



AUTOMATED FLIGHT DATA PROCESSING, ANALYSIS AND MONITORING PROGRAM

1.2.28

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Introduction

Flight Information Analysis Software **WinArm64** is a software complex for automated readout, processing, analysis and presentation of Flight Data Recorders information. The program is developed to be hosted on IBM-compatible PC with 64-bit MS Windows 7/8/10/11. The **WinArm64** program has a comprehensible user-friendly interface and provides a lot of context tips that make the work easy and comfortable.

The software allows:

- import flight data recorders information;
- perform automatic FDR information processing and analysis;
- print flight information for any time interval in graphical and tabular format;
- perform flight path calculation in vertical and horizontal planes and to evaluate non-registered parameters;
- make express-analysis of the flight information (FDM) and to present the results in user friendly graphical, tabular or electronic format;
- view real time 3D express reconstruction of the flight synchronized with the CVR records;
- keep and maintain flight information database to be able to backup, sort out and select the necessary information;
- work with one data file on many computers at the same time keeping the original file unchanged in the server database;
- change calculations and express analysis algorithms, add user-defined modules for express analysis and to create standard tasks to promptly view and print data;
- process (listen to) the voice (CVR) information along with the FDR information, change the duration of the sound and make a transcript of crew communications, perform spectrum analysis and filter (clean) of the record;
- add up to 10 additional data streams from other files to the current data file with voluntary time coordination of those streams;
- keep the database of the express-analysis results and other regular information with the ability of statistical analysis (optional);
- send results of the flight path calculation and other data to the X-Plane Simulator to make realistic reconstructions of flights including cockpit environment and instruments indications.

While working with flight information the user can:

- select, sort and display desired analog parameters and On/Off signals (events) in fast and evident manner;
- fast search of the desired part of the flight;
- select any scale of the parameter axis and time axis;
- select parameter's color;
- display data in codes or engineering units;
- view exact parameter values at the instants they were reordered and to move a scale of any parameter along the screen.

A wide variety of functions allow an operator to set and remove frame and parameter failure marks in different ways to exclude them from calculations and analysis with the possibility to save original information and to return to it at any time.

User can customize many elements of the program interface and to select language (English or Russian).

Graphic forms and standard tasks give the ability to share results of your work with other users and to use them while processing newly created data files.

Specially designed format of data file makes any data file fully independent and usable on any computer with **WinArm64** installed. All the results of your work are now saved directly in the data file.

You are able to add a lot of different information while printing a graph: short name and/or full name of the parameter, parameter values in any position, graph name, service information, transcript of crew members communication and so on. The program has the ability of automatic scale management while printing and supports any print device installed in the MS Windows which makes information printing evident and fast. Now you are able to save your results unto electronic format (emf, bmp, jpg, png files), print and share it with other users.

The **WinArm64** program contains a built-in function that helps you to calculate flight path in horizontal and vertical planes on any stage of the flight. While calculating you are able to correct calculation results by wind influence

and take into account the instants of flying over fixes (VOR and so on). Flight path calculations results may be synchronized with geographical/ aeronautical maps and charts. Visualization utility provides you with the ability of 3D express demonstration of the flight in real time mode with CVR record synchronization and selected parameters monitoring.

The **WinArm64** database is based on client-server architecture. You keep your database (data files archive) on the server; client workstations receive selected files via local area network with the ability either to save them in local databases or transferring back to the server after some corrections were done. The last function is enabled only for users with the highest level of access. High density of the flight data makes data transfer quick for different types of networks.

The changes to the DataFrame (list of parameters and their addresses) as well as to the calibration tables may be made directly during the work with the help of user-friendly interface.

The program (Professional version) has a built-in interpreter of logical and mathematical equations that provides users with the ability to change existing and to compile new algorithms of the express analysis (FDM algorithms).

The program guarantees information protection from unauthorized access through four different levels of access.

The program enables users to analyze (to listen to) the CVR information along with the FDR information as well as to compare (to superimpose) the FDR information of different flights.

Express-analysis results as well as regular information of any type may be saved into the database with the ability of statistical analysis.

Software development, technical support, guarantee and post-guarantee maintenance as well as personnel training is done by the specialists who have great experience of flight information readout, recovery and analysis including aviation accidents and incidents investigations.

1. License Agreement

1.1. Subject of Agreement

The Developer grants to an End User the License (right) to use the software registered under “WinArm64” trade mark installed on a computer belonging or leased by the user and if following conditions and limitations are complied with. The given Product is protected under Russian Federation Copyright and other laws.

All the terms of the present Agreement are applicable to the whole software as well as to any separate part including documentations. The Product is the exclusive proprietary to the Developer.

1.2. Conditions and limitations of using the Product

The Product is supplied “as it is” which means that:

1.2.1 Customizing of Product to the particular End User requirements is not included;

1.2.2 Customizing of Product to the particular End User requirements may be provided based on an additional Agreement or Contract.

1.2.3 An End User may customize the Product using the built-in capabilities;

1.2.4 The Developer is not responsible for the troubles that may appear due to: incompatibility with the particular hardware and software installed on the user’s computer, introducing changes to the Product’s files, virus infection, unqualified personnel actions or technical failures.

1.2.5 The Product is delivered along with the electronic Protection Keys USB-HASP, that protect an End User from unauthorized access and the Developer from unauthorized use of the Product.

1.2.6 The use of the WinArm64 software without the Protection Key, purchased together with the License, will violate the License Agreement.

1.2.7 The License grants the use of Product on a single working place (on a single computer) if additional terms are not included in the delivery Contract.

1.2.8 The Product may be set up on the unlimited number of User’s computers but only the number of working places equal to the number of purchased licenses may be used at the same time.

1.2.9 An End User is not allowed to modify, decompile or distribute the Product, its modules and parts as well as to lease out or rent the Product.

1.2.10 An End User is not allowed to make unauthorized copying of the printed documentation supplied with the Product.

1.2.11 In case of violation of the present Agreement terms and, in particular paragraphs 1.2.6 – 1.2.9, the Developer deprives the User of the License for the right to use the WinArm64 Software, completely waives its warranty and other obligations and reserves the right to file lawsuits in accordance with the current legislation.

1.3. Duration and warranty

1.3.1 The duration of Product’s use purchased on the basis of the present Agreement is not limited.

1.3.2 The warranty period of the Product is 12 (twelve) months counting from the date of acceptance-transferring act signing, if other is not specified by the Contract or Agreement.

1.3.3 The Developer guarantees the work of the Product during the in accordance with the supplied documentation and is obliged to correct any errors that may be encountered except in cases stated in paragraphs 1.2.4, 1.2.6-1.2.9 of the present Agreement.

1.3.4 The Developer provides the technical support and consultations to an End User during the warranty period except in cases stated in paragraphs 1.2.4, 1.2.6-1.2.9 of the present Agreement.

1.4. Terms of supply

1.4.1. The WinArm64 software is delivered electronically with documentation (User Manual) and a USB-HASP Protection Key.

1.4.2. Signing this License Agreement or installing and using WinArm64 means that the User understands and agrees to the provisions of this License Agreement.

1.5. Parties Liability

1.5.1. The Developer’s liability for the possible End User’s damages caused by the Product’s use may not exceed the price paid for the particular item that caused the damage. The Developer’s liability does not cover damages caused by incompliance of an End User with the terms of the present Agreement as well as the loss of data, profit and savings, the damages to the hardware, networks and other consequences and the third party claims imposed upon End User as well.

2. Initial Knowledge

2.1. Conventions

The following conventions are used in this manual:

In bold are the names of different items of user interface, keys, as well as names of the reference software;

In bold italics are highlighted elements to pay special attention to;

In italics are notes and recommendations.

2.2. Beginning work with WinArm64

The WinArm64 program has clear user-friendly interface and context tips. To get the knowledge about all the features of the program it is enough to get acquainted with the present Manual. It should be noted that the present manual assumes that the user has basic knowledge about flight data recording and FDR types, flight dynamics and computer running under **Windows** operating system.

To get the above-mentioned basic or advanced knowledge refer to the appropriate documentation.

2.3. Software packages variants

There are four different delivery packages that depend on the type of the Protection Key purchased:

- Standard (**Std**);
- Professional (**Pro**);
- Network Standard (**Net Std**);
- Network Professional (**Net Pro**).

The type of the package installed is shown in the caption of the program's main window. An unique identification number of the Protection Key that has been used for logging into the program is displayed in the window caption parenthetically. You will not be able to run the program without a protection key. Operation of the program without a protection key means violation of the license agreement and the occurrence of liability in accordance with the current legislation.

Professional package. Using this type of key the user *has access to all program's features* including developing and modifying express-analysis algorithms.

Standard package – is the most popular package. This package *does not provide* the capability to modify and create express-analysis algorithms but users are still *able to run express-analysis* that is provided with the system. The level of access to the program's features depends on the system administrator who assigns user names and passwords as well as capabilities for each user. See [Section 6](#) for how to assign user names and level of access. This package can be supplied without the administration function (with full access to the **Std** profile).

Network package (Std or Pro) is intended for large organizations with personal computers combined into a local area network, and provides full licensed use of the software complex on 50 Customer's computers simultaneously in the functional version of **Std** or **Pro**.

2.4. Components installed

The **WinArm64** system consists of the following major components:

- Executable file winarm64.exe.
- Auxiliary configuration and initialization files.
- The file with the predefined recorded parameters list.
- Drivers for the HASP key;
- Template files
- Help and documentation files.
- Examples of data files, headers and flight path files.

Installation program automatically places above-mentioned files into the appropriate folders.

WinArm64

Program main folder

aip\	This folder contains graphical aircraft models which are used in flight path window
drivers\	This folder contains files that are necessary for protection key driver installation
help\	This folder contains help files in English and Russian languages
samples\	This folder contains samples of different types
server\	This folder contains file server swa64.exe
work\	This is default folder for additional files (standard tasks, templates)
navi\	This folder contains database files DAFIF
winarm64.exe	Executable file of the program
winarm64.ini	Program configuration file
font.ini	Fonts configuration file
param.txt	Text file that contains the predefined parameters list
pass.ini	Password file
winarm64_ru.chm	Help file
файлы *.dot	MS Word template files to print different kind of information in English and Russian languages.
файлы *.fodt	Open Document template files to print different kind of information in English and Russian languages.
файлы *.xpln	X-Plane export template files
about.wav	Audio file

Additionally, the WinArm64 directory may contain files installed in accordance with the Supply Contract - flight samples, header files, additional program modules.

2.5. Technical requirements

To install the flight information analysis ground station **WinArm64** your computer should meet the following minimum requirements:

- Operating system **64-bits Windows 7/8/10/11**;
- Screen resolution at least 1280x1024, High color (16 bits);
- USB interface to connect Protection Key;
- To speed the work it is highly recommended to have a mouse with the scrolling wheel;
- To print or save to a file the results of the express-analysis implementation as well as the current header

Microsoft Word or alternative means capable to work with MS Word (doc, docx files) or ODF (Open Docs Files) like Libre Office (odt files) and etc. should be installed. Express-analysis algorithms output is available to **MS Word** only;

- **Microsoft Excel** installation is recommended for parameters tables output;
- To connect with cloud-servers (**OpenStreetMap, Google Earth, Metar, WinArm Update**) an Internet connection is required.

2.6. For WinArm32 Users

This paragraph is designed for **WinArm32** Users and contains short knowledge about new features appeared in **WinArm64**.

- **WinArm64** is a 64-bits version of the program with increased speed in comparison to **WinArm32**. **WinArm64** interface is largely inherited from the **WinArm32**.

- New formats of cyclograms/dataframes (**hdrx**), flight data (**armx**, **armx**) and standard tasks (**stnx**) are implemented on the basis of the extensible XML markup language. The limit on the number of parameters in the cyclogram/dataframe and in additional streams has been removed. Increased accuracy of parameters of additional streams. A spectral analysis function has been added for audio streams. The new standard job file (**stnx**) has increased the number of parameters to save. It is possible to decode parameters with an arbitrary bit sequence. New options for scaling parameters on graphs have been added. In the new data format (**armx**), it is possible to sort parameters into groups for a more convenient choice.

- Added the ability to process Arinc-767 and 647A (FRED) data.
- **WinArm32** file formats (**arm**, **hdr**, **tra**) are fully supported in **WinArm64**.

*Express-analysis programs implemented in **WinArm32** are fully supported in **WinArm64**.*

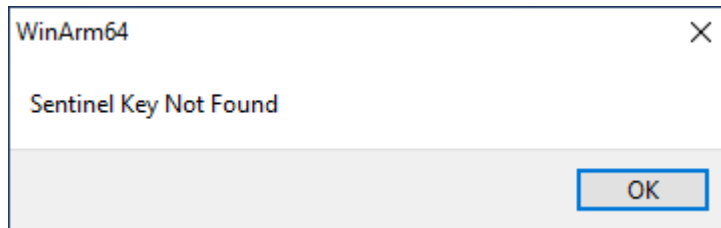
WinArm64 no longer supports data readout from tape-based FDRs and exporting data to **Microsoft Flight Simulator**. Programs for data readout from tape-based FDRs are included in the software set for data input modules (MVD, MVD-23).

3. Software Interface

WinArm64 is a standard **MS Windows** application that supports a multi-window interface. Application functions are controlled using a visual interface based on a set of controls - menus, buttons, switches, the use of a keyboard and a mouse-type manipulator. The interface is implemented based on the principles of building **Windows MS** applications and supports a high level of standardization.

3.1. Program launch

The program (**winarm64.exe** executable) can only be run when the HASP Protection Key is connected. For more information on licensing and installing HASP cookies, see [Section 4](#). If you run the program without a HASP security key connected, the system generates a warning:



After successful launch the password request will be shown:



1 Username field

2 Password field

3 Cancel Button

If Cancel Button will be pushed the program will be opened in "guest" mode - with limited capabilities.

Security and access levels setting are described in [Section 6](#).

*At the request of users with **Pro** version, it is possible to launch the program without opening the password entry window.*

3.2. DataBase Window

Database window showing a list of files. The file 89085_CMS is selected. The Tasks area is not visible.

Reg.No.	Reg.No.	Note	Date	Flight	Pilot	Size	File
89020_CMS	89085_CMS		22.10.19		440 / 372	1.21 mb	89085.hdrx
89020_FDR	89085_CMS		22.10.19		440 / 372	0.95 mb	89085_cms.hdr
89085_CMS	89085_CMS		22.10.19		440 / 372	23.7 mb	89085_cms_210.arm
	89085_CMS		22.10.19		440 / 372	5.94 mb	89085_cms_212.armx
	89085_CMS		22.10.19		440 / 372	5.93 mb	89085_cms_214.armx
	89085_CMS		22.10.19		440 / 372	5.93 mb	89085_cms_215.armx
	89085_CMS		22.10.19		440 / 372	5.31 mb	89085_cms_216.armx

While choosing the cyclogram file (**hdr**, **hdrx**) the **Tasks** area will show on in the bottom.

Database window showing a list of files. The file 89085_CMS is selected. The Tasks area is visible, showing 'Header editing (hdrx)' selected.

Reg.No.	Reg.No.	Note	Date	Flight	Pilot	Size	File
89020_CMS	89085_CMS		22.10.19		440 / 372	1.21 mb	89085.hdrx
89020_FDR	89085_CMS		22.10.19		440 / 372	0.95 mb	89085_cms.hdr
89085_CMS	89085_CMS		22.10.19		440 / 372	23.7 mb	89085_cms_210.arm
	89085_CMS		22.10.19		440 / 372	5.94 mb	89085_cms_212.armx
	89085_CMS		22.10.19		440 / 372	5.93 mb	89085_cms_214.armx
	89085_CMS		22.10.19		440 / 372	5.93 mb	89085_cms_215.armx
	89085_CMS		22.10.19		440 / 372	5.31 mb	89085_cms_216.armx

Tasks: ☒ Header editing (hdrx) ☐ Data file making (armx)

Data Loader: Predefined data stream

Type of the data stream: 12-bits stream

In this area you can choose what to do with this file (**hdr** or **hdrx**).

Choosing **Header editing** and click **OK** the Header Editor will be launched.

When you select **Data file making** and click **OK**, the process of importing data will be launched, depending on the settings you selected in this section and in the Header editor.

In the **Data Loader** you can select a data stream from a file whose type can be specified in the **Type of the data stream** field.

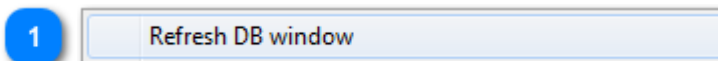
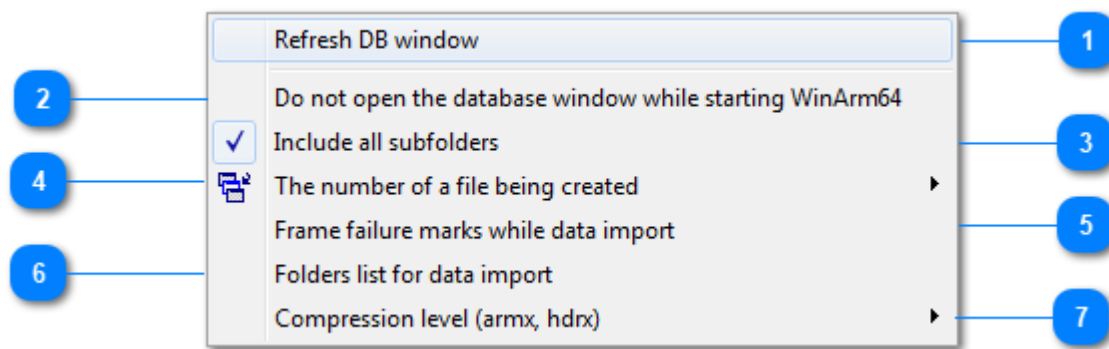
The field in the **Data Loader** section allows you to specify the type (extension) of the imported file. In some cases, this data is used to determine how the source data is converted.

By clicking on the name of the **Type of the data stream** section, you can set additional parameters for importing information - the size of the Block and the Information Header in bytes.

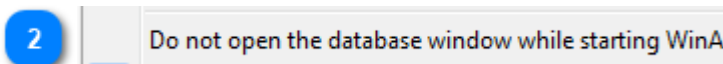
Advanced configuration of copy options is required for advanced users to import from a non-standard data file. Usually, the settings for data import parameters are already defined by the type of information flow or recorder, written in the Header editor and do not require intervention. Some of these fields can be filled automatically when you select a header.

For more information on importing information, see [Section 8](#).

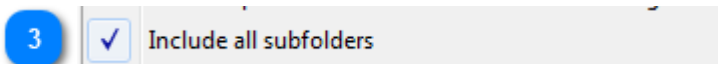
3.2.1. DataBase context menu settings



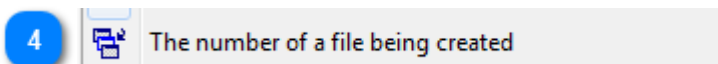
Force the update of the file list when the OS adds or changes information.



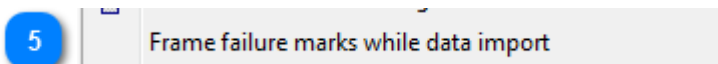
If you select this option, the database window will not be displayed when you start the program. It can be selected by the Database button of the main window of the program.



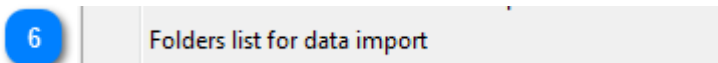
In the activated state, the WinArm64 files will be searched not only in the selected folder, but also in all subfolders.



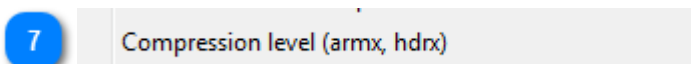
Determines how files will be numbered when created - by the first free number or next to the maximum.



Automatic failure marking when making a copy improves the quality of information displayed. Subsequently, the failure marks can be removed and set manually, but marks are automatically set only when copying and activating this option.

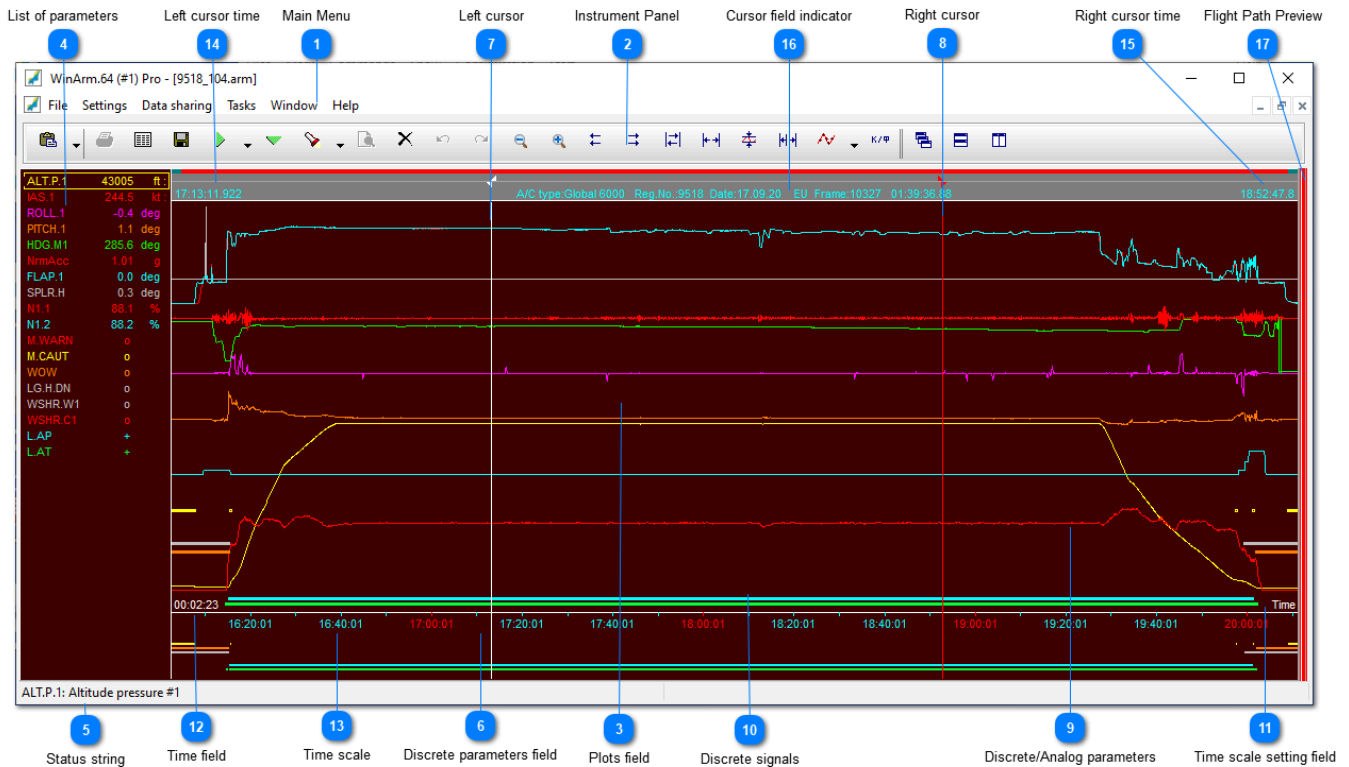


You can specify the list of folders from which the data import process will most often occur. Subsequently, when [data import](#), this list will be displayed in priority order.



This option determines whether the file compression level is high/low/uncompressed.

3.3. Flight Data Plot window



1 Main Menu

Contain elements to control the document current view. [Menu Elements](#).

2 Instrument Panel

Contain functions fast access buttons. [Instrument panel elements](#).

3 Plots field

Data graphical plots presentation area.

4 List of parameters

Lists the displayed parameters, their values, and the dimension. Right-clicking on this field displays the properties window of the selected parameter. For a sound stream, you can enable spectrum analysis in this window and set sound synchronization parameters.

5 Status string

Contain short name and name of selected/active parameter.

6 Discrete parameters field

Field to show discrete (on-off signals) parameters.

7 Left cursor

8 Right cursor

- 9 **Discrete/Analog parameters**
Flight parameters plots. Scaling and positioning can be changed by mouse, scrolling or keys Up, Dn, PgUp, PgDn.
- 10 **Discrete signals**
Discrete parameters/signals in the field of a plot. Change position by mouse and keys Up, Dn.
- 11 **Time scale setting field**
Allow to change time scale - Relative time or FDR recorded time. Right mouse button launch time scale settings dialog.
- 12 **Time field**
Shows left screen border time. Left or Right mouse button click will change the time scale density.
- 13 **Time scale**
Time scale contain time marks of Relative or FDR Recorded time.
- 14 **Left cursor time**
- 15 **Right cursor time**
- 16 **Cursor field indicator**
Indicator allow to see the position of the visible part of the data relative to the content of the whole file and to drag cursors.
- 17 **Flight Path Preview**
Red separation vertical line in the right side of the screen allow, by dragging it by mouse to the left, to show and extend the field with flight path using mapping and satellite imagery resources. (See [3.3.4](#) and [10.22](#)).

Detailed information on working with the Flight Data Plot window presented in [Section 10](#).

3.3.1. Flight Data Plot window Menu

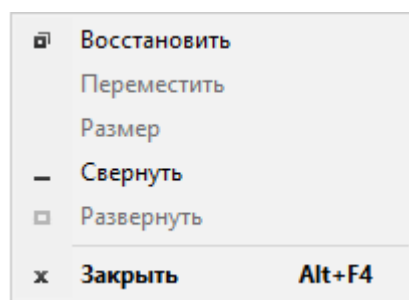


Contains commands to control the current document view:

- 1 **Document window**
Standard functions to work with Windows document.

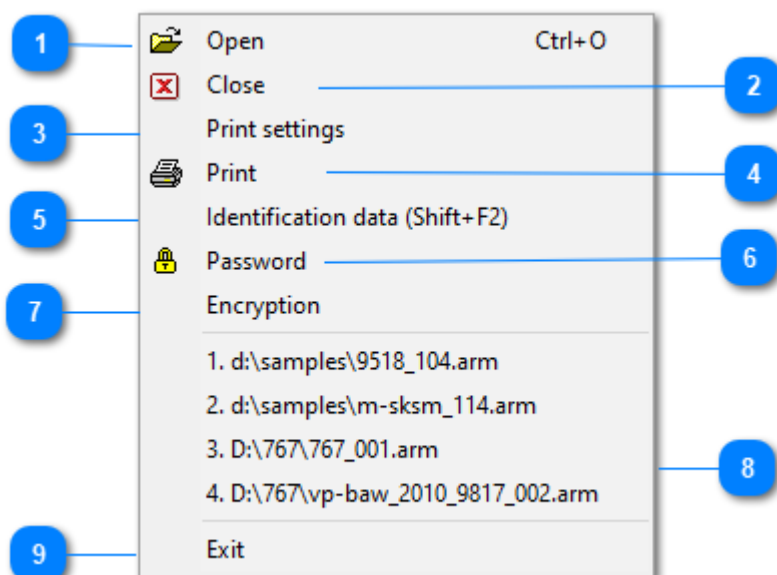
- 2 **File**
Working with files.
- 3 **Settings**
Setting-up the application and views.
- 4 **Data sharing**
Data sharing options.
- 5 **Tasks**
Tasks launch and settings.
- 6 **Window**
Application opened windows arrangement.
- 7 **Help**
Getting help.





3.3.1.1. Document window



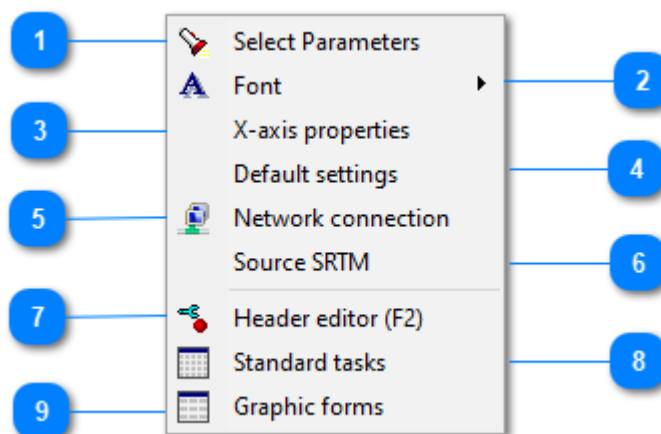
An element contains standard Windows controls for the application windows.



3.3.1.2. File



- 1  Open Launches standard dialog to open file.
- 2  Close Close current (active) file.
- 3 Print settings Opens Print settings dialog. [Section 10.11.](#)
- 4  Print Prints plot to the printer or file (available in "Plot for printing" mode only).
- 5 Identification data (Shift+F2) Shows Identification data recorded by the FDR [Section 10.12.](#)
- 6  Password Setting-up access levels for application functions [Section 6.](#)
- 7 Encryption Data encryption (available for arm, hdr files) [Section 10.19.](#)
- 8 4. D:\767\vp-baw_2010_9817_002.arm List of lately opened files.
- 9 Exit Exit from the application.

3.3.1.3. Settings



- 1  Select Parameters Select parameters from the list to show. [Section 10.1.](#)
- 2  Font Font settings for data presentation in different views.

3 X-axis properties

X-axis properties (time or distance). [Section 10.4.](#)

4 Default settings

Reset interface settings to default (will delete the winarm64.ini file).

5 Network connection

Network settings to connect with swa64 server, UDP and E-Mail connection properties. [Section 7.1.](#)

6 Source SRTM

[SRTM](#) data location setting.

7 Header editor (F2)

Launches dialog box [Header editor](#).

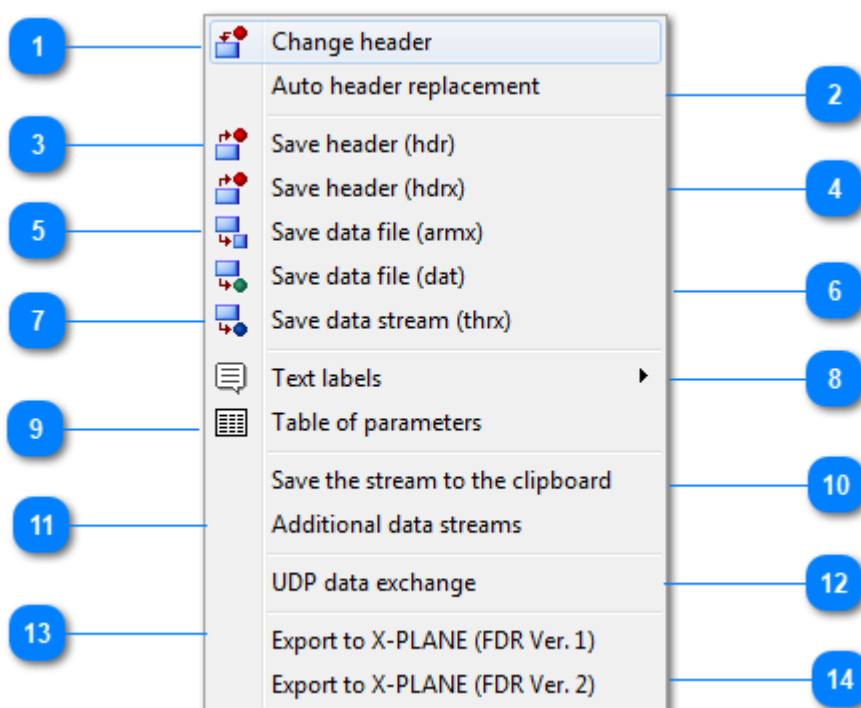
8 Standard tasks

Launches dialog box to work with Standard tasks list. [Section 10.1.1.](#)

9 Graphic forms

Launches dialog box to work with Graphic forms list. [Section 10.1.2.](#)

3.3.1.4. Data sharing



1 Change header

Changes Header in the flight data file arm to the selected from hdr file (for arm files only).

- 2

Auto header replacement

When activated the Header (cyclogram/dataframe) will be changed to the "reference" one from the HDR directory while Express-analysis run. [Section 12.3](#) (available for arm files only).
The checkbox is cleared after each Express-analysis run!
- 3

Save header (hdr)

Saves Header (cyclogram/dataframe) from arm file to the hdr file.
- 4

Save header (hdrx)

Saves Header (cyclogram/dataframe) from arm/armx file to the hdrx file.
- 5

Save data file (armx)

Saves flight data from arm/armx to the thrx data stream binary file.
- 6

Save data file (dat)

Saves flight data from arm/armx to the dat binary file.
- 7

Save data stream (thrx)

Saves flight data from arm/armx to the thrx data stream binary file.
- 8

Text labels

Import/Export of text marks to the txt file. [Section 10.7](#).
- 9

Table of parameters

Formating and output Table of parameters. [Section 10.9](#).
- 10

Save the stream to the clipboard

Save Data stream to the clipboard from the arm, armx file for further input to another arm, armx file. [Section 10.15](#).
- 11

Additional data streams

Additional data streams control. [Section 10.15](#).
- 12

UDP data exchange

When active, parameters marked in the Header (cyclogram) for UDP export will be transmitted via UDP protocol to another Windows applications while cursor movement. [Section 10.20](#).
- 13

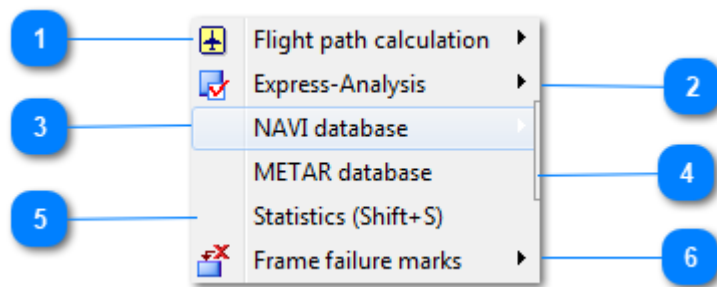
Export to X-PLANE (FDR Ver. 1)

Data export in format of FDR (ver.1) for aviation simulator X-Plane. [Section 11.13](#).
- 14

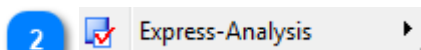
Export to X-PLANE (FDR Ver. 2)

Data export in format of FDR (ver.2) for aviation simulator X-Plane. [Section 11.13](#).

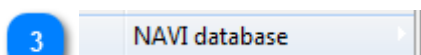
3.3.1.5. Tasks



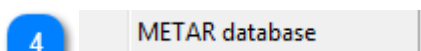
Flight path calculation. [Sub-menu dialog](#) provides variants of evaluation. [Section 11.](#)



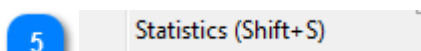
Express-Analysis Run and Settings. [Sub-menu](#) provides options. [Section 12.](#)



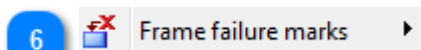
DAFIF Database settings and use [Section 10.17.](#)



METAR Database settings and use. [Section 10.18.](#)

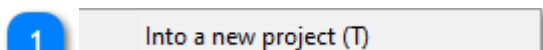
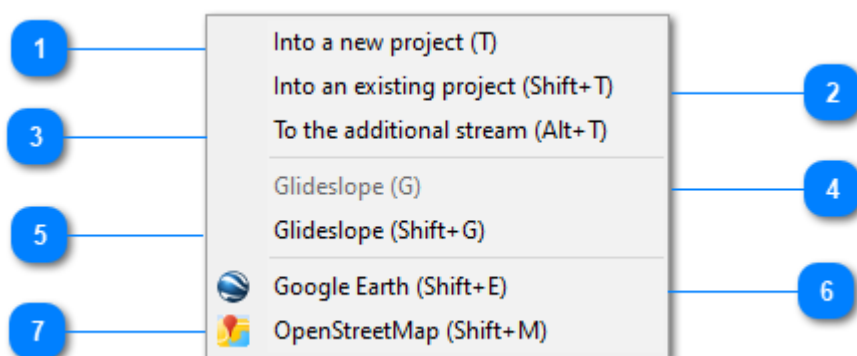


Statistical data on parameters shown on the plot. [Section 10.16.](#)

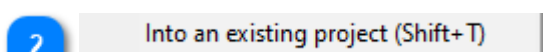


Working with frame failure marks

3.3.1.5.1. Flight path calculation Menu



Flight path calculation to the new project (TRA file).



Flight path calculation to the existing project (TRA file).

3 To the additional stream (Alt+T)

Flight path calculation to the additional stream data file (arm, armx) in form of Latitude and Longitude. Further references to parameters of data calculated will be automatically added to the header (cyclogram) in the Envelope "Flight path parameters" (probably overwhelming Lat Lon data recorded references!) and can be used further for showing flight path with the use of geoinformation data like Google, OpenStreetMap ([Section 11.14](#)).

4 Glideslope (G)

Glide path calculation (TRA file) with the use of text marks (MRM, touchdown). [Section 11.9](#).

5 Glideslope (Shift+G)

Calculate the approach flight path in vertical plane using ILS signals, ground speed and pressure altitude. Touchdown moment is defined by WOW signal. This function can be unavailable for some aircraft types.

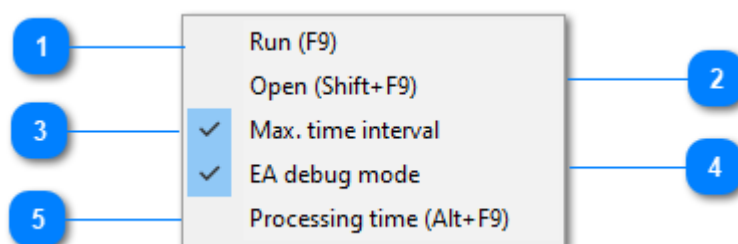
6 Google Earth (Shift+E)

Generates file to view the flight path in Google Earth. The function is available if coordinates are defined in Cyclogram in envelope "Flight path parameters". ([Section 10.21](#))

7 OpenStreetMap (Shift+M)

View the survey flight path in Flight Path Preview right part of the window. The function is available if coordinates are defined in Cyclogram in envelope "Flight path parameters". Geoinformation resources (currently Google© and OpenStreetMap©) will be used. ([Section 10.22](#))

3.3.1.5.2. Express-Analysis Menu



1 Run (F9)

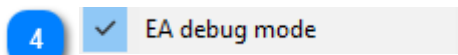
Flight data Express-Analysis Run. [Section 12.3](#).

2 Open (Shift+F9)

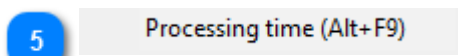
Flight data Express-Analysis results overview. [Section 12.3](#).

3 ☒ Max. time interval

When active the Flight data Express-Analysis will be executed using all the file data, otherwise - at selected interval only.

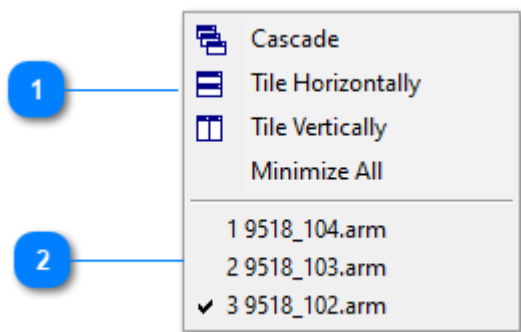


When active the service data on time spent for Flight data Express-Analysis events generation. This function is designed for developer of express-analysis algorithms for testing. Not recommended to use without need due to time-consuming. [Section 12.12](#).



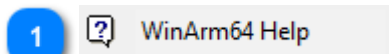
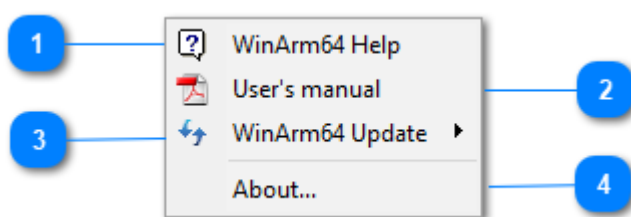
While testing allows to see time needed for execution for each event of express-analysis algorithms. This function is designed for developer of express-analysis algorithms for testing. [Section 12.12](#).

3.3.1.6. Window

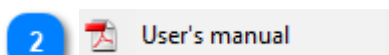


- 1 Standard menu for multidocument Windows interface.
- 2 List of opened windows. **WinArm64** allows to work with 4 windows opened. The same file can be opened numerously - be accurate.

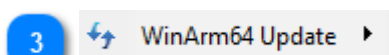
3.3.1.7. Help



Opens Help (CHM file).



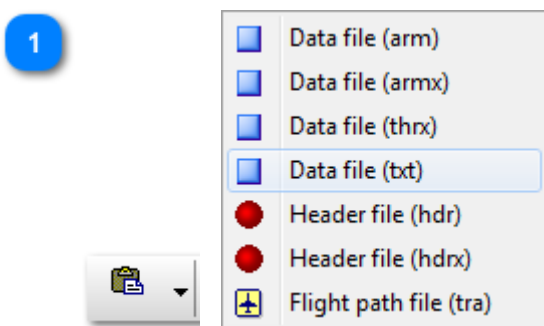
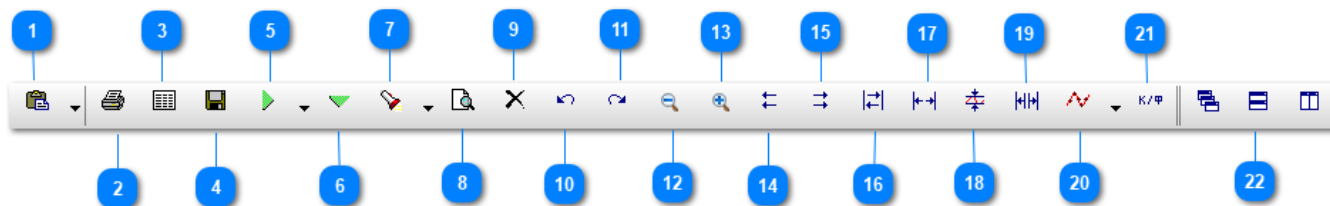
Opens User's Manual (PDF file).



Check for updates available and update settings.

4 About...
WinArm64 information.

3.3.2. Instrument panel



WinArm64 Database opening or standard Open File Dialog.

2 Plots printing. Available in "Plot for printing" mode.

3 Formatting and output Table of parameters. [Section 10.9](#).








4 Saving the selected part of the data to the new file.

5 Plots redraw (same for Enter key). The data will be shown for selected interval. In drop-down menu the mode of presentation can be changed: Plot for analysis or [Plot for Printing](#). If audio stream is the current parameter the button will control the playback (same for Space key).

6 DataFrame mapping. Available for manufacturers and investigators only.

7 Select parameters to show. Drop-down menu will allow to choose the style of the dialog.

8 Label Setting Mode in Plot for printing view with enlarged scaling. [Section 3.3.5.1](#).

- 9  Failure setting and removing mode. [Section 10.6](#).
- 10  Previous time interval.
- 11  Next time interval.
- 12  Increase time interval to show in the window without changing cursors positions.
- 13  Decrease time interval to show in the window without changing cursors positions.
- 14  Scrolling left.
- 15  Scrolling right.
- 16  Change active cursor.
- 17  Maximum time interval (all the file).
- 18  Scaling of parameters to fit to the screen - use when the parameter is not seen, "lost".
- 19  Puts cursors to the left and right screen borders.
- 20   Parameters show-up settings. Drop-down menu will allow to change the way data will be presented.
- 21  Setting parameters to be shown in Engineering units or in "Codes" - FDR binary decoded data.



Windows position settings.

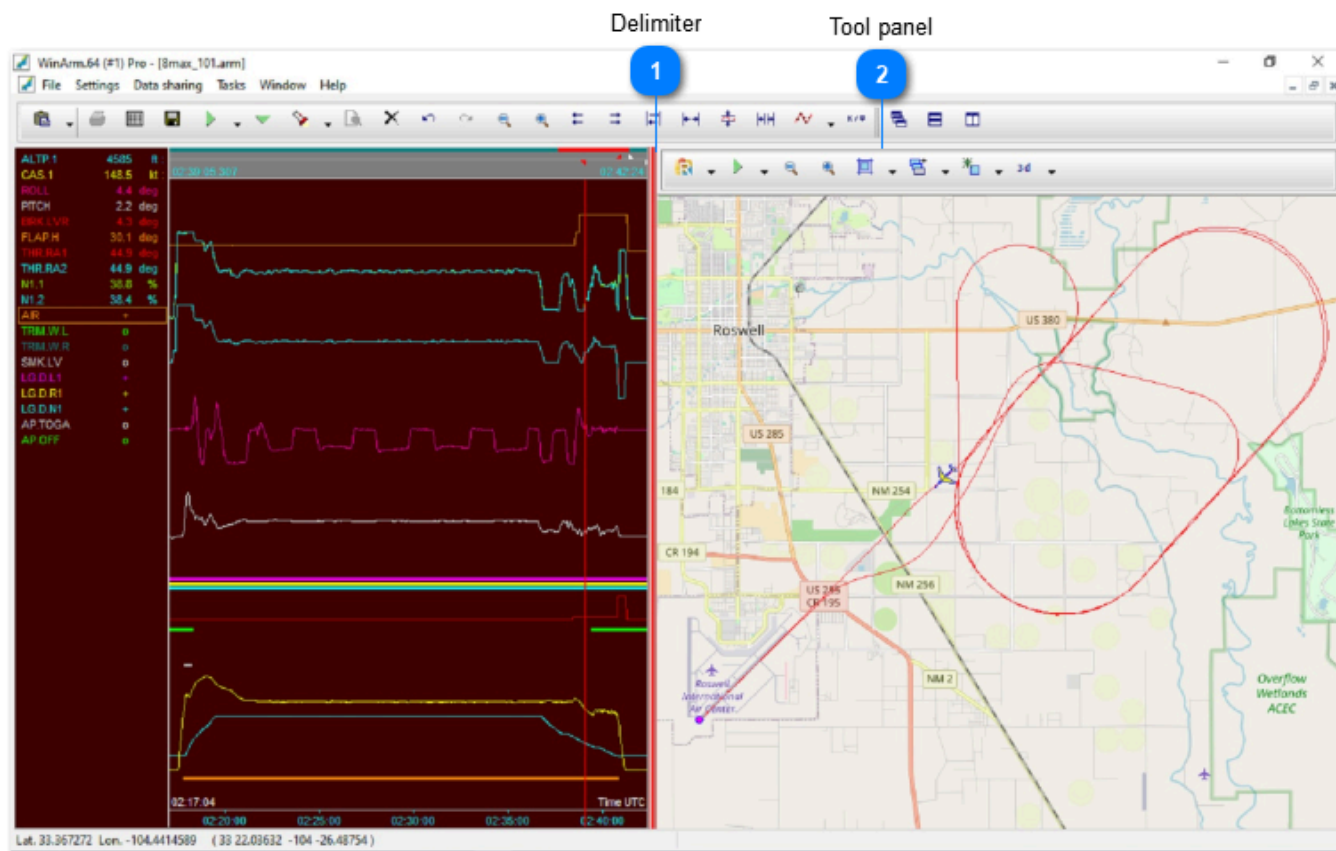
3.3.3. Hot Keys

The following keyboard shortcuts are available in flight information window mode.

Esc	Stops the current operation (plots drawing, express-analysis running (etc)).
Ctrl	With Ctrl key hold is available: parameters scaling, time scaling, selecting the area on the plot, and etc.
Shift	Displays the parameter values in the system cursor position.
F1	Help.
F2	Opens the Header editor window.
Shift+F2	Opens the Identification data window.
Ctrl+F2	Opens the Passport window.
F3	Opens the Scale changing by template window.
F4	Toggles the activeness between moving cursors.
F5	When in Printing mode the scale of the parameter will be moved to the beginning of parameter plot.
F7	Inverts the color of all the parameters displayed on the screen.
F8	Selects the color of active parameter.
F9	Runs Express-Analysis.
Shift+F9	Opens the express-analysis results.
F10	Sets up the relative time value even to the registered value at the active cursor position.
Ctrl+F10	Fills in Date and Flight passport fields automatically.
F11	Sorts flights using identification data.
F12	Cuts a portion of the data between the moving cursors.
Ctrl +F12	Transforms information sequence in the data file.
Tab	<ul style="list-style-type: none"> • Toggles the activeness between moving cursors. • Starts the listening from the beginning if pressed during sound audition.
Ctrl+Tab	Changes the active window (if several windows are open).
Insert	<ul style="list-style-type: none"> • Inserts a text label. • In failures insert/removing mode – inserts frame failure mark on all the frames between the moving cursors.
Delete	<ul style="list-style-type: none"> • Removes the active parameter from the screen (but not from the header). • In failures insert/removing mode –deletes frame failure mark from all the frames between the moving cursors.
PageUp, PageDn	<ul style="list-style-type: none"> • In the “Plot for analysis” mode – changes the scale of the active parameter. • In the “Plot for printing” mode – changes the scale of the active parameter or of the grid of the active parameter (depending on system’s cursor position). <p><i>These keys do not work while viewing raw values (codes) of the parameters.</i></p>

Up, Dn (arrows up and down)	<ul style="list-style-type: none"> • In the “Plot for analysis” mode – moves the graph of the active parameter on 1/15 from the height of the parameters window. If Ctrl is pressed toggles selection between the displayed parameters. • In the “Plot for printing” mode – moves the graph of the active parameter or its scale (depending on system’s cursor position). If Ctrl is pressed both the graph and the scale will be moved. <p><i>These keys do not work while viewing raw values (codes) of the parameters.</i></p>
Left, Right (arrows left and right)	<ul style="list-style-type: none"> • Moves the active cursor one frame. • If Ctrl is pressed – moves the active cursor along the samples of the active parameter. • If Alt is pressed – shifts the view interval
Enter	<ul style="list-style-type: none"> • Displays the data on the screen changing the viewing interval (the interval selected by the moving cursors will be displayed on the whole screen). • If the Shift key is pressed – toggles between the “Plot for analysis” and “Plot for printing” modes. • If the Ctrl key is pressed – displays the information without failure marks installed.
Space	<ul style="list-style-type: none"> • Displays the data on the screen without changing the viewing interval and moving cursors positions. • If the Shift key is pressed - toggles between the “Plot for analysis” and “Plot for printing” modes. • If the Ctrl key is pressed - displays the information without failure marks installed and without changing the viewing interval. • If a parameter of the sound stream type is active – starts the listening from the active cursor position. If listening is already in progress – moves the beginning of the listening interval to the current position or (if text labels bound to the sound stream exist) to the next label.
Space+Tab	Toggles between the “Plot for analysis” and “Plot for printing” modes.
G	Performs quick glideslope calculation.
I+Ctrl	Displays the Integration window.
M+Ctrl	Installs the markers passing and touchdown marks.
O	Prints the data (in hex format) between the moving cursors into text file hex.txt. Printing is done through WordPad.
P	Prints the data (in dec format) between the moving cursors into text file dec.txt. Printing is done through WordPad.
Q	Displays the graphs without interpolation (displays levels of the parameters).
R+Shift	Displays the Runway window.
S+Shift	Displays statistical data of the parameters.
T	Calculates the flight path with saving into a new project.
T+Shift	Calculates the flight path with saving into the existing project.
W	Applies the changes to the parameter of the sound stream type.
A	Shows the distance between cursors in the indicator field.

3.3.4. Flight path overview



1 Delimiter

Left button mouse can seize and move delimiter, expand and take away zone display cartographic information.

2 Tool panel

[Tool panel](#) for display geoinformation data.

To display the flight path together with the geoinformation data provided by providers (**OpenStreetMap**®) it is necessary to have Latitude and Longitude values, at this identifies these parameters must be defined in relevant fields on tab **Flight path parameters** window in **Header editor** ([Section 3.4.6](#)). Data options may be Not only registered, but also evaluated and imported as additional data stream ([Section 11.6](#)). In this case at the right parts screen red dividing band (delimiter) will appear, pulling behind which left button mice, can push apart region display cartographic and geoinformation information.

On right on geoinformation part window the aircraft flight path will be displayed, pertaining to the time interval between moving cursors in the left graphic part of the window. Moving active mobile cursor in the graphics will be accompanied moving labels at the flight path.

Tool panel will appear in the upper part of the window, providing opportunity of settings display information.

Important! The format and manner in which the information is displayed also depends on the applicable policy of geoinformation information provider companies. Rules providing information may be changed by decision of these companies. The content and accuracy of the information provided is also are subject of the politic of these companies.

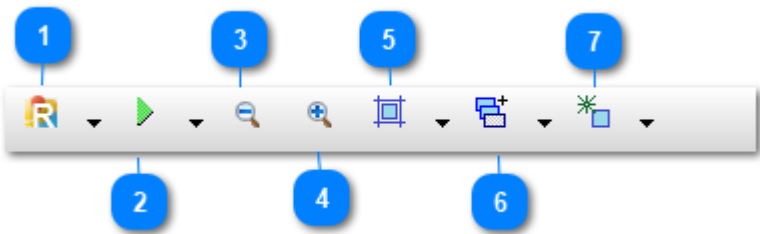
Moving around the map with the mouse cursor, you can see the coordinates of points that are displayed in the left lower corner of **WinArm64** window. For measurements distances between two any dots on map hold down the left mouse button while holding down the **Shift** key (to measure in maritime miles) or **ctrl** (for measuring in kilometers).


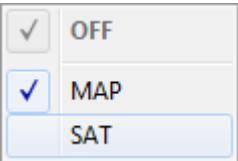
For display aircraft symbol on map instead of simple labels you can copy any file ***.aip** to a file called **config.aip** in the **winarm64\aip** directory, or copy the file with the aircraft type designation (as specified in the Header Editor

in the Add. files field of the Passport, common data tab) to the directory **winarm64\work** (For example **rrj.aip** or **b737.aip**).

*Important! To use this feature, a high-speed Internet connection is required. Nevertheless, if You already worked with given geographical area previously, then map or satellite data is likely to be "cached" -stored in directories **winarm64\maps** , what will allow to browse information in selected area and with chosen resolution without connecting to the Internet. Cache management (which takes up disk space) can be carried out through panel settings.*


3.3.4.1. Flight path overview tool panel

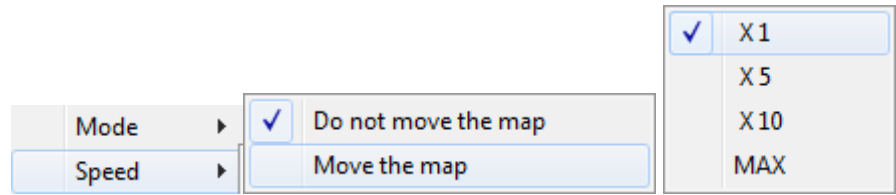


1   The drop-down menu provides the ability to select the type of geoinformation data, displayed on map:

- MAP - schematic map **OpenStreetMap** ;
- SAT - satellite snapshot.


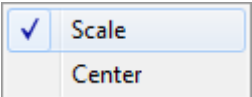
The flag OFF (offline) of the drop-down menu blocks requests for updating geoinformation data. Format, accuracy and way the information is displayed depends on the current policy of companies- providers of geoinformation data.

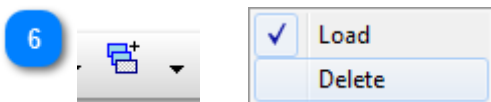
2  Start/stop of the flight demonstrator combined with moving of cursor in the left part of the window and playback of the audio stream if present in the data file. The drop down menu provides opportunity to choose the playback options (map moving and playback speed).



3  Scale down.

4  Scale up.

5   Button and drop-down menu allow fulfill focus on the selected by cursors part of the flight path. Scale - allows automatically pick up scale (zoom) to display the whole part of the selected flight path area. Center - allows to position the aircraft mark (that is, the flight path point, relevant position at active cursor in the left window part) to the center of the screen.



Button and drop-down menu of cartographic information caching management allows to load additional more detailed layers to quickly display data, as well as to clean up cache with maps. The menu item **Load** is automatically selected each time the program is loaded. All maps loaded during operation are saved on the computer in the **winarm64\maps** directory. This allows to accelerate the information view at repeated work with this geographic region without addressing to servers (OpenStreetMap). On the other hand, this data will take up additional space on the user's disk - delete the cache periodically to free up disk space. To clear the cache file, select the **Delete menu item**. After that, files of all levels of detalization will be deleted (except current level, displayed on screen), related to areas displayed. You also may clear folder maps by means of operating system.



Button «**ATS routes**» allows to display information on air routs bases on DAFIF data jointly with cartographic information. For this data the file **ats.dat** must be placed to the **winarm64\maps** directory. Information on air routes is given for reference only (!) and are not official. The data is updated by the user. Working with DAFIF data can be read in Sections [10.17](#) and [11.11](#).

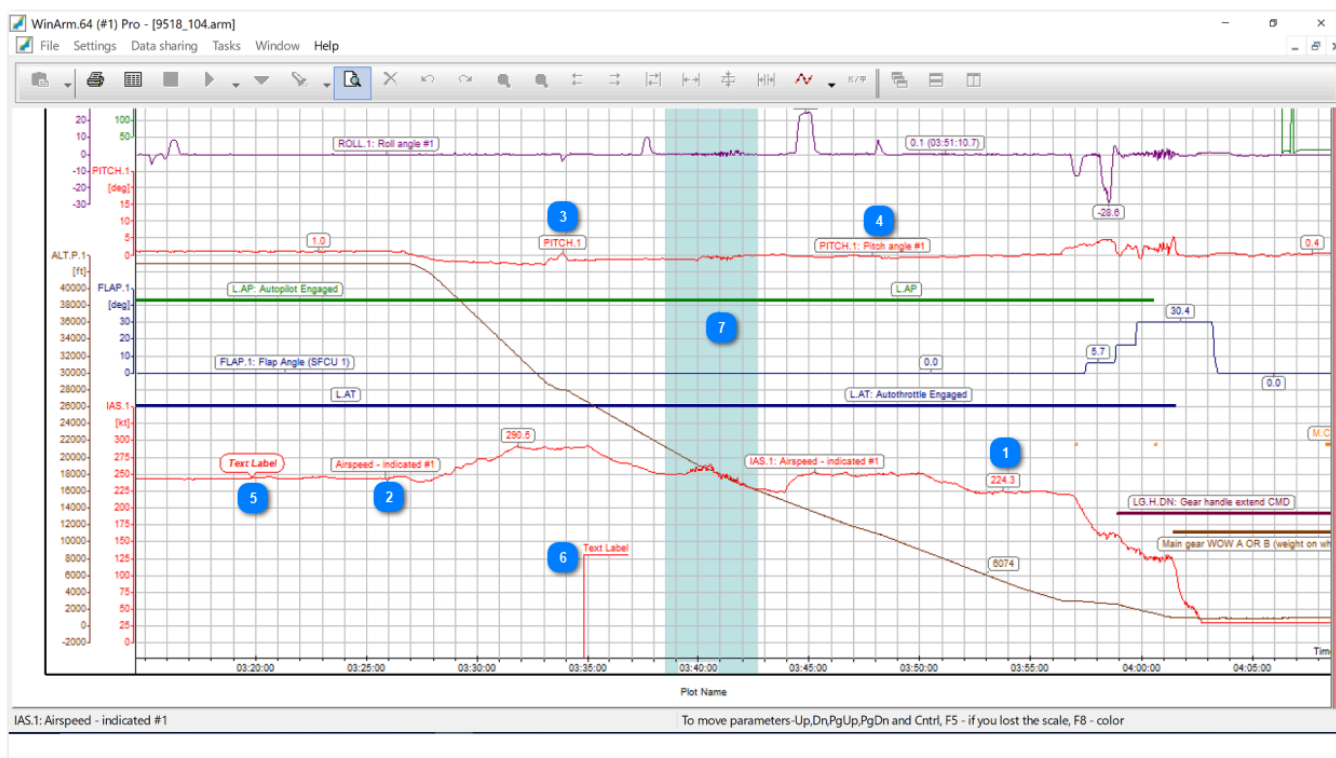
3.3.5. Plot for printing



1 Contains document view settings. [Menu Elements](#).

- 2 Displays scales of selected parameters, their values and units. They can be moved and scaled by keys Up, Dwn, PgUp, PgDwn. Changes depend on position of mouse cursor - top or bottom parts of scales.
- 3 Flight parameters graphs. Scale and location can be changed by mouse or keys Up, Dwn, PgUp, PgDwn. Pressing key Ctrl will change graphs simultaneously with scales. Level of discrete signals in the graphic field can be changed by keys Up, Dwn.
- 4 Allows to change time scale - Relative time or FDR time. Right mouse button activates dialogue settings with time scale properties.
- 5 Shows left border start time. Left or right mouse button will increase or decrease time scale density.
- 6 Time scale consist of time marks in Relative or FDR time.
- 7 Cursor indicator allow to see the position of the visible part of the data in relation to the full file data and to move cursors.
- 8 Plot name can be added or changed after drawing the plot in Graphic forms. [Section 10.1.2](#)
- 9 Label setting mode in Plot for printing view to work with labels within enlarged image scale. [Section 3.3.5.1.](#)

3.3.5.1. Label setting mode



- 1 Parameter value can be indicated by right mouse button click (**RMB**) after focusing on the desired parameter graph.
- 2 Parameter Name can be indicated by **Shift+RMB** after focusing on the desired parameter graph.
- 3 Parameter Short Name can be indicated by **Ctrl+RMB** after focusing on the desired parameter graph.
- 4 Parameter Short Name and Name can be indicated by **Ctrl+Shift+RMB** after focusing on the desired parameter graph.
- 5 Text label can be set by **Alt+RMB** after focusing on the desired parameter graph. The text and its formatting can be set in the popup menu. These text labels are used also to indicate meanings of discrete signals of type **Analog #2. Digital code. On/Off signals word** (Section [9.2.2.2](#)). The software will automatically fill the text label with names of discrete signals active at this moment.
- 6 Text labels could be set in normal mode by pressing **Ins** key. Text labels work is described in Section [10.7](#).
- 7 If cursors are located inside the plot (not at the borders) the area between cursors will be highlighted by the color defined in the pop-up menu **Color scheme/ Selected area (RMB)**. Selected area highlighting results could be seen in **Label setting mode** only.

Labels moving can be done by keys **Left/Right** и **Up/Dwn** after focusing on them (cursor will take the form of hand). Labels deleting can be done by repeated click of **RMB** (without keys) after focusing on them. You can indicate digital values of all parameters shown at the position of the mouse cursor by pressing **Ins** key. Values will be set definitely at moments of parameters recordings (as defined in Data Frame) located around cursor position. User can delete all the labels located between movable cursors by pressing **Del** key in **Label setting mode**. More details on plots printing preparation are described in Section [10.11](#).

3.4. Header Editor window

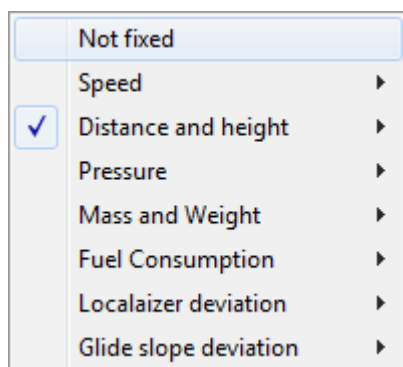
When you start the Header Editor, a dialog box will be opened that allows you to set parameters and settings required for data importing, decoding, interpreting and displaying. When working with the editor, the header part of the **arm**, **armx** files or **hdr**, **hdrx** files will be changed. The flight data will not be changed. When making changes to the Data Frame of some file, these changes are not transferred to other files. For this you need to use [data exchange](#) mechanism. Changes to the file are made after pressing the OK button. When you press a key Esc user will given clarifying question in avoidance losses contributed changes.

Data Frame options are grouped in 7 tabs.

3.4.1. Header editor. Parameters

- 1 Parameter short name (not more than 16 symbols).
- 2 Identification number (ID) - a unique number of the parameter (for the given header/dataframe). Duplication is not allowed.
- 3 Parameter type. Information about Analog parameters types contained in [Section 9.2](#). Information on Discrete signals type contained in [Section 9.3](#). Information on Sound flow type contained in [Section 9.4](#).
- 4 Quantity of digits after comma in parameter values, which will be displayed on charts and in tables. It is recommended to correlate the number of significant digits of the parameter output with precision of recorder registration.
- 5 Parameter name (not more than 98 symbols).

- 6 Physical unit of the parameter. Can be set manually, and by choice from predefined options, available on mouse right buttons click.

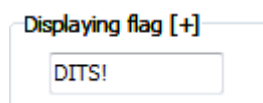


Selecting predetermined unit will give an opportunity of quick recalculation at display on chart (for example meters can be promptly displayed in feet, and etc.).

- 7 Parameter settings. [Section 9.2](#), [Section 9.3](#), [Section 9.4](#).

- 8 Parameter color for Plot for analysis (left) and Plot for printing (right).

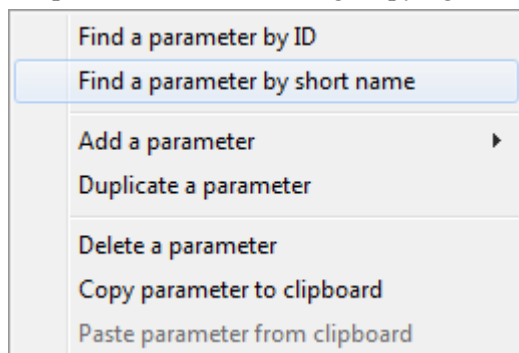
- 9 Displaying flag. Parameter will not be shown if add to the given field a Discrete signal, Token or Event by double click, if present. At availability of active links the sign can be inverted by pressing left key mouse on field with the name sign. After pressing name will change:



- 10 Selecting the property "Do not display" allows you not to display this parameter in the list of parameters for display on chart (for example, for evaluated or service parameters). Chosing "Export - UDP" allows to add parameter in the list for output data via UDP for access of third party applications.

- 11 Button switching language interface of dataframe. Pressing on button changes language of parameter names and units. Letter on the button stands for current language.

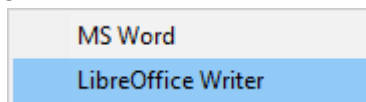
- 12 List of parameters. Allows you to select a parameter to view and edit. Right click mouse button calls up a menu for parameter search, adding, copying to clipboard, duplication, removal.



- 13 Save changes button.

14 Exit from the header editor without saving.

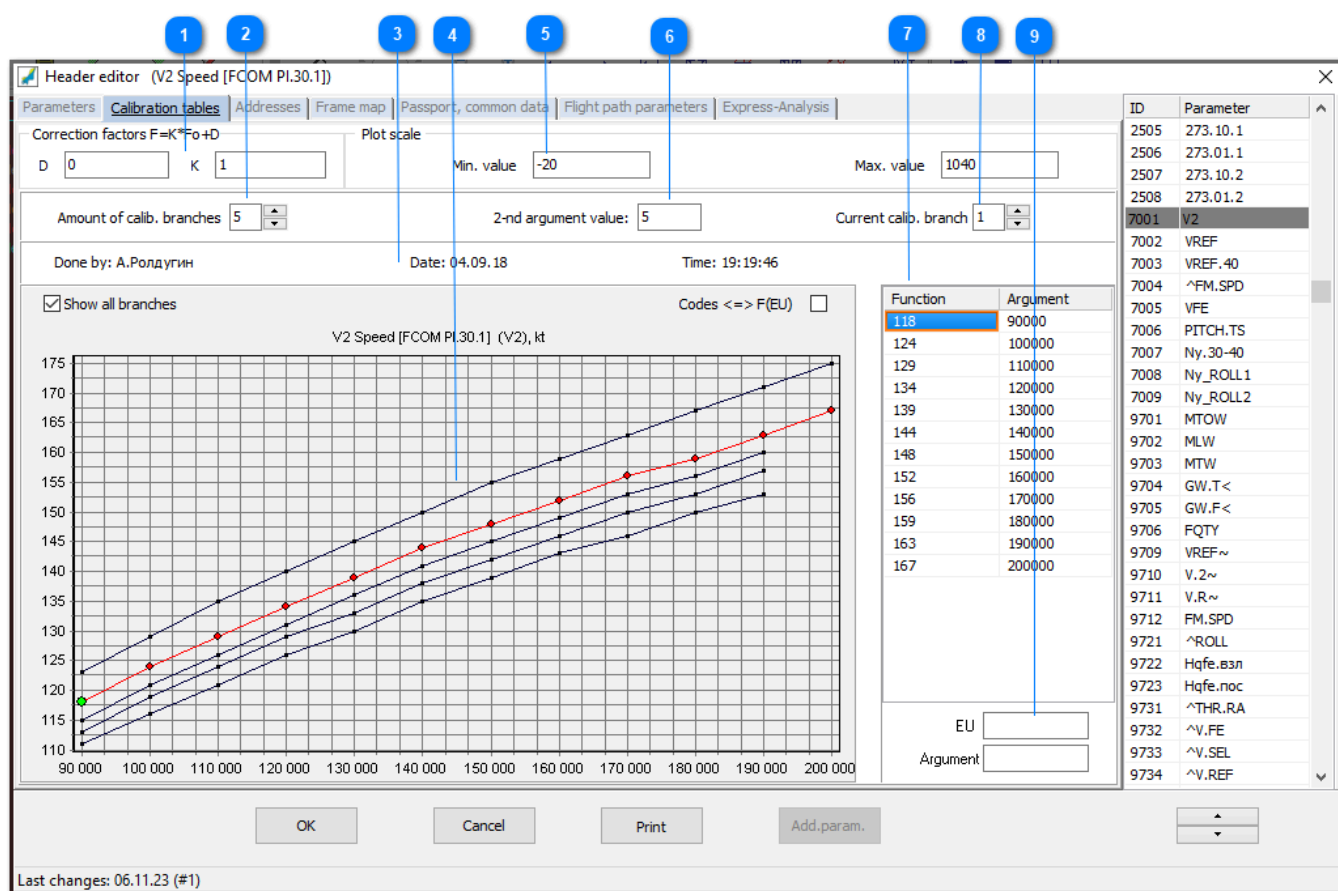
15 Printing the dataframe to the file will call the menu to choose the text editor type:



16 General list of parameters for selection and adding new parameters to the dataframe.

17 Buttons for displacement of parameters up and down through the list for grouping, search and choice.

3.4.2. Header editor. Calibrations

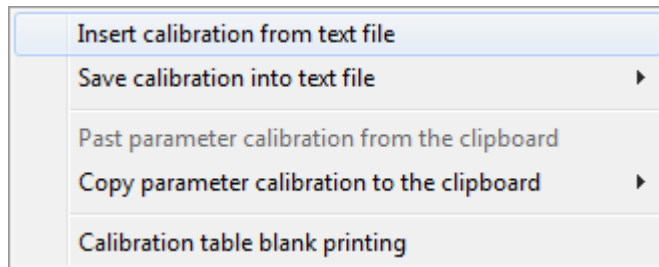


1 Additional linear transformation coefficients (final decoding step parameter). By default coefficient **K** equals 1, **D** - 0, it means that changes of parameter values will not happen.

2 Calibration branches number field.

3 Calibration last changes information.

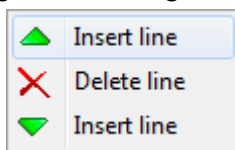
- 4 Displays graph of dependencies physical values from code. Checkbox `Codes <=> F(EU)` ☐ allows to swap the graph scales. Clicking the right mouse button on the graph field calls up a menu for importing and saving all calibration characteristics. Form printout of the current calibration characteristic is only possible if you select the printer context in the print settings.



- 5 Graphic scale values define region display parameter on chart. Data options change automatically at work with graphs (with mouse or keys Up, Dn, PgUp, PgDn.).

- 6 Field for input value of the second argument of current calibration branch.

- 7 Table for viewing and editing calibration characteristics. Click right buttons mouse for calibration nodes adding and removing.



- 8 Calibration branch selection to view and edit.

- 9 Input data in relevant lines will allow calculate code or physical meaning of parameter at current calibration characteristic.

View of the calibration window depends on parameter type. More detailed information on work with calibration characteristics of analog parameters is given in [Section 9.2.1](#).

3.4.3. Header editor. Addresses

Header editor (BODY ROLL RATE)

Parameters | Calibration tables | **Addresses** | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Address properties

Inform. word, bits from word beginning	Offset, bits from word beginning	Failure mark, bits from word beginning
79	0	12
207	0	12
335	0	12
463	0	12
591	0	12
719	0	12
847	0	12
975	0	12

Subframe # (0-for all the subframes)

0

☒ In Frame ☐ In Superframe

Address type

☐ Offset (bits)

☐ 1-bytes word

☒ 2-bytes word

☐ 4-bytes word

Sample time

☐ Equal in frame

☒ On position in frame

OK Cancel Print Add.param.

