KPM
A MEMBER OF THE ABB GROUP

KB^2
Sheet Break Detector

QUICK GUIDE

1. Quick start-up guide

This quick guide leads the way to install, start-up and configure necessary parameters in the normal cases.

1. PREPARING INSTALLATION

– Install fiber optic cable inside conduit. This is easier done when temperature is cool and conduit is straight on the floor.

NOTE: DO NOT PULL FIBER OPTIC CABLE STRONGLY. It may break or cut or connector may get loose.

– Connect conduit to sensor head tube.
– Install sensor head mounting rack or mounting clamps.

2. Sensor unit installation

– Check that dry clean purge air is connected (pressure between 0.5 - 3.0 bar / 7-40 psi).
– Check that the eyelet holes are aimed at the web.
– Check that the sensor distance from the web is 10 – 30 cm (4 - 12").
– Check that the measurement point distance to paper edge is about 30 cm (12").
– Fix position preliminary. Tuning may change this slightly.

3. Display unit installation

– Check that fiber optic conduit bushing is tight.
– Check that fiber optic cable is connected to the optics block:
  - Other optic cable to RX.
  - Another cable to RGB or IR.
– Check the wiring of the power supply.
– Check the wiring of break signal.
– Check the wiring of alarm signal.

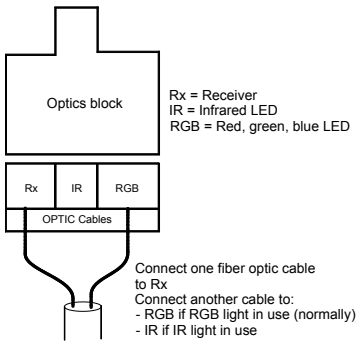

Fig. 1.1. Fiber optic cable connection.

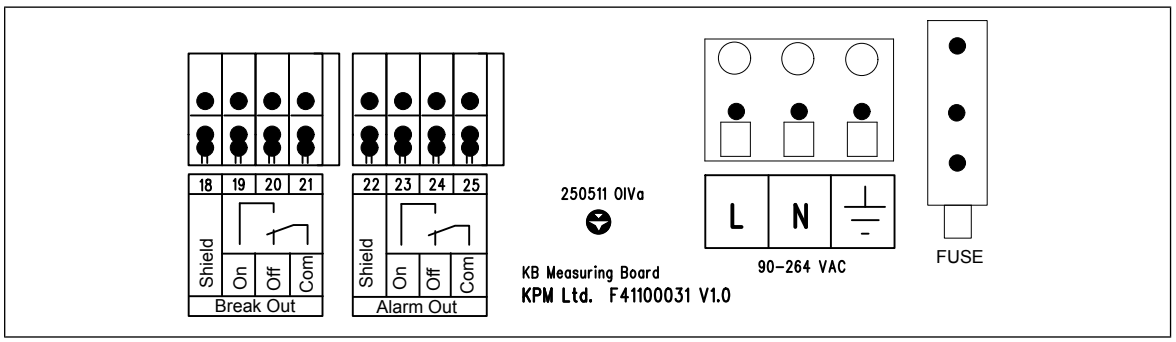

Fig. 1.2. Wiring diagram.

4. Start-up and tuning

Preliminary tuning can be done during installation at the actual place by simulating paper on situation with dry paper on front of sensor head. Final tuning should be always done with real paper running situation.

- Set unit to "Mode: Maintenance" in the "Configuration" menu.
- Turn on the power.
- Select from the "Maintenance" menu "On-line signals".
- Turn the sensor head light beam so that signal levels are on their maximum values (normally 100 – 700) when simulating paper in front of sensor. Paper sheet should be close its correct position. Signal level can be adjusted with "TX Power" and "RX gain" in the "Measurement config" menu. Ambient light should be < 60 %.
- Simulate break: Press "SAMPLE". Store signals as "Break level".
- Simulate paper: When the paper is front of the sensor close to its normal position, press "SAMPLE". Store signals as "Paper level".
- Perform "Calculate Auto-limit" to find the best break detection signal.
- Select the signal suggested by KB pressing right arrow and "ENTER".
- Select "Auto-alarm" to set the alarm signal Low/High limits. Drift alarm action, alarm limit and direction should be set as well.
- Activate the break relay by selecting operating mode ("Configuration" -› "Mode"): "Detect enabled".
- Check that the position memory ring is locked.

5. Final tuning

Final tuning should be always be done with real paper running situation and real break situation. This time paper distance to the detector is stable and temperature as normal running temperature.

- Select "Configuration" -› "Mode" -› "Maintenance" (break relay deactivated).
- While the machine is running without paper press "SAMPLE" and store signals as "Break level". This can be done when the paper machine is warm and before paper sheet is on.
- When the web (paper) is on press "SAMPLE" and store signals as "Paper level".
- Perform "Calculate Auto-Limit" to find the best break detection signal.
- Select the signal suggested by KB by pressing right arrow and "ENTER".
- Activate the break alarm relay by selecting operating mode ("Configuration" -› "Mode"): "Detect enabled".

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INSTRUCTION MANUAL V1.2

Table of contents

1. Description

1.1. System components

KB fiber-optic sheet break detection system contains:

- Sensor head installed above or under the web.
- Fiber-optic cable protected with a flexible conduit.
- Display unit housing the light source, detector, and the measurement computer.

KB from KPM is a solution to high temperature sheet break applications. The light source, detector, and electronics are isolated from the high temperature environment by a 6 m (20'), 9 m (30') or 12 m (40') fiber-optic cable. While the sensor head is exposed to high temperatures, the electronics is mounted in a less hostile environment.

Sensor head "eye" holes are kept clean by purging instrument air through the sensor housing. Flowing air keeps the eyelet holes clean and prevents dirt or steam from contaminating the active optic surfaces. Purging air helps also to keep the sensor head temperature lower in high temperature applications.

KB requires clean instrument air at 0.5 – 3.0 bar (7 - 40 psi), the rotameter or pressure regulator can be used for the easy detection of airflow.

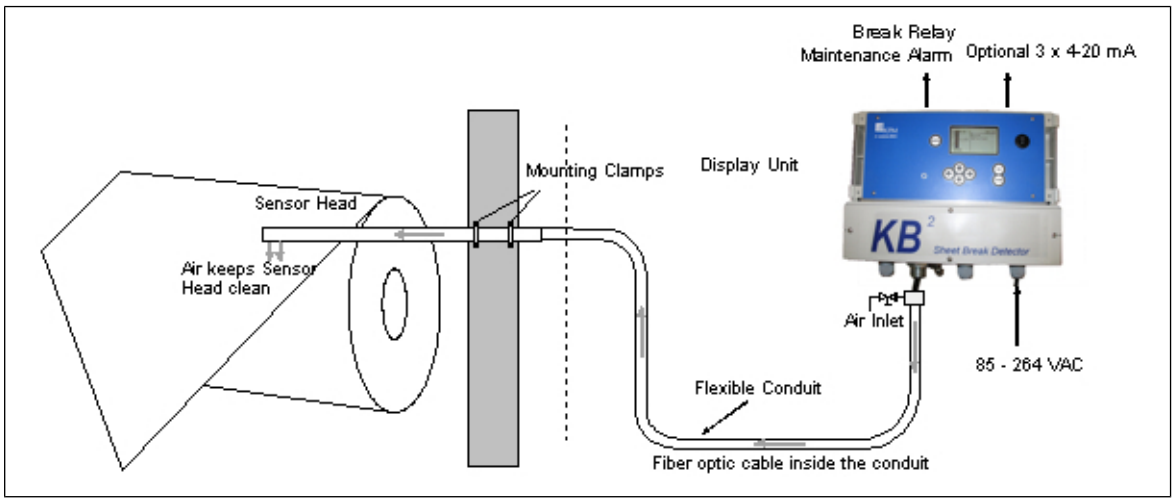

Fig. 1.1. KB system components. Fiber-optic cable can be 6, 9 or 12 m long.

1.2. Operating principle

The KB operates on a proven, non-contact reflection principle. The light source can be either RGB LED (red, green, blue) or IR LED (infrared). The optical sensor is placed above or under the web. Applications include paper or board webs, wires or felts. Thanks to the unique RGB detection method the color of the product or the felt has no effect on the measurement reliability. The sensor is neither affected by dirt, steam nor temperatures up to 180 °C (356 °F) when installed according to Kajaani Process Measurements specifications. There are no electronic components located in the sensor head.

The optical sensor is connected through a fiber-optic cable to the RGB/IR light source located in the display unit. The RGB/IR LEDs emit pulsed red, green, blue, or IR light onto the web surface. The reflected light is received and transmitted through the fiber-optic cable to the detector. All light components are analyzed fast for a reliable break detection.

A break activates a relay, which can be connected to the logic control of a paper machine. The reflected light intensities are also available as optional 4 - 20 mA analog outputs.

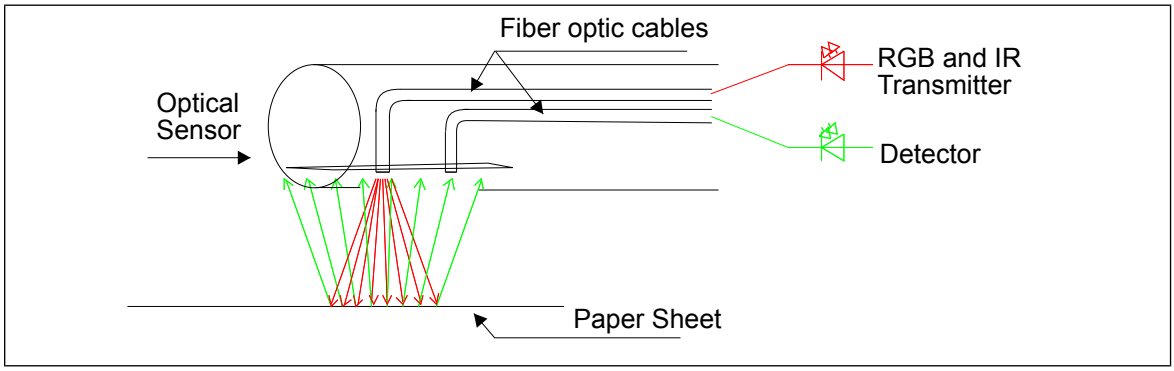

Fig. 1.2. Operating principle.

The self-cleaning sensor head is a 33.7 x 1500 mm (1" x 59") stainless steel tube with two holes serving as eyelets for the fiber-optics and outlets for purge air. Continuous airflow through the stainless steel enclosure keeps positive pressure around the sensor head's eyes and keeps the eyelets free of steam, dust or debris. The openings should be located towards the surface being monitored.

