KPM KC9

Optical Consistency Transmitter

OPERATING INSTRUCTIONS

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Original instructions

SAFETY INFORMATION

All personnel must have the necessary knowledge and training for the work, to minimize risk of injury and damage. All adjustments, settings, calibration routines and service work must be done only by specially trained personnel. It is the responsibility of the supervisor to ensure that this is the case.

All covers must be in place during normal operation. Most of the instruments have moving parts that are operated pneumatically and/or electrically, and some incorporate sharp edges that are capable of causing serious injury. A large part of the service work needs to be done with the compressed air supply connected.

Always read the instructions carefully before operating the equipment. The following notations are used to emphasize important and critical instructions:

NOTE

This label is used for instructions that are important but not related to hazards.

WARNING

This label is used to indicate potential risk of severe injury or damage if warning is ignored.

Table of contents

1 Warnings

NOTE
Always check input supply voltage & frequency before making any connections. Incorrect connections will damage the equipment!

WARNING
Applicable electrical safety regulations must be closely followed in all installation work!
All electric connections must be done by authorized persons!.

WARNING
Make sure that the process pipe is empty and depressurized before installing any mounting parts!

WARNING
During installation, maintenance and service operations, remember that the system may contain hot sample or water - be careful!

WARNING
Make sure that operating voltage is not connected when there are any welding works performed in the vicinity of the devices!

WARNING
The device may contain moving parts. Be careful when testing the device!
Do not push your fingers between any moving parts!

2 Contact information

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new.abb.com/pulp-paper/abb-in-pulp-and-paper/products/process-measurements

3 Description

3.1 System components

The KC9 transmitter standard delivery includes sensor, 10 m interconnect cable and KC9 display unit.

The KC9 sensor is made of acid proof stainless steel and there are bypass and inline models models available for various applications. The sensors have an application specific measurement gap between measurement lenses, providing best accuracy and low maintenance requirement.

The lenses are made of sapphire glass to withstand abrasive liquids. Electrical and optical components are protected within the steel enclosure to handle very demanding environments.

The sensors models available:

1. KC9-P bypass sensor
   - Total consistency measurement of mixed stock with fines and fillers.
2. KC9-A bypass sensor
   - Total and ash consistency measurement of mixed stock with fines and fillers.
3. KC9-25 ST bypass sensor, KC9-25 LC bypass sensor and KC9-25 K bypass sensor, with 25 mm (1”) connections.
   - The ST sensor is suitable for single component pulps
   - The LC sensor is a special type for very low consistency applications
   - The K sensor is a special type for applications with aggressive media, i.e. white and green liquors, supplied with Kalrez-type o-rings.
4. KC9-50 with 50 mm (2”) connections
   - Similar to KC9-25 ST sensor, suitable for single component pulps.
5. KC9-IL inline sensor with fixed installation
   - Suitable for single component pulps.
6. KC9-IL V inline sensor with retraction system.
   - Suitable for single component pulps.

The display unit supplies power to the sensor and communicates with the sensor. The power supply required is 90 – 264 VAC, 50/60 $\pm$ 3 Hz. Analog outputs and system alarm connection to DCS are connected to display unit.

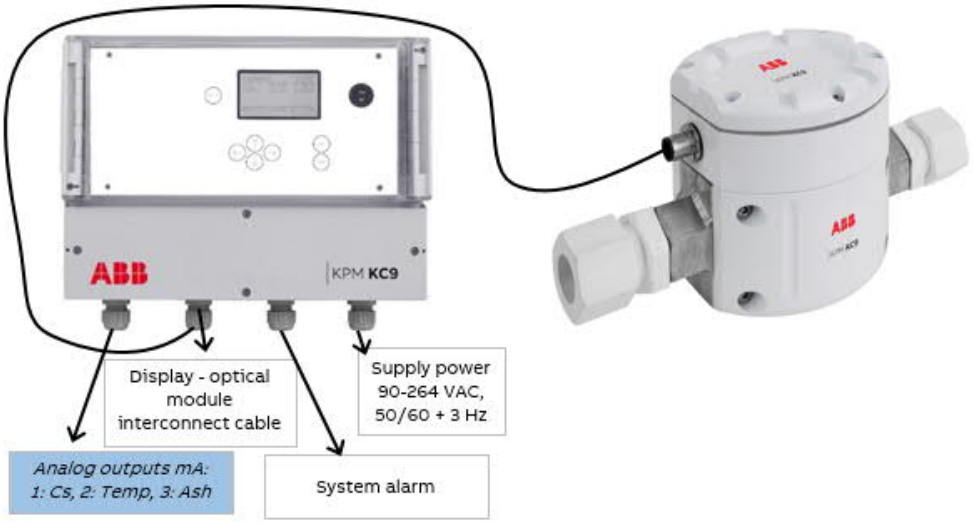
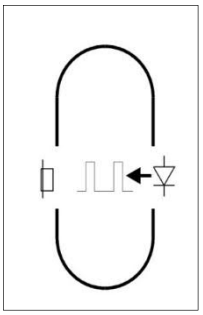


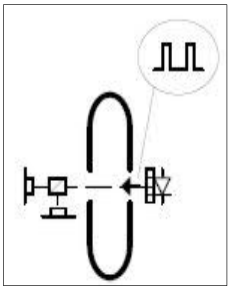
Figure 1. KC9 standard system components. Customer is responsible of supplying and connecting the external cables.

3.2 Measuring principle of KC9-25, KC9-50 and KC9-IL models



Sensor measures transmitted light through the liquid. The measuring principle is based on the particles ability to absorb and transit light. The light source is LED pulsing monochromatic NIR light. The detected measurement signal is calibrated to correlate with consistency or suspended solids. The measuring signal treatment is done by the display unit.

3.3 Measuring principle KC9-P models



Sensor measures transmitted and depolarized light through the liquid. The measuring principle is based on the particles ability to absorb, transit and depolarize light. The light source is LED pulsing monochromatic NIR light. The detected measurement signal is calibrated to correlate with consistency or suspended solids. The measuring signal treatment is done by the display unit.

3.4 Measuring principle KC9-A models

Sensor measures transmitted, depolarized and scattered light through the liquid. The measuring principle is based on the particles ability to absorb, transit, depolarize and scatter light. The light source is LED pulsing monochromatic NIR light. The measuring signal treatment is done by the display unit. Multivariable regression analysis is used to correlate the signals with laboratory values.

4 Dimensions and installation instructions

4.1 KC9 display dimensions

Install the display unit to the wall for easy access. Standard interconnect cable length is 10 meter to the sensor, several can be combined to form a longer cable. Cable has a quick connector at both ends.

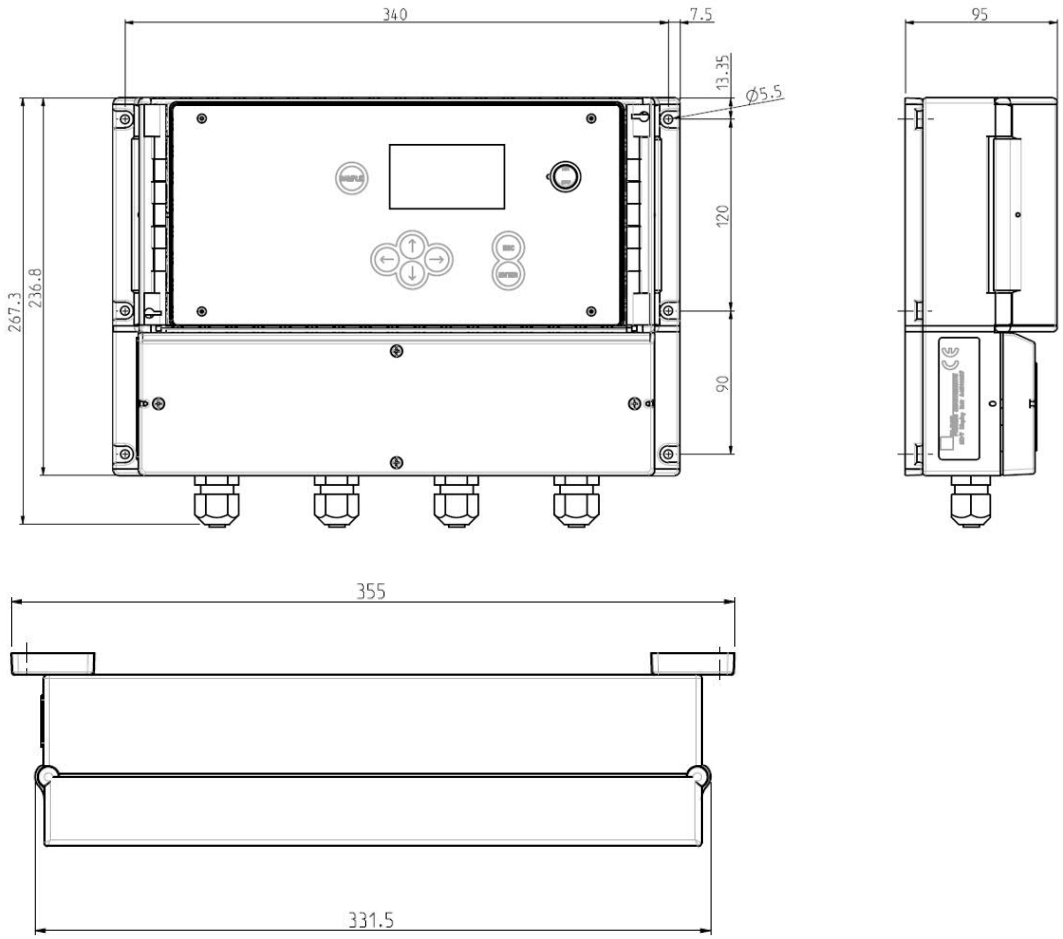


Figure 2. KC9 display dimensions

4.2 KC9-P and KC9-A sensor dimensions

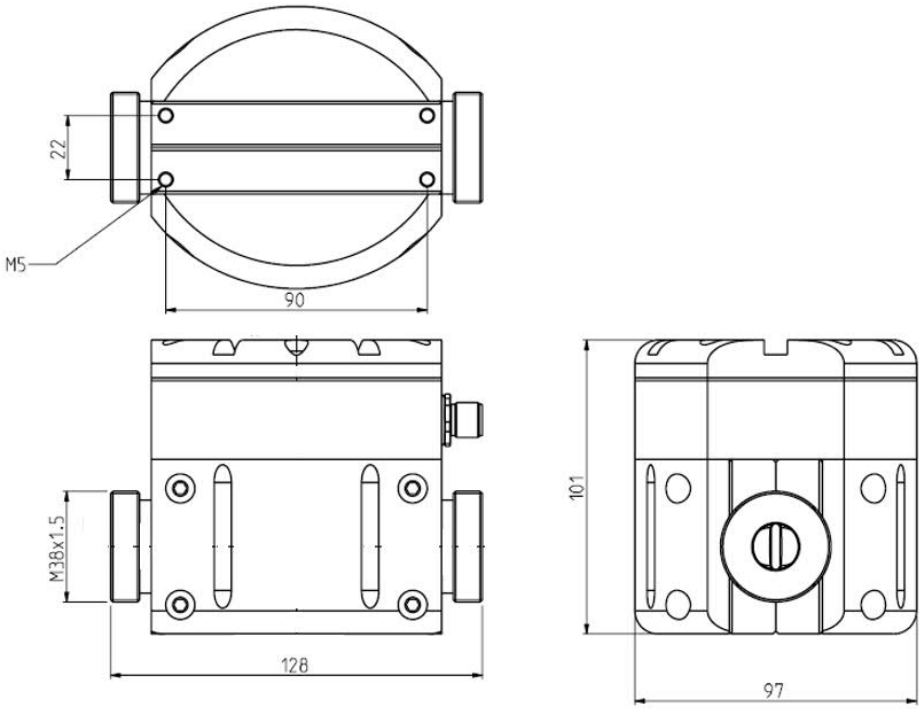


Figure 3. KC9-P and KC9-A sensor dimensions.

4.3 KC9-25 sensor dimensions

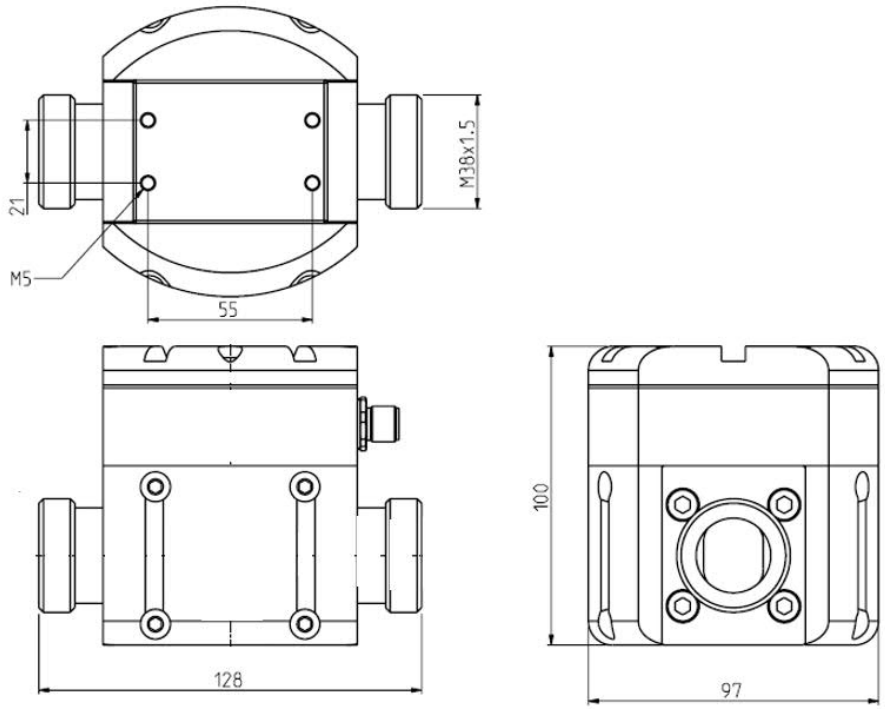


Figure 4. KC9-25 sensor dimensions.

