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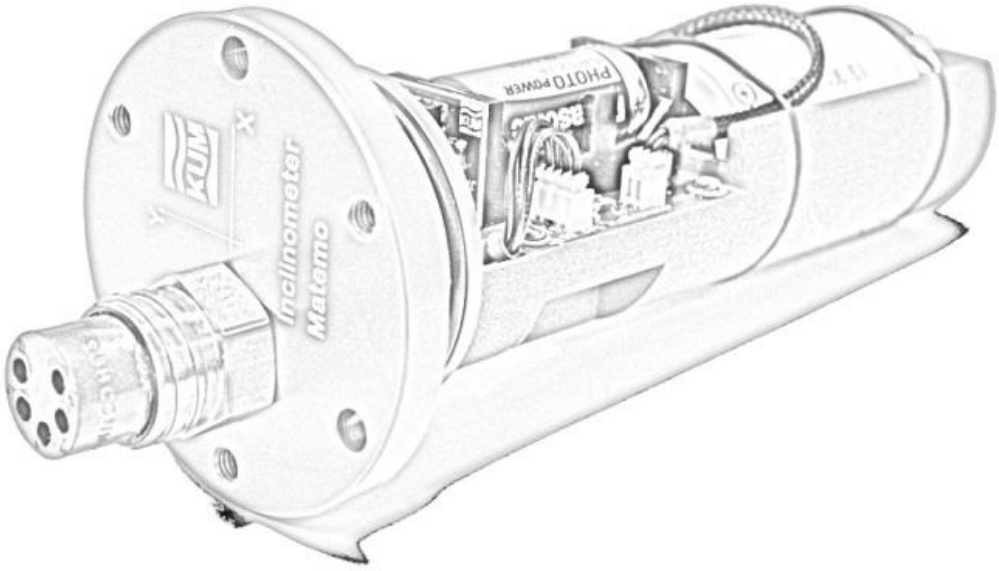
Inclinometer MATEMO

(Multi Axis Tiltmeter for Exposure Monitoring)

User Manual 2017.09



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1 General

1.1 General Safety instructions

Above all service and maintenance works must be done according to the valid safety precautions. Please mark each part before servicing.

When changing batteries or performing maintenance works please use only tools made from bronze or special steel 1.4539 respectively titanium TiAl6V4 in order to avoid any corrosion.

When assembling instruments only take new sealings.

Grease all screw fittings properly when assembling (never dry).

Take only the prescribed lubricants.

All service and maintenance works may only be performed by people with adequate training.

Each time after service and maintenance works test carefully the operational capability of the inclinometer.

User instructions for cables and wires

After disconnection protect each connector (male and female) with dummies in order to avoid the penetration of humidity or other contaminants as well as damaging the connector pins.

In operation and upon transport it is not allowed to apply improper tension on moveable wires and cables. In particular one must pay attention that the inclinometers are not hung up at the cables and that connectors are not unplugged tearing the cable.

User instructions for connections

Moveable electrical external devices (e.g. personal computer) can only get connected using the intended plug and socket outlet.

It is not allowed to use connectors and adaptors that suit in sockets of different voltages.

1.2 Manual Directions

This user manual intends to be an introduction as well as a reference manual. It will help you to answer questions and to solve problems quickly and efficiently.

If problems with your inclinometer occur, please refer to the user manual first and read it carefully.

Use the table of contents to find the corresponding paragraph and study it carefully. If you receive an error message on the screen check all contacts and connections and also refer to the detailed description of error messages of software “MATUI”.

Should there still be unanswered questions you can contact us by indicating your serial number as follows:

1. E-Mail: info@kum-kiel.de
2. In written

   K.U.M. Umwelt- und Meerestechnik Kiel GmbH
   Wischhofstr. 1-3 Geb. 15
   24148 Kiel
3. In urgent cases by telephone:

   Main phone: +49(0)431/7209220

   Please be prepared to have the manual ready for use.

4. Fax: +49(0)431/7209244

2 Technical Description Inclinometer MATEMO

2.1 Technical data

Operation depth:	max. 200m with POM-housing max. 6000m with titanium-housing
Operational life:	max. 36 months with batteries of full capacity
Number of measurements:	max. 62500 measurements per axis (X, Y)
Measuring interval:	1sec-23h:59m:59s
Measuring range:	± 80 ° for each axis
Resolution:	0,1 °
Absolute discrepancy: at ± 60 °	± 0,1 °
more than ± 60 °	± 0,5 °
Power supply:	3,6 V DC Lithium battery (Qty. 1) Designation Saft 33600 with soldering tag
Buffer battery:	3,0 V DC Lithium battery (Qty. 1) Designation CR123A
Total height:	169 mm
Diameter:	64 mm
Material:	POM (up to 200 m) Titanium (up to 6000 m)
Housing:	Tube
Temperature:	
Operation:	- 20 °C to + 85 °C
Storage and transport:	- 20 °C to + 85 °C

2.2 Mounting and operation

Insert the 3,6V Lithium battery (Saft 33600) in the corresponding battery carrier. After that insert the 3,0V buffer battery (CR123A) in the battery carrier that is fixed to the board. Afterwards connect the 3,6V Lithium battery over the 2-pin Molex connector with the corresponding socket on the board (VCC). The 4-pin Molex connector for the connection to the Subconn connector is already mounted on the board upon delivery. Do not disconnect this connection.

