

# uLCD-144P2



## Datasheet

Revision 1.0

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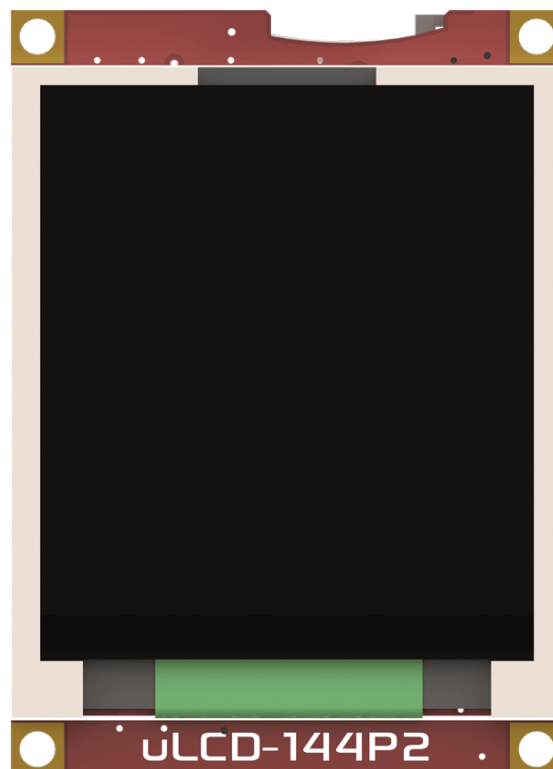
## 1. Description

The uLCD-144P2 is a nifty little Pixxi-28 display module in the 4D Systems micro LCD graphics display range, replacing the original Goldelox powered uLCD-144G2. Combining a resolution of 1.44" 128x128 pixels with 65K True to Life colours, this display module is perfect for animations, slideshows and other multimedia presentations. It is the ideal size for attractive embedded display applications.

This module is compact and cost-effective and features a 1.44" LCD TFT screen, which is the smallest LCD TFT module available from 4D Systems. Driving the module and its peripherals is the Pixxi-28 processor, a very capable chip that provides impressive graphics power, programmed with 4D Systems Workshop IDE Software. The Pixxi-28 version of the uLCD-144 boasts many improvements of features and performance over the original Goldelox powered module.

4D Systems Workshop 4 IDE enables graphic solutions to be constructed rapidly and with ease due to its design being solely for 4D graphics controllers. Unlike the Goldelox version, this Pixxi-28 version supports all 4 of the main Workshop4 environments, including ViSi-Genie.

The uLCD-144P2 has a modest but comprehensive range of features suited for an application requiring a bright eye-catching display, an analog input, Dallas 1-wire sensor capability, audio generation, or simply digital I/O. This is truly an impressive little module. With the change from Goldelox to Pixxi-28, FAT File system has been introduced over the Goldelox RAW only abilities, along with an impressive bump in processing performance.



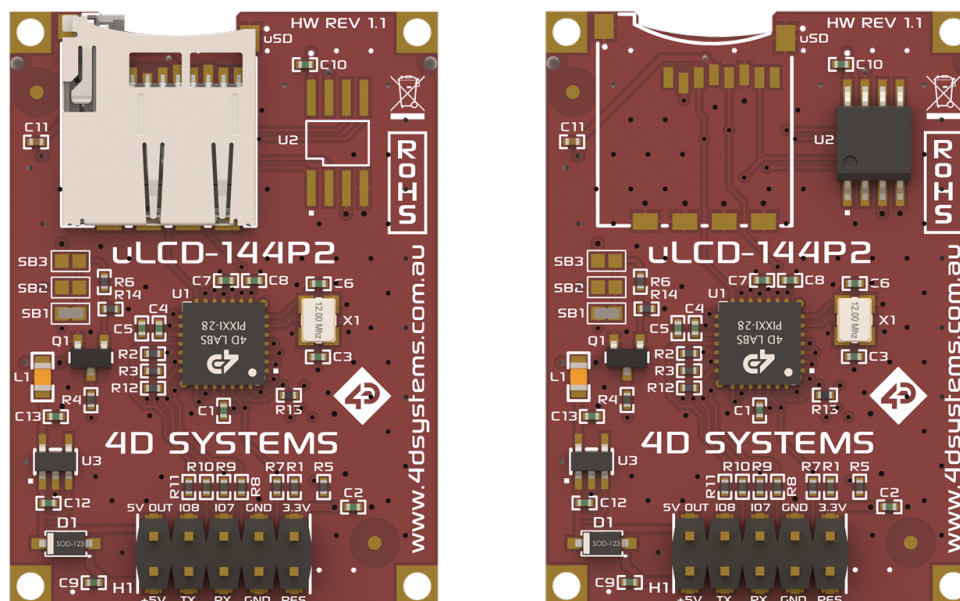
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## 2. Features

- Low-cost 1.44" LCD display graphics user interface solution.
- 128 x 128 resolution, RGB 65K true to life colours, TFT LCD Screen.
- LED backlighting with a greater than 150° viewing angle.
- Easy 10 pin interface to any host device: 3.3Vout, IO7, GND, IO8, RESET, GND, RX, TX, +5V, 5V OUT
- Powered by the 4D-Labs Pixxi-28 processor (also available as a separate OEM IC).
- 32KB of flash memory for user code storage and 14KB of RAM for user variables.
- Asynchronous hardware serial UART port with auto-baud, TTL interface, with 300 to 2.1M baud
- 2 x General Purpose I/O pins, IO7 and IO8 on the PIXXI-28.
- IO7 supports:
  - Analog Input with 12 bit resolution
  - Dallas 1-Wire
  - Digital Input/Output
  - Frequency Output for driving things like a Piezo buzzer/speaker with a pure square wave
  - RTTTL tune engine for driving a speaker with audio tunes
- IO8 supports:
  - Dallas 1-Wire
  - Digital Input/Output
  - Frequency Output for driving things like a Piezo buzzer/speaker with a pure square wave
  - RTTTL tune engine for driving a speaker with audio tunes
  - Audio generation for driving a speaker with WAV files
- Onboard micro-SD memory card adaptor (on selected model) for multimedia storage and data logging purposes. HC memory card support is also available for cards larger than 4GB.
- 16MB Serial Flash memory (on selected model) for multimedia storage, data files, fonts, or for holding extra code functions (to expand the code storage of the processor).
- Built-in extensive 4DGL graphics and system library functions.
- Display full colour images, animations, icons and video clips.
- Supports all available Windows fonts and characters.
- 4.0V to 5.5V range operation (single supply), nominal 5.0V.

