

Project:  
**PEGASUS**

# EUROCONTROL

Software User Manual – FILEWATCH

Doc. No.: PEG-SUM-FW

Issue: **C** Date: 16/06/2003  
Sheet **1 of 18**

Title:

# PEGASUS Software User Manual: Module FILEWATCH

Prepared by: **GNSS Tools Team**

Date: 16/06/2003

Checked by: GNSS Tools Review Team

Distribution:

PEGASUS development team  
PEGASUS development team  
Software Engineering Unit  
SBAS Project  
GBAS Project

EEC/GNSS  
TU BS/IFF  
EEC/SEU  
EEC/GNSS  
EEC/GNSS

This document and the information therein is the property of EUROCONTROL. It must not be reproduced in whole or in part or otherwise disclosed without prior written consent of the Director EUROCONTROL Experimental Centre.

The contents of this document only express the opinions of the author and does not necessarily reflect the official views or policy of the Agency.

Project:  
**PEGASUS**

# EUROCONTROL

Software User Manual – FILEWATCH

Doc. No.: PEG-SUM-FW

Issue: **C** Date: 16/06/2003  
Sheet **2 of 18**

## DOCUMENT IDENTIFICATION SHEET

### DOCUMENT DESCRIPTION

#### Document Title

PEGASUS Software User Manual - Module FILEWATCH

**EDITION :** C **EDITION DATE :** 16/06/2003

#### Abstract

Software User Manual for the look facility module of the PEGASUS data processing and analysis system.  
Issue associated with PEGASUS

#### Keywords

GNSS	GPS	SBAS	GBAS
GLONASS	EGNOS	ESTB	PEGASUS
Graphics	CSV-file	analysis	Quick-look
Software user manual	Visualisation		

**CONTACT PERSON:** EATMP GNSS Programme **TEL:** +33-1-6988-7571 **UNIT:** GNSS Tools

### DOCUMENT STATUS

STATUS		CATEGORY		CLASSIFICATION	
Working Draft		Executive Task		General Public	
Draft		Specialist Task		EATMP	✓
Proposed Issue		Lower Layer Task	✓	Restricted	
Released Issue	✓				

### ELECTRONIC BACKUP

**INTERNAL REFERENCE NAME :** SUM\_FW.DOC

## CHANGE RECORD

Issue	Date	Chapter	Description of Changes
A	17/1/2003	All	Issue associated with PEGASUS*Plus 2.0 First Issue of SUM for this module
B	07/04/2003	All	Issue associated with PEGASUS*Plus 2.1 Colours settings description added
C	16/06/2003	All	Issue associated with PEGASUS 3.0 New features documentation

## **TABLES OF CONTENTS**

<b>1 INTRODUCTION</b> .....	<b>6</b>
1.1 Purpose of this document .....	6
1.2 Definitions, Acronyms and Abbreviations .....	6
1.3 References .....	7
1.4 Overview .....	8
<b>2 INSTALLATION AND SYSTEM REQUIREMENTS</b> .....	<b>10</b>
2.1 Installation.....	10
2.2 System Requirements .....	10
<b>3 FILEWATCH</b> .....	<b>11</b>
3.1 Introduction.....	11
3.2 Managing a Automated Display .....	11
3.2.1 Starting the FILEWATCH.....	11
3.2.2 Starting a sequence.....	11
3.3 Data Input.....	11
3.4 Use of Software .....	11
3.4.1 General description.....	11
3.4.2 Graphs .....	12
3.4.2.1 Printing graphs and copy and paste .....	13
3.4.2.2 Graph configuration bar.....	13
3.4.2.3 Preferences .....	14
3.4.3 Views .....	14
3.4.4 Extract a part of the file... ..	14
3.4.5 Expressions Syntax .....	15
3.4.5.1 Numbers .....	16
3.4.5.2 Variables .....	16
3.4.5.3 Operators .....	16
3.4.5.4 Functions .....	17
3.5 Data Output .....	17

