TIM EK

TIM EVALUATION KIT

USER'S MANUAL

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1 OVERVIEW

The TIM EK Evaluation Kit is an easy-to-use platform for user and performance evaluations of the latest generation of u-blox GPS receiver "TIM" [1] based on the SiRFstar™ II chip set. The TIM is a 25 x 25 x 3 mm sized macro-component mounted on an adapter board called GPS-PS2 and encased in an aluminum housing measuring 105 x 112.5 x 48 mm.

The TIM module located on the GPS-PS2 receiver is a fully self-contained receiver module for the Global Positioning System (GPS). The module provides complete GPS signal processing from antenna input to serial data output (NMEA or SiRF® proprietary data format). A second serial port accepts differential GPS data (RTCM). Based on the SiRFstar™ II chip set manufactured by SiRF Technology, Inc., the module supports features, and maintains the technical specifications of the SiRFstar™ II architecture and maintains compatibility to the GPS-PS1E. Details on this product are summarized in [2].

Figure 1-1: TIM Evaluation Kit (cover removed)

1.1 Contents

The entire Evaluation Kit comes as a complete package with all necessary equipment and accessories, allowing an immediate start-up with a personal computer.

- u-blox GPS-PS2 GPS receiver with TIM module
- Active antenna with 5m cable
- RS-232 Serial interface cable to PC
- 110 / 230 VAC power converter (12V, max 800 mA)
- CD ROM, contents:
    - u-Center GPS visualization software
    - Firmware upgrade utility
    - Sample code for host PC to parse SiRF® and NMEA code
    - Documentation in .PDF format

1.2 Overview

1.2.1 Front Panel Features

Connectors:

- "Port A": Full-duplex RS-232 serial interface, DB9 connector
    - Configurable protocol: NMEA, SiRF[ε] binary messages, RTCM, etc.
    - Default setting: NMEA navigation messages
    - Firmware updates
- "Port B": Full-duplex RS-232 serial interface, DB9 connector
    - Configurable protocol: NMEA, SiRF[ε] binary messages, RTCM, etc.
    - Default setting: RTCM input to receive correction information from a differential GPS device
- 9 - 18V Power jack, 200 mA maximum, suitable for use in office using the enclosed power adapter or in a motor vehicle using the 12 VDC battery power.
- SMA female antenna connector

Indicators:

- 1PPS (accurate GPS "1 pulse per second signal") output LED, green, located on left-hand-side (flashes when in operation)
- Power LED, red, located on right-hand-side

Figure 1-2: TIM Evaluation Kit - GPS receiver - front panel

1.2.2 Internal Features
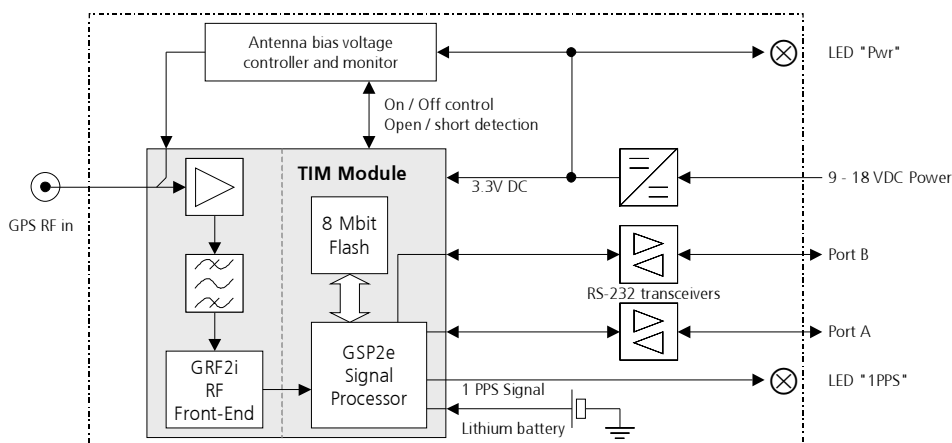
Figure 1-3: GPS receiver: block diagram

The GPS receiver contains following parts:

- TIM GPS Macro-Component
  Dimensions: 25.4 x 25.4 x 3 mm, located on a 82.5 x 32 mm sized GPS-PS2 adapter board
  Contains: SiRF$^{\text{E}}$ GRF2i RF Front-End chip and SiRF$^{\text{E}}$ GSP2e Signal Processor.

- RS-232 level shifter to provide true RS-232 signals to serial ports A and B

- Control and monitoring circuit for active antennae

- DC/DC converter for 9-18 VDC input

- Robust aluminum housing with front panel for connectors and indicators.
  Dimensions: 105 x 112.5 x 48 mm

- Internal backup battery and switchover circuit maintains real-time clock and position / almanac / ephemeris data in static RAM in the absence of external power to enable warm and hot starts.

1.2.3 GPS-PS2 Macro-Component

The TIM macro-component is placed on a rectangular adapter board called GPS-PS2 that fits directly into the TIM EK housing. The additional electronics provide a short- and open-circuit detection for active antennas. Active antennas are antennas with built-in low-noise amplifiers.

Figure 1-4: GPS-PS2 board with TIM macromodule

2 INSTALLATION

2.1 System Requirements

A PC with following minimum system requirements is needed to operate u-Center:
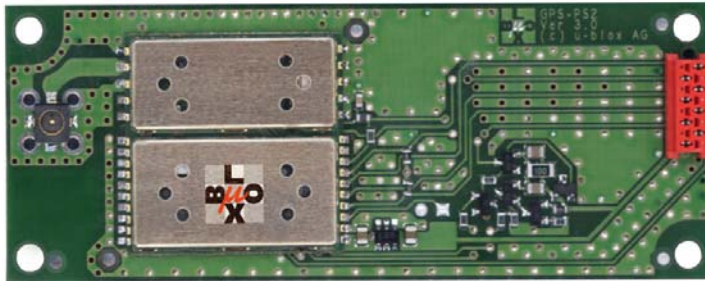
CPU performance: Pentium II / 200 MHz or faster

Memory: 32 MB required. 64 or 128 MB recommended for good performance

Hard disk space: Provide 10-50 MB vacant space for the application (less than 2MB) and data you
                          plan to log.