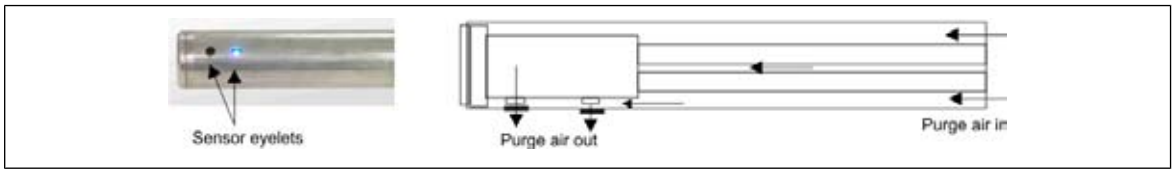

Fig. 1.3. Sensor eylets and purge air operation.

2. Installation

Note: Do not mount several fiber-optic sensor heads side by side; a mutual interference may occur. Infrared dryer might also interference the measurement.

2.1. Delivery limits

Manufacturer supplied components:

- KB sensor head with position memory, 1 ea
- Mounting clamps, 2 ea
- Fiber-optic cable (6 m/20", 9 m/30" or 12 m/40"), 1 ea
- Display unit, 1 ea
- Flexible conduit for a fiber-optic cable protection (SS tubing, 25,4 mm / 1" OD), 1 ea

Options:

- Mounting rack.
- Analog output board.

2.2. Display unit installation

Install the display unit to the wall outside the machine for easy access.

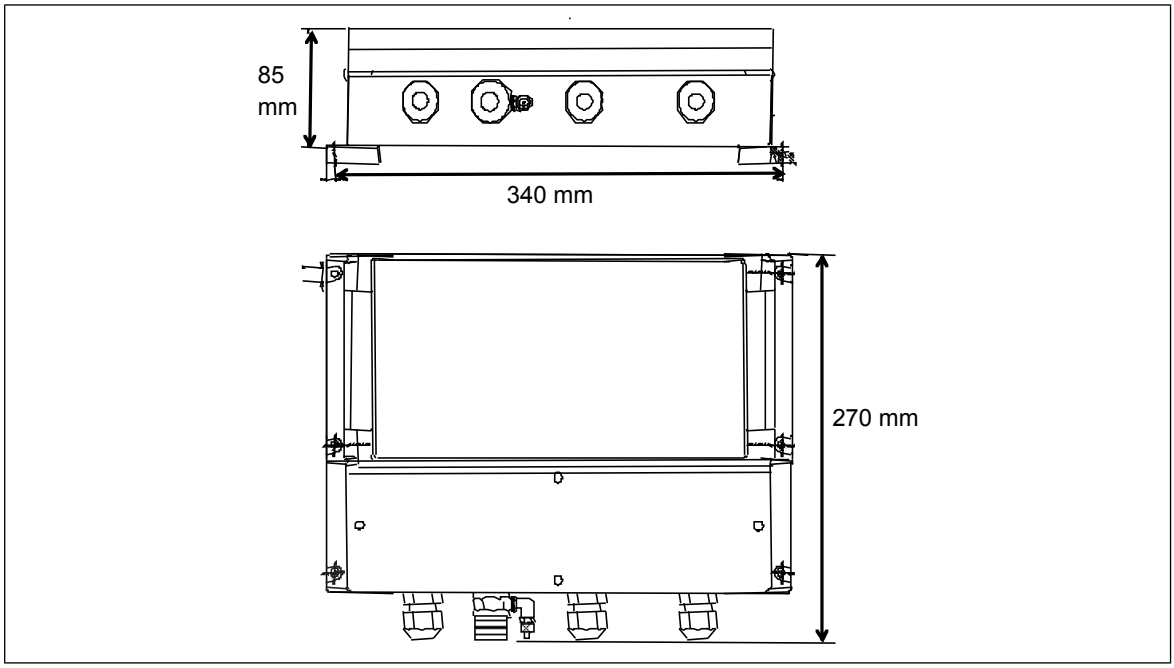

Fig. 2.1. Display unit dimensions (mm).

2.3. Sensor head installation

The fiber-optics cable is delivered mounted to the sensor head. Feed the free fiber-optic cable through the flexible conduit. This is easiest, if the conduit is laying straight on the floor and the fiber-optic cable is at room temperature. Connect the conduit to the sensor head. If you pull, pull the fiber-optic cable from the outer jacket, not from the connectors. The maximum force for pulling from 2 cables is 50 Newton (11 lbf). The minimum bending radius is 50 mm (2"). The sensor should be installed about 25 cm (10") inside from the edge of the web and 15 cm (6") above it. Standard range is 10 - 30 cm (4 - 12").

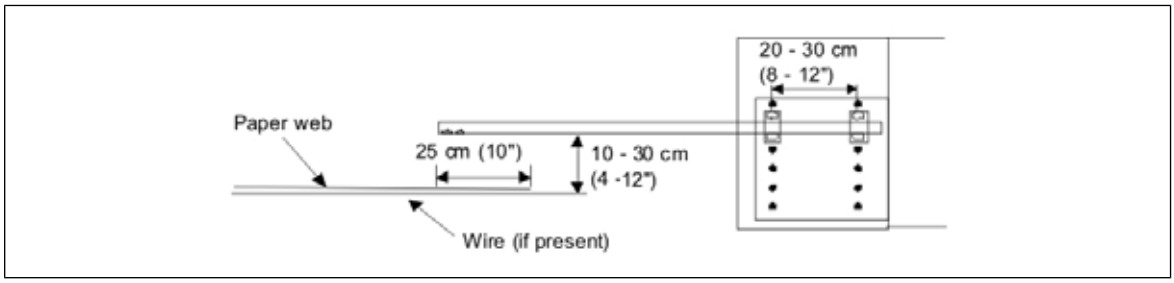

Fig. 2.2. Typical installation.

Install the mounting clamps or the rack (optional) on paper machine's frame or other solid mounting structure. Leave 20 - 30 cm (8 - 12") between the clamps. It is recommended to leave option to adjust clamp height so that sensor head can be positioned optimally during the start-up.

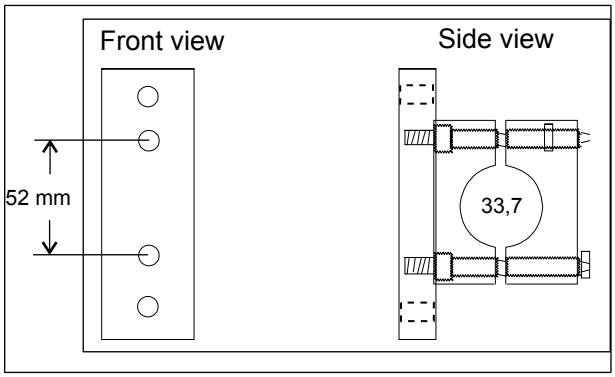

Fig. 2.3. Mounting clamps.

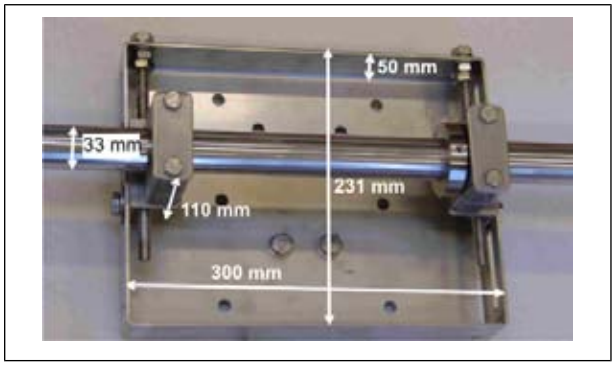

Fig. 2.4. Mounting rack (option).

Slide the sensor tube through the mounting clamps. Rotate the eyes into a position towards the web and semi-tighten the clamps. The groove in sensor head shows the direction of light beam (opposite side). Final adjustment is done with the help of the signal level display after the unit is powered up. The light beam is directed to the measured web. Insert the pin of the position memory ring (fig. 2.5.) into the hole in the clamp and tighten the stop screw. If the sensor is removed for maintenance the memory ring ensures that the sensor head is positioned exactly in the same position as before the removal.

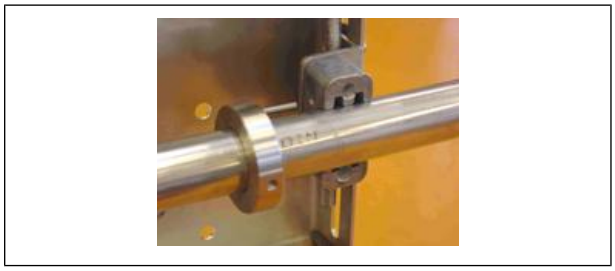

Fig. 2.5. Position memory.

2.4. Fiber-optic cable installation

NOTE: Handle fiber-optic cables with care. Do not pull strongly. Remove protective caps before connecting to the optic block.

Route the flexible conduit with the fiber-optic cable inside it to the display unit.

1. Remove the conduit bushing from the display unit.

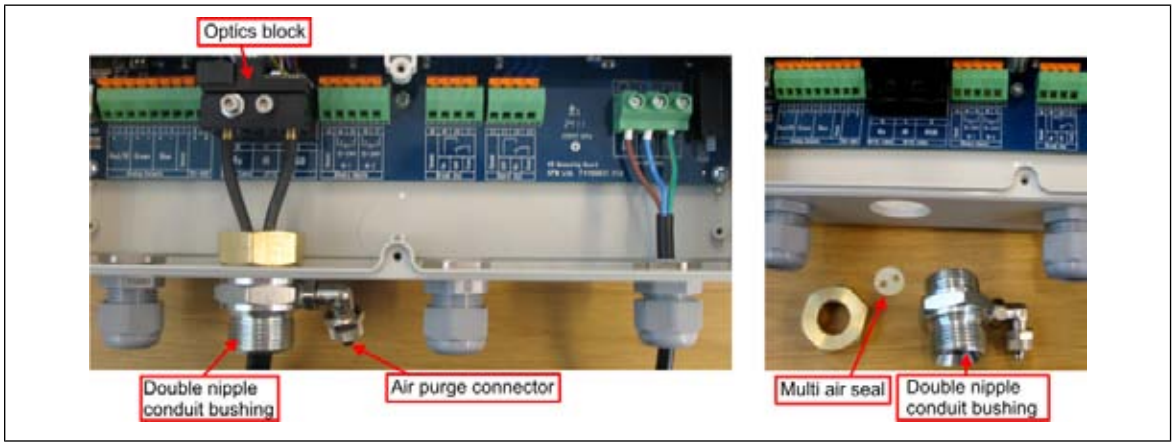

Fig. 2.6. Removing the conduit bushing from the display unit.

2. Guide the end of the fiber-optic cable through the conduit bushing and fasten the bushing to the flexible conduit.
3. Place the multi air seal on top of the fiber-optic cables, fig. 2.7. point A & B.
4. Insert the multi air seal inside the conduit bushing, step C.

