KPM

INSTRUCTION MANUAL

KC/7

Microwave Consistency Transmitter

This manual is applicable for KC7 firmware
FW Ver 1.00 or higher

1   Table of contents

2 Contact information

Kajaani Process Measurements Ltd.
Kettukalliontie 9 E,   FI – 87100 Kajaani, Finland
Tel: +358 10 548 7600, Fax: +358 8 612 0683
E-mail: kpm@prokajaani.com   Please find your local supplier on internet address
www.prokajaani.com

3 Description

3.1 System components

KC/7 in-line consistency transmitter exist in two types: One is flow through type of sensor which is installed between flanges (wafer type) and other is insertion type. Flow through type comes with different pipe dimensions from DN 50 to DN 300. Insertion type can be installed through DN 70 mm flange in larger pipe dimensions than DN250.

Display unit comes with 10 meter interconnect cable. It needs power 86 – 264 VAC and it supplies analog outputs and alarms to user.

There are different models available depending on pipe size.
• Flow-through sensors comes with differ pipe sizes FT 50, FT80, FT 100, FT 150, FT 200 , FT 250, FT 300
• Insertion type of sensor is also available for higher pipe sizes

System covers display unit, sensor and interconnect cable.

Figure 3.1. KC/7 system components

3.2 Measurement principle

KC/7 in-line consistency transmitter function bases on the measurement of microwave delay in pulp slurry.

Transmitter has 2 antennas between which microwave signal moves. Antennas are positioned on another side of transmitter (Flow through sensor) or with a distance (insertion type).

Microwaves are electromagnetic radiation; the travelling time between antennas depends on the media's dielectric constant. Travelling time is proportional to media consistency. In water microwaves moves at a much slower speed that in wood fiber.
Therefore, consistency can be calculated based on the time it takes the microwaves to travel through the measured pulp.
Pulp type has no effect on calibration. Measurement is very fast so that pulp velocity has no effect.

It is essential that there is no free air in the pulp so requested pressure is over 1.5 bar which keeps air dissolved in pulp.
Microwave speed in air is much faster (light speed) than in water and in case air bubbles are present this will have disturbing effect on pulp consistency measurement.

Pulp conductivity has effect on microwave signal level and distance travelled. For this reason each sensor type has own maximum conductivity level below which it can work.

KC/7 measures time it takes for a microwave signal to travel between two antennas. Measured time is called true delay. The delay is directly proportional to the consistency.

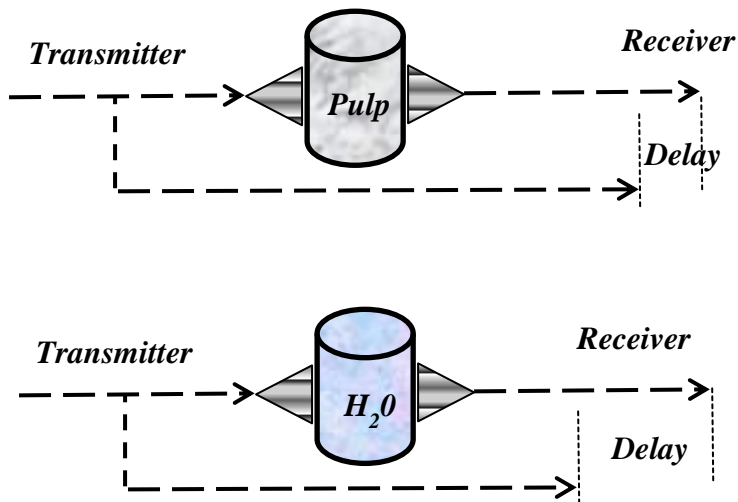*Temperature has an effect on microwave speed and true delay and it is compensated inside the unit.*

