Feltest
FiberScan*ONE*™

Instruction manual

⚠️ *CAUTION!*

Doing measurements of any kind on running paper machines is potentially dangerous and requires alertness, concentration and common sense. The products of Feltest Equipment BV are designed and constructed to be as safe as possible for their intended use. Feltest Equipment BV cannot be held responsible or liable in any way for injuries or damages that occurred using Feltest Equipment BV's products.

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Dear Customer,

thank you for choosing the FiberScan*ONE*™ as your microwave drainage meter .

This high-tech drainage meter is the result of over 5 years of research on how to read the water amount in the forming section, based on microwave technology. Already 5 years before that we started developing our own microwave technology to measure the water content in press felts, which resulted in the PresScan™.

The FiberScan™ research process involved our labs, universities, "centres of excellence" and many service engineers who use our drainage meters every day and helped us to fine-tune the instrument. We are proud of the result: to replace the dangerous and critical ionising radiation equipment by a harmless, easy to handle microwave meter that can be transported freely around the world. The FiberScan™ changed the technology and principles of the drainage meters in the paper industry and sets the new standard!

Feltest Equipment and Cristini Engineering have a policy of constant innovation. We carefully listen to our customers and continuously implement improvements in our products, which usually can be retro-fitted as well. Due to this customer orientation, the latest version of the FiberScan™, the FiberScan*ONE*™, has some important new features:

- ✓ New one-unit design with integrated sensor and control unit;
- ✓ Total weight is even further reduced to 3.4 kg and well balanced;
- ✓ The telescopic sensor handle is extended to 1.51 m;
- ✓ Water height is now readable in excess of 48 mm (this is 48 kg/m^2 of water!), the highest ever achieved with any microwave drainage meter;
- ✓ Special setting for improved accuracy at pulp and heavy board grades;
- ✓ New user interface with graphical functions to show the dewatering trend over the measurement positions and to show CMD profiles;
- ✓ Usable temperature range up to 80°C; TiO_2 compatible
- ✓ Standard wireless Bluetooth® module to load the measurement data to the PC;
- ✓ Host XL™ PC software; an integrated database application to easily generate drainage and retention profiles;
- ✓ Smaller and lighter carrying case.

Thank you,
The FiberScan™ Development and Sales Team

1 IMPORTANT INFORMATION AND GENERAL COMMENTS ON THE SAFE USE OF FIBERSCAN*ONE*™

1.1 Intended use

The Feltest FiberScan*ONE*™ is developed *only* for use in the forming section of running paper machines. With patented microwave technology the FiberScan*ONE*™ measures the amount of water on top of plastic forming fabrics. The instrument is not intended, nor suitable for use on any other object or for any other application.

1.2 Safety precautions

⚠️ **SAFETY WARNING!**
The FiberScan*ONE*™ is developed for use on dangerous machines (i.e. paper machines). The user of the FiberScan*ONE*™ must be properly trained and must take all possible precautions required to perform safe measurements on the machine where the instrument is used.

⚠️ **SAFETY WARNING!**
Do not bend over into the machine. If you must lean against a safety fence, first check its stability. Do not ignore or remove safety constructions.
ALWAYS FOLLOW THE SAFETY INSTRUCTIONS THAT APPLY FOR THE LOCATION WHERE THE MEASUEMENTS ARE DONE.

⚠️ **SAFETY WARNING!**
The user must take all possible safety precautions to prevent entanglement of garments or of the FiberScan*ONE*™ and its accessories and cables into the moving parts of the machine where the instrument is used.

⚠️ **SAFETY WARNING!**
During the use of the FiberScan*ONE*™ the operator must make sure at any time that the connecting cable is not looping around any part of the operator's body, to prevent any possibility to be dragged into the machine's moving parts.

⚠️ SAFETY WARNING!

Although especially designed for the use in rough conditions, the FiberScan*ONE*™ must be carefully inspected before taking it into operation. Always verify if the FiberScan*ONE*™ is in perfect condition to perform safe measurements.
It is particularly important to check if the ceramic sensor plate is in good, undamaged condition and that there are no loose or damaged parts on the FiberScanONE™ exterior.

⚠️ WARNING!

Ceramic materials are sensitive to thermal shock! Temperature alerts are implemented. Please let the FiberScan*ONE*™ warm up slowly if it was stored in a cool environment; preventing to do so might cause permanent and dangerous damages to the ceramic sensor head.

1.3 Technical precautions

⚠️ CAUTION!

Close the connector cap on the handgrip side of the FiberScan*ONE*™ BEFORE taking the FiberScan*ONE*™ into operation. The connector must stay dry at all times!

⚠️ CAUTION!

Only plug in the supplied battery charger into an electricity network that is up to standards. During the charging process, the user should be able to reach the power plug easily.

⚠️ CAUTION!

Plug in the battery charger only indoors, in dry areas, away from heat sources (radiators, heaters, etc.).

⚠️ CAUTION!

Do NOT use the FiberScan*ONE*™ while the battery charger is plugged into the electrical system.

⚠️ CAUTION!

Use only authorised replacement batteries (see paragraph 6.3)

1.4 Important directions for use

⚠️ **CAUTION!**

FiberScan*ONE*™ reads the water grammage, not the total mass. Its advanced technologies make it virtually insensible to both the forming fabric mass as components present in the paper stock.
To calculate the final mass numbers, please read paragraph 2.2 **carefully.**

⚠️ **CAUTION!**

Ceramic is sensitive to thermal shock! Temperature alerts are implemented. Please let the FiberScan*ONE*™ heat up slowly if it was stored in a cool environment; preventing to do so might cause permanent and dangerous damages to the ceramic sensor head.

⚠️ **CAUTION!**

The ceramic plate needs a little break-in time to reach optimal smoothness. This is achieved after only a few hours of usage.

⚠️ **CAUTION!**

Prior to upgrading the instrument firmware, always consult Direct Service at +31 313 652 215. Wrong procedures might damage the control unit ROM.

Updated versions of the "FiberScan Host" software and the FiberScan™ on-board firmware are available for free and can be requested per email at service@feltest.com

2 KNOW WHAT YOU MEASURE! ABOUT THE FIBERSCAN™ AND ITS MEASURING PRINCIPLE

2.1 Introduction

The FiberScan™ is a microwave measurement device for the paper industry; it measures the amount of water above the sensor head (illustration 1). Due to its compact sensor head the measurements can be performed on many positions along the forming section, giving the user the possibility to create detailed drainage curves.

Illustration 1 - FiberScan measures water height

Due to its microwave sensor, the FiberScan™ measures only the water mass, i.e. the water in the paper sheet and the water enclosed in the void volume of the forming fabric. The forming fabric itself is practically transparent for the sensor and also the fibers and fillers in the paper stock do not influence the FiberScan™ results. The test results of the FiberScan™ cannot be compared one-on-one with the results of a gamma gauge, because the latter measures the total mass, so water + fibers and fillers + the forming fabric. The next paragraph will give more details on how to create a drainage curve.

The FiberScan™ is equipped with a temperature sensor in order to compensate for temperature variations.

The instrument contains a memory card where up to 2000 measurements can be saved. The FiberScan*ONE*™ can be connected to a PC by either the USB cable or wireless through Bluetooth™ communication.

2.2 Evaluation of the test results

As mentioned before, the FiberScan™ measures ONLY the **water mass** and is hardly influenced by fibers, fillers and the forming fabric. The previously often used gamma gauges measure something a bit different; that is the **total mass** including fibers and forming fabric. For that reason the test results of both types of instrument can only be compared with each other after some simple additional calculations.

The <u>total</u> mass on the forming fabric is expressed by the following formula:

> **Mass on fabric = FiberScan™ reading – forming fabric water content + solids on fabric**

2.2.1 How to measure the water in the fabrics void volume

Due to its measuring principle the FiberScan™ enables an accurate measurement of the amount of water that is carried by the forming fabric in its void volume. With the older gamma gauges one measured the mass of the carried water *and* the mass of the (worn?) forming fabric.
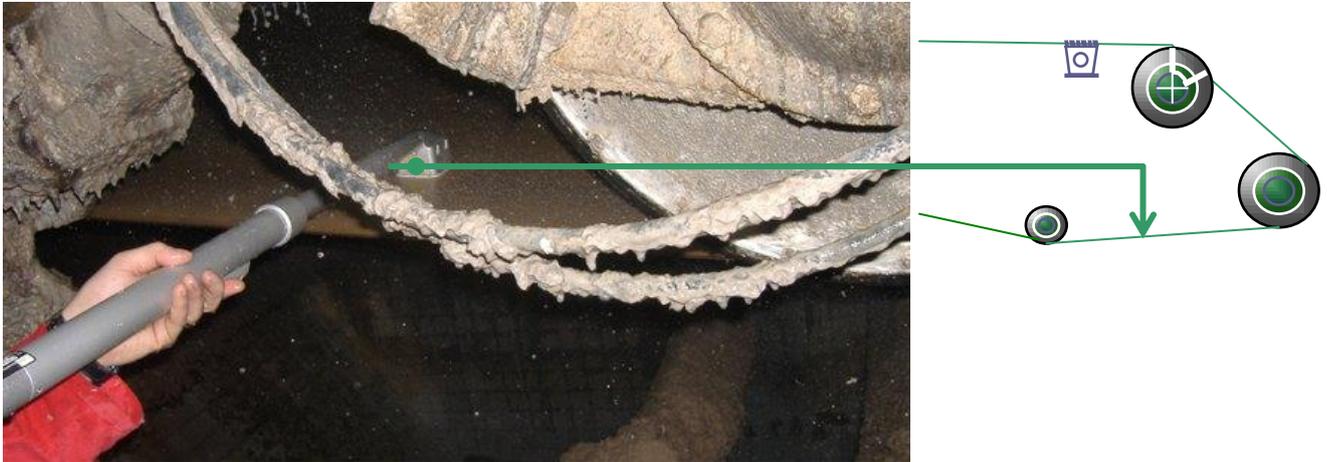
Illustration 2 - Determining the water content in the forming fabric

To measure the water that is contained in the fabrics void volume, place the FiberScan™ sensor head directly on the roll side of the forming fabric. The ideal position would be directly behind the pick-up point but in reality it is mostly impossible and very unsafe to measure there. In many machines the best alternative safe position is after the drive roll, before any showers (illustration 2).

