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TO: Loveshaw Regional Sales Managers  
Distributors  
Customer / Technical Service

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**TOPIC:** TJ (Thermal Ink Jet) HRP Print head operation

There has been some confusion concerning the operation (ink low, ink out, thermal shutdown, etc...) of the TJ print head. Below is an outline of how the system operates.

**PRODUCTS AFFECTED:** HRP ½" and 1 "Head

**Condition A:** Loveshaw programmed print head with a Loveshaw Programmed cartridge (porous or non-porous)

- Red LED is off – normal operation
- Red LED on solid
  - o Ink low...calculated ink level is at 10% remaining...printing is NOT disabled
  - o Baud rate mismatch...power cycle required to recover.
- Red LED flashes slow
  - o Ink out...calculated ink level is at 1% remaining...printing is NOT disabled
  - o At 0% calculated ink left the red LED will continue flashing slowly indicating "Ink out"...as of print head firmware version 7.1, Printing is NOT disabled.
- Red LED flashes fast
  - o No cartridge present.
  - o Print head is recognizing the cartridge (up to 30 seconds). If the cartridges' serial number is stored in the print heads memory then the print head will recognize the cartridge almost immediately. Once the cartridge is recognized the red LED will go out.
  - o When the cartridge actually runs out of ink and begins overheating the print head will go into thermal shutdown mode...this is indicated by the LED flashing fast. While in thermal shut down mode printing is disabled. Once the print cartridge cools down the red LED will go back to flashing slow and print will again be enabled.
  - o Any system error
  - o FPGA download failure
  - o Printing is disabled whenever the red LED flashes fast.
- The print head recognizes if the cartridge is programmed as porous or non-porous and sets the voltages accordingly.
- The print head remembers the last two print cartridge serial numbers and their calculated ink usage.

**Condition B:** Loveshaw programmed print head with an un-programmed (generic) print cartridge (porous or non-porous)

- With no cartridge present the red LED flashes fast.
- After inserting a cartridge the red LED will continue flashing fast until it recognizes the cartridge (up to 30 seconds). Once the print head recognizes the cartridge is not programmed as Loveshaw the red LED will flash slowly.
- Print will be allowed for 1% of the calculated ink volume.
- After printing for 1% of the ink volume print will be disabled and the red LED will flash fast.
- How to recover once print has been disabled...

- Cycling power on the print head allows print to continue for another 1% of the calculated ink volume.
- Remove the un-programmed cartridge, insert a programmed cartridge and wait until the print head recognizes it (the red LED goes out), remove the programmed cartridge and re-insert the un-programmed cartridge...print is now allowed for 1% of the ink cartridge volume.
- Removing and re-inserting the un-programmed print cartridge won't re-initialize printing once print has been disabled.

**Condition C:** Loveshaw programmed print head set to bulk ink option.

- With no cartridge present the red print head LED flashes fast.
- If no power or not connection to the BIS350 then the red LED at the print head flashes fast.
- After inserting a cartridge the LED will continue flashing fast until it recognizes the cartridge (up to 30 seconds). If the cartridges' serial number is stored in the print heads memory then the print head will recognize the cartridge almost immediately.
- Once the cartridge is recognized, and it is a Loveshaw programmed cartridge, the LED goes out. The print head also recognizes if the cartridge is programmed as porous or non-porous and sets the voltages accordingly.
- No dot counting occurs when in bulk ink mode.
- The print head will now rely on the signal from the BIS350 to tell it when ink is low.
  - BIS350 (Bulk Ink System with 350 ml Cartridge) operation...
    - Red LED is off – system is operating normally.
    - Red LED is on steady – BIS350 could not achieve 5 PSI after 15 seconds of continuous pump operation. This indicates the 350ml bulk ink cartridge is empty.
      - Print will continue until thermal shutdown.
      - Replacing the ink cartridge clears the error.
      - The controller displays “Ink Low”
    - Red LED is blinking rapidly –
      - The BIS350 has experienced a rapid loss of pressure, possibly due to a broken line.
      - Or, the print head is going into thermal shutdown mode.
      - Red LED flashes fast for one second, goes out for one second, flashes fast for one second, goes out for one second, etc... - this indicates the 350 ml bulk ink cartridge is missing or the cartridge has not been detected by the BIS350.