Drulo App Operating Manual

Version 1.0.6.0 and higher

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1 Preamble

1.1 Overview

Supply pipes carrying vital substances such as drinking water require particularly proper control and monitoring. As the pressure situation inside the pipe reveals relevant information on fire protection and supply reliability, measurements conducted with pressure loggers are reasonable and provide such information even during supply peak times. Pressure logger are applied at several spots of a supply network section, and a difference in pressure is created as soon as water is discharged at a discharge spot. The pressure curve along the measurement section allows conclusions about the state of the pipe itself. It is reasonable graphically to process the measurement data and compare it in order to give the operator a sound overview of the individual pressure situations at the particular measurement spots. Based on this insight, F.A.S.T. decided to develop the Drulo app to even further support the user. The app is to be applied to evaluate the measurement data collected by a pressure logger. The software also allows to program a pressure logger for a certain measurement process. The read-out measurement data can then be displayed as a measurement value curve.

1.2 Requirements of the tablet

The tablet needs to meet certain requirements in terms of software and hardware before the Drulo app can be installed via Play Store. The operating system (software) of the tablet should be at least android version 4.4 and not higher than android version 7.12. The hardware should feature the equipment (essential or optional) as listed below. If a tablet does not have any of the components marked "`optional`", some functions of the Drulo app cannot be used. Hardware requirements:

- Bluetooth receiver (essential)
- Wifi or 3G / 4G network (optional)
- Back or front camera (optional)
- GPS receiver (optional)
- Internal free memory capacity (essential)

1.3 Installing the Drulo app

Please note that a Play Store account needs to be installed before the Drulo app can be downloaded to your android tablet or smartphone. This account is free of charge. If you already have a Play Store account, please activate the account on your tablet and smartphone respectively. If you do not have a Play Store account yet, please install a new Google account first. The account can either be created through the following link on a PC or on the tablet directly.

Creating a Google account via PC

Please proceed as described below if you wish to install the account on your tablet directly:

1. Call the "`Settings`" program on your tablet.

2. Select "`Accounts & synchronization`" and then "`Add account`" at the lower edge of the screen.

3. Please select "`Google`" as the type of account. You will now be asked if you intend to add an already existing account or if you wish to create a new account. Click on "`New`".

4. Now you need to enter your first name and your surname into the corresponding boxes, then click on "`Continue`".

5. The next step is to enter the requested e-mail address. Please note that you can only choose the part before the "@" symbol. This newly created e-mail address will be your log-in e-mail address for the Play Store from now on. Once you have finalized your e-mail address, click on "`Continue`".

6. Now please select a password for your new account. This password needs to consist of at least eight characters. The system will request you to enter your password again in the second box for verification purposes.

7. Now enter an already existing e-mail address (e.g. with GMX, Yahoo, or WEB.DE) you have access to. Please also select a security question and enter the appropriate answer in the corresponding box.

8. The system will now ask you if you also wish to register with Google+. Please note that it is not required to register with Google+ to operate the Drulo app. So if you do not wish to register with Google+, click on "Not now".

Illustrating 1-1: Play Store account

As a final step, you can now activate the web protocol for your account. This web protocol function assimilates search results on the basis of your search requests and of the visited websites. If you do not wish to activate this function, please remove the corresponding tick. Click on "I agree" to accept the Google terms of use and the Google data privacy policy.

As soon as the account has been activated on your tablet, you can start the Play Store program on your tablet. The corresponding icon of this program looks like a little shopping bag. The Play Store search function is activated by tapping on the lens symbol, which is usually located in the upper right corner. Enter ”Drulo“ and tap again on the lens. After a while the system should display our program as the search result. Now tap on the image of our program in order to be directed to the Description section, where you will have to tap on the “Install“ button to install the program on your tablet. Once the program has been installed, close the Play Store program. The Drulo program can now be started and is ready for operation.

1.4 Drulo pressure logger

1.4.1 Status and operating elements

The pressure logger is equipped with a display where the operating status of the logger is visualized. The device offers three keys for user interface operation. Illustration 1-2 shows the operating elements. Generally, the device is set to power-saving mode, and the display is switched off. If you wish to switch on and activate the pressure logger, please press any of the

three keys. The display will now be activated as well. Navigation in the menu is done with the arrow keys. The "tick" key has the same function as the "Enter key" on a computer keyboard and is used to confirm or to activate the menu functions.

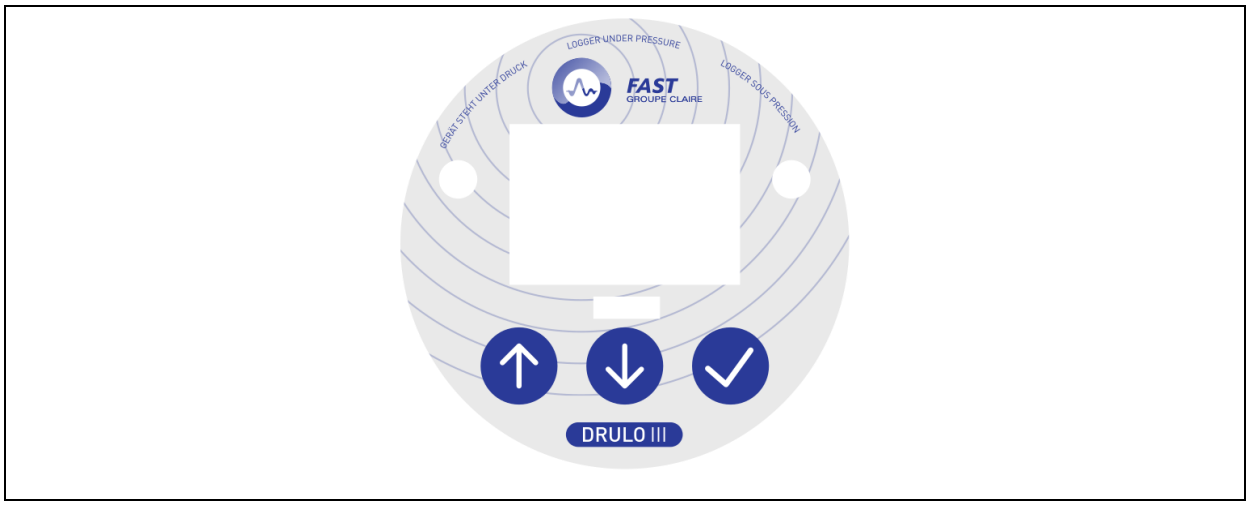

Illustration 1-2: Pressure logger operating elements

The serial number of the pressure logger is stated between the display and the keys, and this serial number is also the Bluetooth ID of the device. So, for example, if the device has a serial number of 1234, subsequent Bluetooth identification in the Drulo app will be "Drulo-1234".

1.4.2 Charging the battery

As already stated before, the pressure logger is equipped with rechargeable batteries which need to be recharged after approximately 1,800,000 acquired measurement points. If the pressure logger is not used for any measurement procedures, the device should be recharged after not later than one year. The charging state of the batteries is also visualized on the pressure logger display. As soon as the pressure logger has been switched on (see Chapter 1.4.1), the charging state of the batteries is indicated in the upper right corner of the display. If the symbol is completely filled black, the batteries are fully charged. An unfilled battery symbol indicates that the batteries are empty. If you need to recharge the batteries, please put the logger on the charging unit. The charging process should be completed after approximately four hours.

1.4.3 Activating Bluetooth

The Bluetooth module required to establish the Bluetooth connection with a tablet is activated as long as the display of the pressure logger is switched on. If the display is switched off, the Bluetooth module is also switched off automatically, i.e. as long as nothing is indicated on the

display, there is no connection possible between the pressure logger and the tablet. The display can be activated through any of the three keys (see also Illustration 1-2) and switches off automatically after two minutes unless a connection with the tablet has been established.

The longest possible distance between the pressure logger and the tablet is about 4 meters provided the logger display is pointing towards the tablet. If this distance between the two devices is exceeded or if the display is pointing away from the pressure logger, data exchange may be flawed or the connection may even not be established at all.

1.5 Connecting a pressure logger

Bluetooth connection (short: BT connection) needs to be established between the pressure logger and the tablet for the "`Program measurement`" (see Chapter 2.4), "`Read measurement`" (see Chapter 2.5), "`Observe measurement`" (see Chapter 2.6), and "`Drulo settings`" (see Chapter 2.3.2) input masks to allow data exchange between the devices. Illustration 1-3 shows the connection structure, which is the same for each of the four input masks as the process to connect the pressure logger is always the same.

All masks stated above are divided in two sections. The right section hosts the data and generally displays some information related to the particular task. Such information cannot be called or changed unless the corresponding Bluetooth connection between the pressure logger and the tablet (indicated in the left section) has been established. The left section hosts the connections between the devices, it indicates the status of the single connections, and it is used to manage and to establish BT connections. So any connection established successfully is indicated on this left side. The section has a header in grey, a lens symbol, and a device list positioned beneath the header. When the Drulo app is started for the first time, the device list is still empty. Once the list is filled, each line in this list represents one pressure logger indicating its device name and its Bluetooth address. The device name is composed from the Drulo serial number (see Chapter 1.4.1) and the "`Drulo-`" prefix.

A new pressure logger is added to the list by tapping on the header part containing the lens symbol. The header will now display a bluish headline (shown in the left section in Illustration 1-3) while the system is searching for new pressure loggers. The search process runs for about one minute and terminates automatically. Once the process is terminated, the bluish headline disappears again. Please note that the pressure logger needs to be activated beforehand through any of the keys (see Chapter 1.4.1) so that it can be identified by the

system. The pressure logger cannot be found by the tablet unless the pressure logger display is activated and information is displayed on it (see Chapter 1.4.3). All activated pressure loggers contactable in the vicinity of the tablet are entered on the device list and can be applied subsequently.

