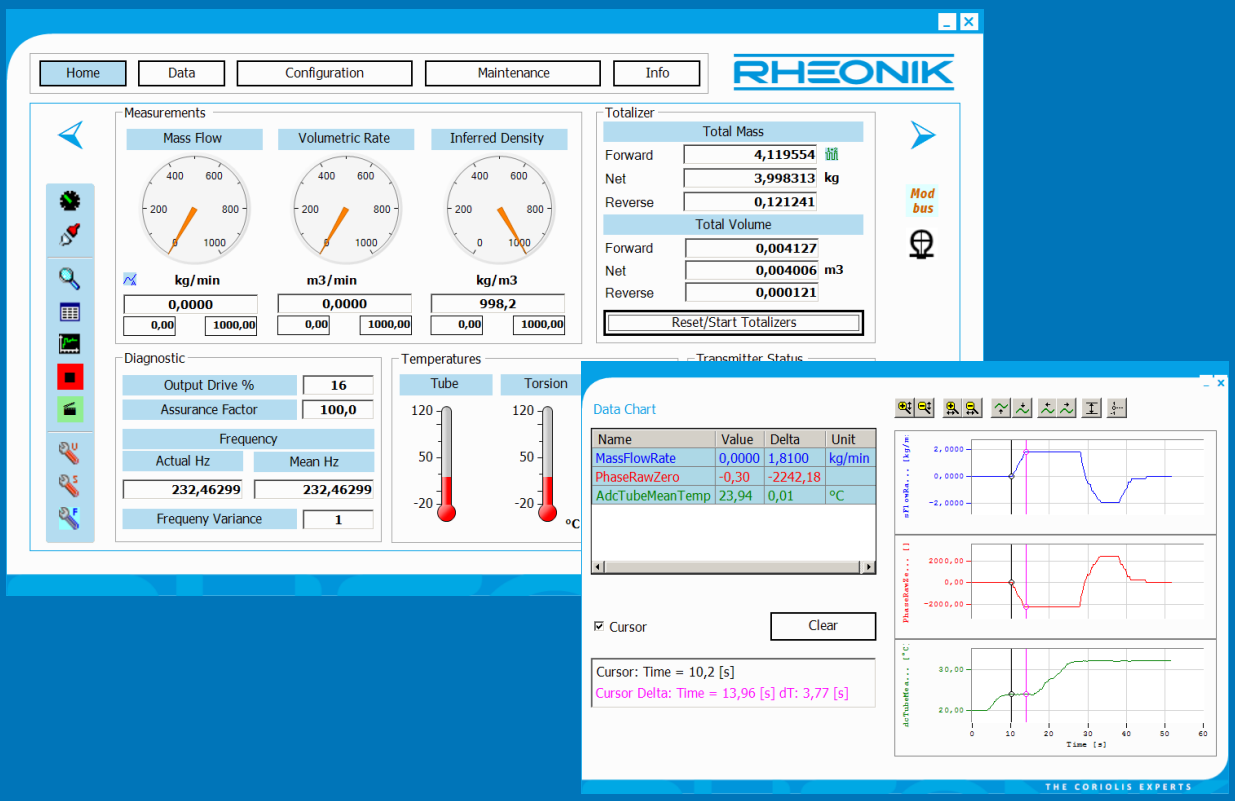
RHEONIK.



RHEComPro Suite User Manual

GET FLOW MEASURED

Rheonik Messtechnik GmbH
Rudolf-Diesel-Straße 5
D-85235 Odelzhausen
Germany

Tel + 49 (0)8134 9341-0
info@rheonik.com

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RHEComPro Suite Software

User Manual for RHE16, RHE20 Series and RHE40 Series Transmitters

RHEONIK.

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Baseline information:

Version 1.00 of this document describes the software version 3.09 of the RHEComPro Suite.

Version 1.01 of this document describes the software version 3.12 of the RHEComPro Suite.

Version 1.03 of this document describes the software version 3.50 of the RHEComPro Suite.

Version 1.05 of this document describes the software version 3.60 of the RHEComPro Suite.

Version 1.06 of this document describes the software version 3.65 of the RHEComPro Suite.

1 Introduction

With the introduction of the RHE16 transmitters Rheonik also delivered the RHECom PC program in order to facilitate an easy operating and configuration of these transmitters. When the RHE20 transmitter series was launched the RHECom program was adapted accordingly and subsequently improved based on customer feedback.

With the launch of the RHE40 transmitter series major enhancement of the RHECom were necessary and customers expressed wishes for native language support. Since the graphics elements of the existing RHECom program could not be easily adapted to the space needed by texts in different languages such as Chinese and Russian a complete redesign was necessary. This redesign allowed the integration of additional features such as an RHE/RHM simulator. The result of the redesign is called RHEComPro Suite and supports following devices

- RHE16 transmitters,
- RHE20 series transmitters,
- RHE40 series transmitters, and the
- RHE/RHM simulator

with following communication interfaces

- serial Modbus RTU via RS485 or USB-to-serial converter,
- Modbus TCP, either directly to RHE40 devices are indirectly via Modbus multiplexer, and
- HART.

The current version supports following languages:

- English
- German
- Russian
- Fresh
- Chinese

Support for Spanish will be available in the next versions. The future of RHEComPro program will see more language support and added convenience features driven by customer feedback.

1.1 Licenses

The basic RHEComPro Version named “RHEComFree” is available free of charge. This includes many basic features and the ability to

- view all measurement data,
- read out of transmitter setup parameters,
- up and download of configuration data and configuration files,
- configure outputs and inputs,
- configure general settings,
- monitor diagnostic information,
- monitor the Assurance View and Factor, and
- use the HART communication.

In general all features that are order options for RHE transmitters such as the onboard data recording feature of the RHE40 devices are supported, as well.

Rheonik offers two license levels for additional features. On the level “RHEComPro” following additional features become available:

- convenience dialog boxes for calibration purposes,
- data trending, and
- data recording on the PC.

The “RHEComPro” license is strongly recommended for users who intend to calibrate the mass flow or the density measurements of an RHM/RHE assembly. The “RHEComPro+” license adds following further features:

- RHE/RHM simulation,
- creation of configuration files with the help of the simulator, and
- comparison of configuration files.

The simulator is particularly helpful for the preparation and tests of complex configurations.

Please contact the Rheonik Support for information on licensing and the availability of test licenses which allow you the evaluation of the more advanced features.

1.2 Referenced Documents

In this manual the features and peculiarities of the RHE transmitters configured and operated by the RHEComPro program cannot be explained in detail. Please refer to the respective manuals in the following list for further information:

1. RHE16 Coriolis Transmitter Operating Manual
2. RHE20 Desktop Reference, Document No. 8.2.1.01
3. RHE40 Desktop Reference, Document No. 8.2.1.14
4. Addendum RHE40 Desktop Reference Data Logging, Document No. 8.2.1.15.
5. RHE20/40 HART® Communication Reference Manual, Document No. 8.2.1.02.

Contact the Rheonik support to obtain the newest version of these manuals or visit www.rheonik.com/support.

2 Installation

2.1 Running the Setup Executable

The RHEComPro suite is available in form of an executable setup file suitable for Windows 7, 8, and 10. In some instances the setup file is packed as “.zip” file in order to pass limitations of email configurations or similar obstacles. In this case the setup file must be unpacked first before run.

The installation executable bears the name

SetupRHEComPro_V3.X.Y.exe

where X and Y are minor version numbers. Newer versions of the software will have a higher version information embedded in the file name. Please use an antivirus program to make sure that this executable was not contaminated during the transfer to your site. Run it when it passes the check to initiate the setup process.

After the start the setup program asks for administration rights. This request must be confirmed to proceed. There are 3 main installation steps (displayed in Figure 1).

Step 1: Select the language of the installation wizard.

Step 2: St the welcome window, read the information in the dialog box and click on the “Next” button to continue.

Step 3: A license agreement appears which must be accepted to proceed.

Step 4: select the folder where the RHEComPro is to be installed. Note that the Software needs a minimum of about 36 MB of free space on hard disk drive. Click “Next” to accept the folder location.

Step 5: Select the type of the installation. For normal use select the “Install RHEComPro” option. The other option is intended for Rheonik Partners and Service and will install the filter data base for RHE40 transmitter series, as well.

Step 6: As an option the location of the RHEComPro Suite in the program start menu of the Windows operating system may be selected.

Step 7: As an option he installation of a desktop icon may be chosen.

Finally, the selected installation parameters are displayed and the installation is started by clicking the “Install” button. Please take a note of the installation directory as you probably need to run the simulator separately to clear it as a communication server at the local firewall or antivirus program.

For Windows 7 the standard installation directory is named

C:\Program Files (x86)\Rheonik\RHEComPro

In general, it is recommended that all the suggested default installation details are accepted unless there are special policies for software installations on your PC.

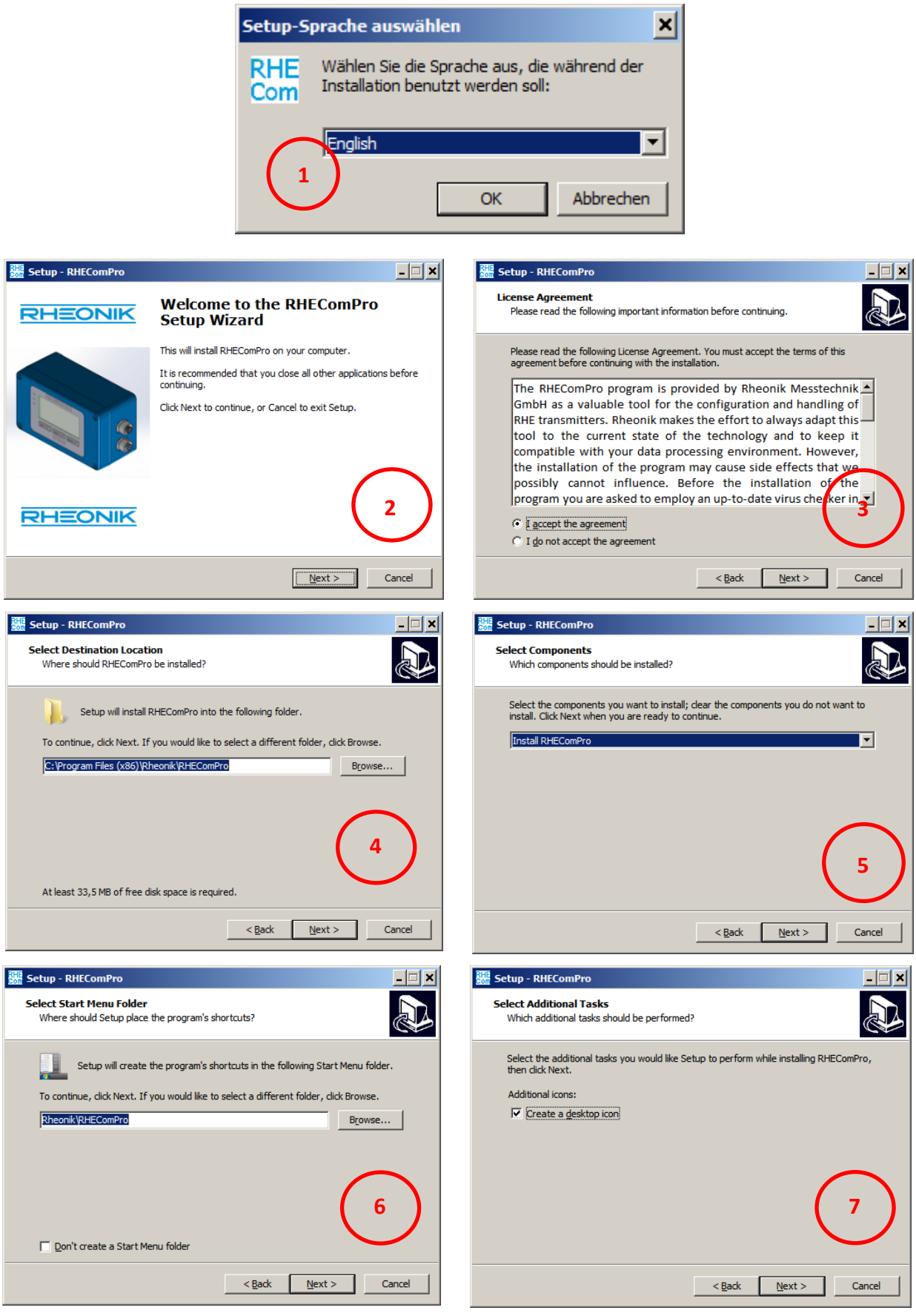

Figure 1: Installation Steps for RHEComPro Software (example for a German Windows 7 installation)

Once installation is complete, you are asked to install the FTDI drivers for the serial-to-USB converter in the RHE transmitter and the runtime environment of the RHEComPro suit..

This installation can be disabled by deactivating the respective check box in the installation windows. It is recommended to skip this installation step when the drivers were already installed during an installation of a previous RHEComPro version.

The installation of the FTDI drivers may be done separately when a previous attempt failed. These drivers are located in the "Drivers" subdirectory in the installation directory. The current version is named

"CDM v2.12.00 WHQL Certified.exe"

Execute this file as a system administrator to install the FTDI drivers.

The runtime environment may be installed separately, as well. It named

"vcredist_x86.exe"

and is found in the installation directory of the RHEComPro Suite.

Upon completion of the driver installation, you can connect your PC to the USB port on the RHE transmitter.

2.2 Clear the Simulator as Communication Server at the local Firewall

In order to facilitate a smooth start of the simulator software (only part of RHEComPro+) this has to be cleared as a communication server at the local firewall. This step may be omitted when you do not intend to use the simulator.

Use to Windows Explorer to navigate to the RHEComPro installation directory. On Windows 7 this is "C:\Program Files (x86)\Rheonik\RHEComPro". Other Windows version use another directory names to store installed programs in, but the remaining part "\Rheonik\RHEComPro" should be identical unless you modified the name of the installation directory by hand.

The name of the simulator executable is "RHESim.exe". Double-click on it to start it. When a firewall is installed on the local PC and its rules forbid the communication server functionality a message box originating from the firewall or antivirus program will pop up and ask you whether the simulator shall be granted a permission to act as server. Please confirm this and also **mark this permission as permanent**.

Close the simulator when this is done. You may check the permission by restarting the simulator and observe the reaction of the firewall program – no message box must appear. In any case terminate the simulator program before starting the RHEComPro.

2.3 License Installation

When the RHEComPro program is started the first time it offers the possibility to enter a license key. This is shown in Figure 2 below.

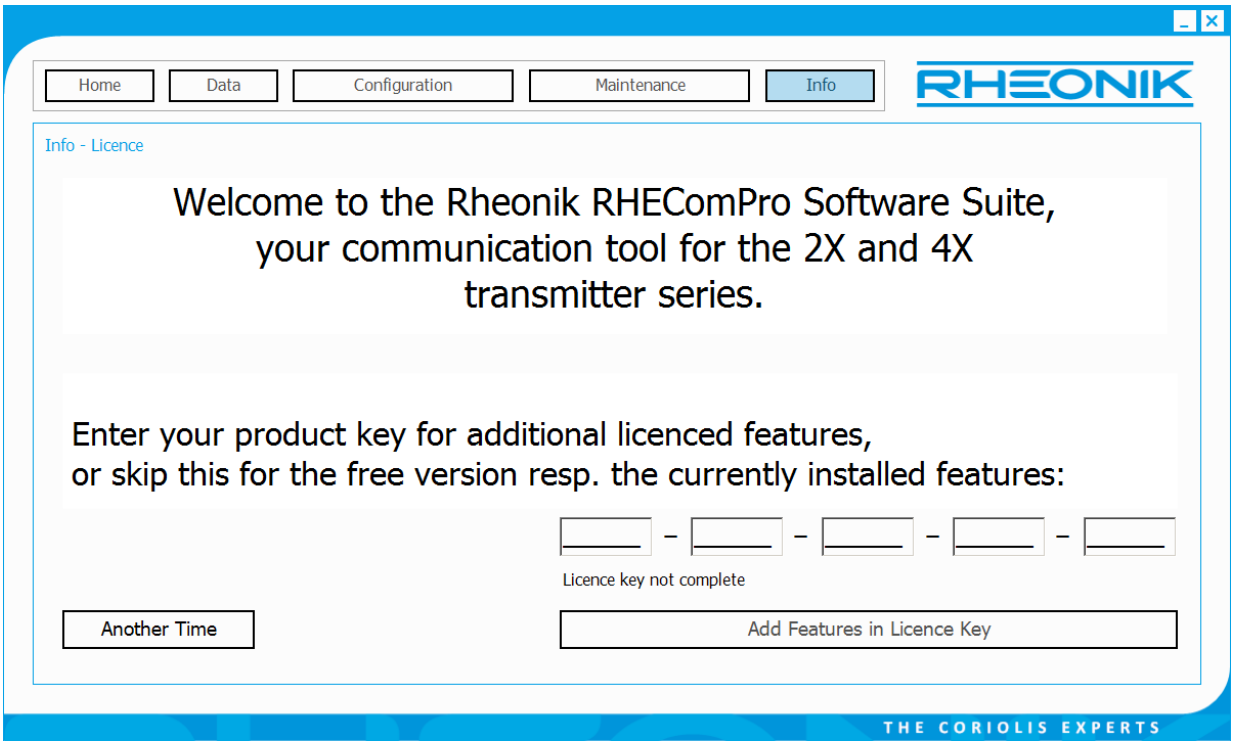

Figure 2: RHEComPro License Key Input

When you obtained a license key from Rheonik you may copy/paste it to the first position in the first input field of key sequence. Confirm the use of the key by pressing the button “Add Features in Licence Key”.

You also may skip the key input by pressing the “Another Time” button. In this case the use of the RHEComPro is restricted to the features the free “RHEComFree” license type offers, see section 1.1.

Either way, the program proceeds to the role and language selection and to the connection configuration dialog explained below.

When the RHEComPro is started the next time you are not bothered with the license input dialog any more. Should you want to enter a license key at a later time, the license input dialog can be activated again via the “Info” menu item “License Handling”.

2.4 Role and Language Selection

When the RHEComPro is started the first time and the license key input dialog is concluded the user is asked to select a role and may select a language. The corresponding dialog is shown in Figure 3.