2.2.2 How to calculate the sheet consistency

The sheet consistency or dryness on the forming fabric is calculated according to the TAPPI methodology:

Sheet consistency = solids *on* the fabric / total mass *on* the fabric

Example:

FiberScan™ total water reading:	**5000**	**g/m²**
FiberScan™ forming fabric water content reading:	**150**	**g/m²**
Solids on forming fabric (paper grammage):	**100**	**g/m²**
Mass on fabric = 5000 g/m² - 150 g/m² + 100 g/m² =	**4950**	**g/m²**
% consistency (dryness) = 100 g/m² / 4950 g/m² =	**2,02**	**%**

3 THE FIBERSCAN*ONE*™ AND ITS COMPONENTS

3.1 Scope of delivery

The Feltest FiberScan™ comes in a robust transportation case. In the case are the following articles:

1 control unit
1 adjustable pole with sensor head
1 USB cable to connect the control unit to a computer
1 reference glass plate to verify and to calibrate the sensor head.
1 battery charger with various adapters
1 inverter 12V to 220V to charge the batteries in a car

3.2 Names of parts

3.2.1 Assembled instrument
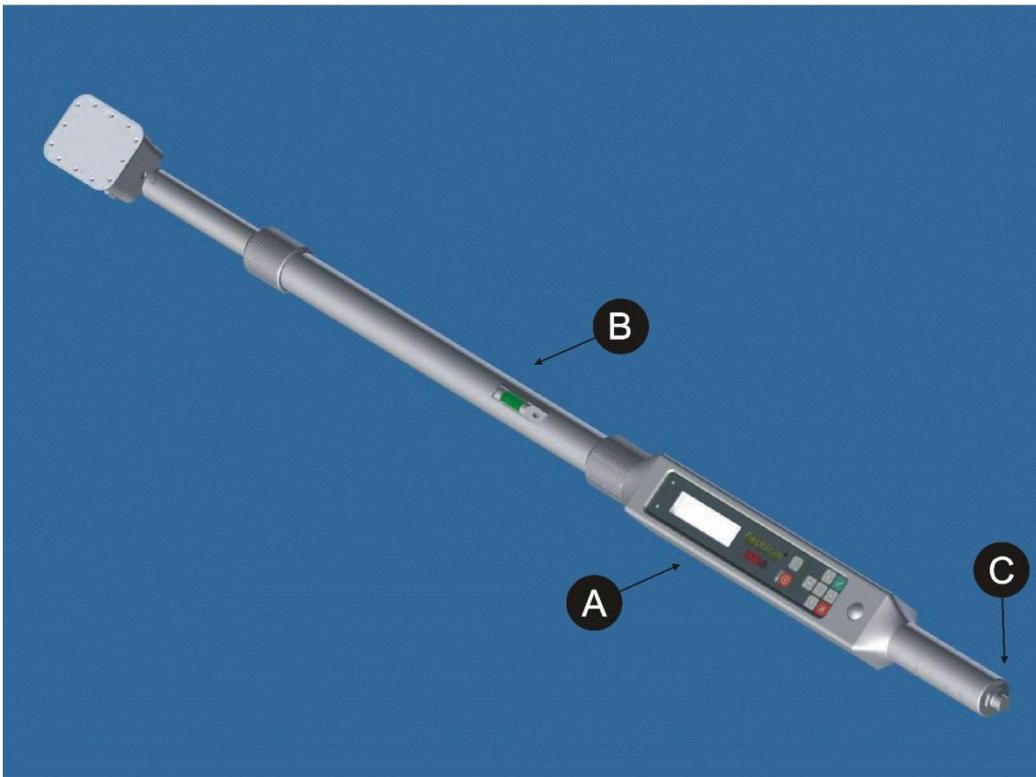
Illustration 3 - the assembled instrument

    A.   Control unit with the display and navigation keys.
    B.   Adjustable pole with sensor head and water level.
    C.   Auxiliary connector for data transmission and battery charging.
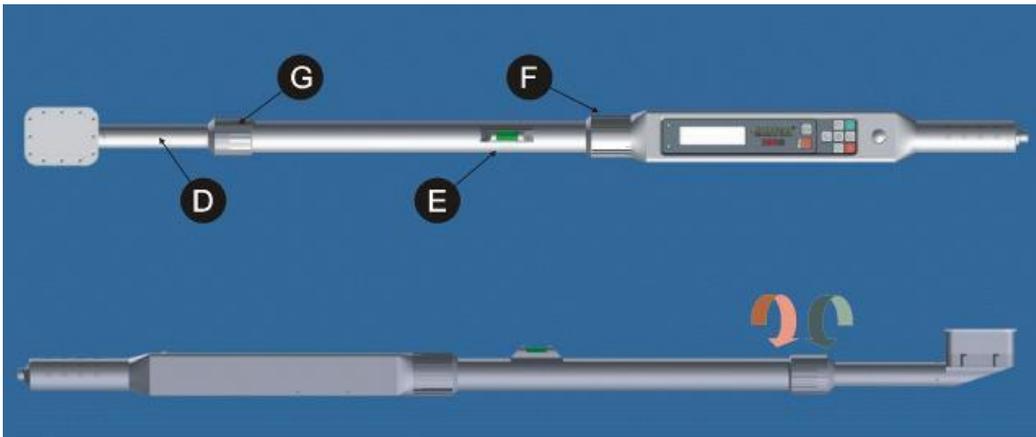
Illustration 4 - Top and side view

    D.   Retractable section of the pole with the sensor head attached to it.
    E.   Water level to check the position during measuring.
    F.   Ring to fix the pole to the control unit.
    G.   Ring to fix the retractable section of the pole
        (turn in the direction of the red arrow to tighten, green to loosen).

3.2.2 Control unit details
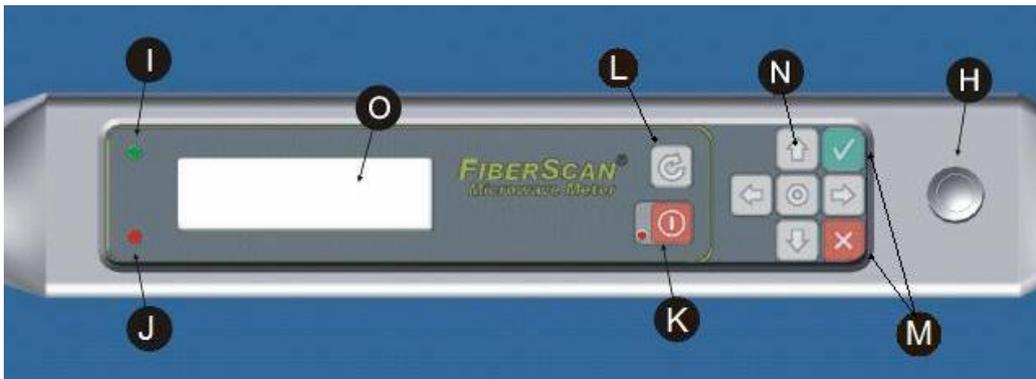
Illustration 5 - Control unit details

    H.   Button to start the measurement, hereafter called "**Measure** button"
    I.   Sensor on-line indicator
    J.   Sensor activity indicator
    K.   On/off key
    L.   Rotate display key (⟳) for left hand / right hand use
    M.   "Accept/Enter" and "Escape/Back" keys, hereafter called ✓ and ✗ respectively.
    N.   Navigation keys, left/right (⬅➡) and up/down (⬆⬇). The center key ⬤ has several functions, depending on the context.
    O.   Display (OLED technology)

3.2.3 Sensor head details

P. Microwave sensor head with ceramic plate.
Q. Status indicator that lights red, orange and green.
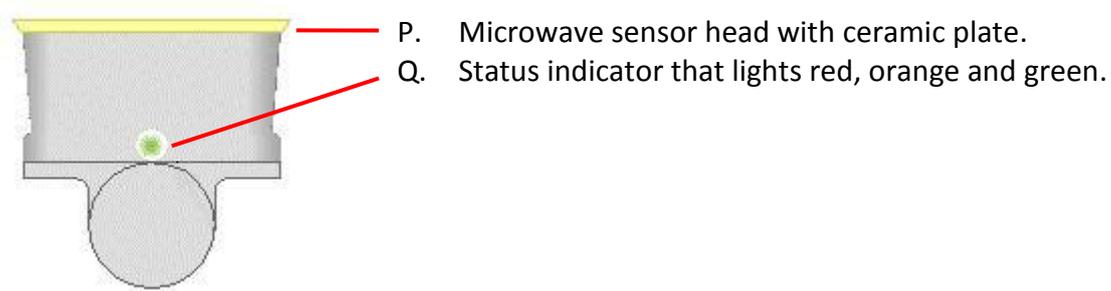
Illustration 6 - Detail sensor head

3.3.4 Cables and other accessories

R. USB cable to connect the FiberScan™ to a computer

S. Worldwide useable battery charger.

T. Inverter to change 12V from the car electrical system into 220V to operate the battery charger in the car.

U. Special glass plate to test the calibration.
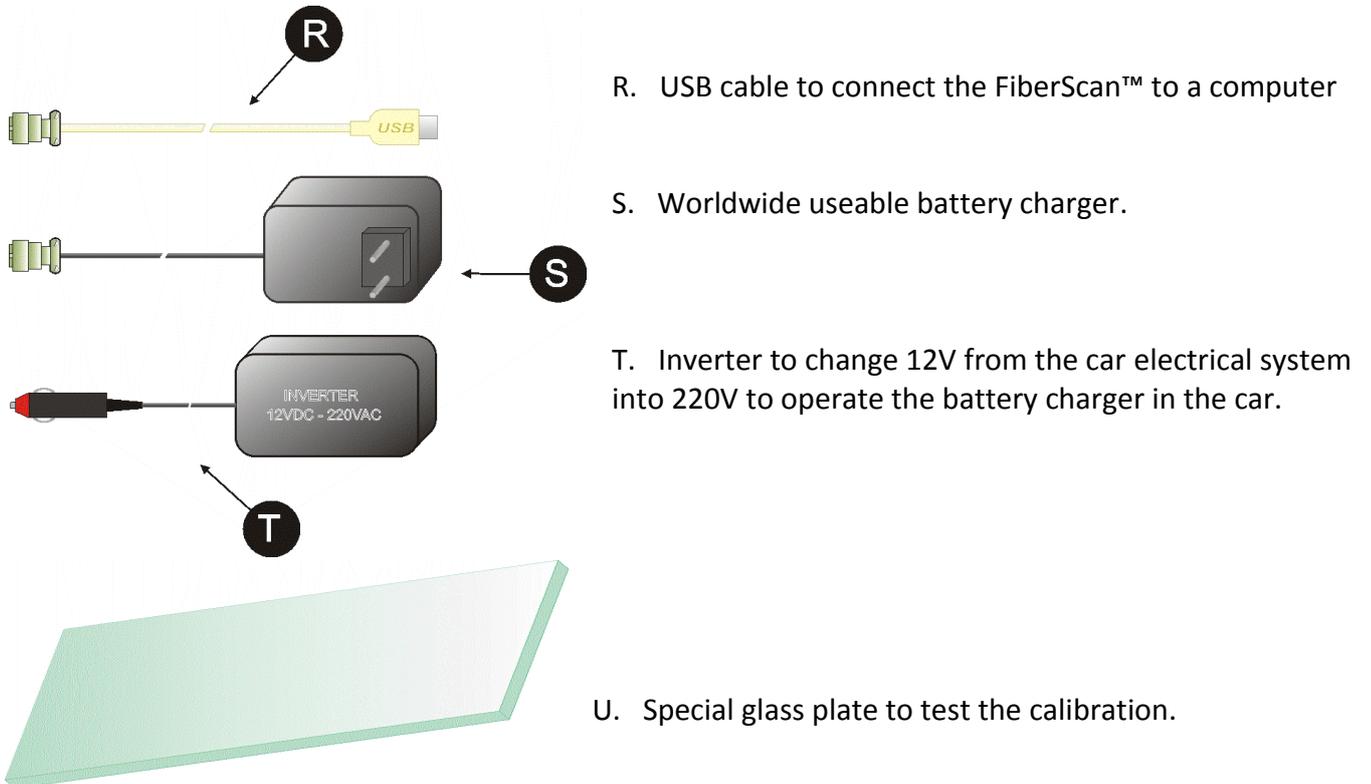
Illustration 7 - Cables and accessories

4 GETTING STARTED

Please follow the instructions below to use the FiberScan™ correctly. Keep the remarks on the evaluation of the FiberScan™ results in mind, as described in paragraph 2.2.

4.1 What measurements can be done with the FiberScan*ONE*™

The FiberScan*ONE*™ is a very versatile tool when investigating the drainage in the forming section. With this gauge the user can:

- o Perform point measurements on several positions in the forming section, thus creating a dewatering curve over the forming section (see paragraph 4.4.6).
- o Create a (partial or full) cross machine direction profile (see paragraph 4.4.7)
- o Investigate pulsations and mass variations by executing a FFT-analysis on the FiberScan*ONE*™ signal (see paragraph 4.4.8).
- o Check if the latest measurement "fits in the picture" by graphically displaying all measurements on the machine (see paragraph 4.5).

