# New Scales-based HOW wizard: Interior changes

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### List of relevant parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter name | New\old | Initial value Keshet | Exists in Parameter Manager? | comment |
| [noise\_level\_error](#_Weight_measurements) | new | 0.1 | Y | Should be above noise level – used to make sure that a fire-all was indeed done. |
| MaxV | old | 30 | Y | The maximum voltage allowed for the printheads (defined by manufacturer). |
| FA\_counter | new | - | N | Restarted for each measurement – will count how many times there is need to send to purge |
|  |  |  |  | Max value for FA\_counter – Liliya – is this a parameter? |
| VH=voltage\_FTL\_H | new | 25 | Y | first voltage in Find Target Layer |
| VL=voltage\_FTL\_L | new | 22 | y | second voltage in Find Target Layer |
| Max\_iterations | New\old? | 3 | y | I’m not sure if to leave it hard coded or to let it be changed in parameter manager. |

### Weight measurements

### Noise Level:

Introduce a new parameter - noise\_level\_error. Set it to 0.1gr (in Parameter Manager).

1. At each fire-all check: If Measurement <noise\_level\_error (no fire-all was done?):
   1. Write to log: Head Optimization Wizard: Scale reading error: Measurement too low, repeat scale reading
   2. Wait 10 seconds and repeat scale reading (scale tmp measurement).
   3. If the reading changes (WT>noise\_level\_error):
      1. Write to log: Head Optimization Wizard: Scale reading error: second scale reading successful.
      2. Continue to the next step
   4. Otherwise:
      1. Write to log: Head Optimization Wizard: Scale reading error: second scale reading failed, send to purge
      2. Send to purge and repeat from the fire-all test.
      3. If the reading changes (WT>noise\_level\_error): continue the wizard.
      4. If the reading is too low again (WT<noise\_level\_error)
         1. Write to log: Head Optimization Wizard: Scale reading error: cancel wizard, check scale and check heads.
         2. Cancel wizard with request to check scale and perform pattern-test.

### Compare Fire-all couple

The sequence today includes the test:



And sends to purge if the test fails. Need to add a counter (FA\_counter) so that there won’t be more than 3 such purge cycles for any measurement.

### Summary: full measurement sequence

1. Set Voltage
2. Set FA\_counter=0
3. Perform 1st fire-all, check if larger than noise level, [section a](#_Weight_measurements)
4. Get scale reading M1 (V)
5. Perform 2nd fire-all check if larger than noise level, [section a](#_Weight_measurements)
6. Get scale reading M2 (V)
7. Check the following condition: (same as was before)

**If** M2(V)<FA\_weight\_factor\*M1(V) **Then:**

* 1. FA\_Counter=FA\_counter+1
  2. if FA\_counter<3 Then
     1. Send to purge
     2. Update the ‘previous scale reading’ (perform 5 scale readings)
     3. Repeat from step III.

Else- cancel wizard

End If

Else: continue to step VIII.

End if

1. Perform 10 scale readings, and **Measurement(V)=average of these 10 scale readings-“previous scale reading”**
2. Continue to next step.

### Find Target Layer

The concept is changed! Will include two iterations (to avoid the measurement at MaxVoltage)

* Perform weight measurement test at the following voltages: voltage\_FTL\_H (VH) and voltage\_FTL\_L (VL), where VH>VL, taken from Parameter Manager. These parameters will vary between products, modes and materials (Vero vs. Support)
* Repeat these two measurements for all heads.
* In each case write to the log as before.
* Target Layer Height Calculation:
  1. Use the results of iterations 1-2 to extrapolate the weight at the Maximum Voltage (MaxV), and from this value- the Maximal possible layer height per head.
  2. Calculate Gain:
     + Eq. 1a.: \* need to add a min value here
     + Eq. 1b:
     + Write to log: Head Optimization Wizard: Gain for Head (head#) \_\_
  3. Calculate Weight(MaxV):
     + If VH=MaxV, Weight(maxV)=Weight(VH)
     + If VH<MaxV, derive the weight at maximum voltage according to:

Eq.2

* + - Write to log: Head Optimization Wizard: Head \*\*, Weight\_maxV=
  1. Calculate Max Layer (gross)
     + Eq. 3:
     + Write to log Head Optimization Wizard: Head \*\*, Maximal layer head = \*\*
  2. Find the minimal value of the Max possible layer height for all heads (MinMaxLH (gross)). Derive the net value

Eq. 7a: LHgross=(LHnet+m)\*n,

Eq. 4b: MinMaxLHnet=(MinMaxLHgross/n)-m

* + - Write to log Head Optimization Wizard: Head \*\*, Minimum of Maximal layer head =\*\*
  1. If MinMaxLHnet<MinLayerHeight (parameter) cancel wizard and request replacement of weak heads (heads with Maximal layer height smaller than MinLayerHeight.
  2. Otherwise set Target Layer Height to be min(MinMaxLH, MaxLayerHeight)
  3. Calculate the Target Weight for each head based on the derived Target Layer-Height and all the relevant factors (material factor, heads factor, mode factor etc’)

### Iterations:

(done separately for each head). *Here again there are major changes*.

