PROCEQ RQ8000

Roll Hardness Profiler
Software Components and Settings

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Screening Eagle Technologies AG
Ringstrasse 2 | CH-8603 Schwerzenbach, Zurich | Switzerland

T +41 43 355 38 00
ScreeningEagle.com

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0. PROCEQ RQ Overview

Proceq RQ applications consist of multiple executable files (.exe), components or Windows processes. Depending on which components are configured to run the application of the software may be changed. Most used application is the RQ8000 roll hardness tester. Benefits and goals of the PROCEQ RQ software structure are:

- Component startup and shutdown in defined order by Configuration component.
- Component status indication on Main Control component.
- Common user interface for all settings by Settings component.
- Import and export of the settings.
- Different user accounts have their own settings.
- File type association.
- Communication between components is defined.
- Modular and configurable software.
- Better loading of multiple processor cores if available.
- Different applications act in a same way which is easier for the user.

1. PROCEQ RQ Software Components

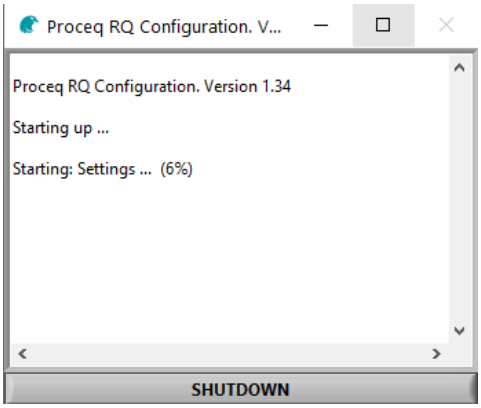
1.1 Configuration

Overview

Configuration component is the first component which will be started after the PROCEQ RQ.exe is run. Configuration will scan the registry "HKEY_CURRENT_USER\Software\PROCEQ RQ\Version 1.0" to find out other installed components. All other components that are defined to be included in the configuration are started in defined order. If some of the components does not respond to the Configuration a time out is generated and message is shown to the user. In case of time out it is preferable to reboot the computer to be sure that none of components is still running in non-responsive state.

When shutdown is activated the Configuration component will shut down every component in reverse order that they were started. If some of the components does not respond to the Configuration all components will be terminated using the Windows TASKKILL command whether they exist or not. This should ensure that there would not be any ghost components running when the Configuration is started again.

User Interface



Configuration components user interface consist of status text window and one button. Status text will show the progress of the startup or shutdown. During startup the "SHUTDOWN" button can be actuated which will abort the startup and start the shutdown. During shutdown the button is disabled. If some of the components does not respond during startup a message is shown to the user. To continue press the "OK" button on the message. Pictures above show a case where the Main Control component does not start and the message is shown.

1.1.2.1 Settings

Settings of the Configuration component may be divided in two categories. First one is the language selection of the component and second ones define the startup behavior of the other components.

1.1.2.2 Language

Type:
Enumeration
Values: English,
Suomi

This setting changes the language of the Configuration component. Note that the different languages may be added after installation so there may be more choices than defined above.

1.1.2.3 PROCEQ RQ Builder

Type:
Enumeration
Values: Include,
Exclude

This setting determines whether the "PROCEQ RQ Builder" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.4 PROCEQ RQ Deceleration View (AC)

Type:
Enumeration
Values: Include,
Exclude

This setting determines whether the "PROCEQ RQ Deceleration View (AC)" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.5 PROCEQ RQ Deceleration View (BC)

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Deceleration View (BC)" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.6 PROCEQ RQ Deceleration View (BC) 2

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Deceleration View (BC) 2" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.7 PROCEQ RQ Deceleration View (ZC)

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Deceleration View (ZC)" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.8 PROCEQ RQ Device Control

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Device Control" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.9 PROCEQ RQ Penetration View

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Penetration View" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.10 PROCEQ RQ Prepare SD Card

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Prepare SD Card" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.11 PROCEQ RQ Velocity Ratio View

Type:
Enumeration
Values: Include,
Exclude

This settings determines whether the "PROCEQ RQ Velocity Ratio View" component is started or not by the Configuration component. If "Include" is selected Configuration will start the component. If "Exclude" Configuration will not start the component.

1.1.2.12 PROCEQ RQ Configuration

Type:
Enumeration
Values: Vital

This settings can not be changed but it indicates that the component is installed and started.

1.1.2.13 PROCEQ RQ Main Control

Type:
Enumeration
Values: Vital

This settings can not be changed but it indicates that the component is installed and started.

1.1.2.14 PROCEQ RQ Settings

Type:
Enumeration
Values: Vital

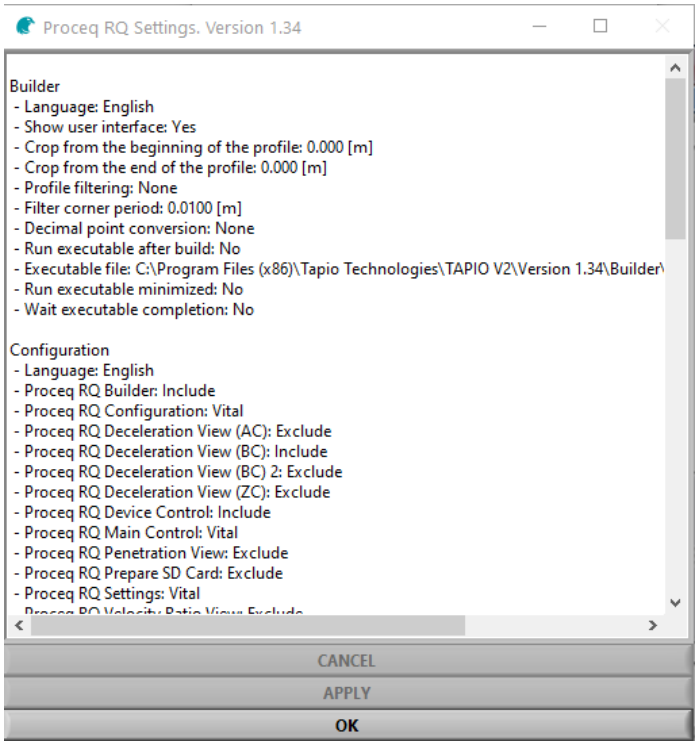
This settings can not be changed but it indicates that the component is installed and started.

1.2 Settings

Overview

Settings is the first component which will be started by the Configuration component. Settings component gives the user an uniform way to adjust all settings available. Other components report their setting to the Settings component during startup. Changes done by user are reported back to the corresponding components. Settings allow similar setting to be changed simultaneously on various components. Settings may be exported to a file or imported from a file for easy setup on multiple PCs.

User Interface

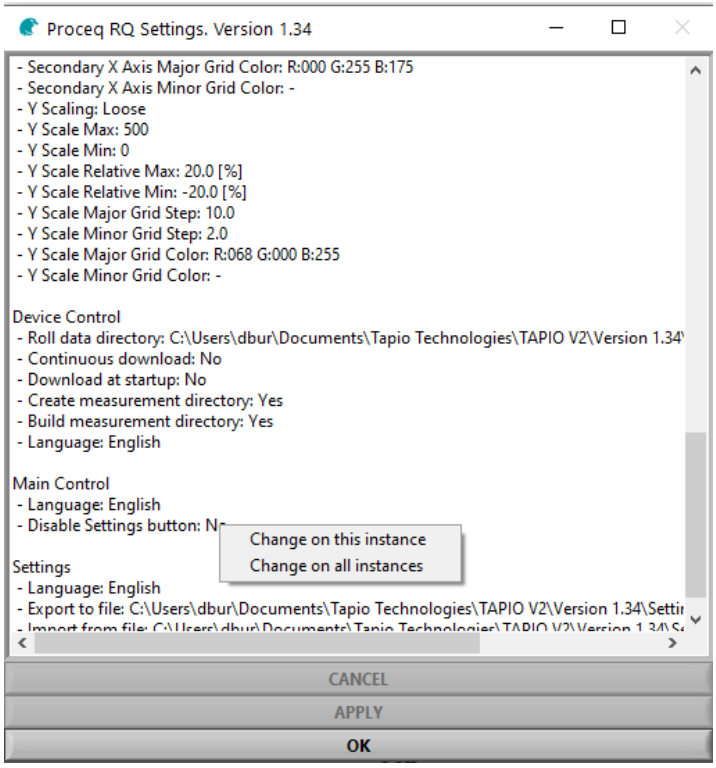


Settings components user interface can be launched from Main Control components user interface by pressing the "SETTINGS" button. All settings from the components are shown as a simple text list where component names are shown as titles and individual settings are listed below the title. "OK" button is for updating the changes to the corresponding components and closing the window. "OK" button is always enabled. If there are no changes nothing will be updated. "CANCEL" and "APPLY" button come enabled after some of the settings are changed. By pressing the "APPLY" button the changes are updated to the corresponding components. Window is left open to make more changes. "CANCEL" button cancels the changes and closes the window. If some of the settings are changed they are marked as an asterisk (*). Asterisk is also shown on the title of the window.

To change a setting user can double click the setting or press the right mouse button to show the context menu. Context menu has two possibilities. First one is to change the setting on the current component only. The second one finds all similar settings on all components and changes them all.

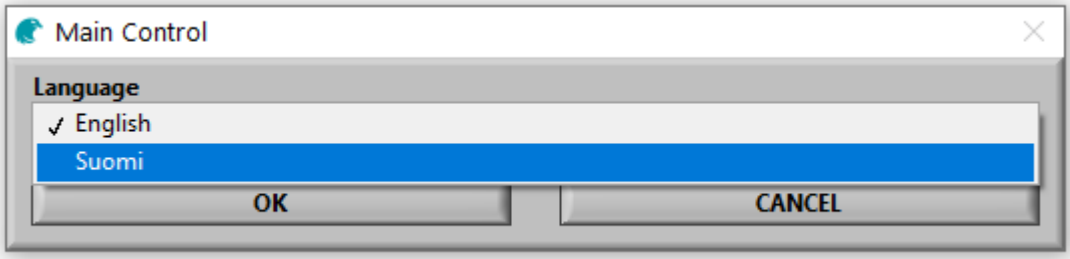
1.2.2.1 Example

Following example shows how to change the language for all included components.

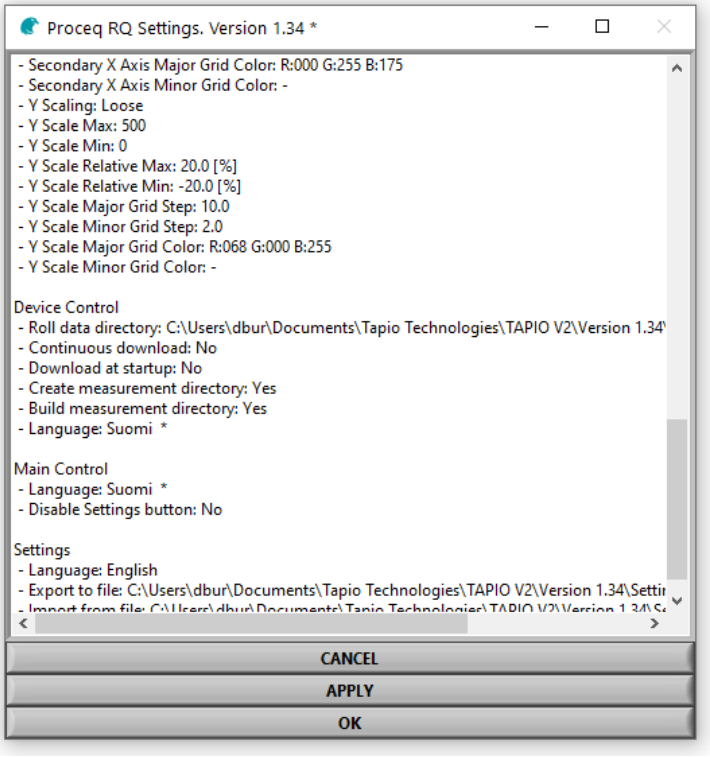


Press the right mouse button down above the language setting to show the context menu. Select the "Change on all instances" from the list and the setting will open.