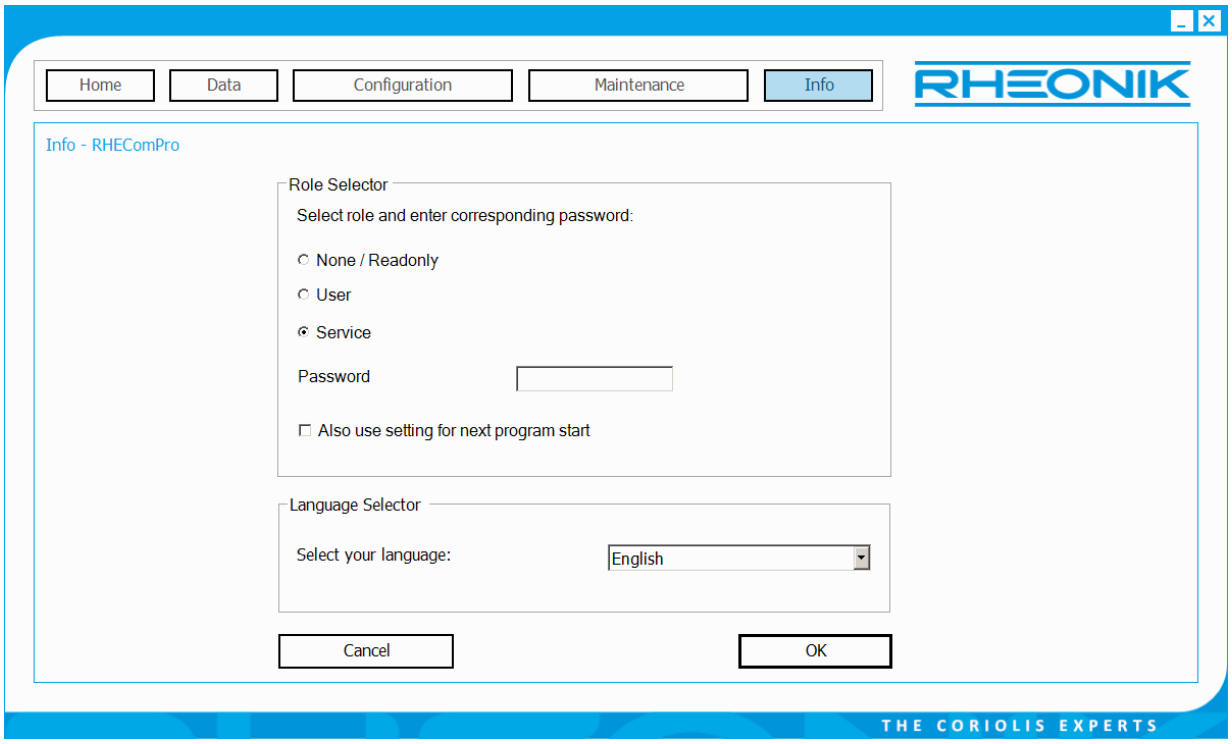

Figure 3: RHEComPro Role and Language Selection

There are three different roles to choose from. In the role “None / Readonly” measurement data will be displayed but no modification is allowed. In the role “User” user level setup parameters may be modified. This is the standard role an operator of an RHE transmitter is likely to choose. The role “Service” is intended for maintenance personal and allows the modification of almost all setup parameters and the setting of test registers. In this role modifications can be made that may not be easily undone.

The roles “User” and “Service” need passwords in the “Password” field. These passwords are no secrets, but are intended to inhibit an accidental role selection. The password for “User” is “1111” and the password for “Service” is “Rhe0n1k”.

A role may be chosen permanently by checking the box “Also use setting for the next program start”. This will cause the application of the selected role when the program is restarted the next time.

The dialog also offers the possibility to select a different language. Currently, English, German, Chinese and Russian may be selected. The selection immediate takes effect when the “OK” button is pressed. It is not necessary to restart the program.

The role and language selection dialog may be reactivated any time. It is found in the “Info” submenu as item “RHEComPro Setup”.

3 Some Important Remarks

Before working with the RHEComPro program you should read this section for a better understanding of the product and its features.

3.1 Appearance of the RHEComPro Window

The appearance and layout of the RHEComPro program adapts itself in multiple ways to external internal settings and features of the attached RHE transmitter. A user cannot assume that the appearance, layout, or functionality remains the same when one of the following factors change:

- installed license,
- selected role,
- type of attached RHE transmitter,
- optional features ordered for the RHE transmitter,
- firmware version installed in the RHE transmitter,
- communication link to the RHE transmitter, and
- activation or deactivation of the Hard Lock/Custody Transfer switch at the RHE transmitter.

Furthermore, most windows can be resized upwards to any screen size. This may affect the appearance of some windows greatly.

The screenshots in this manual all were done with an “RHEComPro+” license in the “Service” role and with a connection to the RHM/RHE simulator using the standard window size and the English language setting. Since this simulator mimics an RHE42 transmitter with all hardware options installed, all available features are accessible and may not be visible or grayed out in a different environment.

3.2 Floating Point Precision

The use of 32-bit floating point numbers for the MODBUS interface has many advantages as they allow great flexibility in the units that can be specified for a measurement value without changing the underlying binary format of that value.

However, the precision of a 32-bit floating point number has a limit of about 6.5 decimal digits. Many numbers are displayed by the RHEComPro software program at maximum available precision and therefore minor imprecision e.g. caused by intrinsic rounding during a unit conversion calculation become visible to the user. Users should note that minor imprecision and/or inconsistency of displayed numbers can be ignored as their magnitude ranges far below any measurement uncertainty.

An input for a setup parameter beyond resolution the 6 decimal digits most probably will result in a different number due to rounding effects when read back.

In some instances the RHE transmitter uses 64-bit floating point numbers internally in order to avoid the accumulation of error. Totalizers, for instance, use 64-bit floating point numbers. These values can be read out as 32-bit or 64-bit floating point numbers on the MODBUS interface level.

3.3 Saving of an RHE Transmitter Setup

When receiving a factory-new RHE transmitter it is wise to save the entire setup onto a file and keep this file for further reference when modifications to setup parameter do not work as intended and parameter settings have to be reverted.

The saving of a setup is done best after the connection to the RHE transmitter has been established by pressing the blue tool symbol in the lower left corner of the dashboard window:

This opens a configuration dialog box which allows the readout of all setup parameters as shown in Figure 4.

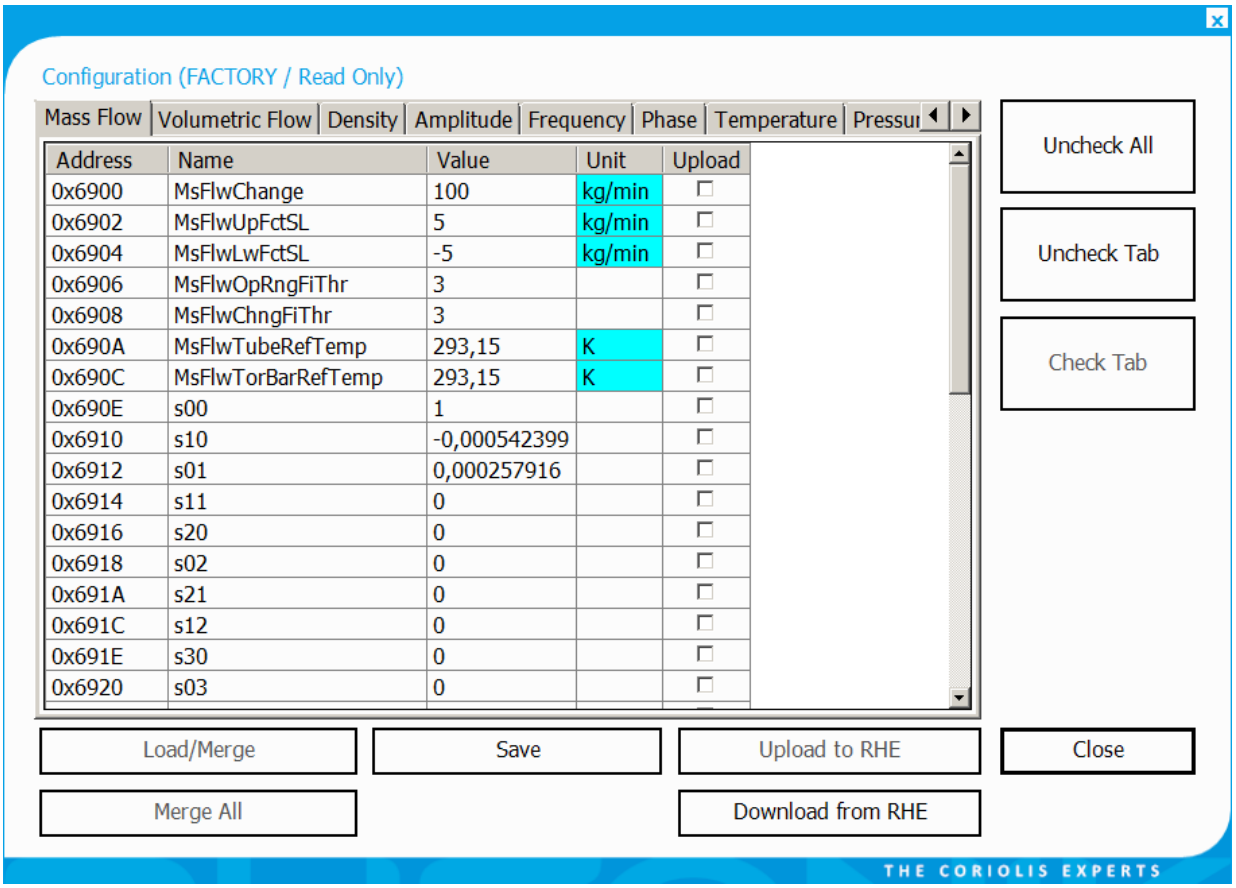

Figure 4: RHEComPro Configuration Dialog Box

Press the “Save” button and select a file to store the setup information in. After this is done successfully close the Configuration dialog box again.

The setup is stored in a CSV Format used by German Microsoft Excel installations with decimal commas and “;” delimiter character. This format can be read back by the RHEComPro program and will ease the task of the Rheonik support when a support inquiry necessitates the transfer of setup files.

All users are encouraged to familiarize themselves with the RHEComPro software by using the RHM/RHE simulator. A mishap does not cause any real harm and can be easily be undone.

4 First Steps

This section is intended for uses who want to familiarize themselves with the RHEComPro program.

4.1 Connection Configuration

When the license handling and the role and language selection has been performed the connection configuration dialog is displayed as shown in Figure 5. This dialog usually is displayed when the RHEComPro program is started and also is available via the “Configuration” / “Connection to RHE transmitter” menu as well as via tool-strip icons in the dashboard windows. This is explained below.

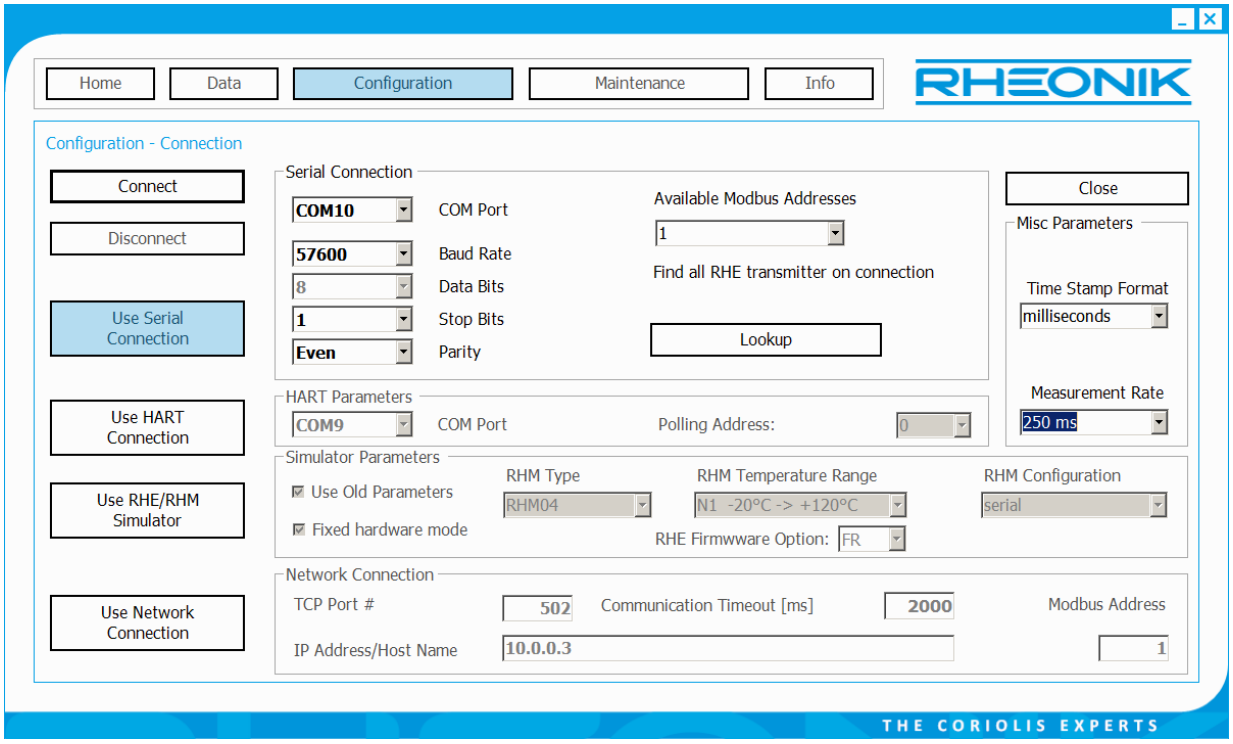

Figure 5: RHEComPro Connection Configuration Dialog

In order to establish a connection the type of the connection has to be specified by pressing one of the buttons the text of which start with “Use”. The program offers the selection of a serial connection using the Modbus RTU protocol, a serial connection using the HART protocol, a connection to the RHE/RHM simulator, and a connection using the Modbus TCP protocol via a network interfaces.

Whenever one of the selection buttons is pressed the button itself becomes inactive, is highlighted by a bluish background color, and the related parameter area to the right becomes active. The parameters in the active parameter area may be modified to specify the communication parameters to be used when the connection is to be established.

The serial communication parameters for the mini-USB socket are fixed as 57600 Baud, 8 Data Bits, 1 Stop Bit, Even Parity, and MODBUS address 1. This is also the default for the RS485 interface when a RHE transmitter is delivered by Rheonik. It is recommended to keep this setting unless the installation environment requires differently.

For a serial connection it is important to make sure that the correct COM port is chosen in the “COM port” field. The COM port must be present in the device table of the operating system before

RHEComPro is started. When connecting to the RHE transmitter mini-USB socket, the cable must be connected before the program is started.

The program will scan for active MODBUS addresses on the interface by pressing the “Lookup” button. Once the scan is complete, any active MODBUS address found can be selected in the drop down selection box labeled “Slave Name/Address”. The “Cancel” button is used to cancel the active address scan at any time - the complete scan can last rather a long time. Upon cancellation of a scan, the intermediate results are still available in the “Slave Name/Address” drop down selection box.

In the case of the simulator the type of the RHM can be specified and it can be chosen whether the parameters of the last simulator run shall be reused. When the parameters are not to be reused the simulator starts with a completely new configuration. This is useful when configuration tests resulted in major problems. The use of the simulator is detailed in section 7.

The use of the HART protocol is described in a separate document which also describes the HART implementation in the RHE20 and RHE40 series transmitter. When a HART connection is established a dedicated set of dashboard windows is shown which are different from the dashboard windows used for the Modbus-type connection.

When using a Modbus TCP connection the current IP address of the transmitter can be seen in the “Network Status” screen of the “Status Info” screen group of the HMI or in the Modbus CurrentIPv4Addr of the “Generic” input register group when RHEComPro is connected to the transmitter via a serial line. This lookup is not necessary when a fixed IP-Address has been configured.

The “Measurement Rate” and the “Time Format” selectors are used when a log file is to be generated.

If necessary the connection handling may be skipped by pressing the “Close” button. This may be the useful when only a configuration of the RHEComPro program itself is intended via the “Info” menu.

When all connection parameters are as intended a press on the “Connect” button. When a connection could be established successfully the main dashboard is displayed as shown in Figure 6.

4.2 Dashboards

There are a number of dashboards available for Modbus connections. The main dashboard is shown when a connection is established, the “Home” menu button is pressed, or the dashboard icon in the tool-strip of one of the other dashboards is activated. The main dashboard is shown in Figure 6.

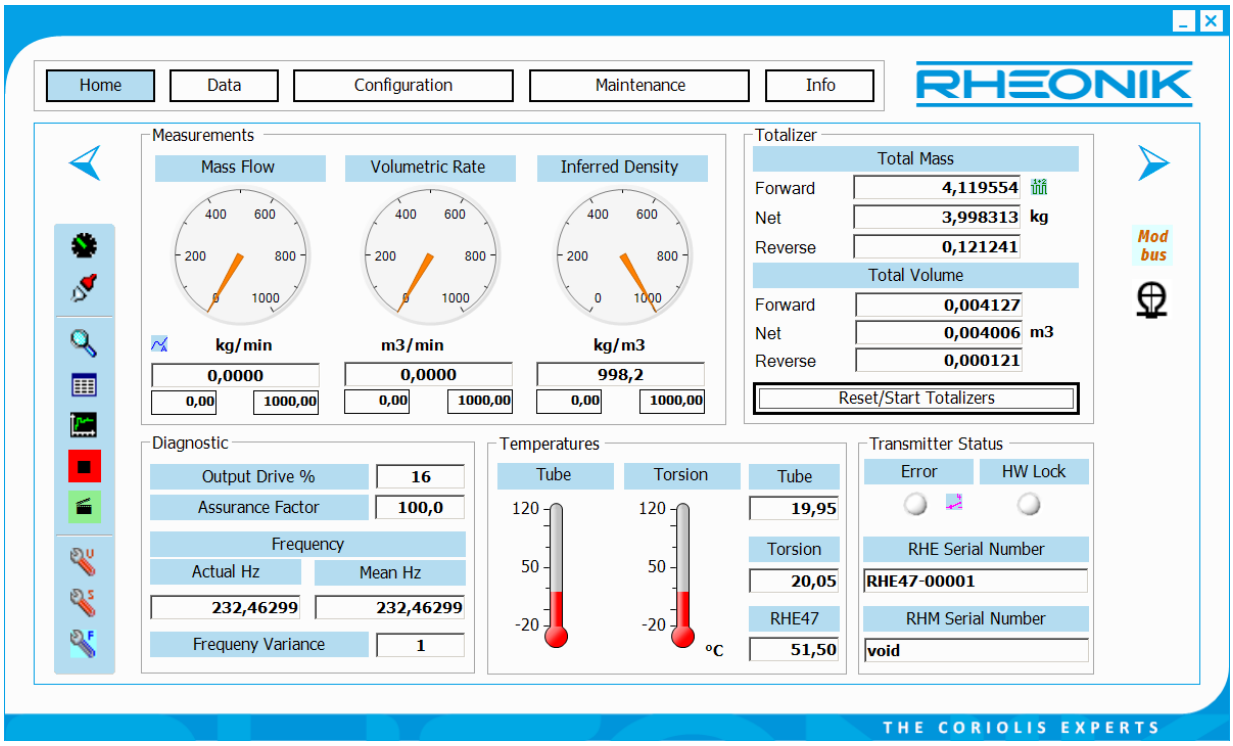

Figure 6: RHEComPro Main Modbus Dashboard

As one can see the main dashboard mainly is used to display measurement values and features a few status information. The central dashboard area only contains one control element, the button "Reset/Start Totalizers" which may be used to reset the totalizers.

On both sides of the dashboard more control elements are found which are common to all dashboards. First of all the buttons with the symbols "⮜" and "⮞" at the left and right upper corners can be used to browse through the other dashboards like a slide show. The symbols on the right side indicate the current connection. In the figure above it indicates a Modbus connection to a simulator.

On the left side to the lower a tool-strip is found which allows a fast access to other controls with the help of the icons shown therein. Note, that some items may be inactive due to the installed license or the selected role. The following table explains the functionality of the icons:

Icon	Name	Description
	Dashboard	Displays the Main Dashboard.
	Configure Connection	Opens the Configure Connection dialog box as described in section 4.1 Also used to disconnect an existing connection to an RHE transmitter or establish a new connection.
	Data Selection	Opens the Data Selection dialog box for selection of MODBUS input registers for logging, monitoring, or chart output. See section 5.1.1 for more details.
	Data View/Monitoring	Displays the values of the MODBUS registers selected by the Data Selection tool for monitoring.
	Data Trend/Chart	Displays charts of the MODBUS registers selected by the Data Selection tool for chart output.
/	Start/Stop Measurement	The periodic update of measurement values is started/stopped by clicking on these icons. They also control the update of values displayed in the Dashboard.

