



# ATTU USER MANUAL

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# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	The box	3
1.2	Interfacing	3
<b>2</b>	<b>Quick setup</b>	<b>4</b>
2.1	Setup using EivaHWConfig.exe	4
2.2	Setup using the web interface	6
2.3	Serial ports	7
2.4	Port configuration	7
2.5	Timing configuration	8
2.5.1	GPS timing	8
2.5.2	NTP timing	9
2.6	Advanced protocol definitions	9
2.7	Updating ATTU firmware	10
2.7.1	Updating using EivaHWConfig	10
2.7.2	Updating through the web interface	10
2.8	Saving and uploading a configuration file	11
<b>3</b>	<b>Technical specification</b>	<b>12</b>
3.1	Accuracy	12
3.2	Using ATTU data in EIVA software	13
<b>4</b>	<b>ATTU Monitoring</b>	<b>14</b>
4.1	Getting started	14
4.2	Day to day operations	15
4.2.1	Devices	15
4.2.2	The Reference ATTU System	16
4.3	Logging and Saving	21
4.4	Webpage access	22
4.5	Menus	22
4.6	Main Menu	22
4.7	Device menu	23

# 1 Introduction

A survey setup today is a hybrid solution where a vessel and ROV configuration merges data time tagged by the sensor (GPS, USBL, MBE, ..) with other sensors where time tagging has to be performed by the acquisition SW (gyro, motion sensor, depth sensor).

It has always been a challenge to migrate those two worlds, especially because a typical computer isn't designed for real time operations.

The EIVA solution for this is the Accurate Time Tagging Unit (he ATTU), where time tagging of your survey data is performed by the use of one or more hardware boxes.

The ATTU will be capable of time tagging sensor data with an accuracy better than 100  $\mu$ s at full load and 50  $\mu$ s at normal load on 24 ports with 100 Hz data. To ensure this, the ATTU must be interfaced with GPS time (ZDA message and special PPS) or connected to a network time server.

## 1.1 The box

The ATTU is basically a specially designed dedicated computer running a stripped down LINUX kernel. This ensures that the EIVA firmware on the computer has unlimited access to resources on the OS, and thus ensures the precise time tagging as requested.

## 1.2 Interfacing

The ATTU can be equipped with up to 3 PCI cards, each adding 8 COM ports to the unit. There are 2 different PCI cards available, one which supports only RS232 communication and the other which supports RS232, 422 and 485. This option however, does not properly support the LED's on the RJ45 Ports, which means that the ports are working correctly, but the LED's will not light appropriately. In these circumstances the LED's should be disregarded. The reason for this is the compatibility of the RJ45 connection box. Unless specified otherwise, the unit is delivered with RS232 only, by default.

When interfacing the ATTU into NaviPac and NaviScan, simply select ATTU/Timebox as the driver type, type in the IP address of the box and define the port number.

## 2 Quick setup

The ATTU can be configured in 2 different ways:

- Using EivaHWConfig.exe (available from <http://download.eiva.dk/> at the ATTU section)
- Using web interface.

The default IP address for the ATTU is 192.168.0.5/255.255.255.0. The EivaHWconfig.exe can however detect the ATTU on the network regardless of the IP. This allows you to configure it.

### 2.1 Setup using EivaHWConfig.exe

The configuration program will upon start search the entire network and detect if any ATTU's are online. If so then they will be listed on the EIVA hardware list

The first time you configure the ATTU it will appear with its default IP and Subnet. By clicking on the ATTU you will be able to change the IP and Subnet in the Misc window appearing to the left (as shown in Figure 1, where the IP has already been changed).

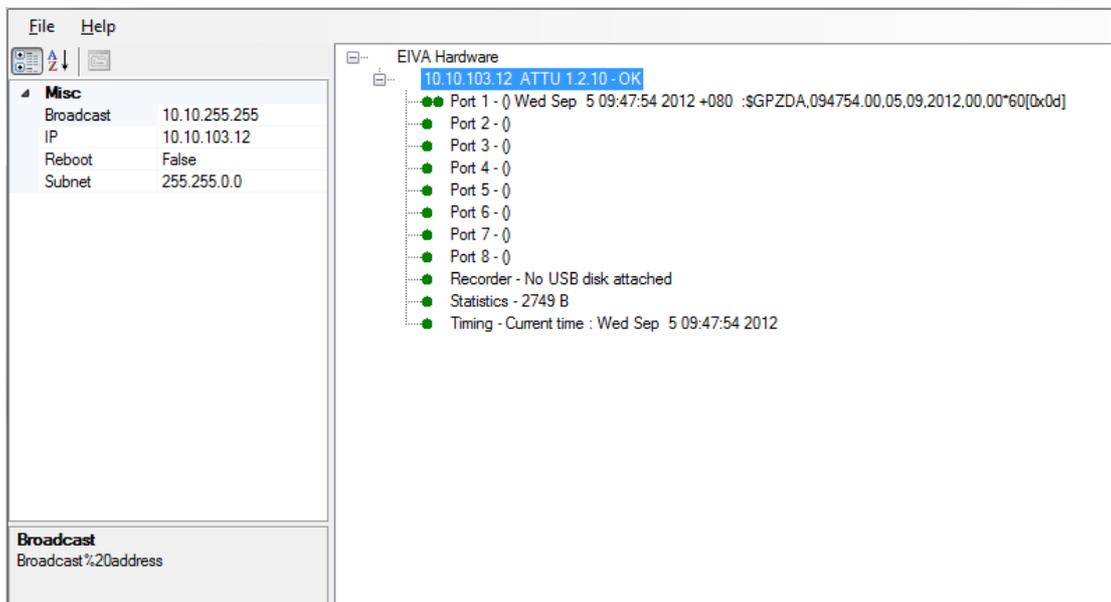


Figure 1: Setup using EivaHWconfig.exe. Showing active ports after IP has been changed.