Interfaces: One RS-232 Serial interface. Direct connection if available through a DB9 connector

Operating system: Microsoft Windows 95 / 98 / ME / 2000 / NT 4.0 Service Pack 5

2.2 Installing Evaluation Kit Software

As long the security framework of the Windows operating system is not configured too strictly, no administrator privileges are needed to install the software.

Please follow the steps below to install the software on your computer.

1. Start the PC with Microsoft Windows 95 / 98 / ME / 2000 / NT 4.0 Service Pack 5

2. Insert the CD in your CD drive

3. The installation wizard u-Setup shall start automatically with a message box labeled "u-Setup - Welcome". If this program does not start automatically, then select "Run" from the start menu and type "e:\u-Setup.exe" (with use lower-case-u, not u-symbol).
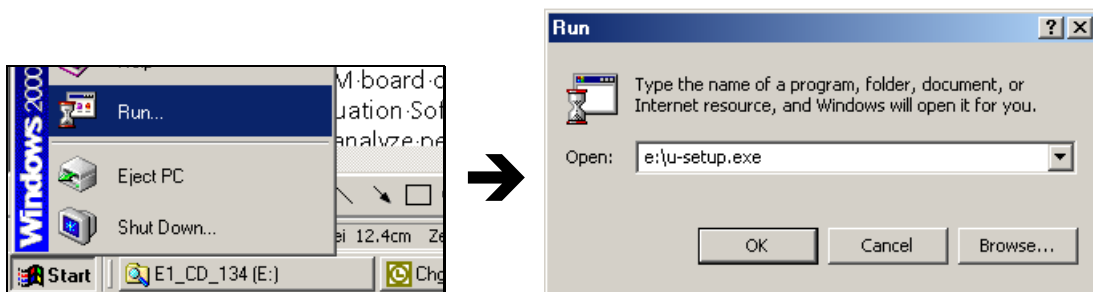

Figure 2-1: Command to install evaluation kit software

4. The u-Setup wizard will guide you through the setup process. Follow the instructions of the wizard.
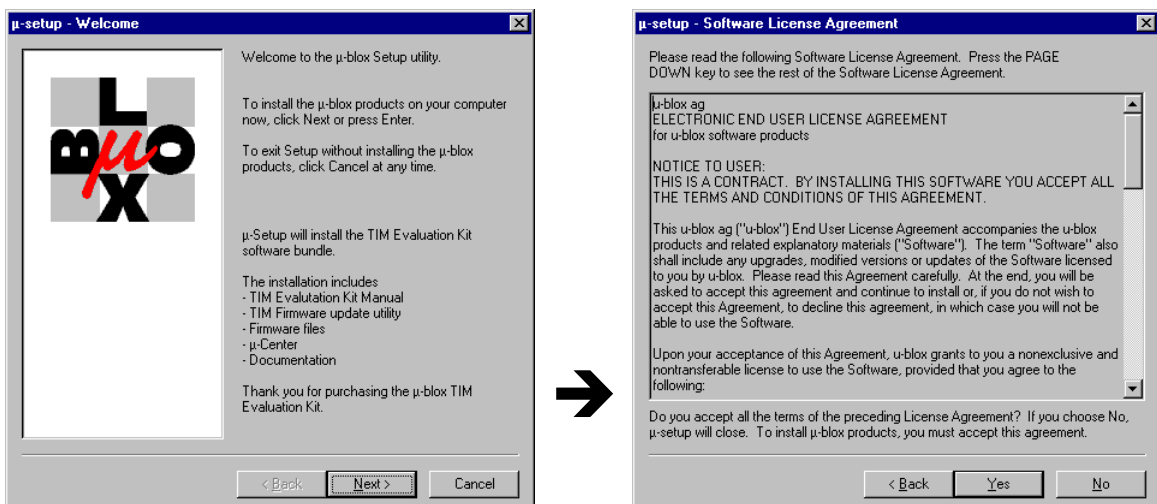
Figure 2-2: u-Setup: Welcome window and Software License Agreement

5. Read the Software License Agreement. The slide bar on the right and side or Page-Up / Page-Down keys are available to scroll the text. You must accept all the terms of the License Agreement to install u-blox products.

6. Select the u-blox products and components desired. At least, include u-Center, the Download Utility and the Firmware Update. You may change the location where you want to install the components.
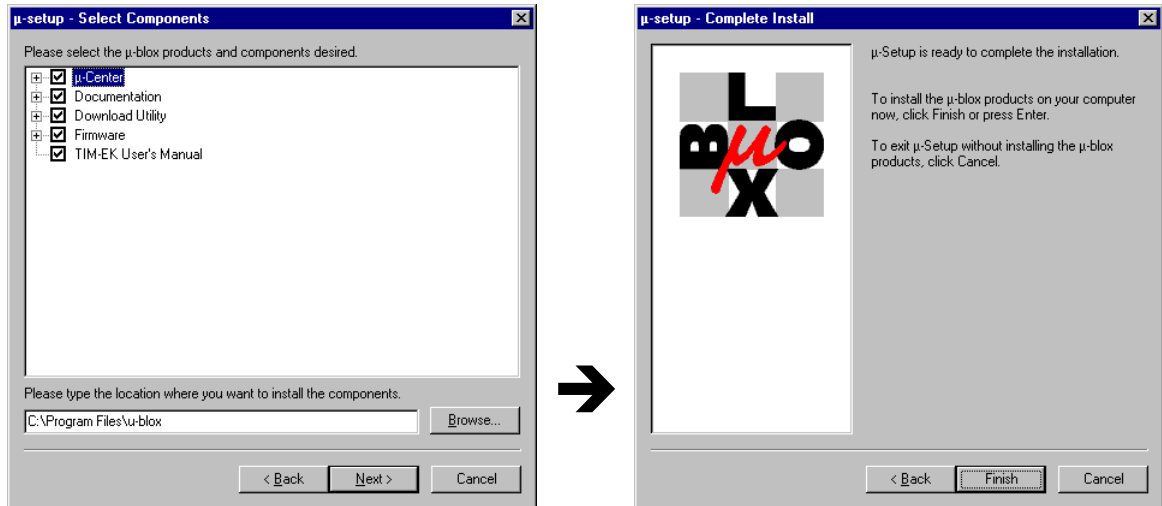
Figure 2-3: u-Setup: Selecting components and ready-to-install

7. u-Setup is now ready to complete the installation. u-Setup will start the setup process as soon you push the "Finish"-button.