#### Prior to iteration step

* Use the Gain calculated after the second iteration (Eq. 1b) , and the Voltage VL and Weight W(VL) to calculate the first iteration voltage.
* *First iteration voltage ==*

#### Iteration n

* Voltage adjustment:
  + 1. Calculate ‘delta weight to target’ of previous step:

Eq. 6:

* + 1. Calculate the voltage:

*Voltage ==*

* + Perform Measurement (‘Current weight’):
    1. Perform measurement according to [section II](#_Weight_measurements)
    2. Check Convergence condition:

|Target\_weight-Current\_weight|<Scale\_Res (parameter).

* + 1. If True: Save last voltage and continue to next head.
    2. If False:
       - if n=max\_iterations:

Save final voltage=

Write to log

* + - * + Head Optimization Wizard: final voltage taken as average of last 2 voltages
        + Head Optimization Wizard: Save voltage \*\* for head Head \*\*

Continue to next head\finish.

* + - * if n< max\_iterations,  Check Convergence progress:

|Target\_weight-Current\_weight|< | dWn|\*1.2

* + - * 1. If True: Calculate the voltage for the next iteration (Eq6) and continue.
        2. Otherwise: check if sign (dWn-1)=sign(dWn) . (can only be explained by a change in number of effective nozzles)
        3. True:

Write to log Head Optimization Wizard: no progress, repeating measurement.

Send to purge

Repeat measurement with the same voltage (save it as current\_weight instead of the previous measurement)

If convergence condition is not reached, continue to next iteration (without checking convergence progress again).

* + - * 1. False:

set Gain=Gain\*1.05

Write to log: Head Optimization Wizard: Increasing gain by 5%.

Continue to next iteration

### Purge sequence

Perform fire-all (still at the purge unit) after every time the head is sent to purge (to ensure nozzle functioning).

### Wizard Cancellations (Summary):

Need to go over and map all the scenarios for wizard cancellation, and what are the messages to the customer in each case.

* Technical problems (scale reading etc’)- as before
* Obsolete issues (remove from wizard):
  + If max number of iterations is exceeded (see different approach in [section VI](#_Iterations_n=3_to) )
  + If next iteration voltage is outside of limits (lower than minV or higher than maxV, [see section VI](#_Iterations_n=3_to)

### Weak head: The following scenarios must remain but with minor corrections

#### If max number of missing nozzles is exceeded:

* + - * Ask for verification (maybe there was a typo)
      * Cancel wizard due to too many missing nozzles:

“Allowed number of missing nozzle exceeded, please replace head”

“\* To avoid replacing head the following steps may be taken:

Perform head-cleaning wizard

Send to purge 5 to 10 times

Perform “pattern-test” to check status”

* + - * This should be the only place in the wizard where there is a cancellation with the message that the number of missing nozzles is exceeded. Need to delete if this appears in other places in the wizard.

#### Failure at measurement stage:

* + - Weight is too low (smaller than 2\*noise\_level\_error) [See below](#_Noise_Level:_1)
    - Weight inconsistency for a particular measurement: if there is a difference between the Weight of the two fire-all stages, see [below](#_Compare_Fire-all_couple).
    - Failure at ‘Find Target Layer’ step – maximal layer height possible for a head is lower than MinLayerHeight. [See below](#_Find_Target_Layer).

### Iteration n:

* + Voltage adjustment
  + Calculate delta weight to target of previous step

Eq. 6:

* + Calculate the voltage:

*Voltage ==*

* + Perform measurement : Current\_Weight
  + Check Convergence condition:|Target\_weight-Current\_weight|<Scale\_Res (parameter).
  + If True: Save last voltage and continue to next head.
  + If False:
    1. if n=max\_iterations
       - Save final voltage=
       - Write to log
         * Head Optimization Wizard: final voltage taken as average of last 3 voltages
         * Head Optimization Wizard: Save voltage \*\* for head Head \*\*
       - Continue to next head\finish.
    2. if n< max\_iterations, Check Convergence progress:

|Target\_weight-Current\_weight|< | dWn|\*1.2

* + - * If True: Calculate the voltage for the next iteration (Eq6) and continue.
      * Otherwise: check if sign (dWn-1)=sign(dWn) . (can only be explained by a change in number of effective nozzles)
        1. True:

Write to log Head Optimization Wizard: no progress, repeating measurement.

Send to purge

Repeat measurement with the same voltage (save it as Weightn instead of the previous measurement)

If convergence condition is not reached, continue to next iteration (without checking convergence progress again).

* + - * 1. False:

set Gain=Gain\*1.05

Write to log: Head Optimization Wizard: Increasing gain by 5%.

Continue to next iteration