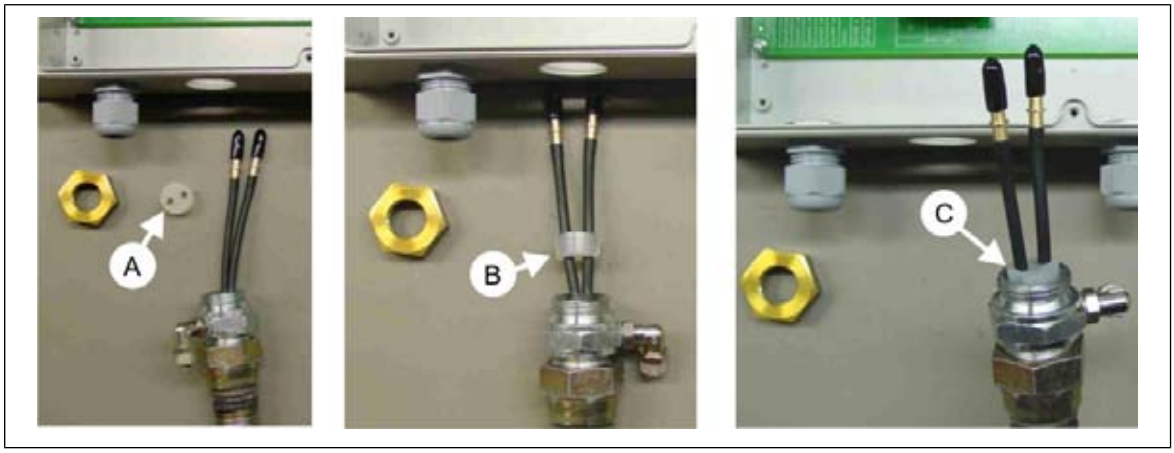

Fig. 2.7. Multi air seal inserting.

5. Open the optics block cover, slide the cables through the bushing hole, cap nut and tighten the bushing loosely, fig. 2.8.
6. Insert one of the cables to the Rx slot and the other one to the RGB slot (or to IR slot if IR light is used). It does not matter which one of the cables is connected to the Rx slot.

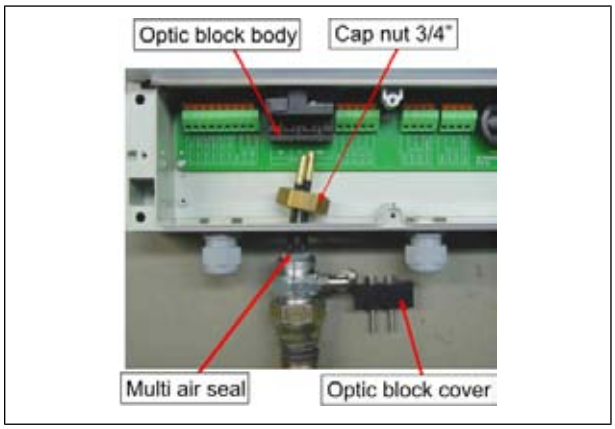

Fig. 2.8. Connecting cables to optical unit.

7. Lock the cables in place with the optic block cover, fig. 2.9. points A & B.
8. Fasten the optic block cover and tighten the cap nut of the cable bushing, points B & C.
9. Connect the instrument air 0.5 - 3.0 bar (7 - 40 psi) to the air inlet connector (point C) at the end of the flexible conduit outside the display unit housing.

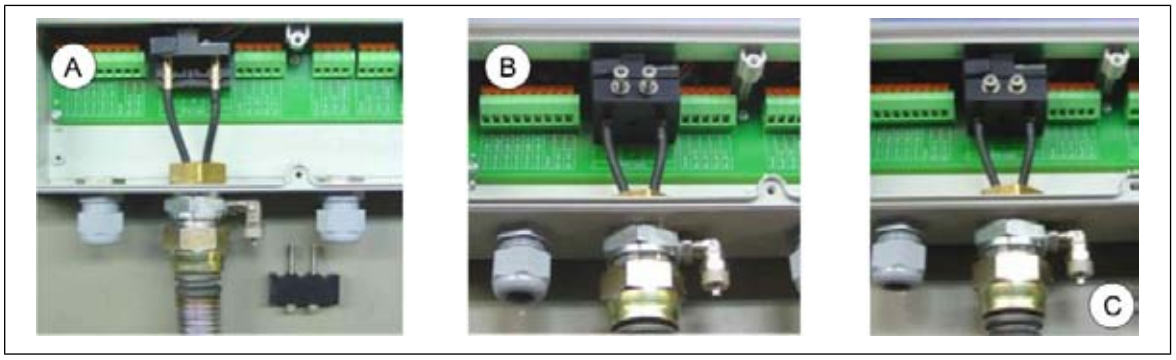

Fig. 2.9. Connecting cables to optical unit.

3. Wiring

3.1. Wiring and fiber-optic cable connection

The terminals for the electrical and fiber-optic cables are located under the bottom cover of the display unit. The layout of the KB measuring board is shown in fig. 3.1.

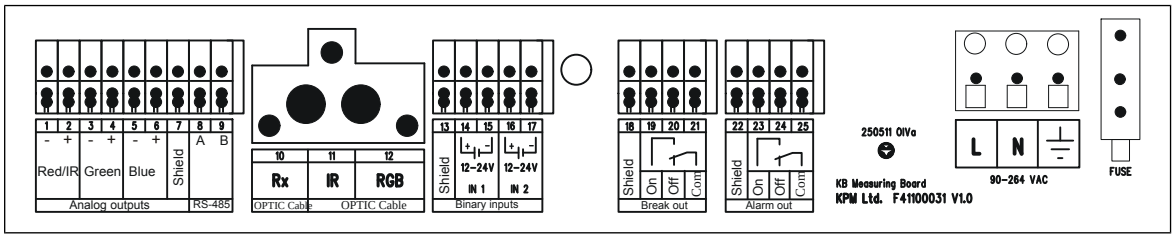

Fig. 3.1. KB Measuring Board layout.

Relays are of dry contact types. In normal operation the "Break Out On" relay is open and it closes during a break. In case the power is lost or turned off the "Break Out On" relay remains open (disabled). "Break Out Off" works in the opposite way.

"Alarm Out 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 Out Off" is OPEN. "Alarm Out On" works in the opposite way.

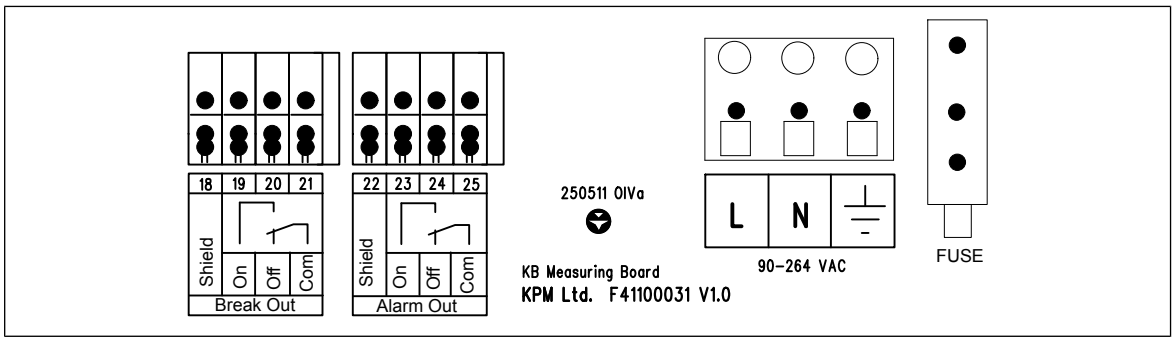

Fig. 3.2. Wiring of Power Supply, Break relay and Maintenance alarm.

Fiber-optic cable is connected to the optics block. It does not matter which one of the two cables is connected to the receiver inlet (Rx). In a normal application another cable is connected to the RGB light source. IR light source is used in special cases such as heavy steam environment or in an application where exceptionally strong light is needed.

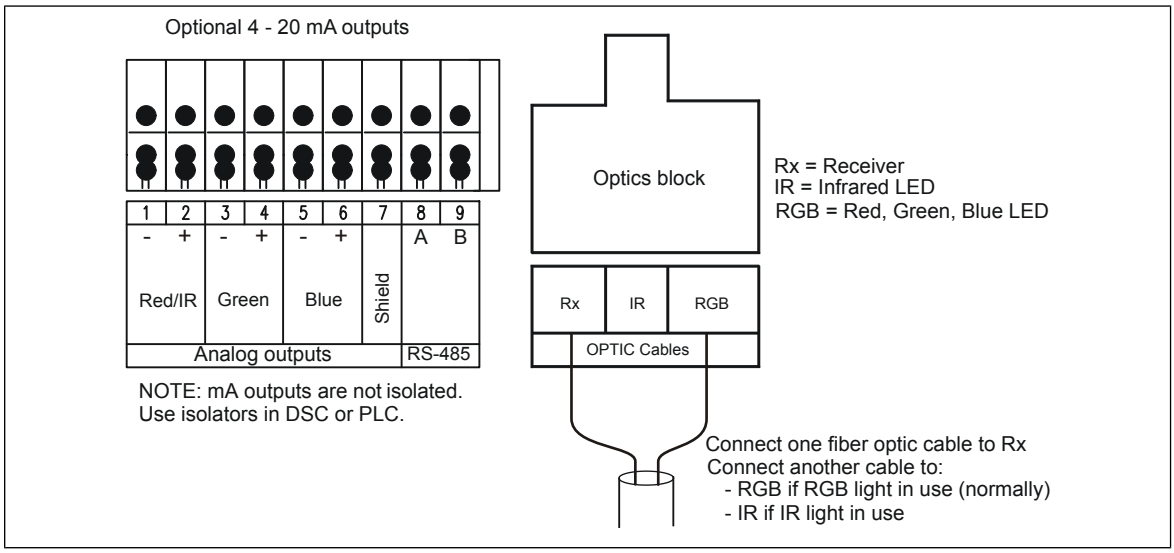

Fig. 3.3. Fiber-optic cable and optional 4-20 mA connections.

