XJ128

High Performance
Ink Jet Printhead

XJ128/200

XJ128/200 Plus

XJ128/360

Guide to Operation

XJ128 Guide to Operation

Xaar Confidential

XAAR

XJ128 Guide to Operation

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Table of Contents

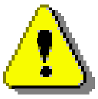
1 Introduction

1.1 Overview

This document is only valid for the Xaar XJ128 product. This document is provided to supply details and information relating to the XJ128 printhead and it's operation. The document will cover the following sections:

- Introduction
- General Product Information
- Product Description
- Mechanical Guide
- Electrical Functions
- Electrical Specifications and Data
- Ink Supply System Design
- Maintenance, Reliability and Lifetime
- Image Processing
- Trouble Shooting
- Feedback and Support
- Appendices

This edition applies to the above product only and to all subsequent releases and modifications until otherwise indicated in new editions. Changes are made occasionally to the information herein; any such changes will be reported in subsequent revisions.



Note that the use of this symbol indicates that the text you are reading is critically important and the instruction should be observed.

This document will make references to other Xaar documents, which should be used in conjunction with this referenced material.

Please address any comments to:

Sales Engineering
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1.2 Safety instructions

Although all efforts have been made to ensure that the XJ128 is safe for use, Xaar cannot be held responsible for any incidents or injuries resulting from mishandling or misuse. It is important to ensure that liquid does not come into contact with electrical areas and that appropriate safety precautions are taken when using the XJ128 printhead.

1.3 Disclaimer

This manual is intended as a guide for the installation and use of the Xaar XJ128 printhead and the contents are believed to be accurate at the time of compilation. Xaar assumes no liability for direct or indirect damage or loss incurred due to errors, omissions, discrepancies or changes between the equipment and it's documentation and does not give any representation, condition or warranty (whether express or implied, by law, custom or otherwise) as to its accuracy, completeness or correctness, or its fitness for purpose, or that use of a device described herein or reproduction of the contents will not infringe any rights of any third party or otherwise whatsoever, and the user agrees that it has not relied on any. Information in this manual is intended for reference only. Equipment and documentation is subject to change without notice.

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2 General Product Information

2.1 The XJ128 printhead

The XJ128 inkjet printhead consists of a piezo based, 128-channel actuator with ink-supply filter and drive circuitry mounted on a metallic chassis. The printhead is available in three different models. Each model operates in a 'binary' mode, thus ejecting a single sized drop upon demand.

2.2 Xaar technology

As with all Xaar technology products the printhead utilises Xaar's patented shear mode, shared wall piezo based technology.

2.2.1 Xaar piezo technology

Xaar's printhead technology is based upon a piezo ceramic material (PZT). When a voltage is applied across this material the material distorts or bends. Xaar uses this phenomenon by machining rows of parallel channels into a PZT block. An electrode is then placed onto the sides of the channel walls allowing a voltage to be applied across it. The way in which Xaar makes the wall bend due to the applied voltage is known as "shear mode." Two channels share the wall, and hence the term "shared wall."

These channels are filled with ink and a pressure wave inside the ink is generated due to the distortion of the PZT walls. This pressure wave forces ink out of the end of the channels via the printheads nozzle.

2.3 Product handling and installation

2.3.1 Anti-static precautions

Xaar printheads are static sensitive devices, which can be damaged if they are touched without the necessary precautions being taken.

Xaar printheads are supplied in antistatic packaging. These should only be opened and handled in an anti-static or electrostatic protected area (EPA). Unpacking and handling of the printheads should be performed with the correct electrostatic discharge (ESD) precautions such as a grounded wrist strap and conductive work mat.

2.3.2 Cleanliness

Xaar printheads are precision devices and should be treated as such. It is essential to carry out all installation and development in as clean an environment as possible.

2.3.3 Handling

The nozzle plate on the printhead is sensitive to handling. On two models of the XJ128 printhead, the nozzle plate has a special coating, called a non-wetting coating (NWC). This keeps the nozzle plate free of excess ink. Contact with this surface must be avoided to prevent damage to this coating. Damage to this coating can cause a reduction in the performance of the printhead. With all models of the XJ128 printhead, contact with the nozzle plate surface must be minimised to avoid damage to the nozzle plate.

2.3.4 Nozzle plate protective cap

The nozzle plate is protected during shipment by a plastic protective guard. This must be carefully taken off prior to the printhead being filled with ink.

2.3.5 Installation and pre-flushing

The XJ128 printhead is supplied having been through a series of printing tests as part of the manufacture. There will be some residual print test fluid within the printhead. In some cases, the residual fluid will be incompatible with the ink to be used with the printhead. In such cases, the printhead will require additional pre-flushing using approved flushing fluids and procedures. These will be ink specific and are detailed in the corresponding Ink and Printhead User Guide.

2.3.6 "Hot-plugging"

The XJ128 printhead must not be connected or disconnected to the electrical supply whilst the power is on. This is known as "hot-plugging" and will cause damage to the printhead.

2.4 Storage and shipment

2.4.1 Storage conditions

- Air Temperature -15°C to 60°C
- Humidity 10% to 90% RH non-condensing

The XJ128 printhead should not be stored outside of its original packaging. It is recommended that the printhead be stored in its packaging until required and that installation time is kept to a minimum.

Should a printhead be removed from an application, the printhead should be flushed clean of ink with the appropriate Xaar cleaning solution. The cleaning solution should then be purged out of the printhead with clean, dry filtered air. This process is detailed in the Ink and Printhead User Guide documentation. Once clean the printhead should be stored in it's packaging. If the original packaging is not available a clean, opaque, ESD proof bag will suffice.

2.4.2 Shipping conditions

In conjunction with the unopened packaging as provided by Xaar, the XJ128 printhead has been tested to withstand the following shipping conditions. Storage and/or shipment of the products outside of these conditions can void any claim for warranty on the printhead.

The XJ128 printhead has passed tests according to standard ETSI EN 300 019-2-2 Transportation, Class 2.3, 1999-09

Description	Detail	
Vibration	X, Y and Z axis	5-20 Hz, -3dB/oct, 0.78 gRMS, 30 mins
Bump	X, Y and Z axis	18g, 6 ms, half sine, ± 100 bumps
Drop Test	One flat drop towards each side	Height 1.0 m
Temperature	Minimum	-15°C
	Maximum	60°C
Humidity		8 to 80%RH non-condensing

Table 2.1- Shipping conditions

2.5 Product support

Support for all Xaar products is available from Xaar. Please contact your regional office for further information. Please refer to section 11 for details.

3 Product Description

The product description detailed in the next section provides a brief overview of the main components that make up the XJ128 printhead. Greater detail is given in later sections of this document.

3.1 Parts description

The XJ128 printhead is built up from the following basic components as shown in figure 3.1.

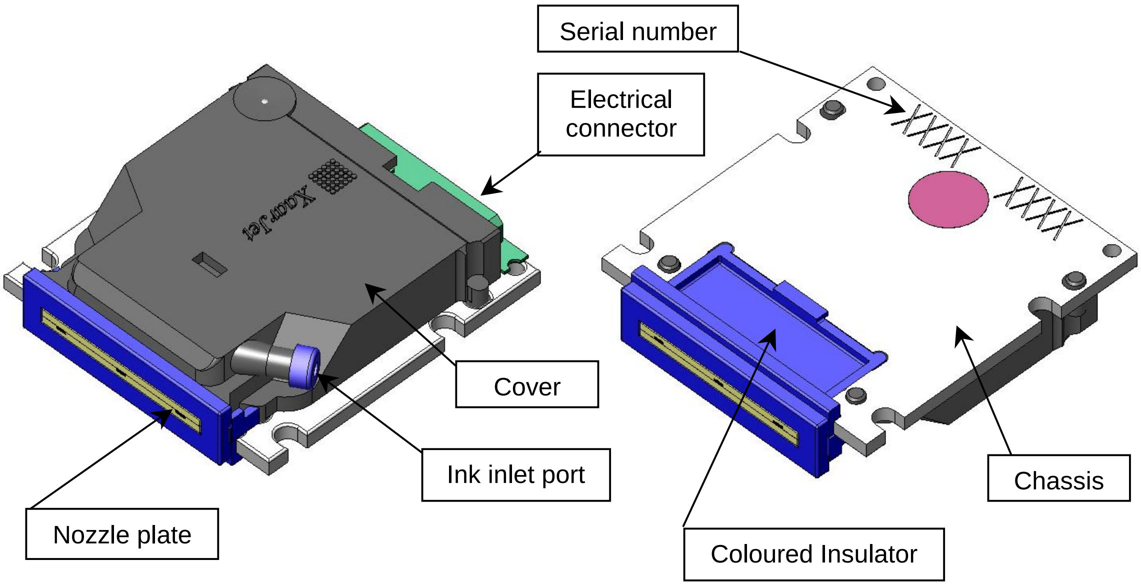


Figure 3.1 - Isometric views of the XJ128 printhead

3.1.1 Actuator

The actuator (not visible in figure 3.1) is located behind the nozzle plate and is the active element of the printhead. The actuator consists of an array of ink channels, which are sawn into a piezo-ceramic material. The actuator converts the electrical energy into a pressure wave necessary to eject drops of ink.

3.1.2 Electrical connector

Interface to the outside user electronics.

3.1.3 Chassis

This is the mounting base for the mechanical assembly. The chassis has datum areas to provide location of the printhead in a mechanical assembly. The chassis is thermally connected to the driver electronics and is used to dissipate or provide heat to the printhead.

3.1.4 Cover

A plastic cover to protect the actuator and electronic circuitry, including ink filter and internal ink path. The cover must not be removed or tampered with. Any attempt to do so will invalidate the printhead warranty.

3.1.5 Coloured insulator

The coloured insulator indicates the model of the printhead, for example XJ128/200, XJ128/360 or XJ128/200 Plus. The colours and associated models are detailed in Table 3.1

3.1.6 Driver chips

The driver chips (not shown in figure 3.1) store and control the information for the ‘firing’ pulses to be sent to the actuator.

3.1.7 Ink inlets and filter

The XJ128 printhead has a single ink inlet port. The ink inlet is the point at which the ink connection is made to the printheads. The printhead is fitted with a filter (not shown in figure 3.1) to protect the actuator and nozzles from contamination. It is made of a 15μm stainless steel mesh. This is the final filter acting as a complement to the filter in the ink delivery system. For maximum life, staged filtering is essential, with the OEM incorporating a primary filter in their design. See section 7 for details.

3.1.8 Nozzle plate

Depending upon the model of the XJ128 printhead, the nozzle plate properties differ. In both cases, the nozzle plate is the plastic film into which the nozzles are formed. Depending upon the printhead model used, different ink system and maintenance strategies must be adopted. These are detailed in sections 7 and 8 of this document.

3.1.8.1 XJ128/200 and XJ128/360

The standard XJ128/200 and XJ128/360 nozzle plate is coated with a special non-wetting coating (NWC). This helps to keep the nozzle plate clear of ink around the nozzle orifices.

3.1.8.2 XJ128/200 Plus

The XJ128/200 Plus printhead utilises a ‘wetting’ nozzle plate. This means that a thin film of ink is required on the surface of the nozzle plate at all times to ensure reliable and high quality printing is achieved.

3.1.9 Serial number

The printhead serial number is marked on the rear of the printhead as shown in figure 3.1

3.2 Product specifications

The specification in table 3.1 details the performance of the each printhead model, as tested under standard operational conditions. These specifications can vary according to printhead integration and system set-up.

The specifications listed in table 3.1 are based upon testing carried out by Xaar under laboratory conditions with approved inks. In a customer application, some specifications such as linear speed, resolution and throughput, together with the final print quality and machine output, will be subject to the design of the machine and the number of passes required to achieve the print quality and coverage desired. The choice of ink and substrate/media used will also ultimately impact the printhead performance.

Description	XJ128/200	XJ128/360	XJ128/200 Plus	Unit
Colour of insulator	Blue	Black	Purple	-
Nozzle plate	Non-wetting	Non-wetting	Wetting	-
Active nozzles	128			-
Nozzle pitch	137.1			µm
Nozzle diameter	50	35	50	µm
Nominal drop volume[1]	80	40	70	pl
Drop velocity[2]	5.0	6.0	5.0	m/s
Maximum drop deviation	1.8	1.0	1.8	degrees
Ambient temperature range	10 to 40	10 to 40	10 to 40	°C
Ambient humidity range (non condensing)	10 to 80 RH	10 to 80 RH	10 to 80 RH	%
Maximum frequency	4.25	5.55	5.55	kHz
Maximum linear speed	540	390	705	mm/s
Pixel resolution (single pass)[3]	200 x 200	360 x 360	200 x 200	dpi
Print width[4]	16.5	9.0	16.5	mm
Printhead weight (dry)	15.5	15.5	15.5	g
Dimensions (W x D x H)	37.2 x 40.8 x 11.3			mm
Recommended printing distance[5]	1.0			mm
Maximum printhead acceleration	39.24 4			m/s^2 g

Table 3.1 - Product specifications

[1] Drop volume is frequency, ink and system dependant.

[2] Drop velocity is ink and system dependant.

[3] At specified printhead angle.

[4] At specified print resolution.

[5] Print distance specified is from nozzle plate. Print quality beyond that distance recommended, will vary.

3.2.1 Printhead life

The printhead is capable of performing up to and beyond 4 billion (4×10^9) drops within an approved system utilising approved ink. This is a typical figure and subject to the use of a successful printhead maintenance system.

Printhead life and performance is dependant on several key factors.

- Materials compatibility of ink and system components.
- Quality of printhead maintenance
- System design and environmental conditions.

Although this document does not cover these factors extensively, many of these issues can be discussed with your local sales engineering representative, who can provide further details and guidance to help printhead integration.

4 Mechanical Guide

Before beginning a design phase with Xaar printheads, please ensure that you have obtained the latest printhead drawings from Xaar Sales Engineering. See section 11 of this document for further information.

4.1 Channel numbering and side definition

Looking directly at the nozzle plate on the printhead, with the nozzles pointing towards you and the ink inlet pointing away from you, nozzle 1 is on the right side of the printhead.

"Top" means position closest to cover side.

"Bottom" means position closest to chassis side.

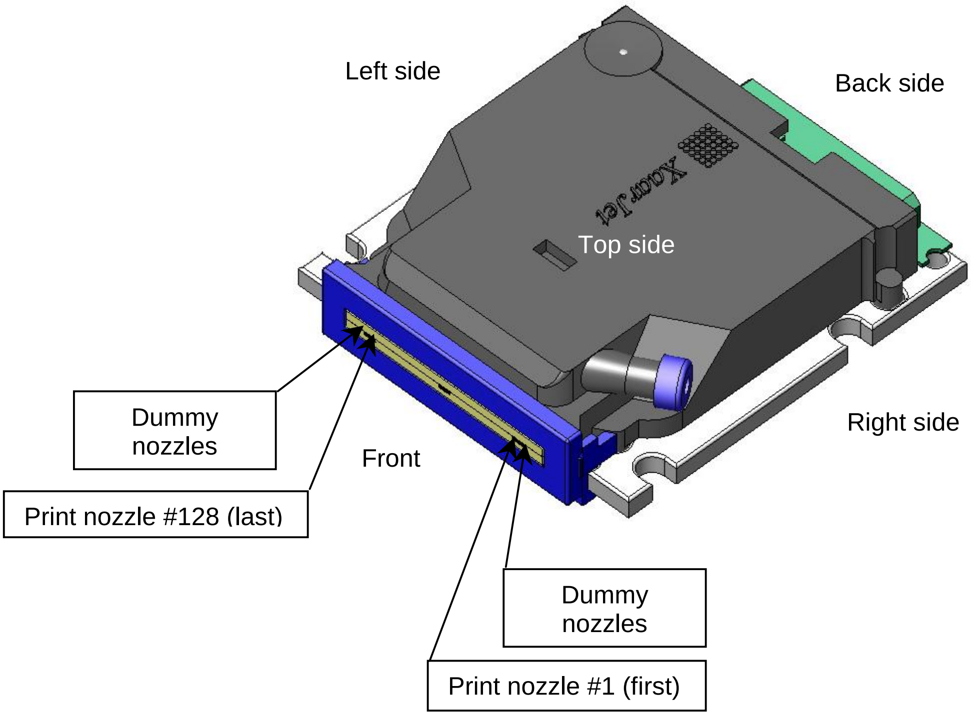


Figure 4.1 - Printhead side definition

There are a total of 134 nozzles viewable on the nozzle plate. The active nozzles are numbered 1 to 128. Nozzle 1 is referenced to the datum features on the printhead. Adjacent to nozzle 1 are 4 "guard" or "dummy" nozzles. These are shown in figure 4.3. Adjacent to nozzle 128 are 2 "dummy" nozzles. All dummy nozzles are non functional and cannot be activated. When looking towards the nozzle plate, on the printhead, the nozzles are numbered from right to left, as shown in figure 4.1.