8. u-Setup will decompress and copy the required files to your computer, update the configuration and add new links to the start menu.
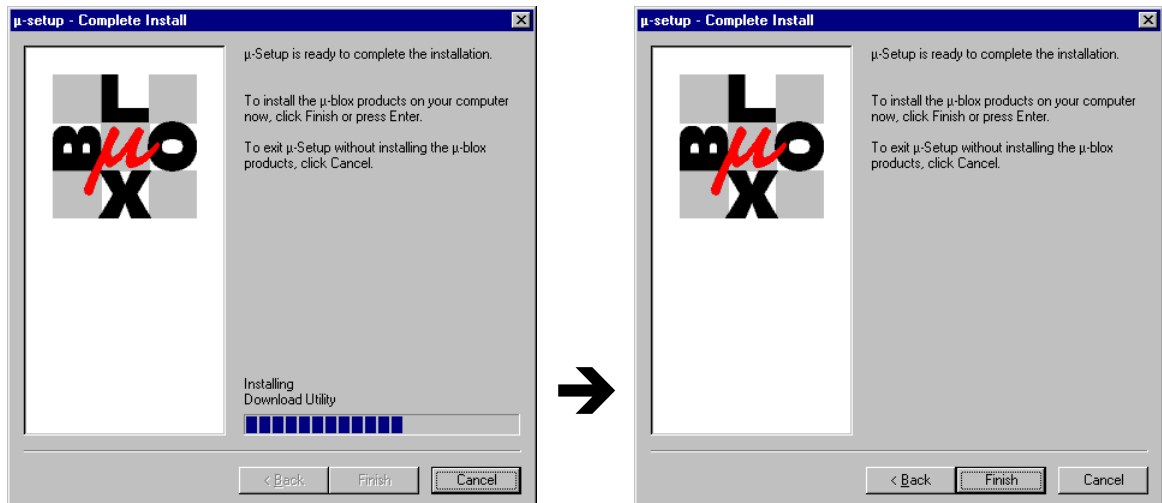
Figure 2-4: u-Setup: Installation in progress and done

Starting u-Center is described in chapter 3.

2.3 Installing Evaluation Kit Hardware

Proceed with the following steps to put the GPS-E1 into operation

1. Use the enclosed serial cable to connect "Port A" to a vacant serial connector at the PC

2. Connect the enclosed active antenna to the antenna jack labeled "ANT".

Important notice:

The antenna should be located where an unobstructed view of the sky is available. However, to verify that the Evaluation Unit is working properly and the software is installed correctly, you do not need to connect the antenna.

3. Connect the power cable to the power jack labeled "PWR" and the other end of the cable to the enclosed power supply. Connect the 230VAC cable to an AC wall outlet.

2.4 Starting the PC

Caution:

Avoid booting the PC while the GPS receiver is connected and turned on during boot time. The PC may misjudge the incoming GPS information (NMEA data sets, etc.) as mouse activities and locks the mouse driver to this data source. This results in erratic behavior of the mouse cursor and mouse-clicks, possibly messing up your windows layout and configuration.

Hint: Disconnect serial cable or keep the GPS receiver turned off while the PC is booting.

3 GETTING STARTED

3.1 u-Center Overview

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

The features include:

- Support for all u-blox GPS receivers. u-Center can communicate with these receivers using either the SiRF[E] binary protocol, or the NMEA-0183 standard protocol. See [5] for details on supported protocol messages.

- Support for non-u-blox receivers that utilize standard NMEA responses

- u-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. u-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.

3.2 Starting u-Center

After installation, the "Program menu" is extended with a new entry "µ-blox Products" providing a new selection of programs and manuals from u-blox. Start u-Center as illustrated below.
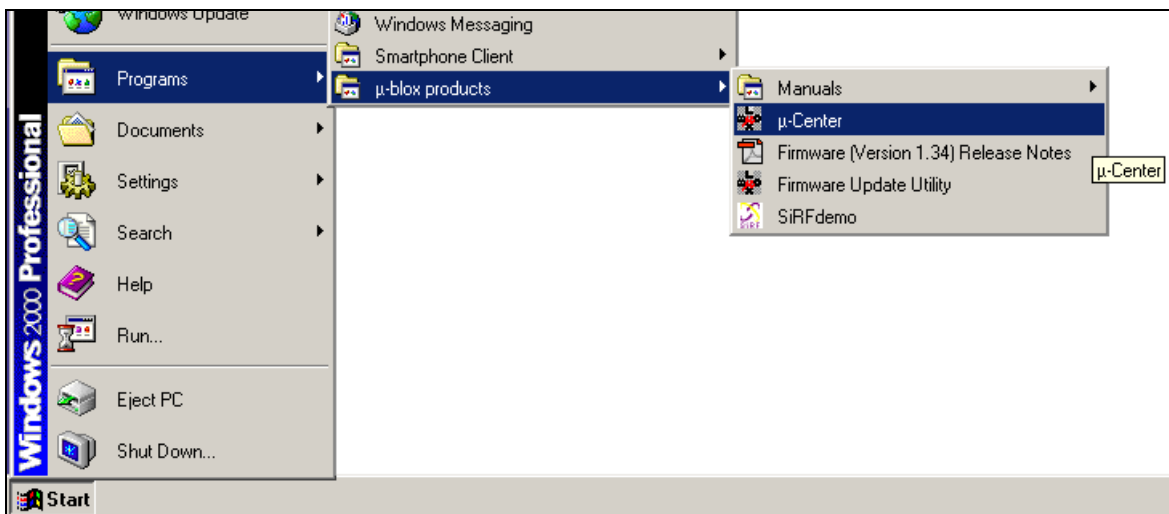
Figure 3-1: Starting u-Center