Last changes: 06.11.23 (#1)

ID	Parameter
331	ROLL
332	ROLL.1
333	ROLL.2
334	ROLL.L
335	ROLL.R
341	PITCH
342	PITCH.1
343	PITCH.2
344	PITCH.L
345	PITCH.R
351	HDG
354	SHDG
355	SCRS.1
356	SCRS.2
361	WX
362	WZ
363	WY
451	VertAcc
452	LongAcc
453	LatAcc
501	CCP.L
502	CCP.R
503	CCF.F
504	CCF.L
505	ELEV.L
506	ELEV.R
507	ELEV1.L
508	ELEV1.R
509	ELEV2.L
510	ELEV2.R

1 Table of parameter addresses. First column introduces addresses (word number) of recorded parameter in the frame, second - shift of addresses in bits from start word (if it is), third - bias label (bit) failure from start word (beginning with 0). Adding of measurements produces by key **ins** , removal **-Del** . Failure label can be not entered (deleted) and it will not be taken into account at processing.

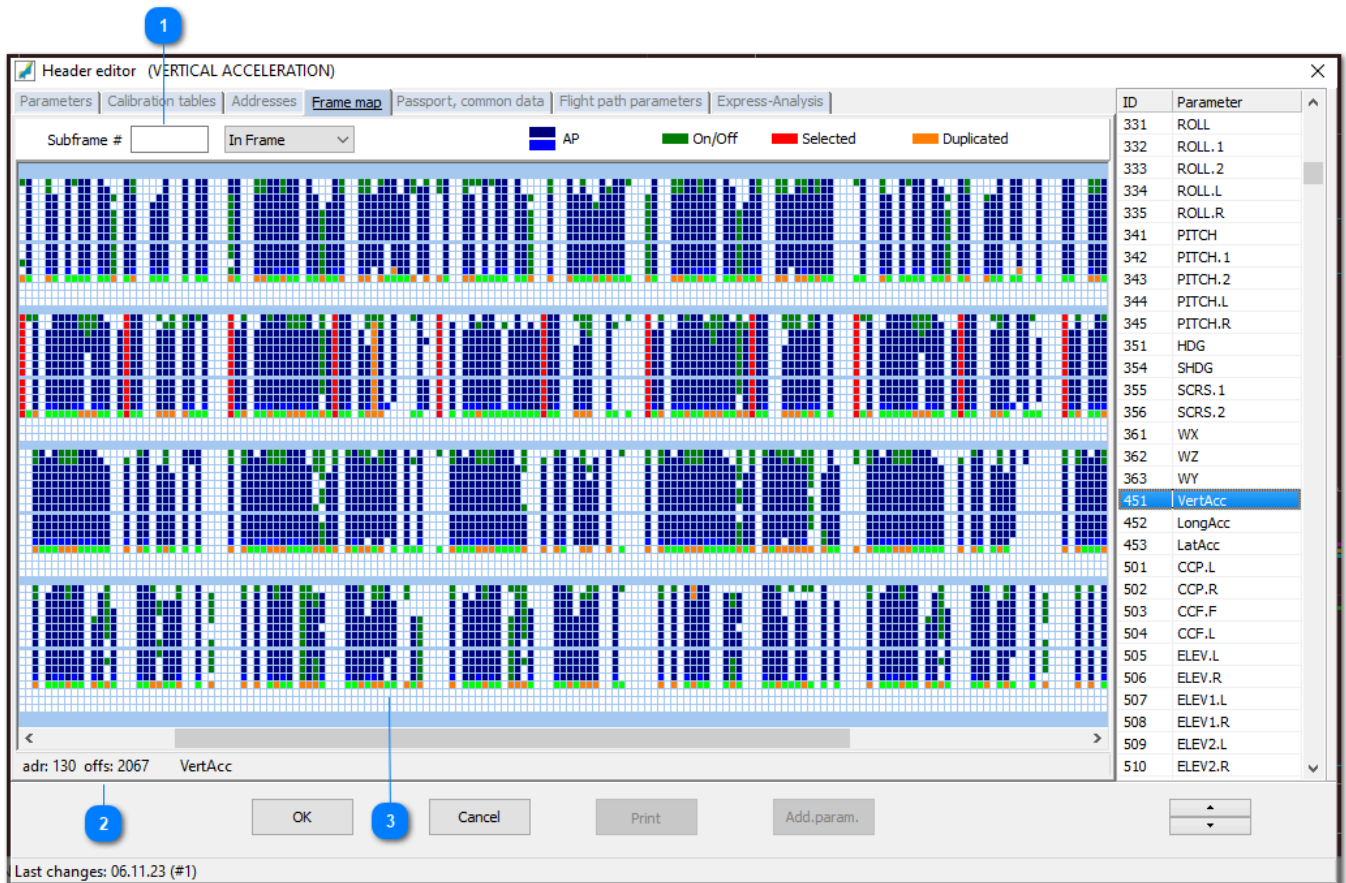
2 Number of subframe. Allows to set subframe in accordance to specification ARINC 753/717, if parameter is recorded not in all the subframes (for example 1, or 1,3) and number of frame in superframe beginning with zero (for example 3/8 - 3rd subframe in 8th frame of superframe).

3 Type of addresses. Informational words can be set in accordance with format informational flow of the recorder. Usually it's 16 bit words.

4 Measurements positions. Position of switch defines in which moments inside the frame measurements are fixed for subsequent piece-wise linear interpolation of parameters according to time. If **On position in frame** checkbox is checked, the program will determine the "readings" time parameter in dependencies from his positions in frame. At noted switch **Equal in frame**, moments of "readings" of all single-read (once per frame) parameters will be 0, two-read (twice per frame) will be 0 and 0.5 and etc.

3.4.4. Header editor. Frame map

This tab allows you to view the Data Frame - location of the parameter or its parts in a frame, subframe, superframe. By moving the mouse cursor in the status bar, you can see the parameter designation and its address. The frame map allows you to visually identify some errors when creating a dataframe, controlling duplication use addresses, violations of structure and etc.



1 In the field Subframe # the value can be inputted in accordance to specification for viewing information, related only to given subframe. By default information output as it is presented - **In frame** . Can ask distribution parameters with addressing **In superframe**. Parameters will be displayed on map in accordance with specified color scheme.

2 In status line the address, bias positions bit relatively to start of the frame and parameters names at cursor positions are displayed.

adr: 654 offs: 10453 LongAcc

3 Frame map. Choose parameter by click any mouse key in completed region of dataframe or from the parameter list on the right.

3.4.5. Header Editor, Passport, Common data

The Passport, Common data tab allows you to enter passport data related to the given flight, if Header editor was called from file flight, or to change the content and the flight “passport” fields as well.

By default program defines seven fields passports flight (before fields Header inclusively). You can return to the default view at any moment after pressing right keys mice on field passports and choice item pop-up menu Standard passport. Choice of others menu points allows to set passports for various aircraft types, fields of which will be used at formation of results of express analysis ([Section 12](#)).

Restrictions! The length of each field of the **arm file passport** cannot exceed 255 characters, and the total number of lines cannot exceed 100. The total number of characters of all fields of the passport (including titles fields) limited value of 2900. There are re no such a restrictions for **armx** file.

Creating and deleting passport fields is carried out after clicking on the right mouse button. Fields values of passports may be textual and digital. Field **date** is given in accordance with format dd.mm.yy. Passport fields can be set choosing values from list (except first 2). List of values for additional fields is created and edited by double clicking on the value field and input text or digital values, dividing their by lines (key Enter). While parameters evaluations and algorithms of express analysis, the first digital value in this field will be taken into account.

More details on editing of passport - [Section 9.1.1.](#)

Passport fields	Passport fields values
A/C type	Ka-32A11BC
Reg.No.	10030
Note	
Date	06.07.22
Flight	1
Pilot	
Header	
External sling	1 - No
Repeated heavy cargo lifting	1 - No
SP-32	1 - No

1 Data format: RPI

2 Seconds per block: 0.25

3 Words per block: 256

4 Time: Day, Month, Year, Flight, Reg.No.

5 Default standard task: 2. FLT

6 ID Subframe (Frame): Subframe inside frame identifier, Frame inside superframe identifier, Subframe inside superframe identifier

7 "Frame failure" mark (bits): 4094

8 Add files. Param.list: work\ka32a11bc param

9 HDX =>

- 1 Data format. The field allows you to select which data format the imported files will belong to. List contains scroll of most common formats. At his choice row values for fields below, determining Data Frame Structure will be automatically formed. In extreme case, you can choose first meaning from list - **Arbitrary** and set all parameters manually.
- 2 Seconds per block. Field sets duration of the information frame.
- 3 Words per block. List allows to choose informativeness of the frame - the quantity of words in frame (multiply 64). For some formats data informative given in bytes.
- 4 Service parameters. These fields are intended to define the parameters that register service (flight) information about the flight (time, date, flight NO, tail or serial number). Data can be added by mouse double click from the list of the header parameters created in advance.
- 5 Default standard task. In given field you can set standard task, which will be loaded when the file is opened. If this function is not selected, then the list of parameters when opening file will remain former (relevant on moment of closing of file).
- 6 ID Subframes (Frame). If data structure suggests division informational stream into subframes, frames and superframes, then the corresponding counters must be entered in these fields for correct decoding of data. Fields are filled by mouse double click from the list of created parameters, determining relevant ID.
- 7 "Frame failure" mark (bits). Field sets meaning bias from start of frame to reserve this position for frame failure mark.

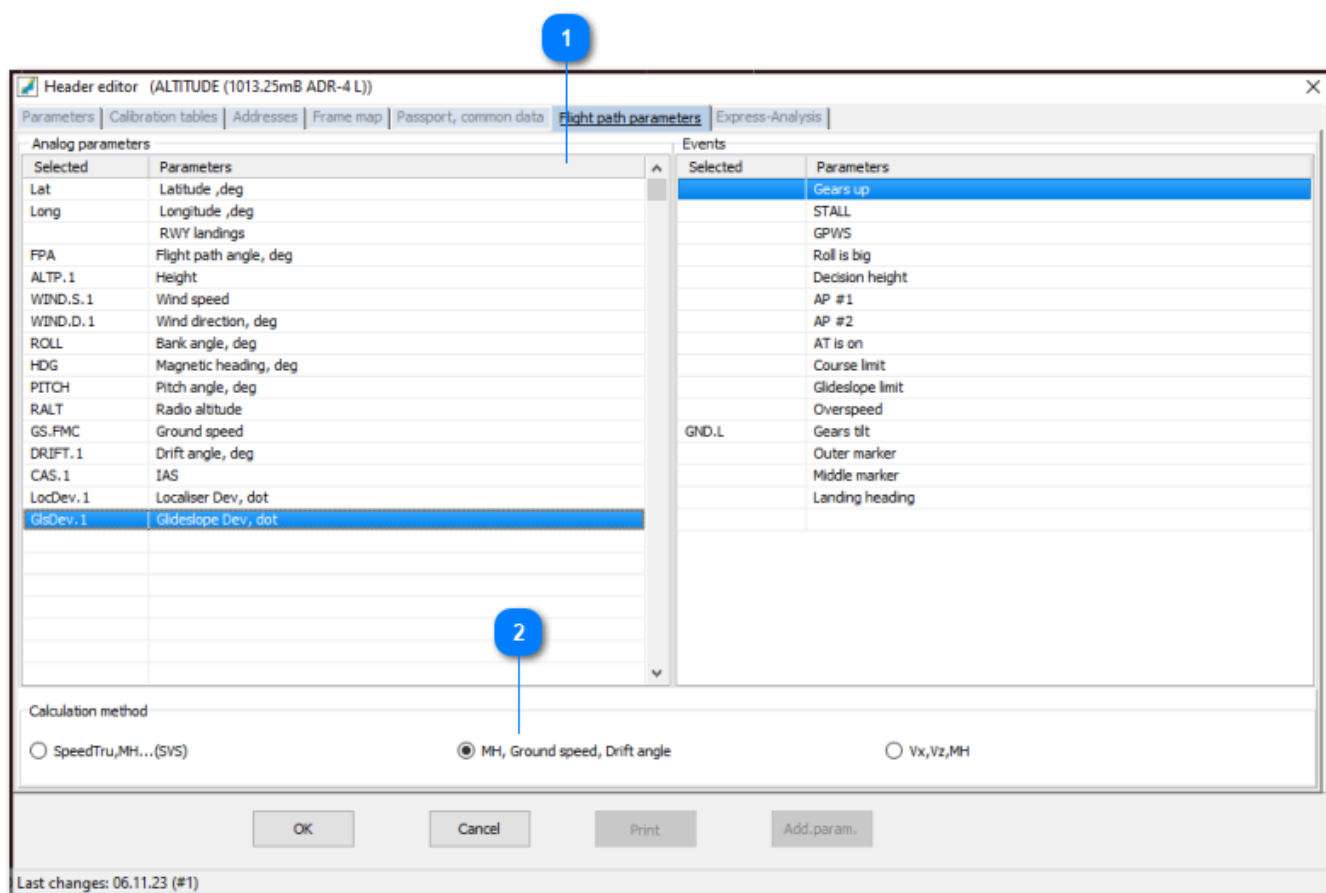
8 Add files. Param.list. General list of parameters. The field allows you to specify the names of additional files (standard tasks *.stn, *.stnx, templates *.xpln, etc.), and the combo box – to select a predefined list of parameters to work with the header (usually this general list - param).

9 Button for converting an edited header (from files **hdr** , **arm**) to **hdrx** . In Header editor for files **hdrx** (**armx**) the given button performs function of transformation of the header to the **XML** format (in the presence of user access).

XML =>

More detail on editing of Common data - [Section 9.1.1](#).

3.4.6. Header Editor. Flight path parameters

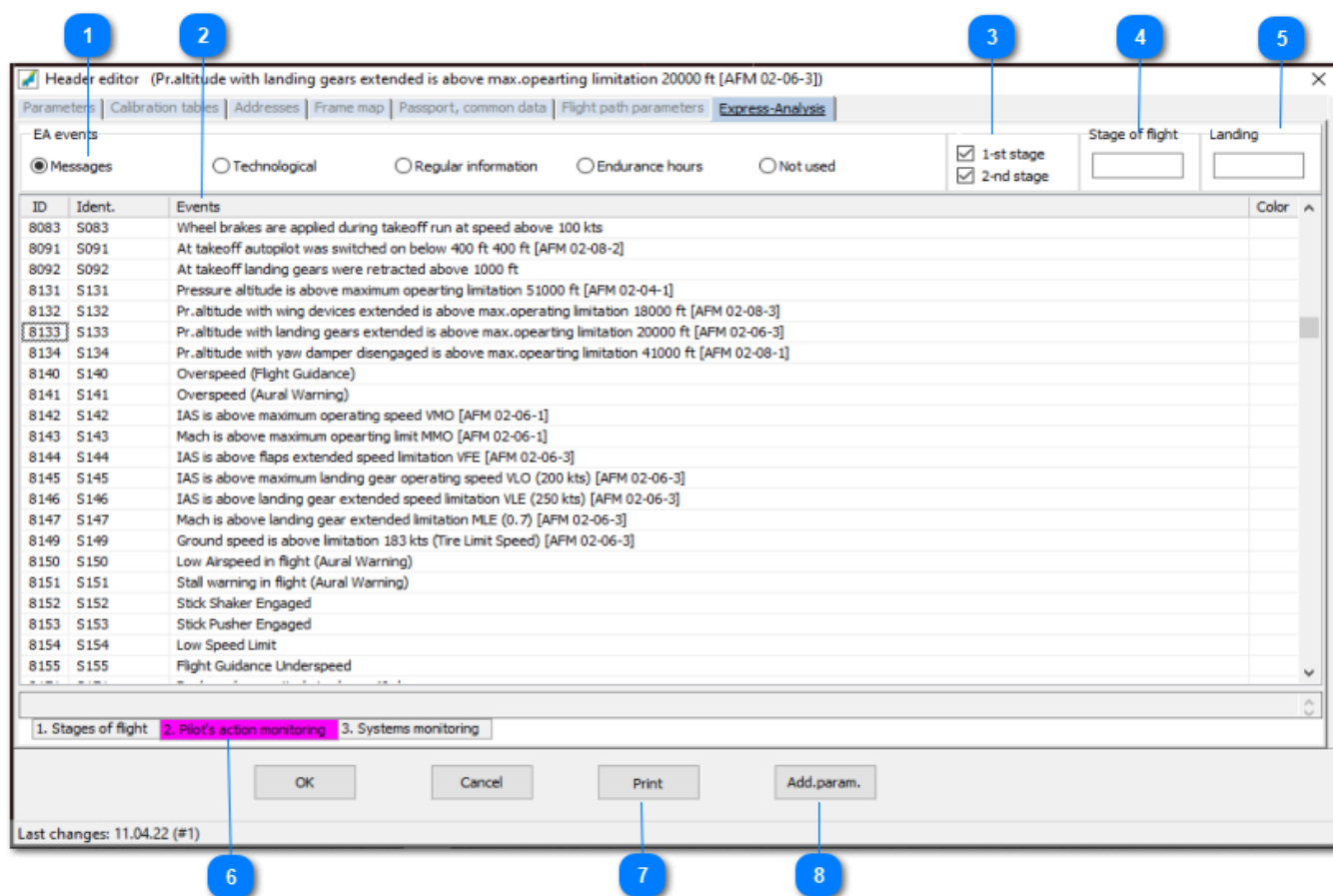


1 List of analog parameters and discrete signals required for calculation and display of flight path. Data can be added by mouse double click from the list of parameters.

2 Flight path calculation variants. Selected by user dependent on parameters available in DataFrame.

More detailed information on preparing the calculation of flight path can be found in [Section 11](#).

3.4.7. Headed Editor. Express-Analysis



1 Group of switches for sorting of express-analysis events by type (events, technological, regular information, operating time and unused).

2 List of events of express analysis, implemented in the header.

3 Switches for sorting of express analysis events by way of implementation of computing.

4 Field defines stages of flight. See. Section 12.7.

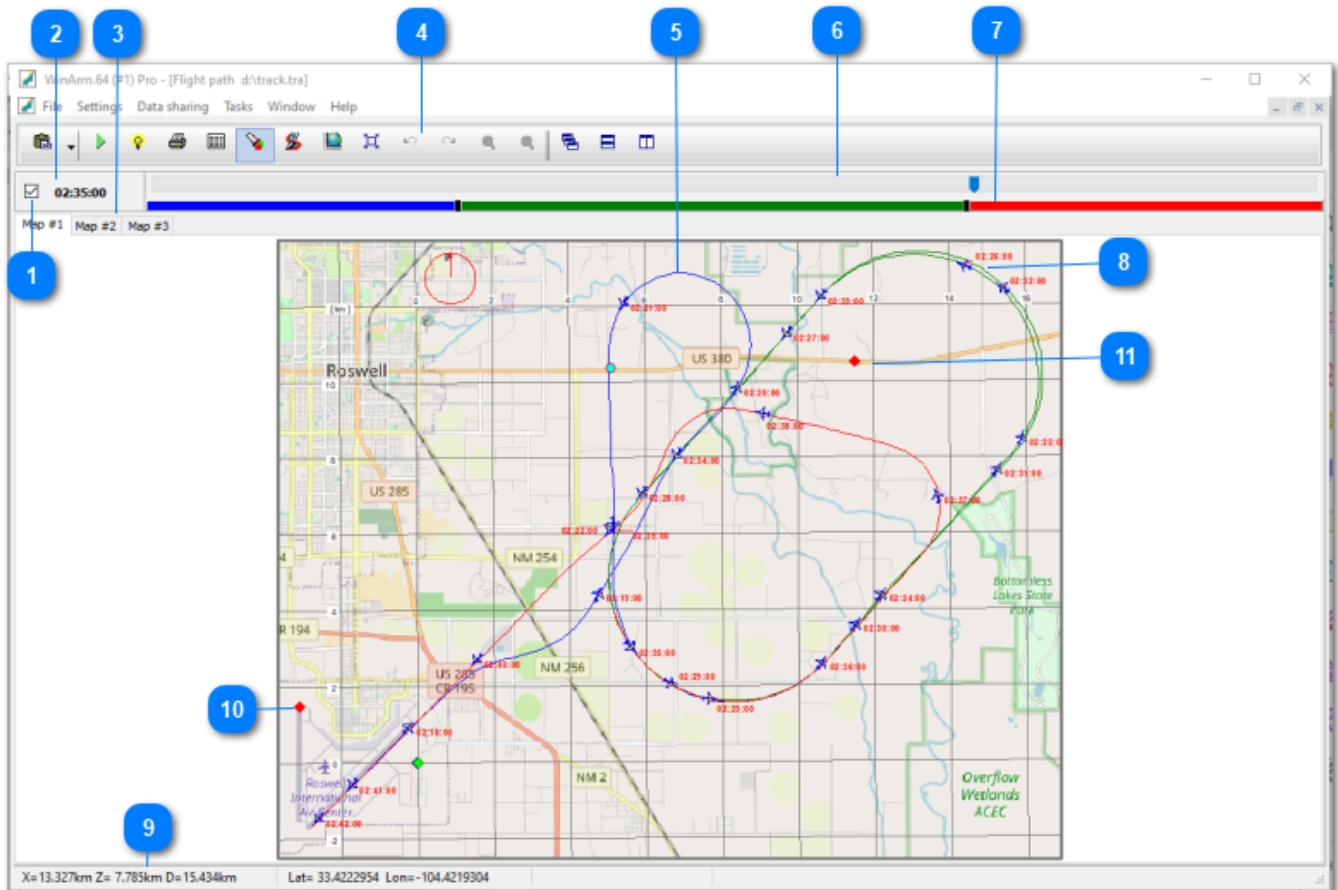
5 Field set up the sign of landings (not used in current software version).

6 Group of tabs for sorting of express analysis events. Formation of events groups can be done in Group Editor by right mouse buttons click. Moving of the event to the selected tab (group) can be carried out through drag and drop by left mouse button at pressed key Ctrl.

7 Button to output algorithms of express analysis to Microsoft Word.

8 Button Add.param. causes dialog window in which some options of express-analysis fulfillment and information display can be set. Changes are not recommended without sufficient training. See Section 12.3.

3.5. Flight Path window



- 1 Windows synchronization switch. Checkbox will allow to synchronize the display of data in Flight Path window and in the Flight Information window. You can place windows side by side using the buttons management panel windows tools.
- 2 Time panel. Displays current time at the position of movement marker indicator.
- 3 Maps tab allows to switch between different types of flight paths views and design.
- 4 [Management panel](#) allows to set up parameters of flight path calculation and display.
- 5 Flight path image, coordinate grids, cartographic and textual information. Information about the position of the mouse cursor will be displayed in the status bar. Stretching rectangle right down at pressed left mouse buttons can increase selected plot. by stretching the rectangle to the left and up you can return the original scale. Right mouse buttons click in the field of flight path display will cause contextual menu with some settings ([Section 11.3.5](#)).
- 6 Marker indicator allows to move along the flight path time scale. Moving also available by keys **Left/Right**.

7 Flight path fragments marker. Allows to set up different colors of flight path fragments (stages of flight). The size of the fragments is changed by dragging the borders of the color zones. Zones colors are set by right mouse button. For plain display all three zones are to be appoint with the same color. White color cleans up flight path image fragment from the graphic.

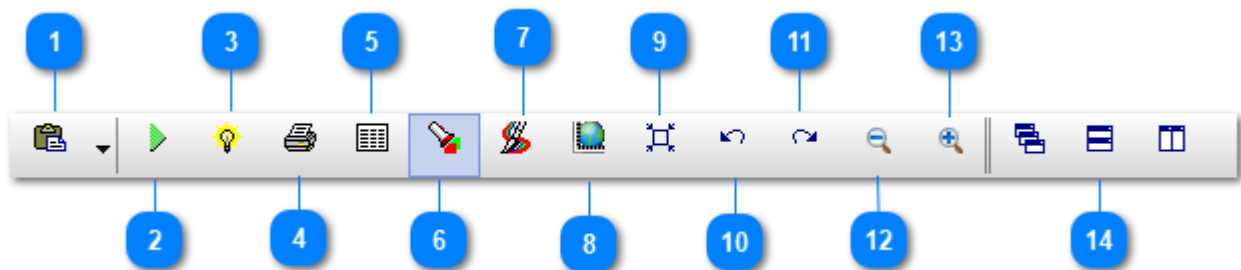
8 Dot at flight path in current position of movement marker indicator.


9 State Line. In this line current coordinates and values of wind (in case his calculation) are displayed.


10 Coordinating dot (label) No. 1.

11 Coordinating dot (label) No. 2.

3.5.1. Flight path tool panel




1  Call window of Data Base of WinArm64 or standard Open File dialogue.

2  Flight demonstrations playback.

3  Insert/delete time marks.

4  Flight path printing.

5  Flight path parameters output into the table (text file).



Turn on/off mode of flight path editing. At off mode the tools panel will take a view:



[Flight path customization.](#)



[Flight path parameters.](#)



Automatic coordination (zoom) of flight path - display all the flight path in visible field graphic.



Rotation of flight path relatively to the coordinates start to the left. [Section 11.3.5.](#)



Rotation of flight path relatively to the coordinates start to the right. [Section 11.3.5.](#)



Decrease scale of flight path. [Section 11.3.5.](#)



Increase scale of flight path. [Section 11.3.5.](#)



Setting location of application windows.

3.5.2. Flight path customization

The screenshot shows the 'Flight path customization' dialog box. It is divided into several sections: 'Grid lines', 'Labels' (subdivided into 'Time labels' and 'Text labels'), 'Flight path', and 'Caption'. Numbered callouts point to specific settings: 1 points to the 'Grid lines' section, 2 to the 'Time labels' section, 3 to the 'Text labels' section, 4 to the 'Flight path' section, 5 to the 'Calculated' radio button, 6 to the 'Lines' section, 7 to the 'Caption' text box, 8 to the 'Transparency' checkbox, and 9 to the 'Reference line color is same as text color' checkbox.

- 1 Coordinate grid. Group of parameters set thickness, step and grid color, color of indicator direction to the North. Coordinate system maybe be selected as rectangular and polar, units - in kilometers or maritime miles.
- 2 Timestamps. The group of parameters set the color, size and type of font, size and type of time reference labels - with model of aircraft ([Section 11.3.6](#)) or in form dots. Adding of time marks described in or in form dots. Adding of time marks described in [Section 11.3.7](#).
- 3 Text labels. The group of parameters sets the color, size and type of font, size and type of lines for text marks - with model of aircraft ([Section 11.3.6](#)) or in form dots. Font of text marks can be selected in editor of text labels. Adding of text marks is described in [Section 11.3.8](#).
- 4 Flight path. Group of parameters offened settings of flight path display:
 - Calculated** - using the method selected in the [Flight path parameters tab](#) of Header editor, or **On regist. coord.** - by recorded or previously calculated values of Longitude and Latitude, contributed into fields of [Flight path parameters tab](#) of Header editor.
 - **Kh** and **Dh** - coefficient multiplication and amendment (delta) to altitude for better visual display of flight path in the trajectories and in three-dimensional projection.
 - **dT** – frequency of flight path dots output in seconds.
 - **dFi** – angle of inclination of the horizon (axonometry angle). At meaning 0 - trajectory drawn in projections on horizontal plane (view above). Permissible values from 0 to 90 degrees.

- 5 Lines. Group of parameters sets lines thickness (projections on horizontal plane, trajectories and vertical projections), and also lines color.
- 6 Fill. The group of parameters sets the fill color of the background of the vertical projection, the transparency of the background, and also projections of the "relief" specified using the registered geometric height ([Section 11.8](#)).
- 7 Sets text, which will appear at the bottom of flight path at print.
- 8 Installed checkbox allows to do background all marks transparent.
- 9 Installed checkbox does color lines call-outs text marks same as text. Given in group **Text labels** options colors will be ignored.

3.5.3. Flight path parameters

The screenshot shows the 'Flight path parameters' dialog box with the following sections and callouts:

- 1** Points to the 'Coordinates, wind, maps' tab.
- 2** Points to the 'Text labels' tab.
- 3** Points to the 'Altitude reduction to zero' section.
- 4** Points to the 'Fixed point' section.
- 5** Points to the 'Magnetic variation, deg' field.
- 6** Points to the 'Output step, sec' field.
- 7** Points to the 'Terminal conditions' table.
- 8** Points to the 'Origin of coordinates' section.
- 9** Points to the 'Calculation' section.
- 10** Points to the 'Map #1' field.
- 11** Points to the 'Sound (wav)' field.

Terminal conditions table:

Time	X, m	Z, m
02:42:24	0	0

Wind Forecast table:

Hrel	Fw, m/s	Qw, deg

Master points parameters:

	Latitude				Longitude			
	deg	min	sec.		deg	min	sec.	
Origin of coordinates	33.30195556			N	104.50587222			W
Master point #1	33.31535833			N	104.53879444			W
Master point #2	33.3965			N	104.38189444			W

Map and Sound settings:

Map #	Path	Scheme #	Path
Map #1	D:\WinArm64\maps\maps.bmp	Scheme #1	
Map #2		Scheme #2	
Map #3		Scheme #3	
A/C type	D:\WinArm64\aip\config.aip	Sound (wav)	

Calculation options:

- ☒ Constant MNK
- ☐ Piecewise linear

Altitude reduction to zero options:

- ☒ Without altitude reduction
- ☐ At the beginning of flight path
- ☐ At the end of flight path

Fixed point options:

- ☐ At the beginning of flight path
- ☒ At the end of flight path
- ☐ At arbitrary point

Magnetic variation, deg: 0

Output step, sec: 0.5

Map #1: D:\WinArm64\maps\maps.bmp

Map #2:

Map #3:

A/C type: D:\WinArm64\aip\config.aip

Scheme #1:

Scheme #2:

Scheme #3:

Sound (wav):

OK **Cancel**

- 1 Terminal conditions.** By default at building trajectories start of trajectories at the moment of time start calculation if located at the origin. In the table you can set, for example points of start and end of the flight, trajectories, or any other intermediate points, which aircraft passed (for example in according to the radar, GPS, etc.). In this case, the trajectory will be built with the calculation of wind characteristics. Double-clicking on the coordinate fields activates the navigational calculator, which allows you to recalculate coordinates from different systems. Knowing geographic coordinates, e.g. runway or control points, with the help of a calculator you can converted it to the coordinate system of the graph with the flight path ([Section 11.4](#)).
- 2 Wind.** In the field Forecast you can set up forecast and actual wind conditions by heights for more accurate calculation. Calculation of wind conditions by control (reference) points maybe done using Least squares method or with the help of piece-wise linear interpolation.
- 3 Altitude reduction to zero.** In this field you can "lead" height to zero at the beginning or at the end of the flight path by removing the barometric altitude recording error or by correcting the difference in pressure at RWY level from standard pressure.
- 4 Fixed point.** Choice of the point allows to fix coordinates of aircraft flight at exactly given place.
- 5 Magnetic variation.** When use Magnetic heading in calculation of flight path it is necessary to enter magnetic variation (for true heading enter 0). Field available at initial calculation of trajectories. For changes it necessary to will rebuild trajectory again within the same time interval into this project or into the new project. In case of a long flight it is better to set the variation corresponding to the most important part of the flight path (takeoff or landing, for example).
- 6 Output step.** Given field is available at initial building of trajectories. For changes, it will be necessary to rebuild the trajectory again within the same time interval into this project or into a new project. Recommended leave 0.5sec
- 7 Master points.** In relevant fields geographic coordinates, necessary For bindings trajectories to map, satellite snapshot and etc. are given. It is necessary to monitor the position of the switches N/S and E/W. Coordinates can be given in degrees, degrees:minutes, degrees:minutes:seconds. Recalculation wile change of format will take place automatically.
- 8 Map.** By clicking on the name of the field **Map No. ...** you can select the one you need to display on each map tab, satellite snapshot and etc. - file *.bmp, *.jpg.
- 9 Scheme.** By clicking on the name of the **Chart No. ...**, you can select the one you need to display on each tab an aeronautical chart generated from an aeronautical database DAFIF ([Section 11.11](#)).
- 10 A/C type.** By clicking on the name of the field (**Aircraft Model**) you can select the model file to display and flight demonstrations ([Section 11.3.6](#)).
- 11 Sound (wav).** Clicking on the fields **Sound (wav)** you can choose sound file (for example CVR record) for simultaneous playback with trajectory flight at demonstrations. File in **wav** format must be prepared in advance and time-synchronized with flight trajectory.

3.5.3.1. Flight path parameters. Text labels

Time	Text
02:27:00	Text Line 1
02:28:00	Text Line 2
02:29:00	Text Line 3
02:30:00	Text Line 4
02:31:00	Text Line 5

The table can be filled with text lines with setting font options by pressing right mouse button. Text labels will be displayed on trajectories in form of call-outs, location and view of which then can be managed. Adding lines is carried out by key INS. Most convenient way is to import text labels from a text file (sub-menu selection by pressing the right mouse button). The data in the table and in the flight path are also automatically moved if text labels are displayed on parameters chart at the moment of flight path calculation. In detail work with textual labels described at [Section 11.3.8](#) and [Section 10.7](#).

3.5.3.2. Flight Path Parameters. Glide slope parameters

Tab allows to set up calculation of flight path in vertical plane while approach along the glide slope to display results in the function of a distance to the RWY threshold.

Outer marker

Specified height, m: 206

Distance from RWY threshold, m: 4000

Middle marker

Specified height, m: 71

Distance from RWY threshold, m: 1200

GS antenna

GS angle, deg: 2.75

Distance from RWY threshold, m: 290

Height of the glide slope entrance point: 600

RWY

RWY HDG (mag.): 75

Kh RWY: 1

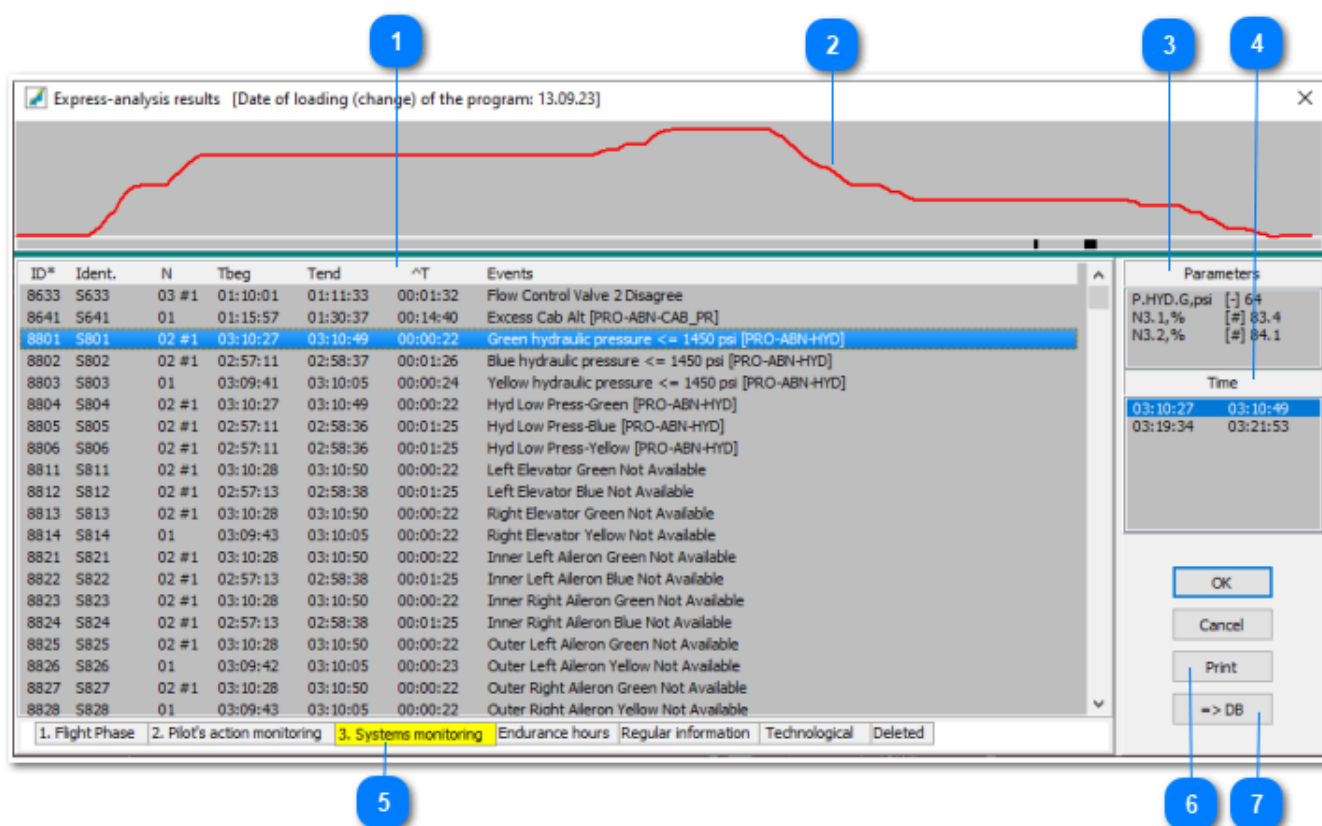
RWY profile

X,m	H,m
0	0
3000	0

- 1 Group of parameters for input data on glide slope parameters.
- 2 Group of parameters for input data on parameters of the RWY.
- 3 Predefined list with data on glide slope from the file \navi\select\rwy.txt.

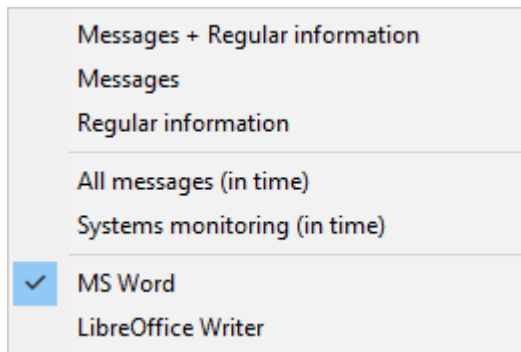
Detailed information on calculation of flight path along the glide slope contained in [Section 11.9](#).

3.6. Window results of express analysis



- 1 List of events with identification number, designation, quantity of implementations, beginning and final time of the implementation, the time interval and the name of the event. Selecting the desired event you can look it's options on the right. Events may displayed in different colors dependent from given settings in algorithms of express analysis.
- 2 Flight Profile. In this field the flight profile is displayed, built on basis of barometric altitude (or another parameter, set in Header editor on tab **Flight path options** in line **Altitude**). Selected below event triggered moment (moments) are shown under the profile displayed.
- 3 Event options. Contains list of parameters and their values at the moment of event triggering in accordance with certain algorithm.

- 4 Time. The time interval of the event triggering is indicated. If the event was triggered some once along the flight, the list is given, choosing lines from which you can see flight parameters, related to the given implementation of event, see location labels on flight profile and call standard task, confirming event.
- 5 Tabs for sorting messages by groups formed by the developer of algorithms of express analysis.
- 6 Button output results of express analysis to print into **Microsoft Word** or **LibreOffice Writer**. Pressing on button will cause menu choice options of printing:



- 7 Button to export data to the **DBWinArm** software (not included to the WinArm64 software package) for collection, analysis and statistical processing of results of express analysis in accordance to programs FDA/FDM.

4. Software Installation and Removal

Before installing **WinArm64**, it is recommended to close all running programs and make sure that configuration of the system answers minimal requirements, given in [Section 2.5](#). If the previous version of **WinArm64** is installed, then, before installing the new version, it must be removed, by use of **Installation And Removing programs** management panel of **Windows**.

***Attention:** It is not recommended to delete previous version manually, so how this may lead to difficulties in the process of installation.*

***Important:** For preserving the list of existing users, and also various settings it is necessary before removing to save files **winarm.ini**, **pass.ini** and **font.ini** to the temporary folder and rewrite them to the root **WinArm64** directory after installations of a new version.*

***Note:** If the previous version of the program was **WinArm32**, then removing it is not necessary. These two versions may work together.*

Program uninstallation removes only those files, which were copied to the hard drive when installing the software. Data files created by the user during work and saved in the main **WinArm64** directory or any subdirectories of the main directory will not be deleted and may be used in the future. If a complete removal is necessary, such files must be deleted manually. After uninstallation of an old version's installation of a new one can be initiated.

Program **WinArm64** is delivered on the USB flash drive (or another installation source). To install the **WinArm64** software it is necessary to open root folder of the installation source and to run program **setup.exe**. Then follow instructions of the installation program.

During the installation process, shortcuts are created on the desktop and in the **Start** menu for quick launch of the software. Also installation program registers to the system **Windows** new types of files.

For operating systems, providing opening access for users to specific folders, after the installation, you must open **full access** to all users who will work with the program, to root catalog **WinArm64**.

Attention, By default installation program will offer install of **WinArm64** to the folder **WinArm64** in root catalog on disk **C:**. Because of some restrictions on access for users to resources of operating system **Windows 7** and later systems, it is recommended that this directory be left unchanged and **Not** to install program, for example to the directory **\Program Files**. If needed you can install the program to any catalog on another (non system) disk.

WinArm64 is protected from unauthorized use with the help of a USB key type **Sentinel HL** (provider can change), included in the delivery package. If the key will not be connected at the moment of software launch then operation will be impossible. After installing the program, you will be needed to activate the key driver. The drivers are located in the **WinArm64\drivers\hasp\Sentinel_LDK_Run-time_setup**. Latest versions of drivers may be loaded from the Website of the vendor <https://cpl.thalesgroup.com/software-monetization/sentinel-drivers> (the website and Vendor can change). If driver will be installed correctly, then the program installations driver will issue corresponding message and inside key a red signaling will light up and information about it will appear in **Windows Dispatcher of devices**.

Configuration **WinArm64 Net (Std or Pro)** is supplied with the network key protection **Sentinel HL**, which is to be installed on one from computers at local network and will provide access to the software for multiple users at once. The number of users who are allowed to work at the same time, is determined when purchasing a license for the program (now it is 50 users maximum). Network setting of protection key and connection of users is produced on the stage of installation and commissioning works and performed by the software developer or the client's network administrator according to special instruction. The **License Manager** can be obtained from the manufacturer's website <https://cpl.thalesgroup.com/software-monetization/sentinel-drivers>. Installation and setting should be performed in accordance with attached instructions.

When use a network protection key please mention two peculiarities. First peculiarity consists of that the local security key can take precedence over the network one, that is, if there is a local protection key, the program will be entered in accordance with its parameters. Second feature consists of that in network version program the list of users and passwords persist directly in the dongle memory (the **pass.ini** file is ignored). A list of users and passwords must be generated by the administrator before start work with network protection key ([Section 6](#)).

4.1. Update of software current version

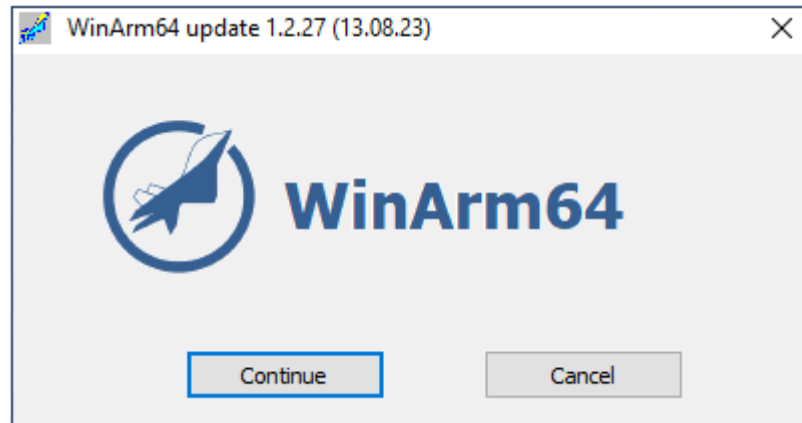
Update of software in case of connections computer to Internet is carried out automatically after detection of a new version. For regular search for updates it is necessary to activate the menu item **Help / Update / Notify about an update available**, or independently check for updates - **Help / Update / Check for updates**.

In the process of update successively will be performed:

- loading file programs updates from the server;
- exit from program **WinArm64**;
- launch programs update (may require user permission);
- performance of program update (button **Continue**);
- launch programs **WinArm64** updated version.

After successful fulfillment of update the directory **WinArm64\WinArm64.old** will save file of a former version.

View of the software window update after launch:



Drawing 4.1

5. Launch and working with files

5.1. First launch

Before first launch it is recommended to make sure that the protection key is connected to the computer and its driver ([Section 4](#)) is installed correctly (red indicator is on). Launch of the **WinArm64** is produced in the standard way by double-clicking the left mouse button on executable module (file **WinArm64.exe**) or on shortcut on the desktop and in the **Start menu**. A window for entering a username and password appears. (Drawing 5.1), which allows user to register.

Program installations **WinArm64** will registers a system user with name **winarm64**, password **100** and access of a system administrator. At first startup programs it is *necessarily* to set exactly these user name and password.



Drawing 5.1

After entering the correct username and password or clicking the **Cancel button**, the program proceeds to work with the appropriate level of access to resources. After logging in, the system administrator adds new users and defines their levels of access to information ([Section 6](#)).

External view of the interface depends on **selected theme** in system window properties screen.

5.2. Next launches


On subsequent launches of the program, the name of a user, which have worked with program last time will be displayed by default in the **Enter password** window.

***Note:** When entering a username and password, you must follow the keyboard language layout and remember, that program distinguishes lowercase and uppercase letters.*

There is an alternative way to log in, which is realized with a **Pro** license, allowing editing existing and adding new algorithms of express analysis. Availability of such a license does not require a password, since the username and the corresponding access level are recorded in the memory of a protection key.

***Note:** A program with a **Pro** license, after making the appropriate settings, will also admits it's usage with ordinary rules - input user name and password. The level of access to resources will be determined by settings, made by administrator ([Section 6](#)).*

Installation program **WinArm64** registers to the systemic registry of **Windows** new types of files, with extensions **armx** (data file), **hdrx** (header file). File opener **arm** , **hdr** and **tra** (**WinArm32** or **WinArm64**) are to

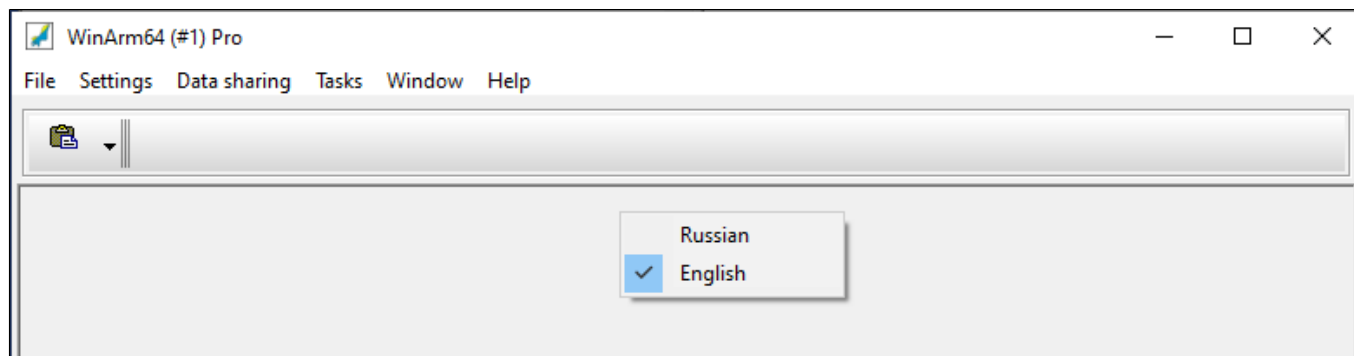
be chosen by means OS. All files of registered types are marked with icon . To launch program with selected file it is necessary to click twice click left mouse button it's name or label.

Program supports also function **Drag and Drop**.

Program automatically saves names of four files previously opened. To call any from these files it is necessary to close window **data Bases** (if opened) and choose relevant lines from menu **File**.

5.3. Language choice

Program allows user to choose language interface, help files and parameters descriptions in the Header (Data Frame). To select a language, close all child windows of the program, including the Data Base window, and display a pop-up menu by clicking the right mouse button inside the main program window (Drawing 5.2).



Drawing 5.2

6. Protection of information

To ensure the safety of information and authorized access to it, the program offers 4 various levels of access:

- System administrator;
- Authorized user;
- User;
- Guest.

*Note : these levels are not spread to the set **Pro** ([Section 2.3](#)).*

Level of access is determined by the username and password which were entered (Drawing 5.1). At wrong in username and/or password system will issue corresponding warning and will offer to repeat input. It is necessary to remember that the system *distinguishes uppercase and lowercase letters*. If password will be entered wrong for three times or if the username and/or password is unknown and the **Cancel button is selected**, then you will be logged in with the lowest priority - **Guest** . The current access level is listed in the header of the software main window.

Adding new users to the system and setting their access level is done only by system administrator using the dialog box that appears after selecting the menu item **File/ Password** (Figure 6.1) .

*Note: the system will automatically block the deletion of the last user with the level access **system administrator***

Access	Login	Password
A	WinArm64	100
A	User1	200
U	User3	500
A	User4	777
AU	User5	300

Drawing 6.1

To add a new user, you must press the **Ins key** when the input focus is on the field list. Removal selected lines with user name is produced by pressing key **Del** . Adding and deleting users is also possible from the menu after pressing the right key mouse on the list box. Changing the access level of the selected user is carried out by setting switch on the **Access Level field** to the desired position. The current access level is displayed in column **Access**: A - administrator, AU - authorized user and U - user.

Setting access specifications for each type of user is carried out in the dialog box **Setting access to resources of WinArm64** , which appears after choice buttons **Setting** (Drawing 6.2) .

WinArm64 security settings

	Advanced user	User	Guest
Information copying from server	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Data file making. Data sharing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Data files deleting	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Graphic forms and standard tasks editing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
New header file making	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Full header editing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calibration tables editing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All passport fields editing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Passport fields editing (except first three fields)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Information printing (plots, tables)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Setting (removing) frame failures	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Data file editing	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
File changing and deleting on server	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Further information processing (the "Tasks" menu item)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

OK

Cancel

Drawing 6.2

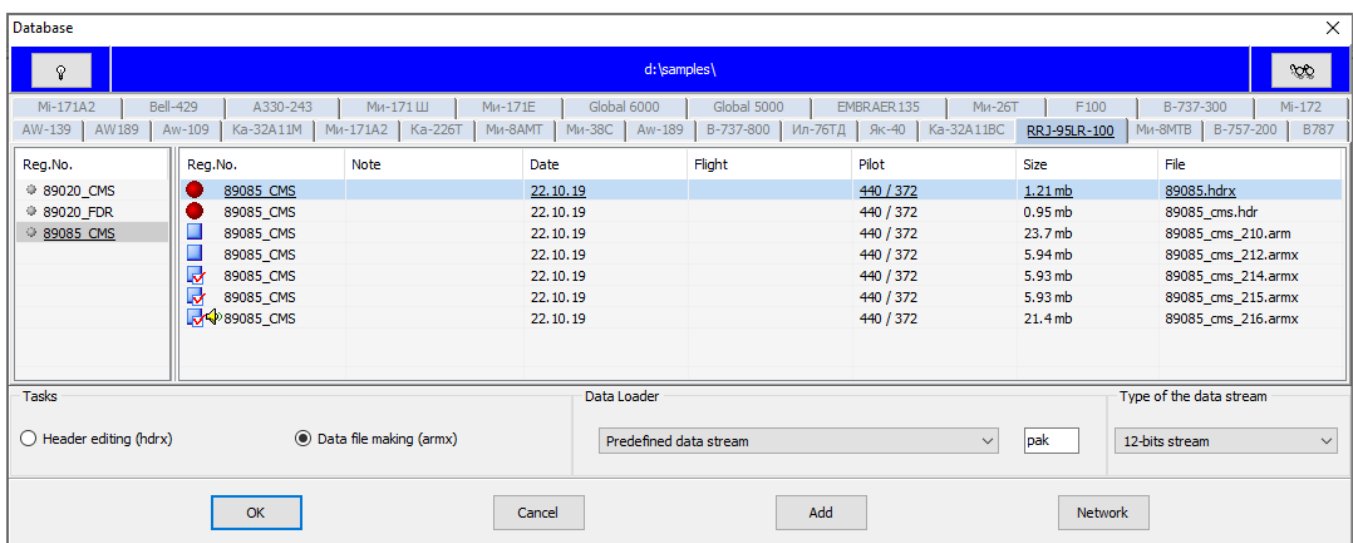
7. Working with the WinArm64 Data Base

Windows **WinArm64** Data Base appears directly after launch of the program or after pressing on

button .

Note: The user can prevent the automatic appearance of the database window after launch. For this it is necessary to choose corresponding point at pop-up menu (Drawing 7.2), which appears after clicks right mouse button on the field, containing the Name of the current folder

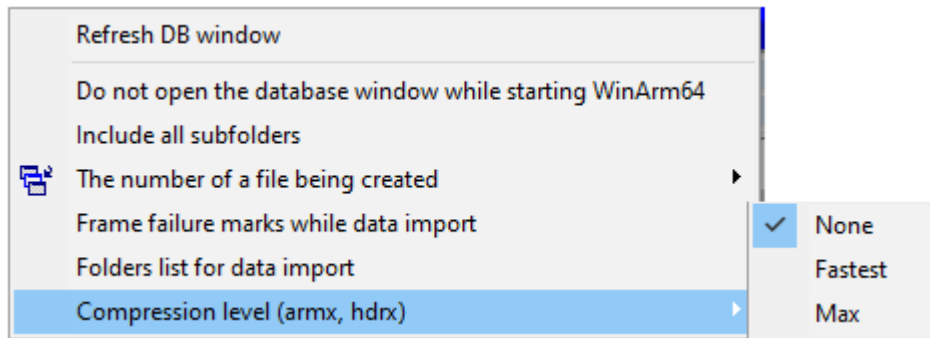
The appearance of the window is shown in Figure 7.1. It is not possible to directly resize the window. The program automatically places the window in the middle of the screen with equal horizontal and vertical indents. Size of indentation determined by the position of left top corner window in the moment of closing (pressing buttons **OK**). So the way to change the database window size at next entrance it is necessary to move it to the desired position, after what exit clicking button **OK** and again launch the database window.



Drawing 7.1


The top central part of the window shows the name of the current folder where the program is searching for data files. To increase the speed of work after changing the current folder, the program caches (buffering) in operational memory all information on found files. At subsequent adding (deleting) files by means of the program, this information will be automatically updated. At adding (removal) files by means of operating system for changes display in database window it is necessary to update information clicking left mouse button on the current folder name field. The same operation can be performed using corresponding item of popup menu (Drawing 7.2).

Right-clicking on the current folder name displays a pop-up menu (Figure 7.2), which allows to set database window mode at startup, turn on in the data file search route not only in the current folder, but also in subfolders, as well as determine the order specifying the number part of the file name when creating a data file. Additionally, this menu allows to set automatic mode of markings frame failures in the process of data import from the file and set list of folders to import data. For files **armx** , **hdrx** it is possible to determine the level of data compression at closing files with saving.



Drawing 7.2

***Note:** at inclusion in search route data files also in subfolders, the current folder name field color will be changed from dark-blue to blue-green.*

To change the folder, press the button  and select the desired folder from the appeared list. Pressing mouse right button at cursor position above the given button displays the list of the four folders that were last used. Choose any of the folders to implement fast transition.

***Note:** The user can select as the current folder not only the local folder, but network folder, located on any from the computers available in local network (recommended only for working with **armx** , **hdrx** files). You can also use a file server **WinArm64 (service SWA64)** to work over the network. Order of work in client-server mode outlined in current and next sections.*

***Note:** if you start the program from **Windows Explorer** by double-clicking on the file name of any of registered types (**arm**, **armx** or **hdr**, **hdrx**, chapter 5.2) with holding pressed **ESC** button, the program will open the database window and make active the folder that contains selected file. At this the file will not be opened.*

By specifying a list of folders for importing data, the user then, [when importing data](#) can faster find files with flight data.

After selecting a new folder, the program searches for header and flight data files. On himself upper level sorting files produced by aircraft type which indicated in the first field of the passport ([Section 3.4.5](#)). On next level sorting produced by any of 6 fields of the passport: TailNo, Note, Date, Flight, Pilot, Size. Select a key field for sorting by clicking the left mouse button on the required heading. By default, the system uses field **TailNo** .

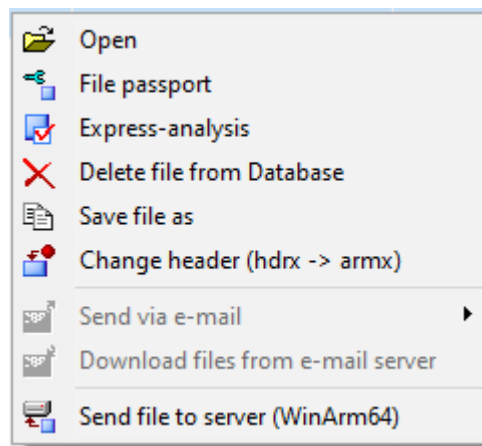
The window displays the **arm**, **armx** and **hdr**, **hdrx** files. Files with the extension **hdr** , **hdrx** are indicated in the list with a red circle (Figure 7.1), and files with the extension **arm**, **armx** - with a blue rectangle. Archived files are indicated by a gray rectangle (only for files **arm**). If inside rectangle there is a red "bird", then this file contains the results of execution of express analysis (section 12). The "loudspeaker" icon indicates that the file contains at least one parameter with the type of audio stream ([Section 9.4](#)).

To select a file from the database, just click anywhere on the line with the file name on the left button mice. Attributes selected file displayed on blue background. If select file data then when you press the **OK** button, the system will switch to the viewing mode of this file ([Section 10](#)). If a file selected is the Header, then, depending on the position of the switch in the **Tasks** field , when you press the **OK** button, the system will pass to the file header editing mode ([Section 9.1](#)) or to the flight data import mode ([Section 8](#)).

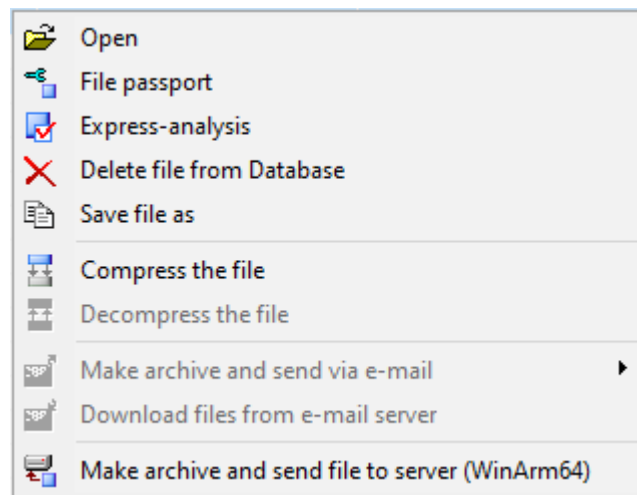
If main program folder contains the folder **HDR** and it's file title name matches the Tail/Serial number of the AC in the current file, as well as in the menu of the chart view window the item **Data exchange/Automatic replacement of the header** has been previously selected (this menu item available even if no file is opened), the program then before file open will offer replace current Header to the Header contained in the folder **HDR**. Attention! "marked" state of the item menu **Exchange data/automatic replacement of the header** will be automatically cleaned after every application.

Right mouse button Click on the field of files of database displays pop-up menu.

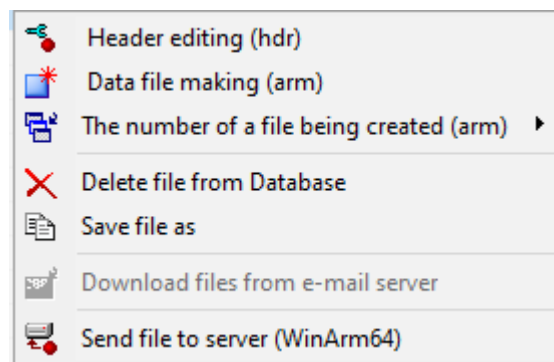
For **armx** files:



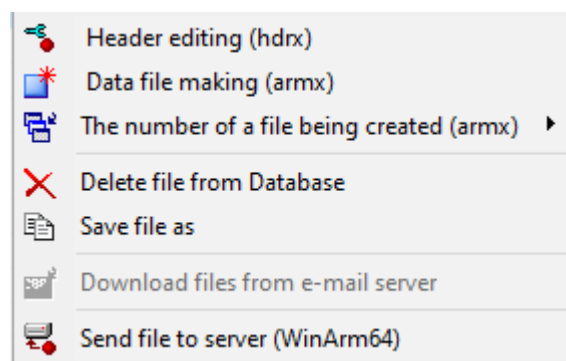
For **arm** files:



For **hdr** files:



For **hdrx** files:



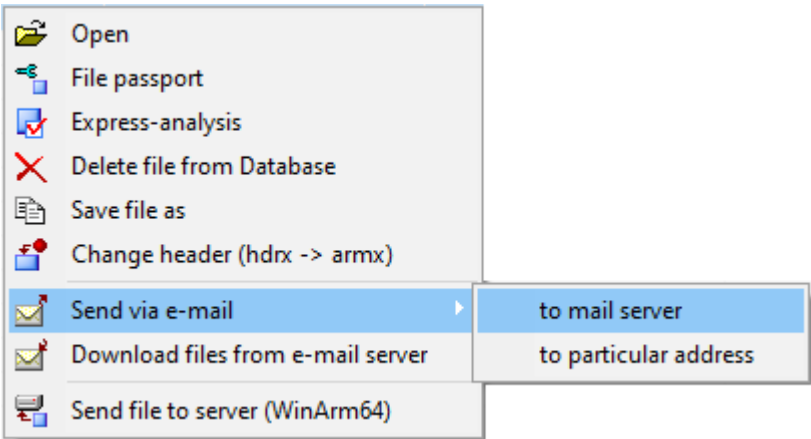
Drawing 7.3

With it's help you can open dedicated file, edit his passport, archive/ unzip file (**arm**) replace Header of file (**arx**), delete file from the database, save it with another name or, in case of network connections

availability and activity of server **WinArm64** , send it to the server database (not to be confused with the email server, see below). Necessary to note that when a file is deleted, it is placed in **the Recycle Bin** and can be restored using the standard **Windows** way.

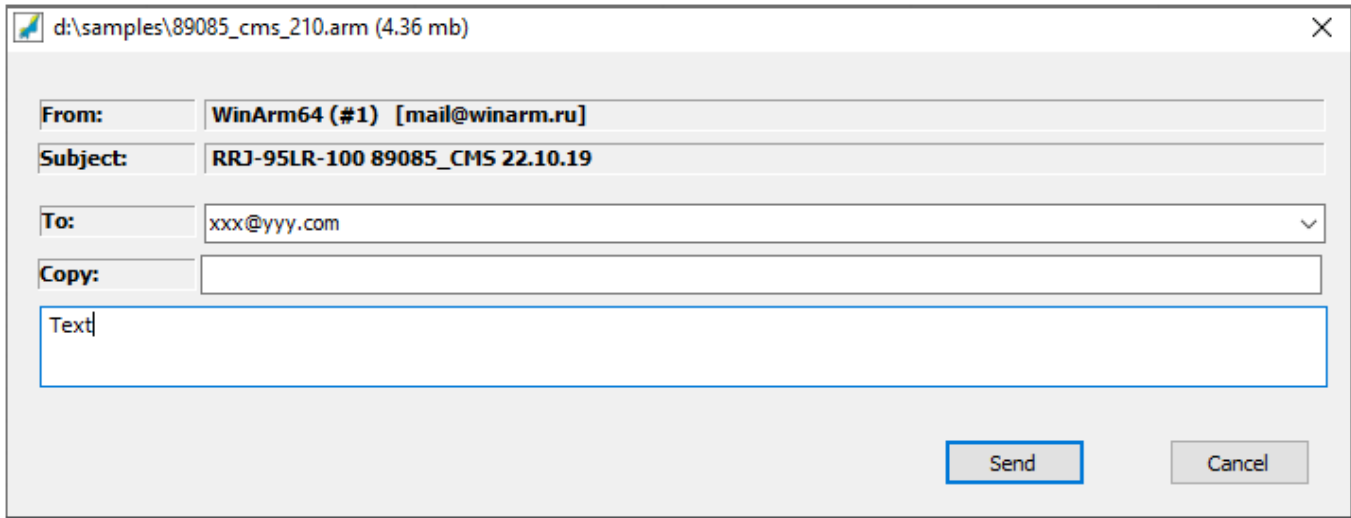
Archival files displayed in database window on a par co everyone the rest. A gray rectangle will appear as an icon and the **Size** column will contain the keyword **"archive"**. If you double-click on the archive file with the left mouse button, the program will offer execute unzipping it.

Two additional services allow you to send and deliver files by E-mail using remote mail server. To use given functions it is necessary to have active Internet connection and set E-mail address from which sending will take place (see below description of the window **Network Connection Settings**). *Attention, if network connection is absent, that menu item become inaccessible.* Before sending file it will be automatically archived. User may choose one of two dispatch options: to predefined server or to specific addressee (Figure 7.4).



Drawing 7.4

Choice item **to server** leads to sending file to mail server, set in window **Network Connection Settings**. Example on drawing 7.8 shows data server as **winarm.ru**. At choice item **addressee**, an additional window appears (Figure 7.5), in which the user can set specific address. When specifying multiple addresses, they are separated by a comma character. Regardless of way of sending the sender name and messages subject will be given automatically. Sender name will consist of the **WinArm64** program name and with a unique user security key number, which made the transaction. The number is enclosed in parentheses - for example " **WinArm64(#1)**". Message subject drawn up from fields passports **Type**, **Board**, date and **Flight**.



Drawing 7.5

In the bottom part of the window the user can enter text message, which will be transferred to the addressee.

Selecting the pop-up menu item **File Delivery from e-mail server** displays the server window electronic mail (Drawing 7.6). In given window the list all files is presented contained at server database. The user can select an arbitrary number of files by checking the appropriate switch for download and/or removal. In the process of files download the program will offer the user an option of their automatic removal from the server. After download the user can change its name and choose a directory to save. The **Database** window will automatically change current directory and will do last from loaded files active.

List of files on e-mail server [mail.winarm.ru]

Date and Time	From	Size	A/C type	Reg.No.	Date of flight	Flight	
<input type="checkbox"/> 18 20:59:39	WinArm64 (#1)	7039366	Ka-226T	226.54	15.12.22	100	
<input type="checkbox"/> 18 21:02:34	WinArm64 (#1)	1741351	B-747-400	EW-556TQ	28.08.20	RSB4732(UAKK-OMSJ)	
<input type="checkbox"/> 18 21:04:03	WinArm64 (#1)	9534381	B-737-8MAX	8MAX	15.04.17	(KROW-KROW)	
<input type="checkbox"/> 18 21:09:29	WinArm64 (#1)	287141	B-737-8MAX	VQ-BGV	06.12.18	GLP182(JNNT-UJDD)	
<input checked="" type="checkbox"/> 18 21:11:59	WinArm64 (#1)	545451	MI-171E	7689	26.07.18	2222	
<input type="checkbox"/> 18 21:12:27	WinArm64 (#1)	442479	MI-171E	7689	27.07.18	2223	
<input type="checkbox"/> 18 21:12:51	WinArm64 (#1)	217159	MI-171E	7689	28.07.18	2224	
<input type="checkbox"/> 18 21:13:24	WinArm64 (#1)	309395	MI-171E	7689	03.08.18	2225	
<input type="checkbox"/> 18 21:13:49	WinArm64 (#1)	695515	MI-171E	7689	06.08.18	2226	

OK

Deleting

Cancel

Drawing 7.6

Right-clicking on the secondary sort field (on the left side of the window) will display pop-up menu (Figure 7.7).

Compress the files


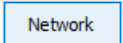
Decompress the file

EA events

Drawing 7.7

With it, you can "batch" archive/unarchive all files **arm**, names which withdrawn in right part of window and also produce sorting of express analysis events ([Section 12.5](#)).

7.1. Work with the file server SWA64

Button  of the database window allows you to connect to the **SWA64 file server** . It becomes active after connections computer to local network. Network connections options are configured in window dialogue (Drawing 7.8), emerging after pressing button .

Network connection settings

WinArm64 Server

IP address Port

UDP

IP address Port (exp.) Port (imp.)

E-Mail

Server information

POP3 incoming server

SMTP outgoing server


Login information

E-mail address


Login

Password

Drawing 7.8

User is to indicate IP address of server ([Section 7.2](#)) and port number. By default system uses port number 8010. Tune server **SWA64** to work with another port is possible in the port initialization file ([Section 7.2](#)). If the server is active and the task is correct networks settings a window with it's database data with indicating IP address and quantity of free space on the disk will appear (Drawing 7.9) and external view of the button will change to  , otherwise in case of a connection error a message will be displayed. When issuing a message it is necessary to check the correctness of network connection settings. If setting are right it is necessary to ask system administrator whether server is active at the moment.

Server SWA64

 d:\swa64 [127.0.0.1] Free space: 118900 mb

AW-139 | Ми-171A2 | EC-155 | B-737-8MAX | **B-737-800** | B-777-300ER | B-737-500 | B-737-300 | B-737-900ER | RRJ-95LR-100 | B787 | Global 5000 | B-757-200

Reg.No.	Reg.No.	Note	Date	Flight	Pilot	Size	File
VP-BBD	VP-BBD		24.02.19	JAI914 (VABB-VAAH)	3333/7777/3333	0.73 mb	vp-bbd_hdr
VP-BUL	VP-BBD		24.02.19	JAI913 (VAAH-VABB)	6666/7777/7777	archive	vp-bbd_101.arm
	VP-BBD		24.02.19	JAI477 (VABB-VOBL)	4566/6789/4566	archive	vp-bbd_102.arm
	VP-BBD		26.02.19	JAI922 (VAPL-VAPO)	5777/5777/6777	archive	vp-bbd_103.arm
	VP-BBD		26.02.19	JAI371 (VAPO-VIDP)	3456/3456/3456	archive	vp-bbd_104.arm
	VP-BBD		26.02.19	JAI371 (VAPO-VIDP)	3456/3456/3456	8.8 mb	vp-bbd_105.armx

Drawing 7.9

After selecting a data file the program will prompt the user to specify a folder to save it, after which the file will be downloaded from the server and the connection will be automatically terminated. Uploaded file will appear in database and may be selected for further processing.

In the sections **UDP** you can configure options for UDP Protocol which will allow user for transmission flight data to other applications ([Section 10.20](#)). In the field **IP address** it is necessary to indicate the address of a computer, at which the client application which will receive data is located. If application is located same computer where **WinArm64** is installed then the addresses will be **127.0.0.1**. In the field **Port (exp)** the port number to which **WinArm64** will transmit data to the client application is to be entered. In the field **Port (imp)** the port through which the client application will transfer requests to **WinArm64** is to be indicated. Port numbers can be chosen arbitrarily from the numbers of open and free ports on computer.

Additionally, in the **Network connection settings window** , E-mail settings are configured, which will be used at choice item pop-up menu **Archive And send By E-mail / to the server** and **Delivery of files from the E-mail server**. The user needs to set the server names for incoming and outgoing mail, as well as an email address, username and password. Confidentiality of information transfer is provided by the possibility of arbitrary setting of the server, login and password, and also the ability to control who sent files to the server and when. To check correctness of settings you can use button **Check connections**.

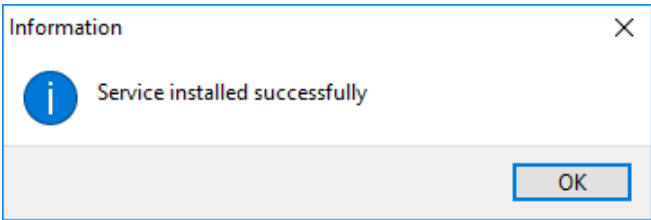
Note: Do not confuse the database Servers WinArm64 with the server (manager) of licenses and with the database of results of express analysis DBWinArm.

7.2. File server SWA64

File Server **SWA64** is a **Windows** service. **SWA64** is designed to host files **arm** , **armx** , **hdr** , **hdrx** data and sharing it with client applications **WinArm64** via local network.