- Module dimensions: 31.0 x 42.0 x 14 mm (including header pins)
- Weight ~ 10g.
- Display Viewing Area: 25.5 x 26.5 mm
- RoHS and REACH Compliant.
- PCB is UL 94V-0 Flammability Rated.

### 3. Pin Configuration and Summary



*uLCD-144P2 uSD version vs Flash version*

#### Interface/Programming Header

Pin	Symbol	I/O	Description
1	+5V	P	Main Voltage Supply +ve input pin. Reverse polarity protected. The range is 4.0V to 5.5V, nominal 5.0V.
2	5V(OUT)	P	5V OUT provides approximately 0.3V less than +5V due to being through a protection diode.
3	TX	O	Asynchronous Serial Transmit pin. Output data is at TTL voltage levels. Connect this pin to the external device Serial Receive (Rx) signal. This pin is tolerant up to 5.0V levels.
4	I08	I/O	General purpose I08 pin. See the <a href="#">General Purpose I/O</a> section for more detail.
5	RX	I	Asynchronous Serial Receive pin. Connect this pin to the external device Serial Transmit (Tx) signal. This pin is tolerant up to 5.0V levels.
6	I07	I/O/A	General purpose I07 pin. See the <a href="#">General Purpose I/O</a> section for more detail.
7	GND	P	Supply Ground.
8	GND	P	Supply Ground.
9	RESET	I	Master Reset signal. Internally pulled up to 3.3V via a 10K resistor. An active Low pulse greater than 2.0µs will reset the module. If the module needs to be reset externally, only use open collector-type circuits. This pin is not driven low by any internal conditions. The host should control this pin via one of its port pins using an open collector/drain arrangement.
10	3.3V	P	Regulated 3.3 Volts output, maximum available current 500mA to power external circuitry.

#### Note

I = Input, O = Output, P = Power, A = Analog Input

## 4. Hardware Interface - Pins

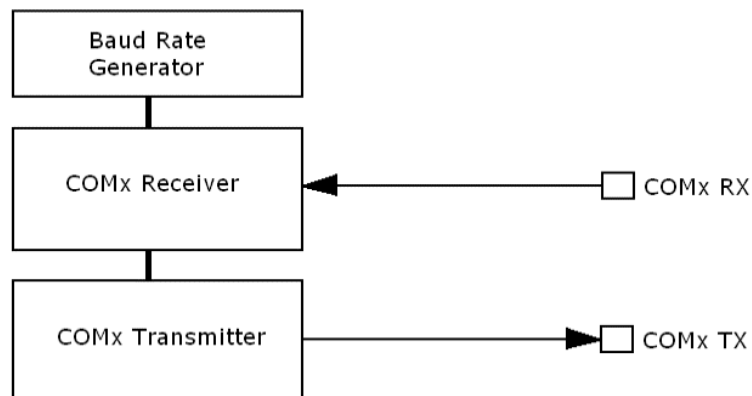
The uLCD-144P2 provides both a hardware and software interface. This section describes in detail the hardware interface pins of the device.

### 4.1. Serial Ports -- TTL Level

The PIXXI-28 Processor has a single hardware asynchronous serial port (COM0), with fixed pins TX/RX. The PIXXI-28's serial port can be used to communicate with external serial devices and is also used for programming the PIXXI-28 itself.

The primary features are:

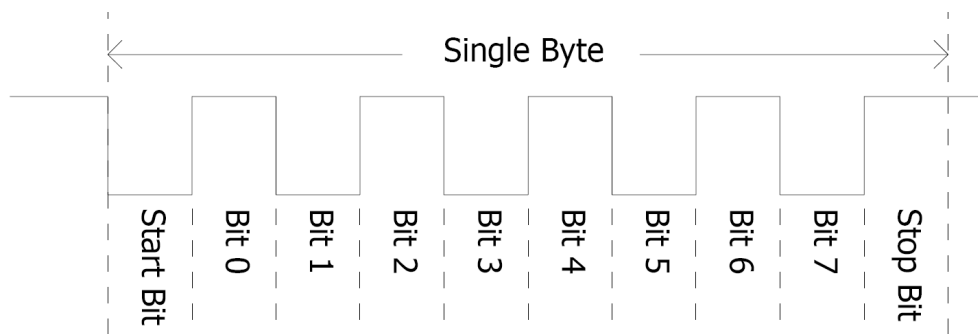
- Full-Duplex 8-bit data transmission and reception.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Independent Baud rates from 300 baud up to 2187500 baud.
- Single byte transmits and receives a fully buffered service. The buffered service feature runs in the background capturing and buffering serial data without the user application having to constantly poll any of the serial ports. This frees up the application to service other tasks.



A single-byte serial transmission consists of the start bit, 8 bits of data followed by the stop bit. The start bit is always 0, while a stop bit is always 1. The LSB (Least Significant Bit, Bit 0) is sent out first following the start bit.



The figure below shows a single-byte transmission timing diagram.



COM0 is the programming interface for User program downloads and PmmC programming. Once the compiled 4DGL application program (EVE byte-code) is downloaded and the user code starts executing, the serial port is then available to the user application.

#### **TX pin 3 (Serial Transmit):**

Dedicated Asynchronous Serial port COM0 transmit pin, TX. Connect this pin to an external serial device receive (RX) signal. This pin outputs at 3.3V levels.

#### **Rx pin 5 (Serial Receive):**

Dedicated Asynchronous Serial port COM0 receive pin, RX. Connect this pin to an external serial device transmit (TX) signal. This pin is 5.0V tolerant.

#### **Note**

Serial port outputs at the level of TTL 3.3V, however, are 5V tolerant, so can accept communications from 5V devices.

## 5. General Purpose I/O

There are 2 GPIO pins available, I07 and I08. Each GPIO has a multitude of high-level functions associated with it and these can be selected within 4DGL user application code.

Refer to the [Pixxi Internal Functions Manual](#) manual for a complete set of built-in 4DGL library functions.

### I07 pin 6 (General Purpose I0):

General purpose I07 pin. The following table lists the available GPIO functions and features.

### I08 pin 4 (General Purpose I0):

General purpose I08 pin. The following tables list the available GPIO functions and features.