Icon	Name	Description
/	Data Logging on/off	Logs the contents of the MODBUS registers selected by the Data Selection tool for log output.
	User Configuration	Starts the Device Configuration dialog box which allows the configuration of all setup parameters of the “User” access level. This function is disabled when logged in with a selected role of “None”, see section 2.4. The modification of an RHE setup parameter is described in section 5.2.3.
	Service Configuration	Starts the Device Configuration dialog box which allows the configuration of all setup parameters of the “User” and “Service” access levels. This function is disabled when logged in with a selected role lower than “Service”, see section 2.4. The modification of an RHE setup parameter is described in section 5.2.3.
	Factory Functions (Read Only)	Starts the Device Configuration dialog box which allows the reading and saving of all setup parameters of the “User”, “Service”, and “Factory” access levels

Table 1: Description of RHECom Toolbar

When the dashboard window is activated the periodic measurement updates are started, as well. The updates may be stopped by configuration activities. When updates are not perceived any more, check the state of the Start/Stop Measurement icon and restart the updates if needed.

A click on the button symbol “➢” lets the interface dashboard appear. This dashboard contains the status of all inputs and outputs of the RHE transmitter and is shown in Figure 7.

In this dashboard the status displays for interface which are not existent or configured to a different functionality in the RHE are deactivated. The frequency output gauges are only activated for digital outputs configured for frequency output and deactivated when an interface is configured for pulse output.

This dashboard also contains extensive status information in form of the error, warning, and info bit fields which can be decoded in human readable form with the help of the “Details” buttons.

Another click on the button symbol “➢” lets the filter dashboard appear. This displays the settings of all filters in the RHE transmitter. The time constant Tau of all filters may be modified with the help of the associated slider or the numeric input field below the slider.

A press on the button “Set Modified Filter Parameters” transfers all modified filter settings to the RHE transmitter and activates them via a transmitter reset. The button “Update Filters from RHE” reloads all filter settings from the transmitter even if they were modified beforehand. Thus, this button can be used to undo accidental change which are not committed, yet.

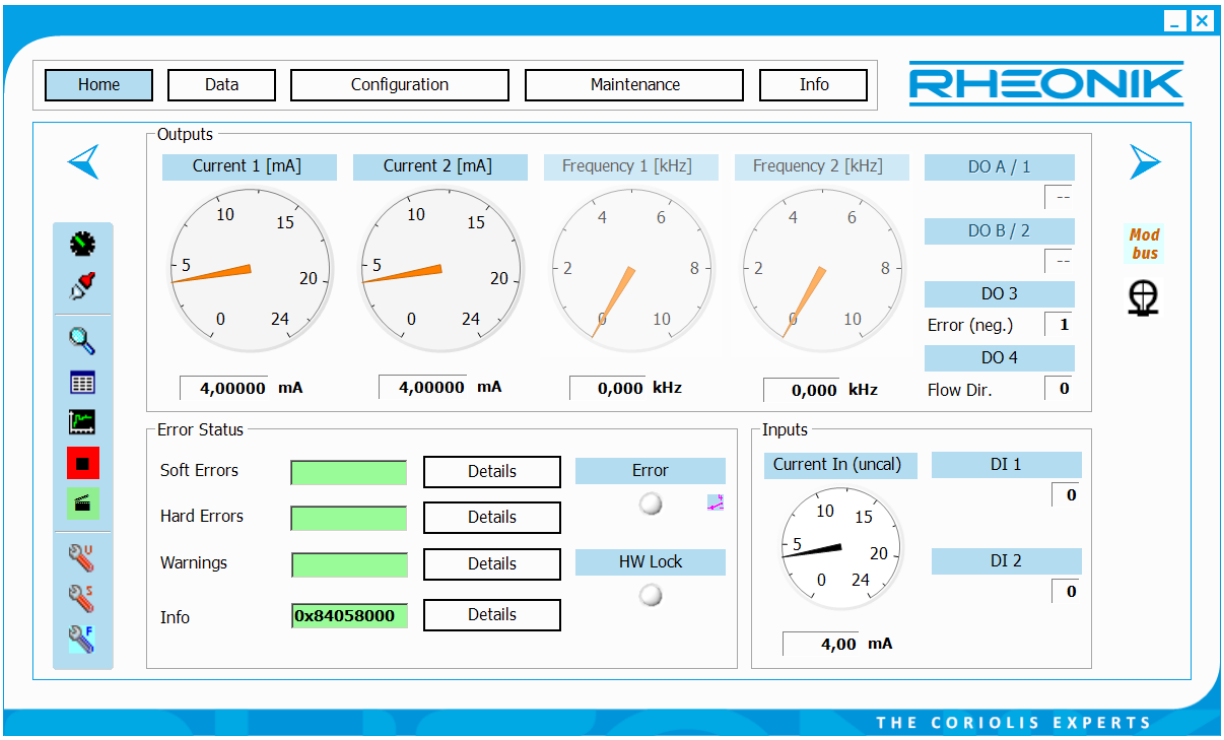

Figure 7: RHEComPro Interface Dashboard

Aside from the same extended status information as the Interface Dashboard the Filter Dashboard offers the ability to zero the sensor by pressing the “Zero Point Calibration” button. As such a button press causes an immediate reaction it should only be pressed when the zeroing process really is intended.

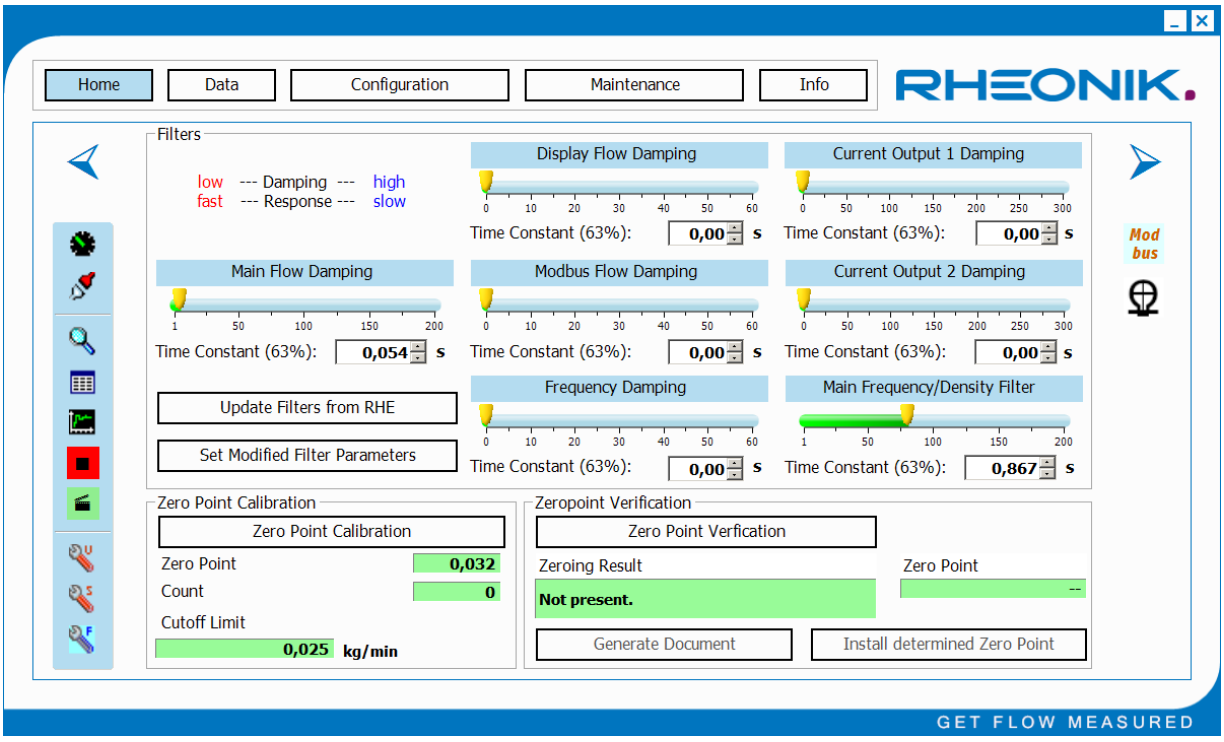

Figure 8: RHEComPro Filter Dashboard

When a firmware with a higher release number than 3.01 is installed in an RHE40 series transmitter, the “Zero Point Verification” feature is available. This allows a validation of the Zero Point currently

in use and is particularly useful for custody transfer environments in which an installation of a new Zero Point is prohibited. When a new Zero Point is determined to be verified a document may be generated which shows its status by pressing “Generate Document”. This automatically also opens the installed PDF reader from which the document may be printed or stored in a repository. The document must be generated before the determined Zero Point is installed or the RHE transmitter is reset.

When an installation allows the modification of a Zero Point the result of the verification step may be taken over as the Zero Point in use by pressing the “Install determined Zero Point” button.

Another click on the button symbol “➢” activates the Diagnostic Dashboard shown in Figure 9. This dashboard contains extensive information about the internal state of the RHE transmitter and especially the state of the output drive to the RHM sensor and the pickup sensors from the RHM. The values shown in the figure are optimal and may not be realistic for real operating environments.

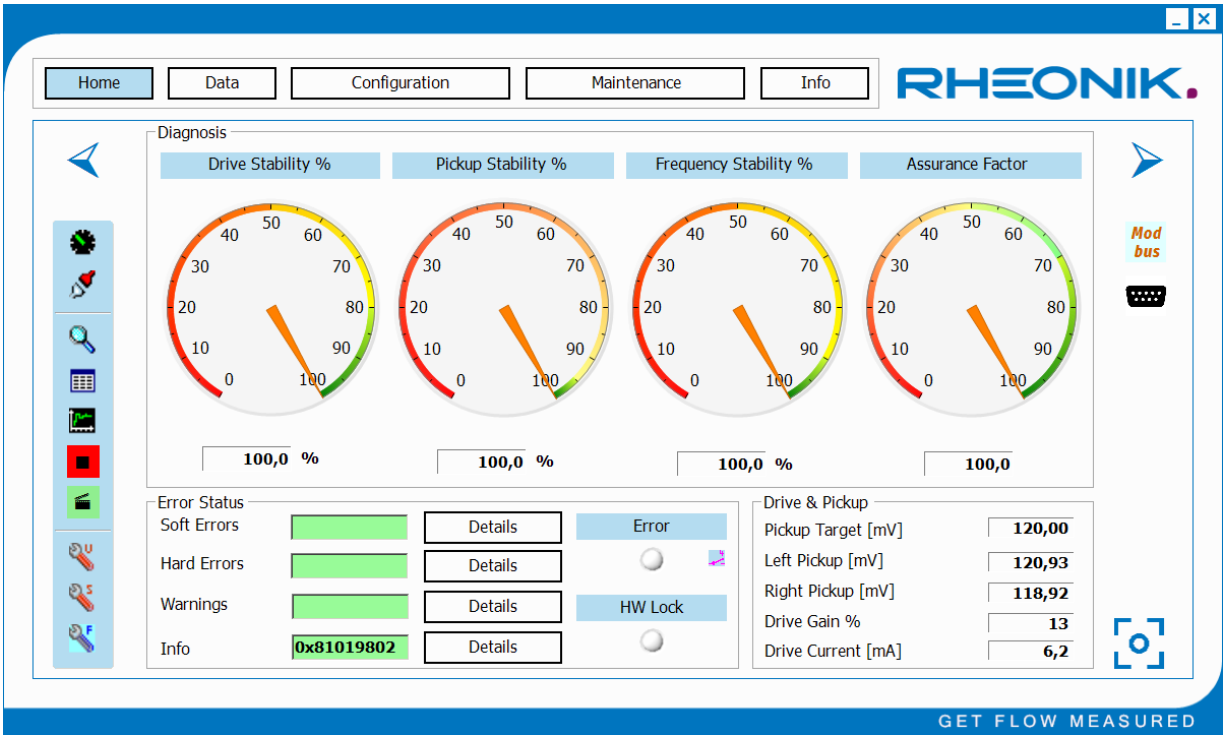

Figure 9: RHEComPro Diagnostic Dashboard

The snapshot symbol at the lower right corner is available since RHEComPro Release 3.6.0. It can be clicked on and will cause a dump of diagnostic data into a CSV file. The amount of data written depends on the series of the attached RHE transmitter. This data is intended to help the Rheonik Service to identify problems in the current installation of the Coriolis system.

5 Menus

Many complex configurations and the calibration support are accessible via the menus of the RHEComPro program. These menus can be activated by clicking one of the five buttons at the top of the RHEComPro window. The following table describes the buttons and their functions:

Home	Forces the display of the Main Dashboard window and clears all menus when they were activated beforehand.
Data	Activates the menu for the configuration of data view, data trend chart, and data recording and other data related features of the RHE40 series.
Configuration	Activates the menu from where all basic configurations of the interfaces, units, and other items of the RHE transmitter can be initiated. This includes the access to the connection handling.
Maintenance	Activates the maintenance menu which allows among other specific RHE-oriented operations the test of I/O-interfaces as well as the mass flow and density calibration of RHE/RHM assemblies.
Info	Displays the Info-related menu from which also the RHEComPro-internal configuration and the license handling can be activated.

Whenever a menu or a dialog box activated from it is visible the corresponding menu button is highlighted by a bluish background color. This is eases the orientation and navigation through the numerous configuration items.

The menus and many dialog boxes offer an additional navigation help in form of a blue text line at the top of the window. Such a text line can be seen e.g. in Figure 5. In this line the texts of the buttons which were pressed on the path to the current dialog item are assembled with a dividing "-" sign and thus indicating the currently selected navigation path.

The menus and the functionality they offer are described in the next subsections. The menus are displayed in the center of the RHEComPro program and feature a set of buttons to the left which are accompanied by a respective explanation to the right.

5.1 Data Menu

The Data Menu as shown in Figure 9 allows the access to features which deal with measurement data, such as display of data values, trend charts, and data logging. Depending on the installed license some menu items are deactivated.

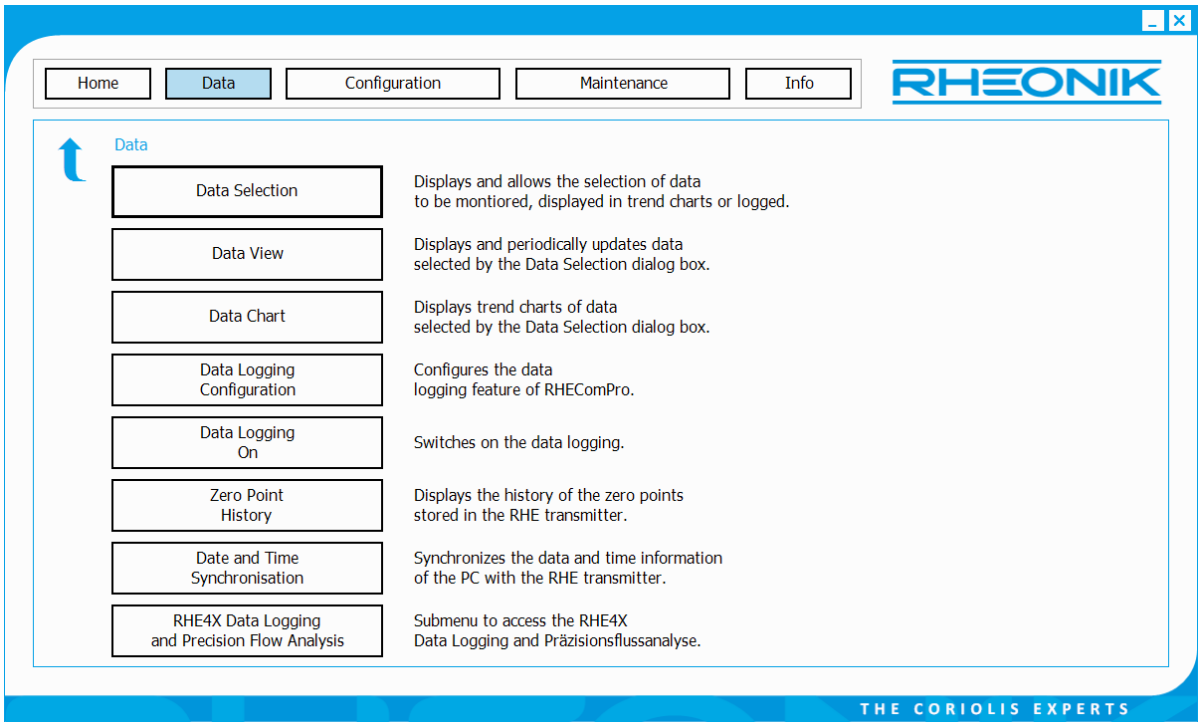

Figure 10: RHEComPro Data Menu

The last three menu items, Zero Point History, Date and Time Synchronization and RHE-local Data Logging are restricted to the RHE40 series transmitter. The RHE-local Data Logging and the respective dialog box is explained in a separate document named Addendum RHE40 Desktop Reference Data Logging with the document number 8.2.1.15.

The other items are explained in the next subsections.

5.1.1 Data Selection, Data View, Data Trend Chart

The Data Selection dialog box can be activated either by the menu item “Data” / “Data Selection” or by the magnifying glass icon in the tool-strips of the dashboards. It offers the access to all measurement values as well as intermediate calculation results and other items which are not displayed in the dashboard windows. All data items are categorized and are listed in respective tabs and may be marked for data view, as a basis for a trend chart, or for data logging. Only three data items may be marked to be displayed in a trend chart.

The “Pressure” tab of the Data Selection dialog box is shown in Figure 11. With the help of the “Check Standard Items” button a number of items are selected for display, trend charts, and logging that seem to be interesting for the majority of users. The button “Uncheck All” will undo all selection in all tabs. When the button “OK” is pressed the current selection is confirmed as a basis for the Data View, Data Chart, or Data Logging features and may affect the respective windows immediate when they are active. The Data Selection dialog box is closed thereafter. The “Cancel” button can be used to close the dialog box and discard any modified selections.

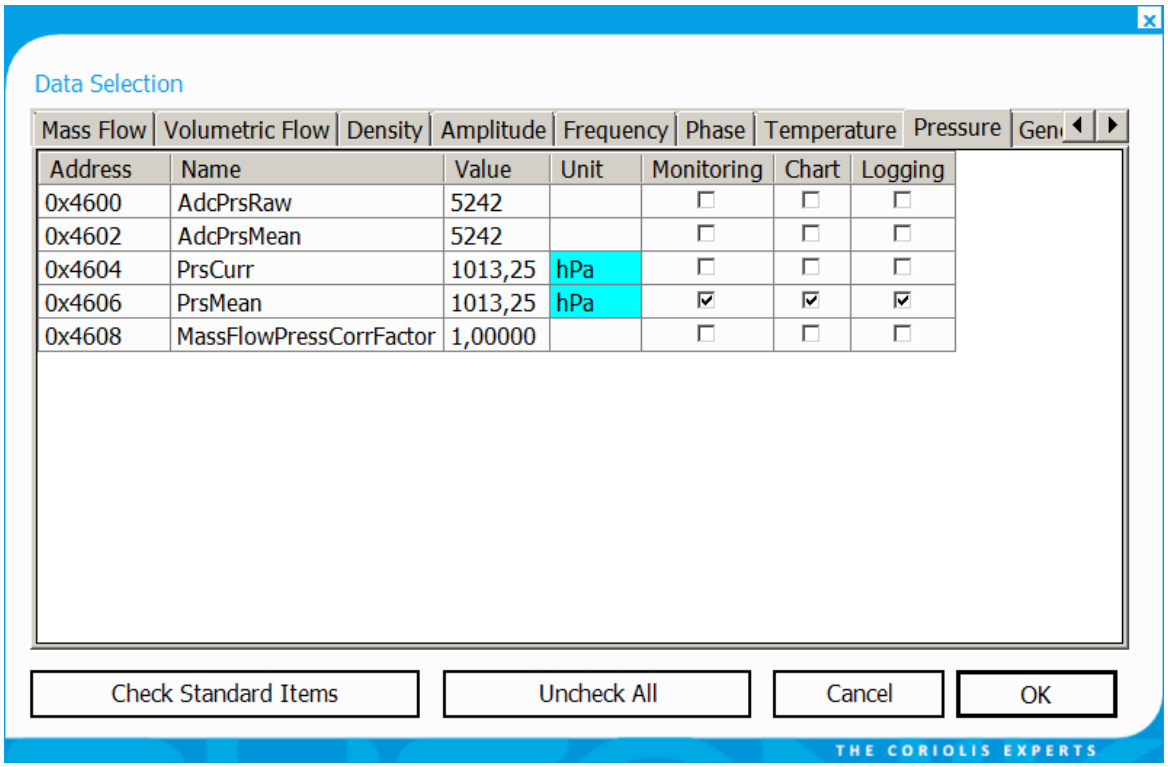

Figure 11: RHEComPro Data Selection Dialog Box

Data items which have been tagged for monitoring are displayed in the Data View dialog box shown in Figure 12.

