4   Sapphire Head Adjustment

4.1 Introduction

4.1.1 Info

The proportions of the test images in this document may differ from the real test prints since the images in the document are for illustration purpose only!

4.1.2 Tools

LD2099801   Head locking key (Allen key) 3.0mm
LH2099800   Head adjustment key Tx10 ball head **(new)**

4.1.3 Remote Connection

For an extensive alignment (more heads...) it is possible to set up a remote control with e.g. your laptop.
The benefit is that you don't need to walk around the printer all the time to push the buttons on the Rho's operator panel.

- Install the VNC viewer on your Laptop (can be found in the web or on the caldera stations web interface)
- Enable the remote access on the Rho's workstation: Applications (Start menu) – Preferences – Remote Desktop
- Connect your laptop to the Rho's WS (direct or over customer LAN) and make the necessary network settings (IP, mask,...)
- Enter the Rho's Desktop via VNC to control it from your PC

4.1.4 Print Head

Print Head: Top view
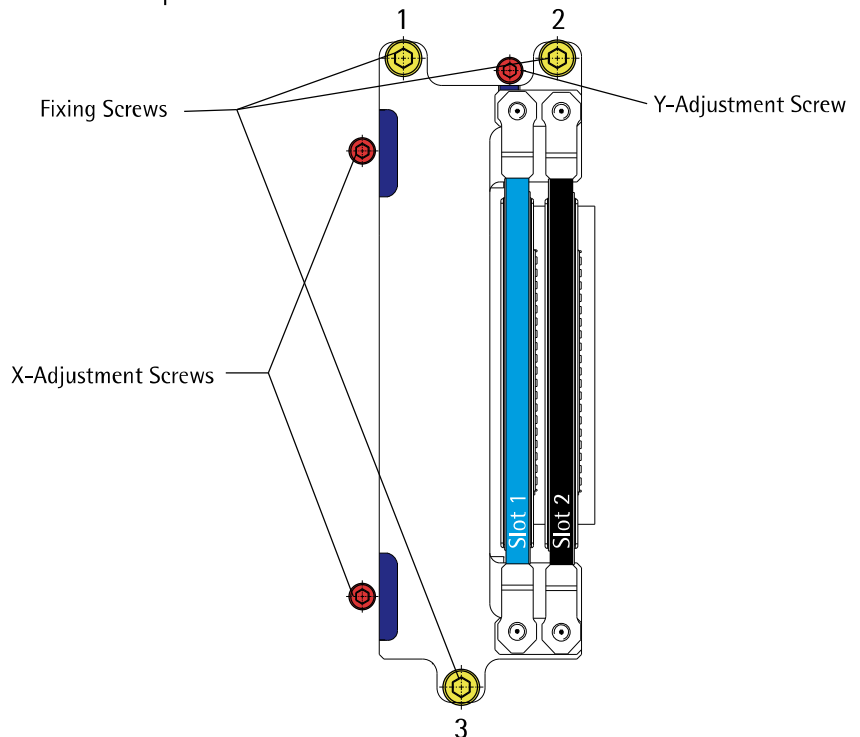
- The fixing screws must be loosen for any mechanical head adjustment
- By turning the adjustment screws CW the head will move away from the screw
- By turning the adjustment screws CCW only the head will not move to the screws, in this way additional the head has to be pushed with a little force by hand
- At the Y-Adjustment screw 1 rotation means approx. 1 Pixel
- Do not forget to close the fixing screws (order: 3, 2, 1) after the mechanical adjustment!

4.1.5 Slot Geometry

Slot 1

Slot 2

Slot 1 — Cyan

Slot 2

Slot 1

Slot 2 — Balck
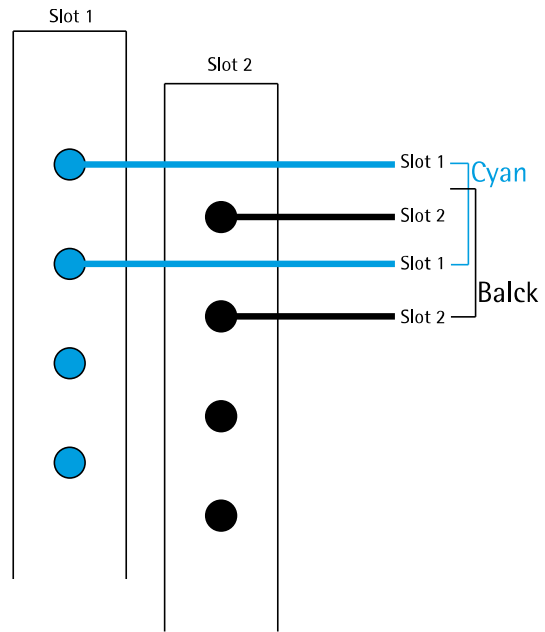
1 Slot 256 nozzles = 1 Head 512 nozzles

4.1.6 Print Head Arrangement

(Seen from printers output side)