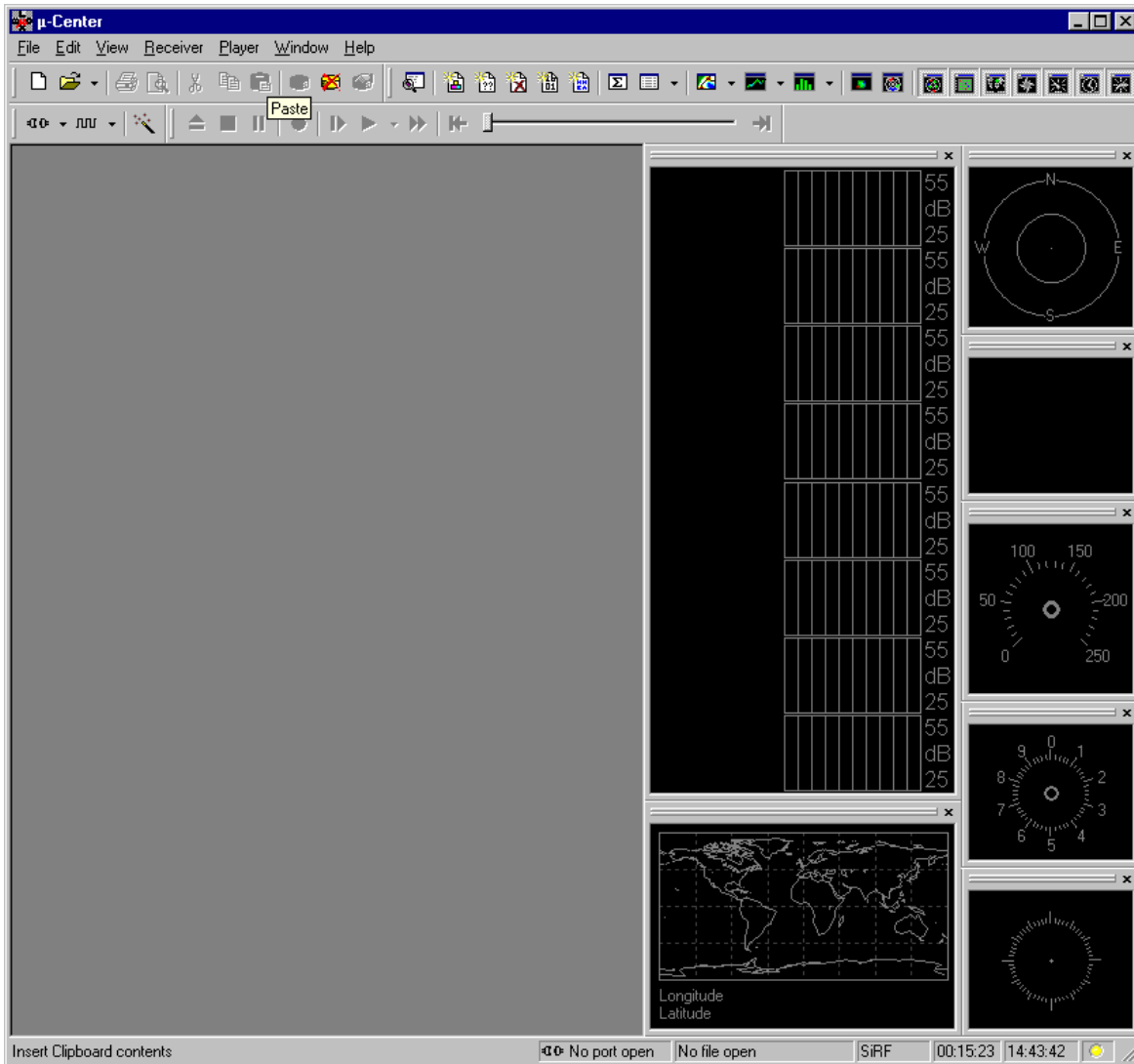u-Center will appear with a screen as shown below:

Figure 3-2: u-Center Start Display

The first time that u-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 baud rate (1'200 … 38'400)

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

- Automatically (Auto Synchronize)
- Manually

3.2.1 Auto Synchronize COM-Port and baud rate

On the Receiver Tool Bar (Figure 3-3) are three different buttons. From left to right:

Figure 3-3: Receiver Tool Bar (Connect / Disconnect button / Baud rate button / Synchronize button)

Press the synchronize-button and after a short time u-Center will automatically find the used COM-Port and the correct baud rate. During the synchronization, the Synchronizing Baud rate display is shown (Figure 3-4)
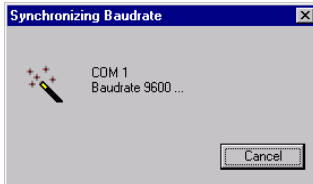
Figure 3-4: Synchronizing Baud rate and COM-Port Display

As soon as u-Center is synchronized to the GPS receiver, the Connect/Disconnect-Button on the Receiver Tool Bar changes to green color (Figure 3-5)
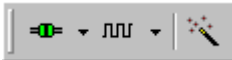
Figure 3-5: Detected COM-Port and Baud rate

Figure 3-6: u-Center and GPS receiver are synchronized (left), or mismatches (right)