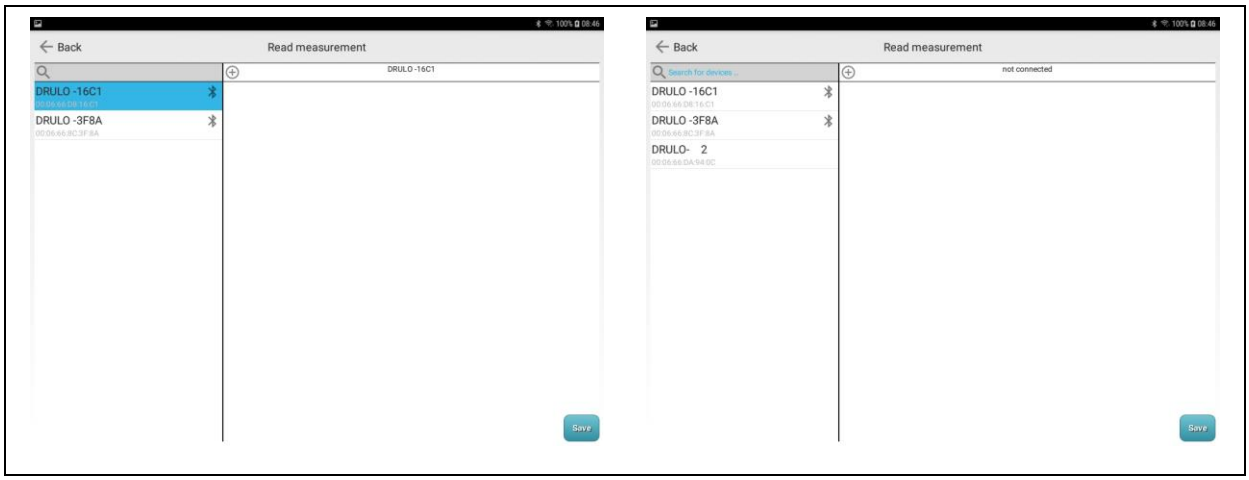

Illustration 1-3: Connecting a pressure logger

As shown in Illustration 1-3 above, there are pressure loggers listed coming along with a symbol similar to "B" (indicated at the end of the line). The difference between the pressure loggers with and without a "B" is that the pressure loggers without the "B" have not yet been connected to the tablet, i.e. they have not been paired yet. Paired devices remain saved on the device list even if the operator has left the particular input mask or app, whereas unpaired pressure loggers are deleted from the list as soon as the particular input mask or app is closed.

For either kind of device (paired or unpaired), tapping on a line will initiate the connecting process between the pressure logger and the tablet. However, an unpaired device is displayed together with a dialog while the system is establishing a connection. This dialog is a pairing request for the currently selected device. Pressing "OK" will complete the connecting prodcess, i.e. the device will then be connected with the tablet. Once a pressure logger has been successfully connected with the tablet, the logger is marked blue, as shown in Illustration 1-3 (to the right) and data can now be exchanged between the pressure logger and the tablet. So if the device list does not display any blue line, there is no connection with any pressure logger available. Tapping on the blue line again will terminate an existing connection. If you wish to delete a certain device from the list, please press the particular line for a little while (about two seconds). A context menu will appear where the selected logger can be deleted by pressing "Delete".

1.6 Watercloud user account

The essential user account for the Watercloud system can be obtained through F.A.S.T. GmbH. As soon as F.A.S.T. has released access to the system, the user can log in to the Watercloud and use the system. Through the "`Login menu`" (see Illustration 1-4), the user can access the system by entering his/her user name and the corresponding password and then by pressing "`Log in`". As soon as the user has logged in to the system, the menu items "`Logger map`" and "`AZ Receiver`" are activated, and the Watercloud can be used. The "`Logger map`" menu item is to open cartographical measurement data management. Clicking on "`AZ Receiver`" opens a page where the networks and tablets connected with the current user account can be managed.

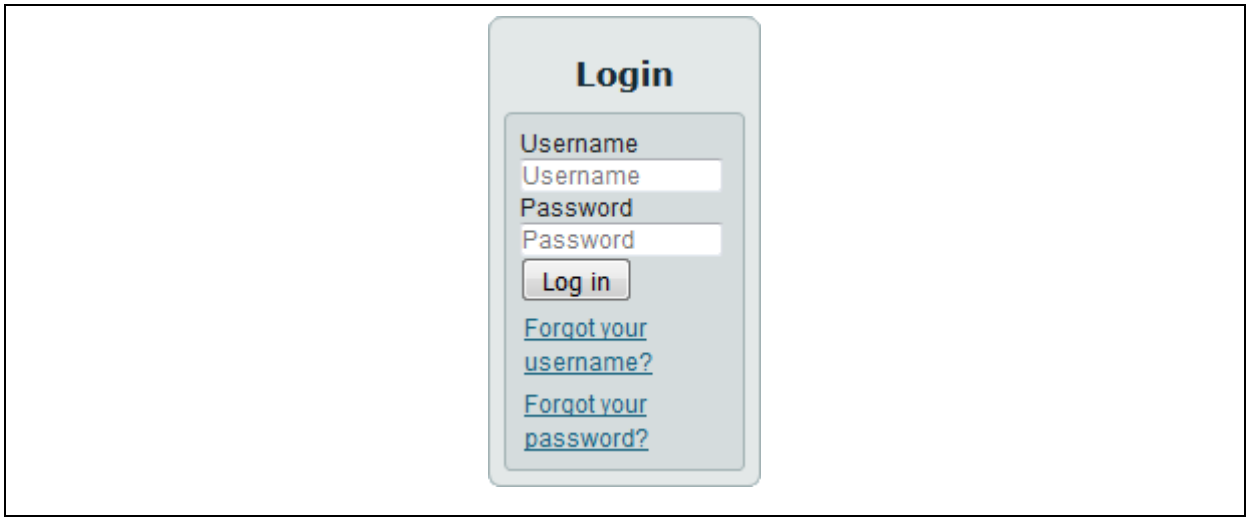

Illustration 1-4: Login menu

2 Drulo app

The start screen displays six fields, which all offer various program functions. The "`Measurements`" field calls the mask to display the measurements saved on the tablet, as described in more detail in Chapter 2.1. The "`Import / Export`" field offers the function to export data collected with the tablet to the Watercloud. For further information on this field, please refer to Chapter 2.2. The settings of the program can be changed through the "`Settings`" field, as described in Chapter 2.3 erläutert. Programming measurements on the pressure logger can be initzialized through the "`Program measurement`" field (for further information, please refer to Chapter 2.4). The measurements acquired by the pressure logger can be read out through the "`Read measurement`" field and can be saved subsequently on the tablet. This process is described in detail in Chapter 2.5. A current measurement can be called from the pressure logger and can be displayed through the "`Observe measurement`" field. Chapter 2.6 is to provide more detailed information on this function.

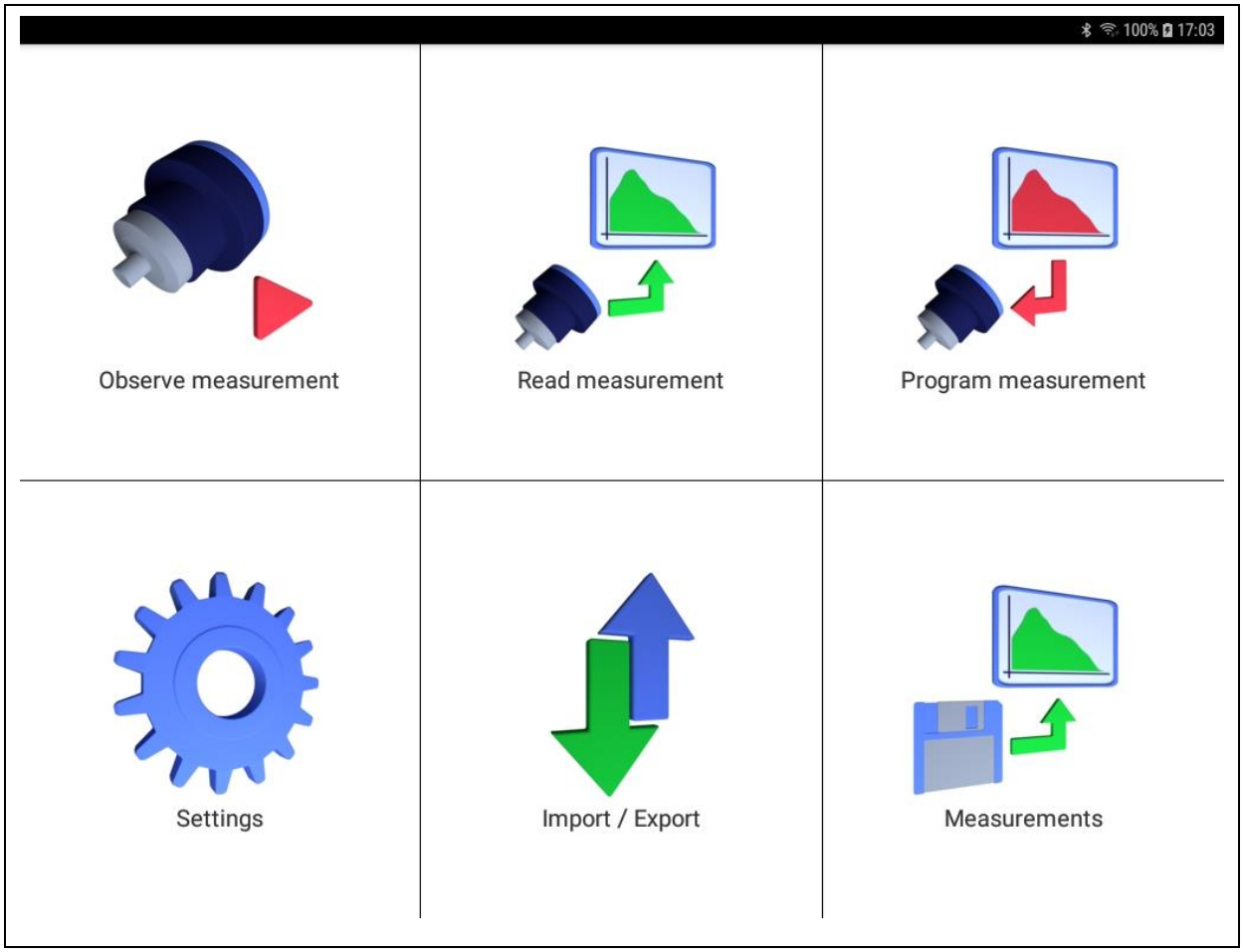

Illustration 2-1: Start screen

2.1 Measurements

If this field is tapped on, a program mask as shown in Illustration 2-2 opens up. All measurements read out from a pressure logger (see Chapter 2.5) are indicated on a list in this mask. Every single line of the input mask constitutes a measurement, with the measurement read out last is on top position on the list. If you wish to return to the start screen again, please press "`<-Back`" (see Illustration 2-1).