#### Note

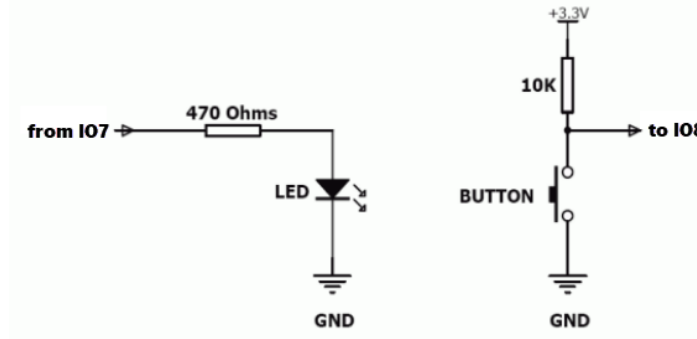
1. Digital GPIO pins are 5.0V tolerant, Digital Output at TTL 3.3V level
2. Analog Input is 0 - 3.3V level only, 12-bit resolution

#### GPIO Functions and Features

Function	I07	I08
Digital Input	Yes	Yes
Digital Output	Yes	Yes
Analog Input 12 bits	Yes	No
Joystick - 5 position multi-switch	Yes	No
Dallas 1-Wire support	Yes	Yes
Sound Generation, RTTTL Tune	Yes	Yes
Sound Generation, Frequency	Yes	Yes
Sound Generation, WAV/Audio	No	Yes

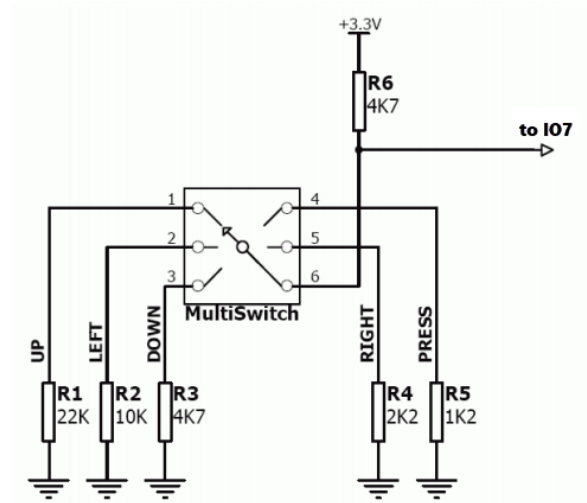
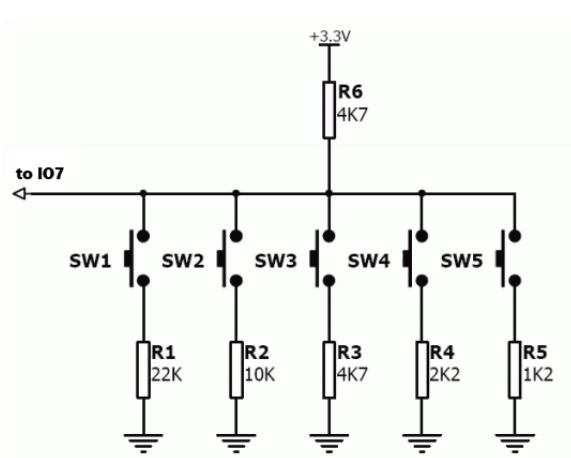
**Digital Input/Output:**

Both I07 and I08 pins can be programmed to be Digital Inputs or Outputs. The diagram below shows a LED connected to I07 (programmed as an output) and a button connected to I08 (programmed as an input).



**Joystick - Multi Switch:**

Multiple buttons or a multi-switch Joystick can be connected to the I07 pin on the uLCD-144P2 module. Up to five buttons or a 5-position multi-switch joystick connects to a junction of a resistor ladder network that forms a voltage divider. The A/D converter of the I07 pin internally reads the analog value and decodes it accordingly. This feature is supported by dedicated 4DGL library functions. The following diagrams indicate how to connect up to five individual buttons or a multi-switch joystick to the I07 pin.

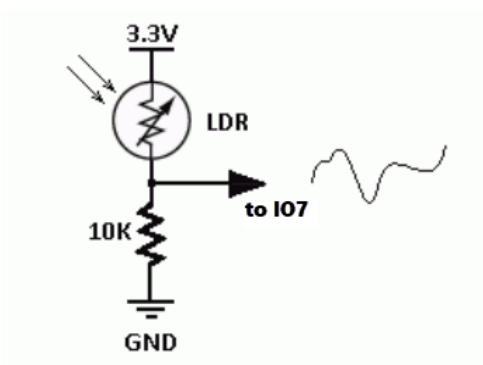


Unused buttons do not need resistors to be connected to the circuit. The table below lists the buttons and corresponding resistor values.

GPIO Functions and Features		
Number of Buttons	Button Number	Resistor Value
1	SW1	22K
2	SW2	10K
3	SW3	4.7K
4	SW4	2.2K
5	SW5	1.2K

### Analog to Digital Converter:

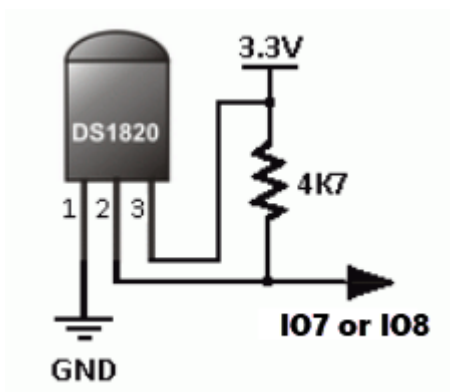
The I07 pin can be programmed as a 12-bit Analog Input. The diagram below is a circuit of a Light Dependent Resistor (LDR) connected to I07 to measure and record changes in ambient light.



### Dallas 1-Wire:

The Dallas 1-Wire protocol is a form of serial communication designed to operate over a single data line plus ground reference. Multiple 1 Wire devices can be attached to the same shared data line to network many devices. One wire device support is available on both the I07 and the I08 pins on the uLCD-144P2 module.

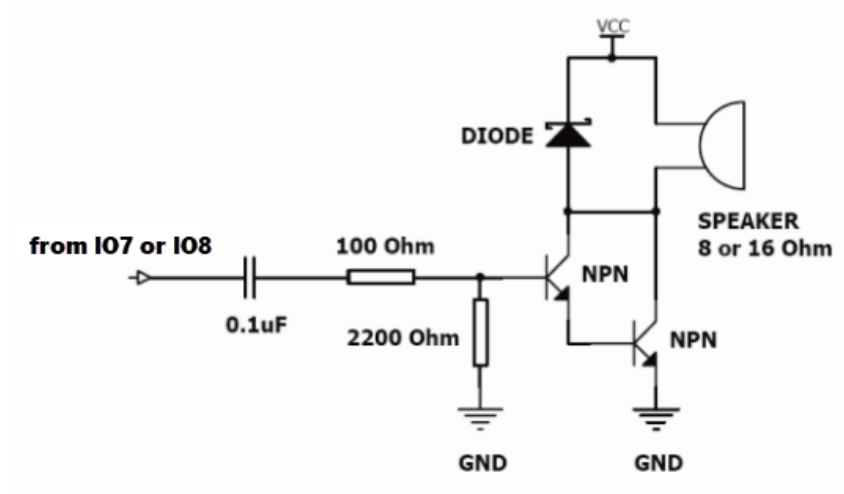
The following diagram depicts a typical 1-Wire temperature sensor interface.