4.2 Printhead mounting

The printhead must be treated with care. The most delicate part of the printhead is the nozzle plate. Avoid contact with the nozzle plate at all times.

Note that all loads on connectors, tubes and cables should be relieved.

4.2.1 Printhead orientation

There are three primary orientations for mounting the XJ128 printhead, as shown in figure 4.2.

1. With the nozzle line horizontal, and the metal chassis down (XaarJet logo facing up), figure 4.2a.
2. With the printhead firing down (Connector facing up), shown in figure 4.2b.
3. With the nozzle line vertical or close to vertical and ink inlet from beneath. This is the best orientation for easiest filling of the printhead with ink, as shown in figure 4.2c.

Positions set between the three primary orientations are also achievable, as indicated in figure 4.2.

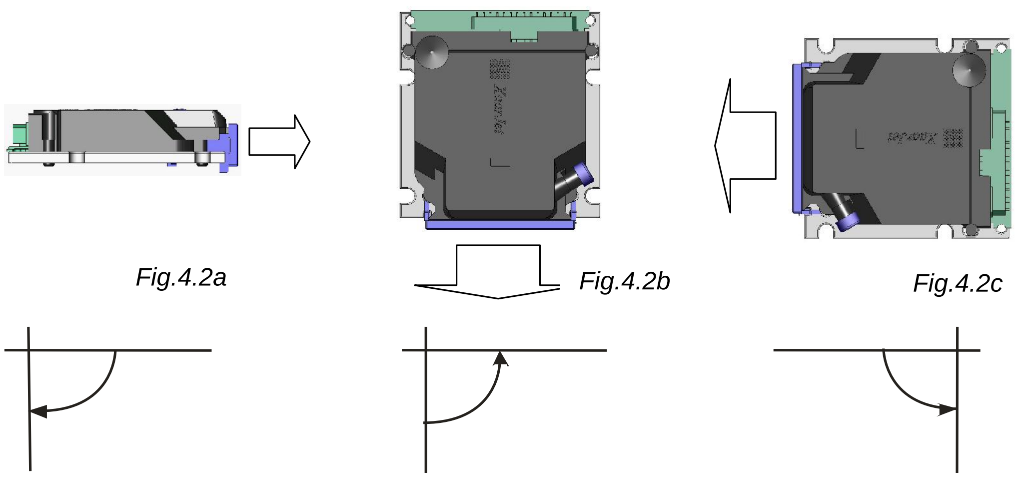


Figure 4.2 - Printhead orientations

4.2.2 Printhead datum locations

The printhead chassis has three datum references with approximate reference dimensions to the first firing nozzle in the printhead. These should be used as a guide to aid quick and easy mounting and alignment of the printhead into appropriate mounting systems.

The mechanical drawing in Appendix D has details of the reference dimensions. The datums are shown in figure 4.3.

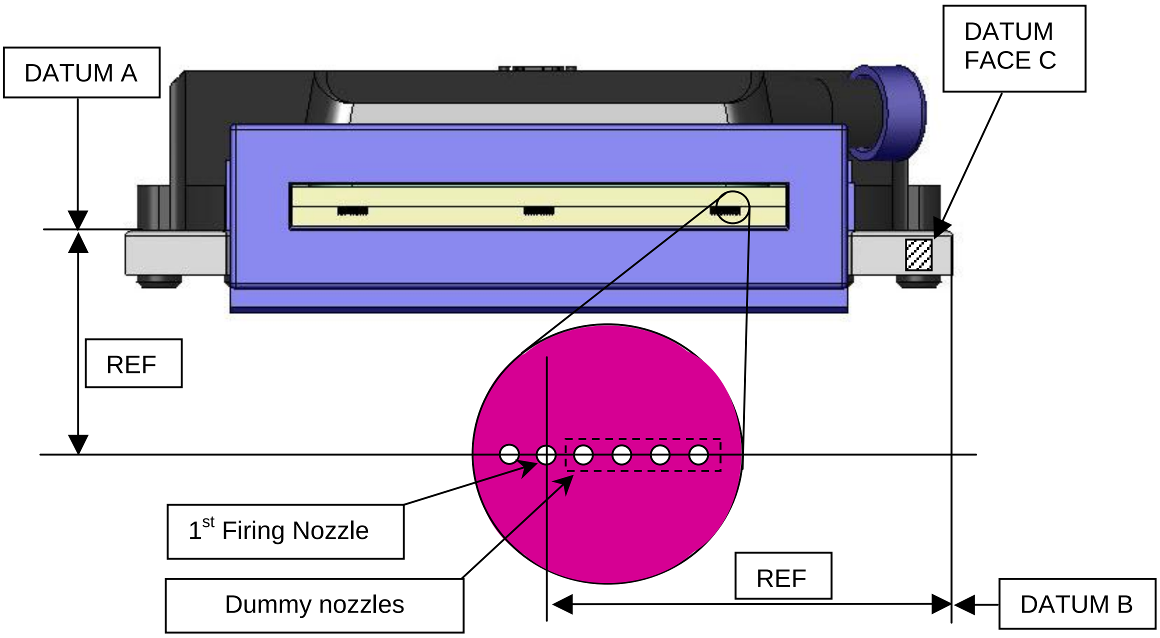


Figure 4.3 - Datum reference to 1st firing nozzle

4.2.3 Print distance

The recommended printing distance between the media or substrate surface and the printhead nozzle plate is shown in figure 4.4.

Greater distances will significantly reduce the print quality of the image. The effect of 'satellite drop' formation is increased significantly at high print distances, reducing overall print quality.

A consistent print distant must be maintained during operation to ensure optimal print quality.

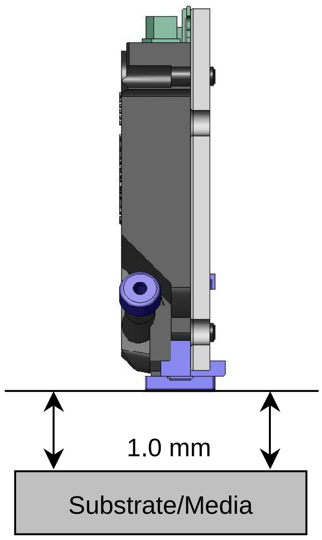


Figure 4.4 - Print distance

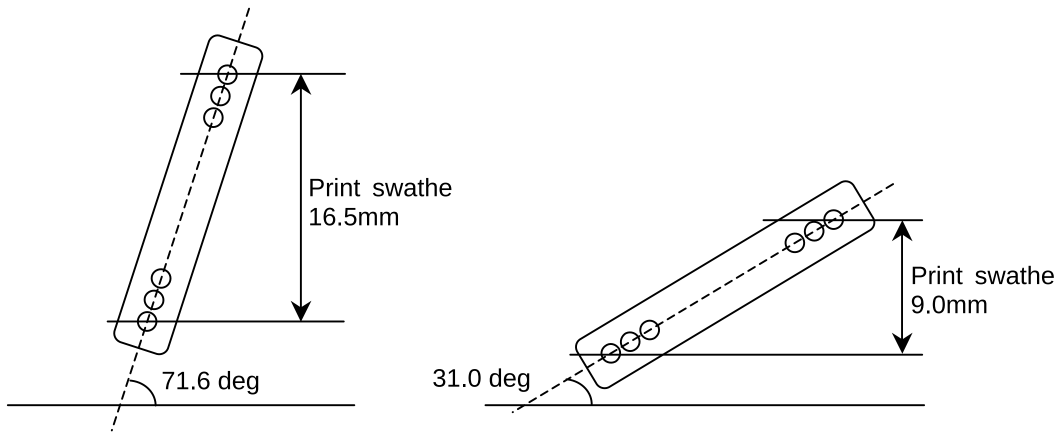
4.2.4 Angle of printhead relative to substrate

The XJ128 printhead is designed to be mounted at an angle, relative to the substrate, to achieve the desired printing resolution. Mounting the printhead at a more acute angle results in a higher vertical printing resolution.

The horizontal printing resolution is driven by the firing frequency and the speed of the printhead relative to the substrate. However, for a given vertical resolution the horizontal resolutions are restricted. This restriction is a consequence of the nozzle divided into three different phases, with the fire of each phase separated by a fixed period.

As an example, for ‘single-pass’ printing[6], the XJ128 printhead should be angled relative to the substrate as shown in figure 4.5, in order to achieve the desired print resolution of 200 x 200dpi for the XJ128/200 or XJ128/200 Plus printhead, or 360 x 360dpi using the XJ128/360 printhead.

Failure to angle the printhead and correctly process the image to be printed may result in a ‘saw tooth’ effect caused by the A-B-C firing sequence.



XJ128/200 and XJ128/200 Plus **XJ128/360**

Figure 4.5 - Angled printheads for printing at specified resolution

4.3 Thermal management

The absolute maximum temperature of the printhead must not exceed 55^{o}C. If the printhead exceeds this temperature, permanent damage can occur.

4.3.1 Printhead temperature

Temperature control of the printhead is important to ensure reliable operation. Printheads produce heat when powered, whether printing or idling. It is essential that heat management be considered when installing the printhead in order to obtain optimum performance and reliability.

Please refer to the Ink and Printhead User Guide for the recommended operational temperature or temperature range of the printhead for the specified ink.

[6] ‘Single-pass’ printing based upon testing using oil-based inks on porous substrates

The operational temperature of the printhead will be controlled by several factors:

- Thermal paths arising from the way the printhead is mounted (heat sinking)
- Thermal paths in the application (mechanical and liquid)
- The type of ink used
- Internal heat generation (electronics etc)
- Environmental heat dissipation

The maximum heat dissipation to be removed from the XJ128 printhead is 6 Watts. A typical value for heat dissipation to be removed from the XJ128 printhead is 1 to 2 Watts, in normal operation.

The most effective way of removing heat from the printhead is through the thermally conductive aluminium chassis. This should be used to 'cool' the printheads during operation by removing heat generated by the printheads through a mechanical interface with a heat sink.

4.4 Ink connection

Ensure that clean ink connectors are used. Ink connections to the printhead should be prompt to reduce risk of contamination. Only use approved inks and associated cleaning solutions available from Xaar.

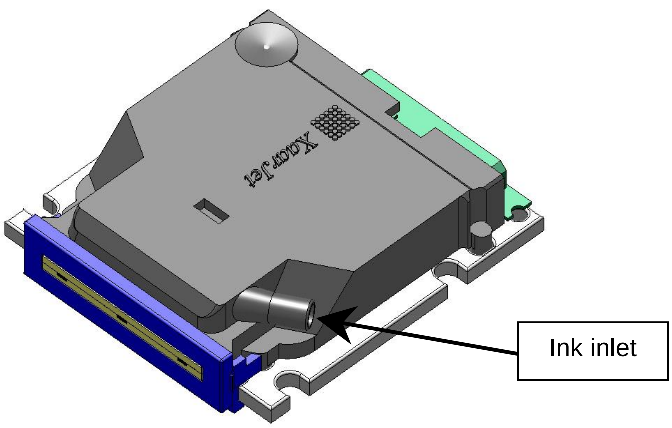


Figure 4.6 – XJ128 ink inlet

The ink connection to the printhead is through the ink inlet port as shown in figure 4.6. Push a 3.0mm ID tube over the ink inlet port. A flexible-type of tubing should be used, as an interference fit is required. The ink inlet port has an OD of 3.1mm. This is also shown on the mechanical drawing in Appendix D. A 4mm OD/3mm ID tubing is recommended when supplying ink to the XJ128 printhead.

The ink supply pressure will depend upon the type of printhead being used. In general, the XJ128/200 Plus printhead will require a lower negative pressure of ink supplied than that required for the XJ128/200 and XJ128/360 printheads supplied with the non-wetting coating. Table 4.1 shows operational and absolute pressure supply details for all printhead models;

Printhead	Parameter	Min	Max	Typical	Unit
XJ128/200 XJ128/360	Operational ink pressure supply	-0.1	-0.4	Note 1	Kpa
XJ128/200 Plus	Operational ink pressure supply	-0.2	-1.0	Note 1	KPa
XJ128/200 XJ128/360 XJ128/200 Plus	Absolute ink pressure supply	-800	2000	-	mBar

Table 4.1 – Pressure supplies

Note: -0.1KPa to –1.0KPa corresponds to –1mbar to –10mbar or –10mm H_20 to –100mm H_20.
Where 1kPa = 10mbar ≅ 100mm ink.

Please refer to appropriate the Ink and Printhead User Guide documentation for specific ink pressure supply values.

The negative pressure of the ink supplied to the printhead must be referenced to the lowest printing nozzle in the printhead. This must be remembered when the printhead is orientated 'on-edge' as shown in figure 4.7.

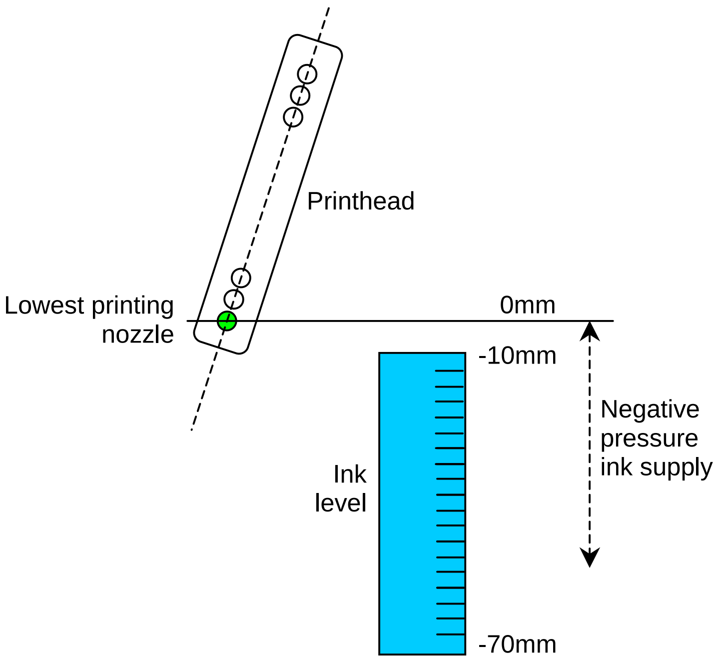
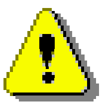


Figure 4.7 – XJ128 printing 'on-edge'



As the printhead filter is integral within the printhead, it cannot be replaced and a build up of contamination inside the filter material can affect the printheads performance. It is therefore important that the ink is filtered to a level of 5µm prior to entering the printhead. This should be done as part of the ink delivery system, please refer to the section 7 for more detail.

Do not operate the printhead without supplying ink to it

4.5 Mechanical system design

This section details important information that will aid in the design of the mechanical system used with the printhead.

4.5.1 Printhead shock and vibration

It is recommended that the printhead is protected from shock and vibration as this will have a severe impact on the printed image quality and printhead life.

4.5.2 Printhead enclosure

The surroundings in which the printhead will be used will have a strong influence on the performance of the printhead and the maintenance it will require. It is recommended that the printhead be used in as clean as environment as possible and the use of an enclosure around the printheads can help to reduce environmental contamination.

4.5.3 Multiple printheads

When using multiple printheads grouped together, the printheads should be arranged as to minimise the distance between printheads. This will help to minimise drop placement errors due to substrate stretch and velocity variation between the first and last printheads.

4.5.4 Substrate / media or printhead motion

To ensure adequate print quality, the substrate/media motion should be smooth and as straight as possible. Errors due to substrate motion can cause drop placement inaccuracies that may be visible in the resulting print.

The description of a moving printhead applies to any printhead operating by either reciprocating over media to generate a print wider than the printhead swathe width, or by indexing the printhead between swathes where the principle movement is of the media.

The maximum acceleration/deceleration the printhead can tolerate before the ink meniscus breaks (resulting in air ingestion, or flooding of the nozzle plate) is 4g. This threshold value will vary with the negative pressure of the head of ink, the level of 'damping' in the ink supply, the type of ink and the ambient temperature.

The effects of system vibration can also be seen in the final print. Typical effects are light-and-dark banding, caused by pressure fluctuations and stitching errors.

5 Electrical Functions

5.1 Function overview

There are several major electrical printhead control functions that are to be handled by the customer application. Table 5.1 details the pin out of the electrical connector and the functions of each signal. The electrical interface is common for all XJ128 printhead models.

Figure 5.1 shows the pin-out convention for the XJ128 printhead.