If the GPS receiver is working correctly, the start display now shows information about the satellite constellation, signal to noise ratio, time etc (Figure 3-7)
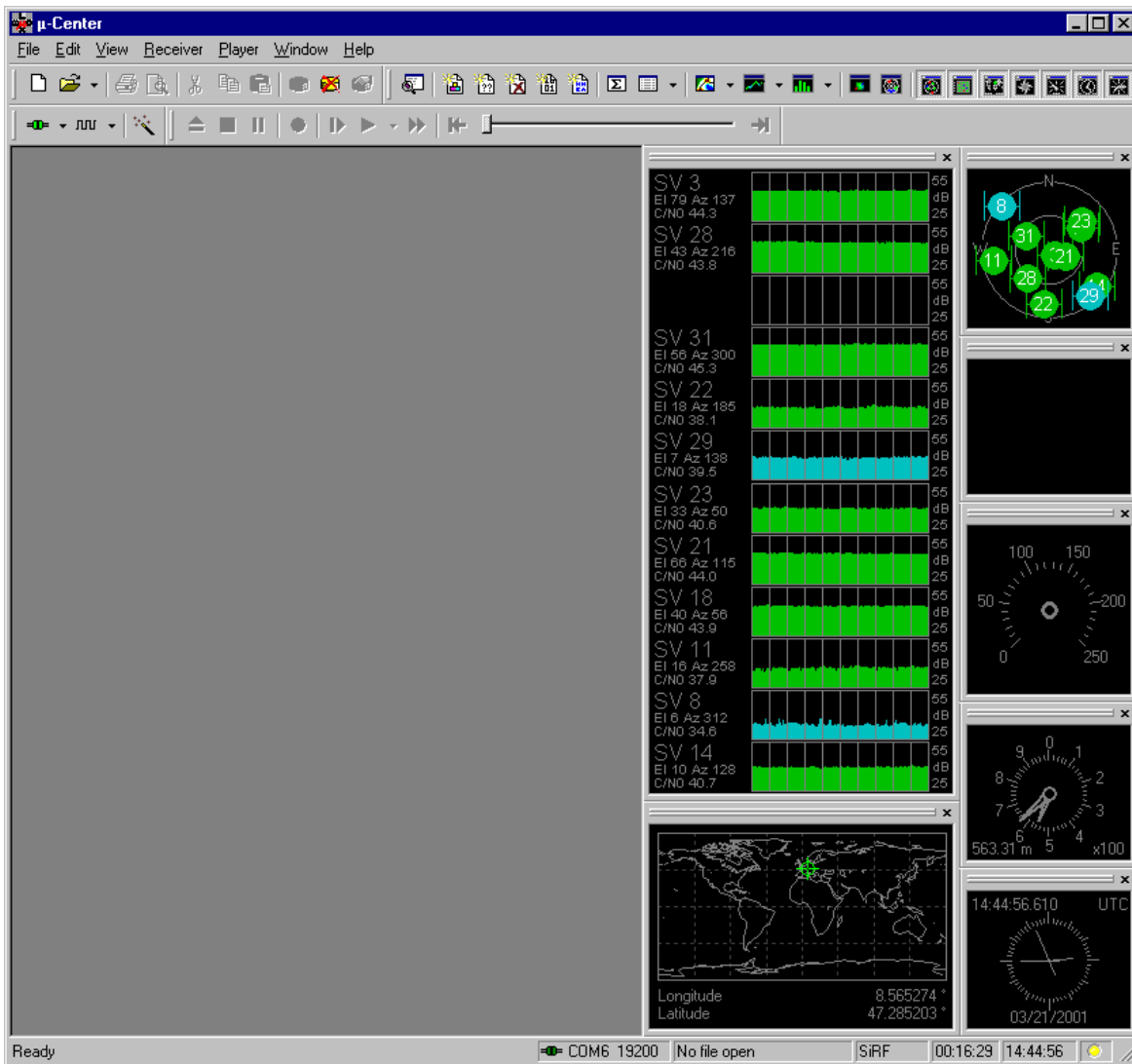
Figure 3-7: Start Display after a successful connection

3.2.2 To Probe Further

Please refer to the User's Guide of the u-Center [3] to learn more about the features of u-Center.

3.3 Troubleshooting

GPS Receiver - red LED is not powered up

Check that the enclosed power cable with power converter is connected appropriately and that power (on the outlet strip) is turned on.

The green LED "1 PPS" has not begun flashing once per second after turning on: It stays off

Check that the antenna cable is connected

Check that the antenna is located at a window or a good location with direct view to the sky

No serial data is received, despite correct LED response

Check that serial cable is connected to port A (not port B). Using the enclosed cable is recommended. In u-Center, check the baud rate.

4 EVALUATION KIT SPECIFICATION

4.1 Overview

The basic technical specifications are summarized in section 1.

4.2 Board Features
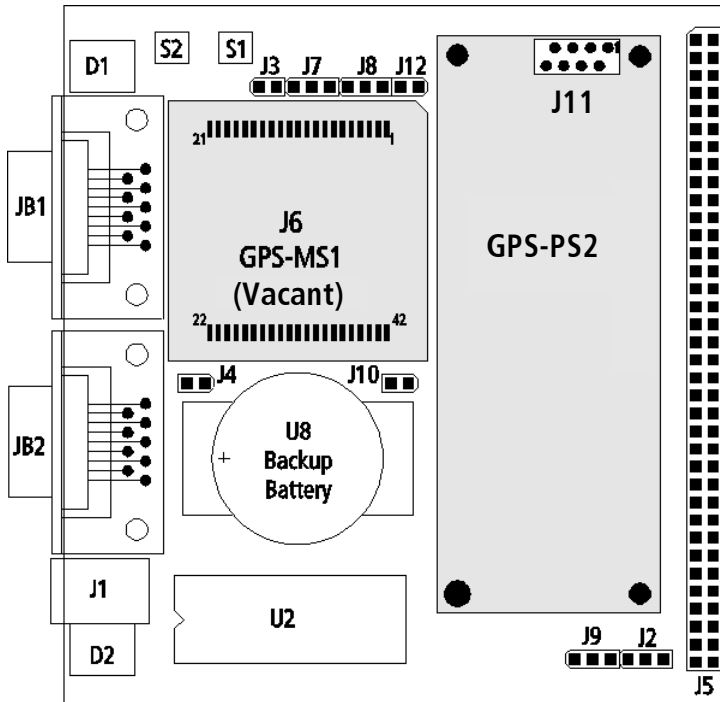
Figure 4-1: Block Diagram

Position	Description of major components
D1	LED - 1 PPS - green
D2	LED - Power - red
J1	Power connector
JB1	Serial Port A
JB2	Serial Port B
J2-J4	Jumpers
J5	General-Purpose I/O header
J6	GPS-MS1E socket (vacant)
J7-J10	Jumpers
J11	GPS-PS2 connector
J12	Jumper
S1	Reset pushbutton
S2	Pushbutton to activate "Firmware Download Mode"
U2	Power regulator
U8	Backup Battery
Not shown	Antenna connector, minor electronic components

Table 4-1: TIM EK Board Features

4.3 External Interfaces

4.3.1 Serial Ports

Pin assignment of the two DB9 connectors for both serial ports is identical.

Pin	Symbol	Direction	Description
2	RxD	In	
3	TxD	Out	
5	GND	Ground	Common reference
All other pins (1,5,6-9) are not connected			

Table 4-2: Serial Port A and B: Pin assignment

Description	Serial Port A	Serial Port B
Supported protocols (**Boldface** = default setting)	NMEA-0183 **SiRF® binary** RTCM for DGPS correction Firmware upgrades	NMEA-0183 SiRF binary **RTCM for DGPS correction**
Supported baud rates (**Boldface** = default setting)	1200 2400 4800 9600 **19200** (See [1]) 38400	1200 2400 4800 **9600** 19200 38400
Default UART configuration (is reconfigurable)	**1 stop bit** **8 data bits** **no parity**	**1 stop bit** **8 data bits** **no parity**

[1] Older releases have used default baud rate of 38400 (Firmware release Dnnn and earlier).