## TABLES OF FIGURES

Figure 1: FileWatch main window .....	12
Figure 2: Graph configuration bar .....	13
Figure 3: Preferences .....	14
Figure 4: Export to CSV .....	15

## 1 Introduction

### 1.1 Purpose of this document

This document is intended to serve as a handbook for the users of the PEGASUS module FILEWATCH. As the purpose of the PEGASUS is mainly based on the processing of data collected in-flight and on-ground with satellite navigation systems, especially the EGNOS Satellite Test Bed (ESTB), a background in the fields of satellite navigation and air traffic management is also necessary for every user working with the PEGASUS software programs. The tools developed allow experimental use of satellite navigation and augmentation systems, notably the European Satellite Test Bed, ranging and (wide-area)-differential ranging processing of GPS and ESTB and combinations.

The purpose of the document is to describe the use of the software program FILEWATCH used either as module in the PEGASUS Project or as a standalone program.

In order to use the prototypes correctly, it is recommended that the user should read the Interface Control Document ICD [1], which describes an important part of the data formats used.

### 1.2 Definitions, Acronyms and Abbreviations

AAIM	Aircraft Autonomous Integrity Monitoring
ASCII	American Standard Code for Information Interchange
Doc. No.	Document Number
DD	Design Document
EEC	EUROCONTROL Experimental Centre
EGNOS	European Geostationary Navigation Overlay System
ESTB	EGNOS Satellite Test Bed
ICD	Interface Control Document
GLONASS	Global Navigation Satellite System by Russia
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
MEDLL	Multipath Estimation Delay Locked Loop
MT	Message Type
PEG	PEGASUS
PEGASUS	Prototype EGNOS Analysis System Using SAPPHIRE
PRN	Pseudo-Random Noise – Satellite Identifier
RAIM	Receiver Autonomous Integrity Monitoring
RINEX	Receiver Independent Navigation Exchange
RTCA	Radio Technical Commission for Aeronautics

SAPPHIRE	Satellite and Aircraft Database Project for System Integrity Research
SARPS	Standards and Recommended Practices
SBAS	Satellite Based Augmentation Systems
SIS	Signal In Space
SUM	Software User Manual
TBD	to be determined / defined
TN	Technical Notes
URD	User Requirements Document
UTC	Universal Time Co-ordinated
WAAS	Wide Area Augmentation System
WGS84	World Geodetic System 1984

## 1.3 References

- [1] PEGASUS Interface Control Document, Doc. No. PEG+-ICD-01 Issue I,
- [2] PEGASUS User Requirement Document<sup>1</sup>, Doc. No. PEG-URD-01 Issue F
- [3] PEGASUS\*PLUS User Requirement Document, Doc. No. PEG+-URD-01, Issue E
- [4] PEGASUS Technical Notes, Doc. No. PEG-TN-SBAS Issue G
- [5] PEGASUS Software User Manual Frame, PEG-SUM-01, Issue I
- [6] PEGASUS Software User Manual Module CONVERTOR, PEG-SUM-CNV, Issue G
- [7] PEGASUS Software User Manual Module PLAUSIBILITYCHECK, PEG-SUM-PBC, Issue G
- [8] PEGASUS Software User Manual Module WinGPSALL, PEG-SUM-WGP, Issue G
- [9] PEGASUS Software User Manual Module TRUTHREF, PEG-SUM-TR, Issue G
- [10] PEGASUS Software User Manual Module MFILERUNNER, PEG-SUM-MFR, Issue G
- [11] PEGASUS Software User Manual Module FILEWATCH, PEG-SUM-FW, Issue A
- [12] RTCA: Minimal Operational Performance Standards for GPS/WAAS Airborne Equipment. Doc. No. Do 229, June 1996, Including Change 1, July 1997
- [13] RTCA: Minimal Operational Performance Standards for GPS/WAAS Airborne Equipment. Doc. No. Do 229 A, June 1998

---

<sup>1</sup> Although the name PEGASUS is used throughout the document, this document establishes the User Requirements for the modules of the PEGASUS programs that decode, process and evaluate the GNSS/SBAS data. Recent developments have integrated all these modules into a PEGASUS frame and the necessary documentation has been modified accordingly – except for the URD where it has been decided not to generate a new issue.