4.4 KC9-50 sensor dimensions

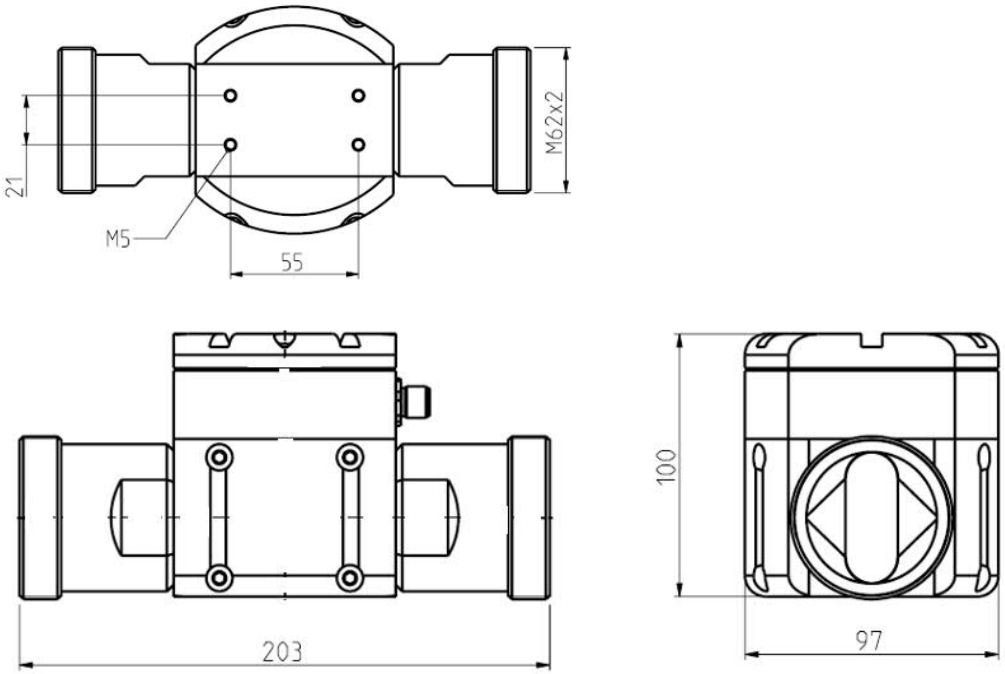


Figure 5. KC9-50 sensor dimensions.

4.5 Installation instructions

> **WARNING**
> Make sure that the process pipe is empty and depressurized before installing any mounting parts!

Manufacturer supplied components normally included these:

- KC9 optical sensor unit
- Display unit
- Interconnect cable 10 m

Options available from manufacturer:

- Sampling valve with 3/4" FEP tube fitting
- Welding or plastic fittings for sample line connection
- Flushing valve for automatic cleaning with water
- Interconnect cable can be extended by connecting them in series
- Mounting flange for inline sensors (IL and IL V)
- Retraction valve and installation jack assembly for inline sensor (IL V)

Bypass sensors are normally installed over process pump. Sample is taken from the pressure side and returned to the suction side of pump. Sensors require a minimum flow rate, see technical specification.

Inline sensors are installed to the pressure side of process pump. Turbulent flow is best, install sensor as close to pump outlet as possible. Inline sensors require a minimum flow rate of 1 m/s when consistency is more than 1 %. When consistency is below 1% flow rate must be 1,5 m/s.

4.6 General installation recommendations

- Process pressure should be over 1.5 bar to avoid air in pulp.
- Avoid installations with high content of black liquor in pulp.
- Avoid exposure to considerable and fast changes in temperature.
- Avoid installation where the sensor is exposed to severe cold weather or direct sunlight.
- Protect the sensor from high pressure water spraying.
- The sensor should never be submerged under water.
- Install the sensor to avoid extreme vibrations.
- The sensor must not be removed while still under process pressure (except KC9-IL V model with retraction system).

4.7 KC9-A and KC9-P sensor installation

KC9-P sensor is a total consistency sensor for low consistency (0–2.0 %) applications. KC9-A sensor measures both total consistency (0–2.0 %) and ash consistency (0–1.0 %). Normally installations are on the short circulation area of the paper/board machine or DIP plant.

Sensor is normally installed to bypass metal piping line of 25 mm (1") or with fluorinated ethylene propylene (FEP) 3/4" tubing (max pressure 4 bar/58 psi). The sensor must not be removed while still under process pressure. Install shut-off valves on both sides of sensor.

The inlet of the bypass pipe should be in location where the suspension is well mixed and the flow is turbulent. Distance from a pump discharge or a pipe elbow is about three pipe diameters downstream. Install the bypass pipe inlet before an elbow or pipe reduction to obtain the highest possible turbulent flow rate in the bypass pipe. The bypass pipe should be short and straight.

To avoid the water film on pipe walls, the bypass pipe should extend at least 20 mm (¾") into the process pipe. The bypass pipe should not have any throttling valve or pipe bend closer than 0.5 m (20") before the sensor.

The bypass pipe must not dewater the pulp stock at shutdown. Therefore the valve upstream the sensor should be closed automatically when the pump stops running.

Sensor has a 3 mm gap between lenses so stock/pulp has to be screened. Sensor can be installed directly to places, where there is over 1 bar (14.5 psi) pressure in the pipeline. This will ensure a proper sample flow through the sensor. In case of low pressure, a pump is needed to supply enough sample flow to sensor. In some installations backflushing with warm water is needed to ensure cleanliness of the optical module.

The measured sample can be returned to the suction side of the pump or back to the process.

4.8 KC9-25 and KC9-50 sensor installation

The KC9-25 can be mounted directly to 25 mm (1") pipe, KC9-50 to 50 mm (2") metal pipe. With larger pipes a bypass line should be used. The sensor must not be removed while still under process pressure. Install shut-off valves on both sides of sensor.

The inlet of the bypass pipe should be in location where the suspension is well mixed and the flow is turbulent. Distance from a pump discharge or a pipe elbow is about three pipe diameters downstream. Install the bypass pipe inlet before an elbow or pipe reduction to obtain the highest possible turbulent flow rate in the bypass pipe. The bypass pipe should be short and straight.

To avoid the water film on pipe walls, the bypass pipe should extend at least 20 mm (¾") into the process pipe. The bypass pipe should not have any throttling valve or pipe bend closer than 0.5 m (20") before the sensor.

The bypass pipe must not dewater the pulp stock at shutdown. Therefore the valve upstream the sensor should be closed automatically when the pump stops running.

The flow rate in the bypass pipe should be same as in the main pipe but not less than 20 l/min (5 gpm) for KC9-25 and 60 l/min (15 gpm) for KC9-50 sensors. At lower rates a risk of dewatering and building up on the windows exists. For pulp stock with printing ink and resin, the flow rate should be twice as high.

Automatic cleaning is recommended for recycled fiber applications and then the flushing water pressure should be higher than process pressure. Use warm water to avoid problems with condensation.

In recycled fiber applications the valve after the sensor should be completely open to purge the sensor throughly.

The measured sample can be returned to the suction side of the pump or back to the process.

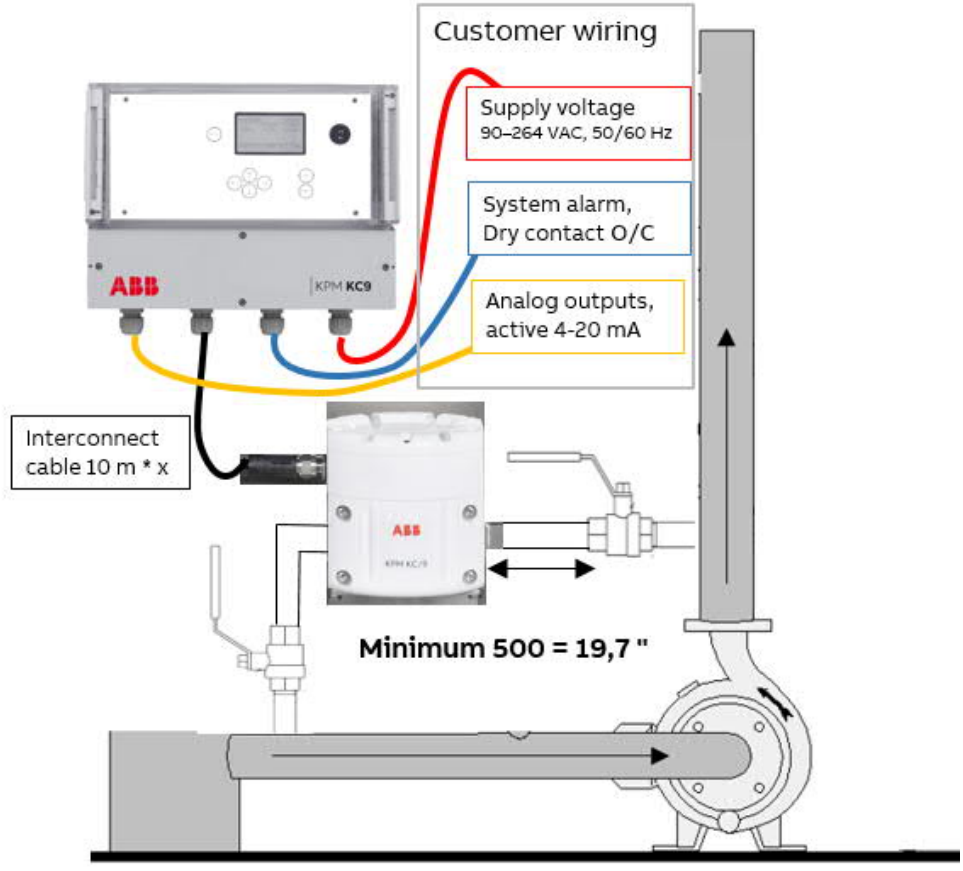


Figure 6. KC9 bypass sensor installation.

4.9 KC9 bypass sensor installation with backflushing and return pump

A backflushing valve (3-way valve) will be installed after the sensor. The sample flows normally directly through the valve opening. Cleaning water is connected to this 3-way valve. Warm water must be used to avoid condensation problem in the sensor. The pneumatic valve actuator needs also an instrument air connection.

The solenoid valve is used to control the valve actuator. Control comes from KC9 display unit at configured sequence. Analog outputs are not updated during flushing to avoid spiking of results.

The sample return pump should be controlled with KC9 display. During the backflushing sequence the pump is stopped to avoid problems with cavitation. Pump must be installed on a platform or stand. Available from ABB KPM.

Additionally the pump must be stopped during the process stop to avoid running the pump dry. ABB KPM can supply a pump with an inverter.

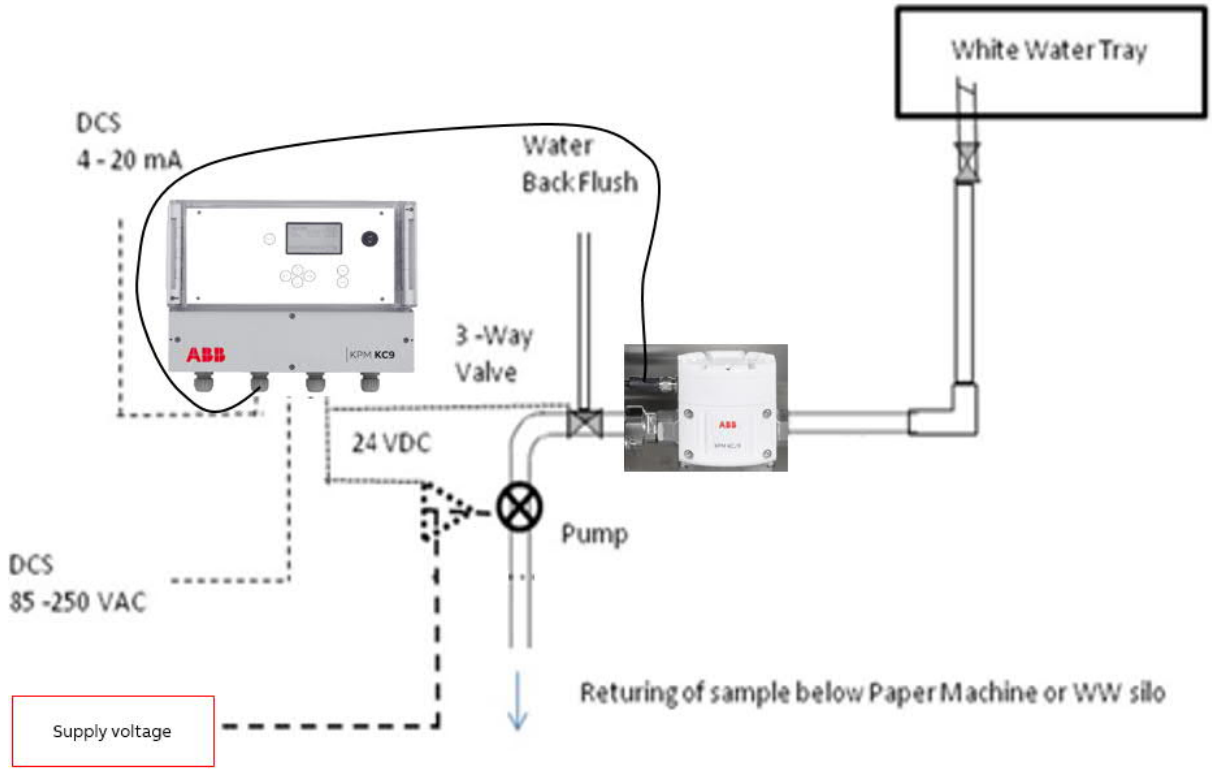


Figure 7. KC9 bypass sensor installation with flushing and sample return pump.

