# µ-Center User's Guide

**µ-blox ag**
Zürcherstrasse 68
CH-8800 Thalwil
Switzerland

Phone +41 1 722 7444
Fax +41 1 722 7447
http://www.u-blox.com

GPS-SW-01002 - 15 March 2001

For most current data sheets, please visit www.u-blox.com

# µ-Center
# GPS Evaluation Software

This software uses parts of source code developed by other companies or groups.
jpg and jpeg graphics import filter:
Copyright © the Independent JPEG Group's software
png graphics import filter:
Copyright © 1998-2000 Glenn Randers-Pehrson,
Copyright (c) 1996, 1997 Andreas Dilger,
Copyright © 1995, 1996 Guy Eric Schalnat, Group 42, Inc.
tiff graphics import filter:
Copyright © 1988-1997 Sam Leffler,
Copyright © 1991-1997 Silicon Graphics, Inc.
Docking views:
Copyright © 1998, 1999 by Cristi Posea
Regular Expression Filter:
Copyright © 1986, 1993, 1995 by University of Toronto
Microsoft Foundation Class MFC4.2:
Copyright © Microsoft Corporation

The following are trademarks of SiRF Technologies, Inc.: Snaplock, SingleSat, FoliageLock, SiRF Binary, SiRFStar, Trickle-Power, Push-to-Fix.
The following are trademarks of Microsoft Corp.: Excel, Windows 95, Windows 98, Windows NT, Windows 2000 and Windows Me
The following are trademarks of µ-blox ag and may be used only to describe products of µ-blox ag:
GPS-MS1E GPS Receiver Module
GPS-PS1E OEM GPS Receiver Module
GPS-E1: Evaluation kit for GPS-PS1E and GPS-MS1E
GPS-SCK: Software Customization Kit
SW Enhancements to µ-blox GPS receivers: Integrated Datalogger and AT command set interface
µ-Center
All Trademarks mentioned in this document are property of their respective owners.

# INTRODUCTION

## Features of µ-Center

This guide explains how to use µ-Center to communicate with a GPS receiver for collection, visualization and analysis of GPS receiver data.

The µ-Center GPS Evaluation Software provides system integrators and end users with a quick and simple way to interface with a µ-blox OEM board or sensor product in order to test performance and develop an integrated system. µ-Center GPS Evaluation Software allows easy connection to µ-blox products and provides a suite of features to view, log, and analyze performance.

The features include:

- Support for µ-blox receivers. These receivers feature the SiRF chipset, which has excellent acquisition and tracking performance. µ-Center can communicate with these receivers using either the SiRF binary protocol, or the NMEA-0183 standard protocol.
- Support for non-µ-blox receivers that utilize standard NMEA responses
- µ-Center makes available all of the necessary information that can be retrieved during the operation of a GPS receiver. All aspects of GPS data (position, velocity, time, satellite tracking, etc.) can be monitored and logged under various test scenarios for evaluation of such a receiver. µ-Center software allows analysis of the collected data in order to investigate performance issues such as accuracy, road test position and trajectory, satellite tracking, time to first fix, etc. All processed data can be captured in ASCII format and ported into popular spreadsheets (e.g. Microsoft Excel) for creating additional plots and statistics.

## Intended Audience

This guide aids GPS end user product developers to evaluate and test µ-blox GPS receivers for navigation and positioning. This guide assumes the user has basic computer skills and is familiar with the Windows Graphical User Interface (GUI) and GPS receiver environments.

If you have any questions about installing or using µ-Center please:

- Read this manual carefully
- Read the user manual of the GPS receiver used
- On our homepage http://www.u-blox.com/ consult the file "OEM GPS Receiver Manuals: Protocol Specification Manual"
- Check if the GPS receiver and the µ-Center software are the latest versions
- Read the answers on our µ-blox homepage Frequently Asked Questions Database (FAQ)

If you don't find an answer to your questions, please contact µ-blox by sending an email to:

support@u-blox.com

# CONTENTS

# 1 GETTING STARTED

## 1.1 Installing µ-Center

To install the µ-Center software on your computer, follow the steps described in the µ-Center Installation Guide.

## 1.2 General Information about displayed values

- Longitude and latitude are always displayed according to the datum selected in the GPS receiver (usually: WGS-84).
- Time is displayed according to UTC
- Height is displayed according to MSL (Height above mean sea level or Orthometric Height) or to HAE (Height above WGS-84-Ellipsoid).

## 1.3 Connecting a GPS Receiver to the PC

This section explains how to connect a GPS receiver to your PC.

µ-Center is optimized for receivers using the SiRF binary message protocol, such as µ-blox GPS receiver. This section assumes that you have purchased a µ-blox Evaluation Kit.

To set up one of these receivers for use with µ-Center:

Connect a serial cable between an available communications port (COM-port) on your PC and the Evaluation Unit, labeled PORT A or PORT B.

When the µ-Center program is installed on your PC, it will automatically display a list of available COM ports to choose from. If your PC has both a serial mouse and a modem, it is likely that there will not be any available COM ports. In this case, it would be easiest to switch to a PS/2 mouse in order to free up a COM-port. Alternatively, a separate I/O card may be purchased.

Your GPS receiver must have following COM-Setting:

- Parity: None
- Data Bits: 8
- Stop Bits: 1
- Flow Control: none
- Speed: The GPS receivers can communicate in different baud rates. The standard baud rate for SiRF binary is 19200 (older firmware version default to 9600 Baud). The standard baud rate for the NMEA-0183 message set is 4800, but µ-blox products work with higher rates. In any case the current baud rate can be detected automatically by µ-Center.

You can use two different protocols (SiRF and NMEA) at the same time by using two different COM-Ports. In this case you have to start µ-Center twice and the results will be displayed in different windows.

## 1.4 Starting µ-Center

After µ-Center has been installed, you can open it by choosing from the list of Programs on the Start menu. You will get a display like Figure 1:

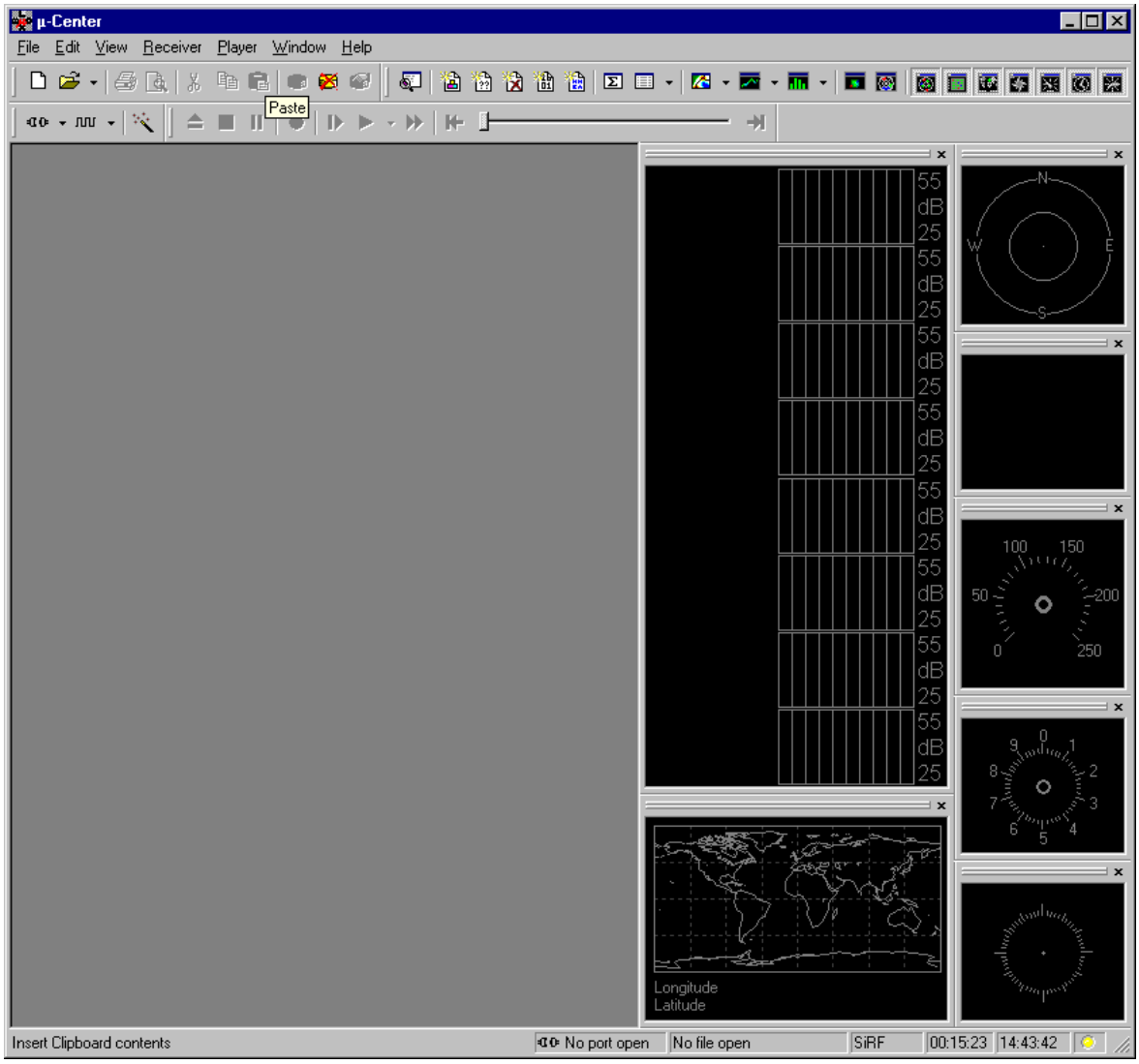



**Figure 1: Start Display**

The first time that µ-Center is running on a new computer, there are a few things that the program needs to know before it can begin normal operation:

- Used COM-Port (COM 1 … COM n)
- Used baudrate (1'200 … 38'400)

COM-Port and baudrate can be selected in two different ways:

- Automatically (Auto Synchronize)
- Manually

### 1.4.1 Auto Synchronize COM-Port and baudrate

On the Receiver Tool Bar (Figure 2) are three different buttons.

**Figure 2: Receiver Tool Bar**

 Connect/Disconnect-Button with COM-Port Selection arrow

 Baudrate-Button with baudrate selection arrow

 Synchronize-Button

Press the synchronize-button and after a short time µ-Center will automatically find the used COM-Port and the correct baudrate. During the synchronization, the Synchronizing Baudrate display is shown (Figure 3)

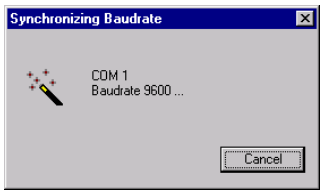



**Figure 3: Synchronizing Baudrate and COM-Port Display**

As soon as µ-Center is synchronized to the GPS receiver, the Connect/Disconnect-Button on the Receiver Tool Bar changes to green color (Figure 4)

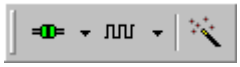


**Figure 4: Detected COM-Port and Baudrate**

If the chosen baudrate mismatches the speed at which the receiver transmits data, the "Communication Information" icon changes to red. See **section 3.1 The Main Frame** to get more information.


**Figure 5: µ-Center and GPS receiver are synchronized**

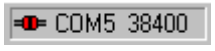



**Figure 6: µ-Center and GPS receiver mismatches**

If the GPS receiver is working correctly, the start display now shows information about the satellite constellation, signal to noise ratio, time etc (Figure 7)

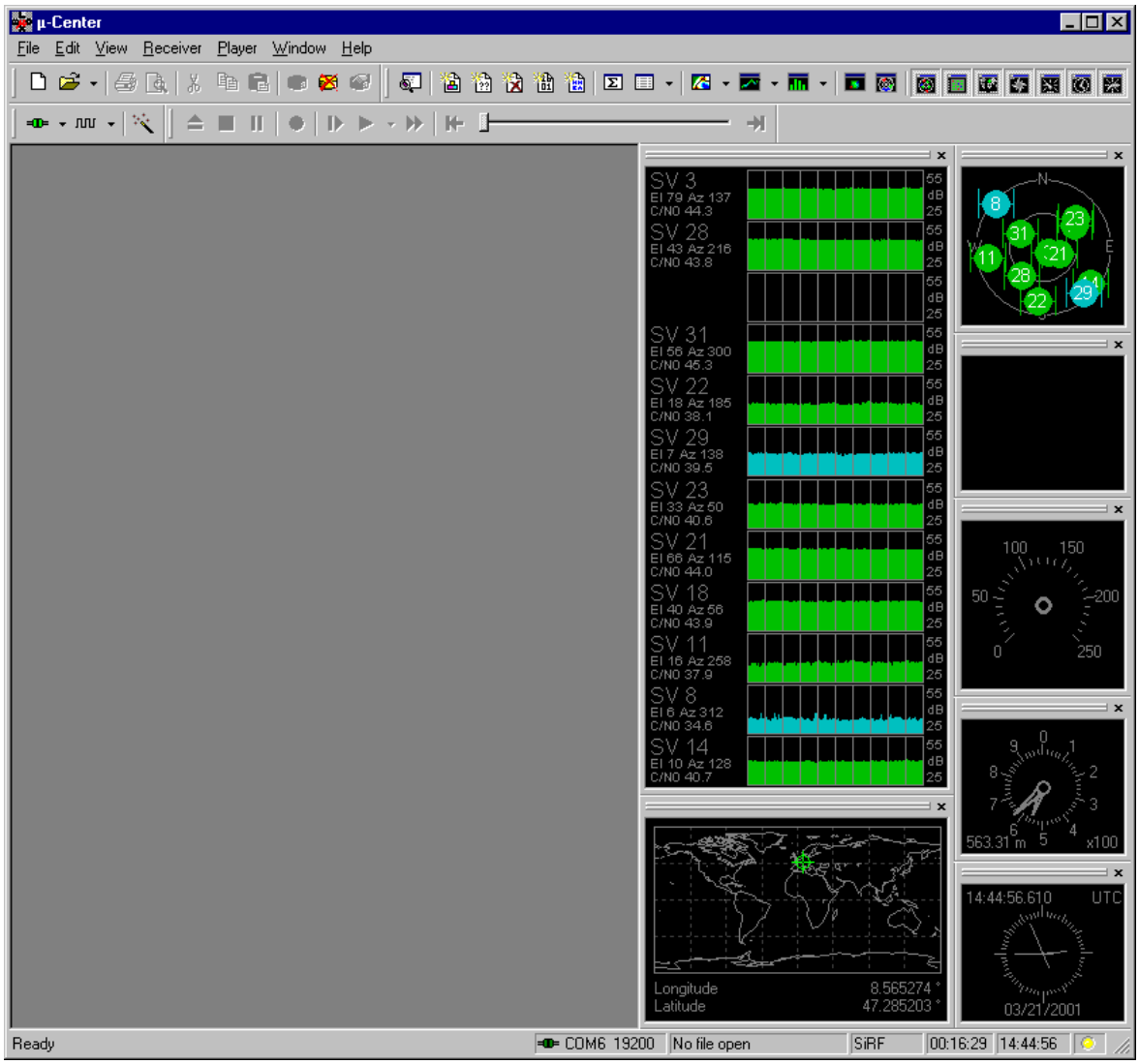
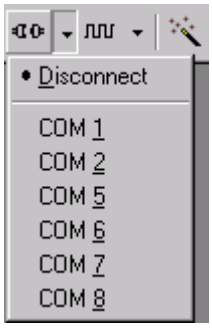


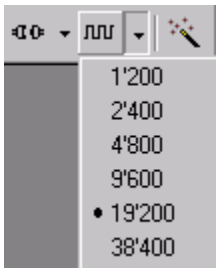

**Figure 7: Start Display after a successful connection**

### 1.4.2 Manual setting of COM-Port and baudrate

Press the Arrow in the Connect/Disconnect-Button and select the used COM-Port




Press the arrow in the Baudrate-Button and select the used baudrate




As soon as µ-Center is synchronized to the GPS receiver, the Connect/Disconnect-Button on the Receiver Tool Bar changes to green color (Figure 4) and the start display shows information about the satellite constellation, signal to noise ratio, time etc (Figure 7).

# 2 CONCEPT AND PHILOSOPHY OF µ-CENTER

When you use µ-Center, it is important to know how the engine of the program works in the background. In principal the software is quite stupid and displays only what it gets. The program gets a data stream and splits this stream into protocol messages. From the messages, relevant parameters are extracted and inserted into the current dataset of the database.

In the current dataset statistical values of the parameters are calculated. Average, Minimum, Maximum and Standard Deviation are calculated for most parameters. If a protocol does not provide a parameter, µ-Center tries to calculate the parameter from the ones that are available. For Example if velocity-north and velocity-east are available, µ-Center calculates the Speed over Ground and Course over Ground, unless this data is available in the protocol too.