- [14] RTCA: Minimal Operational Performance Standards for GPS/WAAS Airborne Equipment. Doc. No. Do 229 B, October 1999
- [15] ESTB-CPF Improvements and Corrective Maintenance ESTB-UPG, Analysis of compliance with MOPS DO-229B, Doc. No. GMV-ESTB\_UPG-TN-001/01
- [16] ESTB SIS User Interface Description, ESA, Doc.-No. : E-TN-ITF-E31-0008-ESA, issue 0, revision 1, 20-06-00
- [17] NAVSTAR Global Positioning System, System Characteristics, NATO-MAS-STANAG 4294, May 1995
- [18] OEM4 User Manual – Volume 2 Command and Log Reference, NovAtel Inc., Pub-No OM-20000047 Revision Level 7, 2001/06/21
- [19] Millennium GPSCard Software Version 4.50, NovAtel Inc., Doc.-No.: OM-2000000041, Revision Level 1, 1998
- [20] Aquarius 5000 Series User's Manual, Dassault-Sercel Navigation Products DSNP, Doc.-No.: 0311374 Rev B, Jan 1999
- [21] ConfPack Configuration Software for DSNP GNSS/GPS Receivers – Reference Manual, Dassault-Sercel Navigation Products DSNP, Doc.-No.: 0311373 Rev B, Jan 1999
- [22] Septentrio PolaRx evaluation kit description V1.01, July 2001
- [23] Portable MEDLL Receiver, Installation and Operation Manual, NovAtel OM-20000065 Rev. 0C, 26.09.2001
- [24] SAPPHIRE I Integrity Monitoring, Technical Note, 1996
- [25] SAPPHIRE II Integrity Monitoring, Technical Note, 1998
- [26] SAPPHIRE DUAU User Manual, Doc. No. DUAU-TN-2472-002, Issue J, May 1999
- [27] PEGASUS\*Plus Receiver Integration Description Document Ref PEG+-RID-01, Issue B
- [28] PEGASUS\*Plus Module Integration Description Document Ref PEG+-MID-01, Issue C

## 1.4 Overview

The PEGASUS\*Plus frame and modules are based on several main software programs allowing the user to decode GNSS data that are then used to perform a GNSS navigation solution. The user is then able to perform further calculation described in the complete set of PEGASUS\*Plus Software User Manuals (which consist of the documents [5], [6], [7], [8], [9], [10] and [11]). The PEGASUS\*Plus Project is presented below:

- The FRAME program will coordinate the automated sequencing of the calling of different steps in the sequence of GNSS data processing. The Software User Manual for the Frame program is contained in [5].

- The CONVERTOR program will translate receiver-native GNSS data into a generic format, the description of which is given in the Interface Control Document (1)]. The Software User Manual for that module is contained in [6].
- The PLAUSIBILITYCHECKS program will perform a check on the raw translated data in order to check the consistency of the recorded data. Simple rules can be defined that operate on the data. The Software User Manual for that module is contained in [7].
- The WinGPSALL program will use the output of the CONVERTOR to determine a GNSS navigation solution and integrity information. The Software User Manual for that module is contained in [8].
- The TRUTHREF program will use the output of the WinGPSALL and an externally provided dynamic reference track to determine the Navigation System Error in dynamic environments. The Software User Manual for that module is contained in [9].
- The M-Files are used to visualise the results of the positioning and integrity monitoring in MATLAB™. The module MFILERUNNER provides operators who do not have the MATLAB™ environment installed with a capability to execute compiled versions of these M-Files. The Software User Manual for that module is contained in [10].
- The FILEWATCH module can be used to visualize results of the data processing graphically and numerically (in a spread-sheet like format). It is useful to obtain a “quick-look and feel” for the results and to localise areas for detailed investigations. This document contains the Software User Manual for that Module.

This document contains the Software User Manual for the PEGASUS\*Plus modules FILEWATCH. This section contains a short introduction to the PEGASUS\*Plus approach of GPS/SBAS data processing.