When the ATTU IP has been configured, a “+” will be shown to the left of the unit name. Clicking this will expand the ATTU menu, showing all the individual ports.

Next to each port, there are one or two circles. The first indicates the state of the port. Green means OK, red means error. The 2<sup>nd</sup> indicates activity on the DCD pin. The DCD pin is where ZDA/PPS need to be wired to. This only works on RS232 ports, which means that at least one RS232 port is required for synchronising with ZDA/PPS from a GPS.

To configure a port just click on it on the list and the parameters pop up in the Misc menu like shown in figure 2.

Misc	
Data bits	8N1
Init String	
Name	GPS 112
Port type	RS232
Protocol	ASCII <input type="button" value="v"/>
Speed	S19200
Two way	Disabled
UDP Port	

Figure 2: Misc window, showing configuration of the individual port.

Please note that it's highly recommended to give each port a meaningful name, as this helps identifying data at later stages. Details on port setup are found at section 2.4.

## 2.2 Setup using the web interface

Enter the IP address of the ATTU in a browser to access the web interface, do this after having configured the correct IP in EivaHWconfig.exe.

The web interface offers the same configuration options as the EivaHWconfig software. The General tab, allows changing of the IP/Subnet and each of the port menus will offer configuration of the ports.

The following are however only viewable in the web interface.

- Status log:  
A general status of the ATTU. Can be useful for EIVA in case of trouble shooting
- PPS Test:  
Graphical test of PPS and ZDA input. See section 2.5.1.



Figure 3: Setup using the unit's web interface. Showing the general tab expanded and the port menus listed below.

## 2.3 Serial ports

The ATTU contains a number of serial ports with RJ45 connectors. The pin out of the connector is as the following:

Pin number	Signal
1	DSR
2	RTS
3	GND
4	TxD
5	RxD
6	DCD
7	CTS
8	DTR

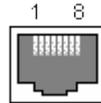


Figure 4: The Pin out of the RJ45 Connector

If the ATTU is connected to a GPS for time sync (input of ZDA telegram and PPS for accurate sync) then the PPS must be wired to the DCD pin.

## 2.4 Port configuration

It is critical that the ATTU knows which data it shall expect on a port. This is not knowledge of a sensor type like TSS Motion sensor, but more about the stream recognition. So you must basically identify how the unit can determine if a string or packet has been received. (See section 2.6).

It is naturally also important that the port I/O definition is correct – baudrate etc.

- Select the port to be configured
- Change the speed and verify that data bits are correct
- Give the port a name. This could be the name of the sensor connected
- Select an UDP port where the ATTU will broadcast
- In the Protocol dropdown box, select Autodetect. If the input is known, the input type can be selected as well

After receiving 1000 bytes of data with the correct speed and data bits, the ATTU should be able to auto detect the format of the incoming data.

## 2.5 Timing configuration

During configuration, the ATTU also needs to know if it is to use GPS ZDA/PPS or an NTP server for timing synchronisation. This can be set in the Timing menu in both the EivaHWconfig software and the web interface.

### 2.5.1 GPS timing

- To configure the ATTU to use GPS, first ensure that Use NTP is set to false
- In the GPS Port dropdown, select the port where the GPS is connected
- If using EivaHWConfig.exe, ensure that the green DCD circle is blinking once a second
- If using the web interface, click on PPS Test. This requires that the browser supports HTML5 Canvas
- The PPS test should look something like:

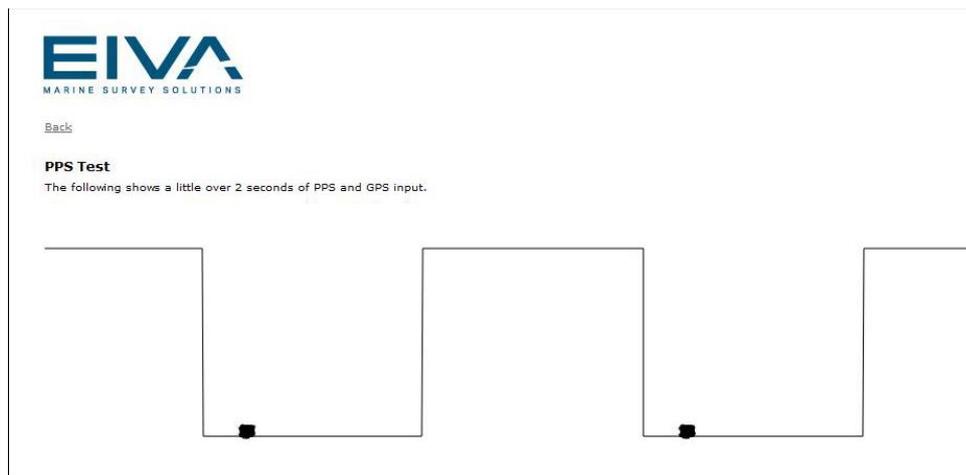


Figure 5: PPS test in the web interface. Showing DCD input (line) and the timing string (dot).

