OPERATING MANUAL

HCQ Navigator

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Order number	Language

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1 GENERAL

1.00 Introduction

The HCQ Navigator is part of the HAMM Compaction Quality System (HCQ) for measuring, evaluating and documenting compaction results.

Before starting use, read this operating manual carefully from the beginning in order to avoid mistakes and hazards occurring, and to familiarize yourself with the correct and safe way to handle the system. The operating instructions must always be present at the place of utilisation of the machine.

We constantly work on the further development of our products. Therefore, please understand that we must reserve the right to change the scope of the delivery in respect of the form, equipment and technology at any time.

This edition is applicable to software version V2.4.X and relates to the Panel PC Xplore iX104C5 with the Microsoft Windows 7 operating system.

The manufacturer has already integrated this operating manual into the HCQ Navigator software. HAMM will not be liable for any damage arising from the use of this edition with any program version other than the one described here.

1.01 Guarantee

No guarantee claims with:

- Operating errors.
- In the case the spare parts used are no original HAMM spare parts.
- In the case the spare parts used are no original HAMM accessories.
- In the case any additional devices / parts have been refitted and/or installed that have not been approved by HAMM.
- In the case of deficient maintenance.
- In the case of any processes that conflict with these operating manual.

1.02 Packaging and dtorage

We have carefully packed our products to ensure proper protection in transit. Please check both packaging and the goods yourself for any damage upon reception of your goods. In the case of damage, the devices must not be put into operation. Damaged cables and connections are a safety risk and must not be used.

In such a case, please contact your supplier.

If the devices are not put into operation upon unpacking, they must be protected against humidity and dirt.

1.03 Signs and Symbols

The signs and symbols used in this operating manual are to help you use this operating manual and the device in a safe and fast manner.

Note	i	Informs about application hints and useful information. No dangerous or harmful situation.
Enumeration	●	Indicates a listing of issues or possibilities.
Operating steps	1.	Are listed according to their succession each starting from 1 for each individual process.
Cross-references		Cross-references help you to find quickly sections in this operating manual which supply you with additional important information. The cross-reference shows you the page of the relevant section. The abbreviation sqq. means "and the following pages". Example: (see page 134 sqq.)
Positioning of illustrations		The positions of illustrations are represented with letters. The positions identified with letters in alphabetical order are only explained in the corresponding text segment, beginning new for each single figure. The end of the positioning line is marked as dot or arrow. In the illustration the dot marks a visible element and an arrow an invisible element which is in arrow direction.
Menus and menu lines		Text references to menus and menu lines are shown in **bold**.
Dialog box		Text references to dialog boxes are shown in ***bold italics***.
Areas in Dialog boxes		Text references to areas in dialog boxes are shown in *italics*.
Buttons and keys		Text references to buttons are in quotation marks.

1.04   Signal Words

A signal word identifies a source of dangers and residual risks.

⚠ **DANGER**

Identifies immediate danger. If this risk is not prevented, this causes death or severe personal injuries.

⚠ **WARNING**

Identifies situations that may be dangerous. If this situation is not avoided, fatality or very serious injuries may be caused.

⚠ **CAUTION**

Identifies situations that may be dangerous. If this situation is not avoided, minor or light injuries may be caused.

NOTICE

Refers to a situation that may cause property damage.

1.05 Safety Instructions

The HCQ Navigator and the associated system components have been produced according to the state-of-the-art. However, danger for life and health of the user or impairment of the machine and of other objects can arise due to their function during the use of the machine.

Read and comply with the following safety instructions before using the product.

- When using the HCQ Navigator together with a roller, also observe all the safety instructions and hazard warnings involved with using the particular roller.

- Read the relevant instruction manual for the proper and safe use of the additional equipment.

- Only trained or instructed personnel be used.

- Configurations and settings may only be made by trained and instructed skilled personnel with knowledge of the machine engineering and the Continuous Compaction Control (FDVK).

- This must be switched off during all assembly work on the roller.

- When installing the DGPS-(Differential Global Positioning System) receiver ensure that you have a secure footing.

- Only use the rubber-tipped pen supplied (digitiser). Other objects damage the surface of the touch-screen of the Panel PC. Such repairs are not covered by the warranty of HAMM AG.

- Electrical connections may only be made to standardized earthed sockets. Do not use damaged power cables. Disconnect the electricity supply before changing locations.

- Do not use the HCQ Navigator near radios or television sets. This could cause radio frequency interference.

- Do not install the Panel PC near electromagnetic fields. This can lead to loss of data on the hard disk.

- Always keep batteries fully charged to ensure that they are always ready for use.

1.06 Intended Use

The HCQ Navigator and the associated system components may only be used in technically unobjectionable condition, as well as according to the intended use, and aware of safety issues and possible dangers, always observing the operating instructions. Use under improper conditions can cause the following serious situations:

- **Danger to the well-being of the user or third parties**

- **Adverse effects on the machine and other physical assets of the user**

- **Endangering the efficient, cost-effective working of the complete system**

Proper use is deemed to be using the HCQ Navigator for Continuous Compaction Control (FDVK) of earthworks and asphalt laying. Only use of the product components supplied in the specified form is accepted. Proper use also includes following the operating manual and thus the manufacturer's guidelines.

Die HAMM AG does not accept any liability for consequences or damages arising from improper use of this product. In such cases the user will bear the complete risk. Unauthorized changes of the product will exclude the manufacturer's liability for any damage resulting from this.

As the HCQ Navigator is software supported, reference is made to the currently valid guidelines for working with a visual display unit.

The scope of supply includes a specific manual for the Panel PC. The warning, safety and working instructions in this manual must also be observed.

The HCQ Navigator has been developed for use with rollers. There are separate operating manuals for these machines and other components. They contain warning, safety and working instructions which must be observed, independently of this operating manual.

Please contact your local Wirtgen Group Service Partner in the event of technical problems or for more detailed information that is not contained in this edition.

1.07 Disposal

Conservation of nature is one of our major tasks. Properly disposed devices avoid negative impacts on human beings and the environment and allows re-using our precious resources.

Materials (metal, plastics) To be able to dispose materials professionally, these materials need to be correctly sorted. Cleanse materials of adhesive impurities.

Please dispose all materials as demanded by local provisions of the relevant country.

Electical / electronic system / battery The electrical / electronic components are not subject to directive 2002/96/EC and the corresponding national laws (in Germany e.g. ElektroG)

Dispose electrical / electronic components directly at a specialised recycling company.

1.08 Application possibilities of the HCQ Navigator

Continuous compaction control and evaluation (FDVK)	Guiding and checking the compaction process
	Compaction measurement and indication the stiffness
	Checking unbonded layers consisting of non-cohesive mixed grains, sands and mixed grain soils with a low fine-grain fraction
	Uniform compaction with the minimum number of passages

Detection of defective and weak spots	Minimisation of sources of error
	Localization of non-visible blocks and filled-in trenches
Calibration	Calibration of selected points with static plate load tests or other methods
	Calibration diagram
	Automatic determination of regression line
Control of the work plan (test method M3)	automatic storage of measuring values
Statistical evaluation	Statistics window
Derivation of compaction rules	Cut function

Areas of application
- road construction
- landfill construction.
- dam construction
- airport construction
- railway line construction
- industrial construction sites

1.09   Functions and features

General		
	Simple, user-friendly operation	Fast familiarization through the use of conventional icons
		Adjustable user interface to give the driver a better overview
		Transreflective touch-screen
	Simplest orientation even on large building lots	Precise DGPS position finding
		Continuously adjustable zoom
		Digital planning data can be used as an aid to orientation
		System can be used without first entering planning data
	Clear data management and archiving	Data transfer by means of the supplied USB 2.0 stick
		Subsequent processing with standard software
	Print function	On the Panel PC via a PDF / directly on the office computer
	Office software	The software CD included in the scope of supply can be used without restriction
	Export function	Exports the recorded measured data for further use in other software

Advantages for the driver		
	Monitoring of the rolling process	Display the current compaction status
		Compaction only where it is required
	Detection of weak points	Quick reaction
		Search for weak points
	Efficient compaction work	Prevention of under and over compaction
		Flexible compaction work
		Time savings
		Saving of diesel fuel
	Work record	Unbroken documentation of the compaction results

Advantages for the employer	**Optimal quality assurance**	Complete record of the compaction work done for the building clients
		Avoidance of warranty costs
		Instrument for self-monitoring
		Control of the work done on the site
	Detection of weak points	Search for weak points
		Rectification of weak points (soil replacement, soil improvement), reduction of conventional measurements

Advantages for the building owner	**Control of the work plan**	Clear, easily understandable compaction log
		Selective re-examinations can be done quickly
		Necessary actions can be taken immediately

2 DESCRIPTION OF HARDWARE

The degree of compaction and bearing capacity are important parameters for the ground quality of soil layers.
The HCQ Navigator enables a satellite supported area compaction control even while compaction is taking place. So the measurements are recorded during rolling process.

The driver can see the number of passes, the asphalt temperature, the compaction and the quality of the compaction, as well as other things on the screen. Thy system saves the compaction temperature and position data.
It also provides comprehensive possibilities for the continuous and reproducible documentation and analysis of compaction results.

> **i** Before a measuring pass, the site management has to create a project containing the necessary project parameters ().

2.00 Method of operation of the HCQ Navigator

Example of compactor The vertical vibrations of a drum are generated by rotating the vibrators inside the drum. As a rule, vibrating rollers are equipped with a large and small amplitude. An appropriate frequency is assigned to each amplitude.

The distance is measured and the position found via the receiver of a Differential Global Satellite Navigation System (DGNSS).
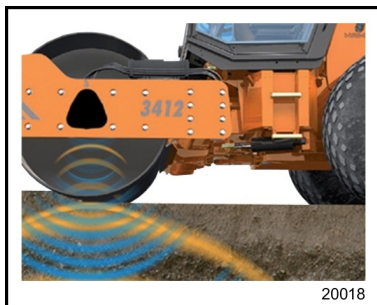
The activated drum together with the subsurface form a vibrating system. This changes its behaviour as the compaction of the ground increases.
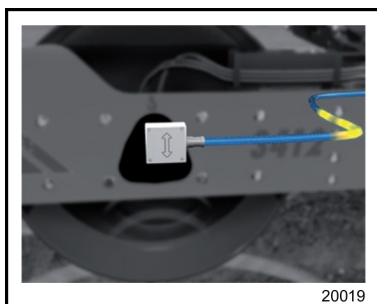
The sensor is mounted on the vibrating components of the drum. It measures the ground reaction in the form of a vertical acceleration, and converts this into a measured compaction value. The calculated HAMM measured value (HMV) describes the stiffness of the ground.

The current HMV is indicated to the operator on the instrument panel, either by an analog dial or a bar diagram (see the manual for the particular machine).

The position of a roller can be determined from the signals from at least 4 satellites of a Global Satellite Navigation System (GNSS).

A DGNSS receiver is used to meet the requirements for Continuous Compaction Control, which achieves an accuracy in the decimetre range by means of a differential or correction signal. A DGPS receiver is used as standard for the HCQ Navigator.

The compaction and position data are combined and prepared for visualisation. Complete documentation and evaluation is thus possible even while compaction is taking place.

2.01 Scope of delivery

The individual components of this HAMM Compaction Quality System are optimally matched to one another.

Compactors pre-equipped with the HCQ Navigator, are fitted in the factory with the HCQ Indicator, speed and frequency displays, and corresponding holders. All functions for evaluating the measurement results are integrated into the HCQ Navigator. No additional systems are required.

The individual components of the HCQ Navigator are supplied in a lockable suitcase.
After the components have been removed, the case must be kept in a safe place, so that the components can be stored safely if they are temporarily taken out of use.

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[A]	Panel PC with touch screen and digitizer	**[B]**	Power packs / Power cable / DGPS connecting cable / USB 2.0 stick
[C]	Panel PC and DGPS receiver manuals	**[D]**	DGPS receiver with magnetic feet

2.02 Technical Data

Please refer to the manuals supplied for the technical data concerning the Panel PC and the receiver.

2.02.01 Conditions for Operation, Storage and Transport

	Panel PC (iX104C5 DMSR)	Receiver
Weight	2.4 kg	1.9 kg
Operating temperature	–34 °C to +60 °C	–30 °C to +70 °C
Storage temperature	–51 °C to +71 °C	–40 °C to +85 °C
Casing	– Protection class IP67 (dust and water resistance) – UV resistant – Robust resistance to vibrations, impacts and other environmental effects (tested according to MIL-STD 810G)	– Protection class IP65 (dust and water resistance) – UV resistant – Resistant to vibration and shock according to MIL-STD 810E/F

i Please refer to the supplied Panel PC and receiver manuals for further information.

2.03   System components of the HCQ Navigator

Example of compactor

20088
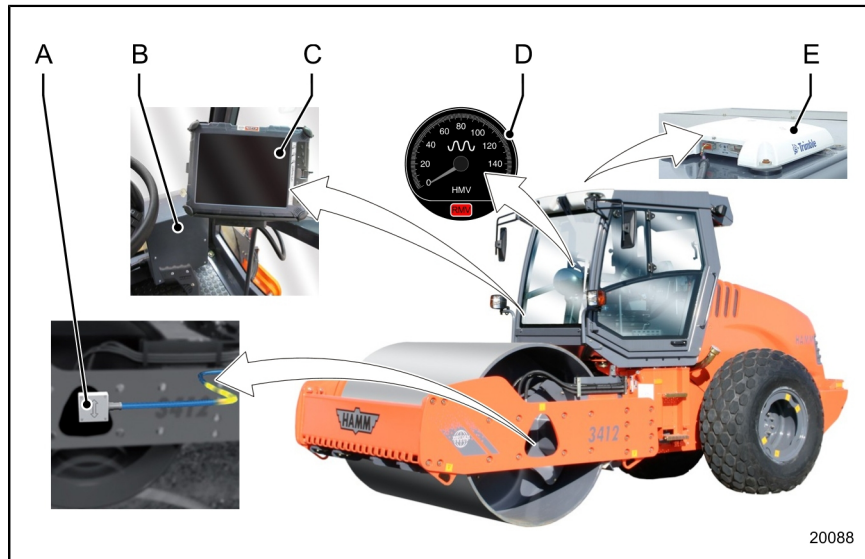
[A]	Compaction meter (drum, left)	**[B]**	Central electrical system with compaction computer
[C]	Panel PC (in holder)	**[D]**	Dial in instrument panel
[E]	Receiver		

2.04   DGPS receiver

2.04.01   Installation Location of Receiver

20167
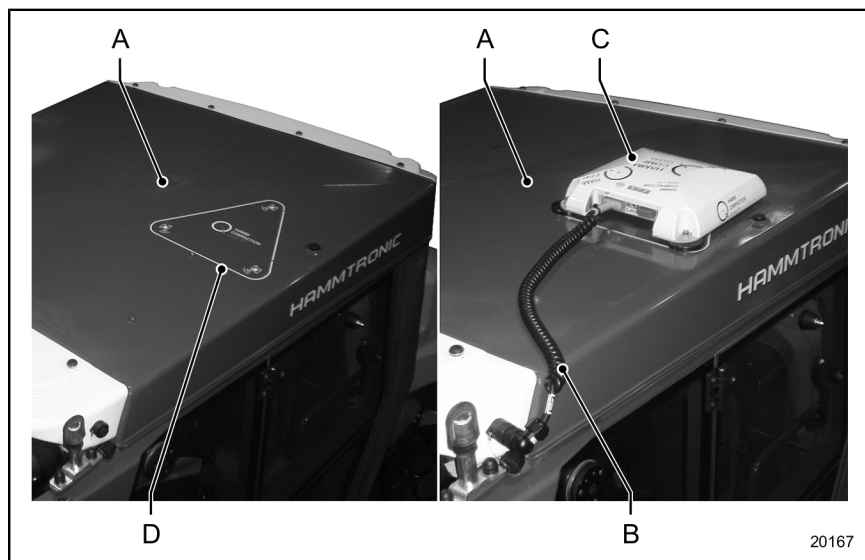
[A]	Roller roof	**[B]**	Connecting cable
[C]	DGPS receiver	**[D]**	Marking

2.04.02   Receiver

DGPS receiver
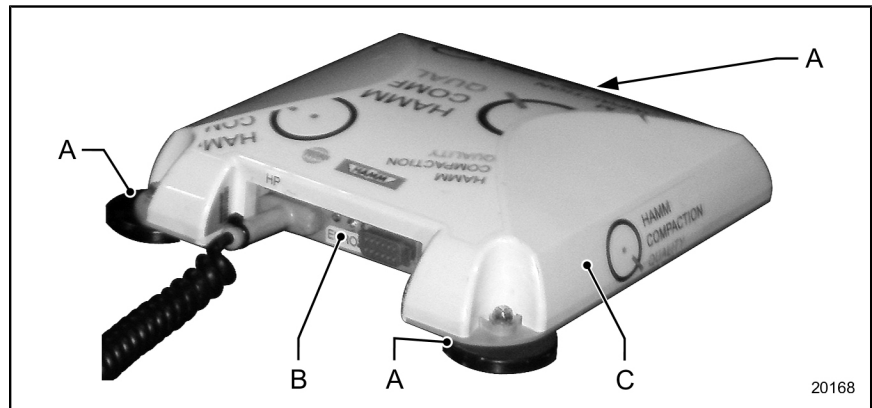
[A]	Magnetic feet	**[B]**	Connection panel
[C]	Receiver casing		

Optional RTK receiver
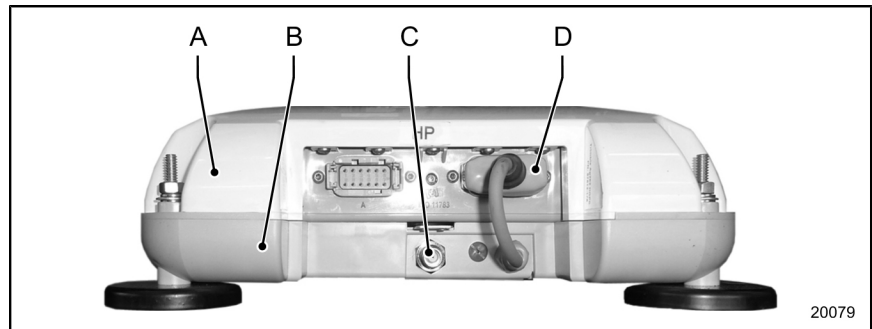
[A]	DGPS receiver	**[B]**	Modem (only when used with real-time kinematics - RTK)
[C]	Radio antenna connector	**[D]**	Connector plug

2.04.03   Receiver connection panel
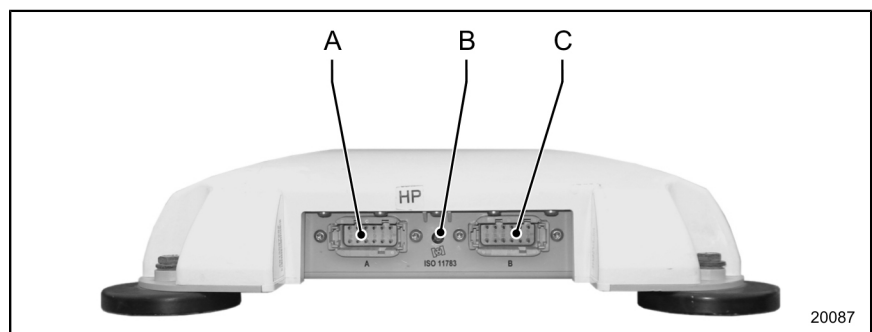
[A]	Port A — HCQ interface	**[B]**	LED receiver status
[C]	Port B — modem interface		

Port A / Port B   Both connectors can fulfil the following functions:

- Serial communication to the HCQ compaction computer
- Communication to the radio modem, if the DGPS difference signal is taken from a local base station.

LED indicator   The following tables describe the sequences of control lights for the individual positioning methods.

LED sequence for WAAS / Egnos and Omnistar VBS

LED colour	LED condition	Status
Off	Off	No power supply
Green	steady light	Normal operation: calculation of DGPS positions (**D**ifferential **G**lobal **P**ositioning **S**ystem)
Green	flashes slowly	No DGPS corrections: Calculation of DG-PS positions using old correction data
Green	flashes quickly	No DGPS corrections reach the DGPS age limit: Calculation of DGPS positions using old correction data
Yellow	steady light	DGPS corrections are received, but no DGPS positions are calculated yet: calculation of autonomous GPS positions
Yellow	flashes slowly	No DGPS corrections: calculation of autonomous GPS positions
Yellow	flashes quickly	Not enough GPS signals: Number of tracked satellites too low to calculate positions

i	WAAS/EGNOS, OmniSTAR VBS and OmniSTAR HP use the satellite-supported differential GPS positioning method.

LED sequence for RTK positioning

LED colour	LED condition	Status
Off	Off	No power supply
Green	steady light	Normal operation: calculation of Fixed-RTK positions (**R**eal **T**ime **K**inematik)
Green	flashes slowly	CMR corrections received, but not initialised: calculation of Float-RTK positions
Green	flashes quickly	No CMR corrections: Calculation of RTK position using old correction data
Yellow	steady light	CMR corrections received, but RTK position cannot be calculated: Calculation of the DGPS (if WAAS/EGNOS is not available) or autonomous position.
Yellow	flashes slowly	No CMR corrections: Calculation of the DGPS or autonomous position
Yellow	flashes quickly	No reception of CMR corrections: No positions are calculated

LED sequence for OmniSTAR HP positioning

LED colour	LED condition	Status
Off	Off	No power supply
Green	steady light	Normal operation: Calculation of converged OmniSTAR HP positions
Green	flashes slowly	Reception of OmniSTAR HP corrections, but only an unconverged position can be calculated
Green	flashes quickly	Reception of OmniSTAR HP corrections, but an HP error has occurred
Yellow	steady light	Reception of OmniSTAR HP corrections, but no position can be calculated Calculation of a DGPS or autonomous solution.
Yellow	flashes slowly	No OmniSTAR HP corrections: Calculation of a DGPS or autonomous position
Yellow	flashes quickly	No OmniSTAR HP correction data are tracked: No positions

2.05   Panel PC

Front view

20171

[A]	Microphone	**[B]**	Loudspeaker
[C]	Function indicator	**[D]**	Brightness sensor
[E]	Reset button	**[F]**	PC status indicator

Reset button

The Panel PC can be switched off with the Reset button, if inputs are no longer possible and the ON/OFF switch does not work.