By pressing the control which is showing the current language a list will appear and the new language can be selected.



Press the "OK" button to accept change and return. By pressing the "CANCEL" button the change can be canceled.

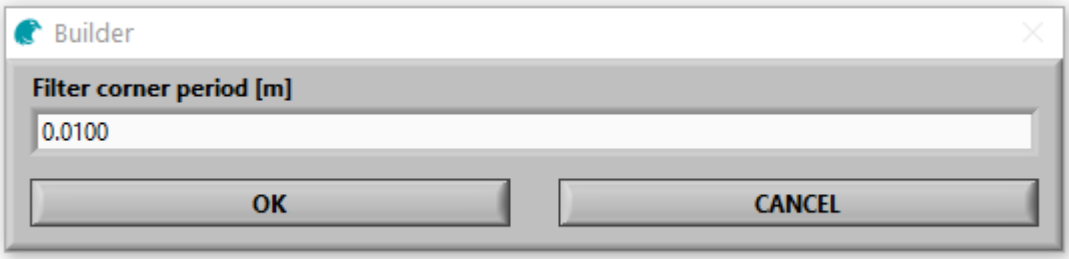


Now all affected settings are marked by an asterisk. Observe that they are changed on all components not only on the Main Control in which the setting was selected.

To apply the changes and close the window press "OK". To cancel the changes press "CANCEL". To leave the window open and apply press "APPLY".

Notice that some setting will become fully updated only after the PROCEQ RQ is first shut down and the restarted. Language is one of such settings.

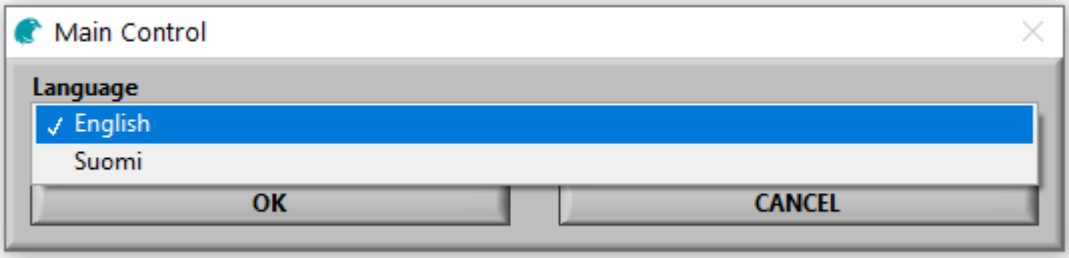
1.2.2.2 Numeric Settings



Numeric settings can be changed by typing a new value to the field. Up and down keys from the keyboard can be also used to change the value by placing the cursor first after the digit you want to change. All numeric settings have minimum, maximum and increment value. These values depend on the setting. Typing a value out of range will be rounded to the nearest value. Period (.) is always used as a decimal separator.

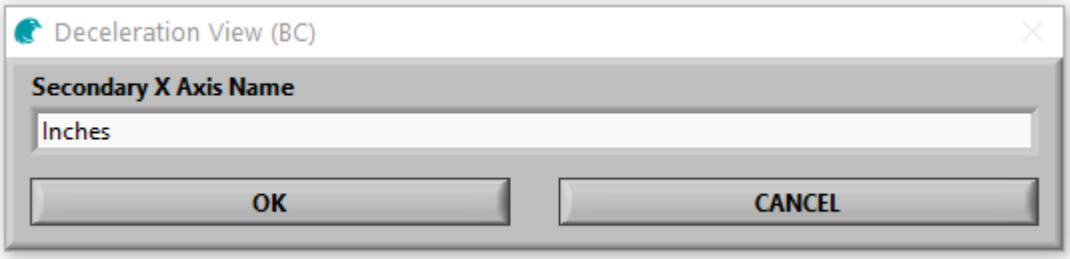
1.2.2.3 Enumerated Settings

Enumerated settings have multiple values which are shown after the left mouse button is pressed above the value.



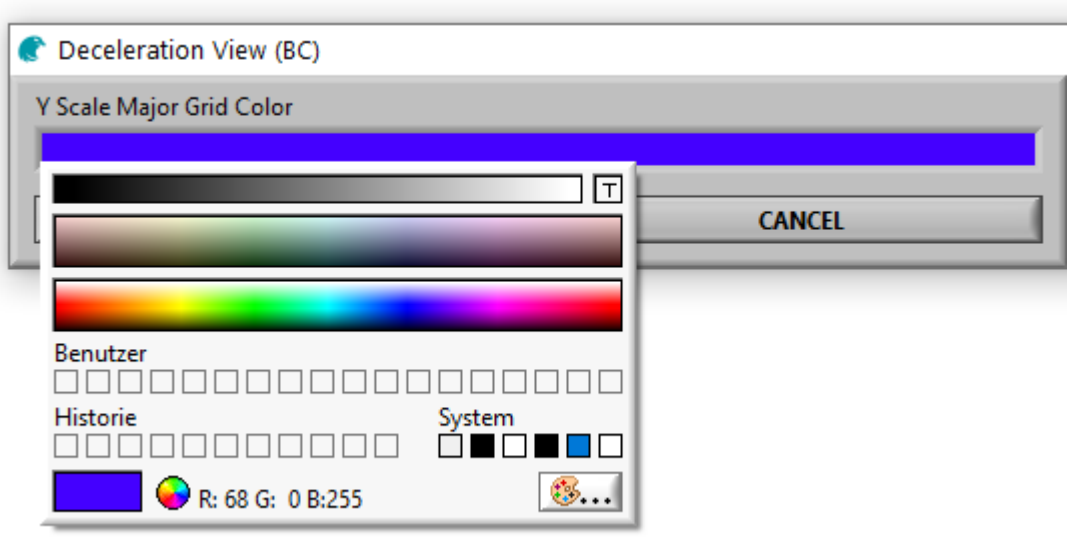
Select the value from the list and press left mouse button again.

1.2.2.4 String Settings

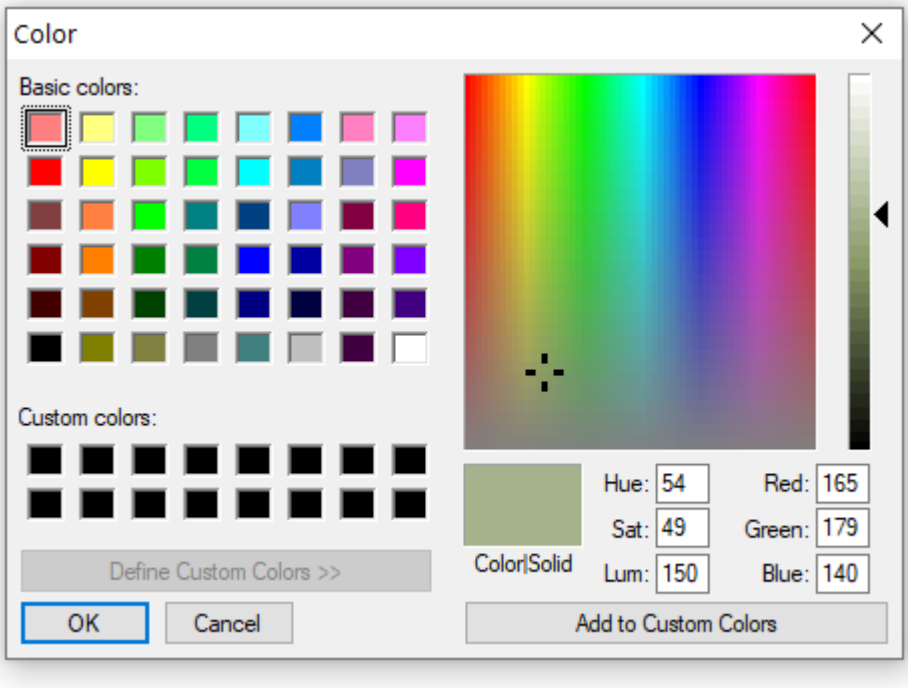


String settings contain text which can be edited by first selecting the value.

1.2.2.5 Color Settings



Color setting will show a color selector after the value is pressed on the left mouse button. A new color can be selected from the selector. "T" color means that the object will be transparent and is not visible.



By pressing the palette button on the right down corner of the color selector a color window will open. In color window the color can be selected more precisely.

1.2.2.6 Path Settings

Path setting contains a path to a folder or to a file depending on component. Value can be edited using keyboard. Path is not checked in any way. So incorrect path may have unpredictable result. Path or the target may not exist. A more traditional way to navigate is to press the folder button on the right side of the value. This will bring on the standard windows file browser from which the file or path can be selected.

Settings

Settings components has three setting from which the first one is the common language setting. Second and the third define a path to a text file which will be used to export and import setting data of selected components. Export or import occurs when the "APPLY" button is pressed after the path has been changed. This is due to nature of the settings update process. So the path must be changed and the change must be applied before the export or import can occur.

1.2.3.1 Language

Type:
Enumeration
Values: English,
Suomi

This settings changes the language of the Settings component. Note that the different languages may be added after installation so there may be more choices than defined above.

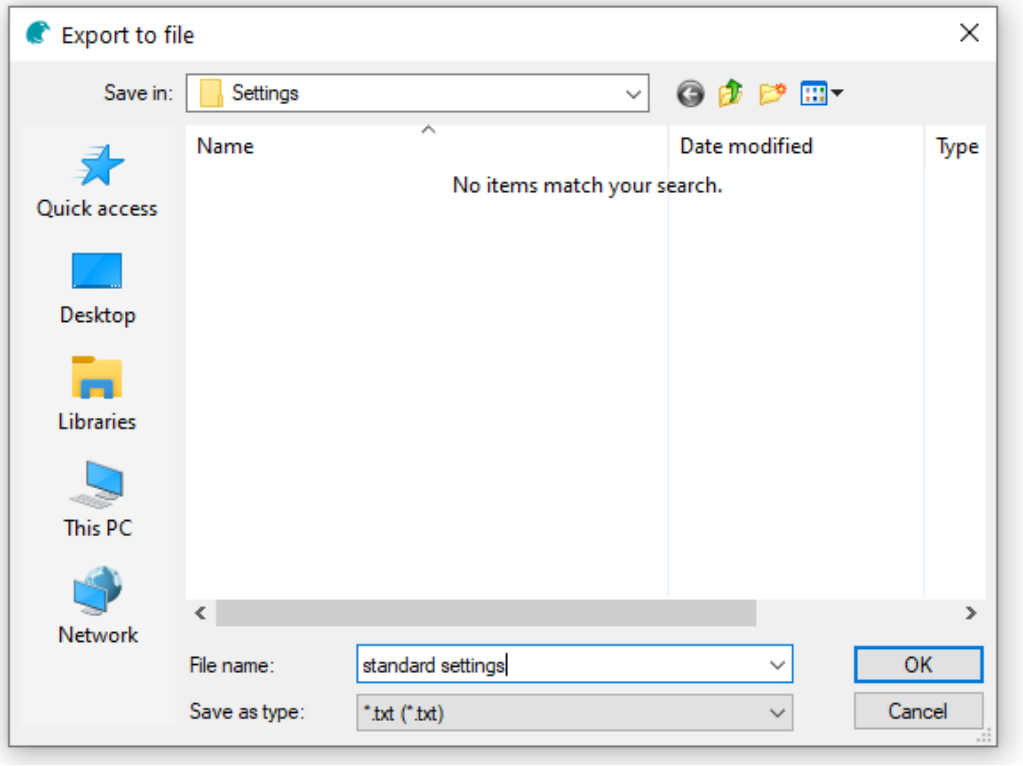
1.2.3.2 Export to File

Type: Path

Value: Path to a text file

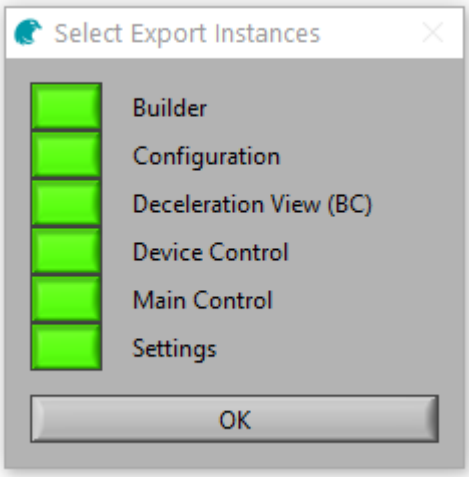
This setting holds the path to a file to which the settings will be exported.