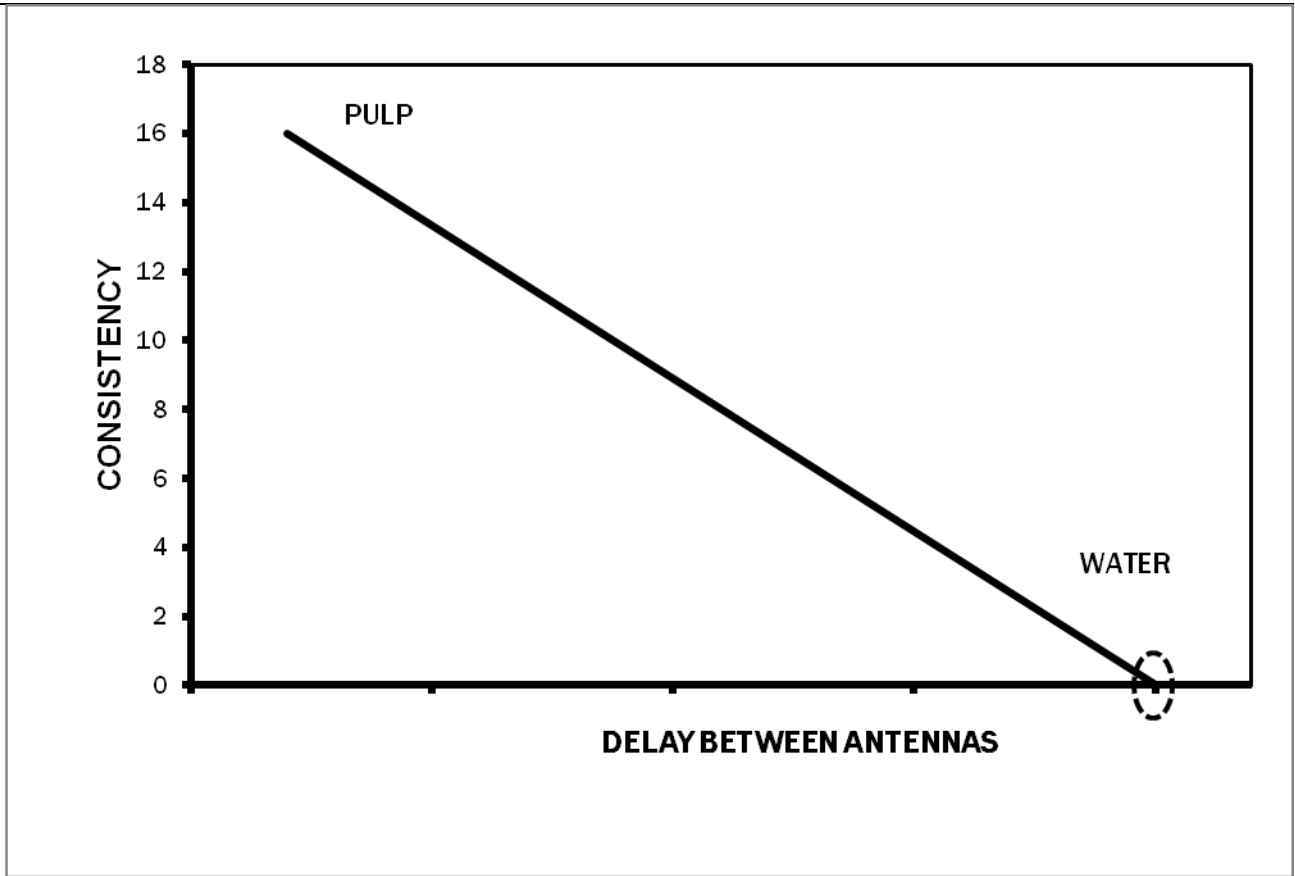

Figure 3.2. Operating principle.

Figure 3.3 Linear response.

4 Installation instructions

4.1 Delivery limits

Manufacturer supplied components:
- *KC/7 sensor unit, 1 ea*
- *Display unit, 1 ea*
- *Interconnect cable, 1 ea*

4.2 Display unit installation

Install the display unit to the wall for easy access. Standard interconnect cable length is 10 meter to the sensor, but longer cables are available. Cable has quick connector at sensor end and display unit end has strip connectors.
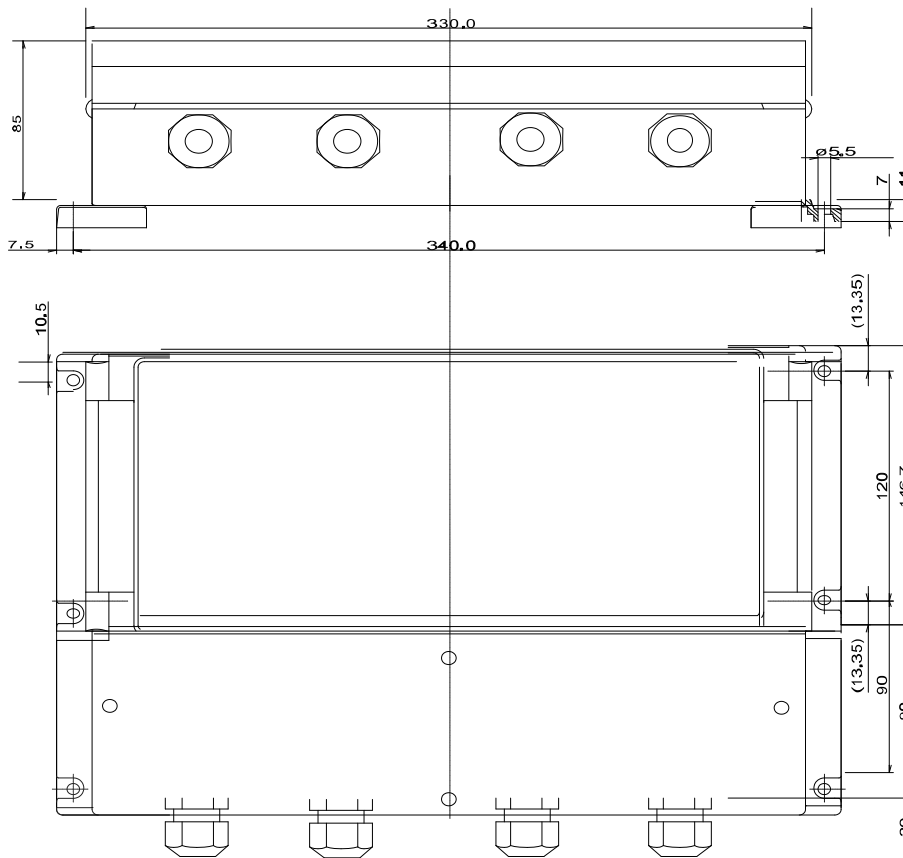

Figure 4.1. Display unit dimensions

4.3 Sensor installation

The KC/7 Flow through senor is installed so called sandwich installation (wafer type) between flanges.
Flanges are not supplied with the sensor, because they are normally mill standards and depends on pipe size and pressure class.

Figure 4.2. Sandwich installation

Sensor can be installed in vertical pipeline, horizontal pipeline or inclined pipeline.
In vertical pipeline installation it is important to locate antennas so that main pulp flow is positioned between antennas.