The black line is the state of the DCD input pin. The black dot is the GPS timing string. The GPS used for the picture above have a 50/50 PPS cycle, and triggers on falling edge of the PPS pulse

- If no pulse is shown, verify that the PPS pulse is wired correctly into the DCD pin
- Select the right pulse definition from the PPS Trigger dropdown, and select the GPS string to expect from the GPS String dropdown menu
- If the timing is working correctly the current time (in UTC) is shown next to the timing label

## 2.5.2 NTP timing

NTP timing is not recommended, as it may reduce the precision of the ATTU (see 3.1).

Select True from the Use NTP dropdown list, and enter the IP of the NTP server the ATTU should use as timing source.

After a couple of seconds, the timing should be working, and the current time (in UTC) is shown next to the timing label.

The NTP server can be a centralised server used on the entire survey network or a master ATTU pointed out to have this role.

## 2.6 Advanced protocol definitions

If the incoming data is not one of the known types or the automatic detect fails, it is possible to specify the type using a regular expression. A regular expression is a kind of data syntax language – see [http://en.wikipedia.org/wiki/Regular\\_expression](http://en.wikipedia.org/wiki/Regular_expression), in which you can define the stream layout.

From the Protocol drop down, select Other.

A new text input called Other should appear. In this input the match expression should be entered. For reference, the known types are defined as:

```
ASCII with <cr><lf>: [^\r\n]+\r\n]
Seapath EM3000: [\0x90-\0xaf]\0x90.{8}
RDI PD0: (\0x7f\0x7f(.)([\0x00\0x01]).){$=(\C2*256)+\C1$}
RDI PD3: \0x7E.{56}
```

## 2.7 Updating ATTU firmware

It is possible to update the ATTU firmware both through the EivaHWConfig tool, and through the ATTU web interface.

### 2.7.1 Updating using EivaHWConfig

When updating the ATTU using the EivaHWConfig tool, first make sure that the unit is on the same IP scope and subnet as the computer you are using, as described in Quick Setup section 2.1.

Next, you simply right click the ATTU you wish to update to bring up its context menu, and select “Upload new firmware”. Navigate to the firmware version you want to upload and select it, then click Open. The ATTU will then update and restart by itself.

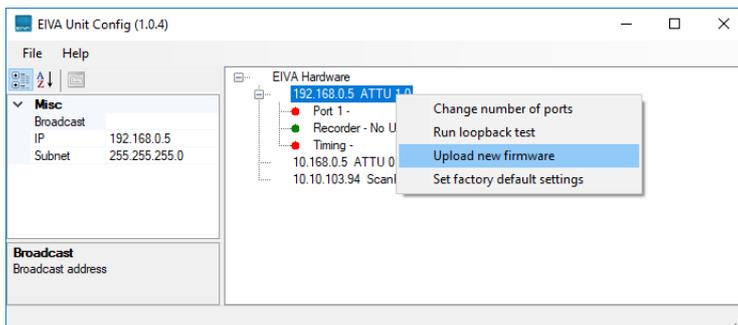


Figure 6: Updating firmware through the EivaHWConfig tool

### 2.7.2 Updating through the web interface

When updating the ATTU through its web interface, you first need to make sure that the computer you are using is in the same IP scope and subnet as the ATTU. If you are not in the same IP scope as the ATTU, you will not be able to access its web interface.

Once you have access to the ATTU web interface, you should see an “Update” link right next to the current firmware version, on the bottom of the web page (see Figure 3). Simply click the link and you will be directed to the Firmware upgrade page. From here, you can select the firmware patch as with the EivaHWConfig tool, and click “Reflash and reboot”.



[Back](#)

#### Firmware upgrade

Latest firmware is available from [download eiva.dk](#).  
Select the firmware file, and copy/paste the flash code.

Firmware file:  Ingen fil valgt.

Flash code:

Be advised, that when using this update method instead of the EivaHWConfig tool, you will also need the specific flash code that belongs to the firmware patch.

## 2.8 Saving and uploading a configuration file

It is possible to download and upload a copy of a previously set configuration for the ATTU. The configuration file contains the network setup such as IP address, along with settings for each serial port.

To download and upload configurations, open the ATTU web interface and look for a button called “Configuration” on the bottom of the web page (see figure 3).

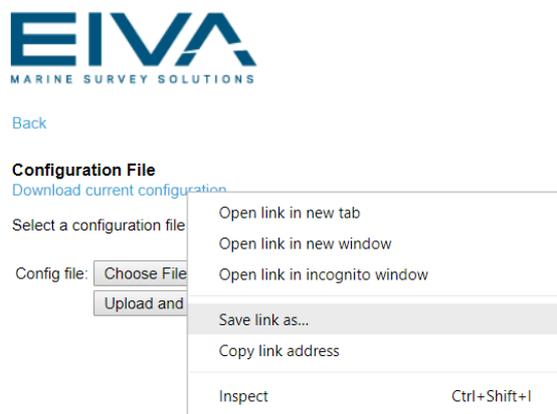


Figure 7: Configuration file menu

In this menu you can right-click the “Download current configuration” link to bring up the context menu, and select “Save link as...” to download a copy of the ATTUs current configuration. You can also simply click the link, to view the current configuration file.

On this menu, you can also choose a previously saved configuration file to upload.

**WARNING:**

Be careful when uploading a configuration file, as the ATTU cannot check if the configuration is valid before it is used. Misplaced characters can render the ATTU unusable.