4.10 Flushing water and instrument air connections

Flushing water can be used for automatic cleaning of sensor and sample line. There is a 24 VDC relay control from KC9 display unit and flushing valve assembly available. Relay control can be changed to dry contact or to main supply voltage (100/110/230 VAC).

Manufacturer delivered flushing valve assembly contains following fittings

- Flushing water has R1/2" inlet connection (Figure 8 A).
- Instrument air connection: R1/4" inlet connection, outlet is 6/4 mm (Figure 8 B).

Sample line connectors are for R3/4" FEP tube. Welding connectors can also be delivered.

Warm water must be used for cleaning to prevent condensation. Water temperature must be same as sample or maximum 20 C warmer.

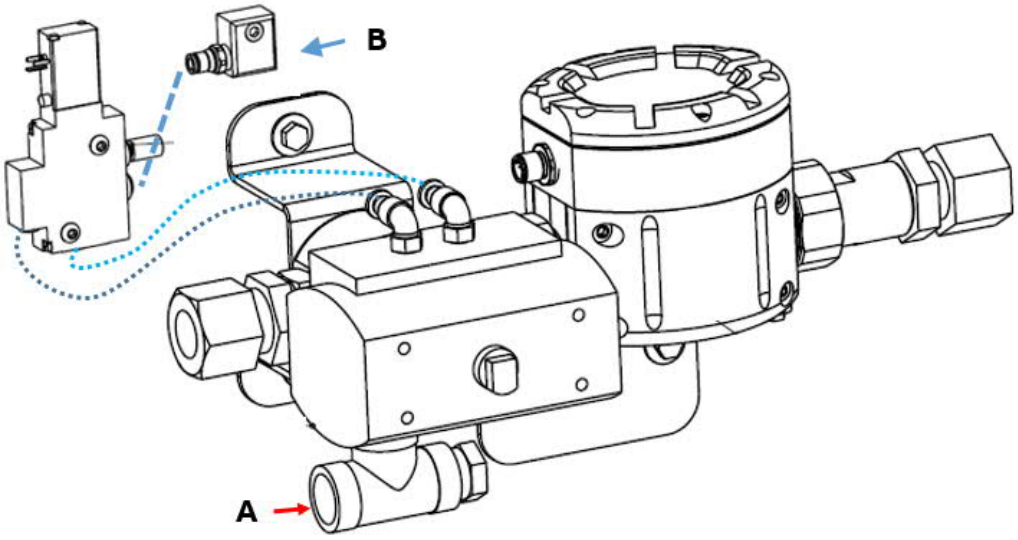


Figure 8. Flushing water (A) and instrument air (B) connections.

4.11 KC9-IL and KC9-IL V sensor installation & locations

The KC9-IL and KC9-IL V can be mounted directly to process pipe. Sensor must be installed to turbulent flow.

KC9-IL V sensor has a retcraction valve enabling the removal of sensor without process shutdown. Jack assebly is used for safe installation of sensor to/from process.

Make sure that before installation or removal KC9-IL sensor that the process pipe is empty and depressurized. Verify that appropriate valves are closed.

For process coupling installation make a 50 mm hole to the wall of the process pipe. To prevent fiber debris from collecting on the edge of the cut-out, ensure that the edges of the hole inside the pipe are ground smooth.

Saddle must be paraller to existing pipe line. Welding instruction drawings for PN10:

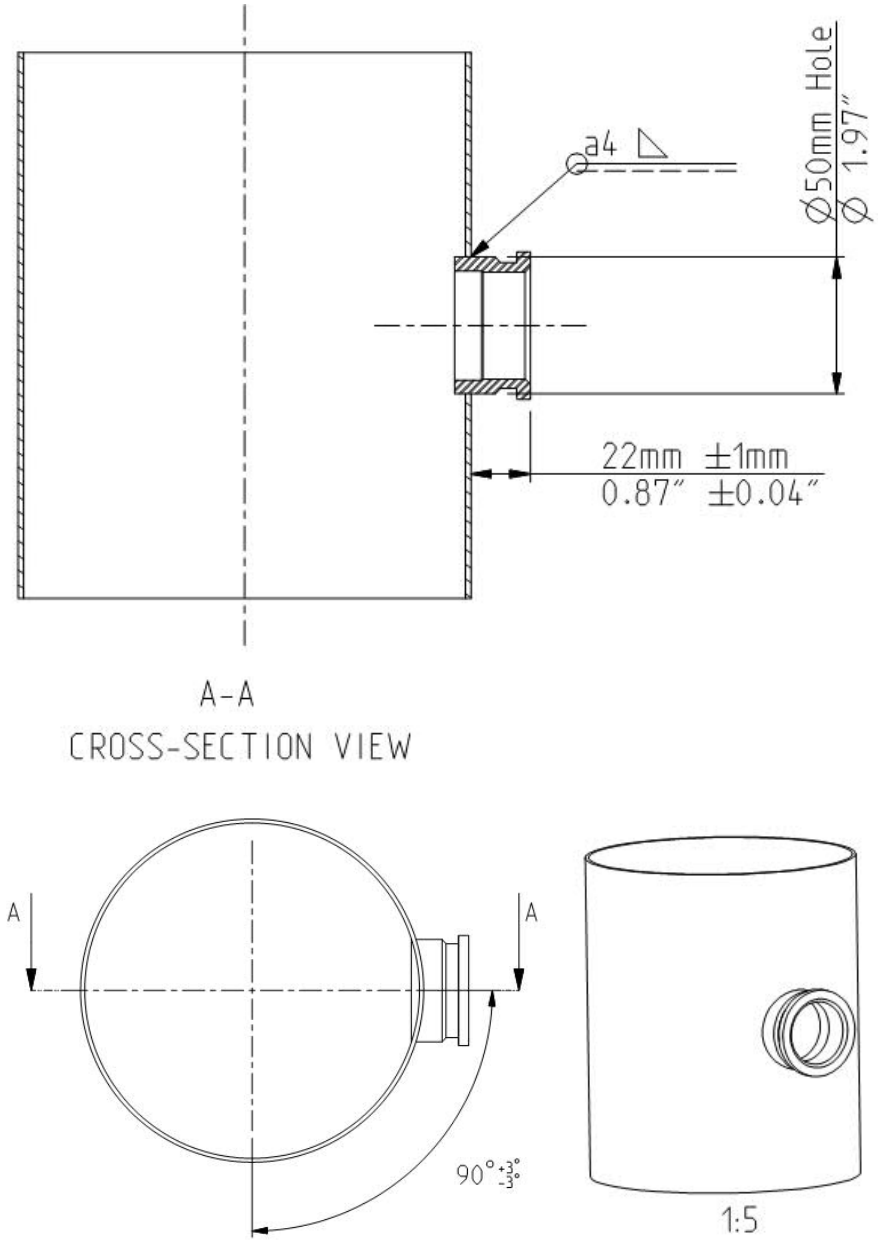


Figure 9. Process coupling welding instruction to process pipe PN10.

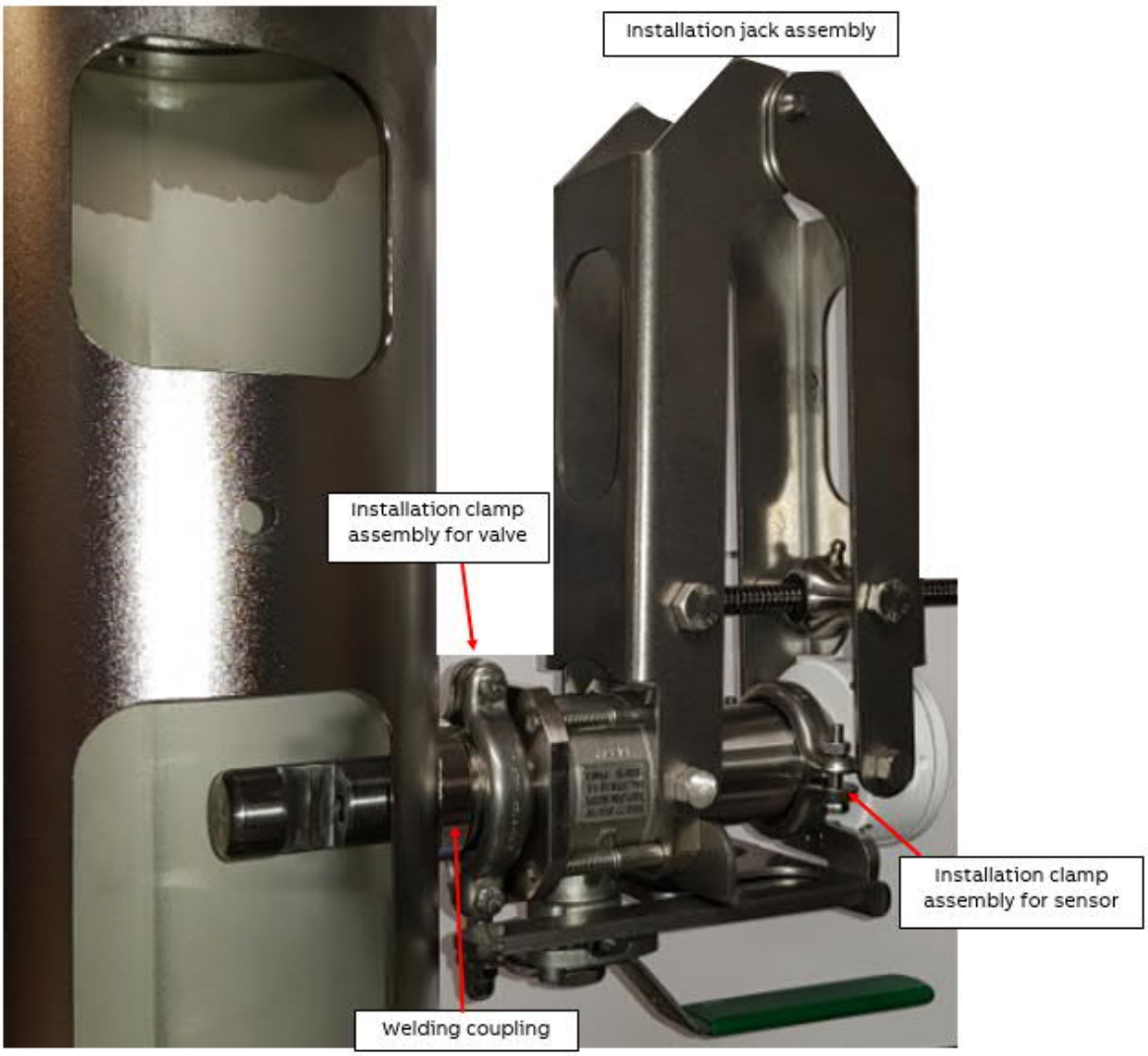


Figure 10. KC9-IL V sensor with installation clamps, retraction valve and installation jack.

5 Electric connections

NOTE
Always check input supply voltage & frequency before making any connections. Incorrect connections will damage the equipment!

WARNING
Applicable electrical safety regulations must be closely followed in all installation work!
All electric connections must be done by authorized persons!.

The terminals for the electrical cables are located under the bottom cover of the display unit. The layout of the connection board is shown in the following figure.

Locate the display unit in place for easy access.

5.1 General instructions

Supply power is 1-phase supply 90 – 264 VAC, 50/60 ± 3 Hz, connected to terminal strip that is located on the lower right corner of the display unit. The supply power cable minimum size is 3 * 1,5 mm^2. Display power can be turned off from internal switch (requires opening the display protection panel).

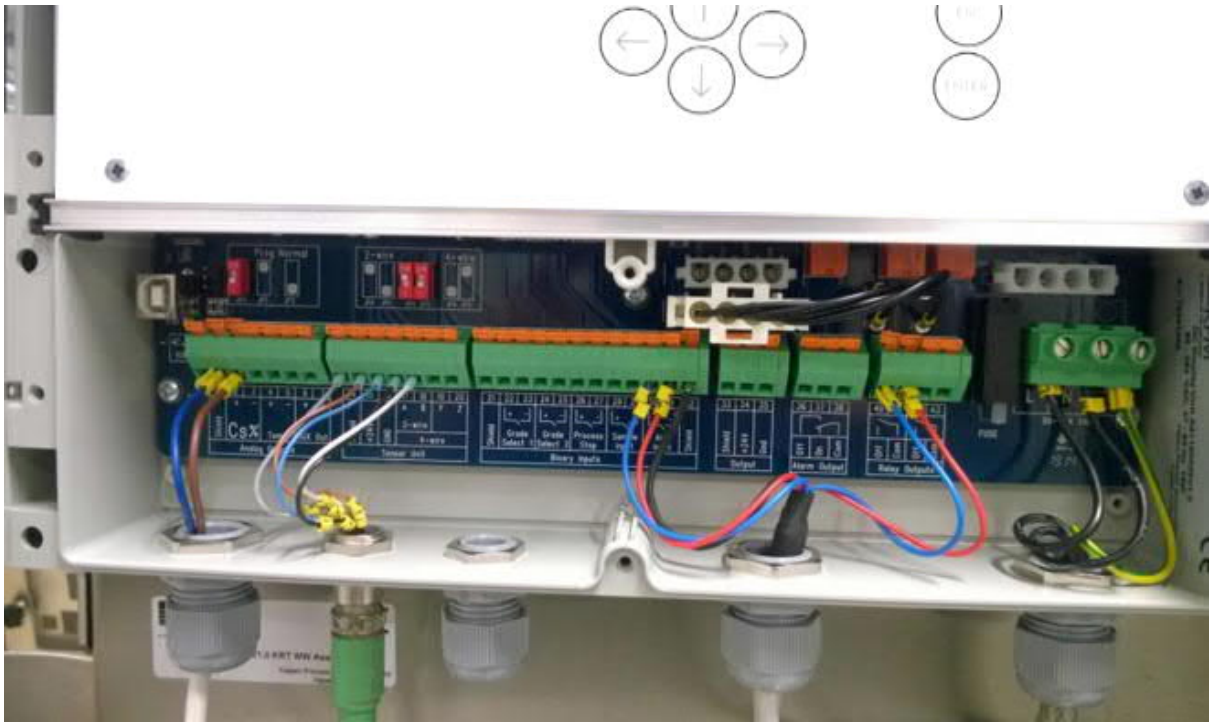


Figure 11. KC9 Display unit wiring.