4. Operation and configuration

4.1. Display and operating keyboard

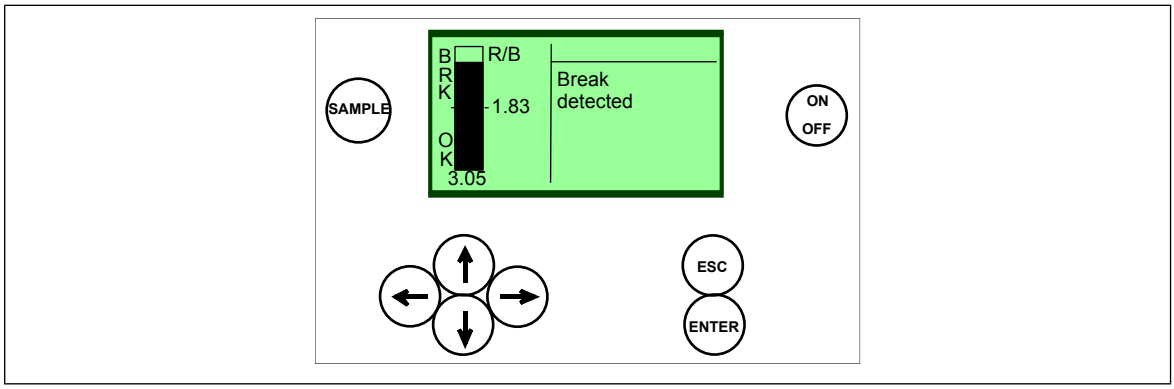

Fig. 4.1. Display and keyboard.

The display contains 7 lines, with 21 characters in a line. The main display (fig. 4.1) shows:
- Selected measurement signal for break detection.
- Signal level of the selected signal.
- Time.
- Break status.
- Alarms, if activated.

Common properties in other menus:
- Selected line 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 for Break or Paper Reference values or deleted.

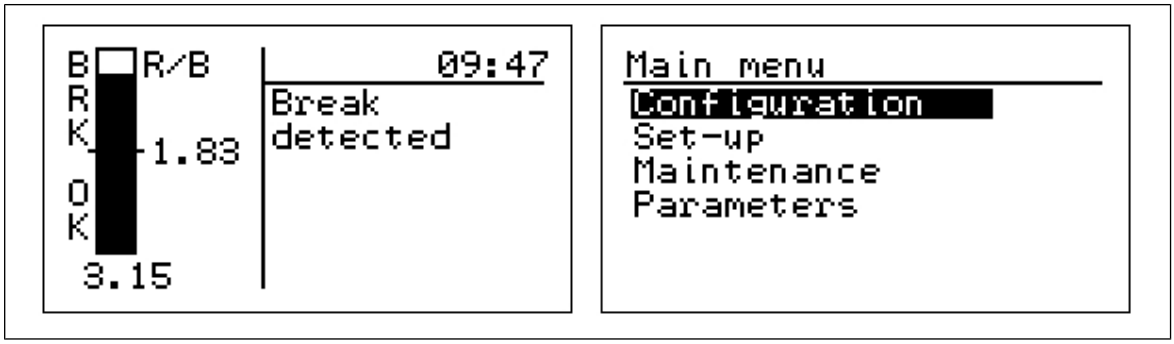

Fig. 4.2. Main display and main menu.

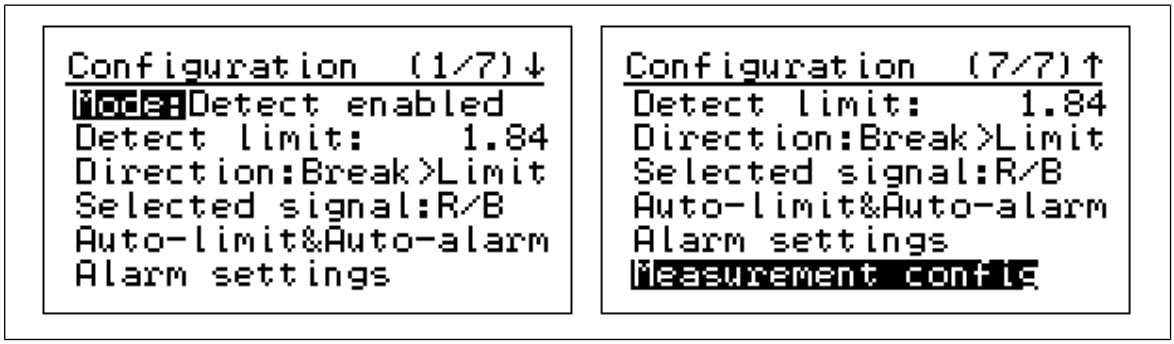

Fig. 4.3. Configuration menu.

(Operating) Mode: Select "Detect enabled" for normal operation. For maintenance select "Maintenance" – it disables the break relay to prevent false break during the maintenance work.

Detect(ion) limit: Set the signal level trigger point for the break.

(Detect) Direction: Select, when the break is activated, if the signal level goes under ("Break < Limit") or above ("Break > Limit") the detection limit.

Selected signal: One of the RGB-signals or combinations thereof can be selected for break detection. The one, which gives the highest difference between the web-on (PAPER) and the web-off (BREAK) situation is selected. In case IR light source is selected, then only IR is possible.

Auto-limit and Auto-alarm:
Auto-limit sets the signal type for break detection, detection level and direction, when performed. Auto-alarm sets the alarm signal and alarm limits, when performed.

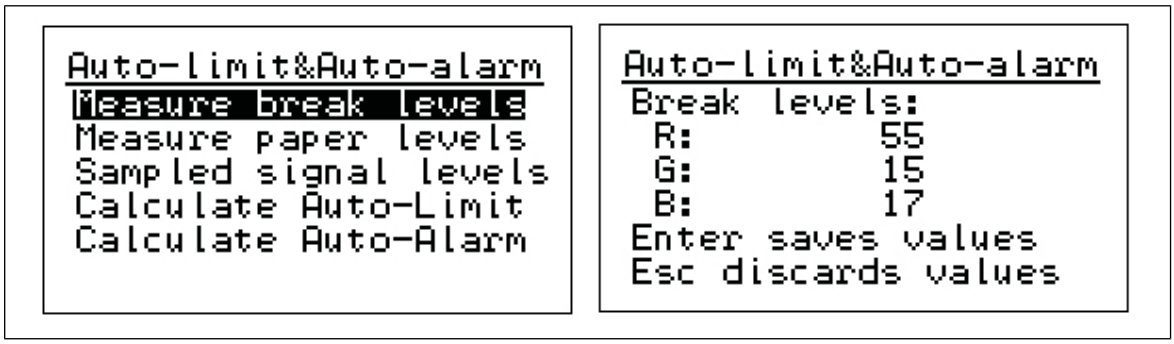

Fig. 4.4. Setting reference values for break levels.

KB records all the signal levels in BREAK/PAPER situations and stores them as reference values.
Measure break (signal) levels: Press right arrow. To store Break signal levels in KB memory press "ENTER". "ESC" will escape without storing. Press "Sample" in front panel to average also signal levels and enter this display, where break and paper values can be stored.

Measure paper (ON signal) levels Press right arrow. To store Paper ON signal levels in KB memory by press "ENTER". "ESC" will escape without storing. Press "Sample" in front panel to average also signal levels and enter this display, where break and paper values can be stored.

Sampled signal levels: Displays both stored signal levels (PAPER and BREAK).

Calculate Auto-limit menu KB calculates the web-on to web-off ratio (Paper-to-Break Ratio) when both cases has been stored as references in memory. KB also suggests the best signal for break detection and puts them in a ranking list. Normally the best signal is chosen for break detection by having it in display and pressing right arrow and then "ENTER". Then KB sets the break trigger point ("Detection Limit") to 50 % of the difference between the web-on and the break-on levels for the selected signal. The unit sets also automatically the detection direction.

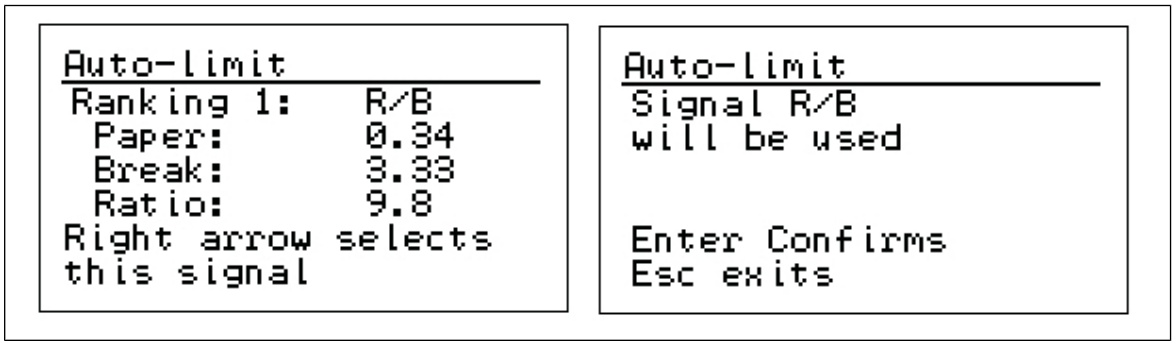

Fig. 4.5. Calculating auto-limits.

Alarm settings:
KB can alarm in situations where the signal level is very low, very high or when signal drifts a lot.

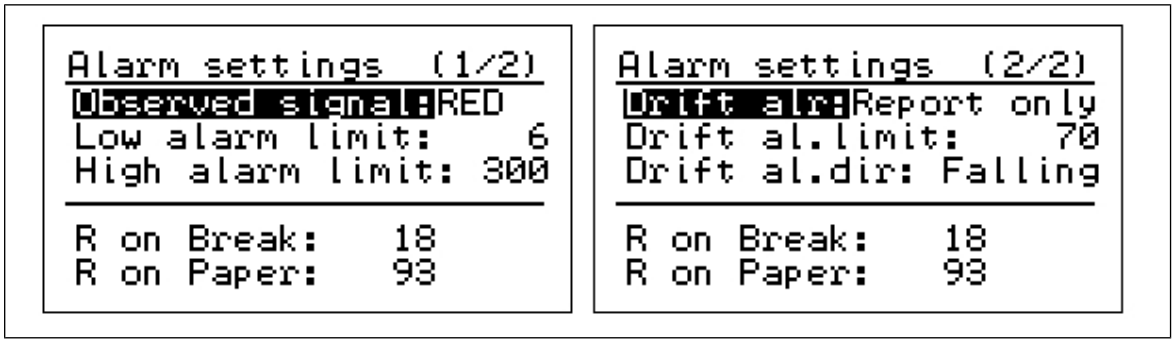

Fig. 4.6. Alarm settings.

Observed signal: Select the R, G or B signal (IR in case of IR light source) which is used to monitor this alarm. Normally the same signal is chosen into alarm as in break detection. Only one main color can be chosen for alarming, no combination possible.

Low/High alarm limit: If a piece of paper gets stuck on the sensor head , signal level can go very low or very high. The low and high alarm limits are set for this case. Alarm will go on if signal goes below low limit (3 default) or over high limit (1000 default). Normally default values are OK.

Drift Alr: Drift alarm is used to give alarm in case measurement signal drifts. For example because of dust or dirt on top of fiber optic lens or in the opening (makes it smaller).
There are three possibilities to use "Drift Alarm":

- **Report only:** In case drift is detected;
  Alarm Relay is activated,
  break detection and Break Relay continue to operate normally.
- **Not in use:** Drift detection is not used.
- **Prev. break:** In case of drift is detected;
  Alarm Relay is activated,
  break detection and Break Relay is not used (purpose is that KB will never give false Break output).