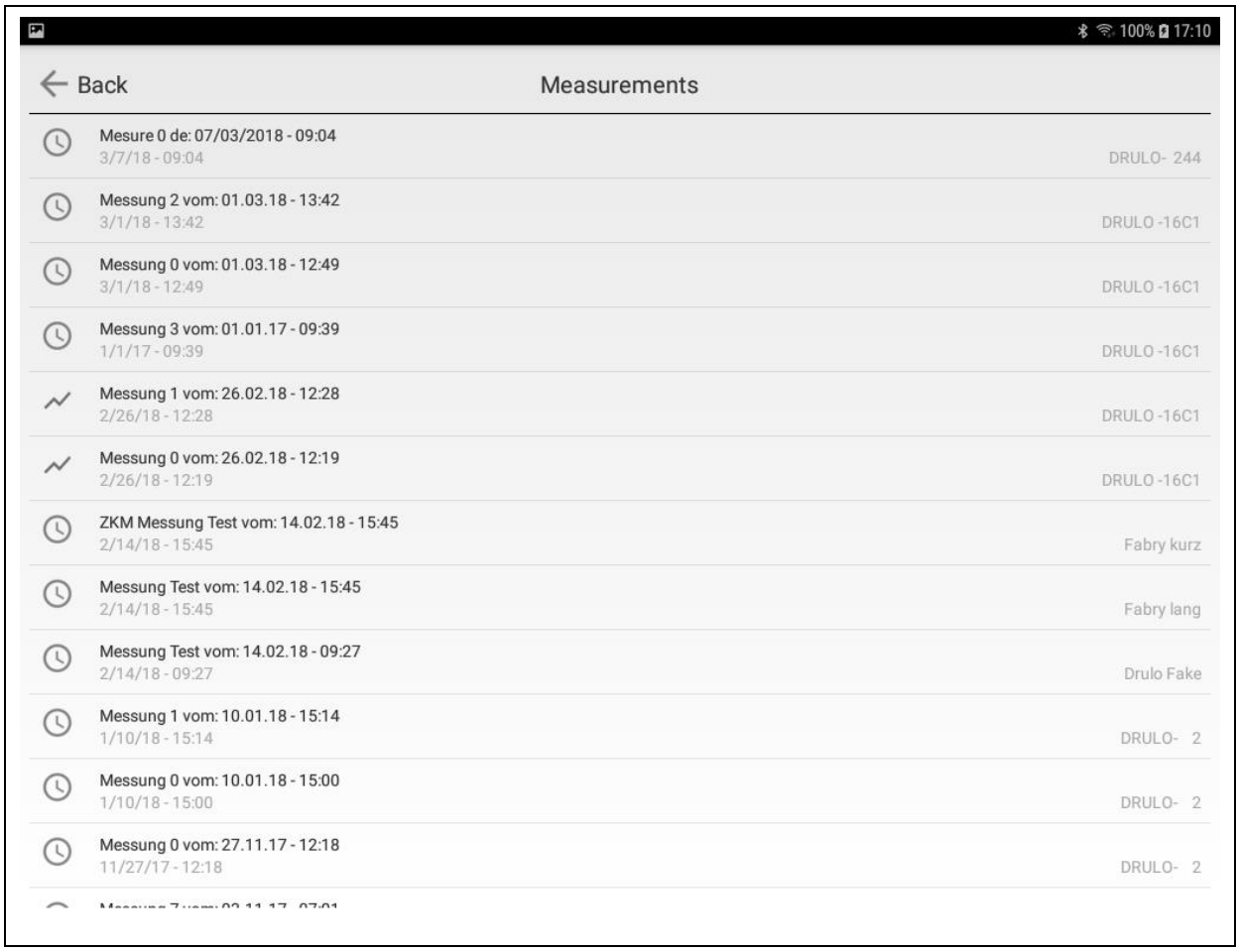

Illustration 2-2: Saved measurements

The list indicates a number of measurements, with the number of measurements displayed being subject to the size of the tablet applied. If you wish to display all other measurements, swipe your finger across the list, i.e. if you swipe your finger from bottom to top, the measurement list will follow your finger in the same direction and indicate the those measurements listed below the ones originally displayed. If a line is pressed for a little while (approximately 2 seconds), a context menu will open up where the "`Delete`" and "`Rename`" menu items are displayed. If you wish to delete a particular saved measurement from the tablet, press the "`Delete`" menu item. Please note that once a measurement has been finally

deleted, it cannot be restored. The name of the measurement assigned by the tablet can be changed through the "Rename" button in the context menu. Tapping on "Rename" opens an input dialog where the requested name of the measurement can be entered. The new name will then be saved and accepted by the system by pressing "Apply".

Each line of the list constitutes a saved measurement and can be either a time-controlled measurement (see Chapter 2.4.1) or an event-controlled measurement (see Chapter 2.4.2). The particular type of measurement is indicated with a symbol positioned at the beginning of the line. A time-controlled measurement is indicated with a clock symbol, an event-controlled measurement is indicated with lines. Tapping on a line makes the mask as shown in Illustration 2-3 appear.

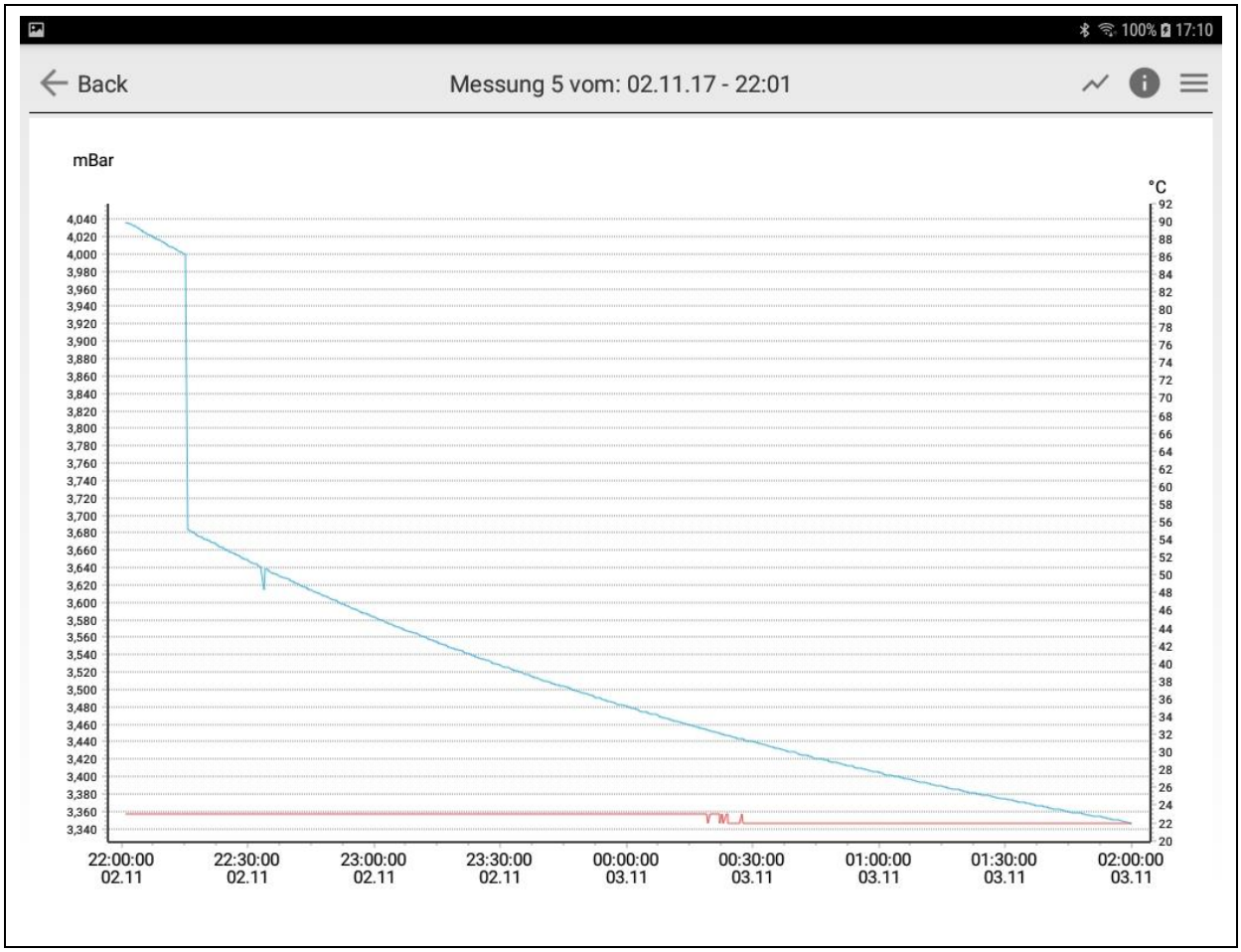

Illustration 2-3: Measurement

If you wish to return to the screen as shown in Illustration 2-2, please tap on "<-Back". The headline hosts another three buttons at its right end where additional information can be obtained and further functions can be called.

Measurement diagram

Tapping on this icon makes the app display the measurement in a diagram. This diagram is the standard view when a measurement has been opened and shows the pressure measurement values as a blue line and, when acquired, the temperature as a red line. If both measurement lines are indicated, the pressure-related values are displayed on the left, and the temperature-related values are displayed on the right. The particular unit of measurement is indicated at the upper end of the corresponding value scale.

If the operator wishes to scale up a certain section of the diagram, the zoom function is the appropriate function to use. Just press the finger on the display to open up the so-called zoom window in the upper left corner of the display. The finger now needs to rest on the display and needs to swipe from its current position towards the lower right corner of the display. This movement creates the zoom window, and as soon as the finger is withdrawn from the display, the lower right corner of the zoom window has been determined and the diagramm will show the corresponding section in more detail. In order to reset the zoom, just proceed vice-versa, i.e. swipe from the lower right to the upper left, and the diagram will show the entire measurement data again. As soon as only ten measurement values are displayed in the diagram due to zooming, detailed information on every single measurement value will be indicated.

Measurement-related information

This button is to call additional information on a specific measurement: “Parameter“, “Info“ (short for “information“), and “Position“. The so-called “Parameter“ indicator provides information on a measurement conducted by a pressure logger. This data can only be displayed, it cannot be changed. The data offered by the “Info“ function, however, is a text that can be complemented or changed by the app user. The “Position“ function allows to lodge position-related data of the tablet in a measurement.

If you wish to acquire the texts for the “Info“ function, press on “Measurement information“ first to display the data. Then press “Info“ to get to the section where such data can be entered into the system. If you wish to input some data into the corresponding box, just tap on the particular box and a keyboard will appear which is required to enter the

text. The app saves the input text automatically. If, however, any information is incorrect or no longer relevant, it can be deleted from the input box by pressing “Delete“.

The “Position“ function is used to add so-called GPS positioning data to the measurement. Tapping on the button opens up the section, and tapping on “Take“ then starts the GPS data acquisition process. Please note that the tablet acquires the coordinates and that this process thus needs to be conducted in the open air at the measurement spot. If the acquired coordinates need to be deleted again, please press the “Delete“ button.

Context menu

This button is visible only when the input mask shows the measurement diagram. If any information is being process in the “Measurement information“ section, this button is not displayed. Tapping on this symbol opens up a contect menu which hosts some helpful functions to display the diagram and also some export functions to transfer the measurement, if requested.