If it can be avoided, never make any manual changes to configuration files, and only use configurations you have previously downloaded.

## 3 Technical specification

### 3.1 Accuracy

The original requirements for the system were defined to be:

**Time tagging better than ½ ms**

But we have via lab-test been able to prove that the system in 99% is significantly better than 50µsec and in 100% is better than 100 µsec.

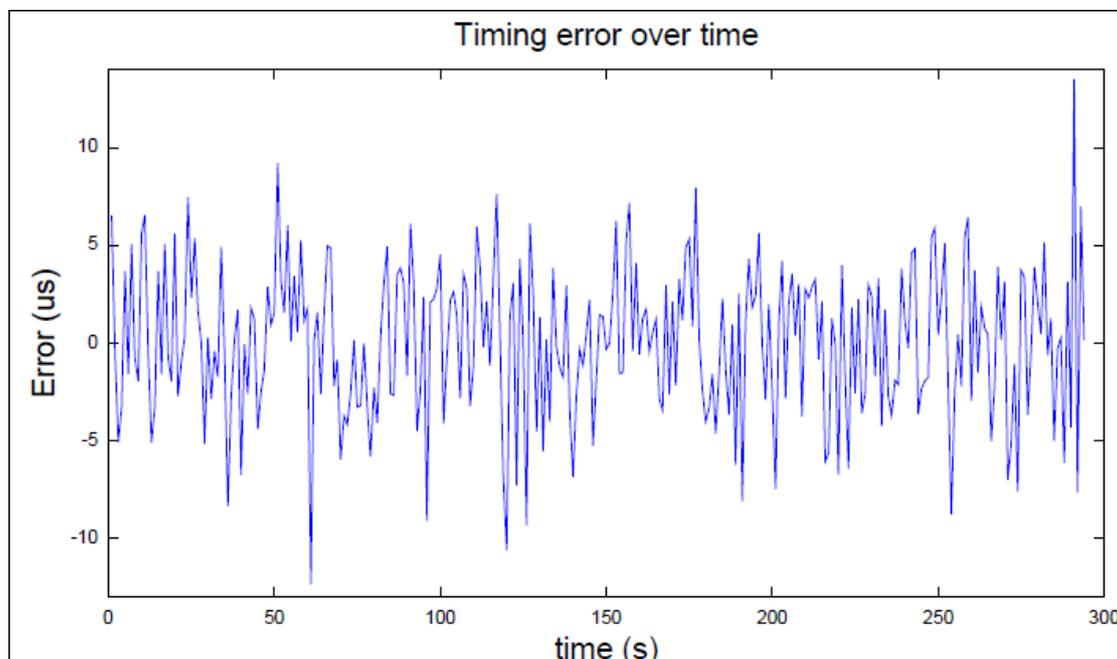


Figure 8: Results from field test on-board high-level survey vessel

These results were obtained using the optimum configurations

- The ATTU interfaces GPS ZDA/PPS (that is not NTP)
- The unit uses 23 ports with max 100 Hz (port 24 was the GPS)

A solution with NTP will degrade the time accuracy – but it will still be way better than the required ½ ms.

## 3.2 Using ATTU data in EIVA software

The ATTU's data can be used in all the EIVA online acquisition products

- NaviPac
- NaviScan
- NaviTag Recorder

For all parts it is important to notice that the pc running the software still must be synchronised with the same time source as the ATTU. This can be done either by interfacing ZDA/PPS into the SW or by using a NTP protocol (towards global server or an ATTU).

This is important as the software uses the local pc clock to validate if timing is reasonable or not, and if the two systems are too far away you may risk losing data.

## 4 ATTU Monitoring

The purpose of ATTU monitoring is to describe the day to day use of the ATTU Time synchronization program. It was created to monitor the ATTU and to synchronize the system time of the computer with the unit.

### 4.1 Getting started

When opening the program, the first thing the user will be shown is this screen:

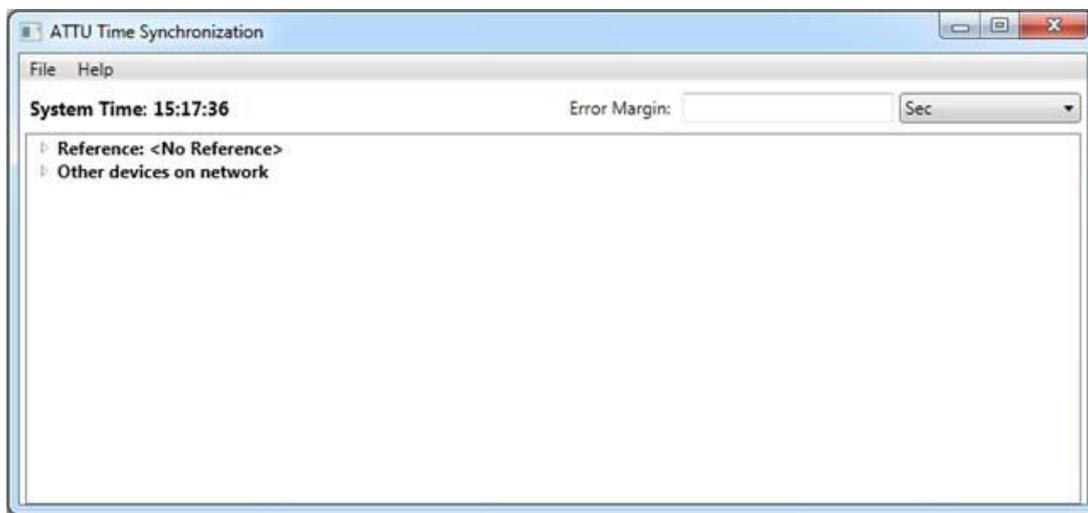


Figure 9: First window when opening the software.