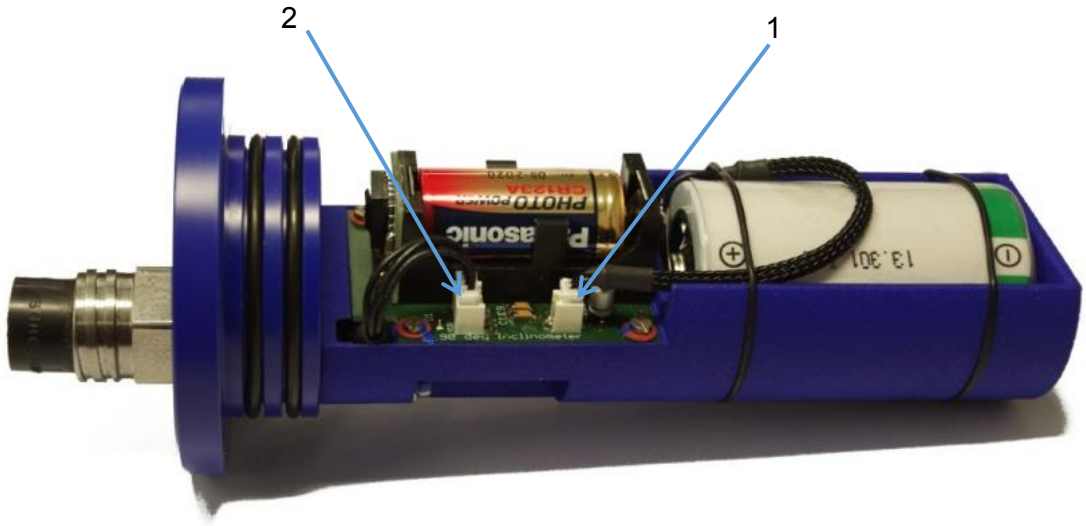

Figure 1 Inclinometer connections

1. Connection battery – board (2-pin Molex connector voltage supply VCC)
2. Connection from 5-pin Subconn connector to 4-pin Molex connector (USB connection)

By means of the programmation cable one connect the inclinometer with the PC or the laptop. It connects the inclinometer over the Subconn connector with a USB A connector.

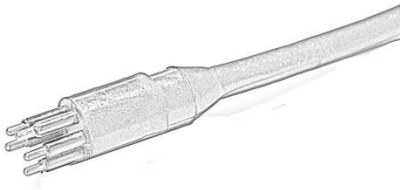

Figure 2 Subconn connector

Figure 3 USB-A connector

MATUI
(Multi Axis Tiltmeter User Interface)

User software for the Inclinometer MATEMO
(Multi Axis Tiltmeter for Exposure Monitoring)

March 2017

3 Software MATUI

3.1.1 Application

By means of the software Matui the following points can be programmed and transferred to the inclinometer electronics from KUM:

- Synchronizing and interrogation of RTC (Real Time Clock) of the inclinometer
- Interrogation of the current tilt values
- Detection and deletion of the offsets immediately or time delayed
- Setting of an interval for data acquisition
- Start and stop of data acquisition
- Delayed start of data acquisition
- Memory readout and its deletion on the inclinometer
- Data evaluation with and without offset consideration
    1. Display in a diagram with one graph for each axis
    2. Data display in a table showing date and time of recording
- Data saving in a binary of CSV file

3.1.2 License condition

To the user is granted a non-exclusive right to install and to use the software simultaneously on an unlimited number of computers provided that the following rules are observed. Each copy must contain all parts from the original.

3.1.2.1 Copyright

The software MATUI and the documentation are bound to Copyright. It is expressively not allowed to multiply the software, even modified software and documentation. Each break of this rule can cause legal steps.

3.1.2.2 Warranty conditions

The whole software package is delivered without warranty. The software features are considered as descriptions only and are not assured, hence they are not enforceable. We don´t assume any liability for secondary damages.

3.1.2.3 Disclaimer

Microsoft®, Windows®, Windows 7®, 8® and other Microsoft® products are either „Registered Trademarks“ or „Trademarks of Microsoft Corporation“ in the US and / or other countries. The “Registered Trademarks” or “Trademarks” of other manufacturers are their properties and have to be treated as such.

3.1.3 System requirements

Software platform.....Windows 7 or Windows 8

Screen resolution .....1024 x 768

Virtual serial interface .....1 from COM1 to COM50

The inclinometer MATEMO is connected with the PC per USB. The USB-to-Serial converter is already fixed on the inclinometer and gets assigned a virtual COM-Port from Windows. So that the software can communicate with the device via this COM-Port it is necessary to install the required driver from the company FTDI (Future Technology Devices International Ltd.).