4.2 Assembling the FiberScan*ONE*™

> ⚠️ *CAUTION!*
> **Assemble the instrument only when the power of the control unit is switched off!**

The FiberScan*ONE*™ is easy to assemble. Take the adjustable pole with the sensor head (B) and connect it to the control unit (A). The two pins in the pole-part will help to align both parts so that the electronics connector will not be damaged. Please note that both parts can only be connected together when the ceramic sensor surface and the display are facing in the same direction. Then carefully tighten the ring (F) to fix both parts together.

> ⚠️ *CAUTION!*
> **If the two parts are not properly aligned or connected, ring (F) will not move easily. In that case re-join the two parts. Do not use excessive force to tighten the ring!**

> ⚠️ *CAUTION!*
> **If the two parts are not properly connected, water can enter the instrument interior and severely damage the electronics!**

Switching the instrument on and off

To switch on the FiberScan™ press the ON/OFF key (K) for a few moments. Once the display lights up, you can release the button.

To switch the instrument off, press the ON/OFF key again for at least 1 second; the message "**<< SHUTDOWN >>**" will appear on the display, and after a few seconds the unit will switch off.

⚠ **CAUTION!**

During the measurements or in any other situation in which the internal memory is accessed, the ON/OFF key is deactivated. This is to avoid any writing errors which could compromise the integrity of the saved data.

In the upper right side of the display is the battery indicator shown. If the batteries run low, the user will be warned by a blinking battery symbol.

⚠ **CAUTION!**

Measurements made when the low battery message was displayed could be less accurate.

If the battery level goes down further, the instrument will automatically switch off. To continue to use the instrument, the batteries must be recharged using the supplied battery charger. For instructions on the battery charger please check paragraph 4.7.

4.3 Understanding the memory structure of the FiberScan*ONE*™

The FiberScan*ONE*™ has memory to store about 2000 measurements. To bring structure in the saved data, the user can select:

- o **PM** = counter/indicator for the paper machine on which the analysis is made; Depending on the number of measurements, the FiberScan*ONE*™ can memorize up to 7 machines.
- o **Pos** = counter/indicator for the position where the measurement is taken (i.e. after forming table, after 1st foilbox etc.). Per PM up to 31 Positions can be memorized. The test result shown for a certain position is the mathematical average of 1 or more measurements on that position.
- o **Mea** = counter/indicator for the actual measurement on a certain position. Up to 255 Measurements per Position can be stored.

Example:

The FiberScan operator starts a dewatering analysis on a paper machine. If it is the first machine he measures, he will set PM to 1. He checks the machine and sees there are 5 positions where he can take a measurement (Pos 1 to 5). At every position he wants to take 3 measurements to check the repeatability of the test results (Meas 1 to 3 for each of the 5 Pos).

Measurements can be deleted directly by pressing the ❌ key. A **Pos**ition with all its related **Mea**surements can be deleted in the same way, but the operator will have to confirm (✅) or cancel (❌) this actiont. The same applies when a **PM** is deleted, together with all its **Pos**itions and **Mea**surements.

More information on the menu and all the options (like setting the instrument to automatically capture for example 3 measurements per position), can be found in paragraph 5.2.

4.4 Starting a measurement

In the following section the full procedure to perform measurements is described step-by-step. For more information on the settings of the FiberScan*ONE*™ please refer to chapter 5.

4.4.1 Primary user interface

When the instrument is switched on, a screen like in illustration 8 appears as the primary user interface:

Illustration 8 - Primary user interface

The menu options are shown at the bottom of the display and can be selected by moving the triangular cursor (inside the red circle in illustration 8) with the ⬅➡ keys.

To activate the Set-up menu, align the cursor accordingly and press ✅ to enter the Set-up menu or press ❌ to go back one menu level.

To change the **PM**, **Pos** or **Mea** counter move the cursor with ⬅➡ to the according menu item. Then use ⬆⬇ to set the desired number. When a **Mea**surement memory position already contains test results, the data will be displayed immediately (like the example in illustration 9). The 🔒 symbol behind the counter indicates that the current memory position contains values that cannot be overwritten.
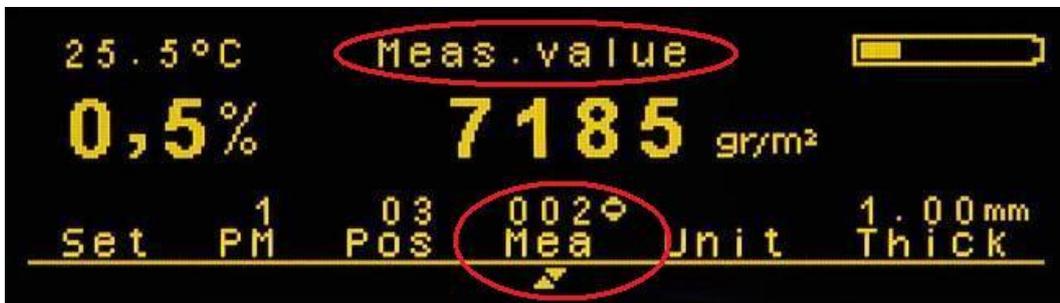
Illustration 9 – Display after a measurement (example)

In the centre of the screen is the text "Meas. value" shown, with underneath the test result.

On the left part of the display the relative standard deviation (RSD%) of the individual samples is shown and above that the average temperature (of the sensor head) during the measurement.

On the top right the battery status indicator is shown, on the bottom right the fabric calliper (as put in by the operator, see paragraph 4.4.2).

If the **Mea**surement memory position contains a CMD profile or FFT measurement, it will be indicated by a symbol in the display: 〰 for a profile and 📊 for a FFT measurement (see illustration 10 for examples). When the **Mea**surement memory position contains a profile, it can be displayed graphically by pressing ⬤. On how to perform a profile or FFT measurement please read paragraphs 4.4.7 and 4.4.8 respectively.
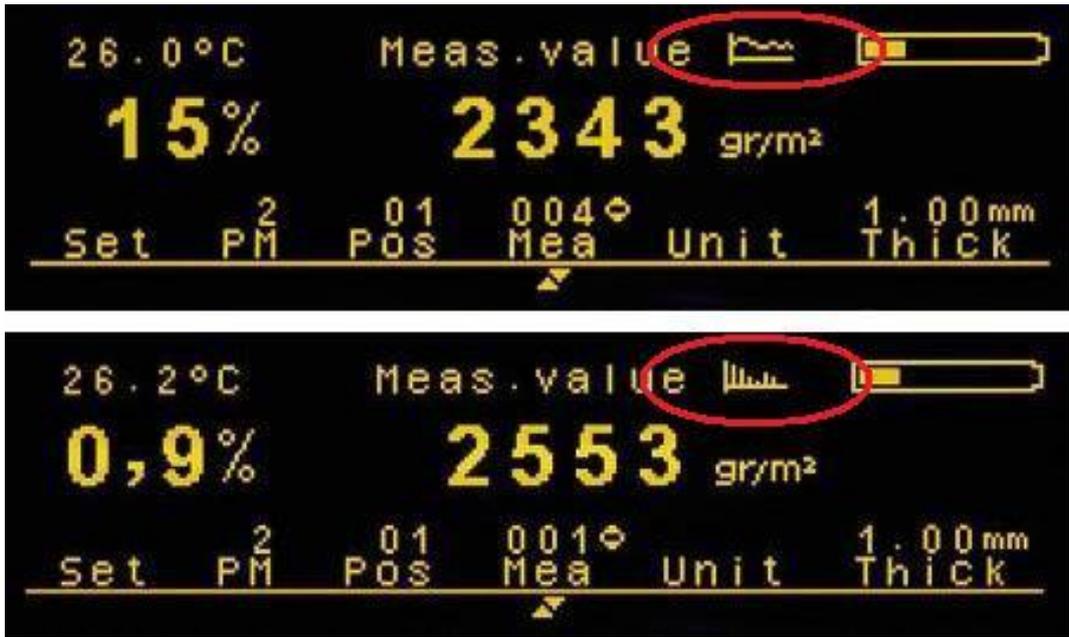
Illustration 10 - examples of profile and FFT measurements

The selected measurement can be deleted directly by pressing ⊠.

> ⚠ *CAUTION!*
> **The measurement will be deleted without further confirmation!**

The measurement unit can be changed between metrical and imperial system. In the metrical system the water amount will be displayed in gram per square meter (g/m^2), in the imperial system in pounds per thousand square feet (lbs/kft^2).
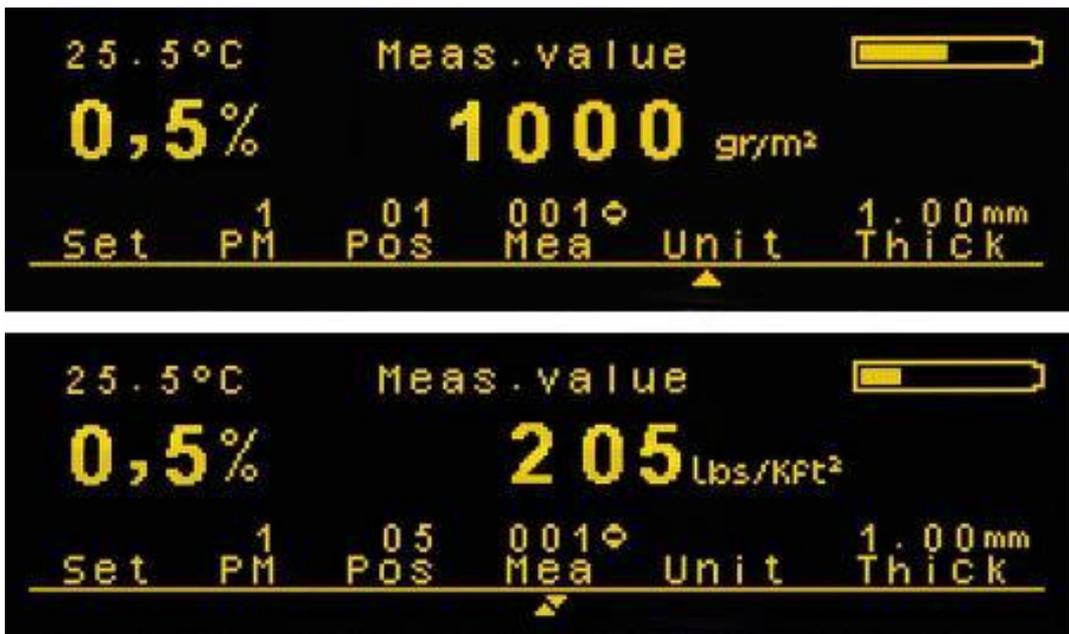
Illustration 11 - metrical and imperial units

To change the Unit, move the cursor to the according menu item and use ⬆⬇ to toggle between the two units (illustration 11).