In horizontal pipelines locate antennas horizontally and electronics on the top of pipeline.
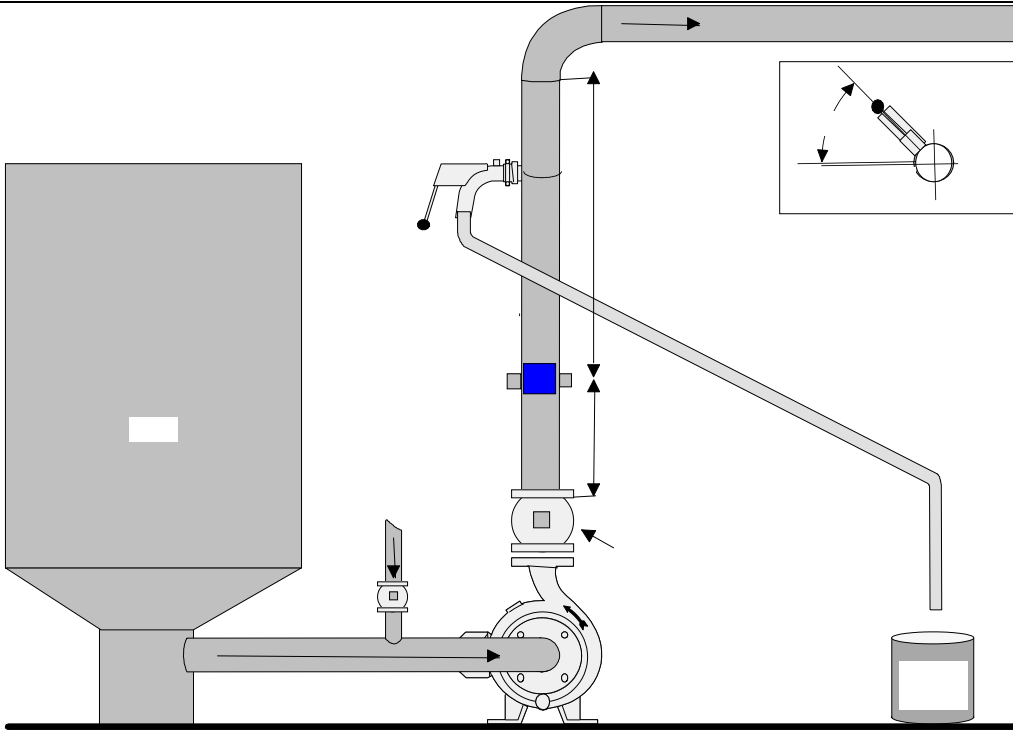This will ensure that antenna is on side of pipeline and not on the top where is possibility to have air pocket.
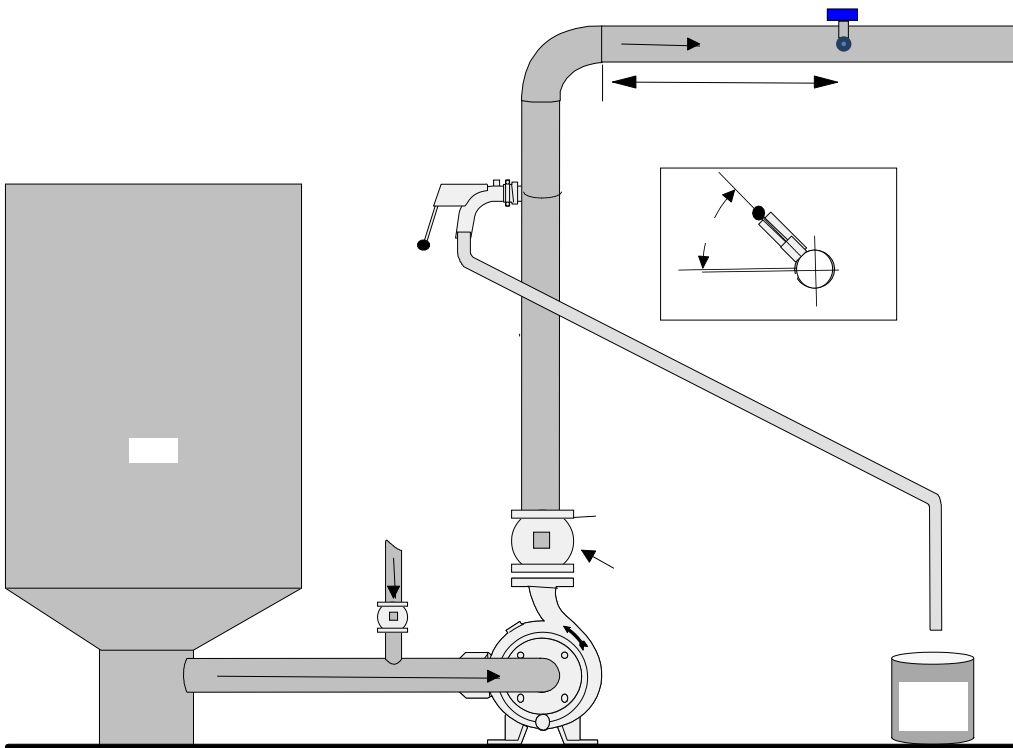
Figure 4.3.a. Vertical pipeline installation.

Figure 4.3.b. Horizontal pipeline installation.

5 Wiring

5.1 KC/7 wiring

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 figure 5.1.