Path to a file must be changed and applied to make the export. File can be selected by pressing the folder button which will open the file browser.

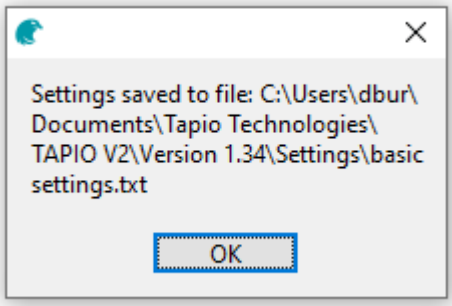


Write the file name to the "File name:" field of the browser and press "OK". After "OK" the setting is marked by an asterisk (*). Note that the file name must be different than before. Otherwise it is not possible to apply the changes. Press "APPLY" to apply changes and a selector is shown.

You are being asked what groups of settings do you wish to export. Choose the option by pressing the right buttons.



The software will confirm the successful export.

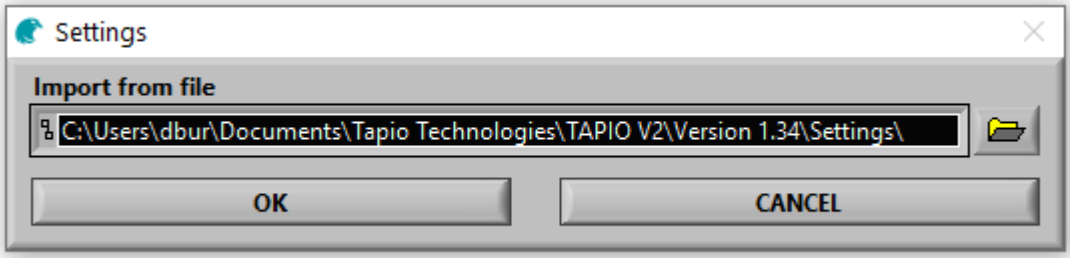


1.2.3.3 Import from File

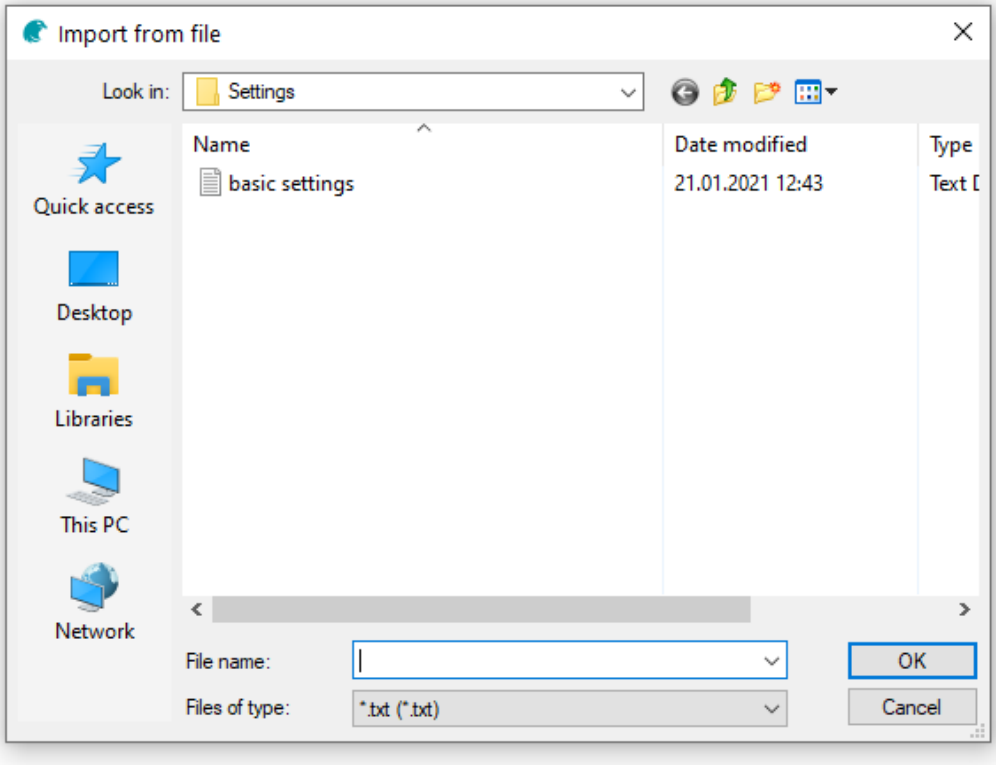
Type: Path

Value: Path to a text file

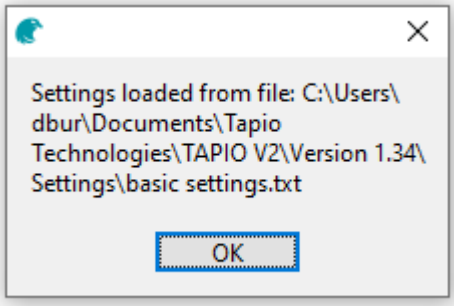
This setting holds the path to a file from which the settings will be imported.



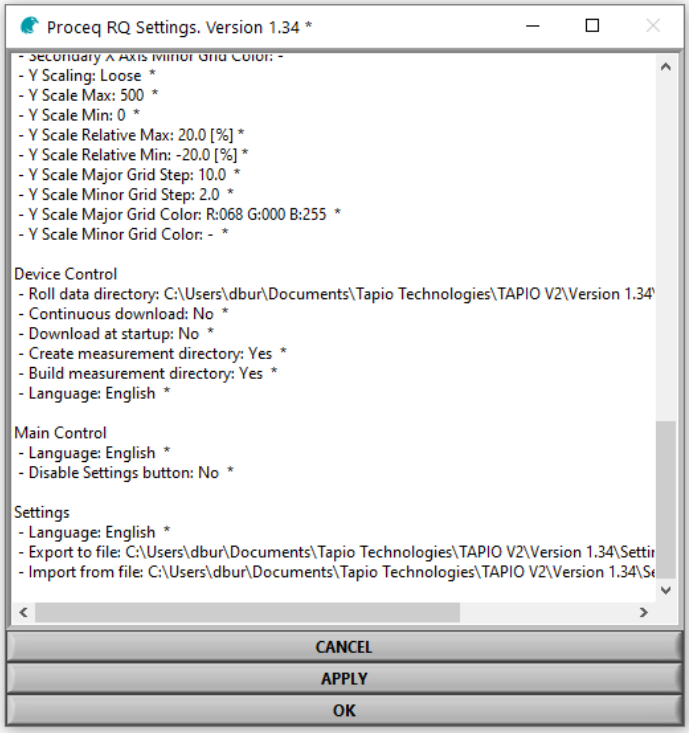
Path to a file must be changed and applied to make the import. File can be selected by pressing the folder button which will open the file browser.



Choose the file from the browser and press "OK". Note that it must be different from the current file so that the changes can be applied. Press the "APPLY" button to apply the changes and a message is shown.



Message show the file which was imported. Press "OK" to continue.



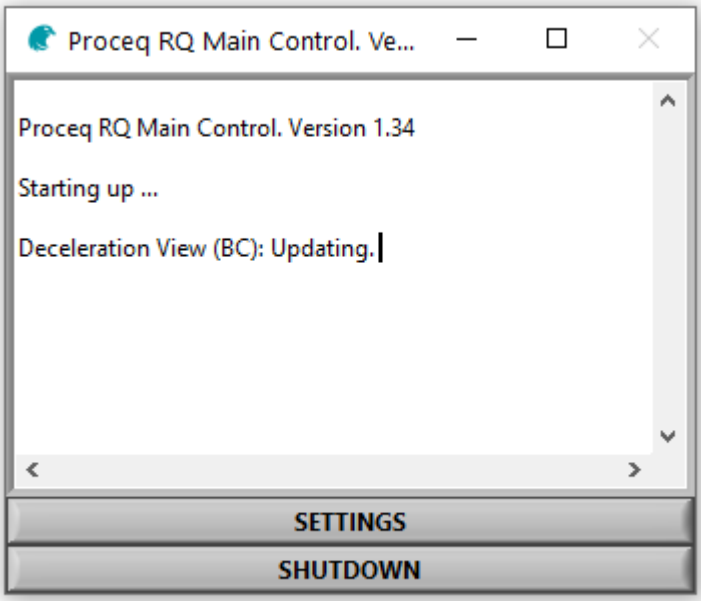
After import all settings that have changed are marked by an asterisk (*). You may choose "CANCEL" to cancel import or "APPLY" to apply all changes.

1.3 Main Control

Overview

Main Control is the second component which will be started by the Configuration component. Main Control provides a uniform means to other components to inform their status to the user. Also shutdown and settings can be applied thru the Main Control.

1.3.1.1 User Interface



Main Control has similar status text window like the Configuration component. Meaning of the status text window is to offer all other components a possibility to inform the user on ongoing activities.

Main Control has also two buttons that serve the whole application. "SHUTDOWN" button starts the shutdown procedure where the Configuration component shuts down all started components in reverse order in which they were started. "SETTINGS" button makes the Main Control inform the Settings component to show its window. This allows user to change settings on all components.

Settings

Main Control component has two settings. First one sets the language of the component. The second one chooses whether the "SETTINGS" button is a enabled or disable.

1.3.2.1 Language

Type:
Enumeration
Values: English,
Suomi

This settings changes the language of the Main Control component. Note that the different languages may be added after installation so there may be more choices than defined above.

1.3.2.2 Disable Settings button

Type:
Enumeration
Values: Yes, No

To prevent changing of the settings the "SETTINGS" button can be disabled so that it can not be pressed. After disabling the "SETTINGS" button it can be enabled again from the Windows registry

key "HKEY_CURRENT_USER\Software\PROCEQ RQ\Version 1.0\Main Control\Settings Disabled" by settings the value to "FALSE".

2. PROCEQ RQ80 Components

These components form an application which is used to operate the PROCEQ RQ80 roll quality profiler device.