R (G, B) Break on and **R (G, B) Paper:** These are stored signal values during Break and Paper. Auto limit calculation is using these values to perform detection limit and other values. These are only for indication in this menu to help select correct alarm limits.

Measurement config(uration): This section determines detection speed (Detect filter), measurement intervall (cycle), light emission intensity and detector sensitivity.

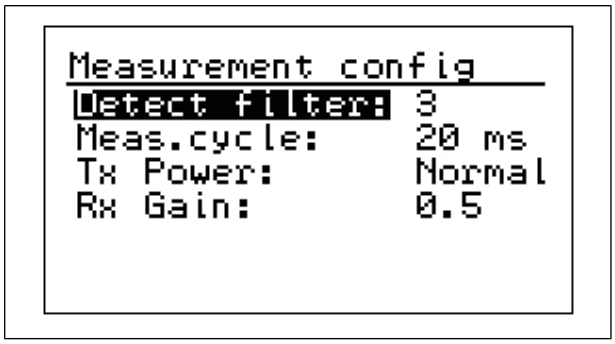

Fig. 4.7. Measurement settings.

Detect filter: Set number of measurement cycles for break determination, default 3. Number 3 means that 3 consecutive measurements are all below detection limits before break relay is activated.

Meas. cycle: Set the measurement cycle time, default 20 ms. Can be between 10 and 60 ms.

Tx Power: Select light source intensity, High/Normal. High can be chosen when the measurement distance is high, for example over 20 cm.

Rx Gain: Detector gain – normally 1 (selectable 4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, 0.5). Effects directly on signal level. Can be adjusted lower if ambient light is too high (over 60 %).

4.3. Set-up

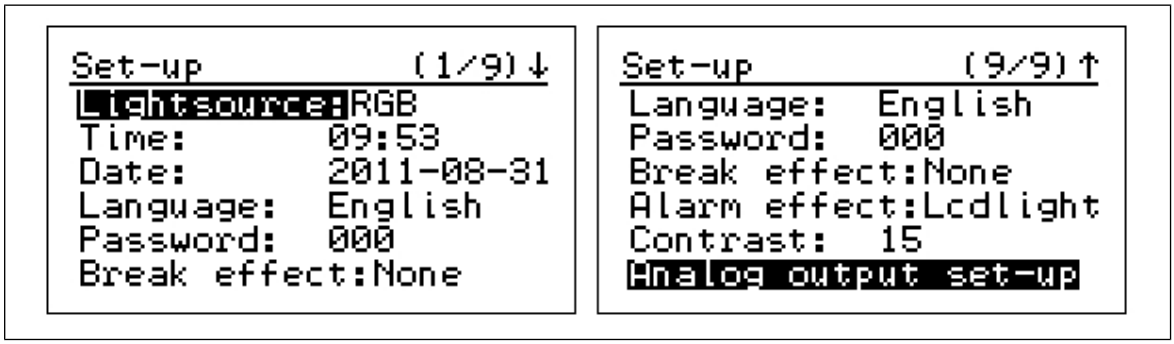

Fig. 4.8. Setup displays.

- **Light source:** RGB (visible Red, Green, Blue) light is recommended in a normal application. IR (Infrared) light is used in special cases, such as heavily steamy environment and/or long measurement distance from the web.
- **Date & time:** Set date and time for data logging.
- **Language:** Select English/Finnish.
- **Password:** Set password. 000 = no password.
- **Break effect:** Select None, Beep, Lcd+Beep, Lcdlight (= blinking display).
- **Alarm effect:**Select None, Beep, Lcd+Beep, Lcdlight (= blinking display).
- **Contrast:** Set the display contrast (1 - 10), default = 10.
- **Analog output setup:** Output and mA-values are shown only, if the analog output board is installed.

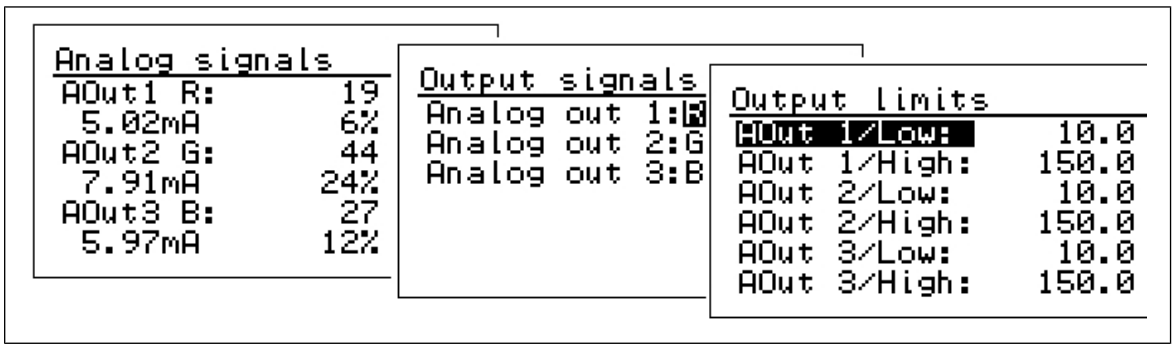

Fig. 4.9. Analog output set-up.

- **Analog output signals:** On optional analog board there are three 4 - 20 mA analog outputs. You can select any of the RGB signals and their combinations to each output. Menu is displayed only, if board is installed.
- **Analog output limits:** Set the signal levels corresponding 4 mA (LOW) and 20 mA (HIGH) for each analog output.
- **Analog output filter:** Select the dampening of the analog signals. The selected filtering time is applied to all the 3 outputs.
- **mA output error mode:** When the self-diagnostics finds a failure the unit sets the outputs to the selected mode. You can set the outputs to go to 22.5 or 3.5 mA, or to freeze to the last good number, or to continue to show the measured values although they may be wrong (mode No eff(ect)).

4.4. Maintenance

In "Maintenance" section you can find device indentification, measured signal values, errors, data logging and event logging.

On-line signals:

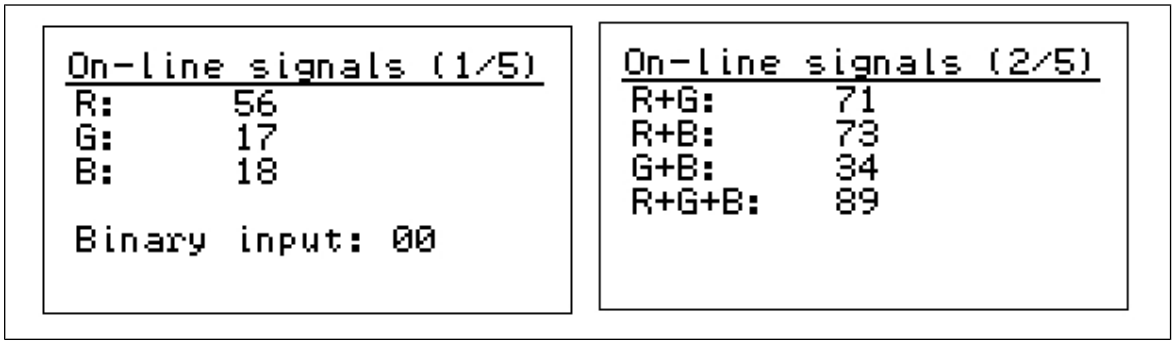

Fig. 4.10. On-line signals, pages 1 and 2.

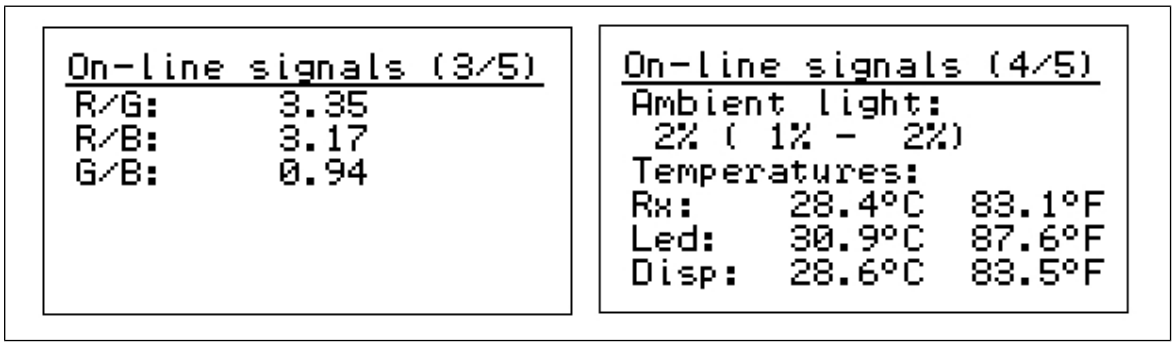

Fig. 4.11. On-line signals, pages 3 and 4.

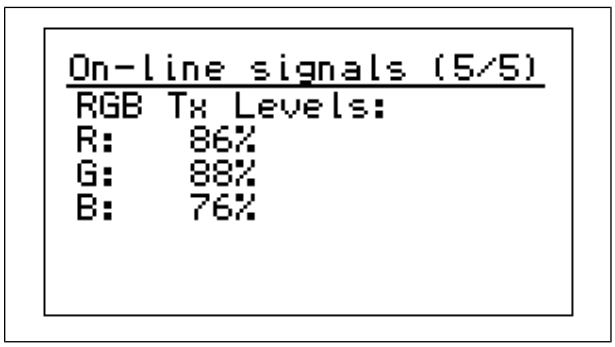

Fig. 4.12. On-line signals, page 5.

You can monitore measured and calculated signals for troubleshooting.

NOTE: "Ambient light" should be less than 60%.

When "Ambient light" value is higher that 60 % there is too much external light, which may disturb measurement. "Signal levels" and "Ambient light" values can be adjusted by parameters "TX Power" and "RX Gain", which are located in "Factory setting" menu. Smaller "RX Gain" value will help receiving less ambient light. ("Min %-Max %" shows the occurred extremes ambient light during one measurement cycle).

Analog signals: Contains measured values and mA output for each channel.

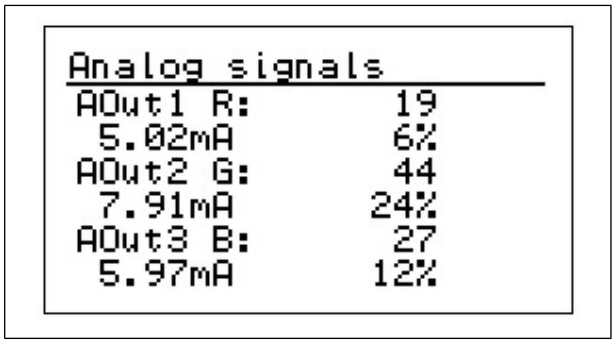

Fig. 4.13. Analog signals.