Status display

The current status of the Panel PC is shown by the status indicator (on, off etc.).

Brightness sensor

The brightness sensor checks the light conditions and regulates the screen lighting.

Function indicator

The hard disk activity is shown here.

Rear side
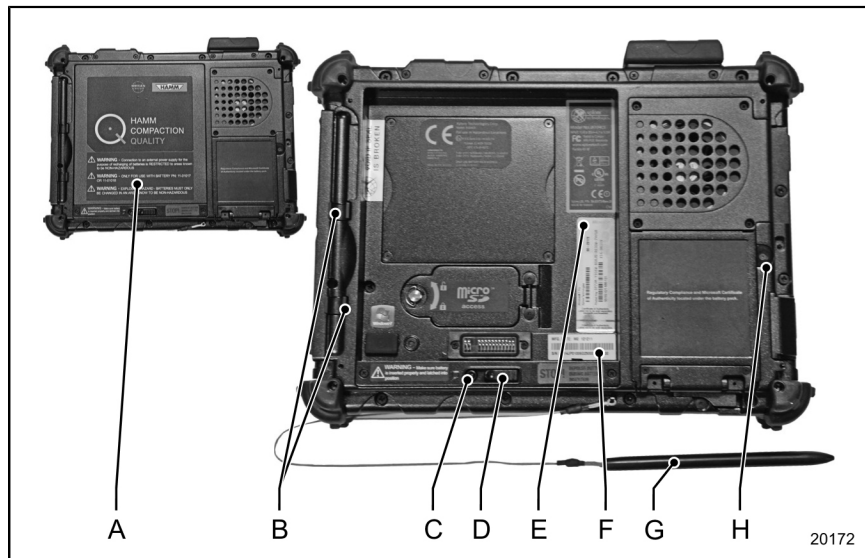
[A]	Battery	**[B]**	Digitiser holder
[C]	Battery catch	**[D]**	Battery lock
[E]	Certificate of Authenticity	**[F]**	Series number
[G]	Digitizer	**[H]**	Camera

Battery

The battery supplies the energy when the Panel PC is not connected to a power supply.

Battery catch

The catch holds the battery in the Panel PC.

Battery lock

The lock secures the connection to the battery.

Digitiser holder

For holding the digitiser when it is not in use.

Digitizer

The digitiser (rubber tipped pen) is the standard tool for navigation and operation within an application.

Left side

20004

[A]   On / off switch

On / off switch

The On / Off switch:

- switches the Panel PC on and off.
- switches the background lighting on and off.
- activates/deactivates stand-by mode.

Right side

20003
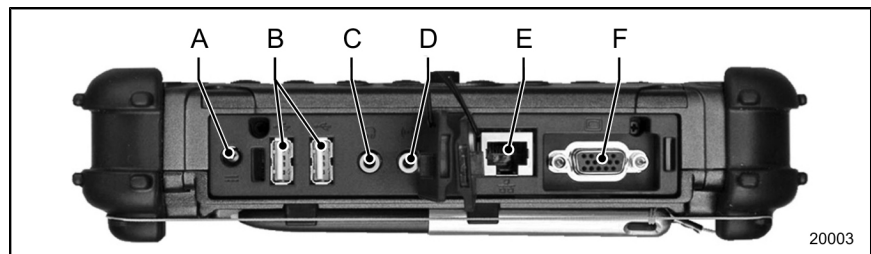
[A]	Power input	[B]	USB 2.0 interfaces
[C]	Headphone / speaker connector	[D]	Microphone connection
[E]	LAN connection	[F]	VGA interface

Power input

Power supply with power pack

USB 2.0 interfaces

Connection of USB 2.0 devices (e.g. mouse, keyboard, USB stick)

Headphone or speaker connector

Stereo headphones or speaker connector

Microphone connection

Connector for external microphone

LAN connection

Standard connection RJ-45

VGA interface

Connection of an external monitor

LED display The LEDs indicate the system status.

[A]   Status indicator   [B]   Brightness indicator
[C]   Function display

Status indicator

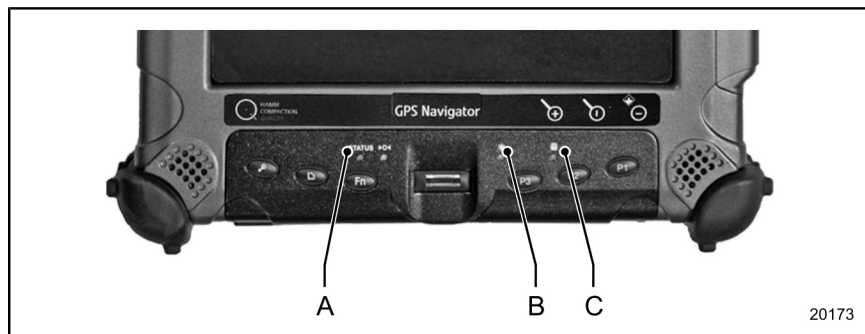|	
green, steady light	The PC is switched on and the battery is fully charged.
green, flashing	The power unit is connected. The battery is recharging.
no light	The PC is switched off.
yellow, steady light	The PC is switched on and in stand-by mode.
yellow, flashing	The PC is switched on and in the warm-up phase. LCD and background lighting are still switched off. They switch on automatically after the warm-up phase.
red, flashing	The PC is switched on in battery mode. The battery is at minimum charge. The power unit must be connected to the power supply.
red, steady light	– The PC is switched on in battery mode. The battery charge is at critical level. The power unit must be connected to the power supply. – The PC is defective (please contact your Wirtgen Group Service Partner).

Brightness indicator

yellow, steady light	Automatic brightness control is activated.
no light	This is the default setting. The brightness control can be set manually.

Function display

green, steady light	The hard disk is ready for operation.
no light	The hard disk is not ready for operation.

Function Keys   The function buttons provide direct access to relevant program functions.
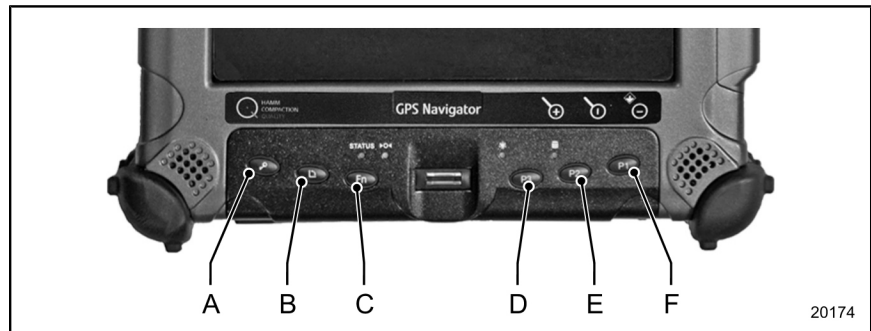
[A]	Safety key	**[B]**	Format switch
[C]	Function key Fn	**[D]**	P3
[E]	P2	**[F]**	P1

Safety key (do not touch)

Block computer

Format switch

To select portrait or landscape format

Function key Fn

Button not in use

P1

Record measuring point

P2

Reduce

P3

Increase

Digitizer

NOTICE

Pointed objects will damage the touch-screen!
When operating the HCQ Navigator with the touch-screen, do not use any objects which could damage the touch-screen! Such repairs are not covered by the warranty of HAMM AG.

The digitiser is a pressure-sensitive pen with a rubber tip used for operating the Panel PC.
The digitiser performs the essential functions of a mouse for navigation and operation within an application. It is attached to the back of the Panel PC.

20170
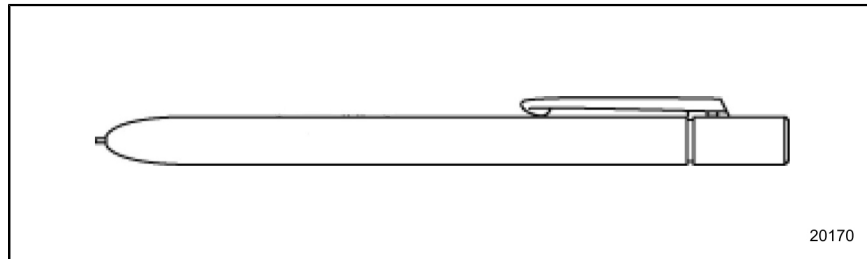
The following functions are executable:

Function	Version
Select object	Touch object with pen
Double-click	Double-touch object with pen
Right click	Position the pen on the object for about 1 second
Drag & Drop	Position the pen on the object, drag it across the screen, and drop it at the desired position.

2.05.01   USB mouse

The usual navigation options can be used if a USB mouse is connected.

2.05.02   Keyboard

USB keyboard If a keyboard is connected, all the navigation options of a conventional keyboard can be used (e.g. cursor keys).

On-screen keyboard In the various input dialogs, the screen keyboard can be opened with the "Change" buttons or the Keyboard icon. In this way, all the navigation options of a conventional keyboard can be used (e.g. cursor keys)..

2.06   Central Electrical System of the HCQ Navigator

Installation locations

20016

[A]	Driver's seat	**[B]**	Steering column
[C]	Panel PC holder)	**[D]**	Instrument panel
[E]	Central electrical system		

20037
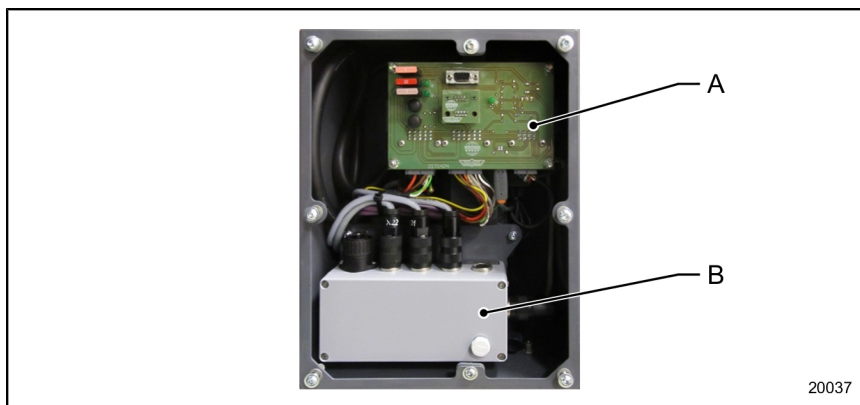
[A]	Printed circuit board of HCQ central electrical system	**[B]**	Compaction computer HCM

2.06.01 Panel PC power supply

During operation in a roller, the Panel PC is supplied with power from the vehicle's PC holder. This is connected to the on-board electrical system of the roller.

20038
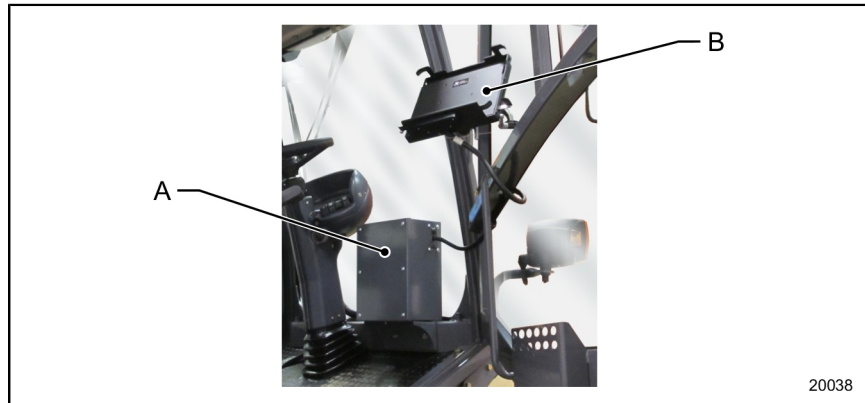
[A] Central electrical system   **[B]** Vehicle's PC holder

The Panel PC can be used outside a roller as follows:

- External power supply - with a power unit
- Internal power supply - with a battery

2.07 Control and Operating Elements

Overview of the instrument panel of a compactor

20010

Overview of the instrument panel of a series HD+

20103

Overview of the monitor display of a series DV

20108

2.07.01 HMV indicator

20011

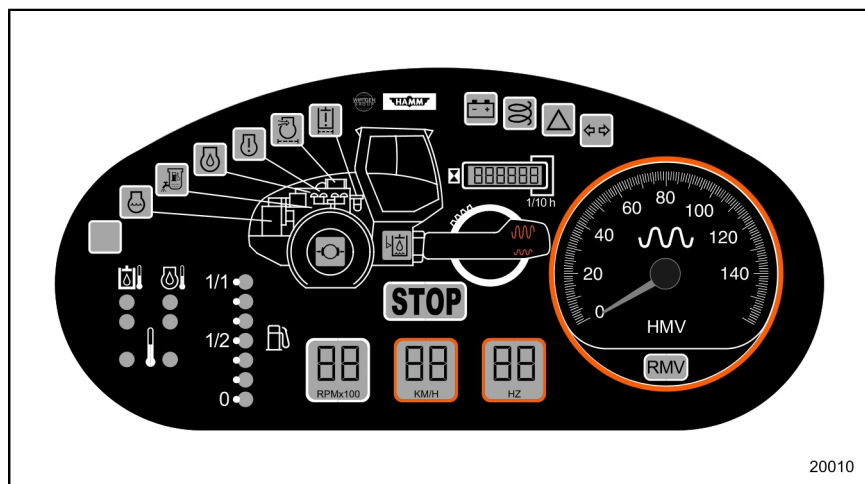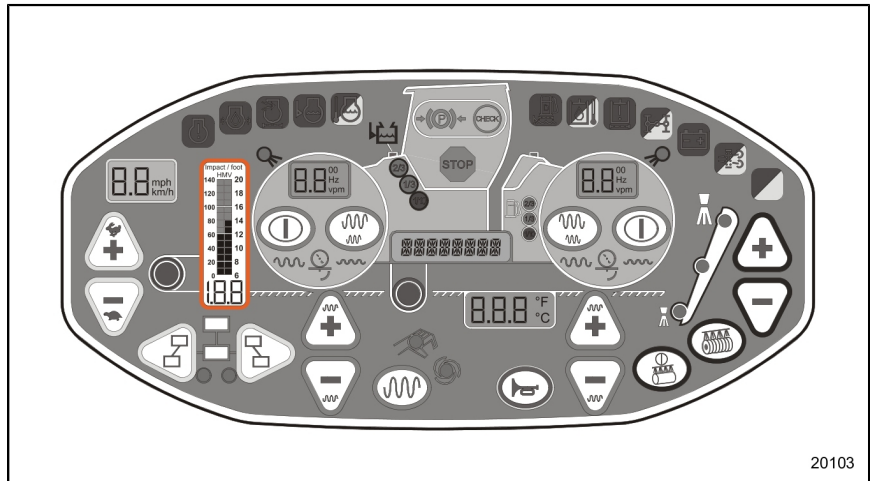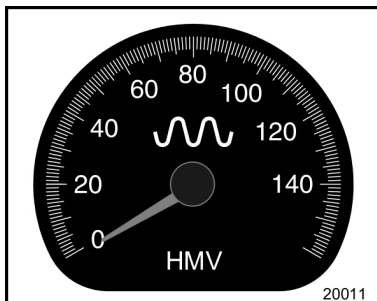The HAMM Measurement Value display (HMV, the indication of the compactors in the figure) indicates to the driver the current stiffness and the maximum possible compaction that can be attained with the roller.

- **Needle rises:**
  Material can be compacted - further passes are required!

- **Needle stops rising:**
  Maximum compaction has been attained - stop compacting.

- **Needle falls:**
  Drum is in jump operation or the material cannot be compacted (cohesive soil with an excessive water content).

HMV value

The HAMM Measurement Value (HMV) corresponds to the actually measured, relative compaction value. This value provides information about the ground compaction achieved, and shows the driver where the ground still needs to be compacted and where compaction is already complete. Subareas which are differently compacted (e.g. areas which are difficult to compact or are non-compactible) can thus be delimited to make the compaction work more efficient.

As a rule, each passage increases the HMV of a layer which is being compacted. The absolute HMV and the increase in compaction per passage depend on the type of roller, the set machine parameters (speed, frequency and amplitude) and the compacted subsoil (layer thickness, water content, type of ground).

If a repeated passage over an area does not increase the compaction or change the HMV, the particular roller must not be used for further compaction. The compaction work is finished as soon as the desired compaction result has been achieved. Otherwise, further measures must be taken (e.g. using a different roller, drying out the subsoil, changing the compaction material).

2.07.02 Resonance Meter Value (RMV) indicator (not present in all machine series)

Example of compactor

20013
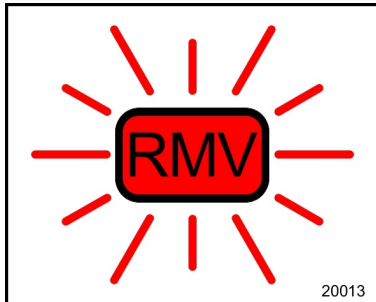
The illuminated display of the Resonance Meter Value (RMV) serves as a jump operation warning light. The light flashes slowly or quickly depending on the intensity.

Cause	Elimination
Incorrect amplitude	Change from large to small amplitude (vibrator
Maximum compaction has been attained	Stop compacting
Machine too light	Use a heavier machine (especially in the case of rock)

RMV indicator (jump operation)

The resonance meter value (RMV) describes the jump operation of a vibrating drum as a result of an unfavourable combination of machine type, machine parameters (e.g. frequency and amplitude) and the state of the compacted subsoil. The RMV provides information about the drum possibly lifting off the ground if the subsoil is very stiff.

The behaviour of the roller changes markedly in jump operation.

Characteristics of jump operation	Results
Strong vibrations, higher noise level	– Severe ergonomic stress on the roller driver – Severe stress on/damage to the roller – Noise pollution of the environment
Falling HMV (half amount)	Loosening of the ground
RMV indicator flashes	Drum approaching jump operation
RMV indicator lights	Drum in jump operation

Switch to the small vibration amplitude if there is any sign of jump operation! If the RMV indicator flashes or lights up after the change, stop compacting and, if necessary, use a different roller.

i Jump operation is forbidden during the last passage of a Continuous Compaction Control (FDVK)!

i Please refer to the corresponding operating manual for information about vibration / oscillation of the HD+ or DV machine.

3 DESCRIPTION OF THE SOFTWARE

3.00 User interface
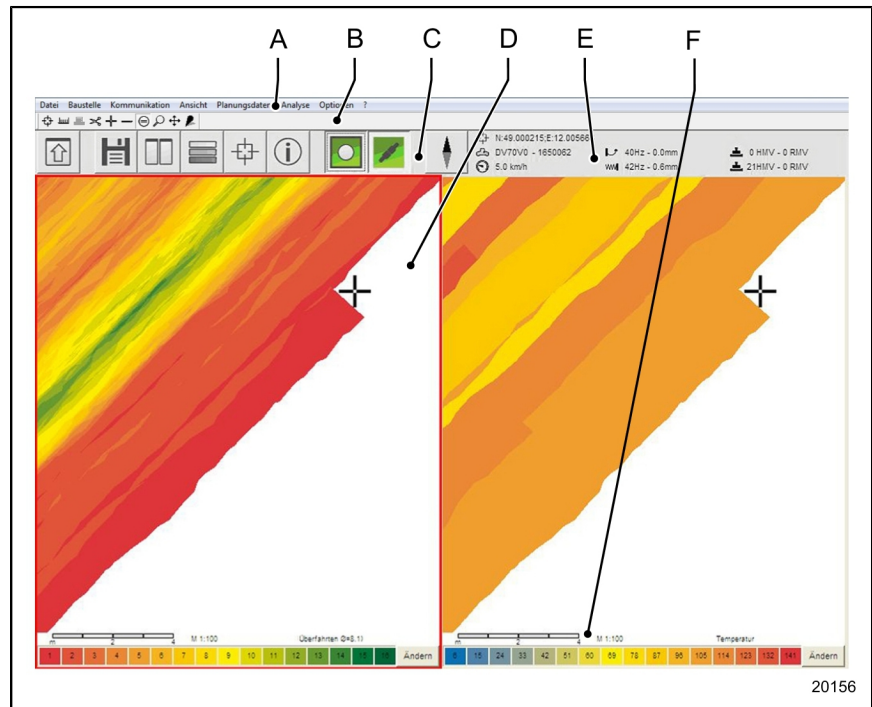
A	Drop-down menus	**B**	Toolbar
C	Button bar	**D**	Display frame
E	Display fields	**F**	Legend

All the required settings for the actual project can be made on the program interface, new projects can also be created, and a wide range of evaluations made.

The pull-down menu line and the toolbar can be hidden with the "Show/ hide menu" button in order to obtain a clearer view during the rolling process / compaction.

The following information can be read on the Panel PC during the compaction process:

Earthmoving	Asphalt laying
Number of passes	
Soil stiffness (HMV)	
Compaction change	Temperature
EV1 / 2 / d	
RMV	
Frequency	
Amplitud	
Cross section	
Speed	
Absolute height	
Satellites	

3.00.01 Title bar

The title bar above the screen window indicates the name of the project, the site section and the layer.
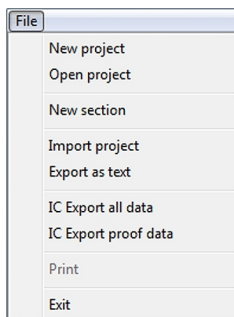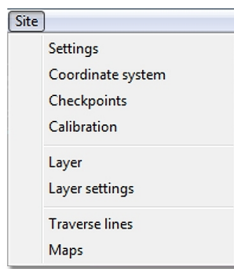
3.00.02 Drop-down menus

The following menus are arranged in this line:

- File
- Site
- Communication
- View
- Planning data
- Analysis
- Options
- ?