In chapter 2 of this document, a short description for the installation and de-installation of the module FILEWATCH is given when they are used as stand alone programs. Chapter 3 will describe the use of the FILEWATCH module.

## 2 Installation and System Requirements

### 2.1 Installation

To install FileWatch, the user should copy and past the executable FileWatch.exe .

To uninstall it, the user should remove the executable FileWatch.exe .

### 2.2 System Requirements

The FileWatch software has been designed, developed and extensively tested for Windows NT 4.0 SP5/6, UK. However, installation and running of the software is possible under Windows 2000, 95, 98, XP and Millenium Edition. No liability on the results for those operating systems can be given with regards to FileWatch. As all the intermediate data needed by FileWatch are stored on the hard drive, free space on the disk containing the Windows temporary directory, or on the one containing the FileWatch executable file, should be big enough.

## 3 FILEWATCH

### 3.1 Introduction

FileWatch is a tool designed to investigate large CSV-like data files. It permits to look at numerical data as well as graphically.

### 3.2 Managing a Automated Display

#### 3.2.1 Starting the FILEWATCH

To start the FileWatch, the user just needs to double-click on the icon in the explorer. No command line options or INI-files are currently supported.

#### 3.2.2 Starting a sequence

FileWatch is called via the main window of the PPlus program or directly via windows explorer, by clicking on the FileWatch icon.

### 3.3 Data Input

FileWatch accepts any kind of CSV-like data files, with no limitation on number of lines or columns. The first line should contain a header providing column names. It supports the comma, semicolon and tab separators.

The first line of the file is always interpreted as header data, independent of its contents. Defective lines or non-compliance of the file with the PEGASUS\*Plus ICD [1] may therefore lead to file misinterpretations with unpredictable results.

### 3.4 Use of Software

#### 3.4.1 General description

The FileWatch window is composed of three main parts:

- On the left, a list shows all values contained in a csv file, without any limitations of size for rows and columns.
- On the top right, a set of controls allows the user to quickly draw graphics representing csv file values.
- At the top, a selector allows the user to select a view of the file, which corresponds to a filter previously created in the “View.CreateView...” menu.

### 3.4.2 Graphs

To draw graphics, three selectors have been provided, which select coordinates for each point of the graphic. The left one acts for the X-axis, the middle one acts for the Y-axis, and the right one acts for the Z-axis which is represented by a gradient of colors from blue to red. A legend for the Z-axis is provided at the right of the graph.

In each selector are listed all the columns names, and two special items:

- The <Line Number> item represents the position of rows.
- The <expression> item allows the user to enter a mathematical expression in the corresponding field under the selector.