Supply voltage 90 – 264 VAC, 50/60 + 3 Hz to terminal strip of the display unit.

Sensor cable (Interconnect cable) connection to terminals 14 -18.

Current output terminals 2 and 3 are for Consistency. Terminals 4 and 5 are reserved for Temperature. Current outputs are active and isolated. Terminals 6 and 7 are for Ash Consistency, availabe with KC9-A.

Binary inputs are closing contacts only. No supply voltage needed.

Alarm relay is used for system alarm. Closing or opening contact, supply voltage not needed.

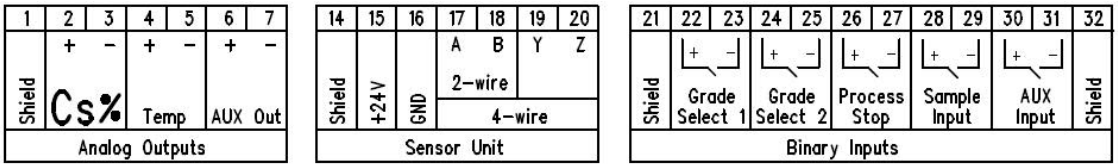
Cleaning cycle control in terminals 40 - 41. Relay is controlling the flushing valve to purge the sensor measurement cap with water. The cleaning cycle can be activated and configured in Maintenance menu.

Pump control in terminals 42 – 43. Normally the pump is stopped during the cleaning sequence. The pump should be stopped also during process stop.

5.2 Analog outputs

Analog output wiring is provided by customer. Analog outputs are active and isolated, no voltage supply required.

- Total Consistency analog output is connected to terminals 2 (+) and 3 (-)
- Ash Consistency analog output is connected to terminals 6 (+) and 7 (-)
- Temperature analog output is connected to terminals 4 (+) and 5 (-)
- Terminal 1 is for cable shield. Only connect cable shield at one end (DCS)



5.3 Binary inputs

Binary inputs are closing contacts only. No supply voltage needed.

- Terminals 22, 23 are for Grade Select 1
- Terminals 24, 25 are for Grade Select 2
- Grade selection table is based on binary inputs:

Grade	Grade select 1 (22,23)	Grade select 2 (24,25)
Grade 1 (Name A)	0	0
Grade 2 (Name B)	1	0
Grade 3 (Name C)	0	1
Grade 4 (Name D)	1	1

- Terminals 26, 27 are for Process Stop. Close = process stop, Open=Run
  Use paper machine fan pump running/not running information or similar to activate the process stop.

- Terminals 28, 29 are for Sampler information to give timestamp to save readings

- Terminals 30, 31 are for Aux Input
  Connected internally, used for pump control

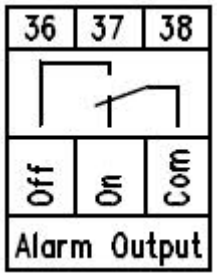
- Terminals 21 and 32 are for cable shield. Only connect shield at one end (DCS)

5.4 Binary output

There is one binary output for system alarm. Output can be open or closing contact. Terminals 38 is common, 36 is alarm relay OFF/normally closed. Contact opens in case the built-in self-diagnostics detects a failure. If power is lost or turned off, the alarm relay OFF is OPEN.

Alarm ON works in the opposite way, 37 is alarm relay ON/normally open. Contact closes in case the built-in self-diagnostics detects a failure. If power is lost or turned off, the alarm relay ON is CLOSED.

Connect suitable external voltage (24 VDC or 110 VAC) if needed for DCS.



6 Display unit operation and configuration

6.1 Display and operating keyboard

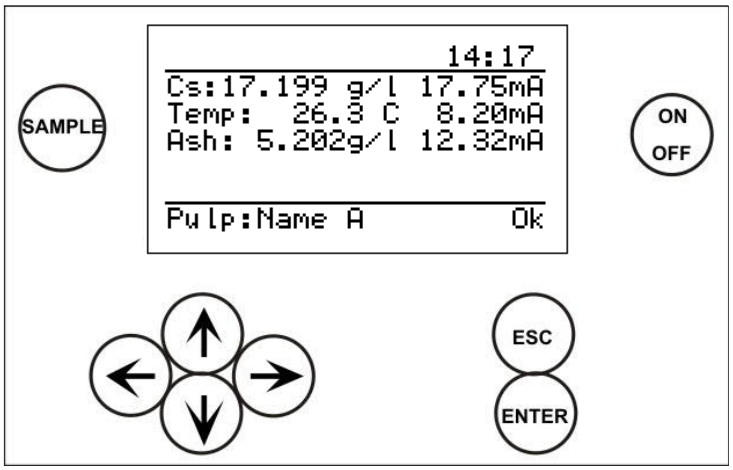


Figure 12. Display and keyboard.

Main display

The main display shows:

- First row: Left corner; Tag name/number Right corner; time.
- Second row: Consistency signal and analog output in milliamps.
- Third row: Temperature as degrees (C / F) and output in milliamps.
- Fourth row: Ash consistency signal and analog output in milliamps (in KPM KC9-A).
- Fifth row: Information text when available:
  - Start cleaning
  - Cleaning in progress
  - Cleaning delay
  - Process stop
  - Service mode

– Sixth row: Left corner; Selected pulp grade, default Name A
– Right corner; Status information Ok or Error

Common properties in other menus

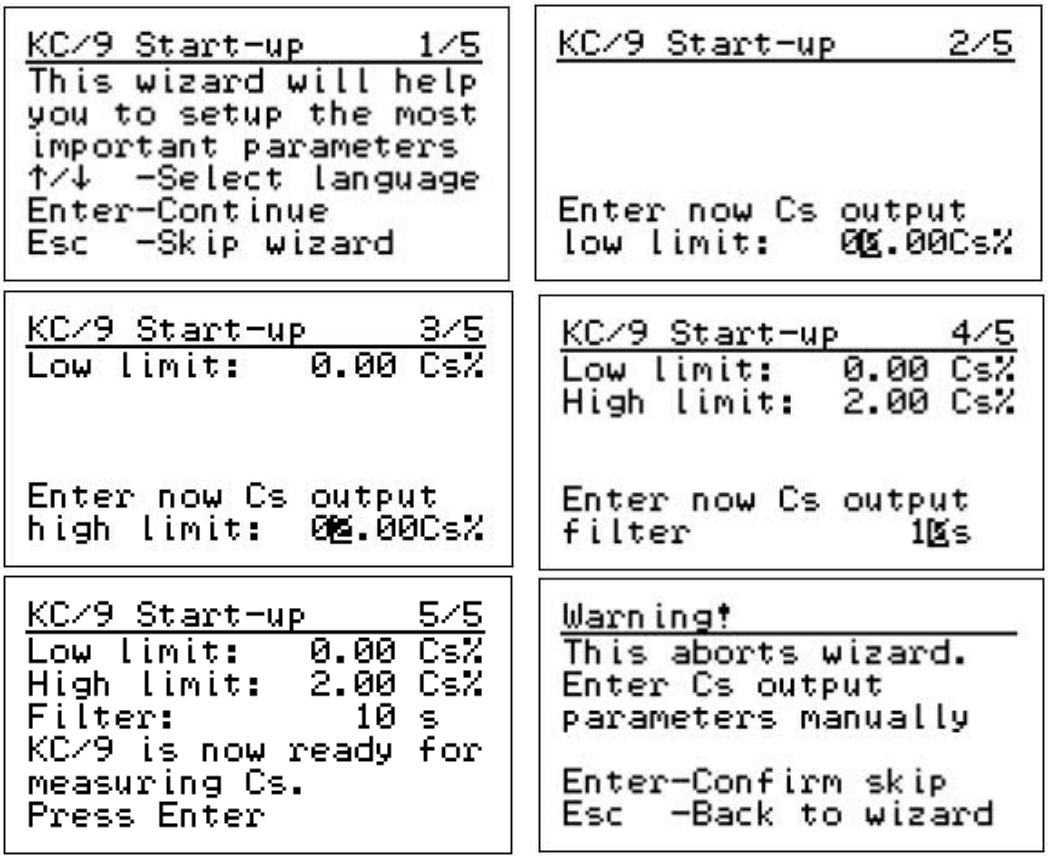
– The display contains 7 lines, 21 characters in a line.
– Selected line is highlighted
– Upper right corner shows:
  - Number of lines or pages in that menu.
  - Arrow indicates hidden lines.
– Help menus in the bottom.

Keyboard

– ON/OFF button: Switch the main power on/off.
– Arrows: Scroll the menus and rows or adjust values.
– Esc: Delete changes or return back to the previous menu.
– Enter: Accept data and input changes.
– Sample: Averages the measured values. After sampling the program asks if the values will be stored (ENTER) or discarded (ESC). In case no key is pressed, the sensor stores automatically sample values after 3 minutes.

6.2 Wizard

KPM KC9 sensor is delivered with factory calibration, which means that the device will measure consistency as soon as you switch the power on.
When power is switched on the first time, the sensor goes to start-up wizard. The wizard guides through the mandatory settings. After the wizard has finished, the sensor is ready to measure and report the total consistency to the DCS.
Language can be selected in first page with up/down keys; English, Finnish and German available. Wizard can be skipped with Esc, warning is given if wizard will be aborted.



If you want to return to wizard go to the Maintenance menu → Default Settings. This will take all settings to default – DO NOT use if you are totally sure it is needed.

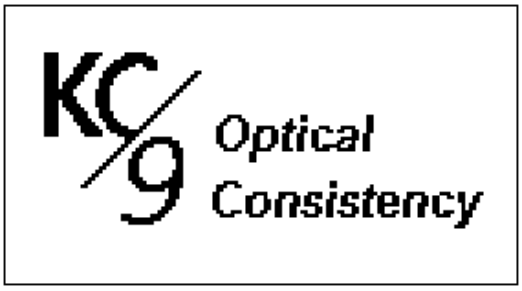
If the Wizard is not used, the configuration of Analog output can be done as follows:

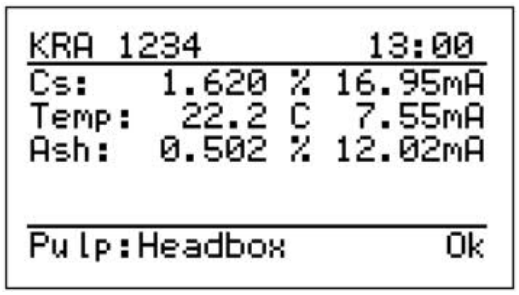
- Configure Analog output scaling and filtering in “Parameters” menu and unit is ready to measure consistency.

- With KC9-A the Analog output 3: Ash scaling has to be configured manually, it is not configured by wizard!

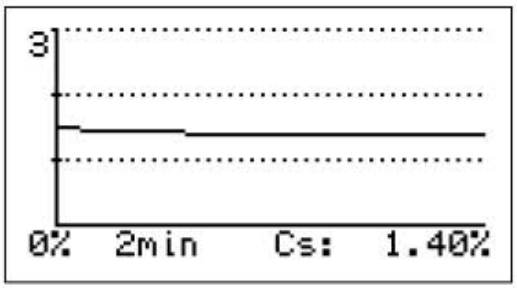
6.3 Main display

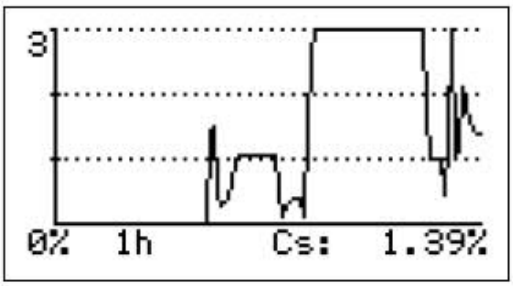
When power is turned on device will briefly show boot-display (KC/9 Optical Consistency) and then display the main menu.
Device tag can be entered from → Maintenance → Device information → Display unit → Tag. Tag will be shown in the left-right corner, if configured.





Arrow right or left brings Trend data display of consistency.
There are three time levels (2 min, 1 hour and 24 hour).





