browsing, it's allowed to simultaneously open the same project files in any number on multiple computers. In the local OS Windows (XP, Vista, 7) there is a limit in 8 connections.

The best way to organize network-based workflow using network computers to store resources is as described below:

1. Create a centralized management folder on any workstation. Configure read-write network access to that computer.

2. Create network profile in this folder (or multiple network profiles) and setup resources configuration of each profile. Connect the virtual folders.

3. Configure the usage of centralized management folder on the all workstations. All network profiles, for which configurations are stored in central control folder, will be available on workstations (which are displayed in **Control Panel's** profiles list).

4. Choose a network profile and make in active.

5. Restart all opened modules of the system to apply changes.

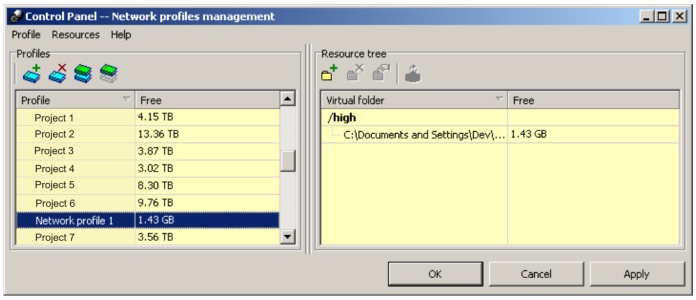


Fig. 77. Example of network profile

Distribution of resources on servers

This option is most appropriate for working with network projects. It is recommended to have dedicated file-servers, which are not used as workstations.

As a file server it is recommended to use *FreeBSD* operating system or *Microsoft Windows Server* and*Linux* OS.

It is recommended to store profile resources in several virtual folders on different servers.

It is recommended to store not more than one virtual folder on one hard disk drive. It provides more uniform load distribution on aggregate bandwidth of disk system of servers and network.

Perform the following actions to create a network profile:

1. In the **Initial setup** window define a centralized management folder.

2. Choose a network profile and make in active.

3. Restart all opened modules of the system to apply changes.

Network access to data is used operation system's tools (network access to folders and files).

There are the following recommendations of network processing management using file servers:

For project or group of projects not more than 1 Tb perform the following:

1. Create a network profile with centralized folder on a server.

2. Allocate hard disk or folder on a server (depending on size of a project) to store data and define virtual folders.

3. Connect created network profile to all workstations involved in the project processing.

4. Restart all opened modules of the system to apply changes.

This data organization is convenient in terms of easy backups (all resources is placed in the same place), and there is no loss in speed while simultaneous processing of small volumes.

If the project (or group of projects) assumes large volumes, it is best to use to place resources multiple file servers; use several different server drives.

It is recommended to allocate resources so that it would be convenient to backup it.

Two strategies of resources allocation on the servers are recommended:

1. Connect different server drives (folders) as virtual folder to store images, and separate server drives to store projects. Administrator involvement is desirable for organization of such structure and to monitor availability of free space on server drives.

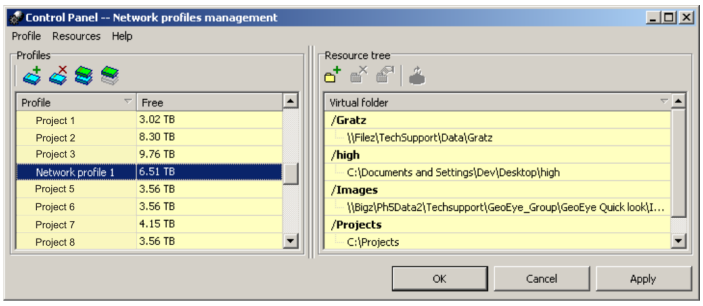


Fig. 78. Example of creating network profile using different server drives to store images and separate network profile for project files

2. Select different server drives (folders) as storages to place images and connect that group of storages to profile, using virtual folder Select separate server drive (s) as virtual folder to store projects.

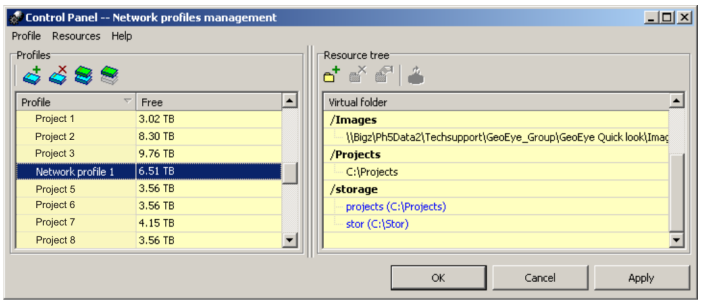


Fig. 79. Example of creating network profile using group of storages for images and separate server for project files

Network data access is only implemented using operating system (network access to files and folders). It is strongly recommended to meet following requirements when network processing is performed:

- network access must be permitted to profile resources with full permissions for all users, who work with them;
- all profile resources connected to workstation should be available while working with the system on this workstation;
- all changes in structure of profile resources, which performed using *Control Panel module*are available for running modules only after restart of these modules;
- if local network contains a server, where profiles are created, it is necessary to control number of users accessing it simultaneously. There are limitations to simultaneous access in non server operating systems *(Windows 2000/XP)*.In this case recommended number of operators working with server storage is not more than 8.
- install hard lock key on a separate computer, which does not has resource-intensive tasks, which can lead to failures in protection and failures of system processing on workstations.

9.4. PHOTOMOD Explorer module. Resources management

PHOTOMOD Explorer module is a service module to work with system resources.

To start the module perform one of the following:

- choose **Start › Programs › PHOTOMOD 7 x64 › PHOTOMOD Explorer**;
- choose **PHOTOMOD Explorer** in the right-click menu of the *System Monitor module* (the icon in the *Windows* system tray);
- choose **Service › PHOTOMOD Explorer** (**Ctrl+Alt+E**) in the main system window.

The *PHOTOMOD Explorer module* is used also during loading data from resources to a project.

The **PHOTOMOD Explorer** window opens and displays active profile resources.

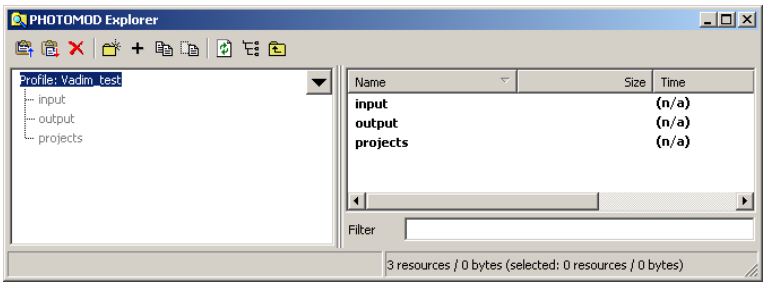


Fig. 80. The ' PHOTOMOD Explorer' window

System resources include projects, cameras data, images and other.

List of projects is presented in hierarchical form and displays in the left part of window. Upper level is a virtual folders.

The button allows to show a list with 10 recently selected resources.

In the right part of the window resources of selected project are displayed. Resources are displayed as a table with the following rows:

- **Name** – name of file or project's subfolder;
- **Size** – [for files only] file size;
- **Time** – time of the last change;
- **Path** – real path to folder or file in a workstation.

Points sorting in columns of the list is performed by mouse click on the column header.

Double-click on file name of TIFF, MegaTIFF or JPEG files allows to open file in a viewer.

Full path to selected folder is displayed in the left status bar, in the right one – resource statistics: `number of resources/their size (selected resources/size)`.

The **Filter** field is used to quick search files in the system profile resources.

Table 13. Brief description of the PHOTOMOD Explorer window toolbar

Buttons	Function
	allows to copy selected resources to clipboard

Buttons	Function
	allows to paste resources from clipboard
	allows to remove selected resources
	allows to create new physical folder in the active profile resources New physical folder couldn't be created on a virtual folder level.
+	allows to connect new virtual folders
	allows to copy resource
	allows to rename resource selected in the right part of window
	allows to refresh window
	allows to display all resources in all subfolders of selected folder, or entire profile. The list on the right side of the window shows all subfolders, and all files of selected folder and path to them
	allows to move one level up in resources tree

The tools should be used carefully to edit resource structure in **PHOTOMOD Explorer** window in order to avoid loss of needed resources, belonging to project (delete, rename or move configuration files of projects, etc.).

In PHOTOMOD Explorer window, it's possible to connect new virtual folder only to local profile. Use Control Panel for network profile.

All changes of connecting new virtual folders in the *PHOTOMOD Explorer module*are displayed automatically in the *Control Panel module*window. The *PHOTOMOD Explorer module* does not provide possibilities to edit or disconnect virtual folders, The Control Panel module is used for this.

Right-click on file name or subfolder in the right part of **PHOTOMOD Explorer** window opens the context menu.

Table 14. Brief description of right-click menu items

Menu items	Function
Open in default program (**F3**)	allows to open file in proper program or choose it manually
Open in file explorer	allows to open file location in *Windows* file system
View as text	allows to open file in a text editor
View in external editor (**F4**)	allows to open file in default external editor defined with **Editor settings** menu item. By default is used included *FAR Manager*
Edit metadata (**Ctrl+F4**)	allows to edit metadata of selected file
Editor settings	allows to choose external editor to use by default. Filename in the command line is specified as %1 and in majority of cases should be enclosed in quotes.
Copy (**F5**)	allows to copy file or folder

Menu items	Function
Rename (**F6**)	rename the resource, except virtual folders
Delete (**F8**)	delete selected resource
Create folder (**F7**)	allows to create *new physical folder* in the active profile resources
Copy to clipboard (**Ctrl+C**)	allows to copy resource resource identifier to clipboard so that it can be copied to another folder with the command Paste from clipboard
Paste from clipboard (**Ctrl+V**)	create a copy of a resource (whose identifier has been saved to clipboard with the Copy to clipboard command above) in the current folder
Refresh (**Ctrl+R**)	allows to refresh windows contents in case of changes in start of *PHOTOMOD Explorer module*
Select all (**Ctrl+A**)	allows to select all resources in the right window
Size in compact format	allows to show resource sizes in human-readable form (e.g. '1 MB') instead of strict number of bytes (e.g. '1048576 b');

The system do not allow the user to **Copy** (using context menu tools) DEMs and orthophotos in **PHOTOMOD MegaTIFF** (`*.prf`) format located in active profile resources. To copy a DEM, choose **Terrain › DEM › Save copy**.

9.5. System Monitor service module

After the system installation *System Monitor* module is launched and in the system tray of *Windows* the  icon displays.

The **Start › Programs › PHOTOMOD 7 x64 › PHOTOMOD System Monitor** menu item is used to start the module.

It is also possible to start module from a command line. Use *--profile='*profile_name' key when launch the run the module from command line to run profile with active profile, defined in a key. Last active profile is used if module runs without key.

It is not possible to change active profile when module is launched from a command line.

Module right-click menu contains the following menu items:

- **PHOTOMOD** – is used to launch the system (also double-click on the  icon);
- **PHOTOMOD UAS** – is used to launch the *PHOTOMOD UAS* program (see the "Processing of UAS data" User Manual);
- **Explorer** – allows to run module to view active profile resources (see Section 9.4);
- **Control Panel** – allows to run module for resources system management;

- **Raster Converter** – allows to run module used to convert raster images (see Section 10);

If these modules run with a *System Monitor module* the *active* profile is used. If these modules run from the main system's window, is used the *current* profile.

- **GeoMosaic** – allows to run the *GeoMosaic* program that is used to create georeferenced orthoimages (see the Orthophotomaps creation User Manual);
- **3D-Mod** – allows to run module fr creation 3d-objects based on 2D-vectors;
- **Distributed processing control center** – allows to setup options and to control distributed processing;
- **Start automatically** – with start of *System Monitor module* **Distributed processing control center** starts automatically;
- **Profile** – allows to select an active profile in the list of local (h) and network (R) profiles;
- **Language** – allows to change the interface language;

Language changes at restart modules. To change the *System Monitor* language also restart the module.

- **Mouse configuration** – allows to setup a configuration of mice or other special devices (like hand wheels/foot pedals), which are used for images stereo processing (see the chapter Mice and hand wheels adjustment for stereo processing);
- **Log cleanup settings**;
- **About** – opens a window indicating the number of system build and serial number of hard lock key, the technical support end date, and also opens the **System Information Panel** window with detailed information about software, hardware configuration, and components of the computer (such as details about the device drivers);
- **Licence info** – opens a window with information on system's modules configuration and hard lock key ID;
- **News** – opens the embedded browser window for quick link to www.racurs.ru news;
- **Automatic download for news** – allows for enabling () or disabling automatic download data on unread news on the www.racurs.ru website;
- **Exit** – allows to close the *System Monitor module* and close the system.

10. Raster Converter source images preparing

Raster Converter is a service system module that could be used to batch and sequence convertation of raster files to inner MS-TIFF format with LZW or JPEG conversation or without it and to convert MS-TIFF images to different formats.

In case of processing amount of images places on different data medium and take much disk space, it is recommended to preliminary prepare raster images with module before creation of a project.

10.1. Raster images convertation

For working with images in program , it is recommended to use MS-TIFF internal raster format, which is the TIFF format with overview pyramid (set of subsampled images copies) for higher image display performance.

The system allows the direct use of various formats of raster images (without having to convert them). It saves the disk space, but slows down significantly operations with images, so it is strongly recommended to use raster images in MS-TIFF format.

PHOTOMOD software supports already existing third-party image pyramids, if available (`*.ovr`).

To start the module perform one of the following:

- choose **Start › Programs › PHOTOMOD 7 x64 › Raster Converter**;
- choose **Rasters › Raster Converter**;
- choose **Raster Converter** in the right-click menu of the *System Monitor module* (the  icon in the *Windows* system tray).

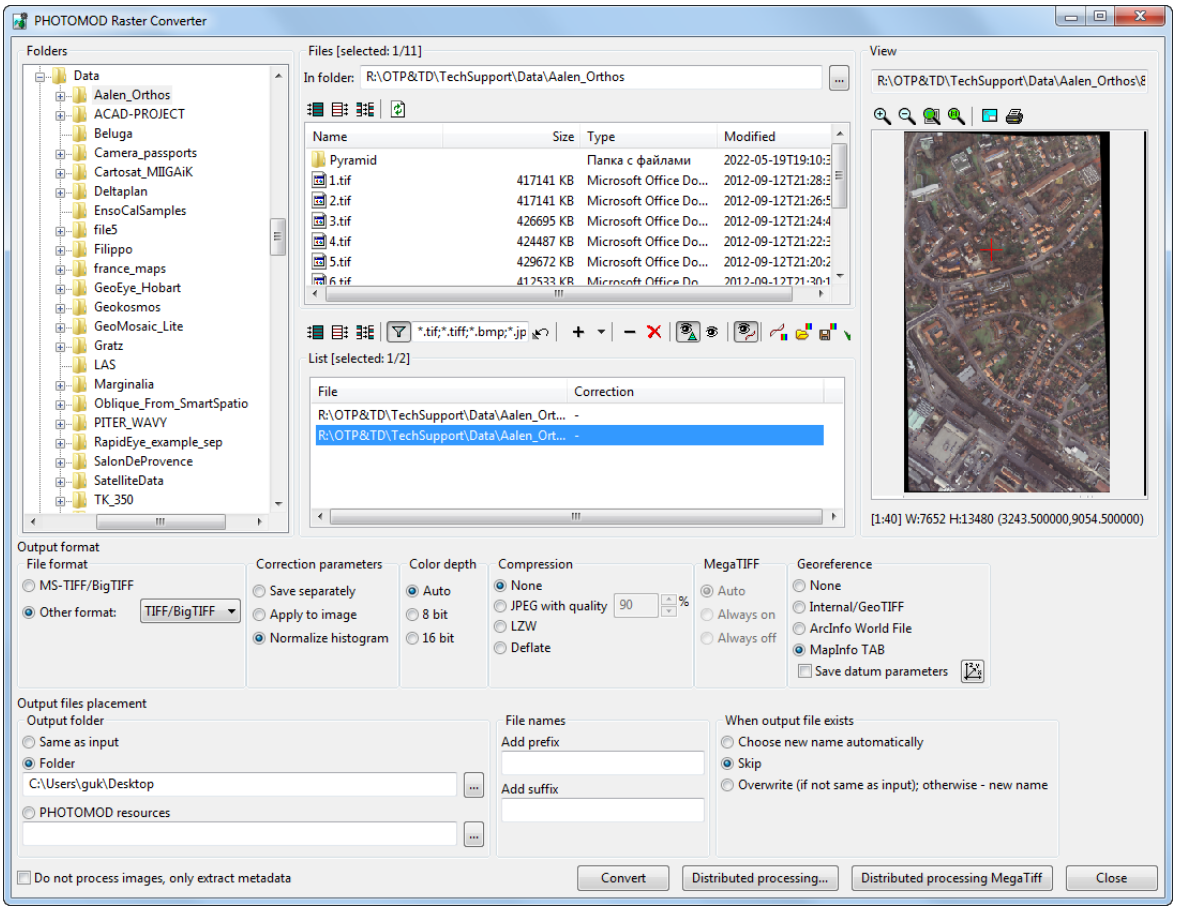


Fig. 81. Raster converter window

The module allows to perform the following processes:

- to convert images in different raster formats to an interior MS-TIFF format;
- to convert images of interior MS-TIFF format and other raster formats to TIFF-files;
- to convert 8 or 16-bit images;
- to convert images without compression or with JPEG or LZW compression;
- to convert raster images with size more than 4 GB to a MegaTIFF-files;
- to perform radiometric correction to improve visual properties of images;
- to convert into a defined folder in Windows file system or in active profile resources;
- to use distributed processing for convertation.

The Raster Converter window contains the following main sections:

- **Folders** – is used to display a folder tree;

- **Files** – is used to display raster files in selected folder and subfolders;
- **List** – is used to display a list of raster files, chosen for convertation;

In the title of **Files** and **List** section is also displayed *[number of selected\all files].*

- **View** – is used to preview display selected raster file;
- **Output format** – allows to define format and parameters of an output file;
- **Output files placement** – allows to define a folder for output files, their names and actions in case of output file already exists.

Module supports the following raster formats of input files:

- Tag Image File Format (`*.tif`, `*.tiff`) – TIFF and GeoTiff formats, included tags for saving of georeferenced information;
- PHOTOMOD MegaTIFF (`*.prf`) – is used to store voluminous TIFF images. MegaTIFF format is a set of following files: `*.prf` and files of MS-TIFF format images placed to folder which has a name of source file;
- Windows Bitmap File (`*.bmp`);
- VectOr Raster Maps (`*.rsw`) – images of *PHOTOMOD VectOr*;
- ERDAS IMAGINE (`*.img`) – *ERDAS* system raster format;
- NITF (`*.ntf`);
- JPEG (`*.jpg`, `*.jpeg`);
- PNG (`*.png`);
- USGS DEM (`*.dem`);
- PCIDSK (`*.pix`) – raster format with georeference in the heading developed by *PCI Geomatics* company;
- Enhanced Compression Wavelet (`*.ecw`) – is the raster file format optimized for storing aerial and satellite images;
- IIQ (`*.iiq`) – is the RAW file format for data obtained using the equipment by *Phase One*;
- BIL (`*.bil`, band Interleaved by line) – is the raster format for storing multi-band data;

- JPEG2000 (`*.jp2`) – raster format with jpeg compression and georeference in the heading developed.

The limitation on output file size of JPEG2000 format – no greater then 500 Mb.

The system allows to create JPEG2000-files with size more than 500 Mb. To do that, in the **MegaTiff** section choose **Auto** or **Always on**.

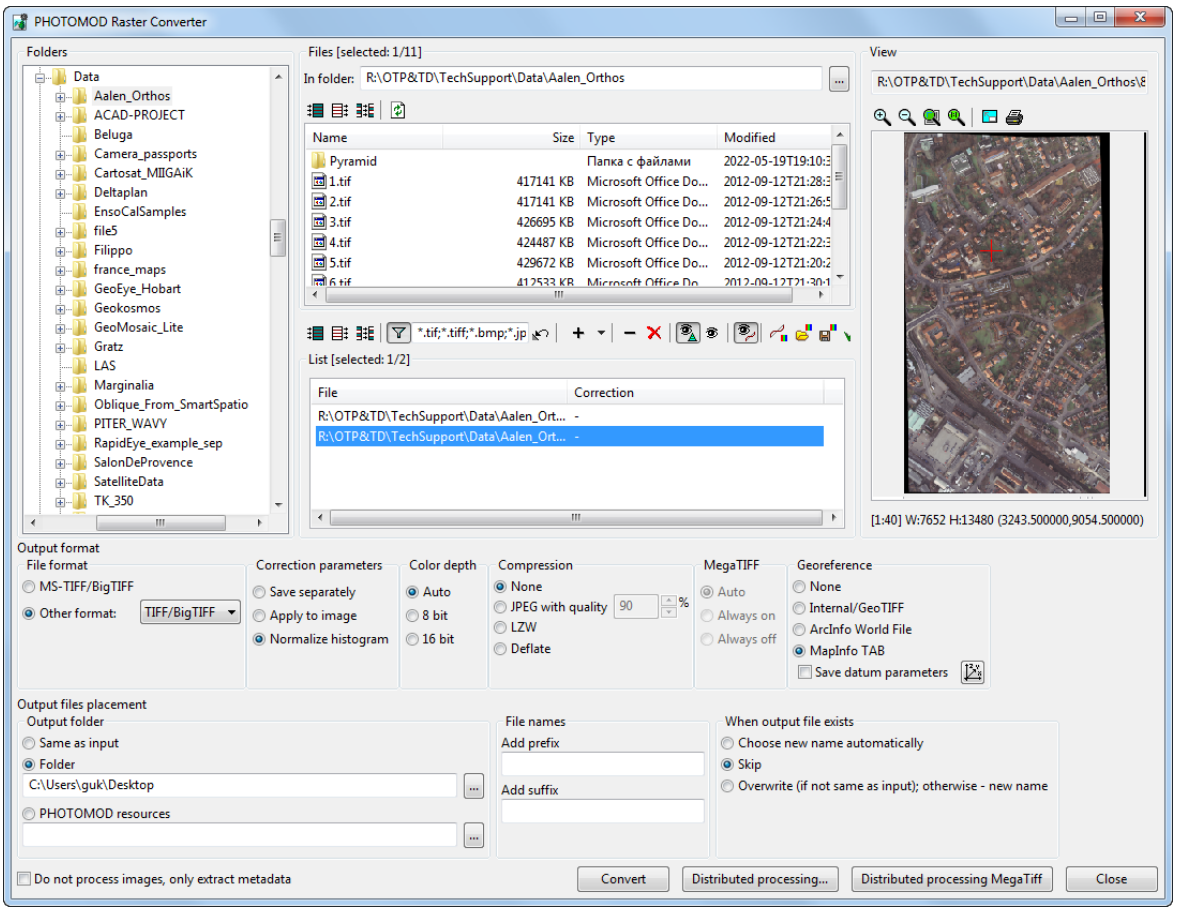


Fig. 82. Raster converter window

The following buttons in the **Source** section allows to select images source files:

- – allows to select all files;
- – allows to unselect all files;
- – allows to invert files selection;
- – allows to refresh lists of files and folders in case of changing in file structure while module is launched.

Table 15. The 'List' section toolbar

Buttons	Function
	allows to select all files
	allows to unselect all files
	allows to invert files selection
	allows to enable display only source images of acceptable raster formats (see above). Filter is enabled by default. The system allows to set the filter parameters manually in the field to the right of the button
	allows to restore filter settings to default values
+	allows to add to the list images files selected in the Files section
−	allows to remove selected images files from the list (they are not removed physically at that)
	allows to remove all images files from the list (they are not removed physically at that)
	allows to enable display of selected images with created pyramid in the View window (enabled by default)
	allows to enable display of all images in the View window with automatic creating of temporary pyramid (in case of its absence)
	allows to enable display of images with radiometric correction applied (enabled by default)
	allows to perform radiometric correction of image selected in the list
	allows to load radiometric correction parameters from a `*.rmc` file
	allows to save radiometric correction parameters of selected image to `*.rmc` file
	allows to save radiometric correction parameters of each selected image to its own `*.rmc` file
	allows to perform the autolevels for selected images without opening the Radiometric correction window
	allows to create the pyramid
	allows to create the pyramid (distributed processing)

The **View** section contains the image view window and toolbar with the following buttons:

-  – allows to zoom in an image by one step (*);
-  – allows to zoom out an image by one step (/);
-  – allows to fit to page data of opened layers (**Alt+Enter**);

-  – allows to display data in 1:1 scale, when one pixel of the image corresponds to one pixel on the screen;
-  – allows to open image on full screen;
-  – allows to setup report printing parameters.

To show/hide scroll bars in the View window is used the **Ctrl+F8** hotkeys.

In case of low visual properties of source image, in the *Raster Converter* module could be performed image radiometric correction.

The **Output format** section is used to define the following output parameters:

- The **File format** section allows to specify output files format:
  - **MS-TIFF/BigTIFF** – interior MS-TIFF format (chosen by default);
  - **Other format:** – allows to select other output files format in drop-down list.
- To perform radiometric correction, choose the following actions in the **Correction parameters** section:
  - **Save separately** (recommended) to save parameters of radiometric correction of images into separate `*.rmc` files. In this case just geometric transformations (rotation-flip) are applied to rasters directly;

    At that the image is displayed in the system with all defined parameters of radiometric correction.

  - **Apply to image** to apply radiometric correction to the image directly without possibility to cancel radiometric transformations applied.
  - **Normalize histogram** is used only to apply histogram normalization automatically (to correct white color level).

    If a source image has more than three channels, it is recommended to perform histogram normalization without radiometric correction in order to obtain output orthophoto with the same number of channels and color depth. In case of creating orthophoto, set off the **Use radiometric correction from project** checkbox in the **Output image parameters** window (see the "Orthorectification" User Manual).

- **Color depth** – **Auto**, **8 bit** or **16 bit**.

If color depth of source image is less or equal 8 bit, then color depth of output image (with the Auto option selected) will be 8 bit, otherwise, 16 bit.

- **Compression** – allows to choose type of compression: without compression (**None**), **JPEG/JPEG2000** with specified quality or **LZW** and **Deflate** without quality loss; In case of using **JPEG/JPEG2000**-compression, define qualiti ty of compression in percent.

  By default compression level is 80%, that allows to reduce images size in 5-7 times. In most cases it does not cause loss of accuracy while the adjustment, and also allows to save storage space.

  This type of compression is applied to output images of MS-TIFF format only.

- In the **MegaTIFF** section define format to convert voluminous images:

  MegaTIFF format is a set of following files: `*.prf` and files of MS-TIFF format images placed to folder which has a name of source file and is created after conversion in specified target folder.

  To limit file size included to MegaTIFF files set, choose **Service › Settings › System** and specify the **Maximum tile file size within MegaTIFF**. Upper limit of file size – 8 192 MB; file size by default – 1 024 MB.

  To convert image in to MegaTIFF format, choose one of the following:

  - **Auto** (by default) for automatic identification of output format depending on source image size: MegaTIFF only if the size is more than 2 GB; otherwise – MS-TIFF format;
  - **Always on** to convert source images to MegaTIFF regardless of their size;
  - **Always off** to convert source images to MS-TIFF regardless of their size. Images with more than 4 GB size are displayed incorrectly in the system.

- In the **Georeference** section specify source files format with georeference:

  - **None** – in case of no georeference files;
  - **Internal/GeoTIFF** – to create GeoTIFF file;

    The **Save datum parameters** checkbox allows to save seven parameters of coordinate system to meta data of TIFF-file.

  - **ArcInfo World File** – to create file in chosen format with ArcInfo georeference;
  - **MapInfo TAB** – to create file in chosen format with `*.tab` georeference file.

    Button  button is used to choose coordinate system of georeference file.

To convert raster image perform the following:

1. Select folder in the **Folders** section or click the ... button in the **File** section for choosing folder.

2. Select image in the **File** section and click the + button to add selected files from the **Files** section to the **List** section.

   The 'down arrow' button on the right of the + button allows to open menu used to perform one of the following actions:

   - **Add all from the current folder**;
   - **Add all from the current folder and subfolders**;
   - **Add satellite images**;
   - **Merge channels from files**.

   The *Raster Converter* module allows to create s to form a list of files located in different local/network folders, as well as on different media.

3. [optional] To display raster images in a **View** section or in the **Raster Converter** window pyramid of selected image is required. Temporary pyramid is build automatically, when you choose file without pyramid in mode of all images displaying. At that, in the folder with source file creates the *\Pyramid* folder with pyramids.

   To create temporary pyramid for image displaying, click the button.

4. [optional] Perform the image radiometric correction. To perform radiometric correction without additional settings click the button. The **Auto levels** window opens.

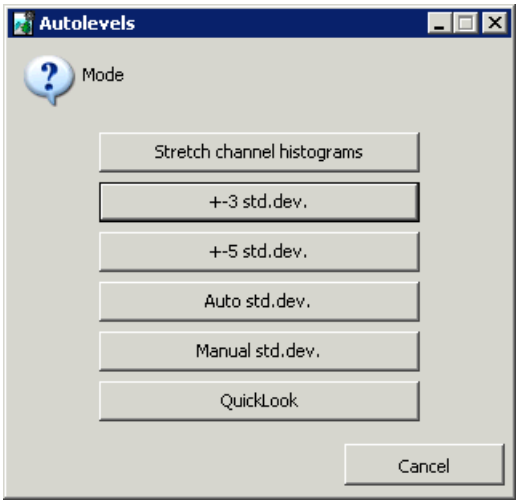


Fig. 83. Selecting image correction mode

The following types of correction are displayed in the window:

- **Stretch channel histogram** – allows to spread histogram evenly, separately in each channel;
  - Set the **Trims left and right** – area of histogram (in percent) which will not consider in stretching of histogram.
- **+-3 std. dev.** – allows to cut histogram area out of 3 standard deviations;
- **+-5 std. dev.** – allows to cut histogram area out of 5 standard deviations;
- **Auto std. dev** – allows to exclude light-exposed areas on image;
- **Manual std. dev.** – allows to cut histogram area out of specified number of standard deviations;
  - Set the value of deviation each pixel from 'average' in the **Standard deviations** field.
- **QuickLook** – allows to use brightness from RSD files.

Processed channels are **Red**, **Blue**, and **Green**. The channels are identified according to the channel order displayed (or user defined) in the **Channels** window. Additional channels are processed using the average **QuickLook** histogram.

5. Specify necessary parameters in the **Output format** section.
6. In the **Output files placement** define an **Output folder** to save converted images:
   - **Same as input**;
   - **Folder** – *Images* folder in the *Windows file system*;

It is strongly not recommended to place image files in the root project folder (e.g., */Projects/InfoMap*).

   - **PHOTOMOD resources** – folder in the active profile resources.
7. [optional] In the **Add prefix** and/or **Add suffix** of the **File names** section define arbitrary symbols to add to image file names.
8. Define actions if files with the same names exist in the target folder:
   - **Choose new name automatically** – new name automatically generated from a template '*Name [i].Ext*', where '*Name.Ext*' – name obtained in the previous step, and *i* – the serial number;

- **Skip** – allows to skip or not rewrite image;
- **Overwrite (if not same as input); otherwise – new name** – overwrite, if the target file in a folder does not coincide with an input or generate a new file name automatically if they match.

9. [optional] Set the **Do not process images, only extract metadata** checkbox on to update metadata of aero/satellite images or to display metadata in existed project.

10. [optional] In order to start distributed processing perform the following actions:

To process images correctly, it is strongly not recommended to choose files on a local PC (in this case the system will display a warning that the input file list contains local paths)..

It is recommended to use the distributed processing mode to convert a big number of relatively small images. To work with more than 3 GB images it is recommended to use MegaTiff distributed processing (see below).

1. Change settings and run the distributed processing server/client (see the "Distributed processing" chapter).

2. Click the **Distributed processing** button. The **Distributed image conversion** window opens.

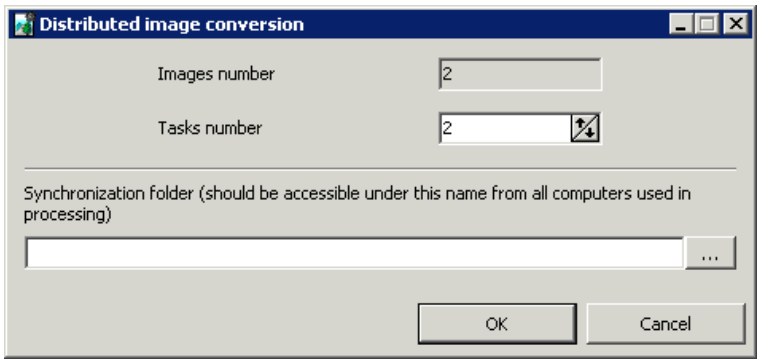


Fig. 84. Distributed image conversion parameters

3. Set the distributed processing **Tasks number**.

It is recommended to define number of tasks depending on computer power and hardware, but not more than *five* tasks.

4. Define a **Synchronization folder**, available on all using PC, for storing temporary folder.

5. Click OK to create distributed processing tasks.

11. [optional] For distributed transformation of the selected images into **MegaTiff** format, perform the following:

To process images correctly, it is strongly not recommended to choose files on a local PC (in this case the system will display a warning that the input file list contains local paths).

To work with more than 3 GB images it is recommended to use MegaTiff distributed processing. To convert a big number of relatively small images it is recommended to use common distributed processing mode (see above).

To limit image files size included to MegaTIFF files set, choose **Service › Settings › System** and specify the **Maximum tile file size within MegaTIFF**. Upper limit of file size – 8 192 MB; file size by default – 1 024 MB.

1. Change settings and run the distributed processing server/client (see the "Distributed processing" chapter).

2. Click the **Distributed processing MegaTiff** button. The **Distributed processing MegaTiff** window opens.

   The window displays the **Number of images** (the number of files in the list for conversion) and the **Number of MegaTiff fragments** (is calculated automatically and depends on initial image sizes);

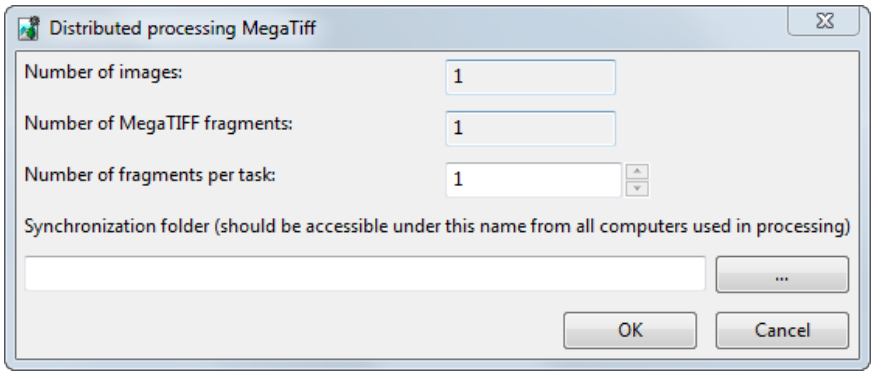


Fig. 85. MegaTIFF distributed processing parameters

3. Set the **Number of fragments per task**;

It is recommended to define **Number of fragments per task** depending on computer power and hardware. Recommended **Number of MegaTiff fragments** / **Number of fragments per task** ratio is no more than 1000.

When setting distributed processing, it is also necessary to take into account the network capacity. For example, for 1 Gbit/s local network the recommended **Max tasks** is no more than 4.

To set **Max tasks** quantity choose **Service › Distributed processing › Monitor** and press the button (see the "Distributed processing" chapter).

4. Define a **Synchronization folder**, available on all using PC, for storing temporary folder.

5. Click OK to create distributed processing tasks.

12. Click **Convert** to start the operation.

10.2. Radiometric correction

Images radiometric correction – means improvement of visual features of initial images.

Their insufficient quality may be due to the peculiar properties of the optical path of surveying devices, radiant energy converter, analog-digital converter, etc. For example, in case of 16-bit image, that looks plain black on a screen, you have to perform histogram correction.

Images radiometric correction could be performed on different stages of project processing, for example:

- on stage of initial images preparation in the*Raster Converter* module;
- on stage of images loading from files, located out of profile resources, including loading of satellite scanner images, as well as ADS 40/80/100 scanner images;
- on stage of block forming from project images;
- on stage of project images setting in the *ImageWizard module*.

The **Radiometric correction** window is used to perform radiometric correction of selected image.

Perform one of the following to open the **Radiometric correction** window:

- click the button or the **Radiometry** button;
- choose the **Block › Image radiometric correction**.

Table 16. The toolbox of 'Radiometric correction' window

Buttons	Function
	allows to load radiometric correction parameters from a `*.rmc` file
	allows to save radiometric correction parameters of image to `*.rmc` file
	allows to zoom in an image by one step (*****)
	allows to zoom out an image by one step (*/*)
	allows to fit to page data of opened layers (**Alt+Enter**)

Buttons	Function
	allows to display data in 1:1 scale, when one pixel of the image corresponds to one pixel on the screen
	allows to change the channels order
	allows to perform the channel transformation
	allows to perform the radiometric correction
	allows to edit curves
	allows to change brightness, contrast and gamma of image
	allows to edit color balance of the image
	allows to apply filters
	allows to apply geometric transformation (rotate, reflection)
	allows to cancel all actions (up to 10 last actions)
	allows to undo the last action
	allows to redo the last undone action
	allows to view raster image histogram (see the “Raster image histograms” chapter in “Creating project” User Manual)

Perform the following actions for radiometric correction:

1. Select image in the **List** section in main window of the *Raster Converter*module.

2. Click the  button or double click the strip name in the list. As a result, *temporary pyramid* for faster refresh of image creates and the **Radiometric correction** window opens.

Temporary pyramid is placed in the *\Pyramid* folder inside of folder with source images. To display images in scales differing from 1:1, required amount of free place on chosen hard disk to store temporary pyramid’s files.

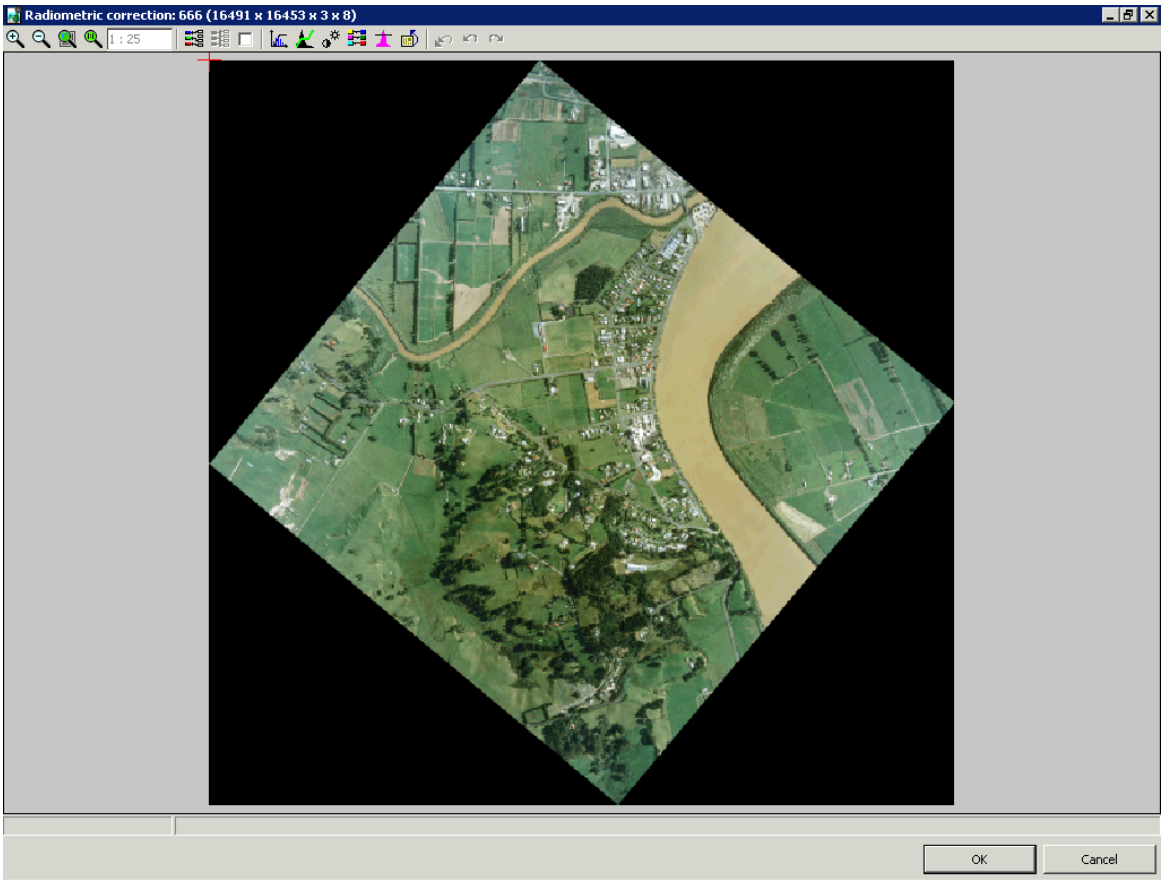


Fig. 86. The 'Radiometric correction' window

Name, height, width and byte per pixel of image are displayed in the title of the **Radiometric correction** window. Coordinates of marker and brightness are displayed in the status bar of window.

3. It is recommended to perform autolevels setup for 16-bit image. Otherwise it is displayed with black color.

If bytes per channel more than 8, histogram of images stretches for full brightness range separately on each channel.

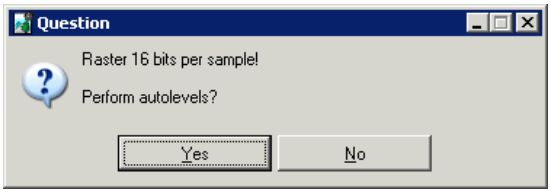


Fig. 87. Requirement to perform radiometric correction

4. Click the **Yes** button. The **Auto levels** window opens.

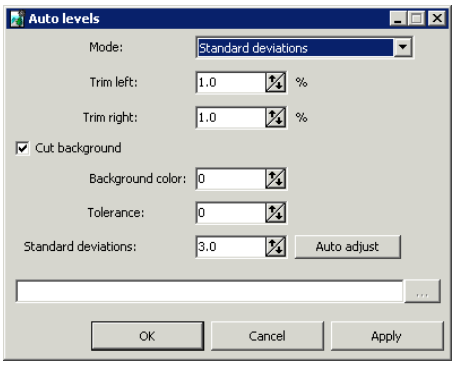


Fig. 88. The 'Auto levels' window

5. Setup parameters of correction (see below) and click OK. Image radiometric correction is performed.

Generally, it is suffices in the **Standard deviations** mode specify the **Standard deviations** value or click the **Auto adjust** button to correct image automatically.