See chapter 3.2.1.3 Installing of the drivers for the virtual Com-Interface.

3.2 Installation

3.2.1 Software installation

Matui_Setup (x86).exe provided on the USB-stick installs the software as well as all necessary DLLs and the user guide. In addition the necessary driver of USB to Serial Chips from FTDI is installed. For installing the drivers higher administrator rights are obligatory.

3.2.1.1 Assignment of an installation path:

For the installing path C:\KUM\Matui is set. But one can also take every other path.

3.2.1.2 Setting of a start menu file:

In the start menu file are the program icon, the Uninstaller and the user manuals stored and can be started at every time.

3.2.1.3 Installing the drivers for the virtual Com-Interface:

After having installed the program with the corresponding DLLs the needed drivers for the Serial-USB-Converter are installed. For this installing you need administrator rights. With some systems it is possible that only a hint shows that higher rights are required and hence the driver is not installed. If this is the case it is possible to execute the ftdi-driver.exe with administrator rights in the file C:\KUM\Matui\Driver.

Important note:

The assigned COM-Port is not allowed to be occupied by another driver. In addition no other software is allowed to have simultaneously access to the interface. The interface is opened from the software only when a communication between PC and device takes place. After that the connection is shut again.

3.3 The program Matui

3.3.1 Program start:

When starting the program the search for a connected inclinometer starts automatically. When being found the present status is read out. The status itemises as follows:

- Logging (yes/no)
- Last memory address (absolute occupied memory)
- Last set interval
- Start time of last data recording

After the present status has been transferred the current date and time are asked. Then all data is recorded in the previewed fields and showed the user.

3.3.2 The main window:

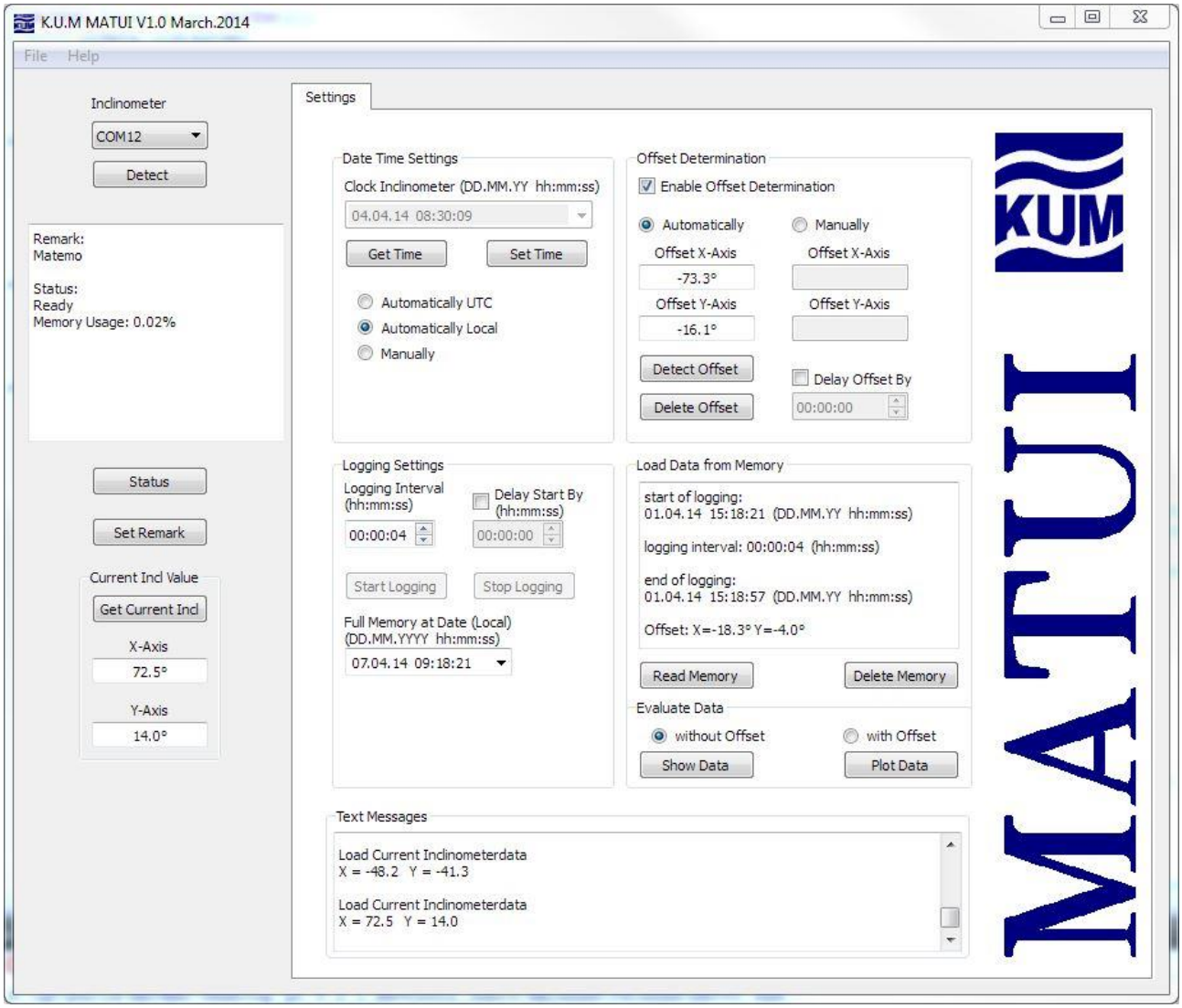

Figure 4 Main window

In the main window the user has the possibility to program the connected inclinometer according to the above mentioned points and to read data out.