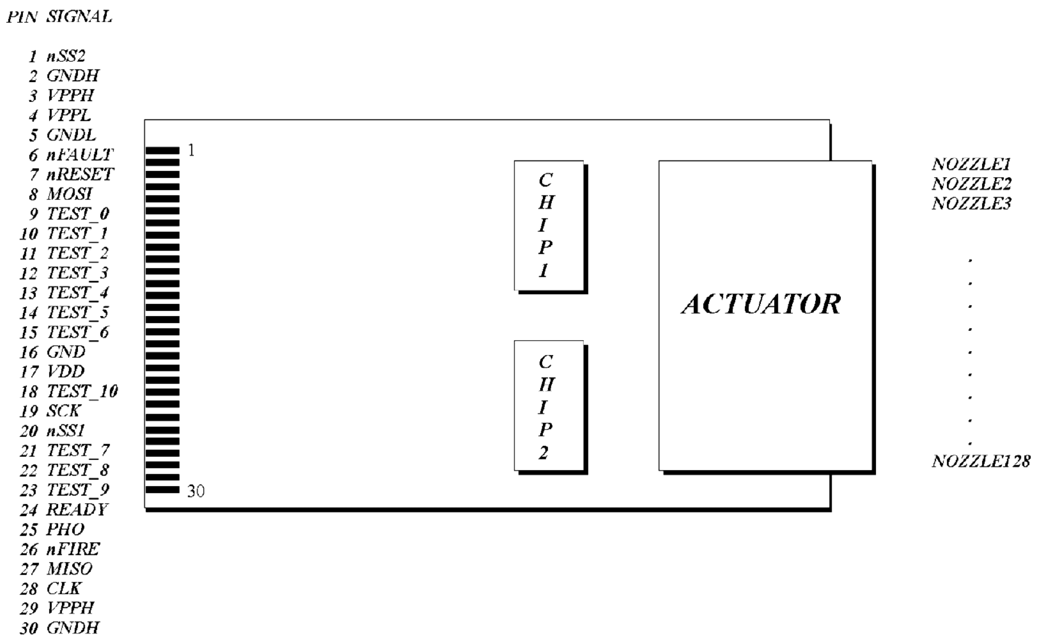


Figure 5.1 – XJ128 printhead pin-out convention

Pin	Signal name	Pin type	Function
1	nSS2	Input	Chip select for MOSI/MISO – chip 2
2	GNDH	Supply	High voltage ground
3	VPPH	Supply	35V high current voltage supply
4	VPPL	Supply	35V low current, low noise voltage supply
5	GNDL	Supply	High voltage, low noise ground
6	nFAULT	Output	High temp error signal
7	nRESET	Input	Driver chip logic reset
8	MOSI*	Input	Serial data input select
9	TEST_0	Input	Not connected
10	TEST_1	Input	Not connected
11	TEST_2	Input	Not connected
12	TEST_3	Input	Not connected
13	TEST_4	Input	Not connected
14	TEST_5	Input	Not connected
15	TEST_6	Input	Not connected
16	GND	Supply	5V logic ground
17	VDD	Supply	5V logic supply
18	TEST_10*	Input	Must be tied to VDD
19	SCK	Input	Main sample clock – 'data strobe'
20	nSS1	Input	Chip select for MOSI/MISO – chip 1
21	TEST_7	Input	Not connected
22	TEST_8	Input	Not connected
23	TEST_9	Input	Not connected
24	READY	Output	'Printhead ready' used for signal timing
25	PHO	Input	Phase order select
26	nFIRE	Input	Printhead 'fire' trigger signal
27	MISO	Output	Serial data output select
28	CLK	Input	State machine clock – 'sample clock'
29	VPPH	Supply	35V high current voltage supply
30	GNDH	Supply	High voltage ground

Table 5.1 – Pin out of electrical connector

5.2 Signal level definition

Low Level represents a logic "0"
This is achieved holding the signal to logic ground (GND).

High Level represents a logic "1"
This is achieved holding the signal to logic power supply voltage (VDD).

* Pull-down resistor inside printheads: 2-30kΩ

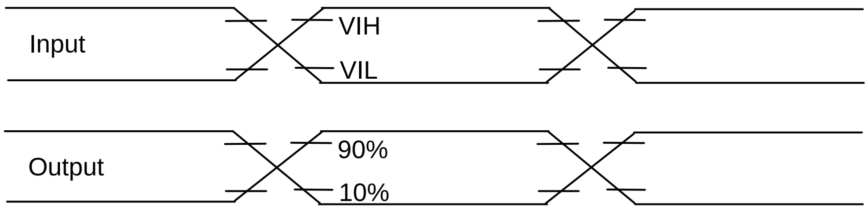


Figure 5.1 - Signal level definition

5.3 Signal descriptions

nSS1 and nSS2

Active low. Chip select lines for driver chip 1 and 2. A low level selects the corresponding 64-channel segment as receiver of the MOSI data. This signals controls the MISO tri-state output signal.

VDD

Power supply for logic circuit. Should be set at +5.0V.

VPPL

Low current, low noise, high voltage power supply. Should be set to +35V.

VPPH

High current, high voltage power supply. Should be set to +35V.

GND, GNDL, GNDH

Grounds for voltage power supplies.

nFAULT

Active low error output signal that indicates a high printhead temperature. Will stay active until temperature goes below the high temperature threshold level, set to 45-55° Celsius. An external system responding to an nFAULT alarm should stop printing and wait for the print head to cool.

The nFAULT driver does not have hysteresis and will begin to switch at a temperature between 45-50° C due to noise induced into the circuit when the head is fired. Be aware that while READY is high there is no noise induced and nFAULT will be stable. Therefore nFAULT should only be sampled while READY is high.

nRESET

Active low, asynchronous reset of the driver chip sequence logic. nReset will not reset the contents of the input data shift registers.

MOSI

Serial data input (Master Out Slave In). Print data is loaded through this line.

TEST_0 - TEST_9

All inputs not required for the operation of the XJ128 printhead. Should not be connected.

TEST_10

No function. But, input must be tied high to VDD (+5V).

If there is any risk that TEST_10 may have dropped to a low level state, then the nRESET signal must immediately be activated (low level) to make the printhead return to correct operating mode.

SCK

Also referred to with other XJ printheads as ‘data-strobe’. Data is clocked into the shift register on the leading edge of the SCK, and clocked out of the shift register on the falling edge of the SCK. 128 load operations are required to completely fill a printhead with pixel data. Data clocked into the head after the 128th DSTB and before nFIRE, will cause the first data loaded to be lost. The maximum frequency of SCK pulses is 2MHz. Print data can be loaded for the next pixel whilst the previous pixel is being printed.

nFIRE

Active low. Level sensitive input used to ‘fire’ the print head. The nFire signal can be activated independent of whether print data has been loaded or not.

READY

Active high. An output indication that two of the three-phase firing sequence is complete. Since the transmission of data is allowed two clock cycles after nFire, this signal does not mean that the head is busy, but is used as a timing pulse so the system can stay synchronised. nFIRE is sampled while READY is active (high level).

PHO

Active high. This signal determines the phase order. When active, the phase order is C-B-A and inactive, the phase order is A-B-C. This signal has the same set-up and hold requirements as nFIRE.

MISO

Master In-Slave Out or Serial out data line. Connected to the most significant bit, i.e. bit 63 of the internal shift register. This signal is a tri-state output signal. The output is controlled by nSS1 and nSS2. This is used when daisy-chaining printheads to shift data from one printhead to another.

CLK

A state-machine clock that drives the driver chip state-machine and synchronisation logic. Should be set to 1MHz. Also referred to with other XJ printheads as ‘sample clock’.

5.4 Electrical connection to the printhead

The electrical interface connector is a 30-pin connector. The printhead interface makes use of an AMP™ connector type: “AMP™ 30 pin receptacle board-to-board connector”. The AMP™ part number for the printhead connector is: 6-176913-0 (female).

A suitable connector that could be used on a printhead interface cable is the corresponding "male" connector for vertical mounting: "AMP™ 30 pin plug/post board-to-board connector". The AMP™ part number for a suitable printhead interface flex-cable connector is 9-176140-0 (male).

The chamfer in the upper left-hand corner of the connector, (when the printhead is viewed from the rear) indicates Pin 1.

Typically, the AMP™ connector is fixed to a 30-way flex-cable. A rigid connection is not advised as this exerts stress onto the surface mount AMP™ connector.

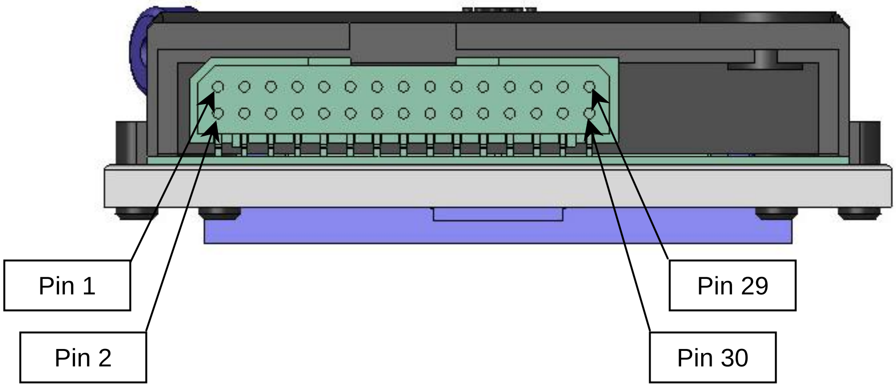


Fig 5.2 – Pin numbering on the printhead electrical connector

5.5 Grounding and isolation

Please note that the following points should be addressed when interfacing with the XJ128 printhead. If a Switched mode power supply is used, ensure it is adequately screened. By default, use screened cables. Filter the mains input to the power supply. Use a short, thick connection, from the incoming earth of the mains supply direct to the chassis of the printing system.

GND, GNDL and GNDH (ground supplies) should be made via the ground of the 30-pin printhead connector. No electrical connection should be made from the 30-pin printhead connector to the chassis of the printhead. GNDL and GNDH should be a common ground, and are joined within the printhead. The low voltage ground (GND), and the high voltage grounds (GNDL and GNDH) must not be joined or grounded at any other point. Refer to section 6.3.1 for detail on grounding schemes.

6 Electrical Specifications and Data

6.1 Electrical requirements

The printhead utilises two custom IC's in a serial arrangement. Data is transferred via a one-bit synchronous serial interface. The operating frequency of the sample clock should be fixed at 1MHz. Please refer to section 6.1.3 for details. The printhead requires three different power supplies, providing two discrete voltages; VDD, VPPH and VPPL.

6.1.1 Absolute maximum electrical ratings

If the absolute maximum rating of any of the parameters stated in table 6.1 is exceeded, the printhead may be permanently damaged. Ensure to use the printhead within the range of the absolute maximum ratings.

Parameter	Symbol	Rating	Unit
Logic supply voltage	VDD1	-0.5 to +6.0	V
High current high voltage supply	VPPH	-0.5 to +35.0	V
Low current high voltage supply	VPPL	-0.5 to +35.0	V
Logic input voltage	VI	-0.5 to VDD+0.5	V
Logic output voltage	VO	-0.5 to VDD+0.5	V
High current supply feed	IPPH	0-200 per 64 channels	mA
Low current supply feed	IPPL	5	mA
Current per pin	I	100	mA

Table 6.1 – Absolute maximum electrical ratings

The maximum capacitance for the input and output pins through the XJ128 printhead connector are shown in table 6.2.

Symbol	Max	Unit
Cin	30	pF
Cout	30	pF

Table 6.2 - Connector pin capacitance

6.1.2 Power supply sequencing

It is important that the power sequencing of the power supplies is maintained at all times. Failure to do so can result in damage to the IC's within the printhead. This procedure is crucial and must not be initiated when connecting or disconnecting from the printhead.

Allow sufficient time for the decoupling capacitors inside the printhead to become charged or discharged during the power up or power down sequence. Due to the design of the power supply no fixed charge/discharge timings can be provided. These must be measured on the application itself. The VPPH should have reached the level of VDD or below before VDD is switched off.

Table 6.3 and table 6.4 show the power up and power down sequencing required by the printhead. Please also reference figure 6.1 for timing requirements. The initial voltage supply must stabilise before switching the second voltage supply.

On Sequence	VDD	VPPH	VPPL	nRESET	Condition
1	0V	0V	0V	ACTIVE	$t_{Power\ on} \geq 100$ ms
2	VDD	0V	0V	ACTIVE	
3	VDD	VPPH	VPPL	ACTIVE	
4	VDD	VPPH	VPPL	INACTIVE	

Table 6.3 - Power up/on sequence

Off Sequence	VDD	VPPH	VPPL	nRESET	Condition
1	VDD	VPPH	VPPL	INACTIVE	$t_{Power\ down} \geq 100\ \mu s$
2	VDD	VPPH	VPPL	ACTIVE	
3	VDD	0V	0V	ACTIVE	
4	0V	0V	0V	ACTIVE	

Table 6.4 - Power down/off sequence

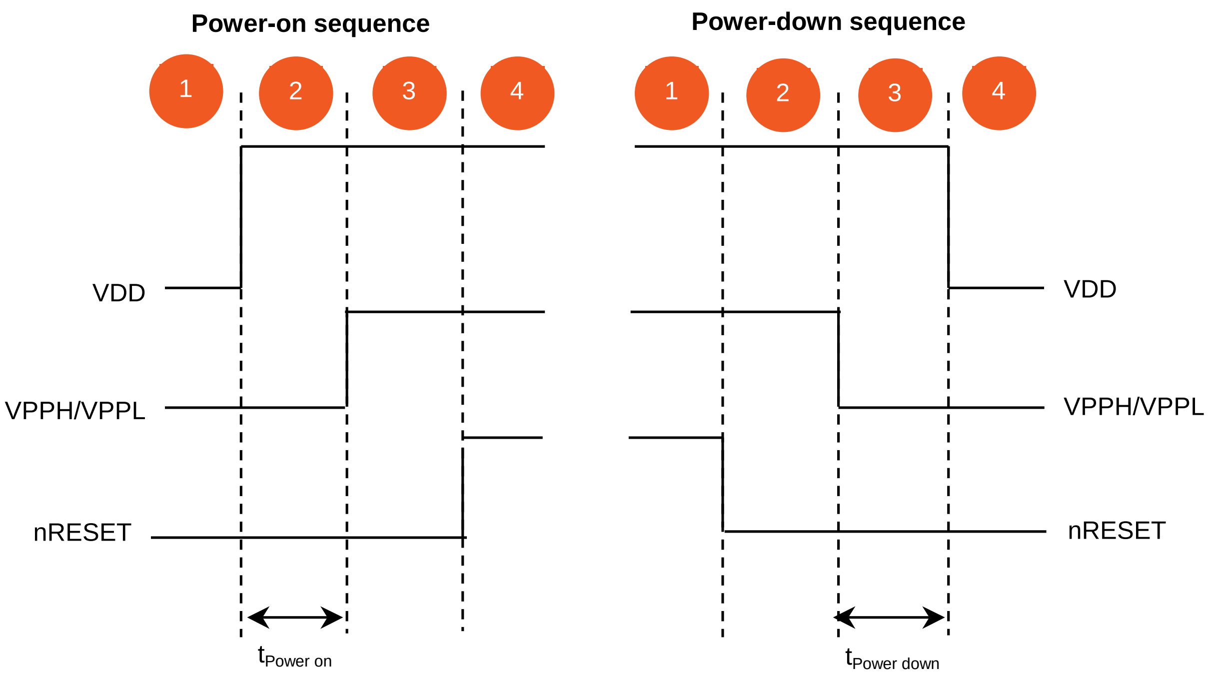


Figure 6.1 – Power on/down sequencing

6.1.3 Recommended electrical operating conditions

To ensure proper and reliable operation of the printhead use the following electrical operating conditions shown in table 6.5. Please also refer to the Ink and Printhead User Guide documentation, which may detail different operating conditions for specific inks.

Parameter	Symbol	Min	Typ.	Max	Unit
Logic supply voltage	VDD	4.5	5.0	5.5	V
High voltage high current supply	VPPH	-	35.0	36.0	V
High voltage low current supply	VPPL	34.0	35.0	36.0	V
High level inputs signal voltage	VIH	0.8 x VDD	5.0	VDD	V
Low level inputs signal voltage	VIL	0	0	0.2 x VDD	V
High current, high voltage supply current	IPPH	-	-	400	mA
Low current, high voltage supply current	IPPL	-	1.7	5.0	mA
Clock frequency	CLK	0.95	1.0	1.05	MHz

Table 6.5 – Recommended electrical operating conditions

Table 6.6 describes the maximum current and loading for the printhead signals not already detailed in this document.