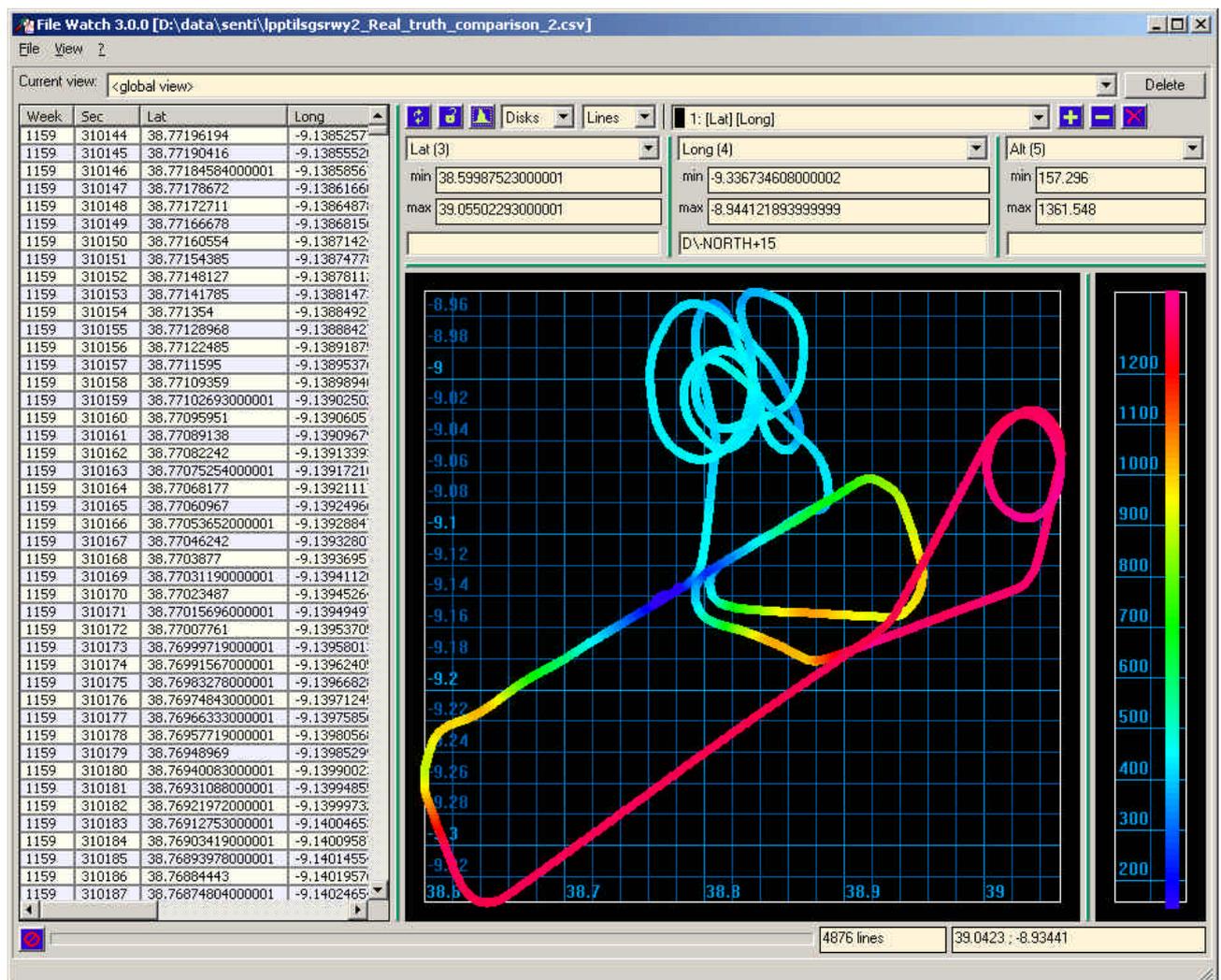


Figure 1: FileWatch main window

The “X min”, “X max”, “Y min”, “Y max”, “Z min” and “Z max” fields represent the current bounds of the graphic. Using the left mouse button, the user is allowed to zoom in the graphics. He also can zoom out clicking the right button. Another way of scaling graph is to enter bounds values in X min, X max, etc.

Note: Not all fields may be visible in all window sizes. If necessary, rescale the window horizontally.

### 3.4.2.1 Printing graphs and copy and paste

The “File.Print...” menu permits to print the graph after having selected printer parameters.

The “File.Copy...” menu copies the graph into the clipboard using the metafile format. The figure can then be pasted in any word or Powerpoint document.

### 3.4.2.2 Graph configuration bar

A configuration bar is placed on the top of the graphical window.

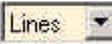


Figure 2: Graph configuration bar

The  button and the “View.Refresh” menu permit to refresh the current graph.

The  button and the “View.Lock Graph Parameters” menu permit to lock the zoom in order to disable the auto scale feature. When the auto-scale feature is disabled, the button looks like : .

The  button and the “View.Histogram” menu turn the selected graphical curve into a statistical histogram. To revert to standard graph, the  button should be pushed.

The   selectors permit to select the look and feel of the graph.

The  selector represents the current selected curve. It shows the colours of all the curves in the graph. It also permits to select which is the current curve, in order to modify its parameters (associated X, Y and Z).