Output mA   Sensor   Power
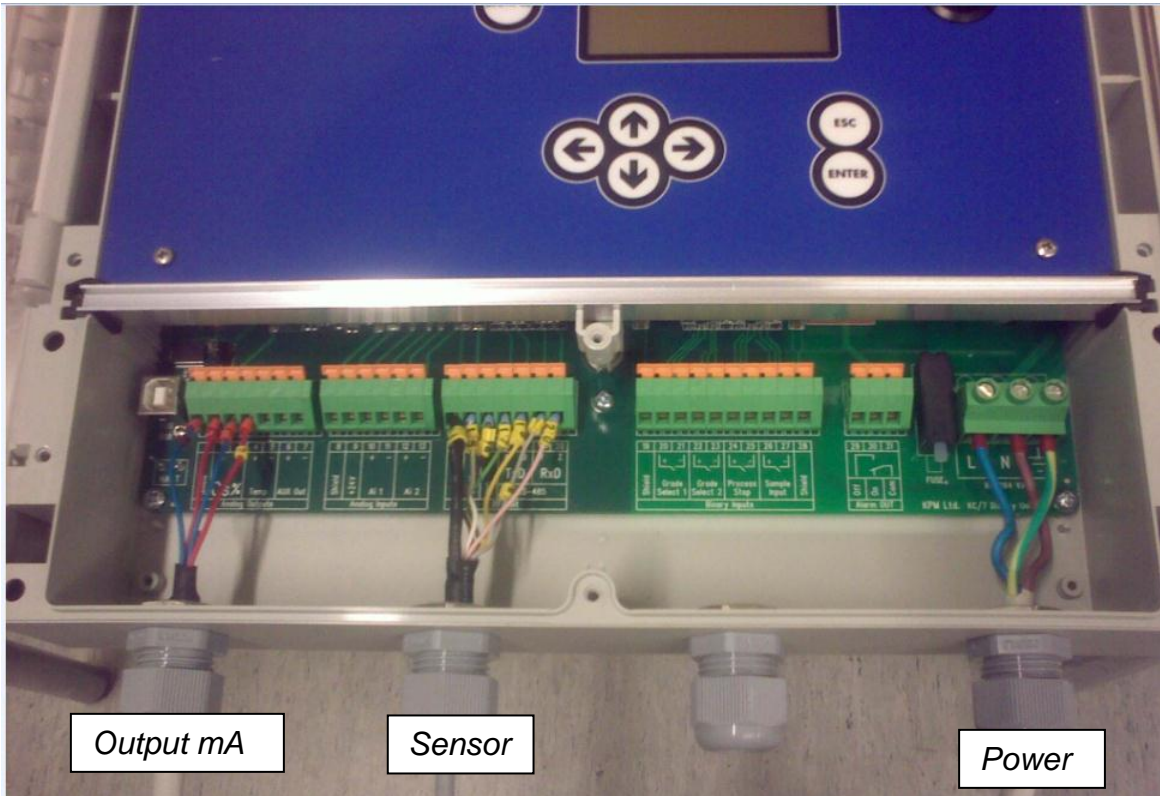
Figure 5.1. Display Unit terminal strip

5.2 Electric connections

Display unit is connected to sensor unit with 10 meter interconnect cable. Cable will be connected to strip terminals from Display unit end and quick connector from sensor end. Locate display unit to easy access.
Connect power (86 – 264 VAC) to terminal strip on the right hand side in display unit.
Sensor cable (Interconnect cable) connection to terminals 14 - 20.

Current output terminals are 1 and 2 for Consistency. Terminals 3 and 4 are reserved for Temperature.

Alarm relay OFF is normally closed. It 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 opposite.