Event log: Event log stores changes made after start setup. Stores also all boot-ups. Holds last 250 events.

Datalog:

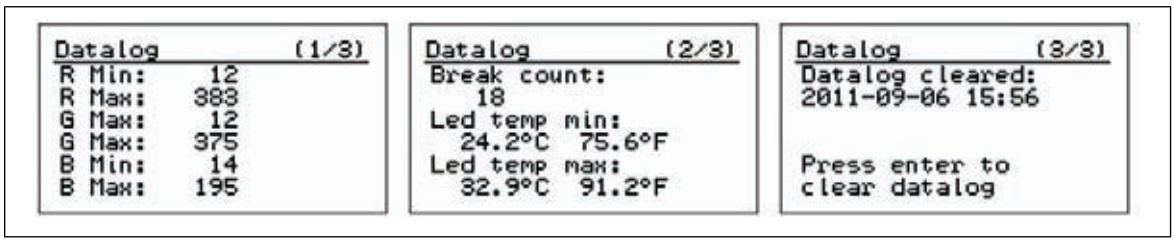

Fig. 4.14. Datalog menus.

Contains measured minimum and maximum signals and monitored internal temperature data since the last reset. **Please; reset during start-up**.

Check alarms: List of maintenance alarms, which are active at a moment. Used for troubleshooting.

Identification:

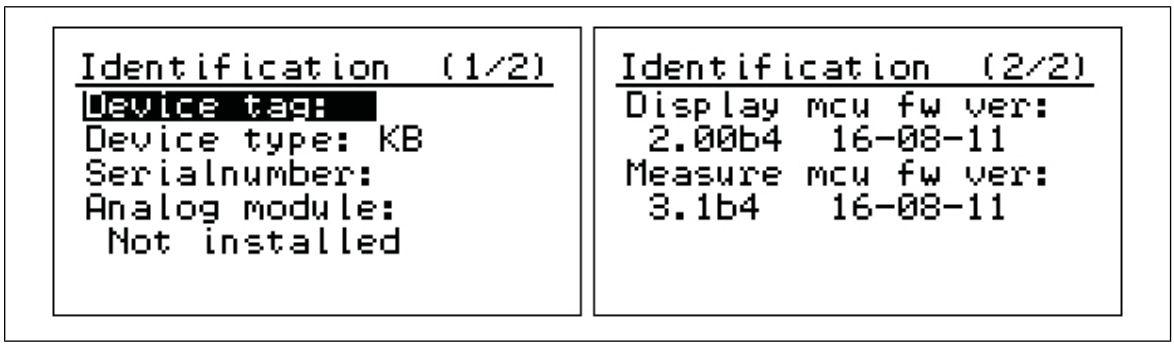

Fig. 4.15. Identification menus.

Contains ID and version information.

Default settings: Reset to configuration settings. Used e.g. if the settings are changed by accident.

Factory Settings

NOTE: Requires always password.

Factory setting values are set during initial setting and there is no need for customer to change them. Please, contact Kajaani Process Measurements for more information.

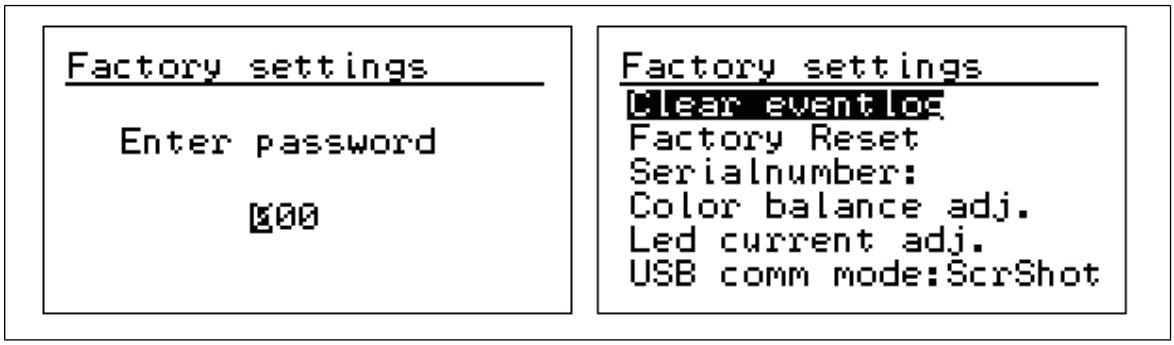

Fig. 4.16. Factory settings.

Clear event log: Clears the event log.

Factory reset: Reset to factory settings.

Serial number: Set serial number.

Color balance adj(ustment):

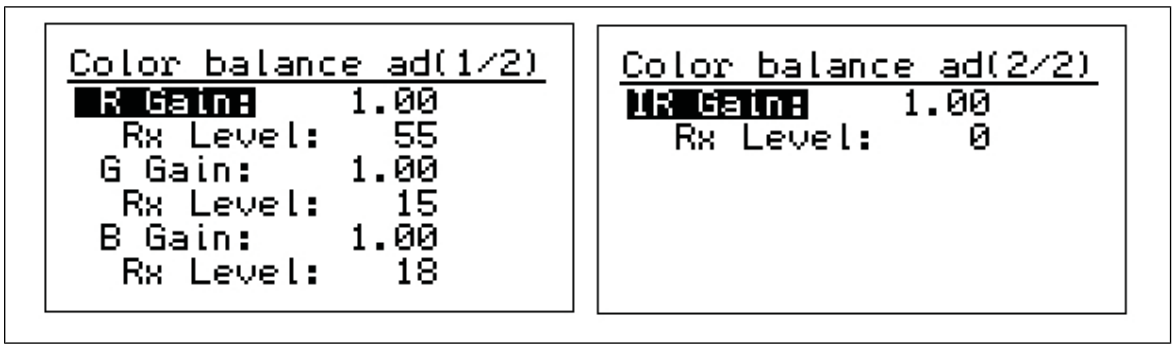

Fig. 4.17. Color balance adjustment.

Individual gain adjustment of R, G, B, and IR lights.

Led current adj(ustment):

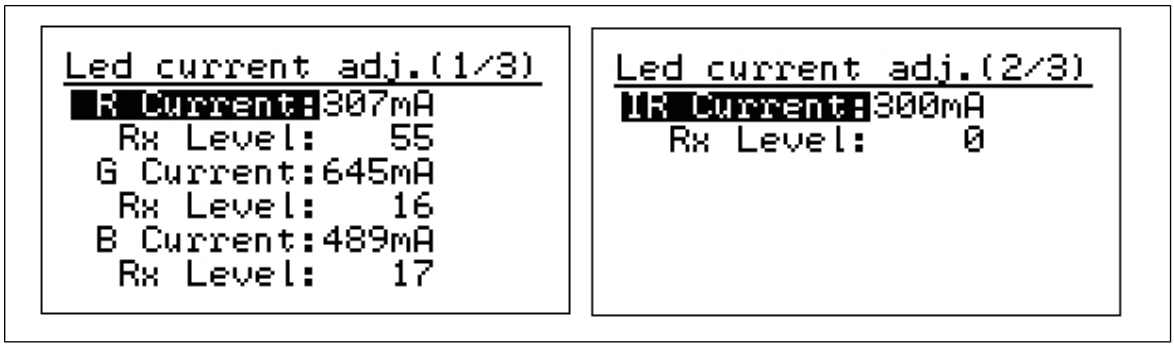

Fig. 4.18. LED current adjustment, pages 1 and 2.

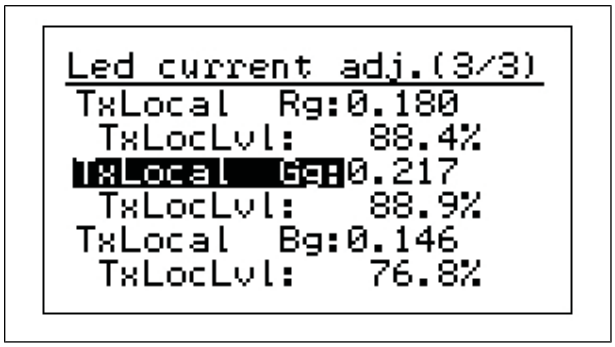

Fig. 4.19. Tx local values, indicate LED light intensity level.

USB comm(unication) mode: Select commumication port mode: ScrShot/Normal.

Analog output trim: KB sends in the edit mode 4 and 20 mA in turn to the selected analog output. With S (gain) and Z (zero offset) the output can be trimmed to correspond 20 mA (gain) and 4 mA (zero).

4.5. Parameters

The "Parameters" display contains normally needed parameters, and they can be modified in this display.

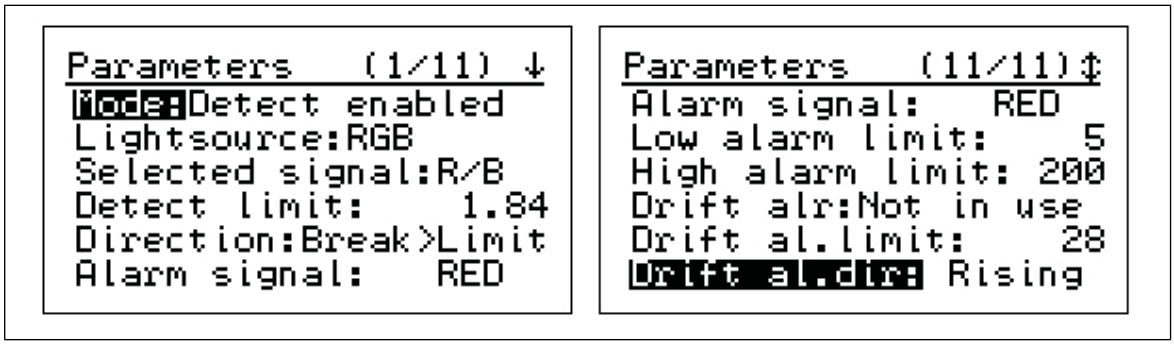

Fig. 4.20. Parameters display.

5. Start-up

5.1. Tuning sensor position

Purpose of tuning is to direct light beam so that reflectance from paper is strongest.
To observe the signal levels:

1. Go to "Maintenance" -› "On-line signals".
2. Locate large piece of paper on the estimated place of measured sheet to simulate paper on situation to find the maximum signal level. Paper distance has effect on the signal level.
3. Rotate the sensor head until the signal levels indicated in the display unit are at their strongest (normally from 50 – 500 with paper). This is usually the perpendicular position against the web.
4. Check the ambient light percentage ("Maintenance" -› "On-line signals"). This should be below 60 % level. If the ambient light is too high, reduce the receiver sensitivity Rx Gain.
5. Fasten the position memory ring.

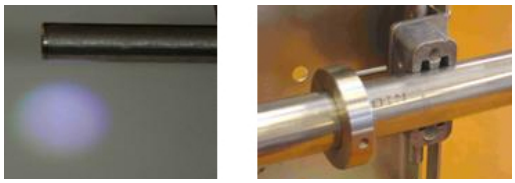

Fig. 5.1. Sensor head light and position memory ring adjustment.