2.1 Device Control

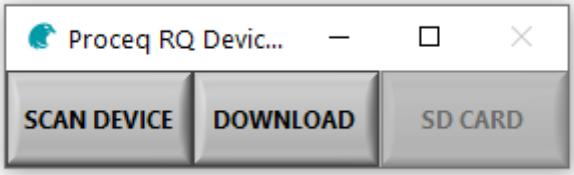
Overview

Device Control component is used to interact with the PROCEQ RQ80 device. It has following capabilities:

- Connecting to a RQ80 device using USB or Bluetooth.
- Adjusting the RQ80 device clock to the PCs time.
- Downloading measurement data from RQ80 device or from RQ80 SD card.
- Reloading older measurement data from the RQ80 SD card.
- Generating a measurement folder from device id and timestamp.
- Saving measurement data as .raw files.
- Converting .raw files to text as .roll files.
- Inform the Builder component to build the measurement directory.

Device Control component is divided in two parts. First one has the user interface and PROCEQ RQ component. Second one is a dynamic one which is started and stopped when needed. It provides the lower level interaction with the RQ80 device and stream file abstraction. Stream file abstraction allows the SD card inserted to the PC to be used like the USB or Bluetooth connected device.

User Interface



Device Control component has three buttons which are used to interact with the RQ80 device. Device Control indicates its status to the user thru Main Control components status window.

2.1.2.1 SCAN DEVICE Button

Connection to the RQ80 device is done using COM ports. Both the USB and the Bluetooth are shown as COM ports after installation and pairing. Device Control component has to scan all COM ports available to find out which of them is the COM port to the RQ80 device. Scanning procedure is started by pressing down the "SCAN DEVICE" button. Device Control remembers found COM port and uses it for future tasks. This allows the use of multiple RQ80 devices. The connection is established with the device which was powered on and detected during scanning.

After the "SCAN DEVICE" button is pressed the Device Control scans available resources. They are COM ports or drives with removable media (SD Card):

Device Control: Scanning for device. Finding resources. Device Control: Drives with removable media:G
Device Control: USB COM ports: COM4
Device Control: Bluetooth COM ports:COM11\COM14\COM6\COM13\COM5\COM7\COM47

After finding resources Device Control starts to test if some of them belongs to RQ80 device. Removable medias are tested first. This means that if there is a RQ80 SD card inserted to the PC it will be detected first instead of USB or Bluetooth connected device. If SD card is not found tests will continue with USB and after that with Bluetooth.

Device Control: Testing drive: G:\ - No connection. Device Control: USB COM ports: COM4 - No connection. Device Control: Testing Bluetooth: COM11 - No connection. Device Control: Testing Bluetooth: COM14 - No connection. Device Control: Testing Bluetooth: COM6 - No connection. Device Control: Testing Bluetooth: COM13 - No connection. Device Control: Testing Bluetooth: COM5 - No connection. Device Control: Testing Bluetooth: COM7 - No connection. Device Control: Testing Bluetooth: COM47 - No connection. Device Control: No device found.

In this case Device Control was not able to connect to the RQ80 device.

Device Control: Scanning for device. Finding
resources. Device Control: Drives with removable
media:.
Device Control: USB COM ports:
COM3 Device Control: Bluetooth
COM ports: .
Device Control: Testing USB: COM3 -
Connected. Device Control: Device found.

In above case the RQ80 device is connected to the PC using USB cable. Device Control founds the device from COM3. Afterwards Device Control uses COM3 when trying to communicate with the device.

2.1.2.2 DOWNLOAD Button

Measured data can be downloaded to the PC by pressing down the "DOWNLOAD" button. After transfer RQ80 device pointers are updated so that only the new measurements are downloaded. So only the measurements done after the last download are available to be downloaded. To download older measurements the SD card has to be inserted to the PC.

Case below shows the typical output when the "DOWNLOAD" button is activated after measuring and connecting the device using USB cable:

Device Control: Connecting. USB COM3.
Done. Device Control: Adjusting device
clock. Done.

Device Control: Initializing download. Reading pointers.
Done. Device Control: Starting new download.
Device Control:
Downloading: 58 % Device
Control: Downloading: 100%
Device Control: Updating pointers.
Done. Device Control: Download
done.

Device Control: Converting data to raw files.

Done. Device Control: Converting raw to roll

files:
Device Control: C:\Users\JR\Documents\Tapio Technologies\TAPIO V2\Version1.3\Roll Data\TTRQP160811\20110901\112909\Raw Data\20110901113051.raw
Device Control: C:\Users\JR\Documents\Tapio Technologies\TAPIO V2\Version 1.3\Roll Data\TTRQP160811\20110901\112909\Raw Data\20110901113011.raw
Device Control: C:\Users\JR\Documents\Tapio Technologies\TAPIO V2\Version 1.3\Roll Data\TTRQP160811\20110901\112909\Raw Data\20110901112929.raw
Device Control: Done.

Device Control: Disconnecting
Deceleration View (BC): Starting
build. Deceleration View (BC): Build
done.

Deceleration View (BC):
Updating. Deceleration View
(BC): Update done.

First the connection is established using COM3. If there is a connection the RQ80 device clock is adjusted to the same time as the PC's clock. If you change the PC time you must first do some download from the RQ80 to change the internal time of the RQ80 device. Otherwise the measurements before the first download will have time stamps according to the earlier time setting. After this the download is initialized and the pointers are read from the RQ80 device. These pointers point to the SD Card and are used to mark where the download ended last time (read pointer) and where is the end of the latest measurement (write pointer). Using these pointers the Device Control knows if there is any data to download. Device Control also remembers if there was a connection failure during last data transfer. If the last download was successful it will start a new download.

Otherwise it will use the old pointers from the last download. These old pointers are reset when the device is disconnected. Disconnection happens if all data is downloaded or the user deactivates the "DOWNLOAD" button before the end of the download.

Next the measurement data is downloaded to a stream file on PC. Progress is displayed in percentage. After all data is downloaded the write pointer is copied to the read pointer to mark the data downloaded.

Then the downloaded stream file is converted to a binary .raw files which are saved to a directories determined by the device id, time stamp and barcode read from the stream file. Raw files are then converted to a text mode .roll files which are used by the Builder component.

When this is done the device is disconnected and the Builder component is informed to build the directories which were created or changed.

2.1.2.3 SD CARD Button

"SD CARD" button is enabled only when the connection is made to the SD card. This is done by inserting the RQ80 SD card to the SD card reader slot in PC and pressing the "SCAN DEVICE" button.

Device Control: Scanning for device. Finding
resources. Device Control: Drives with removable
media:G
Device Control: USB COM ports: .
Device Control: Bluetooth COM
ports: .
Device Control: Testing drive: G:\ -
Connected. Device Control: Device found.

After this the "SD CARD" button will be enabled. Pressing it will print a following status message and open the download selection view:

Device Control: Connecting. SD Card G:\.
Done. Device Control: Adjusting device
clock. Failed.

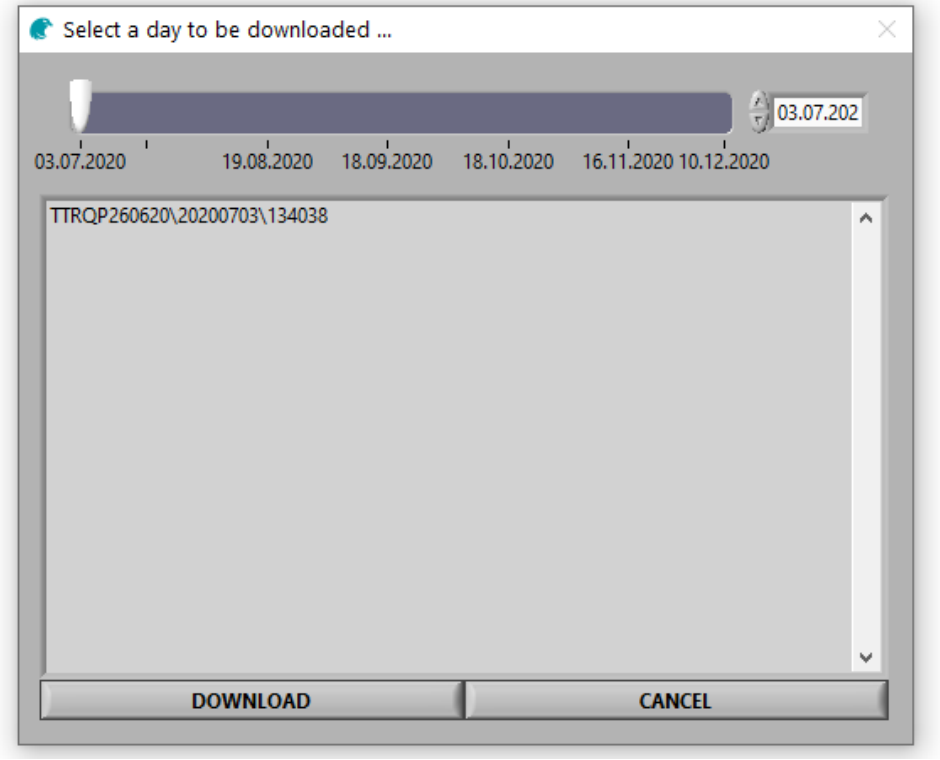
Device Control fails to adjust the device clock because the connection is made to the SD Card not to the actual device.

1.1.1.1.1 Download Selection

Download Selection view will show all measurements found from the SD Card by day basis. This restricts the use of the feature so that the current days measurements cannot be downloaded because the day has not ended yet.

Use the slider or the day control at the upper part of the window to select a day to be downloaded. A text indicator will show a list of measurements done during that day.

When a correct day is selected press the "DOWNLOAD" button at the bottom off the window to start downloading. Otherwise press the "CANCEL" button to return from the selection view.



Settings

2.1.3.1 Roll data directory

Type: Path

This is the base path for the whole directory structure created by the Device control component.

2.1.3.2 Continuous download

Type:
Enumeration
Values: Yes, No

If this is active ("Yes") the Device Control will start a new download action after the old one is finished. Sequence can be started by pressing the "DOWNLOAD" button once. If the "DOWNLOAD" button is deactivated before the finishing of the ongoing download action the sequence will be stopped.

If set to "No" "DOWNLOAD" button will do the action only once.

2.1.3.3 Download at startup

Type:
Enumeration
Values: Yes, No

If set to "Yes" Device Control starts a download action when it is started. This may be used together with the "Continuous download" setting to make the downloading automatic and continuous after startup.

2.1.3.4 Create measurement directory

Type:
Enumeration
Values: Yes, No

This setting determines whether the Device control creates a new directory based on the barcode data transferred from the RQ80 device. If "No" is selected the measurements will be transferred to the current directory indicated by the Builder component. Use "Yes" if the RQ80 device is the first or only device to measure the roll. Use "No" if there are other devices to measure the roll before it.

2.1.3.5 Build measurement directory

Type:
Enumeration
Values: Yes, No

If "Yes" the builder component is informed to build the contents of the current directory after the data is transferred from the RQ80 device. This setting will enable other measurement devices like TAPIO Roll End Profiler V2 to be in charge of the build. Use "Yes" if the RQ80 device is the only device in use or the last device to measure the current roll. Use "No" if some other device will measure the same roll after the Proceq RQ80 device.

2.1.3.6 Language

Type:
Enumeration
Values: English,
Suomi

This settings changes the language of the Device Control component. Note that the different languages may be added after installation so there may be more choices than defined above.