From here the user has multiple choices depending on what he wants to do.

Firstly there is the Main Menu, this will be described in the later topic "Main Menu" under "Menus".

Secondly there is the option of setting the Error Margin, which will be described in a later topic "Faulty ATTU"

Thirdly the user can unfold the two lists to see the total number of devices responding to NTP. This will be described in the section "Day to day operations" under "Devices" When the user unfolds the lists the screen will look like this:

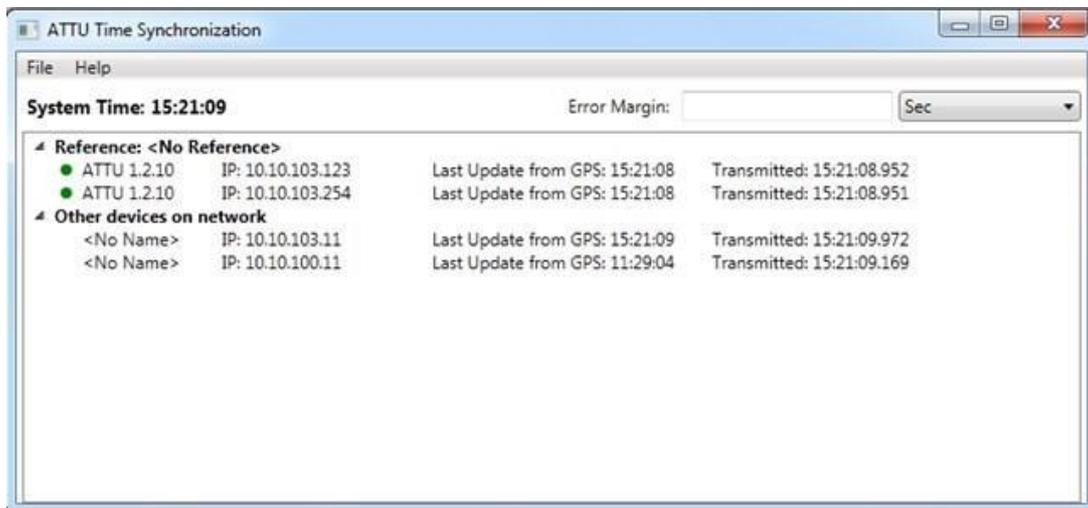


Figure 10: Shows the ATTUs on the network

When the user has unfolded the two lists, depending on what item he right clicks on, a menu will be show. This will also be described in "Menus"

## 4.2 Day to day operations

This part of the document will describe the day to day operations, the operations that the user can access while running the program.

### 4.2.1 Devices

The devices on the network will fall into two categories:

- The devices that will respond to "EIVA LLC:REQ" (ATTUs and the ScanFishes) and to NTP requests.
- The devices that won't respond to "EIVA LLC:REQ", but will still respond to the NTP requests.

Whenever a device of the first type is found by the NTP communication, it will be added to the first list (that has the header "Reference: <No reference>" if no reference is set). A ScanFish may respond in this case, but they will also be sorted as the second type.

Whenever a device of the second type is found by the NTP communication, it will be added to the second list (that has the header Other Devices)

The first list will contain only ATTUs and the second list will contain random other devices.

The other devices aren't a crucial part of the daily usage of the program, but more of a user service, to see which devices on the network that responds to NTP requests.

They contain no name, but an IP, the last time update from the GPS and the transmitted time from the device.

#### **4.2.2 The Reference ATTU System**

The purpose of this program is to be able to set one ATTU as the one every other ATTU is checking its values against. The way to set the referenced ATTU is described in the "Device Menu" section.

When an ATTU has been set to the referenced one, every other ATTU will check every time it updates, if the last input from the GPS is off by a user defined amount. How is described in the Faulty ATTU section.

##### **4.2.2.1 ATTU**

The way an ATTU is represented on the list is by four values;

- The Name, which is depicted as "ATTU" and the firmware version (e.g. "ATTU 1.2.9") The IP address of the ATTU.
- The last update from the GPS. A GPS can be attached to the ATTU, which feeds the
- ATTU with timestamps. This is depicted as "hours:minutes:seconds"

The transmitted time from the ATTU. Whenever the client transmits a package to a device, a transmit timestamp is set. When the package returns the transmit timestamp contains the time when the device send the package back to the client.

- It is depicted as "hours:minutes:seconds.three decimals of milliseconds"

Next to an ATTU device there will always be a marker depicting the status of the ATTU. This will be described further in the "Faulty ATTU" section.

##### **4.2.2.2 Faulty ATTU**

The user can write a number in the Error margin textbox and choose a unit. This number describes how much an ATTU may be off in the last time update of the GPS, before it should be depicted as faulty.

The user can write whatever number he chooses, however it may not be a decimal number. If the user writes a decimal number, this error will be shown:

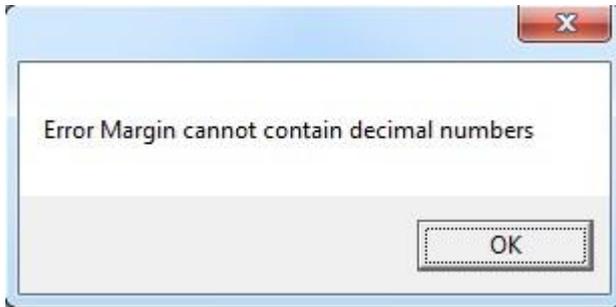


Figure 11: Error message if decimal numbers are used.