File

The **File** menu contains important standard commands such as Open, Create new project, Import / Export data and Print.

Site

The **Site** menu contains commands for configuring the project parameters.
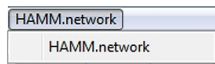
Communication

The **Communication** menu opens the *Communication* window with the list of all rollers in the WLAN group.

New rollers that have to be added to the group can be connected here.

When the program starts, an error message appears if there is no to the WLAN connection to all the machines switched to active.
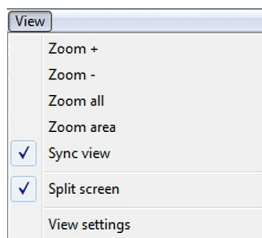
View

The **View** menu contains the main standard commands for zoom, screen segmentation and window displays.
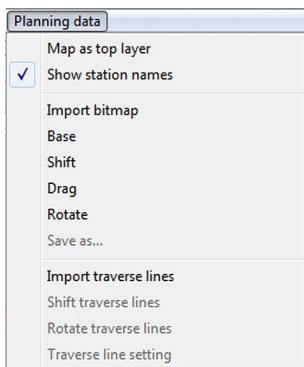
Planning data

| i | The Planning data menu is only available to "Expert" and "Service" users. |

This menu contains the commands required to input digital information about the landscape and the locality (e.g. maps) into the measurement and position data, and to adjust to the map / map position.
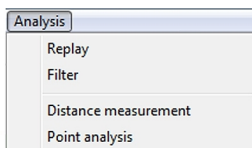
Analysis

This menu contains a range of evaluation options.
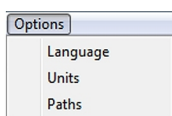
Options

The **Options** menu contains the main standard commands for setting the languages, units of measurement, and project paths.

?
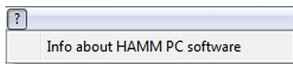
This menu provides a short description of the program and states the version being used.
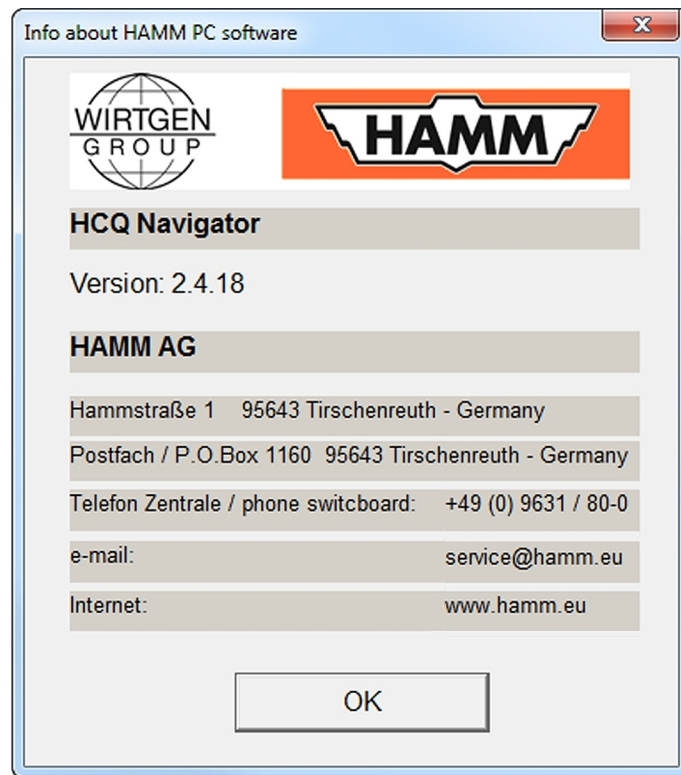
3.00.03   Toolbar
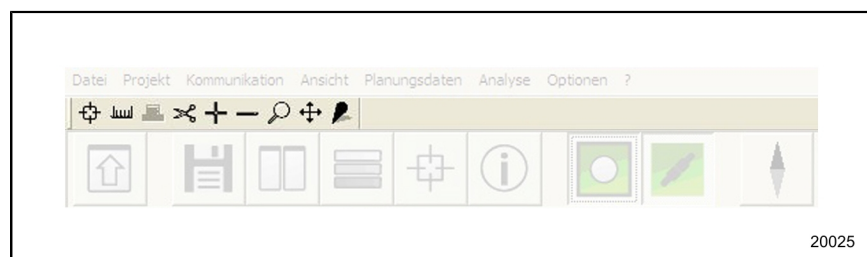
The toolbar contains buttons for quick access to program functions:

Find

Provides information about a freely selectable position within a display frame. The point to be investigated is selected by a single stationary touch and a short movement of the digitizer, and indicated by a cross. The available information appears on the left in the bottom bar.

Distance

Distance measurements within a displayed area. The distance is measured by touching once, and dragging within a displayed area. An arrow indicates the distance and direction of the measurement. The distance information is in the status bar (bottom left).

Printing

The *Print window* dialog box opens for printing, for selecting the window to be printed, and for configuring a connected printer, similarly to the printer setup command in the **File** menu.
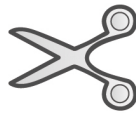
Cross section

Evaluation of the compaction development in a diagram (separate window,).

Increase

Magnifies the measurement and evaluation data for the detailed view.

Reduce

Reduces the size of the measurement and evaluation data to give a clear view.

Zoom

Continuously adjustable magnification of a specific area.
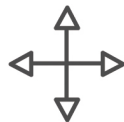
Adapting

Adjusts the size of the visualization to the display window.

Position

With an active window, the **Point analysis** dialog box, in which the selected position is evaluated, is opened by setting a point.

3.00.04 Button bar

20026
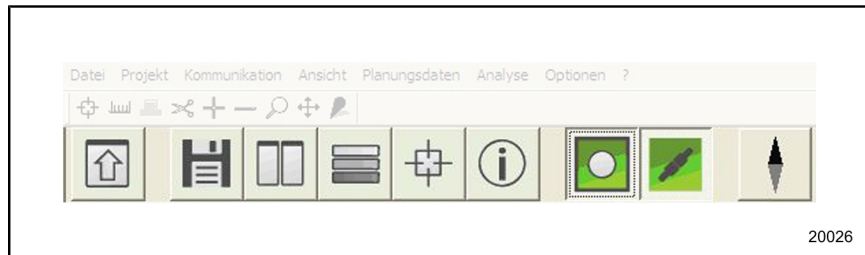
The buttons provide quick access to the most important program functions.

Show/hide menu

Shows/hides the menu bar with the buttons and display areas, and deactivates filter settings. This makes the maximal screen area available for the graphic compaction documentation, and simplifies the touch-screen operation.

Archiving

This button creates a copy of the complete site data, with date and time stamp, on the external data storage device (USB stick). Clicking the button opens the window to select the storage location.

View

Opens the *Window* dialog box to select predefined views.
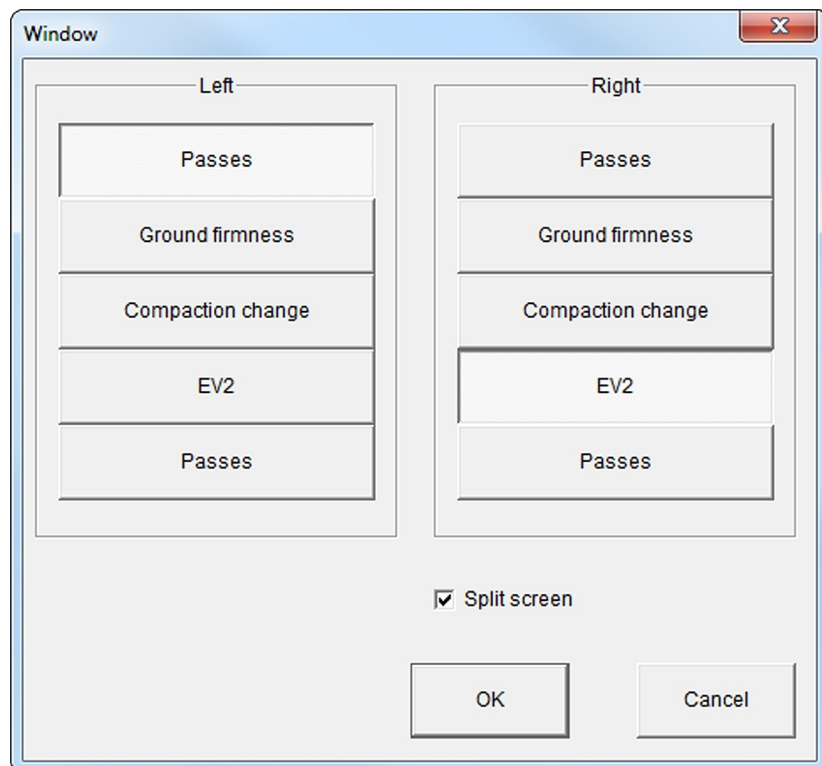
Layer selection

Opens the **Layer selection** window to select predefined layers for the current compaction documentation.

Layer selection
schicht 2
schicht 3
schicht 4
schicht 5
schicht 6
Erdplanung
schicht 7
schicht 3
schicht 4
schicht 8
FSS Schicht

OK   Cancel
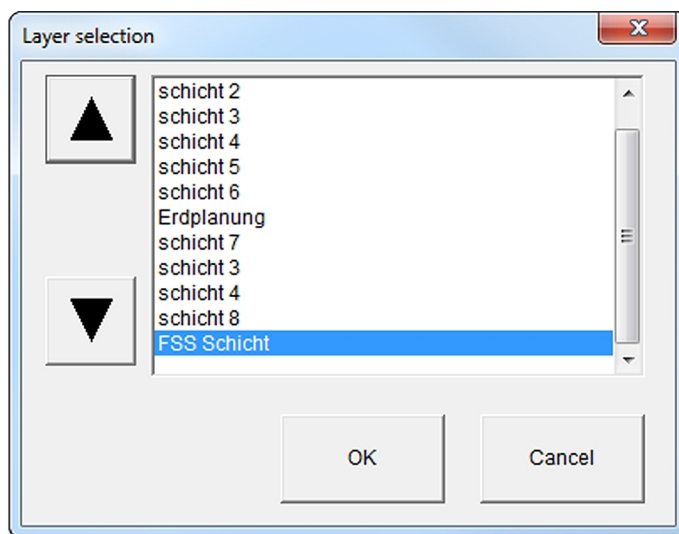
Inputting Measuring Points

Clicking the button saves a measuring point with the current geoposition. The measuring points are further processed in other menus in configuration mode.

More information and work instructions

This button calls information that the driver needs for correct performance of the compaction work. In the case of earth work with a calibrated HCQ system, this is the specification of the work parameters that have to be maintained, such as driving speed, set amplitude and vibration frequency.

Work instructions	
Current information	
Software version	2.4.18
GPS-quality	GPS no signal
Version model	203
Software version HCM	--

In order to ensure measuring accuracy in accordance with the specified calibration, the compaction process must be performed with the following settings:

Speed	3.00	km/h
Frequency	24	Hz
Amplitude	0.80	mm
Direction of travel		Forwards

OK
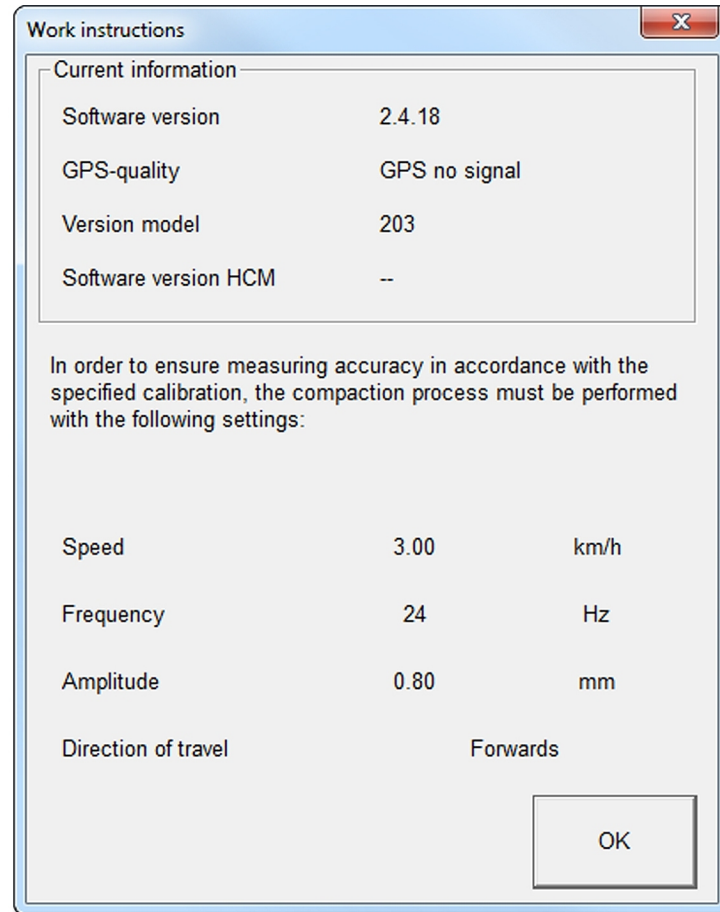
Start / Stop

This button starts and stops the recording of compaction measurements. The communication states are indicated by two icons "Recording on" and "Recording off", which are shown alternately.

Online / Offline

Communications link to the roller. This button is used to show/hide the evaluation of the geo position in the graphic view. The cross hairs are visible when the link is activated, and they show the exact geo position of the centre of the front roller drum.

Geographical orientation

The geographical orientation of the graphic view is only shown if the system is in neither warning nor error state. Then the button can be used to turn the orientation anticlockwise in steps of 45.

3.00.05 Display fields

⊕ N:49.000046;E:12.004241		
☁ DV90VO - 1660018	Ⱳ 38Hz - 0.8mm	⬆ 104 HMV - 3 RMV
◷ 5.0 km/h	⤵ 38Hz	⬆ -

20099
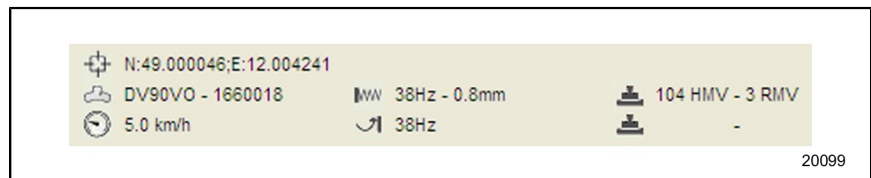
Display of system status and geographical orientation

If the system is in warning or error state, these icons are used to visualise the main system state of the machine:

Warning: The warning state indicates a problem which restricts but does not prevent documentation of the compaction. If the warning icon is activated, a short explanatory text appears in the warning text line at the top right.

Faults: The compaction documentation cannot be recorded in error state.

Geo position indication

The current geoposition of the centre of the front drum according to the set coordinate system is shown alongside the icon. The colour of the icon indicates the accuracy of the signal.

Display of machine info

The type of machine used and the works number of HAMM AG are shown alongside the icon.

Driving speed indicator

The current driving speed is shown alongside the icon in the pre-set view.

Display of work mode

The current work parameters are shown here with icons and numerical text. The top line refers to the front drum and the bottom line to the rear drum. There is no second line in the case of rollers with only one drum.

– Front roller drum

Operation with vibration

Operation with oscillation

Static operation with steel drum

Static operation with rubber-wheeled drum

– Rear roller drum

Operation with vibration

Operation with oscillation

Static operation with steel drum

2356591_00_BAL_HCQ_H900_en   © HAMM AG 2013

Static operation with wheelset

Display of ground compaction measurement

Information about the ground compaction is shown here with icons and numerical text.

Icon during earth work

Icon during asphalt work

3.00.06   Display frame
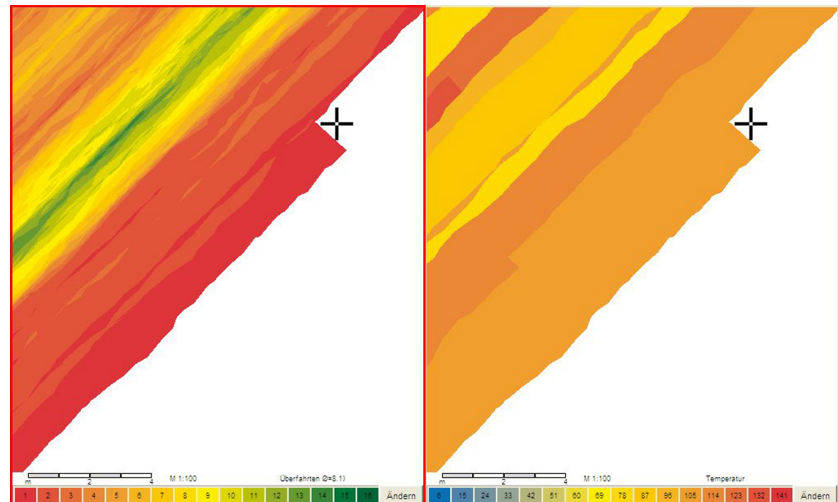
Various views of the measurement and position data, or analysis values (passages, compaction, quality of compaction, cut, statistics, etc.) are shown in the display frame. The maps or geo lines included in the project can also be displayed to improve orientation on the site.

The orientation of the site, the scale and the name of the current view are shown in the bottom part of the views. The colour scale enables the displayed measured values (value range and compaction quality) to be quickly recognised.

The visualization can be displayed by a single view covering the entire screen or in two display frames.

3.00.07 Legend

The following information is given in the legend according to the set window and tools used:

● Scale of the view

● Name of the window

● Assignment of colours to numerical values

20092
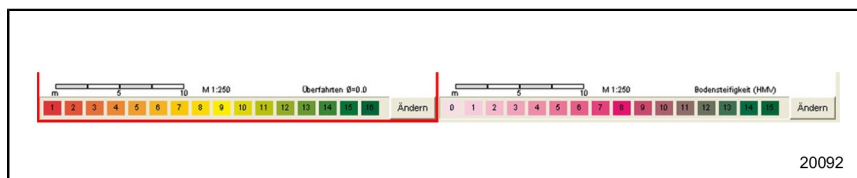
3.01 Projections

3.01.01 Maps

Maps are useful options for orientation on the site (e.g. earth work, for the construction planning, and for documenting the compaction results.
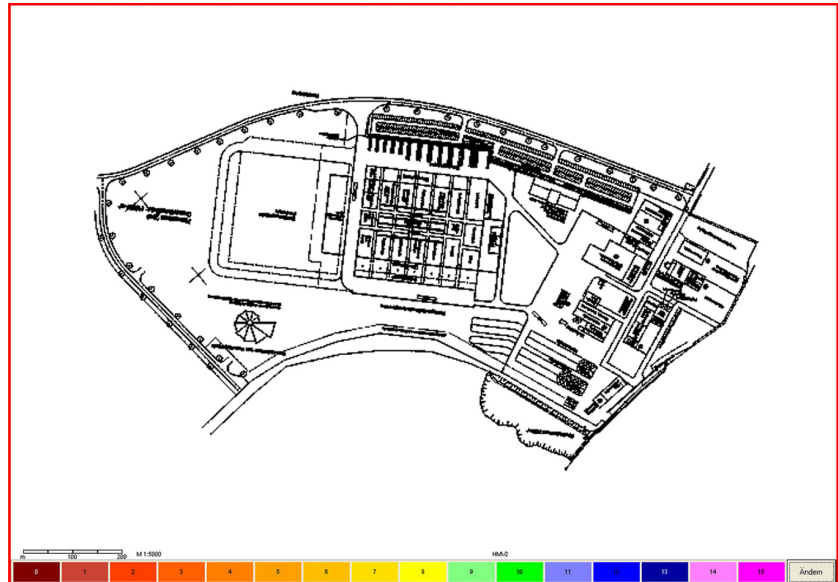
After the processed bitmap has been saved, two files are created in the directory \HammHcqData\Maps. Both have the name of the bitmap. The only difference is in the file extension.

- HAMMLandKarte (*.hlk) contains the actual graphic.
- HAMMDatenReferenz (*.hdr) contains the description of the reference points with the orientation data (displacement and rotation) of the graphic.

All Windows bitmap types (*.bmp; 24 bit, 256 colour, 16 colour, monochrome) can be imported.

The white areas of the imports are shown transparent. so measurement data on white areas of the bitmap are not covered.

3.01.02 Geolines
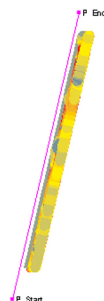
Geo lines are useful options for orientation on the site (e.g. motorway construction, road building), for the construction planning, and for documenting the compaction results.

Geo lines are supplied by the local construction planning office (e.g. surveyor) in the form of files (text file, Excel list), and have to be manually integrated into the project. Each geo line comprises two files, with the same name but different file extensions.

- **HAMMgeolines (*.hgl)** - The individual positions of a geo line are noted in this file in Cartesian form according to Gauss-Krger. However, as the measured data supplied by the DGPS receiver are saved in angular coordinates (WGS 84), the program transforms the coordinates. This achieves a congruence of the differently notated position data.
- **HAMMDataReference (*.hdr)** - Contains the data required for georeferencing, and so is used to transform the coordinates. With the

aid of this coordination file, the geo lines and the DGPS data can be converted into a uniform notation, and then shown in the displayed area.

3.01.03 View of Passages

Depending on the configuration, the "Passages" view shows the number of drum or roller passages in colour.