2.2 Builder

Overview

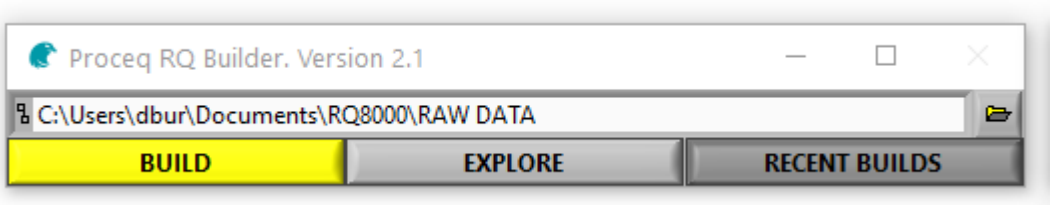
Builder component conducts a build process for a selected measurement directory. Build process can be actuated from user interface of the Builder component or it can be actuated by other components. Build process consist of following tasks:

- All .roll files are loaded from the measurement directory.
- A build directory is initialized for data exchange with the View components.
- Channels found from .roll files are combined, cropped, filtered and saved to the build directory.
- View components are informed that they should calculate and save their channels to the build directory.
- View components are waited to have their channels added to the build directory.
- Data in build directory is converted to a build.rolls text file and saved.
- View components are informed that the build.rolls file is changed and they should update their views to match the new build file.
- View components are waited to have their views updated.
- An external executable file is started with parameters consisting of barcode and time stamp of the measurement directory.

The build process makes it possible to have multiple input (.roll) files which all have multiple channels with same or different type of data. View components calculate additional data like limits, average and filtered channels which are needed to draw their views. These data is calculated based on the data from Builder component and returned back to the Builder. From these and original data Builder forms a build.roll output file. Build.rolls file contains now the original data and everything that the View components need for drawing their views. So the build.rolls file is the end product of the build.

After the View components have updated themselves an executable file is called with parameters containing the path to the measurement directory. This makes it possible to export the measurement automatically or do something else with the results.

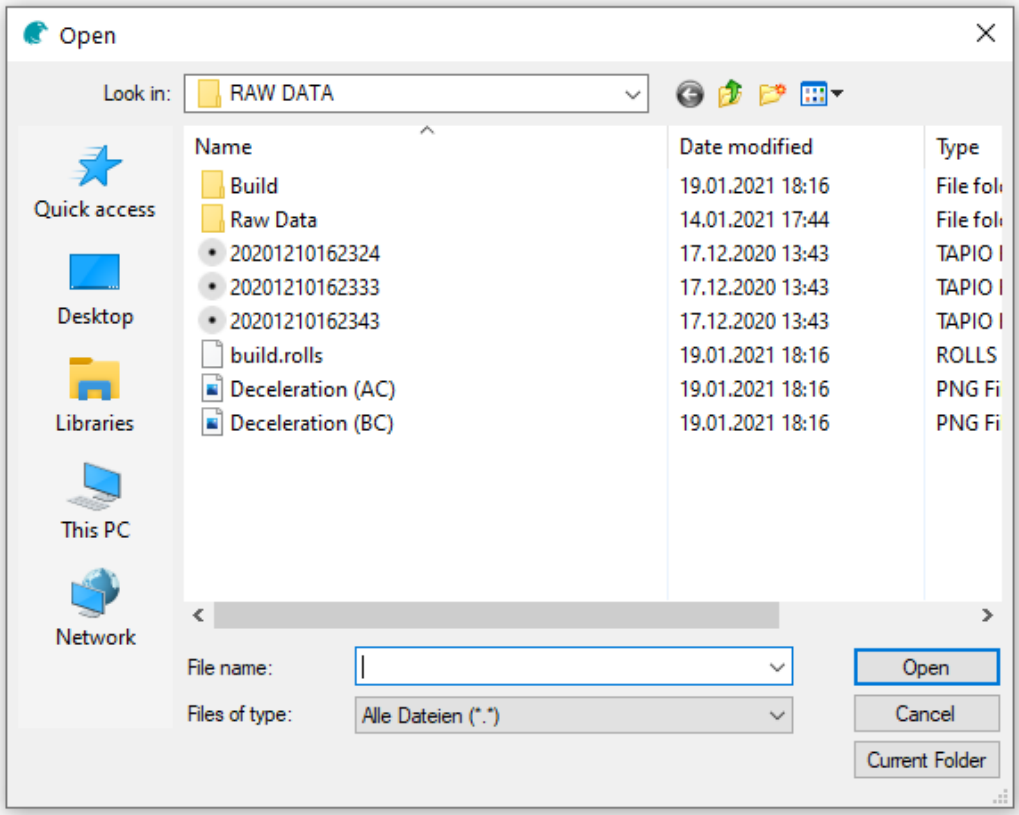
User Interface



Builder user interface has three buttons and one path control with browse button. Measured data is build when the Device control or Roll end profiler informs Builder to build directory. There may be cases where the Builder user interface is not needed at all and it may be turned off from the settings.

2.2.2.1 Path Control and Browse Button

Path control displays the current measurement directory. If the value is changed the build process is automatically started. Value can be changed by manually editing or by pressing the browse button at the right side of the path field. Pressing the browse button will open a directory browser:



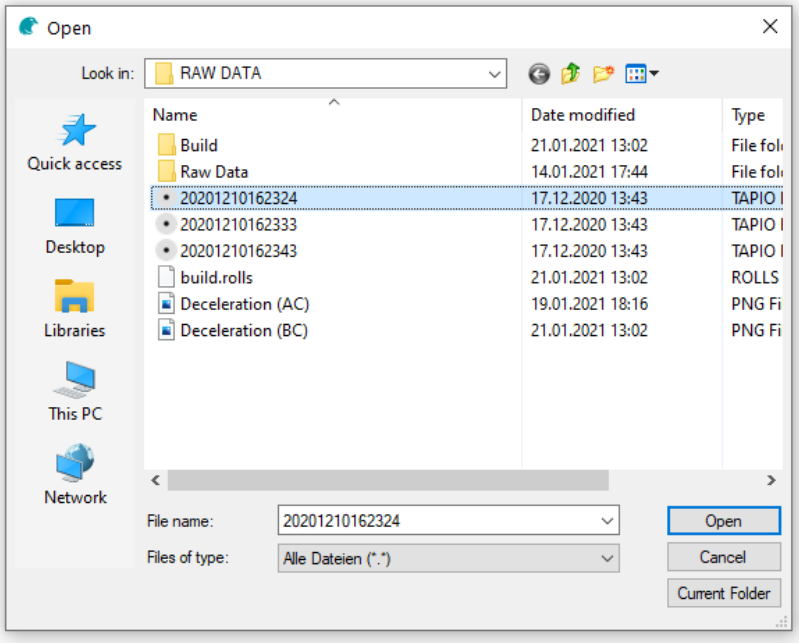
Although it has an "Open" button it should not be used. The intention is to select a new measurement directory. Therefore the "Current Folder" button must be used. Otherwise the directory browser works like a standard Windows file selector. So go to the directory you want to build and press "Current Folder".

2.2.2.2 BUILD Button

This button starts the build process for the current measurement directory. It can be used without changing the directory. "BUILD" button changes its color to yellow when a setting which will affect the build.rolls file has changed. This happens for reminding the user that the build or the views do not match with the settings. So the user should press the "BUILD" button before examining the results if it is yellow.

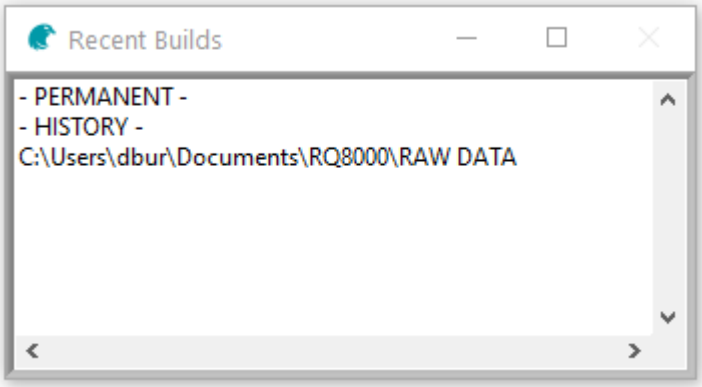
2.2.2.3 EXPLORE Button

By pressing the "EXPLORE" button you can open the current measurement directory to the Windows Explorer. Sometimes it is useful if you want to copy or open the files in another program. You can also browse to another measurement directory. If you select a .roll file, double click it or select "Open" from the right click menu you can change the current measurement directory to that directory.



2.2.2.4 RECENT BUILDS Button

This button selects if the "Recent Builds" window is visible. When it is down the window is visible.



The purpose of the window is to show a list of the paths to the recently build directories. Window is divided in two sections. First is named as "PERMANENT" and the second as "HISTORY". When a build is done the build path is added as first to the history list. You can examine the other measurements in the list just by double clicking them. Double clicking will start a build process.

You may clear the list by right clicking the "HISTORY" and selecting "Clear".

The "PERMANENT" list is for measurements that are wanted to be easily available. Those could include for example an example off a good roll and a bad roll. You can transfer a measurement from "HISTORY" list to "PERMANENT" list by right clicking a path in "HISTORY" list and selecting "Make permanent". Path can be removed from the "PERMANENT" list by right clicking the path and selecting "Move to history".

Settings

2.2.3.1 Language

Type:
Enumeration
Values: English,
Suomi

This settings changes the language of the Builder component. Note that the different languages may be added after installation so there may be more choices than defined above.

2.2.3.2 Show user interface

Type:
Enumeration
Values: Yes, No

This settings controls if the Builder components user interface is visible. Sometimes it is better if the applications user interface is as simple as possible.

2.2.3.3 Crop from the beginning of the profile

Type:
Numeric
Dimension:
m Range: 0 -
1 m

Increment: 0.001 m

This setting controls how much to crop from the beginning of the profile. Cropping affects all channels and is done before the View components receive the data. Sometimes there may be a systematic variation at the beginning of the profile and it is not wanted to be included to the key value calculation or shown in the profile.

2.2.3.4 Crop from the end of the profile

Type:
Numeric
Dimension:

m Range: 0 -
1 m

Increment: 0.001 m

This setting controls how much to crop from the end of the profile. Cropping affects all channels and is done before the View components receive the data. Sometimes there may be a systematic variation at the end of the profile and it is not wanted to be included to the key value calculation or shown in the profile.

2.2.3.5 Profile filtering

Type: Enumeration

Values: None, Moving Average, Box Car, Frequency Domain, First Order Butterworth, Second Order Butterworth, Fourth Order Butterworth, Eight Order Butterworth

Filter is applied to all channels after the .roll files are loaded from the measurement directory. This means that the View components receive the filtered channels and the final build.rolls file channels whose origin field is "measured" are filtered. All filters are lowpass.

2.2.3.6 Filter corner period

Type:
Numeric
Dimension:
m Range:
0.0001 - 1 m

Increment: 0.0001 m

This setting determines the parameter of the profile filtering as follows:

Moving Average and Box Car. Parameter means the length of the data set used in filter.
Frequency Domain. Variations with shorter period than the parameter are removed in frequency domain.

Butterworth. Parameter is the period where the attenuation is -3dB.

2.2.3.7 Decimal point conversion

Type: Enumeration

Values: None, Comma (,), Period (.)

This setting controls how to treat the decimal separators found in files that are combined in the build process. "None" setting leaves them as the are. Normally the original .roll files use period as a decimal separator. Builder component accepts both separators in its input files. Although if you want to open the build.rolls file in another application for example in Excel it is useful if you can choose the Builder component to convert all decimal separators to either comma or period depending on your localization.

2.2.3.8 Run executable after build

Type:
Enumeration
Values: Yes, No

This setting controlls if the Builder component should run an executable file after the build process is ready. Builder component uses following command line to start the executable:

cmd.exe /C ""Executable file"

Parameters" Parameters are as

follows:

BARCODE - If there is no barcode "No Barcode" is
used. TIMESTAMP - In form HHMMSS.