The system allows to save radiometric correction parameters to `*.rmc` files in order to apply these parameters to other images. Perform the following actions to do this:

1. Select image in the **List** section in main window of the *Raster Converter* module.
2. Setup parameters and perform radiometric correction of selected image.
3. Click the button and define a folder to save radiometric correction parameters in file with `*.rmc` extension.

To save radiometric correction parameters in folder with source image, click the button.

4. Choose image for correction in the list.
5. Click the button. The **load correction parameters** window opens.
6. Choose parameters file file and click OK. Correction parameters apply to selected images.

Perform the following to change the number of channels and the channel's order of output image:

1. In the **Radiometric correction** window click the button. The **Channels** window opens.

The first order of channels is set depending on their order in the source image.

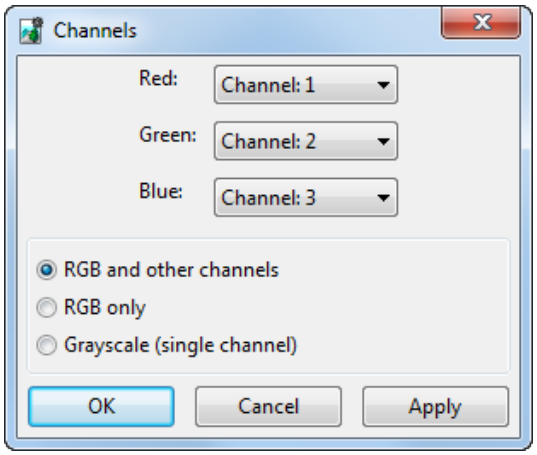


Fig. 89. Window of the order channels setup

2. Specify the mode of channel usage in the system:

   - **RGB and other channels** – all image channels are to be used;

     The user can assign any channel as a red, green, or blue one (see below, next subsection). Other image channels will be considered as supplementary.

   - **RGB only** – only three channels are used;

     The user can assign any channel as a red, green, or blue one (see below, next subsection).

     When processing images with a large number of channels, using **RGB only** mode (or channels designated as such) allows one to exclude “extra” channels from processing if the user does not need them to perform current tasks.

     In this case, the size of the images under processing can be notably reduced (provided that in the *Raster Converter* module, the user intends to apply radiometric correction directly to the images themselves).

   - **Grayscale (single channel)** – is used to display one channel.

     The **Raster Converter** module also provides for transforming a one-channel panchromatic raster image into a three-channel one. For this, when converting such an image, choose **RGB only**. As a result, when saved, the image has three identical channels.

3. Setup channels order to display and use in the system.

   The **Apply** button allows to display changes.

4. Click OK.

When applying the radiometric correction to images (in particular, when setting the mode and order of using raster channels), it is necessary to take into account that the user can apply radiometric correction in different ways, i.e., both apply the selected settings to the raster (overwriting the image – **Apply to image** option) and **Save separately** the correction parameters in a file `*.rmc`.

In certain cases, during further data processing, the user can either use the radiometric correction parameters saved as a `*.rmc` file or not take them into account (see the "Orthorectification" and "Orthophotomaps creation" user manuals).

PHOTOMOD provides for configuring in detail the number and order of channels (including when processing data containing more than three channels) in the output images created by *PHOTOMOD*, after completion of the main processing of the project during the orthorectification.

The configuration is performed in the **Output image parameters** window (see "General orthoimages creation parameters" in the "Orthorectification" User Manual and "Mosaic's main parameters" in the "Orthophotomaps creation" User Manual.

Perform the following to change transformation parameters of output image:

It is impossible to preform channels transformation for image with single channel.

1. In the **Radiometric correction** set the checkbox on near to the button and click the button. The **Channels transformation** window opens.

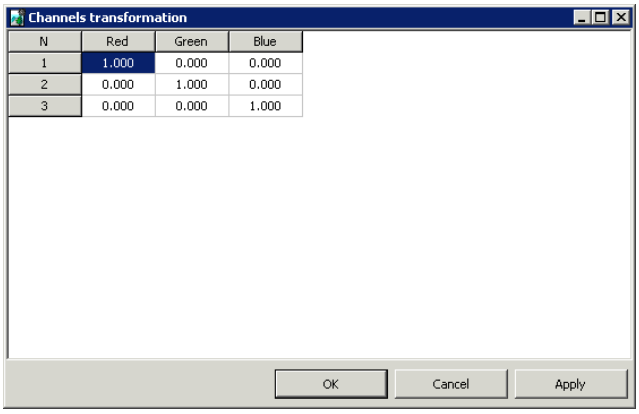


Fig. 90. The Channels transformation window

2. Change values in the channels table.

3. Click the **Apply** button to display changes.

4. Click OK to save changes.

Perform the following to perform more detailed radiometric correction (to correct white color level):

1. In the **Radiometric correction** window click the button. The **Auto levels** window opens.

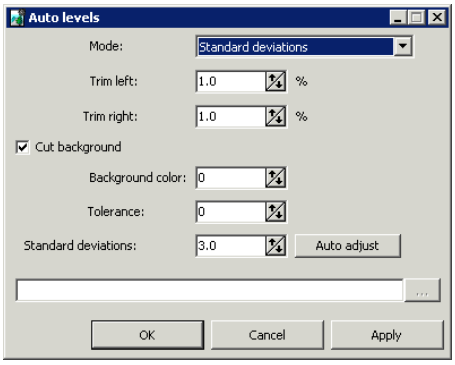


Fig. 91. The 'Auto levels' window

2. Choose the correction **Mode**:

   - **Separate channels** – correction separately for each channel;
   - **All channels** – correction for all channels rateable;
   - **Red**, **Green**, **Blue** – correction only for chosen channel;
   - **Autocolor** – automatic selection of the best brightness for displaying;
   - **Standard deviations** – stretching histogram of source image for full brightness range;
   - **QuickLook** – allows to use brightness from remote sensing data files.

     Processed channels are **Red**, **Blue**, and **Green**. The channels are identified according to the channel order displayed (or user defined) in the **Channels** window. Additional channels are processed using the average **QuickLook** histogram.

   - **External image** – using image from folder as a sample for correction.

3. Set the **Trims left and right** – area of histogram (in percent) which will not consider in stretching of histogram.

4. [optional] By default the **Cut background** checkbox is set. This function allows not to take into account the background on image edges during the correction. To exclude background parts from the correction, set the following parameters:

   - **Background color** – value of background color;

     If the 0 value is set in the **Background color** field, background also will be changed during the correction.

- **Tolerance** – deviation from background color value.

5. Set the value of deviation each pixel from 'average' in the **Standard deviations** field.

The **Auto adjust** button allows to calculate value of **Standard deviations** in such a way as to none of pixels was not light-exposed.

6. Click OK. As a result histogram stretches of source image for full brightness range.

To view histogram of image and setup activation function, that specify arbitrary brightness transformation, perform the following:

Activation function in graphic form is a curve with color of chosen band. Values of brightness on source images are placed by **X**-direction (values in the **In** field), be **Y**-direction – values after transformation (values in the **Out** field). Activation function is specified by creating nodes on curve. Activation function between nodes is a cubic spline.

1. In the **Radiometric correction** window click the button. The **Curves** window opens.

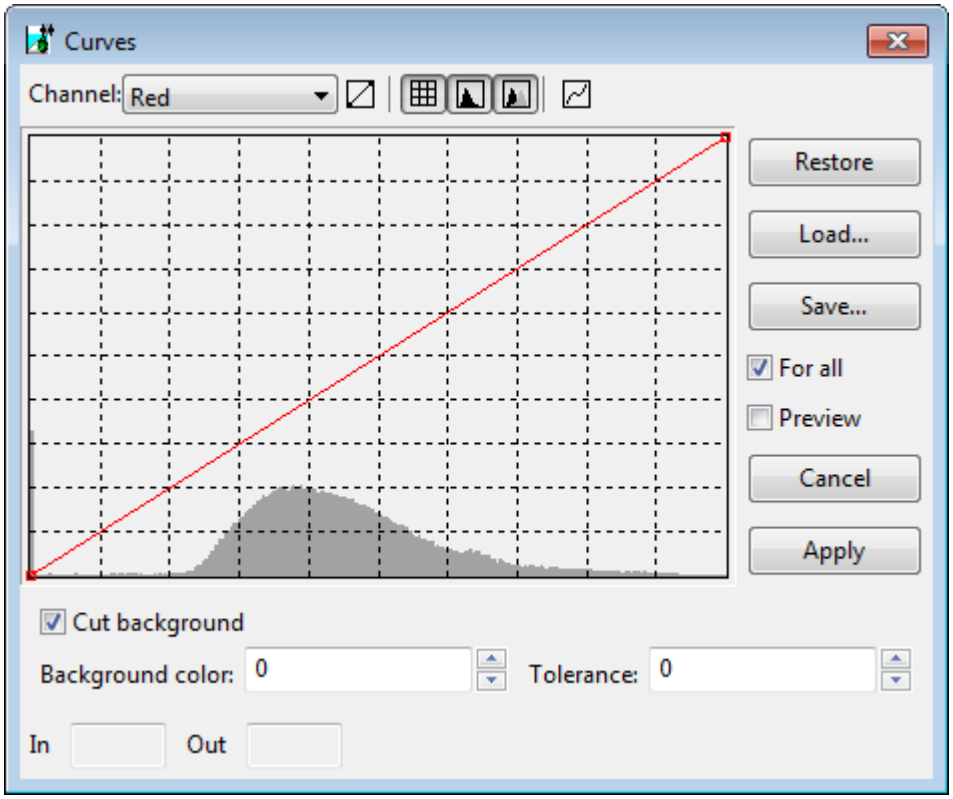


Fig. 92. The Curves window

The window contains the toolbar with buttons used to perform the following operations:

- – allows to restore linear dependence;
- – allows to display grid;
- – allows to show source histogram (with gray color);
- – allows to show destination histogram (with white color);
- – allows to smooth segment;
- **Restore** – allows to restore source curves;
- **Load** – allows to load curves from `crv`-file;
- **Save** – allows to save curves in to `crv`-file (by default in the folder with images).

Values of brightness of node in source and changed histograms are displayed accordingly in the **In** and **Out** fields.

2. [optional] To edit channels histogram separately, set the **For all** checkbox off and choose **Channel** for edit from the list.

   By default the **For all** checkbox is set on to edit curve for all channels in one time.

3. [optional] By default the **Cut background** checkbox is set. This function allows not to take into account the background on image edges during the correction. To exclude background parts from the correction, set the following parameters:

   - **Background color** – value of background color;

     If the 0 value is set in the **Background color** field, background also will be changed during the correction.

   - **Tolerance** – deviation from background color value.

4. [optional] Set the **Preview** checkbox on to preview changes.

5. Click on histogram to add node. To move node, move marker holding pressed **Ctrl** or **Alt** key.

   To select node, click in its vicinity. To delete node, right click on it.

6. Click the **Apply** button to apply changes and return to the **Radiometric correction** window.

To perform color correction do the following actions:

1. In the **Radiometric correction** window click the button. The **Brightness-Contrast-Gamma** window opens.

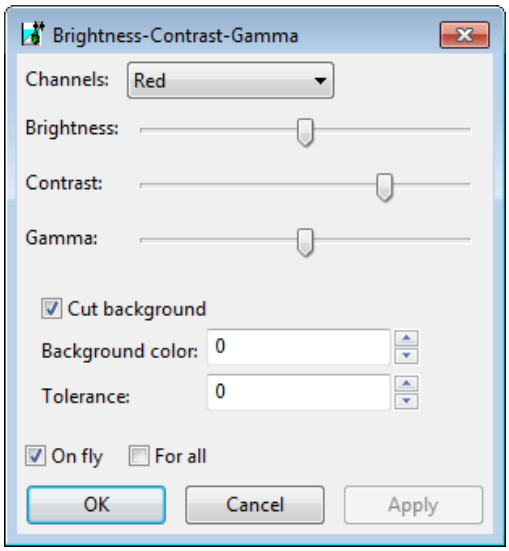


Fig. 93. The 'Brightness-Contrast-Gamma' window

2. Choose **Channels** for correction;

   To correct all the channels in the same time set the **For all** checkbox.

3. Setup balance of image **brightness**, **contrast** and **gamma** using sliders.

4. [optional] By default the **Cut background** checkbox is set. This function allows not to take into account the background on image edges during the correction. To exclude background parts from the correction, set the following parameters:

   - **Background color** – value of background color;

     If the 0 value is set in the **Background color** field, background also will be changed during the correction.

   - **Tolerance** – deviation from background color value.

5. [optional] To display changes automatically set the **On fly** checkbox on.

   The **Apply** button allows to display changes.

6. Click OK to apply color corrections of image.

To perform color balance do the following actions:

1. In the **Radiometric correction** window click the button. The **Color balance** window opens.

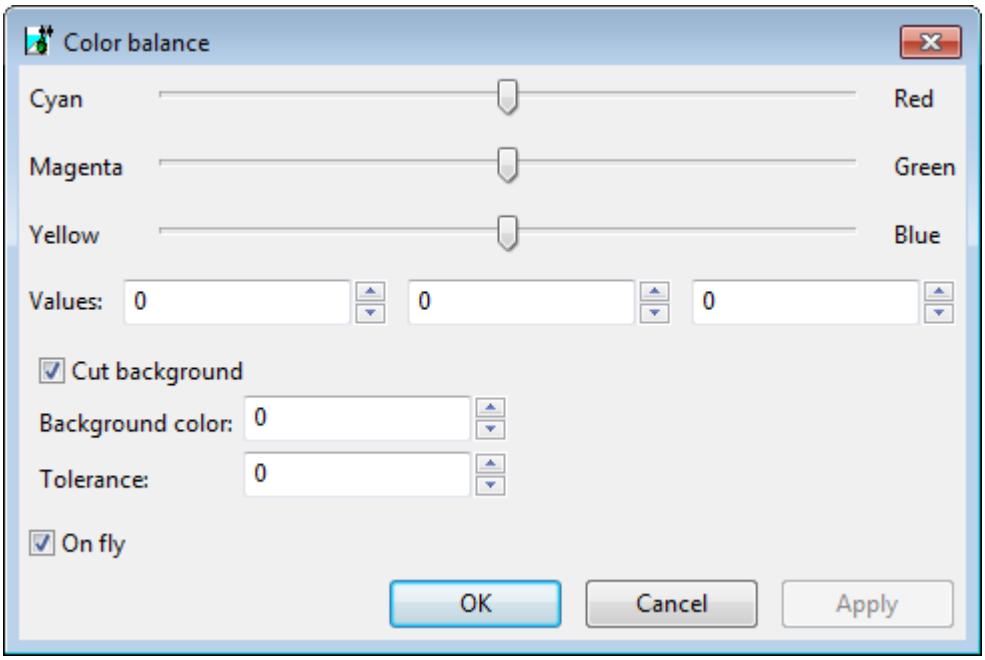


Fig. 94. The Color balance window

2. Set the red, green or blue channels balance using sliders or input values of color in the **Values** field with range from -100 to 100.

3. [optional] By default the **Cut background** checkbox is set. This function allows not to take into account the background on image edges during the correction. To exclude background parts from the correction, set the following parameters:

   - **Background color** – value of background color;

     If the 0 value is set in the **Background color** field, background also will be changed during the correction.

   - **Tolerance** – deviation from background color value.

4. [optional] To display changes automatically set the **On fly** checkbox on.

   The **Apply** button allows to display changes.

5. Click OK to apply color balance of image.

To improve visual properties of source image with using different filters perform the following:

1. In the **Radiometric correction** window click the button. The **Filters** window opens.

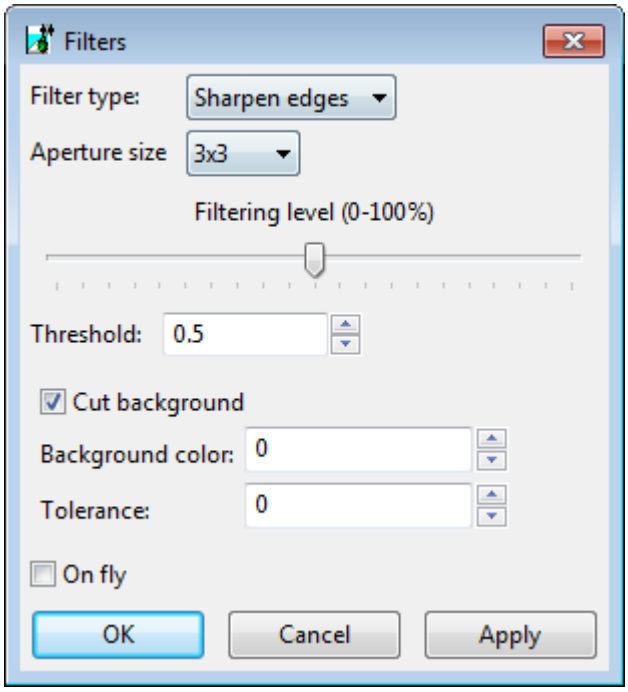


Fig. 95. The Filters window

2. Specify one of the following image processing types in the **Filter type** list:

   - **Blur** – is used for image details dithering;
   - **Gaussian blur** – is a type of blur filter where transfer value is not a linear function, but part of Gauss function (’Bell curve’);
   - **Sharpen** – allows to highlight and intensify differences between image’s individual details (image sharpness);
   - **Sharpen edges** – is used to setup image sharpness, but performs filtering only when brightness differences between details are exceeding some **threshold**;
     - Set the **Threshold**.

Suits very well for identifying and highlighting of objects borders which are homogeneous insight (agricultural fields, for instance), at that inner part of objects remains unchanged.

- **Median** – non-linear filter intended mainly for impulse noises filtration (single pixels with unnatural brightness);
- **Sobel** – non-linear differential filter, which is the first derivative of the initial raster. Used to acquire contour borders of image in raster form.

3. In the **Aperture size** list define the matrix size from 3x3 pixels to 21x21 pixels.
4. Move slider to define **Filtering level** in percent.
5. [optional] By default the **Cut background** checkbox is set. This function allows not to take into account the background on image edges during the correction. To exclude background parts from the correction, set the following parameters:
   - **Background color** – value of background color;

     If the 0 value is set in the **Background color** field, background also will be changed during the correction.

   - **Tolerance** – deviation from background color value.
6. [optional] To display changes automatically set the **On fly** checkbox on.

   The **Apply** button allows to display changes.

7. Click OK to apply filter.

For geometric transformations of image in the **Radiometric correction** window, click the button. The **Rotate-flip** window opens, you can use it for selection of rotation angles (at 90,180, 270 degrees) or horizontal/vertical reflection. To cancel the last operation or all geometric transformations applied to image using appropriate buttons.

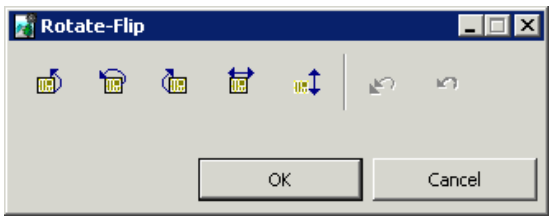


Fig. 96. The Rotate-flip window

10.3. Prepare scanner images

10.3.1. Adding scanner images

The system provides possibility of converting scanner images into internal format, their radiometric correction and also preparing ADS data to load into project.

To add scanner images to a list for convertation is used the **Add pushbroom images** window. In order to open the window click the arrow next to the + button of the **List** section toolbar and choose **Add pushbroom images**.

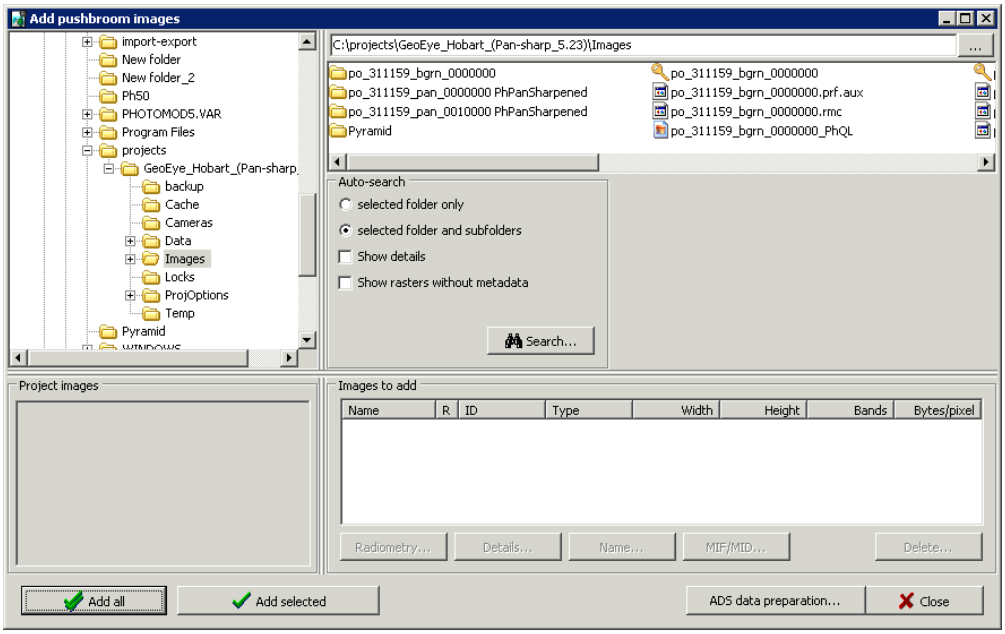


Fig. 97. Automatic images search in remote sensing product

The **Add pushbroom images** window consists of the following parts:

- folder tree in the left part;
- in the **Project images** section is displayed the list of images already added in the project (their project names);
- list of found images in the right part;
- parameters of searching files specifies in the **Auto-search** section;
- the **Images to add** section contains table with found images, their names and properties and also buttons to edit properties of image.

  The table contains the following columns:

- `Name` – allows to change project name of selected image (by default the image name is the same as the file name);

  The **Name** button allows to re-name image.

- `R` – denotes that the radiometric correction was performed;
- `ID` – source name of image, obtained from metadata;
- `Type` – type of sensor, from which image was obtained;
- `Width/Height` – linear size of sheet (in pixels);
- `Bands` – number of channels in image;
- `Bytes/pixel` – number of bytes per pixel of image.

The **Images to add** table contains the following features used to work with images:

- **Radiometry** – allows to perform radiometric correction of selected image;

  If the radiometric correction is already performed the **R** column of the table displays + symbol for selected image, otherwise, – symbol.

- **Details** – allows to open the Image details window to view features of selected image, to save them to `txt`-file or to export of scheme (vector boundary) of image to MIF/MID format;

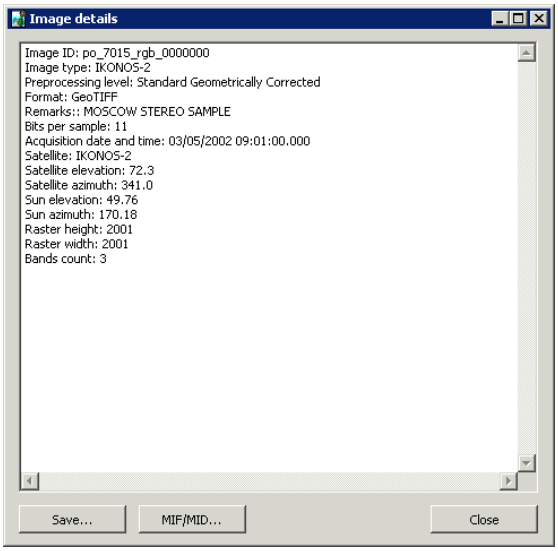


Fig. 98. Image properties

- **Name** – allows to change project name of selected image (by default the image name is the same as the file name);

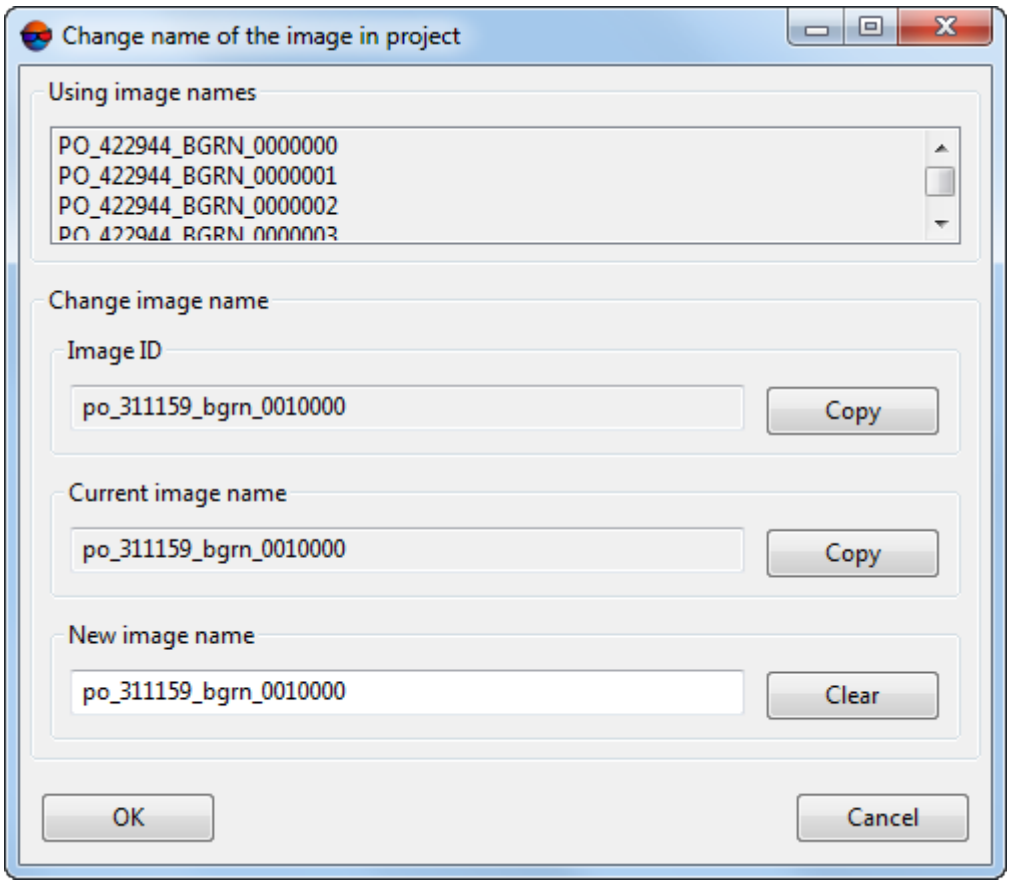


Fig. 99. Edit image name

The buttons of the **Image ID** and **Current image name** fields allows to copy accordingly ID and old name of image in to the **New image name** field. The button allows to clear the **New image name** field.

- **MIF/MID** – allows to export correction parameters of selected images;

Ctrl+A hotkeys allows to select all images.

- **Delete** – allows to remove selected images from the table.

The **ADS data preparing** allows to perform the preprocessing of ADS 40\80\100 data (see the '*ADS data in the system*' chapter in the Project creation User Manual).

In order to add satellite images to a project perform the following actions:

1. In the folder tree choose folder that contains images. The contents of selected path are displayed in the right part of the window.

2. In the **Autosearch** section define the following settings:

   - **Selected folder only** used to search for remote sensing data in the selected folder only;
   - **Selected folder and subfolders** used to search for remote sensing data in the selected folder and its subfolders.
   - **Pan-sharpening** allows to open the **Adding images found** window to view detailed parameters, to perform pan-sharpening operation and images setting.
   - **Show rasters without metadata** – allows to perform search of all files with images in selected folder, including those without metadata.

3. Click the **Search** button. In the **Images to add** section are shown found data.

   Already added images are marked in the table by gray color.

4. [optional] Click the **Radiometry** button to perform radiometric correction of images, selected in the **Images to add** table.

5. Click the **Add all** button to add all images of the table to the list of convertible files. Click the **Add selected** button to add one or more images.

   Scanner images are marked with # symbol before image name.

10.3.2. Detailed properties of adding scanner images

To display detailed parameters of recognized remote sensing products, choose, prepare and add found images manually to load them to a project is used the **Add pushbroom images** window.

Perform the following actions to open **Adding images found** window:

1. Choose folder that contains images. The contents of selected path are displayed in the right part of the window.

2. In the **Autosearch** section set on the **Pan-sharpening** checkbox.

3. Click the **Search** button. The **Adding images found** window opens.

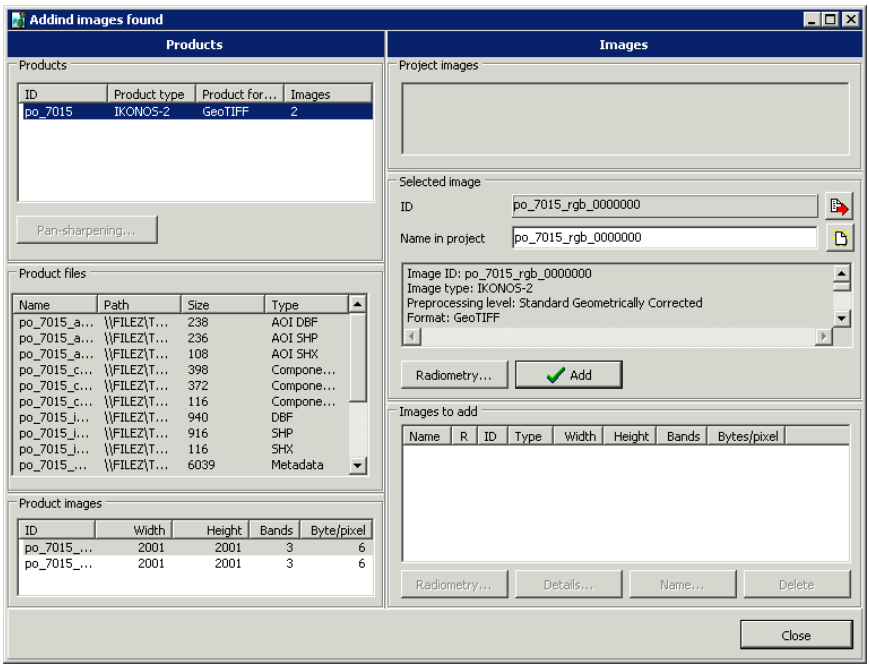


Fig. 100. Detailed properties of adding scanner images

When the images list is formed click the **Close** button in the **Images to add** section to go back to the **Add pushbroom images** window. The **Images to add** section of the **Add pushbroom images** window displays all images to be loaded (added both automatically and manually).

The **Adding images found** window is divided for **Products** and **Images** parts.

In the **Products** parts images, metadata files and service files are displayed.

The **Products** panel is used to view properties of RS products found and contains the following features:

- The **Products** table is used to view found RS products and their properties (ID of product delivered by supplier, product type – sensor type and preprocessing level, product format, number of images included to the product);

  For images without metadata found by auto-search with the **Show rasters without metadata** checkbox set, `Raster` is displayed as a `product type`.

- The **Pan-sharpening** button is used to start *pan-sharpening* operation – merging of color (multispectral) image with grayscale one with more high spatial resolution to obtain as a result color image with better resolution;

- The **Product files** table is used to display all files (images files, files with metadata) of remote sensing product selected in the **Products** panel, and their properties (name, path, size and extension);

- The **Product images** table is used to display only images included to remote sensing product and their properties (ID, width, height, number of channels and number of bytes per pixel).

  It is not recommended to change image ID received from supplier using standard OS *Windows tools, for instance*.Otherwise, you may face some issues during work with the image, since the rest of files related to the product may be associated with initial file name.

The **Images** panel is used to view images properties, perform radiometric correction, define project names and manually form a list of images to be added to a project. The panel **Images** contains the following features:

- The **Project images** list is used to display images loaded to a project (project names of the images).

- The **Selected image** section is used to view properties of image selected in the **Product images** table of the **Products** panel, and to view the image, perform radiometric correction and adding it to the load list.

  The **ID** field displays unique image name, obtained from supplier. The **Name in project** field allows to specify some name of the image in project (by default, it is the same as ID). Button  button allows to clear input field of project name, the  button is used to copy ID to input field of project name.

  The window below shows all properties of selected image, including properties of survey, satellite, sensor.

  The **Radiometry** button is used to view selected image and perform its radiometric correction.

  The **Add** button allows to add selected image to the **Images to add** table to load it then to the project.

- The **Images to add** section is used to display data selected for loading to a project.

  The table shows all images selected for loading: added manually to the **Adding images found** window and added automatically to the **Add pushbroom images** window.

  The table displays the following images properties: ID, width, height, number of channels, number of bytes per pixel, and label about radiometric correction availability +/- in the R column (see Section 10.2).

  The **Radiometry**, **Details**, **Name**, **Delete** buttons are used to work with image selected in the loading table, and allow to perform radiometric correction, change project name, show image properties and delete selected image from loading table (see for the detailed description Section 10.1).

10.4. Merging channels from separate files

The system provides for combining images into single raster files, the different channels of which were originally delivered as separate files. To perform this operation, use the **channels merging** window.

To go to this window, perform the following:

1. Open the folder with detail in the main **Raster Converter** window;

2. Select the needed files and click the + button on the toolbar to add the to the **List**:

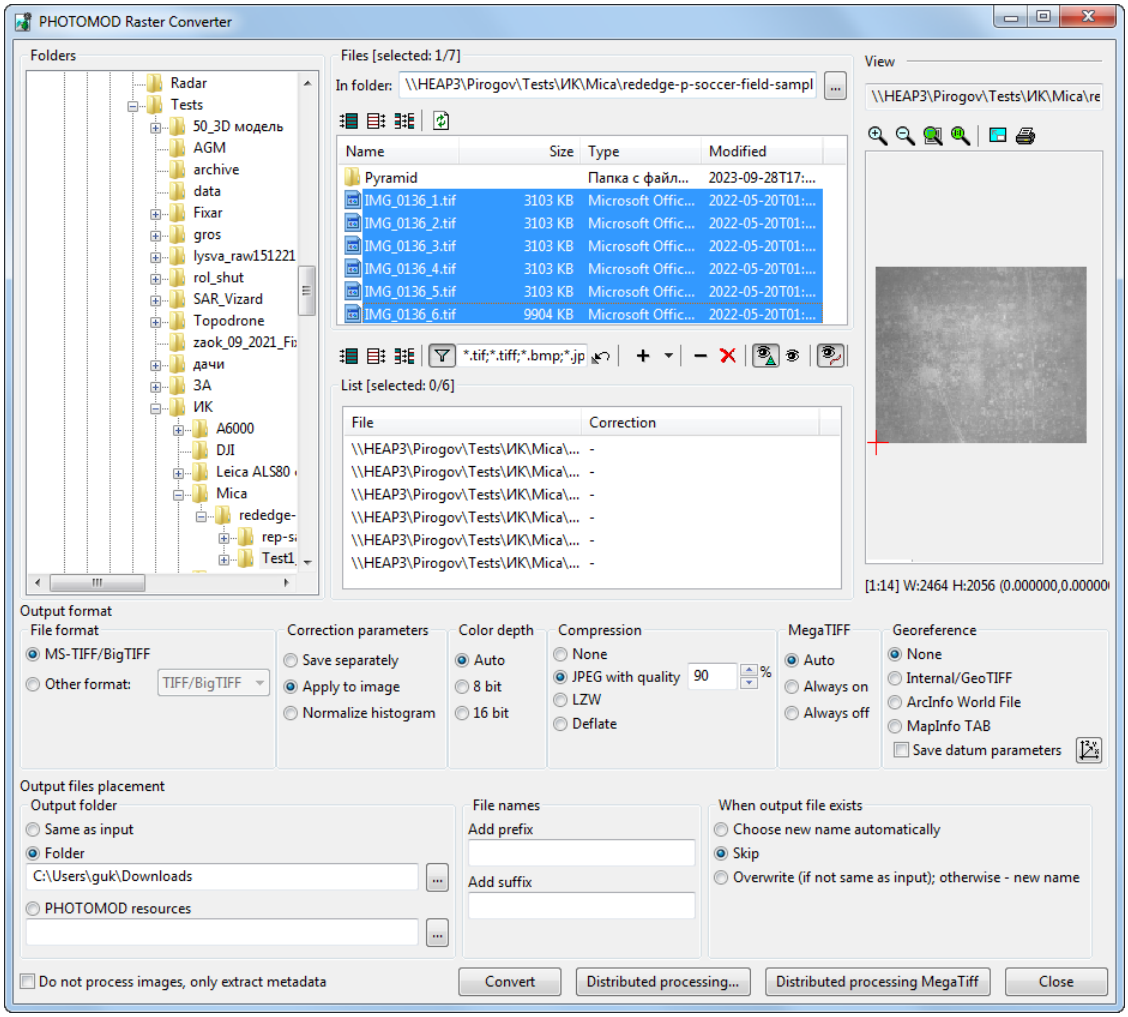


Fig. 101. The “Raster Converter” window

3. Select the needed files in **List** section, click the arrow next to the + button on the toolbar and select **Merge channels from files** in the open dropdown list. The **Merge channels from files** window opens:

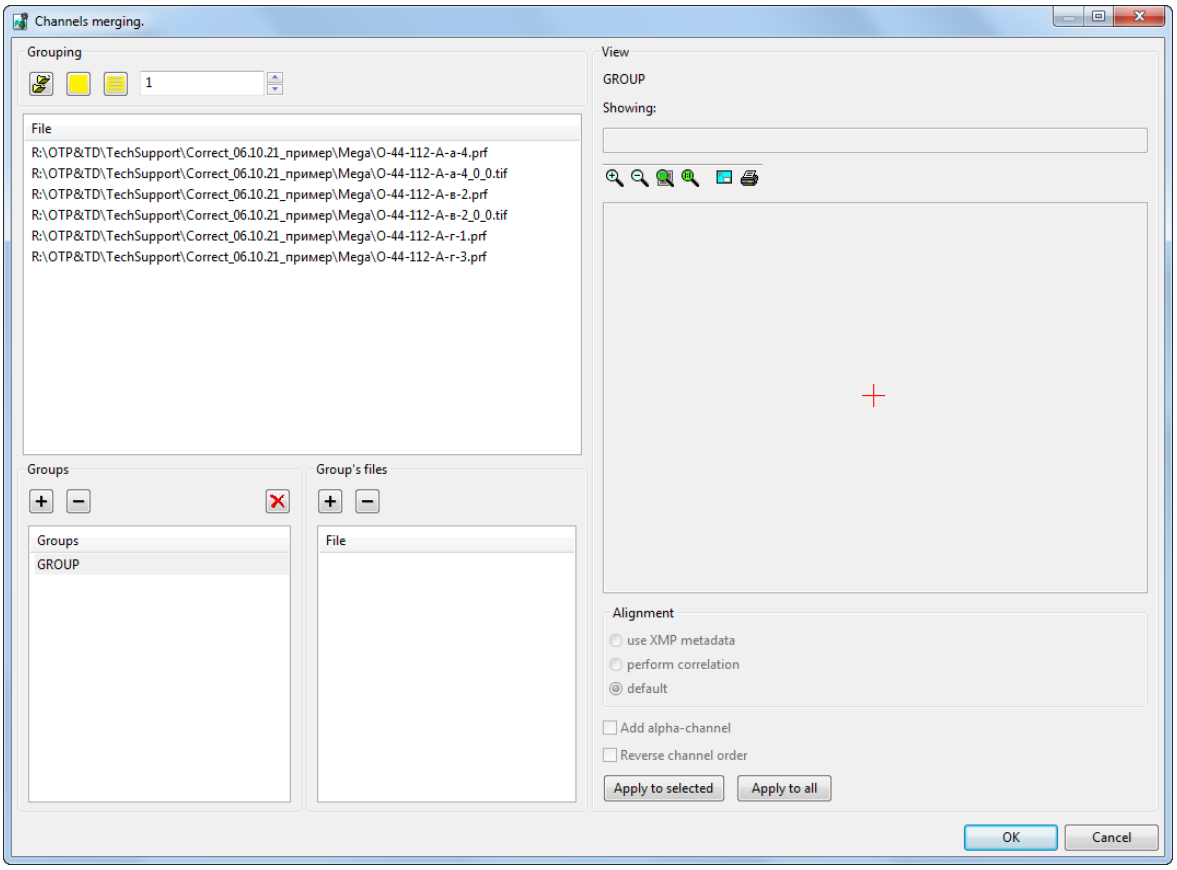


Fig. 102. The “Channels merging” window

The **channels merging** window consists of the following sections:

- **Grouping** – instruments of automatic file grouping;
- **File** list – displays the original list of files under processing containing separate image channels;

The system allows for processing several such images at once.

- **Groups** and **Group’s files** – for manual file grouping;

File group – are files containing single channels of one specific image. Files in a separate group are intended to be merged into a single raster

- **View** – is for previewing the selected raster file;
- **Alignment** – allows the user to set the parameters of geometric alignment of images containing individual channels relative to each other.

Structural and operational features of surveying instruments that record each channel of a single image as a separate file often lead to the fact that images containing single image channels are actually slightly shifted relative to each other. **Alignment** implies a shift of images containing single channels relative to the *first* such image in the group list, until the objects contained in the image match geometrically.

This operation is performed either by processing image metadata (if any), or by means of the *PHOTOMOD* (using the correlator). Note, that if the channel images are displaced relative to each other, then **alignment**, for obvious reasons, leads to the formation of “margins” at the edges of the resulting image.

The name of the resulting image (and group, in case of automatic grouping) corresponds to the name of the first image in the group. During further processing of the project (aerial triangulation and adjustment), it must be taken into account that the geometric characteristics of the resulting image correspond to the geometric characteristics of the first image in the group (relative to which geometric transformations of other images containing other channels are performed).

The system also provides for the possibility of cropping image edges during the creation of *PHOTOMOD* output products, such as DEMs, textured 3D surfaces and orthomosaics (performed after aerial triangulation and adjustment).

The **View** section contains an image view window, a caption that displays the name of a group of images, a field, **showing** the path to the image selected for viewing, and a toolbar with buttons for performing the following operations:

- – allows to zoom in an image by one step (*****);
- – allows to zoom out an image by one step (*/*);
- – allows to fit to page data of opened layers (**Alt+Enter**);
- – allows to display data in 1:1 scale, when one pixel of the image corresponds to one pixel on the screen;
- – allows to open image on full screen;
- – allows to setup report printing parameters.