### Sound Output:

The uLCD-144P2 module is capable of generating complex sounds and RTTL tunes from its I07 and I08 pins. A simple speaker circuit as shown below can be used.

Both I07 and I08 are capable of RTTTL Tunes and Frequency Tones, and I08 is also capable of WAV Audio playback.



## 5.1. System Pins

### +5V (Module Voltage Input):

#### Pin 1:

Module supply voltage input pin. This pin must be connected to a regulated supply voltage in the range of 4.0 Volts to 5.5 Volts DC. The nominal operating voltage is 5.0 Volts.

### 5V (Out):

#### Pin 2:

External circuitry that requires approximately a 5V supply can be powered up via this pin. The voltage at this pin will be approximately 0.3V lower than the +5V input pin, due to the protection diode. The maximum available current is approximately 200 mA, due to the protection diode being shared with the rest of the system.

### GND (Module Ground):

#### Pins 7, 8:

Device ground pins. These pins must be connected to the ground

### RESET (Module Master Reset):

#### Pin 9:

Module Master Reset pin. An active low pulse of greater than 2 microseconds will reset the module. Internally pulled up to 3.3V via a 4.7K resistor. Only use open collector-type circuits to reset the device if an external reset is required.

### 3.3 Vout (3.3V Regulated Output):

#### Pin 10:

External circuitry that requires a regulated 3.3 V supply can be powered up via this pin. The maximum available current is 500mA, due to the 3.3V output being shared with the rest of the internal components.

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## 6. Module Features

The uLCD-144P2 module is designed to accommodate most applications. Some of the main features of the module are listed below.

### 6.1. Display - 1.44" LCD TFT

The uLCD-144P2 is equipped with a full-colour LCD TFT screen. Some of the features of the screen are:

- Screen Size: 1.44" diagonal
- 128 x 128 Resolution LCD TFT display
- Screen Dimensions: 30.9 x 36.5 mm.
- Viewing Area: 25.5 x 26.5 mm
- 65K true-to-life colours
- Luminance: 250 cd/m<sup>2</sup>
- Contrast Ratio: 450
- Viewing Angle: > 150 degrees
- LED Backlighting

#### Note

The Displays used are the highest-rated 'Grade A' Displays, which allow for 0-4 defective pixels. A defective pixel could be solid Black (Dead), White, Red, Green or Blue

## 6.2. Backlight Control

The uLCD-144P2 has a few options for controlling the backlight, unlike the original Goldelox uLCD-144G2 version. The options are selected with a solder bridge on the back of the PCBA. Note, only 1 solder bridge can be closed/connected at any given time.

By default, Solder Bridge 1 is closed/connected, which makes the backlight be controlled by the RESET line of the display. This means when the display is held in reset, the backlight will be off, and when the module is powered and running, the backlight will be on. This gives the ability for an external device to reset the module and have the backlight off while its held in reset.

If Solder Bridge 2 is closed/connected instead, I07 controls the backlight. This gives the Pixxi-28 control over the backlight with ON/OFF control, by turning onn and off I07. I07 will be unavailable for external use. This also gives the ability to use the I07 pin on the 10-way header, and have an external device control the ON/OFF of the backlight. For this to happen, I07 must be selected as an INPUT not an OUTPUT, as Pixxi-28 will not be controlling I07, it will be a pass through for an external device to control it instead.

If Solder Bridge 3 is closed/connected instead, the backlight will be on whenever the module is powered, as this links the backlight to the 3.3V rail.

Please refer to the Schematic to see the connections of the Solder Bridges, relative to the rest of the circuit.

## 6.3. PIXXI-28 Processor

The module is designed around the PIXXI-28 Graphics Processor from 4D-Labs.

The PIXXI-28 is a custom-embedded graphics processor designed to interface with many popular OLED and LCD panels. Powerful graphics, text, images, animation and countless more features are built right inside the chip. It offers a simple plug-and-play interface to many 8-bit MCU 8080 Series colour LCD and OLED displays, as well as 3 or 4 wire SPI displays.

The uLCD-144P2 is utilising the 8-bit MCU 8080 interface to the PMOLED display, which provides 2 GPIO for the User.

Refer to the [PIXXI-28 Processor datasheet](#) for more information.





## 6.4. microSD / Flash Memory

The uLCD-144P2 display module is available in 2 versions. One utilises a microSD connector for microSD card storage, while the other utilises SPi Serial Flash memory.

### Note

The correct PmmC must be loaded in the display when choosing the memory device (**-u** for the **uSD memory** and **-f** for the **serial flash memory**). The correct PmmC will be loaded from factory, however if performing manual updates in the future, ensure the correct one is loaded for the module type you have.

The Flash Memory device is used for all multimedia file retrieval such as images, animations and movie clips, data files, and fonts, or for holding extra code functions (to expand the code storage of the processor)

The SD memory card can also be used as general-purpose storage for data logging applications (RAW and FAT16 format support).

Support is available for either an SD memory card (SD with up to 2GB or SDHC starting from 4GB and above) or the Serial Flash memory chip (16MB).

The dedicated SPI port is clocked at 35 MHz

With microSD storage of 4GB, the uLCD-144P2 can store over 240K full screen images. This is a huge amount of storage and would typically never be completely filled for any normal application.

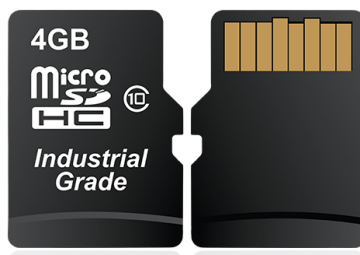
With Serial Flash Memory of 16MB, the uLCD-144P2 can store approximately 970 full screen images in Flash. This is perfect for many applications, and it also caters for applications where a microSD card is impractical or not allowed to be used. Serial Flash memory is slightly faster in performance than microSD card also, so there is a little performance gain from this option.

Storage is also used for other things, such as Fonts, Audio and other Files, but it is a good indication on what the storage options are capable of in this module.

## 6.5. SD/SDHC Memory Cards

The PIXXI-28 processor uses off-the-shelf standard SDHC/SD/microSD memory cards with up to 2GB capacity usable with FAT16 formatting. For any FAT file-related operations, before the memory card can be used it must first be formatted to FAT16. The formatting of the card can be done on any PC system with a card reader. Select the appropriate drive and choose the FAT16 (or just FAT in some systems) option when formatting. The card is now ready to be used in the PIXXI-28 based application.