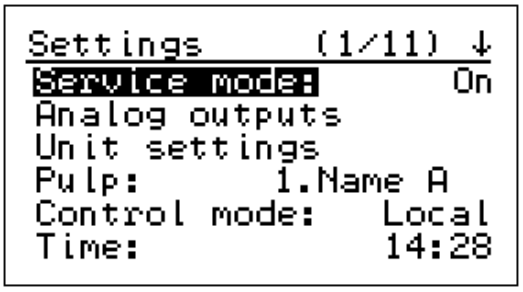
Arrow down key in Trend data display brings ash trend (with KPM KC9-A) and further down Temperature trend display.

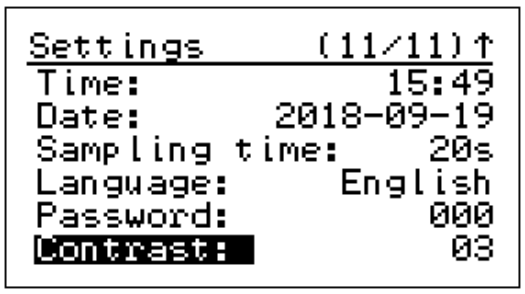
6.4 Main menu

Arrow up or down in main display shows Main menu. Submenus can be accessed from main menu.

6.4.1 Settings

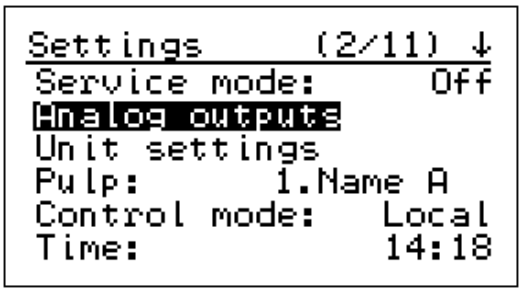
From Settings menu parameters can be reviewed and edited.

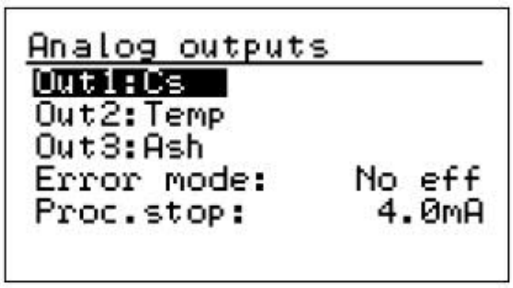


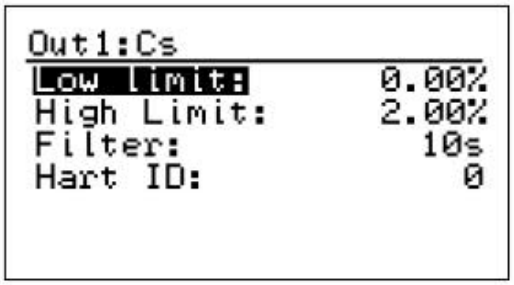


Service mode: ON = pump is not running, analog outputs are not updated.
OFF = normal measurement operation.

Analog Outputs:

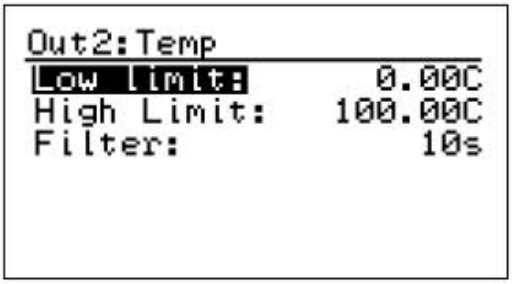


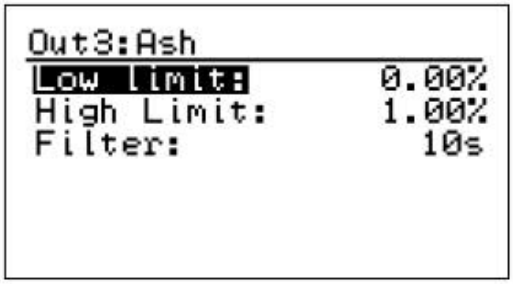




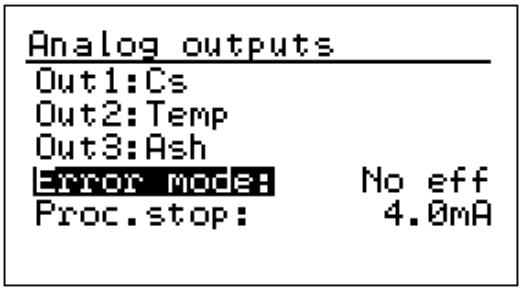
Output 1: Cs Low limit: Consistency low limit value, default 0.00 %. Corresponding to the 4 mA value of the analog output 1 signal.
Output 1: Cs High limit: Consistency high limit value, default 2,00 %. Corresponding to the 20 mA value of the analog output 1 signal.
Cs Filter: Output signal filtering time, 1 – 99 seconds, default 10 s.
Hart ID: Hart ID Address: Default O. Hart communication is available only at AOutput 1

Output 2 is reserved for sensor temperature
Output 3 is for ash consistency. The ash is calibrated to grams/l or %.



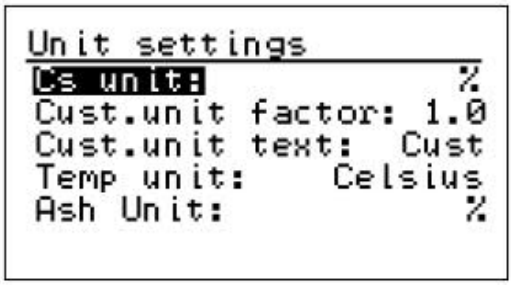


Error mode: Effect for analog outputs 1 and 3, when self-diagnostics detects an error: No effect, Freeze, 3.5 mA or 22.0 mA.
Proc.Stop: Analog output level, when Process stop binary input is activated. No effect, Freeze, 4.0 mA or 20.0 mA



Consistency unit can be chosen %, g/l, mg/l, kg/t, Brix.
There is also one customer specified unit (Cust) where multiplier factor can be adjusted.
Ash unit is g/l or %.

Cs unit: Unit to be used in measurements: %, Cust, Brix, kg/t g/l
Cust. unit factor: If Cust selected for “Cs unit”, setting of factor.
Cust. unit text: If “Cust” selected for “Cs unit”, editing the text.
Temperature can be chosen Celsius or Fahrenheit.



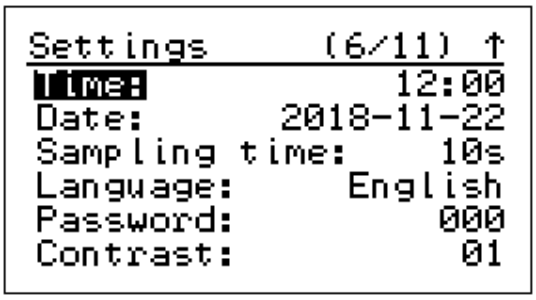
Pulp: Pulp grade can be changed manually, when Control mode is Local.

– Up and down arrows: Scrolling grades (4). Grade name can be edited. Normally only one (calibration) grade is needed.

Control mode: Local = grade is set manually.
Remote = grade changed by binary inputs named Grade 1 and Grade 2.
Grade selection is based on binary inputs. Grade select 1 and Grade select 2 combination as described in the table below:

Grade	Grade select 1 (22,23)	Grade select 2 (24,25)
Grade 1 (Name A)	0	0
Grade 2 (Name B)	1	0
Grade 3 (Name C)	0	1
Grade 4 (Name D)	1	1

Time / Date: For sampling identification and error log.
Sampling time: Averaging time after the SAMPLE-button is pressed.
Language: For display settings (English, Finnish and German available).



Password: For operating the display. 000 = no password requested. 633, works always.
Contrast: Display intensity, default 15 (brightest). Normally 01 is ok.

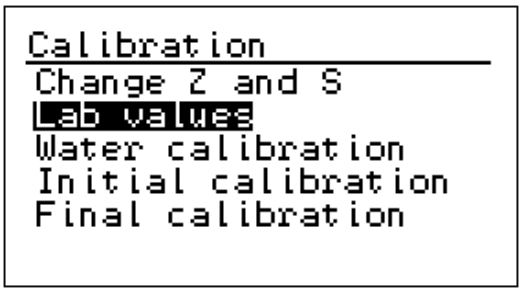
6.4.2 Laboratory values

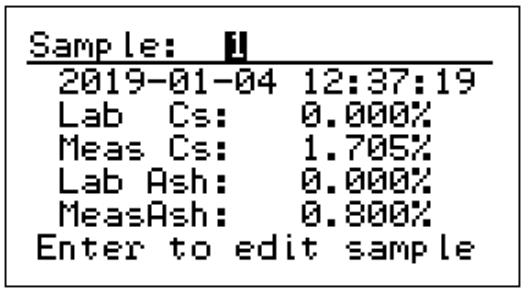
Laboratory values can be entered after the sample has been stored in the device memory. When the SAMPLE button has been pressed the raw measurements are stored. This can be done by pressing ENTER button right after sample taking. The device stores values automatically after 5 minutes if no button is pressed.

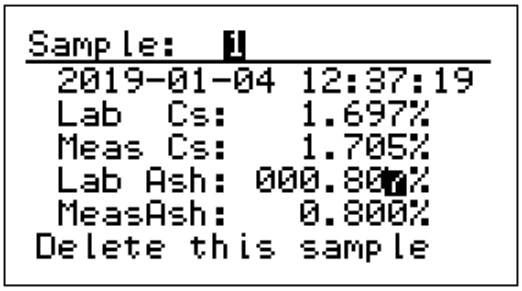
When entering laboratory values first choose a sample based on date and time. Last sample is always set as number 1 and there are 100 latest samples stored in the memory. When a new sample is stored, it deletes the oldest sample if the memory is full.

Calibration → Lab values → Press Enter to edit sample → Give laboratory Cs or g/l (and laboratory ash Cs or g/l with KPM KC9-A)

Numbers are selected with arrows-buttons and value saved by pressing Enter



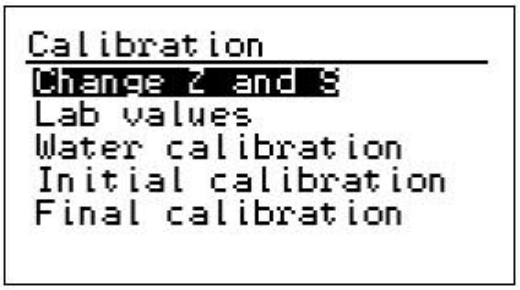




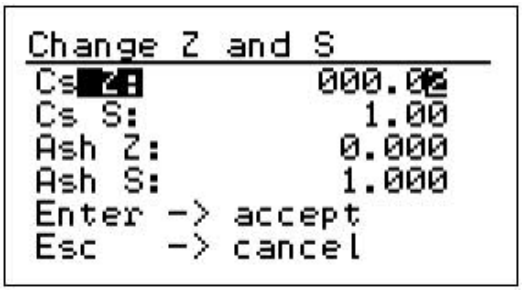
6.4.3 Change Z and S

Calculated consistency and ash result can be adjusted with S = slope (=gain) and/or Z = zero (=offset).

Calibration → Change Z and S



Arrow right → give new value with arrow up/down
Store new value with Enter.

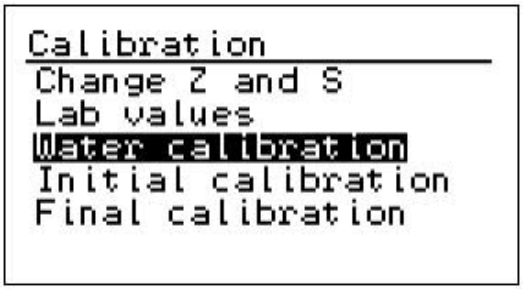


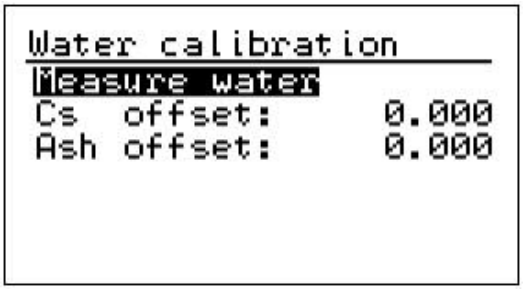
6.4.4 Water calibration

Water calibration is done in production. Normally there is no need to change water calibration.

Use the single point calibration in the start-up to get result trends to correct level.

> NOTE
> Water calibration is normally only done during manufacturing.





6.5 Calibration

The sensor is delivered with factory calibration, meaning it will show results as soon as you switch power on. Factory calibration is performed for the device in factory final testing using clean water and reference sample.

Default value for initial calibration Cs M-sig. S = 1.0 and Cs M-sig Z = 0.0
Default value for final consistency Slope (=gain) is S = 1.0 and for Zero (=offset) Z = 0.0.

Initial calibration should be performed with single laboratory sample. This allows the device settings to be optimized for the conditions in which it will be used.
The result from this check is set to:
Calibration → Initial calibration → Cs calibration → Cs M-sig. S and Cs M-sig Z

6.5.1 Result calculation of KC9-25, KC9-50 and KC9-IL models

Sensor measures raw consistency (N) from = Ln(FS0S)

From N Consistency M is calculated = (N+ CsMsigOffset) * CsMsigGain

6.5.2 Result calculation of KC9-P

Sensor measures raw consistency (N) from = Polar ratio

From N Consistency M is calculated = (N+ CsMsigOffset) * CsMsigGain

6.5.3 Result calculation of KC9-A

Sensor measures raw consistency (N) from = (Polar ratio Cs * PRatio gain) + (FS15V Cs * FS15V gain) + (FS30V Cs * FS30V gain) + (FS15H Cs * FS15H gain) + (BS15 Cs * BS15 gain) + (BS30 Cs * BS30 gain) + (X/Y Cs * XY gain) + (FS0S Cs * FS0S gain) + (FS0P Cs * FS0P gain).