To show/hide scroll bars in the View window is used the **Ctrl+F8** hotkeys.

To create an output raster file, perform the following:

1. Divide files into **groups** by images. One group should contain files with single channels belonging to one image.

   Files can be divided into groups automatically (in case when file names reflect that image files belong to a specific image, or when these files are already distributed over existing separate folders).

The system also allows for manual grouping of files. In the case of processing a large number of images, this process can be quite time consuming, but it allows the user to customize the order of channels in each resulting image as needed.

- [optional] To divide files into groups automatically, do the following:
  - [optional] Click in the **grouping** section, to divide the files into groups **by folder**, in case the files belonging to separate images are already sorted into folders accordingly. The system automatically creates **groups** of files according to the subfolders contained in the data folder;
  - [optional] make sure that image files are sorted in the correct way by their names in the **File** list (to sort by names, if appropriate, click the title of this list by the **left mouse button**).

    The name of the resulting image matches the name of the first image in the group. To provide a further correct comparison of the resulting image with the exterior orientation data, before merging, make sure that in all groups the image files are correctly sorted by names, in the sequence A→Z.

    Specify the number of channels for processed images in the appropriate field of the **Grouping** section, then click to create **file interleaved** groups. The system automatically creates **groups** of files, according to the names of the images and the specified number of channels that each image should contain;
  - [optional] make sure that image files are sorted in the correct way by their names in the **File** list (to sort by names, if appropriate, click the title of this list by the **left mouse button**).

    Specify the number of images among the data under processing in the appropriate field of the **Grouping** section, then click to create **band interleaved** groups. The system automatically creates **groups** of files, according to the names of images and the specified number of images;

    In the process of organizing files into groups, the corresponding image files are excluded from the **File** list and displayed in the **Group's files** section.

    To view **Group's files**, select the required group by clicking it by the **left mouse button** in the **group** list.

    If the grouping was incorrect, click in the **Groups** section to reset current file grouping. Every current group will be deleted, every image file will be displayed in the **File** list.

- [optional] to group files manually, use the **File** list, **Groups** and **Group's files** sections, as well as image **View** section.

Use + and − in the **Groups** section to create or delete new file groups. To edit or delete the selected group, click it in this list by the **left mouse button**.

Use + and − in the **Group's files** section to link the selected file to the pre-selected **group** and to unlink a file added to it earlier from the group, respectively. Files are selected (in the **file** list, to add a file in the selected group; or in the group file list, to remove file from the group) by clicking the **left mouse button**.

The order of adding files to a group determines the order of the channels in the resulting image. The name of the resulting image corresponds to the name of the first image in the corresponding group.

When further processing the project, it must be taken into account that the geometric characteristics of the resulting image correspond to the geometric characteristics of the first image in the group (relative to which geometric transformations of other images containing other channels are performed during alignment).

2. Make sure that files were correctly grouped using the image **view** section;
3. Choose the way of performing **Alignment** (see above):
   - **Use XMP metadata**;
   - **perform correlation**;
   - no alignment (**default**).
4. [optional] Set the appropriate checkboxes to **add alpha-channel** to the resulting image and/or **reverse channel order**. To apply these setting to all images, click the **Apply to all** button. To apply these settings to the selected image (or images), first select the desired groups of images and click the **Apply to selected** button;
5. Click OK to close the **channels merging** window and go to the main **Raster Converter** window to start creating the resulting images.

   After the **channels merging** window is closed, in the **List** section of the **Raster Converter** window, instead of the source raster list, a list of future images that are supposed to be created as a result of merging is displayed.

   At this stage, the system already provides for radiometric correction of those still "virtual" images, which will be considered by the program as an integrated image with several channels.

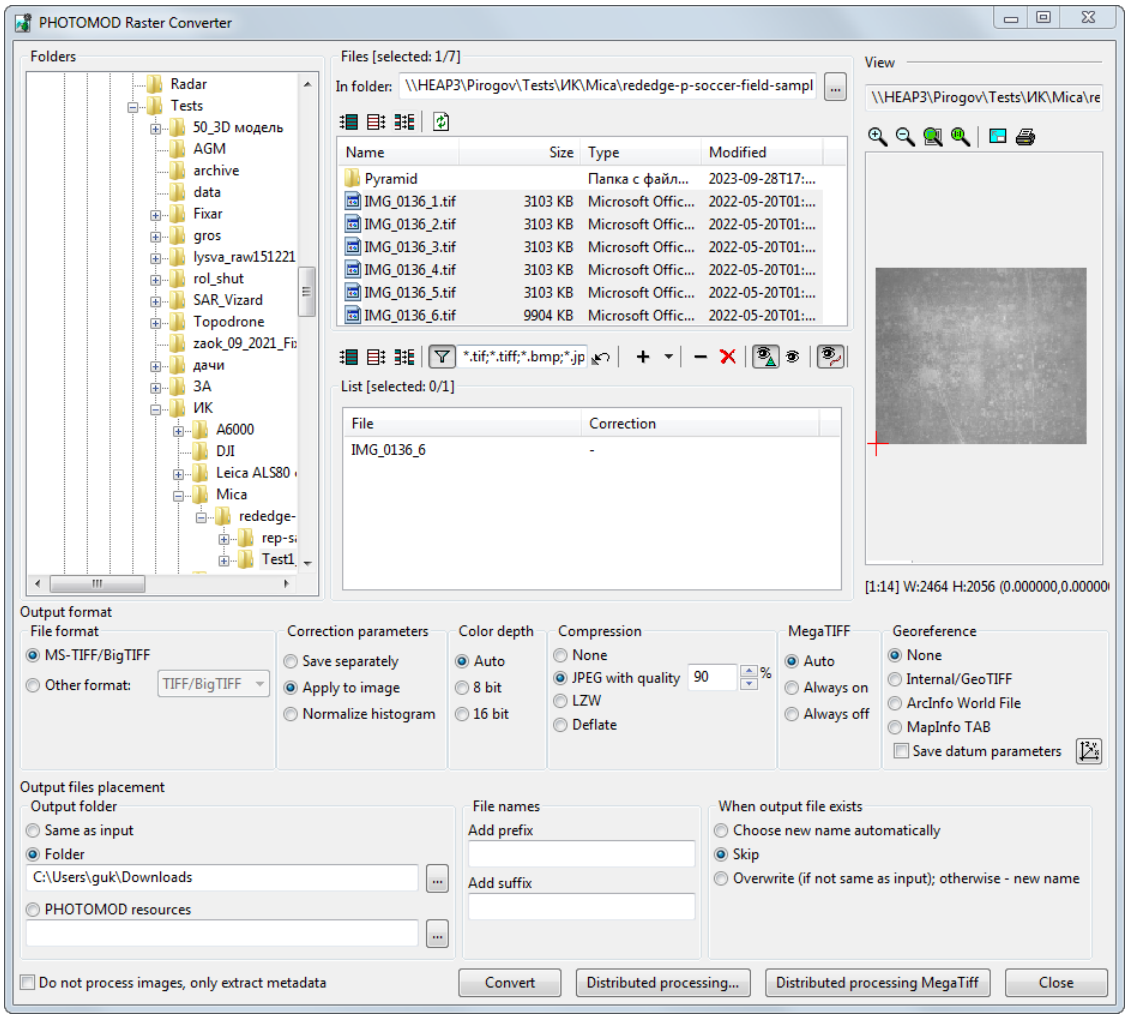


Fig. 103. The “Raster Converter” window

10.5. Printing images

The *Raster Converter* module allows to print raster images.

To setup printing parameters is used the **Print Images** window. In order to open the window click the button in the viewer of selected image.

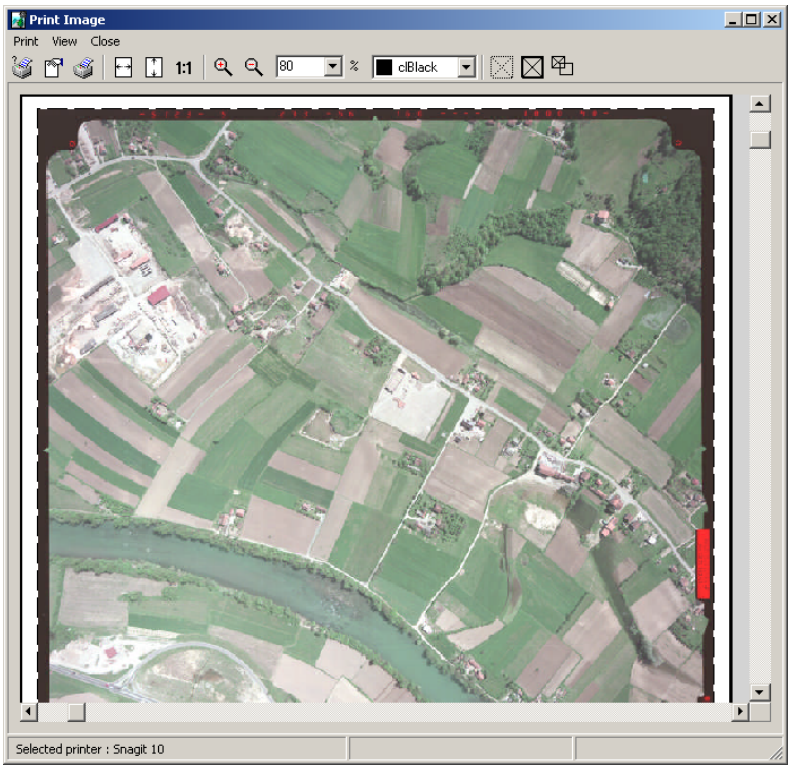


Fig. 104. 'Print Image' window

Table 17. The 'List' section toolbar

Buttons	Function
	allows to choose printer and setup it (**Ctrl+C**)
	allows to setup printing parameters of image
	allows to start image printing (or selected pages) with defined parameters
	allows to fit image width
	allows to fit image height
1:1	allows to display image in 1:1 scale, when one pixel of the image corresponds to one pixel on the screen
	allows to zoom in an image by one step
	allows to zoom out an image by one step
	allows to select scale of image (in %)
	allows to change color of the border of the printable area
	allows to exclude all pages from printing
	allows to include all pages to printing
	allows to files selection

Buttons of toolbar are partly duplicated by **Print** and **View** menu items.

To print image perform the following actions:

1. Choose image in the **List** section of the **Raster converter** window.

2. Click the button. The **Print Image** window opens.

3. Choose the **Print › Parameters** or click the button of the toolbox. The **Print parameters** window opens.

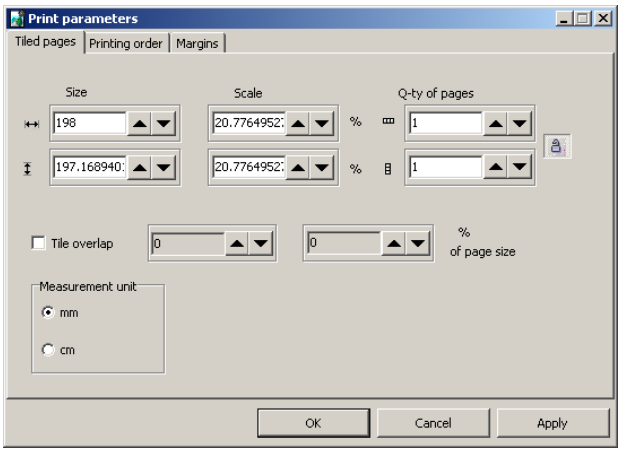


Fig. 105. Print parameters

4. On the **Tiled pages** tab setup the following parameters:

   - **Size** – linear size of print in horizontal and vertical directions;
   - **Scale** – scale of print in percent;
   - **Number of pages** – amount of pages on which print is divided depending on the size and proportions;
   - **Tile overlap** – percent of pages overlap for prints bigger than one page;
   - **Measurement unit** – units of measure for printing parameters.

   The button allows to keep aspect ratio when changing size parameters or to edit these parameter separately.

5. The **Printing order** tab allows to choose direction of pages printing.

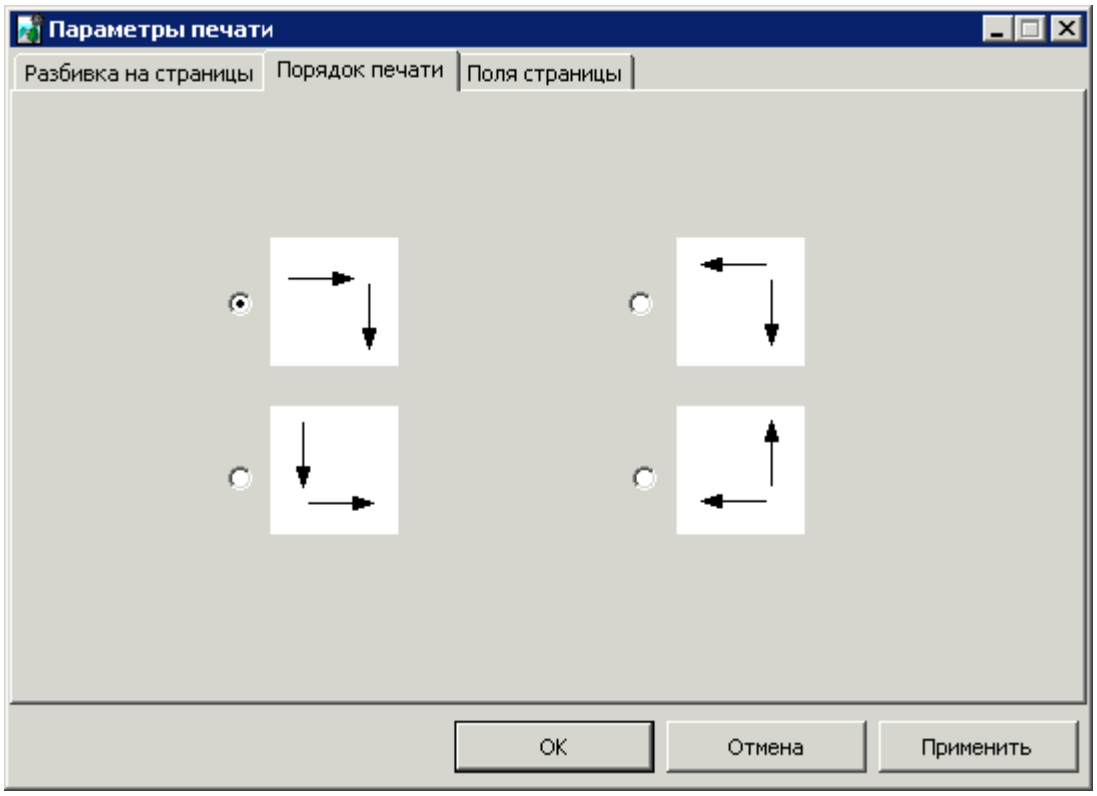


Fig. 106. Printing order parameters

6. The **Margins** tab is used to define size of frames and image position depending on sheet's corners.

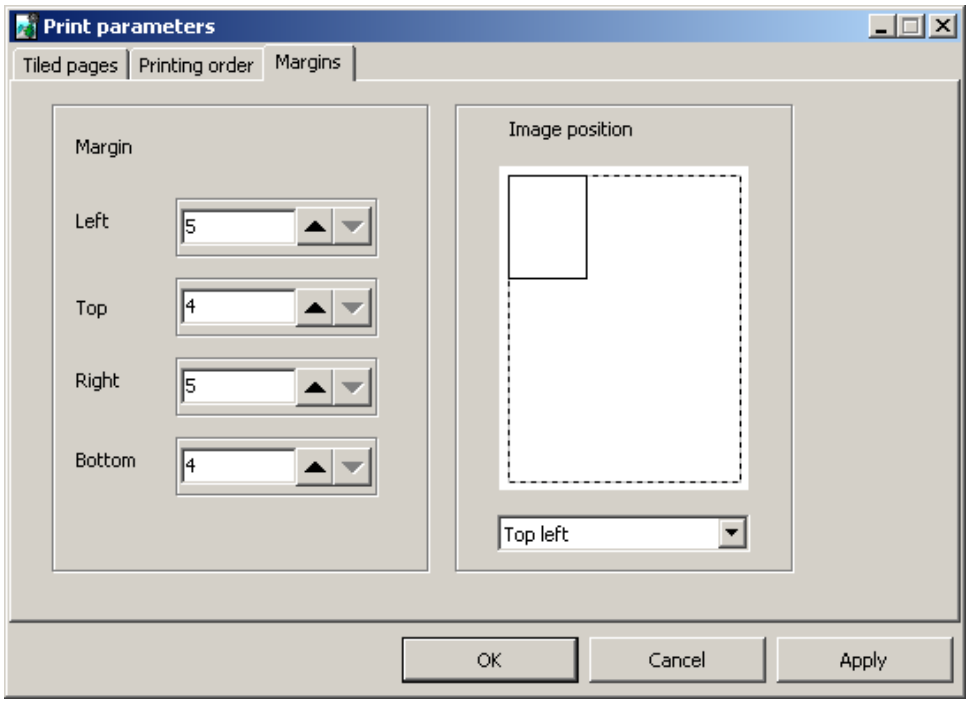


Fig. 107. Margins parameters

7. Click OK to return to the **Print Images** window.

Press and hold **Ctrl** key and click to page's preview to include/exclude pages from printing.

To print only one page and not to change pages selection, choose the **Print this page now** in the right-click menu.

8. To print selected pages, click the button.

11. The pan-sharpening operation

The system provides possibility to perform the *pan-sharpening* operation.

Pan-sharpening is merging of color (multispectal) image with grayscale one with more high spatial resolution to obtain as a result color image with better resolution.

As the result of pan-sharpening operation, new multispectral image is created possessing the same high spatial resolution as the grayscale image.

It is possible to perform pan-sharpening during the adding scanner images, that becomes available when the system detects images suitable for such operation in remote sensing product. Pan-sharpening operation also could be applied to any chosen images (including batch images processing).

Batch processing of scanner imagery is also available, but in this case the pan-sharpening operation is performed for images located in a folder in the *Windows* file system, before adding images in the project.

11.1. Pan-sharpening operation during the adding scanner images

When synthesizing a multispectral image, the following methods can be used to increase spatial resolution of the output image: **Brovey**, **HSV**, **Principal Component Analysis** and **Enhanced Principal Component Analysis** (see Section 11.1.1).

The **Enhanced Principal Component Analysis** method (selected by default) is recommended and does not require radiometric correction. In this case is strongly recommended to refrain from performing radiometry correction.

For correct multispectral image synthesis using the methods **Brovey**, **HSV** and **Principal Component Analysis** radiometric correction must be performed. If a radiometric correction was not performed for the selected image it will be requested to perform it during the pan-sharpening operation.

Perform the following actions to merge images during adding images in project:

1. In the **Adding images found** window (see Section 10.3.2) after found images for pan-sharpening, click the **Pan-sharpening** button. The **Pan-sharpening** window opens.

Adding images found window will open after clicking the **Search** button in case the **Pan-sharpening** checkbox is set (see Section 10.3.1).

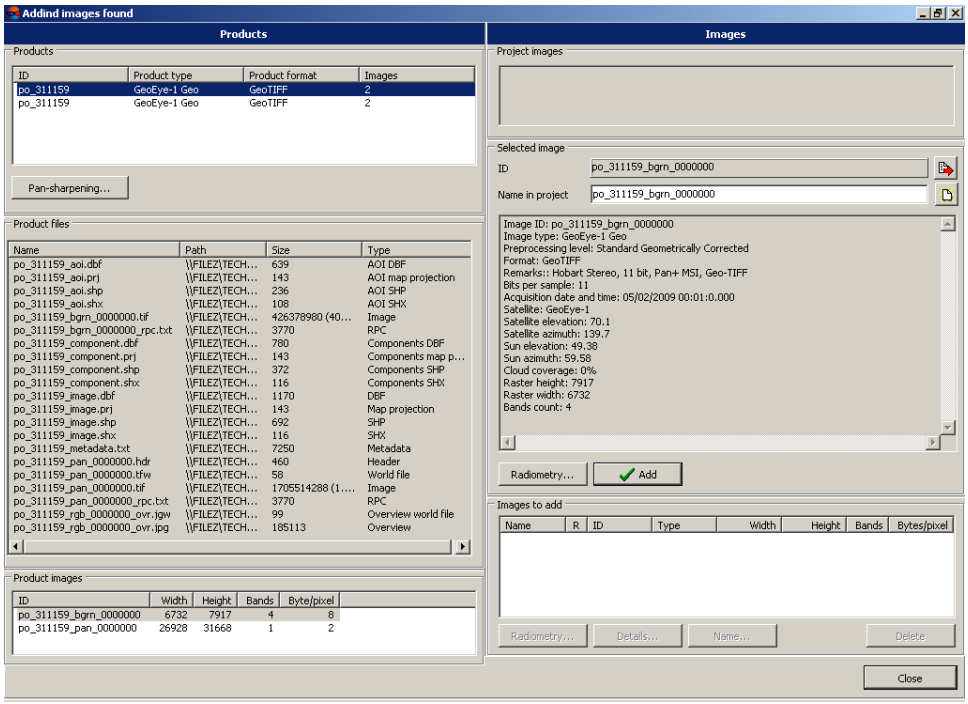


Fig. 108. Example of Geo-Eye images pair: color image (4 channels – BGRN, resolution – 2 km) and panchromatic image (1 channel, 0.5 km resolution)

2. Choose panchromatic image in the **High resolution image** table.

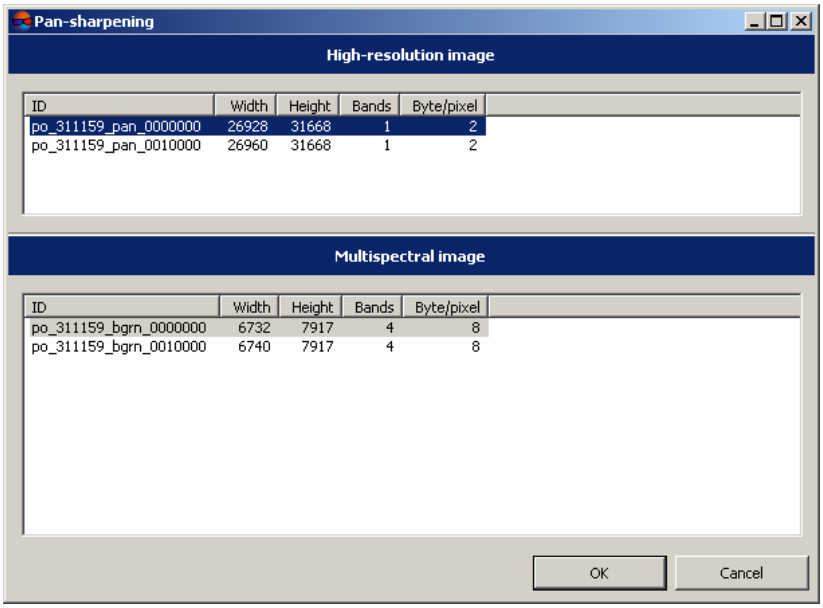


Fig. 109. Choosing images for pan-sharpening

3. Choose color image in the **Multi-spectral image** table.

4. Click OK. The **Pan-sharpening** window opens.

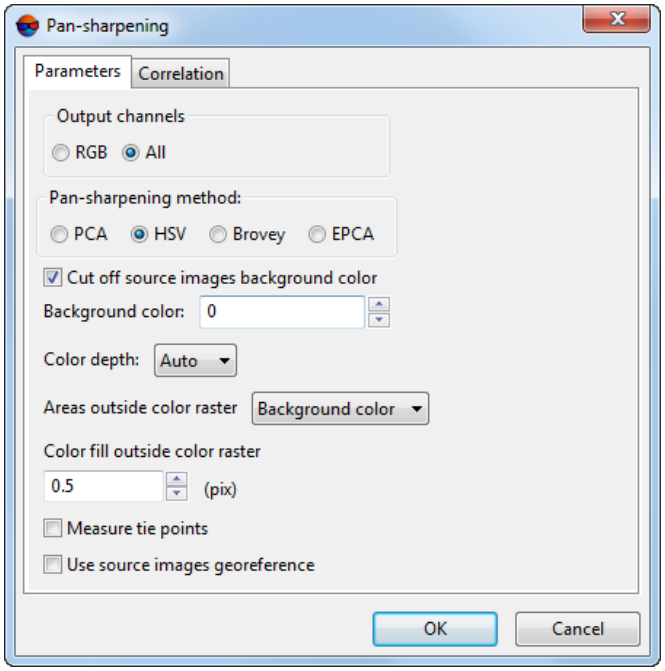


Fig. 110. Parameters of pan-sharpening

5. Setup the parameters of pan-sharpening (see below).

6. Click OK. The virtual file PhPanSharpened with one image is displayed in the **Products** section of the **Adding found images** window.

The process of pan-sharpening performed after specifying parameters of transformation, but before adding images into project (see Section 10.3.1). This process could take much time.

If one of the following methods for increasing spatial resolution was selected during the parameters setup: **Brovey**, **HSV** or **Principal Component Analysis**, and the radiometric correction was not performed for the selected image, it will be requested to perform it.

7. Choose images in the **Product images** table to view its settings in the **Selected image** section and to add in the **Images to add** table.

8. When the images list is formed click the **Close** button to return to the **Add pushbroom images** window.

9. Choose images to load into strip in the **Add pushbroom images** window (see Section 10.3.2), setup transformation parameters in the **Parameters** window. Then load images (see Section 10.3.1).

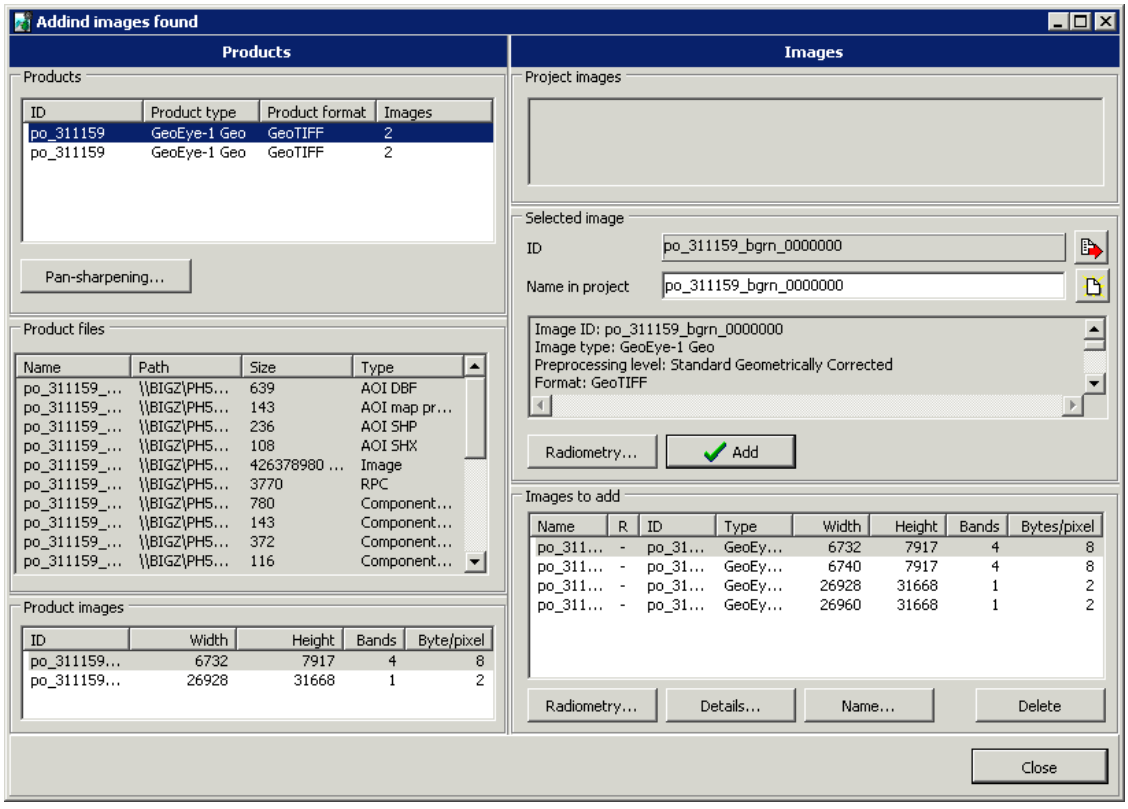


Fig. 111. Virtual product PhPanSharpened with one image

11.1.1. Parameters of pan-sharpening (during adding images in project)

To perform the pan-sharpening operation correctly specify parameters of output image.

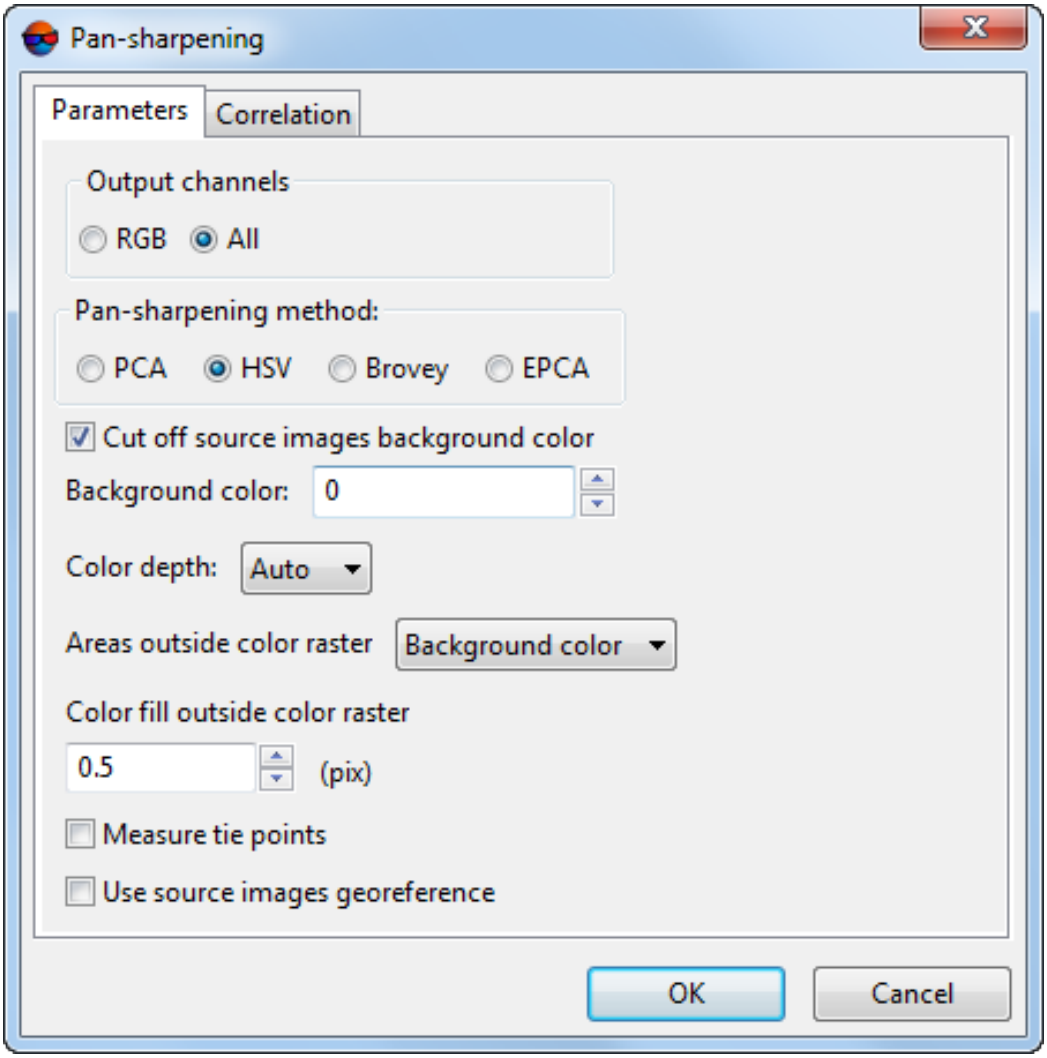


Fig. 112. Parameters of pan-sharpening

The **Parameters** tab is used for setting the following parameters of output image:

- the **Output channels** allows to choose quantity of channels in output images:
  - **RGB** (by default);
  - **All** – all channels from source image.
- the **Pan-sharpening method** section allows to choose one of the following methods of increasing resolution of output image: **PCA** (Principal Component Analysis), **HSV**, **Brovey** or **EPCA** (Enhanced Principal Component Analysis).

Depending on the type of images, different methods might be preferable. The default **Enhanced Principal Component Analysis** method is recommended as it ensures minimum distortion of the initial colors. It is recommended to use other methods if the results are unsatisfactory otherwise.

The **HSV** and **Principal components** methods produce similar results, where is no domination or deficiency of one color. The **Brovey** produce the same results on images with average brightness, but different results on dark or glaring images.

It may be difficult to determine beforehand which color correction parameters should be selected.

- the **Cut off background colors of source images** checkbox allows not to apply histogram stretching to background color of source image. The **Background color** field allows to define color of background.
- the **Color depth** list is used to choose color depth of output image: **8 bit**, **16 bit**, **Auto** (by default).
- the **Areas without color raster** section allows to choose one of the following ways of filling areas without color image:
  - **Background color** to fill areas with background color of source images;
  - **Grayscale raster** to use grayscale image as a base for these areas.
- Value of the **Color area outside color raster** parameter (in pixels) to perform color extrapolation on image edges.
- the **Searching for tie points** checkbox allows to use tie points in pan-sharpening in case of visible shift between objects on color and black-white images.
- **Use source images georeference** checkbox allows to eliminate blur effect on the synthesized image which occurs if sensor features caused a shift of black and white and color images relative to each other in raster coordinate system.

  If the checkbox is cleared, the data processing algorithm implies just a comparison of grayscale and color images, without introducing any additional corrections (the initial “reference point” is the lower left corner of the grayscale image). It is assumed that the images are not shifted and not turned relative to each other.

  If the checkbox is set, georeferencing data (stored in image metadata) are used to compensate for shift between the images. If the required information is not found in the image metadata, RPC coefficients are used to calculate the corrections.

It is strongly recommended to **use source images georeference** when processing *Pleiades* sensor data.

The **Correlation** tab is used to setup correlator parameters for tie points measurement:

Correlation parameters are only available if the **Measure tie points** check box is set in the **Parameters** tab.

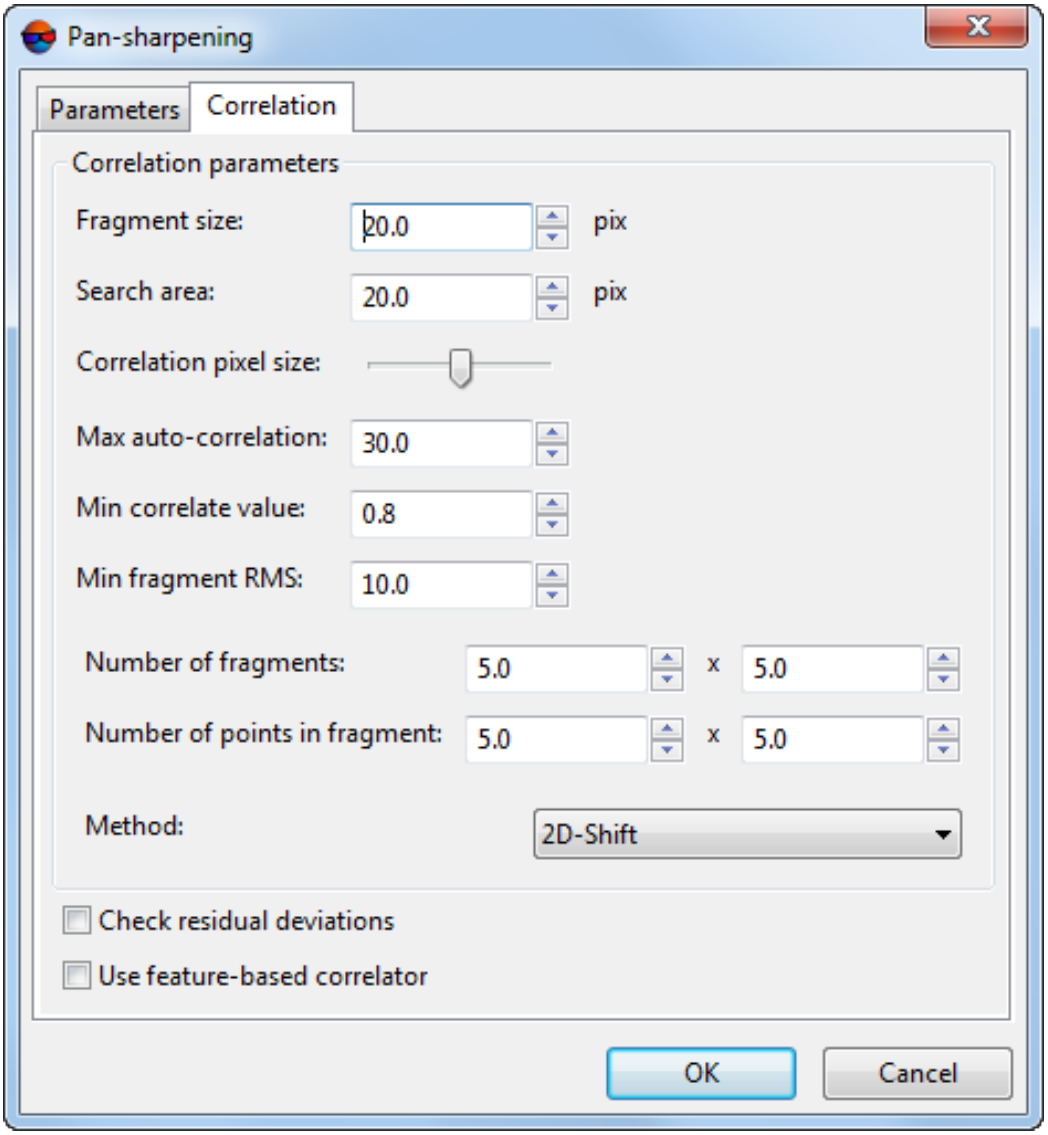


Fig. 113. Correlator parameters for tie points measurement window

Set an appropriate checkbox to **use feature-based correlator** with predefined parameters (see the “Automatic measurement of tie points coordinates (aerial survey)” chapter in “Aerial triangulation” User manual). Clear this checkbox to set the following **correlation parameters** manually:

- **Fragment size** – allows to define a size (in pixels) of a fragment which contains the point indicated on one image;

- **Search area** – – allows to define a search area (in meters) of appropriate point on another image;
- **Correlation pixel size** – allows to define a value of a pixel size of images, where correlation to be performed, if the images have different pixel size;
- **Max. auto correlation** – allows to control auto-correlation of a point, i. e. a degree of point's uniqueness in some its vicinity on the left image;

The more the auto-correlation radius value, the less the point's uniqueness and the more probable its incorrect comparison with the right image even when the correlation coefficient is high.

- **Min. correlate value** – allows to define minimal acceptable value of correlation coefficient;
- **Min. fragment RMS** – allows to define a brightness value of image fragment. The less the value, the worse the correlation.
- **Number of fragments** – number of fragments on one image.

If an image contains objects with big brightness difference (dark lake and light colored field, for example), it is recommended to set more fragments number.

- **Number of points of fragment** – number of matching points on one fragment.
- **Method** – allows to choose **2D-shift** or **Affine** correction to compensate for geometric discrepancies between color and grayscale images during measurement of tie points in those images.

Camera design and operation features often lead to the fact that color and grayscale images are slightly shifted relative to each other.

The correction that compensates for simple **2D-shift** of images is recommended by default. The advantage of this method is also that random errors in tie point measurements that may occur during the operation of the correlator have little effect on the quality of output data.

The **affine** correction is recommended if the use of other settings has led to unsatisfactory quality of certain sections of output images. The affine correction is applicable in a situation where there is reason to suppose that the resulting defects in the output image are due to geometric discrepancies between color and grayscale images, which are more complex than a simple shift due to a small difference in time between the survey moments.

When using the affine correction, the requirements for the quality of measurement by the tie point correlator are significantly increased. This is due to the increasing influence of random measurement errors on the quality of output images

- **Check residual deviations** allows to evaluate the accuracy of overlaying black and white and color rasters (in pixels). Data is displayed in the information window which opens once the pan-sharpening operation is completed.