A faulty ATTU is depicted by the marker next to the ATTU. Whenever everything is well, the marker will be green, but if the ATTU is off by the user defined error margin, it will become red.

This means that something has gone wrong with the GPS and should be investigated. Below it can be seen how a faulty ATTU representation can be seen:

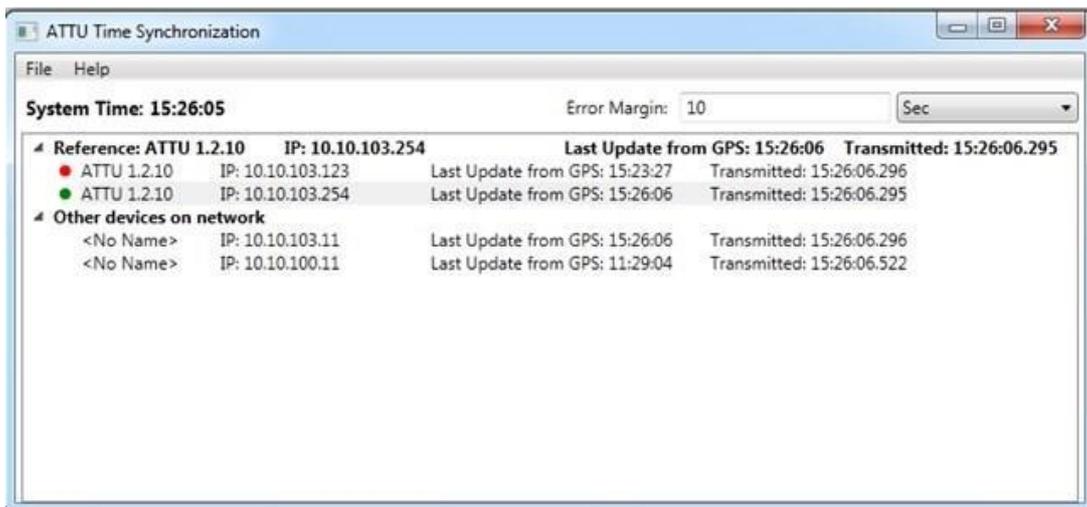


Figure 12: One ATTU is red. It is off by the user defined error margin.

Notice, that the transmitted time is still accurate, this is because a package will still be received and transmitted back, but it will hold the last update of the GPS which potentially hasn't happened for a while.

The transmitted timestamp isn't created by the device, but set on the client side and then altered on the device. Basically it will be possible to say that if the GPS time isn't running and the transmitted is, there is still connection to the ATTU, but no GPS input.

If both times aren't running it means that there is no connection to the device at all, since nothing is transmitted. It is only the GPS time that is marked however, but when the

connection to the ATTU disappears, the GPS time will also stop, so it will be marked none the less. Below an example of this can be seen.

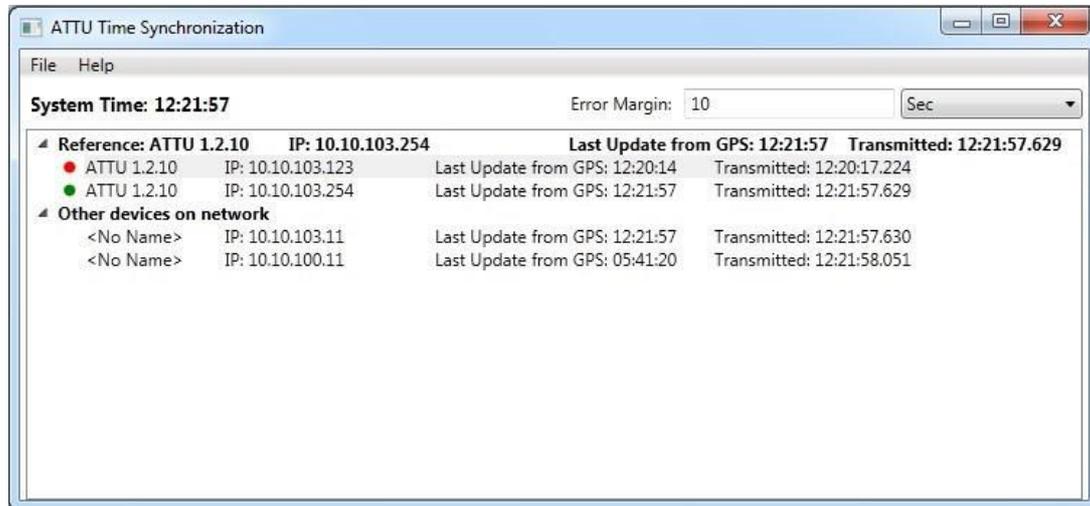


Figure 13: GPS time stops

It is also possible that the reference ATTU will show an error. This can be seen by the tag "Reference:" will change to "REF ERROR" and the reference ATTU will turn red.

This happens when the System Time is 4 seconds ahead of the Transmitted time of the reference ATTU, and will have that effect that the system time no longer will be updated from the referenced ATTU.

#### 4.2.2.3 The system clock

Another task of the reference ATTU is to keep the clock of the computer the program is running on, up to date.