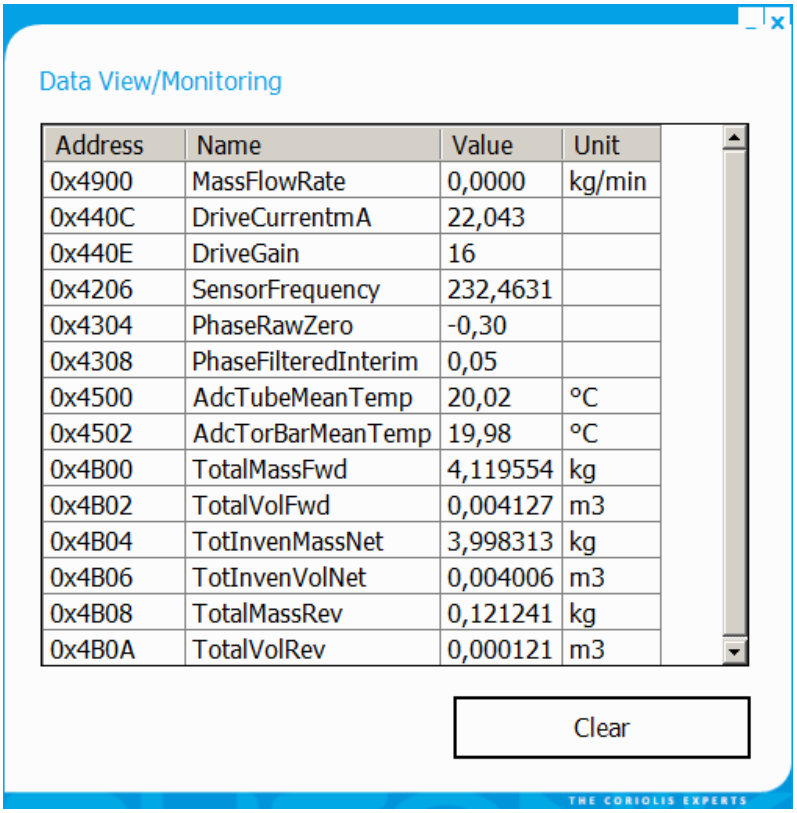

Figure 12: RHEComPro Data View Dialog Box

The Data View dialog box can be activated via the menu “Data” / “Data View” or by the data view icon in the tool-strips of the dashboard windows. When the Data View and the periodic measurements are active all data items in the dialog box are updated periodically. The updates are stopped when the periodic measurements are stopped. The Data View dialog box is independent from the dashboard window and may be displayed together with the Trend Chart and other windows.

Data items which have been tagged for the charts are displayed in the Data Chart window shown in Figure 13.

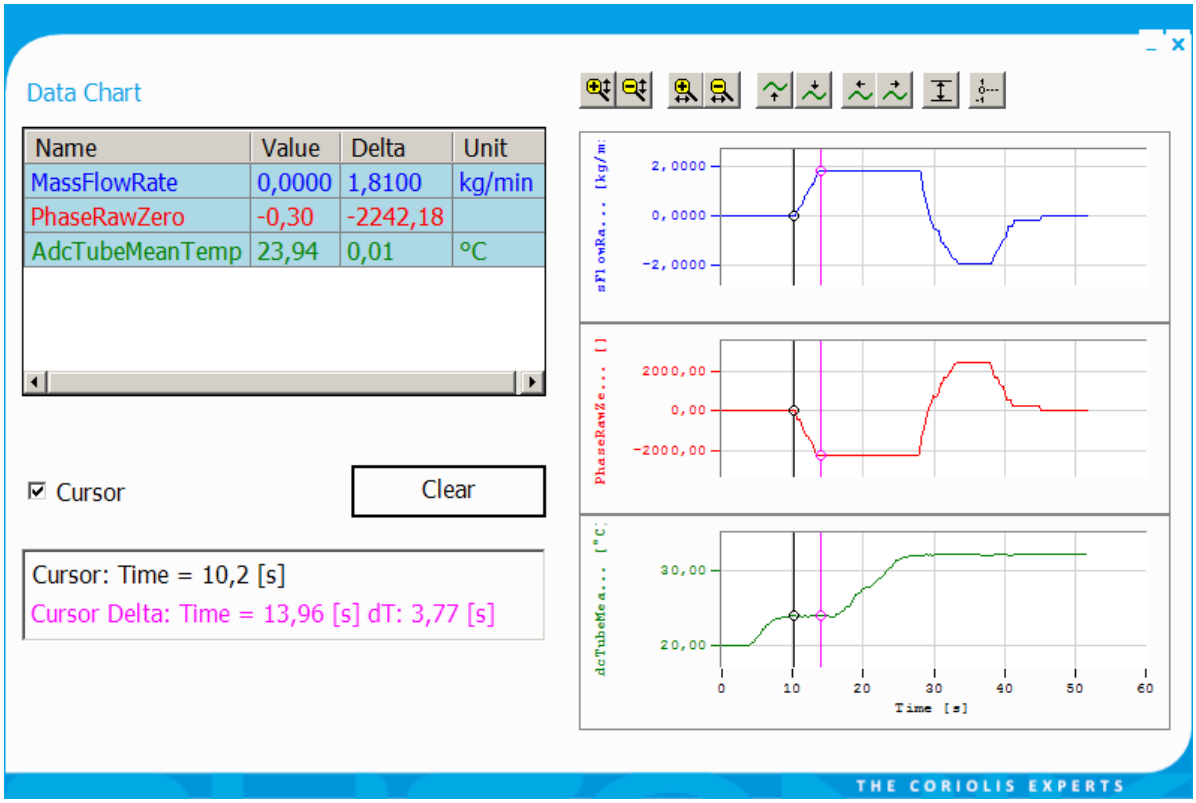

Figure 13: RHEComPro Data Chart Window

The Data Chart window can be activated by the “Data” / “Data Chart” menu item or via the data chart icon in the tool-strips of the dashboards. As mentioned before a maximum of three data items may be displayed in the Data Chart window. As long as the periodic measurements are active data values are periodically added to the charts. The use of the cursor feature shown in Figure 13 requires a stop of the periodic measurements.

5.1.2 Data Logging

Before the data logging is started the user should check the file name and the directory location where the log file is to be stored using the Configure Data Logging dialog box. This dialog box is activated via the “Data” / “Data Logging Configuration” menu item and shown in section 5.1.

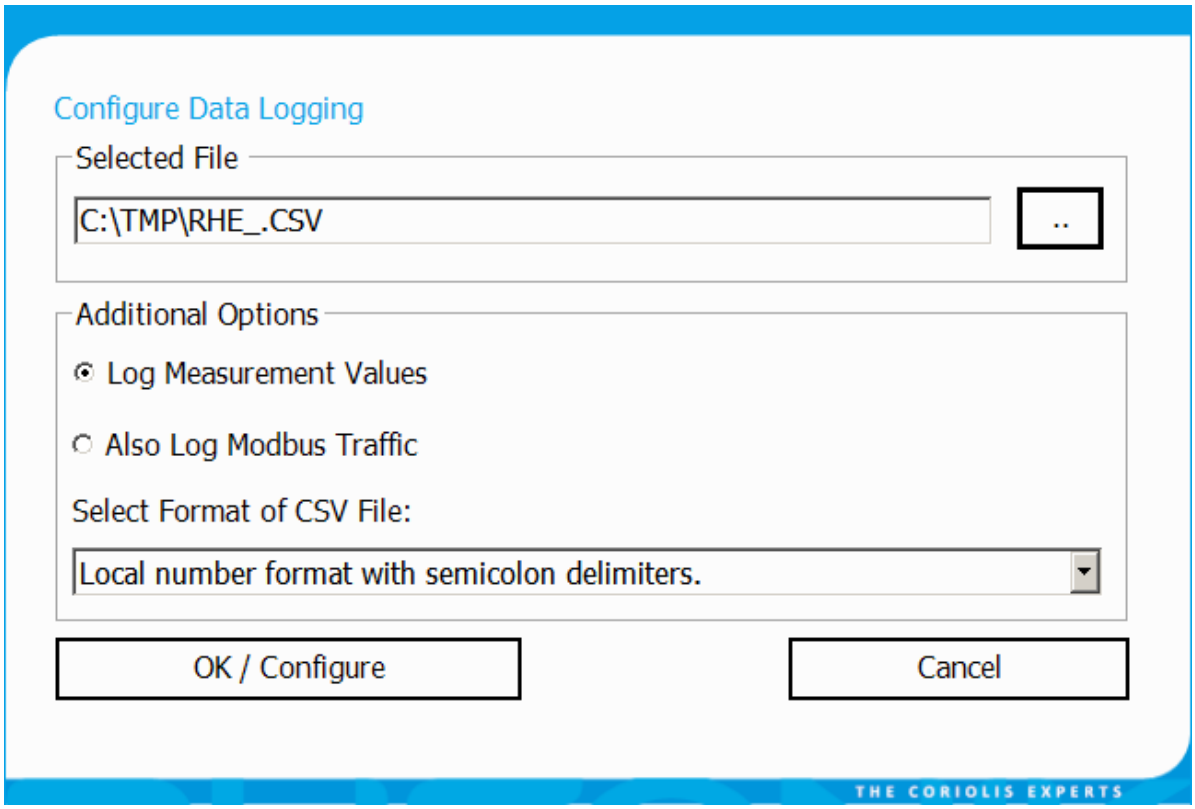

Figure 14: RHEComPro Configure Data Logging

Each time data logging is started, the current date and time is appended to the specified logfile name.

The logfile is written in CSV-format is suitable for import and viewing in a PC program such as Microsoft Excel. By default the local number format is used with delimiting semicolons (";"). This is fit for a German Excel installation because commas are used in numbers to flag the decimal places. For installations which use the decimal points as standard the CSV format can be selected as "Decimal point numbers comma separated" to conform to local conventions. This selection is also valid for other features which write CSV files, except for the configuration/setup data which always uses the decimal comma and delimiting semicolons in order to allow their seamless exchange with the Rheonik Service.

The data logging itself is started by selecting the "Data" / "Data Logging On" menu item or the respective icon in the tool-strips of the dashboards. Both items change their appearance to "Data Logging Off" while the data logging is active and may be used to stop the logging. When the logging stops the log file is closed.

Only the data items selected for logging in the Data Selection dialog box are written into the file. Lines with measurement values are added to the logfile at the measurement interval time as specified in the Connection Configuration dialog box, see section 4.1, as long as periodic measurement updates to the dashboard and logging/display functions in the RHEComPro software is active. Periodic measurement update is started and stopped by clicking on the "Start" and "Stop" icons in the Icon Toolbar.

For update rates shorter than one second, the logging periods may become uncertain when numerous data items use up the MODBUS bandwidth.

5.2 Configuration Menu

The configuration menu provides access to all kinds of convenience dialog boxes which allow the configuration of I/O interfaces, units used by the RHE transmitter, and other items. The entry menu level is shown in Figure 15. Depending on the type of the configuration items up to two more menu levels have to be navigated in order to activate a respective dialog box. Since this is assumed to be self-explanatory it is not shown here.

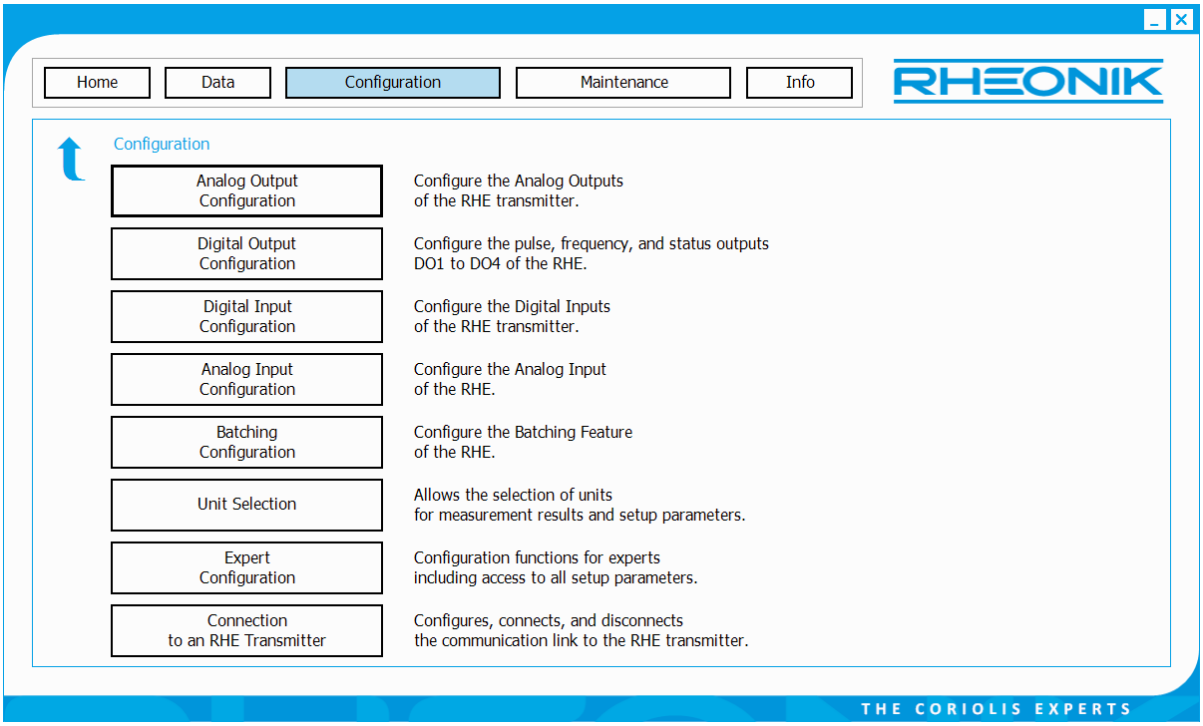

Figure 15: RHEComPro Configuration Menu

As mentioned before the connection configuration is also part of the configuration menu. This dialog box also can be activated via the connection icon in the tool-strips of the dashboard windows.

When modifying the configuration of a factory-new RHE transmitter it is recommended to choose the units first in which the measurement data and setup parameters are displayed. This avoids a possible confusion later.

5.2.1 Unit Selection

When the menu item “Configuration” / “Unit Selection” is activated a new menu is displayed in which all measurement data types are listed for which units may be selected by the user. When one of the new menu items is activated a dialog box appears in which a unit for the respective data type may be chosen. The example in Figure 16 shows the dialog box for the temperature unit.

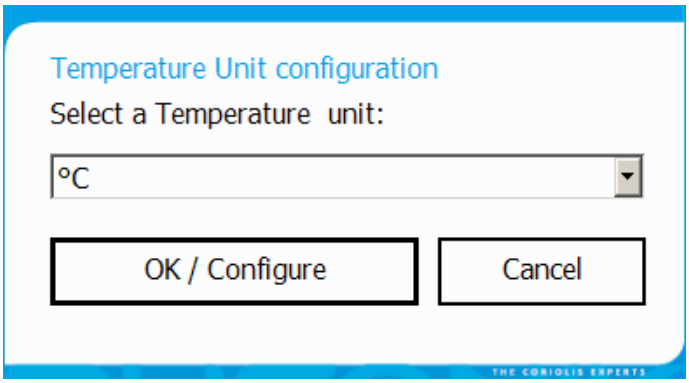

Figure 16: RHEComPro Unit Configuration Dialog Box

The desired unit is chosen with help of the selection box and the configuration then is forwarded to the RHE transmitter by pressing the “OK / Configure” button. The “Cancel” button can be used to close the dialog box without setting a new unit.

5.2.2 Typical I/O Configuration Dialog

All inputs and outputs of the RHE transmitters may be configured with the help of the expert configuration feature described in section 5.2.3. This is shown in the RHE20 and RHE40 Reference Manuals. Most interface configurations, however, may be done much more conveniently with the help of dedicated dialog boxes.

These dialog boxes can be activated via the “Configuration” menu where the type of the output has to be selected. This activates a new menu level where the output channel has to be selected and this in turn causes another menu level to be displayed where the type of the output has to be chosen. This finally activates a dialog box which offers the configuration of the selected output channel depending on the selected type.

The example dialog box shown in is activated by the sequence “Configuration” / “Digital Output Configuration” / “Digital Output 1 Single Channel” / “Digital Output 1 as Pulse Output” / “DO1 Pulse Mass”.

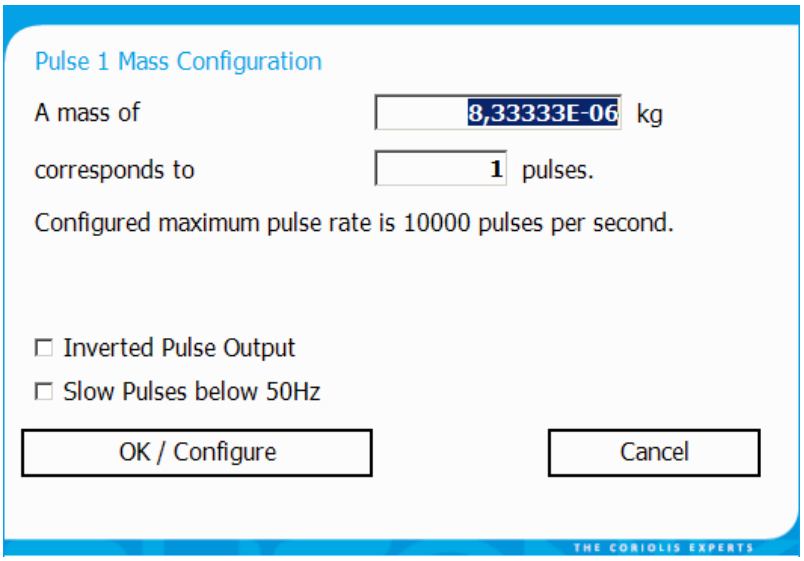

Figure 17: RHEComPro Interface Configuration Dialog Box

All these dialog boxes allow the assignment of measurement values to output signals. In this case a number of pulses are assigned a certain mass. For analog interfaces measurement values are assigned to the 4 and the 20 mA signal levels which the understanding that other measurement values are mapped to a respective current in a linear fashion.

5.2.3 Expert Configuration

Some special configurations are complicated and need access to Modbus registers containing the respective setup specification. The expert configuration function in the RHEComPro software can be used to review and modify setup parameters in the RHE transmitter.

The meaning of the contents of the setup registers is found in the RHE20 and RHE40 Desktop Reference Manual where also the use of the expert configuration for a number of configuration tasks is shown. The expert configuration dialog box can be activated via the menu “Configuration” / “Expert Configuration” / “Access to All Setup Parameters” or the respective tool-strips of the dashboard windows shown in Figure 18.