In the main window one can make the following settings for a recognized inclinometer that is not recording:

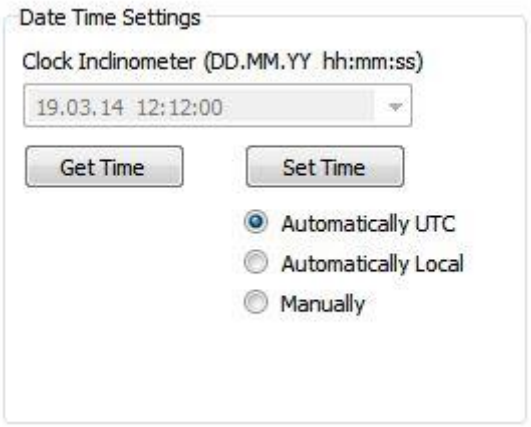

Figure 5 Date / time settings

With the **button „Get Time“** the current date and current time of RTC of the inclinometer appear and are compared to the data of the connected PC. Depending on which of the three radio buttons was set earlier the time of the inclinometer is compared to UTC, local or manually set time of the PC.

Pressing the **button Set Time** the RTC of the inclinometer is set on the current date and time at this point of time. Also here the corresponding radio button must be set before in order to set RTC in UTC, the local chosen time zone on the PC or with the manually set time. Date and time are not editable before the radio button “Manually” is set.

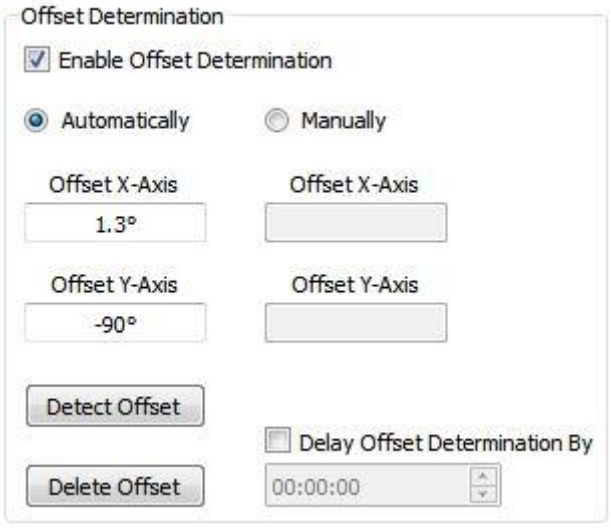

Figure 6 Offset detection

In principle the **offset detection** is set when starting the program or connecting an inclinometer. One assumes that an offset determination is necessary before data recording. For this reason the button “Start Logging” only gets activated after pressing the button „Detect Offset“. When the offset has already been detected earlier and just recording needs to be started it is possible to deactivate the offset determination with the checkbox “Enable Offset Determination” and hence can started the recording without prior offset determination. If the offset detection shall be effected at the sea floor only it is possible to set a time delay. By this the start of recording is also done time delayed. The time delay only is editable by setting the checkbox „Delay Offset Determination By“. In addition the button “Start Lgging” is activated.

Remark: Each time the offset is determined the old value in the inclinometer becomes overwritten. If only the current tilt value shall be put out it is recommendable to use the button “Get Current Incl.” (see general information).

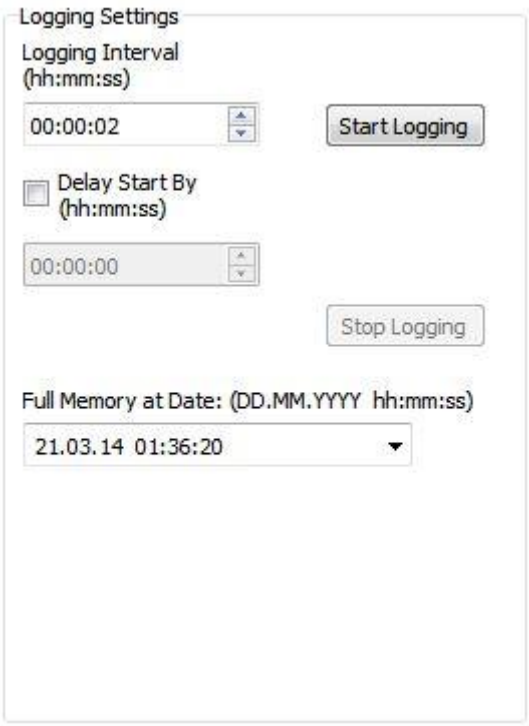

Figure 1 Logging settings

The **logging settings** are done in the field „Logging Settings“. The minimum interval is 1 second.