11.2. Pan-sharpening operation without adding images to project

To apply the pan-sharpening operation for any chosen images, perform the following:

1. Choose the **Rasters › Pan-sharpening**. Parameters of pan-sharpening **Pan-sharpening** window opens.

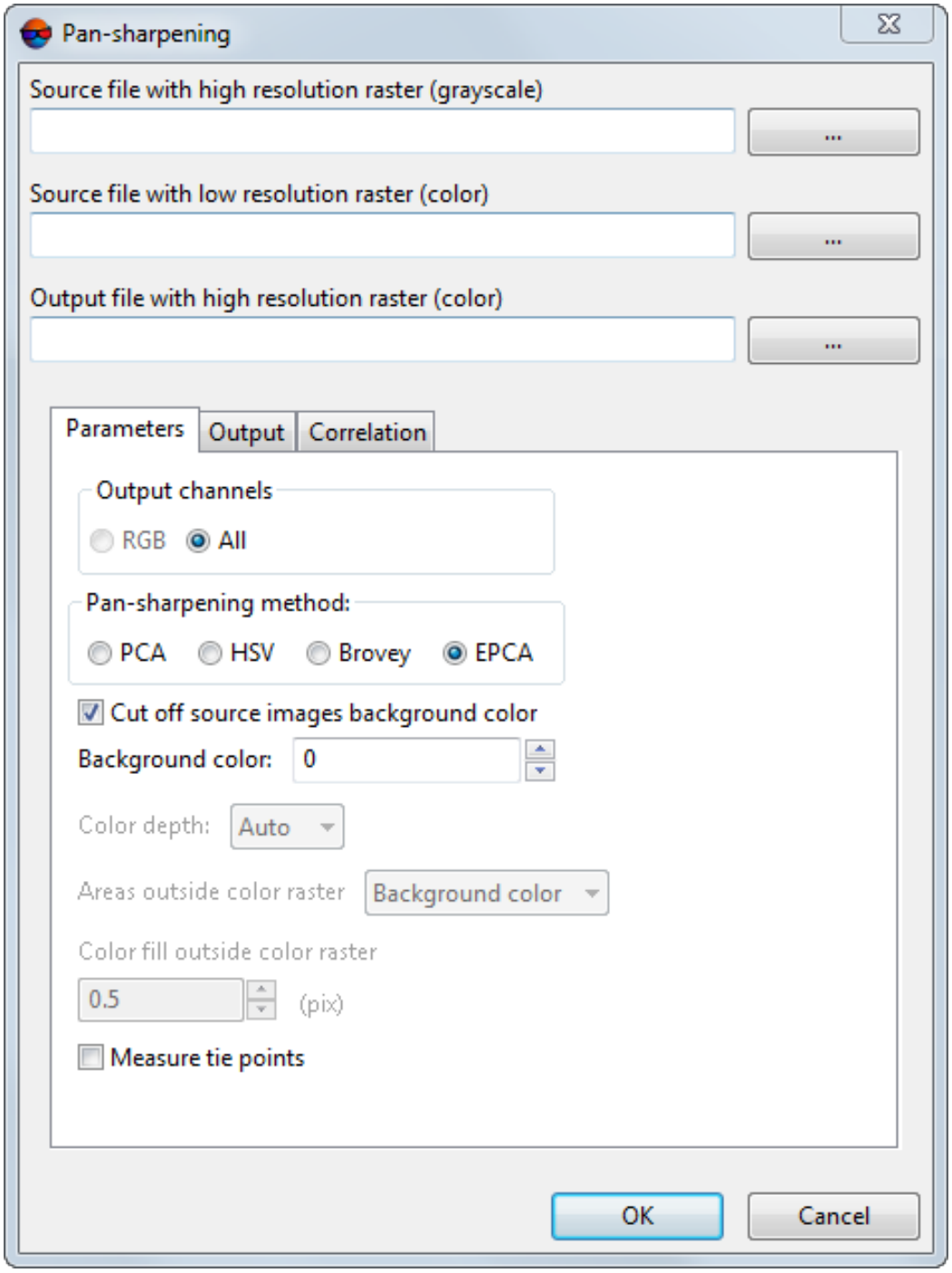


Fig. 114. Parameters of pan-sharpening

2. Choose the panchromatic image in the **Source file with high resolution raster (grayscale)** field.

3. Choose the **Source file with low resolution raster (low)** in the field.

4. Specify name and path of **Output file with high resolution raster (color)**.

The allowed output file formats are:

- **Tag Image File Format** (*.tiff) and **GeoTIFF** – format, included tags for saving of georeferenced information;
- **Windows Bitmap File** (*.bmp);
- **GIS Panorama raster map** (*.rsw) – raster formats of PHOTOMOD VectOr program;
- **ERDAS IMAGINE** (*.img) –- ERDAS system raster format;
- **NITF** (*.nitf);
- **JPEG** (*.jpeg);
- **PNG** (*.png);
- **DGN** (*.dgn) – MicroStation system raster format;;
- **PCIDSK** (*.pix) – raster format with georeference in the heading developed by PCI Geomatics company;
- **JPEG2000** (*.jp2) raster format with jpeg compression and georeference in the heading developed. The limitation on output file size of JPEG2000 format – no greater then 500 Mb.

5. Setup the parameters of pan-sharpening (see below).
6. Click OK to start pan-sharpening operation.

11.2.1. Parameters of pan-sharpening (without adding images in project)

To perform the pan-sharpening operation correctly specify parameters of output image.

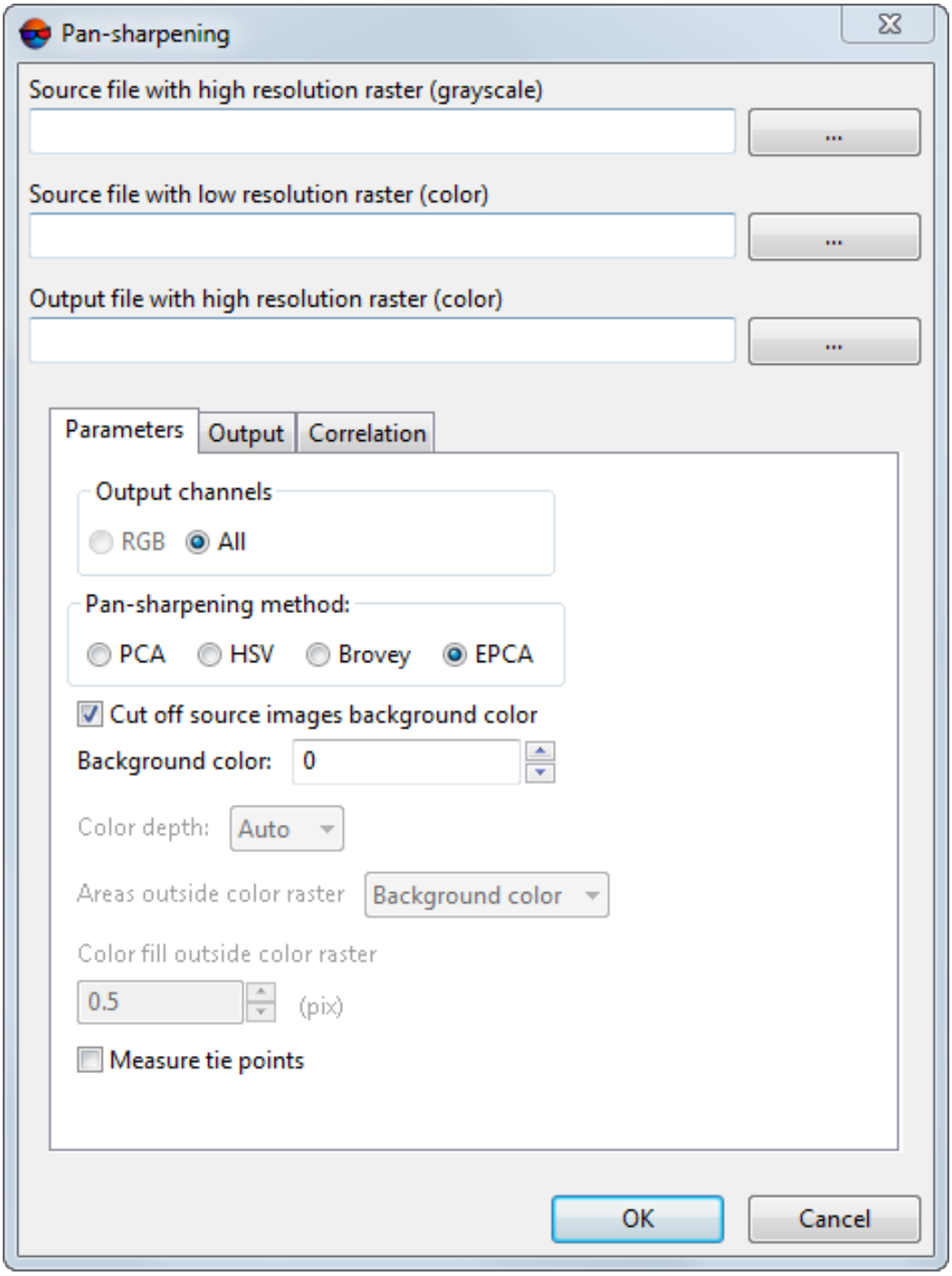


Fig. 115. Parameters of pan-sharpening

The **Parameters** tab is used for setting the following parameters of output image:

- the **Output channels** allows to choose quantity of channels in output images:
  - **RGB** (by default);
  - **All** – all channels from source image.

- the **Pan-sharpening method** section allows to choose one of the following methods of increasing resolution of output image: **PCA** (Principal Component Analysis), **HSV**, **Brovey** or **EPCA** (Enhanced Principal Component Analysis).

  Depending on the type of images, different methods might be preferable. The default **Enhanced Principal Component Analysis** method is recommended as it ensures minimum distortion of the initial colors. It is recommended to use other methods if the results are unsatisfactory otherwise.

  The **HSV** and **Principal components** methods produce similar results, where is no domination or deficiency of one color. The **Brovey** produce the same results on images with average brightness, but different results on dark or glaring images.

  It may be difficult to determine beforehand which color correction parameters should be selected.

- the **Cut off background colors of source images** checkbox allows not to apply histogram stretching to background color of source image. The **Background color** field allows to define color of background.

- the **Color depth** list is used to choose color depth of output image: **8 bit**, **16 bit**, **Auto** (by default).

- the **Areas without color raster** section allows to choose one of the following ways of filling areas without color image:

  ○ **Fill background color** to fill areas with background color of source images;

  ○ **Fill grayscale raster** to use grayscale image as a base for these areas.

- Value of the **Color area outside color raster** parameter (in pixels) to perform color extrapolation on image edges.

- the **Searching for tie points** checkbox allows to use tie points in pan-sharpening in case of visible shift between objects on color and black-white images.

The **Output** tab is used for setting the following parameters of output image:

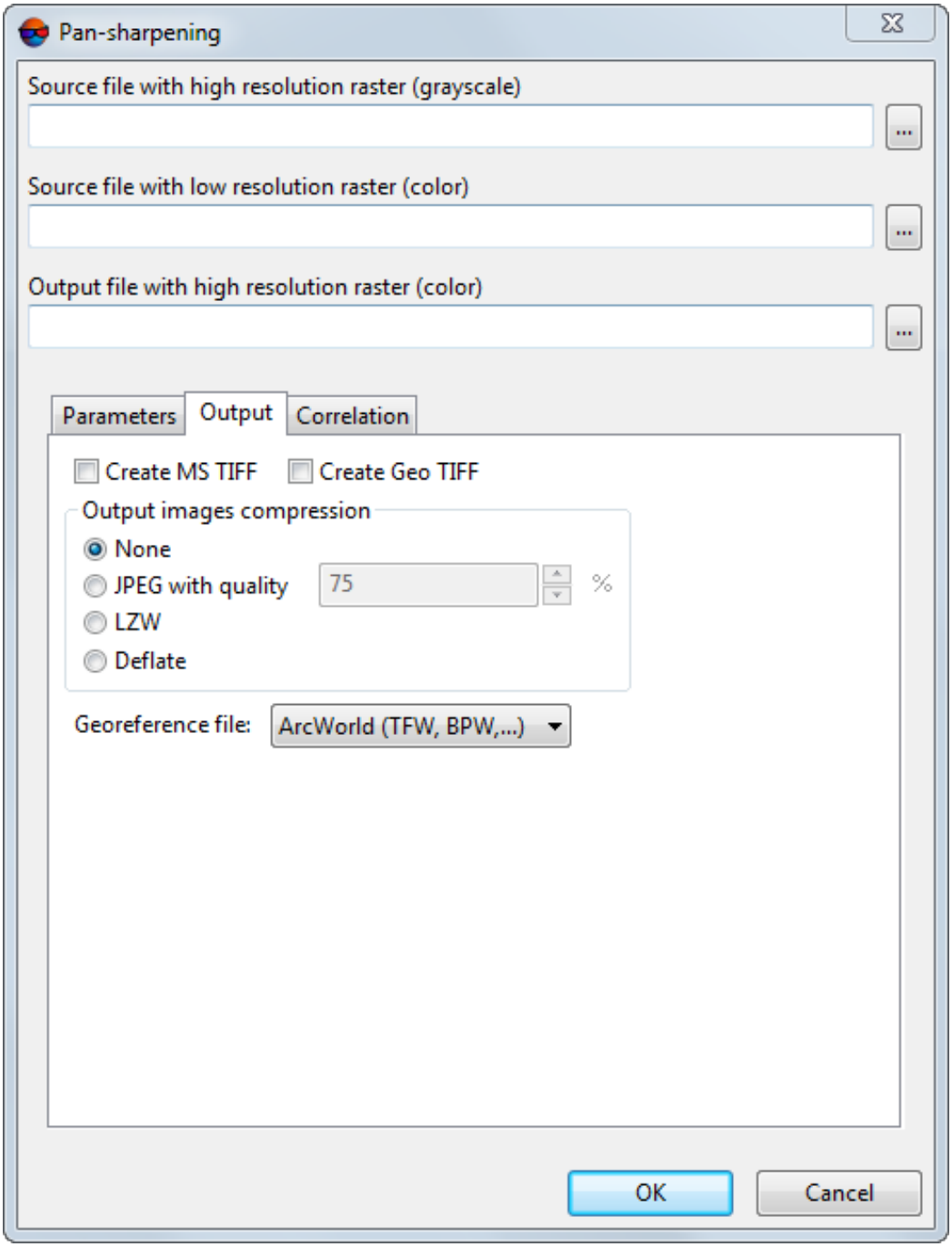


Fig. 116. Output parameters

- **Create MS TIFF** – allows to create output mosaic sheets in MS TIFF format with pyramid that helps to redraw images more quickly on a screen, when using systems with MS TIFF format support.

- **Create GeoTIFF** – allows to create output mosaic sheets in GeoTIFF format with pyramid;

- The **Output images compression** allows to set up the compression parameters of output orthoimages files:
  - **None** – files are creates without compression;
  - **JPEG with quality .. %** – TIFF-files are creates with set quality of JPEG-compression;

    Default compression level is 75 %, that provides the 5-7 times compression of initial image volume.

  - **LZW** – TIFF-files are creates with LZW-compression;
  - **Deflate** – TIFF-files are creates with Deflate compression.
- **Georeference file** – allows to select the format of the additional file created;
  - **None** – files are creates without compression;
  - **PHOTOMOD GEO** (`*.geo`) – *PHOTOMOD* georeference file, contains pixel and ground coordinates of 4 mosaic cells as well as cell size by X and Y axes in given units.

    Example of `*.geo` file:

    Mosaic created by PHOTOMOD 10.01.07

    Units: (m)

    Linscale: 8.600

    Colscale: 8.600

    (0.5, 0.5) (8271360.000 East, 1857514.200 North)

    (0.5, 2446.5) (8271360.000 East, 1836470.000 North)

    (2612.5, 0.5) (8293831.800 East, 1857514.200 North)

    (2612.5, 2446.5) (8293831.800 East, 1836470.000 North)

    Coordinate system: UTM, (North)

  - **Arc World** (`*.tfw` extension at export to `*.tiff` format) – georeference file, used by *Arc INFO*.

    Example of `*.tfw` file:

    1.000000

    0.000000

0.000000

-1.000000

551286.128054

200588.824470

After mosaic export to other formats georeference files (of text format likewise `*.tfw` file) are created with the following extensions: :

- After export to `*.bmp` georeference file with `*.tfw` extension is created;
- After export to `*.jpg` georeference file with `*.tfw` extension is created;
- After export to `*.nitf` georeference file with `*.tfw` extension is created;
- After export to `*.dgn` georeference file with `*.tfw` extension is created;
- After export to `*.png` georeference file with `*.tfw` extension is created.

○ **MapInfo TAB** (`*.tab`) – Georeference file, used by *MapInfo*.

Example of `*.tab` file:

!table

!version 300

!charset WindowsLatin1

Definition table

File “mosaic.tif”

Type “RASTER”

(143424.937,2635592.133) (0,0) Label “Point 1”,

(224834.937,2635592.133) (1163,0) Label “Point 2”,

(143424.937,2565592.133) (0,1000) Label “Point 3”,

(224834.937,2565592.133) (1163,1000) Label “Point 4”

CoordSys Earth Projection 8, 104, “m”, 33.000000, 0.000000, 0.999600, 500000.000000, 0.000000

The **Correlation** tab is used to setup correlator parameters for tie points measurement:

Correlation parameters are only available if the **Measure tie points** check box is set in the **Parameters** tab.

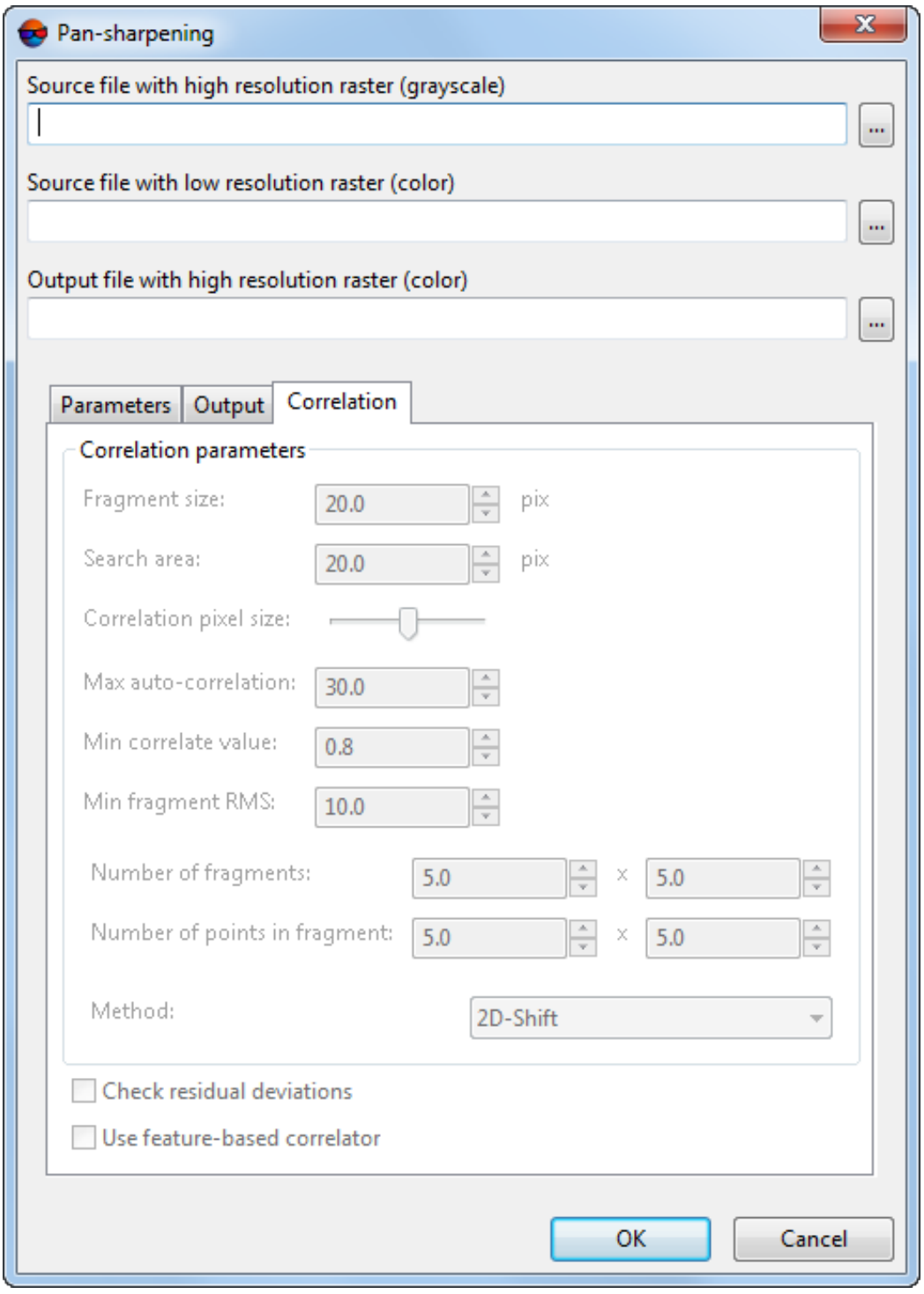


Fig. 117. Correlation parameters

Set an appropriate checkbox to **use feature-based correlator** with predefined parameters (see the “Automatic measurem.ent of tie points coordinates (aerial survey)” chapter in “Aerial triangulation” User manual). Clear this checkbox to set the following **correlation parameters** manually:

- **Fragment size** – allows to define a size (in pixels) of a fragment which contains the point indicated on one image;
- **Search area** – – allows to define a search area (in meters) of appropriate point on another image;
- **Correlation pixel size** – allows to define a value of a pixel size of images, where correlation to be performed, if the images have different pixel size;
- **Max. auto correlation** – allows to control auto-correlation of a point, i. e. a degree of point's uniqueness in some its vicinity on the left image;

The more the auto-correlation radius value, the less the point's uniqueness and the more probable its incorrect comparison with the right image even when the correlation coefficient is high.

- **Min. correlate value** – allows to define minimal acceptable value of correlation coefficient;
- **Min. fragment RMS** – allows to define a brightness value of image fragment. The less the value, the worse the correlation.
- **Number of fragments** – number of fragments on one image.

If an image contains objects with big brightness difference (dark lake and light colored field, for example), it is recommended to set more fragments number.

- **Number of points of fragment** – number of matching points on one fragment.
- **Method** – allows to choose **2D-shift** or **Affine** correction to compensate for geometric discrepancies between color and grayscale images during measurement of tie points in those images.

Camera design and operation features often lead to the fact that color and grayscale images are slightly shifted relative to each other.

The correction that compensates for simple **2D-shift** of images is recommended by default. The advantage of this method is also that random errors in tie point measurements that may occur during the operation of the correlator have little effect on the quality of output data.

The **affine** correction is recommended if the use of other settings has led to unsatisfactory quality of certain sections of output images. The affine correction is applicable in a situation where there is reason to suppose that the resulting defects in the output image are due to geometric discrepancies between color and grayscale images, which are more complex than a simple shift due to a small difference in time between the survey moments.

When using the affine correction, the requirements for the quality of measurement by the tie point correlator are significantly increased. This is due to the increasing influence of random measurement errors on the quality of output images

- **Check residual deviations** allows to evaluate the accuracy of overlaying black and white and color rasters (in pixels). Data is displayed in the information window which opens once the pan-sharpening operation is completed.

11.3. Batch pan-sharpening

The system allows possibility to perform the pan-sharpening operation with same parameters for more than 2 images.

To do this it is necessary to prepare a `*.txt` file with the list of paths to source images: high resolution, low resolution images and also a path of output file which will be created as a result of pan-sharpening.

In order to start batch pan-sharpening perform the following actions:

1. Prepare a `*.txt` or `*.csv` file with the list of paths to source images.

2. Choose the **Rasters › Pan-sharpening**. The **Pan-sharpening** window opens.

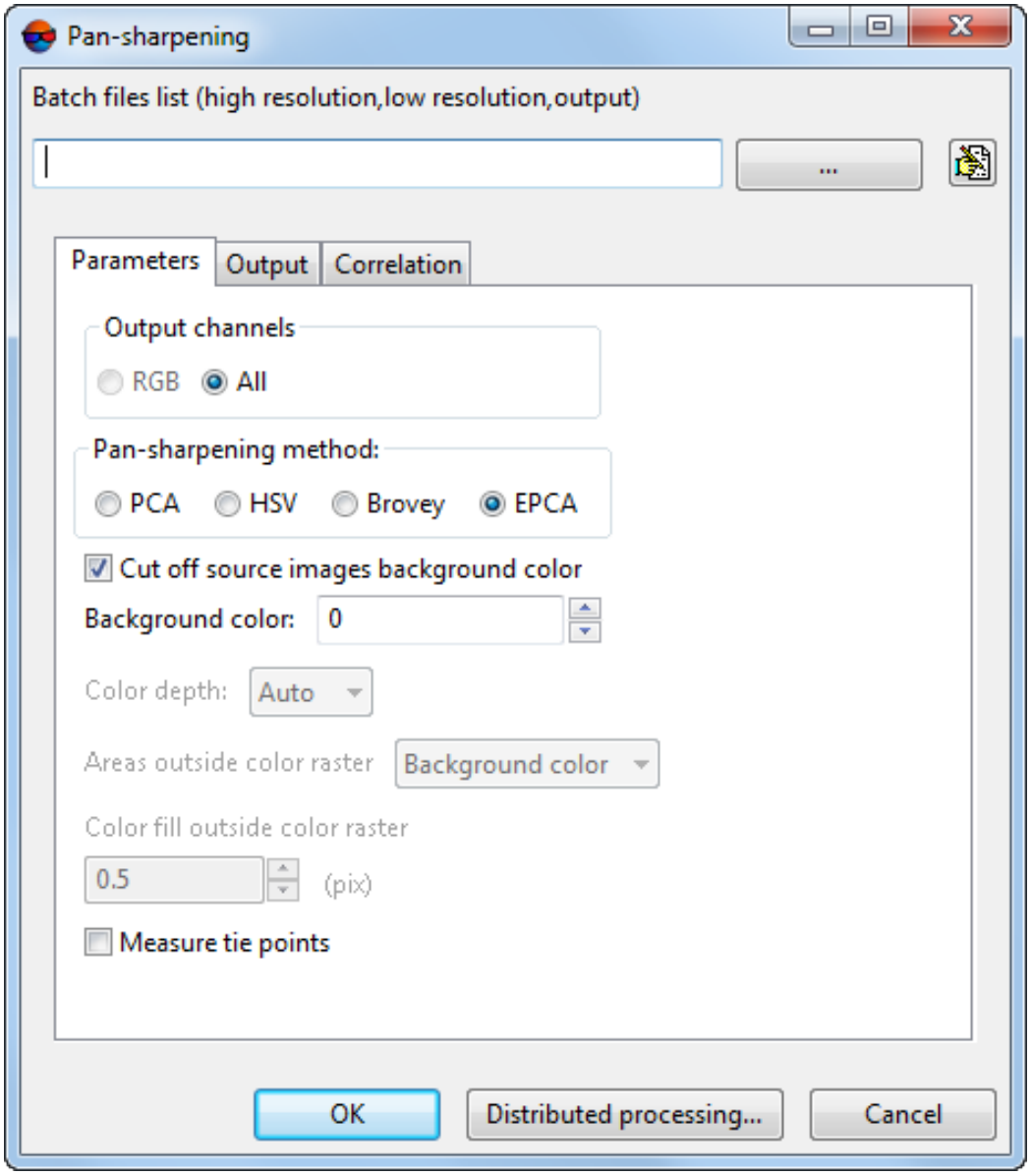


Fig. 118. Parameters of batch pan-sharpening

3. In the **Batch files list** section click the ... button and choose a text file with list of paths to source images.

   Otherwise to form image list click the button. The **Pan-sharpening images list** window opens.

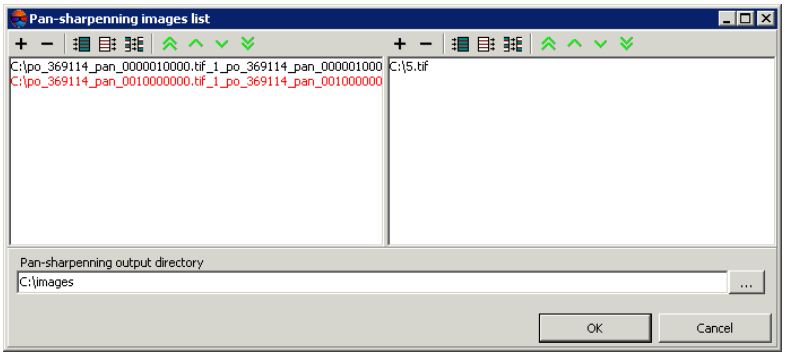


Fig. 119. Pan-sharpening images list

Left part of the window is used to form list of high resolution images, right part – to form list of low resolution images.

The window contains the toolbar with buttons used to perform the following operations:

- + – allows to choose and add image to the list;
- − – allows to remove image from the list;
- – allows to select all images;
- – allows to unselect all images;
- – allows to invert selection of files;
- – allows to move selected image to the top of the list;
- – allows to move selected image up the list;
- – allows to move selected image down the list;
- – allows to move selected image at the end of the list.

Perform the following to create list of source images:

1. Add in the left list high resolution source images.
2. Add in the right list low resolution source images.
3. Click the ... button and define the **Pan-sharpening output directory**.
4. Click OK to return for the **Pan-sharpening** window.

4. Setup the parameters of pan-sharpening.

5. [optional] To start the pan-sharpening operation in distributed processing mode, perform the following actions:

    1. Change settings and run the distributed processing server/client (see the "Distributed processing" chapter).

    2. Click the **Distributed processing** button. The **Distributed processing** window opens.

        The **Number of images** displays in the window.

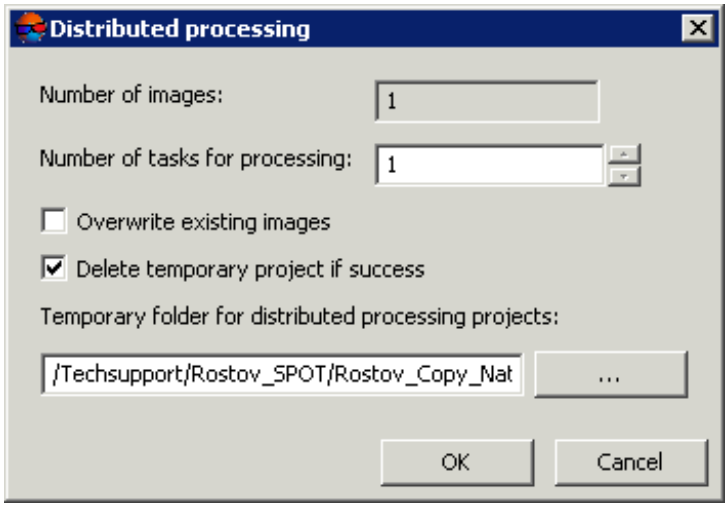


Fig. 120. Parameters of pan-sharpening in distributed processing mode

    3. Specify **Number of tasks for processing**, which are processed by one computer.

    4. [optional] Set on the **Overwrite existing images** to overwrite preliminary created images.

    5. [optional] By default if process was completed successfully, temporary project is deleted. Set the appropriate checkbox off not to delete temporary files.

    6. Select the **Temporary folder for distributed processing** for temporary data storing.

    7. Click OK. Distributed processing tasks are created and the system shows a message about number of created tasks.

6. Click OK to start pan-sharpening operation. When operation complete produces information message, that contains number of created/skipped images as a result of pan-sharpening.

11.4. Batch pan-sharpening for pushbroom images

The system allows possibility to perform the batch pan-sharpening operation with same parameters for more than 2 scanner images.

In order to start batch pan-sharpening perform the following actions:

1. Choose the **Rasters › Batch pan-sharpening for pushbroom images**. The **Batch pan-sharpening** window opens:

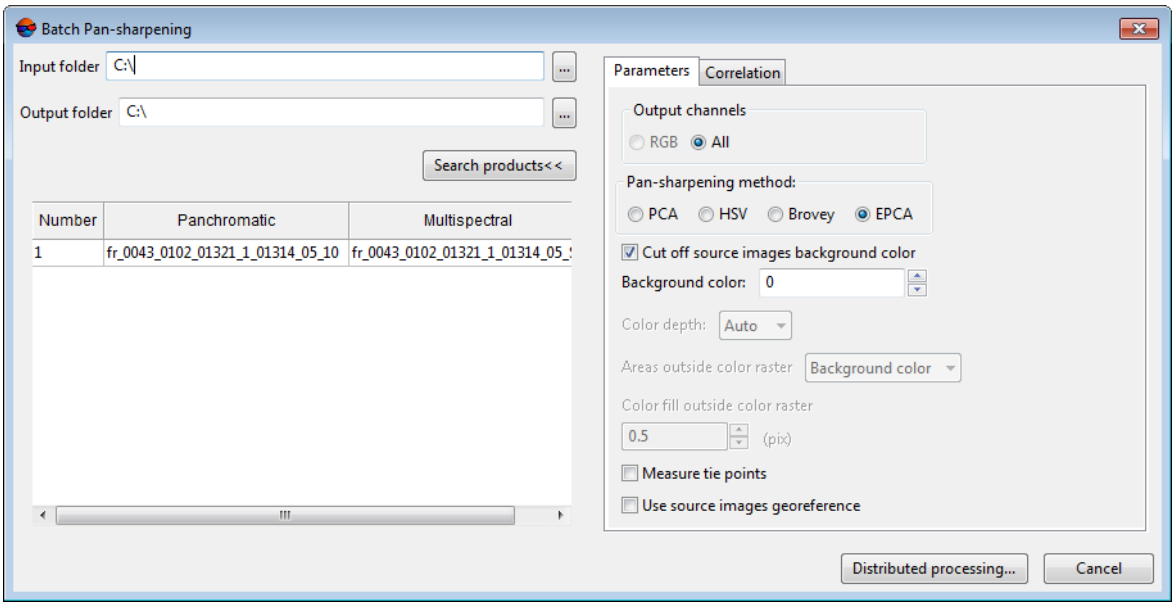


Fig. 121. Parameters of batch pan-sharpening for pushbroom images

2. Click the ... button according to the **Input folder** field and choose the folder in the *Windows* file system that contains scanner images subjected to pan-sharpening;

3. Click the ... button according to the **Output folder** field and choose the destination folder in the *Windows* file system;

4. To form the image list, click **Search products <<** button. If remote sensing data are found in the specified folder, the list of images is formed in the table located in the left part of the window.

If there are no scanner images, check the path to the given folder in the *Windows* file system and also the folder's content. Try to add used images to the scanner project. Check out the list of supported space sensors (see "Formats of satellite scanner images" in the "Creating project" User Manual). For more information contact technical support.

5. [optional] To exclude some images from processing, select the rows of the table containing the desired image pairs and press **Delete**. The following dialog box opens:

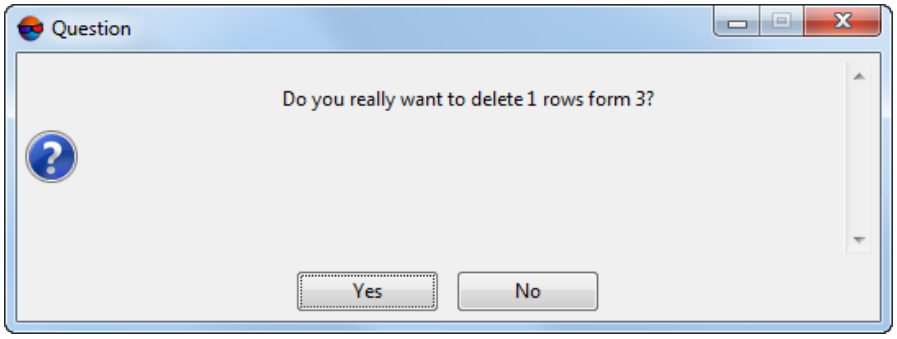


Fig. 122. The dialog box

Click **Yes**, to remove the selected image pairs from the list of images to be processed.

The images themselves will not be deleted from the *Windows* file system, only the image list in the **Batch pan-sharpening** window will be edited. If needed, user can re-create the image list clicking the **Search products <<** button.

6. Setup the parameters of pan-sharpening.

7. Click OK to start pan-sharpening operation. When operation complete produces information message, that contains number of created/skipped images as a result of pan-sharpening.

   [optional] To start the pan-sharpening operation in distributed processing mode, perform the following actions:

   1. Change settings and run the distributed processing server/client (see the "Distributed processing" chapter).

   2. Click the **Distributed processing** button.

12. Distributed Processing

12.1. General Information

Program includes capability of distributed processing of some tasks. This helps achieve maximum utilization of hardware resources for carrying out large projects.

Distributed tasks processing is a capability of parallel task execution with multiple processor cores or multiple computers in local network.

The system allows to perform the following processes in distributed processing mode:

- processing of raster images in the Raster Converter module;
- batch pan-sharpening (see also the Orthophotomaps creation User Manual);
- ADS data preparing (see the Project creation User Manual);
- automatic tie points measurement (see the Aerial triangulation User Manual);
- automatic block layout creation for UAS data (see the Aerial triangulation User Manual);
- automatic points calculation for DEM creation (see the DTM generation User Manual);
- creation of textured TIN 3D surface (see the DTM generation User Manual);
- dense DSM creation (see the DTM generation User Manual);
- dense DEM generation using SGM method (see the DTM generation User Manual);
- batch DTM creation (see the DTM generation User Manual);
- DEM filtering (slope based filter, median filter, smooth filter and filter by image properties – see the DTM generation User Manual);
- transformation of DEM coordinate system (see the DTM generation User Manual);
- batch transformation of DEM's coordinate system (see the DTM generation User Manual);
- rebuilding DEM considering last adjustment (see the DTM generation User Manual);
- filling null cells by minimum values (see the DTM generation User Manual);
- merging of overlapping DEMs (see the DTM generation User Manual);
- splitting DEM into sheets (see the DTM generation User Manual);
- DEM cutting by polygons (see the DTM generation User Manual);
- creation of difference DEM (see the DTM generation User Manual);
- creating of orthophoto (see the Orthorectification User Manual);
- automatic UAS triangulation (see the Processing of UAS data User Manual);
- creating of image pyramids (see the Orthophotomaps creation User Manual);

- creating useful areas (see the Orthophotomaps creation User Manual);
- creating cloudy areas (see the Orthophotomaps creation User Manual);
- cutlines creation (see the Orthophotomaps creation User Manual);
- automatic searching of tie points in the vicinity of cutlines (see the Orthophotomaps creation User Manual);
- orthoimages creation in distributed processing mode (see the Orthophotomaps creation User Manual);
- transformation of point cloud coordinate system (see the LIDAR Data processing User Manual);
- point cloud cutting by polygons (see the LIDAR Data processing User Manual);
- block adjustment in batch mode (see the Block adjustment User Manual);
- batch DEM export (see the DTM generation User Manual);
- LAS filtering by data density (see the LIDAR Data processing User Manual);
- LAS interpolation (see the LIDAR Data processing User Manual).

Computers participating in the distributed processing are assigned the two following modes:

- *Server* is the control center of the distributed processing, responsible for distribution of tasks and synchronization of *Client* computers;

  Server is also could has *Client* status.

- *Client* is a computer, which receives tasks to process from the *Server*;

  Each *Client* must be connected to the *Server.*

  It is possible to temporary exclude *Client* from distributed processing.

There could be several computer groups in one local network to process project in distributed mode independently of each other.

There are the following limitations in the Lite-version of the system: maximal number of task in queue couldn't be more than 10 tasks; maximal connections of client type is 3.

To launch the **Distributed processing control center** perform one of the following:

- in right-click menu of *System Monitor module*choose the **Distributed processing control center**;

  The **Start automatically** menu item allows to launch the distributed processing control center automatically concurrently with launching any module of program when *System Monitor module* is launched.

- choose the **Service › Distributed processing › Control center**.

  If both full version of system and *PHOTOMOD UAS* are installed on a computer, it is possible to launch **Distributed processing center** for different system's version at the same time. Besides it is required to launch **Distributed processing center** one the same system's version on all computers of group to correct tasks processing.

The distributed processing control center is launched with properties of previous working session of program in the *Windows* system tray the icon displays. During the first launch the **Distributed processing setup** window is also opens.

Tooltip to the distributed processing center displays the version of the system from what **distributed processing center** was launched, the port number and information about server/client status.

The distributed processing icon in the *Windows* system tray is different depending on using computer in the distributed processing mode:

- – *Server* and *Client* are not launched (computer is not used in distributed processing);
- – only *Server* is launched;
- – *Server* and *Client* are launched;
- – only *Client* is launched, connection to *Server*;
- Alternating icons (and) – only *Client* is launched, *Server* connection fault.

To use distributed processing in a local network requires the following:

- the same Centralized management folder should be connected to each workstation, involved in distributed processing;

  Active profile is not important for *Client* computers.

- read and write public access and defined full path is required for all folders with data;

Full path is not required for local folders.

- at least one computer should be in *Server* mode and all *Clients* should be connected to one *Server*.

12.2. Workflow of distributed processing

The following workflow is used to distributed tasks processing:

1. Launch the **Distributed processing control center** on all involved computers.
2. Configure the required distributed processing settings:
   - Define one of computers as a *Server* and input free **Port for incoming connections**.

     Ports in the range 0-1023 are reserved by the operating system, so the minimum value of the port is set to 1024.

   - Define all the rest involved computers as a *Clients*, choose server name and **Port for connecting to server**, specified on step 2.

     Server is also could be use as a *Client* at the same time.

     The system also provides an opportunity only to use local computer for distributed processing tasks with using several cores of one computer, i.e. using computer as a *Server* and *Client* at the same time.

3. Open the main *PHOTOMOD* window;
4. Setup the parameters of the current task in an appropriate window and click the **Distributed processing** button. The list of distributed processing tasks is created and displayed in the **Tasks** table.

   Distributed processing tasking process is displayed in the progress bar, which (in most cases) immediately closes automatically after the completion of this operation (see details in Section 8.4.1).

   As the output folders and folders for intermediate data, specify only folders which are available for all involved computers.

   Distributed processing is impossible if the **Distributed processing control center** has not been previously started and configured (see items **1** and **2**). The appropriate message appears in this case.

Fig. 123. A message that appears if items **1** and **2** have not been completed before clicking the **Distributed processing button**

5. Open the **Monitor for distributed processing** to view the progress of tasks performance;

Click the button to perform all distributed processing tasks automatically.

The **Monitor for distributed processing** window also allows to manage distributed processing tasks performance.

12.3. Distributed processing parameters setup

The **Distributed processing setup** window is used to setup distributed processing parameters. Parameters are setup depending on computer's mode.

To open the **Distributed processing setup** window the menu item **Configuration...** of right-click menu of the distributed processing icon is used. The **Distributed processing setup** also opens after the first launch of the **Distributed processing control center**.

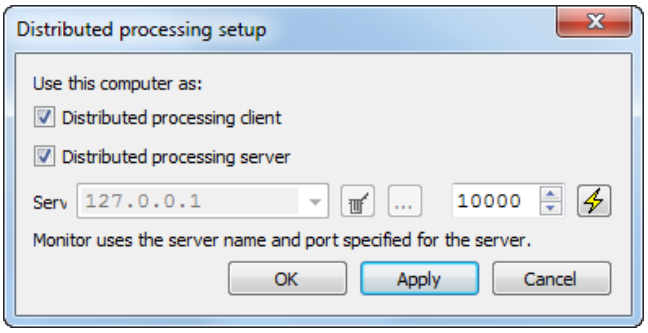


Fig. 124. Distributed processing parameters setup

To use computer as a *Client* of distributed processing, perform the following actions:

The system upgrade may require to delete the existing database and create a new one (when the **Distributed processing setup** window opens, the appropriate informational message appears).

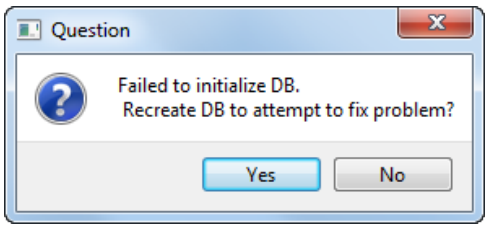


Fig. 125. The dialog window

The *database* contains the distributed processing parameter settings, the lists of tasks and logs of their execution. The database files are saved in the *PHOTOMOD7.VAR* folder at the *Server* by default.

The ⚡ button allows to check the availability of the database (at the specified server IP address and port for connecting to the server) for the current network node.

1. Set on the **Distributed processing server** checkbox.
2. Set the **Distributed processing client** checkbox off.
3. Set free port in the **Port for incoming connections** field.