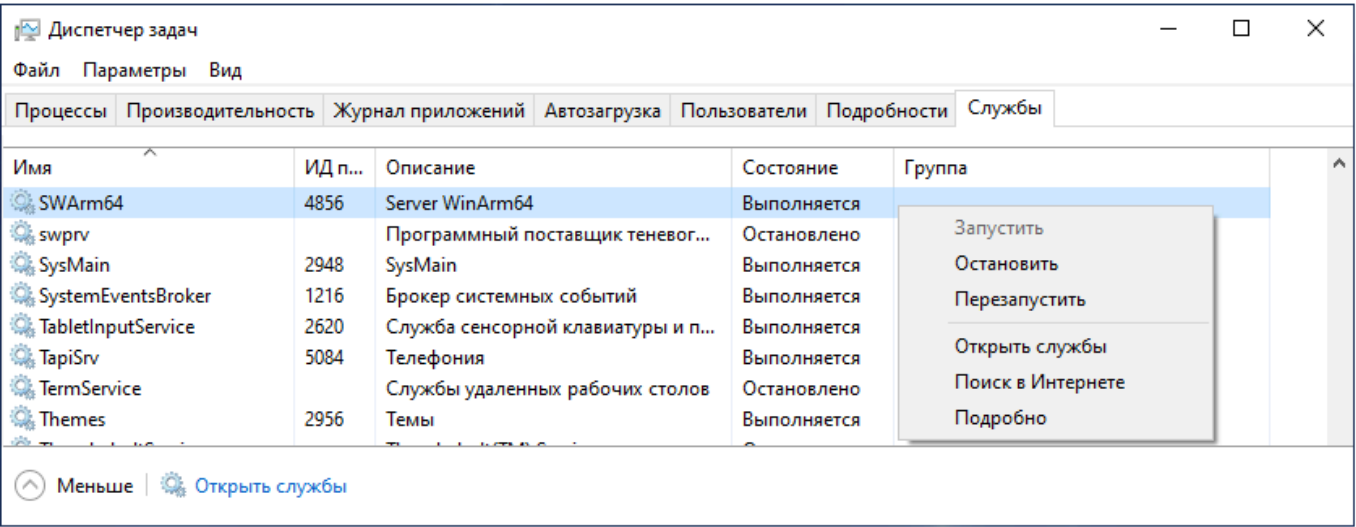
After installation of **WinArm64** an executable file (**swa64.exe**), port settings file (**port.txt**) and service install/uninstall batch files (**install.bat**, **uninstall.bat**) will be located in the directory **winarm64\swa64**. In the future, this folder can be moved to any computer on the local network, where it will the place of storage for data files.

Installation of service is produced by launch of the command file **install.bat** (with administrative access). Results of installation of service will be shown in the message (Drawing 7.10).



Drawing 7.10

After installation of service it is necessary to run it (or reload the computer). Control of service (start, restart, stop) is performed in the **Windows Services window** (Figure 7.12). Removal of service is produced by launch of command file **uninstall.bat** (with administrative access). Removal may be needed, for example, before installing a new version of the service. Before deleting a service, it must be stoped.



Drawing 7.12

Connecting to a file server from another computer is done in the usual way, as follows was described in [Section 7.1](#). If it was not possible to connect to the server, but it is known for sure that the computer with established server included and available at networks, try to allow program **swa64.exe** as exceptions in **Windows firewall**. After connecting a server window will appear on the screen (Figure 7.9) indicating the address and volume of free space. Further work with server doesn't differ from described higher. The TCP/IP port of the server is specified in the text file **port.txt** . Default (no configuration file) server uses port from number 8010. Statistics of connections to server is ongoing in file **log.txt** which will be created in server folder.

8. Data file making

In given section the process of creating data files for subsequent display, print and analyze the recorded information is described. There are four file types of flight data in **WinArm64** system:

- header files with expansion **hdr**, **hdrx**;
- data files with expansion **arm**, **armx**.

Header files - files with extension **hdr** or **hdrx** (from English **header** - header). Data files contain all the information (Data Frame Layout - list of parameters, types and addresses of parameters; express analysis algorithms and etc.) needed to interpret the data. *A copy of the header file* is contained in *each data file* created using this file. This copy may be edited *independently* from the parental file header. Contributed changes will have effect *only in the current* data file. To propagate changes to other data files, as well as to highlight (save) them in the form of new header file, it is necessary to follow procedures described in [Section 10.10](#).

In this manual, the term "header file" is often used to refer to a copy of a header file in data file.

A data file is a file with an **arm** or **armx** extension. This file contains both parametric (flight) data, recorded on board of the aircraft, as well as another information necessary for interpretation of this data and saving of the job results (graphic forms, results of express analysis and etc.). Any data file contains a copy of header file, from which this data file was created. Options of this header can be edited by the user. Changes will *apply to current data file only*. The data file is *self contained*, i.e. to view it on another computer with **WinArm64** installed, no other files *are required* (for full-fledged work, additional files of standard tasks **stn**, **stnx**, stages of flight **stg**, templates **xpln**, and etc.).

Arm, armx data files are formed by attaching initial flight data to header files **hdr**, **hdrx**. Input data are files of various formats.

Data Stream Type field specifies the type of the input data stream. In the **Information source** window you can specify the three-letter extension that the input data file has. This extension will be used by the program when searching for existing data files and, if necessary, executing additional transformations at data import.

At choice type "**bit flow**" in the field **Type of the data stream** two additional data entry fields that allow you to set the total size of the information block and the size of heading inside this block may present. These values must be set if the flight information copy contains each regular data block is preceded by a header. With standard bitstream (only data) values both fields are equal to 0, and fields themselves are automatically hiding. Manual show-hide fields input going on by click left mouse buttons on given field.

To create a data file, select the appropriate header file in the **Databases window** ([Section 3.2](#)), check the **Data file making** check box in the **Tasks** field and click the **OK** button. After selecting the input file in the standard **Windows** dialog, the import procedure will begin. The necessary transformations will be performed depending on the input data type. Further the program automatically generates the **arm** or **armx** data file name from the header file name, symbol underscore and three-digit number. The user can define the principle of setting the number: first free or following the maximum. The choice is made in the item **New file number creation procedure** pop-up menu, which appears after clicks right mouse button in the field with the name of the current folder of the **Database window** ([Section 7](#)). In any case, the user can set it's own file name directly before saving.

After filling in the passport graphics of parameters of the created file (**arm** or **armx**) will automatically appear on the screen. If the parameter graphs are not displayed on the screen, it will mean that the program could not interpret data from selected file. It is necessary to make sure that selected file contains valid flight data and selected data type corresponds to actual data type in the selected flight data file.

In case inconsistencies of flight data file with the format of the header, program issues corresponding warning and gives the user the choice of whether to continue generating the file or not (only for a 16-bit word input stream). Compliance is checked by dividing the length of the file in bytes on length of the frame selected in recorder type. If division carried out without remainder, then the file format counts as correct. In case of inconsistencies of the length of the file with the format of selected recorder and user choice on continuation, the program truncates file size before necessary, discarding superfluous bytes. The creation of data file is also available from the menu that appears after right-clicking on selected header file ([Section 7](#)).

9. Creating and editing header file

The header file can be created either as a new one or from an existing header file from the most close type of aircraft (about saving header file see [Section 10.10](#)), at this the second way is more preferable as it saves time and, in many cases, allows to avoid a series of mistakes for example in setting addresses of recorded parameters.

To create a new header file, click the button **Add Header** in the database window **WinArm64**. To edit an existing header file select it from the list, tag switch **Header Editing** and press **OK**. In both it will open window **Header editor** presented in [Section 3.2](#).

9.1. Editing header file

9.1.1. Tab Passport, Common Data

Tab **Passport, Common Data** ([Section 3.4.5](#)) allows to choose common options of flight recorder and customize passports fields.

By default, the program defines seven fields of the flight passport (up to the field **Header** inclusively). The length of each field of the passport cannot exceed **255** characters, and the total number of lines maybe not be more than **100**. Total quantity symbols in all fields of passport (including fields titles) limited by **2900**. There are no such a restrictions for files **armx** and **hdrx**.

Adding and removing of arbitrary lines in passport also produced by choice of relevant items in pop-up menu. **Strongly recommended** not to delete predetermined passports lines and add lines strictly after all the predefined lines. Otherwise, the correct operation of express analysis algorithms will not guaranteed.

Filling passport fields can be done by one of the ways described below:

- directly after creation data file program will offer to fill passports fields;
- in the window **Header editor** on relevant tab (only at availability of access);
- in the window **Data Base**, after choice of desired file and pressing keys **F2** ;
- in window of viewing charts after pressing keys **ctrl + F2** .

Additional files - this group of files, *with the same name*, which are in *the same directory* and have different extensions that define how they are used. Field **Additional files** sets name of file (without extension) and path to it beginning from the root folder of the program. Subfolder names are separated by a backslash character. This way additional files are tied to specific data file or header. The program allows the use same additional files in any quantity of data files or headers.

On the current moment six types of extensions are supported, determining files, which are used for the following aims:

- passport line number (only for files **hdr** and **arm**) by order (**001**, **010** and etc.) - defines pic files (**from English To pick up - choose**);
- extension **stn** - defines current file of standard tasks for **arm** files;
- extension **stnx** - defines current file standard tasks for **armx** files;
- extension **fom** - defines comments to events of express analysis;
- extension **stg** - contains names of stages of flight for express analysis events;
- extension **xpln** - contains templates for export data to flight simulator **X-Plane**.

Name of additional files (without extensions) used at formation of full names files (by adding the appropriate extension) containing an additional information. For example, if there is a file named **rrj.006** (pick-file) in the **work folder**, the values of the sixth field of the passport will be selected from the list, which is formed from the strings, contained in given file. By analogy, for any passport field it maybe be given like file simple textual format, prepared, for example with **Notepad**. If such a file is specified, then direct editing of this field becomes inaccessible and values must be get out from predetermined list. This function may be used for example for tasks names (identifiers) of all the PICs/FOs of the airliner.

Note: when interpreting such a files, the program adheres to the following rules. All possible field values (lines from the file) are read and stored by the program **like strings** . The values of the first seven fields **are interpreted as strings**. For all the rest fields initial symbols (before first spaces) **which may be converted as a number**, are interpreted as a number; and other characters are ignored and can be used for comment, which will appear in relevant passport field.

Important: the comment must be separated from the field value **by at least one spaces character**, and separator of fractional parts of real numbers must be **dot**.

If there is a file named **pasp.006** in the root folder of the program , then, in the absence of local pick-file (in considered example **work\rrj.006**) it's lines will be used for formation of list of possible fields values. If both files are absent then corresponding passports fields are to be filled manually.

The program provides the ability to create local pick-files, that is, files whose actions apply to a specific field of the passport within a specific file. These data stored inside header file. It means that you can, for example, in the header file of any aircraft, determine all the pilots flying on this airplane. When creating a data file, based on this header file, the name of a particular pilot may be selected from list.

Field **Add files. Param.list** allows to choose from dropdown list the name of a textual file located in the root folder of the program, from which the parameters will be selected when they are adding to the Header ([Section 9.1.2](#)). List drawn up automatically from files of a given format placed in a root program folder.

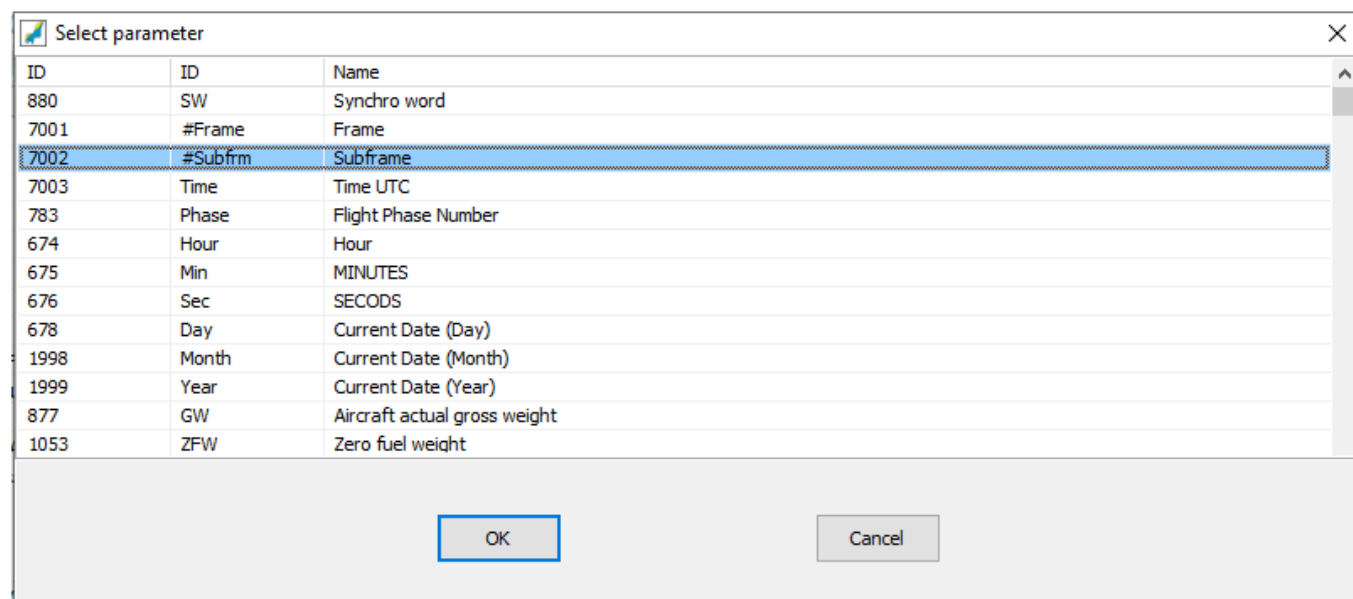
Double click left mouse button on field **Time** allows to set identifier parameter, which contains values of recorded time *in seconds* . In case of work with predetermined types of flight recorders the field is recommended to leave empty, as the program "knows" at what addresses the current time is recorded. This field is used as a rule to display information of flight recorders (data streams), when addresses of time registration are not known in advance and it is necessary to introduce the corresponding design parameter, which will contain values of time recorded in seconds.

Fields **Day, Month, Year** and **Flight**, likewise field **Time**, allow to set values of these parameters, if provided by a specific recorder. Defining these fields will allow to automatically displays current values on the indicator field in the plot view mode, and also allows to automatically fill relevant passport fields ([Section 10.12](#)).

Field **Standard task when opening a file** contains the number of a standard task ([Section 10.1.1](#)), which will be displayed at opening the file. At choice standard task with number 0 or refusal to apply the standard task when opening the file same list of parameters and their positions as after previous closing will be shown.

In the field **Data Format** the type of flight recorder (data stream) may be chosen from the list.

In the field **ID subframe (frame)** are given options, determining ordinal number of subframe inside the frame and superframe (**ID subframe in frame** and **ID subframe in superframe**), and also ordinal frame number in superframe (**frame ID in superframe**). The choice of parameters is made from the list (Figure 9.1), emerging after clicks left mouse button on relevant field.



Drawing 9.1

***Note:** The list is formed from the number of parameters already included in the header file. So these parameters must be included to the Header before the moment of their use.*

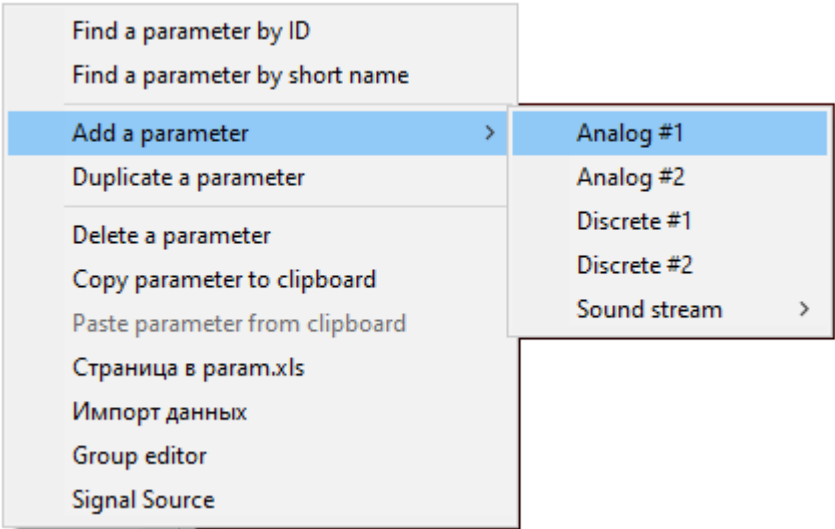
Data fields are used for definitions of values of others parameters in those cases when their registration is carried out not in every subframe.

9.1.2. Tab Parameters

Tab **Options** view is given in [Section 3.4.1](#). The name list in the right part of the window contains a list of parameters of the header file. At the top of the list analog/digital parameters are presented followed by discrete

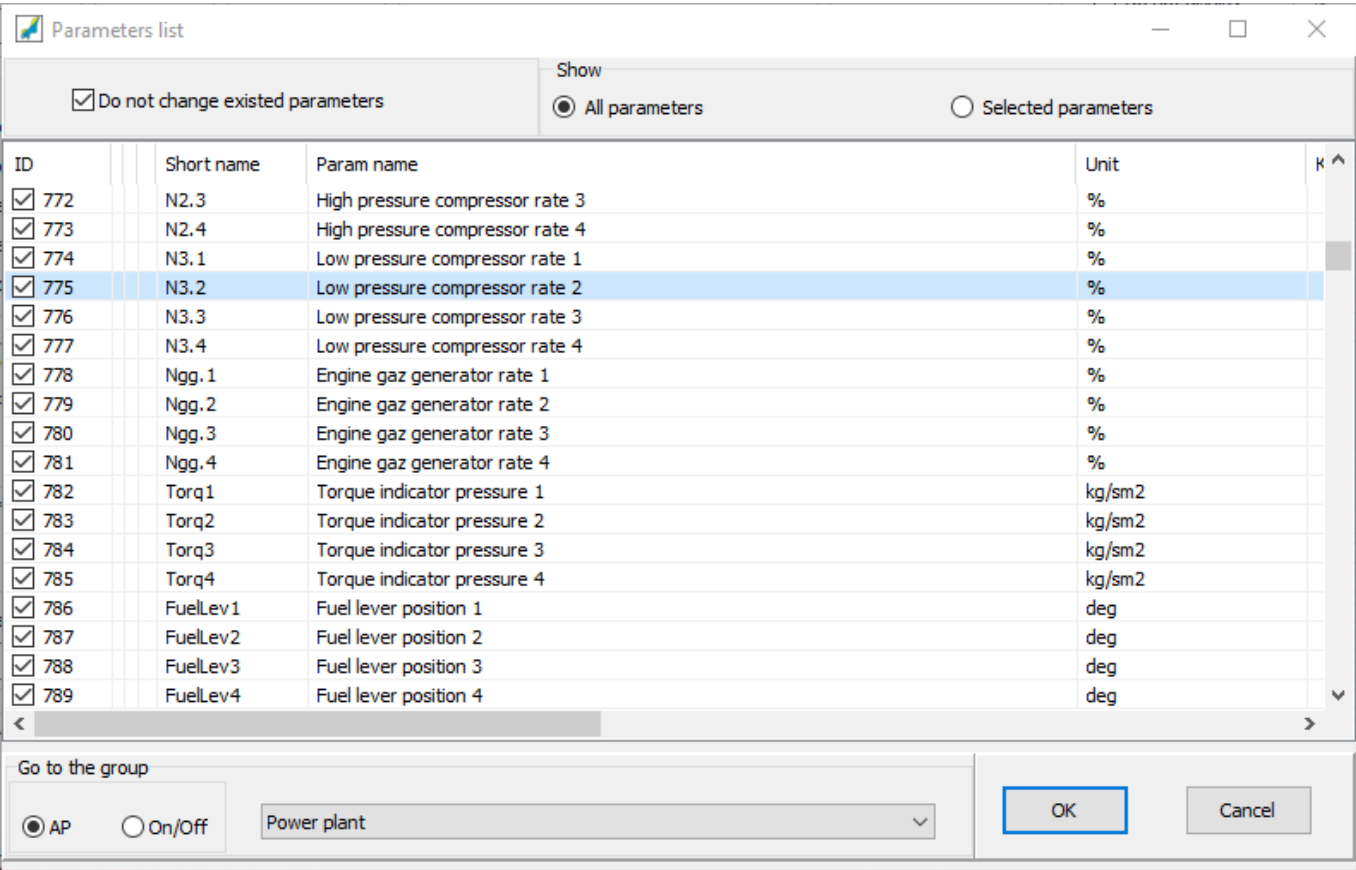
signals. Moving the selected parameter in the list up or down carried out by buttons, located under list. Moving analog parameters and discrete signals can be carried out only inside its groups.

After right-clicking on the list box, a pop-up menu appears (Figure 9.2), allowing you to search for the desired parameter from among the parameters contained in the Header and also to add parameter of desired type, to delete parameter or duplicate it.



Drawing 9.2

Adding of a new parameter to the Header can be made manually (by choice of pop-up menu item), or by choice from generalized list of parameters, which appears after pressing **General List** button ([Section 3.4.1](#)).



Drawing 9.3

Parameters already present in the header file are marked in the list. To add a parameter to header file, you must check the appropriate check button on the left side of the window. For removing parameter from the header file must be unchecked. When adding a new parameter, its description introduced simultaneously in two languages.

To see only chosen parameters provided after selecting press the **Selected only** radio button. For ease of navigation through the list the user can navigate to the corresponding group of analog parameters or discrete signals (depends from provisions switch), choosing it from drop-down list at the bottom of the window.

After right-clicking anywhere in the list, a standard window appears, allowing you to implement search via template.

Each parameter has its own **unique identification number** by which it is selected for use in graphic forms, standard tasks, express analysis algorithms, etc. For predetermined parameters, the number given by **program developers** and determined in the file **param.txt** (or in another selected in the field **Gen. List in tab Passport, Common data**), which supplied with the system. Changing the ID numbers of predefined parameters **is not recommended**. User may change parameter descriptions (Name, designation and etc.) by his discretion.

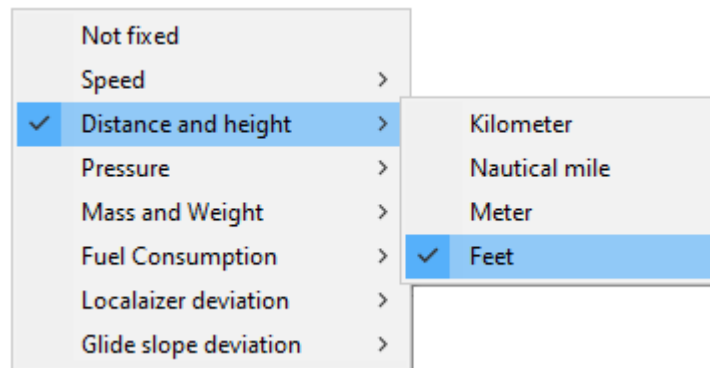
*Note: Every time you press button **OK** in the window **Generalized parameters list** (Drawing 9.3) program changes all parameters attributes, using values defined in the list. To save changes to parameter attributes made earlier, check switch **Do not update already introduced parameters**.*

User can enter new parameter manually, choosing corresponding point of the pop-up menu (Figure 9.2) and defining the type of parameter added. The new parameter will be added before the current. It's identification number will be generated automatically. User may change parameter identification number, the uniqueness of the entered number will be provided automatically. At adding parameter manually it is also necessary to assign it's Short name,

Name and etc. For switching the language of descriptors press button **R** or **E** and enter description of parameter in another language.

*Note: pressing of described buttons leads only to **temporary** change of language to input parameter descriptions. Activation of one or another language when displaying parameters on the screen or printing will happen after selecting the language for the systems in general (Section 5.3).*

Separately, it is necessary to dwell on the **Unit** field. Right-clicking on this the field displays a pop-up menu (Figure 9.4), the items of which define the physical entity of parameter for which the physical unit is introduced. By default it has the state "**not fixed**". In this case, the value of the field can be changed by the user arbitrarily. Fixation of Unit (physical entities) of any parameter leads to blocking given fields and to impossibility of changes of it's values manually (arbitrarily). Text fields at this displayed in dark-blue font. After fixing parameter Unit in the plot view window it's instantaneous recalculation (display) to another units measurements will be available (chapter 10.2.5).



Drawing 9.4

Sometimes it is necessary to hide the display of a parameter in a certain area. For example, a number of parameters may be recorded incorrectly when engines are turned off. In this case, you can use the **Displaying flag** field and set the event ID (discrete signal - registered or evaluated), at appearance of which parameter will Not be displayed. The selection of the identifier of a discrete signal occurs in an additional window that opens after double-clicking with the left mouse button on this field. After setting the ID of a discrete signal clicking the left mouse button on the field header sequentially changes the character [-] to [+], which corresponds to absence of display (or display) parameter at availability of selected discrete signal.

Checked state of the **Do not display** check box (Section 3.4.1) located to the right of the field of color setting, informs the program that the current parameter is a service (intermediate) and it is not necessary to display it in the list of parameters for viewing. The switch allows to hide those parameters values which not informative themselves and are used only for storage of values of intermediate values while carrying out calculations.

The checked state of the **UDP Export** switch (Section 3.4.1) prepares the parameter for export to other applications from the chart view window via UDP protocol. UDP protocol settings carried out in window **Network connection settings** (Section 7.1).

Deleting the current parameter is done with the **Del** key or by selecting the appropriate item in pop-up menu (Figure 9.2).

At the upper level all the parameters are divided in three types: analog parameters, discrete signals and audio streams. In turn, analog parameters are subdivided into "**Analog #1**" and "**Analog 2**", and discrete signals to "**Discrete #1**" and "**Discrete #2**". Parameter type selection is carried out in the field **Type** in tab **Parameters**.

Regardless from parameter type it has a **Short name** (not more than 16 characters), **Name** (full name) and unique identification number. Field **Color** indicate colors to display parameter in modes "**Plot for analysis**" (Section 3.3) and "**Plot for printing**" (Section 3.3.5). Click right button on this field and an affirmative answer to the proposed question allows you to automatically set the colors of all the parameters contained in the header. Using this field to change the color of that or another parameter recommended only at creation of the header. Ways of fast changes of parameter colors in the process of work with graphs are described in Section 10.2.2.

9.1.3. Tab Addresses

Addresses tab (Section 3.4.3) defines the parameter information addresses and the position of the parameter failure mark. In case the parameter is recorded more than one time per second (vertical acceleration, etc.), it is necessary to specify addresses for each sample in the frame. Adding lines is produced with the **Ins** key and their removal by key **Del**.

Address parameter – it is a position inside the recorded data frame. Usually the parameter address is assigned in accordance with the position of information word which has a fixed length of 16 bits (2 bytes). The address of the first information word in a frame is always 1. For recording systems where addresses start with zero add one to every address number. The program also allows assigning addresses with a tolerance of 1 bit.

***Note:** The maximum number of samples per frame for each parameter is 32.*

The parameter sampling moment can be specified either by the actual offset in bits from the start of the frame, or its address in the header, measured in 8, 16 or 32-bit words. Form of parameter sampling setting depends on the switch in the field **Address type**.

***Note:** The **Address type** switch is disabled for the predefined FDR types with regular frame structure. Addresses must be set in 16-bits words for those types.*

In most cases it is recommended to use the second way - to set word address in data frame, as it is comfortable and allows to avoid mistakes in calculations bias in bits.

The first way to specify an address (offset in bits) is used for data files with **arbitrary** frame structure if this type is selected on the **Common data** page. If you change the **Address type** switch the program recalculates addresses from one form to another automatically.

The next column (**Offset, bits from word beginning**) contains an order number of the first information bit inside the information word for the current parameter. Indexing starts from zero.

Bias of parameter failure mark in bits starts from the word given in relevant graph. Maximum possible length of information words recorded within the frame structure is 12 bit, so way bits 13-16 remain free and may be used for this goals.

Most of the recording systems provide registration of some parameters not in each subframe. In such a cases a number of subframe, where parameter recorded is to be set. If parameter is logged in every subframe this field equals to 0. Additionally it is necessary to indicate whether the order number in the frame or in the superframe introduced number applies. If selected recorder doesn't require subframes the given field becomes inaccessible for input.

Data structure of contemporary flight data recorders consists of frames, subframes and superframes. Any frame consists of 4 subframes. Any superframe consists of 16 frames.

Slowly changing parameters are recorded in superframes (for example flight weight). On **Figure 9.5** an example shows setting the parameter address for such a registration. In the subframe # the field present formula kind of **Y/X**, where **X** is an order number of a frame in a superframe (from 0 to 15), and **Y** - order number of a subframe in a frame (from 1 to 4). Allowed also usage of designs kind **Y/X+D** (as on figure). It applied in cases when parameter is recorded few times in a superframe. IN this case **D** defines bias of next moment of registration measured in frames and counted from the given address. For example, if **D=8**, then the program will automatically add 8 frames to the given address until the sum exceeds **15**. **Attention**, if using this way tasks addresses, make sure that in tab **Passport**, **Common data** the parameter defining current number frame in superframe is defined.

Header editor (Aircraft actual gross weight)

Parameters | Calibration tables | **Addresses** | Frame map | Passport, common data | Flight path parameters | Express-Analysis | History

Address properties

Inform. word, bits from word beginning	Offset, bits from word beginning	Failure mark, bits from word beginning
1021	0	12

Subframe # (0-for all the subframes)

4 / 2+8

☒ In Frame ☐ In Superframe

Address type

☐ Offset (bits)

☐ 1-bytes word

☒ 2-bytes word

☐ 4-bytes word

Sample time

☐ Equal in frame

☒ On position in frame

OK Cancel Print Param.list

28.10.19 13:42:50 (key=1)

ID	Parameter
676	Sec
678	Day
1998	Month
1999	Year
877	GW
2901	FLT.1
2902	FLT.2
2903	FLT.3
2904	FLT.4
2905	FLT.5
2906	FLT.6
2907	FLT.7
2908	FLT.8
2931	FROM.1
2932	FROM.2
2933	FROM.3
2934	FROM.4
2946	TO.1
2947	TO.2
2948	TO.3
2949	TO.4
2961	REG.1
2962	REG.2

Drawing 9.5

9.1.4. Tab Frame map

This page lets you view the distribution of the parameters inside the frame according to the current header and check the correctness of the specified addresses and offsets. Each information word is presented by 16 horizontal lines which represent particular bits. Words are counted by columns top down. The address and short name of the word currently located below the cursor are displayed in the bottom part of the window. The offset of the current bit (from word beginning) is also displayed.

The current subframe number must be specified in the appropriate filed for the FDRs that have subframes recording structure. Specifying 0 value means that only parameters registered in each subframe will be displayed.

Note: Regardless of the FDR type only registered analog parameters and On/Off signals will be displayed on this page. The calculated parameters of different types will not be shown.

Color coding is used to display different type of parameters. The analog parameters are displayed in blue color. If a sign bit (type **analog, not calibrated/digital code**) or bits that define the number of the current octant (type **analog, calibrated/several calibration branches and branch number**) are present they will be displayed by light blue color. The one-bit On/Off signals are displayed in green color. The On/Off signals of the UKR type are displayed like analog parameters in blue color. Failure mark positions are displayed in light green color. Empty bits are white. If the program finds conflicting addresses or bits then these parameters will be shown in yellow color. Double click on this parameter to display the list box (near the **subframe #** field) that will contain short names of the conflicting parameters. Currently selected parameter is shown in red color. If the selected parameter is registered more than one time per frame all the addresses will be shown in red. You may use either way to select the parameter: select its short name from the conflicting parameter list (if any) or from the list in the right part of the window or double click on the graphical representation of the parameter.

9.2. Analog parameters types

9.2.1. Analog #1

When this type of parameter is selected the **Header Editor window** takes the form shown on **drawing 9.6**.

The screenshot shows the 'Header editor' window for the parameter 'Left engine exhausted gas temperature'. The window has several tabs: 'Parameters', 'Calibration tables', 'Addresses', 'Frame map', 'Passport, common data', 'Flight path parameters', and 'Express-Analysis'. The 'Parameters' tab is active.

Fields in the 'Parameters' tab include:

- Short name: EGT.1
- Name: Left engine exhausted gas temperature
- ID: 761
- Precision: 0
- Unit: °C
- Colors: Lime (selected), Red
- Displaying flag [-]:
- Do not display: ☐
- UDP export: ☐
- Parameter type: Analog #1 (selected), Analog #2, Discrete #1, Discrete #2, Sound stream
- Analog type #1: One calibration branch (selected)
- Analog #1 (One calibration branch):
- Bits in information word: 12
- Sign: ☐

At the bottom, there are buttons for OK, Cancel, Print, and Param.list. A status bar at the bottom left indicates 'Last changes: 09.03.23 (#1)'.

On the right side, there is a list of parameters with their IDs and names:

ID	Parameter
533	AP.YAW
751	NR
752	NG.1
753	NG.2
761	EGT.1
762	EGT.2
771	P.CO.1
772	P.CO.2
781	THR.1
782	THR.2
801	T.O.GB
1301	TFM.L
1302	TFM.R
1303	TFM.L.1
1304	TFM.R.1
1305	TFM.L.2
1306	TFM.R.2
1311	U.FA.L
1312	U.FA.R
1313	U.FA.F
1314	U.FA.B
1331	TFM.A.L
1332	TFM.A.R
1333	TFM.A.F
1334	TFM.A.B
1401	FF.LV
1402	FF.FA
1403	FF.OL.1
1404	FF.OL.2
1405	FF.OL.3

Drawing 9.6

First it is necessary to choose the type of **analog parameter** from dropdown list in relevant field and to set the Number of bits in information word (field **Bits in information word**). The number of bits in the information word depends on the type of FDR and aircraft.

Switch **Sign**, in the checked state, signals to the program that at the given address (from number of marked bits) is the number represented in a **complement code**. Such a representation applied for transcript of parameters of **synchro** type, when code meaning may be negative, and zero - in the code expression does not coincide with the zero of the physical value of the parameter. IN this case usage of standard design (weight junior/senior bit and sign in senior bit) is impossible, and code meaning parameter translated in physical with the help of graduations.

9.2.1.1. One calibration branch

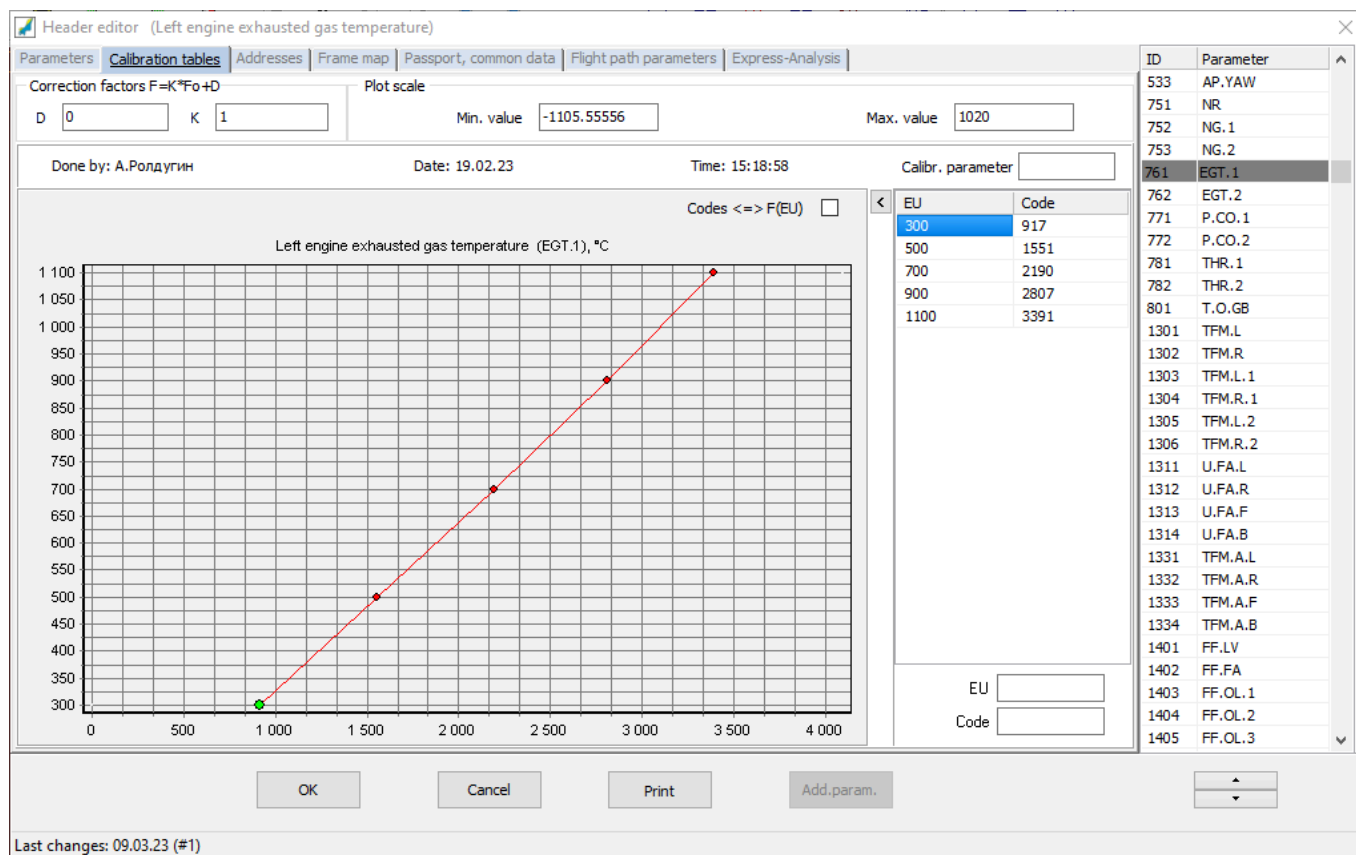
Parameter calibration characteristic is given on tab **Calibration tables** (Drawing 9.7). Service information about by whom and when last changes to the calibration were made is presented in the information line (in the middle part of the window).

The **Calibr. parameter** field (if it is not empty) contains a short name of a parameter that will be used as a calibration parameter for the code values of the active (selected) parameter. The meaning of a calibration parameter is that code values of the registered parameter for which a calibration parameter is defined, before a calibration table is applied, will be divided by the calibration parameter value and multiplied by 100%. In that case, the program will automatically consider the corresponding calibration table to be specified in percent. To specify a calibration parameter you have to use a list that appears after left clicking on the **Calibr. parameter** field. Use **Del** key to delete a calibration parameter.

The calibration is defined in a form of a table. To add a line (a new calibration point) to the table press **Ins** key when the cursor (input focus) is in the table of the calibration points. To delete the current line (the current calibration

point) from the table press **Del** key. By default, the **Code** column shows the code values of the calibration points. Left click on the caption of the column to change to the percents. Left click once again to return to codes.

Attention, if the table contains empty lines the calibration chart will not be displayed. To have it displayed delete all empty lines. The software will automatically delete empty lines when leaving the calibration input mode (input focus change).



Drawing 9.7

Graphical representation of the calibration table will be changing in accordance with adding or modification of the calibration points. The current point is plotted in green color. By default, engineering unit values are presented as a function of code values. Using **Codes=F(EU)** switch you can change it vice versa that is EU values will be along X-axis and code values will be along Y-axis.

The "<" button located near to the **Codes=F(EU)** switch allows to display two additional columns in the table that contain the value of the calibration knots in "forward" and "backward" direction. **Attention**, the program *always* uses *the average calibration values*. The "=" button that appears simultaneously allows you to calculate the average values of the calibration knots. If some values are absent in the "forward" or "backward" columns then the value from the other column will be taken. If both columns are empty no change of calibration will happen.

Right mouse button click will cause the menu for import and saving of all the calibration characteristics. Printing of parameter calibration will be possible only if the printer context is chosen in Printer settings.

To print a header along with all the calibration tables click **Print** button when one of the pages **Parameter**, **Calibration table** or **Addresses** is active and **MS Word** or **LibreOffice Writer** processor will automatically create file and it will appear to help you in printing. Press **Esc** key to abort printing. The legend of all the conventions is located at the end of the file. The values of the most significant or least significant bits for the parameters of the **digital code** (Section 9.2.2.2) type are given after **MSB** or **LSB** labels correspondingly. If the **Express-analysis** page is active when the **Print** button is clicked then express-analysis algorithms will be printed (Section 12).

The program allows the user to calculate the code value from the engineering unit value and vice versa using the current calibration. You just have to input a value in **Code** or **EU** field. The program will calculate the corresponding value and plot it in blue color.

Additionally, this page lets the user set correction factors of a parameter and a way it is presented on the screen. Correction factors are applied to the value received after calibration table applying before plotting the parameter on the screen. They let to change a parameter by multiplication of any value (coefficient **K**) and to move a parameter by

addition of any value (coefficient **D**). The **K** coefficient is 1 and the **D** coefficient is 0 by default that is a parameter value is not changed. The **D** coefficient may be used to eliminate static error of the parameter. The **K** coefficient may be used to change a slope of the calibration or to convert for example speed values from km/h into m/sec or knots. Together the coefficients may be used for calculating the true angle of attack values from the local angle of attack values.

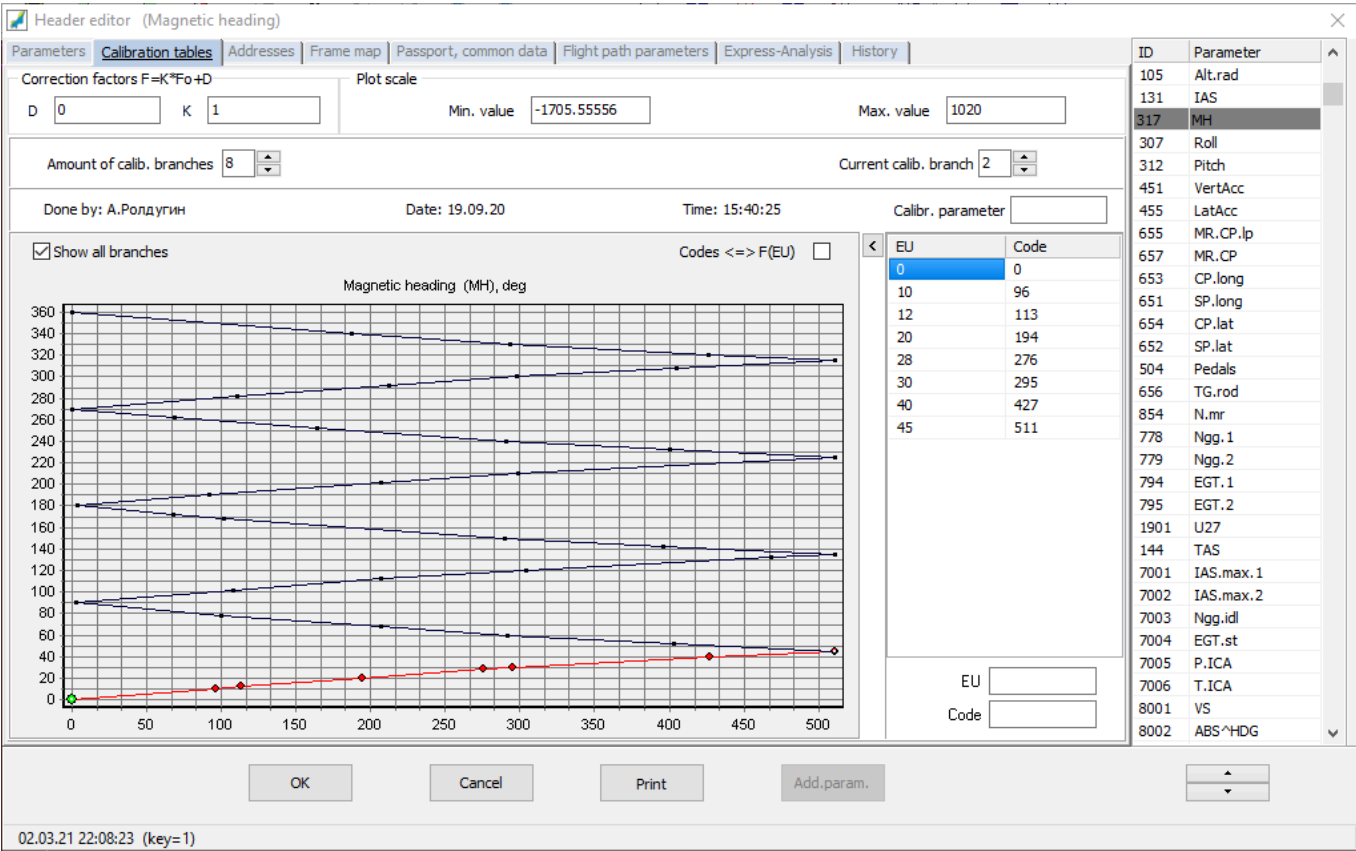
Additionally this page allows the user to set the minimum and maximum values of the parameter (in engineering units) at the top and bottom boundaries of the analog parameters field that will be shown on the screen that is to determine vertical scale of the parameter. The given function has actually an information purpose because it is better to use the other methods (Section 10.2.7) to change the scale of the parameter. However, these fields may be used to precise manual adjustment of the scale of the parameter.

There is an important nuance associated with using this field to adjust the scale when *the first* appearance of the parameter graph on the screen (after adding a new parameter to the header file). After adding new parameter it is important to make sure, that minimum and maximum values of parameter are not equal to 0 *at the same time* , because, in this case, the program will not be able to change the scale of the parameter in ordinary way.

9.2.1.2. Several calibration branches and branch number

Parameters of given type could be met in data frames of aircraft with FDRs BUR-1 and BUR-3. The value of the **bits in information word** field on the **Parameter** page will be 9 in this case, and the **Graduation** tab will accept view, submitted on drawing 9.8. The user has to specify a number of calibration branches and calibration points for each branch (first branch has number 0). In case not all the branches are used for calibration nevertheless the amount of branches must be 8 and it is recommended to specify two arbitrary points (for example 0->0, 1->1) for all the branches that are not used. Select the appropriate switch to view all the branches at the same time. The current branch will be plotted in red color.

Recommendation: You have to assure correct switching from one calibration branch (octant) to another. It is very often that documents with the calibration tables do not contain engineering unit values for the boundaries of the octants (codes 0 and 511) but those values **must be** specified in calibration. If those points are not defined the physical values won't be calculated correctly on octants boundaries.



Drawing 9.8

9.2.1.3. Several calibration branches and coarse parameter

Parameters of this type are found in the aircraft data frame with the FDR MSRP-256. On the tab **Parameter** user is to set of rough parameter to which the calculation will be conducted. It is selected from the **Select parameter** list (Drawing 9.1), that appears after left clicking on the **Coarse parameter** field (Drawing 9.9).

Header editor (Pressure altitude)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis | History

Short name: ALT.P | Name: Pressure altitude | E

ID: 101 | Precision: 0 | Unit: m | Colors: Red, Navy | Displaying flag [-]: | ☐ Do not display | ☐ UDP export

Parameter type:
☒ Analog #1
☐ Analog #2
☐ Discrete #1
☐ Discrete #2
☐ Sound stream

Analog type #1:
Several calib. branches and rough parameter

Analog #1 (Several calib. branches and rough parameter):
Bits in information word: 8 | Sign: ☐ | Rough parameter: ALT.P_rgh

OK | Cancel | Print | Param.list

02.03.21 22:08:23 (key=1)

Drawing 9.9

Note: The list is made from the parameters that are already added to the header. Thus, the desired parameter has to be included in the header in advance.

The **Calibration table** tab for this type is shown on Figure 9.8. The amount of calibration branches and calibration points for each branch has to be specified (first branch has number 0). Select the appropriate switch to view all the branches at the same time. The current branch will be plotted in red color.

9.2.1.4. Two calibration branches and Discrete signal

Parameters of this type are found in the aircraft data frame with the FDR MSRP-64. On the tab **Parameters** (Figure 9.10), the user needs to set the identifier of a discrete signal, by which it will be carried out switching of branches. For the choice use list from window **Select parameter** (Drawing 9.1), emerging after mouse clicks on the field **On/Off signal**.

Header editor (Indicated airspeed)

Parameters Calibration tables Addresses Frame map Passport, common data Flight path parameters Express-Analysis

Short name: IAS.DPSM Name: Indicated airspeed E

ID: 132 Precision: 0 Unit: km/h Colors: Teal Navy Displaying flag [-] ☐ Do not display ☐ UDP export

Parameter type: ☒ Analog #1 ☐ Analog #2 ☐ Discrete #1 ☐ Discrete #2 ☐ Sound stream

Analog type #1: 2 calib. branches and On/Off signal

Analog #1 (2 calib. branches and On/Off signal)

Bits in information word: 8 IAS < 490 On/Off signal ☐ Sign ☐

OK Cancel Print Param.list

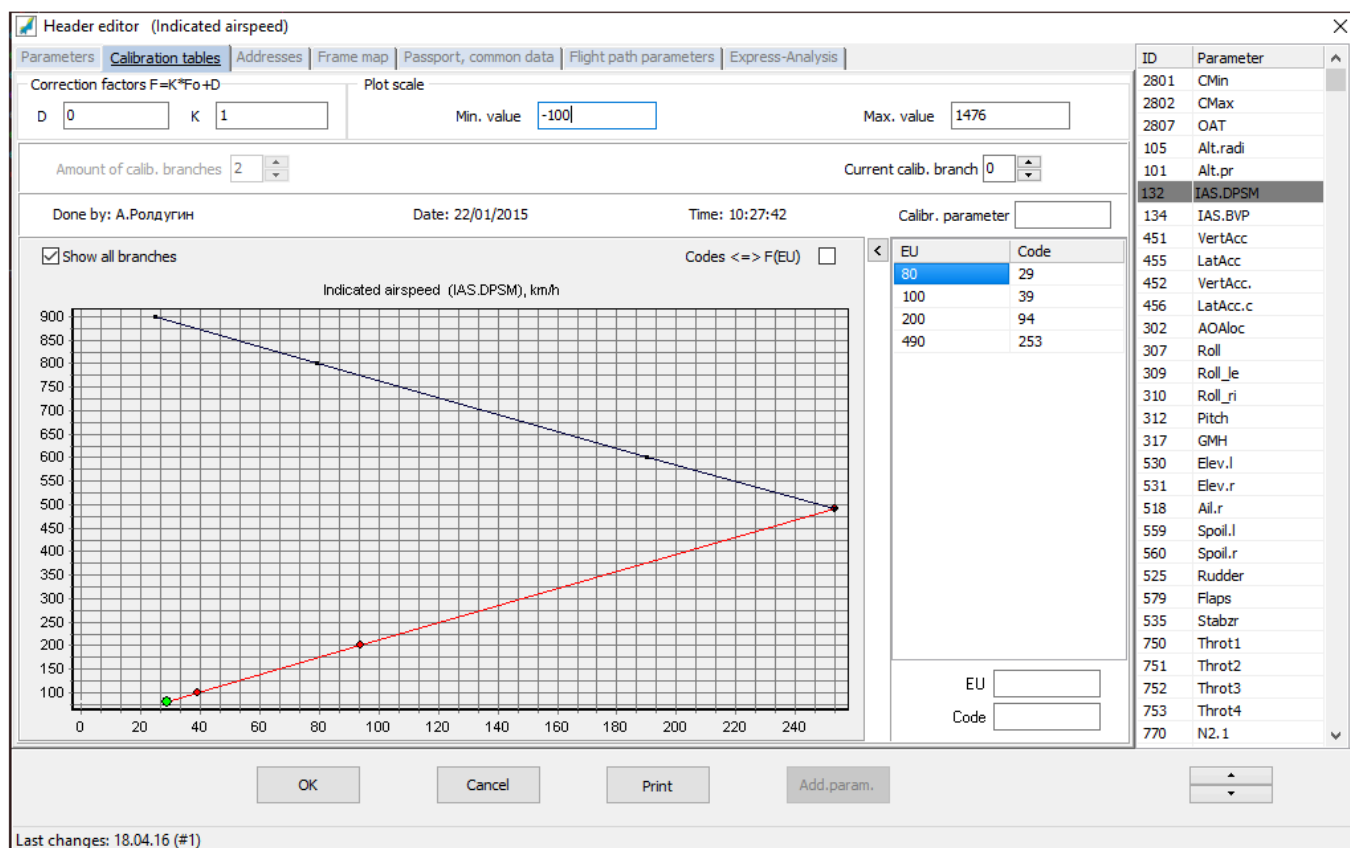
Last changes: 18.04.16 (#1)

ID	Parameter
105	Alt.radi
101	Alt.pr
132	IAS.DPSM
134	IAS.BVP
451	VertAcc
455	LatAcc
452	VertAcc.
456	LatAcc.c
302	AOAloc
307	Roll
309	Roll_je
310	Roll_ri
312	Pitch
317	GMH
530	Elev.l
531	Elev.r
518	Ail.r
559	Spoil.l
535	Stabzr
750	Throt1
751	Throt2
752	Throt3
753	Throt4

Drawing 9.10

Note: The list is made from the parameters that are already added to the header. Thus, the desired On/Off signal has to be included in the header in advance.

Tab **Calibration** in this case presented on **figure 9.11**. The amount of the calibration branches will be set automatically and the user has only to specify calibration points for each brunch. Select the appropriate switch to view both branches at the same time. The current branch will be plotted in red color.



Drawing 9.11

9.2.1.5. Piece-wise linear function of one argument

This type of **calculated** parameter is used for piece-wise linear approximation of functions of one argument. On the **Parameters** tab (Figure 9.12) you need to set the parameter identifier, which will serve as an argument.

Header editor (VFE speed [AFM 02-06-4])

Parameters Calibration tables Addresses Frame map Passport, common data Flight path parameters Express-Analysis

Short name: VFE Name: VFE speed [AFM 02-06-4] E

ID: 7003 Precision: 1 Unit: kt Colors: Silver Custom... Displaying flag [-]: Do not display UDP export

Parameter type: ☒ Analog #1 ☐ Analog #2 ☐ Discrete #1 ☐ Discrete #2 ☐ Sound stream

Analog type #1: Piecewise linear function of 1 argument

Analog #1 (Piecewise linear function of 1 argument): FLP.SLT Argument

Parameter list:

ID	Parameter
2491	ISU.EVS
2501	CVS1.MOD
2502	CVS2.MOD
7001	VMO
7002	MMO
7003	VFE
7004	VS
7005	POIL1.<
7006	POIL2.<
7007	^FQTY
9951	Hqfe.dep
9952	Hqfe.des
9953	SPD.SEL
9954	SPD.LIM
9955	ROLL.ABS
9956	SAT
9957	FQTY.W
3001	M.WARN
3002	M.CAUT
3005	EVENT
3006	I.MRK
3007	M.MRK
3008	O.MRK
3011	PTT.1
3012	PTT.2
3013	PTT-1
3014	PTT-2
3015	PTT-3
3031	WOW
3032	WOW.N

OK Cancel Print Param.list

Last changes: 11.04.22 (#1)

Drawing 9.12

For this type of parameter, on the **Calibration** tab, in the **Code** column, physical values are entered and in the field **EU** - values functions.

9.2.1.6. Piece-wise linear function of two arguments

The type parameter is different from previous only in quantity of arguments. On tab **Parameters** it is necessary to set identifiers of two parameters, which will serve as arguments.

On tab **Calibration** it is necessary to set the quantity of branches, that is actually the number of interpolation nodes by the second argument, and then, setting the nodes of the second argument in corresponding field, enter the dependence of the function on the first argument at a fixed meaning of the second. To view all branches on the chart at the same time, select corresponding switch. Current branch in this case will rendered red color.

9.2.2. Analog #2

9.2.2.1. Real number

This type is automatically assigned to the parameters of **additional streams**. For **arm** files it will be a 4-byte real number, and 8-byte for **armx** files. Direct addressing in the frame of 4-byte real numbers is also possible.

9.2.2.2. Digital code

After choice of this type the tab **Parameters** will look like on drawing 9.13.

Drawing 9.13

This type is widely used on modern recorders made according to the **ARINC standard 429/573/717**. In the field **Digital code** it is necessary to set bits informational words, which will participate in formation of parameter values, and in the field **Code type** choose the way of coding data. Choice of bits is carried out by corresponding switches. After selecting all used bits it is necessary to set the weight of junior *or* senior bit in relevant field. Switching carried out by pressing left buttons on the header fields. In the field **Sign** indicate the number bit in which the sign is encoded. At absence of sign – it is to be set as **no**. Parameter may consist from two successively located information words. In this case used bits are chosen from 32-bit words and 16 bit word which used as junior is indicated, so as in some cases recording systems write down senior word first and then junior. On tab **Addresses** the address of the first by order 16 bit information word is to be set.

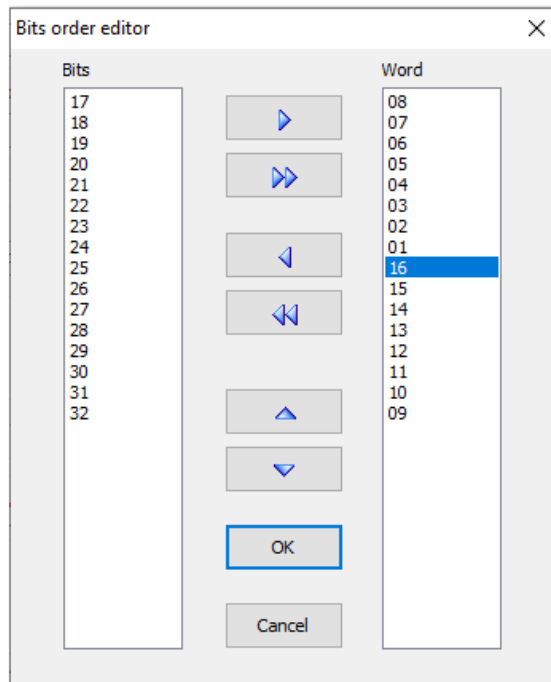
***Note:** If there is a sign bit, its number is excluded from the set of bits that determine parameter value, that is, with the parameter type specified in the sequence diagram 12-bit signed, it is necessary to mark first eleven bits and to indicate the sign located in 12 bit.*

***Note:** Some FDRs assume that at the maximum possible code meaning of parameter (for example 511 at 9-bit informational word) the physical meaning will equals to 0. For correct display of such a parameters it is necessary to mark switch **MAX=0** in the field **Transformations**. At noted switch **1/x** in the field **Transformations** final result of decoding will be reversed.*

In field **Bits order** an order of "assemblies" of bits informational words is provided. Possible variants are:

- words in frame are located in sequences junior-senior (**01...16 -> 17...32**);
- words in frame are located in sequences senior-junior (**17...32 -> 01...16**);
- **arbitrary** choice bitwise sequences from 32-bit bit array.

Right-clicking on the **Digital Code** field with the last option will display dialogue window Bits order editor (Drawing 9.13.1) which allows to implement "assembly" of information words.



Drawing 9.13.1

After setting of all used bits on tab **Addresses** samples addresses and positions of failure marks could be set up.

Choice in the field **Code Type** will allow to execute decoding parameters in **binary decimal code (Dec-Bin)** and **On/Off signals word**. **On/Off signals word** (Drawing 9.14) reflects group (word) of discrete signals as a level of analog parameter. Meaning of the given parameter is in the volume that each bit of the word corresponds to its own discrete signal, while the combination of bits doesn't define a discrete signal.

Click right button on field **Digital code** leads to display window **Editing On/Off signal words** (Figure 9.15), which specifies the names of discrete signals in relation to bits words registration. Titles are given through input of desired text after double clicks left button on the selected line.

Header editor (FLAP SLAT CONF COMMAND)

Parameters Calibration tables Addresses Frame map Passport, common data Flight path parameters Express-Analysis

Short name: FLP.SLT Name: FLAP SLAT CONF COMMAND E

ID: 572 Precision: 0 Unit: Colors: Aqua Maroon Displaying flag [-] Do not display UDP export

Parameter type: Analog #1 Analog #2 (selected) Discrete #1 Discrete #2 Sound stream

Analog type #2: Digital code

Analog #2 (Digital code)

Bits: 01 -> 16: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Bits: 17 -> 32: 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Code type: On/Off signals word (selected)

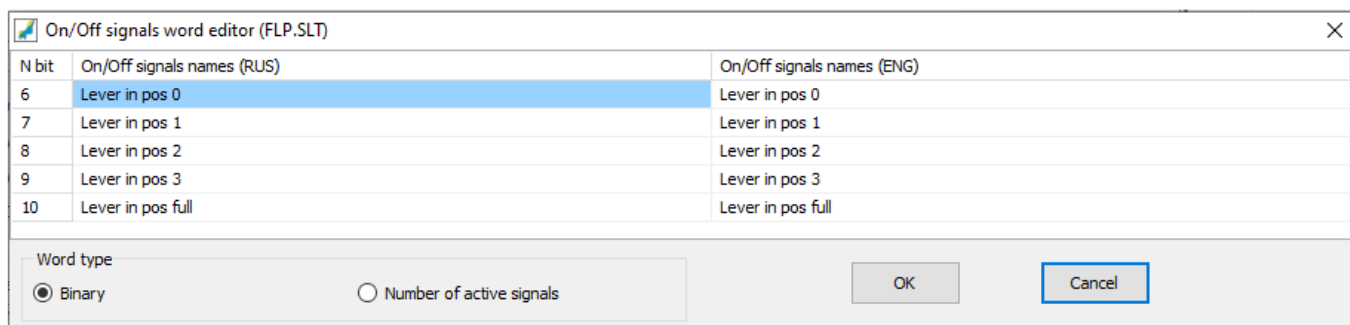
On/Off signal name: Lever in pos 2

OK Cancel Print Param.list

Last changes: 05.12.12 (#1)

ID	Parameter
183	L.DEV.1
184	L.DEV.2
185	G.DEV.1
186	G.DEV.2
451	NRM.ACC
452	LON.ACC
453	LAT.ACC
501	P.CTRL.L
502	P.CTRL.R
503	P.CTRL
504	ELEV.L
505	ELEV.R
521	L.CTRL.L
522	L.CTRL.R
523	L.CTRL
524	AIL.L
525	AIL.R
542	RUDDER
601	STAB
570	FLAPS
571	SLATS
572	FLP.SLT
550	SPL.1.L
551	SPL.2.L
553	SPL.4.L
554	SPL.5.L
560	SPL.1.R
561	SPL.2.R
562	SPL.3.R
564	SPL.5.R

Drawing 9.14



N bit	On/Off signals names (RUS)	On/Off signals names (ENG)
6	Lever in pos 0	Lever in pos 0
7	Lever in pos 1	Lever in pos 1
8	Lever in pos 2	Lever in pos 2
9	Lever in pos 3	Lever in pos 3
10	Lever in pos full	Lever in pos full

Word type
☒ Binary ☐ Number of active signals

OK Cancel

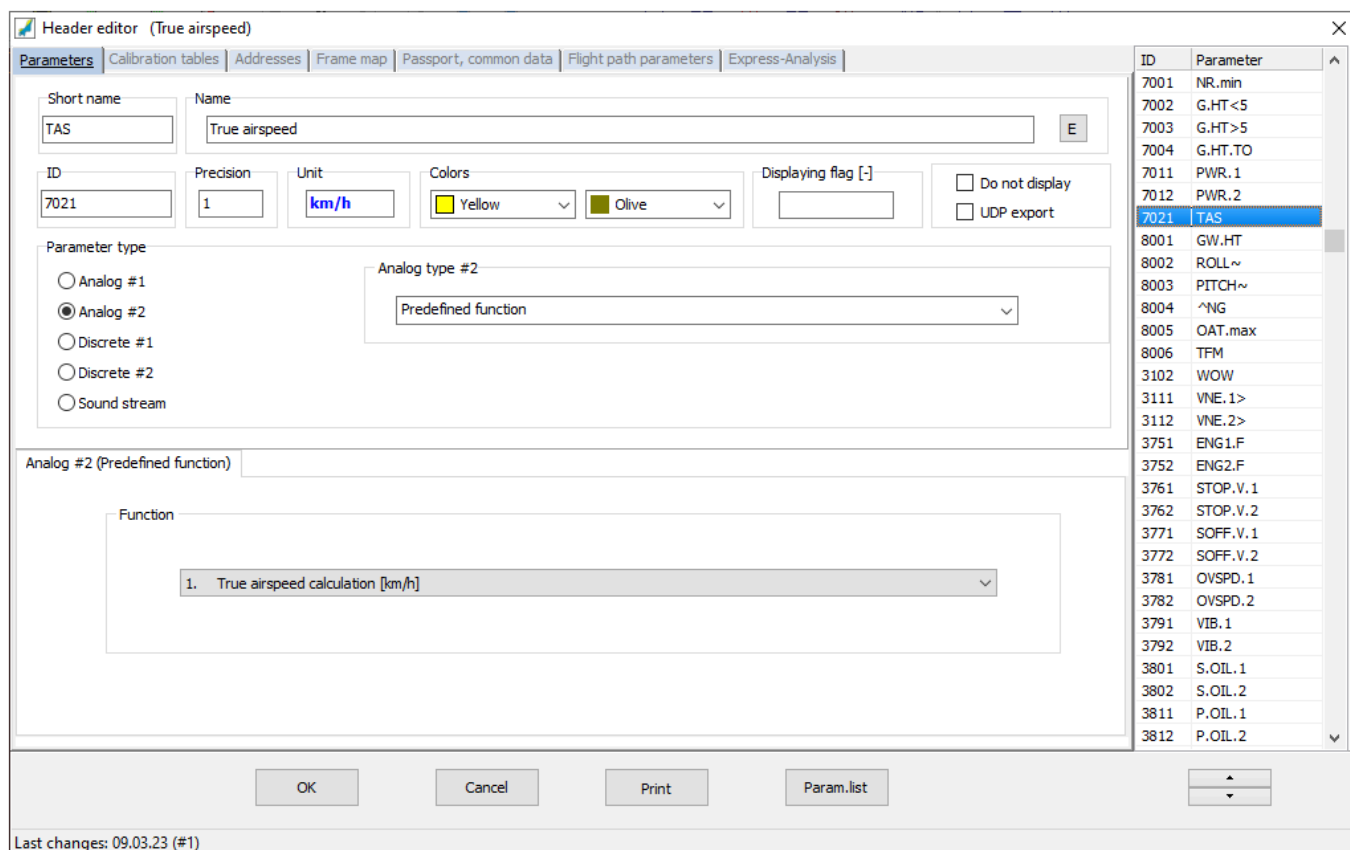
Drawing 9.15

Ways of use of On/Off signal words are given in Sections [10.2.5](#) and [10.11](#) for modes **Plot for analysis** and **Plot for printing** respectively.

9.2.2.3. Predefined function

This parameter type is a function predefined by the **WinArm64** developer which parameters are set by the user. An example is the calculation of the true airspeed based on IAS and barometric altitude (Figure 9.16). In this case, on the tab **Addresses** parameters identifiers, participating in calculation and constant values necessary are set (Figure 9.17).

The program allows specifying three types of values in any of the fields: parameter name from the current header, passport field number or constant value. To specify a parameter name or number fields of passport twice click left button on the required line column **Selected** and in emerging window select the parameter name or the passport line number. To set a constant select the desired row of the Selected column with the left mouse button **and** again, after a short pause, click on it with the same left button. The program will enter data entry mode and the screen will display field input. After definition of parameters program notes options from header by red marker, passport fields - green and constants – gray color.



Header editor (True airspeed)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: TAS Name: True airspeed E

ID: 7021 Precision: 1 Unit: km/h Colors: Yellow Olive Displaying flag [-]: Do not display UDP export

Parameter type:
☐ Analog #1
☒ Analog #2
☐ Discrete #1
☐ Discrete #2
☐ Sound stream

Analog type #2: Predefined function

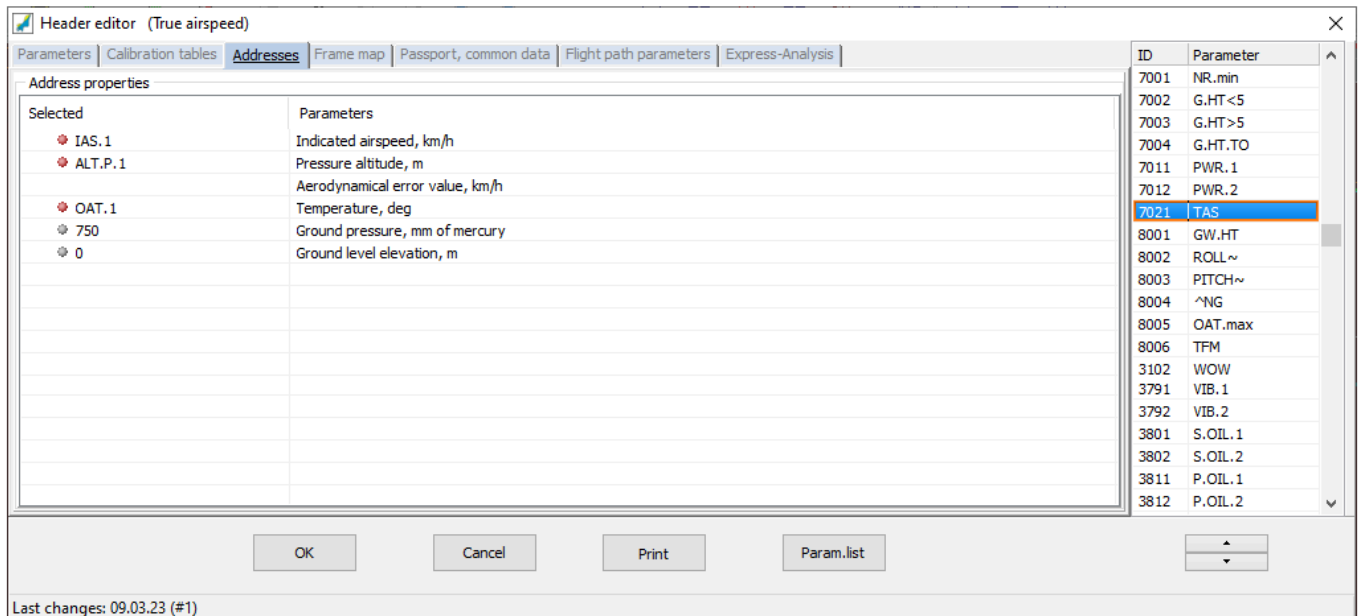
Analog #2 (Predefined function):
Function:
1. True airspeed calculation [km/h]

ID	Parameter
7001	NR.min
7002	G.HT<5
7003	G.HT>5
7004	G.HT.TO
7011	PWR.1
7012	PWR.2
7021	TAS
8001	GW.HT
8002	ROLL~
8003	PITCH~
8004	^NG
8005	OAT.max
8006	TFM
3102	WOW
3111	VNE.1>
3112	VNE.2>
3751	ENG1.F
3752	ENG2.F
3761	STOP.V.1
3762	STOP.V.2
3771	SOFF.V.1
3772	SOFF.V.2
3781	OVSPD.1
3782	OVSPD.2
3791	VIB.1
3792	VIB.2
3801	S.OIL.1
3802	S.OIL.2
3811	P.OIL.1
3812	P.OIL.2

OK Cancel Print Param.list

Last changes: 09.03.23 (#1)

Drawing 9.16



Drawing 9.17

9.2.2.4. SRTM data type

RTM data type (Shuttle radar topographic mission) is one of the variants of the data type **predefined function** And is a digital model of earth surface relief, prepared by NASA based on the results of radar interferometric survey from the space ship "Shuttle". Data is free to use. **WinArm64** uses data with resolution of 3 corner seconds (SRTM 3).

Data is stored in files in form of matrices. Every file stores data on relief for the range of 1 degree in latitude and longitude. Files are identified by name, for example a file named **N 57 E 037.hgt** contains elevation data in the range of 57-58 degrees north latitude and 37-38 degrees east longitude. Files for the required areas of the earth's surface must be previously saved by user in subdirectory **SRTM** of the main programs directory. Download of files can be done from here (for example) http://dds.cr.usgs.gov/srtm/version2_1/SRTM3/.

After creating an **SRTM type parameter**, on the **Addresses tab**, you are to specify identifiers Latitude and Longitude of flight from the current Header.

Further work with the parameter doesn't differ from the standard one.

9.2.2.5. Algorithm Interpreter

This type is used to describe parameters whose values are results of logical and/or arithmetical calculations. Both registered and calculated parameters may be operands in the equation that defines the value of the parameter. The **Parameter** page is presented on the Drawing 9.18.