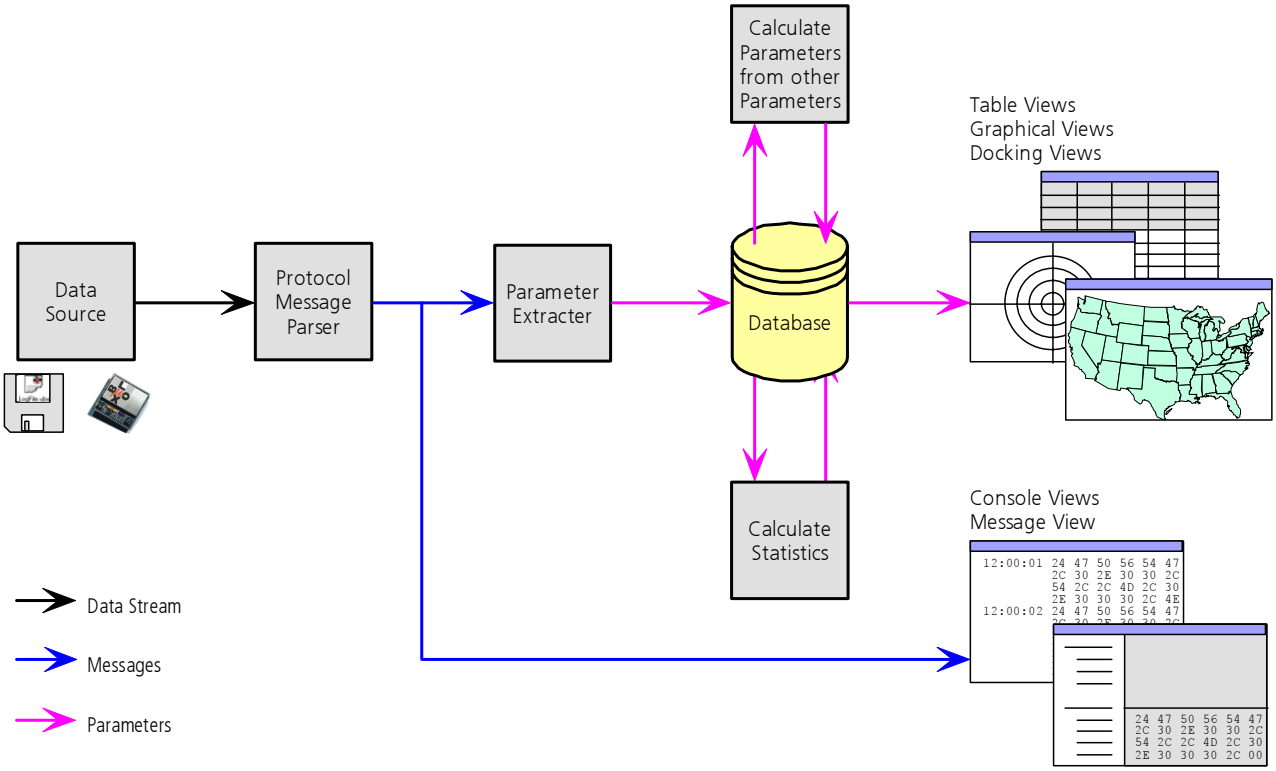



**Figure 8: Engine Architecture**

When a new epoch (change in time) is detected, the current dataset is stored into a history in the database. This history has a limited size. If the Size is exceeded µ-Center keeps only the latest datasets and the oldest ones are removed. This limit may be adjusted. Check **Appendix B Database Limitation**.

µ-Center provides various view classes for observation. Most of the Views take their data from the database. But there are some Views, which get their data directly from the message without using the database at all. The views are updated when the database changes.

- **Message View** This View displays a copy of every known Message. This view allows observing a single message type in detail. It may also be used to send and configure the GPS receiver.

- **Console Views** This type of view displays the messages in a textual form. They are very useful for Software Customization Kit (SCK) users to develop GPS firmware code.
- **Graphical Views** This type of view displays parameters from the database in graphical a form. Charts, Histograms and even a Map Overlay can be created. There are two more views that may be used for statistical performance and antenna pattern analysis.
- **Tabular Views** This type of view shows the parameters of the database in tabular form.
- **Docking Views** These views can be docked to the frame of µ-Center. An analog watch, a compass, a world map, an altitude or a speed meter are available. There are also two docking views that show the current signal power and the constellation of the satellites received by the GPS receiver.

Some of the views are very complicate and use quite a lot of performance of the workstation. You should only open the views that you need, and minimize or even close the ones you are not interested in.

## 2.1 Color coding scheme

In all graphical and docking views, colors indicate the quality of the data. The following table shows the color-coding scheme parameters depending on the navigation solution

| Color | Meaning |
|---|---|
| Yellow | Current value |
| Green | 3D navigation solution |
| Cyan | 2D navigation solution |
| Blue | Degraded navigation solution (e.g. Dead reckoning) |
| Red | No navigation solution |

**Table 1: Standard color-coding scheme**

Some views use a different color-coding scheme. They determine the color depending on the state of the satellite. This scheme applies to the Sky View, the Satellite Position and the Satellite Level Docking Windows

| Color | Meaning |
|---|---|
| Green | Satellite used in navigation |
| Cyan | Satellite signal available, available for use in navigation |
| Blue | Satellite signal available, not available for use in navigation |
| Red | Satellite signal not available |

**Table 2: Satellite color-coding scheme**

## 2.2 Operating Modes

µ-Center has different operating modes. The mode changes when you open or close a log file or when you make an action in the player. To be able to change to the record mode you have to create a new file or open an existing file. The record mode is only available, if you have created a new file or when you have opened a write able file.

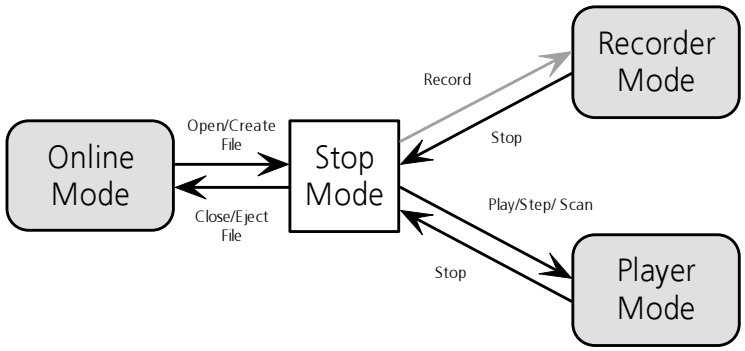



**Figure 9: Relations between operating modes**

The following three sections describe the operating modes and their dataflow in detail.

### 2.2.1 Online Mode

In this mode a GPS receiver is directly connected via a serial port with µ-Center. µ-Center can control and configure the receiver and display the data that the receiver is sending periodically.

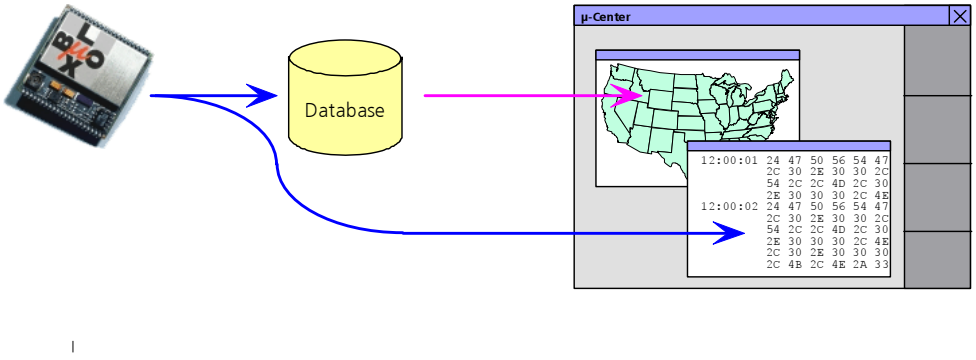



**Figure 10: Dataflow in Online Mode**

### 2.2.2 Stop Mode

In this mode no data from receiver or log file is forwarded to the database and views.

µ-Center is in this mode when a log file is open but player and recorder are not active.

### 2.2.3 Recorder Mode

The Recorder Mode is the same mode as the Online Mode. But µ-Center additionally creates a log file on your disk, contacting all the messages sent by the receiver. You enter this mode by creating a new log file or opening an existing log file without write protection and pressing the record button. This allows you to make overnight measurements and evaluate the data at a later time. µ-blox Support may request a log file from you when you are experiencing a problem with one of our receivers.

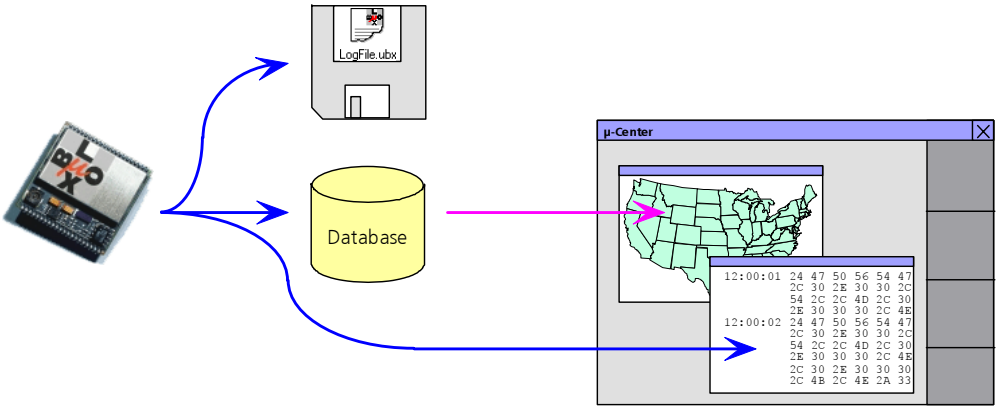



**Figure 11: Dataflow in Recorder Mode**

### 2.2.4 Player Mode

The Player Mode allows replaying a previously recorded log file step by step, in real-time or even in fast motion. You enter this mode by opening a file and pressing the play, step or scan button.

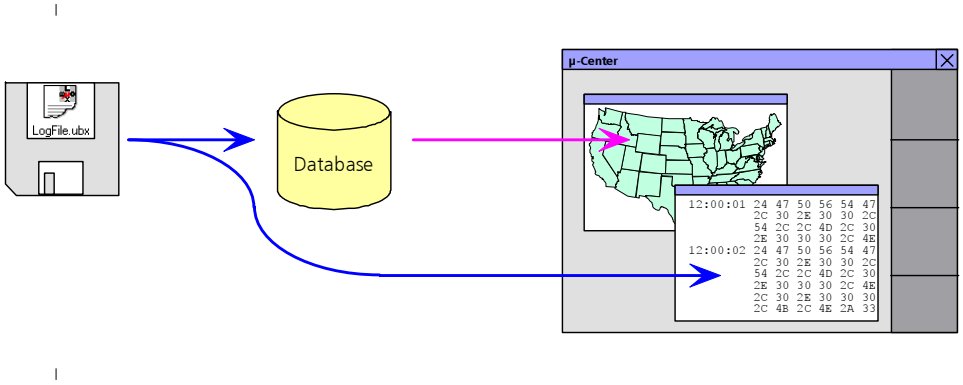



**Figure 12: Dataflow in Player Mode**

### 2.2.5 Relations between Modes

The operating mode depends on the status of the log file player. To change a mode the user has to perform an action. Each mode has different states that are changed by a user action or by events.

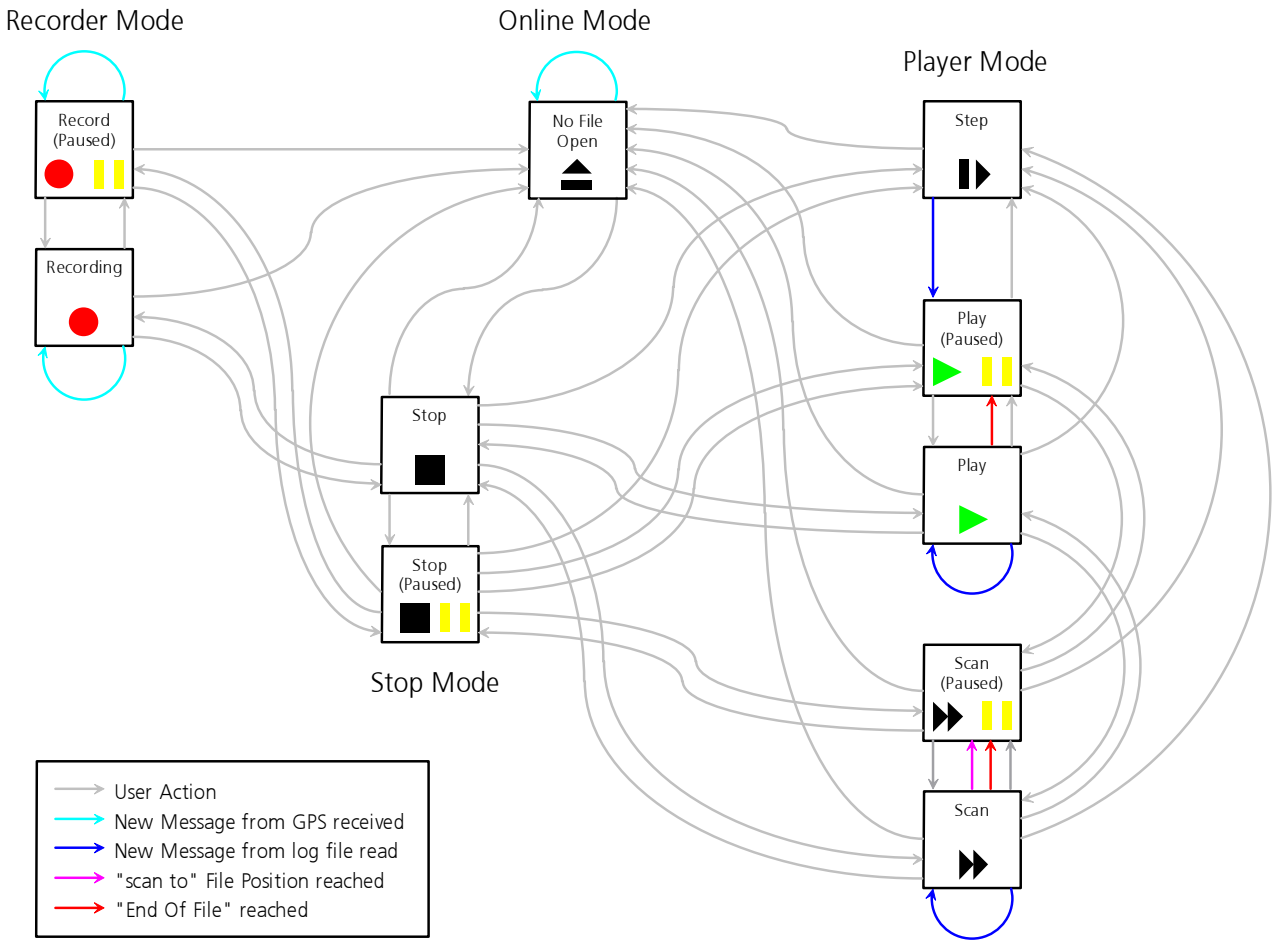



**Figure 13: Relations between different operating modes and their states**

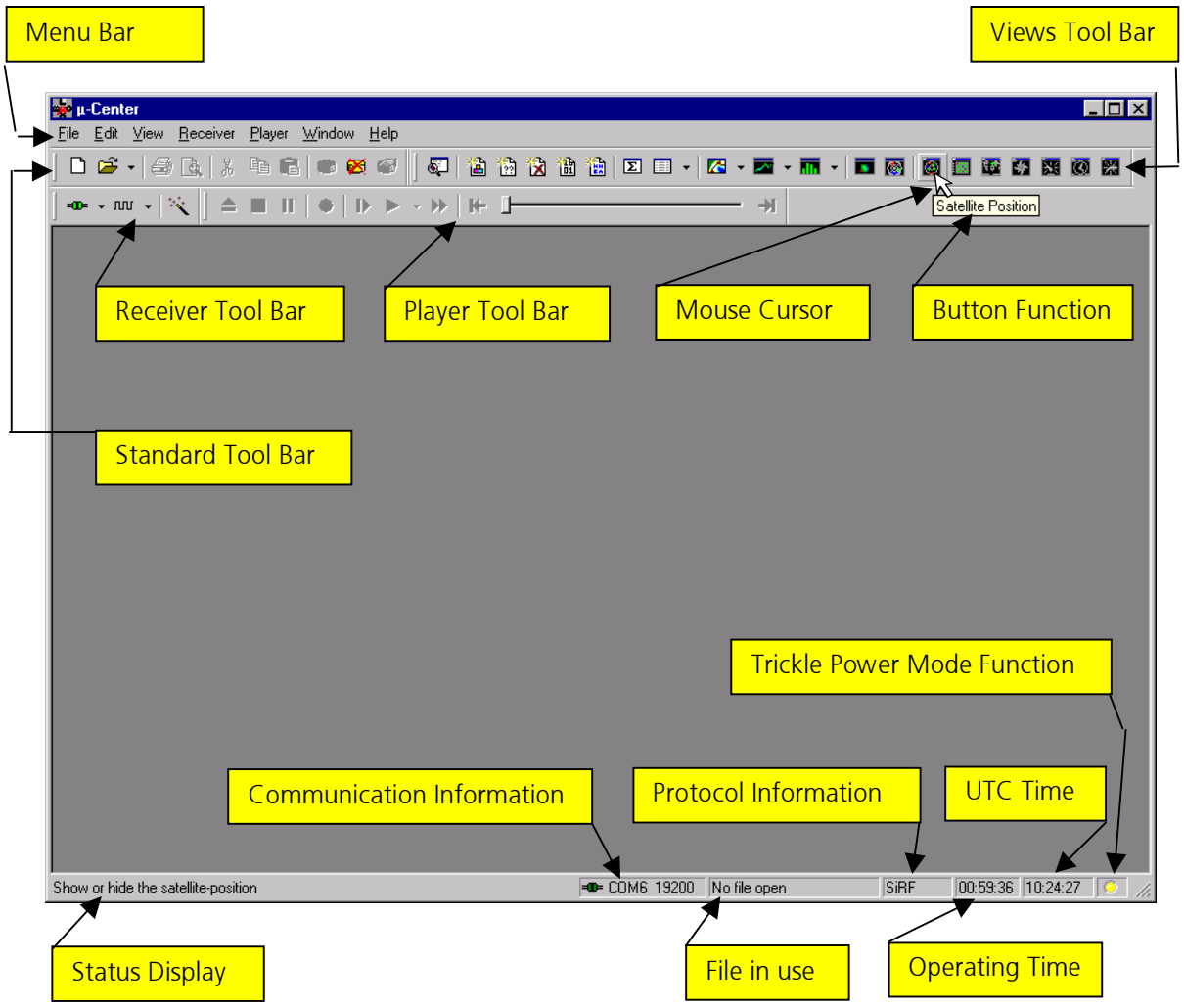
In the online and the recorder mode, µ-Center displays the data from the receiver. In the **player mode** data from a log file is displayed. The player mode has different states. In the **play state** messages are read and displayed periodically from the log file. µ-Center updates the views after each message. The **step state** only gets one message from the log file and immediately falls back into the paused **play state**. In the **scan state** messages are also read periodically but the display is only updated when being paused or by changing the state.