The “Scaling“ function opens a dialog where the units of measurement for pressure and temperature can be changed. The units available for “pressure“ are bar, mbar, psi, and meter, with “meter“ referring to water only. The units available for “temperature“ are Celsius and Fahrenheit. The appropriate unit can be selected by tapping on the corresponding term. The changed settings can then be saved by tapping on “Apply“. If the changed settings are to be rejected and canceled, press “Cancel“.

If the pressure or the temperature is exposed to major fluctuations, the diagram may become very confusing. Therefore, the diagram can be set so as to display only the pressure or only the temperature besides the option to display both pressure and temperature. If only the pressure or only the temperature is to be displayed, press “Diagram“ in the context menu. Please note that only a time-controlled measurement allows to acquire the pressure and the temperature at the same time, i.e. this menu item is displayed only if the current measurement is a time-controlled measurement where also the temperature is being acquired. The measurement values to be indicated in the diagram need to be tapped on and then ticked in the dialog. The selected settings can then be saved by pressing “Apply“, which also updates the measurement diagram. If the new settings need to be rejected or canceled, please press “Cancel“.

Besides the "Import / Export" function as described in Chapter 2.2, the "E-mail" menu item is used to export a single measurement from the app. In order to be able to do so, the tablet needs to be connected with the internet, and a valid e-mail account needs to be established on the tablet. If this menu item has been selected, the dialog as shown in Illustration 2-4 below appears.

Illustration 2-4: Exporting an e-mail

The dialog can be closed without sending out an e-mail by tapping on "Cancel". The "Search" button supports the operator in finding a specific e-mail address saved in the directory of the tablet to take the e-mail address from an already existing contact. The particular name has to be tapped on in the open directory to use as the address for the e-mail to be sent out. An e-mail address can also be complemented manually by tapping on the first input box, which will make a virtual keyboard appear in the lower part of the screen where the operator can enter additional information. The subject line of the e-mail can also take additional information on the contents of the e-mail. If the information entered needs to be changed, just tap on the line and the keyboard will appear again.

There are two different formats available to export a measurement: the Excel format and the Portable Document Format (PDF). The Drulo app generates a corresponding file and attaches the file to the e-mail. The type of file to be attached can be determined with a tick (see Illustration 2-4 "Excel file" and "PDF file"). Creating a file in Excel is not always possible and is subject to the number of measurement values. If this format is not possible, the system will not allow to tick "Excel file".

When all relevant information has been complemented, the e-mail can be sent out by tapping on "Sending". A window will then be displayed in the lower part of the screen where the program to be applied to send out the e-mail has to be selected. Usually, the "G-mail" app is used for this process if a Google account has been installed on the tablet. The Drulo app closes after the program has been selected, and android will change to the particular e-mail program. When the e-mail is sent out, android automatically returns to the Drulo app.

Analogous with the e-mail process, a measurement can also be saved on the tablet in Excel or as a PDF file by tapping on the "`Export to SD card`" menu item and by marking the preferred file format in the dialog appearing. Pressing "`Apply`" after format selection opens a "Save" dialog where the data storage location can be chosen. The dialog displays a list where every line constitutes a folder. Tapping on a line selects the corresponding folder, and the list with the contents of the folder is updated. If there are no more folders available in a selected folder, only one line will be displayed containing two dots. Tapping on this particular line takes the operator back to the previous folder. If the "`Select directory`" button at the lower end of the dialog is pressed, the app will save the files in the folders selected previously.

2.2 Import / Export

Tapping on this field opens an import/export dialog. The current version of the Drulo app 6/1.0.6.99 allows only data export to the Watercloud. The "`E-mail`" button is not yet linked to any function in this dialog. As soon as "`Export`" is pressed, the mask as shown in Illustration 2-5 opens up. If you wish to return to the start screen, please press "`<-Back`". Another button, a symbol similar to a triangle, is positioned at the right end of the headline. This function allows to send the selected data to the Watercloud. As described in Chapter 2.3.4, the Drulo app needs to be connected with the Watercloud and an internet connection must have been established to allow data transfer.

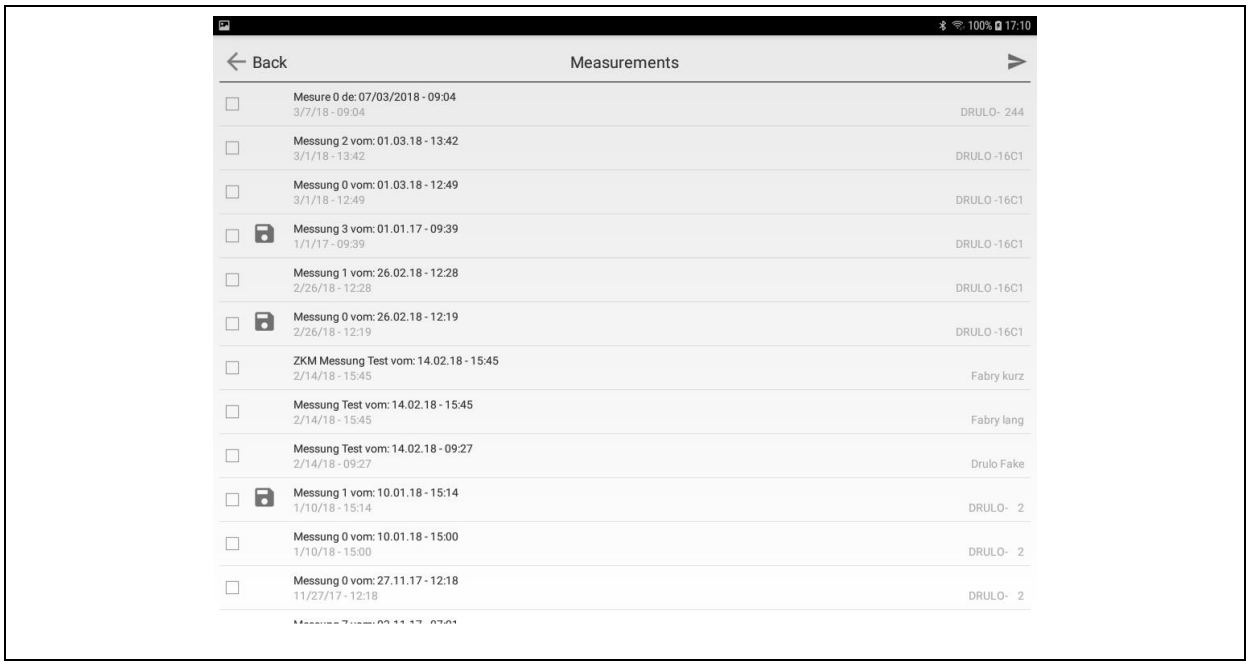

Illustration 2-5: Export selection

The measurements to be sent to the server need to be marked in the selection list before data transfer is started. A particular measurement is marked by tapping on the corresponding line. Each line constitutes a measurement and can be marked through tapping. Tapping on the line again will deactivate the particular measurement again, i.e. this measurement will not be sent to the server. Similar to the process as described in Chapter 2.1, the displayed section of the list can be changed by swiping with the finger up or down the list. Once the requested measurements have been selected, sending the data to the Watercloud can be started by pressing the sending symbol, which is positioned to the right in the headline.

When the measurements have been saved in the Watercloud, each successful saving process is indicated with a diskette symbol by the system. The diskette symbol is always positioned after the selection box. If the symbol does not appear, the data saving process has failed and the data could not be saved.

2.3 Settings

This field opens the "`Settings`" mask, which allows to change the settings of the program or of a pressure logger. The settings related to the program can be changed through the "`Program settings`" button and are described in detail in Chapter 2.3.1. The settings related to communication with the Watercloud ("`Watercloud settings`") are described in Chapter 2.3.4. The parameters of the pressure logger can be changed through the "`Drulo settings`" button (see Chapter 2.3.2). The "`Firmware Update`" field provides functions to update the software installed on the devices, the so-called firmware. For further information on these functions, please refer to Chapter 2.3.3. If you wish to return to the start screen (see Illustration 2-1), please press "`<-Back`".

2.3.1 Program settings

The settings of the Drulo app can be changed in this part of the program. Please note that the settings of the pressure loggers cannot be changed here.

 Program

If the "`Program`" field has been selected, a dialog opens up, which can be closed again by tapping on "`Close`". This dialog displays the program version currently installed on your system as well as the contact data of F.A.S.T. GmbH.

 Delete data

All data saved in the Drulo app can be deleted through the "`Delete data`" field. However, before the data is finally deleted from the database, another dialog is displayed where the operator needs to confirm the decision to delete the data. Pressing "`Yes`" in this confirmation dialog makes the system delete the data irretrievably, whereas pressing "`No`" will stop the process, and the data will remain saved on the Drulo app.

2.3.2 Drulo settings

Tapping on the "`Drulo settings`" field opens a mask where the settings of the pressure logger can be changed. This particularly applies to the language, the time, and the date. Please note that the device needs to be read out first before the device-related information can be obtained in this function.

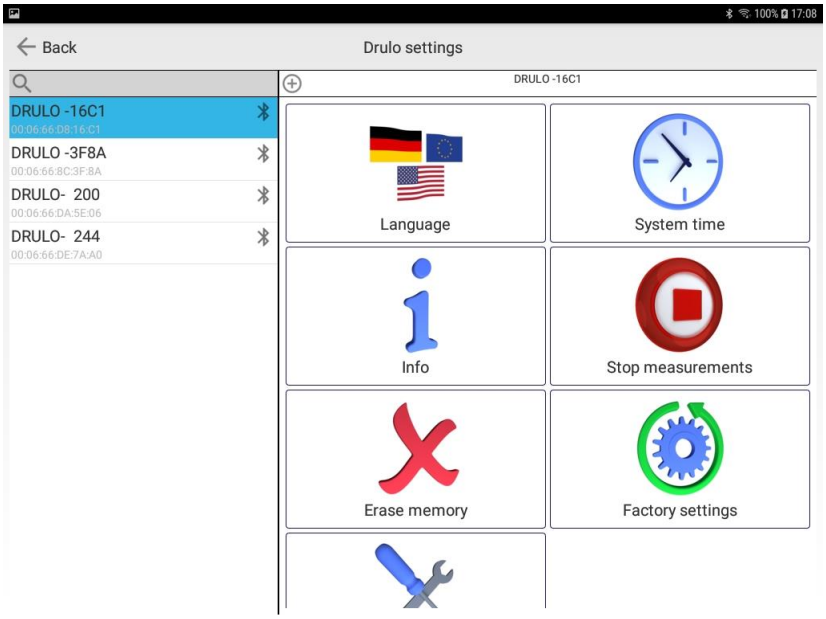

Illustration 2-6: Pressure logger settings

If you wish to receive any information from the pressure logger, the logger needs to be connected with the tablet as described in Chapter 1.5. Once the logger and the tablet are interconnected, all information available in this mask are up-to-date and can be displayed or changed, as requested. The operator can leave the current input mask by pressing "`<-Back`".