   Ports in the range 0-1023 are reserved by the operating system, so the minimum value of the port is set to 1024.

   If not possible to connect with chosen port, choose another one.

4. Click OK.

   It is necessary to restart the distributed processing control center if parameters were changed.

To use computer as a *Client* of distributed processing, perform the following actions:

1. Set the **Distributed processing server** checkbox off.
2. Set on the **Distributed processing client** checkbox.
3. Input in the **Server name or IP address** or click the ... button and choose computer name or IP-address from the list used as a *Server*.

   The list of last computers, used as a Server, are kept in the system. The 🗑 button allows to clear the file list;

4. Input port number which was specified during the **Server** adjustment in the **Port for incoming connections** field.

5. Click OK.

It is necessary to restart the distributed processing control center if parameters were changed.

The system also provides an opportunity only to use local computer for distributed processing tasks with using several cores of one computer, i.e. using computer as a *Server* and *Client* at the same time. Perform the following actions to do this:

1. Set on the **Distributed processing server** checkbox.

2. Set free port in the **Port for incoming connections** field.

If not possible to connect with chosen port, choose another one.

3. Set on the **Distributed processing client** checkbox. Server name and port number are set automatically.

Ports in the range 0-1023 are reserved by the operating system, so the minimum value of the port is set to 1024.

If not possible to connect with chosen port, choose another one.

4. Click OK.

It is necessary to restart the distributed processing control center if parameters were changed.

12.4. Distributed processing management

The **Monitor for distributed processing** window is used for condition monitoring of distributed processing.

Also the menu item **Start monitor** of right-click menu of the distributed processing icon and the **Service › Distributed processing › Monitor** menu items.

Tasks could be created both by *Server* and *Client*.

If the *Server* (and *database*) are disconnected for any reason, the further distributed processing management is not available (when trying to run the **Monitor for distributed processing** window at the *Client* workstation, the appropriate informational message appears).

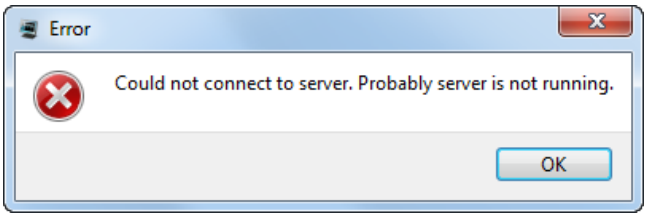


Fig. 126. The informational message

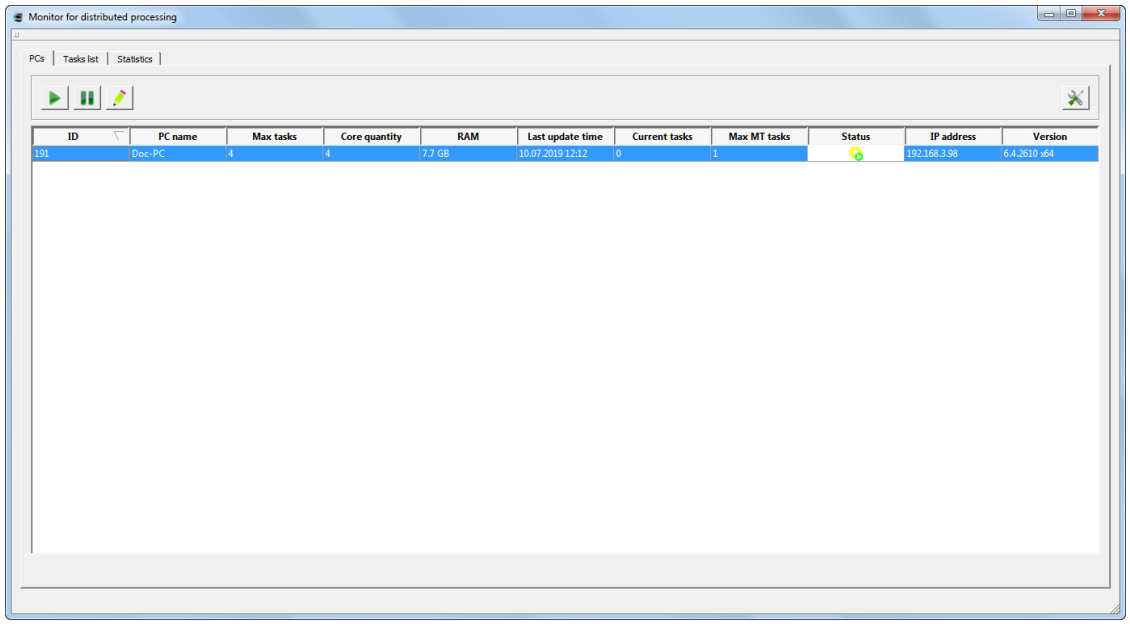


Fig. 127. Monitor for distributed processing

The **Monitor for distributed processing** window contains the following tabs: **PCs**, **Tasks list** and **Statistics**.

In the **Monitor for distributed processing** window displays information about tasks queue and *Clients* computers using. The window also allows to manage tasks processing.

The window refresh automatically each several seconds.

12.4.1. Computers

The **PCs** tab contains toolbar and table of computers, which are currently in the network and configured with the same *Server*.

The *Server* is displayed in this list only in if it also takes part in the processing being also a *Client*.

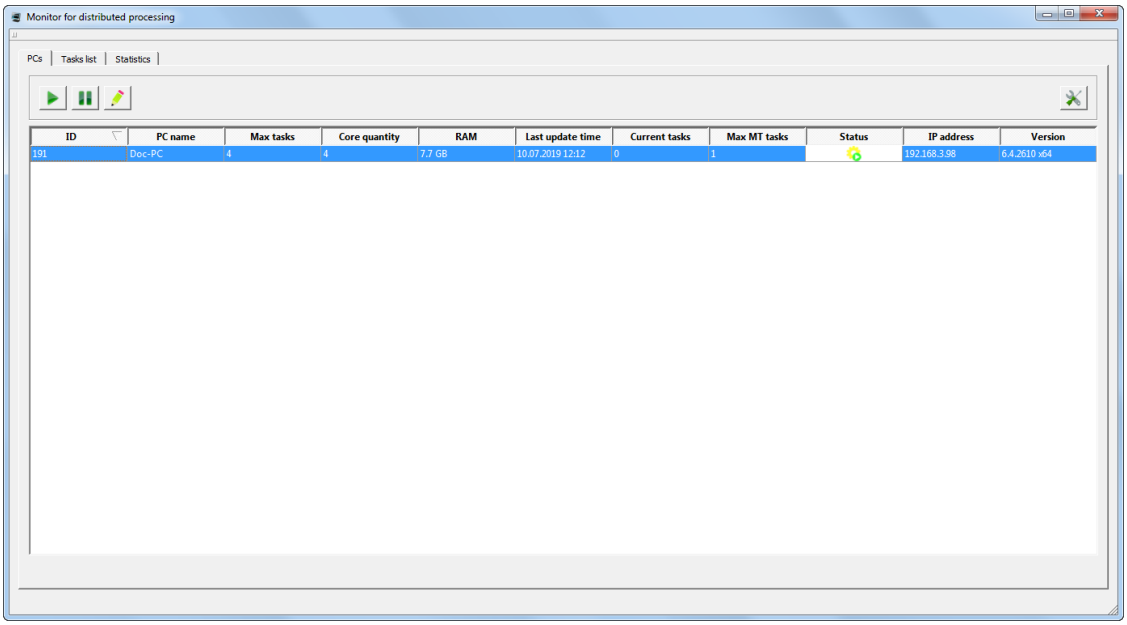


Fig. 128. The “PCs” tab

The table contains following parameters for each computer:

Points sorting in columns of the list is performed by mouse click on the column header.

The button allows to set columns visibility.

- The Computer **ID**;
- **PC Name** – shows network computer name;
- **Max tasks** – the maximum quantity of simultaneously running tasks on *Client*;

The **Max tasks** number by default is equal to the number of CPU’s cores of a workstation (but doesn’t exceed the number available according to the license).

If the capacity of the network connecting workstations equipped with hard disk drives (HDD) does not exceed 1 Gb/s, the recommended total **Max tasks** for all workstations is no more than 16.

- **Core quantity** – the total quantity of Client CPU’s cores;
- The Client’s **RAM**;
- **Last update time** – the time of the last connection between *Server* and *Client*;
- **Current tasks** – tasks number of distributed processing, which currently performed by Client;

- **Max MT tasks** – the maximum quantity of simultaneously running tasks on *Client* in *MultiThreading* mode;

  MultiThreading – in computer architecture, multithreading is the ability of a central processing unit (CPU) (or a single core in a multi-core processor) to provide multiple threads of execution concurrently, supported by the operating system.

  This approach differs from multiprocessing. In a multithreaded application, the threads share the resources of a single or multiple cores, which include the computing units, the CPU caches, and the translation lookaside buffer (TLB).

  Where multiprocessing systems include multiple complete processing units in one or more cores, multithreading aims to increase utilization of a single core by using thread-level parallelism, as well as instruction-level parallelism. As the two techniques are complementary, they are sometimes combined in systems with multiple multithreading CPUs and with CPUs with multiple multithreading cores.

  When setting this option, it is needed to take into account the *Client's* specifications i.e. **RAM** and the number of processor cores. In most cases, the recommended **Max MT tasks** value for a workstation having a multicore processor and 8 GB **RAM** is 1. The recommended **Max MT tasks** value for a workstation with 16 GB **RAM** is 2, etc.

- The permission **Status** for the selected computers to execute new tasks;
  - – allowed;
  - – forbidden.

    When current task complete, *Client* go to sleep mode and doesn't start new tasks temporary.

- **IP-address** – IP-address of the computer;
- **Version** – the PHOTOMOD build number for control of compatibility.

  It is recommended to use the same RHOTOMOD build on all computers working with the same Synchronization folder.

To perform actions with multiple computers, select them in the table using **Shift** and **Ctrl** keys.

Table 18. The "PC" tab toolbar

Buttons	Function
	allow selected computers to execute new tasks (if forbidden)
	forbid selected computer to execute new tasks When current task complete, *Client* go to sleep mode and doesn't start new tasks temporary

Buttons	Function
	allows to open the **Num tasks entry** window to set **Max tasks** and **Max MT tasks** quantity (see below)
	allows to open the **Display options** window to set the visibility of the columns in the table of computers (see below)

To set **Max tasks** and **Max MT tasks** quantity for the selected workstation, select this computer in the table of computers and click the  button of the **PCs** tab toolbar. The **Num tasks entry** window opens:

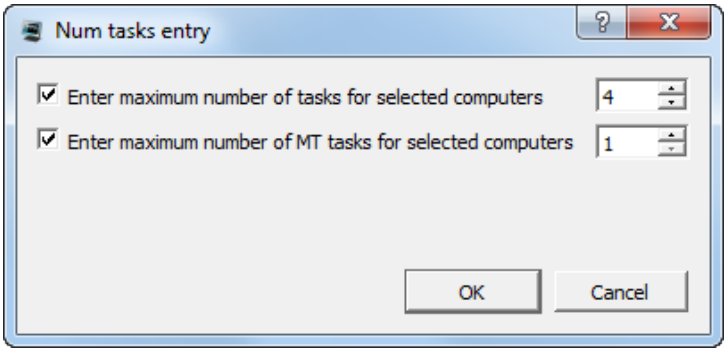


Fig. 129. The “Num tasks entry” window

- [optional] **Enter maximum number of tasks for selected computers** or clear an appropriate checkbox, if this parameter does not need to be changed;
- [optional] **Enter maximum number of MT tasks for selected computers** or clear an appropriate checkbox, if this parameter does not need to be changed;

Click OK. If no workstations were selected above, changes will be applied to all of them.

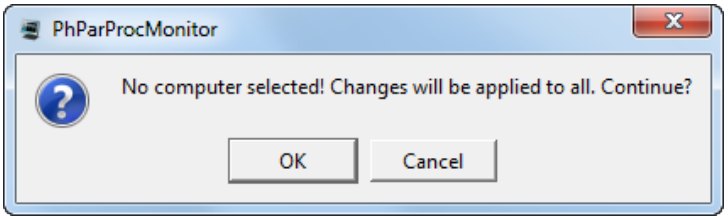


Fig. 130. The question window

The system allows to set visibility of the columns in the table of computers. To do this click the  button of the **PCs** tab toolbar. The **Display options** window opens. Clear an appropriate checkboxes if needed, and click OK.

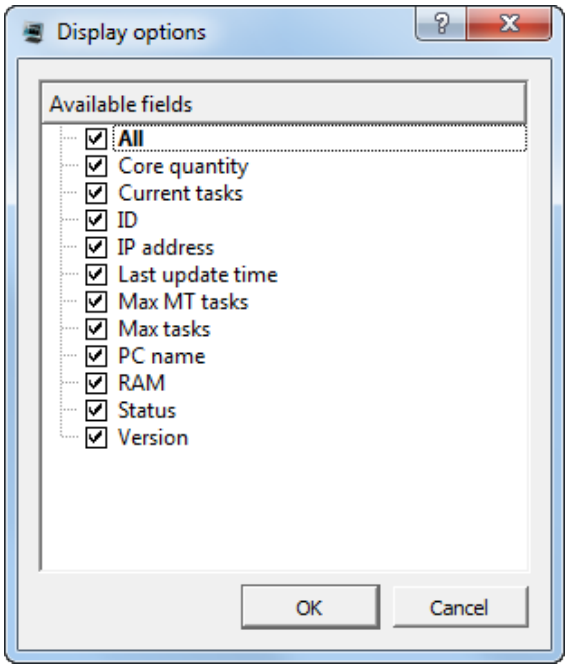


Fig. 131. The “Display options” window

12.4.2. Tasks list

The **Tasks list** tab contains toolbar and table with information about tasks.

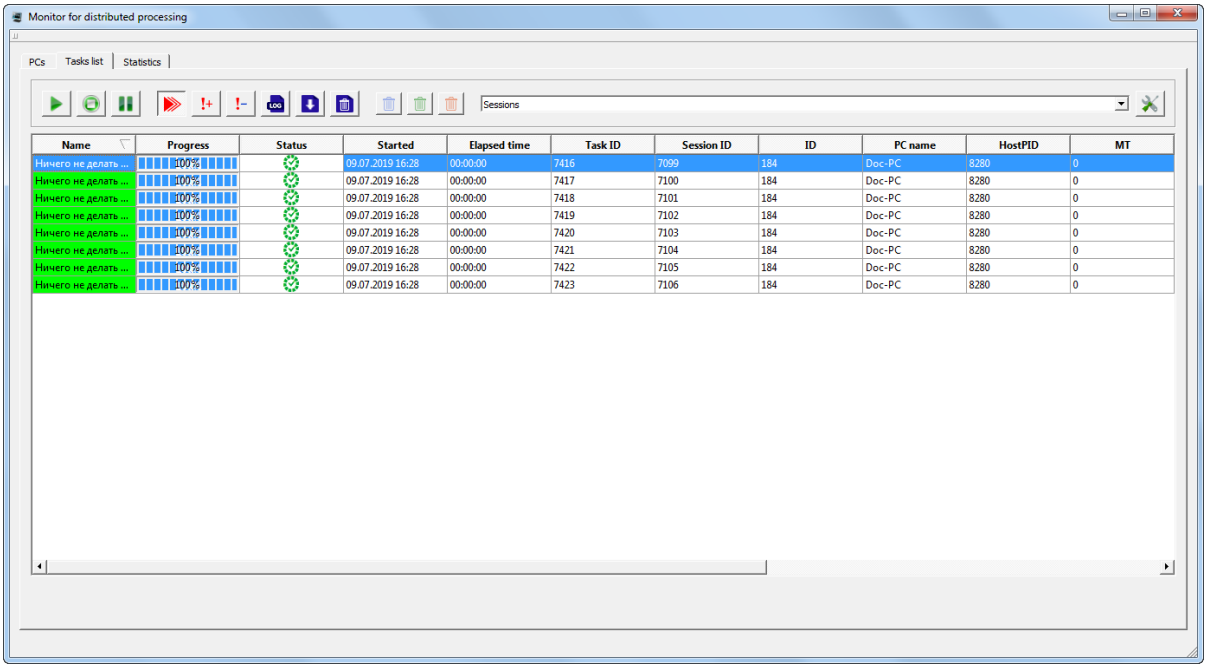


Fig. 132. The “Tasks list” tab

The table consists of columns with following information:

Points sorting in columns of the list is performed by mouse click on the column header.

The button allows to set columns visibility.

- The task **name**;
- The task **progress**;
- The **Status** of the task:
  - – `waiting`;
  - – `unknown error`;
  - – `stopped`;
  - – `paused`;
  - – `performed`;
  - – `restarted`;
  - – `complete`;
  - – `failed` – displayed in case of complete part or resource connection error;
  - – `not complete` – displayed in case of tasks didn't complete because of *Client* was disconnected during the task processing, *Server* was disconnected or task was canceled.
- **Started** – the data and time are displayed for started task;
- **Elapsed time**;
- **Task ID** – unique identifier for each task;
- **Session ID** – unique identifier for each communication session between the *Server* and the *Client*;
- Computer **ID**;
- **Maker** – shows network computer name;
- **Maker ID** – is a unique *PHOTOMOD* session ID;
- **MT** – this parameter estimates if this task is processed in the MultiThreading mode;

1– this task is processed in the MultiThreading mode, 0 – this task is not processed in the MultiThreading mode.

- **Update time** is the time of the latest log entry creation;
- **Priority** – priority of the tasks (integer, the larger the number, the higher the priority, the tasks of higher priority are performed in the first place);

To change the **Priority** of the performed task, double click the appropriate cell of this column.

To sort out performed tasks by priority, click the  icon to the right of the **Priority** column name.

- **Executor** – for started task – the name of *Client* computer, which executes it;
- **Created at** – the date and time of posting task;
- **Profile** – active Client profile at the time of posting of tasks. This profile must be network and connected to other Clients in order that they have been able to execute the tasks;
- The task **description**.

If during the task execution an error occurs on any of network computers, it's highlighted in red in the list. In this case attempts will be made to perform the same tasks on other computers. The task will remain in the queue with a `failed` state until it is deleted manually, if no computer in network is able to execute this task.

Table 19. The "Tasks list" tab toolbar

Buttons	Function
	allows to start selected tasks sequentially
	allows to pause selected tasks
	allows to stop selected tasks
	allows to set on the auto run tasks – automatic distribution of tasks in the queue (according to priority) between the Clients and launch of the tasks
	allows to increase priority of selected tasks by 1
	allows to decrease priority of selected tasks by 1
	allows to show logs for selected tasks (see below)
	allows to perform logs export (see below)
	allows to enable/disable logs saving mode while deleting tasks
	allows to remove selected tasks from the queue
	allows to remove complete tasks from the queue
	allows to clear the queue of tasks

Buttons	Function
	allows to open the **Display options** window to set the visibility of the columns in the table with information about tasks (see below)

The system allows to set visibility of the columns in the table with information about tasks. To do this click the  button of the **Tasks list** tab toolbar. The **Display options** window opens. Clear an appropriate checkboxes if needed, and click OK.

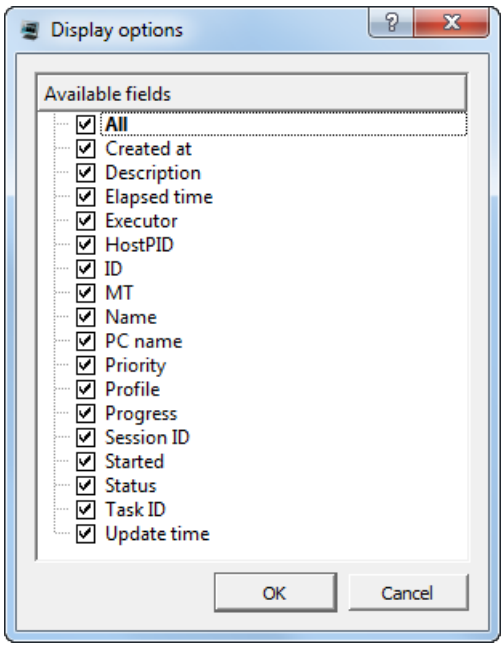


Fig. 133. The “Display options” window

To show logs for selected tasks, select this tasks in the table above and click the  button of the **Tasks list** tab toolbar. The **Session logs** window opens:

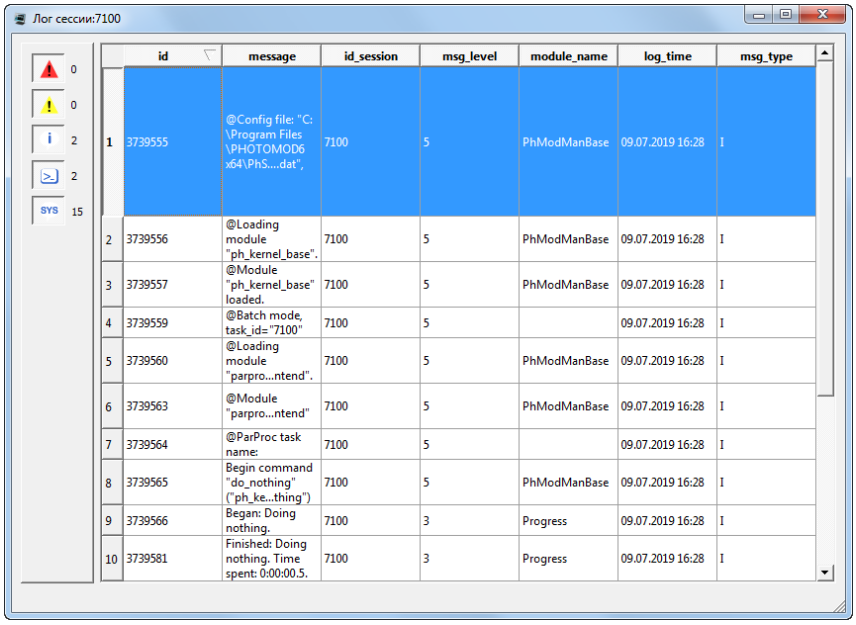


Fig. 134. The “Session logs” window

The **Session logs** window contains the table with messages about tasks performance and the toolbar, allowing to enable/disable the visibility of the messages categories.

The table consists of columns with following information:

Points sorting in columns of the list is performed by mouse click on the column header.

- **ID** – unique identifier for each message;
- the **message** text;
- **Session ID** – unique identifier for each session;
- **Msg level** – message significance level (the greater this value, the less important the message is);
- **Module name** – the used module of the *PHOTOMOD* system;
- **Log time** – the time of message creation;
- **Msg type** – message category.

The buttons of the **Session logs** window toolbar allows to enable/disable the visibility of an appropriate messages categories. The number of messages in the each category is displayed to the right of the corresponding button.

Table 20. The “Session logs” window toolbar

Buttons	Function
	allows to enable/disable the visibility of the error messages
	allows to enable/disable the visibility of the warnings
	allows to enable/disable the visibility of the information messages
	allows to enable/disable the visibility of all the abovementioned message types
	allows to enable/disable the visibility of all messages, including low-severity system messages

Low-severity system message logs () may be required for user-developer interactions during debugging.

To export the logs of the selected tasks perform the following:

1. [optional] select necessary tasks in the table together with task info (otherwise, logs of all the tasks from this table will be exported);

2. click the  button of the **Tasks list** tab toolbar. The **Log export** window opens;

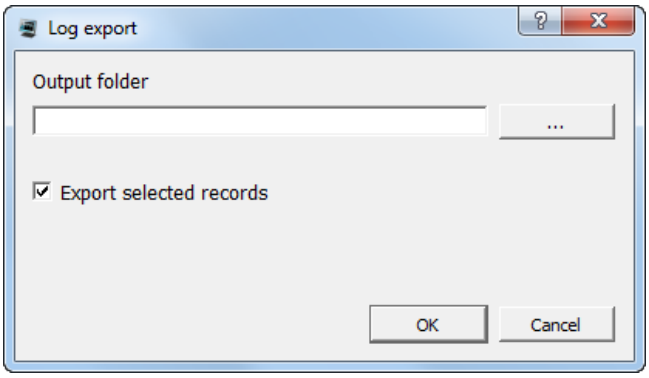


Fig. 135. The “Log export” window

3. press the  button to specify the **Output folder**;

4. [optional] clear the **Export selected records** checkbox to export logs of all the tasks from the table in the **Tasks list** tab;

5. To save logs in the chosen folder, click OK. Task logs are text files with `*.log` extensions. If it is needed to export logs for more than one task, an archive of logs with `*.tar.gz` extensions will be saved in the chosen folder.

12.4.3. Statistics

The **Statistics** tab contains the table with statistics of the current task session.

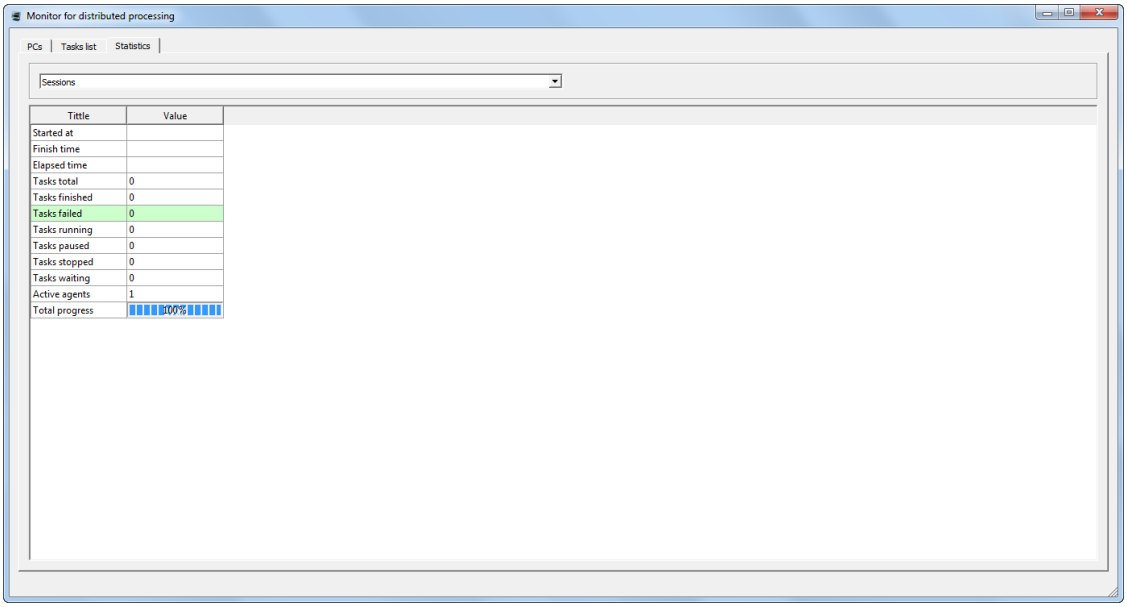


Fig. 136. The “Statistics” tab

The table consists of strings with following information:

- **Start time**;
- **Finish time**;
- **Elapsed time**;
- **Tasks total**;
- **Tasks finished** ();
- **Tasks failed** ();
- **Tasks runned** ();
- **Tasks paused** ();
- **Tasks stopped** ();
- **Tasks waiting** ();
- **Active agents** – the number of *Clients* in the **PCs** tab;
- **Total core quantity** (on all PCs);
- **Total progress**.

12.5. Test of distributed processing

The system provides possibility to test distributed processing for performance measurement of specified parameters, using operating system and local network configuration.

Perform the following actions to start test:

1. Setup distributed processing Server and Client.

2. Choose the **Service › Distributed processing › Test distributed processing**. The **Test distributed processing** window opens.

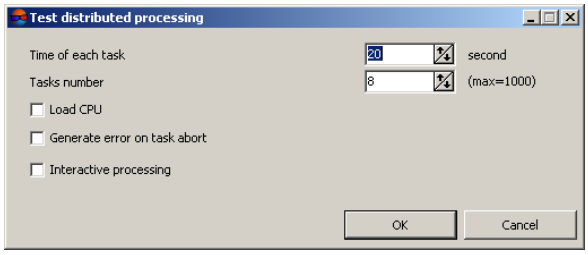


Fig. 137. Test distributed processing

3. Define the following parameters of test:

   - **Time of each task** – allows to specify duration of each task;
   - **Tasks number** performing in test;
   - **Load processor** – allows to set the CPU load to control the use of processor cores;
   - **Generate error on task abort** – allows to mark task as Failure if the task performing was stopped;
   - **Interactive execution** – allows to show the progress window during the test of distributed processing.

   If interactive execution was canceled, created test tasks ate not canceled and stay in the tasks list.

4. Click OK. Specified number of distributed processing tasks are creating as a result. Created tasks are displayed in the **Monitor for distributed processing** window.

5. Click the button to perform all distributed processing task automatically, if needed.

13. Additional features of the system

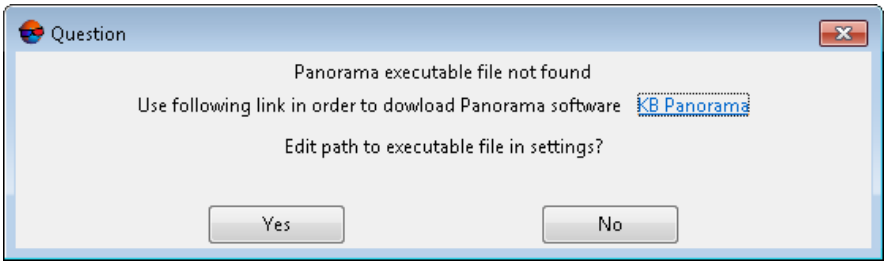
13.1. “Service” menu

Table 21. Brief description of the ’Service’ menu

Menu	Function
Explorer	allows to open the Explorer module to view resources system
GIS Panorama	allows to run the *GIS Panorama Mini* (this software is not included with the *PHOTOMOD* but can be installed separately)
Distributed Processing	contains menu items to run, test and setup distributed processing
Working coordinate system	allows to choose working coordinate system (see the Project creation User Manual)
Recalc working area	allows to refresh 2D-window and fit displayed area depending on load data
GeoCalculator	allows to launch the GeoCalculator program that is used for coordinates transformation form one reference system to another
Autodetect Gauss-Krueger zone	allows to detect the Gauss-Krueger zone automatically for the selected object, provided that any Global coordinate system is used
CSV converter	allows to launch the CSV converter to transform points coordinates in CSV and TXT files and also for other transformations for CSV files
Show in Google Maps	allows to display area on images in the GoogleMaps service (Internet connection required); it is possible only for projects in geodetic coordinate systems or if the coordinate system could be transformed to geodetic
Show in Yandex Maps	allows to display area on images in the YandexMaps service (Internet connection required); it is possible only for projects in geodetic coordinate systems or if the coordinate system could be transformed to geodetic
Load atlas	allows to load the World map to a new vector or raster layer (see Section 13.4)
Save scene	allows to save visible part of images in active 2D-window as a raster image with specified size and quality
Parameters	allows to open the window to set the general parameters of the system
Customize hotkeys	allows to adjust hotkeys using in the system, edit, delete or create new hotkeys
Customize fast commads	allows to use so called shortcut commands, the custom button combinations for quick access to

Menu	Function
	various functions when working with the layers such as **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN**
Save options	allows to save projects parameters and use it automatically when restart the system
Activate mouse driver	allows to turn on/off defined mouse driver
Mouse setup	allows to setup or connect mice, including special mice, hand wheels and foot pedals, and also to macros setup
Prepare ADS data	allows to convert source ADS data and prepare it to use in the system (see the Project creation User Manual)
Last log	allows to display the last log of system actions

If the *GIS Panorama* executable file is not found, an appropriate system message will appear. The software description and URL hyperlink (for download) are indicated in this message.



Click **Yes** to go to path settings (see the “Paths settings” chapter of the “General system’s parameters” User Manual.

13.2. Editing of active layer

The system provides possibility to edit objects of active layer.

The following menu items of the **Edit › Active layer** menu are used:

- **Save** (**Ctrl+S**) – allows to save active layer;
- **Save as** (**Ctrl+Shift+S**) – allows to save active layer with a new name;
- **Close** (**Ctrl+Q**) – allows to close active layer;
- **Layer information** (**Ctrl+I**) – allows to display information about active layer;
- **Show/hide active layer** (**H**);
- **Show/hide labels in active layer** (**Ctrl+H**).

Menu items and hotkeys could be used for *any active layer.*

The system provides possibility to edit objects on layer, and editing of marker position. To do this use the **Edit** menu. Detailed description see in the Vectorization User Manual.

Table 22. Brief description of the 'Edit' menu

Menu items	Function
Group selection	contains menu items to choose mode of vector object selection
Snapping	contains menu items for processing in the snapping mode
Vectors create mode	menu items to change a mode of vector objects creation to work in the following vectors creation modes: creating mode of point objects, unclosed polylines, polygons, as well as polylines and polygons as smooth lines
Curve transforms	menu items to create and edit smooth curve lines
Undo (**Ctrl+Z**)	allows to cancel the last operation of vector objects editing on a layer (as well as several operations with DEMs)
Undo log	allows to open the **Undo log** containing a list of recent editing operations
Redo (**Ctrl+Shift+Z**)	allows to redo the last undone operation
Points editing mode	allows to automatically move common vertices at once
Streamline mode (**Y**)	allows to enable orthogonal mode of linear objects input
Snap-to-ground mode (**T**)	allows to enable snap-to-ground mode
Orthogonal mode (**A**)	allows to enable orthogonal mode of linear objects input
Orthogonal mode in coordinate system	allows to enable orthogonal mode of linear objects input in additional coordinate system
Add coord system	allows to create additional (user) coordinate system as a helping vectorization tool
Edit coord system	allows to change default axes direction of additional coordinate system
Delete coord system	allows to delete additional coordinate system
Alignment mode	turns the *alignment mode* on
Scale when align	allows to scale vector objects during their transformation in the alignment mode
Rotation mode	turns the fast vector objects transformation mode on
Select vertices when marker moves over them	allows to select a vertex, located in marker area on a distance specified in the **Swath** field (**Service › Settings › Vectors**)
Move marker to selected vertex	allows to move marker to the selected vertex automatically (see the "Settings of vector objects display"

Menu items	Function
	chapter of the "General system's parameters" User Manual)
Sync markers	allows to turn on/off synchronous marker moving in all opened 2D-windows
Copy marker to clipboard (**Ctrl+Alt+-**)	allows to copy position of marker in 2D-window to clipboard
Paste marker from clipboard (**Alt+Shift+-**)	allows to move marker to position in 2D-window copied to clipboard
Cancel selection	allows to unselect all objects in active 2D-window
Invert selection	allows to invert objects selection in active 2D-window
Select all (**Ctrl+A**)	allows to select all objects in active 2D-window
Highlight selected objects	allows to highlight vector objects selected in 2D-window
Active layer	contains menu items to work with current active layer
Show/hide labels in all layers (**Ctrl+Shift+H**)	used to change visibility of labels in *all* layers
Toggle Raster layer visibility in Stereopair window	allows to show/hide the **Raster** layer when working in the stereopair window and duplicates the button in the *Layer Manager*.

For ease of use of the **Toggle Raster layer visibility in Stereopair window** function when working with vector objects in the stereopair window, it is advisable to set an appropriate hotkey.

13.3. Objects selection modes

Press and hold **Shift** key and drag a rectangle by mouse to select an object or the object partition (a DEM area, for example). To unselect objects press **Esc**.

To change selecting mode for vector objects the system provides the **Edit › Group selection** menu items:

- **Rectangle** – to select vector objects inside a rectangle;
- **Polygon** – to select vector objects inside arbitrary polygon;
- **Normal** – during vector objects selection previously selected objects will be unselected;
- **Add to selection** – each newly selected object (objects group) is added to a group of selected objects;
- **Subtract from selection** – allows to unselect selected object (objects group);
- **Invert selection** – allows to invert selected objects (objects group);

- **Fully inside** – allows to select objects that hit the selection area;
- **Partly inside** – allows to select objects in which one or more segments intersects a border of selection area;
- **At least one point inside** – allows to select objects in which at least one vertices are in the selection area;

The **Tools** panel partially duplicates menu items **Edit › Group selection**.

The **Vectors › Selection** menu contains the following items used to sequentially select vector objects and their vertices:

- **Select previous object** (**Ctrl+<**) – allows to select an object, previous to selected;
- **Select next object** (**Ctrl+<**) – allows to select an object, next to selected;
- **Select previous line vertex** (**<**) – allows to select a polyline vertex located before the selected one; sequence of vertices is displayed when you select a vector object;
- **Select next line vertex** (**<**) – allows to select a polyline vertex located after the selected one; sequence of vertices is displayed when you select a vector object;

Table 23. Brief description of the 'Tools' toolbar

Button	Function
	allows to select vector objects inside a rectangle
	allows to select vector objects inside arbitrary polygon
	during vector objects selection previously selected objects will be unselected
	each newly selected object (objects group) is added to a group of selected objects
	allows to unselect selected object (objects group)
	allows to invert selected objects (objects group)
	allows to select objects that hit the selection area
	allows to select objects in which one or more segments intersects a border of selection area
	allows to select objects in which at least one vertices are in the selection area
	turns the alignment mode on
	allows to scale vector objects during their transformation in the alignment mode
	turns the fast vector objects transformation mode on
	allows to copy position of marker in 2D-window to clipboard
	allows to move marker to position in 2D-window copied to clipboard
	allows to paste vector objects from clipboard to active vector layer into marker position

Vector objects are pasted to the point of marker position at the time of copying objects to the clipboard. If the marker is not moved between the copy and paste operations, objects are located in the same coordinates as the original; otherwise they shift on a vector that connects marker positions during copy and paste operations.

13.4. Loading atlas

The system allows to load the World atlas as vector or raster layer.

To load the atlas do the following:

1. Choose **Service › Load atlas**. The **Load atlas** window opens.

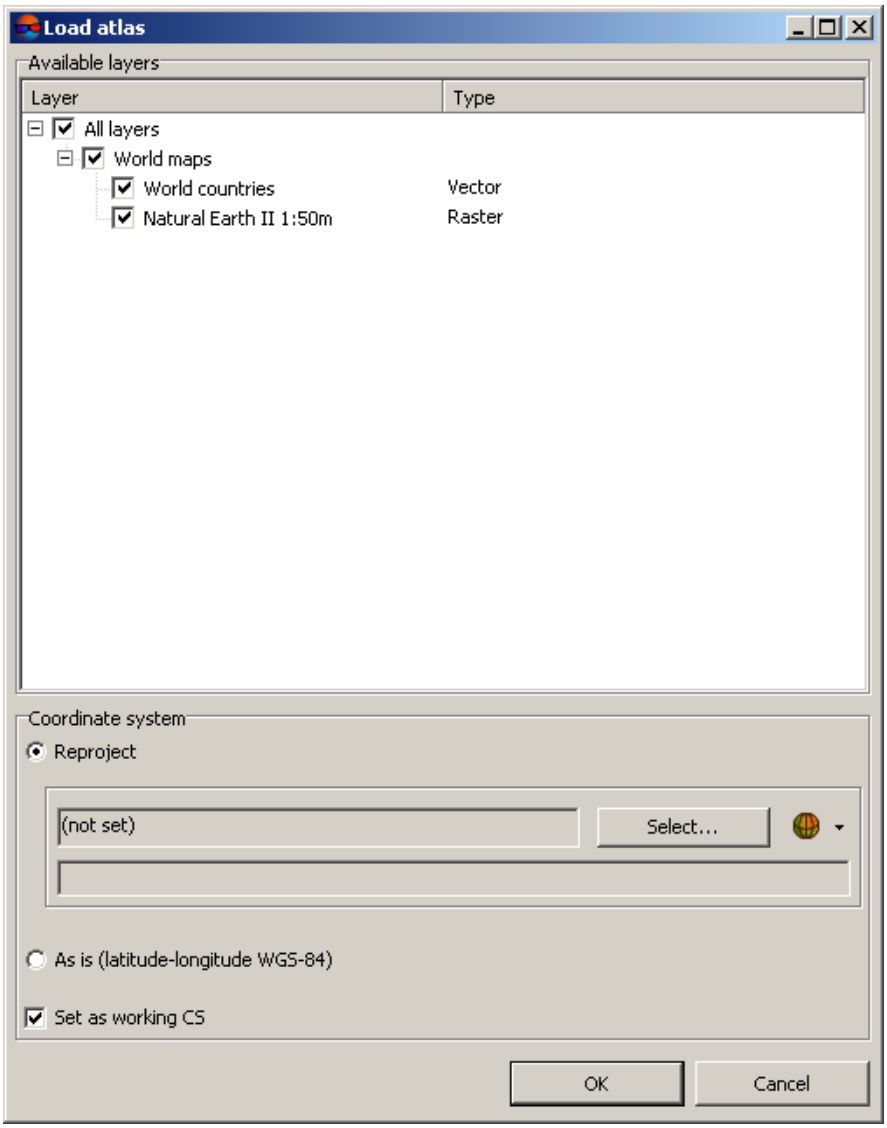


Fig. 138. Parameters of the atlas loading

2. In the **Available layers** set on the following checkboxes to load atlas:
   - **World countries** – to load vector layer;
   - **Natural Earth II 1:50 m** – to load raster layer.

To load one atlas layer with default parameters. double-click on its name.

In the Lite-version of the system only **Natural Earth II 1:50 m** raster layer could be loaded.

3. In the **Coordinate system** section choose type of loading:
   - **Reproject** – to load atlas in chosen coordinate system, e.g. `Spherical Mercator`.
   - **As is (latitude-longitude WGS-84)**.
4. [optional] To use chosen coordinate system as working coordinate system, set the **Set as working CS** checkbox on.
5. Click OK. Chosen layers loads to the project and displayed in 2D-window.

Internet connection is required to load atlas. Loading speed depends on connection speed and computer capacity.

To display vector and raster layers of atlas at the same time in 2D-window, the vector layer should be above raster in the *Layer manager*.