If in the top centre of the screen "Pos. value" is shown, as in illustration 12, the displayed water amount is the average of all the measurements (**Mea**) stored in the selected position (**Pos**). On the left hand side again the relative standard deviation, but now based on the individual **Mea**surements.
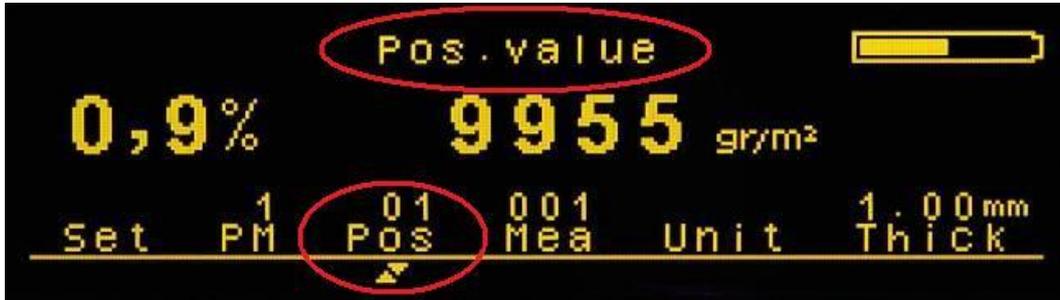
Illustration 12 - Showing average of a position

If a Position does not contain any measurements, a screen as in illustration 13 is shown.
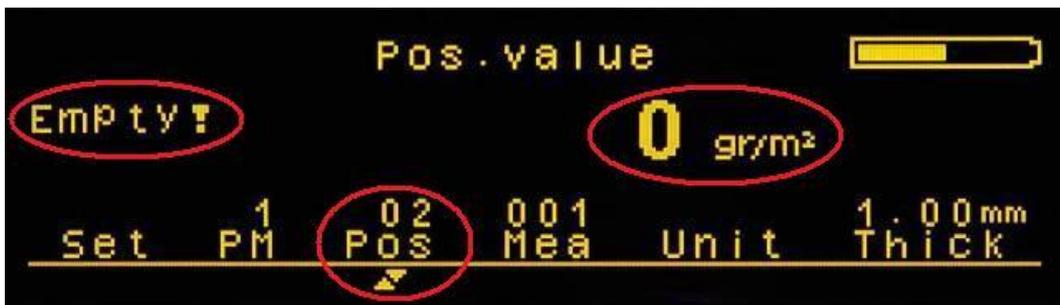
Illustration 13 - Position without measurments

4.4.2 Setting the fabric calliper or thickness

Every forming fabric has void volume that is filled with water. The FiberScan™ detects this water, plus the water on top of the forming fabric. But, the water on top of the forming fabric is drained, but the amount of water inside the fabric stays more or less constant. To get more accurate test results it is necessary to compensate for this amount of water in 2 ways:

1. By measuring the forming fabric in the back-run (without paper, as described in paragr. 2.2.1);
2. By setting the fabric calliper in the FiberScan™ before starting the measurements. A calliper difference of 0.1 mm can make a difference of up to 4% in calculated dry content!
   Especially for thicker forming fabrics (i.e. > 0.7 mm) setting the correct calliper is important!

⚠ ***CAUTION!***
The set calliper is directly linked to the measurements; it is not possible to alter the fabric calliper afterwards!
The default value is 1.00 mm, please set the correct calliper BEFORE starting the measurements!

When performing measurements on positions with 2 forming fabrics (like gap formers or top formers) only the calliper of the forming fabric that is in contact with the FiberScan™ needs to be set.

To set the correct forming fabric calliper, use [⟷] to move the cursor to **Thick**. To edit the value, use the [↕] keys. The edit-mode is indicated by a small dot before the **Thick** text (illustration 14). When the correct value has been set, press [✓] to confirm.

Illustration 14 - fabric caliper menu in edit mode

To obtain the correct forming fabric calliper, use either the fabric's datasheet or measure it with the Feltest Caliper Gauge that has been designed for accurate calliper measurements on running paper machine fabrics. Measuring is more accurate, as it also takes fabric wear into account.

4.4.3 Warming up and calibration

Depending on the storage conditions of the FiberScan*ONE*™ before the dewatering analysis it is advised to open the carrying case in the paper machine hall to allow the instrument to come to room temperature for at least half an hour.

Microwaves and water temperature strongly influence each other, just think of the microwave oven at home. The FiberScanONE™ will give the most accurate test results when the sensor head is calibrated *after* it has been brought on the same temperature as the stock on the paper machine.

It is therefore advised to follow this procedure:

1. Enable the FiberScan™ **Warm up** feature in the **Set** menu (see also paragraph 5.2.3);
2. Carefully warm-up the sensor head to stock temperature, for example by holding the sensor head in the machine's white water for a few of minutes;
3. When the sensor head is expected to be on stock temperature, press the metal **Measure** button once. When the **Warm up** feature is switched on the FiberScan™ will compare the sensors inside temperature (Ti) with the temperature of the ceramic plate (outside temperature or To). When both temperatures are within an acceptable range, the FiberScan™ will start a measurement, otherwise a screen like in illustration 15 will appear. The warm-up procedure can be ended at any time by pushing the metal **Measure** button once again.
4. Quickly xxecute a calibration as long as the FiberScan™ sensor head is still on working temperature:
   a. Dry the surface of the sensor head and the supplied calibration glass;
   b. On the FiberScanONE™ menu go to **Set** > **Cal** and follow the instructions on the screen.
   For more information on the calibration, please refer to paragraph 5.1.

Illustration 15 - Warming up the instrument

4.4.4 Positioning the sensor head

Adjust the handle to the desired length. Use the level placed on the handle to check the correct position of the sensor head on the forming fabric.
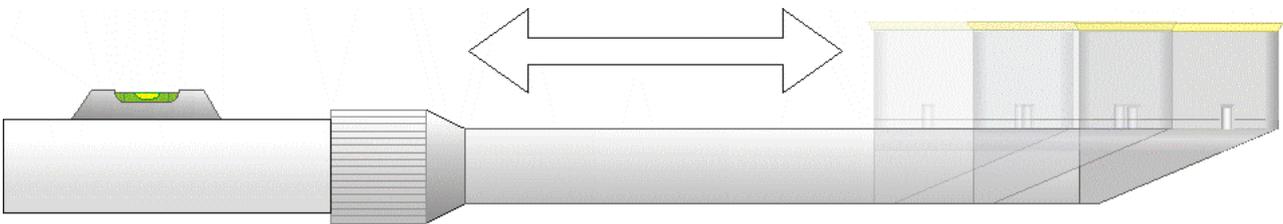
Illustration 16 - Adjust the length of the sensor handle

⚠️ *CAUTION!*

It is useful to adjust the length so that the head is as far as possible from the edge of the forming fabric, to optimize the sensor's interaction with the material.

Please refer to the figures below to see how the sensor head should be placed in order to obtain a correct measurement.

Illustration 17 - Have a stable grip
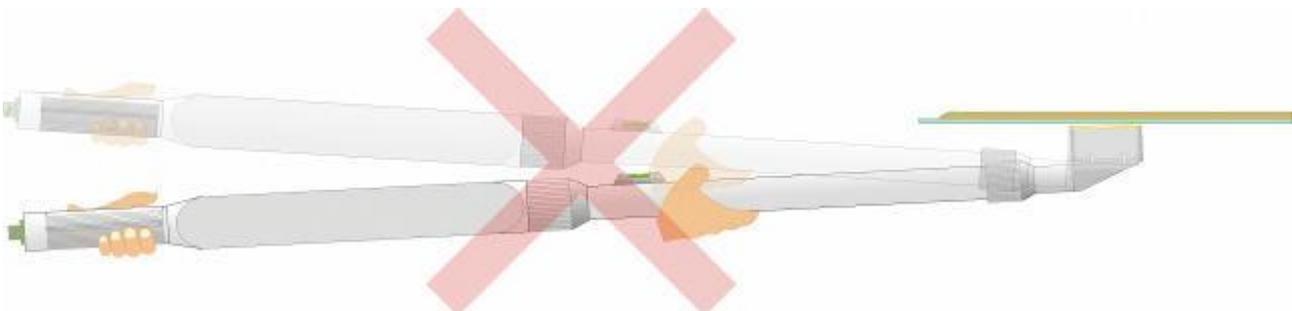
Illustration 18 - Keep the FiberScan at level in cross direction...
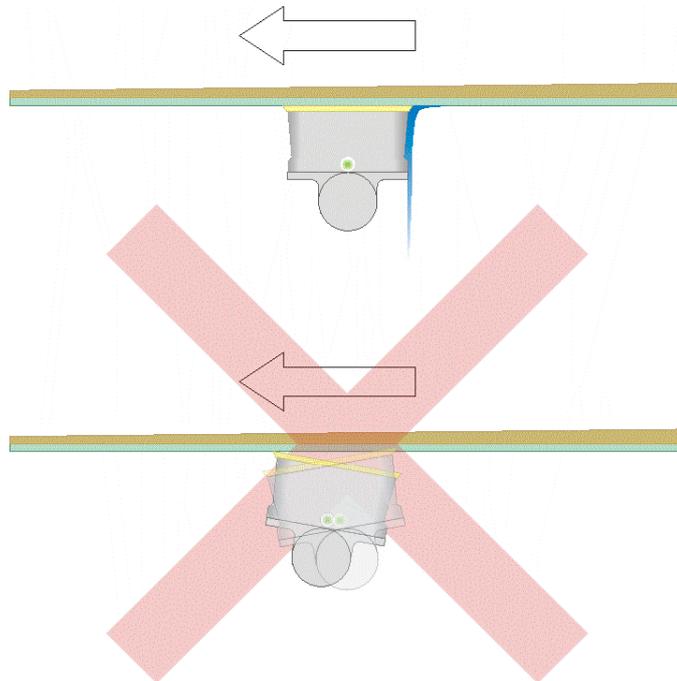
Illustration 19 - ... and in running direction

4.4.5 Measuring in monitor mode

In the monitor mode the water amount and temperature are shown continuously <u>without</u> the data being saved in memory. This function is useful to correctly setup the instrument before starting a full dewatering analysis on a paper machine.

To start the monitor mode, press the metal **Measure** button for at least 4 seconds. Depending on the settings in the **Set** > **Extra** menu (paragraph 5.6), the test results will be shown in digits (illustration 20) or graphically (illustration 21). To stop the monitor mode, press the **Measure** button once again.

Illustration 20 - Monitor mode in digit format

Illustration 21 - Monitor mode in graphic format

4.4.6 Point measurements

When making a dewatering analysis on a paper machine usually point measurements are taken at several positions to check how the amount of water decreases over the consecutive dewatering elements.

To perform a series of point measurements:
1. Set the correct forming fabric calliper (paragraph 4.4.2);
2. Warm-up and calibrate the FiberScan™ (paragraph 4.4.3);
3. Set the desired **PM**, **Pos** and **Mea** counters on the FiberScan*ONE*™ menu;
4. Position the sensor head underneath the forming fabric (paragraph 4.4.4);
5. Press the metal **Measure** button shortly. The indicator in the sensor head will light-up orange for 2 seconds to give the operator some time to stabilize the FiberScan™ again. Then the indicator will light-up red as the test results are acquired.
6. Go to the next position in the paper machine; increase the **Pos** counter on the menu and continue with number 4 and 5 of this list.

In the settings menu of the FiberScan*ONE*™ the instrument can be set to take a number of measurements right after each other with only one push on the metal **Measure** button (**Set** > **Measure** > **Measure for position**; see also paragraph 5.2.2). Also the number of samples that are used to calculate the average test result for a measurement can be set through **Set** > **Measure** > **Measure samples** (paragraph 5.2.1).

4.4.7 Continuous (profile) measurements

With the FiberScan*ONE*™ it is possible to perform a continuous measurement; in praxis this means that the metal **Measure** button acts as a start and stop button. With this function activated it is possible to make full-width or edge profiles of the water amount.

In order to make a trouble free profile measurement, a number of settings must be checked:
1. Activate the continuous measurement function: **Set** > **Measure** > [⟷] and activate **Continuous measure** by pressing [✓]. This will automatically deactivate the FFT-mode.
   Press [⟷] to go to the previous menu page.
2. Check if **Measure samples** and **Measures for position** are both set to 1
3. It is advised to set the **Speed/Accuracy** to 5 (see paragraph 5.2.4 for the reason)
4. Press [✕] to return from the **Set** menu and to start a measurement.

During the measurement, all acquired data will be displayed as a bar graph (illustration 22). The FiberScan*ONE*™ can store over 7900 individual test results, with 2 samples per second enough for 60 minutes of continuous measuring!

Illustration 22 - Display during the continuous measurement

After the measurement has been executed, the profile icon ![icon] will be shown on the left hand side of the battery indicator, as shown in illustration 23.