Parameter	Symbol	Max input current	Max input load	Unit
Chip select for MOSI/MISO – chip 1	nSS1	1.0	-	µA
Chip select for MOSI/MISO – chip 2	nSS2	1.0	-	µA
High temp error signal	nFAULT	-	4.0	mA
Driver chip logic reset	nRESET	1.0	-	µA
Serial data input select	MOSI	3.0	-	mA
5V logic supply	VDD	2.0	-	mA
Main sample clock	SCK	1.0	-	mA
'Printhead ready' used for signal timing	READY	-	4.0	mA
Phase order select	PHO	1.0	-	mA
Printhead 'fire' trigger signal	nFIRE	1.0	-	mA
Serial data output select	MISO	-	4.0	µA
State machine clock	CLK	1.0	-	mA

Table 6.6 – Signal current and loading details

Table 6.7 shows the typical and maximum power consumption expected when operating the XJ128 printhead.

	Typical Power Consumption	Max Power Consumption	Unit
XJ128/200 XJ128/200 Plus	3	6	Watts
XJ128/360	3	6	Watts

Table 6.7 – Power consumption of XJ128 printhead

It is recommended that a safety circuit be implemented into the power supply of the printhead in case of abnormal power failure. The printhead does not contain any current limitation devices, or the ability to shut down the power supply in the necessary sequence.

Failure to operate the printhead with the recommended voltage and current values can result in poor reliability and incorrect drop volume.

6.1.4 Temperature compensation

Temperature compensation within the XJ128 printhead is an internal printhead function. **This section is therefore for information only.**

As the operational temperature of the printhead changes the viscosity of the ink in the printhead will also change. This change in viscosity would influence the drop volume and performance of the printhead if not compensated for. The XJ128 automatically changes the driver chip voltage to compensate for the change in operating temperature.

The temperature compensation for the XJ128 is fixed and cannot be adjusted.

- Lower temperatures give higher viscosity and therefore require a higher driver chip voltage.
- Higher temperatures give lower viscosity and therefore require a lower driver chip voltage.

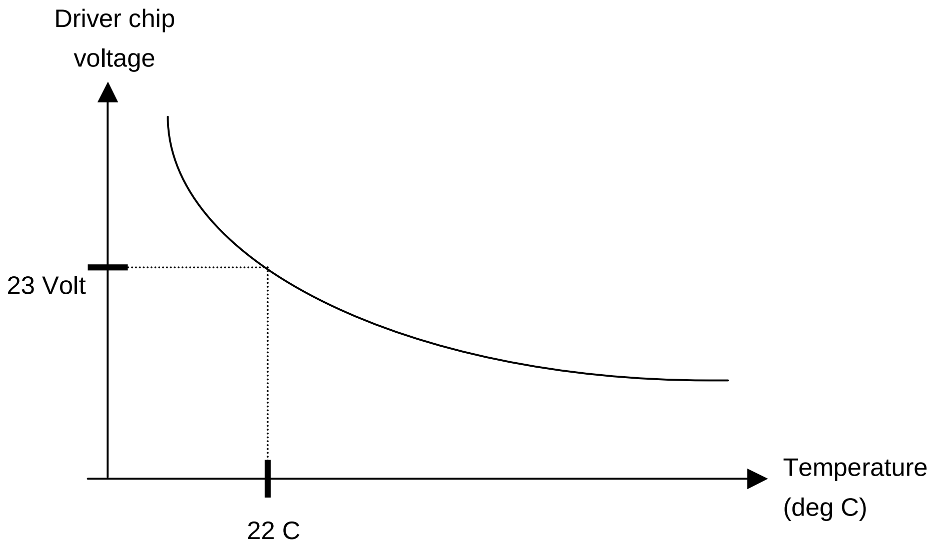


Figure 6.2 - Temperature compensation 'curve' example

6.2 Data structure

6.2.1 Configuration data structure

All XJ128 printhead models are configured and ready to operate following the power-on sequence. No external printhead configuration is required.

6.2.2 Cycle order

Due to the “shared wall” design it is not possible to eject nozzles from adjacent channels at the same time. To overcome this, all the nozzles are divided/grouped into three “droplet ejection” groups, called cycles, as shown in the table 6.8.

Group Name	Driving Group
A Cycle	Nozzles in the range [(1+n*3)… 126]
B Cycle	Nozzles in the range [(2+n*3)… 127]
C Cycle	Nozzles in the range [(3+n*3)… 128]

Table 6.8 - Nozzle grouping into cycles

The first firing nozzle is an ‘A’ cycle. The last firing nozzle is a ‘B’ cycle. If the printhead is used bi-directionally, the order of firing is reversed for the return pass i.e. C-B-A by use of a ‘phase order’ signal, PHO, on the user interface.

The cycle order sequence is controlled by the user application through the interface connector. The A-B-C cycle order is called the ”Normal cycle order” and the C-B-A cycle order is called the ”Reversed cycle order”.

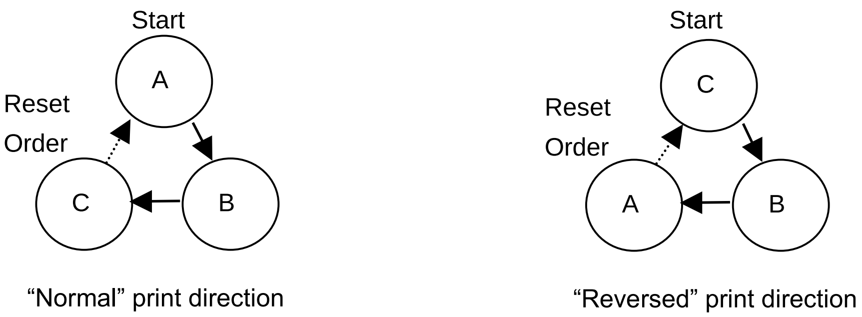


Figure 6.3 – Cycle order when changing the cycle direction using ‘PHO’

With the PHO signal set at low level (inactive), the “Normal cycle order” is used, which means that the printing order of the groups is A-B-C. When the PHO signal is set at a high level (active), the “Reversed cycle order” is used, which means that the used printing order of the groups is C-B-A.

PHO level	Cycle order			
	1	2	3	4
LOW	1+n*3	2+n*3	3+n*3	1+n*3
HIGH	3+n*3	2+n*3	1+n*3	3+n*3

Table 6.9 - PHO pin level settings for cycle order

6.2.3 Phase triggering

For each pulse on the trigger signal, nFIRE, the three cycles will print automatically, as the driver chip controls the three-phase firing of the nozzles internally. Once a printhead has been loaded with a set of data for the 128 nozzles, the complete set of data will be printed following an nFIRE signal from the driver electronics.

The three cycles will fire with a fixed time period between each cycle. This time is known as the cycle delay and cannot be changed.

Printhead	Cycle delay	Units
XJ128	60	µs

Table 6.10 – XJ128 cycle delay

6.2.4 Print data structure

The first bit shifted in will be the most significant bit in the shift register, that is bit 63, which will drive channel 64 or 128. The last bit, which is bit 0, is the least significant bit and will drive channel 1 or 65.

The data loading order/structure is shown in table 6.11.

Data loading order							
	First data	← Shift direction ←					Last data
Data order	0	1	2	…..	61	62	63
Nss1	INACTIVE	INACTIVE	INACTIVE		INACTIVE	INACTIVE	INACTIVE
Nss2	ACTIVE	ACTIVE	ACTIVE		ACTIVE	ACTIVE	ACTIVE
MOSI	CH 128	CH 127	CH 126		CH 67	CH 66	CH 65

Data loading order							
	First data	← Shift direction ←					Last data
Data order	64	65	66	…..	125	126	127
Nss1	ACTIVE	ACTIVE	ACTIVE		ACTIVE	ACTIVE	ACTIVE
Nss2	INACTIVE	INACTIVE	INACTIVE		INACTIVE	INACTIVE	INACTIVE
MOSI	CH 64	CH 63	CH 62		CH 3	CH 2	CH 1

Table 6.11 - Print data loading order

For printheads the print data (a “1” is eject droplet and a “0” is do not eject droplet) is only loaded through data input signal MOSI.

Data for one pixel line is loaded by a sequence of two 64-bit load operations. The ‘data strobe’ (SCK) clock is used to clock data into the shift register on the rising edge. The nSS(x) signal should be pulled low to enable the target chip to load the new print data.

The shift register is double buffered, allowing the loading of the next line of print data whilst the current line is being printed. Data may be loaded into the shift register when the READY signal has switched to the inactive state. During this time, the printhead could be printing the first line of data.

Once all the pixel data has been loaded, the nFIRE signal is triggered to ‘fire’ the loaded data as droplets. It is important that input PHO is stable before nFIRE is triggered. nFIRE ensures that all three cycles (A, B and C) are printed with a fixed time period between each cycle.

As the printhead starts firing the ‘C-cycle’ of the loaded data, the READY signal switches to the inactive state.

Figures 6.4 and 6.5 show the data load sequence and timing for all models of the XJ128 printhead. The timings of these signals shown are tabulated in table 6.12.

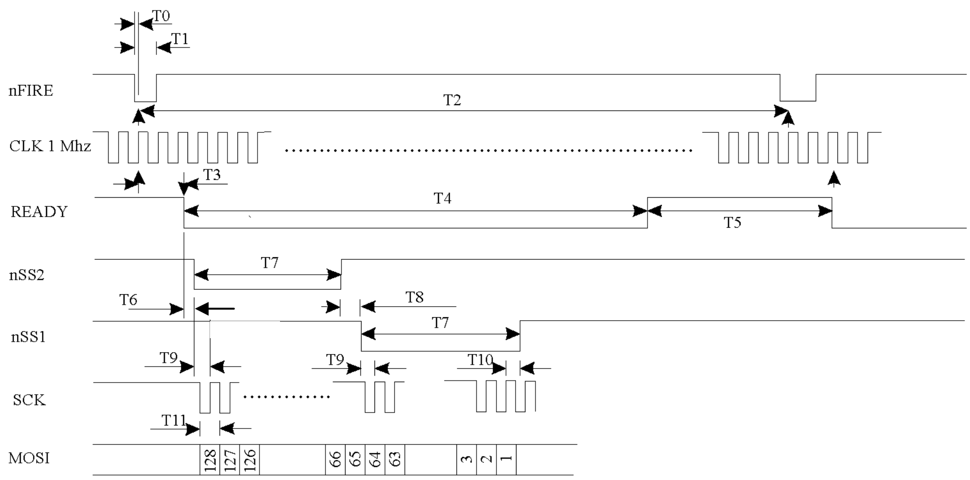


Figure 6.4 – XJ128 print data loading and control signals

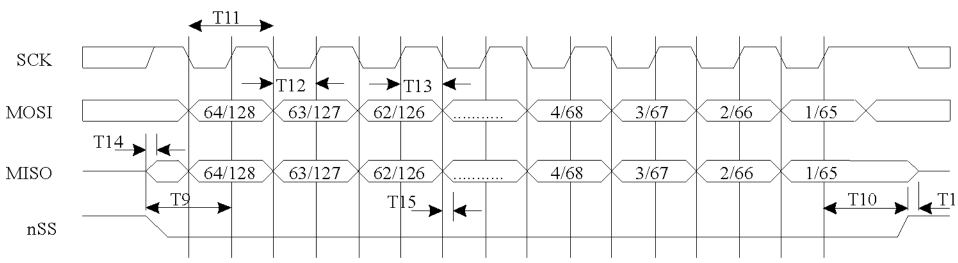


Figure 6.5 – Further timings for XJ128 control signals

Parameter	Symbol	Min	Typ	Max	Units
nFIRE set-up time	T0	100			ns
nFIRE active pulse width	T1	1		120	µs
Print cycle time	T2			180	µs
nFIRE active to READY inactive delay	T3	2.35		3.35	µs
READY inactive pulse width	T4	121.5			µs
READY active pulse width	T5		58.5		µs
READY inactive to nSS2 asserted	T6	250			µs
nSS Data active valid time	T7	32			µs
nSS non active switch time	T8		250		ns
nSS asserted to SCK set-up time	T9	250			ns
SCK to nSS hold time	T10	250			ns
SCK cycle time	T11		0.5	2	µs
MOSI data set-up time to SCK	T12	100			ns
MOSI data hold time from SCK	T13	100			ns
nSS asserted to MISO valid delay time	T14			120	ns
SCK to MISO valid delay time	T15			240	ns
nSS negated to MISO tri-state delay time	T16			240	ns
PHO valid to CLK set-up time	T17	100			ns
PHO valid to nFIRE asserted	T18	0			ns
CLK to nFIRE hold time	T19	10			ns
CLK to PHO hold time	T20	10			ns
CLK to READY negated delay time	T21			240	ns
CLK to READY asserted delay time	T22			240	ns
nRESET pulse width	T23	500			ns

Table 6.12 – Timing details for XJ128 data signals and control

Symbol	Condition	Min	Max	Unit
IDD		-	1.0	mA
VIH	SCK max 2MHz	0.9 * VDD	-	V
VIL	SCK max 2MHz	-	0.1 * VDD	V
VIH	SCK max 1MHz	0.8 * VDD	-	V
VIL	SCK max 1MHz	-	0.2 * VDD	V
VOH	MISO, READY, nFAULT, Iload = max 4mA, VDD = 4.5V	3.8	-	V
VOL	MISO, READY, nFAULT, Iload = max 4mA, VDD = 4.5V	-	0.4	V

Table 6.13 – Recommended electrical operating conditions

6.3 Electrical system design

6.3.1 Power supply and grounding connections

The grounding signals GND, GNDH, GNDL and supply voltages VDD, VPPH and VPPL should be common on the drive electronics and not connected to the chassis earth ground.

The power and grounding supplied between the printhead and driver electronics should be arranged as shown in figure 6.6.

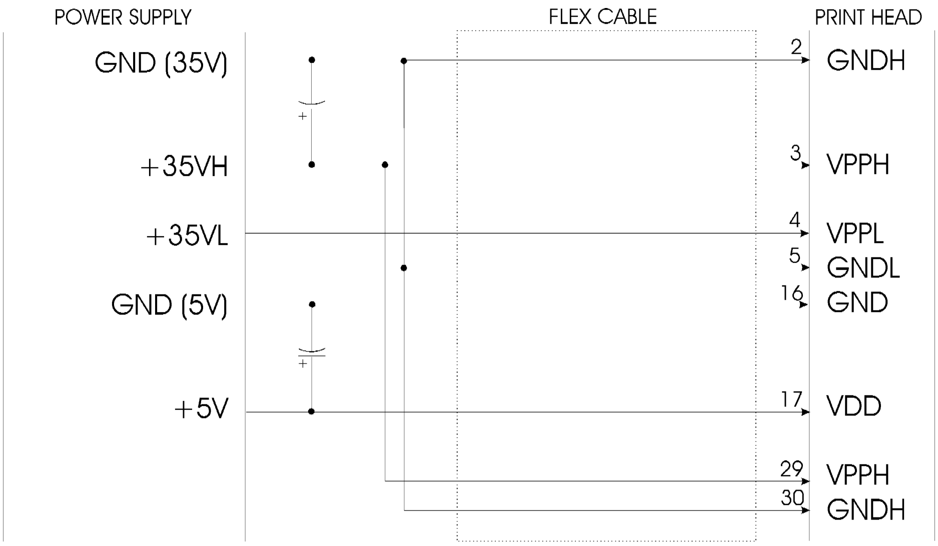


Figure 6.6 – Power supply and grounding arrangement

The negative side of the logic and high voltage supplies should be isolated within the driver electronics, note that they are joined within the printhead and must **not** be joined at any other point.

- The printhead cable does not need to be screened.
- The printhead(s) and driver electronics should be enclosed.
- The enclosure should be grounded to the printer system ground.
- No electrical connection should be made to the chassis of the printhead.
- Electrical inputs into the printhead enclosure from the power source and/or PC are suggested through a bulkhead electrical connector.

Voltage supplies VDD, VPPH and VPPL should be isolated.

6.3.2 Cable lengths and signals

Cable and flat flexible flexi lengths should be kept to a minimum and the signals at the printhead should be checked for noise and signal supply levels. Where (flexi) cables are used a maximum length of 450mm is recommended.

Cables supplying control and power signals to the XJ128 printhead should be screened.

6.3.3 ESD and EMC considerations

Although the printhead has been designed with an ESD path it is possible that the discharge of any electrostatic charge may corrupt the printhead data and or prevent the printhead from firing. It is recommended that the printing system should be designed to minimise the build up of electrostatic charge on the media. All printhead connector pins have ESD protection. The maximum protection level is 2 kV. For further details ESD compliance, refer to Appendix C.