DAYSTAMP - In form YYYYMMDD.

DEVICE - This is the serial number of the RQP V2 device for example TTRQP080910.
ROLLDATA DIR - The part of the Measurement directory path between the drive letter and the device serial number.

RQP V2 DIR - "." just for compatibility for the older
versions. TAPIO DIR - "." just for compatibility for the
older versions.

DRIVE LETTER - Drive letter from the start of the measurement directory path.

1.1.1.1.2 Executable Example

Test using the "Show Parameters.bat" file which comes with the installation. File contains following text:

```
@echo off
echo BARCODE: %1
echo TIMESTAMP: %2
echo DAYSTAMP: %3
echo DEVICE: %4
echo
ROLLDATA DIR:
%5 echo RQP
V2 DIR: %6
echo TAPIO
DIR: %7 echo
DRIVE LETTER:
%8
pause
```

In our test the path to the measurement directory is:

C:\Users\JR\Documents\Tapio Technologies\TAPIO V2\Version
1.3\Roll Data\TTRQP160811\20110901\112909

With our PC this leads to the following command line:

cmd.exe /C ""C:\Program Files (x86)\Tapio Technologies\TAPIO V2\Version 1.3\Builder\Executables\Show Parameters.bat" "No Barcode" "112909" "20110901"

"TTRQP160811" "Users\JR\Documents\Tapio Technologies\TAPIO V2\Version 1.3\Roll Data" "." "." "C""

And the result after pressing the "BUILD" button is a Windows command prompt window containing text:

BARCODE:
"NoBarcode"
TIMESTAMP:
"112909"
DAYSTAMP:
"20110901"
DEVICE:
"TTRQP160811"
ROLLDATA DIR: "Users\JR\Documents\Tapio Technologies\TAPIO V2\Version 1.3\Roll Data" RQP V2 DIR: "."
TAPIO DIR: "."
DRIVE
LETTER: "C"
Press any key to continue . . .

2.2.3.9 Executable file

Type: Path

This defines the path to the executable file which should be run after the build process is ready. Normally executable files are located under program files directory and have an extension like .exe,

.bat or .vbs.

2.2.3.10 Run executable minimized

Type:
Enumeration
Values: Yes, No

If the executable launches the Windows command prompt you may choose if the window is minimized or not when the batch file is running.

2.2.3.11 Wait executable completion

Type:
Enumeration

Values: Yes, No

This setting determines whether the Builder component should wait that the executable file is finished. Value of this setting depends on the executable. If you use the "Yes" value your executable may prevent the Builder component from building other measurement directories. It is advisable to use the "No" value so that you do not hang up the system. Although in some cases it is useful to use "Yes" value.

2.3 View Components

Overview

View components are program modules that are used to display the measured data. Usually one view component handles one type of channels. All view components are based on same program structure, so they have same settings and features. Following chapters explain the differences between components.

2.3.1.1 Deceleration View (AC)

Deceleration View (AC) component displays the maximum deceleration of the hammer after the collision between the hammer and the surface has occurred. These values are affected by the hardness and the energy absorption of the surface.

2.3.1.2 Deceleration View (BC)

Deceleration View (BC) component displays the maximum deceleration of the hammer before the collision between the hammer and the surface has occurred. These values are affected mainly by the hardness of the surface.

2.3.1.3 Deceleration View (BC) 2

This is a duplicate of the Deceleration View (BC). Two views to same data allow different settings which may come handy sometimes.

2.3.1.4 Deceleration View (ZC)

Deceleration View (ZC) component displays the deceleration of the hammer at the moment of collision between the hammer and the surface. Values used to calculate these data are sampled during very short time period. This view is suitable for harder surfaces than paper and plastic film rolls.

2.3.1.5 Velocity Ratio View

Velocity Ratio View component displays the ratio of the maximum velocities after and before the collision between the hammer and the surface. Surface absorbs energy so the ratio is

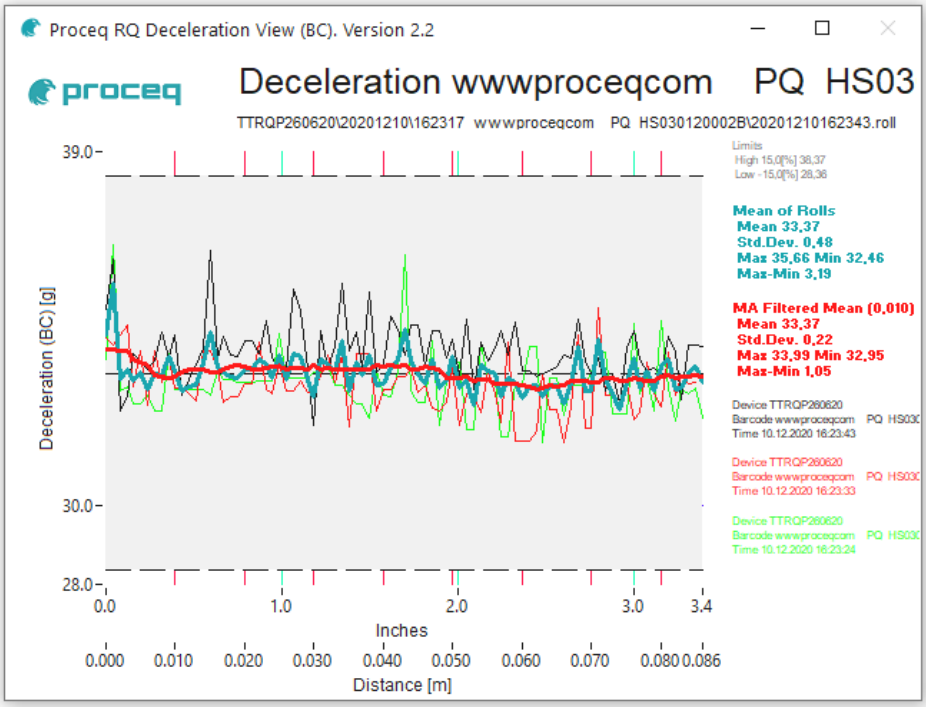
always lower than one.

2.3.1.6 Penetration View

Penetration View component displays the maximum displacement of the hammer after the velocity of the hammer starts to decrease. The decreasing of the velocity happens when the hammer touches the surface and starts to deform it.

User Interface

View components have a simple user interface with no controls. The Builder component takes care of updating of the views after downloading a measurement or changing some settings. Below is the Deceleration View (BC) components window after downloading a measurement.



Window is divided in to four sections. First part is the upper left corner which is reserved for the logo. The logo is a .bmp file which is located in every View components program data directory. For example, in our PC the Deceleration View (BC) components logo can be found from the path:

C:\ProgramData\PROCEQ RQ\Version 1.0\Deceleration View (BC)\logo.bmp

It may be replaced with another bitmap file if necessary. Second part is the rest of the window at the right side of the logo which is for the title and the barcode of the measurement. Below the title is the tail of the measurement directory path which describes the device, time stamp and the barcode.

Third part is the graph. Graph displays the individual profiles from the .roll files located in the measurement directory. View components also calculate an average of the profiles, filtered

average of the profiles and limit profiles.

For example, if a customer roll is measured three times the individual profiles show all three measurements so that the user can see how repeatable is the measurement and which variations come from the roll and which are coming from the measurement itself. Average is calculated and measurement induced variations are decreased compared to the roll induced variations. If a machine roll is measured the filtering can be used to see the large-scale variations. All variations can be checked against the limits displayed behind the profiles.

Fourth part is the parameter and key values section at the right side of the graph. First the limit values are shown in absolute and percentage values. Then comes the key values calculated from the mean profile of the measurement and next the key values of the filtered mean profile of the measurement. After these are the data from the individual measurements. Device serial number, barcode and the time stamp of the barcode. There is a space for five individual measurements.

Settings

2.3.3.1 Language

Type:
Enumeration
Values: English,
Suomi

This setting changes the language of the View component. Note that the different languages may be added after installation so there may be more choices than defined above.

2.3.3.2 Resampling Step

Type:
Numeric
Dimension:
m Range:
0.0001 - 1 m

Increment: 0.0001 m

Native sample step of the RQ80 device is 1mm. This means that the build rolls file and the displayed profiles have one value for every millimeter. If this is considered to give too many data points to the profile the setting can be increased for example to 1cm. Then there will be 100 values per one meter instead of the 1000 values.

2.3.3.3 MA Filter Length

Type:
Numeric
Dimension:
m Range:
0.0001 - 1 m

Increment: 0.0001 m

View components calculate and display a moving average filtered profile from the average profile. This setting controls the length of the data set used by the moving average filter.

2.3.3.4 Convert to Mean %

Type:
Enumeration
Values: Yes, No

If enabled the View component will divide the profiles by their mean values and multiples them by 100%. This means that the value which used to be the mean value of the profile is now 100%.

Notice that this operation will change the dimension of the data.

2.3.3.5 Subtract Mean Value

Type:
Enumeration
Values: Yes, No

If enabled the View component will subtract the profiles mean value from the profile. This means that the value which used to be the mean value of the profile is now 0. Notice that this affects the way how the limit profiles should be calculated. Relative to mean type of calculation will give strange results because the new mean is zero. Use the absolute type of limits instead.

2.3.3.6 Save Picture

Type:
Enumeration
Values: Yes, No

If set to "Yes" View component will save the picture from its window to the measurement directory after every update. Picture file is always named as "view components name.png".

2.3.3.7 Transparency

Type:
Numeric
Dimensio
n: %
Range: 0
- 100 %

Increment: 1 %

This setting will change the transparency of the View components window. This allows the profiles in different View components to be compared when the windows are stacked to the same position.

2.3.3.8 Show MA Profile

Type:
Enumeration
Values: Show,
Hide

This setting controls whether or not the moving average profile is displayed in the graph.

2.3.3.9 Show Distance Axis

Type:
Enumeration
Values: Show,
Hide

This setting controls the visibility of the main distance axis. This axis shows the distance in meters.

2.3.3.10 Show Secondary X Axis

Type:
Enumeration
Values: Show,
Hide

This setting controls the visibility of the secondary distance axis. Secondary axis has its own name, offset and multiplier settings and may be used to convert the distance to more suitable units for example to inches or pintel count.

2.3.3.11 Show Mean Profile

Type:
Enumeration
Values: Show,
Hide

This setting controls whether or not the mean profile is displayed in the graph.

2.3.3.12 Show Rolls

Type:
Enumeration
Values: Show,
Hide

This setting controls whether or not the individual measurements are displayed in the graph.

2.3.3.13 Limits Mode

Type: Enumeration

Values: Absolute, Relative to mean

This setting controls how the limits are calculated. When set to "Absolute" the "Limit Absolute High" setting is used directly as the high limit and the "Limit Absolute Low" setting is used directly as the low limit. When set to "Relative to mean" the limits are calculated relative to the mean value of the profiles. "Limit Relative High" setting set the high limit and the "Limits Relative Low" sets the low limit.

2.3.3.14 Limit Absolute High

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1 um.

When "Limits Mode" setting is set to "Absolute" this value is used as a high limit value.

2.3.3.15 Limit Absolute Low

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1

um. When "Limits Mode" setting is set to "Absolute" this value is used as a low

limit value.

2.3.3.16 Limit Relative High

Type:
Numeric
Dimension:
% Range: -
100 - 100 %

Increment: 0.1 %

When "Limits Mode" setting is set to "Relative to mean" this value is used when calculating the high limit value.

2.3.3.17 Limit Relative Low

Type:
Numeric
Dimension:
% Range: -
100 - 100 %

Increment: 0.1 %

When "Limits Mode" setting is set to "Relative to mean" this value is used when calculating the low limit value.