Header editor (Static Air Temperature (calc))

Parameters Calibration tables Addresses Frame map Passport, common data Flight path parameters Express-Analysis

Short name: SAT Name: Static Air Temperature (calc) E

ID: 9956 Precision: 1 Unit: °C Colors: Yellow Custom... Displaying flag [-]: Do not display UDP export

Parameter type: Analog #1 Analog #2 (selected) Discrete #1 Discrete #2 Sound stream

Analog type #2: Algorithm interpreter

Analog #2 (Algorithm interpreter)

A[+]	TAT	MACH.1
B		

(a1+273.15)/(1+0.2*a2*a2)-273.15

OK Cancel Print Param.list

Last changes: 11.04.22 (#1)

ID Parameter

- 7002 MMO
- 7003 VFE
- 7004 VS
- 7005 POIL.1. <
- 7006 POIL.2. <
- 7007 ^FQTY
- 9951 Hqfe.dep
- 9952 Hqfe.des
- 9953 SPD.SEL
- 9954 SPD.LIM
- 9955 ROLL.ABS
- 9956 SAT**
- 9957 FQTY.W
- 3001 M.WARN
- 3002 M.CAUT
- 3005 EVENT
- 3006 I.MRK
- 3007 M.MRK
- 3008 O.MRK
- 3011 PTT.1
- 3012 PTT.2
- 3013 PTT-1
- 3014 PTT-2
- 3015 PTT-3
- 3031 WOW
- 3032 WOW.N
- 3033 WOW.L
- 3034 WOW.R
- 3041 LG.H.UP
- 3042 LG.H.DN

Drawing 9.18

The user may specify up to 8 analog parameters and 8 On/Off signals that will be used in the calculations. Short names of the analog parameters should be specified in the **A** line and short names of the On/Off signals - in the **B** line. The parameters have to be selected from the **Select parameter** dialog (Drawing 9.19), that appears after double clicking on the appropriate field.

If an analog parameter is selected then the additional function that would be applied to the values of the parameter before using them in the equation may be selected in the bottom part of the window. The following functions may be applied:

- **Without additional conversion** – the values of the parameter denoted in engineering units will be used in the equation without any modifications.
- **Addition of the code values between registration instants inside a frame** – the sum of the absolute values of the additions of codes between registration instants of the parameter inside a frame will be used in calculations. This function is usually used to determine touch down moment in the express-analysis algorithms.
- **Median on the base interval** – the median of the values of the parameter denoted in engineering units will be used in the calculations. You have also to specify the base interval length **in seconds**.
- **Average value on a base interval** – the average of the values of the parameter denoted in engineering units will be used in the calculations. You also have to specify the base interval length **in seconds**.
- **Difference between two adjacent registration instants** – magnitude of the difference (in engineering units) between two adjacent registration instants in a frame or, if a parameter is registered once per frame, the difference of the values in two adjacent frames.

ID	ID	Name
292	BARO.42	Baro Setting 4 Coarse
221	WIND.S	Wind speed (FMS)
222	WIND.D	Wind direction (FMS)
231	LAT	Latitude (FMS)
232	LON	Longitude (FMS)
233	EPU	Estimated Position Uncertainty (EPU)
241	TAT	Total air temperature
242	T.PR	Total Pressure
243	D.PR	Impact/Dynamic Pressure

Without additional conversion

OK Cancel

Drawing 9.19

Click left button on header lines changes symbol "-", on symbol "+", further on symbol "#" and further by circle. If the "+" symbol is set then "registration instants" of the calculated parameter will match the registration instants of the **first** parameter in the corresponding line. Otherwise, the calculated parameter will be "registered" once per frame at relative time 0. If the "+" symbol is set in both **A** and **B** (Analog and Binary) lines then "registration instants" of the calculated parameter will match the registration instants of the first analog parameter as well as the first On/Off signal. If the "#" symbol is set then "registration instants" of the calculated parameter will match the registration instants of all the analog parameters and/or On/Off signals depending on which line (**A** and/or **B**) has the symbol installed.

After adding all the necessary parameters you have to specify the equation that will define the value of the parameter. You have to use the appropriate identifiers (a1, a2, b1 et cetera) instead of short names of the parameters. The interpreter does not differentiate between the capital and ordinary letters. **Important**, equation has to retrieve a numerical value but not a logical value.

The following logical and arithmetical operations and functions are supported by the interpreter:

Operator	Description
+, -, *, /	Arithmetical operations
$x \times 10^y$, $x \times 10^{-y}$	Scientific notation
abs()	Absolute value calculation
sin()	Sine, argument is in radians
sin_g()	Sine, argument is in degrees
cos()	Cosine, argument is in radians
cos_g()	Cosine, argument is in degrees
atan()	Antitangent calculation
asin()	Antisine calculation
acos()	Anticosine calculation
round()	Rounding of number
trunk()	Discard fractional parts
sqrt ()	Square root
exp()	Exponent calculation
x^y	Value X in power Y
ln()	Natural logarithm
PX.Y	The value with the order number Y (counting from 0) of the passport field (line) number X
=, <, >, <=, >=, <=	Logical operations
&	Bit operation «AND» if both operands are analog parameters
&	Boolean «AND» if operands are events or On/Off signals

v	Boolean «OR»
!	Boolean denial
min f, max f	Limiting the minimum and/or maximum values of the parameter by the f value.
an(m), bn(m)	The value of the analog parameter number n (n=1...8) or On/Off signal number n (n=1...8) at the position with m-seconds offset, where m is any number of seconds including negative and fractional.
anshlm, anshrm	Shifts the value of the analog parameter n (n=1...8) to the left or to the right on the specified number of bits (m).
a(x,y)	Unsigned integer that is calculated as a value of a word of y-bits length taken with x-bits offset counting from current frame beginning and LSB equal to 1.
an(<)	Retrieves the exact (without interpolation) value of analog parameter number n (n=1...8) which was registered at previous sampling instant. If the current time corresponds exactly to the sampling instant then the current value (not the value from previous sample) will be retrieved.

Note: The passport field value operation (example **P10**) retrieves the value of the passport field (line) with the specified order number (**10**). The program supports defining several values in one passport field (line). The values have to be separated by at least one space symbol. Use the **PX.Y** equation where **X** is passport field (line) number and **Y** is the order number (counting from 0) of the value in this line. For example, if the 10-th field (line) of the passport contains the string "**10 20 30**" then using **P10.1** you will retrieve the value of **20**.

The program uses the following agreements while interpreting passport fields. All the passport fields are read and saved in memory as strings. First 7 passport fields (lines) **are also interpreted as strings**. The program tries to convert beginning of strings (up to the first space symbol) from all other passport fields (lines) into the values. **If it succeeds then those strings are interpreted as values** and all other symbols in a string are ignored and therefore could be used as comments that will appear in a passport field. **Important:** comments have to be separated from the values by at least one space symbol.

You may use scientific notation (using **E** symbol) to specify constant values. For example, 5.2E+2 or 5.2E-2. **Attention, you must specify the "+" symbol explicitly for positive values.**

The user may limit the values received as a result of calculations using **min** and **max** functions. Drawing 9.20 shows an example of an algorithm that uses those functions.

The screenshot shows the 'Header editor' window for 'Maximum allowed roll angle'. The window has a tabbed interface with 'Parameters' selected. The main configuration area includes fields for 'Short name' (RollMax+), 'Name' (Maximum allowed roll angle), 'ID' (8005), 'Precision' (1), 'Unit' (deg), and 'Colors' (Gray and Black). There are also checkboxes for 'Do not display' and 'UDP export'. The 'Parameter type' section has radio buttons for 'Analog #1', 'Analog #2' (selected), 'Discrete #1', 'Discrete #2', and 'Sound stream'. The 'Analog type #2' dropdown is set to 'Algorithm interpreter'. The 'Analog #2 (Algorithm interpreter)' field contains the expression 'a1 max a2 min 5'. On the right, a list of parameters is shown, with '8005 RollMax+' highlighted. The bottom of the window has buttons for 'OK', 'Cancel', 'Print', and 'Param.list', along with a status bar showing '24.09.20 22:03:27 (key=1)'.

Drawing 9.20

Using the shift operations (**shl** and **shr**) assumes the following procedure:

- rounding (using rounding rules) the current value of the analog parameter;
- shifting the result value on the specified number of bits in given direction.

The joint use of **exp()** and **ln()** functions allows raising numbers even to decimal power. If **X** is to be raised to **Y** power the calculation formula will be **exp(abs(Y)*ln(X))** and if **Y** is odd the result will be negative.

The interpreter supports the multiplication by the logical value. The result of this operation will be the value of the second multiplier if logical value is "true" and 0 – otherwise. An example of using this function is shown on the referring algorithm of calculation of wing mechanization in dependency from the flaps and slats position (Drawing 9.21).

Drawing 9.21

By default installed next order (a priority) fulfillment operations V complex expressions:

1. Functions an (m), b n (m), **shl**, **shr**, **a(x,y)**, **a n (<)**.
2. Selection passport data.
3. calculation functions (**abs ()**, **sin ()** And etc.).
4. Selection constants.
5. Operation boolean denial.
6. Operations shift.
7. Multiplication including logical value, and division.
8. Adding and subtraction.
9. Operations of comparison.
10. Boolean "AND" and "OR".

To change the default priority of the operations include some of them into the brackets. The program has no limitations on nested brackets. Any pair of symbols "**()**", "**[]**" or "**{}**" may be used as brackets.

If the program is not able to interpret the equation after the **OK** button is pressed then the warning message will be popped up. The syntax of the equation must be checked in this case. You are able to perform the express syntax check of the current equation. Just press **F2** button when the equation field is active.

The program supports also "on-the-fly" syntax checking mode. The equation will be displayed in blue color if the program is able to interpret it and in red color – otherwise.

The further work with the calculated parameter has no limitations comparing to the registered parameters.

It should be noted that if any parameter is selected in the list of the **Header editor** window then pressing the **F2** key will show the window that lists all the calculated parameters from the current header whose equations contain the current parameter as an argument. The window will not be shown if the current parameter is not included in any equation.

9.2.2.6. Relative time

This type of parameter is just the current value of the relative time. Adding a parameter of this type to the header assumes its further using as an argument in piece-wise linear functions. Displaying flaps position as an analog parameter in case when only an On/Off signal that indicates flaps going up or down is registered may be an example of using of this type of parameter.

9.2.2.7. Integral

This is a definite integral of the selected parameter. The short name of the integrated parameter is specified in the **Integrated parameter** field (Drawing 9.22). The initial value of the integral could be defined in two ways. If the **Initial value** field contains a short name of a parameter (it could be selected from the window that appears after left double clicking on the field) then the current value of the parameter will be used as initial value for the integral. If the **Initial value** field is empty the initial value will be taken from the **D** field of the **Calibration table** page.

The screenshot shows the 'Header editor' window for 'Calculated Altitude'. The 'Parameters' tab is active. The 'Short name' is 'ALT.CALC' and the 'Name' is 'Calculated Altitude'. The 'ID' is '125', 'Precision' is '0', and 'Unit' is 'ft'. The 'Colors' are set to 'Red' and 'Lime'. The 'Displaying flag' is empty. The 'Parameter type' is 'Analog #2'. The 'Analog type #2' is 'Integral'. The 'Integrated parameter' is 'VS' and the 'Initial value' is 'ALT.P. 1'. The 'Task' field has checkboxes for #1 through #8, with #1 checked. A list of parameters is shown on the right, with '125 / ALT.CALC' highlighted.

ID	Parameter
75	AC.CODE5
101	ALT.P. 1
102	ALT.P. 2
103	ALT.R. 1a
104	ALT.R. 1b
121	OAT
122	VS.ADS
123	VS
125	ALT.CALC
131	IAS
132	GS. 1
133	GS. 2
140	A.RPOC
141	A.SPD
142	A.DP
143	A.LDPA
144	A.TDPA
145	A.PI
146	A.PITCH
147	A.VS
151	Sel.Alt
152	Sel.Hdg
153	Sel.Crs1
154	Sel.Crs2
155	Sel.Spd1
156	Sel.Spd2
157	Sel.VS. 1
158	Sel.VS. 2
161	DH. 1
162	DH. 2

Drawing 9.22

The same parameter of the Integral type could be a part of several sets of equations. To include a parameter (equation) to the system (to the set) you have to check the appropriate box in the **Task** field. You may include a parameter in 8 sets of equations maximum.

More guidance on integration is described in [Section 10.13](#).

9.2.2.8. Smoothing, differentiation

This type of parameter allows to display or to print the smoothed values of a parameter or the values of the first or second derivative (Figure 9.23). Select the appropriate line from the drop down list to choose between smoothing and derivation. The parameter which short name is set in the **Initial parameter** field will be smoothed or differentiated. To specify a short name of the target parameter you have to double click with the left mouse button on the **Initial parameter** field and select a desired parameter from popped up window.

Drawing 9.23

Smoothing or differentiation is done on moving symmetrical base interval with the help of a polynomial of the given degree. The width of base interval and the degree of a polynomial are to be specified by the user in the appropriate fields.

Note: The specified value determines half of the base interval length that is if 10 is set smoothing or differentiation in the target point will be done using 21 points (including the target point) or 10 samples on both sides (before and after) of the target point.

Recommendation: Base interval length determines how many **samples** of the parameter (**not seconds or frames**) will be used. It means that registration frequency (how many times per second) must be taken into account if base interval is to be specified in seconds.

If smoothing is set and polynomial degree is zero then arithmetic average on the given base interval will be calculated. If the appropriate switch is checked then median will be calculated instead of arithmetic average. Median is a value with a property that on a selected interval number of values smaller it is equal to number of values larger than it.

Note: median is usually used to plot slowly changing parameters (amount of fuel) and helps to avoid random registration failures of different kinds.

9.3. Discrete (On/Off) signals type

Selecting the On/Off (discrete) signal of any type in the **Parameter type** field changes the **Parameter** page to the view presented on the drawing 9.24.

Drawing 9.24

Addresses of the On/Off signal are to be set on the **Addresses** page in the same way as for analog parameters.

On tab **Calibration** (Figure 9.25) you can exact position of On/Off signal which it will be plotted in the field of analog parameters (**Section 10.1**), expressed in percent of height of this fields.

Drawing 9.25

9.3.1. Discrete signal (1 bit)

This type of On/Off signal (Drawing 9.24) has two subtypes: without inversion (mostly used) and with inversion. The On/Off signal “with inversion” means that registration of the On/Off signal *stops* if monitored event appears. Besides the address the offset of the bit where the On/Off signal is registered has to be specified on the **Addresses** page. The offset is set in the **Offset, bits from word beginning** column. The shift bias must be on unit less than a bit number of a discrete signal.

9.3.2. Masked discrete signal

This type allows displaying On/Off signals registered using bit masks. The current version of the program supports masks up to the 4 bits long. Examples for this type of On/Off signal is registration of TCAS or ECAM modes.

Select the amount of bits (from 2 to 4) for the mask from the **On/Off signals type** drop down list on the **Parameter** page. Specify the address of the On/Off signal as well as the starting bit for the masked parameter on the **Addresses** page. For example, to display the On/Off signal that is defined by value of 9 from 4-bits long masked information word registered in address 20 starting from bit #3 you have to define the following numbers:

- The **On/Off signals type** field on the **Parameter** page – 1001;
- The **Inform.word** column on the **Addresses** page – 20;
- The **Offset, bits from the beginning** column on the **Addresses** page – 2.

9.3.3. Discrete UKR

The UKR On/Off signals that are used on different type of MSRP FDRs are examples of this type. Additionally the order number of the UKR has to be specified in this case.

9.3.4. Algorithm interpreter

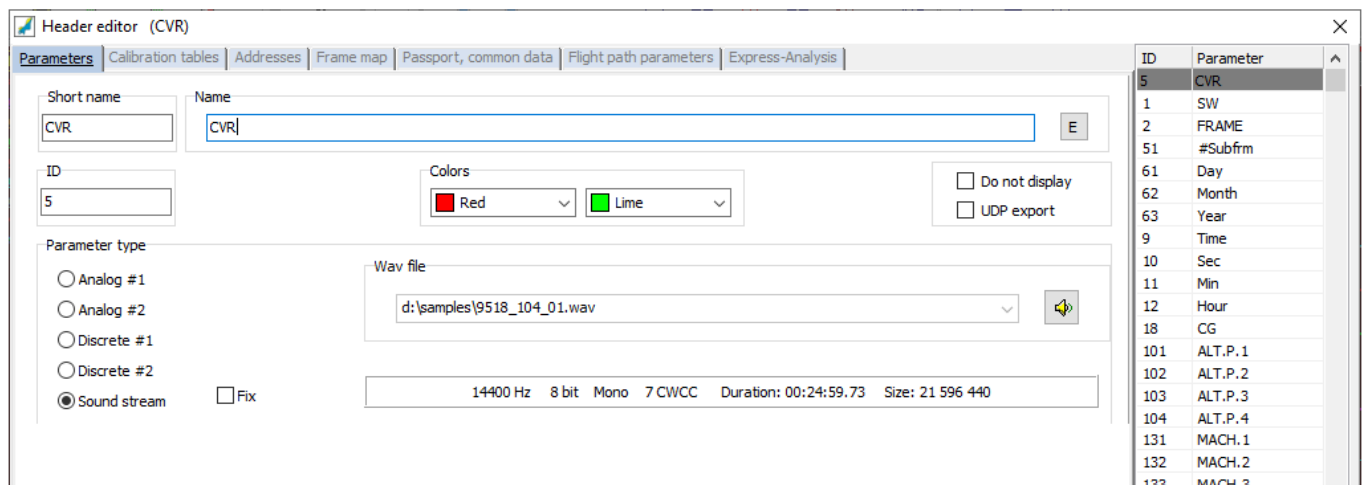
This type is used to describe On/Off signals which are results of logical and/or arithmetical calculations. The only difference from the analog calculated parameters of the same type ([Section 9.2.2.4](#)) is that the result of calculations must be the logical value (true or false).

9.3.5. Word of discrete signals

This type of On/Off signals is implemented through analog parameter without graduation with the type of **digital code** and described in [Section 9.2.2.2](#).

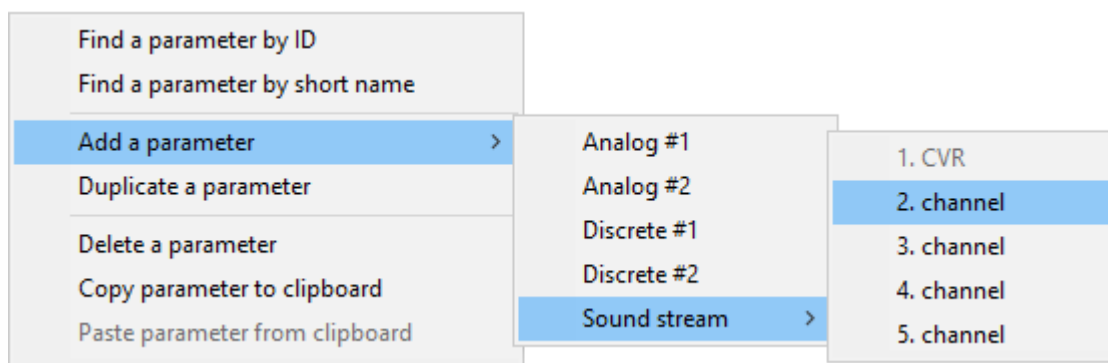
9.4. Sound stream type

This parameter type (Drawing 9.26) is used for adding the sound data, received from various sources.




Drawing 9.26

User may add up to 5 sound channels. Adding new channel is going on after the choice of corresponding item in pop-up menu (Drawing 9.27), emerging after clicks right mouse button on the short names list to pop up the menu. The name of the channels that are already associated with sound files are printed in gray color (disabled for editing).



Drawing 9.27

Every channel must be saved in a separate file of **wav format**. Choice of file for current channel is produced using standard dialogue, emerging after pressing on button . The program automatically creates a copy of the selected file with a predefined name formed from data file name by adding the characters "**_01**" to "**_05**" to the **name** (depending on the channel number), and places it **in the same folder** with the current data file (extension **arm** or **armx**).

Note: If the current header has at least one parameter of sound type and a sound file is associated with this parameter then while moving the data file to another computer **do not forget to move the sound file as well**.

The status line displays the information about the format of the selected channel.


The checked state of the **Fix** box fixes the sound stream at the current position inside data file and inhibits the stream to be scaled along the time axis.

Details on working with "sound stream" in the plot view mode are given in [Section 10.14](#).

10. Display of flight data

The computer screen (monitor) and printing devices could be used as data output devices. Printing may be completed in file format of **emf** , **bmp** , **jpg** and **png**. Tabular values parameters may be saved in text files or in format of **Microsoft Excel**.

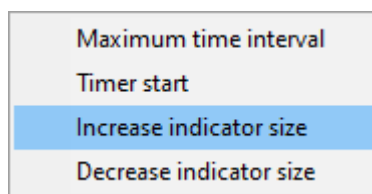
"Plot for analysis" mode is used to work with the data on the screen. **"Plot for printing"** mode is used to prepare the information for printing, to adjust scales of the parameters, to set current values and names of the parameters and to print the graphs. Press **Shift-Space** or select the appropriate menu item from the drop-down list

of the  button to switch between those modes. The program saves the last used mode and will switch to it by default during next loading.

To switch to the mode of displaying the recorded information it is necessary to expand the database window, select the flight data information file and press the **OK button** with unfolding of the window data representation module. Description of functional elements of the window in the mode of **"Plot for analysis"** is given in [Section 3.3](#), and for the **"Plot for printing"** mode - in [Section 3.3.5](#).

When opening data file a kit of parameters from standard tasks ([Section 10.1.1](#)), selected on tab **Passport**, **Common data** ([Section 9.1.1](#)) of **Header Editor** will appear.

The user can change the size of the cursors indicator field by selecting the appropriate pop-up menu items that appear after clicking the right mouse button on the indicator field (Drawing 10.1).



Drawing 10.1

The menu bar, as well as the indicator and shortcut buttons panels are the same in both modes. [Section 3.3.2](#) gives a description of buttons of the tool panel.

Before a detailed description of the functions available in the information display mode, it is necessary to give a definition of a number of terms.

Active parameter - the parameter with which the program will perform further actions (move, zoom, etc.). In the **"Plot for analysis"** mode window, the active parameter denoted by a box around its ID on a numeric field ([Section 3.3](#)). The boundary of the rectangle is solid if all the measures of the parameter are plotted on the screen. The boundary is dash otherwise. In the **"Plot for printing"** mode the information about the parameter that is currently active is indicated in the left part of the status bar ([Section 3.3.5.1](#)).

To make any parameter active in the **"Plot for analysis"** mode use one of the following procedures. Left click close to the desired parameter graph if the system cursor is located on the graph field. Left click on the short name of the parameter if the system cursor is located on the numerical field. If the short name of the parameter is selected the graph of this parameter will flicker two times showing its location.

Note: here and after the terms «graph field» and «analog parameters field» have to be considered as synonyms.

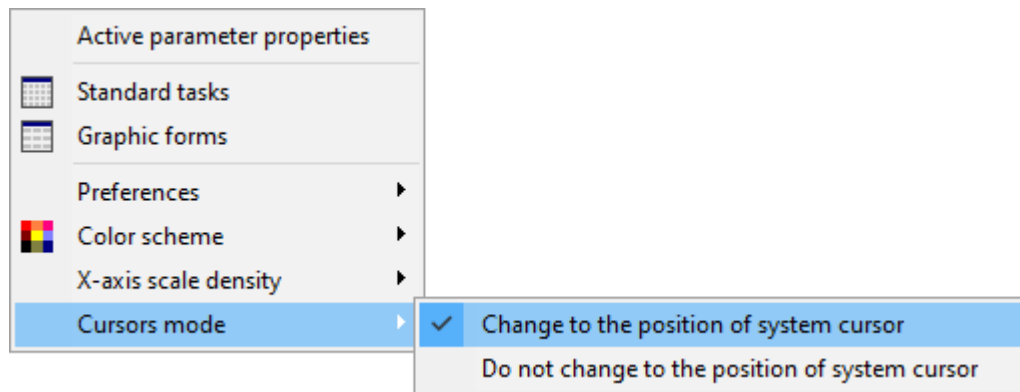
Sequential selection of the active parameter from among those displayed on the screen is carried out by pressing keys **Up** or **Down** at position of the cursor on numerical field or pressing those same keys at hold key **ctrl** at position of the cursor and in any place of the window.

To make a parameter active in the **"Plot for printing"** mode just place the system cursor (no need to click) close to the desired parameter graph. If the system cursor is located on the scales field – the corresponding scale becomes active.

Moving cursors - are two vertical lines that begins from the bottom part of the indicator field and go through the graph field and On/Off signals field. They may be used for different purposes: to select the time interval for viewing plots or performing calculations, to read the current values of the parameters and so on. One of the cursors is called active, the second – passive. The user may define colors for active and passive cursors ([Section 10.2.1](#)).

You may customize behavior of the cursors using the popup menu of the graph field (Drawing 10.2). The currently active mode is marked. If the first mode is selected the cursor that is nearer to the position on the indicator field where left mouse button was pressed is moved to that position and both cursors (system and program's) are

moving together. If the second mode is selected and after the left mouse button is pressed the nearest cursor becomes captured but stays at the present position and moves proportionally to the movement of the system cursor.



Drawing 10.2

For simultaneous displacement of both moving cursors to the edges of the selected interval on the screen use



Do not mix up the moving cursors with the moving markers that are used for selecting the time interval from the whole amount of information recorded in the current data file.

The active cursor - is one of the two **moving cursors** whose position is used to read the current values of the parameters as well as to perform data copying and pasting operations. A cursor becomes active after it was selected by


the left mouse button. To toggle the activeness between cursors use **Tab** or **F4** keys as well as the button. Colors of the active and passive cursors may be changed by the user ([Section 10.2.1](#)). To move the active cursor to the next frame use **Left/Right** keys. To move the active cursor to the next measure (sampling) instant of the active parameter use the same keys but keeping **Ctrl** key pressed. Any transition of the active cursor is carried out by its grabbing with the mouse pointer. To set up cursor's behavior use the popup menu that appears after right clicking on the graph field.

Moving markers - are two triangles connected with the horizontal line that are located in the top part of the indicator field. They are used to select any desirable time interval from the whole file. The markers are set on the boundaries of the indicator if all recorded information is displayed on the screen. Click the left mouse button above the marker and keep it pressed to move the marker. The moving markers will be moved proportionally if you move the moving cursors ([Section 10.3](#)).

Both modes (**"Plot for analysis"** and **"Plot for printing"**) provide:

- Selecting the parameters to be displayed on the screen from the file header, graphic form or standard task;
- Customizing appearance of the graphs of the parameters;
- Displaying graphs as a function of the registered or relative time;
- Changing the scales of the parameters, moving graphs along the screen and selecting desired time interval;
- Outputting parameters in codes or engineering units;
- Determining the values of the parameters in the active cursor position;
- Setting zero-time mark to any position when viewing graphs in the relative time mode;
- Information frames inserting and deleting;
- Text labels inserting and deleting;
- Frame and parameter failure marks setting and removing;
- Saving a set of the parameters as a graphic form or standard task;
- Service information (identification data) viewing;
- Saving the header or the data from the current file in a file of the standard format;
- Printing the values of the parameters in tabular format;
- Flight path calculation in horizontal and vertical planes;
- Running the express-analysis and viewing its results;
- Setting up printer options.
- The **«Plot for printing»** mode additionally provides the following functions:
 - Customizing scales and appearance of the parameters before printing;
 - Adding name, short name and the current values of the parameters before printing;
 - Print preview;
 - Printing of the graph.

The second mode provides the ability to view the information exactly in the same way as it will be printed. The following chapters contain the detailed description of the above mentioned functions.

To select parameters to be displayed on the screen press  or select the **Settings/Select Parameters** menu item. You can choose the style of the window (WinArm32 or WinArm64) by pressing the arrow to the right of the button – your choice will be remembered. The **Select parameters** dialog box in WinArm32 style is shown below (Figure 10.3).

Drawing 10.3

The parameters selection field consists of two main parts. The short names of the parameters from the current header are displayed in the top part of the field, and the full names are displayed in the bottom part. You may change the size of the fields by capturing and moving the boundary with the left mouse button.

To display a graph of the parameter on the screen just select it in the list with the mouse pointer or check the appropriate box in the bottom part of the field. As cursor is moving through the list of parameters the information about the parameter which short name is currently under the cursor's position will be displayed in the upper part of the window just above the parameters selection field.

To exclude the selected parameter click it once again. To exclude all the parameters use the **Clear all** button.

***Note:** You are able to remove the active parameter from the screen directly while viewing the graphs. Just press the **Del** key to do it.*

Identifiers selected parameters displayed on blue background. List selected parameters also shown on the right side of the window. After selecting all the desired options, press the **OK button** to cancellation changes - button **Cancel**.

The short names of the currently selected parameters will be displayed on the blue background. The selected parameters are also listed in the right part of the window. After selecting all the necessary parameters press **OK** button, to avoid changes press **Cancel**.

Not more than 60 parameters can be displayed simultaneously. If there are more parameters to be viewed, only the first 60 will be displayed on the screen.

The standard **Search** dialog will be displayed after right clicking on the list of the parameters. This dialog helps you to find the desired parameter using the part of its short name. If the program finds a parameter that meets the search input the short name of this parameter will be blinking. You may continue the search or stop it and close the window. The cursor will be automatically placed on the latest found parameter after the **Search** window is closed.

The switches in the top part of the window determine what kind of analog parameters and On/Off signals will be present (shown) in the list as well as the output mode for On/Off signals. Select the appropriate switches in the **analog parameters** field to show only "general" analog parameters and/or parameters of **algorithm interpreter** type and/or parameters stored in the additional data streams ([Section 10.15](#)).

Select the appropriate switches in the **Events** field to show only "general" On/Off signals and/or express-analysis events and/or On/Off signals stored in the additional data streams ([Section 10.15](#)). Select the appropriate switches in the **Output mode** field to display On/Off signals on the analog parameters field or On/Off signals field or on both fields simultaneously. On/Off signals will not be displayed on the screen if both switches are not selected.

When the number of parameters recorded by the FDR is extremely high (in moder aircraft) it is more comfortable to have an opportunity to group parameters for quicker search. This opportunity is available in **WinArm64 style** of Select parameters window (Drawing 10.3.1). This form will allow to search and select parameters in accordance to their Group, Signal source, Parameter type, Data stream. The form provides the control over groups, tabs of which are located in the upper part, as well. Right button mouse click will show a menu which will allow to add, delete edit groups. Filling groups is available by drag-and-drop of parameters to corresponding tabs (numerous choice is available with keys Ctrl, Shift). Working with groups is available from the Header editor as well, by pressing right mouse button in the right field of parameters list. Working with groups is available for **armx** files only.

Select parameters (Group) X

ALL 1. Flight 2. Controls 3. Engines 4. Autopilot 5. TCAS/TAWS 6. Systems No Group

ID	Short name	Name	ID	AP	ID	On/Off
<input type="checkbox"/> 18	CG	Computed Center of Gravity	<input checked="" type="checkbox"/> 101	ALT.P.1	<input checked="" type="checkbox"/> 3001	M.WARN
<input checked="" type="checkbox"/> 101	ALT.P.1	Altitude pressure #1	<input checked="" type="checkbox"/> 121	IAS.1	<input checked="" type="checkbox"/> 3002	M.CAUT
<input type="checkbox"/> 102	ALT.P.2	Altitude pressure #2	<input checked="" type="checkbox"/> 191	SEL.SPD1	<input checked="" type="checkbox"/> 3031	WOW
<input type="checkbox"/> 103	ALT.P.3	Altitude pressure #3	<input checked="" type="checkbox"/> 192	SEL.SPD2	<input checked="" type="checkbox"/> 3042	LG.H.DN
<input type="checkbox"/> 104	ALT.P.4	Altitude pressure - IESI	<input checked="" type="checkbox"/> 201	SEL.VS1	<input checked="" type="checkbox"/> 5441	WSHR.W1
<input type="checkbox"/> 105	ALT.L	L Altitude Computed - Combined	<input checked="" type="checkbox"/> 202	SEL.VS2	<input checked="" type="checkbox"/> 5443	WSHR.C1
<input type="checkbox"/> 106	ALT.R	R Altitude Computed - Combined	<input checked="" type="checkbox"/> 203	SEL.VS3	<input checked="" type="checkbox"/> 9808	L.AP
<input type="checkbox"/> 111	ALT.R.1	L radio altitude	<input checked="" type="checkbox"/> 204	SEL.VS4	<input checked="" type="checkbox"/> 9809	L.AT
<input type="checkbox"/> 112	ALT.R.2	R radio altitude	<input type="checkbox"/> 761	N1.1		
<input checked="" type="checkbox"/> 121	IAS.1	Airspeed - indicated #1	<input type="checkbox"/> 762	N1.2		
<input type="checkbox"/> 122	IAS.2	Airspeed - indicated #2	<input type="checkbox"/> 781	N2.1		
<input type="checkbox"/> 123	IAS.3	Airspeed - indicated #3	<input type="checkbox"/> 782	N2.2		
<input type="checkbox"/> 124	CAS	Computed Airspeed (STD) - IESI				
<input type="checkbox"/> 131	MACH.1	Mach #1				
<input type="checkbox"/> 132	MACH.2	Mach #2				
<input type="checkbox"/> 133	MACH.3	Mach #3				
<input type="checkbox"/> 134	MACH.L	L Mach Number Computed				
<input type="checkbox"/> 135	MACH.R	R Mach Number Computed				
<input type="checkbox"/> 136	MACH	Mach Number (STD) - IESI				
<input type="checkbox"/> 141	GS	Ground speed (FMS)				
<input type="checkbox"/> 142	GS.	Groundspeed, m/s				
<input type="checkbox"/> 281	BARO.1	Baro Setting 1				
<input type="checkbox"/> 284	BARO.2	Baro Setting 2				
<input type="checkbox"/> 287	BARO.3	Baro Setting 3				
<input type="checkbox"/> 290	BARO.4	Baro Setting 4				
<input type="checkbox"/> 221	WIND.S	Wind speed (FMS)				
<input type="checkbox"/> 222	WIND.D	Wind direction (FMS)				
<input type="checkbox"/> 231	LAT	Latitude (FMS)				
<input type="checkbox"/> 232	LON	Longitude (FMS)				
<input type="checkbox"/> 233	EPU	Estimated Position Uncertainty (EPU)				

Clear all

OK

Cancel

Drawing 10.3.1

10.1.1. Standard tasks

You may display the graphs with the help of the predefined list of the parameters so called standard task. Select the **Settings/Standard tasks** menu item or the appropriate item from the popup menu of the graph field (Drawing 10.4) to display the list of the currently existing tasks (Drawing 10.5).

X Close without changes

Active parameter properties

Standard tasks

Graphic forms

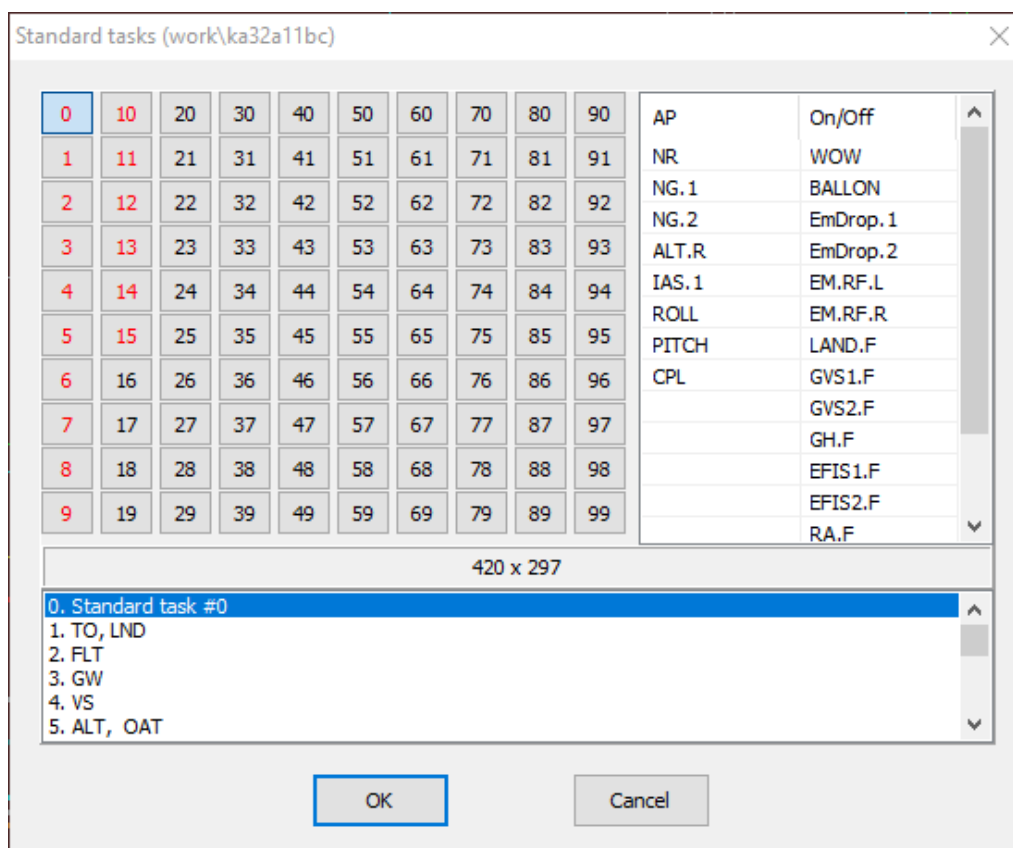
Preferences ▶

Color scheme ▶

X-axis scale density ▶

Cursors mode ▶

Drawing 10.4



Drawing 10.5

The numbers that contain a saved list of the parameters are displayed in red color. The numbers that do not contain parameters (free numbers) are displayed in grey color. The names of the existing standard tasks are also contained in the editable list in the bottom part of the window. The currently active task is marked by the pressed state of the corresponding button. Its name is also written on the blue background in the list of names. The list of the analog parameters and On/Off signals from the active task is shown in the right part of the window. To make a task active just click on the appropriate button or select its name from the list.

Standard tasks are used to display confirmation plots for the express-analysis events. See [Section 12.3](#) to learn more about confirmation plots. Press **F2** key to display the window with the list of express-analysis events that are associated with the currently selected standard task.

To save the set of the parameters that is currently displayed on the screen as a standard task just left click any free number keeping **Ctrl** key pressed. The program will assign a default name to the newly created task. The user is able to change the name. Right click on the desired line and enter a new name in a window that appears.

To delete a standard task left click on its number keeping **Shift** key pressed and confirm deleting. You may click on the button as well as on a line with the name of a standard task that you want to delete.

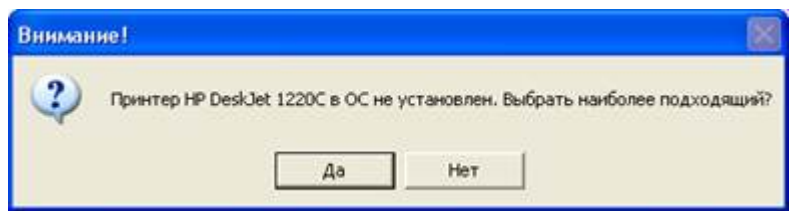
Not more than 30 parameters can be stored in the standard tasks list. If more than 30 parameters are displayed only the first 30 will be saved.

To display the plots of the parameters from a standard task you have to select it (on the button field or in the list) and click **OK** button or just double click its name in the list.

Attention: Selecting **OK** button in the **Standard tasks** window outputs the parameters from the active (selected) task on the screen but does not save currently displayed parameters as a standard task. To save currently displayed parameters as a standard task left click on the desired button keeping **Ctrl** key pressed.

Standard tasks are saved in a separate file and may be used with any data file including files of the different type of aircraft. The standard task contains not only the list of the parameters that are identified using their unique number (field **ID** in the **Header editor** window) but also the information about their scales and attributes (color etc.) as well as the information about the current printer and its settings. To select a printer use the **File/Print settings** menu item.

Before using a standard task the program checks the system if the printer for which this task was saved is installed or not. If the printer is not installed the program will offer the user to select another printer (Drawing 10.6). If the answer is **Yes** the standard Windows printer setup dialog will appear. It is recommended to select a printer with similar paper size and orientation. If the answer is **No** the printer will be selected by the program automatically but matching of the parameters of the page *is not guaranteed* in this case.



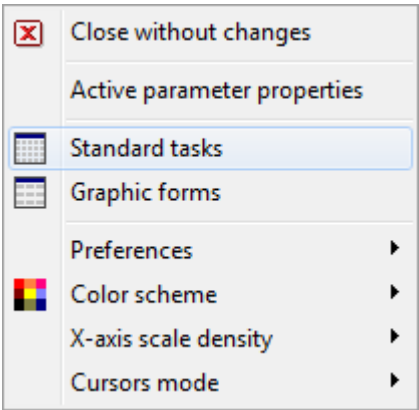
Drawing 10.6

It is recommended to use standard tasks for comparison of the same data (parameters) registered during different flights. The time interval is not saved in a standard task and each time should be adjusted by the user. If the header of the current data file does not contain the parameter with **ID** number that is saved in a standard task the program will omit this **ID** and no errors will occur.

10.1.2. Graphic forms

You can also use predefined graphic forms for displaying parameters on the screen. Graphic forms like standard tasks are predefined sets of the parameters along with their attributes for displaying on the screen and printing. Unlike a standard task a graphic form contains also a time interval, text labels and other settings that belong to a particular file (flight). Graphic forms are saved inside a data file and may be used only with the data from this file. Graphic forms may be used to save the results of work in order to use them in the future for example for printing or transferring to another computer.

To display the **Graphic forms** dialog box select the **Settings/Graphic forms** menu item or the appropriate item from the popup menu of the graph field (Drawing 10.7). The following window (Drawing 10.8) will appear.



Drawing 10.7

Graphic forms					On/Off	
0	10	20	30	40	AP	WOW
1	11	21	31	41	NR	GH.F
2	12	22	32	42	NG.1	
3	13	23	33	43	NG.2	
4	14	24	34	44	ALT.P.1	
5	15	25	35	45	IAS.1	
6	16	26	36	46	ROLL	
7	17	27	37	47	PITCH	
8	18	28	38	48	HDG	
9	19	29	39	49	CPL	

420 x 297

0. Current graphic form

1. Pic. 1. Aircraft Descending

2. Pic. 2. Approach

OK Cancel

Drawing 10.8

Graphic forms saving, deleting and usage procedures are the same as for the standard tasks that were described above.

No more than 60 parameters can be saved in graphic form.

Attention: Selecting **OK** button in the **Graphic forms** window outputs the parameters from the active (selected) form on the screen but does not save currently displayed parameters as a graphic form. To save currently displayed parameters as a graphic form left click on the desired button keeping **Ctrl** key pressed.

The name of the graphic form will be used as a figure name while printing (see details in the [Section 10.11](#)).

After displaying the list of the parameters from a graphic form it becomes the active one. The indicator field will contain the information (the number of the form) about the active graphic form. To save further changes to this form just press **Ctrl+S** keys and confirm the operation (see details in the [Section 10.11](#)).

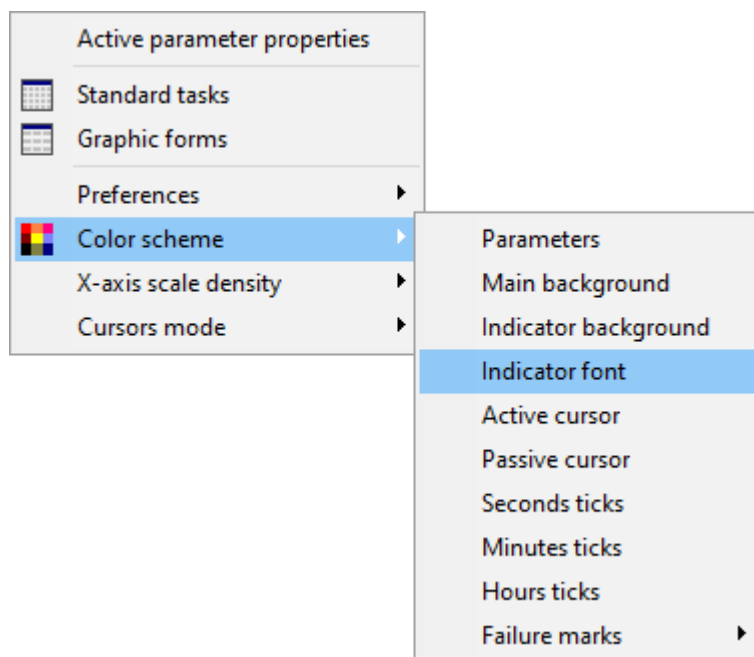
10.2. Customizing parameters appearance

10.2.1. Customizing user interface

User may customize the appearance (color) of many parts of the window:

- Main window background;
- Indicator background;
- Indicator font;
- Active cursor;
- Passive cursor;
- Second ticks;
- Minute ticks;
- Hour ticks;
- Failure marks.

Right click on the graph field to display popup menu (Drawing 10.9) and select the item which color has to be adjusted.



Drawing 10.9

The standard **Color** dialog will appear (Drawing 10.10).



Drawing 10.10

Press **F6** key to invert the background color of the graph field. Press **F7** key to invert the colors of all the parameters that are currently displayed on the screen.

Recommendation: You may use colors inversion when one or some parameters are not clearly seen against existing background and you need to quickly (without changing their colors)) look at their graphs or values.

10.2.2. Selecting the color of the active parameter

Press **F8** key to select the color of the active parameter (marked by the rectangle on the numerical field). The color selection dialog box will appear (Drawing 9.1).

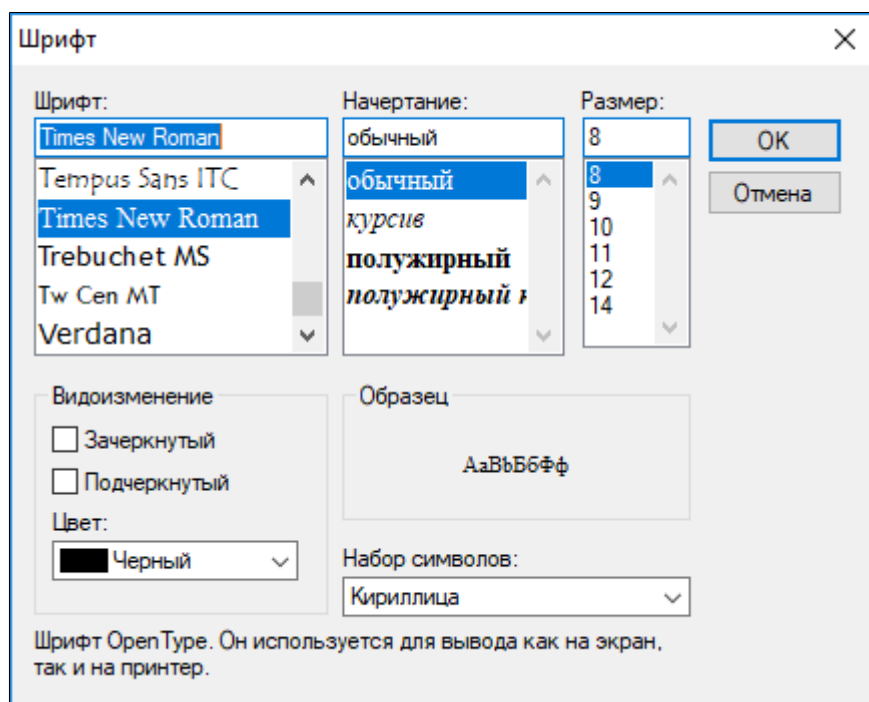
Note: You may change color of all the parameters currently displayed on the screen. Keep **Ctrl** key pressed while selecting **F8** key to perform this operation.

You may also select the color of the parameter using the **Header editor** (Figure 9.1) dialog box that appears after pressing **F2** key. This window allows you to select different colors to display the graph of the parameter in the **"Plot for analysis"** and **"Plot for printing"** modes. However, in case of using the **Header editor** window, the program will rebuild the data file after pressing the **OK** button that will significantly increase the work time. Additionally, you may accidentally change some other attributes of the parameters, so as to protect yourself from such kind of troubles it is *recommended* to use **F8** key for color changing.

Press **F7** key to invert the colors of all the parameters that are currently displayed on the screen.

10.2.3. Font setting


The **Font** dialog of the **Windows** system is used to select font name and parameters. The dialog box appears after selection of the **Settings/Font** menu item. Fonts are configured separately for modes **"Plot for analysis"**, **"Plot for printing"** and Flight path design.

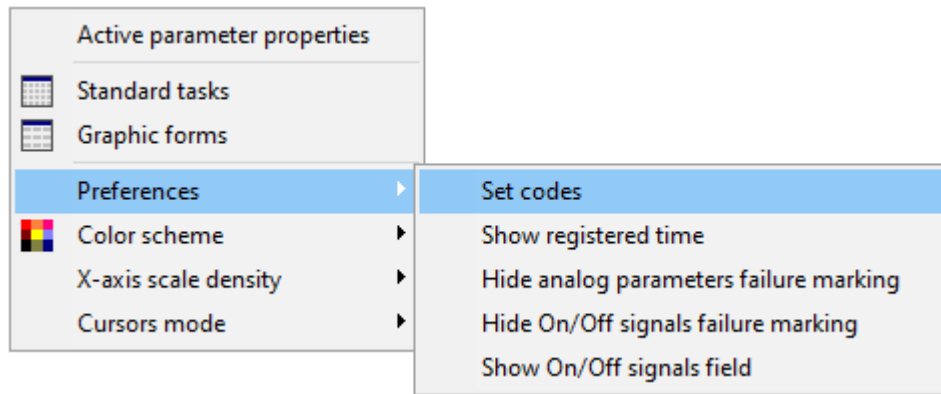


Drawing 10.11

Selected font will be used to print all the objects that contain text. The user may additionally specify fonts for text labels ([Section 10.7](#)).

10.2.4. Parameters output mode (codes-engineering units)

The program is able to display parameters either in engineering units or in code (registered, raw) values. To switch between those modes use the button  or the appropriate item from the popup menu (Drawing 10.12) that appears after right clicking on the graph field.

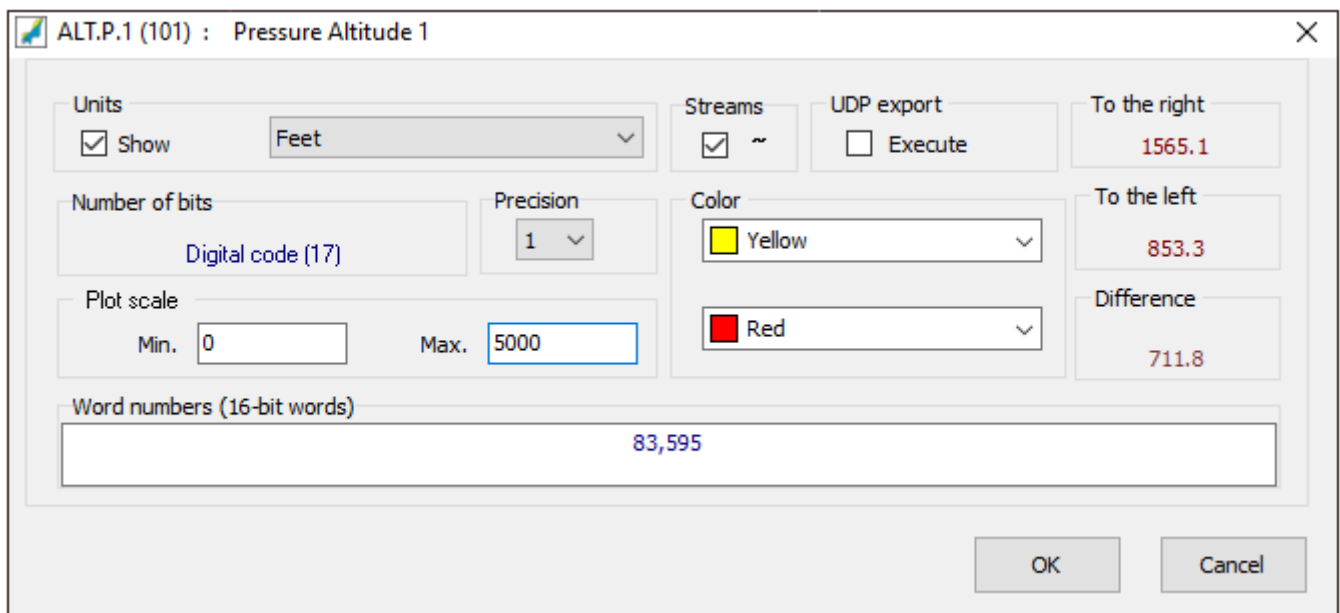


Drawing 10.12

The information about current mode is presented on the indicator field.

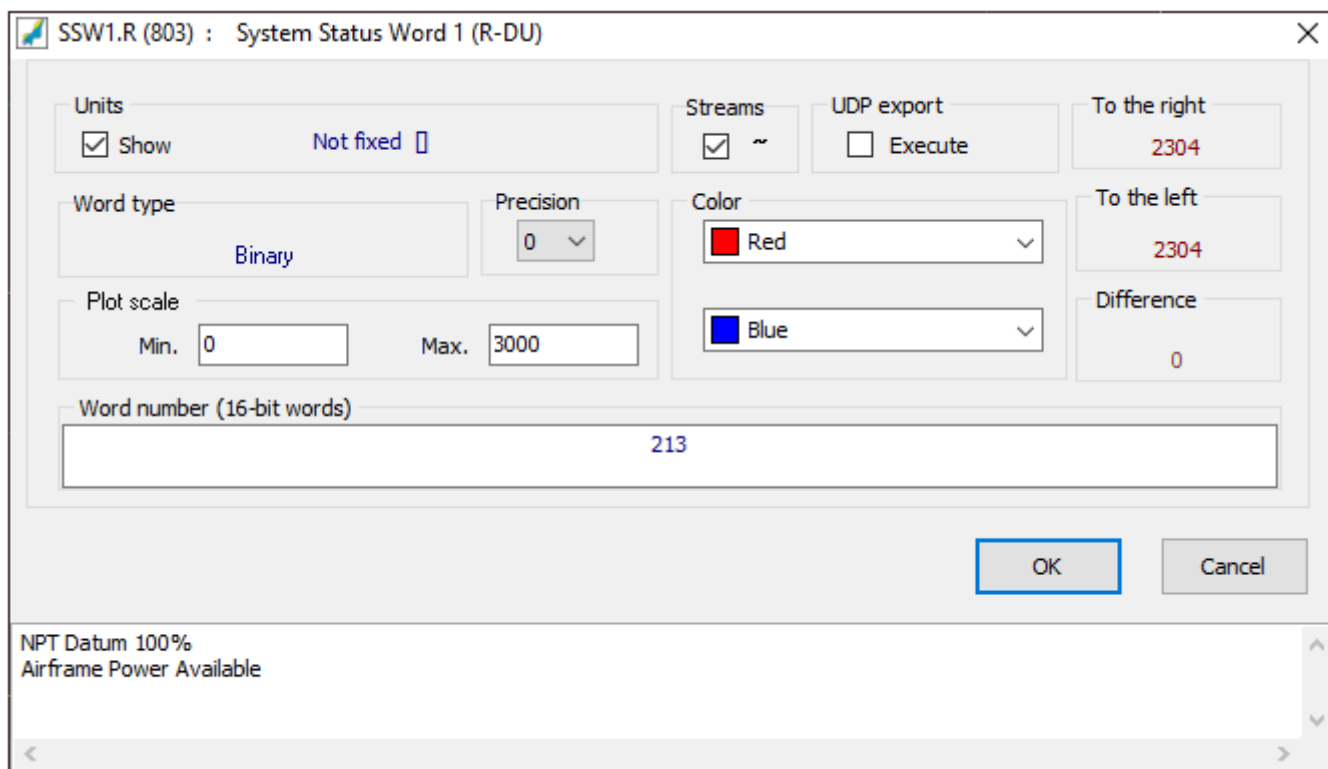
10.2.5. Displaying parameters in different engineering units

Parameters that were described with fixed units (physical sense, see [Section 9.1.2](#)) may be promptly recalculated and displayed in any units of the selected type of physical entity. Right click on the short name of the desired parameter on the **numerical field** or select the **Active parameter properties** item from the **graph field** pop up menu to display a window shown on the Drawing 10.13. To display a parameter in different units just select the desired item in the list of the **Units** field. The window also contains some service information about the selected parameter as well as its value in the positions of the moving cursors and differences between those values. Check the **Show** box of the **Units** field to display the units of the parameters in the **numerical field**. Parameters with the fixed units are marked by “:” symbol in the **numerical field**. Using this window you may also adjust the number of digits behind the comma sign (**Precision** field). It should be noted that the **Precision** and **Color** fields copy the values of the same fields on the **Parameter** page of the **Header editor** window (first item for color field) but may be changed by the user with any level of access.





Drawing 10.13

If a parameter of **digital code – word of On/Off signals** ([Section 9.2.2.2](#)) type is the active one then the window will display the names of all On/Off signals that are registered in the position of the active cursor.



Drawing 10.14

10.2.5. Recorded instants viewing

Click the  button to display or hide the marks (points) that show registration instants of the parameters. Select the type (analog parameter or On/Off signals) from the dropdown list of the  button to which this function will be applied.

To move the active cursor through the registration instants of the active parameter use **Left/Right** keys keeping **Ctrl** key pressed.

10.2.6. Parameters moving and scale changing

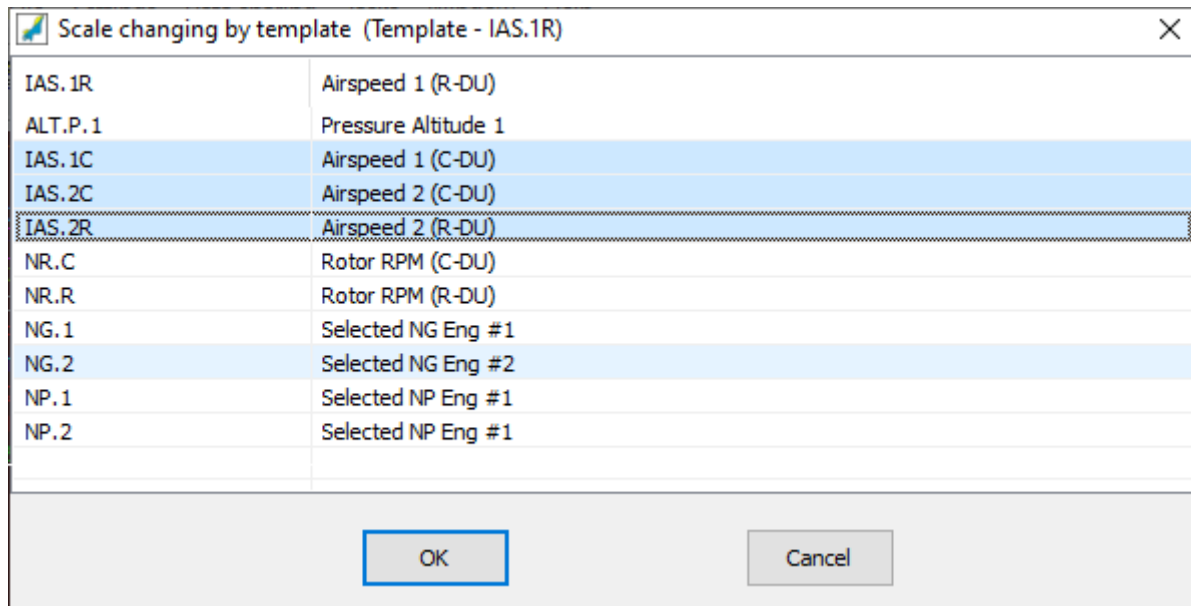
To move the graph of the parameter along the screen you have to click it with the left mouse button and keeping the button pressed move the graph to the new position. The active parameter can be moved by pressing **Up/Down** keys or rotating the scrolling wheel of the mouse. Each time you press the keys the graph will be moved on 1/15 of the graph field height being in the **"Plot for analysis"** mode or one point of the scale being in the **"Plot for printing"** ([Section 3.3.5](#)).

***Note:** You are not able to move the graphs of the parameters if they are displayed in code values.*

To change the scale of the graph along the vertical axis, you need to put the mouse pointer on it, double click left button and not releasing the buttons move manipulator before receiving desired kind of graphic arts. Scale graphic arts will increase at moving mouse pointer up and down.

Setting scale active parameter may also be implemented by pressing keys **PageUp/ PageDn** in the mode **«Plot for analysis"**, change is 1.2 times behind one pressing.

Program provides opportunity setting of scale of any parameter from shown on the plot With using a template parameter. Active parameter will serve as a reference one. This function is activated after pressing the **F3** key . An additional window appears (drawing 10.15). In the header window the name of a template parameter is shown. Choose necessary parameters to scale from the given list and press **OK** . Simultaneous choice of several parameters produced at pressed the **Ctrl** key.



Drawing 10.15

There is a second way to use this function, without displaying an additional window. To scale any of the parameters to the scale of the currently active parameter, click on it's notation or plot holding pressed key **Alt**.

If some parameters come out behind plot borders fields it is recommended to use button



for automatic adapting changes of scales of all the parameters which are out of the scale.

10.2.7. Features in the “Plot for printing” mode

The features of moving and scale changing in the given mode are connected to a possibility of separate moving and scaling of the parameters and their scales if **the mouse pointer is located on the scales field**. Use the **Up** and **Down** keys to move only the scale of the active parameter (its name is indicated in the status bar). Pressing these keys when **Ctrl** key is also pressed results in moving both the graph of the parameter and its scale. Press the **PageUp/PageDn** keys to increase or decrease the range of the scale. The upper part of the scale will be changed if the cursor is located above the middle point of the scale, the lower part of the scale will be changed otherwise (see detailed information in [Section 10.11](#)).

10.2.8. Return to default settings

To return to the default settings of the fonts and user's interface you have to close all the child windows, select the **Settings/Default settings** menu item and confirm the operation.

10.3. Selecting the time interval

Use one of the following methods in order to select the time interval for viewing the graphs:

- Move the markers on the indicator field;
- Move the cursors trough the graph field;
- Select the desired interval with the mouse pointer;

- Select the maximum time interval button


- Select time scale changing buttons and or using a mouse scroll wheel while system cursor is located on the indicator filed;

- Select time interval moving buttons and


- Using the **Alt + Left/Right** keys.

Below are some recommendations on how to use the mentioned methods to select the time interval.

The moving markers give you an ability to select the time interval from the whole file (including the part that is not currently displayed on the screen). The markers are set to the boundaries of the indicator if the whole file is displayed on the screen. Move the markers to any desired position by grabbing them with the left mouse button. To output the part of information located between the markers after they were moved

to the new position press **Enter** key or click the  button (button itself but not the dropdown list). To output the information without changing the time interval, press the **Space** key. The length of the interval between the moving cursors is shown in the middle of the indicator filed after the current frame number.

The moving cursors give you the ability to select the time interval *but only from the part of information that is currently displayed on the screen*. The moving markers will be moved correspondingly when cursors are being moved across the screen. To output the part of information located between the

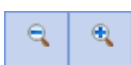
cursors after they were moved to the new position press **Enter** key or click the  button (button itself but not the dropdown list). To output the information without changing the time interval, press the **Space** key.


Press **Left/Right** keys to move the active cursor *on one frame* along the record. Move the cursor to any desired position by grabbing it with the left mouse button. The popup menu (Drawing 10.2) that appears after right clicking on the graph filed lets you select between two possible modes of the cursors' behavior when you click on the indicator field.

The currently active mode is checked. If the first item is checked the moving cursor that is located closer to the clicking point will be moved in the system's cursor position after left clicking on the indicator field. Both cursors will be moved together after that. If the second item is checked the moving cursor grabbed by the left mouse button remains in starting position and moves from it proportionally to transition of a system cursor.


The fastest method of choice of time interval is the selection with the help of the mouse pointer. Transfer the moving cursor to the beginning of the desirable interval. Not releasing the left mouse button, press the right mouse button or **Shift** key and move the cursor to the end of the desirable interval. Current selection will be indicated by color inversion. After releasing the button the program will output the information on the selected interval automatically. The same type of selection will be done by left double clicking in the beginning of the desired interval and moving the cursor to the end of the interval keeping the left button pressed.


If the described procedure is done with the moving markers the choice of an interval will happen on the range of all registered information.



Scaling buttons  let you change the time interval so that while increasing the duration is changed on the current width of the interval from both sides and while decreasing the middle of the interval, width 1/3 from current, is displayed. The same action could be done using mouse scroll wheel while the system cursor is located above the indicator field.

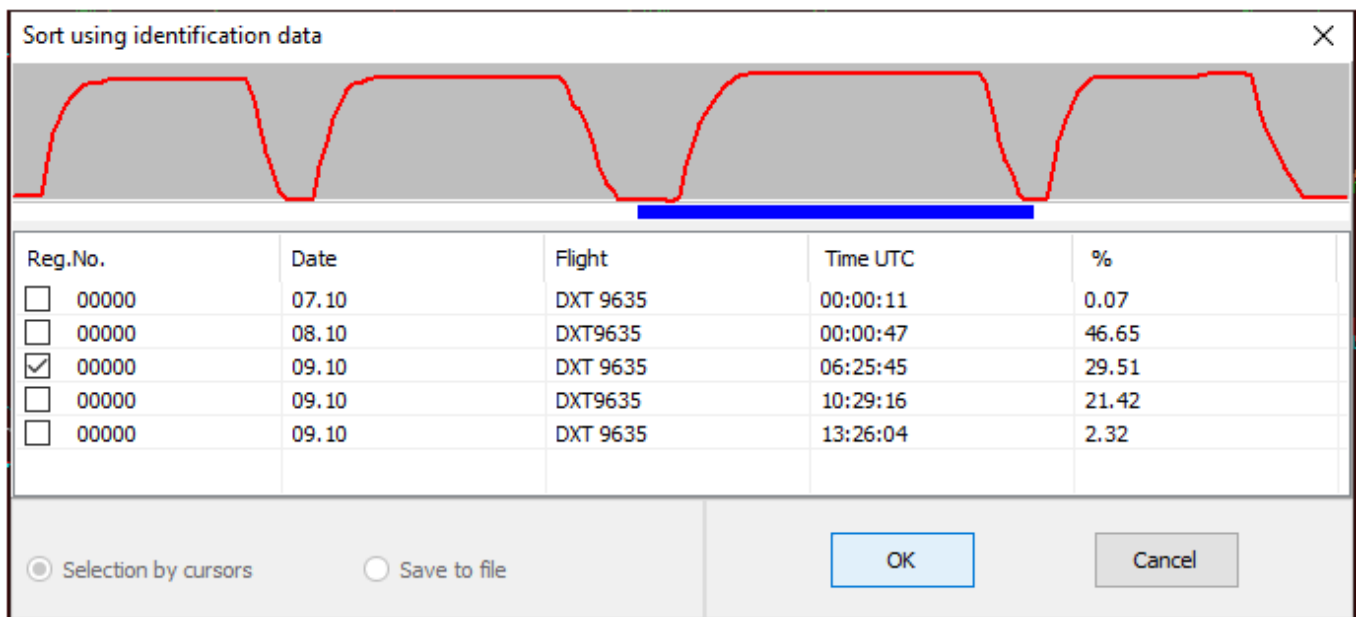
The scrolling buttons  scrolls the time interval approximately on 1/15 of screen width each time. Just click (press and release) the appropriate button to scroll the interval to the left or to the right. The interval will be scrolling until the mouse pointer stays above the button. Remove the pointer from the button to stop scrolling.

Using the **Alt + Left/Right** keys you may move (shift) simultaneously the left and right boundaries of the displayed interval by $\frac{3}{4}$ of its width.

Press the  button to display all the registered information. The same action could be done with the help of the appropriate item of the popup menu that appears after right clicking on the indicator field (Drawing 10.1).

Press the  button to move the cursors to the boundaries of the graph field. The moving markers will be moved proportionally.

The program keeps in memory the information about last 100 intervals. Click the  button to return to the previous interval, click the  button to go to the next interval.



Drawing 10.16

If the current data file contains the information about more than one flight the user may use the special function to search for the flights automatically. The service information (identification data) registered by the current FDR is used as a criteria for the search. Press **F11** key to activate this function. The program will display the window (Drawing 10.16) with the information about existing flights. The graph of the parameter selected in the **Relative height, m** line on the **Flight path parameters** page of the **Header editor** window will be shown in the top part of the window. This field will be empty if no parameter is selected. The user may change the size of the field by moving its bottom boundary. To move to the desired flight just check the corresponding box (selected flight will be marked with blue color in the bottom part of the graph) and press **OK** button. The program will set the moving cursors on the boundaries of the flight. The user may select more than one flight at a time. The cursors will be set to cover all the selected flights.

10.4. Time axis options

The time axis may be displayed either in registered or in relative time. Left click on the time axis label in the right bottom corner of the graph field to switch between those two modes. You may also select the appropriate switch in the **Type** field of the **time axis properties** (Drawing 10.17) dialog box that appears after selecting the **Settings/X-axis properties** menu item. The same dialog appears after right clicking on the time axis label.

Drawing 10.17

Sometimes it is necessary to calculate the time elapsed from the particular moment that is selected by the user. The dialog box presented on Drawing 10.17 gives you the ability to set the relative time value in the active cursor position. Select also the corresponding check box to apply the changes after clicking **OK** button. To view the graphs in the relative time mode select also the appropriate switch in the **Type** field.

Recommendation: It is strongly recommended to place a cursor to the position which will be used to set up the relative time using **Left/Right** keys at a last step for precise positioning to guarantee that a cursor will be **placed exactly at a frame beginning**. You have to place a cursor in the **registered time mode**. Depending on the FDR type (is there or not recording of seconds) you may use the instants where minutes or seconds **of the registered time** change to define the position of frame beginning exactly.

You may output the graphs in the relative time mode for example to calculate the time elapsed from the beginning of take off run until the aircraft left the runway. Set zero value of the relative time at the moment of take off run beginning and change the scale label for example to “time elapsed from take off beginning”. The results could be saved as a graphic form for future use.


Additionally you may adjust the appearance of the time marks and specify axis label that will appear in the relative time mode.

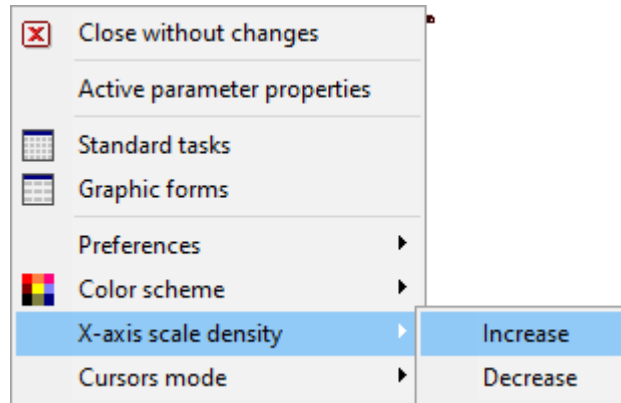
Some FDRs (MSRP-64 and so on) do not register the seconds of the current time. The program will display only hours and minutes for those FDRs while viewing the graphs in registered time mode. In this case it is recommended to set (at any instant) the relative time equal to the registered time and to view plots in the relative time mode.

The program provides the ability of automatic co-ordination of the relative and registered time in the active cursor position. This function is activated after pressing the **F10** key.

This action provides you also with the ability to check if some information frames were lost during read out or not. If minute changing instants of the relative and registered time will correspond to each other at any position in the data file all the information was read out correctly. Otherwise it is necessary to find parts of the file where some frames were lost (or added) and to correct them by inserting or removing information frames ([Section 10.8](#)).

Note: There are also some special methods to recover the information (in case of readout failures) registered by different type of FDRs. The description of those methods is provided in special literature.

The time scale density could be adjusted by clicking on the time label in the left bottom part of the graph field after mouse pointer will change to the  form. Click with the left mouse button to increase time scale density or right click to decrease time scale density. The same actions could be done with the help of the popup menu items that appear after right clicking on the graph field (Drawing 10.18).



Drawing 10.18

Indication of the current value of time in the positions of the cursors is made on the left and right of the field indicator directly above field graphs.

The function **Adjustment to the range 0...24 hours** is enabled by default. If this checkbox is unchecked the relative time will reckon continuously, without transition 24-0, so as 25, 26 and etc. It is comfortable for counting general time recorded by the FDR.