Dynamically tracking cross hairs show the current position of the centre of the front drum.
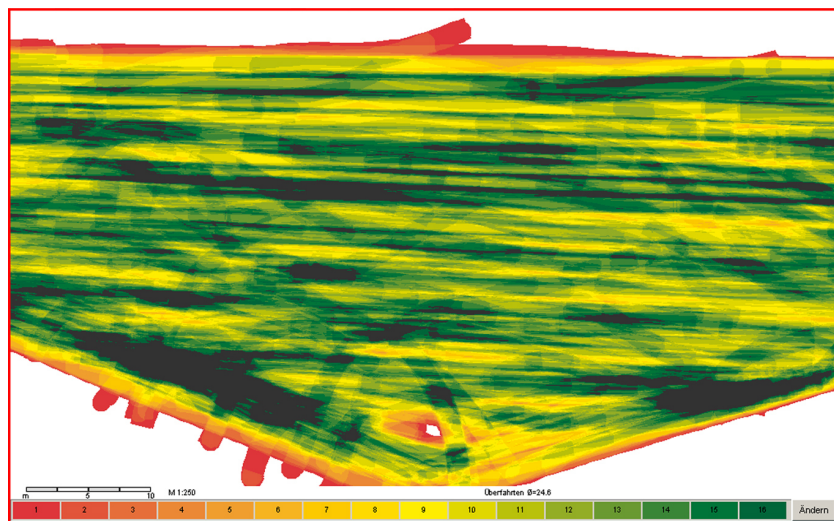
The "Change" button opens the dialog box for setting the colours. Available *colour combinations* can be selected in its preset palettes area.

3.01.04 Views of the Measured Ground Firmness Values

Online measurement with the Measured Ground Firmness Values views requires equipment with HCQ Earth Work.

The "Change" button opens the dialog for setting the colours in all Measured Ground Firmness Values views. The scale has 16 divisions. Another two areas indicate values below the minimum value or above the maximum value. The minimum and maximum values can be changed manually. When the "Scale" button is clicked, the HCQ software searches in the active layer for the lowest and highest value, and so automatically determines the minimum and maximum values.

Available *colour combinations* can be selected in the preset palettes area.

HMV view   The HMV view shows the HMV of the ground firmness in colour. The HMV is the basic measured value of the ground firmness in the HAMM HCQ System. The range of values lies between 0 and 150.
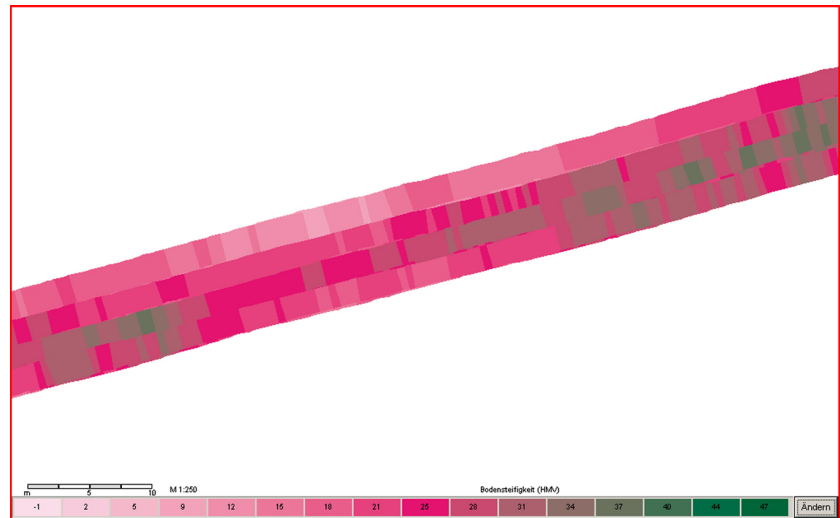
EV views   The EV2 view shows in colour the EV2 ground firmness calibrated on the HMV in the unit MN/m².

This requires a calibration to have been assigned to the active layer in the layer setting. The prerequisite for an exact measurement is adherence to the compaction parameters specified by the calibration. These are:

- Driving direction
- Driving speed
- set amplitud
- Vibration frequency
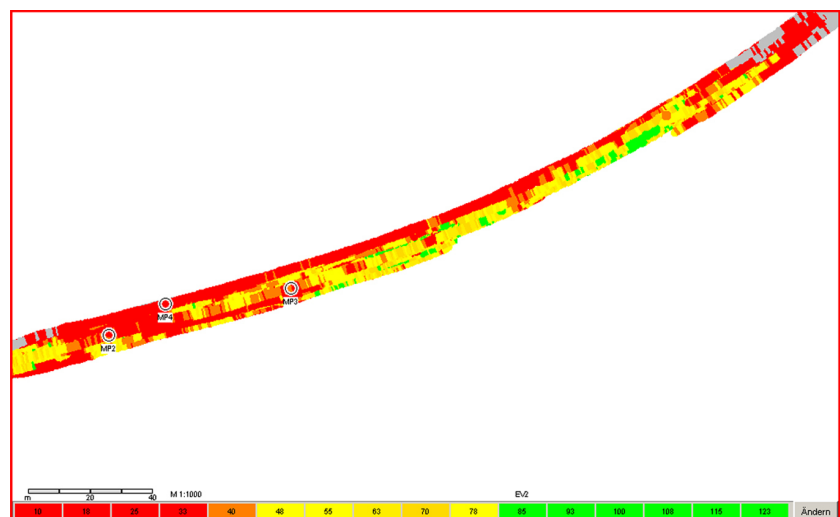
EV1, EVD, ...

Functionally, these views correspond to the EV2 view, but they are based on different calibration methods. The same conditions apply as for EV2.

3.01.05 Compaction Change View

The Compaction change view shows the relative percentage change in the ground firmness compared to the previous passage. A positive value indicators that the compaction has increased since the last passage, a negative value indicates a decrease in compaction or a loosening of the subsoil.
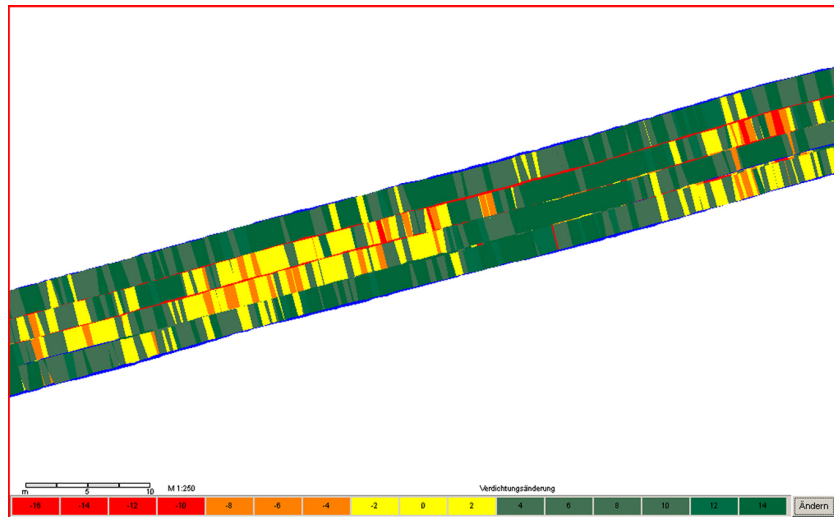
The "Change" button opens the dialog for setting the colours. The scale has 16 divisions. Another two areas indicate values below the minimum value or above the maximum value. The minimum and maximum values can be changed manually. When the "Scale" button is clicked, the HCQ software searches in the active layer for the lowest and highest value, and so automatically determines the minimum and maximum values. A colour can also be defined to indicate an undefined state. This applies to the first passage over an area when there is no relative reference to a previous passage.

Available *colour combinations* can be selected in the preset palettes area.

3.01.06   Temperature View

The temperature view shows the asphalt temperature in colour.

The "Change" button opens the dialog for setting the colours. The scale has 16 divisions. Another two areas indicate values below the minimum value or above the maximum value. The minimum and maximum values can be changed manually. When the "Scale" button is clicked, the HCQ software searches in the active layer for the lowest and highest value, and so automatically determines the minimum and maximum values.

Available *colour combinations* can be selected in the preset palettes area.

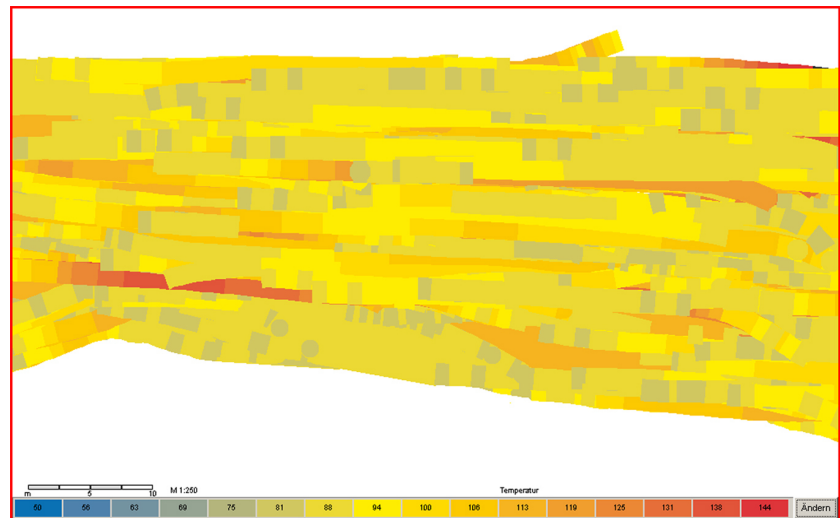Online measurement with the temperature view requires equipment with the HCQ Asphalt and an installed temperature measuring device.

3.01.07   Cut view

The Cut view enables a chronological curve of measured values along a defined cut vector to be displayed. This function requires the screen to be subdivided into two windows. One window containing the source view to be examined, and the other the cut view.

A cut vector in the source window is defined with the cut tool in the toolbar. The history of this line is shown in a Cartesian coordinate system in the Cut window. The abscissa (X-axis) defines the distance from the start of the cut vector. The ordinate (Y-axis) contains the measured variable of the source data window (HMV, EV2, temperature etc.). The Cut window shows a function of the measured value along the path the for each of the up to 16 simultaneously displayable passages.
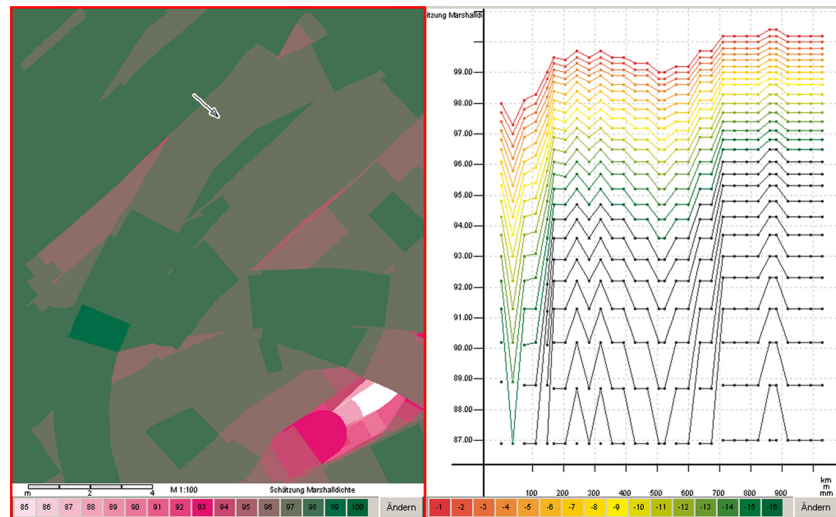
The above example shows a cut vector of an Asphalt marshall density window. The Cut window shows the increases in compaction for each individual passage along the line defined on the left.

3.02   Dialog box

The pull down menus and buttons open the various dialog boxes used for editing.

More detailed explanations on sqq.

4 MOUNTING / INSTALLATION / COMMISSIONING

4.00 Prerequisites

The following conditions must be fulfilled so that the HCQ System can work correctly:

Roller pre-equipped with:	
connected DGNSS receiver	Receiver unit for an existing differential satellite navigation system, e.g. DGPS
DGNSS licence	As a rule, a licence from a relevant provider is required in order to use a DGNSS signal.
DGNSS reception	The receiver must not be too heavily screened by obstacles, such as trees, bridges or hills. Satellite signals cannot be received in tunnels.

4.01 Power supply for system components

The system components are supplied with power by the on-board electrical system as soon as the ignition is turned ON.

The Panel PCs can also be used outside the machine. It is then supplied with power either by its internal battery or an external power supply.

4.02 DGNSS receiver

A GNSS receiver requires a line-of-sight link to at least 4 satellites of a global satellite navigation system (GNSS), such as GPS or GLONASS, to determine a position precisely. An additional correction or difference signal (DGNSS) is required in order to achieve the precision needed to operate HCQ. This can be transmitted either from a geostationary satellite of a satellite-supported supplementary system (SBAS) or a local base station (RTK).

20098

DGPS licence

DGPS receivers made by Trimble are used as standard for HCQ. They work either with the free correction signal from WAAS / EGNOS or the higher quality, chargeable OmniSTAR signals. Without a correction signal (e.g. if there is no licence), the system does not produce any reproducible, documentable measurement results (See Appendix for positional accuracies).

Requirement and activation of a DGNSS licence

The OmniSTAR licences for various lengths of time can be obtained from HAMM AG. Please contact your Wirtgen Group Service Partner.

It makes the selection and order of the required licence and states an activation period.

You receive confirmation with date and time stamp, you also have to have activated the HCQ GPS system on the machine.

Proceed as follows:

1. Place the machine, with mounted HCQ GPS, in an open space with a clear view of the sky.
2. Activate the system about 15 minutes before the confirmed activation time.

The system initialises itself and can be seen on the screen.

> **i** If initialisation does not take place, contact your Wirtgen Group service partner and arrange a new activation time.

Installation
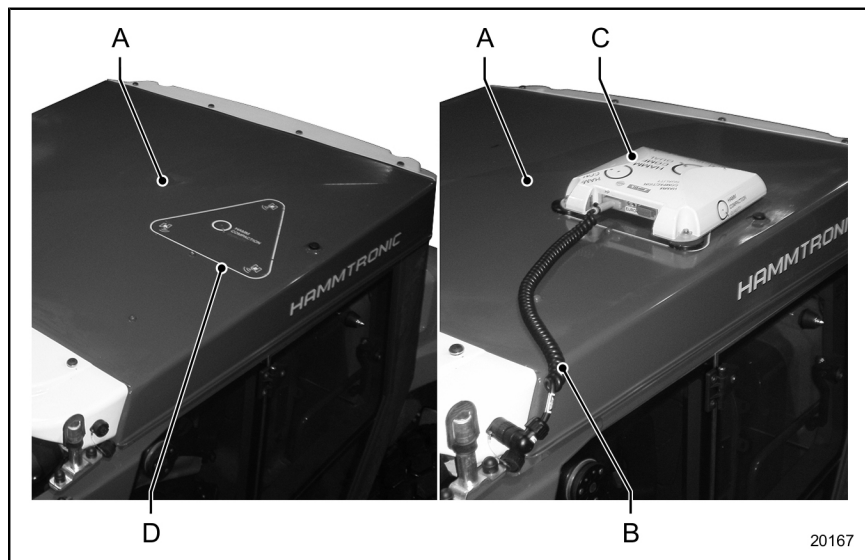
[A]	Roller roof	[B]	Connecting cable
[C]	DGPS receiver	[D]	Marking

⚠ WARNING

Danger of falling! Danger of injury!

Only mount the receiver when the roller is switched off. When mounting the device, make sure that you have a secure footing.

---

1. Mount the DGPS receiver [C] with the magnetic feet on the mark [D], which is glued on the left side of the machine roof.
2. Take the plug of the GPS cable [B] out of its holder and plug it into the receiver [C].
   The DGPS receiver is ready for operation.

> **i** Other GNSS receivers can be used with the HCQ. The requirements for these receivers are to be found in the Appendix.

4.03 Panel PC

4.03.01 Mounting the Panel PC

⚠ **WARNING**

Risk of short circuit!

Moisture and dirt can cause a short circuit.

Keep the spring contact of the PC interface clean and dry.

NOTICE

Magnetic fields cause data loss!

If the Panel PC comes into contact with magnetic fields, data may be lost from the hard disk.

Keep the Panel PC away from magnetic fields.

> **i** In order to avoid radio interference, do not install the Panel PC near a radio or television.
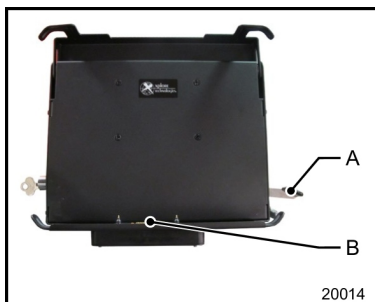
1. Push the locking lever [A] on the vehicle's PC holder down.
2. Place the PC in the open holder.
   The Panel PC is connected to the on-board electrical system of the roller by the docking port [B] in the vehicle's PC holder.
3. Push the locking lever [A] on the vehicle's PC holder up.
4. Lock the PC in the holder with the key [C].
   The Panel PC is ready for operation.

> **i** You will find more detailed information about operating the Panel PC in the Panel PC Manual, which is included in the scope of supply of the HCQ Navigator.
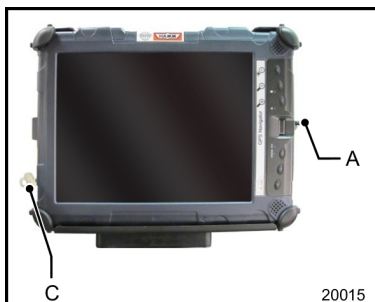
4.03.02 External power connection to the Panel PC

> ### ⚠ WARNING
>
> **Danger to life and limb by an electric shock!**
>
> Electrical connections may only be made to standardized earthed sockets. Do not use damaged power cables. Disconnect the electricity supply before changing locations.

To connect the Panel PC to the external power supply:

1. Switch off panel computer with on / off button (left side).
2. Connect the power cable to the power unit.
3. Connect the power unit to the power socket on the Panel PC.
4. Plug the power plug into an earthed socket.

4.03.03 Battery operation of the Panel PC

> **i** After a lengthy period of non-use and before use on a site, connect the Panel PC overnight to an external power supply in order to fully charge the battery.

The Panel PC can be run for up to 5 hours with the internal lithium ion battery.

Check the battery status by means of the status LED [A] on the battery each time before using it without an external power supply.

green	Device is ready for operation
yellow	Device in stand-by mode
Red	Critical state of charge (connect power supply via power unit!)

4.03.04 Charging the battery of the Panel PC

Once the Panel PC is connected to the mains supply, charging begins automatically if the remaining charge is less than 90 %.
The status LED flashes green during the charging process.

> **i** The battery is not recharged if it is already more than 90 % charged. This prevents the battery from being overcharged.

The charging process is stopped automatically when the battery is 100 % charged.

The status LED lights green when the battery is fully charged.

> **i** The charging process for a completely discharged (7.4 V / 5700 mAh) battery supplied from the factory is about 2.5 hours.

4.03.05 Software installation

Panel PC The HCQ Navigator software is pre-installed on the Panel PC.

Office computer The HCQ Navigator software can be installed on a suitable office computer to prepare, edit and analyse projects. Only the "Measuring point", "Start / Stop" und "Online / Offline" buttons are not available.

System requirements

The following minimum equipment is recommended:

Operation system	Microsoft Windows XP SP 2, Windows Vista, Windows 7
Processor	Pentium 3 (minium 500 MHz)
Memory	256 MByte RAM
CD-ROM drive	

> **i** Administrator rights are required to install the software!

You will find additional information on the CD supplied.
If you have any problems, please contact your local Wirtgen Group Service Partner.

Opening the software on the office computer The software is called from the Windows Start menu (/ All Programs / HCQ Navigator). Operation is the same as for the version on the Panel PC.

4.03.06 Switching on

> **i** Please refer to the corresponding operating manual for information about commissioning the roller.

1. Switch on the roller's ignition.
2. Check the functions before starting compaction.
3. Set the frequency and amplitude.
4. Switch the panel PC on with the On/Off button.
   After the Panel PC has booted up, the starting screen appears with the user accounts "Driver", "Expert" and "Service".

5. Click the user "Driver". The user interface, including the **Open project** dialog box opens.
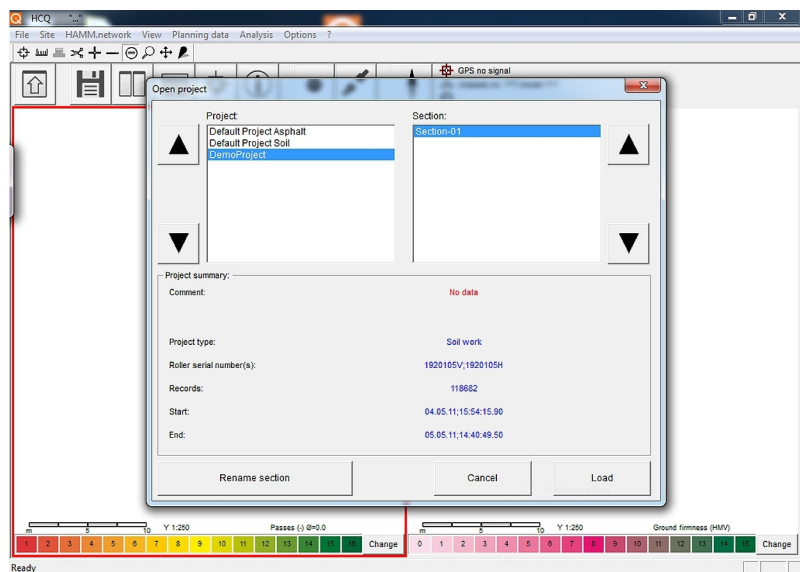
6. Make the necessary settings ([see page 55](#) sqq.).