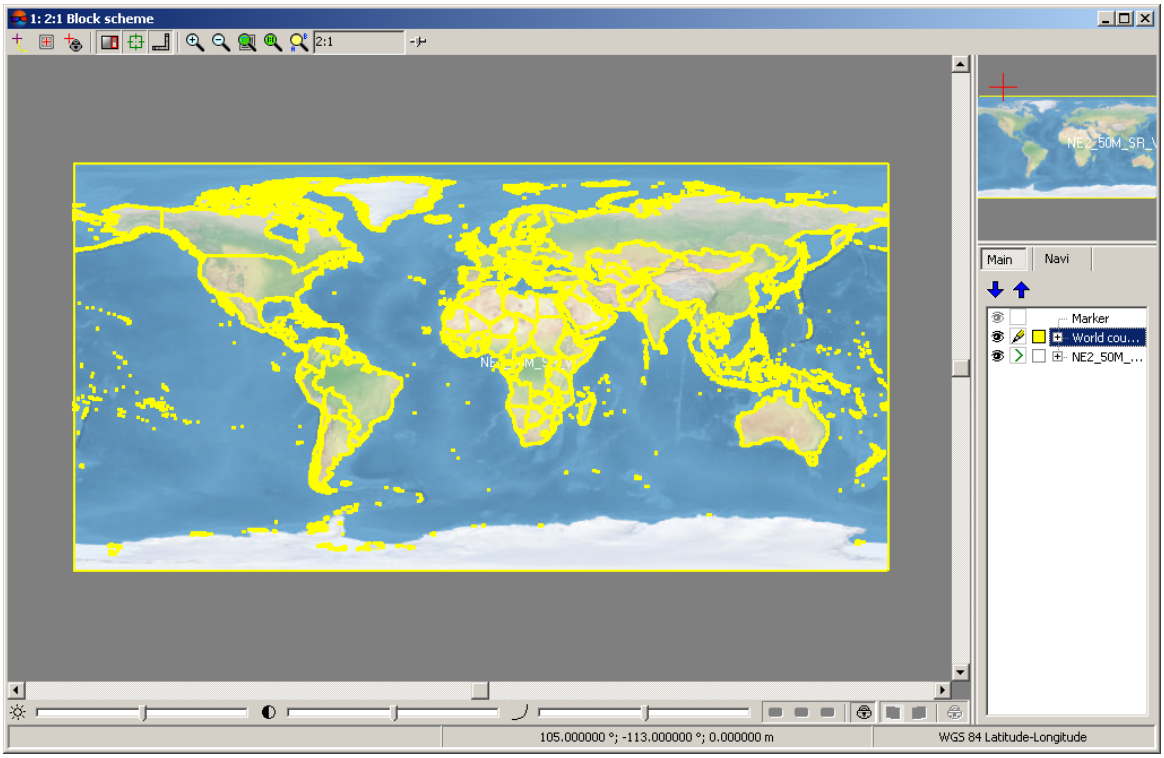


Fig. 139. Atlas view in 2D-window

Vector layer contains polygons – countries borders.

To obtain information about country border, select polygon and choose **Window › Objects attributes**.

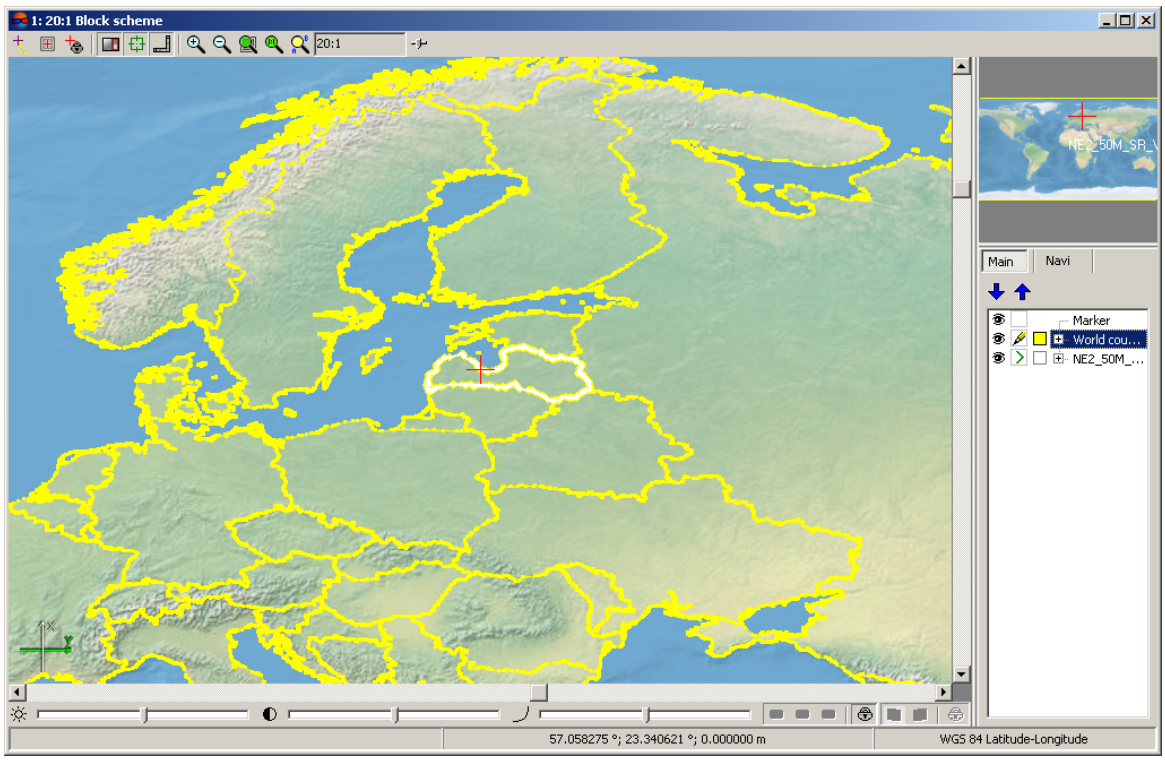


Fig. 140. Selected boarder

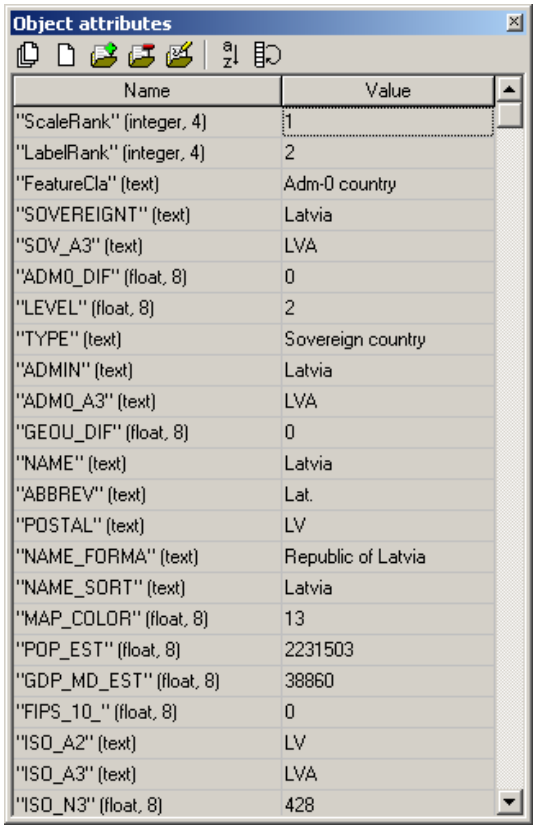


Fig. 141. Information about border

13.5. CSV converter

The CSV converter allows to perform the following transformations:

- coordinates transformation from one CS to another in CSV and TXT files;
- split one big file for several files with defined number of lines in each file;
- transformation of exterior orientation parameters from one CS to another in CSV and TXT files.

To transform points coordinates or exterior orientation parameters from one CS to another perform the following:

1. Choose **Service › CSV converter**. The **CSV converter** window opens. It allows to specify input and output parameters.

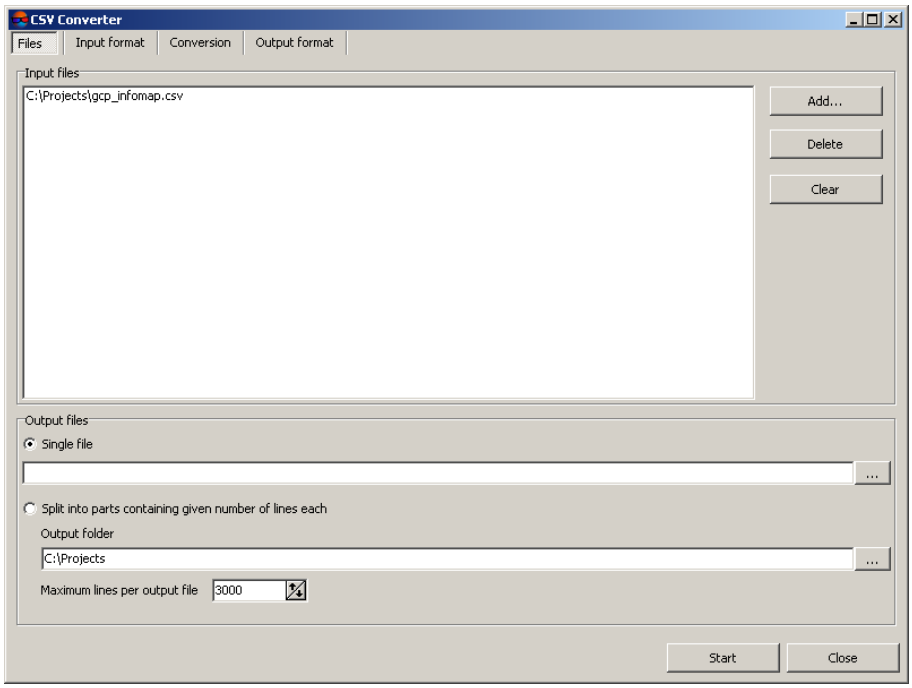


Fig. 142. Input and output parameters

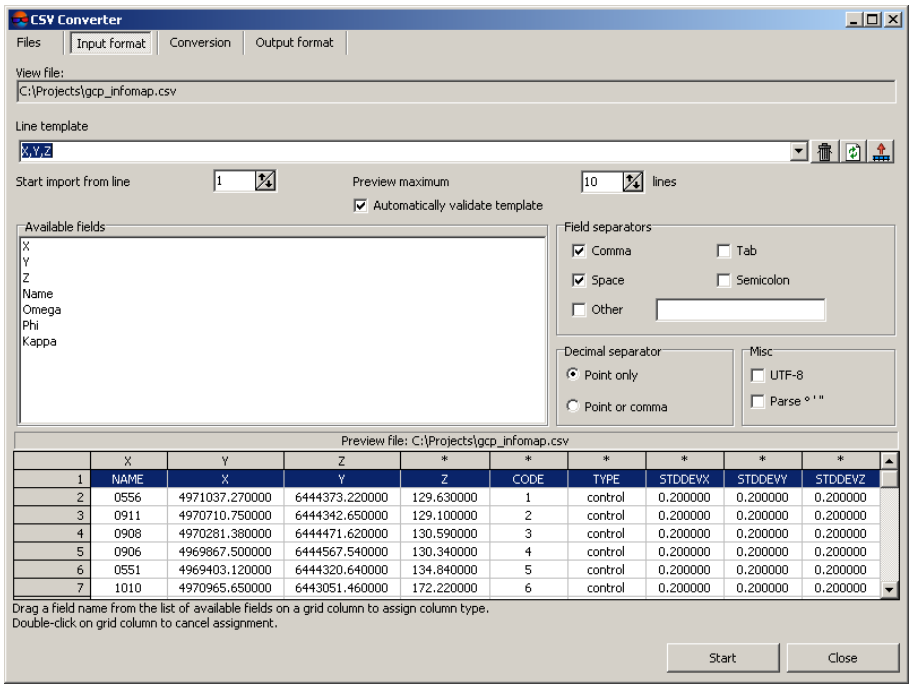
2. To add CSV or TXT files, click the **Add** button in the **Input files** section. The **Add files** window opens.

3. Choose files with `*.csv` or `*.txt` extension with points coordinates in source coordinate system and click the **Open** button. Data loads to the program.

4. In the **Output files** section choose **Single file**.

5. Click the ... button and choose in *Windows file system* a folder for output file.

6. Move to the **Input format** tab and set parameters of input file.



	X	Y	Z	*	*	*	*	*	*
1	NAME	X	Y	Z	CODE	TYPE	STDDEVX	STDDEVY	STDDEVZ
2	0556	4971037.270000	6444373.220000	129.630000	1	control	0.200000	0.200000	0.200000
3	0911	4970710.750000	6444342.650000	129.100000	2	control	0.200000	0.200000	0.200000
4	0908	4970281.380000	6444471.620000	130.590000	3	control	0.200000	0.200000	0.200000
5	0906	4969867.500000	6444567.540000	130.340000	4	control	0.200000	0.200000	0.200000
6	0551	4969403.120000	6444320.640000	134.840000	5	control	0.200000	0.200000	0.200000
7	1010	4970965.650000	6443051.460000	172.220000	6	control	0.200000	0.200000	0.200000

Fig. 143. Setup of input parameters

7. The **Line template** field displays the list of fields, contained in each line of imported file:

   - `Name` – object's name;
   - `Xn, Yn, Zn`, where n – integer number, coordinates of the first and subsequent vertices of the object;
   - * – missed field during import.

   All objects are saved using the same template. Each line of a file contains the same number of fields, that equals to number of fields in template. Lines which does not correspond to the template, are skipped.

   In order to setup active template, perform one of the following actions:

   - drag a field name from the **Available fields** list to the **Preview file** table column. After that the template in the **Line template** field is changes. In order to cancel field selection, double click the column of the **Preview file** table;
   - change the template manually in the **Line template** field. At that column types in the **Preview file** table are changed automatically.

   The button is used to return to default template `Name X Y Z`.

The button is used to compare the **Line template** field with data shown in the **Preview file** table.

The active template corresponds only to lines shown in the **Preview file** table.

The button is used to replace specified field names by field values taken from the first line of the **Line template** table.

8. [optional] The **Automatically validate template** checkbox is set on by default that allows to select current template automatically. In order to configure the template for file containing lines with different columns number, set off the **Automatically validate template** checkbox and configure the template in the **Line template** field manually.

9. [optional] To specify a line from to start data import, define the value of the **Start import from line** parameter.

10. [optional] To display necessary number of lines in the **Preview file** table, set the **Preview maximum** parameter. Default number of lines is 10.

11. In the **Available fields** section select necessary field name and drag it to the table column. To cancel the selection of the field name double click the column header.

12. In the **Field separators** section set on one or multiple checkboxes to specify possible fields delimiter symbol: comma, space, tab, semicolon or other delimiters. Default settings are comma and space.

13. In the **Decimal separator** section setup the following parameters:

    - **Point only** – to use point only as a decimal separator in coordinates;
    - **Point or comma** – to use both point and comma as a decimal separator in coordinates.

    If the *Field separator* is selected as a comma, it is not recommended to specify the *Decimal separator* as a comma, since objects with incorrect coordinates will be created after export operation.

14. In the **Misc** section set the following checkboxes:

    - **UTF-8** – is used to recognize text in Unicode coding;

    Unicode – symbols encoding format that allows to provide symbols of almost all written languages.

    - **Parse ° ’ ’** – is used to recognize records of projection centers or GCP.

15. The **Preview file** table contains data of imported file. Fields type according to the template, located in the **Line template** field, are automatically assigned to the table columns.

The * symbols marks columns with data which is not imported.

16. Move to the **Conversion** tab and set the **Convert coordinate system** checkbox on.

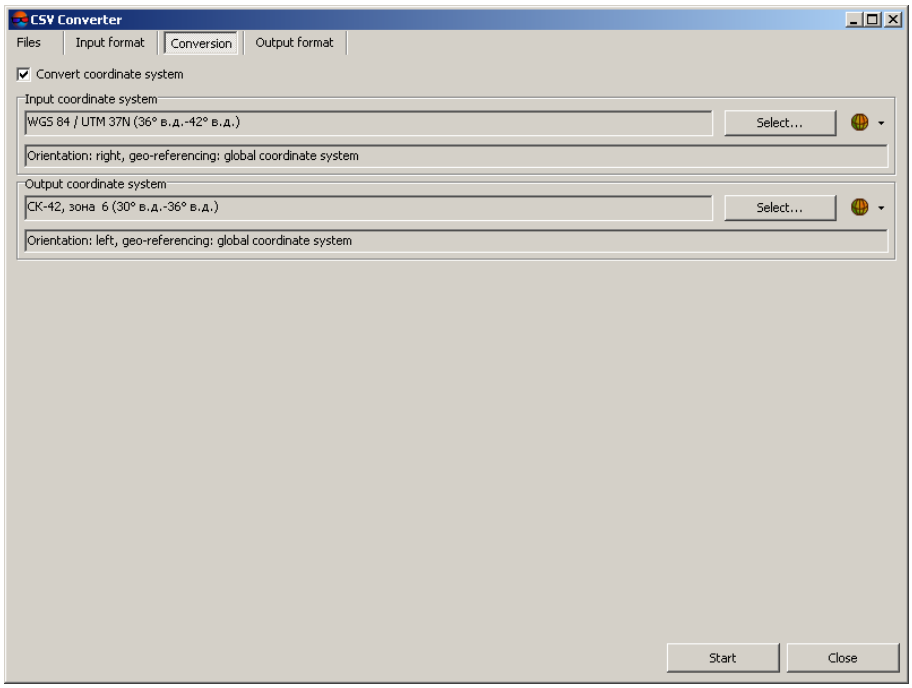


Fig. 144. Choosing of input and output coordinate system

17. Click the **Select..** button in the **Input coordinate system** section to choose input CS with one of the following ways:

- **From DB** – from international or Russian coordinate system database (see*'Coordinate systems databases'* in the Project creation' User Manual);
- **From file** – allows to select coordinate system from `*.x-ref-system` files, located *out* of active profile resources;
- **From resource** – from files with `*.x-ref-system` extension, located in active profile resources, for example, to select coordinate system from another project of active profile.

The system also allows to select coordinate system from a list of recently used coordinate systems.

- **From GeoCalculator** – from the list of *GeoCalculator* program database (see the “Coordinate Systems” chapter in “The GeoCalculator program” User manual).

The *GeoCalculator* program allows to edit coordinate systems, to create new ones, to perform import and export of coordinate systems (see the “The GeoCalculator program” User Manual).

18. [optional] When choosing coordinate system from database the **Coordinate system database** opens, which contains the list of coordinate systems. To perform fast search for coordinate system in the list, input the whole coordinate system name or its part to the **Find** input filed.

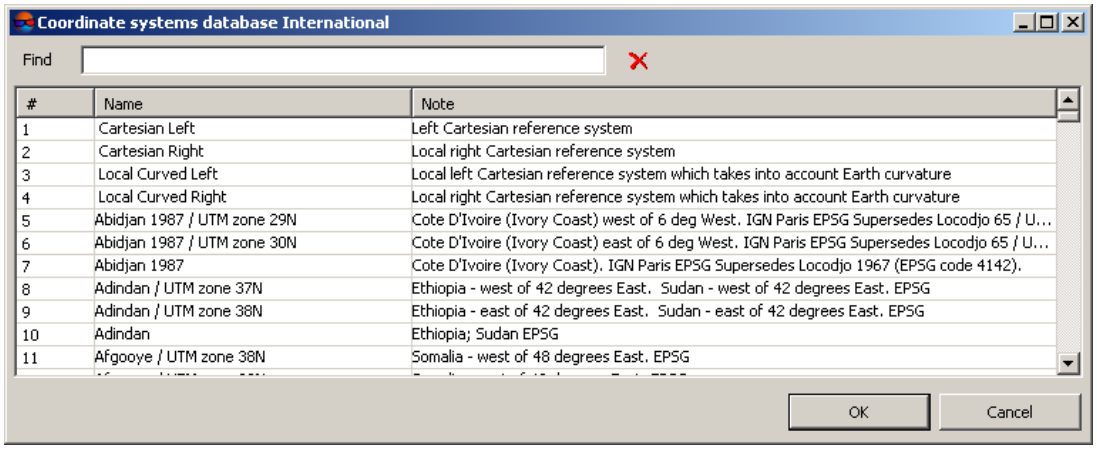


Fig. 145. Coordinate systems database window

19. [optional] To choose geoid, click the button. Select proper type of geoid usage:

- **No geoid**;
- **EGM 96**.

The system allows to use the EGM2008 geoid. See installation instruction in the User Manual. After installation the geoid is displayed in the list.

20. Click the **Select** button in the **Output coordinate system** section and define parameters of output CS in the same way.

21. Move to the **Output format** tab and set parameters of output file.

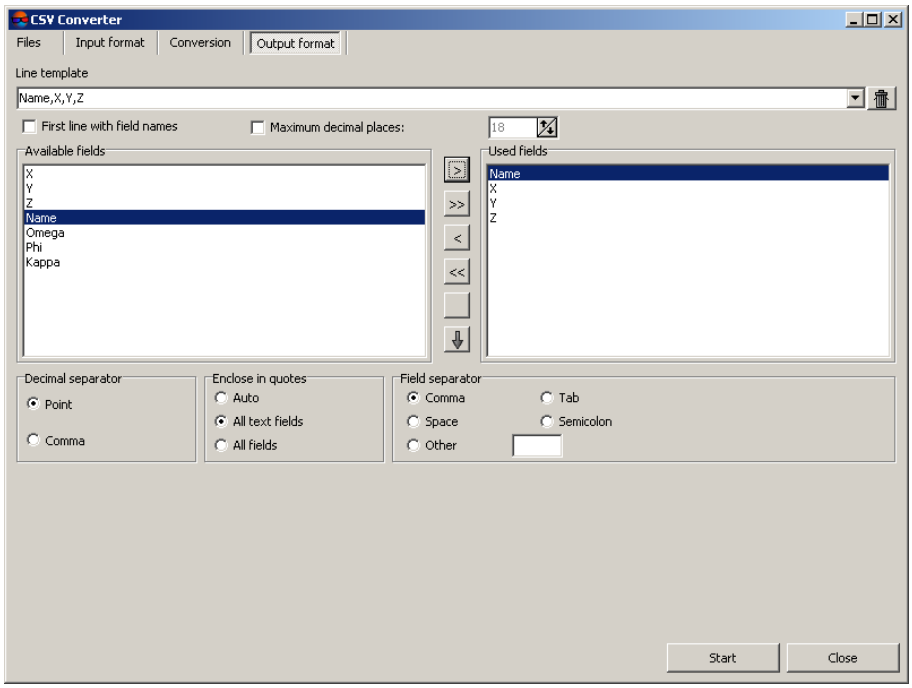


Fig. 146. Setup of output parameters

22. The **Line template** field displays the list of fields, contained in each line of imported file: To clear the field, click the button.

23. [optional] In order to export a line from the **Line template** field, set the **First line with field names** checkbox on.

24. [optional] In order to change number of decimal places in coordinates to be exported, set the **Maximum decimal places:** checkbox on and input needed value.

25. In the **Available fields** list select required field name and click the **Add selected field** button > or click the **Add all fields** button >>, to transfer all field names. After that all or selected field names are moved to the **Used fields** list.

    To cancel field name selection click the **Delete selected field** button < or click the **Delete all fields** button << button to cancel moving all field names. To move selected field to the list bottom, click the button, and to move selected field to the list top click the button.

26. In the **Decimal separator** section select point or comma to be used to separate coordinates.

27. [optional] In order to limit required parts of exported list of coordinates by quotes, in the **Enclose in quotes** section choose one of the following options:

    - **Auto** – allows to limit by quotes the fields, which are located in the file to be exported;

- **All text fields** – allows to limit by quotes only the fields, which contain text information;
- **All fields** – allows to limit by quotes each field, which is located in the exported file.

28. In the **Field separator** section choose, what is used to separate fields: comma, space, tab, semicolon or other delimiters.

If the field separator is selected as a comma, it is not recommended to specify the decimal separator as a comma, since objects with incorrect coordinates will be created after transformation.

29. Click the **Start** button. The transformation results are saved to an output file. Click OK.

30. Click the **Close** button to close the **CSV converter** window.

Perform the following to split one big file to several separate files:

1. Choose **Service › CSV converter**. The **CSV converter** window opens.

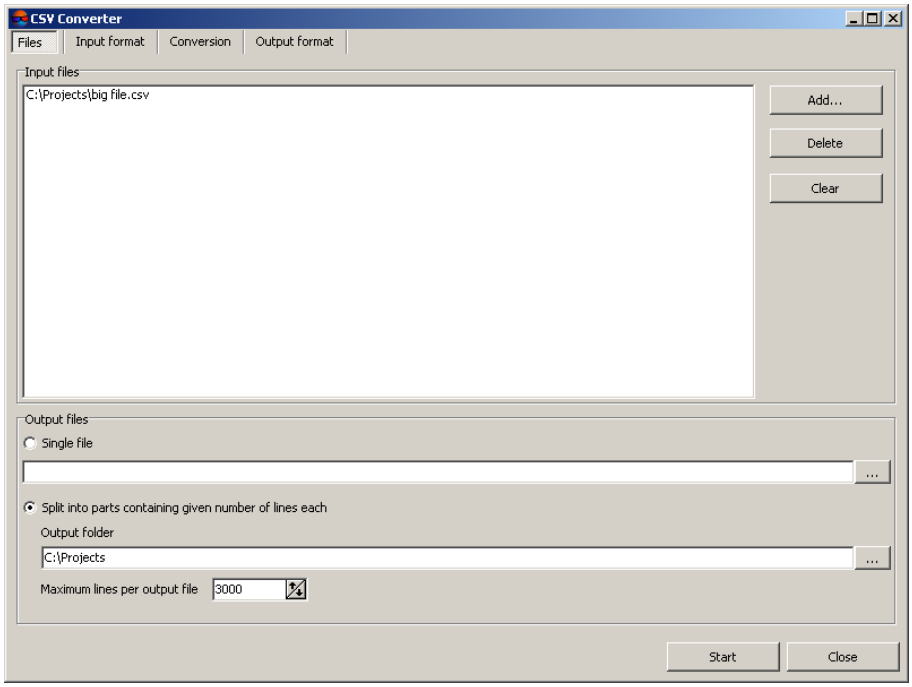


Fig. 147. Choosing of input file

2. To add CSV or TXT files, click the **Add** button in the **Input files** section. The **Add files** window opens.

3. Chose file with `*.csv` or `*.txt` extension. Click the **Open** button. Data is loaded to the program.

4. In the **Output files** section choose **Split into parts containing given number of lines each**.

5. Click the ... button and choose in the *Windows file system* a folder for output files.

6. Define the **Maximum lines per output file**.

7. Click the **Start** button. Several files with defined number of lines are created. Click OK.

13.6. Customize hotkeys

The system allows possibility both to use default hotkeys and to edit combinations of hotkeys to shortcut of system functions.

The user-friendly system allows you to use together with hotkeys so called *shortcut commands*, the custom button combinations for quick access to various functions when working with the layers such as **Vectors**, **DEM**, **Raster**, **Grid**, or **TIN**.

These buttons are placed in the right part of the 2D-window toolbar and available for a user when a layer of one of the abovementioned types is downloaded and editable (). *Shortcut commands* have functionality similar to hotkeys' and can be also customized.

The list of main hotkeys available in the system by default, see in the Hotkeys User Manual.

In order to create or hotkeys combination perform the following actions:

1. Choose **Service › Customize hotkeys**. The **Customize hotkeys** window opens.

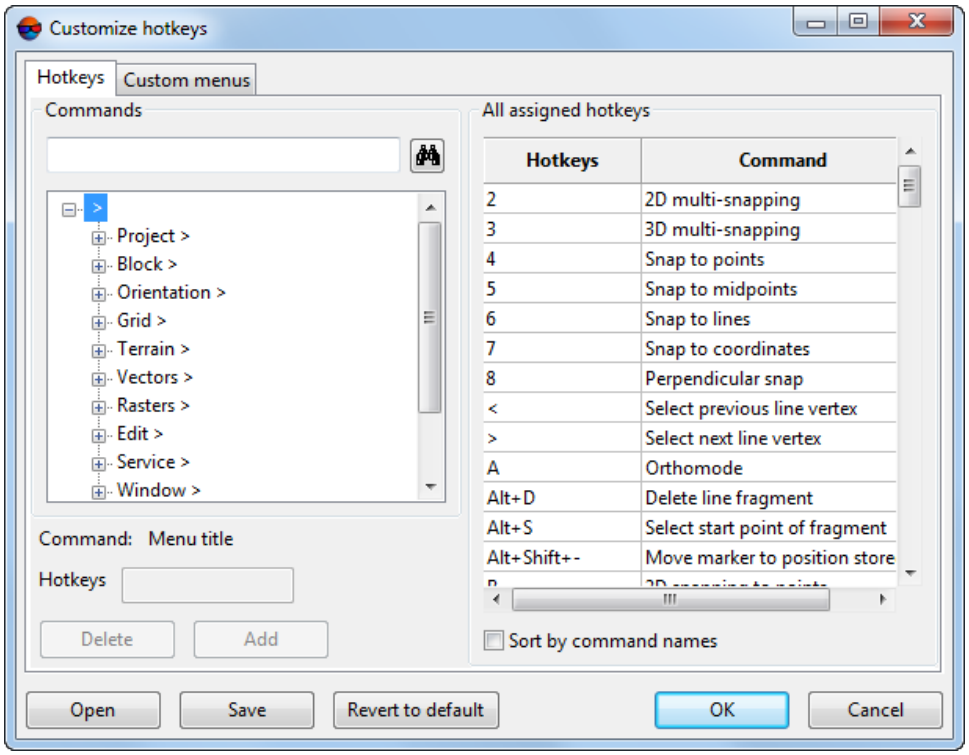


Fig. 148. The 'Customize hotkeys' window

The list of system menu items with their hotkeys is displayed on the **Hotkeys** tab in the **Commands** section. In the **All assigned hotkeys** section is displayed a table with hotkeys in one column and command name in another.

The list of system menu entries in the **Commands** section can vary depending on the program's features or program module (see *PHOTOMOD GeoMosaic* program).

2. In the **Commands** section select hotkeys combination or command name to assign or edit shortcut.

A search field ( ) is provided to facilitate the search.

3. Place marker to the **Hotkeys** field.

4. Press key or shortcut key to assign them chosen command.

Up to three modifiers could be used in a shortcut at the same time: **Ctrl**, **Alt**, **Shift**.

5. Click the **Replace** or **Add** button to change or add the shortcut.

To delete selected shortcut key click the **Delete** button.

6. Click OK. Restart all opened modules of the system to apply changes.

Perform the following actions to create a custom menu:

1. Choose **Service › Customize hotkeys**. The **Customize hotkeys** window opens.

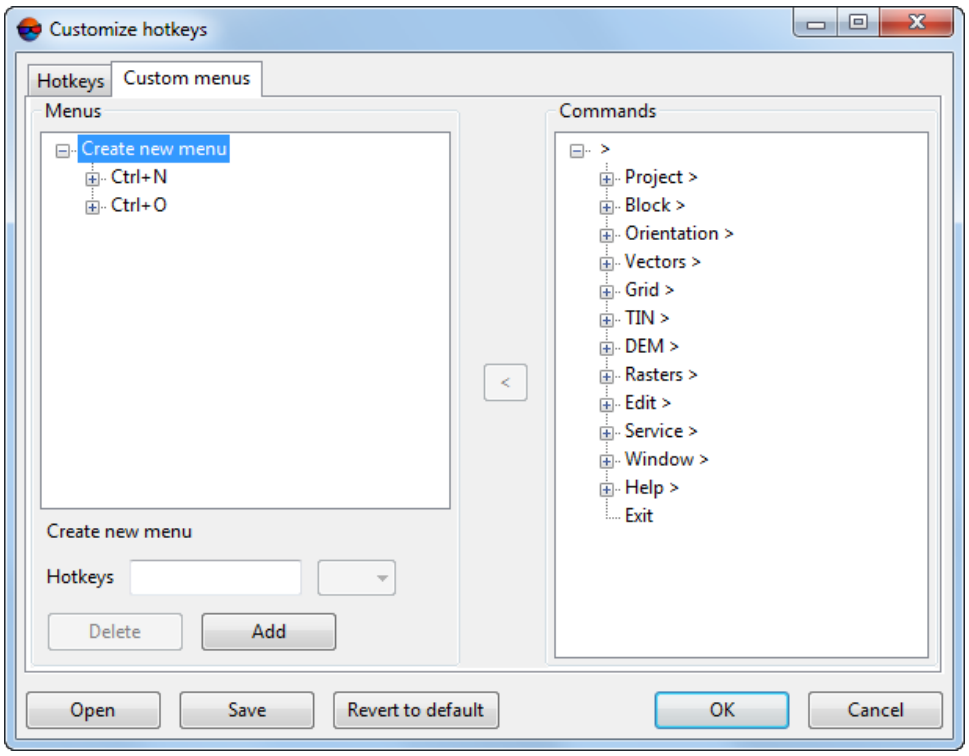


Fig. 149. The 'Customize hotkeys' window

The list of custom menus with their hotkeys is displayed on the **Custom menu** tab in the **Menus** section. The list of custom menus with menu items and hotkeys is displayed in the **Commands** section.

2. In the **Menus** section select the **Create new menu** or select existed one to add or edit menu items.

3. In the **Commands** section select a command to assign a shortcut to it.

4. Place marker to the **Hotkeys** field.

5. Press key or shortcut key to assign them chosen command.

Up to three modifiers could be used in a shortcut at the same time: **Ctrl**, **Alt**, **Shift**.

6. Click the **Add** button to add shortcut for custom menu or **Replace** button to change the shortcut.

To delete selected shortcut key click the **Delete** button.

7. Repeat 2-6 steps to add menu items to created custom menu.

8. Click OK. Restart all opened modules of the system to apply changes.

It is possible to save the settings of hot keys and user menus as files with `*.xml` extension:

- To save the current settings, click **Save**;
- To import the previously saved hotkey configuration and / or user menu settings, click **Open**.

Appendix A. Format and path of project files

Each system project is stored in a folder with definite structure for project files.

It is not recommended to change system files using standard OS *Windows tools*. In case of changes, deleted or added folder, run the automatic recovery storage in the *Control Panel module*.

Project folder contains the following files and folders:

- *backup* folder – is used to store backup files of block scheme, orientation parameters, adjustment and so on;
- *Cache* folder – is used to store cached file of block scheme (`*.x-ini`-files);
- *Cameras* folder – is used to store parameters of project cameras (`*.x-cam`-files);
  - *backup* folder – is used to store backup files of camera parameters.
- *Data* folder – is used to store project data:
  - *backup* folder – is used to store backup files of vector objects;
  - *classifier* folder – is used to store files of vector objects classifier (`*.x-ct`-files);
  - *dem* folder – is used to store DEM-files;

After DEM creation is created the *dem_name.x-dem* file and the *dem_name* with the file, containing the DEM itself, with `*.demtif` extension. This file is used to read data from it.

When an `*.x-dem` file is deleted, its folder is also automatically deleted. Otherwise, if the folder is deleted, the `*.x-dem` file remains in the active profile resources.

In every abovementioned case, deletion of a folder containing a `*.demtif` file causes the DEM deletion.

  - *mosaic* folder – is used to store orthorectificied files (`*.x-mos`-files);
  - [optional] *sheets* folder – is used to store sheets files of created orthoimages;
  - `*.x-data`-files contains vector objects;
  - `*.cx-data`-files contains co-editing vector objects;
  - `*.x-data.meta`-files contains general information about vector layer (e.g., limits);
  - `*.x-grid`-files contains regular nodes grid;
  - `*.x-grid.meta`-files contains general information about grid layer;
  - `*.x-tin`-files contains triangulation irregular network (TIN);
  - `*.x-tin.meta`-files contains general information about triangulation irregular network (TIN) layer;
- Images folder – is used to store project images (e.g. `*.tiff`, `*.bmp` files);
- Locks folder – is used to provide possibility to process project with more than one operator at the same time (`*.lock`-files);
- *ProjOptions* folder – is used to store project parameters files: When you create a project, in the *ProjOptions* folder is created a *PHOTOMOD .COMPUTER_NAME.x-ini* file to store the set of project parameters;
  - *backup* folder – is used to store backup files of project parameters;
- *Temp* folder – is used to store temporary files;
- `*.x-ref-system` file contains data about project coordinate system.

Appendix B. The PHOTOMOD7.VAR configuration folder

At the stage of system first configuration is automatically created the PHOTOMOD7.VAR folder. This folder is used to store configuration, temporary and other system files.

Only one PHOTOMOD7.*VAR* folder creates, even for several installed copies of the system.

It is not recommended to place the configuration folder in the net, because it leads to slowing of system's work.

PHOTOMOD7.VAR folder contains the following files and folders:

- *AutoSave* folder – is used to store autosaved data:
- *Config* folder – is used to store files of general parameters of all profiles;

  It is possible to return to default parameters in case of changing configuration file. To do this, remove a configuration file in the *PHOTOMOD7.VAR* folder and restart the system. Default configuration file are copied from the *PHOTOMOD7.VAR\Config* system files folder.

  Both global settings and settings for the local profile is loaded at startup of the system and saved when you exit. Local project settings is loaded when loading a project and saved when project closing. In case of working without projects, settings are stored in the *PHOTOMOD7.Var\Profiles\[profile_name]\VoidProjOptions.x-ini* file.

- *Logs* folder – is used to store log-files for all profiles;
- *Profiles* folder – is used to store all parameters for each profile separately. The list of local and network profiles is also stored in the folder. It is the same list as in the **Control Panel** module. Configuration file with resource structure and path to local/network folder is also stored in folder of each profile;

  New subfolder creates for each profile.

- *Tmp* folder – is used to store temporary files;
- *UserData* folder – is used to store data out of resources system;
- *policy.x-ini* file – contains general information about configuration parameters (active profile name, name and path to centralized management folder and so on).

B.1. Log cleanup settings

The *PHOTOMOD7.VAR* folder contains the *Logs* folder that is intended to store log files common for all the profiles. To spare the disk space, the function of automatic deleting of deprecated activity logs is provided.

To specify **log cleanup settings** do the following:

1. Choose **Log cleanup settings** in the right-click menu of the *System Monitor module* (the  icon in the *Windows* system tray). The **Cleanup log folder** window opens:

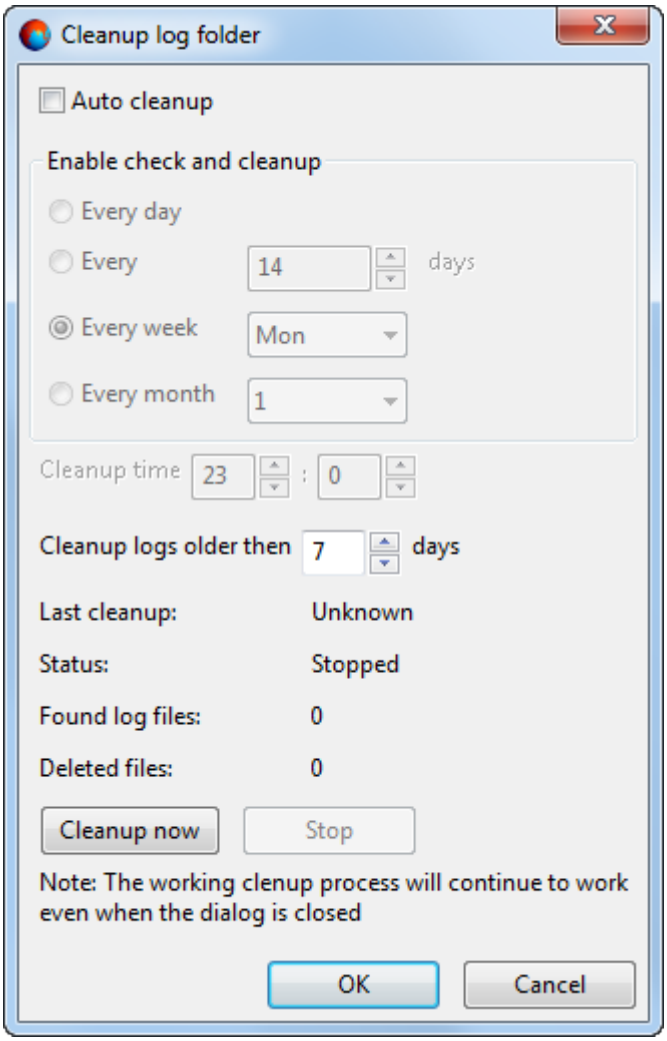


Fig. B.1. The “Cleanup log folder” window

2. In order to automatically delete log files routinely, set the **Auto cleanup** checkbox. The system allows to **enable check and cleanup**:

   - **every day**;
   - **every** certain days (set by the user manually);
   - **every week** (a day chosen by the user);
   - **every month** (a date set by the user).

   The system also allows to specify reasonable **cleanup time**. After customizing, the system will **cleanup logs older than** the user-specified number of days.

   In the window, user can see also the **last cleanup** date and current **status** of the cleanup process. To stop a process that is **running**, click the **Stop** button. For an

unscheduled start of the log cleanup process, that was previously **stopped**, click the **Cleanup now** button.

If user close the **Cleanup log folder** window when cleanup process is **running**, without stopping it, the cleanup process will continue to work even when the dialog is closed.

3. To confirm the settings and the log folder cleanup schedule, as well as to close the **Cleanup log folder** window, click OK.

Appendix C. Network pre-configuration for connecting nodes to the server

This operation is required when using distributed task processing using several computers connected via a local network. It is not required when *PHOTOMOD UAS* is used on a single workstation.

Network pre-configuration for connecting nodes to the server is described for the *Windows 7* operation system. For more information, contact the Racurs Company Technical Support service.

C.1. Requirements to connection with permission for remote start of applications

In order to connect *nodes* to the *server* in case of required remote start of applications on the *nodes*, make the following pre-configurations:

- Allow remote access to WMI on each client participating in distributed processing;
- Set permissions to access COM applications on each client participating in distributed processing;
- Set permissions for folder archiving and recovery on each client participating in distributed processing;
- It is recommended to disable *Firewall* on all clients.

Firewall is a software to protect computers from network attacks.

- Assign a unique network name to each client (including a local one) (the computer's network name is displayed in **Control panel › System › Computer name**);
- Configure shared access to the *PHOTOMOD7.Var* configuration folder;

It is strongly recommended to place the *PHOTOMOD7.Var* into the network share.

C.2. Allow remote access to WMI

To allow remote access to WMI, perform the following:

WMI (*Windows Management Instrumentation*) is the technology for centralized control of Windows-based infrastructure. WMI is installed on all computers with Microsoft operation systems (Windows 2000, Windows XP, Windows 2003, Windows Vista, and Windows 8.1).

1. In the **Start** menu, right click the **Computer** icon and select **Manage**. The **Computer management** window opens.