CMYKcmWV

CMYKWV

F5/1 YM1 CK1 KC1 MY1 F5/2

YM2 CK2 KC2 MY2

F6/1 YM3 CK3 KC3 MY3 F6/2

YM4 CK4 KC4 MY4

CMYKBOcm

mc1 OB1 YM1 CK1 KC1 MY1 BO1 cm1

mc2 OB2 YM2 CK2 KC2 MY2 BO2 cm2

mc3 OB3 YM3 CK3 KC3 MY3 BO3 BO3

mc4 OB4 YM4 CK4 KC4 MY4 BO4 cm4
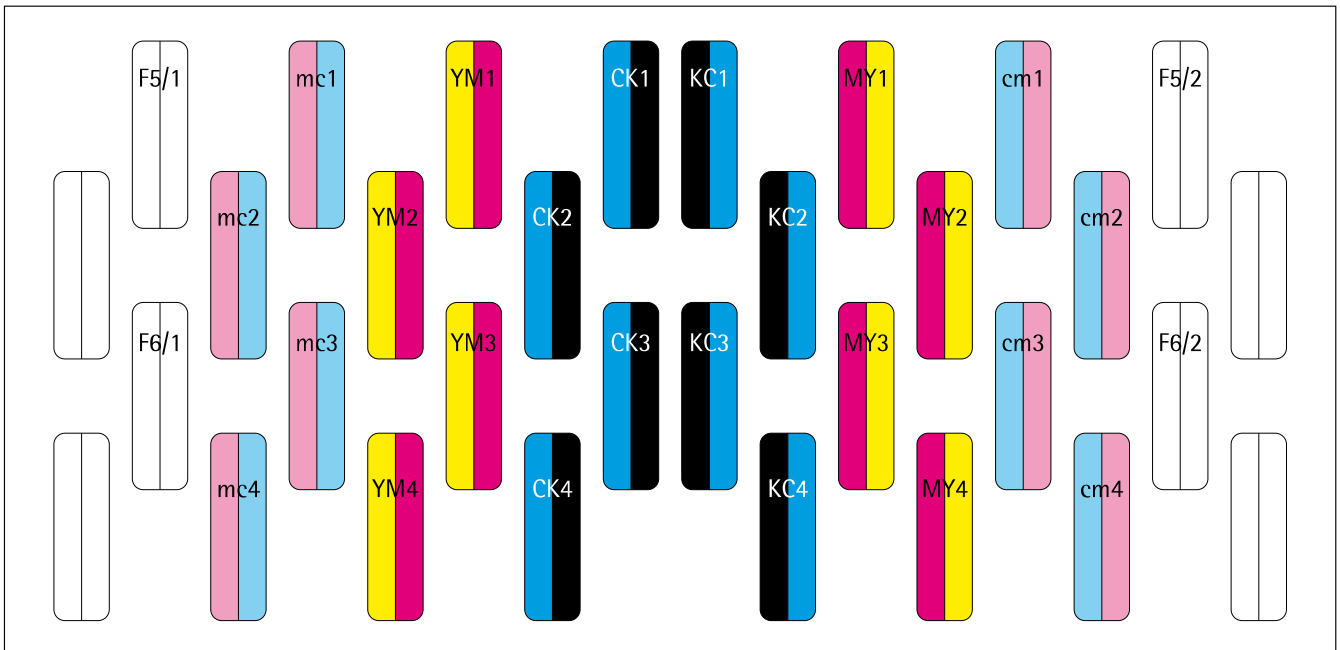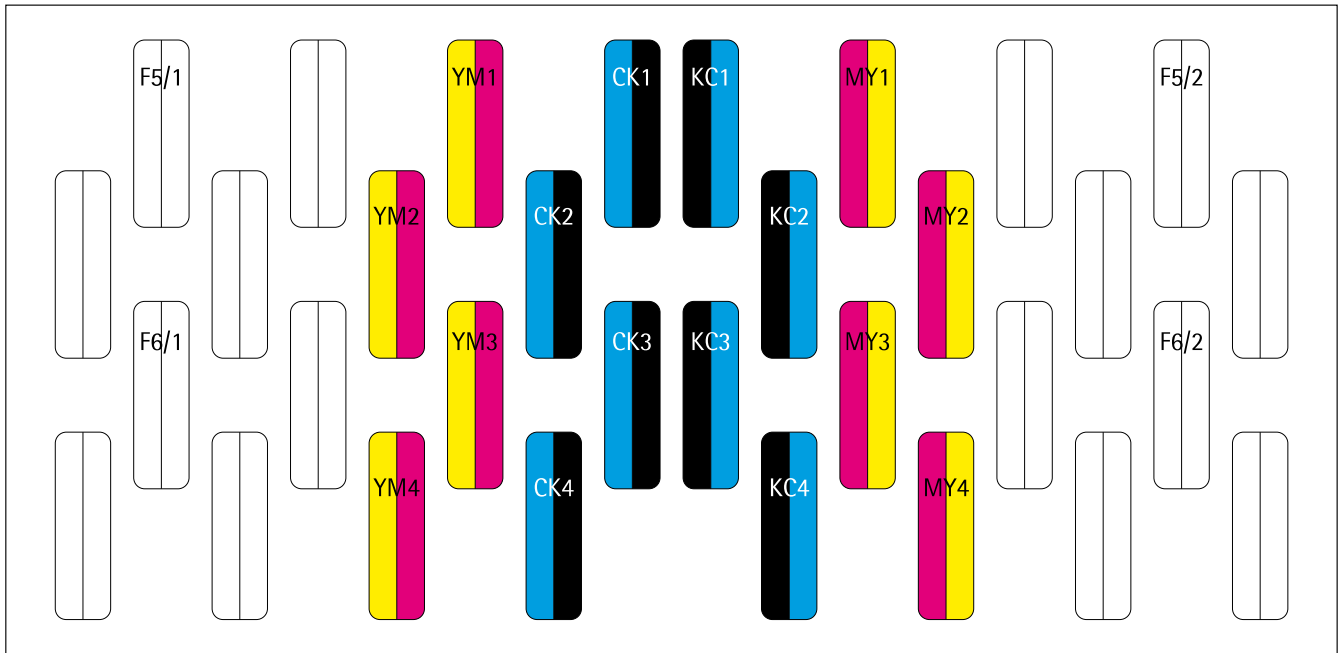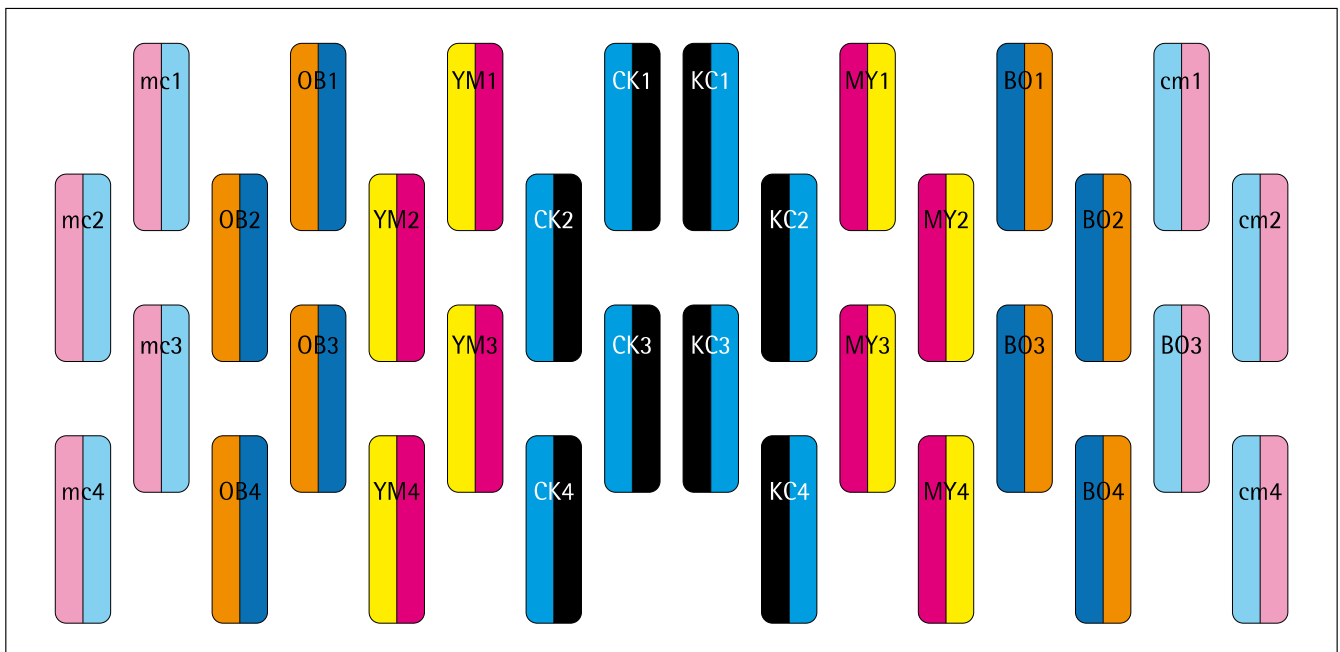
4.1.7 LOIS Calculation & Ink Temperature

Depending on the ink temperature (check Setup file)

42°C	Read value – 348 = LOIS Offset	
47°C	Read value – 318 = LOIS Offset	
51°C	**Read value – 290 = LOIS Offset**	**CMYKBOcmV (Rigid 30 DM)**
53°C		**W (White HD)**

Set the temperature of white heads to 51°C for the Lois calibration and to 53°C for printing!