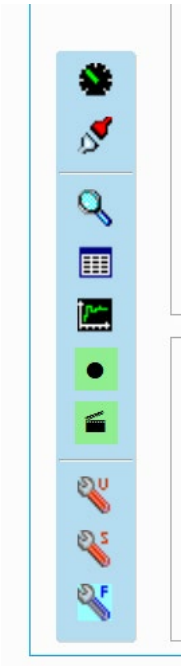

Figure 18: RHEComPro Tool-Strip of the Dashboards

The tool-strip example shown takes this form when the Service role is chosen. In this case, the expert configuration for setup items intended to be modified by standard users can be accessed by clicking on the tool icon with the ‘U’ mark. The export configuration for service personnel is activated by a clock on the tool icon with the ‘S’ mark. This displays an extensive set of setup registers and the guidance of the Rheonik Service is recommended when values are to be modified.

The tool icon with the ‘F’ mark offers read-only access to all setup values. This already was explained in section 3.3.

When the expert configuration feature is activated the dialog box shown in Figure 19 is displayed. Note that all periodic measurement updates to the dashboard and logging/display functions in the RHEComPro software package are stopped when the Configuration dialog appears. These updates will be restarted when the dialog box is closed again.

There are more than 200 configurable parameters in the RHE transmitter. These parameters are grouped by function and accessed using the function tabs in the Configuration dialog window. There is a listing of all parameters by functional group in the Appendices of the RHE Reference Manuals. Specific details concerning each parameter can be found there.

A functional group is selected by clicking on the tab header, e.g. “Generic” in the window. Use the  arrows at the right side of the header row or the left and right cursor keys on the computer keyboard to access additional tab headers that may not be visible due to window width. The window may be resized to improve the readability of the data.

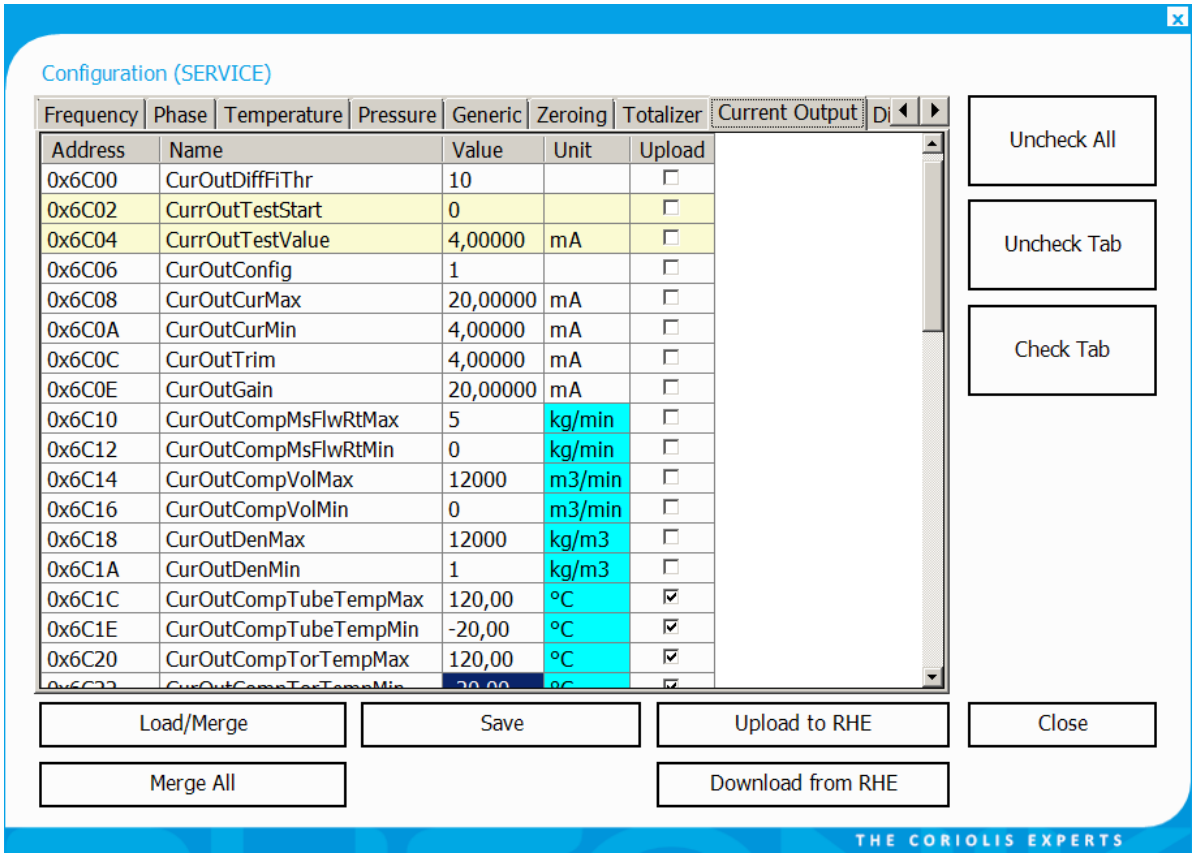

Figure 19: RHEComPro Expert Configuration Dialog Box

Under each tab is a table containing all parameters relevant to that group at the current logged in role access level. In Figure 19 the parameters for Current Output functions at the Service Role access level are listed. Each parameter is identified by its Modbus address and its short name. The unit of a parameter displayed with a blue background indicates that the unit value selection has been set in with the help of the Unit Selection feature 5.2.1.

A light yellow background on any row indicates that the parameter is a test parameter. In the example shown in Figure 19, the light yellow rows can be used to loop check the unit to ensure the 4 – 20mA output is working correctly. Test parameters such as these are not stored in the internal non-volatile memory (NVM) of the RHE transmitter and take effect immediately when uploaded to the RHE transmitter.

Setup parameters are modified by changing the value displayed in the Value column and checking the box in the “Upload” column alongside. When the “Upload to RHE” button at the bottom of the

dialog window is clicked, the Upload dialog appears with a list of all values where the “Upload” checkbox is set. This Upload confirmation box is shown in Figure 20 below.

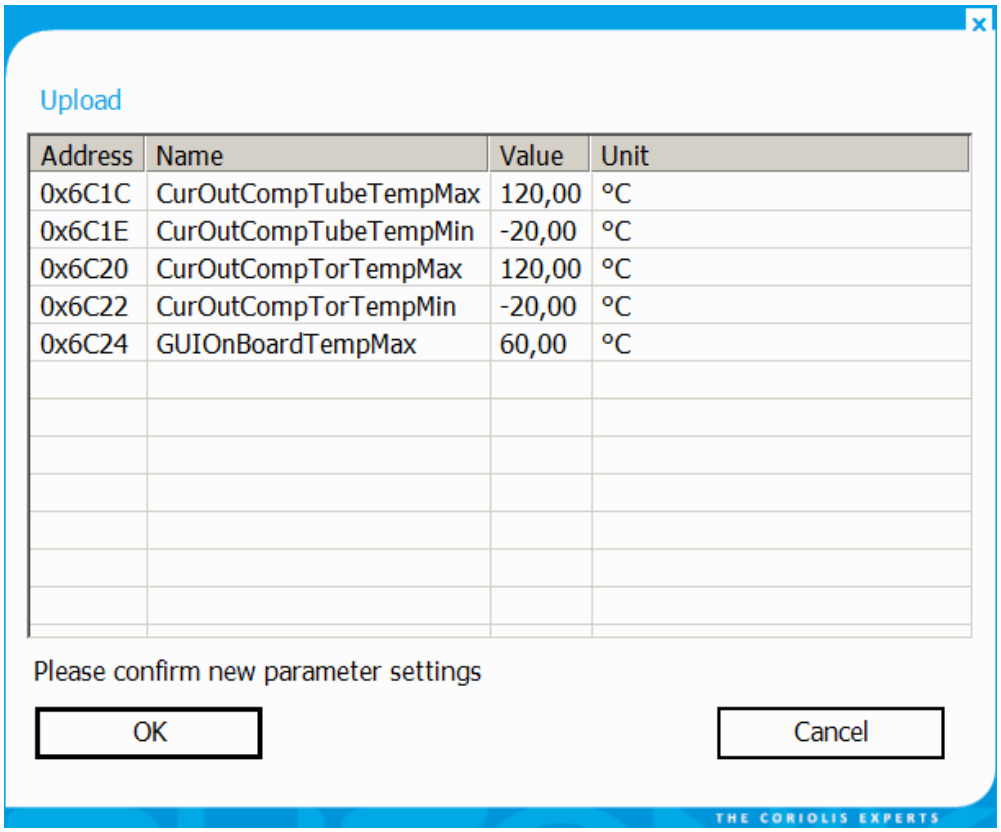

Figure 20: Upload confirmation Dialog Box

The confirmation box allows a review of any modified parameters before committing them as changes to the RHE transmitter configuration. The example in Figure 20 shows only the parameters from Figure 19 where the box in the Upload column is checked. Click the “OK” button to upload the new values to the RHE transmitter after review. Upon upload, the parameter set is saved to the RHE transmitter and the transmitter is reset to activate the new values. The “Cancel” button will abort the upload operation.

In order to confirm the parameters were modified as intended, click the “Download from RHE” button to update all parameters in the Configuration dialog box listing. This may take a few seconds to complete.

Summary of the steps to modify any setup parameters:

1. Change the value of any parameters to be modified in the Value column and check the box alongside it in the Upload column of the Configuration dialog box.
2. Click the “Upload to RHE” button and confirm the new parameter values by clicking the “OK” button in the Upload confirmation dialog.
3. Confirm that all the parameters have been changed in the RHE transmitter by clicking the “Download from RHE” button and checking the parameter values are as intended.

When modifying setup parameters:

- Do not modify unit conversion parameters together with other setup parameters. This can result in values being entered into the RHE transmitter which may differ from what you intended because of conversion.

- Do not set setup parameters together with test parameters (those with a light yellow background). The modification of test parameters has an immediate effect on instrument output. The transfer of the setup parameters forces a reset of the RHE transmitter and all test values are reset to their default values.
- Every setup parameter has a valid value range. These value ranges are described in the parameter details in the Appendices of the RHE Reference Manual. When a value to be uploaded is outside of the value range, a transfer error occurs and the parameter upload is aborted. Question marks will be displayed in the value column for parameters that could not be transferred. Review these parameters using the “Download from RHE” button and carefully check whether an intended parameter modification violates a defined range.

The entire transmitter configuration/setup can be saved into a CSV-type file suitable for viewing in a PC program such as Microsoft Excel. To create a CSV file of the current transmitter setup/configuration, click the “Save” button in the Device Configuration dialog and enter an appropriate file name and folder to store the file in the file selection box which appears. This file is useful to document the current setting when working with Rheonik Service. Note that the values in the saved setup file are based on default units used internally in the RHE transmitter and not on the units selected on the Unit Conversion tab, therefore values in the file may differ from the values displayed in the Device Configuration dialog box.

A saved configuration/setup CSV file may be loaded into the RHEComPro software for further upload to an RHE transmitter by clicking the “Load/Merge” button in the Device Configuration dialog. This allows the duplication of a configuration/setup present in one RHE transmitter into another RHE transmitter. A file selection box appears to allow the selection of the desired file to be opened. Upon opening, the parameter values in the file are converted to the units currently selected in the RHE transmitter. Any loaded parameter value that differs from the current setting in the Device Configuration tab listings causes the “Upload” check box to be activated for that parameter. Clicking the “Upload to RHE” button will, as before, show all the modified parameters in one list. The modified parameters can then be transferred to the RHE transmitter by pressing the “OK” button in the Upload confirmation dialog.

Some parameters, such as serial numbers, calibration information, and test parameters are ignored by the “Load/Merge” mechanism. Parameters which are marked for a higher role level than the currently selected level are also ignored. For the most effective use of file download/upload, it is recommended to use the “Save” and the “Load/Merge” functions on the highest available role access level.

Three additional buttons, “Uncheck All”, “Uncheck Tab”, and “Check Tab”, are available in the Device Configuration dialog. The “Uncheck All” button operates on all parameters in all tabs to clear the check boxes in the upload column. “Uncheck Tab”, and “Check Tab” operate on the check boxes of the parameters in the current tab only. Using “Uncheck All” is recommended before any parameters are modified to prevent unintentional changes being uploaded to a connected RHE transmitter.

Clicking either the “Close” button or the close icon in the window title bar will close the Configuration dialog box. When the measurement updates in the RHEComPro are not started automatically after the Configuration dialog box has been closed, click the “Start Measurement” icon in the tool-strips of the dashboards.

5.2.4 Batching Configuration

The RHE20 and RHE40 series support the filling of containers up to a certain target mass or volume. For this purpose the alarm configuration of a digital output is used to control a valve attached to the respective DO. The alarm setting is controlled by a totalizer which causes the valve to be closed when a defined limit is reached. The valve is opened again when the totalizer is reset. This can be done via a digital input, Modbus interface, or the HMI.

It is possible to use a single valve configuration or control two valves, coarse and fine, for a fast and accurate filling. The coarse valve is closed first at a lower limit and the fine valve then is used to conclude the filling to a precise target limit.

The batching configuration is available when the RHEComPro License is installed via the Configuration/Batching Configuration submenu.

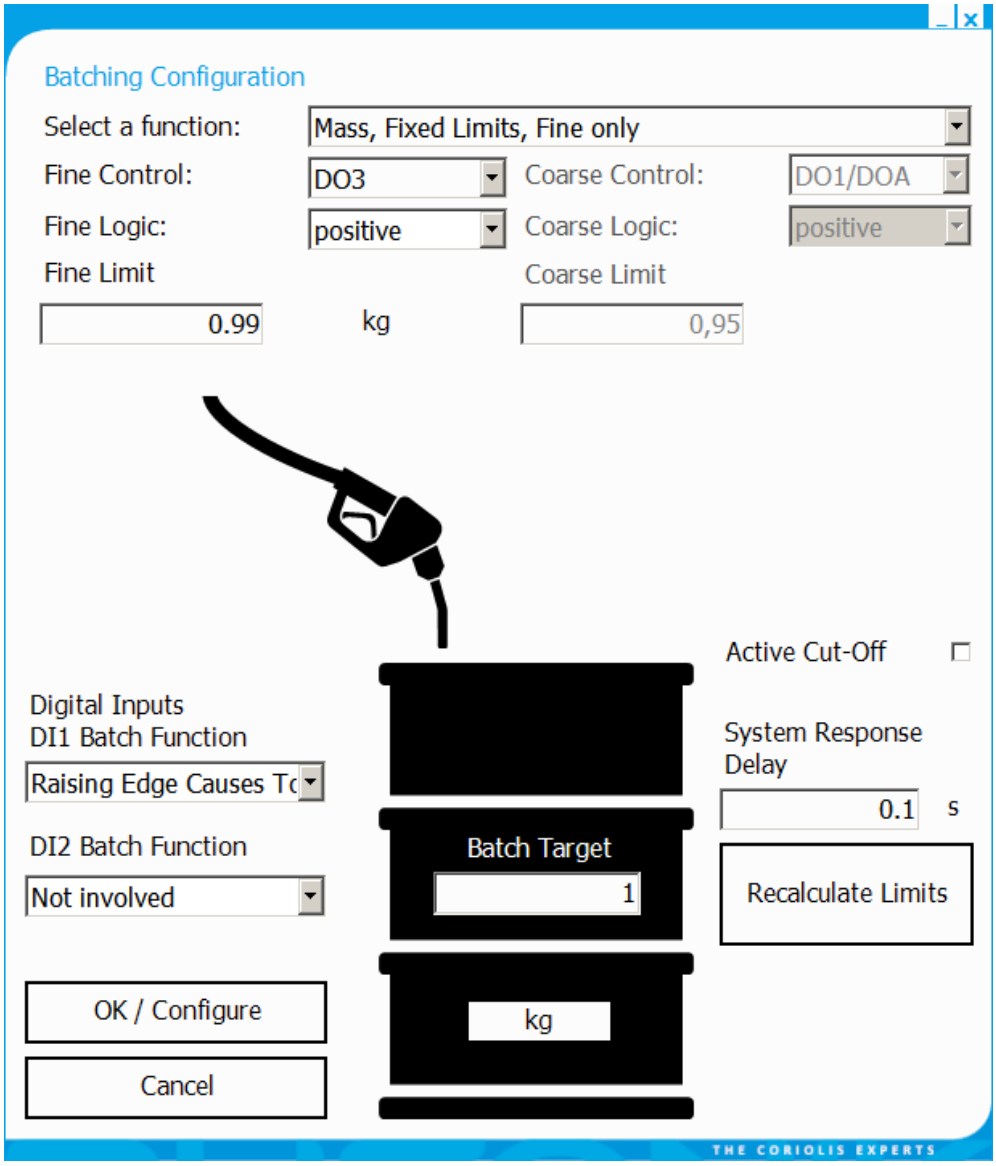

Figure 21: Batching Configuration – Single Channel

When this submenu is activated a dialog box appears which facilitates the configuration of all kinds of batching installations. The appearance of the dialog box changes when a single channel or a dual

channel batching is selected. Figure 21 shows the dialog box when a single channel configuration is selected, Figure 22 shows the same box for a dual channel configuration.

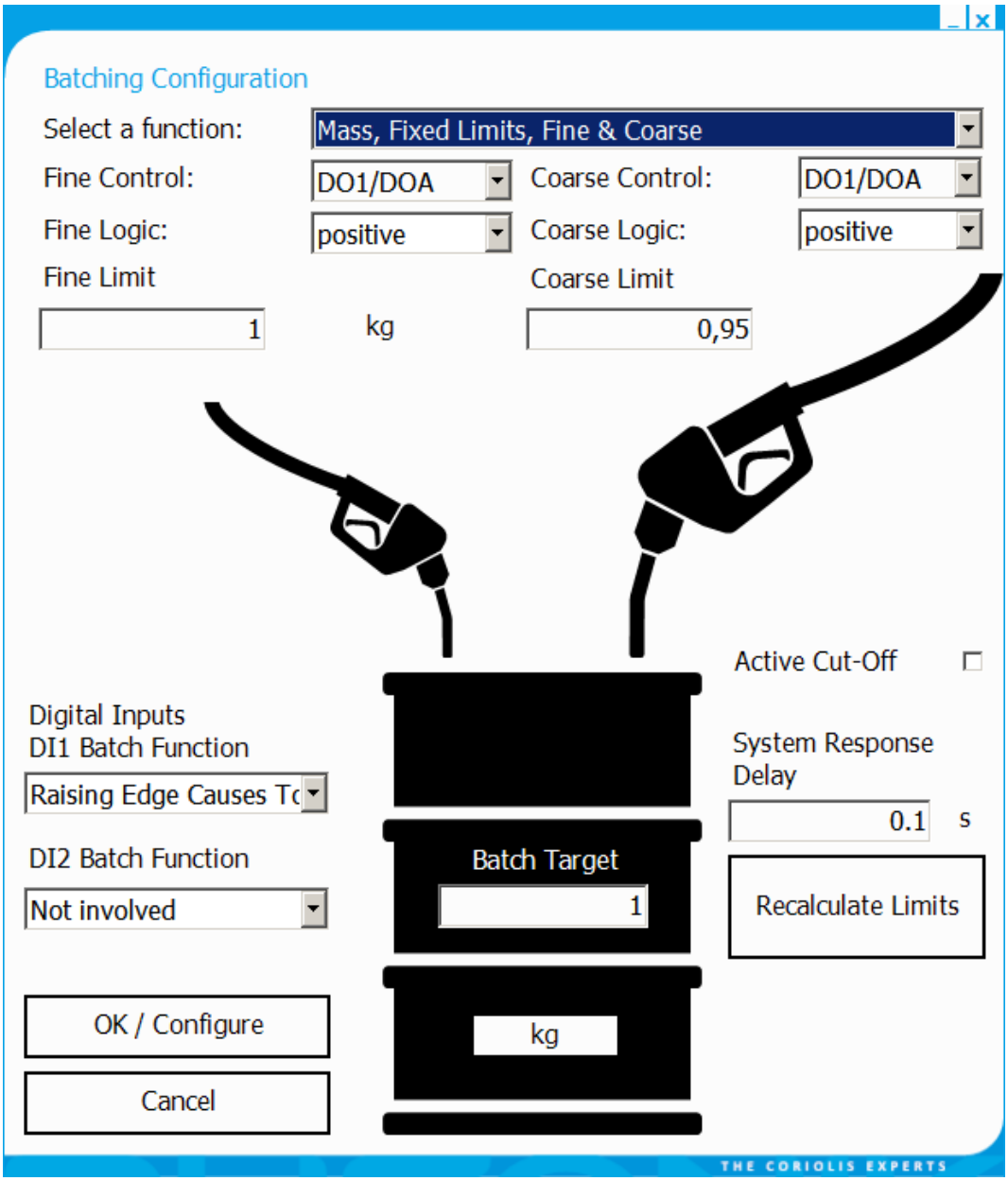

Figure 22: Batching Configuration – Dual Channel

When starting the configuration procedure the functionality has to be selected first. The functionality combines three properties:

- Channels: fine only or coarse and fine;
- Fixed Limits or automatic limit adaptions;
- Mass or Volume targets.