Table 4-3: Serial Port A and B: Protocol and UART Settings

The u-Center software provides means to configure selected protocol, baud rates and further settings related to the UART with aid of NMEA-0183 and SiRF binary messages.

4.3.2 Antenna Connector

The GPS patch antenna is cabled to the receiver through a female SMA connector located on the front panel of the GPS receiver. The center pin carries 4.75V DC bias voltage, suitable for most 4.5 - 5V active antennas.

4.3.3 Power Supply Connector

A female 2.1 mm circular connector (J1) on the front panel of the GPS receiver connects external power from the included AC adapter or a cigarette lighter adapter in a motor vehicle with 12V battery. The center conductor of this connector is the positive supply connection. The outer conductor is connected to circuitry ground.

> **Caution:**
>
> Connecting directly to a power source higher than +18 VDC can result in permanent damage to the GPS receiver unit.

4.4 Internal Interfaces

Internal interfaces are found on the base board inside the TIM EK housing when opened up. These interfaces are of interest if access to special signals like the 1PPS signal is needed.

4.4.1 TIM Adapter Connector

The TIM module is located on the GPS-PS2 board containing a male 8-pin AMP Micromatch connector.

Pin	Symbol	Direction	Description
1	TxB	Out	Port B, transmit data, 3.3V
2	VCC	Power in	5V DC
3	TxA	Out	Port A transmit data, 3.3V
4	Vbatt	Power in	3.3VDC backup battery in
5	RxA	In	Port A, receive data, 3.3V
6	1PPS	Out	1 PPS signal
7	RxB	In	Port B, receive data, 3.3V
8	GND	Ground	Common ground

Table 4-4: TIM Adapter Connector (J11)

4.4.2 GPS-MS1E Socket

The GPS-E1 also contains a *vacant* GPS-MS1E socket (J6) that is solely intended for use with a legacy GPS-MS1E module. Do not use this socket!

For more information, please refer to the former u-blox GPS-E1 evaluation kit.

4.4.3 General-Purpose I/O Header

A double-row header with 2.54 mm pitch is available on the back side of the TIM EK board. It is accessible when the housing cover is removed. The pin assignment is described below:

Pin	Description
1	5.0 V
3	3.3 V
5	RxA (Port A receive, 3.3V levels)
7	TxA (Port A transmit, 3.3V levels)
9	RxB (Port B receive, 3.3V levels)
11	TxB (Port B transmit, 3.3V levels)
33	1PPS
Remaining odd-numbered pins	Not connected
All even-numbered pins	Ground

Table 4-5: General-Purpose I/O Header (J5)

4.5　Internal Controls

4.5.1　RESET Pushbuttons

TIM EK does not support the pushbuttons S1 and S2. Pressing them has no effect on the functional behavior.

To force a system reset, turn power off, wait few seconds and turn power back on.

The most recent TIM firmware require no special boot mode to carry out firmware updates. However, if older firmware versions (Annn, Bnnn, nnn = 3 digits on module sticker) are inside, then the TIM must be restarted in special firmware update mode described below.

4.5.2　Special Booting

To force booting in firmware update mode, the two pads (squared and round one) marked in the red circle and illustrated in Figure 4-2 must be shorted for 2-3 seconds while power is turned on to start up the GPS receiver. Holding a metal tweezers onto the two pads is the most convenient approach to establish a short circuit.
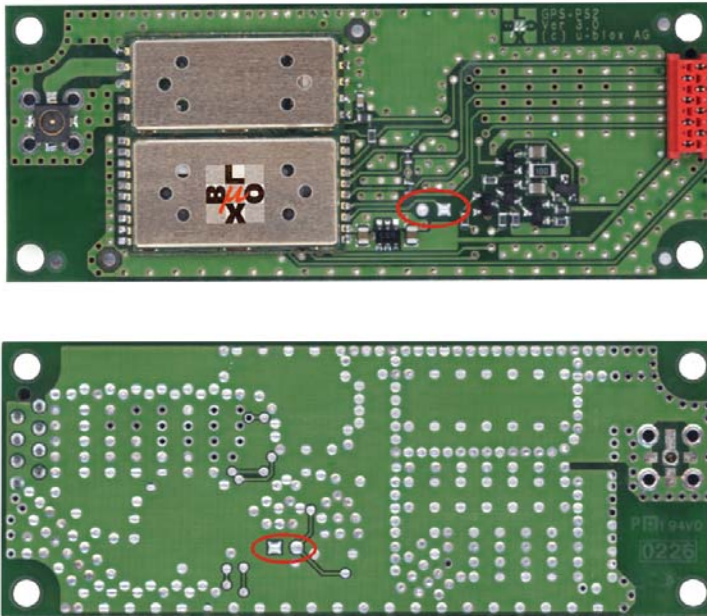

Figure 4-2: GPS-PS2 - Top: top view; bottom: bottom view

4.5.3 Jumpers

Jumpers J2, J3 and J4 are of interest for end users experimenting with the TIM EK.

J2 and J3 are available to qualify active GPS antennas with built-in low-noise amplifiers. Temporarily removing J4 while the TIM EK is turned off will erase all temporarily stored data like position, time, satellite ephemeris and almanac data immediately.

The board contains jumper numbering (like J2), but has no position numbers next to the jumpers. For 3-position jumpers, position 1-2 relates to the left and center pins to the left in relation to the jumper number label, and position 2-3 relates to the center and right pins.

Example: J2   ● (1)   ● (2)   ● (3)

| Nr.	Setting	Default	Description
J2, J3	Don't care		(Not connected)
J4	open 1-2 shorted	 X	No backup battery supply Backup battery supply connected
J7 - J10	Don't care		(Not connected)
J12	open 1-2 shorted	 X	No power to GPS-PS2 with TIM module GPS-PS2 with TIM module powered up

Table 4-6: Jumpers

4.6 TIM GPS Macro-Component

Please refer to the *TIM Data Sheet* [1] for further technical information.