The printing system should be independently tested for EMC conformity.

Any consequences resulting from the use of this equipment in unapproved environments are not the responsibility of Xaar. Xaar recommends that the compatibility of this equipment should be suitably tested in each un-approved environment before use.

7 Ink Supply System Design

A well-designed ink supply system will contribute significantly to the printing systems' performance and reliability. The information in this following section is a recommendation and provides the bare minimum for a well-designed ink supply system. Please consult with your appointed Sales Engineering representative for further details of ink supply system design.

7.1 Ink supply materials compatibility

Materials compatibility of the ink supply system components with the ink is of paramount importance to maximise the lifetime of the printhead and performance of the system. Parts that are "wetted" with ink and are not compatible with the ink may react, releasing chemicals and or materials that can affect the operation of the printhead.

The Ink and Printhead User Guide document details the materials that have been tested and satisfy Xaar's compatibility requirements. It is recommended that ink supply systems use only these Xaar compatibility approved components.

The 'same' material from different manufacturers can yield totally different materials compatibility results.

7.2 Ink preparation

7.2.1 Good ink

It is imperative that only approved inks are used with the printhead. Materials compatibility and performance of the inks can be guaranteed and help to provide a trouble free development and good quality product.

Only use "good" ink that has been stored and transported according to the ink specifications. Do not use ink that is past its use by date, as this may affect performance and with some ink in some circumstances, cause damage to the printhead.

7.2.2 Ink filtration

The printhead has a small integral filter designed to stop particles entering the printhead and blocking the nozzles. If this filter starts to become excessively blocked then the pressure drop across the filter will increase and the performance of the printhead will severely decrease. This filter cannot be replaced or cleaned.

Ink **must** be filtered by a primary system filter, prior to reaching the integral filter. This will ensure that the filter will last for the lifetime of the printhead.

The primary ink filter should be a 5µm replaceable filter that is used to deliver ink to the ink system reservoir. Ink filtration should take place prior to the printhead ink reservoir, please refer to section 7.4 for ink filter positioning. See the appropriate Ink and Printhead User Guide documentation for filter recommendations and materials compatibility.

7.3 Providing a negative pressure ink supply

The printhead acts like a pump and therefore is capable of pulling ink through it. A negative ink supply pressure must be used with the printhead to stop ink flowing in an uncontrolled manner through the printhead.

The influence of the non-wetting coating on the XJ128/200 and XJ128/360 printheads means that the negative head for the ink supplied to the printhead differs to that when supplying ink to the XJ128/200 Plus printhead. In general, the negative head of ink required supplying ink to the XJ128/200 Plus printhead is greater than that required supplying ink to the standard printheads fitted with a non-wetting coating. The negative pressure used with the printhead and the associated ink is stated in the appropriate Ink and Printhead User Guide documentation.

A negative pressure ink supply can be provided in one of two ways.

7.3.1 Gravity fed negative pressure ink supply

The most common and most simple way to supply a negative pressure ink supply is to position the ink reservoir below that of the printhead nozzles. The ink reservoir is open to atmospheric pressure.

The ink supply pressure can be easily changed by moving the ink supply reservoir, up or down, relative to the printhead.

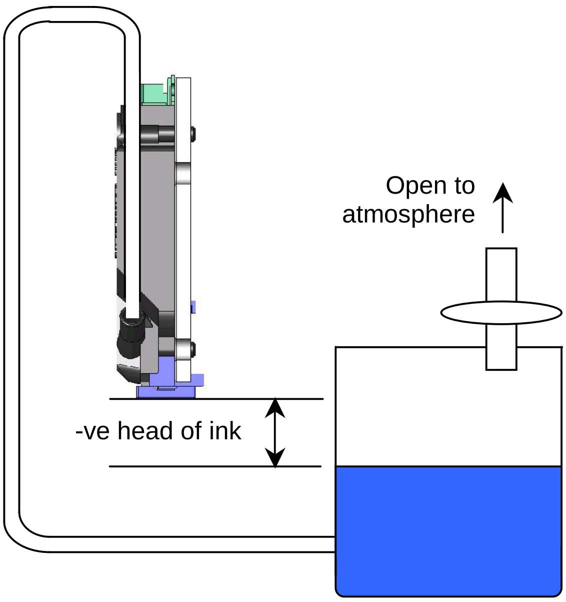
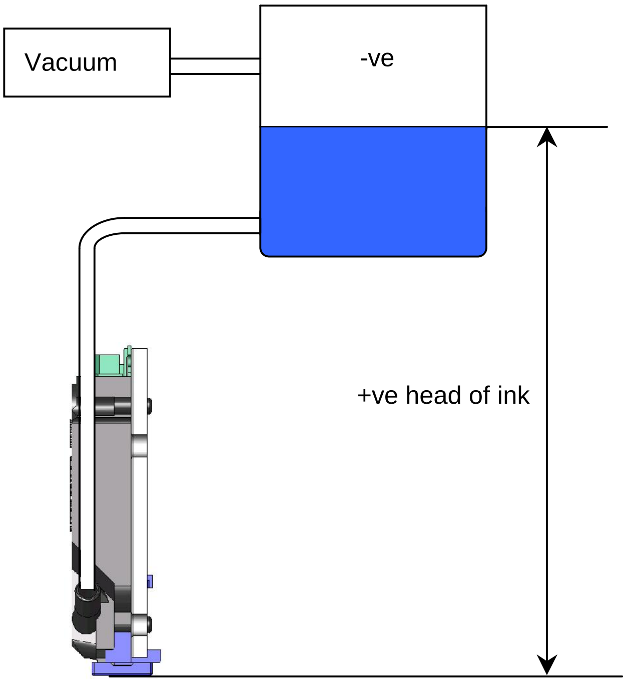


Figure 7.1 – Gravity fed ink supply system

7.3.2 Vacuum fed negative pressure ink supply



The second, more complex technique is a vacuum ink supply system, where a vacuum controls the pressure of the ink at the inlet to the printhead. The ink reservoir is isolated from atmospheric pressure.

This technique requires additional components to accurately control the pressure above the ink, such as a digital vacuum sensor and regulator. The volume of the vacuum supply must be sufficient to avoid small pressure fluctuations in the ink supply.

Figure 7.2 – Vacuum fed ink supply system

7.4 Ink supply system design

An ink supply system should consist of several components. A small ink reservoir (a), stores a small volume of filtered ink supplying it to the printhead, as it is required at the recommended pressure. As the ink in the small reservoir is consumed this must be replaced. Most commonly a small liquid pump (b) supplies this ink, through a system filter (c) to the small reservoir, from a main ink tank (d). The pump is controlled by a feedback system (f) and sensor (e) in the small reservoir. Finally, compatible ink tubing provides the ink flow path between the components.

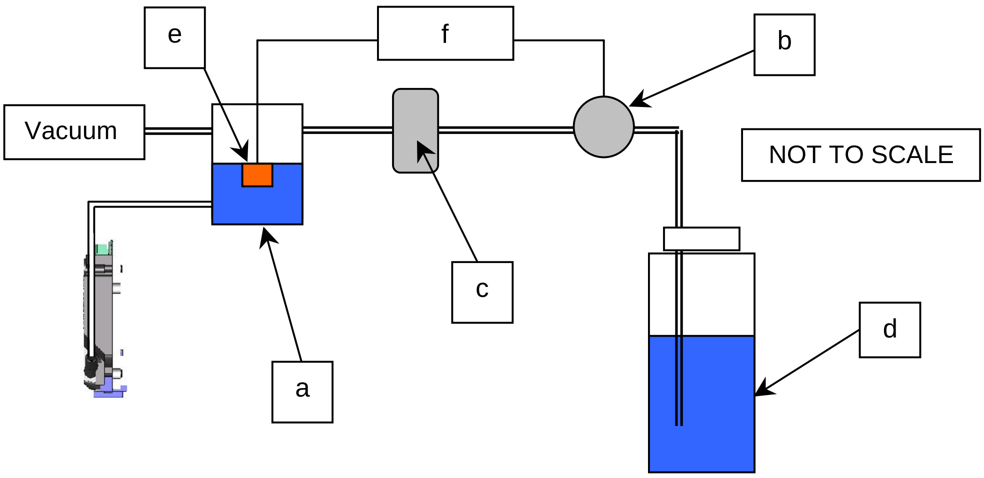


Figure 7.3 - Ink supply system components (system shown – vacuum fed ink supply)

The different forces causing risk of malfunction are Start/Stop accelerations and vibrations from moving the head. The maximum acceleration/deceleration force specified is 4g during operation.

7.4.1 Small ink reservoir

The design of the small ink reservoir should consider the following:

Position it as close to the printhead as possible to minimise tube length and pressure variations between the printhead and reservoir.

Keep the ink volume within the small ink reservoir small, to avoid pressure surges through movement of the reservoir (in the case of a scanning system).

7.4.2 Ink pump system

The ink pump system should be able to respond in such a manner that the ink level in the reservoir is maintained at as constant level as possible. This will minimise ink pressure variation to the printhead. It is also recommended that the pump system can detect a low level of ink in the main ink tank to avoid pumping air into the ink supply system. It is possible for the ink pump to shed particles, so it is recommended that this be placed before the primary system ink filter.

7.4.3 System filter

The system ink filter must be capable of filtering the ink to an adequate level. In use it is important the filter does not contain air, this can cause response delays in the ink feedback system.

7.4.4 Ink tubing

All ink tubing lengths should be kept to a minimum. This is most important between the printhead and the ink reservoir. Tube diameters should be as large as possible to aid ink flow. No tubing less than 3mm ID should be used between the printhead and the 'local' small ink reservoir. The maximum length for ink tubing between these components is 0.5m. Details for this are also found in the appropriate Ink and Printhead User Guide documentation.

7.5 Filling the printhead and supply system

7.5.1 Cleaning the ink supply system

It is recommended that prior to filling the ink supply system, all parts that come into contact with the ink are cleaned and dried prior to filling with ink.

The following process details how to clean ink supply components that use materials that are compatibility approved by Xaar.

- Individual components should be flushed and dried prior to assembly
- Ink supply system should be assembled
- System should be flushed with the appropriate Xaar flushing solution, please refer to the Ink and Printhead User Guide documentation for the appropriate solution
- The system should be purged of flushing solution
- The system and printhead can now be filled with ink, see section 7.5.2.

7.5.2 Filling the printhead

The XJ128 printhead is supplied having been through a series of printing tests as part of the manufacture. There will be some residual print test fluid within the printhead. In some cases, the residual fluid will be incompatible with the ink to be used. In such cases, the printhead will require additional pre-flushing using the approved flushing solution and procedures. These will be ink specific and are detailed in the corresponding Ink and Printhead User Guide.

Filling the printhead for the first time is an important task that must be achieved minimising the amount of air left in the printhead and ink supply system. The level of success achieved from the first filling of the printhead depends on several factors including the orientation of the printhead and the controlling the fill rate of the printhead. In the most common orientation, 'down-shooter', the ink supply tube should be connected to the printhead, as discussed in section 4.4. This is the most difficult orientation for reliably filling the printhead with ink.

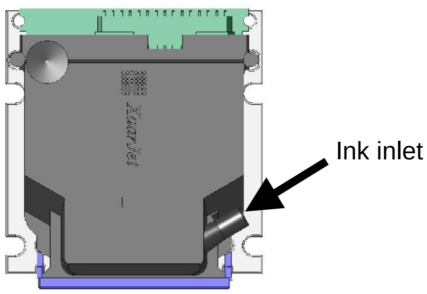


Figure 7.4 - Connecting the ink tubing to the XJ128 'down-shooter'

The best orientation for filling the printhead is with the printhead 'on-edge' and with the ink inlet facing down. See figure 7.5.

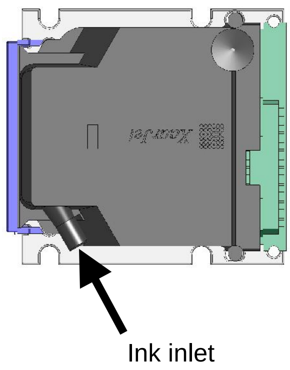


Figure 7.5 – XJ128 printhead 'on-edge'

By controlling the filling process of the printhead for the first time, the performance and reliability of the printhead will be maximised.

With the printhead 'on-edge' as shown in figure 7.5, the following procedure may be followed; Use pressure, no greater than 0.5 bar, to fill the XJ128 printhead with ink. Ink will start to bleed from the nozzles when the printhead is filled with ink. Continue to do this for an additional 5 or 6 seconds to ensure that the air is then removed from the printhead.

If the printhead is in the 'down-shooter' orientation as shown in figure 7.4, the ink must be pulsed between 0.5 and 1.5 bar for periods of 5 seconds each, with ink purging through the printhead at different pressures. This should be repeated for about 5 cycles.

A further 'vacuum purge' is also advised, following the pressure priming of the printhead. Each purge should be 5 seconds in duration, and the process should be repeated about 10 times. The 'vacuum purge' technique is described in section 8.3.2.

For best results, allow the printhead to 'rest' after filling for a minimum of 30 minutes. This allows any diluted air to settle and rise to a free surface. This will ensure that small air bubbles are not in the vicinity of the internal ink filter.

7.5.3 First Use

Prior to printing, a start-up maintenance cycle should be performed on the XJ128 printheads.

The XJ128 printheads that have NWC should be purged with a small amount of ink. The NWC action of the printhead will 'self' clean the ink from the surface of nozzle-plate and printing should not commence until the surface is seen to be clean. Excessive ink can be removed from the edges of the nozzle plate by one of the maintenance procedures.

The XJ128/200 Plus printhead also requires a small purge and then a full nozzle-plate wipe to spread the ink into an even film over the entire surface of the nozzle-plate. The wetting nozzle-plate may require several of these maintenance cycles prior to printing to allow the ink to take (wet) to the nozzle-plate producing a uniform film. The amount of maintenance cycles required to achieve this is ink dependant and so each printhead must be inspected for a consistent and uniform film of ink.

A thin uniform ink layer over the surface of the nozzle-plate is required for good reliability and operation of the XJ128/200 Plus printhead.

The XJ128 printhead should then be correctly primed with ink and ready to start printing.

Purging, wiping and general maintenance procedures are detailed in 'Printhead Maintenance' section 8, of this document.

8 Maintenance, Reliability and Lifetime

8.1 Printhead maintenance

Printhead maintenance plays a central role in the performance and reliability of the XJ128 printheads.

The XJ128/200 and XJ128/360 printheads fitted with the non-wetting coating (NWC) will require a different approach to the maintenance strategy adopted than that required for the XJ128/200 Plus printhead.

As the XJ128/200 Plus printhead utilises a 'wetting' nozzle plate, it is crucial that the printhead is operated with a thin film of ink always present on the surface of the nozzle plate. This ensures that the printhead will operate reliably over time and across the range of operating frequencies. When maintaining the printhead, ensure that the nozzle plate surface is not wiped dry, in order to achieve reliable operation.

8.1.1 Why printhead maintenance

Printhead maintenance is vital for a number of key reasons:

- Printhead lifetime
- Printhead reliability
- Print quality

The extent and nature of the printhead maintenance will determine how the final system performs with the printhead. The aim of a maintenance cycle is to ensure a few simple conditions for the printhead.

- The nozzle plate is clean of ink or debris
- Any build up of air in the channels is removed
- For the XJ128/200 Plus printhead, a thin film of ink remains on the nozzle plate

The extent to which these conditions can occur will depend upon the environment in which the printer is housed, the workload of the system, ink type, media type and the maintenance strategies employed to counter these effects.

8.2 Maintenance strategies

8.2.1 Operational maintenance

Operational maintenance is performed during operation of the machine. It is an automatic function of the printing machine set to run at designated intervals, whilst running a job, to ensure reliable and continuous printing. Depending upon the system a maintenance carriage may need to move into position to perform the maintenance.

8.2.2 Short-term maintenance

Short-term maintenance is performed between printing runs, for example at the start of the run and/ or at the end of the run. It is recommended to be an automatic function of the system to ensure repeatable and reliable execution.

8.2.3 Long-term maintenance

Long-term maintenance is performed at the end of the day or when the system is powered down, and is not in use. This may include capping or flushing the printheads clean of ink with a suitable flushing solution.

8.3 Printhead maintenance methods

A maintenance routine may use one or more of the following methods. Please refer to the Ink and Printhead User Guide documentation for recommendations on which methods suit particular printhead and ink combinations.

8.3.1 Pressure purge

The pressure purge maintenance technique has two main functions:

- Flush the nozzles clean of air or contamination
- Flush the nozzle plate clean of contamination

The method consists of increasing the ink supply pressure until ink is forced through the printhead and out of the nozzles. Figure 8.1 below shows the typical pressure supply needed to perform a pressure purge.