Illustration 23 - Display after a profile measurement

To immediately check the profile on the display of the FiberScan*ONE*™, set the cursor to **Mea** on the menu and press the centre key ⬤ on the keypad. Now the profile will be shown (illustration 24).

Illustration 24 - Example of an edge profile measurement

Shown on the bottom of the chart are, from left to right, the minimum value, the value at the cursor (the dotted line) and the maximum value respectively. The cursor can be moved fast by the ![keys] keys and with more precision by the ![keys] keys. Press the centre key ⬤ again to leave the chart view.

⚠️ *CAUTION!*
When finished executing profile measurements, do not forget to re-set the Speed/Accuracy setting back to 1 for optimal accuracy of the test results.

4.4.8 FFT measurements

With the FiberScan*ONE*™ it is possible to acquire many test results per second. When a Fast Fourier Transformation (FFT) routine is performed on this high amount of data, periodical peaks will become very clear. This function is mainly intended to perform a pulsation study on the forming fabric as it will clearly show periodical changes in water mass, for example induced by fan pumps, vibrations or vacuum pulsations.

In order to make a trouble free FFT measurement, a number of settings must be checked:
1. Activate the FFT function: **Set** > **FFT** > and activate **Enable sampling for FFT** by pressing ✅. This will automatically deactivate the continuous mode. If desired also adjust the other FFT settings (refer to paragraph 5.3 for more information).
2. Check in the **Set** > **Measure** menu if **Measure samples** and **Measures for position** are both set to 1
3. Press ❎ to exit the **Set** menu and to be able to start a measurement.

When a measurement is started by pressing the metal **Measure** button, the display informs the user that the FFT mode is activated (illustration 24). When the measurement is finished, the will be shown on the left hand side of the battery indicator, as shown in illustration 10 on page 18.

Illustration 25 - Display during FFT data acquisition

The acquired data can be processed and analysed in the HostXL™ software for the PC, supplied with the instrument.

4.5 Graphical review of the test results

After two or more point measurements have been taken on a paper machine, the operator can graphically display the results of all positions. This function is very useful to evaluate the trend while still being close to the machine. This function is activated by moving the cursor to the **PM** menu item and then press ⬤. A screen like in illustration 26 will appear.
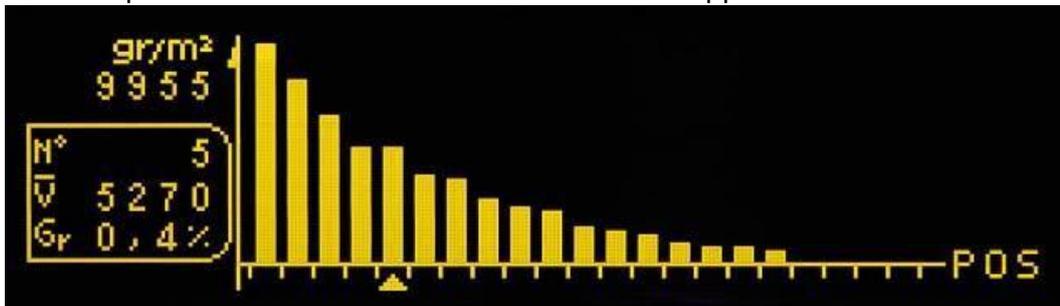
Illustration 26 - Machine review

On the Y-axis are the test results in g/m^2 or lbs/kft^2 and on the X-axis the positions as set in the **Pos** menu. On the left hand side, from top to bottom are shown:

- The measurement unit;
- The highest water amount for this **PM**;
- The number of the selected **Pos**; move the cursor at the bottom of the graph with the ⬌ keys.
- The average water amount for the selected **Pos**;
- The variance on the selected **Pos**.

The X-axis can present up to 21 positions; if a machine contains more than 21 positions the graph will be split in two as in illustration 27. Just press the ⬌ keys to toggle between the two parts of the graph.

Illustration 27 - PM with more than 21 positions

The range on the vertical Y-axis can adjusted to any selected position. To adjust the maximum value on the Y-axis, select a **Pos**ition with the ⬅➡ keys which value will represent the full scale. Then use the ⬆⬇ keys to make this position's value the maximum Y-axis value. In the example of illustration 28, position 5 has a value of 5270 g/m^2 of water and Y-axis range is now set from 0 to 5270 g/m^2. Positions with higher values (in the example positions 1 to 3) will be 'out-of-scale' which is represented by a small triangle on top of the bar.
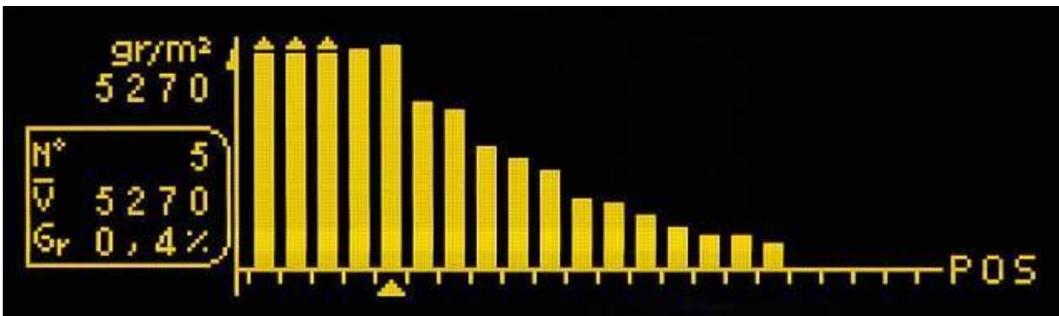
Illustration 28 - Y-axis set to the value of position 5

In this review mode it is easier to identify possible faulty measurements as the values might be out of the expected trend. To take a look at the **Mea**surements that made a certain **Pos**ition move the cursor with the ⬅➡ keys to the desired position and press ✅. A new screen opens that display the **Mea**surement of that **Pos**ition (illustration 29).
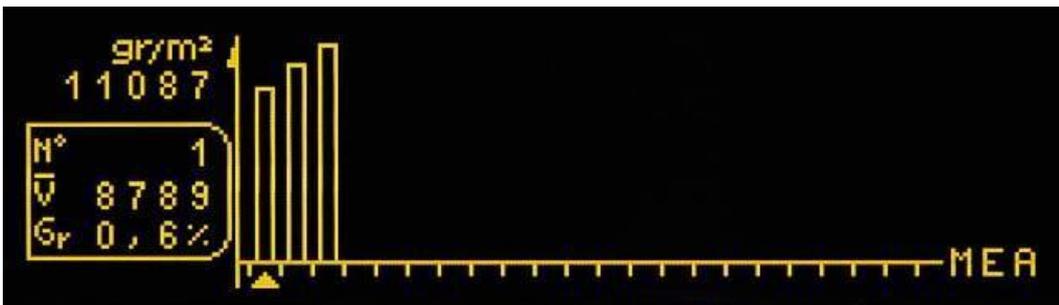
Illustration 29 - Measurements of a position under review

If one of the measurements is too far off it can be deleted by selecting the desired **Mea**surement with the ⬅➡ keys and press ❌ to delete. Confirm the delete by pressing ✅ or keep the measurement by pressing ❌. When a **Mea**surement is deleted, the average for the position will be newly calculated.

To enter the graphical review mode, press the centre key ⬤ again.

4.6 Problems that can occur

The FiberScan*ONE*™ is a very reliable instrument with well proven technology but under some circumstances the instrument needs an adjustment of settings for 'problem free' operation.

4.6.1 Increasing values on the same position

If on a single position in the paper machine several measurements are taken and the values are getting higher every time, the FiberScan™ is not properly warmed up. Solutions can be to activate the warm-up mode and/or decrease the value for the temperature offset (see paragraph 5.2.3).

4.6.2 "Out of scale" and temperature related messages

If the message "Out of scale" appears, it is an indication that the instrument is operating outside its temperature or water conductivity range. If the conductivity of the process water is too high, it usually helps to skip that position and go to a position with less water on top of the fabric.

If the temperature is too low or too high, this is also indicated on the display by a warning sign and a thermometer symbol (see illustration 30).

Illustration 30 - Temperature out of range

> ⚠️ **_CAUTION!_**
> **If the sensor exceeds the maximum operating temperature (+80°C) for a prolonged time, it can be damaged.**

4.6.3 "Error – check connection" message

This message can have two causes. One is that the sensor handle and the control unit are not properly connected. Solution is to switch off the instrument and reconnect the two components and carefully tighten the fixating ring (F).

If the FiberScan*ONE*™ is properly assembled, this message can also have another cause which is related to the paper machine. When there is strong variation in the test results, for example due to turbulence, measuring at the dry line or MD mass variations, the **Speed/Accuracy** value must be increased. Go to **Set** > **Measure** > **Speed/Accuracy** and set a value higher than 1; usually 2 or 3 is sufficient. For more information on the Speed/Accuracy setting please refer to paragraph 5.2.4.

TIP: when this error message appears there are reasons to suspect some kind of pulsations in the machine, a further investigation in FFT-mode could be useful!

4.6.4 "Memory error"/"Memory full" message

The FiberScan™ can store about 2000 point measurements. Of course in continuous or high speed FFT mode the memory will be filled faster. When there is no memory left the instrument will stop measuring and give the "Memory full" message. The operator is requested to free memory by downloading data to the PC and/or by deleting measurements.

The "Memory error" indicates that an irreversible has taken place during writing/reading of the memory. In that case the memory needs to be reformatted (**Set** > **Extra** > **Format memory**) and all saved data will be lost.

4.6.5 Blinking battery symbol

When the battery symbol on the right hand side of the screen starts blinking, the batteries need to be charged. The amount of left operating time is strongly dependent on the instrument settings (FFT-mode or Bluetooth® operation for example consume relatively much energy).

4.7 Charging the batteries

To charge the batteries connect the battery charger (S) to the connector (C) of the control unit. Charging the batteries usually takes less than 1 hour.

> ⚠️ *CAUTION!*
> **The FiberScan™ control unit cannot be used for measuring during battery charging.**

4.7.1 Battery charger operating instructions

The supplied battery charger is designed to charge Li-ion battery packs has two connectors to charge the batteries in both the control unit as the wireless unit. It has following features:

- Suitable for worldwide use thanks to a switch mode power supply (100-240 V AC) and exchangeable primary plug set.
- This battery charger is intended for use with the FiberScan*ONE*™ only.
- Microprocessor controlled charging.
- Short circuit detection and electronic protection against reversed polarity.
- The charge status of the battery pack at the beginning of the charging is not important.
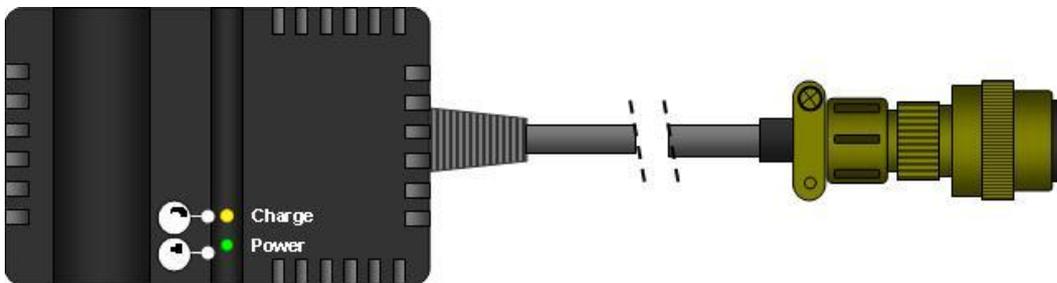
Illustration 31 - Battery charger

Battery charger indicators
- The "Power" indicator lights steady when the charger is plugged in and ready for use.
- The "Charge" indicator lights steady when the fast charging process is active. The indicator is not lighted when the charging process is finished.