4.2   Mechanical Adjustment CMYKcmBO

4.2.1   Y Offset

For a complete head alignment procedure (all print heads) it is needed to put all print heads to an offset in y-direction:
- Loosen all adjustment screws
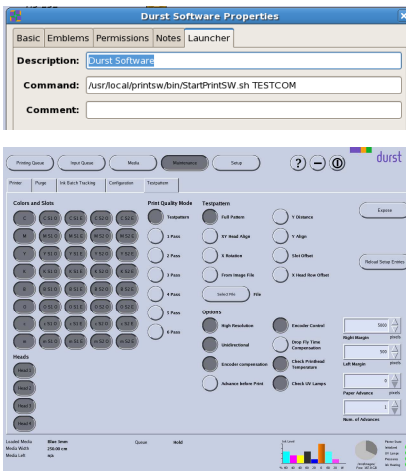- Push all heads to the upper left corner
- Tighten all fixing screws
- Turn all adjustment screws CW until they are touching the heads frame (resistance is tangible)
- Loosen all fixing screws a few rotations
- Turn all Y-adjustment screws 1.5 rotations CW to get the offset

4.2.2   Printing Method

- To **activate TESTCOM mode** in the *Durst Print Software* right click the icon on the Desktop
- Go to *Properties – Launcher*
- Change *Command* to: /usr/local/printsw/bin/StartPrintSW.sh   TESTCOM

- All the pattern are printed in the *Durst Print Software* on the *Maintenance* page – Tab *Testpattern*
- Each image will autoselcet its default print parameters (*High Res., Unidir., Check PH Temp.* and *Check UV*)

- Enter 4200 (Rapid) or 2100 (Presto) or 1050 (Basic) in the *Paper Advance* field for an advance of one pass length

4.2.3   X Rotation
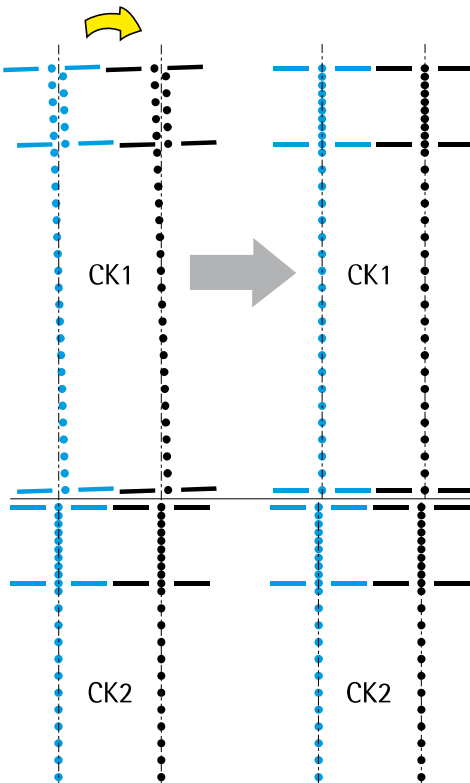
Fig: Rotation on CK heads

- Print *XRotation*
- The image is printed in two steps and showing the lineup of the *top and bottom area within each head*
- If these areas are not aligning the head is out of angle
- The heads can be straightened by using the X-Adjustment screws
- Finally the **dots of short and long block must align** perfect

- In this sample a CW rotation of the headCK1 would be needed (turn CW on upper X-Adjustment screw, or turn CCW on lower screw)
- The adjustment can be done at all heads at the same time
- The alignment between the heads is not important yet!

4.2.4 Y Distance (CK heads)

- Activate CMYK slots only
- Print *YDistance*
- The Y-Distance adjustment is done on the CK heads only since CK are the reference heads in each level
- This adjustment must be done Level by Level (CK1 to CK2, CK2 to CK3, ...) and carefully as this **will affect the following steps**!

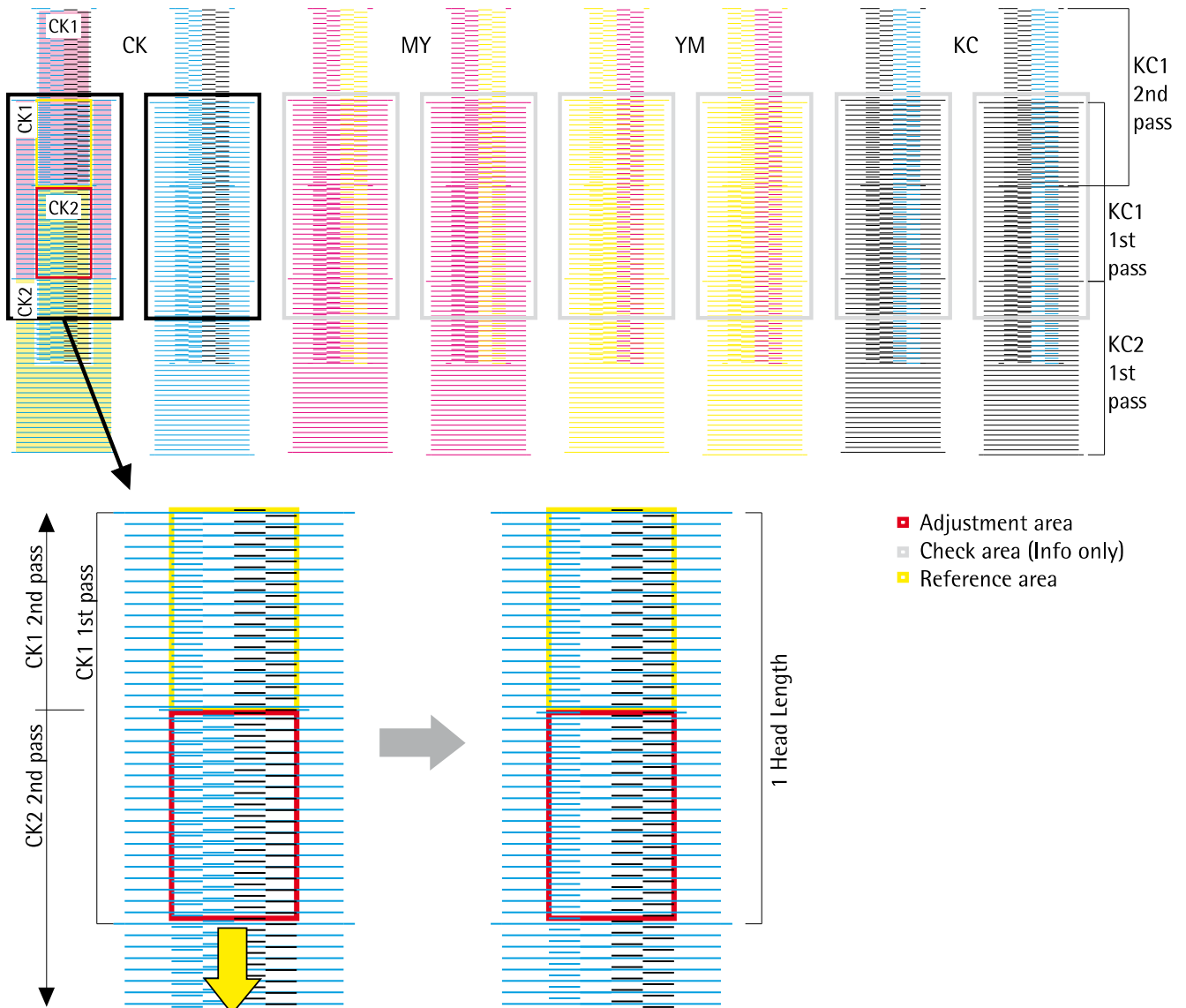

- Adjustment area
- Check area (Info only)
- Reference area

Fig: Pattern showing two heads per color only!