2.3.3.18 Limits fill color

Type: Color

This setting controls the color of the area between the high and low limit behind the profiles.

2.3.3.19 Distance Axis Major Grid Step

Type:
Numeric
Dimensi
on: m
Range:
0 - 10 m

Increment: 0.0001 m

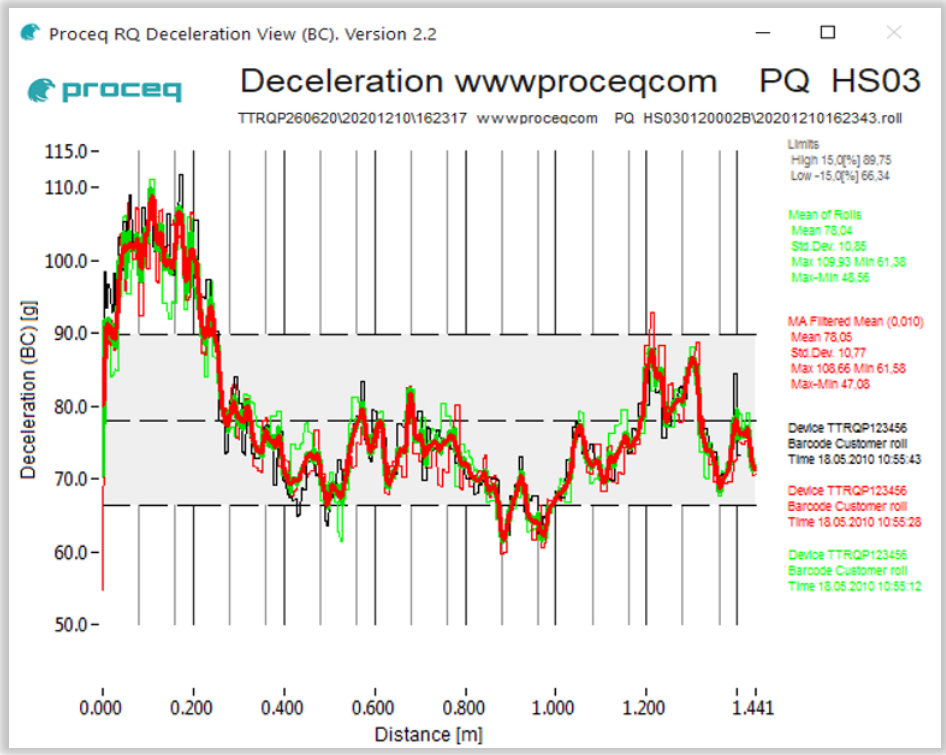
Distance axis has major and minor grids. This setting controls the step size of the major grid. This step also defines the delta between the marker values of the axis. If the grid is too dense and the marker values do not fit the step size is automatically increased (this does not change the setting). Notice that the View Components window size can be adjusted, and it affects to the minimum possible step.

2.3.3.20 Distance Axis Minor Grid Step

Type:
Numeric
Dimensi
on: m
Range:
0 - 10 m

Increment: 0.0001 m

This setting controls the step size of the minor grid. Minor grid is displayed between the major grid lines and start again for every major grid line. This is illustrated by the following picture:



Settings for the picture were:

- Distance Axis Major Grid Step: 0.2000 [m]
- Distance Axis Minor Grid Step: 0.0800 [m]

2.3.3.21 Distance Axis Major Grid Color

Type: Color

This setting controls the color of the major grid. Set to transparent (T) to make the grid invisible.

2.3.3.22 Distance Axis Minor Grid Color

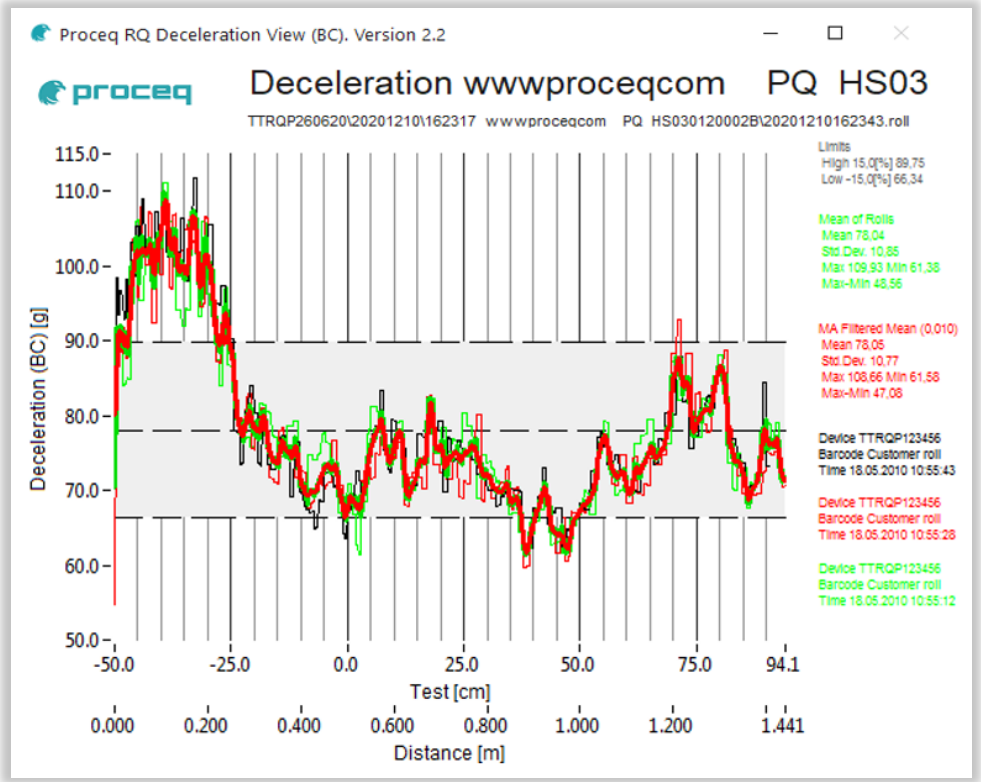
Type: Color

This setting controls the color of the minor grid. Set to transparent (T) to make the grid invisible.

2.3.3.23 Secondary X Axis Name

Type: String

This setting defines the text which is displayed below the secondary x axis. Following picture shows the secondary axis in use:



Settings for the picture were:

- Secondary X Axis Name: Test [cm]
- Secondary X Axis Multiplier: 100.000
- Secondary X Axis Offset: -50.0000
- Secondary X Axis Decimal Digits: 1
- Secondary X Axis Major Grid Step: 25.0000
- Secondary X Axis Minor Grid Step: 5.0000
- Secondary X Axis Major Grid Color: R:042 G:042 B:042
- Secondary X Axis Minor Grid Color: R:146 G:146 B:146

2.3.3.24 Secondary X Axis Multiplier

Type:
Numeric
Dimensio
n: 1
Range: -
Inf - Inf
Incremen
t: None

This value is used as a multiplier in calculation of the secondary x axis.

2.3.3.25 Secondary X Axis Offset

Type: Numeric
Dimension: 1

Range: -
Inf - Inf
Incremen
t: None

This value is used as an offset in calculation of the secondary x axis. Secondary axis range is calculated as follows:

Secondary axis min = (Distance axis min) * Multiplier + Offset
Secondary axis max = (Distance axis max) * Multiplier + Offset

2.3.3.26 Secondary X Axis Decimal Digits

Type: Numeric
Dimension: 1

Range: 0 - 6

Increment: 1

This setting controls the amount of digits after the decimal separator in marker values of the secondary x axis.

2.3.3.27 Secondary X Axis Major Grid Step

Type:
Numeric
Dimensi
on: m
Range:
0 - 10 m

Increment: 0.0001 m

This setting is similar to the corresponding distance axis setting.

2.3.3.28 Secondary X Axis Minor Grid Step

Type:
Numeric
Dimensi
on: m
Range:
0 - 10 m

Increment: 0.0001 m

This setting is similar to the corresponding distance axis setting.

2.3.3.29 Secondary X Axis Major Grid Color

Type: Color

This setting controls the color of the major grid. Set to transparent (T) to make the grid invisible.

2.3.3.30 Secondary X Axis Minor Grid Color

Type: Color

This setting controls the color of the minor grid. Set to transparent (T) to make the grid invisible.

2.3.3.31 Y Scaling

Type: Enumeration

Values: Loose, Max Min, Relative

This setting control how the y scale range is determined. If the setting is "Loose" the range minimum and maximum values are based on the shown profiles so that they fit loosely on the graph. If "Max Min" value is selected the "Y Scale Max" value is used for the range maximum and the "Y Scale Min" for the minimum. If "Relative" value is selected the "Y Scale Relative Max" value is used for the range maximum and the "Y Scale Relative Min" for the minimum.

2.3.3.32 Y Scale Max

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1 um.

When "Y Scaling" is set to "Max Min" this value is used as a maximum value of the y scale range.

2.3.3.33 Y Scale Min

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1 um.

When "Y Scaling" is set to "Max Min" this value is used as a minimum value of the y scale range.

2.3.3.34 Y Scale Relative Max

Type:
Numeric
Dimension:
% Range: -
100 - 100 %

Increment: 0.1 %

When "Y Scaling" is set to "Relative" this value is used as a maximum value of the y scale range.

2.3.3.35 Y Scale Relative Min

Type:
Numeric
Dimension:
% Range: -
100 - 100 %

Increment: 0.1 %

When "Y Scaling" is set to "Relative" this value is used as a minimum value of the y scale range.

2.3.3.36 Y Scale Major Grid Step

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1

um. This setting is similar to the corresponding distance axis setting.

2.3.3.37 Y Scale Minor Grid Step

Type: Numeric

Dimension: Deceleration View: g, Velocity Ratio View: 1, Penetration View: um.

Range: Deceleration View: -1000 - 1000 g, Velocity Ratio View: -10 - 10, Penetration View: -1000 -

1000 um.

Increment: Deceleration View: 1 g, Velocity Ratio View: 0.01, Penetration View: 1

um. This setting is similar to the corresponding distance axis setting.

2.3.3.38 Y Scale Major Grid Color

Type: Color

This setting controls the color of the major grid. Set to transparent (T) to make the grid invisible.

2.3.3.39 Y Scale Minor Grid Color

Type: Color

This setting controls the color of the minor grid. Set to transparent (T) to make the grid invisible.

2.4 Prepare SD Card

Overview

Proceq RQP80 device uses specially formatted and prepared SD cards. This component can be used to format and prepare a normal SD card for RQ80 use. However, there are many types of SD cards on the market. There are quite few guidelines to determine which SD card to use but here are some:

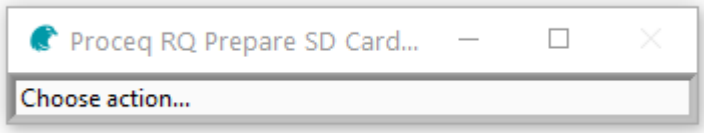
- SDHC does not work.
- Higher speed classification does not mean that the card works.
- Class 2 and 4 have worked.

- RQ80 uses MultiMediaCard (MMC) 1-bit serial interface.
- Constant hitting (30Hz) consumes about 512 bytes / second. So 1GByte card can hold about 20 days of continuous measurement.
- Formatting and preparing of 2GByte card may take 10-20 depending on the computer used.