The PIXXI-28 processor also supports high-capacity HC memory cards (4GB and above). The available capacity of SD-HC cards varies according to the way the card is partitioned and the commands used to access it.



The FAT partition is always first (if it exists) and can be up to the maximum size permitted by FAT16. Windows 7 will format FAT16 up to 4GB. Windows XP will format FAT16 up to 2GB and the Windows XP command prompt will format FAT16 up to 4GB.

RMPET, a 4D Systems Tool found in the Workshop4 IDE, is capable of repartitioning and formatting microSD cards to be the appropriate type and format for 4D Systems processors. This tool should be used for all cards.

### Note

1. An SPI Compatible SDHC/SD/microSD card **MUST** be used. PIXXI-28 along with other 4D Systems Processors requires SPI mode to communicate with the SD card. If a non-SPI compatible SD card is used, then the processor will not be able to mount the card.
2. Read disturbance is a well-known issue with flash memory devices, such as microSD cards, where reading data from a flash cell can cause the nearby cells in the same memory block to change over time. This issue can be prevented by using industrial-grade microSD cards with read disturb protection. Industrial-grade microSD cards have firmware that actively monitors the read operation and refreshes areas of memory that have high traffic and even move data around to prevent read disturb error from occurring. Furthermore, manufacturers may choose to implement read disturb protection on a specific part of the flash memory only, such that the beginning part of the memory might not be protected. The RMPET utility in Workshop4 is designed to create the first partition at an offset from the start of the microSD card to account for this situation. It is therefore recommended to always partition and format an industrial microSD card using the RMPET utility before using it with 4D Systems processors.

## 6.6. FAT16

All 4D Systems displays featuring 4D Systems processors use off-the-shelf standard/micro SDHC/SD memory cards (SPI Compatible Only) with up to 4GB capacity usable with FAT16 formatting.

For any FAT file-related operations, before the memory card can be used it must first be formatted correctly. Built into Workshop4 is a tool created by 4D, called RMPET. RMPET allows the User to easily partition and format microSD cards, to make their file system ready to be used with 4D Systems displays. The formatting of the card can be done on any PC system with a card reader.

The PIXXI-28 processor also supports high-capacity HC memory cards (4GB and above). The available capacity of SD-HC cards varies according to the way the card is partitioned and the commands used to access it.

The FAT16 file system can utilize a maximum capacity of 4GB. The FAT partition is always first (if it exists). Any space larger than 4GB will be RAW, and can still be utilized by your 4D Systems module, using different functions. For more information, refer to [Application Notes](#).

## 7. Display Precautions

- Avoid having to display the same image/object on the screen for lengthy periods. This will cause a burn-in which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.
- Moisture and water can damage the display. Moisture on the surface of a powered display will cause the electrodes to corrode. Wipe off any moisture gently or let the display dry before usage.
- Dirt from fingerprint oil and fat can easily stain the surface of the display. Gently wipe off any stains with a soft lint-free cloth.
- The performance of the display will degrade under high temperatures and humidity. Avoid such conditions when storing.
- Do not tamper with the display flex cable that is connected to the control board. This may affect the connection between the display and the driving circuitry and cause failure.
- Displays are susceptible to mechanical shock and any force exerted on the module may result in deformed zebra strips and cracks, a cracked display cell and a broken backlight.
- Always use the mounting holes on the module's printed circuit board to mount the display.

## 8. Hardware Tools

The following hardware tools are required for full control of the uLCD-144P2 module.

### 8.1. 4D Programming Cable/Adaptor

The 4D Programming Cable and uUSB-PA5-II Programming Adaptor are essential hardware tools to program, customise and test the PIXXI-28 Processor.

Either the 4D Programming Cable or the uUSB-PA5-II Programming Adaptor can be used.

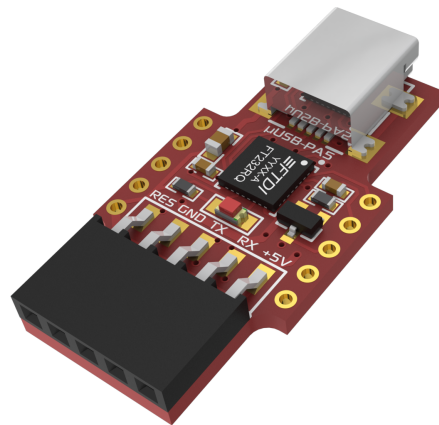
The 4D programming interfaces are used to program a new Firmware/PmmC, Display Driver and for downloading compiled 4DGL code into the processor. They even serve as an interface for communicating serial data to the PC.

The 4D Programming Cable and uUSB-PA5-II Programming Adaptor are available from the [4D Systems website](#).

Using a non-4D programming interface could damage your processor, and **void your Warranty**.



*4D Programming Cable*



*uUSB-PA5-II Programming Adaptor*

## 9. Programming Language

The PIXXI-28 processor belongs to a family of processors powered by a highly optimised soft-core virtual engine called EVE (Extensible Virtual Engine). EVE was designed and created by 4D Systems in the early 2000s.

EVE is a proprietary, high-performance virtual machine with an extensive byte-code instruction set optimised to execute compiled 4DGL programs.

4DGL (4D Graphics Language) was specifically developed from the ground up for the EVE engine core. It is a high-level language that is easy to learn and simple to understand yet powerful enough to tackle many embedded graphics applications.

4DGL is a graphics-oriented language allowing rapid application development, and the syntax structure was designed using elements of popular languages such as C, Basic, Pascal and others.

Programmers familiar with these languages will feel right at home with 4DGL. It includes many familiar instructions such as `IF..ELSE..ENDIF`, `WHILE..WEND`, `REPEAT..UNTIL`, `GOSUB..ENDSUB`, `GOTO`, `PRINT` as well as some specialised instructions `SERIN`, `SEROUT`, `GFX_LINE`, `GFX_CIRCLE` and many more.

For detailed information about the 4DGL language, please refer to the following documents:

- [4DGL Programmers Reference Manual](#)
- [Pixxi Internal Functions Manual](#)

To assist with the development of 4DGL applications, the Workshop4 IDE combines a full-featured editor, a compiler, a linker and a downloader into a single PC-based application. It's all you need to code, test and run your applications.

4DGL is available to be written in two of the four environments offered by Workshop4 IDE, Designer and ViSi. The other two environments, Serial and ViSi-Genie do not directly use 4DGL by the User (Except in Workshop4 Pro, for ViSi-Genie), however, it is present in the background. Serial is an application that runs, and that is written in 4DGL. ViSi-Genie automatically generates 4DGL itself based on what is configured in the GUI.