- Check the line setup in the *Reference area*
- Make the **layout of the *Adjustment area* equal to the layout of the *Reference area*** by moving the CK2 head up or down
- It is not required to get the short lines in the center of the long ones
- Take care of the border area to have the pattern with the same trend all over
- In this sample it would be necessary to move the lower head down
- Then repeat the procedure step by step to all other CK heads
- For that adjustment step a very good alternative to the magnifier is the naked eye, if the pattern looks the same all over (no color or brightness difference) the adjustment should be fine
- The *Check areas* are showing the alignment of the other colors internally and cannot be checked yet, once all the mechanical adjustment is done this print can be repeated – then all the areas should look equal to their reference areas
- Now the CK heads are not to be touched any more (except fixing)

4.2.5 Y Alignment – KC
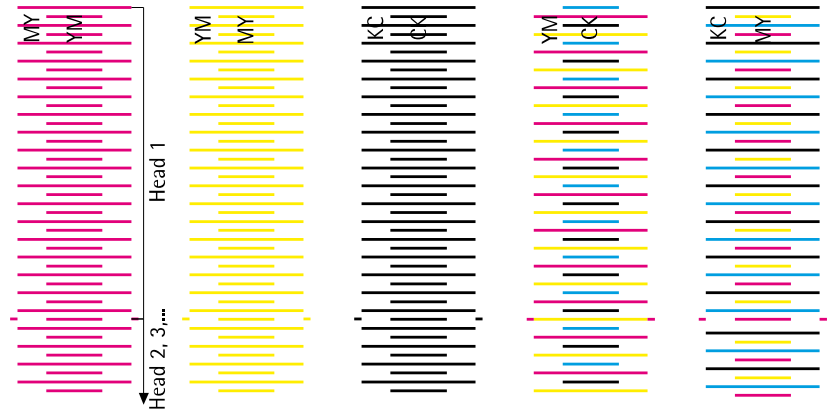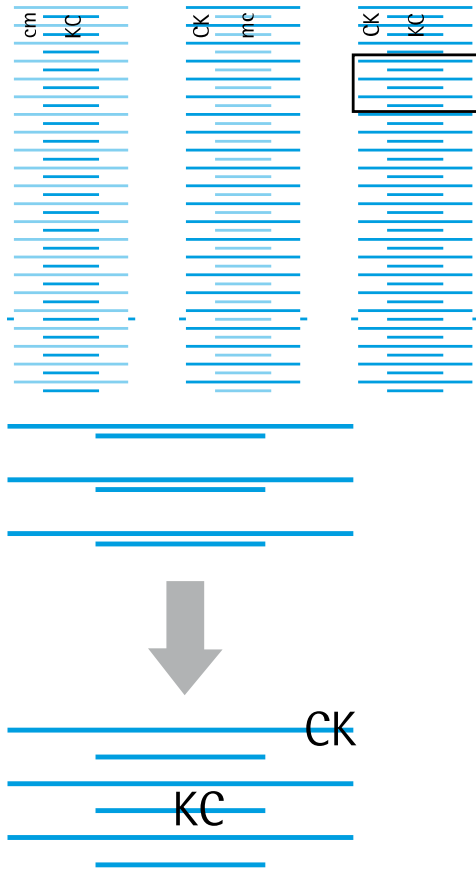
- Print *YAlign*
- This pattern shows the alignment of all heads to the CK reference heads

- Analyze the Cyan pattern
- The **short lines** need to be exactly in the **center of the long lines**
- This can be adjusted by moving the KC heads up or down
- Can be done with all KC heads at the same time
- In this sample the KC head needs to be shifted down
- As result also the Black pattern should get equal distances
- Both pattern (Cyan and Black) need to have a **long line at top** and **short line at bottom**

4.2.6 Y Alignment – YM, MY, BO, OB, cm, mc
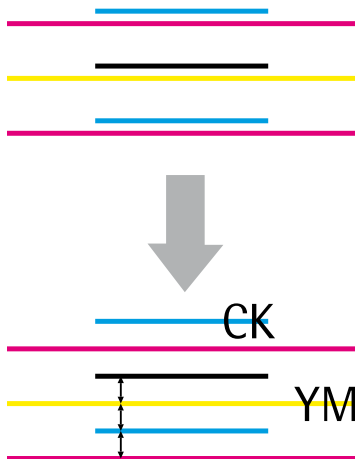
- Print *YAlign*
- This pattern shows the alignment of all heads to the CK reference heads

- Analyze the CK/YM, KC/MY, cm/KC and mc/CK pattern
- The **short lines** need to be exactly in the **center of the long lines**
- This can be adjusted by moving the YM, MY, cm or mc heads up or down
- Can be done with all YM, MY, cm and mc heads at the same time
- In this sample the YM head needs to be shifted down
- As result also the Magenta and Yellow pattern should get equal distances
- **All pattern except** the **CK/YM** need to have a **long line at top** and **short line at bottom**
- **CK/YM** pattern needs to have a **short line at top** and **long line at bottom**

BO, OB:
- The **short lines** need to be exactly in the **center of the long lines**
- Adjust this by moving the BO and OB heads up and down
- The long line needs to be at the top and the short line at the bottom
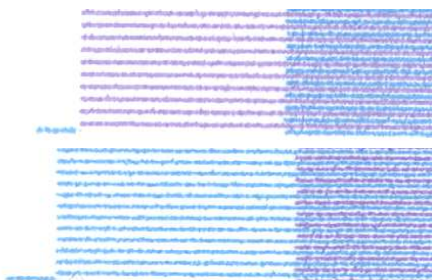
4.3 Mechanical Adjustment White + Varnish

4.3.1 Info

- Purge the white heads before doing the adjustment
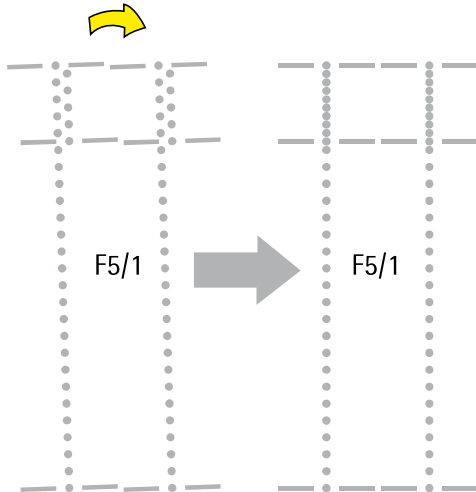- White can be printed on transparent materials (rough side)
- White and varnish pattern can be highlighted with a orange or pink text marker

4.3.2 X Rotation

- Print *XRotation(Spot)*
- The image is printed in two steps and showing the lineup of the *top and bottom area within each head*
- If these areas are not aligning the head is out of angle
- The heads can be straightened by using the X-Adjustment screws
- Finally the **dots of short and long block must align** perfect

- In this sample a CW rotation of the head F5/1 would be needed (turn CW on upper X-Adjustment screw, or turn CCW on lower screw)
- The adjustment can be done at all heads at the same time
- The alignment between the heads is not important yet!