Language

The language used for the pressure logger display can be adapted through this function. Tapping on the field opens a dialog where the requested language can be selected. The language selection list is opened by tapping on the particular language, and pressing "Apply" makes the pressure logger system accept the selected language. Tapping on "Cancel", however, will close the dialog and the language will not be changed.

System time

The system time and the date lodged on a pressure logger can be changed by tapping on this "clock" symbol. A dialog indicates both the time and the date and allows individual settings. Tapping on "Apply" in this dialog saves the changes made on the pressure logger, and pressing "Cancel" will discontinue this setting-changing process.

Info

This field is to provide information on the battery status, on the software version applied, on the hardware version applied, and on the date of the next pressure logger calibration process.

Stop measurement

If the pressure logger has been programmed to run measurements as described in Chapter 2.4, the device will wait until the measurements are being conducted. Tapping on "Stop measurement" interrupts the waiting process for the next measurements, and a dialog opens up where the operator can choose if he/she wants to discontinue the waiting process for the current measurement ("current" button) or if he/she wants to discontinue all measurements ("all" button). Tapping on "Apply" then will stop the waiting process of the pressure logger accordingly.

Erase memory

The memory of the pressure logger is capable of saving up to 40 measurements. As soon as this storage capacity limit has been reached, the oldest measurement will be replaced with the latest measurement. Nevertheless, the above button can be used to delete the saved data on the

pressure logger memory. Please note that all saved measurements will be deleted on the pressure logger and that the memory will be completely empty once this function is applied.

Factory settings

If the operator is not sure which setting is best to use or if unreasonable settings have been selected, the pressure logger can be reset through the "`Factory settings`" field to the state when it was delivered. All and any changes made on the settings will then be reset to factory settings.

2.3.3 Firmware update

PLEASE NOTE: THE PRESSURE LOGGER NEEDS TO BE FULLY CHARGED WHEN A FIRMWARE UPDATE IS RUN.

The mask to run a firmware update is reached through the "`Firmware Update`" field. Tapping on this button open up the dialog shown in Illustration 2-7 (left part). All firmware updates are lodged on a server of our company. Therefore, it is improtant that the tablet is connected to the internet before the firmware update is started and that the internet connection is maintained until downloading the update(s) is completed. The Drulo app starts an enquiry directed to our server by tapping on "`Search`" concerning new firmware updates for the pressure loggers. If there are new updates available, these updates will be listed on the table as can be seen in Illustration 2-7 (left part). If there is no update available, the enquiry does not provide any results and the table will remain empty. If you wish to leave the current screen and to return to the start screen (see Illustration 2-1), please press "`<-Back`".

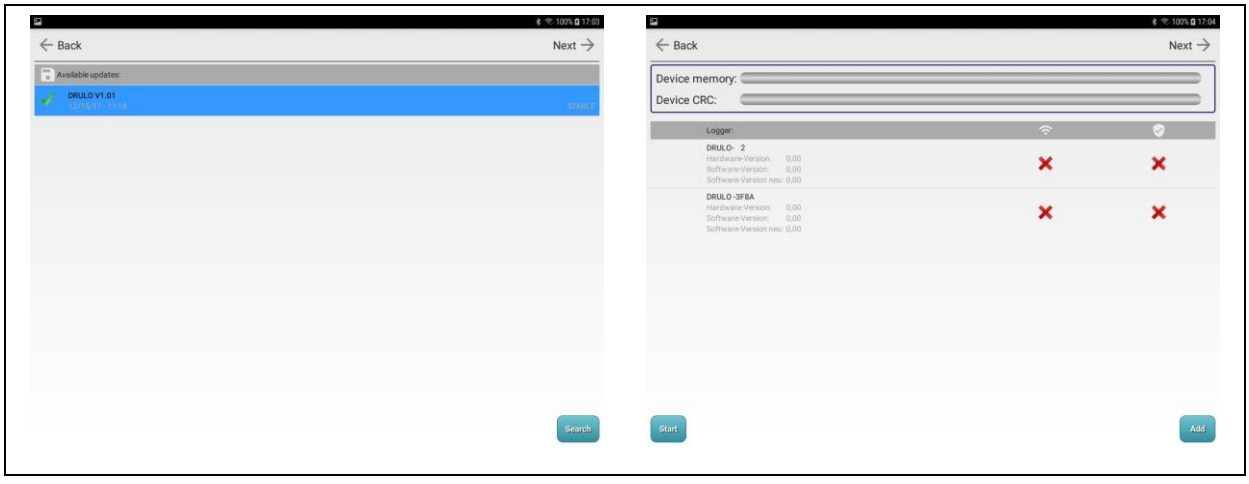

Illustration 2-7: Firmware update 1 / 2 mask

If an update is available, the updates is indicated on the list and should be ticked green at the beginning of the particular update line. If, however, a gear is displayed, the system is currently downloading the update. In some case, the download process may take a little while subject to the quality of the internet connection available. Lines marked with a red "X" cannot be used as downloading the corresponding update in full has failed.

Flawed updates can be deleted from the list by tapping on the corresponding line for a short while. A context menu will appear where the particular update can be deleted by tapping on "Delete". After the flawed update has been deleted, it can be tried to download this update again by pressing "Search".

When downloading the update(s) has been completed, a firmware update can be selected by tapping on a line on the list. As soon as an update has been selected, the corresponding line turns blue, as shown in Illustration 2-7 (left side). Tapping on an update makes the program automatically change to the next mask shown in Illustration 2-7 (right side). This mask is used to initiate the actual update process by pressing "Start". The upper part of the mask hosts two progress bars, which indicate the present state of the update process.

Tapping on "Add" will start the search for pressure loggers located in the vicinity. If a pressure logger is found, the logger will be added to the list beneath the progress bars. Please note that only pressure loggers with an activated Bluetooth connection (see Chapter 1.4.3) and which have already been connected with the tablet previously will be added to the list. The system will then try to run a firmware update on all pressure loggers indicated on the list.

As the first step, program-related data is transferred to the pressure logger, and update progress is indicated after the term "Device memory:". When the bar is entirely filled blue, this initial step has been completred successfully. As the second step, the program-related data lodged on the pressure logger memory is checked. Here as well the bar after the term "Device CRC:" needs to be displayed in blue when the check is completed. With two blue bars, the update process can be started by tapping on "Yes" in the displayed dialog. The pressure logger will now reboot. The reboot process may take a few minutes.

Illustration 2-8: Firmware update 2 / 3 mask

When the firmware update is completed, the mask as shown in Illustration 2-8 (left part) appears. Each updated pressure logger should now have two green ticks. The first tick indicates that communciation with the particular device was successful, and the second tick indicates that the firmwar update has been uploaded. If the list shows any device without two green ticks, this means that a requested firmware update could not be conducted on the particular device. Tapping on "`Start`" will start the update process for this particular device on the list again.

The update progress is not only displayed graphically with the progress bars but also as a text file (log file) and can be read in the "`Event viewer`". The file can also be forwarded to other computers through the "`E-mail`" button. If the firmware update is flawed, the particular error can be identified with the log file. Pressing "`Next ->`" guides the operator to the "`Event viewer`", as shown on the right side of Illustration 2-8. The mask for firmware updates can be closed by pressing "`Close`" (see Illustration 2-8, right part).

2.3.4 Watercloud settings

One option to process the received measurement data is to transfer the data to the Watercloud, which is a web server-based data processing system allowing storing, analyzing, and archiving of the collected measurement data at a central place for years.

Transferring the data to your user account (see Chapter 1.6) of the Watercloud server requires access to the Watercloud and also an effective connection between your user account and the tablet. If you use several tablets, all tablets also need to be connected with the Watercloud server. The number of devices which can be connected with the server is not limited. If you

have no user access yet, we can activate such access for you. Please note that if you also use our Waternet and AZA-OAD programs, each program will require separate connecting.

Connecting

Please log on to the Watercloud system with your user name and your password to connect your tablet with the Watercloud user account (see Chapter 1.6). As soon as your log-in has been successful, the menu as shown in Illustration 2-9 (left part) will be displayed.

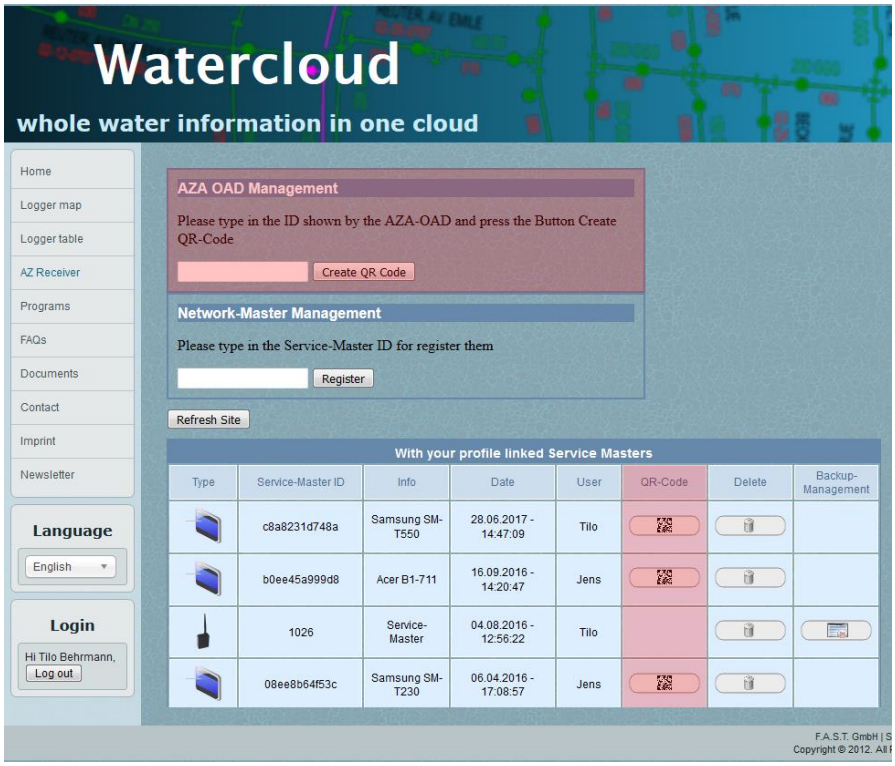

Illustration 2-9: Watercloud

Please click on the ”AZ Receiver“ menu item in the menu to open the page as shown in Illustration 2-9 and enter the “Device ID“ of your tablet left of the “Create QR Code“ button.