## 10. Workshop4 IDE

Workshop4 is a comprehensive software IDE that provides an integrated software development platform for all of the 4D family of processors and modules. The IDE combines the Editor, Compiler, Linker and Downloader to develop complete 4DGL application code. All user application code is developed within the Workshop4 IDE.



The Workshop4 IDE supports multiple development environments for the user, to cater to different user requirements and skill levels.

- The **Designer** environment enables the user to write 4DGL code in its natural form to program the range of 4D Systems' intelligent displays.
- A visual programming experience, suitably called **ViSi**, enables drag-and-drop type placement of objects to assist with 4DGL code generation and allows the user to visualise how the display will look while being developed.
- An advanced environment called **ViSi-Genie** doesn't require any 4DGL coding at all, it is all done automatically for you. Simply lay the display out with the objects you want, set the events to drive them and the code is written for you automatically. This can be extended with additional features when a Workshop4 PRO license is purchased from the 4D Systems website. Extended Advanced features for Visi-Genie are available in the PRO version of WS4. Further details are explained under the **Visi Genie** section of the Workshop4 documentation.
- A **Serial** environment (aka SPE 'Serial Platform Environment') is also provided to transform the display module into a slave serial module, allowing the user to control the display from any host microcontroller or device with a serial port using predefined serial commands.

For more information regarding these environments, refer to the [Workshop4 manuals](#).

The Workshop 4 IDE is available from the [4D Systems website](#).

## 10.1. PmmC Programming

The PIXI-28 processor is a custom graphics processor. All functionality including the high-level commands is built into the chip. This chip-level configuration is available as a PmmC (Personality-module-micro-Code) file, which can be likened to traditional Firmware.

A PmmC file contains all of the low-level micro-code information (analogy of that of a soft silicon) which defines the characteristics and functionality of the device. The ability of programming the device with a PmmC file provides an extremely flexible method of customising as well as upgrading it with future enhancements.

The Display Driver is located inside the PmmC for PIXI-28 and contains the initialisation and parameters associated with the particular display that is to be connected to the PIXI-28 processor, along with product-specific settings and parameters that are required over and above what is found in the PmmC.

The PmmC file can only be programmed into the device with the aid of Workshop 4, the 4D Systems IDE software, or its supporting tools.

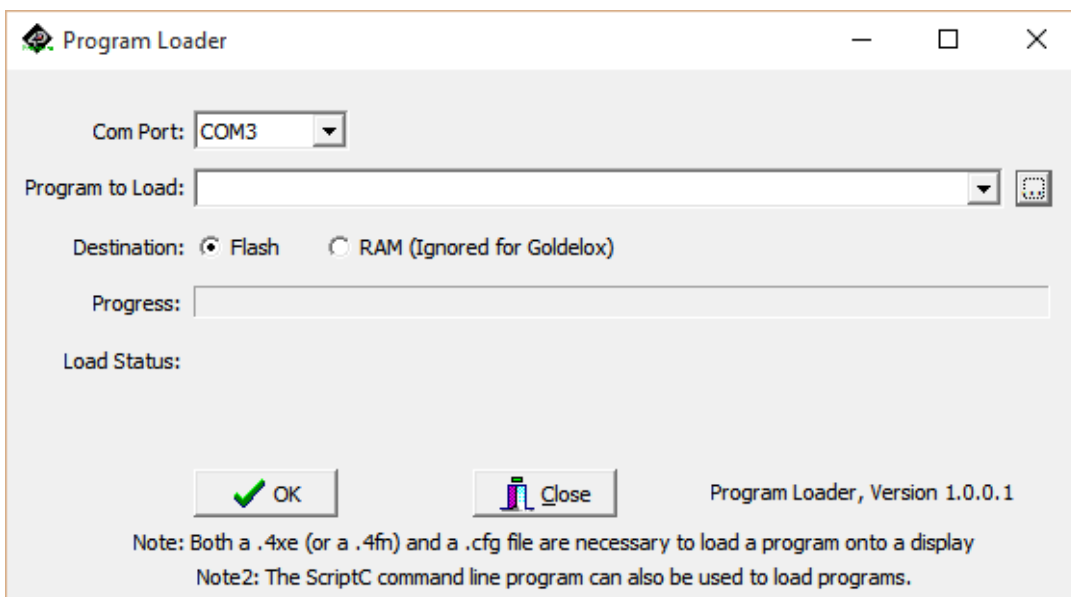
Solutions, which remove the need to use Workshop4 to program the display, are available for commercial customers requiring batch programming or production line programming. These solutions are practical for production staff to minimize the chance of unwanted or unauthorised modifications on the production line.

Three solutions come with the Workshop4 IDE, which can be separated for production line computers if required,

**ScriptC, PmmC Loader** and **Program Loader**.

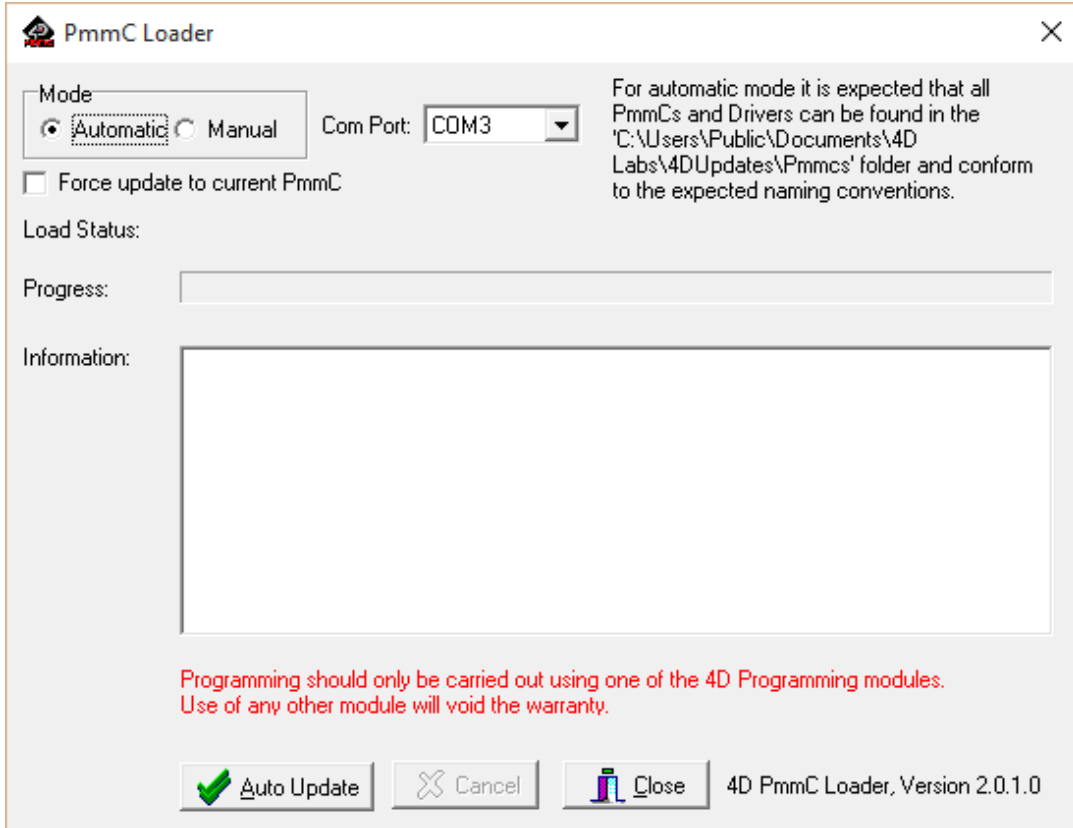
**ScriptC** is a command line interface that can be controlled from a Batch Script or similar, useful for repetitive loading or when controlled from an external application. Example scripts are provided, showing how to load PmmC, Display Drivers and Applications using a batch script.