The GPS time of the reference ATTU will update the clock every minute, but it takes about a second for the system time to update, so an additional second is added to the system time, besides the GPS time.

The figure 12 and 13 below, shows the system clock before an update, and the system clock after an update.

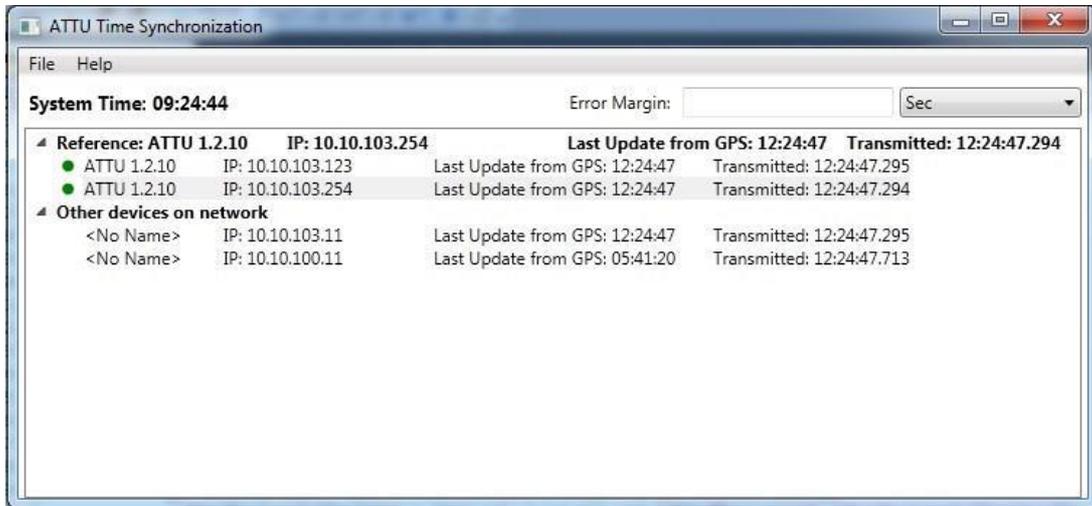


Figure 14: System clock before an update.

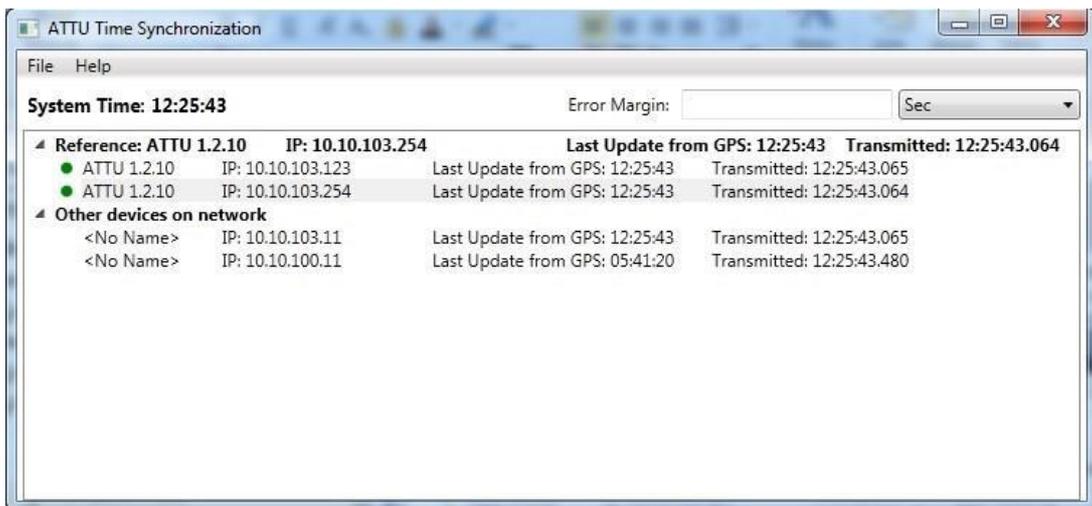


Figure 15: System time after an update.

#### 4.2.2.4 The graph

Whenever the System Clock has been set, the time correction will be displayed on the graph as the number of milliseconds on y-axis and the time of the update on the x-axis.

Every minute the graph is updated with a new observation. On the figure below a reference ATTU has been set for a couple of minutes and it can be seen how a graph has been created.

