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ADAPTIVE PRINTHEAD CONFIGURATION TO PROVIDE FUNCTIONAL COMPENSATION TO THE SYSTEM WITH PHYSICAL FAILURES TO MINIMIZE THE IMPACT OF PRODUCTIVITY

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Adaptive printhead configuration to provide functional compensation to the system with physical failures to minimize the impact of productivity

The idea proposed in this disclosure is focused to minimize one of the most important metrics for our industrial customers. Printing down is not evitable at all from time to time, so it turns into downtime, that can be from hours to days within most of cases which are not predictable. If unfortunately, at the same time, the customer is managing urgent jobs which do not have enough margin in time, it will end up most of time with financial losses due to delivery delay and/or compensation to his/her customer.

In this disclosure, the concept of adapting printhead configuration is disclosed when the system has functional issue related with PHs (printheads). It could be due to the issue from the PH itself, the PH related electrical hardware, PH dedicated primer, ink delivery system, and interaction between what are mentioned above. With a pre-determined contingency configuration, in case the system error is detected, the job will be interrupted and continue printing with the more stable configuration while waiting for the fix or service. For example, one of our customers have a critical order for an important event that needs to be printed by the end of the week. After printing a few meters one PH starts to have communication problems, the operator tries to reseat the PH but the issue continues. He decides to replace it without success. The only solution he has is to call the HP service and arrange a visit/repair. He is forced to stop the production and probably he won't meet his deadline and his customer will be very upset.

In which conditions, the configuration change will be triggered?

- Customer could trigger it manually if one PH does not provide stable print quality, if one PH have intermittent issues and he would like to print the next job without any stop.
- Nozzle health (detected by drop detector) can determined if one PH is not able to provide the minimum quality needed for the job to be printed and sold, usually nozzles out level is higher than the level error hiding can manage, or drop velocity is lower than a certain level.
- Having multiple PH rejections would indicate that it is needed to stop use this PH. It could be a PH, PH interconnect or Carriage PCA issue.
- Communication error is a typical intermittent issue that compromise image quality integrity. It is critical to have good communication while printing big plots.
- If observed severe printer pen-to-rib spacing variation across paper axis can be mitigated using only one row of PH instead of two.

*Except the first one, the rest can be tracked by sensors.

The printer workable with this idea must have at least one redundancy PH per color for being able to form the contingency configurations, either in scan axis or in paper axis.

As in Figure 1 below, it explains one example as the configuration of Printer A with which the carriage is formed with two rows of PHs, symmetric layout, 4 colors, 2 colors per PH, 8 PHs in total. Another example can be the configuration of Printer B with carriage formed with two rows of PHs, 4 colors, 2 colors per PH, 4 PHs in total. Due to more redundancy of PHs in Printer A, it provides more flexibility in terms of variant contingency configurations. As you can see from the figure, different contingency configuration implies different trade offs in some attributes.

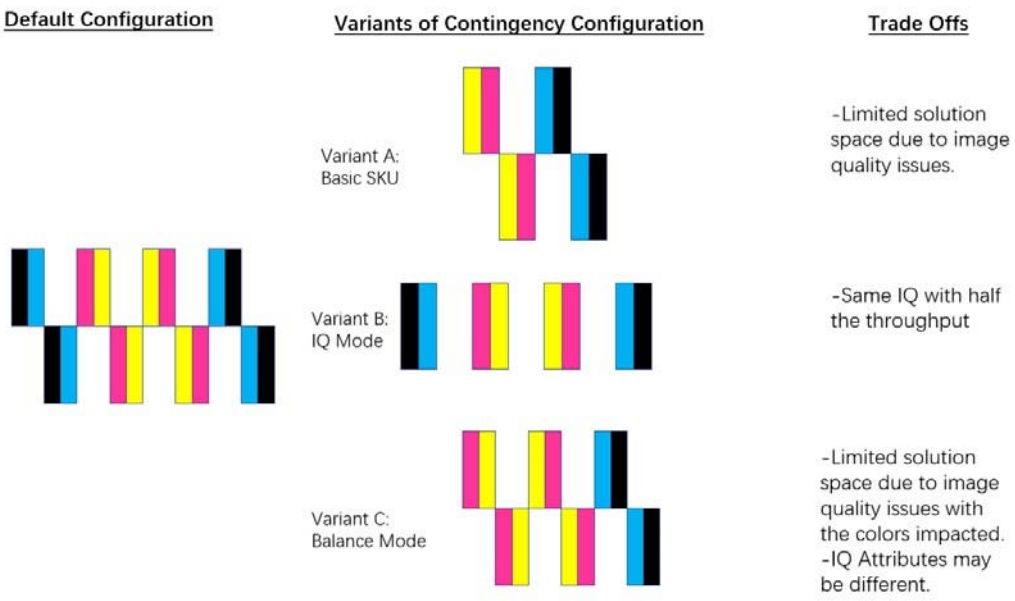

Figure 1 Variants of Contingency Configuration

In the user interface, as explained in Figure 2, a list of variant contingency configuration must be prepared in the printer. Each variant has a name with known trade off included.