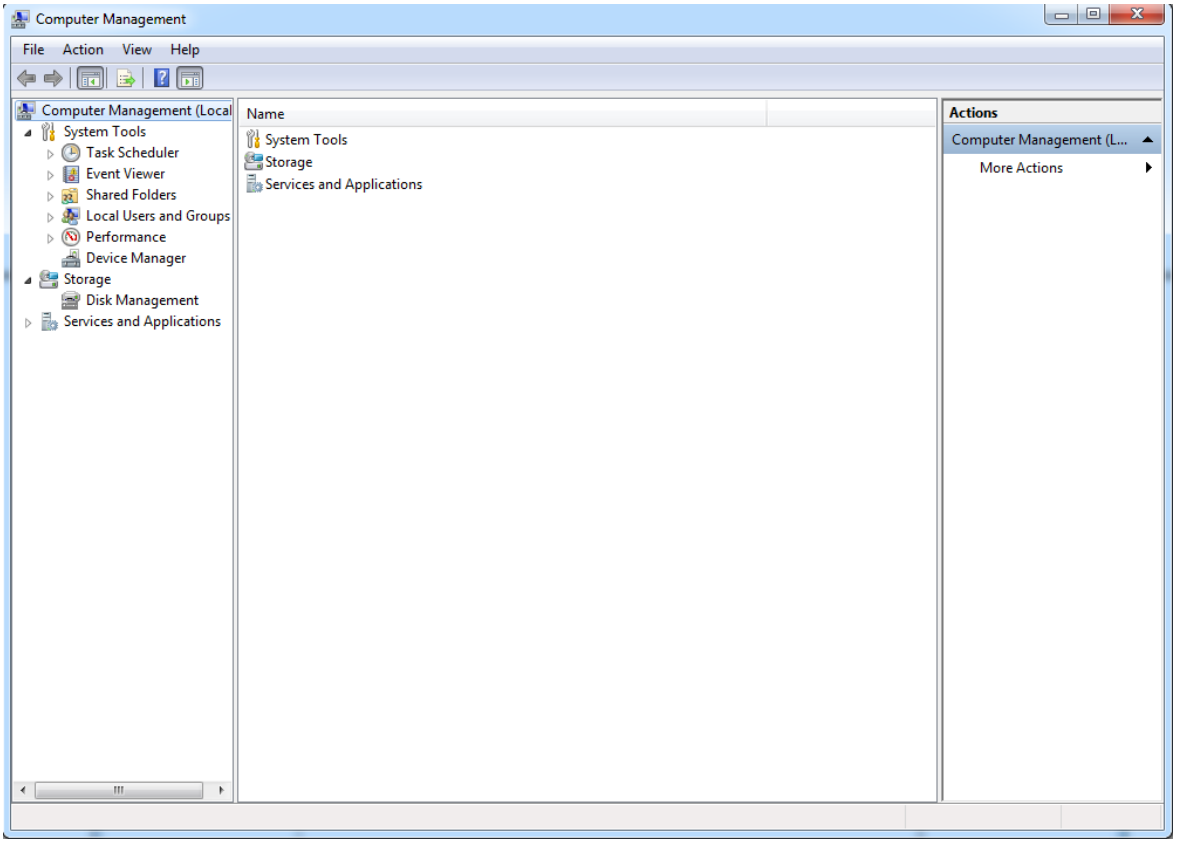


Fig. C.1. The “Computer management” window

2. In the folder tree in the left part of the window, select **Services and Applications › WMI Control**.

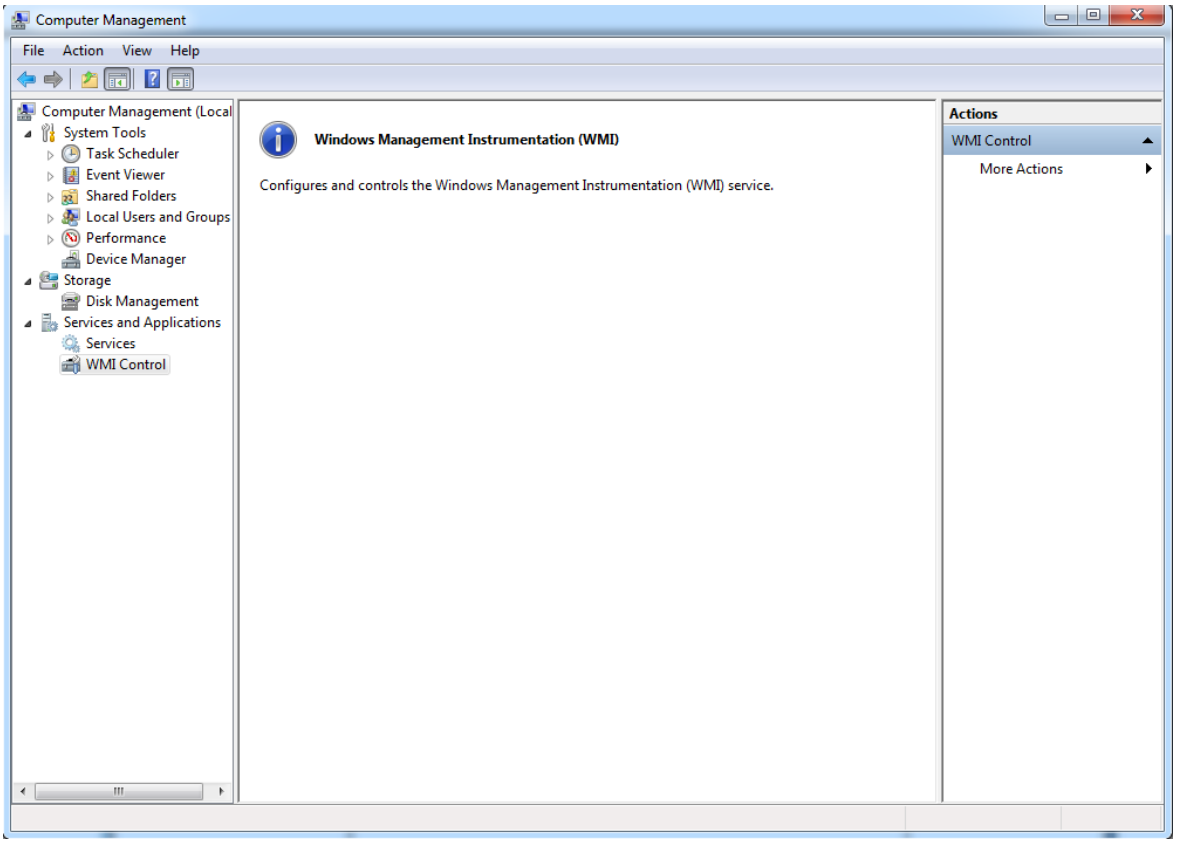


Fig. C.2. The “WMI Control” menu item

3. Right clicking the **WMI Control** open the context menu and choose **Properties**. The **WMI Control Properties** window opens.

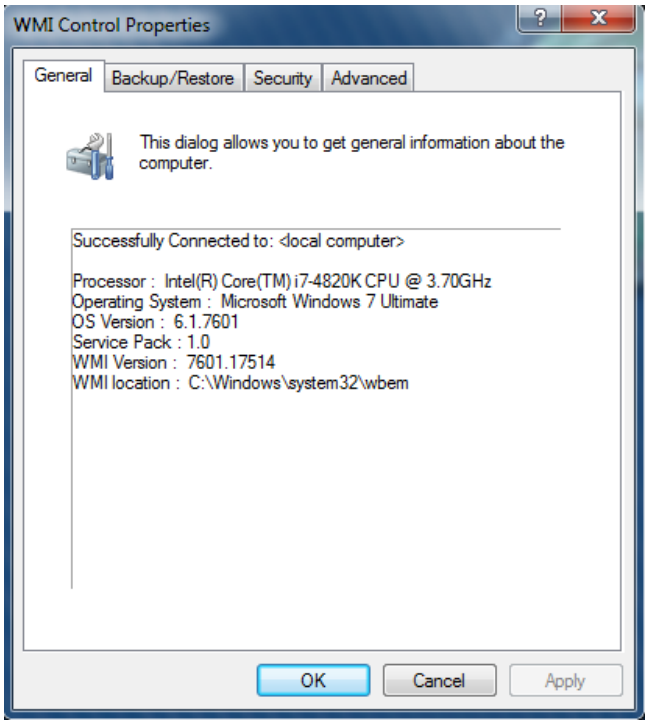


Fig. C.3. General computer information

4. Proceed to the **Security** tab.

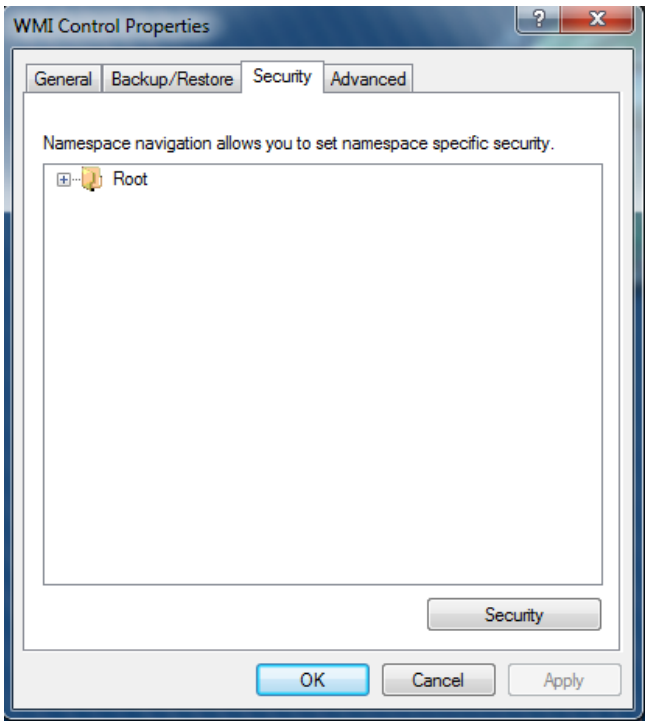


Fig. C.4. The “Security” tab of the “WMI Control Properties” window

5. Click the **+** button against the *Root* folder, then click the *CIMV2* folder.

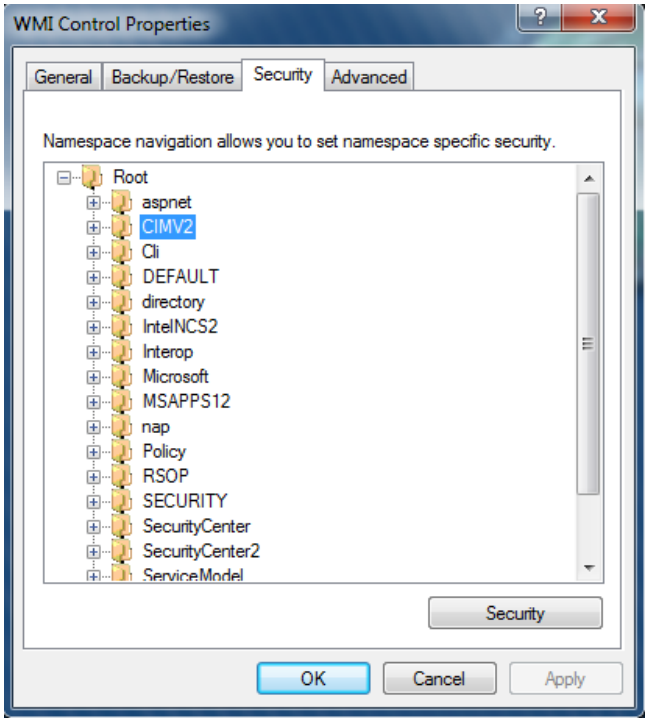


Fig. C.5. Chosen CIMV2 folder

6. Click the **Security** button. The **Security for ROOT\CIMV2** window opens.

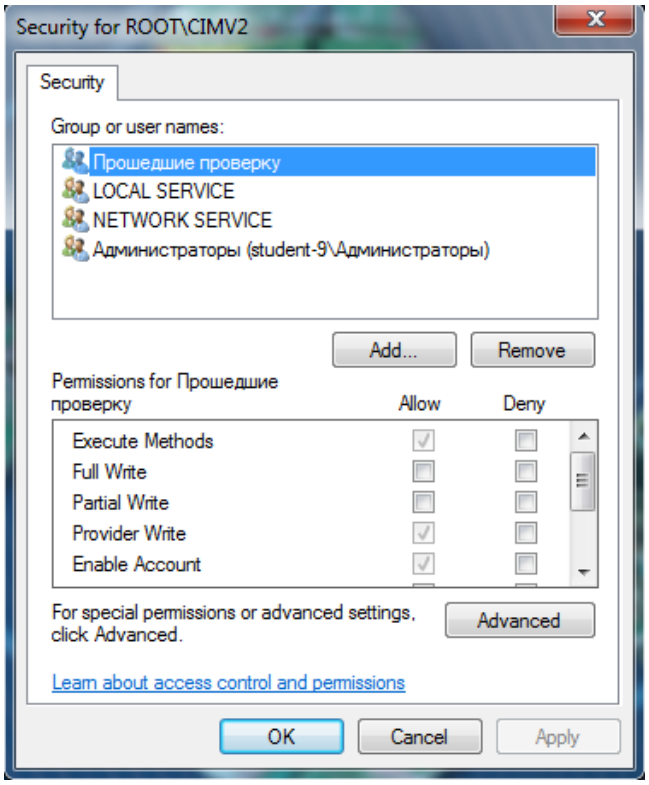


Fig. C.6. The “Security for ROOT\CIMV2” window

7. In the **Group or user names** section, click the **Add** button. The **Select Users, Computers, Service accounts, or Groups** window opens.

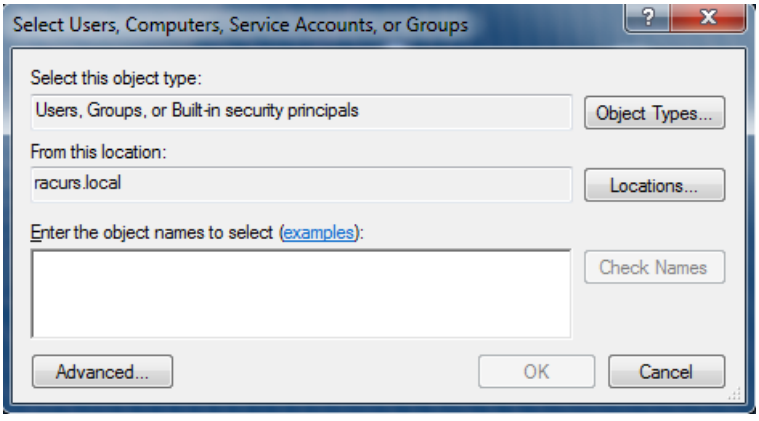


Fig. C.7. The user selection window

8. In the **Enter the object names to select** input field, enter the username on whose behalf the clients will start (this user is to be entered in PHOTOMOD Remote Starter Tool, in the Edit keyring window, the Keyring column).

Entering usernames, use one of the following templates:

- `EnteredName (example: First name Surname);`
- `ObjectName (example: Computer1);`
- `UserName (example: User1);`
- `ObjectName@DomainName (example: User1@Domain1);`
- `ObjectName\DomainName (example: Domain1\User1).`

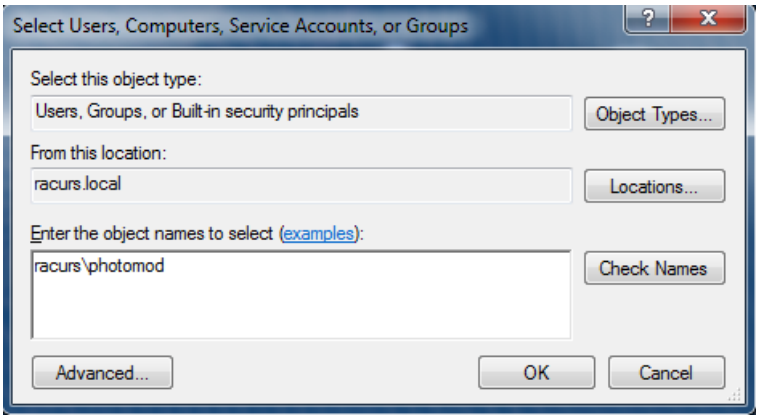


Fig. C.8. Entering a new user name

9. Click OK. The new user is to be displayed in the **Group or user names** section.

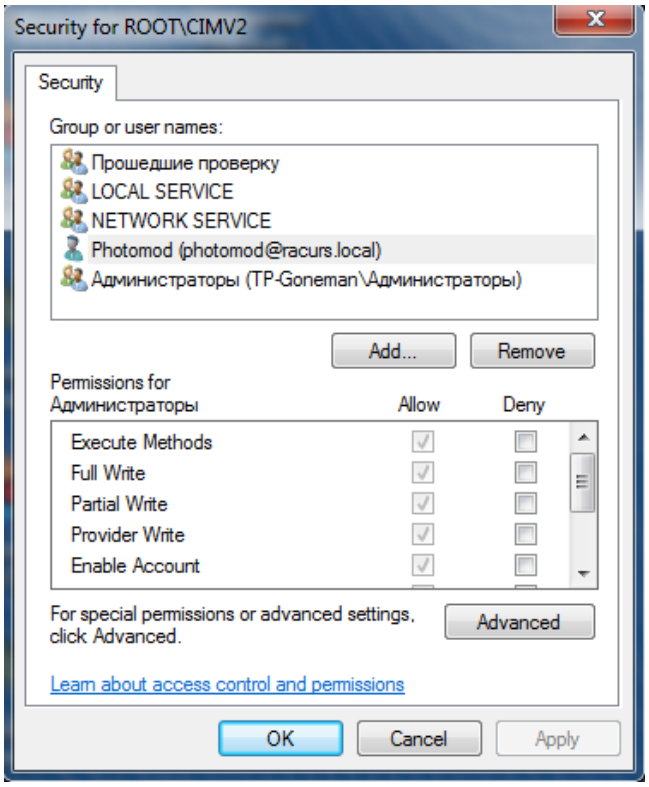


Fig. C.9. A new users is displayed in the “Groups and users” section

10. Select the new user in the **Group or user names** section. In the **Permission for <new user>** section against all the options from the list, set **Allow** checkboxes.

It is strongly encouraged to set the **Allow** checkbox for the **Remote Enable** option. Otherwise remote access to WMI is impossible.

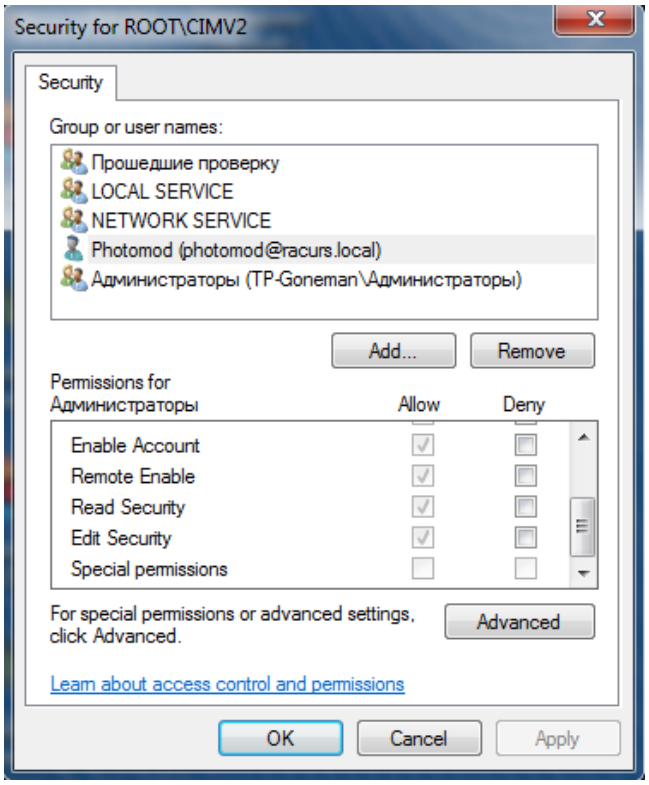


Fig. C.10. Allowances for a new user

11. Click the **Advanced** button. The **Additional security parameters for CIMV2** window opens.

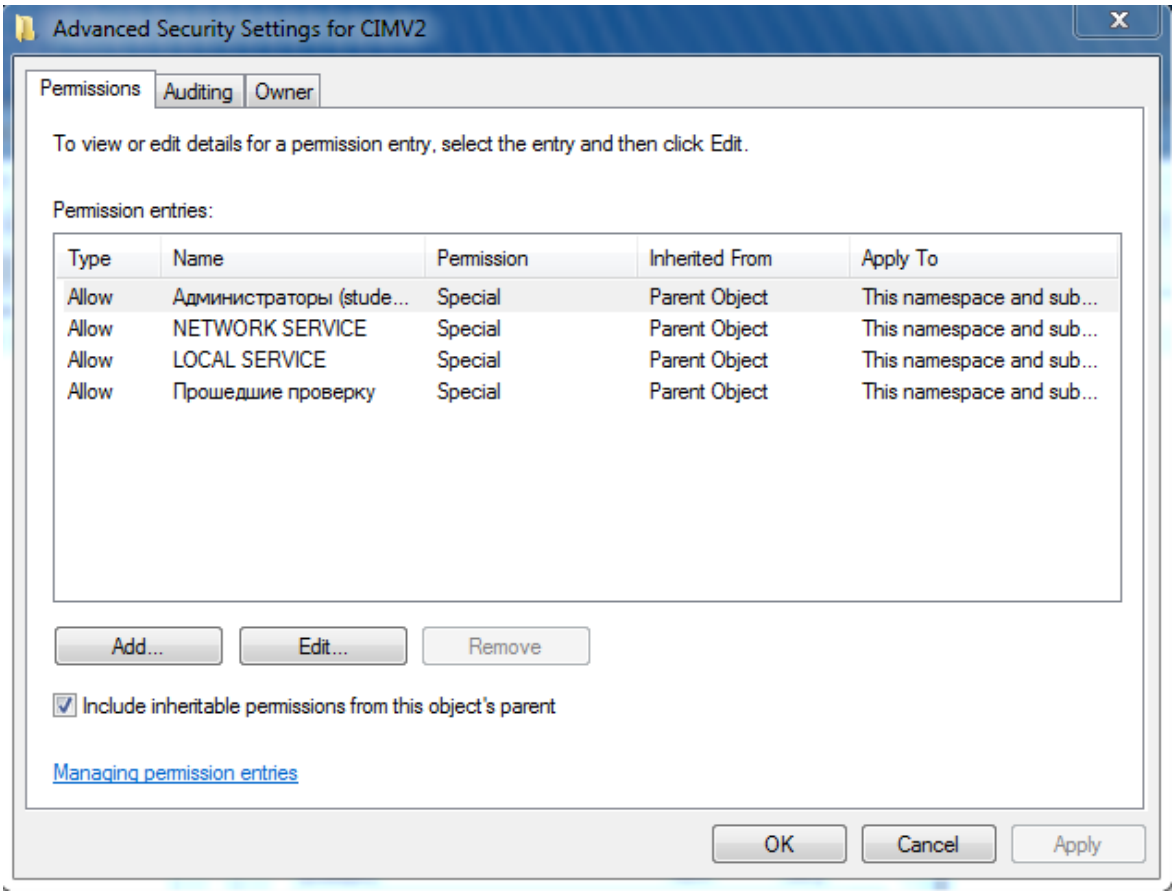


Fig. C.11. Setup of additional security parameters for CIMV2

12. Double click the line with the new user. The **Permission Entry for CIMV2** window opens.

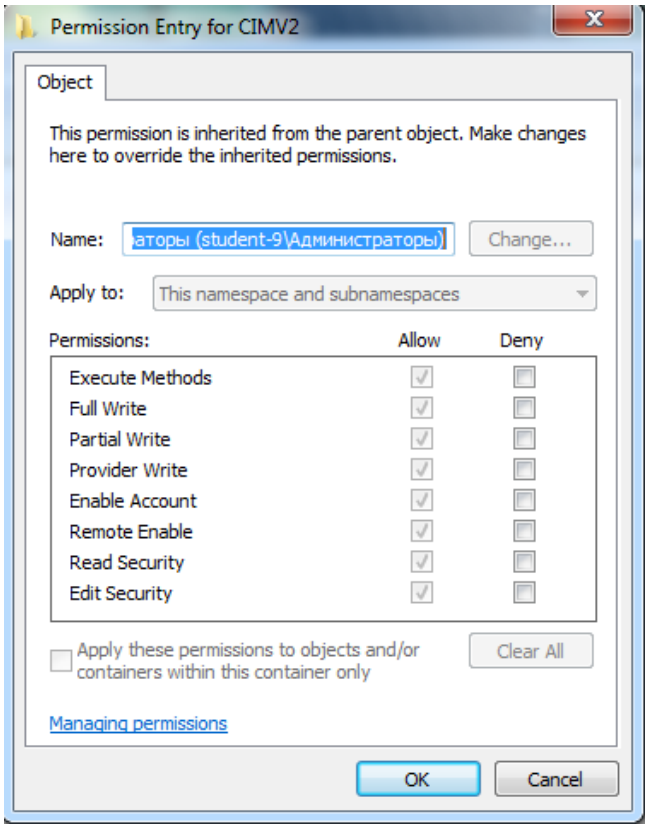


Fig. C.12. Allowance for CIMV2

13. In the **Apply to** drop-down list, select **This namespace and subnamespaces**.

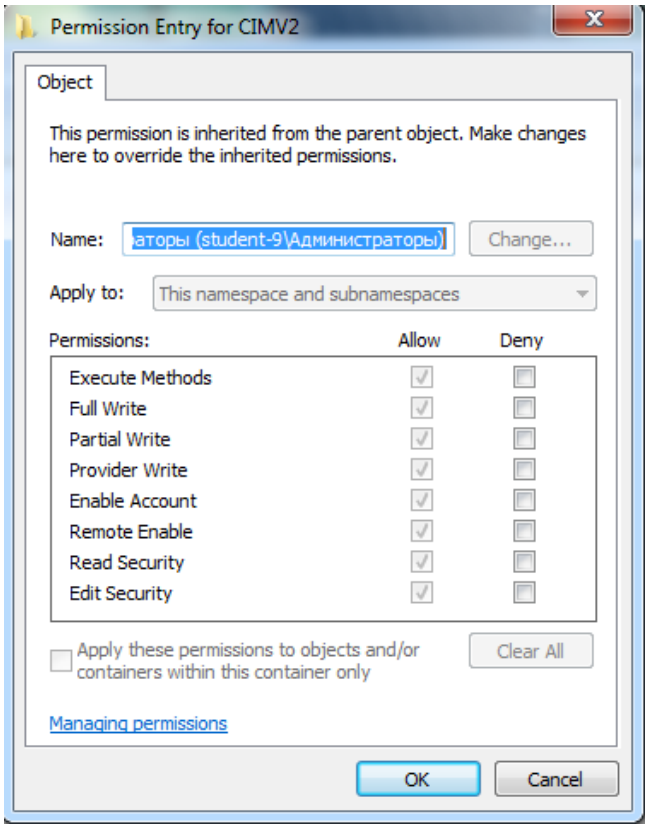


Fig. C.13. Allowance element configuration/setup/customization

14. Click OK. **This space and name subspace** is displayed in the **Apply to** column.

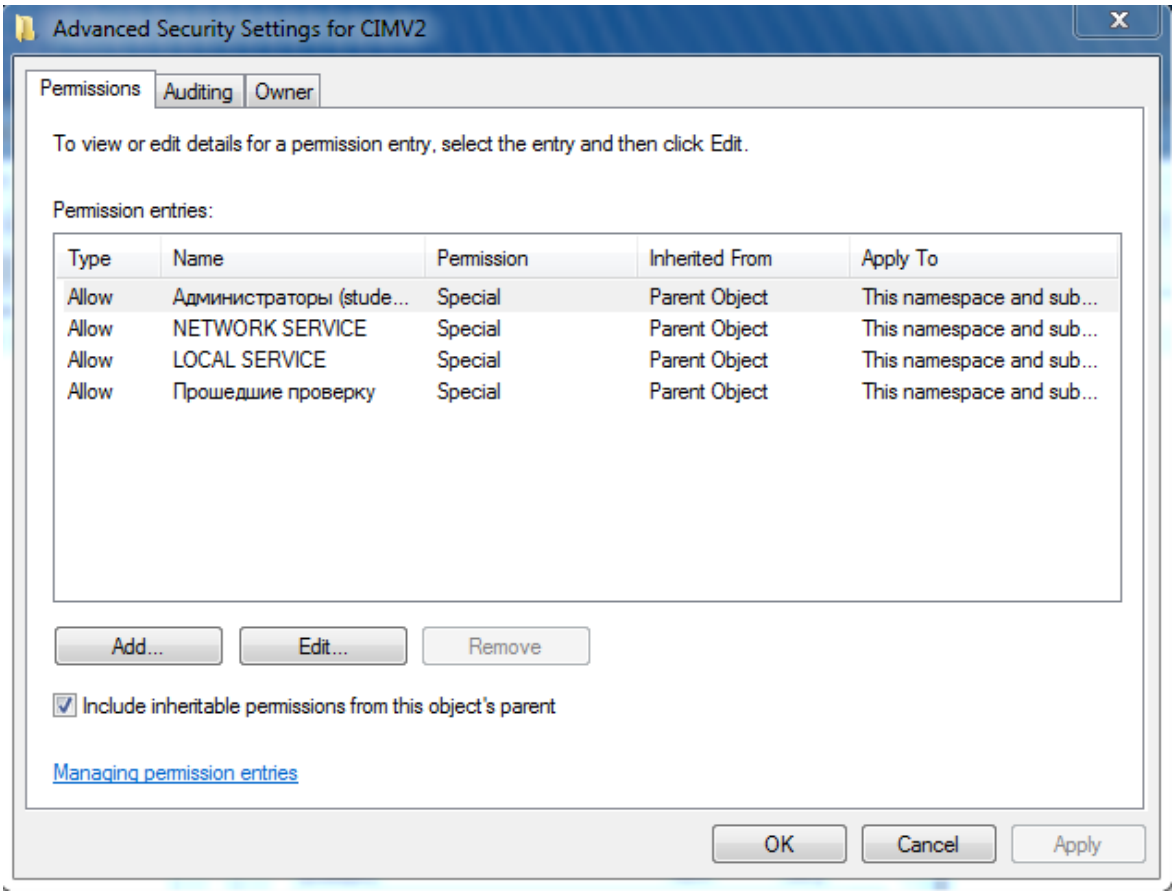


Fig. C.14. Applying allowance settings

15. In the **Additional security parameters for CIMV2** window, click the **Apply** button and then OK.

16. In the **ROOT\CIMV2 security** window, click the **Apply** button and then OK.

17. In the **Properties: WMI Control** window, click OK. Remote access to WMI is configured.

C.3. Permission for remote access to COM applications

Permission for remote access to COM applications allows you to connect, start processes, and run tasks non-stop.

To configure remote access to COM applications, you need to have admimistrator's rights.

To allow remote access to COM applications, perform the following:

COM (*Component Object Model*) is a binary-interface standard for software components by Microsoft. It is used to enable inter-process communication object creation in a large range of programming languages.

1. Enter `dcomcnfg` in the search field of the **Start** menu and press **Enter**. The **Component services** window opens.

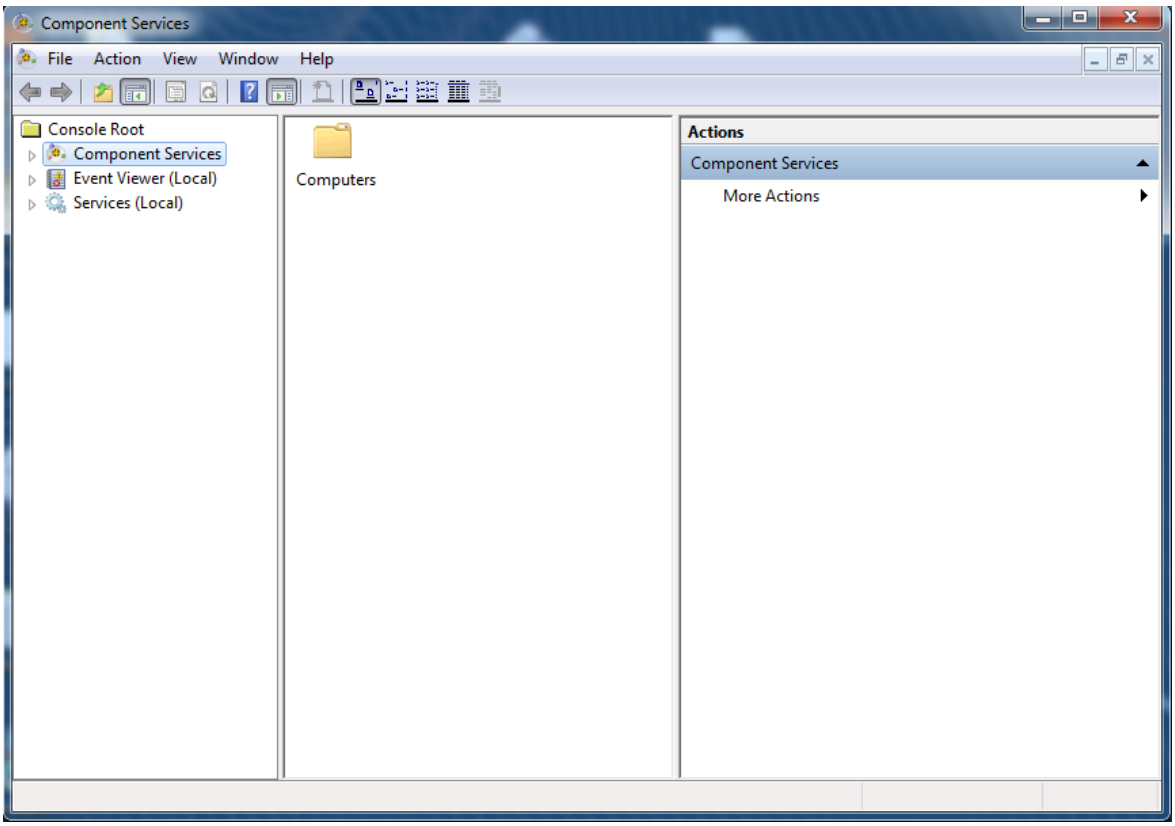


Fig. C.15. The “Component services” window

2. In the folder tree, select **Component services › Computers**. In the central window area the **My computer** icon appears.

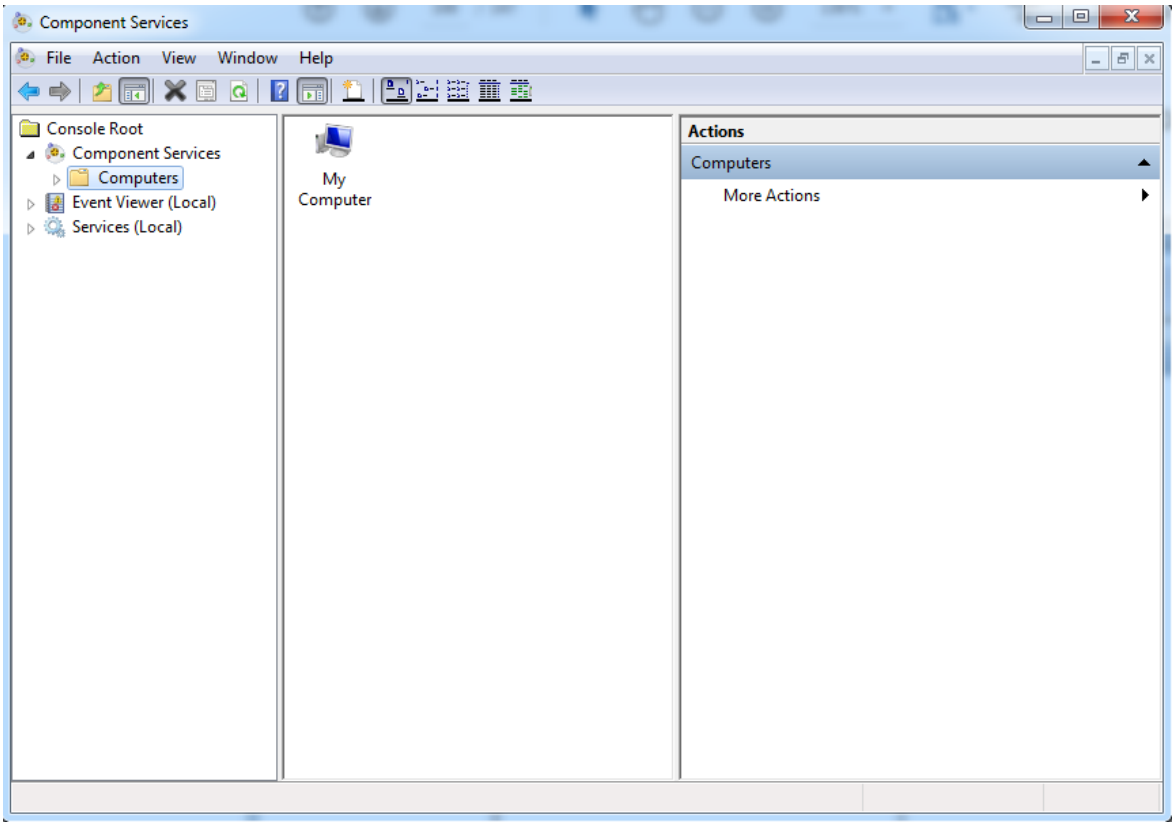


Fig. C.16. The “My computer” icon displayed in the “Component services” window

3. Right clicking the **My computer** icon open the context menu and select **Properties**. The **My Computer Properties** window opens.

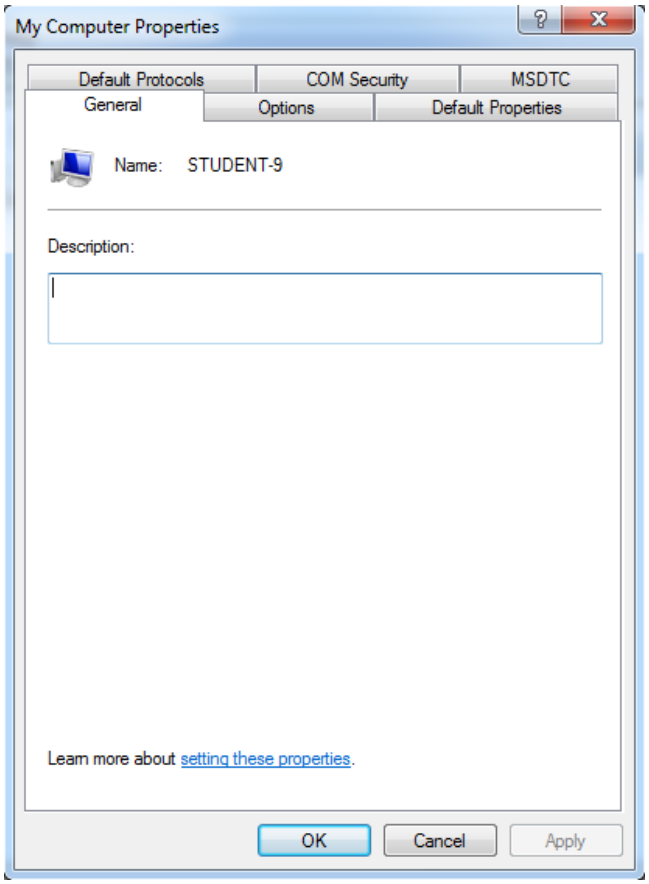


Fig. C.17. The “My Computer Properties” window

4. Open the **COM Security** tab.

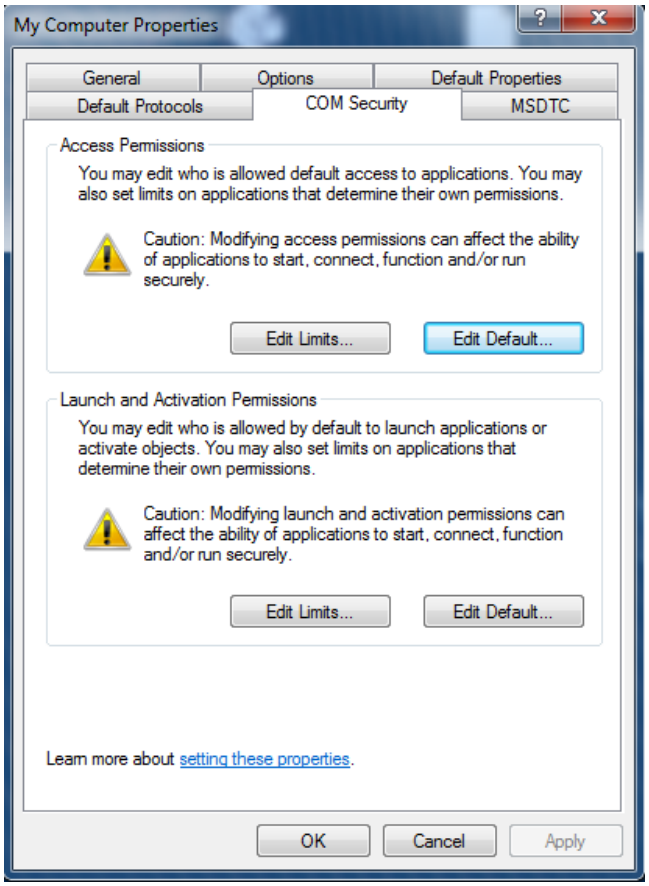


Fig. C.18. COM Security setup

5. In the **Access permissions** section, click the **Edit limits** button. The **Access permissions** window opens.

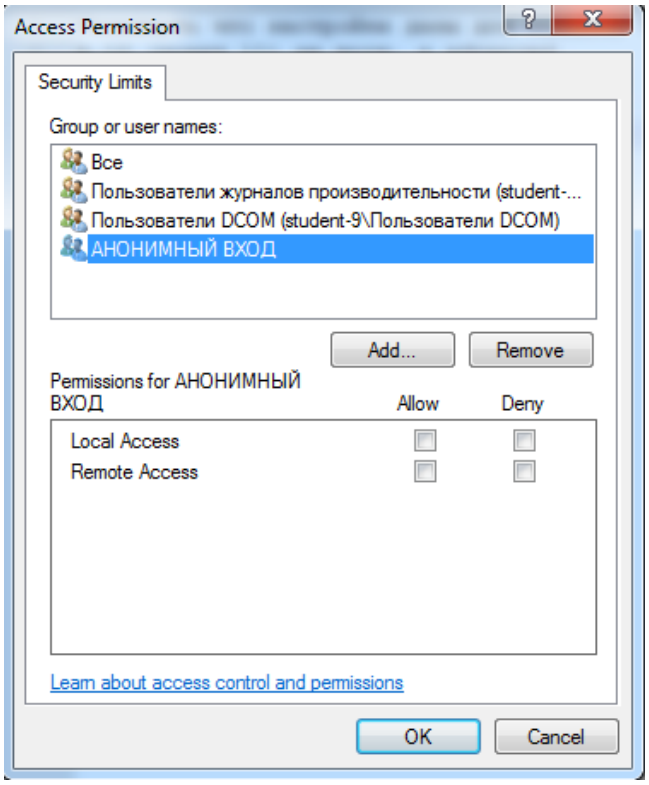


Fig. C.19. The “Access permissions” window

6. In the **Groups and user names** section, click **ANONYMOUS ACCESS**.

7. In the **Permissions for ANONYMOUS ACCESS** group section, set **Allow** check-boxes against **Local access** and **Remote access** options.