You will obtain the “Device ID“ of your tablet by tapping on the ”Connect“ menu item (in the Drulo app) and by opening the dialog shown in Illustration 2-10. The combination of letters and figures stated in red in this dialog indicates the device ID of your tablet. Please enter this device ID into the input box on the Watercloud page and then press ”Create QR Code“. The server will create a so-called QR code, which contains the connection-related information for your tablet.

If your tablet has already been registered on the Watercloud, the "Device ID" does not need to be entered again. Just pick the "Device ID" of your tablet from the table as shown in Illustration 2-9 and click on the corresponding icon in the "QR-Code" column. In either case, a QR code will be displayed in the Watercloud once the corresponding button has been tapped on.

Illustration 2-10: Watercloud nexus dialog

Either position your tablet in front of the monitor so that the camera of the tablet can acquire the QR code or print out the QR code and hold the pinted-out QR code in front of the tablet camera. Please make sure that your tablet is reliably connected with the internet before you acquire the QR code with the tablet camera. The internet connection is necessary to validate the information acquired with the QR code and to confirm the log-in of the device to the Watercloud server.

As soon as the QR code has been identified by the Drulo app, the tablet will issue a short beep, and the data received (such as "User ID" and "Host name") will be displayed in the dialog when the "Details" button located in the upper right corner has been tapped on. Your tablet is now connected with the user account on the Watercloud server. If you tap on "Refresh site" on the Watercloud page, the connected tablet will be listed on the device list of the Watercloud page unless it was already registered previously.

2.4 Programming a measurement

Either five time-controlled measurements (abbreviated with TCM) or one event-controlled measurement (abbreviated with ECM) can be programmed. Please note that combining the two types of measurement (TCM and ECM) is not feasible as both types differ significantly in terms of manner of execution. A time-controlled measurement has a start and an end defined by the interval time and by the number of measurement values to be acquired. The number of measurement values to be acquired can range between 1 and 1,700,000 with this kind of

measurement. With an event-controlled measurement, only the start and the end of the pressure monitoring process can be determined. The actual measurement process is started when the upper pressure pressure limit is exceeded or the lower pressure limit is undercut. If the determined limits are excceeded and undercut respectively, the pressure logger will acquire 5,500 measurement values and will save the data in a measurement.

If the "`Program measurement`" field on the start screen has been tapped on, the mask as shown in Illustration 2-11 will appear. The current input mask can be closed again by tapping on "`<-Back`". The right part of the mask hosts some buttons used to program the pressure loggers and also a list with a blue border. This list shows the measurements which are currently programmed on a pressure logger. One line constitutes one measurement.

Tapping on a line for a approximately 2 seconds, a context menu can be opened in this line. The context menu offers the "`Delete`" and "`Delete all`" menu items, which allow to delete either the input selected currently or all inputs on the list. If a measurement is deleted from the list, the same measurement will also be deleted automatically on the pressure logger.

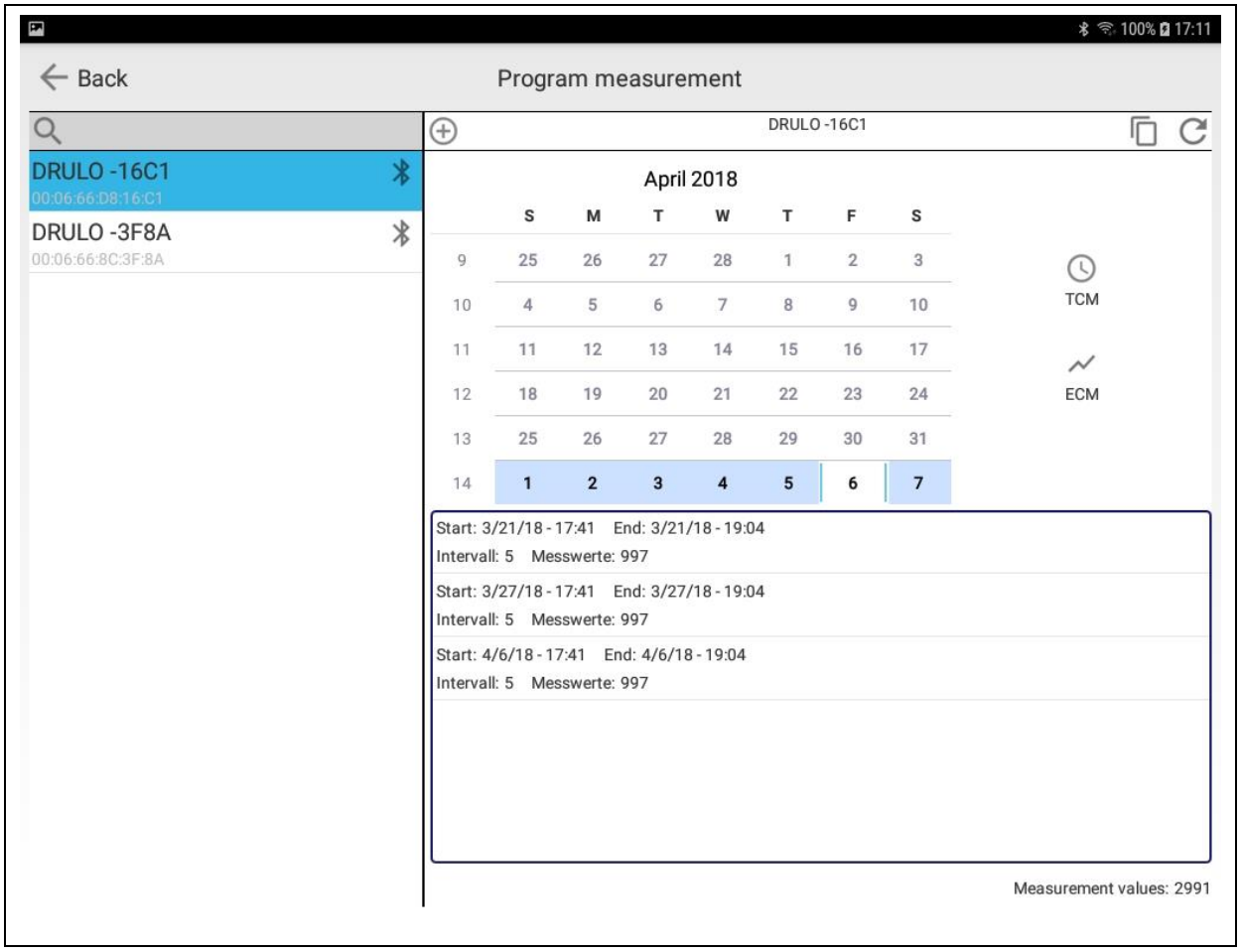

Illustration 2-11: Programming a measurement

As already described in Chapter 1.5, the pressure logger has to be connected with the tablet before the logger can be programmed. As soon as the connection between the two devices has been established, the corresponding measurement can be programmed through the "TCM" (see Chapter 2.4.1) button and the "ECM" (see Chapter 2.4.2) button respectively. The upper part of the right section hosts another two buttons, the functions of which are available only if there is an active connection with the particular pressure logger.

Updating

If the operator is not sure whether the measurements indicated on the list comply with the settings of the pressure logger, the pressure logger can be read out again by tapping on this button. The measurements indicated on the list will then be deleted and the pressure logger is read out again.

Copying a measurement

It may be necessary in some cases to program several pressure loggers instead of just one pressure logger. This button allows to copy the measurements currently indicated on the list onto other pressure loggers. This process copies all available parameters onto the other devices. For further information on this process, please refer to Chapter 2.4.3.

2.4.1 Time-controlled measurement (TCM)

As soon as "TCM" has been tapped on, the dialog to program a time-controlled measurement appears. This dialog is shown in Illustration 2-12. The date, the time, and the interval time can be set by tapping on the corresponding symbol right of the particular input box. When the corresponding symbol has been tapped on, a dialog is displayed where the requested settings (date, time, or interval time) can be entered. Tapping on "OK" then makes the system accept the entered setting and display the setting in the input box. The value shown in the "Interval time" field indicates the time period between two measurement values. So the higher the time value set, the fewer measurement values will be available for a certain measurement period. As already stated previously, a time-controlled measurement allows to acquire both the pressure and the temperature. If this is requested, the corresponding function can be activated by ticking "record".

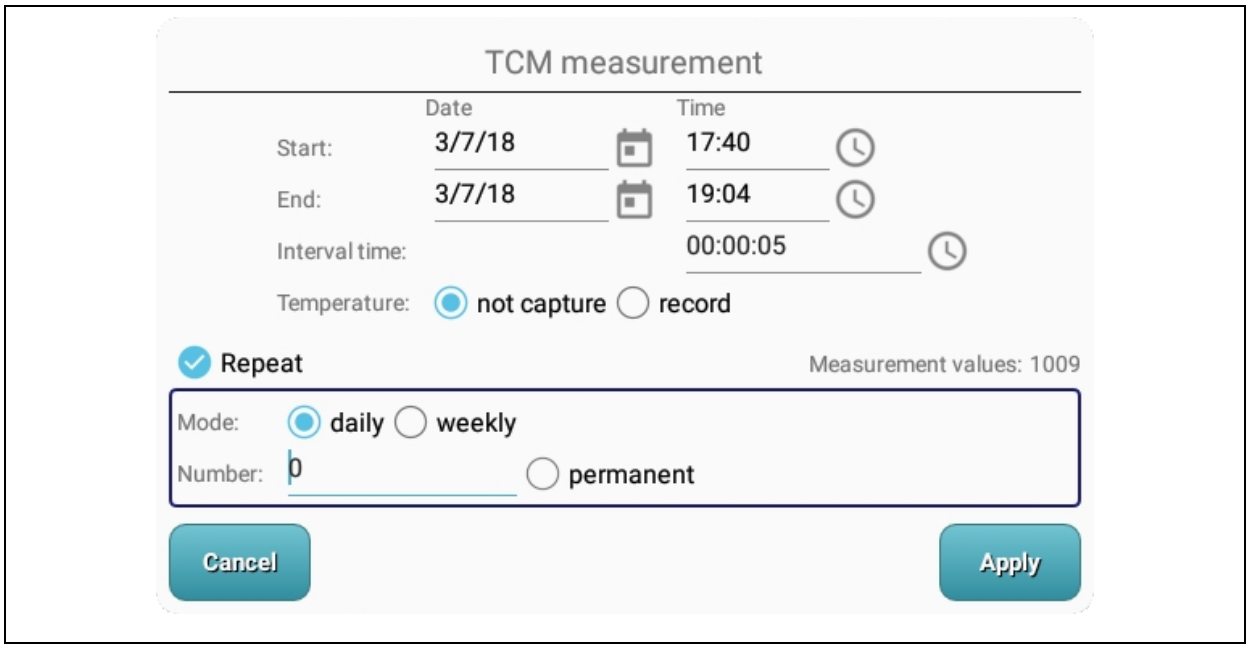

Illustration 2-12: TCM

The "Repeat" field with the blue norder is faded out as a standard and can be faded in and then out again by tapping on "Repeat". Please note that the settings in this section have an impact on all measurements programmed on the pressure logger. These settings are applied to repeat a certain measurement in the future.