You can set the position in a log file. This behaves differently in the player and the stop mode. In the stop mode the position is just set and no data is read and displayed. µ-Center will start recording or playing from that position when changing the mode. If you set the position in the **player mode**, µ-Center will load the data up to this position from the log file and display the contents.

# 3 USING µ-CENTER

## 3.1 The Main Frame

The Main Frame is the primary display screen that µ-Center uses. It displays all of the tool bars and some information provided by the GPS receiver. In the status bar, information about communication, UTC time, Operating Time, used Protocol (NMEA or SiRF), used file, etc. is shown.




- **Button Function:** more detailed information about each button in the tool bars can be obtained by holding the mouse cursor over the button for a few seconds. A Tool Tip message will appear near the Icon with additional information and in the Status Display much more detailed information will be given.
- **Status Display:** display the current action or the function of a button if the mouse cursor is over the button

- **Communication Information:** shows which COM-port is in use and the appropriate baudrate

  Color-Coding of this icon: 
  - Green: data is received
  - Dark Green: data is not received
  - Red: data is received, but errors are detected
  - Dark Red: no data is received and errors have been detected in the past
  - Gray: waiting for first data
- **File in use:** as soon as a file is used (this file must first be opened) the name of the file will be displayed (xxxxxx.ubx)
- **Protocol Information:** This box indicates the current message set that is being used to communicate with the GPS receiver. This is the NMEA-0183 standard or the SiRF binary protocol, which exchanges more extensive information with the receiver. µ-Center can handle both protocols.
- **Operating Time:** Let you know the operating time since you started µ-Center
- **UTC Time:** the current time transmitted by the GPS receiver
- **Low Power Mode:** As soon as the GPS receiver is set in the low power mode the LED displays the status of the low power state (only applicable for low-power capable GPS receivers).

  Color-Coding of this icon: 
  - Yellow: Power is on
  - Dark Yellow: Power is off
  - Gray: waiting for first data

## 3.2 The Menu Bar

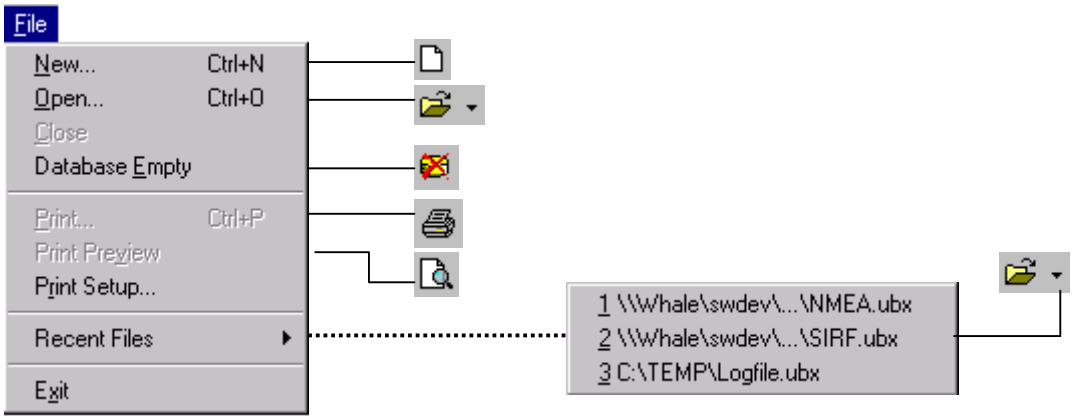
Through the Menu Bar, you can select all functions you need. Instead of navigating though the Menu Bar most functions can be selected directly on a Tool Bar by clicking the corresponding icon.


µ-Center has a total of 7 Menus:
- File Menu
- Edit Menu
- View Menu
- Receiver Menu
- Player Menu
- Window Menu
- Help Menu

A Menu is activated by clicking the Mouse Cursor on the wanted Menu name or by pressing the Alt-Key on the Keyboard together with the underlined character in the menu name (e.g. for the Player Menu press Alt+P).

The Menus are explained in the next sections.

# 4 File Menu and Standard Tool Bar


**New...** µ-Center can capture receiver output data into a log file. Log files are named xxxxx.ubx. Select **New...** in the File Menu and give the file a name and select the directory you want to store the log file. The log action must be started in the **Player Menu**: select **Record** and deactivate **Stop**. The logging time is displayed in the field operating time.

**Open...** A stored log file can be chosen to be replayed

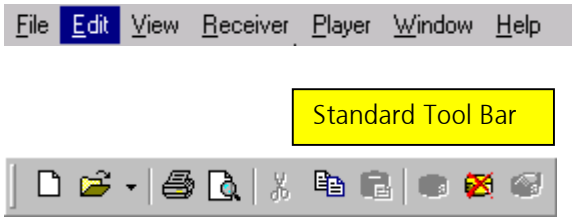
**Close** Closes the log file

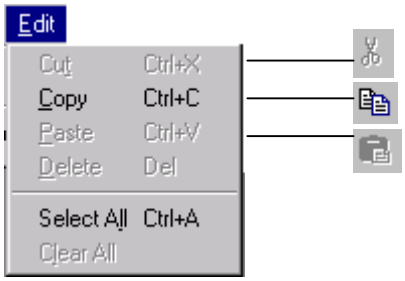
**Database Empty** All stored values are deleted. This function is used in most function located in View Menu (Statistic View, Map View, .)

**Recent Files** Lets you select one of the last used files

**Exit** Terminate µ-Center

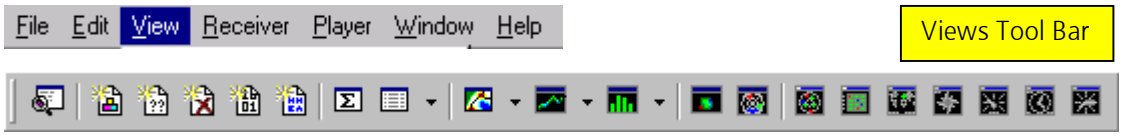
# 5 EDIT MENU AND STANDARD TOOL BAR

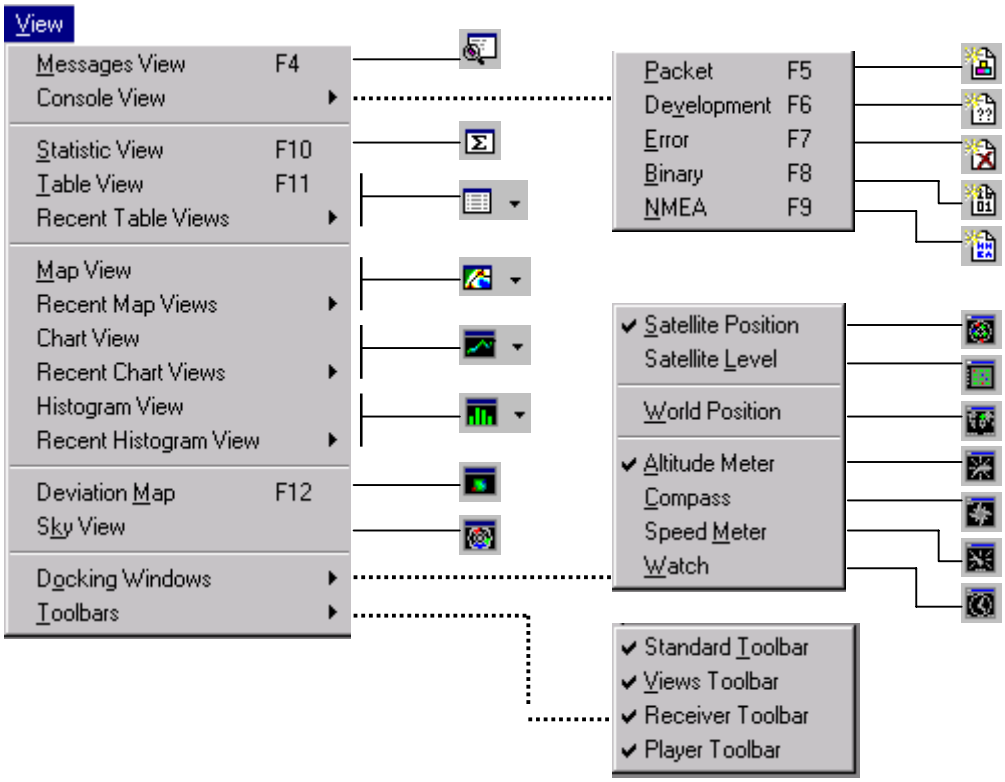



- Same Function as in all Windows-Program

# 6 VIEW MENU AND VIEWS TOOL BAR




## 6.1 View Menu: Messages View (F4)

### 6.1.1 General

In this view all the messages can be observed separately. Following views are possible (the box "**Show tree control**" must checked):

- **SiRF Protocol Input:** SiRF Binary Protocol Messages (commands) can be sent to the GPS receiver. This function can only be achieved, if the GPS receiver is in the SiRF-Protocol Mode. To set the GPS receiver to this mode, read **Section 6.1.2.4**.
- **SiRF Protocol Output:** SiRF Binary Protocol Messages from the GPS receiver can be read (Figure 14, left). This function can only be used, if the GPS receiver is in the SiRF-Protocol Mode. To set the GPS receiver to this mode, read **Section 6.1.2.4**.
- **NMEA Protocol Input:** different NMEA Protocol Message (commands) can be sent to the GPS receiver. This function can only be achieved if the GPS receiver is in the NMEA-Protocol Mode. To set the GPS receiver to this mode, read **Section 6.1.2.4**.

- **NMEA Protocol Output**: all different NMEA Protocol Messages from the GPS receiver can be read (Figure 14, right). This function can only be used if the GPS receiver is in the NMEA-Protocol Mode. To set the GPS receiver to this mode, read **Section 6.1.2.4**.

To get current message values, the box **Update** must be checked

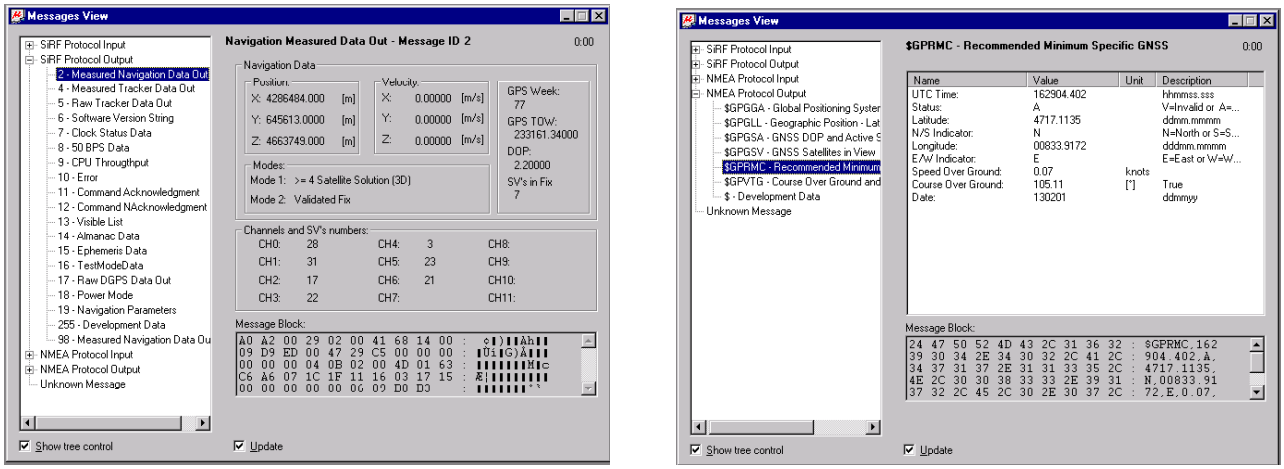



**Figure 14: Reading a SiRF-Protocol (left) or a NMEA-Protocol (right)**

With the Command **Database Empty** in the File Menu or with the Button  , all stored messages are deleted.

The Message Block shows information received from or sent to the GPS receiver in Hexadecimal- and ASCII-Format.
On the right top, the time since the last message was received is shown.
Some time when a command is sent to the receiver, the receiver replies with either an acknowledgement (ACK) that the command was received and executed or a not-acknowledgement (NACK), implying that the command was invalid. These responses are indicated in the upper right corner.

For a detailed description of SiRF-Binary and NMEA protocols, consult our homepage http://www.u-blox.com/ the file "OEM GPS Receiver Manuals: **Protocol Specification Manual**".

### 6.1.2 Using SiRF Protocol Input

#### 6.1.2.1 Introduction

The SiRF Protocol Input Window (Figure 15) is a simple and flexible way to send all possible commands (number 128 to 165) to the GPS receiver.

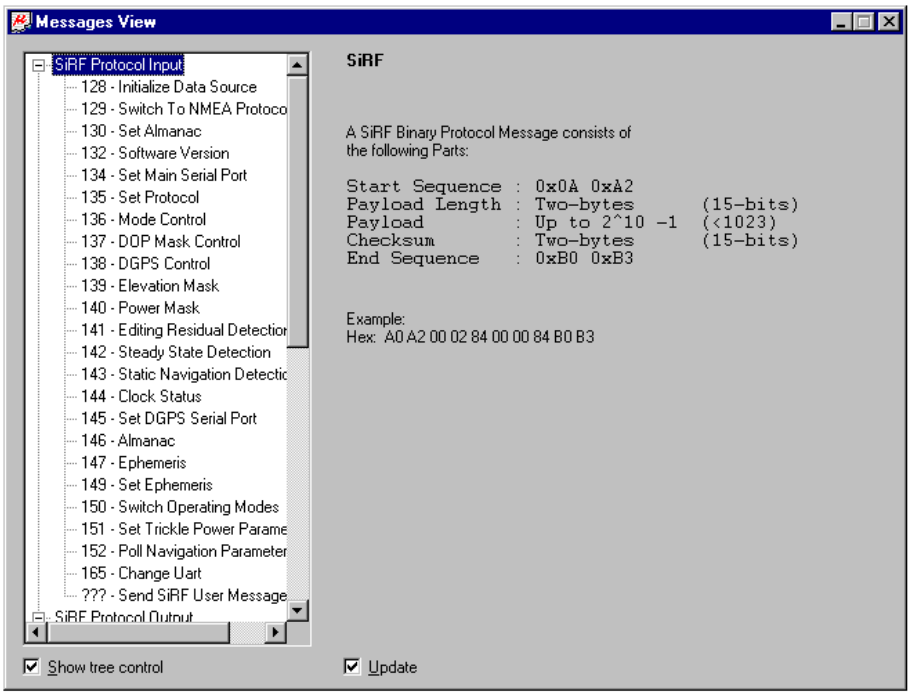



**Figure 15: SiRF Protocol Input Window**

Simply choose the command you wish to send, enter any necessary parameters, and click the button **Send**. A helpful description is provided with each command. Different commands are available for the SiRF message set and the NMEA-0183 message set (Figure 16).