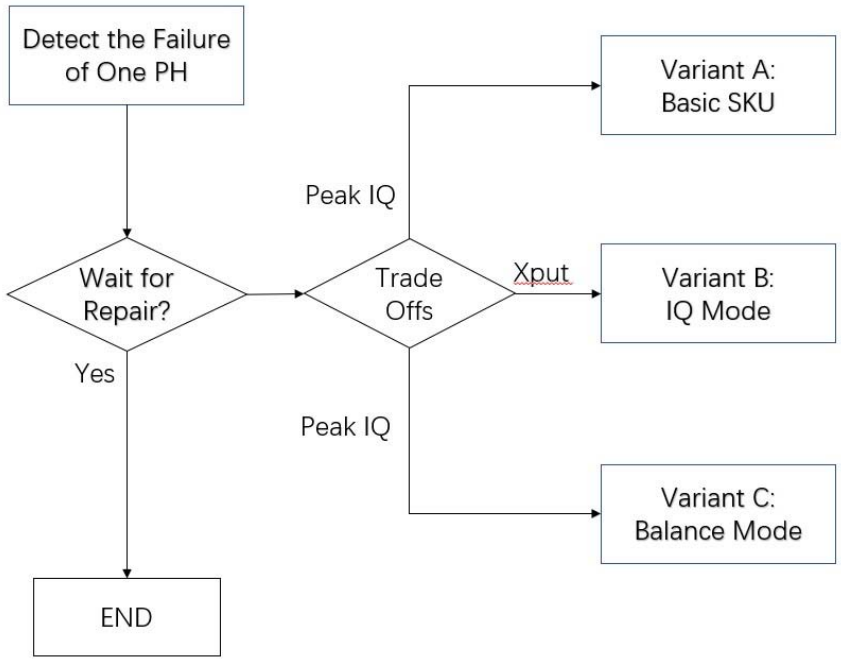

Figure 2 Work Flow Chart with all contingency variants

When the PH related failure is detected, it follows the work flow chart explained in Figure 2.

Following the chart, the customer can decide to wait for the repair, do nothing or start the contingency plan while waiting.

In this example, the options will be:

- **Variant A: Basic SKU** - The other SKU already available within the product line.
- **Variant B: IQ Mode** - The IQ mode keeps peak IQ while the throughput will be half.
- **Variant C: Balance Mode** - It is a balance between A and B. However, some IQ attributes may be different.

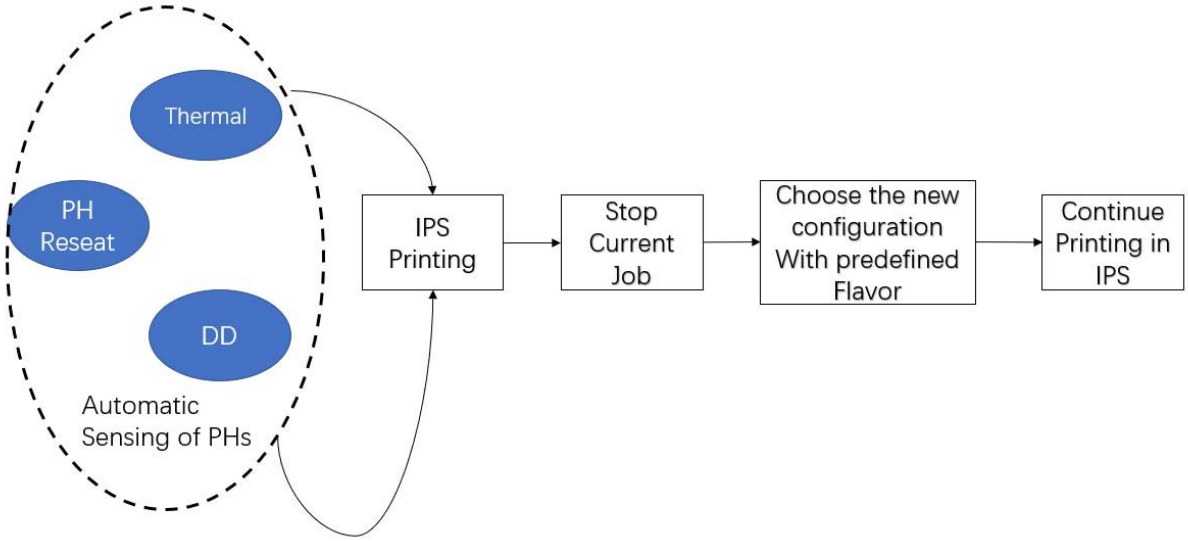

Figure 3 Automatic adaption workflow during printing

In Figure 3, it is mentioned an automatic workflow created based on this idea. This feature can be used to automatically adapt to a more stable configuration in case the sensors of PHs detect some issues. This will prevent from using unstable PH in a short term and troubleshoot when the production is done.

MAIN BENEFITS AND ADVANTAGES

- The main benefit is to minimize the impact in productivity of the machine, by preventing the operator from using the PHs impacted by the repeated and temporarily unsolvable system failures. Allowing the customer to continue printing if needed.
- Another benefit is to provide the flexibility for the customer planning to control and choose the best day for the repair to be done.

These two benefits mean higher printer uptime and it is translated as a better customer experience, better Overall Equipment Efficiency (OEE) and better Net Promoter Score (NPS)

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