The interval determines in which time the memory capacity is exhausted. The date and time are shown in the field „Full Memory at Date“. Here one can also choose date and time. Then the program generates the interval that is needed to have the memory fully written at this point of time.

Start of recording is done by pressing the button „Start Logging“. This is just activated after an offset determination (see offset recognition). After having started the recording the set interval and -if set – the time delay for the start of recording and for the offset determination are transferred to the inclinometer. Afterwards the button „Start Logging“ is deactivated and the button „Stop Logging“ activated.

When the inclinometer is recording the button „Stop Logging“ is available in the program. All other settings are deactivated and become reactivated only when the recording has been stopped successfully.

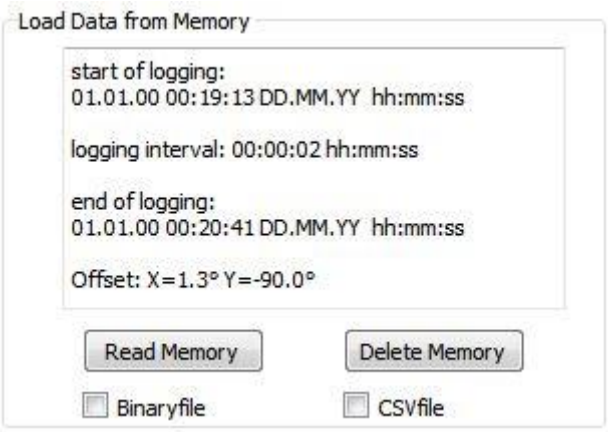

Figure 8 Load data from memory

In order to **load data from memory** recording must be stopped and the memory of the inclinometer must contain data. With the button „Read Memory“ data is loaded from the memory and the header is shown.

The header contains:

- Start of logging
- Logging interval
- End of logging respectively the last point of time of recording a measure value
- Offset

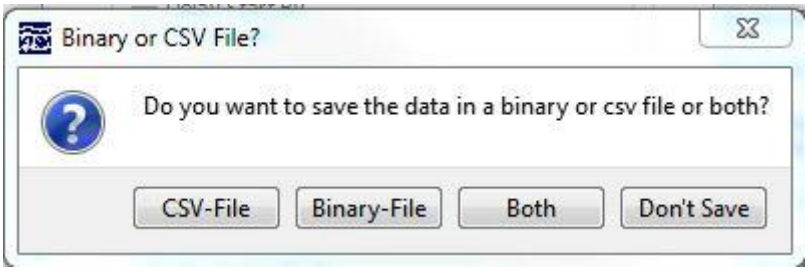

Figure 9 Save data

After the user has pressed the button „Read Memory“ he is asked whether he wants to save the data in a binary file, CSV file or in both formats. But it is also possible to read out the memory without saving the data in a corresponding file. If the saving method is chosen the user is requested to give a storage location for the files. For each file format three files are started. One for each axis and one for both axis together. The exact layout of the files is described in the chapter „Layout of the files“.

With the button „Delete Memory“ the memory of the inclinometer is deleted.

Figure 10 Data evaluation

In order to **evaluate data** (figure 10) primarily they must become read out of the memory. It is not necessary that they are saved in a CSV ore binary file.

With the radio buttons „without Offset“ and „with Offset“ one can decide whether the data of the offset is deducted or not when displaying the data. In doing so one follows the checkbox „Enable Offset Determination“. If this checkbox is set one can choose whether it shall be deducted or not. If it is not set the offset is not deducted. If it is set and if the offset shall be deducted then the offset is valid that has been activated through the radio buttons „Automatically“ and „Manually“.

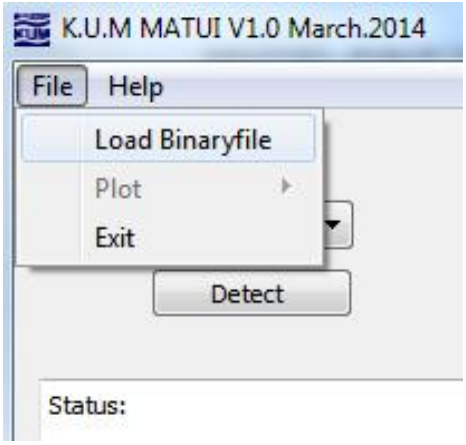

Figure 11 Load binary file

It is also possible **to load formerly saved binary files in the program and to evaluate them**. Under File → load Binaryfile one can choose a binary file that corresponds to the given format. Furthermore you can also load a binary file that contains one axis only. The program recognizes this and puts the missing axis on 0.0°.