Selecting "daily" determines that a measurement is repeated every day at the same, set time. The "Number" box is used to set the number of days when the measurement is to be repeated. So if, for example, a "0" is entered into the "Number" box, the measurement is conducted only once, which is on the day defined for the first and only measurement run. If, however, the number of measurement repetitions has been set to four, the measurement is conducted five times in total (one original measurement + 4 repetitions). The same applies to the setting for any weekly repetition(s). Here the measurement is repeated every week, not every day. If a permanent repetition of the measurements is requested, "permanent" needs to be tapped on. In this case, no value needs to be entered into the "Number" input box. Even if a value has been entered into the "Number" box, it will not be considered.

Please note: If a certain measurement has been programmed and the number of repetitions has been set as desired, no other measurement process can be set for the time when this measurement is being run or repeated. So it is not possible to conduct two measurements at the same time.

The measurement parameters are accepted by pressing "Accept". The dialog closes, and the measurement is saved on the pressure logger immediately. The measurement should now also be stated on the measurement list of the pressure logger, as shown in Illustration 2-11. The dialog can be closed without saving any measurement on the pressure logger by tapping on "Cancel".

2.4.2 Event-controlled measurement (ECM)

If an event-controlled measurement is to be conducted, please tap on "ECM" to open the dialog shown in Illustration 2-13. The start and the end of a pressure monitoring process can be set in the upper part of the dialog. Please note that only the start of the pressure monitoring process can be set but not the start of the measurement process (recording the pressure) itself. The start of the measurement process for an ECM is determined by the set minimum and maximum pressure limits ("Min. Pressure" and "Max. Pressure"). So the pressure logger starts recording the pressure when either the set minimum pressure limit is undercut or when the set maximum pressure limit is exceeded, and a measurement is started then.

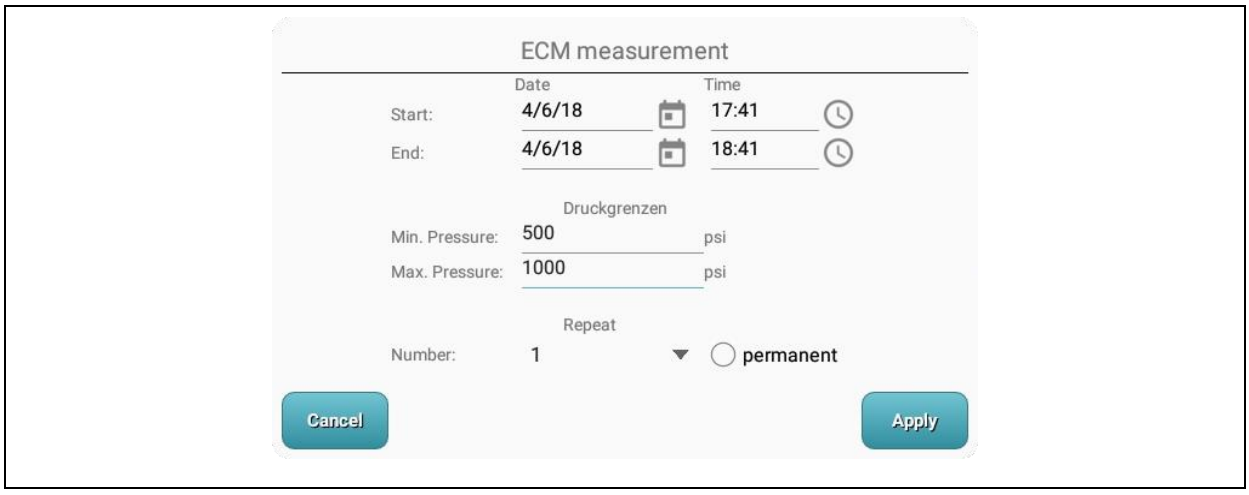

Illustration 2-13: ECM

The date and the time for the measurement time window is set by tapping on the corresponding symbol after the particular input box. As soon as the symbol has been tapped on, a dialog opens up where the date and the time can be set as desired. The dialog can be closed again by tapping on "OK", and the selected settings will be transferred to the input box.

The pressure limits for the monitoring process are set by tapping on the corresponding input box. A keyboard is displayed where the pressure limits can be entered. PLease note that the set unit for the pressure is "mbar" so that, for example, "1,500(mbar)" has to be entered instead of "1.5(bar)".

As already stated above, the "Repeat" box indicates the number of repeated measurements to be saved in the case of pressure limit violations. The number entered into the "Number" box thus indicates the number of pressure limit violations during pressure monitoring between the set start and the set end of the fixed time window. If the pressure limits are violated repeatedly during one and the same pressure monitoring procedure (measurement), the system will not start another measurement but finish the current measurement as set. If however, the pressure limits are violated when a pressure monitoring procedure is finished and the 5,500 measurement values obtained from this measurement have been saved, the system will start another monitoring process in case of a new pressure limit violation. As the pressure logger can manage a maximum of 40 measurements, the device overwrites the oldest measurement if event-controlled measurements are to be saved permanently. Permanent recording of pressure fluctuations during monitoring is activated by tapping on "permanent". With this parameter set, the pressure logger runs measurements permanently as soon as the pressure limits are violated.

2.4.3 Copying a measurement

As already stated at the beginning of this chapter, measurements programmed on a pressure logger can be copied on the precondition that the pressure logger is connected with the tablet and that the measurements in question have been programmed. Tapping on "Copy measurement" (see page 28) opens the dialog shown in Illustration 2-14. The central component of this dialog is a list of pressure logger devices once a search for pressure located loggers in the vicinity of the tablet has been started by tapping on "Search". Please keep in mind that a pressure logger needs to be switched on during the search process (see Chapter 1.4.3). Also, the pressure logger must have been connected with the tablet previously, as described in Chapter 1.5. If these conditions are fulfilled, the pressure loggers positioned in the vicinity of the tablet will be displayed on the pressure logger list of the dialog.

If a pressure logger is indicated on the device list, the copying process can be started by tapping on "Copy". The measurement parameters of the pressure logger connected in the "Program measurement" input mask last (see Illustration 2-11) will be applied. The data copying process can be stopped and the dialog will be closed by pressing "Cancel".

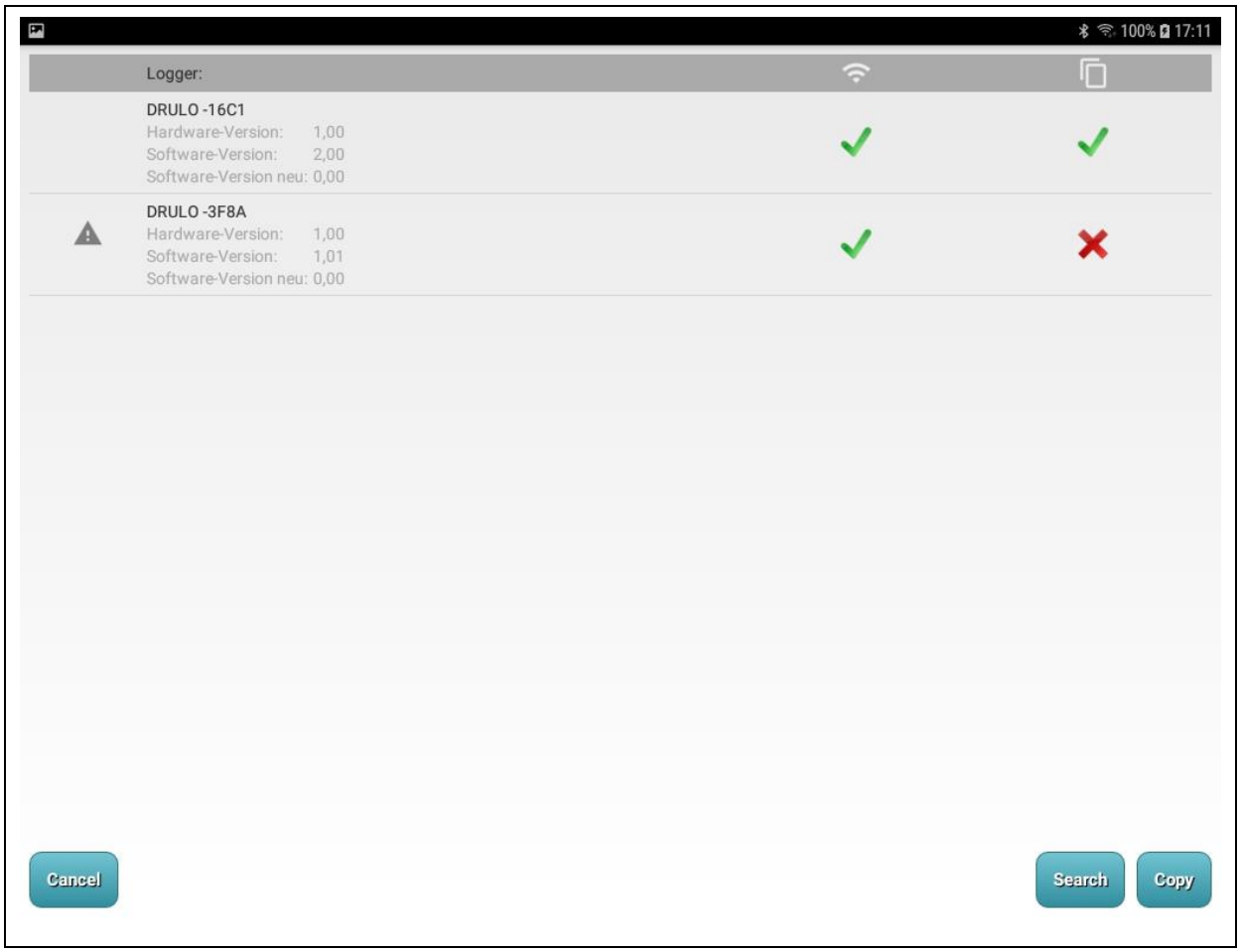

Illustration 2-14: Copying a measurement

Each pressure logger should have two green ticks when the copying process is completed. The first tick indicates that the device was subject to successful communication, the second tick indicates that the data was copied successfully. A pressure logger stated on the list without those two green ticks indicates that copying the measurement parameters could not be executed. However, tapping on "`Copy`" will re-start the copying process for such a pressure logger.