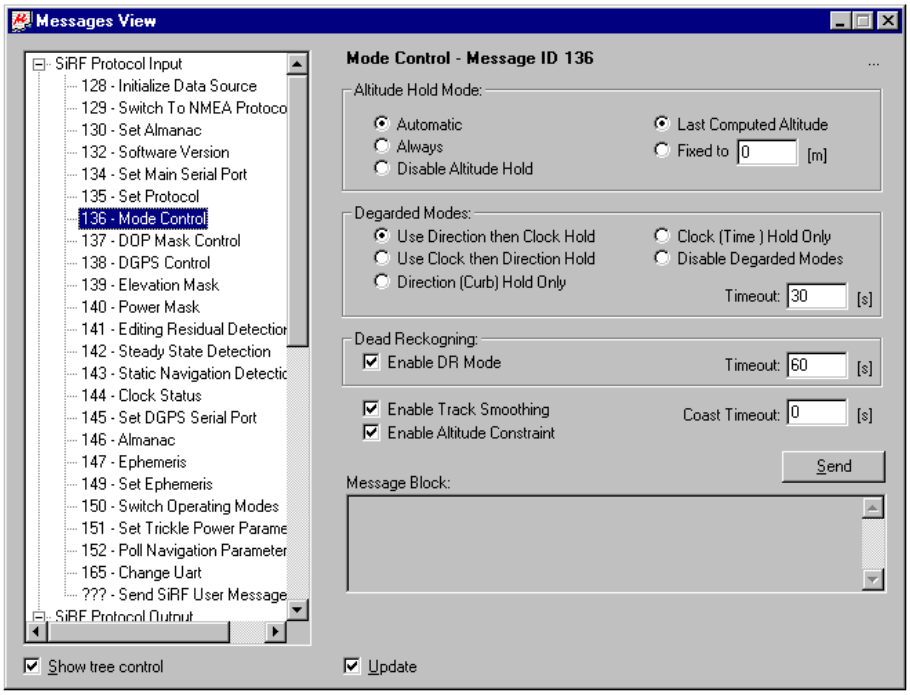



**Figure 16: Command Entry Window**

While using the SiRF binary message set, when a command is sent to the receiver, the receiver replies with either an acknowledgement (ACK) that the command was received and executed (Figure 17), or a not-acknowledgement (NACK), implying that the command was invalid. These responses are indicated in the upper right corner of the message view window.

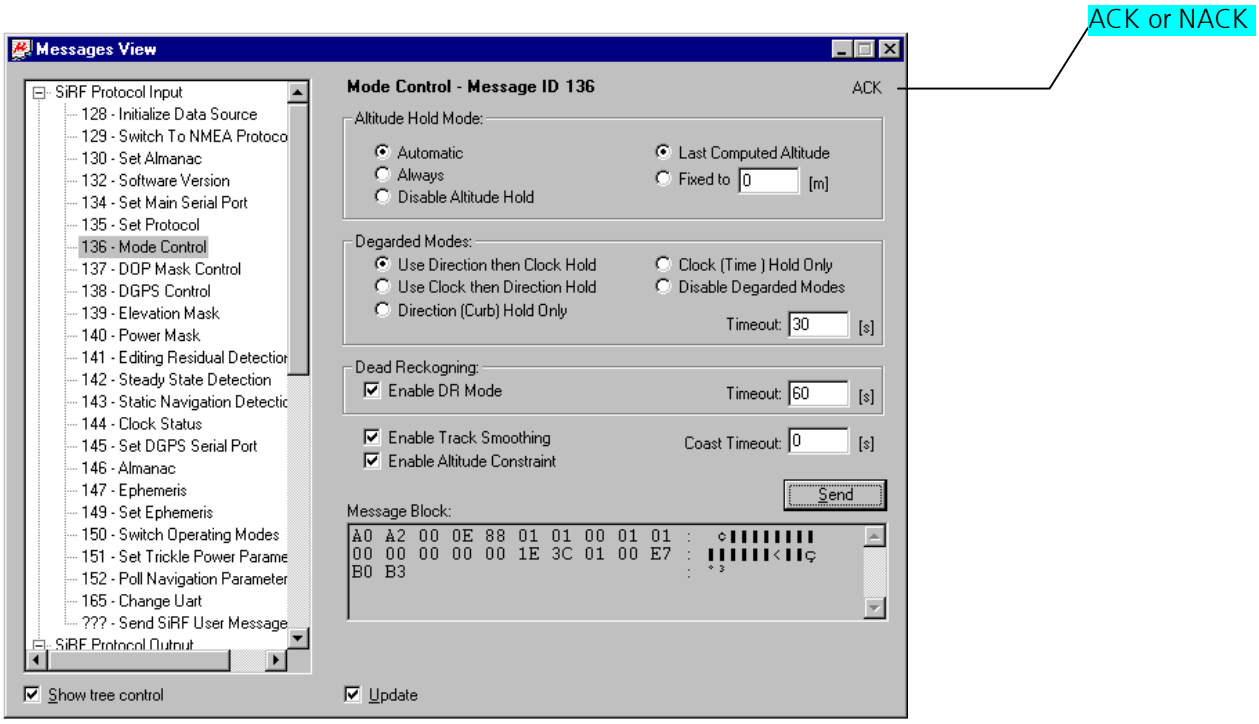



**Figure 17: Successful sent message**

The following commands are available when using the SiRF Message Set:

- **128 - Initialize Data Source:** Resets the receiver using initial position information that is based on the Earth-Centered Earth-Fixed (ECEF) coordinate system.
- **129 - Switch to NMEA Protocol:** Switches the receiver into NMEA mode at the specified baud rate and allows you to set the output rate of the following NMEA messages: GGA, GLL, GSA, GSV, RMC, and VTG.
- **130 - Set Almanac**: Reads almanac data from the specified file (xxxxx.alm) and sends it to the receiver. The input file should contain a complete set of almanac data (32 entries) appended to each other in a binary file. The successful reception of this message will be indicated by ACK.
- **132 - Software Version:** Polls the receiver for its software version.
- **134 - Main Serial Port:** Allows you to set the main serial port (port A) communication settings (Baud Rate, Data Bits, Stop Bit, Parity).
- **135 - Set Protocol:** Sets the serial port protocol to one of the following modes: SiRF, NMEA-0183, ASCII, RTCM, or User1.
- **136 - Mode Control:** Several factors that control the operation of the GPS receiver can be set by using this command. They are: Altitude Hold Mode, Degraded Mode, DR Mode, Enable Altitude Constraint and Enable Track Smoothing
- **137 - DOP Mask Control**: Sets the Dilution of Precision (DOP) mode and the threshold values for GDOP, PDOP, and HDOP.
- **138 - DGPS Control:** This command is used to instruct the receiver to ignore DGPS corrections ("Never"), to output position fixes only when corrections are available ("Exclusive"), or to use corrections whenever they are available ("Auto"). The Time Out parameter sets the acceptable age limit of the DGPS corrections. In exclusive mode, the receiver will not output position fixes if they are based on out of date corrections. When DGPS corrections are out of date in auto mode, the receiver will still continue to output position fixes but they will be without differential corrections.
- **139 - Elevation Mask**: Sets the navigation elevation mask angle. The valid range is from -20 to 90 Degree
- **140 - Power Mask**: Sets the navigation power mask in dBHz. The valid range is from 20 to 50 dBHz
- **141 - Editing Residual Detection**: Sets the editing residual threshold. Enter 0 to disable this feature
- **142 - Steady State Detection**: Sets the threshold for steady state detection. Enter 0 to disable this feature
- **143 - Static Navigation Detection**: Sets the threshold for static navigation. Enter 0 to disable this feature.
- **144 - Clock Status:** Polls the GPS clock status information. GPS week, GPS time of week, estimated GPS time, clock bias, and clock drift.
- **145 - DGPS Serial Port:** Allows you to set the DGPS serial port (port B) communication settings.

- **146 - Almanac**: Requests the receiver to send proprietary almanac data for all of the satellites to the specified file. The data is stored in proprietary format (xxxxxxx.alm).
- **147 - Ephemeris**: Requests the receiver to send its current ephemeris data to the specified file. The data is stored in proprietary format (xxxxx.eph). You may request ephemeris data from a single satellite by choosing its number in the SV ID parameter box or from all satellites.
- **149 - Set Ephemeris:** Reads ephemeris data from the proprietary format (xxxx.eph) and sends it to the receiver. The successful reception of this message will be indicated by ACK.
- **150 - Switch Operating Modes**: Sets the receiver into test mode for the length of time specified. The number of the satellite to be tracked must also be specified.
- **151 - Trickle Power**: Sets parameters for those GPS receivers supporting trickle power mode (See 6.1.2.3 Example 2: Trickle Power Mode).
- **152 - Poll Navigation Parameters**: Sending this command will result in a window appearing that displays the current settings of various receiver parameters. This window is a snapshot of the state of the receiver parameters at the time the command was issued and is not automatically updated when you change parameter values.
- **165 - Change UART:** Change Ports Properties for all Ports. You can select all available ports for the wanted protocol (SiRF, NMEA, ASCII, RTCM or User1) and the appropriate settings like Baudrate, etc
- **???? - Send SiRF User Message**: freely configurable message.

### 6.1.2.2 Example1: Clock Status

Message 144 is named Clock Status. When you have sent the message you can switch to the response from the GPS receiver by clicking on the Output Message Button (Figure 18).

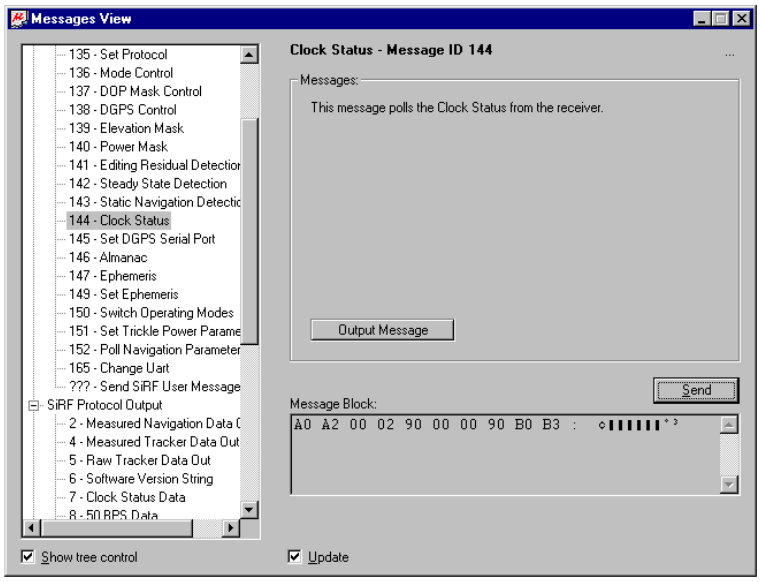



**Figure 18: Message 144 was sent**

SiRF Protocol Output 7, Clock Status Data shows the responses to the message sent in a new window (Figure 19). By clicking the button Poll you can actualize the values.

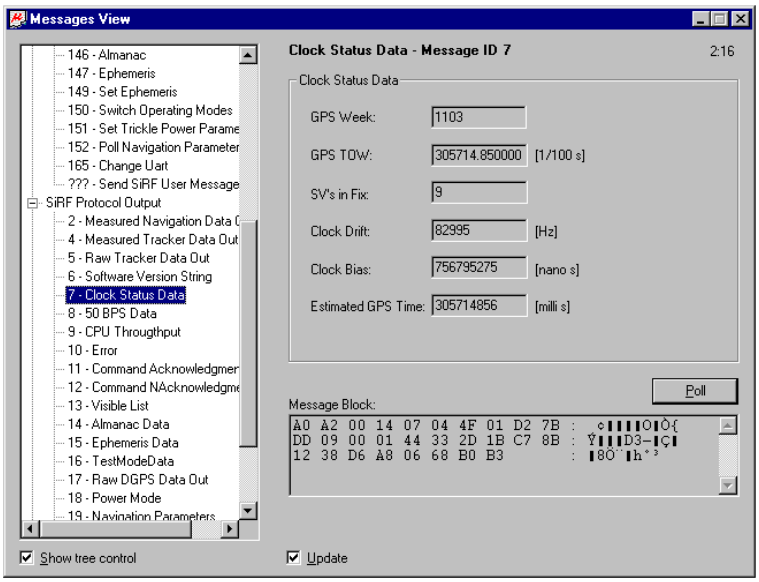



**Figure 19: Clock Status Data**

### 6.1.2.3 Example 2: Trickle Power Mode

Some receivers come equipped with a power saving feature called Trickle Power Mode. When a receiver is placed into Trickle Power mode, it periodically shuts itself off when it does not need to make GPS measurements. With this mode, it is possible to select the amount of time that a receiver spends in the power off state. The Trickle Power window allows the user to place a receiver into Trickle Power mode with different duty cycles. Selecting Message 151 from the SiRF Protocol Input menu opens the Trickle Power window (Figure 20).

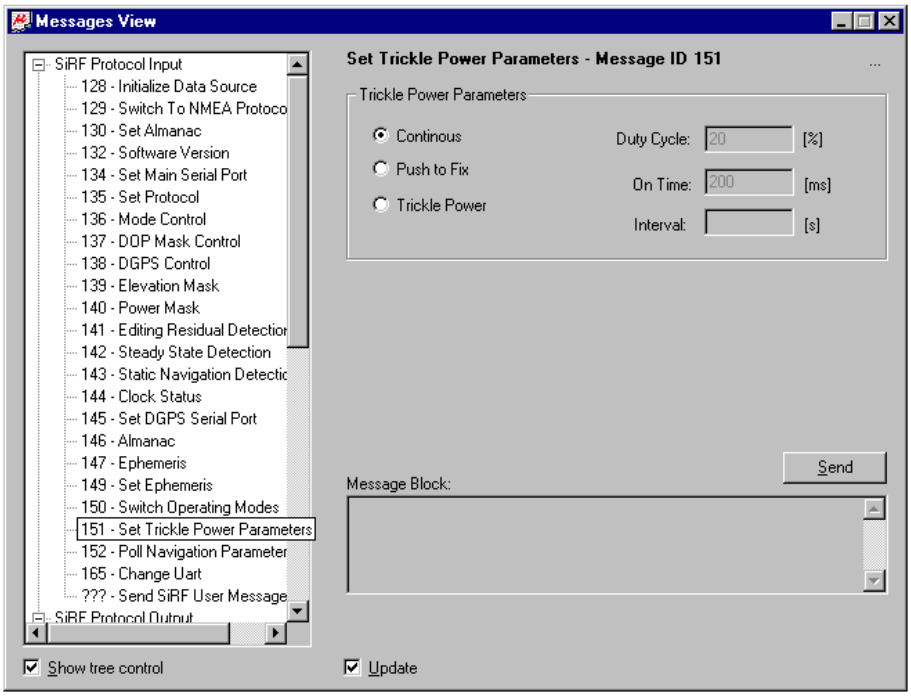



**Figure 20: Set Trickle Power Mode Window**

A duty cycle may be between 1 and 100 percent. The lower the percentage, the longer the receiver spends between measurements with the power off. A 10% duty cycle would set the receiver to take a 200 ms measurement every 2 seconds. A 5% duty cycle would take that measurement every 4 seconds. (Note**:** Duty cycles between 50 and 100 percent automatically put the receiver into continuous mode.)

By checking the Push to Fix mode, a GPS receiver will sleep until the appropriate action is done. Once the action is started it will turn its power on, calculate the navigation fix, and return to the power-saving mode.

To reset a receiver back to its normal operating mode (Continuous Mode), choose the Continuous Radio Button and press the Send button.

For more information about Trickle Mode consult our Homepage: the **Low Power Mode Application Note**

### 6.1.2.4 Setting NMEA- or SiRF-Protocol

In order for the receiver to communicate its information to the PC, it requires a Message Set that both the receiver and the PC will understand. µ-Center understands the SiRF binary message set, developed by SiRF Technologies and the NMEA-0183 standard protocol. You can easily switch between protocols.

- **Switching from SiRF-Protocol to NMEA-Protocol**: Open the list "SiRF Protocol Input" and select the line "129. Switch to NMEA Protocol"(Figure 21, left). Check the wanted messages and if a checksum is used, enter the sending interval of the messages and the needed Baudrate. Pressing the buttons marked **Send** send the command to the receiver that will change the receiver's communication settings for the serial port.
- **Switching from NMEA-Protocol to SiRF-Protocol**: Open the list "NMEA Protocol Input" and select the line "$PSRF100 Set Serial Port"(Figure 21, right). Enter the wished Protocol (SiRF) and the needed Baudrate. Pressing the buttons marked **Send** send the command to the receiver that will change the receiver's communication settings for the serial port

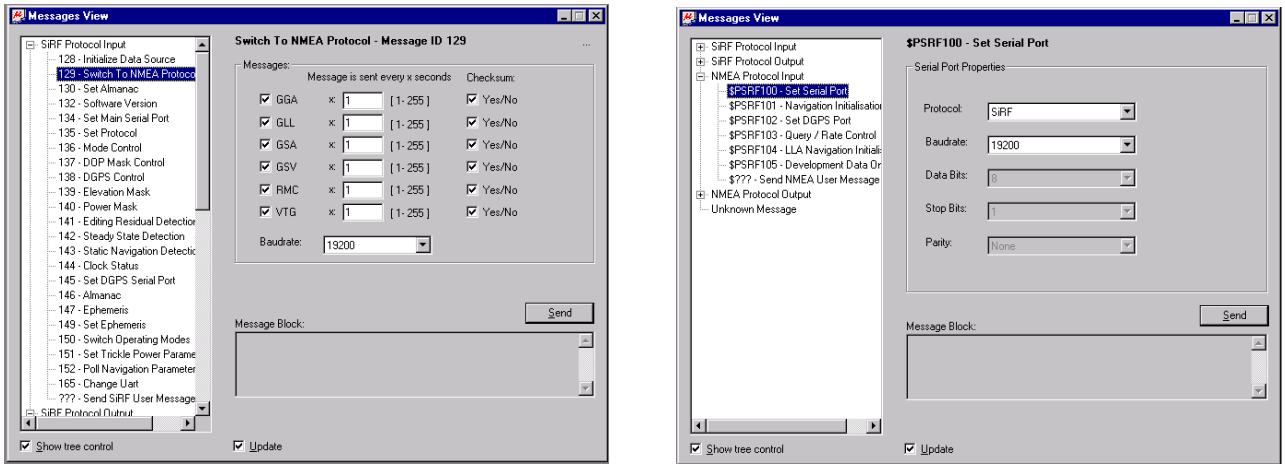



**Figure 21: Switching from SiRF to NMEA (left) or from NMEA to SiRF Protocol (right)**

### 6.1.3 Using NMEA Protocol Input

The following commands are available when using the NMEA message set (Figure 22):

Those command are SiRF specific.