7. Start the measuring passage with the "Start" button. The communications link must have been established (Online/Offline button)!

NOTICE

Data is lost if the PC is undocked while recording!

Disconnecting the data link results in data loss.

Do not disconnect the Panel PC from the power supply or data link.

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5 OPERATING SOFTWARE

5.00 After switching on the unit

3 users with individual properties have been created the HCQ computer. With the start of the software, the user is asked to log in as "driver", "expert" or "service" ([see page 53](#)).

- Driver: The driver has the right to use the HCQ software and create projects.
- Expert: The expert has the same rights as the driver, but he can also delete projects and access selected Windows functions.
- Service: The Service user account is reserved for the Wirtgen Group service partner.

After selection of the user "Driver" or "Expert", the HCQ software opens with the ***Open file*** dialog box.

If a new project is to be created rather than an existing project to be worked on, close the ***Open project*** dialog box and use **File / New** to open the ***Create a new project*** dialog box.

In both versions, the required settings can be made in dialog boxes afterwards ([see page 61](#) sqq.).
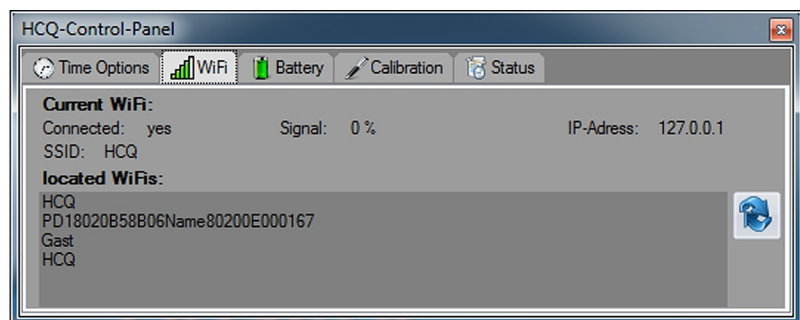
5.01 HCQ Control Panel

If the "Driver" user account has been selected, the ***HCQ Control Panel*** opens in the background at the same time as the HCQ software. It has the following functions:

Time Options tab: For setting the current time and time zone
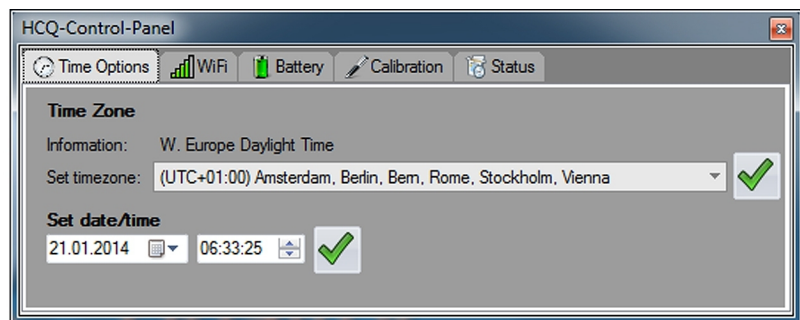
WiFi tab: Shows the status of the current WLAN connection and the networks that are within range.

Battery tab: Shows the battery charge level
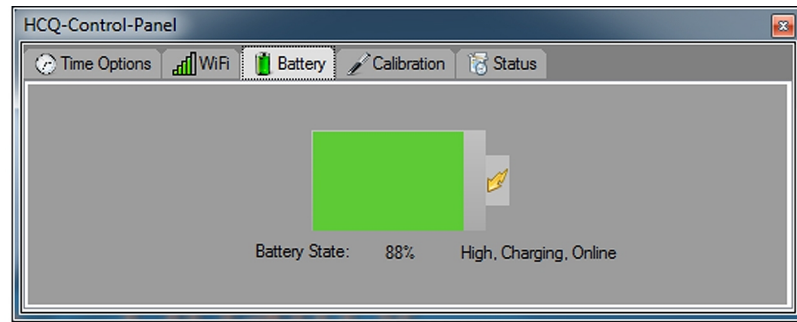
Calibration tab: for calibrating the screen
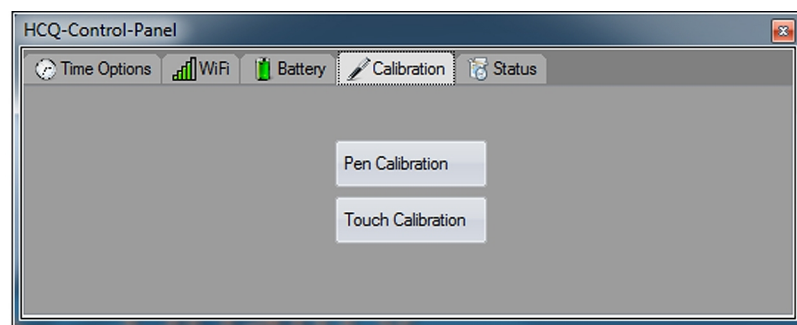
Status tab: Shows the installed software versions
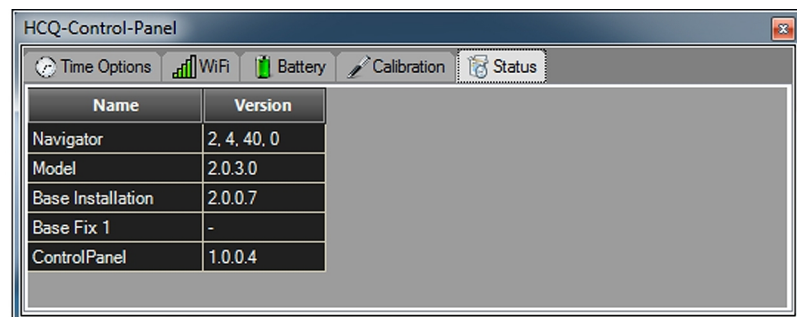
5.02   Calibrating the Screen

The screen can be calibrated if the Panel PC responds very inaccurately to inputs made with the digitizer or finger.

Digitizer   1. Open the HCQ Control-Panel and select the "Calibration" tab. The following view opens:
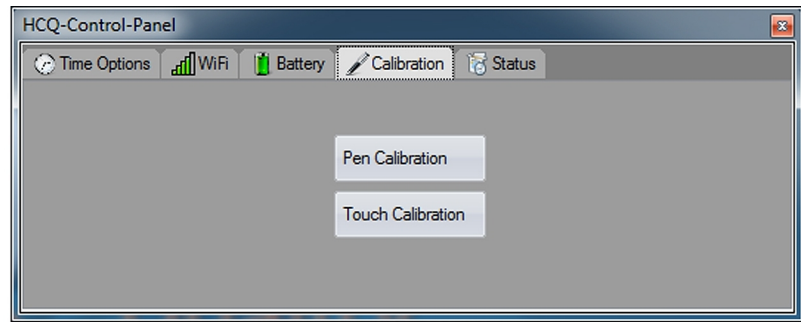
2. Clicking the "Pen Calibration" button opens the ***Pen Tablet Properties*** dialog box.

3. Select the category "Calibrate", and click the "Calibrate…" button to start the calibration process.
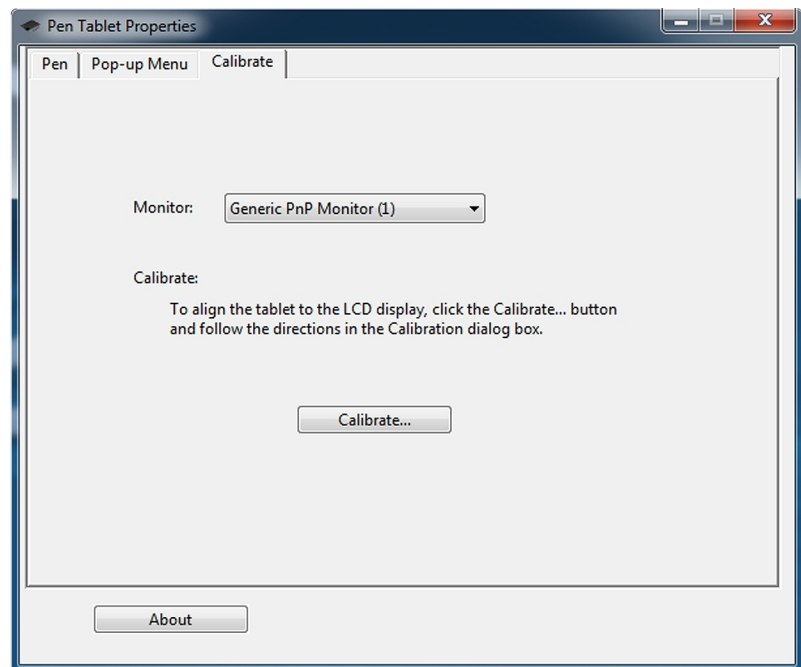
4. Touch the crosses shown in the centre of the screen with the tip of the digitizer.

5. Finish calibration with the "OK" button, repeat with "Try Again" or cancel with "Cancel".

6. After calibration, close the ***Pen Tablet Properties*** dialog box by clicking the "X" in the top right-hand corner.

Touch (with fingers) 1. Open the HCQ Control-Panel and select the "Calibration" tab. The following view opens:
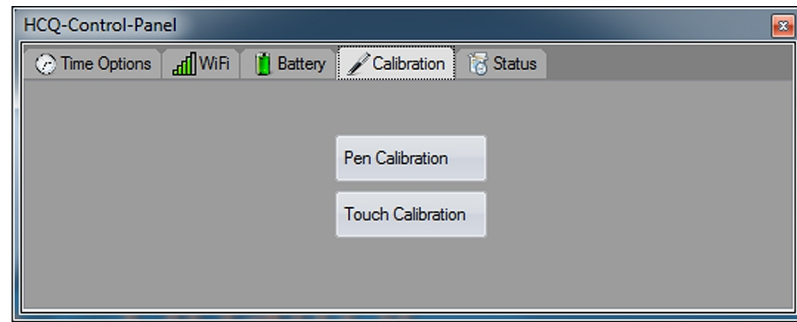
2. Open the **Touch Settings** window by clicking the "Touch Calibration" button.

| i | The length of time to make a right-click can be set in the top area. |

Input by finger touch and outputting a sound with this touch can be activated and deactivated in the lower area.

The "default" settings ("Default" button) are strongly recommended!

Click the "Default" button in the categories "Pen" and "Pop-up Menu" to restore any basic settings that have been changed.

3. Select the category "Calibrate", and click the "Calibrate…" button to start the calibration process.
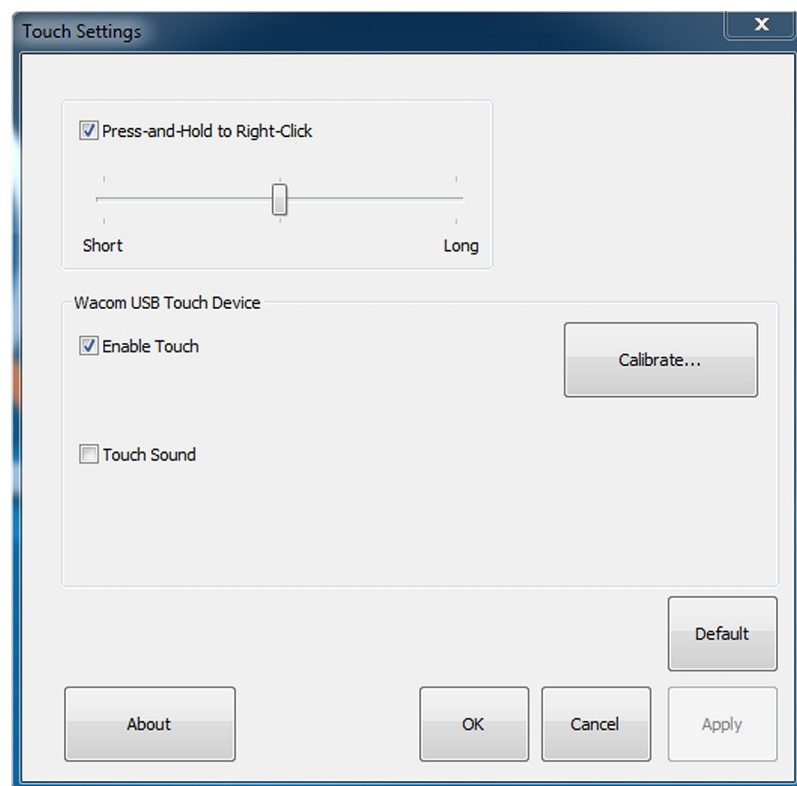
4. Touch the centres of the crosses shown one after the other on the screen with a finger.

5. Finish calibration with the "Finished" button. Go back one step with "Back". Repeat calibration with "Start Over". Cancel calibration with "Cancel".

6. After calibration, close the *Touch Settings* dialog box by clicking the "X" in the top right-hand corner.

5.03 Adjust Language

German is the set language when the HCQ software is started for the first time. Proceed as follows to select another language:

1. Select the **Language** item from the **Options** pull-down menu. The *Select languages* dialog box opens.
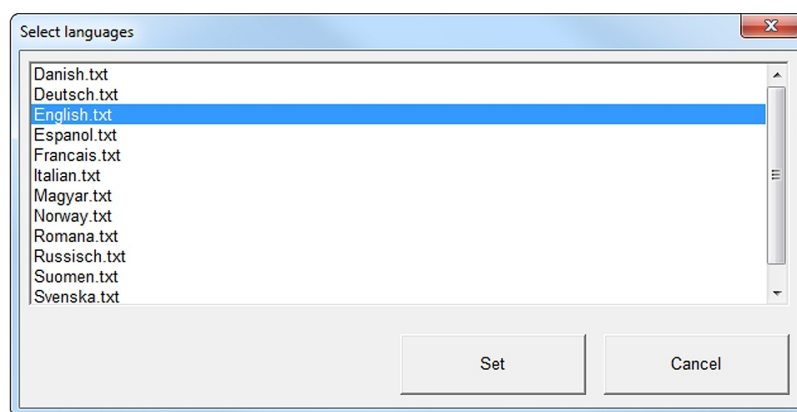
2. Select the desired language from the list, and accept with the "Set" button.

5.04 Setting units

Metric units are set when the HCQ software is started for the first time. Proceed as follows to select other units:

1. Select the **Units** item from the **Options** pull-down menu. The *Unit selection* dialog box opens.

2. Select the desired units from the lists, and click the "OK" button.

5.05   Setting Paths

> **i**   This option is only available for "Expert" and "Service".

⚠ WARNING

Existing project directories are not moved! Projects can only be loaded if the paths refer to the correct storage location (see page 92).

The first time the HCQ software is started, the HammHcqData working directory is created in the Windows public user directory (This is usually C:\Users\Public.). This contains all the other HCQ-specific subdirectories (see page 92).

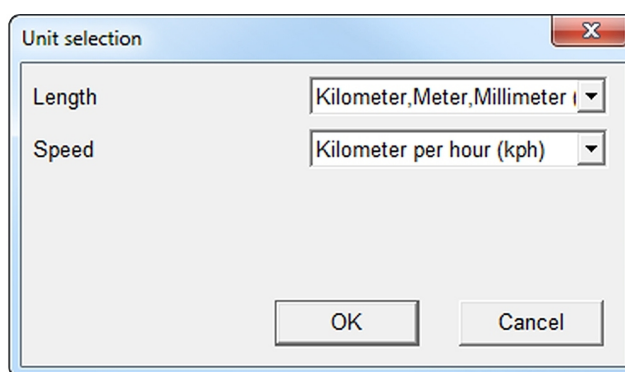1. Select the **Paths** item from the **Options** pull-down menu. The **Assign subdirectories** dialog box opens.

Assign subdirectories		
Workstation:	C:\Users\Public\HammHcqData\Project\	...
Geo lines:	C:\Users\Public\HammHcqData\Lines\	...
Maps:	C:\Users\Public\HammHcqData\Maps\	...
Cover page and final page:	C:\Users\Public\HammHcqData\PrintView\	...
Calibration:	C:\Users\Public\HammHcqData\Calibration\	...
Dictionaries:	C:\Users\Public\HammHcqData\Dictionary\	...
	Confirm	Cancel
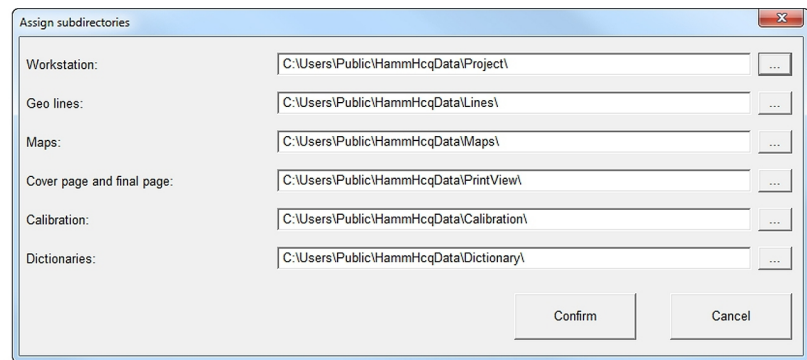
2. From the **Find directory** window that opens, select the desired paths with the buttons on the right. Click the "OK" button in the **Assign subdirectories** dialog box.

5.06   Loading file

To load an existing project:

1. Select the **Open** item from the **File** pull-down menu. The ***Open project*** dialog box opens.
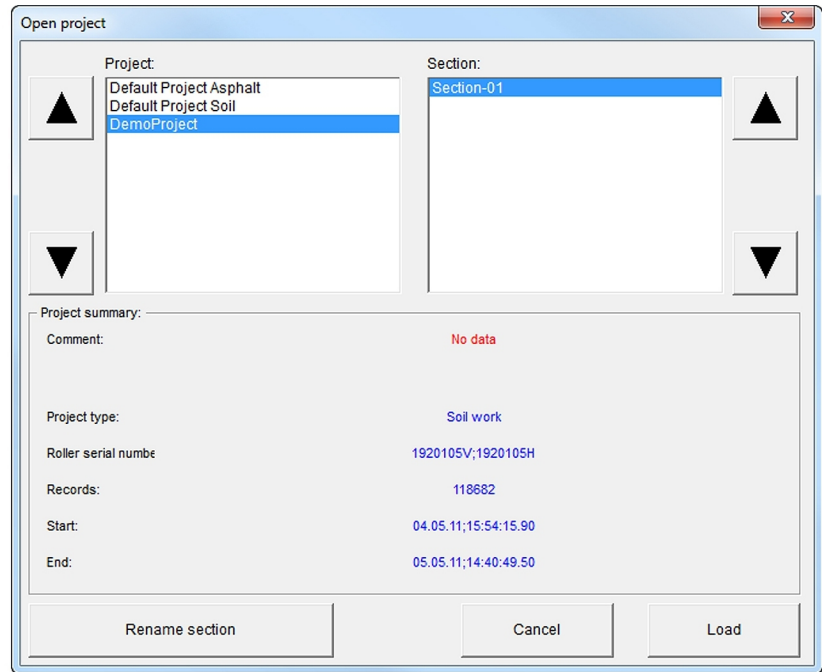
2. Mark the desired site.
3. Select the desired section.
4. Use the "Load" button to confirm the selection.
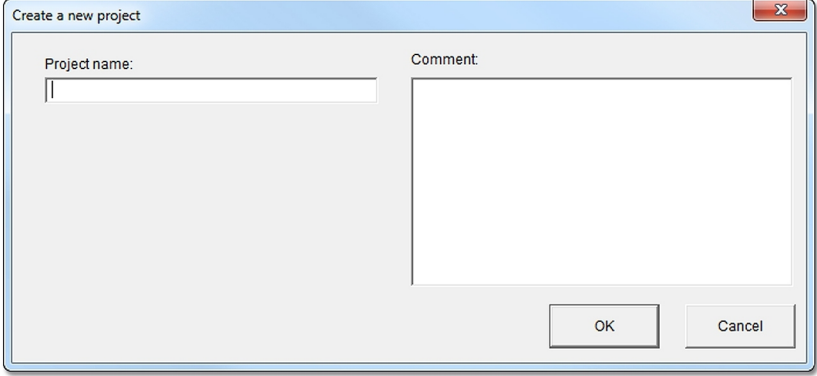
5.07 Projects

5.07.01 Create a new project

General When a new project is created, the HCQ Navigator software fetches a pre-defined set of settings and project parameters from its database.

A project directory is created in the working directory under the selected project name. The roller-related data (vehicle type, roller serial no. etc.) are loaded automatically if there is a connection to a roller. These machine data are always assigned to the relevant recorded data.

Depending on the project requirements, the existing project parameters have to be configured and possibly newly created.

> **i** Creating and configuring a project is only to be carried out by trained specialist staff (e.g., site manager) because knowledge of the machine technology as well as the FDVK is necessary.

Creating project 1. Select the **New** item from the **File** pull-down menu. The *Create a new project* dialog box opens.

2. Enter name of the site and possible comments.
3. Clicking the "OK" button accepts the inputs, and the project is created with the standard settings.

5.07.02 Importing a Project

Import an HCQ project into the existing project directory:

1. Select the **Import project** item from the **File** pull-down menu. The **Directories** dialog box opens:

2. Select the location where the imported project directory is to be stored.

3. Confirm with "OK". A successful import is confirmed by a message.

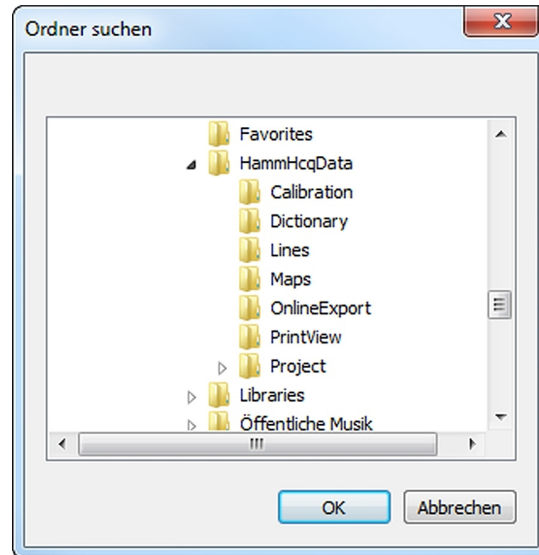> **i** The imported directory must have the same directory structure as the HCQ Navigator (see Appendix). If this is not the case, the import will fail.