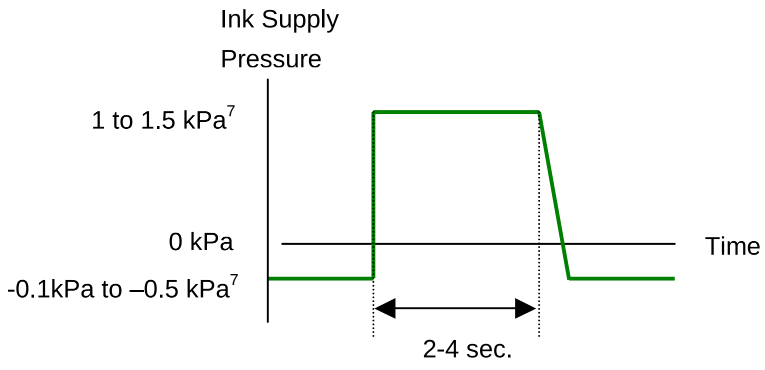


Figure 8.1 - Pressure purge details

If the printhead has an operational temperature different to that of ambient then a pressure purge could introduce a temperature drop and affect performance, therefore a “re-warming” period may be required before operation can resume.

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[7] Ink and system dependant

One way of avoiding such a re-warming period is to ensure that the ink is of the correct operational temperature prior to entering the printhead.

8.3.2 Vacuum purge

The vacuum purge maintenance technique achieves the same two functions as pressure purge, however ink is pulled through the printhead and out of the nozzles by applying a vacuum to the nozzles and nozzle plate area.

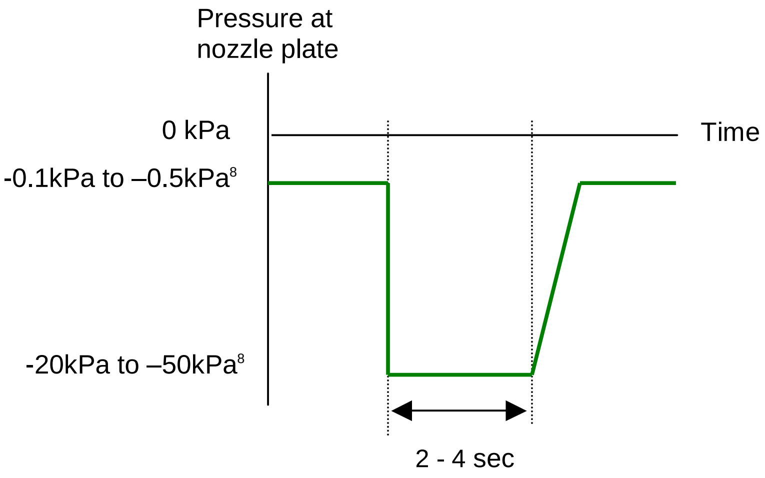

Figure 8.2 - Vacuum purge details

In order for this maintenance technique to be successful, a good seal must be created around the nozzle plate before applying the vacuum to the nozzle plate face. This should be done only with a soft compliant material that will not damage or scratch the nozzle plate surface.

8.3.3 Wiping

Wiping can only be used with the X128/200 Plus printhead, as this printhead utilises the wetting nozzle plate. Wiping must not be used with the XJ128/200 and XJ128/300 printheads as these use a non-wetting coating on the nozzle plate.

Wiping usually consists of the movement of a flexible blade (SH <40) across the nozzle plate. Wiping will often remove fibres that are partially lodged in a nozzle and have resisted purging. It can however re-deposit contamination in another nozzle. Wiping should be carried out in **one direction only** as debris tends to collect on one side of the nozzle plate. Wiping in both directions would re-deposit this debris on the nozzle plate.

It is preferable to wipe at right angles to the line of nozzles to prevent re-contamination, although the stiffness of the blade makes this difficult. A compromise is to wipe with a blade at an angle.

The wiper should itself be cleaned after each wiping operation by passing it over a replaceable absorbent non-shedding pad. To prevent the wiper from scratching the surface of the nozzle plate, wiping must not be carried out on a dry nozzle plate. Normally a purge is performed prior to wiping.

Excessive wiping can scratch the nozzle-plate. A soft (SH 30) fluoroelastomer wiping blade available from Xaar. Please contact your appointed sales engineer for details.

8.3.4 Vacuum wiping

The vacuum-wipe maintenance technique has two main functions:

- Removal of excess ink on the nozzle plate area
- Removal of contamination on the nozzle plate area

Note that no contact is made to the nozzle plate itself, as this could cause scratching and in the case of the XJ128/200 and XJ126/360 would permanently damage the non-wetting coating. A wiping nozzle, which may be a small pipe, drawing a vacuum, is passed along adjacent to the nozzle plate, 'vacuuming' the ink. This is shown in figure 8.3.

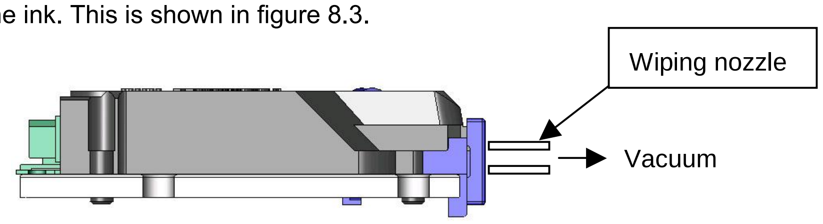

Figure 8.3 – Vacuum wiping of printhead

The vacuum wiping maintenance method is normally used after a printhead purge to remove excess ink. This is an ideal maintenance technique for the printheads with NWC.

8.3.5 Blotting

When using the XJ128/200 and XJ128/360 printheads with some inks, it may be necessary to adopt a 'blotting' maintenance technique. The blotting pad should be a non-shedding absorbent cloth or sponge. Take care not to wipe the printhead across the nozzle plate as this may cause damage to the non-wetting coating. The absorbent cloth or sponge should touch the ink film on the nozzle plate and does not necessarily need to contact the nozzle plate. The blotting would be used following a pressure purge to collect the excess ink that may have collected on the nozzle plate. The procedure is only to be used with the printheads fitted with the non-wetting coating on the nozzle plate as the distribution of the ink on the surface of the nozzle plate after the blotting cannot be controlled.

8.3.6 Ink Spitting

If a printhead is non-operational for a long period of time and filled with ink; depending upon the ink chemistry, the ink in the nozzles in contact with the air can change it's nature. This can sometimes affect performance and in some cases block nozzles. Ink spitting is a technique used to fire the printheads at a low frequency to allow a continuous flow of fresh ink through the nozzles. This helps provide a more reliable start up of the printhead. The amount and frequency of spitting is ink and system dependant and should be determined empirically with each system design.

Ink spitting should not be used as a primary function in order to eliminate the requirement for regular printhead maintenance. For further information, please contact your appointed sales engineer.

8.3.7 Capping

Capping is a procedure that protects the nozzle plate from dust and damage whilst the printheads are non operational. Capping involves designing a cap that fits around the nozzle plate preventing fresh air and dust from contacting the nozzle plate. Some caps may be filled with solutions to help prevent the drying out of nozzles when using volatile inks.

9 Image Processing

9.1 Image processing background

Image processing is a very important part of a printing application depending on the quality of results desired and the limitations of the system being used.

For example, in a very simple application such as printing a monochrome barcode on to a box with a 200dpi binary printhead, the scope and need to do any image processing is small. However, even such a simple application could require the amount of ink being put down on to a substrate to be controlled by image processing.

Some applications such as wide or grand formatting graphics printing require emphasis on high quality image processing RIP's and advanced interleaving techniques to achieve optimum printing results.

For a high-end application such as printing photographic quality images on to an identification card using a greyscale-technology printhead, the amount of time and effort put in to the image processing would be greatly increased. The colours would have to be reproduced accurately from a digital original controlling ink levels and characteristics to a fine degree.

A separate image process will be required for each different combination of the printing ink, substrate and printhead used in a particular system.

Whatever level of image processing control is required for an application there are some fundamental steps that need to be followed regardless of the application:

1. Image must be the correct size for a particular application and printhead resolution.
2. Image data must be in a 'CMYK' or 'greyscale' format for further processing.
3. The amount of ink going on to a substrate may need to be controlled.
4. Image data must be split into individual colours for each individual printing head.
5. A pattern may need to be applied or image may need to be split in to discrete levels if greyscale is being used.
6. An image is required for each printing head in the correct file format.

9.1.1 File formats

Digital images come in a variety of file formats. Some common ones are tiff (with file extension .tif), bitmap (.bmp), jpeg (.jpg), Photoshop® (.psd). Bitmap files are required to print with a Xaar evaluation kit. A binary image is saved as a 1-bit bitmap whilst a greyscale bitmap is saved as a 4-bit bitmap. Tiff files are a high quality, high memory image type. Jpeg files can be used to compress image data. Photoshop® image files can contain supplementary information such as layers in an image.

Pixel values in a digital image will range from 0-255. The quality of an image cannot be improved by image processing. It will depend on how the image was originally captured.

9.1.2 Image processing software

There are many pieces of software available to manipulate image files in preparation for printing. The most popular low cost solution is probably Adobe Photoshop® available on Windows and Macintosh. Examples from Adobe Photoshop® version 5.5 will be given for each stage of the image processing procedure. More expensive commercially available RIP's and custom-drivers are likely to be required for some printing applications using Xaar printheads.

9.1.3 Colour spaces

Digital images are displayed in a variety of colour spaces. RGB (images made from primary colours red, green and blue) is a common format for scanned digital images, as the range of colours possible is large

The required format for printing with Xaar printheads is CMYK (images made from the primary colours cyan, magenta, yellow and black). This often means the colour space of an original scanned digital image has to be changed from RGB to CMYK although images are also scanned in CMYK and digital cameras can record images directly in to a CMYK format.

RGB and CMYK colour spaces are device specific. For example a scanner will have a certain range of colours it can record and similarly printing inks only have a certain range of colours they can produce.

The range of colours perceived by the human eye is much higher and many methods of trying to record colour as a value have been tried. Today the most common way to describe colour is the CIE LAB colour space.

Commission Internaitionale de L'Eclairage (CIE) developed a colour measuring system based on the way the human eye perceives colour. They developed a standardised version called CIELAB. This is the most widely accepted concept for the subjective description of colour.

Photoshop® uses a Lab colour look up table when converting between colour spaces to try and get as close to matching colours as possible.

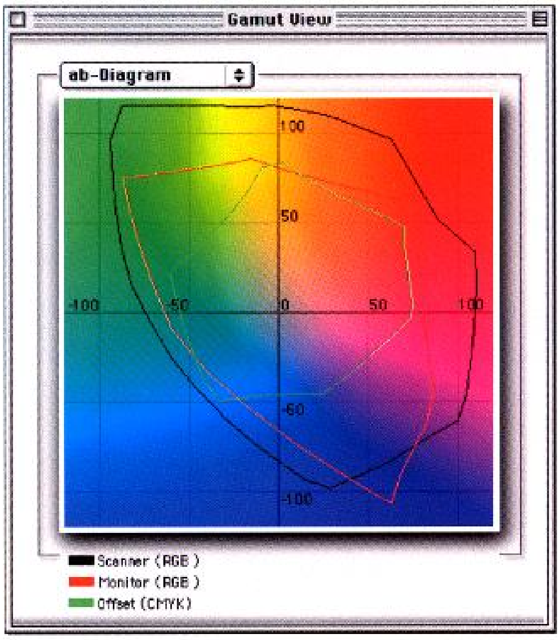

Figure 9.1 - Device colour spaces vs. CIE Lab[1]

The aim of colour processing as to maintain the colour information of an original image in a printed output as accurately as possible or is needed for a particular application.

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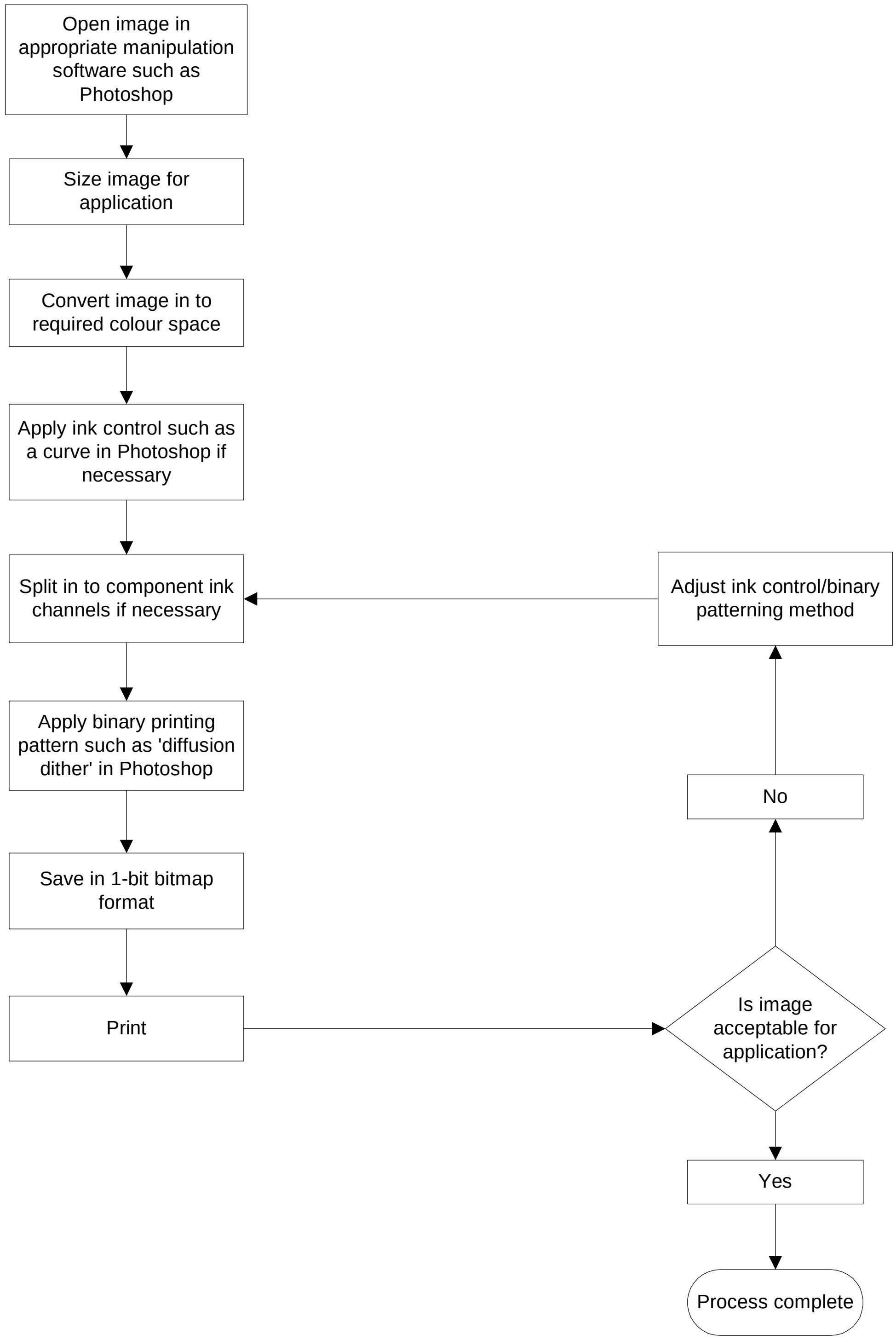
[1] Image courtesy of Gretag Macbeth

9.2 Processing an image

9.2.1 Process flow



9.2.2 *Resolution and sizing*

The pixel size of an image will determine the size of the printed output. For example an image printed at 300 dpi with a pixel size of 1000*1000 will give a printed output size of (1000/300)*(1000/300) inches – about 3*3 inches.

When selecting an image the pixel size should be checked to ensure that when printed at the printhead resolution the size is correct for a particular application.

Photoshop® example:

- From **'File'** menu select **'Open'** and select image
- From the **'Image'** menu select **'Image Size'**:
- Ensure the **'Constrain Proportions'** box is checked and the '**resample image'** box is unchecked
- Enter print resolution (in pixels/inch) of Xaar prinhead being used
- The size of the printed image is now displayed

It is possible to re-size an image (to change the number of pixels it contains). It is recommended not to increase the pixel size of an image as the software being used will have to interpret and add new data to the image that didn't already exist.