The  button and the “View.Add a curve” menu have to be used to add a new curve to the graph. The parameter of the new curve is a duplication of the one precedently selected.

The  button and the “View.Remove selected curve” menu permit to remove the selected curve from the graph.

The  button and the “View.Clear curves list” remove all the curves but one.

### 3.4.2.3 Preferences

The “File.Preferences...” menu allows to change the colours of the graphs. Background, points and lines colours can be changed using the following interface. The “defaults” button selects the default colours.

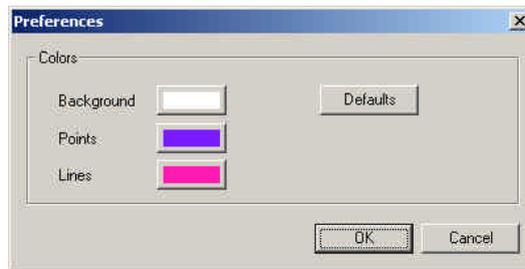


Figure 3: Preferences

### 3.4.3 Views

The “View.CreateView...” menu allows to enter a mathematical expression in order to filter the rows appearing in the list. The graph will be updated accordingly.

The “Current view“ selector at the top of the window allows to switch between all views created, and to return to the global view, which contains all rows of the input file.

### 3.4.4 Extract a part of the file...

The “File.Extract a part of the file...” menu allows the user to extract information from the currently opened file. It opens a new window composed of three parts (see figure 8).