4.3.3 Y Alignment – W, V Heads 1
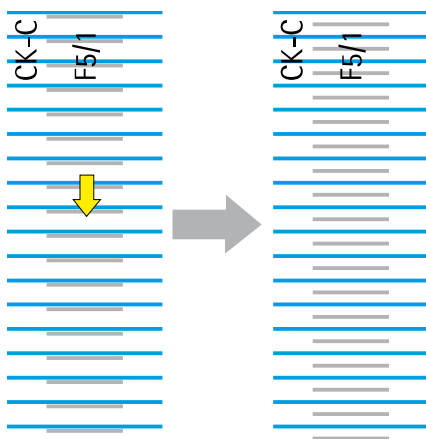
- Print *YAlign(Spot)*
- Bring the lines of F5/1 (and, or the F6/1) in the center of the cyan lines
- The pattern must start with a long (cyan) line at top and end with a short line at bottom

- Make sure the first and last nozzle of the spot color is working
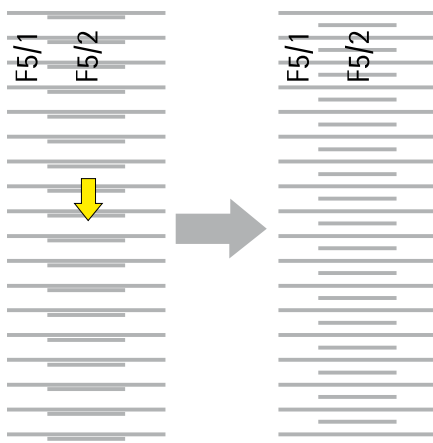- In this sample the F5/1 head needs to go down

4.3.4 Y Alignment – W, V Heads 2

- Print *YAlign(Spot)*
- Bring the lines of F5/2 (and, or the F6/2) in the center of the lines of the number 1 heads
- The pattern must start with a long line at top and end with a short line at bottom

- Make sure the first and last nozzle of the spot color is working
- In this sample the F5/2 head needs to go down

4.4 Slot Offset, Voltage

4.4.1 Parameters and Basics

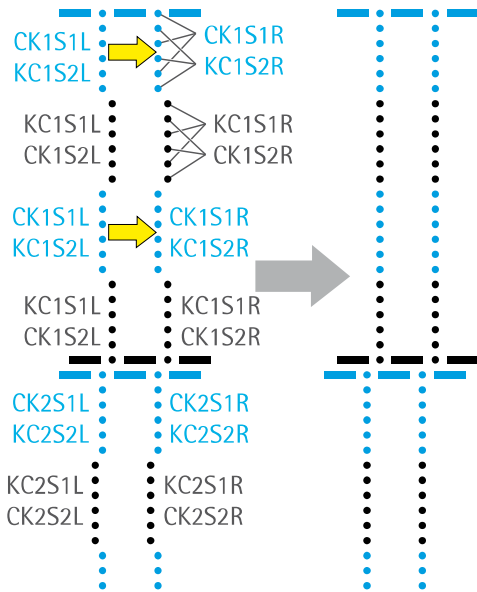| Parameter	Par. Description		Range	Effect/Description	Standard Value	Unit
RhoSlotOffset**AABSCD** *e.g. RhoSlotOffsetCK1S1L*	A B C	Color Group Head Number Slot Number	–10 /+10	Increasing moves to the right (seen from machines output side)	0	Pixel
RhoSlotOffsetRow**F** *e.g. RhoSlotOffsetRow1*	D F	Direction Head Row (Level)	–10 /+10	Increasing moves to the right (seen from machines output side)	0	Pixel
RhoHead**AABSC**Voltage *e.g. RhoHeadCK1S1Voltage*			75 - 95 (practical)	(Increasing means an "earlier" firing and bigger drops)	Values from Spectra protocol	Volt
RhoDFTCDataHMD			0.150 – 0.500	Head Media Distance steps for Drop Fly Time Calculation	0.150 0.200 0.350	cm
RhoDFTCDataDistance**E** *e.g. RhoDFTCDataDistance400 RhoDFTCDataDistance600X*	E	Resolution	practical: –0.300 to –0.100	Measured distance according to RhoDFTCDataHMD	*No standard, e.g.* –0.104 -0.124 -0.172	cm
RhoJetStraighteningEnabled	-		0/1	Deactivates/activates the Jet straightening pulse (JSP)	-	-
RhoHeadVoltageMultiplier	-		practical: 0.6 - 1.5	Factor for effective head voltage values	JSP off: 0.88 JSP on: 1.1	-

4.4.2 Value Setting
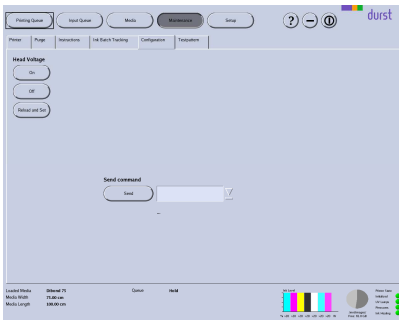
- For a value change in the DurstPrinter.setup file it is not needed to exit the Print SW
- Open the file, modify the values and safe it (exit not needed)
- To activate Slot Offsets: Press the *Reload Setup Entries* button on the *Testpattern* tab in *Maintenance* window
- (To activate new Head Voltage values: Press the *Reload and Set* button on the *Configuration* tab in *Maintenance* window)
- Print *bidirectional*
- All corrections are done in the file *DurstPrinter.setup* (path: /usr/local/printsw/)

4.4.3 Slot Offset Color Internally
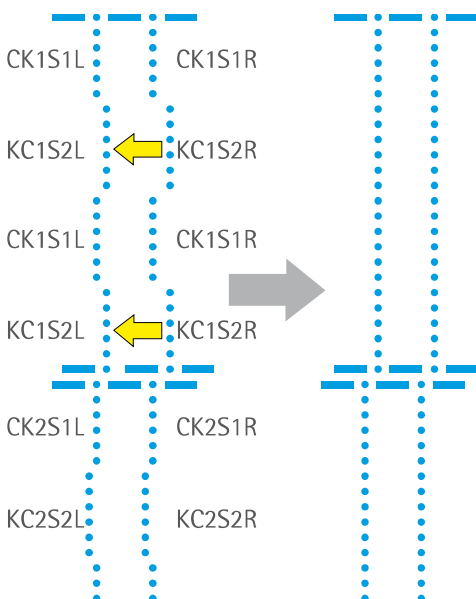
- To be printed with Head Media Distance 2mm (since this is the most common printing distance)
- **New:** There are individual parameters for both directions (left and right)

- Print *SlotOffset*
- Move the left and the right line of all 4 sections within one head length to get two straight lines
- Parameter: *RhoSlotOffset*
- Adjust the distance between all lines to the same value (the experience has shown values between 1.2 and 1.4 mm)
- This alignment can be done with all heads of all colors at the same time
- The alignment between the heads is not important now

- In that sample the KC1S2L and KC1S2R needs to be moved to the left (decrease the values) whereas the KC1S2R might need a bigger shift

4.4.4 Slot Offset to Black

CK1S1L → CK1S1R
KC1S2L → KC1S2R

KC1S1L → KC1S1R
CK1S2L → CK1S2R

CK1S1L → CK1S1R
KC1S2L → KC1S2R

KC1S1L → KC1S1R
CK1S2L → CK1S2R

CK2S1L → CK2S1R
KC2S2L → KC2S2R

KC2S1L → KC2S1R
CK2S2L → CK2S2R

- Print *SlotOffset*
- Move the left and the right line of the colored (non black) sections within one head length to get two straight lines
- Parameter: *RhoSlotOffset*
- Pay attention to keep the same distance between all the lines
- To move one block it is necessary to change 4 parameters!