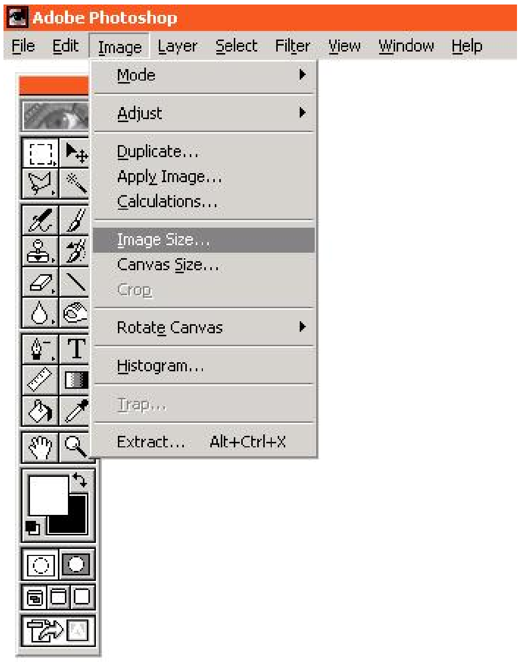


Figure 9.2 - Image size menu option

Decreasing the size does not require the addition of new data but may still cause a slight loss of sharpness to the printed output. Ideally an image should be printed at its original pixel size but a decrease in size will not cause a large problem.

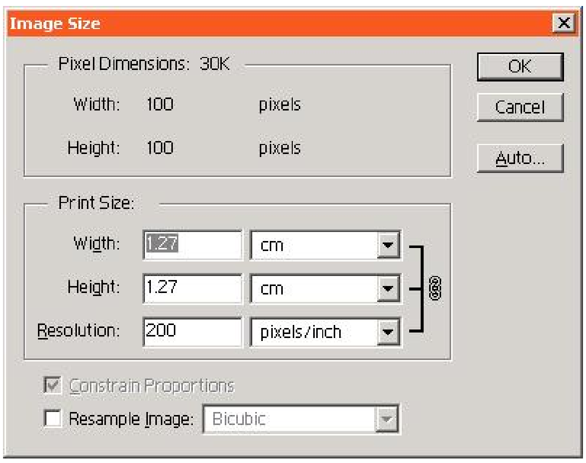


Figure 9.3 - Image size box in Photoshop®

Photoshop® example:

- Check the **'Resample Image'** box in the **'Image Size'** dialogue box
- Enter required pixel or print size
- Proportions between the horizontal and vertical measurements of the image can be constrained. Check the **'Constrain Proportions'** box

9.2.3 Changing colour space

Once the image has been correctly sized it must then be converted to be displayed in the printing format CMYK (if required) or monochrome for printing with a single head. This can be performed by a number of pieces of image processing software including Photoshop®.

Photoshop® example:

- Ensure the correctly sized image is selected
- From the **'Image'** menu select the **'Mode'** menu and then **'CMYK colour'** or **'Grayscale'** for a monochrome image

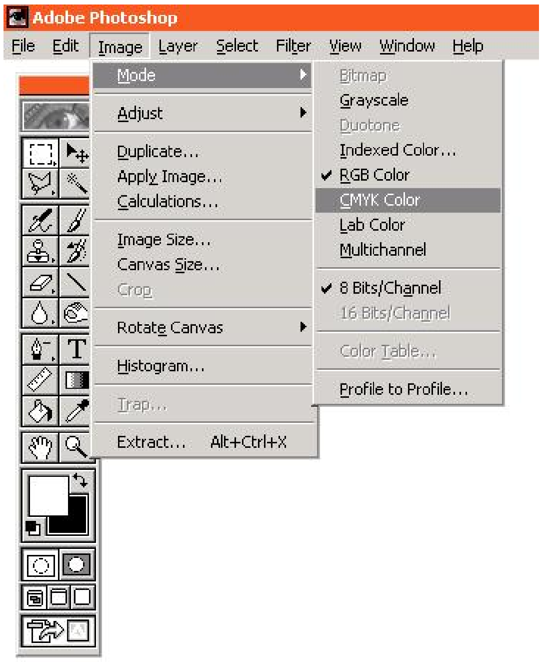


Figure 9.4 Image mode change in Photoshop®

Note: A colour image can only be converted into a 'greyscale' format and not directly into the required printing format – a 1-bit bitmap. When colour channels are split further into the process (see 'Splitting ink channels' section) the output will be the required format.

9.2.4 Ink control

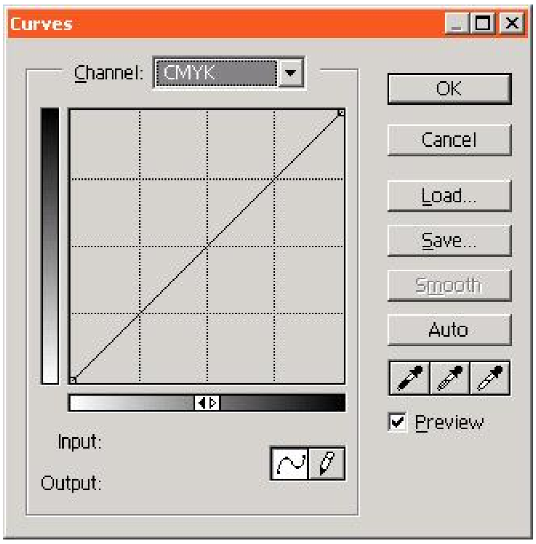
The printed output from a binary printhead will depend on the substrate used, which will define the amount of drop spread.

For some applications such as coding and marking a substrate should be chosen that allows good coverage of a single ink colour.

For other applications such as colour printing of a photo-type image a substrate should be chosen to allow single and mixed colours to achieve acceptable coverage.

As a further step the pixel values in a digital image may be suppressed to suit the substrate to be printed on to.

This can be performed by a number of pieces of image processing software including Photoshop®, where a curve can be applied.



Photoshop® example:

- With the image selected chose the **'Image'** menu followed by the **'Adjust'** menu and then **'Curves'**
- The curve can be manually adjusted or a previously saved curve file may be loaded. These curves have a file format of .acv. The image can be manipulated in two ways. Either each channel can be adjusted separately or all four component colours can be adjusted at the same time. These can be chosen from the drop down menu in the curves dialogue box.

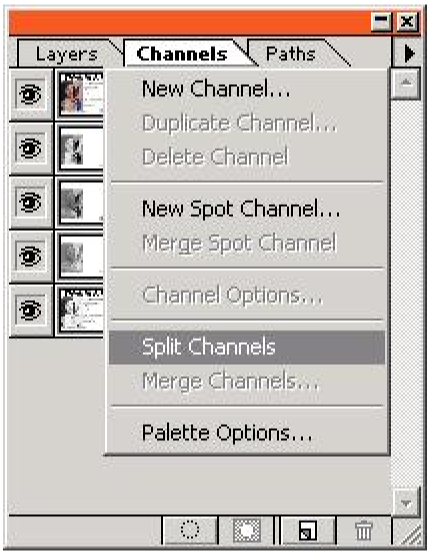
Figure 9.5 - Curves dialogue in Photoshop®

Note: A curve (or any other form of image suppression) may only be performed on a 'CMYK' or 'greyscale' image format. It is not possible to adjust an image when it is in its final 1-bit bitmap printing format.

9.2.5 Splitting ink channels

Before printing a colour image it must be split into its component colour channels – C, M, Y and K.

This can be performed by a number of pieces of image processing software including Photoshop®.



Photoshop® example:

- Ensure the image is selected and in correct colour mode
- From the **'window'** menu select **'show channels'**
- Select the small triangle from the resulting box to pull down the channel menu. Select **'split channels'**
- Monochrome images of the 4 colour channels are now produced

Figure 9.6 - Channels dialogue box in Photoshop®

9.2.6 Binary patterning methods

A pattern must be applied to a monochrome image to allow image data to be represented by a single pixel intensity.

Some of the different patterns include:

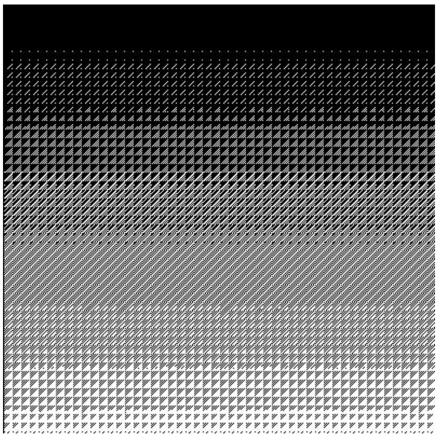


Figure 9.7 - Pattern dither

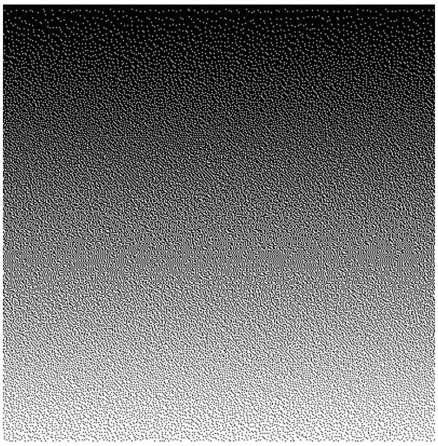


Figure 9.8 - Diffusion dither

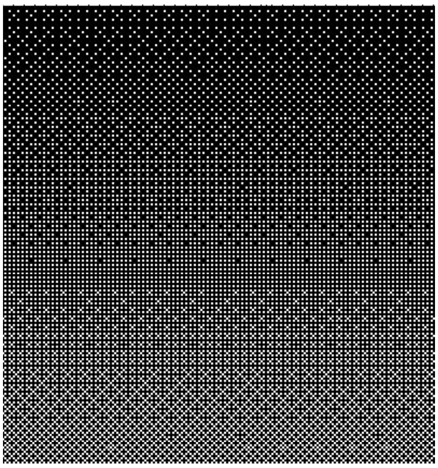
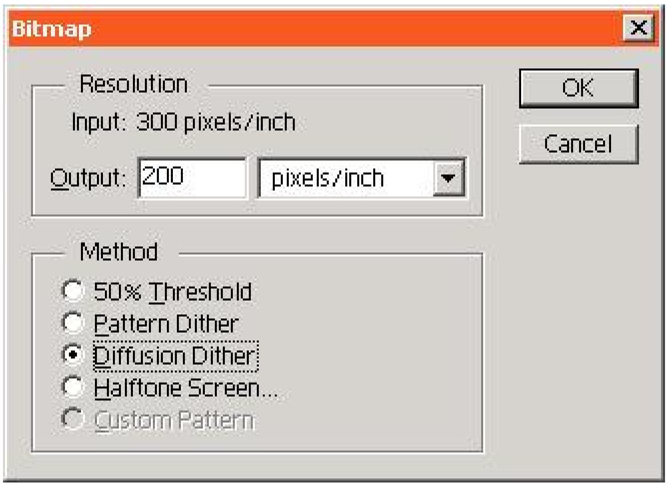


Figure 9.9 - Halftone screen

Diffusion dither is most effective unless the image has quite a small pixel size when the halftone screen is more appropriate.

A pattern can be applied by a number of pieces of image processing software including Photoshop®.



Photoshop® example:

- Ensuring monochrome single channel image is selected
- From the **'image'** menu select the **'mode'** menu and then **'bitmap'**
- Enter required printing resolution in pixels/inch
- Select method of patterning
- Confirm selection

Figure 9.10 – Bitmap dialogue box in Photoshop®

9.2.7 Saving an image for printing

The processed monochrome images need to be saved in the correct format for the printer driver software.

If using a Xaar evaluation kit this format will be a 1-bit bitmap (.bmp)

This can be performed by a number of pieces of image processing software including Photoshop®.

Photoshop® example:

- With the single colour channel image selected in Photoshop select the **'file'** menu followed by **'save as'**
- Choose a file name and select **'save'**
- BMP options should now be displayed
- Save as a 1-bit bitmap
- For Xaar evaluation kit save in a **'windows'** format
- Image is now ready for loading in to a Xaar evaluation system

Figure 9.11 - BMP options in Photoshop® (binary)

9.2.8 *XJ128 image transformation*

The XJ128 printhead is designed to operate at specified mounting angles. This section explains how the user should incorporate an image-slanting feature to the application software. In order to achieve a single pixel line with all the printed dots aligned, it is necessary to angle the printhead as the nozzles are positioned in a single row on the nozzle plate.

Symbol	Definition
hr	Horizontal resolution
vr	Vertical resolution
hru	Horizontal resolution unit (1/hr)
vru	Vertical resolution unit (1/vr)
Natural print direction	The natural print direction is defined as the direction with nozzle 1 as the foremost nozzle
Mounting angle	The angle between a line through the centre of all nozzle plate holes and a line parallel with the print direction

Table 9.1 – Definitions for image transformation

9.2.8.1 Printing angle and horizontal / vertical resolution ratios

Figures 9.12 and 9.13 show the relationship between the horizontal resolution (hr) and vertical resolution (vr) when using the XJ128/200 and XJ128/360 printheads. The corresponding mounting angles for the respective printheads are derived from these relationships. The nozzle positions are superimposed on the figures to show the relative positions of the printed dot position to the printhead nozzles.

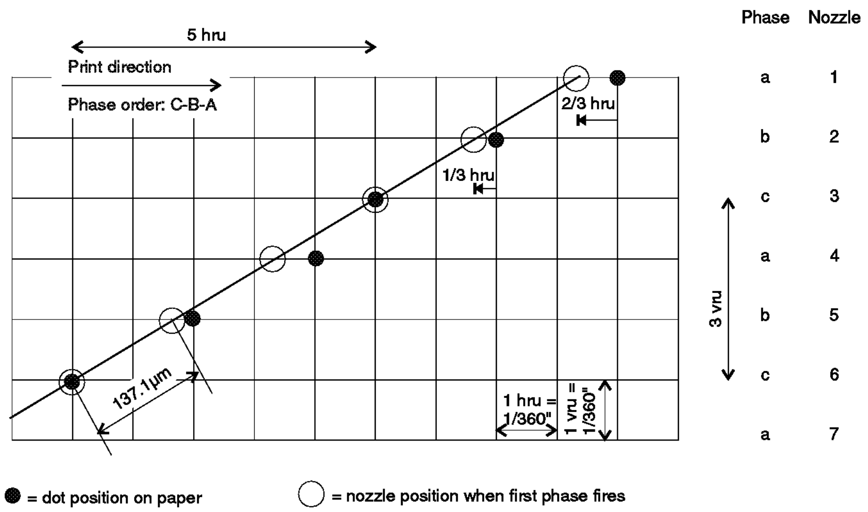


Figure 9.12 – XJ128/360 rear view

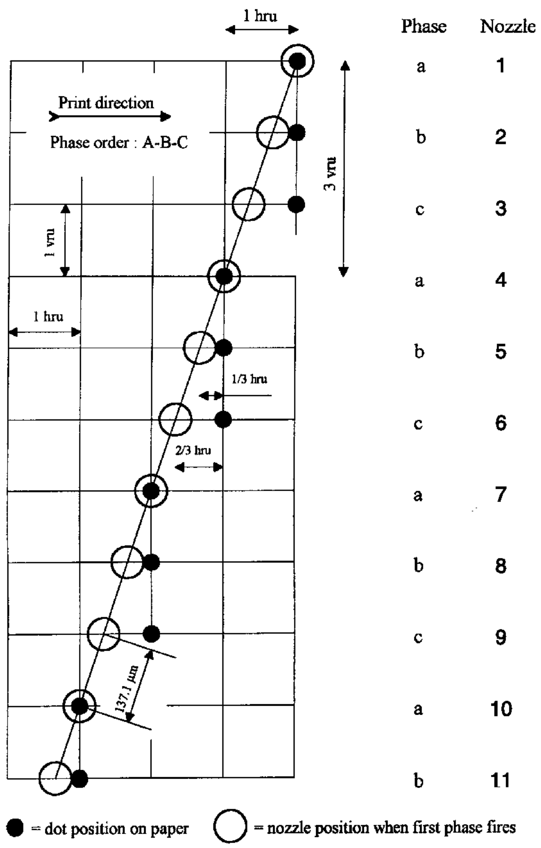


Figure 9.13 – XJ128/200 rear view. Resolution according to CCITT recommendation T.4 for group 3 facsimile units

9.2.8.2 Extraction of image data

Imaging software usually has an orthogonal bitmap as the output. With a printhead orthogonal to the print direction the extraction of image data is a simple as feeding the print head with vertical "slices" of the bitmap. Image extraction for a slanted printhead is performed by feeding slanted "slices" of the bitmap.

These slanted "slices" can be visualised by imagining the line with solid black dots in figures 9.12 and 9.13, scanning across the bitmap just as the substrate passes beneath the printhead. For every printhead position over the substrate, the image data masked out by the black dots is to be sent to the printhead. Figures 9.14 and 9.15 show the top 29 nozzles of the printhead positioned over a section of the bitmap to be printed.