If an error has occurred during the data copying process, the occurence of an error is visualized with a symbol that looks like a triangle with an exclamation mark inside. This symbol is positioned at the beginning of the corresponding line on the device list. Tapping on the particular line for about two seconds opens a context menu on the list. This menu hosts the "`Delete`" and "`Details`" menu items. Tapping on "`Delete`" will delete a pressure logger from the device list, and tapping on "`Details`" will make the system provide extended information on an error.

2.5 Reading out a measurement

Tapping on this field opens the input mask shown in Illustration 2-15. At first, the right section of this mask is empty. As soon as the tablet has been connected with a pressure logger (see Chapter 1.5), the pressure logger is read out automatically, and an overview of the measurements saved on the pressure logger is displayed in this right section. Every line of this overview list constitutes one measurement saved on the pressure logger. If there is no measurement saved on the pressure logger, this section will remain empty even after the pressure logger has been read out.

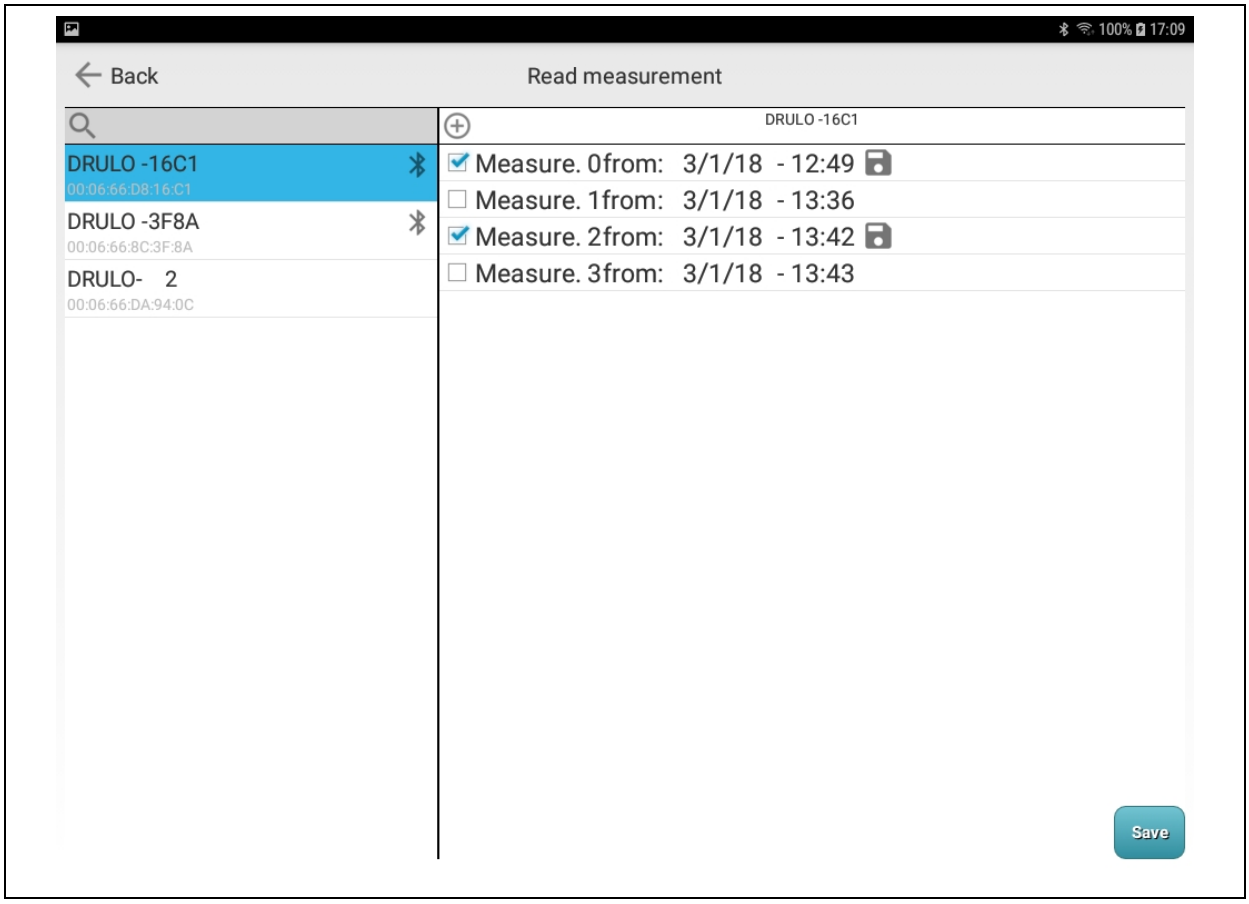

Illustration 2-15: Reading out a measurement

A measurement can be marked for subsequent data read-out and data saving on the tablet by tapping on the corresponding line. If a measurement has been chosen for subsequent data saving purposes, a tick will be displayed at the beginning of the particualr line. Tapping on the marked line again makes the tick disappear, and the measurement will not be read out from the pressure logger. Consequently, the measurement data then will not be saved on the tablet. At least one measurement needs to be selected to start the saving process by tapping on "Save".

When the saving process of the selected measurements is completed, a diskette symbol will appear after each measurement saved on the tablet at the end of the line. If a measurement is not complemented with a diskette symbol, the measurement may not have been selected for the saving process or an error may have occurred during the data saving process. In the first case, the process can be repeated by tapping on "`Save`" again.

The operator can close the current screen and can return to the start screen (see Illustration 2-1) by tapping on "`<-Back`". The measurements just saved can be displayed and evaluated on the start screen by tapping on the "`Measurements`" field (see Chapter 2.1).

2.6 Monitoring a measurement

Monitoring a current measurement at the pressure logger is possible by pressing "`Observe measurement`" on the start screen to open the mask shown in Illustration 2-16. Pressing "`<-Back`" will disconnect the connection with the pressure logger and close the mask.

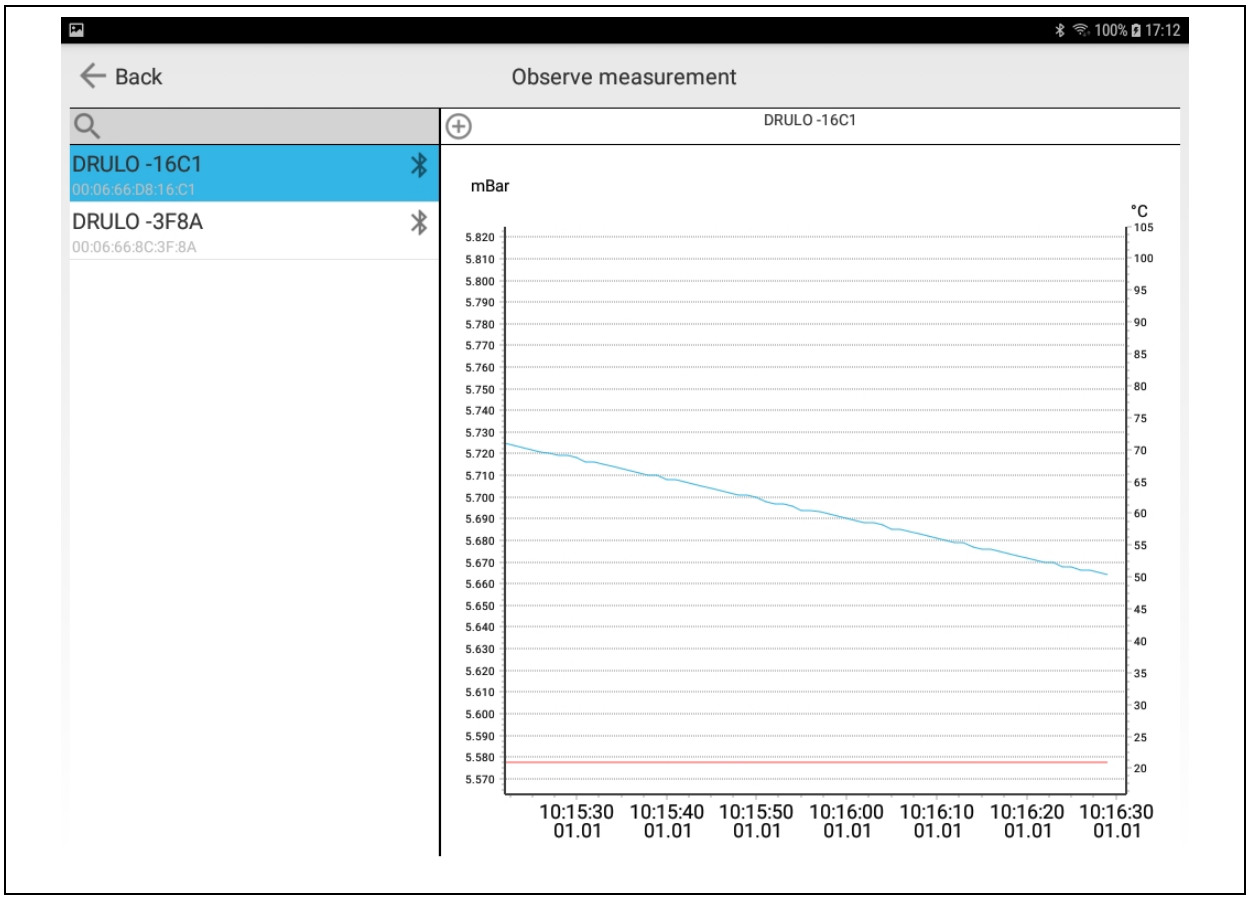

Illustration 2-16: Monitoring a measurement

The current version of the Drulo app and of the pressure logger allows only monitoring time-controlled measurements. If you wish to observe such a time-controlled measurement, please

make sure that the pressure logger is currently running a measurement process as only then the measurement values will be displayed in the diagram. If you wish to start a monitoring process, tap on a line to connect the pressure with the tablet. Chapter 1.5 is to provide more detailed information on this connecting process. As soon as a connection has been established between the device and the tablet, the Drulo app automatically starts to record the pressure measurement values acquired from the pressure logger. Please note that new measurement values will be added to the diagram subject to the set measurement interval and thus a new measurement of the pressure logger. So if the interval is set to 10 minutes, a new measurement value will appear in the diagram only after 10 minutes.

Monitoring a measurement can be discontinued by tapping on "<-Back" or by disconnecting the connection between the pressure logger and the tablet, i.e. by tapping again on the blue line on the device list located in the left part of the input mask.