Figure 5.2. Electrical connections

6 Display unit operation and configuration
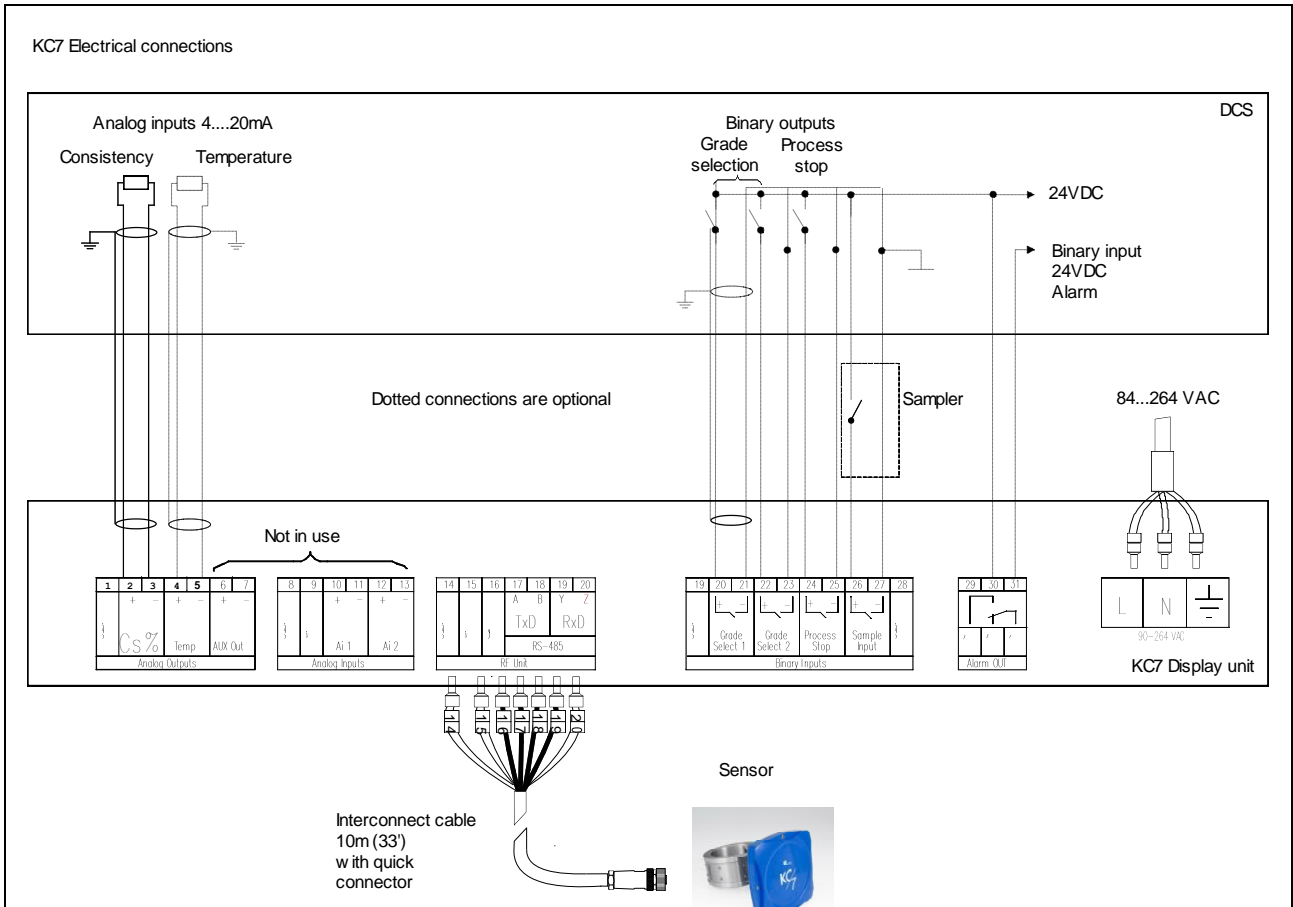
6.1 Display and operating keyboard
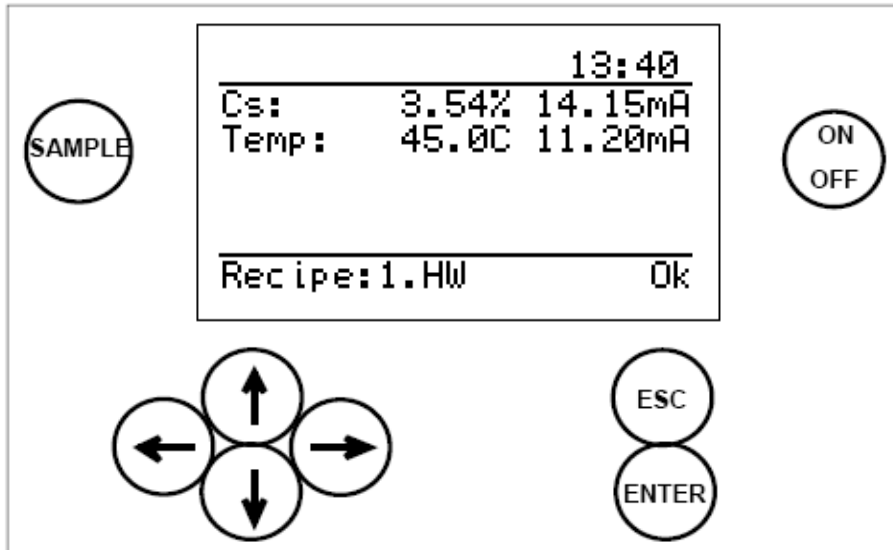
Figure 6.1. Display and keyboard.

The display contains 7 lines, with 21 characters in a line. The main display (fig 6.1) shows:
– Tag number and time.
– Consistency signal level as percentage and output in milliamperes
– Temperature as degrees (C / F) and output in milliamperes
– Recipe and status.

Common properties in other menus:
– Selected line is highlighted
– Upper right corner shows:
   * Number of lines/pages in that menu.
   * Arrow shows, if hidden lines.
– Help menus in bottom.

Keyboard
– ON/OFF button: Switch the mains on/off.
– Arrows: Scroll the menus and rows or adjust values.
– Esc: Delete changes and/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 nothing is pressed then sensor stores sample automatically after 3 minutes.

6.2 Main menu

```
                        13:40
Cs:       3.54%  14.15mA
Temp:     45.0C  11.20mA



Recipe:1.HW             Ok
```
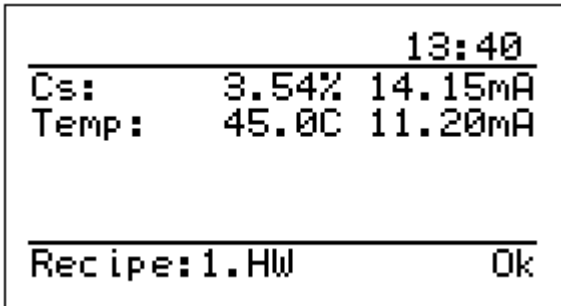
Arrow right or left brings trend data of Consistency. There are three levels in time (2 min, 1 hour and 24 hour).
From trend data arrow down brings Temperature trend.

```
5│
 │
 │
1%   2min        Cs:  3.53%
```

```
8│
 │
 │
2%   1h          Cs:  7.38%
```

```
8│
 │
 │
2%   24h         Cs:  7.45%
```
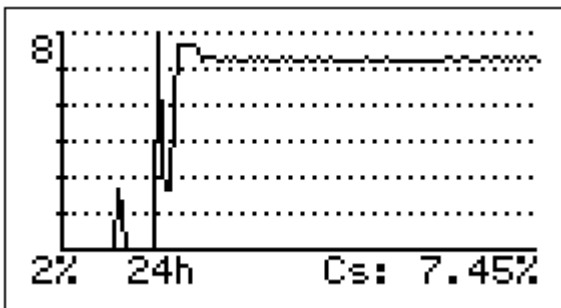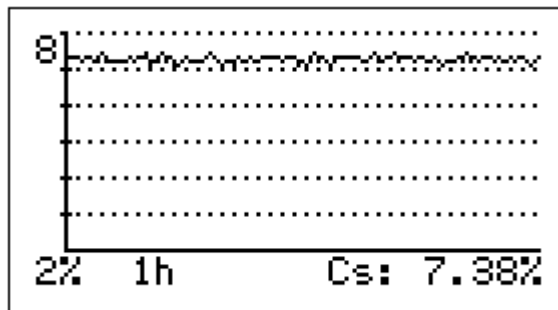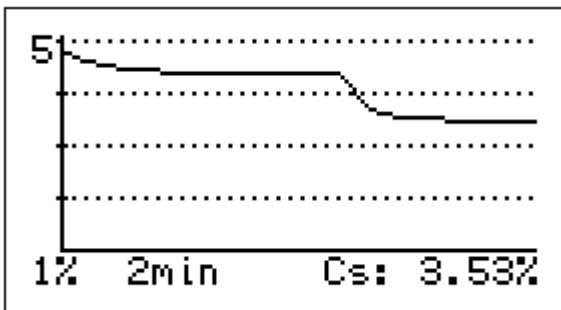
Arrow up or down bring another menus.

```
Main menu
Calibration
Set-up
Maintenace
Parameters
```