- $PSRF100 – Set Serial Port
- $PSRF101 – Navigation Initialization
- $PSRF102 – Set DGPS Port
- $PSRF103 – Query / Rate Control
- $PSRF104 – LLA Navigation Initialization
- $PSRF105 – Development Data On / Off
- $??? Send NMEA User Message

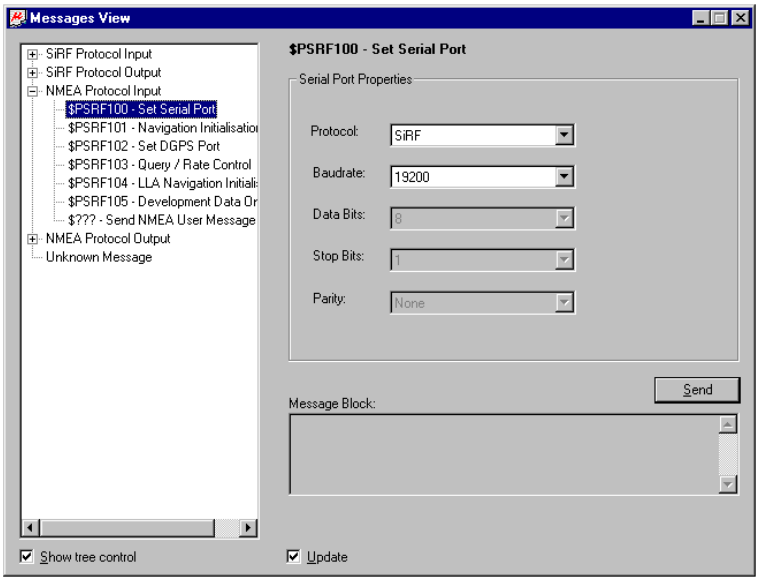



**Figure 22: NMEA Protocol Input**

For detailed description NMEA protocol consult our homepage http://www.u-blox.com/ Document "OEM GPS Receiver Manuals: **Protocol Specification Manual**".

## 6.2 View Menu: Console View

Five different views are possible. The views look different if you use the SiRF-Protocol or the NMEA-Protocol (Figure 23 and Figure 24):

- Packet Console (F5),
- Development Console (F6), only if SiRF Protocol is used
- Error Console (F7), only if SiRF Protocol is used
- Binary Console (F8)
- NMEA Console (F9), only if NMEA Protocol is used

The number of lines is limited to 2000. Under Win9x the number of characters is limited to 30'000 additionally. If the console exceeds those numbers, the oldest items are removed.

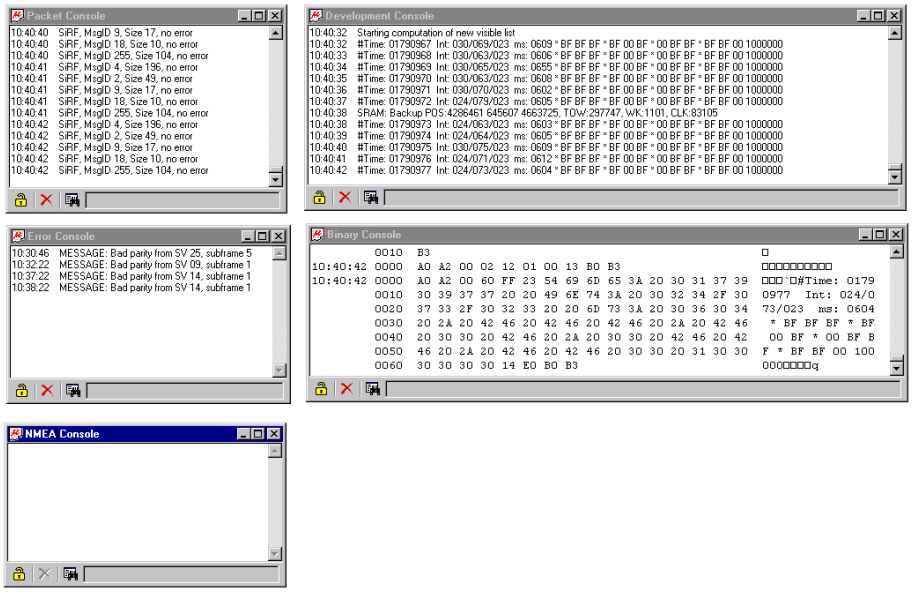



**Figure 23: Console View, using SiRF-Protocol**

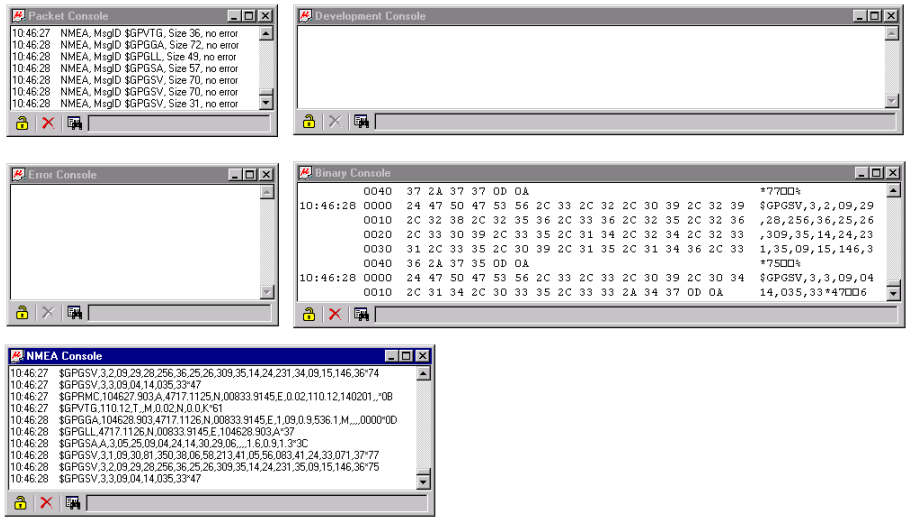
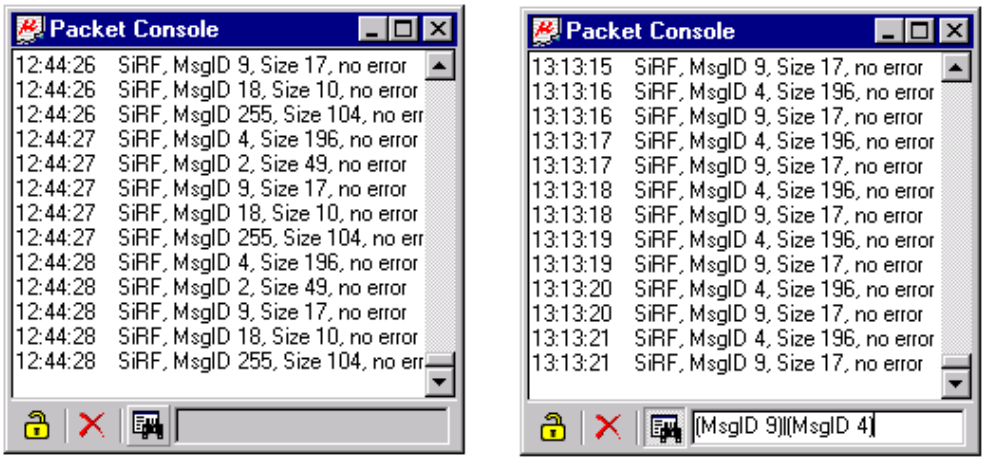



**Figure 24: Console View using NMEA Protocol**

You can lock the view, erase the information or filter the expression (See **Appendix D Regular Expression Evaluation**). In the next example only Message 9 or Message 4 are displayed (right picture).




| Element | Name | Description |
|---|---|---|
|  | Lock | Lock or Update the current displayed messages |
|  | Erase All | Erase all displayed messages |
|  | Filter on/off | Enable or disable the Regular expression filter |
|  | Regular expression filter | Enter the Regular Expression here.<br>See **Appendix D Regular Expression Evaluation** |

**Table 3: Description of the buttons and the display in Console View**

With the Command **Database Empty** in the File Menu or with the Button  , all stored values are deleted.

## 6.3 View Menu: Statistic View (F10)

All available GPS values (transmitted from the GPS receiver or calculated by µ-Center) are displayed. The following relations are displayed:

- Current value
- Minimum value
- Maximum Value
- Average Value
- Standard Deviation

Grey color: the value was not set for the current epoch

Empty field: data is not available

Statistic View

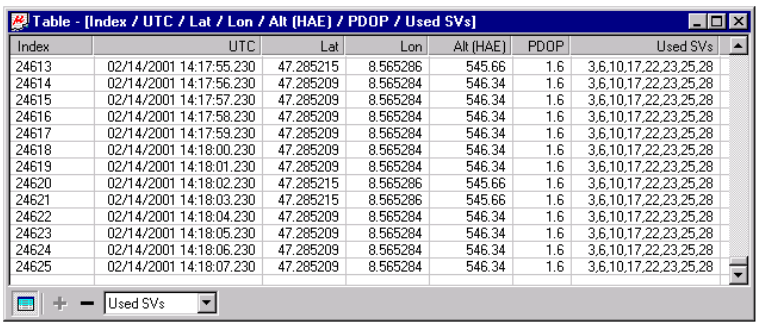
| Title | Count | Current | Minimum | Maximum | Average | Deviation | Unit | Description |
|---|---|---|---|---|---|---|---|---|
| UTC | 23197 | 02/14/2001 13:53:59.309 | 02/14/2001 07:27:24.534 | 02/14/2001 13:53:59.309 | | | time date | Time UTC |
| GPS time | 23197 | 77:309252.309 | 77:286057.534 | 77:309252.309 | | | wno:tow | Time GPS |
| Lat | 23197 | 47.285203 | 47.285178 | 47.285283 | 47.285226 | 0.000023 | ° | Position LTP Latitude |
| Lon | 23197 | 8.565285 | 8.565202 | 8.565323 | 8.565253 | 0.000021 | ° | Position LTP Longitude |
| Alt (HAE) | 23197 | 550.70 | 530.00 | 581.40 | 547.01 | 13.09 | m | Position LTP Altitude (above ellipsoid) |
| Alt (MSL) | 23197 | 502.53 | 481.83 | 533.23 | 498.83 | 13.09 | m | Position LTP Altitude (above mean sea level) |
| X | 23197 | 4286102.52 | 4286096.76 | 4286105.08 | 4286101.08 | 1.55 | m | Position ECEF X |
| Y | 23197 | 645556.00 | 645548.79 | 645558.58 | 645553.30 | 1.52 | m | Position ECEF Y |
| Z | 23197 | 6346918.90 | 6346918.89 | 6346918.93 | 6346918.91 | 1.30 | m | Position ECEF Z |
| VX | 0 | | | | | | m/s | Velocity ECEF X |
| VY | 0 | | | | | | m/s | Velocity ECEF Y |
| VZ | 0 | | | | | | m/s | Velocity ECEF Z |
| VN | 23197 | -0.05 | -0.06 | 0.06 | 0.01 | 0.01 | m/s | Velocity LTP North |
| VE | 23197 | 0.05 | -0.07 | 0.08 | 0.01 | 0.01 | m/s | Velocity LTP East |
| VD | 0 | | | | | | m/s | Velocity LTP Down |
| Speed | 0 | | | | | | m/s | Speed |
| SoG | 23197 | 0.07 | 0.00 | 0.08 | 0.02 | 0.01 | m/s | Speed over Ground |
| CoG | 23197 | 134.01 | 180.04 | 180.00 | 40.10 | 77.53 | ° | Course over Ground |
| HDOP | 23197 | 0.8 | 0.8 | 2.3 | 1.1 | 0.2 | | DOP Horizontal |
| VDOP | 23197 | 1.3 | 1.1 | 3.2 | 1.7 | 0.4 | | DOP Vertical |
| GDOP | 0 | | | | | | | DOP Geometric |
| TDOP | 0 | | | | | | | DOP Time |
| PDOP | 23197 | 1.6 | 1.4 | 3.9 | 2.0 | 0.4 | | DOP Position |

**Figure 25: Statistic View**

With the Command **Database Empty** in the File Menu or with the Button  , all stored values are deleted.

## 6.4 View Menu: Table View (F11) and Recent Table View

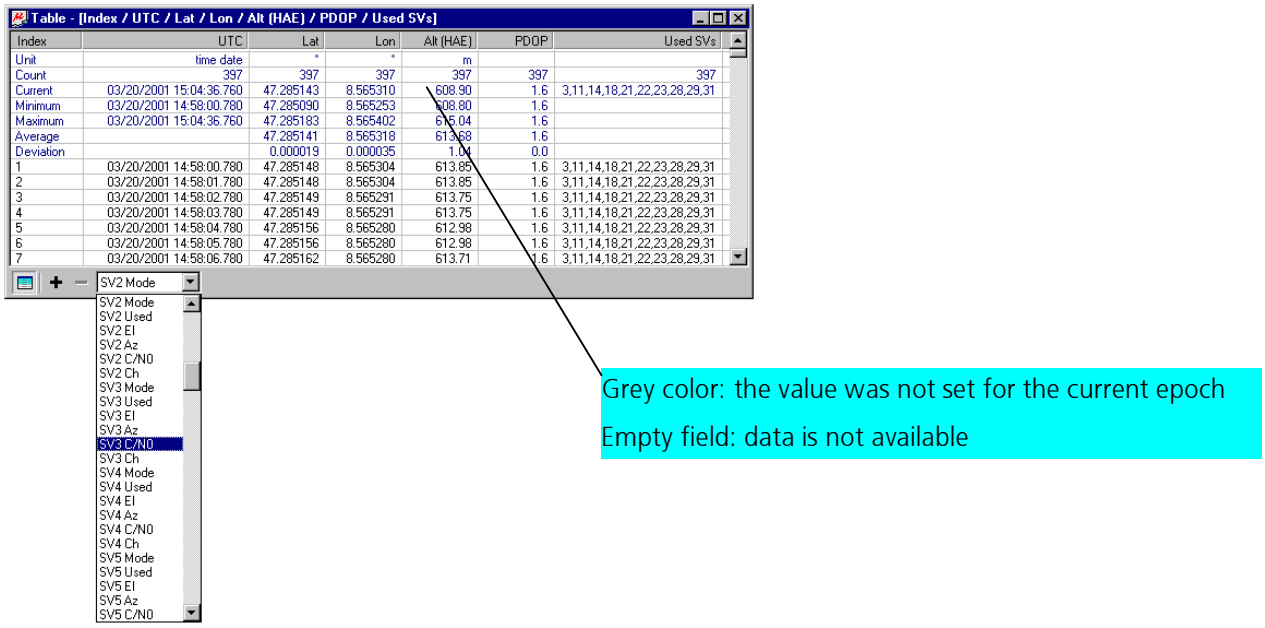
All values from the database can be displayed in a tabular form (Figure 26).




| Index | UTC | Lat | Lon | Alt (HAE) | PDOP | Used SVs |
|---|---|---|---|---|---|---|
| 24613 | 02/14/2001 14:17:55.230 | 47.285215 | 8.565286 | 545.66 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24614 | 02/14/2001 14:17:56.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24615 | 02/14/2001 14:17:57.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24616 | 02/14/2001 14:17:58.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24617 | 02/14/2001 14:17:59.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24618 | 02/14/2001 14:18:00.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24619 | 02/14/2001 14:18:01.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24620 | 02/14/2001 14:18:02.230 | 47.285215 | 8.565286 | 545.66 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24621 | 02/14/2001 14:18:03.230 | 47.285215 | 8.565286 | 545.66 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24622 | 02/14/2001 14:18:04.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24623 | 02/14/2001 14:18:05.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24624 | 02/14/2001 14:18:06.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |
| 24625 | 02/14/2001 14:18:07.230 | 47.285209 | 8.565284 | 546.34 | 1.6 | 3,6,10,17,22,23,25,28 |

**Figure 26: Table View**

To add a new column, first select the desired value (Figure 27) and click the **+** Button. To remove a displayed value, click the **–** Button. To see the Table header click the  Button.




| Index | UTC | Lat | Lon | Alt (HAE) | PDOP | Used SVs |
|---|---|---|---|---|---|---|
| Unit | time date | ° | ° | m | | |
| Count | 397 | 397 | 397 | 397 | 397 | 397 |
| Current | 03/20/2001 15:04:36.760 | 47.285143 | 8.565310 | 608.90 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| Minimum | 03/20/2001 14:58:00.780 | 47.285090 | 8.565253 | 608.80 | 1.6 | |
| Maximum | 03/20/2001 15:04:36.760 | 47.285183 | 8.565402 | 615.04 | 1.6 | |
| Average | | 47.285141 | 8.565318 | 613.68 | 1.6 | |
| Deviation | | 0.000019 | 0.000035 | 1.04 | 0.0 | |
| 1 | 03/20/2001 14:58:00.780 | 47.285148 | 8.565304 | 613.85 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 2 | 03/20/2001 14:58:01.780 | 47.285148 | 8.565304 | 613.85 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 3 | 03/20/2001 14:58:02.780 | 47.285149 | 8.565291 | 613.75 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 4 | 03/20/2001 14:58:03.780 | 47.285149 | 8.565291 | 613.75 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 5 | 03/20/2001 14:58:04.780 | 47.285156 | 8.565280 | 612.98 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 6 | 03/20/2001 14:58:05.780 | 47.285156 | 8.565280 | 612.98 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |
| 7 | 03/20/2001 14:58:06.780 | 47.285162 | 8.565280 | 613.71 | 1.6 | 3,11,14,18,21,22,23,28,29,31 |

**Figure 27: Selecting a new value**

With the function **Recent Table View** one of the last 8 used tables can be selected (Figure 28) and displayed.