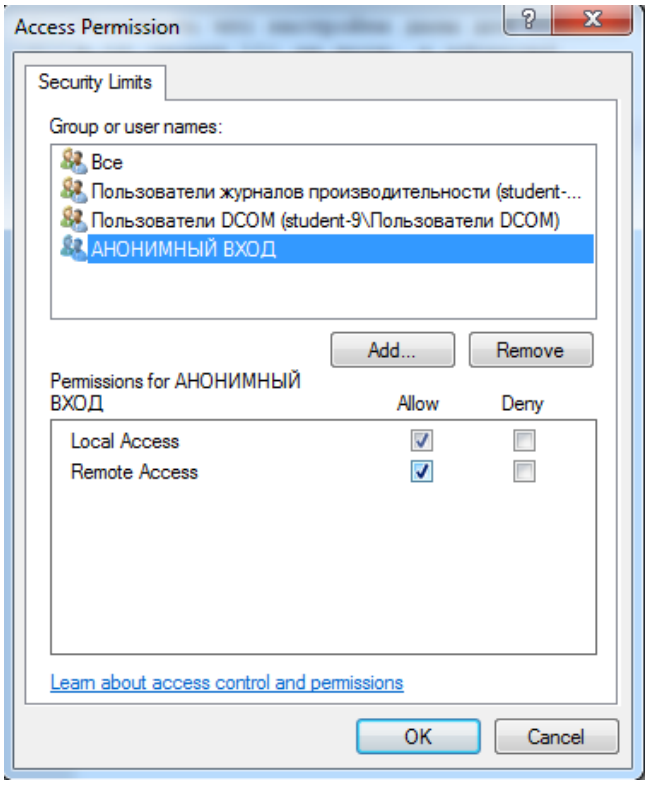


Fig. C.20. Local and remote access allowances

8. Click OK.

9. In the **COM security** tab in the **Launch and activation permissions**, click the **Edit limits** button. The **Launch and activation permission** window opens.

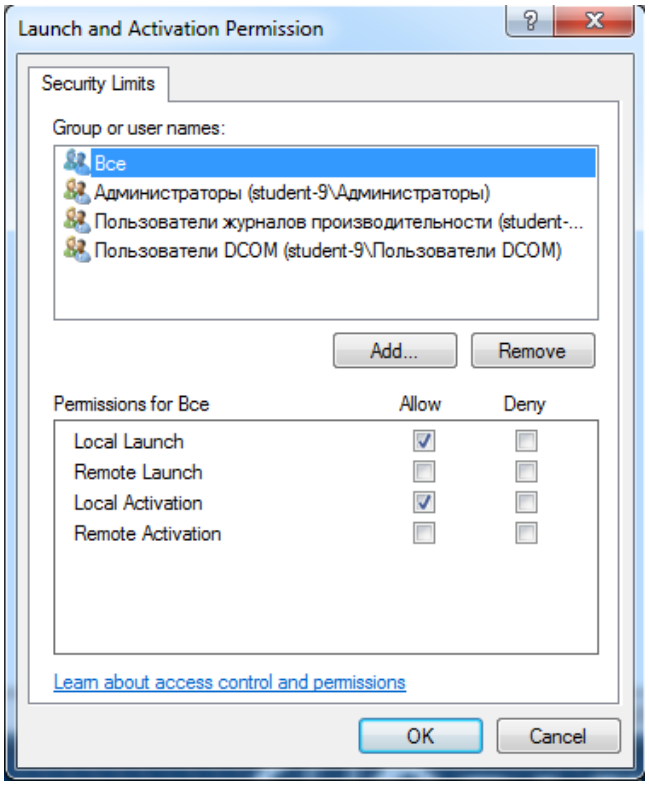


Fig. C.21. Start and activation allowance

10. Click the **Add** button. The **Select: Users, Computers, Service accounts, or Groups** window opens.

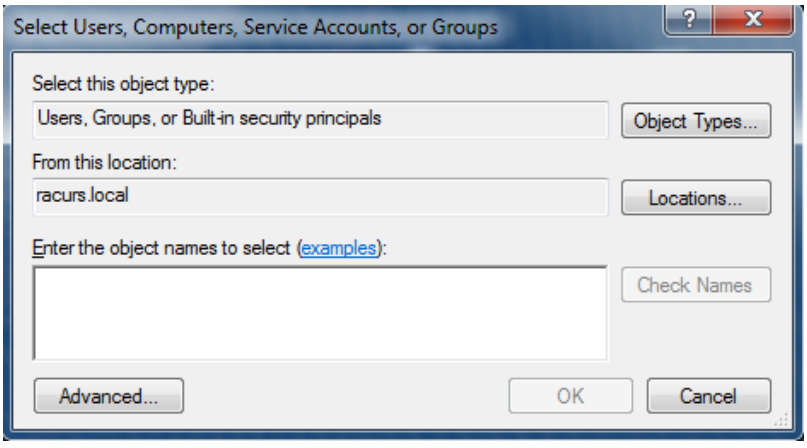


Fig. C.22. User selection window

11. In the **Enter the object names** input field, enter the username for whom remote access to WMI was previously allowed.

Entering usernames, use one of the following templates:

- `EnteredName (example: First name Surname);`
- `ObjectName (example: Computer1);`
- `UserName (example: User1);`
- `ObjectName@DomainName (example: User1@Domain1);`
- `ObjectName\DomainName (example: Domain1\User1).`

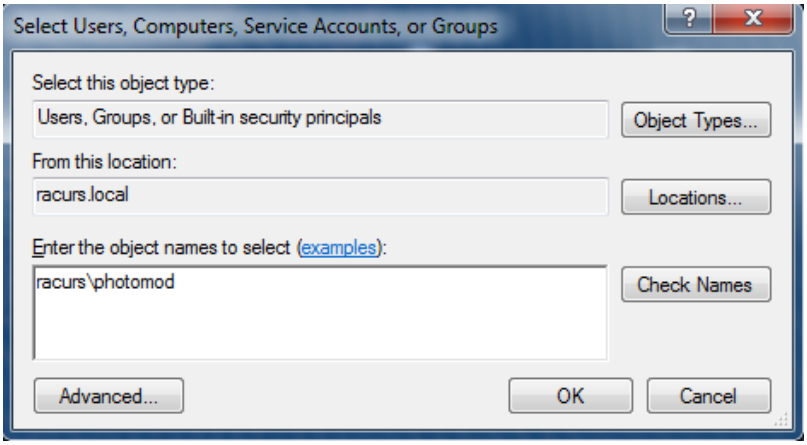


Fig. C.23. Username example

12. Click OK.
13. In the **Allowances for the Photomod group**, set **Allow** checkboxes against all the options from the list.
14. Click OK.
15. In the **Properties: My computer** window, **COM Security** tab, click the **Apply** button. The access to COM applications is configured.

C.4. Permission for data archiving

To set permission for data archiving, perform the following:

1. Enter `local security policy` in the **Start** menu search field and press **Enter**. The **Local security policy** window opens.

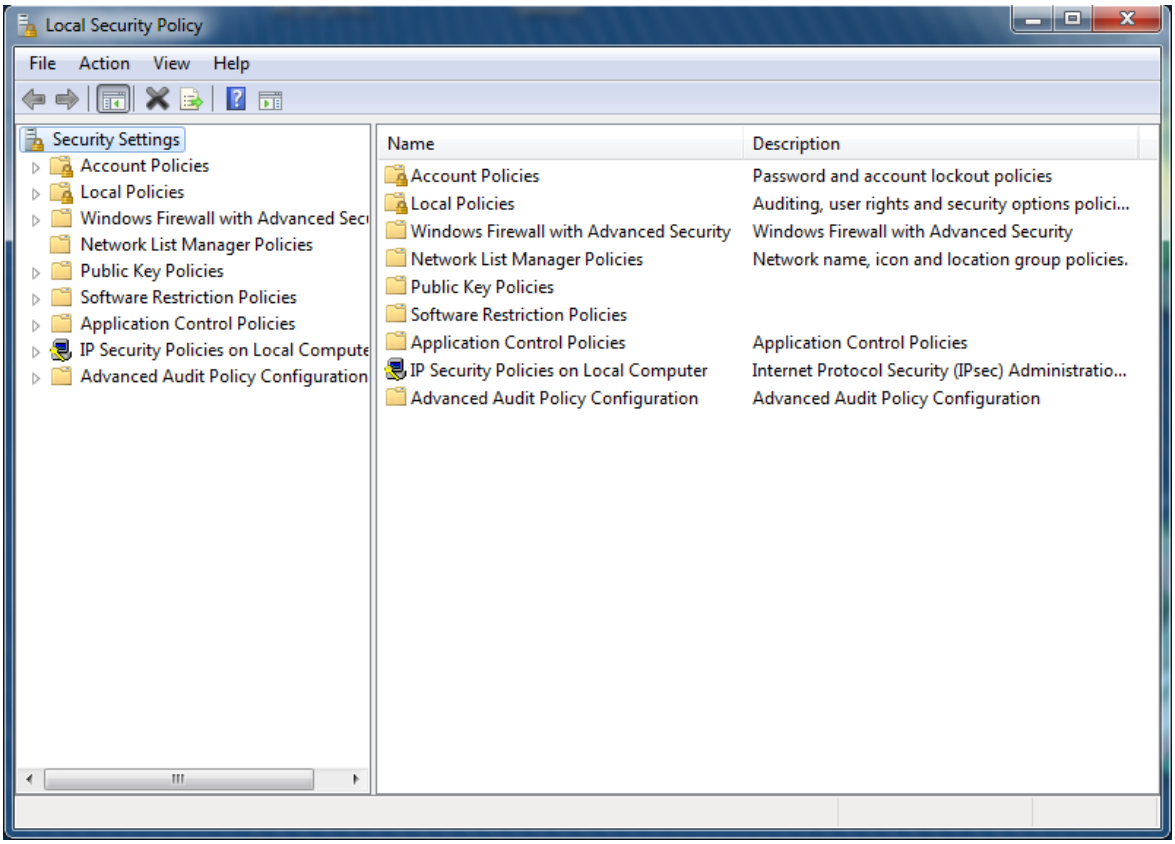


Fig. C.24. Local security policy

2. In the left part of the window in the folder tree, select **Security settings › Local policies › User rights assignment**.

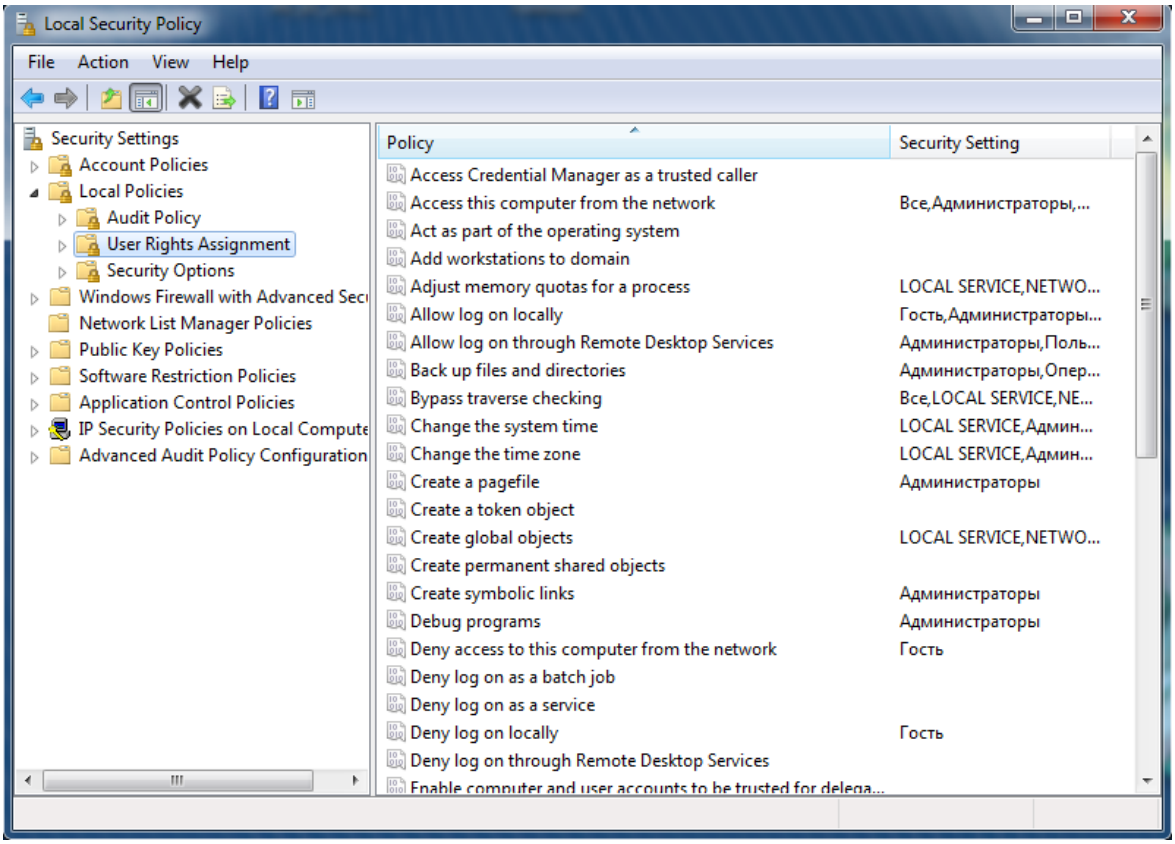


Fig. C.25. Assignment of user rights

3. Right click **Back up files and directories** and select **Properties**. The **Back up files and directories Properties** window opens.

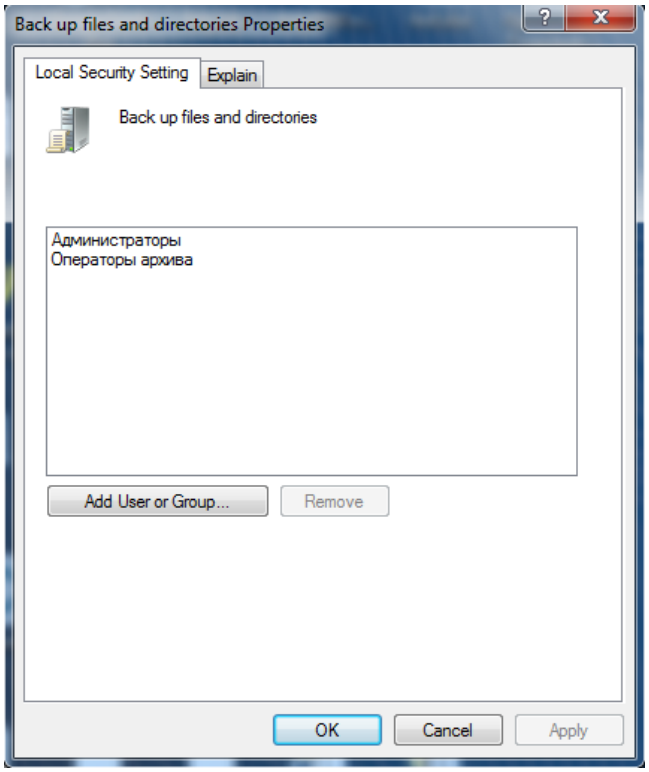


Fig. C.26. File and folder archiving access right setup

4. Click the **Add user or group** button. The **Select: Users, Computers, Service accounts, or Groups** window opens.

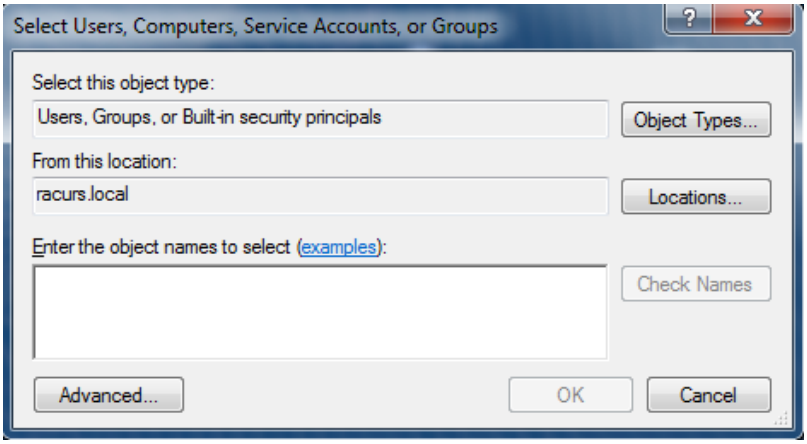


Fig. C.27. The user selection window

5. In the **Enter the object names** input field, enter the username for whom you want to set permission to archive data.

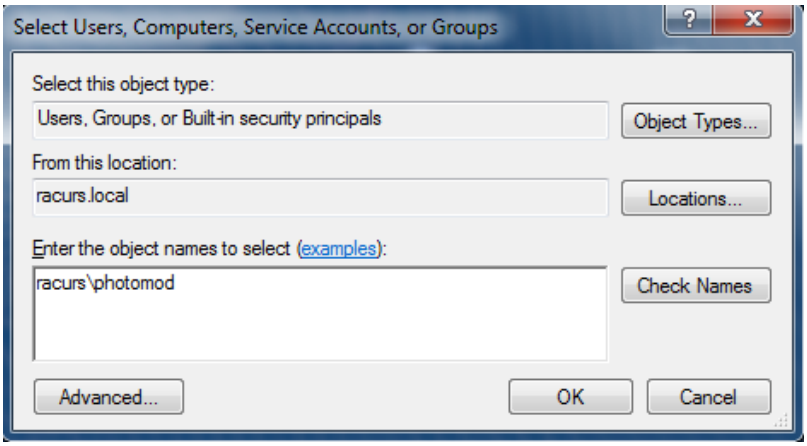


Fig. C.28. Username example

6. Click OK.

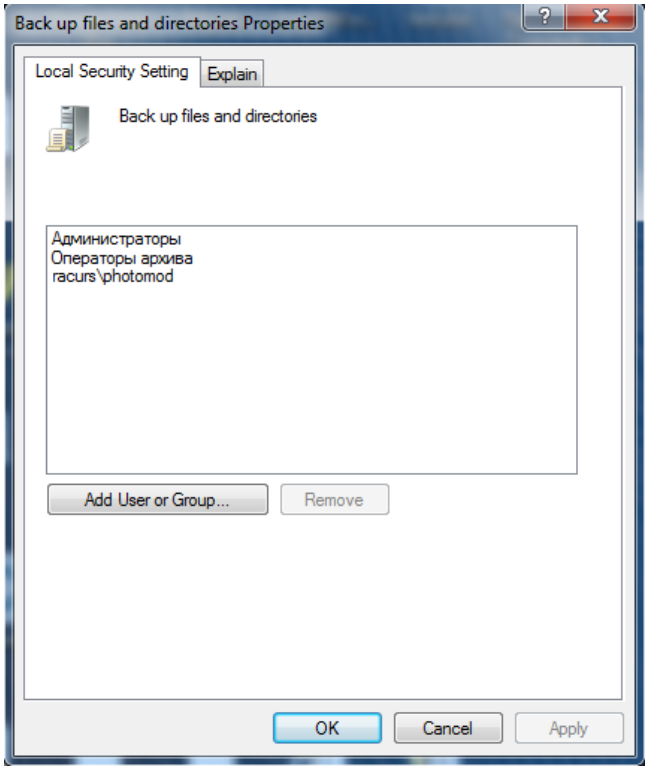


Fig. C.29. Photomod user access to file and folder archiving

7. Click OK. Access to file and folder archiving is allowed to the selected user.

8. In the **Local security policy** window, right click **Restore files and directories** and select **Properties**. The **Restore files and directories Properties** window opens.

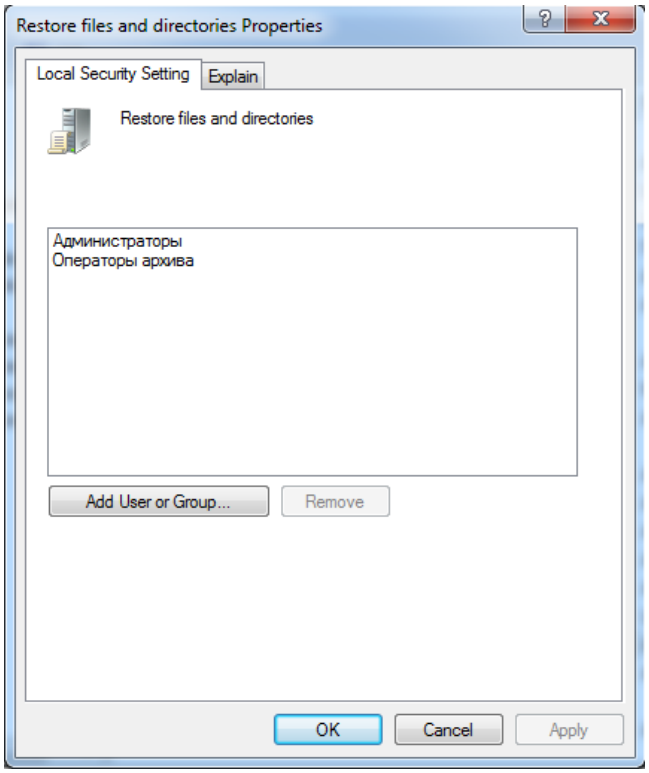


Fig. C.30. Access rights to file and folder recovery

9. Click the **Add user or group** button. The **Select: Users, Computers, Service accounts, or Groups** window opens.

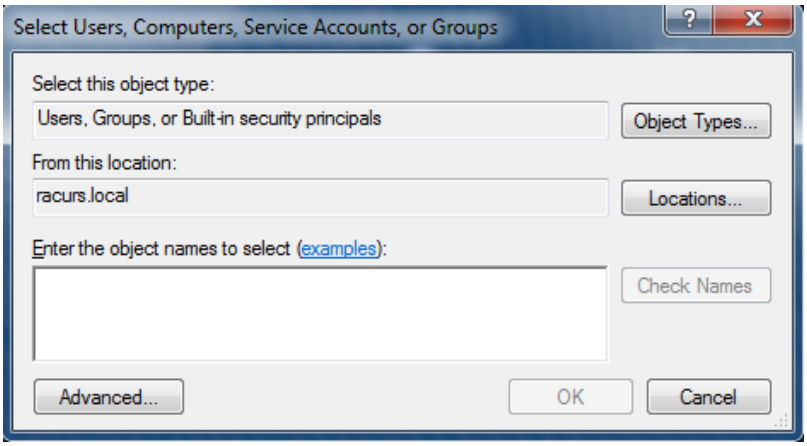


Fig. C.31. The user selection window

10. In the **Enter the object names** input field, enter the username for whom you want to set permission to recover files and folders.

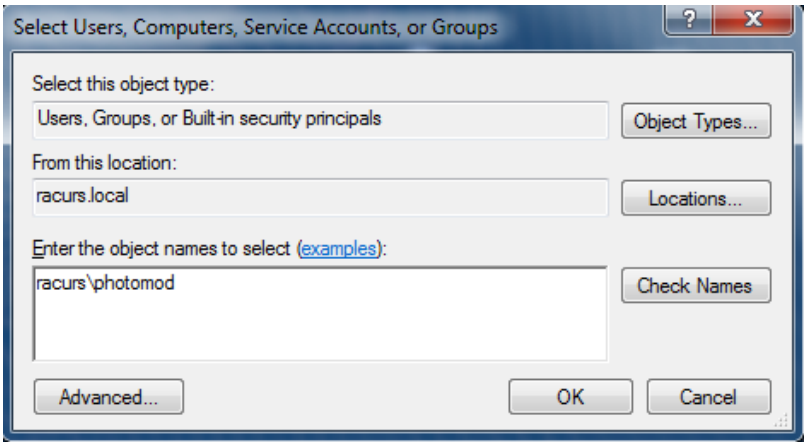


Fig. C.32. Username example

11. Click OK.

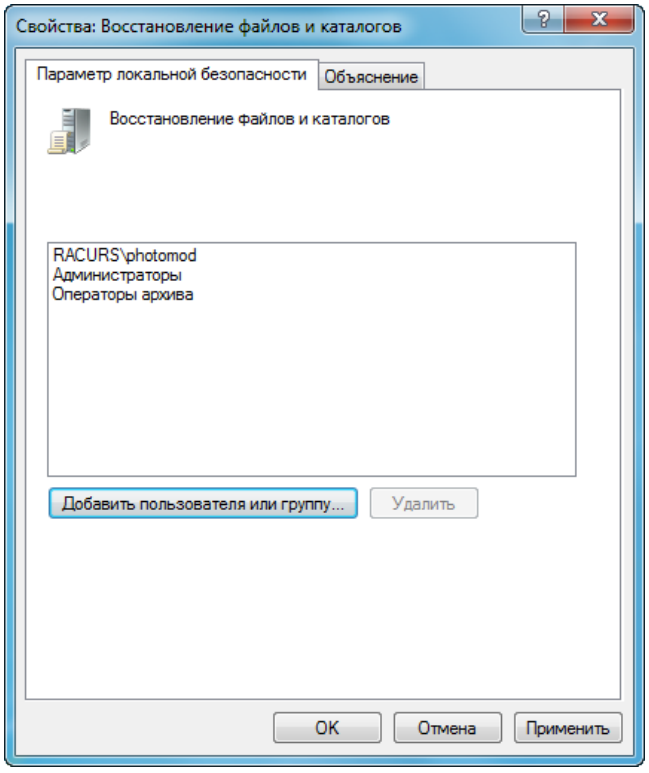


Fig. C.33. Photomod user access to file and folder recovery

12. Click OK. Access to file and folder recovery is allowed to the selected user.

13. In the **Local security policy** window, right click **Replace a process level token** and select **Properties**. The **Replace a process level token Properties** window opens.

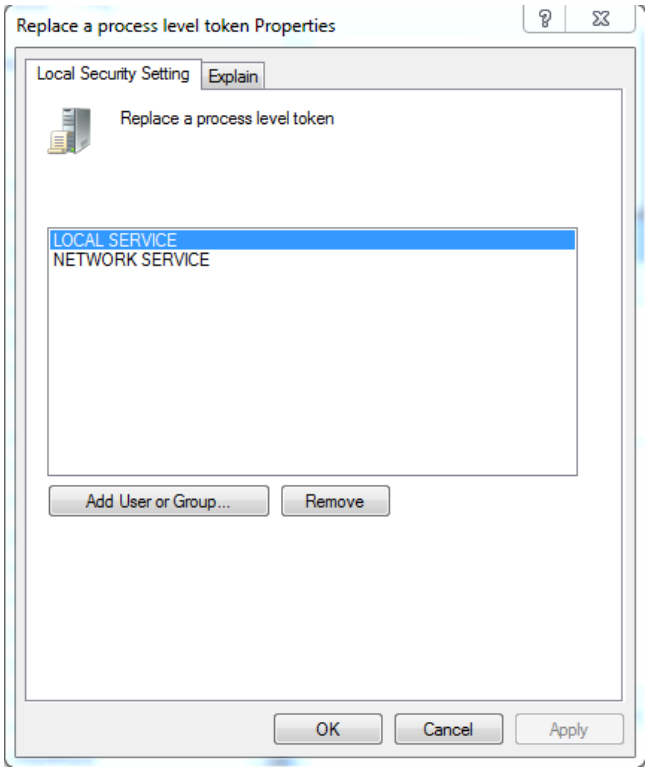


Fig. C.34. Replace a process level token

14. Click the **Add user or group** button. The **Select: Users, Computers, Service accounts, or Groups** window opens.

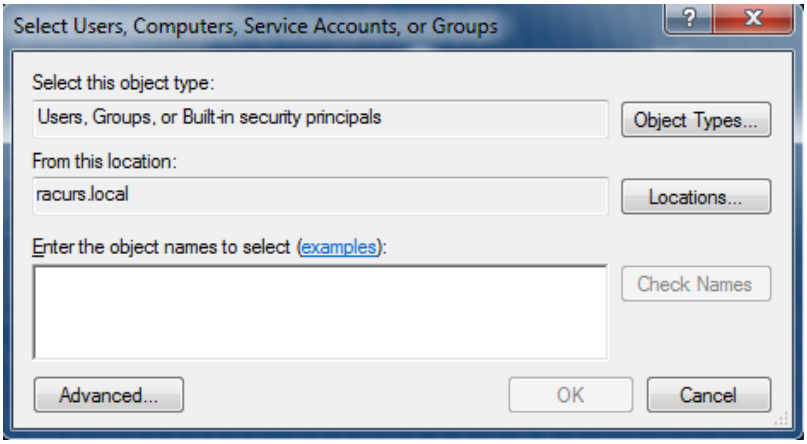


Fig. C.35. The user selection window

15. In the **Enter the object names** input field, enter the username for whom you want to set permission to recover files and folders.

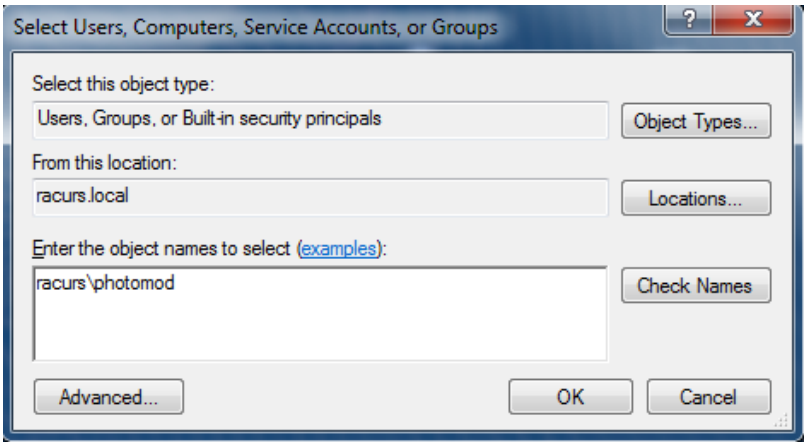


Fig. C.36. Username example

16. Click OK.

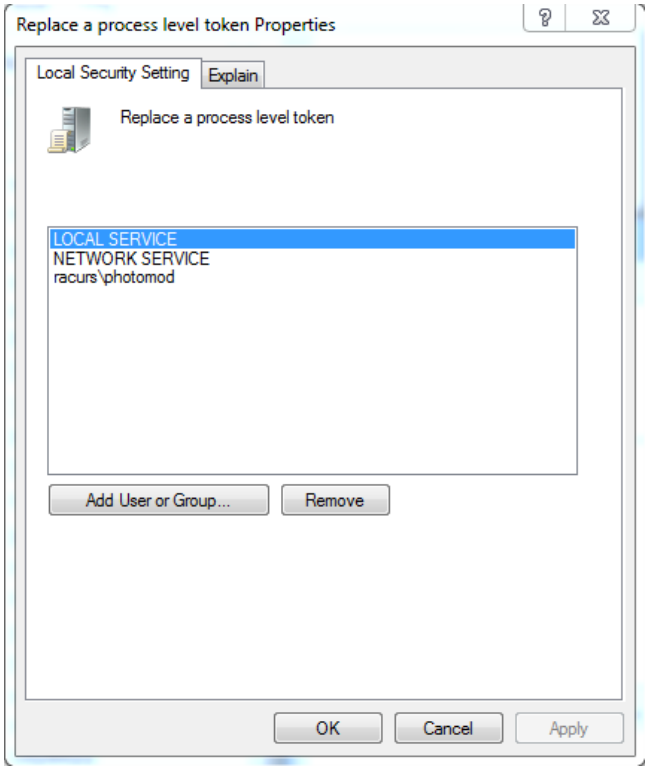


Fig. C.37. Replace a process level token

17. Click OK.

C.5. Shared access setup

To setup shared access to a folder, perform the following:

1. Right click the folder for which you want to setup shared access, open the context menu, and select **Properties**. The **Properties: PHOTOMOD7.Var** window opens.

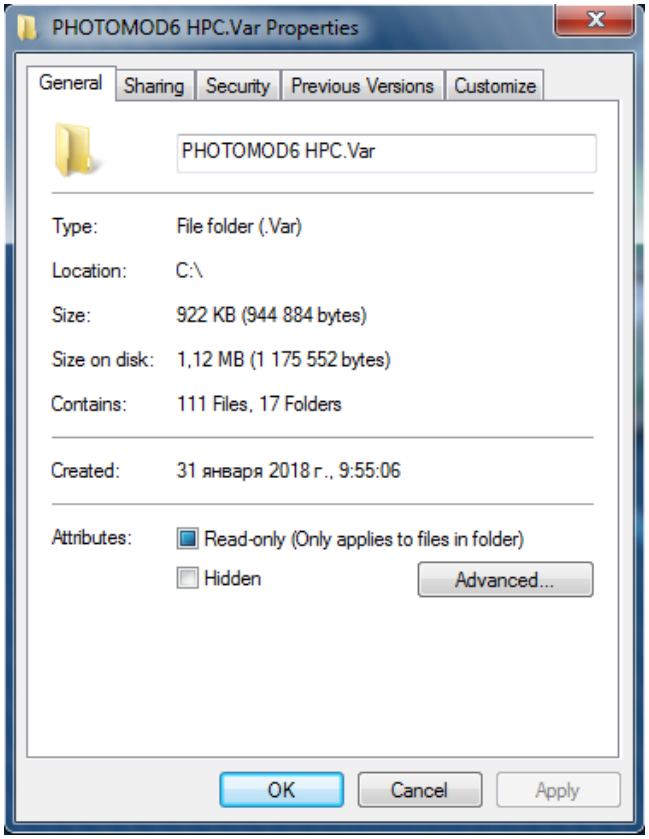


Fig. C.38. General tab

2. Go to the **Access** tab.

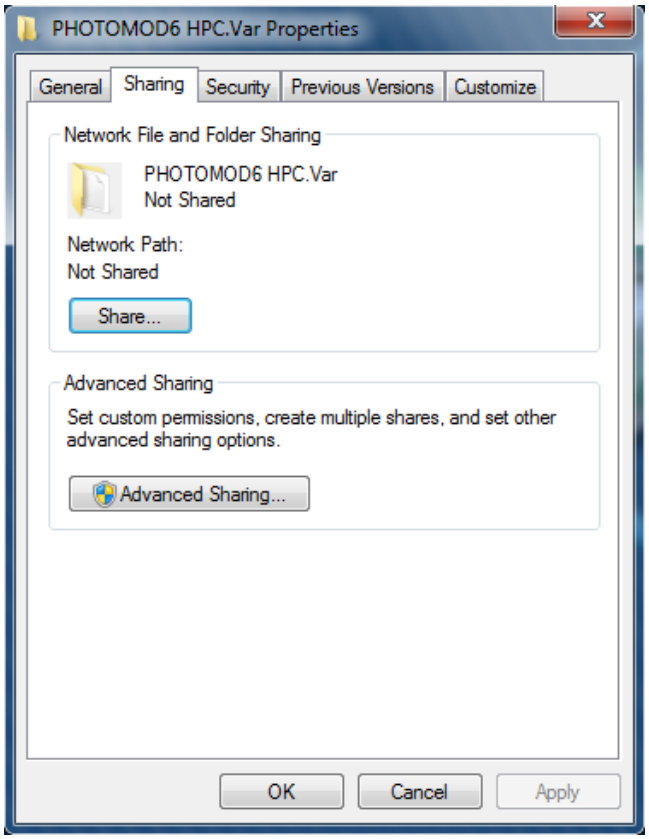


Fig. C.39. Access to shared files and folders

3. In the **Advanced shared access setup** section, click the **Advanced setup** button. The **Advanced shared access setup** window opens.

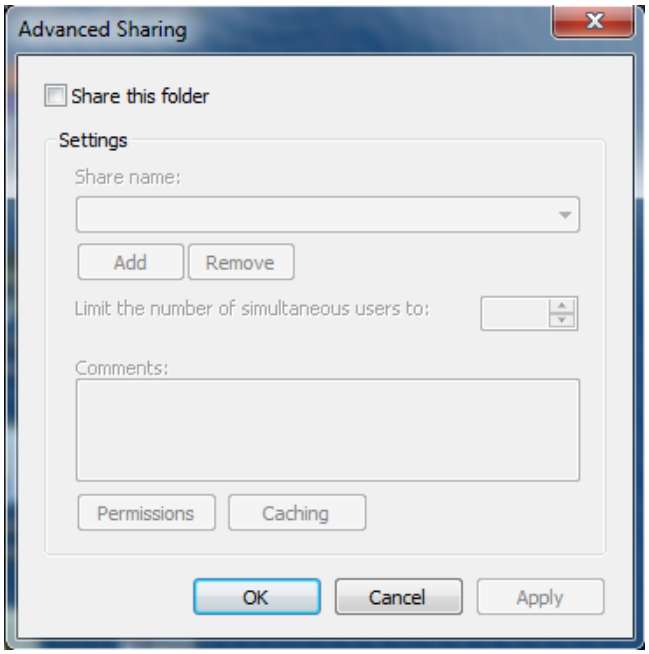


Fig. C.40. Shared access setup

4. Set the **Open shared access to this folder** checkbox.

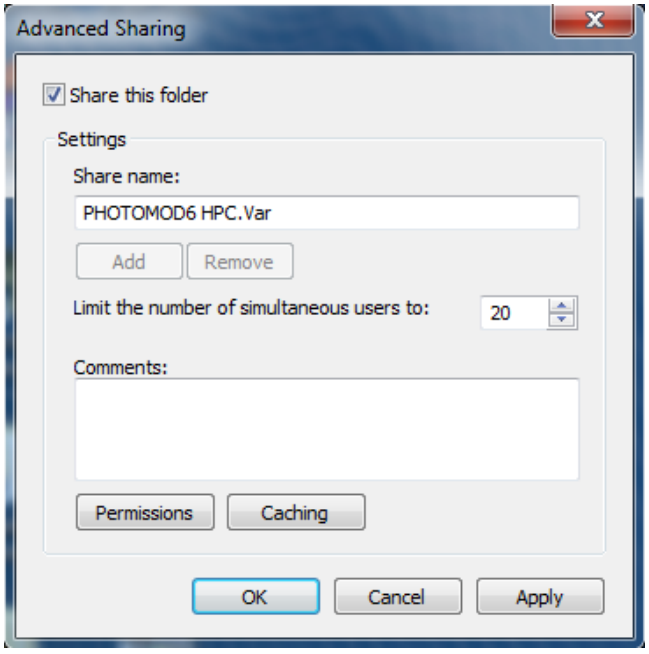


Fig. C.41. Open shared access to this folder

5. Click the **Apply** button.

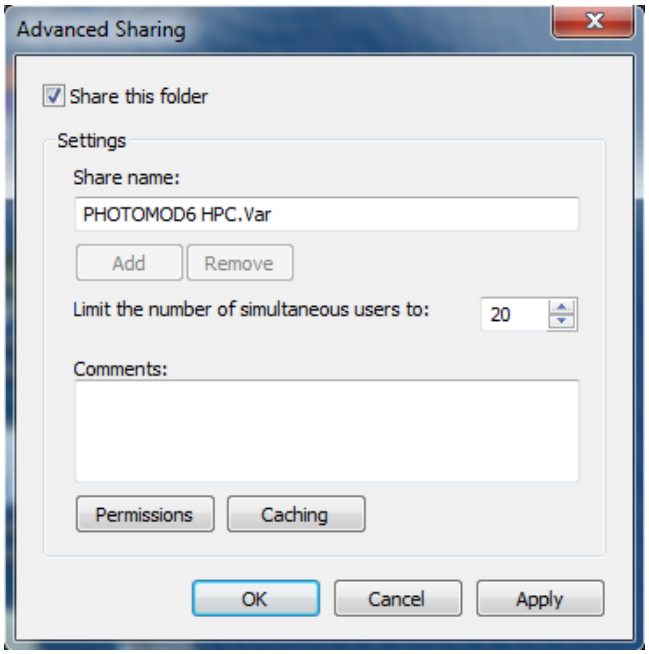


Fig. C.42. Applying shared access to a folder

6. Delete spaces in the folder name in the **Shared resource name** input field.

7. Click OK. Shared access is configured.

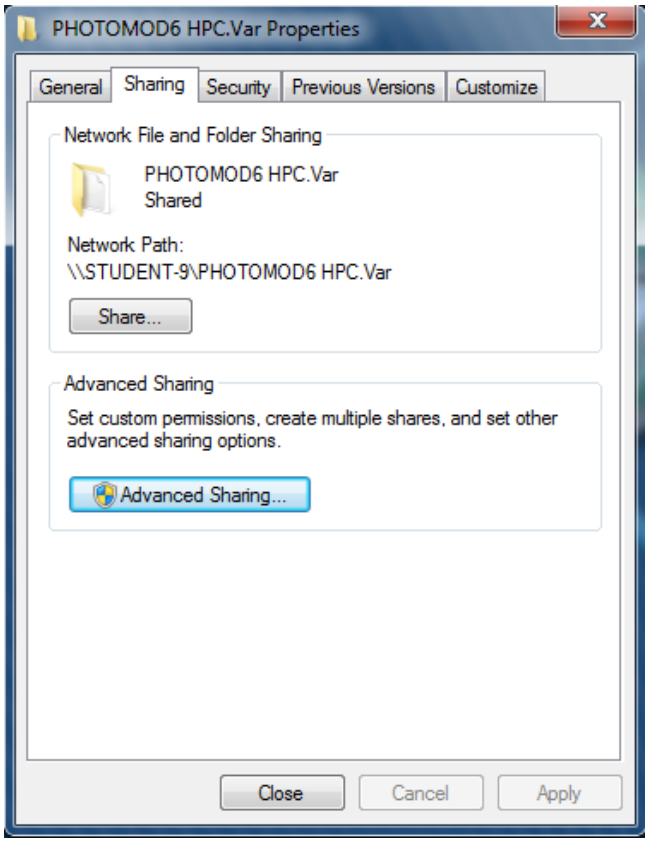


Fig. C.43. Saving shared access configuration