6.3 Set-up

Set-up menu is for configuration of the unit.


```
Set-up        (1/11) ↓
Recipe:        1.HW
Control mode:Local
Edit recipes
Analog outputs
Analog inputs
Time:         13:49
```



```
Set-up        (11/11)↑
Time:         13:50
Date:         2011-10-31
Language:     English
Temp unit:    Celsius
Password:     000
Contrast:     15
```

Recipe name can be edited and there are 4 different recipes available.
Control mode is normally local. Recipe stays as selected manually. In case external switch (binary input for KC/7) for recipe change is available then Remote mode can be used.
Recipe composition (Edit recipe) can be determined when different filler types are used.


```
Edit recipes
Recipe:        1.HW
Filler amount:  0.0%
Kaolin:  0%
CaCO3:   0%
Talc:    0% TIO2:   0%
Filler S:1.000 In use
```

Analog output scaling and filtering can be done here. Also error mode for Analog Output signal can be configured. Process stop signal level can be determined and Hart address as well.

```
 Set-up        Outputs
 Scale out1 (Cs)
 Scale out2 (Temp)
 Scale out3 (No use)
 Error mode:  No eff
 Proc.stop:   4.0mA
 Hart addr:     0
```

```
 Scale out1 (Cs)
 Low limit:    1.00%
 High limit:   5.00%
 Filter:       3s
```

Analog input are normally not used
Date and time are set for sampling purposed and for data logging
Languages available at a moment are English and Finnish
Temperature unit can be changed Celsius/ Fahrenheit
Password 000 means no password needed
Contrast will change display intensity

6.4 Maintenance

```
 Maintenace   (1/10) ↓
 Device information
 On-line signals
 Output signals
 Datalog
 Event log
 Alarms          (1)
```

```
 Maintenace   (10/10)↑
 Event log
 Alarms          (1)
 Sensor settings
 Simulation
 Default settings
 Factory settings
```

Device information is to display existing sensor type, software version and serial number.

```
 Device information
 Display unit
 Sensor unit
```

```
 Display unit
 Type:   KC/7
 Tag:    QIC 123
 Sn:     11461002
 Fw ver:0.19 311011
 Dcs if:3 Analog/Hart
```

```
Sensor unit
Type:   FT150
Sn:     8765453
Fw ver:v7.44
Hw ver:v2
```

On-line signal will display measured signal levels, which may be needed for troubleshooting purposes.

```
On-line signals   1/3
Delay:        8735.0ps
N:               3.523
M:               3.523
CS:              3.52 %
Pulp temp:       45.0C
Rfu temp:        35.1C
```

```
On-line signals   2/3
Bin.inputs:       0000
Rf level:       -37.4dB
Rel.phase:      0.0000
Truephase:      0.0000
```

```
On-line signals   3/3
Ref.level:        0.0dB
Ref.phase:      0.0000
Ref.truep:      0.0000
Ref.delay:       0.00ps
```

Output signal will display existing Analog output as milliamperes and percentage.

```
Output signals
Out1:Cs       14.09mA
 Ok             63.0%
Out2:Temp     11.20mA
 Ok             45.0%
Out3:          3.75mA
 Ok             -1.5%
```

Datalog collects minimum and maximum values since clearance time. Please, remember to clear these counters during start-up time.

```
Datalog         (1/2)          Datalog         (2/2)
          min    max           Datalog cleared:
Delay:    8618  8963ps         2011-10-31 14:27
Cs:       0.02   6.78%
Pulp temp:  20    45C
Rfw temp:   13    36C
RF level:  -37   -37           Enter->clear datalog
```

Event log collects all configuration changes and boot-ups etc. In memory stays 250 last modifications.

```
Event log       (1/50)

13:36 31.10 Cs high
13:36 31.10 Cs high
13:33 31.10 Cs low
13:33 31.10 RF low
13:33 31.10 Boot up
```

Alarm menu will display active alarms at that moment. In case there are no alarms then nothing is displayed. In case more than one alarm is active at same time then there is number of alarms in brackets.

```
Alarms          (1)

      RF level too
    low


+ 13:33:36 31.10.2011
```

Sensor settings will display Auto Level Control ON or OFF. Normally it is OFF.

```
Sensor settings
Auto level ctl: Off
```

Simulation simulates Analog output signal for Consistency and Temperature.

Raw simulation simulates calculation.

```
Simulation
Cs simulation
Temp simulation
Raw simulation
```

```
Cs simulation
Set Cs:      4.00%
OUT1:14.09mA    63.0%


Low limit:     1.00%
High limit:    5.00%
```

```
Raw simulation
Set delay:        08780
Set temperature: 40C
A -35.015 B  8892.440
N:        3.211
M:        3.211
Cs:       3.21
```

Default setting will reset default setting of the unit.