10.5. Reading current parameters values


The values of all the parameters currently displayed on the screen are listed in the numerical field. The values are read in the position of the active cursor. A “+” sign for On/Off signals means that a signal is present, a “o” sign means that a signal is absent. The preciseness of the analog parameters (how many decimals) is set in the **Precision** field of the **Parameter** page of the **Header editor** window ([Section 3.4.1](#)).

The time values at the positions of the cursors are indicated in the left and right parts of the indicator field just above the graph field. The duration of the interval between the moving cursors is shown in the middle part of the indicator's field.

The status bar will display the name of the parameter and its value in the system cursor position if the mouse pointer is located close to the graph of the parameter.

By keeping **Shift** key pressed move the cursor along the screen to view the current parameter values in the cursor position.

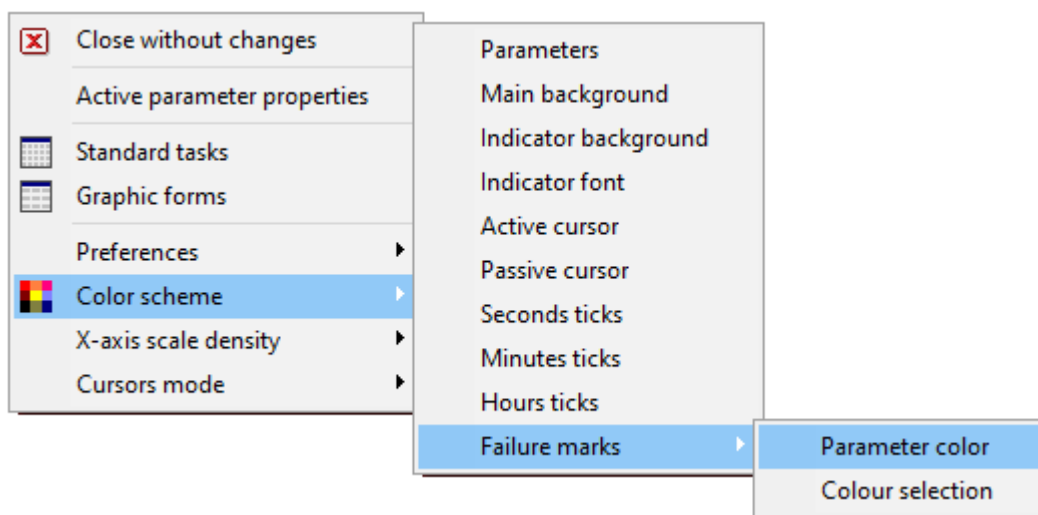
You are able to display a scale of the active parameter by left clicking on the graph field keeping **Shift** key pressed. Do not release the mouse button if you want to move the scale along the screen. Only scale of the active parameter may be displayed on the screen at the given time in the “**Plot for analysis**” mode. This function does not work if parameters are displayed in code values.

By selecting the **Interpolation off** item in the drop down list of the  button or pressing the **Q** key the user may view plots in special mode when the program does not use interpolation of the parameters between registration instants and plots the registered “levels” (steps) of the parameters. Repeat menu selection or key pressing to return to the normal mode. The level mode will be switched off automatically after program’s reloading.

If latitude and longitude identifiers are defined on the **Flight path parameters** page of the **Header Editor** window pressing the **Ctrl** key will display (on the indicator field) the distance between the moving cursors in kilometers ([Section 3.4.6](#)).

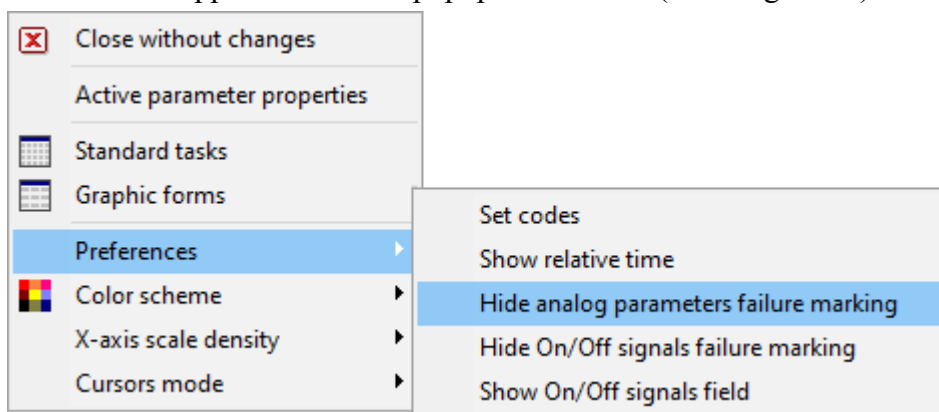
10.6. Marking plots with information distortion (failures)

The parts of the record with erroneous information may be marked in order to be excluded from further processing. Record quality should be analyzed by the user. The program is also able to set failure marks automatically during read out if the appropriate mode is switched on ([Section 3.2.1](#)). The information is considered incorrect if the actual frame structure does not comply with the frame structure of the current FDR type. The **frame failure** mark is set for those frames. The parts of the information with the failure marks will be plotted in the color defined by the user (in white color by default). To define the color right click on the graph field and use the appropriate item (**Color scheme/Failure marks**) of the popup menu (Drawing 10.19).



Drawing 10.19

The program provides the ability not to display parts of the information, marked as failure. This function is applied separately to analog parameters and/or On/Off signals. To select the type of the parameters this function will be applied to use the popup menu items (Drawing 10.20).





Drawing 10.20


Note: While creating the table of the parameters the linear interpolation will be used to determine the values of the parameters for the parts of information marked as failures if those parts are displayed on the screen. Otherwise, the values will not be calculated at all.



Follow the procedure below to set the **Frame failure** mark manually:

1. Place the moving cursors on the boundaries of the desirable interval.


2. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .

3. Press **Insert** key.



4. Press the  button once again to exit from the failure setting/removing mode.
To mark extended parts of the information the following procedure may be used:

1. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .


2. Move the cursor to the beginning of the desirable interval and, not releasing the left mouse button, press also the right mouse button or **Shift** key and move the mouse pointer to the end of the desirable interval.

3. Press the  button once again to exit from the failure setting/removing mode.
To remove the **Frame failure** mark:

1. Place the moving cursors on the boundaries of the desirable interval.

2. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .



3. Press **Delete** key.

4. Press the  button once again to exit from the failure setting/removing mode.

If only **particular analog parameter or On/Off signal** has registration failures it is recommended to exclude it from further processing by setting a **Parameter failure** mark. Follow the procedure below to set the **Parameter failure** mark:


1. Determine the part of the record with incorrect information.


2. Display analog parameter or On/Off signal.


3. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .

4. Place the cursor above the registration instants that have to be marked as failures and click with the left mouse button.

5. Repeat item 4 for all desirable registration instants.

6. Press the  button once again to exit from the failure setting/removing mode.

All the registration instants of any parameter that are located inside the  cursor will be marked as failures. During cursor moving the status bar will contain the short names as well as the numbers of frames and registration instants that are inside the cursor and, therefore, could be marked as failures.



Recommendation: To set/remove failure marks it is highly recommended to display the graphs of the parameters showing registration instants (button ).

Note: The On/Off signal **must** be displayed on the field of the analog parameters if you want to set a failure mark on it.

There is the second way to set a **Parameter failure** mark:


1. Determine the part of the record with the incorrect information.

2. Display analog parameter or On/Off signal.

3. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .

4. Draw the rectangle with the help of the left mouse button keeping pressed **Shift** key. All the registration instants that are inside the rectangle will be marked as failures.

5. Repeat item 4 for all desirable registration instants.




6. Press the  button once again to exit from the failure setting/removing mode.
All the registration instants that are inside the rectangle will be marked as failures.


There is one feature while setting the **Parameter failure** mark caused by the limited screen resolution. The program does not output registration instants that coincide with the instants that are already plotted on the screen. The **Parameter failure** mark is set only for the registration instants that are currently displayed on the screen. Therefore, it is possible that after some failure marks were set and **Enter (Space)** key was pressed hidden registration instants will be displayed and require the failure marks to be set on them also. This feature also exists when you remove **Parameter failure** marks (see below).

Attention: Before removing the failure marks you have to make sure that the program displays the parts of information marked as failures for analog parameters and On/Off signals and that On/Off signals are displayed on the analog parameters field.




Note: You have to display plots showing registration instants (the  button) to remove the failure marks.

To remove the **Parameter failure** mark:

1. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .
2. Place the cursor on the part of information marked as failures and click with the right mouse button.
3. Repeat item 2 for all desirable parts of information.
4. Press the  button once again to exit from the failure setting/removing mode. Failure marks will be removed from the registration instants that are located inside the cursor.

Note: To remove the failure marks you **must** display the information showing the registration instants (the  button).


The second way to remove **Parameters failure** mark is as follows:

1. Press the  button to enter into the failure setting/removing mode. The shape of the cursor will change to .
2. Draw the rectangle with the help of the right mouse button keeping pressed the **Shift** key. Failure marks will be removed from all the registration instants that are inside the rectangle. You may also draw the rectangle with the left mouse and keeping the **Shift** key pressed but in direction from the right bottom corner to the upper left corner.
3. Repeat item 2 for all desirable parts of information.
4. Press the  button once again to exit from the failure setting/removing mode.


Note: If you do the procedure that removes **Parameter failure** mark from the part of information that has **Frame failure** mark inserted then only registration instants that are located inside the cursor or rectangle will be cleared.

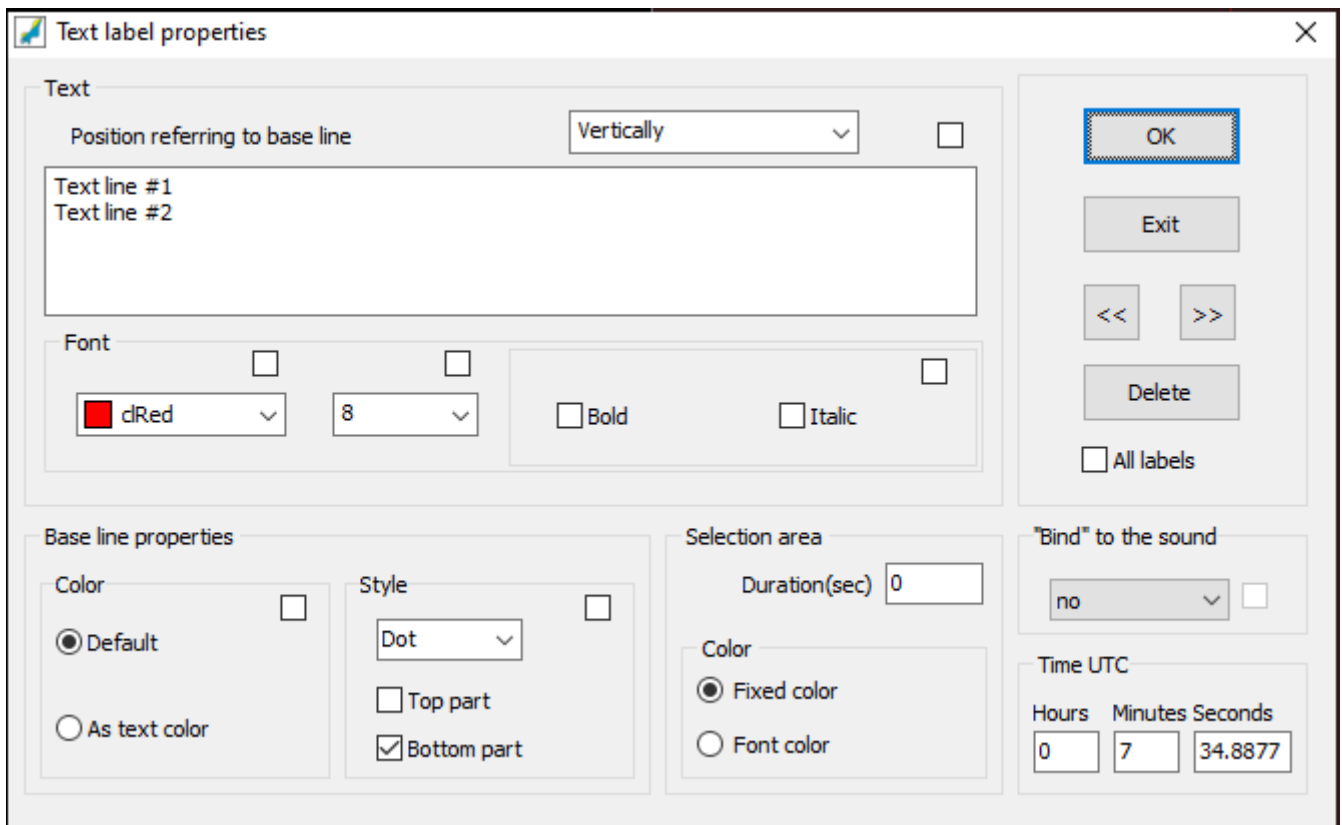
It should be noted that setting failure marks **does not change** the registered information, and only excludes marked parts from further consideration and analysis. To view the information without failure marks press **Ctrl+Enter** keys, to return to the previous view – press **Enter** key.

10.7. Text labels setting and removing


Press **Insert** key to set a text label in the active cursor position. Move the cursor a bit aside and a vertical dot line (called base line) will appear showing text label location. The shape of the cursor will change to  after placing above the base line. You can move the text label along the X-axis by grabbing it with the left mouse button.

If the label contains text it could be moved up and down after the shape of the cursor changes to vertical arrow .


Right click after the shape of the cursor will change to  form to display **Text label properties** dialog box (drawing 10.21).



Drawing 10.21

Press **Insert** key to set a text label in the active cursor position. Move the cursor a bit aside and a vertical dot line (called base line) will appear showing text label location. The shape of the cursor will change to  after placing above the base line. You can move the text label along the X-axis by grabbing it with the left mouse button.

If the label contains text it could be moved up and down after the shape of the cursor changes to vertical arrow .



Right click after the shape of the cursor will change to  form to display **Text label properties** dialog box (Figure 10.21).

Using this window you may specify:

- Text of the label;
- Position regarding to the base line;
- Font and its properties;
- Style and color of the base line;
- Duration and color of the selected area associated with the label;
- Binding a label to a parameter of the sound stream type;
- The exact position of the label in relative time.

To set the exact position of the label specify desirable values of hours, minutes and seconds and change to the relative time mode.

Check the box in the upper right corner of any field if you want to apply the given settings to all the labels.

To scroll through the existing labels use   buttons.

Press the **Delete** button to delete the current label. If the **All labels** box is checked all the labels will be deleted from the file.

Another way (most recommended) to insert text labels is import from the simple ASCII (text) file. Select the **Data sharing/Text labels/Import** menu item to display the file open dialog box.

Each line in the file should contain the information about one text label. The simplest line consists of two fields: time in **hh:mm:ss** format (delimiter “:” is mandatory) and, **after space**, the text of the label. For example:

10:41:09 Cap: Turn right, heading 250.

Note: the text file should be prepared in one of the Windows system text processors (*NotePad* is recommended). When the file is made in DOS mode Cyrillic fonts can be imported inaccurately.

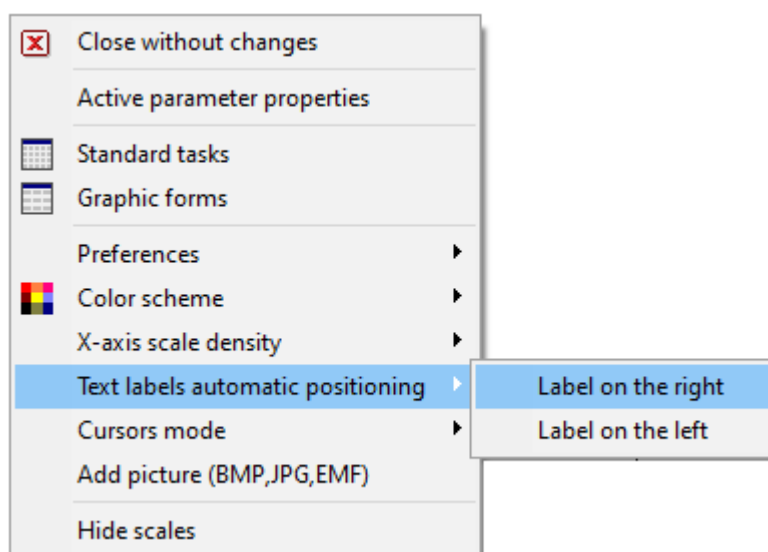
Additionally the line may contain information about position of the label as well as font and color. This format is received for example after exporting the labels using the **Data sharing/Text labels/Export** menu item.

10:41:43 Cap: Engines idle;0.13207547;0;8388608;8;0;0

Additional information is as follows: vertical position of the label (in units of the graph field height), orientation regarding the base line, color, font size, bold or not, italic or not. The fields delimiter is «;». It is **not recommended** to adjust these parameters manually in a text file. Use **Text label properties** dialog box to customize appearance of the labels (Figure 10.21).

It is recommended to use labels export function if you need to change the content of some labels without changing their position and appearance. After all the changes are made and saved use the import function (see above) to activate the changes in the **WinArm64** file.

The program could help you to arrange existing labels vertically. This function will be applied only to the labels that are displayed horizontally (left or right from the base line). Select the part of information with the labels that need to be arranged using the moving cursors and right click to display the popup menu (Figure 10.22).



Drawing 10.22

Select arranging direction: to the left or to right from base line.

You have to remember that the text labels may be saved **only in graphic forms** (Section [Section 10.1.2](#)) or by importing to a text file. If the current set of the displayed parameters along with the text labels is not saved as a graphic form then all the labels will be lost after the file is closed.

10.8. Data Insert and Removal

This option is not available in current version of software.

10.9. Parameters table making

For formation of tables of parameters values it is necessary to install cursors on borders of chosen time interval and to select menu **Data sharing/table of parameters**. A window, presented on drawing 10.23 will appear.

The 'Table properties' dialog box is shown with the following settings:

- Time**
 - Step (sec): 0.5
 - Time origin: ☒ From current value, ☐ From zero
 - Format: ☐ 00h00m00s, ☒ 00:00:00, ☐ Seconds
- Additional significant digits**: 2
- Table type**: ☒ Equal step (with interpolation), ☐ On measuring instants (without interpolation), ☐ On measuring instants (with interpolation), ☐ On labels (with interpolation)
- Text Conversion**: ☐
- Format**: ☐ Text, ☒ Excel
- Parameters list**: ☒ Display, ☐ Template (with an 'Edit' button)

Buttons: OK, Cancel

Drawing 10.23

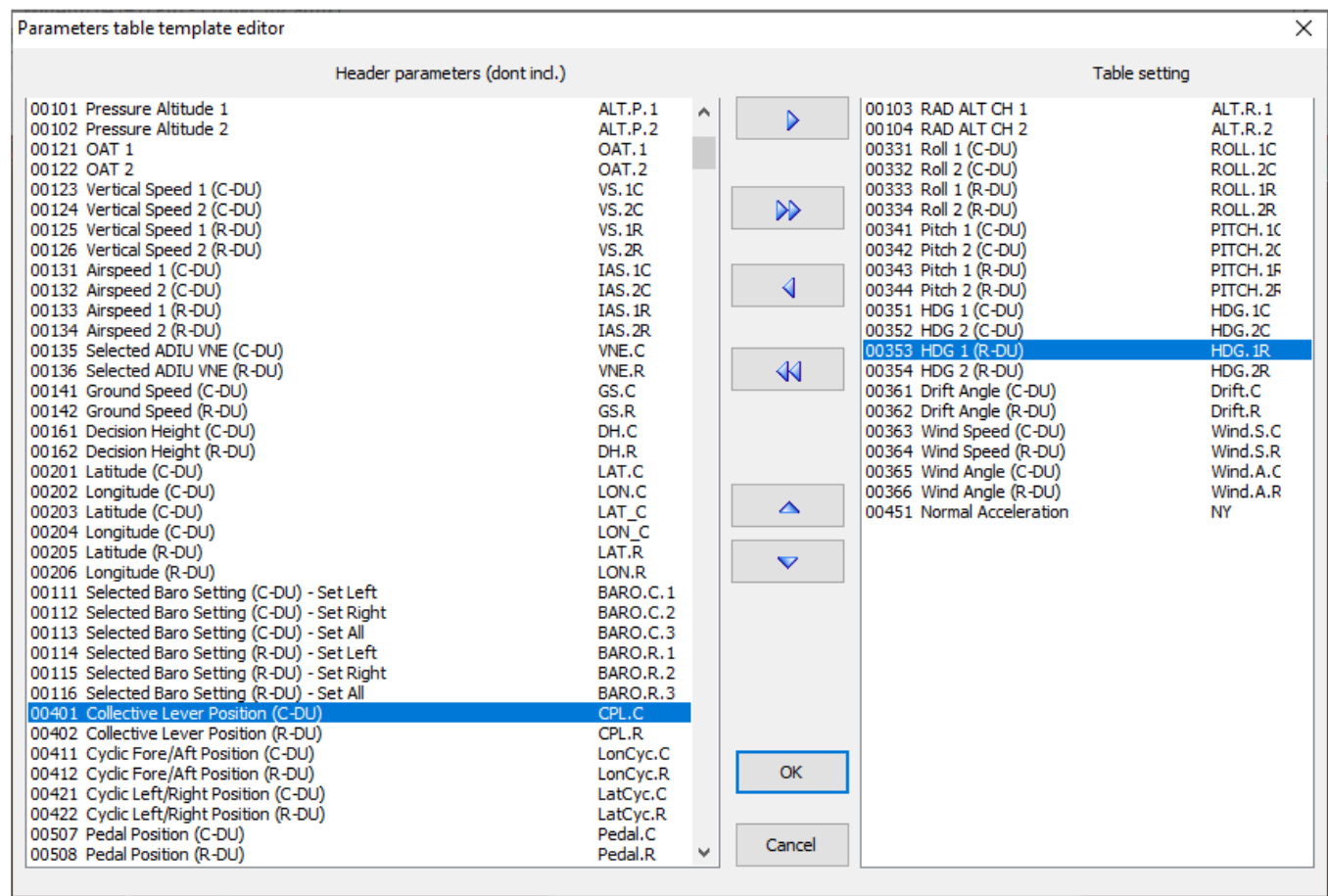
There are four different modes of reading the data:

- **Through equal steps with interpolation.** The table of the values of the parameters linearly interpolated with equal steps will be created. The value of the step is set in the **Step (sec)** field.
- **Through registration instants without interpolation.** The table of the values of the parameters that were read out exactly at the registration instants will be created.
- **Through registration instants with interpolation.** The table of the values of the parameters that were read out exactly at the registration instants will be created. The values of the other parameters in the given time instants will be received as a result of linear interpolation.
- **Through labels.** The program will create a table of the values of the parameters readout at the instants where *text labels* are inserted. The values will be received as a result of linear interpolation. If a label contains a text string it will be also added to the table of parameters.

Using the window presented on Drawing 10.23 you may also customize time format, time origin and number of additional decimals that should be added to the value specified in the file header ([Section 3.4.1](#)).

Additionally you can set up the way, which will be used for choice of required parameters. At switch position field **Parameters list** in position **Screen** the table will consist of values of all parameters currently displayed on the screen. At the position switch **Template** a predefined list (template) will be used to choose

choice parameters, saved in the header of the current data file. For setting (modification) of template use button **Edit** . In additional window you can produce choice and sorting (ordering) of required parameters (Drawing 10.24).



Drawing 10.24


After pressing **OK** (Drawing 10.23), in dependency of the switch in the field **Format** the text file or **Microsoft excel** file will be created.

At choice of textual format text editor **word pad** will open file **tabl.txt** from the **WinArm64** root directory, which will contain a description of the parameters and their values. The file header contains the type and tail number of the aircraft, as well as the name, identifier, units and number of decimal places for each of the presented parameters. This file will be automatically rewritten at every new formation of table, that's why for further use it is necessary to save it under another name.


At choice of format **Excel** the subdirectory **TMP** will receive the file **table#.txt** , data from which then are used for creation of **Microsoft Excel** file. Opened file will consists of two pages. The first page contains parameter values, the second page contains reference data on flight and parameters. The user can save this file in the desired format for further use.

10.10. Files headers saving and changing


The program allows you to save the header from the data file for its further use with data from other flights, as well as to replace the existing header with another prepared earlier. For this relevant points of the

main menu **Data sharing** ([Section 3.3.1.4](#)) is used, or paragraph menu drop-down buttons  ([Section 3.3.2](#)). In the dialogue set the file name for saving the current header or choose file for its replacements.

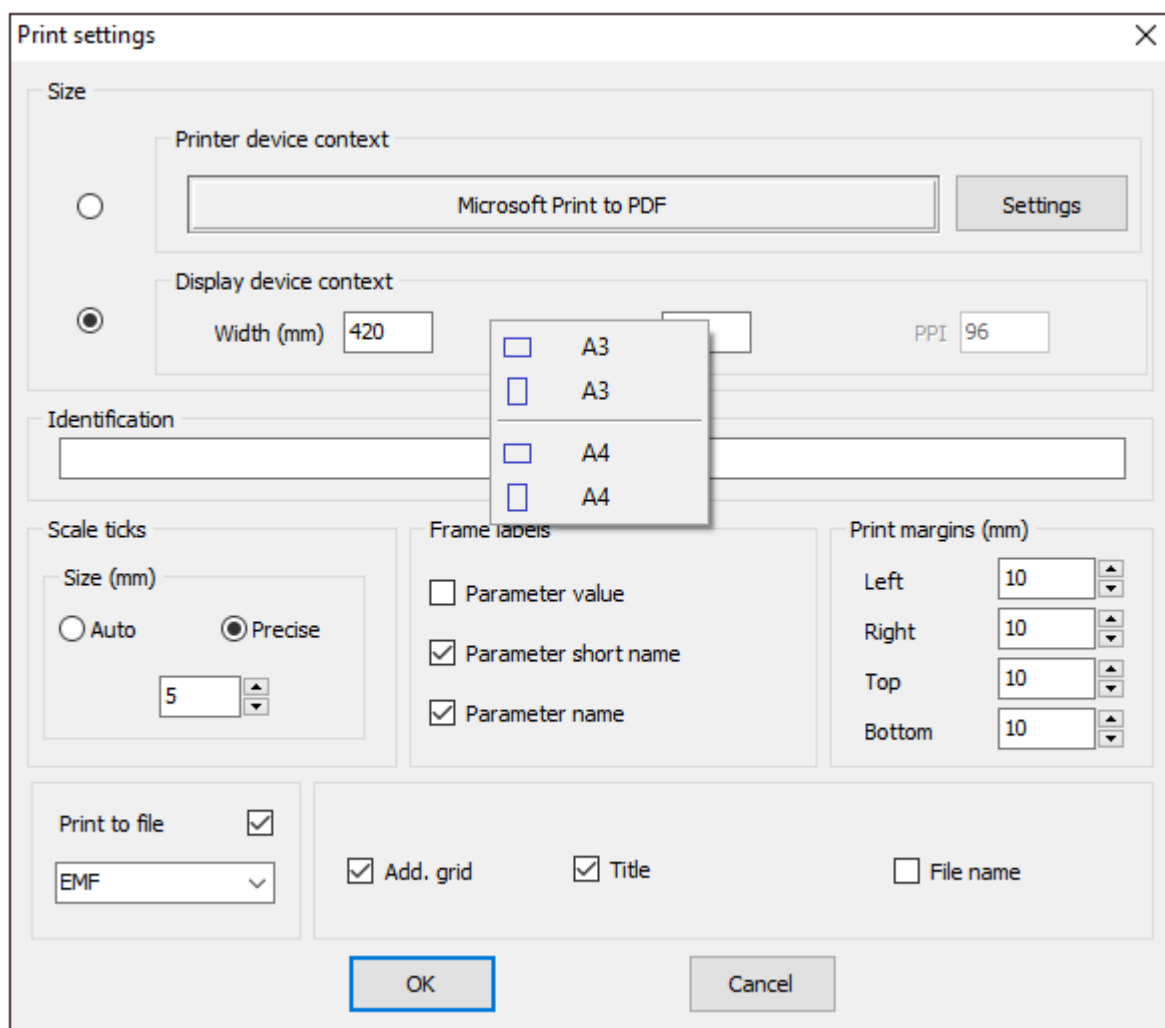
***Note:** when importing a header, you must additionally answer the question about replacing flight passport.*

For export flight data to another flight information processing programs use menu **Data sharing/Save data** (Section 3.3.1.4) or corresponding drop-down menu button  (Section 3.3.2). As a result data file without a header with information words of two bytes will be created. The file be will formed in time interval between moving cursors.

10.11. Graphs printing and printer setup. Features of the “Plot for printing” mode

For transition into the mode **"Plot for printing"** you can press **Shift - Space** or choose corresponding menu item from dropdown button . Window in **"Plot for printing"** shown in Section 3.3.5.

First of all it is necessary to choose the printing context. Chose it with the help of **Print settings** (Figure 10.25) that appears after selecting the menu item **File / Print settings**.



Drawing 10.25

In the **Identification field** , enter the name of the organization or any other information that will appear at printing in the left upper corner of the plot. Further the date and time of printing, number of graphic form and user name will be printed. In the right upper corner the content of the first six fields of the passport are displayed, except for the **Note** field. If any of these fields is not filled, then it will not be printed. If you check **File name** for printing, the name of the file **WinArm64 (arm, armx)** will be shown.

User may tune fields (indentation) of the printed sheet. Choose option **Arbitrary context** will allow you to export an image to a file of arbitrary size up to 840x840 mm with current resolution screen. Dimensions of standard formats (A3 or A4) can be set from pop-up menu, emerging after pressing right mouse button on the field of choice of size of arbitrary context images.

By default, the program prints only those vertical grid lines that go through timestamps containing numeric values. To print additional lines coordinate grids it is necessary to tag switch **Additional grid**.

For printing picture caption inscriptions and file name mark relevant switches.

Program automatically tunes digitization of parameters scales, located on one level by vertical. For definitions of settings given distance between two neighboring ticks of scales (field **Size**). You can set either the exact value of the distance, or select automatic setting. Recommended use of automatic scales adjustment, which carried out with taking into account heights of current font and guarantees absence of "overlays" of scales to each other. Sometimes arises necessity for accurate definitions distances between ticks. In this case, the switch is selected to **precise**, but the user himself must control the absence of overlaying of parameters. To ensure automatic synchronization of vertical scales program changes values divisions at moving parameters. Availability framework text marks limited in box **frame on labels**.


After making all the settings, you need to save the current print job as a graphic form ([Section 10.1.2](#)). The text of the caption will correspond to the specified name of the graphic form.

After saving the list and layout of parameters as a graphic forms it becomes current and its number appears in informational line on indicator field. Further, after pressing **Ctrl + S**, all changes will be saved in this graphic form. The exception is caption text. To change it, you need to enter the graphic forms window ([Section 10.1.2](#)), right-click on the desired line in the list of graphic forms and enter a new name in emerging window.

Next step - choice (output to the screen) of analog parameters and discrete signals, charts of which you wish to print. In case of availability of discrete signals it is necessary to decide will they be printed in the field of analog parameters or discrete signals or in both fields simultaneously.

After displaying all the required parameters on the screen, you can start formatting the graph. It is necessary to remember, that in mode **"Plot for printing"**, active is the parameter, near graphic of which the system cursor is currently located. When the cursor is positioned on the scale field, the active is scale parameter, and not itself. Name of the current active parameter is displayed in status line. Formatting parameters and scales (separate and and joint moving, changing of scale) can be done with the help of keyboard or mouse scroll wheel. For separate displacement of active parameter (cursor on the field graphs) or scale of active parameter (cursor on the field scales), are used keys **Up / Down** or scroll wheel. For separate changes scale active parameter (cursor on field graphs) or scales active parameter (cursor on field scales) **Page Up / Page Dn** keys are used. When the cursor is at the top of the scale, pressing the **Page Up** key will increase size of scales up, and pressing keys **Page Dn** - reduce size scales up. At position of cursor at the bottom parts of scales, pressing keys **Page Up** will reduce size scales down, and pressing keys **Page Dn** - increase size scales down.


To move the scale and the parameter together, use the **Up / Down** keys or the scroll wheel holding key **Ctrl**. At moving scales and parameters program automatically aligns marks located on one level scales providing correct rendering grid lines.

When drawing discrete signals on the field of discrete signals, it is possible to compact them by vertical. For holding seals necessary to move cursor in this place of the screen, where identifiers of discrete signals displayed (the shape of the cursor will change to ) , and click the left mouse button. There are three degrees of compaction, which are applied sequentially after each next clicks.

After scales and positions of all the parameters are adjusted and **saved** in the current graphic form you may add the names of the parameters and their current values. This procedure is done in the **real size**

mode. Press the  button to enter this mode.


To move through the graph in this mode you have to click with the middle mouse button or if it is absent with the left mouse button keeping **Ctrl** key pressed. The shape of the cursor will change to the

 form. Just move the mouse to go to the desirable position. Rotate the scrolling wheel of the mouse to zoom the graph. Left click to exit from the moving mode.

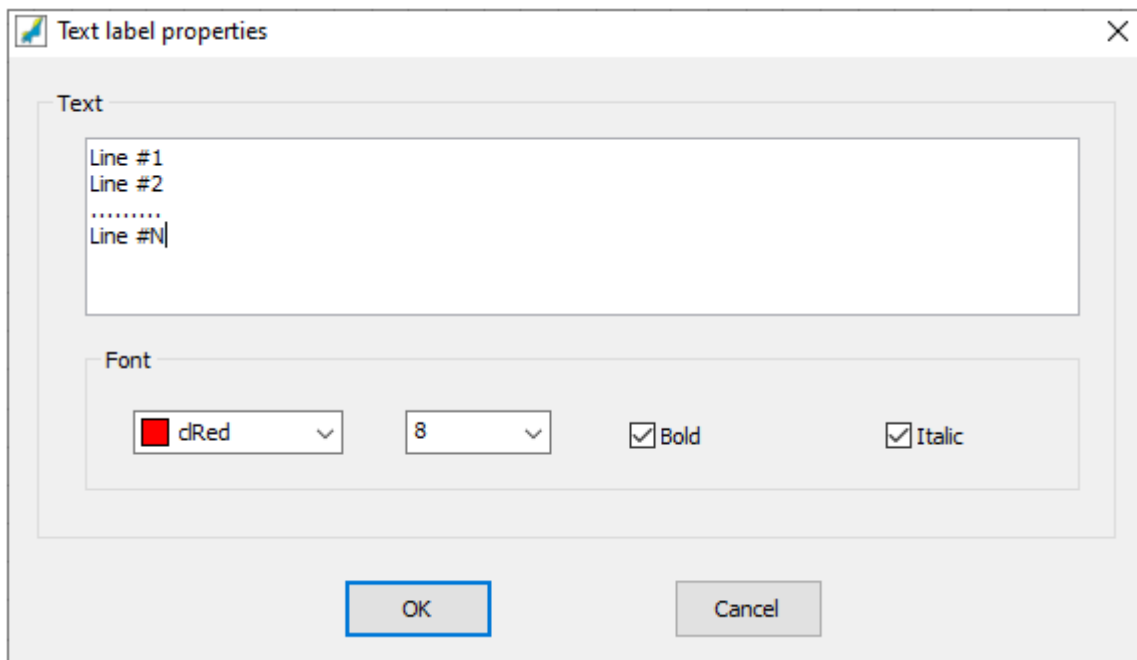
To insert the current value of the parameter right click close to its graph in the desirable position. To insert the full name of the parameter right click close to its graph keeping the **Shift** key pressed. To insert the short name of the parameter right click close to its graph keeping the **Ctrl** key pressed. Keep

both keys pressed to insert the full and short names together. Regardless of the type the label is inserted in the way when the center of the circumscribed rectangle is located at the click point.

You are able to insert also **special text labels** that are bound to a graph of the selected parameter. The feature of this type of label is that they move along with the associated parameter along the graph field and may contain a text in several strings. Right click close to the graph of the desired parameter keeping the **Alt** key pressed to insert the text label of that type. The label properties window will automatically appear (Drawing 10.26). Right click keeping the **Alt** key pressed after system cursor



changes to the  shape and the label receives the input focus to display this window for the label that already exists.

***Note:** just place the system cursor above the label to shift the input focus and change the shape of the cursor.*



Drawing 10.26

Special text labels are also used to display labels (values of discrete signals) for parameters type **Analog#2/ Digital code/On-Off signals word** ([Section 9.2.2.2](#)). Program automatically enters in the **Label Properties window** the names of all discrete signals registered in this moment.

Removal of labels of any type can be done by repeated click right button (without pressing any keys) near the center of describing rectangle, after cursor will accept form . Moving of labels of any type is made by keys **Left / Right** And **Up / Down** after the cursor will receive focus input (cursor will accept form ).


You may insert the values of all the parameters displayed on the screen at the same vertical section specified by the position of the **system cursor** (not moving cursors!!!). Press **Ins** key to perform that action. The values of displayed parameters will be inserted exactly at the registration instants closest to the cursor position.


The user may remove all the labels simultaneously located between moving cursors. Just select the desirable interval being in normal mode, shift to **the real size mode** and press **Del** key.

The user may select a different background color for the part of the plot currently located between the moving cursors. This procedure is usually used to tell that additional attention should be paid to this region. To implement this function select the **Color scheme/Selected area** item of the popup menu and

specify the color. The results may be viewed in real size mode (the  button).

There is one more way to select several parts of the plot with a different background color. You have to use text labels for that purpose. Specify the duration of the interval that will be colored to the

right of the label using the **Duration** field of the **Selection** area (Figure 10.21). The duration has to be set in seconds. The color of the selection depends on the switch box position and may be the same as font color or correspond to the color selected in the **Color scheme/Selected area** item of the graph field popup menu. The results may be viewed in real size mode (the  button).

Select the  button or **File/Print** menu item to print the graph on the current printer. If the **Print to file** box of the **Print settings** dialog box is checked the program prompts you to enter a name of the file. This file will be automatically opened in the standard Image Viewer of the **Windows™** system.

***Note:** The system warning dialog will appear if the Image Viewer is not installed. Just close it and continue to work.*

10.12. Identification data viewing

Identification data registered by the current FDR are shown in the indicator field or in a separate window (Drawing 10.27) that appears after selecting the **File/Identification data** menu item or pressing **Shift+F2** keys. The amount and contents of the identification data depend on the FDR type. For predetermined types of FDRs of some aircraft for which the identification data and its position in data frame is fixed the identification data is displayed automatically.

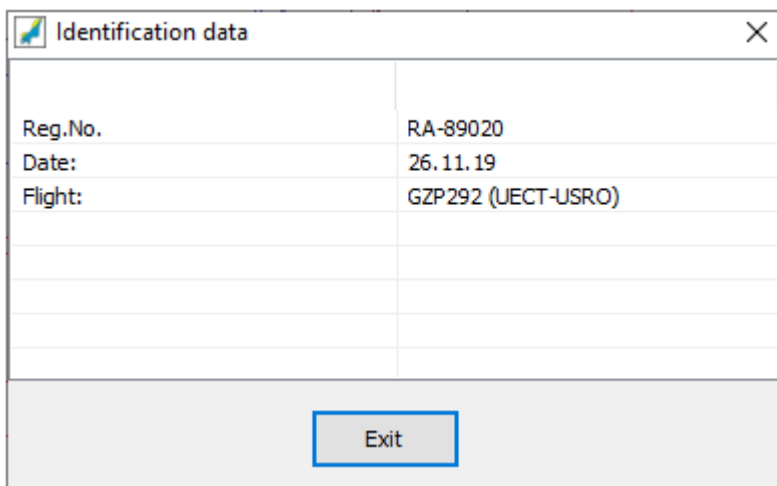
Display of identification data for some types of FDRs suggests explicit setting links on identifiers relevant to parameters on tab **Passport, Common data** window of **Header editor** (Section 3.4.5).

Identification data are read by the program at the position of active cursor. If identification data missing or have obviously unfaithful values it is necessary to close window, move cursor to the new position and open a window again.

The reasons for the incorrect display of identification data (their inconsistencies with what should be set) can be both their actual incorrect setting by the crew and failures (for example, skip frames) when recording or reading information. In all cases, it is recommended to check the received information.

Program provides opportunity automatically bring in identification data (flight date and number), which is displayed on field indicator, to relevant fields of passport. Click **ctrl + F10** and confirm this action in emerging window.

Drawing 10.27 shows an example of displaying identification data for a FDR of type BUR-1.



Identification data	
Reg.No.	RA-89020
Date:	26.11.19
Flight:	GZP292 (UCT-USRO)
Exit	

Drawing 10.27

10.13. Working with parameters of Integral type

If a current header contains at least one parameter of the **Integral** type (Section 9.2.2.7) then the **Task** menu will have the **Integration** item. Select this item or press **Ctrl+I** keys to display the **Integration** window (Figure 10.28).

The Integration dialog box contains the following fields and a table:

- Tasks:** A dropdown menu with "#1" selected.
- Integration step (sec):** A text field with "0.0250" and a dropdown arrow.
- Display step (sec):** A text field with "0.1000" and a dropdown arrow.
- Additional stream to save results:** A dropdown menu with "Stream #01. Empty" selected.

Parameters	Right parts	Algorithm	Initial value
Alt.Calc	VertRate	!Lgpress * (SpeedTru * 0.1544) * sin_g(FPA)/cos_g(FPA)	0
Distance	TAS.m/s	SpeedTru * 0.1544	0

At the bottom are "OK" and "Cancel" buttons.

Drawing 10.28

Integration of the selected task (field **Task**) is performed on the interval between moving cursors after pressing the **OK button** . Either is taken as the initial value. the value of the specified parameter in the position of the left cursor, or a constant value specified in the field **D** tabs **graduation** ([Section 9.2.2.7](#)). For failure from holding integration, click button **Cancel** . The integration results are saved as an additional stream ([Section 10.15](#)), whose number is given user V relevant field (dropdown list). IN further these results may be used for other calculations. **Attention**, if a stream number is specified, which is already contains data, That They will overwritten without warnings.

User Also sets step integration And step output results integration V seconds. The value of the information output step cannot be less than the value of the integration step. Program automatically will fix input user at erroneous ratio specified parameters. On pressing the **OK** button integration of the task selected from the **Task** drop down list will be completed on the interval between moving cursors. The initial value of the integral will be taken from the position of the left moving cursor if the parameter that determines the initial value was defined or the constant value specified on the **D** field of the **Calibration table** page will be taken as initial value. Press **Cancel** button to refuse from integration. Integration results will be saved as an additional data stream which number was specified in the corresponding drop down list. Those results may be used for further calculations. **Attention**, if the number of the additional stream that already contains the data was specified then all the data will be rewritten without confirmation.

You may also customize integration step and output information density. Both values have to be specified in seconds. The output step could not be less than integration step. The program will correct erroneous inputs automatically.

10.14. Working with parameters of Sound stream type

See [Section 9.4](#) once again before reading the current paragraph.

First of all you have to display the parameter of **sound stream** type in standard manner using the **Select parameters** window ([Section 10.1](#)).

You may change position, vertical scale and color of the parameter in standard manner.

The state of the **Fix** check box on the **Parameter** page of the **Header editor** window governs the ability to move and scale (change playback time) the parameter along the time axis ([Section 9.4](#)).

While creating a new parameter of the **sound stream** type the offset of the beginning of the sound comparing to the beginning of the flight data is set to 0 **frames** (no displacement). You have to capture sound stream with the left mouse button to move (displace) it the along the time axis (the **Fix** box must not be checked). The second way to move a sound stream is to input the desired amount of **frames (not seconds)** in the **D** field of the **Calibration table** page of the **Header editor** window. The program starts to count frames from the beginning of the flight data.

You may change playback duration of the selected sound stream by scaling it along the time axis. Left double click on the graph keeping the **Alt** key pressed or enter the desired factor (multiplier) in the **K** field of the **Calibration table** page of the **Header editor** window to scale a sound stream (the **Fix** box must not be checked).

***Important:** Entering the factor you will change the scale of parameter's graph (plot) on the screen and the speed of cursor moving during playback. You will not change the actual length of file and playback speed.*

To implement the selected factor to a sound stream (to change the sound file) you have to press the **W** key while in graph viewing mode with the desired parameter being active one. The program will done necessary conversion and save a new file with the pre-defined name in the current folder and input this name in the **Wav file** field of on the **Parameter** page of the **Header editor** window. The initial file ***will not be changed***. The user may change playback duration once again and conversion will be done ***using the initial, not modified file*** and derivative file will be automatically rewritten! So, conversion is done only once that guaranteed the quality of sound during playback. It should be noted that satisfactory sound quality during playback could be received if file length changes in 75% - 115% range.

***Note:** The pre-defined names for sound files are combined from a name of the corresponding data file, undersign symbol and 01...05 numbers (for initial files) and #1...#5 numbers (for files with modified length) where digits 01...05 correspond to the channel number. If a current folder contains a sound file whose name has # symbol then this file will be loaded by default. Delete this file from a current folder to tell the program to load the initial sound file (with 01...05 numbers).*

You may use the described methods to change the sound file length in order synchronize sound and flight data using, for example, VHF keying On/Off signal. It is a well known fact that, in general, the speed of the sound recording for tape and wire CVRs onboard the aircraft is not equal to playback speed on ground equipment. The playback time may differ from real (astronomical) time significantly. Along with the changing of sound playback time you may use a method of ***associated text label*** to synchronize the flight data and sound information. The user may add a text label (Drawing 10.29), bind it with a particular position in a sound file and, at the same time, with the current frame of flight data information. If this type of label is added then all the conversions of the sound file will be done so as to maintain a position of the ***associated text label towards a sound file as well as a flight data file***.

To add an ***associated text label*** you have to make active a parameter of the sound stream type, move one of the cursors to the desired position, press the **Ins** key and confirm label creation. A new text label ***bound only to a sound stream*** will be created. This type of label will maintain its position towards a sound stream under any sound file conversions.

To bind this label to flight data as well you have to display **Text label properties** window (Drawing 10.29) and check the box on the **"Bind" to the sound** field.

You may also convert any existing text label to the ***associated text label*** type. Open the **Text label properties** window for the desirable label, select the short name of the sound stream from the drop down list on the **"Bind" to the sound** field with which you want to associate the label and check the box if you want to bind it to the flight data information as well. This field is not accessible for editing if there are no parameters of sound stream type in the current header.

Drawing 10.29

Note: It is important to understand that for each parameter of sound stream type **only one** text label associated **both** with sound and flight data information may exist. At the same time you may have **several** labels associated with sound file **only**.


If the **Fix** box is checked on the **Parameter** page of the **Header editor** window then **all conversions** of this parameter (moving and scaling) along the time axis are disabled.

Thus, the generic procedure to synchronize sound and flight data information is as follows:


1. Add a parameter of a sound stream type to the current header and associated a sound file with it. Make sure that the **Fix** box is not checked.
2. Match any of the crew radio communications with the corresponding On/Off signal. Just move a sound stream to the desirable position with the left mouse button or enter the necessary value into the **D** field of the **Calibration table** page of the **Header editor** window.
3. Add the text label associated (bound) with both sound and flight data information at the same location.
4. Calculate a transition factor and enter it in the **K** field of the **Calibration table** page of the **Header editor** window or just scale (stretch/compress) the sound stream parameter with the left mouse button double click keeping the **Alt** key pressed until the second key point moves to the appropriate position.
5. **Check the Fix box to prevent a parameter from inadvertent changing!!!**
6. Press the **W** key if necessary to create a new sound file of appropriate length.

Note: To calculate a transition factor (step 4) you have to choose two instants of external radio communications separated from each other as far as possible. The resulted duration of sound in seconds has to be compared with the actual time length taken from flight data information based on the corresponding VHF keying On/Off signals. Dividing the duration received from flight data on the duration of corresponding sound part we will receive a transition factor.

Now, after synchronization is made you may start to listen to the sound information. Make active a parameter of sound stream type, move one of the cursors to desired position and press the **Space** key


or the  button. If the current position has no sound information then program will move the active cursor to the beginning of sound information.

Note: *You may listen to the information only from one sound stream at a time. If several parameters of sound stream type are displayed on the screen the user may use the **Up/Down** keys to scroll through them without stopping the playback. After selection is changed the playback will continue from the initial position (marked by the left moving cursor) selected at previous step.*

Press the **Esc** key or unpress the  button to stop playback.

To change to a new position without stopping the playback just click with the left mouse button at the desired position on the indicator field.

To loop a fragment for numerous listenings from a selected point:

- Activate the desired parameter of the sound stream type;
- Shift both moving cursors to the beginning of the desired fragment by left double clicking on the indicator panel in the needed position;
- Press the **Space** key or  to start playback;
- press the **Tab** key to return to the beginning of the fragment

If there are text labels associated with the current sound stream then pressing the **Space** key while playback is going on will force the playback to continue automatically from the new position that corresponds to the location of the first associated label while the initial position will be changed to the location where the **Space** key was pressed. Pressing the **Tab** key will resume the playback from a new initial position. If no text labels are associated with the current sound stream then pressing the **Space** key while playback is going on will move the initial position to the current position and playback will continue.

If you put any text labels (transcription) while listening you may save them in a text file using text labels export function (Section [10.7](#)).

10.15. Additional data streams

Up to **10** additional data streams to the current data file (destination file) received from others files (source files) could be added. Files data **arm** may contain before **30** parameters in each additional stream. For **armx** files, the number of parameters in additional streams is not limited. The source file can be either another data file (**arm**, **armx**), or a text file in a predefined format. For exchanging parametric data in **armx files** files of data streams **thrx** are used, for **arm** files memory buffer is used.

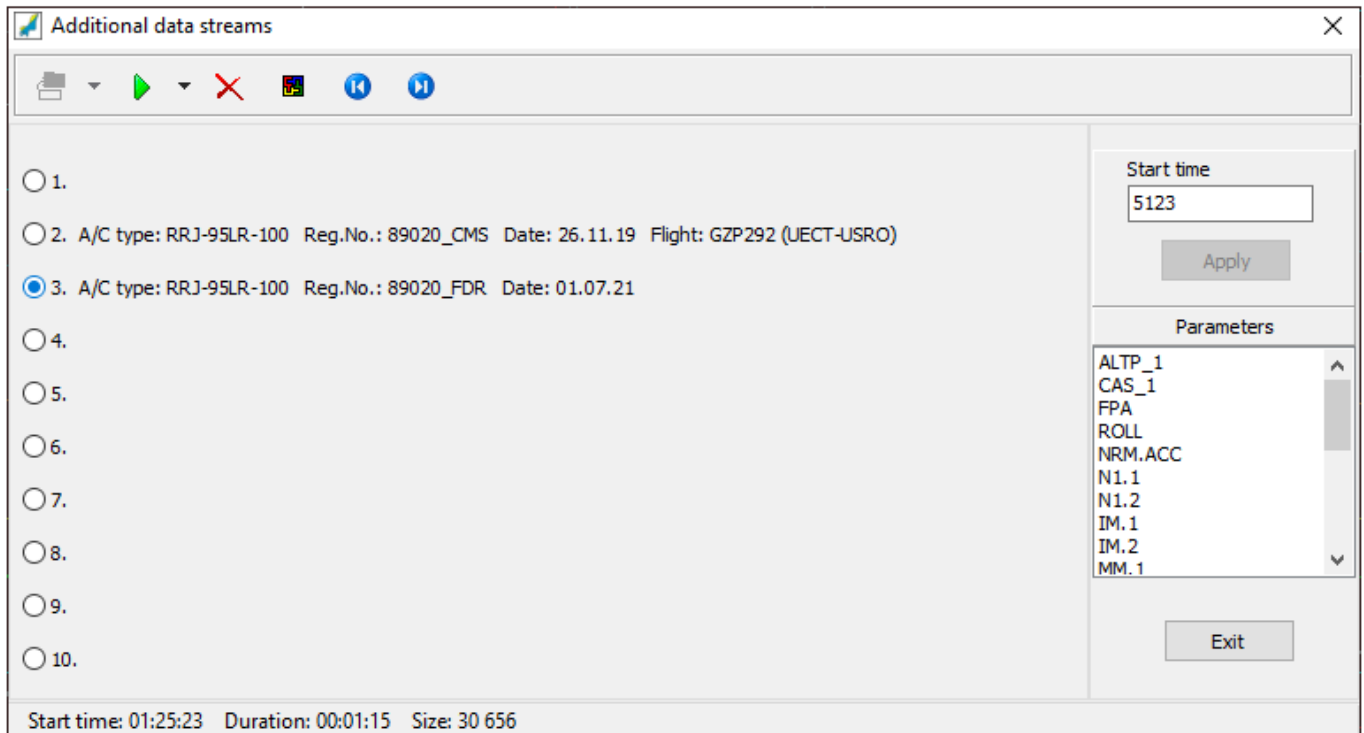
Analog parameters saved in an additional data stream have **Analog not calibrated/Real number** type, are presented *in engineering units* as a function *of relative time*. That allows saving them in a destination-file and their further use without references to a source-file. The values of the parameters are read out based on their sampling instants in a source-file.

The program will automatically assign unique numbers in a destination-file to all the parameters from an additional stream. The full names of the parameters will not be changed and the short names will be combined from initial short names by adding “~” symbol and the order number of the additional stream.

10.15.1. Inserting data streams to the arm file from memory exchange buffer

Add data stream from **arm** file to another **arm** file is done as follows:

- Open a source-file and display parameters that will be added to another data file. Select the desirable interval using the moving cursors.
- Use the **Save the stream to the clipboard** item of the **Data sharing** menu to copy selected parameters to the clipboard.
- Open a destination-file.
- Use the **Additional data streams** item of the **Data sharing** menu to display **Additional data streams** window (Drawing 10.30).



Drawing 10.30

For additions data streams user chooses any free number, reveals button



and in the menu that appears, selects *the clipboard* as the source of the data stream. The program performs the necessary actions, after which it displays information about the added stream.

Directly behind ordinal data stream number first 5 fields of passports of file-source data are displayed.

10.15.2. Inserting data streams to the arm file from text file

The text file format for adding data as an additional stream is similar to that which it turns out after saving tables of parameters values ([Section 10.9](#)). Below the fragment header and data lines are presented:

```
[B-777-300ER][XX-XXX][05.09.19]
Radio Altitude - Left [ALT.R.1][φT][0]
Computed Airspeed [CAS][ys][1]
Pitch Attitude [PITCH][deg][1]
Vertical Acceleration [VertAcc][g][2]
N1 RPM - Left Engine [N1.1][%][1]
N1 RPM - Right Engine [N1.2][%][1]
Weight On Wheels - Nose Gear Compressed [WOW.N]
```


Время UTC	ALT.R.1	CAS	PITCH	VertAcc	N1.1	N1.2	WOW.N
23:05:36	1.0	0.00	-0.70	1.001	54.69	54.79	1
23:05:38	0.8	20.46	-0.70	1.014	57.70	58.68	1
23:05:40	0.2	34.82	-0.53	0.987	76.47	76.45	1
23:05:42	1.0	42.14	-0.53	0.936	82.81	82.72	1
23:05:44	1.0	50.45	-0.53	0.984	83.74	83.74	1
23:05:46	1.0	59.31	-0.53	1.004	84.00	83.87	1
23:05:48	1.0	66.97	-0.53	0.969	84.00	84.00	1
23:05:50	0.8	74.64	-0.53	0.986	83.75	83.87	1
23:05:52	0.2	81.46	-0.53	1.067	83.87	83.94	1
23:05:54	0.8	91.31	-0.53	0.919	83.99	83.87	1
23:05:56	0.0	98.13	-0.53	1.047	84.00	83.87	1
23:05:58	0.0	107.13	-0.53	1.001	84.00	83.87	1
23:06:00	0.0	113.15	-0.53	0.979	84.00	83.87	1

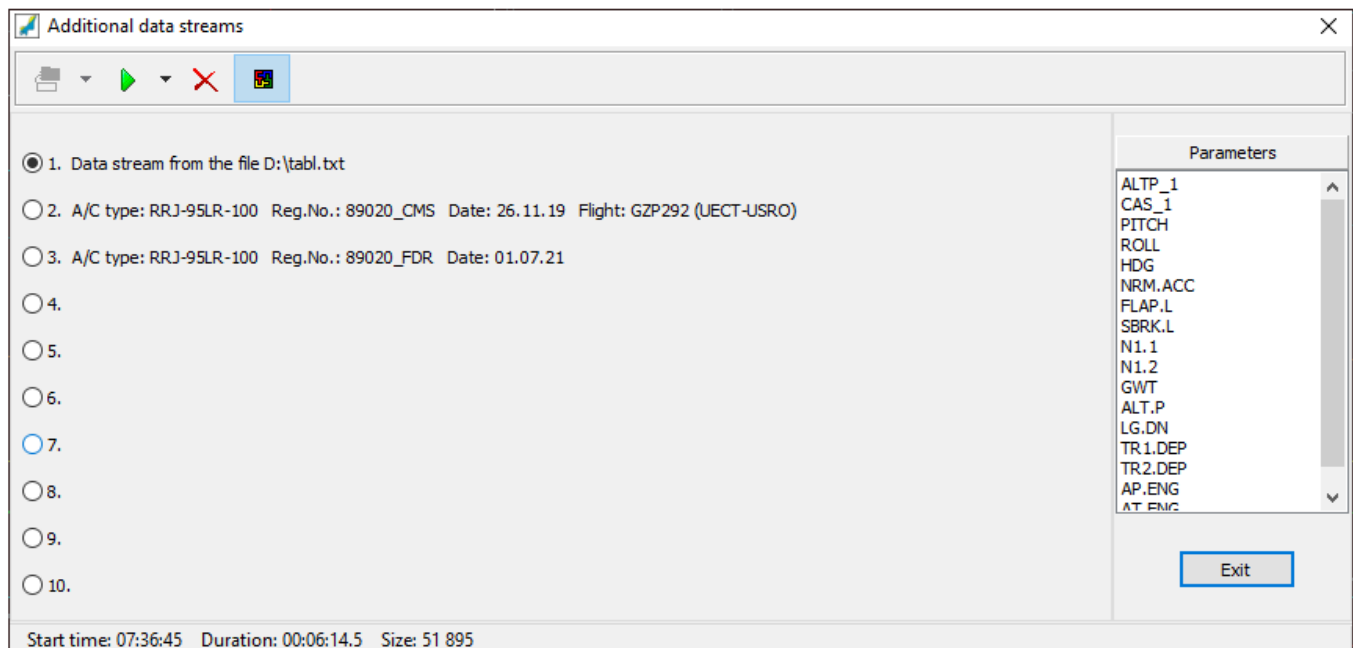
23:06:02	0.0	120.47	-0.53	0.992	84.00	83.82	1
23:06:04	0.2	125.32	-0.70	0.936	83.87	83.87	1
23:06:06	1.0	131.63	-0.70	0.979	83.88	83.87	1
23:06:08	0.8	138.14	-0.53	1.024	83.75	83.81	1
23:06:10	0.0	144.64	-0.35	0.913	83.87	83.87	1

First line contains an aircraft type, registration number and comments (if any). This line is for information purposes only and will be ignored while importing the information but it ***must be included*** in a file. The description of each parameter takes one line. The full name is specified first. The short name, units and precision are followed. Each value must be supplied in square brackets. For On/Off signals two last fields are absent.

Important: On/Off signals description must be strictly after description of all analog parameters. You may not mix description of different types!

After all the analog parameters and On/Off signals are described the empty line must be added that is followed by the line of the captions of the columns. This line will also be ignored while importing the information but must be present in a file. The data are placed in other lines. The fields in the caption line and data lines have to be separated by horizontal **Tab** symbol. The first column contains relative time instants in any of three different formats described in [Section 10.9](#). The step between knots may be arbitrary and even irregular but time values ***must be sorted in ascending order***. Other columns contain the values of corresponding analog parameters and On/Off signals. The order of the column must correspond to the order of parameter's description in the header of a file. Some of the values of the parameters may be absent in the table but separators (**Tab** symbols) must exist in any case.

To add a stream from a text file just open the **Additional data stream** window and use the **Insert the data stream from text file** item of the  button list. Select the name and location of the source file. The program performs necessary conversions and displays information about added stream. The name of the source file is displayed after order number of a stream (Drawing 10.31).

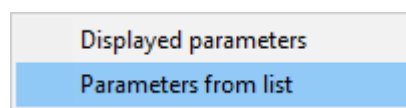


Drawing 10.31

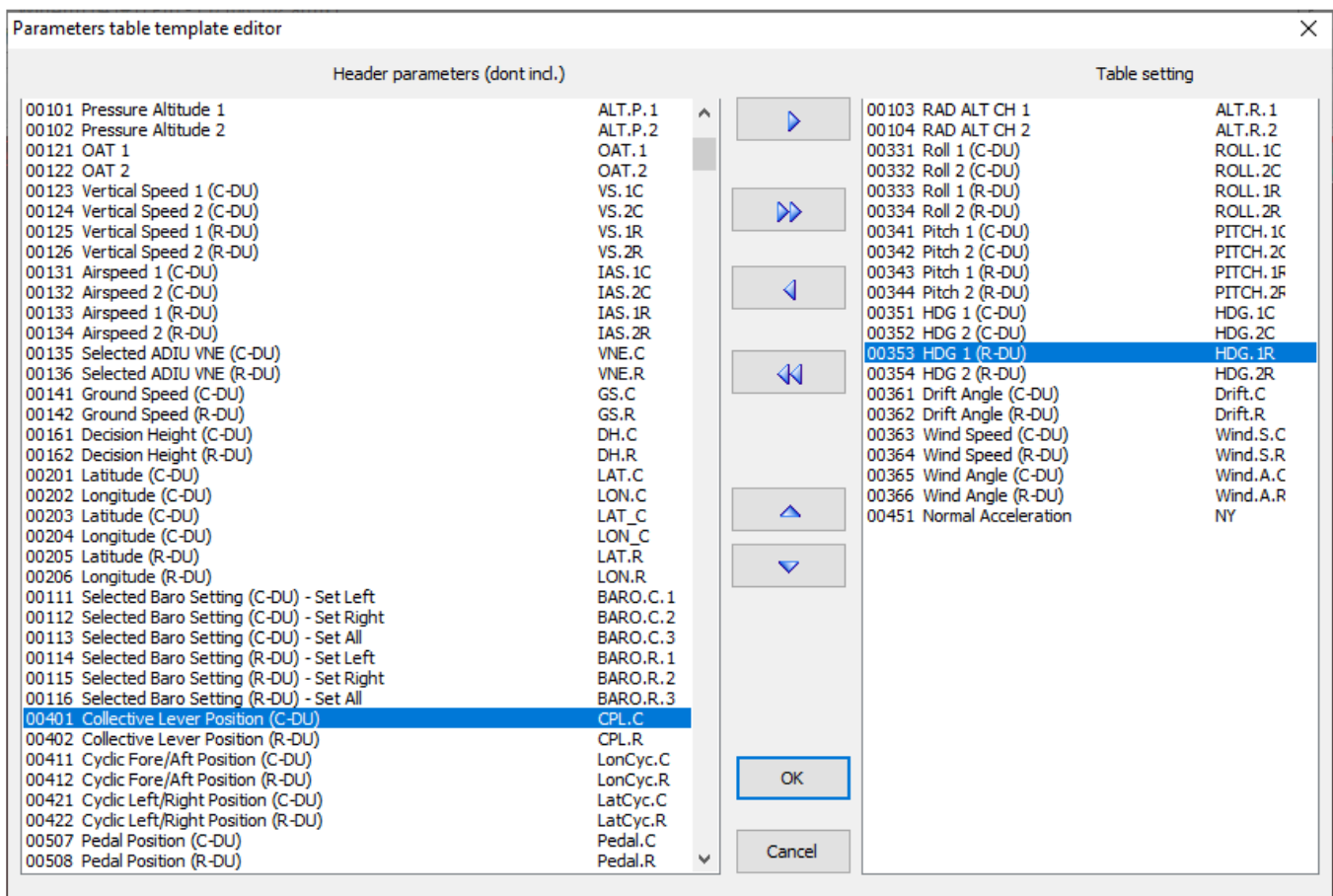
10.15.3. Inserting data streams to the armx file

Exchange of data in **armx** files is going on with the help of structures of special format **thrx**. File **thrx** contains all necessary information on saved data stream. Adding of data stream from **arm** or **armx** files to another **armx** file carried out in the next way:

- Select and open the data source file (**arm** or **armx**) for viewing. With the help of moving cursors choose the want time interval.
- Open menu **Data sharing/Save data stream (thrx)** for copying data of selected interval to the file of data stream **thrx**.
- In the menu that appears select the method for generating the list of saved parameters (Figure 10.32). When you select the **Parameters from list** menu item an additional dialog box will be opened for choosing of parameters for saving to the additional stream. (Drawing 10.33)
- Choose and open for viewing the destination file **armx**.
- Use the menu item **Data sharing/Additional data streams/Add**. In emerging interactive window choose necessary file of additional **thrx** stream.



Drawing 10.32




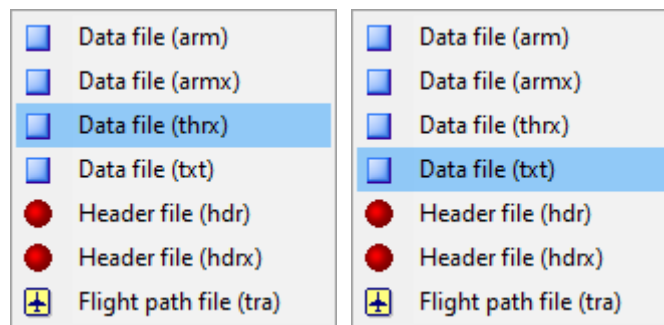
Drawing 10.33

For display window of work with additional streams it is necessary to use menu **Data sharing/Additional data streams/Change** (Drawing 10.34).



Drawing 10.34

File **armx** may be created directly from data stream (**txt** or **thrx**) by choice of corresponding item in drop-down menu on button **Data base**  (Drawing 10.35).



Drawing 10.35

10.15.4. Working with additional data streams

View of the windows to work with additional streams for files arm armx.

Parameters window (Figure 10.30) shows the designations of all parameters contained in a dedicated additional data stream of the **arm** file. For **armx** files in the **Options window** (Figure 10.34) the number of analog parameters and discrete signals contained in dedicated additional stream are shown.

Status line at the bottom part of window gives values of starting time and the duration of the selected stream, as well as its size in bytes (only for **arm** files). Meaning the start time is given as relative, in relation to the data destination file. Set new time start of additional data stream in the field **Start time**. For activation of introduced values press button **Apply**.

***Note:** You can also set the start time directly while viewing graphs by capturing and moving the parameters of the additional stream using the left mouse button.*

The toolbar buttons allow you to perform the following with the selected stream:



Adding the data stream (for **arm** files only)

- Insert data stream from the clipboard (exchange buffer).
- Insert data stream from text file.



Output of the current data stream (for **arm** files only)

- Output of charts of all parameters to the screen.
- Output of values of all parameters to the text file.



Removal of current stream



Fixation of current stream



Linking of start of current stream with the position of active cursor



Linking of the end of current stream with the position of active cursor

For exit from window **Additional data streams** use button **Exit**.

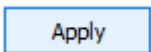
The work with parameters from additional data streams does not differ from work with “normal” parameters. Just select the desired parameters in the **Select parameters** window ([Section 10.1](#)) to display their graph on the screen. If you are not able to see the parameters from the additional stream in the list just check the **Additional data stream** boxes of the **Analog parameters** and **Events** fields. The “~” box shows or hides the “~” symbol in the short names of the parameters from additional data streams. This will take effect in graph viewing window only (not in the **Select parameters** window) ([Section 10.1](#)).

***Note:** There is one feature in working with the parameters from additional data streams. You are able to see the current values of the parameters in the active cursor position only if the cursor is not moving and released (in static mode). You are also not able to scroll through the active parameter samples using **Crtl+Left/Right** keys.*

***Note:** You are not able to remove one or several parameters from an additional data stream. Only the whole data stream may be deleted.*

For time synchronization of additional streams with the main data use one of four ways:

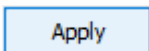
- Enter time start of additional stream in window **Additional data streams**

(field **start time**) after what press button .

- Move start of additional stream at the position of active cursor, clicking buttons



and

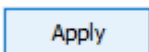


in window **Additional data streams**.

- Move the end of additional stream to the position of active cursor, clicking buttons




and




in window **Additional data streams**.

- Visually move data stream to the desired position through its capture by left mouse button.

After installations of the stream in a required position it is recommended to fix it to avoid random

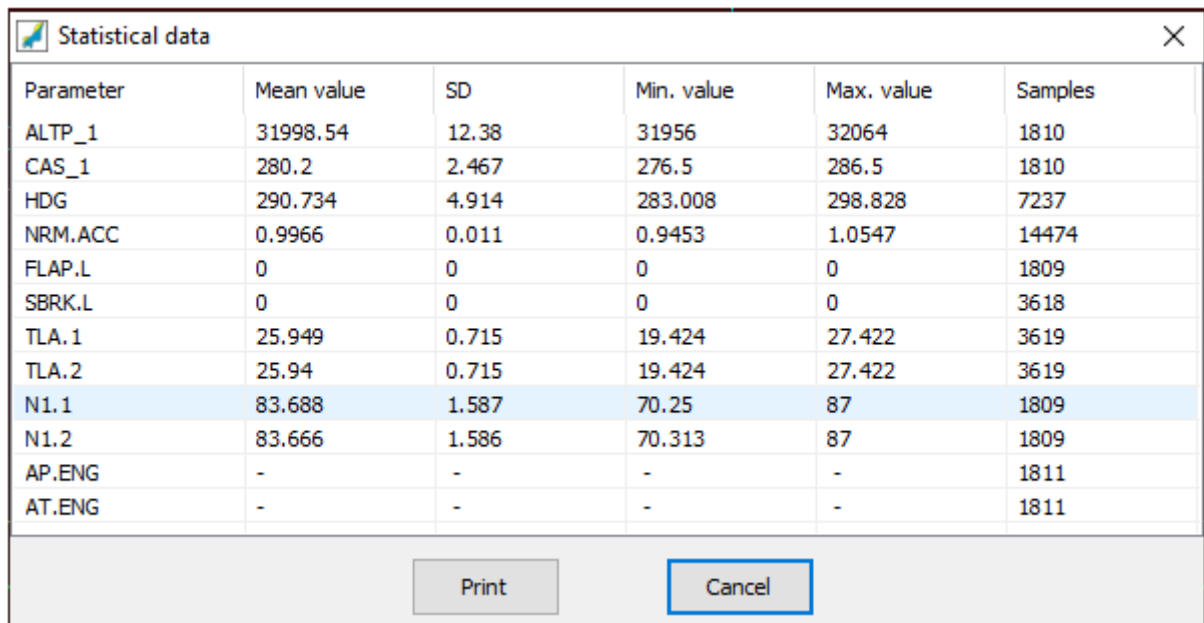
changes. Fixation produced by pressing button  in the **Additional data streams** window. ***Note** that fixing of each stream is to be produced separately after it becomes active.*

Removal of selected additional stream can be done by pressing button  in window **Additional data streams**.

10.16. Statistical data analysis

You may obtain statistical data for all the parameters currently displayed on the screen by pressing **Shift+S** keys or selecting **Tasks/Statistics**. The program will calculate statistical data on the interval between the moving cursors. The results will be shown in the table (Drawing 10.36). The table has the following columns left to right:

- parameter's short name;
- mean value on the selected interval;
- standard deviation on the selected interval;
- minimum value on the selected interval;
- maximum value on the selected interval;
- number of samples on the selected interval.



Parameter	Mean value	SD	Min. value	Max. value	Samples
ALTP_1	31998.54	12.38	31956	32064	1810
CAS_1	280.2	2.467	276.5	286.5	1810
HDG	290.734	4.914	283.008	298.828	7237
NRM.ACC	0.9966	0.011	0.9453	1.0547	14474
FLAP.L	0	0	0	0	1809
SBRK.L	0	0	0	0	3618
TLA.1	25.949	0.715	19.424	27.422	3619
TLA.2	25.94	0.715	19.424	27.422	3619
N1.1	83.688	1.587	70.25	87	1809
N1.2	83.666	1.586	70.313	87	1809
AP.ENG	-	-	-	-	1811
AT.ENG	-	-	-	-	1811

Print Cancel

Drawing 10.36

10.17. DAFIF Navigation Database

The DAFIF database (Digital Aeronautical Flight Information File) was developed by the National Geospatial-Intelligence Agency, (NGA), USA. The name DAFIF is a registered NGA trademark and can be used only as a reference for data source.

