**SRS**

Scales-based

Head Optimization Wizard

(HOW)

Software Requirements Specification

Version 10

|  |  |  |
| --- | --- | --- |
|  | **Name** | **Date** |
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| Approved by: |  |  |
| Version No: | Version 01 | October 18, 2011 |
|  | Version 02 | October 25, 2011 |
|  | Version 03 | Nov 16,2011 |
|  | Version 04 | Nov 20, 2011 |
|  | Version 05 | Nov 27, 2011 |
|  | Version 06 | Dec 18, 2011 |
|  | Version 07 | Dec 25, 2011 |
|  | Version 08 | Feb 19, 2012 |
|  | Version 09 | March 29,2012 |
|  | Version 10 | April 3, 2012 |

1. Overview

Using an online scale as a tool to calibrate the head voltages has the advantage of turning the HOW into a fully automated process, with a minimal operator’s intervention. The fact that no printing is involved in the process makes the process duration shorter (less than an hour) with an estimated average material consumption of 100 grams, a quantity far less than the one consumed with the current HSW.

The process requires that scales (with an accuracy of 0.01 gram and capacity greater than 300 grams) will be placed on the tray. The scales will be connected to one of the embedded computer’s or OCB serial ports. The software will communicate with the scales, and will perform action like weight reading, status check etc.

The concept behind the mechanism described in this paper is that once a layer height is set, the voltage of each head will be calibrated to obtain the required drop-weight. Feasibility test has shown that the target weight has to be multiplied by a factor in order to obtain the required layer height. The reason for it is that the heads temperature drops once the material cooling fans start operating. The resulting decrease in drop weight varies from one head to another and therefor so will the factors.

1. Objectives

The objective of the scales Based HSW, as defined in this document is to allow an HSW process to be carried out on every E/C machine in the testing center. It means that it has to be integrated into the all EDEN-V and Connex products.

The SRS covers an entire HSW process based on the scales-on-tray process. The head replacement procedure is not included in the SRS and has to be copied as is from the current HSW.

1. Implementation
   1. **Process steps**

The process includes the following steps:

* + 1. Print a locator frame for the scale placement.
    2. A test pattern will be printed and the operator will enter the number of missing jets per head.
    3. Selection of a layer height. The voltage will be set to a maximum value and the weight of each head will be measured. Based on the results the target layer will be selected.
    4. The target weight for each head, at each mode, will be calculated.
    5. An iterative process of voltage adjustment will commence. The process will scan head by head and adjust its voltage until the target weight is obtained.
    6. The voltage values and the layer height will be saved in the appropriate mode files.

Note: the process (except the test pattern) will be repeated for each of the modes.

* 1. **Parameters** (2)
     1. **Wizard parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Status**(1) | **Value** | **Comment** |
| m | Old | Product dependent – see HSW | Net to gross layer factor |
| n | Old | Product dependent – see HSW | Net to gross layer factor |
| SG | Old | Product dependent – see HSW | Specific gravity |
| ResX | Old | Mode dependent (HQ=600,HS/DM=1200) | Mode printing resolution in DPI |
| ResY | Old | 300 |  |
| Material\_factor | Old | Material dependent | will be multiplied by Mode\_factor |
| # of nozzles\_head | Old | 96 |  |
| TST-DM-HS | New | 600 | Block-temperature stabilization time (sec) |
| TST-HQ | New | 180 | -“- |
| #\_heads\_machine | New | 8 |  |
| Scales\_X | New | TBD | Block position-X |
| Scales\_Y | New | TBD | Block position-Y |
| Scales\_Z | New | TBD | Block position-Z |
| Factor\_H1 (M0) | New | TBD | WT\_correction factor |
| Factor\_H2 (M1) | New | TBD | WT\_correction factor |
| Factor\_H3 (M2) | New | TBD | WT\_correction factor |
| Factor\_H4 (M3) | New | TBD | WT\_correction factor |
| Factor\_H5 (S0) | New | TBD | WT\_correction factor |
| Factor\_H6 (S1) | New | TBD | WT\_correction factor |
| Factor\_H7 (S2) | New | TBD | WT\_correction factor |
| Factor\_H8 (S3) | New | TBD | WT\_correction factor |
| Max\_V | Old | 36V | WT\_correction factor |
| Max\_layer\_HS /DM | Old | 30 µm | net |
| Max\_layer\_HQ | Old | 16.5µm | net |
| Frequency DM/HS | New | 18000 | Hz |
| Frequency HQ | New | 10000 | Hz |
| #\_ of \_fires | New | 200,000 | For a single WT |
| Max\_mis | Old | 10 | Max # of missing nozzles |
| Max\_count | New | 10 | Max iteration allowed |
| Min\_layer\_height \_HS | old | 24 | Applies to DM as well |
| Min\_layer\_height \_HQ | old | 11 | Enables head ability during DM test |
| First\_iteration\_voltage\_M\_HQ | New | 30 | volt |
| First\_iteration\_voltage\_S\_HQ | New | 28 | volt |
| First\_iteration\_voltage\_M\_HS\_DM | New | 28 | volt |
| First\_iteration\_voltage\_S\_HS\_DM | New | 26 | volt |

* + 1. **Scales parameters**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Status**(1) | **Value** | **Comment** |
| Sc\_wu\_time | New | TBD | Stabilization time when powered up |
| Scales\_ res | New | 0.015 | gram |

1. Oldparameters are already in use by the application. New parameters have to be defined.

**(2)** All parameters should be accessible to the user via the parameter manager. A new tab should be allocated to the new parameters.

* 1. **Formulae**
     1. **Net to gross layer calculation**

*formula 1: LH\_gross = (LH\_ net+m)\*n*

* + 1. **Target layer (gross) calculation**

*Formula 2.1* Maximum layer per head calculation:

*Formula 2.2* Target layer (machine)

*Target layergross = max\_layer\_headgross(i), max\_layermode), i= 1 to n, n=# of heads*

* + 1. **Target weight (scales) calculation.**

*Formula 3:*

*Target- weight=*

* 1. **“Next-voltage” calculation**

“Next voltage” calculation is used during the iterative process of reaching the target weight. The next voltage at which the weight test should be performed is calculated based on the last weight measurement value.

At the first iteration (# 0) an fixed voltage will be set (different for Model and Support). The voltage values appear in the parameter table above. All the following iterations will be based on a calculated DW\_gain. The calculation is shown in formula 5.

*Formula 4:*

*Next voltage =*

Formula 5:

*DW\_gaincalc* =

* 1. **Fire time calculation**

Formula 6:

* 1. **Scales**

The scales user guide will be provided in a separate document. The guide includes the required programing information.

* 1. **Flow charts**

See below the HSW process flow chart.















**Appendix 1:**

Version control

|  |  |
| --- | --- |
| **Version number** | **Change description** |
| 01 | Initial version |
| 02 | Convergence test added |
| 03 | Next-voltage formula corrected, voltage calibration FC corrected |
| 04 | Duplicate parameters deleted |
| 05 | Full HSW process, FC corrected, min layer HQ changed |
| 06 | Stress-test before test pattern added |
| 07 | Stress test changed to duty-cycle jetting |
| 08 | Calculated DW\_gain added |
| 09 | 1st iteration voltage, cancel generic gain, cancel stress test, turn off monitor while jetting, change accuracy to 0.015, change formulae to mode factor |
| 10 | Weight test procedure changed to allow consistent reading. Sc\_stab\_time parameter deleted. |