5.07.03 Exporting a Project

The entire data of a project can be exported and used in other programs.

To export data, select the desired export from the **File** pull-down menu:

*   **Export Text**: All the settings and the recorded measured values are written in plain text in a *.txt file.

*   **IC Export all Data**: All the project data is written drum by drum to a *.vexp file. This file is required for further use with the Veda software.

*   **IC Export proof Data**: Only the data of the last passage are written drum by drum to a *.vexp file. This file is required for further use with the Veda software.

The progress of an export is shown by the progress bar that opens.

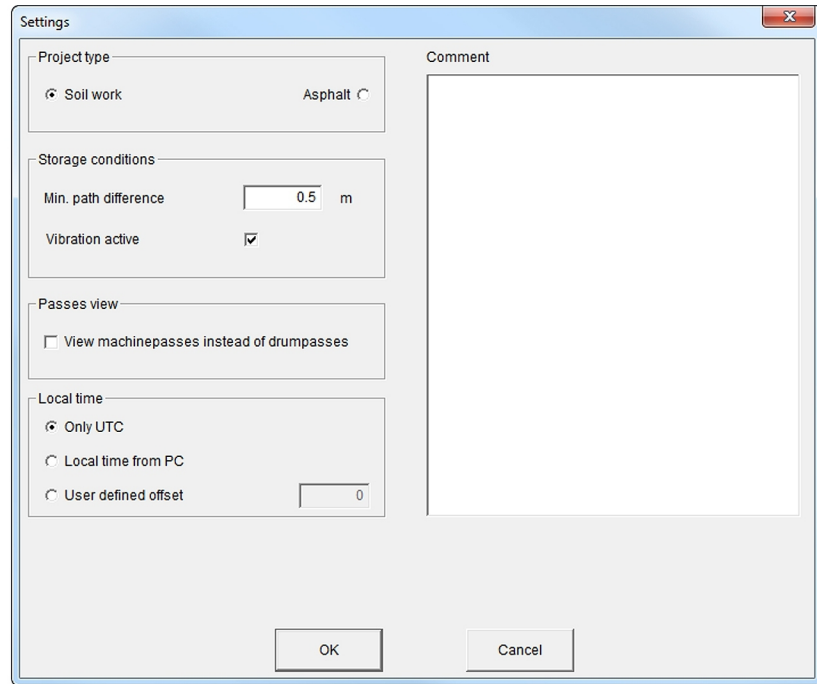A successful export is confirmed by a message.

The exported data are stored in the "Export" directory of the current project, and can be transferred from there to the desired storage location.

5.08 Project Settings

5.08.01 Configuring the basic settings

Specify or change basic settings:

1. Select the **Basic settings** item from the **Site** pull-down menu. The *Basic settings* dialog box opens.

Settings

Project type
- ● Soil work   Asphalt ○

Storage conditions

Min. path difference   0.5   m

Vibration active   ☑

Passes view

☐ View machinepasses instead of drumpasses

Local time
- ● Only UTC
- ○ Local time from PC
- ○ User defined offset   0

Comment

OK   Cancel

2. In the *Project type* area, select whether earth work or asphalt work is to be carried out.

    i Depending on the type of project, different window settings and the appropriate setting options for creating and editing layers are loaded.

3. Enter the Min. path difference from which the recording starts in the *Storage conditions* area. If **vibration** is ticked, the HCQ software only records measured data if the vibration is switched on.

4. Whether the passes are displayed separately for each drum or brought together under machine passes is selected in the *Passages view* area.

    i This affects only the display in the software. The data are recorded separately for each drum.

5. The following variants can be selected in the *Local time* area:

    - Only UTC: Only UTC from the GNSS receiver is used.

    - Local time from PC: The time is recorded in UTC, and the difference from the set PC time is calculated automatically.

    - User defined offset: Freely selectable difference between UTC and the recorded time.

    i The difference is stored in the relevant project. If the project is loaded onto another computer, the applicable local time always appears with the recording.

6. The backgrounds of the project settings are documented in the *Comment* area.

7. Save the entries with OK.

5.08.02 Co-ordinate and reference system selection

HAMM HCQ software has an extensive data base with information on a large part of the globally used co-ordinate systems (sqq.). Thus, the user can work extensively in the view relevant for the site.

For parameterizing the site-specific co-ordinate system:

1. Select the **Coordinate system** item from the **Site** pull-down menu. The ***Coordinate and reference system selection*** dialog box opens.

2. Select the continent in which the site is located.

> **i** The recording is always made in UTM coordinates in the WGS84 reference system. When a different coordinate and reference system is selected, only the view is recalculated.

3. In the *Country or Group* field, carry out a further selection according to regions and countries.

4. In the *Co-ordinate System* field, select the appropriate. Views are possible as polar co-ordinates or as map co-ordinates.

5. In the *Reference System* field, select the appropriate.

> **i** The usually used reference system is preselected for each coordinate system. However, this can be freely changed in the selection line *Reference system* .

6. In the *Area (length / width)* field, the application area of the co-ordinate system - is indicated automatically - defined as polar co-ordinates with origin equator and Greenwich meridian.

7. In the *Notation (east / north)* field, the following possible constellations arise as a function of the reference system set:

- s (preset): Place for zone, sector or meridian strip
- s (added): Position for angular second
- g: Place for angle degree
- k: Place for kilometer
- m: Place for meter and/or angle minute

8. The coordinates can be adjusted precisely to the local measured coordinate system in the fields *East and North offset (metres)*±.

9. In the *Decimal Points* field, adjust the number of the Decimal points for the indicator of geo-coordinates.

10. Save your selection with the "Confirm" button and close the ***Coordinate and reference system selection*** dialog box.

5.08.03 Creating and editing layers

To create new layers or change existing layers for a site:

1. Select the **Change layer** settings and add new layers item from the **Site** pull-down menu. The *Layer settings* dialog box opens. The available options are shown according to whether soil work or asphalt work is being done.

Earthmoving

Asphalt laying

2. Create a new layer using the "Insert" button and carry out the required entries.
   OR

3. Select an existing layer and carry out the required changes.
   OR

4. Select the respective layer and use the "rename" button to rename the layer.

5. Confirm the inputs with the "OK" button.

5.08.04   Selecting layers

In order to select the layer to be edited:

1. Select the **Layer** item from the **Site** pull-down menu. The *Layer selection* dialog box opens.
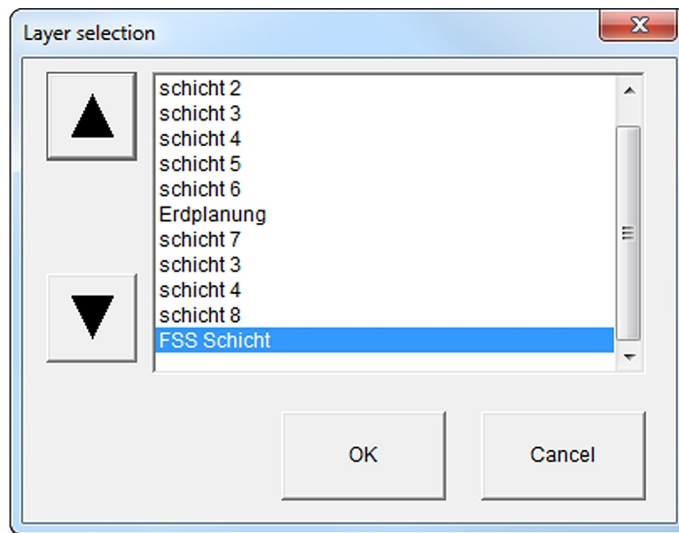
2. Select the required layer and confirm with OK.

5.08.05   Newly creating position points and calibration points - via the menu

1. Select the **Measuring points** item from the **Site** pull-down menu. The *Position and calibration input window* dialog box opens.

2. Use the "Insert" button to open the *Enter measuring point manually* dialog box.

3. Assign the name for the new position / calibration point.

4. Select the type of measuring point.

5. Carry out entries in the areas *GPS Co-ordinates* and *Co-ordinates in the co-ordinate system*.

6. With pressing the "Automatic insert of measured data" button the data in the *Roller measurement* area are automatically entered by the system. Manual input is not possible.

7. When pressing the "Manual insert of measured data" button, the rows in the Measurement Rollers area are activated, the data can be entered by hand.

8. Save the entries with "OK", the ***Enter measuring point manually*** dialog box will be closed.

9. Create all required position/calibration points in this manner.

10. Save all entries with OK. The ***position and calibrating input window*** is closed.

5.08.06 Newly creating position points and calibration points - with the digitizer or mouse

1. Find the measuring point in the view frame and touch it with the digitizer for about 2 seconds **OR** right-click with the mouse.

2. Via the Context menu that opens, "Copy to clipboard" the coordinates.

3. Select the **Measuring points** item from the **Site** pull-down menu. The ***Position and calibration input window*** dialog box opens.

4. Use the "Insert" button to open the ***Enter measuring point manually*** dialog box.

5. Accept the copied coordinates with the "Paste from clipboard" button. In the *Name* area, a name is automatically assigned to the measuring point. However, this can be changed.

6. Save the entries with "OK", the ***Enter measuring point manually*** dialog box will be closed.

7. Create all required position/calibration points in this manner.

8. Save all entries with OK. The ***position and calibrating input window*** is closed.

5.08.07 Editing position and calibration points

To edit positions and calibration points:

1. Select the **Measuring points** item from the **Site** pull-down menu. The *Position and calibration input window* dialog box opens.

2. The layer name and the name of the measuring point are shown automatically in the centre of the upper part of the window.

3. In the *Measurement point type* area, you can see whether this is a calibration point or a measuring point.

4. The position of the measuring point according to the set coordinate system is shown in the *Coordinates in coordinate system* area.

5. The calibration method and the compaction value calculated with it are entered in the *Reference measurement* area.

> **i** You will find more detailed information about the calibration process in the Appendix.

6. Set the view of the measuring points in the *Text direction*, *View* and *Colour* areas.

7. The data calculated from the machine are shown in the *Roller measurement* area.

8. Use the "Renaming" button to rename the measuring points when required.

9. Delete measuring points with "Delete".

10. Measuring points can be loaded from a *.txt or *.csv file with the "Import" button.

11. Measuring points can be written to a *.csv file with the "Export" button.

12. Save all entries in the *Position and calibration input window* pressing "OK".

5.08.08   Carrying out calibration

1. Select the **Calibration** item from the **Site** pull-down menu. The *Calibration* dialog box opens.
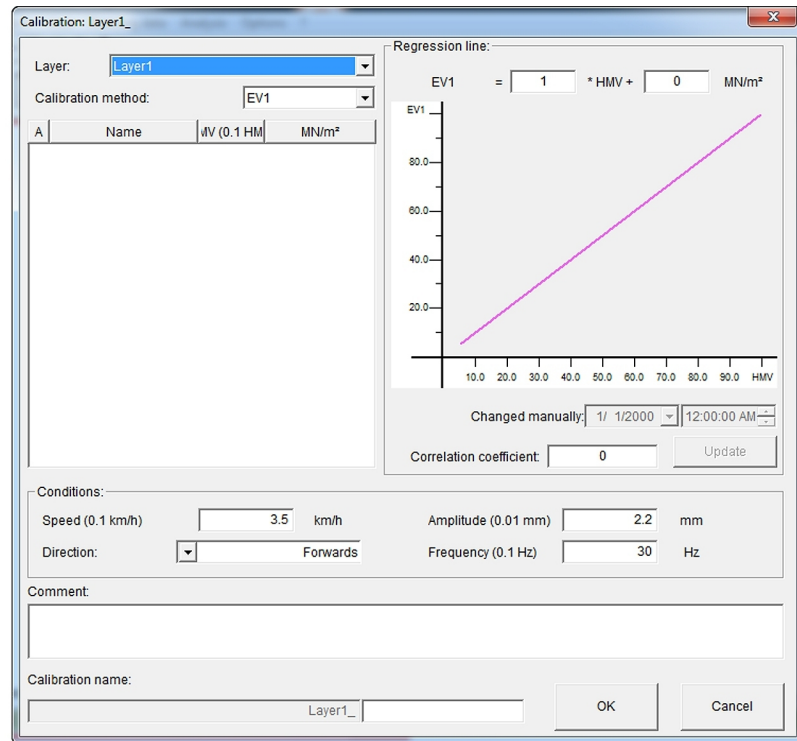
2. Select the respective layer in the pop-up menu.

3. Select the calibration method that is to be used from the pull-down menu. All available calibration points are shown in the table and the graphic.

4. Enter the conditions to be used for the measurement with the roller in the *Conditions* area.
   Calibration points that were recorded under other conditions are greyed out.
   Other unsuitable calibration points can be deactivated in the table with the relevant checkbox. These are shown in red in the graphic and, together with the greyed-out calibration points, are not included in the calculation.

5. When pressing the "Update" button, the HCQ software computes the regression line.

6. A file name for the calibration can be entered in the *Calibration name* field. This enables a number of calibrations to be saved for a single layer.

> **i** The file name is automatically generated from the name of the layer and a freely selected name.

7. Save with OK.

5.09   Maps

5.09.01   Importing map

| i | This option is only available for the "Expert". |

Use the **Import bitmap** command in the **Planning Data** menu to generate maps from bit maps.

All Windows bitmap types (*.bmp; 24 bit, , 256 colour, , 16 colour, monochrome) can be imported.

| i | The white areas of the imports are shown transparent. so measurement data on white areas of the bitmap are not covered. |

1. Select the **Import bitmap** item from the **Planning data** pull-down menu. The *Open* dialog box opens.
2. Find and mark the desired map in the file system.
3. Import by clicking the "Open" button.

| i | The map is always scaled to match the current view area. |

4. Edit the map if necessary ()
5. Select the **Save as...** item from the **Planning data** pull-down menu. The *Save map as...* dialog box opens.

5.09.02 Selecting map

Selecting an existing map in the project:

1. Select the **Maps** item from the **Site** pull-down menu. The *Map selection* dialog box opens.
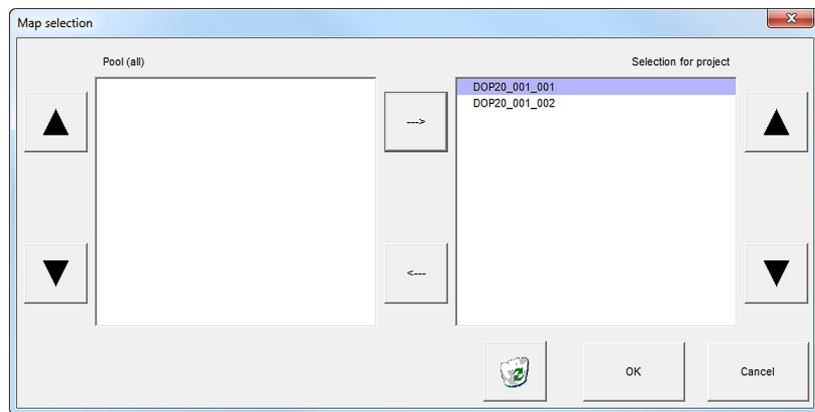
2. Select one of the available maps from the *Available* area.

3. With the right arrow, import into the *Selection for project* area and confirm with the "OK" button.

> **i** If a map from the *Selection for project* area is returned to the *Available* with the left arrow, the project-specific settings of the map are also accepted globally.
>
> Use the "Recycle bin" button to remove a map from the project.

5.09.03 Editing map
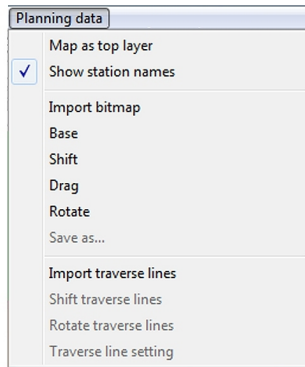
Maps can be inserted into and/or adapted to the area view. To do this, the relevant command line in the **Planning data** pull-down menu has to be activated. Active commands are identified by a tick.

Base	Specify the anchor point around which the map can be rotated and dragged.
Shift	Moving the imported map.
Draw	Expanding or contracting an imported map under retention of the aspect ratio. The position of the specified anchor point (Base) in the area view does not change.
Rotate	Rotating an image around the specified anchor point.
Save As	A name can be assigned to the map in the *Save map as...* dialog box. The files are copied under this name into the global data directory. The map is then available to all the projects on the PC, and can be selected from the **Site** / **Maps** menu.

i
- When a bitmap is imported, the centre of the image is automatically defined as the anchor point (base).
- Following deactivation with the same icon, a dialog box opens for saving the changes made.
- The raw data of the graphics with correctly set edge lengths must be available because the side ratios are retained.
- A map is always rotated and dragged around its anchor point.

5.09.04 Bringing map into the correct position

Bringing a map on the monitor into its correct, referenced position:

1. Create two reference points (sqq.) and display them on the screen.

   i Suitable reference points are, for example, the coordinates of the top left-hand and bottom right-hand corners of the map.

2. Open the **Planning Data** menu.

3. Activate the **Shift** menu item, and move the map on the screen so that the reference point of the bitmap coincides with the associated measuring point set under 1.

4. Touch the **Base** menu item in the **Planning data** pull-down menu, and use it to specify the coincident measuring points as the anchor point (base).

5. Then deactivate the **Base** menu item.

6. Starting from the anchor point, move the map via the **Planning data / Rotate** menu so that the second reference point of the map lies roughly in line with the associated measuring point.

7. Scale the map with the **Planning data / Drag** menu so that the second reference point lies near the second measuring point.

8. If necessary rotate, drag and shift the map until the reference and measuring points are coincident.

9. With the **Planning data / Save as** menu item save the position changes carried out.
Now the card is available at any time for other projects, too.

> ℹ Each map saved is automatically transferred into the database of the HCQ Navigator software. It is then available to all projects on the relevant PC.

5.09.05 Specifying map as the top layer

The map can either be used as a background or laid over all other layers:

1. Click the **Map as top layer** menu item in the **Planning data** pull-down menu.
The project-specific map is laid over all layers. With renewed clicking, the map is hidden again.

> ℹ The underlying measurement and position data can be covered if a map is used as the topmost layer.

5.10 Geolines

Traverse lines are auxiliary lines which represent edge limits (such as the edges of a road) as traverses in the HCQ software. A line comprises arbitrarily many, at least, however, two geo-referenced bases which comprise the following information:

- Identification and/or station name (optionally)
- Longitude
- Latitude
- Altitude (optional)

5.10.01 Importing geolines

Prerequisites To import geo lines into the HCQ system, the following requirements must be met:

1. The georeferenced points must be written in columns in a *.txt or *.csv file. Only one point and its properties may be written in each line.

2. The geodetic reference as well as co-ordinate system must be known.

Creating reference file

1. Use an editor to create a *.txt file with the data of the geo line (station name, latitude, longitude and altitude of the individual geo points).

2. Space, tabs, semicolons and commas may be used as column separators.

> **i** A full stop must be used as the decimal separator!

Import a geo-referenced point file

1. Select the **Import Geolines** item from the **Planning data** pull-down menu. The *Import traverse lines* dialog box opens.

2. Select the file to be imported with the "..." button in the *Source* area.

3. Select the first valid data row.

4. **Columns**: Which information has to be contained in each column has to be specified according to the structure of the imported file. You can also use files with more columns than are necessary. Only the required information will be used.

> **i** If no station name is defined, the HCQ system automatically defines the line number in the source program as station name.

5. With pressing the "Co-ordinate system" button, the *Co-ordinate and reference system selection* window will open. This option is only

required if the imported data is in a different coordinate and reference system than the existing project.

> **i** The coordinate system used must be known so that the lines appear correctly on the screen and in the printout.
>
> If this information is not available, a similar system must be selected. The geo line, hence, does not appear precisely on the defined points; however, it can subsequently still be moved in the image view or be turned. The result is thus usable as an orientation line with low accuracy.

6. Open the window in the *Target* area with the "..." button and **Enter traverse line name**. Enter a unique name for the traverse line that is to be imported.

7. With pressing the "Import" button, the geo line is registered in the software under the newly defined name.
    Now, the user can have them shown or even subsequently modify them by rotating or moving. However, the latter means a loss of the exact geo-referenced position.

5.10.02 Select geo lines

In order to select the geo lines required for the project:

1. Select the **Geolines** item from the **Site** pull-down menu. The **Traverse line selection** dialog box opens.
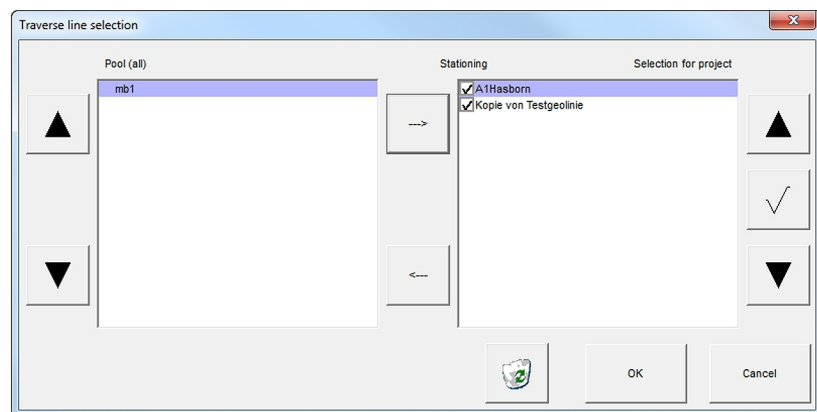
1. In the *Pool (all)* area, select the required geo lines.