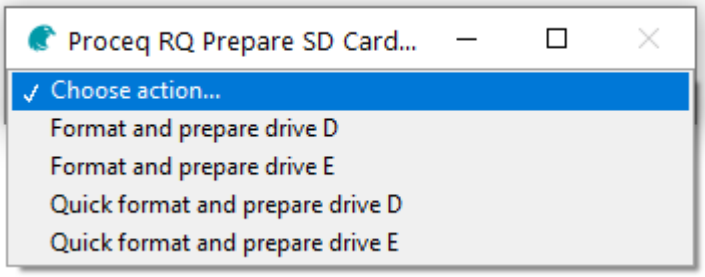
Prepare SD Card components automatically detects any removable drives and adds them to the list box on its user interface.

User Interface

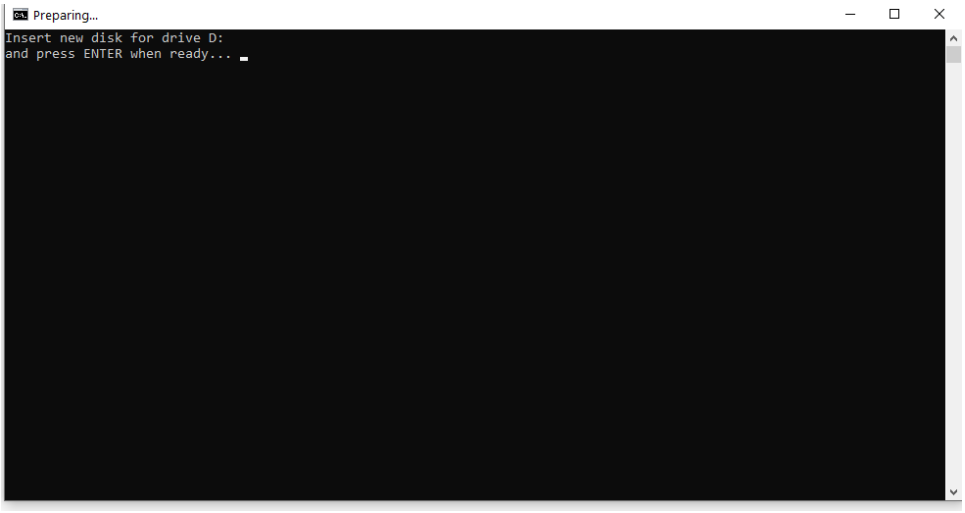
Prepare SD Card components user interface is shown below. It has a single list box which is updated when a new removable media is detected. The SD card must be inserted before the software is started. Two possible actions are added for every removable media. Notice that a USB stick or an external hard drive are also removable medias. Hence please always be sure that you know what you are formatting. Formatting will erase all data from the removable media!



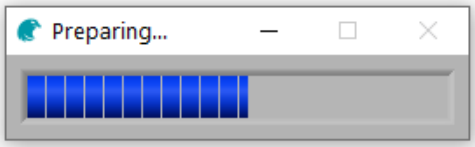
Below is an example where a RQ80 SD card is inserted in the SD card reader slot of the PC. New SD card is seen as a drive D. the E drive represents another medium that shall NOT be formatted. Notice that all other removable medias will also appear on the list so be sure which to select.



If you select "Format and prepare drive" the media is first deep formatted using Windows command prompt (cmd.exe) and then filled with "rqp.dat" file which is used by the RQ80 device. This will take from 1 to 5 minutes depending on your PC and SD card capacity.



The status of the formatting will be displayed in another window:



"Quick format and prepare drive" uses quick format which only resets the file structures on the media and then continues with writing of the "rqp.dat" file. This is faster but the formatting does not detect any SD card failures. This means that the card may not work reliably.

Settings

2.4.3.1 Language

Type:
Enumeration
Values: English,
Suomi

This setting changes the language of the Prepare SD Card component. Note that the different languages may be added after installation so there may be more choices than defined above.

3. APPENDIX Filtering

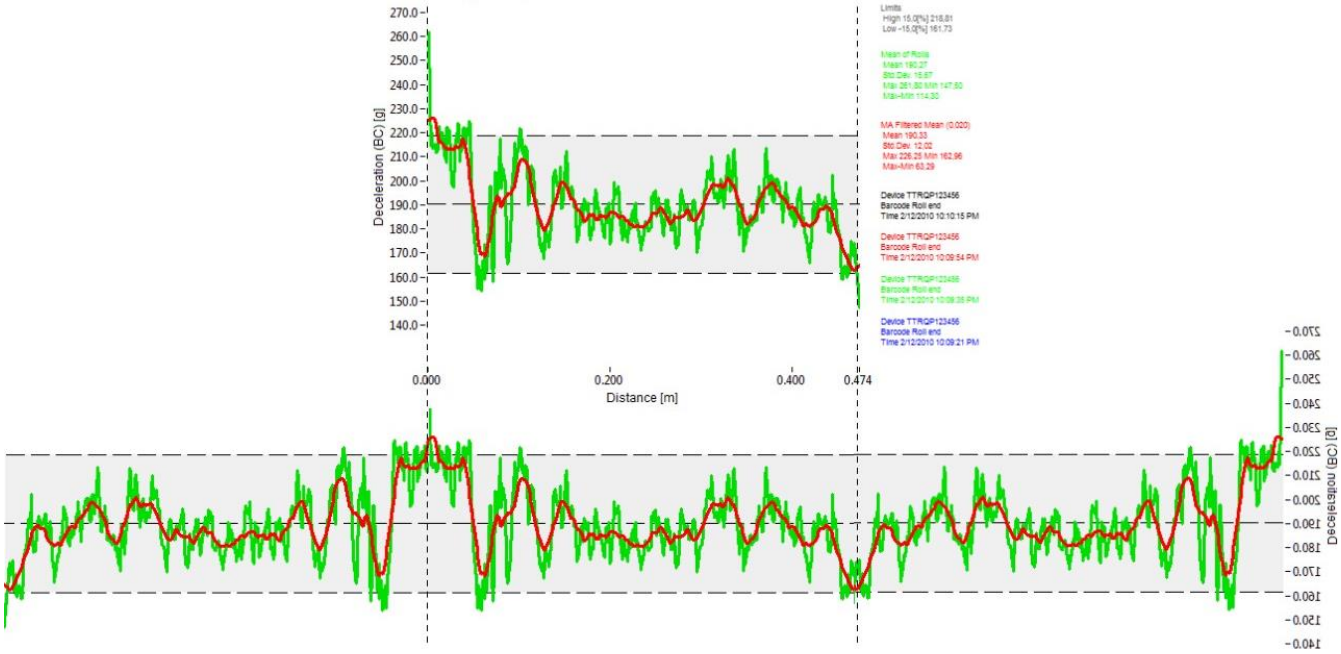
3.1 Overview

Meaning of this appendix is to explain how the short profiles are filtered without the loss of data from the ends of the profile. Of course this is an approximation which just gives reasonable results. Loss is due to fact that the time domain filters have a length which is proportional to the corner period of the filter. Consider a simple moving average filter where the length is chosen to be 100 mm. The profile to be filtered is one meter long (1000 mm).

This means that the first average is calculated using the first 100 values of the profile. If we calculate also the average of the distance values of the profile we get 50 mm which means that the first value we get starts from the 50 mm. This happens also at the end of the profile. So, after filtering our profile is only 900 mm long missing 50 mm from the both ends.

3.2 Mirroring

To minimize the end effects the profile is copied and mirrored in distance domain. Then it is prepended and appended to the original profile to get a profile which is three times longer than the original. This long profile is now filtered using the selected filter. Usually the end effects fit to the prepended and appended mirror profiles and are cut away when the mirror profiles are removed to leave the filtered result.



Above picture shows the resulting profile and how the mirrored profiles are prepended and appended to the original one.

4. APPENDIX Traceability

4.1 Overview

All RQ80 devices are assembled, calibrated and tested before shipping to the customer. If the customer wants to keep a track how the overall level of the device is changing during the time a check sample can be ordered to the shipment. If the level shifts during time so that the results are questionable the device and the check sample should be sent back to PROCEQ for maintenance, recalibration and testing. When wearing parts are changed and recalibration is done the device is ready to be used again. Check sample and the device are paired so that the check sample has a barcode which identifies the device. Traceability builds on two things the commissioning and the check sample.

Main causes for the level change are the wearing out of the hammer tip and the light source in the hammer position detector. If the tip wears out the area of the tip increases. This causes the

level to shift up in deceleration profiles while the penetration decreases. Dimming of the light source may change the level either direction but eventually the device will start hitting even if it is not on the surface.

4.2 Commissioning

Assembling

PROCEQ RQ80 device is designed especially for measuring roll hardness from various types of rolls. All parts are designed by TAPIO Measurement Technologies Oy, Finland. RQ80 parts are inspected and put together by one person. After assembly and initial tests, the device is ready for first time calibration.

Typically, devices that are returned for maintenance inspection and recalibration enter to this stage in which there is possible to replace worn out parts.

First Time Calibration

During first time calibration all functionality of the device is tested. If the calibration is not possible the device is returned to the assembly stage. First time calibration consists of following steps:

- Transferring a bootloader program to the microcontrollers (3).
- Testing the USB connection and charging.
- Bluetooth configuration and pairing.
- Application program loading to the microcontrollers thru Bluetooth.
- Low battery and shutdown voltage limits adjustment.
- Hammer position detector dynamic range adjustment.
- Hammer position calibration.
- Hammer velocity channel gain measurement.
- Hall sensor gain and offset measurements.
- Measurement and SD card download test (30 min).

Hammer position detector is monotonic by nature but it is not linear. Using a special test bench the output of the detector is tested in 800 points evenly distributed on the travel of the hammer (4 mm). This yields to a calibration table (4096 values) which is transferred to the device after which the position measurement is linear and outputs absolute values. Same table is used also for the velocity channel linearization at certain position.

Overnight Test

Overnight test consists of following one-minute cycles:

- Reading a barcode.
- Measuring surface 30 seconds (900 hits).
- Transferring results to the PC.

During 12 hour test the hammer hits over 500000 times and over 500 measurement are transferred. Hammer position detector and other electronics are burned in and mechanical failures will be detected.

Final Calibration

Final calibration consists of following steps:

- Measurement and SD card download test repeated.
- Hammer position detector dynamic range check.
- Hammer position calibration.
- Hammer velocity channel gain measurement.
- Hall sensor gain and offset measurements.
- Comparison of the yesterday's results to the current ones.

If the device shows a significant drift after the overnight test the tests are repeated, and the cause is corrected before accepting the device.

Final Assembly and Tests

At this point the covers are assembled and a special test sample is measured. A standard **check sample** is also evaluated to see if the overall level matches the other devices. The special test sample consist of a table on which there are different number of layers of paper. Results shows how the variations in hardness are detected by the device. Result is compared to other devices.

4.3 Check Sample

Check sample is meant to be measured periodically for example once a month to see how the overall level is changing. PROCEQ is doing the first check sample measurement before shipping the device to the customer. Check sample is manufactured so that the measuring itself should cause minimal effects to the result. Check sample has a rigid base plate with rubber foots which will damp the effect of the surface under the sample. Actual value of the sample is generated by the soft layer of rubber on top of the base plate. Soft rubber has a surface that cause a lot of friction when the hammer is sliding on it.

Because of the friction an additional thin layer of plastic is added to the top of the rubber. Without the low friction plastic the moving speed of the device would have an impact on the measurement due the fact that the forces perpendicular to the hammer will steal the energy from the collision.

To get reliable result from the check sample it must be measured continuously four times. To start the check press the barcode button and read the barcode from the bottom of the plate. Place the device firmly on the plate as seen on the left in the picture below. Press the device against the sample and move it to the end of the sample. Continue pressing and slide the device back to the starting point. Sample will be also measured backwards when the device is moved back to the starting point. After the sample is measured four times in forward direction the device can be lifted from the sample