5.2. Reference values for Paper and Break

1. Teach the unit to recognize the Break-ON conditions.
   Press "SAMPLE". After a short time measured values are displayed. Save those numbers as reference values for break “Save as break level”.
2. Teach the unit to recognize the Paper-ON conditions. While Paper is on, press "SAMPLE". After a short time measured values are displayed. Save those numbers as reference value for paper “Save as Paper level”.

5.3. Auto Limit = Configuring KB for break detection

Auto-limit Calculation can be performed when above mentioned both reference values have been stored in KB memory. This procedure calculates detection limit for break detection.

1. Go to "Configuration" -› "Auto-limit&Auto-alarm" -› "Calculate Auto-Limit". KB has calculated from the Paper ON / Break ON signals "Ratio" (Paper to Break) for all the light components plus 7 calculated combinations thereof. The highest rated signal normally gives the best performance.
2. Select the 1st displayed signal for break detection with arrow right and "ENTER". KB sets the break trigger level (Detection limit) to the mid-point (50 % value) between the "Break"-on/"Paper"-on levels of the selected signal. KB selects the detection "Direction".
3. Set "Configuration" -› (operating) "Mode: Detect enabled" to activate the break measurement. In the "Maintenance" mode the break relay is deactivated to prevent false alarms while working on the unit.

5.4. Auto Alarm

1. Go to "Configuration" -› "Auto-limit&Auto-alarm" -› "Calculate Auto-Alarm".
2. Choose a signal for alarming purposes. Only one base color R, G, B or IR (no combination) can be chosen. Normally, the same signal should be taken for alarming than for the break detection.
3. Pressing the right arrow key calculates proper alarm limits. Low limit is normally between 3 and 10 and high limit around 400 - 1000. They can be changed also manually. Drift alarm is calculated to be 70 % value between paper and break.

5.5. Examples

Open draw

Auto-limit&Auto-alarm values:
Break: R: 6, G: 7, B: 8
Paper on: R: 104, G: 121, B: 144

Auto-limit calculation results: 1. B (blue light gives the highest difference), 144/8=18 (paper-to-break "Ratio" = Normal to Break Ratio), 8 (blue level on "Break"), 144 (blue level on "Paper").
KB selects blue light for break detection and sets "Detect(ion) limit" to 76 =((144+8)/2)
KB sets the detect "Direction" to "Break < Limit" = break relay activates as soon as B-signal drops below 76.

Alarm settings:
- **Observed signal:** Select signal which is used for break detection (B in this case).
- **Low alarm Limit:** Set for example 3.
- **High alarm Limit:** Set for example 1000.
- **Drift Alarm:** Select required action of "Drift Alr", recommended "Report Only".
- **Drift al(arm) limit:** 103 (= 0.70*(144-8)+ 8) = 70 % of range between paper on and break.
- **Drift al(arm) dir(ection):** Falling signal (Break < Limit).

Paper on red wire

Auto-limit&Auto-alarm values:
Break: R: 85, G: 24, B: 26
Paper on wire: R: 94, G: 125, B: 119

Auto-limit calculation results: 1. G (green light gives the highest difference), 125/24=5.2 (paper-to-break "Ratio"), 24 (green level on "Break"), 125 (green level on "Paper").

KB selects green light for break detection and sets the trigger point to 74 (= (125+24) /2).

Alarm settings:
Same way as above in chapter "Open draw".
Observed signal: Select signal which is used for break detection (G in this case).
Low alarm Limit: Set for example 3.
High alarm Limit: Set for example 1000.
Drift Alarm: Select required action of "Drift Alr", recommended "Report Only".
Drift al(arm) limit: 94 (= 0.70*(125-24)+24) = 70 % of range between paper on and break.
Drift al(arm) dir(ection): Falling signal (Break < Limit).

6. Maintenance

6.1. Regular maintenance

KB does not require any regular maintenance. Built-in self-diagnostics monitors internal signals and raises alarm flag in case of a malfunction or certain signals reach alarm limits.

6.2. Alarms

Alarm name	Possible cause	Action
Check cleaning	Sensor eyelet holes blocked.	Check that the sensor head is free of debris.
	Fiber optic cable in the sensor getting dirty.	Check that the purge air is on and flows out from the sensor eyelet holes (pressure 0.5- 3 Bar).
	A LED of the RGB light source has failed or looses the intensity.	Clean the ends of the fiber optic cables using e.g. cotton stick wetted with alcohol containing cleaning agent.
		Check the signal levels of all light components. If the one which is used for break detection shows low intensity select another signal (Configuration -> auto limit calculation ->signal selection).
Ambient light too high (on-line signals, ambient light ≥ 60%)	Sensor head too close to the web surface.	Move the sensor further away from the web or redirect the sensor eyelet holes slightly slantwise at the surface.
	A shiny surface close to the sensor head.	Redirect the sensor to avoid the disturbing reflection.
	A strong light beam from a near by lamp aimed at the sensor head.	Move the disturbing light or redirect the sensor away from the light.
	Reflection from the web surface still too high.	Reduce the Rx (light receiver) gain in the "Measurement config" menu (Available gains 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0).
Optic data timeout	Communication between the display and connection board has jammed.	Turn off the power and restart the unit.
	The flat cable connector in the connection board is loose.	Check that the flat cable connector is tight.
	Measuring Board failure	Replace the measuring board.
Signal out of range, clean meas. probe	Piece of paper on the sensor head.	Check the sensor head.

The R, G or B signal (or IR if in use) is used to monitor the light intensity drift. Gradual drift can be caused e.g. by dust, which is slowly building up on the fiber optics or by dirty water, which gets inside the sensor head and stains the surface of the fiber optics.

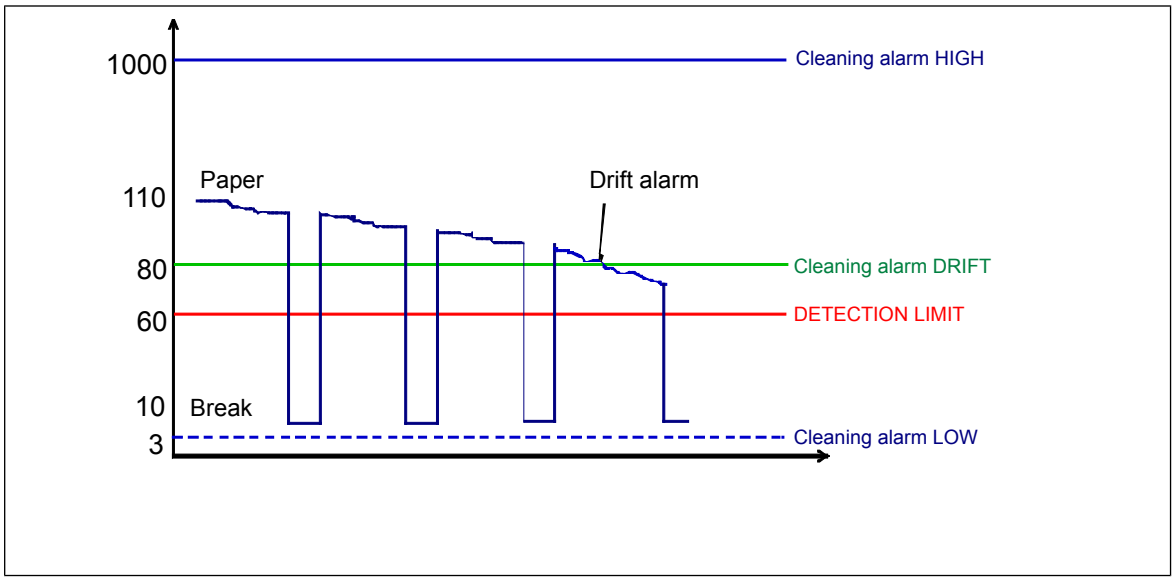

Fig. 6.1. Example of alarm limits and break detection.

KB alarms if signal goes above "Cleaning alarm HIGH" or below "Cleaning alarm LOW". "Drift Alarm" goes on when signal level drops below "Cleaning alarm DRIFT" (here limit = 80 which is 70 % from break (10) to Paper (110). "Detection limit" is set to 60 (50 % value between paper and break). KB informs break whenever signal drops below 60.

6.3. Cleaning the sensor

Fiber Optic lenses should be clean all the time. Cleaning should primarily to be done through the fiber optics opening in the sensor head. Cotton stick are the preferred means.

In case cleaning requires disassembly of the sensor head proceed as follows:

1. Release the fiber optic cable from the display unit and remove also the conduit bushing in order to get the cable to slide inside the conduit.
2. Remove the end plate from the sensor head by removing the two fastening screws.
3. Remove the locking ring.
4. Pull the fiber-optic cable through the optical sensor housing.
5. Wipe the lenses clean with soft fabrics or paper and reinstall.
6. Eyes must be centered over the holes in the pipe.

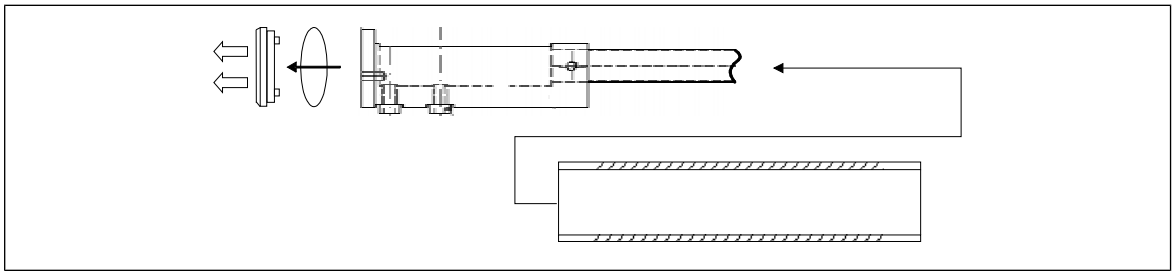

Fig. 6.2. Dismantling the sensor housing.

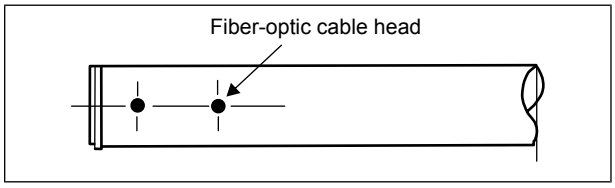

Fig. 6.3. Fiber optic cable head.

7. Appendix 1: Quick start-up guide

This quick guide leads the way to install, start-up and configure necessary parameters in the normal cases.

1. PREPARING INSTALLATION

– Install fiber optic cable inside conduit. This is easier done when temperature is cool and conduit is straight on the floor.