From N Consistency M is calculated = (N+ CsMsigOffset) * CsMsigGain

- CsMsigOffset comes from single point calibration and should be close to zero (later offset comes from multivariable regression analysis, then value is not zero).
- CsMsigGain comes from single point calibration

NOTE! later when multivariable regression analysis is performed CsMsigGain must be set to 1.0

Final consistency is calculated as follows: Cs = S * M + Z

- S = slope/gain for result, adjusted by end user if necessary
- Z = zero or offset, adjusted by end user if necessary

Sensor measures raw ash consistency (N ash) from = (Polar ratio * PRatio gain) + (FS15V Ash * FS15V gain) + (FS30V Ash * FS30V gain) + (FS15H Ash * FS15H gain) + (BS15 Ash * BS15 gain) + (BS30 Ash * BS30 gain) + (X/Y Ash * XY gain) + (FS0S Ash * FS0S gain) + (FS0P Ash * FS0P gain).

From N Ash M is calculated = (N Ash + Ash CsMsigOffset) * Ash CsMsigGain

- Ash CsMsigOffset comes from single point calibration and should be close to zero (later offset comes from multivariable regression analysis, then value is not zero).
- Ash CsMsigGain comes from single point calibration

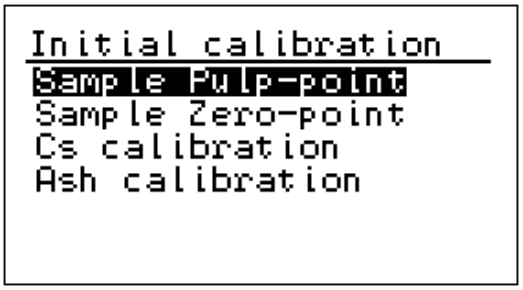
Final Ash consistency is calculated as follows: Ash = S * M + Z

- S = slope/gain for result, adjusted by end user if necessary
- Z = zero or offset, adjusted by end user if necessary

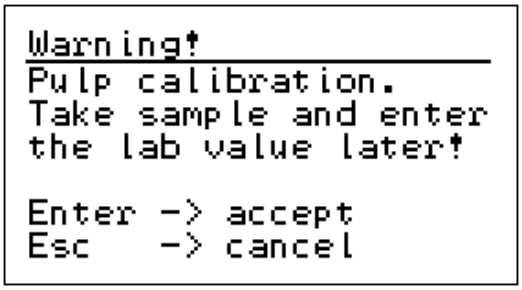
6.5.4 Single point total consistency calibration

Use the single point calibration in the start-up to get result trends to correct level. Displays are from KC9-A model, Ash calibration is not available in all models.

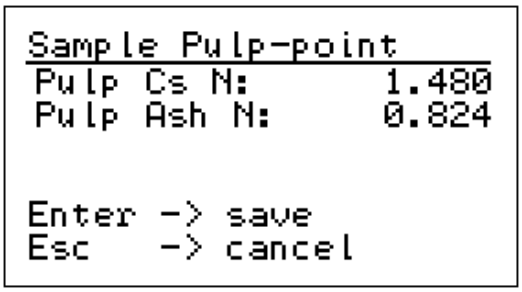
1. Perform initial calibration by taking a sample from Calibration → Initial calibration → Cs calibration → Sample pulp point → (Arrow right)



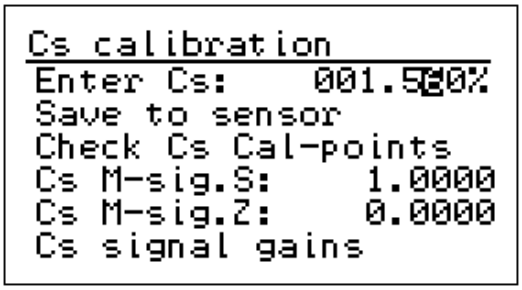
2. There is a warning preventing calibration by mistake (Press escape if you don't want to make initial calibration). Make sure sample is flowing and the conditions are normal. Press Enter and take sample for laboratory analysis.



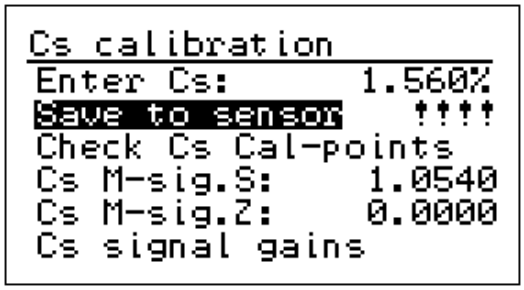
3. Pulp-point N values are shown, store those by pressing Enter



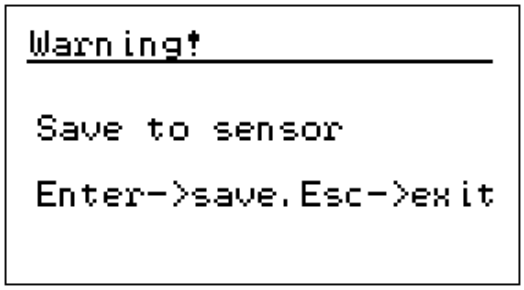
4. Enter the consistency result from laboratory to Calibration → Initial calibration → Cs calibration → Enter Cs (in example 1,480 is changed to 1,560 %)

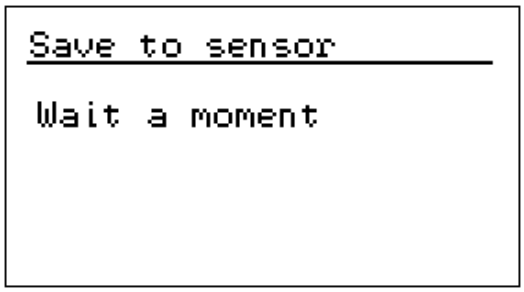


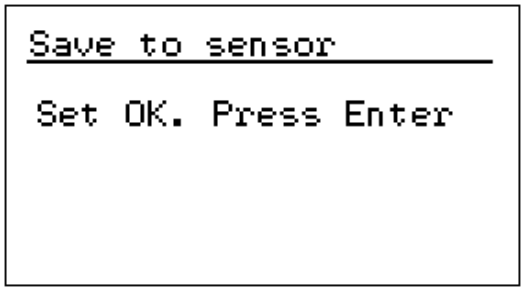
5. New values will be calculated to Cs M-sig. S: and Cs M-sig Z:
   M-sig. S has a new value. Cs M-sig Z should be zero.
   Save these values to sensor from "Save to sensor !!!"



There is a warning preventing calibration by mistake (Press escape if you don't want to save values to sensor). Press Right arrow-button to save the values.



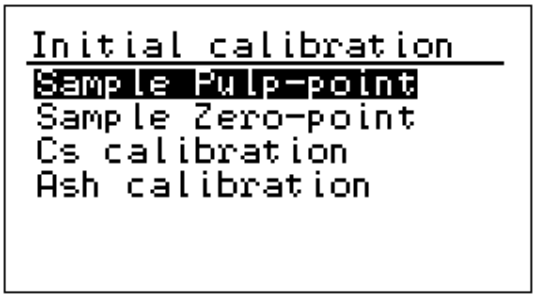




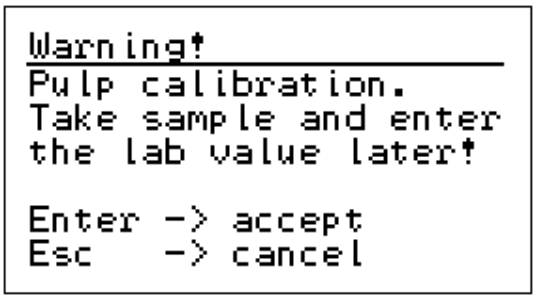
6.5.5 Single point ash consistency calibration of KC9-A

Use the single point calibration in the start-up to get result trends to correct level.
Same pulp point can be used both total and ash consistency. In this case phases 4-5 are needed. If you will calibrate ash on separate occasion, do phases 1-5

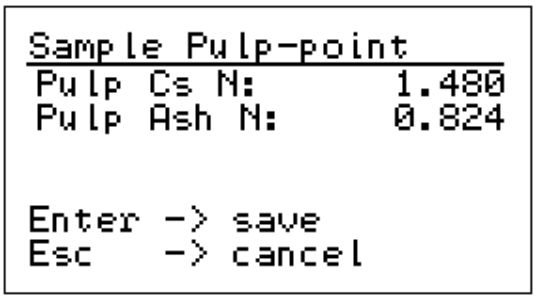
1. Perform initial calibration by taking a sample from Calibration → Initial calibration → Ash calibration → Sample pulp point → (Arrow right)



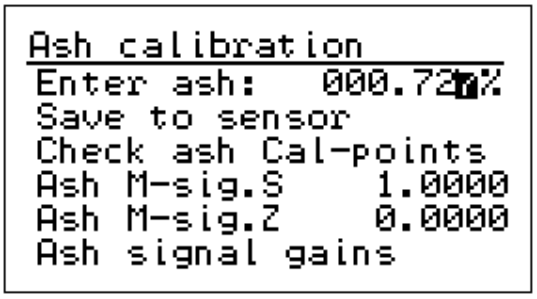
2. There is a warning preventing calibration by mistake (Press escape if you don't want to make initial calibration). Press Enter and take sample for laboratory analysis



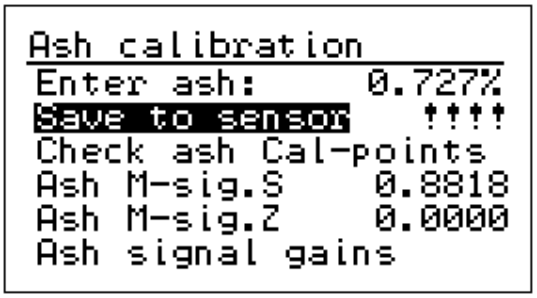
3. Pulp-point N values are shown, store those by pressing Enter



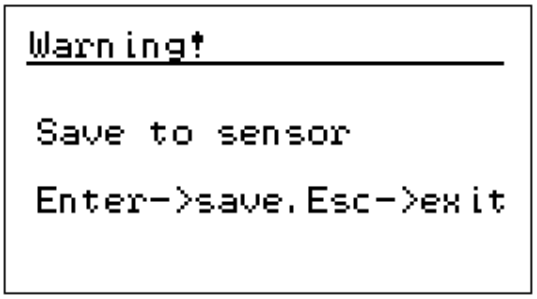
4. Enter the consistency result from laboratory to Calibration → Initial calibration → Cs calibration → Enter ash (in example 0,824 is changed to 0,727 %)

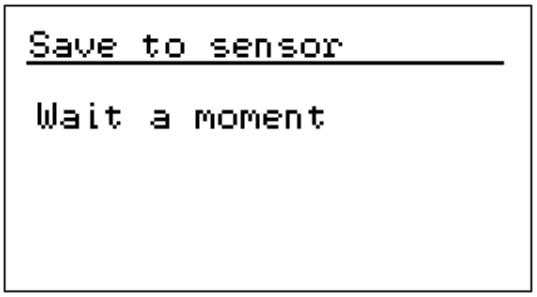


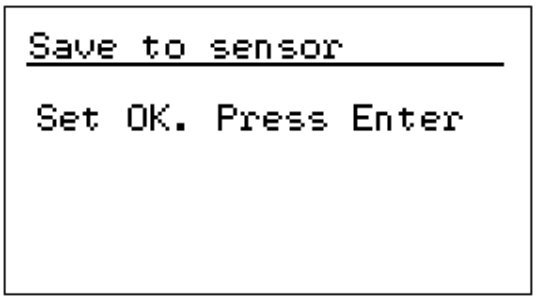
5. New values will be calculated to Ash M-sig. S: and Ash M-sig Z:
   Save these values to sensor from “Save to sensor !!!”



There is a warning preventing calibration by mistake (Press escape if you don’t want to save values to sensor). Press Right arrow-button to save the values.







6.5.6 Multi point calibration of KC9-A

Multi point calibration is required to get optimal accuracy of measurements. The amount of the samples depends on the grade structure and furnish of the machine. Minimum 20 points covering the full range of produced grades is required. The results are correlated to the laboratory results and the calibration formula to calculate N is defined.

NOTE

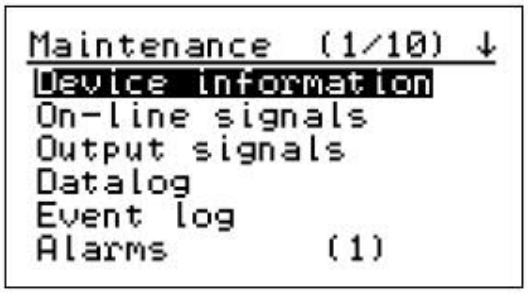
A difference of at least 25 % between consistency minimum and maximum values is needed to accurate calibration.

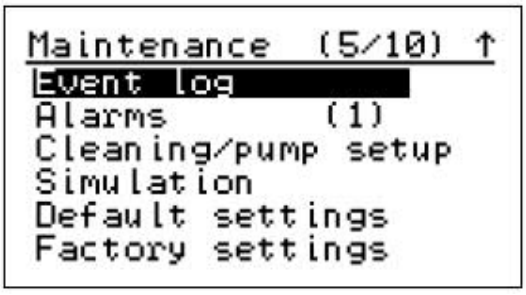
$$\frac{(Csmax - Csmin)}{Csmax} x100 > 25\%$$

Collect samples and remember to press SAMPLE-button. Enter laboratory values for collected samples. Read sample data and send to ABB KPM Kajaani for calibration coefficient calculation.