- This alignment can be done with all heads of all colors at the same time
- Avoid from moving the black lines
- The vertical alignment between the heads is still not important

- In that sample the CK1S1L, CK1S2L, CK1S1R and KC1S2R need to be moved to the right (increase the values)

4.4.5 Slot Offset between Rows (Levels)

Row 1

Part of Row 4

Row 2

Part of Row 4

Row 3
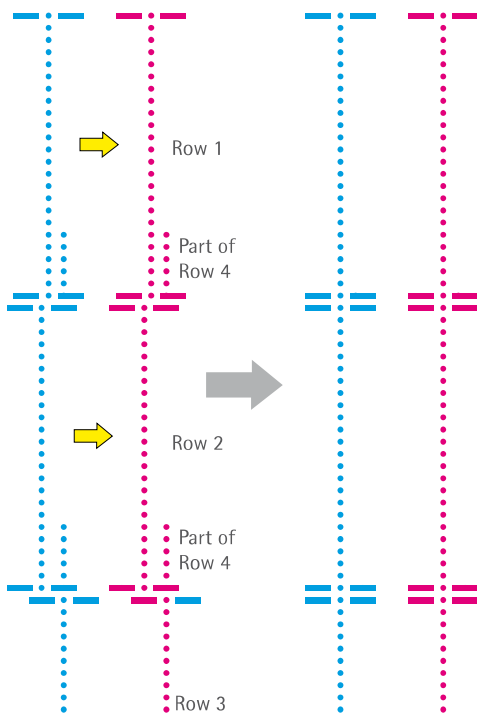
- Printmode: *Unidirectional*
- Print X*HeadRowOffset*
- The image is showing position of row 1, 2 and 3 in relation to row 4
- Move the rows 1 – 3 to line up at the bottom area with the dots from row 4
- Parameter: *RhoSlotOffsetRow*

- This alignment is done for all colors at the same time in one step

In that sample the Row1 and Row2 need to be moved to the right (increase the values, Row2 more than Row1)

Attention: Carriage is moving 4 times in both directions!

4.4.6 Slot Offset for F5 and F6

Detailed explanation will follow...

Repeat the steps from 4.4.4 and 4.4.5 with using the *SlotOffset(Spot)* and *XHeadRowOffset(Spot)* image

4.5 Drop Fly Time Compensation

Parameter	Standard Values	Effect/Description	Range	Unit
RhoDFTCDataHMD	0.150 0.200 0.350	Head Media Distance steps for Drop Fly Time Calculation. 3 measurements – division by space	0.150 – 0.500	cm
RhoDFTCDataDistance400	*No standard, e.g.* -0.151 -0.189 -0.297	Measured distance according to RhoDFTCDataHMD For 600dpi High Speed/all colors	practical: -0.320 to -0.100	cm
RhoDFTCDataDistance600X	*No standard, e.g.* -0.104 -0.124 -0.172	Measured distance according to RhoDFTCDataHMD For 600+dpi default/all colors	practical: -0.280 to -0.060	cm

4.5.1 Adjustment
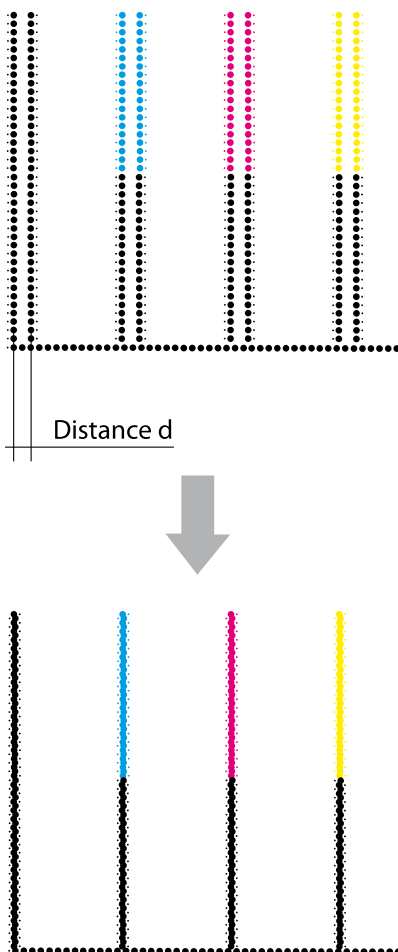
Distance d

1. For an easier adjustment make a safety copy of the setup file and then set the compensation values to 0 in the original file.
2. Print Encodertestimage for *HighSpeed* and Standard (*600dpi)* with all the different distances from *RhoDFTCDataHMD* (default: 6 times)
3. Measure the *Distances d* at all print outs
4. Close the DurstPrinter Software
5. Enter the compensations values *d* in the file DurstPrinter.setup
6. Save and close the file and do the prints again
7. Make the fine tuning now, to get the lines perfect covered

4.6 Encoder Calibration

4.6.1 Adjustment

1. Print *Encodertestimage* (Standard – 600dpi)
2. Analyze the *Encodertestimage* according to the illustrations below
3. Change the *Encoder Basic Calibration* Value
4. Redo this procedure with lower and higher values and compare them to get the perfect encoder calibration value
5. For critical applications the offset can be calibrated even depending on the print pass: Therefore it is necessary to change the *RhoEncoderOffsetXPass* parameters in the *DurstPrinter.setup* file
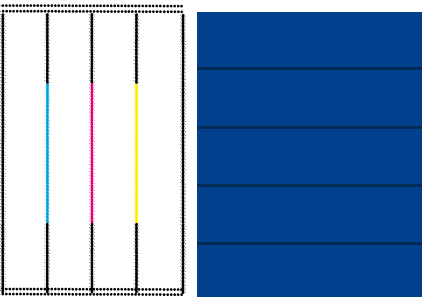
For the rough adjustment make changes in steps of tens or more to get a visible difference!
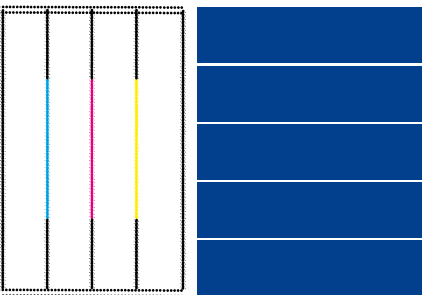
- Double lines in horizontal direction
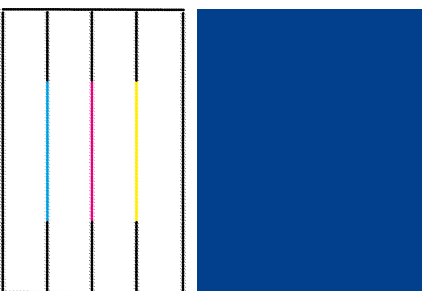- White gaps in the color field

Solution:
- Lower the Encoder Offset Value

- Double lines in horizontal direction
- Dark overlaps in the color field

Solution:
- Enhance the Encoder Offset Value

- Encoder Offset perfect adjusted!
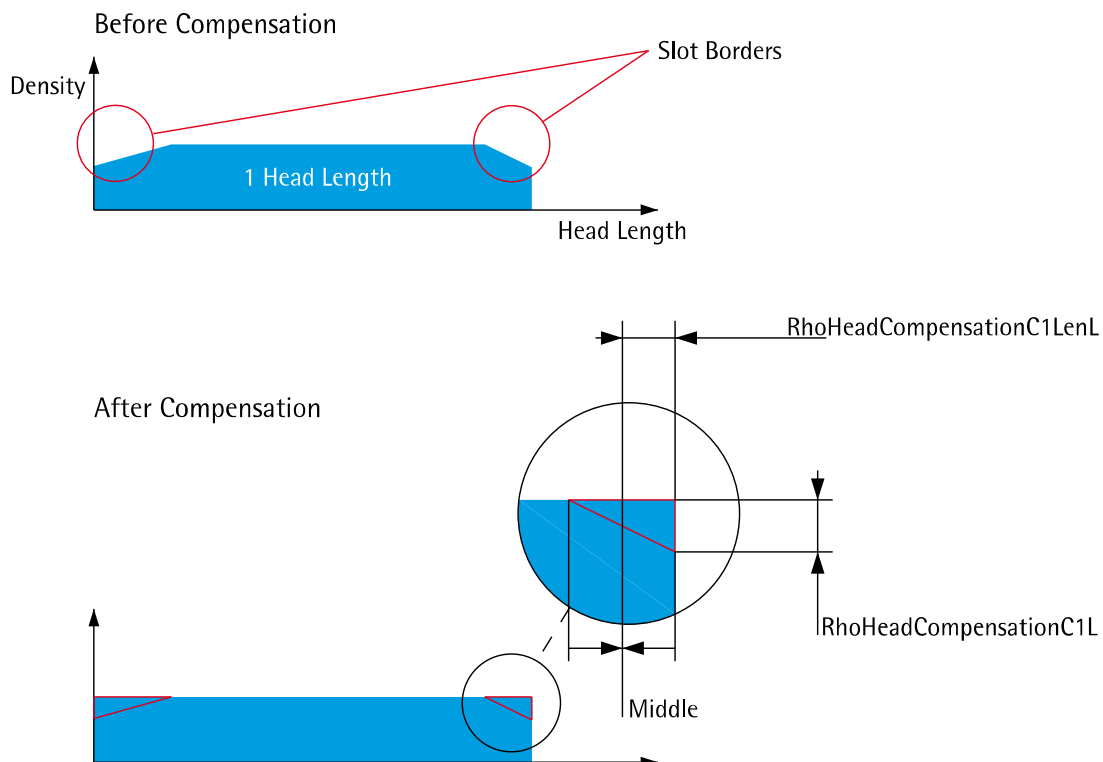
4.7 Slot Border Compensation