NOTE: DO NOT PULL FIBER OPTIC CABLE STRONGLY. It may break or cut or connector may get loose.

– Connect conduit to sensor head tube.
– Install sensor head mounting rack or mounting clamps.

2. Sensor unit installation

– Check that dry clean purge air is connected (pressure between 0.5 - 3.0 bar / 7-40 psi).
– Check that the eyelet holes are aimed at the web.
– Check that the sensor distance from the web is 10 – 30 cm (4 - 12").
– Check that the measurement point distance to paper edge is about 30 cm (12").
– Fix position preliminary. Tuning may change this slightly.

3. Display unit installation

– Check that fiber optic conduit bushing is tight.
– Check that fiber optic cable is connected to the optics block:
  - Other optic cable to RX.
  - Another cable to RGB or IR.
– Check the wiring of the power supply.
– Check the wiring of break signal.
– Check the wiring of alarm signal.

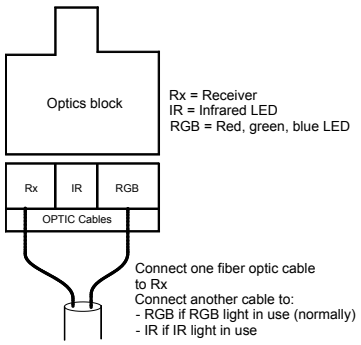

Fig. 7.1. Fiber optic cable connection.

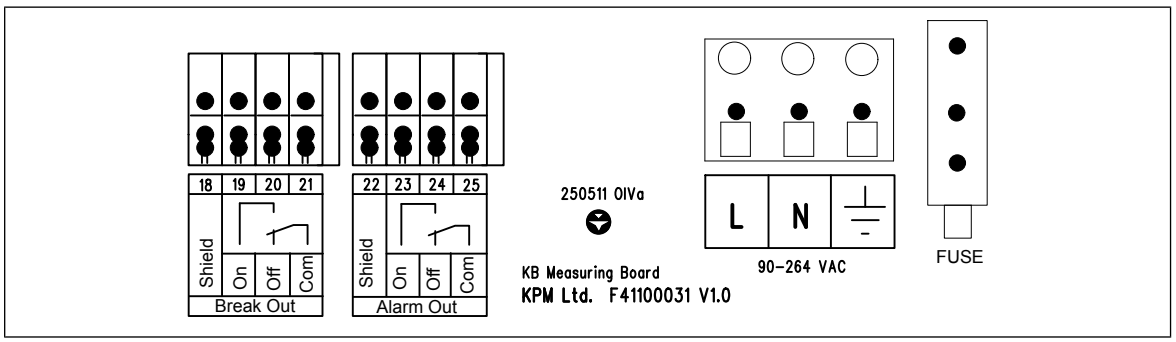

Fig. 7.2. Wiring diagram.

4. Start-up and tuning

Preliminary tuning can be done during installation at the actual place by simulating paper on situation with dry paper on front of sensor head. Final tuning should be always done with real paper running situation.

- Set unit to "Mode: Maintenance" in the "Configuration" menu.
- Turn on the power.
- Select from the "Maintenance" menu "On-line signals".
- Turn the sensor head light beam so that signal levels are on their maximum values (normally 100 – 700) when simulating paper in front of sensor. Paper sheet should be close its correct position. Signal level can be adjusted with "TX Power" and "RX gain" in the "Measurement config" menu. Ambient light should be < 60 %.
- Simulate break: Press "SAMPLE". Store signals as "Break level".
- Simulate paper: When the paper is front of the sensor close to its normal position, press "SAMPLE". Store signals as "Paper level".
- Perform "Calculate Auto-limit" to find the best break detection signal.
- Select the signal suggested by KB pressing right arrow and "ENTER".
- Select "Auto-alarm" to set the alarm signal Low/High limits. Drift alarm action, alarm limit and direction should be set as well.
- Activate the break relay by selecting operating mode ("Configuration" -› "Mode"): "Detect enabled".
- Check that the position memory ring is locked.

5. Final tuning

Final tuning should be always be done with real paper running situation and real break situation. This time paper distance to the detector is stable and temperature as normal running temperature.

- Select "Configuration" -› "Mode" -› "Maintenance" (break relay deactivated).
- While the machine is running without paper press "SAMPLE" and store signals as "Break level". This can be done when the paper machine is warm and before paper sheet is on.
- When the web (paper) is on press "SAMPLE" and store signals as "Paper level".
- Perform "Calculate Auto-Limit" to find the best break detection signal.
- Select the signal suggested by KB by pressing right arrow and "ENTER".
- Activate the break alarm relay by selecting operating mode ("Configuration" -› "Mode"): "Detect enabled".

8. Appendix 2

8.1. Spare parts

3150001	Fiber Optic Cable 6m
3150002	Fiber Optic Cable 9m
3150003	Fiber Optic Cable 12m
2350011	KB/6 conduit, L=4370
2350012	KB/9 conduit, L=7370
2350013	KB/12 Conduit, L=10370
H41110043V1.0	End Cap
2000205	Screw (2 pcs) for end Cap M14x14 DIN 965 A4
2000033	Lock Ring 28 DIN 472 AZ
A41100095V1.0	KB Mounting Assembly
H41100102V1.0	KB Sensor Head
A41100032V1.0	KB Measuring Board
A41100021V1.0	KB Analog Board (3 X 4-20 mA)
3200002	Graphic Display Board
A41100027V1.0	Keyboard KB - KC7
A41100094V1.0	KB Mounting Rack
A41100102V1.0	KB^2 Display Unit

9. Appendix 3

9.1. KB model selection

Type	Order Code	Description
K B 6		
K B 6		**KB/6 Sheet Break Detector with 6 meters (20ft) Fiber Optic Cable**
		KB Display Unit, 85...264VAC, 2 x Alarm relay outputs included
		Flexible Conduit for Fiber optic cable
	N	No Conduit
	C	Full Flexible SS316 Conduit 45mm (15') with Connectors
		Mounting Rack
	N	No adjustable mounting rack
	R	Adjustable SS316 Mounting Rack
		Analog output
	N	No Analog outputs for DCS trending (Analog outputs not needed for break alarm)
	A	3x 4-20 mA outputs for DCS trending
		KB-Connection PC Program
	N	No KB-Connection PC Program
	C	KB-Connection PC Program on CD disk
		RS485 / 232 Converter for PC program
	N	No RS485 / 232 Converter for PC program
	R	RS485 / 232 Converter for PC program, Rack mounting

Type	Order Code	Description
K B 9		
K B 9		**KB/9 Sheet Break Detector with 9 meters (30ft) Fiber Optic Cable**
		KB Display Unit, 85...264VAC, 2 x Alarm relay outputs included
		Flexible Conduit for Fiber optic cable
	N	No Conduit
	C	Full Flexible SS316 Conduit 45mm (15') with Connectors
		Mounting Rack
	N	No adjustable mounting rack
	R	Adjustable SS316 Mounting Rack
		Analog output
	N	No Analog outputs for DCS trending (Analog outputs not needed for break alarm)
	A	3x 4-20 mA outputs for DCS trending
		KB-Connection PC Program
	N	No KB-Connection PC Program
	C	KB-Connection PC Program on CD disk
		RS485 / 232 Converter for PC program
	N	No RS485 / 232 Converter for PC program
	R	RS485 / 232 Converter for PC program, Rack mounting

Type	Order Code	Description
K B 12		
K B 12		**KB/12 Sheet Break Detector with 12 meters (40ft) Fiber Optic Cable**
		KB Display Unit, 85...264VAC, 2 x Alarm relay outputs included
		Flexible Conduit for Fiber optic cable
	N	No Conduit
	C	Full Flexible SS316 Conduit 45mm (15') with Connectors
		Mounting Rack
	N	No adjustable mounting rack
	R	Adjustable SS316 Mounting Rack
		Analog output
	N	No Analog outputs for DCS trending (Analog outputs not needed for break alarm)
	A	3x 4-20 mA outputs for DCS trending
		KB-Connection PC Program
	N	No KB-Connection PC Program
	C	KB-Connection PC Program on CD disk
		RS485 / 232 Converter for PC program
	N	No RS485 / 232 Converter for PC program
	R	RS485 / 232 Converter for PC program, Rack mounting

10. Appendix 4

10.1. Technical specifications

Ambient temperature	Sensor head and fiber optic cable: -10 to 180 ºC (15 ºF to 356 ºF) Electronics unit: -10 to 60 ºC (15 ºF to 140 ºF)
Fiber optic cable	KB/6: 6 m (20'), KB/9: 9 m (30') or KB/12: 12m (40')
Fiber optic cable conduit	Airtight conduit 25,4 mm (1") OD, AISI 316 (L6= 4370, L9=7370, L12=10370)
Installation	Sensor distance from the web 5...30 cm (2...12").
LED pulse frequency	1 kHz
Power supply	90 - 264 VAC, 50/60 Hz
Power consumption	15 W
Enclosure class	IP 66 (Nema 4X)
Purge air connection	Dry instrument air 0.5 – 3.0 bar (7 - 40 psi), 6/4 mm (1/4") connector, normal consumption 30-100l/min
Digital outputs	2 x Closing or opening contact max. 250 VAC, 2A; 220 VDC, 2 A for Break signal and Maintenance alarm
Alarm output delay	Min. 15 ms from the actual break
Analog outputs	Optional 3 pcs 4 - 20 mA max 600 ohm
PC connection	KB PC terminal for set up and monitoring as an option. RS 485 connection to PC. Optional RS 485 / RS 232 converter available for a PC
Dimensions (L x H x D) and weight	Electronics Unit 323 x 237 x 70 mm (12,7 x 9,3 x 2,8"), 3 kg (6,6 lbs) Sensor head Ø 33 mm (1"1/4) AISI 316, pipe 1500 mm (59") long, 4 kg (9 lbs)

11. Appendix 5

11.1. Settings and variables

Parameters:
Mode: Detect Enabled or Maintenance
Light source: RGB or IR
Selected signal: _____
Detect limit: _____
Direction: Break < Det.Limit or Break > Det. Limit
Alarm signal: _____
Low alarm limit: _____
High alarm limit: _____
Drift Alarm:_____
Drift Alarm limit: _____
Drift Alarm direction: _____

Configuration
Autolimit & Autoalarm:

Sampled signal levels:	Paper	Break
RED	_____	_____
GREEN	_____	_____
BLUE	_____	_____
IR	_____	_____

Measurement configuration:

Detect filter:	_____
Measurment cycle:	_____
Tx Power:	_____
Rx Gain:	_____

Set-up

Analog signals:	Low limit	High limit
Analog output 1: _____	_____	_____
Analog output 2: _____	_____	_____
Analog output 3: _____	_____	_____

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FI 87100 Kajaani, Finland
E-mail: kpm@prokajaani.com
Internet address: www.prokajaani.com

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2012-08