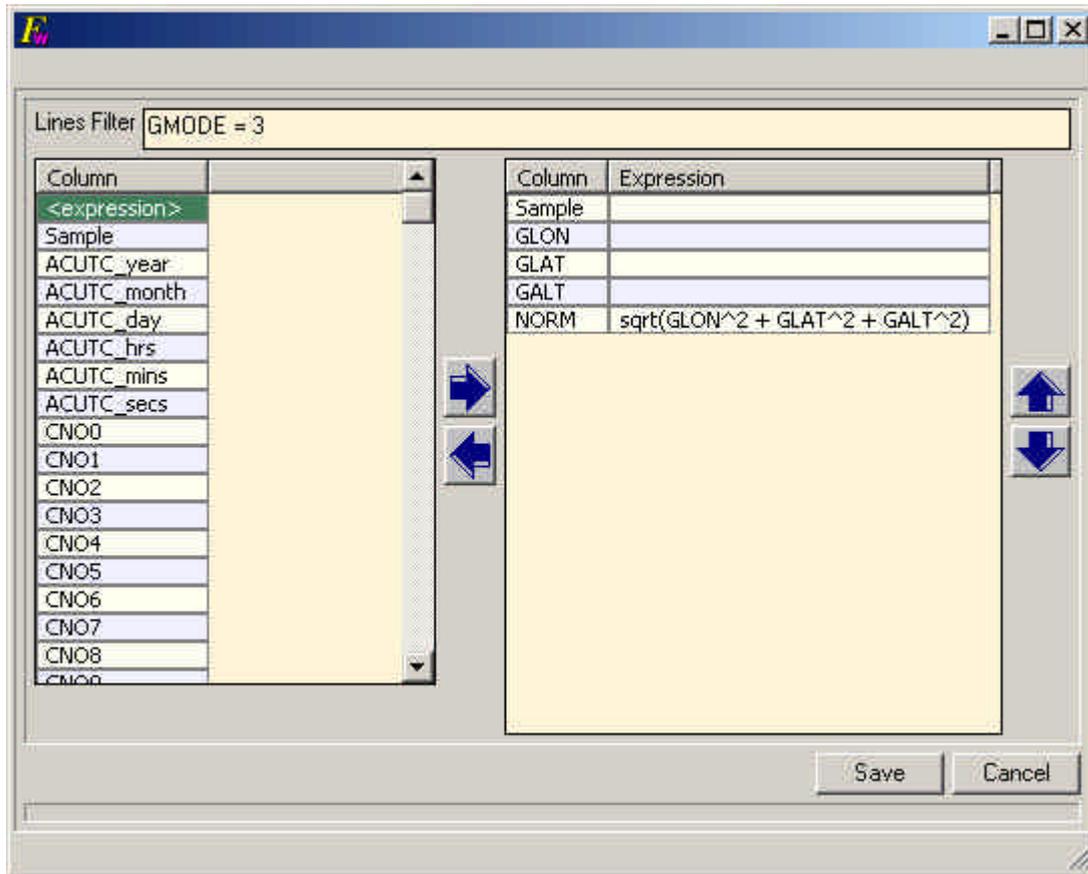


Figure 4: Export to CSV

The left list contains all the column names of the input file, and an <expression> item. The right list represents the output file columns. The arrows between the two lists allow adding or removing columns to the right list.

Selecting the <expression> item and using the left-to-right arrow, the user is asked to enter a mathematical expression and a column name. Then, a so named new column will be added to the right list, containing the given expression.

The “Lines Filter” field at the top of the window allows the user to filter the lines that will be in the output file.

The “Save” button asks the user to select an output file, which finally will contain all the columns listed in the right list.

### 3.4.5 Expressions Syntax

An expression, as used in the export’s window, and in the graphical parameters is basically a mathematical expression.

Four elements are used to define them: numbers, variables, operators and functions.

### 3.4.5.1 Numbers

Numbers have to be written in integer, decimal or scientific format. The storage type is the C double type.

### 3.4.5.2 Variables

Variable can be defined using four syntax elements:

- Column names, case is insensitive. If the column name contains a char which could be interpreted as an operator, this char can be unspecialised by adding a '\ ' char before it. For example, "GPS\–ALT" is a valid name for a column named "GPS–ALT"
- The string "COL" followed by the number of the column (first column is 1). for example, "COL3" is the third column.
- The dollar syntax "\$( expr )". Where expr is a mathematical expression. It can be used in combination with the FIND/FROM/TO function.
- Those three forms can be augmented with the [ expr ] addition which represent the relative line shift. For example, "Sample[-1]" represent the value of the column Sample in the previous line. "Sample[0]" is equivalent to "Sample".

Some examples of valid variables:

- sample
- COL7
- sample [12]
- sample [COL7 [-1]+34]
- \$(sample[2]+2)[ COL7[-3]\*2]

### 3.4.5.3 Operators

The following operators are supported:

expr OR expr expr    expr	Boolean OR
expr AND expr expr && expr	Boolean AND
NOT expr ! expr	Boolean NOT
expr < expr expr > expr expr <= expr expr >= expr	Comparators

expr = expr expr == expr	Equality test
expr <> expr expr != expr	Inequality test
expr + expr expr – expr expr * expr expr / expr	Standard mathematical
expr % expr	Modulo
expr § expr	Integral division
expr ^expr expr ** expr	Power
(expr)	Parenthesis
+ expr	Just like expr
- expr	Minus expr
FIND expr FROM column1 TO column2	Returns the first column number between column1 and column2 containing the value calculated with “expr”

The operators' precedence follows the standard mathematical rules.

#### 3.4.5.4 Functions

The following functions are supported:

ln(x)	returns Neperian (Base e) logarithm
log(x)	returns decimal logarithm
exp(x)	returns exponential
abs(x)	returns absolute value
sgn(x)	returns the sign
int(x)	returns integer part
round(x)	rounds to nearest integer
frac(x)	extracts decimal part
rnd(x)	returns an pseudo-random integer between 0 and x-1
sin(x)	sine
cos(x)	cosine
tan(x)	tangent
sinh(x)	hyperbolic sine
cosh(x)	hyperbolic cosine
tanh(x)	hyperbolic tangent
asin(x)	arc-sine
acos(x)	arc-cosine
atan(x)	arc-tangent

### 3.5 Data Output

FileWatch output consists of a CSV-like file separated with semicolons.

Project:  
**PEGASUS**

# EUROCONTROL

**Software User Manual – FILEWATCH**

Doc. No.: PEG-SUM-FW

Issue: **C** Date: 16/06/2003

Sheet **18 of 18**

**END OF DOCUMENT**