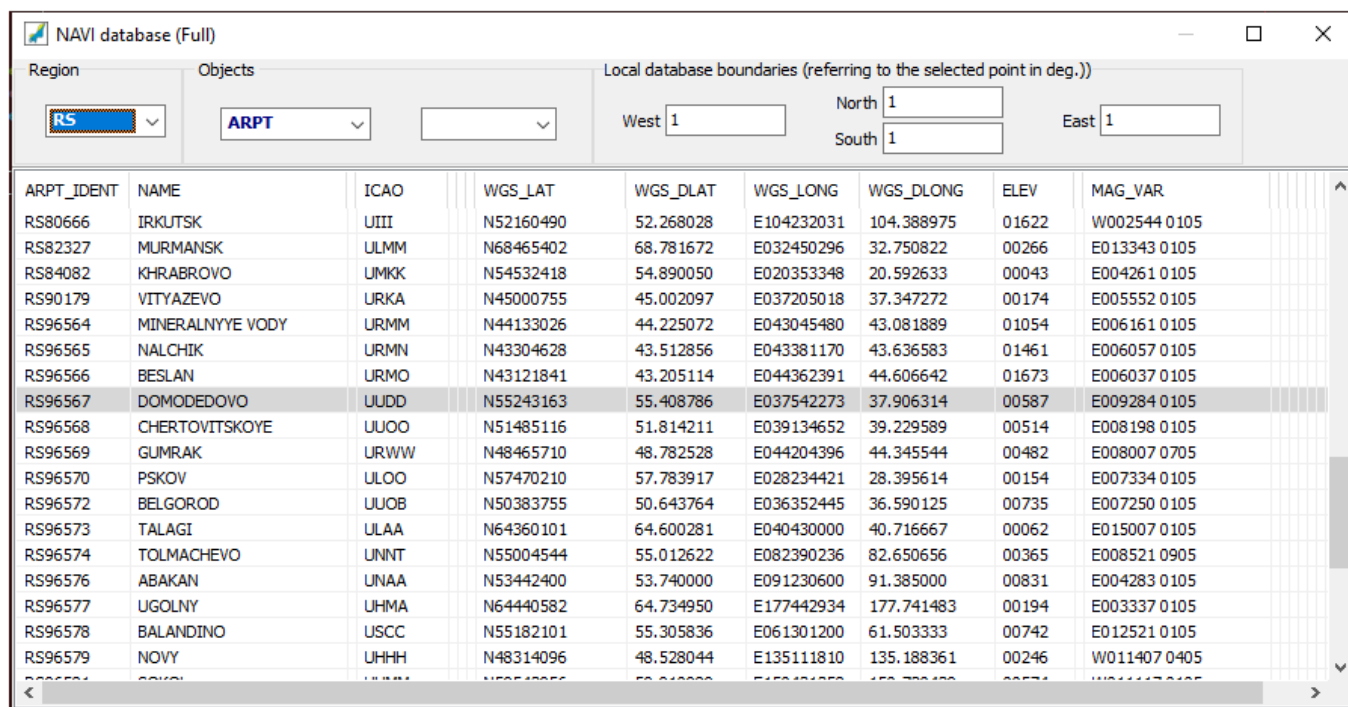
This database is open for general use. The current version can be downloaded from a website at <https://164.214.2.62/dafig/>. The database license allows its free use and distribution including software development on its basis. The only condition is referring to the data source. You may read the complete license agreement at the mentioned website (since 2006 free distribution of the database has been cancelled and updating is now impossible).

The DAFIF database is a set of linked text files that contain information on various navigation objects (airports, air tracks etc.) located all over the world and providing the international navigation system. **WinArm64** uses not the whole database, but only the **ARP**, **WPT** and **ATS** folders that contain information about the airports, waypoints and air tracks respectively. These folders are located in the **NAVI/ALL** subfolder and are supplied with the system. If such a folder exists, the item **NAVI database** appears in the **Tasks** menu whose elements allow working with the navigation database.

10.17.1. Working with DAFIF Navigation Database

This software introduces the notion of global and local database that are displayed as tables after selecting the respective elements in the **Tasks/NAVI database** menu item. The global database (

<https://164.214.2.62/dafif>) is the whole DAFIF database and is located in **NAVI/ALL** directory. The local database is a selection of extracts from the global database within the given range around the selected waypoint. The selected area is determined in degrees with reference to north, south, east and west and is also assigned by the user.



ARPT_IDENT	NAME	ICAO	WGS_LAT	WGS_DLAT	WGS_LONG	WGS_DLONG	ELEV	MAG_VAR
RS80666	IRKUTSK	UIII	N52160490	52.268028	E104232031	104.388975	01622	W002544 0105
RS82327	MURMANSK	ULMM	N68465402	68.781672	E032450296	32.750822	00266	E013343 0105
RS84082	KHRABROVO	UMKK	N54532418	54.890050	E020353348	20.592633	00043	E004261 0105
RS90179	VITYAZEVO	URKA	N45000755	45.002097	E037205018	37.347272	00174	E005552 0105
RS96564	MINERALNYYE VODY	URMM	N44133026	44.225072	E043045480	43.081889	01054	E006161 0105
RS96565	NALCHIK	URMN	N43304628	43.512856	E043381170	43.636583	01461	E006057 0105
RS96566	BESLAN	URMO	N43121841	43.205114	E044362391	44.606642	01673	E006037 0105
RS96567	DOMODEDOVO	UUDD	N55243163	55.408786	E037542273	37.906314	00587	E009284 0105
RS96568	CHERTOVITSKOYE	UUOO	N51485116	51.814211	E039134652	39.229589	00514	E008198 0105
RS96569	GUMRAK	URWW	N48465710	48.782528	E044204396	44.345544	00482	E008007 0705
RS96570	PSKOV	ULOO	N57470210	57.783917	E028234421	28.395614	00154	E007334 0105
RS96572	BELGOROD	UFOB	N50383755	50.643764	E036352445	36.590125	00735	E007250 0105
RS96573	TALAGI	ULAA	N64360101	64.600281	E040430000	40.716667	00062	E015007 0105
RS96574	TOLMACHEVO	UNNT	N55004544	55.012622	E082390236	82.650656	00365	E008521 0905
RS96576	ABAKAN	UNAA	N53442400	53.740000	E091230600	91.385000	00831	E004283 0105
RS96577	UGOLNY	UHMA	N64440582	64.734950	E177442934	177.741483	00194	E003337 0105
RS96578	BALANDINO	USCC	N55182101	55.305836	E061301200	61.503333	00742	E012521 0105
RS96579	NOVY	UHHH	N48314096	48.528044	E135111810	135.188361	00246	W011407 0405

Drawing 10.37

The software uses the navigation information for three basis purposes: automatic scheme files creation to be added to the flight path window ([Section 10.17.2](#) and [11.11](#)), automatic determination of the distance, azimuth etc. to the selected runway in the graph viewing window ([Section 10.17.3](#)) and automatic assignment of glideslope parameters when building up the flight path in the vertical plane ([Sections 10.17.4](#) and [11.12](#)).

10.17.2. Automatic scheme file creation

For automatic scheme file creation the user must select a reference waypoint and assign the range of the surrounding area (local database limits) within which the software will make its selection. The selection of the reference waypoint is done by assigning the two-letter region (country) code in the **Region** field and then selecting the desired object (airport, waypoint or flight track) in the **Objects** field. On [Drawing 10.38](#) the Sheremetyevo airport is selected as the basic point. The area range is assigned to be 1 degree in all directions. After left double clicking on the line containing the basic point name the software will make a search in the assigned limits and display the local database window ([Drawing 10.38](#)). The search may take quite a long time so the user must be patient.

The local database only allows selecting various objects for viewing. Making changes (selection of a different reference point, etc.) is only possible in the global database window.

Simultaneously the file and catalog structure tree is created in the **NAVI/Select** folder that contains descriptions of the found local database objects. The **area.txt** file serves as a key file and must be assigned as a scheme file in the **Flight path parameters** window.

Region		Objects		Local database boundaries (in deg)			
RS		WPT		West 36.906314	North 54.408786	East 38.906314	
					South 56.408786		
WPT_IDENT	DESC	ICAO	WGS_LAT	WGS_DLAT	WGS_LONG	WGS_DLONG	MAG_VAR
AD	SHEREMETYEVO	UUEE	N55591200	55.986667	E037300600	37.501667	E009368 0105
ANB	SHEREMETYEVO	UUEE	N55584800	55.980000	E037274200	37.461667	E009360 0105
AVADI	AVADI	UUWV	N56140000	56.233334	E037260000	37.433334	E009420 0105
BITSA	BITSA	UUWV	N55340000	55.566667	E037370000	37.616667	E009280 0105
BITUL	BITUL	UUWV	N55150000	55.250000	E037460000	37.766666	E009224 0105
BNB	SHEREMETYEVO	UUEE	N55584200	55.978333	E037275400	37.465000	E009360 0105
BP	CHELOBITYEVO	UUWV	N55540000	55.900000	E037410000	37.683333	E009374 0105
BW	SHEREMETYEVO	UUEE	N55590600	55.985000	E037303600	37.510000	E009369 0105
DAKLO	DAKLO	UUWW	N55370000	55.616667	E038380000	38.633333	E009446 0105
DEDUM	DEDUM	UUWV	N55500000	55.833333	E037041800	37.071667	E009318 1005
DK	GLOTAYEVO	UUWV	N55094200	55.161667	E037480600	37.801667	E009207 0105
DR	SKURYGINO	UUWV	N55130000	55.216667	E037220000	37.366667	E009156 0105
GG	VNUKOVO	UUWW	N55343000	55.575000	E037111800	37.188333	E009217 0105
GG059	(GG 059.45/005.94)	UUWW	N55363955	55.610986	E037210320	37.350889	E009251 0105
GG060	(GG 059.45/006)	UUWW	N55364082	55.611339	E037210895	37.352486	E009251 0105
IN	SUKHOTINO	UUWV	N54360000	54.600000	E037200000	37.333333	E009002 0105
KN	KOSTINO	UUWV	N56180000	56.300000	E037430000	37.716667	E009482 0105
KS01	OPALIKHA	UUWV	N55500000	55.833333	E037160000	37.266667	E009293 0105
LEDNI	LEDNI	UUWV	N55390000	55.650000	E037510000	37.850000	E009337 0105

Drawing 10.38

10.17.3. Defining Distance to Selected Runway

This function is available in the graph viewing window only if the latitude and longitude values are registered on board and the identifiers of these parameters are determined on the **Flight path parameters** page (Section 3.4.6) of the **Header editor** and if the **rwyt.dat** file is present in the **NAVI/ALL** catalog. In this case the **Search nearest RWY** item appears in the **Tasks** menu of the graph viewing window.

*Note: the **rwyt.dat** file is supplied with the system. If the user has updated the DAFIF database they can create the new version of this file on their own by selecting the relative item of the popup menu that appears after right clicking on the **Region** or **Objects** fileds in the **NAVI database (Full)** window (Drawing 10.37).*

Selecting the **Tasks/Search nearest RWY** menu item or pressing **Shift+R** you can display the **RWY** window (Drawing 10.39).

RWY						
RWY [ARPT, STRY]	L,m	W,m	H,m	A,deg	D,km	Z,km
24 [VNUKOVO, RS]	3000	60	209	248	2.664	-0.013
20 [VNUKOVO, RS]	3060	60	209	279	3.348	3.245
02 [VNUKOVO, RS]	3060	60	209	243	5.055	-3.245
06 [VNUKOVO, RS]	3000	60	209	248	5.654	0.013
14R [DOMODEDOVO, RS]	3500	70	179	121	40.046	-16.339
07R [SHEREMETYEVO, RS]	3700	60	192	5	40.263	-37.822

Drawing 10.39

This window presents information on the six runways closest to the current aircraft position determined by the moving cursor. Apart from the runway names the table contains information on the runway length and width in meters, threshold elevation in meters as well as the distance (in km), relative bearing (in degrees) and side deviation (in km) of the aircraft position from the **threshold** of each runway.

This window is a modal one, so it does not block the system operation when displayed on the screen. By shifting the moving cursor the user can watch the changing parameters in the table.

The philosophy of using this window is that the user fixes the runway where the landing was finally conducted (or planned) or from which the takeoff was done. To determine the actual runway of takeoff/landing the moving cursor must be moved to the start of the takeoff run or aircraft landing and the values in the table must be assessed. The selected runway is fixed by pressing **Enter** when the input focus is in the

relative line (after selecting this line by the left click). The **RWY** window will change its view (Drawing 10.40) and will display in its upper line the parameters of fixed runway regardless of the moving cursor position. The other six lines will continue displaying the parameters of the closest runways.

RWY							✕
RWY [ARPT, STRY]	L,m	W,m	H,m	A,deg	D,km	Z,km	
24 [VNUKOVO, RS]	3000	60	209	327	177.291	173.593	
32R [DOMODEDOVO, RS]	3794	60	179	336	137.685	25.934	
32L [DOMODEDOVO, RS]	3500	70	179	336	138.692	24.185	
14L [DOMODEDOVO, RS]	3794	60	179	336	141.4	-25.934	
14R [DOMODEDOVO, RS]	3500	70	179	335	142.119	-24.185	
24 [VNUKOVO, RS]	3000	60	209	327	177.291	173.593	
02 [VNUKOVO, RS]	3060	60	209	326	177.373	-149.75	

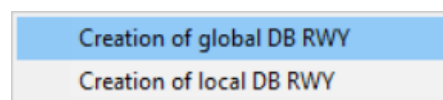
Drawing 10.40

Now by shifting the moving cursor you may easily determine the distance from runway threshold of the point where descent was initiated or landing gear extended.

10.17.4. Creating Runway Databases

This section describes the process of creating the global and local runway databases for their future use for flight path calculation tasks (Section 11.12).

To work with the runway database you must first create the global runway database from the global navigation database. The global runway database is created once after the installation (update) of the DAFIF database. To create it you must use the **Creation of global DB RWY** item in the popup menu (Drawing 10.41) that appears after right clicking the upper part of the **Navi database (Full)** window (Drawing 10.37).



Drawing 10.41

This process is quite time-consuming so you must be patient. After the process is completed the **rwpy.dat** file will appear in the **...\NAVI\All** folder which will further be used by the software to create local runway databases.

The next step is to create the local runway database. It usually includes all airports where a certain airline is operating. To create this database you must create a **Windows** text file named **arpt.txt** in any text processor like **Notepad** and to save it in the **...\NAVI\Select** folder. Each line of this file is assigned to one airport. See the example below:

```
RS30325 SHEREMETYEVO
RS00014 EMELYANOVO
CH00028 PUDONG
CH21133 CAPITAL
GM01853 FRANKFURT MAIN
```

The airport identifiers and names must be input manually by the user and correlate with the names in the DAFIF database. Searching airport names is done by viewing the lines in the global database window after selecting the desired region in the **Region** field and the **ARPT** object in the first popup list of the **Objects** field.

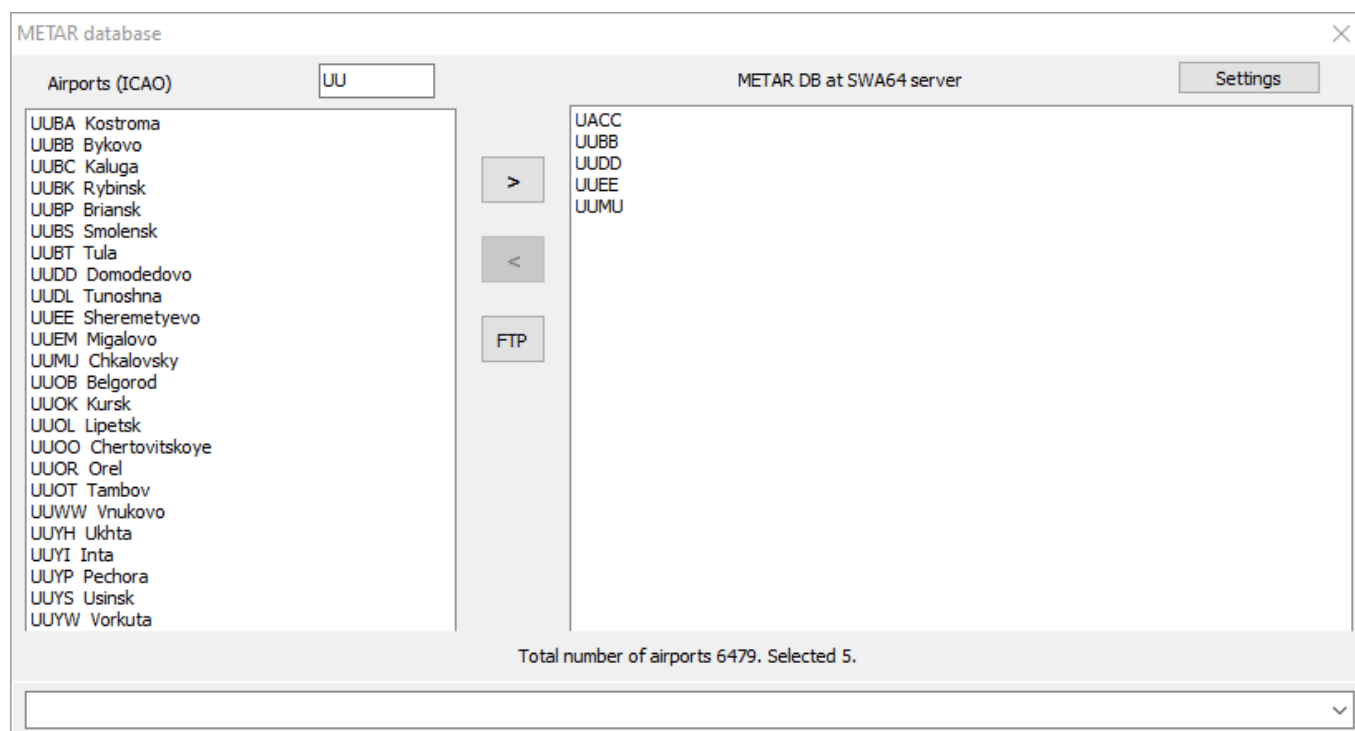
After saving the **arpt.txt** file use the **Creation of local DB RWY** item in the popup window that appears after right clicking the upper part of the **Navi database (Full)** window. After this operation is completed an **rwpy.txt** file will appear in the **...\NAVI\Select** folder that will contain descriptions of all runways and relative navigation aids in the selected airports.

Further use of the local runway database use is described in Section [11.12](#).

10.18. Working with METAR data

After the installation and startup of the **swa64** server (Section [7.2](#)) the user is enabled to download **METAR** (METeorological Aerodrome Report) data that contain information on the actual weather at a certain time. The data are downloaded from the server automatically or manually. To use this function you must use the **Tasks/METAR database** menu item. This function gets available if the **NAVI/All/ARP** folder contains the **Icao.txt** file with the airport identifiers list. This file is supplied with the installation package and may be further corrected by the user. The software only uses the four-letter ICAO codes and airport names from this file.

After selecting the abovementioned menu item the **METAR database** window appears (Drawing 10.42).



Drawing 10.42

If the **swa64** server is not running or installed or if the IP address is inaccurate there will be the following message in the right part of the window: No connection with WinArm64 server. Check the server installation and settings (Section [7.2](#)).

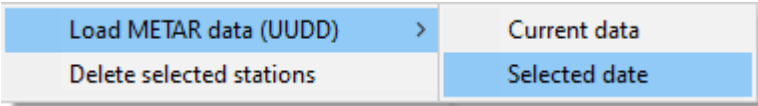
The left part of the window contains all airport codes in the **Icao.txt** file. To sort them by countries you may input the first letters of the codes in the upper part of the window. To obtain the current **METAR** data select the desired airport, right click it to display the popup window and select the desired item. If the **METAR** database contains data on the selected airport the **WordPad** will be run with decoded weather information. The data are saved in the **metar.txt** file in the root folder (**\WinArm64**), and are updated automatically with the next use. If the data on the selected airport are not present on the server the software will display a relative warning.

The software provides the user with an opportunity to keep data archives on selected airports. Add the codes of desired airports to the right part of the window. For each selected airport the software will create a separate text file in the **METAR** folder inside the folder with the **swa32** server named by the four-letter airport code. If the computer is connected to the Internet these data (if exist) will be updated automatically every 15 minutes. The data are saved in the file in a non-decoded form.

If the user selects more than 300 airports the software will warn against the significant traffic of the downloaded data. In this case the data will be updated once within the first ten minutes of every hour. It

should be noted that all data available on the server will be downloaded but only data for selected airports will be saved.

The data are stored in the files until the 15th of each month and then are automatically zipped to **ARCHIVE** folder (inside the **METAR** folder). To view the archive for the selected airport you must select a relative item in the popup window (Drawing 10.43), that appears after right clicking the airport code in the right part of the window.



Drawing 10.43

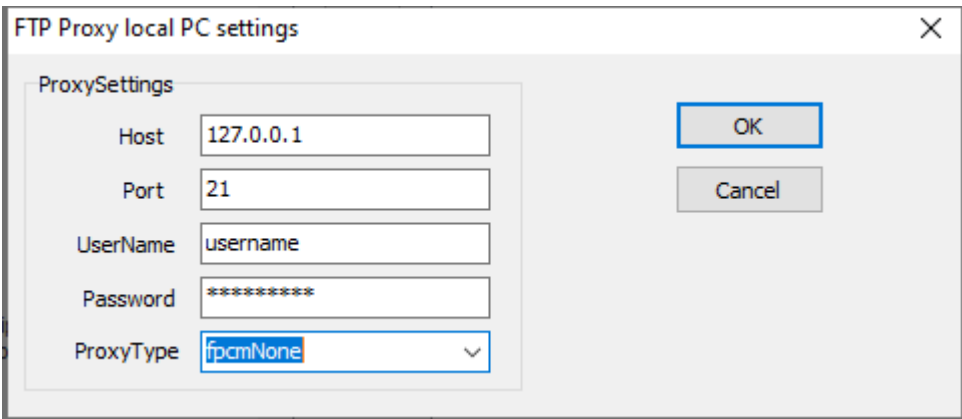
You can view the data for selected date or download all the current data saved in the relative folder (not archive folder). The information will be displayed in the **WordPad** window in a raw form and saved in the **metar.txt** file in the root folder (...\\WinArm64). To obtain decoded information from the file you may use one of the free softwares like **MetarWeather** (<http://www.nirsoft.net/utis/mweather.html>) by downloading the file into this software. If the executable **MetarWeather** file is installed to the **WinArm64** root folder than at the bottom of the **METAR database** window (Drawing 10.42) there will appear an extra line with a popup list. Copy the desired raw data line from the **WordPad** to this line and open the list. The decoded data will appear on the screen.

The popup menu in the right part of the window also allows to delete the selected airport from the list. After the airport is deleted the linked file will be automatically deleted from the disk without any warning,

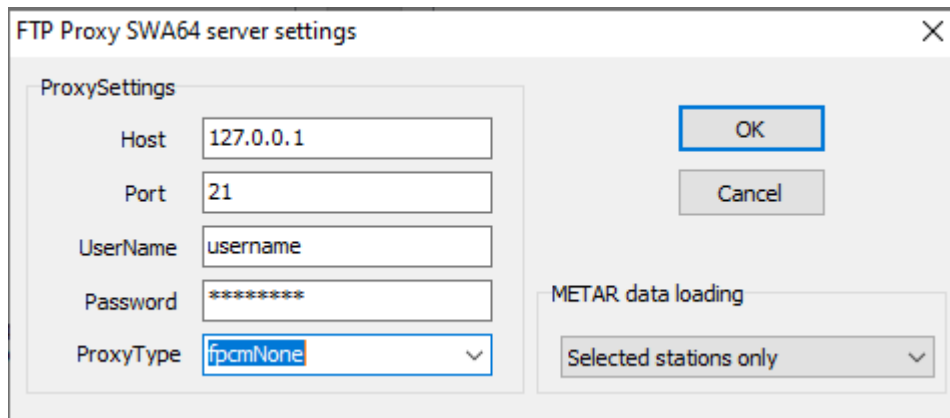
When working with the **METAR** data the user may need to set the proxy server parameters if it is used in particular network. These parameters are saved in the **metar.ini** file. The software stores two separate sets of proxy server settings in two files with the mentioned name: one file in the **swa64** server folder and the other one in the **WinArm** root folder. Such separation is needed due to the possibility of different proxy server settings on the computer where the **swa64** server is installed and on the user computer. The proxy server settings of the user computer are defined in the window (Drawing 10.44) that appears after pressing the **FTP** button in the **METAR database** window (Drawing 10.42).

The proxy server settings on the **swa64** server computer are done in the window (Drawing 10.45) that appears after pressing the **Settings** button in the **METAR database** window (Drawing 10.44).

Apart from the proxy settings this window allows the user to select between downloading all the data available on the **METAR** server or only data relevant to the airports selected in the right part of the window. When you select **All data from METAR server**, the list of selected airports will be ignored. *Attention*, when you download all data the daily internet traffic may be very high.



Drawing 10.44

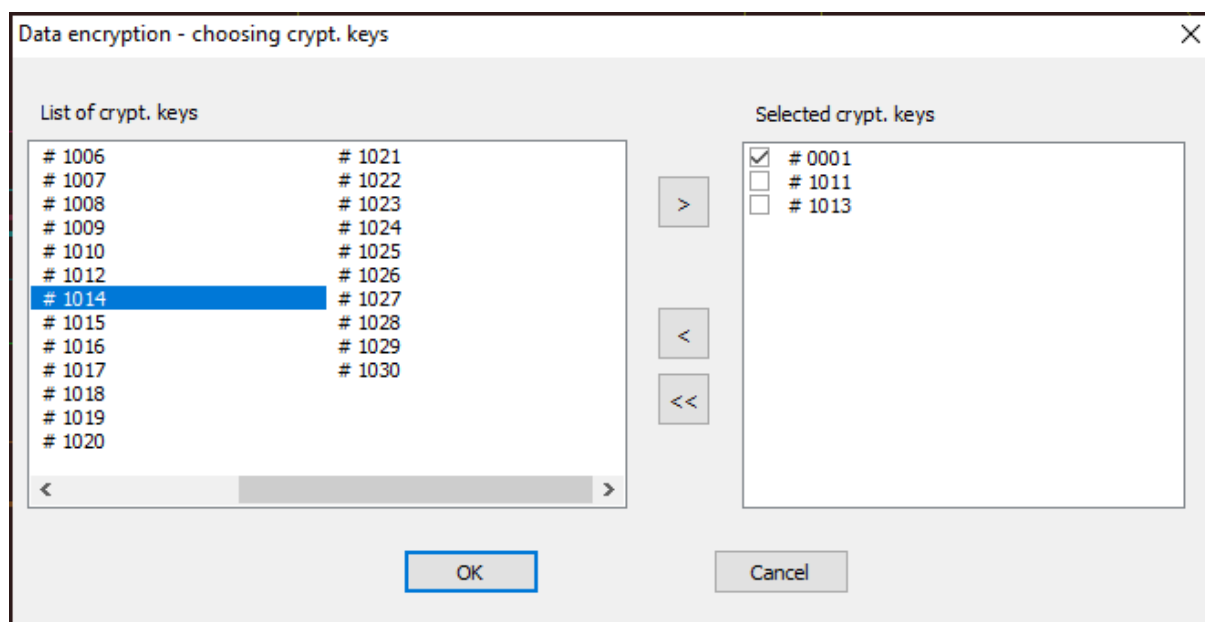


Drawing 10.45

10.19. Data Encryption

Arm data files could be protected from unauthorized access (for **armx** files this function is not applicable). To encrypt the files special information linked to the protection key ([Section 4](#)). After the encryption is completed the data viewing will only be available for those users that login with the key number specified in the list of authorized keys when the encryption was done. Encryption can be done by users with all levels of access. **Attention**, use of encrypted files insignificantly slows the software operation down as the flight information is being decoded while it is being viewed.

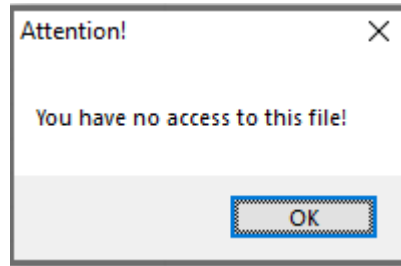
Attention, files, encrypted in **WinArm32** will not be readable in **WinArm64** and vice versa. To encrypt a file, select the menu item **File/Encryption**. Encryption window appears (Figure 10.46).



Drawing 10.46

The left part of the window contains a list of all keys known to the software. The right part of the window contains the authorized keys. When the window is opened the right part contains only one key – the current one that was used to login (the key number is also displayed in the caption of the main program window). If the key in the right part of the window is checked it may be used to cancel the encryption of the file after it was opened. If the key is not checked it may only be used to view the encrypted file.

When someone tries to open an encrypted file without using an authorized key the software will warn about the error (Figure 10.47).



Drawing 10.47

To remove encryption from a file, use the same menu item (**File / Encryption**) and affirmatively answer to confirmation question.

10.20. Links to Other Applications

The software provides a UDP interface to transfer flight data to the third-party applications. Analog parameters values and On/Off signals are transferred if they have the **Export – UDP** switch checked on the **Parameter** tab (Section 3.4.1) of the **Header editor** window. The data are transferred from the moving cursor position if the **Data sharing/UDP data exchange** menu item is ticked. The server settings for transfer protocols are defined in the **Network connection settings** window (Section 7.1). In the client application you will need to select the IP address of the computer that contains the **WinArm32** software that will be used as a server as well as port numbers that will be used for information export and import. These port numbers must correspond to the numbers selected in the **Network connection settings** window (Section 7.1) of the server part. A detailed description of the transferred data packages are beyond the framework of this Manual and may be provided to the interested users upon request.

10.21. Building flight path in Google Earth (Planet Earth)

The program provides the ability to quickly build a flight path in a public **Google Earth** program (Planet Earth). To install **Google Earth**, you can use the link: <http://www.google.com/earth/index.html> . After installation, you need to make sure that the file extension is **kml** associated with **Google Earth**.

Function of building trajectories implemented through menu **Tasks/Flight path/ Google earth**. The menu becomes affordable at condition that values of altitude, latitude and longitude are recorded by the FDR and identifiers of these parameters are defined in relevant fields on tab **Flight path parameters** (Section 3.4.6) of the **Header editor**.

The flight path is built in the interval between cursors. If in this interval there are text labels (Section 10.7), they will be automatically added to flight path. After choice of specified menu item the window **Google Earth track data** (Drawing 10.48).

Using given window you can tune up options of flight path representation.

Data matching field allows you to select one of the trajectory presentation modes (drop-down list **Mode**), as well as enter corrections to the recorded coordinates and height.

The program supports two modes of trajectory representation: three-dimensional (**Absolute**) and in the projection on earthly surface, without accounting heights (**Relative to ground**).

The fields **Latitude**, **Longitude** and **Height** are used to set the appropriate corrections. When opening window in block **FDR** values from the current flight information file in position of active cursor are entered. If need adjustment of values (in order flight path did not go "under the ground" and exactly fit the runway) in the **Earth** block values taken from **Google Earth** are to be entered. Then click the appropriate button to calculate the corrections. When calculating corrections user is to ensure coincidence of position in Google Earth with coordinates at position of active cursor in data file. Amendments may be also entered directly to relevant fields. After calculation amendments by pressing buttons **OK** or **Apply** for latitude and longitude (but not for altitude) they are stored in the header of the current flight data file and may be viewed as the **D** field on the **Calibration** tab (Section 3.4.2). With the following calculations of flight path they will be applied permanently (regardless of changes of time interval and the position of active cursor) until will not be changed. **Attention**, amendments will apply and for all operations (drawing graphs, displaying a table of parameters) with latitude and longitude parameters (but not for height) in **WinArm64**.

Google Earth track data

Data matching

Latitude, deg		Longitude, deg		Height, m		Mode
FDR	59.895401000977	FDR	111.045684814453	FDR	390	absolute
Earth	59.8954	Earth	111.0456848	Earth	200	
Correction: -0.000001000977		Correction: -0.00000014453		Correction: -190		

Time labels

File: D:\winarm64\work\dot.png

Size:

Color: dBlack

Interval: 2 min

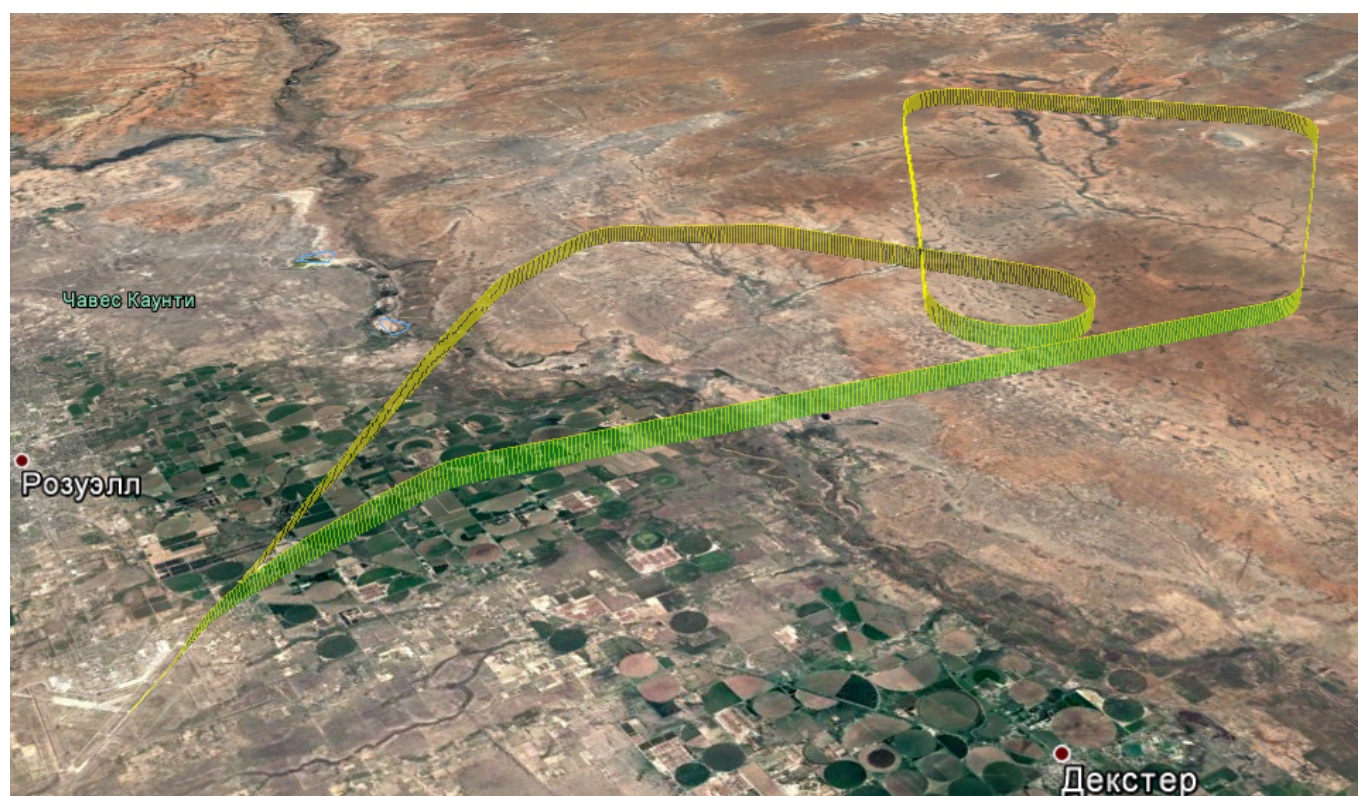
OK Cancel Apply

Drawing 10.48

Time labels field can be set and used while rendering with a specified spacing, as well as to set their color and size. Additionally, you can define a **png** file for the graphic symbol labels.

By pressing the **OK** or **Apply** buttons, all settings of this window are saved in the **kml.ini** file, located in root folder **WinArm64**.

The calculated trajectory is saved by pressing the **OK** button in the **track.kml** file in the root folder **WinArm64** and, at availability of association of file type **kml** with **Google Earth**, will be automatically displayed on screen (Figure 10.49).



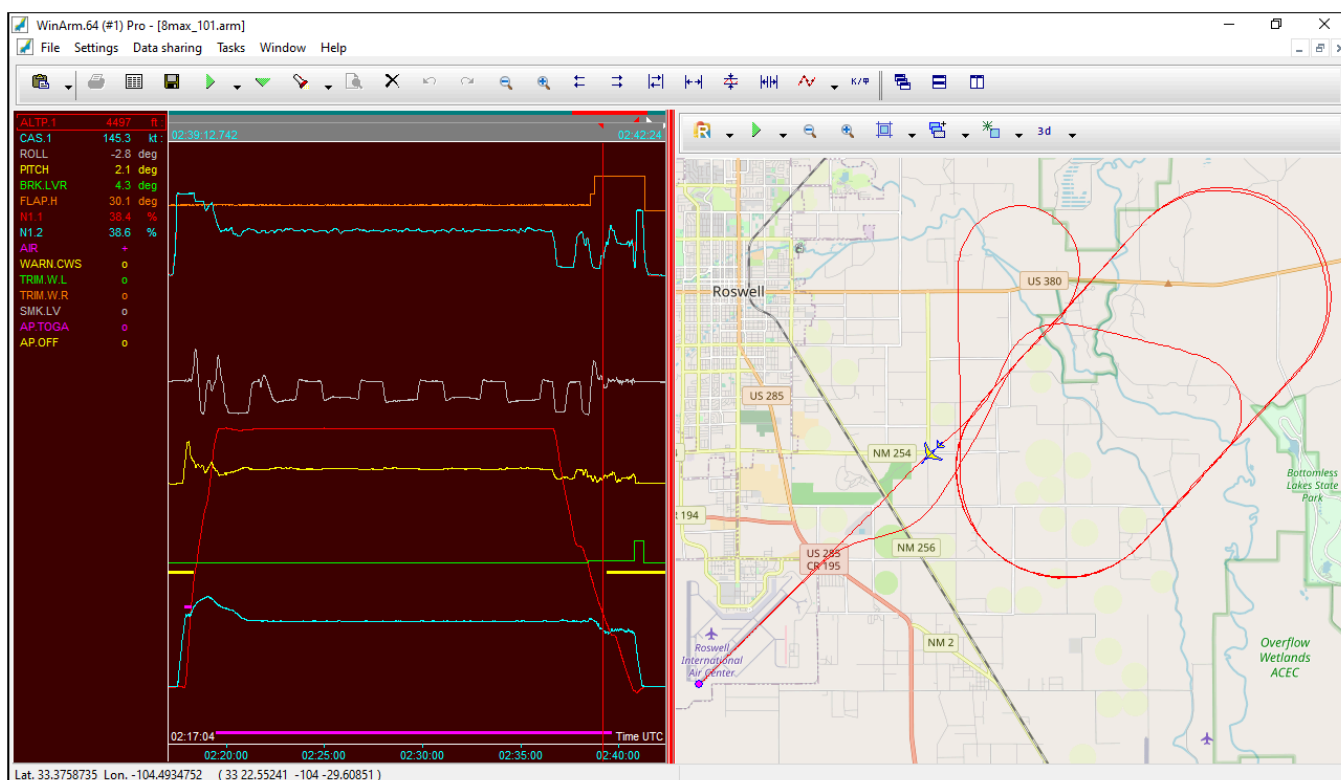
Drawing 10.49

10.22. Building of overview flight path

The program supports work with geoinformation data (currently Yandex © and OpenStreetMap©) in real time scale.

To display the flight path together with the geoinformation data provided the presence of flight latitude and longitude defined in the corresponding fields on the tab **Flight path parameters** of the **Header editor** is needed (Section 3.4.6). This data can be as registered, as also calculated and imported as an additional stream (Section 11.14). In this case in the right part of the screen a red dividing band will appear, pulling behind which with the left mouse button, you can expand the display area of the cartographic and geoinformation information (Figure 10.50).

On the right side of the geoinformation part of the window, the flight path of the aircraft related to interval time relevant to the information in the left graphic part window (Drawing 10.50) will appear. Moving active cursor in the graphics will be accompanied by moving aircraft label on the flight path.



Drawing 10.50

In the upper part of the geoinformation area of window the tool panel is located, providing opportunity of setting ways of information display (Section 3.3.4.1).

Moving around the map with the mouse cursor, you can see the coordinates of the points that are displayed in the lower left corner of the **WinArm64** window. To measure the distance between any two points on the map hold pressed left button with pressed key **Shift**.

To display the aircraft symbol on the map, instead of a simple label, you can copy any ***.aip** file to the file with the name **config.aip** to the directory **AIP** or copy file with designation type of the aircraft (as specified in the **Header Editor** in the **Additional files** field of the **Passport, Common data** tab) to the **WORK** directory (for example **rrj95.aip** or **b737.aip**).

The form, view, quality and accuracy of provided cartographic, satellite and another geoinformation data, as well as it's availability, depends on the politics of providers.

11. Flight Path Calculation

11.1. Common provisions

For settings of flight path calculation parameters use the tab **Flight path parameter** of the **Header editor** ([Section 3.4.6](#)).

The **Analog parameters** list located in the left part of the window contains 16 predefined parameters that depending on the FDR type are used for flight path calculations. The other lines are used for transferring data to flight path window or third party program like **Microsoft Flight Simulator**.

Only last three events: weight on wheel, outer and middle marker passing are used for glide slope calculations. Other lines are used to transfer data to **Microsoft Flight Simulator**.

The program provides three different algorithms for flight path calculation:

- Using true airspeed and magnetic heading;
- Using ground speed, magnetic heading and drift angle;
- Using ground speed projections (V_x , V_z).

Depending on the type of the FDR the user has to select one of those algorithms by checking the appropriate box. Modern aircraft let you calculate the flight path using several algorithms. The recommendation is to select algorithm that use trajectory parameters (groundspeed, drift angle). This recommendation is based on the provision that trajectory parameters already include the wind influence that enhances calculation precision significantly.

***Note:** If current latitude and longitude values are registered they may also be used as second, independent way to display the flight path. Use the **Flight path customization** window to toggle between two modes ([Section 3.5.2](#)).*

In any case, the user has to make sure that parameters used in calculations are registered correctly and all the registration failures are eliminated on the interval the flight path will be calculated at.

Eliminating registration failures you have to remember that the first algorithm also uses the values of the roll, pitch and angle of attack to enhance calculation results. Besides, true airspeed calculation algorithm uses the values of the pressure altitude and IAS. Pressure altitude values are also used if wind speed and direction are specified as functions of the altitude.

After selecting one of the algorithms the user has to define the short names of the parameters from the current header that will take part in the calculations. The parameters have to be selected from the list that appears after left double clicking on the corresponding cell of the **Selected** column ([Section 3.4.6](#)).

***Note:** List id formed from parameters defined in file header.*

If short names of some parameters (for example pitch or true angle of attack) are not defined then the values of those parameters will be 0 by default.

Attention, there is one feature connected to measurement units of selected parameters. If a parameter which short name is selected has fixed units ([Section 9.1.2](#)) then the corresponding right part of the table will not contain the measurement units because the program is able to convert them automatically. If a parameter which unit was not fixed is selected then the right part of the table will contain the information in which units the current parameter has to be derived in order to perform calculations correctly. In this case the user is responsible for providing the values of the parameter derived in correct units.

After defining all the parameters press **OK** button and select the time interval for flight path calculation. Flight path may be calculated only in the **relative time mode** ([Section 10.4](#)). Otherwise, after selection the **Tasks/Flight path calculation** menu item, the warning will be displayed and program will invite to change time mode.

***Recommendation:** Before flight path calculations it is highly recommended to set up the relative time values equal to the registered time values ([Section 10.4](#)).*

The flight path will be calculated on the interval located between the moving cursors. The left and right time boundaries will be read out automatically.

11.2. Simple calculation performing

For start calculation choose menu **Tasks/Flight path calculation /Into a new project**. A dialog box with flight path parameters will appear ([Drawing 11.1](#)).

Flight path parameters

Coordinates, wind, maps | Text labels | Glideslope parameters

Terminal conditions

Time	X,m	Y,m	Z,m
03:05:04			

Wind forecast

Hrel	Fw,m/s	Qw,deg

Altitude reduction to zero

☒ Without altitude reduction

☐ At the beginning of flight path

☐ At the end of flight path

Fixed point

☐ At the beginning of flight path

☒ At the end of flight path

☐ At arbitrary point

Magnetic variation, deg

7

Output step, sec

0.5

Calculation

☒ Constant MNK ☐ Piecewise linear

Master points parameters

	Latitude			Longitude		
	deg	min	sec.	deg	min	sec.
Origin of coordinates	0			0		
Master point #1	0			0		
Master point #2	0			0		

Map #1 **Scheme #1**

Map #2 **Scheme #2**

Map #3 **Scheme #3**

A/C type **Sound (wav)**

OK **Cancel**

Drawing 11.1

First of all the values of the magnetic deviation and output step have to be specified. These value are saved into the flight path project (*.tra file) and may be changed **only when the new project is being created or the second calculation with saving the results into the existing project is done** (Section 11.7). Magnetic variation should be entered as a signed value. East deviation is positive and west – negative.

Note: The value **Output step** sets the time step for drawing the trajectory and printing it out. Integration step in the calculation trajectory is selected by the program automatically and does not depend on the values specified in the described field.

By default, the calculations will be done for calm conditions if the first type of algorithm is selected. If the wind conditions are known they have to be specified at this stage of calculation in the **Wind, forecast** list. These values are also saved into the flight path project (*.tra file) and may be changed **only when the new project is being created or the second calculation with saving the results into the existing project is done** (Section 11.7). To add the line into the list press the **Ins** key when the list is active. To delete the current line press **Del** key.

Important: if the short name of the On/Off signal (registered or calculated) that describes weight on wheel conditions is specified on the **Flight parameters** page of the **Header editor** window then the program will not take into account wind influence while aircraft is on ground. This option let you use the first method of flight path calculation (using airspeed and magnetic heading) even when aircraft moves along the runway.

To understand the purpose of the component parts of the window shown in Figure 11.1, it is necessary understand yourself principles calculation trajectories, which were laid V basis used algorithms.

To understand the meaning of the parts of the window presented on the Drawing 11.1 you have to get acquainted with the main principles that are used in flight path calculation algorithms.

The flight path is calculated from the fixed point. The fixed point is the point that comes first in the **Terminal conditions** list. The coordinates and time when this point was passed have to be specified by the user. The coordinates are set in a rectangular Cartesian system of a rather arbitrary selected beginning of coordinates. The flight path will **always** go through the fixed point regardless of the presence of the additional target points. The beginning or end of the calculation interval as well as any other point may be appointed to be a fixed one. If the beginning or end of the interval are selected the time will be determined automatically. Check the appropriate switch of the **Fixed point** field (Drawing 11.1) to assign the fixed point.

***Note:** If the coordinates of the fixed point are not specified they will be taken as 0 by default. It means that the fixed point will coincide with co-ordinates origin point.*

***Recommendation:** The moments when marker beacons, ILS, VOR or NDB beacons are passed as well as take off roll beginning or touch down event may be selected to be a fixed point.*

***Note:** The fixed point may be changed by the user during the further work while customizing the flight path appearance.*

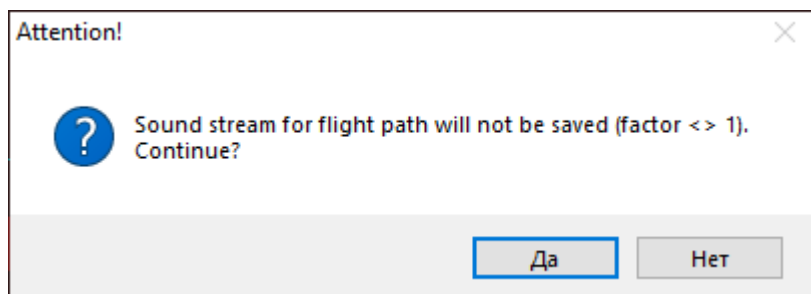
The user may select the **altitude reduction to zero** mode by checking the desired switch of the corresponding field. Altitude reduction will be done by simple subtraction so as the resulting value at the beginning or at the end of the interval will be zero. The result will be put into the **dH** field of the **Flight path customization** window ([Section 3.5.2](#)).

If the current header contains at least one parameter of sound stream type then the **Sound (wav)** field will contain a list with the short names of all the parameters of that type in the current header (Drawing 11.1). Select one of them if you want sound information to be added to the flight path. The program will automatically create *a new sound file* with the predefined name (it could be changed later on) that contains the sound information *for the selected time interval*. If no sound information exists for the selected interval the file will be created all the same but will contain “silence”.

Select **no** item from the list if you do not want to add sound information.

Press the **OK** button to start the calculations. The program will prompt you to specify the project file name. All the changes that are made in the future will be saved in this file *automatically*.

Note: If a parameter of sound stream type was selected but the changes to it were not implemented (W key was not pressed after correction factor entering (see [Section 10.14](#)) then the program will display the appropriate warning.



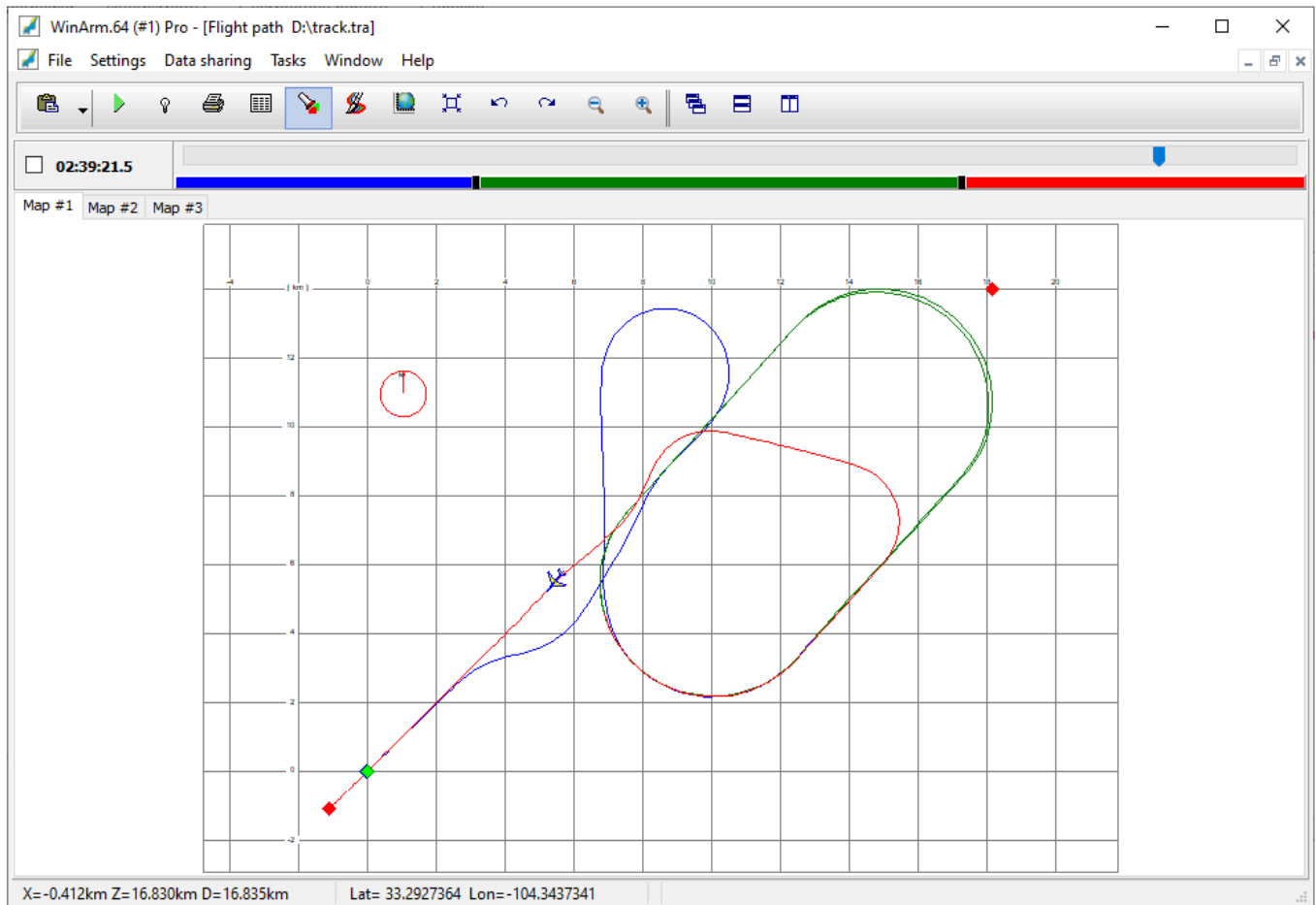
Drawing 11.2

11.3. Flight path customizing

11.3.1. Description of basic elements of the flight path window

The results will be displayed on the screen as soon as calculation is finished (Drawing 11.3). It should be noted that all information necessary for flight path displaying is saved directly in a flight path file. The initial data flight is not needed any more.

The flight path window is *a child window* of the program’s main window (the same as graph viewing windows are). It means that all the standard window alignments and positioning are enabled for this window.



Drawing 11.3

Description of buttons, contained in the menu panels is given in [Section 3.5.1](#). This panel appears every time when the trajectory view window becomes active.

The flight path as well as grid lines and several service points will be shown on the screen. Two red points are used if necessary to bind the flight path to the map or approach chart. We will call them master points. The blue point is the graphical representation of the origin of coordinates. The points that are listed in the **Terminal condition** field (Drawing 11.3) are shown in green color. Capture and drag the origin of coordinates point with the left mouse button to move the flight path to the desired position. You may also move the flight path by capturing any other point of it along with keeping the **Ctrl** key pressed.

The flight path is calculated in true coordinates (not magnetic). Positive directions are to the north and to the east. The initial scale of the grid lines is selected automatically. To display the numerical values of the scale just left click on the graph field keeping the **Shift** key pressed. Repeat this to hide the numerical values. To enhance visualization of the graph it is recommended to click near the origin of coordinates (the blue point). Check the **Do not show** switch on the **Grid lines** field of the **Flight path customization** window ([Section 3.5.2](#)) to remove the grid lines from the graph.

Left click on the graph field keeping the **Shift** and **Ctrl** keys pressed to show the true/magnetic direction indicator. Repeat this procedure to hide the indicator. The color of the indicator may be selected from the list of **Grid lines** field ([Section 3.5.2](#)).

The center part of the status bar indicates the values of wind speed and direction that were used for calculations.

The left part of the status bar indicates the geographical and rectangular coordinates of the point that is currently located under the cursor.

The current position indicator and three-component color ruler are located just under the control buttons panel. The color ruler let you change the colors and length of different parts of the flight path ([Section 11.3.9.2](#)).

11.3.2. Concept of current position

At every moment one point of the flight path is the current point. The current point is marked by the aircraft silhouette if it is defined by the user (Section 11.3.6) or by the red circle with the dark blue boundary otherwise. The current time is indicated in the left part of the current position indicator. The marker on the indicator is moved rateably to the current position.

The current position may be changed using:

- **Left/Right** keys;
- By capturing and dragging the marker on the indicator with the left mouse button;
- By pressing the button.

Pressing the button or **Space** key starts the flight demonstration (Section 11.6). Press this button once again or use **ESC** key to stop the demonstration.

The following functions are bound to the current position idea:

- Displaying the current time on the indicator field.
- Displaying the values of the parameters (Section 11.6).
- Displaying the values of wind speed and direction.

11.3.3. Binding flight path to geographical map

Next step is binding the received flight path to the map. The map should be saved in a file of ***.bmp** or ***.jpg** format. This file should be prepared in advance with any bitmap editor (Corel PhotoPaint or Adobe PhotoShop). It is highly recommended to minimize the size of the file using the 8-bit paletted color depth. The most recommended size of the file is 5-10 Mb. You have to understand that all other objects (flight path, text labels and so on) will be printed with the same resolution as background picture.

***Note:** The map **must have equal** vertical and horizontal scales.*

The window shown in Figure 11.3 has three tabs that can be used for various design appearance of calculated flight path. For each tab a separate file with the map and individual setting could be used. Use the **Flight path**

parameters window to add a map to the desired tab (Section 3.5.3), which appears after pressing on button .

Left click on the **Map #1, Map #2 or Map #3** labels after the shape of the cursor is changed for to display file open dialog. Select the name of the file that contains background map and press **OK** button.

Two red points are used to bind the flight path to the background image. Those points may be moved to any position with the left mouse button. When the system cursor is located above any of the master points the information about it will be shown in the right part of the status bar. You have to move both master points to the positions with the known coordinates (VOR or NDB beacons, grid lines intersections and so on) and specify these coordinates in the appropriate fields of the **Flight path parameters** window (Section 3.5.3). The coordinates input format depends on the position of the switch in the right part of the window. Clicking the appropriate buttons the user specifies the hemispheres. After the binding is completed the values of the origin of coordinates (blue point) will be shown in the **Origin of coordinates** field. These values are for information purposes only and may not be changed.

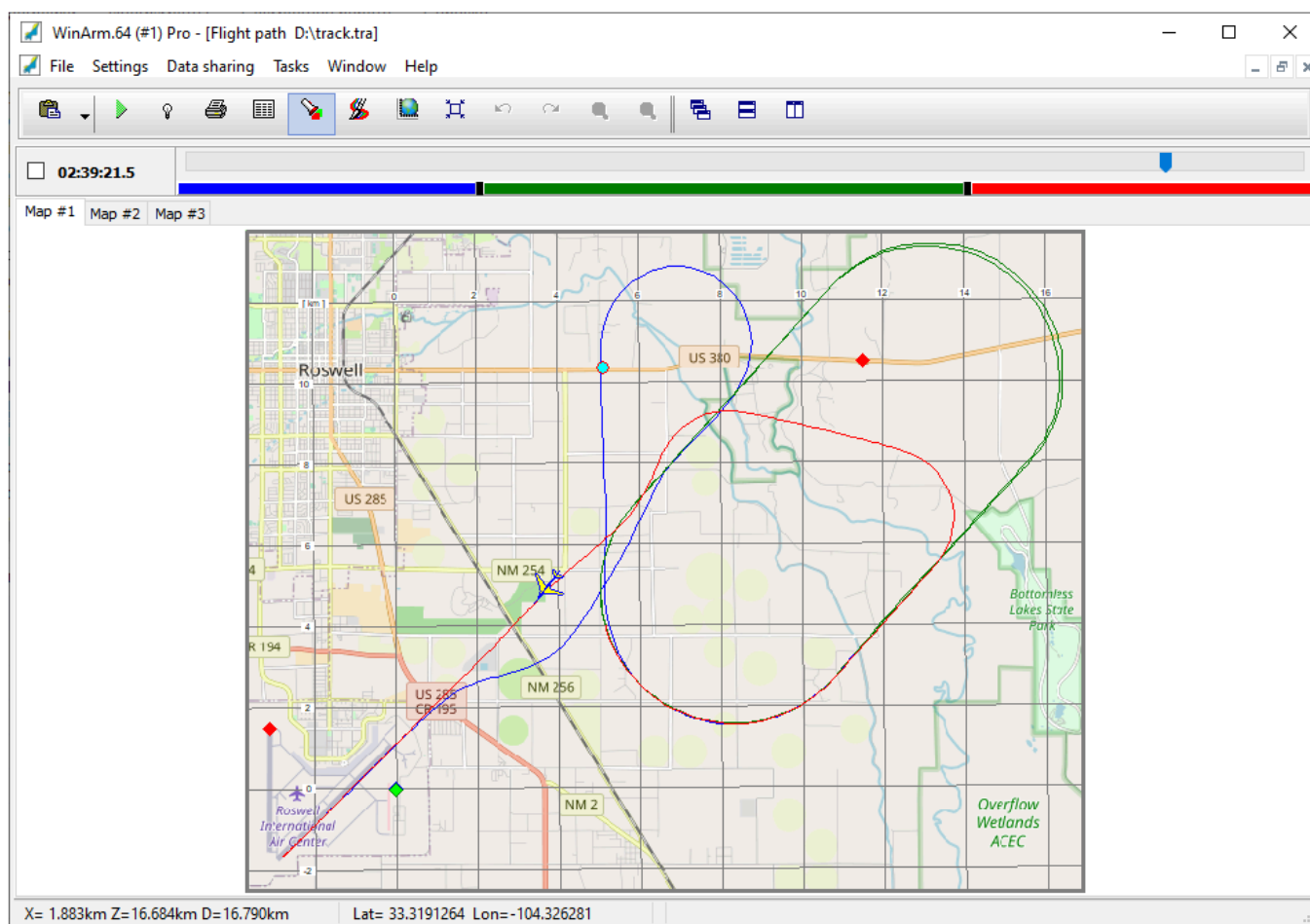
Example of bindings maps using grids lines shown on drawing 11.4.

The master points are placed on the intersections of the grid lines with the known latitude and longitude values. The program provides the ability to zoom the image up to the particular pixel in order to set the master points more precisely. To zoom the image in just select the desired part by the left mouse button drawing the rectangle in the direction from the left upper corner to the right bottom corner. Repeat this procedure to make additional zoom. To zoom the image out to the original size just draw the rectangle in the direction from the right bottom corner to the left upper corner.

It is recommended to check the correctness of distances and angles calculation after the binding is completed. The numerical scales on the Jeppesen charts or the known distance between any points on the map may be used to perform checking. Just set the step of the grid in the **Flight path customization** window (Section 3.5.2) equal to the step on the map and compare the result visually. The **Flight path customization** window appears after clicking the button. To check the correctness of angles (direction) calculation use the direction indicator (see before) or compare the direction of the map grid lines with lines drawn by the program.

At any moment the user may click the button to coordinate the flight path appearance automatically. The flight path will be displayed on the whole interval and axes will be pointed to the north and to the east.

Attention: By pressing this button the existing binding to the map will be removed automatically.



Drawing 11.4

11.3.4. Selecting flight path displaying mode

If the short names for longitude and latitude are defined on the **Flight path parameters** page of the **Header editor** window ([Section 3.4.6](#)) then they may also be used to display the flight path. To toggle between registered and calculated flight path just check the corresponding switch box on the **Flight path** field ([Section 3.5.2](#)). **Attention**, the current version of the program supports displaying only one flight path (registered or calculated) at a time. You are not able to display both of them simultaneously.

11.3.5. Flight path moving, rotating and scale changing

Flight path scaling and rotating are done with the help of the appropriate toolbar ([Section 3.5.1](#)). Toolbar is enabled only if no binding to the map is done. Otherwise the scale and position of the flight path are defined by the master points positions and corresponding buttons are disabled.

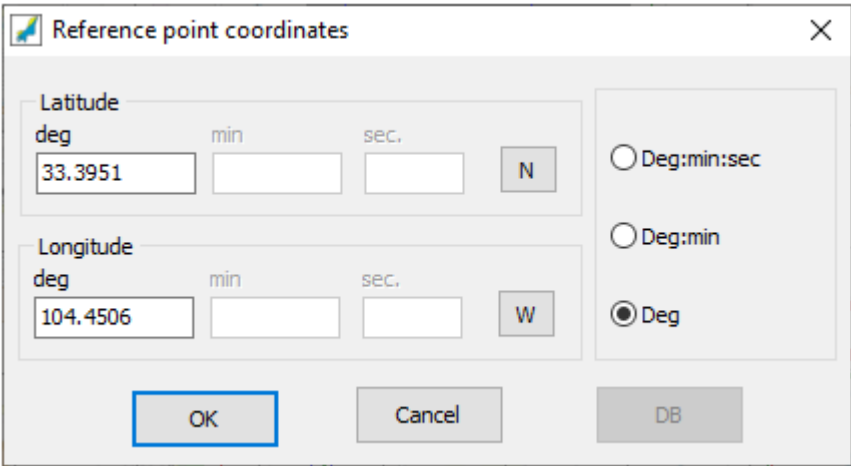
Note: Do not mix **the flight path scale** term with the **image scale** term (zoom).

To move the flight path just capture it at the origin of coordinates point with the left mouse button and drag to the new position. If **Ctrl** key is pressed you are able to capture the flight path at any point not only at the origin of coordinates. To locate the flight path above the map more precisely the following procedure is recommended:

- Determine the time when the point with the known coordinates was passed;
- Move the pointer of the current position indicator to the selected position;
- Add to the plot the reference point with the known coordinates;
- Match the reference point with the current point.

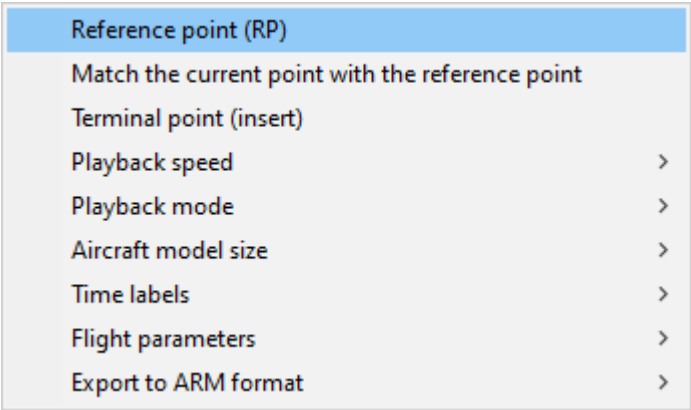
Use the **Reference point coordinates** window ([Drawing 11.5](#)) that appears after selecting the **reference point (RP)** menu item from the popup menu ([Drawing 11.6](#)) to set the coordinates of the reference point. The popup menu will appear after right clicking on the graph field. You may enter co-ordinates manually or use the navigation point's database from scheme files ([Section 11.11](#)).

The reference point is displayed in cyan color. Use the **Match the current...** item of the popup menu (Section 11.3.4) to match the current point with the reference point. If the flight path is displayed in registered coordinates mode (Drawing 11.7) you are able to undo coordinates matching choosing the **Undo coordinates matching** item from the popup menu.



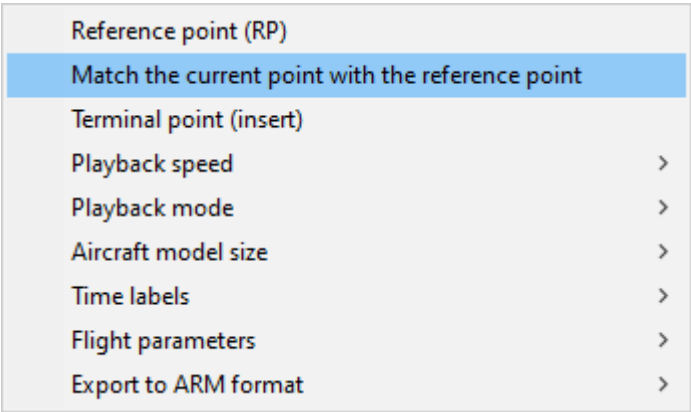
A dialog box titled "Reference point coordinates" with a close button (X) in the top right corner. It contains two main sections: "Latitude" and "Longitude". Each section has three input fields for "deg", "min", and "sec.", followed by a directional button ("N" for Latitude, "W" for Longitude). The "Latitude" section has "33.3951" in the "deg" field. The "Longitude" section has "104.4506" in the "deg" field. To the right of these sections are three radio buttons: "Deg:min:sec", "Deg:min", and "Deg" (which is selected). At the bottom are three buttons: "OK", "Cancel", and "DB".

Drawing 11.5



A vertical popup menu with a blue header "Reference point (RP)". The menu items are: "Match the current point with the reference point", "Terminal point (insert)", "Playback speed", "Playback mode", "Aircraft model size", "Time labels", "Flight parameters", and "Export to ARM format". Each of the last five items has a right-pointing chevron (>) next to it.

Drawing 11.6




A vertical popup menu identical to Drawing 11.6, but with the "Match the current point with the reference point" item highlighted in blue.

Drawing 11.7

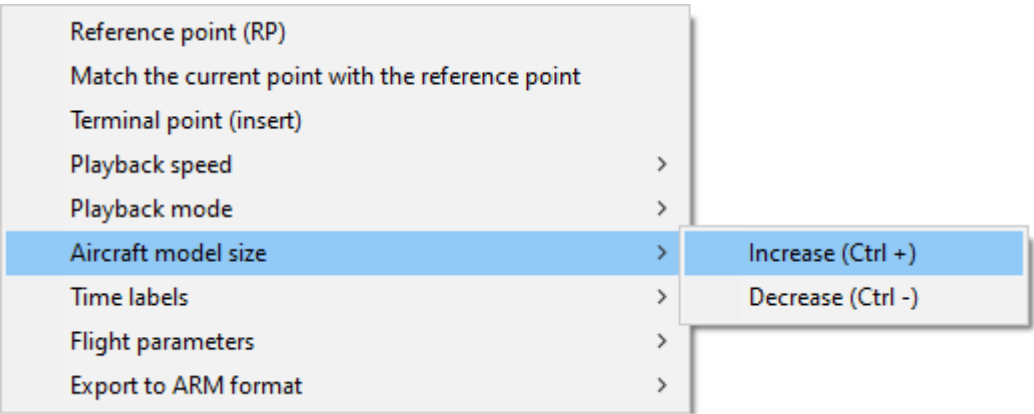
11.3.6. Aircraft silhouette selection

In **Flight parameters** window (Section 3.5.3) user may choose the appearance of the aircraft, which will later be used as an indicator of the current positions on the trajectory, when demonstrating flight and, if desired by the user, to indicate text and timestamps. The choice of the name of the file containing the appearance of the aircraft is

made in window dialogue, which appears after clicks left button on textual field **A/C type** after the cursor changes to . Aircraft model files are installed in a nested folder **AIP** installation of the directory **WinArm64**.

Check the **A/C type** switches of the **time labels** and/or **text labels** fields in the **Flight path customization** window to use the aircraft silhouette for text and/or time labels marking ([Section 3.5.2](#)).

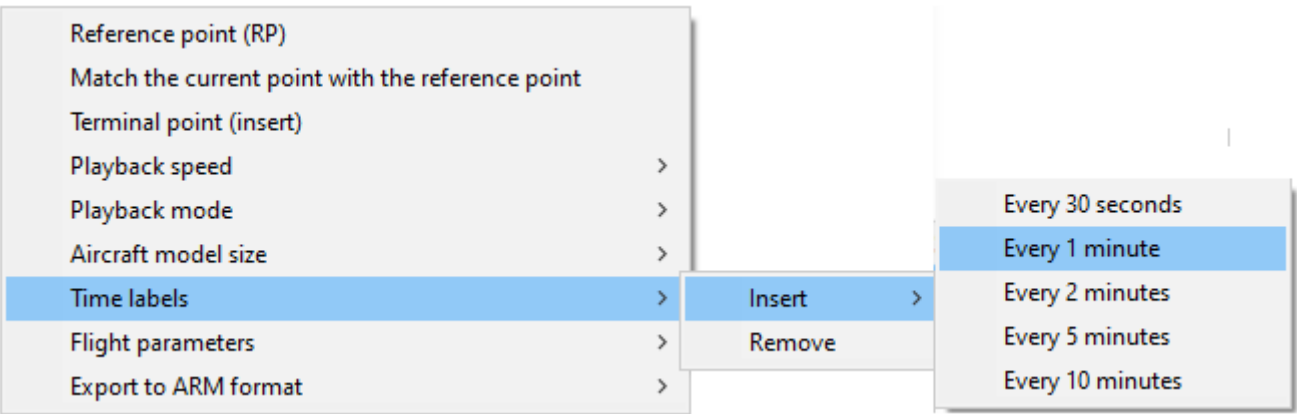
The pop-up menu ([Figure 11.8](#)) that appears after right-clicking anywhere in the trajectory view field allows you to increase or decrease the size of the aircraft model.



Drawing 11.8


11.3.7. Adding time labels


To add or remove the time labels use the appropriate items of the popup menu ([Drawing 11.9](#)) that appears after right clicking on the graph field.



Drawing 11.9


You have to select the step of the time labels adding. To make any label active just locate the system cursor close to its position. The label will be selected automatically. The marker on the current position indicator will be

moved respectively. The button  will be switched on showing that the label is active and in the right part of the status bar the information about this label and possible actions will be displayed. To move the active label the **Left**, **Right**, **Up** and **Down** keys are used. The **Page Up** and **Page Dn** keys are used for label rotation. To change the current position on the flight path (moving along the track) if one of the labels is active use the **Shift+Left/Right** keys.


To add the time label to a rather arbitrary position you have to move the marker on the position indicator and press the button .

Note: Setting the time labels on one of the pages automatically leads to adding them on two other pages.