Purpose
Reduction of the banding effect

The slot geometry makes it possible, that the ends of the slots are not printing with the same density as the nozzles in the centre. The Slot Border Compensation can minimize this effect by increasing/decreasing the density in these areas.
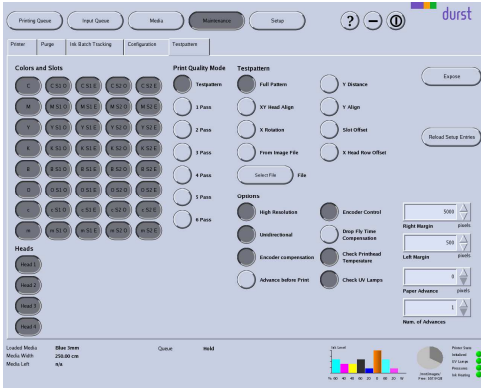
It is recommended to print a few square meters before doing this adjustment!

4.7.1 Parameters

Parameter	Par. Description	Range	Effect/Description	Unit
RhoHeadCompensation**ABP** *e.g.* RhoHeadCompensationC1U RhoHeadCompensationC1L RhoHeadCompensation5_2U RhoHeadCompensation5_2L RhoHeadCompensationm1U RhoHeadCompensationm1L	A Color B Head Row(Line) P Position	0 – 10 (practical) -10 – 10 (practical) from SW 1.1Rev03RC4 up	Increasing enhances the density for the respective length at the upper or lower end of **all slots of one color in one line**	%
RhoHeadCompensation**ABLenP** *e.g.* RhoHeadCompensationC1LenU		0.000 – 1.625	Value for ½ of the effected compensation length of all slots of one color in one line. Measured from Slots 1st or last nozzle.	cm
RhoHeadCompensation**AB** *e.g.* RhoHeadCompensationC1		-40 – 60 (practical)	Value for increasing/decreasing the density over the whole slot length of **all slots of one color in one line**	%

Before Compensation
Density
Slot Borders
1 Head Length
Head Length

After Compensation
RhoHeadCompensationC1LenL
RhoHeadCompensationC1L
Middle

4.7.2 Adjustment

1. Load Bluebackpaper (the wider, the better) in *Printer Software* with a standard HMD (2 mm)
2. Deactivate *Head 2, 3* and *4* in the *Testpattern* tab in the *Maintenance* window.
3. Activate all *slots of one color* (e.g. C1O, C1E, C2O, C2E) and set the *Paper Advance* to "*1024*"
4. Activate *Unidirectional* and *2 Pass* at *Print Quality Mode*
5. Set the *Num. of Advances* to *4* or more and choose *Full Pattern*
6. *Expose* the print and take it out of the machine for analysis
7. Take the density and length values in the middle (see picture above) of the weak areas!
8. Make the corrections in the *DurstPrinter.setup* and redo until the result is ok – do it for all the other colors (in some cases also the quality of white can be enhanced pretty much)
9. To do the procedure for the heads in the 2nd 3rd and 4th level (row), activate the specific *Head* only.

e.g. Cyan Slots of 1st Level
Before Compensation
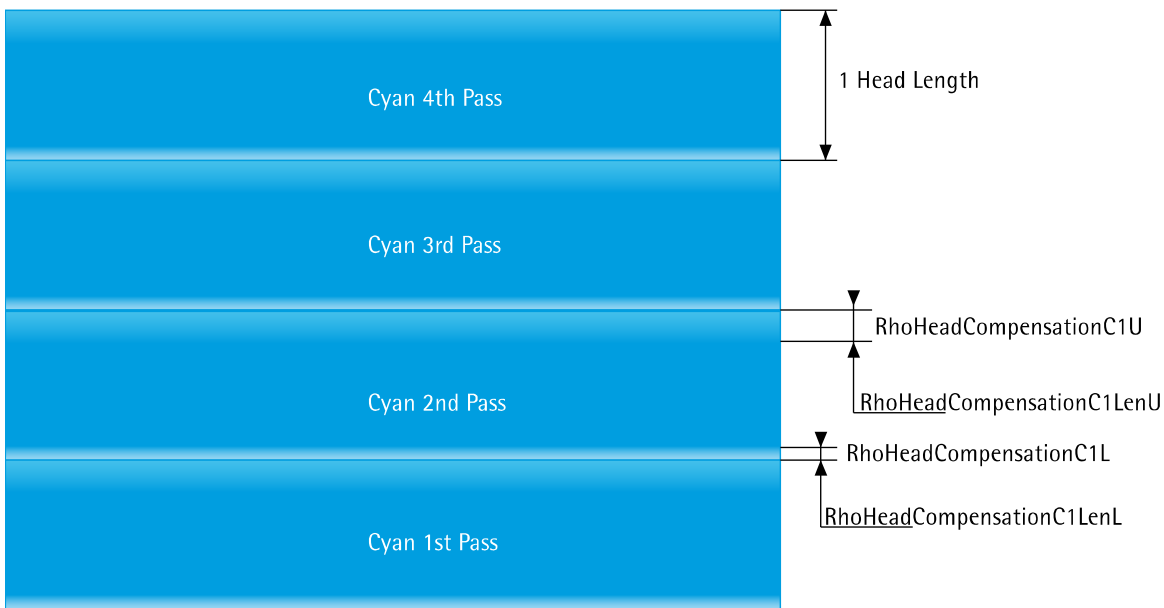
After Compensation
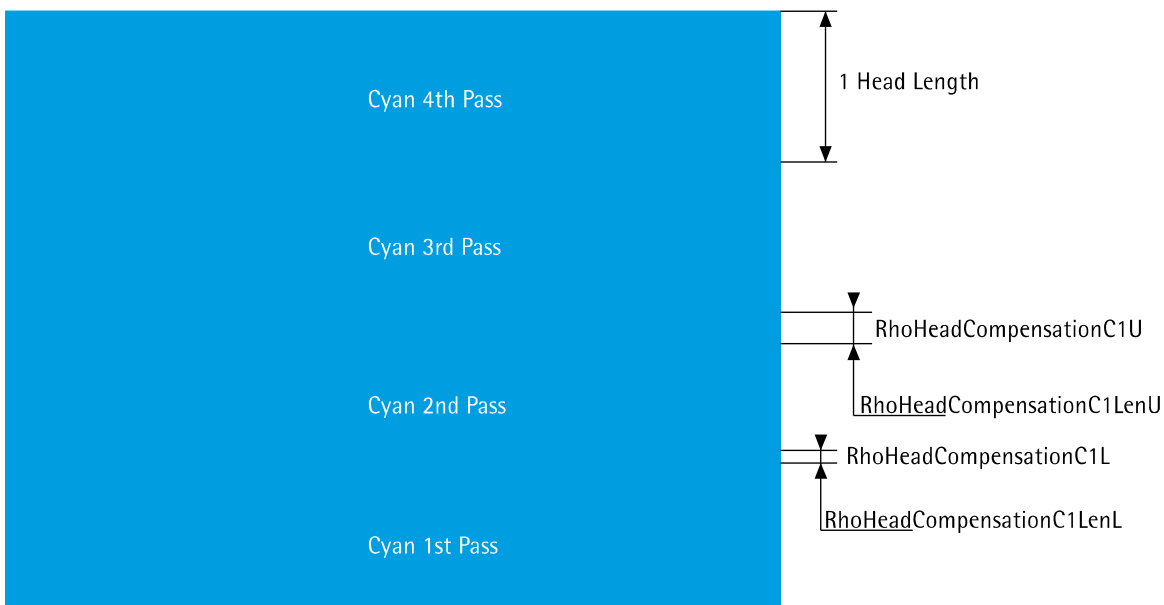
4.8 Density Compensation