3.3.3 Tabular data display:

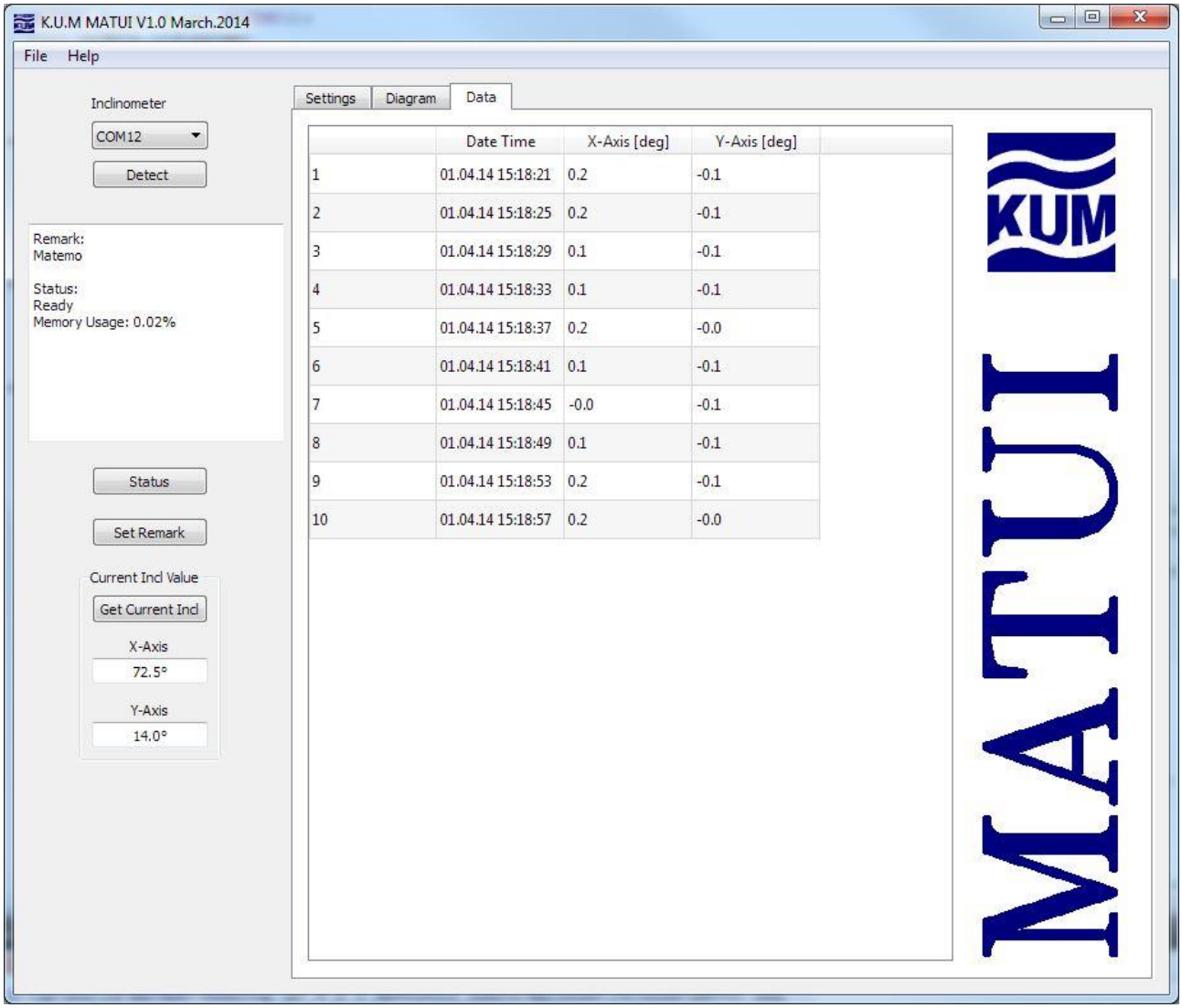

Figure 12 Tabular data display

With the **button Show Data** the data is shown in a table. In this table all values can be classified according to their size. The position in the table, date and time of recording and the values X and Y are displayed.

Remark: The date and time are not saved for each measure value but are evaluated by means of start of logging and set interval.