4.7 Environmental Data

- Storage temperature -40 to +85 °C
- Operating temperature -40 to +85 °C

4.8 Schema
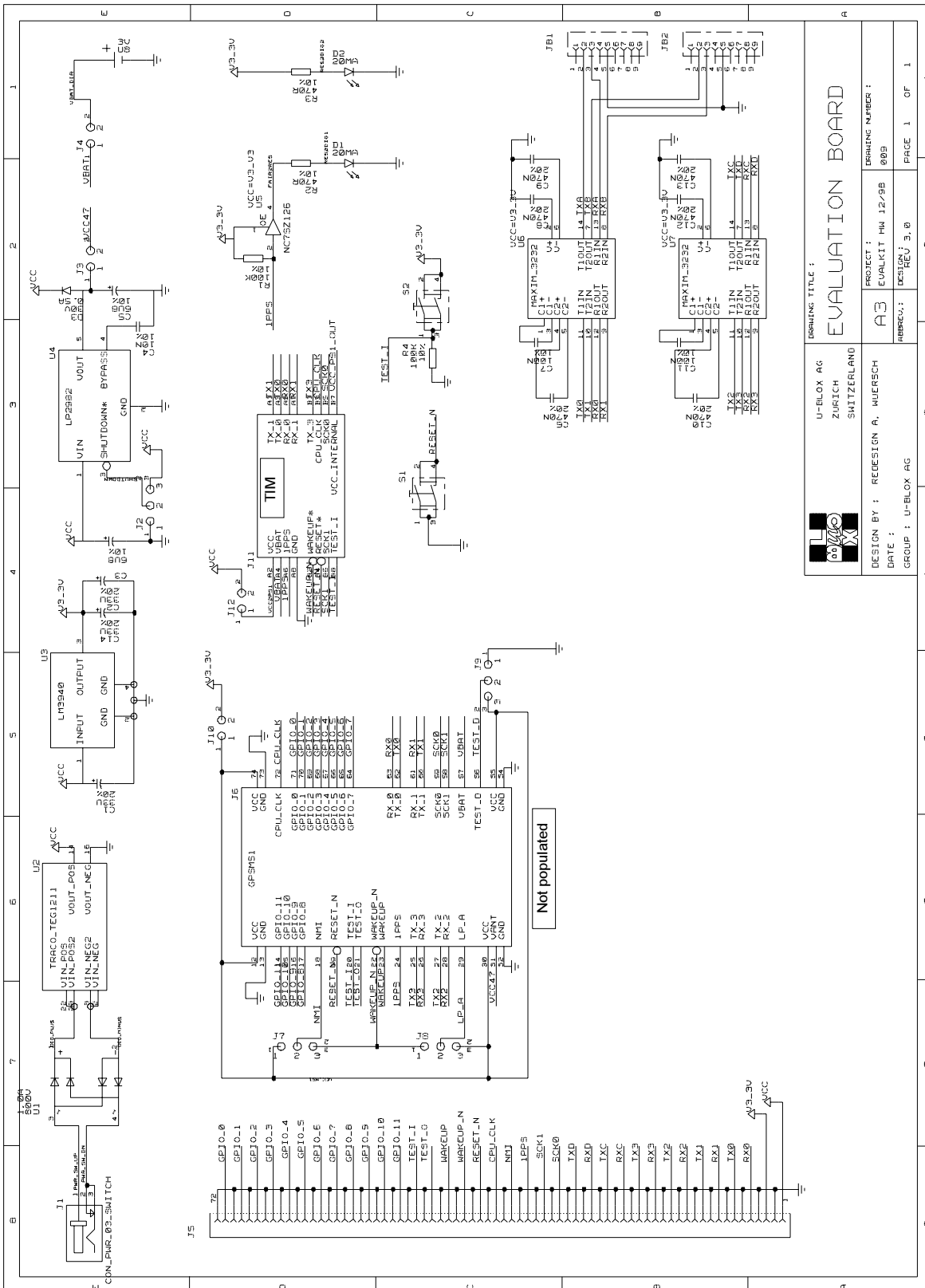
Figure 4-3: TIM EK Board: Schema

The actual connections in use by the TIM module are summarized in Table 4-4 and Table 4-5.

5 FIRMWARE UPDATES

5.1 Overview

The Firmware Update Utility is located on the CD enclosed in the TIM Evaluation Kit.

The firmware update utility consists of two programs which are described in brief: The uDownloader is a standalone command-driven program suitable for handling quick downloads with existing binary image files and configuration files. Command-driven programs fit well into superior batch scripts. The integrated Configuration Manager provides a convenient user interface to select configuration files, make modifications if necessary and carry out downloads. Both programs share a common "UDownDLL.dll" file that contains the core procedures of the download.

This document will only focus on carrying out a simple download of a new binary image using the windows-based Configuration Manager. Advanced features like modifying configuration parameters are described in the separate user documentation [4].

5.2 Prerequisites

Download is carried out via serial interface from PC to the TIM Evaluation Kit's serial port A. Serial port B is not supported for download. In order to start download, the TIM EK must be turned on and actively sending out GPS information in SiRF$^{\circledR}$ binary or NMEA protocol.

Please refer to "special boot procedure" described in section 4.5.1 if one of following conditions applies:

- An older firmware than version C (e.g. see label on TIM module: Annn, Bnnn, nnn = 3 digits) is inside

- A customized firmware is inside that is configured in a way that neither SiRF$^{\circledR}$ nor NMEA protocol is transmitted via serial port A.

5.3 Making a Firmware Update

The Configuration Manager can be started with:
Start → Programs → µ-blox Products → Download Utility → Configuration Manager.
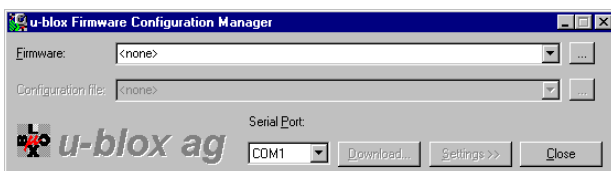
At the very first startup, first a valid firmware file (*.bin) must be selected. Therefore type path and filename into the firmware field or click the "…" button on the right side of the firmware selection field. A file open dialog box appears.