When Automatic Limit Adaption is selected the RHE transmitter will use a control loop to optimize the result of the filling in which the target is compared to the measured value before the next filling is started. This only works when DO3 controls the fine valve.

In the next step the digital outputs have to be selected which are intended to control the valves. When one of the digital outputs DO1/DOA or DO2/DOB is selected this output is reconfigured to a

status alarm output and cannot be used as pulse or frequency output thereafter. DO1 and DO2 are identifications found at the terminals of the transmitter, DOA or DOB are names for parameters sets used to configure these outputs as a status indicator.

Usually one digital input is used to reset the totalizers and thus start the filling. This digital input must be selected in the respective DI selection box. Since Firmware Release 2.06 it is possible to hold off a filling and restart it. Holding off the filling causes the valves to be closes with the help of an override and restarting it will open the valves again and disable the override. Restarting a concluded filling simply starts a new filling process.

Finally the target mass or volume must be entered in the “Batch Target” field followed by a click on the “Recalculate Limits” button. This calculates a first estimate for the limits which cause a shutoff of the valves shown in the “Fine Limit” and “Coarse Limit” fields.

It is possible to set the “Fine Limit” to the intended target and use the “System Response Delay” time specification to offset the system behavior causing any deviation to the target value. The System Response Delay should be the sum of the delays due to RHE-internal filters and the reaction time of the filling valve. When using the Fast-Response (FR) option the filters inside the RHE transmitter can be configured for a delay down to 50ms or less. Please consult the Rheonik Service when you plan a filling application. Filling times down to 500ms with a precision of 1% or down to 2s with a precision of 0.5% are feasible with the Fast Response feature.

The RHE transmitter uses the current flow and the “System Response Delay” in order to project an advance timing to close the valve. This will work fine unless there is a larger variation in the flow at the end of the filling cycle.

Water hammer effects caused by fast-closing valves may cause an oscillating flow with negative flow components. This may disturb the totalizers and even may cause a reopening of a valve after the filling is concluded. When the check box “Active Cut-Off” is activated negative flows are ignored when the close command for the valve has been issued. This also improves the quality of the measured values in the totalizers which should reflect the transferred mass in a precise manner. The “Active Cut-Off” feature should be employed in cases in which the reverse totalizers contain a considerable amount of substance after a filling has been concluded.

This preliminary configuration can be downloaded to the RHE transmitter via a click on the “OK / Configure” button.

After a test run the limits may be optimized using the same dialog box and entering improved limit values into the “Fine Limit” or “Coarse Limit” fields by hand.

5.2.5 Comparison of Setup Files

When a RHEComPro+ license is installed the RHEComPro programs offers the possibility to compare setup files via the “Configuration” / “Expert Configuration” / “Comparison of Setup Files” menu item. When activated the dialog box shown in is Figure 23 displayed.

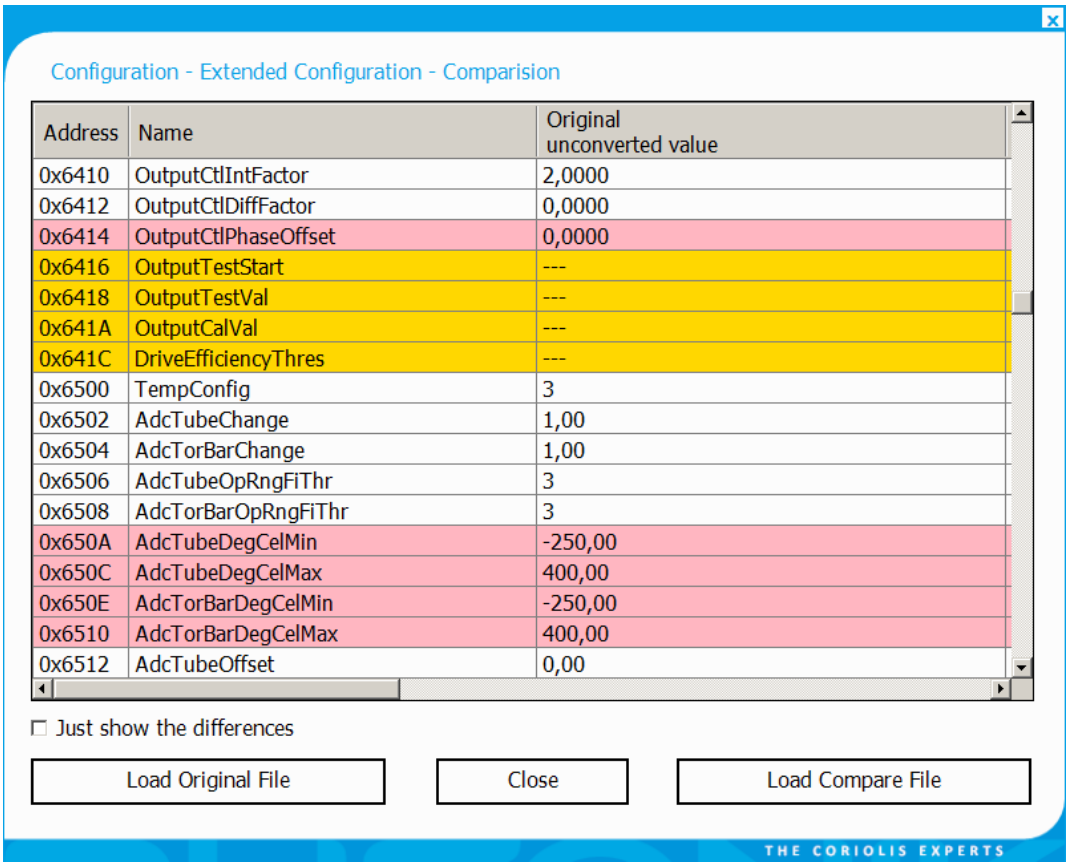

Figure 23: RHEComPro Comparison of Setup Files

When pressing the “Load Original File” button a file selection box opens which allows the selection of the first setup file to be compared. The “Load Compare File” button also opens a file selection dialog box for the specification of a second setup file. All files must be in CSV format and must be originally generated by the RHEComPro program.

Initially all setup registers are shown in rows with their Modbus register addresses and short names in the first two columns. Further columns show the values of the original file and the compared file as unconverted values together with their RHE internal units followed by their converted values and the conversion unit. Note, that the conversion units are taken from the currently attached RHE and may not reflect the unit setting of the RHE when the respective file was saved.

Where values in the original and the compared files differ the entire row is shown in a pinkish color. When a value is missing in one of the files is shown in a golden color. Where values are unmodified the respective row is kept in white. When the check box “Just show the differences” is selected all lines except the pinkish lines are hidden. Thus, only the differences remain and can be reviewed.

The Comparison dialog box can be closed with the help of the “Close” button. In order to compare a stored setup to a setup present in an RHE transmitter, read out and store the current setup as described in section 3.3.

5.3 Maintenance Menu

When the Service role is active the Maintenance Menu offers the access to RHEComPro functions which support maintenance activities such as the calibration of I/O interfaces and measurements. The top-level menu activated with the help of the Maintenance button and is shown in Figure 24.

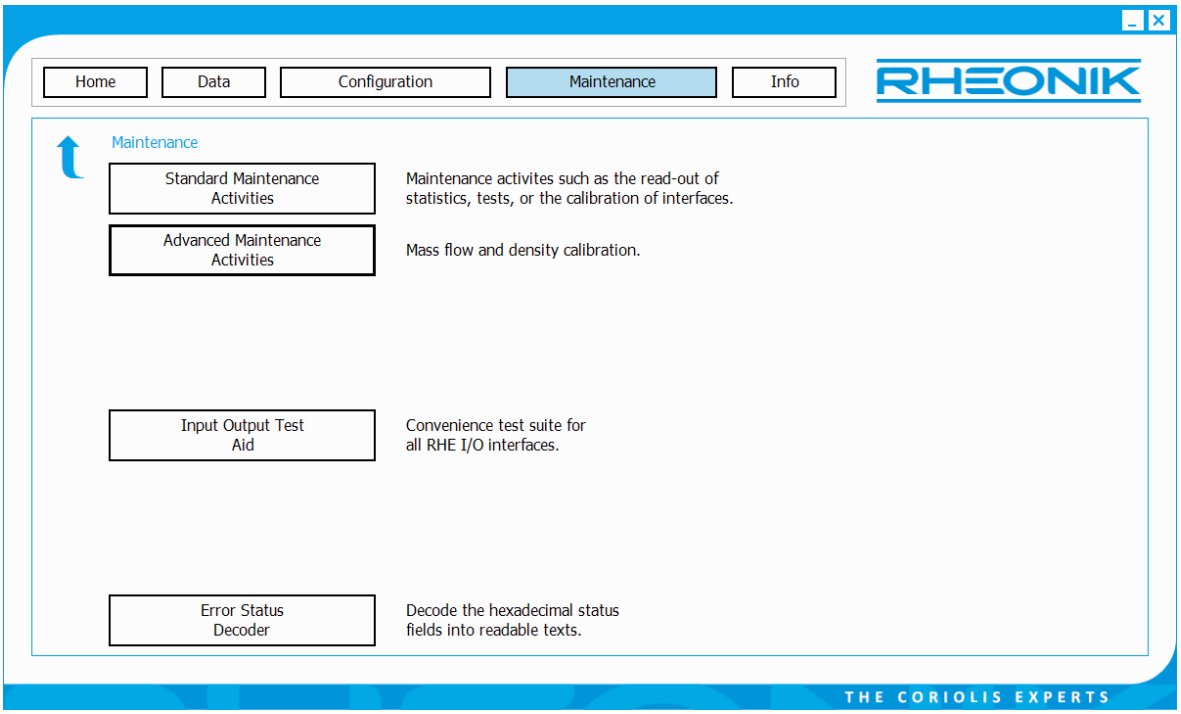

Figure 24: RHEComPro Maintenance Menu

Most of the maintenance activity supported by the RHEComPro should be done under the guidance of the Rheonik Service. The more complex calibration procedures are described in a separate section 6. Some more common items are described in the subsections below.

Note that some of the dialog boxes for the maintenance support are not yet available with translated texts.

5.3.1 Fast Tests for I/O

The Fast Test Aid feature was developed as a quick test for the inputs and outputs of the RHE transmitters in the Rheonik production process.

Therefore, the protection of the current setup has not been considered and the user is advised to save the setup before the tests are started as described in section 3.3. This is necessary only when the Pulse Output test is done. All other tests will switch the respective interfaces into the test mode and leave the corresponding setups intact.

Since the output signals change the user is advised to unplug any connection to external equipment should this be sensible to unexpected signal changes.

The tests are activated when the respective button is clicked. The type of the test can be concluded from the text of the buttons.

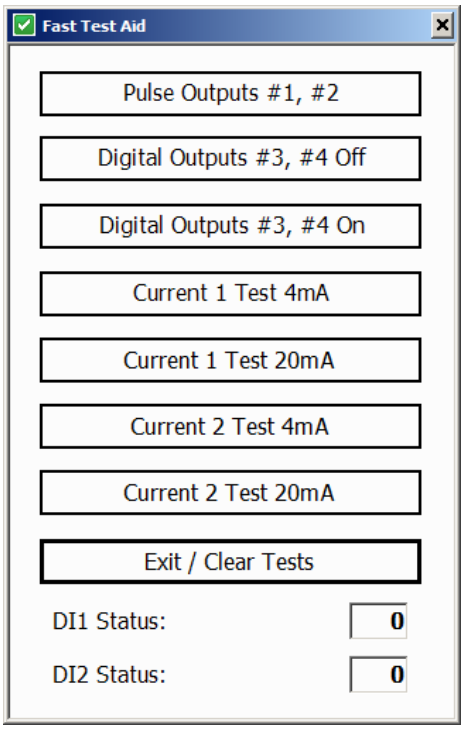

Figure 25: RHEComPro Fast Test Aid

The tests can be terminated via the “Exit / Clear Tests” button. This will switch all interfaces out of the test mode. When the pulse output test has been activated the setup of the DO1 and DO2 configurations has to be restored from the saved setup recommended above.

5.3.2 Error Status Decoder

The access to the Error Status Decoder is part of the top-level Maintenance and Info menus. It allows the conversion of hexadecimal status codes generated by any RHE transmitter into human readable form. The same function can be initiated by the “Details” buttons near the RHE status information in the dashboard windows.

In order to support such a conversion for status information of RHE transmitters which are not attached to a RHEComPro program or for status information which appears only for a short while the offline Error Status Decoder can be used. When activated following dialog box appears:

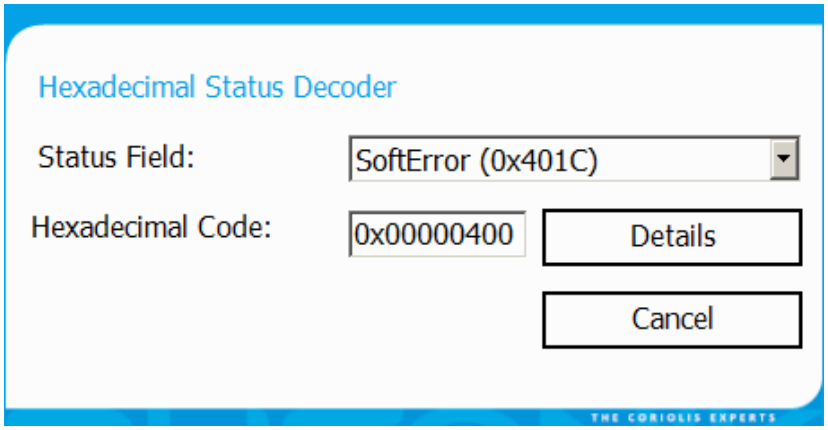

Figure 26: RHEComPro Error Status Decoder

First the type of the status field has to be chosen with the help of the selection box. Thereafter, the hexadecimal status information obtained from the RHE transmitter must be entered into the

"Hexadecimal Code" field. When pressing the "Details" button the dialog box is replaced by a window which decodes the meaning of any bit set in the hexadecimal code and adds a short explanation, just as the "Details" function of the dashboards does.

5.3.3 Passcode Calculator

A User or Service Login into the RHE transmitter via HMI or Modbus interface requires the entry of passcodes. These passcodes depend on the serial number of the RHE transmitter. When the "Passcode Calculator" function is selected via the "Maintenance" / "Standard Maintenance Activities" / "Passcode Calculator" menu item, following dialog box appears:

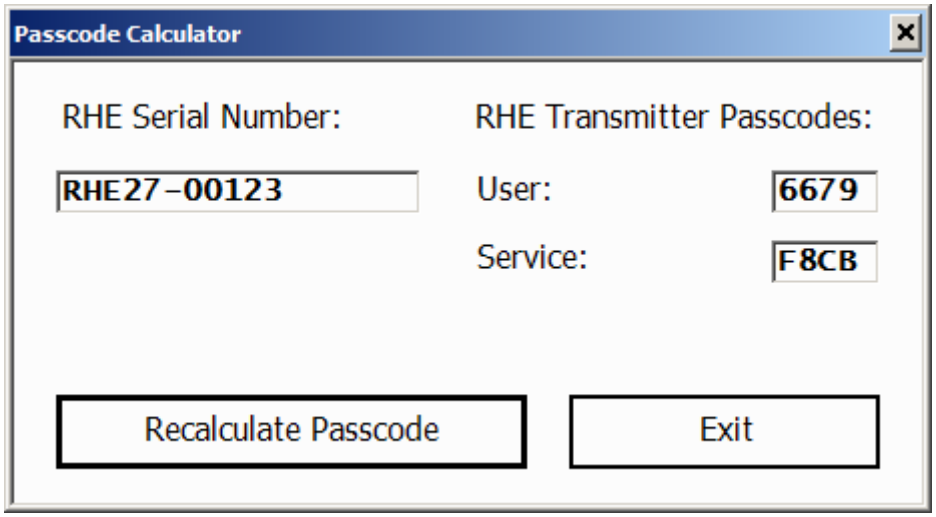

Figure 27: Passcode Calculator Dialog Box

This function reads a serial number out of an attached RHE transmitter – if attached – and calculates the User and Service Passcodes. The string in the "RHE Serial Number" field may be edited to a serial number of another transmitter and the respective passcodes are calculated and displayed when the "Recalculate Passcode" button is pressed.

Note that there actually are two User Passcodes valid for an RHE transmitter. The first passcode is calculated out of the serial number. The other passcode is stored in the Modbus holding register UserPassword (0x6004). This passcode is initialized to the string "1111" and may be changed by the user. Thus, a user may change a forgotten password stored in the RHE transmitter with the help of the calculated passcode.

5.4 Info Menu

The Info Menu contains miscellaneous items which display and administrate information concerning the RHEComPro program and its attached RHE transmitters. Part of it is the License Handling feature explained in section 2.3 and the RHEComPro Setup explained in section 2.4 as well as the Error Status Decoder explained in section 5.3.2.

The "Help" menu item will start a PDF-Reader which then will display the reference manual of the respective RHE attached to the RHEComPro program.