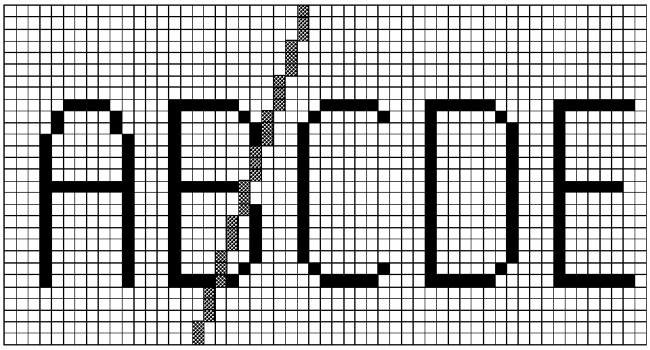


Figure 9.14 – XJ128/200 printhead superimposed over the bitmap

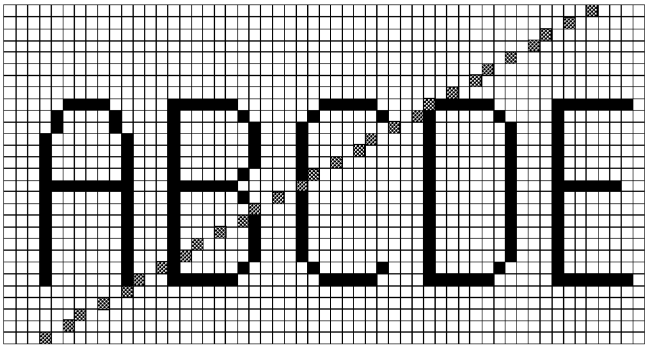


Figure 9.15 – XJ128/360 printhead superimposed over the bitmap

It is then possible to simulate a non-slanted print head by shifting individual rows in the bitmap as shown in the figure 9.16. This is then the orthogonal image that should be used to load into the printhead driver system.

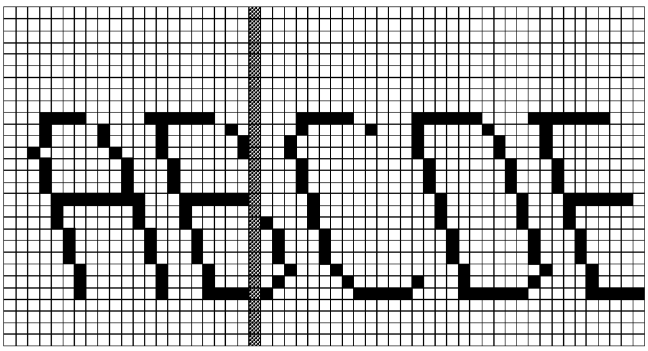


Figure 9.16 - Bitmap adjusted for XJ128/200 printhead

10 Trouble Shooting

10.1 Printhead problems

Should the relevant sections of this document not enable you to solve a problem or issue with the printhead, then please refer to support section 8.2 of this document.

10.2 Returning printhead(s) to Xaar

Should you have any reason to return a printhead to Xaar please contact your local sales engineer and refer to the document XCP001.pdf. Failure to do so could void warranty claims.

11 Feedback and Support

11.1 Feedback

This manual covers the functionality of the XJ128 printhead. As you use this manual, you may have ideas as how it could be improved or modified such to enhance its usefulness to others. Xaar would welcome your comments and suggestions, as well as reports of any errors, which may have found their way into the manual.

11.2 Support

Xaar Technical Support is available to customers who have purchased Xaar printheads or peripherals. Please contact your local sales engineering representative for technical support.

In Europe:

XaarJet
Attn Sales Engineering
Science Park
Cambridge
CB4 0XR
England

Phone +44 (0) 1223 423663
Fax +44 (0) 1223 423590

Email : support@xaar.co.uk
Web : www.xaar.co.uk

In Americas:

Xaar Americas
Attn Sales Engineering
1300 Remington Rd, Suite B
Schaumburg
Illinois 60173
US

Phone +1 847 490 2088
Fax +1 847 490 6849

Email : support@xaar.co.uk
Web : www.xaar-usa.com

In Asia:

Xaar Asia Pacific
Attn Sales Engineering
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Appendices

Appendix A, Environmental Considerations

Recycling packaging materials

The packaging material should be disposed of in accordance with local regulatory directives. However, it is recommended that the packaging be kept in case of any need to re-package the head for shipment.

Recycling the printhead

Recycling of materials used in the printhead are as per the normal electronic devices. However the actuator part, which contains some lead oxide, must be disposed of as per local directives. The lead oxide content is less than 1% of the entire printhead weight.

Appendix B, Document History and Changes

Revision history

Revision	Date	By	Comment
PA1	2003-10-23	TTE	Preliminary revision of new format
A	2004-01-05	JRT	Final release of new version

Document changes

Minor document changes from the previous edition are given in the revision history chapter. Major revisions are assigned a new suffix. Publications are available from your regional office.

Appendix C, Patents, Trademarks and Product Marking

Patents

Xaar printheads are covered by the following US patents and corresponding equivalents in other territories.

US Patent Numbers: 4879568,5016028,5003679,4887100,5361084,5512922.

Xaar may also have other patents or patent applications pending covering subject matter in this document. The furnishing of this document does not give license to these patents.

Trademarks

The following terms, denoted by a trademark sign in this publication, are trademarks of other companies, as follows:

AMP™	AMP Incorporated.
Molex™	Molex Incorporated
Motorola™	Motorola Incorporated
Keytek™	Instrument Corporation
Photoshop®	Adobe Systems Incorporated
GretagMacbeth™	Amazys Holding AG

XAAR and XaarJet are trademarks of the XAAR group of companies.

Other trademarks not listed above may be used in this manual.

Product marking

See Customer reference drawing.

Copyright

Safety standards

The XJ128 printhead complies with the following safety standards:
IEC 801-2
EN 55024-2

CE Compliance and working environment

Resistance to electrostatic discharge (ESD) reveals no damage or critical errors. Testing was performed using a Keytek™ 200 ESD-gun. The discharge level was set according to IEC 801-2 (EN 55024-2). The level of discharges was set to the specification limits of 8 kV for air discharge and 4 kV for contact discharge. All interrupts caused by the discharge were reset without causing any 'hard' failures to the printhead electronics. The level of function errors that could be reset was approximately 300V. This means that the installation should protect the head from direct access if a higher requirement is deemed as necessary. It also requires careful design of the media transport mechanism and head mounting to avoid discharges into the printhead.

During installation of the print head in the application the head must be protected from electrostatic discharges on the connector. The head can be compared with a normal CMOS circuit and must be ESD protected accordingly to avoid later problem caused by discharges. The chip internal protection level is 2 kV.

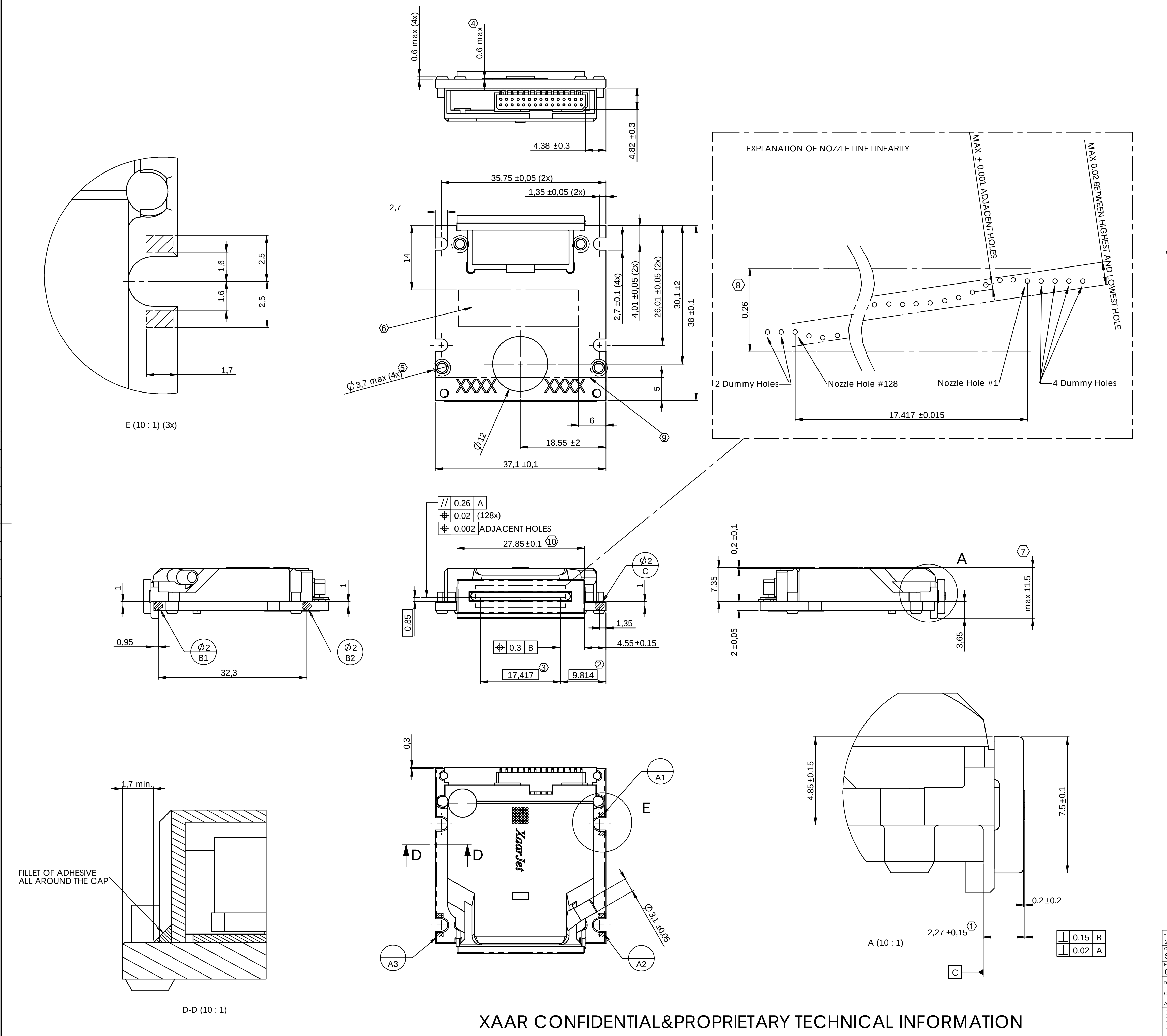
This product has been designed in accordance with the related EMC (Electromagnetic compatibility), low voltage and safety standards.

This product was designed to fulfil the EMC requirements specified for "light industrial environments". Xaar cannot approve the product to be used in other classifications of environment, e.g. "medical" or "industrial".

Any consequences resulting from the use of this equipment in unapproved environments are not the responsibility of Xaar. Xaar recommends that the compatibility of this equipment should be suitably tested in each non-approved environment before use.

For general safety reasons the use of this product in potentially explosive atmospheres must be avoided.

Appendix D, Mechanical drawing



NOTES:

1. DIMENSION TO NOZZLE PLATE FRONT
2. DIMENSION TO FIRST ACTIVE CHANNEL
3. DISTANCE BETWEEN CHANNEL#1 AND CHANNEL #128
4. DIMENSION REFERS TO HEIGHT OF SEAL POCKET INCLUDING ADHESIVE
5. NO PLASTIC OUTSIDE THIS CIRCLE
6. BAR CODE PLACEMENT AREA 26.1 x 8
7. THEORETICAL MAX HEIGHT INCLUDING MAX TOLERANCES 11.5. NORMAL MEASURES 11.0 ±0.25.
8. TWO THEORETICAL LINES PARALLEL WITH PLANE A. NO HOLES OUTSIDE THESE LINES.
9. AREA BELOW THIS LINE USED FOR SERIAL NUMBER MARKING
10. DIMENSION OF FRONT LID INCLUDING GATE: TYPICALLY 28.0 MAX 28.2

XAAR CONFIDENTIAL&PROPRIETARY TECHNICAL INFORMATION

EC APPROVED DATE 2002-02-27	SI, metric		
CAD-SYSTEM SolidWorks		MATERIAL ---	SURFACE TREATMENT ---
FILE NAME 0128J Customer Drawing		SURFACE ROUGHNESS UNLESS NOTED (128 ch)	
DESIGNER PFG 1999-10-07		TOLERANCES UNLESS NOTED LINEAR: ± 0.25	ANGULAR: ± --.--
CHECKED PSR 2000-01-17		EDGE/CORNER BREAKS OUTSIDE MAX: --.--	INSIDE MAX: --.--
APPROVED AEN 2000-01-17			
XAAR		TITLE 128 CHANNEL PRINT HEAD, REF DWG	
SHEET SIZE A1	SCALE 2.5:1	DATE 2002-02-26	DRAWING NUMBER 0128J / SHEET 1 (1)

Appendix E, The Xaar flex-cable

For easy implementation Xaar provides a flat cable that connects to the XJ128 printhead.

The electrical connection from the print head is provided through a standard AMP™ connector part number 9-176140-0 from AMP JAPAN.

The length of the flex cable is standardised to 470mm.

The flat end of the cable is designed for a ZIF (Zero Insertion Force) 1.25 mm pitch; thickness of cable at connecting end is 0.3 mm.

A suitable connector could be Molex™ ZIF connector 5597-30CPB.

When disconnecting the AMP™ connector you must exercise extreme care not to damage the cable or the connector. Use a small screwdriver or wedge to force the male and female connectors apart. Apply pressure to both sides simultaneously.

Using a PCB at the end of the flex cable as 'stiffener' could also be considered.

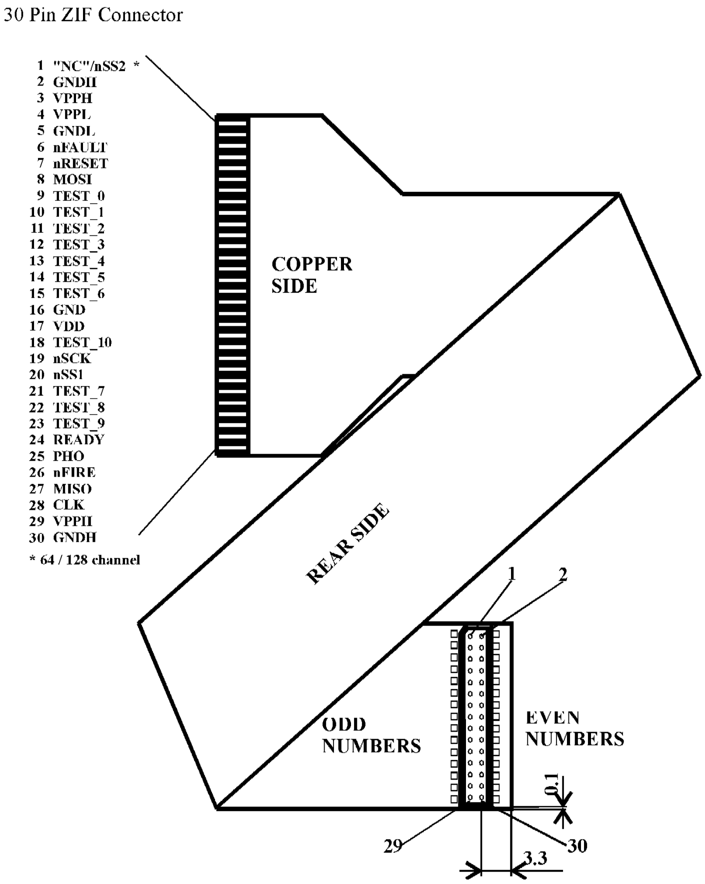
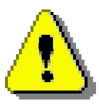


Figure D1 - Pin connections in the XaarJet cable



The flex cable supplied by Xaar reverses the order of pin numbering on the ZIF connector. This means that pin 1 on the ZIF connector goes to pin 30 in the print head.

Glossary

Datum
A physical plane that provides an accurate reference point.

DPI
Dots per Inch

ESD
Electro Static Discharge

EPA
Electrostatic Protected Area.

IC
Integrated Circuit

Media
The surface that ink will be fired upon from the printhead.

Pixel Line
A single line of drops fired from all the nozzles.

PZT
Lead Zirconium Titanate

Resolution
The resolution in dots per inch is defined by the number of ink drops per unit length.

Print Swathe
A single bad of print produced by one pass of the printhead.

TC
Temperature Compensation

NWC
Non-wetting coating

Waveform
The drive signal applied to the PZT wall to produce a pressure wave in the channel.

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