3.3.4 Graphic data display:

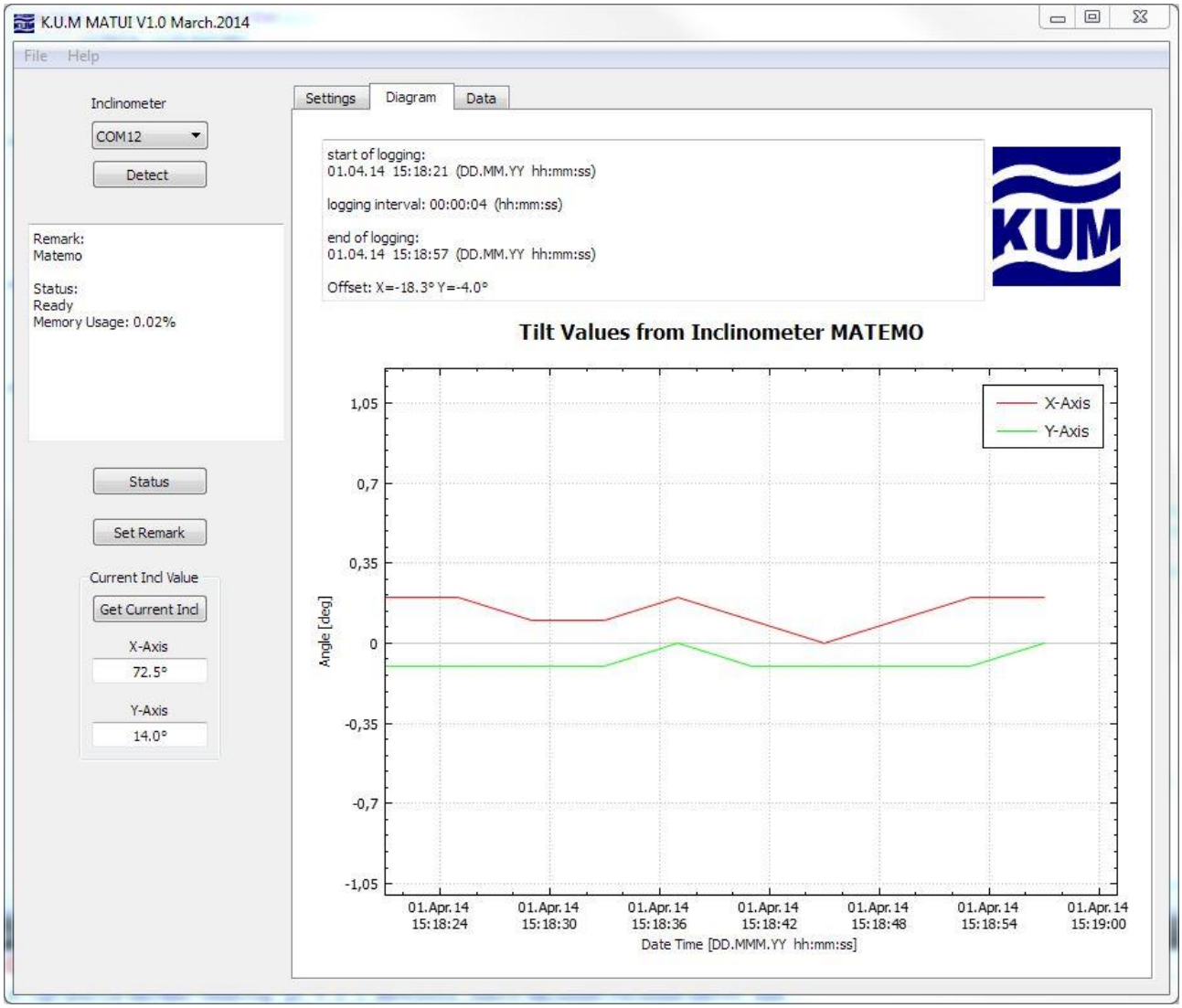

Figure 13 Graphic data display

With the button „Plot Data“ one can display **data graphically in a diagram** (figure 13). The display can be zoomed in using the mouse wheel. If only the scaling of one axis shall be modified one must click it (see figure 14).

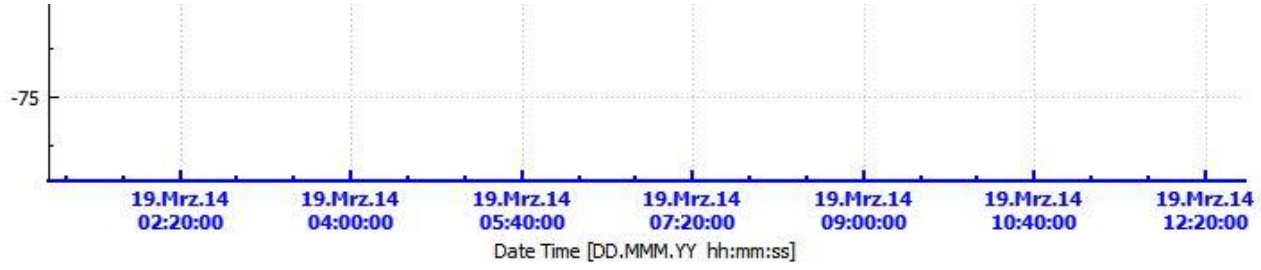

Figure 2 Scaling X-axis

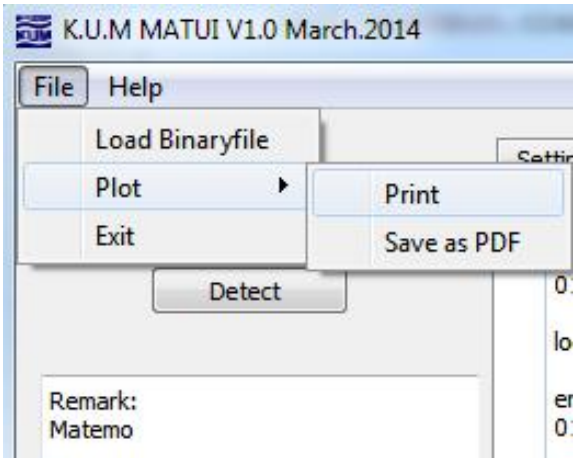

Figure 3 Print out / Saving the diagram

When data was displayed in a diagram it is possible **to save it in a pdf file or to print it out directly**. For this purpose one choose either „print or „save as pdf “ under menu point "File → Plot". Choosing „Print “ one opens the habitual windows print dialogue. Choosing „save as pdf“ the user is requested to give a path for storing the pdf file.