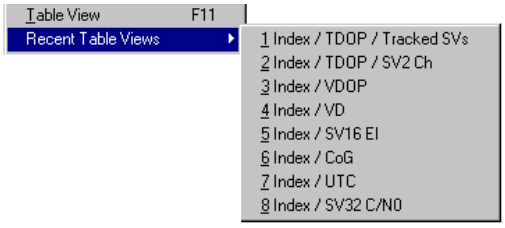



**Figure 28: Recently used tables**

With the Command **Database Empty** in the File Menu or with the Button  , all stored values are deleted.

## 6.5 View Menu: Map View and Recent Map View

### 6.5.1 Introduction

Before you can use a map and display position (Figure 29) and route, you need to calibrate the map (see **Appendix C Map Calibration**).

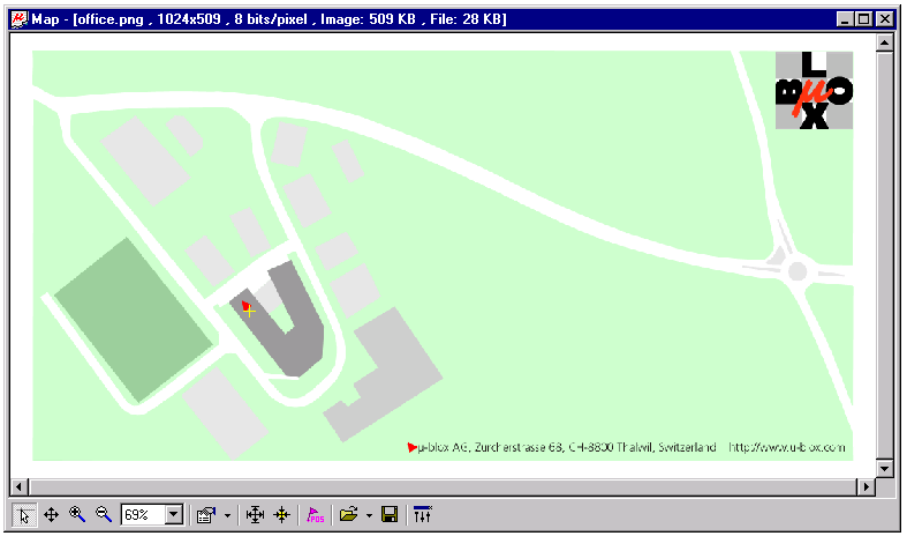
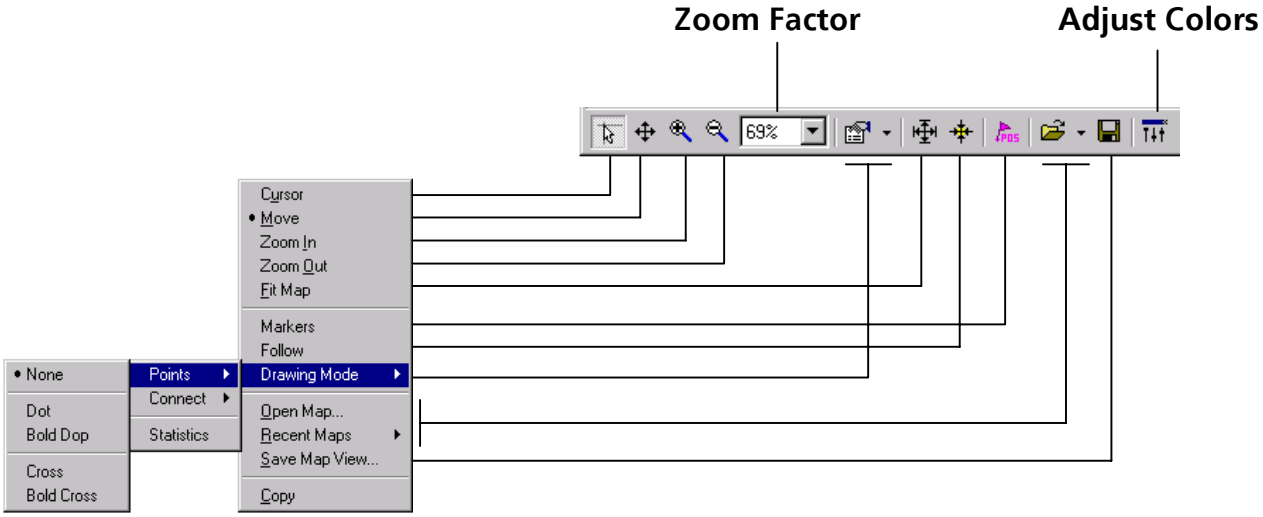



**Figure 29: Displaying a position**

### 6.5.2 Using Map View

You can access the view specific commands in two different ways:

- Using the command in the Tool Bar 
- Holding the mouse arrow inside the map window and pressing the right mouse button will. This will open a context menu:



| Element | Name | Description |
|---|---|---|
|  | Cursor | The position of the cursor is shown on the lower left edge of the µ-Center screen (Longitude, Latitude and Pixel-Position). By holding the left mouse button and moving the cursor over the map you can measure distance from one position to another |
|  | Move | The map inside the Map View Window can be moved |
|  | Zoom In | The map is enlarged by selecting a rectangle |
|  | Zoom Out | The size of the Map is decreased |
|   | Zoom Factor | A specific zoom level can be selected by opening the drop down menu |
|  | Drawing Mode | The size and form of the displayed position can be changed in the menu Points, the connection line between the points can be selected in the menu Connect.. If you want to see some statically values (average, minimum, maximum, standard deviation) directly in the map, select the Menu Statistic |
|  | Fit Map | The map size is adjusted to fit the Map Window |
|  | Follow | Center the map on the current GPS position |
|   | Markers | Add or remove the defined markers (see **Appendix B: Map Calibration** to define a marker) |
|  | Open Map and Recent Maps | Load a new Map and display the last 8 used map and one of them can be selected |
|  | Save Map View | The current display can be stored in different formats |
|  | Adjust Colors | Brightness, contrast and color saturation of map can be adjusted by moving the glides |
| | Copy | The screen to the clipboard |

**Table 4: Description of the buttons and displays in Map View**

With the Command **Database Empty** in the File Menu or with the Button  all recent displayed positions and routes are deleted.

To understand the meaning of the colors used in Map View, see **section 2.1 Color coding scheme**.

### 6.5.3 How to display the value from a stored file

- Select in the **File Menu** (see File Menu and Standard Tool Bar) the menu **Open** or **Recent Files** the file you want display (e.g. my_way.ubx). The file format must correspond to the used protocol (NMEA or SiRF).
- In the **Player Menu** or player Tool Bar  select the menu **Play** or click the button . Deactivate in the **Player Menu** Pause or click the button  .
- Now, the stored positions are displayed (Figure 30).

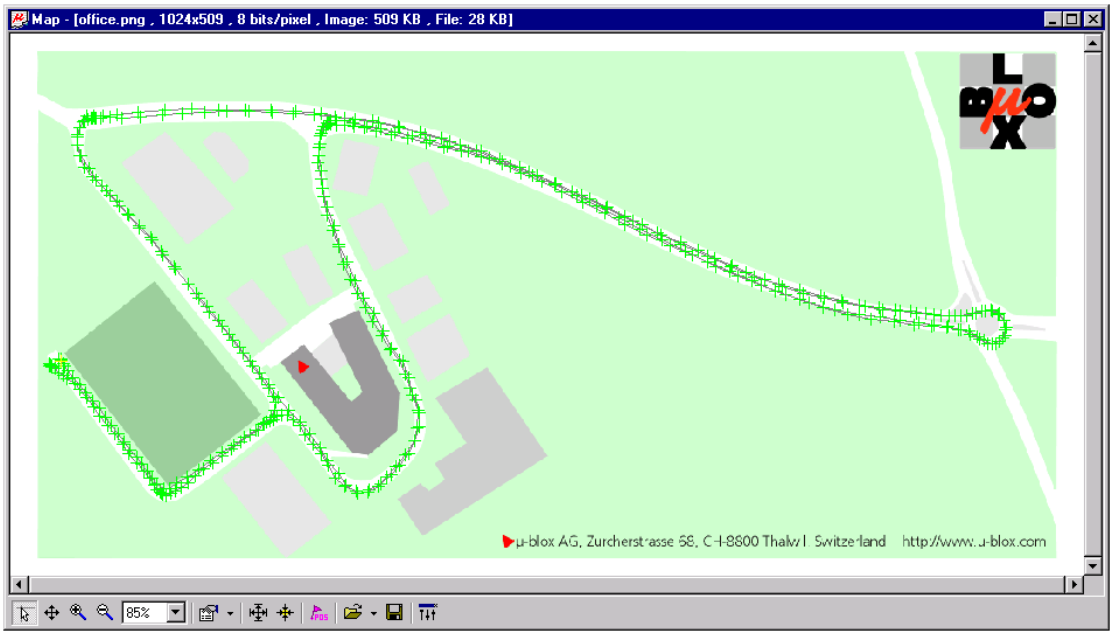



**Figure 30: displaying the content of a file**

## 6.6 View Menu: Chart View and Recent Chart Views

Chart View allows the user to view GPS-Data records in different ways and format and print the entire chart if desired. From this screen, users can view the following elements:

For (Index = 0 to MAX)

- X = Index and Y = Value (Index), see Figure 31
- X = Value (Index) and Y = Index, see Figure 32
- X = Value (Index) and Y = Value (Index), see Figure 33

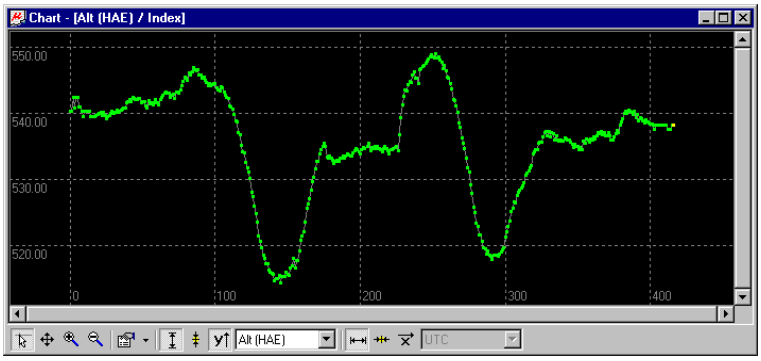



**Figure 31: Altitude as a function of Index (X = Index, Y = Alt)**

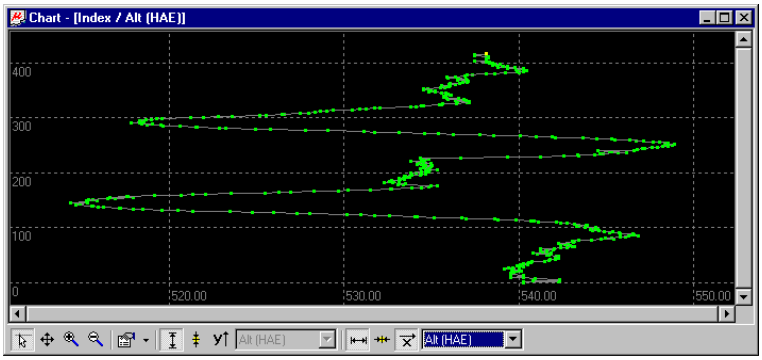



**Figure 32: Index as a function of Altitude (X = Altitude, Y = Index)**

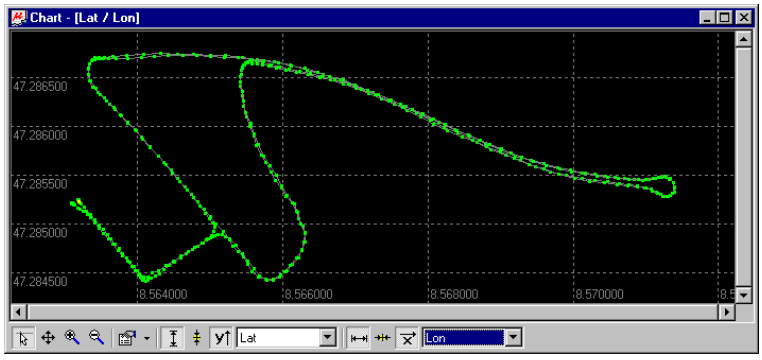



**Figure 33: Latitude as a function of Longitude (X =Longitude, Y = Latitude)**

| Element | Name | Description |
|---|---|---|
|  | Cursor | The cursor position is shown in the lower left edge of the µ-Center windows. Click the right button mouse and hold the button down to measure differences. |
|  | Move | The chart is moved inside the Chart View Window. Click and Drag/Drop the Chart. |
|  | Zoom In | Drawing a rectangle enlarges the chart to the new view. To zoom in the Chart 2x click on the chart |
|  | Zoom Out | Drawing a rectangle decreases the chart to the new view. To zoom out the Chart 2x click on the chart |
|  | Drawing Mode | The size and form of the displayed values can be changed in the menu Points, the connection line between the values can be selected in the menu Connect. For viewing the statically values (average, minimum, maximum, standard deviation) directly in the chart select the Statistics Menu |
|  | Fit Y | Fit the Y Range |
|  | Follow Y | Follow the most current Y-Value (the most current Y-value is always in the middle of the chart) |
|  | Index or Y Value | Switch between the Index and the Y Value |
|   | Y Value | Select the Y Value to be displayed |
|  | Fit X | Fit the X Range |
|  | Follow X | Follow the most current X-Value (the most current X-Value is always in the middle of the chart) |
|  | Index or X Value | Switch between the Index and the X Value |
|   | X Value | Select the X Value to be displayed |

**Table 5: Description of the buttons and displays in Chart View**

To understand the meaning of the color used in Chart View see **section 2.1 Color coding scheme**.

## 6.7 View Menu: Histogram View and Recent Histogram Views

Histogram Views allow the user to view GPS-Data and probability distributions (Figure 34) and print the entire histogram if desired. The number of bins (storage container) is user-defined.