Operation of the charger
Connect the charger to the mains: with the exchangeable primary plug set and the electronic power supply (100-240 V AC) the charger can be used worldwide. To change the primary plug, unlock the mechanism on the back of the unit towards the arrow. Attach the right primary plug to the unit until it is clicks in place. Once the charger is connected to the mains, the power indicator lights up and the charger is ready for use.

⚠️ **WARNING!**
Use this charger only for the FiberScan*ONE*™ Lithium ion (Li-ion) battery packs. Danger of explosion if other types of batteries are connected to the charger.

⚠️ **WARNING!**
Do not attempt to open the charger.

⚠️ **WARNING!**
Keep the charger in a dry place (indoor use only). In order to avoid the risk of fire and/or electric shock, the charger must be protected against humidity and water.

⚠️ **WARNING!**
Do not plug in the charger if there are any signs of damage to the housing, mains pins, cables or connectors. In case of a defect please return to an authorized service centre.

⚠️ **WARNING!**
Keep the charger out of reach of children.

⚠️ **WARNING!**
If the warning instructions are not followed, it may lead to damage to the charger or batteries or even to serious injury to the user.

⚠️ **WARNING!**
Li-ion rechargeable batteries are not to be disposed in domestic waste. Return used batteries to your dealer or to a battery recycling collection point.

4.7.2 Charging the FiberScan*ONE*™ with a 12 V car socket

If needed, the FiberScanONE™ can also be charged in the car while travelling. For this the supplied inverter is needed, that inverts the 12 V from your car system to 230 V that is suitable for the standard battery charger (using the European main plug connector with 2 round pins).

⚠️ **WARNING!**
Inverter! Risk of electrical shock! When switched on, the inverter will supply 220 V AC high voltage!

> ⚠️ **_WARNING!_**
> **Keep the inverter out of reach of children!**

> ⚠️ **_WARNING!_**
> **Risk of damage if the inverter is used for other purposes than charging the FiberScan*ONE*™!**

> ⚠️ **_WARNING!_**
> **The inverter will not operate if the input voltage is higher or lower than the input voltage range. It could be damaged if the 12V model is connected to a 24V battery source!**

> ⚠️ **_WARNING!_**
> **The inverter must be connected only to a car battery that is able to supply sufficient energy (current) to operate the loading!**

Operation

Connect the inverter plug to the 12 Volt cigarette lighter socket of your car. As the currents can get quite high, it is important to make sure there is a good contact between the plug and the socket (push firmly).

Then switch on the inverter and the green "Input" indicator will light up. Within 30 seconds also the "Output" indicator will light up, indicating the Soft Start test is completed and the AC power is now available at the output receptacle.

Caution
- Do not use the inverter near flammable material or in any location which may accumulate flammable fumes or gases.
- Do not use with positive ground electrical systems. Never connect the inverter to AC distributions.
- The surface of the inverter may get HOT especially when operated under full load condition. Therefore place the inverter on a flat surface and keep at least 5 cm (2") clearance for free airflow. Operate the inverter only on ambient temperatures between 0° - 40° Celsius.
- Do not place anything on the inverter during operation.
- Do not allow water drip or splash on the inverter.
- Do not place the inverter under direct sunlight.

4.8 Cleaning and Maintenance

⚠️ **CAUTION!**

After using the instrument, carefully clean and dry the outside of both the control unit and the sensor head before placing it in the carrying case.

⚠️ **CAUTION!**

Always close the control unit connector with the provided cap when not in use.

⚠️ **CAUTION!**

Do NOT open the instrument components for any reason, this will void the warranty!

If the battery pack is exhausted, please contact our service department for replacement at service@feltest.com.

4.8.1 Replacing the ceramic sensor plate

⚠️ **WARNING!**

Do not use a damaged rubber "O"-ring, as it will impair the sensors protection, resulting in costly damages to the microwave sensor!

⚠️ **WARNING!**

Do not touch the microwave sensor surface for any reason!

⚠️ **WARNING!**

It is very important NOT to tighten the screws all the way down in one step, but to GRADUALLY turn one screw until the "resistance" becomes slightly higher and then go to the next screw.

⚠️ **WARNING!**

All the following steps are at the operator's risk. Feltest Equipment BV take no liability for improper installation of the ceramic plate.

The FiberScan^TM has been engineered for an easy ceramic plate replacement, without the need to send it in.

In order to safely apply a new ceramic foil, please follow the next steps:

Step 1 – remove the damaged ceramic plate

Loosen and remove the screws in the ceramic plate.
Carefully remove the damaged ceramic plate from the sensor head. The plate might stick a little to the sensor housing, due to the thread locking material (like Loctite™ or similar products).
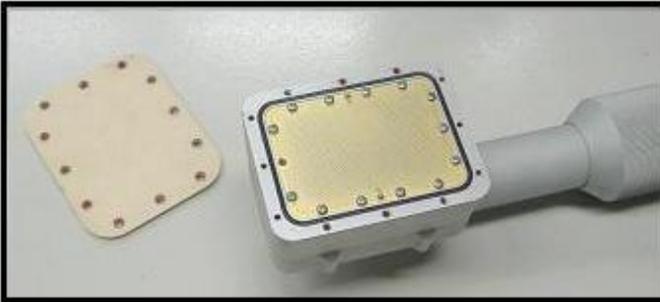
Illustration 32 - Removing the ceramic plate

The ceramic plate is pushed against a silicone "O"-ring underneath to ensure the right waterproof level.

Gently remove the thread locking residues around each screw hole. Be careful not to damage "O"-ring!
Make sure the microwave sensor surface is completely dry. If it is not, please gently blow a little bit of CLEAN compressed air on its surface. If in doubt if water penetrated the sensor's interior, leave the sensor housing open for at least 24 hours in a warm and dry place.

Illustration 33 - The microwave sensor and the black "O"-ring

Step 2 – preparation of the new ceramic plate

Make sure that the hole indicated in figure 45 contains heat conductive paste, to improve the heat exchange between the ceramic sensor plate and the build-in temperature sensor.

WARNING: if the heat conductive paste is not used, the FiberScan™ will not be able to achieve its normal accuracy.
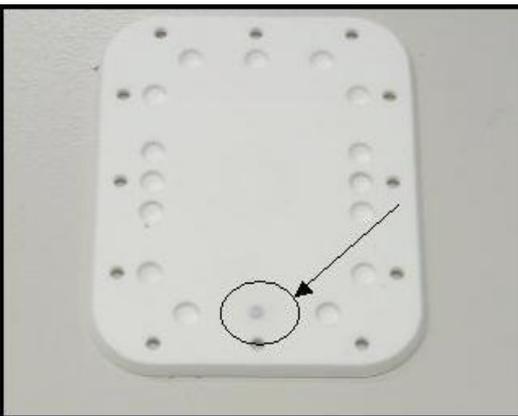
Illustration 34 - The hole for the temperature sensor

Step 3 – installation of the new ceramic plate
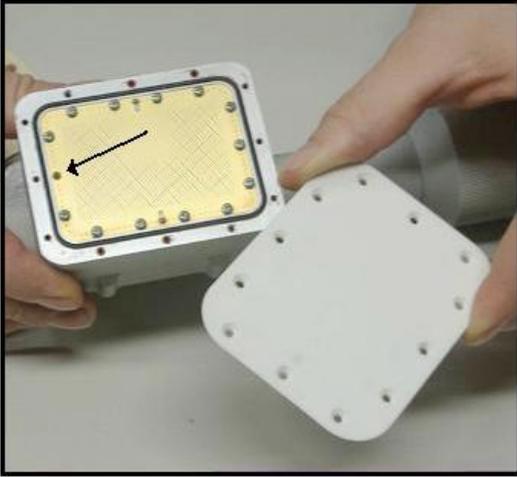
Illustration 35 - Watch the temperature sensor!

Position the new ceramic plate on the sensor housing, taking care that the mounting holes in the ceramic plate coincide with mounting holes in the metal housing.

The temperature sensor (as indicated in illustration 35) should fit into the according hole of the ceramic plate (as indicated in illustration 34).
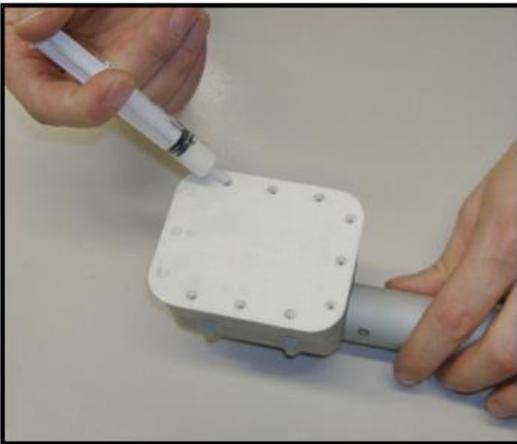
Illustration 36 - Applying the thread locking material

Put a small drop of a thread locking material (like Loctite™ 222 or similar) into the mounting holes, to avoid that the screws will come loose easily.

Do not use too strong glues to make sure that the screws still can be loosened when the ceramic plate needs to be removed again.
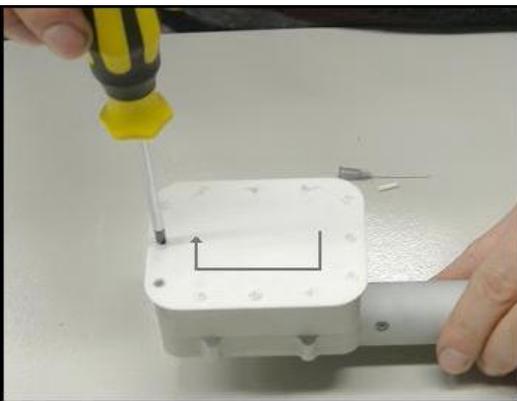
Illustration 37 - Slightly tighten the screws one-by-one

The screws must be tightened very carefully, too much force or tension will crack the ceramic. Therefore the screws must be tightened gradually and one-by-one, as indicated in illustration 37.

As soon as the needed force increases, go to the next screw and work your way around all the screws in at least 3 times. NEVER tighten one screw all the way and then go to the next, this will surely damage the ceramic plate!

IMPORTANT: when the required force becomes higher, stop turning the screws immediately! Look at the distance between the ceramic plate and the metal sensor housing: when the ceramic is in direct contact with the metal housing, the "O"-ring is fully compressed and the screws cannot be tightened any further!

The applied torque on the screws should be between 0.5 and 0.7 N/m. This can be checked with special tools, as shown in illustration 38.

Illustration 38 - The applied torque may not exceed 0.7 N/m

After the installation of a new ceramic plate a new calibration must be started. Check paragraph 5.1 for instructions on the calibration procedure.

5 SETTINGS AND INSTRUMENT CALIBRATION

This chapter will explain all possible settings and the calibration procedure for the FiberScan*ONE*™ in detail. All the functions are available through the **Set** menu item in the main screen of the FiberScan™. Use the [ ] keys to put the cursor at the **Set** menu item and press [✓] to enter the menu (illustration 39). The [✗] key is used to exit the **Set** menu.

Illustration 39 - Set up menu

Measure: change settings for the measurements
CAL: calibrate the instrument
FFT: settings for the fast FFT mode
Test: a test run to check if there are interfering electro-magnetic sources close by
COM: settings for the communication with a PC
Extra: functions for monitor mode, memory formatting and firmware information.

5.1 Instrument calibration

With the calibration procedure it is possible to verify the calibration of the sensor and if necessary, to perform a re-calibration with the supplied special glass plate.

The FiberScan™ works with two calibrations: a factory calibration that takes more than 5 hours in our specialized laboratory and a local calibration that is used to compensate for small deviations due to local circumstances like (stock) temperature. The calibration menu of the FiberScan™ refers to this local calibration.

The calibration influences the accuracy of the FiberScan™, therefore carefully read the following remarks.