6.6 Maintenance

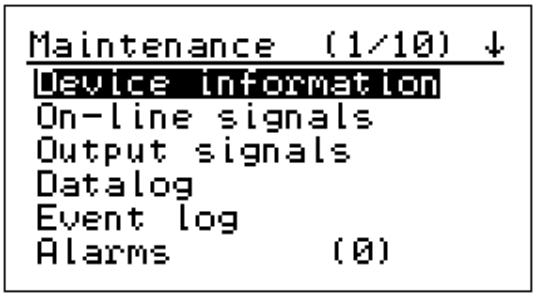
From maintenance menu device information and operation can be checked. There is also possibility to to check diagnostic data, set cleaning and sample pump settings and perform simulation for relays. Default and factory settings are usually not needed by customer.

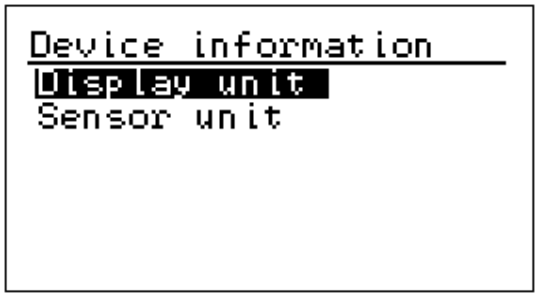


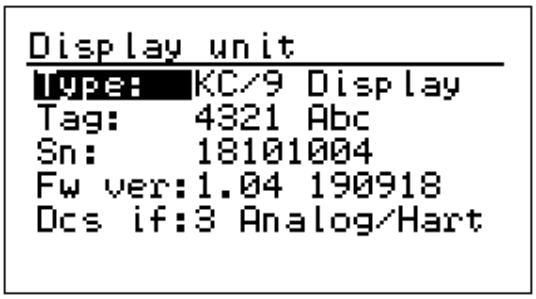


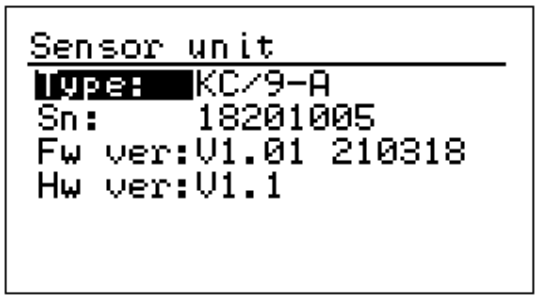
6.6.1 Device info

From Device information display and sensor unit type, software version and serial number can be checked.





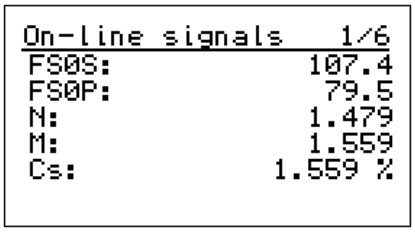




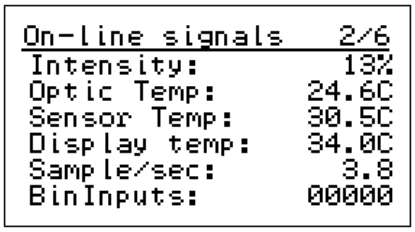
6.6.2 On-line signals

On-line signals displays show measured signal levels and other related information, which may be needed for troubleshooting purposes. Displays are from KC9-A model amount of signals depends on the sensor model.

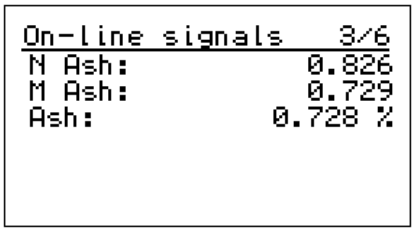
FS0S: Raw attenuation measurement value.
FS0P: Raw polarized measurement value.
N: Raw consistency measurement.
M: Calibrated consistency measurement.
Cs: Consistency measurement after customer calibrations (Cs = S * M + Z).



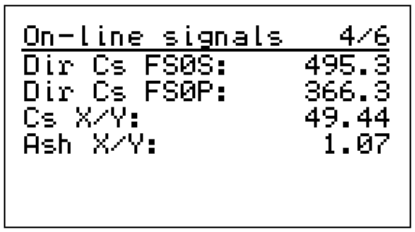
Intensity: Control of the light intensity.
Optic Temp: Optics temperature.
Sensor Temp: Sensor board temperature.
Display Temp: Display temperature.
Sample/sec: Measured samples in one second.
Bin. Inputs: Status of the binary inputs.
First digit is grade selection 1, second is grade selection 2, third is process stop (1=active in picture), fourth is sample input, fifth one is pump control



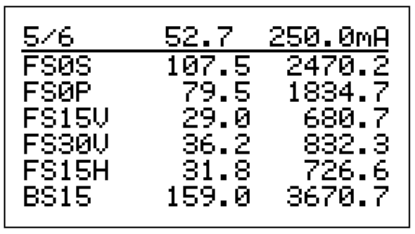
Ash N: Raw ash consistency measurement.
Ash M: Calibrated ash consistency measurement
Ash: Calculated ash measurement after customer calibrations (Ash = S * M + Z).



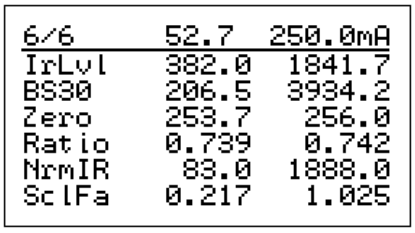
Dir Cs FS0S/FS0P: Preliminary measurement before any compensation
Cs X/Y: Result of calculation
Ash X/Y: Result of calculation



FS0S: Raw attenuation measurement value
FS0P: Raw polarized measurement value
FS15V-30V-15H: Forward scattering signals raw measurement value
BS15/BS30: Backward scattering signals raw measurement value
All with 2 different LED current

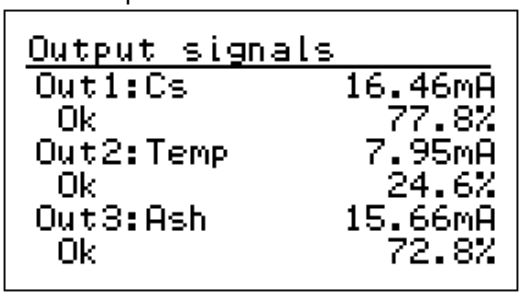


IrLvl: Light intensity
Zero: Electronics base
Ratio: Basic raw measurement
NrmIR: Normalization of IR
Scal.Fa: Scaling factor for signals



6.6.3 Output signals

The display shows existing analog Output signals in milliamps and percentage of the scaled output.

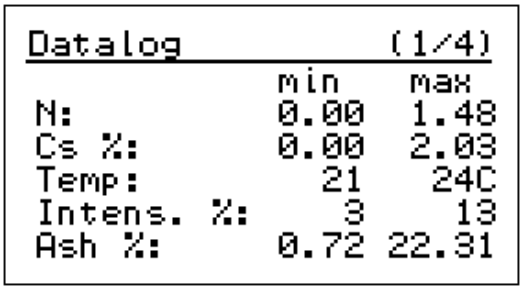


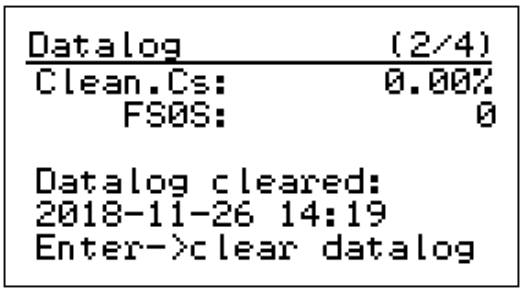
6.6.4 Data log

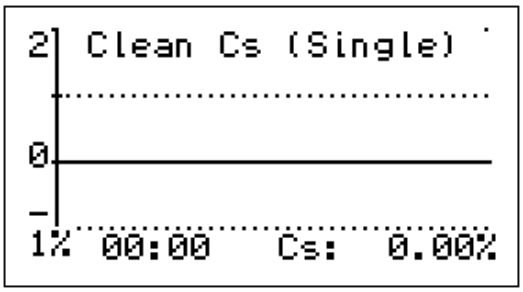
Datalog collects minimum and maximum values since clearance time.
Cleaning displays are shown whenever cleaning sequence has been configured.
First graphics shows last measured water value and second display 24 hour trend.

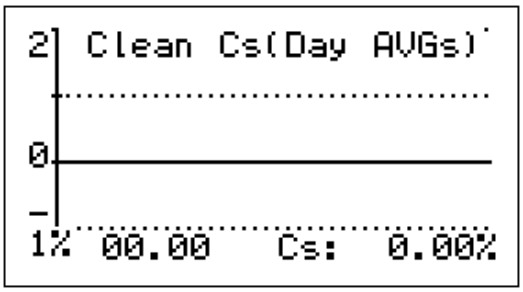
Remember to clear these counters during the start-up.

Clearing is done in page 2 by pressing ENTER



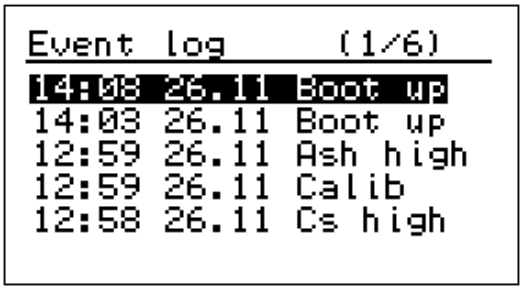


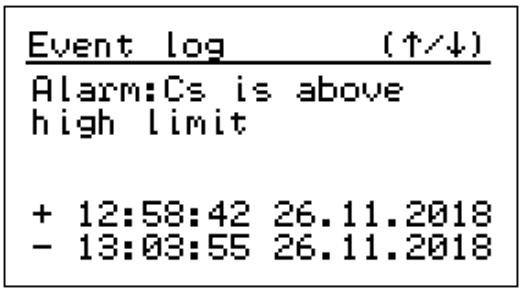




6.6.5 Event log

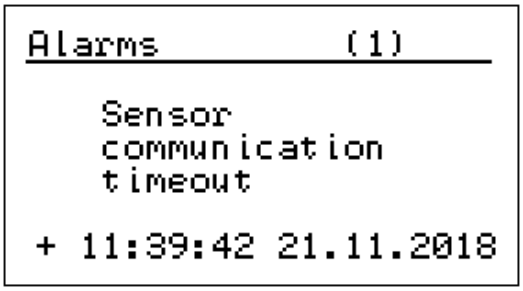
Event log collects all configuration changes, errors, boot-ups etc. 250 last events stay in memory. By selecting an event and pressing ENTER you will find more info about the event. Plus indicates time when event has occurred and minus when it has been removed.

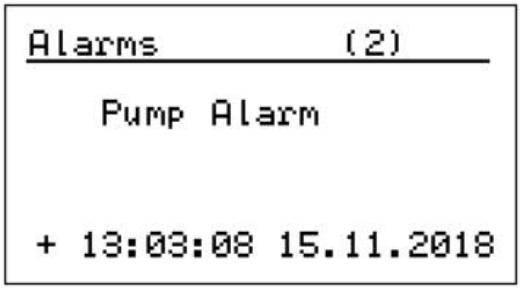


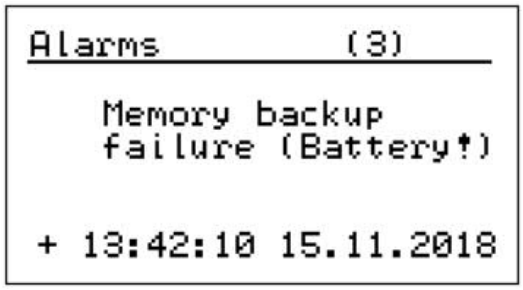


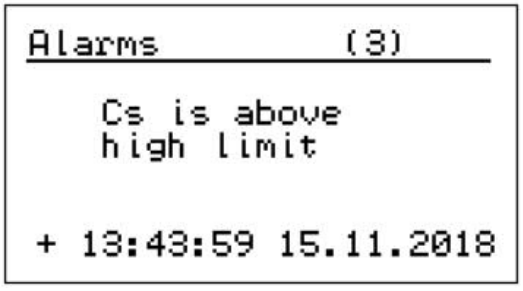
6.6.6 Alarm

Alarm display shows active alarms at the moment. If there are no active alarms in memory, the display will not open. If more than one alarm is active at the same time, then the number of alarms is shown in brackets in the caption line.