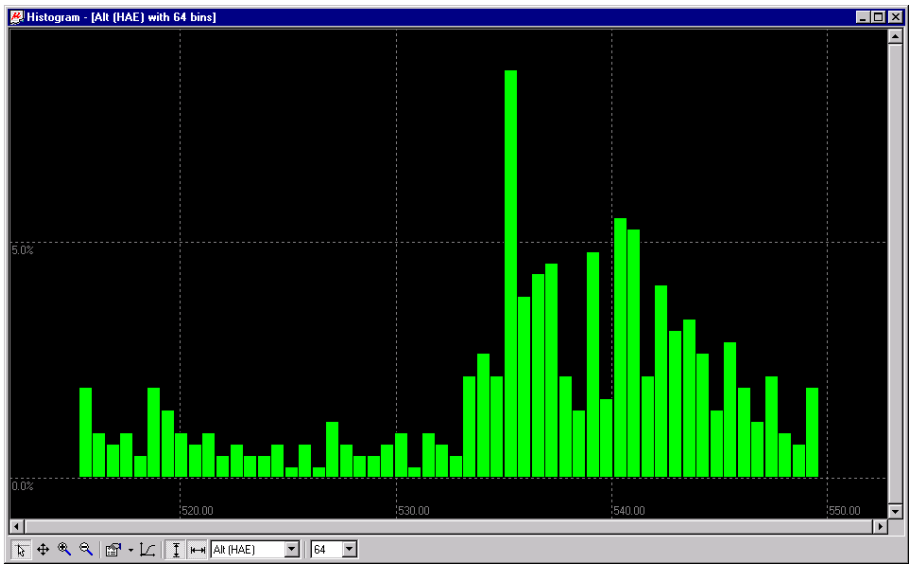



**Figure 34: Altitude Histogram View**

| Element | Name | Description |
|---|---|---|
|  | Cursor | The cursor position is shown in the lower left edge of the µ-Center windows. Click the right button mouse and hold the button down to measure differences. |
|  | Move | The Histogram is moved inside the Histogram View Window. Click and Drag/Drop the Histogram. |
|  | Zoom In | Drawing a rectangle enlarges the Histogram to the new view. To zoom in the Histogram 2x click on the Histogram |
|  | Zoom Out | Drawing a rectangle decreases the Histogram to the new view. To zoom out the Histogram 2x click on the Histogram |
|  | Drawing Mode | The size and form of the displayed values can be changed in the menu Points. The connection line between the values can be selected in the menu Connect. For viewing the statically values (average, minimum, maximum, standard deviation) directly in the Histogram select the Statistics Menu |
|  | Probability | Display the probability Histogram (Figure 35) |
|  | Fit Probability | Fit the Probability Range |
|  | Fit X | Fit the X Range |

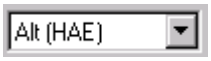
| Element | Name | Description |
|---|---|---|
|  | Y Value | Select the Y Value to be displayed |
|  | Bins | The number of Bins |

**Table 6: Description of the buttons and displays in Histogram View**

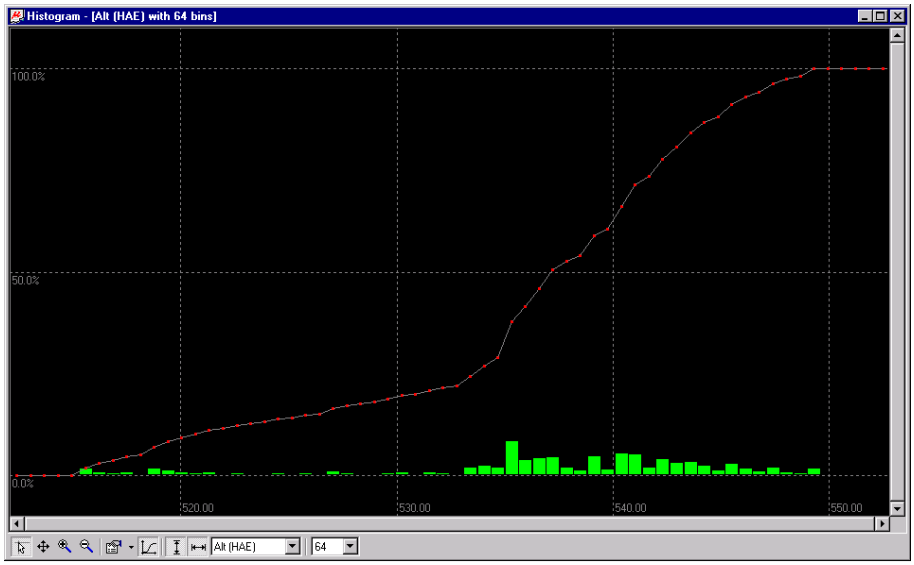
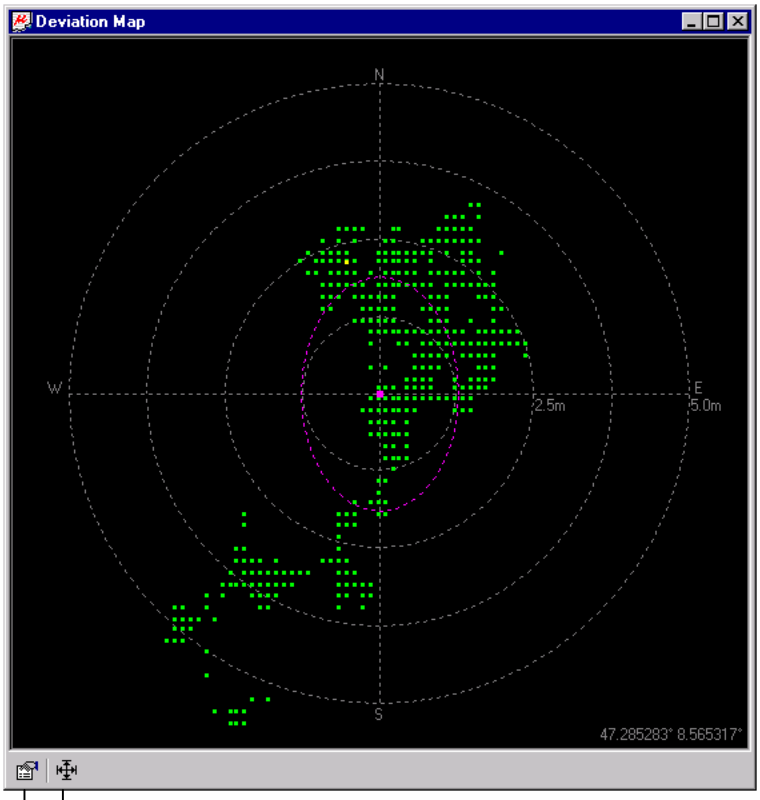



**Figure 35: Probability Chart**

The number of displayed epochs is limited to 1800. To overcome this value consult **Appendix B Database Limitation**.

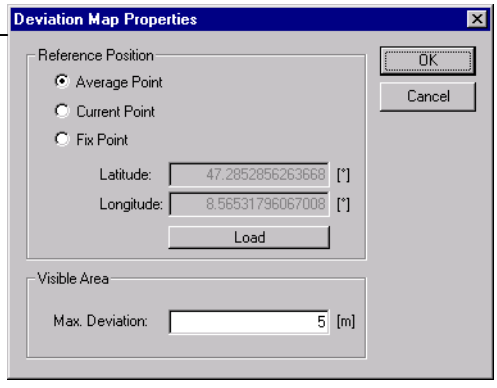
## 6.8 View Menu: Deviation Map (F12)

The Deviation Map shows Longitude and Latitude relative to a defined reference position. Standard Deviation (X-Axes is West/East and Y-Axes is South/North direction) is displayed by a purple ellipse. To understand the meaning of the used color in this Map see 2.1 Color coding scheme.




**Fit:** Fit the scale

**Properties:**




In the Deviation Map Properties, the Reference Position can be set to any of the following three settings:

- The map center is the average of all previously measured positions
- The map center is the currently measured position

- The map center is set to a fix latitude and longitude

The outer circle radius of the Deviation Map can be chosen in the Visible Area Field.

The number of displayed epochs is limited to 1800. To overcome this value, consult **Appendix B Database Limitation**.

## 6.9 View Menu: Sky View

The polar plot graphically displays the position of satellites in the sky (Figure 36), identifies satellites by number, indicates which satellites are being used in the receiver calculation (see 2.1 Color coding scheme), and displays relative satellite signal strength. There are 9 concentric circles (10 degrees steps) representing elevations above the horizon. The outermost circle represents 0 degrees above the horizon. The smallest circle represents 80 degrees above the horizon. The center of the circle represents 90 degrees above the horizon. The line at the top of the circle indicates north with west pointing to the left.

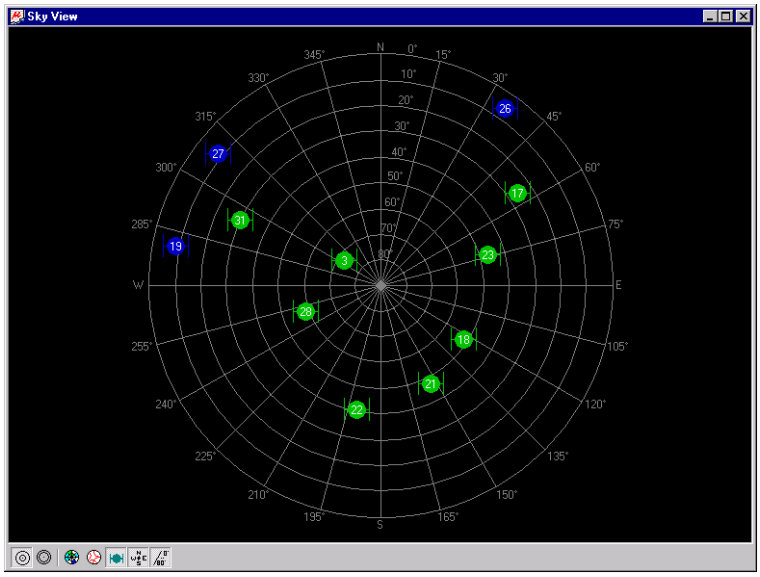



**Figure 36: Sky View**

| Element | Name | Description |
|---|---|---|
|  | Linear | Selects a linear projection of the Sky View |
|  | Sinus | Selects a sinusoidal Projection of the Sky View |
|  | CNO | Display the Carrier to Noise Ratio in dBHz, visualizing the antenna gain and horizon obstruction |

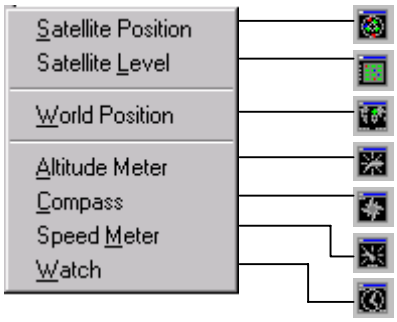
| Color | | Meaning |
|---|---|---|
| +55 | Green | + 55dBHz: High level |
| +40 | Cyan | +40dBHz |
| +25 | Blue | +25dBHz: Low Level |

| Element | Name | Description |
|---|---|---|
|  | Orbits | Display the satellites orbits |
|  | SVs | Display the Satellite Vehicle with the appropriate PRN |
|  | Coord | Display the value of the Sky coordinates on the polar plot |
|  | Elevation | Display on the Map the value of the Elevation |

**Table 7: Description of the buttons in Sky View**

## 6.10 View Menu: Docking Windows

The Docking Windows provide real-time graphic displays of selected current values. These are the most commonly used windows for µ-Center users. To open these windows, select ***Docking Windows*** from the ***View*** menu, or simply click on the icons on the View tool bar.




Seven different panes can be displayed: satellite and signal strength information, position on a world map and 4 analog dials.
The analog dials and digital displays provide information on the following:
- Speed Meter (horizontal speed)
- Compass (course) over ground
- Altitude Meter
- Time (UTC)

The windows can be resized, closed or moved anywhere on the screen.

To understand the meaning of the used color in the Docking Windows: Satellite Position, Satellite Level and World Position, see **Section 2.1 Color coding scheme**.

**Satellite Position**

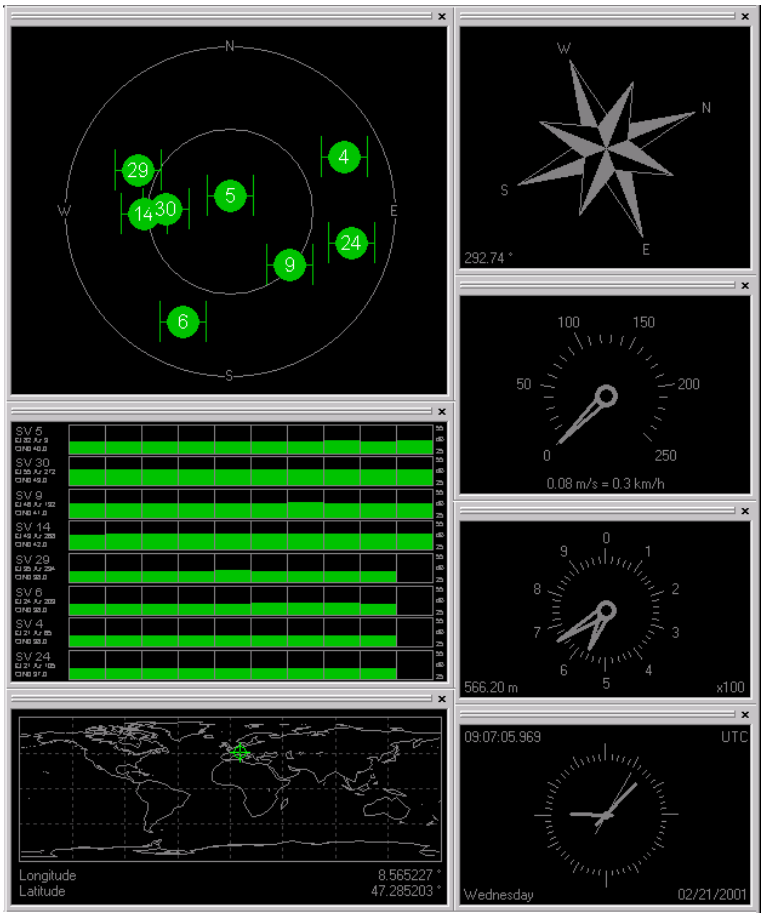
Displays the position of satellites in the sky

**Satellite Level**

Displays Elevation, Azimuth and C/NO (dBHz) for SVs

**World Position**

Displays the current Position on a world map




**Compass**

Displays the current course over ground

**Speed Meter**

Displays the current speed

**Altitude Meter**

Displays the current altitude

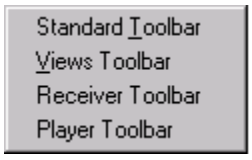
**Watch**

Displays the date and the current UTC-Time

**Figure 37: The seven docked Windows**

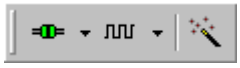
## 6.11 View Menu: Toolbars

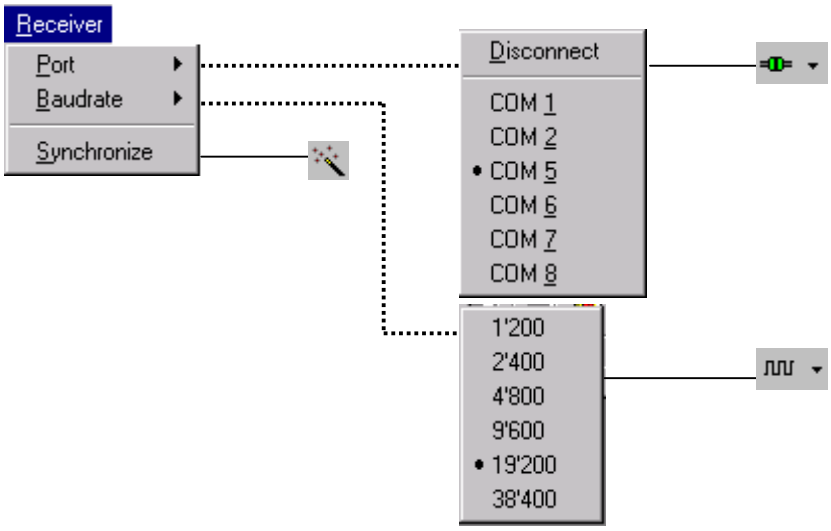
The toolbars can be switched on or off on the main screen



# 7 RECEIVER MENU AND RECEIVER TOOLBAR


Receiver Toolbar



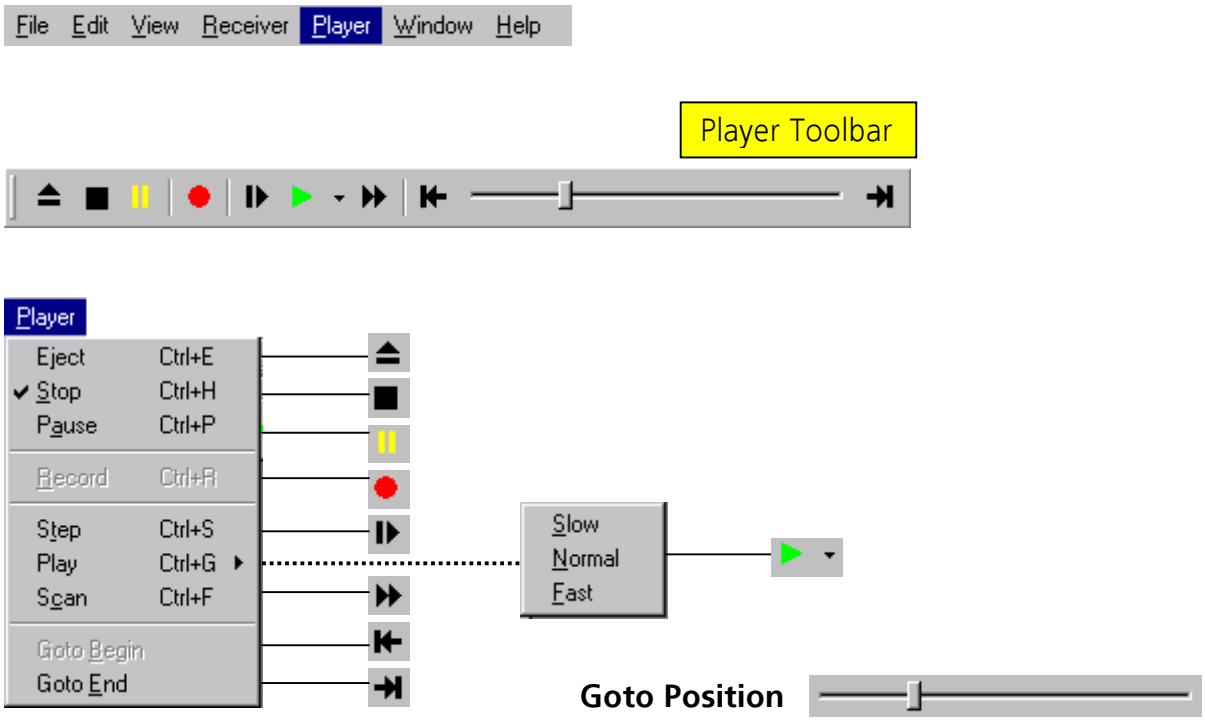



In order to communicate with a GPS receiver, µ-Center must have the correct Communications Port settings. µ-Center tries to automatically set these settings for you by clicking Synchronize. Only the COM Ports that are available on your computer will show up in the COM Port drop down list. If a COM Port is grayed out, then another program in the computer is using it.