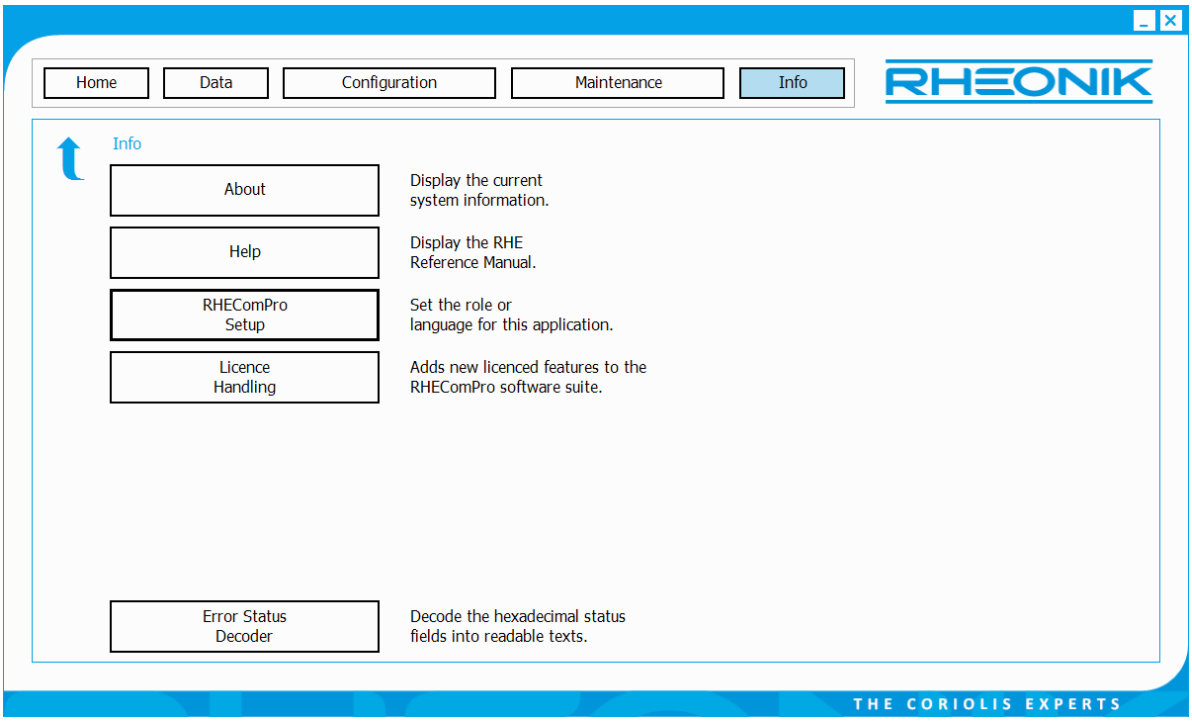

Figure 28: RHEComPro Info Menu

The “About” item displays a set of information which may be important when reporting problems of an RHE transmitter to the Rheonik Service. An example of the displayed information is shown in Figure 29.

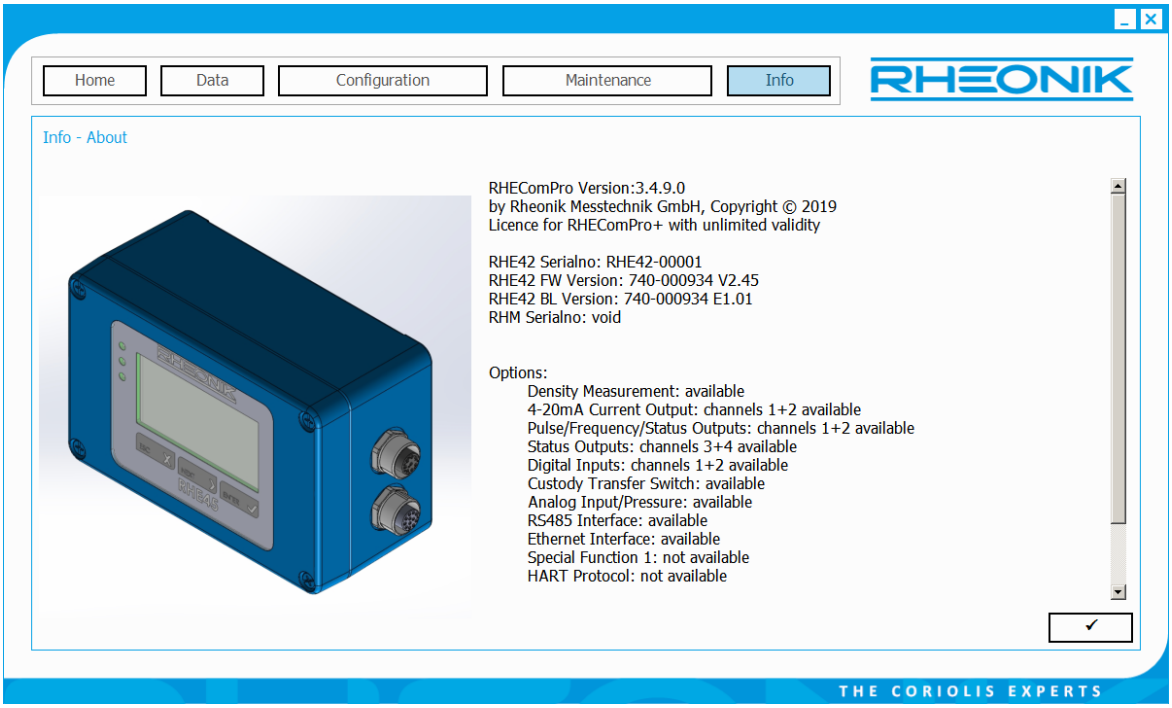

Figure 29: RHEComPro About Window

6 Calibration Aids

6.1 Mass Flow Calibration

All RHE transmitters delivered together with an RHM flow sensor are calibrated at the factory. Meters can be calibrated in the field. This involves comparing meter readings to those of a reference meter and calculating any error between the two. Once the amount of error is established the RHE transmitter can be adjusted to correct readings to the correct values.

6.1.1 Mass Flow K-Factor

The K-Factor determines the sensitivity of the RHM flow sensor to mass flow and is the key parameter when calibrating a meter. Each individual sensor has a unique K-Factor. The K-Factor value is stored in the setup parameter MassFlowKFactor (0x6922) under the Mass Flow parameter group.

6.1.2 Calibration Procedure

The RHEComPro software is required for the calibration process. The "Service" role must be selected and service role password entered at software startup, see section 2.4, to allow write access to the calibration parameters.

Carry out the following steps:

1. Stop flow within the pipe and carry out the zeroing procedure. The meter should be full of process fluid.
2. Zero the totalizer on the electronics
3. Take a container large enough to hold a representative process sample and perform a tare on a weigh scale (for small meters this may be a small beaker or bucket, for large meters, this could be a truck). If an inline reference meter (for instance in a gas application) is to be used instead of weigh scales, prepare the reference meter by performing a zero and resetting the totalizer.
4. Start flow through the meter, collecting the delivered process fluid in the container. Where a reference meter is being used, the flow will also pass through the meter. Important - the mass flow rate must be within the normal measuring range of the RHMxx. Information on the normal flow range can be found on the sensor identification plate. The delivered volume/mass should be of a suitable size so as to provide a representative sample.
5. Stop the flow.
6. Weigh the delivered mass on the scale and note down the RHE totalizer value and the weigh scale value. Where a reference meter is used, note down the totalizer values from both meters.
7. Repeat the process twice more, noting the scale and totalizer values each time. Review the data collected for consistency and average the RHE totalizer values and the weigh scale or reference meter values.
8. Where the error between the instrument and scale readings are outside of the accuracy of the meter, the meter can be corrected by adjusting the internal K-Factor. To calculate the new K-Factor, use the following equation:

$$\text{"New K-Factor"} = \frac{Reference}{RHE\ Total\ Mass} * \text{"Old K-Factor"}$$

The new K-Factor derived from the above equation is entered into the setup parameter MassFlowKFactor (0x6922). Once the new K-Factor is entered, the calibration procedure should be run once again to validate that the meter is now reading correctly. If there is still a deviation between the reference measurement and the RHE total mass that is greater than the uncertainty of the meters, the complete calibration procedure should be repeated and another new K-Factor determined.

The RHECom software supports the calibration with the help of a dedicated dialog box, see section 6.1.3.

Note:

- The determination of a new K-Factor is best done at several *different flow rates*. Three different flow rates (at high, mid, low flow rate) is recommended. The resulting K-Factor for each flow rate can be compared and provided they are in close agreement, a mean K-Factor calculated for entry into the RHE transmitter.
- These measurements are best made *at the operating temperature of the process.*

6.1.3 Calibration Support

When started in the maintenance mode the RHEComPro software offers a “Maintenance” / “Advances Maintenance Activities” / “Mass Flow Calibration” submenu item to assist in recalibrating the mass flow meter in the field/in a reference laboratory. Clicking on “Calibration Support” brings up the “Calibration Aid” dialog box. An example of the “Calibration Aid” dialog box is shown in Figure 30 below.

This dialog box supports several steps performed during the production process of an RHE/RHM assembly. The portion with the blue background color is relevant for the mass flow calibration.

The “Refresh from RHE” button updates the “Forward Totalizer”, the “K-Factor old”, the “Sensor Serial Number”, and the “Sensor Part Number” fields by values currently available at the RHE transmitter.

To perform a calibration using the Calibration Aid dialog box, follow the following procedure:

1. With the meter in a zero flow condition, click on the “Reset Totalizer” button to set the mass flow totalizer to zero.
2. Start flow through the meter and run to give a representative totalizer count for the meter size. Use an independent reference to determine the delivered mass. This reference may be a lab weight scale for small meters, a truck scale for large meters or an inline reference meter.
3. Stop flow and note the reference mass value. Click the “Refresh from RHE” button to read the current K factor from the RHE transmitter into the “K-Factor old” field. Enter the reference mass value into the “Measured Result” field and click the “Recalculate F-Factor”. A new, corrected updated K-Factor will be calculated based upon the RHE Totalized Mass, Reference mass and existing K-Factor. The new K-Factor will appear in the “K-Factor new” field for review.
4. Click on the “Set K-Factor” button to install the new K-Factor into the RHE transmitter.

5. Repeat the calibration procedure to confirm that the new K-Factor calculates the correct mass flow value (within instrument uncertainty) when compared to the reference mass value.

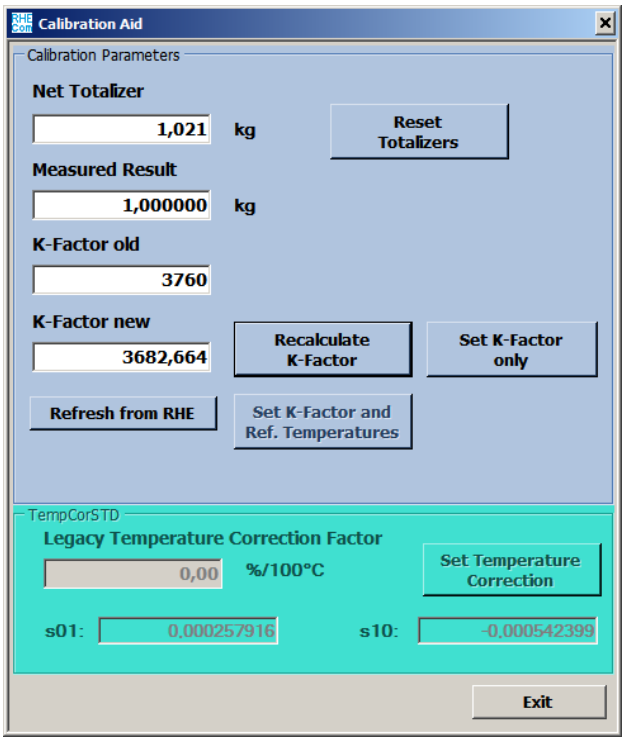

Figure 30: Calibration Aid Dialog Box

Note that all fields can also be entered manually providing the option to use a value totalized on an accumulator connected to the pulse output rather than the internal totalizer to calculate the new K-Factor.

6.2 Two-Point Density Calibration

The RHE transmitter may determine the density of the substance contained in the tube of the RHM sensor by using the effect that the frequency of the sensor drops when the weight of the filled-in substance increases. The higher the density of the substance the lower the frequency of the sensor becomes. The accuracy of the density calculation depends on the sensitivity of the RHM sensor concerning weight differences and the compensation of the temperature effect on the frequency.

RHM sensors ordered with the density calculation feature are pre-calibrated at the factory. The frequencies of the sensor filled with air and filled with water is measured and entered into the setup parameters of the RHE. Other calibration points are available on request. The density of the air is 1.2kg/m³ and the density of water at 20°C is 998.2kg/m³. Since the “air” reference frequency is determined at 20°C (or recalculated to this reference) any further density calibration should be done at this temperature, as well, in order to keep the two reference frequencies comparable. The RHEComPro program allows a compensation of a temperature difference to the reference temperature. Please consult the Rheonik Service if your process temperatures deviate much from the 20° C reference temperatures.

This is considered a two-point calibration and is usually done at the factory, but may also be done at the customer site. When a two-point calibration parameter set already exists in the RHE a

customer may consider the adaption of the density calculation parameters with the help of the Density Field Calibration feature described in section 6.3.

Note, that an active Density Field Calibration inside the RHE will render any change of the Two-Point calibration ineffective. In order to deactivate the Density Field Calibration, set the parameter DnsKFactor (0x684A) to 0. This can be done with the help of the dialog box described in section 6.3.

When used in the role Service the RHEComPro programs offers the ability to change the density calibration information with the help of a dedicated dialog box. This can be activated by selecting the menu „ Maintenance“ / “Advanced Maintenance Activities“ / “Two-point Density Calibration”. After having selected this menu item the following dialog box appears:

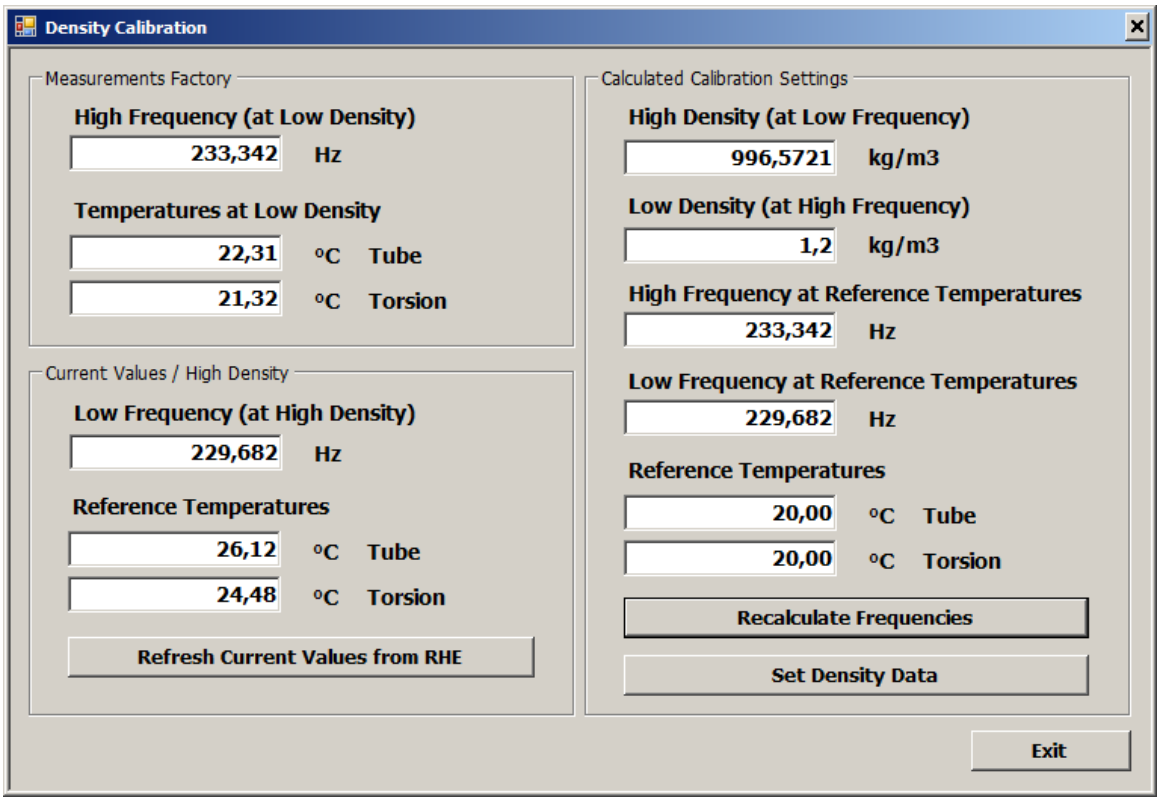

Figure 31: Two-Point Density Calibration

The values in the fields in the upper left box “Measurement Factory” such as „High Frequency“ and the Temperatures at „Low Density“, as well as the “Low Density“ field to the right are taken from the current calibration information inside the setup parameters. These can be overwritten when the RHM production information is present.

Since this dialog box assumes that the sensor is filled with the substance for the high density calibration reference point – usually water – the values in the lower left box “Current Values” such as “Reference Temperatures“ and „Low Frequency“ are determined by the current state of the RHM sensor. From these temperatures the density of pure water is calculated and automatically entered into the “High Density” field at the right side. The button “Refresh Current Values …” will re-read the current state measurements from the RHE and allow a monitoring whether the RHM is in a stable state.

The “High Density” field may be overwritten when the density of the substance inside the RHM is known.

The “Reference Temperatures” field in the right “Calculated Calibration Settings” box may also be overwritten when desired. This only makes sense when the process temperature of the substance is much different from the standard 20°C.

Before the density calibration information is written the button “Recalculate Frequencies” must be pressed. This cause a correction of the frequencies from their original reference temperatures to the reference temperatures shown in the calibration data set.

As a final step a press on the “Set Density Data” button will write the calibration data set into the RHE setup parameters activate them via a system reset.

Note that the density calculation in the RHE transmitter is activated only when it is configured properly in the setup parameters, i.e. „VolDensPresent“ in „Generic“ is set to 1 and „DnsConfig“ in „Density“ is set to 1. Usually these values are set at the factory when the RHE transmitter is ordered with the density calculation option.

The “Density Calibration” dialog box may be closed by clicking on the “Exit” button.

6.3 Density Field Calibration

A simplified density calibration is available when the Service role has been selected and the density is calculated from the RHM frequency (DnsConfig is 1). There is a separate parameter set for the Density Field Calibration which is automatically filled with meaningful values originating from the two-point calibration when the Density K-Factor parameter in register DnsKFactor (0x684A) is 0.

Note: This form of density calibration yield the best results when the RHM sensor is filled with the standard processing substance and in a stable condition, i.e. the process temperature was applied for a longer time span which causes the tube and torsion temperatures inside the RHM to adjust to a near constant value.

The Density Field Calibration feature may be selected via “Maintenance” / “Advanced Maintenance Activities” / “Density Field Calibration”.

After the selection of this submenu item the following dialog box appears:

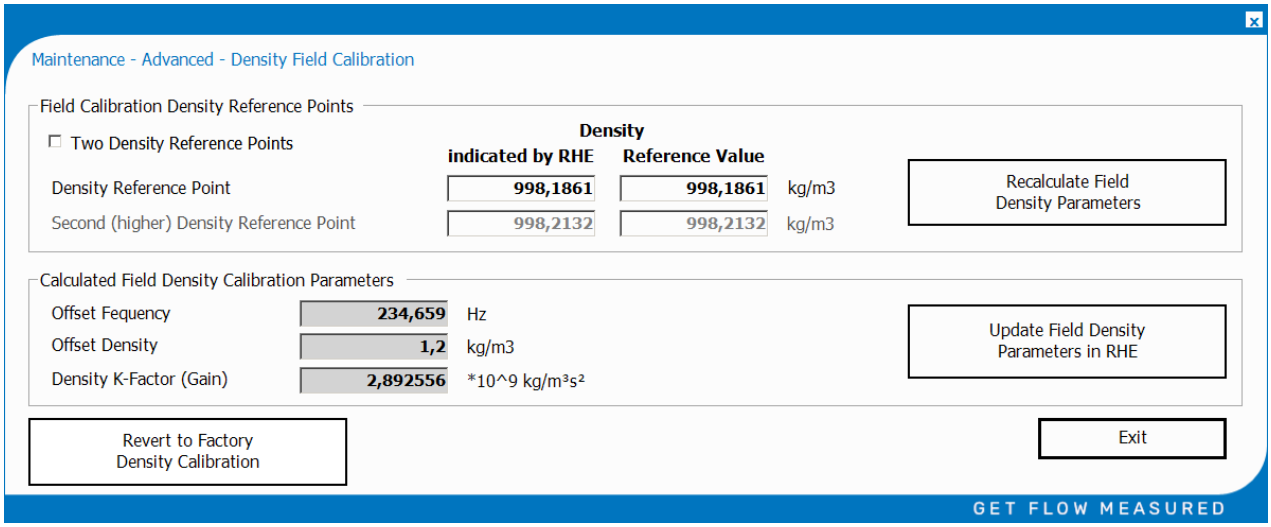

Figure 32: RHEComPro Simple Density Field Calibration Dialog Box

Before changing any calibration parameter the user should be aware that there are two options. In most case it suffices to adapt the density offset by disabling the “Two Density Reference Points” option in the selection box at the left upper side of the window. In this case the currently measured

density is displayed in the first “Density Reference Point” line. The measured value under “Reference Value” may be replayed by the real density of the substance followed by pressing “Recalculate Field Density Parameters” and “Update Field Density Parameters in RHE” as the final step which installs the newly calculated parameters into the RHE transmitter.