2. With the right arrow, import into the *Selection for project* area.

3. Tick geo lines whose station names should be indicated.

4. Confirm with "OK"**.**

> **i** Use the recycle bin button to delete the selected geo line from the current project only, but not from the pool of the geo lines! It is thus available again at any time for another project.
>
> You can transfer the project-specific settings of the traverse line to the centrally saved line with the left arrow.

5.10.03   Editing geo lines
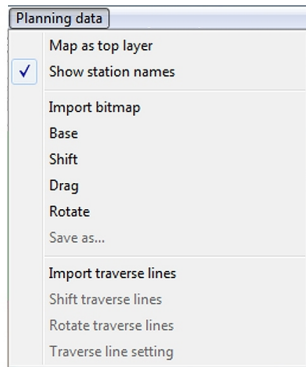
Geo lines can be inserted into and/or adapted to the area view. For this, the respective command line must be activated. Active commands are identified in the **Planning Data** menu by a tick.

Shift	Moving a geo line in the area view by Drag & Drop.
	Measuring data and position data can be coordinated with the loaded geo lines (reference data).
Rotate	Rotating a geoline around a reference point in the area view. The reference point (rotation point) is selected with the "Position info" button. Afterwards, the geo line can be rotated.
	Measuring data and position data can be coordinated with the loaded geo lines (reference data).
Settings	Opens the **Geo line selection** dialog box, with which the view properties of the traverse lines are accessed.

i Following deactivation with the same icon, a dialog box opens for saving the changes made.

Traverse line settings

1. Select the **Geoline settings** item from the **Planning data** pull-down menu. The *Traverse line selection* dialog box opens.
2. Select the desired traverse line and confirm with "OK".
3. The *Transverse line settings* dialog box will open.
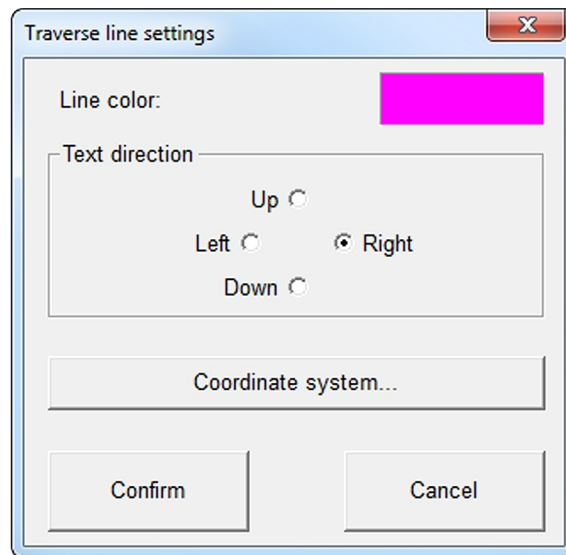
4. The colour selection window is opened by clicking on the colour field in the *line colour* area. Setting the desired colour for the geo line.
5. In the *Text direction* area, specify the position of the reference point identification.
6. Use the "Co-ordinate system" button to open the **Co-ordinate and reference system selection** dialog box. The original settings can be corrected here.
7. Save the settings with "OK".

5.10.04 Manual Referencing Traverse Lines

Bringing a geo line map on the monitor into its correct, referenced position:

1. Selecting an available geo line ().

2. Activate the **Shift traverse lines** item in the **Planning data** pull-down menu.

3. Use the hand icon to move the geo line into the desired position.

4. Activate the **Rotate traverse lines** item in the **Planning data** pull-down menu.

5. Specify the rotation point with the "Position info" button, and click the desired reference point of the traverse line.

6. Turn the geo line into the desired direction.

7. A save query appears when the two menu items **Shift traverse lines** and **Rotate traverse lines** are deactivated.

> **i** Once the geo line has been saved, it can be loaded at any time for other projects, too. The geo line is independent of the project.

5.10.05 Specifying station view

To show / hide station names of geo lines:

1. Select the **Stations** item from the **Planning data** pull-down menu.
   The project-specific identifications (position data) of the stations of a geo line are shown/hidden.

5.11 Screen Set Up

5.11.01 Specifying screen layout

To switch between full image display screen and split screen:

1. Select the **Split screen** item from the **View** pull-down menu.
   The view changes between split screen and full image display screen.
   OR

2. In the button bar, click the "View selection" button and tick "Split screen" or remove the tick.

5.11.02 Specifying window settings

With split screen, a maximum of five different views can be displayed on each side of the screen.

Specifying the views in the respective project:

1. Select the **Window settings** item from the **View** pull-down menu.
   The *Window settings* dialog box opens.
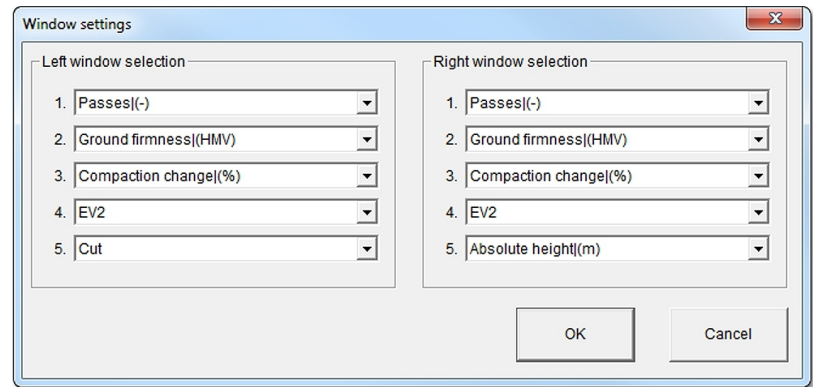
2. In every column in the pop-up menus, select which 5 windows should be able to be selected on the screen.

3. Save with OK.

Once these settings have been specified, the predefined windows can be called up at any time via "View selection" button in the button bar.
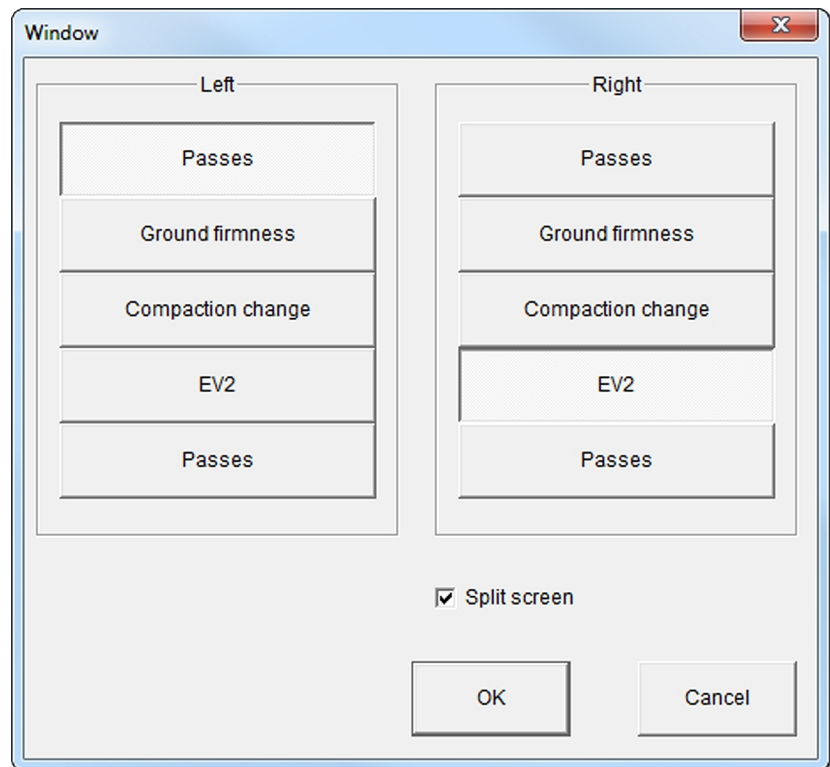
5.11.03   Background colour and text colour change

In order to change the colour view in the viewers:

1. Open the relevant *Settings* or the *Window legend* dialog box with the "Change" button in the legend.
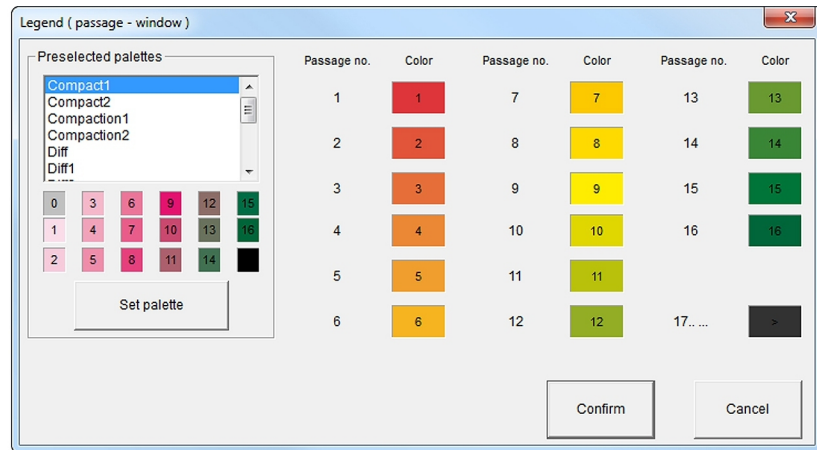
2. Click on any colour field.
   OR
   Select the preselected palette from the "Preselected palettes" window, and accept with "Set palette".
   The dialog box *Settings for background and text colors* is opened in order to assign to passages, value areas, quality steps or layers any background colour and text colour desired.
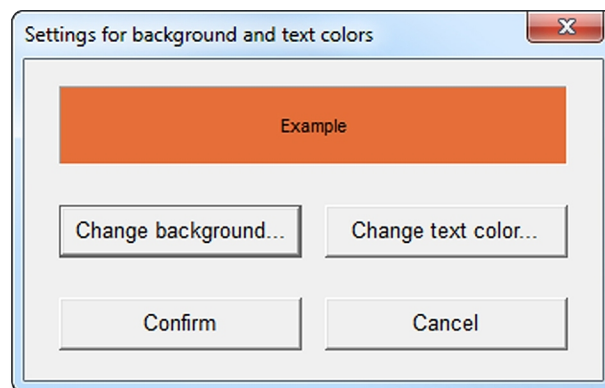
Background change	Opens the **Colour** dialog box with a colour palette primary colours and user-defined colours. Using the "Define colour" button, other colours are added to the user-defined colour palette. Finally, confirm the selection with "OK".
Change text colour	

3. After return to the *Settings* dialog box, save the entries with "Confirm".

5.11.04 Changing values and value areas

To change the value areas which are assigned to the colour fields:

1. Use the "Change" button in the legend to open the respective *Window legend* or *Settings* dialog box.
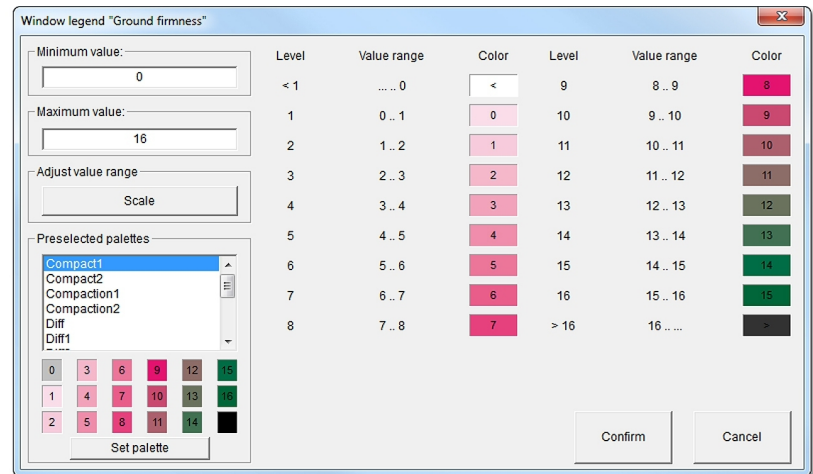
2. Set values and value areas using the buttons in the individual areas.

Minimum / maximum value	Manual input of the measurement range that is to be resolved. The scale is adjusted automatically.
Adapt value area	The colour scale is scaled automatically on the basis of the recorded measured values.
Preselected palette	Selection of a predefined colour palette
Cancel	Quits this dialog. Changes already made are lost.

3. Save all entries with "Confirm".

5.11.05 Zoom

1. Use the **View** menu to click on the desired zoom versions, the view is adapted as desired.
   OR
2. Select the Zoom tool from the toolbar (sqq.). Specify the area that is to be zoomed into by clicking and dragging in the view frame.
   OR
3. Use the Zoom in / Zoom out buttons on the Panel PC.

5.12 Evaluations

5.12.01 Replay

Subsequent analysis of the measuring procedure:

1. Select the **Replay** item from the **Analysis** pull-down menu. The *Data replay* dialog box opens.
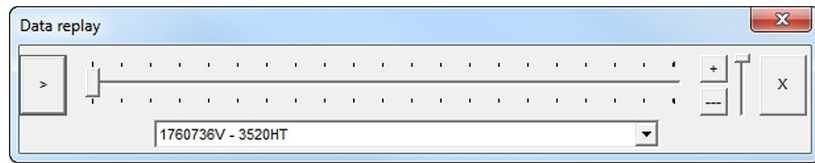
2. From the pull-down menu, select the roller / drum whose measuring pass is to be displayed.

3. Press the ">" button. The recorded measuring procedure is played.

4. With the buttons "+" and "-" you can change the replay speed.

5. With the "x" button, you can close the window.

5.12.02   Carrying out filter settings

In order to consider only specific layers, machines, timeframes or measured values in the Replay, these can be selected in the *Filter settings* window:

1. Select the **Filter** item from the **Analysis** pull-down menu. The *Filter settings* dialog box opens.
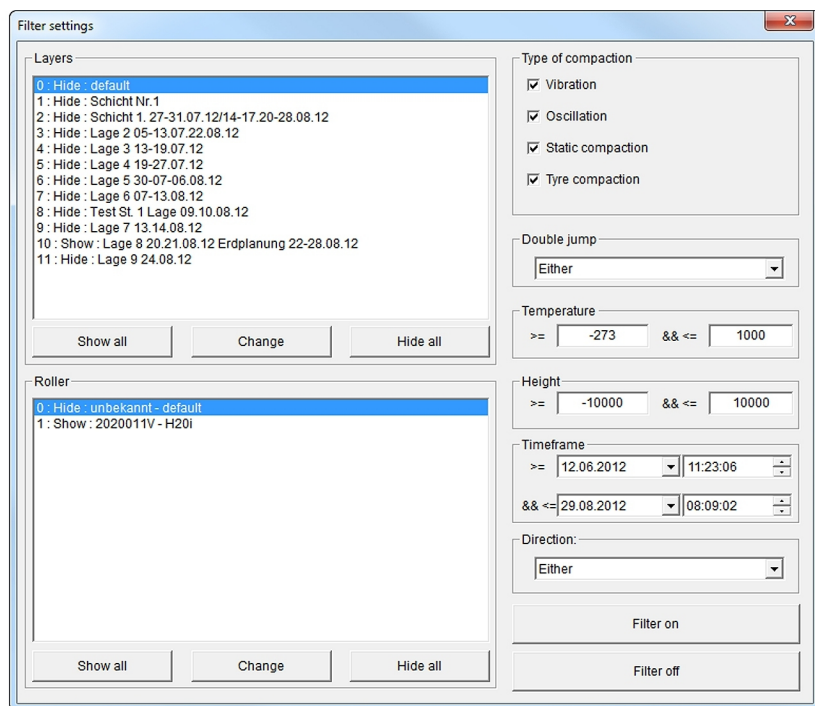
2. Click the "Show all / Hide all" button in the *Layers* or *machines* area. All available records are shown or hidden simultaneously
OR
Press the "Change" button. The particular selected record is shown or hidden.
OR
Double-click the line to be shown or hidden.

3. Select it in the *Compaction mode* area.

4. Select the desired option in the *HCM double jump* area.

5. In the *Temperature* area, adjust the temperature range desired for the analysis.

6. In the *Height* area, enter the height range desired for the analysis.

7. In the *Timeframe* area, adjust the period desired for the analysis.

8. Select the direction of travel to be considered in the *Direction* area.

9. Using the "Filter on" button, activate the configured filter settings. The "Filter active" icon appears in the toolbar.
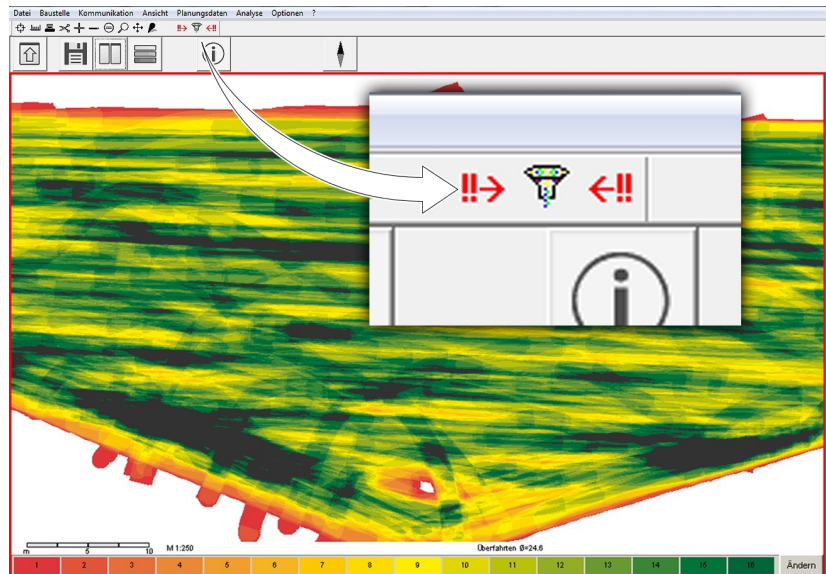
10. Using the "Filter off" button, deactivate the configured filter settings

5.12.03   Carrying out points analysis

To analyze select points on the site:

1. Select the **Point analysis** item from the **Analysis** pull-down menu.
    OR
    In the tool bar, click on the "Position history" button.
    The cursor changes to a flag.

2. By clicking with the mouse, put an analysis point on the compacted surface.
    The *Point analysis* dialog box opens.
    The position together with latitude, longitude and the number of passages are stated in the upper part.

3. Select the measured value that is to be shown in the diagram from the pull-down field.

i	The available measured values depend on whether work is done in soil work or asphalt work.
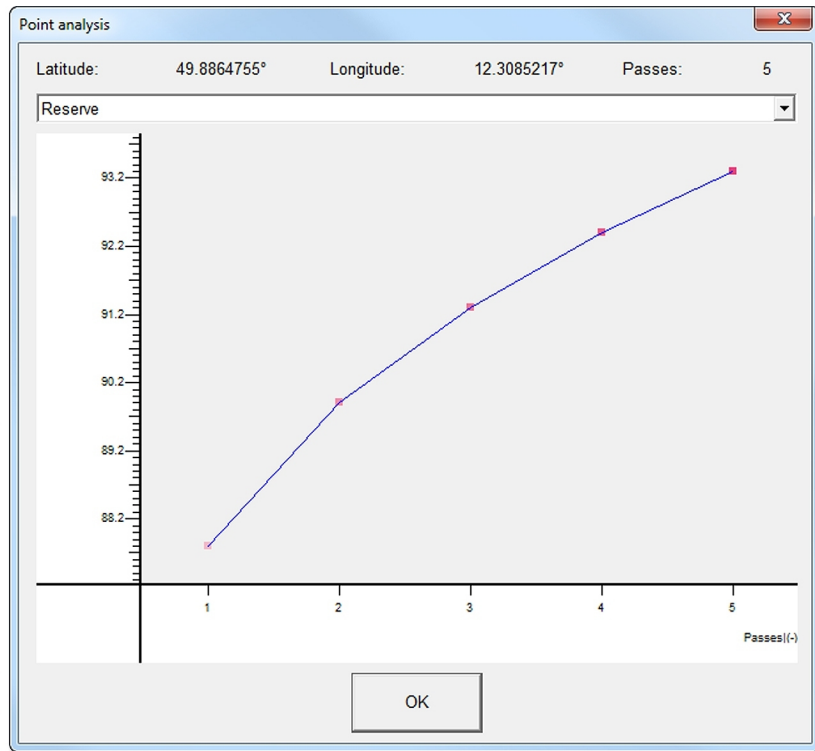
4. Click the **Point analysis** menu line or "Position" button again to disable the function.

5.12.04   Carry out distance measurement

Quick measuring of sections on the site:

1. Select the **Distance measurement** item from the **Analysis** pull-down menu.
   OR
   In the tool bar, click on the "Distance" button.
   The cursor changes to a ruler.

2. Click the starting point and drag the ruler to the end point. The starting point, end point and the distance of the last measurement are shown below the legend.

3. Click the **Distance measurement** menu line or "Distance" button again to disable the function.

5.13 Archiving

Archiving the site data occurs with an USB-Stick:

- Plug USB-Stick into one of two USB ports.

- Click the "Archiving" button on the button bar.
  A window opens with the Directory view. The target path is already preset on the stick. With the "OK" button, you can start the storage process.

- After successful archiving, the message "Storage process finished" appears.

> **i** The folder name of the data backup is complemented by date and time of the storage process.

The data thus saved can be viewed at any time on any computer with HCQ software and be processed. For this, the saved folder must be copied by hand via file managers into the project folder in the user directory.