The SiRF binary protocol uses 19200 Baud as its standard. The NMEA-0183 standard uses a nominal speed of 4800 Baud.

In **section 1.4.1 Auto Synchronize COM-Port and baudrate** and **section 1.4.2 Manual setting of COM-Port and baudrate** the use of those settings are explained.

# 8 PLAYER MENU AND PLAYER TOOLBAR




The primary function of the Player is to display previously recorded GPS data from a file. To record a log file read **section 4 File Menu and Standard Tool Bar** the explanations to **Open…**

Using the player controls, you can step through, or play in sequence, all the message that are read from the log file. The series of buttons in the player toolbar can be used to navigate through the log file.

The records will be displayed on the navigation display window, just as the live GPS data is displayed when the µ-Center is using a standard message set. The current file that is being displayed is shown in the box "File in use".

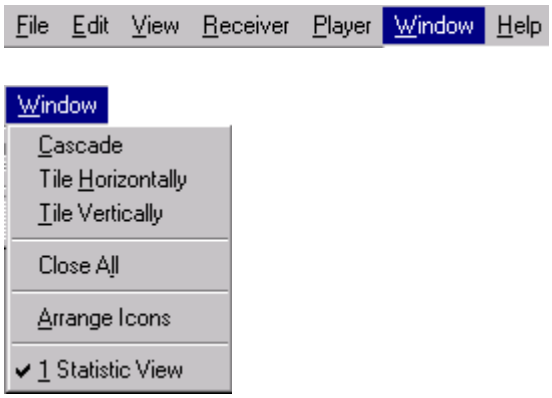
The functions of the player buttons and sliders are as follows:

| Element | Name | Description |
|---|---|---|
| ⏏ | Eject | Close the active log file (same as in the File Menu |
| ■ | Stop | Stops to display or to record a file |
| ⏸ | Pause | Pauses the display or recording to a log file |
| ● | Record | Start to record to new log file (see **section 4 File Menu and Standard Tool Bar** the explanation to New….) |

| Element | Name | Description |
|---|---|---|
|  | Step | The next message is read |
|  | Play | Starts to display a log file. You can select the speed (slow, normal or fast) of the action. After each message the display is updated if needed |
|  | Scan | Reads the entire log file into the database and updates the display at the end of the scan period |
|  | Go to Begin | Set the read path to the begin of the log file |
|  | Go to End | Go to the end of the log file |
|  | Go to Position | This slider bar is used to shuttle back and forth through the history log. Pulling the slider to the right will fast-forward the playback, and pulling it to the left will rewind the playback |

**Table 8: Description of the buttons and the slider in the Player Toolbar**

# 9 WINDOW MENU




Standard Windows-Program behavior.

# 10 HELP MENU



Standard Windows-Program behavior.

# Appendix A RELATED DOCUMENTS

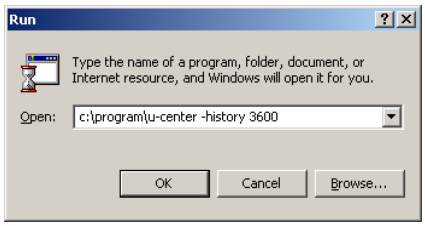
- GPS-MS1E/GPS-PS1E Protocol Specification
- GPSMS1E Datasheet
- GPS-MS1E/GPS-PS1E Trickle Power Mode

All these documents are available on our homepage (http://www.u-blox.com).

# Appendix B DATABASE LIMITATION

Whenever when values are displayed or analyzed, there is a limitation in the number of values. The limitation is set to 1800 epochs by default That means if an epoch is available every second you can analyze data for as much as 30 minutes. After this time the oldest values are discarded.

If you would like to increase the analyzing time above 1800 epochs or 30 minutes, you can choose that when you start the program. In the Windows Start Menu, go to Run… and start µ-Center directly in the Run-Window. You have to add the following argument to the command line: **-history nnnn** where nnnn is the number of epochs. For a total of 3600 epochs (or 1h if you update rate is 1Hz) the Window should be similar to the following screen:




If you use a high value of epochs, the display in real-time can not be guaranteed, especially when many complex windows are opened.

For long-term observations, we recommend to record a log file before analysis.

# Appendix C MAP CALIBRATION

To create your own map you will need a digitized map with orthogonal projection in one of the following pixel graphics formats.

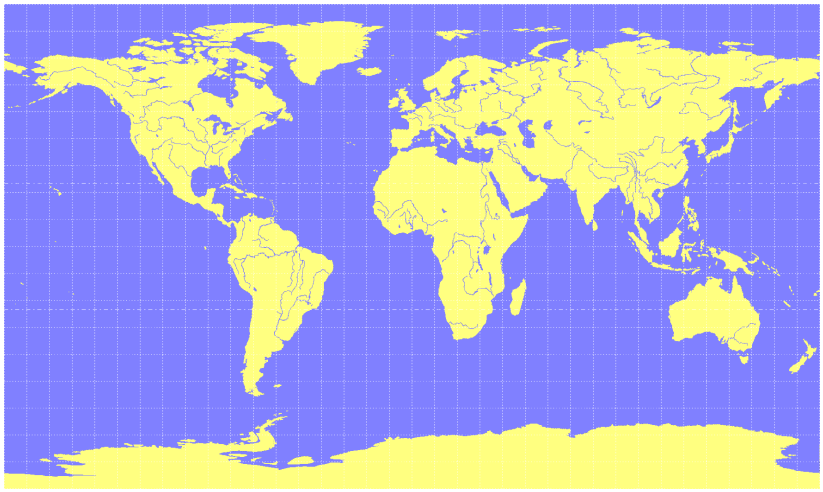
| | |
|---|---|
| **png** | Portable Network Graphics, |
| **bmp** | Windows Bitmap |
| **dib** | Device Independent Bitmap |
| **jpg/jpeg** | Jpeg File Interchange Format |
| **pcx** | PC paintbrush |
| **tif** | Tag Image File Format |

If your map is not in one of the above formats, you can simply convert it in one of the supported formats by a third party program. µ-blox provides two sample maps. office.png is a small map of our headquarters surrounding. world.png is a map of the whole world but with limited resolution.

To use a map in µ-Center, three calibration points are needed. For these points you have to know the pixel coordinates and the according WGS84 coordinates in the latitude/longitude format in degrees (longitude: -180.0 to 180.0, latitude: -90.0 to 90.0). These points are stored in the map calibration file. The calibration file must be stored at the same location as the bitmap itself. It has the same name but a different extension (.mcf). The Format of the calibration file is very simple and can be edited in a simple editor like notepad.

**Examples:**

As an example we will have a closer look at the provided map world.png and its calibration file world.mcf.



**Digital Map File: world.png**

The Map has 1765 Pixels (0 to 1764) in the horizontal and 1046 Pixels (0 to 1045) in the vertical direction. The origin is the upper left corner. To calibrate this map we will use the following three calibration points (#1 to #3).

| | | Pixel | | WGS84 Coordinate | |
|---|---|---|---|---|---|
| Reference Point | # | X | Y | Latitude | Longitude |
| Upper Left Corner | 1 | 0 | 0 | -180.0 | 90.0 |
| Lower Right Corner | 2 | 1764 | 1045 | 180.0 | -90.0 |
| Upper Right Corner | 3 | 1764 | 0 | 180.0 | 90.0 |

To determine the exact pixel position you can use Microsoft Paint (mspaint.exe) or any other pixel-editing program.

The calibration file is a plain ASCII text file. The file may contain comments. The file consists of two sections, which start with keywords encapsulated in braces.

The REFERENCE section, which is mandatory, contains the three points used to calibrate a map. Each reference point is on a single line and has the following syntax:

"# = <x>, <y>, <lon>, <lat>"

where # is the index of the reference point <x> is the horizontal and <y> is the vertical image coordinate and <lat> is the Latitude and <lon> is the Latitude in degrees and WGS84.

The MARKER section, which is optional, defines additional points on the map. Each point is on a single line with the syntax:

"# = i, <x>, <y>[, <text>]" or "# = c, <lat>, <lon>[, <text>]"

where # is the index of the marker point <x> is the horizontal and <y> is the vertical image coordinate or <lat> is the Latitude and <lon> is the Latitude in degrees and WGS84. <text> is a optional string in quotes labeling the marker point. The points must have a unique index from 1 to <num>. The maximum marker point index <num> is written to the same section on a separate line with the syntax "Count = <num>".

```
; I N F O
; ----------------------------------------------------------------
; File:   world.mcf
; Source: (sample data set)


; R E F E R E N C E
; ----------------------------------------------------------------
; 3 Points must be defined to calibrate a Map
; Parameters:
;   #       = index of the point (1 to 3)
;   x,y     = image coordinates
;   lat,lon = world coordinates
; Syntax:
;   # = <x>, <y>, <lon>, <lat>

[REFERENCE]
1 =    0,     0,  -180.0,  90.0
2 = 1764,  1045,   180.0, -90.0
3 = 1764,     0,   180.0,  90.0


; M A R K E R
; ----------------------------------------------------------------
; You can add points (image or world coord) to the map
; Parameters:
;   num     = number of markers that follow
;   #       = index of the point (1 to num)
;   type    = c for world or i image coordinates
;   x,y     = image coordinates
;   lat,lon = world coordinates
;   text    = quoted text decription to the marker (optional)
; Syntax:
;   Count = <num>
;   #     = <type>, <x|lon>, <y|lat>[, <text>]

[MARKER]
Count = 1
1 = c, 8.56525, 47.28519444, "µ-blox ag"
```

**Map Calibration File: world.mcf**

# Appendix D REGULAR EXPRESSION EVALUATION

Normally, when you search for a sub-string in a string, the match should be exact. So if we search for a sub-string "abc" then the string being searched should contain these exact letters in the same sequence for a match to be found. We can extend this kind of search to a case insensitive search where the sub-string "abc" will find strings like "Abc", "ABC" etc. That is, the case is ignored but the sequence of the letters should be exactly the same. Sometimes, a case insensitive search is also not enough. For example, if we want to search for numeric digit, then we basically end up searching for each digit independently. This is where regular expressions come in to our help. Regular expressions are text patterns that are used for string matching. Regular expressions are strings that contain a mix of plain text and special characters to indicate what kind of matching to do. Here's a very brief tutorial on using regular expressions.

Suppose, we are looking for a numeric digit then the regular expression we would search for is "[0-9]". The brackets indicate that the character being compared should match any one of the characters enclosed within the bracket. The dash (-) between 0 and 9 indicates that it is a range from 0 to 9. Therefore, this regular expression will match any character between 0 and 9, that is, any digit. If we want to search for a special character literally we must use a backslash before the special character. For example, the single character regular expression "*" matches a single asterisk. In the table below the special characters are briefly described. A regular expression search is case sensitive.

| Character | Description |
|---|---|
| ^ | Beginning of the string. The expression "^A" will match an 'A' only at the beginning of the string. |
| ^ | The caret (^) immediately following the left-bracket ([) has a different meaning. It is used to exclude the remaining characters within brackets from matching the target string. The expression "[^0-9]" indicates that the target character should not be a digit. |
| $ | The dollar sign ($) will match the end of the string. The expression "abc$" will match the sub-string "abc" only if it is at the end of the string. |
| \| | The alternation or logic OR character (\|) allows either expression on its side to match the target string. The expression "a\|b" will match 'a' as well as 'b'. |
| . | The dot (.) will match any character. |
| * | The asterisk (*) indicates that the character to the left of the asterisk in the expression should match 0 or more times. |
| + | The plus (+) is similar to asterisk but there should be at least one match of the character to the left of the + sign in the expression. |
| ? | The question mark (?) matches the character to its left 0 or 1 times. |
| ( ) | The parenthesis affects the order of pattern evaluation. |
| [ ] | Brackets ([ and ]) enclosing a set of characters indicates that any of the enclosed characters may match the target character. |

**Examples:**

Let's assume that the following lines would appear in the NMEA console without filtering.

```
14:00:03        $GPGGA,140003.242,4717.1126,N,00833.7862,E,1,06,1.3,543.0,M,,,,0000*09
14:00:03        $GPGLL,4717.1126,N,00833.7862,E,140003.242,A*34
14:00:03        $GPGSA,A,3,06,17,25,22,30,10,,,,,,,2.9,1.3,2.6*3A
14:00:03        $GPGSV,2,1,07,06,58,062,44,17,52,161,44,25,45,239,44,22,35,301,44*7F
14:00:03        $GPGSV,2,2,07,30,31,123,44,10,17,059,39,01,05,316,*4E
14:00:03        $GPRMC,140003.242,A,4717.1126,N,00833.7862,E,0.03,80.59,010201,,*36
14:00:03        $GPVTG,80.59,T,,M,0.03,N,0.1,K*56
14:00:04        $GPGGA,140004.242,4717.1126,N,00833.7862,E,1,06,1.3,542.0,M,,,,0000*0F
14:00:04        $GPGLL,4717.1126,N,00833.7862,E,140004.242,A*33
14:00:04        $GPGSA,A,3,06,17,25,22,30,10,,,,,,,2.9,1.3,2.6*3A
14:00:04        $GPGSV,2,1,07,06,58,062,45,17,52,161,44,25,45,239,44,22,35,301,44*7E
14:00:04        $GPGSV,2,2,07,30,31,123,44,10,17,059,39,01,05,316,*4E
14:00:04        $GPRMC,140004.242,A,4717.1126,N,00833.7862,E,0.02,152.96,010201,,*0D
14:00:04        $GPVTG,152.96,T,,M,0.02,N,0.0,K*6B
```

In the examples followed the characters marked red match the regular expression.

**Example 1:** If we want to search for all valid RMC and any GGA Messages

"GP(GGA|RMC,.*,A,)"

```
14:00:03        $GPGGA,140003.242,4717.1126,N,00833.7862,E,1,06,1.3,543.0,M,,,,0000*09
14:00:03        $GPRMC,140003.242,A,4717.1126,N,00833.7862,E,0.03,80.59,010201,,*36
14:00:04        $GPGGA,140004.242,4717.1126,N,00833.7862,E,1,06,1.3,542.0,M,,,,0000*0F
14:00:04        $GPRMC,140004.242,A,4717.1126,N,00833.7862,E,0.02,152.96,010201,,*0D
```

**Example 2:** If we want to search for all GSV messages but only with the message index 2 to 3.

"GSV,.*,[2-3],"

```
14:00:03        $GPGSV,2,2,07,30,31,123,44,10,17,059,39,01,05,316,*4E
14:00:04        $GPGSV,2,2,07,30,31,123,44,10,17,059,39,01,05,316,*4E
```

**Example 3:** If we want to search for all messages starting with $GP and have a G in the message identifier but not at the first position

"^\$GP.+G.*,"

```
14:00:03        $GPGGA,140003.242,4717.1126,N,00833.7862,E,1,06,1.3,543.0,M,,,,0000*09
14:00:03        $GPVTG,80.59,T,,M,0.03,N,0.1,K*56
14:00:04        $GPGGA,140004.242,4717.1126,N,00833.7862,E,1,06,1.3,542.0,M,,,,0000*0F
14:00:04        $GPVTG,152.96,T,,M,0.02,N,0.0,K*6B
```

**Example 4:** If we want to search for all messages having a checksum of which the higher nibble is 3,

"*3.$"

```
14:00:03        $GPGLL,4717.1126,N,00833.7862,E,140003.242,A*34
14:00:03        $GPGSA,A,3,06,17,25,22,30,10,,,,,,,2.9,1.3,2.6*3A
14:00:03        $GPRMC,140003.242,A,4717.1126,N,00833.7862,E,0.03,80.59,010201,,*36
14:00:04        $GPGLL,4717.1126,N,00833.7862,E,140004.242,A*33
14:00:04        $GPGSA,A,3,06,17,25,22,30,10,,,,,,,2.9,1.3,2.6*3A
```

# Appendix E CONTACT

For further information contact:


**Technical Support**

**µ-blox ag**
Zürcherstrasse 68
CH-8800 Thalwil, Switzerland

Phone: +41 (1) 722 74 74
FAX: +41 (1) 722 74 47
E-mail: support@u-blox.com
http://www.u-blox.com

**Headquarter**

**µ-blox ag**
Zürcherstrasse 68
CH-8800 Thalwil, Switzerland

Phone: +41 (1) 722 74 44
FAX: +41 (1) 722 74 47
E-mail: sales@u-blox.com
http://www.u-blox.com

**German Sales Office**

**µ-blox Deutschland GmbH**
Berliner Ring 89
D-64625 Bensheim, Germany

Phone: +49 (6251) 17566-0
FAX: +49 (6251) 17566-11
E-mail: wuestner@u-blox.com
http://www.u-blox.com

# REVISION HISTORY

| Revision Index | Date | Name | Status / Comments |
|---|---|---|---|
| P1 | 7-Feb '01 | JMZ | Draft |
| P2 | 15-Mar '01 | JMZ | Draft |
| - | 21-Mar '01 | JMZ | Public Release |