The possible customization of the time labels is described in the [Section 11.3.9.5](#).

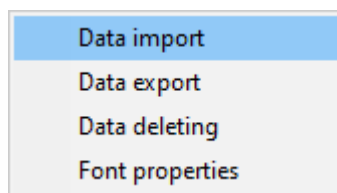
To remove the label just make it active and click the button . To remove all the time labels select the **Time labels/Remove** item from the popup menu ([Drawing 11.9](#)).

11.3.8. Adding text labels

There are different ways to add the text labels to the flight path plot. First of all, all the labels that are already set inside the calculation interval will be added to the flight path automatically. Use the **Text labels** page of the **Flight path parameters** window view the existing text labels ([Section 3.5.3.1](#)), which appears after pressing on button ..

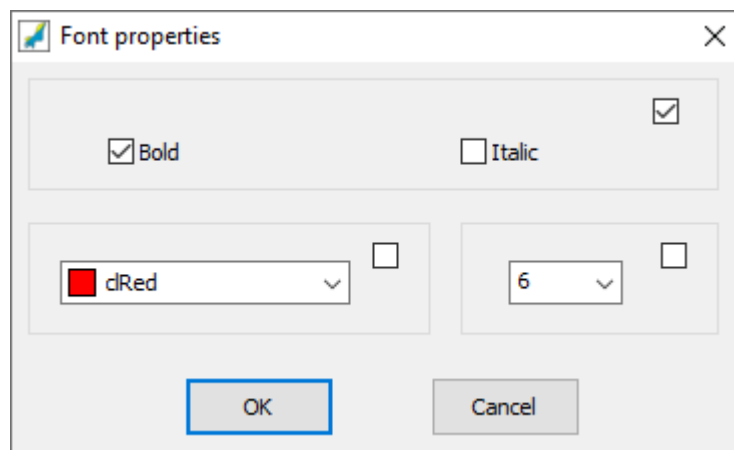
This page lets you add a new label manually (**Ins** key) or delete the selected label (**Del** key). The time should be set in hh:mm:ss format. The ":" delimiter is mandatory. The program allows printing the text labels on no more than 5 lines. The new line symbol is «*». It may be set in any position of the label string.

Another way is to import text labels from a previously prepared file. The file format is described in the chapter [Section 10.7](#). It also contains recommendations for working with text labels. The additional digit in the end of the string defines the label position on the flight path. It is strongly not recommended to change this value manually. All the adjustments of the label properties have to be done using flight path window. Select the appropriate item from the popup menu to import the labels from a file (Drawing 11.10). The popup menu appears after right clicking on the list of labels.




Drawing 11.10

The popup menu also helps you to export labels in the text file, to delete all the labels and to customize font properties for each label separately (Drawing 11.11). If the switch located in the upper right corner of the window is checked then the current settings will be applied to all the text labels.




Drawing 11.11


To make any label active just locate the system cursor close to its position. The label will be selected automatically. The marker on the current position indicator will be moved respectively. The button  will be switched on showing that the label is active and in the right part of the status bar the information about this label and possible actions will be displayed. To move the active label the **Left**, **Right**, **Up** and **Down** keys are used. The **Page Up** and **Page Dn** keys are used for label rotation. To change the current position on the flight path (moving along the track) if one of the labels is active use the **Shift+Left/Right** keys.


Note: Unlike the time labels ([Section 11.3.9.5](#)) the text labels may be different for each page. The possible customization of the text labels is described in the chapter [Section 11.3.9.6](#).



To remove the label just make it active and click the button  or delete the corresponding line on the **Text labels** page (Section [3.5.3.1](#)). Select the appropriate item from popup menu (Section [3.5.3.1](#)) to delete all labels.

11.3.9. Customizing flight path appearance

The program let you customize a big amount of parts of the flight path presentation window. The properties are set in the **Flight path customization** (Section [3.5.2](#)) window that appears after pressing the button .

After all the elements are adjusted it is recommended to unpress the button  in order to disable the **Flight path customization** window calling as well as the other flight path adjustments.

11.3.9.1. Gridlines and direction indicator customization

Using the **Gridlines** field you are able to set the scale and measuring units of the grid lines as well as the color of grid. Additionally the choice between rectangular and polar coordinate systems may be done.

The **Line width** box contains the width of the grid lines in pixels.

The **Grid ticks** box defines the step of the grid lines in selected units (the **Unit** switch box).

Toggling the **Coordinate system** switch box you are able to switch between linear and polar coordinate systems.

The **Do not show** box if checked hides the grids and direction indicator.

The **Color** field let you to specify color of grids (upper list) and color of the direction indicator (bottom list).

11.3.9.2. Colors of the flight path parts

You are able to select up to the three logical parts on the flight path and customize their colors. The length of the part is set by dragging its boundary on the color selection ruler. The color of the particular part is selected from the standard **Color** dialog that appears after right clicking on this part of the color ruler.

11.3.9.3. Flight path customization

On the **Flight path** field the user may set the width of the flight path line and its projection onto horizontal plane (for axonometric projection) as well as the width of the vertical section lines.

Two color lists below define the colors of the vertical section lines when the aircraft is positioned to the observer with the left and right side correspondingly.

The user may also specify the following properties:

Kh	The current value of the altitude will be multiplied to this coefficient. This coefficient is used for improving visualization conditions. To view at the flight path from the top (normal view) you have to set 0 value of this coefficient.
dH	This value will be added to the current value of the altitude. This coefficient is used for improving visualization conditions. If reduction to zero mode is on then this field will be filled in automatically and may not be edited.
dT	The step of outputting the flight path points (in seconds).
dFi	The horizontal plane inclination angle. It is zero for "top view". The possible values are from 0 up to 90 degrees.

The **Transparency** box of the **Brush** field controls the transparency between the vertical section lines in axonometric projection. The brush color (if not transparent) is selected from the top color list of the **Brush** field.

The bottom color list defines the color that will be used for relief drawing. The relief will be displayed if the **Relief** switch in the **Flight path customization** window (Section [11.8](#)) is checked and the short name of the radio altitude is specified on the **Flight path parameters** page (Section [3.4.6](#)).

11.3.9.4. Setting the plot caption

The plot caption is set on the **Caption** field.

11.3.9.5. Time labels customization

Time labels properties are set on the **Time labels** field.

The label is displayed as a circle. The user may specify the colors of the boundary and background (brush) of this circle in the corresponding lists.

The third list defines the color of the reference line if the **Reference line color is the same as text color** box is checked.

The label size is set in the **Size** field.

The **A/C type** box let you change the label appearance from the circle to the aircraft model (Section [11.3.6](#)).

The **Font** field let you set the font properties of the time labels.

The **Transparency** box defines if the labels background will be transparent or not.

11.3.9.6. Text labels customization

Text labels properties are set on the **Text labels** field.

The label is displayed as a circle. The user may specify the colors of the boundary and background (brush) of this circle in the corresponding lists.

The third list defines the color of the reference line.

The label size is set in the **Size** field.

The **A/C type** box let you change the label appearance from the circle to the aircraft model (Section [11.3.6](#)).

The **Do not show** box if checked hides the text labels but they are not removed from the project.

The **Transparency** box defines if the labels background will be transparent or not.

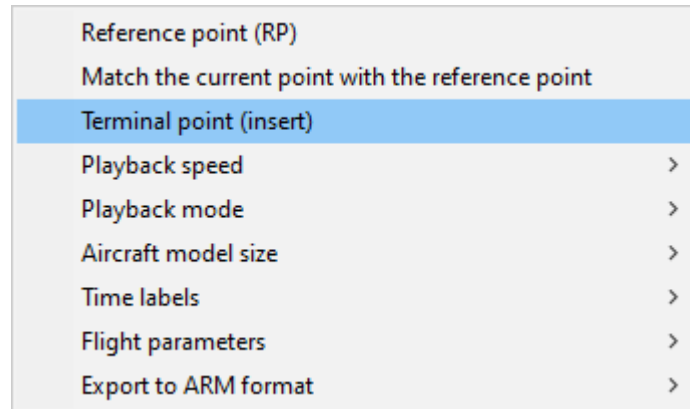
Font settings are defined separately for each label on the **Text labels** page (Section [11.3.8](#)) of the **Flight path parameters** window (Section [3.5.3.1](#)).

11.4. Calculation with additional target points

If the aircraft passed some points (marker beacons etc.) with known coordinates and at the known time moments then this information may be used to correct the calculated flight path. The correction will be done by selecting the constant values (not depended on altitude and other parameters) of wind speed and direction that minimize the residual between calculated and specified target points using the least-squares procedure. The estimated values of wind speed and direction will be added to the values that were set in the **Wind, forecast** field of the **Flight path parameters** window. It should be clear that these values account not only the difference between actual and used wind speed and direction conditions but also all other possible errors of registration of some parameters. They may be called "integral" wind parameters.

The time and coordinates of the additional target points have to be set in the **Terminal conditions** table of the **Flight path parameters** window (Section [3.5.3](#)). Use the **Ins** key to add a line. Use the **Del** key to delete the current line. The first line that represents the fixed point may not be deleted. If some fields will be left empty or contain non-numerical values they will be ignored. After optimization is done the target point will be displayed in green color.

There is also automatic way to specify additional target points. Move the system cursor to the position you want to set up and press the **Ins** key or right click on the point and select the appropriate item from the popup menu (Drawing 11.12). The program adds coordinates of the selected point automatically and recalculates the track. The time value for the new terminal point is taken from the current position and is equal to the value indicated on the indicator bar in the left upper corner of the window.





Drawing 11.12

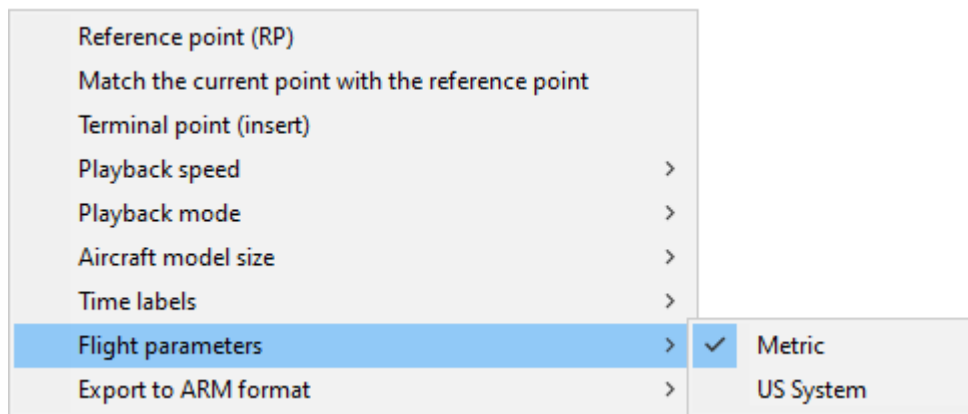
The program has the special calculator to simplify the calculation of the target points rectangular coordinates. The calculator window (Drawing 11.13) appears after left double clicking on that table line, where the coordinates of the next point should be inputted. The different parts of the window show the coordinates of the same point calculated in rectangular, polar and geographical systems. The numerical values are always counted from the origin of coordinates (0,0 point). Changing the coordinates in one of the fields automatically leads to changing them in all other fields. Geographical coordinates format depends on the switch position in the **Master points parameters** field of the **Flight path parameters** window (Section 3.5.3). Press the **OK** button to input the calculated values into the appropriate cells of the line the calculator was called from.

Drawing 11.13

11.5. Flight path printing

Press the  button to print the plot. Printing will be done to the currently selected printer or in a file depending on the settings selected in the Print settings window (Section 10.11).


Press the  button to print the numerical values of the flight path coordinates and other parameters. The standard **Windows™** editor will be loaded and the file will be created. The engineering units of the values (km-m-km/h or nm-feet-knots) depend on the selected item in the popup menu (Drawing 11.14).

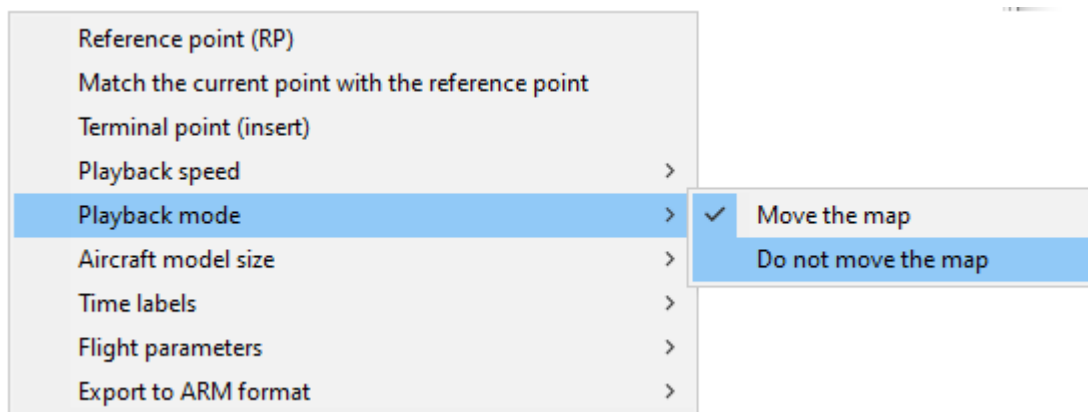


Drawing 11.14

***Note:** This menu item defines the units only for the parameters that are derived during flight path calculation. The units for other parameters are taken from the header of the data file used for calculations.*

11.6. Flight demonstration

Press the  or **Space** key to start demonstration. Press the same button once again or **Esc** key to stop demonstration. Flight demonstration mode depends on the switch position that has to be specified in the corresponding popup menu item (Drawing 11.15). Selecting the moving map mode forces the aircraft to stay in the middle of the window and the map will be moved. It is recommended to use this mode while viewing the flight path in **Zoom** mode.



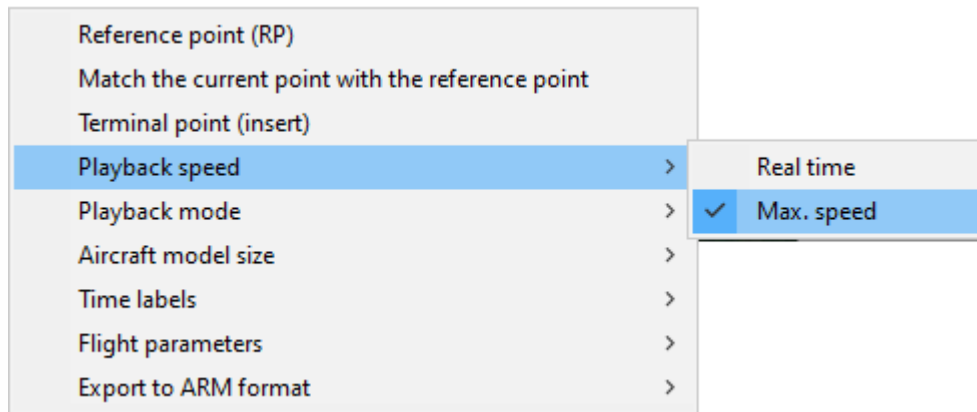
Drawing 11.15

The sound file has to be specified to run the demonstration in real time mode. The name of this file is set in the **Sound (wav)** field of the **Flight path parameters** window. Left click of the label to call file open dialog box. The sound file must contain the information on the same interval that was used for flight path calculation.

After the name of the sound file is specified the program will coordinate the moving of the aircraft along the flight path with the sound play back. For example, if the length of the sound file is 5 minutes then the aircraft will need exactly this time to fly along the entire track.

Use any sound editor (**Sound Forge** etc.) to prepare a sound file. Remember that the play back of the sound information on the ground devices may be done not in real time mode. In this case the sound information has to be synchronized with the parametric information using for example crew VHF communications instants or passing the ILS marker beacons. Correction is done by changing the length of the sound file. All modern sound editors let you change the file length unlimitedly. You have to understand that the more is the time interval between the points selected for synchronization the better. Use the VHF communication instants inside the selected interval to check synchronization results.

If a sound file is not defined you may use the appropriate popup menu item (Drawing 11.16) to toggle between fast and real time playback speeds.



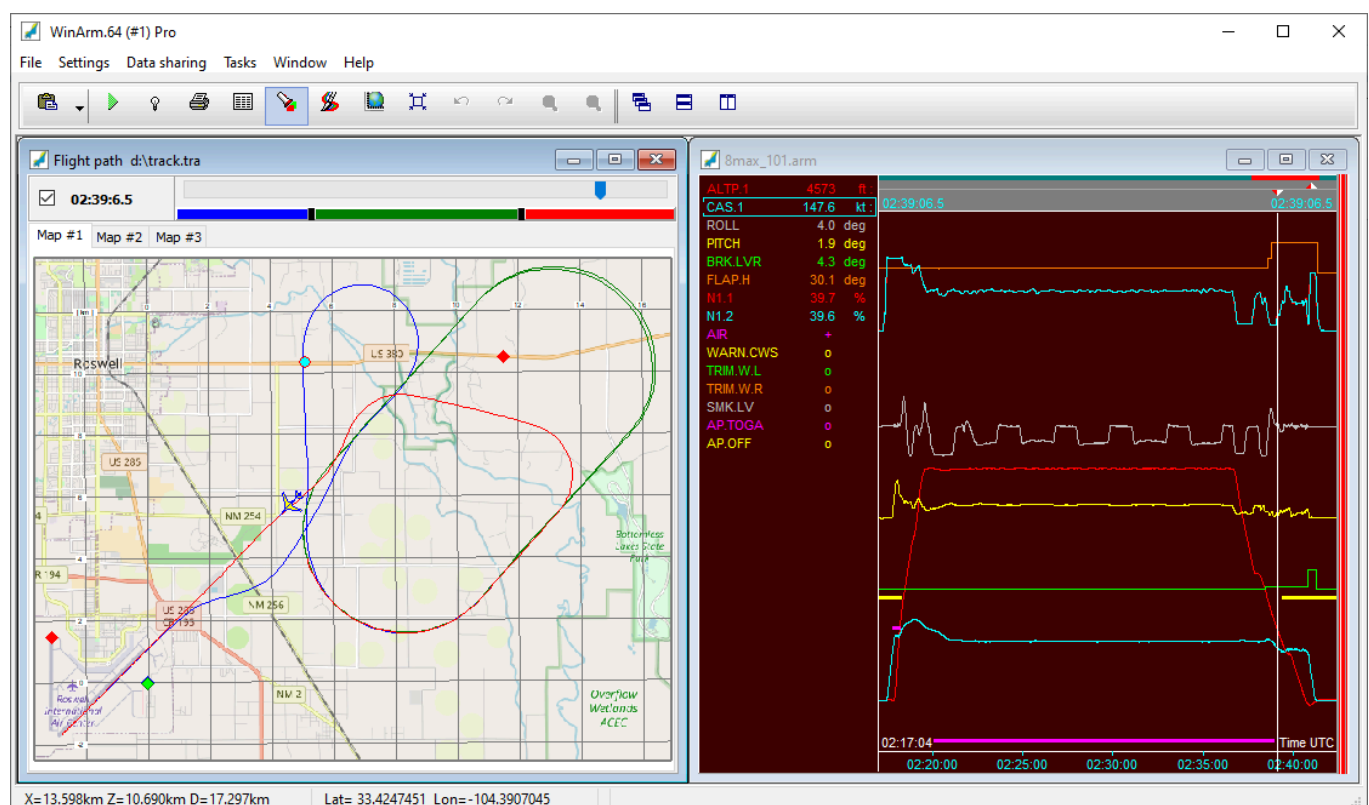
Drawing 11.16

The user may display the current values of the parameters during flight demonstration. The table will be displayed after the units of the parameters are selected from the popup menu (Drawing 10.14). ***Note:** This menu item defines the units only for the parameters that are derived during flight path calculation. The units for other parameters are taken from the header of the data file used for calculations.*

This window may be positioned (docked) in any place of the screen. To close the window as well as to move it and change the size you have to left click inside the window. The boundary as well as window caption and close button will appear. To hide the caption left click once again.

The table will contain the value of the analog parameters and On/Off signals which short names were selected on the **Flight path parameters** page of the **Header editor** (Section 3.4.6).

If both the flight path and flight data files are loaded and the box located in the left upper corner of the flight path window (near to time mark) is checked then the program will automatically establish connection between the two windows and allow you to view the values of the parameters displayed in data viewing window while an aircraft is flying along the track (Drawing 11.17). The connection is established using *relative time*. The user has to make sure that time modes and values are synchronized in data and flight path files. *At any time moment only one data file* may be connected to a flight path file.



Drawing 11.17

If there is a specified connection between files, it is possible to export calculated coordinates from file flight path to the **arm** data file. Export is performed after selecting the item of the pop-up menu on right mouse button **Coordinates export to ARM file** (Drawing 11.18).

Reference point (RP)		1. d:\track.tra
Match the current point with the reference point		2.
Terminal point (insert)		3.
Playback speed	>	4.
Playback mode	>	5.
Aircraft model size	>	6.
Time labels	>	7.
Flight parameters	>	8.
Export to ARM format	>	9.
Coordinates export to ARM file	>	10.

Drawing 11.18

Coordinates are entered into the data file as an additional stream (Section 10.15) with reference to relative time that's why it is also necessary to set the number additional data stream.

Connection between files trajectories and data is carried out by current *relative time*. Synchronization of this time lies on user. At *every moment time* the connection of flight path file may be organized *only with one data file*.

11.7. Saving the flight path into existing project

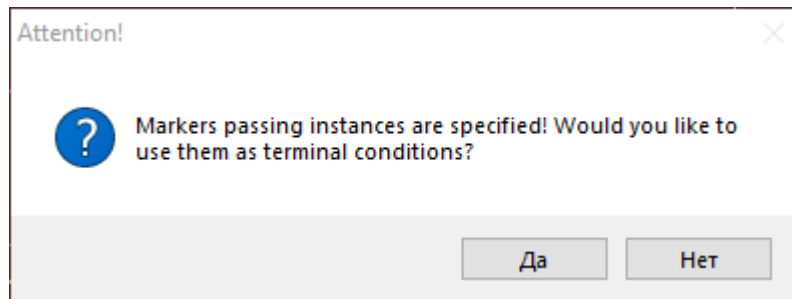
This type of calculation (menu item **Tasks/Flight path calculation/Into existing project**) is used if it is necessary to change magnetic variation, wind conditions or time interval but you want to keep the binding to the map, text labels and so on. After selecting the mentioned menu item the dialog box will appear to help you select the name of the existing project. All other actions are the same as described in Section 11.2.

11.8. Terrain imitation

You have to specify radio altitude short name on the **Flight path parameters** page (Section 3.4.6) to use this function. Check the appropriate box in the **Flight path customization** window (Section 3.5.2) to switch on this function. The height of the terrain is calculated as difference between pressure altitude after all reductions and radio altitude values. Calculations are done only on the intervals where radio altitude values are less than 750 meters. It is recommended to use this mode for low altitudes flights in mountain as well as for helicopter flight path calculation.

11.9. Glide path calculation

The program also may calculate the approach flight path in vertical plane. The results will be displayed as functions from distance to the runway. To perform this calculation the user has to specify the short name of the radio altitude on the **Flight path parameters** page and at least two text labels that define the moments of passing outer or middle markers and touchdown. The maximum accuracy is reached if both markers are used. In this case the program calculates the wind speed and direction basing on marker passing instants. The predefined text labels (Section 10.7) are used to mark marker beacons passing and touchdown moment. The text labels should be the following: **Outer marker**, **Middle marker**, **Touchdown**. The user must strictly comply with the given spelling and case of the letters. The program may install labels automatically if the short names of the parameters are specified in the **weight on wheels (touchdown)**, **outer marker** and **middle marker** fields on the **Flight path parameters** page of the **Header editor** window (Section 3.4.6). Press the **Ctrl+M** keys to install labels. If moments described higher are defined as terminal markers the program will ask question about use of data markers as boundary conditions (Drawing 11.19). For implementation of calculation answer affirmatively. In otherwise case, as in absence of markers, the calculation of flight path in vertical plain will be produced only (Section 11.2).



Drawing 11.19

If the answer is positive then the new page **Glideslope parameters** will appear in the **Flight path parameters** window (Drawing 11.20).

Flight path parameters D:\samples\1.tra

Coordinates, wind, maps | Text labels | **Glideslope parameters**

Outer marker

Specified height, m: 206

Distance from RWY threshold, m: 4000

Middle marker

Specified height, m: 71

Distance from RWY threshold, m: 1200

GS antenna

GS angle, deg: 2.75

Distance from RWY threshold, m: 290

Height of the glide slope entrance point

0

RWY

RWY HDG (mag.): 75

Kh RWY: 1

RWY profile

X,m	H,m
0	0
3000	0

OK Cancel

Drawing 11.20

The user has to specify parameters of marker beacons, glide slope entrance height, runway heading and profile.

Specifying the runway magnetic heading is mandatory.

The height of marker beacons passing set the glide slope angle. If only one beacon is specified then the standard glide slope angle of 2#30' will be assumed.

The **Height of the glide slope entrance point** field sets the value the glide slope will be plotted from.

To display the runway the user has to specify its profile. The profile is set as a combination of values distance/elevation that is counted from the entrance threshold. The simplest way is to specify the runway length and elevation of one threshold comparing to the other one. Specifying **RWY profile factor** let you enhance visualization conditions. All the elevations will be multiplied on this factor.

The program will treat the defined points as target points (Section 11.4) and will calculate their relative rectangular coordinates. The entrance threshold will be selected to be the origin of coordinates. The calculation results will be added to the **Terminal conditions** table of the **Coordinates, wind, maps** page automatically. The values may be changed only through changing markers and runway properties. Calculation results for the specified parameters (Drawing 11.21) are shown on Drawing 11.22.

Flight path parameters d:\track.tra

Coordinates, wind, maps Text labels Glideslope parameters

Terminal conditions

Time	X,m	Z,m
02:42:24	0	0
02:39:06.5	2138.68	1117.03
02:39:06.5	5320.05	4188.56

Wind Forecast

Hrel	Fw,m/s	Qw,deg

Altitude reduction to zero

☒ Without altitude reduction

☐ At the beginning of flight path

☐ At the end of flight path

Fixed point

☐ At the beginning of flight path

☒ At the end of flight path

☐ At arbitrary point

Magnetic variation, deg

0

Output step, sec

0.5

Calculation

☒ Constant MNK ☐ Piecewise linear

Master points parameters

	Latitude				Longitude			
	deg	min	sec.		deg	min	sec.	
Origin of coordinates	33.30192413			N	104.50579306			W
Master point #1	33.3153584			N	104.538794			W
Master point #2	33.3965			N	104.381895			W

Deg:min:sec

Deg:min

☒ Deg

Map #1 D:\WinArm64\maps\maps.bmp

Map #2

Map #3

A/C type D:\WinArm64\aip\config.aip

Scheme #1

Scheme #2

Scheme #3

Sound (wav)

OK Cancel


Drawing 11.21

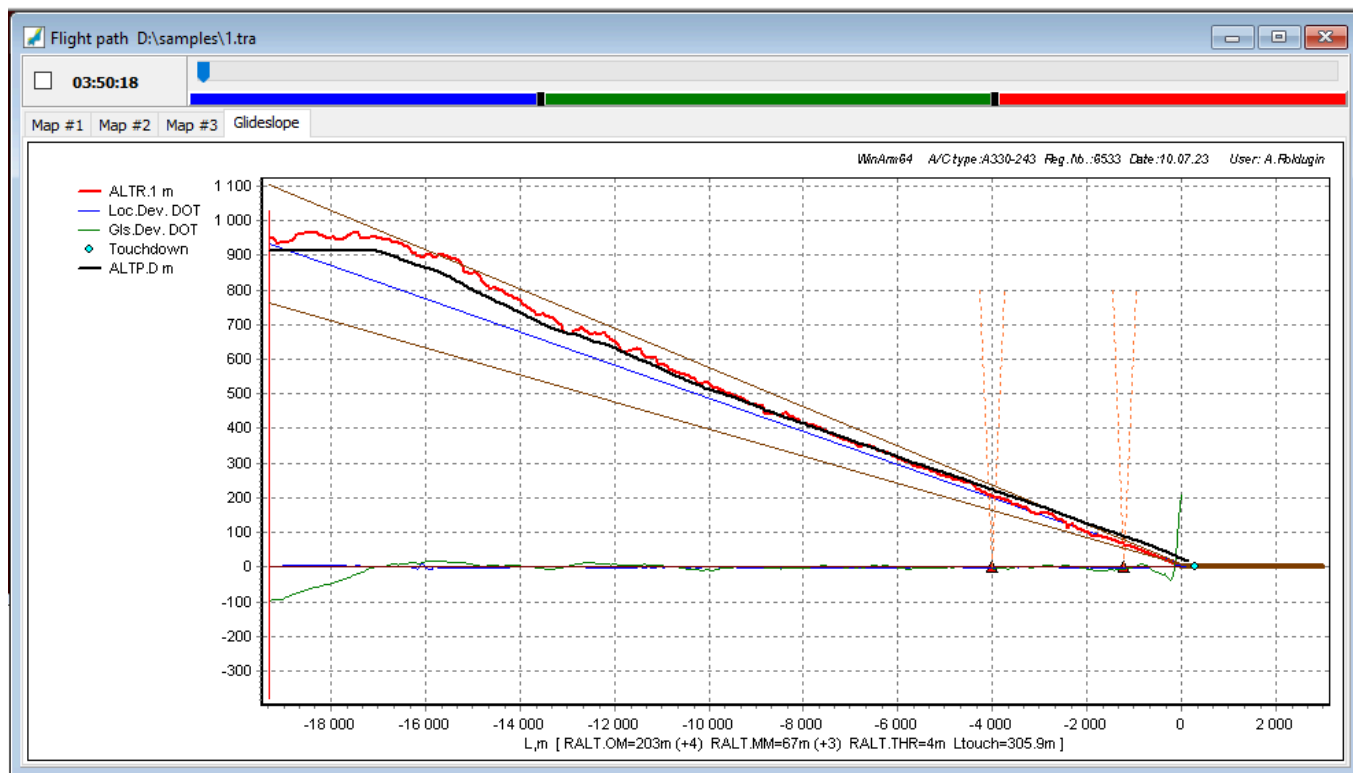
The flight path including vertical plane will be done after pressing the **OK** button. The **Glideslope** page is shown on drawing 11.22.

The radio altitude graph is plotted as a function of distance to the runway threshold. If the short names of the horizontal and vertical deviations from the glide slope (or any other two parameters) are specified in two lines with **Parameter for glide slope plot** caption on the **Flight path parameters** page (Drawing 11.20). To display geometric height and deviations from equisignal zones (or two other parameters at the user's choice), their identifiers must be previously given on tab **Flight path parameters** (Section 3.4.6) as **radio height**, and also in two lines **parameter for glideslope plot**.

To zoom the image in just select the desired part by the left mouse button from the top left corner down to the bottom right corner. Repeat this procedure if you need to zoom more. Make the selection in opposite direction to return to the original size.

For display tables With current values parameters necessary click right button mouse on the graph field and make the appropriate selection in the pop-up menu (Drawing 10.14). Change current positions carried out moving cursor on indicator provisions.

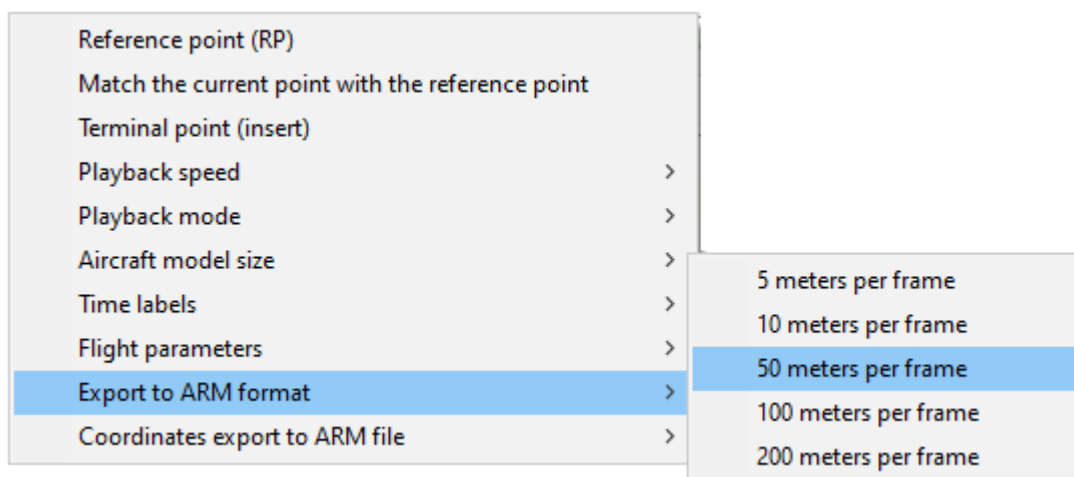
The printing of the currently displayed part of the vertical path will be done on the page of the A4 format after pressing the button .



Drawing 11.22

11.10. Viewing parameters versus distance

Selecting the **Export to *.arm format** popup menu item ((Drawing 11.23) and specifying the resolution creates a new data file (arm file) that will contain only the parameters which short names were defined on the **Flight path parameters** page of the **Header editor** window (Section 3.4.6). The distance to the runway threshold will be used in this file as an argument instead of the time values. The distance is calculated as amount of meters flown along the actual flight path.



Drawing 11.23

Further work with this data file does not differ from the work with regular file but there are some special features.

The type of all the parameters on the **Parameters** page is set as **Analog, not calibrated/Real number**. The **Passport, common data** page of the **Header editor** window for such a type of file is shown on the drawing 11.24.

The dialog box 'Header editor (Time)' has tabs: Parameters, Calibration tables, Addresses, Frame map, Passport, common data, Flight path parameters. The 'Passport, common data' tab is active.

Passport fields	Passport fields values
A/C type	B-737-8MAX
Reg.No.	8MAX
Note	
Date	15.04.17
Flight	(KROW-KROW)
Pilot	
Header	

On the right side of the dialog:

- Data format:** Arbitrary (dropdown)
- Meters in frame:** 100 (input)
- "Frame failure" mark (bits):** 545 (input)
- Bytes per block:** 72 (input)
- Add files. Param.list:** work/B737MAX (dropdown), param (dropdown)
- Time, Day, Month, Year, Flight, Reg.No.:** (input fields)
- Default standard task:**
 - ☒ File: d:\winarm64_stn
 - 0. Parameters to be saved while file closed (dropdown)
- ID Subframe (Frame):**
 - Subframe inside frame identifier (input)
 - Frame inside superframe identifier (input)
 - Subframe inside superframe identifier (input)
- X-axis type:**
 - ☒ Distance
 - ☐ Time

Buttons: OK, Cancel, Print, HDRX =>

Last changes: 06.11.23 (#1)

Drawing 11.24

The program selects automatically arbitrary type of FDR from the **Data format** list and **Distance** switch for the **X-axis type** and also sets up the fields that define the format of the frame. It is ***strongly recommended not*** to change those values.

Passport field values will be same as in a data file that was used for flight path calculation. The range of axis scale properties are set in the **Distance Axis Options** dialog box. (Figure 11.25), which appears after selecting the menu item **Settings / X-axis scale properties**, or clicks right click on designation scales.

The dialog box 'Distance-axis options' has the following settings:

- Format:**
 - ☐ Nautical miles
 - ☒ Kilometers
 - ☐ Meters
- Distance value in active cursor position:**
 - Kilometers: 0.00 (input)
 - ☐ Apply
- Distance-axis label:**
 - Name: Distance to RWY (input)


Buttons: OK, Cancel

Drawing 11.25

The dialogue allows tune format (dimension) of output marks range, signature scales abscissa, and also to install arbitrary value relative range in position of active cursor.

11.11. Adding charts

This function lets you add different navigation charts (for example approach chart) to the graph viewing.

The added data should be first saved in a text file. The name of the file is assigned in the dialog window which appears after left clicking on the **Scheme #1**, **Scheme #2** or **Scheme #3** text fields of the **Flight path parameters** window after the cursor turns into  (Section 3.5.3). Press **OK** when you select the file name.

Note: If the user creates a local navigation database from the DAFIF database (Section 10.17.2) and wishes to use it as a scheme file they must assign the name of **area.txt** from the **NAVI/Select** of the main software catalog.

Below is a part of the file that contains description of various navigation chart sections.

```
<ARPT>
SHEREMETYEVO      +  55.97264    37.41459    9.35
VNUKOVO           +  55.59153    37.26149    9.27
DOMODEDOVO        +  55.40879    37.90631    9.28

<RWY>
SHEREMETYEVO 25L   +  55.97567    37.44366    246
SHEREMETYEVO 07R   +   55.9671    37.38629     66   55.97567    37.44366    197
SHEREMETYEVO 25R   +  55.97802    37.44167    246
SHEREMETYEVO 07L   +  55.96979    37.38673     66   55.97802    37.44167    197
VNUKOVO 20         +  55.61169    37.27687   194.2
VNUKOVO 02         +  55.58655    37.25764    14.2   55.61169    37.27687    197
VNUKOVO 24         +  55.59797    37.29011   239.1
VNUKOVO 06         +  55.58804    37.24603    59.1   55.59797    37.29011    197
DOMODEDOVO 32L     +  55.39543    37.90334   316.8
DOMODEDOVO 14R     +  55.42115    37.87216   136.8   55.39543    37.90334    230
DOMODEDOVO 32R     +  55.39529    37.94176   316.8
DOMODEDOVO 14L     +  55.42328     37.908    136.8   55.39529    37.94176    197

<WPT>
BUZHAROVO         +  55.98333     36.8
AVADI              +  56.23333    37.43333
BITSA              +  55.56667    37.61667
BITUL              +   55.25     37.76667
CHELOBITYEVO       +   55.9      37.68333
```

The program differentiates between the four navigation chart sections:

- airports (<ARPT>);
- runways (<RWY>);
- air tracks (<ATS>);
- waypoints (<WPT>).

Each section starts with a relative key word bracketed by "< >". The key word is followed by a description of the section objects. The description of each object takes one line. The number of fields in the description line depends on the section type. The fields must be divided by horizontal tabulation symbol.

Section <ARPT>

This section contains positions of the aerodrome reference points. Each line has four fields. The first field contains the airport name that will be placed on the chart. The name can be absent but the horizontal tabulation symbol must be present. It is followed by the "+" or "-" symbols that will determine if the object will be displayed on the chart or not. The third and fourth fields determine the latitude and longitude (in degrees).

Section <RWY>

This section contains descriptions of runways. Each line has eight fields. The first field contains the runway name to be placed on the chart. The name can be absent but the horizontal tabulation symbol must be present. It is followed by the "+" or "-" symbols that will determine if the object will be displayed on the chart or not. The third and fourth fields determine the latitude and longitude (in degrees) of the runway entrance threshold. The fifth defines the runway width in feet. The sixth and the seventh fields determine the latitude and longitude (in degrees) of the runway exit threshold. The eighth field defines the extended runway centerline length with relevance to the runway length. The extended runway line will be drawn from the entrance threshold. If this number is absent the extended runway centerline will not be drawn.

Section < ATS >

This section contains air tracks descriptions. Each line has six fields. The first field contains the air track name to be placed on the chart. The name can be absent but the horizontal tabulation symbol must be present. It is followed by the "+" or "-" symbols that will determine if the object will be displayed on the chart or not. The third and fourth fields determine the latitude and longitude (in degrees) of the initial track point. The fifth and sixth fields determine the latitude and longitude (in degrees) of the end of track. The points are linked with straight lines.

Section <WPT>

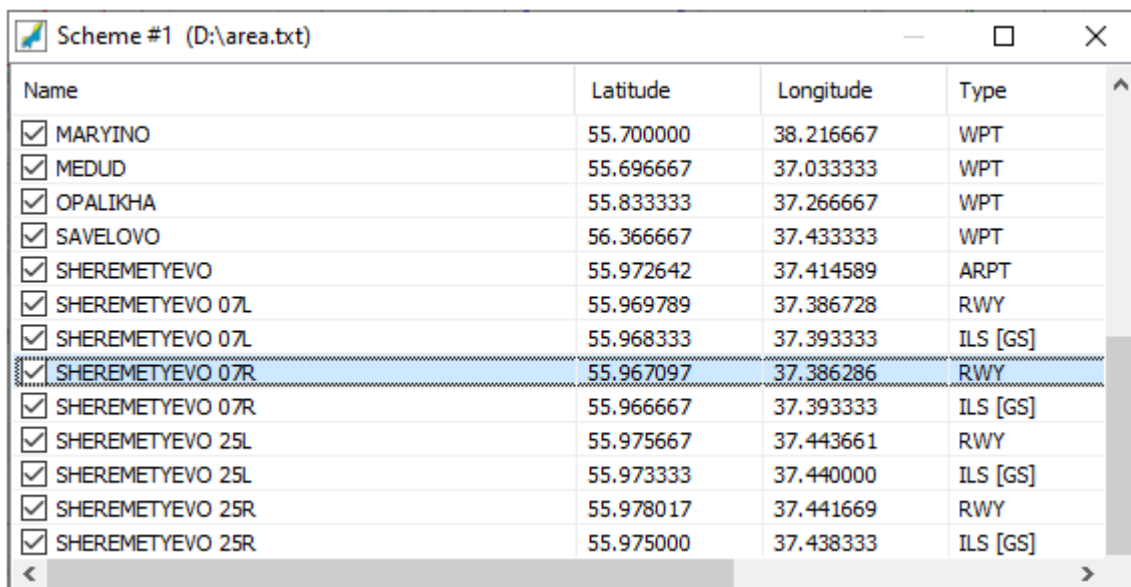
This section contain descriptions of any navigation or other points (VOR, NDB, crash point etc..). Each lin has four fields. The first field contains the point name that will be placed on the chart. It is followed by the "+" or "-" symbols that will determine if the object will be displayed on the chart or not. The third and fourth fields determine the latitude and longitude (in degrees).

After the file name is defined the software will draw in the flight path viewing window all the elements marked with "+". If the cursor is placed over any element its name will appear in the status bar. Right clicking calls up the dialog window (Drawing 11.26) with the help of which the user may delete or add any waypoints on the screen. To add/delete points just check or uncheck a relative switch. After introducing the required changes close the window by pressing the corresponding button in the window header line. All the saved changes will be displayed on the screen and saved in the associated text file.

The predefined points coordinates may be used to automatically assign the coordinates of points used to bind the flight path to the map (master points).

To set the master point coordinates right click it to call for the dialog window (Drawing 11.26). Select the needed point and **left double click it**. The window will be automatically closed and the coordinates changed. You may also call for the dialog window from the **Flight path parameters** window (Section 3.5.3). It will appear after left clicking on the **Master point #1** or **Master point #2** text fields.

Press **DB** button in the **Reference point coordinates** dialog window (Drawing 11.5) to automatically assign the reference point coordinates. The dialog window will appear (Drawing 11.26). Select the needed point and **left double click it**. The window will be automatically closed and the coordinates changed.



Name	Latitude	Longitude	Type
<input checked="" type="checkbox"/> MARYINO	55.700000	38.216667	WPT
<input checked="" type="checkbox"/> MEDUD	55.696667	37.033333	WPT
<input checked="" type="checkbox"/> OPALIKHA	55.833333	37.266667	WPT
<input checked="" type="checkbox"/> SAVELOVO	56.366667	37.433333	WPT
<input checked="" type="checkbox"/> SHEREMETYEVO	55.972642	37.414589	ARPT
<input checked="" type="checkbox"/> SHEREMETYEVO 07L	55.969789	37.386728	RWY
<input checked="" type="checkbox"/> SHEREMETYEVO 07L	55.968333	37.393333	ILS [GS]
<input checked="" type="checkbox"/> SHEREMETYEVO 07R	55.967097	37.386286	RWY
<input checked="" type="checkbox"/> SHEREMETYEVO 07R	55.966667	37.393333	ILS [GS]
<input checked="" type="checkbox"/> SHEREMETYEVO 25L	55.975667	37.443661	RWY
<input checked="" type="checkbox"/> SHEREMETYEVO 25L	55.973333	37.440000	ILS [GS]
<input checked="" type="checkbox"/> SHEREMETYEVO 25R	55.978017	37.441669	RWY
<input checked="" type="checkbox"/> SHEREMETYEVO 25R	55.975000	37.438333	ILS [GS]

Drawing 11.26

11.12. Flight path calculation using local runway database

Order of creation of local RWY data bases is described in Section [10.17.4](#).

To automatically use the data on a certain runway you must first define its identifier in the third line (**RWY landings**) on the **Flight path parameters** page of the **Header editor** window (Section [3.4.6](#)). The runway identifier is assigned by retrieving of the passport field value. To do this add a field (line) on the **Passport, common data** page (Section [3.4.5](#)) with the corresponding number (**36** in this case). After creating the line assign the runway identifier in the **Passport fields values** column. The identifier consists of two parts: runway number and airport name (for example 07R [SHEREMETYEVO, RS]). The accurate runway identifier can be found in the **rwyt.txt** file of the ... \NAVI\Select folder. You can input the runway identifier either manually (by typing or pasting) or using the pre-made **pick-file**. The creation of a **pick-file** is described in Section [9.1.1](#).

***Recommendation:** for more convenient viewing of the runway identifiers it is recommended to import the **rwyt.txt** for example to the **Microsoft Excel** and view structured information in a more convenient way.*

When you assign the identifier in the **RWY landings** line and set the marker passing marks and touchdown moment (Section [11.9](#)) the user may activate the quick glideslope (flight path) calculation function into a temporary file. This function becomes active when you press the **G** button in the graph viewing window or after selecting **Tasks/Flight path calculation/Glideslope** menu item. The glideslope parameter window will open with automatically input runway parameters. If necessary (for example when DAFIF data are absent) the user can input (change) them in a usual way. The resulting file will be automatically named **tmp.tra**. The file name is reflected in the window caption and the file itself is stored in the software root folder. ***Attention***, next time the quick glideslope calculation function is used this file will be automatically updated. If you plan to further use it you will have to rename the file.

11.13. Connection with X-Plane visualization program

This function allows the user to transmit data on the calculated flight path, as well as another necessary information from the recorded ones and evaluated parameters, to the program **X-Plane** (<http://www.x-plane.com>) for realistic reconstruction of flight in real time with reconstruction of cockpit environment and overlay of sound information. **X-Plane** allows to reproduce flight from saved file of special format (**fdr**) which may be formed in **WinArm64** .

With this approach, **X-Plane** is actually an "engine" for displaying data given by user, which may use all the functional possibilities of **X-Plane** :

- Availability of big quantity of aircraft models, instrument panels, scenarios of airports.
- Opportunity of modeling weather conditions of any difficulty.
- Opportunity of viewing reconstruction of flight from any point of space, and also from the working places of pilots.

Recreation of gauges data including displaying signals from ground radio sources, and also action of crew members levers management.

For playback of flight in **X-Plane-11** it is necessary to choose menu **Data sharing/Export to X-PLANE (FDR ver.2)**. For earlier versions of the program, select the menu item **Data sharing /Export to X-PLANE (FDR ver.1)**.

A dialogue with choice of parameters for formation of the **fdr** file will appear (Drawing 11.27).

In table **Options "FDR" file** it is necessary that row parameters (coordinates and altitude required) match the **WinArm64** parameters by clicking on the **ID** or **Short name** fields . If parameter is denoted as (**ratio**), then it is necessary to set the conversion factors **K** and **D** to ensure range changes from 0 before 1 (possibly in iterative way).

X-Plane export parameters (D:\WinArm64\work\B737NG_2.xpln)

"FDR" file save directory

Time origin
☒ From current value
☐ From zero

"FDR" file name (<http://www.x-plane.com/kb/creating-fdr-files/>)

I
 2
 ACFT,Aircraft/Laminar Research/Boeing B737-800/b738.acf,
 TAIL,N12345,
 TIME,08:34:00,
 DATE,08/10/2004,
 PRES,29.83,
 TEMP,65,
 WTMN 730 16

"FDR" file parameters (K, D - transition coefficients)

	ID	Short name	K	D
OAT (deg C)	241	SAT		
Longitude (deg)	204	LON.IR3		
Latitude (deg)	201	LAT.FMC		
Altitude msl (ft)	101	ALTP		
Radio Altitude (ft)	122	RALT.1		
Aileron (ratio)	521	CWP.L	0.012	0
Elevator (ratio)	505	ELEV.L	0.05	0
Rudder (ratio)	545	RUDDER	0.037	0

OK Cancel

Drawing 11.27

11.14. Flight path calculation to the additional data stream

By choosing menu **Flight path calculation /To additional stream** (or by clicking keys **ALT+T**), you can produce calculation of flight path parameters (geographical coordinates) and bring it to additional stream files **arm**, **armx** for further use, for example for display of overview trajectories. At this in Header editor it will be necessary to "bind" coordinates to results of calculation from the stream.

At choice of menu it will proposed to implement settings of calculation, choosing initial or final point of the trajectory, relevant to cursors on graphics, and choosing number of the stream (Drawing 11.28).

Flight path calculation to the additional stream

Coordinates

Latitude , deg
 33

Longitude , deg
 -104

☒ At the beginning of flight path
☐ At the end of flight path

Additional stream to save results

Stream #03. Empty

OK Cancel

Drawing 11.28

12. Flight information Express-analysis

Express-analysis (EA) as an essential part of the FDA/FDM programs is the basic form of flight data processing ensuring the most deep and objective monitoring of flight crew actions and aviation systems performance in flight. Aircraft flight operation manuals and instructions on technical operation of aircraft systems (AFM/FCOM/AMM) establishes limitations, standard operations and etc. while different stages of flight, determining necessary crew actions and recommended modes of systems and equipment operation. Express-analysis is designed to detect, fix and document events, that occurred in flight and are unacceptable or undesirable from a flight safety point of view.

Algorithms of express-analysis of flight information present themselves a symbolic record of requirements and recommendations established by regulatory documentation (AFM, FCOM, AMM and etc.). For everyone type of aircraft algorithms are brought together in individual catalogs of messages (events).

12.1. Principles of Express-analysis development

This chapter describes the principles of express-analysis creating and running in the **WinArm64** environment. From the **WinArm64** point of view all the express-analysis events (algorithms) are *calculated On/Off signals* created with the help of the built-in algorithm interpreter (Sections 9.2.2.4 and 9.3.4). Therefore, they are a part of the header file (Section 9.1). The program provides user-friendly interface of the **Header editor** to create and modify the express-analysis algorithms. This approach along with the ability to export algorithms into the simple text file, to correct them over there and to import them back, provides the portability of the algorithms from one data file to another.

Express-analysis results are saved into the corresponding data file and may be displayed as On/Off signals along with the registered parameters. This way guarantees the maximum level of evidence while checking express-analysis events and analyzing their causes.

In the end of this chapter it should be noted that express-analysis algorithms are not intended to monitor flight performance during training flights or aviation accidents.

12.2. Access levels to the express-analysis algorithms

There are two different levels of access to the express-analysis algorithms:

- **Full access**– with the ability to modify existing and to create new algorithms.
- **User's access** – with the ability to run the existing algorithms and to customize the appearance of the results.

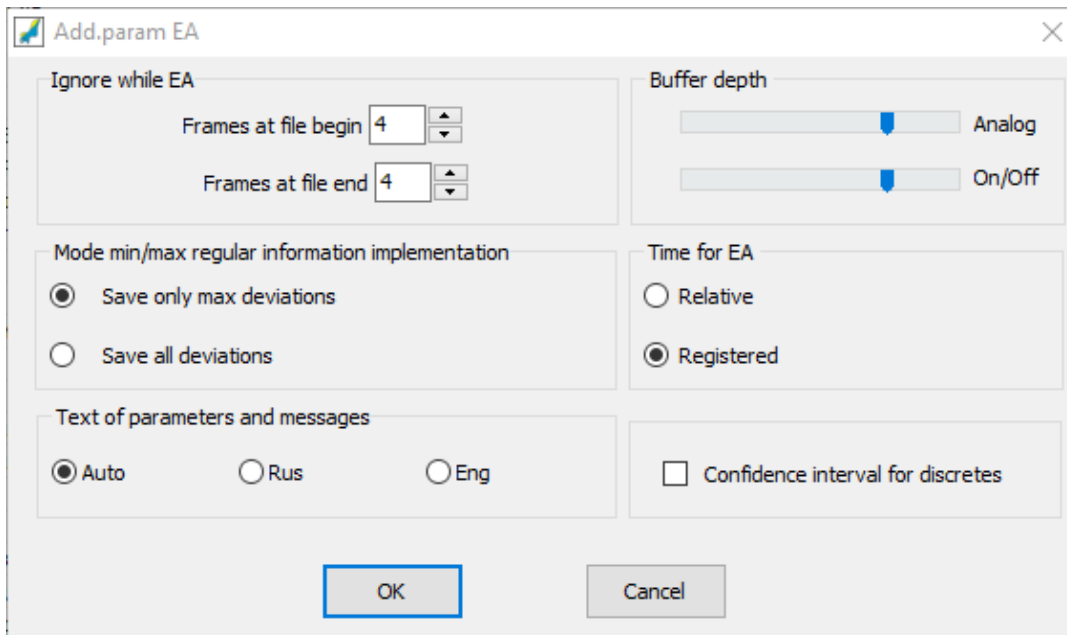
The current level of access is settled by the type of the protection key and by the resource accessibility settings (Section 6). It is necessary to have the **Pro** license in order to get the full access to the express-analysis algorithms (Section 2.3). This key does not require entering user's name and password while logging into the program.

Check the **Further information processing (the "Tasks" menu item)** box of the **WinArm64 security settings** window (Section 6) in order to establish user's level of access for the appropriate type of the user.

12.3. Running express-analysis algorithms. Viewing and printing the results

It is strongly recommended to remove all the registration failures (Section 10.6), especially frame failures, before express-analysis implementing.

If there are bad frames at the beginning and at the end of file, which may affect the correct event generation, user can ask number of frames the program to skip them when performing express-analysis. The task is performed in the corresponding fields of the **Add.param EA** (Drawing 12.1) , which appears after choice buttons **Add. Param.** on tab **Express-analysis** of the **Header editor** window (Section 3.4.7). In this window you can also configure one of two ways of processing of events of **regular information** type (Section 12.9), which suggest preservation of minimal (maximum) values of monitored parameter. By setting the switch to the appropriate position, you can save all implementations of a particular event or only one implementation (on the processing interval) with a minimum (maximum) value of parameter.



Add.param EA

Ignore while EA

Frames at file begin

Frames at file end

Buffer depth

Analog

On/Off

Mode min/max regular information implementation

☒ Save only max deviations

☐ Save all deviations

Time for EA

☐ Relative

☒ Registered

Text of parameters and messages

☒ Auto ☐ Rus ☐ Eng

☐ Confidence interval for discretes

OK Cancel

Drawing 12.1

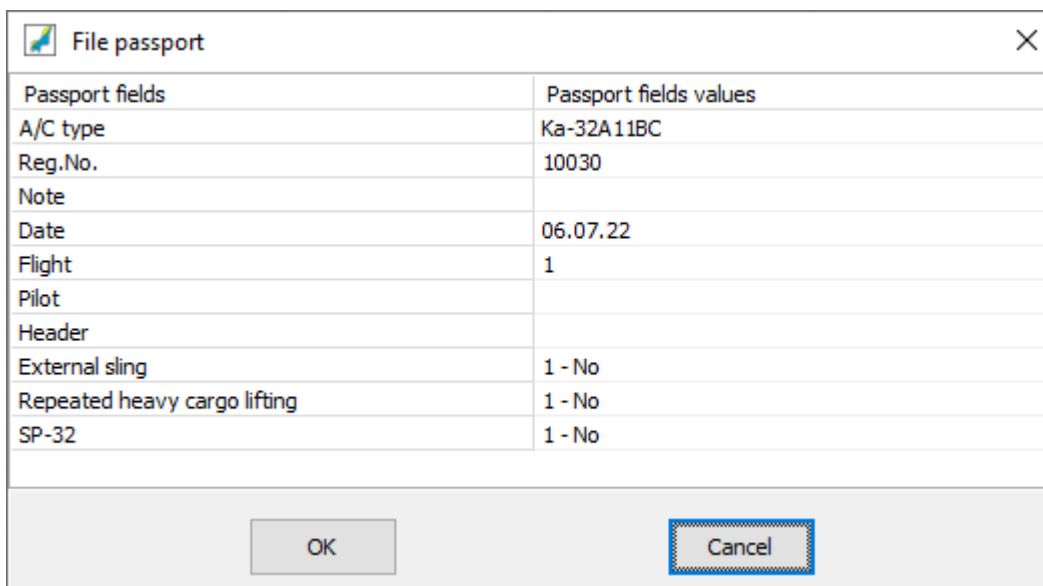
Buffer depth field is used when calculating parameters of the algorithm interpreter type, as well as on stage of fulfillment of express analysis and described in relevant sections (Sections [9.2.2.4](#) and [12.12](#)).

Field **Time for EA** used for definition of time type (relative or registered), which will be used to display results of express-analysis. For fulfillment express-analysis as a functions of registered time an identifier of parameter containing the registered time must be explicitly set in the sequence editor on logged time field (**Time**) (Section [3.4.5](#)). If express analysis is carried out in the function of relative time, it is recommended to set the relative time to the registered (Section [10.4](#)).

Field **Confident intervals for discretes** - allows to set mode, at which time start triggering on/off signals will reckon, beginning with half interval "poll" of this parameter, and end, respectively, in half of this interval after the termination of registration of the on/off signal. This improves the accuracy of determining the response time of the on/off signal and allows "not to lose" single positives discrete signals.

These fields are available only with full access level in express analysis in debugging mode (Section [12.12](#)).

Next, you need to fill in a flight passport for which an express-analysis will be carried out. For filling in the passport fields, you must open the **File Passport window** (Drawing 12.2) from **the Database** (Section [3.2](#)) or window display flight information (Section [3.3](#)). For call window filling flight passport from **Data Base** window it is necessary to highlight corresponding data file and press key **F2** or use relevant pop-up menu item, and to call passport from window viewing charts press **Ctrl + F2**.



Passport fields	Passport fields values
A/C type	Ka-32A11BC
Reg.No.	10030
Note	
Date	06.07.22
Flight	1
Pilot	
Header	
External sling	1 - No
Repeated heavy cargo lifting	1 - No
SP-32	1 - No

OK Cancel

Drawing 12.2

Quantity and fields names of passport depend on aircraft type. Adding passport of the required format occurs automatically in the process of creating a data file. User must fill in the field of the passport with the date in the format dd.mm.yy, otherwise the process of performing express analysis will be interrupted by messages about mistakes.

Strongly recommended not to delete predetermined lines of passports (in **Header editor**), and adding lines should be done **strictly after** all predefined lines. Otherwise algorithms of express-analysis correct operation is not guaranteed.

To run the express-analysis you have to select the desired flight (time interval) with the help of the moving cursors and choose the **Tasks/Express-analysis/Run** menu item or just press **F9** key. However, if the item **Tasks/Express-Analysis/Max. time interval** of the main menu is checked then the express-analysis will be done on the whole interval registered in the current file regardless of the cursors' positions.

Express-analysis is stopped either if the end of the time interval will be reached or if the special terminal event will be registered. The appropriate message will be popped up in the last case. At any time you are able to abort the express-analysis by pressing **Esc** key.

***Note:** Any event whose identification number is more than 9900 will be treated as a terminal event.*

Press the **F9** key in the **Database** window (Section 3.2) initiates package (batch) express-analysis. The express-analysis starts with the active file selected in the window and continue until the end of the list. During this process the program window will be minimized to System Tray and when the express-analysis is finished it will automatically regain its normal size. To interrupt package express-analysis left click the program icon in the System Tray and confirm the action. The express-analysis will be interrupted and the **Database** window will be automatically displayed on the screen.

If the main program folder contains a folder named **HDR** with a header file whose name coincides with the aircraft registration number in the current file and if the **Data sharing/Auto header replacement** menu item was selected in the graph viewing window (this menu item is available even if no data file is open) before conducting the express-analysis the program will suggest changing the current header to the header contained in the **HDR** folder. Caution: the checked condition of the **Data sharing/Auto header replacement** menu item is automatically cleared after each use.

The results of the express-analysis are saved into the data file (with the **arm** extension) and will be kept over there until the express-analysis is made once again or the header of this file is edited i.e. the **OK** button is pressed in the **Header editor** window. Select the **Tasks/Express-analysis/Open** menu item or press **Shift+F9** keys to view currently existing results of the express-analysis.

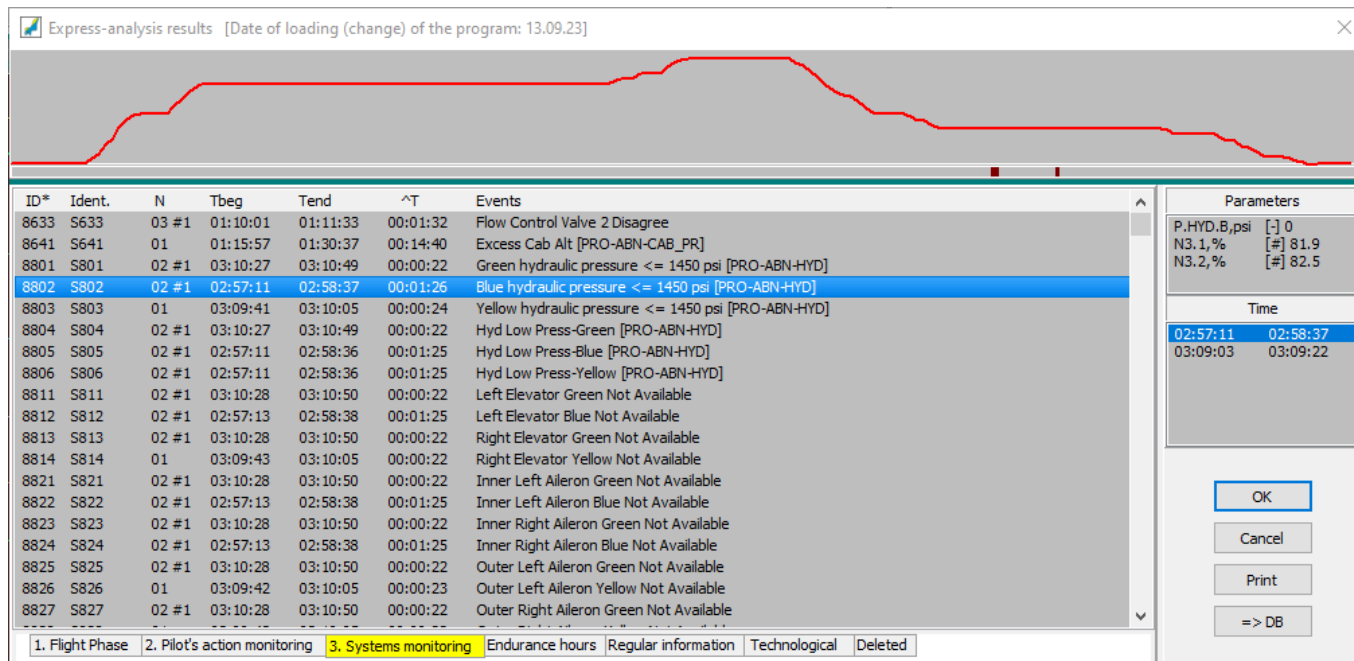
***Recommendation:** The beginning of the time interval for express-analysis implementation should start shortly after the time when the FDR was switched on. The end of the time interval depends on what stages of flight should be analyzed. It is strongly recommended to analyze the whole flight up to the end.*

If the current data file contains information about more than one flight, then the user may use function of automatic search of start and end of flights. Identification data, registered by FDR will be used as criteria (Section 10.3).

Results of express-analysis will be shown in window given on Drawing 12.3.

In the header of window the date of last changes of algorithms of express-analysis is indicated.

The plot of the parameter which short name is selected in the **Relative height, m** line of the **Analog parameters** list of the **Flight path parameters** page of the **Header editor** window will be presented in the top part of the window. This field will be empty if no parameter is selected. The user may change the size of the graph field by dragging its lower boundary.



Drawing 12.3

Depending on the type of the aircraft the window will have different amount of pages. Each page contains the events of the same type. The following information is displayed for the event of the **message** type (Drawing 12.3):

Caption	Description
ID	The unique number of the event
Ident.	The short name of the event
N	The amount and the order number of the current event
Tbeg	Recovered time of the event beginning
Tend	Recovered time of the event end
^T	Duration of the event
Type of event	Description of the event

The following information is displayed for the event of the **regular information** type:

Caption	Description
ID	The unique number of the event
N	The amount and the order number of the current event
T	Recovered time of the event beginning (for events registered on interval) or time of registration (for events registered in one point)
Ident.	The short name of the event
Value	The value of the target parameter
Type of event	Description of the event

The following information is displayed for the event of the **endurance hours** type:

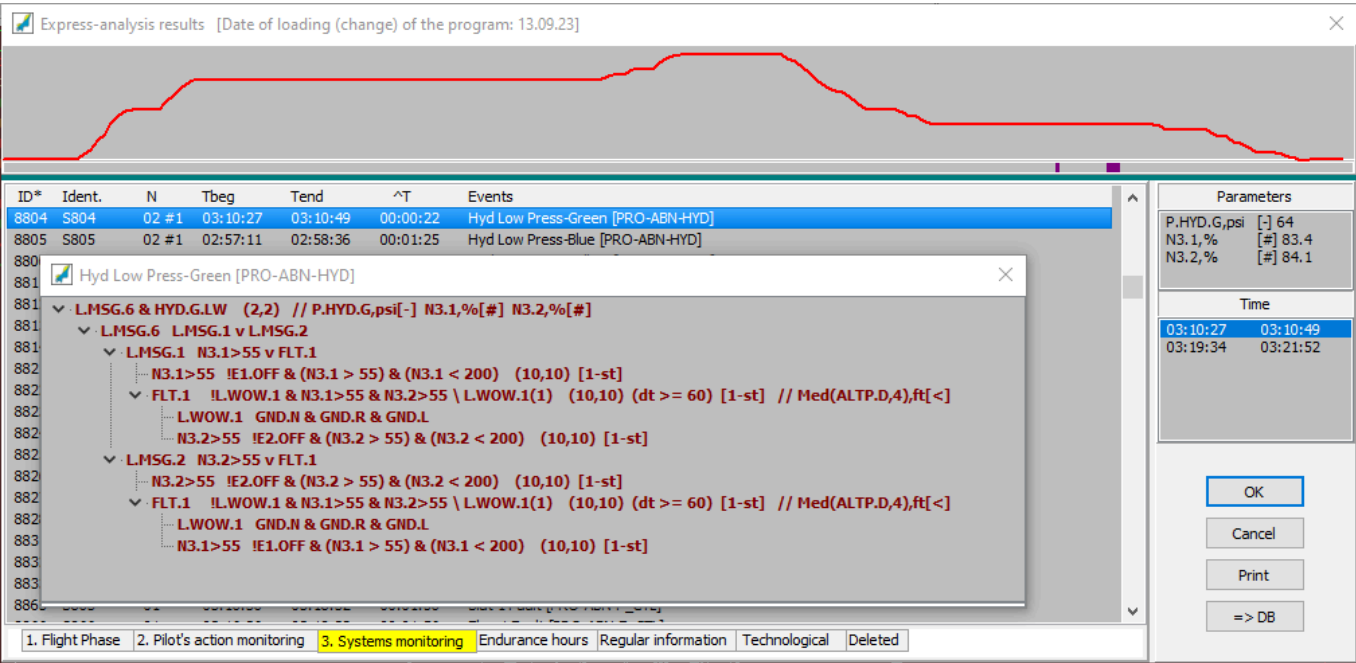
Caption	Description
ID	The unique number of the event
T/N	Duration or amount of all the events of current type
Type of event	Description of the event

If more than one event were registered on the current time interval then the "N" column would contain the equation like **x#y**, where **y** is the order number of the current (selected) event and **x** is the quantity of the events. Use

the **Time** list located in the right part of the window to select a particular event (the value of **y** parameter) in this situation. The program is able to register up to 80 occurrences of the particular event.

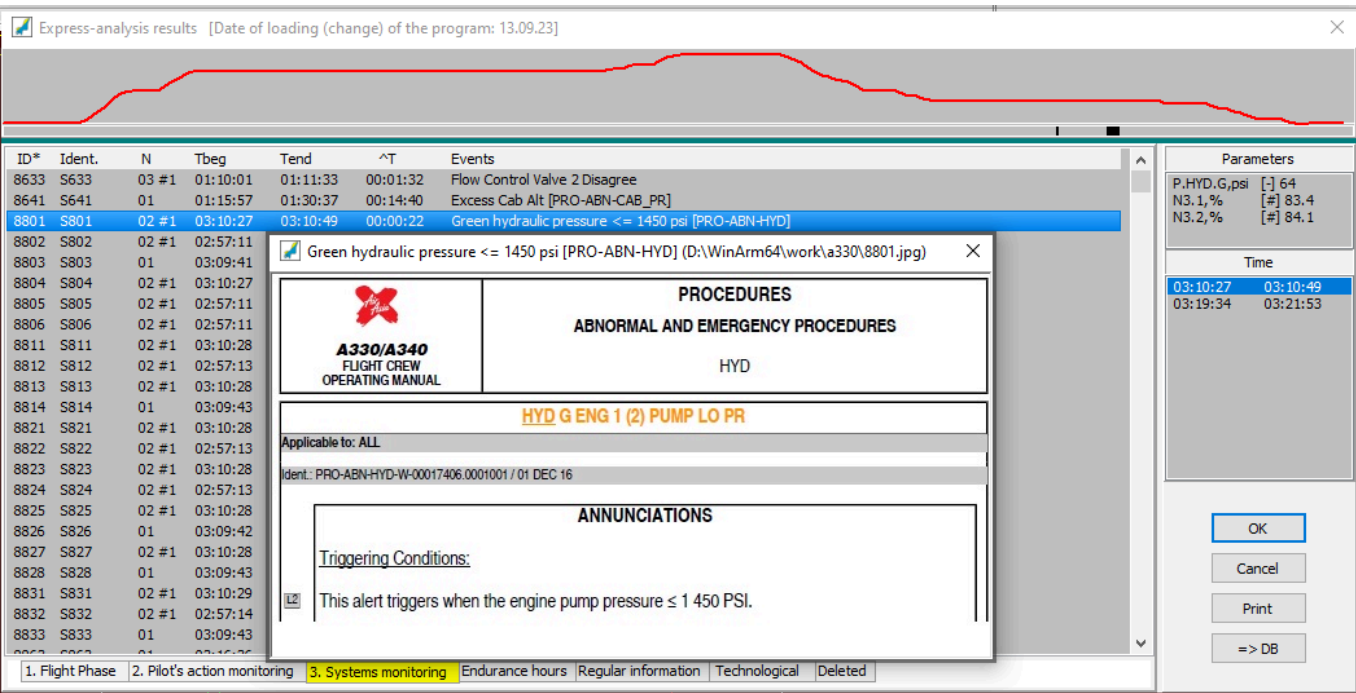
***Note:** If any event is fixed for the 81-st time and more then it will be recorded on the place of the event number 80. First 79 events will not be changed. The term "will be recorded" means that data structure associated with the event will be saved. The functions that retrieve the amount of the registered events and the total duration of the events will still be working correctly regardless of the number of the events.*

To view the event generation algorithm (Drawing 12.4), select it (event) in the list and press **F2**.



Drawing 12.4

Various graphic files (**bmp** , **jpg** , **png** , **emf**) can be attached to events . It may be, for example, copies of the pages of the FCOM or other documents. To view these files, you need to choose event from list and press key **F3** (Figure 12.5).