> ⚠ *IMPORTANT!*
> **For the best accuracy it is advised to first bring the sensor head to working temperature (the temperature of the stock) by keeping the sensor head in the white water and then execute the calibration procedure, especially if the working temperature is close to the working limits of the instrument.**

> ⚠ *CAUTION!*
> **Before proceeding, please make sure that the sensor surface is completely dry and clean, free from any residue.**

⚠ CAUTION!

For a calibration the sensor needs to be in an area free of disturbances. Make sure that the sensor head is <u>at least</u> 50cm away from metallic objects and/or telecommunication equipment like mobile phones. As the human body contains a lot of water, also people should keep the distance. See illustration 40.
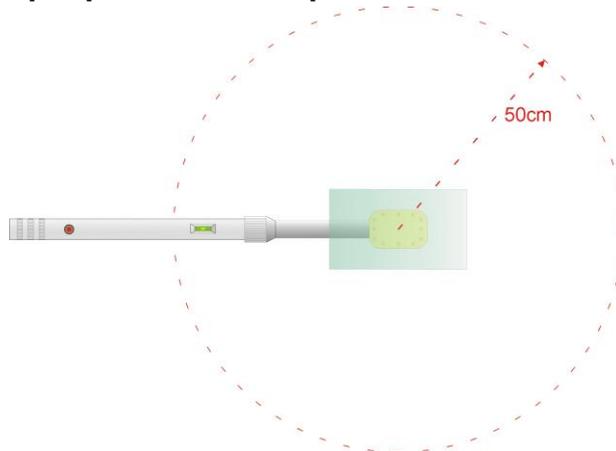
Illustration 40 - Minimum free zone during calibration

⚠ CAUTION!

If the procedure is not correctly executed, the instrument can give less accurate test results.

⚠ CAUTION!

The reference glass plate is placed correctly when the centre of the glass is on the centre of the sensor head, as shown in illustration 41.
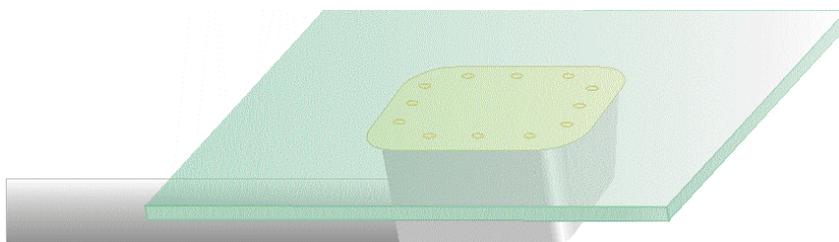
Illustration 41 - Position of the glass plate on the sensor head

Before starting the calibration procedure please:
1. Verify that the sensor is correctly connected to the control unit.
2. Set the **Speed/Accuracy** to 1 for best accuracy (**Set** > **Measure**, see paragraph 5.2.4).
3. Make sure that both the sensor head and the glass plate are clean and dry.

![FELTEST equipment logo]

The calibration procedure

As a first step, the calibration is verified with the reference glass plate. If the FiberScan™ measures a test result over ± 5% of the reference value, a re-calibration is required.

On the main screen, move the cursor the to the **Set** menu item and enter the menu by pressing ☑. Then select the **CAL** menu item and press ☑ to start the procedure (illustration 42).

Illustration 42 - Calibration start screen

When the metal **Measure** button is pressed, the FiberScan*ONE*™ will measure the reference glass plate. If the test results are within the tolerance range of ±5% of the reference glass plate, the result is accepted (illustration 43) and the calibration menu is automatically exited after approximately 5 seconds.

Illustration 43 - Calibration check successful

If the test results are outside the tolerance range of ±5% of the reference glass plate (illustration 44), the user will be asked to perform a new calibration by pressing the ◉ key. Please leave the glass plate on the sensor! To abort the calibration procedure press ⊠.

Illustration 44 - Calibration check failed, re-calibration required

⚠ *CAUTION!*
During the calibration process do not remove the reference glass plate from the sensor and keep distance from it.

Once the calibration process has started, the progress bar will appear (illustration 45).

Illustration 45 - Calibration in progress

When the progress bar is at 100%, the sensor head LED will start flashing orange; now remove the reference glass plate and press the metal **Measure** button once again (illustration 46). Now the second phase of the calibration procedure is started, setting the zero point.

Illustration 46 - Instruction for the zero point calibration

If you are uncertain if the first phase of the procedure was done correctly (for example when the reference plate moved) it is possible to press the ❌ key and exit the procedure without calibration changes.

When the zero point calibration is started, again the progress bar is shown and when the full calibration procedure is finished, the user is notified (illustration 47). After a few seconds the calibration verification procedure is re-started automatically (illustration 42 and following).

Illustration 47 - Re-calibration carried out successfully

If the calibration procedure was correctly executed, the verification will have a positive result and the calibration procedure will end; if the verification fails the full calibration procedure must be repeated.

5.2 Measurement settings

In the **Set** menu item many settings for the measurements can be changed. After selecting **Set** and **Measure** there will be 2 screens available (illustration 48).


```
MEASURE                    1/2        MEASURE                    2/2
> Measure samples      05           > Pulp grade                  ☐
  Measures for Position 03            Continuos measure           ☐
  Warm up              ☐
  Warm up offset     05°C
  Speed/Accuracy         5
```

Illustration 48 - The Measure menu

Use the ⬛ keys to toggle between the two screens. Select the desired setting by using the ⬛ keys and ✅ to enter the setting. Values can be increased and decreased using the ⬛ and when the correct value has been set, leave by pressing the ❌ key. Check boxes (like at "Warm up") can be activated or de-activated by pressing the ✅ key.

Exit the **Measure** menu by pressing the ❌ key.

5.2.1 Measure samples

Every time the operator presses the metal **Measure** button, the FiberScan*ONE*™ will start collecting data. With this setting, the user can decide how many samples must be averaged to one **Mea**surement value. In the example of illustration 48 the FiberScan™ takes 5 samples to calculate 1 value in the **Mea** menu. Taking a sample costs approximately 1 second. A higher number of samples will increase the reproducibility but consume more time. This value can be set between 1 and 64 samples.

5.2.2 Measures for position

With this setting the FiberScan*ONE*™ can be set to take a number of measurements right after each other, pressing the metal **Measure** button only one time. In the example of illustration 48, pressing the **Measure** button will result in 3 measurements, so the **Mea**surements counter will be 3 higher.

5.2.3 Warm up and warm up offset

If the function **Warm up** is activated (with a little √ in the checkbox) the instrument will not acquire data when the temperature sensors on the inside and the outside of the sensor are too far apart, as set in the **Warm up offset** setting. It is advised to use the **Warm up** function as it improves the accuracy of the FiberScan™.

The default **Warm up offset** is 5°C. On machines with very hot stock (> 60°C) the ceramic plate can cool down rather fast after a measurement, making the outside sensor temperature fall outside the 5°C offset. In that case the offset can be changed to, for example, 10°C.

5.2.4 Speed/Accuracy

The FiberScan™ reads many values per second. If there is a large variance in the sample values, the software can decide that the measurement is not good and the measurement is rejected. When this happens the message "**Error – check connection**" is shown on the display.

This high variance in test results is often not caused by the operator, but by the paper machine; for example on highly turbulent positions (where water drops temporarily jump out of the FiberScans measuring range), close to the dry line (wet/dry stripes) or at paper machines with considerable MD mass variations. Generally spoken: when this error message appears there are usually some kind of pulsations in the machine, a further analysis in FFT-mode can be useful!

The **Speed/Accuracy** setting changes the way the FiberScan™ handles the raw data from the sensor. By averaging *more* rough data into each sample value, the differences between several sample values will be reduced. Logical side-effect is that there will be more time needed to create one sample, thus reducing the measurement speed. With **Speed/Accuracy** set to 1 the accuracy and resolution are best. With this setting at the maximum of 5, the repeatability is very good, but all peaks are filtered flat.

When calibrating the FiberScanONE™ the **Speed/Accuracy** must be set to 1. When doing measurements on difficult positions like described before, usually a setting of 2 or 3 is sufficient for problem free measurement. When doing profile measurements, especially on the edges of the forming fabric, the **Speed/Accuracy** can be best set at 3 to 5.

5.2.5 Pulp grade (grades > 500 g/m^2)
On heavy grades, pulp or massive board, an additional correction is applied for even better accuracy.

5.2.6 Continuous (profile) measure
When this function is activated, all new measurements will be continuous measurements. This means that the metal **Measure** button is used to start a measurement and to stop the measurement again. When making profiles, it is advised to set the **Measure samples** and **Measure for position** to 1. See also paragraph 4.4.7.

5.3 FFT settings
The FFT-mode of the FiberScan*ONE*™ can be used for pulsation studies in the forming section of the paper machine. With an extra high sampling rate and Fast Fourier Transform analysis periodical water amount variations can be found, including the frequency with which they appear. When the FFT menu is opened (**Set** > **FFT**) the following screen will appear:

Illustration 49 - FFT menu

Checking the box **Enable sampling for FFT** by pressing the ☑ key will put the FiberScan™ in FFT –mode. If the continuous (profile) mode was active, it will be automatically disabled. In FFT-mode the FiberScan*ONE*™ will acquire and save test results with a high frequency, the data can be analysed on the PC with the HostXL™ application.

The **sampling frequency** can be set up to 1024 Hz or 1024 samples per second. This means that with an FFT analysis there will be reasonable results for pulsations with a frequency up to 512 Hz. Lowering the sampling frequency will limit the FFT's frequency range but will allow sampling over a longer period of time. This can be useful for pulsations with lower frequencies.

The **Set sampling duration** setting is used to change the time period that the FiberScan™ is acquiring data after pressing the metal **Measure** button. The maximum "recording time" is directly related to the sampling frequency: at 1024 Hz the maximum sampling duration is 7 sec. at 512 Hz it is 15 sec. etc.

5.4 Interference test

> ⚠️ *CAUTION!*
> **Measurements made with the FiberScan™ could be impaired if there is an intense radio frequency disturbance on the sensor's operating band. To avoid inaccurate measurements, always perform an immunity test before beginning a measurement session.**

With the **Set up** > **Test** menu item it is possible to check if there are any sources that could influence the microwave sensor. To run this immunity test, it go to the place where the measurements will take place. Make sure the sensor head is clean and dry and keep it in a free area (like with the calibration procedure: no metal or body parts within 50 cm, no mobile phones close by). Then select the **Test** item by using the ⬚ keys and activate it by pressing ✅. A screen like illustration 50 will appear. When the metal **Measure** button is pushed, the immunity test is started.

Illustration 50 - Starting the interference test

When the test is passed the user can carry out a measurement on that location.

If the test failed the word "WARNING" is shown and the measurement results may be incorrect or out of range. In that case try to find a new location (for example on the opposite side of the paper machine) and run the test again.

5.5 Communication menu

The **COM** menu contains several settings for the communication between FiberScan*ONE*™ and the personal computer running the HostXL™ software application. When the **Set** > **COM** menu is activated, a screen like illustration 51 is shown.

Illustration 51 - COM menu

At the bottom of the screen, the type of communication with the PC is set; after selecting this sub-menu item with the ⬚ keys, pressing ✅ will toggle between USB and Bluetooth®.

5.5.1 Connect to Host

When the **Connect to Host** item is selected and activated with the ☑ key, the FiberScan*ONE*™ will build up a connection with the PC through the selected port: either USB cable (illustration 52) or wireless Bluetooth® (illustration 53).

Illustration 52 - Connect through USB cable

Illustration 53 - Communication through a Bluetooth connection

Before using the Bluetooth® interface the PC software application HostXL™ must be installed on the computer, otherwise the FiberScan*ONE*™ will not be able to establish a connection and continue to show the 1st screen of illustration 53. To end the Bluetooth® search mode switch the FiberScanONE™ off. If an already established wireless connection needs to be disconnected, press ☒ or **C**ancel.