When the “Two Density Reference Points” is activated two different density/frequency pairs should be available which differ as much as possible from each other. This should be done only after having consulted the Rheonik Support.

As with other RHE setup parameters a misconfiguration may render an entire feature useless. Should this happen here, press the “Revert to Factory Density Calibration” button. This causes the RHE to revert all parameters of the Density Field Calibration to values derived from a previous two-point calibration. Thereafter, these parameters may be modified correctly.

6.4 Analog Output Calibration

The analog output interfaces are calibrated at the factory. If needed RHEComPro can assist you in recalibrating these interfaces.

For the calibration process a calibrated 5-to-6 digit current meter is needed. This current meter has to be attached to the current output interface to be calibrated instead of the normal shunt resistor. Note, that existing barriers may short-circuit current outputs when an overload is detected. This condition can only be cleared by removing the power from the RHE.

The calibration support for the current interfaces is found in the menu “Maintenance” / “Standard Maintenance Activities” and “Analog Output 1 Calibration” or “Analog Output 2 Calibration” depending on the selected interface. When one of these menu items is selected, the dialog box shown in Figure 33 appears and the respective current output is switch into a test mode and a 4mA output is applied.

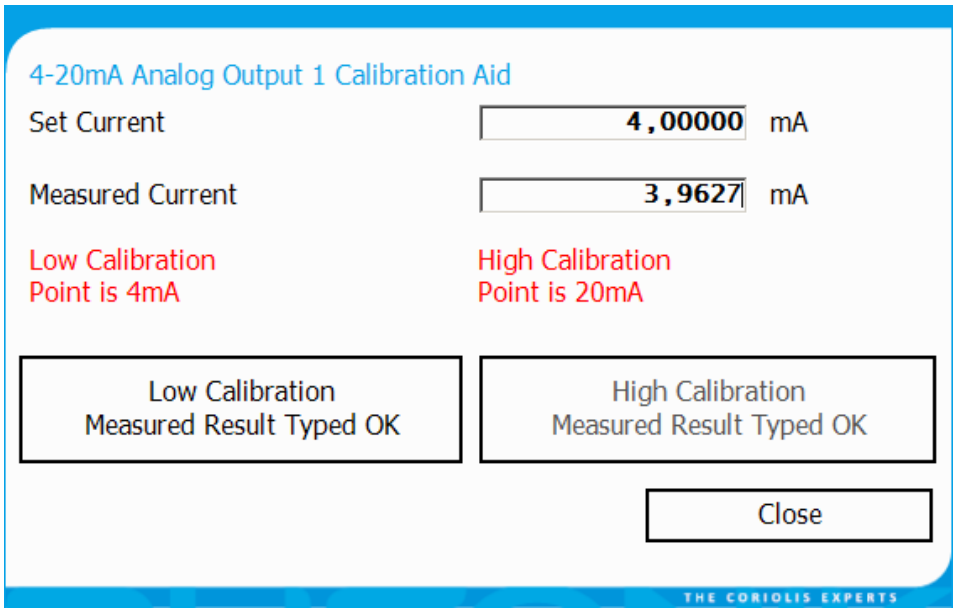

Figure 33: Analog Output Calibration Aid, 4mA Stimulus

Read the measurement result shown by the current meter and enter the value in the field “Measured Current”. It should read somewhere in between 3.9 to 4.1mA. If the reading deviates

check your measurement setup. Thereafter press “Low Calibration Measured Result Typed OK” and the current output is switched to a 20mA current. The dialog box will appear as shown in Figure 34.

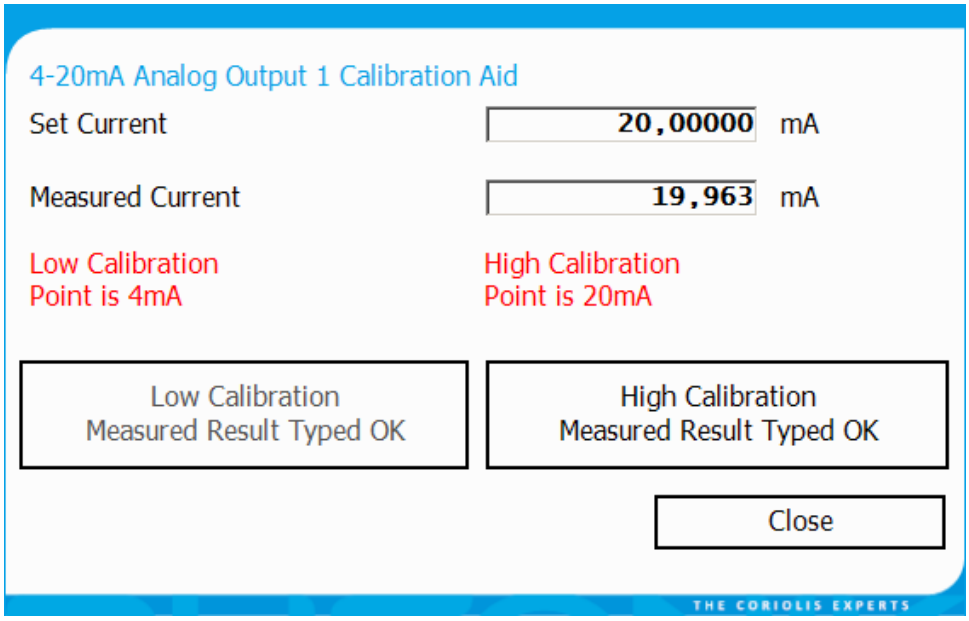

Figure 34: Analog Output Calibration Aid, 20mA Stimulus

Again the current meter reading must be entered into the “Measured Current” field. The measurement is concluded when pressing “High Calibration Measured Result Typed OK”. Close the window with the help of the “Close” button.

The success of the calibration effort can be checked with the help of the Fast Tests functions which can be activated by the “Maintenance” / “Standard Maintenance Activities” / “Fast Tests” menu item. The current output test available there stimulate the output by using the calibration information.

6.5 Analog Input Calibration

The analog input interfaces are calibrated at the factory. If needed RHEComPro can assist you in recalibrating these interfaces.

For the calibration process one of the analog output interfaces of the RHE transmitter has to be wired in a fashion that the current generated by the current output is measured by the current input. The selected current output must be configured to “passive” because the current input provides the power in this case. Furthermore, thus only make sense if the current output was calibrated successfully beforehand.

Note, that existing barriers may short-circuit current outputs or inputs when an overload is detected. This condition can only be cleared by removing the power from the RHE. Furthermore, the calibration process stimulates both current outputs at the same time. Therefore, it is recommended to detach all external equipment from the current outputs.

The analog input calibration aid can be activated via the menu item “Maintenance” / “Standard Maintenance Activities” / “Analog Input Calibration”. The dialog box is shown in Figure 35.

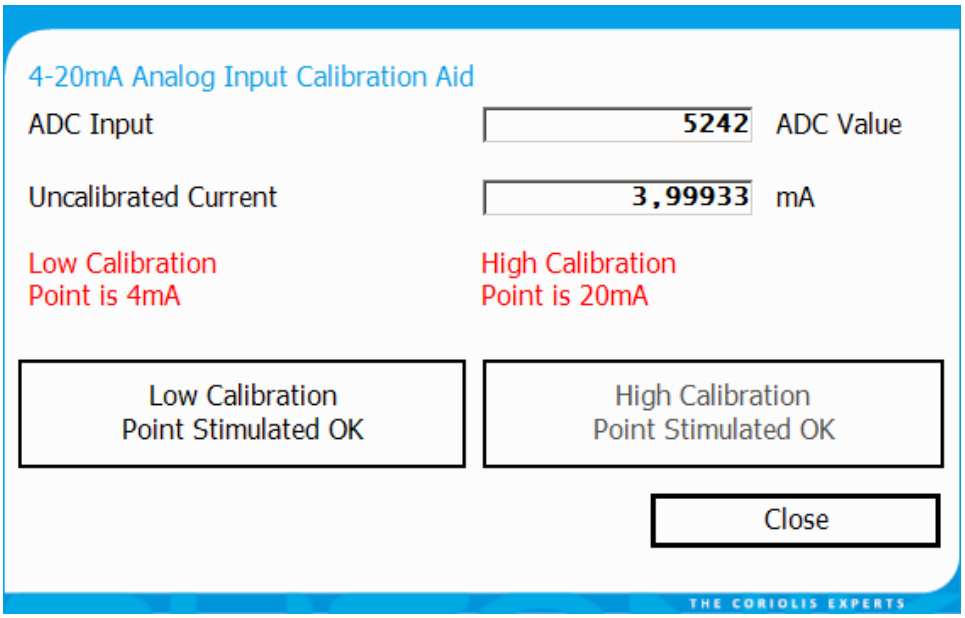

Figure 35: Analog Input Calibration Aid, 4mA Stimulus

First the current output are set to a 4mA current which is measured by the current input and displayed in the "Uncalibrated Current" field. This value is updated every second. Wait until it settles and then press the "Low Calibration Point Stimulated OK" button.

The current output then is switched to a 20mA current. When the current displayed in the "Uncalibrated Current" field has settled, press the "High Calibration Point Stimulated OK" button. Close the dialog with the help of the "Close" button thereafter.

6.6 Temperature Sensor Calibration

There should be no need to calibrate the temperature sensors of the RHE16 or the RHE40 series transmitters. The temperature sensors of the RHE20 series are calibrated at the factory.

The calibration procedure requires two different precision resistors which depend on the type of Pt temperature sensors used in the RHM sensor. Please contact the Rheonik Service when you feel that the temperature sensor circuitry needs to be recalibrated. The Rheonik Service can you supply with the required precision resistors and help you with the calibration procedure.

For the RHE20 and RHE40 series it is possible to configure a temperature offset depending on the length of the cable which connects the RHM sensor to the RHE transmitter. This configuration can be done via a dialog box which is activated via the Maintenance/Standard Maintenance Activities/Temperature Offset Configuration submenu item. This activates following dialog box:

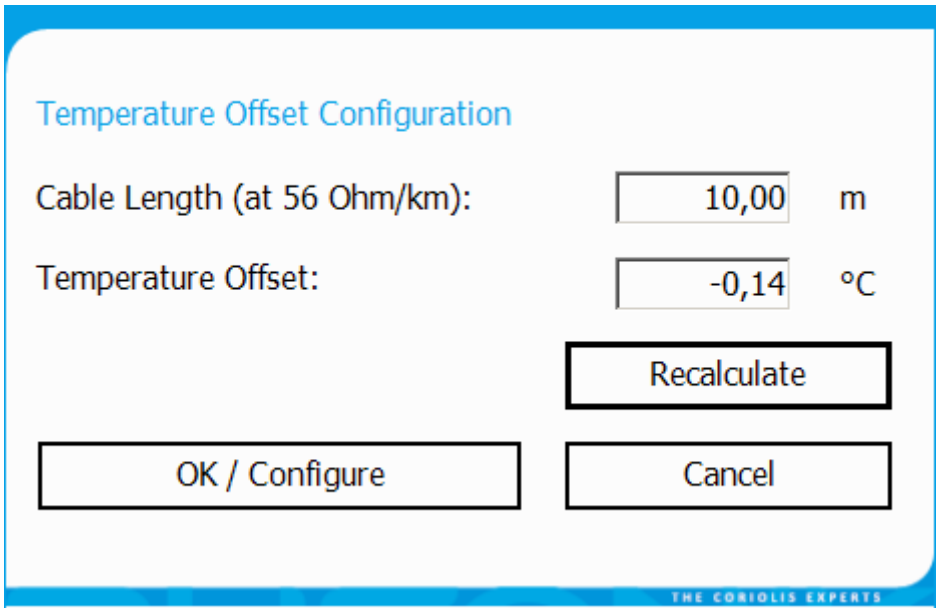

Figure 36: Temperature Offset Configuration dialog box

In this box the cable length can be entered and a click on the “Recalculate” button determines a temperature offset based on the standard Rheonik cable parameters of a resistance of 56 Ohms/km. Should other cables be used the temperature offset can be overwritten by hand with a value calculated offline. This value also may be positive in order to compensate for a minor deviation of the Pt100 or Pt1000 temperature sensors. The calculated correction depends on the type of the temperature sensors which is automatically determined from the temperature sensor configuration stored in the RHE.

Please use this feature with care. Larger offsets will have a major effect on the RHE-internal temperature compensation features and thus may invalidate the present mass flow calibration as well as the density calibration.

7 Simulator Use

When a RHEComPro+ license is installed the RHESim RHM/RHE simulator is available and can be started via the Connection Configuration window, see section 4.1.

The RHESim simulator integrates a large portion of the original RHE40 series firmware, a small physics engine simulating the behavior of the RHM sensors, and a Windows-compatible frame which provides HMI elements as inputs to the physics engine and the external interface portion of the firmware. From a user viewpoint the RHE40 firmware behaves very similar to the RHE20 firmware. When the simulator is started, a window as shown in Figure 37 is displayed.

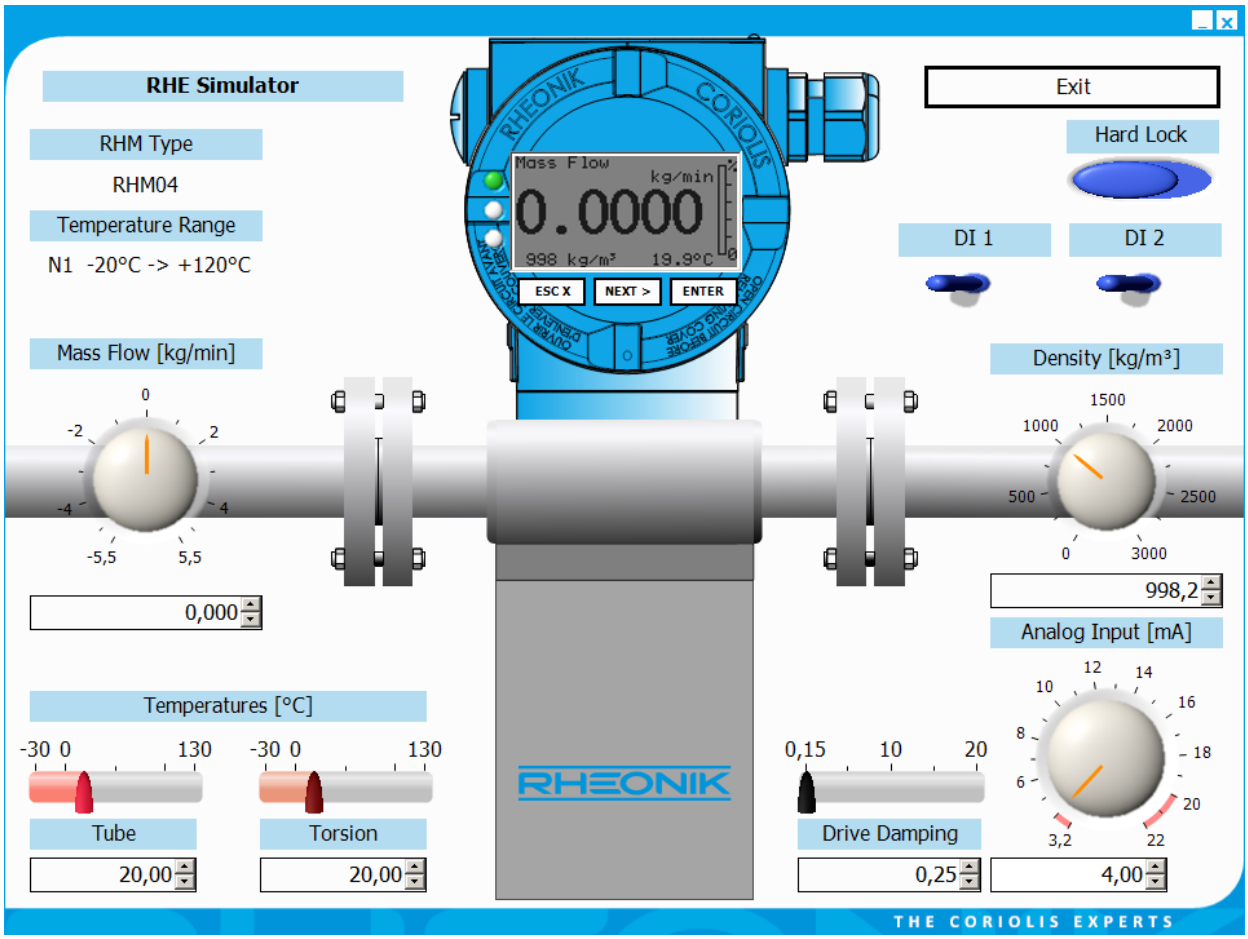

Figure 37: RHEComPro Simulator Window

The physical stimuli can be entered via the knob-like controls or typed as numbers into the associated number input fields. Two switch-type controls are used to stimulate the digital input and one slide switch simulates the Hard Lock/Custody transfer switch.

The RHE20/40 user interface consisting of display, its backlight illumination, and input buttons is displayed in upper top of the window. The simulated display and the input buttons are fully functional as if they were attached to a real RHE20 or RHE40 transmitter.

When the simulator is started the first time or the box “Use Old Parameters” in the Connection Configuration window is not checked the simulator will assume a new setup parameter set. Otherwise, the setup parameters of the last simulation run is used just as the real RHE20 or RHE40 transmitter would do. Thus, misconfigured setups can be replaced by standard values or it can be experimented with different parameter settings based on a personalized setup.

The simulator is considered a valuable tool to

- train the use of the RHE20/40 HMI,
- train the use of the RHEComPro program,
- try new setting of setup parameters and observe the effects,
- prepare the setup parameters for deployment of RHE transmitters,
- demonstrate special features to customers,
- and last but not least to test new RHE20/40 firmware features.

About Rheonik

Rheonik has but one single purpose: to design and manufacture the very best Coriolis meters available.

Our research and engineering resources are dedicated to finding new and better ways to provide cost effective accurate mass flow solutions that provide value to our customers. Our manufacturing group care for each and every meter we produce from raw materials all the way to shipping, and our service and support group are available to help you specify, integrate, start-up and maintain every Rheonik meter you have in service. Whether you own just one meter or have hundreds, you will never be just another customer to us. You are our valued business partner.

Need a specific configuration for your plant? Don't compromise with a "standard" product from elsewhere that will add extra cost to your installation. If we can't configure it from our extensive and versatile product range, our exclusive **AnyPipeFit Commitment** can have your flow sensor customized with any size/type of process connection and face to face dimension you need.

No matter what control system you use as the backbone in your enterprise, with our **AnyInterface Commitment**, you can be sure that connection and communication will not be a problem. Alongside a wide variety of discrete analog and digital signal connections, we can also provide just about any network/bus interface available (for example: HART, ProfibusDP, ProfiNet, EtherCAT, PowerLink, EtherNet/IP, CAN, ….) with our RHE 40 Series family of transmitters. Rheonik RHE 40 Series transmitters can connect to your system – no headache and no conversion needed.

Rheonik Messtechnik GmbH
Rudolf-Diesel-Straße 5
D-85235 Odelzhausen
Germany

Tel + 49 (0)8134 9341-0
info@rheonik.com