Change to the according directory and select the actual firmware file. Open it by clicking the *"Open"* button or double clicking the according file.
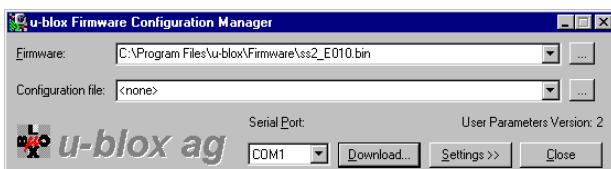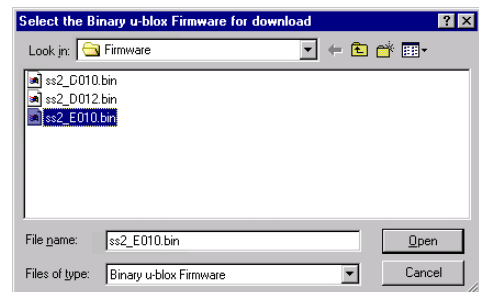
If you have chosen an existing file, the buttons and controls required for a firmware download get enabled now.

To the left side of the download button there's a dropdown list containing all serial ports found at startup. For changing the serial port you may want to use for download, open the list with a mouse click or <ENTER> if focused (blue colored) and select the appropriate serial port. Baud rate detection is automatic by default. Baud rate detection is automatic by default.
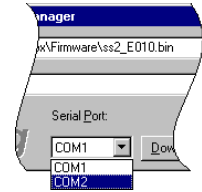
If you want to download the firmware with its default settings as contained in the firmware without any changes, select the appropriate serial and click on the *"Download…"* button to start download procedure. A progress dialog as described below pops up that shows the download status.
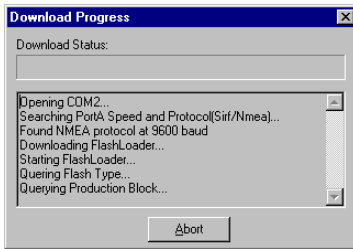
A dialog pops up showing the download progress. There are many detail information displayed that tell what the download process is doing at the moment. This information also can give a hint for solving problems if some should occur.

As soon as the utility begins to write data into the flash, a progress bar shows the status of the whole firmware download.

The user can abort the download at any time by simply clicking the *"Abort"* button, although it's not recommended.
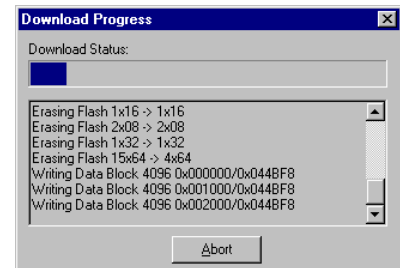
Important notice:

Aborting while a download in progress results to corrupted contents in the Flash EPROM of the GPS receiver. The same applies if the serial link is disconnected, the PC being shut off or a PC system crash or reboot took place. A special boot procedure described in section 4.5.2 is necessary to enable another download.
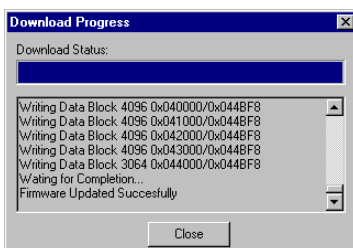
After the whole download process there will be displayed a message whether the download was successful or not.

6 UNINSTALLING SOFTWARE

6.1 Uninstalling the u-Center Software

The current CD does not include an automatic "uninstall" utility for the u-blox products. You need to proceed with following steps when planning to un-install them.

Caution:

To carry out a thorough un-installation, manual modifications in the registry will be necessary. Tampering with the registry settings may cause irreparable configuration settings that impair stable and reliable PC performance. If you are not a **very experienced** user of the Microsoft Registry Editor "RegEdit.exe", please consult your **system administrator** or a proficient **PC expert** for this.

Note: The following procedure shows how to remove **every u-blox specific data**.

1. Use "Explorer" to remove directory and files where all u-blox software and documentation is located. If no other destination was specified during the installation. The directory to remove may most likely be located in

   ```
   c:\'Program Files'\
   ```

   Remove 'u-blox' including all files and subdirectories if you want to remove **all** u-blox documents, applications, etc.

2. You will also need to remove the shortcuts registered in the Start Menu. To remove these entries, the easiest way is to proceed as follows:
   Open **Start → Programs** where you can find an entry **µ-blox Products**. Right-click on this entry. A pop-up menu will appear, where you click on 'Delete'. Confirm to delete the folder. That's it!

3. Finally, you need to clear out the registry settings using "RegEdit.exe", including all hierarchical sub-entries.

   ```
   HKEY_CLASSES_ROOT\.ubx              (u-Center log file type registration)
   HKEY_CLASSES_ROOT\.s3              (if Software Customization Kit is installed)
   HKEY_CLASSES_ROOT\.sck             (if Software Customization Kit is installed)

   KEY_CLASSES_ROOT\u-Center.document  (u-Center Document)
   KEY_CLASSES_ROOT\sck_auto_file     (if Software Customization Kit is installed)

   HKEY_CLASSES_ROOT\s3_auto_file

   HKEY_CURRENT_USER\Software\u-blox   Download Utility and Roger Settings
   HKEY_CURRENT_USER\Software\µ-blox   u-Center Settings
   ```

   The following registry entry removes the start menu entries:

   ```
   HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\
   MenuOrder\Start Menu\Programs\'µ-blox Products'
   ```

4. Delete any other personal shortcuts or icons you have created on the desktop, Quick Launch bar or subdirectories.

The un-installation procedure is now complete.

A RELATED DOCUMENTS

[1] TIM - GPS Receiver Macro-Component - Data Sheet, GPS.G2-MS2-01001

[2] GPS-PS2 - GPS Receiver Module - Data Sheet, GPS.G2-PS2-02011

[3] u-Center GPS Evaluation Software - User's Guide, GPS-SW-01002

[4] TIM Firmware Update Utility - User's Manual, GPS.G2-SW-02004

[5] TIM GPS Receiver - Protocol Specification - Application Note, GPS.G2-X-01003

[6] The GPS Dictionary, GPS-X-00001

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

B GLOSSARY

Please refer to the *GPS Dictionary*, [6].

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