4.8.1 Parameters

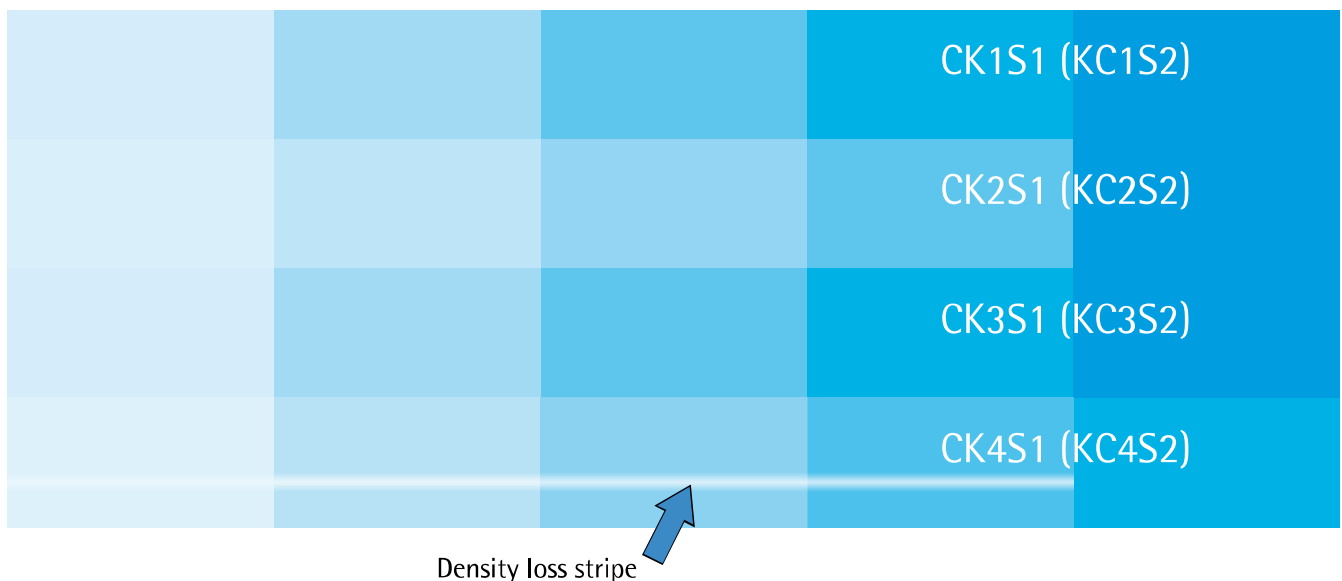| Parameter	Par. Description		Range	Effect/Description	Unit
RhoAdvancelessMode	-		0/1	Printing images without advance (advance step = carriage length) Activate for Density Compensation procedure	-
RhoHead**AABSC**Voltage e.g. *RhoHeadCK1S1Voltage* *RhoHeadcm1S2Voltage*	A B C	Color Group Head Number Slot Number	75 - 95 (practical)	(Increasing means an "earlier" firing and bigger drops)	Volt

4.8.2 Requirements

- Image files separated from Durst Lienz C_100_80_60_40_20............lm_100_80_60_40_20
- Activate the RhoAdvancelessMode in the Setup file
- Load the image files direct into the /mnt/images folder (Do not run the files through the Caldera Rip)

4.8.3 Procedure

1. Disable all KC heads (Unplug the fire pulses. In one of the next sw versions the possibility for enabling/disabling heads via buttons will be implemented.)
2. Adjust print quality: Pass 2, UNI, 2.0 HMD
3. The files can be cropped in their height to one carriage length (HS: 260mm, Presto: 130mm)
4. Print the color bars for all slot groups
5. Make corrections on the voltage parameters in the Setup file to get equal color/density on all headlines.
6. Activate the new voltage settings with the *Reload and Set* button in the tab *Other*.
7. A step of 1 volt already changes the density noticeable
8. Density differences possibly may not be visible in all color steps
9. Depending on its strength heads with density loss stripes like head 4 in the sample below can be replaced (confirm at Service Department Lienz)

Before Compensation

Density loss stripe

After Compensation

CK1S1 (KC1S2)

CK2S1 (KC2S2)

CK3S1 (KC3S2)

CK4S1 (KC4S2)

4.9   Print Position Offsets

Parameter	Requirement	Effect/Description	Unit
RhoRefPosCarriage	3 digits e.g. -43 043	Increasing moves the print to the purge side, decreasing moves it in the opposite direction 1mm = 16 Pixel	Pixel
RhoStopSensorOffset		Increasing moves the print to the machines input side (border grows), decreasing moves to machines output side (border shrinks)	1/10mm
RhoLeftStopSensorOffset			1/10mm
RhoLeftEdgeGuidePositionCM	e.g.: 253.9	Position for Left Edge guided printing measured from purge side	cm
RhoBoardMeasurementCalibrationFactor	e.g.: 0.993310		

4.9.1   X – Direction (Carriage Direction)

- Take a well cut (straight edges, right angles) board
- Create a Media Channel according to your board with 0 as default Media Margins on all 4 sides
- Print a cropped image (ideally a plain color field) aligned to the **right** side with a custom border (e.g. 1cm)
- Measure the real border
- The difference between the entered and the real border can be compensated with the parameter *RhoRefPosCarriage* in the DurstPrinter.setup file
- The *PrintSoftware* must be closed when changing the parameter
- Reread the Setup file in the *Testcom* and send the new offset to the Rho
- Reinitialize the print carriage (with the *GoInit* button)

4.9.2   Y – Direction (Media Transport Direction)

- Take a well cut (straight edges, right angles) board
- Create a Media Channel according to your board with 0 as default Media Margins on all 4 sides
- Print a cropped image (ideally a plain color field) aligned to the **top** side with a custom border (e.g. 1cm)
- Measure the real border
- The difference between the entered and the real border can be compensated with the parameter *RhoStopSensorOffset* in the DurstPrinter.setup file
- The *PrintSoftware* must be closed when changing the parameter