For more details on connecting the FiberScan*ONE*™ to the PC, please refer to the manual of HostXL™.

5.5.2 Host-Sensor direct (for professional maintenance only)

⚠️ **WARNING!**
This option must be used by expert personnel only, as it could alter the sensor head's response and risks to invalidate the instrument's factory calibration. Please consult our Direct Service at +31 313 652 215.

The **Host-Sensor direct** item of the **COM** menu will establish a direct connection between the PC and the sensor head, the control unit will act only as a bridge. For further details on connecting the sensor head to a computer, please refer to the HostXL™ user manual.

This option is only for checking and changing the <u>factory calibration</u> of the microwave sensor and should not be used by non-expert personnel!

5.5.3 Firmware update

The FiberScanONE™ internal firmware can be easily upgraded to the latest version, to add for example new functions and/or improve the instruments flexibility.

![FELTEST equipment logo]

> ⚠️ **WARNING!**
> **Once the Firmware update function has been activated, the control unit will no longer accept any commands! The control unit cannot be switched on or off except <u>after</u> a firmware update.**
> **Therefore NEVER activate this function if there is no firmware update available!**

> ⚠️ **WARNING!**
> **This operation must be carried out only by expert personnel. Always consult our Direct Service at +31 313 652 215. Wrong procedures might damage the control unit's system resources (ROM).**

> ⚠️ **WARNING!**
> **Update only when the FiberScan*ONE*™ batteries are fully charged!**

> ⚠️ **WARNING!**
> **Before updating the firmware, close all other running the programs (like antivirus etc.), de-activate any energy saving or stand-by functions of the PC and if a notebook is used, connect it to the electricity network.**
> **For Microsoft Windows versions with other than Western character sets (like Chinese, Cyrillic, Japanese etc.), the Western version with characters as used in this manual MUST be running.**

The firmware (or on-board software) of the FiberScan™ can be upgraded by the user, using the HostXL™ PC-software. This is a feature that should be performed by expert personnel only, as wrong procedures can severely damage the FiberScan™. To prevent unintended selection of the menu item, the ✅ key must be held down for at least 5 seconds before the connection will be established. If the ✅ button is released before that time, the ❌ button must be pressed to regain control of the unit.
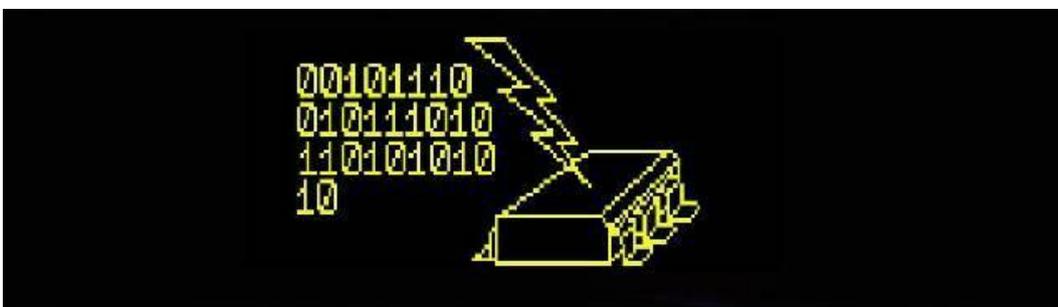
Illustration 54 - Ready for firmware update

For detailed instructions on firmware upgrades please refer to the upgrade manual that is included in the upgrade package.

5.6 Extra / miscellaneous menu

In the **Set** > **Extra** menu there are 3 functions as shown in illustration 55.

Illustration 55 - Menu Extra

Monitor type refers to the measurement mode in which the data are not stored, but where the Fiber-Scan*ONE*™ continuously shows the test results on the display (see paragraph 4.4.5). Here the user can set how the test results must be shown: like a continuous bar graph (**Graphic**, illustration 21 on page 22) or numerical (**Digit**, illustration 20 on page 22). Use the [keys] keys to select this sub-menu item, press ☑ to toggle between the two options. To start the measurement in **Monitor mode** go to **Set** > **Measure** > [ ] > and activate **Continuous Measure** by pressing the ☑ key.

Format memory contains information on the FiberScan™ memory and the possibility to format the full memory, erasing all saved data. Entering this sub-menu item with the ☑ key will give a screen similar to illustration 56. To format the memory press ☑, to exit press ☒.
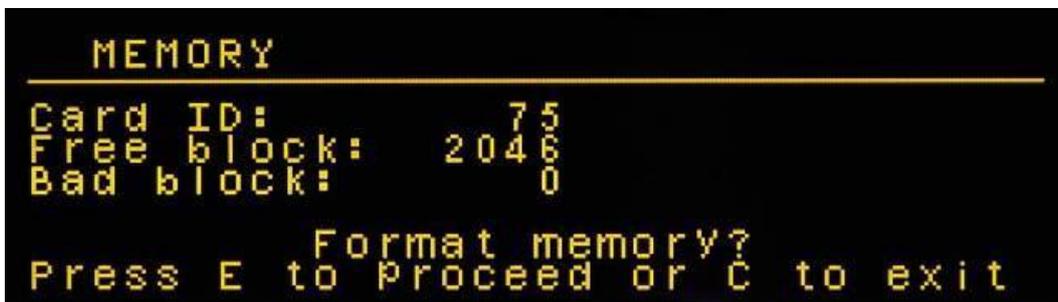
Illustration 56 - Format memory menu

The **Info** item of the **Extra** menu will give information on the version of the firmware that is installed on the FiberScan*ONE*™.

6 TECHNICAL SPECIFICATIONS

> ⚠️ **WARNING!**
> **Device requiring special protection!**

> ⚠️ **WARNING!**
> **Fiberscan™ is a CLASS A device; the instrument should be used only in industrial environments. The use of this instrument in other environments could cause disturbances to other devices nearby.**

> ⚠️ **WARNING!**
> **The manufacturer will not accept liability for improper use of this device.**

Installation category: II

Pollution level: 2

6.1 Measurement specifications

Parameter		*Min.*	*Max.*	Notes
Water amount				
Range	$g/m^2\,H_2O$	0	48000	*1**
Resolution	$g/m^2\,H_2O$	10	20	*2**
Temperature				
Range	°C	0	80	
Resolution	°C	0.5		

1*: with a forming fabric calliper of 1.7 mm
2*: 10 g/m^2 in the range 0 - 10000 g/m^2, 20 g/m^2 in the range 10000 - 48000 g/m^2

6.2 Mechanical specifications

Control unit

Parameter				Notes
Weight	kg	1.75		*1**
Max. dimensions	mm	535 x 64 x 64	L x W x H	
IP protection level		68		*2**

1*: control unit only
2*: under the condition that the FiberScanONE™ is correctly assembled and with the connector closed with the supplied cap

Sensor handle

Parameter		*Min.*	*Max.*	Notes
Weight	kg	1.65		*3**
Dimensions head	mm	73 x 91 x 70	L x W x H	*4**
IP protection level		68		*5**
Overall length: control unit + handle assembled	mm	1150	1510	

3*: weight of sensor and pole together
4*: sensor housing only
5*: under the condition that the FiberScanONE™ is correctly assembled

6.3 Electrical specifications

Control unit

Parameter		*Min.*	*Max.*	Notes
Power supply voltage	V dc	6.6	9	
Power consumption - when switched off	mA	-	0,004	*1**
Power consumption - when switched on	mA	60	140	*2**

1*: The necessary current to check if the on/off key is pressed
2*: Min. value is with the instrument in operation, max. value additionally with Bluetooth® in operation.

Accumulators

Type of rechargeable battery pack		Lithium-Ion battery 7.2 V – 2200 mAh		*3**

3*: Battery pack must be replaced by qualified personnel only.

Microwave sensor

Parameter		*Min.*	*Max.*	Notes
Power supply voltage	V dc	6.0	12	
Power consumption	mA		100	

Battery charger (ANSMANN 9C94142)

Parameter		*Min.*	*Max.*	Notes
Power supply voltage	V ac	100	240	
Network frequency	Hz	50	60	
Power	VA		17	
Secondary output voltage	V dc	-	7.4	
Output power	mA		1300	

6.4 Environmental conditions

Parameter		*Min.*	*Max.*	Notes
Operating temperature	°C	0	+80	*1**
Maximum relative humidity	%		80	
Storage temperature	°C	-10	+85	

1*: Will not detect frozen water or water in frozen materials

6.5 Identification plates

Control unit:

Sensor handle:

7 TECHNICAL ASSISTANCE

All countries of the world, excluding the countries mentioned underneath.
FELTEST EQUIPMENT BV
Bijenkorf 55
NL-6961 PA Eerbeek - The Netherlands
Phone: +31 313 652 215
Fax: +31 313 654 068
e-mail: service@feltest.com
Web: www.feltest.com
Contact: Mr. Marcel Lensvelt

Canada, United States, Mexico
CRISTINI NORTH AMERICA INC.
700, Cristini Blvd
Lachute QC J8H 4N3 – Canada
Phone: +1 450 562 5511
Fax: +1 450 562 5055
e-mail: jfeola@cristini.com
Web: www.cristini.com
Contact: Mr. John Feola

Australia, China
GIUSEPPE CRISTINI S.P.A.
Via Bombardieri, 5
I-24020 Fiorano al Serio (BG) - Italy
Phone: +39 035 715111
Fax: +39 035 711451
e-mail: fiberscan@cristini.it
Web: www.cristini.com
Contact: Ms. Alessia

Japan
NOMURA SHOJI CO., LTD
3-15-2, Nihonbashi, Chuo-Ku
103-0027 Tokyo – Japan
Phone: +81 3 3275 8001
Fax: +81 3 3275 8005
e-mail: ns01@nomurashoji.com
Web: www.nomurashoji.com
Contact: Mr. Masaru Futaba

Russia
UNITSERVICE LTD
Basseynaya, 53
196135 St. Petersburg – Russia
Phone: +7 812 371 5027
Fax: +7 812 371 5027
e-mail: nikolay.syomin@feltrimarone.spb.ru

Contact: Mr. Nikolay Syomin

8 WARRANTY TERMS

Feltest Equipment BV warrants the proper execution of the agreed performance (as described in chapter 8 of this manual) for a period of twelve months after delivery.

Feltest Equipment BV warrants that the goods are of good quality and free from defects. Feltest Equipment BV shall only be liable under this warranty if the product is used under normal use and service conditions and in a proper manner as specified in the enclosed instructions. All other warranties are excluded.

During the warrant term, this warranty applies to the original buyer of the product and to each transferee owner of the product.

No warranty is given for defects that are the result of:
  a. normal wear and tear;
  b. injudicious use;
  c. non-maintenance or defective maintenance;
  d. installation, alteration, assembly, modification or repair by Buyer or by third parties.
  e. delivered items of goods that were not new at the moment of delivery;

No warranty is given for consequential loss or damage, for misusing and/or abusing and/or improperly maintaining the product in a manner contrary to Feltest Equipment BVs instruction manual.

If it transpires that the delivery or the product has not been sound and there is not a defect as mentioned above Seller may choose whether:
  a. to repair the item of goods;
  b. to replace the item of goods;
  c. to provide the customer with a credit note for a proportionate part of the invoiced amount.

For warranty Services, buyer must return the product at Buyer's costs and risk to Feltest Equipment BV's site at the following address:

> Feltest Equipment B.V.
> Hoofdweg 131/D
> 7371 GG Loenen
> The Netherlands

Please check on the website www.feltest.com under "contact" and "delivery address" if this address is still applicable.

Buyer may no longer invoke an instance of non-performance if he does not lodge a written claim with Feltest Equipment BV within one month of the date on which he discovers the defect or could reasonably be expected to discover it.