5.14 Communication - Work with several rollers

Prerequisites In order to communicate with multiple rollers on a single WLAN data network, the following entries must be made in the system:

- the roller designations and

- the assigned IP numbers.

> **i** The settings can be made in the file HAMM-Net.txt in the "Settings" project directory.

Communication Enter the roller that is to be integrated into the particular network:

1. Select the **HAMM network** item from the **Communication** pull-down menu. The *Communication* dialog box opens.

Drum:	IP Panel PC:
1920105V	192.168.1.10
1920105H	192.168.1.67
1650062V	192.168.1.89
1650062H	192.168.2.82

HAMM.network — OK — Cancel
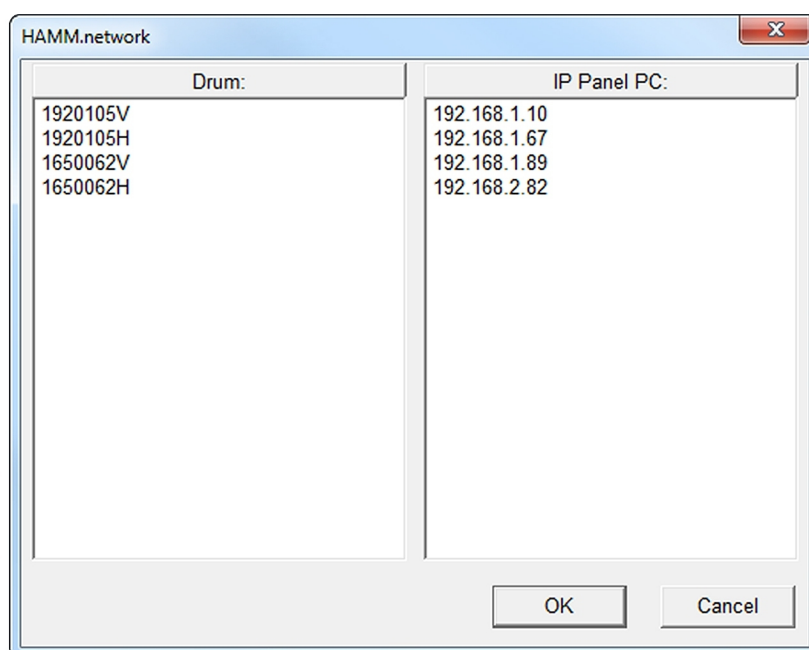
2. Enter the drums that are to be displayed one beneath the other in the left-hand "Drum" column.

> **i** Only the data of the drums entered here will be acquired.

3. Enter the IP addresses of the rollers or Panel PCs that are to be connected in the right-hand "IP Panel PC" column.

> **i** Each Panel PC has a permanently set IP address, which you are given by your Wirtgen Group service partner or is to be found on the corresponding sticker on the enclosure.

4. Save inputs with "OK".

> **i** The connection is established as soon as the entered Panel PCs come into range. If no WLAN network connection exists at HCQ program start to all active machines, an error message appears.

Fehler

Network server NOT started on computer.
Please check the IP settings on all machines.
Details:
1. Create : Port=60000;Typ=SOCK_STREAM;IP="192.168.1.10";ERROR=10049;
2. Create : Port=60000;Typ=SOCK_STREAM;IP="192.168.1.67";ERROR=10049;
3. Create : Port=60000;Typ=SOCK_STREAM;IP="192.168.1.89";ERROR=10049;
4. Create : Port=60000;Typ=SOCK_STREAM;IP="192.168.2.82";ERROR=10049;

OK
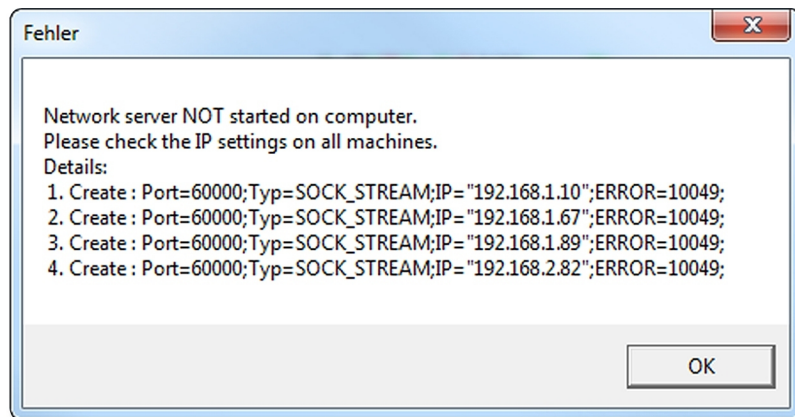
5.15 Printing

To print selected windows:

1. Select the **Print** item from the **File** pull-down menu.
   OR
   Click the "Print" button in the toolbar
   The *Print window* dialog box opens.
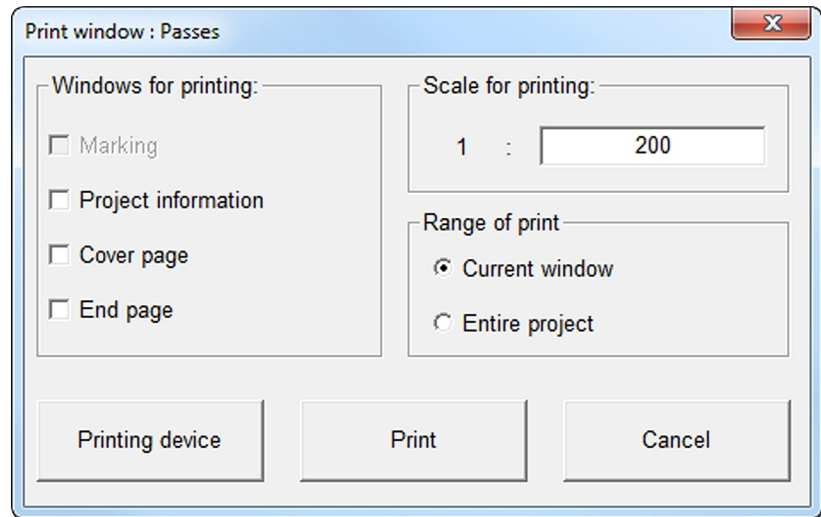
2. The pages to be printed can be selected in the check boxes.
3. Enter it in the *Scale for printing* area.
4. Select the desired option in the *Range of print* area.
5. Use the "Printing device" button for the required setup.
6. Use the "Print" button in the preview window to start the printing process.

6 TAKING OUT OF SERVICE

6.00 Panel PC

Switching off

i When shutting down the panel computer, no data will be lost. All measurement data are automatically saved during the measurement recording.

1. By pressing the "Stop" button the measuring procedure ends.
2. Stop rollers.
3. In the menu **File** press on the **Exit** menu line. The software is closed down.
4. Switch off panel computer with on / off button (left side).

Dismantling

i Find out about the decommissioning of the rollers in the operating instructions of the respective machine.
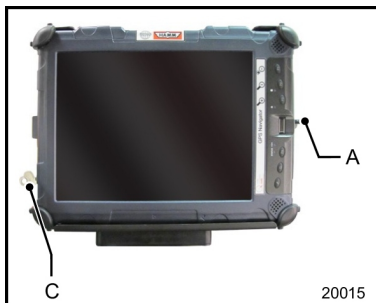
5. Shut off the rollers with the ignition key.
6. Unlock panel computer holder with key [C].
7. Push the locking lever [A] on the vehicle's PC holder down.
8. Remove computer from the open holder.
9. Keep computer in the case provided.

6.01 Receiver

> ⚠ **WARNING**
>
> **Danger of falling! Danger of injury!**
>
> Only dismount the receiver when the machine is switched off.
> During disassembly, pay attention to stable footing!

1. Connectors [D] of the GPS cable must be released at the receiver [B] and be plugged into the intended fixture.

2. Unplug the GPS cable [C] from the socket on the machine roof [A], and seal the socket with a screw plug.

3. Remove the receiver on the magnetic feet from the machine roof [A], and store it in the case supplied.
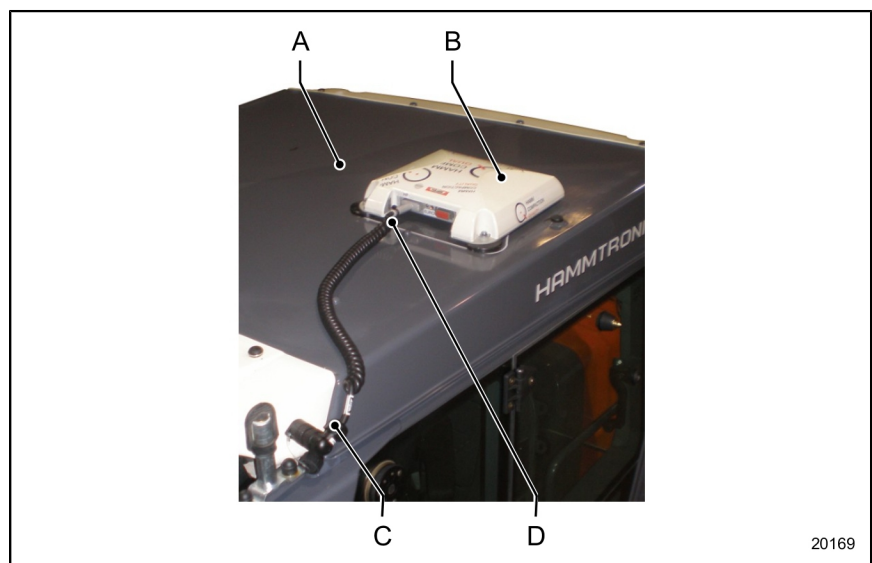
6.02 Office computer

Shut down the HAMM computer software at an office computer:

1. In the **File** menu, click the **Exit** menu line.
   The software is closed down.

6.03 Uninstalling software

Uninstall the software on the office computer when required, using the operating system.

Windows Start Menu / Control Panel / Programs and Functions

7 APPENDIX

7.00 Directory structure

HCQ- file directory The file directory of the HAMM-HCQ-Software, HammHcqData, is located in the public user directory. As a function of language and operating system, this is as follows:

- Windows XP, German: C:\Dokumente und Einstellungen\ HammHcqData
- Windows XP, English: C:\Documents and Settings\HammHcqData
- Windows 7: C:\Users\Public\HammHcqData

The folder structure within the directory HammHcqData is as follows:

Calibration			Global calibration information
Dictionary			Country-dependent menu texts
Lines			Geolines
Maps			Bitmaps (maps...)
PrintView			Cover sheet and End page for print out-put
Project			Folder for projects
	Default Project		Sample project with default settings
		Calibration	Calibration Defaults
		Dictionary	unused
		ErrorData	unused
		Export	unused
		Planning Data	unused
		Lines	unused
		Maps	unused
		Project	Default view settings...
		Settings	Default settings for window, co-ordinate system, network...
	Project1		User project; The name can be freely chosen by the user.
		Calibration	Calibration data
		Dictionary	Menu texts of the currently set language
		ErrorData	Measurement data with e.g. storage con-ditions that have not been not fulfilled
		Export	unused
		Planning Data	Planning sata (bitmaps, geolines)
		Lines	Geolines
		Maps	Maps as bitmaps
		Project	Measuring data

		Settings	Settings for window, co-ordinate system, network...
	Project2		
		...	

In every HammHcqData folder, a project called Default Project is created automatically at installation. This contains all basic settings which then again serve as a default for the new creation of projects. In the **Open project** dialog box, this project is not visible.

HCQ program directory The program directory can be freely chosen by the user at the time of installation. Typically:

Windows XP

C:\Program Files\HCQ Navigator or

C:\Program Files\HCQ Navigator

Windows 7

C:\Programme (x86)\HCQ Navigator or

C:\Program Files (x86)\HCQ Navigator

7.01 DGPS Correction Signal Versions

According to use, GPS-positioning systems deliver different accuracies.

Absolute accuracy of GPS-positioning methods

Positioning method DGPS	Near absolute accuracy
RTK with local base station	2.5 cm / 1 in
OmniSTAR HP	15 cm / 6 in
OmniSTAR VBS	75 cm / 30 in
WAAS/EGNOS	1 m / 40 in

7.02 Coordinate System

The HCQ system receives the position information in the notation usual in the GPS: "degree". The latitudes, here, have their origin in the equator, the longitudes in the prime meridian in Greenwich. The height information is received as height above the geoid (corresponds, about, to the sea level) in meters. The position here refers to the so-called reference ellipsoid WGS84 (World Geodetic system in 1984).

Positions, however, are mostly depicted in land surveying and in road construction in co-ordinate systems specific for region or specific for country. HAMM HCQ software has an extensive data base with information on a large part of the globally used co-ordinate systems that allows the user to work extensively in the view relevant for the site. Parameterizing the site-specific co-ordinate system is via the window "Co-ordinate and reference system selection".

7.02.01 Types of co-ordinate systems

There are various types of co-ordinate systems. Views are possible as polar or as map co-ordinates. In addition, every system has an individual origin, which is often defined independent of the equator or the Greenwich meridian.

The most familiar ones are:

Geographical co-ordinates (Greenwich) [degree]

- Range (L / B): -180 to +180 / -090 to +090 degrees

- Notation (E / N): ±ggg / ±gg

UTM co-ordinates (northern hemisphere)

- Range (L / B): -180 to +180 / -089 to +089 degrees

- Notation (E / N): sskkkmmm / ±kkkkmmm

Gauss Krüger co-ordinates (3 degree-wide strips)

- Range (L / B): -180 to +180 / -089 to +089 degrees

- Notation (East/North): ssskkkmmm / ±kkkkmmm

7.03   Reference Systems

The reference system and/or rotation ellipsoid forms the basis for the co-ordinate systems of geopositions. The geo co-ordinate systems model the earth as a rotation ellipsoid which corresponds as exactly as possible to the dimensions of the earth. The axes are designed in each case so that the axis for the region to be surveyed optimally corresponds to the earth's surface. The measures of this ellipsoid are determined with the equator axis (big half-axis) as well as the polar axis (small axis). In addition, this model is fixed at several earth points.

Customary reference systems are as follows:

- WGS84 (World Geodetic System 1984) with WGS84 ellipsoid

- ETRS89 (European terrestrial reference system 1989) with GRS80 ellipsoid

- DHDN (German main triangle network) with Bessel ellipsoid

The HCQ software uses these reference systems for the surface co-ordinates of the geopositions, i.e. for longitude latitude determination.

The Geoid, which defines surfaces with the same gravity field all around the globe, is used in geodesy ,in addition to the ellipsoid model, for height interpretation. The heights are documented thus as height relative to the geoid, which roughly corresponds to the common height above the sea level. The model integrated in the HCQ - regardless of the set reference ellipsoid - is always the globally used WGS84-EGM96.

7.04   Geo Points

The HCQ system allows for the option to save geodetic positions combined with extra information as data records. Here, we basically distinguish between two types of points:

- **Info point** : assigns to a position a name as well as a comment.

- **Calibration point**: assigns to a position and measured data determined by the rollers, a reference measurement value, in addition.

7.05   Soil Compaction Reference Values

Soil type	Recommended setting (last pass)	HMV range	Stiffness / load capacity
Silty / loamy soils with **excessive** water content	• large amplitude • maximum frequency • speed: 2 - 2.5 km/h	0 - 5	low
Silty / loamy soils with the **correct** water content	• large amplitude • maximum frequency • speed: 2 - 2.5 km/h	5 - 15	low
Sandy soils / gravely soils	• small amplitude • reduce the frequency by 5 - 8 Hz (Hammtronic only!) • speed: 2.5 - 3 km/h	15 - 30	medium

| Soil type	Recommended setting (last pass)	HMV range	Stiffness / load capacity
anti-freeze compound / base layer material / HGT	• small amplitude • reduce the frequency by 5 - 8 Hz (Hammtronic only!) • speed: 2.5 - 3.5 km/h	30 - 50	high
Rock	• small amplitude • reduce the frequency by 5 - 8 Hz (Hammtronic only!) • speed: 2.5 - 3.5 km/h	50 - 100	very high

7.06   Recommended Working Depths

This overview shows the working depths of the various types of vibration rollers at a large amplitude and maximum frequency.

i   **Deviations from reference values are possible!**

The working depths are correspondingly halved at a small amplitude. The stated values must be regarded as guide values, and can vary widely under different soil conditions.

Machine type	Soil type		
	Rock	**Sand / gravel**	**Clay / loam / silt**
3205		25 - 30 cm (9.8 - 11.8 in)	15 - 20 cm (5.9 - 7.9 in)
3307		28 - 40 cm (11.0 - 15.7 in)	20 - 25 cm (7.9 - 9.8 in)
3410, 3411	50 - 70 cm (19.7 - 27.6 in)	42 - 50 cm (16.5 - 19.7 in)	25 - 35 cm (9.8 - 13.8 in)
3412	70 - 85 cm (27.6 - 33.5 in)	50 - 65 cm (19.7 - 25.6 in)	28 - 40 cm (11.0 - 15.7 in)
3414	85 - 105 cm (33.5 - 41.3 in)	60 - 70 cm (23.6 - 27.6 in)	30 - 42 cm (11.8 - 16.5 in)
3516	97 - 125 cm (38.2 - 49.2 in)	67 - 80 cm (26.4 - 31.5 in)	30 - 40 cm (11.8 - 15.7 in)
3518	110 - 140 cm (43.3 - 55.1 in)	72 - 95 cm (28.4 - 37.4 in)	35 - 45 cm (13.8 - 17.7 in)
3520	125 - 155 cm (49.2 - 61.0 in)	90 - 115 cm (35.4 - 45.3 in)	37 - 52 cm (14.6 - 20.5 in)
3625	150 - 195 cm (59.0 - 76.8 in)	120 - 160 cm (47.2 - 63.0 in)	45 - 55 cm (17.7 - 21.7 in)
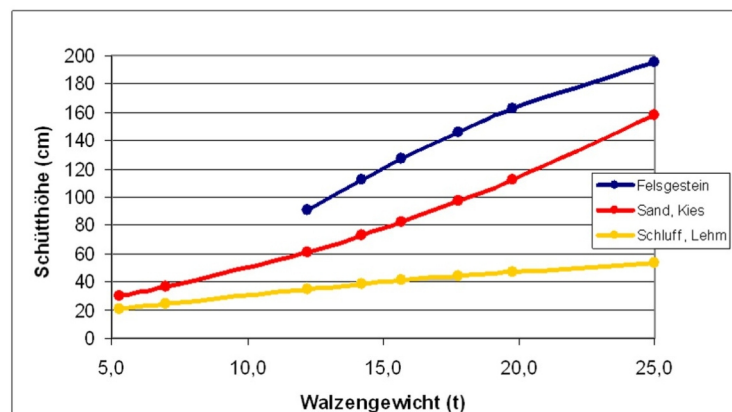
20017

7.07   Calibration

7.07.01   General

Information about compaction is initially gained during a measuring procedure by looking at the course of the measurement value changes.

An allocation of these measured data to absolute values (e.g., load-carrying capacity EV2) is possible only by previous calibration by means of conventional measuring systems. Therefore, it is possible to determine relevant evaluation parameters from the compaction measurement (HMV).

The calibration produces, by means of conventional processes (e.g., bearing plate, Proctor) a linear connection between the compaction measured data of the machine (HMV) and the load-carrying capacity (e.g. EV2) or other alternative physical evaluation parameters of the ground.

7.07.02   Advantages

The stiffness value HMV measured by the machine is measured dynamically, i.e. by the compaction frequency vibrating in the vibration frequency.

For the acceptance of the work, the static load-carrying capacity of the ground is to be proven, something that, however, means a lot of time involved and therefore can only be carried out selectively. In many areas, therefore, a linear connection exists between both measurands when observing some instructions. Thus, it is possible, for instance, to draw conclusions - from a calibration of the dynamically measured dimensionless HMV value - concerning dimension-related ground load-carrying capacity values like EV1 or EV2.

The following requirements must be met:

- The parameters of speed, amplitude, compaction frequency and direction of movement during measuring procedures must precisely correspond to those of the calibration.
- The calibration applies for the same ground and the same underground conditions, i.e. typical for a given layer.

After calibration, it is possible to comprehensively survey the ground with the rollers, using the unit relevant for the load-carrying capacity, e.g., EV2 in MN/m².

7.07.03   Prerequisites

The basis of the calibration are at least three value pairs (HMV reference values) which are saved in geo points and were determined under equal conditions:

- Driving speed
- Amplitud
- Compaction frequency
- Driving direction
- All HMV roller measured data must have been determined with an identical machine.
- The measuring method of the reference measured data must be identical.
- All the calibration geo points consulted for reference must be assigned to the same layer.

8 MAINTENANCE

8.00 Recharging Battery

Charging the batteries sqq.

8.01 Changing the Battery

Removal of the battery
1. Switch off panel computer with on / off button (left side).
2. Disconnect panel computer from power supply (sqq.).
3. Press battery catch with a pin.
4. Move battery lock in the direction of battery catch.
5. Remove the battery.

Inserting the battery
1. Insert new battery into the empty battery compartment.
2. Press battery downwards.
3. Return the battery lock into its starting position.
   The battery catch engages and the battery is secured.

> **i** The switched off panel computer can be stored for 30 days with charged battery.

8.02 Replacing the Digitizer

By constantly using the digitizer, the tip can wear out and scratch the screen.

In the case of appearance of the following problems, please replace the digitizer:

- The digitizer no longer moves easily across the screen.
- The digitizer is not working properly anymore.

Further information on this is available in the panel computer manual that is part of the scope of delivery.

8.03 Caring for your Screen

<div style="background-color:#2196f3; text-align:center;">**NOTICE**</div>

Damage to the screen!
Alcohol can damage the computer screen!
Do not use any alcohol-based detergents!

Carefully wipe the screen with a soft, moist cotton cloth.

> **i** By leaving on or re-applying the protective film provided to the screen, you can protect your screen from wear and tear.