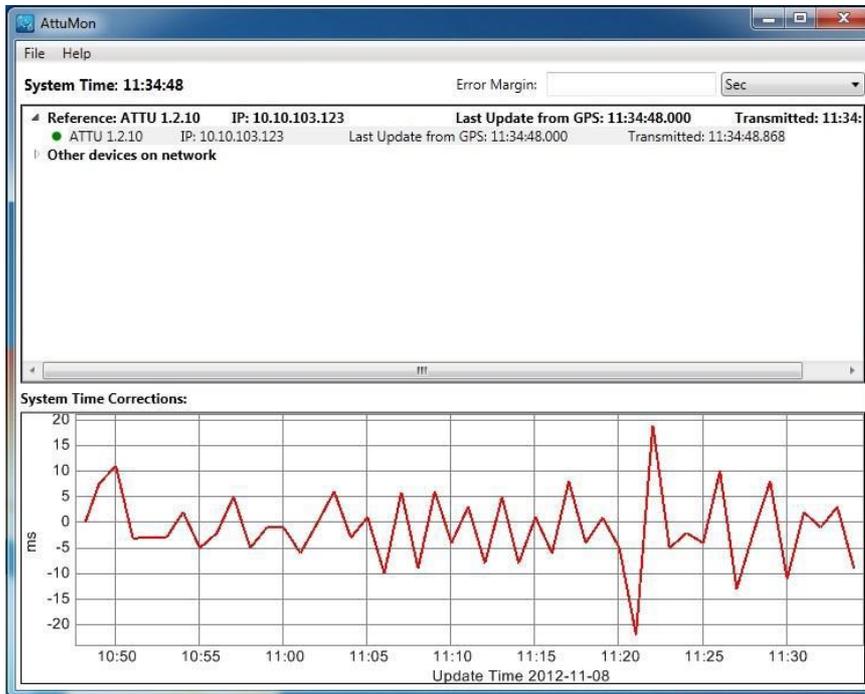


Figure 16: Correction graph

Whenever removing the reference ATTU, the ATTU that is referenced or setting a new ATTU the graph will be reset and started again.

Every time the graph is reset, an observation at (0,0) is added to the graph automatically. This is done so that the graph starts to create lines on the first minute rather on its second minute.

This will make the second observation rise or fall from 0, depending if the time correction is positive or negative.

## 4.3 Logging and Saving

For diagnostic purposes every ATTU can be chosen to be logged.

This is done by opening the menu for the ATTU and choosing to log it. When an ATTU is chosen to be logged, the logging process can be started by clicking the logging button in the main menu.

The logged string contains the string also depicted on the list, and it is logged every second.

The standard Windows Save As dialog can be accessed to choose where the logging files should be saved.

If no path is chosen, the path will default to a folder called "Default Logging", and the files will be named by the ATTUs IP.

Below is an example of how an ATTU is logged.

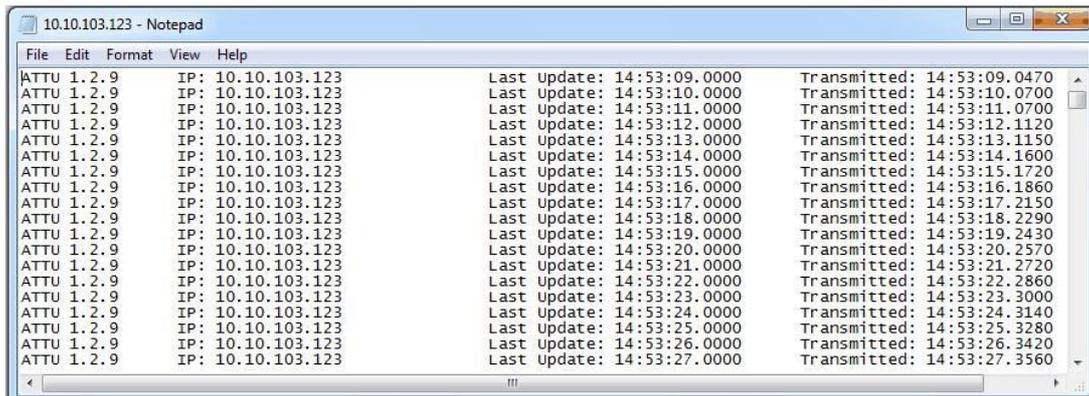


Figure 17: ATTU Logged

The chosen ATTU for logging is saved between openings of the program, but if the "no ATTU" has been chosen as the logged one, or the chosen one doesn't exist anymore, then this error will be shown:



Figure 18: Error if no ATTU has been chosen for logging.

## 4.4 Webpage access

By double clicking an ATTU, the webpage of the ATTU will be shown by the users default browser.

The webpage is defined by the ATTU's IP, and at that page every information about the ATTU can be seen, and the options for that ATTU can be changed.

## 4.5 Menus

There are two different menus in the program. The Main Menu, always visible at the top of the screen, and the Device Menu visible when right clicking a device on the list. The content of the Device Menu is different depending on what device have been clicked.

## 4.6 Main Menu

The Main Menu contains two submenus.

### **File**

In the file submenu, three functions can be accessed:

- Save As

Opens the standard Windows Save As dialog where a path and filename can be chosen. The default filename is "Log Name" and the default file extension is ".txt"

- Log IP

Starts the logging of the ATTU with the chosen IP. If no ATTU has been chosen it will simply say "Log IP:", but if an ATTU has been chosen, the IP of that ATTU will follow the colon. If no ATTU has been chosen or the ATTU no longer exist on the list, a click on this button will show the user an error.

- Exit:

Closes the application

## Help

In the Help submenu, two functions can be accessed:

- Help

Shows this document.

- About

Shows the information like product version, for the program.

## 4.7 Device menu

Depending on what device has been right clicked a different device menu will pop up.

If the referenced ATTU is right clicked, the only option the user gets is Remove Reference. This will reset the referenced ATTU and set it to "Reference: <No Reference>".

If a device in the "Other devices on the network" is clicked, the user only gets the option to remove the device. This simply removes the device, but it will reappear if it still exists on the network.

If an ATTU is clicked in the main list, the user will get three options:

- Make Reference ATTU

Sets this ATTU as the reference, but the ATTU does not disappear from the list of all ATTUs, it will simply be copied. See "The Reference ATTU System" for more information

- Remove ATTU from list

Removes the ATTU from the list. If the ATTU still exists on the network and can respond, it will simply return after its next update.

- Make logged ATTU

Sets this ATTU as the logged one, saving it in settings to persist it, and setting its IP to the Main Menu option Log IP.