6.5 Factory settings

Factory setting is for basic configuration of the unit. Customer do not need to enter this menu.

```
Factory settings

    Enter password

        000
```

```
Factory settings    ↓
Display sn: 11461002
Analog output trim
Analog input trim
Sampling time:    30s
RFU/PC com:Screenshot
Basic constants
```

```
Factory settings    ↑
Analog input trim
Sampling time:    30s
RFU/PC com:Screenshot
Basic constants
Clear event log
Reset lifetime temp
```

```
Basic constants       ↓      FT150 constants
Delay filter: 10s            A gain:          0.2804
FT50 constants               A offset:      -46.2310
FT80 constants               B gain:         -7.8015
FT100 constants              B offset:     9204.5000
FT150 constants (Use)
FT200 constants


Warning!
Modifying values will
change the output

Enter-> edit anyway
Esc-> cancel
```

6.6 Parameters

Parameter menu is to list all existing parameters in same display. This menu also allows to change each parameter. Please note that before changing any parameter there should be reason to change it.

```
Parameters      2/3 ↕        Parameters      1/3 ↕
Filler:    0.0%              Cur.recipe:  1.Name A
Kaolin:    0%               S:           1.00
CaCO3:     0%               Z:           0.00
Talc:      0%               Low limit:   3.00%
TIO2:      0%               High limit:  1.00%
Filler S:  1.000           Outp.filter: 10s

Parameters      3/3 ↕
Hart ID:       0
```

7 Start-up

7.1 Sensor installation

1. Make sure that the sensor is installed correctly and pressure and conductivity requirement are filled.
   Pressure should be over 1.5 bar to avoid free air in pulp
2. Connect sensor cable, turn on the power.

7.2 Set-up

1. Select recipe. Normally only 1 recipe is needed. Remote control is also normally local. Remote means that recipe can be changed through binary input. Recipe is entered when filler is used.
2. Set Analog output scaling
3. Analog Inputs are not used.
4. Set date and time
5. Set Language
6. Set Temperature unit
7. Set password 000 means no password needed
8. Set display contrast

7.3 Calibration

The KC/7 is delivered with factory calibration, which means that it will measure consistency as soon as you switch the power on. Factory calibration is performed on the device in connection with final testing using clean water.
We recommend that you calibrate the device again when setting it up. This allows the device settings to be optimized for the conditions in which it will be used.

Perform calibration by taking a consistency sample and pressing sample button to store measured values.
When measured consistency differs from laboratory value please enter difference in OFFSET value in calibration parameter.

7.3.1

7.3.2 Single point calibration

Press sample button and take laboratory sample.
Compare laboratory result to sensor stored value and enter difference as offset value in calibration parameter.

7.3.3 Multi point calibration

Taking multiple samples by pressing Sample button sensor stores measured values in memory. Laboratory values should be entered respectively in KC/7 memory. When 3 or more samples are stored calculation can be performed.
Please note that there must be large variation in consistency readings (about 1.0 %) before slope calculation gives reliable value. Default value for slope is 1.0 and for offset 0.0.
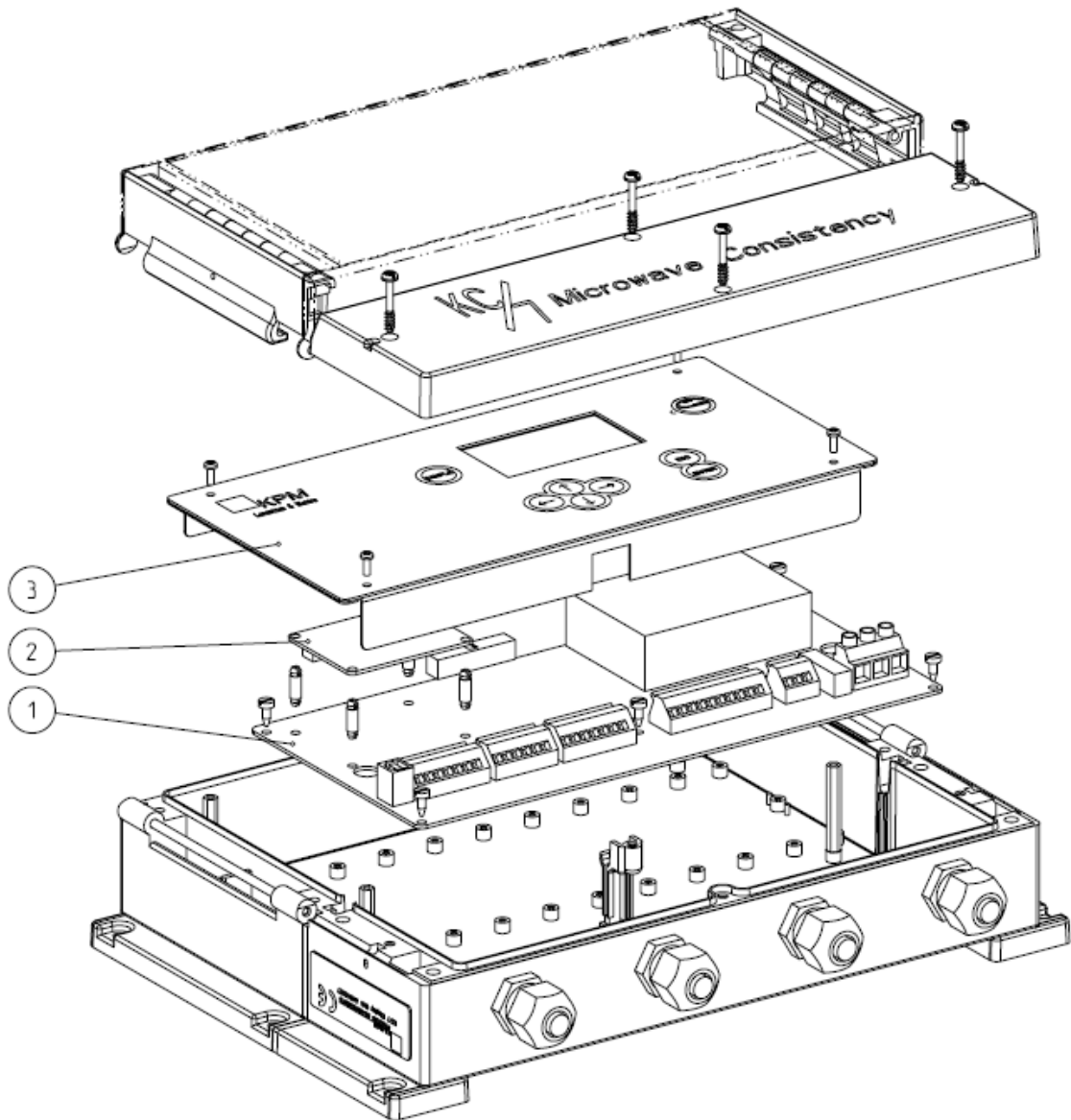
8 Maintenance