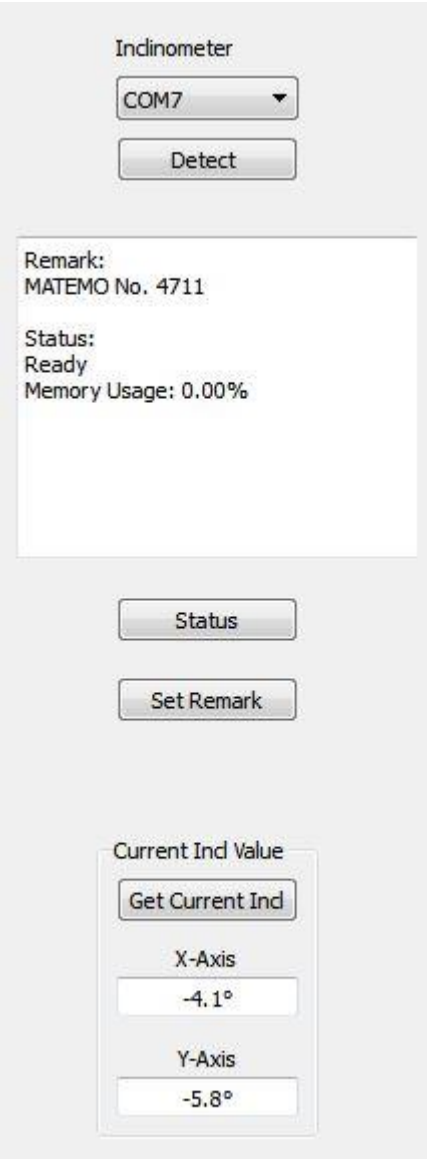

Figure 4 General Information

You find **general information** about the connected inclinometer on the left side of the program. Here the Com-port is given and how the present status of the inclinometer is. The user can write down a remark that is shown under Remark. The status is divided as follows:

- Ready (setting can be made)
    - Occupied storage space in percent
- Logging (inclinometer is recording)
    - Start time of logging
    - Logging interval
    - Occupied storage space in percent

With the button „Detect“ one can start another search for a connected inclinometer. In general this is only necessary when the program shall read the inclinometer completely in again. The button „Status“ updates the data in the status window

With the button „Set Remark“ the user can freely set a remark. 25 characters are available.

One can call for a current value in the field „Current Incl. Value. With the button „Get Current Incl.“ the current values for X and Y axis are called and shown. If the checkbox „Enable Offset Determination“ is set the activated offset (automatically or manually set) is deducted automatically. If the offset shall not be deducted it is enough to deactivate the checkbox „Enable Offset Determination for a short time or to set the manual offset on 0.0°.

3.4 Layout of the files

3.4.1 CSV file

Data in a CSV file are separated through a semicolon. First the header is shown. There one finds start of logging, set interval, end of logging respectively point of time of the last measure value and last offset.

Then follow data with the corresponding logging date. The logging date was not adopted in the internal memory of the inclinometer but evaluated from the start of logging and set interval when setting the CSV file.

3.4.2 Binary file

In the binary file the first 50 Byte are reserved for the header. The decoding of the header is as follows:

- 7 Byte start date and time in BCD format (ss mm hh DD MM YY)
- 4 Byte interval in BCD format (ss mm hh DD); a 0x80 means that this time unit was deactivated. With version 1.0 it is standard that the day setting is not activated.
- 7 Byte end date and end time in BCD format (ss mm hh DD MM YY)
- 3 Byte last storage address
- 2 Byte Offsetx
- 2 Byte Offsety
- 25 Byte for user´s remark

After the header follows data for X and Y. These are saved with 16 Bit, but only 11 Bit (resolution 0.1°) are user data. These values still must be multiplied with 0.1 to get the tilt value.

3.5 Hints

3.5.1 Data read out despite deletion:

If data is deleted with the button „Delete Memory“ it can be recovered with a trick.
One has to disconnected first tension supply and then USB connection for 5 seconds round about. Afterwards one reconnects first tension supply and then USB connection. When starting the inclinometer reads the storage address in and hence will „forget“ the deleted status. But this trick only works until the next command „Start Logging“ is executed because then the storage address is overwritten definitely.

3.6 Version overview

Each new version with its modifications is documented in the following list:

Version	Modification	From	Release Date
V1.0	-	T. Gades	30.03.2014
V1.1	min interval = 1sec	T. Gades	28.07.2016
V1.2	Bug fix Read Memory	T. Gades	02.02.2017
V1.3	CSV-file in english	T. Gades	07.03.2017