Drawing 12.5

If generation algorithm of the event covers the registration of the values of some parameters then, after selecting this event from the list, those values will be shown in the **Parameter** field located in the right upper part of the window (Drawing 12.3). In the given window the following conditional labels are used:

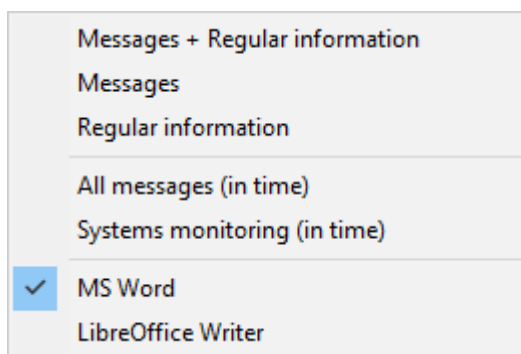
- +** The maximum value of the parameter on the interval of event registration
- The minimum value of the parameter on the interval of event registration
- <** The value of the parameter at the moment of the event registration beginning
- >** The value of the parameter at the moment of the event registration end
- m** The median of the values of the parameter on the interval of event registration
- o** The mathematical average of the parameter in engineering units on the interval of event registration
- s** The standard deviation of the parameter in engineering units on the interval of event registration
- ~** Meaning integral of parameter by time on interval of event
- #** Parameter value in the moment of registration of first located higher in the list of parameter-extremum (**[+]** or **[-]**)

Double click with the left mouse button on the desired event to view the confirmation plot. The program will change to the **Plot for analysis/printing** screen and display the standard task that confirms the selected event. The name of the current event will be automatically used as a figure caption. The interval of the event registration is shown by the moving cursors. Press **ESC** or **Shift+F9** keys to return to the list of events. If there is no standard task for event confirmation the program will display appropriate warning. See Section [12.4](#) for the instructions how to customize confirmation plots.

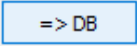
If the analysis revealed that the event was registered incorrectly it may be excluded from further processing by moving on the **Deleted** page. Select the incorrect event, press **Del** key and confirm deleting to move the event on the **Deleted** page. Deleting may also be done by dragging the event with the left mouse button on the **Deleted** page keeping the **Ctrl**keypressed.

To recover the event from the **Deleted** page you have to select it and, again, press the **Del** key.

After verifying the validity of all events, the user can print the results express analysis using form (template) of the established sample. Printing is carried out through the program **Microsoft Word** or **Libre Office** from the context menu (Drawing 12.6) after clicking the **Print button** (Drawing 12.3). Finally the user can print it and/or save for further use.



Drawing 12.6

Button  (Figure 12.3) generates a data file, which is then can be imported to the corresponding program for analyzing the results of express analysis, if it is installed on the computer. Description of the given programs is given in separate user guide.

12.4. Customizing plots used for events confirmation and events colors

Having the user level of access to the express-analysis you are allowed to customize appearance of the plots used for events confirmation procedure. The name of the file that contains standard tasks used for confirmation (Section [10.1.1](#)) has to be specified in the **Add files** field of the **Common data** page of the **Header editor** window (Section [3.4.5](#)). This file has to be made in advance using the standard tasks creating procedure provided by the program (Section [10.1.1](#)). It should be noted that when you create standard tasks file for the first time the program saves it in the program's root folder with the **_.stn (_.stnx)** name which located in the **WinArm64** root folder. After all the tasks are made the file has to be saved with another name and this name (*without extension*) should be specified

in the **Add files** field. The file should be saved either in the program's root folder or in any subfolder. If the file is located in a subfolder then, besides the name, the path from the root folder should be specified. Subfolder names have to be separated by the backslash (Section 12.7).

When you open a data file which *already has* the name of the standard tasks file in the mentioned field then this file becomes active one and all newly created tasks **will be saved in this file** automatically.

The order number of the task used for confirmation of the currently selected event as well as the amount of seconds that will be used to display graphs before and after event registration interval have to be set in the **Plot options** field on the **Parameter** page of the **Header editor** window.

Attention: If the standard tasks file name is not specified tasks from the default file **_.stn** will be used for events confirmation.

Additionally the user may customize the file that contains the comments that will accompany express-analysis events. The file must be located in the same folder as the file that contains standard tasks and have the same name with the **fom** extension. The file has simple text format (in Windows encoding). Each comment has the following format:

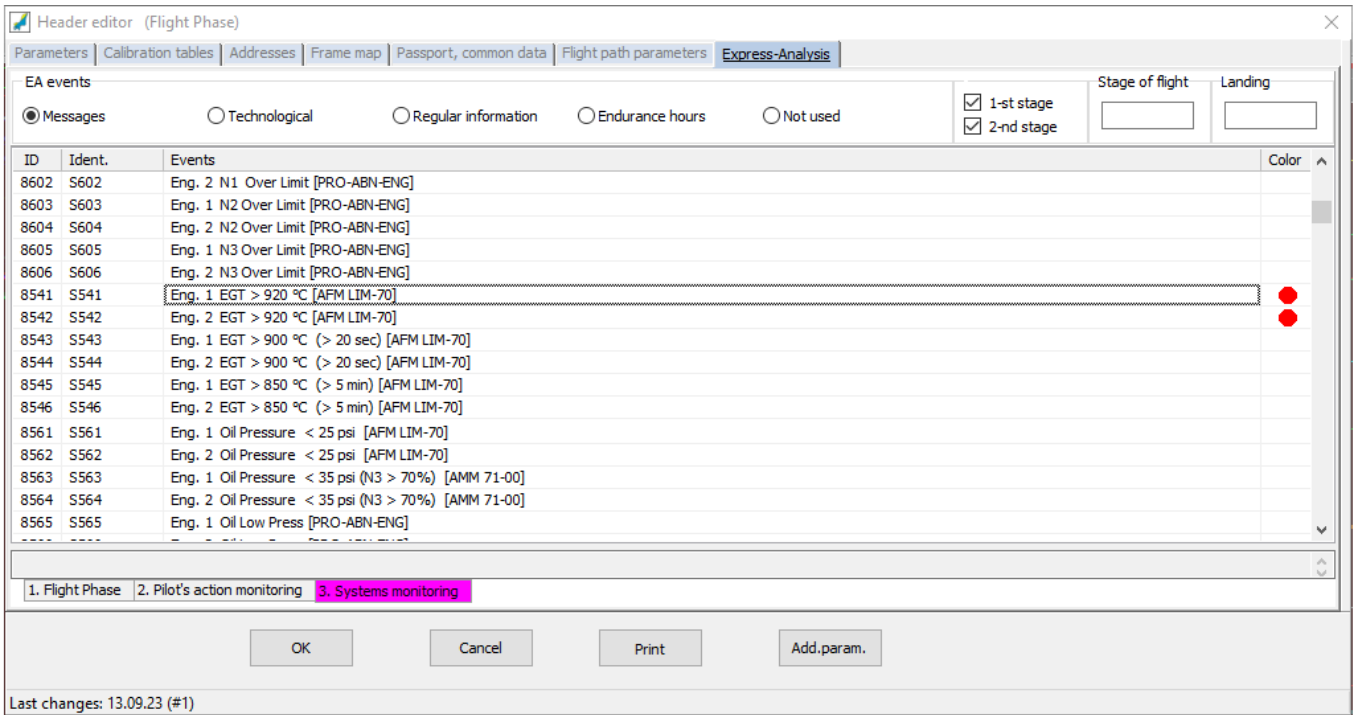
```
<8541>
AFM LIM-70
DURATION          EGT °C
-                  920
20 sec            900
5 min             850
```

The text of the comment is preceded by the unique number of the corresponding event. The number should be placed inside < > symbols. The comment starts from the next line, may occupy several lines and must not contain the symbols mentioned above.

You may edit a file with comments not only with the text processors but also using the program interface. You have to use the **Express-analysis** page of the **Header editor window** to edit a comment to the selected event (Drawing 12.7).

Important: When you open the **Header editor** window all the comments from the associated **fom** file on hard disk are copied into the operational memory. All the changes are done with those data in the operational memory. The changes are saved to the file only after pressing the **OK** button in the **Header editor** window and confirming the operation otherwise, the changes will not be saved.

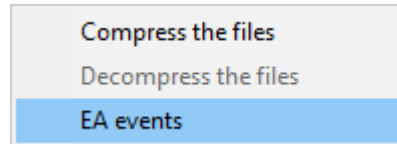
Having the user level of access to the express-analysis algorithms you are also allowed to customize the colors which will be used for events printing on the screen as well as for preparing the hard copy of the results. The standard **Color** selection dialog is used to specify the color. This dialog appears after left double clicking on the desirable line of the **Color** column. In the example shown on Drawing 12.7 the **selected** event will be displayed in Red.



Drawing 12.7

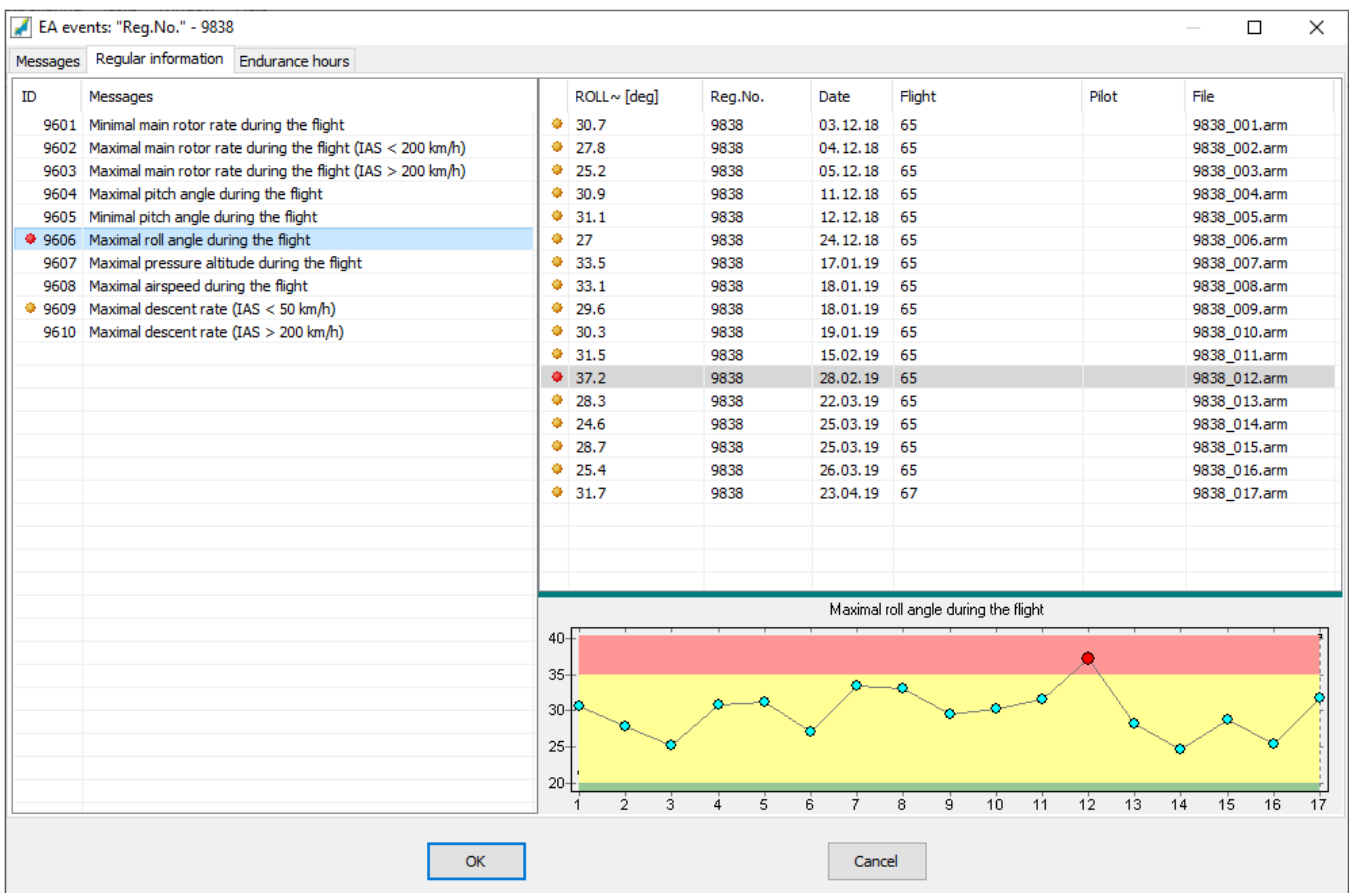
12.5. Sorting of express-analysis messages and setting color of "risk zones"

Program provides an opportunity of sorting by any event of express-analysis and operation endurance of aircraft, registered within selected time interval of flights selected by certain criterion. Sorting performed after choice pop-up menu item **Sort EA events** (Drawing 12.8) of the secondary sorting field in **Data Base** (Section 3.2) or double click mouse left button on selected meaning (parameter) of this fields. The sorting will be done for those registration number (or Captain or etc) that is currently selected on the second-level sorting field. Before sorting, you need to make sure that the express-analysis is performed in all the desired files, that there is a sign of red "bird" in its designations in the **Data Base** window (Section 7).



Drawing 12.8

A new window that normally has three pages named **Messages**, **Regular information** and **Endurance hours** will appear. The **Regular information** and **Endurance hours** pages will appear only if the second-level sorting was done using the registration number (**Reg.No.**) field as a key and express-analysis algorithms contain at least one parameter of **regular information** and/or **endurance hours** type. See Drawings 12.9, 12.10 and 12.11 for example.



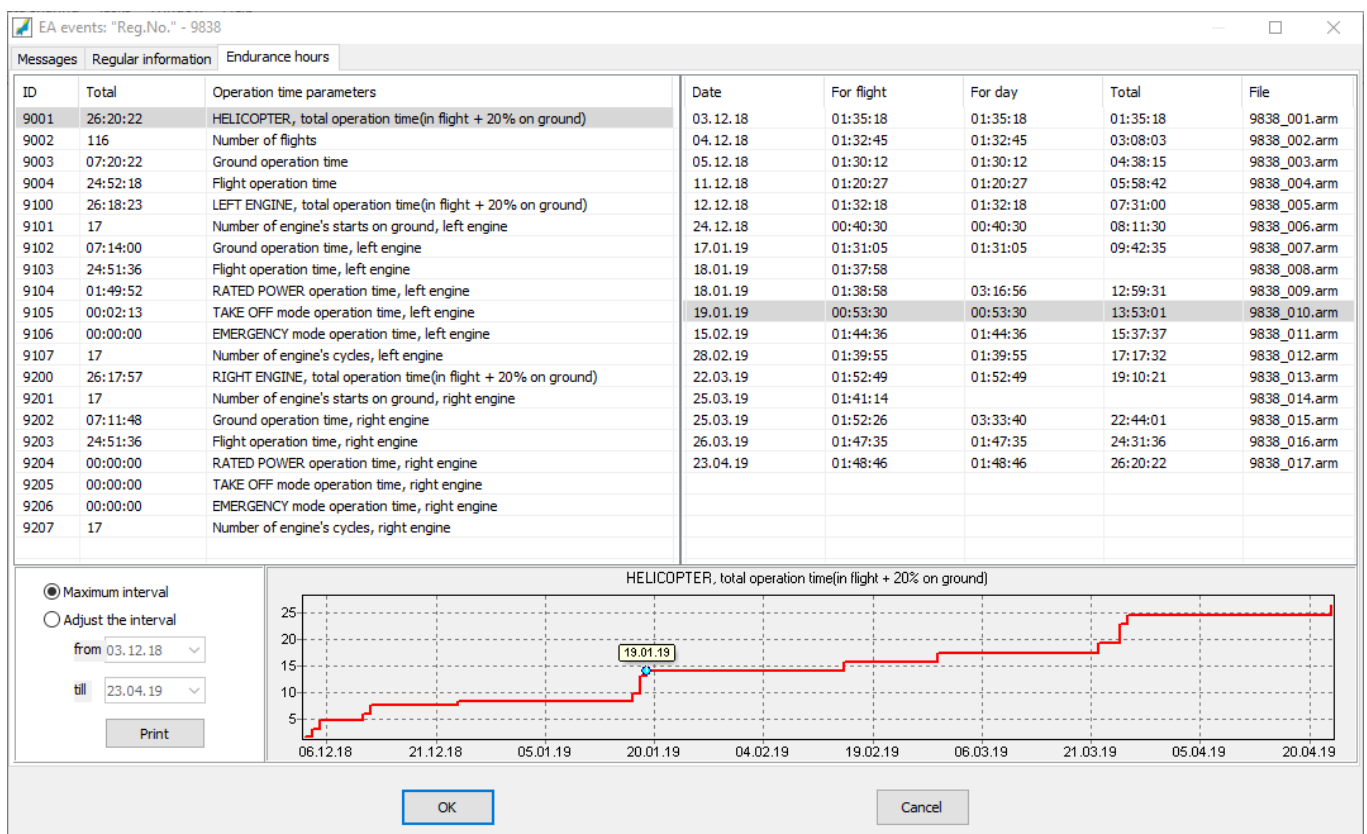
Drawing 12.9

EA events: "Reg.No." - 9838						
Messages Regular information Endurance hours						
ID	Messages	Reg.No.	Date	Flight	Pilot	File
8202	Left engine start on ground	9838	25.03.19	65		9838_014.arm
8203	Right engine start on ground	9838	25.03.19	65		9838_014.arm
8206	Lift off (no external sling)					
8208	Touch down					
8209	Left engine is switched off on ground					
8210	Right engine is switched off on ground					
8303	Collective lever is not fully down while left engine is being started [RFM 2.28]					
8306	Warming up time on IDLE after left engine is started less than 1 min					
8307	Warming up time on IDLE after right engine is started less than 1 min					
8313	Take off place longitudinal slope exceeds limitation [RFM 1.13]					
8361	Bank angle magnitude exceeds limitations while flying without external sling [RFM 1.13]					
8393	Cooling down time on IDLE before switching off of the left engine less than 2 min [RFM 2.54]					
8394	Cooling down time on IDLE before switching off of the right engine less than 2 min [RFM 2.54]					
8415	Gas temperature diffen between eng1 and eng2					
8441	Free turbine overspeeding, left engine					
8442	Free turbine overspeeding, right engine					
8477	Gyro MG2 in flight failure					

OK

Cancel

Drawing 12.10



Drawing 12.11

The left part of the **Messages** page contains the list of all the messages (events) registered in the selected files. The right part displays all the flights where the message currently selected in the left part was registered. Left double click on the desired line in the right part of the window to load the current data file and to open the message confirmation plot automatically. You may also press the **OK** button to load a file that is currently selected in the right part of the window. Press **ESC** key to return to the messages list from data file viewing mode.

If the selected files contain parameters of **regular information** type then the **Regular information** page will contain the summary of all the parameters that are monitored. The left part of the window contains the list of the monitored parameters. If a parameter exceeds the set limitations at least in one of the selected files then the special mar of yellow color (small deviations) or red color (significant deviations) will appear in the **ID** column near to the name of the parameter. If a parameter becomes the active one (after left clicking on its name) then the bottom right part of the window will contain the graphical representation of the parameter's tren versus flights. You may change

height of the graphical field by moving its upper boundary with the left mouse button. The scale of the horizontal "flight" axis could be changed after left clicking and selecting the desired region in the direction from the left to the right keeping the mouse button pressed. The same action performed in right-left direction will display all the data.

The upper right part of the window contains the tabular representation of the selected parameter. There is a link between the tabular and graphical fields. Selecting any line in the right part of the window will change the focus (active point) on the graph. On the other hand, clicking the particular point on the graph will change selection in the table.

Left double click on the line in the left part of the window will load the active file from the right part into the graph viewer. You may also press the **OK** button to load a file that is currently selected in the right part of the window. Left double click on the desired file in the right part of the window to load it directly. Press **ESC** key to return to the messages list from data file viewing mode.

The user may customize the "width" of the yellow and red limitation regions. The **Express-Analysis** page of the **Database** window is used for customization. The display mode switch in the upper part of the window must be in the **Regular information** position (Drawing 12.12).

EA events	Regular information	Stage of flight	Landing
9601 Minimal main rotor rate during the flight	83 <2>	87 <31>	
9602 Maximal main rotor rate during the flight (IAS < 200 km/h)			92 <9>
9603 Maximal main rotor rate during the flight (IAS > 200 km/h)			92
9604 Maximal pitch angle during the flight			20 <2>
9605 Minimal pitch angle during the flight	-30 <2>	-20 <2>	25 <2>
9606 Maximal roll angle during the flight			20 <2>
9607 Maximal pressure altitude during the flight			5050 <4>
9608 Maximal airspeed during the flight			VNE. 1 <2>
9609 Maximal descent rate (IAS < 50 km/h)		-3 <4>	VNE. 1 <4>
9610 Maximal descent rate (IAS > 200 km/h)		-8 <4>	

Drawing 12.12

The values may be entered either directly or by selecting the desired parameter from the additional window (Drawing 12.13) that appears after left double clicking on the desired field. The values of the selected parameter may be added to (subtracted from) the given value to allow the flexible adjustment of the yellow and red limitations.

Drawing 12.13

If the selected files contain parameters of **endurance hours** type then the total values summed up from all the files will be displayed in the left part of the window. The **Total** column will contain the operating time summed on the specified time interval. The right part of the window contains the details (data separated out onto particular flights) about the parameter selected in the left part. The reference graph which shows a tendency of parameter's behavior is given in the bottom part of the window. This graph has a link to the table in the right part of the window and vice

versa. Selecting any parameter in the table will display the appropriate label on the graph. On the other hand, clicking a particular point on the graph will change selection in the table.

You may define the time interval that will be used for sorting. Select the **Adjust the interval** switch and specify the desired dates. You may save sorting results into the **Microsoft Word** file using the **Print** button.

Left double click on the line in the left part of the window will load the currently active data file from the right part of the window. You may also press the **OK** button to load a file that is currently selected in the right part of the window. Left double click on the desired file in the right part of the window to load it directly. Preess **ESC** key to return to the messages list from data file viewing mode.

12.6. Printing express-analysis algorithms

Printing of express-analysis algorithms is carried out from the tab **Express-analysis** of **Header Editor** after pressing the **Print button**. **Microsoft Word** opens automatically generating file with express-analysis algorithms. User may print this file and/or save it for further work.

The user can choose between normal and syntactic printing. Selecting a print type determined answer on question programs, emerging after pressing on button **Print**. At syntactic printing various groups of parameters will be marked by color:

- tokens and readiness - red;
- analog parameters - blue;
- discretets - green;
- functions – dark red.

At the end of the document containing express-analysis algorithms, a list of recorded parameters is given. In this list, only those parameters that are used in given algorithms are color marked.

12.7. Change and Creation of express-analysis events

To use principles and methods described in this chapter the user has to have advanced experience in working with **WinArm64**, especially with **algorithm interpreter** (Sections [9.2.2.4](#) and [9.3.4](#)), and have some knowledge in express-analysis algorithms building area.

***Attention**, unskilled modifying of the algorithms supplied with the program may result in their incorrect work and program reinstallation necessity*

. Creation and modification of algorithms for generating express analysis events is possible only if availability complete access granted license **Pro** (Section [2.3](#)).

To create an express-analysis event just add a new parameter to the header of the current file and select **Discrete #2/Express Analysis Event** as a type for this parameter. Specify the unique number for this parameter that must be above **8000**.

***Note:** Express-analysis algorithms may contain some pre-calculated values, the so called L-values. Those values may be both analog parameters and On/Off signals but in any case they have to be of **algorithm interpreter** type.*

Express-analysis is stopped either if the end of the time interval is reached or if the special terminal event is registered. The corresponding message will be popped up in the last case. Any event whose identification number is more than **9900** will be treated as terminal event.

After defining the short name and full name of the event the equation (generation algorithm) has to be specified. For the standardization purposes only it is recommended to start the short name of the event of the **message** type (see below) with the letter **S**.

The **Header editor** window for the **Discrete #2/Event express analysis** type of the parameter is shown on Drawing 12.14. Appearance and functions provided by this window is very similar to ones provided by the window of **Algorithm interpreter** type of the parameter (Section [9.2.2.4](#)).

Drawing 12.14

Important: Equation (algorithm) that describes conditions of the event registration consists generally from two parts separated by the backslash «\» symbol. The left part of the equation (before backslash) describes the condition which being met results in starting the registration of an event. The right part of the equation (after backslash) describes the condition which being met results in stopping the registration of an event. If the backslash symbol is absent the event registration starts and stops using the same condition. If there is a backslash symbol but there is no equation after it then, after the condition becomes true, registration of the event starts and continues up to the end of the information processing.

If two parts are separated by the "|" symbol then after the left part condition becomes **TRUE** the program checks what event comes earlier either the left part condition becomes **FALSE** again or right part condition becomes **TRUE**. If right part condition comes first the event will not be registered at all.

The program does not differentiate between the capital and ordinary letters in the equation. The only exception to this rule is given below when describing the method of optimization (use of capital letter **B**).

There are two more ways to dismiss event registration. First way is to check the **Don't save** box in the **Additionally** field. If this box is checked the event will not be registered if it is not closed before the processing is finished (end of the time interval is reached or terminal event is registered). In other words, event will not be registered if the beginning conditions for event registration have been met but the conditions to stop registration are not met before the end of the processing. The second way is to use the **Clear** list in the **Additionally** field. The current event will not be registered if the On/Off signal or event selected from the list will be registered before the conditions specified in the equation to stop event registration are met.

All the functions and arithmetic operations described in Sections 9.2.2.4 and 9.3.4, are valid for express-analysis algorithms creation. It is **strongly recommended** to read those chapters once again.

The following express-analysis run-time functions are introduced additionally:

- ok (bn)** Takes the "true" value at the moment when the event **bn** (n=1..8) changes its value from "false" to "true" (considering delays).
- no (bn)** Takes the "true" value at the moment when the event **bn** (n=1..8) changes its value from "true" to "false" (considering delays).
- @bn, !@bn** Checks the existence (absence) of the On/Off signal or event **bn** (n=1...8)

an(m), bn(m)	Retrieves the value of the analog parameter (n=1..8) or On/Off signal/event (n=1..8) with m seconds shift where m is any value of seconds including negative or fractional.
t0 (bn), t0(#)	The time of the beginning of the last realization of the event bn (n=1..8) or of the last realization of the current event. If there are no events registered the value will be 0. This function works only with the events which registration had already finished at the present moment.
tk (bn), tk (#)	The time of the end of the last realization of the event bn (n=1..8) or of the last realization of the current event. If there are no events the value will be 0. This function works only with the events which registration had already finished at the present moment.
t^ (bn), t^ (#)	The duration (interval) of the last realization of the event bn (n=1..8) or of the last realization of the current event. If there are no events the value will be 0. This function works only with the events which registration had already finished at the present moment.
t (bn), t (#)	The time elapsed from the moment of registration beginning of event bn (n=1..8) or current event. This function works with the event which are being registered at the present moment. If there is no event the value will be 0.
dt	The same as t (#) function.
dm (bn), dm (#)	The value of the analog parameter dm (m=1..4), saved in the data structure of the last registered realization of the event bn (n=1..8) or of the current event.
hm (bn), hm (#)	The value of the analog parameter hm (m=1..4), saved at the moment of the beginning of the last realization of the event bn (n=1..8) or of the current event.
t, t1, t2	The value of the current relative time as well as times of the beginning and end of information processing interval.
n (bn), n (#)	The amount of the realizations of the event bn (n=1..8) or the amount of the realizations of the current event.
g (bn), g (#)	The total duration of all the realizations of the event bn (n=1..8) including event currently being registered if any or the total duration of all the realization of the current event.
a(x,y)	Integer unsigned value calculated from a word of y-bits length taken with the x-bits offset (shift) from the beginning of the current frame considering that least significant bit value of this word is 1.
last	The presence of this modifier that is installed in the square brackets [] in the end of the equation tells the program that only the last registered realization of the current event should be saved.

The functions in the table are listed in accordance with the priority of their execution. Functions and actions, described in Sections [9.2.2.4](#) and [9.3.4](#) have less a priority.

Below some examples and comments are given regarding the use of described functions and operations.

The **ok (bn)** and **no (bn)** functions are used to define **the instants** of the **bn** event registration beginning and end correspondingly. They retrieve the **"true" value only once** at the instants of event registration beginning or end correspondingly (taking the **T0** and **Tk** values into account). The particular equation may contain **only one** function of this type. These functions do not work with On/Off signals. An example (Drawing 12.15) shows the possible way of determining the moment of engine warm-up after start-up. An equation **no(b1)** will have the value **"true"** at the moment of the end of engine warm-up.

Necessary to mark one more useful feature of the specified command - if result of its fulfillment will have the meaning **"false"** then further part of formulas will not be interpreted what significantly reduces processing time.

The presence of **(bn)** or absence **(!bn)** of discrete signals or events can be recorded with the uppercase **B**. At absence (for **Bn**) or availability (for **!Bn**) of the given discrete or event, further interpretation of the formula is not performed, which significantly reduces the operating time.

Drawing 12.15

The functions $t_0(bn)$, $tk(bn)$ and $t^{\wedge}(bn)$ retrieve the **recovered** values of the beginning, end and duration of the last realization of the bn event. If "#" symbol is placed instead of bn then the retrieved value belongs to the last realization of the current event i.e. to the event which condition contains these functions. It must be clear that these functions work **only** with the events which registration (generation) **had been finished** before the current time moment. The retrieved values are denoted in seconds of relative time and depend on the express-analysis run-time settings that are specified in the elements of the **Time delay, sec** field (Figure 12.14).

The following basic definitions are entered by the express-analysis technology:

1. Time of the event beginning

$$T_{eb} = T_{rb} - T_0;$$

where T_{eb} – recovered time of the event registration beginning

T_{rb} – time of the event registration beginning

T_0 – delay of the event registration beginning

2. Time of the event end

$$T_{ee} = T_{re} - T_k;$$

where T_{ee} – recovered time of the event registration end

T_{re} – time of the event registration end

T_k – delay of the event registration end

The T_0 and T_k values are specified in the corresponding fields (Drawing 12.14). The meaning of those values is that the condition of the event registration must be **constantly** true for at least T_0 seconds in order the event starts to register. In this case the recovered time is the time when condition actually became true. If the equation contains the explicit event termination condition (after "\" or "|" symbols) it should be constantly false during those T_0 seconds.

Similarly, condition of the event registration must be **constantly** false for at least T_k seconds in order the event stops to register. The recovered time is the time when condition actually became false. If the equation contains the explicit event termination condition (after "\" or "|" symbols) it should be constantly false during those T_k seconds.

This mechanism is usually used to eliminate the impact of information registration failures on formation events.

The values may be changed for the particular algorithm. For example, exceeding the maximum operational angle of attack value must be monitored with the delays no more than 1 second.

If the **Not recov** switch is checked the time of event beginning and end will not be recovered i.e. $T_{eb}=T_{rb}$ and $T_{ee}=T_{re}$.

Important: Important: after the program reveals that conditions of any event become true it sets the flag but registration of the event does not start immediately. If conditions are constantly true for T_0 seconds then registration starts and, if necessary, the actual time of the event beginning is recovered. However, because express analysis is implemented in one pass (the program does not come back to check any conditions) the result of the time recovering may not be used in other algorithms which use the current event as an argument. That is, if the T_0 value for the S1 event is 120 seconds then the event will exist only after 120 seconds elapse from the instant when the conditions became true. However, registration time will be recovered when the event is plotted behindhand or added to the express-analysis results. If the **Not recov** switch is checked then the event will be plotted from the moment of the actualization (in our example 120 seconds after conditions became true).). Thus, to achieve the maximum obviousness of the express analysis results, it is recommended to recover the time for the **messages** whereas recovering the time for **readinesses** and **tokens** makes it sometimes difficult to analyze correctness of the event registration.

An example of using the $t^{(bn)}$ function is shown in Figure 12.16. In this example, registration of event is going on at condition when work engine time in Idle mode was the value less than 55 seconds and at current moment engine is not at Idle mode any more.

In some cases, it may be necessary to introduce an additional delay in the moment of updating events. For example, an aircraft may register a discrete signal **LG.UP** (Landing gears Retract-Release Lever to the position Retract). Cycle of retracting takes 12 seconds. In this case readiness of LG retraction must exhibit through 12 seconds after start of registration of given discrete signal. For solutions For such a task, the program provides a tool for introducing additional delays. Delay amount introduced on field $\wedge T$ (Figure 12.17) , and the way of application (from start or from the end of condition fulfillment of registration of event) is chosen from dropdown list fields **Time delay**. Field values for considered case with LG retraction is shown on drawing 12.17. When use additional delays it is necessary to consider that their quantities must be more than those specified in fields **T0** and **Tk** respectively, otherwise their exercise will not have practical meaning.

If the **min duration** item is selected in the list and the value of the $\wedge T$ field **is not zero** then after the event is closed the program compares the actual event duration with the specified value. The event will not be registered if the actual duration is less than specified value.

Header editor (Warming up time on IDLE after left engine is started less than 1 min)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: S106 | Name: Warming up time on IDLE after left engine is started less than 1 min | E

ID: 8306 | Colors: Red, Black | ☐ Do not display | ☐ UDP export

Parameter type: ☐ Analog #1 | ☐ Analog #2 | ☐ Discrete #1 | ☒ Discrete #2 | ☐ Sound stream

Discrete type (calc.): Express analysis event

Discrete #2 (Express analysis event): ☐

A	B
	Twarm. 1

no(b1) & (t^(b1) < 55) [b1<,b1>]

Time delay,sec: To 0 | Tk 0 | ^T 0 | min duration | Plot options: T<= 120 | T=> 120 | #task 10 | Additionally: ☐ 1-st stage | ☐ Rec.Off | ☐ Save Off | Clear | No

OK | Cancel | Print | Param.list

Last changes: 09.12.19 (#1)

Drawing 12.16

Header editor (Landing gear UP after takeoff)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: Tgearup | Name: Landing gear UP after takeoff | ID: 9873 | Colors: Lime, Green | Do not display: ☐ | UDP export: ☐

Parameter type:
☐ Analog #1
☐ Analog #2
☐ Discrete #1
☒ Discrete #2
☐ Sound stream

Discrete type (calc.): Express analysis event

Discrete #2 (Express analysis event):
☐

A	B	C
	FLIGHT	LG.UP

Time delay, sec: To: 2, Tk: 2, ^T: 12, min duration:
Plot options: T<= 400, T=> 400, #task 1
Additionally: ☐ 1-st stage, ☐ Rec. Off, ☐ Save Off, Clear, No

OK | Cancel | Print | Param.list

Last changes: 09.11.23 (#1)

ID	Parameter
9871	Tstart. 1
9872	Tstart. 2
9873	Tgearup
9874	RDtoend
9881	T.APPR
9882	T.GA. 1
9883	T.GA. 2
9884	T.MRK. 1
9885	T.MRK. 2
9886	T.FLARE
8001	S001
8002	S002
8003	S003
8011	S011
8012	S012
8013	S013
8014	S014
8015	S015
8016	S016
8021	S021
8022	S022
8023	S023
8024	S024
8031	S031
8032	S032
8041	S041
8042	S042
8051	S051
8052	S052
8053	S053

Drawing 12.17

The **t (bn)** function retrieves the recovered value of time elapsed from the beginning of the **bn** event registration. If the event is not being registered at the current moment then the retrieved value will be zero. If time recovering procedure has to be implemented then the retrieved value will change abruptly from 0 up to the **T₀** value at the time recovering moment.

Functions **dt** and **t(#)** return *restored* meaning of time past from start of fulfillment of conditions for the formation *of the current* event. If there is no event, then the return value is 0. If events start time recovery is produced, then at the moment of recovery the function meaning is changing abruptly from 0 to **T₀**.

The **n (bn)** and **g (bn)** functions retrieve the number of realizations of the **bn** event and the total duration of all the realizations of the **bn** event including being currently registered if any. The number of registered events is incremented at the moment **when event registration stops**. If **"#"** symbol is placed instead of **bn** then the retrieved values belong to the current event i.e. to the event which condition contains these functions.

show the way how time boundaries modifiers may be used. These modifiers are used only for the purpose of moving the boundaries of the events while plotting them and do not affect the conditions of the event registration. Modifiers are written in the square brackets (**[]**) after the main equation. Modifiers are usually used when the **ok (bn)** and **no (bn)** functions are present in the equation. Using these function results in the condition becomes true only in **one** point (time instant). So, the duration of the event on the confirmation plots and in the report on the results will be only one frame that sometimes does not correspond to the physical meaning of the event. For example, at formation events of a small duration - warming up engine after launch (Drawing 12.15), rendering (registration) of events logical realize on throughout total time warming up engine after launch. Use the **[b1<,b1>]** modifier to achieve desired results. This modifier moves the left and right boundaries of the event to the left and right boundaries of the corresponding **b1** event or On/Off signal. If more then one On/Off signal or event are used in the equation then modifiers like **[b2<,b1>]** or **[b1<,b2>]** may be used.

Example of another type of events, for which it is necessary to move borders, given on drawing 12.18. In given case moving interval of record is carried out with the help of modifier **[b2*,***]**, that there is left border installed on moment of appearance of current event **b2** (readiness launch left engine), a right border - on current time moment which corresponds to appearance of event **b1** (token of the operation of the left engine).

Drawing 12.18

The **dm (bn)** function retrieves the value of the analog parameter **dm** ($m=1..4$) that was saved in the data structure of the last realization of the event **bn** ($n=1..8$). If **"#"** symbol is placed instead of **bn** then the retrieved value belongs to the last realization of the current event i.e. to the event which condition contains these functions. The values of the maximum four analog parameters may be associated with each registered event. The value of an analog parameter is saved in case one of the special symbols (see table below) is specified near to the parameters' short name. Symbols are changing sequentially by click left buttons mouse.

+	The maximum value of the parameter on the interval of event registration
-	The minimum value of the parameter on the interval of event registration
<	The value of the parameter at the moment of the event registration beginning
>	The value of the parameter at the moment of the event registration end
m	The median of the values of the parameter on the interval of event registration
o	The mathematical average of the parameter in engineering units on the interval of event registration
s	The standard deviation of the parameter in engineering units on the interval of event registration
~	Meaning of integral of parameter by time on interval of event
#	The value of the parameter at the time of registration of the first one located above in the parameter list extremum ([+] or [-])

Note: If the box located just above the **A** symbol is checked then the text file will be created in the **TXT** subfolder of the program's main folder after express-analysis is completed. The name of the file will correspond to event's unique number. This file will contain time instants of the beginning and stop of each realization of the event as well as the values of the associated parameters.

To save the value of the parameter **even if it is not an argument in the equation** just add its short name to the **A** line and select one of the above mentioned symbols. The symbols are selected in turn after each left mouse click on the filed that contains the number of the appropriate column. Right click on the desired column to remove any symbol.

Important: If one of the following symbols is selected "+", "-", "s", "o", the program provides the ability to perform failure filtering with the help of the standard algorithm. To apply filtering you have to display the **Select parameter** window once again (left double click on the desired field) after one of the symbols is selected and specify the threshold for filtering (Drawing 12.19). This value has to be specified in engineering units. The threshold is selected based on the a priori knowledge and depends on the possible (from the physical point of view) rate of the parameters value changing. Filtering is implemented for each sample of the parameter. The value is considered to be a failure and eliminated from further processing if it **differs** from the values registered **right before and after** it more then on the **specified threshold** and those two values differ from each other **less then on double threshold**.

ID	ID	Name
10	Sec	Seconds
11	Min	Minutes
12	Hour	Hours
61	Day	Day
62	Month	Month
63	Year	Year
101	ALT.R	Radio altitude
111	ALT.P.1	Pressure altitude #1
112	ALT.P.2	Pressure altitude #2
121	IAS.1	Indicated airspeed #1
122	IAS.2	Indicated airspeed #2
131	VNE.1	Never exceed airspeed #1
132	VNE.2	Never exceed airspeed #2
141	GW.1	Gross weight #1
142	GW.2	Gross weight #2
151	OAT.1	Outside air temperature #1
152	OAT.2	Outside air temperature #2
161	VS.1	Vertical speed #1
162	VS.2	Vertical speed #2
301	ROLL	Roll angle
302	PITCH	Pitch angle
303	HDG	Giro-magnetic heading
311	WY	Yaw angle rate
312	WZ	Pitch angle rate
313	WX	Roll angle rate
451	NrmAcc	Normal acceleration
452	LatAcc	Lateral acceleration
453	LngAcc	Longitudinal acceleration
501	CPL	Collective pitch control lever position

Without additional conversion

Filter threshold 15

OK Cancel

Drawing 12.19

It should be also noted that saved parameters will be displayed in the window with express analysis results (field **Parameter**) after the corresponding event is selected.

The **a(x,y)** function retrieves an integer unsigned value defined as a value of the word of length **y-bits** that is taken with offset **x-bits** from current frame beginning and with low significant bit value of 1. Number of bits that defines offset is countered from the beginning of the current frame and may be both positive and negative. This function is usually used to output parameters in codes or to determine the value of the counters.

The **hm (bn)** function retrieves the value of the analog parameter **hm** ($m=1..4$), saved at the moment of the beginning of the last realization of the event **bn** ($n=1..8$). If "#" symbol is placed instead of **bn** then the retrieved value belongs to the last realization of the current event i.e. to the event whose condition contains these functions. This function is usually used to determine the intervals of steady-state value of some parameters. The function works as follows: before the condition comes true for the first time the function saves the values of the parameters that are added to the **A** line. The values will be "frozen" at the moment when the condition comes true for the first time. They will stay constant until the event registration is finished. Comparing the frozen values with the current ones let you

trace the steady-state value intervals of the parameters. An example on Drawing 12.20 shows the way of determining the level flight (altitude is constant) without vertical speed.

Drawing 12.20

The program supports "on-the-fly" syntax checking mode. The current equation will be displayed in blue color if the program is able to interpret it and in red color – otherwise.

There is the second way to check the syntax of the current equation. Just press **F2** button while cursor is located on the equation field. The window with full algorithm decryption will be popped up if everything is correct. Error message will be shown otherwise.

Generally, the program checks all the equations for syntax errors after the **OK** button is pressed in the **Header editor** window. If the program finds an error the appropriate warning will be displayed. This warning will contain the unique number (**ID**) of the event that has an error.

By default, the values of all the parameters used in equations are calculated one time per frame at the frame beginning (address number 0). The linear interpolation is used for calculations. Left click on the caption of the **A** or **B** lines to change in a circle the "-" symbol on the "+" symbol and further on the "#" symbol. If the "+" symbol is set then the values of the parameter will be calculated at the time moments when the first parameter in the **A** line is registered. If both lines (**A** and **B**) have the "+" sign then the values will be calculated at both first analog parameter and first On/Off signal (event) registration moments. If the "#" symbol is set in **A** or **B** line or in both lines then the values of the parameter will be calculated at all the time moments when all the selected analog parameters or On/Off signals or all of them are registered.

After the event generation conditions are specified the type of the event and confirmation parameters (Section 12.4) must be set. The program defines 4 different types of events:

- **Message** (will be displayed in the report on the express analysis results);
- **Technological event** (will not be displayed in the report on the express analysis results, for information purposes only);
- **Regular information** (is saved in the regular information database (Section 12.9));
- **Endurance hours** (is saved in the endurance hours database (Section 12.10)).

Use the appropriate popup menu item to select the type of the event (Drawing 12.21). The popup menu appears after right clicking on the equation fields.

✓ Message	
Technological event	
Regular information	>
Endurance hours	>
Not used	

Time
Count

Drawing 12.21

Depending on the selected type the event will be placed on the appropriate sheet on the **Express-analysis** page of the **Header editor** window (Drawing 12.22). Use the appropriate switch to display the desired sheet.

Header editor (Main rotor rate)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | **Express-Analysis**

EA events

☒ Messages ☐ Technological ☐ Regular information ☐ Endurance hours ☐ Not used

☒ 1-st stage ☒ 2-nd stage

Stage of flight: Landing:

ID	Ident.	Events	Color
8401	S201	Left engine in flight flame out	
8402	S202	Right engine in flight flame out	
8403	S203	LEFT ENGINE OUT warning in flight activation	
8404	S204	RIGHT ENGINE OUT warning in flight activation	
8405	S205	EMERGENCY mode of the left engine while in flight	
8406	S206	EMERGENCY mode of the right engine while in flight	
8411	S211	Gas temperature of the left engine exceeds limitation of 990 degrees [RFM 1.20]	
8412	S212	Gas temperature of the right engine exceeds limitation of 990 degrees [RFM 1.20]	
8413	S213	Gas temperature of the left engine at engine start exceeds limitation of 780 degrees [RFM 1.20]	
8414	S214	Gas temperature of the right engine at engine start exceeds limitation of 780 degrees [RFM 1.20]	
8415	S215	Gas temperature differ between eng1 and eng2	
8421	S221	Rotor's RPM of the left gas generator exceeds limitation of 101% [RFM 1.20]	
8422	S222	Rotor's RPM of the right gas generator exceeds limitation of 101% [RFM 1.20]	
8423	S223	Rotor's RPM difference between left and right gas generators is more than 3% [RFM 1.20]	
8431	S231	Carrier rotors' RPM in flight at airspeed less than 200 km/h exceeds limitation of 98% [RFM 1.14]	

1. Stages of flight | 2. Pilot's action monitoring | **3. Systems monitoring**

OK Cancel Print Add.param.

Last changes: 09.12.19 (#1)

Drawing 12.22

If the type **Message** is selected the user has the ability to place the event onto the one of the given sheets. The amount and names of the sheets are defined by the express-analysis designer either manually in the **Group editor** window (Drawing 12.23) that appears after right clicking of the name of any sheet in the bottom part of the **Express-analysis** page (Section 3.4.7) or automatically after adding the appropriate lines into the file that contains express-analysis algorithms (Drawing 12.22).

Group editor

1	Этапы полета	Stages of flight
2	Контроль ТП	Pilot's action monitoring
3	Контроль АТ	Systems monitoring

OK Cancel

Drawing 12.23

Moving a message to the selected page is done by dragging it with the left button at pressed key **Ctrl**.

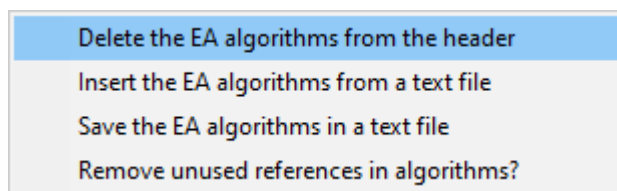
Also on tab **Express analysis** (Drawing 12.22) of the **Header editor** in the field **Stage of flight** you can set the identifier of the corresponding parameter. This parameter must contain the formula calculation digital values of stage of flight with taking into account given below tables compliance.

Stage	
1	Before takeoff
2	Takeoff
3	Route
4	Climb
5	Descend
6	Approach
7	Landing
8	After landings

If an identifier is specified, the numerical designation of the flight stage for each express-analysis event will be automatically entered into a file generated by the program for subsequent import of information to the Data Base of analysis of results of express analysis (description of the programs contained in separate user guide).

12.8. Export, import and deleting the express-analysis algorithms

The mentioned operations would be implemented after selecting the appropriate item from the popup menu (Drawing 12.24) that appears after right clicking on the main field of the **Express-analysis** page of the **Header editor** window (Section [3.4.7](#)).



Drawing 12.24

The file that contains express-analysis algorithms has a simple Windows encoding and consists of a header and algorithms. The fields of the file are delimited by the **tab** symbol.

If the algorithms are being inserted in the header that already contains some algorithms they will be deleted at first and then the new ones will be inserted. The criteria that the program uses to determine does the parameter belong to the express-analysis or not is that the value of the unique number (**ID**) is more than **8000** and the type of the parameter is **algorithm interpreter** or **express-analysis event**.

It is necessary to note that creating of express-analysis programs should be done with the help of the **Header Editor** interface (Section [3.4](#)) but not through direct creation or editing textual file algorithms.

12.9. Features while creating events of Regular information type

For the standardization purposes only it is recommended to start the short name of the event of **regular information** type with the letter **R**.

The point of this type of event is that some kind of information (not monitored by the standard express analysis) is collected regularly (in several flights) in order to analyze the quality of performing the flight in general and to conduct statistical researches. As an example of this type of information the average deviation from the glide path or the elevator average deviation from the trim position during climbing may be mentioned. The regular information may be fixed in one point (for example the maximum IAS value during the whole flight) or on the interval (for example the elevator average deviation from the trim position during some stage of the flight).

To fix the values of some parameters at one point follow the procedure below:

- Add the parameter which minimum or maximum value has to be fixed to the **A** line at the first position.
- Put the desired symbol ("+" or "-") in the caption of the first column and display the **Select parameter** window once again if you need to specify the filter threshold for failure filtering (Section [12.7](#)).
- Add no more than three parameters which values have to be fixed along with the value of the main parameter to the **A** line. The values of the additional parameters will be fixed automatically. You do not need to put any symbols in the column header.
- Define the equation (condition) that specify the beginning and the end of the desired time interval.

Figures 12.25 and 12.26 show an example of task and results of rendering maximum vertical overload at landing. At the moment of achievement of maximum overload additionally roll, pitch angles values and aircraft weight are fixed. As a condition of setting interval where the search for the maximum overload will take place, the token of landing serves. Dedicated line on drawing 12.26 contains results of algorithm fulfillment. Field **Parameter** in the right part of the window contains the values of additional parameters at the moment of reaching the maximum vertical overload.

Header editor (Maximum vertical acceleration during landing (touchdown))

Parameters

Calibration tables

Addresses

Frame map

Passport, common data

Flight path parameters

Express-Analysis

Short name

R021

Name

Maximum vertical acceleration during landing (touchdown)

E

ID

8821

Colors

Aqua

Blue

☐ Do not display

☐ UDP export

Parameter type

☐ Analog #1

☐ Analog #2

☐ Discrete #1

☒ Discrete #2

☐ Sound stream

Discrete type (calc.)

Express analysis event

Discrete #2 (Express analysis event)

☐ (+)

A

VertAcc

Roll

Pitch

GW

B [+]

Ttchdn

no(b1) [b1<,b1>]

Time delay, sec

To

0

Tk

0

^T

0

min duration

Plot options

T<=

30

T>=

30

#task

2

Additionally

☐ 1-st stage

☐ Rec.Off

☐ Save Off

Clear

No

OK

Cancel

Print

Param.list

Last changes: 27.10.23 (#1)

ID

Parameter

8613

S413

8614

S414

8621

S421

8622

S422

8623

S423

8624

S424

8631

S431

8632

S432

8641

S441

8642

S442

8643

S443

8801

R001

8802

R002

8803

R003

8804

R004

8805

R005

8806

R006

8807

R007

8808

R008

8809

R009

8810

R010

8811

R011

8812

R012

8813

R013

8814

R014

8815

R015

8816

R016

8817

R017

8818

R018

8821

R021

Drawing 12.25

Express-analysis results [Date of loading (change) of the program: 27.10.23]

ID	Ident.	N	T	Param.	Value	Events
8801	R001	01	00:25:11	IAS.BVP,km/	238.8	Takeoff rotation speed (IAS)
8802	R002	01	00:25:19	Alf.ind,deg[-	8.6	Maximum angle of attack while takeoff rotation
8803	R003	01	00:25:42.5	Gradient,deg	3.3	Tilt angle while initial climb
8804	R004	01	00:25:51.5	Alt.radi,m[-]	144	Flaps retraction height while takeoff
8805	R005	01	00:25:51.5	IAS.BVP,km/	321.2	Flaps retraction IAS while takeoff
8806	R006	01	00:26:02.5	IAS.BVP,km/	361.7	Slats retraction IAS while takeoff
8807	R007	01	02:53:04.5	IAS.BVP,km/	225	IAS minimum during the flight
8808	R008	01	00:27:13.5	IAS.BVP,km/	496.9	IAS maximum during the flight
8809	R009	01	01:14:38	MACH[+]	0.68	MACH maximum during the flight
8810	R010	01	00:26:05.5	Alf.ind,deg[-	10.2	Maximum angle of attack during the flight
8811	R011	01	02:52:48.1	Pitch,deg[-]	-6.1	Minimal pitch attitude during the flight
8812	R012	01	00:27:22.1	Pitch,deg[+]	16.1	Maximum pitch attitude during the flight
8813	R013	01	00:28:27	abs.Roll,deg	25	Maximum roll attitude during the flight
8814	R014	01	02:51:51.5	IAS.BVP,km/	379.7	IAS when landing gear down
8815	R015	01	02:52:18.5	IAS.BVP,km/	330.2	IAS of slats extension
8816	R016	01	02:52:11.5	IAS.BVP,km/	352.7	IAS of flaps extension start
8817	R017	01	02:52:34	IAS.BVP,km/	271	IAS of flap extension to 43 deg
8818	R018	01	02:54:24.5	IAS.BVP,km/	230.9	Approach speed
8821	R021	01	02:56:18.1	VertAcc,g[+]	1.29	Maximum vertical acceleration during landing (touchdown)
8822	R022	01	02:56:19.7	abs.Nz,g[+]	0.26	Maximum lateral acceleration during landing (touchdown)
8823	R023	01	02:56:21	abs.Nz,g[+]	0.24	Maximum lateral acceleration during landing (taxi)

1. Stages of flight

2. Pilot's action monitoring

3. Systems monitoring

Endurance hours

Regular information

Technological

Deleted

Parameters

Roll

1.2

Pitch

2.9

GW

130

OK

Cancel

Print

=> DB

Drawing 12.26

180

To fix the statistical data of the parameter on the selected interval the following procedure has to be followed:

- Add first to the string **A** a parameter, whose statistical characteristic is necessary to fix.
- put down desired symbol (" **m** " , " **o** " , " **s** " or " **~** ") in the header of the first column and again go to **Select Parameter** if you need to set a threshold value for filtering failures (Section 12.7).
- Add to line **A** not more than three analog parameters whose statistical values are also must be fixed at a given interval. Set these parameters to the desired characters (" **m** " , " **o** " , " **s** " or " **~** ").
- Set formula (condition), defining start and end of the desired interval.

Drawings 12.27 and 12.28 shows an example of the task and results of the estimation of the average meaning (mathematical expectation) of the IAS and of standard deviation from this meaning at final approach.

Header editor (Approach speed)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: R018 | Name: Approach speed | ID: 8818

Discrete type: Express analysis event

Colors: Aqua, Blue

Discrete #2 (Express analysis event):

	(o)	(s)
A	IAS.BVP	IAS.BVP
B	RIndg.3	

Time delay, sec: To 0, Tk 0, ^T 0, min duration

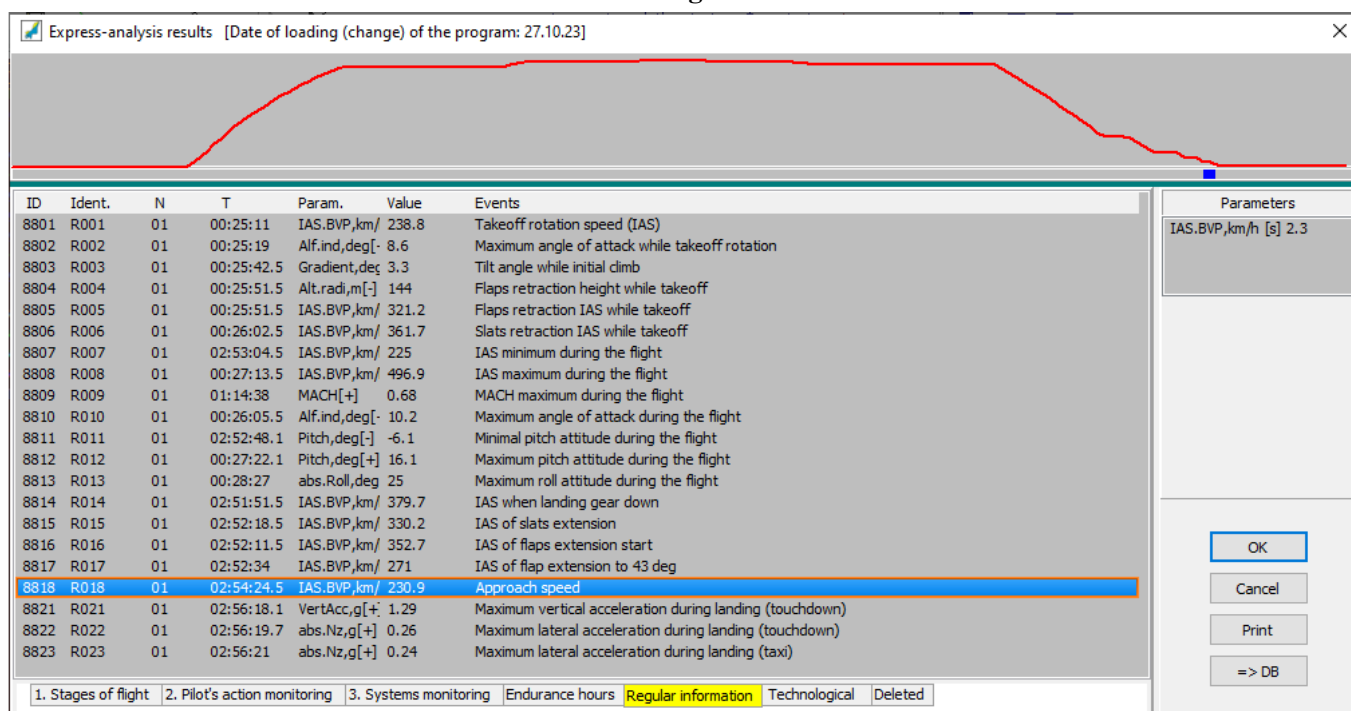
Plot options: T<= 500, T>= 500, #task 2

Additionally: 1-st stage, Rec.Off, Save Off, Clear, No

OK | Cancel | Print | Param.list

Last changes: 27.10.23 (#1)

Drawing 12.27



Drawing 12.28

Header editor (Number of engine's starts, left engine)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: F101 Name: Number of engine's starts, left engine E

ID: 9101 Colors: Red Black Do not display UDP export

Parameter type: Analog #1 Analog #2 Discrete #1 Discrete #2 (selected) Sound stream

Discrete type (calc.): Express analysis event

Discrete #2 (Express analysis event):

A: B: Rstart.1

n(b1)

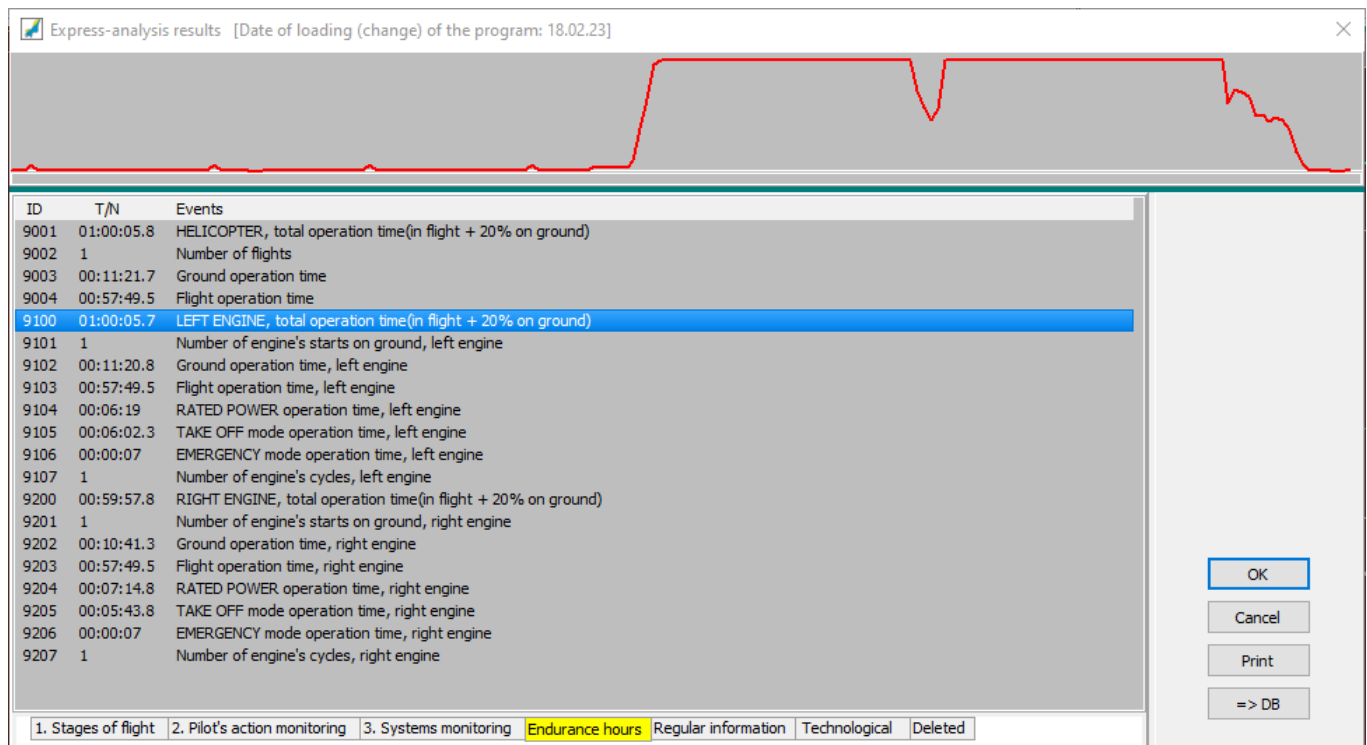
Additionally: 1-st stage Rec. Off Save Off Clear No

OK Cancel Print Param.list

Last changes: 06.11.23 (#1)

ID	Parameter
8492	S292
8493	S293
8494	S294
8495	S295
8496	S296
9601	R001
9602	R002
9603	R003
9604	R004
9605	R005
9606	R006
9607	R007
9608	R008
9609	R009
9610	R010
9001	F001
9002	F002
9003	F003
9004	F004
9100	F100
9101	F101
9102	F102
9103	F103
9104	F104
9105	F105
9106	F106
9107	F107
9200	F200
9201	F201
9202	F202

Drawing 12.30



Drawing 12.31

12.11. Features of two-pass express-analysis implementation

The previous chapters describe the implementation of the classic one-pass express-analysis. Using this approach the program does not come back (to the beginning of the flight) to check conditions or fix values of the parameters. This feature along with the necessity of setting delays of the event registration beginning and end (Section 12.7), results in the fact that some parts of the flight may not be processed by express-analysis.

To remove the mentioned above and some other deficiencies as well as to optimize algorithms performance the two-pass express-analysis was implemented. The main idea of this approach is that during the first pass all the tokens and readinesses may be defined as well as the values of some parameters may be saved (for example pressure altitude of the aerodrome of departure). Those values will be used in equations during the second pass. Thus, there is no need to specify these values in the passport of the flight. Additionally, the two-pass express-analysis provides the ability to amend the algorithms of the event generation because during the second pass the program "knows" about all the stages of the flight and may use the values of some parameters that were saved during the first pass.

The event will be generated during the first pass if the **1-st pass** box of the **Additionally** field on the **Parameter** page of the **Header editor** window is checked (Section 12.7). The program automatically selects the two-pass algorithm if the mentioned box is checked at least for one of the events.

At this on tab **Express analysis** window **Header editor** (Section 3.4.7) will display a panel of sorting events by pass number. By setting switch in position of 1st and/or 2nd pass you can view events related to the selected stage.

The only difference of the two-pass algorithm is that the events that were generated during the first pass are treated as On/Off signals during the second pass. Thus, the **ok(bn)** and **no(bn)** functions may not be used with those parameters. All other functions and operators, including values retrieving function **dm (bn)**, may be used without limitations.

You also have to understand that events that happened during the first pass exist during the second pass **only on the same time interval** as in the first pass but not from the second pass beginning. For example, if the takeoff run token was registered at definite time interval during the first pass then, during the second pass, the existence check of this event will return **true** value on the same time interval **only**. But, retrieving the number of the event realizations (**n(b1)**) will count all the 1-st pass events starting from the second pass beginning. That is, for our example, the check for the takeoff run event realization (**n(b1)>0**) may be done at the beginning of the second pass and, depending on the result, express-analysis may be stopped or continued.

One more special feature of the **t0 (bn)** and **tk (bn)** functions usage concerning the first pass is that during the second pass these functions are determined (feed back correct values) **only** on those intervals where the argument event existed during the first pass. Thus, use of these functions **must always** be confirmed by existence check of such argument events (for example **B1 & t0(b1)>5**).

Figures 12.32, 12.33 and 12.34 show an example of using the two-pass algorithm. During first pass at formation of aircraft in the air token values of take-off RWY barometric altitude and take-off flap position are saved (Figure 12.32). In the second aisle memorized meaning of takeoff RWY barometric altitude used in condition for takeoff end readiness formation (Figure 12.33). The takeoff position of the flaps from the first pass used in the second pass to form a token of take-off before the start of retracting flaps (Figure 12.34).

Header editor (Flight #2)

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: FLT.2 Name: Flight #2

ID: 9862 Colors: Gray Black

Parameter type: ☐ Analog #1 ☐ Analog #2 ☐ Discrete #1 ☒ Discrete #2 ☐ Sound stream

Discrete type (calc.): Express analysis event

Discrete #2 (Express analysis event)

A: Med(ALT.P. 1,4) Med(FLP.H,4)

B: Tstart WOW E1.RUN E2.RUN

B1 & B2 & B3 & B4 \ B2

Time delay, sec: To 10 Tk 10 ^T 60 min duration

Plot options: T<= 300 T=> 300 #task 1

Additionally: ☒ 1-st stage ☐ Rec.Off ☐ Save Off Clear No

OK Cancel Print Param.list

Last changes: 04.09.17 (#1)

ID	Parameter
9847	RDctrl.3
9848	RDctrl.4
9849	RDctrl.5
9861	FLT.1
9862	FLT.2
9863	FLT.3
9864	FLT.4
9871	Tstart.1
9872	Tstart.2
9873	TO.Flp
9874	TO.End
9881	T.APPR
9882	T.GA.1
9883	T.GA.2
9884	T.MRK.1
9885	T.MRK.2
9886	T.FLARE
8001	S001
8002	S002
8003	S003
8011	S011
8012	S012
8013	S013
8014	S014
8015	S015
8016	S016
8021	S021
8022	S022
8023	S023
8024	S024

Drawing 12.32

Header editor (End of takeoff (altitude 1500 ft, flaps up))

Parameters | Calibration tables | Addresses | Frame map | Passport, common data | Flight path parameters | Express-Analysis

Short name: TO.End Name: End of takeoff (altitude 1500 ft, flaps up)

ID: 9874 Colors: Teal Navy

Parameter type: ☐ Analog #1 ☐ Analog #2 ☐ Discrete #1 ☒ Discrete #2 ☐ Sound stream

Discrete type (calc.): Express analysis event

Discrete #2 (Express analysis event)

A: ALT.P. 1

B: FLT.2 FLP.UP

B1 & B2 & [(a1-d1(b1)) > 1500] \ b1

Time delay, sec: To 5 Tk 0 ^T 0 min duration

Plot options: T<= 300 T=> 300 #task 1

Additionally: ☐ 1-st stage ☐ Rec.Off ☐ Save Off Clear No

OK Cancel Print Param.list

Last changes: 04.09.17 (#1)

ID	Parameter
9847	RDctrl.3
9848	RDctrl.4
9849	RDctrl.5
9861	FLT.1
9862	FLT.2
9863	FLT.3
9864	FLT.4
9871	Tstart.1
9872	Tstart.2
9873	TO.Flp
9874	TO.End
9881	T.APPR
9882	T.GA.1
9883	T.GA.2
9884	T.MRK.1
9885	T.MRK.2
9886	T.FLARE
8001	S001
8002	S002
8003	S003
8011	S011
8012	S012
8013	S013
8014	S014
8015	S015
8016	S016
8021	S021
8022	S022
8023	S023
8024	S024

Drawing 12.33

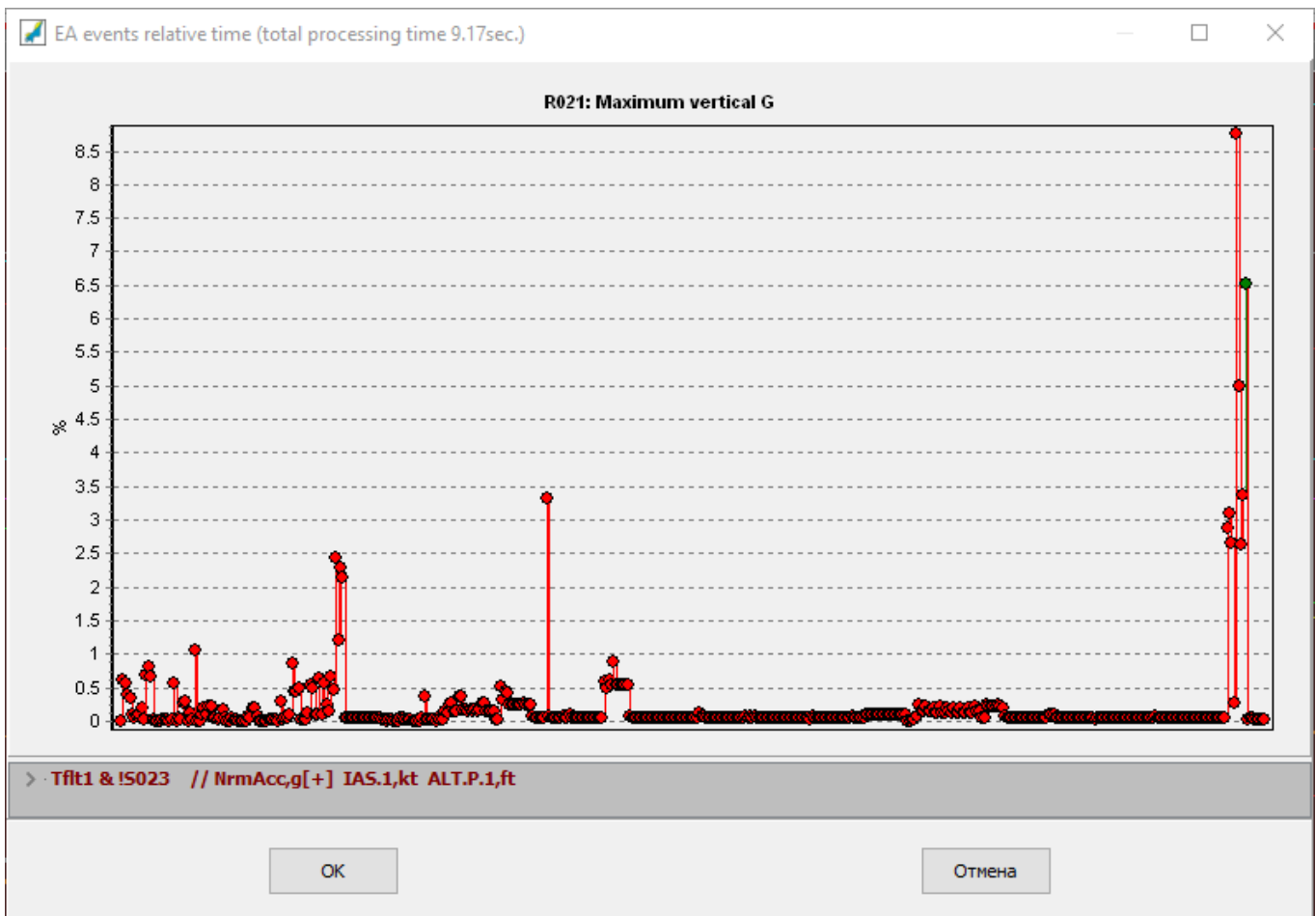
12.12. Express-analysis debug mode

This feature may be used only if you have full access to the express-analysis algorithms. Toggling this mode from on to off and vice versa is done with the help of **Tasks/Express-Analysis/EA debug mode** menu item.

The user may use the following additional functions with the debug mode switched on:

- additional express-analysis settings (Section [12.3](#));
- monitor time used for every particular event calculation.

In debug mode the menu **Tasks/Express-Analysis/Processing time** becomes available for developer after performing express analysis which will displays a window (drawing 12.35). For display the given window **Alt** keys + **F9** could be used as well.



Drawing 12.35

The total duration of the express-analysis execution is shown in the caption of the window. The histogram shows the time intervals in percent that were spent on calculation of the particular event. Each event is represented by the circle. Left click on the desired circle to display event details. The name and the equation of the selected event are shown in the top and bottom parts of the window correspondingly. Press the **OK** button to edit the selected event using the **Header editor** window. Press the **Cancel** button to return to viewing the graphs.

If the developer is not satisfied with the execution time of express analysis, then you can try to reduce it by optimizing the algorithm for generating the most critical (in terms of processing time) events and setting the depth of buffer of calculated parameters. Move the appropriate sliders on the **Common data** page of the **Header editor** window (Section [12.3](#)) to change the depth of the buffer. Moving the slider to the right increases the buffer depth. It means that the righter is the slider the more parameters values will be saved in the buffer. While calculating the value of any parameter, at first, the program seeks the buffer for the value of the desired parameter at the given time moment, and, if finds, do not waste the time to retrieve it from the data file. However, if the program does not find the desired value in the buffer the total execution time increases on duration of the buffer reading. The optimal value for the buffer depth (minimum duration of express-analysis execution) may be selected *only tentatively*.