8.1 Regular maintenance

No regular maintenance needed or KC/7.

8.2 Alarms

9 Appendix 1: Spare parts

1. *A41140083 V1.1 KC/7 Measuring board*
2. *A41140086 V1.1 KC/7 Analog board*
3. *E31140033 V1.0 KC/7 display plate assembly*

10

4. 015329   Cover
5. 016404 R10   KC/7 RF unit assembly
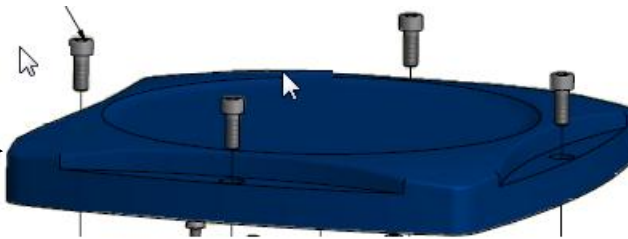*6. E4140052 v1.0 Sensor cable*
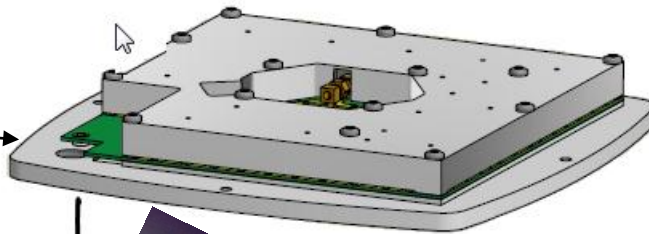*7. A4110051 V1.0 KC/7 Interconnect cable*

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25 Appendix 2: KC/7 Model selection table

TYPE						MICROWAVE CONSISTENCY TRANSMITTERS
						SPECIFICATION
1	2	3	4	5	6	
K	C	7				Microwave Consistency Transmitter SS PN16
						Standard
						KC7 Display unit
						Meter Size
			0	5		50 mm (2")
			0	8		80 mm (3")
			1	0		100 mm (4")
			1	5		150 mm (6")
			2	0		200 mm (8")
			2	5		250 mm (10")
			3	0		300 mm (12")
			0	0		Insertion PN25
						Cable length between detector (RF part) and Converter
					A	10 m (32.8 ft) (standard)
					C	30 m (98.4 ft)

26 Appendix 3: Technical specifications

SENSOR TYPE: *Microwave Consistency Transmitter*
OUTPUT SIGNAL: *2 x Analog outputs 4 - 20 mA + HART*
BINARY INPUTS: *24 VDC, Process Stop, Grade Change (2) and Sampler Input*
BINARY OUTPUT: *12 – 48 VDC max 10mA, Dry Contact*
ANALOG INPUT: *2 x external input, 4-20 mA, Isolated*
MEAS. RANGE: *0 - 16 % Cs*

REPEATABILITY: *0.01 % Cs*
RESOLUTION: *0.001 % Cs for sizes FT 80 – 300 mm (3” – 12”)*
0.002 % Cs for 50 mm (2”) size
INSTALLATION: *Wafer type between flanges or Sandvik DN70 mm*
LENGTH: *100 mm all FT models*
WEIGHTS kg: *FT50 9kg, FT80 10 kg, FT100 12 kg, FT150 15.5 kg, FT200 20kg*
FT250 25 kg, FT300 30 kg, Insertion type 12kg
Display 2.3kg

PROCESS TEMP: *0 - 100 °C (32 - 212 °F)*

PROCESS PRES.: *Recommendation >1,5 Bar (>22 psi), no air*

PROCESS pH: *2,5 – 11,5 pH*

CONDUCTIVITY	50mm	80mm	100mm	150mm	200mm	250mm	300mm	IT
LIMITS mS/cm:	25	13	13	10	9	9	7	13

AMBIENT TEMP: *Sensor 0-70°C (32-158°F), Display 0–60°C (32 - 140 °F)*

FLOW VELOCITY: *No effect, Insertion type max flow 5m/s (16.4 ft/s)*
MATERIALS: *Sensor: SS 316L; Window: Ceramic, Display: ABS*

APPROVALS: *EMC, CE, PED*
ENCLOSURE CLASS: *Sensor IP66 (Nema 4x), Display Unit IP65 (Nema 4)*

POWER SUPPLY: *86 to 264 VAC, 47 - 63Hz; 20VA*