**Program Loader** is a GUI interface designed to download Applications to either Flash or RAM, useful for testing or production loading, without the need for Workshop4 itself.





**PmmC Loader** is a GUI interface designed to download PmmC's and Drivers to 4D Systems Processors. It can automatically update existing PmmC's and Drivers present on a module or manually change or force download to a blank processor or module, overwriting anything written in previously.



Please contact our Support Team for more information on what we can provide. Some solutions also exist for external processor-based loading, if there is a requirement for that. This solution is available under NDA. Using a non-4D programming interface could damage your module, and **void your Warranty**.

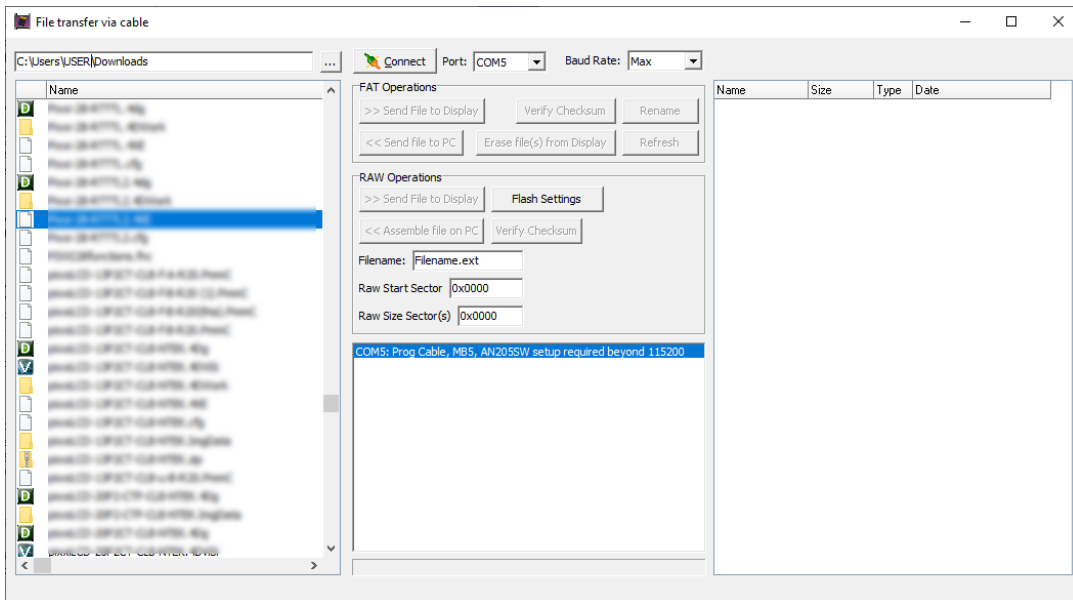
## 10.2. File Transfer

The PIXXI-28 processor is capable of transferring files over the serial UART from the PC. This is used when the SPI Serial Flash Memory is loaded by Workshop4, but it can also be used to load the micro-SD card if desired.

The process of loading a micro-SD card can take some time, depending on the size of the files needing to be transferred, and it is often faster to remove the micro-SD card from the display module, place it into your PC using a Media/Card reader, and copying the files directly. However in cases where this is not possible, transferring over the serial UART is available.

Additional to Workshop4 natively using File Transfer during its programming phase, File Transfer can also be run manually by opening the File Transfer application from the Windows Start Menu, or from the /DEP folder inside the Workshop4 installation folder.

When loading content on to the SPI Serial Flash Memory manually, you must erase the memory before writing new files.



File Transfer can be used for loading SPI Serial Flash Memory or the micro-SD card. When actioning the programming process from Workshop4, the appropriate one will be loaded based on your hardware and software settings.

If using the 4D Programming Cable, some software modifications to the USB chip inside the cable are required in order to transfer at full speed. Please refer to this **post** on the 4D Systems Forum, for details on the change. When using the uUSB-PA5 or uUSB-PA5-II, this is not required, it only relates to the **4D Programming Cable**.

## 11. Display Module Part Numbers

The following is a breakdown of the part numbers and what they mean.

### Modules

- uLCD-144P2 (uSD)
- uLCD-144P2 (Flash)

where:

uLCD - microLCD Display Family

144 - Display size (1.44" 128 x 128 Resolution)

P2 - PIXXI-28 Processor

uSD - microSD Card version

Flash - SPI Serial Flash version

## 12. Starter Kit

4D Systems highly recommends all first-time buyers of 4D Systems' displays, to purchase the Starter Kit when purchasing their first 4D Systems display solution.

The Starter Kit provides all the hardware that is required to get the User up and running.

Not all development environments and features will be needed by every User. However, purchasing the display solution in a Starter Kit allows you to take full advantage of all of the features of the 4D Systems Display Solution and try out each of the 4D Workshop4 Environments before settling with the preferred feature set.