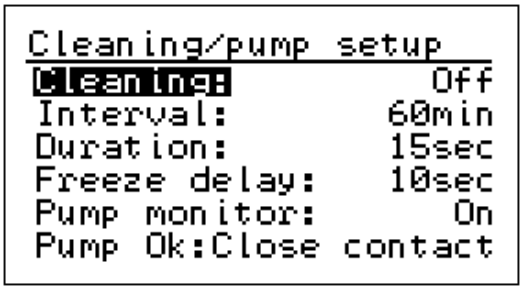






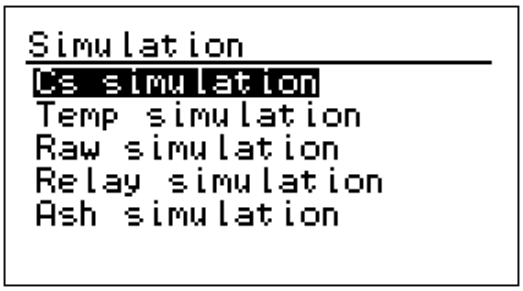
6.6.7 Cleaning cycle / pump setup

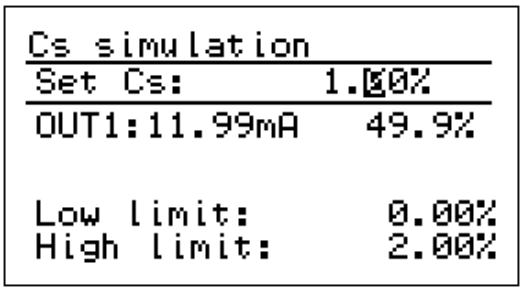
Cleaning: Setting cleaning On/Off.
Interval: Time between cleanings.
Duration: Cleaning time, seconds.
Freeze delay: Analog output continues to be frozen after the cleaning period has stopped. Time required for fresh pulp to enter to sensor.
Pump monitor: Pump alarm can be activated. Used for white water sensor with pump. Alarm will effect also consistency output when configured on.
Pump Ok: Pump monitoring can be open or closed contact.

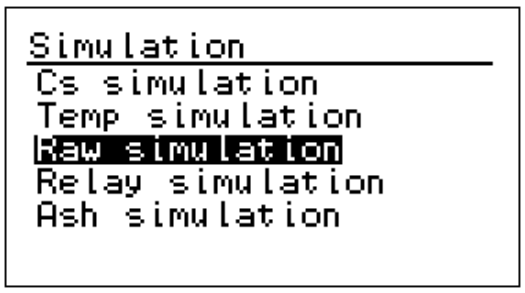


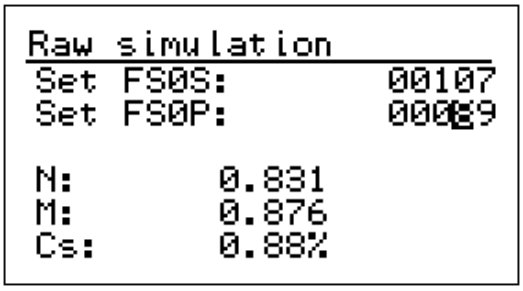
6.6.8 Simulation

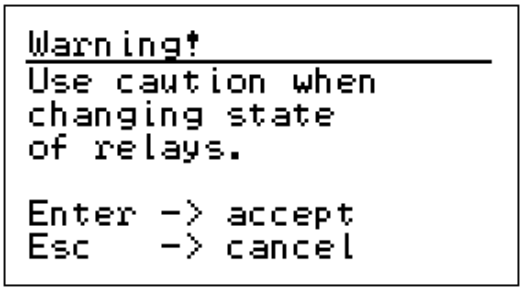
Cs and Temp simulation simulate analog output signal for Consistency and Temperature. Raw simulation simulates calculation. Ash signal simulates Analog output 3.

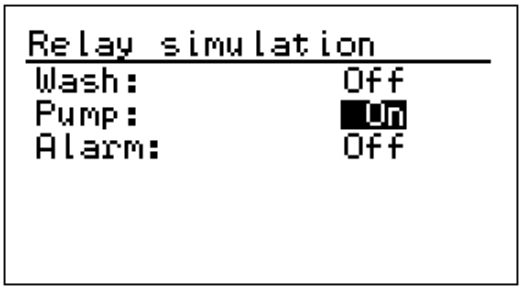








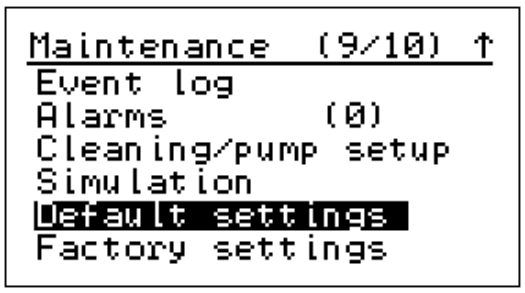


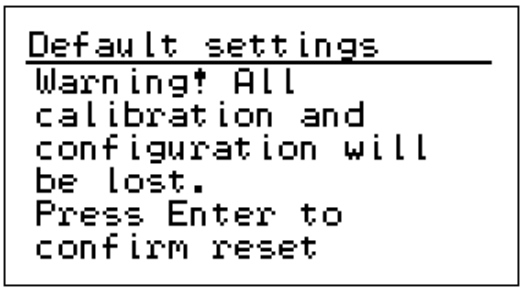


6.6.9 Default settings

Default settings will reset the parameters to default settings of the unit. Normally user does not need to take default settings.

> NOTE
> Default settings are normally only taken during manufacturing or software update.

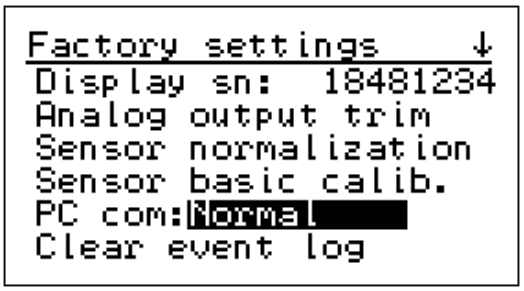


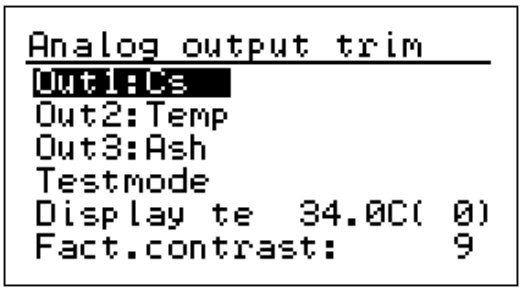


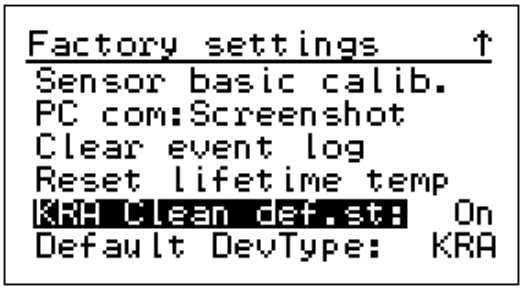
6.6.10 Factory settings

The basic configuration of the unit is set in factory settings. Normal user does not need to enter this menu.

> NOTE
> Factory settings are normally only adjusted in manufacturing or software update.







Appendix 1: Technical Specifications

Technical specifications – KPM KC9 Optical Consistency Measurements	
Sensor type	KPM KC9 Optical consistency transmitter
Applications	KPM KC9-25, KC9-25 LC, KC9-50, KC9-IL and -IL V for clean pulps. KPM KC9-25 K for white and green liquor. KPM KC9-P for total consistency of mixed stock with fines and fillers. KPM KC9-A for total and ash consistency of mixed stock with fines and fillers.
Output signals	3 × 4–20 mA, Active, Consistency, Ash Consistency (KPM KC9-A) and Temperature
Binary inputs	4 x Closing dry contact, Process stop, Grade change (2), Sampler input
Binary output	2 x Closing relays, 230 VAC, 110 VAC or 24 VDC for flushing control. 1 x Dry contact opening/closing relay for system alarm.
Power requirements	90–264 VAC, 50/60Hz ± 3; 20VA (20W), connected to display unit.

Sensor type	KC9-25	KC9-25 LC	KC9-25 K	KC9-50	KC9-P	KC9-A	KC9-IL & -ILV
Measurement range	Cs 0–2%	Cs 0–0,02%	Cs 0–5%	Cs 0–5%	Cs 0–2%	Cs 0–2% Ash 0–1%	Cs 0–14%
Process temperature	90 °C	60 °C	100 °C	90 °C	60 °C	60 °C	90 °C
Minimum flow velocity	20 l/min	20 l/min	20 l/min	60 l/min	10 l/min	10 l/min	Cs<1% 1m/s Cs>1% 1.5m/s
Pressure class	PN25	PN25	PN25	PN25	PN25	PN25	PN25
Process connection	Bypass 25 mm	Bypass 25 mm	Bypass 25 mm	Bypass 50 mm	Bypass 25 mm	Bypass 25 mm	NS40 saddle

Instrument air	If flushing valve is used, pressure 4 – 8 bar (60 – 120 psi), oil-free	
Process pressure	Minimum 1 bar, turbulent flow	
Ambient temperature	Sensor, 0 - 60°C (32 - 140°F); Display Unit = - 10 - 60°C (-14...140°F)	
Interconnect cable	10 m cable from sensor to display unit, max 5 in series	
Materials	Wetted parts AISI 316, Windows: Sapphire, Display: Polycarbonate	
Conformance	73/23/EEC, 89/336/EEC, EN 61000-6-4:2001, EN 61000-6-2:2001, EN 61010-1:2001	
Enclosure class	IP 65 (Nema 4x)	
Dimensions (LxHxD) & Weight	KC9-2x 128 x 101 x 97 mm (5,0 x 4,0 x 3,8")	Weight: 2,6 kg (5,7 lbs.)
	KC9-50 203 x 101 x 97 mm (8,0 x 4,0 x 3,8")	Weight: 2,6 kg (5,7 lbs.)
	KC9-P&-A 128 x 101 x 97 mm (5,0 x 4,0 x 3,8")	Weight: 2,6 kg (5,7 lbs.)
	KC9-IL 149 x 79 x 79 mm (5,9 x 3,1 x 3,1")	Weight: 1,0 kg (2,2 lbs.)
	KC9-IL V 283 x 79 x 79 mm (11,1 x 3,1 x 3,1")	Weight: 1,0 kg (2,2 lbs.)
	IL V Valve & Jack 362 x 284 x 110 mm (14,2 x 11,2 x 4,3")	Weight: 5,8 kg (12,8 lbs.)
	Display 355 x 268 x 95 mm (14,0 x 11,2 x 3,7")	Weight: 2,7 kg (6,0 lbs.)

Appendix 2: Spare parts

KC9 - Spare part	
Order code	**Description**
4LA41150213V1.0	KC9-25 Flow-through sensor 0-2% Cs
4LA41150450V1.0	KC9-25 Low Consistency flow-through sensor 0-200 mg Cs
4LA41150445V1.0	KC9-25 K, Flow-through Kalrez sensor for white liquor dreg content measurement
4LA41150218V1.0	KC9-50, 2" Flow-through sensor 0-5 % Cs
4LA41150272V1.0	KC9-IL - In-line Consistency sensor PN25 0-14 % Cs
4LA41150400V1.0	KC9 ILV, In-line Consistency sensor PN25 0-14 %Cs
4LA41100162V1.0	Graphical Display KB/KC7/OC/KC9 L
4LA41150084V1.2	Connection Board OC/KC9 L
4LA41140086V2.0	Analog Board OC/KC9 L
4LA41140033V1.2	Display Plate Assembly (including A41100027 and 4LA41100162)
4LA41150226V1.1	Sample valve with 3/4" FEP tube fitting
4LA41150255V1.0	Retraction valve assembly
4LA41150284V1.0	Jack assembly
4LH41010017V1.0	Mounting Flange AISI316, NS 40
4LH41010018V1.0	Blind Flange AISI316, NS 40
4L2600002	Clamps NS40 SS304 (complete with AISI316 bolts and nuts)
4LH41010016V1.0	Teflon gasket for NS40 flange (KS2, KS4, KC9-IL & IL V)
4L2500004	Tube FEP3/4" 1m
4LA41150406V1.0	Backward flushing assembly (without solenoid valve)
4LA41150416V1.0	Forward flushing assembly (without solenoid valve)
4L2400008	3-way valve, flushing
4L2150009	Actuator, backflushing valve
4LA41150420V1.0	Solenoid valve assemby with R1/4"-6mm fitting
4L2200013	Solenoid valve 4/2 24 VDC 6/4 mm inlet & outlets
4L2200014	Flow Control Valve SMC R1/8-6/4mm
4LH41150407V1.0	Connector gasket KC9 16
4LH41150439V1.0	Connector gasket KC9 25
4LH41150448V1.0	Connector gasket KC9 50
4L2450025	Connector R1/2-OD3/4"
4L2450024	Connector R3/4-OD3/4"
4LH41150263V1.1	Cover Gasket KC9 - A
4LH41150264V1.1	Cover Gasket KC9 - 25
4LH41150262V1.2	Cover Gasket KC9 - IL
4L10203178A	Brush Cleaning device, KC9-25
4LH41150441V1.0	Butt weld end DN25 (Welding Nipple KC9-25 inlet 25 mm & outlet 16 mm)
4LH41150438V1.0	Butt weld end DN25 (Welding Nipple KC9-25 inlet & outlet 25 mm)
4LH41150446V1.0	Butt weld end DN50 (Welding Nipple KC9-50)
4LH41150424V1.0	Mounting Nut M38 x 1,5 (for KC9 DN25 welding connectors)
4LH41150447V1.0	Mounting Nut (for KC9 DN50 welding connectors)
4LA41150186V1.0	1" NPT (external thread) fitting and M38 x 1,5 nut
4LA41150187V1.0	2" NPT (external thread) fitting and M x 1,5 nut
4L2900009	Sensor Display interconnect cable 10m, 33 ft.
4L10603261	Cleaning Brush 25 mm
4L21750200	Pressure cylinder cleaning device

Waste Electronics and Electrical Equipment (WEEE)

This product is labelled with this symbol in accordance with European Directive 2012/19/EU, to indicate that it must not be disposed with your other household waste. Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

In the European Union
Please contact your local ABB representative who will inform you about the take-back of the product. Small products (and small amounts) might be taken back by your local collection facilities.

In countries outside the European Union
Please contact your local authorities and ask for the correct method of disposal.

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