Starter Kits typically include:

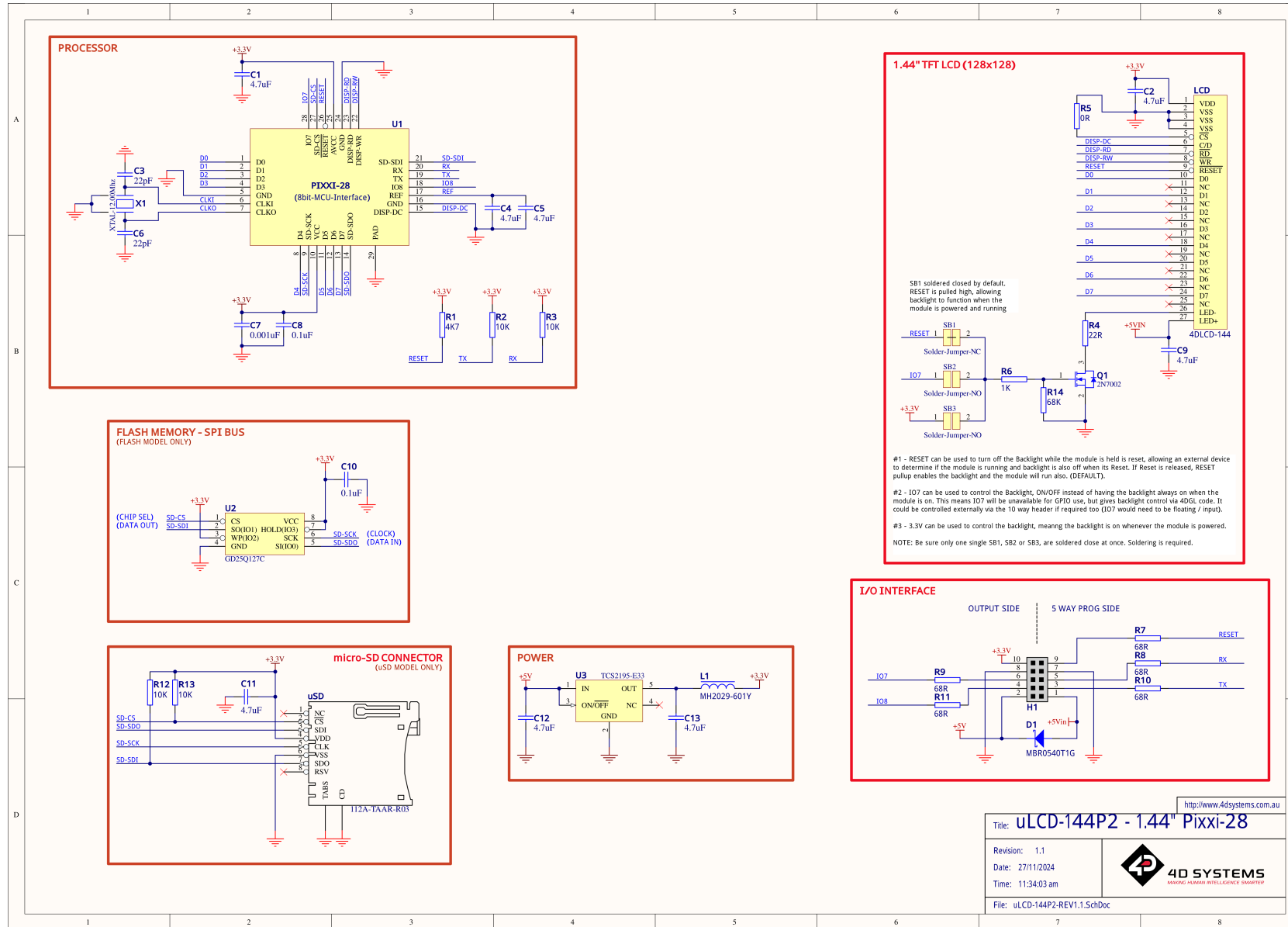
- uLCD-144P2 Display Module
- uUSB-PA5-II Programming Adaptor
- 4GB micro-SD Card
- 5-way Male to Male adaptor (for converting the Female-Female cable to be Male-Female)
- 150mm 5-way Female-Female jumper cable, for quick connection to another device or breadboard
- Quick Start Guide

Please refer to the [4D Systems website](#) for the current components included in the Starter Kit.

Simply select the Starter Kit option when purchasing the chosen display module on the 4D Systems shopping cart, or from your local distributor.



# 14. Schematic Diagram - REV 1.1



## 15. Specifications

### Absolute Maximum Ratings

Operating ambient temperature	-20°C to +70°C
Storage temperature	-30°C to +80°C
Voltage on VCC with respect to GND	-0.3V to 6.0V
Maximum output current sunk/sourced by any pin	15mA

### Note

Stresses above those listed here may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the recommended operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### Recommended Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage (VCC)	Stable external supply required	4.0	5.0	5.5	V
Processor voltage (VP)		–	3.3	–	V
Operating Temperature		-10	–	+60	°C
Input Low Voltage (VIL)	all pins	GND	–	0.2VP	V
Input High Voltage (VIH)	non 5V tolerant pins	0.8VP	–	3.3	V
Input High Voltage (VIH)	5V Tolerant Pins, RX pin	0.8VP	–	5.5	V
Reset Pulse	External Open Collector	2.0	–	–	µs
Operational Delay	Power-Up or External Reset	500	–	3000	ms

### Global Characteristics Based on Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
Supply Current (ICC)	5V Supply – uLCD-144P2 (uSD)	–	TBD	–	mA
Supply Current (ICC)	5V Supply – uLCD-144P2 (Flash)	–	TBD	–	mA
A/D Converter Resolution	I07 Pin	–	–	12	bits
Flash Memory Endurance	PmmC/4DGL Programming	–	10000	–	E/W

Optical Characteristics					
Parameter	Conditions	Min	Typ	Max	Units
Contrast Ratio (Centre point)	Back-light On	300	450	–	–
Luminance of white (Centre point)		160	200	230	cd/m <sup>2</sup>
White Uniformity		80	–	–	%
Response Time Rising + Falling (Tr + Tf)		–	–	240	ms
Viewing Angle	Vertical above Centre (Contrast Ratio >=10)		30		degrees
	Vertical below Centre (Contrast Ratio >=10)		30		degrees
	Horizontal Left of Centre (Contrast Ratio >=10)		30		degrees
	Horizontal Right of Centre (Contrast Ratio >=10)		30		degrees

Ordering Information
<b>Order Code:</b> uLCD-144P2 (uSD) or uLCD-144P2 (Flash)
<b>Package:</b> 65mm x 50mm x 30mm
<b>Packaging:</b> Module sealed in antistatic foam padded 4D Systems Box



## 16. Revision History

### Hardware Revision

Revision Number	Date	Description
1.1	27/11/2024	Initial Public Release Version

### Datasheet Revision

Revision Number	Date	Description
1.0	05/02/2025	Initial Public Release Version

## 17. Legal Notice

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